Committee Member Packet Distribution

Wednesday, February 4, 2015

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Water Supply Advisory Committee February 12-13, 2015 Meeting

Items that are provided in the Wednesday packet distribution are listed in bold

Committee Member Packet Distribution

Friday, February 6, 2015

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Water Supply Advisory Committee February 12-13, 2015 Meeting

Items that are provided in the Friday packet distribution are listed in bold

[1] Items 9a, 9b, and 9c were provided with the Wednesday Packet Distribution but were inadvertently left off the Table of Contents

TO: WATER SUPPLY ADVISORY COMMITTEE (WSAC)

FROM: HEIDI LUCKENBACH

SUBJECT: UPDATE ON SOQUEL CREEK WATER DISTRICT ACTIVITIES

DATE: February 4, 2015

Soquel Creek Water District Board Meetings

January 6, 2015 The Board received a quarterly report from Hydro Metrics regarding coastal monitoring data that discusses water levels and salt concentrations in coastal monitoring wells. There is only one SqCWD coastal monitoring well in the Purisima area with groundwater levels above protective elevations. There have been no notable changes in salt concentration trends over the last few quarters.

January 20, 2015 The Board indicated its interest in devising a plan to retain the most cost-effective components of the Conservation Plus (CP) program, which was put on hold in response to the budget shortfall, that would be implemented regardless of the CP Program, but can still form the backbone of a robust CP program in the future. The intent is that these CP program components can begin relatively quickly to help maintain on-going conservation savings, yet reduce program costs.

Soquel/Aptos Groundwater Management Plan Basin Implementation Group (BIG)

January 29, 2015 BIG received a technical memorandum from Hydro Metrics providing the work plan for completing the Soquel-Aptos Area groundwater model. This work plan is based on two scoping meetings held in late 2014.

They also reviewed memoranda that discussed protective groundwater elevations for seawater intrusion and cross sectional models pertaining to intrusion. Working with preexisting cross-sectional models and developing new cross-sectional models was proposed. These memoranda were teamed with reports from Hydro Metrics and Todd Groundwater. Todd Groundwater reported that the biggest challenge for managing groundwater resources in the Soquel-Aptos basin is not weaknesses in technical analysis but weaknesses in correlations between pumping, water levels and water quality.

An oral report was provided, one of the desired outcomes was to provide an update on the state requirements of the local formation of a groundwater sustainability agency. It also focused on furthering public engagement and how basin users can collaboratively meet the new state laws of groundwater sustainability.

Mid-County Groundwater Stakeholder Group

January 27, 2015 The group discussed the formation of a Groundwater Sustainability Agency and development of recommendations/strategies for local water agencies to consider for furthering public engagement.

County-Wide Updates

Historic salmon and steelhead populations have been greatly diminished by reductions in streamflow, increased erosion and sedimentation, barriers to migration, and removal of large woody material from streams. Coastal water quality has been degraded by urban runoff and leaky sewer systems. The natural benefits of wetlands, floodplains, riparian corridors, and groundwater recharge areas have been significantly diminished by development and agricultural use. The County and its partner agencies are conducting a range of efforts to address these and other water resource challenges.

In 2014, streamflow in the San Lorenzo River, the primary water source of Santa Cruz, reached the lowest levels reported in 77 years of monitoring.

The County, City of Santa Cruz, and Scotts Valley Water District received a Proposition 84 stormwater grant to implement projects to reduce stormwater runoff and increase groundwater recharge by infiltrating runoff from impervious surfaces. This will be implemented in 2015.

Attachments: Annual County of Santa Cruz Water Resources Status Report

DRAFT

AGENDA: January 27, 2015

January 13, 2015

Board of Supervisors
County of Santa Cruz
701 Ocean Street
Santa Cruz, CA 95060

SUBJECT: County Water Resources Status Report

Members of the Board:

This letter presents the annual status report on County water resource management activities, with highlights on four major efforts being taken with regard to drought response, sustainable groundwater management, integrated regional water management, and restoration of coho salmon and steelhead habitat. Additional information attached to this letter provides a summary of all water resource management efforts related to water supply and water conservation, water quality protection, habitat restoration, and stormwater and flood management in the Santa Cruz and Pajaro regions (Attachment 1).

Drought Response and Water Supply Planning

2014 was the third year of a critical drought in California, with Santa Cruz County in the area of the state that was designated as subject to exceptional drought. Streamflow in the San Lorenzo River, the primary water source of Santa Cruz, reached the lowest levels reported in 77 years of monitoring. Following the rains of December 2014, the state of drought in Santa Cruz County has only abated one level, and is still considered to be extreme drought, according to the U.S. Drought Monitor.

All large public water systems in the county implemented water rationing, use restrictions, and/or conservation programs in 2014 to address the impacts of the drought. Santa Cruz had some of the highest levels of water use reduction in the state, with reductions of 28% in the Santa Cruz City service area, and 20-27% in other jurisdictions. (Attachment 2).The County also adopted emergency measures to limit excessive outside watering. County staff responded to reports and observations of excessive or unpermitted water use and sent out 14 notices to water users and stream diverters to reduce use. Most of the small public water systems under County jurisdiction fared relatively well, with only one system needing to haul water and three other experiencing water quality issues. All of these systems were dependent on surface water. Lompico County Water District was in danger of running out of water and received emergency drought funding to complete an emergency intertie to San Lorenzo Valley Water District. The intertie had to be used twice during 2014.

Although the current drought may pass, the Santa Cruz region continues to face water supply shortfalls during normal years as well as future droughts. All of the major water agencies are continuing to explore future water supply options, as described in Attachment 1.

Sustainable Groundwater Management

The state adopted the Sustainable Groundwater Management Act of 2014, which provides the authority and the responsibility to manage groundwater use and supplies to eliminate adverse effects of overdraft. The provisions of the Act, which went into effect January 1, 2015, will empower and enhance local management efforts already underway in Santa Cruz County to manage the three major overdrafted groundwater basins: Soquel-Aptos, Santa Margarita/Scotts Valley, and Pajaro. Key provisions of the Act include:

- Formation of local Groundwater Sustainability Agencies (GSA) by June 30, 2017. A GSA can be a single agency or a Joint Powers Authority. In the absence of any other agency coming forward, the county would become the GSA.
- Development of a Groundwater Sustainability Plan (GSP) by January 31, 2022 for medium and high priority basins, or by January 31, 2020, for critically overdrafted basins. The Pajaro Valley is the only basin in the county currently identified as critically overdrafted.
- Twenty years after adoption of the GSP, the basin must achieve sustainability through implementation of the GSP and use of the tools provided by the act, including the authority to: determine the sustainable yield of the basin, measure and limit extraction, impose fees for groundwater management and enforce the terms of the GSP.
- Sustainable groundwater management is defined in the Act as management and use of groundwater without causing undesirable results such as lowering of groundwater levels, reductions in storage, seawater intrusion, degradation of water quality, land subsidence, or depletion of streamflow.
- If local agencies fail to act, the state will act to achieve sustainability.

The Pajaro Groundwater Basin is the only basin in the county designated as critically overdrafted, but it is already subject to a higher level of management though the powers conferred on the Pajaro Valley Water Management Agency (PVWMA) through the special legislation that created the agency in 1984. The PVWMA Board adopted an updated Basin Management Plan (BMP) in 2014 and is now seeking approval to charge the water use fees necessary to fund full implementation of the BMP. The PVWMA is already specifically designated as a GSA under the new Act.

Most of the Soquel-Aptos groundwater basin is designated as medium or high priority for management, given the current levels of overdraft, depressed groundwater levels, seawater intrusion, and streamflow depletion. The Soquel Creek Water District and Central Water District have already developed a groundwater management plan and are implementing it through the Basin Implementation Group (BIG) established by a joint exercise of powers agreement. In order to comply with the new Act, these efforts will need to be strengthened significantly and expanded outside the boundaries of the water districts. A number of efforts are already underway to improve management of the Soquel- Aptos basin:

- Soquel Creek Water District and Central Water District invited the County, the City of Santa Cruz and the Pajaro Valley Water Management Agency to participate in the Basin Implementation Group (BIG). On August 19, 2014, your Board accepted that invitation and designated the first and second district supervisors to work the committee to expand the scope of the BIG. The City has also agreed to participate. Your Board also previously approved County participation in the Soquel-Aptos Groundwater Authority (SAGMA) on September 27, 2005. The SAGMA agreement also provides a basis for further organizing a groundwater management program.
- Discussions among staff are currently underway regarding the best approach for building on current efforts to implement the Groundwater Sustainability Act. There is some consideration to having the County assume the lead in developing the approach, given that the County is the

only agency that has authority over the full geographic extent of the basin. It is anticipated that all participating agencies would contribute to the costs of the effort. There is also some consideration for forming one large Groundwater Sustainability Agency to encompass all of the north county groundwater basins, excluding the Pajaro basin. These discussions will be carried to the committee of elected representatives designated to work on expansion of the BIG.

- The County, Soquel Creek Water District and Central Water District have held a series of meetings for private groundwater users, small water systems, and other interested stakeholders in the Soquel-Aptos groundwater basin, to discuss basin management issues and engage non-municipal pumpers in long term management of the basin. Discussions are currently underway about the best mechanism to formalize ongoing stakeholder participation in the next steps for development and implementation of the GSP.
- The water districts have initiated the development of a groundwater model to better guide management of the basin. It is anticipated that this will be a two year process and that all agencies, including the County will contribute financially. County staff are particularly interested in modeling the effects of groundwater depletion on streamflow, and better assessing the effects of inland pumping on the depleted groundwater levels along the coast. Staff will return to your Board for consultation once the scope of work and costs are better defined.
- County staff continue to monitor stream diversions, measure streamflow, measure groundwater levels in private wells, and work with small public water systems in the Soquel-Aptos groundwater basin. Staff will be updating the county-wide well database to better quantify the amount of private water extraction.

There is an ongoing history of groundwater management in the Scotts Valley/Santa Margarita groundwater basin, which includes Scotts Valley and extends northwest to Boulder Creek, serving the Scotts Valley Water District, San Lorenzo Water District, Lompico Water District, Mt. Hermon Association and a number of small water systems and individual users. The groundwater basin also helps to sustain baseflow in the San Lorenzo River, which is the primary supply for the City of Santa Cruz. Discussions about ongoing basin management occur among staff and elected officials at biannual meetings of the Santa Margarita Basin Advisory Committee. Discussions are just beginning regarding the process for building on current efforts to come into compliance with the Sustainable Groundwater Management Act. Staff will report to your Board as further action is considered.

Integrated Regional Water Management

Integrated regional water management (IRWM) continues to be a key program at the local and state level to promote a coordinated approach to the range of water resource issues. This program has helped to further bolster the County's long-standing watershed management approach, bringing together water agencies, resource protection agencies, and other stakeholders to address water supply, habitat protection, water quality protection, flooding, groundwater recharge, stormwater management, and wastewater management in an integrated and comprehensive manner. County staff have been actively engaged in IRWM in northern Santa Cruz County, the Pajaro Watershed, the Central Coast Region, and at the state level.

Updated IRWM plans for both the Santa Cruz and the Pajaro Region were completed in 2014. Both regions have received state grants to implement a range of programs in their regions. There will be some additional grant funds available through Proposition 84 and a significant amount of new funding will be available through Proposition 1. The region is also making use of the IRWM approach to provide coordination of projects for emergency interties, stormwater management, and possibly groundwater management. These efforts are described further in Attachment 1.

Steelhead and Coho Salmon Recovery Strategy

The County of Santa Cruz has a long history of implementing programs and projects that benefit local steelhead and coho salmon populations. Since steelhead and coho salmon were listed under the federal Endangered Species Act, the County has actively participated in the development of the recovery plans that provide a blueprint for species recovery. Now that the National Marine Fisheries Service has completed two of the three recovery plans related to steelhead and coho salmon within Santa Cruz County, staff believes the timing is right to identify high priority actions that the County can implement as a recovery partner.

The Coho Salmon Recovery Plan identifies specific Objectives, Recovery Actions and Action Steps in each of the six Santa Cruz County watersheds included in the plan: Waddell, Scott, San Vicente, San Lorenzo, Soquel and Aptos. In each watershed, Objectives, Recovery Actions and Action Steps are prioritized as 1, 2 or 3, with 1 being the most critical for recovery. County Water Resources staff have combined these Objectives, Recovery Actions and Action steps across the six watersheds to look at priorities throughout Santa Cruz County. From this document, the Priority 1 actions from the Coho Salmon Recovery Plan were evaluated more closely and integrated with action steps from the South-Central Steelhead Recovery Plan and the Draft Central Coast Steelhead Recovery Plan. While there are somewhat different priorities for steelhead and coho salmon, many of the recovery actions for the two species are the same.

Staff have developed a Draft Steelhead and Coho Salmon Conservation Strategy, which consists of 20 high priority actions that the County could take or continue to take to improve habitat for steelhead and coho salmon. The intention is to implement these actions 2015-2018. Most of these can be accomplished within current work programs and budgets, but some may require more focused effort or grant assistance. In addition, the plan lists 12 well established programs and policies that were identified as high priority actions in recovery plans. The draft strategy is currently begin reviewed by the affected departments, the Fish and Game Advisory Commission and the Water Advisory Commission. Staff is also consulting with other local agencies regarding putting together a more comprehensive collaborative approach to coho and steelhead habitat restoration in the County. We anticipate bringing a report on these activities to your Board in spring of 2015.

Conclusion and Recommendation

County staff are working closely with other partner agencies to provide a comprehensive and integrated approach to water resources management in the County resulting in a substantial number of collaborative projects to address significant water resources issues. We anticipate further successful efforts in the coming year.

It is therefore RECOMMENDED that your Board accept and file this report and direct the Water Resources Division Director to provide a follow up annual report on County water management activities in January 2016.

Sincerely,

RECOMMENDED:

Giang T. Nguyen
Health Services Agency Director

SUSAN A. MAURIELLO
County Administrative Officer

Attachments: 1. Status of Water Resource Management Efforts in Santa Cruz County, 2014
2. Water Use Restrictions and Savings in Santa Cruz County, 2014

Cc: Public Works Department
Planning Department
Environmental Health
Water Advisory Commission
Water Agencies
LAFCO

Status of Water Resource Management Efforts in Santa Cruz County, 2014

Santa Cruz County continues to address major water resource challenges. Most of the groundwater basins are being pumped in excess of sustainable yield and the major water supply agencies do not have sufficient sustainable supplies to meet current and future demand. Historic salmon and steelhead populations have been greatly diminished by reductions in streamflow, increased erosion and sedimentation, barriers to migration, and removal of large woody material from streams. Coastal water quality has been degraded by urban runoff and leaky sewer systems. The natural benefits of wetlands, floodplains, riparian corridors, and groundwater recharge areas have been significantly diminished by development and agricultural use. The County and its partner agencies are conducting a range of efforts to address these and other water resource challenges.

Following is a summary of 2014 water resource management efforts, organized by 7 topic areas:

- Drought Response
- Water Supply and Conservation
- Water Quality
- Stormwater and Flood Management
- Watershed and Aquatic Habitat
- Santa Cruz Integrated Regional Water Management (IRWM) Planning and Administration
- Pajaro Water Management Efforts

Drought Response

1. 2014 was the third year of a critical drought in California, with Santa Cruz County in the majority of the state that was designated as subject to exceptional drought. Streamflow in the San Lorenzo River, the primary water source of Santa Cruz, reached the lowest levels reported in 77 years of monitoring.

2. Following the rains of December 2014, the state of drought in Santa Cruz County has only abated one level, and is still considered to be extreme drought, according to the U.S. Drought Monitor.

3. All large public water systems in the county implemented water rationing, use restrictions, and/or conservation programs in 2014 to address the impacts of the drought. Santa Cruz saw some of the highest levels of water use reduction in the state, with reductions of 28% in Santa Cruz City, and 20-27% in other jurisdictions.

4. The County adopted emergency measures to limit excessive outside watering. County staff responded to reports and observations of excessive or unpermitted water use and sent out 14 notices to water users and stream diverters to reduce use.

Water Supply and Conservation

1. The City of Santa Cruz formed a Water Supply Advisory Committee in order to further re-evaluate the water supply deficiencies and potential options to address those deficiencies. The Committee is expected to make recommendations to the City Council in mid to late 2015.

2. The City of Santa Cruz completed a baseline water conservation study and will complete a new ten year water conservation plan to quantify the amount of additional conservation that can be reliably expected.

3. The Soquel Creek Water District continues to face the need to cut pumping by 35% and has conducted a series of public workshops to evaluate its options without a desal project, including use of water exchange, recycled water, groundwater injection, water use curtailment, and augmented groundwater management.

4. County staff continue to work with the water agencies to complete an evaluation of potential opportunities for water exchanges, including potential yield, infrastructure needs, costs, fish impacts, and water rights issues. A draft evaluation report is being completed and circulated for review.

5. The County, Soquel Creek Water District and Central Water District have held a series of meetings for private groundwater users and other interested stakeholders in the mid-county groundwater basin, to discuss basin management issues and engage non-municipal pumpers in long term management of the basin.

6. Soquel Creek Water District and Central Water District invited the County, the City of Santa Cruz and the Pajaro Valley Water Management Agency to participate in the Basin Implementation Group (BIG) for the mid-county/Soquel/Aptos groundwater basin. These efforts will be furthered by the adoption of the Sustainable Groundwater Management Act, which mandates formation of Groundwater Sustainability Agencies by 2017 and development of a plan by 2022 to achieve groundwater sustainability by 2042.

7. The City of Santa Cruz continues to negotiate its habitat conservation strategy with the fishery resource agencies. This work has been somewhat delayed by other water planning efforts that will help determine options and costs for alternative supplies that will allow the City to give up some of its current water supply in order to support the recovery of Coho salmon and steelhead.

8. The San Lorenzo Valley Water District has started to develop the information necessary to evaluate the impact of its stream diversions on fish habitat. It is expected that this process will take 5-10 years to reach an agreement on the amount of stream flow the District needs to release to adequately restore fish habitat.

9. The San Lorenzo Valley Water District and the Scotts Valley Water District secured a grant from the California Department of Public Health to construct emergency interties connecting the two districts and the four subareas of the San Lorenzo District. These interties can eventually be used of conjunctive management and water exchange, but not until a full evaluation of fishery and other environmental impacts is completed.

10. County staff worked with staff from the Local Agency Formation Commission, San Lorenzo Valley Water District and Lompico County Water District to pursue an effort to make capital improvements and merge the two Districts to address substantial deficiencies in water quality and reliability. The merger was approved by LAFCo, pending the approval by Lompico voters of capital improvement bond in early 2015. An emergency intertie between the districts was completed with the aid of state drought funding assistance.

11. County staff are working with the City of Santa Cruz, Soquel Creek Water District, and Scotts Valley Water District to apply for grants to evaluate recycled water options.

12. County staff have assisted Pasatiempo golf course in the pursuit of options to use recycled water from Scotts Valley on the golf course.

13. Scotts Valley Water District will complete an update of the groundwater model for the Scotts Valley area in 2015 which will help determine groundwater management objectives and options, including the effects of water exchange.

14. Central Water District completed a study of options for moving pumping to the Purisima formation and reduce pumping from the Aromas Formation, which is overdrafted and subject to naturally elevated levels of hexavalent chromium. Central and Soquel Districts are continuing to evaluate options to address hexavalent chromium, including treatment, modification of wells or abandonment of some wells.

15. The County, City of Santa Cruz, and San Lorenzo Valley Water District are conducting a project to identify and better understand the occurrence of karst geology, which has the potential to store and transmit significant amounts of water, but which is very susceptible to adverse impacts from overlying land use. This work should be completed in 2015 and may result in recommendations to update county policies to provide more water resource protection in karst areas.

16. County staff continue to regulate the 130 small water systems with 5-199 connections. The County is using a one-time grant from the State Department of public Health to bolster that program. Three smaller water systems are in the process of consolidating with larger systems, and two systems are in the process of upgrading their surface water treatment. County staff were in contact with all the systems during the drought and conducted measurements of groundwater depth if requested. With the adoption of the new lower state drinking water standard for hexavalent chromium, larger systems are conducting tests and a number of south county systems may have elevated levels.

17. The County, City of Santa Cruz, and Scotts Valley Water District received a Proposition 84 stormwater grant to implement projects to reduce stormwater runoff and increase groundwater recharge by infiltrating runoff from impervious surfaces. This will be implemented in 2015.

18. The County continues to coordinate submission of groundwater level data to the State's groundwater monitoring program (CASGEM). County staff also implement a cooperative program to monitor private well levels in the inland mid-county area.

19. County staff continue to work with the water agencies and the real estate community to implement the water conservation programs, including promotion of greywater reuse.

20. The presence of naturally elevated levels of hexavalent chromium in excess of the new state drinking water in the south county groundwater will create expensive treatment challenges for the City of Watsonville, Soquel Water District, Central Water District and some small water systems that draw water from the Aromas formation. Soquel has worked with consultants to develop a new treatment approach.

Water Quality

1. County staff continue to work with the State, City of Santa Cruz, City of Capitola, and the Sanitation District to implement projects and conduct monitoring to assess public health threats, reduce bacterial contamination and improve beach water quality. The Water Resources Division Director continues to serve on the State Clean Beach Task Force.

2. County staff maintain ongoing efforts for water quality protection through septic system management, monitoring and investigation, funded by CSA 12. In 2014 Staff began work with the Onsite Sewage Disposal Technical Advisory Committee to update the County's onsite wastewater management program and sewage disposal ordinance to bring it into compliance with new state septic system requirements.

3. The County Water Resources laboratory continues to offer free nitrate testing to residents with individual wells. Several wells with nitrate above drinking water standards have been identified through this program.

4. Public Works staff has received approval from the State Clean Beach Task Force for grant funds to upgrade the sewer system near Soquel Creek and Neary Lagoon, to eliminate potential sewer leaks and sources of contamination to Cowell and Capitola beaches.

Watershed and Aquatic Habitat

1. The Resource Conservation District of Santa Cruz County worked with landowners and agency partners to complete over 70 habitat improvement projects through the Integrated Watershed Restoration Program (IWRP). These projects included wetland restoration, fish barrier removal, rural road upgrades, stream habitat improvement, and community education.

2. County staff continued to work with the water agencies to maintain annual sampling of stream habitat and juvenile salmonids in four watersheds: San Lorenzo, Soquel, Aptos and Pajaro. In 2014, Steelhead numbers were very low in Aptos Lagoon and Soquel lagoon compared to the two previous years and steelhead were again not found in Pajaro Lagoon. Numbers in the upland streams were also significantly reduced as a result of the drought.

3. County staff completed riparian assessments and general stream condition surveys for much of Bean, Zayante, and Branciforte creeks and portions of Soquel, Lompico and Mountain Charlie Gulch.

4. County staff continued to implement the large woody material management program to maintain large wood for habitat value in county streams without jeopardizing public safety. There were few requests for large woody material removal due to the limited number of storms in the 2013-14 winter season.

5. County staff are participating in a multi-agency group working with Caltrans to replace the Highway 1 Bridge at Scott Creek in a way that also enhances lagoon and beach habitat for listed species including coho salmon, steelhead, tidewater goby, red-legged frog, and snowy plover.

6. County staff are working with the National Marine Fisheries Service to identify critical efforts to be implemented from the Coho Salmon Recovery Plan, which was released in 2013, and

the draft Steelhead Recovery Plan, which was released for agency review in 2014. Staff are developing a coho and steelhead conservation strategy for key actions for the County to take. Staff are also consulting with other local agencies regarding putting together a more comprehensive collaborative approach to coho and steelhead habitat restoration in the County.

7. County Planning and Environmental Health staff continued to meet with other regulatory agencies to coordinate effective approaches to environmental code compliance.

8. County staff are participating with the Coastal Watershed Council, City of Santa Cruz, and other entities in the San Lorenzo River Alliance, which is seeking to improve water quality and reinvigorate community engagement with the lower river and the watershed.

Stormwater and Flood Management

1. County Public Works staff maintained the ALERT flood warning system.

2. County staff continued to implement the County's stormwater management program and are updating the program to address the new requirements of the State's new municipal stormwater permit, which was adopted in 2013.

3. The County, City of Santa Cruz, and Scotts Valley Water District received Proposition 84 stormwater grant to implement projects to reduce stormwater runoff and increase groundwater recharge by infiltrating runoff from impervious surfaces. This will be implemented in 2014 and 2015.

4. The County and water agencies are working with Ecology Action of Santa Cruz to implement a grant to promote use of low impact development measures and rainwater catchment to reduce stormwater runoff.

Integrated Regional Water Management (IRWM)

1. Regional partners competed most of the work on 8 projects funded by a $1 million Proposition 84 IRWM Planning Grant:
   a. Update the IRWM plan framework, including governance, financing, relation to land use planning, and stakeholder involvement, County Environmental Health, $14,000
   b. Provide improvements to the IRWM Plan, including updated objectives, management strategies, projects, project prioritization and effectiveness assessment, data management, and performance evaluation, County Environmental Health, $120,000
   c. Develop a climate change strategy relative to water resources and water facilities, County Environmental Health, $31,500.
   d. Evaluate the potential to increase pumping in the eastern Purisima Formation in order to reduce pumping from the overdrafted Aromas formation, Central Water District, $200,000
   e. Update the Santa Margarita Groundwater Model, Scotts Valley Water District, $221,519
   f. Develop detailed recommendations for conjunctive use and water transfers, County Environmental Health, $164,500
   g. Develop a hydrologic and hydraulic model of the middle and lower Watsonville Slough system to support future management and enhancement efforts, Resource Conservation District, $199,056

h. Administer and manage the Grant, Regional Water Management Foundation (RWMF), $49,175

2. The RWMF received a $100,000 grant from California Department of Water Resources to promote engagement of disadvantaged communities in IRWM. Work will be focused in Davenport and Watsonville with an evaluation of other potential low income communities in the region.

3. County and RWMF staff completed work on the IRWM Plan Update, which was adopted by the County and other partner agencies in August. This plan will help guide water management efforts and will form the basis for application for additional water bond grant funds.

4. The Santa Cruz IRWM region applied for drought funding under Proposition 84 to explore groundwater recharge with recycled water and make more efficient use of the City of Santa Cruz supply. Although the application scored well, there was not enough funding available for the Central Coast funding area.

5. Partner agencies continue to provide $80,000 to the RWMF to support ongoing IRWM planning and management in the region for FY 2014-15.

6. County staff have provided outreach to the community on IRWM efforts, including one public workshop and talks to County Commissions and service groups.

7. County staff participated in statewide water planning, including the Public Advisory Committee for the California Water Plan Update 2013, and the IRWM Strategic Plan development.

Pajaro Management Activities

County staff also participate actively in the Pajaro IRWM, which encompasses the entire 1300 square mile Pajaro watershed. Pajaro IRWM includes water supply and flood management projects throughout the Pajaro Valley, as well as water quality and habitat restoration projects in the Pajaro Valley outside the Watsonville Slough system. The Pajaro IRWM is led by Santa Clara Valley Water District, San Benito County Water District and the Pajaro Valley Water Management Agency. Following is the list of current water resource management activities within the Santa Cruz County portion of the Pajaro Watershed:

1. The Pajaro Valley Water Management Agency (PVWMA) adopted the Basin Management Plan Update in 2014. Implementation of this plan is expected to reduce groundwater extraction by 12,000 af/yr and halt further seawater intrusion.

2. PVWMA formed an Ad Hoc Funding Committee to develop a rate structure for collection of pumping fees to fund implementation of the updated Basin Management plan. The new rates will be put to a vote of the well owners in 2015.

3. The Community Water Dialog, a community stakeholder group continued to promote grower and community support for a variety of efforts to implement managed recharge projects, improved irrigation efficiency, and community support for improved basin management.

4. The Resource Conservation District has worked with the agricultural community to implement a variety of outreach, technical assistance and cost-sharing programs to reduce water use, promote groundwater recharge, and improve water quality.

5. The City of Watsonville, County and other entities have worked together to better characterize and address the causes of excessive harmful algae blooms at Pinto Lake. Additional grant funds have been received to better characterize the specific sources and to begin implementation of measures to reduce nutrient loading.

6. The County, City and other entities continue to pursue implementation of a project with the Army Corps of Engineers to significantly upgrade the flood conveyance system to provide an adequate level of flood protection.

7. In 2014 the Resource Conservation District and partner agencies completed College Lake Improvement and Watershed Management Project. This project involved field work and modeling to better understand the movement and storage of water in College Lake, and evaluated various scenarios for management of the lake for water supply, fish habitat, wildlife habitat and agricultural use. Modelling and findings from this effort will support further evaluation of water supply options for College Lake, which is identified as an important project in the PVWMA Basin Management Plan.

8. In late 2013 the Pajaro Region was notified that they were the only region in the Central Coast selected for Round 2 of Proposition 84 funding, at an amount of $7,569,000. Within Santa Cruz County, this grant will fund an increased recycled water storage project for PVWMA and an agricultural water quality and aquifer enhancement project to be conducted by the Resource Conservation District of Santa Cruz County.

9. PVWMA and its partners received approximately $5 million in drought relief funding under Proposition 84. This will help fund expanded storage and distribution for irrigation use of recycled water, improved irrigation efficiency and improved use of plentiful winter streamflow.

DRAFT Attachment 2

Water Use Restrictions in Santa Cruz County, and Water Savings Since 2013, Through December, 2014

Agency	2014 Drought Restrictions	Average Residential Water Use June-Nov. 2014 (gal. per person per day)	Average Monthly Savings June-Nov. 2013 to 2014
State Requirements, July 15, 2014	• Water Waste Prohibitions • Limit outside watering to 2 days per week or equivalent savings		Objective of 20%
County of Santa Cruz	• Permanent Water Waste Prohibition o No hosing off of hardscapes o No irrigation run-off o Shut-off nozzle required on hoses o Limit outside watering to 2 days per week o No spray irrigation 10am-5pm • 20% voluntary reduction		
City of Santa Cruz Water Department	• Stage 3 (of 5) Water Shortage Emergency • Mandatory 25% reduction • Permanent Water Waste Prohibition o No spray irrigation 10am-5pm o No hosing off of hardscapes o Shut-off nozzle required on hoses o No irrigation run-off o Water service at visitor facilities only on request	47	26%
Soquel Creek Water District	• Stage 3 (of 5) Water Shortage Emergency • Permanent Water Waste Prohibition o No Watering 10am-8 pm o No hosing off of hardscapes o No irrigation run-off o Shut-off nozzle required on hoses • 200% Water Demand Offset for new connections	62	22%
Scotts Valley Water District	• Stage 1 (of 3) Water shortage • Permanent Water Waste Prohibition o No spray irrigation 10am-5pm o No hosing off of hardscapes o Shut-off nozzle required on hoses o No irrigation run-off	82	19%
San Lorenzo Valley Water District	• Stage 2 (of 5) Water Restrictions o Outdoor watering 3 days only o No spray irrigation 10am-5pm o No hosing off of hardscapes o Shut-off nozzle required on hoses o No irrigation run-off	74	21%
City of Watsonville	• Permanent Water Wise Use • 20% voluntary reduction • Permanent Water Waste Prohibition o No spray irrigation 9 am-5pm o Shut-off nozzle required on hoses o No irrigation run-off	96	12%

Notes: Water usage and reductions from reports submitted by urban water agencies to state: http://www.waterboards.ca.gov/waterrights/water_issues/programs/drought/conservation_reporting_info.shtml

DRAFT Attachment 2

See agency websites for more detail on programs and restrictions.

Water Supply Advisory Committee Meeting
First session: Thursday, February 12
5:00 p.m. – 9:30 p.m.

Fellowship Hall, Peace United Church of Christ
(formerly the First Congregational Church)

900 High Street, Santa Cruz

Second session: Friday, February 13
2:00 p.m. – 6:00 p.m.
City of Santa Cruz Police Department Community Room

155 Center Street, Santa Cruz

Flow Agenda[1]

Meeting Objectives:
At this meeting the Water Supply Advisory Committee (WSAC) will receive presentations on supply, demand and reliability analyses created or updated specifically for use by the Committee in its process. These analyses create a baseline or point of departure for the Committee's work planned during Phase Two of the WSAC process.

In addition to desired outcomes for each substantive agenda item, the objectives for this WSAC meeting include:

- Reach a common understanding of baseline information on supply, demand and water system reliability and identify any additional information that is needed to support Committee understanding of baseline conditions and analytical results;
- Reach a common understanding of the baseline conditions that are set by physical, legal, or regulatory limits and which are driven by formal or operational policy that may be subject to modification and possible further evaluation as part of scenario planning;

[1] This is the Flow Agenda prepared for use by the facilitator. It includes information that is excluded from the official agenda about the timing of the meeting and the content of agenda items. We expect that, as much as we hope to stick to this flow agenda, we will have to make adjustments during the meeting to the schedule and the contents described here. The Committee is required to do pretty much exactly what the official agenda says, so we get the "wiggle room" we need in the official agenda by making the official version less specific about schedule and content. You will easily recognize the official agenda by the lighthouse logo on its first page.

- Reach a common understanding of the principles of risk assessment and of the primary risks the water system faces;
- Reach a common understanding of how scenarios are created and identify an initial set of variables around which to build scenarios for future consideration.
- Reach agreement on the approaches being taken to develop consolidated alternatives and to refine evaluation criteria and rating scales for use in the MCDS tool and more generally in decision making.

First Session:

Roll Call

1. Welcome to the public and public comment (5:00-5:10)
We encourage members of the public to attend this Committee's meetings and invite public comment about items on the agenda at the beginning of each session. We will invite additional comment during the session before making major decisions. We invite public comments about items relevant to this Committee's work but not on the meeting's agenda during the Oral Communication section at the end of Friday's session.

2. Committee member updates (5:10-5:20)
Members provide news of significant communication between them and organizations with significant interest in the development of water policy in Santa Cruz.

3. Agenda Review (5:20-5:30)
The Committee reviews the agenda for both sessions of this meeting.

Desired outcomes:
- Understanding of the relevance of this meeting's tasks to the Committee's work as a whole
- Agreement on the agenda for this meeting

Packet Materials Related to this Agenda Item:
3a February WSAC Meeting Flow Agenda
3b February WSAC Meeting Formal Agenda

4. Update on Results of January 27th City Council Meeting (5:30-5:40)

Desired Outcome:
- Understanding of Council actions, feedback from the Council, and agreement on any actions needed to respond to that feedback

Packet Materials related to this item:

4a Links to staff report on Recon, including report and attachments Recon Staff Report Recon Report
4b Links to staff report on proposed approach and schedule for remaining WSAC work Phase 2 Staff Report Phase 2 schedule
4c Links to staff report on P2C contract amendment P2C Contract Staff Report and P2C Contract Amendment

5. WSAC Phase Two Work Plan – (5:40-5:50)

Committee members will receive a short briefing on the basic work plan for Phase Two WSAC work, and will have a chance to ask any questions about the Technical Work Plan Progress Report.

Desired Outcome

- Understanding of the status of work being undertaken by the Technical Team to support the WSAC process.

Packet Materials Related to this item:

5a WSAC Work Plan Graphic
5b Technical Work Plan Update Memo
5c Update Memo on Enrichment Opportunities
5c Proposed Contract Amendment for Stratus Consultants

6. Presentation of Baseline Demand, Supply and Reliability Analyses (5:50-7:20)

The Committee will receive several presentations related to the baseline supply and demand forecasts. Questions from the Committee on the presentations will be responded to during or immediately following each presentation

This presentation and discussion will cover the following:

- Future demand forecast
- Existing supply assumptions
- Reliability analyses using the Confluence model
- Presentation of a draft preliminary problem statement

The baseline information for system demand represents a forecast based on current and future condition adjusted for those factors such as plumbing and building code changes and price elasticity that will affect future demand in any case.

The baseline information presented for the Santa Cruz water system represents a status quo picture of the system including, current supply sources and restrictions on those supplies (e.g. legal and hydrologic), operating procedures, treatment capabilities and capacity and infrastructure for collecting, storing and delivering water.

The baseline presented is intended to be a point of departure not an end point.

Desired Outcomes for Agenda Items 6 and 8

- Understanding of baseline information on supply, demand and water system reliability and identify any additional information that is needed to support Committee understanding of baseline conditions and analytical results;
- Understanding of the baseline conditions that are set by physical, legal, or regulatory limits and which are driven by formal or operational policy that may be subject to modification and possible further evaluation as part of scenario planning;
- Understanding of how the Confluence model can/will be used to simulate changes in the system; and
- Understanding of what a potential problem statement might look like

Packet Materials Related to this item:

6a Summary memo on baseline demand forecast

6b Link to Modeling and Forecasting Working Group demand forecasting presentation

6c Summary memo on system assumptions used in Confluence model runs

6d Summary memo of Confluence model run results

6e Links to Modeling and Forecasting Working Group Confluence modeling presentation and summary sheet on History of Confluence modeling assumption changes

7. Break (7:20-7:30)

8. Committee Discussion of Baseline Information (7:30-8:30)

The Committee will have the opportunity to work together to discuss and explore the baseline information presented in Agenda Item 6, ask questions and receive responses from members of the technical team, hear from members of the public about questions they may have and identify any additional information that is needed to support Committee understanding of baseline conditions and analytical results.

Desired Outcomes: (see also Outcomes for Agenda Item 6)

- Agreement on any additional information that is needed to support Committee understanding of baseline conditions and analytical results; and
- Agreement that the baseline information, as presented and revised per any WSAC discussion and agreement, will serve as the point of departure for scenario planning.
- Agreement that the Confluence model will be used to simulate plausible futures

as part of scenario planning.

9. Subcommittee Reports (8:30-9:10)

- Outreach Subcommittee
  Report on:
  - Editorial Board Meetings
  - Additional plans for outreach and community engagement

Packet Materials Related to this Item:
9a Outreach Committee Meeting Minutes
9b Editorial Calendar
9c First Editorial

- Planning Subcommittee
  Report on:
  - Progress Report on Planning Subcommittee Work Plan (note Planning Subcommittee work plan products and comments are also relevant to Agenda Items 15 and 18)

Desired Outcomes:

- Understanding of work being done by subcommittees; and
- Agreement on any Committee direction to subcommittees

10. Correspondence received from the community (9:10-9:20)

Mike Rotkin reports on correspondence received from the community.

Desired outcomes:

- Understanding of the correspondence received
- Agreement on any direction to be given to the Corresponding Secretary

11. Materials resulting from the previous meeting (9:20-9:25)

Desired Outcome

- Agreement on final version of Action Agenda from the December meeting

Packet Materials Related to this Agenda Item:
11a December Action Agenda

12. Wrap up, plans for second session and evaluation of this session (9:25-9:30)

Desired Outcomes:

- Continuity between sessions
- Understanding of the quality of the session's process

Second Session

13. Welcome and Public comment (2:00-2:05)
We encourage members of the public to attend this Committee's meetings and invite public comment about items on the agenda at the beginning of each session. We will invite additional comment during the session before making major decisions. We invite public comments about items relevant to this Committee's work but that are not on the meeting's agenda during the Oral Communication section at the end of this session.

14. Reflections on the previous session (2:05-2:10)
The Committee briefly recaps key outcomes from the previous session and reviews the agenda for today's session.

Desired outcomes:
- Acknowledgement of the major achievements of the previous session
- Agreement on any changes to today's agenda

15. Update on Work on Consolidated Alts (2:10-2:50)
The Committee will receive an update from the technical team on the approach to and progress on creating consolidated alternatives.

Desired Outcomes:
- Understanding of the purpose of consolidating alternatives
- Agreement on the approach being used to create consolidated alternatives and on the use of the consolidated alternatives that are under development in the scenario planning exercise planned for the March WSAC meeting

Packet materials related to this item:
15a Status Report on Work on Consolidated Alts

16. Risk Assessment and Scenario Planning (2:50-4:10)
This session will begin with a brief overview of the scenario analysis process including:
- the opportunities for and constraints on changing system inputs and assumptions as part of scenario planning (with a summary of those inputs and assumptions from Thursday's meeting); and
- single variable risk based futures and multiple variable futures.

The Committee will then review the information they received in the packet on risk assessment and hear brief presentations on external risks to the SCWD system that need to be considered as part of scenario development.

Desired Outcomes

- Understanding of the iterative nature of scenario planning;
- Understanding of the role risks play in developing plausible futures;
- Understanding of the role risk management plays in portfolio development;
- Initial understanding of the specific risks the Santa Cruz water system faces today and as well as the potential range of plausible future risks;
- Understanding of the opportunities for and constraints on changing system inputs and assumptions as part of scenario planning.
- Agreement on a priority set of risks to have the Technical Team build into scenarios that will be used in the first round of scenario planning at the March meeting. (Note: there is a reasonable limit to the number of scenario that can be developed and that the Committee can work with in the first round of scenario planning. That limit is between 2 and 4. Scenario planning is an iterative process, so additional or refined scenarios can be looked at in subsequent rounds.)

