

Report  
to the  
City of San Diego  
and to the  
Volcan Land and Water Company  
on the  
Safe Net Yield  
Value  
Cost of Completed System  
and  
Cost of Water Delivered  
of the Properties of the  
Volcan Land and Water Company  
by  
Philip H. Harroun  
Consulting Engineer  
San Francisco, California  
August, 1914.



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San Francisco. August, 1914.

To the Honorable Mayor, Charles F. O'Neill  
and the City Council of the City of San Diego

and

To the Volcan Land & Water Company.

Gentlemen:

On May 22, 1914 the Volcan Land & Water Company presented an offer of sale of certain properties comprising a system for water supply to the City of San Diego, which offer is on file with the City.

On June 1, the writer was jointly retained by the City of San Diego and the Volcan Land & Water Company to pronounce upon the value of this property. Since that date this question has been under investigation and the results of this investigation are embodied in the following report.

No questions of title have been investigated. It is assumed that the Volcan Land & Water Company has legal title to the property which it proposes to transfer to the City, and also to the water which it proposes to conserve and divert, other than those disabilities specifically allowed for in this report.



The Volcan Land & Water Company has made available to the writer the results of its investigations extending over the past few years. These investigations consist of surveys, studies of precipitation and runoff, preliminary design of necessary structures, and in addition there has been made available such cost records as are shown on the books incurred in bringing the property up to its present stage of development. This data has been taken as the basis for the report.

It was the desire of the City Council not only to be advised of the value of the property but it was also expressly desired that a study be made of the safe net yield which the properties would be able to furnish to the City upon full development. It has also been found necessary to arrive at the cost of the system, when fully developed, in order that it may be seen whether such cost is within economic limits. The report, therefore, will be divided into three major divisions treating

- First: The safe net yield which the system may be expected to deliver to the City of San Diego;
- Second: The value of the property which is offered to the City for the sum of two and one half million dollars (\$2,500,000.00);
- Third: The cost of development of the property required to deliver to the City the safe net yield found, and also, the cost per thousand gallons delivered.

#### DESCRIPTION OF THE SYSTEM

Briefly, the project of the Volcan Land & Water Company consists of the construction of a dam forming



a reservoir on the San Luis Rey River at Warner Ranch. The waters in this reservoir are to be diverted into the drainage of the Santa Ysabel River. Upon the Santa Ysabel River three reservoirs are proposed, the first and most easterly called the Sutherland Reservoir, the second some five miles west called the Pamo Reservoir, and the third below Bernardo called the Carroll Reservoir.

The Waters from the Warner Reservoir in passing into the Santa Ysabel drainage may be regulated either in the Sutherland or Pamo Reservoirs. The waters from Pamo and Sutherland reservoirs combined with those of the Warner Reservoir are to be carried in a canal, some 25 miles in length, into what is called San Clemente Reservoir. This latter reservoir is a little east of north and some 13 miles distant from the center of San Diego, and is to be used as a regulating reservoir. It is also to carry sufficient storage to provide against interruption in the supply. From San Clemente Reservoir the waters would flow by gravity into the University Heights Reservoir in the north-easterly section of the City. The waters from Carroll Reservoir would be carried by independent pipe line to the City. The general scheme of the system is shown on Plate 1, accompanying this report.



SAFE NET YIELD WHICH THE SYSTEM MAY BE EXPECTED  
TO DELIVER TO THE CITY OF SAN DIEGO

The safe net yield of this system may be defined as that quantity of water which the system would have been able to deliver during the period of greatest drought of which there is record. The studies required to determine this question are intricate and require much time in the analysis of the many elements of rainfall, runoff, evaporation, transpiration and other factors entering into the question. It is not believed that presentation of the details of this technical study would be of interest to others than engineers and for that reason they are not presented in the body of this report. Plates 2 to 19 accompanying this report may be referred to for these items. However, in order that the conditions may be understood, a brief outline of the data available and the methods pursued in arriving at the safe net yield is presented below.

There are available records of rainfall in the near vicinity of the San Luis Rey and Santa Ysabel watersheds at 13 different points all more or less fragmentary but extending back as far as the season of 1872-1873. In addition, the records of some 28 rainfall stations within the drainage areas are available for the past two or three years. These records have been studied and expanded, using the Escondido record as a base, so as to obtain a continuous record at these stations for the



last 42 seasons. From these records the Ischyrose lines within the drainage areas under consideration have been developed and from them the normal precipitation since 1872 has been determined.

Stream gaugings of the run-off on the various watersheds are available for the past eleven seasons at Pala on the San Luis Rey River and for the seasons of 1905-1906 and 1911-1912, to date, at Warner Dam. On Santa Ysabel River, gaugings are available from 1906-1907 to date at Pamo, and for the past two years at Bernardo. Through a study of these records in connection with the precipitation, the relation between rainfall and runoff has been determined and used in estimating the run-off for the past 42 years. These expanded runoff records have then been applied to the various reservoir sites where, in connection with a study of the reservoir capacity, evaporation and other factors, the safe net yield which may be expected from the various units of the project has been determined. The final results of these studies are shown graphically by the various tables and curves accompanying this report.

It is found that the safe net yield which Warner Reservoir would have been able to supply during the period of greatest drought occurring since 1872 is 17,600 acre feet or 24.3 cubic feet per second. To support this draft would require a dam of sufficient height to provide 106,800 acre feet of storage. Although this amount of water could have been continuously supplied from Warner



Reservoir during the period of greatest drought occurring during the past 42 years, it would not have been possible for the Volcan Land & Water Company, or other owner of the property, to utilize this entire amount because of the necessity of considering priorities on the river below. These prior demands have been studied and it is believed that the only priorities which will affect the yield of the Warner Reservoir are those of the Escondido Mutual Water Company and of the Ripoon Indians.

On June 21, 1912, an agreement was entered into between the Escondido Mutual Water Company and Mr. Wm. G. Henshaw for the Volcan Land & Water Company defining the rights of the Escondido Water Company. It has therefore been necessary to determine what effect this contract would have had upon the safe net yield of Warner Reservoir. It is found that during the critical period determining the safe net yield it would have been necessary to release from the storage in Warner Reservoir the average amount of 742 acre feet per annum in order to meet this contract requirement. For this reason, therefore, the safe net yield to which the Volcan Land & Water Company would be entitled is 16,854 acre feet.

In the light of legal opinion and the studies which have been made of the information available regarding priorities, it is believed that no further demands can hold against Warner diversion.



The safe net yield and development proposed upon the Santa Ysabel River is also complicated by priorities upon that stream. As in the case of the San Luis Rey River, these have been studied and provided for. Below the Sutherland and Pamo reservoir sites and above the Carroll site lies the San Pasqual Valley. This valley contains a number of properties in a high state of cultivation through the use of the waters of the Santa Ysabel River. Any development above this valley must provide for the requirements of these lands.

A study of the situation shows that the amount of water required in the San Pasqual Valley over and above that which would originate within the drainage area below the Pamo Reservoir amounts to 3,850 acre feet per annum, and in considering the possibility of the development and safe net yield of the Sutherland and Pamo Reservoirs it has been considered that this amount of water must be permitted to pass to the properties in the San Pasqual Valley.

The same condition holds below the Carroll Reservoir. The priorities there consist of the development upon the San Dieguito Ranch and also 50 miner's inches of continuous flow which is furnished to the town of Del Mar. These amount to 1,330 acre feet per annum. This amount has therefore been deducted from the gross yield of Carroll Reservoir and has been provided for these priorities in determining the safe net yield available for the Volcan Land & Water Company.



The determination of the maximum economic conservation upon the Santa Ysabal River is extremely complicated because of the development proposed in three different reservoirs and of the two riparian districts. In addition, the surveys and field investigations of the Volcan Land & Water Company have not yet been carried far enough so as to afford sufficient information from which to say what are the maximum economic possibilities of storage in the three different sites, - at Sutherland, Pamo and Carroll.

Three different studies have been made of the possible combinations of storage and consequent determination of safe net yield which appear to the writer will be ultimately found to cover the economic possibilities of the situation. Until further field investigations have been made, either by the Volcan Land & Water Company, or its successor, the final selection of the economic plan cannot be determined.

The first study was undertaken on the assumption that the dam at Sutherland Reservoir could be constructed to a sufficient height so as to give the storage required for maximum conservation of the runoff originating above that point, and that the Pamo Reservoir should consequently be constructed with a sufficient storage to conserve to the maximum the runoff originating below Sutherland and above Pamo, at the same time penalizing this runoff to the extent of 3,850 cubic feet per second for the priorities in the San Fasil Valley.



On this basis it was found that a storage capacity of 62,000 acre feet was required for Sutherland Reservoir with a height of dam approximately 200 feet, and the safe net yield resulting would be 9,400 acre feet. The Pamo Reservoir would consequently require a storage capacity of 42,300 acre feet and the safe net yield after providing for the priorities of the San Pasqual Valley would be 1,600 acre feet per annum. This would require a dam of 150 feet approximate height. As previously indicated, the field investigations of the Volcan Land & Water Company have not been sufficient to show whether the great height of the dam and storage capacity at Sutherland can be economically had, and when reliable information is obtained on this point it may be found that it is inadvisable because of the great cost to construct a dam at this point of the height required to provide this storage.

Studies of the existing data show that with a flow line of 124 feet at Sutherland and a dam of approximately 130 feet height, a storage of 16,400 acre feet can be economically had. A second study of the safe net yield was made on this assumption, and that Pamo Reservoir could then be developed to the maximum height necessary to conserve the waste from Sutherland together with the water originating between Sutherland and Pamo, after deducting the priorities of the San Pasqual Valley. Under these conditions, it was found that the safe net yield of the Sutherland Reservoir would be 6,550 acre feet and of Pamo



3,500 acre feet. To support the draft of 3,500 acre feet would require a dam of approximately 160 feet in height at that point which would provide a storage capacity of 32,000 acre feet.

This condition imposes a storage capacity and height of dam at Pamo which in the light of present surveys seems excessive and may be prohibitive from the standpoint of cost. At Pamo the field investigations indicated that a dam may be constructed of an economic height of 156 feet with a . . . consequent storage capacity of 47,500 acre feet.

The third study was based upon the assumption that the Sutherland flow line be limited to 124 feet and the Pamo flow line at 156 feet. Under these conditions the safe net yield from Sutherland Reservoir would be 6,650 acre feet and from Pamo Reservoir 2,400 acre feet. Until further investigations should prove the contrary, this third study should be accepted. If future investigations show that either Sutherland or Pamo reservoirs can be economically increased in capacity it will increase the safe net yield estimated to the limiting yields determined in the first and second studies.

Carroll Reservoir has also been studied in the light of the maximum conservation possible. To fully conserve these waters it is found that the height of the dam at Carroll should be 110 feet and the storage capacity 55,100 acre feet. Under these conditions the safe net yield of the reservoir would be 4,200 acre feet.



The priorities below Carroll have already been mentioned and it has been estimated that 1,330 acre feet are required for these priorities. Consequently the safe net yield possible for the use of the City from Carroll Reservoir amounts to 2,870 acre feet.

The following tabulations show the safe net yield of the entire system under the three different combinations:

Safe net yield of the system on the basis of the maximum possible conservation at Sutherland Reservoir.

	Acre feet.	Miners Inches.	Million Gallons daily.
Warner Reservoir	16,858	1,165	15.0
Sutherland "	9,400	650	8.4
Pamo "	1,600	110	1.4
Carroll "	2,870	196	2.5

Safe net yield of the system on the basis of 16,400 acre feet storage at Sutherland and sufficient storage at Pamo to conserve the balance of the runoff.

	Acre feet.	Miners inches.	Million gallons daily.
Warner Reservoir as before	16,858	1,165	15.0
Sutherland Reservoir	6,650	455	5.9
Pamo "	3,500	240	3.1
Carroll Reservoir as before	2,870	196	2.5



Safe net yield of the system on the basis that the economic storage possible at Sutherland is 16,400 acre feet and at Pamo 47,500 acre feet.

	Acre feet.	Miners inches.	Million gallons daily.
Warner Reservoir as before	16,858	1,165	15.0
Sutherland Reservoir	6,650	455	5.9
Pamo Reservoir (Approx.)	2,400	165	2.1
Carroll Reservoir as before	2,870	196	2.5

Should the City of San Diego acquire this property and institute condemnation proceedings against the irrigation priorities in the San Pasqual Valley and below Carroll Reservoir it would increase the amount available for domestic supply by 3,850 acre feet per annum from the Sutherland-Pamo combination of reservoirs and 600 acre feet per annum from the Carroll Reservoir, or 3.4 million gallons daily and 0.5 million gallons daily respectively.

**VALUE OF THE PROPERTY WHICH IS OFFERED TO THE  
CITY OF SAN DIEGO FOR THE SUM OF  
TWO AND ONE HALF MILLION DOLLARS.**

In pronouncing upon the value of the property which is offered by the Volcan Land & Water Company to the City of San Diego for the sum of two and one half million (\$2,500,000.00) dollars, the greatest difficulty has been found. For the last nine years or more the owners of this property have been gradually acquiring the necessary water



rights and rights of way and have been perfecting their organization leading up to the point where construction might be commenced. The Company has found it necessary to secure all of the water rights upon the San Luis Rey River, with the exception of the City of Oceanside, from Warner Dam to the Ocean, a distance of nearly 50 miles. This has been a long and expensive process.

In securing these rights, in a majority of cases, the riparian properties upon the river have been purchased outright and most of these properties are still in the hands of the Company. The writer estimates that the money cost in securing these properties along the San Luis Rey River is not less than \$1,500,000.00.

Upon the Santa Ysabel River the rights secured by the Company are comparatively few and it is estimated that these Santa Ysabel properties and rights have cost \$150,000.00 making the total cost of these properties not less than \$1,650,000.00. Rights of way through forest reserves and upon Government lands have also had to be secured.

A further complication has been the difficulties encountered in dissolving the old Pamo-Linda Vista Irrigation District. In this case it was necessary to purchase the outstanding bonds of the district and foreclose upon it. This procedure was necessary in order that the Pamo-Sutherland-Carroll combination of reservoirs might be made available. All of these elements have added greatly to the length of



time necessary and to the cost of bringing the property up to the point where actual construction might begin. The value of the actual construction already undertaken is a comparatively small element at this time.

In addition to the items mentioned in the offer made by the Volcan Land & Water Company to the City, dated May 22, 1914, I am advised by the Company that it will furnish to the City full and complete rights of way from Pano Reservoir to the San Clemente Reservoir, or from the Carroll Reservoir to the City of San Diego, as may be desired. The writer believing that the right of way from the Pano Reservoir to the San Clemente Reservoir is the most necessary to the development, has included the value of this right of way in the estimates of value presented.

In placing a value upon the reservoir lands the writer, not being an expert in land values, has based his judgment upon the value of lands for such purposes as has been found by the Railroad Commission of California and the Courts, modified to meet the conditions on this system in accordance with the writer's judgment.

In placing a value upon the power possible of development the writer has proceeded along the following lines: this system if acquired by the City of San Diego will furnish water primarily for domestic purposes. Any power which may be developed from the property is incidental and cannot be developed to the detriment of the



domestic service. The field investigations undertaken by the Company have not yet been carried far enough to say what the final economic arrangement of the units of the system must be in order to give the greatest conservation with the least expenditure of money. Until full studies are had this cannot be learned. The writer believes that the amount of power which it will be ultimately found can be economically developed will be a comparatively small amount, and certainly not sufficient to permit the City to enter the power field commercially, although probably sufficient for the City's own needs. As the power possibilities of the system are at this time so indeterminate and vague the writer has only given a nominal value to this element.

The question of the value of water rights has led to great controversy, the State and Federal Courts being divided in their views. Recently the Supreme Court of the United States, in the case of the San Joaquin & Kings River Canal & Irrigation Company vs County of Stanislaus, 191 Fed. 876, has held that a value must be placed upon water rights as they are property under the decisions of the Courts of California. The value of water rights are extremely difficult of determination and the writer knows of no logical method whereby these values may be measured. In certain cases within the State these values have been pronounced upon by bodies of competent jurisdiction and the writer considers under the



circumstances that the values found by such bodies are the only index which may be obtained.

In the case of the Spring Valley Water Works vs City and County of San Francisco, before the United States Circuit Court, Judge Ferrington found the value of the water rights of the Spring Valley Water Company to be \$50,000. per million gallons. This corresponds approximately to a value of \$775. per miners inch.

In the case of Sierra Madre vs Baldwin (a condemnation suit) before the Superior Court of Los Angeles County, it was stipulated that a fair value for gravity water, independent of any works, was \$3500.00 per miners inch.

In the case of Hollywood Union Water Company vs City of Los Angeles, before the Superior Court of Los Angeles County, (a rate case) it was mutually agreed that the value of gravity water was \$2500.00 per miners inch.

The Railroad Commission of California, in decision No. 1515, Petition of the City of Glendale to fix the valuation of certain water systems in said City, gave a value of \$2000. per miners inch for gravity water. That decision also lists among others the following values for gravity water:

\$2,000. price reached by one Burr, Los Angeles County, in Lear San Fernando in 1906.

\$2,500. selling price at McCloy Rancho in 1902.

\$1,500.- \$1,800. results of sales in this vicinity in 1902.

In the case of Hollywood Union Water



In the recent application of the City of San Diego to fix water rates to consumers without the City, before the Railroad Commission of California, Mr. H. A. Whitney, Hydraulic Engineer of the City of San Diego, placed a value of \$1500. per inch upon the 400 inches of water owned by the City of San Diego.

It will be seen from the above that the value of water rights for gravity water, officially fixed by bodies of competent jurisdiction, has ranged from a minimum of \$775. to a maximum of \$3500. per miners inch.

If it be accepted that water rights have a value, it appears to the writer that that value must vary directly with the demand, scarcity and difficulty of securing the commodity. If this be true, the value of \$775. per inch, found by Judge Farrington in the Spring Valley Case, is not a measure of the value of water in San Diego County where there is much greater scarcity and difficulty in securing the same.

The writer has estimated the value of the water rights of the Volcan Land & Water Company upon three different bases.

- First: \$1,000 per inch;
- Second: \$1,500 per inch as was considered a fair value by the City's Hydraulic Engineer, Mr. Whitney;
- Third: \$2,000 per inch as found by the Railroad Commission in the Glendale case.



In the case of the ~~rights upon the San Luis~~ Rey River, these values have been placed against the safe net yield of the Warner Reservoir penalized by the amount required to support the priorities stated, as the Company has or will acquire and transfer to the City full title to all riparian rights.

Upon the Santa Ysabel River the Company has not acquired all rights and will only transfer to the City such rights as it owns at the present time. The writer estimates that it will cost the Volcan Land & Water Company or the City of San Diego, the sum of \$459,000. to acquire the balance of these rights. For this reason the value of the water rights per miners inch possible of conservation upon the Santa Ysabel River has been penalized by this amount, and the values given are those for the safe net yield after applying this penalty and also after supplying existing priorities.

The following table shows the value of the property which the Volcan Land & Water Company proposes to transfer to the City of San Diego for the sum of two and one half million dollars, on the basis of water rights at a value of \$1000. per miners inch;



Water rights on San Luis Rey River, being 1165 inches less 10% transmission losses, or 1049 inches net delivered, at \$1,000 per inch \$1,049,000.

Water rights on Santa Ysabel River developed by a combination of Sutherland and Palo reservoirs which in combination will yield 620 inches, less 10% transmission losses, or 558 inches net At \$1,000. per inch \$558,000.

Water rights from Carroll Reservoir development, being 196 inches, less 10% transmission losses, or 176 inches net, at \$1,000 per inch 176,000.  
\$734,000.

Less cost of acquiring balance of riparian rights on Santa Ysabel River necessary to make these rights effective. \$459,000.

Net value of rights on Santa Ysabel River 275,000.

Total value of water rights \$1,324,000.

Investment value of lands, rights of way, Construction, general and all other items except power, which it is proposed to transfer \$1,325,000.

Nominal value for power possible of development 10,000.

Total value of property offered ----- \$2,659,000.

On this basis it will be seen that the value of the properties proposed to be transferred is \$159,000. in excess of the sum which the City proposes to pay for the same.



If the value of the water rights be taken at \$1500.  
per miners inch we have the following resulting values:

Water rights on the San Luis Rey River, being 1166 inches, less 10% transmission losses, or 1049 inches net delivered, at \$1,500 per inch	<b>\$1,573,500.</b>
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Water rights on Santa Ysabel River developed by a combination of Sutherland and Pano reservoirs which in combination will yield 620 inches, less 10% transmission losses, or 558 inches net at \$1,500 per inch	<b>\$837,000.</b>
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Water rights from Carroll Reservoir development, being 196 inches, less 10% transmission losses, or 176 inches net at \$1,500 per inch	<u>\$264,000.</u> <b>\$1,101,000.</b>
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Less cost of acquiring balance of riparian rights on Santa Ysabel River, necessary to make these rights effective	<u>\$ 459,000.</u>
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Net value of rights on Santa Ysabel River	<u>642,000.</u>
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Total value of water rights	<b>\$2,215,500.</b>
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Investment value of lands, Rights of way, Construction, general and all other items except power, which it is proposed to transfer	<b>\$1,325,000.</b>
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Nominal value for power possible of development	10,000.
Total value of the property offered -----	<u><b>\$3,550,500.</b></u>

In this case the value of the property  
is \$1,050,500. in excess of that sum which the City  
proposes to pay.



Should the value of water rights be placed at \$2,000. per inch we have the following conditions:

Water rights on San Luis Rey River, being 1166 inches, less 10% transmission losses, or 1049 inches not delivered at \$2,000. per inch	\$2,098,000.
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Water rights on Santa Ysabel River developed by a combination of Sutherland and Palo reservoirs which in combination will yield 620 inches, less 10% transmission losses, or 558 inches net, at \$2,000. per inch	\$1,116,000.
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Water rights from Carroll Reservoir development, being 196 inches, less 10% transmission losses, or 176 inches net, at \$2,000. per inch	352,000.
	<u>\$1,468,000.</u>

Less cost of acquiring balance of riparian rights on Santa Ysabel River, required to make these rights effective	<u>459,000.</u>
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Net value of rights on Santa Ysabel River ---	<u>\$1,009,000.</u>
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Total value of water rights -----	<u>\$3,107,000.</u>
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Investment value of lands, Rights of way, Construction, general and all other items except power, which it is proposed to transfer	\$1,325,000.
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Nominal value for power possible of development	<u>10,000.</u>
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Total value of the property offered	\$4,442,000.
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In this last case the value of the property is \$1,942,000. in excess of the sum for which it is offered to the City.



COST OF DEVELOPMENT OF THE SYSTEM REQUIRED TO DELIVER TO THE CITY THE SAFE NET YIELD FOUND AND, ALSO, THE COST PER THOUSAND GALLONS DELIVERED.

In presenting estimates of cost of developing the entire system and determining the cost of the commodity which would be furnished therefrom, attention is again called to the fact that at the present time investigations both in the field and office, by the Volcan Land & Water Company, have not proceeded far enough to determine the final and economic design of the system. For this reason these estimates are approximate but are to be accepted as fully justified in the light of the information available.

The studies of the safe net yield of the various reservoirs proposed has shown that the amount of the lands within the reservoir sites which it is proposed to deliver to the City is not sufficient to provide for the requisite storage. This is certainly the case with Warner and Carroll reservoirs and probably upon more complete information will be found to be true of the Pamo and Sutherland reservoirs also. The estimates of the total cost to complete the system therefore have included in them sufficient funds to acquire the additional lands necessary to provide the storage required for the safe net yield found.

The estimated cost of the structures has been entirely on the line of permanent construction.



Conduits and tunnels have been estimated on the basis of concrete construction and lining, and siphons and flumes of steel and concrete. There has been included the cost of a 30" riveted steel pipe line from Carroll Reservoir into the center of the low service distribution district of the City of San Diego. Two 36" riveted steel pipe lines have been estimated for, running from the regulating reservoir of San Clemente to University Heights Reservoir in the City of San Diego. These pipe lines would have an approximate capacity of 50 million gallons daily to meet the maximum daily demands which will be made upon the system.

The inclusion of these elements provides for the complete construction of the entire collecting and transmission system such that the water is brought immediately to the distribution system of the City. On this basis, and taking the value of the water rights at \$1,000. per miners inch, the cost of the complete property would be as shown in the following table:



Estimate of cost of complete collecting  
and distribution system, to yield 23  
million gallons daily.

