Appendix A - Non-Potable Demand Assessment Methodology

Appendix A: Non-Potable Demand Assessment

Landscape Irrigation

Landscape irrigation demands were the primary recycled water use identified within the study area. In developing these demands, each customer's landscaped area was estimated using recent aerial imagery from Google Earth, as well as GIS-compatible aerial imagery. From the aerial review, the percentage of each customer's site that is landscaped was estimated and applied this percentage to the total parcel area. In addition, recent aerial imagery was used to check that each site's perceived irrigated space did not include artificial turf. Parcel areas that had artificial turf fields were removed from the total irrigated acreage.

In order to calculate demand, an annual average irrigation factor of 3.4 acre-feet per year (AFY) per acre of landscaped area was applied based on: annual evapotranspiration (ET_o) of 44.8 inches; total annual precipitation of 15.3 inches; and effective precipitation (Eppt) of 25% of total annual precipitation:

$$Annual\ Average\ Irrigation\ Demand\ \left[\frac{AFY}{acre}\right] = \frac{ET_o\ \left[\frac{in}{yr}\right] - Eppt\left[\frac{in}{yr}\right]}{12\ \left[\frac{in}{ft}\right]}$$

$$= \frac{44.8\frac{in}{yr} - 0.25\ \times\ 15.3\frac{in}{yr}}{12\frac{in}{ft}}$$

$$= 3.4\frac{AFY}{acre}$$

The ET_o and precipitation values are taken from the climate data presented in Palo Alto's 2015 Urban Water Management Plan (UWMP) and summarized below in Table 1.

Table 1: City of Palo Alto Climate Data

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Standard Monthly Average ET_o [1]	1.4	1.9	3.4	4.4	5.5	6.0	6.2	5.5	4.4	3.1	1.7	1.3	**44.8**
Average Rainfall[2] (in)	3.2	2.9	2.3	1.0	0.4	0.1	0.0	0.1	0.2	0.7	1.7	2.7	**15.3**

Source: City of Palo Alto 2015 Urban Water Management Plan

Notes:

1. Average ET_o data for closest active station (Hayward) reported by CIMIS website http://www.cimis.water.ca.gov/
2. Average rainfall data for Palo Alto reported by NOAA website http://www.wrcc.dri.edu/

July is the maximum demand month for landscape irrigation, with a maximum day peaking factor of 1.7. This maximum day peaking factor was applied for all landscape irrigation demands throughout the study area. The peak hour landscape irrigation demands were calculated using an hourly peaking factor of 3.0 assuming an 8-hour irrigation window at night. These peaking factors are summarized in Table 5.

Dual Plumbing

The first step to determining dual-plumbing demands was to estimate the total building square footage. For future developments where site-specific details were not yet known, information was gathered on anticipated building density from developers and architects. If this information was not available, the likely building density was estimated using allowable floor area ratios (FARs) in the development's respective zoning code. The estimated total building square footage was found with the following calculation:

$$Total\ Building\ Area\ [Sq\ Ft] = Total\ Parcel\ Area\ [Sq\ Ft] * FAR * FAR\ Reduction\ Factor$$

It was assumed that not all buildings would be calculated to the maximum FAR over the entire parcel area, so a FAR reduction factor of 0.75 was applied to find the most likely building density. Any comments from developers on likely development density were incorporated into the estimate.

After determining total building square footage, the total potential daily water demand for urinal and toilet fixtures was determined using the following calculation:

$$\begin{aligned} Total\ Daily\ Water\ Demand\ \left[\frac{Gallons}{Day}\right] \\ = Flow\ Rate\ \left[\frac{Gallons}{Flush}\right] * Duration\ [Flush] * Average\ Daily\ Use * No.of\ FTEs \\ + Flow\ Rate\ \left[\frac{Gallons}{Flush}\right] * Duration\ [Flush] * Average\ Transient\ Daily\ Use * No.of\ Transient\ FTEs \end{aligned}$$

Full Time Equivalents (FTEs) are defined as the occupants who spend at least 40 hours per week (8 hours per day) in the building. Transient FTEs represent occupants that do not utilize the building services on a regular basis, such as visitors, customers, or delivery persons. The number of FTEs and Transient FTEs were estimated from the total building footprint square footage and the space type metrics outlined in Table 2. Space types for existing buildings were determined based on known information about the site. Future developments were categorized as "General Office," "Service," "R&D or Laboratory," "Hotel," or "Mixed Use High" based on developer input and zoning descriptions.

Table 2: Space Type Default Occupancy Numbers

Space Type	Gross Square Feet per Occupant – FTE	Gross Square Feet Per Occupant – Transient FTE
General Office	250	0
Retail, general	550	130
Service (e.g. financial, auto)	600	130
Restaurant	435	95
Grocery Store	550	115
Medical Office	225	330
R&D or Laboratory	400	0
Warehouse, distribution	2500	0
Warehouse, storage	20000	0
Hotel	1500	700
Education, daycare	630	105
Educational, K–12	1300	140
Education, postsecondary	2100	150
Mixed Use Corridor[1]	480	90
Mixed Use High[2]	460	80

Source: LEED Reference for Building Operations and Maintenance, Version 4**Error! Reference source not found.**. Appendix 2-Table 1. Default Occupancy Numbers.

Notes:

1. Developed based on zoning description, which averages General Office, Retail, Service, Restaurant, and Grocery Store occupancy numbers.
2. Developed based on zoning description, which averages General Office, Retail, Service, Restaurant, Grocery Store, and R&D/Laboratory occupancy numbers.

Water fixture metrics that were used for flow rate, duration and average daily use are summarized in Table 3.

Table 3: Water Fixture Metrics

Fixture Type	Flow Rate[1] (gallons/flush)	Duration (flush)	Avg Daily Use – FTE[1]	Avg Daily Use – Transient FTE[2]
Urinals	0.5	1	2	0.4
Toilet (Water Closet)	1.28	1	2	0.5

Notes:

1. Source: 2011 CalGreen Green Building Requirements. (Table 13C.5.303.2.2).
2. Source: LEED 2009 Water Use Reduction Additional Guidance (Version 7). Table 1. Non-residential Default Fixture Uses.

IKEA and the Mitchell Park Library and Community Center are the two customers in the service area known to have dual plumbing. Since IKEA's site-specific meter data was not available, its demands were estimated using the methodology outlined above. For the Mitchell Park facilities, the demand was taken

from the Phase 3 Business Plan in which it was assumed that 30% of the water measured by the site's W4 meter is used for toilet flushing that could be converted to recycled water.

In order to adjust each site's total daily water demand to an annual average demand, the daily demand was multiplied by the customer's assumed number of days of operation. The values used for days of operation for different customer types are summarized in Table 4.

Table 4: Days of Operation

Space Type	Days of Operation
Retail, general	365
Hotel	365
Mixed Use High	365
General Office	260
Service (e.g. financial, auto)	260
R&D or Laboratory	260

The peak hour dual-plumbing demands were calculated using an hourly peaking factor of 2.0, assuming the average occupancy of the buildings is 12 hours during the day. Peaking factors are summarized in Table 5.

Cooling Towers

Demands for cooling towers included customers previously identified as having cooling towers and customers assumed to have cooling towers through review of building characteristics. In addition, certain future developments were identified as potential cooling tower users through specific conversations with developers and architects.

The magnitude of cooling tower demand was determined using the following equation:

$$Cooling\ Tower\ Demand\ (AFY) = \frac{Total\ Building\ Area\ [Sq\ Ft]}{330\ \left[\frac{Sq\ Ft}{Ton\ of\ Load}\right] * 4.1} * 0.02\ \left[\frac{AFY}{Ton\ of\ Load}\right]$$

This demand calculation was based on historical cooling tower use data from southern California, adjusted for the climate in Palo Alto. The historical data from several office buildings in Burbank, California showed about 330 square feet per ton of cooling tower load and about .02 AF of water use per ton of cooling tower load. This resulted in an average cooling tower water demand of 0.073 AF per 1,000 square feet of building area. This demand metric was then adjusted to Palo Alto's climate using Cooling Degree Days – the number of degrees that a day's average temperature is above 65°F (which is assumed to be when air conditioning is needed), summed over an entire year. Since Burbank has approximately 4.1 times as many CDDs as Palo Alto, the Burbank cooling tower use factor was divided by 4.1 to yield a cooling tower use factor of 0.018 AF per 1,000 square feet for the Palo Alto area. This factor was applied to all developments assumed to have cooling towers in the service area.

Based on the total number of cooling degree days per month in Palo Alto, August is the maximum demand month for cooling tower demands, with a maximum day peaking factor of 2.7. The peak hour cooling tower

demands were calculated using an hourly peaking factor of 2.0, assuming the average occupancy of the buildings is 12 hours during the day.

These peaking factors are summarized in Table 5.

Table 5: Demand Peaking Factors

Demand Type	Peaking Factor
Maximum Day	
Irrigation	1.7
Cooling Tower	2.7
Hourly	
Irrigation	3.0
Dual Plumbing	2.0
Cooling Tower	2.0

Appendix B - Recycled Water Customers and Demand Estimates [Confidential – Not Included]

Appendix C - Potential Uses Considered but Not Included

Appendix C: Users Considered but Eliminated

Appendix A identifies potential non-potable recycled water customers throughout the Strategic Plan study area whereas this appendix identifies customers that were considered but not included in the study.

The 1992 Palo Alto Recycled Water Master Plan (RWMP) was used as the starting point for identifying potential recycled water demands. Additional uses were then identified through review of available recycled water feasibility studies, Urban Water Management Plans, General and Specific Plans and aerials of the study area. The City and District then reached out to the Regional Water Quality Control Plan (RWQCP) Partner Agencies and other stakeholders to verify if the customers identified in their areas could realistically be expected to accept recycled water and whether additional customers should be considered.

Customers from the 1992 RWMP that are not included in this Strategic Plan include:

- East Palo Alto Greenhouses – In the 1990s there were a number of functioning greenhouses in East Palo Alto, but now there are not many greenhouses known to be operating in the area. Those that are still operating are not anticipated to have significant demand.

- Medians and Streetscapes – The State Water Resources Control Board has proposed regulations prohibiting the irrigation of ornamental turf in publicly owned medians and streetscapes (i.e. the landscaped area between the street and sidewalk). The prohibition includes recycled water irrigation systems unless the system was installed prior to 2018. While irrigation of trees within medians and streetscapes are exempt from the proposed regulation, the default assumption for the Strategic Plan was not to include medians and streetscapes unless stakeholders provided information confirming the type of vegetation and associated water use for specific areas.

  Stakeholders suggested that medians along Foothill Expressway be considered. However, through field investigations, Palo Alto determined that the portion of Foothill Expressway in its service area is not irrigated and verification of irrigation of the portion within Los Altos could not be obtained. As such, Foothill Expressway was dropped from further consideration.

- Gate of Heaven Cemetery – This customer, though previously identified as a potential customer in Los Altos's service area, was found to be within Cupertino's service area.

Additional customers considered but not included:

- Cooley Landing Park – Recycled water is currently being trucked to this East Palo Alto park to support the establishment period for new native landscaping. Following the establishment period there will be no irrigation demand.
- East Bayshore Redevelopment - East Palo Alto staff noted that the area along East Bayshore has potential for significant multi-family residential redevelopment. However, there were no specific redevelopment plans, and the City indicated it would probably not pursue dual-plumbing for residential use.
- East Palo Alto Neighborhood Gardens and Sports Fields – Through review of aerials of East Palo Alto, a number of sizeable gardens and what looked like communal sports fields in between

residences were identified. East Palo Alto city staff indicated that these are temporary uses that sprung up on vacant lots. When the building moratorium in East Palo Alto is lifted, the City expects that these sites will be developed.

- Edith Park – This park in Los Altos Hills was recently redone to minimize irrigation needs.
- Gateway District Retail Center Redevelopment – This potential redevelopment area was in review in East Palo Alto's General Plan, but East Palo Alto city staff noted there are no specific plans for redevelopment of this area.
- Los Altos Redevelopment along El Camino – The majority of redevelopment will occur in the next few years. Because the City currently does not require installation of recycled water infrastructure for new developments, incorporating recycled water use within these buildings seems unlikely.
- Ravenswood Family Health Center – This facility in East Palo Alto is dual-plumbed. However, review of the facility's plans showed that the dual-plumbing was for on-site rain capture and not designed to have recycled water incorporated.
- San Antonio Redevelopment – This redevelopment area in Mountain View received conditions of approval prior to Mountain View's dual-plumbing ordinance and, as a result, is not dual-plumbed for recycled water.
- Single Family Residences – Los Altos Hills and Purissima Hills Water District (PHWD) indicated interest in working with large residential irrigators in Los Altos Hills to convert to recycled water use. Review of potential residences focused on parcels along Purissima Road and Fremont Road where PHWD identified the potential to repurpose abandoned or soon to be abandoned potable water pipelines for recycled water distribution. In these areas the residences averaged less than 1 acre-foot per year (AFY) of total water consumption. These volumes are not considered significant enough for residences to willingly undertake conversion of their irrigation systems plus the regulatory complexity involved with using recycled water at single family residences.
- Sobrato Phase I – Construction for this site in East Palo Alto, which is also known as Amazon I, was already underway at the time of the demand assessment and was determined not to include purple pipe for recycled water.
- Stanford Shopping Center – The General Manager of Stanford Shopping Center contacted the City at the start of the Strategic Planning process inquiring about the possibility of extending recycled water infrastructure to the shopping center. Through subsequent discussions, the shopping center indicated potential for both irrigation use as well as dual-plumbing use in future buildings. However, estimated demands were not provided.

