3-26-19

MORENA RESERVOIR - HYDROGRAPHY

Data from "Capacity & Flooded Area Curve of Morena Reservoir" Compiled from data on file in Department of Water, June, 1916. Approved by George Cromwell. Evaporation from R. Wueste.

Depth Gauge Height Feet	Storage Capacity Million Gallons	Storage Capacity Acre Feet	Area of Water Surface Acres	Seasonal Evaporation Acre Feet
10	1.4	4.3	0.68	3.85
20	4.3	13.2	4.38	24.79
30	33.6	103.2	11.24	63.62
40	81.4	249.9	21.65	122.54
50	182.0	558.7	38.42	217.46
60	351.4	1078.8	72.54	410.58
70	660.9	2029.0	111.16	629.17
80	1080.4	5316.8	152.31	862.07
90	1690.5	5189.8	225.05	1273.78
100	2557.6	7851.8	303.94	1720.30
110	3736.1	11469.8	437.62	2476.93
120	5473.9	16804.9	623.57	3529.41
130	7854.6	24113.6	850.08	4811.45
140	11094.4	34059.8	1137.26	6436.89
150	15226.9	46746.6	1370.65	7757.88

Note: Elevation Outlet - 33.5 gauge height, at which height reservoir holds 41.5 M.G. or 127.4 A.F.

Fixed Spillway - Gauge 146.0', at which reservoir holds 13028 M.G. - 39,996.0 A.F. Stop plank can be placed to gauge 148.5' giving a maximum storage of 13848 M.G. - 42513.4 A.F.

RUNOFF OBSERVED AND RESTORED AT THE VARIOUS IMPOUNDING RESERVOIRS OF THE WATER SYSTEM OF THE CITY OF SAN DIEGO.

Quantities in Acre Feet.

Season	Morena Reservoir	Barrett Reservoir	Lower Otay Res'r
1887-88	4771	5018	1802
1888-89	7640	8036	2885
1889-90	12248	12883	4625
1890-91	12785	13448	4828
1891-92	6297	6623	2378
1892-93	7053	7419	2663
1893-94	3908	4111	1422
1894-95	26511	27885	10011
1895-96	1626	1710	205
1896-97	6340	6668	2393
1897-98	947	996	0
1898-99	456	480	0
1899-00	305	321	0
1900-01	2018	2123	744
1901-02	2068	2175	465
1902-03	4201	4419	1209
1903-04	320	337	47
1904-05	11053	11626	2791
1905-06	16050	16882	7801
1906-07	14651	15411	5279
1907-08	6065	6379	1438
1908-09	9759	10264	5148
1909-10	6752	7102	3443
1910-11	1844	5110	1900
1911-12	2960	6600	854
1912-13	773	3040	304
1913-14	3400	4579	2106
1914-15	14210	11040	10340
1915-16	72695	53499	38198
1916-17	14476	9523	3739
1917-18	10637	6227	2500
1918-19	4969	4489	154
1919-20	12507	18600	1163
1920-21	4227	2962	357
1921-22	44433	55282	28409
Mean	7175	7548	2645

The above means are without the flood season of 1915-16.

THE CONSTRUCTION OF THE SWEETWATER DAM,

By JAMES D. SCHUYLER, M. Am. Soc. C.E.

Read October 17th, 1888
Vol. XIX - November 1888

Synoposis taken from the
above reference

Page 202:

The circumstances which led to the building of the dam were that the San Diego Land and Town Company (a first cousin of the A. T. & S. F. Ry) owned a large body of fertile and desirable mesa and valley lands bordering on San Diego Bay, adjacent to San Diego on the south, which were unsalable without water to irrigate them. These lands constitute the greater part of the "Rancho de la Nacion," including the town site of National City, which also languished with thirst. The Sweetwater River passes nearly through the center of the lands, and is of the nature described - intermittent in flow, at least for many miles above its mouth.

