Attachment 7: Water Supply Costs & Benefits

Contents

Water Supply Costs & Benefits

The four projects contained in this Proposition (Prop) 84 Implementation Grant Proposal provide numerous water supply benefits to the Mokelumne/Amador/Calaveras (MAC) Integrated Regional Water Management (IRWM) Planning Region, to local communities within the region, and to the State of California. While most of these benefits are quantifiable, there are local, regional and statewide benefits that are more difficult to assign a monetary value. In summary, water supply benefits provided by the projects contained in this Proposal are:

- Elimination of storage tank and distribution system losses
- Restoration of storage capacity
- Restoration of distribution system capacity
- Increased water supply reliability
- Reduced water system Operations and Maintenance costs (O&M)
- Improved water use efficiency
- Improved fire flows
- Increased groundwater sustainability
- Reduced surface water diversions
- Increased conjunctive use opportunities

These benefits generally fall into the categories of benefits associated with:

- Avoided Water Supply Projects;
- Avoided Water Shortage Costs; and
- Avoided Operations and Maintenance Costs.

The following is project-specific information detailing the quantitative and qualitative "Water Supply Costs and Benefits" provided by each of the aforementioned projects. Note, the table numbers used in this document have been correlated to the table numbers used in the *Implementation Proposal Solicitation Package, Integrated Regional Water Management, Proposition 84, Round 1* (Prop 84 PSP, August 2010).

Lake Camanche Tank Rehabilitation & Lateral Replacement Project

Summary

The Lake Camanche Tank Rehabilitation & Lateral Replacement Project consists of improvements to the Amador Water Agency (AWA) water distribution system serving Lake Camanche Village, a disadvantaged community. The project would rehabilitate five redwood storage tanks by fabricating and lining the tanks with geomembrane liners. Lining the not only reduces water losses and increases storage capacity, but it also improves the water quality by reducing the substrate that microorganisms can grow on. In addition to the storage tank rehabilitation, the project would replace 200 leaking service laterals with ¾-inch diameter copper pipe. The existing laterals are very brittle and subject to severe longitudinal cracking, resulting in significant water losses and infrastructure damage.

Lining the storage tanks will reduce system losses by approximately 8% and will increase system storage by approximately 15%. It will also reduce the risk of coliform contamination and lower annual expenditure on chlorine treatment (discussed further in Attachment 8). Currently, the tanks are only filled to about 85% of capacity to manage leakage. The lost storage diminishes system reliability and emergency response capability.

Additionally, losses from leaking system laterals currently equals 6% to 9% of system production, or about 5.8 to 8.7 MG annually. This project would replace 200 of these laterals and reduce system losses by about 2.4 MG.

Under the No Project Condition, AWA would continue to operate the storage tanks for another 10 to 15 years, after which time they would replace the tanks with new steel tanks. Existing leaking laterals would remain in service under the No Project Condition. System loss from the leaking tanks (currently about 7.9 MG per year) and leaking laterals (currently about 2.4 MG per year) would be expected to increase at a rate of 5% per year.

The primary water supply benefits of this project are:

- Eliminating storage tank losses
- Restoring distribution system storage capacity
- Reducing system losses from leaking laterals

Non-quantifiable water supply benefits from the project potentially include:

- Increase water supply reliability
- Improved water use efficiency
- Sustainability of groundwater supplies

Table 1 summarizes the project's water supply benefits, while Table 2 provides a qualitative measure of several of the benefits as well as the monetary estimate of physical project costs.

Table 1: Lake Camanche Tank Rehabilitation & Lateral Replacement Project Summary of Water Supply Benefits

Type of Benefit	Assessment Level	Beneficiaries
Eliminate storage tank losses	Quantitative	Local
Restore distribution system storage capacity	Quantitative	Local
Reduce system losses	Quantitative	Local
Increased reliability	Qualitative	Local
Improved water use efficiency	Qualitative	Local, Regional, Statewide
Sustainability of groundwater supplies	Qualitative	Local, Regional

Table 2: Lake Camanche Tank Rehabilitation & Lateral Replacement Project Benefit-Cost Analysis Overview

Type of Benefit	Assessment Level	Beneficiaries
Costs – Present Value of Total Capital and O&M		$484,687
Quantifiable Benefits		
Eliminate storage tank and lateral losses		$243,876
Increased storage capacity		$342,152
	Qualitative Indicator*	
Qualitative Benefits		
Increased water supply reliability	++	
Improved water use efficiency	++	
Sustainability of groundwater supplies	+	

* Magnitude of effect on net benefits:
+ = Likely to increase net benefits relative to quantifiable estimates.
++ = Likely to increase net benefits significantly

Project Costs

Capital costs for tank lining and lateral replacement are taken from Table 2, Attachment 4 (referenced as Table 7 – Project Budget in Exhibit B of the Prop 84 PSP) for the Lake Camanche Tank Rehabilitation & Lateral Replacement Project. Costs in Table 2 of Attachment 4 are expressed in 2010 dollars. Costs were converted to 2009 dollars using the CPI All Urban Consumers series (CUUROOOOSAO). Total upfront capital costs are $560,135 (2009 dollars), of which approximately half are assumed to be incurred in 2011 and half in 2012.

Reduced system loss and reduced risk of coliform contamination are expected to lower annual operating costs. These cost savings are expressed as project benefits and therefore are not presented here so as to avoid double counting.

Table 3 (referenced as Table 11 of Exhibit C of the Prop 84 PSP) presents the project costs; the present value of the project costs is $484,687. Annual water supply benefits from reducing storage tank and lateral water losses are summarized in Table 4 (referenced as Table 12 in Exhibit C of the Prop 84 PSP). Present value of reducing these losses is $243,876. Table 5 (referenced as Table 13 in Exhibit C of the Prop 84 PSP) summarizes the annual water supply benefits from increased storage capacity. Present value of restored storage capacity is $342,152.

Combined water supply benefits from reducing system water losses and increasing system storage capacity are summarized in

Table 6 (referenced as Table 15 in Exhibit C of the Prop 84 PSP). Present value of combined water supply benefits is $586,027; however, to avoid the double-counting of benefits, the larger of the two values (benefits associated with avoided costs) is used in calculating the benefit-to-cost ratio.

Proposal project costs and benefits summary is presented in Table 7 (referenced as Table 20 in Exhibit C of the Prop 84 PSP). The present value of project water supply benefits is $342,152, while the present value of project water quality benefits (as described in Attachment 8) is $21,466. Therefore, the total present value of the overall benefits of the Lake Camanche Tank Rehabilitation and Lateral Replacement Project is $363,618. Present value of project costs is $484,687; therefore the project benefit-cost ratio is 0.75.

Table 3: Lake Camanche Tank Rehabilitation & Lateral Replacement Project
Annual Cost of Project (referenced as Table 11 of Exhibit C of the Prop 84 PSP)

	Initial Costs	Operations and Maintenance Costs [1]						Discounting Calculations	
	(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)
YEAR	Grand Total Cost From Table 7 (row (i), column(d))	Admin	Operation	Maintenance	Replacement	Other	Total Costs (a) +…+ (f)	Discount Factor	Discounted Costs(g) x (h)
2009							$0	1.000	$0
2010							$0	0.943	$0
2011	$283,475						$283,475	0.890	$252,293
2012	$276,660						$276,660	0.840	$232,394
2013							$0	0.792	$0
2014							$0	0.748	$0
2015							$0	0.705	$0
2016							$0	0.665	$0
2017							$0	0.628	$0
2018							$0	0.592	$0
2019							$0	0.559	$0
2020							$0	0.527	$0
2021							$0	0.497	$0
2022							$0	0.469	$0
2023							$0	0.443	$0
2024							$0	0.417	$0
2025							$0	0.394	$0
Project Life									
							Total Present Value of Discounted Costs (Sum of Column (i))		$484,687
							Transfer to Table 20, column (c), Exhibit F: Proposal Costs and Benefits Summaries		

Comments: Project costs are from Table 7 and have been converted to 2009 constant dollars using CPI Series ID CUUR0000SAO. System operating costs are expected to fall relative to the Without Project condition. The annual reductions in system operating costs are treated as project benefits and are quantified in Table 13 and Table 16.

(1) The incremental change in O&M costs attributable to the project.