Appendix D - Opinions of Probable Costs

A1					Palo Alto Recycled Water Feasibility Study
Last Updated:	4-Feb-19		**Discount Rate**		**Project Life**
Updated by:	K. Howes		3%		30 Years
CCI (SF, June 2018): 12014.72					
Item	**Size**	**Qty**	**Unit**	**Unit Cost**	**Total Cost**
Capital Costs					
General Requirements					
Mobilization			*Applied to all capital costs*	10%	$2,265,933
Traffic Control			*Applied to all capital costs*	4%	$906,373
Treatment					
MBR	0.0		MGD	$ 17,200,000	$0
Ozone	0.0		MGD	$ 360,000	$0
BAC	0.0		MGD	$ 323,000	$0
MF/UF system	0.0		MGD	$ 1,317,000	$0
RO System	0.0		MGD	$ 1,586,000	$0
RO Concentrate Treatment	0.0		MGD	$ 1,510,000	$0
Advanced Oxidation and Disinfection	0.0		MGD	$ 470,000	$0
Free Chlorine	0.0		MGD	$ 271,000	$0
Chemicals (Storage and Use)	0.0		MGD	$ 134,000	$0
Sitework/Piping/Structures	0.0		MGD	$ 3,427,000	$0
Conveyance					
High-Density Urban Pipeline, HDPE					
6 Inch		0	LF	$ 186	$0
8 Inch		18,494	LF	$ 200	$3,699,008
10 Inch		9,029	LF	$ 212	$1,914,318
12 Inch		6,873	LF	$ 254	$1,747,873
16 Inch		22,301	LF	$ 277	$6,178,938
18 Inch		0	LF	$ 290	$0
20 Inch		0	LF	$ 334	$0
24 Inch		0	LF	$ 381	$0
30 Inch		0	LF	$ 462	$0
Repurposing Pipe					
6 Inch		0	LF	$ 55	$0
8 Inch		0	LF	$ 66	$0
Sheeting and Shoring (Open Cut)	*3% of Open Cut Pipeline Cost*			3%	$406,204
Microtunneling					
Tunnel and Casing (36")		800	LF	$ 1,728	$1,382,400
Jacking Shaft		3	EA	$ 300,000	$900,000
Receiving Shaft		3	EA	$ 150,000	$450,000
Horizontal Directional Drilling					
24 Inch Bore Diameter		350	LF	$ 528	$184,800
PTGAB					
6 Inch		0	LF	$ 375	$0
8 Inch		0	LF	$ 500	$0
10 Inch		0	LF	$ 625	$0
12 Inch		0	LF	$ 750	$0
16 Inch		0	LF	$ 1,000	$0
20 Inch		0	LF	$ 1,250	$0
Jacking Shafts		0	EA	$ 258,000	$0
Receiving Shafts		0	EA	$ 148,000	$0
Pipe Bridge					
Pipe Bridge Support		8	LF	$ 5,000	$40,000
Pipe Bridge Pipe					
6 Inch		0	LF	$ 66	$0
8 Inch		0	LF	$ 86	$0
10 Inch		0	LF	$ 108	$0
12 Inch		65	LF	$ 139	$9,049
16 Inch		0	LF	$ 175	$0
Potholing		579	EA	$ 500	$289,560
Cathodic Protection	*3% of Pipeline Installation Cost*			3%	$506,178
Customer Services (no meter replacement)		62	EA	$ 10,000	$620,000
Customer Services (with meter replacement)		132	EA	$ 15,000	$1,980,000
Planter Box (Housing Pipe on Bridge Sidewalk)		6	CY	$ 2,000	$12,000
Planter Box (Installation Labor)		8	Day	$ 4,000	$32,000
Pump Stations					
Pump Station #1	0		Total installed HP, including standby	$ -	$0
Pump Station #2	0		Total installed HP, including standby	$ -	$0
Pump Station #3	0		Total installed HP, including standby	$ -	$0
Pump Station #4	0		Total installed HP, including standby	$ -	$0
Pump Station #5	0		Total installed HP, including standby	$ -	$0
Phase 3 RWQCP Pump Station Improvements		1	LS	$ 1,389,000	$1,389,000
Phase 3 Booster Pump Station		1	LS	$ 918,000	$918,000
Hydropneumatic Tank - Pump Station #1	0		Gal	$ -	$0
Hydropneumatic Tank - Pump Station #2	0		Gal	$ -	$0
Hydropneumatic Tank - Pump Station #3	0		Gal	$ -	$0
Hydropneumatic Tank - Pump Station #4	0		Gal	$ -	$0
Hydropneumatic Tank - Pump Station #5	0		Gal	$ -	$0
Storage Tank					
Storage Tank	0.0		MG	$ 1,500,000	$0
Underground Construction		0.0	LS	$ 1,000,000	
Injection Well					
		0	EA	$ 1,000,000	$0
Extraction Wellhead Treatment					
Hale		0	AFY	$ 2,937	$0
Rinconada		0	AFY	$ 2,937	$0
Peers		0	AFY	$ 3,353	$0
El Camino		0	AFY	$ 4,538	$0
Eleanor		0	AFY	$ 4,538	$0
Library		0	AFY	$ 4,538	$0
Mountain View Feasibility Study Long-Term Recommended Phase					
		0	LS	$ 3,326,000	$0
Subtotal					**$25,832,000**
Sales Tax	*Applied to half of capital costs (not including General)*			9%	$1,020,000
Construction Cost Subtotal					**$26,852,000**
Market Adjustment Factor				10%	$2,685,000
Construction Contingency				40%	$10,741,000
Construction Cost Total					**$40,300,000**
Engineering and Admin Services (Design)				15%	$4,028,000
Construction Management				10%	$2,685,000
Engineering Services During Construction				3%	$806,000
Property Acquisition (Property Only)		0	SQ FT	$ 500	$0
Property Acquisition (House on Property)		0	SQ FT	$ 1,000	$0
Rinconada Land Cost		0	LS	$ 4,500,000	$0
Peers Land Cost		0	LS	$ 7,000,000	$0
On-Time Fee		0	LS	$ 75,000	
Total Capital Cost					**$47,800,000**

A1					Palo Alto Recycled Water Feasibility Study
Last Updated:	4-Feb-19		**Discount Rate**		**Project Life**
Updated by:	K. Howes		3%		30 Years
CCI (SF, June 2018): 12014.72					
Item	**Size**	**Qty**	**Unit**	**Unit Cost**	**Total Cost**
O&M Costs (Annual)					
Advanced Water Treatment					
MBR	0		MGD	$ 560,000	$0
Ozone	0		MGD	$ 93,000	$0
BAC	0		MGD	$ 131,000	$0
MF/UF system	0		MGD	$ 342,000	$0
RO System	0		MGD	$ 574,000	$0
RO Concentrate Treatment	0		MGD	$ 226,000	$0
Advanced Oxidation and Disinfection	0		MGD	$ 73,000	$0
Free Chlorine	0		MGD	$ 32,000	$0
Chemicals	0		MGD	$ 121,000	$0
Labor for Treatment (no MBR)	0	1,040	hrs/MGD	$ 100	$0
Labor for MBR	0	1,040	hrs/year	$ 100	$0
Monitoring		0	$/year	$ 1,000,000	$0
Conveyance					
Annual Inspection and Maintenance of Pipeline - Average Annual Operator Hours per			LF	$0.78	$44,942
Pump Stations					
Consumables					
Equipment				1%	$0
Mechanical				1%	$0
Electrical/Instrumentation				1%	$0
Electricity Requirement					
Energy Charge		444,385	kWh/year	$ 0.15	$66,658
Labor Costs					
Total No. Operators		0	No.		
Average Annual Operator Hours per Year		520	Hours		
Total Operator Hours per Year		0	Hours	$ 99.81	$0
Phase 3 RWQCP Pump Station Improvements		1	LS	$ 96,000	$96,000
Phase 3 Booster Pump Station		1	LS	$ 81,000	$81,000
Storage Tanks					
Annual O&M				1%	$0
Injection Wells					
Annual O&M		0	EA	$ 15,000	$0
Extraction Wells					
Groundwater Pumping Charge		0	AFY	$ 1,960	$0
Hale Extraction Well/Wellhead Treatment		0	AFY	$ 265	$0
Rinconada Extraction Well/Wellhead Treatment		0	AFY	$ 263	$0
Peers Extraction Well/Wellhead Treatment		0	AFY	$ 224	$0
El Camino Extraction Well/Wellhead Treatment		0	AFY	$ 256	$0
Eleanor Extraction Well/Wellhead Treatment		0	AFY	$ 256	$0
Library Extraction Well/Wellhead Treatment		0	AFY	$ 242	$0
Mountain View Feasibility Study Long-Term Recommended Phase					
		0	LS	$ 100,000	$0
Total O&M Costs ($/yr)					**$290,000**
Annualized Costs ($ / Year)					
Annualized Capital Costs ($/Year)	*One payment per year, spread over Project Life*				$2,439,000
Annual O&M Costs					$290,000
Total Annualized Cost					$2,729,000
Deliveries of Recycled Water	800 AFY				
Estimated Unit Cost ($/AF)					**$3,400**

A2					Palo Alto Recycled Water Feasibility Study
Last Updated:	4-Feb-19		**Discount Rate**		**Project Life**
Updated by:	K. Howes		3%		30 Years
CCI (SF, June 2018): 12014.72					
Item	**Size**	**Qty**	**Unit**	**Unit Cost**	**Total Cost**
Capital Costs					
General Requirements					
Mobilization			*Applied to all capital costs*	10%	$2,987,744
Traffic Control			*Applied to all capital costs*	4%	$1,195,097
Treatment					
MBR	0.0		MGD	$ 17,200,000	$0
Ozone	0.0		MGD	$ 360,000	$0
BAC	0.0		MGD	$ 323,000	$0
MF/UF system	0.0		MGD	$ 1,317,000	$0
RO System	0.0		MGD	$ 1,586,000	$0
RO Concentrate Treatment	0.0		MGD	$ 1,510,000	$0
Advanced Oxidation and Disinfection	0.0		MGD	$ 470,000	$0
Free Chlorine	0.0		MGD	$ 271,000	$0
Chemicals (Storage and Use)	0.0		MGD	$ 134,000	$0
Sitework/Piping/Structures	0.0		MGD	$ 3,427,000	$0
Conveyance					
High-Density Urban Pipeline, HDPE					
6 Inch		0	LF	$ 186	$0
8 Inch		50,383	LF	$ 200	$10,077,166
10 Inch		8,600	LF	$ 212	$1,823,362
12 Inch		5,500	LF	$ 254	$1,398,705
16 Inch		1,000	LF	$ 277	$277,070
18 Inch		0	LF	$ 290	$0
20 Inch		7,115	LF	$ 334	$2,375,058
24 Inch		0	LF	$ 381	$0
30 Inch		0	LF	$ 462	$0
Repurposing Pipe					
6 Inch		2,200	LF	$ 55	$120,839
8 Inch		1,850	LF	$ 66	$121,540
Sheeting and Shoring (Open Cut)	*3% of Open Cut Pipeline Cost*			3%	$478,541
Microtunneling					
Tunnel and Casing (36")		820	LF	$ 1,728	$1,416,960
Jacking Shaft		3	EA	$ 300,000	$900,000
Receiving Shaft		3	EA	$ 150,000	$450,000
Horizontal Directional Drilling					
24 Inch Bore Diameter		350	LF	$ 528	$184,800
PTGAB					
6 Inch		0	LF	$ 375	$0
8 Inch		236	LF	$ 500	$118,025
10 Inch		0	LF	$ 625	$0
12 Inch		0	LF	$ 750	$0
16 Inch		0	LF	$ 1,000	$0
20 Inch		0	LF	$ 1,250	$0
Jacking Shafts		2	EA	$ 258,000	$516,000
Receiving Shafts		2	EA	$ 148,000	$296,000
Pipe Bridge					
Pipe Bridge Support		56	LF	$ 5,000	$280,000
Pipe Bridge Pipe					
6 Inch		431	LF	$ 66	$28,252
8 Inch		0	LF	$ 86	$0
10 Inch		50	LF	$ 108	$5,424
12 Inch		0	LF	$ 139	$0
16 Inch		65	LF	$ 175	$11,387
Potholing		746	EA	$ 500	$372,750
Cathodic Protection	*3% of Pipeline Installation Cost*			3%	$593,614
Customer Services (no meter replacement)		62	EA	$ 10,000	$620,000
Customer Services (with meter replacement)		137	EA	$ 15,000	$2,055,000
Planter Box (Housing Pipe on Bridge Sidewalk)		6	CY	$ 2,000	$12,000
Planter Box (Installation Labor)		8	Day	$ 4,000	$32,000
Pump Stations					
Pump Station #1	200		Total installed HP, including standby	$ 7,444	$1,488,839
Pump Station #2	300		Total installed HP, including standby	$ 6,433	$1,929,951
Pump Station #3	40		Total installed HP, including standby	$ 13,288	$531,505
Pump Station #4	60		Total installed HP, including standby	$ 11,483	$688,978
Pump Station #5	0		Total installed HP, including standby	$ -	$0
Phase 3 RWQCP Pump Station Improvements		0	LS	$ 1,389,000	$0
Phase 3 Booster Pump Station		0	LS	$ 918,000	$0
Hydropneumatic Tank - Pump Station #1	9,100		Gal	$ 29	$266,555
Hydropneumatic Tank - Pump Station #2	8,500		Gal	$ 30	$258,258
Hydropneumatic Tank - Pump Station #3	2,900		Gal	$ 41	$117,657
Hydropneumatic Tank - Pump Station #4	700		Gal	$ 45	$31,202
Hydropneumatic Tank - Pump Station #5	0		Gal	$ -	$0
Storage Tank					
Storage Tank	0.0		MG	$ 1,500,000	$0
Underground Construction		0.0	LS	$ 1,000,000	
Injection Well					
		0	EA	$ 1,000,000	$0
Extraction Wellhead Treatment					
Hale		0	AFY	$ 2,937	$0
Rinconada		0	AFY	$ 2,937	$0
Peers		0	AFY	$ 3,353	$0
El Camino		0	AFY	$ 4,538	$0
Eleanor		0	AFY	$ 4,538	$0
Library		0	AFY	$ 4,538	$0
Mountain View Feasibility Study Long-Term Recommended Phase					
		0	LS	$ 3,326,000	$0
Subtotal					**$34,060,000**
Sales Tax	*Applied to half of capital costs (not including General)*			9%	$1,344,000
Construction Cost Subtotal					**$35,404,000**
Market Adjustment Factor				10%	$3,540,000
Construction Contingency				40%	$14,162,000
Construction Cost Total					**$53,200,000**
Engineering and Admin Services (Design)				15%	$5,311,000
Construction Management				10%	$3,540,000
Engineering Services During Construction				3%	$1,062,000
Property Acquisition (Property Only)		0	SQ FT	$ 500	$0
Property Acquisition (House on Property)		0	SQ FT	$ 1,000	$0
Rinconada Land Cost		0	LS	$ 4,500,000	$0
Peers Land Cost		0	LS	$ 7,000,000	$0
On-Time Fee		0	LS	$ 75,000	
Total Capital Cost					**$63,000,000**

A2					Palo Alto Recycled Water Feasibility Study
Last Updated:	4-Feb-19		**Discount Rate**		**Project Life**
Updated by:	K. Howes		3%		30 Years
CCI (SF, June 2018): 12014.72					
Item	**Size**	**Qty**	**Unit**	**Unit Cost**	**Total Cost**
O&M Costs (Annual)					
Advanced Water Treatment					
MBR	0		MGD	$ 560,000	$0
Ozone	0		MGD	$ 93,000	$0
BAC	0		MGD	$ 131,000	$0
MF/UF system	0		MGD	$ 342,000	$0
RO System	0		MGD	$ 574,000	$0
RO Concentrate Treatment	0		MGD	$ 226,000	$0
Advanced Oxidation and Disinfection	0		MGD	$ 73,000	$0
Free Chlorine	0		MGD	$ 32,000	$0
Chemicals	0		MGD	$ 121,000	$0
Labor for Treatment (no MBR)	0	1,040	hrs/MGD	$ 100	$0
Labor for MBR	0	1,040	hrs/year	$ 100	$0
Monitoring		0	$/year	$ 1,000,000	$0
Conveyance					
Annual Inspection and Maintenance of Pipeline - Average Annual Operator Hours per			LF	$0.78	$58,100
Pump Stations					
Consumables					
Equipment				1%	$46,393
Mechanical				1%	$46,393
Electrical/Instrumentation				1%	$46,393
Electricity Requirement					
Energy Charge		794,111	kWh/year	$ 0.15	$119,117
Labor Costs					
Total No. Operators		4	No.		
Average Annual Operator Hours per Year		520	Hours		
Total Operator Hours per Year		2,080	Hours	$ 99.81	$207,610
Phase 3 RWQCP Pump Station Improvements		0	LS	$ 96,000	$0
Phase 3 Booster Pump Station		0	LS	$ 81,000	$0
Storage Tanks					
Annual O&M				1%	$0
Injection Wells					
Annual O&M		0	EA	$ 15,000	$0
Extraction Wells					
Groundwater Pumping Charge		0	AFY	$ 1,960	$0
Hale Extraction Well/Wellhead Treatment		0	AFY	$ 265	$0
Rinconada Extraction Well/Wellhead Treatment		0	AFY	$ 263	$0
Peers Extraction Well/Wellhead Treatment		0	AFY	$ 224	$0
El Camino Extraction Well/Wellhead Treatment		0	AFY	$ 256	$0
Eleanor Extraction Well/Wellhead Treatment		0	AFY	$ 256	$0
Library Extraction Well/Wellhead Treatment		0	AFY	$ 242	$0
Mountain View Feasibility Study Long-Term Recommended Phase					
		0	LS	$ 100,000	$0
Total O&M Costs ($/yr)					**$520,000**
Annualized Costs ($ / Year)					
Annualized Capital Costs ($/Year)	*One payment per year, spread over Project Life*				$3,214,000
Annual O&M Costs					$520,000
Total Annualized Cost					$3,734,000
Deliveries of Recycled Water	1,100 AFY				
Estimated Unit Cost ($/AF)					**$3,400**

