Marrow Dam + Jan 1-1915- to May 31
1915- 7,325,000,000 Gals-
includes ouflow from Barrett Dam
probably 1/3*
Watershed 190 in US.
45 in Mexico ?
235.

CSH.

RECORDS OF CITY OF SAN DIEGO WATER SYSTEM

1915 Obtained Mar 21 1915.

Pumped from San Diego River

January	86,091,000	gallons
February	103,891,000	"
March to 15th	72,707,000	"
Total	262,689,000	"

City Consumption

January	172,621,327	gallons
February	147,678,519	"
Mar to 15th	93,886,290	"
	414,186,136	"

Total Consumption (including outside consumption)

January	182,121,327	gallons
February	156,678,519	"
Mar to 15th	99,386,290	"
	438,186,136	"

FURNISHED CITY BY CUYAMACA WATER CO.

	Million Cu.Ft.	Million Gallons
Through meter at Boundary & El Cajon Jan to Mar 15th, 1915.----------	8.159	61
Highland Ave. Jan to March 15th -----	10.536	79
Total		140.
Pumped by City from San Diego River		262.7
Jan 1st to March 15th 1915		402.7
Consumption during that time		438.1
		35.4

SAN DIEGO WATER SYSTEM

Storage & Diversion.

MORENO RESERVOIR

Storage Jan. 1, 1915 - 1,310,000,000 galls. Contour 84.
" " 15, 1915 - 1,318,250,000 " " 84.16
" Feb. 1, 1915 - 1,693,000,000 " " 90.05
" " 15, 1915 - 2,566,000,000 " " 100.10
" Mar. 15, 1915 - 2,986,000,000 " " 104.36
" " 15, 1915 - 3,552,000,000 " " 108.85
Spillway at 146 contour capacity 13,700,000,000 gallons.

LOWER OTAY RESERVOIR

Turned in from Dulzura Conduit (Meas. at Camp Crossing near the Lower end of the Dulzura Donduit)
Dec. 1914 - 18,912,600 gal.
Jan. 1915 - 135,827,000 "
Feb. 1915 - 687,491,500 "
To Mar 15,1915 - 474,812,500 "

Total per D C 1,317,043,600 gall.

Draft from Dec. 1, 1914 to Mar. 15, 1915

City	237,380,000 gall.	
Outside consumers	60,294,000 "	appr.
Storage Dec.1,1914	2,224,500,000 "	contour 68' 9"
" Mar.15,1915	5,513,000,000 "	" 96' 9½"

UPPER OTAY RESERVOIR

Nov. 1st, 1914	241,211,740
Mar 16, 1915	735,000,000

furnished yes. above
Mar. 17, 1915

SAN DIEGO WATER SYSTEM

Storage & Diversion.

MORENO RESERVOIR

Storage Jan. 1, 1915 - 1,310,000,000 galls. Contour 84.
" " 15, 1915 - 1,318,250,000 " " 84.16
" Feb. 1, 1915 - 1,693,000,000 " " 90.~~88~~
" " 15, 1915 - 2,566,000,000 " " 100.10
" Mar. 1, 1915 - 2,986,000,000 " " 104.36
" " 15, 1915 - 3,552,000,000 " " 108.85
Spillway at 146 contour capacity 13,700,000,000 gallons.

LOWER OTAY RESERVOIR

Turned in from Dulzura Conduit (Meas. at Camp Crossing near the Lower
Dec. 1914 - 18,912,600 gal. (end of the Dulzura Conduit)
Jan. 1915 - 135,827,000 "
Feb. 1915 - 687,491,500 "
To Mar ~~15, 1915~~ -
~~424,812,500~~ = 882,387,500
Apl. 1915
Total per D-C ~~1,317,043,600~~ gall.

