



# *Scenario Planning to Support Decision Making*

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CRWU and Water Utility Climate Alliance (WUCA)  
Webinar Series

Laura Dubin, ORISE Intern, EPA

Keely Brooks, WUCA, Southern Nevada Water Authority

Ralph Marra, Southwest Water Resources Consulting LLC

Wally Wilson, Tucson Water

Marc Waage / Laurina Kaatz, Denver Water

November 6, 2013

*Use your mouse to hover over the comment bubble icons in the top left corner of your screen to view accompanying script text for each slide.*





## *Housekeeping*

- Mute/un-mute
- Question & Answer sessions
- Technical difficulties – dial \*0



# *Climate Ready Water Utilities (CRWU)*

## CRWU Mission Statement

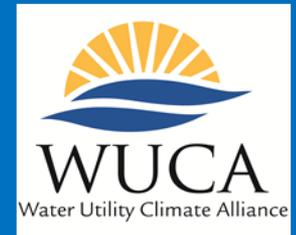
*To provide the water sector (drinking water, wastewater, and stormwater utilities) with the practical tools, training, and technical assistance needed to adapt to climate change by promoting a clear understanding of climate science and adaptation options.*



# Water Utility Climate Alliance

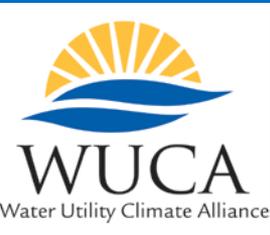
[www.wucaonline.org](http://www.wucaonline.org)

43 million drinking water customers



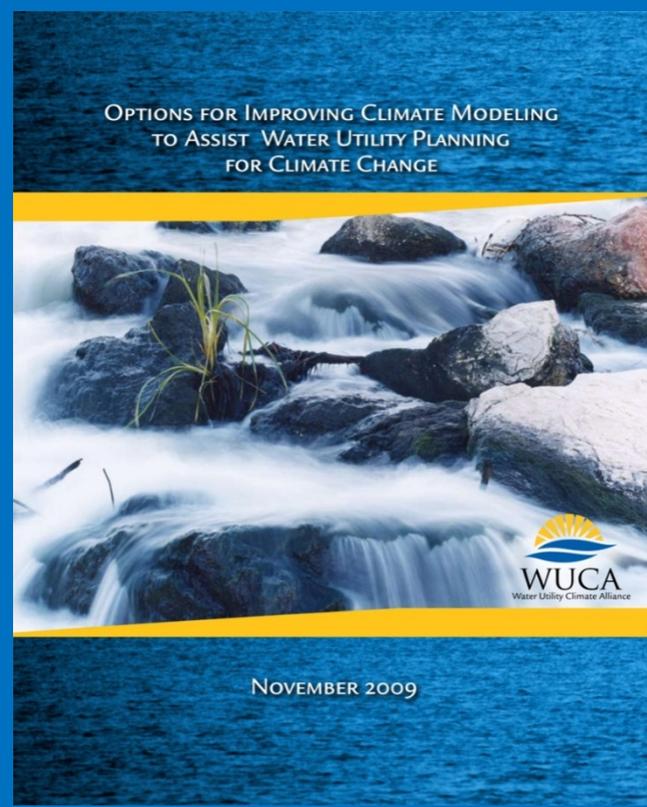
## Mission Statement

The Water Utility Climate Alliance provides leadership in assessing and adapting to the potential effects of climate change through collaborative action. We seek to enhance the usefulness of climate science for the adaptation community and improve water management decision-making in the face of climate uncertainty.



# White Papers (2009-2010)

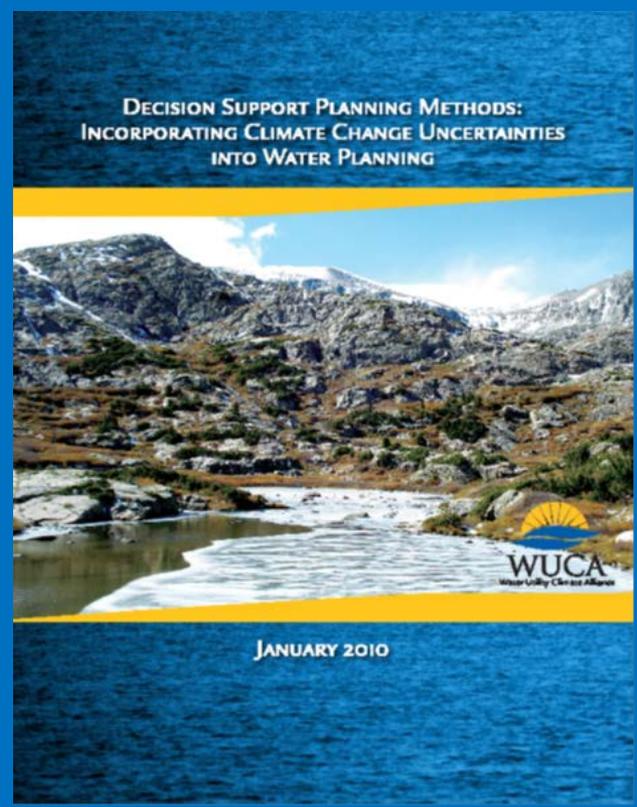
[http://www.wucaonline.org/html/actions\\_publications.html](http://www.wucaonline.org/html/actions_publications.html)



OPTIONS FOR IMPROVING CLIMATE MODELING  
TO ASSIST WATER UTILITY PLANNING  
FOR CLIMATE CHANGE



NOVEMBER 2009



DECISION SUPPORT PLANNING METHODS:  
INCORPORATING CLIMATE CHANGE UNCERTAINTIES  
INTO WATER PLANNING



JANUARY 2010

*Options for Improving Climate Modeling to Assist Water Utility Planning for Climate Change*

*Decision Support Planning Methods: Incorporating Climate Change Uncertainties into Water Planning<sup>2</sup>*



# CRWU and WUCA Webinar Series

Topic	Date
<b>Scenario Planning to Support Decision Making</b>	<i>Today</i>
<b>Robust Planning to Support Decision Making</b>	<i>December 4, 2013</i>
<b>Bottom-up Threshold Analysis to Support Decision Making</b>	<i>March 19, 2014</i>
<b>Communicating Climate Change</b>	<i>Spring 2014</i>
<b>Financing Adaptation</b>	<i>Spring 2014</i>

- Additional topics and dates under consideration
- Visit <http://www.epa.gov/climateredyutilities> for updates and archived presentations



- Background on Scenario Planning  
Ralph Marra, Southwest Water Resources Consulting, LLC
- Utility Case Study  
Wally Wilson, Tucson Water
- Utility Case Study  
Marc Waage and Lurna Kaatz Denver Water
- Wrap up and Q & A



## *Background on Scenario Planning*

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Ralph Marra, Southwest Water Resources Consulting LLC



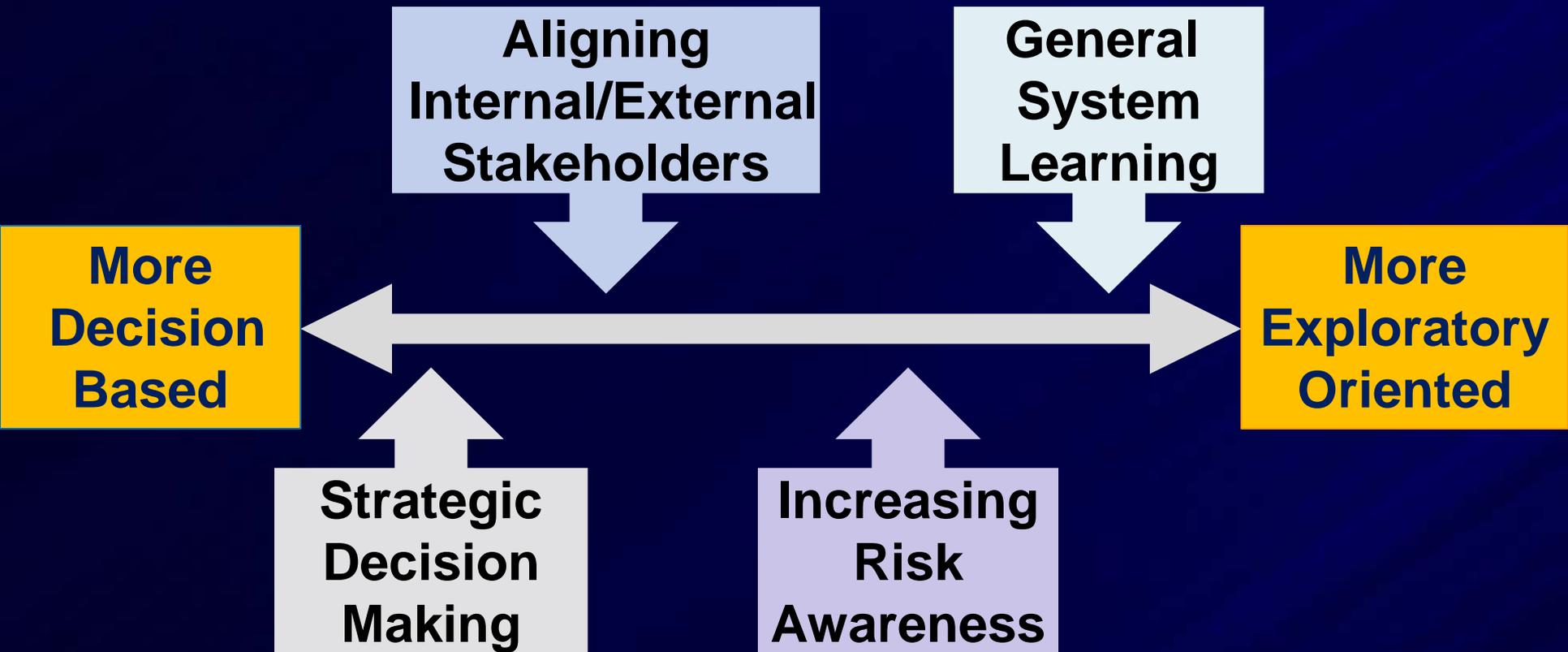
# Scenario Planning

## Where it Applies & What it Can Do

- ◆ Applies to dynamic planning environments where uncertainty is high
- ◆ Provides a “strategic” framework to address critical planning issues
- ◆ Identifies & prioritizes key planning uncertainties
- ◆ Assists in developing a “consensus” vision of emerging challenges & opportunities
- ◆ Enhances an organization’s flexibility and preparedness for whatever happens