A3					Palo Alto Recycled Water Feasibility Study
Last Updated:	4-Feb-19		**Discount Rate**		**Project Life**
Updated by:	K. Howes		3%		30 Years
CCI (SF, June 2018): 12014.72					
Item	**Size**	**Qty**	**Unit**	**Unit Cost**	**Total Cost**
Capital Costs					
General Requirements					
Mobilization			*Applied to all capital costs*	10%	$4,033,005
Traffic Control			*Applied to all capital costs*	4%	$1,613,202
Treatment					
MBR	0.0		MGD	$ 17,200,000	$0
Ozone	0.0		MGD	$ 360,000	$0
BAC	0.0		MGD	$ 323,000	$0
MF/UF system	0.0		MGD	$ 1,317,000	$0
RO System	0.0		MGD	$ 1,586,000	$0
RO Concentrate Treatment	0.0		MGD	$ 1,510,000	$0
Advanced Oxidation and Disinfection	0.0		MGD	$ 470,000	$0
Free Chlorine	0.0		MGD	$ 271,000	$0
Chemicals (Storage and Use)	0.0		MGD	$ 134,000	$0
Sitework/Piping/Structures	0.0		MGD	$ 3,427,000	$0
Conveyance					
High-Density Urban Pipeline, HDPE					
6 Inch		0	LF	$ 186	$0
8 Inch		60,148	LF	$ 200	$12,030,275
10 Inch		32,577	LF	$ 212	$6,906,936
12 Inch		3,550	LF	$ 254	$902,801
16 Inch		5,500	LF	$ 277	$1,523,885
18 Inch		0	LF	$ 290	$0
20 Inch		8,115	LF	$ 334	$2,708,868
24 Inch		0	LF	$ 381	$0
30 Inch		0	LF	$ 462	$0
Repurposing Pipe					
6 Inch		2,200	LF	$ 55	$120,839
8 Inch		1,850	LF	$ 66	$121,540
Sheeting and Shoring (Open Cut)	*3% of Open Cut Pipeline Cost*			3%	$722,183
Microtunneling					
Tunnel and Casing (36")		820	LF	$ 1,728	$1,416,960
Jacking Shaft		3	EA	$ 300,000	$900,000
Receiving Shaft		3	EA	$ 150,000	$450,000
Horizontal Directional Drilling					
24 Inch Bore Diameter		350	LF	$ 528	$184,800
PTGAB					
6 Inch		0	LF	$ 375	$0
8 Inch		236	LF	$ 500	$118,025
10 Inch		0	LF	$ 625	$0
12 Inch		0	LF	$ 750	$0
16 Inch		0	LF	$ 1,000	$0
20 Inch		0	LF	$ 1,250	$0
Jacking Shafts		2	EA	$ 258,000	$516,000
Receiving Shafts		2	EA	$ 148,000	$296,000
Pipe Bridge					
Pipe Bridge Support		87	LF	$ 5,000	$435,000
Pipe Bridge Pipe					
6 Inch		566	LF	$ 66	$37,101
8 Inch		123	LF	$ 86	$10,631
10 Inch		50	LF	$ 108	$5,424
12 Inch		50	LF	$ 139	$6,961
16 Inch		65	LF	$ 175	$11,387
Potholing		1,122	EA	$ 500	$560,750
Cathodic Protection	*3% of Pipeline Installation Cost*			3%	$845,358
Customer Services (no meter replacement)		62	EA	$ 10,000	$620,000
Customer Services (with meter replacement)		147	EA	$ 15,000	$2,205,000
Planter Box (Housing Pipe on Bridge Sidewalk)		6	CY	$ 2,000	$12,000
Planter Box (Installation Labor)		8	Day	$ 4,000	$32,000
Pump Stations					
Pump Station #1	300		Total installed HP, including standby	$ 6,433	$1,929,951
Pump Station #2	300		Total installed HP, including standby	$ 6,433	$1,929,951
Pump Station #3	40		Total installed HP, including standby	$ 13,288	$531,505
Pump Station #4	60		Total installed HP, including standby	$ 11,483	$688,978
Pump Station #5	69		Total installed HP, including standby	$ 10,920	$753,446
Phase 3 RWQCP Pump Station Improvements		0	LS	$ 1,389,000	$0
Phase 3 Booster Pump Station		0	LS	$ 918,000	$0
Hydropneumatic Tank - Pump Station #1	11,200		Gal	$ 25	$285,278
Hydropneumatic Tank - Pump Station #2	10,500		Gal	$ 27	$280,820
Hydropneumatic Tank - Pump Station #3	2,900		Gal	$ 41	$117,657
Hydropneumatic Tank - Pump Station #4	700		Gal	$ 45	$31,202
Hydropneumatic Tank - Pump Station #5	1,900		Gal	$ 42	$80,542
Storage Tank					
Storage Tank	0.0		MG	$ 1,500,000	$0
Underground Construction		0.0	LS	$ 1,000,000	
Injection Well					
		0	EA	$ 1,000,000	$0
Extraction Wellhead Treatment					
Hale		0	AFY	$ 2,937	$0
Rinconada		0	AFY	$ 2,937	$0
Peers		0	AFY	$ 3,353	$0
El Camino		0	AFY	$ 4,538	$0
Eleanor		0	AFY	$ 4,538	$0
Library		0	AFY	$ 4,538	$0
Mountain View Feasibility Study Long-Term Recommended Phase					
		0	LS	$ 3,326,000	$0
Subtotal					**$45,976,000**
Sales Tax	*Applied to half of capital costs (not including General)*			9%	$1,815,000
Construction Cost Subtotal					**$47,791,000**
Market Adjustment Factor				10%	$4,779,000
Construction Contingency				40%	$19,116,000
Construction Cost Total					**$71,700,000**
Engineering and Admin Services (Design)				15%	$7,169,000
Construction Management				10%	$4,779,000
Engineering Services During Construction				3%	$1,434,000
Property Acquisition (Property Only)		0	SQ FT	$ 500	$0
Property Acquisition (House on Property)		0	SQ FT	$ 1,000	$0
Rinconada Land Cost		0	LS	$ 4,500,000	$0
Peers Land Cost		0	LS	$ 7,000,000	$0
On-Time Fee		0	LS	$ 75,000	
Total Capital Cost					**$85,100,000**

A3					Palo Alto Recycled Water Feasibility Study
Last Updated:	4-Feb-19		**Discount Rate**		**Project Life**
Updated by:	K. Howes		3%		30 Years
CCI (SF, June 2018): 12014.72					
Item	**Size**	**Qty**	**Unit**	**Unit Cost**	**Total Cost**
O&M Costs (Annual)					
Advanced Water Treatment					
MBR	0		MGD	$ 560,000	$0
Ozone	0		MGD	$ 93,000	$0
BAC	0		MGD	$ 131,000	$0
MF/UF system	0		MGD	$ 342,000	$0
RO System	0		MGD	$ 574,000	$0
RO Concentrate Treatment	0		MGD	$ 226,000	$0
Advanced Oxidation and Disinfection	0		MGD	$ 73,000	$0
Free Chlorine	0		MGD	$ 32,000	$0
Chemicals	0		MGD	$ 121,000	$0
Labor for Treatment (no MBR)	0	1,040	hrs/MGD	$ 100	$0
Labor for MBR	0	1,040	hrs/year	$ 100	$0
Monitoring		0	$/year	$ 1,000,000	$0
Conveyance					
Annual Inspection and Maintenance of Pipeline - Average Annual Operator Hours per			LF	$0.78	$87,864
Pump Stations					
Consumables					
Equipment				1%	$58,338
Mechanical				1%	$58,338
Electrical/Instrumentation				1%	$58,338
Electricity Requirement					
Energy Charge		1,040,732	kWh/year	$ 0.15	$156,110
Labor Costs					
Total No. Operators		5	No.		
Average Annual Operator Hours per Year		520	Hours		
Total Operator Hours per Year		2,600	Hours	$ 99.81	$259,513
Phase 3 RWQCP Pump Station Improvements		0	LS	$ 96,000	$0
Phase 3 Booster Pump Station		0	LS	$ 81,000	$0
Storage Tanks					
Annual O&M				1%	$0
Injection Wells					
Annual O&M		0	EA	$ 15,000	$0
Extraction Wells					
Groundwater Pumping Charge		0	AFY	$ 1,960	$0
Hale Extraction Well/Wellhead Treatment		0	AFY	$ 265	$0
Rinconada Extraction Well/Wellhead Treatment		0	AFY	$ 263	$0
Peers Extraction Well/Wellhead Treatment		0	AFY	$ 224	$0
El Camino Extraction Well/Wellhead Treatment		0	AFY	$ 256	$0
Eleanor Extraction Well/Wellhead Treatment		0	AFY	$ 256	$0
Library Extraction Well/Wellhead Treatment		0	AFY	$ 242	$0
Mountain View Feasibility Study Long-Term Recommended Phase					
		0	LS	$ 100,000	$0
Total O&M Costs ($/yr)					**$680,000**
Annualized Costs ($ / Year)					
Annualized Capital Costs ($/Year)	*One payment per year, spread over Project Life*				$4,342,000
Annual O&M Costs					$680,000
Total Annualized Cost					$5,022,000
Deliveries of Recycled Water	1,250 AFY				
Estimated Unit Cost ($/AF)					**$4,000**

A4				Palo Alto Recycled Water Feasibility Study
Last Updated:	4-Feb-19	**Discount Rate**		**Project Life**
Updated by:	K. Howes	3%		30 Years
CCI (SF, June 2018): 12014.72				

Item	Size	Qty	Unit	Unit Cost	Total Cost
Capital Costs					
General Requirements					
Mobilization			*Applied to all capital costs*	10%	$0
Traffic Control			*Applied to all capital costs*	4%	$0
Treatment					
MBR	0.0		MGD	$ 17,200,000	$0
Ozone	0.0		MGD	$ 360,000	$0
BAC	0.0		MGD	$ 323,000	$0
MF/UF system	0.0		MGD	$ 1,317,000	$0
RO System	0.0		MGD	$ 1,586,000	$0
RO Concentrate Treatment	0.0		MGD	$ 1,510,000	$0
Advanced Oxidation and Disinfection	0.0		MGD	$ 470,000	$0
Free Chlorine	0.0		MGD	$ 271,000	$0
Chemicals (Storage and Use)	0.0		MGD	$ 134,000	$0
Sitework/Piping/Structures	0.0		MGD	$ 3,427,000	$0
Conveyance					
High-Density Urban Pipeline, HDPE					
6 Inch		0	LF	$ 186	$0
8 Inch		0	LF	$ 200	$0
10 Inch		0	LF	$ 212	$0
12 Inch		0	LF	$ 254	$0
16 Inch		0	LF	$ 277	$0
18 Inch		0	LF	$ 290	$0
20 Inch		0	LF	$ 334	$0
24 Inch		0	LF	$ 381	$0
30 Inch		0	LF	$ 462	$0
Repurposing Pipe					
6 Inch		0	LF	$ 55	$0
8 Inch		0	LF	$ 66	$0
Sheeting and Shoring (Open Cut)	*3% of Open Cut Pipeline Cost*			3%	$0
Microtunneling					
Tunnel and Casing (36")		0	LF	$ 1,728	$0
Jacking Shaft		0	EA	$ 300,000	$0
Receiving Shaft		0	EA	$ 150,000	$0
Horizontal Directional Drilling					
24 Inch Bore Diameter		0	LF	$ 528	$0
PTGAB					
6 Inch		0	LF	$ 375	$0
8 Inch		0	LF	$ 500	$0
10 Inch		0	LF	$ 625	$0
12 Inch		0	LF	$ 750	$0
16 Inch		0	LF	$ 1,000	$0
20 Inch		0	LF	$ 1,250	$0
Jacking Shafts		0	EA	$ 258,000	$0
Receiving Shafts		0	EA	$ 148,000	$0
Pipe Bridge					
Pipe Bridge Support		0	LF	$ 5,000	$0
Pipe Bridge Pipe					
6 Inch		0	LF	$ 66	$0
8 Inch		0	LF	$ 86	$0
10 Inch		0	LF	$ 108	$0
12 Inch		0	LF	$ 139	$0
16 Inch		0	LF	$ 175	$0
Potholing		0	EA	$ 500	$0
Cathodic Protection	*3% of Pipeline Installation Cost*			3%	$0
Customer Services (no meter replacement)		0	EA	$ 10,000	$0
Customer Services (with meter replacement)		0	EA	$ 15,000	$0
Planter Box (Housing Pipe on Bridge Sidewalk)		0	CY	$ 2,000	$0
Planter Box (Installation Labor)		0	Day	$ 4,000	$0
Pump Stations					
Pump Station #1	0		Total installed HP, including standby	$ -	$0
Pump Station #2	0		Total installed HP, including standby	$ -	$0
Pump Station #3	0		Total installed HP, including standby	$ -	$0
Pump Station #4	0		Total installed HP, including standby	$ -	$0
Pump Station #5	0		Total installed HP, including standby	$ -	$0
Phase 3 RWQCP Pump Station Improvements		0	LS	$ 1,389,000	$0
Phase 3 Booster Pump Station		0	LS	$ 918,000	$0
Hydropneumatic Tank - Pump Station #1	0		Gal	$ -	$0
Hydropneumatic Tank - Pump Station #2	0		Gal	$ -	$0
Hydropneumatic Tank - Pump Station #3	0		Gal	$ -	$0
Hydropneumatic Tank - Pump Station #4	0		Gal	$ -	$0
Hydropneumatic Tank - Pump Station #5	0		Gal	$ -	$0
Storage Tank					
Storage Tank	0.0		MG	$ 1,500,000	$0
Underground Construction		0.0	LS	$ 1,000,000	
Injection Well					
		0	EA	$ 1,000,000	$0
Extraction Wellhead Treatment					
Hale		0	AFY	$ 2,937	$0
Rinconada		0	AFY	$ 2,937	$0
Peers		0	AFY	$ 3,353	$0
El Camino		0	AFY	$ 4,538	$0
Eleanor		0	AFY	$ 4,538	$0
Library		0	AFY	$ 4,538	$0
Mountain View Feasibility Study Long-Term Recommended Phase					
		1	LS	$ 3,326,000	$3,326,000
Subtotal					**$3,326,000**
Sales Tax	*Applied to half of capital costs (not including General)*			9%	$150,000
Construction Cost Subtotal					**$3,476,000**
Market Adjustment Factor				10%	$348,000
Construction Contingency				40%	$1,390,000
Construction Cost Total					**$5,300,000**
Engineering and Admin Services (Design)				15%	$521,000
Construction Management				10%	$348,000
Engineering Services During Construction				3%	$104,000
Property Acquisition (Property Only)		0	SQ FT	$ 500	$0
Property Acquisition (House on Property)		0	SQ FT	$ 1,000	$0
Rinconada Land Cost		0	LS	$ 4,500,000	$0
Peers Land Cost		0	LS	$ 7,000,000	$0
On-Time Fee		0	LS	$ 75,000	
Total Capital Cost					**$6,200,000**