Draft from Dec. 1, 1914 to Mar. 15, 1915
City 237,388,000 gall.
Outside consumers 60,294,000 " appr.
Storage Dec. 1, 1914 2,224,500,000 " contour 69' 9"
" Mar. 15, 1915 5,513,000,000 " " 96' 9½"

Subtract from Lower Otay amount furnished by City Wells

UPPER OTAY RESERVOIR

Nov. 1st, 1914 241,211,740

Mar 16, 1915 735,000,000

DATES COMPANIES WERE INCORPORATED

Spreckels Bros. Commercial Co. Aug. 18/ 87

San Diego Gas Co. Feb. 24/ 73

San Diego Gas Fuel & Electric Light Co. Mar. 25/ 87
" " " " " " " May 18/ 87
" " Gas Light Co. Aug. 16/ 89
" " & Old Town Railroad Sept. 20/ 86

Old Town & Pacific Beach Railroad Oct. 23/ 88

San Diego Water Co. Mar. 18/ 65 Recd Apr. 14/ 69
Notice of appropperation of 20,000 miners inches of water of the San Diego River located opposite the Old Dam of the San Diego Mission about 12 miles from the town Old San Diego.
Theo. H. Blake; Tose M. Esteidllo & Chas. E. Todd.

San Diego Water Co. Jan. 30/ 73 Recd. Feb. 7/ 73

San Diego & Coronado Water Co. No. 161 Mar. 9/ 86
" " " " 390½ July 6/ 88
439 Aug. 19/ 88

San Diego Water Co. No. 454 June 25/ 89
" " " " No. 611 July 2/ 89

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San Diego Water Co. No. 454 June 25/ 89

" " " " No. 611 July 2/ 89

Memorandum of how water was served to City of San Diego.

Authority C. S. Alverson.

----oOo----

The first pumping station on the San Diego River by Gruendike and others built about 1875 and not used after 1886. Gruendike and others sold to San Diego and Coronado Water Company, date_____?

This company sold to San Diego Water Co. in August 1889 and which in turn sold to City of San Diego in 1901.

The Old Town Pumping Plant was built in 1886 by the San Diego and Coronado Water Company, which, as stated before, was sold to the San Diego Water Company in 1889 and to the City in 1901 as above.

Report to Mayor in 1901 by C. S. Alverson contains a complete inventory of the plants taken over by the City at that time. This is a public document and available.

In 1889 to about 1900 the stockholders of the San Diego Water Co. were almost identical with the San Diego Flume stockholders. At least as early as 1894 the San Diego Water Co. was buying water from the San Diego Flume Co. (present Cuyamaca Water Co.) at 5¢ a thousand gallons to supplement the above mentioned pumping plants. The City did not actually deal with the Flume Co. during this period until 1901 when it bought out the San Diego Water Co. After 1901 the City bought some of its water directly from the Flume Co. probably until 1906.

BY H.A. WHITNEY---- Excerpt

The following is a tabulation showing the amount of water used each year, the average amount per day and the number of taps in service. This will give an idea of the rapid growth of San Diego in the years fro 1902 to 1914.

Year	Amount used per year in gallons	Avg. per day in gallons	No. of Taps	Gallons per tap daily
1902	588,597,292	1,612,598	3,593	499
1903	734,405.550	2,012,070	3,774	541
1904	771,049,665	2,112,443	4,044	522
1905	761,022,665	2,085,000	4,505	463
1906	944,079,932	2,586,520	5,070	510
1907	1,282,030325	3,380,010	6,331	534
1908	1,386,390,000	3,798,328	7,085	536
1909	1,387,000,000	3,800,000	8,264	461
1910	1,853,215,000	4,531,000	9,388	493
1911	1,862,230,000	5,102,000	10,282	496
1912	2,141,120,000	5,869,000	12,681	462
1913	2,503,952,800	6,860,000	14,153	493
1914	2,688,000,000	7,309,589	14,630	499

In the first of January, 1909, the Dulzura conduit was put into commission and the water system, with the exception of Morena being added, has not been changed since that date. The season of 1908 and 1909 produced an unusually large run-off and the water impounded in Lower Otay reservoir at the beginning of 1909 was 4,279,070,430 gallons with approximately one billion gallons in Upper Otay reservoir. The amount of water now impounded in Upper and Lower Otay reservoirs is less than 1,800,0000000 gallons.

2 Whitney

V. L. & W. CO.

The figures above readily show that we are drawing water from our reservoirs from year to year faster than we are impounding the same and without costly improvements we cannot keep pace with the growth of the city.

As the matter stands now we have only realized an average of five million gallons daily and have been using six and one-half million gallons daily since 1909, including the consumers outside the city. Had we had the improvements in at the beginning of 1906 and had been able to utilize the runoff to the best advantage we would have been able to realize an average of 12,000,000 gallons daily up to January, 1915. On the other hand had the conditions existed similar to what they were from 1893 to 1903, Morena and Lower Otay Reservoirs would have been filled to practically over flowing and yet we would not have been able to realize over five and one-half million gallons daily average during these ten years.

