Climate change and the challenges for water supplies

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1. First step – acknowledge that we don't have good projections for localized effects.
2. General expectations for our region affecting water purveyors (IPCC, USEPA)
    a. Hotter, earlier spring onset, higher evapotranspiration (ET), temperature spikes in summer more frequent
    b. Maybe more precipitation (and probably more as rain), but maybe not – IPCC sees as likely but less certain than temperature increases, with increased annual stream flow possible but with increased seasonality.
    c. EPA suggests precipitation more concentrated in more intense storm events.
3. Rough, generalized, potential, possible, relevant implications for water supplies
    a. Summer water demands likely to increase.
    b. ET up, but so is precipitation – balance for stream flow? Models suggest higher annual flows, but more frequent low flows. If precipitation higher in winter but not summer, ET impacts are amplified.
    c. More days where recharge possible (ground not frozen), but also more days where soil moisture deficit might exist – balance for recharge?
    d. More rainfall in storms can overcome soil moisture deficit during warm season when recharge usually low due to ET, but more ET – balance for recharge?
    e. If temperatures are up, how will vegetative cover change? ET, stream flow and recharge impacts?
    f. More runoff due to higher rainfall and more storms, but lower stream base flow possible if ET is up and recharge is down – balance for reservoirs?
    g. Higher temperatures and lower low stream flows – effects on coldwater ecosystems? EPA suggests more algal blooms in streams, more hypoxia, changing toxicity for some pollutants.
    h. More intense storms – impact on surface water supply treatment needs? Or physical impacts on treatment plants in flood plains?
4. What do water purveyors need?
    a. Knowledge sufficient for operational, institutional and program decisions – risks, choices, cost-benefit, time frames for action, etc.
    b. Public willingness to absorb costs (economic, social, individual) of change
    c. Clear regulatory objectives – drive planning, facilities, improvements, rates. Issue not so much perfect direction, but specific and useful.
5. Water purveyors have some, limited ability to benefit the global warming equation
    a. Treatment plants increasing energy use as treatment standards raised, but working to decrease energy use as treatment tech improves. EPA sees energy use as key role, and water conservation the best focus. Triple win by reducing energy use to collect, treat and deliver water (purveyor), to use it on-site (customer), and to treat the resulting wastewater.
    b. Purveyors generally react to development, don't guide it. Can serve both smart growth (compact and efficient development) and dumb growth (low density suburbs). But available supplies restrict or allow growth.
    c. Conclusion – purveyors are global warming "impact takers" and must cope

6. Key concerns for purveyors
    a. Potential loss of supplies – reduced safe yields or aquifer dependable yields
    b. Increased demands driven by increased irrigation needs, etc.
    c. Increased competition for water from other water users (power, agriculture)
    d. Increased competition with ecological needs
    e. Increased treatment needs and costs
7. Priorities for coping with inconclusive results
    a. Get better results! Models that allow scenario testing. Some exist, especially modern safe yield models. What if the drought of record isn't a useful guide?
    b. What are the major limiting factors, the most sensitive variables?
    c. What are the costs of indecision and of decision?
    d. Utility infrastructure has long life span – Most cost effective to incorporate adaptive functionality whenever other major changes are needed. Do the easy stuff immediately, especially when it has ancillary benefits.
    e. Protect what we have – a lost water supply is <u>always</u> negative
    f. Every policy has two parts – risk assessment and risk tolerance
    g. Every policy exists in a context – no policy is an island. Interrelationships will increasingly dominate policy choices. Watershed management. Smart growth and smart preservation.
    h. All policies have costs – even a policy to change nothing
    i. A basic problem is that we haven't solved the problems of the present, such as understanding the water needs of ecosystems. Climate change poses a compounding of issues for water supply.