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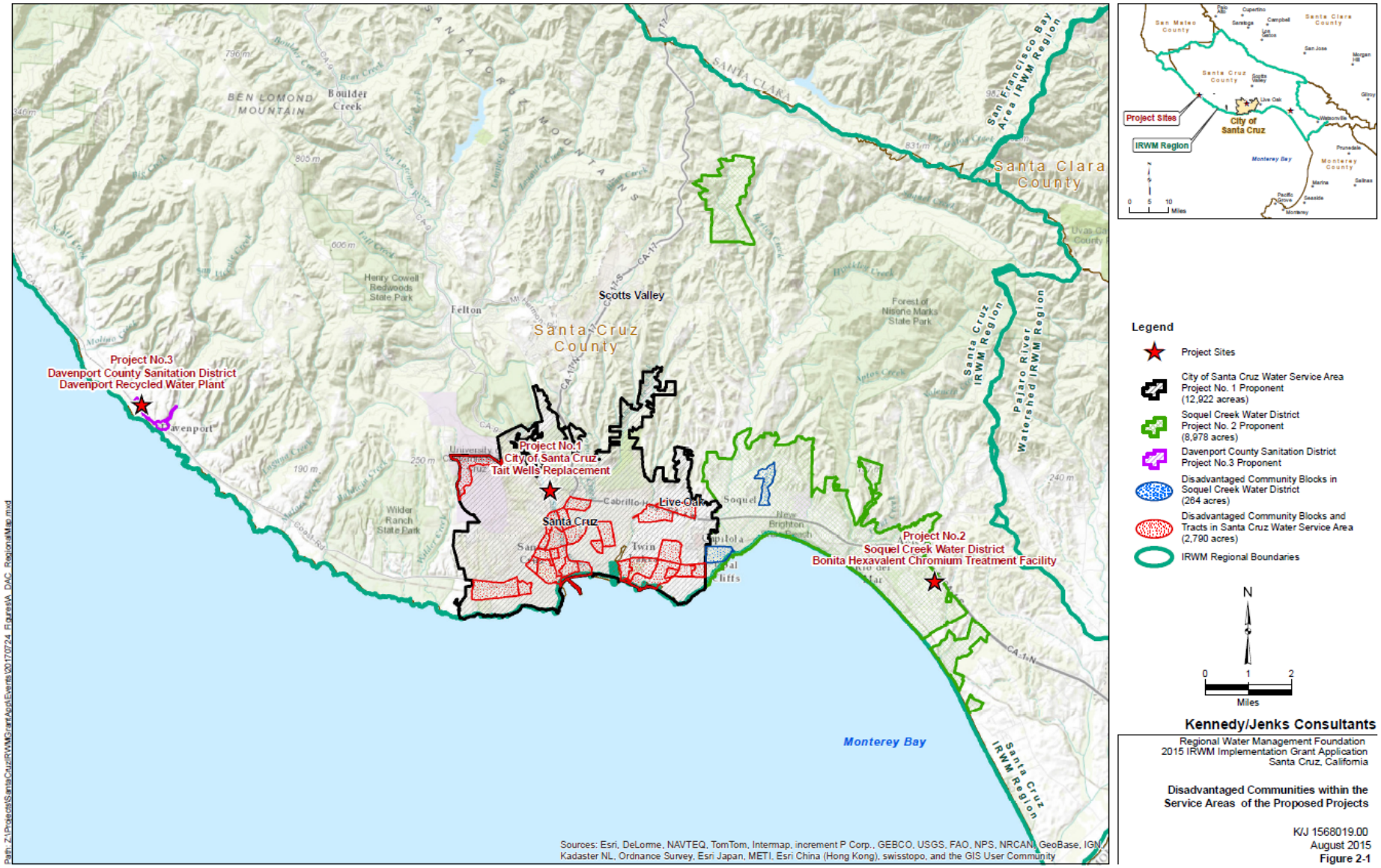
Project Summary Table and Regional Map

PSP Table 4 – 2015 IRWM Grant Solicitation Project Summary Table

		City of Santa Cruz Tait Wells Replacement	Soquel Creek Water District Bonita Hexavalent Chromium Treatment Facility	Davenport County Sanitation District Recycled Water Plant
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	X	X
IR.6	Contaminant and salt removal through reclamation, desalting, and other treatment technologies and conveyance of reclaimed water for distribution to users			
IR.7	Water banking, exchange, reclamation, and improvement of water quality	X	X	X
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	
IR.11	Ecosystem and fisheries restoration and protection	X	X	

Regional Map

Figure 2-1 on the next page shows the Santa Cruz IRWM regional map and the locations of the 3 proposed projects.


Project No.3
Davenport County Sanitation District
Davenport Recycled Water Plant
Project No.1
City of Santa Cruz
Tait Wells Replacement
Project No.2
Soquel Creek Water District
Bonita Hexavalent Chromium Treatment Facility
Santa Cruz County
Santa Clara County
Scotts Valley
Felton
Santa Cruz
Live Oak
Soquel
Capitola
Monterey Bay
Project Sites
IRWM Region
City of Santa Cruz
Legend
Project Sites
City of Santa Cruz Water Service Area Project No. 1 Proponent (12,922 acreas)
Soquel Creek Water District Project No. 2 Proponent (8,978 acres)
Davenport County Sanitation District Project No.3 Proponent
Disadvantaged Community Blocks in Soquel Creek Water District (264 acres)
Disadvantaged Community Blocks and Tracts in Santa Cruz Water Service Area (2,790 acres)
IRWM Regional Boundaries
N
0 1 2
Miles
Kennedy/Jenks Consultants
Regional Water Management Foundation
2015 IRWM Implementation Grant Application
Santa Cruz, California
Disadvantaged Communities within the Service Areas of the Proposed Projects
K/J 1568019.00
August 2015
Figure 2-1
Sources: Esri, DeLorme, NAVTEQ, TomTom, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, and the GIS User Community

Project 1: Tait Wells Replacement Project

1. Project Description

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

25 word description: The replacement of Tait Wells Nos. 1 and 3 with 10-12"diameter wells drilled to a depth of 100', and rehabilitation of Tait Well No. 4.

a. Expanded Project Description

With the City facing a serious drought, the Water Department is drilling two wells to replace Tait Wells Nos. 1 and 3, and rehabilitating Tait Well No. 4; all wells are adjacent to the San Lorenzo River and will capture river underflow, optimize operational flexibility related to diversion of San Lorenzo surface water, and improve overall water supply reliability from the Tait St. Diversion. Based on the finding of the 2009 Tait St. Diversion Sanding Study (Ref. 1), the wells would likely be 10-12" casings, drilled to 90-100' depths.

b. How the Project Addresses a Current Need

The Santa Cruz IRWM Region challenges include water supply, surface water quality, groundwater quality and providing adequate fish flows for special status salmonid species. In normal hydrological conditions, the City is highly dependent on surface water and obtains, on average, 79% of its supply from the San Lorenzo River and North Coast streams, 17% from Loch Lomond Reservoir and 4% from groundwater. The region is in fourth drought year with two back-to-back critically dry years. Hence, the City is rationing to constrain drinking water demands to 42.7 gallons per capita per day (June 2015 residential demand) - amongst the lowest in the state's 400 urban water suppliers. 2015 water supply availability projections include a 20% reduction in overall system demand, compared to 2013 production (which includes a 5% reduction). Loch Lomond reservoir storage is expected to decline to 1.6 billion gallons (58%) by October 2015 and the City risks not meeting drinking water demands if the drought were to continue into a 5th year.

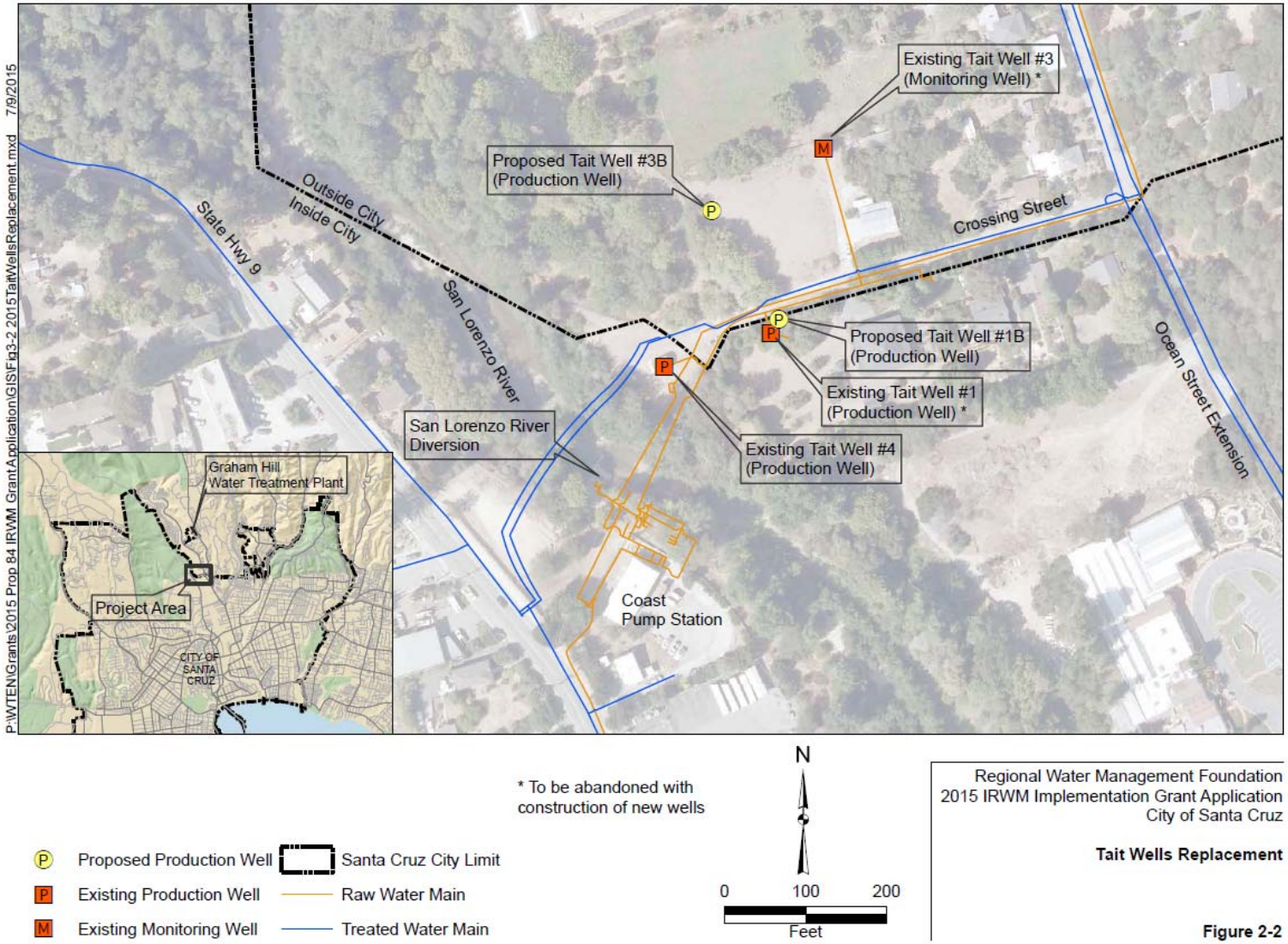
The City is also at risk of not meeting existing ecosystem water requirements. Releases from Loch Lomond and downstream bypass flows maintained at the Tait St. Diversion are determined in consultation with State and Federal fisheries agencies. The Endangered Species Act Section 10 Permit (Habitat Conservation Plan) process is anticipated to further restrict surface water use. In the driest hydrologic conditions, City proposed instream flows will result in peak-season shortages of around 600 million gallons; the California Department of Fish and Wildlife and National Marine Fisheries Service have counter-proposed close to 1.4 billion gallons instream flows (Ref.13). Due to the urgency of the water shortage, in 2014 and 2015 the City requested and received a State Water Board Order for a temporary reduction in the downstream release from Loch Lomond from 1.0 cfs to 0.2 cfs (Ref. 4). As of July 2015, continuous flows of 3 cfs and pulse flows of 6.0 cfs for 12 hours – 2x/week at the Tait St. Diversion and similar rearing flows in North Coast streams are currently being voluntarily provided by the City under an agreement with the Department of Fish and Wildlife.

Since the 1930s the City has utilized shallow wells to pump San Lorenzo River underflow. The Tait Wells are classified as river bank infiltration wells by the California Division of Drinking Water. The wells are located close to the Tait St. Diversion and are operated on an as needed basis in conjunction with an open river intake to supplement the blend of surface water sent to the Graham Hill Water Treatment Plant (GHWTP). Tait Wells Nos. 2 and 3 are non-functional and wells Nos. 1 and 4 are failing; operation of these wells is unreliable and average annual output is about 25% of their original capacity. In 2009, Wood Rogers recommended developing new wells to improve reliability and operation (Ref.1).

Fully functional wells serve important seasonal purposes: In the dry season the wells could provide up to 25% of raw water treated to meet daily demand; during winter Tait Wells water is blended with surface water when turbidity at the San Lorenzo River intake exceeds the effective limit for treatment (~25NTU). The City has observed that the NTU (turbidity) and TOC (Total Organic Carbon) water from Loch Lomond Reservoir and the San Lorenzo River in drought has made it more challenging to produce high quality finished water that meets drinking water quality standards. Water from Loch Lomond has higher disinfection byproduct (DBP) precursor potential that, without blending with source water of lower TOC, has higher potential to exceed the 80 µg/L Maximum Contaminant Limit (MCL)(Ref 3.). While the City has made changes to the treatment process and in the distribution system to enhance the water quality provided to customers, long-term drought preparedness could be improved by a greater quantity and quality of low NTU/TOC water blended from the Tait St. Diversion and wells. The Tait Wells consistently provide water that is associated with lower DBP precursors and therefore aids in the delivery of safe drinking water.

2. Project Map

The project map that follows, Figure 2-2, shows location of the Tait Wells.



