AGENDA

WSAC Planning Subcommittee

Friday, April 10, 2015

Attendees: Rosemary, Heidi, David B, Doug, Sue (Special Guest), Nicholas, David Mitchell, Bill Faisst, Carolyn Wagner (Stratus), Erica, RIck
Apologies: Mark, Sid, Peter

Meeting Desired Outcomes:

- Agreement on any additional actions to take regarding modifications to the assumptions underlying the interim baseline forecast
- Agreement on one or more potential criteria related to community character to work on developing for inclusion in the MCDS portfolio criteria
- Updates on the technical work plan and the enrichment series.

1. Follow-up discussion with David Mitchell regarding questions on the interim demand forecast -- See attached materials with various questions and responses provided to date – hear from David about most recent set of questions received.

- **(See detailed correspondence attached to this agenda for full context.)**
- **University**
    - **Discussion of graph (handout); [NEED HANDOUT ELECTRONICALLY]**
    - **David reviewed his revised work**
    - **Rosemary reported that UCSC has not really been responsive to our request for additional water-use projection information**
    - **Propose to use revised ("straightline") projections as High and Low bounds. If we need an interim point, we would use the average of the two.**
    - **Takeaway: UCSC will achieve its growth targets, but on a timeline that is uncertain and unpredictable.**
    - **Discussion of whether 349 MGY is really the ultimate target.**
        - **Trying to make the case that there is a lower lower-bound.**
        - **Rick asserted that LAFCO or the City may well be within their rights to assert a water-neutral requirement (though there is question about LAFCO jurisdiction).**
        - **Rosemary and David B asserted that LAFCO has no jurisdiction over UCSC growth within the existing service area and that we are obligated to provide UCSC's water needs within that existing service area.**
    - **Adopted the revised range, with Rick standing aside.**
- **Income Adjustment**
    - **Discussion of whether to use CalTrans or locally-sourced growth data for SC County.**
    - **David would plan to take into account that we develop a range, differentiated by income-growth assumptions. CalTrans as high end; local data as low end (lowered "considerably", even as far as no growth).**
- **Drought Rebound**

- **Discussion of local behavior v the literature, as evidenced in consumption data.**
- **David noted that it's not a "controlled experiment" – that there are many confounding factors that enter in, and that it's difficult (if not impossible) to isolate for a single factor. That said, he will do the work to see what the data show about local rebound effects.**
- **Discussion of permanent changes that result from drought that are captured in the model:**
  - **Plumbing code changes and adoption**
  - **Steady price increases (drive technology adoption – appliances, etc.)**
  - **Landscape change outs (largely driven by price)**
  - **Rebates essentially accelerate these considerations; model contemplates this**

2. Update on work of Working Group on peak season demand reduction

Sue reported on and inquired about the Peak Season Demand working group.

- **Three streams of thought relating to conservation**
  - **Maddaus DSS and Peak Season work clarity / transparency**
  - **Conservation actions underway and planned**
    - **Includes content and implications of Baseline Survey**
  - **Capitalize on and interpret Gene Bregman's survey as regards public interest**
    - **Would require some more-detailed analysis of crosstabs, etc.**
    - **E.g., 85% are doing "about as much as I can", while there is high tolerance for complying with current curtailments on an ongoing or frequent basis**
      - **Some discussion of how "firm" that attitude of continued conservation really is**
- **Proposal to have a one-hour public enrichment session to present / discuss this material before or circa April/May meeting.**
  - **Targeted at public and committee.**
  - **Sue would work with Toby ahead of time.**
  - **Discussion about staff availability given the timing and planned travel, and publicity opportunities to drive attendance, and time-of-day scheduling**
  - **Committee to consider a later date**

3. Discussion and agreement, if possible, on creating one or more portfolio level criteria related to community character – goal would be to brainstorm and discuss possible criteria and then some additional work would be done to further develop the criterion for discussion at the 4/24 Planning Subcommittee meeting. (Resource Document: Excerpt of the City's General Plan attached to the email conveying this agenda)

- **Rosemary expressed concern about lack of "qualitative" community character criterion in the MCDS.**
- **For today, discussion of purpose of such a criterion**
- **Nicholas shared that the community and the Cttee have interests that diverge between driving demand down as low as practicable v supplying as much water as we want**
  - **Without specific criteria to "vote" about this, these interests can't be surfaced**
- **Tension between explicit calls in the GP for drought-tolerant landscaping v values of choice and diversity throughout the document.**

- **Discussion of whether the community character is essentially captured in the GP-based water demand baseline estimates**
- **Discussion of whether the community character really constitutes a foundational element of the decision process, and must be day-lighted in our portfolio / scenario work. Could do this without a criterion, but would characterize the outcomes in terms of community impacts (curtailment, etc.).**
- **Discussion of how the Cmte's recommendations are likely to look – adaptive pathways of portfolio(s) against scenarios.**
- **Rosemary to work in a full Cmte discussion into upcoming agenda (April / May, aspirationally).**
- **"Green canopy" consideration, as regards air quality considerations as we propose changes to community character.**

