

SAN DIEGO, CALIFORNIA, December 10, 1917

Col. Ed Fletcher,
Office.

Dear Sir:-

On November 24th you instructed me to prepare statements showing the cost of water delivered by the following water systems:

City of San Diego System.
Cuyamaca Water System.
Sweetwater Water System.
Escondido Mutual Water System.

The statements appear on the following pages.

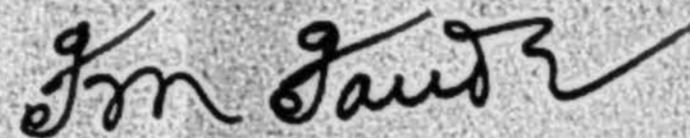
In preparing the statements the fact that the actual quantity of water supplied consumers is usually less than the safe yield of the system has been kept in mind, and for this reason the costs have been worked out not only for the actual quantities delivered to consumers, but also for quantities as indicated by the safe yield studies which have been made by reputable engineers for the various properties.

In computing interest charges, the City of San Diego System carries $4\frac{1}{2}$ and 5 percent on the investment, while the three other systems are computed at the rates of both 6 and 8 percent. In the case of the City, actual rates paid on bond issues are used as it is always possible for a great municipal corporation to secure money at a lower rate than a private utility, which frequently has to pay as high as 8 percent for borrowed money. Even when the City system is given the advantage of the lower interest rates it develops that the cost of water on that system is higher than on any of the others.

Col. Ed Fletcher,
Page 2.

Other pertinent points in connection with these
computations are discussed under the individual statements.

Very truly yours,



Associate Member

American Society of Civil Engineers.

FMF:EK

COST OF WATER DELIVERED BY CITY OF SAN DIEGO WATER SYSTEM

In this instance the water is assumed to be delivered to the University Heights Reservoir, which is practically at the gates of the city. Owing to the extensive, complicated and costly distribution system inside the city, much of it under pavements, the high cost of bookkeeping, meter reading, service repairs, etc., and the relatively small quantity of water served to each individual consumer, it would be unfair to figure costs of water delivered to the consumer's meter on the city's system and compare such costs with costs of water delivered to consumers on such systems as the Cuyamaca, Sweetwater and Escondido, especially as on these last named systems approximately 90% of the water is delivered to irrigation consumers whose use is vastly greater than that of the ordinary domestic consumer inside the City limits.

COST OF SYSTEM AND RATE OF INTEREST

The greater portion of the system outside the city, and usually referred to as the "impounding system", consisting of the Morena Reservoir, the Upper and Lower Otay Reservoirs, the Chollas Heights Reservoir, the Dulzura Conduit, the Otay Pipe Line, etc., was purchased in 1913 and 1914 from the Southern California Mountain Water Company for \$4,000,000. Bonds bearing 4½ percent interest were issued to cover this purchase. About \$800,000 represented Real Estate and Rights of Way and \$3,200,000 represented physical property.

Since the purchase of the above mentioned property the

impounding system has been enlarged and improved by the construction of additional facilities which have cost, to January 1, 1917, according to the report of the Manager of Operations, \$738,981. The cost of these improvements is covered by bonds bearing 5% interest.

Total Cost, bearing 4½% interest -----	\$4,000,000
Total Cost, bearing 5% interest -----	<u>738,981</u>
Total Cost entire impounding system to January 1, 1917 -----	\$4,738,981

During the floods of January 1916 the Lower Otay Dam was completely destroyed. Contracts have recently been let for the construction of a concrete dam on this location at a total cost of approximately \$700,000. This cost, however, should not be included in computing the cost of water delivered at the City's gates, as a water system capable of delivering the same amount of water could be built on the same general lines, and with the structures on the same locations, for not to exceed \$4,750,000.

MAINTENANCE AND OPERATION EXPENSE

The maintenance and operation expense for the impounding system, as reported by the Manager of Operations, is as follows:

Year 1915 -----	\$50,992
Year 1916 -----	\$86,051

The year 1916 shows a much higher cost than in 1915 and the heavy increase was due almost entirely to expenditures necessitated by the floods of January, 1916. As the year 1915 represents practically normal conditions, the maintenance and operation expense for that year may be taken as a fair average, or in round numbers \$51,000.

