November 27, 1922.

CITY OF SAN DIEGO, CALIFORNIA
ADDITIONAL WATER SUPPLY
SAN DIEGO RIVER RESOURCES.

H. N. Savage
Hydraulic Engineer.

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CITY OF SAN DIEGO, CALIFORNIA

ADDITIONAL WATER SUPPLY

SAN DIEGO RIVER RESOURCES.

H. N. Savage
Hydraulic Engineer.

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PART I

SAN DIEGO RIVER WATER RESOURCES.

San Diego, California,
November 27, 1922.

To the Honorable, The Mayor,
The Common Council and
The Board of Water Commissioners of
The City of San Diego, California.

Subject: Additional Municipal Water Supply, San Diego River Resources, Conclusions, Recommendations.

The following report is herewith submitted in compliance with the requirements of the Board of Water Commissioners' Resolution 111, date Aug. 11, 1921:

"BE IT RESOLVED By the Board of Water Commissioners of The City of San Diego, that the Hydraulic Engineer be, and he is hereby authorized and directed to receive and assemble available reports and data relative to the water resources of the San Diego River, to analyze same, to make investigations and surveys and perform such other work as may be necessary to amplify this data, to hire such assistance as may be required, and to make a report with recommendations to this Commission."

and with the supplemental requirements of the Common Council's Resolution No.27239, date Jan. 16, 1923:

"That the Hydraulic Engineer be, and he is hereby requested to file with the City Clerk, as supplementary to his 'Progress and Preliminary Report of January 14th, 1922, on the San Diego River Additional Water Supply Sources,' maps and plats showing the areas to be flooded under the various proposed damsites, the list of property owners involved, the approximate cost of acquiring titles, and the plans and specifications covering the construction of such dam as might be recommended by said Hydraulic Engineer.

A comprehensive survey, compilation, analysis and study of the San Diego River Drainage Basin resources has been made in compliance with the foregoing resolutions. The results show that a dam constructed near the head of the Mission Gorge at Site No.2 will impound and makeavailable the economical maximum safe net duty of the San Diego River Drainage Basin runoff at a materially lower unit cost than at any other site on the River, and that the net safe duty of a reservoir at that point on the River will be largely in excess of the net safe duty of the City of San Diego's present impounding system.

Following is a comparative tabulated estimate of the safe net duty of water impounded by a dam at Mission Gorge Site No.2, and the net cost to the City of San Diego of the water carried, filtered and delivered into the Municipal Distribution System by gravity at an elevation that will supply two-thirds of the present total water being consumed in the City of San Diego; also, similarly, the safe net duty and cost to the City of obtaining water by the construction of a dam at Mission Gorge Site No.3, and at the El Capitan Site.

The estimated safe net continuous daily duty of the water which may be conserved and made available for delivery for consumption in the City of San Diego from each projected storage development as set forth in this report is intended to be prominently conservative. It is expected and believed that in operation continuous daily yields materially in excess of those indicated will be realized, particularly from the ultimate reservoir storage capacities which may be found justified. The estimated auxiliary pumping yields may be more than double for periods of a short duration of years.

GRAPHICAL COMPARISON
MISSION GORGE DAMSITES Nos. 2 & 3 & EL CAPITAN

PROJECT	(c) Total Cost	Reservoir Storage Capacity Billion Gallons	Maximum Safe Duty Million Gallons Per Day	Cost Million Gallons Per Day Duty	(d) Unit Cost Per 1000 Gallons
MISSION GORGE No.2.					
1st Development (Diversion) — Cost $947,000.	$947,000.	0.78	(e) 0.0	——	$ 0.56
2nd Development (Storage) — Additional Cost $1,522,000.	2469,000.	28.30	5.0	$494,000.	9.13
3rd Development " — Additional Cost $2,292,000.	4761,000	74.30	10.3	462,000.	8.40
4th Development " — Additional Cost $548,000.	5309,000.	96.00	(f) 12.5	424,000	7.67
Total Development — $5,309,000. — Total Cost; 12.5 Million Gallons — Maximum Safe Duty Per Day; 7.67 — Cost Per 1000. Gallons (Filtered and Delivered)					
MISSION GORGE No.3					
1st Development (Storage) — Cost $3,350,000.	$3,350,000.	8.14	4.5	$743,000.	$ 14.20
2nd Development " — Additional Cost $754,000	4,105,000	14.40	5.7	720,000.	13.38
3rd Development " — Additional Cost $4,995,000.	9,099,000.	90.20	(f) 13.5	673,000	11.76
Total Development — $9,099,000. — Total Cost; 13.5 Million Gallons — Maximum Safe Duty Per Day; 11.76 — Cost Per 1000 Gallons					
EL CAPITAN					
1st Development (Diversion) — Cost $1,843,000.	$1,843,000	0.16	(e) 0.0	——	$ 15.58
2nd Development (Storage) — Additional Cost $2,989,000.	4,832,000	18.13	4.9	$906,000.	13.05
3rd Development " — Additional Cost $3,615,000.	8,447,000	39.70	9.7	872,000.	16.05
Total of 3rd Development — $8,447,000. — Total Cost; 39.7 Million Gallons — Maximum Safe Duty Per Day; 16.05 — Cost Per 1000 Gallons					

Notes:
(a) No continuous safe duty of water can be obtained by diversion without storage but an average of about 2.5 million gallons per day can be diverted without storage.
(b) Exclusive of sub-surface water supply.
(c) The estimates contain no amounts to cover the cost of the determination of water rights or for condemnation of lands not obtainable at fair prices.
(d) Unit Cost Includes-Interest, Depreciation, Operation, Maintenance, Filtration and Delivery into the City's Distribution System.
(e) The estimated costs contain no amounts to cover contingencies, administration, legal or engineering requirements.