Table 4: Lake Camanche Tank Rehabilitation & Lateral Replacement Project
Annual Water Supply Benefits (referenced as Table 12 in Exhibit C of the Prop 84 PSP)

(a) Year	(b) Type of Benefit	(c) Measure of Benefit (Units)	(d) Without Project	(e) With Project	(f) Change Resulting from Project (e) – (d)	(g) Unit $ Value (1)	(h) Annual $ Value (f) x (g) (1)	(i) Discount Factor (1)	(j) Discounted Benefits (h) x (i) (1)
2009	System Losses	MG	-18.0	-18.0	0.0	$2,070	$0	1.000	$0
2010	System Losses	MG	-18.4	-18.4	0.0	$2,070	$0	0.943	$0
2011	System Losses	MG	-18.8	-18.8	0.0	$2,070	$0	0.890	$0
2012	System Losses	MG	-19.2	-19.2	0.0	$2,070	$0	0.840	$0
2013	System Losses	MG	-19.7	-7.7	12.0	$2,070	$24,845	0.792	$19,680
2014	System Losses	MG	-20.2	-7.7	12.5	$2,070	$25,839	0.747	$19,308
2015	System Losses	MG	-20.7	-7.7	13.0	$2,070	$26,883	0.705	$18,951
2016	System Losses	MG	-21.2	-7.7	13.5	$2,070	$27,978	0.665	$18,607
2017	System Losses	MG	-21.8	-7.7	14.1	$2,070	$29,129	0.627	$18,276
2018	System Losses	MG	-22.4	-7.7	14.7	$2,070	$30,337	0.592	$17,956
2019	System Losses	MG	-23.0	-7.7	15.3	$2,070	$31,605	0.558	$17,648
2020	System Losses	MG	-23.6	-7.7	15.9	$2,070	$32,937	0.527	$17,351
2021	System Losses	MG	-24.3	-7.7	16.6	$2,070	$34,336	0.497	$17,064
2022	System Losses	MG	-25.0	-7.7	17.3	$2,070	$35,804	0.469	$16,786
2023	System Losses	MG	-25.7	-7.7	18.0	$2,070	$37,346	0.442	$16,518
2024	System Losses	MG	-26.5	-7.7	18.8	$2,070	$38,965	0.417	$16,259
2025	System Losses	MG	-18.7	-7.7	11.0	$2,070	$22,816	0.394	$8,982
2026	System Losses	MG	-10.1	-7.7	2.4	$2,070	$4,968	0.371	$1,845
2027	System Losses	MG	-10.1	-7.7	2.4	$2,070	$4,968	0.350	$1,741
2028	System Losses	MG	-10.1	-7.7	2.4	$2,070	$4,968	0.331	$1,642
2029	System Losses	MG	-10.1	-7.7	2.4	$2,070	$4,968	0.312	$1,549
2030	System Losses	MG	-10.1	-7.7	2.4	$2,070	$4,968	0.294	$1,461
2031	System Losses	MG	-10.1	-7.7	2.4	$2,070	$4,968	0.278	$1,379
2032	System Losses	MG	-10.1	-7.7	2.4	$2,070	$4,968	0.262	$1,301
2033	System Losses	MG	-10.1	-7.7	2.4	$2,070	$4,968	0.247	$1,227
2034	System Losses	MG	-10.1	-7.7	2.4	$2,070	$4,968	0.233	$1,158
2035	System Losses	MG	-10.1	-7.7	2.4	$2,070	$4,968	0.220	$1,092
2036	System Losses	MG	-10.1	-7.7	2.4	$2,070	$4,968	0.207	$1,030
2037	System Losses	MG	-10.1	-7.7	2.4	$2,070	$4,968	0.196	$972
2038	System Losses	MG	-10.1	-7.7	2.4	$2,070	$4,968	0.185	$917
2039	System Losses	MG	-10.1	-7.7	2.4	$2,070	$4,968	0.174	$865
2040	System Losses	MG	-10.1	-7.7	2.4	$2,070	$4,968	0.164	$816
2041	System Losses	MG	-10.1	-7.7	2.4	$2,070	$4,968	0.155	$770
2042	System Losses	MG	-10.1	-7.7	2.4	$2,070	$4,968	0.146	$726
Project Life									
							Total Present Value of Discounted Benefits Based on Unit Value (Sum of the values in Column (j) for all Benefits shown in table)		**$243,876**

Comments: Redwood storage tanks currently leak at a rate of 7.9 MG/Yr. Leakage rate expected to increase by 5% per year. Under the Without Project condition tanks would be replaced within 10 to 15 years. Benefit assessment assumes lining would eliminate 25 years of losses (life of tank lining). Laterals currently account for 6% to 9% of system losses. Replacing 1/3 of the laterals would reduce system losses by about 2.5% of production, or 2.4 MG/Yr over 30-year useful life.

Table 5: Lake Camanche Tank Rehabilitation & Lateral Replacement Project
Annual Costs of Avoided Projects (referenced as Table 13 in Exhibit C of the Prop 84 PSP)

	Costs				Discounting Calculations	
(a)	(b)	(c)	(d)	(e)	(f)	(g)
YEAR	**Alternative (Avoided Project Name): Tank Retrofit & Lateral Replacement** ***Avoided Project Description:*** *96,000 gal. steel storage tank needed to offset reduced storage in existing redwood tanks. Storage elevation in redwood tanks lowered about 15% to prevent excessive leakage.*				**Discount Factor**	**Discounted Costs (e) x (f)**
	Avoided Capital Costs	**Avoided Replacement Costs**	**Avoided Operations and Maintenance Costs**	**Total Cost Avoided for Individual Alternatives (b) + (c) + (d)**		
2009				$0	1.000	$0
2010				$0	0.943	$0
2011				$0	0.899	$0
2012				$0	0.839	$0
2013		$31,902		$31,902	0.792	$25,250
2014		$31,902		$31,902	0.747	$23,821
2015		$31,902		$31,902	0.704	$22,473
2016		$31,902		$31,902	0.665	$21,201
2017		$31,902		$31,902	0.627	$20,001
2018		$31,902		$31,902	0.591	$18,869
2019		$31,902		$31,902	0.558	$17,801
2020		$31,902		$31,902	0.526	$16,793
2021		$31,902		$31,902	0.497	$15,842
2022		$31,902		$31,902	0.468	$14,946
2023		$31,902		$31,902	0.442	$14,100
2024		$31,902		$31,902	0.417	$13,302
2025		$31,902		$31,902	0.393	$12,549
2026		$31,902		$31,902	0.371	$11,838
2027		$31,902		$31,902	0.350	$11,168
2028		$31,902		$31,902	0.330	$10,536
2029		$31,902		$31,902	0.312	$9,940
2030		$31,902		$31,902	0.294	$9,377
2031		$31,902		$31,902	0.277	$8,846
2032		$31,902		$31,902	0.262	$8,346
2033		$31,902		$31,902	0.247	$7,873
2034		$31,902		$31,902	0.233	$7,428
2035		$31,902		$31,902	0.220	$7.007
2036		$31,902		$31,902	0.207	$6,610
2037		$31,902		$31,902	0.195	$6,236
Project Life						
					Total Present Value of Discounted Costs (Sum of Column (g))	$342,152
					(%) Avoided Cost Claimed by Project	**100%**

	Costs				Discounting Calculations	
(a)	(b)	(c)	(d)	(e)	(f)	(g)
YEAR	**Alternative (Avoided Project Name): Tank Retrofit & Lateral Replacement** ***Avoided Project Description:*** *96,000 gal. steel storage tank needed to offset reduced storage in existing redwood tanks. Storage elevation in redwood tanks lowered about 15% to prevent excessive leakage.*				**Discount Factor**	**Discounted Costs (e) x (f)**
	Avoided Capital Costs	**Avoided Replacement Costs**	**Avoided Operations and Maintenance Costs**	**Total Cost Avoided for Individual Alternatives (b) + (c) + (d)**		
Total Present Value of Discounted Avoided Project Costs Claimed by alternative Project (Total Present Value of Discounted Costs x % Avoided Cost Claimed by Project)						**$342,152**
Comments: System storage capacity is reduced by 96,000 gallons under the Without Projection Condition. Replacement cost of storage capacity is valued at $5/gallon (2009 dollars). Annualized value of storage is $0.33/gal, assuming a 6% discount rate and 40-year useful life.						

Table 6: Lake Camanche Tank Rehabilitation & Lateral Replacement Project
Total Water Supply Benefits (referenced as Table 15 of Exhibit C of the Prop 84 PSP)

Total Discounted Water Supply Benefits (a)	Total Discounted Avoided Project Costs (b)	Other Discounted Water Supply Benefits (c)	Total Present Value of Discounted Benefits (d) (a) + (c) or (b) + (c)
$243,876	$342,152	$0	**$342,152**
Comments: Water supply benefit (a) equal to 12.5 years of avoided storage tanks losses and 30 years of avoided lateral losses valued at variable production cost of water (see Table 12). Avoided project costs (b) equal 25 years of amortized replacement costs for 96,000 gallons of storage capacity valued at $5.00/gallon (see Table 13).			

Table 7: Lake Camanche Tank Rehabilitation & Lateral Replacement Project
Project Costs and Benefits Summary (referenced as Table 20 in Exhibit C of the Prop 84 PSP)

Project	Agency	Total Present Value Project Costs (1)	Total Present Value Project Benefits				B/C Ratio
			Water Supply (2)	Flood Damage Reduction (3)	Other (4)	Total	
(a)	(b)	(c)	(d)	(e)	(f)	(g) (d) + (e) + (f)	(h) (g) / (c)
Project Title: Lake Camanche Tank Rehabilitation & Lateral Replacement Project	Amador Water Agency	$484,687	$342,152	$0	$21,466	$363,618	**0.75**
TOTAL		**$484,687**	**$342,152**	**$0**	**$21,466**	**$363,618**	**0.75**

(1) From Exhibit C, Table 11, column (i). Or from Exhibit #, Table 17, column (i). If project is a multi-purpose project, avoid double-counting costs.