A4					Palo Alto Recycled Water Feasibility Study
Last Updated:	4-Feb-19		**Discount Rate**		**Project Life**
Updated by:	K. Howes		3%		30 Years
CCI (SF, June 2018): 12014.72					
Item	**Size**	**Qty**	**Unit**	**Unit Cost**	**Total Cost**
O&M Costs (Annual)					
Advanced Water Treatment					
MBR	0		MGD	$ 560,000	$0
Ozone	0		MGD	$ 93,000	$0
BAC	0		MGD	$ 131,000	$0
MF/UF system	0		MGD	$ 342,000	$0
RO System	0		MGD	$ 574,000	$0
RO Concentrate Treatment	0		MGD	$ 226,000	$0
Advanced Oxidation and Disinfection	0		MGD	$ 73,000	$0
Free Chlorine	0		MGD	$ 32,000	$0
Chemicals	0		MGD	$ 121,000	$0
Labor for Treatment (no MBR)	0	1,040	hrs/MGD	$ 100	$0
Labor for MBR	0	1,040	hrs/year	$ 100	$0
Monitoring		0	$/year	$ 1,000,000	$0
Conveyance					
Annual Inspection and Maintenance of Pipeline - Average Annual Operator Hours per			LF	$0.78	$0
Pump Stations					
Consumables					
Equipment				1%	$0
Mechanical				1%	$0
Electrical/Instrumentation				1%	$0
Electricity Requirement					
Energy Charge		-	kWh/year	$ 0.15	$0
Labor Costs					
Total No. Operators		0	No.		
Average Annual Operator Hours per Year		520	Hours		
Total Operator Hours per Year		0	Hours	$ 99.81	$0
Phase 3 RWQCP Pump Station Improvements		0	LS	$ 96,000	$0
Phase 3 Booster Pump Station		0	LS	$ 81,000	$0
Storage Tanks					
Annual O&M				1%	$0
Injection Wells					
Annual O&M		0	EA	$ 15,000	$0
Extraction Wells					
Groundwater Pumping Charge		0	AFY	$ 1,960	$0
Hale Extraction Well/Wellhead Treatment		0	AFY	$ 265	$0
Rinconada Extraction Well/Wellhead Treatment		0	AFY	$ 263	$0
Peers Extraction Well/Wellhead Treatment		0	AFY	$ 224	$0
El Camino Extraction Well/Wellhead Treatment		0	AFY	$ 256	$0
Eleanor Extraction Well/Wellhead Treatment		0	AFY	$ 256	$0
Library Extraction Well/Wellhead Treatment		0	AFY	$ 242	$0
Mountain View Feasibility Study Long-Term Recommended Phase					
		1	LS	$ 100,000	$100,000
Total O&M Costs ($/yr)					**$100,000**
Annualized Costs ($ / Year)					
Annualized Capital Costs ($/Year)	*One payment per year, spread over Project Life*				$316,000
Annual O&M Costs					$100,000
Total Annualized Cost					$416,000
Deliveries of Recycled Water	200 AFY				
Estimated Unit Cost ($/AF)					**$2,100**

A5					Palo Alto Recycled Water Feasibility Study
Last Updated:	4-Feb-19		**Discount Rate**		**Project Life**
Updated by:	K. Howes		3%		30 Years
CCI (SF, June 2018): 12014.72					
Item	**Size**	**Qty**	**Unit**	**Unit Cost**	**Total Cost**
Capital Costs					
General Requirements					
Mobilization			*Applied to all capital costs*	10%	$3,443,427
Traffic Control			*Applied to all capital costs*	4%	$1,377,371
Treatment					
MBR	0.0		MGD	$ 17,200,000	$0
Ozone	0.0		MGD	$ 360,000	$0
BAC	0.0		MGD	$ 323,000	$0
MF/UF system	0.0		MGD	$ 1,317,000	$0
RO System	0.0		MGD	$ 1,586,000	$0
RO Concentrate Treatment	0.0		MGD	$ 1,510,000	$0
Advanced Oxidation and Disinfection	0.0		MGD	$ 470,000	$0
Free Chlorine	0.0		MGD	$ 271,000	$0
Chemicals (Storage and Use)	0.0		MGD	$ 134,000	$0
Sitework/Piping/Structures	0.0		MGD	$ 3,427,000	$0
Conveyance					
High-Density Urban Pipeline, HDPE					
6 Inch		0	LF	$ 186	$0
8 Inch		21,500	LF	$ 200	$4,300,241
10 Inch		14,500	LF	$ 212	$3,074,272
12 Inch		5,500	LF	$ 254	$1,398,705
16 Inch		0	LF	$ 277	$0
18 Inch		0	LF	$ 290	$0
20 Inch		44,714	LF	$ 334	$14,925,980
24 Inch		0	LF	$ 381	$0
30 Inch		0	LF	$ 462	$0
Repurposing Pipe					
6 Inch		0	LF	$ 55	$0
8 Inch		0	LF	$ 66	$0
Sheeting and Shoring (Open Cut)	*3% of Open Cut Pipeline Cost*			3%	$710,976
Microtunneling					
Tunnel and Casing (36")		0	LF	$ 1,728	$0
Jacking Shaft		0	EA	$ 300,000	$0
Receiving Shaft		0	EA	$ 150,000	$0
Horizontal Directional Drilling					
24 Inch Bore Diameter		0	LF	$ 528	$0
PTGAB					
6 Inch		0	LF	$ 375	$0
8 Inch		0	LF	$ 500	$0
10 Inch		122	LF	$ 625	$76,266
12 Inch		0	LF	$ 750	$0
16 Inch		0	LF	$ 1,000	$0
20 Inch		114	LF	$ 1,250	$142,530
Jacking Shafts		2	EA	$ 258,000	$516,000
Receiving Shafts		2	EA	$ 148,000	$296,000
Pipe Bridge					
Pipe Bridge Support		61	LF	$ 5,000	$305,000
Pipe Bridge Pipe					
6 Inch		92	LF	$ 66	$6,031
8 Inch		240	LF	$ 86	$20,744
10 Inch		91	LF	$ 108	$9,871
12 Inch		0	LF	$ 139	$0
16 Inch		172	LF	$ 175	$30,132
Potholing		870	EA	$ 500	$435,225
Cathodic Protection	*3% of Pipeline Installation Cost*			3%	$736,597
Customer Services (no meter replacement)		0	EA	$ 10,000	$0
Customer Services (with meter replacement)		106	EA	$ 15,000	$1,590,000
Planter Box (Housing Pipe on Bridge Sidewalk)		0	CY	$ 2,000	$0
Planter Box (Installation Labor)		0	Day	$ 4,000	$0
Pump Stations					
Pump Station #1	300		Total installed HP, including standby	$ 6,433	$1,929,951
Pump Station #2	225		Total installed HP, including standby	$ 7,135	$1,605,408
Pump Station #3	0		Total installed HP, including standby	$ -	$0
Pump Station #4	0		Total installed HP, including standby	$ -	$0
Pump Station #5	0		Total installed HP, including standby	$ -	$0
Phase 3 RWQCP Pump Station Improvements		0	LS	$ 1,389,000	$0
Phase 3 Booster Pump Station		0	LS	$ 918,000	$0
Hydropneumatic Tank - Pump Station #1	12,200		Gal	$ 24	$288,554
Hydropneumatic Tank - Pump Station #2	7,200		Gal	$ 33	$235,789
Hydropneumatic Tank - Pump Station #3	0		Gal	$ -	$0
Hydropneumatic Tank - Pump Station #4	0		Gal	$ -	$0
Hydropneumatic Tank - Pump Station #5	0		Gal	$ -	$0
Storage Tank					
Storage Tank	1.2		MG	$ 1,500,000	$1,800,000
Underground Construction		0.0	LS	$ 1,000,000	
Injection Well					
		0	EA	$ 1,000,000	$0
Extraction Wellhead Treatment					
Hale		0	AFY	$ 2,937	$0
Rinconada		0	AFY	$ 2,937	$0
Peers		0	AFY	$ 3,353	$0
El Camino		0	AFY	$ 4,538	$0
Eleanor		0	AFY	$ 4,538	$0
Library		0	AFY	$ 4,538	$0
Mountain View Feasibility Study Long-Term Recommended Phase					
		0	LS	$ 3,326,000	$0
Subtotal					**$39,255,000**
Sales Tax	*Applied to half of capital costs (not including General)*			9%	$1,550,000
Construction Cost Subtotal					**$40,805,000**
Market Adjustment Factor				10%	$4,081,000
Construction Contingency				40%	$16,322,000
Construction Cost Total					**$61,300,000**
Engineering and Admin Services (Design)				15%	$6,121,000
Construction Management				10%	$4,081,000
Engineering Services During Construction				3%	$1,224,000
Property Acquisition (Property Only)		0	SQ FT	$ 500	$0
Property Acquisition (House on Property)		0	SQ FT	$ 1,000	$0
Rinconada Land Cost		0	LS	$ 4,500,000	$0
Peers Land Cost		0	LS	$ 7,000,000	$0
On-Time Fee		0	LS	$ 75,000	
Total Capital Cost					**$72,600,000**

A5					Palo Alto Recycled Water Feasibility Study
Last Updated:	4-Feb-19		**Discount Rate**		**Project Life**
Updated by:	K. Howes		3%		30 Years
CCI (SF, June 2018): 12014.72					
Item	**Size**	**Qty**	**Unit**	**Unit Cost**	**Total Cost**
O&M Costs (Annual)					
Advanced Water Treatment					
MBR	0		MGD	$ 560,000	$0
Ozone	0		MGD	$ 93,000	$0
BAC	0		MGD	$ 131,000	$0
MF/UF system	0		MGD	$ 342,000	$0
RO System	0		MGD	$ 574,000	$0
RO Concentrate Treatment	0		MGD	$ 226,000	$0
Advanced Oxidation and Disinfection	0		MGD	$ 73,000	$0
Free Chlorine	0		MGD	$ 32,000	$0
Chemicals	0		MGD	$ 121,000	$0
Labor for Treatment (no MBR)	0	1,040	hrs/MGD	$ 100	$0
Labor for MBR	0	1,040	hrs/year	$ 100	$0
Monitoring		0	$/year	$ 1,000,000	$0
Conveyance					
Annual Inspection and Maintenance of Pipeline - Average Annual Operator Hours per			LF	$0.78	$68,908
Pump Stations					
Consumables					
Equipment				1%	$35,354
Mechanical				1%	$35,354
Electrical/Instrumentation				1%	$35,354
Electricity Requirement					
Energy Charge		668,276	kWh/year	$ 0.15	$100,241
Labor Costs					
Total No. Operators		2	No.		
Average Annual Operator Hours per Year		520	Hours		
Total Operator Hours per Year		1,040	Hours	$ 99.81	$103,805
Phase 3 RWQCP Pump Station Improvements		0	LS	$ 96,000	$0
Phase 3 Booster Pump Station		0	LS	$ 81,000	$0
Storage Tanks					
Annual O&M				1%	$18,000
Injection Wells					
Annual O&M		0	EA	$ 15,000	$0
Extraction Wells					
Groundwater Pumping Charge		0	AFY	$ 1,960	$0
Hale Extraction Well/Wellhead Treatment		0	AFY	$ 265	$0
Rinconada Extraction Well/Wellhead Treatment		0	AFY	$ 263	$0
Peers Extraction Well/Wellhead Treatment		0	AFY	$ 224	$0
El Camino Extraction Well/Wellhead Treatment		0	AFY	$ 256	$0
Eleanor Extraction Well/Wellhead Treatment		0	AFY	$ 256	$0
Library Extraction Well/Wellhead Treatment		0	AFY	$ 242	$0
Mountain View Feasibility Study Long-Term Recommended Phase					
		0	LS	$ 100,000	$0
Total O&M Costs ($/yr)					**$400,000**
Annualized Costs ($ / Year)					
Annualized Capital Costs ($/Year)	*One payment per year, spread over Project Life*				$3,704,000
Annual O&M Costs					$400,000
Total Annualized Cost					$4,104,000
Deliveries of Recycled Water	900 AFY				
Estimated Unit Cost ($/AF)					**$4,600**

A6					Palo Alto Recycled Water Feasibility Study
Last Updated:	4-Feb-19		**Discount Rate**		**Project Life**
Updated by:	K. Howes		3%		30 Years
CCI (SF, June 2018): 12014.72					
Item	**Size**	**Qty**	**Unit**	**Unit Cost**	**Total Cost**
Capital Costs					
General Requirements					
Mobilization			*Applied to all capital costs*	10%	$980,415
Traffic Control			*Applied to all capital costs*	4%	$392,166
Treatment					
MBR	0.0		MGD	$ 17,200,000	$0
Ozone	0.0		MGD	$ 360,000	$0
BAC	0.0		MGD	$ 323,000	$0
MF/UF system	0.0		MGD	$ 1,317,000	$0
RO System	0.0		MGD	$ 1,586,000	$0
RO Concentrate Treatment	0.0		MGD	$ 1,510,000	$0
Advanced Oxidation and Disinfection	0.0		MGD	$ 470,000	$0
Free Chlorine	0.0		MGD	$ 271,000	$0
Chemicals (Storage and Use)	0.0		MGD	$ 134,000	$0
Sitework/Piping/Structures	0.0		MGD	$ 3,427,000	$0
Conveyance					
High-Density Urban Pipeline, HDPE					
6 Inch		0	LF	$ 186	$0
8 Inch		14,100	LF	$ 200	$2,820,158
10 Inch		10,200	LF	$ 212	$2,162,592
12 Inch		10,000	LF	$ 254	$2,543,100
16 Inch		0	LF	$ 277	$0
18 Inch		0	LF	$ 290	$0
20 Inch		0	LF	$ 334	$0
24 Inch		0	LF	$ 381	$0
30 Inch		0	LF	$ 462	$0
Repurposing Pipe					
6 Inch		0	LF	$ 55	$0
8 Inch		0	LF	$ 66	$0
Sheeting and Shoring (Open Cut)	*3% of Open Cut Pipeline Cost*			3%	$225,775
Microtunneling					
Tunnel and Casing (36")		0	LF	$ 1,728	$0
Jacking Shaft		0	EA	$ 300,000	$0
Receiving Shaft		0	EA	$ 150,000	$0
Horizontal Directional Drilling					
24 Inch Bore Diameter		0	LF	$ 528	$0
PTGAB					
6 Inch		0	LF	$ 375	$0
8 Inch		0	LF	$ 500	$0
10 Inch		0	LF	$ 625	$0
12 Inch		0	LF	$ 750	$0
16 Inch		0	LF	$ 1,000	$0
20 Inch		0	LF	$ 1,250	$0
Jacking Shafts		0	EA	$ 258,000	$0
Receiving Shafts		0	EA	$ 148,000	$0
Pipe Bridge					
Pipe Bridge Support		0	LF	$ 5,000	$0
Pipe Bridge Pipe					
6 Inch		0	LF	$ 66	$0
8 Inch		0	LF	$ 86	$0
10 Inch		0	LF	$ 108	$0
12 Inch		0	LF	$ 139	$0
16 Inch		0	LF	$ 175	$0
Potholing		343	EA	$ 500	$171,500
Cathodic Protection	*3% of Pipeline Installation Cost*			3%	$232,549
Customer Services (no meter replacement)		17	EA	$ 10,000	$170,000
Customer Services (with meter replacement)		16	EA	$ 15,000	$240,000
Planter Box (Housing Pipe on Bridge Sidewalk)		0	CY	$ 2,000	$0
Planter Box (Installation Labor)		0	Day	$ 4,000	$0
Pump Stations					
Pump Station #1	150		Total installed HP, including standby	$ 8,256	$1,238,474
Pump Station #2	0		Total installed HP, including standby	$ -	$0
Pump Station #3	0		Total installed HP, including standby	$ -	$0
Pump Station #4	0		Total installed HP, including standby	$ -	$0
Pump Station #5	0		Total installed HP, including standby	$ -	$0
Phase 3 RWQCP Pump Station Improvements		0	LS	$ 1,389,000	$0
Phase 3 Booster Pump Station		0	LS	$ 918,000	$0
Hydropneumatic Tank - Pump Station #1	0		Gal	$ -	$0
Hydropneumatic Tank - Pump Station #2	0		Gal	$ -	$0
Hydropneumatic Tank - Pump Station #3	0		Gal	$ -	$0
Hydropneumatic Tank - Pump Station #4	0		Gal	$ -	$0
Hydropneumatic Tank - Pump Station #5	0		Gal	$ -	$0
Storage Tank					
Storage Tank	0.0		MG	$ 1,500,000	$0
Underground Construction		0.0	LS	$ 1,000,000	
Injection Well					
		0	EA	$ 1,000,000	$0
Extraction Wellhead Treatment					
Hale		0	AFY	$ 2,937	$0
Rinconada		0	AFY	$ 2,937	$0
Peers		0	AFY	$ 3,353	$0
El Camino		0	AFY	$ 4,538	$0
Eleanor		0	AFY	$ 4,538	$0
Library		0	AFY	$ 4,538	$0
Mountain View Feasibility Study Long-Term Recommended Phase					
		0	LS	$ 3,326,000	$0
Subtotal					**$11,177,000**
Sales Tax	*Applied to half of capital costs (not including General)*			9%	$441,000
Construction Cost Subtotal					**$11,618,000**
Market Adjustment Factor				10%	$1,162,000
Construction Contingency				40%	$4,647,000
Construction Cost Total					**$17,500,000**
Engineering and Admin Services (Design)				15%	$1,743,000
Construction Management				10%	$1,162,000
Engineering Services During Construction				3%	$349,000
Property Acquisition (Property Only)		0	SQ FT	$ 500	$0
Property Acquisition (House on Property)		0	SQ FT	$ 1,000	$0
Rinconada Land Cost		0	LS	$ 4,500,000	$0
Peers Land Cost		0	LS	$ 7,000,000	$0
On-Time Fee		0	LS	$ 75,000	
Total Capital Cost					**$20,700,000**