Page 203

The construction of this dam was decided upon and work begun in November, 1886. The original plan designed was a narrow wall of concrete masonry, 50 feet high, 10 feet wide at bottom, 3 feet on top, arched up stream. On the upper side an embankment of loose earth was to be filled in against the masonry wall to its full height, After two months' work had developed the character of the design, the plan was disapproved by the management, and the writer was called upon to design a suitable structure and execute its construction. Some thirty-five thousand dollars had already been expeneded, and in order to utilize as much of the old work as possible, the new structure was planned to rest upon and encase the foundations already laid. This decision influenced to some extent the radius of the arch of the new dam, as well as its position on the sides. In other words, to avoid throwing away the work already done, the new work was adapted to the old in a way that ultimately increased the length of the dam on the crest somewhat more than would have been necessary by shifting the point of radius to one side of the central axis of the canon, and making the radius somewhat shorter than it otherwise would have been. An engineer is sometimes driven to adaptations of this sort against his judgment to save, or to give the appearance of saving, the pockets of his employers.

The modifications of the original plan were radical ones. The combination of earth and masonry was rejected, as it seemed to the writer that water alone was sufficiently heavey for the masonry wall to support without adding the last straw on the camel's back, of a mass of saturated earth. Agravity profile was adoped, and rubble masonry formed of blocks of stone up to four tons weight, was substituted for bastard concrete composed of cement mortar, with small stonew rammed into it, which had been previously used. So much of the old plan was retained, however, as to form an embankment 50 feet wide on top, 10 to 15 feet high across the canon, against the face of the

Page 203 continued:

wall, but clay, well rammed in layers, was substituted for the silt and quicksand loosely dumped, with which the dam was formerly being made. The object of this clay-filling was to cut off possible seams in the bed rock underneath the dam, and reduce the pressure on the structure. The top of the embankment is 70 feet below the top of the dam.

Page 204: THE FOUNDATION After the bowlders, sand and gravel had been stripped from the base of the dam on either side of the old work, the bed rock was found to be very irregular in surface, presenting the appearnace of a number of pyramids and cones thrown heterogeneously together, but bound solidly in one mass, and well polished by attrition. The rock was very close in texture and exceedingly hard. No attempt was made to cut out the bed in levelbenches, as the unevenness of the bottom, as nature left it, gave the assurance that whatever movement might occur in the structure built on such a base, there could be no possibility of its slipping or sliding on the base. Wherever there were seams in the rock they were invariably occupied by roots, and the excavation was carried down till the seams pinched out and the roots disappeared. The rock was then thoroughly scrubbed by hand, and a thin grout of pure cement applied with brooms, filling the minutest crevices and angles in the rock, before starting the masonry.

The side walls of the canon required more excavation to reach a satisfactory anchorage than the bottom. The north side was composed of shattered rock scored with innumerable seams, filled with red clay. In this material the excavation was carried to a depth (perpendicular to the slope) of 20 to 25 feet, before a solid ledge, free from seams, was encountered. This ledge lay with a slope nearly parallel with the surface slope, and in direction so nearly parallel to the radial line of the curve of the dam, that it could not have been better placed to receive the arch thrust, and formed a natural skewback. This was carefully stripped and treated with cement grout in the same manner as the base.

The abutment on the south side was against the end of a dyke of trap rock, crossing over the hills to the south in a direction nearly parallel to a line passing through the center of radius, and dipping westward at an angle of about 10 degrees from the vertical. After cutting into the face of this rock 5 to 10 feet, all seamy, loose material w was stripped away, and a bedding that was deemed sufficiently good was obtained, although the rock was not as free from seams nor as solid in mass as the north abutment. However, the entire foundation is an admirable one, of rock in place throughout.

Page 205: THE PLAN- The original height of 50 feet was arbitrarily adoped at the beginning of the work, without any special investigation of the quantity of water to be stored by a dam of that height, but was "guessed" to be sufficient for present necessities, and the estimate of its cost was considered to be about the limit of the expenditure the company cared to make on any experimental scheme. There was an immediate and pressing need for water, the rainy season was [redacted] passing, and it was desired to get up a part of the structure as rapidly as possible in order to catch a partial supply for the coming summer. Accordingly, in compliance with this desire, the foundation was rapidly laid and the structure hurriedly carried up to a point where it was safe to begin catchment. The base of the dam was laid with a width of 36 feet, and at a height of about 15 feet above the

Page 205 continued:

lowest course, it was drawn into a thickness of 24 feet. At this level (whose elevation above tide is 140 feet) the lowest pipes pass through the dam. Above this level the structure was carried to a height of 45 feet, with a top width of 5 feet, base as stated of 24 feet, face batter (upstream) of 1 to 6. In anticipation of a probable addition to the height of the dam in future, the back was built in three steps, to give an opportunity of bonding the new work to the old. The profile of this upper portion of the structure is shown in Plate XXX. It was a gravity profile, whose line of pressure passed within the inner third of the base. It was constructed in arch form, convex to the stream, on a radius of 225 feet on the face line at top.