(2) From Exhibit C, Table 15, column (d)

(3) From Exhibit E, Table 19, row (e)

(4) From Exhibit D, Table 16, column (j)

Summary of Findings

The primary quantifiable water supply benefits of this project are the following:

- **Eliminate storage tank losses.** The value of this annual benefit is equal to the annual loss multiplied by the variable production cost of water. The variable production cost of water is approximately $2,070/MG. The benefit calculation assumes that under the No Project Condition the tanks would be replaced in 12.5 years (the midpoint of the remaining useful life range of 10 to 15 years) and that storage tanks losses would increase at a rate of 5% per year.

- **Restore distribution system storage capacity.** The value of this benefit is equal to the replacement cost of the lost storage capacity. The project would increase system storage by approximately 96,000 gallons. The replacement cost is $5/gallon, or about $480,000 in upfront capital cost. The annualized value of this storage capacity, assuming a 40-year useful life and a 6% discount rate, is $31,900/year for 25 years.

- **Reduce system losses from leaking laterals.** The value of this annual benefit is equal to the annual loss from leaking laterals multiplied by the variable production cost of water. Avoided annual water loss from replacing one third of system laterals is estimated at 2.4 MG. Laterals are assumed to have a 30-year useful life. Losses are valued at $2,070/MG.

Although some of the water supply benefits of this project cannot be monetized, they are summarized briefly in Table 8Table 8. Water storage capacity will be increased as a result of the tank linings, providing a cleaner, more reliable supply of potable water for the local community and ensuring sufficient supplies are in place during period of drought and/or emergency (i.e. wild fires). The project will also increase the reliability of water supply deliveries through the replacement of leaking service laterals, reducing the risk of disruptions during peak demand or emergencies. Finally, local, regional and statewide communities will benefit from reduced losses, which will help meet statewide targets for potable water use reductions and associated reductions in demands on the local groundwater basin.

Table 8: Lake Camanche Tank Rehabilitation & Lateral Replacement Project Qualitative Benefits Summary – Water Supply Benefits

Type of Benefit	Qualitative Indicator
Water supply benefits to Lake Camanche Village	++
Water supply reliability increase for Lake Camanche Village	++
Improved fire-fighting capacity	++
Improved potable water quality	+
Improved groundwater sustainability	+

* Magnitude of effect on net benefits:
+ = Likely to increase net benefits relative to quantifiable estimates.
++ = Likely to increase net benefits significantly

References

Personal communications with Gene Mancebo, General Manager, Michael Lee, Financial Services Manager, and Erik Christeson, Interim Manager of Engineering & Planning, November and December 2010

Amador Water System Leak Detection & Repair Program

Summary

The Amador Water System (ASW) Leak Detection & Repair Program is a phased project in which Amador Water Agency (AWA) will first install a system of eighteen "master meters" on key pipelines within the AWS to determine those which have the most significant leakage (and thus the greatest need for repair or replacement), and then develop and implement a prioritized list of repairs to reduce overall system water losses. The first phase of the project (for which grant funding is being requested) consists of the master meter installation, leak identification and project prioritization. The actual replacement and rehabilitation of water conveyance facilities within the AWS will be implemented during later phases of the project and will be funded with AWA reserves, through other available grants and/or through water rate recovery.

Under the No Project condition, the AWS would continue to be operated as it is at present. System losses would approach 7% and main breaks would be repaired as they occur.

Water supply benefits from implementation of Phase 1 of the AWS Leak Detection & Repair Program potentially include:

- Reduced system losses
- Increase water supply reliability
- Reduced system operations and maintenance requirements (e.g. reduce main repairs)
- Reduced diversion from Mokelumne River
- Improved water use efficiency

All benefits associated with this project (quantitative and qualitative) are related to Water Supply and are discussed in Attachment 7. All project benefits will accrue to local households in the Amador Water System distribution. However, some of the water supply benefits (reduced water loss and reduced Mokelumne River diversions as described in Attachment 7) has the potential to generate regional and statewide benefits (e.g. improved ability to meet Statewide 20x2020 water use targets and reduced power-related greenhouse gas emissions).

Although insufficient data exists to quantify all benefits at this time, some physical measures can be used to highlight the importance and magnitude of these measures.

Table 9Table 9 lists the benefit categories for the project, while Table 10 provides a qualitative measure of several of the benefits as well as the monetary estimate of physical project costs.

Table 9: Amador Water System Leak Detection & Repair Program
Summary of Benefits

Type of Benefit	Assessment Level	Beneficiaries
Increased reliability	Qualitative	Local
Avoided treatment costs (reduced system losses)	Quantitative	Local
Reduced Operations & Maintenance costs	Qualitative	Local
Improved water use efficiency	Qualitative	Local, Regional, Statewide
Reduced Mokelumne River Diversions	Qualitative	Local, Regional, Statewide

Table 10: Amador Water System Leak Detection & Repair Program Benefit-Cost Analysis Overview

Type of Benefit	Assessment Level	Beneficiaries
Costs – Present Value of Total Capital and O&M		$593,914
Quantifiable Benefits		
Reduced system water loss		$871,302
Reduced main repairs		$126,238
	Qualitative Indicator*	
Qualitative Benefits		
Increased water reliability	++	
Reduced Operations & Maintenance costs	++	
Reduce Mokelumne River diversions	+	
Improved water use efficiency	++	

* Magnitude of effect on net benefits:
+ = Likely to increase net benefits relative to quantifiable estimates.
++ = Likely to increase net benefits significantly

Project Costs

Capital costs for the master meter installation and monitoring are taken from Table 10 of Attachment 4 (referenced as Table 7 – Project Budget in Exhibit B of the Prop 84 PSP) for the Amador Water System Leak Detection & Repair Program. Costs in Table 10 of Attachment 4 are expressed in 2010 dollars. Costs were converted to 2009 dollars using the CPI All Urban Consumers series (CUUROOOOSAO). Total upfront capital costs are $304,665 (2009 dollars), of which approximately half are assumed to be incurred in 2011 and half in 2012.

Future project phases will entail system audits and leak detection. Detailed costs for these future project phases have not been developed. Preliminary estimates, based on leak detection costs for similar systems, indicate costs of $7,500 for pre-screening system audits and $85,000 for detailed system audits. The cost estimate assumes detailed system audits would be conducted, on average, every five years and pre-screening audits would be conducted in the intervening years. Costs would be allocated across three distribution systems, with 66% of the cost allocated to AWS.

Future project phases will also entail main replacement and repair. This activity would be guided by the system audits and leak detection program. For cost estimation, it is assumed that between 100 and 200 linear feet of main would be replaced annually over a 20-year period at an average cost of $85 per foot. The cost estimate uses the mid-point cost for

replacing 6'', 8'', 10'', and 12'' diameter mains and assumes 150 linear feet would be replaced annually.

Table 11 (referenced as Table 11 in Exhibit C of the Prop 84 PSP) presents the project costs. The present value of the project costs is $593,914. Annual benefits from reducing system water loss from 6.8% to 3.8% are summarized in Table 12 (referenced as Table 12 in Exhibit C of the Prop 84 PSP). Present value of reducing these system losses is $871,302. Table 13 (referenced as Table 13 in Exhibit C of the Prop 84 PSP) summarizes the annual benefits from reduced repairs of main breaks. Present value of reduced main repairs is $126,238. The combined benefits from eliminating annual water losses and avoiding expenditures on main repairs are summarized in Table 14 (referenced as Table 15 in Exhibit C of the Prop 84 PSP). The present value of combined water supply benefits is $997,540; it is important to note that the operations and maintenance savings associated with reduced system losses were quantified separate from water savings from leak repair to avoid double-counting of benefits.

Proposal project costs and benefits summary is presented in Table 15 (referenced as Table 20 in Exhibit C of the Prop 84 PSP). Present value of project benefits is $997,540. Present value of project costs is $593,914. Project benefit-cost ratio is 1.68.

Table 11: Amador Water System Leak Detection & Repair Program
Annual Cost of Project (referenced as Table 11 in Exhibit C of the Prop 84 PSP)

	Initial Costs	Operations and Maintenance Costs [1]					Discounting Calculations	
	(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)
YEAR	Grand Total Cost From Table 7 (row (i), column(d))	Admin	Operation System audits and leak detection	Maintenance	Replacement Main repair & replacement	Other	Total Costs (a) +…+ (f)	Discount Factor	Discounted Costs(g) x (h)
2009							$0	1.000	$0
2010							$0	0.943	$0
2011	$156,109						$156,109	0.890	$138,937
2012	$148,556						$148,556	0.840	$124,787
2013			$56,100		$12,750		$68,850	0.792	$54,560
2014			$4,950		$12,750		$17,700	0.748	$13,232
2015			$4,950		$12,750		$17,700	0.705	$12,483
2016			$4,950		$12,750		$17,700	0.665	$11,777
2017			$4,950		$12,750		$17,700	0.628	$11,110
2018			$56,100		$12,750		$68,850	0.592	$40,771
2019			$4,950		$12,750		$17,700	0.559	$9,888
2020			$4,950		$12,750		$17,700	0.527	$9,328
2021			$4,950		$12,750		$17,700	0.497	$8,800
2022			$4,950		$12,750		$17,700	0.469	$8,302
2023			$56,100		$12,750		$68,850	0.443	$30,466
2024			$4,950		$12,750		$17,700	0.417	$7,389
2025			$4,950		$12,750		$17,700	0.394	$6,971
2026			$4,950		$12,750		$17,700	0.372	$6,576
2027			$4,950		$12,750		$17,700	0.351	$6,204
2028			$56,100		$12,750		$68,850	0.331	$22,766
2029			$4,950		$12,750		$17,700	0.312	$5,521
2030			$4,950		$12,750		$17,700	0.294	$5,209
2031			$4,950		$12,750		$17,700	0.278	$4,914
2032			$4,950		$12,750		$17,700	0.262	$4,636

