C-1917

REPORT
OF THE
J. JOHNSTON, JR.
WATER SYSTEM
ON THE
SANDIEGO RIVER
SANDIEGO COUNTY, CALIF.

By C. S. ALVERSON,

SEPT.20-1917. HYDRAULIC ENGINEER.

REPORT OF C.S.ALVERSON, HYDRAULIC ENGINEER TO J.JOHNSTON,JR.,ON THE UNDERGROUND WATRR WATER SUPPLY ON THE SAN DIEGO RIVER, SAN DIEGO COUNTY, CALIFORNIA, NEAR RIVERVIEW STATION.

Mr.J.Johnston,Jr.

Escondido,Cal.

Sir:-

At your request I submit the following report on the safe estimated water supply for muncicpal purposes to the City of San Diego from your Pumping Plant near Riverview Station on the San Diego River, San Diego County, California.

I have been familiar with the San Diego River since July 1886, when I was assistant Engineer of the San Diego Flume Company. During the thirty years past I have made a thorough studt, and accumulated a great deal of data, on the surface and underground water supply of the San Diego River. From the above information I have submitted several reports to the users of the water; to the City of San Diego and others.

The requirements of a domestic and municipal water system calls for a continuous supply. For this reason as well as other conditions an underground reservoir is more reliable than an artificial storage reservoir. To the former belongs your system.

In this report I have taken into account the vested and acquired rights of others from the Old Mission Dam to the headwaters of the various branches of the San Diego River

There are several methods of delivering the water to the City of San Diego; as to which is the most feasible can be determined at a later date.

GENERAL DESCRIPTION.

The San Diego River has several branches. The principal ones are North Fork or Coleman Creek, which heads in Section 4, T. 13 S. R. 4 E.,about one and one half miles S.E. of the Town of Julian. It runs in a Northwesterly direction on through Spencer Valley and then turns abruptly to the Southwest and runs for several miles through a rocky and wooded canyon.

Cedar Run heads in Sections 15-16-22 T.13 S.R. 4 E. and runs in a westerly and southerly direction and joins the North Fork near the corner to Secs.1-2-35-36 Tps.13-14 S.R.2 E. Boulder Creek heads to the East of the three high peaks of the Cuyamaca Mountains; and the upper 12 square miles of drainage is the source of supply for the Cuyamaca Reservoir.

Commencing at the Cuyamaca Dam with an elevation of stream bed of approximately 4550 feet above sea level it runs a little N. of W. for about two and one half miles; thence nearly South for one and one-fourth miles; thence Westerly for about eight miles and joins the North Fork Elv.825 ft.above sea level about one-third of a mile above the Diverting Dam of the Cuyamaca Water Co. Elevation of stream bed at Diverting Dam about 805 ft. A.S.L. From the Diverting Dam the river flows in a West and southerly direction; and about two and one-half miles below Sand Creek joins it from the East; and at six-and one-half miles the South Fork from the East joins the stream. The junction of these two streams forms the San Diego River proper. The South Fork heads to the West of the Cuyamaca Mountains and is formed

by the junction of the Conejos and King Creeks in Sec.6 T.15 S. R. 3 E. and flows Westerly for about four miles where it joins the North Fork as above described. About one and one-fourth miles below the junction of the North and South Forks the Chocolate Creek joins from the South near the center of Sec.8, Chocolate Creek heads near Alpine Heights and is about five miles in length. About one mile below the junction of Chocolate Creek, we come to the proposed El Capitan Dam Site; the total watershed to this point is 191 square-miles. As to whether it will ever be built is a question. Two miles below El Capitan dam site is Cape Horn Point or contraction. Three miles below Cape Horn is the Monte contraction, and one and three fourths miles below the Monte contraction is the U.S.Gauging Station. About one mile below the U.S.G.Station, the San Vicente Creek joins the river from the North. The San Vicente Creek has about 71 square miles of watershed. The San Vicente Creek has several branches and heads to the South of the Ballena Valley, and in all probability was the ancient bed of the San Diego River. About one-half mile below the San Vicente Creek Junction Los Coches Creek joins from the South. Los Coches Creek heads in Sec.24, Tp.15 S.R.1 E. and has about 16 square miles of watershed. From the junction of Los Coches Creek to the Riverview contraction, it is some two miles by river channel, or 128 sq.mi. of watershed from proposed El Capitan Dam Site, or a total of 319 square miles of watershed above Riverview contraction. The surface run-off and underground storage from the above area is your source of water supply; less the prior and vested rights of the Cuyamaca Water Company and the irrigators above the Riverview contraction. The Elevation of the river bed at

Riverview contraction is 368 ft. A.S.L.