During construction the stream was carried in a conduit 30 inches square through the masonry near the bottom of the original creek bed. But one storm of the season of 1886-87 (a dry one) swelled the creek sufficiently to exceed the capacity of this conduit, and then it rose and ran over the top of the masonry for two days only, without injury. This occurred February 14th and 15th,1887, when the flow reached a maximum of about 500 cubic feet per second. The gate at the upper end of the conduit was finally closed April 20th, 1887, and the conduit was filled sold with masonry from below. From that time until June 1st, the catchment was about 80,000,000 gallons.

By the 1st of June the structure, as planned, was completed to the height of 60 feet above the bottom, 10 feet higher than theheight originally contemplated. It contained about 7,500 cubic yards of masonry and had cost all told (including the preliminary experiments) about $100,000. Meantime, surveys of the reservoir basin and watershed had developed the fact that the 60-foot dam would impound 1,221 million gallons, whereas, its extension to 90 feet in height would give a capacity of nearly five times that quantity, or 5,882 million gallons. Also that the area of the watershed tributary to the dam is about 186 square miles, of which one-third is above an elevation of 3000 feet, and between that elevation and 6,500 feet. The watershed was evidently ample to justify the hope that the greater reservoir would be filled almost every year of ordinary rainfall. The increased volume of water stored would so largely extend the utility of the works, and give so considerable increase in security against the disasters following a sever drouth, that the increased expense of extending the height of the dam while the working force and plant were on the ground and fully organized, seemed to be immediately justifiable. These arguments were embodied in a report, which was favorably considered by the directors of the company, and orders were given, about a fortnight before the 60-foot dam was completed, to extend the structure to a height of 90 feet.

Page 208 In all the later portion of the work, from May 1st, till its final completion, the mortar was mixed in a machine invted and patented by Mr. E. L. Ransome of San Francisco, consisting of a cubical dice-box suspended on bearings attached at two corners diagonally opposite, through the center of which passed a perforated tube for injecting water, the box being revolved by horse-power. The ordinary charge was three barrels of sand and one barrel of cement, which was dumped into a hopper from a platform above the mixer, and admitted into the box through a door. The box was generally given three or four revolutions after charging with sand and cement before the water,

Page 208 continued:

was admitted. A cock from a small tank regulated the flow of water, which was turned in slowly, the whole supply required being admitted in the next three or four revolutions. Eight to ten revolutions were sufficient to thoroughly mix the mortar, requiring two to three minutes in all.

Page 209: All the hoisting was done with horse-power. This was frequently criticised as questionable economy, but taking into consideration the scarcity and high price of fuel, the cost of the number of hoisting engines that would have been required, the delays occasioned by breakage, the skilled labor required to do the work, etc., the advantage in cost and convenience was one the side of animal power.

Page 210: The total volume of masonry laid was as follows:

In the dam proper	19,269.0	cubic yards
" " wasteway	481.2	"
" " inlet tower	376.8	"
" " conduit from dam to tower	182.0	"
" " gate houses	71.0	"
In various accessories	127.0	"
Total	20,507.00	

In this work 17,562 barrels of cement were used, an average of 1.17 cubic yards, of masonry per barrel of cement.

The total cost of the dam was $234,074.11, distributed as follows:

Plant - Tools, etc.			$6,236.76
Materials - Cement	$63,111.03		
Cement hauling	8,614.18		
Lumber	2,408.08		
Iron work	4,915.99		
Pipes, gates, etc.	5,152.58		
Miscellaneous materials, powder, etc.	3,229.84		
			87,431.70
Labor - Common and skilled labor	$93,590.55		
Foreman	8,866.49		
Teams	19,696.12		
Enginering, salaries and expenses	10,555.20		
Clerical work	853.88		
Earth work (contract)	7,666.51		
Miscellaneous expense	1,376.90		140,405.65
Total			$234,074.11

The cost of the flowage tract for the reservoir is not included in the above. A little over one-half the land cost $16,426.93. The remainder is in litigation under an action of codemnation. A San Diego

Page 210 continued:

jury under the stimulus of "boom" prices awarded the owner $280 an acre, or a little over $100,000 for land, one-third of which was worthless, and the remainder unimproved. This judgment is being contested before the Supreme Court. The clearing and grubbing of about three hundred acres of the resercoir basin cost $10,808.46.

