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PSP Table 4 – 2014 IRWM Drought Solicitation Project Summary Table

		Santa Cruz Tait Wells Replacement	Santa Cruz – Improve Potable Water Quality and WS Reliability	SVWD – Conj Use- and Enhanced GW Recharge at Hanson Quarry
Drought Project Type				
D.1	Provide immediate regional drought preparedness	X	X	
D.2	Increase local water supply reliability and the delivery of safe drinking water	X	X	X
D.3	Assist water suppliers and regions to implement conservation programs and measures that are not locally cost-effective			
D.4	Reduce water quality conflicts or ecosystem conflicts created by the drought.	X	X	X
IRWM Project Type				
IR.1	Water supply reliability, water conservation, and water use efficiency	X	X	X
IR.2	Stormwater capture, storage, clean-up, treatment and management			
IR.3	Removal of invasive non-native species, the creation and enhancement of wetlands, and the acquisition, protection, and restoration of open space and watershed lands			
IR.4	Non-point source pollution reduction, management, and monitoring			
IR.5	Groundwater recharge and management projects			X
IR.6	Contaminant and salt removal through reclamation, desalting, and other treatment technologies and conveyance of reclaimed water for distribution to users		X	
IR.7	Water banking, exchange, reclamation, and improvement of water quality		X	X

		Santa Cruz Tait Wells Replacement	Santa Cruz – Improve Potable Water Quality and WS Reliability	SVWD – Conj Use- and Enhanced GW Recharge at Hanson Quarry
IR.8	Planning and implementation of multipurpose flood management programs			
IR.9	Watershed protection and management			
IR.10	Drinking water treatment and distribution	X	X	X
IR.11	Ecosystem and fisheries restoration and protection	X	X	X

PSP Table 4: Drought Explanations and IRWM Project Explanations are provided in each individual Project description

The 3 projects with their associated elements are shown on Figure 3-1 the attached Regional Project Location Map.

Tait Wells Replacement

- Tait Wells

Improve Potable Water Quality and Water Supply Reliability to Address Drought Impacts

- FlexNet Tower Location
- Irrigation Meter Location
- Water Storage Tank Location
- Coast Raw Water Main

Conjunctive Use and Enhanced Groundwater Recharge Project at Hanson Quarry

- Hanson Quarry
- Santa Margarita Groundwater Basin

N

0 0.75 1.5
Miles

Kennedy/Jenks Consultants

Regional Water Management Foundation
2014 IRWM Drought Grant Application
Santa Cruz

Regional Project Location Map

K/J 1468028*00
Figure 3-1

\\SFOISGDATA\Z_Drive\Projects\SantaCruzCo\Events\20140721_DroughtGrantApp\Fig3-1_LocationMap.mxd 7/16/2014

Project 1: Tait Wells Replacement Project

1. Eligible IRWM Project Explanation

The City of Santa Cruz Water Department (City) Tait Wells Replacement Project can be considered as three of the eligible IRWM project types, as described below:

IR.1 Water supply reliability, water conservation, and water use efficiency – The City is solely reliant on local supplies, so utilizing the maximum capacity of all available supplies is critical to supply reliability. The project provides an average capacity of over 400 gpm and a maximum capacity up to 800 gallons per minute (gpm) from the two replacement wells to regain lost capacity, as the existing wells only produce an average capacity of 150 gpm. Additional pumping at the Tait Wells allows the City to better utilize its water right of up to 12.2 cubic feet per second (cfs)/7.9 million gallons per day (MGD) diversion from the San Lorenzo River. In addition, these wells will provide a better water quality than a direct diversion. This additional high quality source of supply (available when the North Coast sources are limited) will improve the overall reliability of the City water supply portfolio and reduce disinfection byproduct (DBP) precursors (present in the San Lorenzo River) that make meeting drinking water standards challenging.

IR.10 Drinking water treatment and distribution – The project provides raw water of lower turbidity and DBP precursors that will facilitate meeting drinking water treatment standards at Graham Hill Water Treatment Plant (GHWTP).

IR.11 Ecosystem and fisheries restoration and protection – The use of wells that pump river underflow rather than the direct diversion to draw water from the San Lorenzo River at Tait Wells is more protective for fish and other aquatic life. In addition, optimizing use of water from Tait Wells retains water in storage in Loch Lomond that is available for release for ecosystem and fisheries benefit during dry years.

2. Project Description (1 page)

Implementing Agency: City of Santa Cruz Water Department (City)

25 word description: The Santa Cruz Tait Wells Replacement Project includes replacement of Tait Wells 1 and 4 with 12"diameter wells drilled to a depth of about 100'.

a. Eligible Drought Project Type Explanation

D.1 Provides immediate regional drought preparedness by replacing two wells that will be able to withdraw water near the San Lorenzo River, even during lower flow periods associated with drought. Optimizing this high quality source water provides regional benefit by retaining water in storage at Loch Lomond to be available as drought conditions continue.

D.2 Increases local water supply reliability and the delivery of safe drinking water by optimizing the diversion rate of this high quality water, allowing storage to remain in Loch Lomond, and improving the reliability of the City water resource portfolio. The diversion through wells provides a lower turbidity water that is associated with lower DBP precursors and therefore aids in the delivery of safe drinking water.

D.4 Reduces water quality conflicts or ecosystem conflicts created by the drought –The use of wells rather than direct diversion reduces the potential impacts to the ecosystem associated with the use of San Lorenzo River water. In addition, the wells are a lower turbidity water that is easier to treat and results in lower DBP production than Loch Lomond, thereby reducing water quality conflicts.

b. How the Project Alleviates Drought Impacts

The region is in the third year of below average rainfall and has a surface water availability of 13% of average through March 2014. Consequently, the City is:

At risk of not meeting existing drinking water demands: Loch Lomond is the City's sole raw water reservoir and is at about 65% capacity as of February 2014 and, with Stage 3 restrictions of 15 to 25%, the reservoir is estimated to be at 45% capacity or 1.2 billion gallons in October 2014, of which 900 million gallons is usable storage. With future Stage 4/5 restrictions of 35 to 45% and resulting 6 MGD demands, this leaves about 150 days (5.3 months) of usable storage assuming no inflow. This poses a significant risk to the City of not meeting existing drinking water demands if the drought were to continue into a fourth year.

At risk of not meeting existing ecosystem water demands: the City requested and received a State Water Board Order for a temporary, 180 day reduction in the downstream release from Loch Lomond from 1.0 cfs to 0.2 cfs. The reduction has saved 64 million gallons Loch Lomond storage over 4 months. Ecosystem demands were already not being met because of dry downstream reaches. Continuous flows of 1 cfs and pulse flows of 6.1 cfs for 12 hours/week (3.9 MG/week) are currently required by fisheries agencies to provide fish passage, but as storage in Loch Lomond declines, these pulse flows may have to be reduced.

Facing Drinking water MCL violations: It is beneficial to use a lower DBP precursor source water, like the Tait Wells, because the total trihalomethane (TTHM) production potential of 140 µg/L from use of Loch Lomond water exceeds the 80 µg/L Maximum Contaminant Limit (MCL).(Ref 1. Santa Cruz AWWA presentation, 2013, slide 6)

Other drought related adverse impacts: Since high quality sources like Tait Wells are not currently optimized, DBP formation potential is increased, requiring reservoir storage to be maintained at 60% capacity to minimize water age and DBP formation; this may increase fire risk because fire storage is not being increased to 90% because of DBP formation. The drought has also resulted in financial challenges because water restrictions have reduced revenues and increased costs.

Expedited funding is needed: This third year of drought has not only brought water supply and water quality challenges but has also resulted in financial challenges for the City. Water conservation has reduced demands from approximately 11 MGD to less than 9 MGD with a commensurate reduction in revenues on the order of $1.1 million (Ref 2. TUCP Cover Report, July 2014, p. 2). In addition, conservation programs have resulted in over $1 million in increased costs for increased staffing and increased treatment needs (Ref 3. 4/8/14 Santa Cruz City Council Report, p.2). The overall impact to the City is over $2 million for this year's drought, to date. Therefore, expedited funding is needed to produce sufficient supply and meet DBP MCLs, considering the City's financial challenges from both lost revenue and increased costs.

3. Project Map

The project map that follows, Figure 3-2, shows location of the Tait Wells as described in Project 1, Section 2 and Attachment 4 – Work Summary.

4. Project 1 Physical Benefits

Overview of Benefits of Project 1

The Santa Cruz Tait Wells Replacement Project would have the following quantifiable physical benefits:

A. Reliably and sustainably produce 230 MGY/706 AFY of high quality water
B. Lower weighted average turbidity with wells (2.4 NTU) as compared to direct diversion/well mix (8.5 NTU)

The project also has several non-quantifiable benefits (which are detailed in Project 1, Section 5), including:

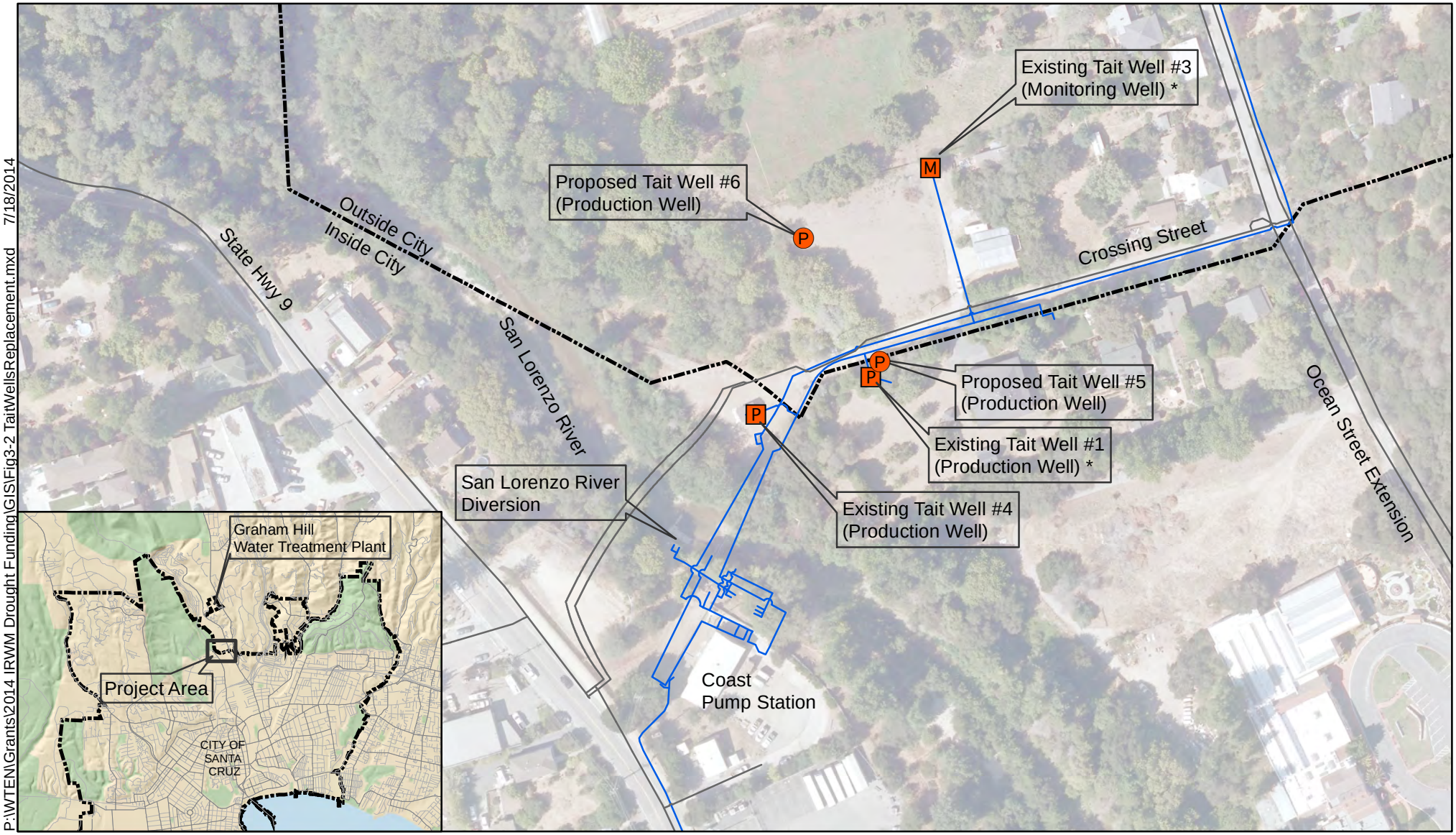
- Enable the City to transition back to the surface water sources sooner after high turbidity rain events (through blending).
- Reduce reliance on Loch Lomond, the sole source of water for the City during rain events (due to high turbidity in other sources).
- New Tait Wells will improve operational flexibility during dry periods, when meeting customer demands while maintaining fish bypass flows is particularly challenging.

