

Staff Summary:
Water Supply Planning Study
Prepared by Carollo Engineers, August 2009

The City contracted with Carollo Engineers in November 2008 to prepare a Water Supply Planning Study (WSPS). The purpose was to analyze certain of the water supply issues related to the City's Plan Santa Barbara process (General Plan update) and update of the City's Long-Term Water Supply Program (LTWSP). Other issues have been, and are being, addressed in separate studies. The Water Supply Planning Study included:

- State Water Project (SWP) Reliability Assessment
- Local Climate Change Impact Assessment;
- Expanded Recycled Water Use Assessment;
- Water Conservation Opportunities; and
- Water Supply Management Assessment

Carollo was selected through a Request For Proposals process based on the proposed scope of work, cost estimate, and experience with the City's water system. This memo summarizes key points of the study. Staff will use these findings as a part of the developing recommendations for the update of the LTWSP.

State Water Project Reliability

Climate Change:

- Most analysis addresses long-term impacts (i.e. out to 2100); near term impacts are interpolated
- International research being augmented by various State of California analyses
- Expected impacts in the Delta watershed:
 - Increase in heat waves
 - Average temperature increases of 5.5 to 10.4 °F by 2100
 - Reduction in snow pack and the storage capacity it provides (25% to 40% by 2050)
 - Greater runoff during winter/spring storms; reduced storage capabilities in existing reservoirs due to modified flood control operations; lower summer flows
 - Reduced overall project storage capacity until additional storage is built
 - Sea level rise of 20"-55" projected by 2100
 - Increased salinity and flooding in the Delta
 - Potential water quality impacts in the Delta due to warmer water
- Many impacts expected even if corrective actions are taken; significant reliability impact will occur until major improvements can be made
- Current long-term projections may underestimate impacts (e.g. further sea level rise due to increased ice melt)
- State recommendations include: aggressive conservation, integrated flood management, ecosystem enhancements, expanded storage, improved conveyance, fix all aspects of the Delta, planning for sea level rise, and increased emergency preparedness

Other Vulnerabilities

- Delta flooding risks increased due to higher runoff and sea level rise
- 240% increase in levee failures due to flooding

- Seismic vulnerability:
 - 60% change of 6.5 magnitude earthquake within 25 years = 28% chance of 30 or more islands failing
 - Delta exports likely to be interrupted for 2 months to 2 years while repairs are made
 - Risk of interruption will continue until an isolated conveyance facility can be constructed

Environmental Limitations

- Delta smelt:
 - Considered a bellwether species – close to extinction
 - Wanger restrictions have generally been carried forward into revised December 2008 Biological Opinion (BO)
 - Delivery reductions of up to 50% in some dry years
 - Legal challenge underway
- Long Fin smelt:
 - Severe reductions in numbers – considered qualified for Endangered Species Act (ESA) protection by California Department of Fish and Game
 - Potential additional delivery reductions of 600,000 to 1.1 million AFY
 - Two legal challenges pending
- Salmon:
 - 2008 Wanger decision determined planned protection measures to be sufficient
 - Unprecedented close of commercial salmon fishery in 2008 and likely in 2009
 - New BO expected in 2009 [recently issued; further delivery reductions of up to 10%]
- Potential Public Trust Doctrine Legal Challenges – recent action withdrawn; others possible
- Area of Origin Issues:
 - Potential delivery deduction of 50,000 AFY
 - Legal action pending from both sides
 - Not clear how this affects Delta conveyance issues and contractors south of the Delta

SWP Delivery Reliability Evaluation

- Two time frames for reliability analysis:
 - “Current Conditions” assumptions:
 - Current facilities
 - Current Delta smelt restrictions
 - Historical hydrology (1922 – 2003) without climate change impacts
 - “Future Conditions” (2027) assumptions:
 - Current facilities (no storage or conveyance improvements assumed)
 - Current Delta smelt restrictions
 - Hydrology (rainfall and runoff) includes climate change impacts
 - Effects of sea level rise not included (5-year DWR analysis underway)
 - Catastrophic event not assumed
- Summary of SWP reliability (from Table 2.2 in WSPS):

