Community Resilience in Uncertain Times: A risk management perspective

"Tomorrow's Clean Water Utility… Is the Future Already Here?

NACWA Winter Conference
February 3-6, 2013

Discussion points

- **Review of risks to resilient infrastructure**
  - Overarching uncertainty and costs of changing climate
- **Overview of a tested approach and tools to manage risk and uncertainty**
- **Some examples**

Today's utility faces today's… and tomorrow's risks

- Traditional agency organization
- Emerging integrated utilities
- Regional integration options
- Community engagement
- Environmental Justice
- Financial capability
- Green infrastructure options
- Wet weather
- Emergency resiliency
- Energy production
- Reuse/ resource recovery
- Nutrient management accountability
- Population change
- Land use change
- Decision processes
- "Failure to Act"

Super Storm Sandy: *Bellwether of our risky future*

- **Perfect storm**
- **On heels of Hurricane Irene**
- **Significant tidal surge along east coast**

Image courtesy USGS

Super Storm Sandy: *Bellwether of our risky future*

Overarching and strongly influencing our existing challenges…

Climate change affects the water cycle

- **Temperature**
- **Precipitation**
- **Sea level change**
  - Storm surge
  - Ice and snow melt
  - IDF curves
  - Flooding and drought

What are the costs of climate change?
Cost for addressing climate risk- variable and BIG

Source	$ US Billion per year , current to 2010-2050
World Bank (2006)	9-41
Stern (2006, 2010)	4-37
UNDP (2007)	5-67
UNFCC (2007)	2-41
Parry et al. (2009)	~2-3x UNFCC
Stern, World Economic Forum, Davos, January 2013	*"I got it wrong on climate change—it's far, far worse"*

Closer to home: NACWA-AMWA report to Congress illuminated potential costs climate change-related W and WW utility costs through 2050

SUMMARY
Drinking Water = $325 - $692 billion
Wastewater = $123 - $252 billion

GRAND TOTAL
Drinking Water
and Wastewater = $448 - $944 billion

Does not include ~ $500B in estimated infrastructure needs already identified by EPA not specifically related to climate change, nor emergency response costs.

Considering the economic, social, and environmental consequences of our changing climate can be daunting

But needn't be overwhelming

The water community—in fact, all communities across sectors, need a

- Scalable
- Flexible
- Consistent
- Transparent
- Scientifically defensible approach

to assess and address climate risk…

that can be conducted in a timely manner—not decades

A tested, transparent, scientifically defensible, timely process for assessing and addressing risk and resiliencey exists

What infrastructure, operations, services, human health and safety, environmental, policy,and interagency issues should we consider to develop a resilient future?

1. *Determine Goals*

   identify overarching questions and goals driving resilience planning and implementation

2. *Identify and Assess*

   infrastructure and operations that now influenced by climate variables (temperature, precipitation, sea level rise, extreme events)

3. *Determine How*

   climate is projected to change locally using State-of-the Science expertise and models: i.e. CLIMsystems' SimCLIM

4. *Assess How*

   the projected changed climate will affect infrastructure and operations determined to be influenced by climate variables

5. *Identify resiliency solutions*

   or portfolios of solutions and prioritize based on risk/cost , and policy considerations

Continue process for more in depth assessment of risk levels and resiliency solutions for other important infrastructure

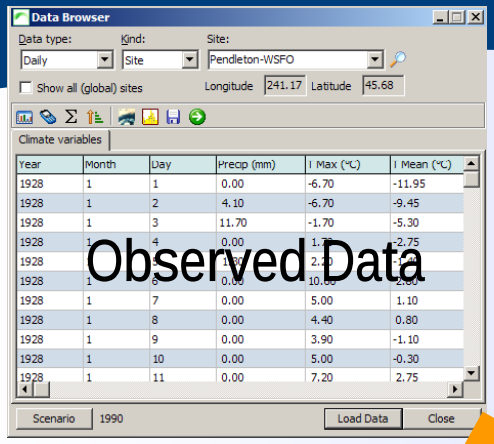
Our approach and CLIMsystems' SimCLIM quickly translate complex science to local, regional climate risk