Benefit A: Reliably and sustainably produce 230 MGY/706 AFY of high quality water

The construction of 2 new wells will produce 23 MGY/706 AFY from the Tait Wells, which is five times the current production from the four existing wells. For the purposes of Table 5A, a current production of 50 MGY/153 AFY is used for the Without Project condition. The estimated useful life for the wells, pumps and motors is 50 years, since they will be used intermittently. Therefore, a 50 year analysis starting in 2015 is provided in PSP Table 5A that follows.

Benefit B: Lower weighted average turbidity with wells (2.4 NTU) as compared to direct diversion/well mix (8.5 NTU)

The construction of the Tait Wells allows the use of a source water that has a lower average weighted turbidity than direct surface diversions (2.4 NTU vs 8.5 NTU). For the purposes of Table 5B, a weighted turbidity is used for the Without Project condition that reflects the relative proportions of direct diversion as compared to Tait Wells as detailed in Project 1, Section 5.b.ii, The estimated useful life for the wells, pumps and motors is 50 years, since they will be used intermittently. Therefore, a 50 year analysis starting in 2015 is provided in PSP Table 5B that follows.



* To be abandoned with construction of new wells

P Proposed Production Well

P Existing Production Well

M Existing Monitoring Well

Santa Cruz City Limit

Raw Water Main

Treated Water Main

N

0 100 200

Feet

Kennedy/Jenks Consultants

Regional Water Management Foundation
2014 IRWM Drought Grant Application
Santa Cruz

Tait Wells Replacement

K/J 1468028*00

Figure 3-2

Table 5A – Annual Project Physical Benefits			
Project Name: Tait Wells Replacement Project Type of Benefit Claimed: Regained Water Production_____ Units of the Benefit Claimed : AFY Additional Information About this Benefit: This is based on current production of about 50 MGY/153 AFY/95 gpm			
(a)	(b)	(c)	(d)
	Physical Benefits		
Year	Without Project	With Project	Change Resulting from Project (c) - (b)
2014	153	0	-153
2015	153	706	553
2016	153	706	553
2017-2064	153	706	553
2065	153	706	553
Total	7803	35300	27497
Comments: The project provides 23 MGY/706 AFY at an average pumping rate of 434 gpm with a potential maximum pumping rate of 800 gpm.			

Table 5B – Annual Project Physical Benefits			
Project Name: Santa Cruz Tait Wells Replacement Project Type of Benefit Claimed: Improved Average Turbidity with Tait Wells_____ Units of the Benefit Claimed : Nephelometric Turbidity Unit (NTU)_____ Additional Information About this Benefit: The without project condition is an average weighted turbidity that reflects the 153 AFY (22%) at an average 2.4 NTU of Tait Well production compared to the 553 AFY (78%) of average 10.2 NTU direct diversion. This represents average conditions of flow and turbidity.			
(a)	(b)	(c)	(d)
	Physical Benefits		
Year	Without Project	With Project	Change Resulting from Project (c) - (b)
2014	8.5	0	-8.5
2015	8.5	0	-8.5
2016	8.5	2.4	-6.1
2017-2064	8.5	2.4	-6.1
2065	8.5	2.4	-6.1
Comments:			

5. Technical Analysis of Physical Benefits Claimed

a. Technical Analysis and Description of Physical Benefit A: Reliably and sustainably produce 228 MGY/706 AFY of high quality water

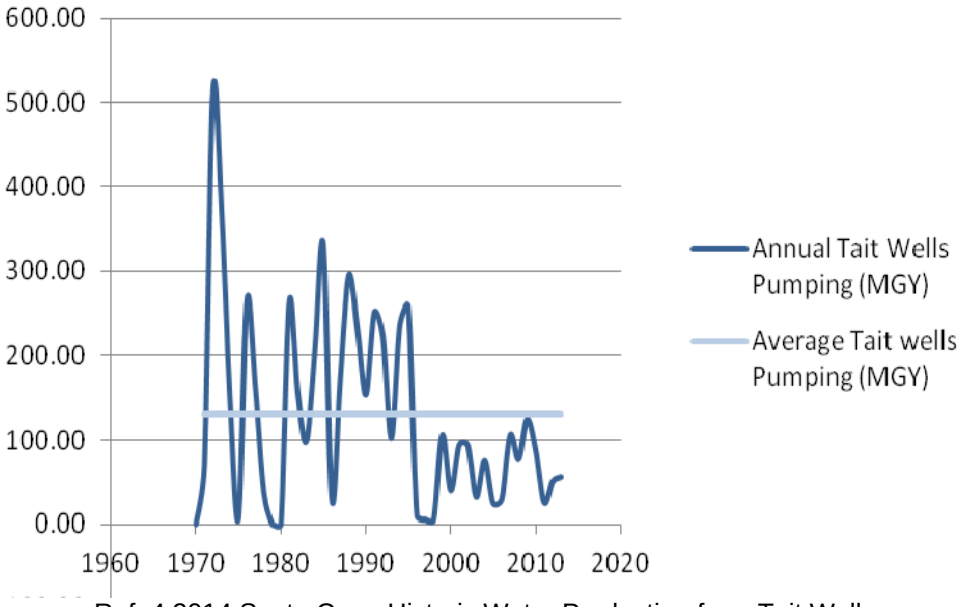
i. List any recent and historical conditions that provide background for the benefit being claimed (i.e., recent water shortages, loss of habitat or ecosystem function, or water quality problems).

As discussed in Project 1, Section 2, over the last three years of drought, reductions in rainfall have significantly reduced available water supply to the City requiring the City to maximize available sources, especially those with high quality water when available.

ii. Provide a description and estimates of without-project conditions (i.e., the level of the physical benefit in the future, without the project, but with other projects that might be planned).

Without the Tait Wells Replacement Project, production from the existing Tait wells will be limited to 50 MGY/153 AFY, and Loch Lomond water with higher DBP precursors will be used more frequently, risking TTHM MCL violations and accelerating the drawdown of the critical drought supply in the reservoir. This will result in an additional 178 MGY/543 AFY (228 MGY/706 AFY minus 50 MGY/153 AFY) of water in storage left in Loch Lomond, the sole City raw water reservoir, for drought/dry season use. Thus, the Tait Well project will increase the yield and reliability of the water supply portfolio. In addition, operation of the surface water diversion is much more challenging during low stream flow conditions without the project, as it is very difficult to match pumping of in stream flows for domestic use while also ensuring adequate fish bypass flows.

iii. Provide a description of methods used to estimate physical benefits.
The physical benefits were estimated using the annual production data for the Tait Well field (Ref 4. Santa Cruz Production Data, 2014). There have been substantial fluctuations in annual production depending hydrologic conditions, conditions of wells, and availability of other sources. There are several years where no production occurred, and other years (such as 1985) when production exceeded 300 MGY/921 AFY, as shown on the graph below. Production has declined significantly since the mid 1990s as the age and poor construction methods of the wells (built in the 1920s) failed. Based on the current configuration of the system, availability and reliability of other water sources, and number of wells currently planned, the projected annual yield is anticipated to be 250 MGY/767 AFY, roughly 5 times the currently annual production. 228 MGY/706 AFY is the 5-year average produced during the last extended drought period of 1988 to 1992, and represents a realistic and sustainable yield from the well field.



Ref. 4 2014 Santa Cruz, Historic Water Production from Tait Wells

The methods used to monitor the physical benefits of water production at the Tait Wells is pump discharge water meter data that are collected from the wells.

iv. Provide a description of all new facilities, policies, and actions required to obtain the physical benefits.

Production of 228 MGY/706 AFY of well water will require installation of two 100' deep 12" diameter wells, as well as new pumps, motors, and controls for both wells and a new electrical condition for one of the wells.

v. Provide a description of any potential adverse physical effects as a result of the project.

The potential adverse effects as a result of the project are temporary construction effects, such as additional traffic and noise from well drilling equipment and other construction equipment. There are no permanent adverse physical effects of the project that cannot be mitigated. A Notice of Exemption for this project was filed in May 2014 as it is a replacement of an existing facility.

b. Technical Analysis and Description of Physical Benefit B: Lower weighted average turbidity with wells (2.4 NTU) as compared to direct diversion/well mix (8.5 NTU)

i. List any recent and historical conditions that provide background for the benefit being claimed (i.e., recent water shortages, loss of habitat or ecosystem function, or water quality problems).

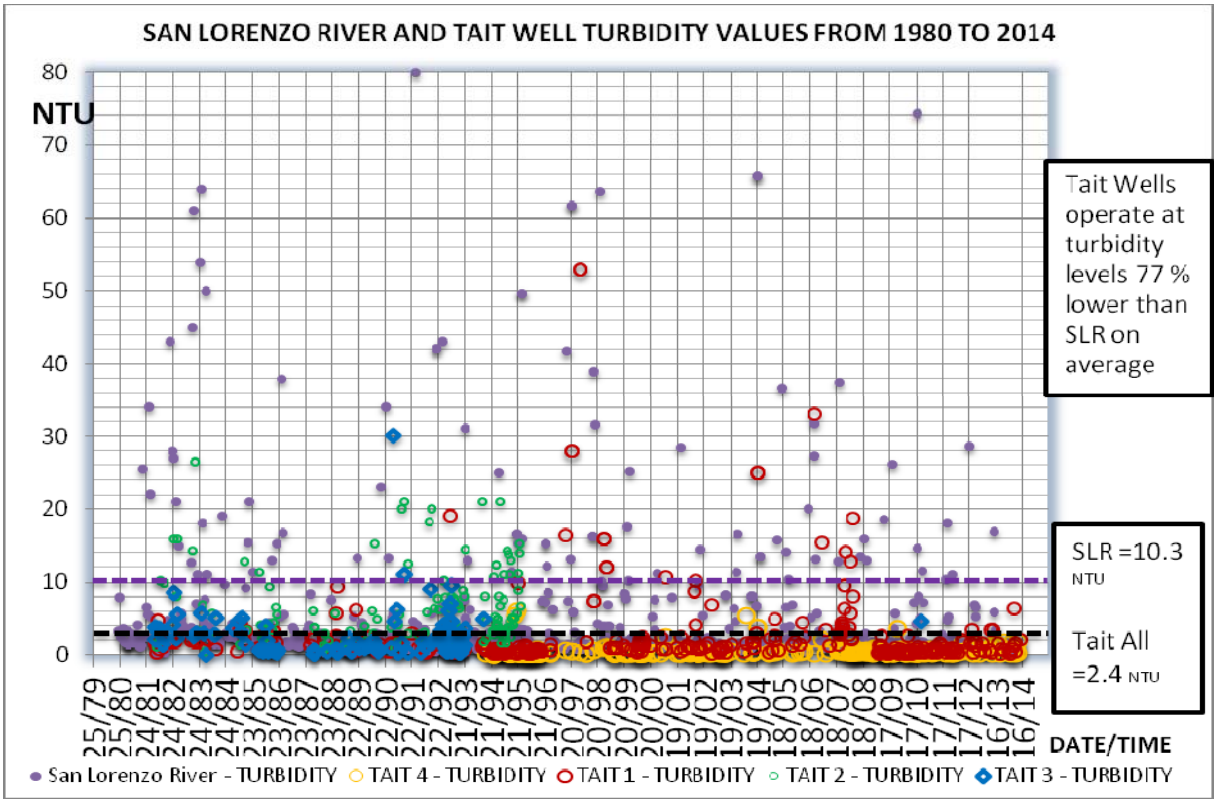
As highlighted in Project 1, Section 2, turbidity issues limit the use of the surface diversion. In addition, turbidity is associated with higher disinfection by product (DBP) precursors that are found in both surface diversions but also from Loch Lomond.

ii. Provide a description and estimates of without-project conditions (i.e., the level of the physical benefit in the future, without the project, but with other projects that might be planned).

Without the Tait Wells Replacement Project, the City cannot maximize the use of the San Lorenzo River water right because surface water diversions cannot occur during high turbidity events and the Tait Wells pumping will be limited to 50 MGY/153 AFY. Loch Lomond water with higher DBP precursors will need to be used, resulting in elevated DBP levels, higher health risks faced by the public, and increased likelihood of MCL violations for TTHMs. The Without Project condition for turbidity is a weighted average turbidity of 8.5 NTU that reflects average conditions of flow and turbidity - 153 AFY of 2.4 NTU Tait Well water plus 553 AFY of 10.2 NTU direct diversion water. Actual conditions are of much higher variability in both flows and turbidities.

iii. Provide a description of methods used to estimate physical benefits.