4. Technical Work Plan update

Technical Team reported as follows:

- **"Punchlist" of items from March scenario exercises, etc.**
- **Gary has added a Virtual Reservoir into the Confluence model, in order to allow us to model additional g/w or surface storage.**
- **David B asked for CAs to include considerations about technical feasibility such as needs for pilot plants or studies, and information as to the time line for getting alts functional, etc.**
    - **Bill noted that the Team is adding rough timeline and feasibility information to each of the CAs (feasibility, construction/on-line, regulatory (CEQA), risk assessment, etc.). This should be responsive.**
- **Further discussion of interaction between Alts investments and CIP to identify areas where items already in CIP can be leveraged to save costs on the Alts; need to take this into account in budgetary planning.**
- **Discussion of CCA – Community Choice Aggregation – and energy implications**
    - **Cost and GHG implications; in context of Climate Action Plan**
    - **Timing of coming online**
    - **Would like to add this to enrichment**
- **Further discussion of energy footprint considerations**
    - **Provisional approach: provide information about energy use of each CA; deal with amelioration at the portfolio level**
    - **Also, opportunities as part of CIP/Alts – e.g., micro- or in-line hydro.**
- **Maddaus work review (Carolyn)**
    - **Carolyn trolling through the entire DSS portfolio to identify assumptions, overlaps, etc. Eye on this is to improve transparency.**
    - **She will get a "design memo" to Sue and Doug, describing her proposed approach to the DSS review of Sue and Doug's comments.**
    - **Discussion of Program C duplication / over-counting – work will be done to get this ready for April/May.**
    - **Sue brought up a simplified tool that David Mitchell created for the Alliance for Water Efficiency. May be useful as a "check" against DSS, but not a replacement for it. David's model is more simple and approximate.**
- **David B reminded that Tech Team needs to provide a written update to WSAC at/for April/May meetings.**
- **Erica mentioned idea of "you solve the gap", a la the March scenario exercise.**

- **Tabled for now.**

5. Enrichment series update
   - Feedback on Climate Change Forum

   - **General feedback and discussion.**
   - **Bill F to provide some literature on fog.**

6. Other Committee business/Topics for April 24 Planning Subcommittee meeting
   - Follow-up work on community character MCDS portfolio criterion
   - Tentative – Alts Criteria Ratings for CAs
   - April 30/May 1 WSAC meeting agenda review
     - **Business concentrated on Thursday; scenario planning and report out on Friday**
     - **Discussion of whether our scenarios adequately circumscribe our problem space**
       - **David B. expressed desire for Technical team to "show some more of their work" as regards the inputs for the scenarios if feedback is wanted as to the sufficiency of the scenarios**
       - **WUCA – Water Utility Climate Alliance – source of comparative information from other water districts**

Hi Rosemary,

Thanks for inviting David to respond to my suggestions.
It feels to me like we're making progress.

Some notes and questions

1. UCSC growth
I think the main question here is: *Is there any uncertainty about the estimate of future water demand that UCSC will provide?"*
If there is no uncertainty, then there is no need for a range.
If, however, the University submits a figure that maximizes their potential to grow, then I would say that the figure is uncertain. A different scenario can easily be imagined that would result in less than maximum growth.

2. Income adjustment
David notes that there was no growth in real per capita or median household income from 1993-2013.
David reports that CalTrans is projecting real growth in per capita income of 1.7% per year through 2035.
Doesn't this discrepancy between the past and the projection suggest that a range for the future should include a *no growth* scenario?

If I understand David's method, it is to apply a high and low income elasticity coefficient to the CalTrans estimate. I have no problem with David's coefficients. It's the CalTrans projection that introduces significant uncertainty.

3. Drought rebound
David responds, "In both the low and high forecasts, neither gross per capita water use nor residential per capita water use fully recover to pre-drought (2008) levels".
Yes, I understand that factors such as price increases and conservation programs keep demand from rebounding to pre-drought levels.

My concern is that David's adjustment for demand reduction due to the drought drops to zero ---even in the low estimate. He writes, "demands don't fully recover until about 2030 in the low demand forecast".

My suggestion is that we introduce into the low demand estimate an assumption that some portion of that reduced drought-year demand is permanent, reflecting permanent changes in how long people take showers, irrigate their yards, etc. Since we're talking permanent changes, that means a new definition of "unconstrained demand".

Thanks,
Rick

On Mar 25, 2015, at 6:00 PM, Rosemary Menard <RMenard@cityofsantacruz.com> wrote:

Good Afternoon Rick,

I'm responding to the information I received from you earlier today requesting some additional work on assumptions related to the interim water demand forecasts.