Page 211: THE WASTEWAY;- This important adjunct to the dam was carefully considered and proportioned to carry the probable maximum flow of the stream that may be presented for discharge, with a full reservoir. It is located at the south end of the structure, and is 40 feet in length by 5 feet in depth, divided into eight bays of 5 feet each. These bays are formed by piers of masonry, set at right angles to the flow, and provided with recesses on the upper face, in which loose flash-boards of 2 inch plank rest on an incline of 35 degrees from the vertical. Any set of boards may be removed from top to bottom, or the water may be held at successive levels from the top to the bottom of the weir by removing the top boards all the way across. The water falling over the weir drops into a series of pools, 3 feet deep, which relieve the structu e of shock, and passes down an inclined plane with a fall of 1 to 10, until it is carried away from the dam a distance of 50 feet, and then plunges into the canon below. The capacity of the wasteway is about 1500 cubic feet per second. This may be increased to about 1800 cubic feet per second by opening a 30-inch blow off gate in the main pipe below the dam.

Page 213 THE RESERVOIR:- Red clay soil constitutes the bed of the reservoir basin, or the major portion, outside of the old river bed and bottoms, and is of an impervious nature. The following table of area and contents of reservoir is presented:

Contour elevation	Area in acres	Contents Gallons
145 feet (level of lowest outlet valve in tower)	3.51	11,640.000
150	10.72	30,577,000
155	17.12	79,631,000
160	43.10	175,819,000
165	75.21	329,546,000
170	113.40	547,068,000
175	153.75	835,851,000
180	200.77	1,221,355,000
185	272.22	1,710,538,000
190	326.96	2,302,261,000
195	397.85	3,005,642,000
200	463.80	3,824,197,000
205	538.94	4,778,549,000
210	630.94	5,882,278,000
215	721.86	

PRICE OF LABOR: Masons were paid $ to $5 per day; common labor, $2 to $2.50; foremen 4 to $6; carpenters $3.50 to $4; blacksmiths $4; teams, including driver, $5; machinsts, eight cents to $1 per hour.

Page 214 continued:

The work was done in the midst of the "boom" in Southern California, when labor of all kinds was difficult to obtain, independent and restless on account of the general feverish excitement, and inclined to pick up and at any moment and move on in search of better pay. All classes of supplies, tools and materials were correspondingly higher than the ordinary prices. These conditions increased the cost of the work twenty to twenty-five per cent, above the normal.

There hasbeen no lack of wiseacres who predicted the failure of the enterprise as a permanent irrigation scheme; and some of the mostintelligent citizens of the country criticised the location of thereservoir so near the mouth of the stream, on account of its presumed liability to obliteration as a reservoir by reasons of the deposit of sand and silt. A careful examination of the water of the stream at flood time, when it was most heavily charged with sediment, convinced the writer that fears of this nature were groundless. An estimate made, within reasonable limits, indicated on e thousand years as the time when it might be expected to fill. Samples taken by the State Engineering Department of California of the water of the Yuba, Bear, and American Rivers, immediately below the hydraulic mines, yielded an average of only about one half of one per cent of sediment. Were the Sweetwater as heavily charged, it might fill the reservoir basin in one to two hundred years, but the voids would still contain a considerable volume of water that would drain out and be available, and the utility of the reservoir would not be destroyed if it were entirely filled with sand.

THE DISTRIBUTING SYSTEM: From the dam to the lower end of the canon 1,600 feet, the main pipe is 36 inches in diameter, and covered with masonry laid in lime mortar, plasted with cement. From this point it is reduced to 30 inches diameter, and follows the valley for 5 miles, and thence rises to the top of the Chula Vista Mesa 92 feet above sea level. Its entire length is 29,800 feet, and at its terminus the water is divided into two 24 inch pipes, one running south 1 mile, the other west half a mile, where it is reduced to 18 inches diameter, and is carried northward to and through National City.