Water rights		\$1,783,000.
Lands & Rights of Way		1,171,000.
Construction		
Warner Reservoir	\$325,000.	
Warner-Pamo Conduit	429,000.	
Pamo Reservoir	425,000.	
Sutherland Reservoir	345,000.	
Pamo-San Clemente Conduit	862,000.	
Carroll Reservoir	238,000.	
Carroll-San Diego Pipe line 30" riveted steel	716,000.	
San Clemente - University Heights pipe line - two 36" riveted steel pipes	<u>635,000.</u>	
		\$3,975,000.
General & Miscellaneous		959,000.
Nominal value of power possibility		10,000.
	Total --	<u>\$7,898,000.</u>

As the City is offered for the sum of two and one half million dollars, property of the value of \$2,659,000. included in the above estimates, the cost to the City of the completed system will therefore be \$159,000. less than the total above arrived at, or \$7,739,000.

Allowing 10% for losses of water in transmission, this system will deliver into the distribution system of the City of San Diego 23 Million gallons daily.

The cost of the water delivered into the City on the basis of 4½% interest on the value of the property will therefore be as follows:

Estimate of cost of water delivered  
to the City of San Diego.

Interest on \$7,739,000. at 4½%	\$348,255.
Depreciation, general repairs, operation and maintenance	93,400.
Total annual cost	<u>\$441,655.</u>



These total annual charges amount to 5.261 cents per thousand gallons delivered.

It is interesting to compare the total cost of the property on the basis of its safe net yield per million gallons delivered with the cost of other properties. Mr. H. A. Whitney, Hydraulic Engineer for the City of San Diego, estimates that it would cost the City of San Diego \$1,160,000. to place the City's collecting and transmission system upon the same permanent construction basis as that which has been estimated for the system under consideration. This added to the four millions which it cost the city to acquire the same would make that property have a value of \$5,160,000. The safe net yield of the system owned by the City is taken at  $7\frac{1}{2}$  million gallons daily.

The City of San Francisco has recently offered to the Spring Valley Water Company the sum of \$34,500,000. for its properties. This includes the City distribution system. If we eliminate the City distribution system at the value found by Judge Farrington, in his decision in the case we arrive at a value of \$28,000,000. for the balance of the system corresponding to that of the impounding and transmission system of the City of San Diego and that estimated for the Volcan Land & Water Company's system in this report.

The following statement shows the cost of the property in dollars per million gallons of safe net yield:

	Cost of collecting and transmission system.	Safe net yield in million gallons	Cost per million gallons daily of safe net yield.
Spring Valley Water Company	\$28,000,000.	35,000,000.	\$800,000.
City of San Diego	5,160,000.	7,500,000	688,000.
Volcan Land & Water Company	7,739,000.	23,000,000.	336,500.

The writer is advised by Mr. H. R. Fay,

Superintendent of the Department of Water of San Diego, that within the past few days the City has asked the Cuyamaca Water Company to present an offer of that property to the City. Should the City acquire the Cuyamaca Water Company it is very probable that a re-arrangement of the various elements of the system of the Volcan Land & Water Company, above proposed, might be made. In the light of the information available it seems that probably the water from Earner and Sutherland reservoirs might be brought directly into the flume of the Cuyamaca Water Company in the vicinity of the diverting dam and thence transmitted through the flume and pipe line of that system to the University Heights Reservoir. Under these circumstances the waters from Pamo Reservoir might be passed to Carroll Reservoir and thence through the proposed pipe line to the low service distribution zone of the City.

Such a combination, if possible, would probably



result in saving several hundred thousand dollars in the total cost of the complete system, but at this time sufficient data is not at hand to determine this question.

CONCLUSIONS.

Finally, it may be said that in the light of the information available the following conclusions are justified:

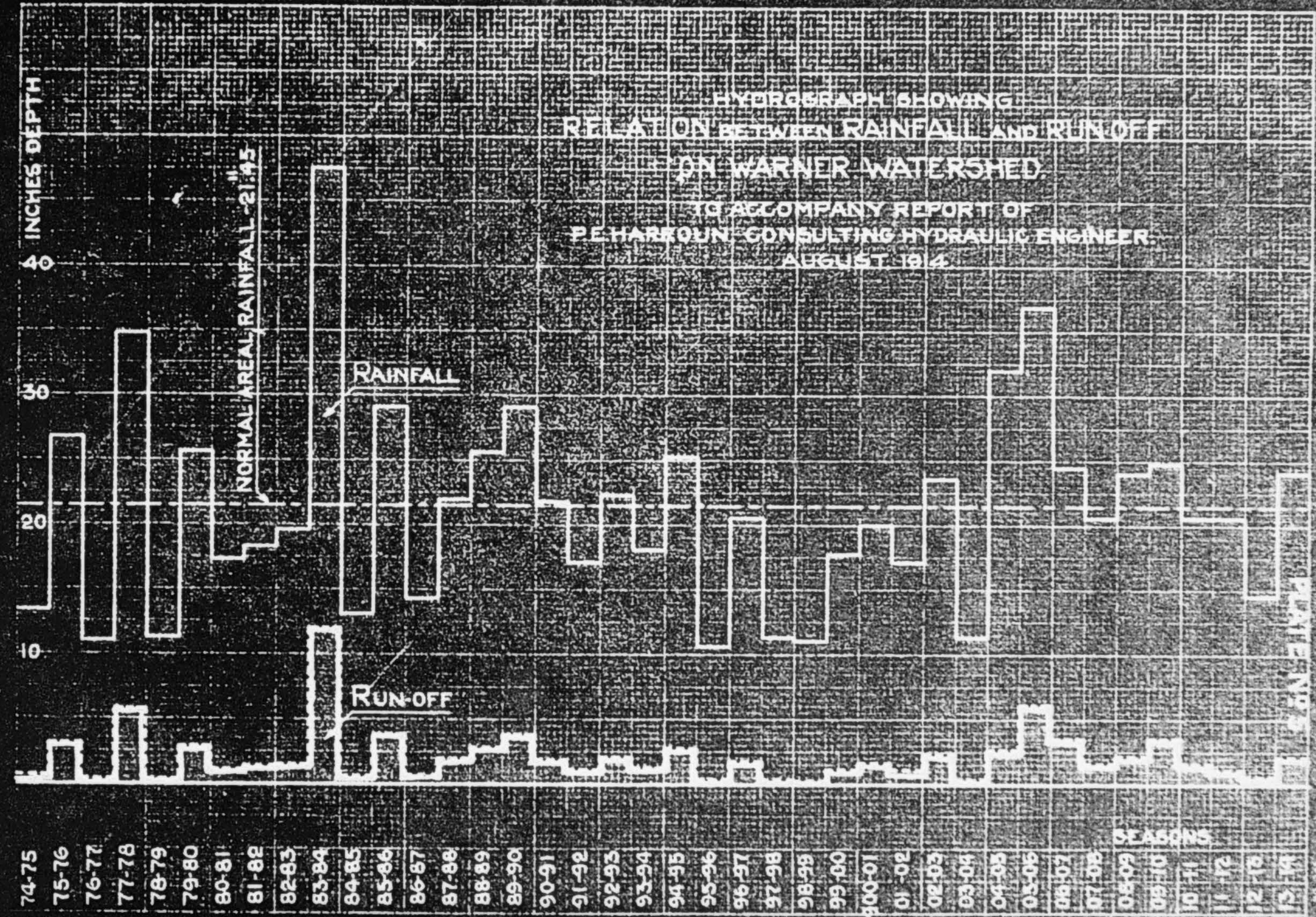
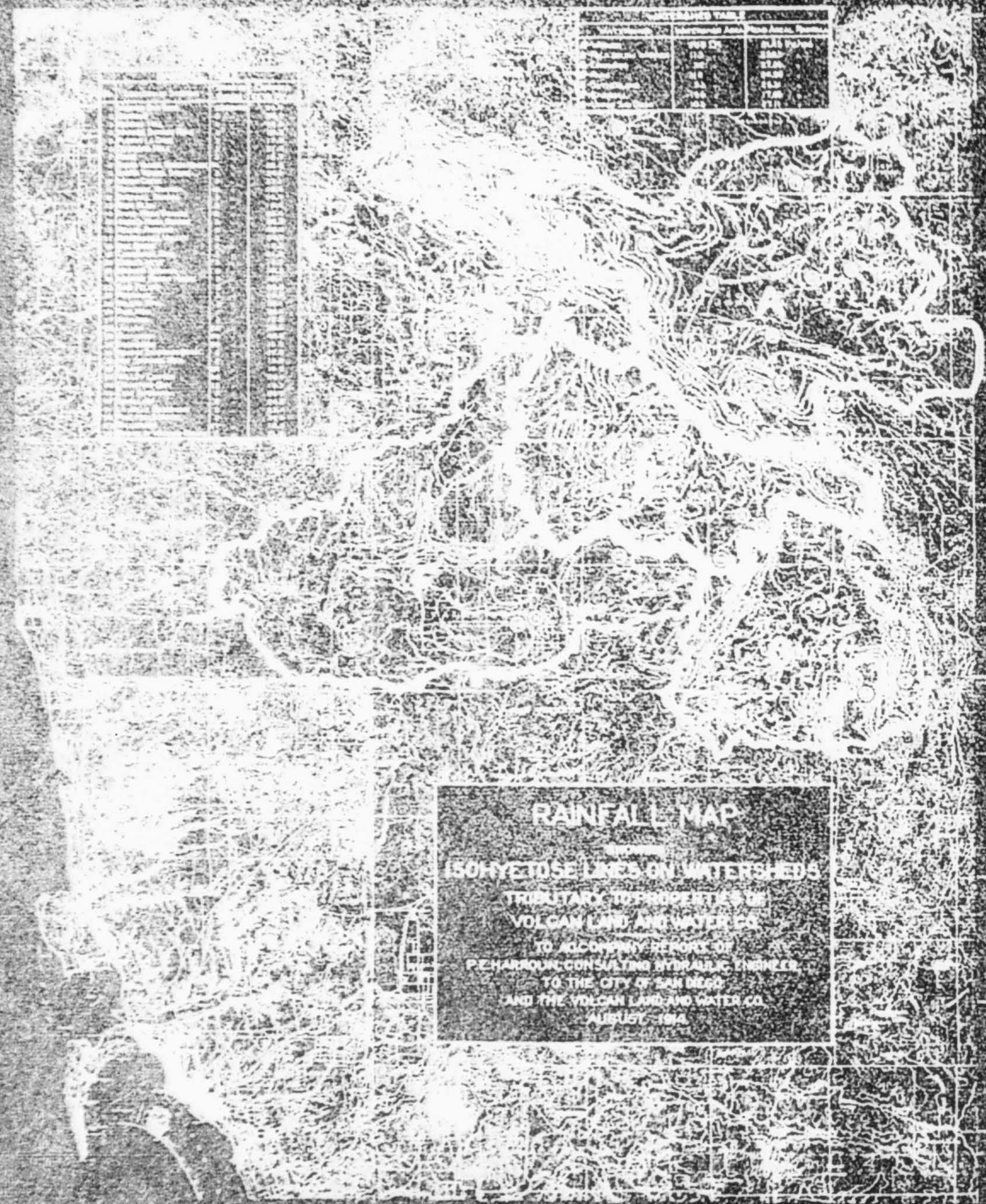
THAT	The safe net yield of Warner Reservoir will be	15			million gallons daily.
THAT	the safe net yield of Sutherland Reservoir will be	5.9	"	"	"
THAT	the safe net yield of Pamo Reservoir will be	2.1	"	"	"
THAT	the safe net yield of Carroll Reservoir will be	<u>2.5</u>	"	"	"
THAT	the safe net yield of the entire system will be	25.5	"	"	"
THAT	Allowing 10% for losses in transmission there will be delivered into the City of San Diego				23 million gallons daily.
THAT	On the basis of \$1,000. per miners inch for water rights, the value of the property offered to the City of San Diego by the Volcan Land & Water Company for the sum of two and one half million dollars is				\$2,659,000.
THAT	On this basis the total cost of the complete development of the system on the basis of permanent construction and such as to deliver to the City of San Diego 23 million gallons daily will be				\$7,739,000.

**THAT** Upon the basis of  $4\frac{1}{8}\%$  interest on the value of the property together with annual depreciation, maintenance and operating cost and the delivery of 23 million gallons daily, this water will cost, delivered into the distribution system of the City of San Diego, per thousand gallons 5.26 cents.

Respectfully presented,

P. B. Harroun







MASS CURVE SHOWING  
RELATIONSHIP BETWEEN RAINFALL AND RUN-OFF  
IN RAINLAND WATERSHED  
TO ACCOMPANY REPORT OF  
P. C. HARRISON, CONSULTING HYDRAULIC ENGINEER  
AUGUST, 1914.

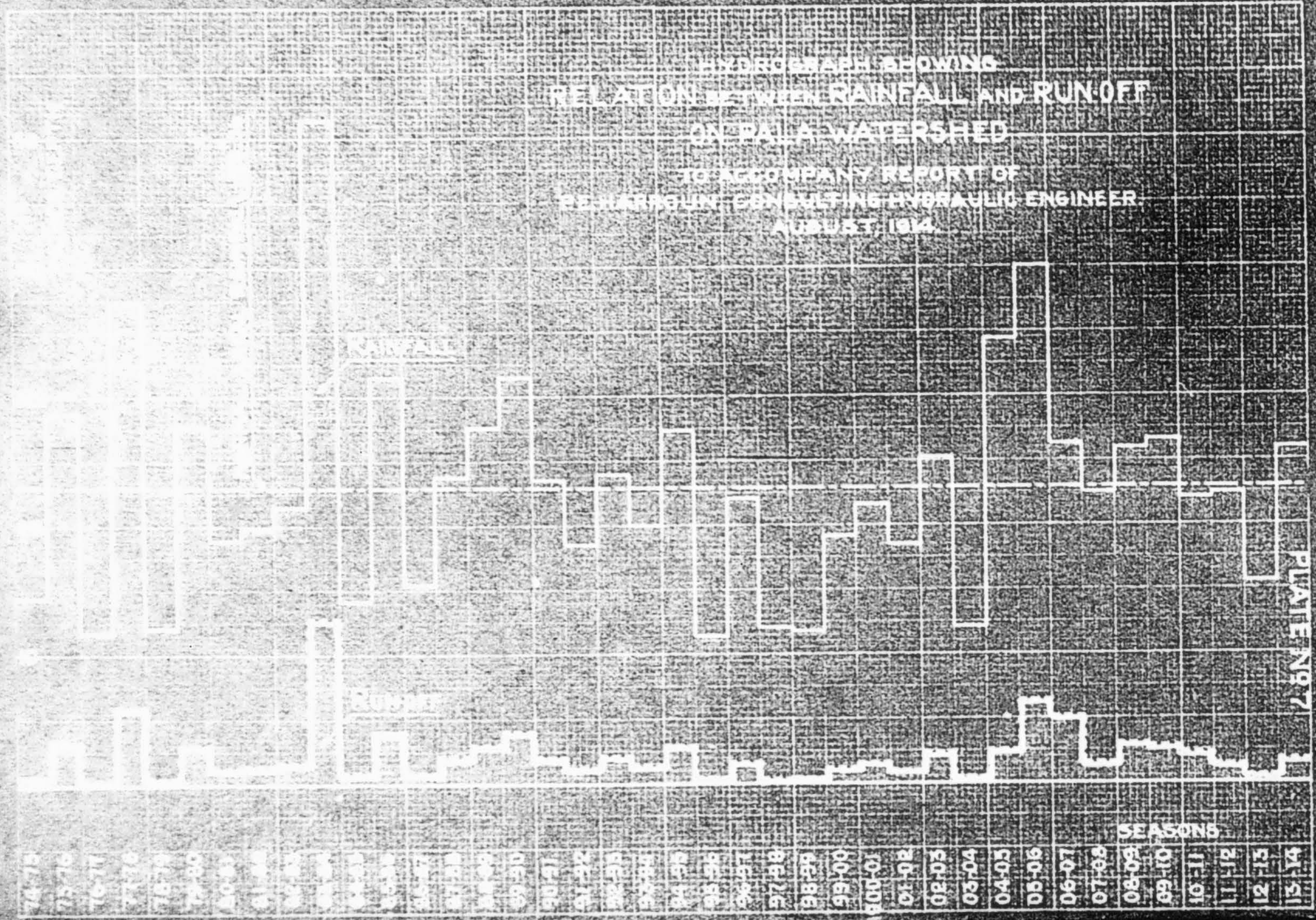
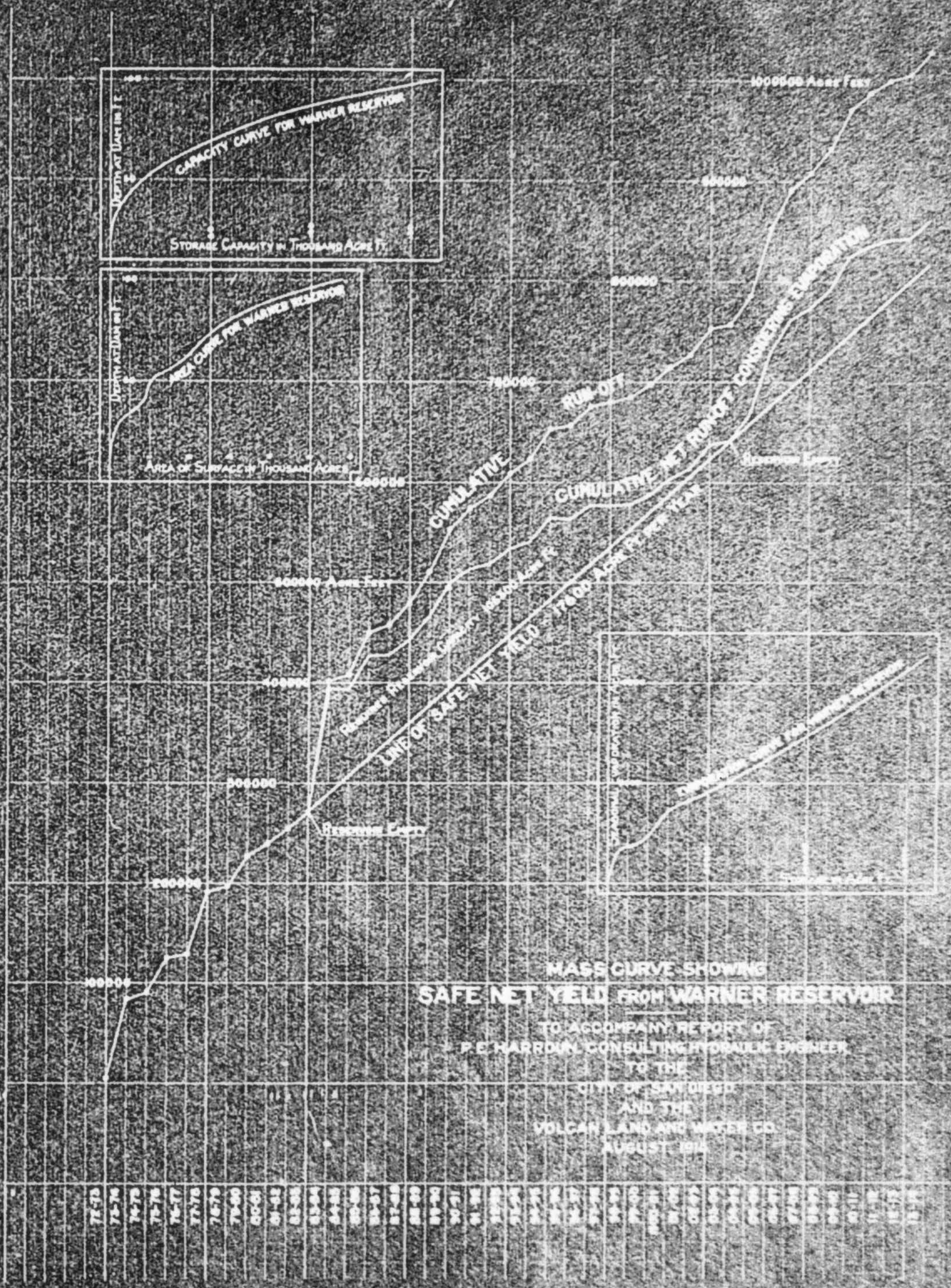


PLATE No 7



MASS CURVE SHOWING  
SAFE NET YIELD FROM WARNER RESERVOIR  
TO ACCOMPANY REPORT OF  
P. C. HARRISON, CONSULTING HYDRAULIC ENGINEER  
TO THE  
CITY OF SAN DIEGO  
AND THE  
VOLCAN LAND AND WATER CO.  
AUGUST, 1914.



HYDROGRAPH SHOWING  
RELATION BETWEEN RAINFALL AND RUN-OFF  
ON PALA WATERSHED  
TO ACCOMPANY REPORT OF  
P. E. HARRISON, CONSULTING HYDRAULIC ENGINEER  
AUGUST, 1914.