3. Physical Benefits

Overview of Benefits

The City of 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 (Primary benefit)
B. Reduction of TOC from > 5 mg/l to <2 to 4 mg/l and associated reduced weighted average turbidity of 8.5 Nephelometric Turbidity Unit (NTU) from direct diversion/well mix to 2.4 NTU with wells (Secondary benefit)

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

The replacement of two wells and rehabilitation of Tait Well No. 4 will increase output up to 230 MGY/706 AFY, which is five times the recent average annual production from the existing wells. For the purposes of Table 5A, an average production of 50 MGY/153 AFY is used for the Without Project condition. The estimated useful life for the wells is 50 years, since they will be used intermittently. Therefore, a 50 year analysis starting in 2016 is provided in PSP Table 5A.

Benefit B: Reduction of TOC from > 5 mg/L to <2 to 4 mg/L and associated reduced weighted average turbidity of 8.5 NTU from direct diversion/well mix to 2.4 NTU with wells (Secondary Benefit)

The construction of the Tait Wells allows the use of a source water that has a lower TOC (<2 to 4 mg/L) than the > 5 mg/L TOC that would be available from Loch Lomond/San Lorenzo River with an associated reduced average weighted turbidity of 2.4 NTU with wells (compared to 8.5 NTU with direct surface diversions). For the purposes of Table 5B, a > 5 mg/L TOC value is used for the Without Project condition. The estimated useful life for the wells is 50 years, since they will be used intermittently. Therefore, a 50 year analysis starting in 2016 is provided in PSP Table 5B.

PSP 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
Anticipated Useful Life of Project: 50 years

Additional Information About this Benefit: This is based on average "without project" production of about 50 MGY/153 AFY.

(a)	(b)	(c)	(d)
	Physical Benefits		
Year	Without Project	With Project	Change Resulting from Project (c) - (b)
2016	153	0	-153
2017-2065	153	706	553
2066	153	706	553
Total	7803	35300	27497

Comments: The project provides 230 MGY/706 AFY at an average pumping rate of 434 gpm with a potential maximum pumping rate of 800 gpm.

PSP Table 5B – Annual Project Physical Benefits			
Project Name: Tait Wells Replacement Project Type of Benefit Claimed: Reduced TOC with Tait Wells Units of the Benefit Claimed : mg/L Anticipated Useful Life of Project: 50 years Additional Information About this Benefit: The without project condition is a typical TOC concentration using San Lorenzo River or Loch Lomond source water.			
(a)	(b)	(c)	(d)
	Physical Benefits		
Year	Without Project	With Project	Change Resulting from Project (c) - (b)
2016	>5	--	->5
2017-2065	>5	<2-4	>1-3
2066	>5	<2-4	>1-3
Comments: Without project condition of TOC varies from <2 mg/L in very good conditions to 5 mg/L in the blend sent to the surface water treatment plant. It is expected that 230 MGY of Tait Well water would improve the "With Project" condition to from <2 to 4 mg/L, resulting in a ppm reduction of at least 1 mg/L, but potentially 3 mg/L. In addition, NTU, which is associated with TOC, is also expected to decline from a without project weighted average turbidity of 8.5 NTU with direct diversion/well mix, to 2.4 NTU with wells in the proposed project.			

4. Technical Analysis of Physical Benefits Claimed

a. Technical Analysis and Description of Physical Benefit A: Reliably and sustainably produce 230MGY/706 AFY of high quality water (Primary Benefit)

i. Provide an explanation of need for the project, including recent and historical conditions that provide background for benefits to be claimed; for example, recent water shortages, loss of habitat or ecosystem function, and water quality problems.

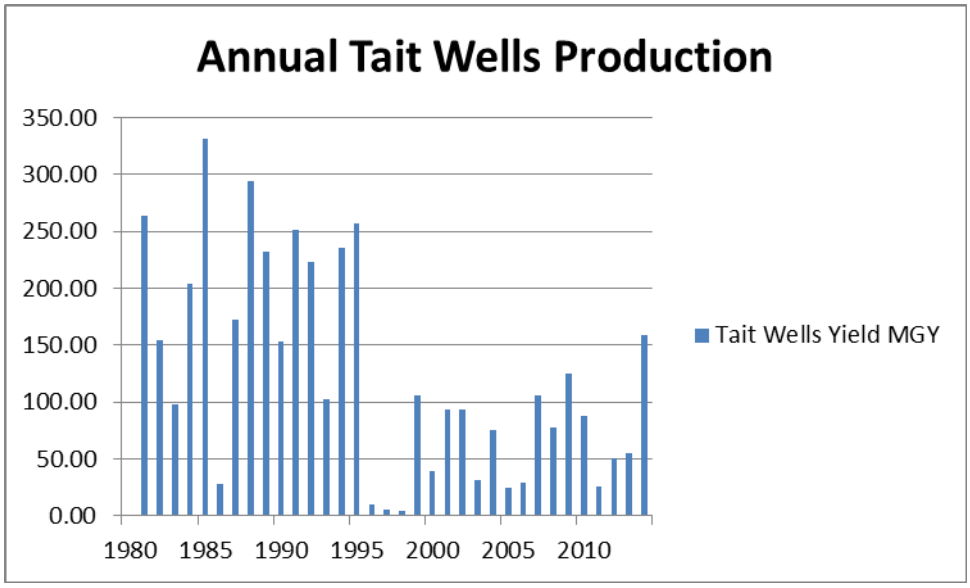
As noted in 1b. Project Description, the region is in the fourth year of below average rainfall. In 2015, the City is confronting a multi-year drought including two back-to-back critically dry years. Consequently, the City is at risk of not meeting existing drinking water demands except for intensive water rationing measures requiring the City to maximize available sources, especially those with high quality water, when available. In addition, the City draws some of its supplies from an over-drafted groundwater basin at risk for seawater intrusion; therefore groundwater is not a reliable supplemental supply (Ref. 10). As discussed earlier, Tait Wells Nos. 2 and 3 are non-functional and wells Nos. 1 and 4 are failing. Consequently the operation of these wells is unreliable, and average annual output is roughly one quarter of their original capacity. The Tait Wells Replacement Project draws water from San Lorenzo River underflow adjacent to the Tait Diversion which withdraws surface water. Having the Tait Wells at full capacity optimizes the use of San Lorenzo River water while maintaining bypass flows for fishery benefits.

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, annual production from the existing Tait Wells will continue to decline, forcing the City to rely more heavily on water stored in Loch Lomond and over-drafted groundwater during drought. In addition, operation of the adjacent Tait surface water diversion for San Lorenzo River flow is much more challenging during low stream flow conditions without the project, as it is very difficult to match pumping of instream 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 5) graphed on the figure below. There have been substantial fluctuations in annual production depending on hydrologic conditions, conditions of wells, and availability of other sources. To save energy, the wells are not run when there is sufficient water in the sump from the Tait surface water diversion. There are several years where no production occurred, and other years (such as 1985) when production exceeded 300 MGY/921 AFY.

Production has declined significantly since the mid-1990s as a result of the age and poor construction methods, typical of the 1930s, of the wells. 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 of fully-functional Tait Wells is anticipated to be 230 MGY/706 AFY. The City was able to produce an average of 230 MGY/706 AFY during the last extended drought period of 1988 to 1992, and represents a realistic and sustainable yield from the well field.



The method 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.

Easements for right of way access to the two well replacement sites will need to be obtained from Santa Cruz County. Replacing Tait Well 3 with a Tait Well No. 3b on the same parcel involves negotiation with the private property owner of the parcel. Rehabilitation of Tait Well No. 4 requires a physical assessment of the condition of the well prior to mechanical and chemical well maintenance work. Air lifting may be required if mechanical and chemical methods do not produce acceptable rehabilitation results. In addition to the rehabilitation of Tait Well No. 4, achieving the production of 230 MGY/706 AFY of well water will also require installation of two 100' deep 10-12" diameter wells, as well as new pumps, pedestal, motors, and controls for both wells and a new electrical service for one of the wells. A security fence, gate and camera will be required.

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. As described in the Draft Initial Study prepared for Tait Well No. 1b, any potential environmental impacts from the proposed project would be less than significant (Ref. 15). With compliance with applicable regulations, the proposed project would not result in substantial adverse effects on human beings or permanent adverse

physical effects. A Notice of Exemption for Tait Well No. 1b project was filed as it is a replacement of an existing facility. An Initial Study will be prepared for Tait Well No. 3b.

vi. Description of whether the proposed project effectively addresses long-term drought preparedness
The Tait Wells Replacement Project contributes to sustainable water supply and reliability at all times including and most importantly achieves the following long-term drought preparedness measures:
- Promote water conservation, conjunctive use, reuse and recycling
- Efficient groundwater basin management

Conjunctive Use: The Tait Wells Replacement Project significantly improves the City's ability to conjunctively manage (the coordinated and planned use and management) surface water and groundwater which thus allows the City to address long-term drought challenges of limited supply. One of the primary water supply issues the City is facing is that all sources are becoming more limited in dry conditions. Therefore the resiliency and flexibility of operating the water supply system infrastructure must be improved to prepare the City for extended dry seasons and multi-year droughts that may occur more frequently in the future if climate change results in less runoff and natural recharge of coastal aquifers (Ref.7).

Replacing the two Tait Wells will allow more efficient production of surface water from the San Lorenzo River in drought periods, allowing groundwater sources from the mid-County aquifer, some of which are at risk for overdraft and associated seawater intrusion, to rest. In 2014 the City added 158 million gallons of water from Tait Wells Nos. 1 and 4 to the total amount of water produced. For comparison, in the drought year 1976, the Tait Wells were in better condition and were able to add 266 million gallons (Ref. 5). Three functional Tait Wells could alleviate drought impacts on water supply production in the winter by meeting a larger portion of system demand, adding to the number of days that San Lorenzo River water can be used to meet demands under turbid conditions (with the combination of higher quality water from the Tait Wells with more turbid river water). Operational flexibility from a locally sourced water supply will help the City to continue to meet daily demands, rather than solely relying on stored water in Loch Lomond, limited supplies from North Coast streams and groundwater from mid-County over-drafted aquifers.

Conjunctive management of surface and groundwater supplies is also critical to the City because the City also must meet instream flow requirements to benefit special status anadromous fish at all times including during long-term droughts. Since 2007 the City has been bypassing water from the North Coast and Tait St. sources to benefit salmonids, per agreements with the Department of Fish and Wildlife. The current releases from Loch Lomond and downstream bypass flows maintained at the Tait St. Diversion are determined in consultation with State and Federal fisheries agencies. It is anticipated that the Habitat Conservation Plan process will result in further restrictions of the use of surface water, as the City's historic diversion practices can have significant effects on available habitat for anadromous fisheries. During dry periods meeting customer demands while simultaneously maintaining fish bypass flows is particularly challenging. Municipal supply which is deferred to provide improved instream flows is presently made up from increased use of Loch Lomond. By augmenting the surface water diversions with Tait 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.

Efficient Groundwater Management:

Groundwater is a small percentage of the City's overall water supply portfolio but it is a very important source of supply during normal, dry and critically dry years from May to October. Given the threat of seawater intrusion and lowered groundwater levels in the Purisima Formation, from which the City pumps, the City moved some pumping inland. Beltz Well No. 12 helps to maintain the City's annual yield of groundwater production without exacerbating evidence of seawater intrusion (Ref. 10). This improves reliability and flexibility of the City's groundwater system. In late April 2015 the City of Santa Cruz signed an MOU with the Soquel Creek Water District to continue to cooperatively monitor groundwater and adaptively manage inland and coastal groundwater pumping. The goals of the MOU are to protect the Purisima A-unit offshore outcrop aquifer from seawater intrusion, maintain inland groundwater levels that

promote continued groundwater flow toward coastal wells, and provide both agencies adequate flexibility to respond to changing water demands, changing water supply availability, and infrastructure limitations (Ref.11). The City will voluntarily limit pumping to the 25-year average of 170 MG (520 acre-feet) during all years, and to 210 MG (645 acre-feet) during critically dry years. When Tait Wells Nos. 1 and 3 are replaced, and Tait Well No. 4 is rehabilitated, the additional supply from the Tait Wells during extended dry seasons may provide approximately 1.3 MGD to meet demand that would otherwise be met with groundwater. With this reliable supply in the dry months, the Tait Wells Replacement Project will minimize customer impacts while the City achieves the goals of the MOU of efficient groundwater management, which is critical to reduce the potential for or eliminate impacts from seawater intrusion.

b. Technical Analysis and Description of Physical Benefit B: Reduction of TOC from > 5 mg/L to <2 to 4 mg/L and associated reduced weighted average turbidity of 8.5 NTU from direct diversion/well mix to 2.4 NTU with wells (Secondary Benefit)

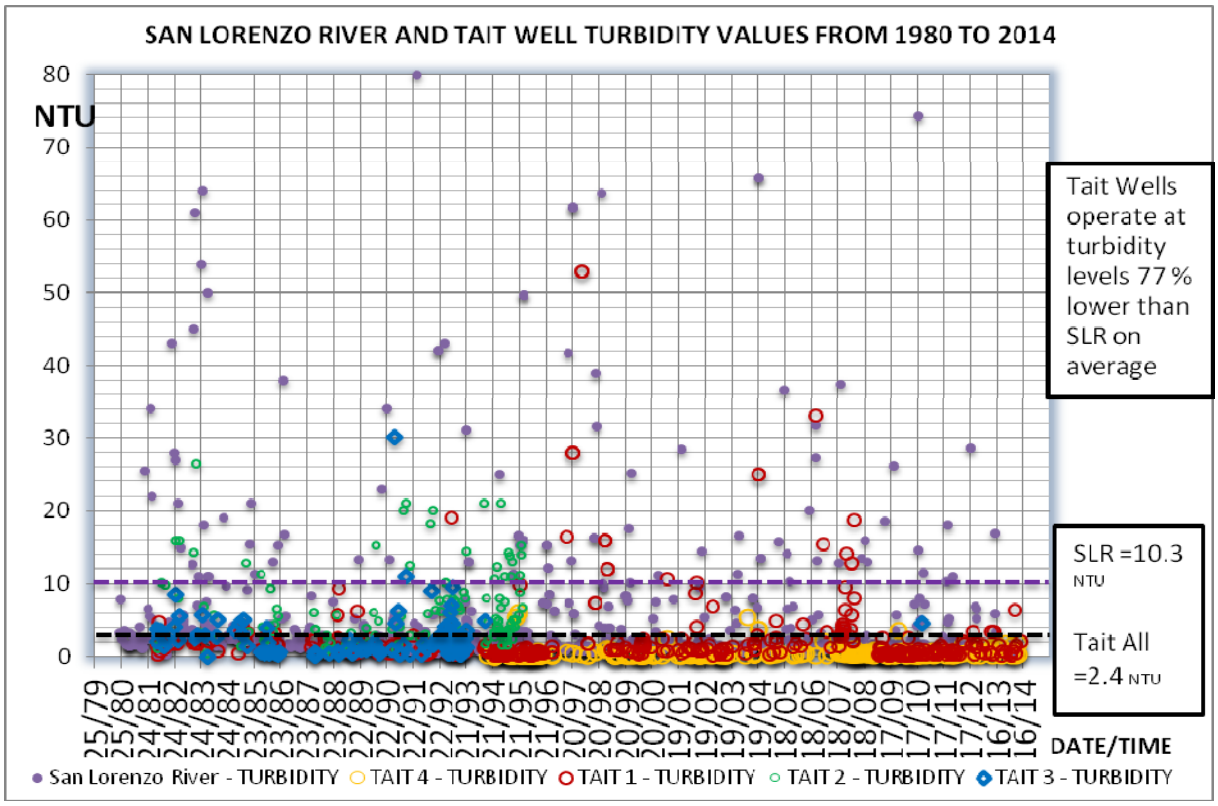
i. Provide an explanation of need for the project, including recent and historical conditions that provide background for benefits to be claimed; for example, recent water shortages, loss of habitat or ecosystem function, and water quality problems.