At the terminus of the 36-inch main a blow off gate is located, to be used as a relief to the wasteway of the dam in case of a sudden flood whihch mich exceed the capacity of the wasteway, or to draw off the water from the reservoir, if, for any cause, it was desired to do so.

Wrought iron pipes were used throughout. The total length of mains and laterals that have been laid is 58 miles, with 5½ miles n hand to e laid this season. They are of three clases, viz., straight double riveted pipe, manufuacted and laid by the Risdon Iron Works, San Francisco; converse lock joint, kalamined lapwh welded tube, made by the National Tube Works of McKeesport, Pa; and spiral rivted pipe made by the AbendrothRoot Manufacturing Company, New York, About 16 per cent of the pipe was of the first class, 72 percent of the second, and 12 per cent of the third. The length and diameter of each class furnished was as follows:

page 214 continued

RISDON IRON WORKS, SANFRANCISCO

Wrought iron straight riveted	36	inches diameter	1,594 feet
	30	"	
	24	"	28,213
	18	"	2,034
			16,468

NATIONAL TUBE WORKS

KAlamined tube	12	inches diameter	25,903 feet
	8	"	7,620 ~~[illegible]~~
	6	"	132,333
	4	"	50,745

ABENDROTH, ROOT & COMPANY

Spiral steel and iron	24	inches diameter	5,950, feet
	12	"	10,029 "
	8	"	4,020
	6	"	17,870
		Total	302,779

The introduction of spiral pipe into the system was unfortunate as it does not stand the test of transportation across the continent, and will have to be taken up and specially treated to make it water right. It will answer very well for sub-irrigation, if it could be properly controlled, byt as it is laid in streets and avenues that system is not desirable or conducive to comfort in traveling/

The total cost of the pipe line was as follows:

Pipe	$301,928.80 x~~$~~
Freight	39,183.03
Distribution	6,271.06
Gates	1,849.62
Materials, tools etc.	5,932.57
Right of way and miscellaneous expenses	2,968.00
Pipe laying	144,630.78
Total	502,763.86

PROBABLE DUTY OF THE WORKS:- One of the most interesting questions to the to the Stockholders of the Company is the result that may be reasonably expected in the way of irrigation from such a reservoir. The assumption is made that in average years, say three out of five, the watershedwill yield a sufficient supply to fill the reservoir, besides maintaining the consumption through the rainy season, thus starting on the irrigation season about May 1st with a full reservoir. From May 1st to Octobee 1st is the average season of irrigation - about one hundred and fifty days. Where pipe distribution is in use, a fair average allowance in Southern California is a duty of ten acres per miner's inch (five hundred acres per cubic coot per second). There are instances of a much hi her duty having been attained- a duty of even forty acres per miner's inch having been accomplished in one place. Alotting 700,000,000 gallons for the annual consumption of National City, and for

Page 214 continued:

loss by evaporation during the summer months, the remainder would yield a flow of 2000 miners' inches per day for two hundred days; with a duty of ten acres per inch, this amount would irrigate 20,000 acres. In the course of time it is expected that a duty as hig h as twenty acres per inch will be reached, in which event, a reservoir full may be extended over two years' time, and still irrigate 20,000 acres, and afford a domestic supply to the town of Natonal City.

Water rights, giving to the purchaser simply the privilege of becoming a customer forwater have been sold on the San Diego Flume Company flume at the ra e of $2000 per miners' inch. At this rate the value of the irrigation supply of the reservoir is $4,000,000. The construction of the works has already added a value of $1,500,000 to the principal tract of five thousand acres which has been supplied with a complete system of water pipes, and another million to the value of town property in National City, and ands in its immediate vicinity.

Run off at Sweetwater Dam

1913-14 55.5 Ac. Ft.

July 1st 1914 to March 5th 1915 13030 Ac. Ft.

Phoned by Creel March 19th 1915.

Gage Heights

Sweetwater

	Gage	Capacity
Feb 1	39.8	
Feb. 3	40.0	625,000,000 Gals

"The Sun.

C. W. CO. ~~Corr~~ Engr. Data

FILE

9~~2~~ 8th St.
San Diego, Cal.
June 8th, 1913.

