# MODEL: 650 MG Gap

**Question:** How much does each high-level criterion matter to you when addressing a 650 MG shortfall?

**Scale:** Critical, Very Important, Moderately Important, Somewhat Important, Not Salient

## Implementability

**Notes:** The likelihood of getting this approach done.

**Question**: How much does each subcriterion matter to you and your constituents in evaluating how well an approach meets the requirements for Implementability?
Scale: Critical, Very Important, Moderately Important, Somewhat Important, Not Salient

### Technical Feasibility

**Notes:** Technical feasibility is an estimate of whether this approach would work as envisioned. For complex proposals, rated on the basis of core elements. When rating, City staff used the 10-year horizon on the assumption that it would be very difficult to make predictions about what technical innovations would occur more than 10 years out. If you want to change the ratings and look at a longer timeframe, the scale gives you the leeway to do that.

**Question:** How feasible is this approach technically?

**Scale:** Widely used, Demonstrated in field, Promising in 3-5 years, Promising in 6-10 years, Maybe 10-20 years, More than 20, Never

### Legal Feasibility

**Notes:** Remember the initial ratings you see here are default ratings. You, the Ctte members, initiate these ratings (not the City). This addresses siting, water rights, environmental and other legal rights relevant to implementing this approach as envisioned. As you learned from Martha Lennihan, to have a water right is only the beginning: numerous factors affect the way the right can be exercised. A water right that has limitations or questions about how it can be exercised would rate as having 'some ambiguities.'

**Question:** Within the required timeframe for this approach, are the necessary rights currently held in the form needed or feasible to acquire or modify as needed?

**Scale:** Unambiguous yes, Yes but some ambiguities, Can probably acquire, Difficult to acquire, Very unlikely]

### Regulatory Feasibility

**Notes:** This addresses environmental and regulatory review. When rating, the City staff looked at the difficulty of getting regulatory approvals under existing regulations as well as the possible necessity of responding to or taking advantage of potential new regulations that might come into place over the next decade. If you wish to adjust these ratings, please be sure to identify which type of regulatory approvals you think would be easier or harder to get (environmental, earthquake hazard, etc). In the scale, the analysis of regulatory feasibility includes the possibility of needing new regs or policies. Water Department staff did not think that any of the elements of our local situation would result in having regulatory agencies relax regulations to help Santa Cruz address the water situation. On the other hand, continuing drought at a state/western US level could over time result in regulatory revisions to facilitate addressing the larger water problem. This relaxation, if it occurred, could make some options more feasible from a regulatory point of view. When rating, City staff used a 10-year horizon on the assumption that it would be very difficult to make predictions about what regulatory innovations would occur more than 10 years out. If you want to change the ratings and encompass a longer timeframe, the scale gives you the leeway to do that.

**Question:** Is this approach likely to receive easy, quick regulatory approval?

**Scale:** Easy and quick, Slow but relatively sure, V slow no regulatory chng, Up to 10 year new reg, Not feasible (regulatory)

### Political Feasibility

**Notes:** Remember the initial ratings you see here are default ratings. You, the Ctte members, initiate these ratings (not the City). Extent to which an approach will claim and retain the support of formal political entities as well as informal social and political groups. This applies to demand reduction (e.g. volunteerism, finances for incentives or enforcement of regulations) and to supply (e.g. majority public vote requirement for desalination, willingness to make large capital investments, or concerns about oversupply and inmigration).

**Question:** What level of political support is this approach likely to have?

**Scale:** Enthusiasm now, Acceptable now, Active resistance now, Acceptable in 5 years, Acceptable in 10 years, Acceptable in 20 years, Likely never

## Cost-Effectiveness

**Question:** How important are the subcriteria to you or your constituents in evaluating how well an approach meets the requirements for Cost-effectiveness?

**Scale:** Critical, Very Important, Moderately Important, Somewhat Important, Not Salient

### Cost to City: Upfront Costs

**Notes:** This includes siting, permitting, installation or construction and other start-up costs.

**Question:** What are the upfront costs of this proposal?

**Scale:** Worst - 2.00E+5; Best - 0.00

### Cost to City: Operation and Maintenance

**Notes:**

**Scale:** Worst - 2.00E+6; Best - 1.00E+5

### Cost to Customer: Rates

**Notes:** This cost is based on a simplified lifecycle cost (capital cost divided by the life of the project plus annual O&M converted to cost per gallon) and compared to estimates of the cost of a gallon of water to an average single family residential customer in 2018, which is about 1 penny per gallon. An average single family residential customer uses 8 ccg (6,000 gallons) per month. Had to make scale in "per 100 gallons" to stay on the good side of the
software. With any luck, Carie's tryptophane-affected brain managed the conversion. (And if not, it is all relative and won't affect the decision model!)

