

Memorandum

To: The Water Supply Advisory Committee (WSAC)
From: Bob Raucher and Colleen Donovan, Stratus Consulting Inc.
Date: 4/24/2015
Subject: Technical Team Progress Update

In this memorandum, we provide an update of the Technical Team's activities for Phase 2 of WSAC activities, reflecting efforts in March and April.

Brown and Caldwell -- Engineering and Planning Assessments of Alternatives

Brown and Caldwell (BC) has been actively engaged in reviewing, consolidating, and evaluating alternatives to enhance water supply. BC has developed and updated a two-page template to provide a consistent and easy-to-use guide for each relevant supply-side alternative, incorporating revisions and improvements since the March WSAC meeting versions (e.g., to reflect the updated MCDS criteria). BC also has continued to identify new information that will improve estimates of infrastructure needs and preliminary estimates of costs and potential water supply enhancements.

BC also has helped with reviews and comments on technical drafts developed by Pueblo Water Resources (PWR), related to groundwater issues and implications for aquifer storage and retrieval (ASR) and indirect potable reuse (IPR) in the Santa Margareta and Aptos groundwater basins, and North Coast groundwater supply options. Bill Faisst is participating in the April 22 enrichment session related to the PWR work and John Ricker's investigation of regional water exchange potential.

Pueblo Water Resources, Inc. – Groundwater Issues (ASR, IPR, North Coast Groundwater)

Pueblo Water Resources, Inc. (PWR) has completed a preliminary evaluation of existing information on the basic components of ASR and IPR, and also of potential groundwater supply issues related to the North Coast. They have prepared two draft technical memoranda, which have been reviewed by the SCWD and by BC and Stratus. PWR will make modest revisions based on these comments, as well as comments provided earlier by Mike Cloud (IPR member) on a prior draft version of the ASR-related memo). PWR also has presented relevant information from their efforts in the April 22 enrichment session on local groundwater issues and exchange potential.

Maddaus Water Management, Inc. – Demand Management/Conservation

Maddaus Water Management Inc. (MWM) has continued to work with Stratus in assisting to update the evaluation of the revised Program C Recommended, using their Decision Support System Least Cost Planning Model (DSS Model), with the revised demand forecast estimates provided by Mr. Mitchell. MWM has been providing clarifications and detailed information to Stratus, as Stratus has been working to identify any double counting across demand management measures within Program C and other Consolidated Alternatives, and to properly net out savings attributable to plumbing codes or Program A (the latter being embedded in the revised Demand forecast developed by Dave Mitchell).

MWM have also been providing responses and updated DSS runs in response to several requests from Stratus related to providing more transparency, netting out measure-specific administrative costs, ensuring consistent approaches to estimating present values, and other issues. The objective is to have more transparent and consistent assessments of demand management options for Santa Cruz. This work is on-going.

Habitat Conservation Plan (HCP) and Climate Change-related Activities – Balance Hydrologics, Gary Fiske, Stratus Consulting

Climate change. Stratus Consulting has been coordinating with and advising Shawn Chartrand, of Balance Hydrologics, and Gary Fiske on methodological and data issues related to incorporating climate change projections into the instream hydrologic flow models, with and without HCP-related restrictions. In the past 3 months, these climate-altered streamflow results have been run through the *Confluence* model to examine projected impacts on system yields and potential curtailments of projected changes in precipitation and temperature, based on downscaled results from one Climate Change Model (GCM) approved by *CalAdapt* for application to California.

A technical memorandum was prepared and included in the WSAC packet for the March meeting, describing the methods and results of the climate change analysis and the associated water supply implications derived from the *Confluence* model runs. The memorandum also includes information we obtained from interactions with Bruce Daniels at UC Santa Cruz (and Board member for Soquel Creek Water District). Dr. Daniel's work is a regression-based analysis of observed climate data, then using the regression results to project forward to anticipate future climate changes using current trajectories.

Dr. Daniels, Shawn Chartrand, and Joel Smith (Stratus Consulting, and IPCC Assessment Report chapter author) presented their insights on climate change impacts on local water issues at a recent Enrichment session, held on April 8.

Initial efforts also were made to examine wildfire-related risks (as may be heightened under climate change). Introductions and initial coordination was established between Shawn Chartrand and Joanna Nelson (Stanford University Post-Doctoral ecologist) to begin exploring how fire-related risks to instream flows and water quality may be incorporated into the hydrologies

Extended Drought. Also addressed has been the need to reflect changes in variability (e.g., frequency and duration of droughts) that go beyond the projected changes in long-term averages that typically emerge from the GCM runs. Part of this variability-oriented effort has entailed examining information from the Paleo-climate record to consider the plausibility of extended, multi-year droughts (e.g., six to eight years or longer). Although such extended-period droughts are not evident in the hydrologic datasets collected over relatively recent past decades, extended mega-droughts are evident in tree-ring data for earlier centuries, with some droughts lasting for as long as 200 years. Further, future climate projections predict extended mega-droughts and more severe drought conditions than have been observed in recent and, in some cases historic, past within the coming century.