Mr. Ed. Fletcher,
San Diego, Cal.
Dear Sir:

Referring again to the Sweetwater statement of water cost:

I have given the mean runoff as 12,841 acre-ft or or 885 Min. Inches

Covert has just given me the following:

Safe net yield, using 4ft evaporation per year (Covert)
6100 acre ft or 420 Min. Inches

" " " using 5ft evaporation per year (Lee preferred)
4900 acre-ft or 338 Min. Inches.

Appraised Valuation , Covert,as presented to R.R. Commission
$ 1,400,000

Corresponding cost per Miner's Inch = $4140.

Very sincerely yours,

March 12, 1914.

Mr. Rufus Choate,
San Diego, Cal.

My dear Mr Choate:

Kindly get a $5. hat at Marstons or Benboughs and charge to me. Yours for the good of the cause. "Nuff sed."

FK

B. P. CHENEY, President
C. D. LANNING, Vice-President and Treasurer
95 MILK STREET, BOSTON, MASS.

OFFICES
NATIONAL CITY, CALIFORNIA
SAN DIEGO, CALIFORNIA
307-308 UNION BLDG.

JOHN E. BOAL, General Manager
JOHN GOULD, Assistant Treasurer
F. S. JENNINGS, Counsel

SWEETWATER WATER COMPANY

OWNERS OF SWEETWATER DAM AND DISTRIBUTING SYSTEM

NATIONAL CITY, CALIFORNIA,

March 9, 1914.

Mr. Ed. Fletcher,
San Diego,
California.

My dear Friend & Neighbor:-

Mr. Rufus Choate called me up a day or two ago and asked that I furnish you some information as to the amount of water we have received this season and the amount that is now flowing into the reservoir.

Our total gain to March 8th has been 9-1/3 feet or expressed in gallons 931,413,000. In the last week we received 203 acre feet which roughly speaking would be 66,000,000 gallons, an average of something like 9450000 gallons per day.

As Mr. Choats seemed to inquire particularly for the flow during Thursday I find that the report showed an increase of seven hundredths of a foot, or 7,548,000 gallons for the twenty-four hours.

If this does not answer your inquiry fully please advise and I will endeavor to amplify it.

I am,

Yours very truly,

John E Boal

General Manager.

B. P. CHENEY, President
C. D. LANNING, Vice-President and Treasurer
95 MILK STREET, BOSTON, MASS.

OFFICES
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F. S. JENNINGS, Counsel

SWEETWATER WATER COMPANY

OWNERS OF SWEETWATER DAM AND DISTRIBUTING SYSTEM

SAN DIEGO, CALIFORNIA. May 20th, 1914.

Mr. Ed. Fletcher,

#920 Eighth Street,

City.