The recent and historical conditions for the project is the comparison of historic turbidity values between the San Lorenzo River direct diversion and the Tait Wells, as shown on the figure below (Ref.4, Santa Cruz Turbidity Data, 2014) . The San Lorenzo River (solid blue) has more variable turbidity values that range from less than 4 up to 80 NTU, while turbidity in the Tait Wells varies from around 1 NTU up to 52 NTU. The average Tait Wells turbidity of 2.4 NTU (dotted black line) is 77% lower than the average San Lorenzo River turbidity of 10.3 NTU (dotted purple line). As discussed in Item ii, a weighted average turbidity of 8.5 NTU is used in the Without Project condition. The City is able to use San Lorenzo River water only when the turbidity is less than 20 NTU, as higher turbidity water cannot be effectively treated at GHWTP.



The method used to monitor the physical benefits of lower turbidity water at the Tait Wells as compared to the San Lorenzo River is the turbidity measurements at both locations.

iv. Provide a description of all new facilities, policies, and actions required to obtain the physical benefits.

Production of 228 MGY/706 AFY of lower turbidity well water will require installation of two 100' deep 12" diameter wells, as well as new pumps, motors, and controls for both wells and a new electrical condition for one of the wells.

v. Provide a description of any potential adverse physical effects as a result of the project.

The potential adverse effects as a result of the project are temporary construction effects, such as additional traffic and noise from well drilling equipment and other construction equipment. There are no permanent adverse physical effects of the project that cannot be mitigated. A Notice of Exemption for this project was filed in May 2014 as it is a replacement of an existing facility.

c. Non-Quantifiable Benefits

In addition to the quantitative physical benefits described above, the Tait Wells would provide three non-quantitative benefits:

- Enable the City to transition back to the surface water sources sooner after high turbidity rain events, by blending otherwise untreatable turbid surface water with high quality well water, resulting in a blend of water the GHWTP is capable of treating.

- Reduce reliance on Loch Lomond, the sole source of water for the City during rain events (due to high turbidity in other sources), which improves system reliability and redundancy during the winter and preserves water in storage for dry season/drought.

- New Tait Wells will improve operational flexibility during dry periods because meeting customer demands while maintaining fish bypass flows is particularly challenging. The City voluntarily allows some water to flow past the main point of diversion to support downstream habitat, and to provide spawning and outbound migration flows for special status species such as steelhead trout and Coho salmon. The downstream bypass flows are determined in consultation with State and Federal fisheries agencies; It is challenging to simultaneously meet customer demand and maintain specified bypass flows because the City's Tait surface water diversion pump station is not presently configured to pump over the entire flow range needed to optimize surface water diversions. Because the fish bypasses flows take priority over meeting system demands, the City routinely allows more water to flow downstream than is actually required because of the limited number and size of pumps available. The water lost downstream is presently made up from increased use of Loch Lomond for municipal supplies. By augmenting the surface water diversions with well water, the City would better be able to align surface water diversions, fish bypass flows, and meet customer demands while reducing the use of water from Loch Lomond, which both preserves storage for drought/dry season and reduces use of higher DBP precursor supply.

6. Cost Effective – Analysis

Table 6a – Cost Effective Analysis

Project name: _Santa Cruz Tait Wells Replacement

Question 1	Types of benefits provided as shown in Table 5 Benefit A: Reliably and sustainably produce 230 MGY/706 AFY of high quality water Beneift B: Lower weighted average turbidity with wells (2.4 NTU) as compared to direct diversion/well mix (8.5 NTU)
Question 2	Have alternative methods been considered to achieve the same types and amounts of physical benefits as the proposed project been identified? Yes.
	If no, why? Not Applicable.
	If yes, list the methods (including the proposed project) and estimated costs.

Alternatives Description	Estimated Costs (Capital and O&M)	Describe studies, plans, or documents that identify alternatives and costs of those alternatives
Project 1: Tait Wells Replacement	$840,500 in capital costs; operations costs are for pumping	2014 Santa Cruz Estimate for Attachment 5
Alternative A: Radial Wells	Ranney – $11.2 m in 2014 capital costs. Operations are the same as wells but maintenance is more complex and costly than with conventional wells and requires specialty contractors that are not located in CA	2009 – Wood Rodgers Sanding study – see p. 74 of pdf
Alternative B: Well at alt location	$4.8 m in 2014 capital costs for new 210 gpm (ave) 640' deep 16-inch diameter well and Fe/Mn treatment, O&M will be higher as the well is 540'deeper and because there is GW treatment O&M	See Beltz 12 Phase 1 Project Summary Report and Phase 2 Treatment Work Plan (2010) – to be used 130 days per year during dry and critically dry years and need to monitor Soquel Creek base flows

The proposed project includes the construction of two replacement wells for a total capital cost of $840,500 (2014). O&M costs are expected to be comparable for the project and the alternatives.

Question 3	If the proposed project is not the least cost alternative, why is it the preferred alternative? Provide an explanation of any accomplishments of the proposed project that are different from the alternative project or methods. The project is the least cost alternative. As shown in Table 6a, Question 2, two alternatives have been considered: (1) a radial well design that would cost an additional $10.36 million to construct and cost more to operate than the Tait wells, or (2) the placement of wells at an alternative location that would cost $4 million more and provide a smaller yield than the Tait wells. Additional details are provided below.

Comments:

Alternative A – Additional Narrative

Ranney-type lateral collector wells (shown in Figure 12 below from Ref. 6, p.36) were included in the 2009 Wood Rodgers Final Alternative Evaluation Report for Tait Street Sanding Study. Ranney collectors are more complex to construct and maintain than conventional vertical wells and would include a caisson wet well, influent piping laterals, vertical turbines pumps, top set motors, valving, manifolds and piping, control enclosures on top of the caissons housing electrical switchgear and MCCs, and minimal site improvements. Piping and electrical service to the Ocean Street extension

site is included with this alternative. The top of the caisson wet well would extend above ground with adequate freeboard above the flood plain to protect electrical equipment and motors. The wells would not achieve the full diversion entitlement per the Ranney Collector evaluation included in this report. They would, however, be used to supplement the gravity diversion or provide water when surface water conditions are poor as with the Tait wells. The Ranney collector would operate in conjunction with the gravity diversion to achieve the full diversion entitlement. P. 74 of the Wood Rodgers study (Ref. 6) provides the 2009 cost of the project including multipliers was $10.43 which was escalated to 2014 to be $11.2 million (compared to the capital cost of developing the Tait Wells of $0.84 million). While Operation and Maintenance costs were not included, Ranney type wells are comparable in operations with vertical wells but have higher maintenance costs because specialty contractors that are not located in California are needed to provide maintenance services.

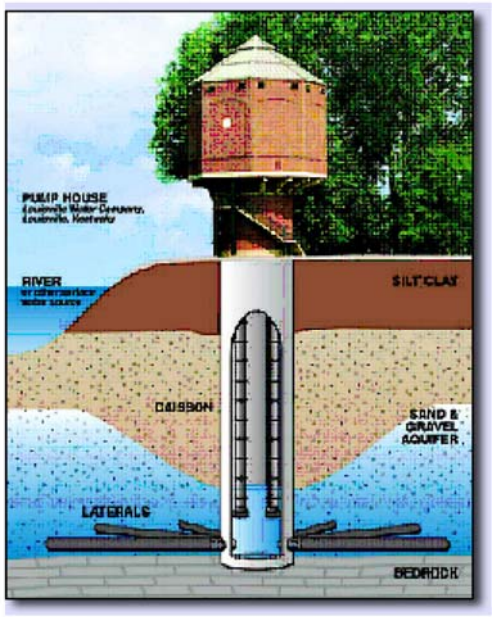


Figure 12.
Ranney Collector

Alternative B – Additional Narrative

In 2010, the City prepared two documents that describe and provide costs to replace an existing well with a new Beltz Well 12 at the Beltz well field. The Phase 1 document (Ref. 7, Preliminary Project Summary Report, Beltz Well 12- Phase 1, p.1) described the construction of a new well that is 700' deep and a target production of 210 gpm. The Phase 2 document (Ref. 8, Preliminary Summary Report Beltz Well 12- Phase -2, p.2) describes an iron and manganese well head treatment plant.

The well would be operated at a lower pumping rate, around 210 gpm, for a maximum of 130 days and would be a City back-up supply for dry or critically dry years (ref 7, p. 3). The pumping restrictions are in order to ensure that baseflow in Soquel Creek is not impacted and to not exacerbate seawater intrusion that occurs in wells closer to the coast. In total, the well would provide about 40 MGY/125 AFY. While this project is not truly comparable to the Tait Well replacement because it is a deeper well that will be operated to produce less water, it provides a comparison for a more expensive, less productive alternative.

Project 1 References

1. AWWA DBP Study Presentation, Santa Cruz, 2013.

2. Temporary Urgency Change Petition Cover Letter from Santa Cruz to SWRCB, July 2014

3. Santa Cruz City Council Staff Report, 4/8/14.

4. Tait St Annual Production, Santa Cruz, 2014

5. Turbidity and other data, Santa Cruz 2014

6. Tait St Diversion Sanding Study, Wood Rodgers, 2009.

7. Beltz Well 12 Phase 1 –Well Construction Project Summary, Santa Cruz, 2010

8. Beltz Well 12 Phase 2 – Water treatment Plant Project Summary, Santa Cruz, 2010.

These references files are found in the file named Att3_DG_ProJust_2of4.pdf.

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Project 2: Improve Potable Water Quality and Water Supply Reliability to Address Drought Impacts

1. Eligible IRWM Project Explanation

The City of Santa Cruz Water Department (City) project to Improve Potable Water Quality and Water Supply Reliability to Address Drought Impacts can be considered as five of the eligible IRWM project types, as described below:

IR.1 Water supply reliability, water conservation, and water use efficiency – The City is solely reliant on local water supplies; therefore, water supply reliability is critical since there is no infrastructure to import water and limited ability to deliver emergency supplies between agencies. The project provides vastly improved water metering via radio reading and a base station that will allow up to hourly instead of bimonthly monitoring for the City's 34 agricultural irrigation customers on the 16.7 mile (88,000 linear foot [LF]) North Coast pipeline. The more frequent meter readings will allow rapid identification and repair of pipeline leaks and unauthorized use (reducing waste and illegal connections) and will also allow coordinated agricultural delivery. Past leaks on the order of 2.2 AF/day have gone undetected for months, with water losses amounting to 150 AF or more. Coordinating agricultural delivery to allow at least 600 gpm in the North Coast pipeline is critical to maintaining sufficient suction-side pressure to allow the City to reliably pump the highest quality water in their portfolio, thus avoiding DBP problems in their delivered water. The City is primarily a municipal and industrial water supplier with limited agricultural customers and therefore does not meet the irrigated acres threshold to prepare an Agricultural Water Management Plan. However, the City will benefit from implementing radio read meters, which are an agricultural Efficient Water Management Practice.

IR. 6 Contaminant and salt removal through reclamation, desalting, and other treatment technologies and conveyance of reclaimed water for distribution to users – As the highest quality water sources are not available to the City at all times, the installation of aerators, which are a demonstrated treatment technology to minimize DBP formation by 40 to 50%, in 5 potable water storage tanks is necessary to meet drinking water standards while preserving optimal storage levels in tanks for fire service. Increased wildfires are a risk in portions of the City service area (especially during drought), and fire storage is essential to public safety.

IR.7 Water banking, exchange, reclamation and improvement of water quality – The radio base station, irrigation radio meter read, and water storage tank aerators together would improve water quality for the City's drinking water customers by maximizing the delivery of the highest quality North Coast sources and minimizing DBP formation in the water storage tanks.

IR.10 Drinking water treatment and distribution – The radio base station and irrigation radio meter read allows the use of the maximum quantity of the highest quality North Coast source, which is the easiest to treat and minimizes DBP formation. The water storage tank aerators minimize DBP formation in the distribution system, which has a higher probability of forming during drought because the GHWTP treats a higher percentage of Loch Lomond source water. As discussed in Project 1. Loch Lomond is the sole raw water dry season/drought storage facility available to the City and is also used in the wet season (to avoid high turbidity events in the San Lorenzo River). However, Loch Lomond has higher total organic carbon, a DBP precursor, than the other City water sources.