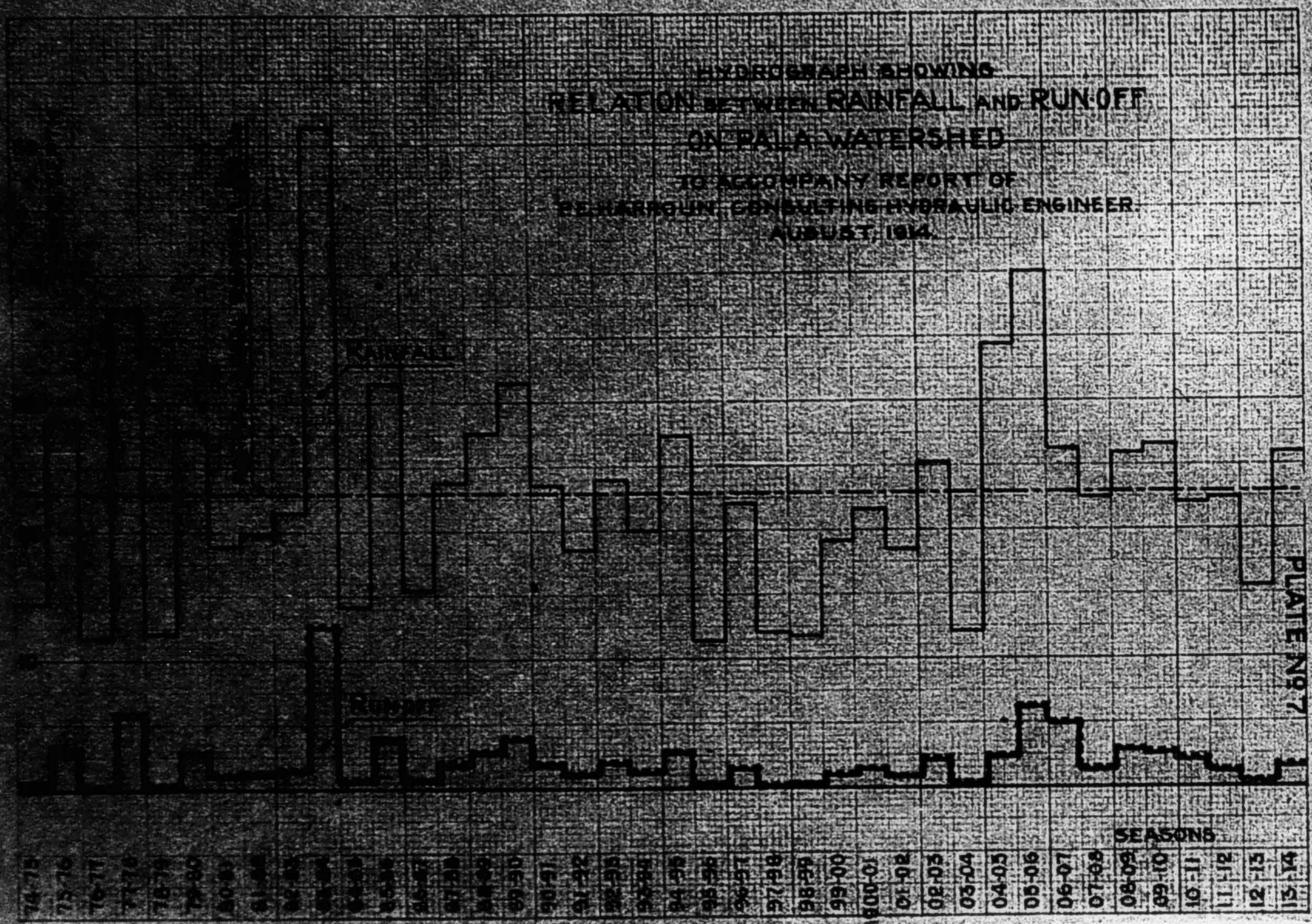


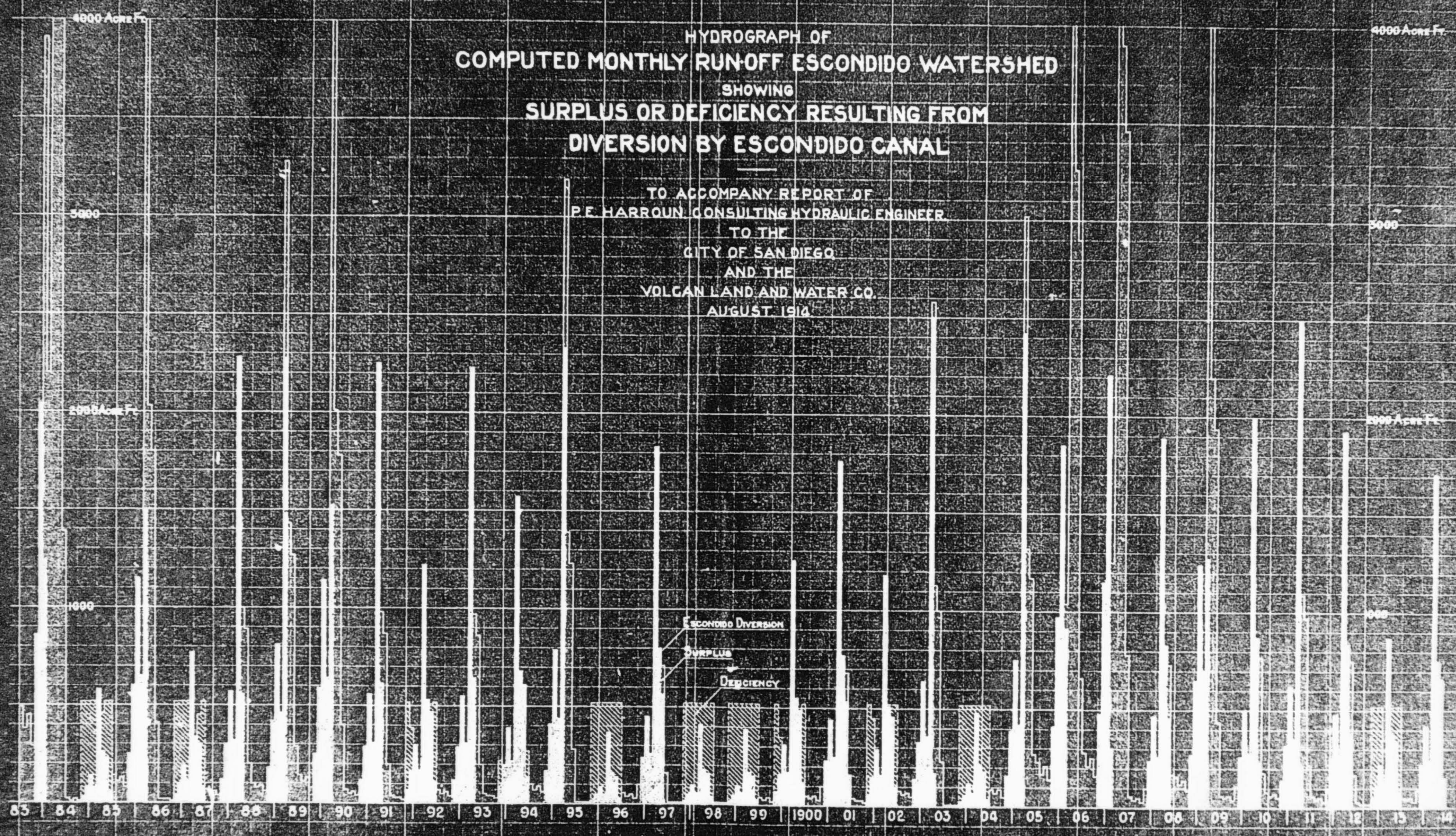
PLATE No 7





# HYDROGRAPH OF COMPUTED MONTHLY RUN-OFF ESCONDIDO WATERSHED SHOWING SURPLUS OR DEFICIENCY RESULTING FROM DIVERSION BY ESCONDIDO CANAL

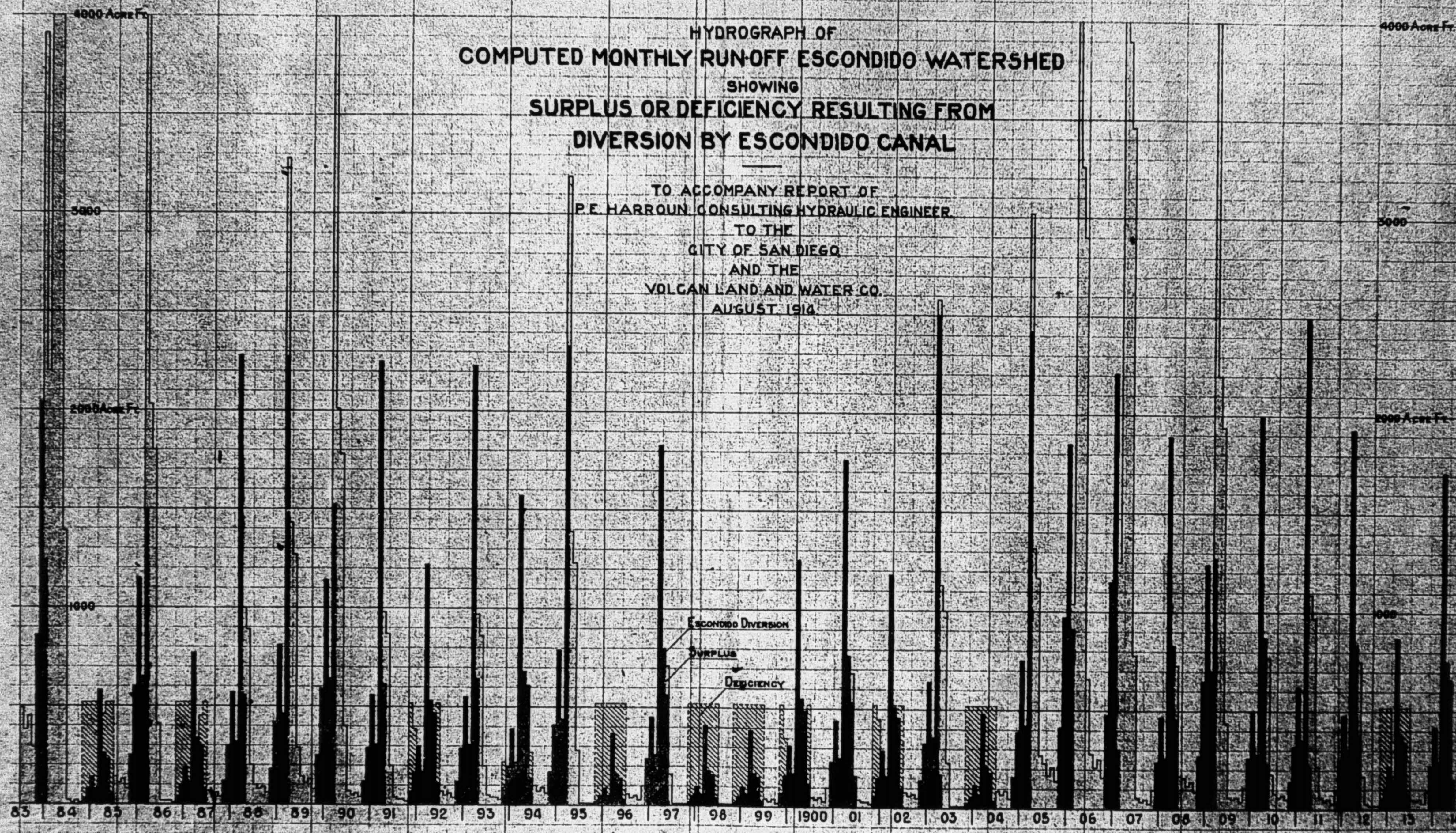
TO ACCOMPANY REPORT OF  
P. E. HARROUN, CONSULTING HYDRAULIC ENGINEER  
TO THE  
CITY OF SAN DIEGO  
AND THE  
VOLCAN LAND AND WATER CO.  
AUGUST 1914





# HYDROGRAPH OF COMPUTED MONTHLY RUN-OFF ESCONDIDO WATERSHED SHOWING SURPLUS OR DEFICIENCY RESULTING FROM DIVERSION BY ESCONDIDO CANAL

TO ACCOMPANY REPORT OF  
P. E. HARROUN, CONSULTING HYDRAULIC ENGINEER,  
TO THE  
CITY OF SAN DIEGO  
AND THE  
VOLCAN LAND AND WATER CO.  
AUGUST 1914





THE FOLLOWING  
DRAINAGE MAINTENANCE AND RUN-OFF

ON THE WATERSHED

OF THE DISTRICT OF  
COLUMBIA  
AUGUST 1942

PLATE NO. 11

2  
11-01  
11-02  
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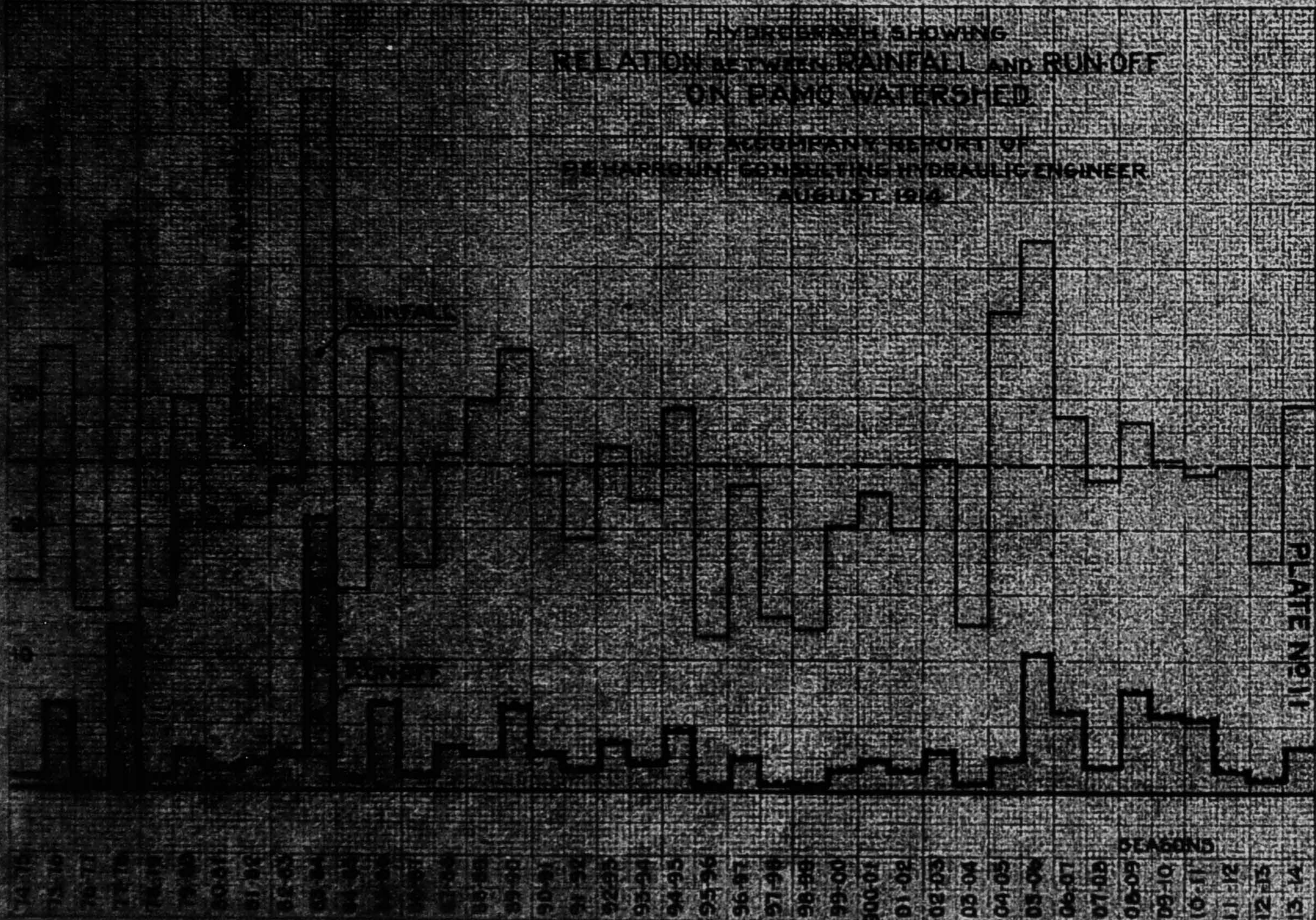




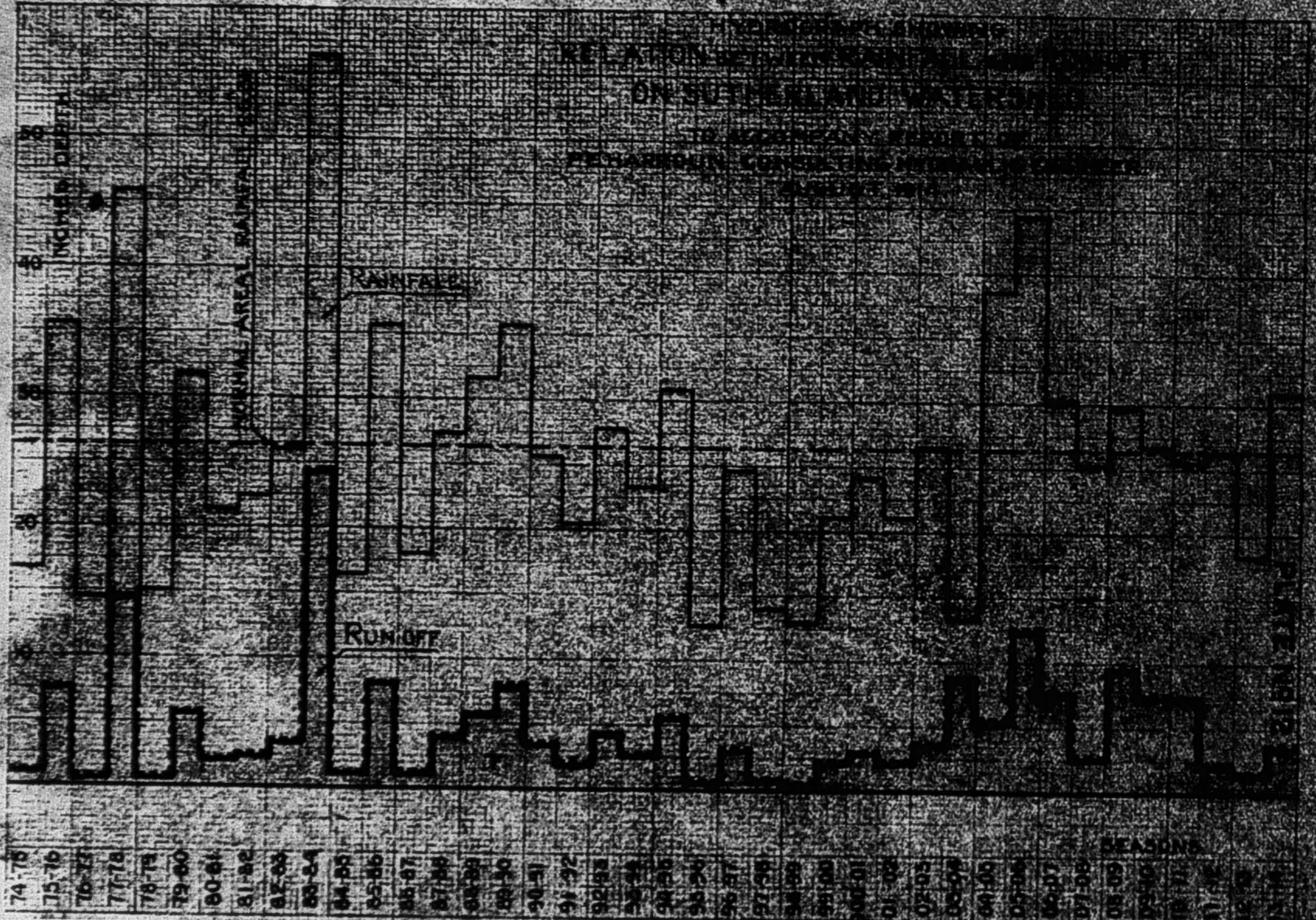


A GRAPHCAL REPRESENTATION SHOWING  
 RELATION BETWEEN RAINFALL AND RUN-OFF  
 ON DAMO WATERSHED

IN ASSISTANT REPORT OF  
 BR. HARRISON CONSULTING HYDRAULIC ENGINEER  
 AUGUST 1914



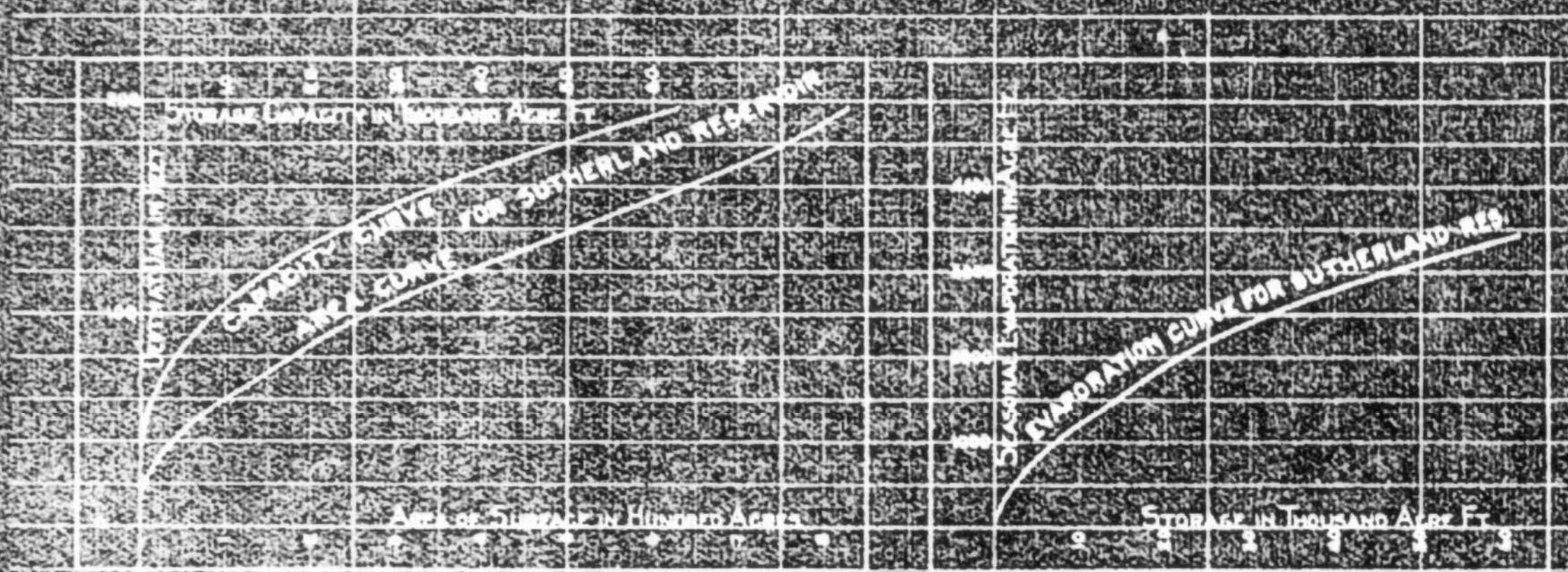






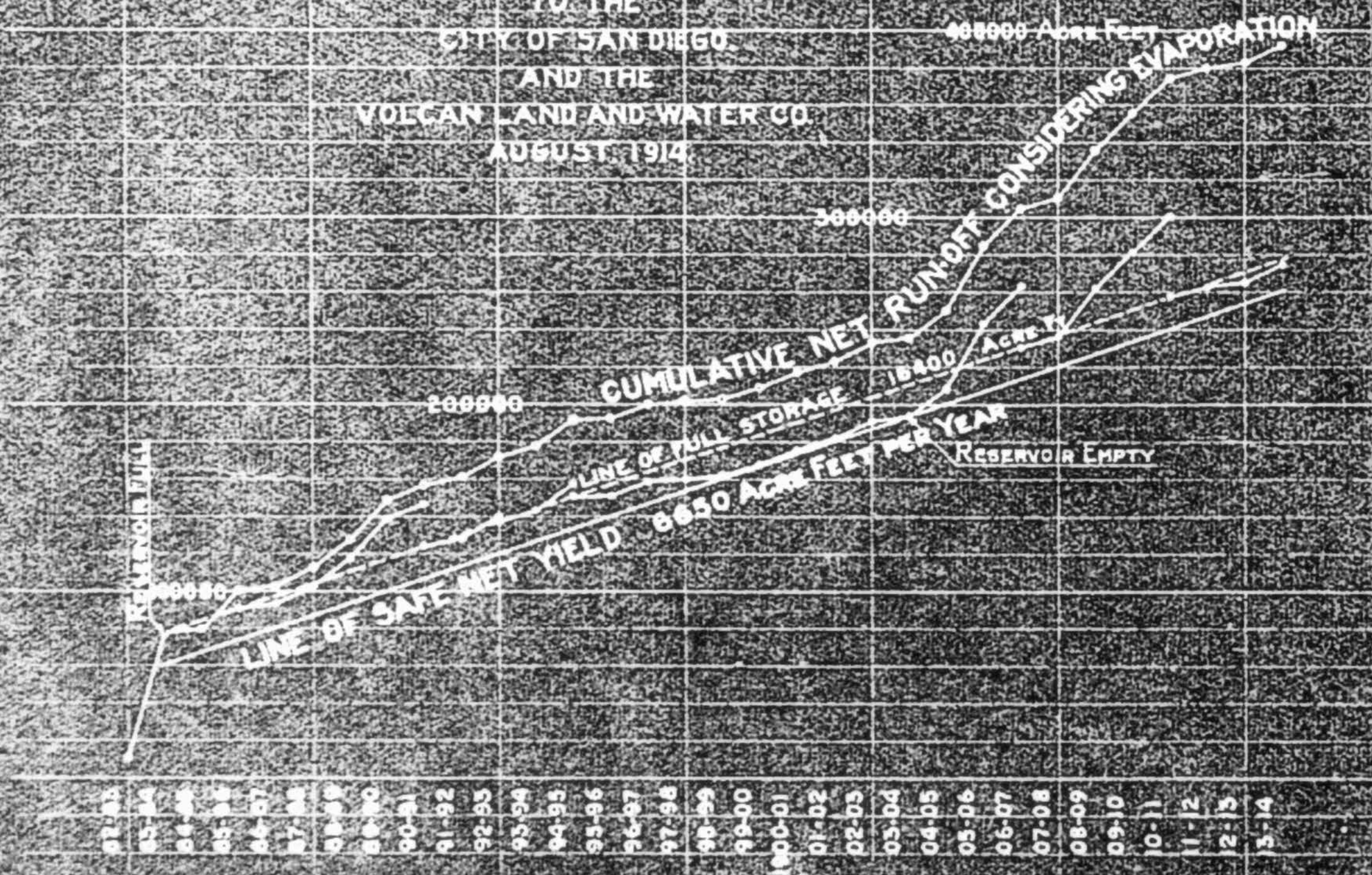






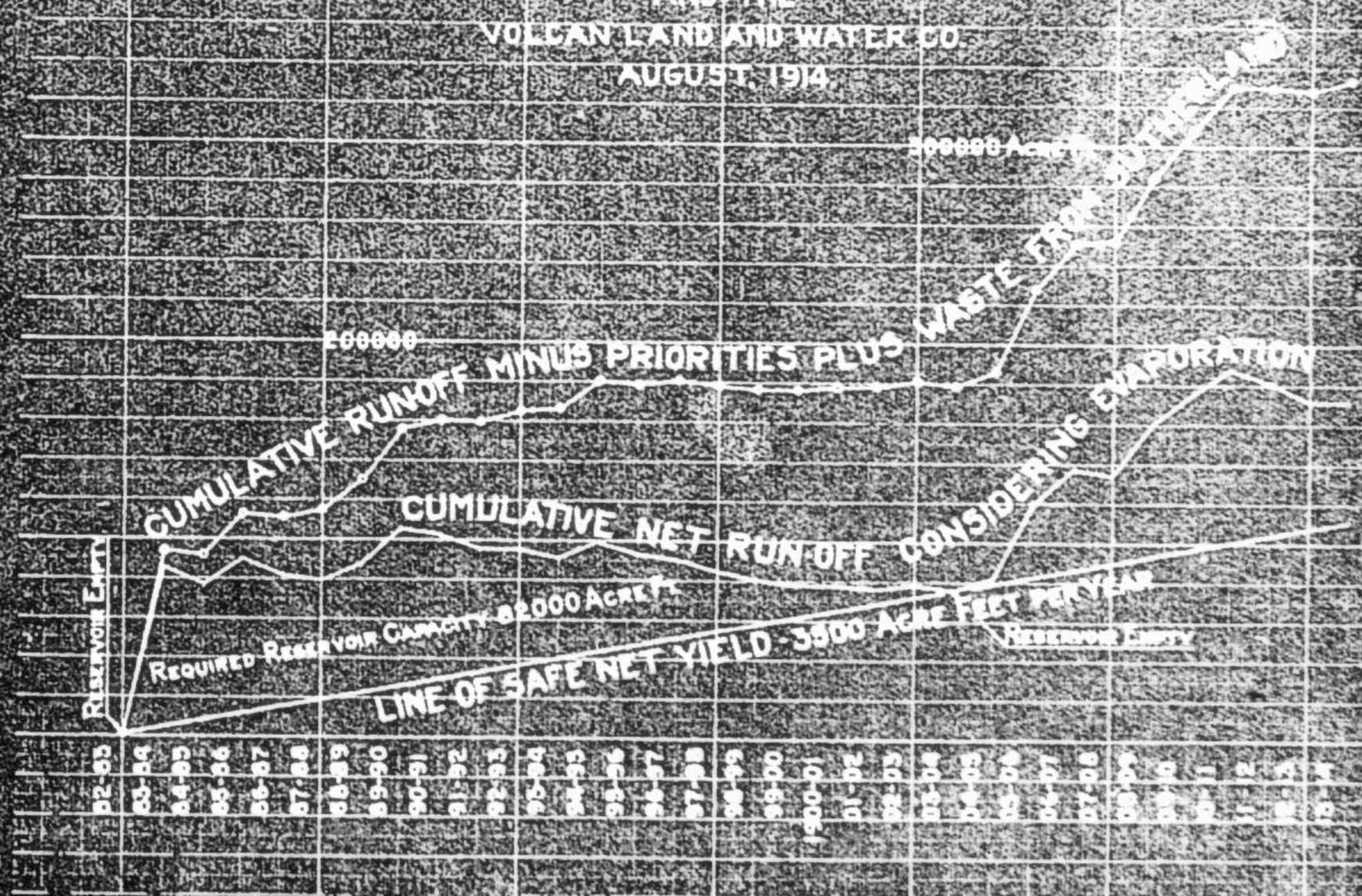
**MASS CURVE SHOWING SAFE NET YIELD FROM SUTHERLAND RESERVOIR**

TO ACCOMPANY REPORT OF  
P. E. HARRISON, CONSULTING HYDRAULIC ENGINEER,  
TO THE  
CITY OF SAN DIEGO  
AND THE  
VOLCAN LAND AND WATER CO.  
AUGUST, 1914