Local-Regional Impacts

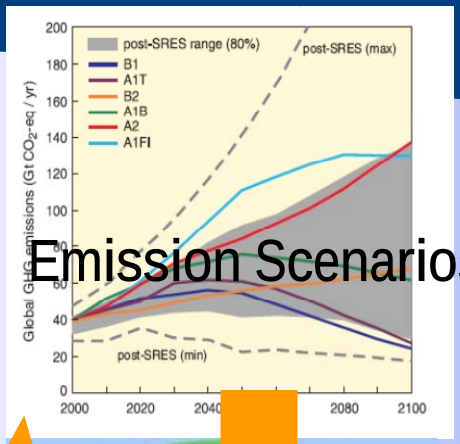
Global Climate Science

SimCLIM Bridges the Gap: translates global science to local action

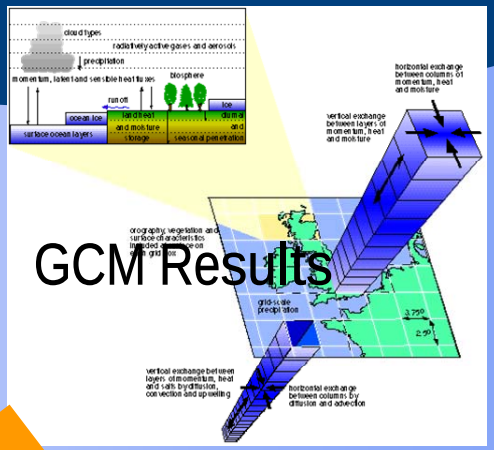
SimCLIM Input and Output



Observed Data

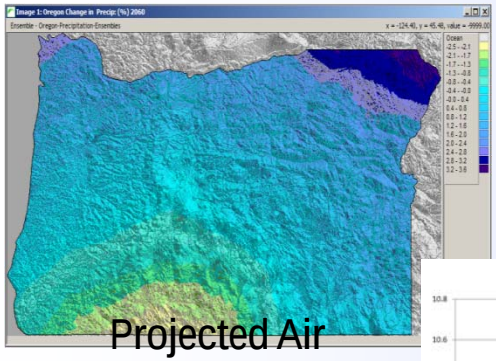


Emission Scenarios



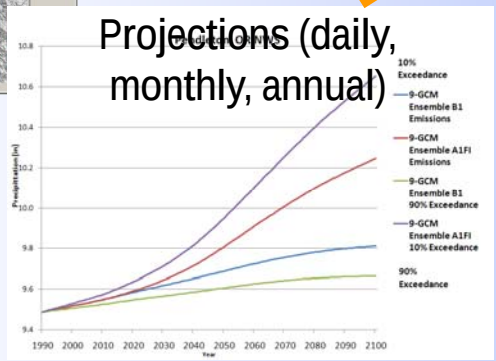
GCM Results

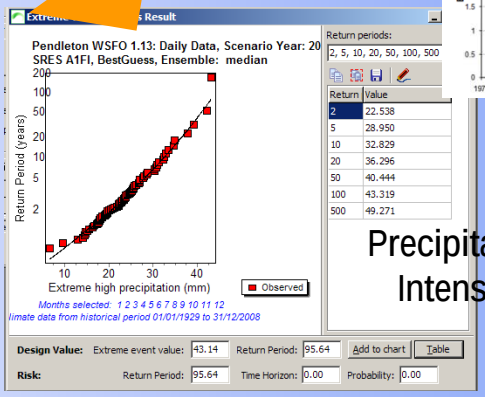
SimCLIM



Projected Air Temp/Precip. Patterns

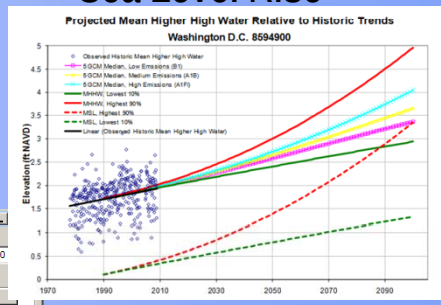
Local Time Series Projections (daily, monthly, annual)





Precipitation Intensity

Sea Level Rise



IPCC AR5 Patterns Available

Where has this basic approach been tested?