Installing aerators in the 5 large water distribution storage tanks would greatly improve potable water quality in the distribution system during drought. During normal conditions when surface flows are higher, DBPs are generally managed through treatment and aerators are only run when needed. However, during drought, aerators are an important step to maintain drinking water quality because high quality source water is not available and storage times are increased due to water use curtailments.

IR.11 Ecosystem and fisheries restoration and protection – The construction of the aeration facilities to better treat and manage DBPs would allow the City to use more Loch Lomond water while allowing other drought-limited flowing sources to remain available for fisheries and ecosystem protection. The aeration facilities would provide the City with an additional tool during the drought to balance the challenges of supply shortages, regulatory stream flow requirements for protected species, and potable water quality for its customers.

2. Project Description (1 page)

Implementing Agency: City of Santa Cruz Water Department (City)

25 word description: The Santa Cruz Project includes a radio base station, equipment for radio meter reading at 34 irrigation locations, and aerators at 5 large storage tanks.

a. Eligible Drought Project Type Explanation

D.1 Provides immediate regional drought preparedness by (1) providing facilities to optimize municipal use of highest quality local water while allowing agricultural customers in the region to grow crops, and (2) using drought storage from Loch Lomond while minimizing DBP formation in the distribution system.

D.2 Increases local water supply reliability and the delivery of safe drinking water by installing a radio base station and 34 radio read meters for agricultural customers, which will allow 600 gpm flows to remain in the North Coast Pipeline and allow pumping of high quality water with lower DBP formation potential. Reservoir aeration facilities will further improve supply reliability by maximizing use of the drought storage in Loch Lomond while maintaining the safety of the drinking water by reducing DBP formation in the distribution system.

D.4 Reduces water quality conflicts or ecosystem conflicts created by the drought by maximizing the use of the highest quality water when available and also minimizing the DBP formation impacts of using Loch Lomond. The City surface water sources have regulated flows for endangered Coho salmon and threatened steelhead trout, and the project would reduce ecosystem conflicts of drought by maintaining in-stream flows.

b. How the Project Alleviates Drought Impacts

The region is in the third year of below average rainfall and has a surface water availability of 13% of average through March 2014. Consequently, the City is:

At risk of not meeting existing drinking water demands: Loch Lomond is the City's sole raw water reservoir and is at about 65% capacity as of February 2014 and, with Stage 3 restrictions of 15 to 25%, Loch Lomond is estimated to be at 45% capacity or 1.2 billion gallons in October 2014, of which 900 million gallons is usable storage. With future Stage 4/5 restrictions of 35 to 45% and resulting 6 MGD demands, this leaves about 150 days (5.3 months) of usable storage assuming no inflow. This poses a significant risk to the City of not meeting existing drinking water demands if the drought were to continue into a fourth year.

At risk of not meeting existing ecosystem water demands: the City requested a Temporary Urgency Change Petition (TUCP) and received a State Water Board Order for a temporary, 180 day reduction in the downstream release from Loch Lomond from 1.0 cfs to 0.2 cfs. The reduction has saved 64 million gallons Loch Lomond storage over 4 months. Ecosystem demands were already not being met because of dry downstream reaches. Continuous flows of 1 cfs and pulse flows of 6.1 cfs for 12 hours/week (3.9 MG/week) are currently required by fisheries agencies to provide fish passage, but as storage in Loch Lomond declines, these pulse flows may have to be reduced.

Facing Drinking water MCL violations – Loch Lomond water has the potential to develop TTHM potential of 140 µg/L in water storage tanks as compared to the maximum contaminant level (MCL) of 80 µg/L (Ref.1 Santa Cruz AWWA presentation, 2013, slide 6). Therefore, with increased usage of stored Loch Lomond water in drought, the potential for TTHM MCL violations increases significantly.

Other drought related adverse impacts - The City has reduced distribution system flushing to save water which increases DBP levels and has also kept water tanks at minimum levels, limiting fire storage, to reduce DBP formation. The drought has also resulted in financial challenges in that water conservation has reduced revenues and increased costs.

Expedited funding is needed. This third year of drought has not only brought water supply and water quality challenges, but has also resulted in financial challenges for the City. Water conservation has reduced demands from approximately 11 MGD to less than 9 MGD with a commensurate reduction in revenues on the order of $1.1 million (Ref.2 TUCP Cover Report, July 2014, p.2). In addition, conservation programs have resulted in over $1 million in increased costs for increased staffing and increased treatment needs (Ref. 3 4/8/14 Santa Cruz City Council Report, p.2). The overall impact to the City is over $2 million this water year to date. Therefore, expedited funding is needed to meet DBP MCLs and to optimize supply delivery to both agricultural and domestic customers, given the City's financial challenges from both lost revenue and increased costs.

3. Project Map

The project maps that follow shows location of the automated meter read and radio tower (figure 3-3) and aerators (Figure 3-4) which are the elements of the project to Improve Potable Water Quality and Water Supply Reliability to Address Drought Impacts as described in Project 2, Section 2 and Attachment 4 – Work Summary.

4. Project 2 Physical Benefits

Overview of Benefits of Project 2

The Santa Cruz Project to Improve Potable Water Quality and Water Supply Reliability to Address Drought Impacts would have the following quantifiable physical benefits:

A. Aerators would reduce DBP formation in 15.5 million gallons of storage by 40 to 50% (from 70 µg/L to 28 to 35 µg/L)
B. Radio meter reading would save 63 AFY from North Coast Pipeline leakage reduction

The project also has several non-quantitative benefits (which are detailed in Section 5), including:

- Water savings and optimizing flows for fish protects the $3 million in investments made in the 60 to 80 fisheries restoration projects.
- Reduced energy usage and greenhouse gas (GHG) emissions from not driving to read meters.
- Automatic meter read data and existing FLEXNET system will allow development of future strategies to optimize both irrigation use and the City pumping from North Coast Pipeline.
- The addition of aerators will allow the City to maintain higher water levels in the storage tanks for fire protection and emergency storage.
- The addition of aerators avoids system flushing for DBP reduction and thus saves water.
- The project provides some overall customer benefits such as aesthetic improvements to the water.

P:\WTEN\Grants\2014 IRWM Drought Funding\GIS\Fig3-3 IrrigationMeters.mxd 7/18/2014

North Coast Irrigation Customer Meter

Santa Cruz City Limit

Coast Raw Water Main

Raw Water Main

Treated Water Main

N

0 0.5 1

Miles

Kennedy/Jenks Consultants

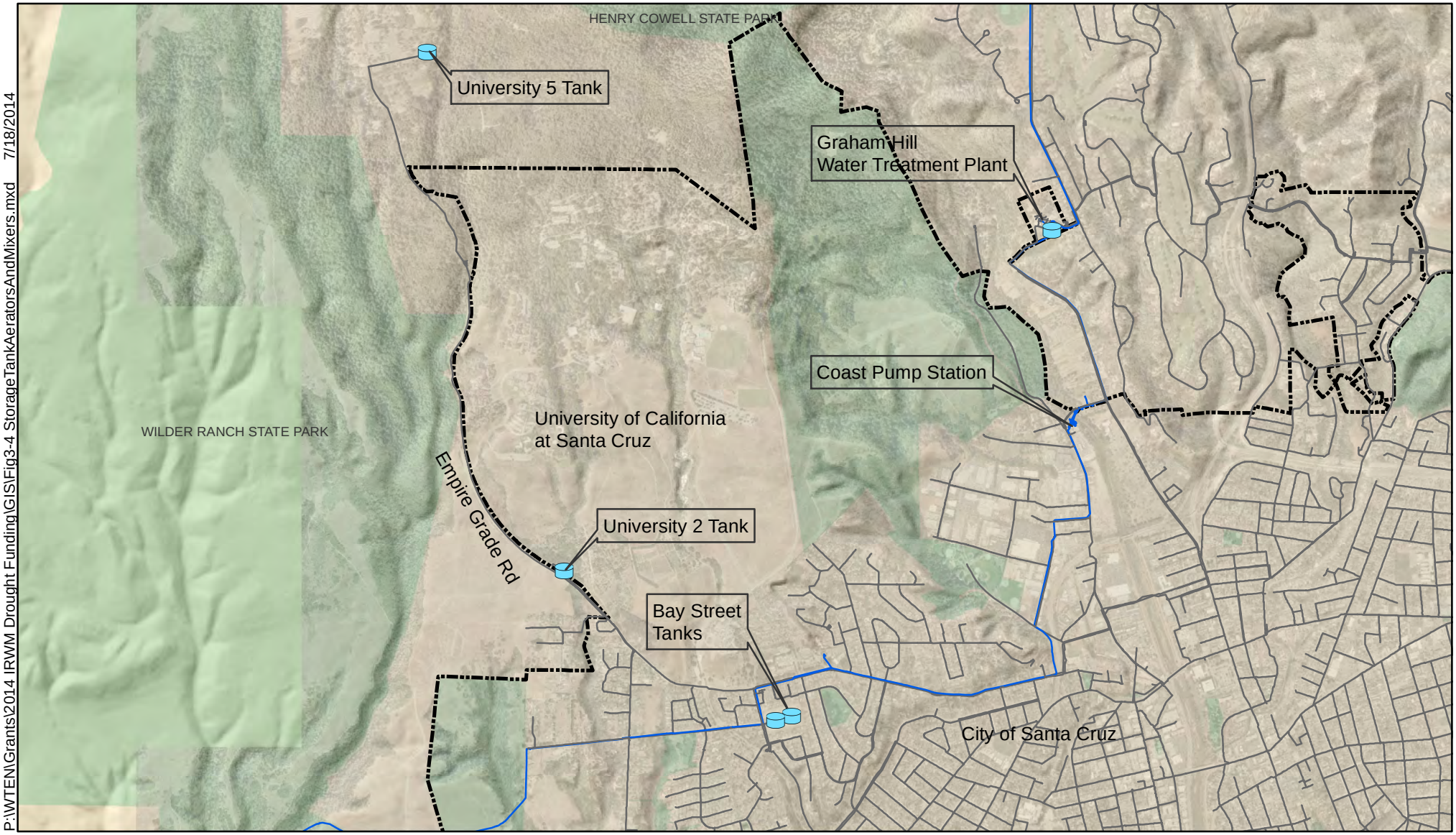
Regional Water Management Foundation
2014 IRWM Drought Grant Application
Santa Cruz

Improve Potable Water Quality and Water Supply Reliability to Address Drought Impacts

Irrigation Meters

K/J 1468028*00

Figure 3-3



P:\WTEN\Grants\2014 IRWM Drought Funding\GIS\Fig3-4 StorageTankAeratorsAndMixers.mxd 7/18/2014

Water Storage Tank

Santa Cruz City Limit

Raw Water Main

Treated Water Main

N

0 0.5 1

Miles

Kennedy/Jenks Consultants

Regional Water Management Foundation
2014 IRWM Drought Grant Application
Santa Cruz

Improve Potable Water Quality and Water Supply Reliability to Address Drought Impacts

Storage Tank Aerators and Mixers

K/J 1468028*00

Figure 3-4

Benefit A: Aerators would reduce DBP formation in 15.5 million gallons of storage by 40 to 50%

The installation of aerators in 5 large water storage tanks that total 15.5 million gallons of storage is estimated to reduce DBPs by 40 to 50% from a tank baseline of 70 µg/L to 28 to 35 µg/L. DBPs often increase in the distribution system from long term storage in tanks further increasing the risk of violating TTHM MCLs. For the purposes of PSP Table 5A, a DBP concentration of 70 µg/L is used in the Without Project condition. The estimated useful life for the aerators is 20 years; therefore, a 20 year analysis starting in 2016 is provided in PSP Table 5A that follows.

PSP Table 5A – Annual Project Physical Benefits

Project Name: SCWD Drought Mitigation Project to Improve Potable Water Quality and Protect Ecosystem for Fisheries

Type of Benefit Claimed: 40 - 50 % DBP Reduction

Units of the Benefit Claimed : ug/L

Additional Information About this Benefit:

(a)	(b)	(c)	(d)
	Physical Benefits		
Year	Without Project	With Project	Change Resulting from Project (c) - (b)
2014	70	0	-70
2015	70	28 - 35	42-35
2016	70	28 - 35	42-35
2017-2034	70	28 - 35	42-35
2035	70	28 - 35	42-35

Comments: These DBP reduction estimates are based on extensive study work conducted by Santa Cruz in the Bay Street Reservoir and do NOT include the anticipated increases to 140 ug/L for when a greater proportion of Loch Lomond may be used later in 2014 and possibly 2015 if the drought continues.