**MASS CURVE SHOWING SAFE NET YIELD FROM PAMO RESERVOIR**

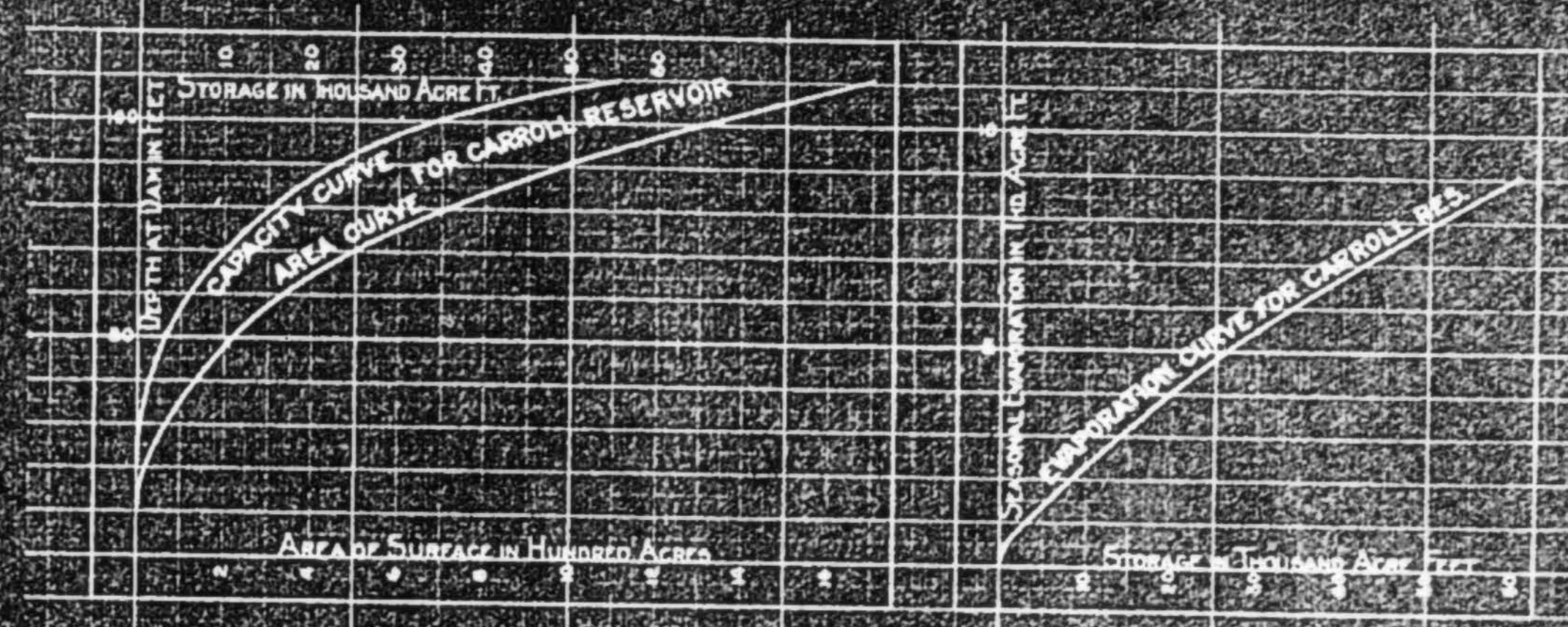
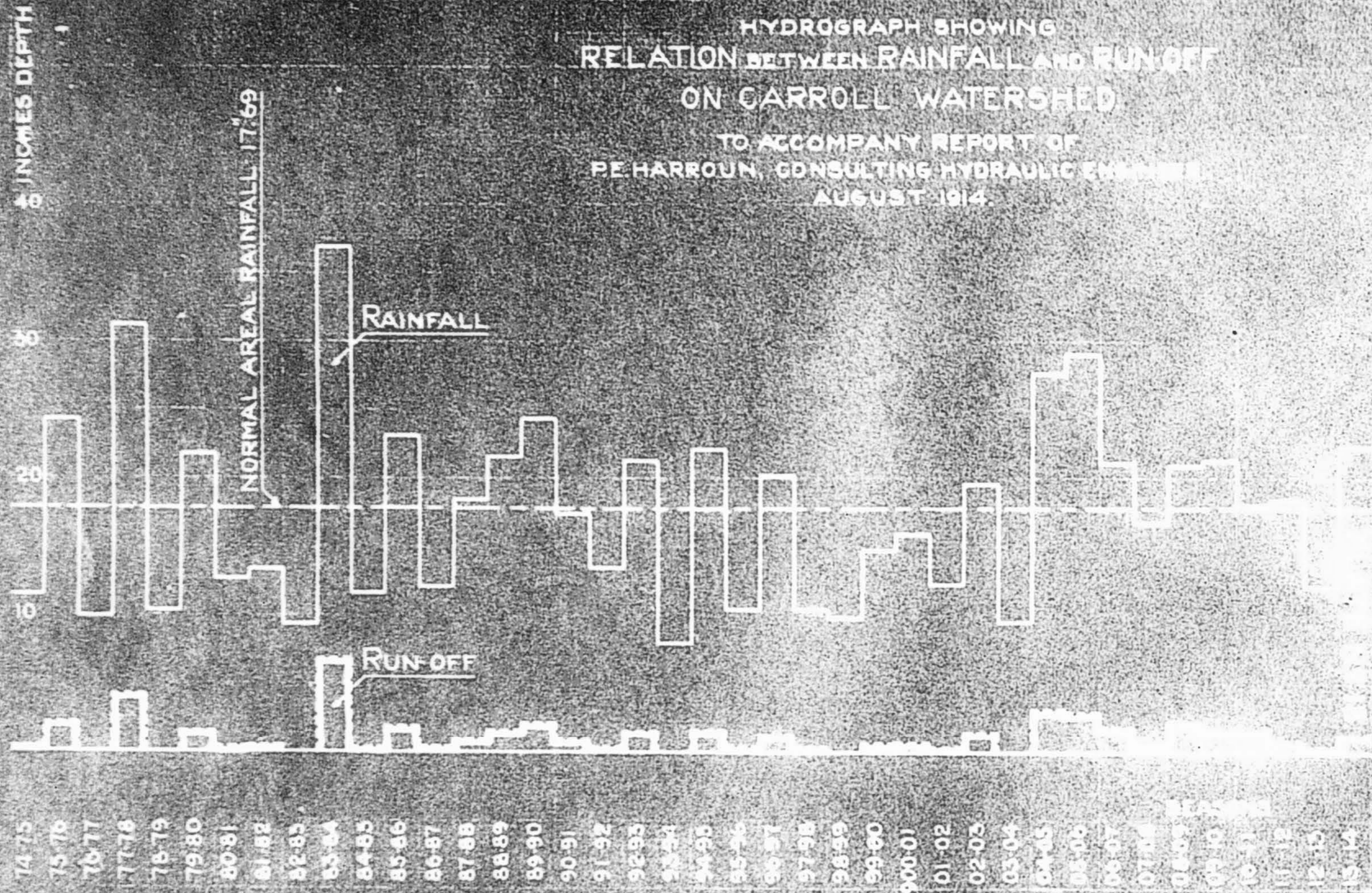
TO ACCOMPANY REPORT OF  
P. E. HARRISON, CONSULTING HYDRAULIC ENGINEER,  
TO THE  
CITY OF SAN DIEGO  
AND THE  
VOLCAN LAND AND WATER CO.  
AUGUST, 1914





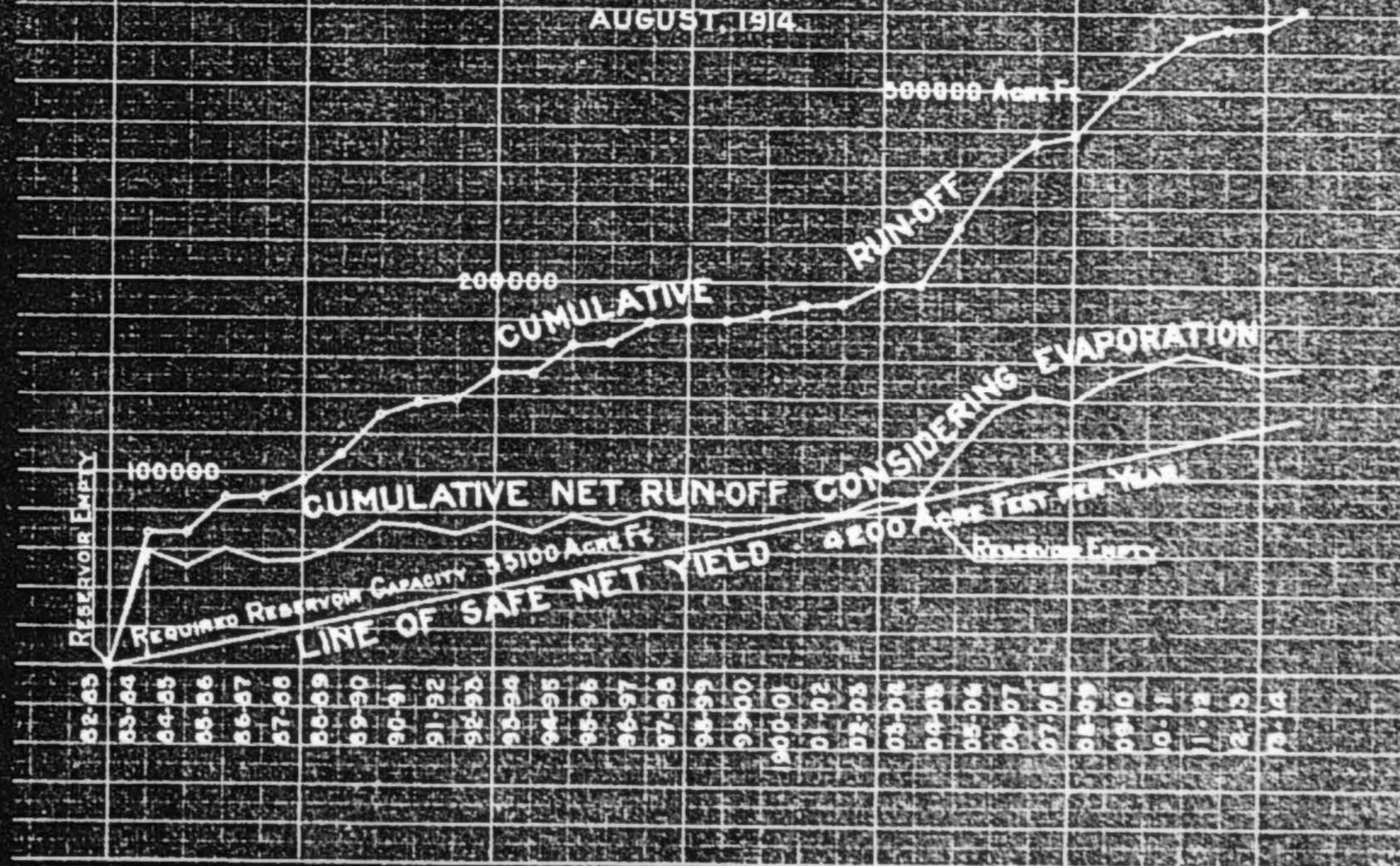
HYDROGRAPH SHOWING  
RELATION BETWEEN RAINFALL AND RUN OFF  
ON CARROLL WATERSHED

TO ACCOMPANY REPORT OF  
P.E. HARROUN, CONSULTING HYDRAULIC ENGINEER  
AUGUST 1914.



MASS CURVE SHOWING  
SAFE NET YIELD FROM CARROLL RESERVOIR

TO ACCOMPANY REPORT OF  
P.E. HARROUN, CONSULTING HYDRAULIC ENGINEER  
TO THE  
CITY OF SAN DIEGO  
AND THE  
VOLCAN LAND AND WATER CO  
AUGUST 1914.





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# REPORT

## ON VOLCAN LAND AND WATER COMPANY

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BY  
PHILIP E. HARROUN



Mayor's letter asking  
for Harroun  
statement above & below  
Normal Rainfall  
~~to take~~ Capacities  
add more on Lower & Upper  
Steps & Spillways  
Discharge Streams May 15th  
visit City Council and  
Water supply in book  
definite explanation  
of our offer to city

# REPORT

TO THE

City of San Diego and to the Volcan  
Land and Water Company

On the Safe Net Yield, Value,  
Cost of Completed System and  
Cost of Water Delivered, of  
the Properties of the Volcan  
Land and Water Company



BY  
PHILIP E. HARROUN

Consulting Engineer  
San Francisco, California

August, 1914

A few suggestions on  
Harroun's Report.

Cover, change to read WATER  
followed by half tone showing  
timber or water view  
on property.

Who is Harroun?  
Play up the Ry commission's  
choice in Spring Valley  
valuation.

Water views on pages 6-10  
11-13-15- and before plates  
best view of floods.



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Introductory .....	Page 1
Description of System .....	" 2
Safe Net Yield .....	" 4
Value of Property Offered to City for \$2,500,000 .....	" 12
Cost of Development of Entire System and Cost of Water Developed .....	" 22
Conclusions .....	" 27

## PLATES

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Plate 3	Curve of Comparative Rainfall and Runoff.
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Plate 5	Seasonal Relation between Rainfall and Runoff on Warner Watershed.
Plate 6	Relation between Rainfall and Runoff on Pala Watershed.
Plate 7	Seasonal Relation between Rainfall and Runoff on Pala Watershed.
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Plate 18	Seasonal Relation between Rainfall and Runoff on Carroll Watershed.
Plate 19	Mass Curve of Safe Net Yield of Carroll Reservoir.

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*Atase*  
*1/15*

**REPORT OF  
PHILIP E. HARROUN**

Consulting Hydraulic Engineer

ON THE

**Volcan Land and Water Company's Property and Its Availability  
as a System to Supply the Needs of the City of San Diego**

San Francisco, August, 1914.

To the Honorable Mayor, Charles F. O'Neill, and the  
City Council of the City of San Diego, and  
To the Volcan Land & Water Company:  
Gentlemen:

On May 22, 1914, the Volcan Land & Water Company presented an offer of sale of certain properties comprising a system for water supply to the City of San Diego, which offer is on file with the City.

On June 1, the writer was jointly retained by the City of San Diego and the Volcan Land & Water Company to pronounce upon the value of this property. Since that date this question has been under investigation and the results of this investigation are embodied in the following report.

No questions of title have been investigated. It is assumed that the Volcan Land & Water Company has legal title to the property which it proposes to transfer to the City, and also to the water which it proposes to conserve and divert, other than those disabilities specifically allowed for in this report.

The Volcan Land & Water Company has made available to the writer the results of its investigations extending over the past few years. These investigations consist of surveys, studies of precipitation and runoff, preliminary design of necessary structures, and in addition there has been made available such cost records as are shown on the books incurred in bringing the property up to its present stage of development. This data has been taken as the basis for the report.

It was the desire of the City Council not only to be advised of the value of the property but it was also expressly desired that a study be made of the safe net yield which the properties would be able to furnish to the City upon full development. It has also been found necessary to arrive at the cost of the system, when fully developed, in order that it may be seen whether such cost is within economic limits. The report, therefore, will be divided into three major divisions treating,

First: The safe net yield which the system may be expected to deliver to the City of San Diego;

Second: The value of the property which is offered to the City for the sum of two and one-half million dollars (\$2,500,000.00);

Third: The cost of development of the property required to deliver to the City the safe net yield found, and also, the cost per thousand gallons delivered.



On Santa Ysabel River, gaugings are available from 1906-1907 to date at Pamo, and for the past two years at Bernardo. Through a study of these records in connection with the precipitation, the relation between rainfall and runoff has been determined and used in estimating the runoff for the past 42 years. These expanded runoff records have then been applied to the various reservoir sites where, in connection with a study of the reservoir capacity, evaporation and other factors, the safe net yield which may be expected from the various units of the project has been determined. The final results of these studies are shown graphically by the various tables and curves accompanying this report.

It is found that the safe net yield which Warner Reservoir would have been able to supply during the period of greatest drought occurring since 1872 is 17,600 acre feet or 24.3 cubic feet per second. To support this draft would require a dam of sufficient heights to provide 106,300 acre-feet of storage. Although this amount of water could have been continuously supplied from Warner Reservoir during the period of greatest drought occurring during the past 42 years, it would not have been possible for the Volcan Land & Water Company, or other owner of the property, to utilize this entire amount because of the necessity of considering priorities on the river below. These prior demands have been studied and it is believed that the only priorities which will affect the yield of the Warner Reservoir are those of the Escondido Mutual Water Company and of the Rincon Indians.

On June 21, 1912, an agreement was entered into between the Escondido Mutual Water Company and Mr. Wm. G. Henshaw for the Volcan Land & Water Company, defining the rights of the Escondido Mutual Water Company. It has therefore been necessary to determine what effect this contract would have had upon the safe net yield of Warner Reservoir. It is found that during the critical period determining the safe net yield it would have been necessary to release from the storage in Warner Reservoir the average amount of 742 acre feet per annum in order to meet this contract requirement. For this reason, therefore, the safe net yield to which the Volcan Land & Water Company would be entitled is 16,854 acre feet.

In the light of legal opinion and the studies which have been made of the information available regarding priorities, it is believed that no further demands can hold against Warner diversion.

The safe net yield and development proposed upon the Santa Ysabel River is also complicated by priorities upon that stream. As in the case of the San Luis Rey River, these have been studied and provided for. Below the Sutherland and Pamo reservoir sites and above the Carroll site lies the San Pasqual Valle. This valley contains a number of properties in a high state of cultivation through the use of the waters of the Santa Ysabel River. Any development above this valley must provide for the requirements of these lands.

A study of the situation shows that the amount of water required in the San Pasqual Valle over and above that which would originate within the drainage area below the Pamo Reservoir amounts to 3,850 acre feet per annum, and in considering the possibility of the development and safe net yield of the Sutherland and Pamo reservoirs it has

## DESCRIPTION OF THE SYSTEM

Briefly, the project of the Volcan Land & Water Company consists of the construction of a dam forming a reservoir on the San Luis Rey River at Warner Ranch. The waters in this reservoir are to be diverted into the drainage of the Santa Ysabel River. Upon the Santa Ysabel River three reservoirs are proposed, the first and most easterly called the Sutherland Reservoir, the second some five miles west called the Pamo Reservoir, and the third below Bernardo called the Carroll Reservoir.

The waters from the Warner Reservoir in passing into the Santa Ysabel drainage may be regulated either in the Sutherland or Pamo Reservoirs. The waters from Pamo and Sutherland reservoirs combined with those of the Warner Reservoir are to be carried in a canal, some 25 miles in length, into what is called San Clemente Reservoir. This latter reservoir is a little east of north and some 13 miles distant from the center of San Diego, and is to be used as a regulating reservoir. It is also to carry sufficient storage to provide against interruption in the supply. From San Clemente Reservoir the waters would flow by gravity into the University Heights Reservoir in the northeasterly section of the City. The waters from Carroll Reservoir would be carried by independent pipe line to the City. The general scheme of the system is shown on Plate 1, accompanying this report.

## SAFE NET YIELD WHICH THE SYSTEM MAY BE EXPECTED TO DELIVER TO THE CITY OF SAN DIEGO

The safe net yield of this system may be defined as that quantity of water which the system would have been able to deliver during the period of general drought of which there is record. The studies required to determine this question are intricate and require much time in the analysis of the many elements of rainfall, runoff, evaporation, transpiration and other factors entering into the question. It is not believed that presentation of the details of this technical study would be of interest to others than engineers and for that reason they are not presented in the body of this report. Plates 2 to 19 accompanying this report may be referred to for these items. However, in order that the conditions may be understood, a brief outline of the data available and the methods pursued in arriving at the safe net yield is presented below.

There are available records of rainfall in the near vicinity of the San Luis Rey and Santa Ysabel watersheds at 13 different points all more or less fragmentary but extending back as far as the season of 1872-1873. In addition, the records of some 28 rainfall stations within the drainage areas are available for the past two or three years. These records have been studied and expanded, using the Escondido record as a base, so as to obtain a continuous record at these stations for the last 42 seasons. From these records the Isohyetose lines within the drainage areas under consideration have been developed and from them the seasonal precipitation since 1872 has been determined.

Stream gaugings of the runoff on the various watersheds are available for the past eleven seasons at Pala on the San Luis Rey River and for the seasons of 1905-1906 and 1911-1912, to date, at Warner Dam.



been considered that this amount of water must be permitted to pass to the properties in the San Pasqual Valle.

The same condition holds below the Carrol Reservoir. The priorities there consist of the development upon the San Dieguito Ranch and also 50 miner's inches of continuous flow which is furnished to the town of Del Mar. These amount to 1,330 acre feet per annum. This amount has therefore been deducted from the gross yield of Carroll Reservoir and has been provided for these priorities in determining the safe net yield available for the Volcan Land & Water Company.

The determination of the maximum economic conservation upon the Santa Ysabel River is extremely complicated because of the development proposed in three different reservoirs and of the two riparian districts. In addition, the surveys and field investigations of the Volcan Land & Water Company have not yet been carried far enough so as to afford sufficient information from which to say what are the maximum economic possibilities of storage in the three different sites,—at Sutherland, Pamo and Carroll.

Three different studies have been made of the possible combinations of storage and consequent determination of safe net yield which appear to the writer will be ultimately found to cover the economic possibilities of the situation. Until further field investigations have been made, either by the Volcan Land & Water Company, or its successor, the final selection of the economic plan cannot be determined.