A6					Palo Alto Recycled Water Feasibility Study
Last Updated:	4-Feb-19		**Discount Rate**		**Project Life**
Updated by:	K. Howes		3%		30 Years
CCI (SF, June 2018): 12014.72					
Item	**Size**	**Qty**	**Unit**	**Unit Cost**	**Total Cost**
O&M Costs (Annual)					
Advanced Water Treatment					
MBR	0		MGD	$ 560,000	$0
Ozone	0		MGD	$ 93,000	$0
BAC	0		MGD	$ 131,000	$0
MF/UF system	0		MGD	$ 342,000	$0
RO System	0		MGD	$ 574,000	$0
RO Concentrate Treatment	0		MGD	$ 226,000	$0
Advanced Oxidation and Disinfection	0		MGD	$ 73,000	$0
Free Chlorine	0		MGD	$ 32,000	$0
Chemicals	0		MGD	$ 121,000	$0
Labor for Treatment (no MBR)	0	1,040	hrs/MGD	$ 100	$0
Labor for MBR	0	1,040	hrs/year	$ 100	$0
Monitoring		0	$/year	$ 1,000,000	$0
Conveyance					
Annual Inspection and Maintenance of Pipeline - Average Annual Operator Hours per			LF	$0.78	$27,152
Pump Stations					
Consumables					
Equipment				1%	$12,385
Mechanical				1%	$12,385
Electrical/Instrumentation				1%	$12,385
Electricity Requirement					
Energy Charge		201,615	kWh/year	$ 0.15	$30,242
Labor Costs					
Total No. Operators		1	No.		
Average Annual Operator Hours per Year		520	Hours		
Total Operator Hours per Year		520	Hours	$ 99.81	$51,903
Phase 3 RWQCP Pump Station Improvements		0	LS	$ 96,000	$0
Phase 3 Booster Pump Station		0	LS	$ 81,000	$0
Storage Tanks					
Annual O&M				1%	$0
Injection Wells					
Annual O&M		0	EA	$ 15,000	$0
Extraction Wells					
Groundwater Pumping Charge		0	AFY	$ 1,960	$0
Hale Extraction Well/Wellhead Treatment		0	AFY	$ 265	$0
Rinconada Extraction Well/Wellhead Treatment		0	AFY	$ 263	$0
Peers Extraction Well/Wellhead Treatment		0	AFY	$ 224	$0
El Camino Extraction Well/Wellhead Treatment		0	AFY	$ 256	$0
Eleanor Extraction Well/Wellhead Treatment		0	AFY	$ 256	$0
Library Extraction Well/Wellhead Treatment		0	AFY	$ 242	$0
Mountain View Feasibility Study Long-Term Recommended Phase					
		0	LS	$ 100,000	$0
Total O&M Costs ($/yr)					**$150,000**
Annualized Costs ($ / Year)					
Annualized Capital Costs ($/Year)	*One payment per year, spread over Project Life*				$1,056,000
Annual O&M Costs					$150,000
Total Annualized Cost					$1,206,000
Deliveries of Recycled Water	500 AFY				
Estimated Unit Cost ($/AF)					**$2,400**

B1					Palo Alto Recycled Water Feasibility Study
Last Updated:	4-Feb-19		**Discount Rate**		**Project Life**
Updated by:	K. Howes		3%		30 Years
CCI (SF, June 2018): 12014.72					
Item	**Size**	**Qty**	**Unit**	**Unit Cost**	**Total Cost**
Capital Costs					
General Requirements					
Mobilization			*Applied to all capital costs*	10%	$4,956,940
Traffic Control			*Applied to all capital costs*	4%	$1,982,776
Treatment					
MBR	1.5		MGD	$ 16,125,000	$24,000,000
Ozone	0.0		MGD	$ 360,000	$0
BAC	0.0		MGD	$ 323,000	$0
MF/UF system	0.0		MGD	$ 1,317,000	$0
RO System	0.0		MGD	$ 1,586,000	$0
RO Concentrate Treatment	0.0		MGD	$ 1,510,000	$0
Advanced Oxidation and Disinfection	0.0		MGD	$ 470,000	$0
Free Chlorine	0.0		MGD	$ 271,000	$0
Chemicals (Storage and Use)	0.0		MGD	$ 134,000	$0
Sitework/Piping/Structures	0.0		MGD	$ 3,427,000	$0
Conveyance					
High-Density Urban Pipeline, HDPE					
6 Inch		0	LF	$ 186	$0
8 Inch		39,500	LF	$ 200	$7,900,443
10 Inch		4,000	LF	$ 212	$848,075
12 Inch		6,000	LF	$ 254	$1,525,860
16 Inch		11,500	LF	$ 277	$3,186,305
18 Inch		0	LF	$ 290	$0
20 Inch		6,000	LF	$ 334	$2,002,860
24 Inch		0	LF	$ 381	$0
30 Inch		0	LF	$ 462	$0
Repurposing Pipe					
6 Inch		0	LF	$ 55	$0
8 Inch		0	LF	$ 66	$0
Sheeting and Shoring (Open Cut)	*3% of Open Cut Pipeline Cost*			3%	$463,906
Microtunneling					
Tunnel and Casing (36")		0	LF	$ 1,728	$0
Jacking Shaft		0	EA	$ 300,000	$0
Receiving Shaft		0	EA	$ 150,000	$0
Horizontal Directional Drilling					
24 Inch Bore Diameter		350	LF	$ 528	$184,800
PTGAB					
6 Inch		0	LF	$ 375	$0
8 Inch		179	LF	$ 500	$89,519
10 Inch		0	LF	$ 625	$0
12 Inch		0	LF	$ 750	$0
16 Inch		0	LF	$ 1,000	$0
20 Inch		0	LF	$ 1,250	$0
Jacking Shafts		0	EA	$ 258,000	$0
Receiving Shafts		0	EA	$ 148,000	$0
Pipe Bridge					
Pipe Bridge Support		14	LF	$ 5,000	$70,000
Pipe Bridge Pipe					
6 Inch		123	LF	$ 66	$8,063
8 Inch		0	LF	$ 86	$0
10 Inch		0	LF	$ 108	$0
12 Inch		0	LF	$ 139	$0
16 Inch		0	LF	$ 175	$0
Potholing		677	EA	$ 500	$338,260
Cathodic Protection	*3% of Pipeline Installation Cost*			3%	$486,295
Customer Services (no meter replacement)		62	EA	$ 10,000	$620,000
Customer Services (with meter replacement)		139	EA	$ 15,000	$2,085,000
Planter Box (Housing Pipe on Bridge Sidewalk)		0	CY	$ 2,000	$0
Planter Box (Installation Labor)		0	Day	$ 4,000	$0
Pump Stations					
Pump Station #1	200		Total installed HP, including standby	$ 7,444	$1,488,839
Pump Station #2	60		Total installed HP, including standby	$ 11,483	$688,978
Pump Station #3	60		Total installed HP, including standby	$ 11,483	$688,978
Pump Station #4	6		Total installed HP, including standby	$ 26,306	$157,836
Pump Station #5	0		Total installed HP, including standby	$ -	$0
Phase 3 RWQCP Pump Station Improvements		0	LS	$ 1,389,000	$0
Phase 3 Booster Pump Station		0	LS	$ 918,000	$0
Hydropneumatic Tank - Pump Station #1	6,800		Gal	$ 33	$227,638
Hydropneumatic Tank - Pump Station #2	5,500		Gal	$ 36	$197,127
Hydropneumatic Tank - Pump Station #3	1,400		Gal	$ 43	$60,621
Hydropneumatic Tank - Pump Station #4	0		Gal	$ -	$0
Hydropneumatic Tank - Pump Station #5	0		Gal	$ -	$0
Storage Tank					
Storage Tank	1.5		MG	$ 1,500,000	$2,250,000
Underground Construction		0.0	LS	$ 1,000,000	
Injection Well					
		0	EA	$ 1,000,000	$0
Extraction Wellhead Treatment					
Hale		0	AFY	$ 2,937	$0
Rinconada		0	AFY	$ 2,937	$0
Peers		0	AFY	$ 3,353	$0
El Camino		0	AFY	$ 4,538	$0
Eleanor		0	AFY	$ 4,538	$0
Library		0	AFY	$ 4,538	$0
Mountain View Feasibility Study Long-Term Recommended Phase					
		0	LS	$ 3,326,000	$0
Subtotal					**$56,509,000**
Sales Tax	*Applied to half of capital costs (not including General)*			9%	$2,231,000
Construction Cost Subtotal					**$58,740,000**
Market Adjustment Factor				10%	$5,874,000
Construction Contingency				40%	$23,496,000
Construction Cost Total					**$88,200,000**
Engineering and Admin Services (Design)				15%	$8,811,000
Construction Management				10%	$5,874,000
Engineering Services During Construction				3%	$1,762,000
Property Acquisition (Property Only)		50,000	SQ FT	$ 500	$25,000,000
Property Acquisition (House on Property)		0	SQ FT	$ 1,000	$0
Rinconada Land Cost		0	LS	$ 4,500,000	$0
Peers Land Cost		0	LS	$ 7,000,000	$0
On-Time Fee		0	LS	$ 75,000	
Total Capital Cost					**$129,600,000**

B1					Palo Alto Recycled Water Feasibility Study
Last Updated:	4-Feb-19		**Discount Rate**		**Project Life**
Updated by:	K. Howes		3%		30 Years
CCI (SF, June 2018): 12014.72					
Item	**Size**	**Qty**	**Unit**	**Unit Cost**	**Total Cost**
O&M Costs (Annual)					
Advanced Water Treatment					
MBR	2		MGD	$ 540,000	$810,000
Ozone	0		MGD	$ 93,000	$0
BAC	0		MGD	$ 131,000	$0
MF/UF system	0		MGD	$ 342,000	$0
RO System	0		MGD	$ 574,000	$0
RO Concentrate Treatment	0		MGD	$ 226,000	$0
Advanced Oxidation and Disinfection	0		MGD	$ 73,000	$0
Free Chlorine	0		MGD	$ 32,000	$0
Chemicals	0		MGD	$ 121,000	$0
Labor for Treatment (no MBR)	0	1,040	hrs/MGD	$ 100	$0
Labor for MBR	2	1,040	hrs/year	$ 100	$104,000
Monitoring		0	$/year	$ 1,000,000	$0
Conveyance					
Annual Inspection and Maintenance of Pipeline - Average Annual Operator Hours per			LF	$0.78	$53,279
Pump Stations					
Consumables					
Equipment				1%	$30,246
Mechanical				1%	$30,246
Electrical/Instrumentation				1%	$30,246
Electricity Requirement					
Energy Charge		550,080	kWh/year	$ 0.15	$82,512
Labor Costs					
Total No. Operators		4	No.		
Average Annual Operator Hours per Year		520	Hours		
Total Operator Hours per Year		2,080	Hours	$ 99.81	$207,610
Phase 3 RWQCP Pump Station Improvements		0	LS	$ 96,000	$0
Phase 3 Booster Pump Station		0	LS	$ 81,000	$0
Storage Tanks					
Annual O&M				1%	$22,500
Injection Wells					
Annual O&M		0	EA	$ 15,000	$0
Extraction Wells					
Groundwater Pumping Charge		0	AFY	$ 1,960	$0
Hale Extraction Well/Wellhead Treatment		0	AFY	$ 265	$0
Rinconada Extraction Well/Wellhead Treatment		0	AFY	$ 263	$0
Peers Extraction Well/Wellhead Treatment		0	AFY	$ 224	$0
El Camino Extraction Well/Wellhead Treatment		0	AFY	$ 256	$0
Eleanor Extraction Well/Wellhead Treatment		0	AFY	$ 256	$0
Library Extraction Well/Wellhead Treatment		0	AFY	$ 242	$0
Mountain View Feasibility Study Long-Term Recommended Phase					
		0	LS	$ 100,000	$0
Total O&M Costs ($/yr)					**$1,370,000**
Annualized Costs ($ / Year)					
Annualized Capital Costs ($/Year)	*One payment per year, spread over Project Life*				$6,612,000
Annual O&M Costs					$1,370,000
Total Annualized Cost					$7,982,000
Deliveries of Recycled Water	900 AFY				
Estimated Unit Cost ($/AF)					**$8,900**