	Initial Costs	Operations and Maintenance Costs [1]					Discounting Calculations	
	(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)
YEAR	Grand Total Cost From Table 7 (row (i), column(d))	Admin	Operation System audits and leak detection	Maintenance	Replacement Main repair & replacement	Other	Total Costs (a) +…+ (f)	Discount Factor	Discounted Costs(g) x (h)
2033			$56,100				$56,100	0.247	$13,862
2034			$4,950				$4,950	0.233	$1,154
2035			$4,950				$4,950	0.220	$1,089
2036			$4,950				$4,950	0.207	$1,027
2037			$4,950				$4,950	0.196	$969
2038			$56,100				$56,100	0.185	$10,358
2039			$4,950				$4,950	0.174	$862
2040			$4,950				$4,950	0.164	$813
2041			$4,950				$4,950	0.155	$767
2042			$4,950				$4,950	0.146	$724
2043			$56,100				$56,100	0.138	$7,740
2044			$4,950				$4,950	0.130	$644
2045			$4,950				$4,950	0.123	$608
2046			$4,950				$4,950	0.116	$573
2047			$4,950				$4,950	0.109	$541
2048			$56,100				$56,100	0.103	$5,784
2049			$4,950				$4,950	0.097	$481
2050			$4,950				$4,950	0.092	$454
2051			$4,950				$4,950	0.087	$429
2052			$4,950				$4,950	0.082	$404
Project Life									
							Total Present Value of Discounted Costs (Sum of Column (i))		$593,914
							Transfer to Table 20, column (c), Exhibit F: Proposal Costs and Benefits Summaries		

Comments: Project costs for first phase are from Table 7 and have been converted to 2009 constant dollars. Future project phases will entail leak detection and main replacement. Preliminary cost estimates for these phases are shown in columns (c) and (e). O&M savings associated with reduced system losses are treated as project benefits and are quantified in Table 12. They are not shown here to avoid double counting project benefits.

Table 12: Amador Water System Leak Detection & Repair Program
Annual Water Supply Benefits (referenced as Table 12 in Exhibit C of the Prop 84 PSP)

(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)
Year	Type of Benefit	Measure of Benefit (Units)	Without Project	With Project	Change Resulting from Project (e) – (d)	Unit $ Value (1)	Annual $ Value (f) x (g) (1)	Discount Factor (1)	Discounted Benefits (h) x (i) (1)
2009	System Losses	MG	-133.5	-133.5	0.0	$2,070	$0	1.000	$0
2010	System Losses	MG	-133.5	-133.5	0.0	$2,070	$0	0.943	$0
2011	System Losses	MG	-133.5	-133.5	0.0	$2,070	$0	0.890	$0
2012	System Losses	MG	-133.5	-133.5	0.0	$2,070	$0	0.840	$0
2013	System Losses	MG	-133.5	-130.6	2.9	$2,070	$6,096	0.792	$4,829
2014	System Losses	MG	-133.5	-127.6	5.9	$2,070	$12,192	0.747	$9,111
2015	System Losses	MG	-133.5	-124.7	8.8	$2,070	$18,288	0.705	$12,893
2016	System Losses	MG	-133.5	-121.7	11.8	$2,070	$24,385	0.665	$16,217
2017	System Losses	MG	-133.5	-118.8	14.7	$2,070	$30,481	0.627	$19,124
2018	System Losses	MG	-133.5	-115.8	17.7	$2,070	$36,577	0.592	$21,650
2019	System Losses	MG	-133.5	-112.9	20.6	$2,070	$42,673	0.558	$23,828
2020	System Losses	MG	-133.5	-109.9	23.6	$2,070	$48,769	0.527	$25,691
2021	System Losses	MG	-133.5	-107.0	26.5	$2,070	$54,865	0.497	$27,266
2022	System Losses	MG	-133.5	-104.1	29.4	$2,070	$60,961	0.469	$28,581
2023	System Losses	MG	-133.5	-101.1	32.4	$2,070	$67,058	0.442	$29,660
2024	System Losses	MG	-133.5	-98.2	35.3	$2,070	$73,154	0.417	$30,525
2025	System Losses	MG	-133.5	-95.2	38.3	$2,070	$79,250	0.394	$31,196
2026	System Losses	MG	-133.5	-92.3	41.2	$2,070	$85,346	0.371	$31,695
2027	System Losses	MG	-133.5	-89.3	44.2	$2,070	$91,442	0.350	$32,036
2028	System Losses	MG	-133.5	-86.4	47.1	$2,070	$97,538	0.331	$32,238
2029	System Losses	MG	-133.5	-83.4	50.1	$2,070	$103,635	0.312	$32,314
2030	System Losses	MG	-133.5	-80.5	53.0	$2,070	$109,731	0.294	$32,278
2031	System Losses	MG	-133.5	-77.5	56.0	$2,070	$115,827	0.278	$32,143
2032	System Losses	MG	-133.5	-74.6	58.9	$2,070	$121,923	0.262	$31,919
2033	System Losses	MG	-133.5	-74.6	58.9	$2,070	$121,923	0.247	$30,112
2034	System Losses	MG	-133.5	-74.6	58.9	$2,070	$121,923	0.233	$28,408

(a) Year	(b) Type of Benefit	(c) Measure of Benefit (Units)	(d) Without Project	(e) With Project	(f) Change Resulting from Project (e) – (d)	(g) Unit $ Value (1)	(h) Annual $ Value (f) x (g) (1)	(i) Discount Factor (1)	(j) Discounted Benefits (h) x (i) (1)
2035	System Losses	MG	-133.5	-74.6	58.9	$2,070	$121,923	0.220	$26,800
2036	System Losses	MG	-133.5	-74.6	58.9	$2,070	$121,923	0.207	$25,283
2037	System Losses	MG	-133.5	-74.6	58.9	$2,070	$121,923	0.196	$23,852
2038	System Losses	MG	-133.5	-74.6	58.9	$2,070	$121,923	0.185	$22,502
2039	System Losses	MG	-133.5	-74.6	58.9	$2,070	$121,923	0.174	$21,228
2040	System Losses	MG	-133.5	-74.6	58.9	$2,070	$121,923	0.164	$20,026
2041	System Losses	MG	-133.5	-74.6	58.9	$2,070	$121,923	0.155	$18,893
2042	System Losses	MG	-133.5	-74.6	58.9	$2,070	$121,923	0.146	$17,823
2043	System Losses	MG	-133.5	-74.6	58.9	$2,070	$121,923	0.138	$16,815
2044	System Losses	MG	-133.5	-74.6	58.9	$2,070	$121,923	0.130	$15,863
2045	System Losses	MG	-133.5	-74.6	58.9	$2,070	$121,923	0.123	$14,965
2046	System Losses	MG	-133.5	-74.6	58.9	$2,070	$121,923	0.116	$14,118
2047	System Losses	MG	-133.5	-74.6	58.9	$2,070	$121,923	0.109	$13,319
2048	System Losses	MG	-133.5	-74.6	58.9	$2,070	$121,923	0.103	$12,565
2049	System Losses	MG	-133.5	-74.6	58.9	$2,070	$121,923	0.097	$11,854
2050	System Losses	MG	-133.5	-74.6	58.9	$2,070	$121,923	0.092	$11,183
2051	System Losses	MG	-133.5	-74.6	58.9	$2,070	$121,923	0.087	$10,550
2052	System Losses	MG	-133.5	-74.6	58.9	$2,070	$121,923	0.082	$9,953
Project Life									
								Total Present Value of Discounted Benefits Based on Unit Value (Sum of the values in Column (j) for all Benefits shown in table)	$871,302

Comments: Under the Without Project condition system losses equal 6.8% of production, or 133.5 MG per year. With the project, system losses projected to fall to 3.8% of production, or74.6 MG per year, for an annual savings of 58.9 MG per year. Savings assumed to phase in over a 20-year period. Water savings valued at the variable production cost of water, which is $2,070/MG.