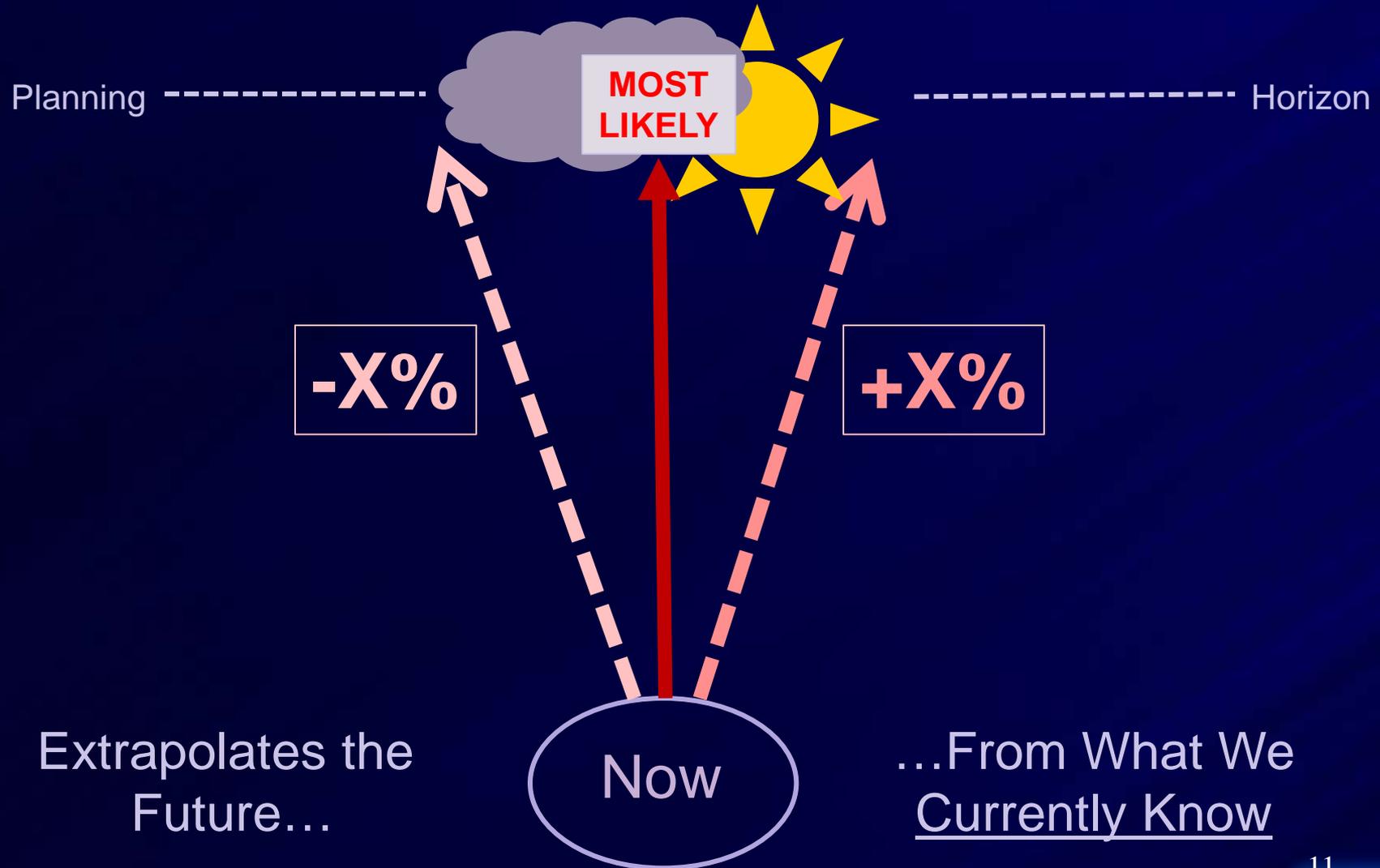
# Scenarios and Uncertainty

## A Range of Applications



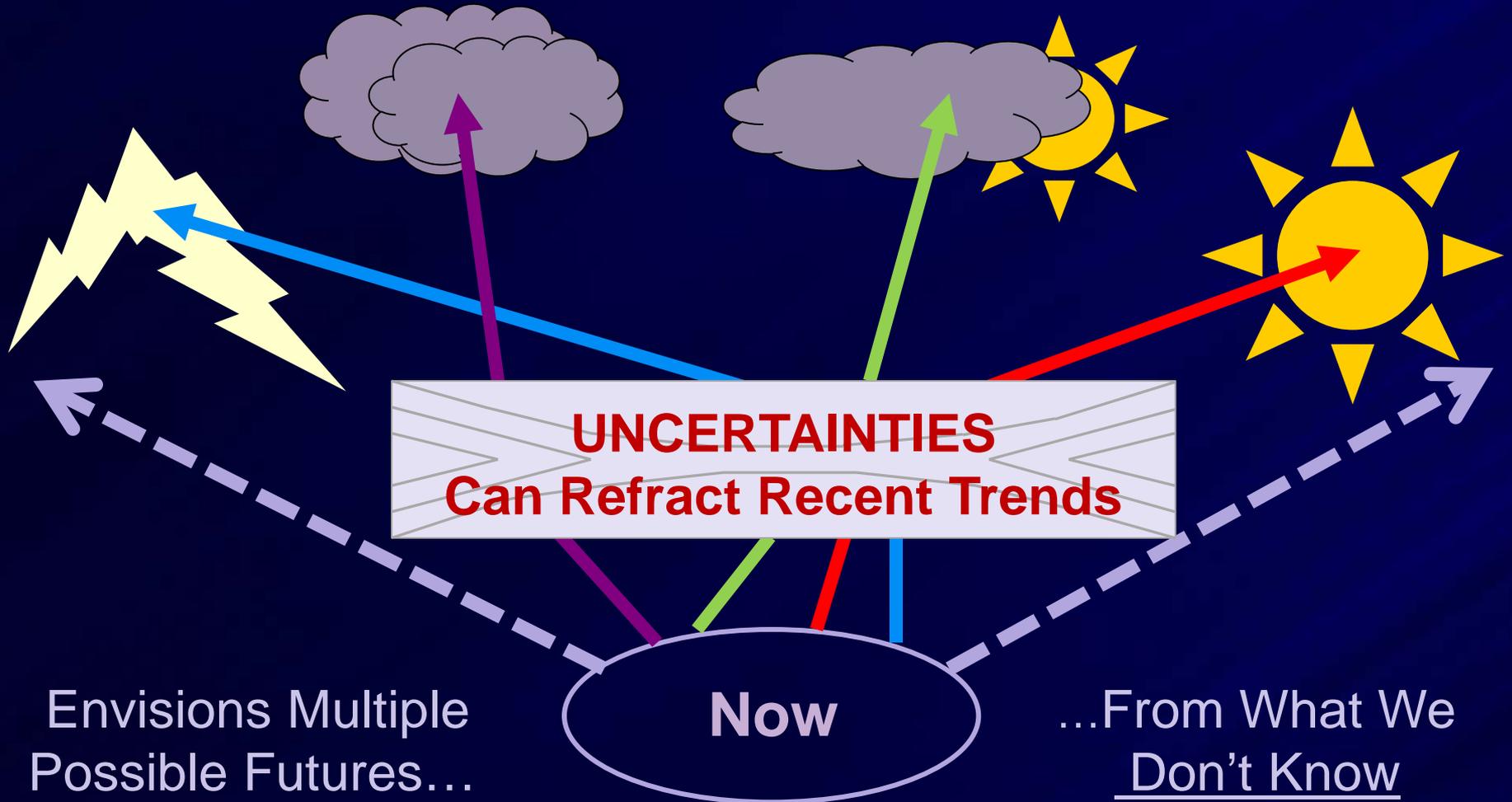
# Traditional Predictive Planning

## The Past is the Key to the Future



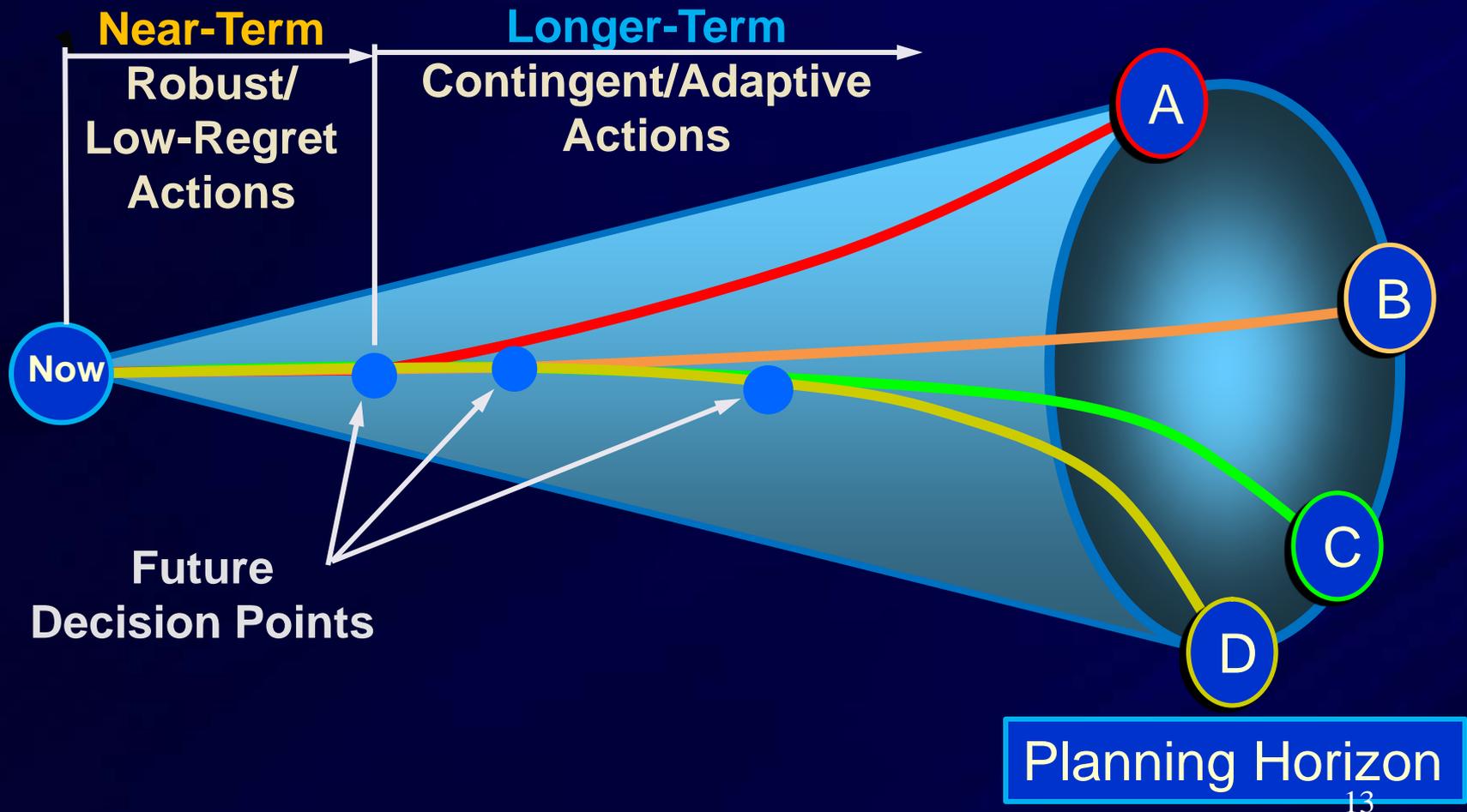
# Scenario Planning

Explores a Broader Range of Future Possibility



# Defining the Range of Future Possibility

## Developing the End-Member Futures



**“Prediction is  
difficult, especially  
about the future.”**

**--Yogi Berra**





**Scenario Planning is not about  
PREDICTING or FORECASTING what  
will happen in the Future**



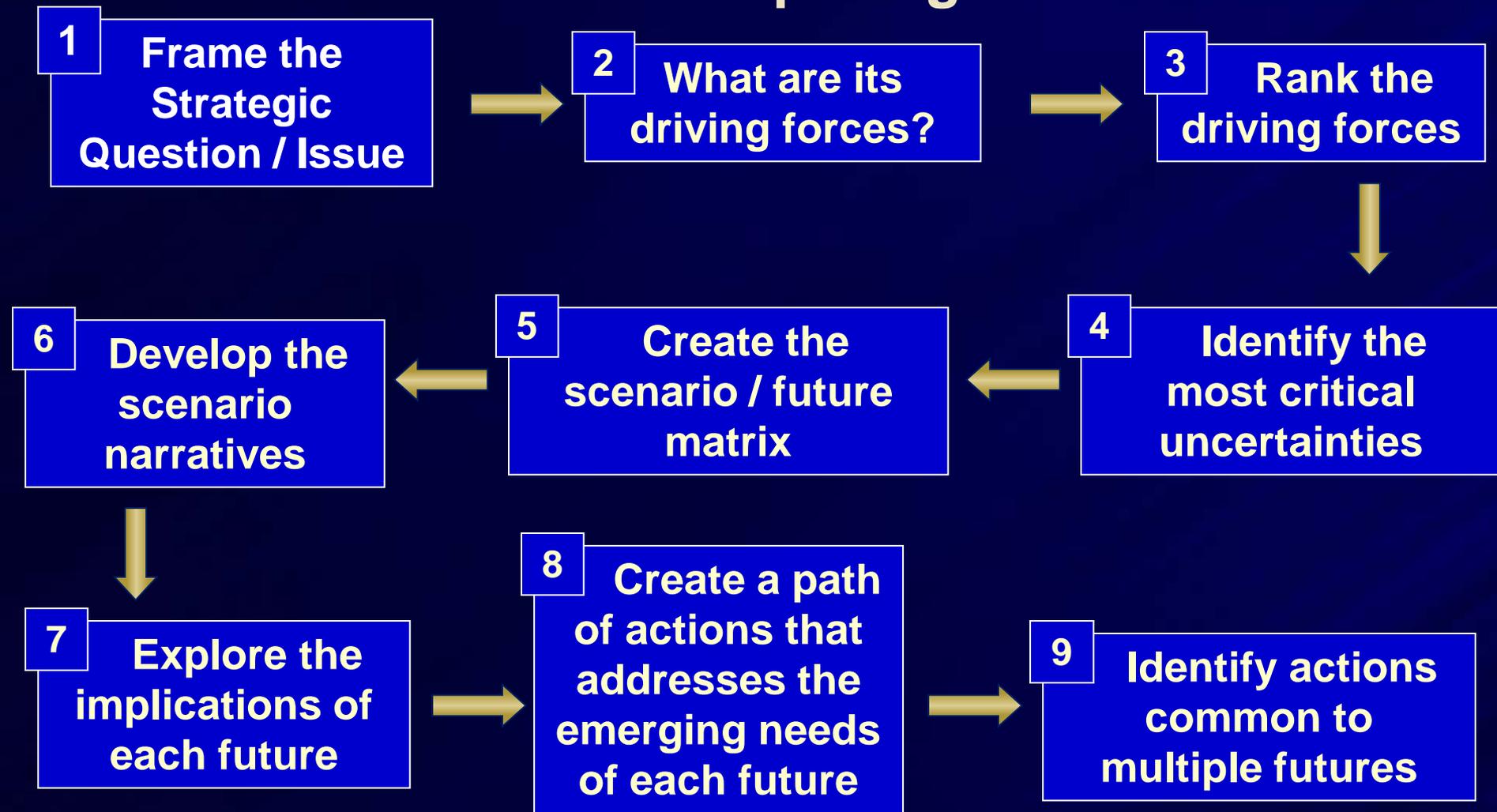
**It's about BEING PREPARED  
for whatever happens  
in the Future**

# Scenario Planning is Not New in the Water World

- ◆ **U.S. Bureau of Reclamation** recently used it to assess supply & demand implications of climate change in the Colorado River Watershed
- ◆ **Denver Water** explored the potential implications of climate change within its Service Area
- ◆ **Tucson Water** applied it to address system and resource uncertainties in its planning process
- ◆ And there are others...