It is my recommendation, and it is based upon the demands of the Board of Fire Underwriters, that a city situated as San Diego and growing at the rate that San Diego is and expects to in the future, have a water supply of not less than double the present average daily consumption, together with transmission and distributing mains accordingly.

H. A. WHITNEY

CITY OF SAN DIEGO DATA 4 W.S.P.

September 1, 1914.

Reservoir	Gage	
Morena	63.29'	1,275,000,000
Upper Otay	66' 9"	625,000,000
Lower Otay	75' 3-3/4	2,725,000,000
Chollas	About	30,000,000
University	About	9,000,000
		4,664,000,000
Mr. Whitney ~~is quoted as saying that~~ 700,000,000 is below outlets, subtract		700,000,000
Net amount available ----------		3,964,000,000.
Pumping at Old Town Plant, San Diego River, is abandoned. New plant, 5 miles above, pump capacity 4 millions now being erected.		
Amount available in storage ----------		3,964,000,000
Net amount anticipated for next year from watershed (average 4 years preceding)		950,000,000
Total available for next season ----------		4,914,000,000
Total system losses, evaporation, seepage, etc., estimated at ----------		2,000,000,000
Amount available for consumption ----------		2,914,000,000

Assuming use of 8½ million gallons per day, the above supply is good for 360 days or until Sept. 1st, 1915.

Assuming 3 millions a day pumped from the San Diego River, this period will be extended three months or until December 1,1915.

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14

unpublished W.S.P.

REPORT OF THE HYDRAULIC STUDY OF THE WATER SYSTEM FOR THE CITY OF SAN DIEGO TO BE USED IN CONJUNCTION WITH THE RATE FIXING CASE BETWEEN THE CITY OF SAN DIEGO AND THE CITY OF ENCANTO, AS HEARD BEFORE THE RAILROAD COMMISSION OF THE STATE OF CALIFORNIA.

H. A. Whitney, Hydraulic Engineer.

The object of this study is to determine the probable safe yield from the present system as installed and the possibility of increasing the efficiency of same by certain extensions or additions. A thorough examination of each of the improvements enumerated in the following pages has been entered into and will be explained item by item.

The Impounding System for the City of San Diego.

The impounding system consists of three large reservoirs and the several creeks draining the water from the various sheds into these reservoirs; The Morena Reservoir on the Upper Cottonwood Creek, the Dulzura Conduit for receiving drainage of the Pine and Cottonwood creeks with the old river bed of the Dulzura Creek for conveying water from the end of the Dulzura Conduit into the Lower Otay reservoir; The Lower Otay reservoir and the watershed of the Lower Otay; The Upper Otay reservoir and its watershed; A pipe line over twenty miles long consisting of various sizes of pipe from 40" down to and including 24".

Cottonwood Creek.

The extremities of the drainage area of the Cottonwood Creek run to the center of Township 16 South, Range 6 East, and include the areas of the sheds known as the Morena watershed, Pine Valley watershed and the Barrett watershed.

Morena Watershed.

The area of the Morena watershed is 135 square miles. The average rainfall from what rain guagings we have available is 19.76 inches. The average run-off, taken for the last eight years, is 22,784 acre feet.

Barrett Watershed.

The area of the Barrett Watershed is 135 square miles. This includes the drainage area of the Pine Valley watershed and Cottonwood Creek above the present Barrett Dam site located in Section 22, Township 17 south, Range 3 east. The average rainfall on this area for the past eight years is 15.45 inches. The average run-off for the last eight years is 18,017 acre feet, this includes the discharge of Dulzura Conduit subsequent to January, 1909.

The Cottonwood Creek is one of the principal tributaries of the Tia Juana River. Its origin is in the Laguna Mountains of the Coast Range. It flows south and west about 20 miles where it is joined by the Pine Valley creek from the north. It is about 1½ miles south of this junction that the Government gauging station is established and it is from here that the run-off (as mentioned in the above paragraph) is taken. The Cottonwood flows south from the junction of the Pine Creek for a distance of 12 miles, at which point it enters the Tia Juana River close to the Mexican boundary about 22 miles east of the Coast line. The total drainage area of the Cottonwood Creek is 340 square miles. Two hundred and seventy square miles of this is above the Barrett Dam site, 135 square miles of which is contained in the drainage area of Pine Creek above Barrett Dam site at an elevation of 1506 feet and 135 square miles in the Morena watershed, as mentioned in the fore part of the report.

