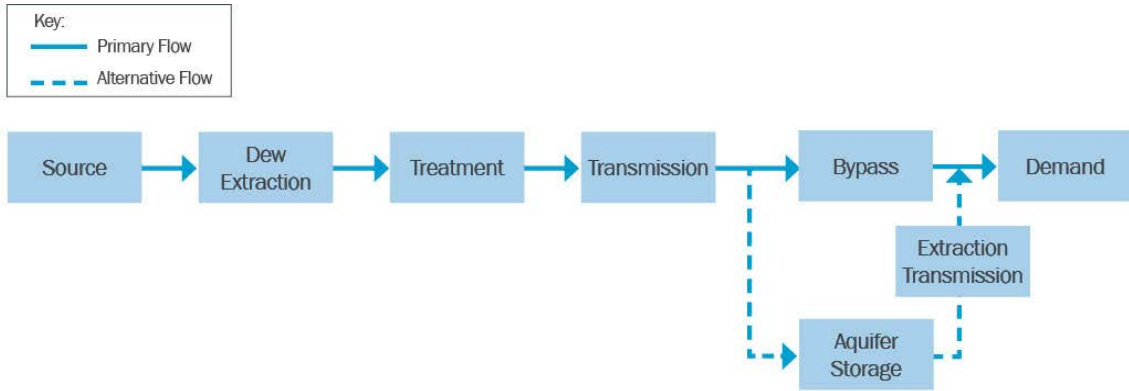


City of Santa Cruz Water Supply Advisory Committee
Solutions Phase -- Technical Summary

Consolidated Alternative 08 - Water From Atmosphere

This alternative would use existing technologies proposed by WCA-38 and WCA-77 to convert water vapor in the air into potable water. This alternative's technology would extract water from the surrounding atmosphere and produce purified water through a filtration system, operated by an engine or motor. The relatively high humidity in Santa Cruz is said to be an "ideal location" for this alternative. This technology can be used for agricultural and residential units if there is sufficient water. The block diagram below presents this alternative schematically. This alternative has several outstanding issues, e.g., assessment of energy use, environmental document completion, and possible permitting through the California Coastal Commission.



SCHEMATIC OVERVIEW - KEY COMPONENTS FOR CA-08 WATER FROM ATMOSPHERE

Description: Extract water from the high humidity environment in Santa Cruz to be used for potable water demands.

Applicable WCAs: WCA - 38 ("Dew Point: Atmospheric Water Generation").

Estimated Annual Yield (million gallons [MG]) 300

Reliability Over Time (seasonal and inter-annual variability)

Costs	Best Estimate	Likely Range	Comments Costs and energy use based on Dew Point literature
Capital Cost (\$M/mgd)	\$300	\$75 to \$300	
Annual Present Value	TBD	TBD	
Capital cost/MG annual capacity	TBD	TBD	
PV Cost/MG			
Energy (KWh/MG)	900,000	600,000 to 912,000	

Key Components

1. Refrigeration/condenser	4. Commercial unit can produce about 3000 gal/day.
2. Filtration/disinfection	5. Average life span of 12-15 years; repairs and part replacement may extend life of technology.
3. Note: residential unit produces about 10 gal/day	6. Website says capable of custom-made units.

Implementation Requirements Summary

Residential unit would require in home plumbing and electrical connection. Commercial units would require similar connections.

Required Land Area (acres) 2

Permitting Summary

Building permit for each installation

EVALUATION

Technical Feasibility

Demonstrated in field.
Technology has been demonstrated to work; however, it has not been tested on this scale nor has the commercial maturity of such a system

Legal Feasibility

Can probably acquire;
Assumes this system would be implemented for commercial and residential use on willing participants.

Regulatory Feasibility

Easy and quick.

Based on the information that Dew Point Manufacturing provided this appears to be feasible.