DEPRECIATION ALLOWANCE OR ANNUITY

The depreciation of the impounding system, as reported by the Manager of Operations, is \$76,002. This is figured on the straight line basis. On the sinking fund basis, we have an average life of all structures of approximately 50 years, and have to determine the amounts which if invested at compound interest for this period will at the end equal \$3,938,981, which is the cost of physical property. Following the usual practice of figuring annuities at 2% less than the rate of interest allowed on the investment, we have the following:

Annuity which, if invested at 2½% compound interest, will in 50 years equal \$3,200,000 is -----	\$32,832
Annuity which, if invested at 3% compound interest, will in 50 years equal \$738,981 is -----	\$ 6,577
Making a total depreciation annuity for the impounding system of -----	\$39,409

While the above method gives only approximate results, a fair annuity for depreciation will be \$39,400.

NECESSARY ANNUAL INCOME REQUIRED TO SUPPORT THE PROPERTY

The necessary annual income is computed as follows:

Interest at 4½% on \$4,000,000 -----	\$180,000
Interest at 5% on \$ 738,981 -----	36,949
Maintenance and Operation Expense -----	51,000
Depreciation Annuity -----	<u>39,400</u>
Total Necessary Annual Income -----	\$307,349

SAFE YIELD OF SYSTEM

The safe yield of the system as determined by the Hydraulic Engineer of the Railroad Commission of the State of California is 6½ million gallons daily, which is equivalent to 2,372,500,000 gallons per year, or 7,281 acre feet per year.

COST OF WATER DELIVERED AT CITY GATES

Based upon the necessary annual income required to support the property and the safe yield of the system, the cost of water delivered at the City gates is as follows:

Cost per thousand gallons ----- \$ 0.129
 Cost per acre foot ----- 42.20

Under date of February 23, 1917, the Manager of Operations reported to the Mayor and Common Council of the City of San Diego, that the cost of gravity water delivered at University Heights Reservoir (City Gates) during 1915 and 1916 was as follows:

	<u>1915</u>	<u>1916</u>
Interest at 4 1/8% on \$4,000,000 -----	\$176,781	\$171,281
Interest at 5% on \$ 520,196 -----	26,010	---
Interest at 5% on \$ 738,981 -----	---	33,928
Maintenance -----	21,232	26,954
Operation -----	29,760	59,097
Depreciation -----	76,002	76,001
	<u>\$329,785</u>	<u>\$367,261</u>

Gravity water delivered (Gallons) -----	# 1,735,918,071	# 1,923,665,141
Gravity water delivered (acre feet) -----	5,327	5,903
Cost per thousand gallons -----	\$0.189	\$0.19
Cost per acre foot -----	\$61.90	\$62.20

Note:- The number of acre feet and the cost per acre foot were not figured by the Manager of Operations.

= Less than the safe yield as determined by the Railroad Commission, in other words, the system was not worked to full capacity.

COST OF WATER DELIVERED BY CUYAMACA WATER SYSTEM

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Cost of System and Rate of Interest

In 1915 the Reproduction Cost, annual depreciation, etc., of this water system were determined by Fulton Lane, President of the Board of Public Utilities of the City of Los Angeles, as follows:

	<u>Reprod- uction Cost</u>	<u>Annual Deprec- iation Straight Line Method</u>
<u>Collection System</u> Including Cuyamaca Reservoir, Diverting Dam and Pumping Plants--\$	154,907	\$ 2,052
<u>Transmission System</u> Including Flume, La Mesa Ditch etc. -----	878,676	27,670
<u>Distribution System</u> Including Distribution Pipe Lines, La Mesa Reservoir, Murray Hill Reservoir, Eucalyptus Reservoir, etc. -----	289,579	10,194
<u>Miscellaneous</u> Including Measuring Stations, Telephone Line and Stock, Mater- ial, etc. -----	24,209	1,188
<u>Totals, Physical Property</u> -----	<u>\$ 1,347,371</u>	<u>\$ 41,104</u>
<u>Real Estate & Rights of Way</u> -----	310,224	0
<u>GRAND TOTAL</u> -----	<u>\$ 1,657,595</u>	<u>\$ 41,104</u>

