Water Utility Climate Adaptation and Resilience Planning: Some Guiding Principles

Joel Smith
The Challenge of Adaptation to Climate Change

• We cannot adapt to a specific forecast of future climate
  • At best we know the direction of change of key variables
  • Some key aspects are uncertain

• Challenge is how to make decisions about investments and other decisions with long lifetimes in light of the uncertainties?

• This situation is not unique to climate change adaptation

• There is a path forward!
Some Desirable Attributes of Adaptation

• Flexibility
  • The adaptation can accommodate different conditions by adjusting

• Robustness
  • The adaptation can withstand widely varying conditions

• Resilience
  • Classic definition concerns capacity to recover from shocks
  • In context of climate change has been used to also include withstanding shocks

• The terms are often used interchangeably in the climate change context
Two Guiding Principles for Adaptation

• Make decisions that work or function over a wide range of possible conditions; what is desired is:
  • Flexibility
  • Robustness
  • Resilience

• Consider Economics
  • Basically, benefits should exceed costs
  • Complicated when benefits (avoided impacts) may not happen or be much larger decades into the future
    • Discounting – do not spend a lot now to avoid risks many years from now
Other Approaches to Adaptation

• Win win
  • Aka “No Regrets.”
  • Look for adaptations that can be justified without consideration of climate change but help adapt to changing climate

• “Low Regrets”
  • Relatively small investments that provide some degree of adaptation
Adaptation Examples that Satisfy These Principles

• Incremental investments
  • Low cost adjustments to infrastructure
    • Can buy additional protection now and into the future

• Maintain options
  • Buy land on which can build infrastructure in the future

• Diverse portfolio of options (for example, supply)

• Use resilient or flexible management systems
  • Water markets are responsive to changing conditions
Transformative Adaptation

• Previous types of adaptation try to keep systems functioning as they are
  • May not work over long run
• In many cases more “transformative” changes are needed
  • Relocation
  • Change in livelihood
  • Change in behavior
• Transformation can be politically more challenging

Isle de Jean Charles, Louisiana
How Do We Assess Adaptation Options?

Two basic approaches:

1. Traditional assessment approaches
   • Often used to help identify an optimal solution

2. Deep Uncertainty approaches
   • Recognize “deep uncertainty” is part of problem and try to identify adaptations that can work across an array of possible outcomes
Traditional Assessment Approaches

Optimization Approaches

1. Benefit-Cost Analysis (BCA) - King of traditional approaches
   • Express all benefits and costs in common unit, typically money
   • Seek to maximize
     • Net Benefits
     • Benefit cost ratio

2. Cost-effectiveness
   • Seek the least costly way to achieve a common outcome

3. Multi-criteria assessment
   • It is typically applied where different metrics are used

4. Triple Bottom Line (TBL) splits out financial, social, and environmental benefits
   • TBL can be used in the above approaches

Traditional approaches work best when uncertainties are well-characterized
   • Can also be applied when they are not; for example, for individual scenarios
Challenge of Applying BCA to Climate Change

- Probabilities of outcomes are not known
  - There are no reliable probabilities on GHG emissions
  - Challenging with regional climate change
- Timing of impacts
  - How to assess risks to life and limb over generations
  - Property is more straightforward but even that has challenges

<table>
<thead>
<tr>
<th>Cost to adapt</th>
<th>Adaptation Benefits</th>
</tr>
</thead>
<tbody>
<tr>
<td>$$</td>
<td>$$$$$$$  ✔</td>
</tr>
<tr>
<td>$$$$$$$</td>
<td>$$$  ✗</td>
</tr>
<tr>
<td>$$$</td>
<td>$$$              ?</td>
</tr>
</tbody>
</table>
Deep Uncertainty

• Recognize climate change cannot be predicted – some uncertainties remain

• Philosophies
  • Risk Management
  • Adaptive Management

• Types of Adaptation
  • No Regrets
  • Low Regrets
  • Incremental Adaptation
Consider likelihood and consequence of outcomes

Source: Major and O'Grady, 2010
Philosophy: Adaptive Management

• Recognizes that we can make adjustments as conditions change
• Design systems/decisions so future conditions can be incorporated
  • Option to use land for investment in future such as a reservoir
• Examples:
  • Thames River barrier to protect London from storm surges over rest of century
  • MWD organized near-term investments in local supplies expecting some will need to expand and some be contracted as demand, regulations, climate, another factors change
• ASCE recommends adaptive management approach be applied
Other Key Factors Will Change And Should be Considered

- Population
- Income
- Technology
- Preferences/Culture

Key point is not to project these but understand how change in these and other factors can change vulnerability of a system to climate
How Precise Do We Need to Be in Our Projections?

Adaptations Often Incorporate Ranges or are Incremental

• Culverts can accommodate a wide range of flow and come in incremental diameters from 6” to 1’

• Decisions on sea level rise and flooding such as freeboard are often made in 1’ increments
Before You Jump In – Clearly Articulate…

● What is your endgame? What question(s) do you want to answer e.g., what variables, levels of confidence

● How will you get there?
  ○ Method – simple, sophisticated
  ○ Data – type, scale, magnitude of change, level of uncertainty
  ○ Tools – current, new?

● Will it be useful?

● New science?

● Messaging – internal, external

Source: L. Kaatz, Denver Water
Key Takeaways

• The challenge of anticipating climate change is making decisions in light of uncertainty
  • Note: that is the challenge of anticipating any future change
• Uncertainty approaches are better suited to identify and assess options for anticipation of climate change
  • Adaptive management, risk management
  • No regrets, low regrets
  • Incremental, modular (scalable), diversification
  • May need to transform systems.
• Other factors besides climate are also changing and can be relevant
• You need to take an active role in decision making process
  • Tell the scientists what information you need