With respect to item #1 below, I have attached the handout I provided at the February WSAC meeting about LAFCO, LAFCO's policies and the University's future water demand for your information. As noted in the LAFCO information, developments within the existing service area boundary are not subject to LAFCO decision-making or policy direction, and I gave an example of developments at the Marine Science Campus of such a development. Since preparing this information last month, I have learned that the University is in the process of planning some major improvements to its on-site housing that would be located within the existing service area boundary. As you are probably aware, because one of the drivers of Santa Cruz's housing issues relates to housing for University students, the City is strongly supportive of this initiative.

I'm waiting to receive the requested feedback from the University about its future demands and will share that with everyone when I receive it as well as ask the technical team to incorporate it into the demand forecasts and Confluence model runs that the Committee will be looking at during its next meeting.

With respect to items #2 and #3, I asked David Mitchell to review the requests and give me feedback about whether robust and relevant data sets exist to support the changes that you are requesting. I think we all can appreciate the value of maintaining the soundness of our demand forecasting methodology by basing it on the best, most relevant data sources we can.

This afternoon I received the following responses from David:

#2. Income projections.

As a reminder, both the low and high demand forecasts assume that household income will grow at the rate projected by Caltrans for Santa Cruz County. The low demand forecast assumes a lower demand response than the high demand forecast to changes in income. The low demand forecast assumes that a 10% increase in income would increase single family demands by 2% (income elasticity of 0.2) and multifamily demands by 0.4% (income elasticity of 0.04). The high demand forecast assumes that a 10% increase in income would increase single family demands by 3% (income elasticity of 0.3) and multifamily demands by 0.6% (income elasticity of 0.06). So the demand response to changes in income for the high demand forecast is 50% greater than for the low demand forecast.

I've researched regional income projections and have not found alternative long-range projections for Santa Cruz County. Caltrans is the only county-level income projection I have been able to identify. AMBAG's 2014 Regional Growth Forecast does not address per capita or household income growth. ABAG's Projections 2009 include projections for mean household income through 2035. For the Bay Area it projects a real annual growth rate of 1.1% for 2015-2035. This is lower than the 1.7% real annual growth rate in per capita income Caltrans is projecting for Santa Cruz County. A mid 2000s projection of median household income for the Sacramento Area Council of Governments prepared by the California Center for the Continuing Study of the California Economy estimated a real rate of growth

of 1.2% for median household income for the period 2010-2050, also lower than what Caltrans has projected for Santa Cruz County. This doesn't necessarily imply the Caltrans forecast is high given Santa Cruz County's proximity to Silicon Valley. Different regions grow at different rates depending on economic circumstances. In his email Rick suggested work by Richard Heinberg supported a lower income growth assumption for Santa Cruz. An internet search on Richard Heinberg did not identify any publications or reports addressing future rates of income growth for Santa Cruz county, the Bay Area, or California. According to census data, per capita and median household income in Santa Cruz County did not grow in real terms at all over the period 1990-2013. Despite Rick's suggestion not to rely on historical patterns of income growth for the forecast, the lack of income growth over the past 23 years provides the strongest justification, in my opinion, for including a lower income growth assumption in the low demand forecast.

#3. Drought rebound.

Rick suggests two adjustments to the drought rebound assumptions in the interim forecast. First, he suggests not having demand fully recover from the current drought. In both the low and high forecasts, neither gross per capita water use nor residential per capita water use fully recover to pre-drought (2008) levels, so his first suggestion has already been addressed. His second suggestion is to assume that some level of rationing is required every 6-7 years and to adjust the demand forecast accordingly. If implemented, this suggestion would confound and invalidate the Confluence modeling results. In order to assess system reliability, the Confluence model requires a forecast of unconstrained demand. Rick is suggesting instead to use a forecast of constrained demand. This would defeat the purpose of the analysis, which is to identify the frequency and magnitude of water supply shortfalls under various hydrologic and supply development conditions given expected demands for water. The interim demand forecast makes adjustments in expected demand for ongoing conservation programs, plumbing codes, and water rate increases, which are predicted to reduce the amount of water customers would freely choose to purchase. These adjustments are necessary and appropriate for a forecast of unconstrained demand. Adjusting the forecast to include periodic rationing is not.

At this point I don't see the need for a meeting, but if you feel I've missed something important, please don't hesitate to let me know.

Have a good evening

Rosemary

From: Rick Longinotti [mailto:longinotti@baymoon.com]
Sent: Wednesday, March 25, 2015 8:27 AM
To: Rosemary Menard
Cc: Bob Raucher; Karen Raucher; John Aird
Subject: demand forecast follow up

Hi Rosemary,

I want to follow up on the discussion that we had at the end of our WSAC meeting on Friday regarding David Mitchell's demand forecast. I propose that John Aird, who is a member of the Community Water Coalition, and I meet with you next week to discuss the following concerns. Tuesday is a good day for us, and other days can work as well.