The first study was undertaken on the assumption that the dam at Sutherland Reservoir could be constructed to a sufficient height so as to give the storage required for maximum conservation of the runoff originating above that point, and that the Pamo Reservoir should consequently be constructed with a sufficient storage to conserve to the maximum the runoff originating below Sutherland and above Pamo, at the same time penalizing this runoff to the extent of 3,850 cubic feet per second for the priorities in the San Pasqual Valle.

On this basis it was found that a storage capacity of 62,000 acre feet was required for Sutherland Reservoir with a height of dam approximately 200 feet, and the safe net yield resulting would be 9,400 acre feet. The Pamo Reservoir would consequently require a storage capacity of 42,300 acre feet and the safe net yield after providing for the priorities of the San Pasqual Valle would be 1,600 acre feet per annum. This would require a dam of 150 feet approximate height. As previously indicated, the field investigations of the Volcan Land & Water Company have not been sufficient to show whether the great height of the dam and storage capacity at Sutherland can be economically had, and when reliable information is obtained on this point it may be found that it is inadvisable because of the great cost to construct a dam at this point of the height required to provide this storage.

Studies of the existing data show that with a flow line of 124 feet at Sutherland and a dam of approximately 130 feet height, a storage of 16,400 acre feet can be economically had. A second study of the safe net yield was made on this assumption, and that Pamo Reservoir could then be developed to the maximum height necessary to conserve the

waste from Sutherland together with the water originating between Sutherland and Pamo, after deducting the priorities of the San Pasqual Valle. Under these conditions, it was found that the safe net yield of the Sutherland Reservoir would be 6,650 acre feet and of Pamo 3,500 acre feet. To support the draft of 3,500 acre feet would require a dam of approximately 180 feet in height at that point which would provide a storage capacity of 82,000 acre feet.

This condition imposes a storage capacity and height of dam at Pamo which in the light of present surveys seems excessive and may be prohibitive from the standpoint of cost. At Pamo the field investigations indicated that a dam may be constructed of an economic height of 156 feet with a consequent storage capacity of 47,500 acre feet.

The third study was based upon the assumption that the Sutherland flow line be limited to 124 feet and the Pamo flow line at 156 feet. Under these conditions the safe net yield from Sutherland Reservoir would be 6,650 acre feet and from Pamo Reservoir 2,400 acre feet. Until further investigation should prove the contrary, this third study should be accepted. If future investigations show that either Sutherland or Pamo reservoirs can be economically increased in capacity it will increase the safe net yield estimated to the limiting yields determined in the first and second studies.

Carroll Reservoir has also been studied in the light of the maximum conservation possible. To fully conserve these waters it is found that the height of the dam at Carroll should be 110 feet and the storage capacity 55,100 acre feet. Under these conditions the safe net yield of the reservoir would be 4,200 acre feet.

The priorities below Carroll have already been mentioned and it has been estimated that 1,330 acre feet are required for these priorities. Consequently the safe net yield possible for the use of the City from Carroll Reservoir amounts to 2,870 acre feet.

The following tabulations show the safe net yield of the entire system under the three different combinations:

**SAFE NET YIELD OF THE SYSTEM ON THE BASIS OF THE MAXIMUM POSSIBLE CONSERVATION AT SUTHERLAND RESERVOIR**

	Acre feet.	Miners inches.	Million gallons daily.
Warner Reservoir.....	16,858	1,165	15.0
Sutherland Reservoir .....	9,400	650	8.4
Pamo Reservoir .....	1,600	110	1.4
Carroll Reservoir .....	2,870	196	2.5

**SAFE NET YIELD OF THE SYSTEM ON THE BASIS OF 16,400 ACRE FEET STORAGE AT SUTHERLAND AND SUFFICIENT STORAGE AT PAMO TO CONSERVE THE BALANCE OF THE RUNOFF.**

	Acre feet.	Miners inches.	Million gallons daily.
Warner Reservoir, as before.....	16,858	1,165	15.0
Sutherland Reservoir .....	6,650	455	5.9
Pamo Reservoir .....	3,500	240	3.1
Carroll Reservoir, as before.....	2,870	196	2.5



**SAFE NET YIELD OF THE SYSTEM ON THE BASIS THAT THE ECONOMIC STORAGE POSSIBLE AT SUTHERLAND IS 16,400 ACRE FEET AND AT PAMO 47,500 ACRE FEET**

	Acro feet.	Miners inches.	Million gallons dally.
Warner Reservoir, as before.....	16,858	1,165	15.0
Sutherland Reservoir .....	6,050	455	5.9
Pamo Reservoir (Approx.) .....	2,400	165	2.1
Carroll Reservoir, as before.....	2,870	196	2.5

Should the City of San Diego acquire this property and institute condemnation proceedings against the irrigation priorities in the San Pasqual Valle and below Carroll Reservoir, it would increase the amount available for domestic supply by 3,850 acre feet per annum from the Sutherland-Pamo combination of reservoirs and 600 acre feet per annum from the Carroll Reservoir, or 3.4 million gallons daily, and 0.5 million gallons daily respectively.

**VALUE OF THE PROPERTY WHICH IS OFFERED TO THE CITY OF SAN DIEGO FOR THE SUM OF TWO AND ONE-HALF MILLION DOLLARS**

In pronouncing upon the value of the property which is offered by the Volcan Land & Water Company to the City of San Diego for the sum of two and one-half million (\$2,500,000.00) dollars, the greatest difficulty has been found. For the last nine years or more the owners of this property have been gradually acquiring the necessary water rights and rights of way and have been perfecting their organization leading up to the point where construction might be commenced. The Company has found it necessary to secure all of the water rights upon the San Luis Rey River, with the exception of the City of Oceanside, from Warner Dam to the Ocean, a distance of nearly 50 miles. This has been a long and expensive process.

In securing these rights, in a majority of cases, the riparian properties upon the river have been purchased outright and most of these properties are still in the hands of the Company. The writer estimates that the money cost in securing these properties along the San Luis Rey River is not less than \$1,500,000.00.

Upon the Santa Ysabel River the rights secured by the Company are comparatively few and it is estimated that these Santa Ysabel properties and rights have cost \$150,000.00 making the total cost of these properties not less than \$1,650,000.00. Rights of way through forest reserves and upon Government lands have also had to be secured.

A further complication has been the difficulties encountered in dissolving the old Pamo-Linda Vista Irrigation District. In this case it was necessary to purchase the outstanding bonds of the district and foreclose upon it. This procedure was necessary in order that the Pamo-Sutherland-Carroll combination of reservoirs might be made available. All of these elements have added greatly to the length of time necessary and to the cost of bringing the property up to the point where actual construction might begin. The value of the actual construction already undertaken is a comparatively small element at this time.

In addition to the items mentioned in the offer made by the Volcan Land & Water Company to the City, dated May 22, 1914, I am advised by the Company that it will furnish to the City full and complete rights of way from Pamo Reservoir to the San Clemente Reservoir, or from the Carroll Reservoir to the City of San Diego, as may be desired. The writer believing that the right of way from the Pamo Reservoir to the San Clemente Reservoir is the most necessary to the development, has included the value of this right of way in the estimate of value presented.

In placing a value upon the reservoir lands the writer, not being an expert in land values, has based his judgment upon value of lands for such purposes as has been found by the Railroad Commission of California and the Courts, modified to meet the conditions on this system in accordance with the writer's judgment.

In placing a value upon the power possible of development the writer has proceeded along the following lines: This system if acquired by the City of San Diego will furnish water primarily for domestic purposes. Any power which may be developed from the property is incidental and cannot be developed to the detriment of the domestic service. The field investigations undertaken by the Company have not yet been carried far enough to say what the final economic arrangement of the units of the system must be in order to give the greatest conservation with the least expenditure of money. Until full studies are had this cannot be learned. The writer believes that the amount of power it will be ultimately found can be economically developed will be a comparatively small amount, and certainly not sufficient to permit the city to enter the power field commercially, although probably sufficient for the City's own needs. As the power possibilities of the system are at this time so indeterminate and vague the writer has only given a nominal value to this element.

The question of the value of water rights has led to great controversy, the State and Federal Courts being divided in their views. Recently the Supreme Court of the United States, in the case of the San Joaquin & Kings River Canal & Irrigation Company vs. County of Stanislaus, 191 Fed., 875, has held that a value must be placed upon water rights, as they are property under the decisions of the Courts of California. The value of water rights are extremely difficult of determination and the writer knows of no logical method whereby these values may be measured. In certain cases within the state these values have been pronounced upon by bodies of competent jurisdiction and the writer considers under the circumstances that the values found by such bodies are the only index which may be obtained.

In the case of the Spring Valley Water Works vs. City and County of San Francisco, before the United States Circuit Court, Judge Farrington found the value of the water rights of the Spring Valley Water Company to be \$60,000 per million gallons. This corresponds approximately to a value of \$775 per miner's inch.

In the case of Sierra Madre vs. Baldwin (a condemnation suit) before the Superior Court of Los Angeles County, it was stipulated that a fair value for gravity water, independent of any works, was \$3,500.00 per miner's inch.



In the case of Hollywood Union Water Company vs. City of Los Angeles, before the Superior Court of Los Angeles County (a rate case), it was mutually agreed that the value of gravity water was \$2,500.00 per miner's inch.

The Railroad Commission of California, in decision No. 1515, Petition of the City of Glendale to fix the valuation of certain water systems in said City, gave a value of \$2,000 per miner's inch for gravity water. That decision also lists among others the following values for gravity water:

- \$2,000 price reached by one Burr, near San Fernando in 1906.
- \$2,500 selling price at McClay Rancho in 1902.
- \$1,500—\$1,800 results of sales in this vicinity in 1902.

In the recent application of the City of San Diego to fix water rates to consumers without the City, before the Railroad Commission of California, Mr. H. A. Whitney, Hydraulic Engineer of the City of San Diego, placed a value of \$1,500 per inch upon the 400 inches of water owned by the City of San Diego.

It will be seen from the above that the value of water rights for gravity water, officially fixed by bodies of competent jurisdiction, has ranged from a minimum of \$775 to a maximum of \$3500 per miner's inch.

If it be accepted that water rights have a value, it appears to the writer that that value must vary directly with the demand, scarcity and difficulty of securing the commodity. If this be true, the value of \$775 per inch, found by Judge Farrington in the Spring Valley case, is not a measure of the value of water in San Diego County where there is much greater scarcity and difficulty in securing the same.

The writer has estimated the value of the water rights of the Volcan Land & Water Company upon three different bases.

- First: \$1,000 per inch;
- Second: \$1,500 per inch as was considered a fair value by the City's Hydraulic Engineer, Mr. Whitney;
- Third: \$2,000 per inch as found by the Railroad Commission in the Glendale case.

In the case of the rights upon the San Luis Rey River, these values have been placed against the safe net yield of the Warner Reservoir penalized by the amount required to support the priorities stated, as the Company has or will acquire and transfer to the City full title to all riparian rights.

Upon the Santa Ysabel River the Company has not acquired all rights and will only transfer to the City such rates as it owns at the present time. The writer estimates that it will cost the Volcan Land & Water Company, or the City of San Diego, the sum of \$459,000 to acquire the balance of these rights. For this reason the value of the water rights per miner's inch possible of conservation upon the Santa Ysabel River has been penalized by this amount, and the values given are those for the safe net yield after applying this penalty and also after supplying existing priorities.

The following table shows the value of the property which the Volcan Land & Water Company proposes to transfer to the City of San Diego for the sum of two and one-half million dollars, on the basis of water rights at a value of \$1,000 per miner's inch:

Water rights on San Luis Rey River, being 1165 inches less 10% transmission losses, or 1049 inches net delivered, at \$1,000 per inch.....	\$1,049,000
Water rights on Santa Ysabel River developed by a combination of Sutherland and Pamo reservoirs which in combination will yield 620 inches, less 10% transmission losses, or 558 inches net, at \$1,000 per inch.....	\$ 558,000
Water rights from Carroll Reservoir development, being 196 inches, less 10% transmission losses, or 176 inches net, at \$1,000 per inch.....	176,000
	<u>\$734,000</u>
Less cost of acquiring balance of riparian rights on Santa Ysabel River necessary to make these rights effective..	\$ 450,000
Net value of rights on Santa Ysabel River.....	<u>\$ 275,000</u>
Total value of water rights.....	<u>\$1,324,000</u>
Investment value of lands, rights of way, construction, general and all other items except power, which it is proposed to transfer.....	1,325,000
Nominal value for power possible of development.....	10,000
	<u>\$2,659,000</u>

On this basis it will be seen that the value of the properties proposed to be transferred is \$159,000 in excess of the sum which the City proposes to pay for the same.

If the value of the water rights be taken at \$1,500 per miner's inch we have the following resulting values:

Water rights on San Luis Rey River, being 1165 inches, less 10% transmission losses, or 1049 inches net delivered, at \$1,500 per inch.....	\$1,573,500
Water rights on Santa Ysabel River developed by a combination of Sutherland and Pamo reservoirs which in combination will yield 620 inches, less 10% transmission losses, or 558 inches net at \$1,500 per inch.....	\$ 837,000
Water rights from Carroll Reservoir development, being 196 inches, less 10% transmission losses, or 176 inches net at \$1,500 per inch.....	264,000
	<u>\$1,101,000</u>
Less cost of acquiring balance of riparian rights on Santa Ysabel River, necessary to make these rights effective.....	459,000
Net value of rights on Santa Ysabel River.....	<u>\$ 642,000</u>
Total value of water rights.....	<u>\$2,215,500</u>
Investment value of lands, rights of way, construction, general and all other items except power, which it is proposed to transfer.....	1,325,000
Nominal value for power possible of development.....	10,000
	<u>\$3,550,500</u>



In this case the value of the property is \$1,050,500 in excess of that sum which the City proposes to pay.

Should the value of the water rights be placed at \$2,000 per inch we have the following conditions:

Water rights on San Luis Rey River, being 1165 inches, less 10% transmission losses, or 1049 inches, net delivered at \$2,000 per inch.....	\$2,098,000
Water rights on Santa Ysabel River developed by a combination of Sutherland and Pamo reservoirs which in combination will yield 620 inches, less 10% transmission losses, or 558 inches net, at \$2,000 per inch .....	\$1,116,000
Water rights from Carrol Reservoir development, being 196 inches, less 10% transmission losses, or 176 inches net, at \$2,000 per inch.....	352,000
	<u>\$1,468,000</u>
Less cost of acquiring balance of riparian rights on Santa Ysabel River, required to make these rights effective .....	459,000
Net value of rights on Santa Ysabel River.....	<u>\$1,009,000</u>
Total value of water rights.....	\$3,107,000
Investment value of lands, rights of way, construction, general and all other items except power, which it is proposed to transfer.....	\$1,325,000
Nominal value for power possible of development....	10,000
Total value of the property offered.....	<u>\$4,442,000</u>

In this last case the value of the property is \$1,942,000 in excess of the sum for which it is offered to the City.

**COST OF DEVELOPMENT OF THE SYSTEM REQUIRED TO DELIVER TO THE CITY THE SAFE NET YIELD FOUND AND, ALSO, THE COST PER THOUSAND GALLONS DELIVERED**

In presenting estimates of cost of developing the entire system and determining the cost of the commodity which would be furnished therefrom, attention is again called to the fact that at the present time investigations both in the field and office, by the Volcan Land & Water Company have not proceeded far enough to determine the final and economic design of the system. For this reason these estimates are approximate, but are to be accepted as fully justified in the light of the information available.

The studies of the safe net yield of the various reservoirs proposed has shown that the amount of the lands within the reservoir sites which it is proposed to deliver to the City is not sufficient to provide for the requisite storage. This is certainly the case with Warner and Carroll reservoirs and probably upon more complete information will be found to be true of the Pamo and Sutherland reservoirs also. The estimates of the total cost to complete the system therefore have included in them sufficient funds to acquire the additional lands necessary to provide the storage required for the safe net yield found.

The estimated cost of the structures has been entirely on the line of permanent construction. Conduits and tunnels have been estimated on the basis of concrete construction and lining, and siphons and flumes of steel and concrete. There has been included the cost of a 30" riveted steel pipe line from Carroll Reservoir into the center of the low service distribution district of the City of San Diego. Two 36" riveted steel pipe lines have been estimated for, running from the regulating reservoir of San Clemente to University Heights Reservoir in the City of San Diego. These pipe lines would have an approximate capacity of 50 million gallons daily to meet the maximum daily demands which will be made upon the system.

The inclusion of these elements provides for the complete construction of the entire collecting and transmission system such that the water is brought immediately to the distribution system of the City. On this basis, and taking the value of the water rights at \$1,000 per miner's inch, the cost of the complete property would be as shown in the following table:

**ESTIMATE OF COST OF COMPLETE COLLECTING AND DISTRIBUTION SYSTEM, TO YIELD 23 MILLION GALLONS DAILY**

Water rights .....	\$1,783,000
Lands and rights of way.....	1,171,000
Construction—	
Warner Reservoir .....	\$325,000
Warner-Pamo Conduit .....	429,000
Pamo Reservoir .....	425,000
Sutherland Reservoir .....	345,000
Pamo-San Clemente Conduit.....	862,000
Carroll Reservoir .....	238,000
Carroll-San Diego pipe line, 30" riveted steel.....	716,000
San Clemente-University Heights pipe line, two 36" riveted steel pipes .....	635,000
	<u>\$3,975,000</u>
General and miscellaneous .....	959,000
Nominal value of power possibility.....	10,000
Total .....	<u>\$7,898,000</u>

As the City is offered for the sum of two and one-half million dollars, property of the value \$2,659,000 included in the above estimates, the cost to the City of the completed system will therefore be \$159,000 less than the total above arrived at, or \$7,739,000.

Allowing 10% for losses of water in transmission, this system will deliver into the distribution system of the City of San Diego 23 million gallons daily.

The cost of the water delivered into the City on the basis of 4½% interest on the value of the property will therefore be as follows:

**ESTIMATE OF COST OF WATER DELIVERED TO THE CITY OF SAN DIEGO**

Interest on \$7,739,000 at 4½%.....	\$348,255
Depreciation, general repairs, operation and maintenance.....	93,400
Total annual cost.....	<u>\$441,655</u>



These total annual charges amount to 5.261 cents per thousand gallons delivered.

It is interesting to compare the total cost of the property on the basis of its safe net yield per million gallons delivered with the cost of other properties. Mr. H. A. Whitney, Hydraulic Engineer for the City of San Diego, estimates that it would cost the City of San Diego \$1,160,000 to place the City's collecting and transmission system upon the same permanent construction basis as that which has been estimated for the system under consideration. This, added to the four millions which it cost the city to acquire the same, would make that property have a value of \$5,160,000. The safe net yield of the system owned by the City is taken at 7½ million gallons daily.

The City of San Francisco has recently offered to the Spring Valley Water Company the sum of \$34,500,000 for its properties. This includes the City distribution system. If we eliminate the City distribution system at the value found by Judge Farrington in his decision in the case we arrive at a value of \$28,000,000 for the balance of the system corresponding to that of the impounding and transmission system of the City of San Diego and that estimated for the Volcan Land & Water Company's system in this report.

The following statement shows the cost of the property in dollars per million gallons of safe net yield:

	Cost of collecting and transmission system.	Safe net yield in million gallons daily.	Cost per million gallons daily of safe net yield.
Spring Valley Water Company	\$28,000,000	35,000,000	\$800,000
City of San Diego	5,160,000	7,500,000	688,000
Volcan Land & Water Company	7,739,000	23,000,000	336,500

The writer is advised by Mr. H. R. Fay, Superintendent of the Department of Water of San Diego, that within the past few days the City has asked the Cuyamaca Water Company to present an offer of that property to the City. Should the City acquire the Cuyamaca Water Company it is very probable that a re-arrangement of the various elements of the system of the Volcan Land & Water Company, above proposed, might be made. In the light of the information available it seems that probably the water from Warner and Sutherland reservoirs might be brought directly into the flume of the Cuyamaca Water Company in the vicinity of the diverting dam and thence transmitted through the flume and pipe line of that system to the University Heights Reservoir. Under these circumstances the waters from Pamo Reservoir might be passed to Carroll Reservoir and thence through the proposed pipe line to the low service distribution zone of the City.

Such a combination, if possible, would probably result in saving several hundred thousand dollars in the total cost of the complete system, but at this time sufficient data is not at hand to determine this question.

## CONCLUSION

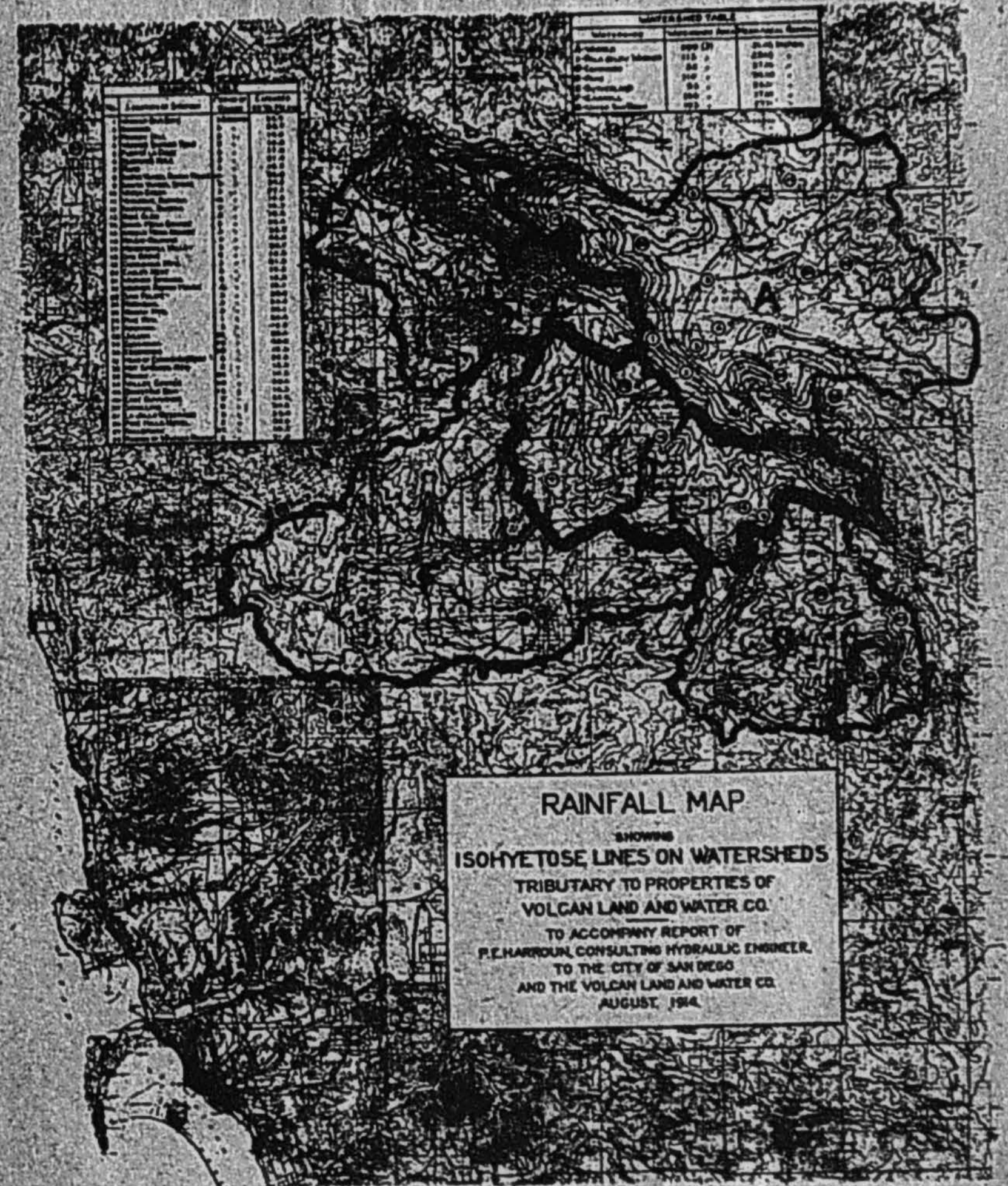
Finally, it may be said that in the light of the information available the following conclusions are justified, that:

The safe net yield of Warner Reservoir will be 15 million gallons daily			
The safe net yield of Sutherland Reservoir will be .....	5.9	"	"
The safe net yield of Pamo Reservoir will be..	2.1	"	"
The safe net yield of Carroll Reservoir will be..	2.5	"	"
The safe net yield of the entire system will be	25.5	"	"
Allowing 10% for losses in transmission there will be delivered into the City of San Diego	23	"	"
On the basis of \$1,000 per miner's inch for water rights, the value of the property offered to the City of San Diego by the Volcan Land & Water Company for the sum of two and one-half million dollars is.....			\$2,659,000
On this basis the total cost of the complete development of the system on the basis of permanent construction and such as to deliver to the City of San Diego 23 million gallons daily will be.....			\$7,739,000
Upon the basis of 4½% interest on the value of the property, together with annual depreciation, maintenance and operating cost and the delivery of 23 million gallons daily, this water will cost, delivered into the distribution system of the City of San Diego, per thousand gallons .....			5.26 cents.