# An Example of a Scenario Planning Process

## A Nine-Step Program



# What are the Most Important Drivers?

## Understanding the System's Influences

Financing

Politics

Environmental Needs

Emerging Contaminants

New Supply Sources

Energy

Aging Infrastructure

Public Perception

System Security

Media Coverage

Water Rate\$

Economy

Climate Variability

Water Quality

Technology

Drought

Growth Pressure

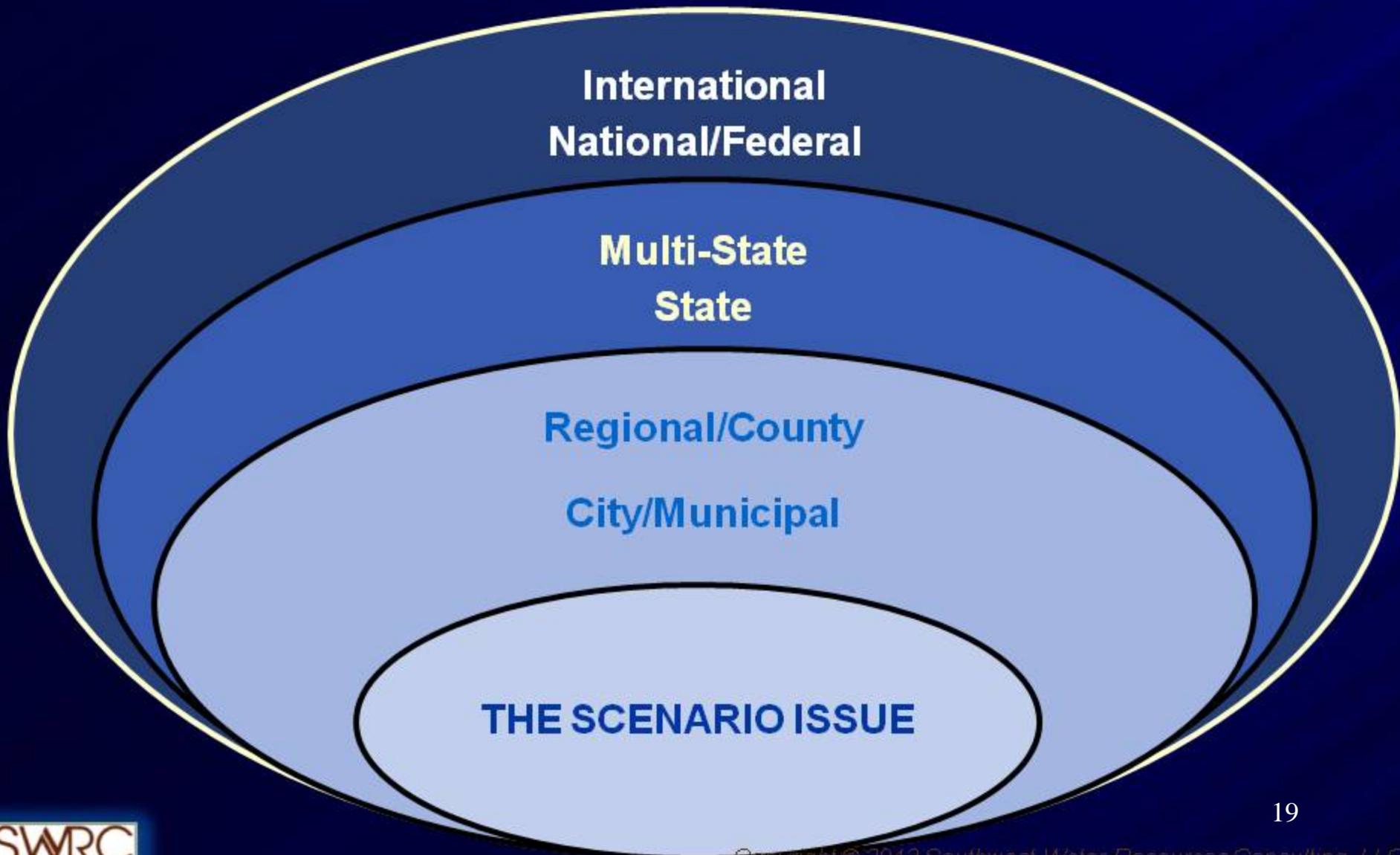
Regulation

Conservation



# Understanding the System

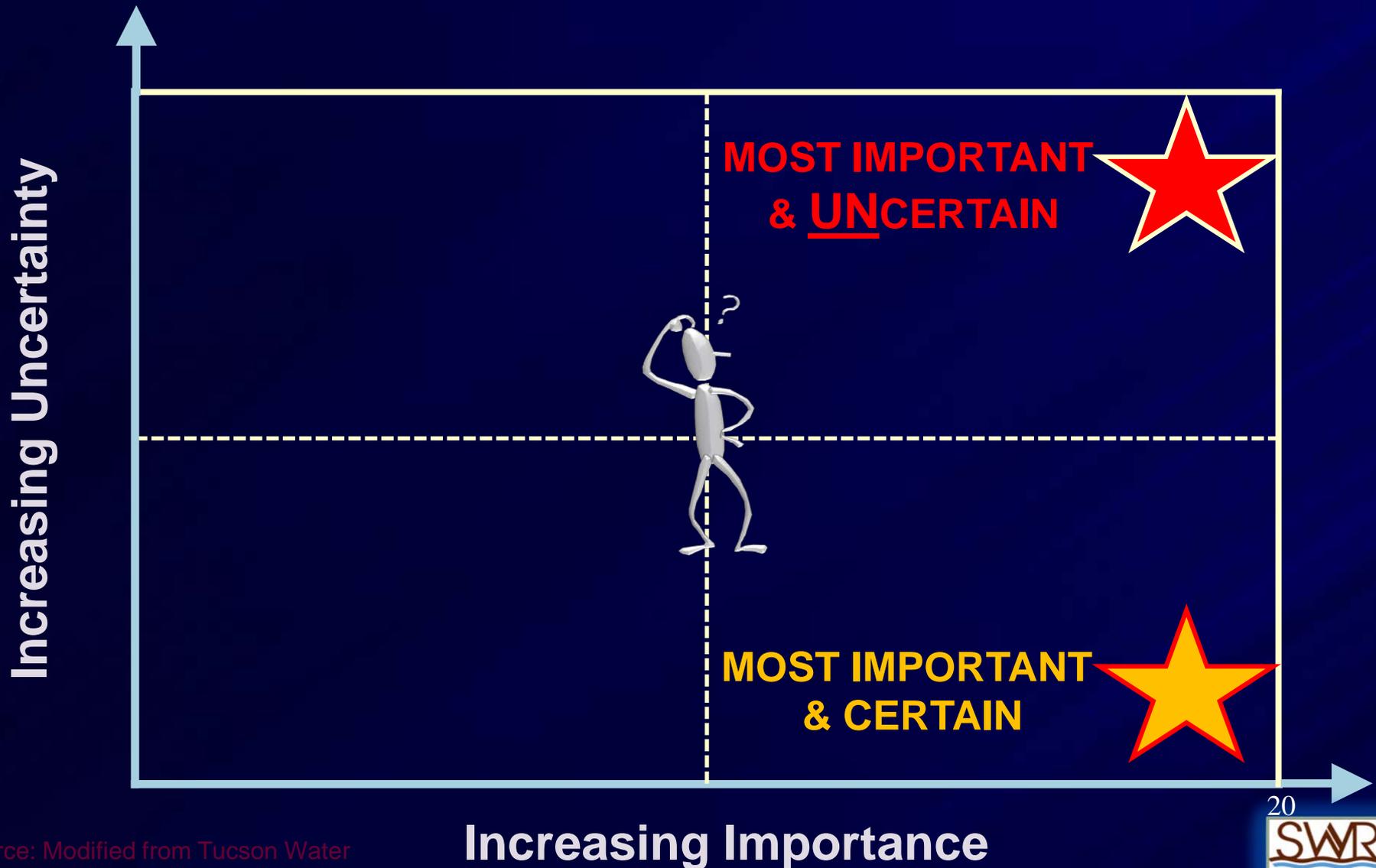
Drivers Can Exert Influence on Many Levels