- **CH2M HILL and our partners have used and are using this approach on multiple large strategic risk and resilience planning and infrastructure projects**

- **Easily customized for any scale or set of local requirements-technical or political**

Climate change impacts on NYC drainage and sanitation system

- **Potential climate and population change impacts on drainage and sanitation infrastructure resilience.**
- **Analyzing potential conditions for this century, under two climate scenarios**
- **Sea level rise, rainfall and temperature**
- **Vulnerability analysis (street flooding and sewer spills):**
  - Hunts Point WWTP
  - Flushing Bay Watershed
- **Screening and analysis of adaptation options:**
  - Developing framework for Citywide adaptation planning

North Carolina sea level rise risk management

- **State of North Carolina study of sea level rise and storm impacts on coastal flooding and erosion.**
- **Halcrow advised on the overall study framework, bringing experience/lessons from international climate adaptation work**
- **Study scope includes:**
  - 100-yr sea-level & storminess scenarios
  - Landform response
  - Flooding and erosion
  - Damages & economic impacts
  - Ecosystem impacts
  - Social vulnerability
  - Adaptation recommendations

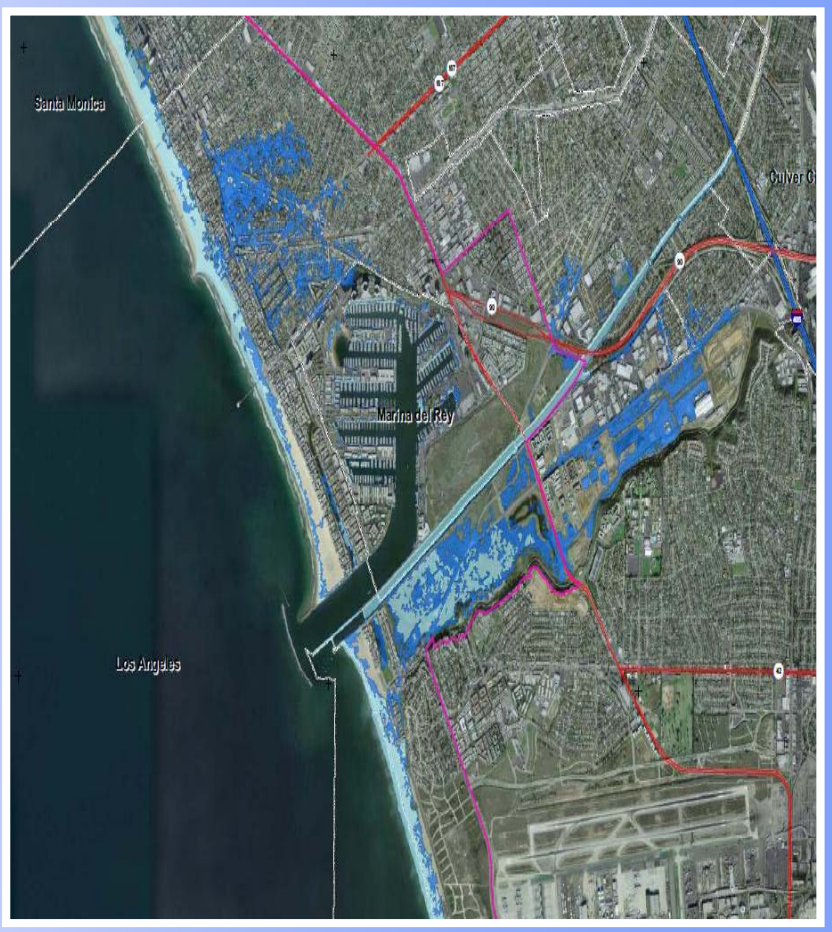
Climate risk planning keeps Alexandria, Virginia above water