C1					Palo Alto Recycled Water Feasibility Study
Last Updated:	4-Feb-19		**Discount Rate**		**Project Life**
Updated by:	K. Howes		3%		30 Years
CCI (SF, June 2018): 12014.72					
Item	**Size**	**Qty**	**Unit**	**Unit Cost**	**Total Cost**
Capital Costs					
General Requirements					
Mobilization			*Applied to all capital costs*	10%	$3,353,169
Traffic Control			*Applied to all capital costs*	4%	$1,341,268
Treatment					
MBR	0.0		MGD	$ 17,200,000	$0
Ozone	0.0		MGD	$ 360,000	$0
BAC	0.0		MGD	$ 323,000	$0
MF/UF system	2.5		MGD	$ 1,317,000	$3,300,000
RO System	2.5		MGD	$ 1,586,000	$4,000,000
RO Concentrate Treatment	0.0		MGD	$ 1,510,000	$0
Advanced Oxidation and Disinfection	2.5		MGD	$ 470,000	$1,200,000
Free Chlorine	0.0		MGD	$ 271,000	$0
Chemicals (Storage and Use)	2.5		MGD	$ 134,000	$340,000
Sitework/Piping/Structures	2.5		MGD	$ 3,427,000	$8,600,000
Conveyance					
High-Density Urban Pipeline, HDPE					
6 Inch		0	LF	$ 186	$0
8 Inch		2,000	LF	$ 200	$400,023
10 Inch		1,500	LF	$ 212	$318,028
12 Inch		5,000	LF	$ 254	$1,271,550
16 Inch		20,500	LF	$ 277	$5,679,935
18 Inch		0	LF	$ 290	$0
20 Inch		0	LF	$ 334	$0
24 Inch		0	LF	$ 381	$0
30 Inch		0	LF	$ 462	$0
Repurposing Pipe					
6 Inch		0	LF	$ 55	$0
8 Inch		0	LF	$ 66	$0
Sheeting and Shoring (Open Cut)	*3% of Open Cut Pipeline Cost*			3%	$230,086
Microtunneling					
Tunnel and Casing (36")		0	LF	$ 1,728	$0
Jacking Shaft		0	EA	$ 300,000	$0
Receiving Shaft		0	EA	$ 150,000	$0
Horizontal Directional Drilling					
24 Inch Bore Diameter		0	LF	$ 528	$0
PTGAB					
6 Inch		0	LF	$ 375	$0
8 Inch		0	LF	$ 500	$0
10 Inch		0	LF	$ 625	$0
12 Inch		0	LF	$ 750	$0
16 Inch		458	LF	$ 1,000	$458,096
20 Inch		0	LF	$ 1,250	$0
Jacking Shafts		1	EA	$ 258,000	$258,000
Receiving Shafts		1	EA	$ 148,000	$148,000
Pipe Bridge					
Pipe Bridge Support		0	LF	$ 5,000	$0
Pipe Bridge Pipe					
6 Inch		0	LF	$ 66	$0
8 Inch		0	LF	$ 86	$0
10 Inch		0	LF	$ 108	$0
12 Inch		0	LF	$ 139	$0
16 Inch		0	LF	$ 175	$0
Potholing		295	EA	$ 500	$147,290
Cathodic Protection	*3% of Pipeline Installation Cost*			3%	$250,732
Customer Services (no meter replacement)		0	EA	$ 10,000	$0
Customer Services (with meter replacement)		0	EA	$ 15,000	$0
Planter Box (Housing Pipe on Bridge Sidewalk)		0	CY	$ 2,000	$0
Planter Box (Installation Labor)		0	Day	$ 4,000	$0
Pump Stations					
Pump Station #1	300		Total installed HP, including standby	$ 6,433	$1,929,951
Pump Station #2	0		Total installed HP, including standby	$ -	$0
Pump Station #3	0		Total installed HP, including standby	$ -	$0
Pump Station #4	0		Total installed HP, including standby	$ -	$0
Pump Station #5	0		Total installed HP, including standby	$ -	$0
Phase 3 RWQCP Pump Station Improvements		0	LS	$ 1,389,000	$0
Phase 3 Booster Pump Station		0	LS	$ 918,000	$0
Hydropneumatic Tank - Pump Station #1	0		Gal	$ -	$0
Hydropneumatic Tank - Pump Station #2	0		Gal	$ -	$0
Hydropneumatic Tank - Pump Station #3	0		Gal	$ -	$0
Hydropneumatic Tank - Pump Station #4	0		Gal	$ -	$0
Hydropneumatic Tank - Pump Station #5	0		Gal	$ -	$0
Storage Tank					
Storage Tank	0.0		MG	$ 1,500,000	$0
Underground Construction		0.0	LS	$ 1,000,000	
Injection Well					
		5	EA	$ 1,000,000	$5,000,000
Extraction Wellhead Treatment					
Hale		0	AFY	$ 2,937	$0
Rinconada		0	AFY	$ 2,937	$0
Peers		0	AFY	$ 3,353	$0
El Camino		0	AFY	$ 4,538	$0
Eleanor		0	AFY	$ 4,538	$0
Library		0	AFY	$ 4,538	$0
Mountain View Feasibility Study Long-Term Recommended Phase					
		0	LS	$ 3,326,000	$0
Subtotal					**$38,226,000**
Sales Tax	*Applied to half of capital costs (not including General)*			9%	$1,509,000
Construction Cost Subtotal					**$39,735,000**
Market Adjustment Factor				10%	$3,974,000
Construction Contingency				40%	$15,894,000
Construction Cost Total					**$59,700,000**
Engineering and Admin Services (Design)				15%	$5,960,000
Construction Management				10%	$3,974,000
Engineering Services During Construction				3%	$1,192,000
Property Acquisition (Property Only)		20,000	SQ FT	$ 500	$10,000,000
Property Acquisition (House on Property)		0	SQ FT	$ 1,000	$0
Rinconada Land Cost		1	LS	$ 4,500,000	$4,500,000
Peers Land Cost		1	LS	$ 7,000,000	$7,000,000
On-Time Fee		0	LS	$ 75,000	
Total Capital Cost					**$92,200,000**

C1					Palo Alto Recycled Water Feasibility Study
Last Updated:	4-Feb-19		**Discount Rate**		**Project Life**
Updated by:	K. Howes		3%		30 Years
CCI (SF, June 2018): 12014.72					
Item	**Size**	**Qty**	**Unit**	**Unit Cost**	**Total Cost**
O&M Costs (Annual)					
Advanced Water Treatment					
MBR	0		MGD	$ 560,000	$0
Ozone	0		MGD	$ 93,000	$0
BAC	0		MGD	$ 131,000	$0
MF/UF system	3		MGD	$ 342,000	$860,000
RO System	3		MGD	$ 574,000	$1,400,000
RO Concentrate Treatment	0		MGD	$ 226,000	$0
Advanced Oxidation and Disinfection	3		MGD	$ 73,000	$180,000
Free Chlorine	0		MGD	$ 32,000	$0
Chemicals	3		MGD	$ 121,000	$300,000
Labor for Treatment (no MBR)	3	1,040	hrs/MGD	$ 100	$260,000
Labor for MBR	0	1,040	hrs/year	$ 100	$0
Monitoring		0	$/year	$ 1,000,000	$0
Conveyance					
Annual Inspection and Maintenance of Pipeline - Average Annual Operator Hours per			LF	$0.78	$23,320
Pump Stations					
Consumables					
Equipment				1%	$19,300
Mechanical				1%	$19,300
Electrical/Instrumentation				1%	$19,300
Electricity Requirement					
Energy Charge		342,958	kWh/year	$ 0.15	$51,444
Labor Costs					
Total No. Operators		1	No.		
Average Annual Operator Hours per Year		520	Hours		
Total Operator Hours per Year		520	Hours	$ 99.81	$51,903
Phase 3 RWQCP Pump Station Improvements		0	LS	$ 96,000	$0
Phase 3 Booster Pump Station		0	LS	$ 81,000	$0
Storage Tanks					
Annual O&M				1%	$0
Injection Wells					
Annual O&M		5	EA	$ 15,000	$75,000
Extraction Wells					
Groundwater Pumping Charge		5,900	AFY	$ 1,960	$11,564,000
Hale Extraction Well/Wellhead Treatment		0	AFY	$ 265	$0
Rinconada Extraction Well/Wellhead Treatment		0	AFY	$ 263	$0
Peers Extraction Well/Wellhead Treatment		0	AFY	$ 224	$0
El Camino Extraction Well/Wellhead Treatment		0	AFY	$ 256	$0
Eleanor Extraction Well/Wellhead Treatment		0	AFY	$ 256	$0
Library Extraction Well/Wellhead Treatment		0	AFY	$ 242	$0
Mountain View Feasibility Study Long-Term Recommended Phase					
		0	LS	$ 100,000	$0
Total O&M Costs ($/yr)					**$14,820,000**
Annualized Costs ($ / Year)					
Annualized Capital Costs ($/Year)	*One payment per year, spread over Project Life*				$4,704,000
Annual O&M Costs					$14,820,000
Total Annualized Cost					$19,524,000
Deliveries of Recycled Water	5,900 AFY				
Estimated Unit Cost ($/AF)					**$3,300**

C2					Palo Alto Recycled Water Feasibility Study
Last Updated:	4-Feb-19		**Discount Rate**		**Project Life**
Updated by:	K. Howes		3%		30 Years
CCI (SF, June 2018): 12014.72					
Item	**Size**	**Qty**	**Unit**	**Unit Cost**	**Total Cost**
Capital Costs					
General Requirements					
Mobilization			*Applied to all capital costs*	10%	$4,213,006
Traffic Control			*Applied to all capital costs*	4%	$1,685,202
Treatment					
MBR	0.0		MGD	$ 17,200,000	$0
Ozone	0.0		MGD	$ 360,000	$0
BAC	0.0		MGD	$ 323,000	$0
MF/UF system	2.8		MGD	$ 1,317,000	$3,700,000
RO System	2.8		MGD	$ 1,586,000	$4,400,000
RO Concentrate Treatment	0.9		MGD	$ 1,510,000	$1,400,000
Advanced Oxidation and Disinfection	2.8		MGD	$ 470,000	$1,300,000
Free Chlorine	0.0		MGD	$ 271,000	$0
Chemicals (Storage and Use)	2.8		MGD	$ 134,000	$370,000
Sitework/Piping/Structures	2.8		MGD	$ 3,427,000	$9,600,000
Conveyance					
High-Density Urban Pipeline, HDPE					
6 Inch		0	LF	$ 186	$0
8 Inch		11,000	LF	$ 200	$2,200,124
10 Inch		5,500	LF	$ 212	$1,166,103
12 Inch		3,000	LF	$ 254	$762,930
16 Inch		2,500	LF	$ 277	$692,675
18 Inch		0	LF	$ 290	$0
20 Inch		18,500	LF	$ 334	$6,175,485
24 Inch		0	LF	$ 381	$0
30 Inch		0	LF	$ 462	$0
Repurposing Pipe					
6 Inch		0	LF	$ 55	$0
8 Inch		0	LF	$ 66	$0
Sheeting and Shoring (Open Cut)	*3% of Open Cut Pipeline Cost*			3%	$329,920
Microtunneling					
Tunnel and Casing (36")		0	LF	$ 1,728	$0
Jacking Shaft		0	EA	$ 300,000	$0
Receiving Shaft		0	EA	$ 150,000	$0
Horizontal Directional Drilling					
24 Inch Bore Diameter		0	LF	$ 528	$0
PTGAB					
6 Inch		0	LF	$ 375	$0
8 Inch		160	LF	$ 500	$80,017
10 Inch		0	LF	$ 625	$0
12 Inch		0	LF	$ 750	$0
16 Inch		0	LF	$ 1,000	$0
20 Inch		619	LF	$ 1,250	$773,912
Jacking Shafts		3	EA	$ 258,000	$774,000
Receiving Shafts		3	EA	$ 148,000	$444,000
Pipe Bridge					
Pipe Bridge Support		19	LF	$ 5,000	$95,000
Pipe Bridge Pipe					
6 Inch		170	LF	$ 66	$11,143
8 Inch		0	LF	$ 86	$0
10 Inch		0	LF	$ 108	$0
12 Inch		0	LF	$ 139	$0
16 Inch		0	LF	$ 175	$0
Potholing		414	EA	$ 500	$207,245
Cathodic Protection	*3% of Pipeline Installation Cost*			3%	$342,552
Customer Services (no meter replacement)		0	EA	$ 10,000	$0
Customer Services (with meter replacement)		25	EA	$ 15,000	$375,000
Planter Box (Housing Pipe on Bridge Sidewalk)		0	CY	$ 2,000	$0
Planter Box (Installation Labor)		0	Day	$ 4,000	$0
Pump Stations					
Pump Station #1	300		Total installed HP, including standby	$ 6,433	$1,929,951
Pump Station #2	0		Total installed HP, including standby	$ -	$0
Pump Station #3	0		Total installed HP, including standby	$ -	$0
Pump Station #4	0		Total installed HP, including standby	$ -	$0
Pump Station #5	0		Total installed HP, including standby	$ -	$0
Phase 3 RWQCP Pump Station Improvements		0	LS	$ 1,389,000	$0
Phase 3 Booster Pump Station		0	LS	$ 918,000	$0
Hydropneumatic Tank - Pump Station #1	0		Gal	$ -	$0
Hydropneumatic Tank - Pump Station #2	0		Gal	$ -	$0
Hydropneumatic Tank - Pump Station #3	0		Gal	$ -	$0
Hydropneumatic Tank - Pump Station #4	0		Gal	$ -	$0
Hydropneumatic Tank - Pump Station #5	0		Gal	$ -	$0
Storage Tank					
Storage Tank	0.0		MG	$ 1,500,000	$0
Underground Construction		0.0	LS	$ 1,000,000	
Injection Well					
		5	EA	$ 1,000,000	$5,000,000
Extraction Wellhead Treatment					
Hale		983	AFY	$ 2,937	$2,887,865
Rinconada		983	AFY	$ 2,937	$2,887,865
Peers		983	AFY	$ 3,353	$3,296,834
El Camino		983	AFY	$ 4,538	$4,462,774
Eleanor		983	AFY	$ 4,538	$4,462,774
Library		983	AFY	$ 4,538	$4,462,774
Mountain View Feasibility Study Long-Term Recommended Phase					
		0	LS	$ 3,326,000	$0
Subtotal					**$70,489,000**
Sales Tax	*Applied to half of capital costs (not including General)*			9%	$2,907,000
Construction Cost Subtotal					**$73,396,000**
Market Adjustment Factor				10%	$7,340,000
Construction Contingency				40%	$29,358,000
Construction Cost Total					**$110,100,000**
Engineering and Admin Services (Design)				15%	$11,009,000
Construction Management				10%	$7,340,000
Engineering Services During Construction				3%	$2,202,000
Property Acquisition (Property Only)		20,000	SQ FT	$ 500	$10,000,000
Property Acquisition (House on Property)		0	SQ FT	$ 1,000	$0
Rinconada Land Cost		1	LS	$ 4,500,000	$4,500,000
Peers Land Cost		1	LS	$ 7,000,000	$7,000,000
On-Time Fee		0	LS	$ 75,000	
Total Capital Cost					**$152,100,000**