Packet Material Related to this Item
16a Scenario Analysis Process
16b Risk Assessment Primer

17. Break (4:10-4:20)

18. Update on Plan for Refining Criteria (4:20-5:15)
The Committee will hear from the Planning Subcommittee on an approach for refining evaluation criteria and rating scales

Desired Outcomes

- Understanding of the status of work to refine evaluation criteria and rating scales
- Understanding of a proposed approach to refine evaluation criteria and rating scales (see packet document 18a);
- Agreement of the approach to pursue to refine criteria and rating scales;
- First actions on implementing an approach to refine evaluation criteria and rating scales;
- Agreement on any direction to the Planning Subcommittee, Technical Team or staff related to work on refining evaluation criteria and rating scales between the February and March meetings

Packet Materials Related to this Item
18a Proposed approach for refining evaluation criteria and rating scales

19. IRP Panel – Perspectives on Decentralized Water Systems (5:15-5:45)
The IRP has been asked to consider various materials related to decentralized water and/or wastewater systems. In this panel, the IRP will share ideas and perspectives about decentralized water systems.

Desired Outcome

- Committee member exposure to a range of information and perspectives on decentralized water systems

20. Overview of March Agenda (5:35-5:45)

The Committee will receive a preview of the proposed agenda for the March 18/20 meeting

Desired Outcome:

- Committee member input on the proposed agenda
- Increased continuity for Committee members between one meeting and the next.

21. Oral communication (5:45-5:55)

We invite public comments about items relevant to the Committee's work but not on the meeting's agenda

22. Evaluation and wrap up (5:55-6:00)

Review the session and consider items to be carried forward to the next meeting.

Agenda Item 3b

Peace United Church of Christ
Fellowship Hall
900 High St.
Santa Cruz, California 95060

Santa Cruz Police Department
Police Community Room
155 Center St.
Santa Cruz, California 95060

WATER SUPPLY ADVISORY COMMITTEE (WSAC) AGENDA

Regular Meeting

February 12 – 13, 2015

5:00 P.M. REGULAR MEETING - SESSION ONE (FEBRUARY 12): FELLOWSHIP HALL

2:00 P.M. REGULAR MEETING - SESSION TWO (FEBRUARY 13): COMMUNITY ROOM

Statements of Disqualification: Section 607 of the City Charter states that "…All members present at any meeting must vote unless disqualified, in which case the disqualification shall be publicly declared and a record thereof made."

The City of Santa Cruz has adopted a Conflict of Interest Code, and Section 8 of that Code states that no person shall make or participate in a governmental decision which he or she knows or has reason to know will have a reasonably foreseeable material financial effect distinguishable from its effect on the public generally.
General Business: Any document related to an agenda item for the General Business of this meeting distributed to the WSAC less than 72 hours before this meeting is available for inspection at the Water Administration Office, 212 Locust Street, Suite A, Santa Cruz, California. These documents will also be available for review at the WSAC meeting with the display copy at the rear of the Council Chambers.

Appeals: Any person who believes that a final action of this advisory body has been taken in error may appeal that decision to the City Council. Appeals must be in writing, setting forth the nature of the action, the basis upon which the action is considered to be in error, and addressed to the City Council in care of the City Clerk Administrator.

Other - Appeals must be received by the City Clerk Administrator within ten (10) calendar days following the date of the action from which such appeal is being taken. An appeal must be accompanied by a fifty dollar ($50) filing fee.

City Councilmember Attendance: Four or more members of the City Council may be in attendance at this meeting.

The City of Santa Cruz does not discriminate against persons with disabilities. Out of consideration for people with chemical sensitivities we ask that you attend fragrance free. Upon request, the agenda can be provided in a format to accommodate special needs. Additionally, if you wish to attend this public meeting and will require assistance such as an interpreter for American Sign Language, Spanish, or other special equipment, please call the City Clerk's Department at 420-5030 at least five days in advance so that we can arrange for such special assistance, or email CityClerk@cityofsantacruz.com. The Cal-Relay system number: 1-800-735-2922.

Water Supply Advisory Committee Agenda

February 12, 2015 - 5:00 PM – 9:30 PM

SESSION ONE

Call to Order – Meeting Convenes

Roll Call

Welcome to Public and Public Comment

Opportunities for public comment on agenda items are provided on agenda items as they are heard. An opportunity for oral communication by members of the public about issues relevant to the work of the Committee is provided at the end of the final session of the meeting.

Committee Member Updates

Committee Members will update the Committee on significant communications between them and other Santa Cruz entities with significant interest in the development of water policy in Santa Cruz.

Agenda Review

Committee Members will review the agenda for both sessions of the WSAC's tenth meeting.

Update on Results of January 27th City Council Meeting

Water Director Rosemary Menard and WSAC members attending the Council session will provide a brief update on the products developed for and the outcomes of the January 27th City Council meeting.

WSAC Phase Two Work Plan

Water Director Rosemary Menard will brief Committee Members on the basic work plan for Phase Two of the WSAC's work.

Presentation – Baseline Demand, Supply and Reliability Analyses

Members of the WSAC Technical Team will provide presentations regarding the baseline demand forecasts and supply and system reliability analyses.

Break

Committee Discussion of Baseline Information

Committee Members will discuss the baseline information received during the previous presentation.

Subcommittee Reports

Members of the Outreach Subcommittee and the Planning Subcommittee will provide Committee Members with information about their work and receive feedback and any agreed upon direction from the Committee on future work.

Correspondence Received from the Community

Committee Corresponding Secretary Mike Rotkin will provide a summary on correspondence sent to the Committee by members of the public since the previous Committee meeting.

Materials Resulting from Previous Meeting

Committee Members will review the Action Agenda of the Committee's December meeting.

Written Review and Wrap Up – Identification of any incomplete issues to be carried forward to tomorrow's session.

Adjournment – The Water Supply Advisory Committee will adjourn from its first session on February 12 of the regular meeting of February 12-13, 2015. The Committee will reconvene for its second and final open session on February 13 at 2:00 p.m. in the Police Community Room at the Santa Cruz Police Department.

Water Supply Advisory Committee Agenda

February 13, 2015 – 2:00 PM – 6:00 PM

SESSION TWO

Call to Order – Meeting Reconvenes

Roll Call

Welcome to Public and Public Comment

Opportunities for public comment on agenda items are provided on agenda items as they are heard. An opportunity for oral communication by members of the public about issues relevant to the work of the Committee is provided at the end of the final session of the meeting.

Review of Previous Session

Committee Members will review the previous session and the agenda for the current session.

Update on Work on Consolidated Alternatives

Members of the Technical Team will lead Committee Members in an update regarding the approach to and progress on developing consolidated alternatives.

Risk Assessment and Scenario Planning

Technical Team member Karen Raucher will lead the committee through a work session on risk assessment and scenario planning.

Break

Update on Plan for Refining Criteria

Members of the Planning Subcommittee will lead Committee Members in a discussion regarding the approach for refining evaluation criteria and rating scales.

IRP - Perspectives on Decentralized Water Systems

Members of the Independent Review Panel will provide a range of ideas and perspectives about decentralized water systems.

Agenda for March

Committee Members will discuss the agenda outline for the Committee's March meeting.

Oral Communication

Written Review and Wrap Up – Identification of any incomplete issues to be carried forward to next meeting.

Adjournment – The Water Supply Advisory Committee will adjourn from the second session on February 13, 2015 of the regular meeting of February 12-13, 2015 to its next meeting on March 18, 2015 at 5:00 PM and March 20, 2015 at 2:00 PM in the Fellowship Hall at Peace United Church of Christ, 900 High St. Santa Cruz, CA 95060.

week starting … / WSAC Meetings	~~January-15~~					February-15					March-15					~~4/1/2015 No Mtg~~			May-15				
		~~4-Jan~~	~~11-Jan~~	~~18-Jan~~	~~25-Jan~~	1-Feb	8-Feb	15-Feb 2/12 & 2/13	22-Feb		1-Mar	8-Mar	15-Mar 3/18 & 3/20	22-Mar	29-Mar				26-Apr 4/30 & 5/1	3-May	10-May	17-May	24-May

DRAFT WSAC AGENDAS

Phase 1 Recon → Phase 2

Agenda
- Baseline Conditions/Problem Solving Framework
- Consolidated Alternatives
- Risk Assessment
- Scenario Planning Primer and Prep
- Refining Criteria

Agenda
- Consolidated Alternatives
- Evaluation Critieria
- Scenario Planning Exercise, including Portfolio Development
- Facilitated Town Hall (public participation during meeting) on

Agenda
- Portfolio Analysis Results
- Addn'l Scenario Planning
- Portfolio Analysis Phase 2
- Initial work on defining furute conditions to use in developing recommendations
- Preliminary Problem Definition

WORKFLOW, DESIRED OUTCOMES, PLANNING COMMITTEE ENGAGEMENT BETWEEN MEETINGS

Work with Planning stte on Recon Report, approach to consolidate alternatives, enrichment

Understanding of:
1. Supply, demand and water system reliability
2. Principles of risk assessment and the role in scenario planning
3. How scenario planning is used as a planning tool and readiness for scenario planning.

Work with Planning stte to develop scenarios and scenario planning exercise, consolidated alts and evaluation criteria.

- Agreement on Consolidated alts to use in Scenario Planning
- Agreement on evaluation criteria to use in scenario planning
- Identification of portfolios for scenarios.

Work with Planning stte on analytical results for portfolios

- Agreement on any additional scenario and portfolios for those scenarios
- Identification of additional analyses on portfolios
- Initial work on future conditions and problem definition

SUBCOMMITTEES & WORKING GROUPS (Outreach, Planning, M&F)

Planning, Jan 16
Recon Report
Consolidate Alts

Planning, Jan 30
Refine Scenarios; Problem Statement; Enrichment opportunities; Criteria Definitions

Planning, Feb 20
Consolidated Alts Evalution Criteria

Planning, Mar 6
Consolidated Alts Evalution Criteria

Planning, Mar 27
Portfolio Analysis Results

Planning, Arp 10
Portfolio Analysis Results

Planning, Apr 24
Agreement Models

Planning, May 8
Future Conditions and Problem

Modleing & Forecasting
Jan 7: Demand Mgmt Decision Support System Model (Maddaus)
Jan 21: Confluence (Fiske)
Jan 14: Shortage Contingency Planning (Goddard)

Modleing & Forecasting
Feb 4: Products to be used in "Real Deal" (baseline discussion; may be incorporated into

Outreach
Town Hall Meeting on Scenarios, Portfolios and Analytical Results of

Complementary Enrichment Items, Date
Subject

Enrichment, Feb 11
Beyond Building Codes, John Rosenblum
Reliability and Local Economy, David Mitchell

Enrichment, March 18
Regional Water Transfers
John Ricker, Piret Harmon, Kim Adamson

Enrichment, April 29
Groundwater Recharge

TECHNICAL WORK ELEMENTS & PROGRESS

Groundwater
Pueblo evaluates hydrogeology (ASR, IPR, North Coast Groundwater)

Water Demand
City and Dave Mitchell develop new demand projections

Continue to Indentify Environmental Issues
Energy/GHG; Climate Change Impacts; Marine; Freshwater; Terrestrial

Technical Work Elements
Progress

Conservation
Maddaus Evaluates Peak Season Demand Reduction

Economics
David Mitchell Evaluates Price Elasticity & Develops an Econometric Model

CITY COUNCIL/WATER COMMISSION/OTHER

- Jan 27: WSAC Recon Rpt
- CO for P2C

- Mar 3: Joint Study Session (CC/WC) on rate structures

June-15					July-15					August-15					September-15					October-15				
31-May	7-Jun 6/11 & 6/12	14-Jun	21-Jun	28-Jun	28-Jun	5-Jul	12-Jul	19-Jul 7/23 & 7/24	26-Jul	2-Aug	9-Aug 8/13 & 8/14	16-Aug	23-Aug	30-Aug	30-Aug	6-Sep 9/10 & 9/11	13-Sep	20-Sep	27-Sep	27-Sep 9/30 & 10/2	4-Oct	11-Oct	18-Oct	25-Oct

AGREEMENT DEVELOPMENT PROCESS

Agenda
- Identifying Future Conditions to be used for developing recommendations
- Draft Problem Definition
- First cut of work on Portfolio needed to meet agreed upon future
- Review and Discussion of Model Agreements

Agenda
- Additional Portfolio Analysis (if needed)
- Begin work on Agreement

Agenda
- Agreement

Agenda
- Agreement

Agenda
- Agreement

Work with Planning stte on
nalytical results for portfolios, and
n future conditions and problem

Potential Enrichment, TBD
Carbon/Energy

Memorandum

To: Santa Cruz Water Supply Advisory Committee

From: Bob Raucher, Colleen Donovan**,** Stratus Consulting Inc.

Date: 2/4/2015

Subject: An update on enrichment opportunities

In this memorandum we present past, planned, and possible additional enrichment opportunities to share with the Santa Cruz Water Supply Advisory Committee (WSAC). There has been broad interest in offering a series of supplemental "enrichment" presentation/discussions because there are so many technical analysis issues for WSAC to consider within the context of its deliberations, and there is limited time available for such presentations and discussions within the constraints and other priorities associated with formal WSAC meetings. Most of the items listed below have been suggested by WSAC members, and others have emerged from the Water Department or Technical Team. And, we are open to additional suggestions or requested priorities.

There are several options for how we can organize these enrichment presentations: immediately preceding the formal WSAC meetings, or the evening prior to a formal WSAC meeting (such as the upcoming February 11 session), and/or at other times and venues as convenient for Committee members. We also could investigate whether these might also be offered as on-line Webinars that can be recorded for viewing at any time.

Below is the list of what enrichment opportunities have already occurred. In addition, there have been a series of technical presentations provided within the context of the Modeling and Forecasting Working Group, through the series of their Wednesday evening sessions (including presentations by Toby Goddard and Dave Mitchell related to water demand, Shawn Chartrand on flow modeling, Gary Fiske on the Confluence model, and Bill and Lisa Maddaus on demand forecasting and conservation program evaluation using their DSS modeling tool). These have covered some of the topics for which interest had been expressed.

Below is the list of what enrichment opportunities have already occurred.

Table 1. Enrichment opportunities that have already occurred

Enrichment topic	Presenter	Date presented
1. Water rights 101, as relates to Santa Cruz water-rights issues.	Martha Lennihan	November 21, 2014
2. Aquifer/hydrology/hydrogeology 101, as relates to Santa Cruz aquifers	Mike Cloud	November 19, 2014

Below is a list of what is currently scheduled or anticipated.

Table 2. Enrichment opportunities that are currently scheduled or anticipated

Enrichment topic	Presenter	Date of presentation
1. Water supply and the local economy	David Mitchell	February 11, 2015
2. Conservation measures that go beyond building code	John Rosenblum	February 11, 2015
3. Panel on regional water exchanges	John Ricker and staff from Soquel Creek and Scotts Valley (Piret Harmon, Kim Adamson)	March 18, 2015 (not formally scheduled)
4. Local aquifers and recharge/recovery issues	Pueblo Water Resources	Around the time of the April WSAC meeting (likely, but not formalized)
5. Panel on climate change & local watershed impacts	Bruce Daniels, Shawn Chartrand, and possibly Joel Smith	Around the time of the April WSAC meeting (tentative)

Below is a list of other possible enrichment topics for which interest has been expressed (not necessarily in order of importance or level of interest):

1. History of water treatment technology and where we are headed

Some topics could include: membranes, UV and ozone today, whether forward osmosis is a viable option in the near future, and decentralized systems. There are at least two variations on this theme, as described below.

Desal technology. A WSAC presentation on desal technology (including a glimpse at the concept and viability of forward osmosis), examples of technology applications, including capital and operating costs, energy footprint, energy offset strategy, life cycle cost analysis, and environmental issues.

Potential Presenter: Rhodes Trussell, possibly joined by Brown & Caldwell.

Decentralized approaches*:* A look at some emerging thinking on the viability and value of more decentralized water and/or wastewater management approaches.

Potential Presenter: David Sedlak (UCB, Water 4.0). We are trying to see if we can schedule conveniently for WSAC, and also arrange a viable way for Sedlak to get oriented to the Santa Cruz context so his discussion can be better tailored to the local situation.

2. Panel on water reuse: regulatory, public health, and technology overview

To provide more context before the enrichment presentation, we might first distribute various materials, including a white paper on regulatory developments and public health implications of indirect potable reuse (IPR) and direct potable reuse (DPR), and on technologies for IPR and DPR, including status of deployment or planned deployment of such technologies. Some topics could include water quality, regulatory development, and public health perspectives.

Potential Panelists: Brian Ramaley (IRP), Rhodes Trussell (and/or George Tchobanoglous), Bob Holmquist (SWQCB, retired).

3. Life Lessons" panel from the IRP on water-supply challenges they've faced and solved

Presenters: IRP members.

4. Carbon footprint. What is a carbon footprint, how is one developed, and how can WSAC use this information?

Potential Presenter: John Rosenblum.

5. Climate change impact on water demands

Potential Presenter: Jack Keifer (Hazen and Sawyer), others (see overlap with item 8).

6. Revenue gaps and the rate impacts of reduced water consumption

In recent years, water utilities have struggled to develop appropriate pricing structures to allow for sufficient financial reserves for maintenance and growth and also promote conservation of water resources.

Potential Presenter: David Mitchell, or Bob Raucher, or possibly someone from Raftelis.

7. Perspectives on and details regarding historical growth, future growth, economic drivers, etc.

Potential Presenters: Juliana Rebagliati, Bill Tysseling.

8. Future demand forecasts for Santa Cruz

This could include (1) a discussion about future demand and the assumptions that go into growth projections, (2) a presentation by Bill Maddaus on future demand per the Long Term Conservation Master Plan, (3) implications of climate change on supply and demand, and (4) implications of fish flow releases.

Potential presenters: Juliana Rebagliati (1), Bill Maddaus (2), Dr. Sarah Feakins (3), Dr. Heather Cooley (3), Chris Berry (4), and Jeff Hagar (4).

9. How to think about long-range future planning

Potential Presenters: Someone from IFTF.org (Dawn Alva), possibly Heather Cooley (Pacific Institute).

10. Addressing water quality challenges

Potential presenters: Brian Ramaley. Could be embedded in item 2.

11. Groundwater recharge

Potential presenters: Andy Fisher (perhaps coordinate with anticipated Pueblo Water Resources presentation that is anticipated in April?).

12. Watersheds and fisheries

Potential presenters: Donna Meyers.

POLICY ANALYSIS
FOR THE
PUBLIC AND PRIVATE
SECTORS
M.CUBED

5358 MILES AVENUE
OAKLAND, CA 94618
PH: 510-547-4369
FX: 510-547-3002
MITCHELL@MCUBED-ECON.COM

Agenda Item 6a

DATE: February 3, 2015
TO: City of Santa Cruz Water Supply Advisory Committee
FR: David Mitchell
RE: Baseline Water Demand Forecast Summary Report

I. Introduction

This memorandum describes the baseline water demand forecast for the City of Santa Cruz water system. The baseline water demand forecast represents future projected water demands given the following:

- Projected rates of growth in single-family, multi-family, and non-residential customer categories through 2030, as embodied in the City's General Plan and regional AMBAG projections.
- Projected increases in UCSC demands in accordance with the Water Supply Assessment/Sphere of Influence Amendment EIR.
- Anticipated conservation savings associated with plumbing codes, appliance standards, and the City's current level of conservation programming.
- Anticipated changes in demands due to forecasted increases in the cost of water and household income.

Thus, the baseline demand forecast is intended to characterize future demands on the system given current projections for growth, cost of water, regional income, plumbing code and appliance standards, and continuation of the City's existing conservation program. It does not incorporate potential future actions that may be taken by the City to further reduce demand for water through additional investment in conservation or adoption of City policies and regulations intended to reduce waste, promote efficiency, or otherwise limit water use. The potential benefits and costs of additional demand management will be addressed through the alternatives and scenario analyses. The purpose of the baseline demand forecast is to assess the magnitude of the supply-demand gap and system reliability under the status quo and to provide a point of reference for judging the efficacy of new demand management measures in terms of system reliability, cost, and other performance metrics.

The starting point for the baseline demand forecast is the 2010 UWMP demand projection. Adjustments are made to this forecast to account for future effects of plumbing codes/appliance standards, existing conservation programs, water rates, income growth, slower than projected growth in in-city commercial demand, and the effects of the current drought. The remainder of this memorandum describes the basis for and magnitude of each of these adjustments. In total, the adjustments reduce 2030 demand from what the 2010 UWMP projected by 18 percent, from 4,046 million gallons per year (mgy) to 3,302 mgy.

II. Forecast Period

The baseline demand projection covers the period 2015-2035. It is assumed for the projection that City buildout is reached by 2030. No further growth is assumed after this date in the projection. Between 2030 and 2035 demands are projected to decrease slightly due to real increases in the cost of water, on-going effects of plumbing code/appliance standards, and continuation of City conservation programs.

III. Adjustment for Plumbing Code/Appliance Standards

Plumbing codes and appliance standards for toilets, urinals, clothes washers, and showerheads will continue to reduce indoor residential and non-residential water demands over the forecast period. Plumbing codes for toilets, urinals, showerheads, and faucets were first adopted by California in 1991, mandating the sale and use of ultra-low flush toilets (ULFTs), 1 gallon-per-flush urinals, and low-flow showerheads and faucets. Effective January 1, 2014, AB 715 (enacted in 2007) requires that toilets and urinals sold and installed in California cannot have flush ratings exceeding 1.28 and 0.5 gallons per flush, respectively. Additionally, SB 407 (enacted in 2009) requires that commercial and residential properties built prior to 1994 must be fully retrofitted with water conserving plumbing fixtures by 2017 (single-family residential) or 2019 (multi-family residential and commercial). SB 837 (enacted in 2011) requires that sellers of real property disclose on their Real Estate Transfer Disclosure Statement whether their property complies with these requirements. Additionally, SB 407 conditions issuance of building permits for major improvements and renovations upon retrofit of non-compliant plumbing fixtures. Each of these laws is intended to accelerate the replacement of older, low efficiency plumbing fixtures, and ensure that only high-efficiency fixtures are installed in new residential and commercial buildings.

Federal appliance standards for water and energy use by residential and commercial clothes washers are further reducing indoor water demands. The maximum water factor for residential clothes washers under current federal standards is 9.5.[1] In March of this year, the federal standard will reduce the maximum water factor for top- and front-loading machines to 8.4 and 4.7, respectively. In 2018, the maximum water factor for top-loading machines will be further reduced to 6.5. For commercial washers, the maximum water factors were reduced in 2010 to 8.5 and 5.5 for top- and front-loading machines, respectively. Starting this year, the maximum water factor for Energy Star certified washers is 3.7 for front-loading and 4.3 for top-loading machines. EPA estimates that Energy Star washers comprised more that 60% of the residential market and 30% of the commercial market circa 2011.[2] A new Energy Star compliant washer uses about two-thirds less water per cycle than washers manufactured in the 1990s.

The effects of plumbing codes and appliance standards on future water demand were estimated with the Maddaus Water Management Decision Support System (DSS) model. DSS uses a plumbing fixture inventory and turnover model to estimate water savings over time from the replacement of toilets, urinals, showerheads, and clothes washers in existing single-family residential, multi-family residential, and commercial buildings and the installation of code-compliant fixtures in new buildings. The

[1] Water factor equals the number of gallons used per cycle per cubic foot of capacity. Prior to 2000, the water factor for a typical new residential clothes washer was about 12.

[2] Energy Star Unit Shipment and Market Penetration Report Calendar year 2011 Summary. Accessed on January 28, 2015 from:
http://www.energystar.gov/ia/partners/downloads/unit_shipment_data/2011_USD_Summary_Report.pdf

estimated reduction in water demand (relative to 2010 fixture/appliance efficiency levels) is summarized in Table 1.

Table 1. Projected Water Savings from Plumbing Codes/Appliance Standards (MGY)

Sector	2015	2020	2025	2030	2035
Single Family	-17.8	-42.0	-77.3	-112.7	-134.1
Multi Family	-18.1	-39.7	-68.8	-97.8	-113.3
Non Residential	-3.2	-6.9	-10.2	-13.1	-14.8
Total	-39.1	-88.6	-156.3	-223.7	-262.3

IV. Adjustment for City's Existing Conservation Program

The City has had a long-standing commitment to water conservation and offers a variety of programs, informational materials, and incentives to help customers become more water efficient. The current level of programming represents a baseline level of investment in conservation below which it is not expected the City would ever go. The 2010 UWMP demand projection is adjusted downward to account for the expected water savings from this level of program activity over the forecast period. The current level of conservation programming is labeled Program A in the City's forthcoming Conservation Master Plan Update. A preliminary forecast of expected water savings for Program A was developed with the DSS model. The preliminary DSS forecast is based on an older, higher baseline demand forecast. Because water savings calculated by the DSS model are partly a function of the level of baseline demand,[3] the preliminary Program A savings were re-scaled to conform to the lower adjusted baseline demand forecast presented in this memorandum. The original DSS and re-scaled Program A savings projections are reported in Table 2.[4]

Table 2. Projected Water Savings from Program A Conservation Level (MGY)

Forecast	2015	2020	2025	2030	2035
Prelim. DSS	-46.6	-109.6	-143.0	-138.6	-133.5
Re-Scaled DSS	-40.4	-102.3	-131.2	-124.5	-117.6

V. In-City Commercial Growth Adjustment

The 2010 UWMP projected in-city commercial water use would increase by approximately 6 mgy per year over the forecast period. Over the past decade, however, new demand from the in-city commercial sector has been increasing at about a third this rate. On the other hand, the rate of hotel/motel growth has exceeded the 2010 forecast. To account for the slower overall growth in commercial demand while

[3] For example, water savings from household or commercial water audits are calculated as a percentage of pre-audit demand. As average demand changes, the magnitude of water savings changes too. If, for instance, a residential audit is forecast to reduce a household's water use by 5%, on average, then if average household water use is 300 gallons/day, audit savings would be 15 gallons/day, but if average household water use falls to 250 gallons/day, audit savings would be 12.5 gallons/day.

[4] The decrease in Program A savings after 2025 is primarily due to the way in which savings from toilet, urinal, and washer rebates are allocated overtime between the program category (active savings) and the plumbing code/appliance standard category (passive savings).

leaving room for accelerating growth in the hotel/motel sector, the increase in new in-city commercial demand forecasted in the 2010 UWMP has been reduced by half to 3 mgy per year. The reduction in forecasted demand due to this adjustment is shown in Table 3.

Table 3. Reduction in 2010 UWMP Demand Forecast for Slower Than Projected In-City Commercial Demand (MGY)

	2015	2020	2025	2030	2035
Com. Demand Adjustment	-14.3	-28.7	-43.0	-57.3	-57.3

VI. North Coast Agricultural Water Adjustment

The 2010 UWMP demand forecast included approximately 25 mgy of raw water irrigation deliveries. These deliveries are not part of the City's treated water demands and are handled separately in the Confluence model. Annual demand for the irrigation/golf customer category is therefore reduced by 25 mgy to account for this.

VII. Cost of Water Adjustment

The 2010 UWMP demand forecast did not account for the effect of future rate increases on future water demand. Municipal water service is a normal economic good: more is demanded at lower prices than at higher prices. Hundreds of studies have demonstrated this empirically.[5]

City water rates are forecast to increase by 10 percent per year over the next five years. This means that after adjusting for expected inflation, the cost of water will have increased 45 percent by 2020.[6] Thereafter, City water rates are likely to continue to outpace general inflation, leading to a more gradual but still upward trend in the cost of water. This is not unique to Santa Cruz. Water service costs have been increasing broadly across the country for more than a decade. Since 1998, the consumer price index for water, sewer, and trash service maintained by the U.S. Bureau of Labor Statistics has increased at an average annual rate of 4.4 percent whereas the annual increase in the general price index has averaged just 2.2 percent. Given these trends, Table 4 gives the projected increase in water rates relative to 2014 rates after adjusting for inflation.

Table 4. Projected Increase in Inflation-Adjusted Water Rates Relative to 2014

	2015	2020	2025	2030	2035
Projected Increase	6.7%	45.1%	59.7%	75.9%	93.7%

Responsiveness of demand to changes in price varies by customer category and season. Single-family residential demand tends to be more price responsive than multi-family residential demand. Commercial demand is typically less price responsive than residential demand. Summer demand is more price responsive than winter demand. Demand responsiveness can be measured empirically and is usually summarized in terms of a single parameter called price elasticity. The price elasticity

[5] For a review of the literature, see Dalhuisen, et al., "Price and Income Elasticities of Residential Water Demand: A Meta-Analysis." Land Economic, May 2003 79:292-308.

[6] We use Caltran's 2014 county-level inflation forecast for Santa Cruz County to calculate the inflation-adjusted increase in water cost.

parameter measures the expected percentage change in demand given a 1 percent change in price. Thus, if price elasticity is -0.1, then a 1 percent increase in price would be expected to cause a 0.1 percent decrease in demand and a 10 percent increase in price would be expected to cause a 1 percent decrease in demand.

The ranges for residential price elasticity for use in water planning studies recommended by the California Urban Water Conservation Council (CUWCC) are given in Table 5.[7] We selected residential elasticity values within these ranges to adjust future residential demand for the projected rate increases shown in Table 4. For non-residential demand we set the elasticity parameter to -0.10, which is consistent with two recent estimates of commercial price elasticity derived from demand data for 24 municipal water districts located throughout California.[8] The elasticity values used to adjust demands for future rate increases are shown in Table 6. The overall system weighted average price elasticity of -0.167 almost exactly matches a recent estimate of price elasticity for Bay Area Water Supply and Conservation Agency (BAWSCA) water districts serving communities along the San Francisco Peninsula.[9]

Table 5. Summary of CUWCC Recommended Ranges for Residential Price Elasticity

Single Family Residential Customers	**Range of Estimates**
Winter season	-0.10 to -0.30
Summer season	-0.20 to -0.50
Multi Family Residential Customers	
Winter Season	-0.00 to -0.15
Summer Season	-0.05 to -0.20

Table 6. Price Elasticity Parameters Used to Adjust Future Demand for Expected Rate Increases

Season	**Single Family**	**Multi Family**	**Non Residential**	**Overall System**
Winter	-0.150	-0.075	-0.100	
Summer	-0.300	-0.150	-0.100	
Wtd Annual Avg	-0.239	-0.116	-0.100	-0.167

The percentage demand adjustment resulting from applying the price elasticities in Table 6 to the rate increases in Table 4 are shown in Table 7.

[7] See Table 8-9 in CUWCC's Water Conservation Rate Structures Handbook.

[8] Both studies were prepared for California Water Services Company (Cal Water) within the last year. One estimated a commercial price elasticity of -0.06 and the other estimated an elasticity of -0.07. The difference between the two estimates is not statistically significant. Other studies of non-residential demand summarized in Steven Renzetti's book *The Economics of Water Demand* (2002) have reported greater price responsiveness, but these studies comingled commercial and industrial water uses and many are several decades old. We have rounded up the estimate to -0.1 to be conservative, but do not believe there is sufficient empirical evidence to justify a value beyond this.

[9] Using an econometric demand model, the BAWSCA study estimated a system-wide price elasticity of -0.168. See Regional Water Demand and Conservation Projections: Final Report. September 2014. Bay Area Water Supply and Conservation Agency.

Table 7. Percentage Demand Adjustment for Expected Rate Increases

Sector	2015	2020	2025	2030	2035
Single Family	-1.6%	-10.8%	-14.3%	-18.2%	-22.4%
Multi Family	-0.8%	-5.2%	-6.9%	-8.8%	-10.8%
Non Residential	-0.7%	-4.2%	-6.0%	-7.6%	-9.4%

VIII. Growth in Income Adjustment

It has also been demonstrated empirically that residential water demand is sensitive to level of income. Water use rises with income level due to larger homes, more water using fixtures and appliances, larger landscapes, and greater prevalence of pools and spas. While the relationship between water and income possibly has been moderating, recent studies still show a statistically significant positive relationship.[10] The two studies completed for Cal Water mentioned previously estimated income elasticities for single family residential demand of 0.208 and 0.375, respectively. For development of the baseline demand forecast, we use a single family income elasticity of 0.25. For the multi-family sector, we use an income elasticity of 0.05. We apply these elasticities to Caltran's 2014 county-level real per capita income forecast for Santa Cruz County. The resulting percentage demand adjustments are shown in Table 8.

Table 8. Percentage Demand Adjustment for Expected Real Increases in Per Capita Income

Sector	2015	2020	2025	2030	2035
Single Family	+0.7%	+3.7%	+6.4%	+8.8%	+11.2%
Multi Family	+0.1%	+0.7%	+1.3%	+1.8%	+2.2%

IX. Net Price and Income Adjustment

The price and income adjustments work in opposite directions. The net percentage adjustment from the two effects is given in Table 9. Note that for non-residential demand, only a price effect is assumed. The magnitudes of these adjustments in million gallons per year are reported in Table 10.

Table 9. Net Percentage Demand Adjustment for Expected Increases Rates and Per Capita Income

Sector	2015	2020	2025	2030	2035
Single Family	-0.9%	-7.1%	-7.9%	-9.4%	-11.3%
Multi Family	-0.6%	-4.5%	-5.6%	-7.0%	-8.6%
Non Residential	-0.7%	-4.2%	-6.0%	-7.6%	-9.4%

Table 10. Net Demand Adjustment for Expected Increases Rates and Per Capita Income (MGY)

Sector	2015	2020	2025	2030	2035
Single Family	-12.2	-96.0	-106.0	-125.0	-147.3
Multi Family	-4.8	-33.7	-41.9	-51.9	-62.2

[10] Reasons for possible moderation include more concentrated distribution of income, less urban flight to suburban areas by higher income households, on-going effects of plumbing codes and appliance standards that apply equally across all income categories, and changes in landscaping preferences away from large turf areas.

Non Residential	-6.4	-43.9	-59.3	-77.1	-95.1
Total	-23.3	-173.6	-207.2	-254.0	-304.6

X. Drought Recovery Adjustment

Mandatory Stage 3 drought restrictions coupled with drought rates caused a significant drop in City water sales in 2014. Monthly system demand in 2014 was 20 to 30 percent below 2013 levels. Mandatory Stage 3 drought restrictions were lifted in December 2014.[11] The baseline forecast for 2015-2035 is predicated on normal weather conditions. Nonetheless, from previous drought episodes we know that demands can take several years to recover from a severe rationing event. The baseline demand forecast therefore was adjusted to account for this recovery period. Non-residential irrigation demands were assumed to recover relatively quickly over two years. Residential demands were assumed to recover more gradually over five years. This pattern is consistent with what has been observed historically in Santa Cruz as well as other parts of California. Table 11 gives the drought adjustments for each customer category.

Table 11. Drought Recovery Adjustment (MGY)

Sector	**2015**	**2016**	**2017**	**2018**	**2019**
Single Family	-206	-103	-52	-26	-13
Multi Family	-78	-39	-20	-10	-5
Commercial	-51	-26	0	0	0
Municipal	-10	0	0	0	0
Irrigation/Golf	-31	-10	0	0	0
UCSC	-52	-26	0	0	0
Total	-428	-204	-72	-36	-18

XI. Baseline Demand Forecast

The above adjustments are applied to 2010 UWMP forecasted water sales to get adjusted water sales. Miscellaneous water uses and system losses are then added to adjusted water sales to get the baseline demand forecast. Miscellaneous water uses and system losses are estimated at 7.5 percent of total baseline demand. In total, the adjustments reduce 2030 demand from what the 2010 UWMP projected by 18 percent, from 4,046 million gallons per year (mgy) to 3,302 mgy. A summary of the adjustments and resulting baseline forecast is provided in Table 12. The 2010 UWMP and adjusted baseline forecasts are compared in Figure 1. Demand adjustments by customer category are provided in Attachment 1.

[11] The City Council is assessing the need to return to Stage 3 mandatory restrictions on a month-to-month basis.

Table 12. Baseline Demand Forecast (MGY)

Year	2010 UWMP Sales 1/	Plumb. Code Adj	Scaled PRGM A Savings	Com Growth Adj	North Coast Adj	Price/ Income Adj	Drought Adj	Adj Sales	Misc/ Losses 2/	Adj Baseline Demand	2010 UWMP Demand	% Difference
2015	3405	-39	-40	-14	-25	-23	-428	2835	230	3065	3685	-17%
2016	3435	-49	-52	-17	-25	-51	-204	3037	246	3284	3717	-12%
2017	3464	-58	-62	-20	-25	-86	-72	3140	255	3395	3749	-9%
2018	3494	-68	-76	-23	-25	-125	-36	3141	255	3396	3782	-10%
2019	3524	-78	-89	-26	-25	-167	-18	3122	253	3375	3814	-12%
2020	3554	-89	-102	-29	-25	-174	0	3136	254	3390	3846	-12%
2021	3572	-101	-111	-32	-25	-179	0	3124	253	3377	3846	-12%
2022	3590	-114	-120	-34	-25	-186	0	3111	252	3364	3846	-13%
2023	3608	-127	-128	-37	-25	-193	0	3098	251	3349	3845	-13%
2024	3627	-141	-130	-40	-25	-200	0	3090	251	3341	3845	-13%
2025	3645	-156	-131	-43	-25	-207	0	3082	250	3332	3845	-13%
2026	3664	-172	-130	-46	-25	-216	0	3076	249	3325	3885	-14%
2027	3682	-186	-128	-49	-25	-225	0	3070	249	3319	3925	-15%
2028	3701	-199	-127	-52	-25	-234	0	3064	248	3313	3966	-16%
2029	3720	-212	-126	-54	-25	-244	0	3059	248	3307	4006	-17%
2030	3739	-224	-125	-57	-25	-254	0	3054	248	3302	4046	-18%
2031	3739	-233	-123	-57	-25	-263	0	3038	246	3284	4046	-19%
2032	3739	-241	-122	-57	-25	-274	0	3020	245	3265	4046	-19%
2033	3739	-249	-120	-57	-25	-284	0	3004	244	3248	4046	-20%
2034	3739	-256	-119	-57	-25	-294	0	2988	242	3230	4046	-20%
2035	3739	-262	-118	-57	-25	-305	0	2972	241	3213	4046	-21%

1/ 2010 UWMP demand less miscellaneous water uses and system losses.

2/ Miscellaneous water uses and system losses calculated at 7.5% of adjusted baseline demand.

