Scenarios Analysis Process

*What future does the WSAC **need & want** to plan for?*

NOT the future…

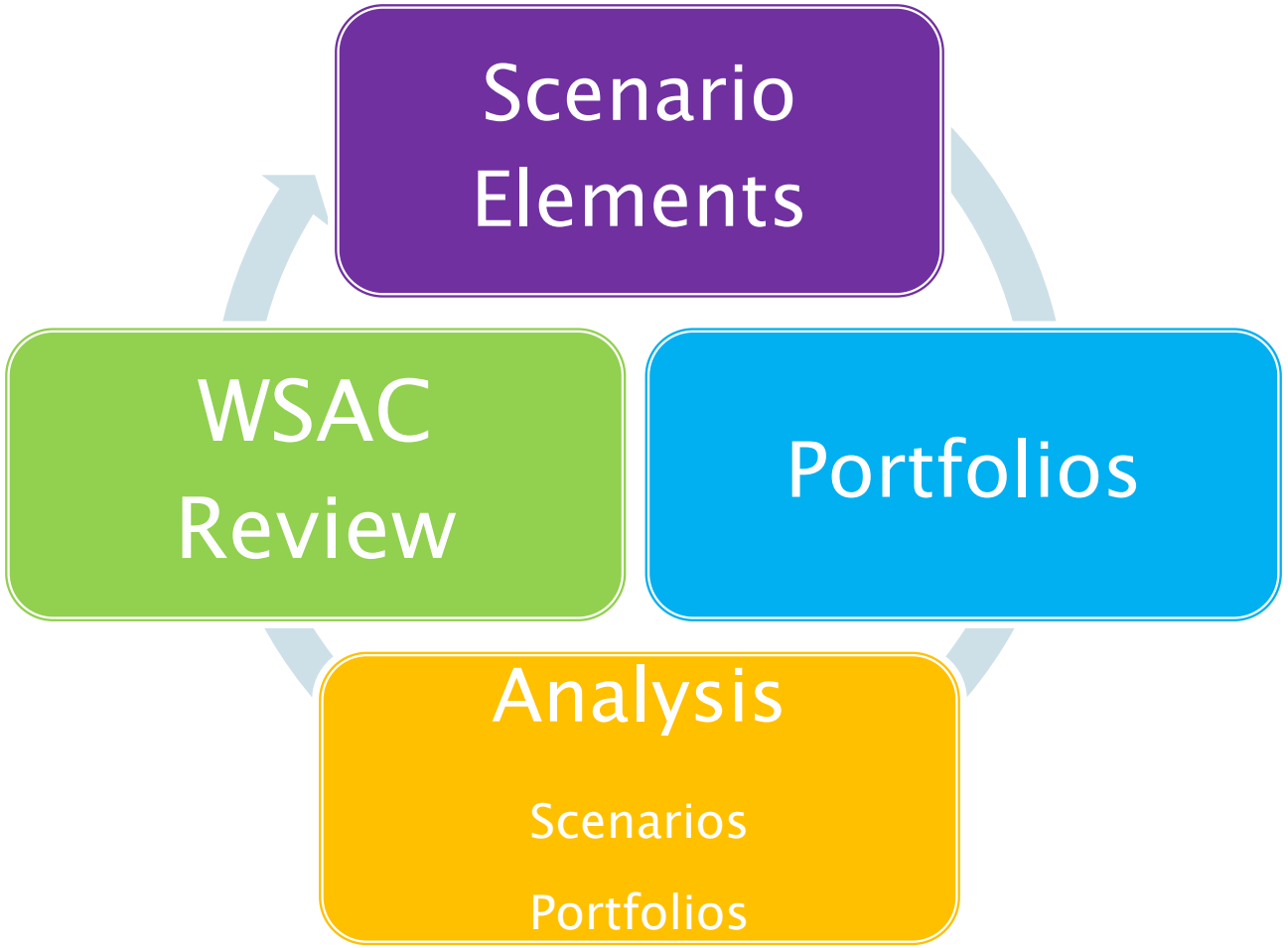
- you hope will occur
- that represents the best possible water world
- that can be met by your desired set of Alts

You need to plan for a future that:

- represents community values
- represents future risks
- is system based
- Is based on best available information

- Capture the issues that are most likely to challenge your system

Iterative Process



Scenario Objective:

Develop 3-4 Multiple Variable Scenarios, representing a unique combination of:

- *Risks*
- *System Assumptions*
- *Narrative values – criteria*

Scenario Elements

Example: Climate Change Challenge Scenario

Risks

- Drought – severity, frequency and duration
- Sea level Rise – x feet and increased storm surge
- Flood
- Wildfire

System

- Hydrologic record
- Demand
- 1 billion gallon reserve – expressed as Rule Curve in Confluence

Community values – criteria

- Sustainability
- Environmental Impacts

Scenario Elements

WSAC Scenario Timing

1. Single variable community interests
   - ✓In October – identified community values
   - ✓In Recon and Phase 2 – MCDS criteria

2. Single Variable risk
   - ✓ Yesterday – identified system element – Demand
   - ✓ Today – risks!

3 Multiple variable?
   - ✓ First cut today if time allows

Scenario Elements

Portfolios

Iterate to find the sweet spot that:

- Is resilient against individual risks
- Is robust across risks
- Is cost-effective
- Meets community values expressed in criteria

Portfolios

Portfolios: Timing

Begin iterations in March

Portfolios

Analysis – Scenarios

- Tech Team:
  - Examine sensitivity of scenario to changes in assumptions about the future.