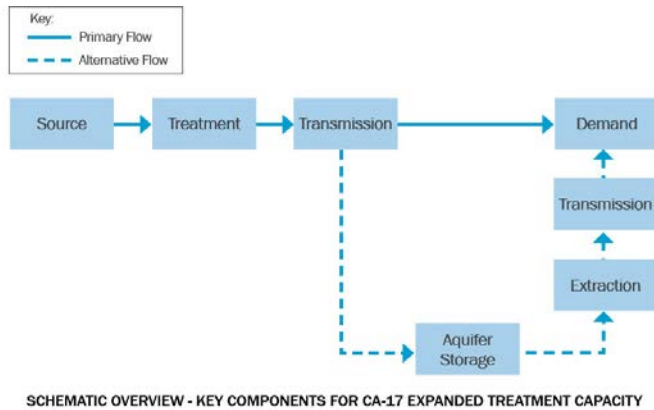
<p><u>Political Feasibility</u> Acceptable now. On a small scale this would be acceptable.</p>
<p><u>Regional Water Benefits</u> Across county. Possibly, if widely implemented</p>
<p><u>Local Economy</u> Slight positive or no effect. Depends on application of technology</p>
<p><u>Energy</u> 5 Would be on a small scale and located at demand users sites; based on the information that DEW Point Manufacturing provided</p>
<p><u>Marine Ecosystem Health</u> Does not harm</p>
<p><u>Freshwater and Riparian Health</u> Does not harm</p>
<p><u>Terrestrial Resources</u> N/A</p>
<p><u>Environmental Profile</u> The environmental profile of this portfolio is acceptable without mitigation.</p>
<p><u>Groundwater Resources</u> Does not affect. May help alleviate groundwater withdrawal if applied on a large scale or at sites dependent on groundwater.</p>
<p><u>Infrastructure Resilience</u> Most challenges well. Assumes located at point user demand site; based on the information that DEW Point Manufacturing provided</p>
<p><u>Supply Reliability</u> Makes system significantly more reliable. Assumes that these units would be widely used</p>
<p><u>Scalability</u> Can scale up. Could be implemented on few to many sites</p>
<p><u>Preserves Future Choices</u> Increases choice</p>
<p><u>Yield</u> 300 MG</p>
<p><u>Operational Flexibility</u> Greatly increases</p>
<p><u>Addresses Peak Season Demand</u> Maybe. Still generally dependent on weather.</p>
<p><u>Implementability</u> Could be implemented with some challenges</p>
<p><u>Supply Diversity</u> Portfolio greatly increases the diversity of Santa Cruz's supply portfolio</p>
<p><u>Sustainability</u> This portfolio is very sustainable although it is very energy intensive</p>
<p><u>Issues to Resolve</u> Need more details on the product and applications in which this technology has been used; potential regulations</p>

**City of Santa Cruz Water Supply Advisory Committee
Solutions Phase -- Technical Summary**

Consolidated Alternative 17 - Expand Treatment Capacity

This alternative would add a new 14-mgd water treatment plant (WTP) (pretreatment for turbidity control, membrane filtration, and UV disinfection near the Tait Street Diversion to produce treated water that the City would pipe directly into the distribution system. The past analyses for this alternative indicate that the alternative would allow an annual water diversion increase of about 560 MG. Confluence modeling will determine actual potential yield.

The alternative has several outstanding issues, e.g., determine the final treatment train (MF would need pretreatment ahead of MF to remove elevated SLR turbidity concentration), preparation and approval of environmental documents, determination if water rights and diversion permits would need modifications (e.g., for transfer of water to ASR), 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 would trigger water rights permit modifications since the place of use would change. For example, see Lochquifer and SCDA alternatives for components needed to transfer water to SqCWD for storage and recovery. The block diagram below presents this alternative schematically.



Description: "Operational performance improvement (incremental supply improvements from current sources included)"

Applicable WCAs: WCA-06 ("McKinney: Expanded Treatment Capacity"), WCA - 27 ("Malone: Enhanced Storage and Recharge").

Estimated Annual Yield (million gallons [MG]) Up to 977 MGY if City perfects its right to SLR diversion with about **560 MGY in new water**. Availability of water may decrease substantially in drier years.

Reliability Over Time (seasonal and inter-annual variability)

Costs	Best Estimate	Likely Range	Comments
Capital Cost	\$86M	\$57M to \$129M	
Annual			
Present Value			
Capital cost/MG annual capacity	\$154,000	\$103,000 to \$231,000	
PV Cost/MG			
Energy (KWh/MG)	15,000	1,400 - 2,000	

Key Components

1. Low head pumping to new MF WTP	4. UV Disinfection and conditioning.
2. Turbidity reduction system to protect MF system from high turbidity and potential fouling organic carbon.	5. Backwash and filter cleaning solution management systems
3. Microfiltration (MF) process	6. Solids management (sewer discharge?)
7. Pump Station to transfer treated water to the City distribution system	

Implementation Requirements Summary

Carry out preliminary planning; prepare, circulate and certify environmental documents; complete design documents; file for and obtain permits; bid and construct improvements and initiate operations

Required Land Area (acres) 1

Permitting Summary

CEQA/NEPA compliance; NWFS and CFDFW sign offs

EVALUATION

Technical Feasibility

Widely used

Legal Feasibility

Can probably acquire.

Actions to perfect water rights; potentially adjust diversion based upon HCP and revised, higher bypass need to be addressed

Regulatory Feasibility

Slow but relatively sure

Political Feasibility

Acceptable now

Regional Water Benefits

3 jurisdictions

Local Economy

Positive local job

Energy

4

Marine Ecosystem Health

Cumulative harm.

Increased GHGs, thus site selection is crucial; salmonoid population

Freshwater and Riparian Health

About as it is now.