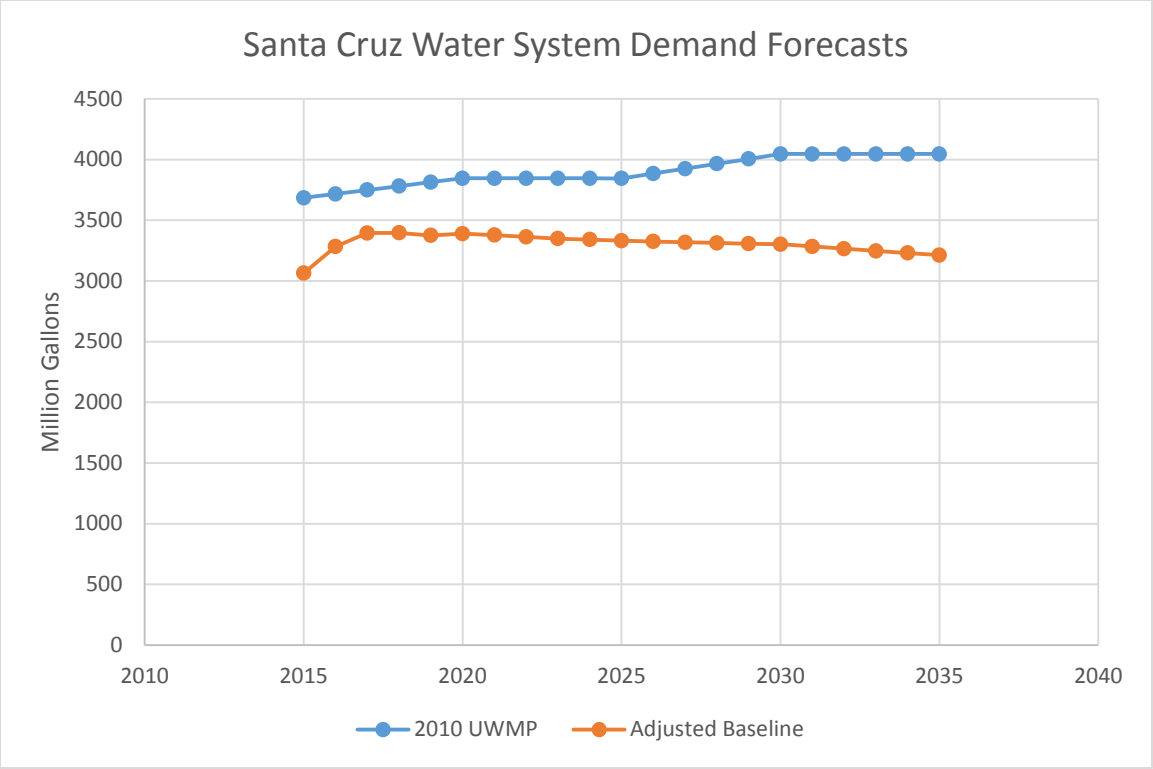

Santa Cruz Water System Demand Forecasts
Million Gallons
4500
4000
3500
3000
2500
2000
1500
1000
500
0
2010
2015
2020
2025
2030
2035
2040
2010 UWMP
Adjusted Baseline

Figure 1

Attachment 1: Demand Adjustments by Customer Category

Single Family Residential (MGY)

Year	UWMP	Code Adj	Price/Inc Adj	Drought Adj	Adj UWMP	% Diff	2014 Actual
2014	1362	-13		-412	936	-31%	936
2015	1367	-18	-12.2	-206	1131	-17%	
2016	1372	-22	-27.5	-103	1219	-11%	
2017	1377	-27	-48.0	-52	1250	-9%	
2018	1382	-32	-70.1	-26	1254	-9%	
2019	1387	-36	-94.5	-13	1243	-10%	
2020	1392	-42	-96.0	0	1254	-10%	
2021	1397	-48	-97.3	0	1251	-10%	
2022	1402	-55	-99.1	0	1248	-11%	
2023	1407	-62	-101.4	0	1244	-12%	
2024	1412	-69	-103.7	0	1239	-12%	
2025	1417	-77	-106.0	0	1234	-13%	
2026	1422	-85	-109.3	0	1227	-14%	
2027	1427	-93	-112.8	0	1221	-14%	
2028	1432	-100	-116.7	0	1215	-15%	
2029	1437	-107	-120.7	0	1210	-16%	
2030	1442	-113	-125.0	0	1204	-16%	
2031	1442	-118	-129.0	0	1195	-17%	
2032	1442	-122	-133.6	0	1186	-18%	
2033	1442	-126	-138.1	0	1177	-18%	
2034	1442	-130	-142.5	0	1169	-19%	
2035	1442	-134	-147.3	0	1161	-20%	

Multi-family Residential (MGY)

Year	UWMP	Code Adj	Price/Inc Adj	Drought Adj	Adj UWMP	% Diff	2014 Actual
2014	762	-14		-156	592	-22%	592
2015	767	-18	-4.8	-78	666	-13%	
2016	772	-22	-10.2	-39	700	-9%	
2017	776	-26	-16.8	-20	713	-8%	
2018	781	-31	-24.1	-10	716	-8%	
2019	785	-35	-31.9	-5	713	-9%	
2020	790	-40	-33.7	0	717	-9%	
2021	795	-45	-35.2		714	-10%	
2022	799	-50	-36.8		712	-11%	
2023	804	-56	-38.5		709	-12%	
2024	808	-62	-40.2		706	-13%	
2025	813	-69	-41.9		702	-14%	
2026	818	-75	-43.8		698	-15%	
2027	822	-82	-45.7		695	-15%	
2028	827	-87	-47.7		692	-16%	
2029	831	-93	-49.7		689	-17%	
2030	836	-98	-51.9		686	-18%	
2031	836	-101	-53.8		681	-19%	
2032	836	-105	-55.9		675	-19%	
2033	836	-108	-58.0		670	-20%	
2034	836	-111	-60.1		665	-20%	
2035	836	-113	-62.2		660	-21%	

Commercial/Industrial (MGY)

Year	UWMP	Growth Adj	Code Adj	Price/Inc Adj	Drought Adj	Adj UWMP	% Diff	2014 Actual
2014	683	-11	-2.5	0.0	-102	567	-17%	567
2015	690	-14	-3.2	-4.5	-51	617	-11%	
2016	696	-17	-4.0	-9.4	-26	640	-8%	
2017	703	-20	-4.8	-15.3	0	663	-6%	
2018	710	-23	-5.5	-21.8		659	-7%	
2019	716	-26	-6.2	-28.8		655	-8%	
2020	723	-29	-6.9	-31.0		656	-9%	
2021	729	-32	-7.6	-33.1		657	-10%	
2022	736	-34	-8.3	-35.2		658	-11%	
2023	743	-37	-8.9	-37.4		659	-11%	
2024	749	-40	-9.6	-39.6		660	-12%	
2025	756	-43	-10.2	-42.0		661	-13%	
2026	763	-46	-10.8	-44.3		662	-13%	
2027	769	-49	-11.4	-46.8		662	-14%	
2028	776	-52	-12.0	-49.3		663	-15%	
2029	783	-54	-12.6	-51.9		664	-15%	
2030	790	-57	-13.1	-54.6		665	-16%	
2031	790	-57	-13.5	-57.0		662	-16%	
2032	790	-57	-13.8	-59.5		659	-17%	
2033	790	-57	-14.2	-62.0		656	-17%	
2034	790	-57	-14.5	-64.6		654	-17%	
2035	790	-57	-14.8	-67.2		651	-18%	

Municipal (MGY)

Year	UWMP	Growth Adj	Code Adj	Price/Inc Adj	Drought Adj	Adj UWMP	% Diff	2014 Actual
2014	54	0	0		-21	33	-39%	33
2015	54	0	0	0	-10	44	-19%	
2016	54	0	0	-1	0	53	-1%	
2017	54	0	0	-1	0	53	-2%	
2018	55	0	0	-2		53	-3%	
2019	55	0	0	-2		52	-4%	
2020	55	0	0	-2		53	-5%	
2021	55	0	0	-3		52	-5%	
2022	55	0	0	-3		52	-5%	
2023	55	0	0	-3		52	-5%	
2024	55	0	0	-3		52	-6%	
2025	55	0	0	-3		52	-6%	
2026	55	0	0	-3		52	-6%	
2027	55	0	0	-4		52	-7%	
2028	56	0	0	-4		52	-7%	
2029	56	0	0	-4		52	-7%	
2030	56	0	0	-4		52	-8%	
2031	56	0	0	-4		52	-8%	
2032	56	0	0	-5		51	-8%	
2033	56	0	0	-5		51	-9%	
2034	56	0	0	-5		51	-9%	
2035	56	0	0	-5		51	-9%	

Irrigation/Golf (MGY)

Year	UWMP	N.Coast Adj	Code Adj	Price/Inc Adj	Drought Adj	Adj UWMP	% Diff	2014 Actual
2014	250	-25	0		-93	132	-47%	132
2015	251	-25	0	-2	-31	193	-23%	
2016	252	-25	0	-3	-10	214	-15%	
2017	253	-25	0	-5	0	222	-12%	
2018	253	-25	0	-7		221	-13%	
2019	254	-25	0	-10		220	-14%	
2020	255	-25	0	-10		220	-14%	
2021	256	-25	0	-11		220	-14%	
2022	257	-25	0	-12		220	-14%	
2023	258	-25	0	-12		220	-15%	
2024	259	-25	0	-13		221	-15%	
2025	260	-25	0	-14		221	-15%	
2026	261	-25	0	-15		221	-15%	
2027	262	-25	0	-16		222	-15%	
2028	264	-25	0	-17		222	-16%	
2029	265	-25	0	-17		222	-16%	
2030	266	-25	0	-18		223	-16%	
2031	266	-25	0	-19		222	-17%	
2032	266	-25	0	-20		221	-17%	
2033	266	-25	0	-21		220	-17%	
2034	266	-25	0	-22		219	-18%	
2035	266	-25	0	-23		218	-18%	

UC Santa Cruz (MGY)

Year	UWMP	Drought Adj	Adj Demand	Actual
2014	263	-104	159	159
2015	276	-52	224	
2016	289	-26	263	
2017	301	0	301	
2018	314	0	314	
2019	326	0	326	
2020	339	0	339	
2021	340	0	340	
2022	341	0	341	
2023	342	0	342	
2024	343	0	343	
2025	344	0	344	
2026	345	0	345	
2027	346	0	346	
2028	347	0	347	
2029	348	0	348	
2030	349	0	349	
2031	349	0	349	
2032	349	0	349	
2033	349	0	349	
2034	349	0	349	
2035	349	0	349	

System Total Baseline Demand Forecast

Year	SFR	MFR	BUS/IND	MUNI	IRR/GOLF	UCSC	SUBTOTAL	PRGM A SAVINGS	SUBTOTAL	MISC/LOSS	TOTAL
2015	1131	666	617	44	193	224	2875	-40	2835	230	3065
2016	1219	700	640	53	214	263	3089	-52	3037	246	3284
2017	1250	713	663	53	222	301	3203	-62	3140	255	3395
2018	1254	716	659	53	221	314	3217	-76	3141	255	3396
2019	1243	713	655	52	220	326	3210	-89	3122	253	3375
2020	1254	717	656	53	220	339	3238	-102	3136	254	3390
2021	1251	714	657	52	220	340	3235	-111	3124	253	3377
2022	1248	712	658	52	220	341	3232	-120	3111	252	3364
2023	1244	709	659	52	220	342	3226	-128	3098	251	3349
2024	1239	706	660	52	221	343	3220	-130	3090	251	3341
2025	1234	702	661	52	221	344	3214	-131	3082	250	3332
2026	1227	698	662	52	221	345	3205	-130	3076	249	3325
2027	1221	695	662	52	222	346	3198	-128	3070	249	3319
2028	1215	692	663	52	222	347	3191	-127	3064	248	3313
2029	1210	689	664	52	222	348	3185	-126	3059	248	3307
2030	1204	686	665	52	223	349	3179	-125	3054	248	3302
2031	1195	681	662	52	222	349	3161	-123	3038	246	3284
2032	1186	675	659	51	221	349	3142	-122	3020	245	3265
2033	1177	670	656	51	220	349	3124	-120	3004	244	3248
2034	1169	665	654	51	219	349	3107	-119	2988	242	3230
2035	1161	660	651	51	218	349	3090	-118	2972	241	3213

Date: February 4, 2015

To: Water Supply Advisory Committee

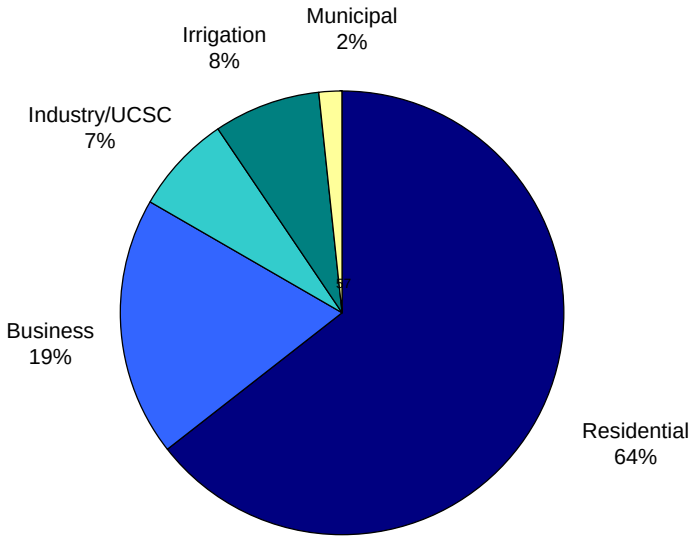
From: Heidi Luckenbach

Subject: Overview of The Santa Cruz Water Department (SCWD) System

This document provides a general overview of the Santa Cruz water system, culled from various existing documents. The purpose of this document is to distill and consolidate information about the Santa Cruz water system in terms of system components, features of those components, and operating parameters. It is this information that forms the basis of supply modeling using the Confluence model. Understanding this information will allow further understanding of the baseline condition, supply modeling and the development and analysis of scenarios.

The Santa Cruz water system covers a service area of approximately 20 square miles. ~30 miles of raw water main and 300 miles of treated water main delivers water to ~25,000 customers. The composition of these customers is shown below.

Percentage of water use by customer class, 2006 - 2010

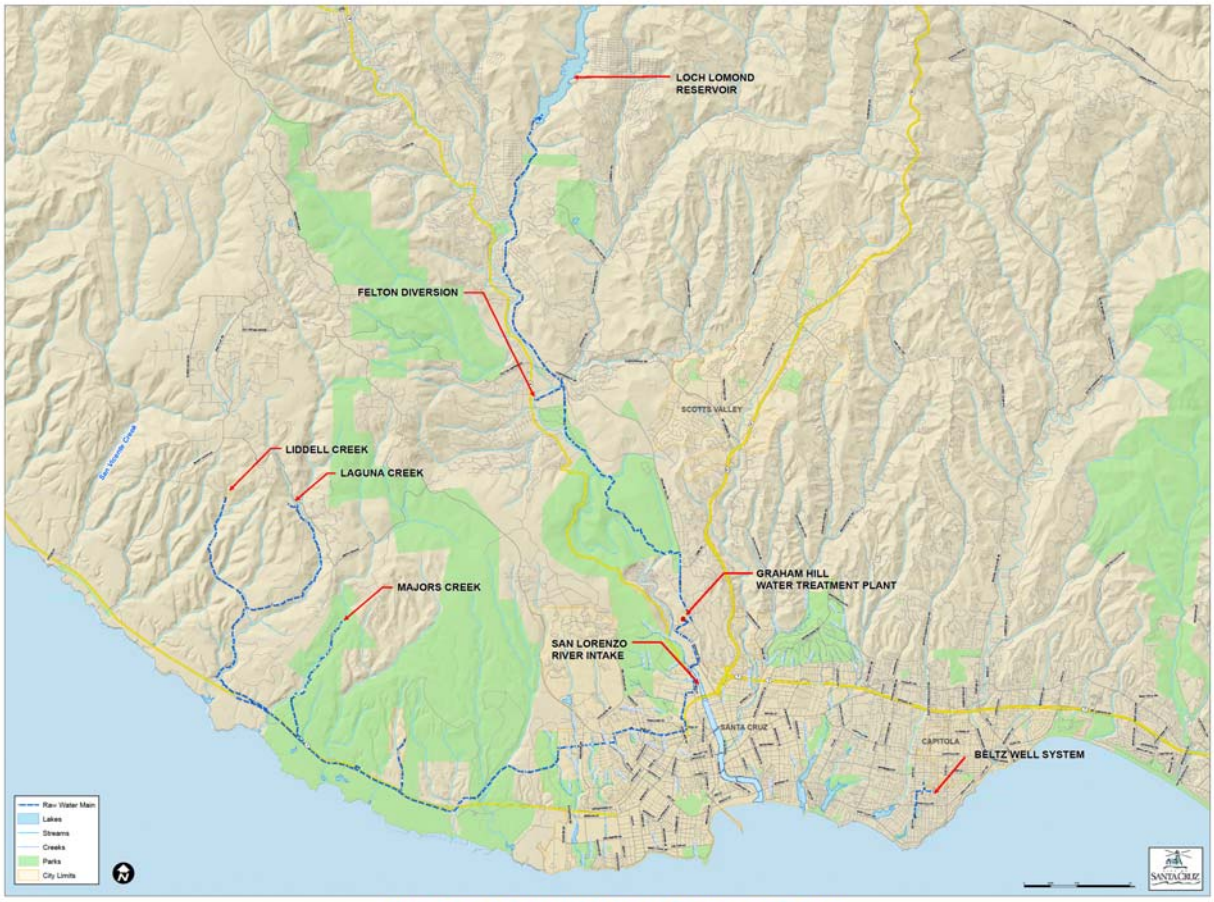


The following table summarizes the major components of the SCWD water system.

SANTA CRUZ WATER DEPARTMENT FACILITIES	
SOURCE – GROUNDWATER	
Beltz Wells 1 & 2 (converted to monitoring wells)	Beltz Well 8
Beltz Well 4 (out of service)	Beltz Well 9
Beltz Well 6 (out of service)	Beltz Well 10
Beltz Well 7 (converted to monitoring wells)	Beltz Well 12
SOURCE – SURFACE WATER	
Laguna Creek Dam	San Lorenzo River Tait Intake
Reggiardo Creek	Felton Diversion Inflatable Dam
Liddell Spring	Newell Creek Dam
Majors Creek	
Tait Well 1	
Tait Well 2 (abandoned)	
Tait Well 3 (out of service)	
Tait Well 4	
TREATMENT PLANTS	
Graham Hill Water Treatment Plant	Beltz Treatment Plant
Beltz 12 Treatment Plant	Loch Lomond Treatment Plant
TREATED WATER STORAGE	
Bay Street Tanks (2@6MG)	Rollingwoods (0.27 MG)
Carbonera Tank (1 MG)	Santa Cruz Gardens Tanks (0.25 MG/0.25MG)
DeLaveaga Tank (1 MG/1 MG)	University 2 Tank (1 MG)
Filtered Water Tank @ GHWTP (1 MG)	University 4 Tank (0.4 MG)
Pasatiempo Tanks (0.3 MG/0.75 MG)	University 5 Tanks (2 MG)
PUMPING FACILITIES	
Carbonera Pump Station	Rollingwoods Pump Station
Coast Pump Station	San Lorenzo River Pump Station
Delaveaga Pump Station	Springtree Pump Station
Dimeo Lane Pump Station	Tait Booster Station
Felton Diversion Pump Station	Thurber Lane
Felton Pump Station	University No. 2
Kite Hill Pump Station	University No. 4
Morrissey Pump Station Pasatiempo Pump Station	University No. 6

Water sources

The system relies entirely on rainfall, surface runoff, and groundwater infiltration occurring within watersheds located in Santa Cruz County. No water is purchased from State or Federal sources or imported to the region from outside the Santa Cruz area.



Where Your Water Comes From

The **Live Oak Well** system (otherwise referred to as the Beltz Well System) consists of three production wells (Beltz 8, 9, and 10) and a treatment plant located in the southeast portion of the City water service area. The facilities were acquired by the City from the Beltz Water Company in 1964, and are occasionally still referred to as the "Beltz" wells. Wells 8 and 9 were installed in 1998 as replacement wells for Wells 1 and 2, which were damaged in the 1989 Loma Prieta earthquake. Well 7, which began operating in 1974, has been replaced by Well 10. The source of water for these wells is the Purisima Formation, which extends east into the mid-County area and serves as a mutual groundwater resource for 2 other public water agencies, several small water systems, and numerous private wells, of which neighboring Soquel Creek Water District is the single largest user.

Beltz 12 and Beltz 12 Treatment plant were put into service in 2015. This facility is located in the northeast portion of the service are with the intended function of moving groundwater pumping inland and to supplement groundwater pumping during critically dry years by 0.3 MGD. This well was designed to draw water from both the Purisima as well as the Santa Margarita.

The **North Coast** sources (Liddell, Laguna, Reggiardo, Majors) are located approximately six to eight miles northwest of downtown Santa Cruz. The use of these sources by the City dates back as far as 1890.

The **San Lorenzo River** is the City's largest source of water supply. The main surface water diversion is located at Tait Street near the City limits just north of Highway 1 and dates back to the 1920s. The Tait Street Diversion is supplemented by two shallow, auxiliary wells (Tait 1 and 4) located across the river. These wells are treated as if they are hydraulically connected to the river and tied to the City's appropriative rights for surface diversion. The other diversion on the San Lorenzo River is **Felton Diversion**, which is an inflatable dam and intake structure built in 1974, located about six miles upstream from the Tait Street Diversion. Water is pumped from this diversion through the Felton Booster Station to Loch Lomond Reservoir. The facility is used to augment storage in the reservoir.

Loch Lomond Reservoir was constructed in 1960 and has a maximum capacity of 2,810 million gallons (mg). In addition to providing surface water storage, the reservoir and surrounding watershed are used for no-body-contact public recreation purposes, including fishing, boating, hiking, and picnicking. The Newell Creek watershed above the reservoir is about nine square miles. In addition to the City, the San Lorenzo Valley Water District is entitled to receive a portion of the water stored in Loch Lomond.

The City's SWRCB license for Newell Creek allows for diversion to storage of up to 1,825 million gallons per year (mgy). These water rights allow only for diversion to storage and not for direct diversion. Furthermore, based on the historical use of the reservoir, licensed withdrawals of Newell Creek water from Loch Lomond Reservoir are restricted to 1,042 mgy. Of this total 1,042 mgy, the San Lorenzo Valley Water District ("SLVWD") is entitled to102 mgy (approximately 10%). Although the district has not taken water in recent years, the City has reopened discussions with SLVWD about its entitlement to this water and the City expects that the SLVWD eventually intends to exercise its right to that supply.

The table below, taken from the 2010 UWMP, shows the gross annual water production from the various sources for the period 1985 – 2010.

Year	North Coast Streams	San Lorenzo River	Tait Wells (a)	Loch Lomond Reservoir	Live Oak Wells	TOTAL
1985	1,004.4	1,926.7	331.5	793.9	174.7	4,231.2
1986	1,123.3	1,867.5	27.6	1,192.7	33.6	4,244.7
1987	592.5	2,246.5	172.5	971.8	389.6	4,372.9
1988	692.1	2,066.5	294.1	650.4	429.8	4,132.9
1989	872.3	2,187.2	232.3	455.0	298.6	4,045.4
1990	820.6	2,001.2	152.8	187.0	227.4	3,389.0
1991	661.9	1,921.0	251.1	510.1	178.7	3,522.8
1992	633.7	1,807.6	223.1	625.2	264.4	3,554.0
1993	826.1	1,667.2	102.3	1,035.7	135.5	3,766.8
1994	665.6	1,861.0	235.5	931.8	169.1	3,862.9
1995 (b)	1,207.7	1,317.2	256.8	857.2	90.0	3,728.9
1996	1,312.5	1,267.3	9.9	1,389.8	54.7	4,034.2
1997	1,291.6	1,719.6	5.3	1,304.5	79.9	4,400.9
1998	1,484.8	1,527.7	4.8	996.8	99.6	4,113.7
1999	1,580.0	1,966.0	106.1	583.7	92.4	4,328.2
2000	1,417.3	2,073.2	--	797.0	187.0	4,474.5
2001	1,326.5	2,003.0	--	842.4	171.4	4,343.2
2002	1,386.2	1,976.2	--	538.0	143.8	4,044.2
2003	1,297.0	1,917.9	--	748.5	129.7	4,093.0
2004	1,315.4	1,984.4	--	652.6	123.6	4,076.1
2005	1,487.2	1,573.3	--	583.8	84.9	3,729.2
2006	1,603.8	1,610.2	--	467.3	118.5	3,799.8
2007	848.7	2,261.6	--	487.8	178.9	3,777.0
2008	890.2	2,064.9	--	530.4	164.4	3,649.9
2009	814.5	2,037.8	--	197.1	164.4	3,213.9
2010	1,168.1	1,468.5	--	411.0	151.4	3,199.0
1985-2010:						
Average	1,089.4	1,858.5	160.4	720.8	166.8	3,928.0
Percent of Total	27.7	47.3	4.1	18.4	4.2	100.0
Last Five Years:						
Average	1,065.0	1,888.6	--	418.7	155.5	3,527.9
Percent of Total	30.2	53.5	--	11.9	4.4	100.0

Notes:

(a) Tait Wells production is included with the San Lorenzo River beginning in 2000

(b) Coast treated water main placed into service

Major Components and Status

The City operates four **water treatment facilities**. All surface water is treated at the Graham Hill Water Treatment Plant, (GHWTP); the Live Oak Treatment Plant treats groundwater from wells 8, 9 and 10; Beltz 12 treats water from Beltz Well 12; and, for completeness, there is a small membrane plant at Loch Lomond for treating to potable water standards.

Generally speaking, the **Graham Hill Water Treatment Plant (GHWTP)** is limited by the following.

- Overall age and need for routine maintenance;
- Solids handling;
- Filters: The rate at which the filters can treat the water has been reduced over the last several years; this is being corrected with the current Filter Rehab Project;
- Source water quality: the current treatment process is limited with regards to turbidity.

The SCWD capital improvement program includes approximately $20 million (M) in improvements to the GHWTP including a $4M project that is currently underway to rehabilitate the filters.

The **Live Oak Treatment Plant** treats groundwater to remove iron and manganese from three wells. The limitations at the treatment plant are due to reduced source water availability. The treatment facility was designed (and wells constructed) to treat 1MGD in all years and 2MGD in critically dry years. Declining groundwater levels have reduced these volumes to 0.8MGD to 1.1MGM, respectively, relying on Beltz 12 for a portion of this production capacity.

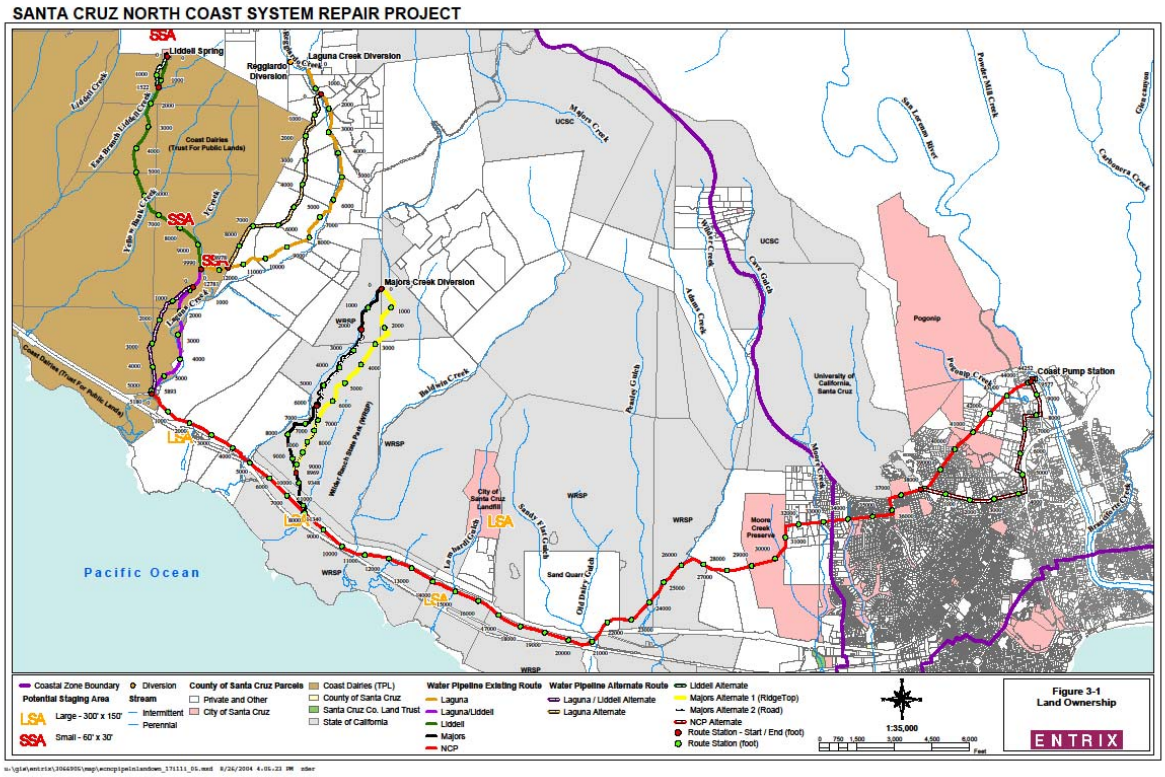
Beltz 12 was put into service in 2015 with the intent to move groundwater pumping inland and to add to groundwater supply in critically dry years (0.3MGD).

The **Loch Lomond Treatment Plant** is used to treat surface water for the purpose of providing potable water at the Loch Lomond Recreational facility and the Ranger's house.

The City maintains a number of **treated water storage tanks** distributed throughout the service area. The largest was the Bay Street Reservoir which was originally constructed in 1924. Together with the filtered water tank, it provided water pressure to the gravity zone which encompasses the majority of the City water service area, and serves as distribution storage for pumping to elevated zones. The reservoir reached the end of its useful life and was deconstructed in 2008. The second of two 6 MG replacement tanks is currently being constructed and should be in service in April 2015. The remaining system tanks are all on an inspection and maintenance schedule: in 2013 University 2 Tank was rehabilitated for $1.5M; in 2014 the DeLaveaga Tanks were rehabilitated for $1.4M; and the University 5 and 6 Tanks are

scheduled for maintenance in FY 16 and 17. While this work will extend the useful life of each facility, redundancy and capacity issues have not always been addressed.

The ~18-mile long **North Coast Main** delivers raw water diverted at the North Coast sources by gravity to the Coast Pump Station, where it is pumped to the GHWTP. The system includes five distinct pipeline reaches and the City is in the process of implementing a long-term (10-20 year), ~$35M rehabilitation and replacement program for the entire North Coast system. Both pipeline and diversion structures are and will be rehabilitated or replaced to restore their integrity and reduce transmission losses. New pipeline will be replaced partly in its current alignment and partly in a new alignment to avoid sensitive habitats. The first phase between Highway 1 and the Bay Street Reservoir was completed in 2007 (construction costs ~$2M). The second phase between Highway 1 and the Coast Pump Station was completed in 2012 (construction costs ~$3M. The third phase between Wilder Ranch State Park and Scaroni Road is currently in final design and permitting and going to bid in 2015 (engineer's construction estimate of ~$6M).



The 9-mile long, 50-year old **Newell Creek Pipeline** delivers raw water from Loch Lomond Reservoir through Henry Cowell State Park to the GHWTP. The age and condition of the pipe, coupled with the environmental conditions through which the pipeline was installed, require that portions of this pipeline

be replaced and possible realigned. Inspection of this pipeline is scheduled for 2017; $13M is currently budgeted (as a placeholder) in subsequent years for replacement/rehabilitation.

The **Coast Pump Station** is located next to the **Tait Street Diversion** and pumps raw water from the North Coast and San Lorenzo River sources up to the GHWTP. The Coast Pump Station and ancillary facilities are in fairly good condition. The Tait Street Diversion and Tait Street Wells will be evaluated in the current and subsequent fiscal years to evaluate their condition, replace existing wells, and potentially install new wells.

The **Felton Booster Pump Station** is used to pump water from the Felton Diversion to NCD and from NCD to the GHWTP. The entire pump station was modernized in 2006.

Felton Diversion is operated intermittently as needed. It is normally used in the winter months of dry years, but the diversion dam is inflated every year for maintenance purposes and to facilitate fisheries research. Monies are budgeted to evaluate and rehabilitate this facility.

Operations

The Water Department follows a variety of policies, procedures, and legal restrictions in operating the water supply system. In general, the system is managed to take advantage of the better quality and least expensive sources as a first priority, and to retain the maximum amount of water possible in Loch Lomond Reservoir to safeguard against future droughts. In addition to considerations for cost, water quality, and storage, legal constraints on the diversion of surface waters contained in the City's water rights govern the operation of the water system.

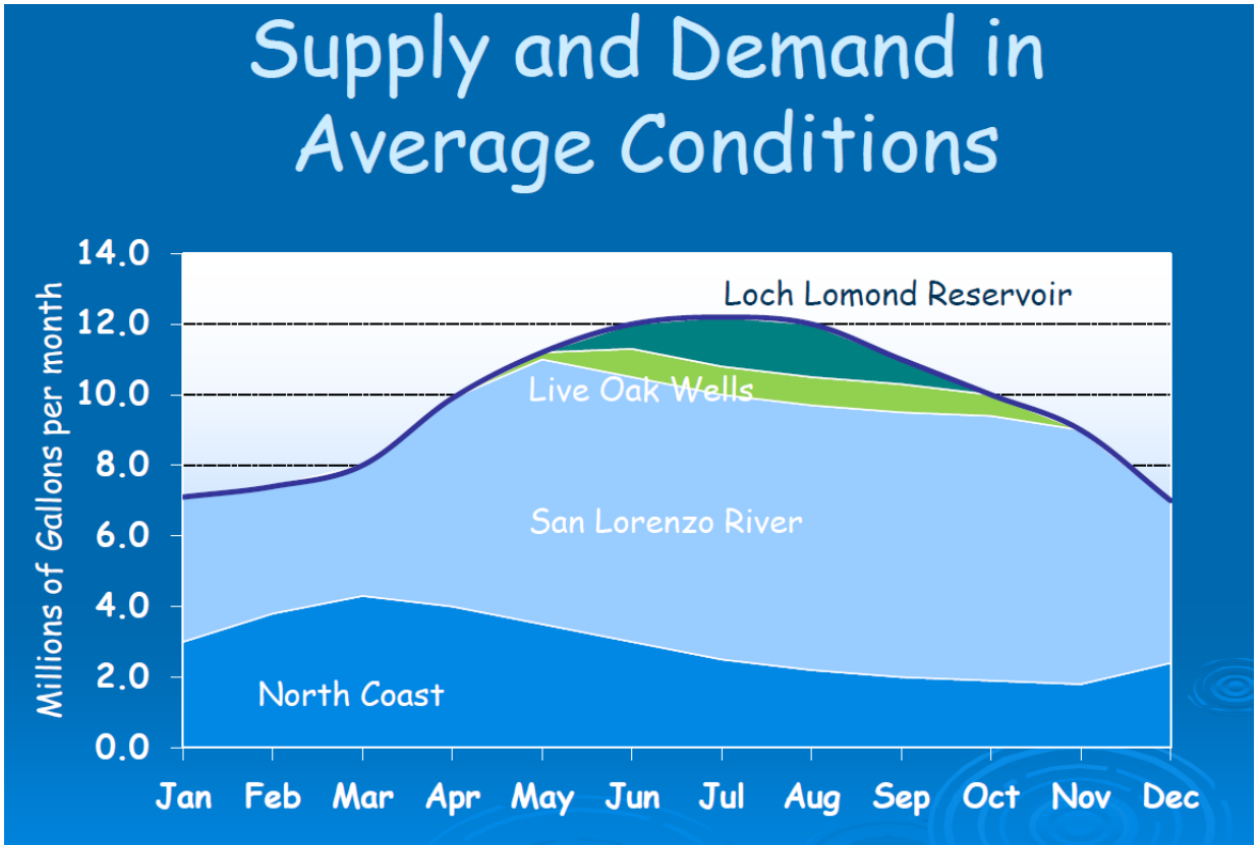
Water supplies are generally dispatched to meet daily demands in the following order:

1. North Coast
2. San Lorenzo River
3. Live Oak Wells
4. Loch Lomond Reservoir

Due to the excellent water quality and the lowest production cost, the North Coast sources are used to the greatest extent possible. As pre-1914 sources, the City's North Coast diversions are least affected by water rights limitations. Production from these sources is limited by both infrastructure constraints in winter/spring months, by flows in the dry season, and by fishery bypass issues. Recent production figures are ~2mgd.

Additional water needed to meet daily demands is pumped from the San Lorenzo River at Tait Street. Under favorable conditions, up to 7.5 mgd can be produced from the Tait Street Diversion and wells throughout the dry season.

During the summer and fall, when the City's flowing sources are inadequate to meet peak season daily demands, supplemental water is brought in from the Live Oak Wells and from Loch Lomond Reservoir. On a typical summer day the Live Oak Wells contribute about 0.8 mgd. Withdrawals from the reservoir vary between 2 and 4 mgd depending on weather and customer demand. Withdrawals are also made from Loch Lomond during the winter season when the North Coast and San Lorenzo River sources become untreatable due to excessive turbidity from storm runoff.



Limitations

In-Stream Flow Releases In accordance with the requirements of its water rights, the City releases a minimum flow of 1.0 cubic foot per second (cfs) (equal to 0.65 mgd or approximately 20 million gallons per month) from storage in Loch Lomond Reservoir, to support fishery resources beneath the dam. (This flow has been temporarily reduced to 0.2cfs during the 2014 drought.)

In 2007 the City voluntarily began releasing in-stream flows from the North Coast system on an interim basis. Over the last 3 years combined in-stream flow releases on the North Coast system have averaged 0.38 mgd or about 11 million gallons per month to maintain habitat below the diversion points. Since that time, the City has provided enhanced flows above and beyond the previous interim flows which address all life history needs of special status salmonids in streams that the City diverts from. These flows are commonly referred to as "short term flows" and are part of an agreement between the City and DFW regarding tolling of an agreement to wait on completion of streambed alteration agreements for the North Coast diversions until after the anadromous salmonid HCP is completed. However, it is anticipated that these agreements would mirror the HCP and that there will not be a second round of negotiations on streambed alteration agreement - related flows once the HCP is completed. The City anticipates having to bypass substantially more flow in the future from the North Coast sources and from the San Lorenzo River once a final, long-term agreement with regulatory agencies has been negotiated.

Well Operations and Groundwater Production The City's wells are normally operated 150 to 200 days of the year during the dry season at a steady combined production rate of about 0.8 mgd. Historically, annual groundwater production has varied from less than 100 mgy to as much as 430 mgy, depending on hydrologic conditions and the availability of water from other sources. As indicated in the table above, groundwater production peaked during the 1987-92 drought. During that period, the system was operated at times at its full 2 mgd design capacity.

Annual water production from the Purisima Formation by the City of Santa Cruz and the Soquel Creek and Central Water Districts over the past five years is presented in the table below. In addition, it is estimated that approximately 1,000 +/- private urban, rural, and small water system wells produce an additional 667 mgy from the aquifer (Hydrometrics, 2011).

Groundwater Production by Public Agencies, 2006-2010 (million gal)

Year	2006	2007	2008	2009	2010
City of Santa Cruz	119	179	164	164	151
Soquel Creek Water District	966	1,027	1,021	934	914
Central Water District	7	4	6	12	7
Total	**1,092**	**1,210**	**1,191**	**1,110**	**1,072**

Reduced Groundwater Availability The City has been advised by its hydrogeologist that the yield of the Live Oak well field now is substantially less than the 420 mgy that the City had long assumed for

water supply planning purposes, and that the dry season pumping rate that can be sustained without causing seawater intrusion in average years appears to be not more than 170 mgy (Hopkins, 2010). Likewise, the Soquel Creek Water District recently has been presented with a reevaluation of the safe yield of the Soquel Aptos basin that is considerable lower than previously thought.

Because of reduced groundwater availability, the City relocated pumping further inland with the construction of Beltz 12.

This unexpected loss of drought year groundwater yield is emblematic of the continuing change and uncertainty facing the City in its effort to provide a safe, reliable, and adequate municipal water supply. The City operates the Beltz wells within parameters agreed upon by both the City and the District. These parameters were developed to sustain groundwater levels and reduce the possibility of seawater intrusion.

The City maintains **water rights** of various types on its surface water sources. These rights and their conditions are shown on the table below.

Summary of Water Rights Held by the City of Santa Cruz

Source	License/ Permit Number	Period	Maximum Diversion Rate (cfs)	Fish Flow Requirement (cfs)	Annual Diversion Limit (mil gal)
North Coast	Pre-1914	Year round	No limit	None	None
San Lorenzo River:					
Tait Street Diversion and Wells	1553, 7200	Year-round	12.2	None	None
Felton Diversion to Loch Lomond Reservoir	16601, 16123	Sept	7.8	10	977
		Oct	20	25	
		Nov-May	20	20	
		Jun-Aug	0	--	
Newell Creek:	9847				
Collection to storage (max amount/year)		Sept-Jun	No limit	--	1,825
Withdrawal		--	--	1	1,042

These restrictions on use present some operational limitations to the City. These have been incorporated in to the Confluence model.

Water Supply Modeling

The City has been using the Confluence Model to assist with water supply planning since the 1990s. Over the past few decades, conditions in the system have changed and warranted modifications to the modeling assumptions. The following table shows some of the inputs to the model that have been scrutinized by staff and modified over the years as operational and environmental conditions change.

Summary of Santa Cruz Confluence Input Changes

Demands	IWP	IWP Update	HCP pre-2013	Desal EIR	HCP Current
Service Area Annual Demand (BG)	4.6-5.3	3.5-4.5	3.5-4.0	3.5-4.0	3.5-3.2
North Coast Annual Demand (BG)	31	81	81	81	40
Percent occuring in Peak Season	64%	→	→	→	59%
Hydrology					
Hydrologic Record	59 years	73 years	→	→	→
Available Flows	Linsley- Kraeger	Balance	Multiple Scenarios	Tier 2/3 Tier 3	City Proposal (T3/2) & DFG5
Diversions					
Turbidity Constraints	25 ntu	Updated 25 ntu	Updated 25 ntu; 200 ntu	Updated 25 ntu	Updated 25 ntu
Tait Street Buffer (cfs)	0	→	→	→	0.5
North Coast Transmission losses	15%=>1%	8%=>3%	→	→	→
Groundwater Availability					
Beltz (mgd)	1.0-2.0	3 scenarios 0.3-1.0 in PS months	0.8 all years + 0.3 dry years in PS months	2 scenarios: (1) 0.8 all years + 0.3 dry years in PS months (2) 0.3 dry years in PS months	0.8 all years + 0.3 dry years in PS months
Tait Street Well Capacity (cfs)	1.78				1.29 off-pk; 0.78 pk
Loch Lomond					
Rule curves	Optimize to end of 1977	Optimize to end of 1977	Optimize to end of 1990	Optimize to end of 1977	Optimize to end of 1990
Max/usable capacity (mg)	2810/1710	2810/1740	→	→	→
Water rights					
3200 AF withdrawal	Total Newell & Felton	→	→	→	Newell Only
Allowable diversion months	Oct-May	Nov-May			Sept - Jun
Treatment Plants					
GHWTP summer/winter capacity (mgd)	20/20	20/20	16.5/16.5	16.5/16.5	16.5/10
Desalination		Sharing w/ SqCWD	Sharing w/ SqCWD	Sharing w/ SqCWD & 2 operating modes	N/A

In 2005 the City Council of the City of Santa Cruz adopted the Integrated Water Plan (IWP) and certified the Environmental Impact Report for the IWP. This series of events established the framework, or metrics, against which reliability of the water supply has been measured. These reliability guidelines are summarized below, excerpted from the Draft Environmental Impact Report (DEIR) for the scwd^2 Regional Seawater Desalination Project.

Results of the supply/demand analysis (Appendix C of the DEIR) were expressed in terms of frequency and severity of water supply shortages. The IWP recommended limiting shortages of water and associated curtailment of water during times of drought by no more than 15 percent of average annual demand and further recommended limiting the frequency of curtailments as follows.

Individual Peak Season Shortage Targets (Individual Frequency Targets): This target would be exceed if peak season shortages between 0 and 10 percent occur in more than 15 percent of the years and/or if peak season shortages of 10 to 20 percent occur in more than 2 percent of the years.