Identify what matters and what doesn't!

For example: Demand

Analysis

Single variable – Demand

Task David to give Gary new demand ranges AND Provide rational for these changes

Include consideration of plausible ranges:

- USC growth
- Commercial growth
- Income
- Price
- Rebound
- Anchors – gal per capita per day and others

Analysis – Portfolios

Tech Team: Present information on the Alternatives

How well does the selected set of Alts in the Portfolio:

- reduce risks
- provide a cost-effective solution
- minimize side effects
- meet community interests as defined in the criteria

Analysis

Analysis – Timing

Example March WSAC meeting

- First Full iteration analytic findings will be presented in April based on scenarios and portfolios develop by WSAC in April

Analysis

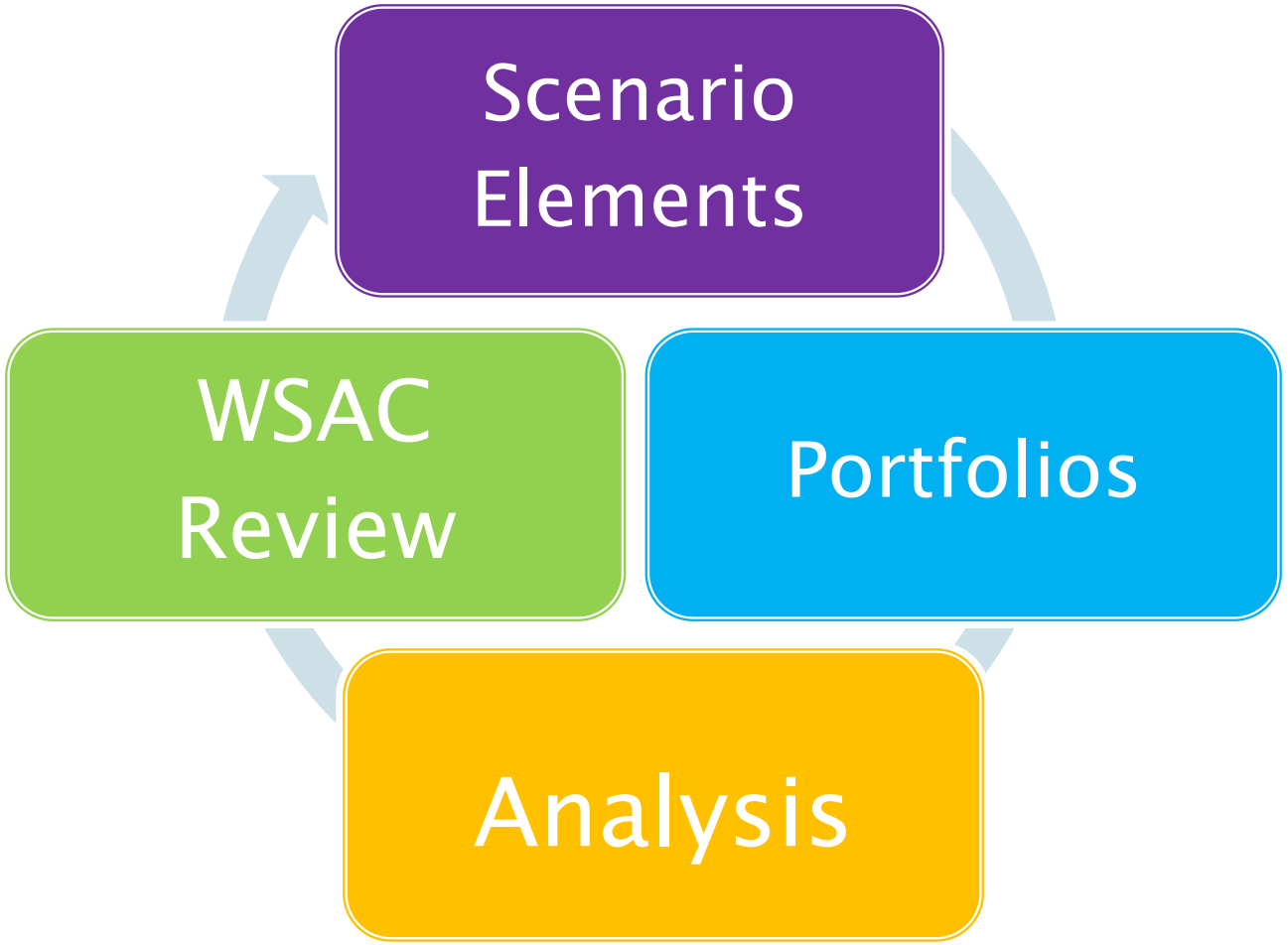
WSAC Review

- Use analytical information to refine both the:
  - Scenarios
  - Portfolios

- Timing – April and forward

WSAC Review

Iterative Process



Today's ambitious agenda

- Risks overview
- Identify single variable risk scenarios
- Revisit single variable system scenarios
- Identify interests to include in scenarios (if time!)
- First cut!