Table 13: Amador Water System Leak Detection & Repair Program
Annual Costs of Avoided Projects (referenced as Table 13 in Exhibit C of the Prop 84 PSP)

	Costs				Discounting Calculations	
(a)	(b)	(c)	(d)	(e)	(f)	(g)
YEAR	Alternative (Avoided Project Name): Leak Repair *Avoided Project Description:* *Avoided O&M to repair broken mains plus value of increased system storage capacity.*				Discount Factor	Discounted Costs (e) x (f)
	Avoided Capital Costs	Avoided Replacement Costs	Avoided Operations and Maintenance Costs	Total Cost Avoided for Individual Alternatives (b) + (c) + (d)		
2009				$0	1.000	$0
2010				$0	0.943	$0
2011				$0	0.899	$0
2012				$0	0.839	$0
2013			$10,000	$10,000	0.792	$7,915
2014			$10,000	$10,000	0.747	$7,467
2015			$10,000	$10,000	0.704	$7,044
2016			$10,000	$10,000	0.665	$6,646
2017			$10,000	$10,000	0.627	$6,269
2018			$10,000	$10,000	0.591	$5,915
2019			$10,000	$10,000	0.558	$5,580
2020			$10,000	$10,000	0.526	$5,264
2021			$10,000	$10,000	0.497	$4,966
2022			$10,000	$10,000	0.468	$4,685
2023			$10,000	$10,000	0.442	$4,420
2024			$10,000	$10,000	0.417	$4,170
2025			$10,000	$10,000	0.393	$3,934
2026			$10,000	$10,000	0.371	$3,711
2027			$10,000	$10,000	0.350	$3,501
2028			$10,000	$10,000	0.330	$3,303
2029			$10,000	$10,000	0.312	$3,116
2030			$10,000	$10,000	0.294	$2,939
2031			$10,000	$10,000	0.277	$2,773
2032			$10,000	$10,000	0.262	$2,616
2033			$10,000	$10,000	0.247	$2,468
2034			$10,000	$10,000	0.233	$2,328
2035			$10,000	$10,000	0.220	$2,196
2036			$10,000	$10,000	0.207	$2,072
2037			$10,000	$10,000	0.195	$1,955
2038			$10,000	$10,000	0.184	$1,844
2039			$10,000	$10,000	0.174	$1,740
2040			$10,000	$10,000	0.164	$1,641

	Costs				Discounting Calculations	
(a)	(b)	(c)	(d)	(e)	(f)	(g)
YEAR	Alternative (Avoided Project Name): Leak Repair *Avoided Project Description:* *Avoided O&M to repair broken mains plus value of increased system storage capacity.* Avoided Capital Costs	Avoided Replacement Costs	Avoided Operations and Maintenance Costs	Total Cost Avoided for Individual Alternatives (b) + (c) + (d)	Discount Factor	Discounted Costs (e) x (f)
2041			$10,000	$10,000	0.155	$1,548
2042			$10,000	$10,000	0.146	$1,461
2043			$10,000	$10,000	0.138	$1,378
2044			$10,000	$10,000	0.130	$1,300
2045			$10,000	$10,000	0.123	$1,227
2046			$10,000	$10,000	0.116	$1,157
2047			$10,000	$10,000	0.109	$1,092
2048			$10,000	$10,000	0.103	$1,030
2049			$10,000	$10,000	0.097	$972
2050			$10,000	$10,000	0.092	$917
2051			$10,000	$10,000	0.086	$865
2052			$10,000	$10,000	0.082	$816
Project Life						
					Total Present Value of Discounted Costs (Sum of Column (g))	$126,238
					(%) Avoided Cost Claimed by Project	100%
					Total Present Value of Discounted Avoided Project Costs Claimed by alternative Project (Total Present Value of Discounted Costs x % Avoided Cost Claimed by Project)	$126,238
Comments: Annual number of main repairs reduced by 1 relative to the Without Projection condition. This benefit is valued at $10,000 per year, or $10,000 per avoided main repair, which is the average repair cost of recent main repairs for this system.						

Table 14: Amador Water System Leak Detection & Repair Program
Total Water Supply Benefits (referenced as Table 15 of Exhibit C in the Prop 84 PSP)

Total Discounted Water Supply Benefits (a)	Total Discounted Avoided Project Costs (b)	Other Discounted Water Supply Benefits (c)	Total Present Value of Discounted Benefits (d) (a) + (c) or (b) + (c)
$871,302	$126,238	$0	**$997,540**

Comments: Water supply benefit (a) equal to 12.5 years of avoided system losses valued at variable production cost of water (see Table 12). Avoided project costs (b) equal 12.5 years of amortized replacement costs for 96,000 gallons of storage capacity valued at $5.00/gallon (see Table 13).

Table 15: Amador Water System Leak Detection & Repair Program
Project Costs and Benefits Summary (referenced as Table 20 of Exhibit C of the Prop 84 PSP)

Project	Agency	Total Present Value Project Costs (1)	Total Present Value Project Benefits				B/C Ratio
			Water Supply (2)	Flood Damage Reduction (3)	Other (4)	Total	
(a)	(b)	(c)	(d)	(e)	(f)	(g) (d) + (e) + (f)	(h) (g) / (c)
Project Title: AWS Leak Testing & Repair Program	Amador Water Agency	$593,914	$997,540	$0	$0	$997,540	**1.68**
TOTAL		**$593,914**	**$997,540**	**$0**	**$0**	**$997,540**	**1.68**

Summary of Findings

The primary quantifiable water supply benefits of this project are the following:

- **Reduced system losses.** System losses currently approach 7% of water production. The leak testing and repair program is expected to reduce system losses by up to 3% of production, an annual water savings of 59 MG per year. The value of this annual benefit is equal to the annual avoided water loss multiplied by the variable production cost of water. The variable production cost of water is approximately $2,070/MG. Annual benefits of reduced system losses are calculated over the 40-year useful life of the project and are assumed to phase in over a 20-year period.

- **Reduced main repairs.** Replacement of aging mains is expected to reduce main repairs by an average of 1 per year over the 40-year useful life of the project. This benefit is valued at $10,000 per year, or $10,000 per avoided main repair, which is the average repair cost of recent main repairs for this system.

Benefits from this project will not be realized immediately; benefits will be accrued after subsequent project phases have been completed, repair or replacing project infrastructure to reduce water loss. There is a moderate degree of uncertainty associated with benefits for this project. While it is know that there is significant water loss from the AWS, the location and severity of specific leaks are not yet known and therefore the magnitude and cost of repairs and/or replacements has not yet been determined. These factors will have a considerable impact on the timing of repairs/replacements and the relative water savings to be achieved with each repair or replacement project.

Possible adverse effects from implementation of the Amador Water System Leak Detection & Repair Program are all short-term construction-related impacts and may included temporary increases in traffic congestion and noise. All work will be conducted on pipelines underlying paved surfaces, and therefore considered to be mitigatable. Mitigation measures will be implemented during construction to minimize potential impacts, and all impacts will be less than significant in nature.

Table 16: Amador Water System Leak Detection & Repair Program
Qualitative Benefits Summary – Water Supply Benefits

Type of Benefit	Qualitative Indicator
Increased reliability	++
Reduced Operations & Maintenance costs	++
Improved water use efficiency	++
Reduced Mokelumne River Diversions	+

* Magnitude of effect on net benefits:
+ = Likely to increase net benefits relative to quantifiable estimates.
++ = Likely to increase net benefits significantly

References

Personal communications with Gene Mancebo, General Manager, Michael Lee, Financial Services Manager, and Erik Christeson, Interim Manager of Engineering & Planning, November and December 2010.

West Point Water Main & Tank Replacement Project

Summary

The West Point Water Main & Tank Replacement Project consists of replacing deteriorating water mains and a leaking redwood water storage tank in the portion of the Calaveras County Water District (CCWD) service area providing potable water supplies to the disadvantaged community of West Point. This project is important for West Point both from a water supply reliability standpoint and from a safety standpoint. Not only does the redwood water storage tank leak, but it is also susceptible to fire, which could lead to a catastrophic failure of the water system should a wildfire occur. The water main replacement will include 3,900-feet of 12-inch transmission main along Winton Road between the water treatment plant and downtown West Point and an additional 2,700 feet of water mains within the downtown area along Main Street and Pine Street. A new 50,000-gallon ignition-resistant steel water storage tank will replace the leaking redwood tank and 1,500 feet of galvanized steel line to the tank will be replaced with PVC pipe.

Under the No Project Condition, the system would continue to be operated as it is at present. Under this scenario, system losses would exceed 25%, main breaks would be repaired as they occur, and fire flow capacity would remain substandard.

Water supply benefits from the West Point Water Main & Tank Replacement Project potentially include:

- Reduced system losses
- Restored distribution system storage capacity
- Reduced operations and maintenance costs (e.g. reduced tank and main repairs)
- Increase water supply reliability
- Improved water use efficiency

Although insufficient data exists to quantify all benefits at this time, some physical measures can be used to highlight the importance and magnitude of these measures. Table 17 lists the benefit categories for the project, while Table 18 provides a qualitative measure of several of the benefits as well as the monetary estimate of physical project costs.

Table 17: West Point Water Main & Tank Replacement Project
Summary of Water Supply Benefits

Type of Benefit	Assessment Level	Beneficiaries
Reduced system losses	Quantitative	Local
Restored distribution system storage capacity	Quantitative	Local
Reduced operations & maintenance costs	Quantitative	Local
Improved water supply reliability	Qualitative	Local, Regional, Statewide
Improved water supply efficiency	Qualitative	Local, Regional, Statewide
Improved fire flows	Qualitative	Local

Table 18: West Point Water Main & Tank Replacement Project
Benefit-Cost Analysis Overview

Type of Benefit	Assessment Level	Beneficiaries
Costs – Present Value of Total Capital and O&M		$1,194,295
Quantifiable Benefits		
Reduced system water loss		$62,281
Increased storage capacity and reduced main breaks		$841,331
	Qualitative Indicator*	
Qualitative Benefits		
Increased water supply reliability	++	
Improve fire flows	++	
Improved water use efficiency	++	

* Magnitude of effect on net benefits:
+ = Likely to increase net benefits relative to quantifiable estimates.
++ = Likely to increase net benefits significantly

Project Costs

Capital costs for tank and main replacement are taken from Table 18 of Attachment 4 (referenced as Table 7 – Project Budget in Exhibit B of the Prop 84 PSP) for the West Point Water Main & Tank Replacement Project. Costs in Table 18 of Attachment 4 are expressed in 2009 dollars. One-third of the mains are assumed to be replaced in 2011. The tank and the other two-thirds of the mains are assumed to be replaced in 2012. For the benefit-cost analysis, 25% of capital costs are assigned to 2011 and 75% are assigned to 2012.