Drawn by G.C.
Traced by G.C.
Checked by S.E.K.

CITY OF SAN DIEGO—CALIFORNIA
ADDITIONAL WATER SUPPLY
SAN DIEGO RIVER RESOURCES
COMPARATIVE QUANTITIES, COSTS
Scale as Shown
Sept.-1922.
[signature] Hydraulic Engineer.

S-445

PART II

MISSION GORGE RESERVOIR BASIN

DAMSITE NO.2,

DEVELOPMENT PROJECTED.

SAN DIEGO RIVER RESOURCES.

Comprehensive and relatively exhaustive investigations, surveys and studies of the water resources and topography of the San Diego River Drainage Basin show that the Mission Gorge Reservoir Basin located on the San Diego River seven and one-half (7.5) miles up river from the East boundary line of the City of San Diego offers the most economical opportunity for the conservation of the maximum available water resources of the San Diego River, for the City of San Diego.

Mission Gorge Reservoir Basin.

The area of the San Diego River Drainage Basin above the Mission Gorge Reservoir Basin is about 375 square miles, exclusive of the area tributary to the Cuyamaca Reservoir.

In order to conserve for delivery to the City of San Diego the maximum continuous safe net duty of the available runoff from the San Diego River Drainage Basin, it may be necessary to provide an ultimate reservoir storage capacity for about 300,000 acre feet or about 100 Billion gallons of water.

A maximum continuous safe net duty of about 12.5 million gallons per day of stored water may be obtained from the San Diego River and can be depended upon from the ultimate storage projected for the Mission Reservoir Basin and this duty may be increased, after the reservoir has been once filled, to over 15 million gallons per day, provided the subsurface supply is developed and utilized.

Storage ultimately for about 300,000 acre feet or about 100 Billion gallons of water may be provided in the Mission Gorge Reservoir Basin below reservoir contour 156 feet (elevation 400 feet above sea level) by the construction across the San Diego River of a relatively

low dam to be located at the outlet of the Reservoir Basin at the most economical site available near the head of the Mission Gorge.

Comprehensive investigations, surveys and studies have been made of the topography, and the geological formation of the entire Mission Gorge. Of the several possible damsites in the Gorge, a site where the elevation of the streambed is 244 feet above sea level and located only about 1/2 mile below the head of the Gorge at what has been designated as site No.2 is prominently the most economical site for the construction of a dam to the height which will be ultimately required to conserve, in the Mission Gorge Reservoir, the economic maximum safe net duty of the San Diego River Basin runoff for the City of San Diego. At this point (damsite No.2) very comprehensive core drill borings and test pit excavations have just been completed.

The construction of a dam at the site selected will:

(a) Comprehend the largest area of the San Diego River Drainage Basin economically practicable to conserve water from and deliver it by gravity into and through the Municipal Distribution System.

(b) Provide the storage capacity required to develop the economic maximum continuous safe net duty of the drainage basin runoff.

(c) Provide, at a relative minimum expenditure, a dependable water supply which may be filtered and delivered by gravity into the Municipal Distribution System at an elevation and under a pressure head which will supply two-thirds of all the water now being delivered to consumers in the City of San Diego from the Municipal Distribution System.

(d) Provide an additional water supply for the City of San Diego over and above its present supply at the lowest cost per unit of quantity of any available additional water resources.

(e) The projected maximum storage works and carrying system ultimately to be required-- dam, pipe conduit and filtration plant-- may be

constructed economically in four stages of development as the City's requirement for water increases.

First development: diversion dam, pipe conduit, sedimentation basin, filtration plant; duty estimated 10 million gallons per day average between 1/3 and 1/5 of the time.

Second development: reservoir storage 27 Billion gallons of water, duty continuous safe net 5 million gallons per day; may be increased to over 6½ million gallons per day, by auxiliary pumping from reservoir subsurface sand deposits.

Third development: reservoir storage increased to 75 billion gallons of water, duty continuous safe net 10.3 million gallons per day; may be increased to over 13 million gallons per day by auxiliary pumping from reservoir subsurface sand deposits.

Fourth and ultimate development: reservoir storage increased to about 100 Billion gallons of water, duty continuous safe net 12.5 million gallons per day; may be increased to over 15 million gallons per day by auxiliary pumping from reservoir subsurface sand deposits.

FIRST DIVERSION DEVELOPMENT, PROJECTED.

By constructing at first only the base portion of the curtain wall of the projected Mission Gorge Reservoir ultimate dam; and the base portion of the projected ultimate outlet tower and tunnel works, a pipe conduit to connect with the Municipal Distribution System; a sedimentation basin, and a filtration plant, it will be possible to divert water, when available from the discharge of the San Diego River, and filter and deliver it by gravity into the Municipal Distribution System at an elevation which would supply two-thirds of all the water now being delivered to consumers in the City of San Diego.

Diversion development from the San Diego River, if without storage, would have no dependable continuous safe duty.

A study of the runoff from the San Diego River Drainage Basin, observed and intergolated as if at the Mission Gorge, for the eighteen-year period from 1904-5 to 1921-2 inclusive, indicates that an average of about 10 million gallons of water per day could have been obtained by direct diversion from the San Diego River without storage during about one-third of the eighteen-year period. A study of the runoff for the previous eighteen-year period from 1888-6 to 1903-4 inclusive, and which would have included the nine consecutive leanest runoff years which have occurred in the past seventy-four years, indicates that an average of about 10 million gallons of water per day could have been obtained by direct diversion from the San Diego River without flood runoff reservoir storage during about one-fifth of this previous eighteen-year period.

The average annual duration of any considerable runoff of water from the San Diego River Drainage Basin is limited to about five months late in the winter and following spring portion of runoff seasons.