As highlighted in Section 1b, high TOC and associated turbidity issues limit the use of the surface diversion. In addition, TOC is associated with higher disinfection by product (DBP) precursors that are found in both surface diversions, especially in the wet season, but also from Loch Lomond, in the dry season. A primary indicator of source water quality is TOC (Total Organic Carbon) which is a component of NTU (turbidity) which is described further below. TOC is a water quality variable that changes depending on the source waters and their relative proportions. When the highest quality source waters are unavailable (i.e., North Coast sources and the Tait Wells) and the percentage of lower quality water is increased in the blend being produced, then the treatment plant's production is carefully managed to produce finished water quality that meets drinking water quality standards. However, there is an increased risk of violating Trihalomethane (THM) MCLs when the blend of source water has TOC greater than 5 mg/L. The following table shows the TOC of the surface water sources that vary in the blend of raw water sent to the GHWTP depending on hydrologic conditions and other factors (Ref. 16).

Blend of Santa Cruz Source Water Quality Affects Total Organic Content (mg/lL

Very Good = TOC < 2 mg/L	Good = TOC 2-4 mg/L	Poor = TOC > 5 mg/L
Tait Wells	Loch Lomond Reservoir	Loch Lomond Reservoir (unblended)
North Coast Sources (All 3 sources)	North Coast Sources (Reduced Quantity/Fewer Sources)	San Lorenzo River (Turbid)
Clean & Flowing San Lorenzo River	San Lorenzo River (Dry)	

Furthermore, a comparison of historic turbidity values, which are simpler to obtain and more frequently collected than TOC, for the San Lorenzo River direct diversion and the Tait Wells is shown on the figure below (Ref.6). The San Lorenzo River (purple dot) has more variable turbidity values that range from less than 4 up to 80 NTU, while turbidity in the Tait Wells (red circles) 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). The City is able to use San Lorenzo River water only when the turbidity is less than 25 NTU, as higher turbidity water cannot be effectively treated at GHWTP. The Tait Wells not only has lower TOC and turbidity but also allow more frequent use of San Lorenzo River.



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 during high turbidity events with elevated TOC. Furthermore, pumping from Tait Wells Nos. 1 and 4 will continue to decline beyond the annual average of 50 MGY/153 AFY requiring higher usage of Loch Lomond water with higher DBP precursors. In either case, drinking water will result in potentially elevated DBP levels, and increased likelihood of MCL violations for THMs.
In the Without Project condition, the turbidity data above can be aggregated into 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 method used to monitor the physical benefits of lower TOC water at the Tait Wells as compared to the San Lorenzo River and Loch Lomond is measurement of TOC at the three locations.

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

Easements for right of way access to the two well replacement sites will need to be obtained from Santa Cruz County. Replacing Tait Well 3 with a Tait Well No. 3b on the same parcel involves negotiation with the private property owner of the parcel. Tait Well No. 4 requires a physical assessment of the condition of the well prior to mechanical and chemical well maintenance work. Air lifting may be required if mechanical and chemical methods do not produce acceptable rehabilitation results. In addition to rehabilitation of Tait Well No. 4, production of 230 MGY/706 AFY of well water will also require installation of two 100' deep 10-12" diameter wells, as well as new pumps, pedestal, motors, and controls for both

wells and a new electrical condition for one of the wells. A security fence, gate and camera will be required.

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. As described in the Draft Initial Study prepared for Tait Well No. 1b, any potential environmental impacts from the proposed project would be less than significant. With compliance with applicable regulations, the proposed project would not result in substantial adverse effects on human beings or permanent adverse physical effects. A Notice of Exemption for Tait Well No. 1b project was filed as it is a replacement of an existing facility. An Initial Study/Mitigated Negative Declaration will be prepared for Tait Well No. 3b.

vi. Description of whether the proposed project effectively addresses long-term drought preparedness
As described earlier in Section 4.a, the Tait Wells Replacement Project contributes to sustainable water supply and reliability at all times including and most importantly during water shortages and achieves the following long-term drought preparedness measures:
- Promote water conservation, conjunctive use, reuse and recycling
- Efficient groundwater basin management

However, the Tait Wells Replacement Project also addresses other drought preparedness measures specific to the City. The City produces water from (1) surface water diversions in North Coast streams, (2) a surface water diversion and Tait Wells that can withdraw up to 12.2 cfs from the San Lorenzo River; (3) water stored in Loch Lomond Reservoir; and (4) groundwater. Long-term drought preparedness for the City includes three vital components: 1) increasing source water production flexibility for flowing sources of surface water, 2) using Tait Well water to help preserve reservoir storage, and 3) protecting groundwater resources from seawater intrusion. In addition to implementing restrictions (Stage 3 as of 2015) per the Water Shortage Contingency Plan (March 2009), the City is engaged in planning for long-term drought preparedness (Ref. 13).

The Tait Wells Replacement Project will also assist in meeting drinking water quality needs related to drought preparedness. Tait Wells provide a limited supply of high quality water, however with replaced pumping capacity in the near future the reliable yield from Tait Wells will improve the quality of the blend of raw water during long-term drought circumstances when yields from other high and medium quality sources are reduced. As discussed in Section 4b, in addition to maximizing the potential of existing sources, these wells will provide higher quality water compared to directly diverted surface water. The addition of up to 1.3 MGD will lower the TOC in the blend of raw water. This is an important benefit because as a result of the recent multi-year drought, the City has been challenged to comply with the Long Term 2 Enhanced Surface Water Treatment Rule and the Stage 2 Disinfectants and Disinfection Byproducts Rule (D/DBPR). These rules focus on maintaining levels of disinfection to reduce the risk from pathogens, while at the same time limiting the use of chemicals for disinfection to prevent production of harmful DBPs. Continued compliance relies on both maximizing use of the highest quality sources such as Tait Well water, and managing the DBP formation in the distribution that occurs as the proportion of Loch Lomond water increases. As a result of the Tait Wells Replacement Project, the City will be better able to balance the raw water quality being produced into finished water in long-term drought periods with three Tait Wells in service.

5. Direct Water-Related Benefit to a DAC

Water from the Tait Wells Replacement Project area is treated and delivered to customers throughout the service area, portions of which are Disadvantaged Communities (DAC). As described in Attachment 7, 36.1% of the City's service area is DAC by geography and/or population. Although the City is not seeking a DAC waiver, the water from the Project is blended with other sources and distributed to the entire City service area. Therefore, it benefits all of the DAC in the City service area.

The critical water supply needs, per Table 9 of the 2015 IRWM Grant Program Guidelines, of the DAC members in the City's service area are:

- Infrastructure renovations to a public water supply system necessary to assure continued reliability of the minimum quality and quantity of water

- Replacement of water supply wells that have exceeded their useful life (older than 50 years)

The detailed critical water supply needs are described as follows.

The Tait Wells Replacement Project involves infrastructure necessary to assure continued reliability of the minimum quality and quantity of water that can be utilized from the San Lorenzo River at Tait St. In 2009, a study of the Tait St. Diversion, the main diversion on the San Lorenzo River, concluded that all four of the Tait Wells have reached the end of their useful lives as Tait Wells Nos.1 and 3 were constructed prior to 1955. Tait Well No.4, which is to be rehabilitated, was constructed in 1992 and is 23 years old. The Project will provide access to San Lorenzo River that cannot be obtained at the surface water diversion, thereby providing operational flexibility for this valuable source. Water from these wells will be reliably less turbid and contain less TOC than flowing surface water, and will be available during times when the City bypasses flow for endangered species habitat and recovery. As described earlier in Section 1b, the drought is highlighting the limitations of the City's ability to supply water without rationing. Without the Project all customers, including DAC communities, are at risk of not having their potable water demands met in spite of intensive water conservation measures and stringent water use restrictions. The City serves a population of 95,244 in the City limits, a portion of unincorporated Santa Cruz County, and a small portion of the City of Capitola. May 1, 2015, the City Council declared a Stage 3 Water Emergency. Mandatory water use regulations are now in effect to reduce demand by 25%.After four dry years, the City is at risk of not meeting existing drinking water demands except for with the use of intensive water rationing measures, which lowered the per capita residential consumption from 63.1 gallons per person June 2013 per day to 42.7 in June 2015 (Ref. 14). The City is also unable to provide water without raising rates. The net effect on the Water Fund from rationing water in 2014 was a financial loss on the order of about $3.0 million in water sales revenue out of an approximately $26 million annual operating budget (Ref. 2). Should additional rate increases be needed to meet revenue needs; the DAC customers are least able to bear higher water bills. Therefore, expedited funding is needed to produce sufficient supply to serve to DAC and all customers and meet DBP MCLs, considering the City's financial challenges from both lost revenue and increased costs.

6. Project Performance Monitoring Plan

The City will establish monitoring measures to report on how the proposed project is achieving intended water supply and water quality benefits. Monitoring and project performance will be evaluated with qualitative and quantitative methods. Source yield from the Tait Wells will be measured at each well. Enhancements to yield measured during storm events and other operational challenges for the surface water diversion will be estimated based on pre project conditions. Operations and maintenance flexibility to target full potential production up to 12.2 cfs from the San Lorenzo River could be tracked and reported based on lowered TOC and NTU in the source water blend. Improved water quality will be tracked with existing water quality sampling and reporting procedures.

PSP Table 6 – Project Performance Monitoring Plan Project: Tait Wells Replacement Project		
Proposed Physical Benefits	Targets	Measurement tools and methods
Water Quantity: Reliably and sustainably produce 230 MGY/706 AFY of high quality water	230 MGY	Production meter data at Tait well sites
Water Quality: Reduction of TOC from > 5 mg/l to <2 to 4 mg/l and associated reduced weighted average turbidity of 8.5 NTU from direct diversion/well mix to 2.4 NTU with wells	Total TOC blend <2 - 4 mg/L	Monitoring data at Tait well sites

7. Cost Effective Analysis

PSP Table 7 – Cost Effective Analysis

Project name: _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 (Primary Benefit) Benefit B: Reduction of TOC from > 5 mg/l to <2 to 4 mg/l and associated reduced weighted average turbidity of 8.5 NTU from direct diversion/well mix to 2.4 NTU with wells (Secondary Benefit)
Question 2	Have alternative methods been considered to achieve the same types and amounts of physical benefits as the proposed project been identified? Yes as described below.
	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	~$1.1 m in capital costs; operation costs are for pumping	2015 Estimate for Table 8 Project Budget
Alternative A: Radial Wells	Ranney -- $11.4 m in 2015 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 Rogers Sanding Study p. 74 of pdf
Alternative B: Well at alternate location	$4.9 m in 2015 capital costs for new 210 gpm (average) 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 groundwater 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 and rehabilitation of Tait Well No. 4 for a total capital cost of ~$1.1 m.

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 $10.3 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 $3.8 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. 1, 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. 1) provides the 2009 cost of the project including multipliers was $10.43 which was escalated to 2015 to be $11.4 million (compared to the capital cost of developing the Tait Wells of $1.1 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.

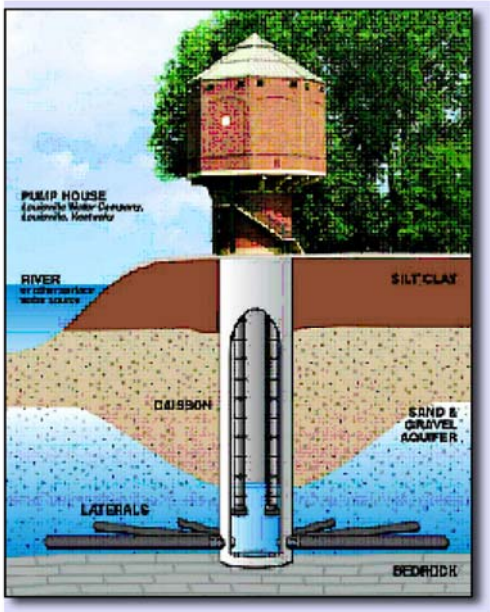


Figure 12.
Ranney Collector

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. 8, 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. 9, 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. 8, 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. *2009 Wood Rodgers Final Alternative Evaluation Report for Tait Street Sanding Study*

2. *Santa Cruz City Council Agenda Report*, April 14, 2015

3. *AWWA DBP Study Presentation*, Santa Cruz, 2013 slide 6

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

5. *Historical Water Production*, Tait St. Annual Production, Santa Cruz, 2015

6. *Turbidity and other data*, Santa Cruz 2014

7. Flint L.E. and Flint, A.L. 2012, *Simulation of Climate Change in San Francisco Bay Basins, California: Case Studies in the Russian River Valley and Santa Cruz Mountains*; U.S. Geological Survey Scientific Investigation report, 2012-5132, 55p.