Year	Estimated Average Annual Deliveries from Delta for Average Conditions and Various Dry Year Scenarios									
	Average Annual		Single Dry Year		2-Year Drought		4-Year Drought		6-Year Drought	
	%	afy	%	afy	%	afy	%	afy	%	afy
Current (2007)	63	2,079	6	198	34	1,122	35	1,155	35	1,155
2027	66-69	2,228	7	231	26-27	875	32-37	1,139	33-35	1,122

- Carollo recommendations:
 - Use 2-year dry period values for extended drought
 - Revisit after release of 2009 State Water Project Reliability Report
- Delta Vision Strategic Plan recommendations:
 - Plan for 40% water supply reductions due to drought
 - Plan for 1-year interruption of all SWP deliveries from the delta due to catastrophic event (seismic and/or levee failure)

Potential SWP Improvements

- Co-equal goals included in Bay Delta Conservation Plan (BDCP):
 - Restore Delta ecosystem
 - Create reliable water supply
- Dual conveyance approach:
 - Improve existing channel through Delta
 - Construct an “isolated facility” to convey water around the Delta
- Target: increased diversions during wet period to offset reduced diversions during dry periods
- BDCP status/schedule:
 - Draft EIR/EIS scheduled for release in 2009
 - Final EIR/EIS during 2010
 - Permitting & final design during 2011
 - Construction 2012-2016
 - Obvious potential for delays, but broader consensus exists now and much is at stake; 2/3 of State’s population depends on the Delta for water; huge economic impacts being felt
- Costs:
 - Very early estimate: \$11-\$33 billion
 - Potential sources of funding: user fees, State bonds, and Federal appropriations
 - Storage improvements would be additional
- Flood control management:
 - Inventory of needed levee improvements under way
 - Improved weather forecasting capabilities
 - System wide flood management integration
- Increased storage:
 - 5 major surface water reservoir projects undergoing feasibility analysis
 - Delta Vision Strategic Plan promotes increased surface/groundwater conjunctive use to take advantage of wet period flows
- Groundwater banking:
 - Optimize available supplies by more fully utilizing wet period deliveries
 - Variety of contractual arrangements possible
 - Potential benefits from working through CCWA

Local Climate Change Impacts

- Rainfall patterns:
 - Slight trend of increasing local annual rainfall amounts, but not statistically significant
 - Increasing frequency of extreme rainfall events
 - Evident in recent rainfall history; 69% increase since 1948
 - Trend predicted to continue as climate change continues
 - Expect more intense runoff as a result of extreme events
- Recommendation: assume 20% increase in both frequency and duration of dry periods

- Irrigation demand:
 - With more concentrated rainfall, expect longer irrigation periods
 - Net increase in irrigation requirements expected; though not clear how much
 - Monitoring of changes in irrigation demands and climate data recommended
- Sea Level Rise:
 - 55" estimate of sea level rise by 2100 recommended for long-term planning purposes
 - EEWTP and Charles Meyer Desalination Facility may not be affected by 2027; but likely will by 2100

Expanded Use of Recycled Water

- State and City policies support and require the use of recycled water
- Source of supply is influent to EEWTP; currently averaging 7.8 mgd; assumed to continue to be at least 6.0 mgd into the future
- Current demand in AFY, Average Day Demand (ADD), and Maximum Month Demand (MMD):

	AFY	ADD (mgd)	MMD (mgd)
Customer Demand:			
Phase 1 Service Area:	449	0.400	0.800
Phase 2 Area – South:	109	0.097	0.194
Phase 2 Area – North:	289	0.258	0.516
Total Customer Demand:	847	0.760	1.500
Process Water to EEWTP:	291	0.260	0.340
Total:	1,138	1.000	1.800