Your plan represents one of the community's insurance policies

What kinds of water insurance will your Portfolio include?

Outline

Overview of risk assessment and risk management

- Define Key Terms
- Glance at a Risk Profile Matrix

Risks Faced by SCWD

Objectives

- Identify key risks
- Shape scenarios
- Guide portfolio-building efforts
- **NOT intended to be a full-fledged risk management exercise (beyond scope of WSAC)**

SCWD Risks

- Drought
- Seismic events
- Regulatory requirements, including habitat conservation plan (HCP)-driven fish-flows
- Economic events
- Flooding- (not Sea Level Rise)
- Wildfire in the watershed.

- Climate Change: combine changes in: hydrology, drought, flooding, wildfire

Key Terms

- Risk Assessment – how large is the risk?
- Risk Management – how do we reduce the risk?

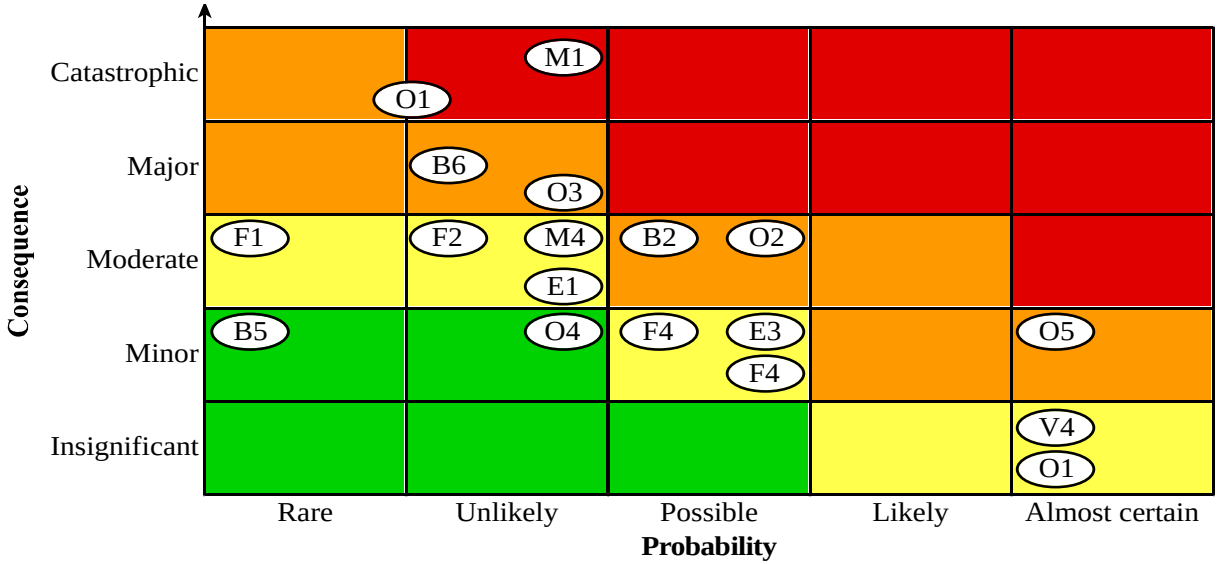
- Resiliency – ability to recover swiftly from an event
- Robustness – ability to withstand multiple types of risk

- Reliability – ability to consistently deliver water
  - E.g., meets at least 85% of water demands…
  - in at least 18 years out of every 20 (i.e., 90% of years)

Risk Management Framework

- **Risk = Probability * Consequence**
- Probability of adverse event occurring
  - Large uncertainty -- often consider "plausibility"
  - Utility's past experience and knowledge
  - Expert forecasts (e.g., USGS)
- Consequence of adverse event, if/when it occurs
  - Direct expenses borne by Water Dept (largely financial)
  - Broader suite of societal impacts borne by community
  - Environmental impacts

Risk Profile: Characterizing and Ranking Various Water Department Risks



Operational Risks
O1 Contaminated water supply
O2 Water asset failure
O3 Chlorine gas leak
O4 Incorrect asset design
O5 Unaccounted water loss

Event Risks
VI Threats to employees
V2 Vandalism
V3 Natural disaster
V4 Vehicle accidents
V5 Sabotage/terrorism