Cumulative Peak Season Shortage Targets (Cumulative Frequency Targets): The cumulative frequency target would be exceeded if shortages between 0 and 20 percent occur in more than 17 percent of the years.

Worst Year Peak Season Shortage Target: The worst peak season shortage target would be exceeded if any shortage is greater than 15%.

Frequency Targets (Expressed as a probability of exceeding the target)				
Individual Peak Season Shortage Targets				
0-10% Peak Season Shortage	**10-20% Peak Season Shortage**	**20-30% Peak Season Shortage**	**Cumulative Peak Season Shortage**	**Acceptable Worst Year Peak Season Shortage (15%)**
15% of years	2% of years	0	17% of years	15

The 2010 UWMP contemplated several levels of future demand ranging from 2030 annual volumes of 4 billion gallons per year (bgy) to 4.5bgy. The DEIR for the desalination project reevaluated future demands based on existing and new conservation projects and programs as well as existing conditions in the community and based its analyses on 2030 demands ranging from 3.5bgy to 4bgy. More recent work by staff and the WSAC technical team reduce 2030 demand to ~3,300 mgy.

The Confluence model is built around the physical infrastructure and operational parameters of the water system. The model has been modified over time as operational conditions change such as changes in demand or hydrology for example. As the WSAC considers various scenarios, the Confluence model may be used to evaluate other conditions such as other demand patterns, climate change, etc.

References:

City of Santa Cruz, 2011. "*City of Santa Cruz 2010 Urban Water Management Plan*," prepared by City of Santa Cruz Water Department, December 2011.

Gary Fiske & Associates, 2003. "*City of Santa Cruz Integrated Water Plan*," adopted in November 2005. Prepared by Gary Fiske & Associates for the City of Santa Cruz, June 2003.

URS Corporation, 2013. "*City of Santa Cruz and Soquel Creek Water District Proposed scwd^2 Regional Seawater Desalination Project Draft Environmental Impact Report*," prepared by URS Corporation, May 2013.

GARY FISKE AND ASSOCIATES, INC.
Water Resources Planning and Management

Date: February 4, 2015
From: Gary Fiske
To: Water Supply Advisory Committee
Re: Baseline System Reliability

This memorandum describes the results of my analysis of baseline system reliability. Because the Santa Cruz water system is primarily dependent on surface water, its performance in any year is a function of that year's and immediately prior years' hydrology. Since rainfall in any year is highly uncertain, the question of "how reliable is the system?" is a complicated one to answer. Several approaches are used in this memo; other suggestions by the committee would be welcome.

DEFINING THE BASELINE

The baseline is defined by:

- Current supplies and infrastructure
- The interim demand forecast

The Confluence® model was used to assess the performance of the baseline against each of three flow regimes. The second and third of these are the two HCP flow assumptions which bound the current discussions with the California Department of Fish and Wildlife and the National Marine Fisheries Service (collectively the "agencies"):

- Natural flows, which assume no HCP instream requirements
- City Proposed (Tier 3/2) flows
- DFG-5 flows

System performance with each of these three flow assumptions is assessed against forecasted 2020 and 2035 demands.

All of these flow sets are based on historic hydrology. Daily flows at each of the City's points of diversion have been either gauged or estimated over a 73-year historic period (1937-2009). All of the baseline results that follow assess future system performance assuming that the distribution of future hydrology will look like this historical record. This is a very big assumption. Climate change may make future hydrology drier than this 73-year period, with different seasonal patterns of rainfall, and longer and more severe droughts. As we continue to work with the WSAC, we will be modeling various alternative assumptions about how climate change may modify historical flow patterns.

EXISTING SUPPLY ASSUMPTIONS

As described by Heidi's memo to the committee, the existing system consists of the following supply sources, listed in the order that they are dispatched to meet demand on any day:

- North Coast diversions

2924 NE 43RD AVENUE • PORTLAND, OR 97213
PHONE (503) 577-3003 • FAX (503) 327-8698 • EMAIL gary@fiske-assoc.com

- Tait Street diversion and wells
- Live Oak wells
- Loch Lomond reservoir

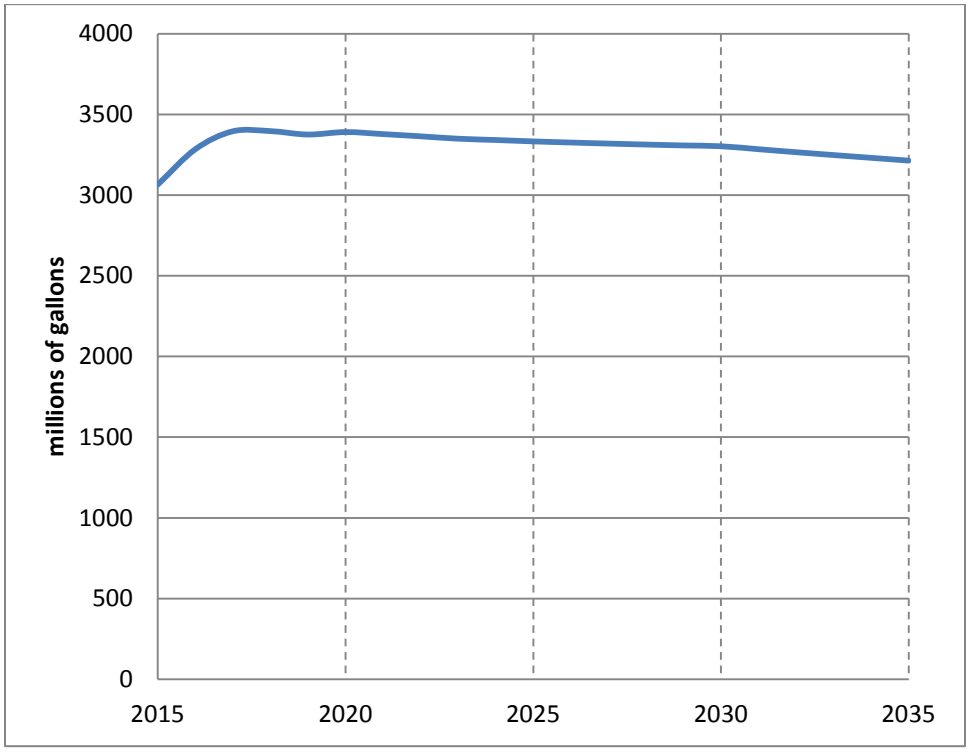
In addition, whenever possible, water is diverted from Felton to Loch Lomond.

DEMAND FORECAST

As described in David Mitchell's memorandum to the committee, the 2015-2035 demand forecast is as shown in Figure 1. This is a forecast of unconstrained demand, i.e., the volume of water that Santa Cruz municipal and industrial customers would use without any curtailments or other restrictions imposed by the utility.

After increasing for the next several years, annual demand is forecast to slowly decrease between 2020 and 2035 (by a total of about 175 mg). Thus, we would expect baseline system reliability to slightly improve between these years.

Figure 1. Interim Annual Demand Forecast



BASELINE SYSTEM RELIABILITY

Definition of Terms

To understand what follows, two terms must be defined:

> Shortage: A shortage occurs when the system is unable to provide sufficient water to serve unconstrained customer demand.

System reliability: The projected frequency and magnitude of future system shortages.

System Reliability Metrics

In Santa Cruz, since the vast bulk of shortages occur in the peak-season (May-October), all of our reliability measures are for that period.[1] There are many ways to portray system reliability. For purposes of this presentation, we use the following three approaches, which are in increasing order of complexity and completeness:

- Worst-year peak-season shortage. This is a single number that represents the expected peak-season shortage under the worst historical hydrologic conditions. (These worst conditions occurred in the 1977 drought.) While very important and easily understood, such a single number only provides information about shortages under one of the 73 historic hydrologic conditions. It does not tell us about what magnitudes of shortage, if any, might occur under less severe conditions.

- Peak-season shortage profile. This shows the likelihood of peak-season shortages within different ranges.

- Peak-season shortage duration curve. Such a curve provides a complete graphical depiction of how often different size peak-season shortages can be expected to occur.

In what follows, these measures are expressed both as volumes (millions of gallons) and as percentages of unconstrained peak-season demand.

Worst-Year Peak Season Shortages

Table 1 compares the worst-year peak-season shortages under the three flow regimes for forecast years 2020 and 2035. With Natural flows (i.e. without any HCP requirements for enhanced fish flows), the baseline system could fully serve future demands even under worst hydrologic conditions. The City Proposed (Tier 3/2) HCP flows result in a worst-year peak season shortage in 2020 of more than 600 mg or 32%; by 2035 this is forecast to decrease to 500 mg. The DFG-5 flow proposal would result in extremely severe worst-year peak-season shortages, approaching 1.4 billion gallons in 2020.

Table 1. Expected Worst-Year Peak-Season Shortages

FLOWS	2020		2035	
	Volume (mg)	Percent	Volume (mg)	Percent
Natural	0	0%	0	0%
City Prop	630	32%	500	26%
DFG-5	1360	68%	1220	64%

[1] In some years, there are small additional shortages immediately following the peak season (i.e., in November) before the fall rains begin in earnest. It is possible that these off-peak shortages may become more significant if future flows are different due to climate change.

Peak-Season Shortage Profiles

Table 2 and Table 3 show respectively the forecasted peak-season shortage profiles in 2020 and 2035.[2]

Table 2. 2020 Shortage Profiles

FLOWS	Likelihood of Peak-Season Shortages				
	0%	<15%	15%-25%	25%-50%	>50%
	0	<300 mg	300-500 mg	500-1000 mg	>1000 mg
Natural	100%	0%	0%	0%	0%
City Prop	92%	7%	0%	1%	0%
DFG-5	90%	1%	4%	3%	1%

Table 3. 2035 Shortage Profiles

FLOWS	Likelihood of Peak-Season Shortages				
	0%	<15%	15%-25%	25%-50%	>50%
	0	<285 mg	285-475 mg	475-950 mg	>950 mg
Natural	100%	0%	0%	0%	0%
City Prop	97%	1%	0%	1%	0%
DFG-5	90%	1%	4%	3%	1%

Several conclusions can be drawn from these profiles:

- With Natural flows, there are no shortages of any magnitude under any hydrologic condition. Since we saw above that there are no expected shortages under worst-year conditions, this is not surprising.

- As expected, the DFG-5 profile is worse (i.e. results in a higher likelihood of larger shortages) than the profile for City Proposed flows. For example, in both forecast years, there is about an 8% likelihood (6 out of 73 years) of a peak-season shortage larger than 15% under DFG-5. This compares to around 1% (1 out of 73 years) under the City Proposal.

- Even under the most stringent flow regime (DFG-5), there are no expected shortages in 90% of historic hydrologic conditions. The City's supply reliability challenges are in the driest years.

- While similar, the 2035 profiles are slightly more favorable than the 2020 profiles due to the somewhat lower forecast demand.

[2] Note that the totals in any row may not add to 100% due to rounding.

Peak-Season Shortage Duration Curves

Figure 2 compares the 2020 peak-season shortage duration curves across all 73 historic hydrologic conditions for the three flow sets. Figure 3 shows the same comparison for 2035.

Figure 2. Peak-Season Shortage Duration Curves: 2020

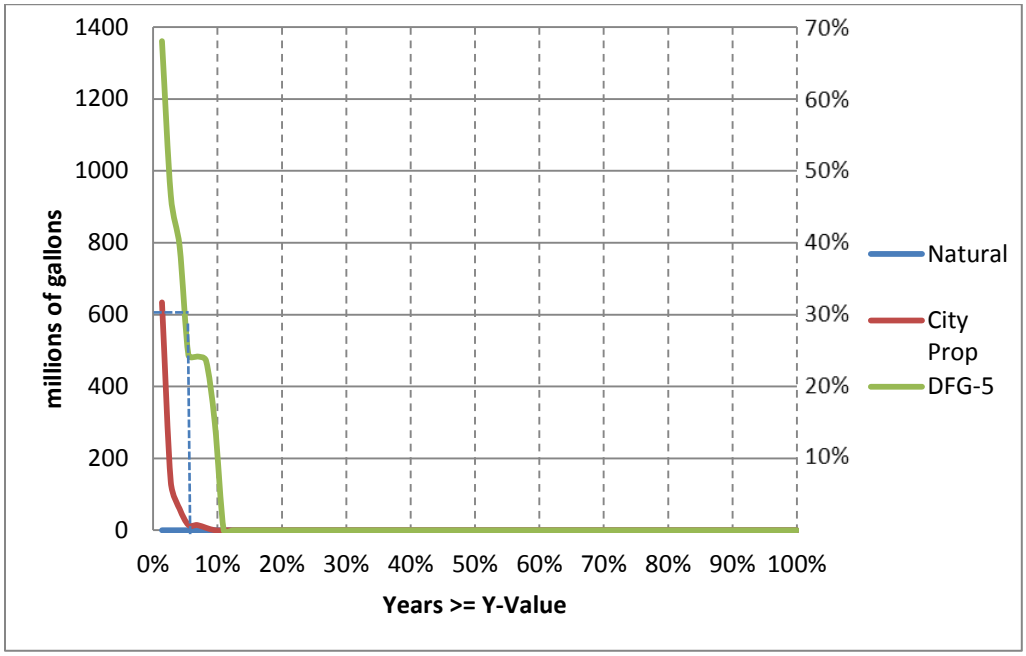
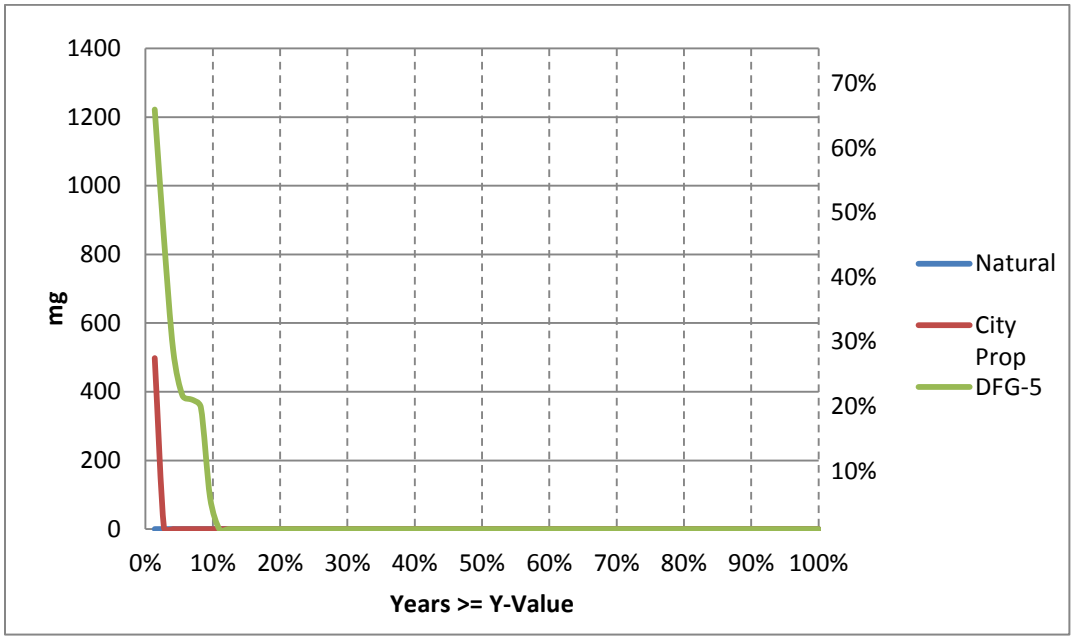


Figure 3. Peak-Season Shortage Duration Curves: 2035



Thus, for example, in 2020 under DFG-5 flows, there is about a 5% likelihood of a peak-season shortage of 600 mg or more (see blue-dashed lines in Figure 2). The curves clearly illustrate how much more severe the supply reliability challenges would be under DFG-5 than under the City Proposal. Moreover, when the two charts are compared, the slight improvement between 2020 and 2035 is evident.

Both the worst-year shortages in Table 1 and the shortage profile tables in Tables 2 and 3 are based on the data underlying these charts.

Figures 4 and 5 are duration curves for 2020 (expressed as peak-season shortage percentages) broken down by year type. Figure 4 shows that in 2020, assuming City Proposed flows, there is about a 15% likelihood of a Critically-Dry year having at least a 15% shortage. Figure 5 shows that probability rising to about 55% with DFG-5 flows (plus about a 10% likelihood of such shortages in Dry years). Results in 2035 (not shown) are slightly more favorable.

Figure 4. 2020 Peak-Season Percent Shortage Duration Curves by Year Type: City Proposed Flows

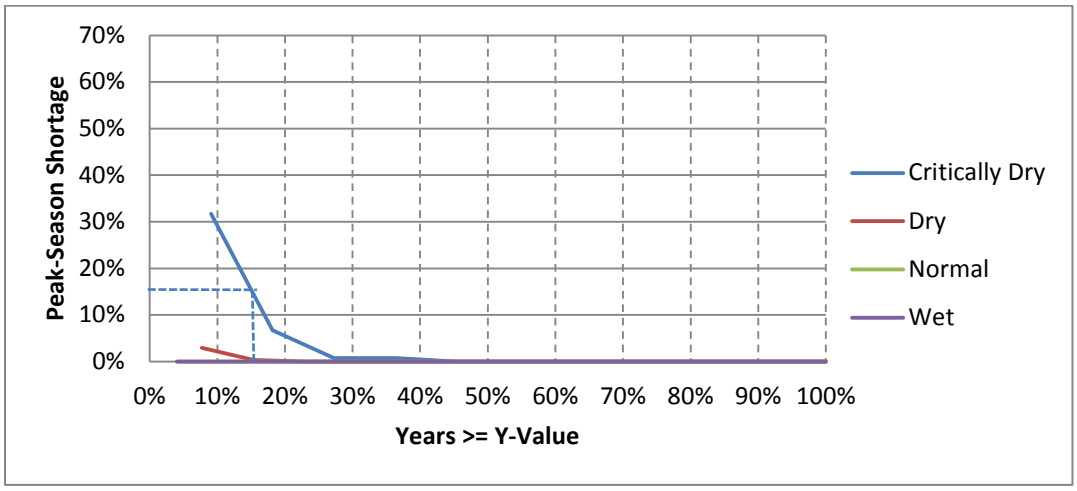
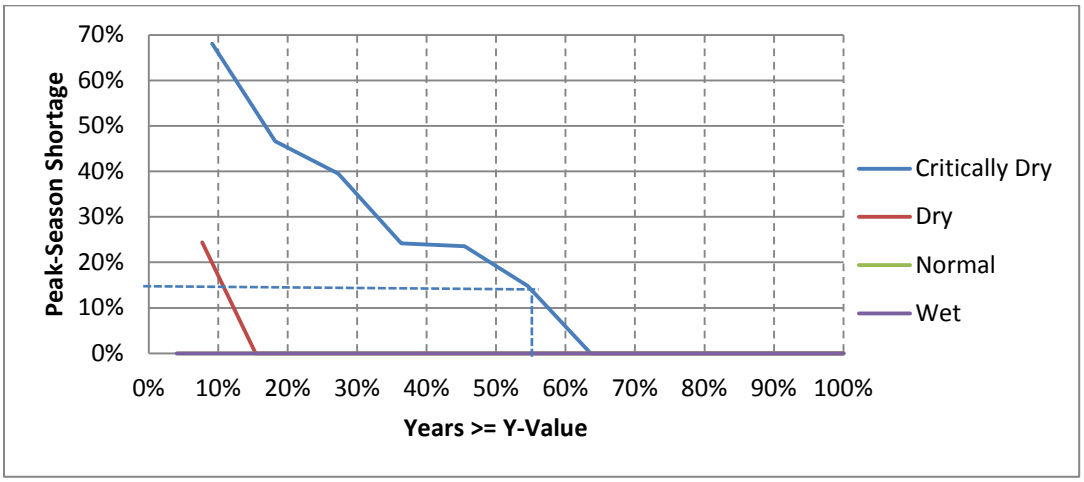


Figure 5. 2020 Peak-Season Percent Shortage Duration Curves by Year Type: DFG-5 Flows



Key Conclusions

Under baseline conditions, and assuming that future hydrology looks like the historic record, the City would have sufficient supply to serve its demands in the absence of any HCP flow restrictions. While the outcome of the HCP negotiations with the agencies is uncertain, we assume that the two flow proposals currently being discussed bound that outcome. Under either of those proposals, the City faces peak-season shortages in the driest hydrologic conditions. In those driest years, those shortages can be significant, around 600 million gallons under City-Proposed flows and close to 1.4 billion gallons under DFG-5 flows.

WSAC Outreach Subcommittee Meeting
January 21, 2015

Present: Charlie Kuetman, Doug Engfer, Greg Pepping, Erica Stanojevic, David Stearns
Absent: Peter Beckman

Sentinel Editorials

The Santa Cruz Sentinel has offered WSAC a monthly column for approximately 650 words to talk about what the committee is working on. The subcommittee discussed possible topics; one idea was to recap the most recent meeting. The subcommittee will discuss with the full committee at the February WSAC meeting. In the meantime, content for the first column is due prior to the February meeting so Greg volunteered to draft something for subcommittee review.

Action Items:

- **Greg** to write draft column for subcommittee review by **Friday night, January 23.**
- **Doug** to work on a draft editorial content calendar.

"Real Deal" Rename

The subcommittee discussed and agreed that the second phase of the committee's work should be named something different than "Real Deal." Real Deal doesn't provide any context for the work the committee will be conducting in phase 2 and is a generic term. Charlie suggested using the term "Action."

Action Items:

- **Eileen** to email the full committee with the suggestion that the second phase of work be renamed. "Action" will be proposed, but committee members will be asked for any other names they'd like to propose for consideration.

Phase 2 Outreach Objectives

The subcommittee discussed and agreed on the following objectives for phase 2 of their work:

- Community stakeholders have a clear understanding of the problem WSAC is trying to solve.
- Stakeholders are familiar with the broad range of proposals (to solve the problem) that the committee reviewed and analyzed.
- Stakeholders understand the process that WSAC used to develop their list of recommendations: that the group was consensus-based; that it included professional input; that there was an independent review panel; that the group evaluated political feasibility as well as technical feasibility.
- Customer awareness of the recommendations going to council is maximized.
- The community feels empowered to participate in the WSAC process.

The objectives will form the basis for developing tactics and strategies for outreach and engagement.

Civinomics

Erica shared an email she received from Civinomics offering to work on an infographic that describes WSAC's process and progress. The group agreed that Erica should explore the idea further with Civinomics.

Action Item:

- **Erica** to forward email from Civinomics to outreach subcommittee members.
- Subcommittee members to provide feedback to **Erica ASAP** on the elements they'd like to see included in the infographic, from the list of elements provided by Civinomics.

NEXT MEETING FEBRUARY 18, 10:00-11:00AM, WATER DEPARTMENT CONFERENCE ROOM

WSAC Column in the Santa Cruz Sentinel

This document describes the proposed schedule for and content of a series of columns that the Santa Cruz Water Supply Advisory Committee (WSAC) would prepare and publish locally in the Sentinel on the OpEd page.

Context and Purpose

The fundamental premise is for the WSAC to inform the community about the work that it is doing to solve the City's water supply/demand mismatch.

The goals are many-fold:

- Engender trust by demonstrating transparency
- Broaden outreach, education, engagement
- Bring the town together to discuss the Committee's eventual recommendation in an informed manner
- Tell the broader story as it develops – pull the community into the process and discussion
- Demonstrate that Santa Cruz is the West's subject-matter expert on water-planning and –policy reform

The Santa Cruz Sentinel will be the home of this "community campfire" conversation.

Outline and Tentative Schedule

We intend to publish a column after each WSAC meeting, within 2 weeks of each meeting and preferably on a Sunday (allowing one week for drafting and one week for the Sentinel editorial and publication process). One exception: the initial column will introduce the series and provide broad context, and will run before the February WSAC meeting. Each column will describe the Committee's work during the corresponding meeting and contextualize that work within the overall decision-making process.

The following table outlines our proposed calendar for these columns. Of course, the details (and even the headline-level topics) may change as we go along and our process flows and develops.

Target Publication Date	Meeting Dates	Topical Coverage
8 February	n/a	Introduce the series; layout the path forward for the Committee, providing a roadmap for the rest of the columns
1 March	12, 13 February	Defining the problem by characterizing the "baseline case" – where we will be regarding supply

Target Publication Date	Meeting Dates	Topical Coverage
		and demand if we do nothing
5 April	18, 20 March	Scenario planning – potential visions for Santa Cruz's future and the implications of each of those visions for water supply & demand
17 May	30 April, 1 May	Decision criteria and ratings; solutions categories and descriptions
28 June	11, 12 June	Solution portfolio development and analysis
9 August	23, 24 July	Rating portfolios based on criteria
30 August	13, 14 August	Mapping portfolios onto scenarios
27 September	10, 11 September	Developing recommendation(s)
18 October	30 September, 2 October	Final recommendation(s)

What's up with the WSAC?

Greg Pepping, Santa Cruz Water Supply Advisory Committee

In 2013 the City of Santa Cruz shelved its plans to build a desal plant with Soquel Creek Water District. With that course change, we were left with the fundamental question: what are we going to do to ensure a reliable, safe, and adequate water supply for our community? To some, we don't need to do anything. To others, we can conserve our way out of the "problem." And others believe we should construct a desal plant, build more dams, and more. That's the nature of a community: we have a variety of opinions.

That said, we all want a bright future for Santa Cruz. The challenge now is to forge some level of agreement on what that means and how to get there.

In February of 2014, the Santa Cruz City Council created a 14-member Water Supply Advisory Committee (WSAC). The WSAC charter states that its purpose is to "explore, through an iterative, fact-based process, the City's water profile, including supply, demand and future risks; analyze potential solutions to deliver a safe, adequate, reliable and environmentally sustainable water supply; and develop strategy recommendations for City Council consideration."

The WSAC members represent a wide range of backgrounds and interests - engineers and environmentalists, mothers and fathers, lifetime residents and more-recent arrivals. While each of us approaches this work from a different angle, we are united in one respect: we seek real solutions, and we highly value transparency in this process.

Early on the WSAC decided to divide our work into two phases. Phase 1, "Recon" (for reconnaissance), focused on establishing trust within the committee, learning more about the City's water system, identifying a wide-ranging set of possible solutions, and developing the tools and processes we will use to evaluate those solutions and develop final recommendations. We've just completed Phase 1, and our 164-page summary report is available at www.santacruzwatersupply.com.

What's next for the WSAC? Phase 2, which some call the Decision Phase, or the "Real Deal." In Phase 2 we will evaluate all of the solutions before us and offer a recommendation to City Council that addresses Santa Cruz's water needs for many years to come. That set of *possible* solutions we'll be considering is comprehensive, and includes supply (such as desal and other alternatives), storage (such as lining an empty quarry to serve as a new reservoir) and enhanced conservation. A number of content experts are also serving the WSAC as technical advisors. Most likely, our recommendation will be a portfolio of multiple alternatives, addressing the inherent uncertainties that relate to our water future.

The website above, along with https://civinomics.com/santacruzwater, allows you to learn more about Santa Cruz's many water options.

This is the first in a series of essays from WSAC members. Over the next several months, future essays will describe our ongoing work and the progress we are making. Our goal is to help ensure that everyone has a clear understanding of the work we are doing. We genuinely want input from and engagement

with the community as we work to resolve this long-standing issue. Please contribute as you feel compelled, and know that you have the opportunity, and even duty, to do so.

The WSAC charter directs us to come back to City Council with our recommendations, and as elected officials they will set the direction for what we do as a community to address our water future. Originally WSAC was to serve for twelve months, but we're expecting to take a bit longer; we will offer our final recommendations by October of this year.

I believe I speak for all WSAC members when I say we look forward to continuing this work with the entire community. Together we will develop a consensus on recommendations that secure our water future and that we can all support.

Real Deal Planning Subcommittee meeting: 1/16/15

Attendees: Rosemary, David B, Mark, Sid, Doug, Colleen, Bill F, Rick, Peter, Erica, Heidi, Nicholas

1. Council report update - We reviewed the items to be reported to the Council on 1/27/15
    a. Recon Report was reviewed by Rosemary, Doug and David B
    b. Rosemary will load it onto the web so that all can access it (the website or dropbox)
    c. Proposed Work Plan & Schedule
    d. P2C contract
    e. Stratus contract will be ready for Council consideration in February. Rosemary explained that the overall cost for the technical consultants will be in the $1MM range. She reported that this appeared not to cause any "angst" for Mayor, and Vice-Mayor in preliminary conversations.

2. WSAC attendance at 1/27/15 meeting is key
    a. Items on agenda for WSAC
        i. Recon Report
        ii. Go-forward plan & schedule
        iii. P2C contract amendment
        iv. [Stratus contract amendment at a future date]
    b. Propose note to WSAC to attend (many will be out of town or otherwise unavailable). The WSAC item will be in the Council's 7:00 session and is the second item on the agenda so is likely to start at about 7:30p. Rosemary agreed to send it.
    c. David B recommended that WSAC members also be invited to attend the 2 February Water Commission meeting, where "demand offset fees" will start to be discussed.
    We asked if the Water Commission meeting could be broadcast via TV. Rosemary said she would look into this.
    d. WSAC's representatives need to get organized so that they can speak to the items in the Report in an informed and compelling way. Someone needs to step forth to be the "presenter" of the Recon Report. The selected "presenter" will need to work closely with Rosemary on the presentation. We noted that Mike Rotkin has done this for WSAC before and would be a good candidate. We expect that those who will attend will need to contact each other to organize themselves will need to communicate with each other. We noted that there are no Brown Act considerations here; we will be making no decisions (just getting organized).

3. Work plan outline and update
    a. Refer to the draft staff Phase Two report for details - draft distributed by Rosemary pre-meeting.
    b. Technical team met in SF on Friday, 9 January, to get organized for Phase Two and draft a preliminary work plan and schedule.
    c. We discussed how staff and RDP Subcommittee can monitor / are monitoring work in progress (WIP) by technical team. We need an easy way to keep track of what has been referred to the technical team and that status of WIP.
        i. WIP report suggested and agreed upon.
        ii. Work calendar will be updated regularly (monthly) and posted on the website for general access.
        iii. The WIP Report will include some more-detailed discussion of the ongoing work elements, as an overview of various elements of the technical work product.
    d. Problem Statement Definition discussion
        i. Problem definition will be the focus of WSAC's February meeting. Question was asked: Do we need more of a problem statement than "What will we recommend to Council?" as suggested by Mark?
        ii. What is the problem statement, in form, format, and content?
        iii. The desired outcome of our discussions in the Committee will be the understanding of the problem well enough to allow the Committee to develop scenarios that will allow us to understand the conditions that we are planning for so that we will be able to define the solution(s).
        iv. We noted that the Committee will develop this understanding and therefore characterize the problem space over time, rather than *a priori* during the February meeting.
        v. To get the necessary understanding WSAC will develop an understanding of the following items:
            1. Baseline demand - there are four versions of this
                a. Version 1
                    i. No additional conservation measures beyond Program A
                    ii. "Basic code changes" impacts will be included
                b. Version 2
                    i. Incorporate an estimate of price elasticity using a plug-in number provided by Dave Mitchell. This will not be a full econometric model.
                c. Two UCSC versions
                    i. Demand agreed in the settlement (349 MGY max

ii. Demand that reflects historical use (this has been lower than the settlement amount)

2. Baseline supply - there are two versions of this
    a. A high estimate and
    b. A low estimate of fish flow impacts per the HCP
3. Frequency and duration of shortages
    a. This discussion will be informed by outputs from various "runs" of the Confluence model
4. "Sample agreements"
    a. Staff and consultants will assemble examples of agreements reached by other agencies to resolve problems of similar complexity so that we can understand the mechanisms that may be included in our agreement.

vi. Further discussion about the Problem Definition

1. We recognized that we will not try to "define" the problem in February. One of us suggested that, instead of aiming for a "problem definition," we should specify that our aim is to develop a "problem-solving framework." This framework will be informed by the baseline demand and supply and by the anticipated frequency and duration of shortages (which will, in turn, inform scenario planning).
2. Our problem statement is essentially a framework identifying the areas where further discussion will take place toward an agreement (again, supply, demand, scenarios, uncertainties, etc.).
3. We anticipate that by June we should have a fleshed-out problem-solving framework, and could start work on potential areas of agreement on portfolio(s), building toward ultimate consensus.

4. Consolidated Alternatives discussion (Bill and Colleen)
    a. Discussion of Consolidated Alts process and overview memo.
        i. The implications of reducing the number of alts. This is quite different from creating portfolios. Rather, we are looking now to consolidate similar or related alternatives. Portfolios will ensue later. We need to be careful to use different nomenclature to avoid confusion between consolidated Alts and portfolios of Alts.
        ii. Example discussion – CA-15
            1. Demonstrates that there is a "winnowing" to the most-promising alternatives within a given Consolidated Alt
            2. Discussed need for transparency about the winnowing logic, for the sake of the Committee and its work.

3. Agreed upon need for adequate "footnoting" of the various consolidated alts. We need to be prepared to explain to the public, particularly those who submitted alts, why certain alts were chosen and why others were rejected for further study and analysis. By documenting our assumptions, the community has a starting point for future discussions when assumptions change.

b. Timeframe – complete by March
c. February meeting will include a presentation and discussion of WIP by Technical Team.

5. Enrichment Discussion
   a. Rick leading this effort
      i. Rick will circulate a list via email for RDP Subcommittee consideration
   b. The list should include the following:
      i. David Mitchell on economic implications
      ii. Additional suggestions from the Tech team
      iii. IRP may have additional suggestions
      iv. Suggestions from biologists that Heidi will contact (Erica to provide some names)

6. Future work
   a. Criteria discussion – there is work to be done here that has been held over from December.
      i. Technical staff to propose a process that allows the WSAC to work through the remaining Criteria, ensuring that the timing of the development of Criteria makes sense in the context of the development of scenarios, portfolios, etc.
      ii. Rosemary has this item and will bring it to RDP Subcommittee
   b. Next meeting of the Subcommittee : 30 January, 9-10:30a PT
      i. Rosemary and Doug will work up agenda
      ii. The agenda should include further discussion about working on the criteria reflected in the post meeting e-mails with Philip.

AGENDA (v2)

WSAC Planning Subcommittee

Friday, January 30, 2015

Attendees: Rosemary, David, Rick, Mark, Nicholas, Doug, Bob R
Apologies: Erica, Peter, Sid

Meeting notes are in italics.

Meeting Desired Outcomes:

- Agreement on plan and schedule for working on criteria
- Agreement on selected criteria to ask technical team for assistance on definitions and/or scales
- Agreement on future meeting dates;

1. Quick update on results of 1/27 Council actions on WSAC items
    - *All items approved.*
    - *Council expressed concern about need for enhanced Outreach in order to engage the community.*
        i. *Past experience is that outreach needs to be consistent, active, repetitive, and still there will be folks who are not fully engaged or informed until the final question comes to the Council.*
    - *Further, folks outside of Outreach need to take responsibility to engage with their constituencies (and others) on a regular basis.*
    - *Rosemary conveyed that staff is thinking about enhanced activities, including Town Hall meetings, direct-mail pieces, etc.*
    - *Door-to-door?*
2. Discussion of proposed agenda for February and March WSAC meetings
    - *Rosemary explained the agenda-setting process and the new agenda document format (notably, the desired objectives) and meeting structure (allowing substantial time for Cmte discussion).*
    - *February:*
        i. *On Thursday the focus is Baseline. On Friday the focus is on risk-assessment and scenario planning in preparation for March, where we will really home in on scenarios. We will also spend focused time on the process for criteria improvement.*
            1. *David suggested adding a 4th meeting objective relating to the process for finalizing Criteria and Scales.*
            2. *David suggested elevating the Council report to earlier in the flow*
            3. *David noted need for technical-team report on WIP - to be added to every meeting agenda.*
                a. *Bob agreed to a quick report, based on written summary*
            4. *Rick suggested adding an item relating to enrichment curriculum*
                a. *To integrate with RDP report*
            5. *Consolidated Alts – this is an update item; Mark was curious about the process for finalizing the consolidated alts. He expressed desire that*

there be sufficient time for WSAC and public comment, both in February and later. (Relevant to both February, March, and beyond.)

6. *As part of overview of March agenda, make sure to highlight that Thursday may be useful for extended scenario work. Note that it's optional to work it on Thursday.*

- *March:*
    i. *Both days are focused on scenario planning, with substantial time and exercises devoted to scenarios. Again, lots of discussion time (including public involvement in a Town Hall format). Finalizing criteria during March.*
        1. *David suggests that February action report be moved up.*
        2. *Discussion of some of the mechanics relating to creating and exercises scenarios, and the tools we'll use (Confluence, MCDS, TBL, etc.).*
        3. *Expect a relative handful of scenarios (4 or so) that circumscribe the range of uncertainties.*

3. Review WIP in preparation for February WSAC meeting
    - Also, confirm timing of WIP reports to RDP and/or WSAC
    - *See discussion above about report to WSAC.*
    - *No report for this time. In future will report to RDP at each such meeting in written format.*
4. Proposed Planning Subcommittee meeting dates (all proposed meetings are Fridays from 9 to 10:30 am):
    - February 20
    - March 6
    - March 27
    - April 10
    - April 24
    - May 8

    After the May 8th meeting, the Committee will have to be dissolved and/or re-formed as its 6-month window will be up.
    Will do a Doodle poll on this.
5. Enrichment Curriculum discussion
    - Overview of topical and speaker list
    - February 11, 2015 – 4:00 pm to 6:00 pm
        i. David Mitchell – Water Reliability and the Community's Economy
        ii. John Rosenblum – Deep Conservation – Going Beyond National and State Building Codes
    - *Agreement on Feb curriculum.*
        i. *Discussion of ways to enhance outreach using various net-based tools (email blasts, etc.), as well as print media*
        ii. *Discussion of recording audio and prezos, and making available on WSAC website*
    - *Future sessions*
        i. *Pueblo – coming together – Bob talking with them to finalize arrangements.*
        ii. *Ricker – inter-district transfers. Target 18 March; pre-meeting.*
            1. *Want to ensure that we get clarity about when SC may get water back after it's been transferred.*

2. *Address SVWD (Piret Harmon) proposals relating to Hanson Quarry.*

iii. *IFTF – futures.*
1. *Bob R needs to look into this more before he can express an opinion about its value.*
2. *David mentioned that Rand has a water-specific future-planning tool, as well ("robust decision making" process)*
3. *Rosemary suggested that the RDP group spend more time researching this before February WSAC meeting and confer there.*

iv. *Sedlak – decentralized infrastructure.*
1. *Staff exploring this.*

v. *Daniels – climate change. Targeting March/April.*
1. *Maybe a panel format?*
2. *Include Shawn Chartrand (HCP context)*
3. *Bob suggested Joel Smith from Stratus – "internal expert" on the models.*

vi. *Ramalay – water quality and re-use / recycling.*
1. *Panel with Brian, Trussell, Holmquist (state public health)*

vii. *Juliana Rebagliati & Bonnie Lipscomb – local economic interests & trends.*

6. Evaluation Criteria –
- Suggested plan and schedule – see attached
- Identifying criteria to send to the Technical Team for input and suggestions
- *Proposal for consideration:*
  i. *RDP sub-group work up a proposal to WSAC, with tech staff support*
  ii. *Regrettable lack of detail and completeness in our current understanding of criteria and scales, despite a number of separate notes files.*
    1. *Rosemary offered that staff and team would create "baseline" set*
       a. *Bob would want some going-in clarity on the task and definitions*
       b. *Clear indication of which are relevant and tractable; qualitative v quantitative*
       c. *Could involve consolidating, deleting and/or adding, as appropriate*
       d. *Will be an iterative process; importance of use in the context of applying the criteria against given alts*
    2. *RDP then review / refine baseline*
    3. *WSAC then review / refine baseline*
    4. *Finalization takes place over time, iteratively; take advantage of topical flow in WSAC meetings (e.g., economics).*
    5. *Need a consistent process and responsible party for documenting*
  iii. *Need to have finalized for MCDS*
- *Discussion of definition of "local economy" and local impacts*
  i. *Is there a connection between water-supply reliability and economic health?*
- *Rosemary and Doug to update the criteria summary memo for distribution to the WSAC.*

7. Follow Up items for next meeting

No new items identified.

Agenda Item 11a

Peace United Church of Christ
Fellowship Hall
900 High St.
Santa Cruz, California 95060

WATER SUPPLY ADVISORY COMMITTEE (WSAC) AGENDA

Regular Meeting

December 17 & December 19, 2014

ACTION Agenda prepared January 21, 2015 with action taken in bold type.

5:00 P.M. REGULAR MEETING - SESSION ONE (**DECEMBER 17**): FELLOWSHIP HALL

2:00 P.M. REGULAR MEETING - SESSION TWO (**DECEMBER 19**): FELLOWSHIP HALL

Statements of Disqualification: Section 607 of the City Charter states that "…All members present at any meeting must vote unless disqualified, in which case the disqualification shall be publicly declared and a record thereof made."

The City of Santa Cruz has adopted a Conflict of Interest Code, and Section 8 of that Code states that no person shall make or participate in a governmental decision which he or she knows or has reason to know will have a reasonably foreseeable material financial effect distinguishable from its effect on the public generally.