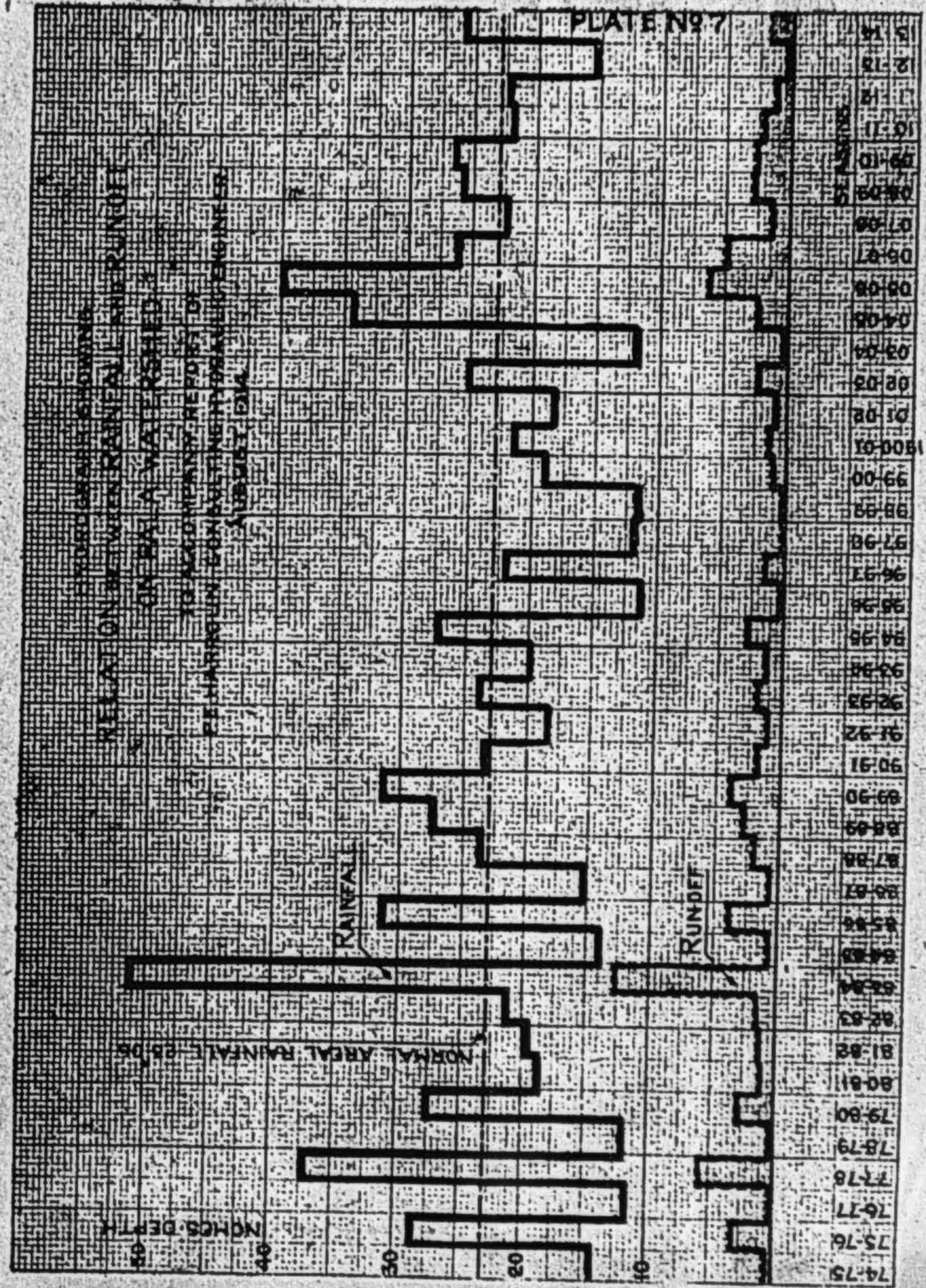
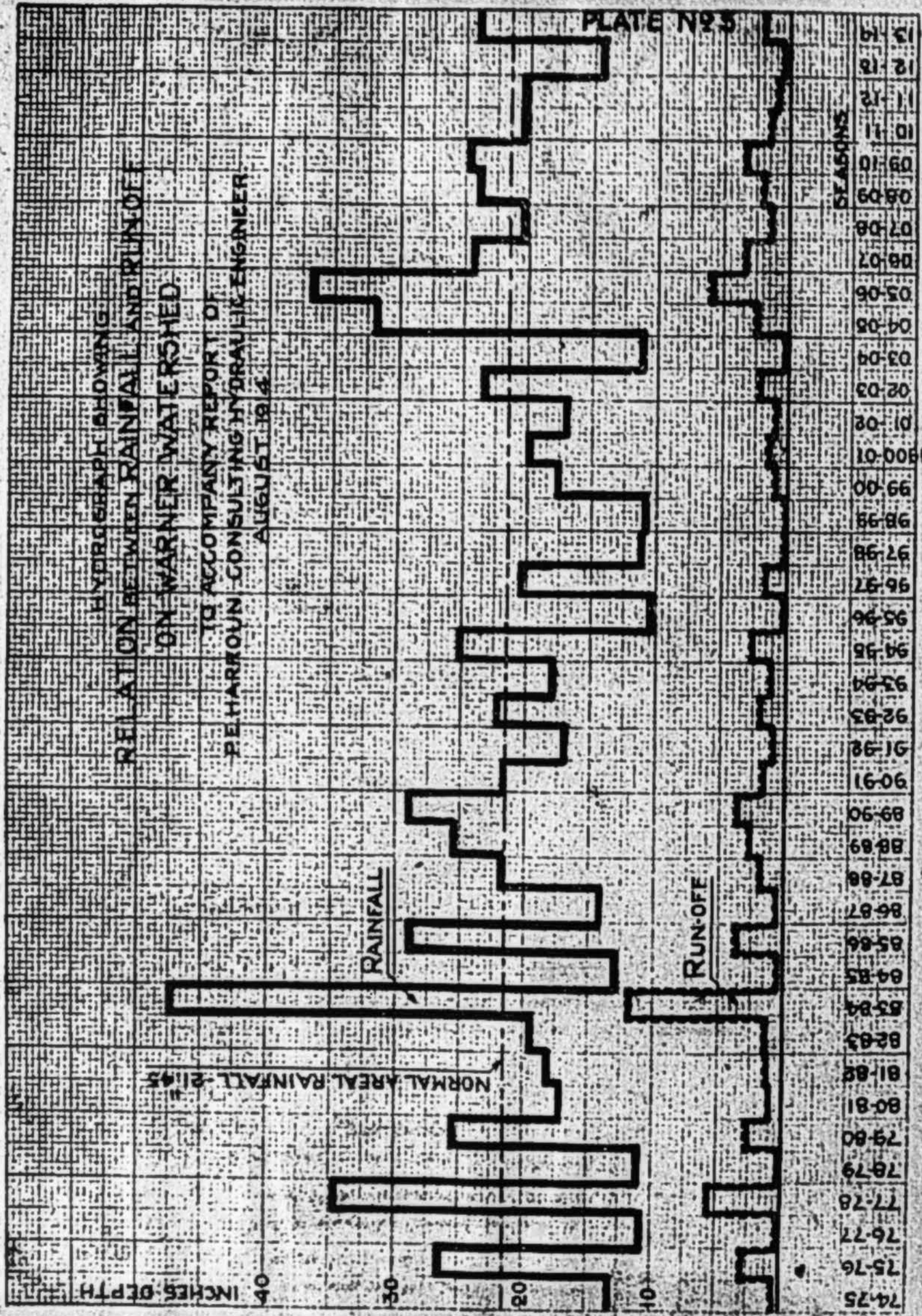
Respectfully presented,

P. E. HARROUN.



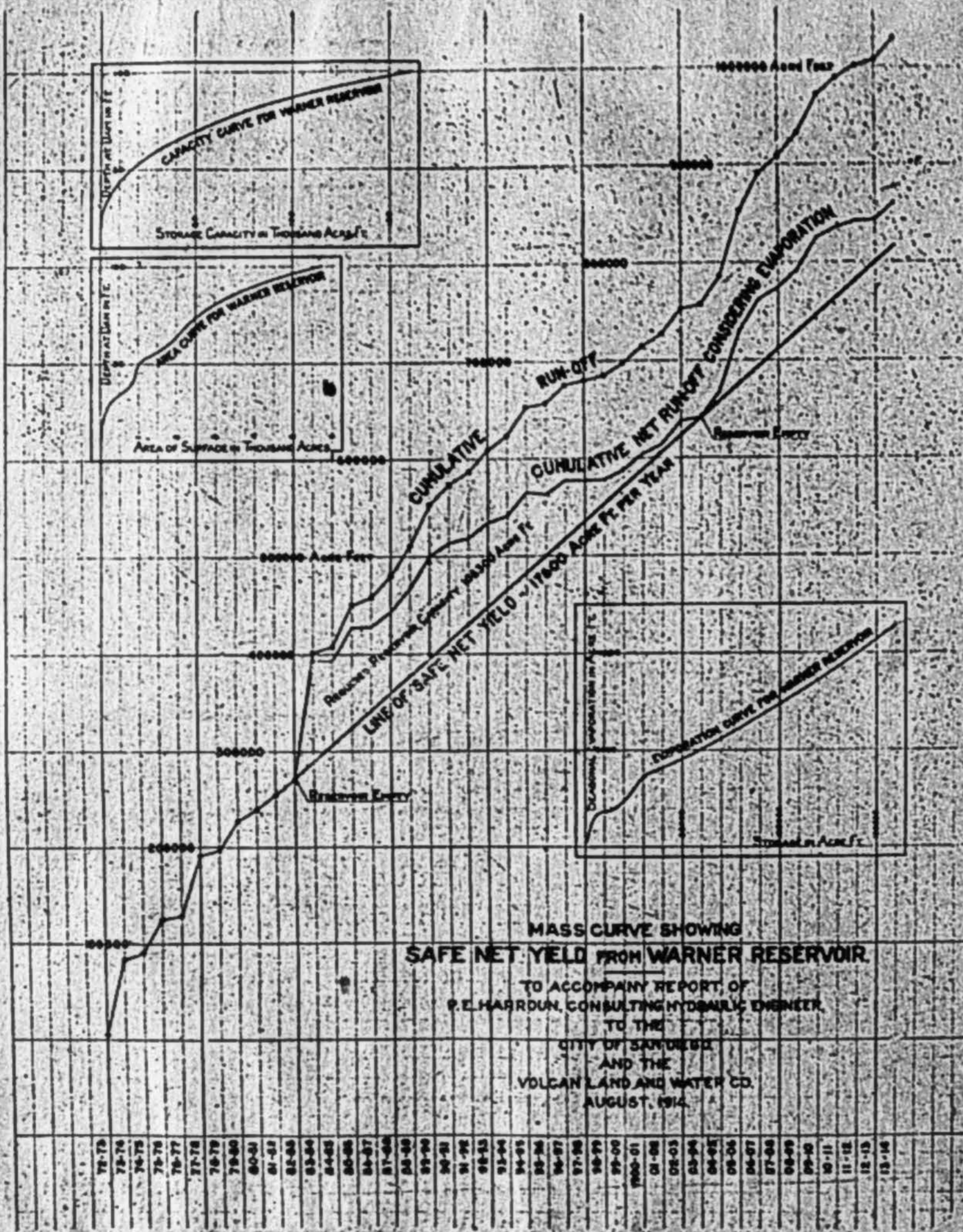




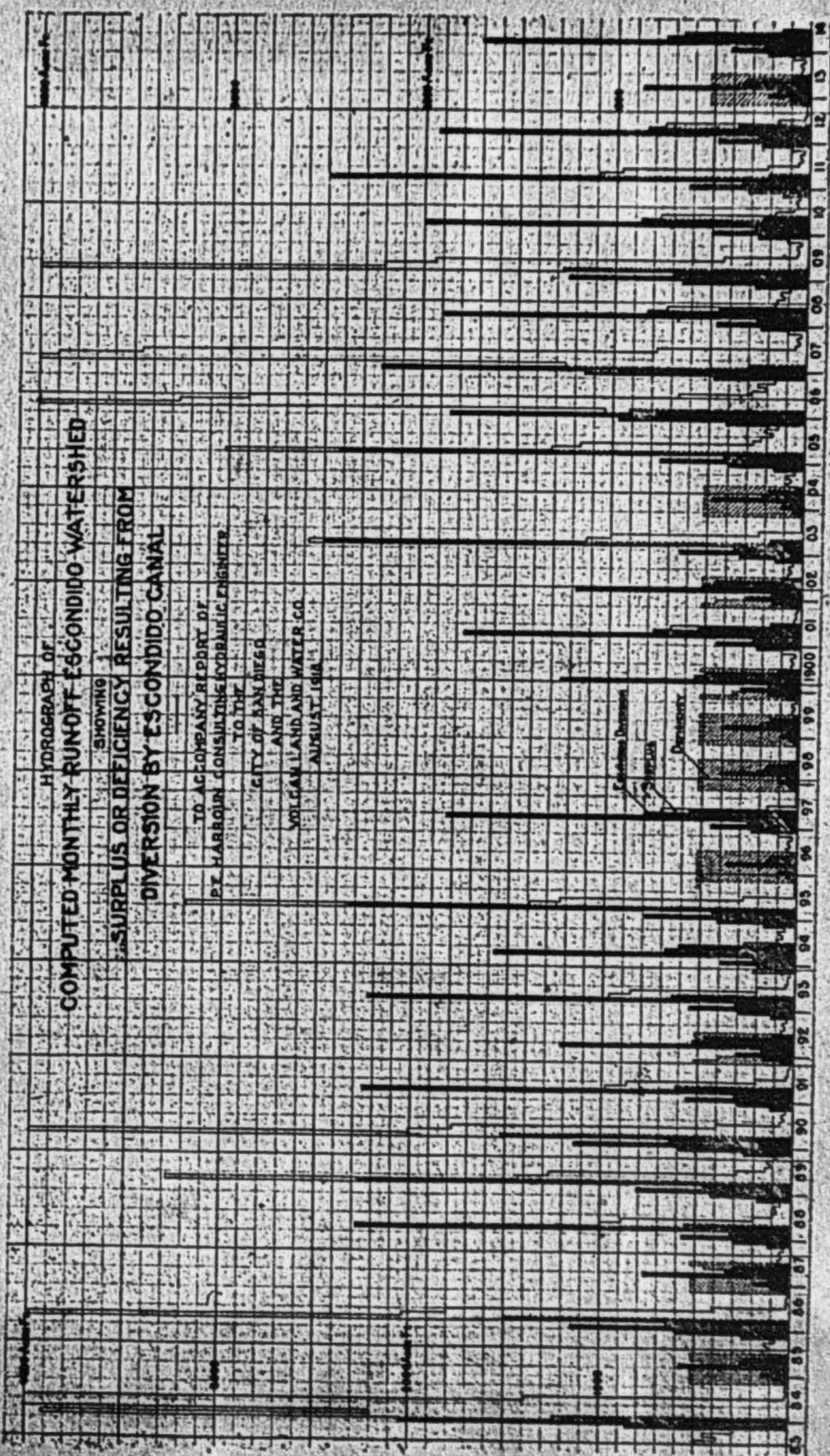




# PLATE No 8



# PLATE NO. 9





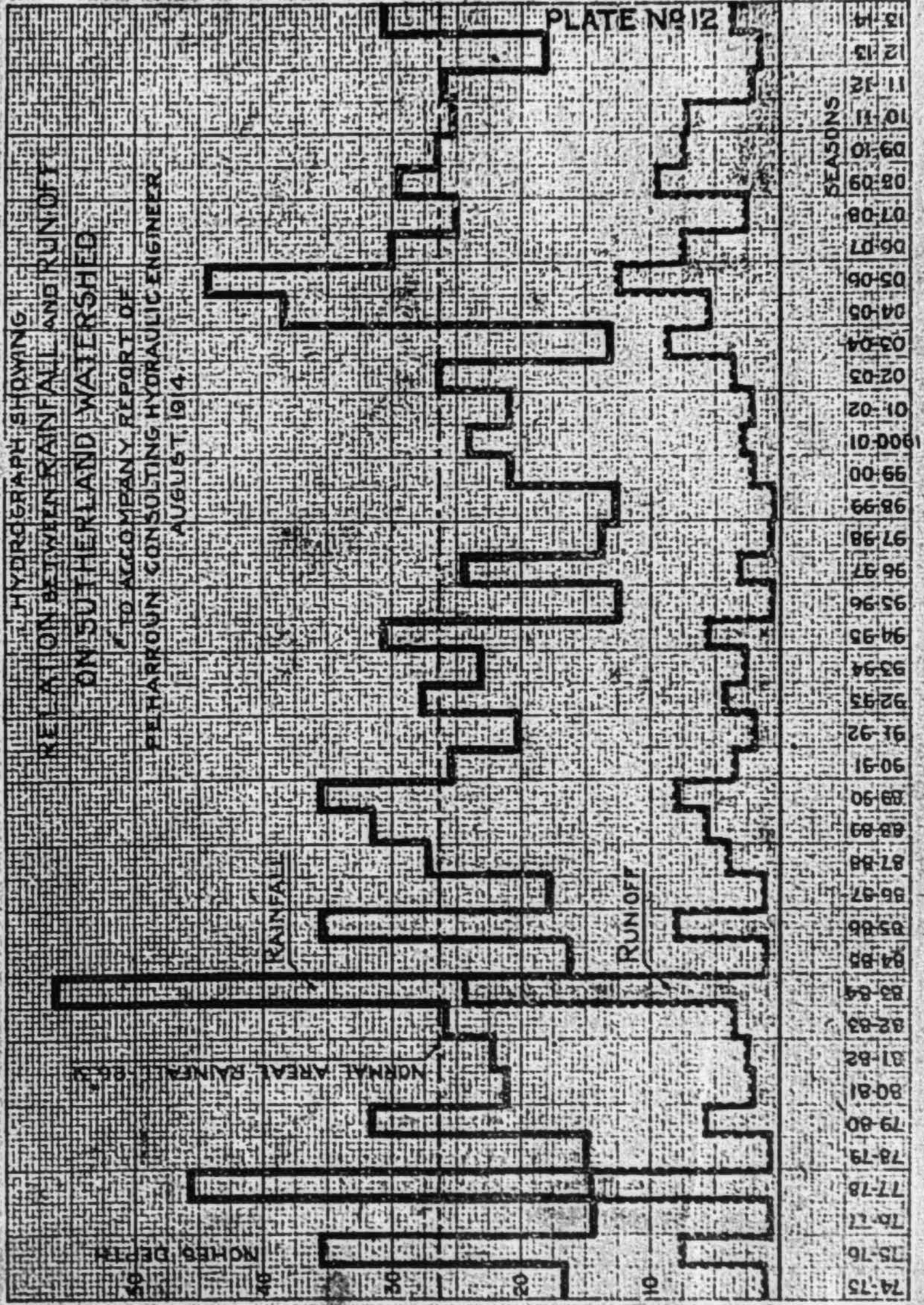
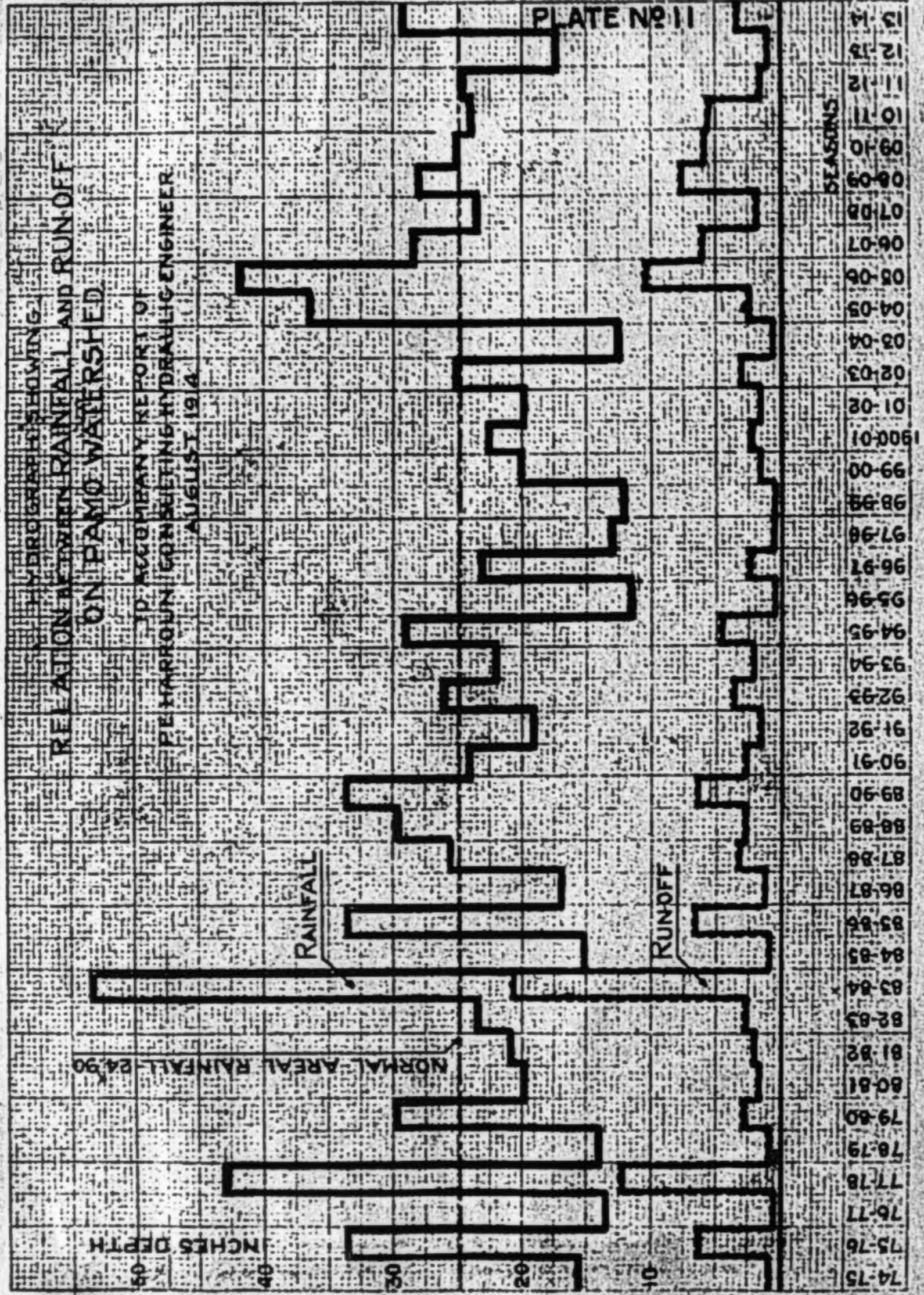
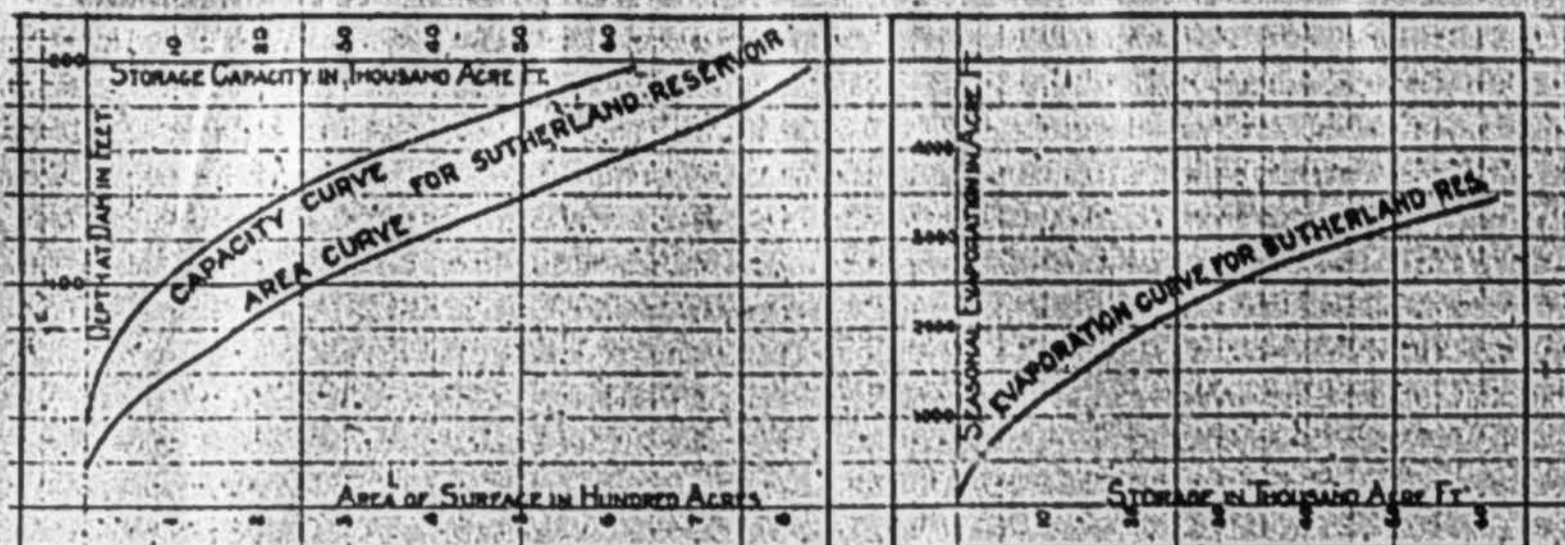




PLATE No 13



MASS CURVE SHOWING  
SAFE NET YIELD FROM SUTHERLAND RESERVOIR.