March 18, 1915.

Mr Ed. Fletcher,
Manager, V.L. & W Co.

Dear Sir:

The catchment of water in Spreckles System for this season to March 15th has been as follows:

Morena dam	2242	million gallons
Dulzura conduit	1517	" "
Upper Otay	494	" "
Lower Otay	2269	" "
Total ----------	6522	million gallons

The runoff of water in the Sweetwater system for this season to March 15th has been as follows:

Sweetwater Dam	4244	million gallons

The runoff of the San Diego River for this season to March 15th:

Catchment at Cuyamaca Dam	1933	million gallons
Catchment at U.S. gage station Diverting Dam	779	" "
Catchment at U.S. gage station South Fork	18	" "
Total catchment ----------	2730	million gallons
Water running to waste at U.S. gaging Station at Lakeside	7700	" "
Total Runoff --------	10430	million gallons

Runoff at points on Volcan System for this season up to March 15th:

San Luis Rey River at U.S. Gaging Station at Warner Dam ----------	12080	million gallons
San Dieguito River at U.S. Gaging Station at Cowell Dam ---------	11100	" "
Total runoff on Volcan System	23180	million gallons

Yours truly,

C.E.H.

H-K

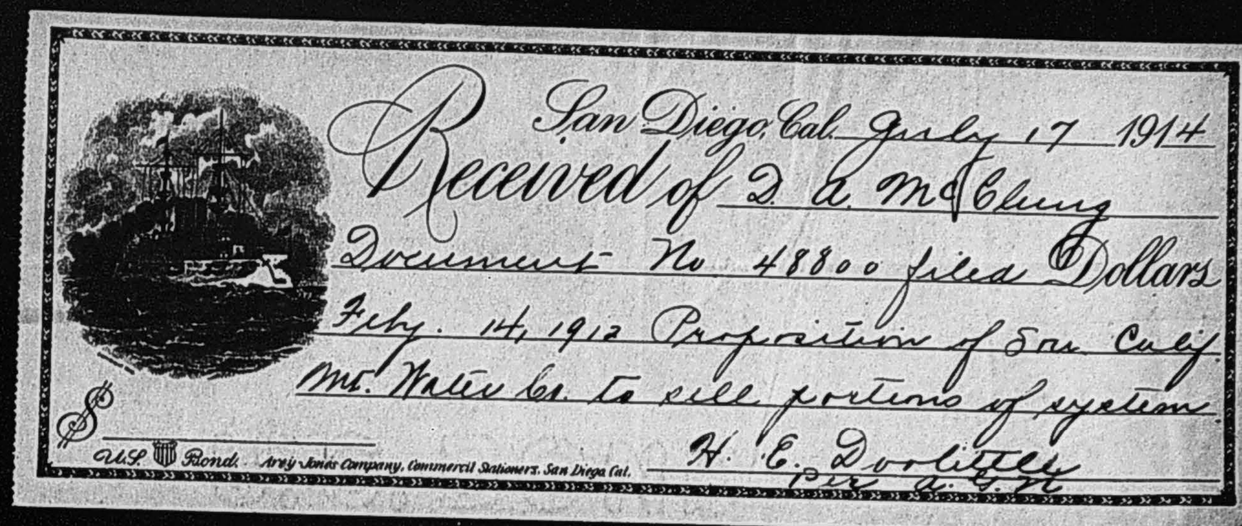
The basin of Cottonwood Creek is rough throughout and contains very few valley areas, although there are some at elevations exceeding 3000 feet; below this elevation the creek flows through a deep narrow canyon, broken only by a short stretch of open country with comparatively light grade at the junction of Pine Valley Creek. Altitudes range from 600 feet above sea level, where the Cottonwood empties into the Tia Juana River, to 5200 feet on the Laguna mountains. In the accompaning exhibits is an Iso-Hyetose map prepared from rain gauges of various stations for a comparatively long time. This illustrates very nicely, that while we have a slight rainfall in the Otays, we have comparatively copious rainfall on the higher elevations.

The Cottonwood basin is very poorly forested, however the Government has established what is known as the Cleveland Forest Reserve and is protecting the timber and brush from fires. Such timber as there is consists of scattered oaks, cottonwoods, alders and brush and is confined to the small valleys along the Cottonwood Creek and Pine Valley streams.