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- System limitations, from Table 4.13 (expressed as MMD in mgd):

Scenario	Disinfection	Booster Pumps	Storage	Tertiary Filtration
<u>Without Blending</u>				
Phase I	Limited to amount not utilized by the Phase II zone	1.7 mgd	1.0 mgd ⁽²⁾	Limited to amount not utilized by the Phase II zone
Phase II	Limited to amount not utilized by the Phase I zone	1.6 mgd	1.5 mgd ⁽³⁾	Limited to amount not utilized by the Phase I zone
System Overall	4.3⁽¹⁾ mgd	3.3mgd	2.5 mgd	4.4 mgd
<u>With Blending</u>				
Phase I	Limited to amount not utilized by the Phase II zone	1.7 mgd	1.2 mgd ⁽²⁾	Limited to amount not utilized by the Phase II zone
Phase II	Limited to amount not utilized by the Phase I zone	1.6 mgd	1.5 mgd ⁽³⁾	Limited to amount not utilized by the Phase I zone
System Overall	6.0⁽¹⁾ mgd	3.3 mgd	2.7 mgd	6.0 mgd
Notes				
(1) Assumes that both the contact basin and the reservoir are used for the required 90 minutes contact time.				
(2) For the Phase I zone, the available supply is fixed by volume of storage and the method of operation of the tertiary filters. Supply can be increased by either increasing storage or altering the method of operation of the tertiary filters.				
(3) For the Phase II zone, the available supply is fixed by the volume of storage. Supply can be increased for Phase II only by increasing storage. Currently more than adequate.				

- Capacity conclusions per above:
 - The overall limiting facility is storage. The existing system, under current operational procedures, can serve an MMD of 2.5 mgd without blending and 2.7 mgd with blending. Given current MMD of 1.8 mgd, the existing system can serve 0.7 mgd of additional MMD, or about 0.35 mgd of ADD (392 AFY).
 - Phase I: Given that distribution demand plus process water demand is at or near 1.0 mgd, and that the desired elimination of blending would reduce the effective Phase I storage capacity, storage is likely to become a limitation in the Phase I area first. Solutions: Increase storage capacity (either construct more storage or increase the chlorine contact chamber capacity), or operate the filters on a continuous basis, or a combination of both.
 - Phase II: current MMD of 0.71 mgd is well within the 1.5 MG storage capacity of the Golf Course reservoir, which defines the daily demand limit in Phase II zone.
 - Consider use of secondary effluent for process water in lieu of filtered effluent.

- Estimated Operating Costs (\$/AF):

	Phase I Zone	Phase II Zone
Treatment Costs:		
Tertiary Filtration	\$57	\$57
Disinfection	\$57	\$57
Distribution Power Costs:	\$43	\$132
Total:	\$157	\$247

- Water Quality:

- Current water quality targets:
 - Chloride: <300 mg/l
 - TDS: <1,500 mg/l
 - Turbidity: < 2.0 NTU
- Blending required to meet these targets; amounts range from 200 to 600 AFY; averaging about 400 AFY or 30% of distribution water
- Horticultural standards for recycled water quality:
 - Ayers & Wescott used to date; Sodium Adsorption Ratio (SAR) is a key parameter
 - 2004 EPA "Guidelines for Water Reuse" cited as potential updated target (TDS of 1,000 mg/l)
- Conceptual demineralization project identified:
 - Needed secondary effluent improvements not included here
 - Rehabilitate tertiary filters and add slipstream treatment of microfiltration followed by reverse osmosis for mineral removal (per Alternative 5, Tertiary Filter Rehab study)
 - Estimated capital cost: \$4,624,500
 - O&M annual cost: \$249,000
 - Total annual cost: \$652,185
 - Additional unit cost: \$341/AF
 - Potable blend alternative: \$143,250 per year or \$75/AF at assumed potable water cost of \$250/AF