TO ACCOMPANY REPORT OF  
P.E. HARROUN, CONSULTING HYDRAULIC ENGINEER,  
TO THE  
CITY OF SAN DIEGO,  
AND THE  
VOLCAN LAND AND WATER CO.  
AUGUST, 1914.

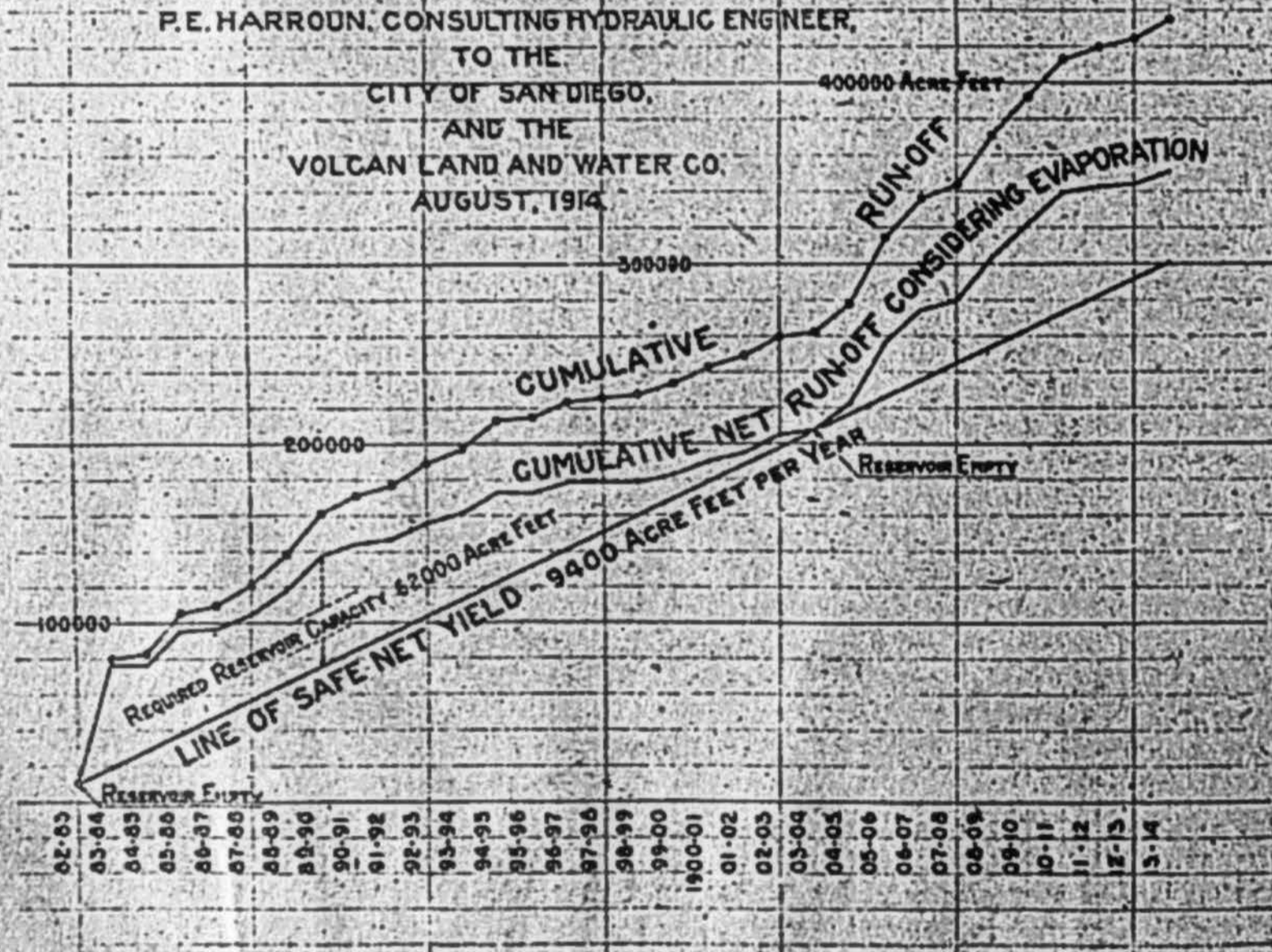
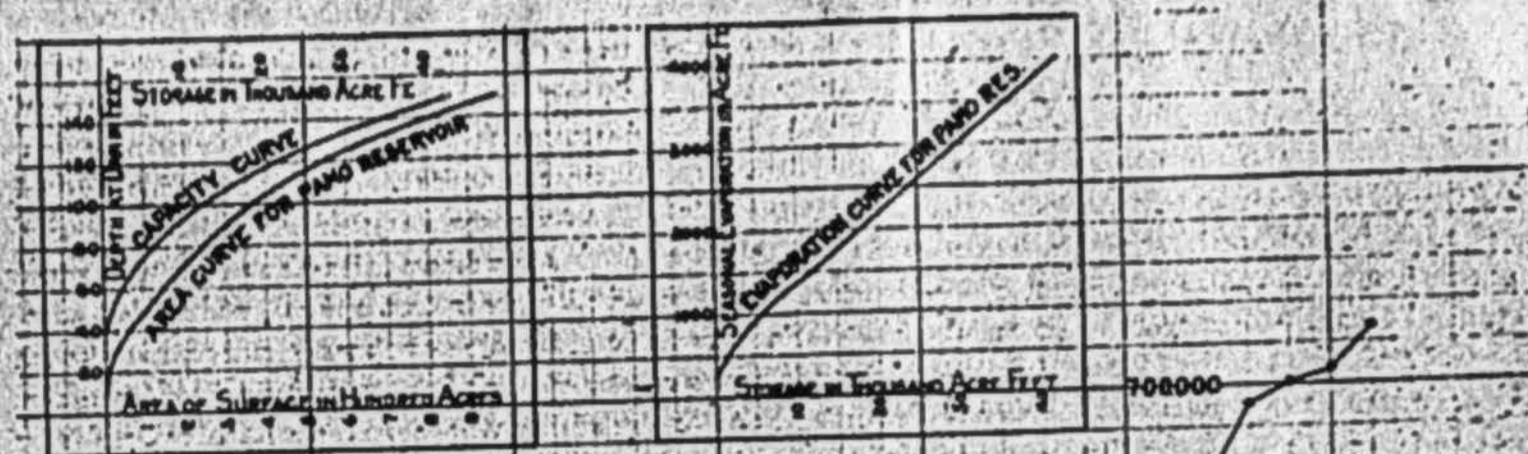


PLATE No 14



MASS CURVE SHOWING  
SAFE NET YIELD FROM PAMO RESERVOIR.

TO ACCOMPANY REPORT OF  
P.E. HARROUN, CONSULTING HYDRAULIC ENGINEER,  
TO THE  
CITY OF SAN DIEGO,  
AND THE  
VOLCAN LAND AND WATER CO.  
AUGUST, 1914.

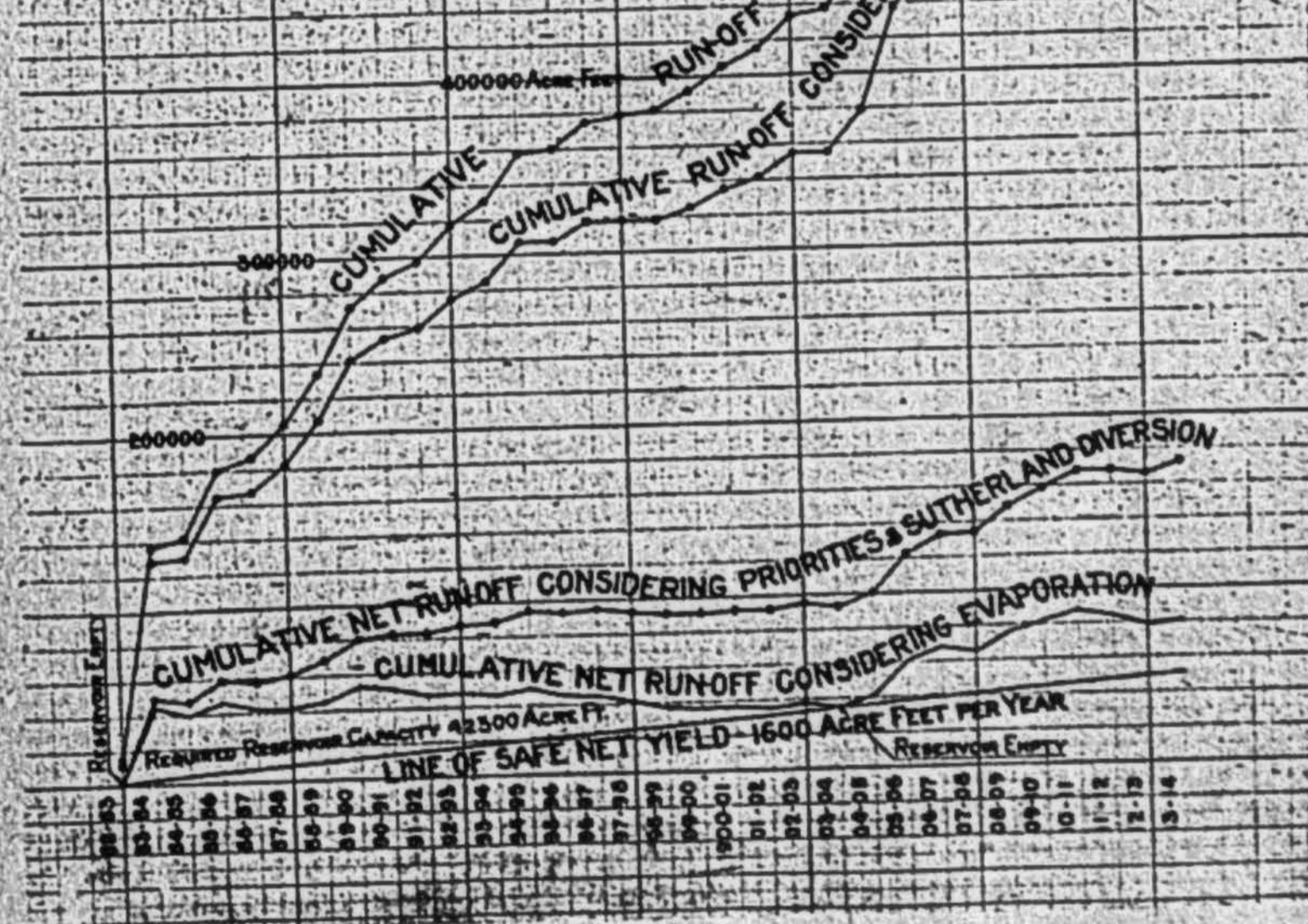
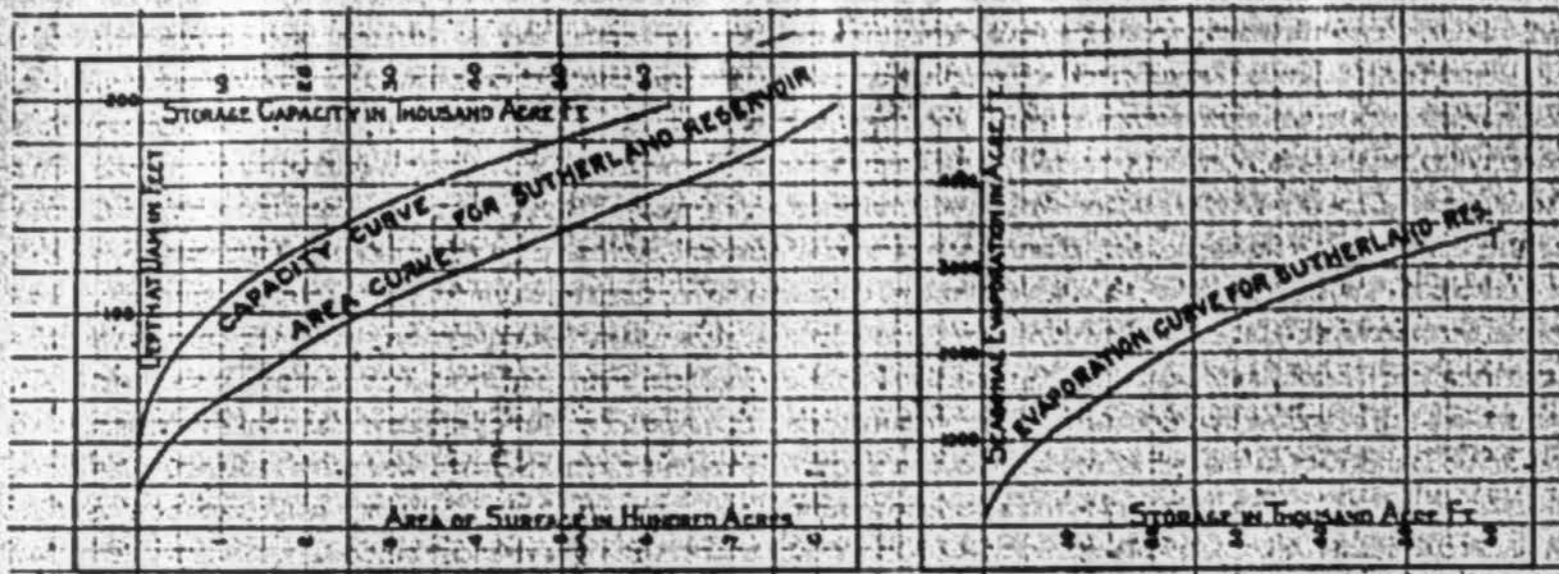




PLATE No 15



MASS CURVE SHOWING  
SAFE NET YIELD FROM SUTHERLAND RESERVOIR

TO ACCOMPANY REPORT OF  
P.E. HARROUN, CONSULTING HYDRAULIC ENGINEER,  
TO THE  
CITY OF SAN DIEGO,  
AND THE  
VOLCAN LAND AND WATER CO.  
AUGUST, 1914.

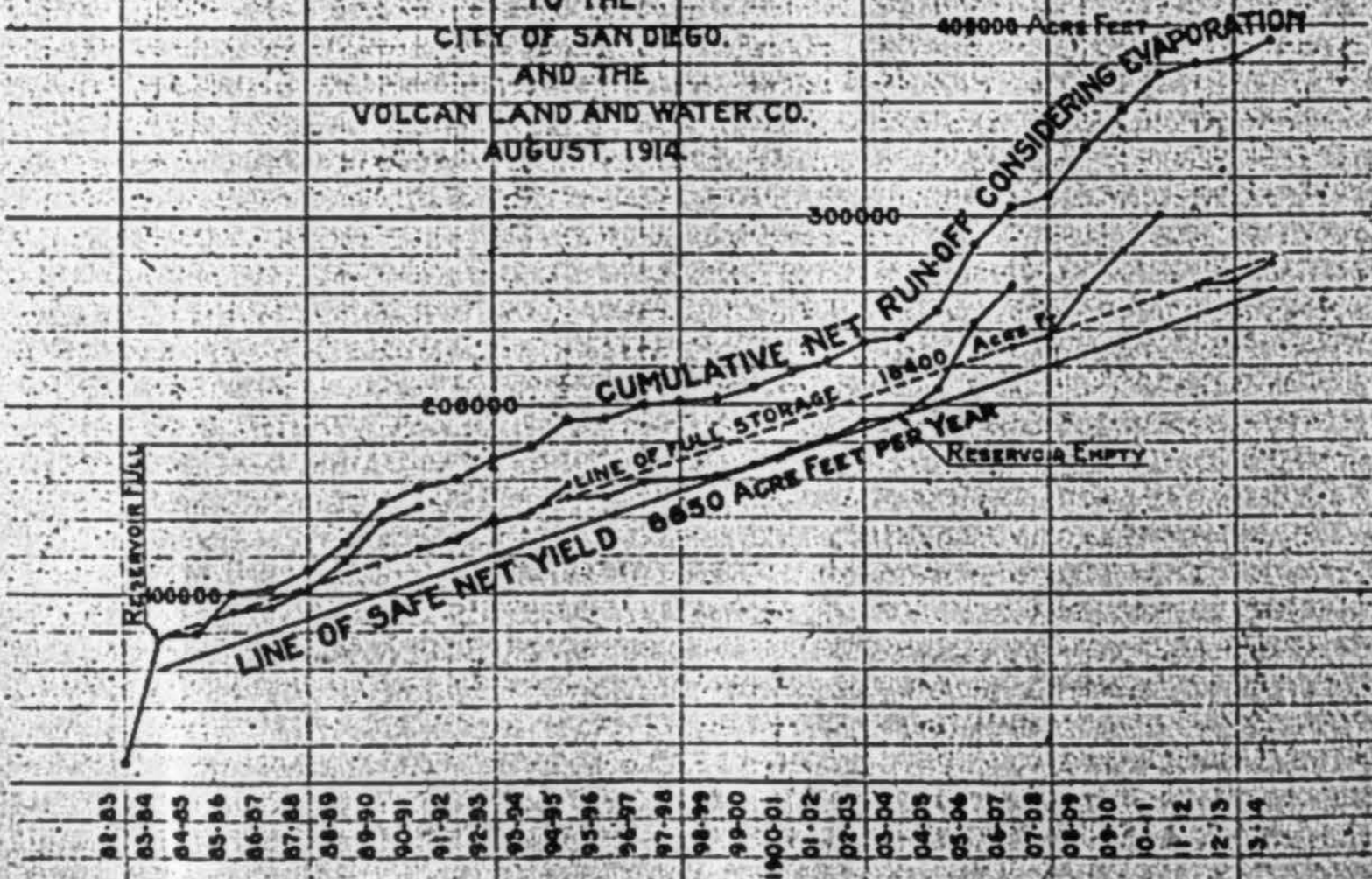
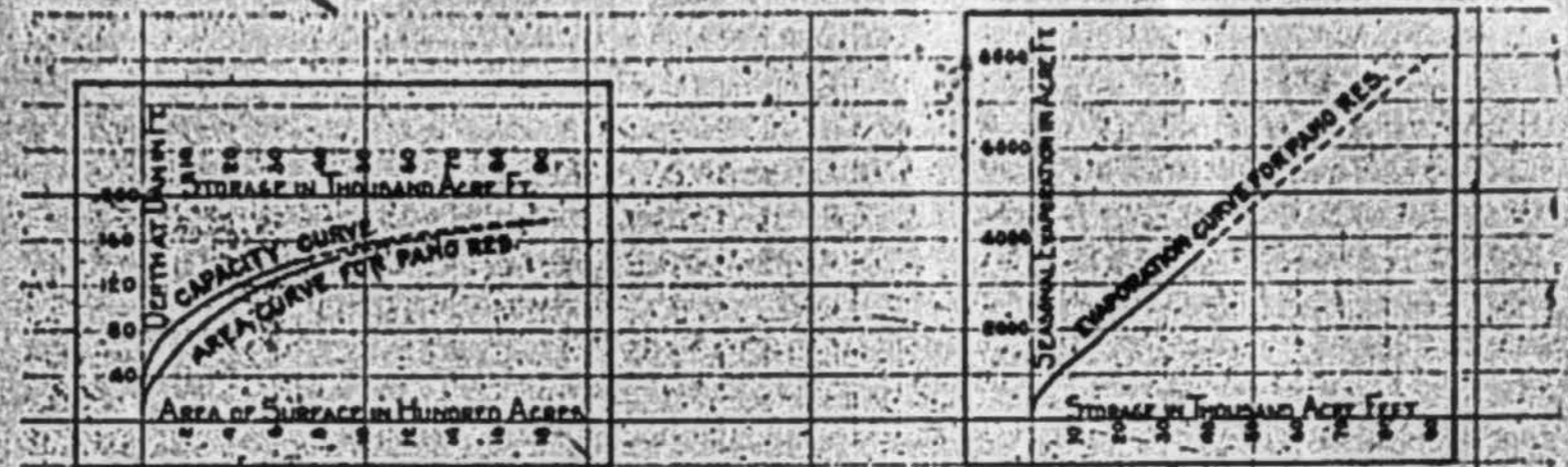
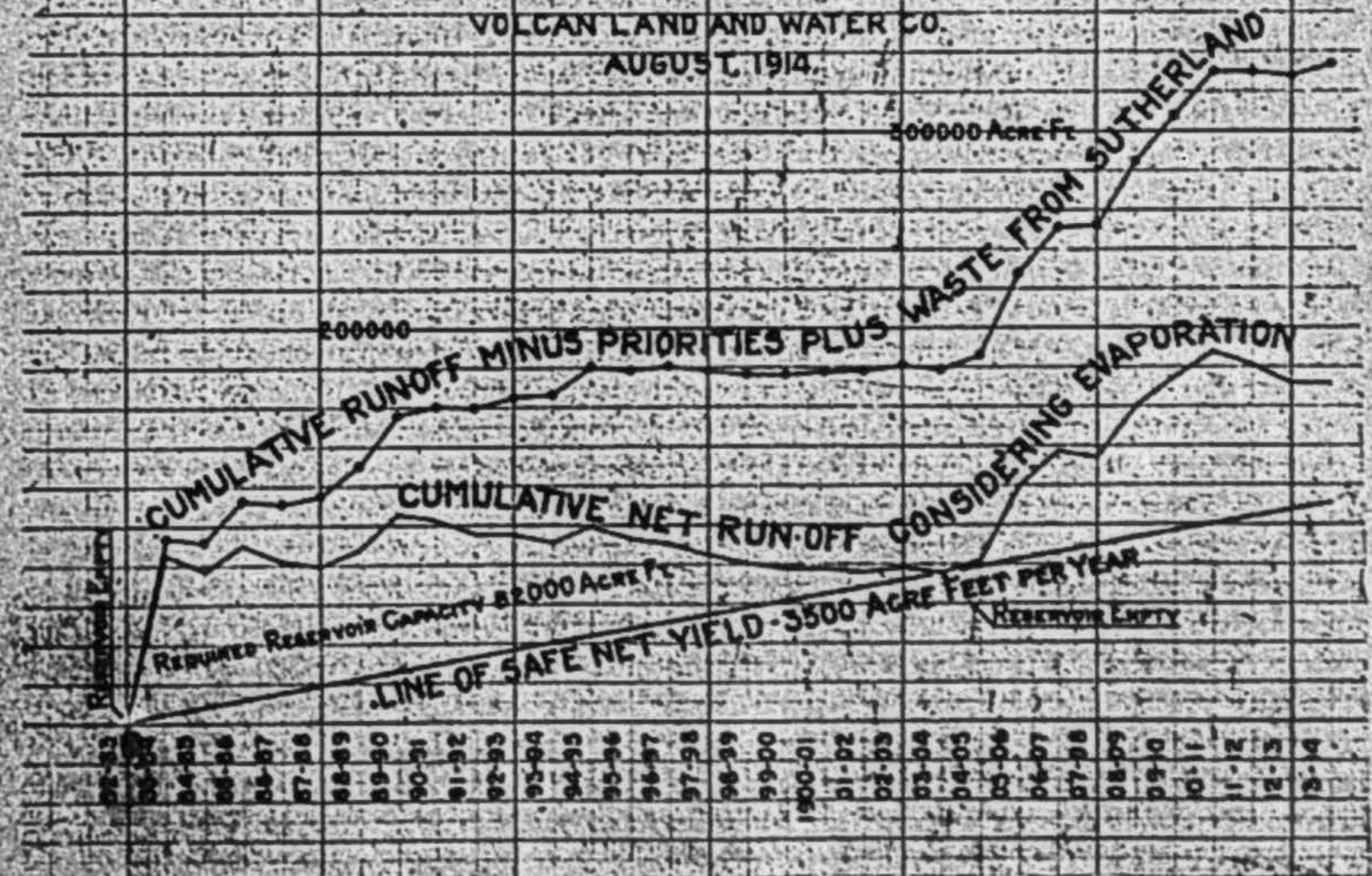