The annual rainfall ranges from 10 to 20 inches along the foothills and from 20 to 30 inches in the mountains. The yearly precipitation of the watershed behind Barrett Dam site (where the run-off is measured) will, I presume average 20 inches.

The gorge at Barrett has been explored from time to time for the purpose of building an impounding dam but up to the present time no satisfactory bed rock for a foundation has been obtained.

The branches of the Dulzura Conduit extend between the 70 and 80 foot contours, shown on the accompaning sketch of the proposed Barrett Reservoir, and conveys the water from the Pine Valley and Cottonwood Creeks from a point 1½ miles north of the Barrett Dam site in a southwesterly direction for


San Diego, Cal. July 17 1914
Received of D. A. McClung
Document No 48800 filed Dollars
Feby. 14, 1912 Proposition of San Cuelj
Mt. Water Co. to sell portions of system
H. E. Dorlitzer
U.S. Bond. Arey Jones Company, Commercial Stationers, San Diego Cal.

20
180

15 ~~400~~ 220 =

45
5
225 =

⊗
30"

about Oct 10 1913
Merona 56ft.

13½ miles. From the small diverting dam at the entrance of the Pine Creek intake and the Cottonwood intake the conduit is concreted for about one-half or three-fourths of a mile. From the intake of the Dulzura Conduit to a point about one and one-half miles west of the Morena Dam there is a valley covered with deep sand and overgrown with cottonwoods, chaparral, willows and tule swamps of large areas.

Morena Dam.

The Morena reservoir is situated in Township 17 south, and lies one-half in range 5 east and one-half in Range 4 east. The top of the dam is at an elevation of about 3032 feet and the outlet is at an elevation of 2913 feet; it is of the rock filled type with concrete facing on the upstream side.

Description of Gorge Below Morena Dam.

The drop of the Cottonwood Creek from the outlet of Morena Reservoir to a point about one and one-half miles west is about 1200 feet. This gorge is filled with rocks which have been eroded and fallen to the valley below, making travel through it practically impossible.

The City of San Diego had no occasion to let water out of Morena reservoir until March 29, 1913. This was done when the ground was thoroughly saturated. The flood gates at Morena were opened sufficiently to give the full capacity to the Dulqura Conduit. Measurements were taken of the quantity of water let from Morena at a weir at the end of the outlet tunnel. Further measurements were taken from the Dulqura conduit and at the end of the Dulzura Conduit from which we were able to calculate the losses between these various points. Measurements were again taken at the outlet of the Dulzura Creek where it empties into the Lower Otay reservoir. The compilation of

Gage Heights Morena Reservoir

		Gage	Acft.	Mill Gallons
Oct. 10 about	1913	56. ft		
Feb. 21-	1914	77.1		
Feb. 23	1914	81.4		
March 7	"	83.19		
Apr 6	1914	84.99		

— Upper Otay —

Apr 6 - 1914 contained 725 million Gallons

Lower Otay

	Gage	Mill Gallons
Oct 1 - 1913	88' 9½"	4.279
Oct 31 1913	86' 5¾"	3,872
Mar 6 1914	~~86' 8¾"~~	~~3.920~~
Mar 1st 1914	88'-5½"	
Apr 2nd 1914	88-6½"	
Apr 4th 1914	87'-10½"	

Dulzura Conduit

March 1st 1914	1,47	10 200 000 gals
2nd	1,60	11 900 000

these figures is submitted with this report and it was found that practically 50% of the water was lost between the outlet of Morena reservoir and where the Dulzura Creek enters the Lower Otay reservoir. The greater part of this loss was suffered in passing this water from the foot of the rocky canyon, as mentioned above, through the sandy swamp to the intake of the Dulzura Conduit.

In order to give a more perfect understanding of the quantities of water which the rain would produce on a watershed of the area of the Cottonwood and Pine Valley, namely, 270 square miles, I call your attention to the fact that we, assuming a rainfall of 20 inches as an average annually, would be able to gather what would be a daily average of 256,500,000 gallons of water, this taken for the last seven years of which we have authentic records.

Table #1 gives the principal data for all the main reservoirs and other improvements upon the impounding system.

Table #2 is the rain fall record by months from the beginning of when records were kept.

Table #3 is the rainfall record for Barrett from January, 1909.

Table #4 is the Otay rainfall records from June, 1906.