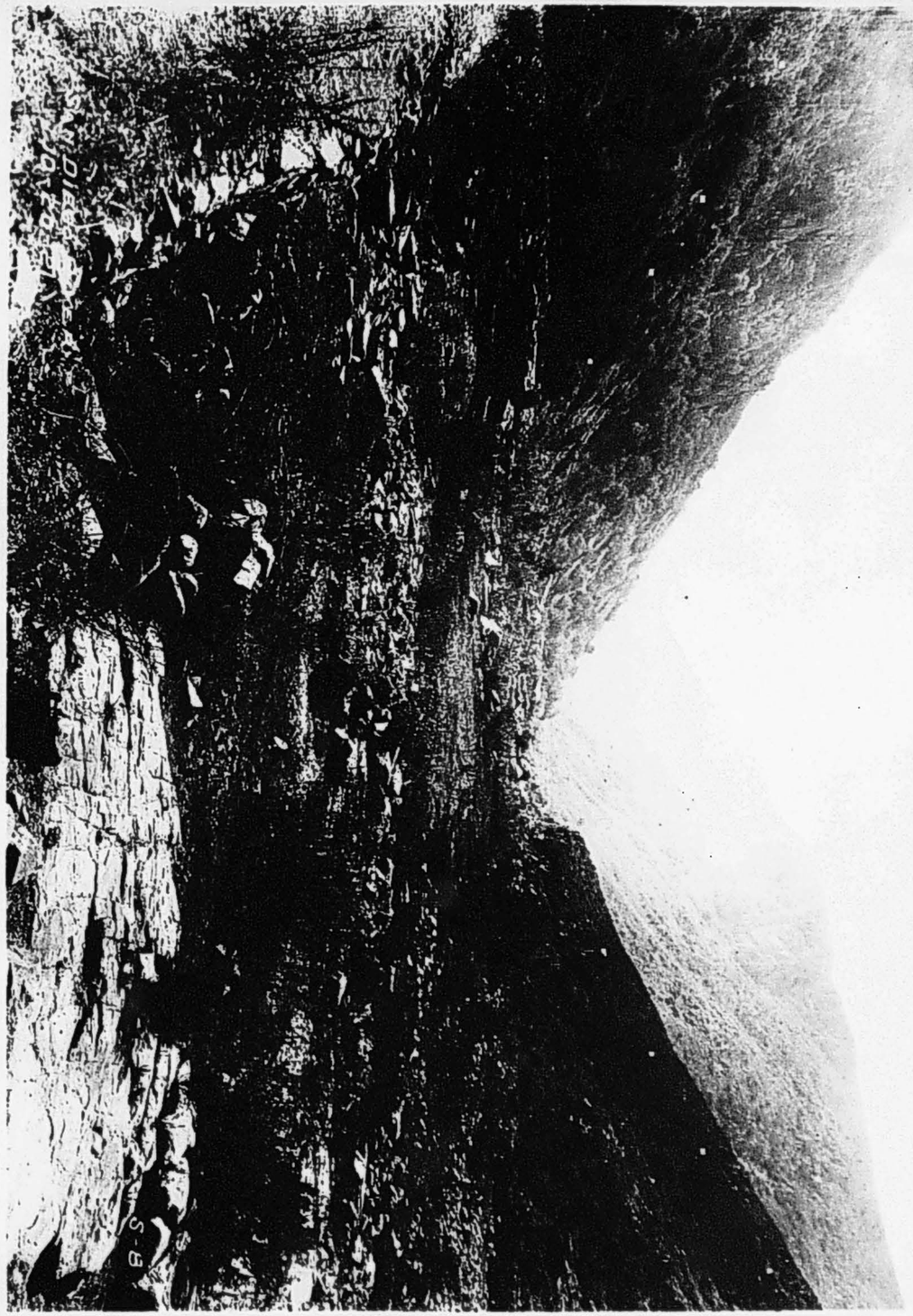
San Diego River, Mission Gorge Reservoir Basin, looking upstream from vicinity Damsite #2.

Water obtained by diversion from the San Diego River projected Mission Gorge Reservoir Basin development, if without storage at first, could be delivered by gravity through the Municipal Distribution System for consumption in the City below elevation about 200 feet above sea level.

The City of San Diego is under contract to receive from and pay the San Dieguito Mutual Water Company for a minimum of 2 million gallons of water per day, continuous delivery, for a further period of about seven years. Water received from the San Dieguito Mutual Water Company will be available by gravity for delivery through the low pressure portion of the Municipal Distribution System for consumption in the City below elevation about 200 feet above sea level.

Water obtained from the San Diego River by direct diversion up to the extent required at the time of diversion, for consumption in the City of San Diego below elevation about 200 feet, other than from under the San Dieguito Contract, will obviously decrease by just so much the otherwise necessary draft of water from the City's Morena, Barrett and Otay Municipal Reservoirs, provided those reservoirs are not at the time overflowing.

The FIRST diversion development of the Mission Gorge Reservoir project contemplates the construction of a dependable masonry diversion dam with a cross section safe for overtopping by floods (which may have a peak discharge of over 75,000 cubic feet per second), which will form the upstream or curtain portion of the ultimate storage dam required. The first construction work to be of sufficient cross section and height to impound water only up to the 55-foot reservoir contour (elevation 300 feet above sea level) providing river regulation above the diversion dam for only about 2500 acre feet or about three-fourths of a billion gallons of water.



San Diego River, Mission Gorge Damsite #2 looking downstream.

The diversion dam as contemplated for the first development will be76 feet high above streambed, 550 feet long on top. The construction work will involve the excavation of about 10,000 cubic yards of earth and rock material and the placing of about 25,000 cubic yards of concrete masonry.