Since this valuation, various additions to capital have been made and a new concrete multiple arched dam has been constructed at La Mesa Reservoir, at a total cost of approximately \$130,000. This new dam renders the old earth fill dam obsolete. The necessary changes which should be made on account of this construction are as follows:

	Reproduction Cost	Annual Depreciation Straight Line Method
Add for additions to Capital including new dam -----	\$ 130,000	\$ 1,298
Subtract for old dam -----	27,529	1,298
Net Additions -----	\$ 102,471	\$ 0
And the totals for Physical property become -----	\$ 1,449,842	\$ 41,104
And the grand totals for physical property and real estate and rights of way become -----	\$ 1,760,066	\$ 41,104

In this computation of cost of water the figures will be carried through for both 6% interest with 4% sinking fund and 8% interest with 6% sinking fund.

Maintenance and Operation Expense

For the first ten months of 1917 the actual maintenance and operation expense was \$40,968. Extending for twelve months gives \$49,200. This does not, however, include at least \$5,000 of flume maintenance which will be expended in December of this year. The fair average maintenance and operation expense will run at least \$54,200 or say \$55,000 per year.

Depreciation Annuity

Depreciation as previously shown is \$41,104 per year on \$1,434,842 worth of physical property, showing an average useful life of 35 years for the property.

Following the usual practice of computing annuities at 2% less than the rate of interest allowed on the investment we have

Annuity which, if invested at 4% compound interest, will in 35 years equal
\$1,449,842 ----- \$ 19,700

Annuity which, if invested at 6% compound interest, will in 35 years equal
\$1,449,842 ----- \$ 13,000

Necessary Annual Income Required to Support the Property

The necessary annual income is computed as follows:

	6% Interest and 4% Sinking Fund	8% Interest and 6% Sinking Fund
Interest on \$1,760,066 -----	\$ 105,604	\$ 140,805
Maintenance and Operation Expense -----	55,000	55,000
Depreciation Annuity -----	19,700	13,000
Total Necessary Income -----	\$ 180,304	\$ 208,805

Safe Yield of System

The safe yield of the system as determined by Charles H. Lee is 7,344 acre feet per year, or 2,393,000,000 gallons per year, or 6,556,000 gallons per day.

Cost of Water Delivered to Consumers

Based upon the necessary annual income required to support the property and the safe yield of the system, the cost of water delivered to consumers is as follows:

	6% Interest and 4% Sinking Fund	8% Interest and 6% Sinking Fund
Cost per thousand gallons -----	\$ 0.076	\$ 0.088
Cost per acre foot -----	24.60	28.40

The total quantity of water delivered to consumers in 1916 was 1,772,950,000 gallons or 5,441 acre feet. Based upon the necessary annual income required to support the property and the actual consumption of water in 1916, the cost is as follows:

	6% Interest and 4% Sinking Fund	8% Interest and 6% Sinking Fund
Cost per thousand gallons -----	\$ 0.102	\$ 0.118
Cost per acre foot -----	33.10	38.40

The following are comparative reproduction costs of the physical property of the Cuyamaca Water Company's system as determined by various engineers and introduced as exhibits at hearing before the Railroad Commission in 1915. These costs are to January 1, 1915.

Fulton Lane for Cuyamaca Water Company -----	\$ 1,347,371
J. H. Dockweiler for La Mesa, Lemon Grove and Spring Valley Irrigation District -----	1,309,424
Railroad Commission Hydraulic Department -----	1,237,287
H. A. Whitney for City of San Diego -----	1,807,234

It should be noted that the above reproduction costs include physical property only. None of the parties to this proceeding made estimates of reproduction cost for Real Estate and Rights of Way except Cuyamaca Water Company.

COST OF WATER DELIVERED BY SWEETWATER
WATER SYSTEM

Cost of System and Rate of Return

The cost of the Sweetwater System to September 30th, 1912, was as follows:

Sweetwater Dam -----	\$ 472,488
Pipe System -----	630,255
Meters -----	25,620
Pumping Plants -----	33,835
Equipment -----	3,491
Buildings -----	3,299
Miscellaneous -----	702
Total Physical Property -----	\$ 1,169,690
Real Estate and Rights of Way -----	\$ 142,249
Total Cost to September 30, 1912 -----	\$ 1,311,939

The books of the Sweetwater Company show that the total cost of the system to date is about \$1,630,000.