Benefit B: Radio meter reading would save 63 AFY from North Coast Pipeline leakage reduction

The meter automation installation would save up to 63 AFY from major leaks that occur every year. The increase in meter reading frequency from bi-monthly to hourly would allow leaks to be discovered and pinpointed more quickly on the 88,000 LF North Coast pipeline, about half of which is at least 50 years old. The estimated useful life for the radio read meters and base station is 20 years; therefore, a 20 year analysis starting in 2016 is provided in PSP Table 5B that follows.

PSP Table 5B – Annual Project Physical Benefits			
Project Name: SCWD Drought Mitigation Project to Improve Potable Water Quality and Protect Ecosystem for Fisheries Type of Benefit Claimed: Water Savings from North Coast Pipeline leakage reduction _____ Units of the Benefit Claimed : Acre-feet per year (AFY)_____ Additional Information About this Benefit: This benefit is reduced from the historical leak rates as 3.5 miles of 16 total miles of pipeline have been replaced.			
(a)	(b)	(c)	(d)
	Physical Benefits		
Year	Without Project	With Project	Change Resulting from Project (c) - (b)
2014	0	0	0
2015	0	0	0
2016	0	63	63
2017-2034	0	63	63
2035	0	63	63
Comments: Meter automation water savings estimate is based on locating and repairing an average of 2.5 leaks/year of average leakage rate of 100 gpm for a 2-month duration based on bi-monthly meter reads			

5. Technical Analysis of Physical Benefits Claimed

a. Technical Analysis and Description of Physical Benefit A – Aerators would reduce DBP formation in 15.5 million gallons of storage by 40 to 50%

i. <u>List any recent and historical conditions that provide background for the benefit being claimed (i.e., recent water shortages, loss of habitat or ecosystem function, or water quality problems).</u>

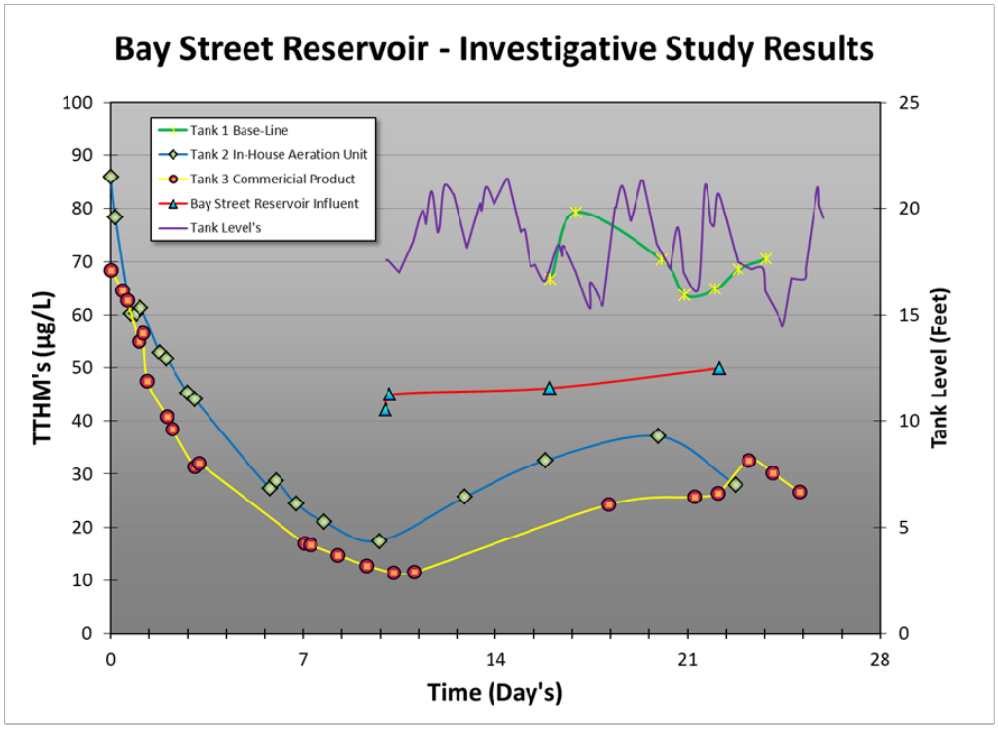
As discussed in Project 2, Section 2, over the last three years of drought, DBP formation potential has increased as a result of a longer residence time in the water distribution system and increased use of lower quality source water from Loch Lomond as higher quality sources are less available.

ii. <u>Provide a description and estimates of without-project conditions (i.e., the level of the physical benefit in the future, without the project, but with other projects that might be planned).</u>

Without the meter automation installation, a higher quantity of Loch Lomond water would be used as higher quality North Coast water would not be available. Without the aeration project, DBPs in the distribution system will rise, which risks of exceedance of the Locational Running Annual Average (LRAA) for TTHM in the distribution system. The City could conduct additional distribution flushing if CDPH requires that to meet the LRAA, but flushing would waste water; otherwise, the City will be required to issue 40,000 quarterly customer notifications if a violation occurs and could incur a CDPH fine.

iii. <u>Provide a description of methods used to estimate physical benefits.</u>

The methods used to estimate the benefit of DBP reduction include data regarding the formation of DBPs in the distribution system, especially in large water storage tanks or pipeline dead ends. The City conducted a series of studies in 2013 to evaluate methods of DBP reduction in the Bay Street Reservoirs, as shown on the graph below.



(Ref.1, Santa Cruz AWWA 2013 Presentation, slide 20)

The individual tanks were filled with highest quality source water (influent quality of 45 – 50 µg/L TTHM) and were allowed to sit without any additions/withdrawals for 7 days, resulting in the Day 0 starting conditions of 70 – 85 µg/L. At Stage 3 demand restrictions, water age in tanks ranges from 8 to 9 days and at Stage 5 restrictions it is expected to be as high as 12 days. Reductions from the various storage tank aeration methods tested reduced TTHMs from around 85 µg/L (which exceeds the MCL) to an average of around 20 µg/L. A more conservative 40 to 50% reduction from 70 µg/L to 28 to 35 µg/L is used for the benefits table. These reduced DBPs in the storage tanks are critical to meeting the MCL in the distribution pipelines, as described below.

DBPs in dead end distribution pipelines, which draws on water from the water storage tanks and further extends water age, is based on the City's LRAA data. The LRAA is developed from TTHM samples collected at 6 out of 9 sites under the Stage 2 DBP rule from 10/1/12 through 5/12/14 are summarized in Table A that follows. Stage 2 DBP compliance locations are selected to represent the oldest water age in the distribution system and the sample sites are in the zones impacted by the 5 tanks. The LRAA is an average of 4 quarters of data. There are several instances of DBP at or within 5 µg/L of the 80 µg/L MCL within individual samples which collectively meet the MCL based on the LRAA. These data were collected prior to the increased use of Loch Lomond water.

Table A – Santa Cruz Stage 2 DBPM Sampling and LRAA Data

Location→	Site 123 (Ponderosa Drive)	Site 137 (Tanner Heights)	Site 127 (Swift and Modesto St)	Site 139 (Coast Rd)	Site ARV12 (Branciforte Drive	Site 304 (GHWTP Finished Water)
Date	Ave LRAA (µg/L)	Ave LRAA (µg/L)	Ave LRAA (µg/L)	Ave LRAA (µg/L)	Ave LRAA (µg/L)	Ave LRAA (µg/L)
8/15/2013	70	63	47	58	62	33
11/21/2013	66	67	50	60	61	34
2/20/2014	69	72	54	69	67	36
5/12/2014	65	70	53	69	68	30

(Ref. 4. Santa Cruz, Stage 2 DBP Sampling and LRAA Data, 2014)

As the City uses more Loch Lomond water in the drought and to avoid diverting fish flows, the DBP values in the distribution system can be expected to increase and potentially result in violations of the DBP MCL. The City is highly concerned about keeping DBPs sufficiently low to meet MCLs regardless of the source water.

The methods used to monitor the physical benefits of DBP reduction is the compliance and operational water quality sampling that the City currently conducts.

iv. Provide a description of all new facilities, policies, and actions required to obtain the physical benefits.

Reduction of DBPs by 40 to 50 percent will require installation of radio read equipment on 34 existing irrigation meters, installation of radio base station, and installation of aerators at 5 waters storage tanks.

v. Provide a description of any potential adverse physical effects as a result of the project.

The potential adverse effects as a result of the project are temporary construction effects, such as additional traffic from equipment installation and calibration, and noise from construction equipment. The permanent adverse physical effect of the aerator project is noise, which will be mitigated. The aerators will use additional energy.

b. Technical Analysis and Description of Physical Benefit B: Radio meter reading would save 63 AFY from North Coast Pipeline leakage reduction

i. List any recent and historical conditions that provide a background for the benefit being claimed (i.e., recent water shortages, loss of habitat or ecosystem function, or water quality problems).

The SCWD has operated and maintained the North Coast system since the 1880s. It consists of three small diversion dams and a natural spring, and 16 miles of transmission pipelines ranging in size from 10 to 22 inches, including both buried and unburied pipe. The system relies entirely on rainfall runoff and emergent groundwater to furnish up to 25 percent of SCWD's overall water production with the highest quality water available. Over half of the 16 miles of pipeline is over 50 years old and traverses woodland, riparian forest,

wetland, and grassland habitats, with approximately 50 trestles and stream crossings. As such visibility of the pipeline is restricted over much of its length, making it difficult to inspect for and detect leaks. (Ref. 5 North Coast Leaks and Water Use, 2014, p.1)

ii. Provide a description and estimates of without-project conditions (i.e., the level of the physical benefit in the future, without the project, but with other projects that might be planned).

Without the automated meter read installation, pipeline leaks and water waste would continue for longer durations. Leaks are found primarily from pipeline inspections, which are difficult because of the limited access points to the pipeline and the rugged terrain of the alignment. As described earlier, the pipeline traverses challenging steep terrain, with approximately 50 trestles and stream crossings. Bi-monthly meter reads are unlikely to provide the frequency necessary to discern all but the largest leaks.

iii. Provide a description of methods used to estimate physical benefits.

The method to estimate physical benefits is evaluation of the City's North Coast Pipeline repair information. The City has had 40 leak repair work orders from 1998 to the present on the North Coast pipeline, which averages 2.5 leaks per year. Approximately half of the North Coast pipeline is at least 50 years old; some sections may date back to initial construction in the 1880s. The larger leaks that have been discovered include:

a. Lombardi Creek Leak wasted 200 gpm/ 126 AF for the 5 months the leak went undetected.
b. Sandy Flat Leak wasted 500 gpm/ 378 AF for the 6 months the leak went undetected.
c. Little Baldwin Creek wasted 250 gpm/ 189 to 378 AFY for the 6 months to a year the leak went undetected.
(Ref. 5, p.1)

Although many large leaks have been repaired and 3.5 miles of pipeline replacement has occurred, leaks may continue to occur in the future until the pipeline is fully rehabilitated/replaced. As an estimate, an average flow of about 100 gpm for 2 months (the time between meter reads) for 2.5 leaks/year equates to approximately 63 AFY. The horizon for pipeline replacement is 25 to 30 years or about 2044 because of the complexity of the pipeline location and limited access. The savings, however, are limited to the life to the meter and radio tower equipment which is 20 years.

The meter automation installation would allow for savings of up to 63 AFY for the average 2.5 major leaks that occur annually in the North Coast pipeline. Increased meter reading frequency from bi-monthly to hourly would more quickly detect leaks on the 88,000 LF North Coast pipeline.

The methods used to monitor the physical benefits of water savings from finding leaks on the North Coast pipeline are the water meter, water diversion, and flow data that the City currently collects.

iv. Provide a description of all new facilities, policies, and actions required to obtain the physical benefits.

Saving water requires installation of radio read equipment on 34 existing irrigation meters and installation of a radio base station.

v. Provide a description of any potential adverse physical effects as a result of the project.

The potential adverse effects as a result of the project are temporary construction effects, such as traffic from equipment installation and calibration, and noise from construction equipment. There are no permanent adverse physical effects of the project.

c. Non Quantifiable Benefits

In addition to the quantitative physical benefits described above, the project has six non-quantifiable benefits:

- Water savings from reduced leakage on the North Coast Pipeline would result in additional water to maintain special status fish and habitat flows, which in turn protects the estimated $3 million invested to date in the 60 to 80 fisheries restoration projects in the Santa Cruz region.

- Automatic meter reading will reduce driving for meter reads, resulting in reduced energy usage and GHG emissions. It is estimated that the bi-monthly meter reads requires a 16 mile round trip; occasionally additional travel is required as a result of a bad meter read. It is infeasible to gather meter data manually on the frequency (up to hourly) expected from the radio read system.