**Question:** How does the cost of this option compare to the cost of an average single family residential customer's cost for a gallon of water in 2018?

**Scale:** Worst - 6.00; Best - 0.00

### Cost to Customer: Individual Purchase

**Notes:**This subcriterion gets to the cost to an individual of buying, installing and maintaining a system that helps reduce demand or provide storage or supply for that particular household. Example: installing a cistern.

**Question:** What is the cost to the individual of buying, installing and maintaining this system?

**Scale:** None, Small, Significant

## Community Well-being

**Notes:** Encompasses a range of social and community values. Notice now that this criterion now encompasses a pretty narrow range of social and community values (it was hacked back at the November meeting). When you assign your weights, make sure that you don't inadvertently give the subcriteria more weight than you really intended to.

**Question:** How important are the subcriteria to you and your constituents in evaluating how well an approach meets the criterion 'Community Well-being?'

**Scale:** Critical, Very Important, Moderately Important, Somewhat Important, Not Salient

### Regional Water Stability

**Notes:** This gets at approaches that would benefit SC water customers and the region.

**Question:** Would this approach improve regional water stability?

**Scale:** Across County, 4 jurisdictions, 3 jurisdictions, 2 jurisdictions, SC Water only

### Local Economy

**Notes:** This criterion is measured in terms of numbers of jobs and is meant to synthesize the effect of water supply, water reliability, confidence and local jobs as they might affect local economy. This is one of the technical criteria that changed across simplified scenarios. It turns out that the zero gap simplified scenario leaned into this criterion in some interesting ways.

**Question:** How might this proposal affect Santa Cruz's economy, as reflected in local jobs?

**Scale:** Positive local job, Slight positive, No effect, Slight negative, Negative for local jobs

## Environmental Well-being

**Notes:** This criterion relates to the degree to which a water supply or demand management strategy contributes to or impacts the quality and sustainability of the natural environment.

**Note:** "terrestrial" was taken out as a subcriterion because none of these proposals appeared to impact terrestrial resources. Note on the note: Unless you count laying of pipe--which ought to be counted. This is my bad. –CF

**Question:** How important are the subcriteria to you and your constituents in evaluating how well an approach meets the criterion "Environmental Well-being?'

**Scale:** Critical, Very Important, Moderately Important, Somewhat Important, Not Salient

### Energy

**Notes:** In providing some very broad guesstimates for this criterion, the City staff considered the energy usage of the City's current treatment plant as a 4 and rated the others with respect to that. The City recently compared energy intensity of the treatment of desal vs traditional sources (surface and groundwater) as 15, 1.5 and 2.1 kWh/1000 gallons respectively. This subcriterion has gone back and forth between carbon emissions and kWh/1000
gallons; later in the process you will want to look at both. There are several issues wrapped up (or lost) in the present kWh/1000 gallon scale that you will want to tease out in Real Deal. There is the actual energy use at the plant along with pumping and delivery. Differing emissions for different sources of energy. The energy that goes into construction parts including, as Bob outlined in his Reuse discussion, the impact of actually making (delivering, digging, installing?) the pipe. Where the emissions occur and what time of mitigation requirements there may be. ...Do you care about energy because of its cost? The volatility of its cost? Because it is a surrogate for carbon emissions?

**Question:** How much energy will this approach require per MG of water?
(Treating surface water, which the City rated as a 4, is about 1.5 kWhl1000 gallons, see accompanying note.)

**Scale:** 5, 4, 3, 2, 1

### Marine Ecosystem Health

**Notes:**

**Question:** How would this approach affect marine ecosystem health?

**Scale:** Positive effect, does not harm, may harm, cumulative harm, Sig harm to population

### Freshwater and Riparian Health

**Notes:** This rating encompasses the positive (e.g. when restoring watersheds or by creating an easier option to leave more water in the river) as well as potential harm. One of the commenters on the Convention model referred to the former as 'direct beneficial impact' and the latter as 'indirect beneficial impact.'

**Question:** If this approach were implemented, how would it affect freshwater and riparian ecosystems?

**Scale:** Plentiful healthier water, About as it is now, Degraded ecosystem health

### Groundwater Resources

**Notes:** The word "active" in the scale means putting water back not just resting wells.

**Question:** How would this approach affect groundwater resources?

**Scale:** Actively restores, Allows restoration, Does not affect, Depletes Resource, Greatly Depletes Resource

## Adaptability

**Notes:** Characteristic of a supply project that relates to how well the approach can be modified over time to respond to changing conditions.