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

9. *Beltz Well 12 Phase 2 – Water Treatment Plant Project Summary*, Santa Cruz, 2010

10. *City of Santa Cruz Groundwater Resources*, Rivera, I. Presentation, December 2014.

11. *Cooperative Monitoring/Adaptive Groundwater Management Agreement. Memorandum of Understanding between City of Santa Cruz and Soquel Creek Water District*, April 23, 2015

12. *Central California Coast Coho Salmon Recovery Plan* http://www.westcoast.fisheries.noaa.gov/publications/recovery_planning/salmon_steelhead/domains/north_central_california_coast/central_california_coast_coho/lorenzo_ii.pdf

13. *June 15, 2015 Water Supply Advisory Committee Phase II Report*, Santa Cruz City Council

14. City of Santa Cruz, July 2015. *Residential Per Capita Water Use Reporting For State Water Resources Control Board*, comparison of 2013 and 2015 production and residential gallons per capita per day

15. URS, May 1, 2014. *Draft Initial Study Tait Well Replacement Project*.

16. Personal communication with Hugh Dalton, Water Quality Production Manager, City of Santa Cruz Water Department, 7/17/2015.

These references files are available upon request.

Project 2: Bonita Hexavalent Chromium Treatment Facility Project

1. Project Description

Implementing Agency: Soquel Creek Water District (District)

25 word description: 3,200 feet 12-inch diameter raw water pipeline, 2,000 gpm centralized hexavalent chromium treatment and replacement well pumps for Seascape, San Andreas, and Bonita Wells.

a. Detailed Project Description

The District will construct 3,200 linear feet of 12-inch diameter, C-900 PVC raw water pipeline, a 2,000 gallon per minute (gpm) centralized well head water treatment system using a Strong Base Anion Exchange process to remove naturally-occurring hexavalent chromium (chromium-6) from three wells, and install three (3) 200 horsepower (hp)/1,000 gpm replacement well pumps at the Seascape, San Andreas and Bonita wells (Project). The Project will bring the District into compliance with the California State Water Resource Control Board (SWRCB) Division of Drinking Water's (DDW) final maximum contaminant level (MCL) of 10 micrograms per liter (µg/L) or parts per billion (ppb) for chromium-6 as was recently adopted by the SWRCB on July 1, 2014. Without the Project, approximately 1/3 of the District's water supply will not comply with state drinking water regulations.

The 2,000 gpm water treatment plant (WTP) at the Bonita Well site is located in unincorporated Santa Cruz County between the communities of Rio Del Mar and La Selva Beach. Raw water will be conveyed to the Bonita WTP via the new 3,200 feet PVC raw water pipeline from the District's Seascape well to the San Andreas well and an existing raw water pipeline from the San Andreas well to the Bonita treatment system. Replacement 200 hp/ 1,000 gpm groundwater pumps at the Seascape, Bonita and San Andreas wells will also be necessary to overcome increased pressure losses associated with the chromium-6 treatment filters. A new sewer force main from the treatment facility to the existing County of Santa Cruz sewer system north of the site will be constructed for the disposal of domestic wastewater and brine waste, which is treated to a non-hazardous level, from the Project.

b. How the Project Addresses a Current Need

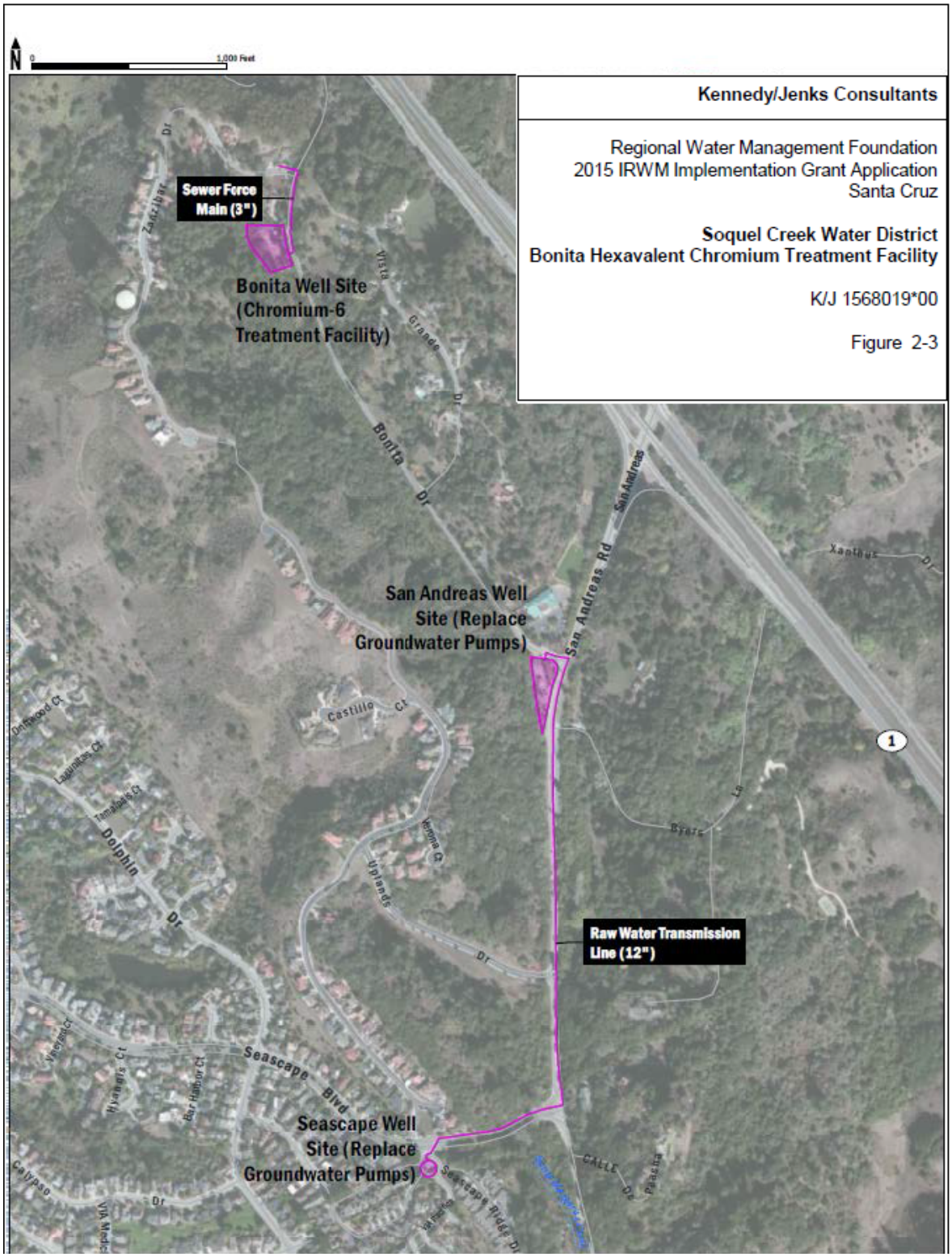
Among the many current water needs of the Santa Cruz IRWM Region are adequate water supply, which must all be provided locally from limited and over-drafted sources, and addressing groundwater quality challenges - both naturally occurring and anthropogenic. The Santa Cruz IRWM region is in the fourth year of below average rainfall with two back-to-back critically dry years. The surface water cumulative runoff from the San Lorenzo River from October 1, 2014 to March 31, 2015 measures 26,544 acre-feet or about 36 percent of average runoff through March (SCWD, 2015). The District relies solely on groundwater from the Purisima (2/3 of supply) and Aromas Red Sands (1/3 of supply) formations to supply its 38,000 customers (14,400 service connections) (District, 2010, p.2-2). The Aromas Red Sands is found to contain total chromium from 5 ppb to 40 ppb, well above the recently adopted chromium-6 MCL of 10 ppb. In addition, the District board declared a Groundwater Emergency in June 2014 (District, 2014, p.1) because both the Purisima and Aromas Red Sands formations are over-drafted and susceptible to seawater intrusion. Inland pumping locations, such as at the wells to be treated, reduces the seawater intrusion risk.

Upon promulgation of the Chromium-6 MCL of 10 ppb, the District lost approximately 3,300 gpm of supply as a result of four groundwater production wells exceeding the new standard. Without the project, the District would be limited to the pumping capacities of the remaining wells, most of which are vulnerable to seawater intrusion. The District cannot afford to lose this valuable supply, because it places it at risk of not meeting customer demands, even with demand restrictions, and would exacerbate the seawater intrusion problem.

In addition, the project would allow the District to provide groundwater to neighboring IRWM partner, the City of Santa Cruz, in drought years, in exchange for surface water in wet seasons, allowing conjunctive use between the two agencies. This excess surface water supply can be provided to the District to reduce reliance on coastal aquifers and, when protective water levels are achieved, water can be provided back to the surface water agency in times of drought, enhancing regional long-term drought preparedness. Interagency interties have been constructed to support water exchanges.

2. Project Map

The project map that follows, Figure 2-3 shows location of the Bonita Water Treatment Plant and Associated Wells.



3. Physical Benefits

Overview of Benefits

The Soquel Bonita Chromium-6 Treatment Project would have the following quantifiable physical benefits:

A. Reliably and sustainably produce 1,600 AFY of drinking water that meets MCLs(Primary benefit)
B. Reduce delivered water chromium-6 from 0.016 - 0.018 mg/l to 0.002 – 0.008 mg/l (16-18 ppb to 2-8 ppb) (Secondary benefit)

Benefit A: Reliably and sustainably produce 1,600 AFY of drinking water that meets MCL (Primary Benefit)

The construction of raw water pipeline, centralized treatment and replacement pumps will increase drinking water production up to 1,600 AFY compared to the without project alternative. For the purposes of Table 5A, a current production of 0 AFY is used for the Without Project condition. The estimated useful life for the WTP is 30 years. Therefore, a 30 year analysis starting in 2016 is provided in PSP Table 5A.

Benefit B: Reduce delivered water chromium-6 from 0.016 – 0.018 mg/l to 0.002 – 0.008 mg/l (16-18 ppb to 2-8 ppb) (Secondary Benefit)

The construction of a raw water pipeline, centralized treatment and replacement pumps will deliver drinking water production at a Chromium-6 concentration of 0.002 – 0.008 mg/l (2-8 ppb or ug/l) which is below the MCL of 0.010 mg/l (10 ppb). For the purposes of Table 5B, a current Chromium-6 concentration of 0.016 – 0.018 mg/l (16-18 ppb) is used for the Without Project condition. The estimated useful life for the WTP wells is 30 years. Therefore, a 30 year analysis starting in 2016 is provided in PSP Table 5B that follows.

PSP Table 5A – Annual Project Physical Benefits

Project Name: Bonita Hexavalent Chromium Treatment Facility Project
Type of Benefit Claimed: Regained Water Production
Units of the Benefit Claimed : AFY
Anticipated Useful Life of Project: 30 years

Additional Information About this Benefit: 1,600 acre feet/yr on average, peak day capacity of 2.8 MGD, 2,000 gpm

(a)	(b)	(c)	(d)
	Physical Benefits		
Year	Without Project	With Project	Change Resulting from Project (c) - (b)
2015	0	0	0
2016	0	0	0
2017-2046	0	1,600	1,600
2047	0	1,600	1,600
Total		480,000	

Comments: Regain 1,600 AFY of groundwater supply by removal of Hexavalent Chromium to comply with MCL while also providing necessary capacity for water exchanges with neighboring IRWM partner water agency

PSP Table 5B – Annual Project Physical Benefits			
Project Name Bonita Hexavalent Chromium Treatment Facility Project Type of Benefit Claimed: Reduction of hexavalent chromium levels in groundwater supply Units of the Benefit Claimed : mg/l reduction in hexavalent chromium Anticipated Useful Life of Project: 30 years Additional Information About this Benefit: The without project condition is five groundwater production wells with hexavalent chromium ranging between 0.016 – 0.018 mg/l would fail to deliver water meeting state requirements.			
(a)	(b)	(c)	(d)
	Physical Benefits		
Year	Without Project	With Project	Change Resulting from Project (c) - (b)
2015	0.016 – 0.018	n/a*	n/a*
2016	0.016 – 0.018	n/a*	n/a*
2017-2046	0.016 – 0.018	0.002 – 0.008	-0.010 to -0.014
2047	0.016 – 0.018	0.002 – 0.008	-0.010 to -0.014
Comments: The proposed strong base anion exchange hexavalent chromium treatment facility will treat raw groundwater with concentrations of naturally occurring hexavalent chromium ranging between 0.016 – 0.018 mg/l to levels ranging between 0.002 – 0.008 mg/l for compliance with the Chromium-6 MCL of 0.010 mg/l (10 ppb). Without treatment, the three groundwater production wells would fail to deliver water meeting drinking water standards and put the District at risk of not meeting demands. * There is no water being delivered before the project starts up because of the MCL exceedance for Chromium-6; therefore these entries are not applicable (n/a)			

4. Technical Analysis of Physical Benefits Claimed

a. Technical Analysis and Description of Physical Benefit A: Reliably and sustainably produce 1,600 AFY of high quality water (Primary Benefit)

i. <u>Provide an explanation of need for the project, including recent and historical conditions that provide background for benefits to be claimed; for example, recent water shortages, loss of habitat or ecosystem function, and water quality problems.</u>

The recent and historical conditions that explain the needs for this project include a multi-year drought, increased seawater intrusion, and new water quality regulations. The Santa Cruz IRWM region is in the fourth year of below average rainfall and is confronting two back-to-back critically dry years. In addition, drought conditions have reduced recharge in both the Aromas and Purisima formations, which provide the District with its entire supply, which exacerbates sea water intrusion issues as well as limit supply.

From a water quality perspective, the District has been actively monitoring its 17 groundwater wells for chromium-6. During the 2001 monitoring, the District discovered chromium-6 at concentrations greater than 5 µg/L in five of the currently active 17 total production wells. Since 2001, the District voluntarily tested water from the impacted wells on an annual basis, and now monitors in accordance with the new regulations. Chromium-6 was measured in the District's Aromas Red Sands wells at concentrations ranging from 5 ppb to 40 ppb, which was below the applicable MCLs for total chromium (50 µg/L) at the time. Aquifers in the Purisima Formation have chromium-6 levels of no more than 0.50 ppb. In 2014, a chromium-6 MCL was promulgated by the state at a concentration of 10 ppb, which rendered water from several of the District's Aromas wells unusable without treatment. Treatment to reduce naturally occurring hexavalent chromium concentrations will provide the District with supply capacity of 2,000 gpm from the 3 wells to be treated. This will not only help the District more reliably meet current curtailed demands from inland wells with reduced seawater intrusion risk,

but also allow the District to reciprocate water exchanges with neighboring IRWM surface water agency, City of Santa Cruz, during drought cycles.