1. **UCSC growth**
You are proposing that Mitchell plug in the number for future demand that UCSC will provide in response to your request. I think that is a good idea for the high end forecast. For the low end forecast, I propose that Mitchell plugs in a number that represents water neutral growth for the campus. Having a range of possible future demand at UCSC seems ideal, since we there is a great deal unknown about future campus growth (The drafting process for the University's 2035 Long Range Development Plan has not yet begun; and LAFCO has not yet approved the application for water service extension for the current LRDP and requires water neutrality for any water service extension.)

2. **Growth in income adjustment**
I propose that MItchell include in his low end forecast an assumption that a rise in income will not be a repeat of past patterns. I think that the WSAC's assumption that future climate may be different from past patterns is wise and I think it is wise to consider a similar assumption for income. Analysts such as Richard Heinberg suggest that a more likely scenario is a growth rate crippled by escalating energy prices.

Mitchell's current assumption that incomes will rise is based on CalTrans County Economic Forecast. Here are the assumptions in the CalTrans document:

"The longer term forecast from 2018 to 2040 is based on the extrapolation of the near term forecast twenty-three years hence...
While there are many long term unknown factors associated with the US and California economies, the trend forecast for the regions is a plausible scenario of growth, in the absence of unexpected shocks or changes in the nation and the world".

The near term forecast in this 2013 document covers 2014 and 2015. The forecast for those years notes:

"The national economy is forecast to grow at a significantly faster rate in 2014, accelerating further in 2015...As the national economy expands, California will outpace the nation in job creation in 2014 and 2015."

Extrapolating from these two years and assuming "an absence of unexpected shocks or changes in the nation and the world" lacks the rigor that I would expect of a future forecast.

3. **Demand rebound from drought levels**
Mitchell's latest memo reads:
In the Feb WSAC interim demand forecast we assumed demands would rebound from the current drought over a 3 to 5 year period. We assumed that non-residential demands would recover in 3 years while residential demands would recover in 5 years. For the high demand forecast we retain these assumptions. For the low demand forecast we assume recovery of demands other than for municipal irrigation and golf courses is more gradual. While the bulk of the adjustment occurs by 2020, demands don’t fully recover until about 2030 in the low demand forecast

I propose that MItchell modify the low end forecast by including the assumption that demand does not fully recover after droughts. I also propose that Mitchell include an assumption that critically dry years happen every 6-7 years (the historical average), and that this frequency of low rainfall could very well reinforce the low water use behavior that occurred in 2014.

I've included some links below to studies of water demand rebounds following drought.

Thanks,
Rick

http://www.ub.edu/graap/drought.pdf
DO DROUGHTS HAVE LONG-TERM EFFECTS ON WATER CONSUMPTION? EVIDENCE FROM THE URBAN AREA OF BARCELONA, 2014

Abstract: This paper examines the long-term effects of droughts on water consumption using data of municipalities of the urban area of Barcelona. Two important characteristics of the sample of municipalities are the relatively low water consumption in the pre-drought period and the fact that indoor uses are clearly predominant. Controlling for prices, income and several socio-demographic factors, we find that a severe drought episode along with the communications campaigns launched in response may have stimulated a change in the attitudes and habits of consumers about water conservation not only during the drought episode but also in later periods.

http://digitool.library.colostate.edu///exlibris/dtl/d3_1/apache_media/L2V4bGlicmlzL2R0bC9kM18xL2FwYWNoZV9tZWRpYS8xMjA0NjQ=.pdf
POLICIES VERSUS PERCEPTION: ESTIMATING THE IMPACT OF DROUGHT AWARENESS ON RESIDENTIAL WATER DEMAND, 2011

In response to the water shortages of 2002, Colorado utilities adopted numerous policies promoting water conservation. However, despite this demand-management emphasis, utilities are still distinguishing between the impacts of conservation programs and the psychological impacts of the drought itself. That is, water managers are unsure if post-drought decreases in water consumption are solely due to utility-controlled policies or if they result from a combination of drought awareness and/or permanent changes in water-use behaviors. For this reason, gauging

the effectiveness of conservation policies requires answering the following: First, did awareness of the drought lead consumers to conserve more water than predicted, given utility policies alone? Next, if drought awareness did influence demand, is continued awareness--as opposed to utility policies or permanent changes in water use—the reason water demand has failed to return to pre-drought levels? To answer these questions, this research estimates an econometric water demand model using billing data from a major Colorado utility. Results show that drought awareness did decrease water demand both during and after the height of the drought; however, baseline demand still appears to be trending downward even after we control for both drought awareness and utility policies.

Response to WSAC Questions
Concerning Interim Baseline Demand Forecast

Prepared by
David Mitchell, M.Cubed
February 10, 2015

Several WSAC members submitted questions concerning the interim baseline demand forecast that I will be presenting at its February meeting. In addition to discussing these questions at Thursday's meeting, I thought it would be helpful to provide written responses as well. I have chosen to answer each question in full even though this entails some repetition since some topics (such as about drought rebound) are raised by more than one questioner.