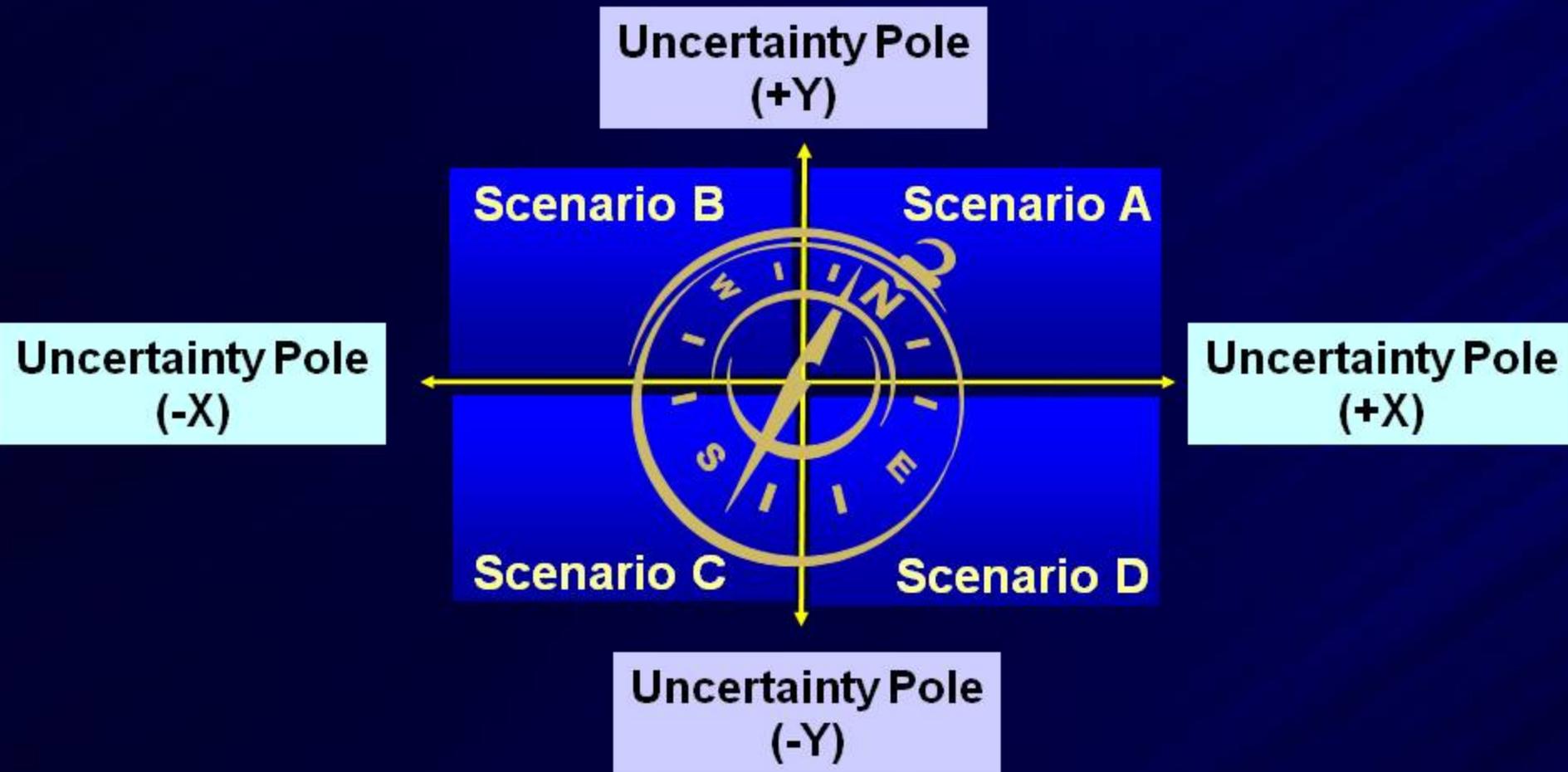


# Rank the Driving Forces

## Identifying the Scenario Building Blocks

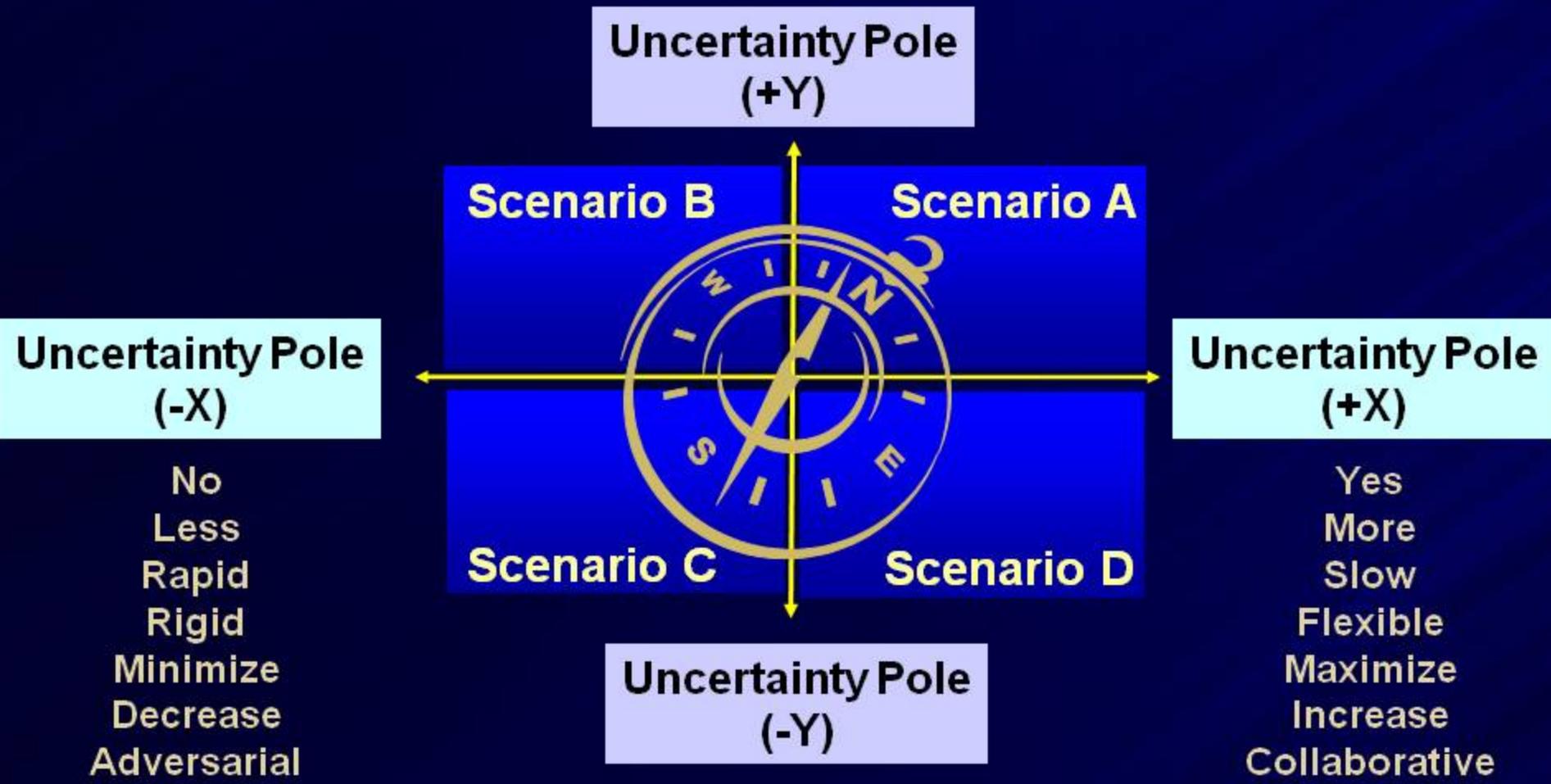


# The Scenario Planning Matrix With Two Uncertainty Axes—Four Futures



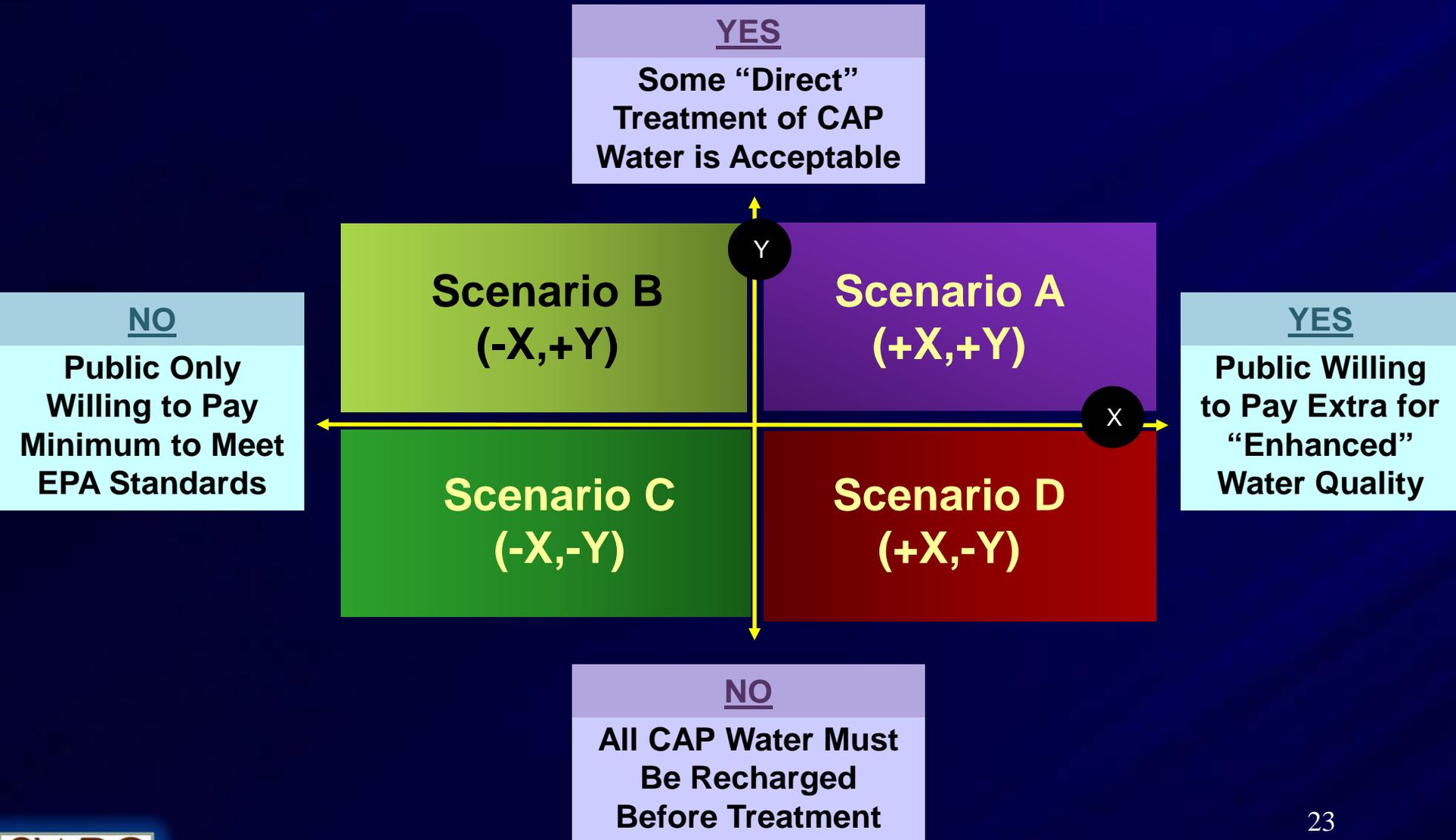
# The Scenario Planning Matrix

## With Two Uncertainty Axes—Four Futures

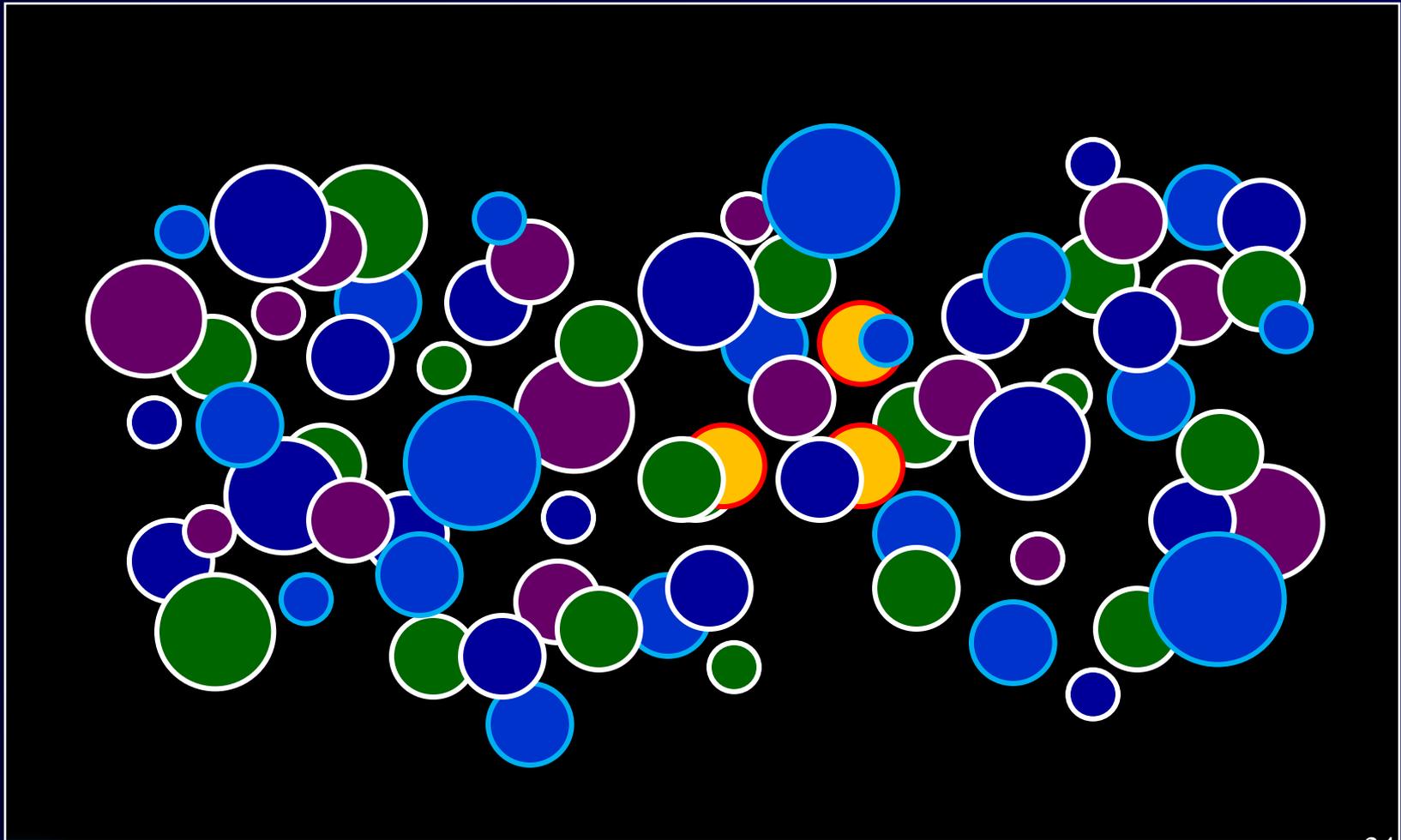


# The Scenario Planning Matrix

## Tucson Water's End-Member Futures

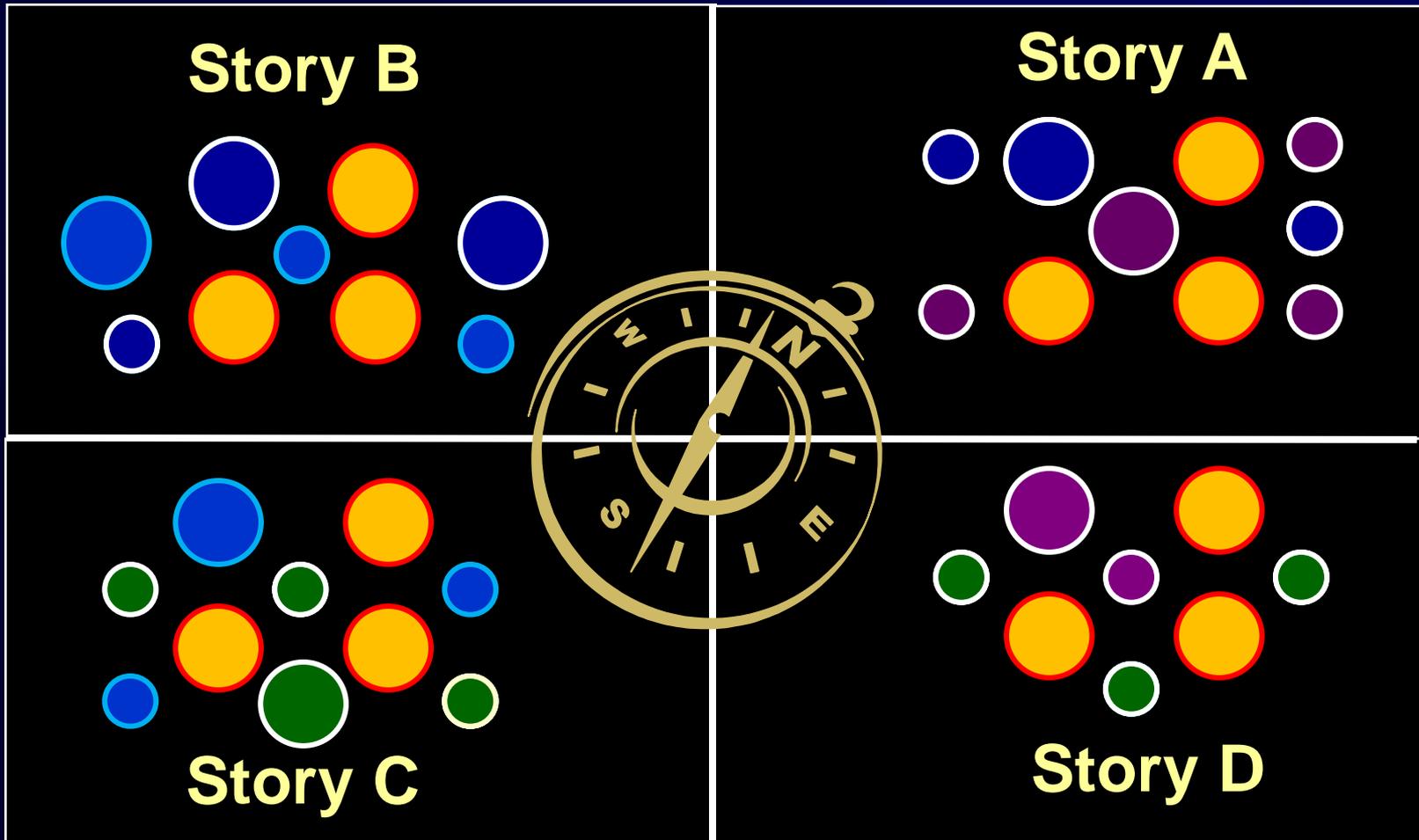


# The Dynamic Planning Environment With Its Certainties and Many Uncertainties



# Simplifying the Planning Environment

## Developing Credible Stories about Possible Futures



 = "Certain" Elements



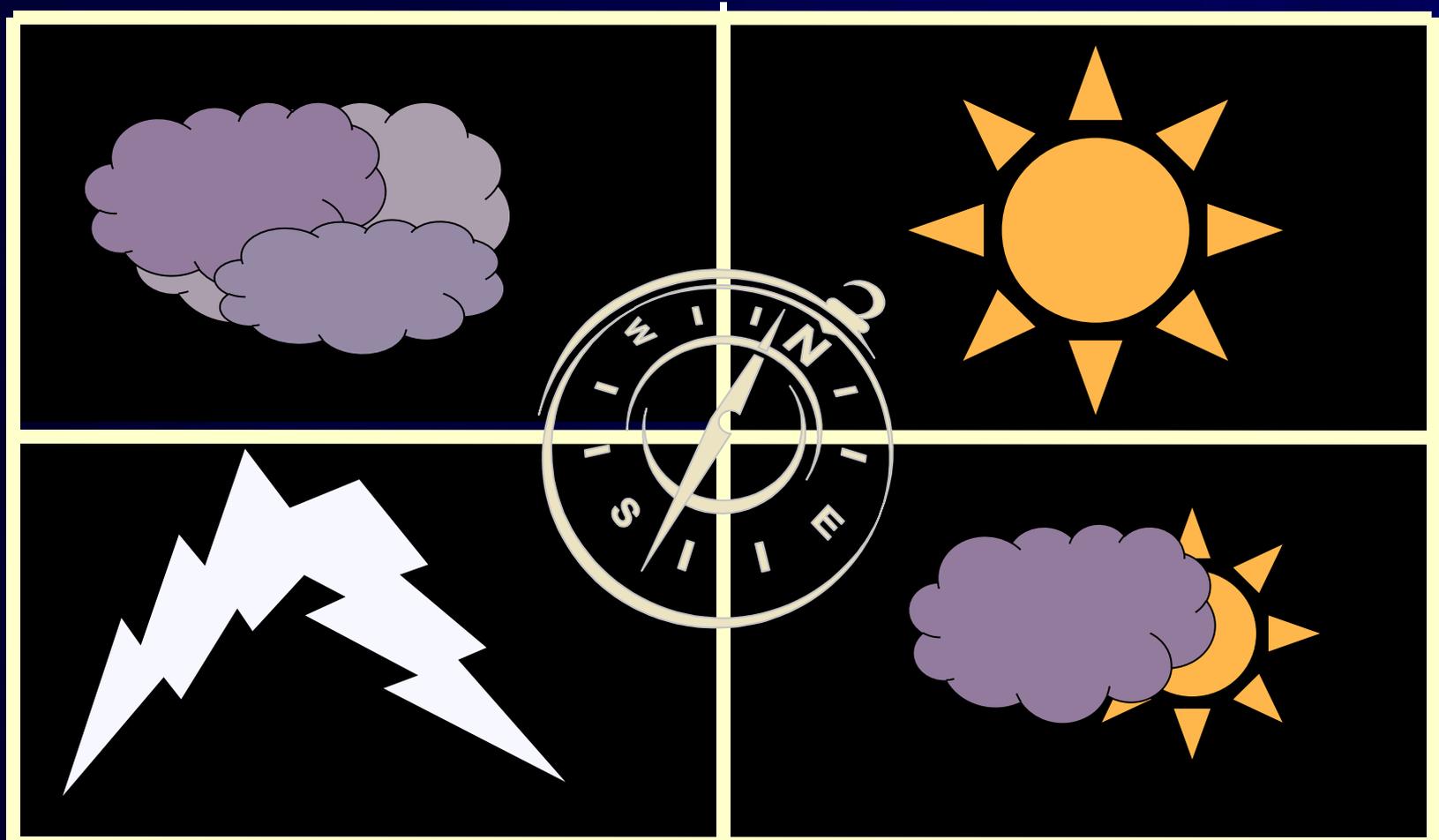
= "Possible"  
Elements

# Defining the Range of Future Possibility

Credible

Challenging

Divergent



# The Evocative Power of the Narrative



# The Power of the Narrative

## A Common “Meta” Scenario Structure



# The Power of the Narrative

- ◆ Scenario Narratives are **VISIONING TOOLS** that can add something “**NEW**” by asking “**WHAT IF**”
- ◆ They can **PROVOKE** deeper insight by drawing on both **MENTAL & EMOTIONAL INTUITIONS**
- ◆ **WE ALL** tell “stories”—to ourselves and each other—to understand and structure our place in the World
- ◆ Organizations & Nations also tell stories—possibly of a **MYTHIC PAST** or an “**OFFICIAL**” **FUTURE**
- ◆ Narratives **CHALLENGE & BROADEN** our existing, accepted **VIEWS** about what may lie ahead

# Identifying the Functional Implications

**What does each scenario mean to you?**

- ◆ **WHAT are the emerging challenges? WHAT are the envisioned vulnerabilities and risks to your utility?**
- ◆ **HOW is each scenario constrained? How can your utility benefit or lose given these constraints?**
- ◆ **HOW is each scenario freer and more open? How can your utility benefit from this “openness” and WHY?**
- ◆ **WHAT are the emerging capabilities & opportunities? WHAT is driving them forward?**
- ◆ **WHO “wins” and “loses” given these opportunities? HOW might the losers react?**

# Implications Summary

	<b>“Blue Skies” (Scenario A)</b>	<b>“Hard Labor” (Scenario B)</b>	<b>“Big Scary” (Scenario C)</b>	<b>“Touchy Feely” (Scenario D)</b>
<b>Multi-National &amp; National</b>	<ul style="list-style-type: none"> <li>• Implication A</li> <li>• Implication B</li> <li>• Implication AA</li> </ul>			
<b>Multi-State &amp; State</b>	<ul style="list-style-type: none"> <li>• Implication C</li> <li>• Implication D</li> <li>• Implication E</li> </ul>			
<b>County/ Municipal/ Local</b>	<ul style="list-style-type: none"> <li>• Implication F</li> <li>• Implication G</li> </ul>			
<b>Organizational (Internal)</b>	<ul style="list-style-type: none"> <li>• Implication H</li> <li>• Implication I</li> <li>• Implication J</li> <li>• Implication K</li> </ul>			

# Implications Summary

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<b>Organizational (Internal)</b>	<ul style="list-style-type: none"> <li>• Implication H</li> <li>• Implication I</li> <li>• Implication J</li> <li>• Implication K</li> </ul>	<ul style="list-style-type: none"> <li>• Implication H</li> <li>• Implication I</li> <li>• Implication Q</li> <li>• Implication R</li> <li>• Implication S</li> </ul>	<ul style="list-style-type: none"> <li>• Implication H</li> <li>• Implication Q</li> <li>• Implication R</li> <li>• Implication Y</li> <li>• Implication Z</li> </ul>	<ul style="list-style-type: none"> <li>• Implication H</li> <li>• Implication I</li> <li>• Implication R</li> <li>• Implication Z</li> <li>• Implication DD</li> </ul>

# Identifying Potential Adaptive Actions

What can you do to prepare for each scenario?

- ◆ How can the **EMERGING VULNERABILITIES** and **RISKS** be addressed?
- ◆ How can constraints and deficiencies be **REMEDIED** or **MITIGATED**?
- ◆ What strategies & actions would be most **EFFECTIVE** given the envisioned conditions?
- ◆ What initiatives would enhance **PREPAREDNESS** by increasing future capability?
- ◆ What (in)actions would **JEOPARDIZE** future viability?