The estimated cost of the diversion development provides for the purchase of about 500 acres of river regulation flowage and damsite lands, including improvements and damages, estimated to cost about $40,000; the construction of a masonry overflow upstream or curtain portion of the ultimate dam and outlet works to cost $260,000; the construction of a sedimentation basin to cost $25,000; the construction of a gravity flow 36-inch diameter pipe conduit 12.6 miles long of 10 million gallons per day capacity to connect with the Municipal Distribution System on Eleventh Street atthe South Line of Balboa Park to cost $559,000; and the construction of a filtration plant with a rated capacity of 7 million gallons per day and a maximum capacity of 10 million gallons per day, to cost $63,000.

The total cost of the Mission Gorge Diversion Development, which will provide an estimated duty equivalent to about 10 million gallons of filtered water per day during about one-fourth of the total time, delivered by gravity into the Municipal Distribution System, is $947,000.

SECOND DEVELOPMENT, PROJECTED.

The SECOND development of the Mission Gorge Reservoir Project provides for increasing the cross section thickness and height of the first Diversion Development of the upstream or curtain portion of the ultimate dam to a height sufficient to impound water up to the 116-foot reservoir contour (elevation 360 feet above sea level) providing storage in the Mission Gorge Reservoir Basin for about 87,000 acre feet or 27 Billion gallons of water. This storage will insure a continuous safe net duty of about 5 million gallons of stored water per day at the reservoir.

The dam as contemplated for the second development will be 126 feet high above streambed, 670 feet long on top. The additional construction work will involve the additional excavation of 13,000 cubic yards of earth and rock material, and the placing of 78,000 cubic yards of additional concrete masonry.

The estimated cost of the SECOND development provides for the purchase of about 3000 acres of additional reservoir flowage and damsite lands, including improvements and damages, estimated to cost about $870,000; the construction of an addition to the cross section and height of the dam, to cost $652,000.

The total estimated additional cost of the SECOND development of the Mission Gorge Reservoir Project is $1,522,000; making the total cost of the FIRST and SECOND developments $2,469,000, which will provide a continuous safe net duty of 5 million gallons of filtered water per day delivered by gravity into the Municipal Distribution System. The continuous safe net duty of 5 million gallons per day may be increased, after the storage reservoir has once been filled, to over 6½ million gallons per day, by developing and utilizing the underground water in the reservoir basin.

THIRD DEVELOPMENT, PROJECTED.

The THIRD development of the Mission Gorge Reservoir Project provides for increasing the cross section thickness and height of the second development of the upstream or curtain portion of the ultimate dam, to a height sufficient to impound water up to the 146-foot reservoir contour (elevation 390 feet above sea level) providing storage for about 230,000 acre feet or about 75 Billion gallons of water. This storage will insure a continuous safe net duty of 10.3 million gallons of stored water per day at the reservoir.

The work contemplated for the THIRD development will increase the height of the dam to 156 feet above streambed, and its length on top to 740 feet. The additional construction work will involve the excavation of 9,000 cubic yards of earth and rock material, and the placing of 65,000 cubic yards of additional concrete masonry.

The estimated cost of the THIRD development provides for the purchase of about 2900 acres of additional reservoir flowage and damsite lands, including improvements and damages, estimated to cost about $1,155,000; the construction of an addition to the cross section and height of the dam, to cost $547,000; the construction of an additional gravity flow 36-inch diameter pipe conduit 12.6 miles long of 10 million gallons per day capacity to connect with the Municipal Distribution System on Eleventh Street at the South line of Balboa Park, or at Old Town as may develop advisable, to cost $536,000; and the construction of additional filtration plant with a rated capacity of 6 million gallons per day and a maximum capacity of 9 million gallons per day, to cost $54,000.

The total estimated additional cost of the THIRD development of the Mission Gorge Reservoir Project is $2,292,000, making the total cost of the FIRST, SECOND and THIRD developments $4,761,000, which will provides

continuous safe net duty of 10.3 million gallons of filtered water per day delivered by gravity into the Municipal Distribution System. The continuous safe net duty of 10.3 million gallons of filtered water per day may be increased after the storage reservoir has once been filled, toover 13 million gallons per day, by developing and utilizing the underground water in the reservoir basin.

FOURTH AND ULTIMATE DEVELOPMENT.

The FOURTH and ULTIMATE development of the Mission Gorge Reservoir Project provides for the extension and completion of the masonry dam to a sufficient height to impound water up to the 156-foot reservoir contour (elevation 400 feet above sea level) and a spillway either over top or independent, adequate to pass safely floods of over 75,000 cubic feet per second, providing storage for about 300,000 acre feet or about 100 Billion gallons of water.

This storage will insure a continuous safe net duty of 13.5 million gallons of stored water per day at the reservoir.

The dam as contemplated for the ULTIMATE development will be 166 feet high above streambed, and 770 feet long on top. The additional construction work will involve the excavation of about 3,000 cubic yards of earth and rock material and the placing of about 25,000 cubic yards of concrete masonry.

The estimated additional cost of the FOURTH and ULTIMATE development provides for the purchase of about 1,100 acres of additional reservoir flowage and damsite lands, with improvements and damages, estimated to cost about $335,000, and the construction of an extension of the dam, to cost $213,000.

The total estimated additional cost of the ULTIMATE development of the Mission Gorge Reservoir Project is $548,000, making the total cost of the FIRST, SECOND, THIRD AND ULTIMATE developments $5,309,000, which

will provide a continuous safe net duty of 12.5 million gallons of filtered water per day delivered by gravity to the Municipal Distribution System.

The continous safe net duty of 12.5 million gallons of filtered water per day may be increased, after the storage reservoir has once been filled, to over 15.0 million gallons per day, by developing and utilising the underground water in the reservoir basin.

The continuous safe net duty as given for the several developments of the Mission Gorge Reservoir Project contemplates the continued diversionfor both storage and direct delivery of water by the Cuyamaca Water Company to its consumers as heretofore practised.

PART III.