B E L O W R I V E R V I E W C O N T R A C T I O N.

From the Riverview contraction the river flows in a westerly direction through the North El Cajon Valley to the Old Mission Dam (built about 1776) and located some 800 ft.East of the West boundary line of EL CAJON GRANT, and at the head of the gorge above the Mission Valley. Elevation river bed 275 ft. A.S.L. Distance five and three-quarter miles. Additional area 57 sq.mi. From Riverview contraction to Old Mission Dam and along the river bottom the estimated storage capacity of the underground reservoir is some 14,000 Acre-feet, or 4,604,225,000 gallons. The superficial area of the sands and gravels is some 1275 acres. The source of supply is its own runoff; and the surplus underground water and the excess surface runoff above the Riverview contraction.

G E O L O G I C A L F O R M A T I O N.

In the study of surface and underground water supplies the geological formation and structure often becomes an important factor in determining the amount of the available water supply of the section investigated.

The following is an outline of the geological formation along the San Diego River from Mission Dam, thence up-stream.

At the Old Mission Dam there is an intrusive rock ridge that originally formed a basin or lake; the lower strata of this section is conglomerates, clay, and adobe, on top of which is from 20 to 30 feet in depth of sand and fine gravel. As you go up stream the deposits of sand and gravel deepen and widen and granite becomes the underlying bed rock.

At Riverview contraction,(where your water supply begins) the following conditions exist: The contraction narrows to abqut 1000 ft. in width of water bearing sands and gravel. In 1894 the San Francisco Savings Union bored six 10-in.drive wells near the Riverview Contraction. In all six wells the strata passed through were practically the same,viz.: The first 50 feet sand, gravel, etc. water bearing, then 30 feet of loosely consolidated conglomerates through which the water would slowly percolate; then 6 feet of very coarse gravel and cobblestones free from fine sand or silt and good water bearing; then for a few feet through a fine grained material.

On July 6-1912, I personally examined your pumping plant, Designated as No.6 on Map.

J. JOHNSTON JR. PUMPING PLANT.

Located about 800 feet N.W. of Riverview Railroad Station. 40 H.P.Gas Engine belt connected to an 8-inch centrifugal pump. Speed of Engine 240 R.P.M.Speed of pump 640 R.P.M. Water supply from eight 12-in.dia.drive wells with 6-in.dia.casing, and from 60 to 80 feet in depth. Pumps about 2700 gallons per minute. Average 10 hours per day for 6 months. Equals 38,880,000 cu-ft. or 900 Acre-feet. Continuous pumping would be 3,888,000 gallons per 24 hours.

LOG OF WELLS: 5 ft.of river sand, 5 ft.of fine silt, 50 ft.of sand and gravel. (Water bearing) 20 ft.of partially cemented conglomerate. (Log of all wells similar).

CO. LAKESIDE FARM PUMPING PLANT.

Located near right bank of San Diego river, about one-half mile N.W.of the town of Lakeside. Designated as No.9 on Map.
Examined July 6-1912. High and low service pumps; direct connected

to a 55 H.P. gas engine. Pumps about 1710 gallons per minute, or a total for the irrigation season of 27,864,000 cu-ft.or 640 Acre-feet. Water supply from six drive wells from 48 to 83 ft. in depth. Log of Well No.IV located in the high water channel,7-1/2 ft.of fine silt. 70 ft.of coarse water bearing sand

4-1/2 " of yellow gravel

1-1/2 " of decomposed granite material

83-1/2 " total depth of well.

JOHN H.GAY'S PUMPING PLANT.

Located near Left Bank of the San Diego River, about one and one-half miles above Lakeside. Designated as No.3 on Map. Examined July 6,1912. A 35 H.P. gas engine; belt connected to an 8-inch centrifugal pump. Pumps 1575 gallons per minute or 2,268,000 gallons per day. Water supply four 12-inch dia.drive wells about 50 ft.in depth. There are several other pumping plants located up and down the river, but the above actual tests show that there is a large underground reservoir that will yield an unfailing supply.