- **Increasing extreme events flooding, storm surge in Alexandria**
- **Plausible future scenarios, SimCLIM, and local data for 2050 and 2100 climate risks:**
  - Sea level changes
  - Changes in extreme events- IDF curves
- **Sizing and redesign of storm sewer infrastructure**
- **Developing grey AND community-focused sustainable green infrastructure adaptations**

Hurricane Isabel flooding, September 2003
Photo Credit: Mark Young/The Journal Newspapers

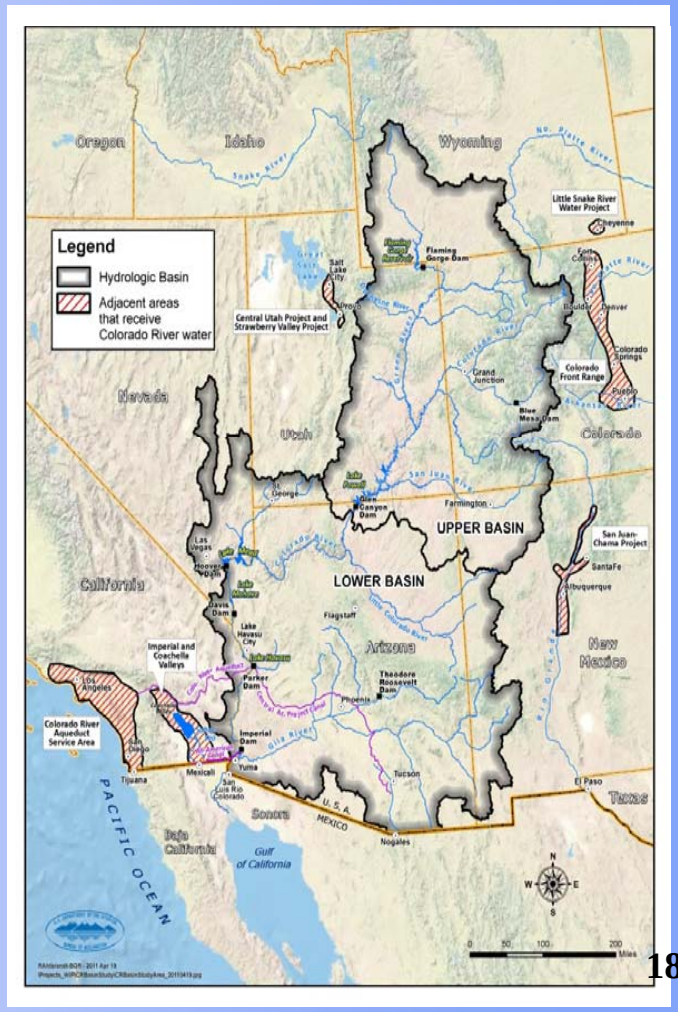
LA Bureau of Sanitation: Risk and resiliency analysis for City-wide drainage and sanitation infrastructure

- **Effluent water quality**
  - Changes in maximum temperature and other environmental variables
  - Potential for more stringent effluent limits
- **Infrastructure and operations, policy, and community resiliency**
  - Sea level rise and storm surge in coastal areas
  - Outfall elevations
  - Increased inland flood events
  - Critical infrastructure and service at risk