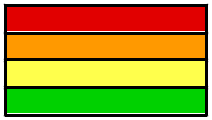
Market/Regulatory Risks
M1 City water system failure
M2 Poor contract management
M3 Unauthorized purchases
M4 Regulatory noncompliance

Business/Information System Risks
B1 Architecture capacity not sufficient
B2 Unauthorized access
B3 Inappropriate handling of media
B4 Critical information not recorded
B5 Lack of community consultation
B6 Key IT system failure

Financial Risks
F1 Liquidity, cash flow
F2 Credit rating downgraded
F4 Major customer bankrupt

Employee Relations Risks
E1 Noncompliance with OSHA
E2 Loss of key personnel
E3 Inadequate training

Risk ratings:



Challenges in Risk Management

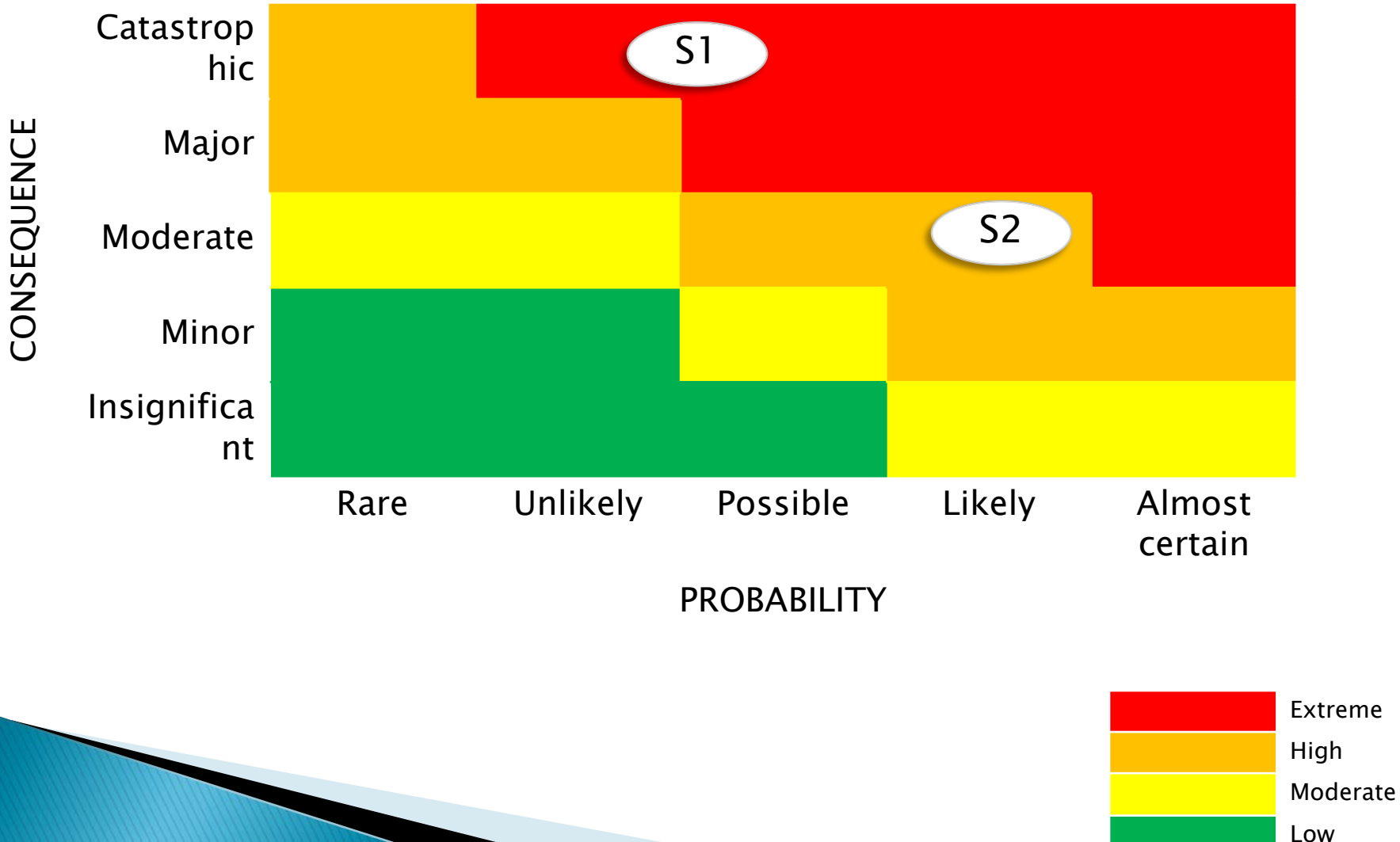
- Probabilities often unknown – apply broad ranges, consider “plausible” events
- Consequences not often well estimated or defined
- Effectiveness of possible risk mitigating options not always well known
- Who decides what risk is acceptable?