General Business: Any document related to an agenda item for the General Business of this meeting distributed to the WSAC less than 72 hours before this meeting is available for inspection at the Water Administration Office, 212 Locust Street, Suite A, Santa Cruz, California. These documents will also be available for review at the WSAC meeting with the display copy at the rear of the Council Chambers.

Appeals: Any person who believes that a final action of this advisory body has been taken in error may appeal that decision to the City Council. Appeals must be in writing, setting forth the nature of the action, the basis upon which the action is considered to be in error, and addressed to the City Council in care of the City Clerk Administrator.

Other - Appeals must be received by the City Clerk Administrator within ten (10) calendar days following the date of the action from which such appeal is being taken. An appeal must be accompanied by a fifty dollar ($50) filing fee.

City Councilmember Attendance: Four or more members of the City Council may be in attendance at this meeting.

Agenda Item 11a

WATER SUPPLY ADVISORY COMMITTEE (WSAC) AGENDA

December 17, 2014 - 5:00 PM

SESSION ONE

Call to Order – Co-Facilitator Nicholas Dewar called the meeting to order at 5:03pm

Roll Call: Committee Members present: Doug Engfer, Sid Slatter, Peter Beckman, Mike Rotkin, Sue Holt, Sarah Mansergh, David Baskin, Rick Longinotti, Greg Pepping, Mark Mesiti-Miller, Charlie Keutmann, Rosemary Menard and David Stearns. Committee Members absent: Erica Stanojevic and Dana Jacobson.

Welcome to Public and Public Comment

Co-facilitators Fox and Dewar welcomed the public. One member of the public spoke on matters relating to the MCDS tool.

Committee Member Updates

Two members of the Committee spoke on matters relating to working group meetings and the Soquel Creek Water District's goals with respect to watersmart and waterinfluence. **By consensus, the Committee agreed to bring additional information to future WSAC meetings.**

Agenda Review

Co-Facilitator Nicholas led Committee Members in a review of the agenda for the WSAC's eighth meeting. **By consensus, the Committee agreed to accept the agenda as presented.**

Alternative Evaluations and MCDS Report

Bill Faisst led the Committee Members in a discussion on the nine alternatives that B&C reviewed.

Break

Alternative Evaluations and MCDS Report Cont.

Committee Members discussed whether or not to continue to use MCDS as a

decision-making tool. **By consensus, the Committee agreed to continue to use MCDS until Committee Members consider it to be no longer useful and agree to use another tool.**

Discussion of what the Ratings and Sensitivity Analyses Tell us About what the Research Agenda Needs to Focus On

By consensus, the Committee agreed to discuss this topic during the next session of this meeting on Friday, December 19, 2014.

Identification of "What if" Scenarios to Run for Presentation and Discussion During Session 2 on Friday

Committee Members discussed ideas to provide to MCDS team members Carie Fox and Philip Murphy.

Written Review and Wrap Up – Identification of any incomplete issues to be carried forward to the following session.

Adjournment The Water Supply Advisory Committee adjourned from its first session on December 17 at 9:31 PM of the regular meeting of December 17 & 19, 2014 to its second and final session on December 19 for an open session after the hour of 2:00 p.m. in the Fellowship Hall at the Peace United Church of Christ.

Agenda Item 11a

Water Supply Advisory Committee Agenda

December 19, 2014 – 2:00 PM – 6:00 PM

SESSION TWO

Call to Order – Co-Facilitator Nicholas Dewar called the meeting to order at 2:01 P.M.

Roll Call: Committee Members present: Doug Engfer, Sid Slatter, Peter Beckmann, Mike Rotkin, Sue Holt, Sarah Mansergh, David Baskin, Erica Stanojevic, Rick Longinotti, Greg Pepping, Rosemary Menard, Mark Mesiti-Miller and Charlie Keutmann. Committee Member tardy: Dana Jacobson. Committee Member absent: David Stearns.

Presentation – Correspondence Received from the Community

Committee Corresponding Secretary Mike Rotkin led Committee Members in a discussion on correspondence received from the community regarding the website and communications with community members and Soquel Creek Water District.

Public Comment

Three members of the public spoke on matters relating to feasibility, clarifications of external communications and communications with the WSAC.

Review of Previous Session

Co-Facilitator Nicholas Dewar led the Committee in a review of the previous session and an overview of the current session.

Additional Discussion on the Research Agenda

Co-Facilitator Fox presented analyses of the use of MCDS to find indications of areas requiring prioritized research. The analyses showed the importance attached to the local economy and the lack of agreement about the applicability of the rating scales to rate the selected alternatives against the Local Economy criterion.

Planning Subcommittee Process Planning Work Session

Members of the Real Deal Planning Subcommittee led the Committee in a report on the Subcommittee's strategic planning work session on December 16th. **By consensus, the Committee agreed to give the Real Deal Planning Subcommittee the following tasks:**

- **Work with Water Director Rosemary Menard on the preparation of the**

Recon Report,

- **Work with the technical consultants to consolidate alternatives and also collect together the smaller alternatives for the Committee's consideration,**
- **Prepare a draft problem statement for the Committee's consideration,**
- **Work with the technical consultants to initiate a Scenarios planning process for the Committee, and**
- **Work with the City and the technical consultants to propose a schedule of Enrichment activities for the Committee.**

Discussion and Agreement on Proposed Meeting Schedule for the Remaining Phases of the Committee's Work

Co-Facilitator Nicholas Dewar led the Committee in a discussion of the Committee's upcoming schedule. **By consensus, the Committee agreed to propose to the City Council the extension of the Committee's work schedule through October; to the following meeting dates: Febrary 12 & 13 and March 18 & 20; to ask that the facilitators poll the Committee Members after the meeting to determine whether the following dates will be suitable for them in the event that the City Council agrees to an extension of the committee's work schedule: April 30/May 1, June 11 & 12, July 23 & 24, August 13 & 14, September 10 & 11, and September 30 & October 2; and that the year starts in the month of May for the purpose of interpreting Article IX(a)(i) of the Committee's Charter concerning the number of meetings that Committee Members may miss in a year.**

Recon Outreach Subcommittee Update

Members of the Recon Outreach Subcommittee reported to the Committee that the Subcommittee had reached the end of its term as determined by the Committee when the Subcommittee was created. **By consensus, the Committee agreed to create a Real Deal Outreach Subcommittee. Committee Members Charlie Keutmann, Erica Stanojevic, Peter Beckmann, Doug Engfer, Greg Pepping and David Stearns will populate the Subcommittee. The Subcommittee is charged with engaging and informing the public about the process of the Real Deal. The Subcommittee's duration is temporary and will last for six months beginning in January.**

Oral Communication

Three members of the public spoke on matters regarding Committee goals, lifetime values and accuracy of measurement values.

Materials Resulting from the Previous Meeting

The Committee Members reviewed the Action Agenda prepared for the previous meeting. **By sense of the meeting, the Committee agreed on the November Action Agenda with a typo correction.**

Criteria Definitions Scales and Ratings

Co-Facilitator Fox led Committee Members in a discussion of the Criteria and the rating scales used to rate alternatives against individual criteria. **The Committee agreed by consensus to use present value amounts to provide rating scales for criteria that rate Alternatives according to their cost (e.g. gallons of water per dollars of cost).**

Written Review and Wrap Up – Identification of any incomplete issues to be carried forward to next meeting.

Adjournment – The Water Supply Advisory Committee meeting adjourned at 6 p.m. from the second session on December 19 of the regular meeting of December 17-19, 2015 to its next meeting on February 12, 2015 at 5:00 PM and February 13, 2015 at 2:00 PM. Location to be determined.

Memorandum

To: The Water Supply Advisory Committee

From: Robert Raucher and Colleen Donovan, Stratus Consulting Inc.; and Bill Faisst, Brown and Caldwell

Date: 2/6/2015

Subject: Consolidating the Alternatives

Goal and Purpose of Consolidation

The goal of consolidating the more than 70 water convention alternatives (WCAs)[1] is twofold: to capture the range of high-level ideas that people from the community suggested for the water convention; and to balance the need to have a manageable number of consolidated alternatives (CAs) – in terms of time, clarity, and resources – which the technical team will carry forward in more-detailed analysis. The technical team is working and coordinating with the subcommittee to define the appropriate set of CAs to present at the March Water Supply Advisory Committee (WSAC) meeting. We imagine this process will be iterative and involve dialogue among the technical team, City staff, the planning subcommittee, and other WSAC members.

Our approach to consolidation is outlined below. There will be an opportunity at the February meeting to discuss both the purpose of CAs and the approach outlined in this memorandum.

Process and State of the Work

We have begun the process of consolidating the WCAs so that the WSAC has a set of approximately 20 manageable and representative CAs to carry through Phase 2 and eventually to use in building portfolios for the scenario-analysis process. Eventually, the Confluence® model will test the CAs to determine how well they address water shortfalls as part of scenario planning.

We have compiled the full list of WCAs in a spreadsheet, along with the indicator variables below. The purpose of this compilation exercise is threefold:

- First, we want to group similar alternatives to reduce redundancy. For example, several people submitted similar ideas about water reuse for irrigation, and we can group these into one CA.

1. Sixty-seven alternatives came from submissions to the Alts Fair, one was submitted after the Alts Convention (Tanaka), and five were recently added (Program C from the Conservation Master Plan; home water recycling; peak season reductions – 10%, 25%, and 50%; Hanson quarry; and deep water desalination).

- Second, we want to ensure that the WSAC captures the full breadth of project types in the final list of CAs so that each major type of alternative is reflected.

- Third, we want to clearly demonstrate that at a high level we have not discarded, omitted, or lost any alternatives from consideration during the consolidation process.

As shown in the accompanying spreadsheet, we took care not to lose any alternatives during the consolidation process and we have carefully documented what has happened to each alternative.

- ***Column A – WCA #:*** we assigned a unique number to each WCA (WCA1 through WCA72)

- ***Column B – WCA name***

- ***Column C – Description****:* a brief overview of the alternative

- ***Column D – Focus area****:* an indicator of whether a particular alternative falls under demand, supply, storage, institutional/administration, or strategy

- ***Column E – Water source(s)****:* an indicator of where water comes; for example, whether it comes from winter flows, reclaimed water, saltwater, conservation (e.g., mandatory or voluntary), decentralized (grey water and rainwater), groundwater, some combination of sources, or some other source

- ***Column F – Where to store the water****:* an indicator to identify proposed storage options for a given alternative, for example, Loch Lomond, new surface reservoirs, groundwater, or other options

- ***Column G – Intended use(s)****:* an indicator for how an alternative proposes to use water, for example, potable, non-potable, or both; groundwater recharge, stream augmentation, or some other use

- ***Column H – Additional treatment required****:* a yes/no indicator for whether a particular alternative requires additional treatment

- ***Column I – Additional infrastructure****:* a yes/no indicator for whether a particular project requires additional infrastructure

- ***Column J – Outstanding issues****:* for alternatives that the technical team has already examined, we provide a preliminary list of outstanding issues.

Figure 1 provides an illustration of our process during consolidation and how WSAC can use the consolidated groupings in the portfolio development work as part of scenario planning.

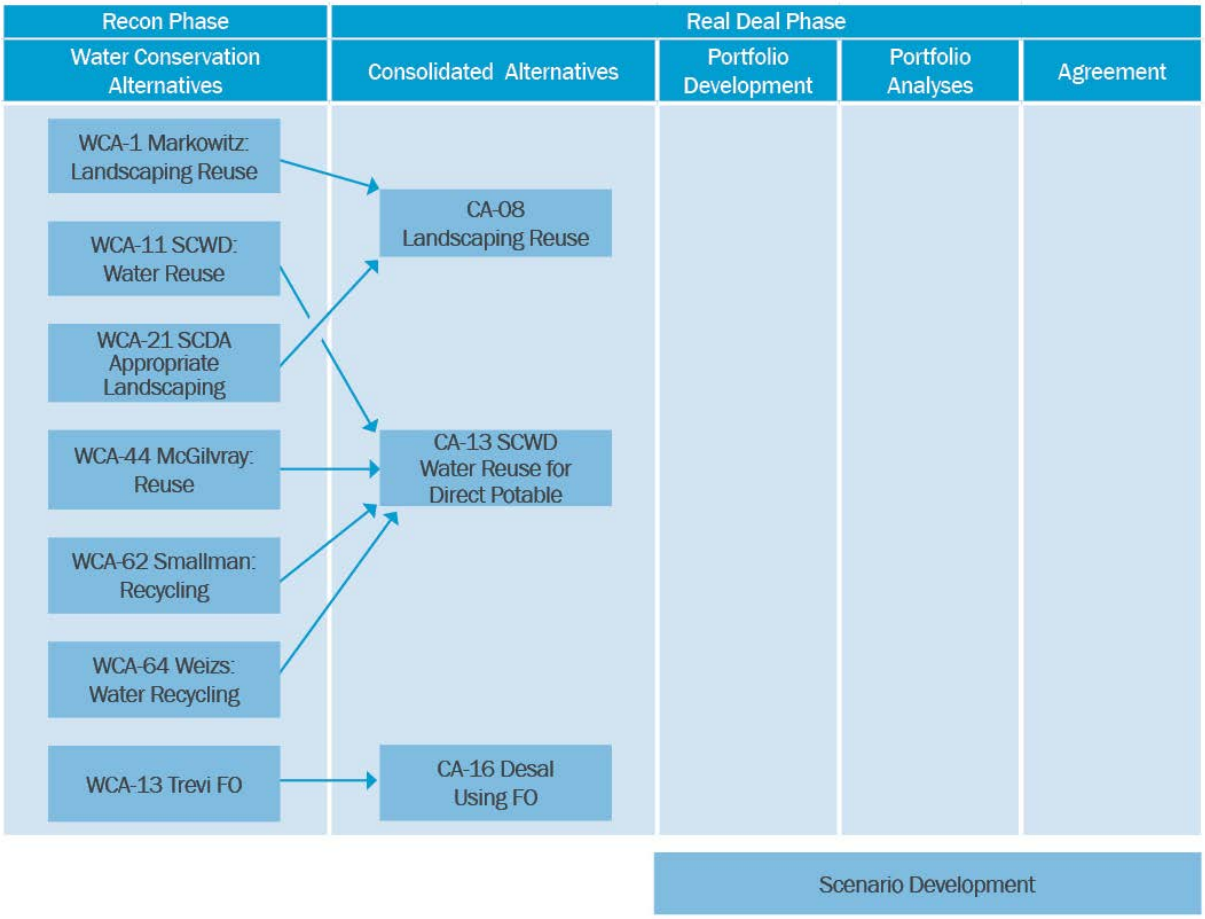


Figure 1. Flow schematic for portfolio development.

Figure 2 presents three simplified schematics that show the typical components required for functional CAs that are not based on water efficiency/water conservation. Water efficiency/water conservation would occur in parallel with alternatives that create supply from new sources (e.g., recycled water, water from new groundwater sources, captured stormwater, or additional diverted surface water).

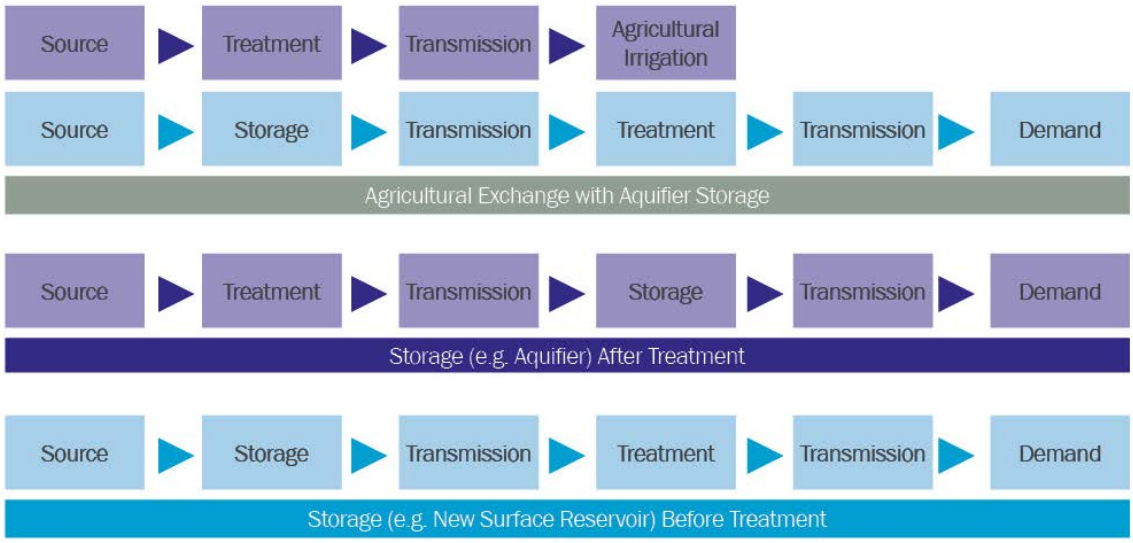


Figure 2. Schematic overview: key components (for example, non-water efficiency CAs).

Examples of CAs

Because many WCAs appear to use similar water sources, means of treatment and/or transmission, and storage – similar high-level ideas – we propose grouping similar WCAs. *One example is creating a CA about expanded treatment capacity.* Below, we include our assumptions and reasoning for this example.

***Assumptions*:** We assumed that the City would add a new 14-million-gallons-per-day (mgd) water treatment plant (WTP) at the Tait Street Diversion and pipe treated water directly into the distribution system. The City could send water in excess of the City's demand to the City's Live Oaks wells, to the Soquel Creek Water District, or to the Scotts Valley Water District (or both), for aquifer storage and recovery.

***Reasoning*:** We have assumed that this alternative captures the intent of both WCA-06 McKinney: Expanded Treatment Capacity, and WCA-27 Malone: Enhanced Storage and Recovery. Both of these alternatives propose to capture additional surface flow from the San Lorenzo River and divert such flow to storage for retrieval later by the City. This CA would have an added benefit for the City, in that a new WTP would replace the Graham Hill WTP (GHWTP) with a modern, more seismically durable facility, obviating the need to upgrade the GHWTP.

A second example is creating a CA for off-stream water storage. Below, we include our assumptions and reasoning for this example.

***Assumptions*:** We assume that the City would convert Liddell Quarry into a surface-water reservoir to create new storage. Water diverted from the City's existing surface-water rights would fill the new reservoir during average-rainfall and wet years, likely using parts of the existing North Coast Pipeline combined with new pumping systems, a reservoir inlet/outlet pipeline, and a re-contoured and lined reservoir.

***Reasoning*:** We have assumed that this CA captures the high-level intent of WCA-05 Bevirt: North Coast Quarries (modified to include diversion of water from City existing sources); WCA-26 Fieberling: Expand Storage (addresses off-stream storage); WCA-30 McGilvray (2): Quarries for Water Storage; WCA-32 SCWD: Zayante Dam and Reservoir;WCA-33 Smallman: Reservoirs; and WCA-34 Smallman: Storm Aquarries. All of these WCAs propose to store diverted surface water in surface-storage reservoirs. Although we are not capturing all of the specifics for each WCA included in this CA, we are incorporating this high-level idea: off-stream storage drawing water under the City's existing water rights. We selected a quarry site because such an approach would eliminate the need and associated environmental and political issues that would flow from damming an existing channel and degrading existing, likely undisturbed habitat.

Transparency

The technical team intends that the approach described here will be transparent to the WSAC members, the public at large, and, more importantly, the proposers who have offered potential solutions for the City's water challenges. The planned iterative process for creating CAs will allow ample opportunity for discussion and alternative adjustment.

Conclusion

The technical team is prepared to apply the approach described above, developing a set of CAs and explaining the rationale for each CA's essential components. We look forward to WSAC feedback and ideas on how we might polish and implement the consolidation process.

Water Convention Alt #	Alternative Name from Master List	Description	Focus Area	Water Source(s)	Where to store the water	Intended use(s)	Additional treatment required	Additional infrastructure	Outstanding issues
WCA-01	Markowitz: Landscaping, Capture, Re-use	Use graywater for your landscape; minimize irrigation requirements; minimize lawns/design in patios. Rainwater to go into the house/building for domestic, non-potable use.	Demand	Decentralized (rainwater, graywater)	Rainwater catchments	irrigation (non-potable)	No	No	
WCA-02	SCDA: Conservation Building Codes	Form a working group to consider building code revisions that include onsite water systems. These would go that go beyond the California Building Code, so that new buildings are highly water-efficient and can capture and re-use water onsite. The City can pass an ordinance requiring efficient fixtures in existing buildings.	Demand	Conservation (mandated)	NA	irrigation (non-potable)	No	No	
WCA-03	SCDA: Water-Neutral Development	Implement a water demand offset program, where developers fund conservation retrofits elsewhere in the system to offset the new demand for water created by the development. The City needs to prevent growth from eroding our drought security by adopting a water---neutral growth policy in which developers fund conservation programs that aren't already funded by ratepayers.	Demand	Conservation (mandated)	NA	Potable or nonpotable	No	No	
WCA-04	WaterSmart: Home Water Reports	The software organizes water use information to help engage customers, and allows customer-specific responses by staff. WaterSmart software analyzes billing data to disaggregate indoor and outdoor usage, lot size, home characteristics, location, the impact of weather and seasons, and any efficiency measures installed as part of a conservation program. Comparisons are made with other similar customers but no physical measures or incentives are delivered.	Demand	Conservation (voluntary)	NA	Potable or nonpotable	No	No	
WCA-05	Bevirt: North Coast Water	This alternative for initial comparison uses only the Liddell quarry which would hold about 650 million gallons (MG) since its construction would not require building a dam. The San Vicente site was dropped since the San Mateo Peninsula Open Space Trust and the Sempervirens Fund have acquired the site and initiated creation of a conservation easement over the site to prevent future development. If the City withdrew stored water over a 3-year drought cycle, production would be about 200 MG annually after allowing for evaporation and leakage losses.	Storage	Winter flows	New surface reservoirs	Potable or nonpotable	No	Pumping stations, Ranney collectors, pipeline	Water rights (new diversion location from which to fill the reservoir, routing of fill pipeline), geotechnical and construction issues associated with installing a liner on steep slopes over a porous karst formation, preparation and approval of environmental documents, California Department of Fish and Wildlife (CDFW) and National Marine Fisheries Service (NMFS) approvals for water diversions from streams with salmonoid populations, and agreements with the landowner about ownership and operations .
WCA-06	McKinney: Expanded Treatment Capacity	This alternative for initial comparison would add a new 14-mgd water treatment plant (WTP) (pretreatment for turbidity control and membrane filtration) near the Tait Street Diversion to produce treated water that would be piped directly into the distribution system. The write up for this alternative indicates that the alternative would allow an annual water diversion increase of about 560 MG.	Supply	Winter flows	Loch Lomond, Other	Potable	Yes	Pumping station	determine the final treatment train (MF would need pretreatment ahead of MF for elevated SLR turbidity concentration), preparation and approval of environmental documents, determination if water rights and diversion permits would need modifications, and development of a plan to store and use diverted water beneficially. If the City would have excess water during normal or wet years, it might transfer extra water to Soquel Creek Water District (SqCWD) and/or Scotts Valley Water District (SVWD) but doing so would require agreements with the agencies and likely would trigger water rights permit modifications since the place of use would change.
WCA-07	McKinney: Ranney Collectors on SLR	Use Ranney collectors with a 12.9-mgd capacity (maximum capacity allowed under the current City of Santa Cruz [City] diversion permit), installed near the City's Felton diversion to draw water allocated under the City's existing water rights. Water drawn through the collectors would have greatly reduced turbidity. Much higher water quality would allow continuous refilling of Loch Lomond while also operating the GHWTP. More studies would be required to project increased diversion opportunity, however the increased diversion likely would be somewhat less than about 560 MG annually as projected for McKinney: Expanded Treatment Capacity	Supply	Winter flows	Loch Lomond, GW recharge, other	Potable	No	Ranney collectors	the City would need to conduct additional analyses for available flow, addressing any bypass requirements under the habitat conservation plan. The City would also need to determine its plan to store and use diverted water beneficially. If the City would have excess water during normal or wet years, the City might transfer extra water to Soquel Creek Water District (SqCWD) and/or Scotts Valley Water District (SVWD) but doing so would require agreements with the agencies and likely would trigger water rights permit modifications since the place of use would change.
WCA-08	Paul: (13) The Lochquifer Alternatives	Use treated water sold by the City to Soquel Creek County Water District (SqCWD) during normal and wet years. SqCWD would use the transferred water either for groundwater recharge through seven 250-gallon-per-minute (gpm) recharge wells, for conjunctive use (well field resting) recharge, or both. The City would take more water from its San Lorenzo River and/or Newell Creek diversions, about 2.5 million gallons per day (mgd) or about 915 MG annually, to match the desalination alternative. If recharge occurred continuously for five years, total transferred water would be about 4,600 MG. Facilities would include Ranney collectors at the Felton Diversion, to insure that the Graham Hill Water Treatment Plant (GHWTP) could treat the diverted water continuously. During drought years the City would receive returned water (groundwater) from SqCWD. The City also would pump its Tait Street wells year round since the recharged Purisima aquifer would yield available water without causing seawater intrusion. Potential yield would be 2 mgd from the Live Oak wells and 2.5 mgd from SqCWD; 4.5 mgd total. If the City used these sources for six months, total production, after deducting out a 1-mgd production allowance for the existing wells, would be about 640 MG annually.	Supply	Winter flows	Loch Lomond, GW recharge, other	Potable	No	Pumping stations, Ranney collectors, pipeline	Water rights (modification of place of use), assembling appropriate information to site injection wells, modeling the Purisima aquifer to project better potential performance, and agreement with SqCWD on how the alternative's water would be conveyed, shared and paid for.
WCA-09	Ripley: Reuse for agriculture	produce filtered disinfected effluent (CA Title 22 unrestricted water) from the City Wastewater Treatment Plant (WWTP) at a rate of about 4.3 mgd. The City would pump the effluent north through a new pipeline aligned along the railroad right of way, with turnouts to irrigate up to about 1,300 acres on private land and leased land on properties owned by the California State Parks (CSP) and the United States Bureau of Land Management (BLM),. This process is assumed to take place over 180 days per year and total water available for crop irrigation would be about 780 MG. The City would build 12 new 250-gpm extraction wells that discharge into new pipeline that in turn would connect to the existing City North Coast pipeline. The water would combine with diverted surface water from the City North Coast rights, for treatment at the GHWTP. To develop space for new facilities within the WWTP site, the City would need to relocate its Line Maintenance Facility from the WWTP site to a new site on the West Side.	Supply	Wastewater effluent/groundwater	Aquifer	irrigation (non-potable)	Yes	Line maintenance facility, delivery pipeline, extraction wells, return pipeline, storage reservoir	Legal agreements with CSP, BLM, and property owners and with irrigators, securing the right of way for the new delivery and return pipelines such as along the railroad ROW, geotechnical investigations for well construction, assessment of the groundwater basin to ensure that operation would not adversely affect the groundwater basin, permitting through the California Coastal Commission, preparation and approval of CEQA/NEPA documents (NEPA is included because the project includes BLM land), and location and purchase of new Line Maintenance Facility site.
WCA-10	SCDA: Regional Aquifer Restoration	have the same components as "Paul Lochquifer" but the recharge and return rates would be lower. This alternative would transfer about 800 MG from the City to SqCWD over an extended period but SqCWD would return only about 145 MG to the City during dry years. The City's drought production from its Live Oak wells would increase from 1 mgd to 2 mgd, or about 365 MG. The long-term average approximate production increase appears to be [(145+365)/6.5] = 78 MG.	Supply	Winter flows	Loch Lomond, GW recharge, other	Exchanges with neighboring systems	No	Pumping stations, Ranney collectors, pipeline	water rights (modification of place of use), assembling appropriate information to site injection wells, modeling the Purisima aquifer to project better potential performance, and agreement with SqCWD on how the alternative's water would be conveyed, shared and paid for.

WCA-11	SCWD: Water Reuse	Produce complete advance treatment (CAT) water from the City Wastewater Treatment Plant (WWTP) at a rate of about 3.7 mgd. The City would pump the CAT water from the WWTP through a new pipeline to the Bay street Reservoirs site where the new pipeline would connect to the existing North Coast pipeline. The combined water would flow to the inlet end of the GHWTP, to be treated and distributed to the City. This alternative would produce up to about 1350 MG annually. The City would have the option of selling surplus treated water to either SqCWD or Scotts Valley Water District as part of either a conjunctive use (aquifer resting) or ASR project. To develop space for new facilities within the WWTP site, the City would need to relocate its Line Maintenance Facility from the WWTP site to a new site on the West Side.	Supply	Wastewater effluent	Loch Lomond, GW recharge, other	Potable	Yes	Pumping station, pipeline, relocated City Sewer line maintenance facility from WWTP to another site	permitting such reuse through CA Division of Drinking Water, gaining public acceptance for adding CAT water as part of its potable water supply, and possibly reaching agreements with adjacent agencies.
WCA-12	SustainableWaterCoalition: Desalination	Use seawater desalting through a new reverse osmosis desalination facility to produce about 2.5 mgd for addition to the City potable water supply. Annual production would be about 915 MG. This alternative's components and development would match those for the previously proposed scwd2 desalination facility. For comparison with other alternatives, BC has assumed that the City would own and operate the facility and would use the water produced year round. Excess water would allow the City to either idle the Live Oak wells for conjunctive use aquifer recover to perhaps undertake Live Oak well operation in an ASR mode to restore the aquifer more rapidly.	Supply	Seawater	GW recharge, other	Potable	Yes	Marine intake and pipeline, onshore pumping station, desal facillity, brine storage and brind disposal pipeline	Environmental document completion, permitting through the California Coastal Commission, and public vote approving alternative implementation.
WCA-13	Trevi: Forward Osmosis Desalination	Use seawater desalting through a Trevi forward osmosis (FO) system. This alternative's other components would match those for seawater desalting.	Supply	Seawater or recycled water	GW recharge, other	Potable	Yes	Offshore sea water intake, pipelines, and pumping station, Trevi process site, brine return pipeline	Trevi technology is still in its infancy and being tested at a pilot scale. As described, it would require a lower grade heat source for separately drawing the solution from the potable water but the alternative description did not designate a source for lower grade heat.
WCA-14	Gratz: Regional Water Authority	Advance regional restructuring by bringing together contiguous water districts to facilitate a comprehensive vision and policy for groundwater planning, management, and resource conservation	Institutional/Administration	NA	NA	NA	NA	NA	
WCA-15	Smallman: Regional Water Authority	a County-wide, regional District which would have a similar role as the Santa Clara Valley Water District, SCVWD, has with all water retailers in Santa Clara County. Just like SCVWD, this District would wholesale recycled water, manage ground water, water storage reservoirs, and recreational areas	Institutional/Administration	NA	NA	NA	NA	NA	
WCA-16	Gratz: Maximize Conservation Behavior	Use the WaterSmart Software	Demand	Conservation (voluntary)	NA	Potable or nonpotable	No	No	
WCA-17	Holt: Rate-Driven Conservation Behavior	Use rate incrases to strengthen water wavings	Demand	Conservation (voluntary)	NA	Potable or nonpotable	No	No	
WCA-18	McGilvray: (10) Regional Collaboration	Coordinate with Soquel Creek, Scotts Valley, and San Lorenzo Valley to address the water shortage issues in the region	Institutional/Administration	NA	NA	NA	NA	NA	
WCA-19	McGilvray: (11) Seawater Desal	Same as desal alternative	Supply	Seawater	GW recharge, other	Potable	Yes	Marine intake and pipeline, onshore pumping station, desal facillity, brine storage and brind disposal pipeline	Environmental document completion, permitting through the California Coastal Commission, and public vote approving alternative implementation.
WCA-20	McGilvray: (9) Implement Conservation	Implement the Santa Cruz Master Conservation Plan	Demand	Conservation (voluntary)	NA	Potable or nonpotable	No	No	
WCA-21	SCDA: Climate Appropriate Landscape	Proposes a number of recommendations, including promoting climate-appropriate landscaping, offering free graywater and rainwater evaluations, increase rebate incentives to convert lawns and shrub spray irrigation heads, price landscape water at Block 3 raes, use water budgets for all landscape accounts, and revise the water budget allotments	Demand	Decentralized (rainwater, graywater)	Rainwater catchments	irrigation (non-potable)	No	No	
WCA-22	SCDA: Conservation Education	Educate and empower the citizenry to use water in way that works for the whole community, including the wildlife, thereby diminishing or eliminating the need for mandatory curtailment. Partner with schools and community organizations to do hands-on watershed restoration work and teach water conservation practices such as rainwater catchment, graywater recycling, climate-appropriate landscaping, and safe use of composting toilets.	Demand	Conservation (voluntary)	NA	Potable or nonpotable	No	No	
WCA-23	SCDA: Conservation Pricing	Price water to encourage conservation	Demand	Conservation (voluntary)	NA	Potable or nonpotable	No	No	
WCA-24	SCDA: Demand Management During Droughts	The City will establish a policy of timely demand management in response to dry conditions that will enable adequate storage for future dry years	Demand	Conservation (other)	NA	Potable or nonpotable	No	No	
WCA-25	Scott: Composting Toilets	Compost public toilets	Demand	Conservation (other)	NA	Nonpotable	No	No	
WCA-26	Fieberling: Expand Storage	Build an off-stream storage reservoir located on state land north of the existing City landfall 3 miles west of the city	Storage	Winter flows	New surface reservoirs	Potable or nonpotable	No		
WCA-27	Malone: Enhanced Storage and Recharge	Use judicious measures to capture and manage excess San Lorenzo River runoff coupled with adequate storage. Storage options: 1) Enlarge storage capacity of Loch Lomond reservoir 2) Water swaps with neighboring water agencies 3) Groundwater recharge as storage 4) Use abandoned quarries 5) Build new dams, for example: Zayante Creek, Waterman Gap.	Storage	Winter flows	Loch Lomond, Other	Potable			
WCA-28	Malone: Regional Water Exchanges	The City would help Soquel Creek recharge its aquifer to the point where, during extreme low rain years, Soquel Creek could ship some of its groundwater to Santa Cruz to help cope with a drought	Storage	Winter flows	Loch Lomond, GW recharge, other				
WCA-29	Malone: Stormwater Capture	Capture some of the excess runoff in these extremely high runoff years using a variety of smaller storage options	Storage	Stormwater					
WCA-30	McGilvray: (2) Quarries for Water Storage	Use former quarries, such as Hansen Quarry, Eastern Cemex quarry, and/or Granite Sand Quarry at Dimeo dump for raw water storage.	Storage	Winter flows	New surface reservoirs	Potable or nonpotable	No		
WCA-31	McGilvray: (3) Water Capture and Transfers	Capture San Lorenzo winter flow, send to SV, SqCWD or storage	Storage	Winter flows					
WCA-32	SCWD: Zayante Dam and Reservoir	Build a dam on Zayante Creek to create the Zyante Reservoir to store winter flows	Storage	Winter flows	New surface reservoirs	Potable or nonpotable	No	dam, pump station, pipe	
WCA-33	Smallman: Reservoirs	As an alternative to the Zayante Dam, which would harm fish habitat, Smallman proposes to create four additional reservoirs. In some cases this involves building a different dam	Storage	Winter flows	New surface reservoirs	Potable or nonpotable	No		
WCA-34	Smallman: Storm Aquarries	Remodel the existing Zayante Diversion Dam on the San Lorenzo River so that it collects mainly heavy storm water flows, rather than the lower flow, clear water as it does now	Storage	Winter flows	New surface reservoirs	Potable or nonpotable	No	Ranney collectors, pipe, dam, leach fields	
WCA-35	Paul: (1-10,22) Foundation Strategies	Using a top-down, science-based, what does it take, and include the neighbors strategy for reviewing water supply and conservaiton alternatives. Consider water quantities, energy/elevation, costs, lifetimes, and regulatory buy-ins.	Strategies	NA	NA	NA	No	No	

WCA-36	Aqueous: Desalination (non-membrane)	Build desal with a smaller footprint, less power demand, less capital, no pretreatment, no membranes, high raw water intake. The AQUEOUS System (AQ500K) is NOT a membrane based system, but a closed recycling thermal dynamic system using increasing pressure that reaches significant temperatures causing the molecular level separation of gas, liquids and solids via a multiphase process that is extraordinarily efficient.	Supply	Seawater	Aquifer storage if needed	Potable	?	?	
WCA-37	Brown: Zero-emission Wave Energy	Converts ocean wave energy into zero-emission electricity and desalinated water	Supply	Seawater	Aquifer storage if needed	Potable	?	?	
WCA-38	DewPoint: Atmospheric Water Generation	Dew Point's Water harvesting generators continuously simulate the "Dew Point" thus transforms the limitless water vapor in the air and condenses it into safe, clean water	Supply	Moist air	Storage likely not needed.	irrigation (non-potable)	No	Yes	
WCA-39	Garges: Residential Gray-water	Reuse water from showers and bathtubs for sanitation and irrigation	Demand	Decentralized (rainwater, graywater)	NA	Nonpotable	No	No	
WCA-40	Gratz: Recycled Water for Irrigation	use recycled water for irrigation	Supply	Recycled water/groundwater	Storage possibly not needed.	irrigation (non-potable)	Yes	Line maintenance facility, delivery pipeline, extraction wells, return pipeline, storage reservoir	
WCA-41	McGilvray: (1) Recycled Water for Irrigation	Use 30 MG of recycled water per year	Supply	Recycled water	Storage possibly not needed.	irrigation (non-potable)	Yes	Line maintenance facility, delivery pipeline, extraction wells, return pipeline, storage reservoir	
WCA-42	McGilvray: (4,5) Upgrade Water Treatment	Add 2nd pipeline to Loch Lomond. Obtain permission to take water direct from Felton diversion. Use a better settling agent	Supply	Winter flows	Loch Lomond	Potable or nonpotable	Yes		
WCA-43	McGilvray: (6,7) Pipelines Along RR Line	Install on RR right of way Santa Cruz to Watsonville.	Supply	Recycled water	Ag irrigation and/or GW recharge	GW recharge	Yes		
WCA-44	McGilvray: (8) Tertriary Treatment, Re-use	Enlarge tertiary water treatment capacity at Neary Lagoon wastewater treatment plant	Supply	Recycled water	Groundwater	irrigation (non-potable)	Yes	Line maintenance facility, delivery pipeline, extraction wells, return pipeline, storage reservoir	
WCA-45	McKinney: Additional Wells and WTPs	Develop new groundwater resources can diversify the City of Santa Cruz potable water supply. Wells located in the alluvium adjacent to the San Lorenzo River at the Felton Diversion, Coast Pump Station, and Tait Street well field can provide a reduced turbidity supply during periods of high runoff. Wells coupled with satellite water treatment plants in portions of the distribution system where water age affects water quality can increase supply modestly, reduce water waste, and improve quality. Sites for satellite production include the Branciforte service area, Carbonera Tank, Tanner Heights, Harvey West, University service infrastructure, Wilder Ranch, North Coast brackish sources, Lompico Formation on the North Coast, and the North Coast Recirculation Pump Station.	Supply	Groundwater	Groundwater	Potable or nonpotable	Yes	new satellite WTPs	
WCA-46	McKinney: Water Reuse	Repurpose existing infrastructure to effectively deliver Reclaimed Water from the City of Santa Cruz's Wastewater Treatment Facility (SCWWTF) to augment the SLR. Several alternatives, including expanding reclaimed water filtration capactiy at WWTP, building a new tertiary treatment plant off site a Coast Pump Station or Bay Street reservoir, or Build a Tertiary water main up Bay Street to the Bay Street Reservoir and tie into existing coast main or repurpose Scotts Valley WWTP effluent main for reclaimed water supply line.	Supply	Recycled water		Stream augmentation, potable	Yes	Line maintenance facility, delivery pipeline, extraction wells, return pipeline, storage reservoir	
WCA-47	Paul: (11) Multi-purpose Settling Ponds	Make use of our existing diversion facilities at Felton and/or Tait Street by using the multipurpose settling pond to remove turbidity.	Supply	Winter flows	GW recharge, other	GW recharge	No	Settling pond	
WCA-48	Paul: (12) Diversion Alternatives	To capture turbid winter flows, use diversions such as ranney collectors, infiltration galleries, or casing path wells	Supply	Winter flows	Loch Lomond, GW recharge, other		Yes	Possibly	
WCA-49	Paul: (14) Upgrade Water Intertie	Expand existing 6" SCWD/SqCWD intertie now by increasing pipe diameter to 18" for a short distance; get emergency or temporary permit; install a bi-directional variable-speed lowpressure inline pump to control water transfer capacity of at least 2000 AFY; capture an extra 300 to 500 AFY this winter. Re-apply for rights each winter during tide-over	Supply	Winter flows					
WCA-50	Paul: (15) Cross-County Pipeline	Cross-County Pipeline conveys <6000 AFY of raw water to Loch Lomond from some or all streams between the San Lorenzo River just above Boulder Creek and Soquel Creek, inclusive, and possibly Bear Creek and Aptos Creek. It includes diversions from some or all of said streams, and can augment any of the streams when needed for fish habitat. Diversion equipment would inherently filter out turbidity. The Pipeline would store winter water in Loch Lomond, then distribute Loch water throughout the year to the participating aquifer-dependent water districts, who in turn can rest their wells to recharge aquifers very quickly. A new water treatment plant would be built in the vicinity of the Loch or Scotts Valley to serve participating water districts primarily by gravity, possibly generating hydroelectricity in the process	Supply	Winter flows	Loch Lomond, GW recharge, other	Stream augmentation, potable	No	New WTP, pipeline, Ranney Collectors (or other diversions)	
WCA-51	Paul: (16) Water Looping	pumping water from the bottom of the range to the top of the range to significantly enhance the stream flow in that range of the stream for a few weeks out of the year	Supply			Stream augmentation	No	pipeline	
WCA-52	Paul: (17) Detention Tub String	Construct a detention tub string to hold reclaimed water long enough so that it can be treated as potable	Supply	Recycled water	detention tub	Potable			
WCA-53	Paul: (18) Weir Systems	Create a boom in fish populations by raising the water depth by a few inches or feet in crucial segments of streams at times of year crucial for fish. The program would be administered by fish biologists using inexpensive computer-controlled weirs	Supply						
WCA-54	Paul: (19) Stream Relocation	Eco-sensitively re-route a stream to the next canyon, to make an off-stream reservoir out of its original canyon. Uses fish-friendly Ranney collector or infiltration gallery to filter turbidity out of the water being placed in the reservoir, so reservoir will not silt up and its water will be pre-treated, so as to be more pure for dry-season stream augmentation and human use	Supply	Winter flows	New surface reservoirs	Potable	No	Ranney collectors	
WCA-55	Paul: (20) SLR Alluvial Plain Wells	Pump alluvial wellwater from Tait Street to Felton in either a water-looping scheme (See Sec. 16) or in a simple effort to stimulate and support fish migration by increasing the flow from Felton to the sea	Supply	Groundwater		Stream augmentation	No		
WCA-56	Paul: (21) Groundwater Rights Mgt	Promote a regional Groundwater Management/Reclamation District to incentivize conservation among private well owners, and to gain their financial participation in groundwater recharge projects	Supply						