# Potential Actions Summary

	<b>“Blue Skies” (Scenario A)</b>	<b>“Hard Labor” (Scenario B)</b>	<b>“Big Scary” (Scenario C)</b>	<b>“Touchy Feely” (Scenario D)</b>
<b>Multi-National &amp; National</b>	<ul style="list-style-type: none"> <li>• Action A</li> <li>• Action B</li> </ul>			
<b>Multi-State &amp; State</b>	<ul style="list-style-type: none"> <li>• Action C</li> <li>• Action D</li> <li>• Action E</li> </ul>			
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# Potential Actions Summary

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# Identifying Robust & Prudent Actions

	All Potential Actions
<b><u>Scenario A</u></b> <b>“Blue Skies”</b>	A, B, C, D, E F, G, H, I, J, K L, M, BB, DD
<b><u>Scenario B</u></b> <b>“Hard Labor”</b>	A, C, E, F, H, J, L, M, N, O P, Q, R, S, T, U, V, W, Y
<b><u>Scenario C</u></b> <b>“Big Scary”</b>	A, C, E, F, H J, L, N, O, P, Q R, T, U, V, W X, Y, Z
<b><u>Scenario D</u></b> <b>“Touchy Feely”</b>	A, B, C, E, F H, J, L, N, Q R, T, U, Y, Z AA, BB, CC, DD

# Identifying Robust & Prudent Actions

	All Potential Actions	Potentially Robust Actions
<b>Scenario A</b> "Blue Skies"	A, B, C, D, E F, G, H, I, J, K L, M, BB, DD	A, C, E, F, H  J, L, N, Q, R  T, U, V, Y
<b>Scenario B</b> "Hard Labor"	A, C, E, F, H, J, L, M, N, O P, Q, R, S, T, U, V, W, Y	
<b>Scenario C</b> "Big Scary"	A, C, E, F, H J, L, N, O, P, Q R, T, U, V, W X, Y, Z	
<b>Scenario D</b> "Touchy Feely"	A, B, C, E, F H, J, L, N, Q R, T, U, Y, Z AA, BB, CC, DD	

THESE ARE  
"LOW-  
REGRET"  
ACTIONS  
COMMON  
TO  
MULTIPLE  
FUTURES

# Identifying Robust & Prudent Actions

	All Potential Actions	Potentially Robust Actions	Potentially Prudent Actions
<b>Scenario A</b> "Blue Skies"	A, B, C, D, E F, G, H, I, J, K L, M, BB, DD	A, C, E, F, H  J, L, N, Q, R	O, P, W, Z  BB, DD
<b>Scenario B</b> "Hard Labor"	A, C, E, F, H, J, L, M, N, O P, Q, R, S, T, U, V, W, Y	T, U, V, Y	<p>THESE ACTIONS DEPEND ON PERCEIVED RISKS &amp; <u>WHAT WE MIGHT DO TO CONTAIN THEM</u></p>
<b>Scenario C</b> "Big Scary"	A, C, E, F, H J, L, N, O, P, Q R, T, U, V, W X, Y, Z		
<b>Scenario D</b> "Touchy Feely"	A, B, C, E, F H, J, L, N, Q R, T, U, Y, Z AA, BB, CC, DD		

# Identifying Robust & Prudent Actions

	All Potential Actions	Potential Robust Actions	Potential Prudent Actions	Potential Recommended Actions
<b>Scenario A</b> "Blue Skies"	A, B, C, D, E F, G, H, I, J, K L, M, BB, DD	A, C, E, F, H  J, L, N, Q, R  T, U, V, Y	O, P, W, Z  BB, DD	C, H, J, L, N,  O, P, R, T, Y  W, DD FINAL SELECTION WILL DEPEND ON ON <u>ADDITIONAL ANALYSIS</u> , ONE'S <u>RISK TOLERANCE</u> & <u>STRATEGY</u> <sup>39</sup>
<b>Scenario B</b> "Hard Labor"	A, C, E, F, H, J, L, M, N, O P, Q, R, S, T, U, V, W, Y			
<b>Scenario C</b> "Big Scary"	A, C, E, F, H J, L, N, O, P, Q R, T, U, V, W X, Y, Z			
<b>Scenario D</b> "Touchy Feely"	A, B, C, E, F H, J, L, N, Q R, T, U, Y, Z AA, BB, CC, DD			

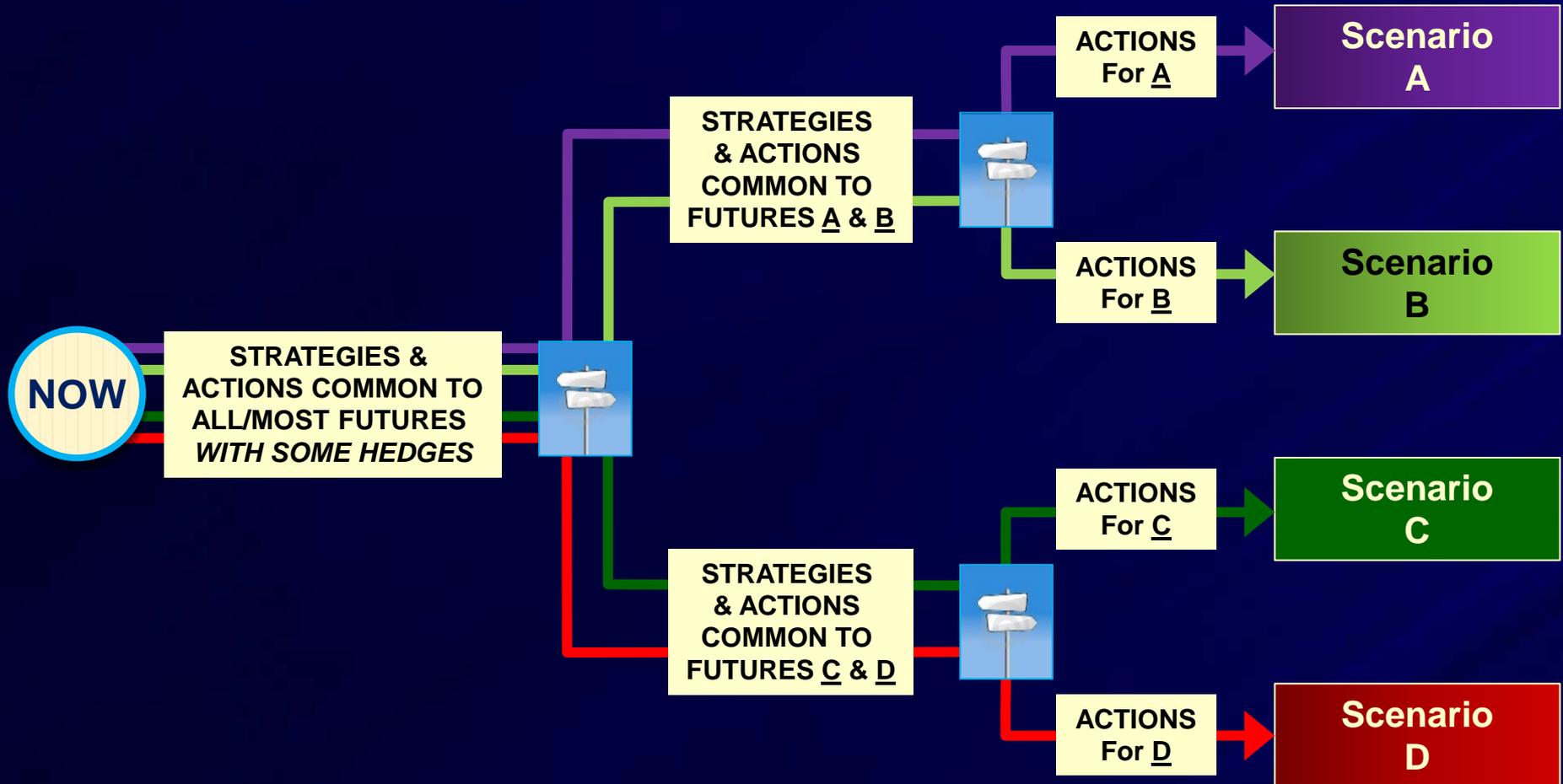
# Developing an Effective Strategic Plan

## Some Things to Consider

- ◆ Which “LOW-REGRET” strategies & actions are common to MOST FUTURES?
- ◆ Which apply only to one or two but could be prudent hedges to off-set BIG POTENTIAL RISKS?
- ◆ Which actions would increase planning FLEXIBILITY and ADAPTIVE CAPACITY?
- ◆ How could an evolving scenario be influenced so that it “MUST BE” ACHIEVED or AVOIDED?
- ◆ What actions could increase the potential for “HIGH REGRET” outcomes?

# A Scenario Planning Strategy

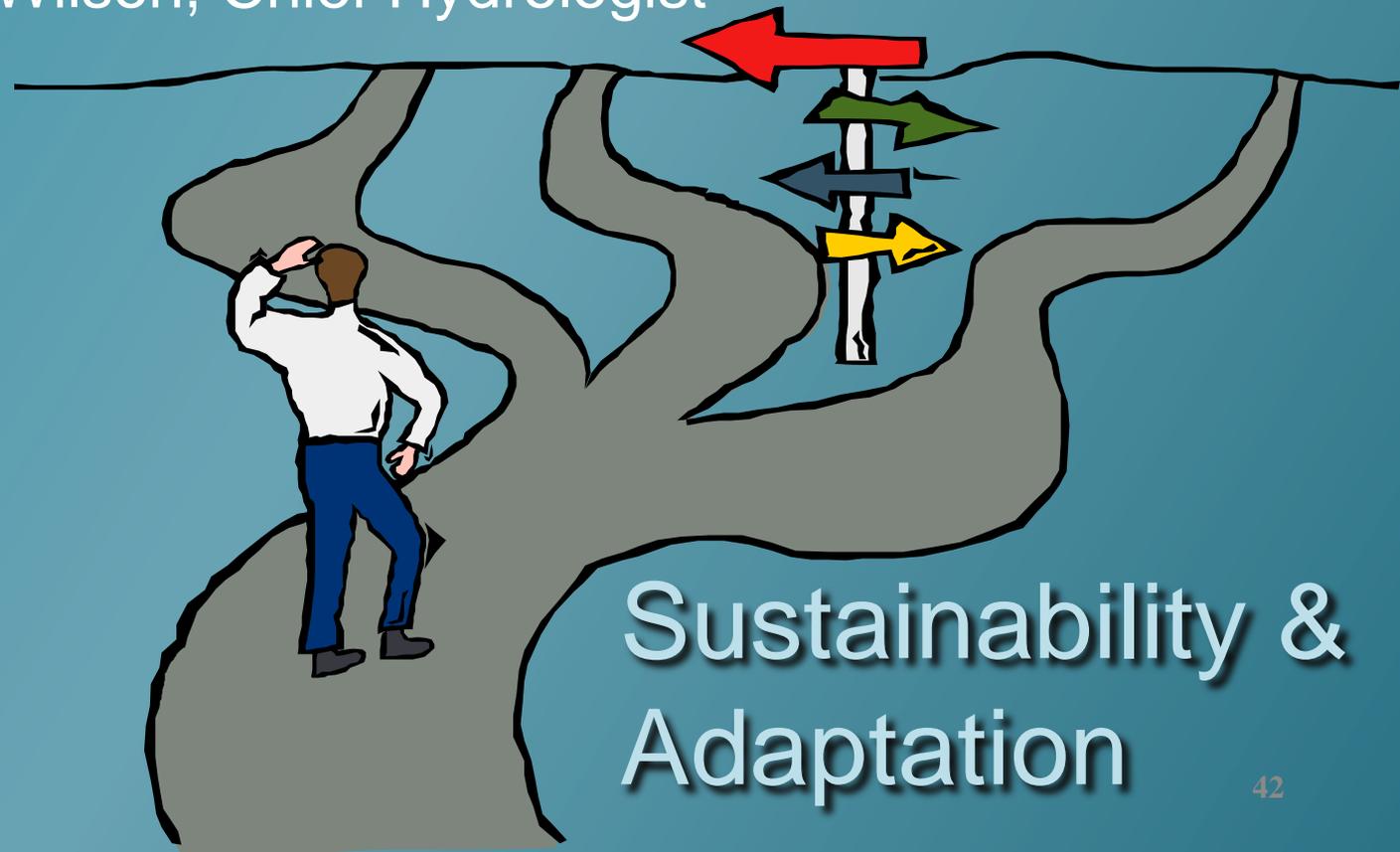
## Pre-Positioned and Prepared



# Along the Scenario Planning Pathway

Presenter:

Wally Wilson, Chief Hydrologist

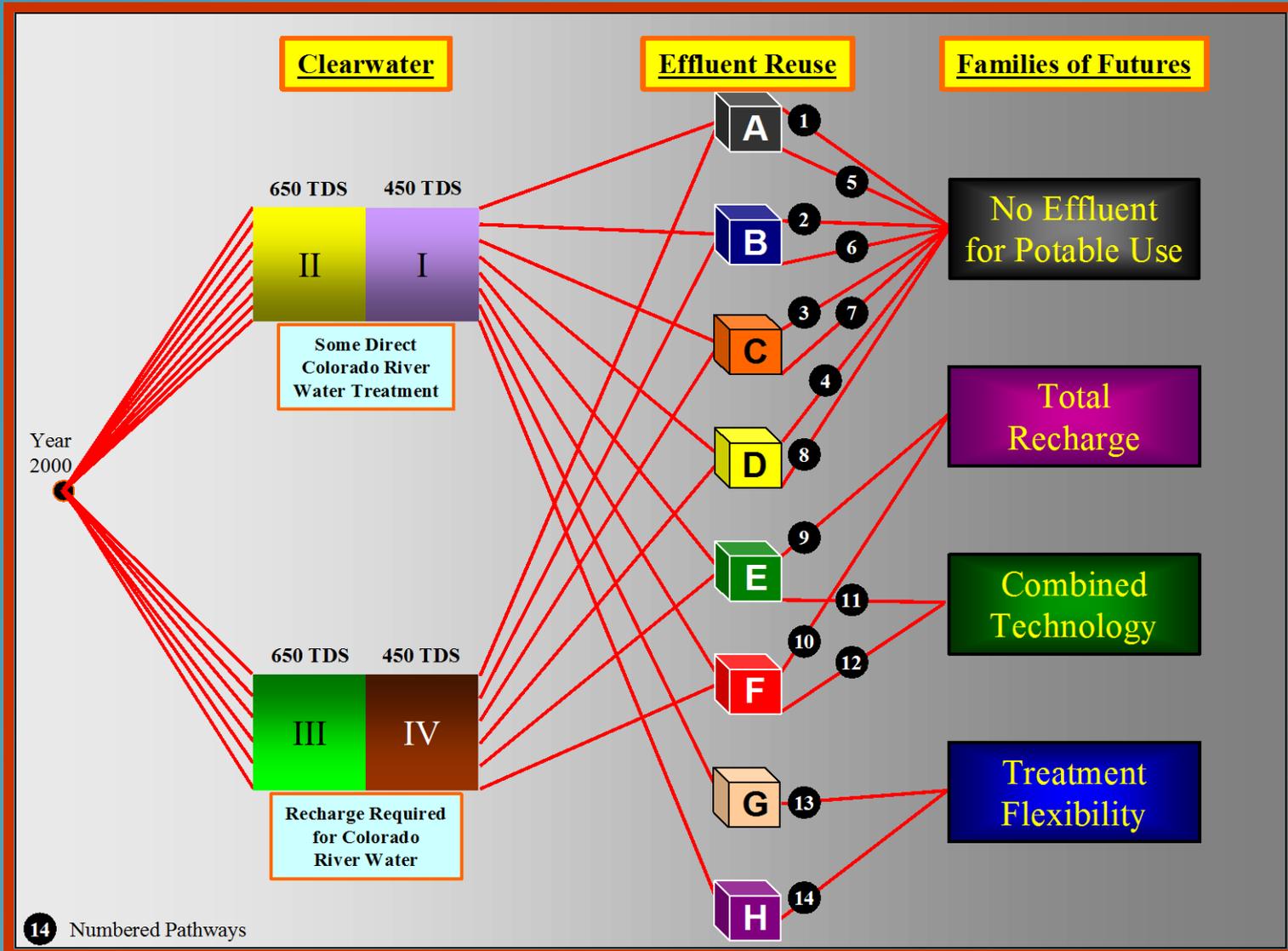


Sustainability &  
Adaptation

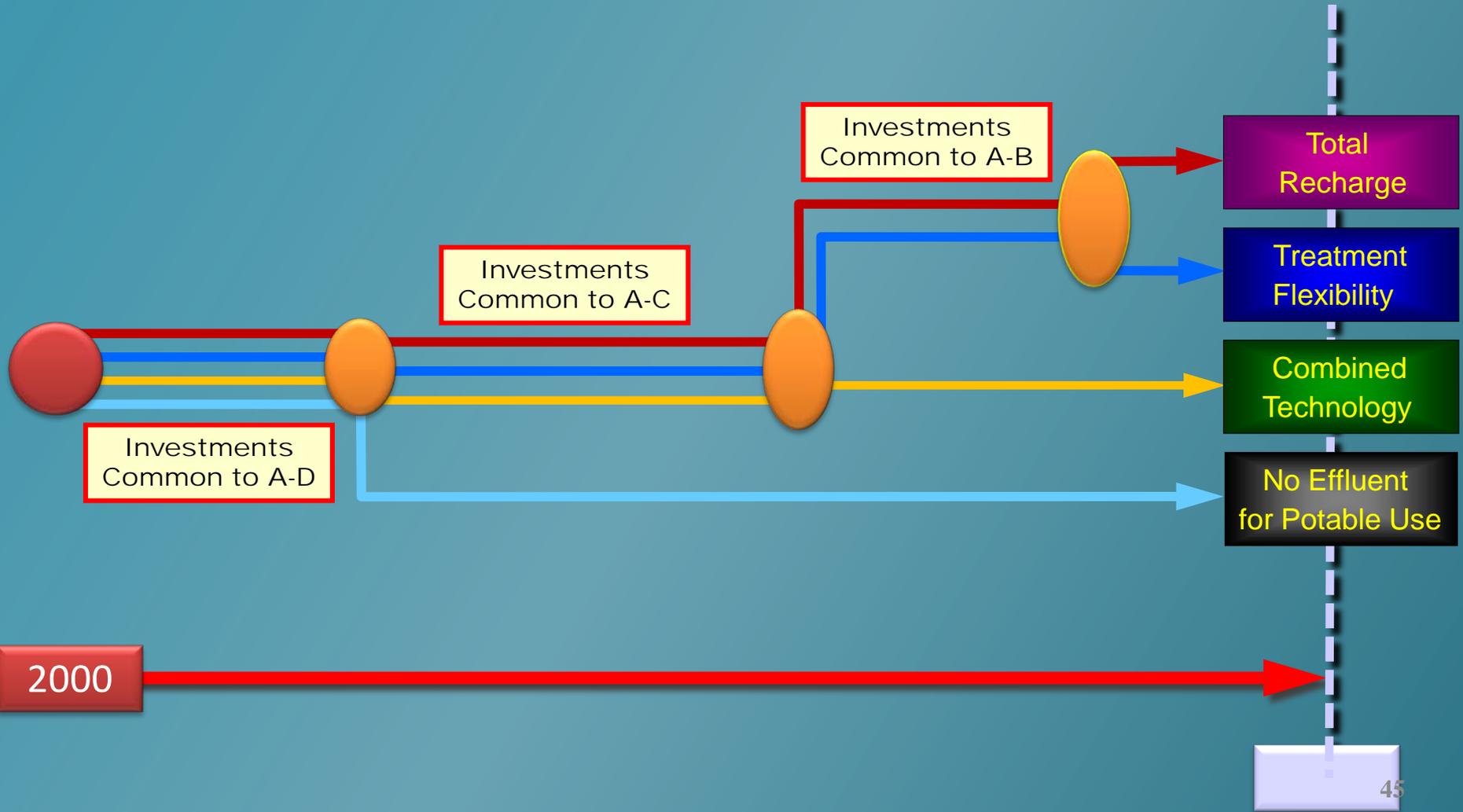
# Goals

- Fully Utilize Renewable Resources
- Meet Demands through 2050

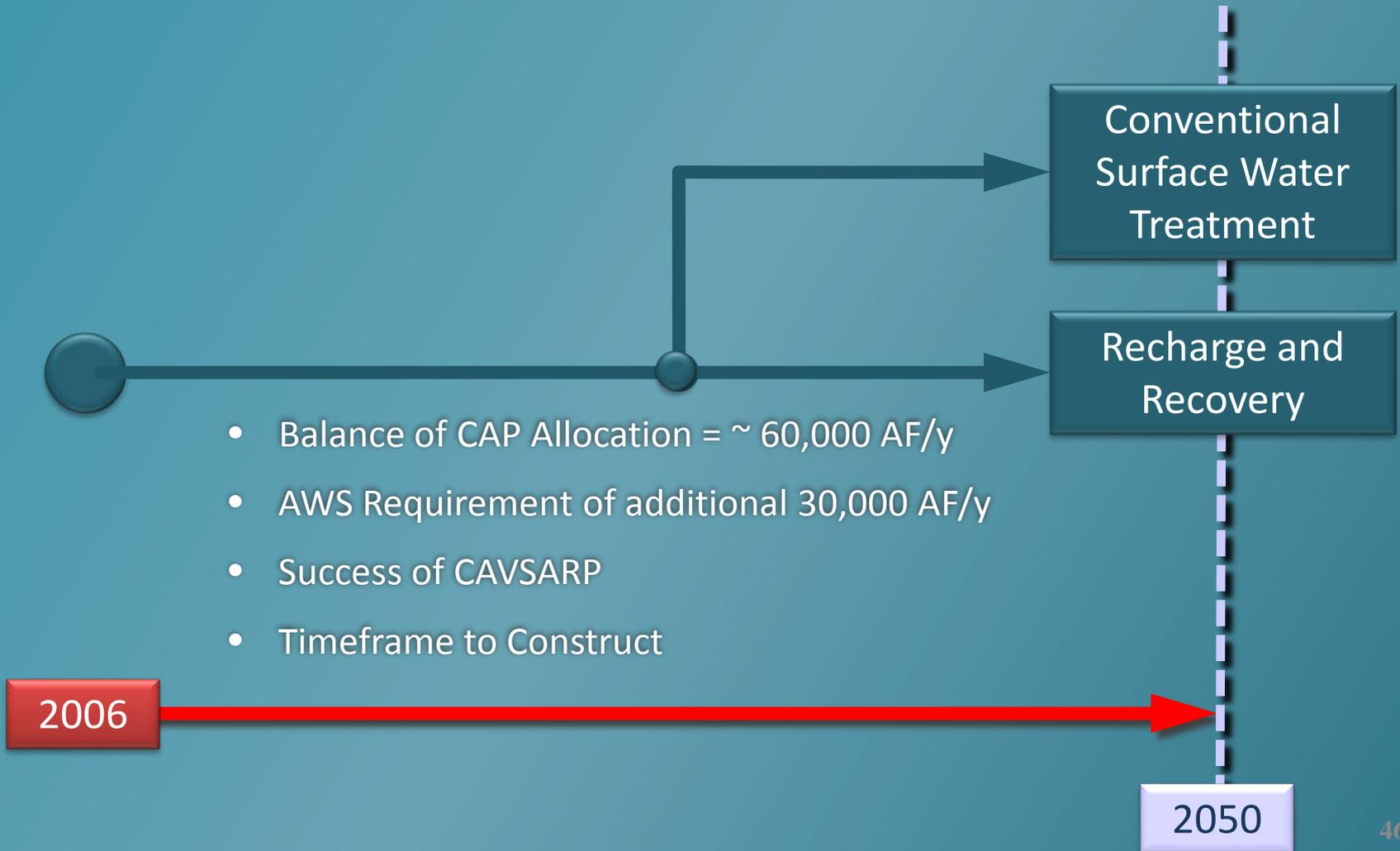
# Complexity of Futures



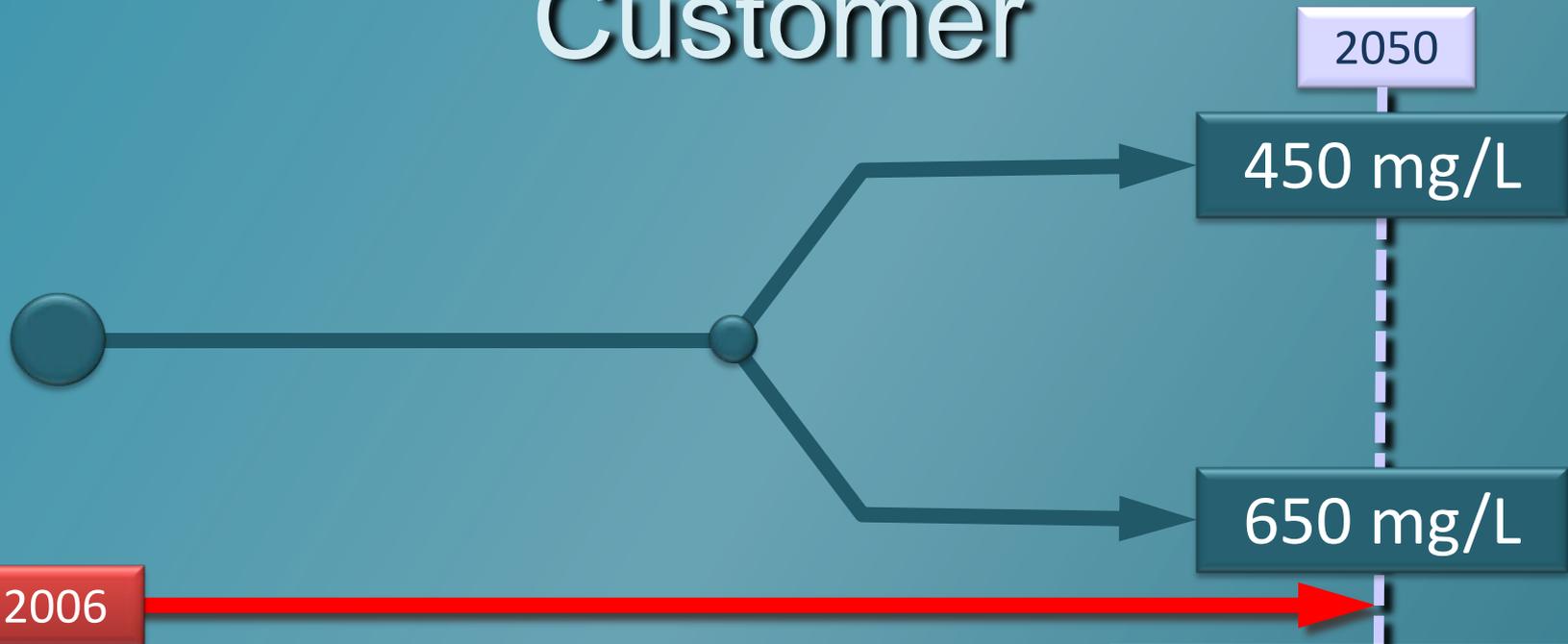
# Pathways to the Future



# Decision Point Method of Full CAP Use



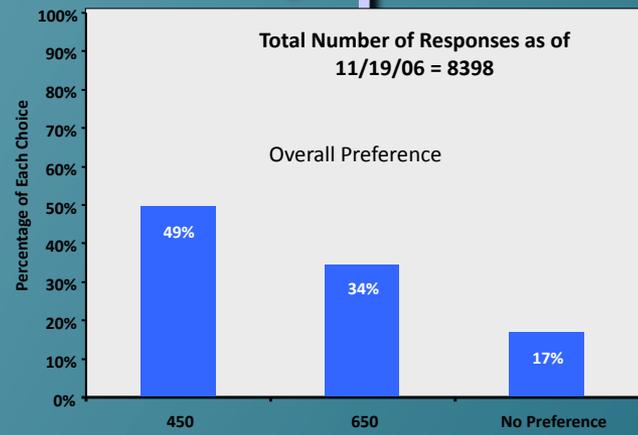
# Decision Point Mineral Content of Delivered to Customer