For comparison Cuyamaca and Sweetwater rainfall is given for the same periods in Tables #5 and #6.

Diagram #1 is the average of a number of rain gauge stations throughout the county and shows the seasonal precipitation as expressed in percentage of the normal.

Diagram #2 gives the run-off by years for Sweetwater from 1887-8, Cuyamaca from 1893-4 and Cottonwood from 1906-7.

Table #7 is a table of precipitation of actual rainfall for San Diego, Cuyamaca and Sweetwater with the normal as taken

V. L. & W. CO. 2 D City Syst

DEPARTMENT OF WATER

City of San Diego, California

April 12, 1915.

Wm. S. Post, Associate Member,
American Society of Civil Engineers,
Fletcher Bldg.,
SAN DIEGO, CALIF.

Dear Sir:-

In compliance with your request of March 29th, I take pleasure in submitting to you the cost of the various items entering into the construction of the Mission Valley Pumping Plant, together with the cost per thousand gallons of water delivered into the University Heights reservoir. This includes the interest on the amount invested, the depreciation, maintenance, etc.

Cost of Wells	$4207.40	
Cost of Pumps, Motors	8437.00	$12644.40
Cost of Main Pumps & Motors	7911.00	
Cost of Conduit, Etc.	28511.13	36422.13
Cost of Water Rights to Feb. 28th		100.00
Cost of Pump House and Engineer's Cottage		8646.71
Cost of Main out of Valley		32477.81
TOTAL		$90291.05
Cost per 1000 gallons pumped, Main Pumps		.035592
" " 1000 " " , Well "		.007978
Cost per 1000 gallons pumped, Main & Well Pumps		.043570

Very truly,

(Signed) H. A. Whitney

HAW-J HYDRAULIC ENGINEER

Head plus friction 360 ft-
Max. Capacity 5 M.G-
Main delivery pipe 16 Inch
Electric Charge 1½ cts per KW hr. less 10% discount.

for a 20 years record. Campo which is only about 10 miles from Morena is given for comparison for Morena. Morena is estimated from the 1900 to 1906 period from Campo rainfall. The years prior to 1900 are estimated from a normal year factor taken from a mean of San Diego, Cuyamaca and Sweetwater.

Diagram #3 shows the seasonal variation in precipitation from the normal for Morena, Barrett and the Otays.

Diagram #4 is a curve showing the presumable run-off in acre feet per square mile of water-shed at Morena and the per cent. of the normal year of rainfall for same period. This curve well illustrates the close relation of rain fall and run-off for heavy fainfalls but the wide variations in the run-off to rainfall below 115% of normal. In the years of 50% or less or normal the run-off is practically negligable.

A Hydrograph of the daily flow of the Cottonwood Creek above the Barrett dam site has been prepared and is submitted in a separate exhibit. This is from December, 1906, to January 1, 1913. This well illustrates the peak runoff periods and the duration of certain floods which can not be taken care of by the Dulzura Conduit, yet might be conserved by a small impounding dam on the Pine Creek just above the present intake.

Table #14 is prepared showing the actual runoff of the Cottonwood for the years of which we have records, viz. 1906 to 1913, also the records from 1893 to 1913 for Cuyamaca and Sweetwater River. The mean annual per cent. of run-off is shown respectively, also the mean of Cuyamaca and Sweetwater for comparison to the Morena during the years for which we have records. This comparison has agreed so closely that a 20 year record has been calculated from these constants in order to see what effect the past seasons would have had upon the

Morena, Barrett and Otay reservoirs had they been constructed in 1893 and the run-off waters conserved. The calculation covering the conservation of the run-off for the various reservoirs and passage and leaks from one to the other is illustrated by Table 24 for Morena, Table 25 for Barrett and Table 26 for the Otay reservoir.

In Diagram #17 is shown the capacity curves of the Morena, Barrett and Otay Reservoirs which were used in getting areas from which the evaporation was calculated. The actual run-off was taken for the period of which we had records and calculated from table #14 for the seasons prior to that. The evaporation is assumed to be 56 inches per year. The loss between Morena and Barrett is presumed to be only 3% . The loss between Barrett and Otay is taken as 18%, as calculated from Table #29. From this net of tables Diagrams #10 and #11 are constructed. Diagram # 10 shows the total mass curve run-off in acre feet. The dotted line gives net supply, after deducting the wastes from the runoff. Allowing for the amount of water which San Diego supplies to the consumers outside the City, together with present consumption of San Diego, see Diagram #14 and #15, the total for 1913 will amount to about 8,000,000 gallons per day.