Terrestrial Resources

N/A

Environmental Profile

The environmental profile of this portfolio is acceptable with appropriate and effective mitigation

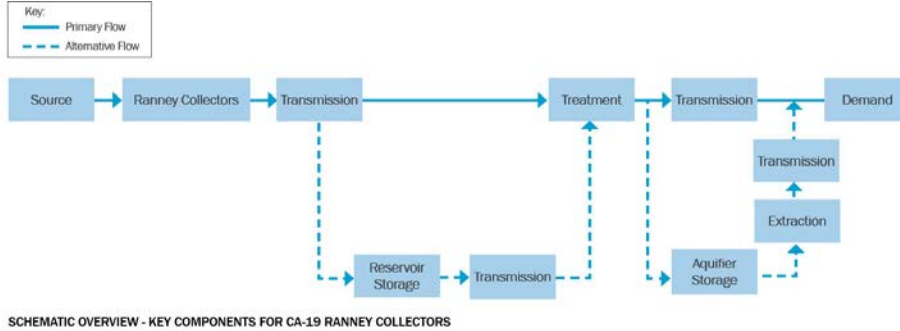
<p><u>Groundwater Resources</u> Depletes resources. Possibly depletes; depends on future of water source availability</p>
<p><u>Infrastructure Resilience</u> Meets most challenges well. New infrastructure with current seismic/building codes</p>
<p><u>Supply Reliability</u> Somewhat more reliable</p>
<p><u>Scalability</u> Can scale up</p>
<p><u>Preserves Future Choices</u> Increases choice</p>
<p><u>Yield</u> 560 MG</p>
<p><u>Operational Flexibility</u> Greatly increases</p>
<p><u>Addresses Peak Season Demand</u> No</p>
<p><u>Implementability</u> Could be implemented with some challenges</p>
<p><u>Supply Diversity</u> Somewhat increases the diversity of Santa Cruz's supply portfolio</p>
<p><u>Sustainability</u> This portfolio is somewhat sustainable</p>
<p><u>Issues to Resolve</u> Right-sizing for new WTP; water rights issues; available flows versus any new fish bypass requirements; possible need for new pipelines for potable water and for excess water used for groundwater recharge. Possibility of using new MF WTP to replace GHWTP; possibility of using extra water for groundwater recharge if the City can resolve legal issues associated with water rights and reach agreement with other local agencies, e.g. SVWD and/or SqCWD.</p>

**City of Santa Cruz Water Supply Advisory Committee
Solutions Phase -- Technical Summary**

Consolidated Alternative 19 -Ranney Collectors

This alternative would 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 CA 17.

The alternative has several outstanding issues, e.g., 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. The block diagram below presents this alternative schematically.



Description: "Operational performance improvement (incremental supply improvements from current sources included)"

Applicable WCAs: WCA-07 ("McKinney: Ranney Collectors on SLR"), WCA-42 ("McGivray: (4,5) Upgrade Water Treatment"), WCA - 48 ("Paul: (12) Diversion Alternatives"), WCA-49 ("Paul: (14) Upgrade Water Intertie"), WCA-57 ("Paul: (23) Loch-Down Alternatives")

WORKING DRAFT

Up to 977 MGY if City perfects its right to SLR diversion with **about 560 MGY in new water**. Availability of water may decrease substantially in drier years.

Estimated Annual Yield (million gallons [MG])

Reliability Over Time (seasonal and inter-annual variability)

Costs	Best Estimate	Likely Range	Comments
Capital Cost	\$16M	\$11M to \$24M	
Annual Present Value			
Capital cost/MG annual capacity	\$30,000	\$20,000 to \$45,000	
PV Cost/MG			
Energy (kWh/MG)	15,000	1,400 - 2,000	

Key Components

1. Ranney collectors installed by Felton Diversion	4
2. Continuous refill of Loch Lomond	5
3	6

Implementation Requirements Summary

Carry out preliminary planning; prepare, circulate and certify environmental documents; complete design documents; file for and obtain permits; bid and construct improvements and initiate operations.

Required Land Area (acres) N/A

Permitting Summary

CEQA/NEPA compliance; NMFS and CFDFW sign offs

EVALUATION

Technical Feasibility

Demonstrated in field

City of Santa Cruz Water Supply Advisory Committee
Solutions Phase -- Technical Summary

Consolidated Alternative 19 -Ranney Collectors

Legal Feasibility

Yes, but some ambiguities

Regulatory Feasibility

Slow but relatively sure

Political Feasibility

Acceptable in 5 years

Regional Water Benefits

Across County

Local Economy

Positive local job

Energy

4

Marine Ecosystem Health

Cumulative harm

Freshwater and Riparian Health

Degraded ecosystem health.
Potential increased diversion and related adverse impacts on fishery.

Terrestrial Resources

N/A

Environmental Profile

The environmental profile of this portfolio is acceptable with appropriate and effective mitigation

Groundwater Resources

Actively restores

Infrastructure Resilience

Many moderately well

Supply Reliability

Makes system significantly more reliable

Scalability

Can scale up

Preserves Future Choices

Increases choice

Yield

560 MG

Operational Flexibility

Greatly increases

Addresses Peak Season Demand

Yes

Implementability

Could be implemented

Supply Diversity

Portfolio significantly increases the diversity of Santa Cruz's supply portfolio

Sustainability

This portfolio is somewhat sustainable.

Issues to Resolve

Site-specific geotechnical conditions; preferred siting for caisson and laterals; resolution of any water rights issues. Possibly use excess water produced by the Ranney collectors, after treatment, for groundwater recharge.