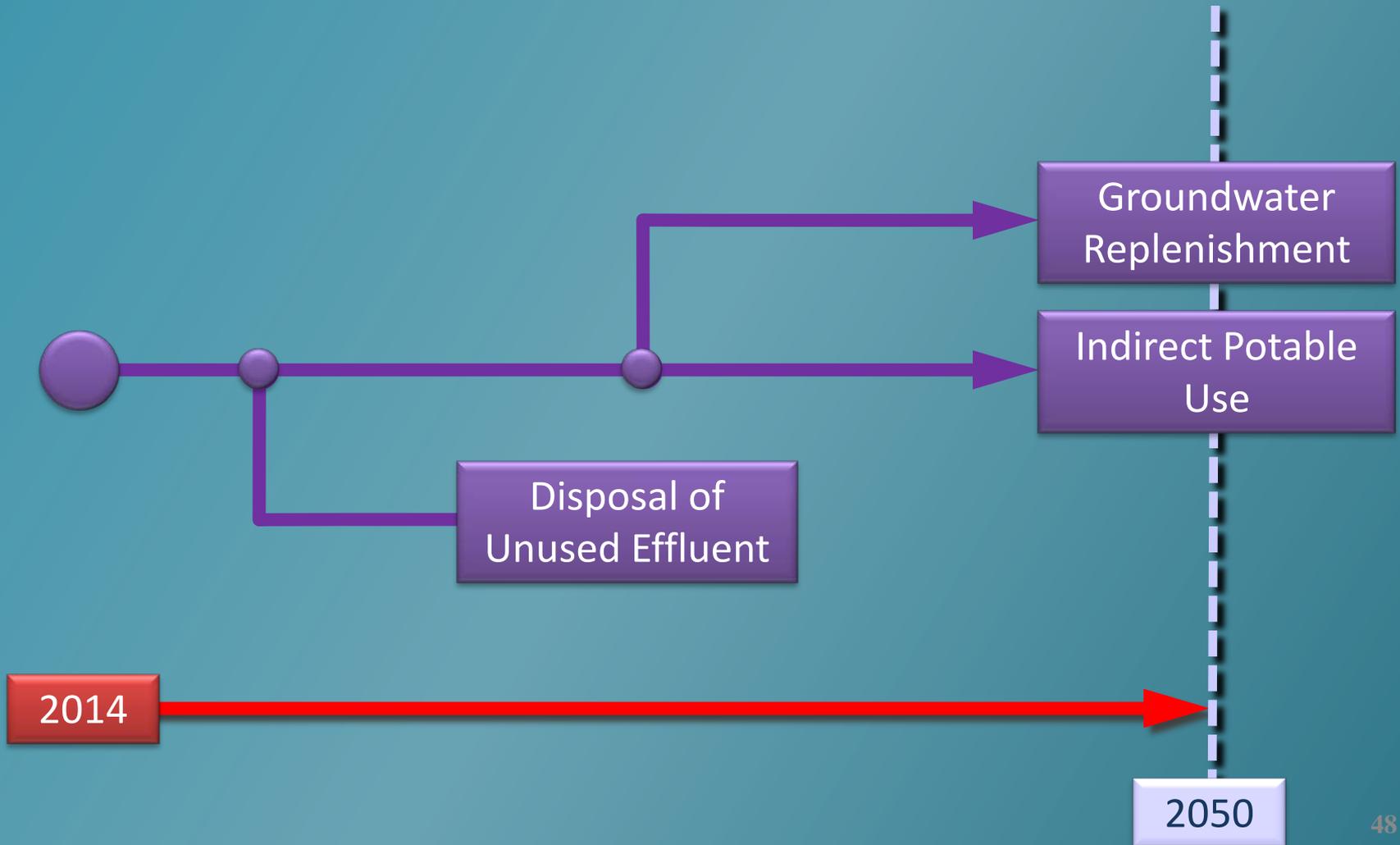
2006



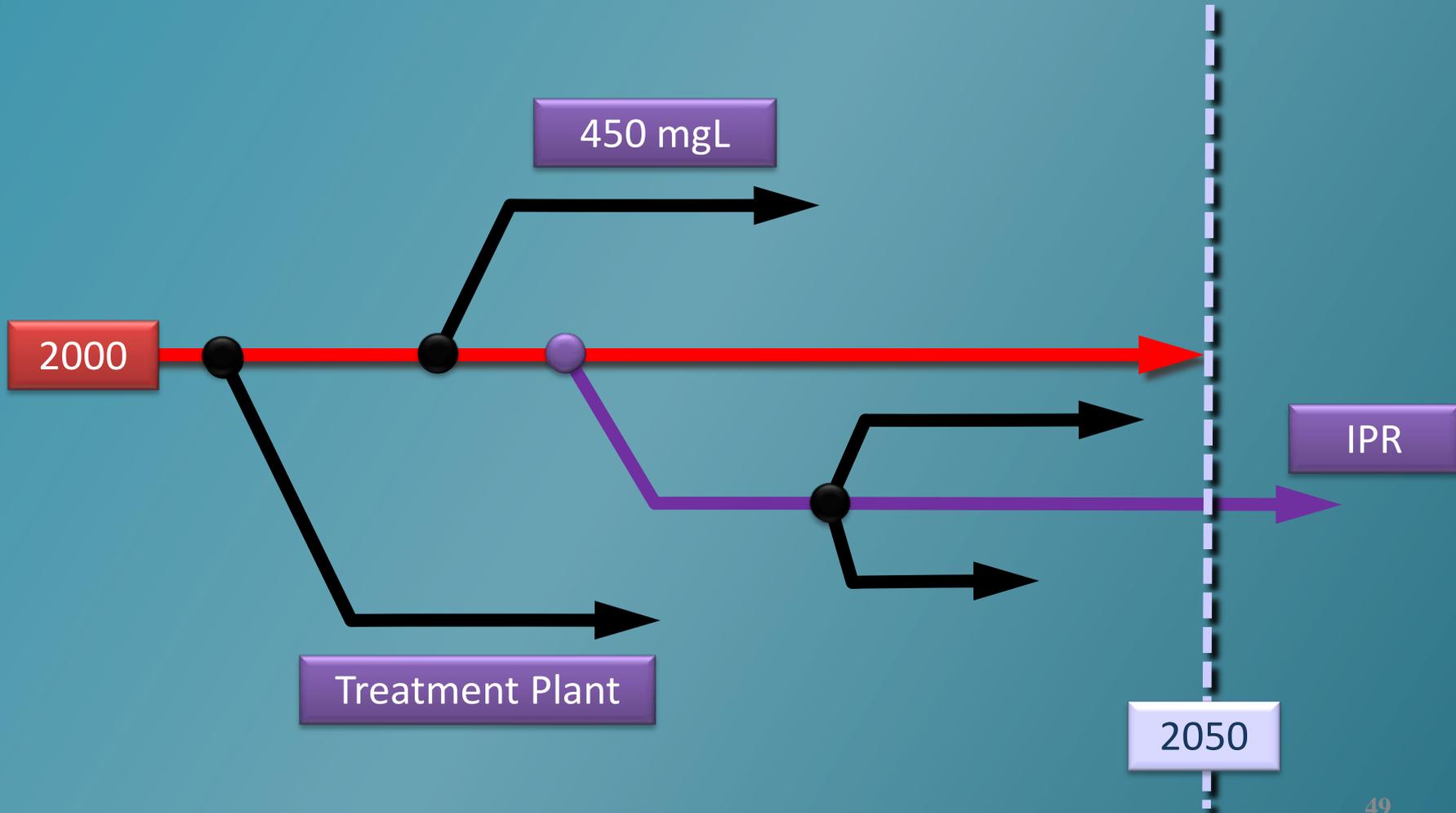
- Community Decision of Water Quality
- Forums and Taste Testing
- Results were inconclusive



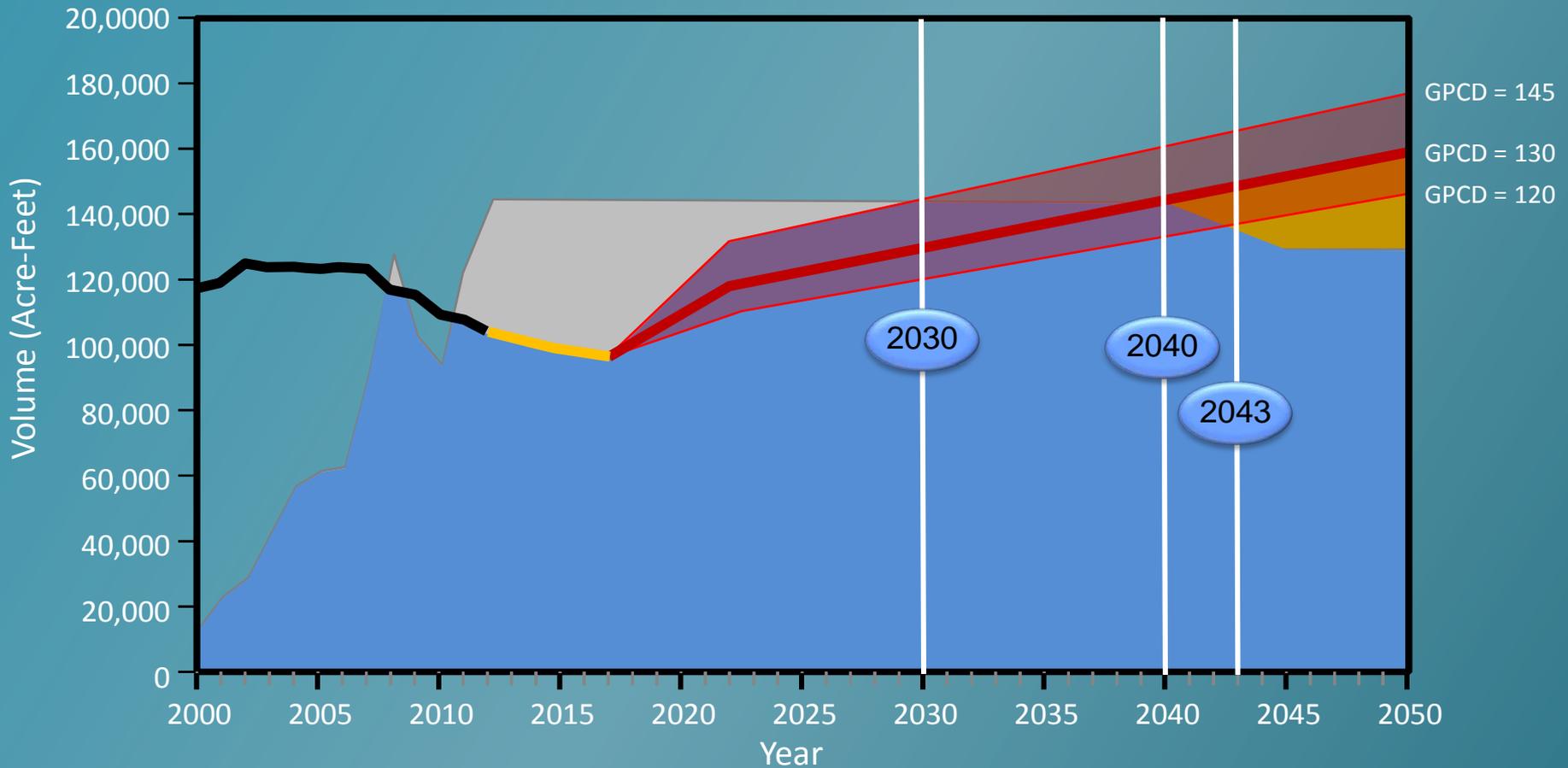
# Decision Point Full Use of Effluent



# Long Range Plan Timeline



# Potable Water Use - Projection to 2050 with Shortage



\* The population data was provided to TW by United States Census Bureau



# **Denver Water: A Scenario Planning Case Study**

**CRWU and WUCA Webinar Series  
October 9, 2013**



**DENVER WATER**

**Marc Waage and Lurna Kaatz**



Wyoming

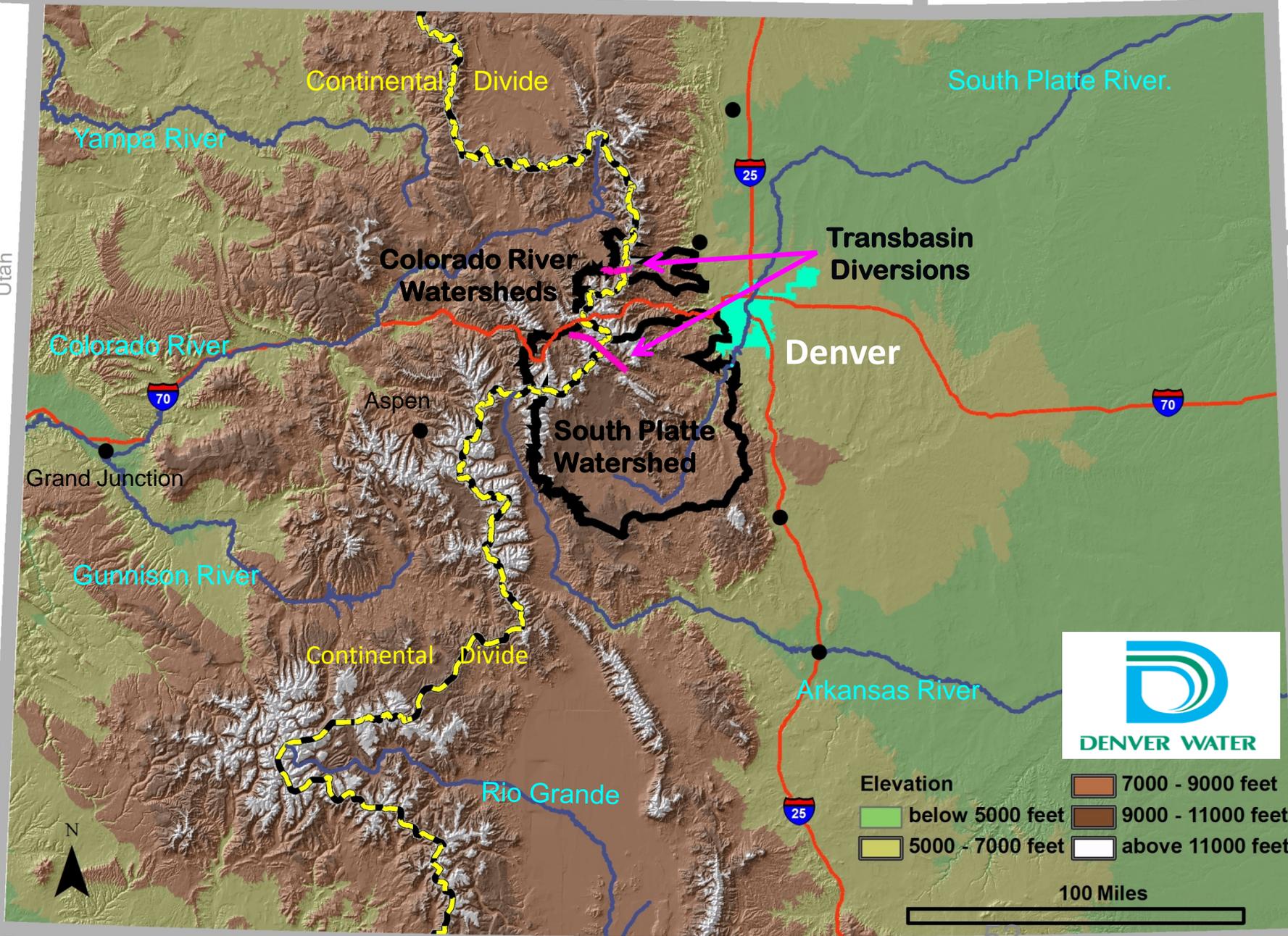
Nebraska

Utah

Kansas

New Mexico

Oklahoma



**Transbasin Diversions**

**Denver**

**Colorado River Watersheds**

**South Platte Watershed**



Elevation	
	7000 - 9000 feet
	below 5000 feet
	5000 - 7000 feet
	above 11000 feet

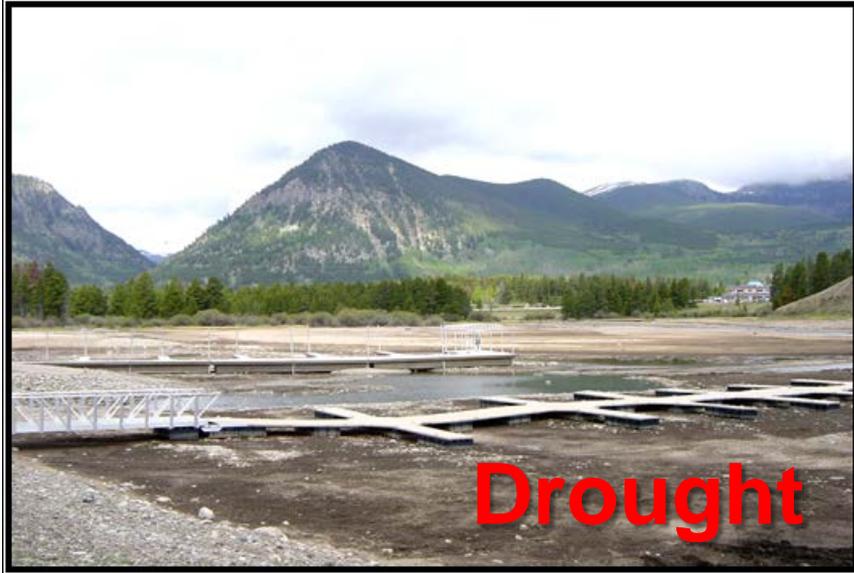
100 Miles



# Water Planning Challenges

**Groundwater Decreases**

**Climate Change**



**Drought**

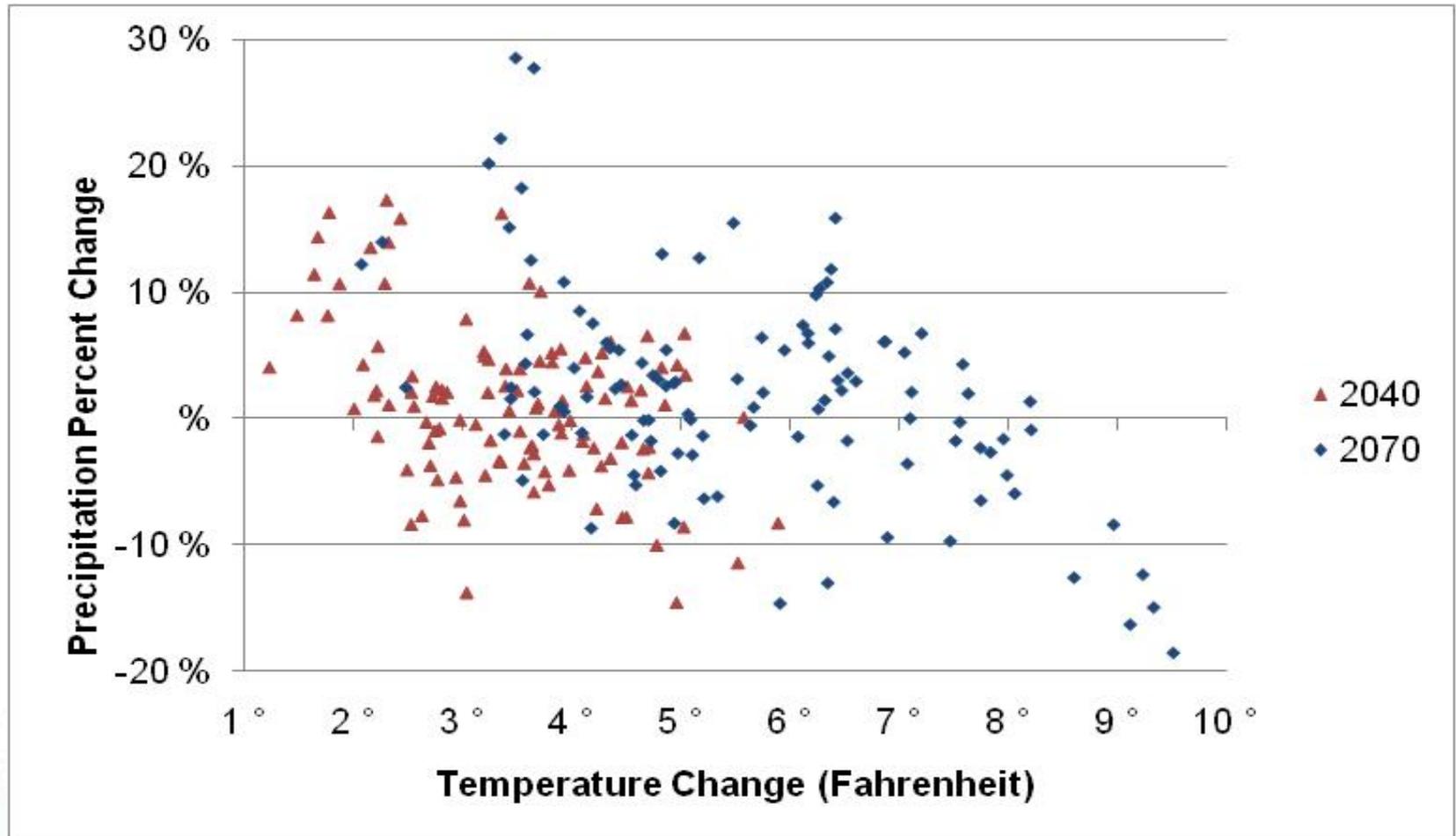


**Wildfire**

**Population Growth**

**Colorado River Compact Call**

# Projected Climate Changes for Denver's Watershed



# IRP 2010 Upgrades

- **Better address long-term uncertainties**
- **Incorporate triple bottom line analysis**
- **Plan across entire water system**
- **Add watershed management**
- **Inform 10-year capital plan**