WCA-57	Paul: (23) Loch-Down Alternatives	Divert winter water using equipment which would substantially de-turbidify the water by making it filter down through stream beds. The water would come from streams at elevations comparable to or higher than those of Loch Lomond Reservoir, for the reasons stated in the previous paragraph. A new 8 mgd treatment plant near the Loch would insure that when the diverted water is added to the Loch, it meets excellent quality standards. Throughout the year, the new treatment plant would also treat Loch water on its way down to participating agencies, which would shut off their wells and thus let their aquifers recharge very quickly. The name "Loch-Down" originates from how it features water flowing downhill, generating hydroelectricity--instead of consuming energy required to pump uphill, as is done currently from Felton to the Loch. Larger diversions can be achieved without enlarging the treatment plant, but merely by adding a simple buffer pond and/or some pipeline	Supply	Winter flows			Yes		
WCA-58	Paul: (24) Cowell Railroad Pipeline	Construct a pipeline through Henry Cowell State Park along the existing railroad right-of-way, and install a subsurface diversion device such as a Ranney collector at Felton to filter out turbidity, increase capacity and save energy	Supply	Winter flows			Yes	Pipeline, Ranney collector	
WCA-59	SCDA: Enhance Existing Infrastructure	City conduct an evaluation of the cost, benefit, feasibility and environmental impact of the following: aquifer recharge with potable water, aquifer recharge on North Coast, adding new treatment facility (possibly at Bay St. Reservoir), wells to tap Santa Margarita Aquifer in Live Oak area, relocate the main San Lorenzo River diversion upstream, accelerate the replacement of old pipes in the distribution system	Supply	Winter flows			?	?	
WCA-60	SCDA: Watershed Restoration	City should conduct a cost/benefit analysis of funding stormwater infiltration projects in groundwater recharge zones City convene a joint effort with Scotts Valley Water District and San Lorenzo Valley Water District to contract with the California Conservation Corps to engage in watershed restoration, including restoration of roads; storm water infiltration projects; and partnering with schools and community groups to do restoration	Supply	Stormwater					
WCA-61	Smallman: Conservation Savings Accounts	Set up conservation savings accounts for water customers to increase the incentive for them to install water saving improvements. This account will accrue money from a percentage of the billing. The water agency shall also apply for grants for this program to help build these accounts	Demand						
WCA-62	Smallman: Recycled Water	Build and Advanced Treated Recycled Water Treatment Plant at the corner of Delaware Avenue and Natural Bridges Drive	Supply	Wastewater effluent		potable or nonpotable	Yes	Treatment plant, pipeline, transmission mains, injection wells	
WCA-63	Smallman: Water Skate Parks	This alternative is similar to the "Storm Aquarry Plan", but treats the water immediately to a potable degree, rather storing partially treated water into reservoirs. the potable water would be injected directly into the distribution system, or go to storage facilities replacing water that is normally drafted from the ground water basin	Supply	Stormwater					
WCA-64	Weisz: Water recycling	Treat wastewater effluent to potable drinking standards	Supply	Recycled water		Potable or nonpotable	Yes	Yes	
WCA-65	zNano: Conservation rebate program	Offer a rebate for water efficient technologies and retrofit (WET&R) projects using 3 years of public financing	Demand	Conservation (voluntary)	NA	Potable or nonpotable	No	No	
WCA-66	zNano: On-site Water Re-use	Through rebates, encourage homeowners or businesses to install zNano water treatment appliances to reuse water in the home or business. These appliances help recover waste water	Demand	Decentralized (rainwater, graywater)	NA	nonpotable	No	No	
WCA-67	Tanaka	Convert waste plastic into fuel to provide an energy source for desal							
WCA-68	Program C from the long term conservation master plan	Program C is defined in Table 4 of the MWM TM dated 9/30/2014. It includes a side variety of water conservation/efficiency measures, some mandated, some incentivized through rebates and some using public and customer outreach and/or communication to encouraged changed behavior.	Demand	Conservation (voluntary)	NA	Potable or nonpotable	No	No	
WCA-69	SCWD: Peak season reductions – 10%, 25% and 50%	Develop programs to decrease peak season demands through peak reduction or peak-demand shifting	Demand	Conservation (mandated/voluntary)	NA	Potable or nonpotable	No	No	
WCA-70	Home Water Recycling	Use commercially produced recycling systems in new residential construction and possibly retrofitted into existing residential units. The units would traated gray water to supply treated for toilet flushing and dry season landscape irrigation. Installation could include single family, condo, and multi-family units.	Demand	Decentralized (rainwater, graywater)	NA	Nonpotable	No	No	

Memorandum

To: The Water Supply Advisory Committee

From: Rosemary Menard, Nicholas Dewar, Karen Raucher

Date: 2/4/2015

Subject: Scenario Analysis Process Outline

This memorandum provides the Water Supply Advisory Committee (WSAC) with an overview of the scenario process that we will use in the Real Deal.

Our objective in writing this memorandum is to ensure that we all have a common understanding of the scenario process, including:

- Why scenario analysis is a good analytic tool for the WSAC
- How multi-criteria decision support (MCDS), criteria, and simple scenarios already used by WSAC fit into the next steps of the scenario analysis process
- How to use risk assessments to build scenarios
- How Committee members can use information developed by the Technical Team as they work with scenarios and portfolios.

The definitions in Box 1 and in the working glossary (also in the February materials packet) are provided to ensure that all readers have a shared understanding of the terms we use in this memorandum and this context. Please let Nicholas know if you want to discuss the definitions or how we are using them.

Box 1. Definitions

Decision support tools – Techniques used to help groups reach agreements (e.g., MCDS, Interest Based Bargaining).

Analytic tool – A technique for organizing and sharing information that increases its usability for decision-making (e.g., scenario analysis, triple bottom line, risk assessment, MCDS).

System – The components of the water system, from source to tap (simulated in the Confluence model).

Risk Assessment – Identification of the factors that make a system vulnerable; risk equals probability of an event occurring multiplied by its consequences (e.g., seismic and drought events).

System Plan – The set of management actions selected to meet future needs.

Portfolio – The set of future management actions to be recommended by WSAC as part of the system plan.

1. Background

Scenario analysis is a relatively new tool in the water utility planning toolkit. Water agencies are increasingly turning to scenario analysis as a means of identifying how well their water system plan can handle a variety of potential futures. Scenario planning

explicitly asks the question, "If my future looks like x, then what plan do I need to have in place to ensure my system provides adequate, reliable supplies of water for the best value with the smallest set of unwanted side effects?"

In the past, water utilities planned for one future. This worked well in a world where demand changes were linear; climate was expected to operate within bounds seen within recorded history; and technological, regulatory, and other potentially significant influences on water systems were sufficiently handled with the phrase, "all else considered equal."

Today, estimating demand is increasingly complex and no longer has a direct linear relationship to changes in population. At the same time, climate variability and climate change require agencies to plan for events that may occur outside of historical temperature and precipitation records. To make planning for the future even more difficult, it is largely unknown how future regulatory requirements, economic issues, and technological changes will influence community water systems. These large uncertainties and unknowns create significant planning challenges for water agencies that often, as part of their planning process, need to make expensive, long-term, and often irreversible decisions about investments in the community's infrastructure and water resource portfolio. Accordingly, water agencies now need to develop plans that meet the needs of more than one potential future, but they often struggle with how to do this. It is important for the WSAC to understand that most water agencies around the world are grappling with challenges that are similar to those facing the WSAC.

Scenario analysis is an analytic tool used to support the decision-making process by illuminating the kinds of events that may cause the system plan to fail. Decision-makers use the information developed as part of scenario analysis to identify the range of plausible future events, understand risks to the community, and evaluate the management actions that will ensure that the system performs as needed if these events occur in the future.

2. Overview of Next Steps in Scenario Development

Scenario analysis involves a number of discreet steps. It begins by identifying the set of community values that represent important community planning objectives. WSAC tackled this step by developing criteria that represent community interests as part of MCDS and scenario work in Recon. Insights from the *Attitudinal* survey and other city reports can also be used to ensure that the WSAC decisions reflect the full range of community values and interests.

The next step is to identify the set of external risks to the system that WSAC also needs to consider as it develops Portfolios. Finally, individual risks and community interests are combined to develop multi-variable scenarios.

A summary of the scenario process steps that will occur in the Real Deal are outlined in the following list and then described in more detail in the next sections. Scenario process steps include:

1. ***Identifying future risks to the system by developing single-variable scenarios***. Single-variable scenarios are used to identify the severity, frequency, and consequences of external, uncontrollable future events that the Portfolio needs to handle.

2. ***Developing multi-variable scenarios***. The future will likely present more than one event that presents challenges. The WSAC will bundle single-variable scenarios to develop a set of risks that it wants to ensure the community water system can handle. As part of developing multi-variable scenarios, the WSAC may also want to add future community interests that have the potential to affect water supply planning.

3. ***Building draft Portfolios (i.e., plans)***. WSAC will combine individual Alts into Portfolios designed to meet the future needs expressed in each multi-variable scenarios.

4. ***Analyzing how well each Portfolio performs***. The Technical Team will analyze each Portfolio with the objective of providing WSAC with an evaluation of how well the Portfolios perform in regards to meeting: (1) community needs for insurance against external events, and (2) community interests as expressed in MCDS. As part of the analytic findings, the Technical Team will provide information that informs MCDS criteria and scales, as well as risk reduction.

5. ***Iterate Steps 2 through 4***. Based on the findings from Step 4, the WSAC can decide if and how it wants to modify the scenarios (e.g., combining them) and the Portfolios. Iteration allows the WSAC to improve measures of community interest (criteria and scales); understand the severity, frequency, and consequences of risks; improve Portfolio performance; and reduce Portfolio side effects.

Step 1: Identifying future risks to the system by developing single-variable scenarios

Typically, once community interests are identified and a simple scenario exercise has been run (as WSAC did in Recon), the next step is to develop single-variable, risk-based scenarios. A single-variable scenario explicitly asks, "What happens if we change one planning variable and hold all else constant?" Single-variable scenarios provide an elegant frame for identifying how the water system responds to uncontrollable external events (e.g., long-term droughts, earthquakes). It is important to note that single-variable scenarios are designed to examine external threats to a system. This is done to support a decision-maker's need to ensure their plan operates successfully regardless of future conditions, so that he or she understands what kinds of events a plan needs to be resilient against. Risk management is a form of insurance against future uncontrollable, external events.

The first step in developing single-variable scenarios is risk identification. The WSAC needs to identify the events that create risks to the system and that may have large, and perhaps unpredictable, future consequences on the system's reliability (i.e., its ability to provide water when needed, and in the amounts needed). For example, the Santa Cruz Water Department (SCWD) system, which is largely supplied by winter rains that are stored for summer use, is vulnerable to regulatory requirements that decrease the availability of stored water for summer use or to climate changes that decrease the reliability of winter rains. An analysis of plausible single-variable futures allows decision-makers to identify and focus on the risk factors that drive planning requirements.

The objective of developing single-variable scenarios is to identify the set of uncontrollable, external events that can cause the system to not perform as desired (e.g., supply water at the level needed). Identifying individual risks allows planners to understand the specific alternatives that, when combined in a portfolio, are necessary and sufficient to reduce risks.

Typically, single-variable scenarios are developed using a risk-assessment tool. Risk assessments are also sometimes referred to as a vulnerability analysis. The Technical Team will share a simplified risk assessment of the SCWD with the WSAC at the February meeting.

Risk assessment

A risk assessment identifies the probability and consequence of an event occurring. The information from a risk assessment is often presented in a risk matrix. An example of a single-variable risk matrix is provided in Figure 1. It shows that the starred event, perhaps an eight-year drought, has a probability x of occurring and will result in a y level of consequences.

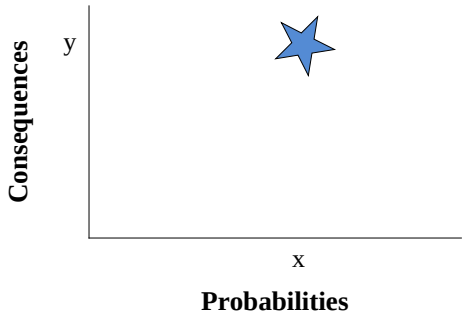


Figure 1. Risk profile matrix.

However, the likelihood of many future events is impossible to predict, making the use of probabilities difficult. Instead of using one specific probability in their risk assessment, many agencies are now developing plausible ranges that an event will occur. A plausible range means that the likelihood of an event occurring is equally likely for any quasi probability in this range. For example, we understand the climate is changing and that future drought events are likely to be more frequent and severe, but we don't know exactly how likely – how probable – their occurrence will be. So instead of selecting one probability and planning for that event, the lowest plausible probability and the highest plausible probability are selected and everything in this range is considered equally likely to occur. This is referred to as the "plausible range" of quasi probabilities that an event will occur.

Planning groups use risk assessments and risk matrices as they identify and build plans that will perform well (i.e., meet the community's needs) under future conditions. Plans can be developed that either reduce the probability that an event will occur or mitigate the consequences to the system if the event does occur.

The technical team is working closely with SCWD to develop a simple risk assessment of the SCWD system as the next step in scenario development.

At the February meeting, the Technical Team will provide WSAC with a simplified Risk Assessment that presents the plausible range and level of consequence for the following events:

- Droughts
- Seismic events
- Regulatory requirements (including fish flows)
- Economic events
- Sea level rise
- Wildfire in the watershed.

The WSAC needs to inform the Technical Team if there are other uncontrollable external events it would like to see examined as part of the risk assessment.

Step 2: Developing multi-variable scenarios

Once WSAC has reviewed the risk assessment findings in the February meeting, it can determine which single-variable scenarios – which building blocks – it wants to either examine in more detail or combine to create multi-variable scenarios that represent sets of future risks. As suggested above, this is done iteratively to allow the WSAC to see what happens to system risks and needs under a range of plausible futures. The WSAC will have the opportunity, during the February meeting, to identify two or three single- or multi-variable scenarios that it would like to see the Technical Team explore in more detail for the March meeting.

Step 3: Building draft Portfolios (i.e., plans)

Once WSAC has developed a first set of single- and multi-variable scenarios, it will begin the process of identifying Portfolios that meet the community's water needs and other criteria under a range of plausible futures. Developing Portfolios that meet future needs as represented by the scenarios is also done iteratively to allow the WSAC to identify how well different sets of Alts work together to reduce risks and meet community interests under a range of plausible futures. This process will begin in earnest in March.

Step 4: Analyzing how well each Portfolio performs

The Technical Team will take the Portfolios developed by the WSAC and analyze them to illuminate their ability to meet future needs, reduce risks, and meet interests as articulated in each scenario. Information provided by the Technical Team will include:

- Analysis of the consequences to the system of the combined risks in the multi-variable scenario (combining risks is not a linear process)
- Analytic insights into how well the Portfolio reduces the risks and satisfies other interests, as expressed in the criteria.

Step 5: Iterate Steps 2 through 4

When planning under large future uncertainty, it is important to identify the future events and community needs that drive plan performance. For example, if SCWD needs to plan for large drought events, and planning for large drought events meets all other risk- and interest-based needs, then it is not necessary to focus on any other risks and interests when developing a plan: the water manager has identified the scenario that needs to be planned for. However, it is unlikely that a Portfolio designed to meet a single future event will also meet all other identified risks and interests. Iterating the combination of external events and community needs, and the Portfolios needed to meet each plausible future, allows WSAC to identifying the drivers – the events that override other planning needs.

3. Conclusion

This memorandum provides a great deal of technical information. We look forward to clarifying this information in February and working with the Committee to ensure the scenario analysis process meets your decision-making needs.

Memorandum

To: Santa Cruz Water Supply Advisory Committee (WSAC)

From: Karen Raucher and Bob Raucher, Stratus Consulting Inc.

Date: 2/6/2015

Subject: An Overview of Risk Management

In considering plausible future scenarios and possible additions and modifications to the current Santa Cruz system's water supply portfolio – it is important to recognize and consider the risks to which the water system is exposed. To help provide context and background for considering these risks, this technical memorandum offers a brief overview of risk management and related terms and concepts. We then offer an overview of our three-step framework for risk management and how we will apply that framework to the ongoing risk-identification exercise for WSAC.

The term "risk management" has been defined and deployed in many settings. We adopt the general convention that originates with the National Research Council (NRC, 1983), which makes a useful distinction between risk assessment and risk management. Specifically NRC distinguishes between *risk assessment* – the science of identifying and attempting to estimate the size of a risk, and *risk management* – the decision-making steps required to merge risk assessment with other information (such as economic, policy, and other considerations) to develop and implement a response for reducing the risk.

Risk management also has been more broadly defined as "the identification, assessment, and prioritization of risks followed by coordinated and economical application of resources to minimize, monitor, and control the probability or impact of unfortunate events or to maximize the realization of opportunities" (Brown and Carriquiry, 2007). This definition essentially combines the risk assessment and risk management components of the NRC approach into a single suite of activities.

To help the WSAC forge a useful approach to risk management, we define the risk-management framework as consisting of the following three steps, and will structure our approach accordingly:

1. ***Risk identification:*** the process of recognizing and understanding where and to what the system is vulnerable, i.e., identifying factors that make the system vulnerable.

2. ***Risk assessment:*** using empirical estimation, ranking, or other means to characterize the level of risk posed to a system. The level of risk is defined as the probability of an event occurring, multiplied by its consequences.

3. ***Risk management:*** identifying, evaluating, selecting, and implementing strategies to increase resiliency and retain or add flexibility (i.e., to reduce the consequences or

probability of an adverse effect). Risk management strategies may include adaptive management and "no-regrets" or "low-regrets" alternatives to reduce the probability or consequences associated with a potential adverse event. An example of a risk-management strategy would be a water department adding a specific supply-side alternative to the water-supply portfolio to increase the diversity of water sources and reduce the adverse effects of frequent drought on water supply; another example would be adding seismic protections to a critical pipeline to reduce the probability of failure in the event of an earthquake.

The three-step framework helps delineate the risk-management challenges facing the Santa Cruz Water Department (SCWD) and the greater community it serves.

1. Risk identification

The SCWD has identified the following risks to system performance:

- Droughts
- Seismic events
- Regulatory requirements, including habitat conservation plan (HCP)-driven fish-flows
- Economic events
- Sea level rise
- Wildfire in the watershed.

WSAC needs to inform the Technical Team if there are other, uncontrollable external events they would like us to examine as part of the risk identification exercise for SCWD.

It is important to note that we do not intend to develop a formal risk assessment or risk-management strategy as part of WSAC activities. Rather, our intent is to help identify important risks so that WSAC can consider them as they work on defining plausible future scenarios and considering how potential future portfolios might perform.

2. Risk assessment

The risk assessment process allows you to characterize and prioritize risks; and help determine where you may need to gather more information in order to assess, prioritize, and manage a risk. Risk assessments may be conveyed using a risk profile matrix (see Figure 1), where the X axis identifies the probability that the identified risk will occur, while the Y axis captures the consequence to the system if that event does occur.

Figure 1 provides an example of a risk profile matrix. In this fairly detailed example, the risks are organized by internal functional area (e.g., operations, information technology) and external "events" (e.g., terrorism, natural disasters).

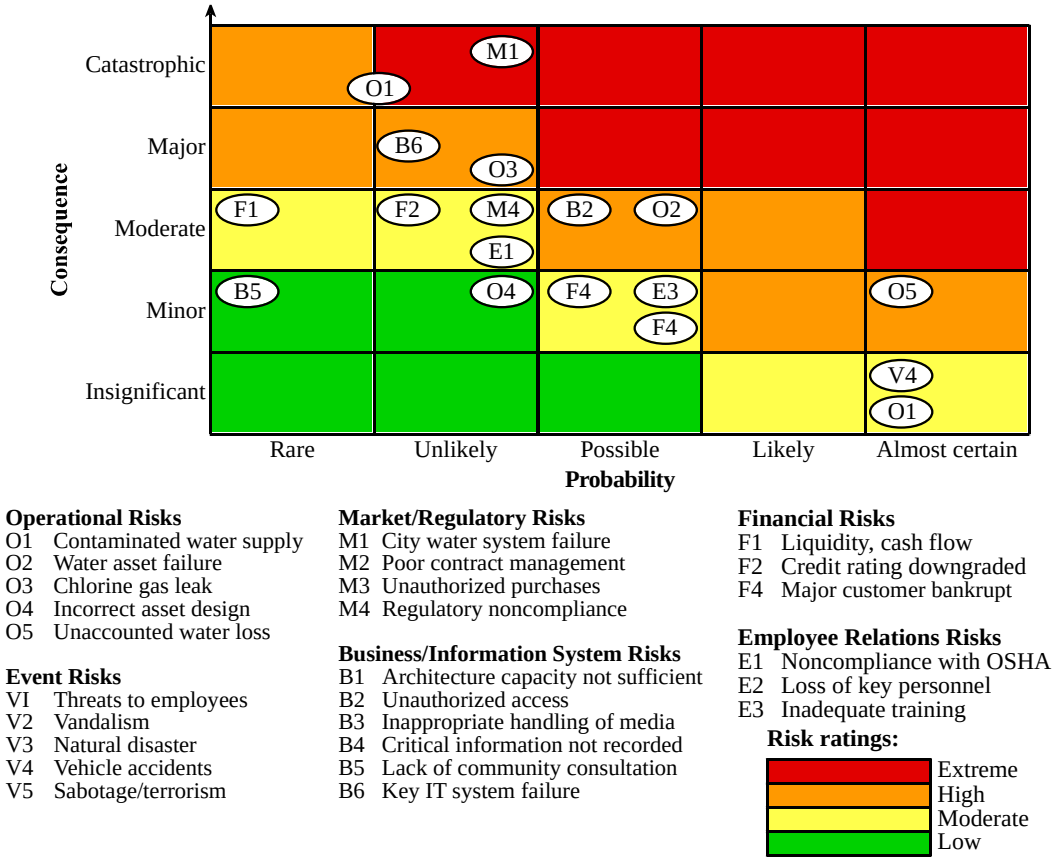


Figure 1. Utility risk profile: Characterizing and ranking various utility risks.

As this figure demonstrates, a risk-profile matrix is useful in several ways. It is a visual aid for understanding how the numerous risks that a utility faces may vary along the probability and consequence dimensions. It also enables and encourages utility managers and invited stakeholders to determine which cells reflect extreme-, high-, or low-risk rankings. Risk profiling in this manner encourages utilities to consider a broad range of risks. It also allows practical judgment to enter the process because it is not simply a formula: managers need to actively consider what each category of probability or consequence means. A risk-profile matrix also helps utilities consider how any one specific type of risk, such as climate change-related risks, relate to other important risks that the utility faces.

3. Risk management

The WSAC will need consider how their choice of alternatives in building on SCWD's existing portfolio may help manage the risks associated with the challenges the system faces now and into the future. The Technical Team will support WSAC risk-management

choices by assessing how a set of proposed alternatives might reduce either the probability that an identified risk will occur, or reduce the consequences of the event if it does occur.

Conclusion

The WSAC will have the opportunity to ask more questions about the risk identification and risk assessment process during the February 2015 meeting. The Technical Team will also bring a short presentation about each risk to the meeting. WSAC members can use risk-assessment information to identify the risks they want to know more about, the risks they want to manage as part of scenario development, and how the alternatives can be used to help manage risks.

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DATE: **February 4, 2015**

TO: **WSAC**

FROM: **Planning Subcommittee**

SUBJECT: **Proposed approach for improving and agreeing upon Evaluation Criteria**

This memo describes the process that the Planning Subcommittee proposes to follow in order to finalize the Committee's evaluation criteria.

Background

By the end of the WSAC meeting in December, the Committee had spent some focused time discussing issues related to the evaluation criteria, subcriteria, and rating scales used in the MCDS model runs. (For the purpose of this discussion, criteria and subcriteria are all going to be referred to as criteria.) In particular, those discussions focused on creating common (and agreed upon) definitions of criteria, better, clearer, more understandable and agreed upon scales, and the organizational structure of those criteria.

After reviewing the notes from December's meeting, it's clear that the lively discussion that the Committee had on the topics of criteria and rating scales, is not, for the most part, completely captured in a usable set of criteria or scales, so there is much work to be done to prepare for our Decision Phase discussions.

The following table summarizes the state of the various criteria and scales.

		Criterion Definition		Scale Definition		
Criteria and sub-criteria	Needed? (Y / N / Portfolio Attribute / Solution Attribute)	Complete?	Tech input needed?	Complete?	Tech input needed?	Notes
Implementability						
Technical feasibility	Y	Y	N	N	N	
Legal feasibility	Y	N	N	N	N	
Regulatory feasibility	Y	N	N	N	N	
Political feasibility	Y	N	N	N	N	
Cost-Effectiveness						
Cost to City: Upfront Costs	Portfolio Attribute	N	?	N	?	
Cost to Customer: Rates	Portfolio Attribute	N	?	N	?	
Cost to Customer: Individual Purchase	Solution Attribute	N	?	N	?	
Community well being						
Regional Water Stability	?	N	N	N	N	Is this part of the Committee's remit?
Local Economy	?	N	?	N	?	Tech input needs depend upon criterion definition
Environmental well being						
Energy	?	N	Y	N	Y	How to separate from energy-related opex?
Marine Ecosystem Health	Y	N	?	N	?	
Freshwater and Riparian Health	Y	N	?	N	?	
Groundwater Resources	Y	N	?	N	?	
Terrestrial Ecosystem Health	Y	N	?	N	?	
Adaptability						
Infrastructure Resilience	Y	N	Y	N	Y	
Reliability	Y	N	Y	N	Y	
Scalability	Y	N	Y	N	Y	
Preserves Future Choices	Y	N	N	N	N	
Effectiveness						
Yield	Portfolio Attribute	Y	N	Y	N	
Flexibility	Y	Y	N	Y	N	Perhaps rename "Operational Flexibilty"
Addresses Peak Season Demand	Portfolio Attribute	Y	N	Y	N	

As you can see, the various criteria and ratings differ in their completeness as well as with respect to who has primary responsibility for finalizing them:

- Some need work on both criterion and scale definition
- Some need work only on scale definition
- Some of those criteria and scales fall to the Committee (such as "political feasibility"); others require input from the technical team (such as "resilience" and "reliability")
- Some may not even amount to "ratable" criteria, but rather are either solution or portfolio attributes (such as "yield")

Proposal

The Planning Subcommittee proposes that the Committee follow a multi-step process to create a finalized and agreed-upon set of evaluation criteria and scales. The Subcommittee proposes that the Committee's technical team play a substantial role in that process.

Here is a summary of the process we propose:

1. Technical staff and team would create a "baseline" set of criteria and scales, based on the work that the Committee has done to-date and the technical team's guidance (where appropriate).
    - Would incorporate Committee's input to-date: MCDS "notes", December's discussions, etc.
    - May mean eliminating or combining some criteria
    - May mean adding some new ones (such as "adequately addresses supply/demand gap" or "mitigates operational risk")
2. The Planning Subcommittee would then review / refine baseline; technical team would issue revised baseline.
3. Full Committee would then review / refine baseline; technical team would issue revised baseline, which becomes our "working baseline" going forward.
    - This will likely require substantial discussion at one or more Committee meetings.
4. Finalization would take place over time, as the Committee's work progresses. We would expect that there will be tuning throughout the Decision Phase.

Some key considerations:

1. This will be an iterative process through the Decision Phase; as we've seen, use of the criteria to evaluate solutions helps the Committee understand and fine-tune the criteria and scales.
2. We need a consistent, documented process and a single party who is responsible for tracking the process. That responsibility will fall to the technical team, reporting to the Planning Subcommittee and the full Committee.
3. Note that we need to get this finalized timely so that Philip can update the MCDS for use during the Decision Phase.

Draft Agenda for WSAC Meeting on Marcy 18/20
Agenda Item 20a

Time	***Wednesday, March 18 – 5 pm to 9:30 pm***	***Packet Items***
10 min	• *Welcome and Public Comment*	
10 min	• *Committee Member Updates*	
10 min	• *Agenda Review*	*Flow Agenda, Brown Act Agenda*
45 min	*Consolidated Alternatives*	• *Consolidated Alternatives with technical summary sheets for each alt*
45 min	*Evaluation Criteria*	• *Revised Evaluation Criteria definitions, and rating scales*
10 min	• *Break*	
20 min	• *Scenario Planning Exercise Set Up*	• *Scenario Planning Materials*
2 hours	• *Scenario Planning Exercise in small groups – runs through end of meeting with report out on Friday*	
	Friday, March 20, – 2 pm to 6 pm	
30 min	• *Scenario Planning Exercise Report Outs (assumes 4 groups with specific areas of report outs for each group – as provided in the exercise set up discussion)*	
90 minutes	• *Facilitated Town Hall type open discussion on Scenario Planning Exercise between Committee members, between public and Committee members, between Committee members and technical team*	
10 min	• *Break*	
30 min	• *Committee discussion about next steps (e.g. MCDS and other analyses to come back in the next meeting (4-30/5-1)*	
5 min	• *Correspondence received from Community*	
30 min	• *Subcommittee reports* o *Outreach Subcommittee* o *Planning Subcommittee*	
5 min	• *Action on February action agenda and meeting summary*	• *February Action Agenda and Meeting Summary*
5 min	• *Draft Agenda for 4/30-5/1 WSAC meeting*	• *Draft 4/30-5/1 WSAC Agenda*
10 min	• *Oral Communication*	
5 min	• *Wrap up and Adjourn*	

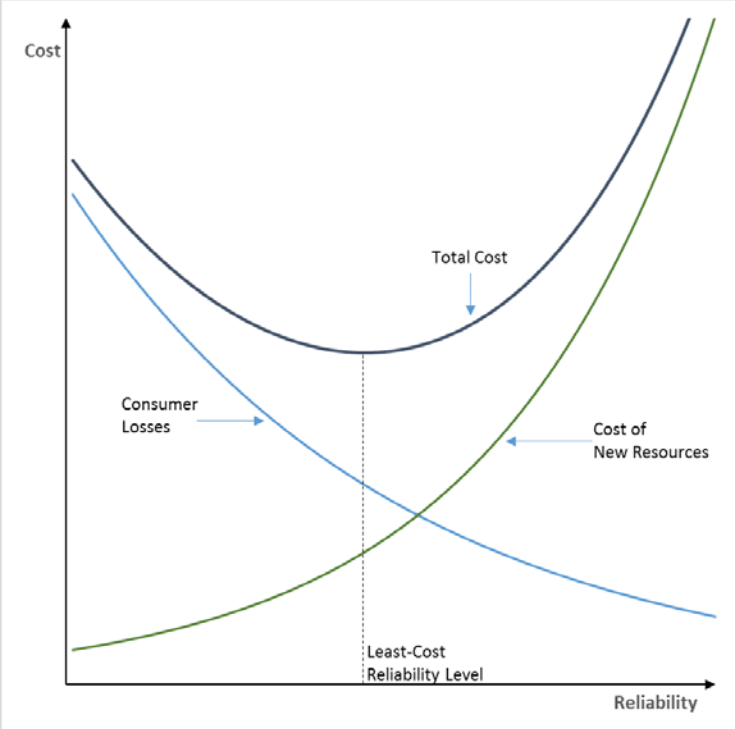
Consumer Costs of Water Shortage: Overview and Empirical Evidence

David Mitchell
February 11, 2015

A key question in water utility planning is how much supply is enough? In most developed countries, water utility customers have come to expect that water will be available when, where, and in the quantity they want it. This "on-demand" service model requires that utilities size their water systems so they can meet maximum hour, day, and season demands without risk of running short. Where supply is variable, meeting demands reliably can impose significant costs on water systems and their customers if doing so requires building in supply redundancy. In such cases it is prudent to ask the question: is it worth it?

The answer depends in part on what costs consumers incur if their water demands are not met. That is, if during some periods, they must forgo consuming as much as they would like. Much of California is currently in such a situation, where water users have been asked, and in some cases mandated, to curb their consumption in order to balance available supplies with demand. It is clear consumers are made worse off when their consumption is restricted in this way. Had their use not been restricted, they would have freely chosen to purchase the restricted units of water at the prevailing water rate, so the water they had to give up is worth at least that much to them. And for most consumers it will be worth much more than that. Thus when reliability declines and the frequency or magnitude of shortages increases, consumer costs of forgone consumption go up. Conversely, when reliability improves and the frequency or magnitude of shortages decreases, consumer costs of forgone consumption go down. Note that consumer costs move in the opposite direction as system costs with changes in reliability. Increasing reliability raises system costs and lowers consumer costs and vice versa.

Figure 1. Total Cost of Water Supply Reliability

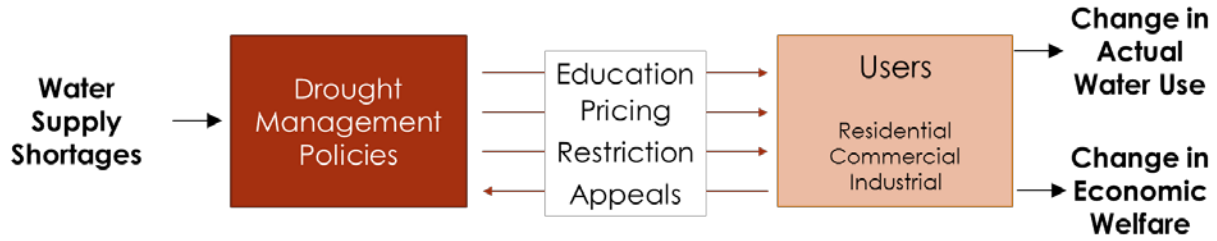


The forgoing means that reliability planning involves balancing consumer losses from shortages against system costs incurred to avoid such shortages. This is shown in Figure 1, which illustrates that beyond some point more reliability stops being worth it to consumers. That point is where the two lower lines in the figure cross. To the right of that point the cost of adding new resources to the system exceeds the consumer loss those new resources would mitigate. In other words, new resources beyond that point would not be worth it to consumers if their only purpose was to mitigate shortage losses.

For any given level of reliability, the total cost to the community is the consumer losses from shortages at that reliability level plus the resource cost incurred to provide that level of reliability. This is the u-shaped curve in Figure 1 labeled Total Cost. From a least-cost perspective, the reliability sweet spot occurs at the bottom of the u. At that level of reliability, total consumer cost is minimized. It is important to emphasize that resource cost is meant to be viewed broadly to include the full spectrum of socio-economic costs associated with adding new system resources, not simply the direct financial cost of a project.

A useful framework for translating water supply shortages into consumer losses is illustrated in Figure 2. As noted by Dixon, et al (1996), "the size of the water supply cutbacks, the drought management strategies adopted by water agencies, and customer response to these policies together determine the effect of water supply shortages on consumer welfare."

Figure 2. Translating Water Supply Shortages into Consumer Losses



For residential water users, typical shortage-induced changes in economic welfare include:

- Constraints on behavior – such as shorter showers or restrictions on when or how water can be used.
- Quality of life impacts – such as desiccated landscapes, impaired parks and play fields, and dirty cars, windows, and hardscapes.
- Increased water costs due to drought rates or penalties.
- Increased household expenses for installing conservation fixtures or replacing destroyed landscaping.

For commercial and industrial water users, typical shortage-induced impacts include:

- Reduced profits due to restrictions on output, increases in production costs, or reductions in product or service demand.
- Reduced labor income and employment.
- Loss of customer goodwill and market share.

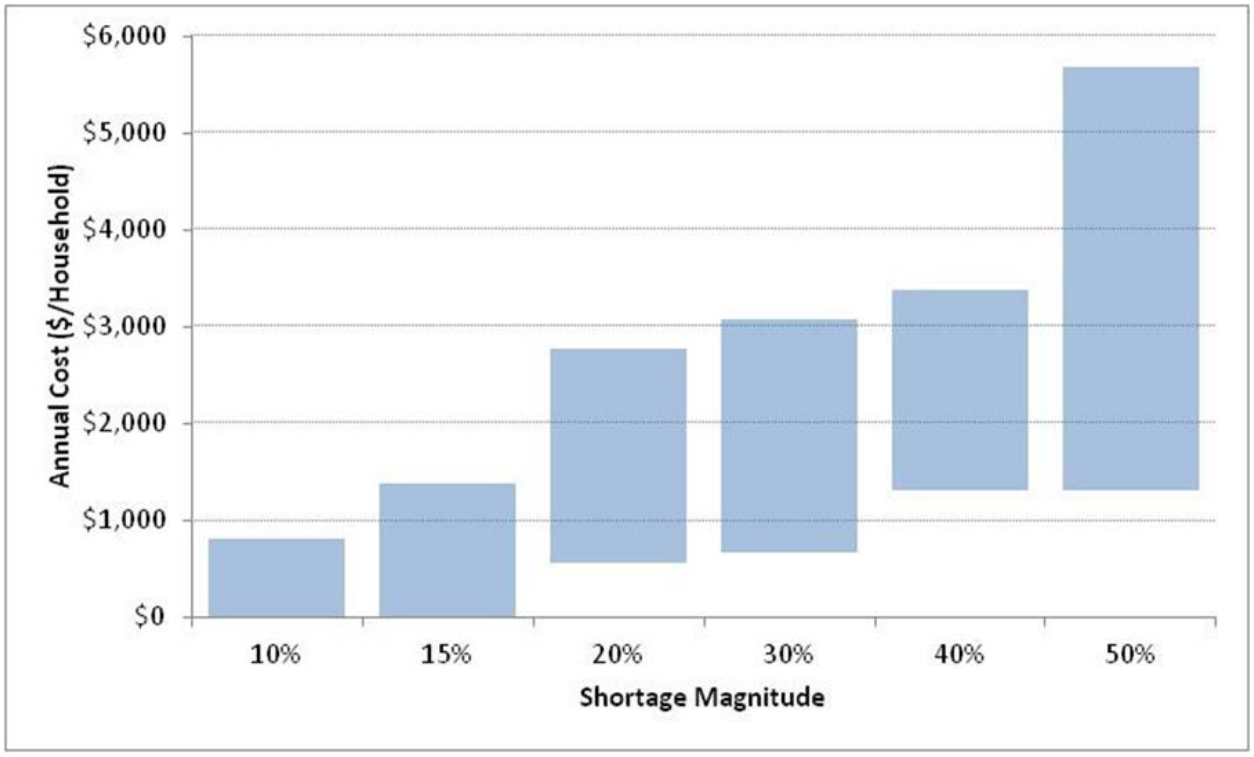
Measuring these impacts is an important though challenging empirical exercise that we do not delve into here. Rather, for the remainder of this brief, we provide an overview of some of the findings from the published empirical literature on economic costs of water shortages.

Residential Cost of Water Shortage

One measure of change in economic welfare that is widely used in the economics literature is willingness-to-pay (WTP). In the context of residential water shortages, WTP is defined as the maximum dollar amount households would be willing to pay to avoid the drought management strategies adopted

by their water agencies. The ranges in WTP reported in four empirical studies of residential WTP to avoid water shortages lasting one-year are illustrated in Figure 3. Note that for low magnitude shortages (<= 15%), the low end of the range is zero, indicating that households may not find low magnitude shortages terribly disruptive and thus would be willing to pay little or nothing to avoid them. WTP increases with shortage magnitude, possibly in a non-linear fashion. The very large range in WTP for a 50% shortage reflects the rarity of such events and corresponding uncertainty in WTP to avoid them.

Figure 3. Residential WTP to Avoid Water Shortage Lasting One-Year



RAND examined residential impacts of water shortages resulting from California's 1987-92 drought. It found the largest impacts were in the residential sector. Drought policies mostly shielded commercial and industrial users – though some sectors, such as the green industry were significantly impacted. Based on residential demand models estimated for a water agency in the east bay, residential impacts due to restrictions during the summer of 1991 were in the range of $40 to $60 million (2012 dollars) for the Bay Area as a whole.