**Question:** How important are the subcriteria to you and your constituents in evaluating how well an approach meets the criterion 'Adaptability?'

**Scale:** Critical, Very Important, Moderately Important, Somewhat Important, Not Salient

### Infrastructure Resilience

**Notes:** Infrastructure resilience relates to the extent to which this approach will help the overall system to withstand natural disasters such as earthquakes, fires, floods, tsunamis and or systemic power outages related to the above--but not drought. (That is the next subcriterion.) Potable reuse rated lower than desal for resilience because desal uses another source of supply (the ocean) and would be a brand new facility built to all current seismic codes. In an earthquake, these factors would be assets compared to possible impacts of losing the wastewater treatment, which in turn would affect the reuse plant. In your rating, remember that in the extreme climate change simplified scenario (1 BG shortfall), fire and landslides may put more pressure on the system's resilience.

**Question:** How well would this approach contribute to the system's ability to withstand natural disasters and other disturbances? (The top of the scale is "meets most challenges well.")

**Scale:** Most challenges well, Many moderately well, Some somewhat, Few barely, Doesn't improve resilienc, Slightly degrades, Significantly degrades]

### Reliable Supply

**Notes:** Reliability of water supply relates to how much water can be produced under various climate conditions such as drought or extreme precipitation. Remember that in

the extreme climate change simplified scenario (the billion gallon shortfall), less rainfall isn't the only issue: turbidity, timing of storm events or other factors may also affect the supply.In rating the alternatives against this subcriterion, City staff saw demand strategies as potentially reducing the reliability of supply. They felt that the water demand offset program generally makes the system less reliable. With demand management actions being used to offset growth, new customers can be added without increasing supply. But at the same time, all customers are living closer to some reasonable limit of possible reduction in water use or increases in water use efficiency. This means that if the supply drops even further, there is no cushion--little or no discretionary water use that can be eliminated or reduced--so curtailments would be more difficult for customers and, in worst case scenarios could significantly cut in to the water used to protect public health and safety.

**Question:** How much will this approach help the existing system to produce consistently?

**Scale:** Makes system sig more rel, Somewhat more reliable, Slightly more reliable, No change, Makes system less reliabl

### Scalability

**Notes:** Scalability measures the extent to which an approach can be scaled up as needs change. Note that for Loquifer, as with some of the other proposals, the design is scalable but once you commit to one of the designs, the project is not. One of the Ctte members had asked for a negative scale for scalability, but that just didn't make sense; it was hard to imagine a circumstance where adding one of these approaches would make the system less scalable.

**Question:** How easily can this approach be scaled up within the overall system? (The tilde~ in the scale is shorthand for 'might not meet by itself but sure would help a lot.')

**Scale:** Scales up w no limit, Can scale to ~1BG gap, Can scale to ~650 MG gap, Can scale to ~ 300 MG gap, Not scalable

### Preserves Future Choices

**Notes:** In general, this rating was about the extent to which large capital investments might lock the city in to a certain set of solutions. The Ranney collectors rated well because they would be helpful in perfecting the Felton water right at a higher level. What is missing in the structure of the model is a way to send a signal about options lost by INaction.

**Question:** How well does this approach preserve future choices?

**Scale:** Increases choice, Somewhat inc choice, No effect, Reduces choice, City locked in

## Effectiveness

**Notes:** The ability of a particular approach to meet the gap by decreasing demand, increasing supply or instituting management changes that help the Water Department "do more with less."

**Question:** How important are these subcriteria to you and your constituents in evaluating the how well a proposal meets the requirements for "Effectiveness?"

**Scale:** Critical, Very Important, Moderately Important, Somewhat Important, Not Salient

### Yield

**Notes:** Reduction in demand or increase in supply.

**Question:** How much water will this approach save or produce?

**Scale:** Worst - 17.00; Best - 1800.00

### Flexibility

**Notes:** The degree to which this approach increases management flexibility that in turn helps the system "get by with less" while still meeting resilience, reliability and other goals. (This is particularly designed for approaches that don't actually increase supply or reduce demand, but might nevertheless be useful.) In rating 'flexibility,' the City staff looked at an approach's ability to provide diversity, the
ability to create a cushion in terms of water availability and other factors. For instance, reuse and desal were seen as "adding another treatment plant" and therefore tended to rate well for flexibility.

**Question:** To what extent does this approach increase flexibility?

**Scale:** Greatly increases, Moderately increases, Somewhat increases, Does not increase, Decreases

### Addresses Peak Season Demand

**Notes:** This subcritierion addresses the extent to which a proposal reduces peak season demand or provides water that is not dependent on winter rains.