In this computation of the cost of water the figures will be carried through for both 6% interest with 4% sinking fund and 8% interest with 6% sinking fund.

Maintenance and Operation Expense

Mr. John E. Boal, Manager of the System, states that a fair, average, annual Maintenance expense of the system is \$42,000.

Depreciation Annuity

Assuming the average life of the system as 35 years, and the cost of physical property as \$1,480,000, then the

Annuity which, if invested at 4% Com- pound interest, will in 35 years equal \$1,480,000 is -----	\$ 20,100
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And the

Annuity which, if invested at 6% Com- pound interest, will in 35 years equal \$1,480,000 is -----	\$ 13,300
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Necessary Annual Income Required to Support the Property

The necessary annual income is computed as follows:

	<u>6% Interest and 4% Sink- ing Fund</u>	<u>8% Interest and 6% Sink- ing Fund</u>
Interest on \$1,630,000 -----	\$ 97,800	\$ 130,400
Maintenance & Operation Expense -----	42,000	42,000
Depreciation Annuity -----	20,100	13,300
Total Necessary Income -----	\$ 159,900	\$ 185,700

Safe Yield of System

The safe yield of the system as determined by the hydraulic engineer of the Railroad Commission is 3,750,000 gallons per day, and as determined by Charles H. Lee is 4,200,000 gallons per day. The safe yield of the system may therefore be assumed as 4,000,000 gallons per day, or 1,460,000,000 gallons per year, or 4,480 acre feet per year.

Cost of Water Delivered to Consumers

Based upon the necessary annual income required to support the property and a safe yield of 4 million gallons per day, the cost of water delivered to consumers is as follows:

	<u>6% Interest and 4% Sink- ing Fund</u>	<u>8% Interest and 6% Sink- ing Fund</u>
Cost per thousand gallons -----	\$ 0.109	\$ 0.127
Cost per acre foot -----	\$ 35.70	\$ 41.20

The total quantity of water delivered to consumers in 1916 was 1,160,000,000 gallons or 3,560 acre feet, which was lower than normal due to the interruption of service after the floods of January 1916. The average delivery to consumers for the seven years, 1910-1916 inclusive, was 1,336,000,000 gallons or 4,100 acre feet.

Based upon the necessary annual charges and a delivery of 4,100 acre feet the cost delivered is as follows:

	<u>6% Interest and 4% Sink- ing Fund</u>	<u>8% Interest and 6% Sink- ing Fund</u>
Cost per thousand gallons -----	\$ 0.12	\$ 0.139
Cost per acre foot -----	\$ 39.00	\$ 45.30

COST OF WATER DELIVERED BY ESCONDIDO
MUTUAL WATER SYSTEM

Cost of System and Rate of Interest

Mr. A. W. Wohlford of the Escondido Mutual Water Company states that the reproduction cost of the system to date is \$517,375, the cost of the original system being \$350,000, and of improvements made after the original construction \$167,345.

In this computation of the cost of water the figures will be carried through for 6% interest with 4% sinking fund and for 8% interest with 6% sinking fund.

Maintenance and Operation Expense

Mr. Wohlford states that a fair, average, annual maintenance and operation expense for the system is in round figures \$12,000.

Depreciation Annuity

For the purpose of computing depreciation annuities, this system may be considered as somewhat similar to the City system which has an average useful life of 50 years.

Following the usual practice of computing annuities at 2% less than the rate of interest allowed on the investment, we have

Annuity which, if invested at 4% compound interest, will in 50 years equal \$517,375 -----	\$ 3,388
Annuity which, if invested at 6% compound interest, will in 50 years equal \$517,375 -----	\$ 1,780

Necessary Annual Income Required to Support the Property

The necessary annual income is computed as follows:

	<u>6% Interest and 4% Sinking Fund</u>	<u>8% Interest and 6% Sinking Fund</u>
Interest on \$517,375 -----	\$ 31,042	\$ 41,390
Maintenance and Operation Expense--	12,000	12,000
Depreciation Annuity -----	3,388	1,780
Total Necessary Expense -----	\$ 46,430	\$ 55,170

Safe Yield of System

So far as can be determined no actual study of the safe yield of the system has ever been made. Actual diversions by the system show a maximum of 7,277 acre feet in the season 1914-1915, and a minimum of 1,922 acre feet in the season 1905-1906. An agreement entered into with the Volcan Land and Water Company limits the total diversion to 4,140 acre feet per season. The actual average diversion for 10 years, 1905-1915, was 3,671 acre feet.