Reduced system loss and reduced number of main repairs are expected to lower annual operating costs. These cost savings are expressed as project benefits and therefore are not presented here so as to avoid double counting.

Table 19 (referenced as Table 11 in Exhibit C of the Prop 84 PSP) presents the project costs; the present value of the project costs is $1,194,295. Annual benefits from reducing system water loss from 25% to 20% are summarized in Table 20 (referenced as Table 12 in Exhibit C of the Prop 84 PSP). Present value of reducing these system losses is $62,281. Table 21 (referenced as Table 13 in Exhibit C of the Prop 84 PSP) summarizes the annual benefits from increased storage capacity and reduced main breaks. Present value of restored storage capacity and reduced main repairs is $841,331. The combined benefits from eliminating annual water losses, increasing system storage capacity, and reducing expenditures on main repairs are summarized in Table 22 (referenced as Table 15 in Exhibit C of the Prop 84 PSP). Present value of combined water supply benefits is $903,612.

Proposal project costs and benefits summary is presented in Table 23 (referenced as Table 20 in Exhibit C of the Prop 84 PSP). Present value of project benefits is $903,612. Present value of project costs is $1,194,295. Project benefit-cost ratio is 0.76.

Table 19: West Point Water Main & Tank Replacement Project
Annual Cost of Project (referenced as Table 11 in Exhibit C of the Prop 84 PSP)

	Initial Costs	Operations and Maintenance Costs [1]						Discounting Calculations	
	(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)
YEAR	Grand Total Cost From Table 7 (row (i), column(d))	Admin	Operation	Maintenance	Replacement	Other	Total Costs (a) +…+ (f)	Discount Factor	Discounted Costs(g) x (h)
2009							$0	1.000	$0
2010							$0	0.943	$0
2011							$0	0.890	$0
2012	$371,203						$371,203	0.840	$311,811
2013	$1,113,611						$1,113,611	0.792	$882,484
2014							$0	0.748	$0
2015							$0	0.705	$0
2016							$0	0.665	$0
2017							$0	0.628	$0
2018							$0	0.592	$0
2019							$0	0.559	$0
2020							$0	0.527	$0
2021							$0	0.497	$0
2022							$0	0.469	$0
2023							$0	0.443	$0
2024							$0	0.417	$0
2025							$0	0.394	$0
Project Life									
								Total Present Value of Discounted Costs (Sum of Column (i))	$1,194,295
								Transfer to Table 20, column (c), Exhibit F: Proposal Costs and Benefits Summaries	

Comments: Project costs are from Table 7 and are reported in 2009 constant dollars. System operating costs are expected to fall relative to the Without Project condition. The annual reductions in system operating costs are treated as project benefits and are quantified in Tables 12 and 13.

Table 20: West Point Water Main & Tank Replacement Project
Annual Water Supply Benefits (referenced as Table 12 of Exhibit C of the Prop 84 PSP)

(a) Year	(b) Type of Benefit	(c) Measure of Benefit (Units)	(d) Without Project	(e) With Project	(f) Change Resulting from Project (e) – (d)	(g) Unit $ Value (1)	(h) Annual $ Value (f) x (g) (1)	(i) Discount Factor (1)	(j) Discounted Benefits (h) x (i) (1)
2009	System Losses	MG	-14.5	-14.5	0.0	$1,700	$0	1.000	$0
2010	System Losses	MG	-14.5	-14.5	0.0	$1,700	$0	0.943	$0
2011	System Losses	MG	-14.5	-14.5	0.0	$1,700	$0	0.890	$0
2012	System Losses	MG	-14.5	-14.5	0.0	$1,700	$0	0.840	$0
2013	System Losses	MG	-14.5	-11.6	2.9	$1,700	$4,930	0.792	$3,905
2014	System Losses	MG	-14.5	-11.6	2.9	$1,700	$4,930	0.747	$3,684
2015	System Losses	MG	-14.5	-11.6	2.9	$1,700	$4,930	0.705	$3,475
2016	System Losses	MG	-14.5	-11.6	2.9	$1,700	$4,930	0.665	$3,279
2017	System Losses	MG	-14.5	-11.6	2.9	$1,700	$4,930	0.627	$3,093
2018	System Losses	MG	-14.5	-11.6	2.9	$1,700	$4,930	0.592	$2,918
2019	System Losses	MG	-14.5	-11.6	2.9	$1,700	$4,930	0.558	$2,753
2020	System Losses	MG	-14.5	-11.6	2.9	$1,700	$4,930	0.527	$2,597
2021	System Losses	MG	-14.5	-11.6	2.9	$1,700	$4,930	0.497	$2,450
2022	System Losses	MG	-14.5	-11.6	2.9	$1,700	$4,930	0.469	$2,311
2023	System Losses	MG	-14.5	-11.6	2.9	$1,700	$4,930	0.442	$2,181
2024	System Losses	MG	-14.5	-11.6	2.9	$1,700	$4,930	0.417	$2,057
2025	System Losses	MG	-14.5	-11.6	2.9	$1,700	$4,930	0.394	$1,941
2026	System Losses	MG	-14.5	-11.6	2.9	$1,700	$4,930	0.371	$1,831
2027	System Losses	MG	-14.5	-11.6	2.9	$1,700	$4,930	0.350	$1,727
2028	System Losses	MG	-14.5	-11.6	2.9	$1,700	$4,930	0.331	$1,629
2029	System Losses	MG	-14.5	-11.6	2.9	$1,700	$4,930	0.312	$1,537
2030	System Losses	MG	-14.5	-11.6	2.9	$1,700	$4,930	0.294	$1,450
2031	System Losses	MG	-14.5	-11.6	2.9	$1,700	$4,930	0.278	$1,368
2032	System Losses	MG	-14.5	-11.6	2.9	$1,700	$4,930	0.262	$1,291
2033	System Losses	MG	-14.5	-11.6	2.9	$1,700	$4,930	0.247	$1,218
2034	System Losses	MG	-14.5	-11.6	2.9	$1,700	$4,930	0.233	$1,149

(a) Year	(b) Type of Benefit	(c) Measure of Benefit (Units)	(d) Without Project	(e) With Project	(f) Change Resulting from Project (e) – (d)	(g) Unit $ Value (1)	(h) Annual $ Value (f) x (g) (1)	(i) Discount Factor (1)	(j) Discounted Benefits (h) x (i) (1)
2035	System Losses	MG	-14.5	-11.6	2.9	$1,700	$4,930	0.220	$1,084
2036	System Losses	MG	-14.5	-11.6	2.9	$1,700	$4,930	0.207	$1,022
2037	System Losses	MG	-14.5	-11.6	2.9	$1,700	$4,930	0.196	$964
2038	System Losses	MG	-14.5	-11.6	2.9	$1,700	$4,930	0.185	$910
2039	System Losses	MG	-14.5	-11.6	2.9	$1,700	$4,930	0.174	$858
2040	System Losses	MG	-14.5	-11.6	2.9	$1,700	$4,930	0.164	$810
2041	System Losses	MG	-14.5	-11.6	2.9	$1,700	$4,930	0.155	$764
2042	System Losses	MG	-14.5	-11.6	2.9	$1,700	$4,930	0.146	$721
2043	System Losses	MG	-14.5	-11.6	2.9	$1,700	$4,930	0.138	$680
2044	System Losses	MG	-14.5	-11.6	2.9	$1,700	$4,930	0.130	$641
2045	System Losses	MG	-14.5	-11.6	2.9	$1,700	$4,930	0.123	$605
2046	System Losses	MG	-14.5	-11.6	2.9	$1,700	$4,930	0.116	$571
2047	System Losses	MG	-14.5	-11.6	2.9	$1,700	$4,930	0.109	$539
2048	System Losses	MG	-14.5	-11.6	2.9	$1,700	$4,930	0.103	$508
2049	System Losses	MG	-14.5	-11.6	2.9	$1,700	$4,930	0.097	$479
2050	System Losses	MG	-14.5	-11.6	2.9	$1,700	$4,930	0.092	$452
2051	System Losses	MG	-14.5	-11.6	2.9	$1,700	$4,930	0.087	$427
2052	System Losses	MG	-14.5	-11.6	2.9	$1,700	$4,930	0.082	$402
Project Life									
								Total Present Value of Discounted Benefits Based on Unit Value (Sum of the values in Column (j) for all Benefits shown in table)	$62,281

Comments: Under the Without Project condition system losses equal 25% of production, or 14.5 MG per year. With the project, system losses projected to fall to 20% of production, or 11.6 MG per year, for an annual savings of 2.9 MG per year. Water savings valued at the variable production cost of water, which is $1,700/MG.