- The installation of radio read meters and the base station would enable staff to use the more frequent meter data with FlexNet software for potential future strategies of collaboration with irrigators (i.e., weekly schedules). Combining this infrastructure improvement with data analysis will result in improved management of flows in the pipeline to benefit both the irrigators and the City by allowing fewer instances of zero or near zero production that result from North Coast Pipeline pressure problems. (7/8/14 Santa Cruz Council Staff Report)

- The addition of storage tank aerators would allow the City to maintain higher water levels in the storage tanks for fire and emergency storage. Reservoirs currently are maintained at 60% full to reduce water age and DBP formation; with the aerators, the storage tanks could be operated at 90% full, which provides an additional 6.4 MG system-wide and equates to an increase from 2.1 days of treated water storage to 3.2 days of treated water storage at 6 MGD Stage 5 demand. This is valuable in case of wildfires North Coast or Loch Lomond source water pipeline outages, and/or electrical gear failures at GHWTP.

- The addition of aerators avoids system flushing for DBP reduction and thus saves water. City staff estimates that under Stage 3 restrictions, 25% operating volume flushing for DBP reduction would be required once a month from August through December 2014, wasting 4.8 MG. Under Stage 5 restrictions (which could occur in 2015), 25% operating volume flushing would occur twice a month, wasting 23.04 MGY. Installing aerators

could save about 27.8 MG of water over the next 18 months if DBP levels exceed the MCL of 80 µg/L.

- The project provides several water quality benefits to customers, including: improved taste and odor of the water; a reduced corrosivity of the water, which could reduce leaching of lead and copper from pipes and solder; and an overall lower DBP to report in the consumer confidence report, which improves customer perception of the water quality.

6. Cost Effective- Analysis

<table>
<tr><th colspan="2">PSP Table 6 – Cost Effective Analysis
Project name: _ Improve Potable Water Quality and Water Supply Reliability to Address Drought Impacts _____</th></tr>
<tr><td>Question 1</td><td>Types of benefits provided as shown in Table 5

Benefit A: Aerators would reduce DBP formation in 15.5 million gallons of storage by 40 to 50%
Benefit B: Radio meter reading would save 63 AFY from North Coast Pipeline leakage reduction</td></tr>
<tr><td rowspan="3">Question 2</td><td>Have alternative methods been considered to achieve the same types and amounts of physical benefits as the proposed project been identified? Yes.</td></tr>
<tr><td>If no, why? Not Applicable.</td></tr>
<tr><td>If yes, list the methods (including the proposed project) and estimated costs.
<table>
<tr><th>Alternatives Description</th><th>Estimated Costs (Capital and O&M)</th><th>Describe studies, plans, or documents that identify alternatives and costs of those alternatives.</th></tr>
<tr><td>Project 2:</td><td>$1,310,844 in 2014 capital costs</td><td>Santa Cruz Project 2 Attachment 5 Budget, 2014</td></tr>
<tr><td>Alternative A: DBP Precursor removal Treatment at GHWTP</td><td>In 2014$
Alt 11-A -$36.6 m capital and $2.0m in O&M
Alt 21-A $17.3 m capital and $1.4m in O&M
Alt 21-B $30.7 m capital and $1.6m in O&M</td><td>Alternatives 11-A; 21-A and 21-B: 2010 GHWTP Technical Review: Final Alternatives Evaluation Report (p. 28), HDR</td></tr>
<tr><td>Alternative B: Chloramine conversion</td><td>In 2014, $17.6 m capital and $1.2m O&M</td><td>Alternative 23: 2010 GHWTP Technical Review: Final Alternatives Evaluation Report (p.28), HDR</td></tr>
</table>
The proposed project includes the installation of radio read equipment on 34 existing irrigation meters, installation of radio base station, and installation of aerators at 5 waters storage tanks for a total capital cost of $1,310,844 (2014). O&M costs are expected to be nominal the meters take minimal power, and aerators are used on an as-needed basis.</td></tr>
<tr><td>Question 3</td><td>If the proposed project is not the least cost alternative, why is it the preferred alternative? Provide an explanation of any accomplishments of the proposed project that are different from the alternative project or methods.

The proposed project is the least cost alternative.</td></tr>
</table>

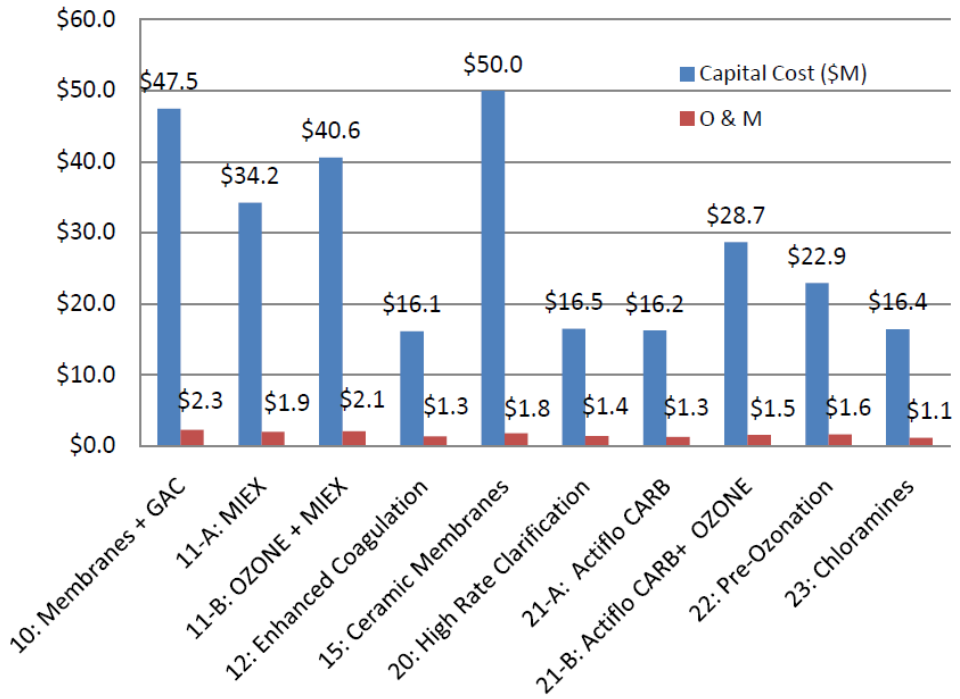
	Additional details are provided below.

Comments:

Alternative A – Additional Narrative

The SCWD explored other treatment processes over the last ten years through a Water Quality and System Improvement Study conducted by Camp Dresser McKee and HDR engineering firms. The main recommendations focused on treatment plant upgrades, which included new technology such as the Actiflow-CARB or the MIEX ionic exchange systems to reduce DBP precursors and/or remove DBPs at GHWTP. Each of these options would require major construction at the GHWTP and significant capital and operations and maintenance (O&M) costs. The figure below from the 2010 HDR report (Ref 6. GHWTP Technical Review: Final Alternatives Evaluation Report, HDR, 2010, p.20) summarizes the range of options and capital and O&M costs in 2011 dollars. The recommended alternatives are Alt 11-A- MIEX; Alt 21-A: Actiflow CARB and Alt 21-B: Actiflow CARB and ozone, which range in 2014 capital cost from $17.7m to 37.4m and O&M cost from $1.2m to $2.1m. The 2011 costs were escalated using the Engineering News Record (ENR) index to 2014. All of the alternatives are significantly out of the current financial means of the City.

All costs were escalated to 2011 dollars, based on an approximate date for the mid point of construction.



Capital and O&M Cost Summary from Screened Alternatives (Ref. 6, p. 20)

Alternative B – Additional Narrative

One of the other alternatives to reduce DBP in the distribution systems is to convert from chlorine to chloramine disinfection. The 2010 HDR technical review cited in Alternative A include Alternative 23 – Chloramines, which had a 2014 capital cost of $17.9m and 2014 O&M cost of $1.2m (Ref. 6, p. 20). Non construction costs associated with chloramine conversion includes customer outreach and response, line flushing, and general trouble shooting associated with a transition period. This alternative is also significantly out of the current financial means of the City.

Project 2 References

1. AWWA DBP Study Presentation, Santa Cruz, 2013.

2. Temporary Urgency Change Petition Cover Letter from Santa Cruz to SWRCB, July 2014

3. Santa Cruz City Council Staff Report, 4/8/14.

4. Historic DBP Data, Santa Cruz, 2014.

5. North Coast Leaks and Water Use, Santa Cruz, 2014

6. GHWTP Technical Review: Final Alternatives Evaluation Report, HDR.2010

These references files are found in the file named Att3_DG_ProJust_3of4.pdf.

Project 3: Conjunctive Use and Enhanced Groundwater Recharge Project at Hanson Quarry

1. Eligible IRWM Project Explanation

The SVWD Conjunctive Use and Enhanced Groundwater Recharge at Hanson Quarry Project can be considered five of the eligible IRWM project types:

IR.1 Water supply reliability, water conservation, and water use efficiency – The project constructs an injection/aquifer storage and recovery (ASR) which allows for implementing the Groundwater Management Plan Basin Management Objective of groundwater recharge, which provides long-term water supply reliability for northern Santa Cruz County. The project provides information to support full-scale groundwater recharge by both advanced treated recycled water and/or surface water, which increases water in aquifer storage and allows for increased groundwater production during future droughts.

IR. 5 Groundwater recharge and management projects – The project builds upon prior Conjunctive Use evaluation work and constructs an injection/ASR well and monitoring wells that will provide key understanding of site-specific groundwater recharge conditions at Hanson Quarry. This project is the first step to a full-scale recharge program that will allow long-term improvements to aquifer storage in accordance with the Santa Margarita Groundwater Management Plan.

IR.7 Water banking, exchange, reclamation and improvement of water quality – The project constructs an injection/ ASR well and monitoring wells and advanced treated recycled water and surface water studies that supports long-term full-scale regional water banking and conjunctive use. Banked water facilitates exchanges and transfers between agencies some of which have single water sources thus improving the regional water supply portfolio

IR.10 Drinking water treatment and distribution – The project provides an injection/ASR well for pilot testing of groundwater recharge, production of potable drinking water, and is the first step to full-scale groundwater recharge with advanced treated recycled water and/or surface water. The improved base flows that would result from long-term groundwater recharge also facilitates surface water extractions for drinking water uses for the City of Santa Cruz (the City) and San Lorenzo Valley Water District (SLVWD).

IR.11 Ecosystem and fisheries restoration and protection – The project supports long-term groundwater recharge and storage and therefore supports baseflow in the San Lorenzo River tributary of Bean Creek. This in turn contributes to restoration and protection of fisheries for special status species in the watershed.

2. Project Description

Implementing Agency: Scotts Valley Water District (SVWD)

25 word description: The SVWD Project includes an injection/ASR well, 2 monitoring wells, advance treated recycled water recharge study, and water rights planning for recharge of surface water.

a. Eligible Drought Project Type Explanation

D.2 Increase local water supply reliability and the delivery of safe drinking water by providing an injection/ASR well to allow, initially, for 150 AFY of long-term recharge into the Lompico Sandstone. The well will also provide information for design of the full-scale advanced treated recycled water and/or surface water recharge, which will result in increased water in storage for long-term local water supply reliability. The stored groundwater will provide safe drinking water accessible to the northern portion of the Santa Cruz Region during future droughts in the face of climate change.

D.4 Reduce water quality conflicts or ecosystem conflicts created by the drought by allowing for increased groundwater storage with advance treated recycled water and/or surface water which improves baseflow in the San Lorenzo River system for ecosystem benefits such as fisheries habitat.

b. How the Project Alleviates Drought Impacts

As the region seeks to increase recover groundwater levels to make the local water supplies more drought resistant, a regional conjunctive use project has been envisioned for the Santa Margarita Groundwater Basin since 1994 (Ref. 1 SVWD GWMP, 1994, p. 9, 12). The project is the first three of six stages that will ultimately result in production of up to 2,000 AFY, which helps to bridge the estimated supply deficit of 3,400 AFY (in 2015) to 4,100 AFY (in 2025) (Ref 2: TM4- Water Demand, Phase 1 Conjunctive Use Study, 2010, p. 24). The project could provide future drought-proof supply of 10,000 AFY from recycled water and surface water recharge.

Stage 1 includes Site-Specific Geologic/Recharge Investigation and Injection/ASR Well; Stage 2 includes Advanced Treated Recycled Water Study and Coordination with CDPH to evaluate indirect potable reuse; and Stage 3 includes Water Rights Confirmation for Groundwater Recharge to investigate recharge of up to 313 AFY of excess surface water at Hanson Quarry. Future Stages 4, 5, and 6 are for recharge of advance treated recycled water and winter-time surface water from other sources.