Granite rock is the only exposure for many miles east of Lakeside. The three Cuyamaca Peaks are a dark basic rock ranging from fine to a coarse texture. The geological formation of the San Diego River and its branches may be described as follows: The higher mountains are formed of ancient crystalline schists and massive rock. Lower down eruptive rock has been intruded. The region bordering on the Coast consists of conglomerate deposits of unknown depth. The intrusions, foldings, and uplifts have formed spurs and knobs; and these changes in the earth's surface in turn have formed valleys and trough-like depressions into and through which the modern river has cut its way in its flow to the ocean. The denuding and erosion of the hills and the detritus brought down

by the river during the floods, have filled these depressions to a greater or less depth with silt, sand, gravel and boulders, and formed underground storage reservoirs. These reservoirs conserve the waters in the rainy season and equalize the flow throughout the year. These underground reservoirs, together with the surface runoff of the watershed, forms your water supply.

I have divided these underground basins as follows:

T A B L E N O. 1.

NAME	LOCATION	DRAINAGE.
El Cajon Basin	Mission Dam to Riverview	57 sq-mi.
Lakeside "	Riverview to U.S.GAUGE STA.	11[illegible] " "
Monte "	U.S.GAUGE STA.to MONTE	425 "
Cape Horn "	Monte to Cape Horn	7.50 "
Capitan Grande	Cape Horn to El Capitan Dam	5.2[illegible] "

SUPERFICIAL AREA OF POROUS MATERIAL AND ESTIMATED DEPTH.

NAME	AREA ACRES	ESTIMATED DEPTH IN FT.	POROSITY OF MATERIAL PER CENT.
Lakeside Basin	1150	50 to 80	30
Monte "	425	40 to 100	33
Cape Horn "	880	60 to 120	33
Capitan Grande	150	40 to 70	33

The above table gives you the location and drainage area of the basins from Riverview contraction to the proposed El Capitan Dam Site, a total of 128 square-miles of direct watershed. The 2d section of the table gives you the superficial area and approximate depth of the loose porous material as determined by thw wells sunk on various parts of the basins. Added to this is the underground storage in the less porous material adjacent to the same.

T A B L E NO. II.

R A T I N G T A B L E

COMPILED FROM 21 YEAR PERIOD. AVERAGE PRECIPITATION AND RUNOFF.

PERIOD FROM 1893-94 to 1913-14, Incl.

San Diego River Drainage Area	Area Sq-mi.	Mean Annual Precipitation Ins.	Mean Annual Precipitation Ac.Ft.	Mean Annual Total Ac.-Ft.	Runoff per Sq.Mi. Ac.ft.
Drain Basin above the Cuyamaca Dam	12	36.2	23,168	4,110	342.5
Cuyamaca Dam to Diverting Dam	92	25.0	122,417	12,144	132.0
DIVERTING DAM to El Capitan Dam Site	87	19.5	90,480	6,824	78.4
	191				
El Capitan Dam Site to U.S. Gauging Station	17	18.0	16,320	1,292	76.0
U.S.Gauging Sta. to Old Mission Dam	168	12.5	112,000	6,216	37.0
	376		364,385	30,586	

T A B L E N O. III.

SURFACE RUNOFF OF THE SAN DIEGO RIVER
FOR THE 191 SQUARE MILES
ABOVE EL CAPITAN DAM SITE.

VALUES ARE IN ACRE FEET.

Season.	Above the Cuyamaca Dam Area 12 Sq.Mi.	Cuyamaca to Diverting Dam Area 92 Sq.Mi.	Diverting to El Capitan Dam Area 87 Sq.Mi.	Seasonal Sum Total 191 Sq.Mi.
1893-94	2,563	11,640	6,518	20,721
94-95	11,269	28,820	16,139	56,238
95-96	2,152	3,850	2,156	8,158
96-97	4,216	14,650	8,204	27,070
97-98	834	3,840	2,150	6,824
98-99	472	1,033	578	2,083
99-00	260	655	367	1,282
1900-01	3,031	4,360	2,442	9,833
01-02	2,351	4,555	2,551	9,457
02-03	2,516	8,375	4,690	15,581
03-04	492	986	552	2,030
04-05	6,531	22,065	12,356	41,252
05-06	12,780	33,390	18,698	64,868
06-07	9,259	29,945	16,769	55,973
07-08	3,201	12,632	7,074	22,907
08-09	7,171	20,760	11,625	39,556
09-10	5,134	13,630	7,633	26,397
10-11	2,765	10,324	5,782	18,871
11-12	3,520	13,336	7,468	24,324
12-13	2,982	5,476	3,066	11,524
13-14	2,505	10,700	6,492	19,697
Sum Total	86,315	255,024	143,310	484,649
Average per Season	4,110	12,144	6,824	23,078.5
Mean per Square Mile	342.5	132.0	78.4	120.8

NOTE:
One acre-foot equals 325,850 gallons.