Questions from Sue Holt

1. Rebound

Is there a conflict between expecting a full rebound in demand from our current drought (such as we've seen after past droughts) vs. the weakening relationship between income and water demand that you discuss (page 6, due to the factors mentioned in footnote 10)? When we recover fully from this drought (fingers crossed), will demand return to its previous level or will users' behavior and equipment have changed to some extent? Have complete rebounds been seen in other regions that have recovered from recent droughts? Should we be moderating our assumption about the extent of rebound to expect for Santa Cruz this time?

It is important to keep in mind that droughts don't occur in a vacuum, so that when we look at the data on past droughts and recoveries we have to be cognizant of other factors at play. I have tried to illustrate this in the Feb WSAC baseline demand presentation slide 12. For example, looking at 1977, which was a short but deep drought, rebound in demand was quick at first then the economy went into a sharp recession in 1981 and then 1982 and 1983 were very wet El Nino years. Demand fell in 1982 and 1983 primarily because of wet weather, but by 1985 it was about 9% above where it had been in 1976. Had there not been a recession or the two El Nino years, in my estimation the rebound would have occurred sooner. The pattern of recovery from the 1987-91 drought was also confounded by the 1990-91 economic recession. But from the end of 1992 it took about five years for demand for recover to its pre-drought level. Similarly, the 2009 drought coincided with the worst recession since the Great Depression. When the drought ended, the economy was still mired in recession. Unemployment in Santa Cruz County did not peak until February of 2010 at 15.5%. Unemployment has since fallen to about 6.0%. The recession would have slowed any rebound from the drought. Of equal or greater consequence, 2010-11 was unusually wet, especially in the spring of 2011, which reduced demand by delaying the start of the irrigation season. Demand starts to recover in 2012 and 2013, but then water use restrictions are imposed in 2014.

During each of these drought-recovery episodes, other factors were also at work. Population and income were changing, technology was advancing, plumbing codes and appliance standards were changing, and water rates were increasing. These factors were also influencing demand for water. In the interim baseline demand forecast we have tried to make allowances for these various factors. As a consequence, the forecast does not predict that demand will "fully recover" to levels seen before the 2009 drought. In fact, the interim baseline demand forecast does not again reach the level seen in 2013. The interim baseline demand forecast starts with actual demand in 2014, which reflects the effects of Stage 3 drought restrictions. Demand in 2014 was about 30% less than average demand for 2007-08. Absent the reinstatement of mandatory water use restrictions, the interim baseline forecast predicts that irrigation uses, which were sharply curtailed by administrative fiat in 2014, will rebound quickly. It assumes the recovery of residential demands will be much more gradual, lasting five years. At the same

time, the forecast is adjusting for the on-going effects of plumbing codes, appliance standards, conservation programs, and rising water rates, such that the net result is demand never "fully recovers" to its 2007-08 level. The drought recovery in the interim baseline demand forecast follows a pattern similar to what was observed following the 1977 drought, except that in the interim baseline forecast demand peaks after three years of growth and then declines thereafter. The interim baseline forecast in 2015 is 19% less than average demand in 2007-08; in 2025 it is 14% less; and in 2035 it is 16% less.

2. Normal droughts

The baseline is meant to characterize normal conditions and normal conditions include a drought every 15 years or so. Perhaps our baseline should include another drought in the next two decades, say 2030-2035. If we don't program in another "regular" drought, we'll need to devote one of our scenarios for this purpose. Since we'll be limited to maybe four scenarios, devoting two of them to the baseline and a regular drought seems wasteful. It would leave us with only two scenarios to play with to characterize our future possibilities.

I would characterize the purpose of the baseline demand forecast somewhat differently. It is meant to characterize the amount of water customers are expected to demand, given projected water rates, income level, population growth, and improvements in water use efficiency. It is a prediction of future demand assuming customers are free to choose how much they consume given the forecasted future cost of water and other factors.

Drought, per se, is not a function of demand. It is an outcome of hydrology. The consequences of drought depend on both the level of demand and the availability of supply. Confluence simulations are used to evaluate these consequences under varying hydrology. Assessing the consequences of more frequent droughts, longer droughts, or deeper droughts requires changing the underlying assumptions about future hydrology, such as is being done for the climate change analysis.

While demand does not depend directly on hydrology, it is influenced by weather. Hotter, drier years push demand up. Cooler, wetter years push it down. The Confluence model makes adjustments to the baseline demand forecast to account for these weather effects when it runs a simulation.

3. Weighting of elasticities

In Table 6, it's unclear how the weighted annual average elasticity values were calculated across the different categories. Single-family and multi-family categories seem to carry different summer vs. winter weights.