Table 21: West Point Water Main & Tank Replacement Project
Annual Costs of Avoided Projects (referenced as Table 13 of Exhibit C in the Prop 84 PSP)

	Costs				Discounting Calculations	
(a)	(b)	(c)	(d)	(e)	(f)	(g)
YEAR	Alternative (Avoided Project Name): Steel Storage Tank *Avoided Project Description: Avoided O&M to repair broken mains plus value of increased system storage capacity.*				Discount Factor	Discounted Costs (e) x (f)
	Avoided Capital Costs	Avoided Replacement Costs	Avoided Operations and Maintenance Costs	Total Cost Avoided for Individual Alternatives (b) + (c) + (d)		
2009				$0	1.000	$0
2010				$0	0.943	$0
2011				$0	0.899	$0
2012				$0	0.839	$0
2013	$6,646		$60,000	$66,646	0.792	$52,751
2014	$6,646		$60,000	$66,646	0.747	$49,765
2015	$6,646		$60,000	$66,646	0.704	$46,948
2016	$6,646		$60,000	$66,646	0.665	$44,291
2017	$6,646		$60,000	$66,646	0.627	$41,784
2018	$6,646		$60,000	$66,646	0.591	$39,419
2019	$6,646		$60,000	$66,646	0.558	$37,187
2020	$6,646		$60,000	$66,646	0.526	$35,082
2021	$6,646		$60,000	$66,646	0.497	$33,097
2022	$6,646		$60,000	$66,646	0.468	$31,223
2023	$6,646		$60,000	$66,646	0.442	$29,456
2024	$6,646		$60,000	$66,646	0.417	$27,789
2025	$6,646		$60,000	$66,646	0.393	$26,216
2026	$6,646		$60,000	$66,646	0.371	$24,732
2027	$6,646		$60,000	$66,646	0.350	$23,332
2028	$6,646		$60,000	$66,646	0.330	$22,011
2029	$6,646		$60,000	$66,646	0.312	$20,765
2030	$6,646		$60,000	$66,646	0.294	$19,590
2031	$6,646		$60,000	$66,646	0.277	$18,481
2032	$6,646		$60,000	$66,646	0.262	$17,435
2033	$6,646		$60,000	$66,646	0.247	$16,448
2034	$6,646		$60,000	$66,646	0.233	$15,517
2035	$6,646		$60,000	$66,646	0.220	$14,639
2036	$6,646		$60,000	$66,646	0.207	$13,810
2037	$6,646		$60,000	$66,646	0.195	$13,028
2038	$6,646		$60,000	$66,646	0.184	$12,291

	Costs				Discounting Calculations	
(a)	(b)	(c)	(d)	(e)	(f)	(g)
YEAR	Alternative (Avoided Project Name): Steel Storage Tank *Avoided Project Description: Avoided O&M to repair broken mains plus value of increased system storage capacity.*				Discount Factor	Discounted Costs (e) x (f)
	Avoided Capital Costs	Avoided Replacement Costs	Avoided Operations and Maintenance Costs	Total Cost Avoided for Individual Alternatives (b) + (c) + (d)		
2039	$6,646		$60,000	$66,646	0.174	$11,595
2040	$6,646		$60,000	$66,646	0.164	$10,939
2041	$6,646		$60,000	$66,646	0.155	$10,320
2042	$6,646		$60,000	$66,646	0.146	$9,736
2043	$6,646		$60,000	$66,646	0.138	$9,184
2044	$6,646		$60,000	$66,646	0.130	$8,665
2045	$6,646		$60,000	$66,646	0.123	$8,174
2046	$6,646		$60,000	$66,646	0.116	$7,711
2047	$6,646		$60,000	$66,646	0.109	$7,275
2048	$6,646		$60,000	$66,646	0.103	$6,863
2049	$6,646		$60,000	$66,646	0.097	$6,475
2050	$6,646		$60,000	$66,646	0.092	$6,108
2051	$6,646		$60,000	$66,646	0.086	$5,762
2052	$6,646		$60,000	$66,646	0.082	$5,436
Project Life						
					Total Present Value of Discounted Costs (Sum of Column (g))	$841,331
					(%) Avoided Cost Claimed by Project	100%
					Total Present Value of Discounted Avoided Project Costs Claimed by alternative Project (Total Present Value of Discounted Costs x % Avoided Cost Claimed by Project)	$841,331

Comments: Annual number of main repairs reduced by 6 relative to the Without Projection condition. This benefit is valued at $60,000 per year, or $10,000 per avoided main repair, which is the average repair cost of recent main repairs for this system. The project would also increase distribution system storage by 20,000 gal. CCWD's 2005 Master Plan calculated a deficit for the Bummerville treated water storage of 263,000 gallons; therefore, the recommendation is to replace the existing redwood tank with a new tank. However, a single tank of sufficient size to supply the entire treated water storage required would promote water quality deterioration and increased DBP formation during normal operation. Therefore, a smaller tank and an upgraded fire flow pump are recommended to satisfy the four-hour fire flow demand. The storage tank would be situated at the existing location of the redwood tank and would be a minimum of 50,000 gallons, an increase of 20,000 gallons. The tank would be supporting a zone of single-family homes and residential fire demand of 1,000 gpm. The tank would also provide the required emergency and operational storage per District standards.

Table 22: West Point Water Main & Tank Replacement Project
Total Water Supply Benefits (referenced as Table 15 of Exhibit C of the Prop 84 PSP)

Total Discounted Water Supply Benefits (a)	Total Discounted Avoided Project Costs (b)	Other Discounted Water Supply Benefits (c)	Total Present Value of Discounted Benefits (d) (a) + (c) or (b) + (c)
$62,281	$841,331	$0	**$903,612**

Comments: Water supply benefit (a) equal to 40 years of avoided system losses valued at variable production cost of water (see Table 12). Avoided project costs (b) equal 40 years of avoided main repair costs plus amortized replacement costs for 20,000 gallons of storage capacity valued at $5.00/gallon (see Table 13).

Table 23: West Point Water Main & Tank Replacement Project
Project Costs and Benefits Summary (referenced as Table 20 of Exhibit C of the Prop 84 PSP)

Project	Agency	Total Present Value Project Costs (1)	Total Present Value Project Benefits				B/C Ratio
			Water Supply (2)	Flood Damage Reduction (3)	Other (4)	Total	
(a)	(b)	(c)	(d)	(e)	(f)	(g) (d) + (e) + (f)	(h) (g) / (c)
Project Title: West Point Storage Tank & Main Replacement Project	Calaveras County Water District	$1,194,295	$903,612	$0	$0	$903,612	**0.76**
TOTAL		**$1,194,295**	**$903,612**	**$0**	**$0**	**$903,612**	**0.76**

Summary of Findings

The primary quantifiable water supply benefits of this project are the following:

- **Reduced system losses.** System losses currently exceed 25% of water production. The new storage tank and main replacements are expected to reduce system losses to 20% of production, an annual water savings of 2.9 MG per year. The value of this annual benefit is equal to the annual avoided water loss multiplied by the variable production cost of water. The variable production cost of water is approximately $1,700/MG. Annual benefits of reduced system losses are calculated over the 40-year useful life of the project.

- **Restored distribution system storage capacity.** CCWD's 2005 Master Plan calculated a deficit for the Bummerville treated water storage of 263,000 gallons; therefore, the recommendation is to replace the existing redwood tank with a new tank. However, a single tank of sufficient size to supply the entire treated water storage required would promote water quality deterioration and increased DBP formation during normal operation. Therefore, a smaller tank and an upgraded fire flow pump are recommended to satisfy the four-hour fire flow demand. The storage tank would be situated at the existing location of the redwood tank and would be a minimum of 50,000 gallons, an increase of 20,000 gallons. The tank would also provide the required emergency and operational storage per District standards. The value of this benefit is equal to the replacement cost of the foregone storage capacity. The project would increase system storage by approximately 20,000 gallons relative to the Without Project condition. The replacement cost is $5/gallon, or about $100,000 in upfront capital cost. The annualized value of this storage capacity, assuming a 40-year useful life and a 6% discount rate, is $6,646/year for 40 years.

- **Reduced main repairs.** Replacement of the aging mains is expected to reduce main repairs by an average of 6 per year over the 50-year useful life of the project. This benefit is valued at $60,000 per year, or $10,000 per avoided main repair, which is the average repair cost of recent main repairs for this system.

Although some of the benefits of this project cannot be monetized, they are summarized briefly in Table 24. Water storage capacity will be increased as a result of the tank replacement, providing a cleaner, more reliable supply of potable water for the West Point community and ensuring sufficient supplies are in place during period of drought and/or emergency (i.e. wild fires). The new steel tank will be ignition-resistant, and will improve the quality of water stored in the tanks, reducing the amount of chlorination required and providing a better-quality potable supply to West Point. The project will also increase the reliability of water supply deliveries through the replacement of leaking water mains, reducing the risk of disruptions during peak demand or emergencies. Finally, the reduction of losses will help both CCWD and the State meet their 20x2020 urban water use efficiency goals by increasing water use efficiency and reducing production rates. This water loss

reduction will translate into reduced potable water treatment, which results in power cost savings and power production benefits such as the reduction of greenhouse gas emission.