Table II on Page 8 gives you the mean annual rainfall at specified locations, also the mean annual runoff in acre-feet and acre-feet per square mile. This Data is compiled from records taken at Cuyamaca Dam, Diverting Dam, U.S.Gauging Sta. and other sources.

Table III on Page 9, is the surface runoff from the 191 square miles above the proposed El Capitan Dam Site (which may never be built) and is compiled from reliable and actual measurements.

4,100Acre-feet = 1,338,243,500 gallons per year
12,144 " " = 3,957,122,400 " " "
6,824 " " = 2,223,600,400 " "" "
23,078 " " = 7,519,956,300 " " "

(NOTE) One Acre-foot = 325,850 gallons.

The present total annual requirements of the Cuyamaca Water Company is 7600 Acre-Feet or 2,476,460,000 gallons.

Average Annual surface runoff for 191 sq.mi.is:

23,078 Ac.Ft.or 7,519,956,300 gallons.

Annual requirements of Cuyamaca Company is:	7,600	" " "	2,476,460,000 "
Balance available below	15,478	" " "	5,043,496,300 "

The surplus surface runoff of the 191 sq.mi.of watershed above the proposed El Capitan Reservoir can be utilized to fill the underground reservoirs to the Riverview contraction and below the Mission Dam and so on to the Ocean.

The accompanying Maps show the topography and general details embodied in this report.

APPROXIMATE GRADE OF BED OF SAN DIEGO RIVER.

Elevation in feet, Datum, Mean Sea Level, Distance in Miles.

LOCATION.	ELEVATION RIVER BED	DISTANCE MILES.	GRADE Ft.per Mi.
Bridge at Old Town	6	0	
E.Line Pueblo Lands	44	4.4	8.6
Loop Dam Site	182	7.3	19.0
Old Mission Dam	275	1.6	58.1
Riverview Contraction	368	5.7	16.3
Lakeside Gauging Sta.	408	3.1	13.0
Monte Contraction	440	1.3	24.6
Cape Horn Point	530	3.5	25.7
El Capitan Dam Site	605	2.5	30.0
Mouth South Fork	635	1.75	17.1
Diverting Dam	800	6.50	10.0

Total Bridge to Diverting Dam - 37.65 miles.

C O N C L U S I O N

You have asked me to submit a report as to what in my judgment is a safe net yield from a pumping plant located at or near your present site, for the purpose of supplying water to the City of San Diego. There are several conditions to be taken into consideration.

FIRST:- A domestic and municipal water system calls for a continuous supply, under any ordinary conditions.

SECOND: The vested and acquired rights along the river for the domestic and irrigation use must be allowed for. From 25 to 50 per cent. of the water used onthe valley lands is return or seepage water for use on the stream farther down or below.

THIRD: During periods of extended drouth the plane of saturation becomes lowered and the water bearing material becomes depleted by continuous pumping.

FOURTH: Some years the water in the river channel flows on the surface the entire year. Other years for only a few months. For the wet years an additional supply could be used locally when the water is running to waste.

In my judgment, by increasing your pumping facilities you can furnish the city of San Diego 7.5 million gallons per day for the full period.

7.5 million gallons per day equals 2,737,500,000 gallons per year. On this quantity the gross revenue per year at 6 cts. per 1000 gallons delivered would be $164,250.00.

The 7.5 million gallons per day is based on the recurrence of an extraordinary dry period as shown in Table No.III page 9, from 1897-98 to 1903-04 inclusive. If this period had been normal then a daily supply of 10 million gallons oz 3,650,000,000 gallons per year from the locality of your present pumping plant would have been feasible.

As I have previously stated, I have been familiar with the San Diego River since 1886, and have made a special study of this and other streams in Southern California. My information is based on personal examination and actual tests, and I am willing to assert that if you have not a good reliable proposition that will stand the test of expert examination, I do not know who has.

My opinion is based on so much detail and examination at different periods, that it is possible to embody only a small portion of such detail work in this report.

Respectfully submitted,

C S Alverson

San Diego, California. Civil and Hydraulic Engineer.

September 30th, 1916.

Ed Fletcher Papers

1870-1955

MSS.81

Box: 35 Folder: 32

Business Records - Reports - Alverson, C.S - Report: J.J. Johnson Water System on the San Diego River