To calculate the weighted average elasticity, the 12 calendar months are divided between winter and summer categories. The winter category represents months in which outdoor water use is low and demand is primarily for indoor uses. Indoor demands are less responsive to price changes. The months of Jan-Apr and Nov-Dec are assigned to the winter category. The summer category represents months in which outdoor water use is high. Outdoor demands are more responsive to price changes. The months of May-Oct are assigned to the summer category. The winter and summer weights are calculated separately for the single-family, multi-family, and non-residential customer categories using 10 years (2001-2010) of monthly consumption data. For the single-family customer category, the winter weight is 40% and the summer weight is 60%. For the multi-family customer category, the winter

weight is 46% and the summer weight is 54%. For the non-residential category, which includes commercial, municipal, irrigation, and golf, the winter weight is 36% and the summer weight is 64%.

4. References

My online search could not find the citation in footnote 7 - the CUWCC's Water Conservation Rate Structures Handbook. Can a link to the document be provided? Might we also have links to the two Cal Water studies mentioned in footnote 8?

The two Cal Water studies are not yet publicly available. They will become public documents when Cal Water submits its General Rate Case filing with the CPUC in the summer.

The full citation for the CUWCC handbook is:
Chesnutt, Thomas W., et al. "Designing, Evaluating, and Implementing Conservation Rate Structures: A Handbook Sponsored by the California Urban Water Conservation Council." California Urban Water Conservation Council, Sacramento, Calif. (1997).

I do not know if it is electronically available. I believe copies may be obtained by contacting the CUWCC: 916-552-5885.

Questions from Rick Longinotti

1. Need to update the estimate of current water use
You have used as a starting point the 2010 Urban Water Management Plan's estimate of current water use. That Plan used an average of 2007-2008 water consumption as its estimate of current water use. However, water use declined steeply in 2009 due to Stage 2 restrictions. Though restrictions were rescinded, water use dropped below 2009 levels in 2010 and dropped again in 2011. Water demand rose in 2012 and again in 2013, but still remained lower than the 2007-08 levels. Shouldn't our current demand estimate be updated to reflect our recent water use? I recommend averaging the years 2010 through 2013.

The interim baseline demand forecast starts with actual demand in 2014, which reflects the effects of Stage 3 drought restrictions. Demand in 2014 was about 30% less than average demand for 2007-08. Absent the reinstatement of mandatory water use restrictions, the interim baseline forecast predicts that irrigation uses, which were sharply curtailed by administrative fiat in 2014, will rebound quickly. It assumes the recovery of residential demands will be much more gradual, lasting five years. At the same time, the forecast is adjusting for the on-going effects of plumbing codes, appliance standards, conservation programs, and rising water rates, such that the net result is demand never "fully recovers" to its 2007-08 level. The drought recovery in the interim baseline demand forecast follows a pattern similar to what was observed following the 1977 drought, except that in the interim baseline forecast demand peaks after three years of growth and then declines thereafter. The interim baseline forecast in 2015 is 19% less than average demand in 2007-08; in 2025 it is 14% less; and in 2035 it is 16% less.

The interim baseline demand forecast nearly matches average demand for the years 2010-13. It is within +/- 3% of average demand for 2010-13, except in 2015 where it is 6% less. After 2025, the interim baseline demand forecast always is less than average demand for 2010-13, despite projected growth in population and the economy.

2. Residential Growth Adjustment
You have adjusted the 2010 estimate of growth in commercial water demand to better reflect actual growth trends in commercial water use. Would it be warranted to adjust the residential water demand estimate to better reflect actual rates of residential building?

The interim forecast is predicated on the City's General Plan 2030. The General Plan serves as the principal policy and planning document guiding long-range land use decisions in cities and counties and the Water Department tries to align its demand forecasts with it. The Water Department will be updating the residential growth projections for the 2015 UWMP, but these were not ready yet for inclusion in the interim baseline forecast. The interim projection can be adjusted if warranted when the updated growth projections become available. Additionally, the statistically-based demand models the Water Department will be developing over the next several months will incorporate the updated residential growth projections.

3. UCSC growth
You use an estimate for UCSC growth that is based on the settlement agreement between the City and UCSC that estimates that water demand on campus will roughly double by 2030. Since that settlement agreement, our local LAFCO has adopted the following policy:
"In cases where a basin is overdrafted or existing services are not sustainable, a boundary change proposal may be approved if there will be a net decrease in impacts on water resources."
Because of this requirement, UCSC will need to participate in a program to offset their proposed increased water use. Because of this LAFCO requirement, wouldn't it be more realistic to model water demand at UCSC remaining flat?
Basing the UCSC forecast solely on projected increases in student enrollment and average water use per student would lower the overall baseline interim forecast by about 130 mgy in 2020; 114 mgy in 2025; 97 mgy in 2030; and 76 mgy in 2035. However, this would not account for new water uses for new campus landscape and building development on currently undeveloped parts of UCSC property.
4. Growth in Income Adjustment
You note that water use rises with income, due to larger houses. larger landscapes, pools, etc. You've chosen to estimate an increase in water use due to rising income, using an elasticity coefficient that is based on two studies. Can we trust that those studies would produce results consistent with our community, in which large homes often have landscapes that use less water, and the culture of water conservation extends across income levels?