Commercial and Industrial Water Shortage Impacts

The green industry is comprised of nurseries, landscape installers, and landscape service providers. It is at risk of both reductions in consumer demand and changes in input costs during water shortages and therefore is one of the more vulnerable business sectors to water shortages. A study by Foster and Associates (1994) estimated that statewide 4,500 green industry jobs and $129 million in wages and salaries (2012 dollars) were directly lost due to water shortages in 1991. The 1991 recession was a confounding factor, and the study estimated it directly accounted for the loss of an additional 4,000 green industry jobs and $100 million in wages and salaries. A further 13,500 jobs and $382 million in

wages and salaries were lost through a combination of causes. In total, the study concluded water shortages were the primary cause of 18% of total green industry job loss and 21% of total output loss.

A 2007 study by the Bay Area Economic Forum on economic impacts of water shortages in the Bay Area reported the ranges of employment impacts that would result from a one-year shortage shown in Table 1. Note the very limited impact associated with low magnitude shortages, particularly for commercial customers. However, for a 30% shortage potential impacts rise sharply.

Table 1. Bay Area Economic Forum Water Shortage Employment Impact Estimates

Shortage Magnitude	Payroll Losses (%)	
	Industrial	Commercial
10%	0.8-1.1	0.1
20%	1.6-2.0	0.2
30%	4.9-6.8	3.0-6.0

Macro-Economic Impacts

Water shortage impacts do not occur in isolation from the rest of the economy. Impacts ripple throughout and, for large enough shortages, can be detected in macro-economic indicators. Australia's 10-year drought, which Australians refer to as the "Big Dry" is a case in point. At a macro-level, the following range of impacts were reported in the literature:

- Australia's agricultural exports were decimated by the drought. Rice exports were especially hard hit, falling by 90%.
- In agricultural regions, household consumption fell by 5-11%, gross regional product by up to 11%, and employment by up to 21%.
- In 2002-03, nationwide the drought shaved 1.6% off GDP growth, 0.8% off employment growth, and 0.9% off wage growth. Exports fell by 5%. 40% of the reduction in GDP growth was associated with non-agricultural industries.
- Wholesale electricity costs doubled in 2007 due to loss of hydropower.
- The Australian government provided more than $4.4 billion (U.S. dollars) in drought economic assistance to distressed communities and businesses.

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Risk Fact Sheet: Economy

Risk Description

The primary risk to the Santa Cruz economy from water is the possibility that the Water Department will not be able to reliably provide sufficient water to meet business demands. Curtailments are used to allocate limited supplies in Santa Cruz when water supplies are insufficient to meet total demands.

The critical question is, ***"How much water is needed to ensure curtailments do not adversely impact the local economy, if curtailments are frequent, severe, and/or extend over long periods (multiple years)?"***

Available Information

The adverse impact (i.e., risk) to local economies (as well as on the well-being of residential customers) depends on their severity, duration, and frequency of curtailments. Empirical evidence indicates that the adverse economic impact increases dramatically (nonlinearly) as the level of curtailment increases. For example, short-term, moderate water use restrictions that curtail demands by 10% to 15% may be endured as a temporary and relatively minor inconvenience. But as curtailments increase in severity (e.g., to levels of 20% or more), or extend over multiple years, then the adverse impact on households, businesses, and local economies becomes far more pronounced.

Studies of drought impacts for East Bay Municipal Utilities District (EBMUD) provide a glimpse into how economic impacts may be associated with water supply shortfalls. As illustrated in Figure 1 for EBMUD, the economic losses associated with either a 10% and 15% reductions in water supplies are significantly less than the losses associated with a 25% shortage, particularly for commercial entities. Total economic losses for EBMUD are projected to be nearly 4 times greater at a 25% shortage level than for a 15% shortfall. Other studies examining the economic losses for business entities associated with water shortages confirm that the relationship between shortage and economic losses is not linear; rather there is a threshold above which businesses begin to suffer significant losses that may even threaten their viability.

Round table discussions with members of the Santa Cruz business sector indicate that they experience moderate economic losses due to low-level or short duration curtailments, but that there is a threshold, close to what they experienced in 2014, where the losses will probably become more substantial.

Risk Metric

Frequency, duration and severity of curtailment.

Risk Management Options

Risks can be managed by either reducing the probability that an event will occur OR by reducing the consequences of the event if it does occur.

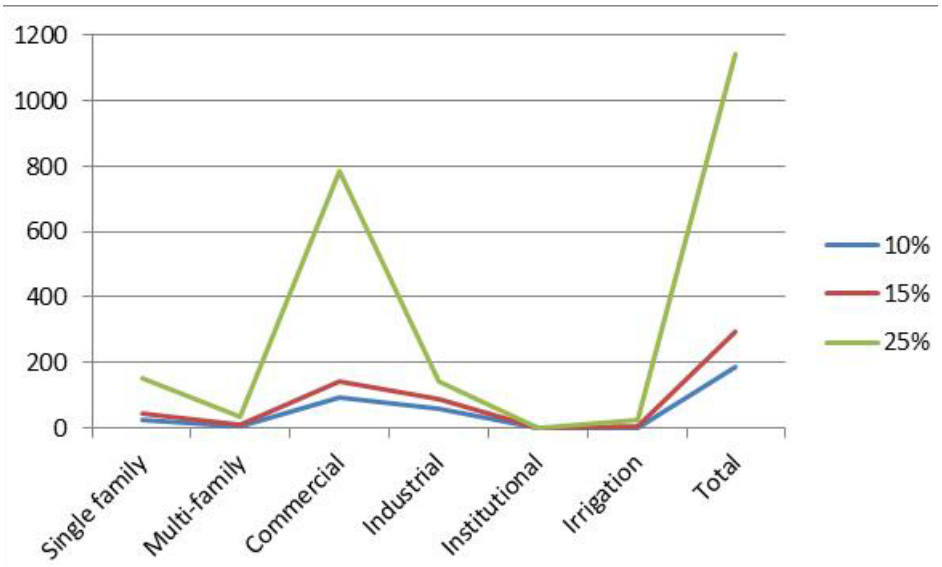

Figure 1. Customer Class Water Shortages and Water Shortage Costs for EBMUD (2040 level of development). Millions of dollars in impact, for shortages of 10%, 15% and 25%. Water shortage cost = consumer surplus losses for residential, institutional, and irrigation customer classes plus regional value added losses for CI customer classes. Regional value added losses equal the sum of losses to labor income, proprietor income, profits and property income, and indirect business taxes.

Source: M.Cubed, 2008.

Probability

Management options for reducing the probability that curtailments will reach a frequency, severity or duration that approaches or exceeds the threshold for economic losses:

- Increase the reliability of water supply
  - Decrease demands[1]
  - Increase water efficiencies
  - Increase supplies from current sources
  - Add new sources
  - Increase current storage
  - Add new storage.

1. Note – Curtailments may be viewed by some people as a form of demand management: when supplies are low, demand is managed - decreased – through mandatory curtailments. This means that as you decrease demands, through demand management, under normal conditions, you decrease the amount of demand that is available to curtail during events that stress the system, for example during droughts.

Consequence

Management options for reducing the consequences of curtailments so that when they do occur businesses do not meet or exceed their economic loss thresholds. These include:

- Targeting curtailments on those entities that are most resilient to reduced water availability,
- Removing curtailments from commercial entities that are at their loss thresholds
- Providing tax or other fiscal benefits to entities struggling under curtailments, and/or
- Discouraging businesses from locating in the City if they cannot manage water supply limits.

Reference

M.Cubed, 2008

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Risk Management Options

Risks can be managed by either reducing the probability that an event will occur OR by reducing the consequences of the event if it does occur.

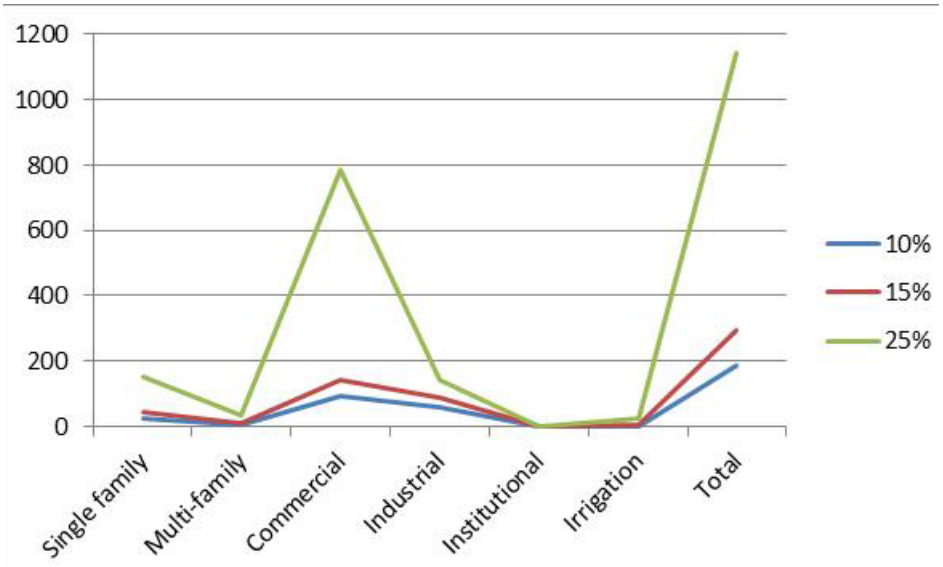


Figure 1. Customer Class Water Shortages and Water Shortage Costs for EBMUD (2040 level of development). Millions of dollars in impact, for shortages of 10%, 15% and 25%. Water shortage cost = consumer surplus losses for residential, institutional, and irrigation customer classes plus regional value added losses for CI customer classes. Regional value added losses equal the sum of losses to labor income, proprietor income, profits and property income, and indirect business taxes.

Source: M.Cubed, 2008.

Probability

Management options for reducing the probability that curtailments will reach a frequency, severity or duration that approaches or exceeds the threshold for economic losses:

- Increase the reliability of water supply
  - Decrease demands[1]
  - Increase water efficiencies
  - Increase supplies from current sources
  - Add new sources
  - Increase current storage
  - Add new storage.

1. Note – Curtailments may be viewed by some people as a form of demand management: when supplies are low, demand is managed - decreased – through mandatory curtailments. This means that as you decrease demands, through demand management, under normal conditions, you decrease the amount of demand that is available to curtail during events that stress the system, for example during droughts.

Consequence

Management options for reducing the consequences of curtailments so that when they do occur businesses do not meet or exceed their economic loss thresholds. These include:

- Targeting curtailments on those entities that are most resilient to reduced water availability,
- Removing curtailments from commercial entities that are at their loss thresholds
- Providing tax or other fiscal benefits to entities struggling under curtailments, and/or
- Discouraging businesses from locating in the City if they cannot manage water supply limits.

Reference

M.Cubed, 2008

Risk Fact Sheet: Drought

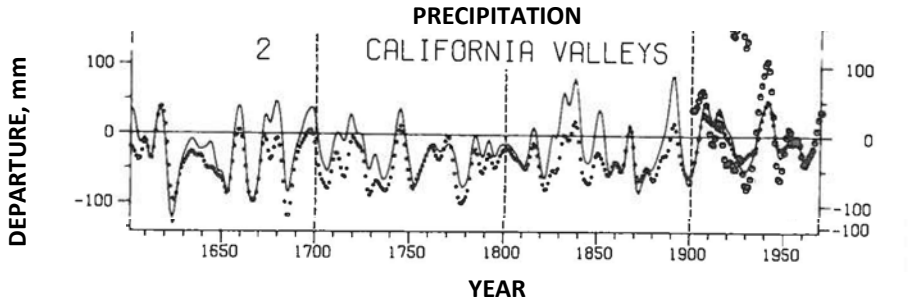
Risk Description

The primary risk to the Santa Cruz water supply from drought is the inability of the Department to reliably provide sufficient water to meet user demands during periods of below-average rainfall.

Available Information

The adverse impact of a drought is dependent on the severity, duration, and frequency of drought events. The Santa Cruz Water Department (SCWD) currently plans for a 3-year drought-duration, which is based on the severity of the 1976–1979 drought. Other nearby utilities, such as Santa Barabara and San Francisco, have moved toward using a 7-year and 8-year drought duration model, respectively, in their planning, to reflect greater climate variability than seen in the more recent historical records.

Paleo records show that, historically, droughts in the Santa Cruz region were frequently much longer than 3-8 years. Paleo climate reconstruction for California Valleys show that precipitation from the 17th century until the 20th century was consistently below average 20th-century values, with long periods of relative drought and short periods of high rainfall. These data show that cycles of below-average precipitation have commonly lasted from 30 to 75 years (Figure 1; Fritts, 1991).



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Risk Metrics

Severity, frequency and duration of curtailments.

Reductions in water quality.

Drought may also compound risks associated with flooding and fire.

Risk Management Options

Probability

Based on paleo records and observed current conditions, the risk of long-term and severe droughts is high. There are no actions the WSAC can take to reduce the probability of a drought.

Consequence

Management options for reducing the consequences of drought events include:

- Diversifying the supply portfolio
- Decreasing demands
- Increasing current water storage
- Adding new water storage
- Maximizing use of high-flow events
- Developing climate independent water supplies including reuse and desalination
- Other?

Reference

Fritts, H.C. 1991. *Reconstructing Large-Scale Climatic Patterns from Tree-Ring Data: A Diagnostic Analysis.* University of Arizona Press, Tucson, AZ.

Risk Fact Sheet: Seismic Events

Risk Description

The Santa Cruz drinking water system is at risk from earthquake events from nearby active faults. Based on the experience of the Santa Cruz Water Department (SCWD) and other utilities during earthquake events, possible damage could include, but is not limited to:

- Structural damage to and/or failure of transmission, treatment, and distribution facilities and occupied buildings
- Loss of the control system and automated operation of facilities
- Ruptured chemical tanks and/or feed piping
- Power outages at the raw water supply pumps, treatment plants, and treated water pump stations.

Available Information

The nearest active faults are the Butano, Zayante, and San Andreas faults. According to a 1994 report by the California Division of Mines and Geology, "Fault Activity Map of California and Adjacent Areas," the Butano and Zayante faults are potentially active undivided quaternary faults. This type of fault has had evidence of displacement during the last 1.6 million years. The San Andreas is a well-known active fault. USGS has reported there is a 10% chance of an earthquake of magnitude 6.7 Richter or greater on the Santa Cruz segment of the San Andreas fault before 2030, and a 21 % chance for the entire San Andreas fault system (USGS Fact Sheet 152-99,1999; CDM, 2002).

Seismic activity on these faults could cause damage (ranging from minor to severe) to the supply, treatment, and distribution system components. Earthquake damage to the Santa Cruz system has in the past, and would most likely in the future, result from ground shaking or seismically induced liquefaction. Conversely, ground rupture is not a likely threat to the Santa Cruz Facilities. Ground shaking will create forces of varying magnitude (based on soil conditions) throughout the system. Piping and structures (buried or above grade) would be subjected to these forces and could potentially sustain damage. Liquefaction can also occur to varying degrees throughout the system. The area's most susceptible to liquefaction are the lower San Lorenzo River basin and other areas with sandy soils. Sandy soils tend to liquefy during ground shaking and can cause localized soil failure, displacement, and subsequent damage to piping and structures that are buried or above grade structures that rely on the soil's strength to support the foundations. Because the Ben Lomond Fault, that passes through the Santa Cruz system, is not considered active, the probability of an earthquake and significant ground ruptures within the Santa Cruz system is low. Based on the experience of the SCWD and other utilities during earthquake events, possible damage could include, but is not limited to:

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- Ruptured chemical tanks and/or feed piping
- Power outages at the raw water supply pumps, treatment plants, and treated water pump stations.

Risk Metric

Severity, frequency and duration of curtailments, and/or service outages for all or parts of the system.

Risk Management Options:

Probability

The SCWD cannot take any measures to reduce the probability of a seismic event.

Consequence

The SCWD has already responded to these risks by:

- Installing an emergency generator system at the University Pump Station No. 2.
- Purchasing three portable generators
- Providing emergency power system at the Felton Booster Station.

Additional options to manage seismic risks include reducing the consequences of possible transmission line failure through adding redundancy (e.g., back-up pipelines, additional water sources, hardening vulnerable infrastructure).

Reference

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Risk Fact Sheet: Flood (does not include sea level rise factors)

Risk Description

The primary risk to the Santa Cruz water system from floods is damage to electrical equipment.

Risks associated with 100-year floods include:

- Inundation of the Tait Street Wells, which would impair the Santa Cruz Water Department's (SCWD's) ability to pump water from the San Lorenzo due to loss of electricity
- Flooding of the Coast Pump Station, which would hinder SCWD's ability to deliver water to its customers along the Coast Pipeline due to loss of electricity

Risks associated with 100-year to 500- year floods include:

- Inundation of the Graham Hill WTP, Beltz WTP, and almost all pump stations due to a loss of electricity
- Impaired access to valves and service connections for distribution lines.

Other flood related system risks include:

- Bridge washouts along the supply lines off the Coast Pipeline and running from Loch Lomond Reservoir to the Graham Hill WTP, which have many creek and river crossings.

Available Information (CDM, 2002)

Figure 1 identifies the areas of 100-year flooding, 100- to 500-year flooding, and 500-year flooding potential. Areas along the coast and river ways have a potential to flood once every 100 years. Almost all of the area shown in Figure 1 has a flooding potential of once in every 100 to 500 years. There are a few small areas that are located in the 500-year flood zone. This does not reflect sea level rise or increased storm surge, as associated with climate change.

President Obama recently established a Federal Flood Risk Management Standard in order to improve the resilience of communities against the impacts of flooding changes due to climate change. Federal projects must now update floodplain maps using climate-informed science, by adding 2 feet to the base flood elevation for non-critical actions and 3-feet for critical actions, or by increasing the area subject to flooding by the 0.2 percent annual chance of flood. The term "critical action" shall mean any activity for which even a slight chance of flooding would be too great

Risk Metric

- Inability to access water from the Tait Street wells.
- Loss of ability to deliver water to customers along the Coast Pipeline
- Loss of treatment capacity
- Loss of access to distribution system values
- Loss of supply due to breaks in supply lines because of bridge washout.

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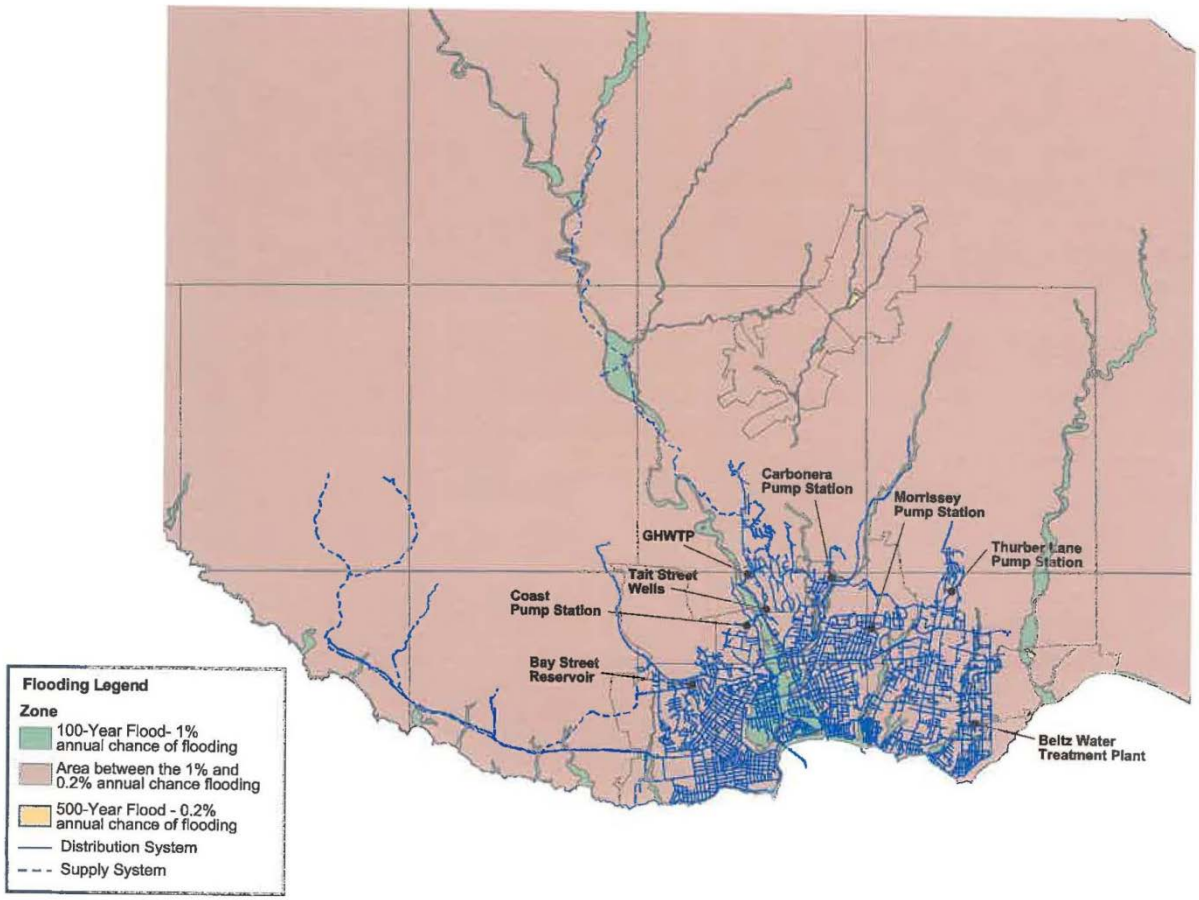

Figure 1. Flooding potential in the Santa Cruz area.

Source: CDM, 2002, Figure A-2.

Risk Management Options

Probability

Management options for reducing the probability that flood events will result in one of the losses listed above include:

- Moving electrical connections and components to higher locations within a facility (Tait St Wells, Coast Pipelines)
- Investing in movable back-up generators
- Fortifying, moving, or providing duplicate supply lines that run under bridges.

Most of the available actions are beyond the domain of WSAC.

Consequence

Management options for reducing the consequences of flood events include implementing an alternative that provides water and water treatment that is not vulnerable to flood risks.

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Risk Fact Sheet: Wildfires

Risk Description

Wildfires have the potential to affect the Santa Cruz Water Department (SCWD) system both directly and indirectly.

Direct risks include damage to:

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- Distribution facilities (CDM, 2002).

Indirect risks include:

- Turbidity excursions
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Available Information

Figure 1 shows fire hazard severity zones for places within the State Responsibility Areas (SRAs). While none of the SCWD system is expected to be in the highest severity areas, some parts do fall within moderate and high hazard areas, including the Felton Booster Station; Loch Lomond Reservoir; Rolling Woods Pump Station; Rolling Woods Reservoir; Santa Cruz Gardens Reservoir; Thurber Lane Pump Station; University No. 4 and 6 Pump Stations; University No. 2, 4, and 5 Reservoirs; and Liddell Springs, Laguna Creek, and Majors Creek intakes (see Figure 1; CDM, 2002).

The Felton and Tait Street Diversions and the Graham Hill Water Treatment Plant (GHWTP) are outside of the SRAs but are adjacent to wooded areas that are within moderate to high fire hazard area. If wildfires hit in these areas, they could prevent staff from safely operating these facilities and could cause structural or mechanical damage (CDM, 2002).

Risk Metric

Reduction in supply reliability as measured by the frequency, severity, and duration of curtailments.

Risk Management Options

Risks can be managed by either reducing the probability that an event will occur OR by reducing the consequences of the event if it does occur.

Probability

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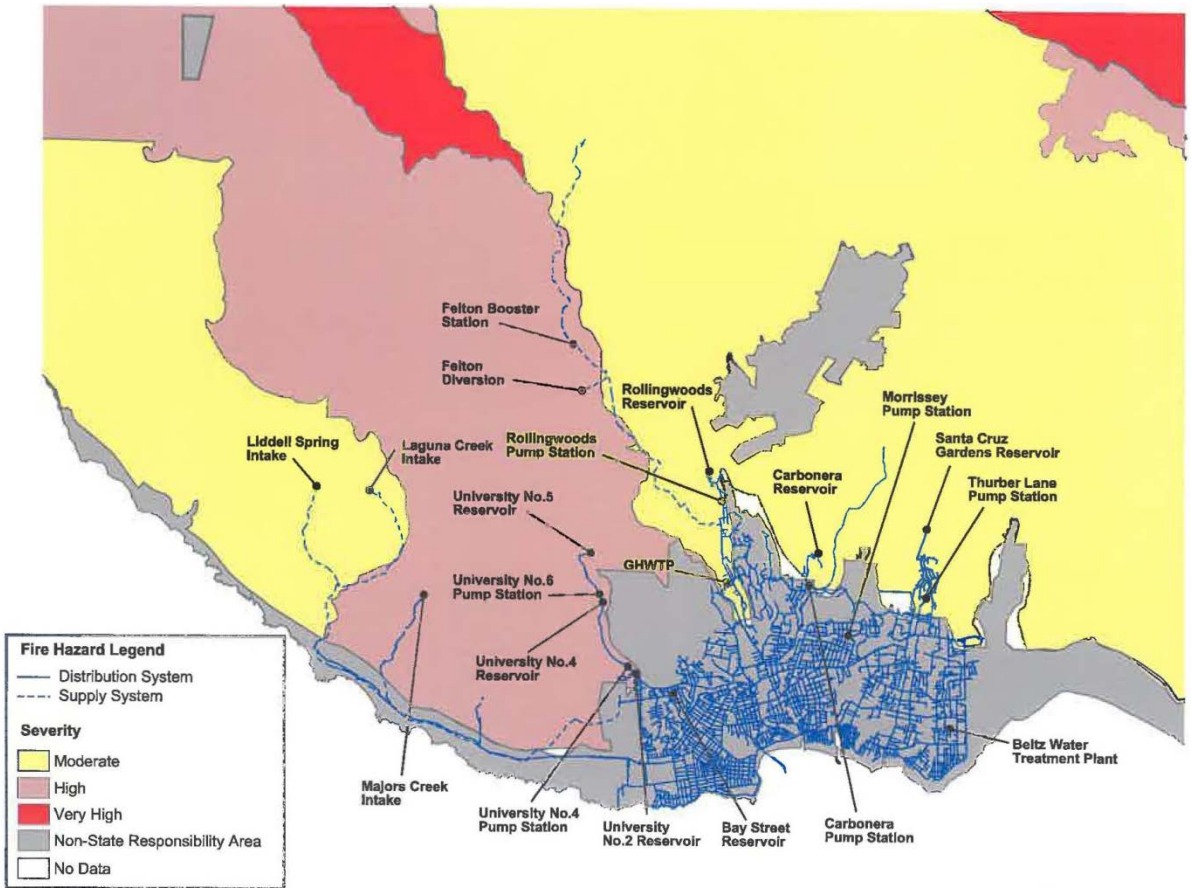

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Consequence

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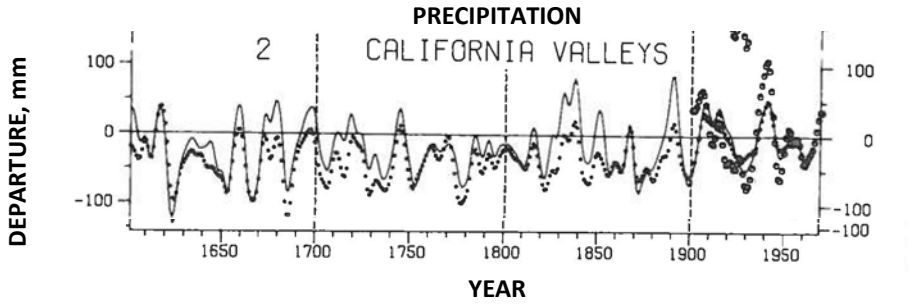

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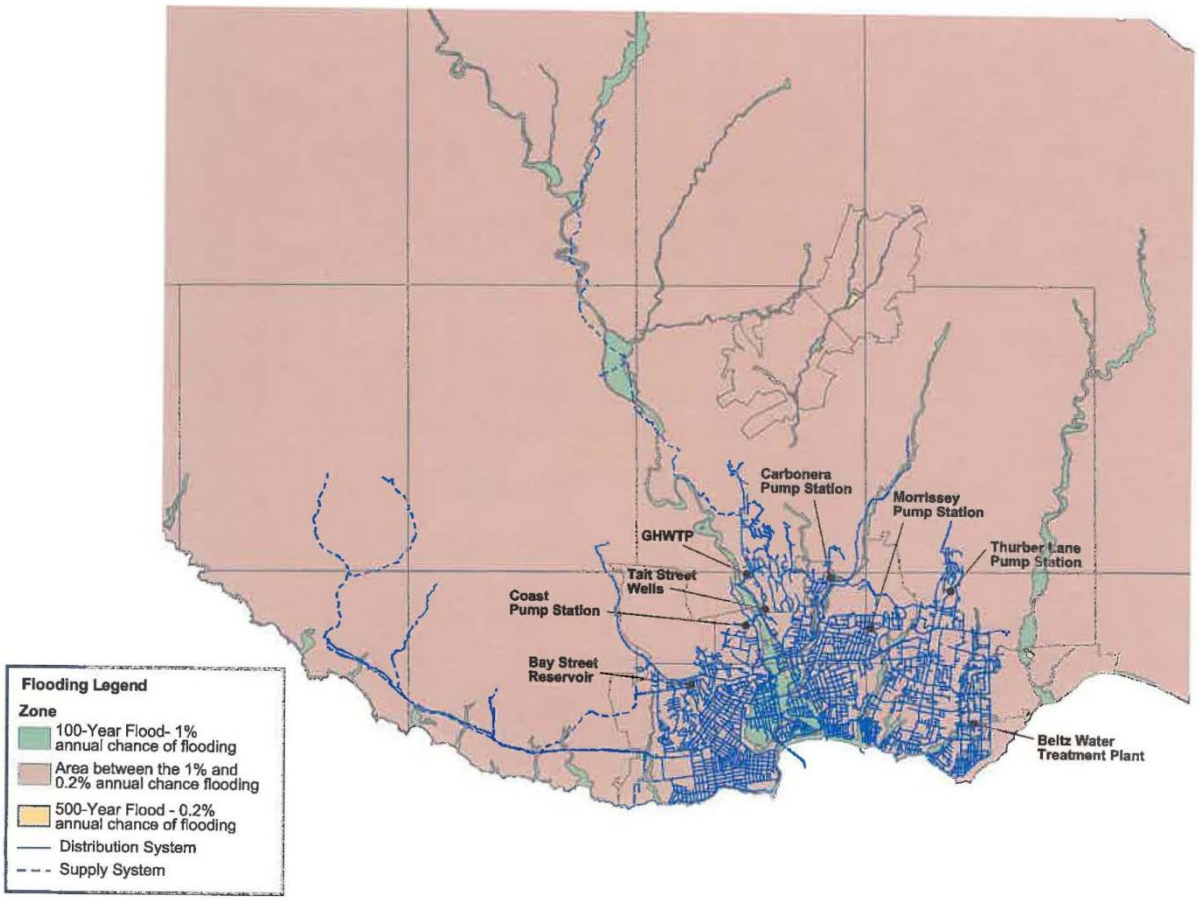

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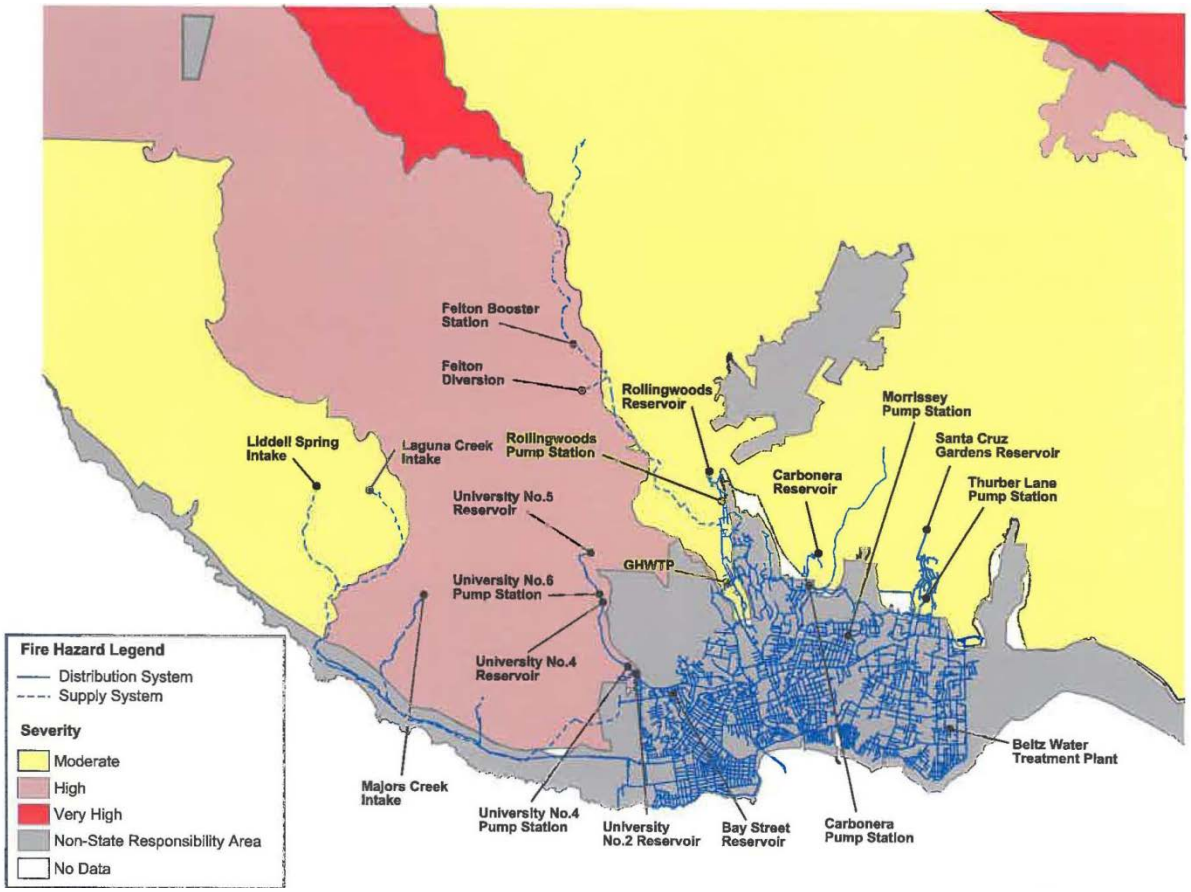

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Management options for reducing the consequences of wildfire include developing redundant distribution and treatment facilities in areas with lower probabilities of wildfire.

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Baseline Reliability Assessment

Presented to

Water Supply Advisory Committee

February 12, 2015

Confluence History and Context

- Roots in power planning
- Designed specifically for water resources planning
- Has been applied to a variety of system types & sizes
- Used to help address many issues in Santa Cruz

Confluence: What it is and isn't

Confluence is:

- Planning model
- Simulation tool

Confluence can compare scenarios

Confluence isn't:

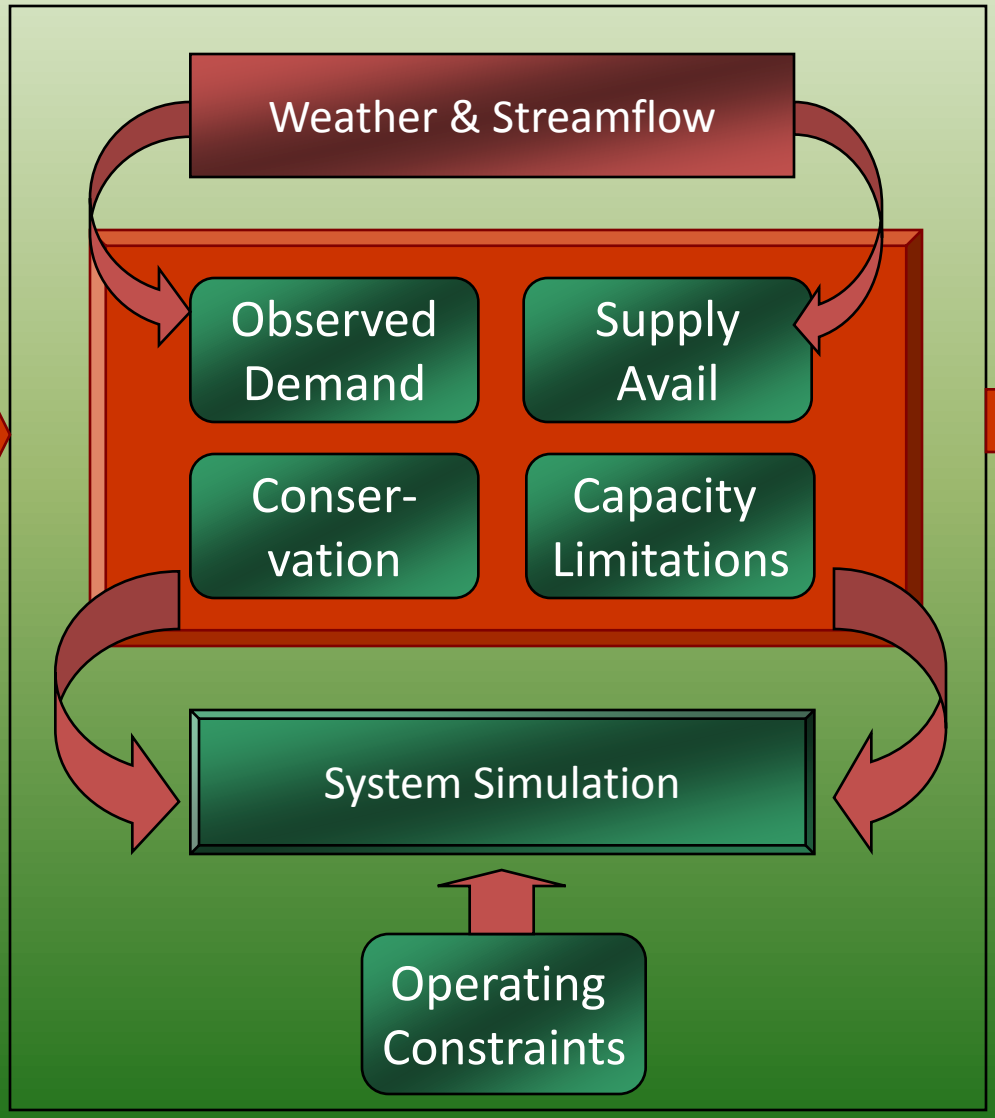
- Operations model
- Optimization tool

Confluence can't find the "best" scenario

Key Changes in Modeling Assumptions in Last Year

Modeling Parameter	Previous	Current
Demand Shape (Percent of annual demand in peak season)	64%	59%
Annual Loch Lomond Withdrawal Limit	3,200 AF	No limit
N Coast Annual Ag Demands (mg)	81.4	40
Tait Street Flow Buffer (cfs)	0	0.5
Tait Street Well Capacity (cfs)	1.78	1.29 peak 0.78 off-peak

Confluence® Model Structure



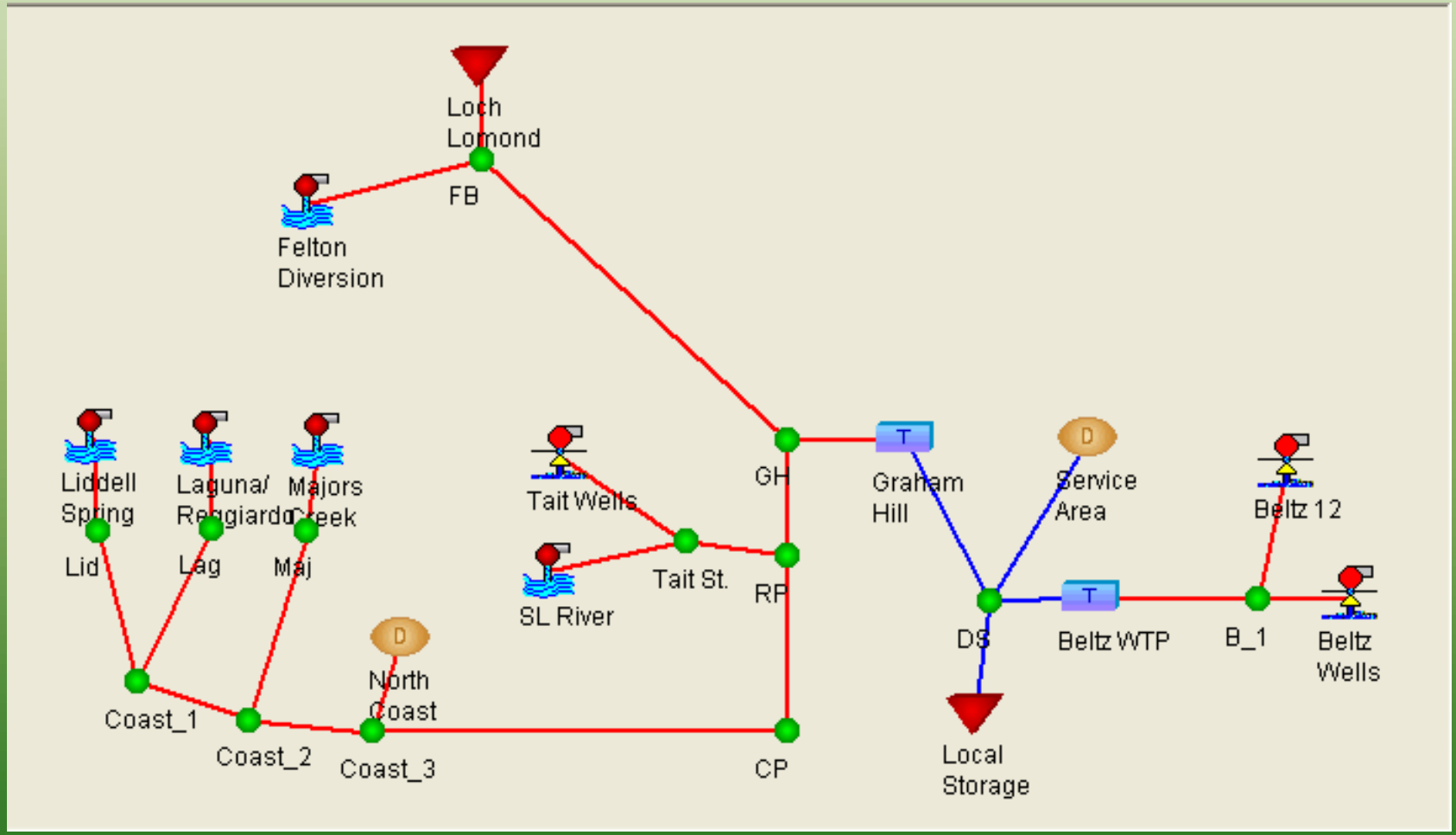
Inputs

- Demands
- System structure
- Supplies
- Conservation
- Facilities
- System operations
- Simulation Parameters

