A Practitioners Dilemma

Laurna Kaatz, Climate Program Manager, Denver Water

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Climate Change is Difficult

We are dealing with a *wicked problem*:

- Complex scientific components
- No solution that is positive across values
- Challenges fundamentally planning assumptions

A "wicked problem" is when...

uncertainty about future conditions (environmental, economic, and social) and differences in social and economic values make it impossible to define an optimal solution at all scales and in all domains.

Wicked Problems

Some problems are so complex that you have to be highly intelligent and well informed just to be undecided about them

Laurence J. Peter



The Denver Water Story

- Probabilities based on history
 - You know the risk and can maximize the return

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- Planning in a perfect world
- Traditional planning
- Shifting probabilities?
- What else could happen?





Projected Changes for Central Mountains in Colorado





"Revealing" uncertainties (Martyn Clark, NCAR)



What is the State of Science for Responsible Climate Adaptation???

DW Challenges

- Obligation to customers
- Risked loss of trust (or worse... your job!)
- Organizational buy-in

Scientific Inquiries

- What is the science telling us?
 - Warming
 - Variability
- What should we expect from science?
 - Precipitation projections?



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New Planning Techniques



- Life without probabilities
 - Spend time determining what will happen or focus on preparing for whatever happens?
 - Predict or prepare?



Embracing Uncertainty

- -Focus on tools and resources
- -Flexible, adaptive
- -Limits to what we can afford



Planners must determine how much, where, and when to make investments and changes

Goal: Robust adaptive strategies

- Low-regret near-term actions
- Conditions to monitor
- Decision triggers and longer-term actions







3-4°F with wetter winters, increased P



Inquiries to consider

- What do we need to know to be prepared?
- Are climate models and projections the right tools?
- Are we underestimating uncertainties?
- Does 'concreteness' blind decision makers to surprise?



Water Utility Climate Alliance



Vision: Climate-resilient water utilities, thriving communities Mission: Collaboratively advance water utility climate change adaptation

2017-2018 WUCA Projects



- Best Practices in Climate Adaptation
 - Defining climate adaptation
 - Phase 1:
 - State of the science for climate adaptation
 - BPs in climate assessment
- Business Process Mapping
 - Funding from WRF
 - Link to BPs



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Mainstreaming Observations:

Credible? Relevant? Legitimate?

Trust
Co-production
Understanding
Proof
Capacity





Portland Water Bureau Survey



A Case Study Examination of How Climate Change is Shifting Water Utility Planning



Prepared for:

Water Utility Climate Alliance (WUCA) American Water Works Association (AWWA) Water Research Foundation (WRF) Association of Metropolitan Water Agencies (AMWA)

Project Manager: Laurna Kaatz, Denver Water



Available at <u>www.WUCAonline.org</u>

https://www.portlandoregon.gov/ water/climatechange

Water Utility Built Assets and Infrastructure

A synthesis of interviews with national and international water utilities

WRITTEN BY: Kavita Heyn Climate Science & Sustainability Coordinator, Portland Water Bureau

Whitney Winsor Climate Planning Intern, Portland Water Bureau

Climate Risks to



Society for Decision Making under <u>Deep</u> Uncertainty



The Society is a multi-disciplinary association of professionals working to improve methods and tools in this field, facilitate their use in practice, and ultimately encourage sound decision making in our rapidly changing world.



Thank you





EXTRA SLIDES



Barriers to Climate Adaptation

- Politics and agendas
- Changing organizational priorities
- Stakeholders
- Immediate vs long-term
- Responsibility: Mission and Stranded assets
- Issues and actions are not black or white
- Vertical axis of uncertainty
- Careful who and what we ask for