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 project, loss of production capacity of approximately 3,300 gpm would be experienced by Soquel Creek Water District as the water could not be delivered with chromium-6 in violation of the MCL. With implementation of the project, the loss of production capacity is reduced by 2,000 gpm (capacity of treatment facility). Without the project, the District will need to rely on increased water conservation (the District is in a Stage 3 Water Shortage Emergency because of the drought) and increase pumping from wells in the Purisima formations which may not have sufficient capacity to meet demand. These Purisima wells are also located closer to the ocean which exacerbates sea water intrusion issues during the declared Groundwater Emergency.

Unlike many regions in the state, the Santa Cruz IRWM planning region does not receive water imported via state or federal water supply projects. Despite the many benefits of a local water supply, the region's current water demand exceeds sustainable supply, resulting in overdrafted aquifers, diminished streamflow, and inadequate long-term supply. Without this project, there is very limited opportunity to either conjunctively manage water resources with adjacent agencies or provide alternative supplies to provide this equivalent benefit. This project prepares Soquel Creek Water District to be able to participate in water exchanges involving transfers of excess available surface water from the San Lorenzo River during the winter months of November through April. Water would be transferred from the City of Santa Cruz diversions on the San Lorenzo River to the Soquel Creek Water District to meet demands, allowing a reduction in pumping from overdrafted groundwater basins, helping those basins to recover. As basin recovery occurs, increased groundwater levels will increase stream baseflow and improve habitat for special status fisheries, and during dry summers water could be provided back to the City of Santa Cruz to help meet their demands while leaving more flow in the streams for fish. The City of Santa Cruz would also benefit indirectly from increases in groundwater levels in the western Purisima basin, which the City shares with the Soquel District. A planning study previously evaluated these water transfers in the Conjunctive Use Final Report, Phase 11 (Santa Cruz County Environmental Health Services, 2015, p. 23)

iii. Provide a description of methods used to estimate physical benefits.
The physical benefit of the estimated well production of 2,000 AFY was estimated using the annual production data for the 3 wells. In addition the water quality benefits are based on the hexavalent chromium demonstration facility at the San Andreas well in operation since October 2014. The treatment facility, which has a limited capacity and was intended to demonstrate treatment efficiencies, has provided drinking water to the Distribution system with water quality samples in compliance with the MCL. The water quality test results verify hexavalent chromium levels have been reduced to approximately 3 ppb. The method used to monitor the physical benefits of water production at the Bonita WTP is pump discharge water meter data that are collected from the WTP.

iv. Provide a description of all new facilities, policies, and actions required to obtain the physical benefits.
The new facilities and actions required to obtain the physical benefit of 2,000 AFY of reliable drinking water is to build a 12-inch diameter C900 PVC 3,200' raw water pipeline using open cut methods with pavement restoration, a secure 4,000 square foot WTP building on existing District property with associated strong base anion exchange hexavalent chromium treatment equipment, install and to install new well pumps and motors and related appurtenances 1,000 gpm/ 200 hp units at three existing well sites to overcome the additional pressure losses created by the new water treatment facility. (Black and Veatch, 2015)

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 construction equipment. There are no permanent adverse physical effects of the project that cannot be mitigated. Portions of the District's property contain habitat for the Santa Cruz long-toed salamander (SCLTS). The Project has been designed and will be constructed and operated to avoid disturbance to potential habitat for this species.

vi. Description of whether the proposed project effectively addresses long-term drought preparedness
The Bonita Hexavalent Chromium Treatment Facility Project contributes to sustainable water supply and reliability during water shortages and achieves the following long-term drought preparedness measures:
- Promotes water conservation and conjunctive use
- Efficient groundwater basin management

Conjunctive Use: The Project provides the District necessary pumping and groundwater treatment capacity, in an inland area with lower seawater intrusion risk, to participate in conjunctive use with the neighboring City of Santa Cruz Water Department which has surface water supplies. Excess surface water during winter months (November-April) would be transferred to the Soquel-Aptos groundwater basin, allowing the District to reduce groundwater extractions and facilitate in-lieu recharge of the Purisima Formation and Aromas Red Sands aquifer (both over drafted coastal aquifers). Recovery of the groundwater basin would occur over the long-term during non-drought years, and groundwater returned during drought years would address drought preparedness for the City of Santa Cruz. Additionally, as recovery occurs, groundwater aquifers would be less vulnerable to seawater intrusion and establish efficient groundwater basin management. Existing interties between the City of Santa Cruz and the District would be utilized to facilitate the water exchange.

While relying on groundwater aquifers in drought periods may temporarily deplete groundwater levels in the short term, the overall recovery of the aquifers is beneficial because there are more years when in lieu recharge occurs than extractions for drought assistance (Hydrometrics, 2012, p.27). As the freshwater gradient increases, TDS and chlorides will decrease, reducing the risk for seawater intrusion. These three quantifiable benefits (increase in groundwater levels, decrease in TDS and decrease in chlorides) are documented and evaluated on a quarterly basis as well as in the Soquel-Aptos Area Groundwater Management Annual Review and Report for each water year.

Recovery of groundwater aquifers results in increased baseflow in creeks, streams and rivers and reduced TDS/Chlorides in GW from reduced seawater intrusion.

Efficient Groundwater Management: In the situation facing the District and the Santa Cruz IRWM region, the conjunctive use opportunity presented by this Project as described above, is directly related to efficient groundwater management as a long-term drought-preparedness measure. Recovery of the groundwater aquifers will occur during in-lieu recharge and would occur over the long-term during non-drought years as a result of conjunctive management of the Purisima and Aromas basins in coordination with the City of Santa Cruz. Additionally, as recovery occurs, groundwater aquifers would be less vulnerable to seawater intrusion and establish efficient groundwater basin management.

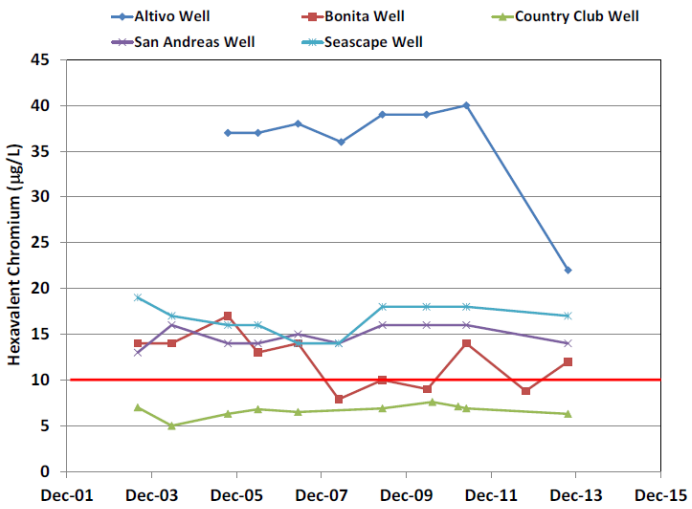
Further benefits of basin recovery are increased groundwater levels with associated increases in stream baseflow and available fish habitat, and during dry summers, groundwater could be provided back to the City of Santa Cruz to help meet their demands while leaving more flow in the streams for fish. The City of Santa Cruz would also benefit indirectly from increases in groundwater levels in the western Purisima basin, which the City shares with the Soquel District.

b. Technical Analysis and Description of Physical Benefit B: Reduction of hexavalent chromium levels in groundwater supply (Secondary Benefit)

i. Provide an explanation of need for the project, including recent and historical conditions that provide background for benefits to be claimed; for example, recent water shortages, loss of habitat or ecosystem function, and water quality problems.

As described in 4.a above, the District has actively monitored chromium-6 concentrations for many years, a summary of historic data are provided in the graph below. While the levels shown in the graph are well below the original 50 ppb MCL for total chromium, the levels are above the 10 ppb MCL which was set for Chromium-6 in 2014.

Figure 8 Historical Hexavalent Chromium Concentrations in the District's Chromium Impacted Wells



(Corona Environmental Consulting, 2014, p. 14.)

In addition, several years prior to the promulgation of the 10 ppb MCL for chromium-6, the District proactively evaluated treatment technologies and commissioned a demonstration facility at the San Andreas well to gain knowledge and advise the full scale treatment facility and CEQA process (Jacobs, 2011, p. 19-26). The demonstration facility was the first facility in the State to be permitted to deliver treated water to the Distribution system

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).

As described earlier, without the project, the District would not be able to deliver water from the wells because the water does not meet the chromium-6 MCL drinking water standards, and would instead experience a shortage of up to 35% or 1,600 AFY. Instead the District will need to rely on increased water conservation (the District is in Stage 3 Water Shortage Emergency because of the drought) and increase pumping from wells in the Purisima formations, which are not impacted by chromium-6, and which may not have sufficient capacity to meet demand. These Purisima wells are also located closer to the ocean which exacerbates sea water intrusion issues during the declared Groundwater Emergency. This shift in pumping will exacerbate coastal drawdown of water levels and likely impede the District's groundwater management goal of raising coastal water levels to protective elevations.

With the project, water quality delivered to customers is improved and risk of cancer is reduced as evaluated in the Public Health Goal for Hexavalent Chromium (Cr VI) in Drinking Water (OEHHA, 2014)

iii. Provide a description of methods used to estimate physical benefits.
The physical benefits were estimated using raw water monitoring and the estimate hex chrome reduction from the demonstration plant -Since operation commenced at the demonstration facility at San Andreas Well in October of 2014, all water quality requirements specified in the permit amendment imposed by the SWRCB Division of Drinking Water have been met.
Treated water is sampled monthly for hexavalent chromium and nitrate and weekly for total coliform. When blending is implemented, hexavalent chromium samples are weekly. Raw water and Treated water samples are used to evaluate % efficiency of the process.

iv. Provide a description of all new facilities, policies, and actions required to obtain the physical benefits.
As described earlier in Section 4.a, the new facilities and actions required to obtain the physical benefit of 2,000 AFY of reliable drinking water is to build a 12-inch diameter C900 PVC 3,200' raw water pipeline using open cut methods with pavement restoration, a secure 4,000 square foot WTP building on existing District property with associated strong base anion exchange hexavalent chromium treatment equipment, install and to install new well pumps and motors and related appurtenances 1,000 gpm/ 200 hp units at three existing well sites to overcome the additional pressure losses created by the new water treatment facility.

v. Provide a description of any potential adverse physical effects as a result of the project.
As described earlier in Section 4.a, the potential adverse effects as a result of the project are temporary construction effects, such as additional traffic and noise from construction equipment. There are no permanent adverse physical effects of the project that cannot be mitigated. Portions of the District's property contain habitat for the Santa Cruz long-toed salamander (SCLTS). The Project has been designed and will be constructed and operated to avoid disturbance to potential habitat for this species.

vi. Description of whether the proposed project effectively addresses long-term drought preparedness
As described earlier in Section 4.a, the Bonita Project contributes to sustainable water supply and reliability during water shortages and achieves the following long-term drought preparedness measures:
- Promote water conservation, conjunctive use, reuse and recycling
- Efficient groundwater basin management

5. Direct Water-Related Benefit to a DAC

As shown on Figure A in Attachment 7, there is a small population of DAC in the District service area; however it is less than the 25% threshold required in the 2015 Proposal Solicitation Package.

6. Project Performance Monitoring Plan

The District will establish monitoring measures to report on how the proposed project is achieving intended benefits. Monitoring and project performance will be evaluated with qualitative and quantitative methods. Source Chromium-6 values the raw water wells will be measured at each well compared to WTP production Chromium-6 values. Operations and maintenance can be measured against the status quo (i.e. two unreliable, partially functioning wells). In addition, flexibility of operations can be measured against exclusively using the surface water diversion providing quantitative information about the water conserved in Loch Lomond that was provided by the Tait Wells (i.e. days of production of Loch Lomond water).

PSP Table 6 – Project Performance Monitoring Plan Project: Tait Wells Replacement Project		
Proposed Physical Benefits	Targets	Measurement tools and methods
Water Quantity	1,600 AFY	Water Production meter data at Bonita WTP
Water Quality	0.002 – 0.008 mg/l (2-8 ppb) Cr. 6 concentrations for product water	Water Quality monitoring data at Bonita WTP

7. Cost Effective Analysis

PSP Table 7 – Cost Effective Analysis

Project name: _ Bonita Hexavalent Chromium Treatment Facility Project

Question 1

Types of benefits provided as shown in Table 5

A. Reliably and sustainably produce 1,600 AFY of drinking water that meets MCL (Primary benefit)
B. Lower delivered water chromium-6 from 0.016 – 0.018 mg/L (16-18 ppb) to 0.002 – 0.008 mg/L (2-8 ppb) (Secondary benefit)

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.
Alternate hexavalent chromium removal technologies were evaluated in 2011 and documented in a report titled "Screening of Potential Hexavalent Chromium Treatment Technologies" by Jacobs Engineering Group. Additionally, piloting of the least cost alternative was carried out and documented the 2014 Tailored Collaboration Water Research Foundation Report #4488. Additionally, seven implementation scenarios were evaluated by Corona Environmental Consulting, LLC as documented in a 2014 study titled, "Hexavalent Chromium Treatment Implementation Study." The alternatives, as evaluated in the 2011 Jacobs report are summarized below.