Risk Management Exercise

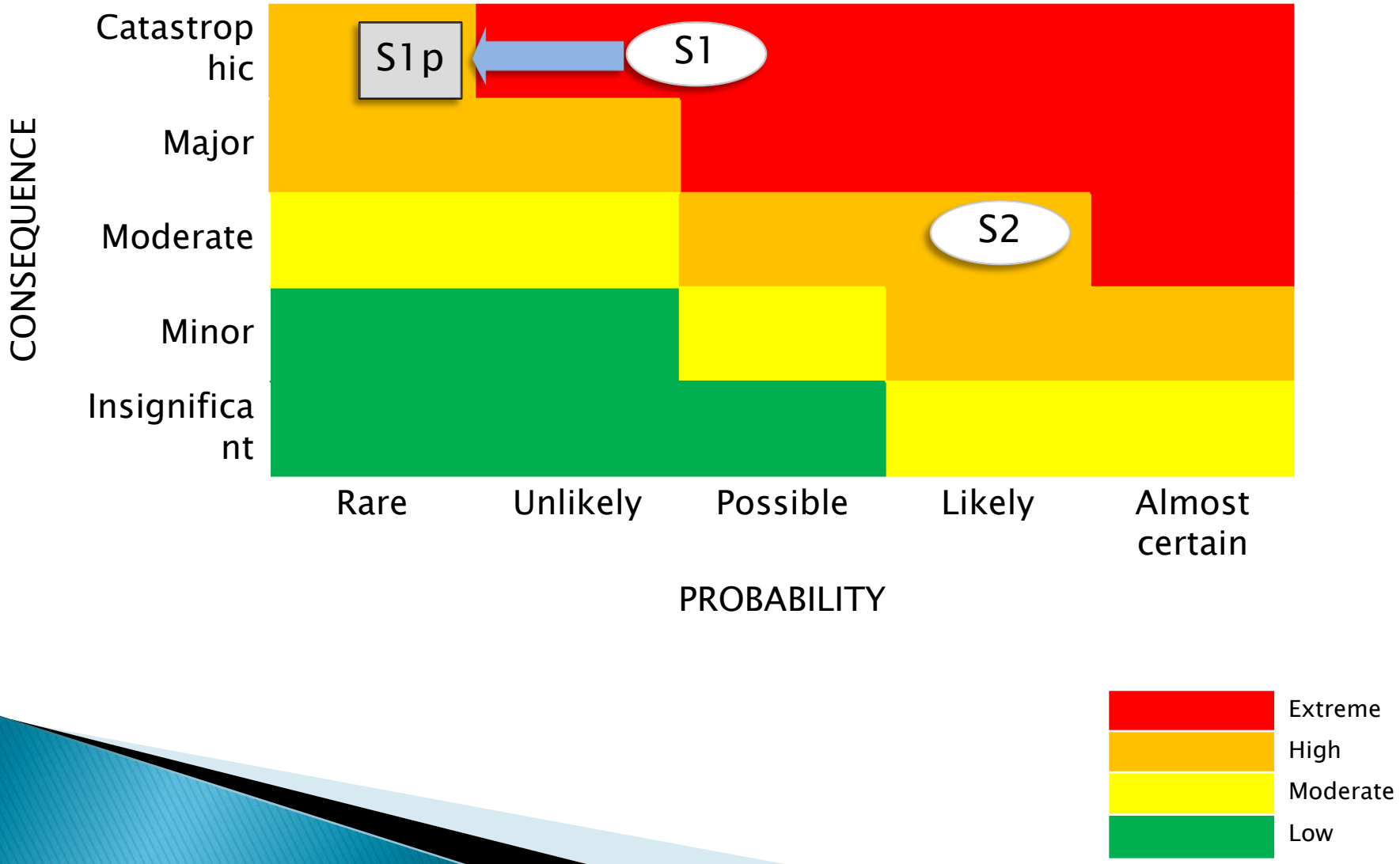
- Where do risks get placed in the profile matrix?

- What can be done to manage the risks?
  - Reduce probabilities?
  - Reduce consequences?