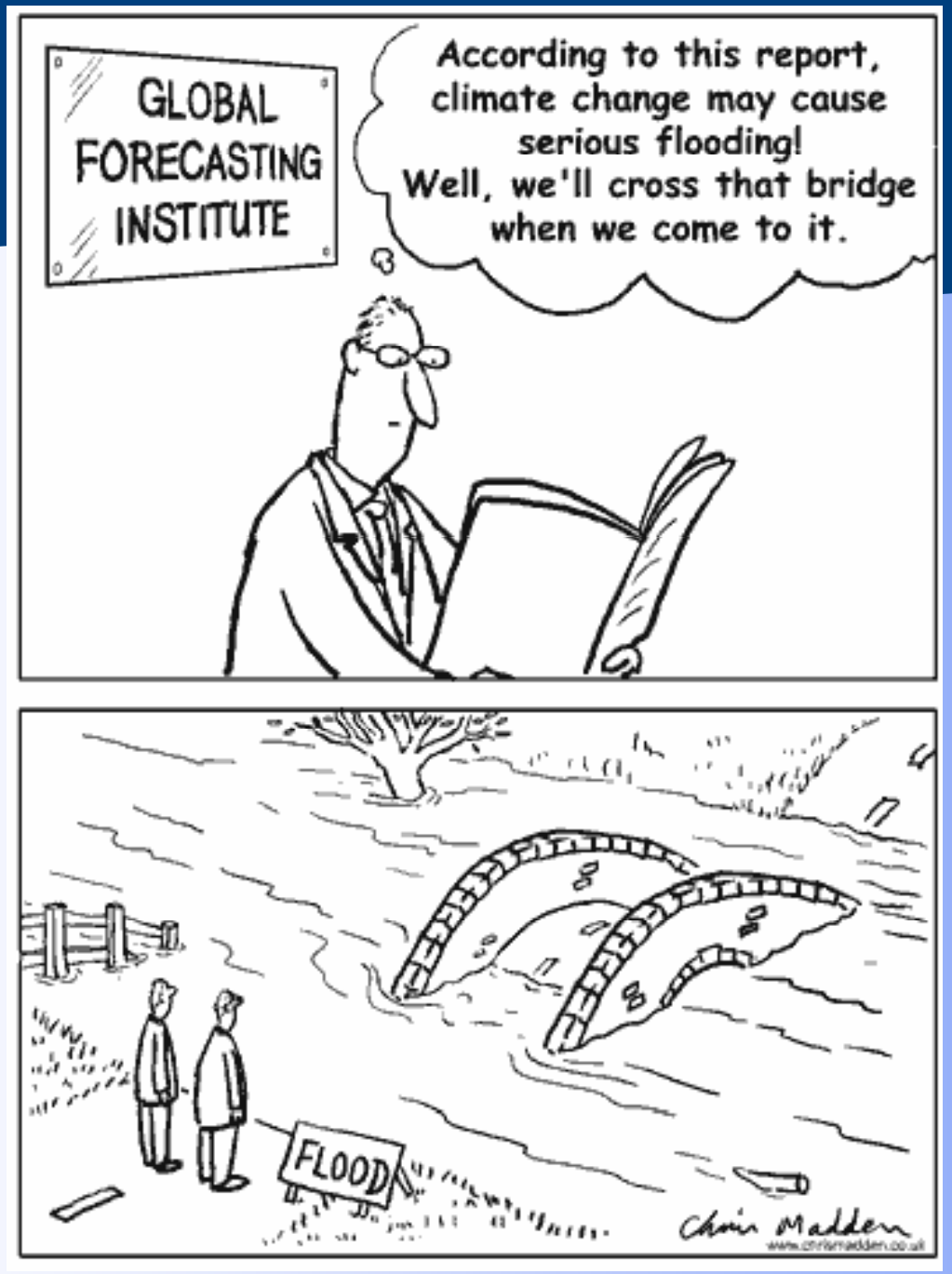
CH2M HILL leading consultant team for the climate risk assessment and adaptations for the Western US: Colorado River Basin Study

- **Colorado River System:**
  - 30MM people: M&I, agriculture, hydropower, Native American tribes and communities, ecosystems, recreation
- **Supply and demand imbalances exist and are increasing- related to climate change**
- **Stakeholders,USBR, and 7 states**
  - developed plausible future scenarios through 2100
  - identified highest service risks
  - identified and tested more than 50 potential adaptation projects
  - Working with utilities, communities, tribes, states and fed to prioritize and synergize implementation



Summary

- Risk and resiliency are today's and tomorrow's challenges
- Multiple, inter-related impacts affect community function and economic resilience
- Impacts and costs are uncertain; are projected to grow
- CW agencies can be the leading-edge unifying force for integrated resiliency solutions
- Scientifically defensible, transparent, flexible approach and tools exist to expedite understanding and managing risk and uncertainty to create a more resilient future.


GLOBAL FORECASTING INSTITUTE
According to this report, climate change may cause serious flooding!
Well, we'll cross that bridge when we come to it.
FLOOD
Chris Madden

CH2MHILL.

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