Dear Sir;-

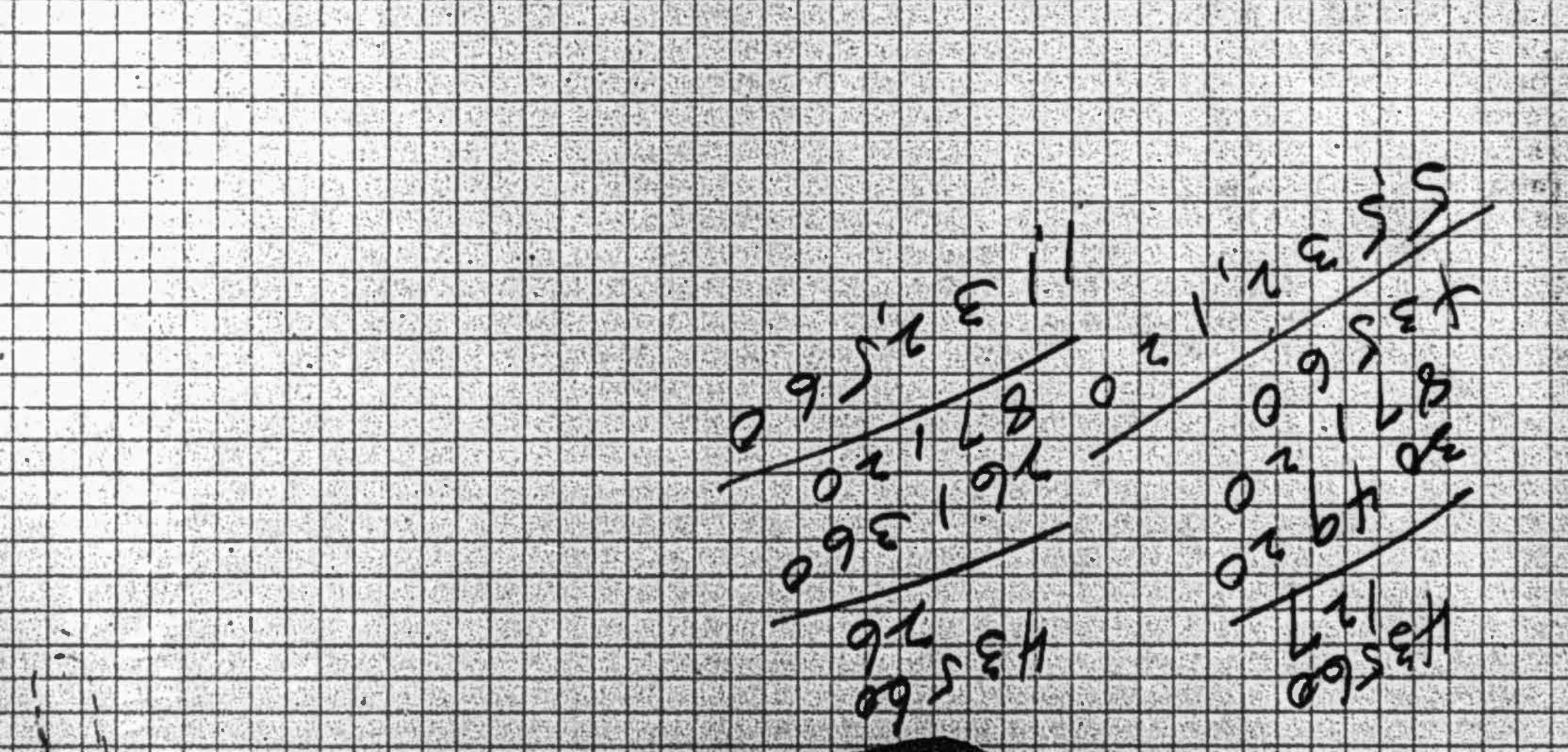
Your inquiry of the 19th received. The lowest part of the spillway of the Sweetwater Dam is approximately 22 inches below the top of the storage section, and up to that point would hold about 10,300,000,000 gallons and would cover about 1025 acres of land.

Very truly yours,

John E Boal

General Manager.

JEB/E



146 204 113

154,916,213 Irrig — 8,712,100 Indians = 146,204,113

154,916,213

13,883,744 Dom —

68,245,090 City, —

237,045,027

Sweetwater Water Company

Summary of Monthly Use of Water
by
John F. Covert

Millions of Gallons.

Month	1910	1911	1912	1913	1914	1915	1916	Monthly Average	Monthly Percent
Jan.	3.3	7.8	6.5	39.0	10.8	11.7	11.5	12.9	1.03
Feb.	15.3	4.9	75.4	15.3	10.4	8.0	8.5	19.7	1.47
Mar.	49.0	5.2	55.7	27.0	32.3	15.7	17.8	29.0	2.17
Apr.	106.0	144.0	8.5	92.6	96.8	90.0	43.0	83.0	6.22
May	192.0	204.5	63.0	200.0	131.8	70.8	151.0	144.7	10.83
June	198.4	194.0	218.0	158.0	186.0	243.0	165.8	194.5	14.56
July	193.0	194.0	198.0	171.0	196.1	209.0	147.0	187.1	13.98
Aug.	195.0	221.3	223.8	189.0	202.2	240.8	194.5	209.1	15.64
Sept.	189.5	195.0	192.0	179.3	188.0	195.0	151.4	184.5	13.78
Oct.	81.5	147.0	145.0	139.8	104.2	193.5	92.0	129.0	9.65
Nov.	52.0	104.3	131.0	64.6	65.8	69.5	101.0	84.2	6.30
Dec.	75.0	60.0	113.1	26.4	18.6	38.0	76.5	58.3	4.37
Totals	1350.0	1482.0	1430.0	1302.0	1243.0	1385.0	1160.0	1336.0	100.00
Percent Metered	95.6	94.9	93.6	91.8	92.6	93.2	95.8	93.9	

Note:- The above is the monthly water use on the Sweetwater System for the past seven years and represents the actual demand on the system, - everybody apparently receiving a full supply during the entire period.