This project (Stages 1, 2, and 3) is a necessary first step for long-term drought protection for the region's water providers, including SVWD, SLVWD, the City, and Mount Hermon Association.

The primary drought impacts for the region are the below average rainfall in 2012 through 2014, reduction in groundwater recharge, and reduced stream flow. The rainfall of 7.35 inches in 2013 is lower than the 1990-1992 and the 1976-1977 droughts. The 12-month period from Feb 2013 to Jan 2014 of 6.1 inches was the lowest annual rainfall recorded (Ref.3 SVWD El Pueblo Precipitation, 2014 –in Table A). As a consequence, SVWD is:

At risk of not meeting existing drinking water demands: Decreased demands from water conservation measures have allowed existing wells to meet peak demands. However, if one of the existing large capacity wells fails during peak demand periods, SVWD is at risk of not meeting peak summer demands. Inability to meet existing drinking water demands would be exacerbated in future years of drought.

At risk of not meeting existing ecosystem water demands: The San Lorenzo River is habitat for special status fish species Coho salmon and steelhead trout. Baseflows to the river from groundwater have shown a downward trend over the years. Loss of baseflow is even more critical during droughts. Federal coho/steelhead recovery plans cite increased baseflows a critical elements to increase populations.

Facing Drinking Water MCL violations: SVWD water quality data for WY 2013 indicate that Well #11B is above the MCL for arsenic. Other SVWD wells may be above secondary MCLs for TDS, iron, manganese, and sulfate. As groundwater levels decline, lower quality water may be used, exacerbating water quality challenges. The new well is expected to meet all primary MCLs, allowing well #11B to be taken off line. Future recharge is expected to use higher quality sources that will meet all primary and secondary MCLs.

Expedited funding is needed: The SVWD Board of Directors as well as the Santa Margarita Groundwater Basin water users have acknowledged the need to increase groundwater recharge for long-term drought protection and the Hanson Quarry has been frequently identified in prior conjunctive use studies as an ideal location for recharge. Lehigh-Hanson, the quarry owners, have recently offered access to the property creating a unique opportunity to conduct site-specific recharge verification work prior to detailed design of a full-scale program. The expedited funding takes advantage of the current availability of the site, which was not previously accessible, and takes an important next step to development of a regional, long-term approach to groundwater conjunctive use so that additional water storage can be developed in the Region to meet drought needs in the face of climate change.

3. Project Map

The project map that follows, Figure 3-5, shows the location of the elements of the Conjunctive Use and Enhanced Groundwater Recharge Project at Hanson Quarry as described in Project 3, Section 2 and Attachment 4 – Work Summary.

4. Project 3 Physical Benefits

Overview of Benefits of Project 3

The SVWD Conjunctive Use and Enhanced Groundwater Recharge Project at Hanson Quarry has several quantifiable physical benefits, including:

A. Allows groundwater injection of up to 150 AFY
B. Allows 313 AFY of SLVWD Loch Lomond water rights to replenish groundwater storage

The project also has several non-quantifiable benefits (which are detailed in Section 5), including:

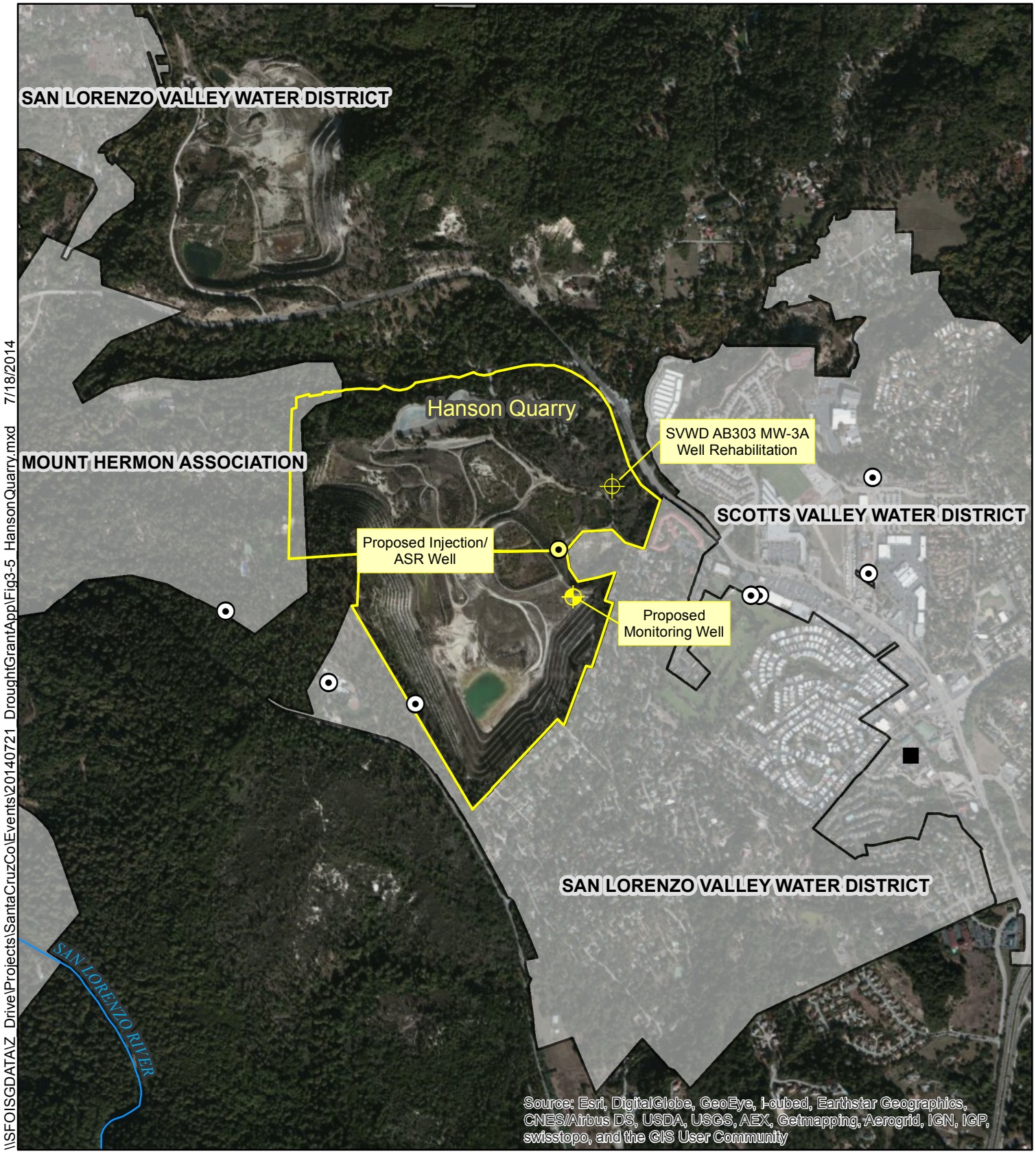
- The new injection/ASR well will be used to pilot test recharge and improve understanding of site-specific underlying geology for full-scale extraction/recharge facilities
- Future project stages allow for:
    - Meeting future recycled water contaminant removal permitting requirements
    - Storage of up to 10,000 AF of recycled water
    - Long-term base flow for ecosystem (especially fisheries habitat)
    - Recreation at Hanson Quarry
    - Water quality improvements

Benefit A: Allows groundwater injection of up to 150 AFY

Stage 1 of the project is estimated to allow injection of up to 150 AFY in the new injection/ASR well. Stages 2 and 3 will confirm the source of injection water (recycled water and/or surface water), therefore the actual injection will likely not start until 2020 when infrastructure is built and regulatory requirements are completed to start injection. The estimated useful life for the well is 20 years; therefore, a 20 year analysis starting in 2020 is provided in PSP Table 5A that follows Figure 3-5.

Benefit B: Allows 313 AFY of SLVWD Loch Lomond water rights to replenish GW groundwater storage

Stage 3 of the project is estimated to allow diversion of SLVWD's full 313 AFY of Loch Lomond water right in 7 out of every 10 years, which is a diversion frequency consistent with rainfall that is at least 75% of average. While the estimated useful life of this water right is indefinite, the analysis of availability has been limited to 67 years, in alignment with local precipitation records. The 67 year analysis starts in 2017, as it may take additional time to assure that the water rights and infrastructure changes of Stage 3 are in place prior to starting the diversion. 2017 is a non-delivery year per Section 5.8b. The results of the analysis are provided in PSP Table 5B that follows Figure 3-5. More detailed explanation is found in Section 5.b.



\\SFOISGDATA\Z Drive\Projects\SantaCruzCo\Events\20140721 DroughtGrantApp\Fig3-5 HansonQuarry.mxd 7/18/2014

⊙ Existing Scotts Valley Water District Production Wells

■ Existing Scotts Valley Wastewater Treatment Plant

N

0 750 1,500
Feet

Note:
Proposed locations are approximate

Kennedy/Jenks Consultants

Regional Water Management Foundation
2014 IRWM Drought Grant Application
Santa Cruz

Conjunctive Use and Enhanced Groundwater Recharge Project at Hanson Quarry

K/J 1468028*00

Figure 3-5

Table 5A – Annual Project Physical Benefits			
Project Name: SVWD Conjunctive Use and Enhanced Groundwater Recharge Project at Hanson Quarry Type of Benefit Claimed: Groundwater Injected_____ Units of the Benefit Claimed : Acre-feet per year (AFY)_____ Additional Information About this Benefit:			
(a)	(b)	(c)	(d)
	Physical Benefits		
Year	Without Project	With Project	Change Resulting from Project (c) - (b)
2014	0	0	0
2015	0	0	0
2016	0	0	0
2017	0	0	0
2018	0	0	0
2019	0	0	0
2020	0	150	150
2021-2038	0	150	150
2030	0	150	150
Comments: This benefit starts in 2020 because of the regulatory and infrastructure requirements necessary to bring either surface water and/or advance treated recycled water for injection. Currently, approximately 682 AFY of recycled water is discharged to the ocean because there is no where to store it. The project facilities could recharge approximately 1/5 of this available recycled water supply.			

Table 5B – Annual Project Physical Benefits			
Project Name: SVWD Conjunctive Use and Enhanced Groundwater Recharge Project at Hanson Quarry Type of Benefit Claimed: Use of SLVWD Loch Lomond Water Right_____ Units of the Benefit Claimed : Acre-feet per year (AFY)_____ Additional Information About this Benefit: This benefit starts in 2017, a non-delivery year, as it may take additional time to assure that the water rights/agreements and infrastructure modifications proposed in Stage 3 are in place prior to starting the diversion.			
(a)	(b)	(c)	(d)
	Physical Benefits		
Year	Without Project	With Project	Change Resulting from Project (c) - (b)
2014	0	0	0
2015	0	0	0
2016	0	0	0
2017	0	0	0
2018	0	313	313
2019	0	313	313
2020	0	313	313
2021	0	313	313
2022	0	313	313
2023	0	313	313
2024	0	313	313
2025	0	0	0
2026	0	313	313
2027	0	0	0
2028	0	313	313
2029	0	313	313
2030	0	313	313
2031	0	0	0
2032	0	313	313
2033	0	313	313
2034	0	0	0
2035	0	313	313
2036	0	0	0
2037	0	313	313
2038	0	313	313
2039	0	313	313
2040	0	313	313
2041	0	0	0
2042	0	313	313
2043	0	313	313
2044	0	313	313
2045	0	313	313

2046	0	0	0
2047	0	0	0
2048	0	313	313
2049	0	313	313
2050	0	313	313
2051	0	313	313
2052	0	313	313
2053	0	313	313
2054	0	313	313
2055	0	313	313
2056	0	313	313
2057	0	0	0
2058	0	0	0
2059	0	0	0
2060	0	0	0
2061	0	0	0
2062	0	313	313
2063	0	313	313
2064	0	0	0
2065	0	313	313
2066	0	313	313
2067	0	313	313
2068	0	313	313
2069	0	313	313
2070	0	313	313
2071	0	313	313
2072	0	313	313
2073	0	313	313
2074	0	313	313
2075	0	313	313
2076	0	313	313
2077	0	0	0
2078	0	313	313
2079	0	313	313
2080	0	313	313
2081	0	313	313
2082	0	313	313
2083	0	313	313
Comments: Diversion of 313 AF occurs when Annual Precip is > 75% of the annual average and is based on a 67-year precipitation record at the El Pueblo Station in Scotts Valley from Water Year 1946-1947 through Water Year 2012-2013; diversion occurs about 7 out every 10 years.			