MISSION GORGE RESERVOIR BASIN

DAMSITE NO.3 DEVELOPMENT CONSIDERED.

DAMSITE NO.3 DEVELOPMENT CONSIDERED.

Investigations, surveys, studies, drawings and estimates have been made of the alternative possibility of developing the Mission Gorge Reservoir Basin by the construction of a very high masonry dam located near the lower end of the Mission Gorge about 2.5 miles below the head of the gorge, where the elevation of the streambed is only 100 feet above sea level, and 144 feet lower than the damsite selected near the head of the gorge. The area of the San Diego River Drainage Basin above the Mission Gorge Reservoir Basin, if Damsite No.3 is developed, would be about 280 square miles, exclusive of the area tributary to the Cuyamaca Reservoir.

Damsite No.3 First Development.

The initial or first development of the Mission Gorge Reservoir Damsite No.3 considered, provides for the construction of a dependable masonry dam with a cross section safe for overtopping by floods (which may have a peak discharge of over 75,000 cubic feet per second) which will form the upstream or curtain portion of the ultimate dam required. The first construction work to be of sufficient cross section and height to impound water up to the 310-foot reservoir contour (elevation 310 feet above sea level), providing storage in the Mission Gorge Reservoir Basin for 25,000 acre feet or about 8 Billion gallons of water. This storage will insure a continuous safe net duty of 4.5 million gallons of stored water per day at the reservoir.

The dam considered for the first development would be 220 feet high above streambed, and its length on top 810 feet. The construction work would involve the excavation of 110,000 cubic yards of earth and rock material, and the placing of about 300,000 cubic yards of concrete masonry

The estimated cost of the first development considered provides for the purchase of about 625 acres of reservoir flowage and damsite lands,

including improvements and damages, estimated to cost about $78,000; the construction of a masonry overflow upstream or curtain portion of the ultimate dam, to cost $2,710,000; the construction of a 36-inch diameter pipe conduit 10.5 miles long, of 10 million gallons per day capacity to connect with the Municipal Distribution System on Eleventh Street at the South line of Balboa Park, to cost $479,000; the construction of a filtration plant with a rated capacity of 7 million gallons per day and a maximum capacity of 10.5 million gallons per day, to cost $63,000; the construction of a pumping plant, with a rated capacity of 10 million gallons per day, to cost for pumping machinery alone, $20,000.

The total estimated cost of the first development of the Mission Gorge Reservoir Damsite No.3 considered would be $3,380,000, which would provide a continuous safe net duty of 4.5 million gallons of filtered water per day, the majority of which could probably be delivered by gravity into the Municipal Distribution System.

Damsite No.3 Second Development.

The second development of the Mission Gorge Reservoir Damsite No.3 considered, provides for increasing the cross section thickness and height of the first development of the upstream or curtain portion of the ultimate dam to a height sufficient to impound water up to the 330-foot reservoir contour (elevation 330 feet above sea level), providing storage for about 44,000 acre feet or about 14 Billion gallons of water. This storage will insure a continuous safe net duty of 5.7 million gallons of stored water per day at the reservoir.

The work considered for the second development would increase, the height of the dam to 240 feet above streambed, and its length on top to 880 feet. The additional construction work would involve the excavation of 15,000 cubic yards of earth and rock material, and the placing of

85,000 cubic yards of concrete masonry.

The estimated cost of the second development provides for the purchase of about 1,075 acres of additional reservoir flowage and damsite lands, including improvements and damages, estimated to cost about $134,000; the construction of an addition to the cross section and height of the dam, to cost $630,000.

The total estimated additional cost of the second development of the Mission Gorge Reservoir Basin Damsite No.3 considered would be $764,000; making a total cost of the first and second developments $4,124,000, which would provide a continuous safe net duty of 5.7 million gallons of filtered water per day, the majority of which could be delivered by gravity into and through the Municipal Distribution System.

Damsite No.3 Third and Ultimate Development.

The third and ultimate development of Mission Gorge Reservoir Damsite No.3 considered provides for the extension and completion of the masonry dam to a sufficient height to impound water up to the 290-foot reservoir contour (elevation 390 feet above sea level) and a spillway over top or independent, adequate to pass safely floods of over 75,000 cubic feet per second, providing storage for 275,000 acre feet of water. This storage would insure a continuous safe net duty of 13.8 million gallons of stored water per day at the reservoir.

The dam as considered for the ultimate development is 300 feet high above the streambed, and 1200 feet long on top. The additional construction work would involve the excavation of 55,000 cubic yards of earth and rock material, and the placing of 290,000 cubic yards of concrete masonry.

The estimated cost of the third or ultimate development of Mission Gorge Reservoir Basin Damsite No.3 considered provides for the purchase

of about 5,400 acres of additional reservoir flowage and damsite lands, including improvements and damages, estimated to cost about $1,905,000; the construction of an addition to the cross section and height of the dam, to cost $2,560,000; the construction of an additional 36-inch diameter pipe conduit 10.5 miles long, of 10 million gallons per day capacity to connect with the Municipal Distribution System on Eleventh Street at the South line of Balboa Park, or at Old Town as may develop advisable, to cost $456,000; and the construction of an additional filtration plant with a rated capacity of 6 million gallons per day, and a maximum capacity of 9.0 million gallons per day, to cost $54,000; and the construction of additional pumping plant with a rated capacity of 10 million gallons per day, to cost $20,000.