I am starting in 1893-4 with 12,500 acre feet in the reservoirs and with a draw of 8,000,000 gallons per day. The flood of 1894-5 practically filled Morena, Barrett and Otay, yet in eight years the reservoirs were drained to their outlets; thus illustrating the need of our conserving every drop of water possible in the present sheds, and using no more than what we are at present for irrigating work and where it is possible to curtail even this use.

Diagram #11 is similar to #10 with the exception that the 8,000,000 gallons daily withdrawal, leaks and waste are massed into one curve. The amount of water impounded at any time may be ascertained by measuring from base line to the Consumption Curve. At no time does the total amounts of conserved water reach the line of total impounding capacity.

Diagram #9 is based upon Table #27, it shows what the condition of our present system would have been had we had it in operation from the time when we started run-off records with the addition of a 15,000,000 gallon reservoir at Barrett and a conduit between Morena and Barrett with only 3% loss, the loss from the Dulzura conduit to Otay being taken at 18%. The evaporation is taken at 56 inches, the withdrawal is 8,000,000 gallons.

This illustrates that even with the present system improved to the utmost (outside of a conduit from the end of the Dulzura Conduit to Otay) that our supply will just about equal our present demands even if we consider the last seven years (which I have shown in Table #14 are 1.35% nommal years) as averaging normal years.

Diagram #12 is based upon tables #14, #15, #17, #19, #23, #27, #28 and #29. This diagram gives the total run-off into the Otay from the Dulzura Conduit and the Otay watersheds. The actual consumption of San Diego and other consumers have been taken into account. The reservoir leaks as they exist and the loss in passage are allowed for. Starting with 20,000 acre feet in 1907, we have at the present time about half that amount. In 1907 we were using less than half our present consumption.

Diagram #13 consists of two curves, run-off and waste and consumption curve. The same data as used in diagram

#12 applies to this diagram; they are practically identical with the exception that the two lower curves of #12 are combined into one in #13 to show the total amounts impounded from time to time as well as the rapid drop from 1910 to date.

Diagram #14 illustrates the curve of consumption inside the City of San Diego compared to the curve of increase in water taps, from the years 1902 to 1913 based upon Table #28. In 1902, 588,597,892 gallons of water were used through 3593 service taps while at the present time 2,500,000,000 are used annually through 14,000 taps. This is an increase of over 300% in 12 years. The population has increased accordingly.

In October, 1913, the City voted $200,000 for pumping plants along the San Diego river for the purpose of saving what water it is possible. It is presumed we will get from 3,500,000 gallons to start with to an average of about 2,000,000 gallons a day later on when the water plane will have fallen.

On December 30, 1913 the people voted bonds to build a conduit between the base of the Howser Canyon, one and one-half miles west of Morena dam, to the intake of the Dulzura Conduit where it leads up the Cottonwood valley. By the building of this aqueduct we are in hopes to eliminate the greater part of the loss between Morena and Barrett, as shown in table #29. In the months of March and April for a period of 39 days water was let from Morena reservoir. This was shortly after a rain and at a time when the ground was thoroughly saturated. Measurements were taken at the Morena dam also at the end of the Dulzura Conduit and again near the inlet of the Lower Otay reservoir. Out of 1,193,359,427 gallons turned from Morena 658,192,527 reached the end of the conduit and 605,551,753 arrived at Lower Otay Reservoir. It is estimated 40% of the Morean water was lost in passing to the Dulzura Conduit, 44.4% was lost

between Morena and the end of the Conduit and 48.8% between Morena and Lower Otay.

On account of the head of Lower Otay going down, the daily delivery capacity of our pipes are reduced. Although we have placed a booster pump upon our present line and have voted to build an additional line from Bonita into town, it will no doubt be necessary to install a pump near the Otay reservoir to get the water below the intake. With conditions of the above nature facing the City of San Diego it behooves us to take immediate steps to triple our water supply and in the meantime refuse any additional consumers as well as eliminate all irrigation where possible.

Ed Fletcher Papers

1870-1955

MSS.81

Box: 35 Folder: 31

Business Records - Reports - Alverson, C.S - History Facts: To Henshaw with excerpts from Whitney