(Signed) John F. Covert

SWEETWATER WATER COMPANY

SUMMARY OF MONTHLY USE OF WATER -- ACRE FEET

MONTH	1910	1911	1912	1913	1914	1915	1916	MONTHLY AVERAGE	MONTHLY PERCENT.
Jan.	10	24	20	119	33	36	35.3	39.7	1.03
Feb.	47	15	231	47	32	25	26.2	60.4	1.47
March	151	16	171	83	99	48	54.6	88.9	2.17
April	325	441	26	284	297	276	132.3	254.4	6.22
May	589	627	193	614	404	217	463.7	443.9	10.83
June	608	594	668	485	570	745	508.0	596.9	14.56
July	593	594	607	525	602	642	450.5	573.3	13.98
Aug.	598	679	686	581	620	738	596.7	641.2	15.64
Sept.	581	598	588	550	577	598	465.6	565.3	13.78
Oct.	250	451	444	428	320	593	282.4	395.5	9.65
Nov.	160	320	402	198	202	213	311.7	258.1	6.30
Dec.	231	184	347	81	57	117	234.8	178.8	4.37
TOTALS	4143	4543	4383	3995	3813	4248	3551.8	4096.4	100.00
% METERED	95.6	94.9	93.6	91.8	92.6	93.2	95.8	93.9	

3-6-17 JFC-J

August 14, 1917.

Mr. Ellis:

Please see me in relation to this. Can you figure this out in million gallons of water, so that I can get an idea of what the total use of water is on the Sweetwater system?

Ed Fletcher.

F-S

Succotash Water Company.

Summary of Monthly Use of Water — Million Gallons.

Month	1910	1911	1912	1913	1914	1915	1916	monthly average	monthly percent
Jan	3.3	2.8	6.5	39	10.8	11.7	11.5	12.9	1.03
Feb	15.3	4.9	25.4	15.3	10.4	8.0	8.5	19.7	1.47
Mar	49.0	5.2	55.7	27.0	32.3	15.7	17.8	29.0	2.17
Apr	106.0	144.	8.5	92.6	96.8	90.0	43.0	83.0	6.22
May	192.0	204.5	63.0	200.0	131.8	70.8	151.0	144.7	10.83
June	198.4	194.0	218.0	155.	186.	243.	165.8	194.5	14.56
July	193.0	194.0	198.0	171	196.1	209.0	147.0	187.1	13.98
Aug	195.0	221.3	223.8	189.0	202.2	240.8	194.6	209.1	15.64
Sept	189.5	195	192.0	179.3	188	195	151.4	184.5	13.78
Oct	81.5	147.0	145.0	139.8	104.2	193.5	92.0	129.0	9.65
Nov	52.0	104.3	131.0	64.6	65.8	69.5	101.0	84.2	6.30
Dec.	75.0	60.0	113.1	26.4	18.6	38.0	76.5	58.3	4.37
Totals	1350	1482	1430.0	1302	1243.0	1385.0	1160	1336.0	100.
Percent metered	95.6	94.9	93.6	91.8	92.6	93.2	95.8	93.9	

note: The attached is the monthly water use on the Succotash System for the past seven years and represents the actual demand on the system, & every body apparently receiving a full supply during the entire period

(Signed) John F Comstock

JOHN E. BOAL,
VICE-PRES'T AND GEN'L MGR.
F. S. JENNINGS, COUNSEL
JOHN GOULD, TREASURER

OFFICES
NATIONAL CITY, CALIFORNIA
SAN DIEGO, CALIFORNIA
508-509 UNION BLDG.

SWEETWATER WATER COMPANY

OWNERS OF SWEETWATER DAM AND DISTRIBUTING SYSTEM

Eees

NATIONAL CITY, CALIFORNIA,
August 10, 1917.

Mr. Ed. Fletcher,
920 8th Street,
San Diego, Calif.

Dear Sir:

Enclosed find statement of monthly water use of Sweetwater System for the past seven years. This is the actual demand on the system and apparently everybody received a full supply as we had plenty of water during the entire period.

Very truly yours,

John F. Goold

Chief Engineer.

jfc-j.
encl.

Ed Fletcher Papers

1870-1955

MSS.81

Box: 56 Folder: 1

Business Records - Water Companies - Cuyamaca Water Company - Hydraulics: Sweetwater Water Company