The income elasticity for the interim baseline demand forecast was purposely selected to be at the lower end of the range of published estimates for income elasticity for the reasons you cite. The average income elasticity reported in Hanemann's (1998) review of 39 published studies of municipal water demand was 0.52 and the median was 0.43.[1] The estimate we are using for the interim baseline forecast is 0.25. Thus we are assuming an income effect that is 42% smaller than the median effect and 52% smaller than the average effect reported in the studies summarized in Hanemann (1998). As stated in the demand memorandum, the estimate we are using is consistent with estimates derived from two analyses of 24 different water service districts located throughout California, representing a broad mixture of residential communities – large, small, high income, low income, inland, coastal, northern,

[1] Hanemann, W. M. (1998). Determinants of Urban Water Use. In D. Baumann, J. Boland, & W. M. Hanemann, *Urban Water Demand Management and Planning* (pp. 31-75). New York: McGraw-Hill.

southern, and central -- and trends in water use over the last 10 years. In my estimation we are using a defensible and conservative estimate of the income effect on water demand, but I don't disagree that it would be preferable to have an empirical estimate derived from local data. Estimating income response will be part of the statistically-based demand models the Water Department will be developing in the next several months.

5. Drought Recovery

You have assumed following the greatly reduced consumption of 2014, that water demand will completely return to previous levels by 2020. Doesn't history suggest that although there is a rebound of water consumption following curtailment, that the rebound won't reach previous levels? The 2010 UWMP notes that water consumption peaked in 1987 at 4.1 billion gallons. Following the drought years of 1988-91, the City's water use never reached the previous peak. The UWMP reports that "After restrictions ended, water use gradually recovered over a period of several years and then stabilized at a level of about 3.75 billion gallons at the beginning of the decade." That's a drop of almost 9% below the 1987 peak.

It is important to keep in mind that droughts don't occur in a vacuum, so that when we look at the data on past droughts and recoveries we have to be cognizant of other factors at play. I have tried to illustrate this in the Feb WSAC baseline demand presentation slide 12. For example, looking at 1977, which was a short but deep drought, rebound in demand was quick at first then the economy went into a sharp recession in 1981 and then 1982 and 1983 were very wet El Nino years. Demand fell in 1982 and 1983 primarily because of wet weather, but by 1985 it was about 9% above where it had been in 1976. Had there not been a recession or the two El Nino years, in my estimation the rebound would have occurred sooner. The pattern of recovery from the 1987-91 drought was also confounded by the 1990-91 economic recession. But from the end of 1992 it took about five years for demand for recover to its pre-drought level. Similarly, the 2009 drought coincided with the worst recession since the Great Depression. When the drought ended the economy was still mired in recession. Unemployment in Santa Cruz County did not peak until February of 2010 at 15.5%. Unemployment has since fallen to about 6.0%. The recession would have slowed any rebound from the drought. Of equal or greater consequence, 2010-11 was unusually wet, especially in the spring of 2011, which reduced demand by delaying the start of the irrigation season. Demand starts to recover in 2012 and 2013, but then water use restrictions are imposed in 2014.

During each of these drought-recovery episodes, other factors were also at work. Population and income were changing, technology was advancing, plumbing codes and appliance standards were changing, and water rates were increasing. These factors were also influencing demand for water. In the interim baseline demand forecast we have tried to make allowances for these various factors. As a consequence, the forecast does not predict that demand will "fully recover" to levels seen before the 2009 drought. In fact, the interim baseline demand forecast does not again reach the level seen in 2013. The interim baseline demand forecast starts with actual demand in 2014, which reflects the effects of Stage 3 drought restrictions. Demand in 2014 was about 30% less than average demand for 2007-08. Absent the reinstatement of mandatory water use restrictions, the interim baseline forecast predicts that irrigation uses, which were sharply curtailed by administrative fiat in 2014, will rebound quickly. It assumes the recovery of residential demands will be much more gradual, lasting five years. At the same time, the forecast is adjusting for the on-going effects of plumbing codes, appliance standards, conservation programs, and rising water rates, such that the net result is demand never "fully recovers" to its 2007-08 level. The drought recovery in the interim baseline demand forecast follows a pattern similar to what was observed following the 1977 drought, except that in the interim baseline forecast

demand peaks after three years of growth and then declines thereafter. The interim baseline forecast in 2015 is 19% less than average demand in 2007-08; in 2025 it is 14% less; and in 2035 it is 16% less.