5. Technical Analysis of Physical Benefits Claimed

a. Narrative Description of Physical Benefit A – Groundwater injection of 150 AFY

i. List any recent and historical conditions that provide a background for the benefit being claimed (i.e., recent water shortages, loss of habitat or ecosystem function, or water quality problems).

As highlighted in Attachment 2, the Santa Margarita Groundwater Basin .has had long-standing issues with dropping water levels and loss of storage on the order of 12,000 – 15,000 acre-feet. As the Santa Cruz Region lacks imported water supplies and has limited surface water storage, solely in Loch Lomond, all available storage is valuable to the Region. As the Phase 1 Conjunctive Use Study Tech Memo 4 - Regional Water Demand noted, the demand deficit in the region is on the order of 3,400-4,100 AFY (Ref.3, p.24) therefore the long-term injection of 150 AFY provides a significant start to rebuilding storage in the Region.

ii. Provide a description and estimates of without-project conditions (i.e., the level of the physical benefit in the future, without the project, but with other projects that might be planned).

Without the injection capacity of this well, SVWD is in jeopardy of not providing the long-term recharge to the Santa Margarita Groundwater Basin which reduces the region's long-term resilience to drought and climate change.

iii. Provide a description of methods used to estimate physical benefits.

The estimate of physical benefits are derived from study work conducted in the Phase 1 Conjunctive Use Study (Ref 4. Santa Cruz Conjunctive Use Study, Technical Memorandum 1-B-Recharge p. 22) which assumed a recharge rate of 150 gpm (or 242 AFY) from injection wells. Since the well will require resting in between injection cycles, a value of 150 AFY or about 60% of the full recharge rate is assumed. In addition, since there is ample recycled water (estimate at 682 AFY even after summer irrigation occurs), the injection/ASR well would provide an ideal mechanism for storing this recycled water in the groundwater basin, where it can be put to beneficial use rather than discharged to the ocean.

The method used to monitor the physical benefits of groundwater injection is the inflow meter to the well.

iv. Provide a description of all new facilities, policies, and actions required to obtain the physical benefits.

Production of 150 AFY of groundwater will require construction of a new 500' deep injection/ASR well

v. Provide a description of any potential adverse physical effects as a result of the project.

The potential adverse effects as a result of the project are temporary construction effects, such as dust from disturbed soils, and noise from drilling and construction equipment. No permanent adverse physical effects that cannot be mitigated are anticipated.

b. Narrative Description of Physical Benefit B: Allows 313 AFY of SLVWD Loch Lomond water rights to replenish groundwater storage

i. List any recent and historical conditions that provide a background for the benefit being claimed (i.e., recent water shortages, loss of habitat or ecosystem function, or water quality problems).

As described in the Phase 1 Conjunctive Use Study (Ref. 5, Tech Memo 2A – Water Rights p. 11),San Lorenzo Valley Water District (SLVWD) has an entitlement from the City pf Santa Cruz to purchase 313 AFY of Loch Lomond water which was acquired through the sale of SLVWD land used to construct the Loch Lomond. They have never been able to exercise the entitlement because of the lack of infrastructure. In addition, there has been recent movement to change the place of use for some of Loch Lomond water rights, and the recent drought has highlighted some of the challenges with the surface water rights system in California and conjunctive management of supplies. In addition, the recent availability of the Hanson Quarry has renewed interest in use of this water.

ii. Provide a description and estimates of without-project conditions (i.e., the level of the physical benefit in the future, without the project, but with other projects that might be planned).

Without the use of the 313 AFY of Loch Lomond water for 7 out of 10 years, the SVLWD and Region will lose the opportunity to provide in-lieu or direct recharge to the Santa Margarita GW basin.

iii. Provide a description of methods used to estimate physical benefits.

The methods used to estimate the benefit are the annual precipitation data from 1946 to 2013 from the SVWD El Pueblo station (Ref 3) presented in Table A below. These precipitation data are used to estimate a conservative diversion frequency for the water from Loch Lomond to SLVWD. This water could be used for direct delivery, which could offset groundwater pumping and provide an in-lieu recharge benefit, or could be used to directly recharge the aquifer at Hanson Quarry. PSP Table 5B is completed with the assumption that anytime the annual precipitation is less than 75% of the annual average of 41.84 inches, the 313 AF cannot be diverted. This occurs approximately 3 out of every 10 years.

Table A – Annual Precipitation at El Pueblo Station

Year	TOTAL ANNUAL INCHES	% of Ave
46-47	27.88	67%
47-48	35.59	85%
48-49	36.21	87%
49-50	85.85	205%
50-51	43.73	105%
51-52	59.64	143%
52-53	29.4	70%
53-54	43.51	104%
54-55	48.19	115%
55-56	27.71	66%
56-57	49.98	119%
57-58	70.4	168%

Year	TOTAL ANNUAL INCHES	% of Ave
58-59	22.62	54%
59-60	41.26	99%
60-61	24.46	58%
61-62	45.03	108%
62-63	49.32	118%
63-64	37.62	90%
64-65	33.04	79%
65-66	28.35	68%
66-67	47.08	113%
67-68	40.31	96%
68-69	65.1	156%
69-70	51.56	123%
70-71	25.01	60%
71-72	31.73	76%
72-73	60.3	144%
73-74	34.91	83%
74-75	35.84	86%
75-76	19.89	48%
76-77	27.44	66%
77-78	49.69	119%
78-79	51.1	122%
79-80	38.53	92%
80-81	47.74	114%
81-82	70.93	170%
82-83	86.25	206%
83-84	34.54	83%
84-85	35.03	84%
85-86	58.27	139%
86-87	23.15	55%
87-88	23.81	57%
88-89	30.67	73%
89-90	20.58	49%
90-91	26.64	64%
91-92	33.55	80%
92-93	50.06	120%
93-94	27.81	66%
94-95	58.74	140%
95-96	47.08	113%
96-97	47.67	114%
97-98	63.74	152%
98-99	40.66	97%
99-00	49.41	118%
00-01	33.74	81%
01-02	41.3	99%
02-03	42.46	101%

Year	TOTAL ANNUAL INCHES	% of Ave
03-04	36.87	88%
04-05	57.35	137%
05-06	63.33	151%
06-07	22.72	54%
07-08	33.13	79%
08-09	33.53	80%
09-10	46.28	111%
10-11	58	139%
11-12	32.36	77%
12-13	31.87	76%
Average	41.84	--

The method used to monitor the physical benefits of surface water use is the meter at the point of diversion of the surface water.

iv. Provide a description of all new facilities, policies, and actions required to obtain the physical benefits.

The new policies and actions required to obtain the physical benefit are implementing Stage 3 to confirm current water rights place of use filings, and implement additional the water rights filings and/or agreement to receive Loch Lomond water, most likely in the vicinity of the Felton diversion.

v. Provide a description of any potential adverse physical effects as a result of the project.

The potential adverse effects as a result of Stage 3 of the project are those effects associated with surface water diversion at an existing diversion structure or through an existing pipeline. No permanent adverse physical effects that cannot be mitigated are anticipated.

c. Non-Quantifiable Benefits

The project also has several non-quantifiable benefits:

- The injection/ASR well will be used to pilot test recharge by bringing in recharge water in tanker trucks. The well logs from drilling and pilot recharge test in conjunction with the new and rehabilitated monitoring wells will improve the understanding of site-specific underlying geology so that more detailed design of the number and location of other injection/ASR wells and/or the location and size of recharge ponds can occur. The information will be critical to designing a full-scale facility that can fully utilize advanced treated recycled water (up to 692 AFY) and/or surface water (up to 313 AFY 7 out of 10 years) to maximum future benefit.
- Implementation of Stages 1, 2 and 3 provides numerous future benefits, including:
    - Stage 2 will prepare the majority of CDPH engineering reports to support permitting of Stage 4 advance treatment of recycled water contaminant removal at Scotts Valley tertiary recycled water facility for recharge at Hanson Quarry.
    - Confirming the hydrogeologic conditions necessary to recharge and store up to 10,000 AF of surface water or advance treated recycled water for dry year/drought use.

- Increasing the water in storage using recharge of surface water or recycled water for increase of long-term base flow for ecosystem (especially for special status fisheries habitat). Another benefit of base flow will be more surface water for downstream diverters.
- Recreation at Hanson Quarry could be included as a public benefit with walking trails and potential terrestrial habitat restoration.
- Water quality improvements are anticipated in the groundwater because recharge will occur with advanced treated recycled water or surface water, both of which are of higher quality than the ambient groundwater, which has high iron and manganese.

6. Cost Effective- Analysis

<table>
<tr><th colspan="2">Table 6 – Cost Effective Analysis
Project name: _ Conjunctive Use and Enhanced Groundwater Recharge Project at Hanson Quarry _____</th></tr>
<tr><td>Question 1</td><td>Types of benefits provided as shown in Table 5

Benefit A: Groundwater injection of up to 150 AFY
Benefit B: Allows 313 AFY of SLVWD Loch Lomond water rights to replenish groundwater storage</td></tr>
<tr><td rowspan="3">Question 2</td><td>Have alternative methods been considered to achieve the same types and amounts of physical benefits as the proposed project been identified? Yes.</td></tr>
<tr><td>If no, why? Not Applicable.</td></tr>
<tr><td>If yes, list the methods (including the proposed project) and estimated costs.
<table>
<tr><th>Alternatives Description</th><th>Estimated Costs (Capital and O&M)</th><th>Describe studies, plans, or documents that identify alternatives and costs of those alternatives.</th></tr>
<tr><td>Proposed Project 3 (Injection/ASR well only)</td><td>$1.04 million Capital, O&M is same for proposed project and alternative</td><td>SVWD Project 3 Attachment 5 Budget, Stage 1 Budget Detail</td></tr>
<tr><td>A. Percolation Ponds</td><td>$1.33 million Capital, O&M is same for proposed project and alternative</td><td>TM 3a Engineered Facilities (p. 41) 2010 Santa Cruz Phase 1 Conjunctive Use Study escalated to 2014 and adjusted to 150 AFY of recharge</td></tr>
</table>
The Proposed Project 3 includes 3 Stages; for the purposes of this injection benefit, only the injection/ASR well portion of Stage 1 was considered and includes a 500’ deep, 12” diameter injection/ASR well with pumps, motors, and electrical for the recovery use. Design, CEQA, land acquisition, and administration costs are also included. The estimated project cost for the injection/ASR portion of the project is $1.04 million of capital. The operations and maintenance (O&M) for both the project and alternative would include bringing recharge water to the site. It is assumed that well maintenance and percolation pond maintenance are equivalent.</td></tr>
<tr><td>Question 3</td><td>If the proposed project is not the least cost alternative, why is it the preferred alternative? Provide an explanation of any accomplishments of the proposed project that are different from the alternative project or methods.
The proposed project is the least cost alternative based on the other alternatives.
Additional details are provided below.</td></tr>
</table>

Comments:

<u>Alternative A</u> – Additional Narrative

One of the alternatives to an injection/ASR well for recharge is to use percolation ponds at Hanson Quarry which could take more space and may not target the recharge to the Lompico Aquifer as effectively as an injection/ASR well. This is estimated to cost $1.33 million in 2014 $. (Ref. 6. Santa Cruz Phase 1 Conjunctive Use Studies – TM 3 Engineered Facilities, p. 41) Therefore the injection/ASR well is a lesser cost alternative than percolation ponds.

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Project 3 References

1. Groundwater Management Plan, 1994. Scotts Valley Water District. Pp 9, 12.

2. Santa Cruz County Phase 1 Conjunctive Use and Enhanced Aquifer Recharge Project Report, Appendices, TM 4- Regional Water Demand, Nov 2010, Kennedy/Jenks Consultants. P.22.

3. El Pueblo Monthly Precipitation Data, 2014, SVWD.

4. Santa Cruz County Phase 1 Conjunctive Use and Enhanced Aquifer Recharge Project Report, Appendices, TM-1B- Evaluation of Recharge Potential -Feb 2011, Kennedy/Jenks Consultants. P.22

5. Santa Cruz County Phase 1 Conjunctive Use and Enhanced Aquifer Recharge Project Report, Appendices, TM-2A- Water Rights-November 2010, Kennedy/Jenks Consultants. P.11

6. Santa Cruz County Phase 1 Conjunctive Use and Enhanced Aquifer Recharge Project Report, Appendices, TM-3- Engineered Facilities-November 2010, Kennedy/Jenks Consultants. P.41

These references files are found in the file named Att3_DG_ProJust_4of4.pdf.