- Opportunities for Expanded Use of Recycled Water:

- Increased usage at existing user sites:
 - Irrigation: Samarkand, golf course greens, S.B. Zoo, Chase Palm Park
 - Toilet flushing: Harbor lot, Shoreline Park, Elings Park, Cabrillo Ball field, La Mesa Park
 - Lowest cost for expanded use
 - 96 AFY of demand identified
- New user sites adjacent to the existing system:
 - Hotels, multi-family housing, Mission Linen, the Armory, Mission Terrace
 - Costs limited to service connections and on-site modifications
 - Added cost for backflow requirements; especially multi-family with individual meters
 - 64 AFY of demand identified
- Distribution system extensions
 - 27 potential new users identified; served by 9 extension projects
 - 166 AFY of demand identified
 - Pipeline costs: \$526 to \$3,752 per AFY of displaced potable demand, plus user site modification costs

- Future Development
 - Some projects identified; other not proposed yet
 - Demand not quantified at this point
 - Recommendation to incorporate likely future development into system planning
- Expanded Use Issues
 - Toilet flushing: provided for in the California Plumbing Code; reliability becomes more important; being implemented at East Bay MUD and Irvine Ranch Water District
 - Industrial reuse: potential local applications include car washing and commercial laundries

Water Conservation Opportunities

- Metered sales ratio of 90%-94%; meets CUWCC BMP goal
- Percent usage by class (calendar year 2006 – average weather year):

Single Family Residential:	45%
Multi-family Residential:	24%
Commercial:	17%
Industrial:	3%
Irrigation (dedicated meters):	5%
Recycled Water:	6%
- Outdoor: 43%; Indoor 57% (based on analysis of 2001 – above average rainfall)
- Age of housing: 92% built prior to 1990
- Large user analysis: top 10 accounts average more than 25,000 gallons per day; conservation efforts here are likely to be more productive
- Per capita usage analysis:
 - City usage: 130 gallons per capita per day (gcd)
 - National average: 160 gcd
 - Statewide average: 229 gcd
 - Central Coast average: 179 gcd
 - South Coast average: 208 gcd
- Potential rate structure modifications:
 - Increase number of residential tiers
 - Implement inclining block rates based on season
 - Implement water budget based rates
- Conclusions/Next Steps:
 - Additional savings in the range of 5% to 10% over 30 years seem feasible
 - Program costs will be above average for other agencies due to City efforts made to date
 - Conservation budget likely to increase to support additional water savings
 - Perform comprehensive technical/economic analysis of water savings from specific conservation measures and a benefit-cost analysis of those measures to determine which potential new water conservation measures will be most cost effective for the City to pursue
 - Incorporate identified measures and programs into the water conservation component of the LTWSP
 - Conduct a water rate study to identify rate structure modifications to fine tune pricing signals and continue to meet revenue requirements; high tier block rate could fund added conservation costs

Water Supply Management Assessment

- Diversity of the City's water supply is an asset in view of climate change impacts, increased demands, and Delta export constraints
- Adjust operations to maximize diversions of surface water when available to make storage available to capture runoff
- Consider potential impact of reduced groundwater recharge and Mission Tunnel inflow as a result of climate change
- Desalination is an expensive option, but provides flexibility in how other supplies are used; may be feasible to operate on an exchange/transfer basis
- Pay attention to pending State regulations regarding energy requirements and green house gas emissions related to water supplies
- Expect to be required to incorporate State planning requirements into the City's updates of its Urban Water Management Plan
- Continue participation in the Integrated Regional Water Management Plan process to insure eligibility for grant funding
- Update information on the City's groundwater basins, particularly Storage Unit No. 1, the Foothill Basin, and bedrock aquifer supplies; pay particular attention to groundwater injection potential and seawater intrusion issues
- Pursue cost effective expansion of recycled water use and water conservation per above
- Retain enlargement and/or silt removal at Gibraltar and Cachuma as a potential long-term options