Table 24: West Point Water Main & Tank Replacement Project
Qualitative Benefits Summary – Water Supply Benefits

Type of Benefit	Qualitative Indicator
Water supply benefits to West Point	++
Water supply reliability increase for West Point	++
Improved fire-fighting capacity	++
Improved potable water quality	+
Reduced diversions from Calaveras River	+

* Magnitude of effect on net benefits:
+ = Likely to increase net benefits relative to quantifiable estimates.
++ = Likely to increase net benefits significantly

References

Personal communications with Edwin Pattison, Water Resources Manager, and Steve Hutchings, District Engineer, November and December 2010.

Camanche Regional Water Treatment Plant Phase 1 Project

Summary

In the late 1990s, representatives from EBMUD, AWA and CCWD (together with local community members) identified a shared need to address water supply and quality issues that each agency faced within the areas surrounding Camanche Reservoir. An analysis of delivered water to customers in the area indicated concerns regarding water quality issues in addition to reliability concerns. Subsequently, a partnership between the three water supply agencies was formed, and the concept of a modernized regional WTP serving the combined localized needs of said agencies was envisioned. Since that time, work on the effort has included preliminary engineering efforts as well as environmental review. The need for the project was seen as critical, hence warranting its inclusion in the 2006 MAC IRWM Plan.

The Camanche Regional WTP Project, as a whole, includes the design and construction of a 0.5 MGD membrane filtration water treatment plant at Camanche South Shore Recreation Area (CASS), a new raw water pipeline to provide raw water from the Mokelumne Aqueducts to the new treatment plant (the Phase 1 project for which grant funding is being sought), and a new cross-Camanche Reservoir treated water pipeline from CASS WTP to provide treated water to the Camanche North Shore Recreation Area (CANS). The 0.5 MGD plant will be designed such that it can be expanded to treat up to 2.0 MGD without significant building or facility alteration. This additional capacity would be used to supply

neighboring areas of Amador and Calaveras Counties, including the Lake Camanche Village area (a DAC), Burson and Wallace, as needed and as based on a number of factors (water supply, water quality, water rights, future infrastructure, etc.).

The Camanche Regional Water Treatment Plant Project is a regional project that will benefit numerous areas within the MAC IRWM planning region. Once the Camanche Regional Water Treatment Plant Project is fully implemented, it will help address the water needs of the three separate water system purveyors (AWA, CCWD, and EBMUD). A phased approach will be applied relative to the project's design and construction. Phase 1 of the overall Camanche Regional Water Treatment Plant Project is a discrete component involving installation of a gravity flow pipeline that will initially connect the existing Camanche WTP with EBMUD's Mokelumne Aqueducts in order to supply an alternative, better-quality raw water source for production of higher-quality potable water for use in the Camanche South Shore Recreation Area (CASS). Use of this alternative gravity supply source will eliminate the need to operate the existing Camanche Reservoir pumped supply resulting in annual energy cost savings of $23,500.

Following implementation of subsequent project phases (specifically, construction of the new Camanche Regional WTP), the new Mokelumne Aqueduct to CSS WTP pipeline will connect to the new water treatment plant and ultimately produce higher-quality potable water for CASS and the Camanche North Shore Recreation Area (CANS). With additional infrastructure investments and water rights changes, the system can be connected to the Lake Camanche Village area in Amador County, and the communities of Burson and Wallace in Calaveras County.

The specific water supply benefits resulting from the Camanche Regional Water Treatment Plant Phase 1 Project is reduced water system Operations and Maintenance costs. Additionally, long-term, after all components of the Camanche Regional Water Treatment Plant have been constructed, water supply benefits of the overall project will also include:

- Greater reliability of water supply
- Reduced dependence on groundwater (improving the sustainability of the underlying groundwater basin)
- Improved supplied water quality
- Conjunctive use opportunities

Although insufficient data exists to quantify the benefits of the overall project at this time, some physical measures can be used to highlight the importance and magnitude of these measures. Table 25 lists the benefit categories for the overall Camanche Regional Water Treatment Plant Project.

Table 25: Camanche Regional Water Treatment Plant Project
Summary of Water Supply Benefits

Type of Benefit	Assessment Level	Beneficiaries
Increased reliability	Qualitative	Local
Reduced treatment costs	Quantitative	Local
Increased groundwater sustainability	Qualitative	Local, Regional
Improved water quality	Qualitative	Local, Regional
Conjunctive use opportunity	Qualitative	Local, Regional

The "Without Project Baseline"

The Camanche Regional Water Treatment Plant Phase 1 Project will construct the Mokelumne Aqueduct to CSS WTP pipeline. This pipeline will be approximately six miles long, and will be constructed of 12-inch diameter HDPE piping. The pipeline will initially connect two of the three EBMUD Mokelumne Aqueducts to the existing water treatment plant at CASS in order to provide an alternative high-quality raw water to the existing plant (and correspondingly better treated water to residents). As such, the Phase 1 project will, alone, provide a reliable, long-term high-quality supply of water supply to the existing Camanche Water Treatment Plant. The reduced bacterial loading on the existing water treatment plant will improve the plant's performance, reduce the number of violation notices that have been occurring at the aging treatment plant, and provide better quality water to local users. Additionally, use of Pardee Reservoir water as the alternative raw water source for the existing WTP will extend the useful life of the plant until such time the new plant can be constructed.

Once the new water treatment plant has been constructed, along with the cross-Camanche pipeline (subsequent phases of the larger project), the overall project will not only continue to provide high-quality water to the Camanche South Shore Recreation area, but will also be providing a similar high-quality supply to the Camanche North Shore Recreation Area. Upon resolution of infrastructure interconnection and water rights issues, water can be supplied to Burson, Wallace, and other near-by communities. Ultimately, the project will both improve potable water quality and water supply reliability in the Amador and Calaveras County communities bordering Lake Camanche.

Under the No Project Condition, EBMUD would continue to operate the existing Camanche Water Treatment Plant, without upgrades, and continue to use Camanche Reservoir as the source of raw water (with annual pumped energy costs of $23,500). While the overall volume of water treated at the plant will not likely change in the near future, the ability of the plant to treat the Camanche raw water will deteriorate, resulting in an increasing number of Surface Water Treatment Rule violations. Historically, EBMUD has reported the violations to the California Department of Public Health, but there have been no monetary fines or other repercussions associated with the violations. This could potentially change as the number of

violations increase and as the quality of treated water degrades. Ultimately, at some point in the future, the existing water treatment plant will be unable to meet drinking water standards or will acutely fail. At this time, the treatment plant will either be closed or will require significant upgrades in order to provide suitable potable water supplies.

Description of Water Supply Benefits

As previously noted, there are no water supply benefits associated with the Camanche Regional Water Treatment Plant Phase 1 Project. However, long-term, after all components of the Camanche Regional Water Treatment Plant have been constructed, water supply benefits of the overall project will include:

- Greater reliability of water supply
- Reduced dependence on groundwater (improving the sustainability of the underlying groundwater basin)
- Improve water quality
- Conjunctive use opportunities

The new plant will be designed to produce potable water compliant with both existing and foreseeable drinking water regulations. Because the water will come from the Mokelumne Aqueducts, and as the aqueducts are vital to EBMUD's ability to provide water to their service area in the San Francisco Bay Area, the source of water to the new Camanche Regional WTP will be more reliable and will, accordingly, provide a more reliable source of water to local Camanche Reservoir communities. At present, the local communities of Lake Camanche Village, Burson and Wallace depend on groundwater as their predominant water supply. In all three communities, groundwater is overdrafted and local wells have been drying up at an alarming rate. By providing a source of surface water to these communities, the water agencies responsible for local supply distribution can conjunctively manage the surface water and groundwater supplies to ensure long-term supply sustainability in addition to potable supply reliability and quality.

Summary of Findings

Although the water supply benefits of the Camanche Regional Water Treatment Plant Project cannot be monetized, they are summarized briefly in Table 26 for the overall project. Construction of the overall Camanche Regional Water Treatment Plant Project will provide substantial more benefits than the Phase 1 project, but the level and timing of these benefits is uncertain. The fully completed project will provide a high-quality potable water to several Camanche Reservoir communities that are currently depended on an over-drafted groundwater supply. Project implementation will allow these communities to conjunctively manage their groundwater supplies with a higher-quality, reliable surface water source, thereby ensuring the sustainability the groundwater basin and the economic viability of these small communities. Additionally, the development and operation of a regional water treatment plant will provide economies of scales relative to water treatment, and will help keep water rates to a level affordable by the communities.

Table 26: Camanche Regional Water Treatment Plant Project
Qualitative Benefits Summary – Water Supply Benefits

Type of Benefit	Qualitative Indicator
Water supply benefits to Camanche Reservoir communities of CASS, CANS, Lake Camanche Village, Burson and Wallace	+
Water supply reliability increase for Camanche Reservoir communities of CASS, CANS, Lake Camanche Village, Burson and Wallace	+
Reduced dependence on local groundwater basin	+
Increased opportunities for conjunctive use	++

* Magnitude of effect on net benefits:
+ = Likely to increase net benefits relative to quantifiable estimates.
++ = Likely to increase net benefits significantly

References

Personal communications with Tom Francis, Senior Civil Engineer, and Eileen White, Manager of Operations, November and December 2010.