Actual delivery to consumers for the same period shows a maximum of 1,561 acre feet, a minimum of 596 acre feet, and an average of 1,112 acre feet.

With an average diversion of 3,671 acre feet and an average delivery to consumers of 1,112 acre feet, the loss in storage and in transit is practically 70 per cent.

It would probably be possible to reduce this loss to 60 percent, but it is extremely doubtful if a further reduction could be made unless considerable additional improvements were made.

Assuming an annual diversion of 4,140 acre feet and a loss in storage and transit of 60%, we have 1,656 acre feet available for delivery at consumers' meters. Under present conditions, and in view of the lack of detailed mass curve studies, it may be assumed that the safe yield of the system is 1,660 acre feet, or 540,911,000 gallons per year, or 1,480,000 gallons per day.

Cost of Water Delivered to Consumers

Based upon the necessary annual income required to support the property and an assumed safe yield of 1,660 acre feet, the cost of water delivered to consumers is as follows:

	<u>6% Interest and 4% Sink- ing Fund</u>	<u>8% Interest and 6% Sink- ing Fund</u>
Cost per thousand gallons -----	\$ 0.086	\$ 0.102
Cost per acre foot -----	28.00	33.20

As previously stated the average delivery to consumers for an average of ten years, 1905-1915, was 1,112 acre feet. This is equivalent to 362,345,000 gallons per year or 993,000 gallons per day. Based upon the necessary annual income required to support the property and an average annual delivery to consumers of 1,112 acre feet, the cost of water delivered is as follows:

	<u>6% Interest and 4% Sink- ing Fund</u>	<u>8% Interest and 4% Sink- ing Fund</u>
Cost per thousand gallons -----	\$ 0.128	\$ 0.152
Cost per acre foot -----	41.80	49.60

During the season 1914-1915, the last of which I have any record, the total delivery to consumers was 1,076 acre feet, or nearly the same as the average delivery for the 10 years from 1905 to 1915.

SUMMARY OF COST OF WATER DELIVERED

System	Reproduction Cost	Necessary Annual Income Required to Support Property: (4% & 5% Interest) (on bond Issues)		Safe Yield per year		Cost of Water Delivered Based upon Safe Yield and Necessary Annual Income		
		6% Interest	8% Interest	Million Gallons	Acre Feet	Thousand Gallons	Acre Foot	
City of San Diego	\$4,738,981	\$307,349	-	2,372	7,281	\$0.129	\$ 42.20	
Cuyamaca System	1,760,066	-	\$180,304	\$208,805	2,393	7,344	(\$0.076 (a) 0.088 (b))	24.60 (a) 28.40 (b)
Sweetwater System	1,630,000	-	159,900	185,700	1,460	4,480	(0.109 (a) 0.127 (b))	35.70 (a) 41.20 (b)
Escondido System	517,375	-	46,430	55,170	541	1,660	(0.086 (a) 0.102 (b))	28.00 (a) 33.20 (b)

Notes: Based upon actual deliveries in 1915 cost per thousand gallons on City System was \$0.189 (Report of City Manager)

Based upon actual deliveries in 1916 cost per thousand gallons on City System was \$0.19 (Report of City Manager)

Based upon actual deliveries in 1916 cost per thousand gallons on Cuyamaca System was \$0.102 (a) and \$0.118 (b).

Based upon average actual deliveries for 7 years (1910-1916) cost per thousand gallons on Sweetwater System was \$0.12 (a) and \$0.139 (b).

Based upon average actual deliveries for 10 years (1905-1915) cost per thousand gallons on Escondido System was \$0.128 (a) and \$0.152 (b).

(a) 6% interest and 4% Sinking Fund - (b) 8% interest and 6% Sinking Fund.

Ed Fletcher Papers

1870-1955

MSS.81

Box: 36 Folder: 19

**Business Records - Reports - Faude, F.M - "Report:
Cost of Water Delivered by City of San Diego Water
System, Cuyamaca Water System, Sweetwater
System, Escondido Mutual Water system"**



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