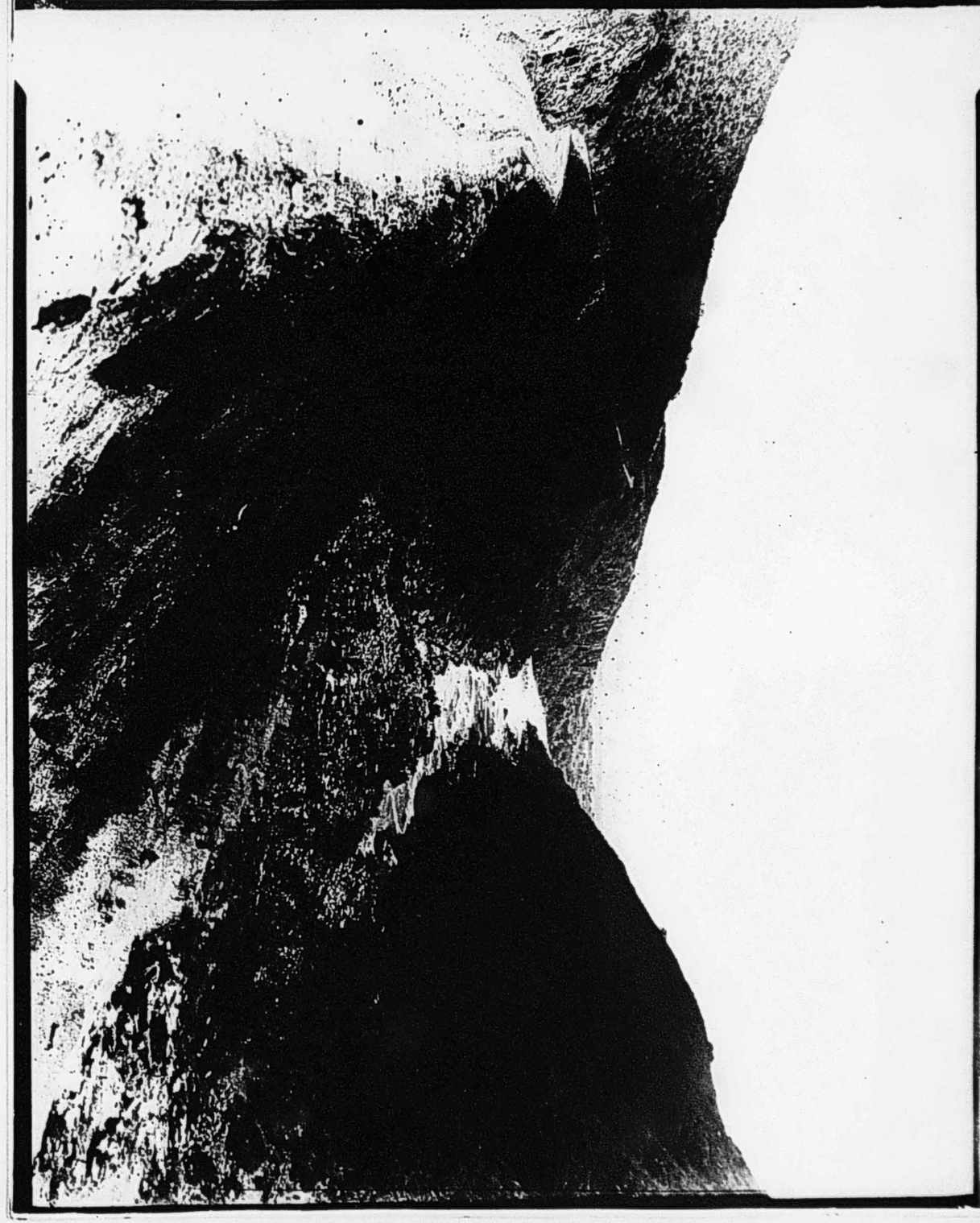
The total estimated additional cost of the third and ultimate development of the Mission Gorge Reservoir Project Damsite No.3 considered would be $4,995,000; making a total cost of the first, second and ultimate developments $9,099,000, which would provide a continuous safe net duty of 13.8 million gallons of filtered water per day, the great majority of which could be delivered by gravity into the Municipal Distribution System. The continuous safe net duty of 13.8 million gallons of filtered water per day could be increased, after the storage reservoir had once been filled, to over 16 million gallons per day, by developing and utilizing the underground water in the reservoir basin.

PART IV

EL CAPITAN RESERVOIR BASIN

DAMSITE NOS.1 AND 2.

DEVELOPMENT CONSIDERED.



San Diego River, Mission Gorge Damsite #3, looking downstream.

EL CAPITAN RESERVOIR BASIN CONSIDERED.

A Comprehensive and relatively exhaustive investigations, surveys and studies of the water resources and topography of the San Diego River Drainage Basin show that the El Capitan Reservoir Basin, located on the San Diego River 25 miles up river from the East boundary line of the City of San Diego, offers an opportunity for the conservation of a portion of the available water resources of the San Diego River for the City of San Diego.

The area of the San Diego River Drainage Basin above the El Capitan Reservoir Basin is about 178 square miles, compared to the area of about 375 square miles above the Mission Gorge Reservoir, both exclusive of the area tributary to the Cuyamaca Reservoir.

In order to conserve for delivery to the City of San Diego the maximum continuous safe net duty of the tributary available runoff from the San Diego River Drainage Basin above the El Capitan Reservoir Basin, it would be necessary to provide for an ultimate reservoir storage capacity of about 200,000 acre feet or about 65 Billion gallons of water. Such a reservoir when full would flood practically the entire length of the Cuyamaca Water Company's Flume from the El Capitan Damsite back up to the Cuyamaca Water Company's Diverting Dam, a distance of 8 miles.

Storage for about 123,000 acre feet or about 40 Billion gallons of water may be provided in the El Capitan Reservoir Basin below reservoir contour 190 feet (elevation 743 feet above sea level), without raising the water surface in the reservoir sufficiently to flood the Cuyamaca Water Company's Flume, by the construction across the San Diego River of a high dam to be located at the outlet of the reservoir basin at the most economical site available.

El Capitan Damsites Nos. 1 and 2.