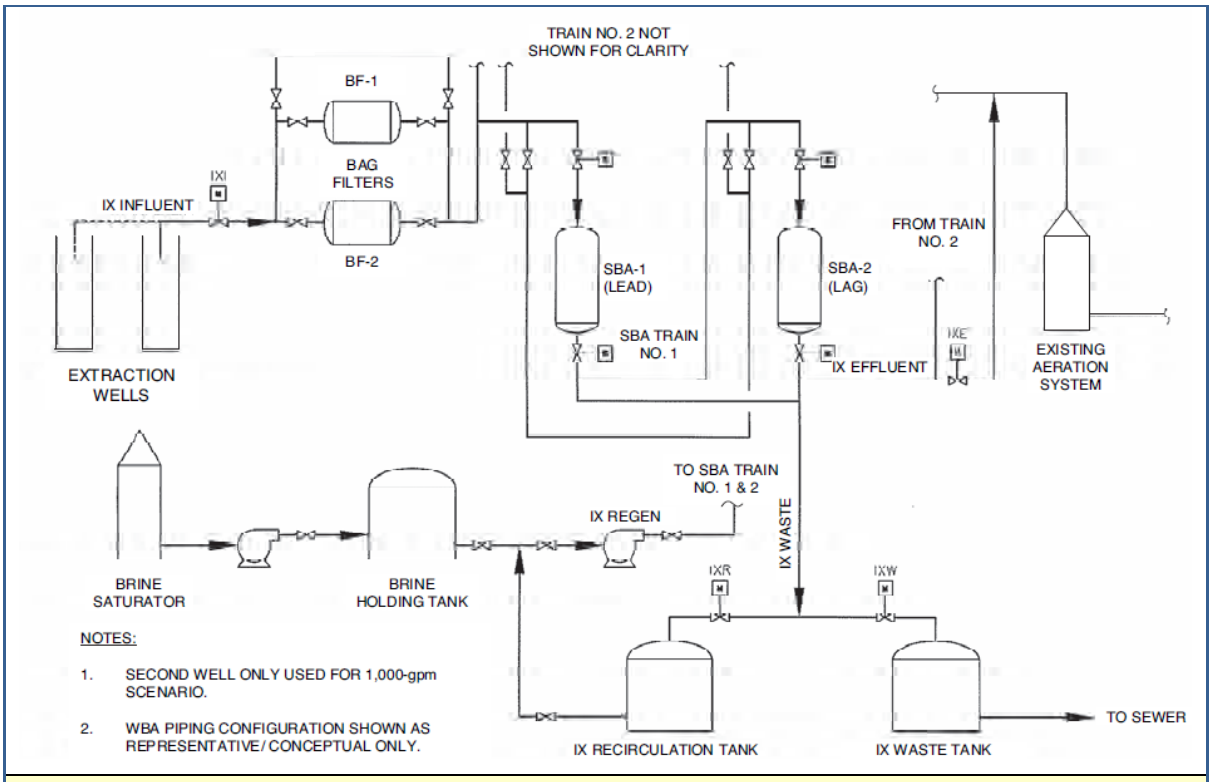
Alternatives Description	Estimated Costs (Capital and O&M)			Describe studies, plans or documents that identify alternatives and costs of those alternatives
	Capital (2011$)	Annual O&M at 100% utilization (2011$)	20-yr – Net Present Worth at 100% utilization (2011$)	
Project – Strong Base Anion Exchange	$2.4m	$200,000/year	$4.9m	Jacobs, 2011: • Figure 8 – Capital Cost Comparison, p. 19, • Figure 10 – Annual Operations and Maintenance Comparison for 100% Utilization, p.24. • Figure 12 for 20-year Net Present Worth for 100% utilization, p. 26 All alternatives are for 1,000 gpm facilities.
Alternative A: Weak Base Anion Exchange*	$2.0m	$470,000/year	$11m	
Alternative B: Reduction Coagulation Filtration*	$2.35m	$275,000/year	$4.8m	
Alternative C: Chemical Reductive Media*	$2.75m	$275,000/year	$5.75m	

* The lowest 20-year NPW cost of the technology evaluated was used for this table

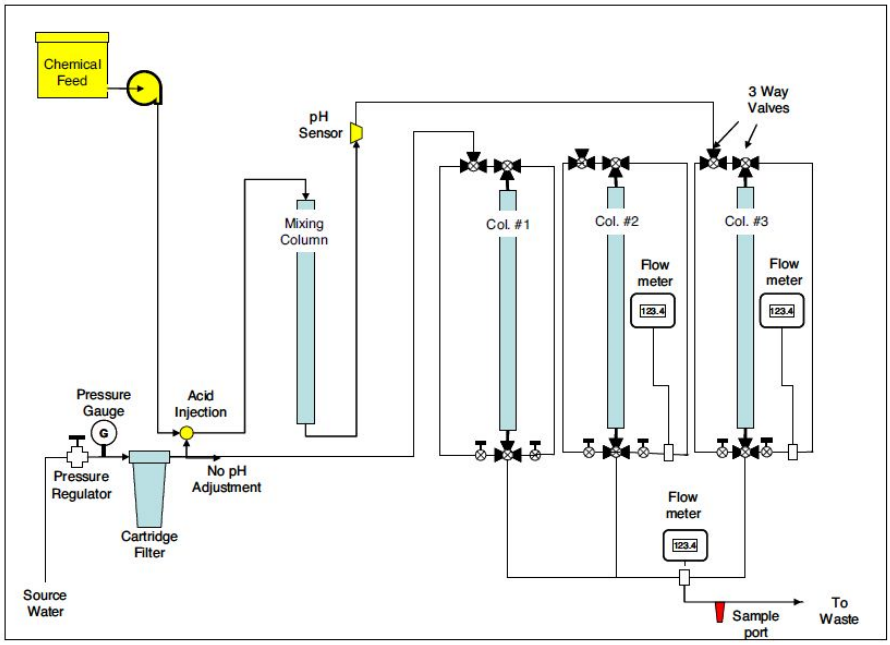
	The proposed project also includes the construction of raw water pipeline and replacement of well pumps which would be required for all alternatives. Therefore the addition of these other facilities has no bearing on the outcome of the financial analysis and are not included in this table. In addition, the actual project treatment capacity is 2,000 gpm, not 1,000 gpm as was evaluated in the 2011 Jacobs report. However, the comparison of the alternatives in the 2011 Jacobs report for the purposes of selecting a least cost alternative is valid without adjusting for the increased flows or for escalating to 2015 $.
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. Based on the 2011 Jacobs Report, the Strong Base Ion Exchange Alternative is slightly more expensive on a 20-year net present worth basis than the Reduction Coagulation Filtration alternative so the project is not the least cost alternative. However, based on Table 11 on page 31 of the 2011 Jacobs Report, the Strong Base Ion Exchange Alternative was selected because it represents the most mature potable water treatment technology; the actual lifecycle costs are lower than in the Jacobs Report because direct sewer disposal is utilized in the project. In addition, Table 11 notes that the Reduction Coagulation Filtration Alternative has a large footprint to accommodate multiple processes that require more operational attention than other technologies. Therefore, the selection of the Strong Base Ion Exchange technology is justified even if it is not strictly the least cost alternative. Additional details regarding the technologies are provided below.

Comments: Additional descriptions of the alternative technologies from pages 7-11 of the 2011 Jacobs Report.

Project Strong Base Anion Exchange– The strong base anion exchange (SBA-IX) operates in a similar fashion to WBA-IX with the exception that the resin is regenerated with a brine solution to restore the exchange capacity. SBA-IX also has the benefit of being able to operate without pH depression which eliminates the need for acid and caustic chemical feed and storage systems on-site. However, in the absence of a brine line for ocean discharge, the regeneration brine used in the SBA-IX process typically needs to be disposed of off-site and can potentially become a hazardous waste due to the enhanced levels of hexavalent chromium and other co-occurring contaminants. The regeneration brine can also be treated by adding ferrous sulfate and ferric chloride as coagulants to precipitate the hazardous constituents that have accumulated in the brine. The figure below is a schematic representation of the SBA-IX process as illustrated in McGuire et.al. (2007). The “existing aeration system” shown in the figure will not be required for the District’s treatment needs.

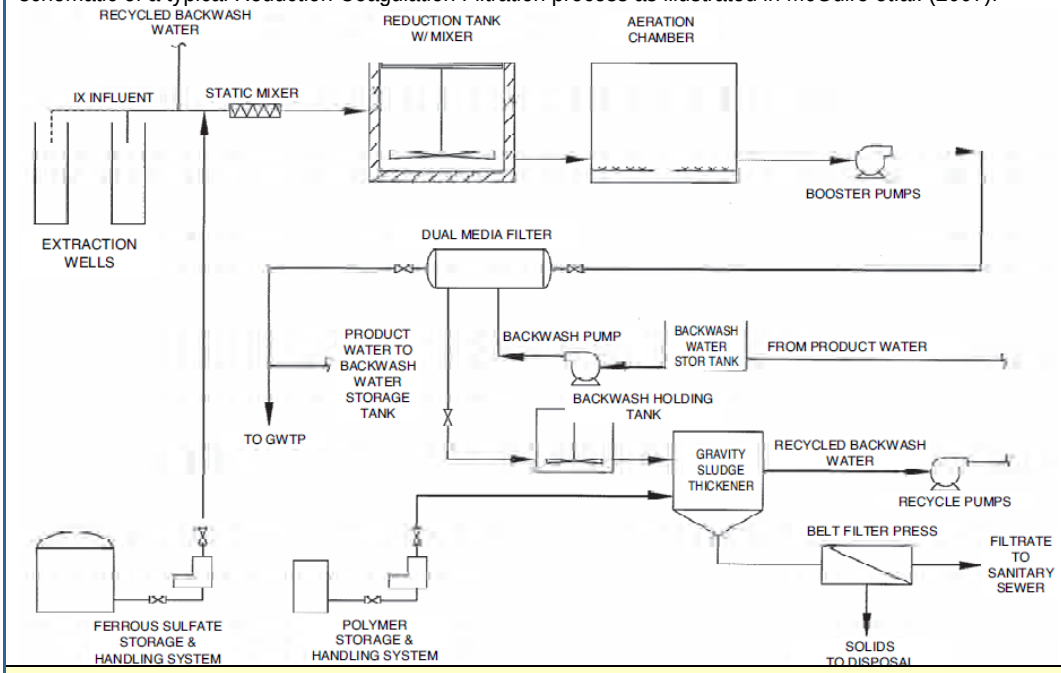


Alternative A: Weak Base Anion Exchange-For hexavalent chromium removal, a typical weak base anion exchange (WBA-IX) system would consist of pressure vessels loaded with WBA-IX resin that are oriented in a lead/lag configuration. The WBA-IX resin is operated as a single use, non-regenerable resin that would be disposed of as a hazardous waste after its exchange capacity has been consumed. Treatment by WBA-IX requires pH reduction to approximately 6.0 in order to operate the resin with charged exchange sites. Following the WBA-IX treatment, the pH will need to be readjusted to the raw water conditions to reduce the potential for distribution system challenges. The figure below is a schematic representation of the WBA-IX process as illustrated in the Water Research Foundation's (WaterRF) 2007 report "Hexavalent Chromium Removal Using Anion Exchange and Reduction with Coagulation and Filtration".

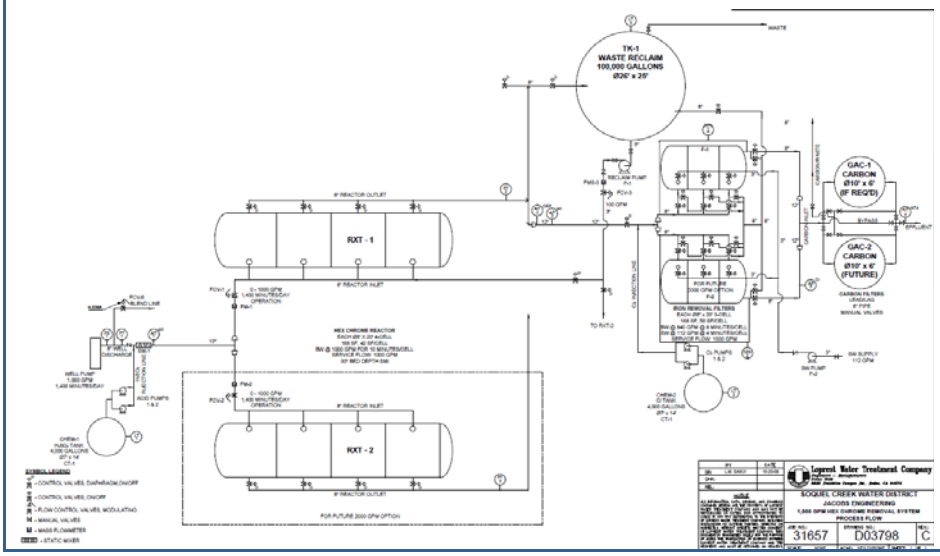


Alternative B: Reduction Coagulation Filtration- The removal of hexavalent chromium by reduction to trivalent chromium

with ferrous sulfate and subsequent coagulation with ferric iron and filtration has long been used in industrial treatment processes and has been demonstrated in Glendale, CA to be an effective technology in drinking water applications. The reduction/coagulation/filtration (RCF) process typically includes an aeration step following the reduction process to oxidize the ferrous iron to ferric, followed by coagulation and media filtration to remove the ferric and chromium hydroxide particles. Periodically the filters will require backwashing to restore the hydraulic capacity by removing trapped particulates. Residual processing facilities, including backwash recovery tanks and solid processing equipment can be utilized to increase the water efficiency and reduce the volume of residuals for disposal. The figure below is a process schematic of a typical Reduction Coagulation Filtration process as illustrated in McGuire et.al. (2007).



