Agenda Item 8d

Memorandum

To: Water Supply Advisory Committee members

From: Karen Raucher and Robert Raucher, Stratus Consulting Inc.; and Gary Fiske, Gary Fiske and Associates

Date: 4/24/2015

Subject: Key findings and observations on Consolidated Alternatives

The ongoing analyses of the various consolidated alternatives (CAs) and a portfolio have provided some useful insights. Some of the key takeaway messages identified by the Technical Team include:

1. Fish flows matter a lot – there are significant differences in projected shortages between City-proposed and DFG-5 flows, regardless of whether or not climate change is factored into the assessment.

2. Climate change projections make an appreciable difference, compared to using historical flows.

3. Winter flows can provide appreciable increases in yields and system reliability, assuming storage is available (either surface or aquifer, using the Loch and/or a "virtual reservoir"), and assuming infrastructure is provided to divert, convey, treat, and return the water (and assuming a high percentage of the water can be retrieved by the City in future dry years).

4. Storage is valuable:

    a. Aquifer storage and retrieval (ASR) seems viable (Pueblo Water Resources analysis)
    b. New surface water storage options seem limited (however, raising the Newall Creek Dam may be worth consideration, especially in view of capital improvement program (CIP) investments.

5. Turbidity issues do not make a significant difference in terms of adding to system reliability:

    a. We need to develop greater clarity on the exact nature of the "Turbidity Constraint" – Is it really turbidity-driven, or is it an infrastructure (pipe) constraint that happens to be triggered by high turbidity? However, either way turbidity does not present an important system limitation.

6. Climate-independent CAs (reuse and desalination) offer greater value to the system's reliability than other options (and also diversify other risks associated with high reliance on rainfall), all else equal.

7. North Coast groundwater appears to be a viable potential source, such as through a possible exchange of non-potable recycled water for irrigation (based on initial work by Pueblo Water Resources).

8. The elements of the portfolio (existing, plus potential additions) interact in ways that can make yield changes greater or less than the sum of the parts.

   a. E.g., the interaction of climate-independent sources with storage provides considerable supplemental value (i.e., by enabling in lieu recharge/resting of the Loch or other storage).

9. The revised University of California, Santa Cruz, demand forecast makes a dent in future demand projections, but does not provide a large overall difference in the scale of the supply gap.

10. CIP issues indicate a significant need to invest large sums in the San Lorenzo River the backbone of the existing system. We need to consider how this interfaces with how the various CAs are evaluated.

11. Examining peak season shortages and, especially, looking at contributions to supply during those peak season shortage periods, is a very informative way to portray CA yields and their contributions to system reliability (see below).

12. The size of the shortage (and associated value of the portfolios), depends on how many years of normal or wet years there are prior to drought (i.e., How much storage can be added before needs escalate?).

In addition, below are two tables summarizing results developed from the various CA-based *Confluence* model runs provided and discussed elsewhere. DFG-5 flows and the mid-range January interim demand forecast are base assumptions used in generating these results. All other assumptions laid out Gary Fiske's detailed memoranda (provided in Packet Items 8a-2 and 8a-3, 8b-2 and 8b-3, and 8c-2) are also applied.

As a reminder, "yield" as applied here is a measure of how well an alternative does in reducing peak-season shortages. Specifically, it is the difference between the peak-season shortage for the base system and the peak-season shortage for the system including the supply-side and/or demand-side additions associated with the alternative.

The tables show yields for the worst hydrologic year and the average yield across all hydrologic conditions. These results convey the approximate value of using each alternative alone to improve peak-season system reliability assuming historical hydrology and climate change and other simplifying assumptions.

The starting base system peak-season shortages are shown in Table 1.

Table 1. Base system peak-season shortages

Worst-year yield (mg)		**Average yield (mg)**	
Historical	**Climate change**	**Historical**	**Climate change**
1,360	1,150	60	420

The yields in Table 2 show the reductions in the base system peak-season shortages, given current simplifying assumptions, which result from each alternative if used alone, and for one portfolio combining two CAs.

Table 2. Comparison of project yields

	Worst-year yield (mg)		**Average yield (mg)**	
Consolidated Alternatives	**Historical**	**Climate change**	**Historical**	**Climate change**
Winter flow capture	1,360	1,150	60	420
North Coast exchange	530	850	45	410
Indirect potable reuse	1,360	1,150	60	420
Felton Ranney collectors	1,360	115	60	290
C Rec Conservation	130	90	25	100
North Coast exchange + C Rec	640	1,120	55	420