C2					Palo Alto Recycled Water Feasibility Study
Last Updated:	4-Feb-19		**Discount Rate**		**Project Life**
Updated by:	K. Howes		3%		30 Years
CCI (SF, June 2018): 12014.72					
Item	**Size**	**Qty**	**Unit**	**Unit Cost**	**Total Cost**
O&M Costs (Annual)					
Advanced Water Treatment					
MBR	0		MGD	$ 560,000	$0
Ozone	0		MGD	$ 93,000	$0
BAC	0		MGD	$ 131,000	$0
MF/UF system	3		MGD	$ 342,000	$950,000
RO System	3		MGD	$ 574,000	$1,600,000
RO Concentrate Treatment	1		MGD	$ 226,000	$210,000
Advanced Oxidation and Disinfection	3		MGD	$ 73,000	$200,000
Free Chlorine	0		MGD	$ 32,000	$0
Chemicals	3		MGD	$ 121,000	$340,000
Labor for Treatment (no MBR)	3	1,040	hrs/MGD	$ 100	$290,000
Labor for MBR	0	1,040	hrs/year	$ 100	$0
Monitoring		0	$/year	$ 1,000,000	$0
Conveyance					
Annual Inspection and Maintenance of Pipeline - Average Annual Operator Hours per			LF	$0.78	$32,816
Pump Stations					
Consumables					
Equipment				1%	$19,300
Mechanical				1%	$19,300
Electrical/Instrumentation				1%	$19,300
Electricity Requirement					
Energy Charge		453,458	kWh/year	$ 0.15	$68,019
Labor Costs					
Total No. Operators		1	No.		
Average Annual Operator Hours per Year		520	Hours		
Total Operator Hours per Year		520	Hours	$ 99.81	$51,903
Phase 3 RWQCP Pump Station Improvements		0	LS	$ 96,000	$0
Phase 3 Booster Pump Station		0	LS	$ 81,000	$0
Storage Tanks					
Annual O&M				1%	$0
Injection Wells					
Annual O&M		5	EA	$ 15,000	$75,000
Extraction Wells					
Groundwater Pumping Charge		5,900	AFY	$ 1,960	$11,564,000
Hale Extraction Well/Wellhead Treatment		983	AFY	$ 265	$260,797
Rinconada Extraction Well/Wellhead Treatment		983	AFY	$ 263	$258,689
Peers Extraction Well/Wellhead Treatment		983	AFY	$ 224	$220,625
El Camino Extraction Well/Wellhead Treatment		983	AFY	$ 256	$251,497
Eleanor Extraction Well/Wellhead Treatment		983	AFY	$ 256	$251,783
Library Extraction Well/Wellhead Treatment		983	AFY	$ 242	$238,429
Mountain View Feasibility Study Long-Term Recommended Phase					
		0	LS	$ 100,000	$0
Total O&M Costs ($/yr)					**$16,920,000**
Annualized Costs ($ / Year)					
Annualized Capital Costs ($/Year)	*One payment per year, spread over Project Life*				$7,760,000
Annual O&M Costs					$16,920,000
Total Annualized Cost					$24,680,000
Deliveries of Recycled Water	6,100 AFY				
Estimated Unit Cost ($/AF)					**$4,000**

C3					Palo Alto Recycled Water Feasibility Study
Last Updated:	4-Feb-19		**Discount Rate**		**Project Life**
Updated by:	K. Howes		3%		30 Years
CCI (SF, June 2018): 12014.72					
Item	**Size**	**Qty**	**Unit**	**Unit Cost**	**Total Cost**
Capital Costs					
General Requirements					
Mobilization			*Applied to all capital costs*	10%	$6,472,618
Traffic Control			*Applied to all capital costs*	4%	$2,589,047
Treatment					
MBR	0.0		MGD	$ 17,200,000	$0
Ozone	0.0		MGD	$ 360,000	$0
BAC	0.0		MGD	$ 323,000	$0
MF/UF system	3.3		MGD	$ 1,317,000	$4,400,000
RO System	3.3		MGD	$ 1,586,000	$5,300,000
RO Concentrate Treatment	1.0		MGD	$ 1,510,000	$1,500,000
Advanced Oxidation and Disinfection	3.3		MGD	$ 470,000	$1,600,000
Free Chlorine	0.0		MGD	$ 271,000	$0
Chemicals (Storage and Use)	3.3		MGD	$ 134,000	$440,000
Sitework/Piping/Structures	3.3		MGD	$ 3,427,000	$11,000,000
Conveyance					
High-Density Urban Pipeline, HDPE					
6 Inch		0	LF	$ 186	$0
8 Inch		19,994	LF	$ 200	$3,999,025
10 Inch		12,529	LF	$ 212	$2,656,383
12 Inch		9,873	LF	$ 254	$2,510,803
16 Inch		47,801	LF	$ 277	$13,244,223
18 Inch		0	LF	$ 290	$0
20 Inch		0	LF	$ 334	$0
24 Inch		0	LF	$ 381	$0
30 Inch		0	LF	$ 462	$0
Repurposing Pipe					
6 Inch		0	LF	$ 55	$0
8 Inch		0	LF	$ 66	$0
Sheeting and Shoring (Open Cut)	*3% of Open Cut Pipeline Cost*			3%	$672,313
Microtunneling					
Tunnel and Casing (36")		800	LF	$ 1,728	$1,382,400
Jacking Shaft		3	EA	$ 300,000	$900,000
Receiving Shaft		3	EA	$ 150,000	$450,000
Horizontal Directional Drilling					
24 Inch Bore Diameter		350	LF	$ 528	$184,800
PTGAB					
6 Inch		0	LF	$ 375	$0
8 Inch		0	LF	$ 500	$0
10 Inch		0	LF	$ 625	$0
12 Inch		0	LF	$ 750	$0
16 Inch		160	LF	$ 1,000	$160,033
20 Inch		0	LF	$ 1,250	$0
Jacking Shafts		1	EA	$ 258,000	$258,000
Receiving Shafts		1	EA	$ 148,000	$148,000
Pipe Bridge					
Pipe Bridge Support		8	LF	$ 5,000	$40,000
Pipe Bridge Pipe					
6 Inch		0	LF	$ 66	$0
8 Inch		0	LF	$ 86	$0
10 Inch		0	LF	$ 108	$0
12 Inch		0	LF	$ 139	$0
16 Inch		65	LF	$ 175	$11,387
Potholing		916	EA	$ 500	$457,860
Cathodic Protection	*3% of Pipeline Installation Cost*			3%	$785,141
Customer Services (no meter replacement)		62	EA	$ 10,000	$620,000
Customer Services (with meter replacement)		142	EA	$ 15,000	$2,130,000
Planter Box (Housing Pipe on Bridge Sidewalk)		6	CY	$ 2,000	$12,000
Planter Box (Installation Labor)		8	Day	$ 4,000	$32,000
Pump Stations					
Pump Station #1	400		Total installed HP, including standby	$ 5,800	$2,320,102
Pump Station #2	0		Total installed HP, including standby	$ -	$0
Pump Station #3	0		Total installed HP, including standby	$ -	$0
Pump Station #4	0		Total installed HP, including standby	$ -	$0
Pump Station #5	0		Total installed HP, including standby	$ -	$0
Phase 3 RWQCP Pump Station Improvements		1	LS	$ 1,389,000	$1,389,000
Phase 3 Booster Pump Station		1	LS	$ 918,000	$918,000
Hydropneumatic Tank - Pump Station #1	5,800		Gal	$ 35	$204,714
Hydropneumatic Tank - Pump Station #2	0		Gal	$ -	$0
Hydropneumatic Tank - Pump Station #3	0		Gal	$ -	$0
Hydropneumatic Tank - Pump Station #4	0		Gal	$ -	$0
Hydropneumatic Tank - Pump Station #5	0		Gal	$ -	$0
Storage Tank					
Storage Tank	0.0		MG	$ 1,500,000	$0
Underground Construction		0.0	LS	$ 1,000,000	
Injection Well					
		5	EA	$ 1,000,000	$5,000,000
Extraction Wellhead Treatment					
Hale		833	AFY	$ 2,937	$2,447,343
Rinconada		833	AFY	$ 2,937	$2,447,343
Peers		833	AFY	$ 3,353	$2,793,927
El Camino		833	AFY	$ 4,538	$3,782,012
Eleanor		833	AFY	$ 4,538	$3,782,012
Library		833	AFY	$ 4,538	$3,782,012
Mountain View Feasibility Study Long-Term Recommended Phase					
		0	LS	$ 3,326,000	$0
Subtotal					**$92,822,000**
Sales Tax	*Applied to half of capital costs (not including General)*			9%	$3,769,000
Construction Cost Subtotal					**$96,591,000**
Market Adjustment Factor				10%	$9,659,000
Construction Contingency				40%	$38,636,000
Construction Cost Total					**$144,900,000**
Engineering and Admin Services (Design)				15%	$14,489,000
Construction Management				10%	$9,659,000
Engineering Services During Construction				3%	$2,898,000
Property Acquisition (Property Only)		30,000	SQ FT	$ 500	$15,000,000
Property Acquisition (House on Property)		0	SQ FT	$ 1,000	$0
Rinconada Land Cost		1	LS	$ 4,500,000	$4,500,000
Peers Land Cost		1	LS	$ 7,000,000	$7,000,000
On-Time Fee		0	LS	$ 75,000	
Total Capital Cost					**$198,400,000**

C3					Palo Alto Recycled Water Feasibility Study
Last Updated:	4-Feb-19		**Discount Rate**		**Project Life**
Updated by:	K. Howes		3%		30 Years
CCI (SF, June 2018): 12014.72					
Item	**Size**	**Qty**	**Unit**	**Unit Cost**	**Total Cost**
O&M Costs (Annual)					
Advanced Water Treatment					
MBR	0		MGD	$ 560,000	$0
Ozone	0		MGD	$ 93,000	$0
BAC	0		MGD	$ 131,000	$0
MF/UF system	3		MGD	$ 342,000	$1,100,000
RO System	3		MGD	$ 574,000	$1,900,000
RO Concentrate Treatment	1		MGD	$ 226,000	$220,000
Advanced Oxidation and Disinfection	3		MGD	$ 73,000	$240,000
Free Chlorine	0		MGD	$ 32,000	$0
Chemicals	3		MGD	$ 121,000	$400,000
Labor for Treatment (no MBR)	3	1,040	hrs/MGD	$ 100	$350,000
Labor for MBR	0	1,040	hrs/year	$ 100	$0
Monitoring		0	$/year	$ 1,000,000	$0
Conveyance					
Annual Inspection and Maintenance of Pipeline - Average Annual Operator Hours per			LF	$0.78	$71,588
Pump Stations					
Consumables					
Equipment				1%	$23,201
Mechanical				1%	$23,201
Electrical/Instrumentation				1%	$23,201
Electricity Requirement					
Energy Charge		466,792	kWh/year	$ 0.15	$70,019
Labor Costs					
Total No. Operators		1	No.		
Average Annual Operator Hours per Year		520	Hours		
Total Operator Hours per Year		520	Hours	$ 99.81	$51,903
Phase 3 RWQCP Pump Station Improvements		1	LS	$ 96,000	$96,000
Phase 3 Booster Pump Station		1	LS	$ 81,000	$81,000
Storage Tanks					
Annual O&M				1%	$0
Injection Wells					
Annual O&M		5	EA	$ 15,000	$75,000
Extraction Wells					
Groundwater Pumping Charge		5,000	AFY	$ 1,960	$9,800,000
Hale Extraction Well/Wellhead Treatment		833	AFY	$ 265	$221,014
Rinconada Extraction Well/Wellhead Treatment		833	AFY	$ 263	$219,228
Peers Extraction Well/Wellhead Treatment		833	AFY	$ 224	$186,970
El Camino Extraction Well/Wellhead Treatment		833	AFY	$ 256	$213,133
Eleanor Extraction Well/Wellhead Treatment		833	AFY	$ 256	$213,376
Library Extraction Well/Wellhead Treatment		833	AFY	$ 242	$202,059
Mountain View Feasibility Study Long-Term Recommended Phase					
		0	LS	$ 100,000	$0
Total O&M Costs ($/yr)					**$15,780,000**
Annualized Costs ($ / Year)					
Annualized Capital Costs ($/Year)	*One payment per year, spread over Project Life*				$10,122,000
Annual O&M Costs					$15,780,000
Total Annualized Cost					$25,902,000
Deliveries of Recycled Water	5,900 AFY				
Estimated Unit Cost ($/AF)					**$4,400**

D1				Palo Alto Recycled Water Feasibility Study
Last Updated:	4-Feb-19	**Discount Rate**		**Project Life**
Updated by:	K. Howes	3%		30 Years
CCI (SF, June 2018): 12014.72				

Item	Size	Qty	Unit	Unit Cost	Total Cost
Capital Costs					
General Requirements					
Mobilization			*Applied to all capital costs*	10%	$3,772,451
Traffic Control			*Applied to all capital costs*	4%	$1,508,980
Treatment					
MBR	0.0		MGD	$ 17,200,000	$0
Ozone	4.7		MGD	$ 360,000	$1,700,000
BAC	4.7		MGD	$ 323,000	$1,500,000
MF/UF system	4.7		MGD	$ 1,317,000	$6,200,000
RO System	4.7		MGD	$ 1,586,000	$7,500,000
RO Concentrate Treatment	1.2		MGD	$ 1,510,000	$1,900,000
Advanced Oxidation and Disinfection	4.7		MGD	$ 470,000	$2,200,000
Free Chlorine	4.7		MGD	$ 271,000	$1,300,000
Chemicals (Storage and Use)	0.0		MGD	$ 134,000	$0
Sitework/Piping/Structures	0.0		MGD	$ 3,427,000	$0
Conveyance					
High-Density Urban Pipeline, HDPE					
6 Inch		0	LF	$ 186	$0
8 Inch		0	LF	$ 200	$0
10 Inch		0	LF	$ 212	$0
12 Inch		5,000	LF	$ 254	$1,271,550
16 Inch		0	LF	$ 277	$0
18 Inch		0	LF	$ 290	$0
20 Inch		500	LF	$ 334	$166,905
24 Inch		1,400	LF	$ 381	$533,568
30 Inch		2,600	LF	$ 462	$1,202,422
Repurposing Pipe					
6 Inch		0	LF	$ 55	$0
8 Inch		0	LF	$ 66	$0
Sheeting and Shoring (Open Cut)	*3% of Open Cut Pipeline Cost*			3%	$59,161
Microtunneling					
Tunnel and Casing (36")		0	LF	$ 1,728	$0
Jacking Shaft		0	EA	$ 300,000	$0
Receiving Shaft		0	EA	$ 150,000	$0
Horizontal Directional Drilling					
24 Inch Bore Diameter		0	LF	$ 528	$0
PTGAB					
6 Inch		0	LF	$ 375	$0
8 Inch		0	LF	$ 500	$0
10 Inch		0	LF	$ 625	$0
12 Inch		0	LF	$ 750	$0
16 Inch		0	LF	$ 1,000	$0
20 Inch		1,200	LF	$ 1,250	$1,500,313
Jacking Shafts		1	EA	$ 258,000	$258,000
Receiving Shafts		1	EA	$ 148,000	$148,000
Pipe Bridge					
Pipe Bridge Support		0	LF	$ 5,000	$0
Pipe Bridge Pipe					
6 Inch		0	LF	$ 66	$0
8 Inch		0	LF	$ 86	$0
10 Inch		0	LF	$ 108	$0
12 Inch		0	LF	$ 139	$0
16 Inch		0	LF	$ 175	$0
Potholing		107	EA	$ 500	$53,500
Cathodic Protection	*3% of Pipeline Installation Cost*			3%	$97,008
Customer Services (no meter replacement)		0	EA	$ 10,000	$0
Customer Services (with meter replacement)		0	EA	$ 15,000	$0
Planter Box (Housing Pipe on Bridge Sidewalk)		0	CY	$ 2,000	$0
Planter Box (Installation Labor)		0	Day	$ 4,000	$0
Pump Stations					
Pump Station #1	60		Total installed HP, including standby	$ 11,483	$688,978
Pump Station #2	400		Total installed HP, including standby	$ 5,800	$2,320,102
Pump Station #3	0		Total installed HP, including standby	$ -	$0
Pump Station #4	0		Total installed HP, including standby	$ -	$0
Pump Station #5	0		Total installed HP, including standby	$ -	$0
Phase 3 RWQCP Pump Station Improvements		0	LS	$ 1,389,000	$0
Phase 3 Booster Pump Station		0	LS	$ 918,000	$0
Hydropneumatic Tank - Pump Station #1	0		Gal	$ -	$0
Hydropneumatic Tank - Pump Station #2	0		Gal	$ -	$0
Hydropneumatic Tank - Pump Station #3	0		Gal	$ -	$0
Hydropneumatic Tank - Pump Station #4	0		Gal	$ -	$0
Hydropneumatic Tank - Pump Station #5	0		Gal	$ -	$0
Storage Tank					
Storage Tank	4.8		MG	$ 1,500,000	$7,125,000
Underground Construction		1.0	LS	$ 1,000,000	
Injection Well					
		0	EA	$ 1,000,000	$0
Extraction Wellhead Treatment					
Hale		0	AFY	$ 2,937	$0
Rinconada		0	AFY	$ 2,937	$0
Peers		0	AFY	$ 3,353	$0
El Camino		0	AFY	$ 4,538	$0
Eleanor		0	AFY	$ 4,538	$0
Library		0	AFY	$ 4,538	$0
Mountain View Feasibility Study Long-Term Recommended Phase					
		0	LS	$ 3,326,000	$0
Subtotal					**$43,006,000**
Sales Tax	*Applied to half of capital costs (not including General)*			9%	$1,698,000
Construction Cost Subtotal					**$44,704,000**
Market Adjustment Factor				10%	$4,470,000
Construction Contingency				40%	$17,882,000
Construction Cost Total					**$67,100,000**
Engineering and Admin Services (Design)				15%	$6,706,000
Construction Management				10%	$4,470,000
Engineering Services During Construction				3%	$1,341,000
Property Acquisition (Property Only)		50,000	SQ FT	$ 500	$25,000,000
Property Acquisition (House on Property)		0	SQ FT	$ 1,000	$0
Rinconada Land Cost		0	LS	$ 4,500,000	$0
Peers Land Cost		0	LS	$ 7,000,000	$0
On-Time Fee		1	LS	$ 75,000	
Total Capital Cost					**$104,600,000**