Alternative C: Chemical Reductive Media- Iron based reductive media have been shown to remove hexavalent chromium in drinking water at bench and - pilot-scale applications. While the exact removal mechanism is uncertain, it is thought to be a combination of reduction, adsorption and precipitation/filtration of the hexavalent chromium. A typical chemical reduction media (CR) system for hexavalent chromium would include prefiltration and pressure vessels loaded with CR media. Other process equipment may include post-filtration, pH adjustment, and residual processing equipment. The figure below is a process schematic of a typical Chemical Reduction Media technology. (Jacobs, 2011)



Project 2 References

1. *Bonita WTP – Hexavalent Chromium Removal Treatment System, Basis of Design Report,* Black & Veatch Corporation, May 8th 2015

2. *Bonita WTP Hexavalent Chromium Removal Treatment System Procurement Contract*, A. Shirolkar, J. Wallin - Black & Veatch Corporation, J. Aieta - ACE Engineering, PLLC, Corona Environmental Consulting LLC, July 2015

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4. *Soquel Creek Water District: Hexavalent Chromium Treatment Implementation Study,* C. Seidel, C. Gorman, Corona Environmental Consulting LLC , August 6th, 2014

5. *Hexavalent Chromium Treatment with Strong Base Anion Exchange and Chemical Reductive Media,* C. Seidel-Jacobs Engineering Groups, J. Darby, P. Green-UC Davis, May 2012

6. *Hexavalent Chromium Treatment with Strong Base Anion Exchange,* C. Seidel, C. Gorman, A. Ghosh - Corona Environmental Consulting LLC, T. Dufour, C. Mead, J. Henderson - Soquel Creek Water District, X. Li, J. Darby, P. Green - UC Davis, L. McNeill - Utah State University, D. Clifford - University of Houston, 2014

7. *2014 Tailored Collaboration- Report #4488,* Water Research Foundation, 2014

8. *Water Resources of Santa Cruz County*, Soquel Water District, September 2005

9. *Revised Protective Groundwater Elevations and Outflows for Aromas Area and Updated Water Balance for Soquel-Aptos Groundwater Basin,* C. Tana, D. Williams - HydroMetrics Water Resources Inc., April 3rd 2012

10. *Screening of Potential Hexavalent Chromium Treatment Technologies*, Jacobs Engineering Group. 2011.

11. *Public Health Goal for Hexavalent Chromium (Cr VI) in Drinking Water,* Office of Environmental Health Hazard Assessment, July 2011. Available at: http://oehha.ca.gov/water/phg/pdf/Cr6PHG072911.pdf

12. *2015 Water Supply Outlook,* Santa Cruz Water Department, 2015. Available at: http://cityofsantacruz.com/departments/water/drought/2015-water-supply-outlook

13. *Resolution 14-22- Groundwater Emergency Declaration*, Soquel Creek Water District, 2014.

14. *Urban Water Management Plan 2010*, Soquel Creek Water District, 2010.

Project 3: Davenport Recycled Water Plant

1. Project Description

Implementing Agency: Davenport County Sanitation District (District)

25 word description: Wastewater treatment upgrades including tertiary treatment for unrestricted use recycled water, seasonal storage pond, facilities for crop irrigation, and sludge removal to reduce spill risk.

a. Expanded Project Description

The Davenport wastewater treatment facility is located near Highway 1 about 12 miles north of Santa Cruz and serves a disadvantaged community of about 85 homes, 11 businesses, one volunteer fire department and one elementary school in the community. The facility cannot adequately treat and dispose of treated wastewater, especially during the wet season. IRWM funding would be used for construction of the upgrades at the treatment plant to produce higher quality recycled water for irrigation use on food crops, new recycled water storage pond, and construction of pump and piping infrastructure. The project will help the District to ensure discharge compliance during wet periods and alleviate the high sewer rates to the disadvantaged community, as well as provide a drought proof water source for adjacent agricultural parcels. The District is also seeking funding from the State's Clean Water State Revolving Fund (CWSRF) program for design and construction and the Community Development Block Grant program.

b. How the Project Will Address a Current Need of the Region

Water supply and measures to mitigate climate change impacts are two main needs of the Santa Cruz IRWM region and in Davenport. This project will address both these challenges by providing recycled water to benefit local farming with a reliable water supply. In addition, the project addresses wet weather capacity of the wastewater treatment facility and provides recycled water storage, both of which are necessary to meet future hydrologic variability associated with climate change.

Water Supply: The Santa Cruz IRWM Region relies entirely on rainfall, surface water, and groundwater within watersheds located in the County; no water is imported from outside the region. Water supply is often not reliable within the Region in years with normal precipitation because of competing ecosystem needs and/or depleted groundwater in parts of the Region; this situation is exacerbated when below average water years occur. The current fourth year of drought, including two consecutive critically dry years is spotlighting the vulnerability of the Region's water supplies. Specifically, the Davenport community relies on surface water diverted from Mill Creek and San Vicente Creek for supply because local groundwater resources are extremely limited. Upgrades to the treatment plant and new recycled water storage and infrastructure will provide drought proof recycled water from Davenport to allow new local agricultural development of edible crops on over 50 acres of nearby land.

Climate Change: Findings from a 2012 U.S. Geologic Survey study showed strong evidence for temperature increases in the future for the Santa Cruz Region along with altered patterns of rainfall and runoff and reduced recharge. Davenport currently owns and operates a wastewater treatment plant that consists of a 4 million gallon treatment lagoon, filters, and a chlorine contact tank that produce Title 22 secondary-23 quality recycled water which has limited beneficial uses. Wastewater storage, treatment, and disposal challenges in the wet season exist at Davenport today because of limited storage capacity in the lagoon, which is at risk of overtopping annually during average rainfall years, and limited land application area that becomes too saturated in the wet season and creates runoff in violation of the Waste Discharge Permit. These wastewater system limitations were compounded when the local CEMEX concrete plant, which had used treated effluent in its concrete manufacturing plant, ceased operation in 2010, magnifying an already challenging wastewater disposal situation. Climate change effects are likely to bring extreme rainfall events which will further exacerbate this wet season need, as well as extreme dry periods, as is currently being experienced which result in water supply risk.

2. Project Map

The project map on the page that follows, Figure 2-4 shows the location of the Davenport Recycled Water Plant.

3. Physical Benefits

Overview of Benefits

The Davenport Recycled Water Project has the following two benefits:

A. Increase available water supply by producing 14 acre-feet/year of Title 22 disinfected tertiary quality recycled water (Primary Benefit)
B. Eliminate the discharge of 40 mg/L of Biological Oxygen Demand (BOD) wastewater during the wet season by restoring treatment lagoon storage capacity (Secondary Benefit)

Benefit A: Increase available water supply by producing 14 acre-feet/year of Title 22 disinfected tertiary quality recycled water (Primary Benefit)

The upgrades at the wastewater treatment plant will allow the supply of 14 AFY of tertiary treated recycled water for unrestricted use compared to the without project alternative. For the purposes of Table 5A, a current production of 0 AFY is used for the Without Project condition. The estimated useful life for the recycled water plant is 50 years. Therefore, a 50 year analysis starting in 2015 is provided in PSP Table 5A.

Benefit B: Eliminate the discharge of 40 mg/L of Biological Oxygen Demand (BOD) wastewater during the wet season by restoring treatment lagoon storage capacity (Secondary Benefit)

The upgrades at the wastewater treatment plant will prevent wastewater, with a treated effluent BOD of 40 mg/L, to be released during the wet season compared to the without project alternative. For the purposes of Table 5A, a current production of 0 AFY is used for the Without Project condition. The estimated useful life for the recycled water plant is 50 years. Therefore, a 50 year analysis starting in 2015 is provided in PSP Table 5B.

Paper Size 11" x 17" (ANSI B)

0 400 800

Feet

Map Projection: Lambert Conformal Conic
Horizontal Datum: North American 1983
Grid: NAD 1983 StatePlane California III FIPS 0403 Feet

Legend

- Study Area
- Property Boundary & ID
- Stream
- Jack and Bore HWY/RR
- New Pipelines
- Disposal Area
- New Storage Pond/Pumpstation
- Irrigation

G:\11837 - Santa Cruz Sanitation District\1637\84\0848\Davenport Recycled Water Study\05-GIS\Maps\Figures\Feasibility Study\Alternative 4 Ag Reuse.mxd

© 2012 While every care has been taken to prepare this map, GHD and DATA CUSTODIAN make no representations or warranties about its accuracy, reliability, completeness or suitability for any particular purpose and cannot accept liability and responsibility of any kind (whether in contract, tort or otherwise) for any expenses, losses, damages and/or costs (including indirect or consequential damage) which are or may be incurred by any party as a result of the map being inaccurate, incomplete or unsuitable in any way and for any reason.

Data source: Data Custodian, Data Set Name/Title, Version/Date. Created by:mmellard

Kennedy/Jenks Consultants

Regional Water Management Foundation
2015 IRWM Implementation Grant Application
Santa Cruz

Davenport County Sanitation District
Davenport Recycled Water Plant

K/J 1568019*00
Figure 2-4

PSP Table 5A – Annual Project Physical Benefits Project Name: Davenport Recycled Water Plant Type of Benefit Claimed: Increase available water supply for beneficial reuse Units of the Benefit Claimed : AFY Anticipated Useful Life of Project (years): 50			
(a)	(b)	(c)	(d)
	Physical Benefits		
Year	Without Project	With Project	Change Resulting from Project (c) – (b)
2015	0	0	0
2016	0	0	0
2018	0	14	14
2019 - 2067	0	14	14
Total	0	700	700
Comments: This benefit is estimated based on the estimated available recycled water that ranges from 14 AFY in below average rainfall years up to 20 AFY in average rainfall years from the Davenport Recycled Water Plant. The conservative value of 14 AFY is used for the purposes of this table.			

PSP Table 5B – Annual Project Physical Benefits Project Name: Davenport Recycled Water Plant Type of Benefit Claimed: Eliminate the discharge of 40 mg/l of Biological Oxygen Demand (BOD) wastewater during the wet season Units of the Benefit Claimed : mg/L Anticipated Useful Life of Project (years): 50			
(a)	(b)	(c)	(d)
	Physical Benefits		
Year	Without Project	With Project	Change Resulting from Project (c) – (b)
2015	0	0	0
2016	0	0	0
2017	40	0	-40
2018 - 2067	40	0	-40
Comments: Concentration of BOD reduced with project by preventing overtopping of the effluent lagoon. The sludge will be removed in phase 1 of the project in 2016. Hence the BOD benefits will begin in 2017.			

4. Technical Analysis of Physical Benefits Claimed

a. Technical Analysis and Description of Benefit A: Increase available water supply by producing 14 acre-feet/year of Title 22 disinfected tertiary quality recycled water (Primary Benefit)

i. Provide an explanation of need for the project, including recent and historical conditions that provide background for benefits to be claimed; for example, recent water shortages, loss of habitat or ecosystem function, and water quality problems.

As described in the Project Need, the Region relies entirely on rainfall, surface water, and groundwater within watersheds located in the County. Recent drought has had significant impacts in the Region, particularly in limited surface water supplies. The Davenport community relies on surface water diverted from Mill Creek and San Vicente Creek for supply because local groundwater resources are extremely limited. Although neither Mill or San Vicente Creeks are monitored continuously for flow, the surface water cumulative runoff from October 1, 2014 through March 31, 2015 from the San Lorenzo River, the local surface water with a long period of record, measured about 36 percent of average runoff through March (Santa Cruz Water Department, 2015) and it is expected that Mill and San Vicente Creeks would be similarly limited in flow during this historic drought and could not be used for agricultural water supply.

In addition, Davenport has a permanent population of about 300 residents and a median household income of $48,500, classifying it a Disadvantaged Community (DAC). Until recently, CEMEX operated a concrete plant in Davenport that employed about 250 people and contributed about $185,000 per year through rates and financial agreements to the operations budget for the drinking water and wastewater facilities in the District. CEMEX used a large quantity of wastewater in its concrete process, which was the primary method of disposal of treated effluent. In January 2010, CEMEX ceased operation of the 100-year-old concrete plant in Davenport, causing a severe hike in water and sewer rates for residents and businesses and significant effluent disposal challenges. With limited economic opportunities in Davenport, cultivation of additional acres of high value crops such as berries, is of significant benefit and can only occur with the higher quality recycled water as there is insufficient groundwater or surface water to provide reliable irrigation water.

ii. Provide estimates of without-project conditions (i.e., levels of the physical benefits in the future, without the project, but with other projects that might be planned).

Without the project, the effluent from the Davenport community will not provide a beneficial use. It will be sprayed onto land adjacent to the treatment plant that does not need the water. In addition, without the project, the wastewater treatment plant capacity is insufficient to treat and store the volume of effluent received during wet weather; a discharge of hundreds of gallons of effluent could occur (linked to Benefit B). The project provides beneficial reuse of recycled water by providing at least 14 AFY during below average rainfall years for the irrigation of new edible crops grown locally by two farmers on 55.5 acres of land owned by State Parks and Coast Dairies & Land Co. (CDLC) to provide local economic benefit in a DAC. Up to 20 AFY of recycled water is available during average rainfall years.

iii. Provide a description of methods used to estimate physical benefits.
The physical benefits of 14 AFY of beneficial reuse of recycled water were estimated using the Water Balance Model prepared for the Davenport Recycled Water Feasibility Study (GHD, 2015). The model includes consideration of inflows such as recycled water, rainfall and outflows such as evaporation, available land for irrigation for a number of crop types, and evapotranspiration. The water balance estimated that the 14 AFY of recycled water is available during below average rainfall years while 20 AFY of recycled water is available during average rainfall years. The Feasibility Study was submitted to the State Water Resources Control Board for review in May 2015 as it is a grant funded feasibility study.

iv. Identify all new facilities, policies, and actions required to obtain the physical benefits.
The new facilities required to obtain the benefit of 14-20 AFY of new water supply include treatment plant and pond upgrades to increase the recycled water quality from Title 22 secondary-23 quality water for disposal to the dedicated spray field to a disinfected tertiary water quality requirement for delivery to new agricultural reuse customers for use on food crops. Detailed improvements include alarms in the coagulant, disinfection, filtering, and de-chlorination systems that would trigger automatic shutdown of the tertiary treatment system as necessary. In addition the project includes construction of a new recycled water (treated effluent) storage pond, construction of a pump station and piping from the treatment plant to the new pond, construction

of a truck fill station and hose bibb, and construction of a pipeline to Coast Dairies land which is planned for crop irrigation (GHD, 2015, p. 23-24). Actions completed include a coastal development permit and environmental review to allow this project to be constructed. User agreements with the farmers/land owners are in process in order to obtain the physical benefits. In addition, an easement agreement is needed to be completed with CDLC in order to site the tertiary water storage pond. The District has been working with CDLC and anticipates completing negotiations by the end of 2015.

v. Provide a description of any potential adverse physical effects and what is being done to mitigate those impacts. If none, explain.