Outputs

- Reliability
- Costs & rates
- Demands
- Supply utilization
- Lake operations
- Conservation savings
- Transmission loadings
- Scenario comparisons
- Diagnostic reports

Interactive Data Map



Defining the Baseline

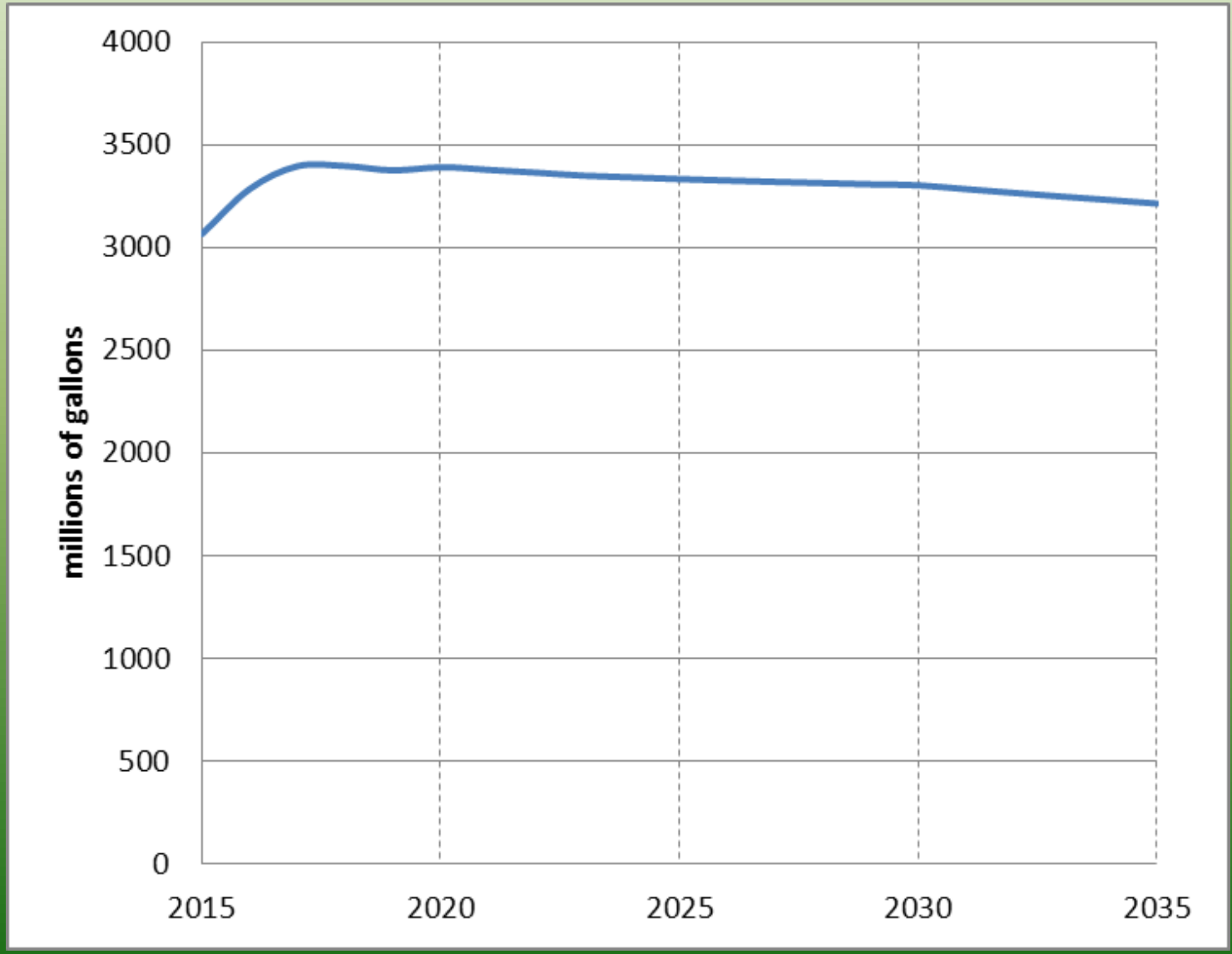
- Supplies and infrastructure
- Demand forecast
- Available streamflows

Existing Supplies

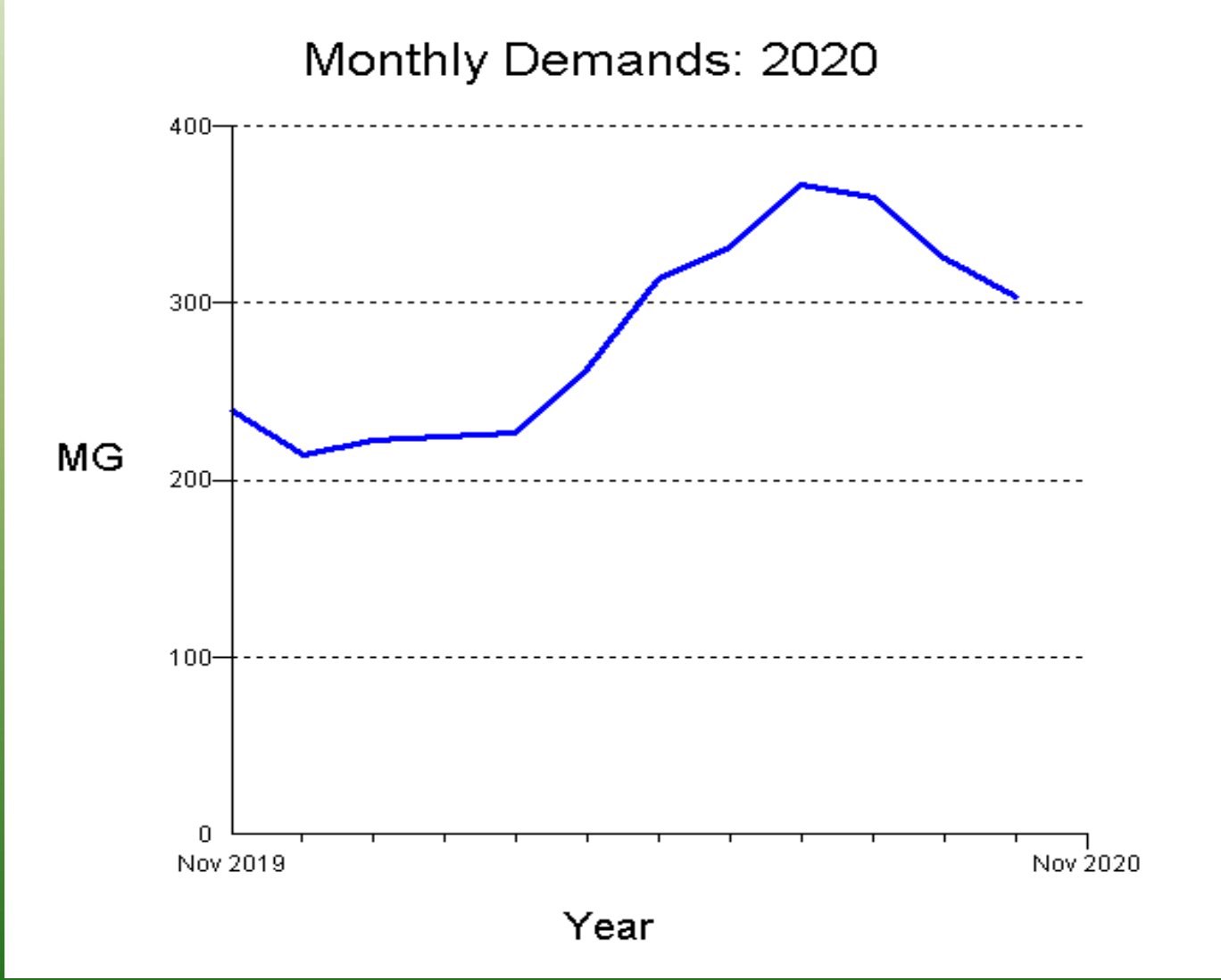
- North Coast
- San Lorenzo River (Tait Street diversion)
- Live Oak Wells
- Loch Lomond Reservoir

Also Felton diversion to Loch Lomond

Interim Annual Demand Forecast



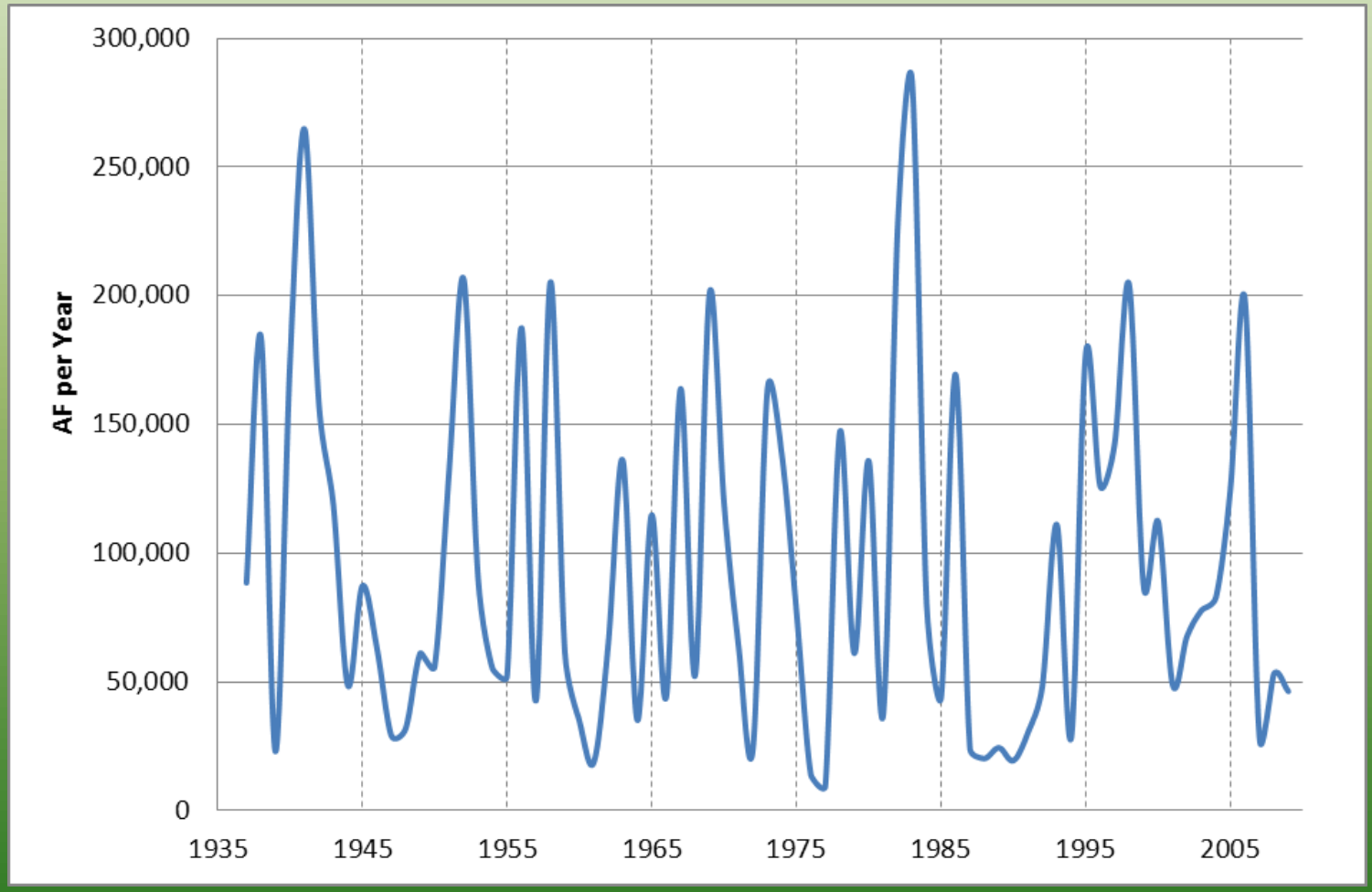
Monthly Demand Pattern



Available Streamflows

- Based on 1937-2009 historic record
  - Will add 2010-2014 when data available
  - Assumes future will look like that record
- Three alternative flow sets:
  - Natural (no HCP fish flow requirements)
  - Two proposals on table in HCP negotiations
    - City Proposed (Tier 3/2)
    - CDFW Proposed (DFG-5)

Historic Flow Record: Annual San Lorenzo River Runoff



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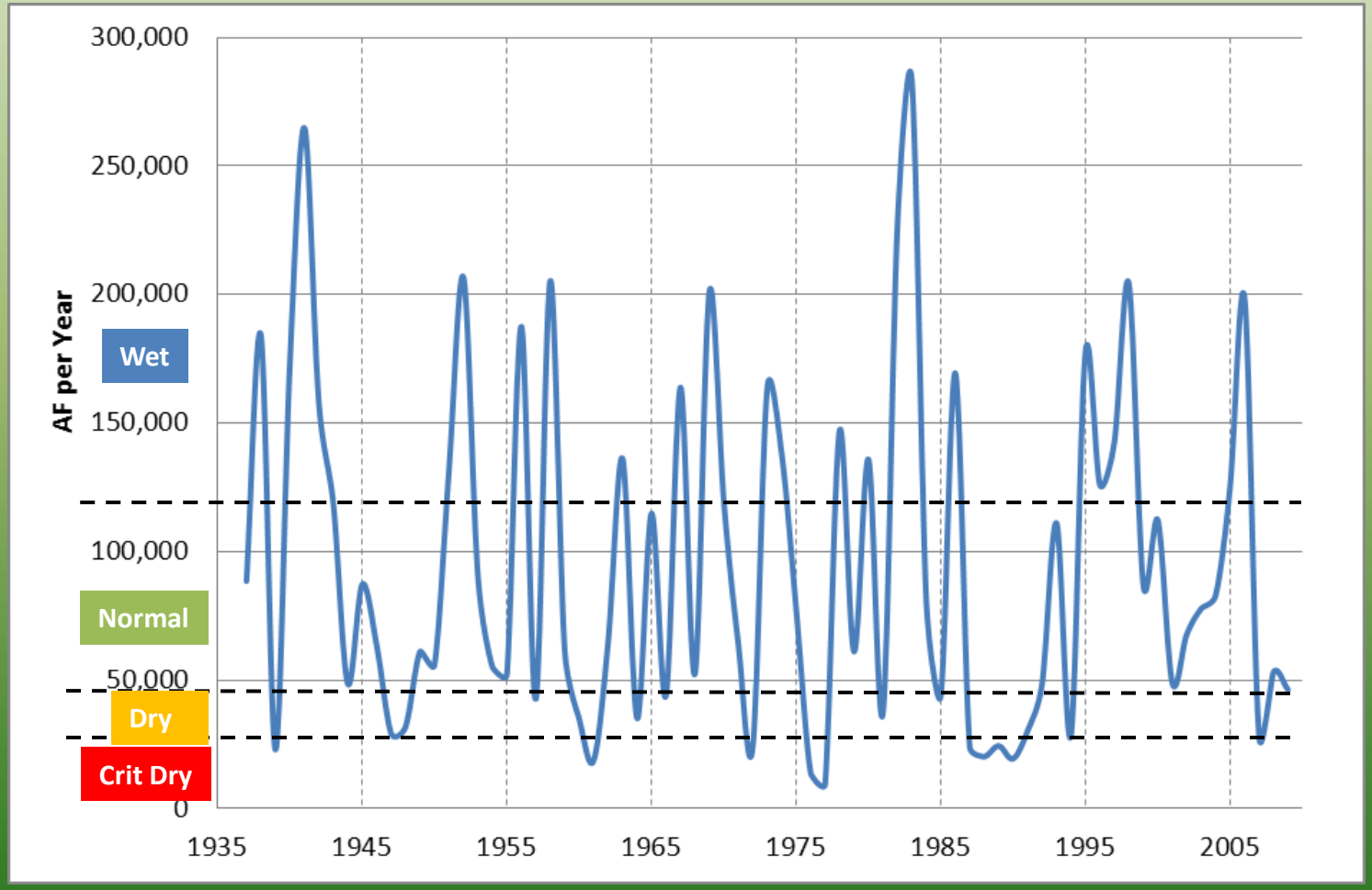


Projecting Water Supply Reliability: Key Definitions

- Shortage

  A shortage occurs when the system is unable to provide sufficient water to serve unconstrained customer demand.

- System reliability

  How often do we expect there to be future system shortages of various sizes?

Worst-Year Peak-Season Shortages

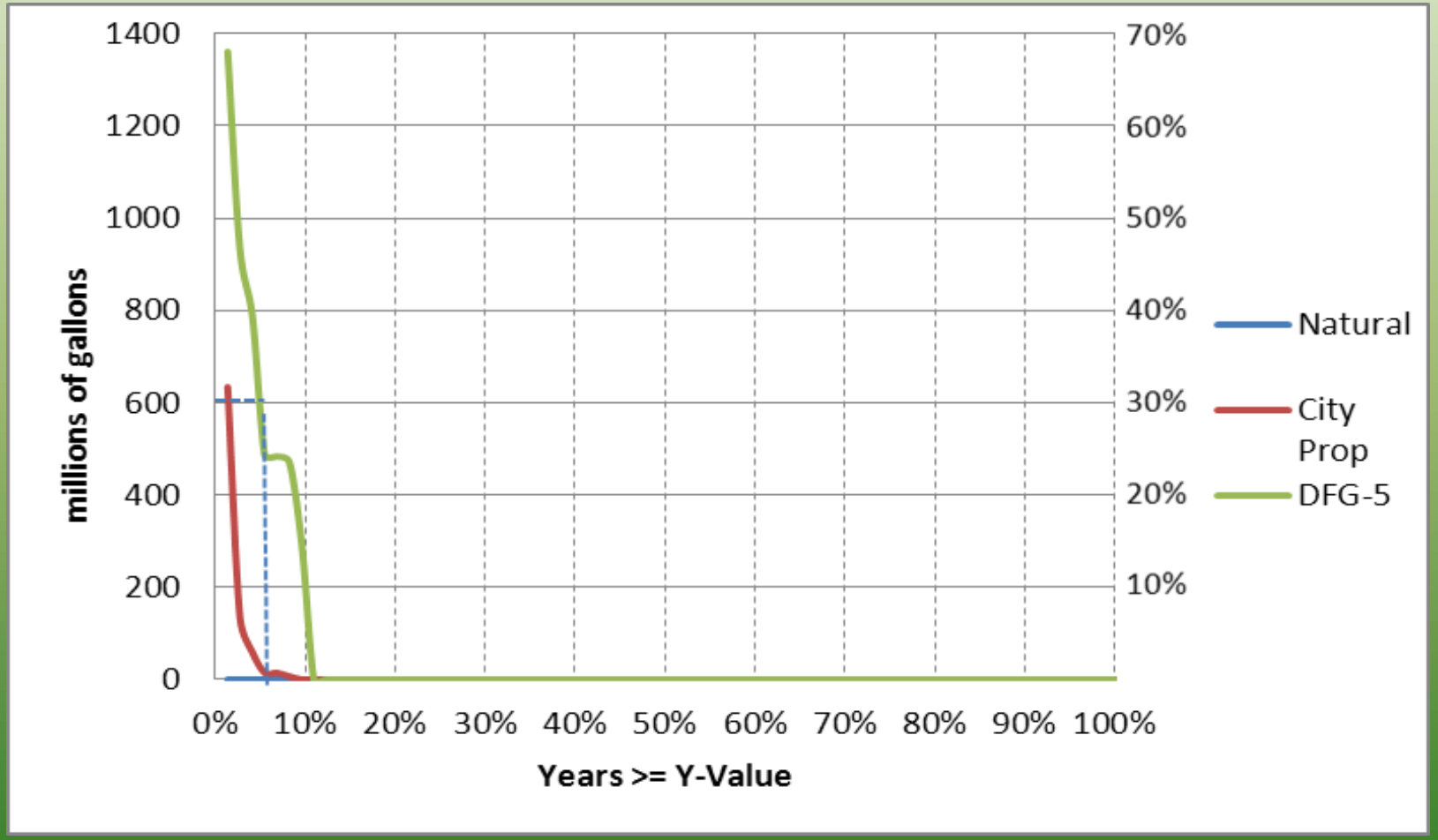
FLOWS	2020		2035	
	Volume (mg)	Percent	Volume (mg)	Percent
Natural	0	0%	0	0%
City Prop	630	32%	500	26%
DFG-5	1360	68%	1220	64%

Peak-Season Shortage Profiles

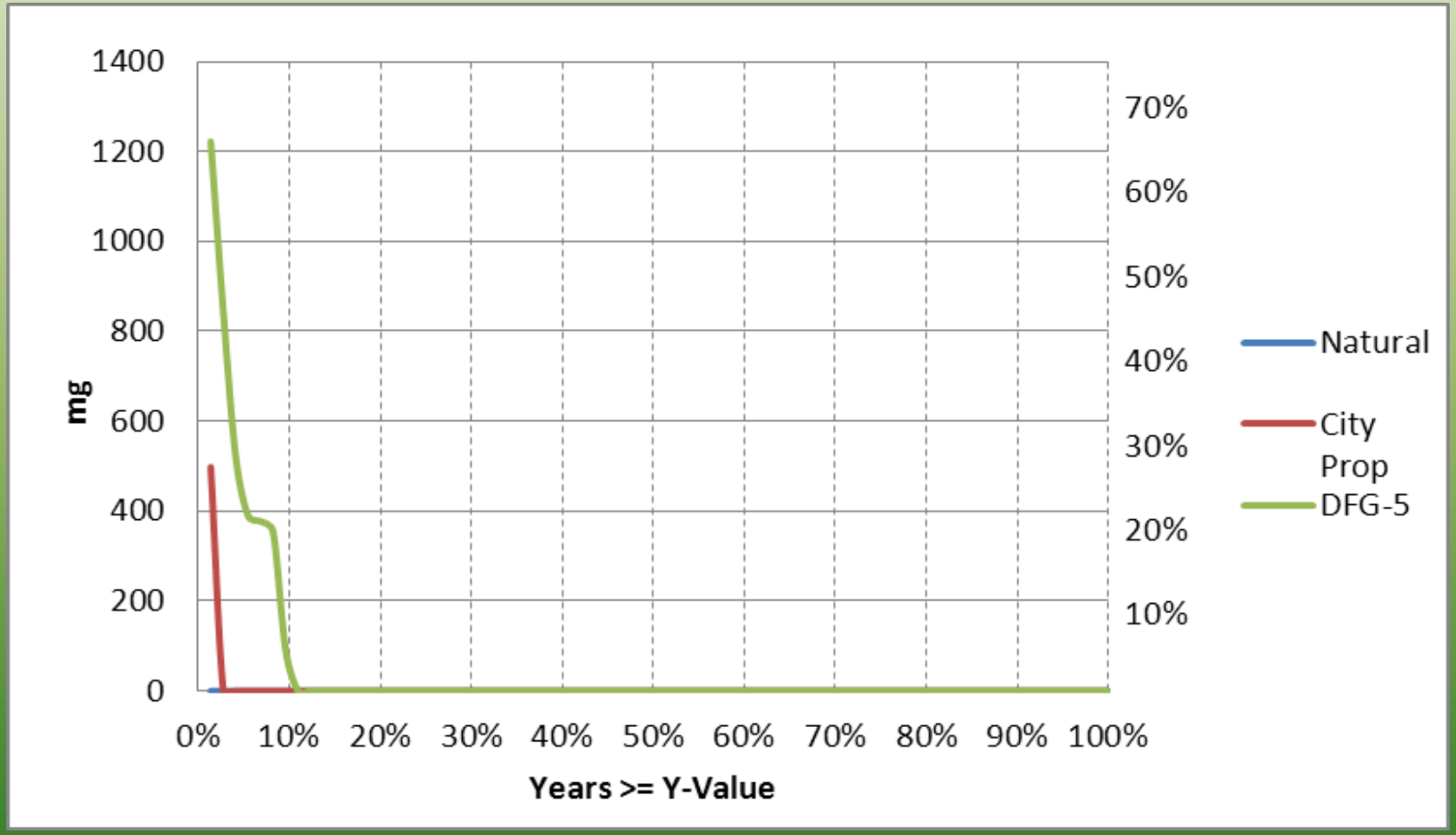
FLOWS	Likelihood of Peak-Season Shortages : 2020				
	0%	<15%	15%-25%	25%-50%	>50%
	0	<300 mg	300-500 mg	500-1000 mg	>1000 mg
Natural	100%	0%	0%	0%	0%
City Prop	92%	7%	0%	1%	0%
DFG-5	90%	1%	4%	3%	1%

FLOWS	Likelihood of Peak-Season Shortages : 2035				
	0%	<15%	15%-25%	25%-50%	>50%
	0	<285 mg	285-475 mg	475-950 mg	>950 mg
Natural	100%	0%	0%	0%	0%
City Prop	97%	1%	0%	1%	0%
DFG-5	90%	1%	4%	3%	1%

2020 Peak-Season Shortage Duration Curves

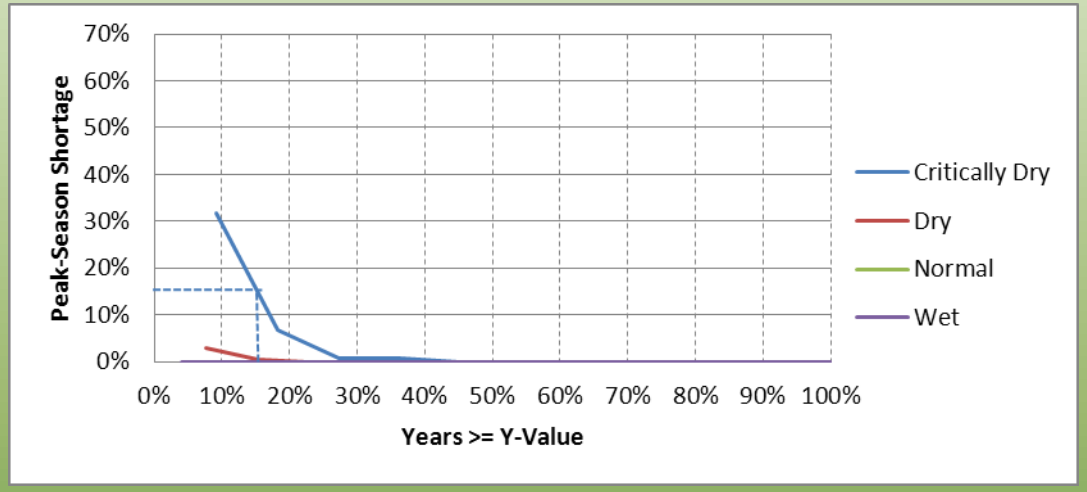


2035 Peak-Season Shortage Duration Curves

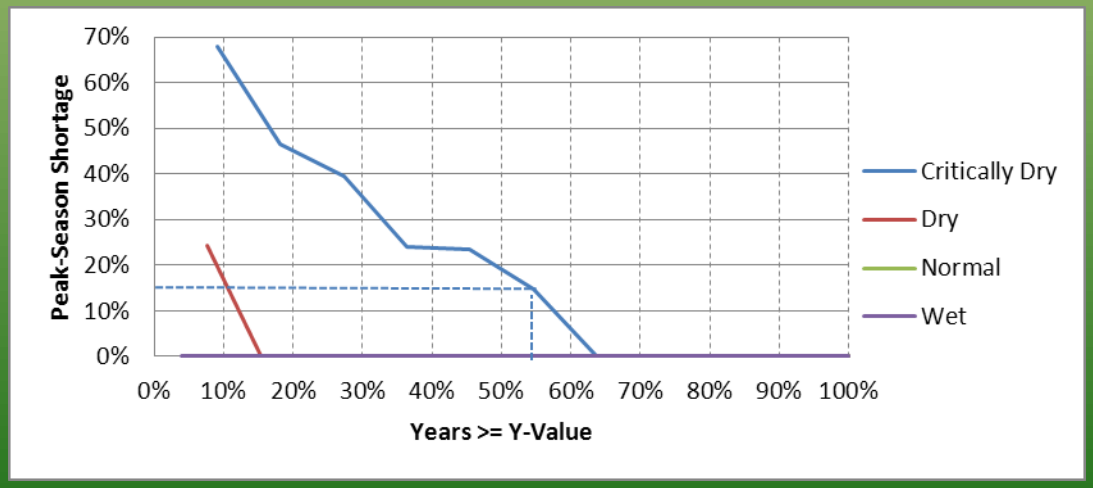


2020 Peak-Season Percent Shortage Duration Curves by Year Type

City Proposed Flows



DFG-5 Flows



The Baseline “Bottom Lines”

- Based on existing supplies and infrastructure, the latest demand forecast, and the historical flow record, the City’s water supply reliability challenges depend on the eventual outcome of HCP negotiations.
- Assuming future streamflows will look like the past, reliability problems under both HCP flow proposals occur under the driest conditions.
- Under those conditions and under both HCP flow proposals, water shortages can be significant.

Questions??

Response to WSAC Questions

Concerning Interim Baseline Demand Forecast

Prepared by
David Mitchell, M.Cubed
February 11, 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 also address the concerns about the forecast raised by SC Desal Alternatives in its February 10 Water Wonk Week email broadcast. I have chosen to answer each question in full even though this entails some repetition since some topics (such as 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 (also reproduced below on page 4). 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 (Stage 1 restrictions still in place), but then Stage 3 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"

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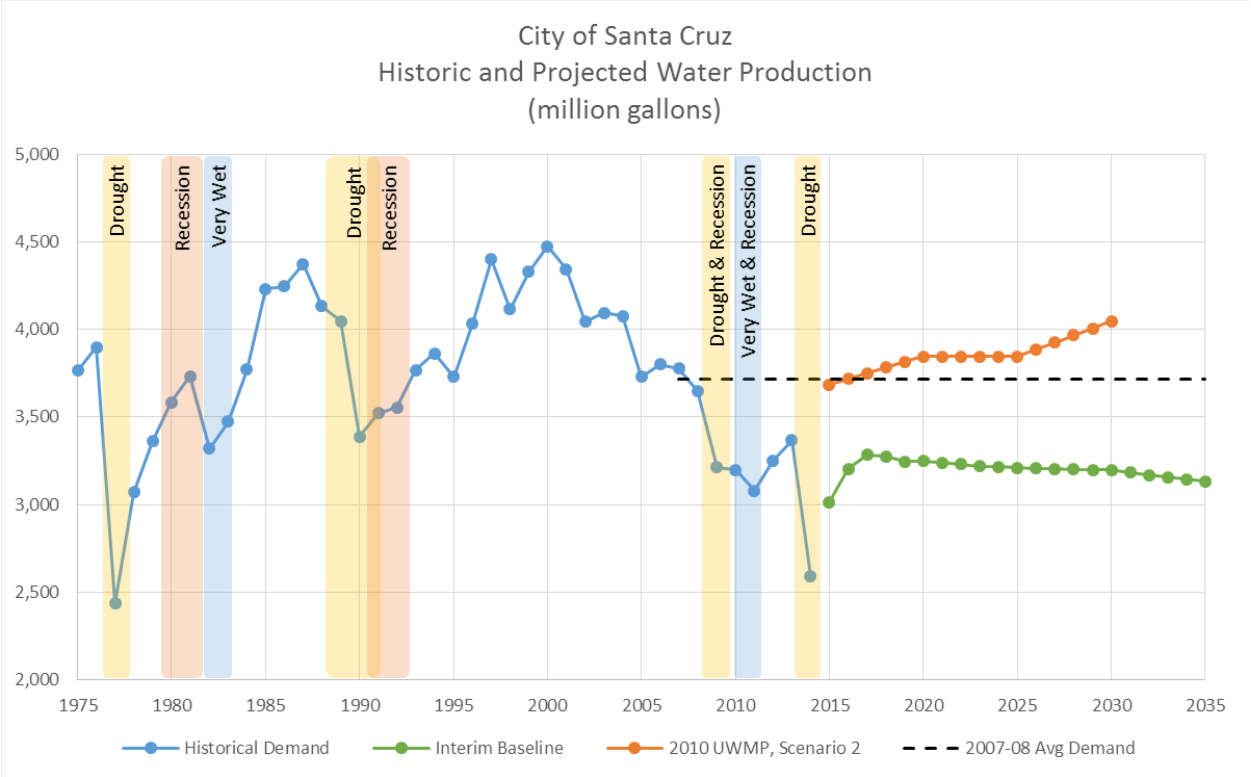
Average demand for 2010-13 was 3,224 mgy. The interim baseline demand forecast is within +/- 3% of this average, except in 2015 where it is 6% less. After 2025, the interim baseline demand forecast always is less than average demand for 2010-13, despite projected growth in population and the economy. The figure below compares historic demand to the interim baseline demand forecast as well as the 2010 UWMP demand forecast. It also shows average demand for 2007-08 to facilitate the comparison with the interim baseline forecast.



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 inside-city component of the interim forecast is predicated on the City's General Plan 2030 and its accompanying EIR. The outside-city component is predicated on AMBAG projections. 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?

See separate discussion of this issue.

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, 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

[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.

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.

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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. This includes metered water consumption from all of the city's customers, miscellaneous unmetered used, and system water loses. It does not include raw water transmission losses and raw water sales to north coast agriculture.

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%.

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

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

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**

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

Concerns about Interim Baseline Demand Forecast from SC Desal Alternatives

The February 10 broadcast email of Water Wonk Week from SC Desal Alternatives raised four concerns with the interim baseline demand forecast. The concerns are based on the questions from Rick Longinotti which were discussed earlier. Even though what I write below repeats much of what is said above, I provide full responses to the concerns raised in the SC Desal Alternatives so that my replies to those concerns may be more easily tracked by those following the Water Wonk Week email broadcast.

From SC Desal Alternatives February 10 Water Wonk Week email:

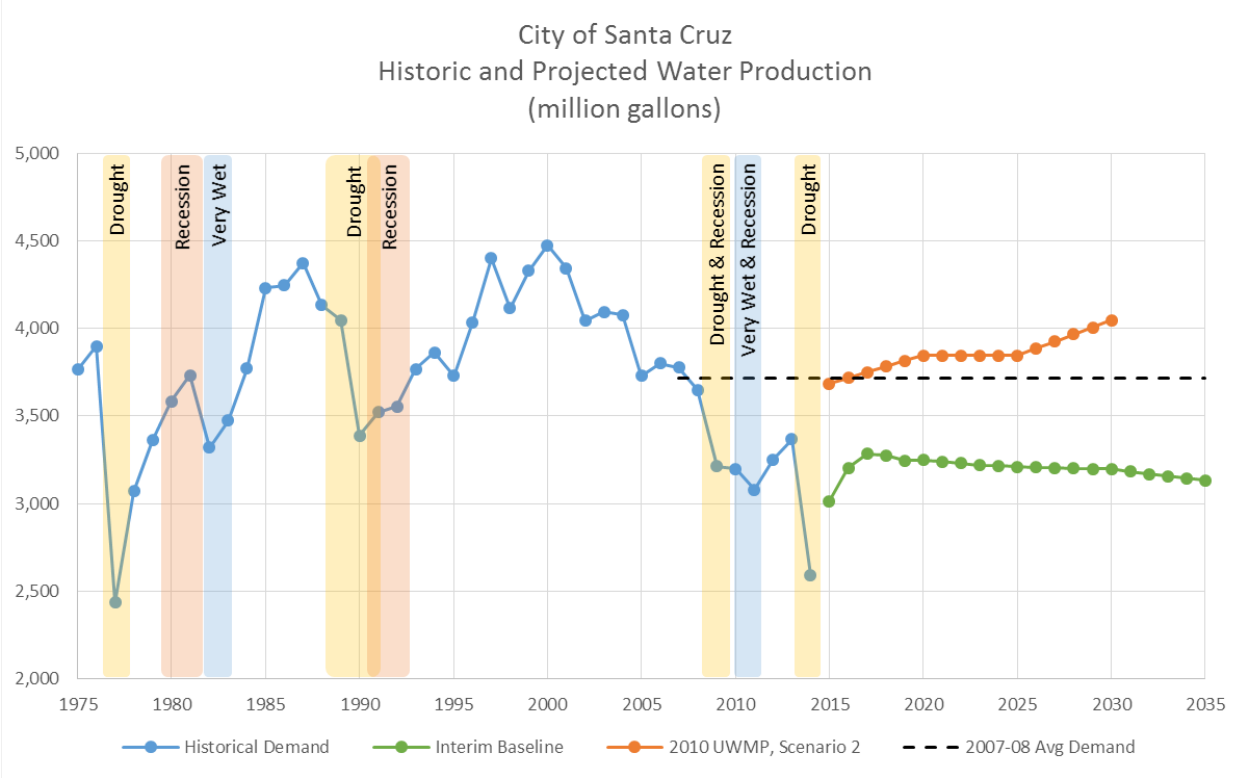
City staff is presenting its new estimate of water demand on Thursday, promising that it will be more accurate this time. However, there are several assumptions in the new estimate that Desal Alternatives questions:

1. that our "current" demand is equivalent to 2007-08 levels, when water demand has declined in more recent years.
2. that in the aftermath of last year's drought, water demand will completely rebound to former levels. What about all those people who were inspired by the drought to replace fixtures and landscapes, etc?
3. that growth in water demand at UCSC will nearly double in the next 15 years, despite the LAFCO policy that growth be water-neutral.
4. that as income rises in our community, that water consumption will rise (based on the experience of other communities in the USA, rather than local experience)

that our "current" demand is equivalent to 2007-08 levels, when water demand has declined in more recent years.

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. The figure below compares historic demand to the interim baseline demand forecast as well as the 2010 UWMP demand forecast. It also shows average demand for 2007-08 to facilitate the comparison with the interim baseline forecast.



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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.

that growth in water demand at UCSC will nearly double in the next 15 years, despite the LAFCO policy that growth be water-neutral.

See separate discussion of this issue.

that as income rises in our community, that water consumption will rise (based on the experience of other communities in the USA, rather than local experience)

Given the housing and water use characteristics of Santa Cruz, 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. 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.[2] 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 interim baseline 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, 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.

[2] 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.

Issues related to LAFCO and LAFCO Policies

The information provided here is in response to the question received related to UCSC growth and LAFCO's policy as quoted in the underlined section of the question below.

> 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?

To provide clarity, information is provided in a Q/A format.

Q. Does LAFCO have any jurisdiction over decisions related to providing water service **inside** a utility's water service established water service boundary?

A. No. Once LAFCO approves an agency's water service area, it is no longer responsible for any other approvals for, or review of, water service to customers or projects located within that water service area. At that juncture LAFCO only involves itself in the agency's operation should the agency be asked or seek permission to serve properties or customers outside the previously approved water service area boundaries.

Q. Does LAFCO's policy quoted above apply to any additional development that UCSC might pursue that lies **within** the existing water service area boundary areas covered by either its main campus or its other satellite sites or facilities elsewhere in the water service area?

A. No.

Q. Is it feasible that some part of the increased demand included in the interim demand forecast is associated with UCSC growth that is occurring or planned to occur within the existing water service area?

A. Yes. The new Marine Science building being planned for the Marine campus is an example.

Q. What is the status of decision-making by LAFCO over extending water service to the UCSC land area that is outside the current City water service boundary?

A. Since the Draft EIR on extending water service to the north campus was found to be inadequate by the courts several years ago, no further steps have been taken by the University to resolve this matter.

Q. What is the status of the University's compliance with the City-CLUE-University Settlement Agreement?

A. The University is in compliance with all applicable provisions of the City-CLUE-University Settlement Agreement that relate to water, and neither the LAFCO policy statement quoted above nor any provision that would result in a similar outcome is included as a provision of the Settlement Agreement.