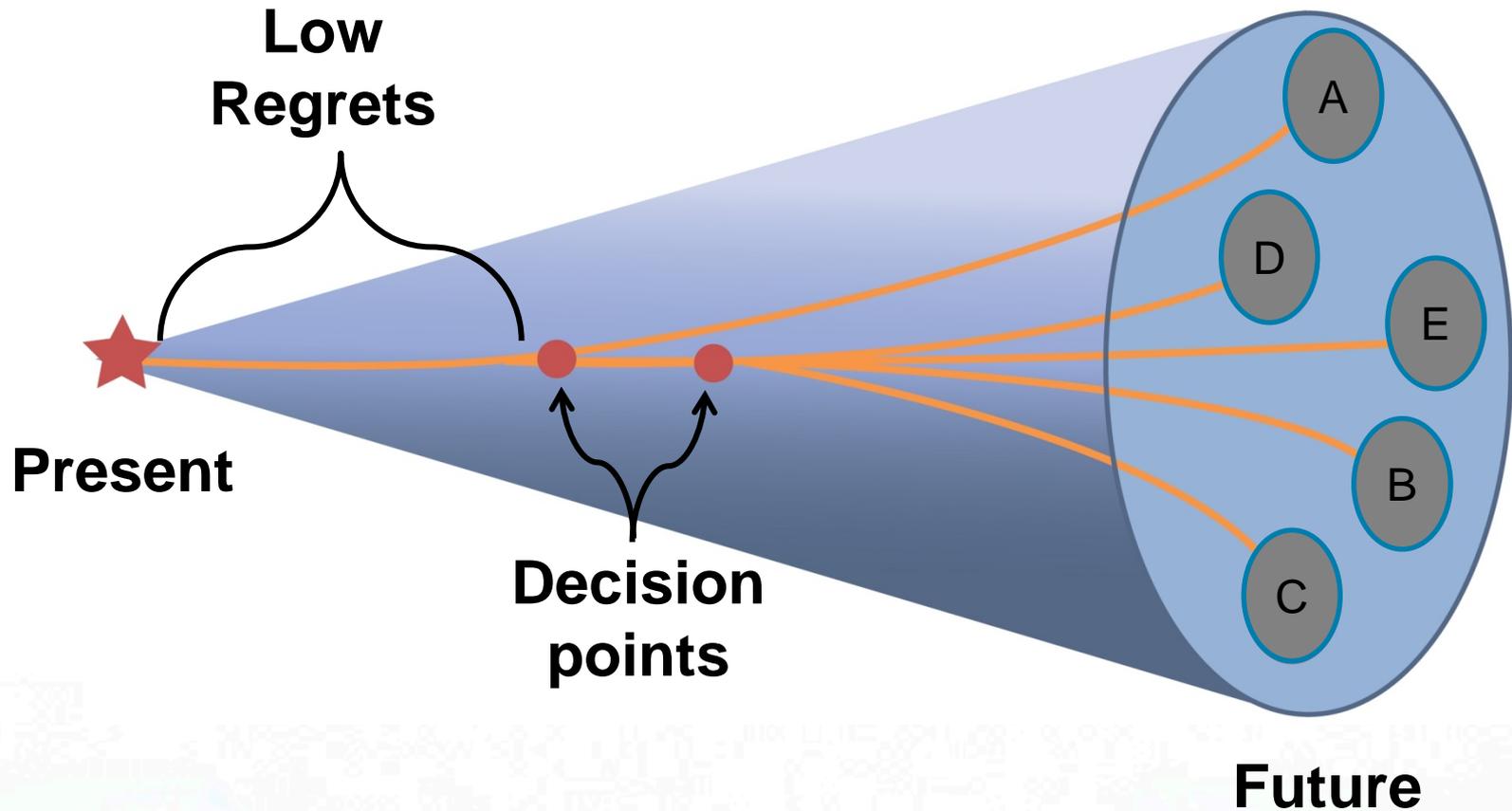


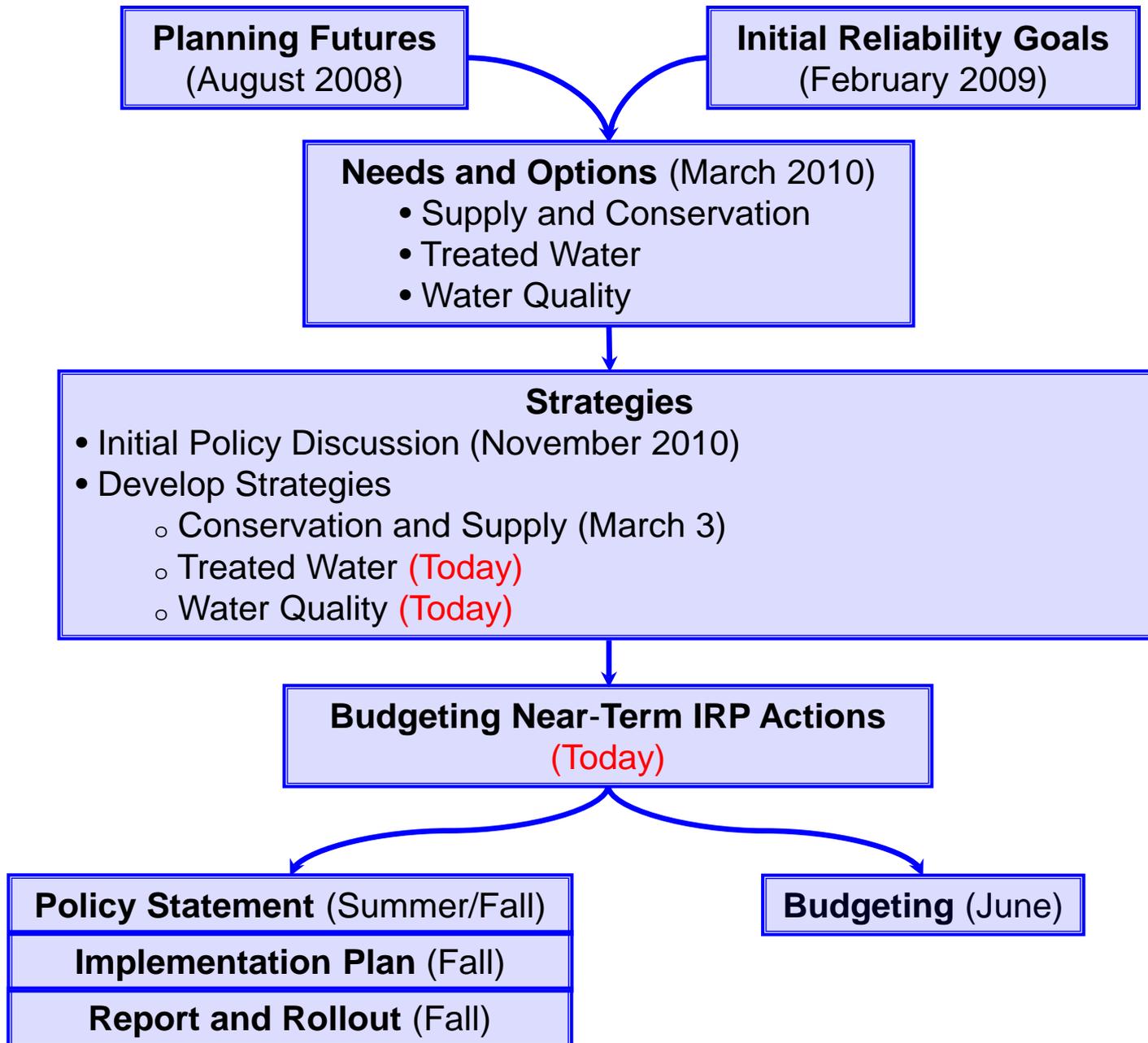
# Planning Futures

- **Traditional Future** - The future is extrapolated from past trends, few other unanticipated major changes occur.
- **Water Quality Rules** - The public demands the highest practical quality of drinking water. Contaminant removal and other drinking water requirements are extremely stringent.
- **Hot Water** - A warmer climate accompanied by more frequent and more severe droughts.
- **Economic Woes** - An ongoing energy crisis accompanied by a prolonged, deep economic downturn.
- **Green Revolution** - Environmental values and sustainable living become dominant social norms.

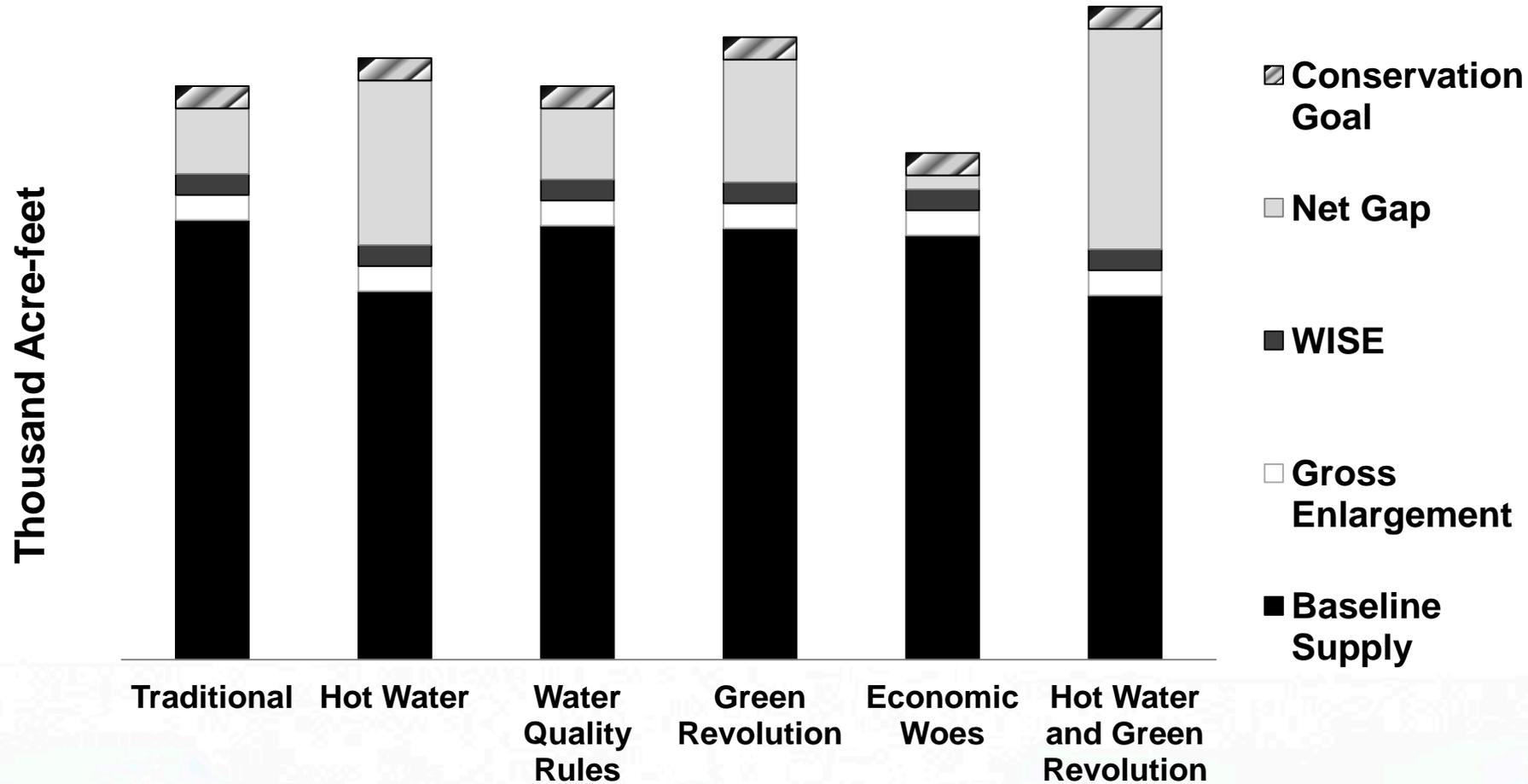
# Scenario Planning

## The Cone of Uncertainty





# Conceptual Supply Gaps in 2050



# Outcomes

- This is an evolutionary process to change thinking and better prepare for a range of future conditions.
- Keeping it simple helps the transition.
- Climate change is a major driver.
- No regrets planning has become LOW regrets planning.
- Identifying and preserving adaptation options is key.
- Flexibility and managing expectations are important.
- There is more analysis to come - robust decision-making.



# Lessons Learned in Scenario Planning

- Obtain explicit support from upper management
- Engage a wide range of subject-matter experts
- Allow for intense professional disagreements
- Keep the deliberative conversation moving and vitally alive—the Conversation is the Key
- Establish a smaller “core” planning team to reconcile differences generated in sessions
- Document what was done for those who follow
- There is some heavy lifting upfront in the process but it gets easier with revisions. Be sure to revisit and revise.
- Charting new courses is just the beginning. Implement what you learn.

# Climate Ready Tools & Resources

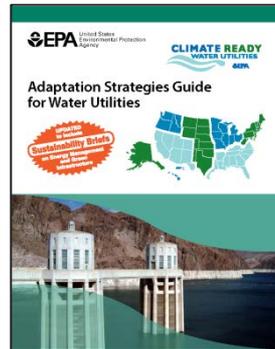
## Climate Ready Process

### Adaptive Response Framework



Explore Elements of Climate Readiness

### Adaptation Strategies Guide



Learn Climate and Adaptation Basics

### Toolbox

- Featured Resource**
- Region Map**
- Activities**
- Funding**
- Publications and Reports**
- Tools and Models**
- Training, Workshops and Seminars**

Research and Gather Information

### Extreme Events Workshop Planner



Collaborate with Partners

### Climate Resilience Evaluation and Awareness Tool



Assess Risks and Evaluate Opportunities



## *Connect with CRWU*

Please send questions and feedback to  
[CRWUhelp@epa.gov](mailto:CRWUhelp@epa.gov)

- Host pilot projects and exercises to improve and learn about available tools
- Share your success stories with CRWU and other utilities as part of future releases
- Visit EPA climate change page:  
<http://www.epa.gov/climatechange>

[www.epa.gov/climateredyutilities](http://www.epa.gov/climateredyutilities)



## *Upcoming Events*

<b>Topic</b>	<b>Date</b>
<b>Robust Planning to Support Decision Making</b>	<i>December 4, 2013</i>
<b>Bottom-up Threshold Analysis to Support Decision Making</b>	<i>March 19, 2014</i>
<b>Communicating Climate Change</b>	<i>Spring 2014</i>
<b>Financing Adaptation</b>	<i>Spring 2014</i>

**To register for these events and download resources, visit the CRWU website:**

**[www.epa.gov/climateredyutilities](http://www.epa.gov/climateredyutilities)**



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*Thank you*  
*Any questions?*