The potential adverse effects resulting from the project are temporary construction effects, such as additional traffic and noise from construction equipment. There are no permanent adverse physical effects of the project that cannot be mitigated through appropriate measures to control recycled water runoff from irrigation.

vi. Provide a description of whether the proposed project effectively addresses long-term drought preparedness

The Davenport Recycled Water Plant contributes to sustainable water supply and reliability during water shortages and achieves the following long-term drought preparedness measures:
- Promotes water conservation, conjunctive use, reuse and recycling
- Solutions that yield a new water supply

The project will allow Davenport to promote water reuse and recycling by producing and storing Title 22 disinfected tertiary quality recycled water during wet weather periods for beneficial reuse on nearby agricultural lands during dry weather periods.

The Water Balance completed as part of the Feasibility study estimates that 20 AFY of recycled water would be reused in an average weather year; and during dry weather years, 14 AFY would be reused. This additional 14-20 AFY will enhance long-term drought preparedness by allowing local farmers to continue agricultural operations even during below average rainfall years.

In addition, by not utilizing the limited groundwater for irrigation and using recycled water instead, groundwater will be retained in storage for neighbors whose wells are going dry.

b. Technical Analysis and Description of Benefit B: Eliminate the discharge of 40 mg/L of Biological Oxygen Demand (BOD) wastewater during the wet season (Secondary Benefit)

i. Provide an explanation of need for the project, including recent and historical conditions that provide background for benefits to be claimed; for example, recent water shortages, loss of habitat or ecosystem function, and water quality problems.

The recent and historical conditions that provide the benefit of eliminating the discharge of 40 mg/l of BOD of wastewater during the wet season are based on current available wastewater storage at the existing wastewater treatment plant. Davenport currently owns and operates a wastewater treatment plant that consists of a 4 million gallon treatment lagoon, filters and a chlorine contact tank. Title 22 secondary-23 quality water is currently produced.

The WDR for the plant allows:
(i) The treatment lagoon depth to reach 18 feet while maintaining 2 feet of freeboard and
(ii) Davenport to apply the treated effluent to adjacent grassland as long as it does not create surface runoff.

The treatment lagoon was designed with an operating range of between a depth of 8 to 18 feet while maintaining 2 feet of freeboard as shown in figure 2-5 below. This range allows Davenport to reliably ensure that there are no WDR violations (e.g. encroaching on the 2 feet of freeboard because of flows higher than treatment, storage, and disposal capacity) during wet weather. Currently, the accumulation of sludge in the treatment lagoon over the past 30 years has resulted in a reduction in that operating range. The current operating range is between a depth of 15 and 18 feet. As a result, Davenport is at a higher risk of the WDR violation of encroaching into the 2 feet of freeboard, as occurred on March 26, 2011 when Davenport pumped dechlorinated secondary effluent, with a BOD estimated at 40 mg/l, to the nearby creek in an effort to increase freeboard and avoid uncontrolled over topping of the treatment lagoon which would be catastrophic. Anecdotally, Davenport staff has indicated that prior to the recent drought, pumping occurred annually for about 10 years. More recently, during the high rainfall period in early December 2014, the treatment lagoon rose from a depth of 15 feet on 12/1/2014 to 17.5 feet on 12/3/2014. If the rains had continued for another 2 weeks, the treatment lagoon depth would have exceeded 18 feet (i.e. encroached into the 2 feet of freeboard) and Davenport would have been at risk for overtopping the lagoon and would have violated the WDR. Davenport has already been issued a notice of violation (NOV) for the March 2011 event (Regional Water Quality Control Board, 2011, p. 1 and 2) and is at risk of additional NOV and/or future fines, which, under mandatory minimum penalties. California Water Code Section 13885(h) requires that a mandatory minimum penalty of $3,000 be assessed by the Regional Board for each serious violation which can include effluent violations.

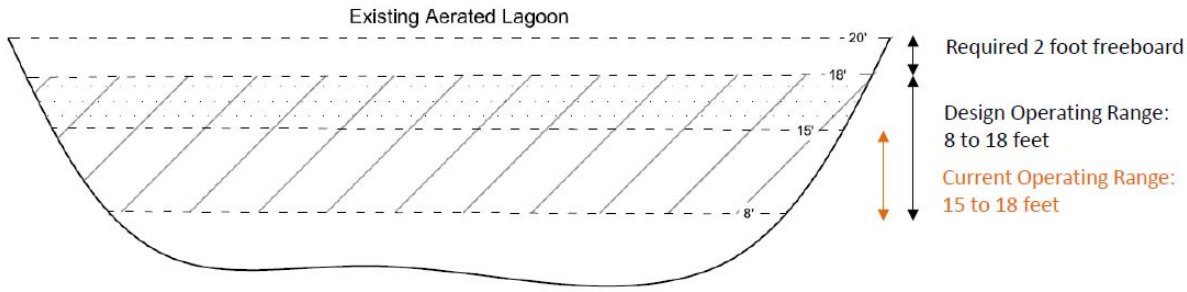

Figure 2-5 Davenport existing aerated lagoon

Hence, Davenport needs new treated effluent storage, sludge removal, and treatment plant upgrades in order to ensure that Davenport meets the WDRs by being able to reliably store treated effluent (to prevent surface runoff) and untreated influent (to prevent exceeding 18 feet lagoon depth). The treatment plant upgrades will also allow Davenport to produce Title 22 disinfected tertiary quality water for beneficial reuse to meet the needs of the Santa Cruz IRWM region.

ii. Provide estimates of without-project conditions (i.e., levels of the physical benefits in the future, without the project, but with other projects that might be planned).

Without the project, Davenport is annually at risk of WDR violations for overtopping the lagoon in the winter. In terms of water quality, overtopping the lagoon would result in the spillage of dechlorinated secondary effluent with a BOD concentration of about 40 mg/l.

During extended wet periods, the ground is too saturated for Davenport to apply the treated effluent without risking surface runoff. Since the 2010 closure of the CEMEX concrete facility, Davenport has lost a significant user of treated effluent further overtaxing land application disposal facilities, In addition, accumulation of sludge in the treatment lagoon over the past 30 years mean that the 18 feet limit is reached very quickly when there are high inflows during wet weather and the 2 feet of freeboard is reduced. Once the freeboard is encroached upon, operations staff often needs to pump out the lagoon to the creek because land application facilities are overtaxed.

Davenport staff has reported encroaching in the freeboard every year from 2000-2010 before the start of the drought. This project will allow Davenport to pro-actively manage the risk of violations, and at the same time, achieve an additional complementary benefit of reuse (linked to Primary Benefit A). With this project, the risk of spillage is eliminated and the concentration of BOD discharged to the creek drops from 40 mg/l to 0 mg/L.

iii. Provide a description of methods used to estimate physical benefits.
The methods used to estimate physical benefits include review of the records of the levels in the treatment lagoon and the BOD concentration of the effluent. The treatment plant upgrades will restore the available operating range in the treatment lagoon and allow Davenport to operate the plant as designed. An analysis was performed as part of the Feasibility Study to evaluate the existing lagoon's capacity to treat various flow scenarios if the design operating range is restored. The analysis concluded that the design 8 to 18 feet operating range will allow Davenport to adequately handle peak flows without violating the WDR. (GHD, 2015, page 17)

Water quality – The 40 mg/l reduction in BOD concentration is based on the average treated effluent BOD concentration over the past ten years. The spilled effluent will likely be untreated raw influent since there will be limited treatment; however, since the spillage occurs during high rainfall periods, the BOD will also likely be diluted. Hence, a figure of 4mg/L is used to estimate these benefits.

iv. Identify all new facilities, policies, and actions required to obtain the physical benefits.
The new facilities required to obtain the benefit of 14-20 AFY of new water supply include treatment plant and pond upgrades to increase the recycled water quality from Title 22 secondary-23 quality water for disposal to the dedicated spray field to a disinfected tertiary water quality requirement for delivery to new agricultural reuse customers for use on food crops. Detailed improvements include alarms in the coagulant, disinfection, filtering, and de-chlorination systems that would trigger automatic shutdown of the tertiary treatment system as necessary. In addition the project includes construction of a new recycled water (treated effluent) storage pond, construction of a pump station and piping from the treatment plant to the new pond, construction of a truck fill station and hose bibb, and construction of a pipeline to Coast Dairies land which is planned for crop irrigation (GHD, 2015, p. 23-24). Actions completed include a coastal development permit and environmental review to allow this project to be constructed. User agreements with the farmers/land owners are in process in order to obtain the physical benefits. In addition, an easement agreement is needed to be completed with CDLC in order to site the tertiary water storage pond. The District has been working with CDLC and anticipates completing negotiations by the end of 2015.

v. Provide a description of any potential adverse physical effects and what is being done to mitigate those impacts. If none, explain.
The potential adverse effects resulting from the project are temporary construction effects, such as additional traffic and noise from construction equipment. There are no permanent adverse physical effects of the project that cannot be mitigated through appropriate measures to control recycled water runoff from irrigation.

vi. Provide a description of whether the proposed project effectively addresses long-term drought preparedness
As detailed in the Primary Benefit discussion, The Davenport Recycled Water Plant contributes to sustainable water supply and reliability during water shortages and achieves the following long-term drought preparedness measures:
- Promotes water conservation, conjunctive use, reuse and recycling
- Solutions that yield a new water supply

5. Direct Water-Related Benefit to a DAC

Davenport is an unincorporated community in Santa Cruz County located on the coast 12 miles north of the City of Santa Cruz. It has a permanent population of about 300 residents and a median household income of $48,500 that, as described in Attachment 7, was derived, in an income survey classifying Davenport as an "Economically Disadvantaged Community" (as defined in California Water Code Sec. 79505.5). The income survey was prepared in 2014 by the Rural Community Assistance Corporation and approved by the State Water Resoure Control Board.

The project's water related benefit serves 100% of the Davenport service area which exceeds the 25% threshold stated in the 2015 IRWM Proposal Solicitation Package. The specific Critical Water Quality Need of Davenport, consistent with Table 9 of the 2015 IRWM Grant Program Guidelines, include:

- Providing wastewater treatment necessary to abate or prevent surface water contamination;
- Providing wastewater treatment required to protect beneficial uses or meet a discharge standard.

As also discussed in Attachment 7, Davenport has been severely impacted by the 2010 closure of the CEMEX cement plant, which had operated since 1906 and for many years had subsidized the communities sewage and water operations and maintenance costs, in addition to providing jobs in the community. In 2013-14, with IRWM funding support from DWR, the Region conducted a DAC Pilot Project to engage DACs, identify water-related needs, and advance projects to address those needs. High priority projects identified included the construction of a recycled water treatment facility and increased capacity of the existing facility's storage lagoon.

As detailed earlier, the Davenport Treatment Facility faces wastewater storage, treatment, and disposal challenges in the wet season. This is because of:

- limited storage capacity in the lagoon is at risk of overtopping annually during average rainfall years,
- limited land application area becomes too saturated in the wet season and creates runoff in violation of the Waste Discharge Permit. Before the CEMEX closure, the concrete manufacturing plant used effluent in the wet season which relieved some pressure on the land application area.

The facility improvements in the proposed project addresses storage capacity of the wastewater treatment facility reduce the likelihood of future surface water contamination as well as protect beneficial uses and meet a discharge standard. The Central Coast Regional Water Quality Control Board provided a letter in strong support of grant funding for this facility, the April 4, 2015 letter states "the Central Coast Water Board views the sanitation district's proposed project as a perfect example of a shovel-ready project that will improve California's water resources, assist an economically disadvantaged community, increase the health and safety of the local population, and provide for much-needed agricultural water supply"

6. Project Performance Monitoring Plan

PSP Table 6 – Project Performance Monitoring Plan Project: Davenport Recycled Water Plant		
Proposed Physical Benefits	Targets	Measurement tools and methods
Increase available water supply for beneficial reuse	Supply 14 AFY / Year of Recycled Water	Metered Recycled Water
Eliminate the discharge of 40 mg/l of Biological Oxygen Demand (BOD) wastewater during the wet season	BOD of discharged wastewater	BOD measurements

7. Cost Effective Analysis

PSP Table 7 – Cost Effective Analysis

Project name: Davenport Recycled Water Plant

Question 1

Types of benefits provided as shown in Table 5

Primary Benefit: Increase available water supply by producing 14 acre-feet/year of Title 22 disinfected tertiary quality recycled water

Secondary Benefit B: Eliminate the discharge of 40 mg/l of Biological Oxygen Demand (BOD) wastewater during the wet season

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?

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
Proposed Project (Alt 4 in feasibility study)	$3,968,000 in Capital Costs $29,000 in Annual O&M Costs	Davenport Recycled Water System Feasibility Study, 2015, p. 29-30.
Alternative A (Alt 2 in feasibility study): Same quantity of recycled water supplied as proposed alternative, but with new recycled water storage pond located on CEMEX land instead	$3,968,000 in Capital Costs $29,000 in Annual O&M Costs	Davenport Recycled Water System Feasibility Study, 2015, p. 29-30
Alternative B (Alt 3 in feasibility study): Same quantity of recycled water supplied as proposed alternative, but with new recycled water storage pond located on CEMEX land instead and an extension of recycled water pipeline to serve urban water demand	$5,214,000 in Capital Costs $35,000 in Annual O&M Costs	Davenport Recycled Water System Feasibility Study, 2015, p. 29-30

The costs shown above do not include the estimated construction management costs (about 15% of project cost) and the cost of purchasing land for the treated storage pond.

The proposed project supplies the same quantity of recycled water for beneficial reuse in the most cost effective way when compared to the alternatives by building the new recycled water storage pond on lower cost land. It would be operationally more efficient to have the storage pond on CEMEX property, directly adjacent to the existing wastewater treatment plant, as described in Alternative A. However, the District has not had success gaining access to this site or entering negotiations with CEMEX. Hence, the anticipated cost of building the storage pond on CEMEX land is anticipated to be much higher ($350,000 more). Alternative B of supplying recycled water for urban landscaping in Davenport was also explored,

	but is not cost effective because of the high incremental capital cost of laying additional transmission mains.
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 proposed project is the least cost alternative.
Comments:	

Project 3 References

1. *Davenport Recycled Water Feasibility Study*, GHD, April 2015.

2. Notice of Violation, Regional Water Quality Control Board, September 23, 2011.

3. 2015 Water Supply Outlook, Santa Cruz Water Department, 2015. Available at: http://cityofsantacruz.com/departments/water/drought/2015-water-supply-outlook