The comparative feasibility of the development of the El Capitan Reservoir Basin at two alternative damsites has been investigated. El Capitan Damsite No.1 is located 25 miles up the San Diego River from the East boundary line of the City of San Diego, and 6 miles above Lakeside. Comprehensive core recovering drill borings consisting of 25 holes disclosed the existence of continuous solid bedrock suitable for the foundation and abutments for a high dependable masonry dam, but at such considerable depths below the natural surface as to render the construction of a dependable masonry dam at this site relatively prohibitively expensive.

El Capitan Damsite No.2 is located 24.5 miles up the San Diego River from the East boundary line of the City of San Diego, 0.5 miles below Damsite No.1, and 7.5 miles above Lakeside.

Comprehensive core recovering drill borings consisting of 22 holes disclosed the existence of continuous solid granite bedrock suitable for the foundation and abutments of a high dependable masonry dam and at relatively less depths below the surface than at Damsite No.1.

First Development.

The initial or first development of the El Capitan Reservoir Project Damsite No.2 considered, provides for the construction of a dependable masonry dam with a cross section safe for overtopping by floods (which may have a peak discharge of over 50,000 cubic feet per second), which will form the upstream or curtain portion of the ultimate dam required. The first construction work to be of sufficient cross section and height to impound water up to the 140-foot reservoir contour (elevation about 693 feet above sea level) providing storage in

the El Capitan Reservoir Basin for 56,000 acre feet or about 18 Billion gallons of water. This storage would insure a continuous safe net duty of 4.9 million gallons of stored water per day at the reservoir.

The dam considered for the first development would be 150 feet high above streambed, and its length on top 1170 feet. The construction work would involve the excavation of about 380,000 cubic yards of earth and rock material and the placing of about 370,000 cubic yards of concrete masonry.

The estimated cost of the first development considered provides for the initial payment of $75,000 for reservoir flowage lands on the Capitan Grande Indian Reservation, the condemnation and purchase of which has been authorized by an Act of Congress; the purchase of about 840 acres of reservoir flowage and damsite lands (in private ownership) including improvements and damages, estimated to cost about $42,000; the re-location on hydraulic grade line and the re-construction of the Cuyamaca Water Company's Conduit syphon pipe reaches, to cost $150,000; the re-location above the reservoir ultimate flood flow line and re-construction of the County Highway, to cost $50,000; clearing the reservoir basin, to cost $25,000; the construction of a masonry overflow or curtain portion of the ultimate dam, to cost $3,465,000; the construction of a gravity flow 30-inch diameter pipe conduit 25.5 miles long, of 10 million gallons per day capacity, to the City's University Heights Reservoir, to cost $937,000; and the construction of a filtration plant with a rated capacity of 7 million gallons per day and a maximum capacity of 10 million gallons per day, to cost $63,000.

The total estimated cost of the first development of the El Capitan Reservoir Project considered would be $4,807,000, which will provide a continuous safe net duty of 4.9 million gallons of filtered water per day delivered by gravity into the City's University Heights Reservoir.

Second Development.

The second development of the El Capitan Reservoir Project considered provides for increasing the cross section thickness and height of the first development of the upstream or curtain portion of the ultimate dam to a height sufficient to impound water up to the 190-foot reservoir contour (elevation 743 feet above sea level), providing storage for about 128,000 acre feet or about 40 Billion gallons of water. This storage would insure a continuous safe net duty of 9.7 million gallons of stored water per day at the reservoir.

The work considered for the second development would increase the height of the dam to 200 feet above streambed, and its length on top to 1470 feet. The additional construction work would involve the excavation of 160,000 cubic yards of earth and rock material, and the placing of 305,000 cubic yards of concrete masonry.

The estimated cost of the second development provides for the purchase of about 570 acres of additional reservoir lands, to cost $5,000; the construction of an addition to the cross section and height of the dam, to cost $2,650,000; the construction of an additional gravity flow 36-inch diameter pipe conduit 25.5 miles long, of 10 million gallons per day capacity, to the City's University Heights Reservoir, to cost $933,000; the construction of additional filtration plant with a rated capacity of 3 million gallons and a maximum capacity of 4.5 million gallons per day, to cost $27,000.

The total estimated additional cost of the second development of the El Capitan Reservoir Basin Project considered would be $3,615,000, making a total cost of the first and second development of $8,422,000.

The estimates of cost of the first and second development of the El Capitan Reservoir Basin Project do not include any sum to cover the cost of determining the ownership of the water rights of the San Diego

River, nor is it deemed practicable to estimate the time or cost involved in determining these rights.

No provision has been made for the payment of any sum, in addition to the tentative award of $75,000, which the Secretary of the Interior may require in compliance with the Act of the Congress granting to the City of San Diego permission to condemn lands in the Capitan Grande Indian Reservation for reservoir flowage purposes.

No reduction has been made in the estimated continuous safe net duty of the water for delivery to the City of San Diego on account of the quantity of water which may be required by the Act of Congress to be delivered by the City to riparian land owners along the San Diego River below the projected reservoir, and along the pipe conduit to San Diego.

The estimates of continuous safe net duty from the runoff from the San Diego River Drainage Basin above the El Capitan Reservoir Basin do contemplate and provide for continued diversion of water for both storage and direct delivery by the Cuyamaca Water Company as heretofore practiced.

The maximum ultimate development of the El Capitan Reservoir Basin Project would require a dam of sufficient height to impound water up to the 235-foot reservoir contour, providing storage for about 200,000 acre feet or about 65 Billion gallons of water. Such a reservoir when full would flood practically the entire length of the Cuyamaca Water Company's Flume between the El Capitan Damsite and the Company's Diverting Dam, a distance of about 5 miles.