D1					Palo Alto Recycled Water Feasibility Study
Last Updated:	4-Feb-19		**Discount Rate**		**Project Life**
Updated by:	K. Howes		3%		30 Years
CCI (SF, June 2018): 12014.72					
Item	**Size**	**Qty**	**Unit**	**Unit Cost**	**Total Cost**
O&M Costs (Annual)					
Advanced Water Treatment					
MBR	0		MGD	$ 560,000	$0
Ozone	5		MGD	$ 93,000	$440,000
BAC	5		MGD	$ 131,000	$620,000
MF/UF system	5		MGD	$ 342,000	$1,600,000
RO System	5		MGD	$ 574,000	$2,700,000
RO Concentrate Treatment	1		MGD	$ 226,000	$280,000
Advanced Oxidation and Disinfection	5		MGD	$ 73,000	$350,000
Free Chlorine	5		MGD	$ 32,000	$150,000
Chemicals	0		MGD	$ 121,000	$0
Labor for Treatment (no MBR)	5	1,040	hrs/MGD	$ 100	$490,000
Labor for MBR	0	1,040	hrs/year	$ 100	$0
Monitoring		1	$/year	$ 1,000,000	$1,000,000
Conveyance					
Annual Inspection and Maintenance of Pipeline - Average Annual Operator Hours per			LF	$0.78	$6,434
Pump Stations					
Consumables					
Equipment				1%	$30,091
Mechanical				1%	$30,091
Electrical/Instrumentation				1%	$30,091
Electricity Requirement					
Energy Charge		718,547	kWh/year	$ 0.15	$107,782
Labor Costs					
Total No. Operators		2	No.		
Average Annual Operator Hours per Year		520	Hours		
Total Operator Hours per Year		1,040	Hours	$ 99.81	$103,805
Phase 3 RWQCP Pump Station Improvements		0	LS	$ 96,000	$0
Phase 3 Booster Pump Station		0	LS	$ 81,000	$0
Storage Tanks					
Annual O&M				1%	$71,250
Injection Wells					
Annual O&M		0	EA	$ 15,000	$0
Extraction Wells					
Groundwater Pumping Charge		0	AFY	$ 1,960	$0
Hale Extraction Well/Wellhead Treatment		0	AFY	$ 265	$0
Rinconada Extraction Well/Wellhead Treatment		0	AFY	$ 263	$0
Peers Extraction Well/Wellhead Treatment		0	AFY	$ 224	$0
El Camino Extraction Well/Wellhead Treatment		0	AFY	$ 256	$0
Eleanor Extraction Well/Wellhead Treatment		0	AFY	$ 256	$0
Library Extraction Well/Wellhead Treatment		0	AFY	$ 242	$0
Mountain View Feasibility Study Long-Term Recommended Phase					
		0	LS	$ 100,000	$0
Total O&M Costs ($/yr)					**$8,010,000**
Annualized Costs ($ / Year)					
Annualized Capital Costs ($/Year)	*One payment per year, spread over Project Life*				$5,337,000
Annual O&M Costs					$8,010,000
Total Annualized Cost					$13,347,000
Deliveries of Recycled Water	5,300 AFY				
Estimated Unit Cost ($/AF)					**$2,500**

Appendix E - Concept Option Variations [Confidential – Not Included]

Appendix F - Cost Per Unit of Water Analyses for Palo Alto, Cal Water, Purissima Hills Water District and East Palo Alto [Confidential – Not Included]

Appendix G - Funding Matrix

Summary of Potential Recycled Water Funding Opportunities – Updated March 13, 2019

Program	Administering Agency	Funding Type	CEQA/ NEPA Required?	Program Purpose	Eligible Uses	Eligibility Requirements	Due Date & Future Rounds	Funding Amounts & Terms	Cost Share	Priority Determination / Critical Factors
Title XVI Water Reuse & Reclamation Grant Program - Construction	U.S. Bureau of Reclamation (Reclamation)	Grant	CEQA and NEPA	Construction of water recycling treatment and conveyance facilities.	Planning, design, construction (can include prior costs)	A Title XVI Feasibility Study must be submitted to Reclamation for review and approval prior to submitting a construction application. Project must receive congressional authorization in order to receive construction grant funding.	Most recent round was due in Summer 2018. Next round anticipated spring 2019	The total amount of available funds varies each year. The 2018 FOA included $34M for Title XVI. Historically, there has been a max of ~$4M per applicant, though the new administration has favored funding fewer projects with larger awards per project. Maximum grant award of 25% of the total project costs or $20 million, whichever is less. Grant funding is provided over multiple applications submitted on an annual basis until the project is complete or the total federal cost share has been provided. Typically limited to 3 years of costs per application.	75% cost share	1 Project must receive congressional approval.
Website	https://www.usbr.gov/watersmart/title/index.html									
Water Infrastructure Improvements for the Nation (WIIN) Subset of Title XVI	U.S. Bureau of Reclamation (Reclamation)	Grant	CEQA and NEPA	Construction of water recycling treatment and conveyance facilities for projects that have a Title XVI Feasibility Study completed, *but are not congressionally authorized.*	Similar to Title XVI: planning, design, construction (including prior costs)	A Title XVI Feasibility Study must have already been submitted to Reclamation for review and approval and the project must have a Determination of Feasibility from Reclamation	Reclamation appears to intend three rounds of funding – the first was in 2017, the second was in 2018, and a third to be released shortly after announcement of Round 2 awards – anticipated in spring 2019.	$50M total has been allocated under WIIN. $10M released in first FOA, $20M released in second FOA, $20M anticipated for third FOA. Maximum grant award of 25% of the total project costs. Typically limited to 3 years of costs per application.	75% cost share	1 Competitive program, but will only get more competitive as additional agencies submit their Feasibility Studies. Better to get money early and keep going back.
Website	A specific funding website has not been developed. For reference, visit: https://www.usbr.gov/watersmart/title/index.html									

Program	Administering Agency	Funding Type	CEQA/ NEPA Required?	Program Purpose	Eligible Uses	Eligibility Requirements	Due Date & Future Rounds	Funding Amounts & Terms	Cost Share	Priority Determination / Critical Factors
Drought Response Program – Drought Resiliency Projects	Reclamation	Grant	CEQA and NEPA	Increase the reliability of water supply; improve water management; implement systems to facilitate the voluntary sale, transfer or exchange of water; and provide benefits for fish, wildlife, and the environment to mitigate impacts caused by drought.	Construction, tool development to improve water management, installation of data collecting devices, improving habitat. Proposed resiliency project should improve ability of water managers to deliver water during a drought.	Based on most recent FOA, project cannot be part of a congressionally authorized Title XVI Project. Must demonstrate that project is supported by an existing drought contingency plan; quantify benefits during droughts; address urgent needs and severe drought impacts.	Anticipate FOA in December 2018, with applications due February 2019	$8.3M was awarded in 2018 FY2019 budget TBD Funding Group I: up to $300,000 for projects that can be completed within 2 years Funding Group II: up to $750,000 for larger projects that can be completed within 3 years	50% cost share	4 Competitiveness would be evaluated if and when another FOA is released based on project status and scoring criteria. Status of next round is unknown.
Website	https://www.usbr.gov/drought/									
Integrated Regional Water Management (IRWM) Implementation Grant Program	California Department of Water Resources (DWR)	Grant	CEQA Only	Identify and implement projects and programs that increase regional self-reliance, reduce conflict, and manage water to concurrently achieve social, environmental, and economic objectives.	Planning, design, land acquisition, legal fees, environmental documentation, environmental mitigation, construction/ implementation, construction administration	Project must be included on the project list of an IRWM Region's IRWMP. Palo Alto is within the San Francisco Bay IRWM Region and thus, the project must be in its IRWMP.	Prop 1 – Round 1 is underway; local call for projects closed Nov. 16, 2018 FY20/21: Round 2 Implementation Grant Solicitation anticipated City submitted a project in Fall 2018 for Round 1; currently awaiting selection for inclusion in regional application.	$58.5M for the 2 rounds of implementation funding in the SF Funding Area, which includes the entire SF Bay Area IRWM Region and a portion of the East Contra Costa IRWM Region. ($65M is allocated to SF Funding Area, $6.5M to be allocated to DAC Involvement.) $22.75M anticipated available in each round for non-DAC implementation projects	50% cost share	3 Limited funding available for competitive area. Participate in SF Bay Area IRWM process. Ultimately, up to SF Bay Area project prioritization and selection process as to which projects are included in an application
Website	https://water.ca.gov/Work-With-Us/Grants-And-Loans/IRWM-Grant-Programs or Bay Area IRWM Program: http://bayareairwmp.org/									

Program	Administering Agency	Funding Type	CEQA/ NEPA Required?	Program Purpose	Eligible Uses	Eligibility Requirements	Due Date & Future Rounds	Funding Amounts & Terms	Cost Share	Priority Determination / Critical Factors
Clean Water State Revolving Fund (CWSRF) loan program	State Water Resources Control Board (SWRCB)	Loan	CEQA+ (includes CEQA and select federal crosscutters, i.e., not full NEPA)	Construction of publicly-owned facilities including wastewater treatment, local sewers, sewer interceptors, water reclamation and distribution, stormwater treatment, and combined sewers.	Planning, design, construction, construction management, mitigation measures (can include prior planning/design costs). Construction costs incurred prior to executing funding agreement NOT eligible for reimbursement.	Must either provide proof of submitted UWMP, proof of CUWCC MOU, or copy of Water Conservation Program for State Board approval. Letter of 2015 UWMP approval from DWR required prior to executing financing agreement.	Applications are continuously accepted, though the State Board now implements a deadline of December 31 and a scoring system to be added to the Fundable List. Projects must first get on Fundable Project List before applications will be reviewed. May be as long as 2 years from application submittal to contract	Typically, there is $200M-$300M available; Water recycling projects are given priority. Interest rate is ½ of the General Obligation Rate at the time of award (SRF i=1.9% for this year). Financing term up to 30 years. There is no maximum financing amount for a project / agency.	0%	2 Program is very popular. Application review can be up to 12 months, so financial forecast could change by the time an application is prepared, submitted, and reviewed. Highest scoring projects will be “corrective”, or address drinking water or Delta water quality; help implement a climate change action plan or address multiple water quality issues; and those with both a complete application and at least 90% design/specs
Website	https://www.waterboards.ca.gov/water_issues/programs/grants_loans/srf/									
Water Recycling Funding Program (WRFP) Construction Grants	SWRCB	Loans & Grant	CEQA+ (includes CEQA and select federal crosscutters, i.e., not full NEPA)	Promote beneficial use of recycled water to augment fresh water supplies in CA by supporting water recycling projects and research.	Planning, design and construction, including reasonable costs to provide emergency backup water supply for a recycled water system; pilot projects for new potable reuse (can include prior planning/design costs). Construction costs incurred prior to executing funding agreement NOT eligible for reimbursement.	Apply through CWSRF program.	Applications are continuously accepted, though the State Board now implements a deadline of December 31 and a scoring system to be added to the Fundable List. Projects must first get on Fundable Project List before applications will be reviewed. May be as long as 2 years from application submittal to contract	Prop 1 provided $625M for planning and construction of water recycling projects; however, this funding has been exhausted. Future allocations to the WRFP are possible, though currently TBD. Project could receive $15M or 35% of project costs for construction, whichever is less. Offers 1% financing for recycled water projects through CWSF	N/A	2 By applying for CWSRF, the City will automatically be applying for any available grant funding under the umbrella CWSRF program.
Website	https://www.waterboards.ca.gov/water_issues/programs/grants_loans/water_recycling/									

Program	Administering Agency	Funding Type	CEQA/ NEPA Required?	Program Purpose	Eligible Uses	Eligibility Requirements	Due Date & Future Rounds	Funding Amounts & Terms	Cost Share	Priority Determination / Critical Factors
Infrastructure SRF (ISRF) Loan Program	California Infrastructure and Economic Development Bank (I-Bank)	Loan	Application does not consist of environmental portion; however, CEQA would be required prior to construction	Construction and/or repair of publicly-owned wastewater collection and treatment systems.	Architectural, engineering, financial and legal services, plans, specifications, admin expenses, land acquisition, construction, machinery/equipment	Project complete construction within 2 years of financing approval. Must have applied for all required permits.	Applications are continuously accepted. Loans typically awarded three months after application submittal	ISRF Program funding is available in amounts ranging from $50,000 to $25M, with loan terms of up to 30 years. Pre-payment of loan not allowed until Year 13 of loan	N/A	5 Projects must demonstrate job creation, though this is only a small piece of the application. Loan terms not as good as other programs, and there are penalties to early repayment
Website	http://www.ibank.ca.gov/infrastructure-state-revolving-fund-isrf-program/									
Water Infrastructure Finance and Innovation Act (WIFIA)	USEPA	Loan	CEQA and NEPA	Construction of wastewater conveyance and treatment projects, drinking water treatment and distribution projects, desalination, and water recycling projects	Planning, preliminary engineering, design, environmental review, revenue forecasting, construction, land acquisition, capitalized interest	Federal assistance may not exceed 80% of project costs.	Letters of Interest accepted during selection periods. FY 2018 solicited letters of interest from April-July 2018. 62 Letters of Interest applied for $9.1B; 39 projects selected to apply for $5B in loans	$5B was available in 2018. Minimum project size for large communities (population > 25,000) is $20M; for small communities is $5M. Interest rate greater or equal to U.S. Treasury rate of similar maturity, based on the weighted average life of the loan. Loans for 35 years or useful life of project, whichever is less. WIFIA received a 2-year $100M reauthorization at end of 2018.	51% non-WIFIA; (up to 80% of project costs can be covered by federal funds, using a combination of programs)	6 Non-refundable application fees of $25,000 (small communities) or $100,000 (>25,000 people). Total fees: $250K-$500K plus possibly additional fees for administration of loan. Low funding amount available. National program. Better local/state options.
Website	https://www.epa.gov/wifia									