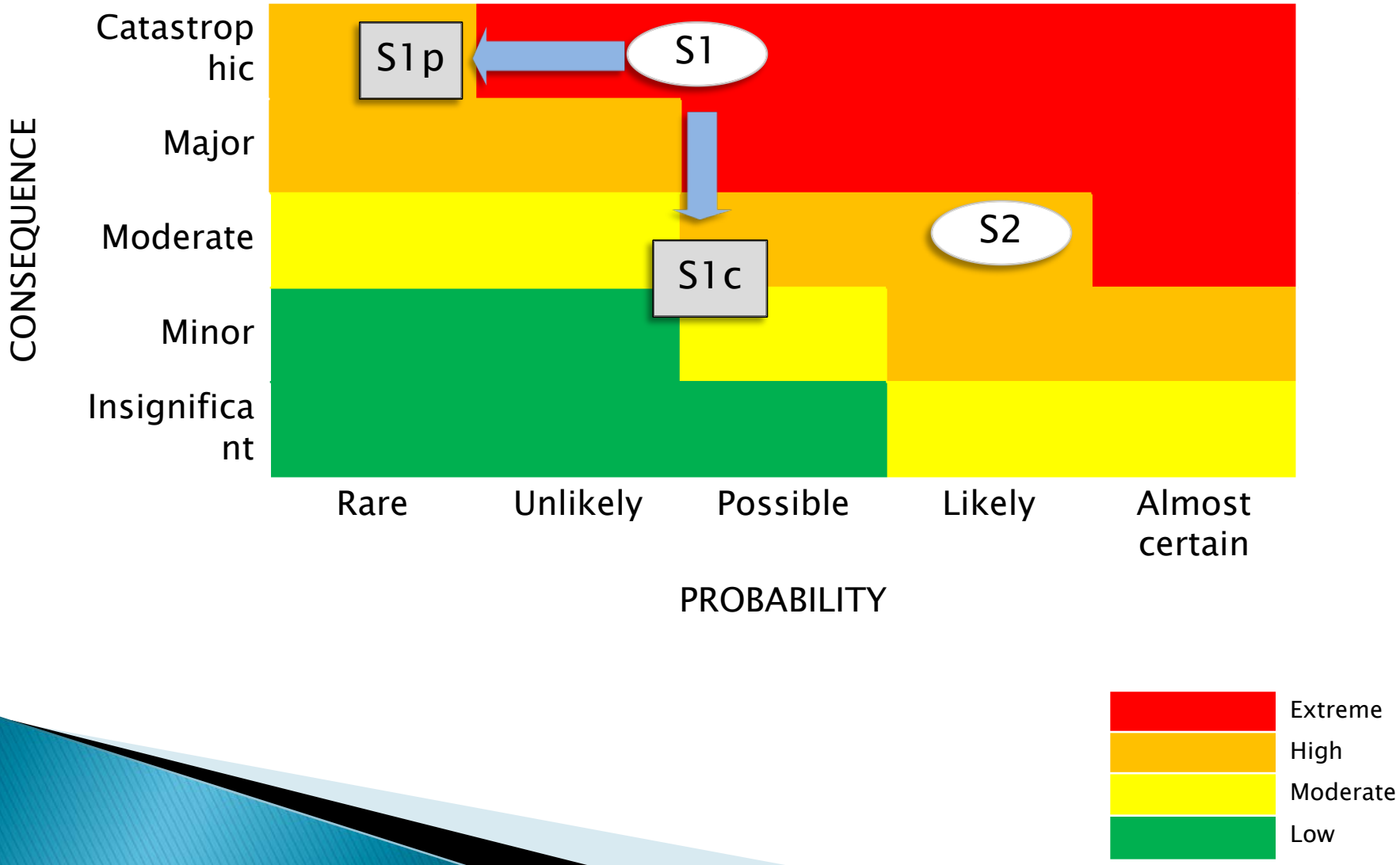
Seismic Risk Example



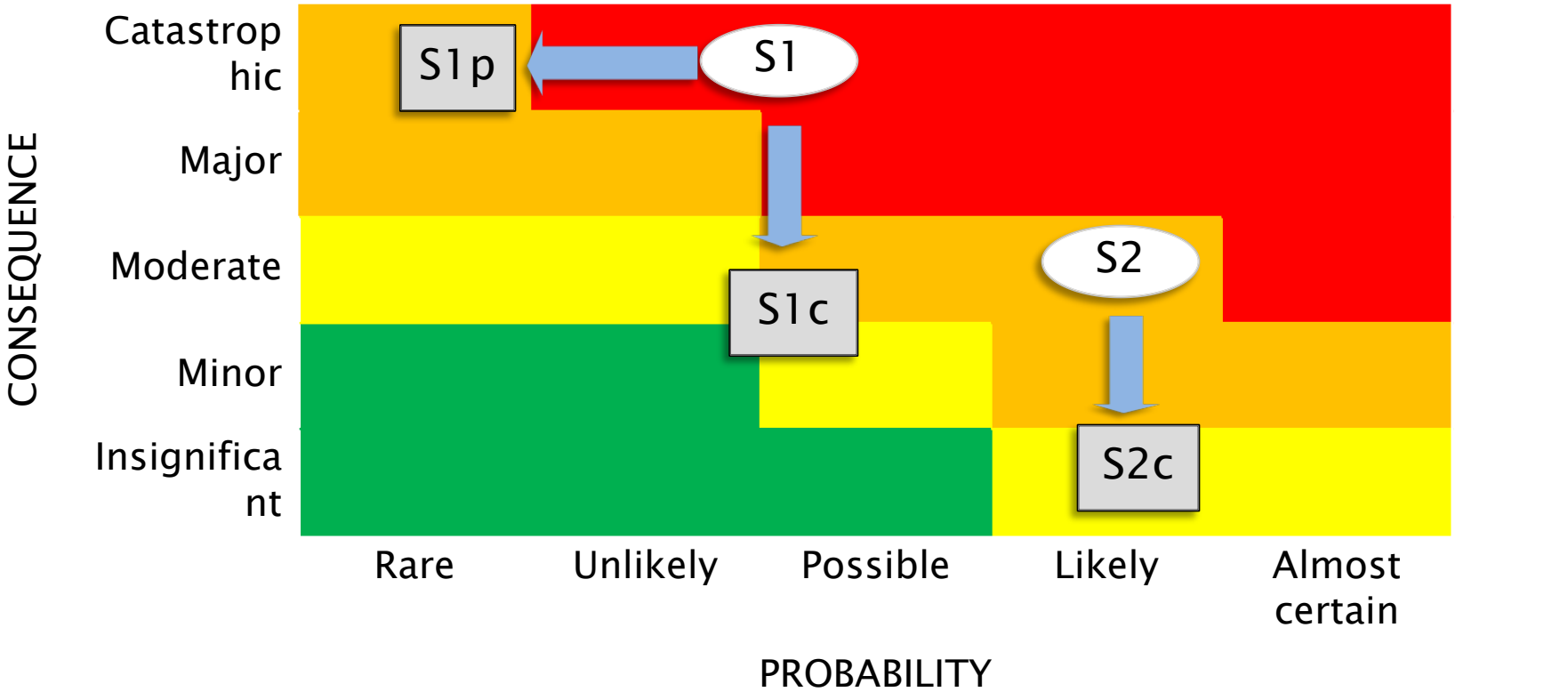
Hardening the Transmission Line Reduces the Probability the Pipeline will Fail (Robustness)