In conformity with the requirements of the Common Council's Resolution No.27239, dated January 16, 1922, there are appended hereto portfolio blue prints showing the controlling physical and engineering conditions and plans. Detailed drawings and specifications are being developed and will be concluded immediately after a policy has been determined

upon by the Municipal Officials for the development of additional water supply.

PRELIMINARY DIVERSION DEVELOPMENT.

Provided the projected pipe conduit from the El Capitan Reservoir Basin to a connection with the City's University Heights Reservoir together with the filtration plant, both as considered for the first development, is constructed at first, it will then be practicable, by constructing at first only the base portion of the projected permanent El Capitan Reservoir Outlet Tower Works and the base portion of the curtain wall of the ultimate dam, to divert water when available, from the unregulated discharge of the San Diego River, and filter and deliver it by gravity into the City of San Diego's University Heights Reservoir.

If water is diverted direct from the San Diego River for immediate domestic use without storage, it would be necessary to construct and operate a sedimentation basin at a convenient place along the pipe conduit to relieve the river water of the majority of silt it will be carrying in suspension during flood runoff periods.

Diversion development direct from the San Diego River, if without reservoir storage, would have no dependable continuous safe duty. A study of the runoff from the San Diego River Drainage Basin observed and interpolated as if at El Capitan Damsite from 1905 to 1922 indicates that about 10 million gallons of water per day could have been obtained by direct diversion during about one-third of the total period.

The total estimated cost of the preliminary diversion development is $1,843,000, which expenditure would reduce by nearly the same amount the estimated cost of the projected first development of the El Capitan Reservoir Project as hereinbefore outlined, except for the construction, operation and maintenance of the sedimentation basin.

PART V

CONCLUSIONS

AND

RECOMMENDATIONS.

CONCLUSIONS.

1. The City of San Diego will consume during the calendar year 1922 an average of over eleven and one-third million gallons of water per day, of which an average of about one million gallons per day is being received by the City under contract from the San Dieguito Mutual Water Company now being delivered at Torrey Pines at an elevation of about 160 feet and consumed mostly in La Jolla, Ocean Beach, Pacific Beach and vicinity. The remainder of the well over ten million gallons of water being consumed per day, is being drawn from the City of San Diego's Municipal Impounding and Storage Reservoirs.

2. The daily consumption of water in the City of San Diego during the last twenty-year period has increased at an average annual rate of about one-half million gallons per day.

The daily consumption of water during the calendar year 1922 is averaging over a million gallons per day higher than the daily consumption of water during the calendar year 1921, or an increase of over twice the previous average annual increase in consumption.

The safe net continuous daily duty of the City of San Diego's Municipal Water System as now developed and in storage is about eight million gallons of water per day.

3. When the automatic flash gates now being provided are installed in the overtop spillway bays of Lower Otay and Barrett Dams, and when the work now under way at Morena Reservoir, spillway discharge capacity enlarged to about 36,000 cubic feet per second, and reservoir storage capacity increased from about thirteen Billion gallons to about Seventeen Billion gallons, and when thereafterward the reservoirs, Morena, Barrett and Otay are once filled to their capacity, the safe net continuous daily duty of the City of San Diego's Municipal Water System will be about ten million gallons per day.

4. The annually increasing requirement for water for domestic consumption in the City of San Diego, and prominently, accentuated as it has been by the greater annual increase in consumption during the calendar year 1922, makes it doubly imperative for the City of San Diego to undertake immediately the development of an additional water supply, by the acquisition of reservoir flowage lands and the construction of impounding and carrying works in sufficient time and to the extent required to insure the catchment and storage of one or more flood years runoff in advance of a succession of lean years runoff, nine of which occurred successively from 1895-6 to 1903-4, inclusive.

RECOMMENDATIONS.

It is recommended that the City of San Diego proceed immediately to obtain an additional supply of water from San Diego River Resources by the development, at the earliest practicable date, of Mission Gorge Reservoir Basin Project, by means of a storage reservoir dam to be located at Mission Gorge, Site No.2, and that the work proceed in the following order:

1. Secure at the earliest practicable date, options to purchase to the fullest extent obtainable at a fair price all the flowage and damsite lands required in the Mission Gorge Reservoir Basin, below elevation 360-370 inclusive of Damsite No.2 as shown on attached drawing S-401. The options to be subject to approval by the voters of the City of San Diego.

2. Submit at the earliest legally justifiable date to the voters of the City of San Diego for approval a bond issue for the purpose of acquiring the flowage and damsite lands, and for the construction of the masonry storage dam required for the projected first and second developments of the Mission Gorge Reservoir, Basin Project.

3. Proceed with the development of the Project in the following order of work:

(a) Exercise the City's option to purchase the required flowage and damsite lands and pay in full therefor, or begin to pay interest thereon, until the City elects to pay in full therefor.

(b) Acquire the remainder of the required flowage and damsite lands by purchase, if at all practicable, or by condemnation if unavoidably necessary.

(c) Construct a main pipe conduit with a capacity of 10 million gallons per day from Mission Gorge Damsite No.2 to the Municipal Distribution System on the South line of Balboa Park at Eleventh Street, a distance of 12.6 miles.

(d) Install a filtration plant with a maximum capacity of 10 million gallons per day in the vicinity of the Municipal Mission Valley Pumping Plant.

(e) Construct a sedimentation basin at a convenient place along the pipe conduit between the conduit headworks and the filtration plant.

(f) Construct a dependable masonry diversion and storage dam at Mission Gorge Damsite No.2, to the greatest height possible to accomplish, with the bond funds which may be provided and remain available after completing the work provided for in the foregoing recommendations.

H. H. Savage,
Hydraulic Engineer.

Ed Fletcher Papers

1870-1955

MSS.81

Box: 42 Folder: 3

Business Records - Reports - Savage, H.N - "Report: San Diego Additional Water Supply, San Diego River Resources"

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