Questions from Doug Engfer

1. Is there anything missing from this baseline, or is this full-system demand?

The interim baseline demand represents full system demand for treated water delivery.

2. Growth
Please characterize the growth rates inherent in the General Plan. What is annual % growth in population, jobs, etc.?
Population forecast for inside- and outside-city service areas are from the AMBAG Monterey Bay Area 2008 Regional Forecast, as reported in Table 2-3 of the 2010 UWMP. Service area 2010-2035 forecasted population growth rate is just under 0.5%.

Table 2-3. Population Forecast for the Santa Cruz Water Service Area (a)

Year	2010	2015	2020	2025	2030	2035
City of Santa Cruz	58,919	62,480	63,265	64,649	65,884	67,807
Santa Cruz County	32,236	32,831	33,478	34,162	34,746	35,176
City of Capitola	1,010	1,020	1,050	1,070	1,070	1,075
Service Area Total	92,165	96,331	97,793	99,881	101,700	104,058

Notes:
(a) Source: AMBAG Monterey Bay Area 2008 Regional Forecast

Projected growth in housing and commercial/industrial space within City of Santa Cruz is reported in Table 4-9 of 2010 UWMP. 3,350 new residential units are forecast for 2010-2030. The forecast is taken from the City's General Plan 2030 buildout analysis (DC&E, 2009). This corresponds to an annual growth rate of about 0.7%.

General Plan 2030 Water Demand

	Buildout Projections (a)	Water Factor	Water Demand (mgy)
Single Residential (b)	840	194 gal/unit/day	59.6
Multiple Residential (b)	2,510	70 gal/unit/day	64.3
Business/Industry:			
- Commercial Sq Ft	1,087,983	66 gals/ft^2/year	71.8
- Hotel Rooms	311	93 gal/room/day	10.6
- Office Sq Ft	1,273,913	18 gal/ ft^2/year	22.9
- Industrial Sq Ft	776,926	12 gal/ ft^2/year	9.3
Total			**238.5**

Housing and commercial/industrial growth rate outside of the City of Santa Cruz is projected to be same as the AMBAG population forecast.

3. Drought adjustment

Can you share the data that show essentially "full recovery" in demand within 5 years?

The interim baseline demand projection makes the assumption that irrigation-based demands that were restricted in 2014 would recover within one (municipal) to two years (irrigation/golf). This assumes drought restrictions are not reinstated in 2015. The interim baseline demand projection assumes that residential demands would recover more slowly over a five-year period.

These assumptions reflect professional judgment based on a review of the historical data. At the same time, it is important to bear in mind that the interim baseline demand forecast incorporates other adjustments for price and on-going conservation such that forecasted total demand never "fully recovers" in the sense of reaching its level prior to 2009.

Historically total production has recovered at varying rates following significant droughts. It is important to emphasize that the historical record is noisy with other events that influence water demand (see Feb WSAC baseline demand presentation slide 12), which makes it difficult to say definitively what the recovery rate would have been absent these other events. From the historical record we see:

1977 drought: very deep but short drought. Demand started to rebound quickly until 1980-81, then economy went into recession and 1982-83 were very wet with cool summers, which caused a significant drop in demand. Following the 1982-83 El Nino, demand growth resumed and by 1985 exceeded pre-drought demand in 1976 by about 9%.

1987-91 drought: longer but shallower drought than 1977. End of drought coincides with 1991-92 recession. Demand recovers to pre-drought level by 1997. About a 5-year recovery.

2009 drought: shallow and short drought followed by very wet 2010-11. Precipitation in March, May, and June of 2011 was significantly above average, delaying start of irrigation season and curbing demand. The 2009 drought also coincides with the Great Recession which started in 2008. Unemployment peaked in Santa Cruz County at 15.5% in 2010 (compared to about 6% now). Demand starts to recover in 2012 and 2013, but then water use restrictions imposed in 2014.

4. Demand projections

Please include, for context, data from (say) 2005-2014, too. This applies to the graph and the data tables.

See Feb WSAC baseline demand presentation slide 12 -- Historic and Projected Water Production chart covering 1975-2035. Here is the data for 2005-2014 actual production and 2015-2035 forecasted production.

Year	Production (MGY)
2005	3,729
2006	3,800
2007	3,777
2008	3,650
2009	3,214
2010	3,199
2011	3,078
2012	3,250
2013	3,367
2014	2,590*

2010 UWMP	Interim Baseline

2015	3685	3015
2016	3717	3204
2017	3749	3285
2018	3782	3276
2019	3814	3244
2020	3846	3249
2021	3846	3240
2022	3846	3230
2023	3845	3219
2024	3845	3215
2025	3845	3209
2026	3885	3206
2027	3925	3203
2028	3966	3201
2029	4006	3199
2030	4046	3197
2031		3184
2032		3170
2033		3157
2034		3144
2035		3132

*Provisional estimate