Adding a Redundancy Reduces Consequences of Pipeline Failure (improving Resilience)



Distribution System Risk: Effective Rapid Response to Main/Service Line Breaks



Shortage Risks to Local Economy

- Extended and/or severe curtailments adversely impact businesses (and residential customers)
  - Direct loss of jobs, income, tax revenues, output
  - Secondary impacts multiply through regional economy

- Impacts hard to predict, but grow disproportionately with shortage levels (e.g., above 20%)
  - EBMUD study – Economic losses at 25% are 4 times greater than at 15% shortage
  - SC: What can businesses do if pushed to Stage 4?

Economic Risks: Mitigating Consequences

- Shield vulnerable businesses from severe curtailments
  - Target more resilient businesses
- Provide tax or other fiscal relief to the most adversely impacted
  - E.g., City-funded water use efficiency investments
- Encourage more water-insensitive types of business to remain or move to City

Economic Risk: Mitigating Probability

- Reduce likelihood or severity of curtailments
  - Manage water demands
  - Promote greater water use efficiencies
  - Enhance and diversify water supply portfolio
  - Increase water storage

Drought Risks: rainfall dependent system

- Inability to reliably provide sufficient water to meet user demands during periods of below-average rainfall.

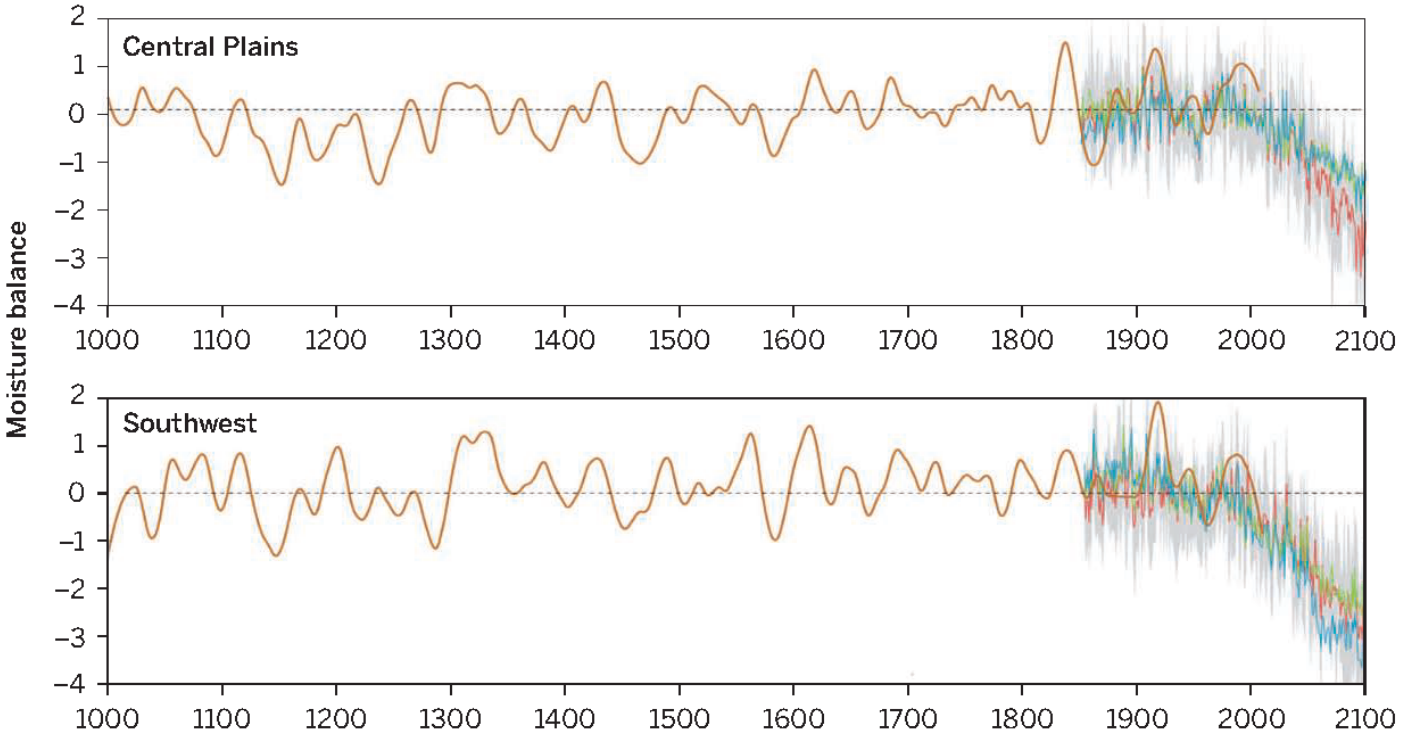
- Big ? – What severity, frequency, and duration of drought do you want to prepare your system to handle?