The application of an extended drought simulation is an important way to explore the Santa Cruz water system's vulnerability to climate variability as part of their water respective system planning processes. We examined the reasoning and data behind extended drought scenarios employed by Santa Barbara and San Francisco Public Utilities Commission. Santa Barbara applies a seven-year extended drought and the San Francisco Public Utilities Commission applies an eight-year extended drought.

Additionally, the team developed a preliminary extended drought simulation that Santa Cruz could use in their future planning. This simulation was developed using methods similar to those employed by Santa Barbara and SFPUC (e.g., using real data from observed droughts in Santa Cruz in the last 40 years and combining and extending those to simulate a longer and more severe drought than any on record).

A technical memorandum was prepared by the team describing the basis of an extended drought that may be applied for water planning purposes. The memorandum – provided for the March WSAC meetings -- presented the water supply implications of this planning drought, based on applying the *Confluence* model, and served as the basis for one of the scenarios examined in the portfolio development exercise.

David Mitchell, M-Cubed – Demand Projections

Mr. Mitchell presented the draft interim demand forecast at the February WSAC meeting, and based on feedback, Mr. Mitchell augmented the interim demand forecast with low and high forecasts to bound the probable range of demand over the forecast period and account for uncertainty in assumptions. Working with Water Department staff, Stratus, and MWM, Mr.

Mitchell developed two additional interim demand forecasts – a lower forecast and an upper forecast.

Dave Mitchell subsequently has modified these interim demand projections to reflect recently obtained information regarding future water demands at UC Santa Cruz. This set of updated interim demand projections will be presented at the WSAC April meeting. The data and assumptions used to generate the updated lower, mid, and upper forecasts are documented in a technical memorandum that will be circulated as part of the April WSAC packet.

Also, working with Toby Goddard at SCWD and Carolyn Wagner of Stratus Consulting, Mr. Mitchell initiated development of the datasets that will be used to estimate new statistically-based models of water demand for single family, multi family, and non-residential customer categories.

Stratus Consulting and Gary Fiske - Evaluations of Key Consolidated Alternatives

A suite of follow-up analyses has been conducted over the past month by Gary Fiske and Stratus Consulting, using the *Confluence* model to provide a more in-depth assessment of several key types of CAs. The key classes of CAs included:

- (1) Those that rely on tapping available winter flows from the San Lorenzo River and using some form of surface or aquifer storage [CAs 9, 16, 18];
- (2) Those that increase treatment capacity and upgrade the treatment process to enable use of turbid water (including winter flows), that can be used to meet current demand and/or be stored in some fashion [CA 17 and CA 19]; and
- (3) Those that are fixed drought-proof supplies that can be used to directly meet current demands as needed, and (for some) can contribute directly or indirectly to storage [CAs 7, 11, 13, 15, and 10].

Confluence model runs were set up to help assess how much these different types of CAs assist in reducing water shortages (the gap between supply and demand) under both historical and climate change-impacted hydrologies, with DFG-5 fish flow requirements. Interesting insights have been gleaned from these exercises, as will be highlighted in the April WSAC packet materials and at the April 30 WSAC meeting.

Similar analyses were also conducted for the demand management CA-03 (Revised Program C Recommended), and for a Portfolio consisting of a combination of CA-03 with CA-10 (indirect potable reuse).

In all of the above analyses, input from Bill Faisst (BC) and Shawn Chartrand (Balance Hydrologics) were very useful.

Stratus Consulting

In addition to all the items noted above, Stratus Consulting has been engaged in a broad array of technical issues. A partial list of the additional technical activities includes:

- ▶ Scenario planning and development (including development of scenarios and related materials for scenario-driven portfolio building exercise for the April meetings).
- ▶ Detailed investigation of the methods and findings of the MWM demand management alternatives, to ensure internal consistency and to provide needed transparency in how DSS results are generated.
- ▶ Risk assessment and risk management, building on issues presented and raised in the February meeting.
- ▶ Triple bottom line and related analyses, under development as technical information emerges on costs, etc., to reveal how CAs and portfolios can be evaluated.
- ▶ MCDS-related support, including review and input on criteria and related scales for rating the alternatives
- ▶ Enrichment activities: assisting with planning and organization
- ▶ Background research on curtailment impacts, carbon footprinting, risks associated with credit ratings, and the current energy and carbon system (on-going)
- ▶ Organization, review, consolidation, and evaluation of alternatives. Developing summary template information for the Consolidated Alternatives covering conservation/demand management, and decentralized (i.e., graywater) approaches.
- ▶ Reviewing and managing all subcontractor work efforts

In addition, Stratus Consulting continues to actively engage in WSAC planning and meeting-support activities, as well as project administration and contract management.