**Question:** To what extent would this approach help address peak season demand?

**Scale:** Yes, Maybe, No

# PROPOSAL:

### WaterSmart
**Notes:** Life of project is 10 years, so annualized up front cost is $180. Annual cost is $100,000.

### Landscaping, Capture, Reuse
**Notes:** Proposal states this approach could reduce residential use with rain catchment by 30 to 40%. Residential use is avg of 1.9 bgy, so using 30%, we'd be looking at .57bgy, which is a lot of water. Maddaus has estimated the utility cost of this kind of program at $43,000 per mg, so the total cost of this would be $248 m. If half were incentivized = $124 m with avg life of 20 years so 6.2 m/year + 100,000 = 6.3 m for 576 mgy = $0.011 per gallon. Total capital costs estimated at $25 million.

### Water Neutral Development
**Notes:** Estimated that of the 0.5 bgy in projected demand for new growth, 240 mgy will be offset as a result of building code changes that will occur without investments (these building code changes are those already planned to be in place, not the "beyond building codes" alternative), leaving 260 mgy. Using the remaining years of the General Plan (15), this equates to an avergae yield of 17 mgy. Program costs were comprised of the cost of all the non-building code programs in the Long Term Consevration Master Plan divided by the estimated number of new equivalent dwelling (or residential) units per year estimated in the General Plan. This is where the $4,000 edu used in the 'cost to consumer' came from.

### North Coast Water
**Notes:** Chose the 11,000 af option = 3.6 bg total storage. Figure 1/2 available in a given year (constrained not by available water in storage but by ability to refill from sources experiencing drought conditions) Multiple cost estimate of $28 m x 5 due to under representation of costs (karst, steep side wialls) = $140 m = $12,860/mg
Life is 50 years = $2.8 m/year + 1.5 m O&M = $4.3 m/year/1.8 bgy = $0.002.
Total capital cost estimated at $128 million.

### The Loquifer Alternative
**Notes:** Proposer estimated yield at 6000 afy (= 2 bgy). The project proposes in lieu recharge of Scotts Valley and Soquel Creek aquifers by having the City provide water service to them instead of pumping from their wells. 6000 is about the annual demand of both of these other water agencies. City could not provide water to them in the summer, only in the winter, so winter demand is approximately 40% of annual demand, making the yield 800 mgy.

As described, this project makes no specific assumptions about how, how much or when the city could get water back from these other water districts and no infrastructure or infrastructure costs are included in the project that would support returning water to the city.

Calculations are based on the following Yield is 800 mgy, with no specifically identified benefit to Santa Cruz

Proposed treatment plant at Loch Lomond is not needed so up front cost is $50 m not $85 m, making the cost per mg = $62,500. Life of the project is 20 year (aquifers full by then?) so annualized upfront cost is $2.5 m + $1.2 m for annual O&M, which makes cost per gallon $0.0046/gal (as compared to $0.01/gal for water in 2018).
Total capital costs estimated at $50 million.

### Expanded Treatment Capacity

**Notes:**
The assumption is that new water would be equal to 30 additional days of pumping to Loch Lomond at 11 mgd = 330 mgy

Assume 20 year life. Total capital costs estimated at $65 million.

### Ranney Collectors on SLR

**Notes:** The assumption is that new water would be equal to 30 additional days of pumping to Loch Lomond at 11 mgd = 330 mgy

Assume 50 year life. Total capital costs estimated at $15 million.

### Reuse for Agriculture

**Notes:**Project life is 50 years; most of these numbers from Catherine Borroman, so only did the calculations. Total capital cost: $98 million.

### Aquifer Restoration

**Notes:** For the purposes of this analysis, using the cost of infrastructure in Lochquifer plus 30% to account for the infrastructure needed to get water back to the City (complete WAG) using for a yield 600 myg which comes from 180 mgy from more pumping of existing beltz wells, 260 mgy of water back from SqCWD using existing infrastructure (upgraded pump station at 41st) and 160 mgy from SVWD, which requires infrastructure ranging from wells, pipelines, pumpstations etc. The big difference between this alt and Lochquifer is this one focuses on what the City gets back not what it provides to others with no guarantee of getting anything back. Also increased annual O&M by 300,000 to account for pumping to get the water back. Note the cost of operating this project to give water to other agencies is annual (as in Lochquifer) but the cost of getting water back is only in a drought. Total capital costs estimated at $65 million.

### Water Reuse (Potable)

**Notes:** Total capital cost estimated as $70 million.

### Desal RO

**Notes:** Total capital costs estimated at $70 million, assuming regional cost split.

### Desal FO

**Notes:** Assume 20 year life. Total capital costs $70 million assuming regional cost split.