Management Options

Probability

There are no actions the WSAC can take to reduce the probability of a drought.

Mega- droughts in today's news



Management Options

Probability

- Based on paleo records and observed current conditions, the risk of long-term and severe droughts is high.

Consequence

- Have a water efficient community.
- Using demand to manage long-term drought is different than short term ones. If conservation is already ratcheted down, less room to manage droughts with curtailments or curtailments will hurt more
- Diversifying the supply portfolio so that it includes a non-rainfall based supply source
- Increase current water storage or add additional storage so that storage capacity will last – is this plausible?
- Maximize use of high-flow events – in combination with increased storage – is this plausible?
- Other ideas?

Climate Change: Likely Impacts on Water Utilities

- Impacts include risks to:
  - Water quantity
  - Water *quality*
  - Facilities & supporting infrastructure

Climate Change Risks

- Increase in drought:
  - Severity
  - Frequency
  - Duration
- Increased risk of wildfire
- Increases in extreme precipitation events:
  - Increases in turbidity events
  - Increases in slide events
  - Increases in flooding events
- Increases in Sea Level
  - Increases in storm surge
  - Increases in groundwater salinity levels

Time to role up your sleeves!

Single variable priorities

- Review system single variability from yesterday
- What risks are your priorities to plan for?
- What interests are your priorities to plan for?

Objective: First round scenario for the Technical Team to analyze

Single variable – Demand

Task David to give Gary new demand ranges AND Provide rational for these changes

Include consideration of plausible ranges:

- USC growth
- Commercial growth
- Income
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- Rebound
- Anchors – gal per capita per day and others

Single variable – risks

- Drought
- Seismic events
- Regulatory requirements, including habitat conservation plan (HCP)-driven fish-flows
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- Flooding- Sea Level Rise
- Wildfire in the watershed.

- Climate Change!
  - Combine – drought, flood, wildfire

Drought risk analysis

- Run multi-year droughts through Confluence
  - Duration?
  - Frequency?
  - Severity?

Single variable – Interest

- **Traditional** – baseline
- **Climate Change** – How will water supplies and demands be effected by changes in climate?
- **Economic needs** for additional water
  - Reduce commuting
  - Be a good neighbor
  - Innovate business that requires additional water
- **Environmental needs** for additional water
  - 100% for flows for fish
- **Sustainability**
  - – Supplies, demands and actions can all continue indefinitely

Multiple variable – select

- Risks from single variable
  - Drought
  - Economic
- System
  - Demand
  - Other?
- Interests

  - **Tech Team – no promises!! This is complicated and time consuming to do right!**

Example: Climate Change Challenge Scenario

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- Drought – severity, frequency and duration
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System

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- Demand
- 1 billion gallon reserve – expressed as Rule Curve in Confluence

Community values – criteria

- Sustainability
- Environmental Impacts

Scenario Elements

Planning for the great unknown

- Select the Climate variability for drought
  - – not the 73-year record
- Identify how the climate variability will increase due to CC
- Long-term averages from downscaled Global Circulation Models

Add narratives

- **Traditional** – baseline
- **Climate Change** – How will water supplies and demands be effected by changes in climate?
- **Economic needs** for additional water
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- Environmental needs for additional water
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