PLATE No 16

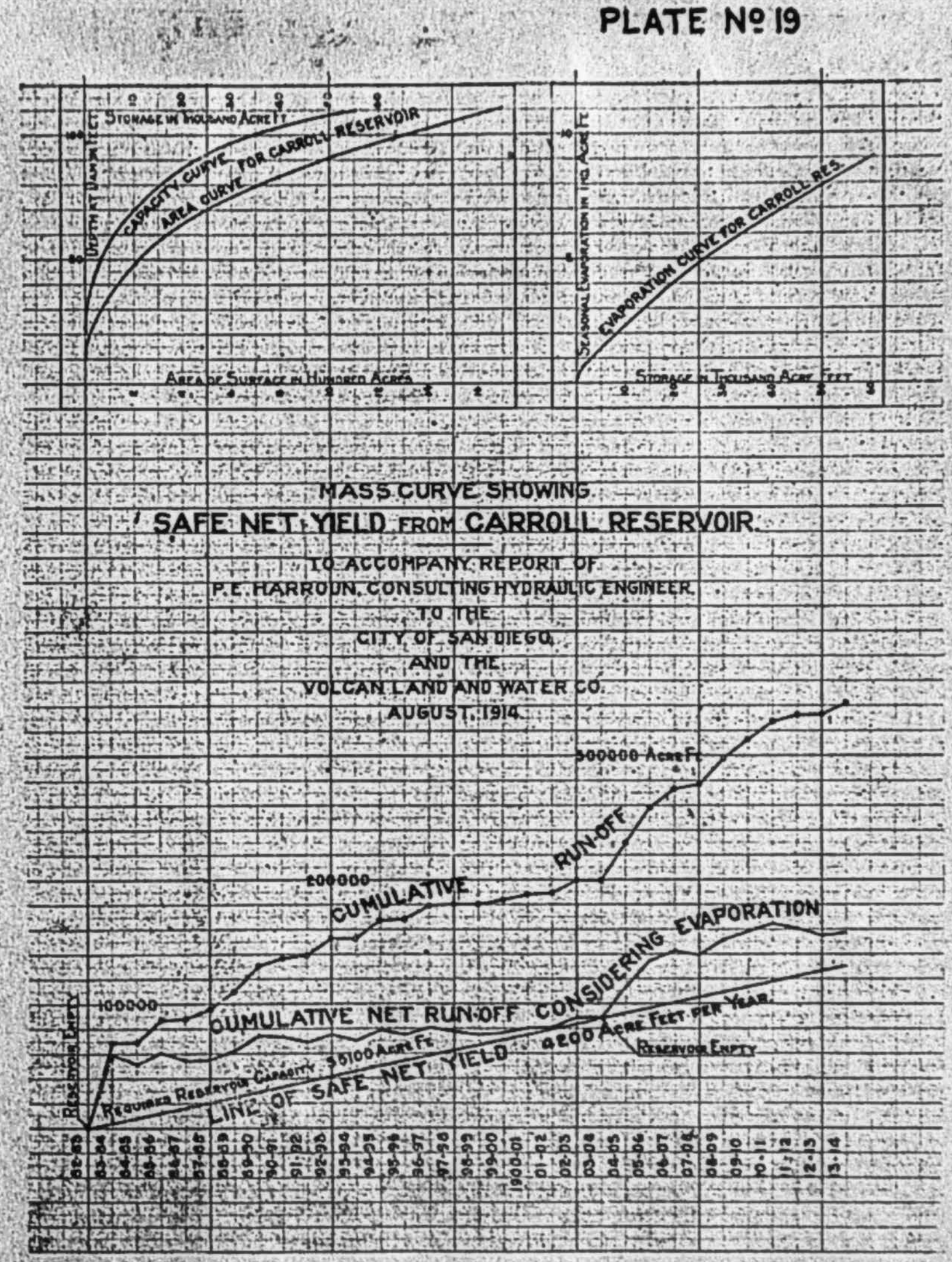
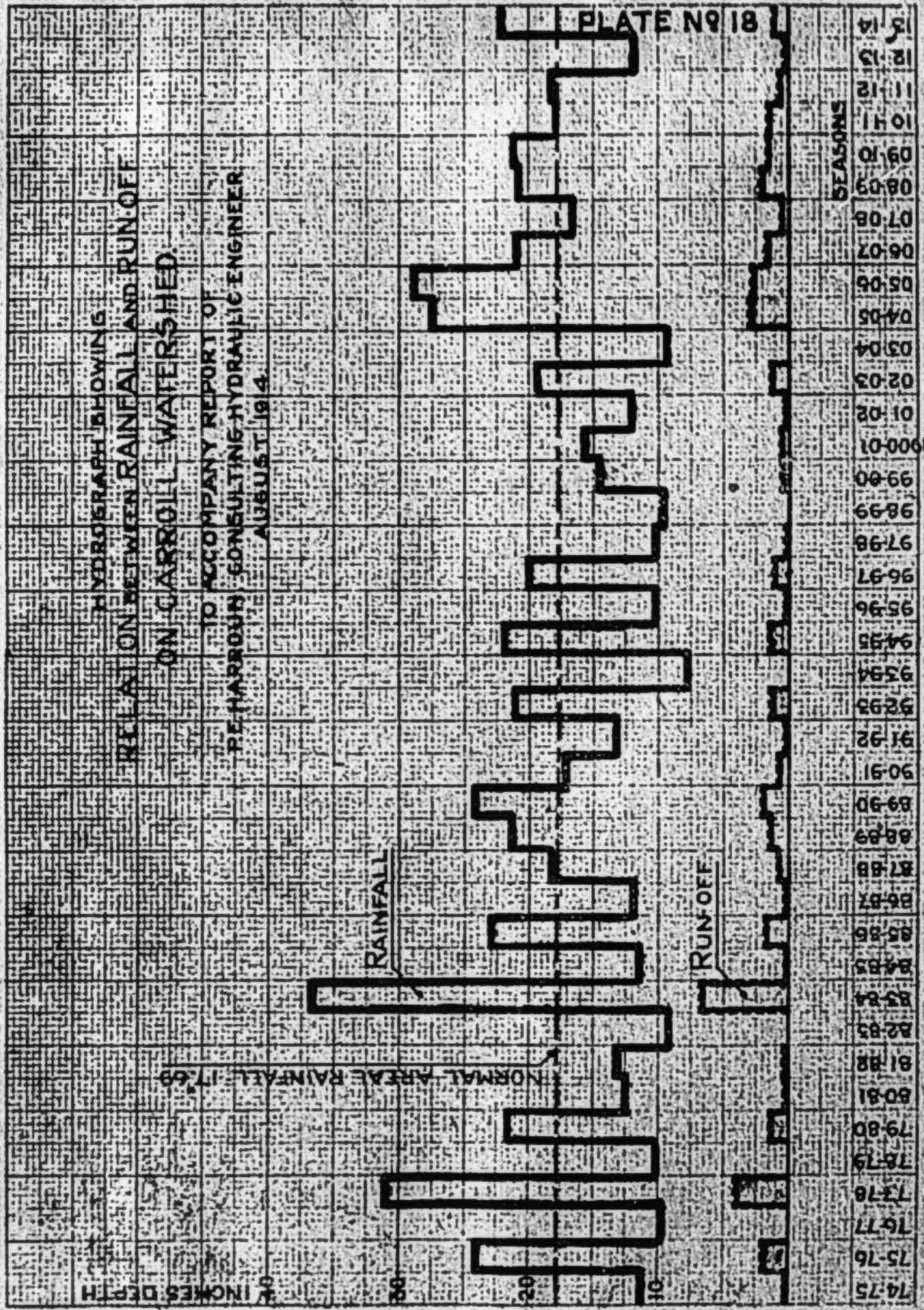


MASS CURVE SHOWING  
SAFE NET YIELD FROM PAMO RESERVOIR

TO ACCOMPANY REPORT OF  
P.E. HARROUN, CONSULTING HYDRAULIC ENGINEER,  
TO THE  
CITY OF SAN DIEGO,  
AND THE  
VOLCAN LAND AND WATER CO.  
AUGUST, 1914.









Property  
of Ed Fletcher

Please return







**Report  
to the  
City of San Diego  
and to the  
Volcan Land and Water Company  
on the  
Safe Net Yield  
Value  
Cost of Completed System  
and  
Cost of Water Delivered  
of the Properties of the  
Volcan Land and Water Company  
by  
Philip K. Harroun  
Consulting Engineer  
San Francisco, California.  
August, 1914.**



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<b>Conclusions</b>	" 27

PLATES

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SAN FRANCISCO, August, 1914.

To the Honorable Mayor, Charles F. O'Neill,  
and the City Council of the City of San Diego

and

To the Volcan Land & Water Company.

Gentlemen:-

On May 22, 1914, the Volcan Land & Water Company presented an offer of sale of certain properties comprising a system for water supply to the City of San Diego, which offer is on file with the City.

On June 1, the writer was jointly retained by the City of San Diego and the Volcan Land & Water Company to pronounce upon the value of this property. Since that date this question has been under investigation and the results of this investigation are embodied in the following report.

No questions of title have been investigated. It is assumed that the Volcan Land & Water Company has legal title to the property which it proposes to transfer to the City, and also to the water which it proposes to conserve and divert, other than those disabilities specifically allowed for in this report.



The Volcan Land & Water Company has made available to the writer the results of its investigations extending over the past few years. These investigations consist of surveys, studies of precipitation and runoff, preliminary design of necessary structures, and in addition there has been made available such cost records as are shown on the books incurred in bringing the property up to its present stage of development. This data has been taken as the basis for the report.

It was the desire of the City Council not only to be advised of the value of the property but it was also expressly desired that a study be made of the safe net yield which the properties would be able to furnish to the City upon full development. It has also been found necessary to arrive at the cost of the system, when fully developed, in order that it may be seen whether such cost is within economic limits. The report, therefore, will be divided into three major divisions treating

- Thought 9-10-17*
- First: The safe net yield which the system may be expected to deliver to the City of San Diego;
- Second: The value of the property which is offered to the City for the sum of two and one half million dollars (\$2,500,000.00);
- Third: The cost of development of the property required to deliver to the City the safe net yield found, and also, the cost per thousand gallons delivered.

#### DESCRIPTION OF THE SYSTEM

Briefly, the project of the Volcan Land & Water Company consists of the construction of a dam forming



a reservoir on the San Luis Rey River at Warner Ranch. The waters in this reservoir are to be diverted into the drainage of the Santa Ysabel River. Upon the Santa Ysabel River three reservoirs are proposed, the first and most easterly called the Sutherland Reservoir, the second some five miles west called the Pamo Reservoir, and the third below Bernarido called the Carroll Reservoir.

The waters from the Warner Reservoir in passing into the Santa Ysabel drainage may be regulated either in the Sutherland or Pamo reservoirs. The waters from Pamo and Sutherland reservoirs combined with those of the Warner Reservoir are to be carried in a canal, some 25 miles in length, into what is called San Clemente Reservoir. This latter reservoir is a little east of north and some 13 miles distant from the center of San Diego, and is to be used as a regulating reservoir. It is also to carry sufficient storage to provide against interruption in the supply. From San Clemente Reservoir the waters would flow by gravity into the University Heights Reservoir in the north-easterly section of the City. The waters from Carroll Reservoir would be carried by independent pipe line to the City. The general scheme of the system is shown on Plate 1, accompanying this report.



SAFE NET YIELD WHICH THE SYSTEM MAY BE EXPECTED  
TO DELIVER TO THE CITY OF SAN DIEGO

The safe net yield of this system may be defined as that quantity of water which the system would have been able to deliver during the period of greatest drought of which there is record. The studies required to determine this question are intricate and require much time in the analysis of the many elements of rainfall, runoff, evaporation, transpiration and other factors entering into the question. It is not believed that presentation of the details of this technical study would be of interest to others than engineers and for that reason they are not presented in the body of this report. Plates 2 to 19 accompanying this report may be referred to for these items. However, in order that the conditions may be understood, a brief outline of the data available and the methods pursued in arriving at the safe net yield is presented below.

There are available records of rainfall in the near vicinity of the San Luis Rey and Santa Ysabel watersheds at 13 different points all more or less fragmentary but extending back as far as the season of 1872-1873. In addition, the records of some 28 rainfall stations within the drainage areas are available for the past two or three years. These records have been studied and expanded, using the Escondido record as a base, so as to obtain a continuous record at these stations for the



last 42 seasons. From these records the Isohyetose lines within the drainage areas under consideration have been developed and from them the seasonal precipitation since 1872 has been determined.

Stream gaugings of the run-off on the various watersheds are available for the past eleven seasons at Pala on the San Luis Rey River and for the seasons of 1905-1906 and 1911-1912, to date, at Warner Dam. On Santa Ysabel River, gaugings are available from 1906-1907 to date at Pamo, and for the past two years at Bernardo. Through a study of these records in connection with the precipitation, the relation between rainfall and runoff has been determined and used in estimating the run-off for the past 42 years. These expanded runoff records have then been applied to the various reservoir sites where, in connection with a study of the reservoir capacity, evaporation and other factors, the safe net yield which may be expected from the various units of the project has been determined. The final results of these studies are shown graphically by the various tables and curves accompanying this report.

It is found that the safe net yield which Warner Reservoir would have been able to supply during the period of greatest drought occurring since 1872 is 17,600 acre feet or 24.3 cubic feet per second. To support this draft would require a dam of sufficient height to provide 106,200 acre feet of storage. Although this amount of water could have been continuously supplied from Warner



Reservoir during the period of greatest drought occurring during the past 42 years, it would not have been possible for the Volcan Land & Water Company, or other owner of the property, to utilize this entire amount because of the necessity of considering priorities on the river below. These prior demands have been studied and it is believed that the only priorities which will affect the yield of the Warner Reservoir are those of the Escondido Mutual Water Company and of the Rincon Indians.

On June 21, 1912, an agreement was entered into between the Escondido Mutual Water Company and Mr. Wm. C. Henshaw for the Volcan Land & Water Company defining the rights of the Escondido Mutual Water Company. It has therefore been necessary to determine what effect this contract would have had upon the safe net yield of Warner Reservoir. It is found that during the critical period determining the safe net yield it would have been necessary to release from the storage in Warner Reservoir the average amount of 742 acre feet per annum in order to meet this contract requirement. For this reason, therefore, the safe net yield to which the Volcan Land & Water Company would be entitled is 16,854 acre feet.

In the light of legal opinion and the studies which have been made of the information available regarding priorities, it is believed that no further demands can hold against Warner diversion.



The safe net yield and development proposed upon the Santa Ysabel River is also complicated by priorities upon that stream. As in the case of the San Luis Rey River, these have been studied and provided for. Below the Sutherland and Pamo reservoir sites and above the Carroll site lies the San Pasqual Valle. This valley contains a number of properties in a high state of cultivation through the use of the waters of the Santa Ysabel River. Any development above this valley must provide for the requirements of these lands.

A study of the situation shows that the amount of water required in the San Pasqual Valle over and above that which would originate within the drainage area below the Pamo Reservoir amounts to 3,850 acre feet per annum, and in considering the possibility of the development and safe net yield of the Sutherland and Pamo reservoirs it has been considered that this amount of water must be permitted to pass to the properties in the San Pasqual Valle.

The same condition holds below the Carroll Reservoir. The priorities there consist of the development upon the San Dieguito Ranch and also 50 miner's inches of continuous flow which is furnished to the town of Del Mar. These amount to 1,320 acre feet per annum. This amount has therefore been deducted from the gross yield of Carroll Reservoir and has been provided for these priorities in determining the safe net yield available for the Volcan Land & Water Company.



The determination of the maximum economic conservation upon the Santa Ysabel River is extremely complicated because of the development proposed in three different reservoirs and of the two riparian districts. In addition, the surveys and field investigations of the Volcan Land & Water Company have not yet been carried far enough so as to afford sufficient information from which to say what are the maximum economic possibilities of storage in the three different sites, - at Sutherland, Pamo and Carroll.

Three different studies have been made of the possible combinations of storage and consequent determination of safe net yield which appear to the writer will be ultimately found to cover the economic possibilities of the situation. Until further field investigations have been made, either by the Volcan Land & Water Company, or its successor, the final selection of the economic plan cannot be determined.

The first study was undertaken on the assumption that the dam at Sutherland Reservoir could be constructed to a sufficient height so as to give the storage required for maximum conservation of the runoff originating above that point, and that the Pamo Reservoir should consequently be constructed with a sufficient storage to conserve to the maximum the runoff originating below Sutherland and above Pamo, at the same time penalizing this runoff to the extent of 3,850 cubic feet per second for the priorities in the San Pasqual Valle.



On this basis it was found that a storage capacity of 62,000 acre feet was required for Sutherland Reservoir with a height of dam approximately 200 feet, and the safe net yield resulting would be 9,400 acre feet. The Pamo Reservoir would consequently require a storage capacity of 42,300 acre feet and the safe net yield after providing for the priorities of the San Pasqual Valle would be 1,600 acre feet per annum. This would require a dam of 150 feet approximate height. As previously indicated, the field investigations of the Volcan Land & Water Company have not been sufficient to show whether the great height of the dam and storage capacity at Sutherland can be economically had, and when reliable information is obtained on this point it may be found that it is inadvisable because of the great cost to construct a dam at this point of the height required to provide this storage.

Studies of the existing data show that with a flow line of 124 feet at Sutherland and a dam of approximately 130 feet height, a storage of 16,400 acre feet can be economically had. A second study of the safe net yield was made on this assumption, and that Pamo Reservoir could then be developed to the maximum height necessary to conserve the waste from Sutherland together with the water originating between Sutherland and Pamo, after deducting the priorities of the San Pasqual Valle. Under these conditions, it was found that the safe net yield of the Sutherland Reservoir would be 6,650 acre feet and of Pamo



3,500 acre feet. To support the draft of 3,500 acre feet would require a dam of approximately 180 feet in height at that point which would provide a storage capacity of 82,000 acre feet.

This condition imposes a storage capacity and height of dam at Pamo which in the light of present surveys seems excessive and may be prohibitive from the standpoint of cost. At Pamo the field investigations indicated that a dam may be constructed of an economic height of 156 feet with a consequent storage capacity of 47,500 acre feet.

The third study was based upon the assumption that the Sutherland flow line be limited to 124 feet and the Pamo flow line at 156 feet. Under these conditions the safe net yield from Sutherland Reservoir would be 6,650 acre feet and from Pamo Reservoir 2,400 acre feet. Until further investigation should prove the contrary, this third study should be accepted. If future investigations show that either Sutherland or Pamo reservoirs can be economically increased in capacity it will increase the safe net yield estimated to the limiting yields determined in the first and second studies.

Carroll Reservoir has also been studied in the light of the maximum conservation possible. To fully conserve these waters it is found that the height of the dam at Carroll should be 110 feet and the storage capacity 55,100 acre feet. Under these conditions the safe net yield of the reservoir would be 4,200 acre feet.

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The priorities below Carroll have already been mentioned and it has been estimated that 1,380 acre feet are required for these priorities. Consequently the safe net yield possible for the use of the City from Carroll Reservoir amounts to 2,870 acre feet.

The following tabulations show the safe net yield of the entire system under the three different combinations:

Safe net yield of the system on the basis of the maximum possible conservation at Sutherland Reservoir.

*8 Reservoir  
caps  
proposed*

	Acre feet.	Miners inches.	Million gallons daily.
Warner Reservoir	16,858	1,165	15.0
Sutherland "	9,400	650	8.4
Pamo "	1,600	110	1.4
Carroll "	2,870	196	2.5

Safe net yield of the system on the basis of 16,400 acre feet storage at Sutherland and sufficient storage at Pamo to conserve the balance of the runoff.

	Acre feet.	Miners Inches.	Million gallons daily.
Warner Reservoir as before	16,858	1,165	15.0
Sutherland Reservoir	6,650	455	5.9
Pamo "	3,500	240	3.1
Carroll Reservoir as before	2,870	196	2.5



Safe net yield of the system on the basis that the economic storage possible at Sutherland is 16,400 acre feet and at Pamo 47,500 acre feet.

	Acre feet.	Miners inches.	Million gallons daily.
Warner Reservoir as before	16,858	1,165	15.0
Sutherland Reservoir	6,650	455	5.9
Pamo Reservoir (Approx.)	2,400	165	2.1
Carroll Reservoir as before	2,870	196	2.5

Should the City of San Diego acquire this property and institute condemnation proceedings against the irrigation priorities in the San Pasqual Valle and below Carroll Reservoir it would increase the amount available for domestic supply by 3,850 acre feet per annum from the Sutherland-Pamo combination of reservoirs and 600 acre feet per annum from the Carroll Reservoir, or 3.4 million gallons daily and 0.5 million gallons daily respectively.

**VALUE OF THE PROPERTY WHICH IS OFFERED TO THE  
CITY OF SAN DIEGO FOR THE SUM OF  
TWO AND ONE HALF MILLION DOLLARS.**

In pronouncing upon the value of the property which is offered by the Volcan Land & Water Company to the City of San Diego for the sum of two and one half million (\$2,500,000.00) dollars, the greatest difficulty has been found. For the last nine years or more the owners of this property have been gradually acquiring the necessary water



rights and rights of way and have been perfecting their organization leading up to the point where construction might be commenced. The Company has found it necessary to secure all of the water rights upon the San Luis Rey River, with the exception of the City of Oceanside, from Warner Dam to the Ocean, a distance of nearly 50 miles. This has been a long and expensive process.

In securing these rights, in a majority of cases, the riparian properties upon the river have been purchased outright and most of these properties are still in the hands of the Company. The writer estimates that the money cost in securing these properties along the San Luis Rey River is not less than \$1,500,000.00

Upon the Santa Ysabel River the rights secured by the Company are comparatively few and it is estimated that these Santa Ysabel properties and rights have cost \$150,000.00 making the total cost of these properties not less than \$1,650,000.00. Rights of way through forest reserves and upon Government lands have also had to be secured.

A further complication has been the difficulties encountered in dissolving the old Pamo-Linda Vista Irrigation District. In this case it was necessary to purchase the outstanding bonds of the district and foreclose upon it. This procedure was necessary in order that the Pamo-Sutherland-Carroll combination of reservoirs might be made available. All of these elements have added greatly to the length of



time necessary and to the cost of bringing the property up to the point where actual construction might begin. The value of the actual construction already undertaken is a comparatively small element at this time.

In addition to the items mentioned in the offer made by the Volcan Land & Water Company to the City, dated May 22, 1914, I am advised by the Company that it will furnish to the City full and complete rights of way from Pamo Reservoir to the San Clemente Reservoir, or from the Carroll Reservoir to the City of San Diego, as may be desired. The writer believing that the right of way from the Pamo Reservoir to the San Clemente Reservoir is the most necessary to the development, has included the value of this right of way in the estimates of value presented.

In placing a value upon the reservoir lands the writer, not being an expert in land values, has based his judgement upon value of lands for such purposes as has been found by the Railroad Commission of California and the Courts, modified to meet the conditions on this system in accordance with the writer's judgment.

In placing a value upon the power possible of development the writer has proceeded along the following lines: this system if acquired by the City of San Diego will furnish water primarily for domestic purposes. Any power which may be developed from the property is incidental and cannot be developed to the detriment of the



domestic service. The field investigations undertaken by the Company have not yet been carried far enough to say what the final economic arrangement of the units of the system must be in order to give the greatest conservation with the least expenditure of money. Until full studies are had this cannot be learned. The writer believes that the amount of power which it will be ultimately found can be economically developed will be a comparatively small amount, and certainly not sufficient to permit the City to enter the power field commercially, although probably sufficient for the City's own needs. As the power possibilities of the system are at this time so indeterminate and vague the writer has only given a nominal value to this element.

The question of the value of water rights has led to great controversy, the State and Federal Courts being divided in their views. Recently the Supreme Court of the United States, in the case of the San Joaquin & Kings River Canal & Irrigation Company vs County of Stanislaus, 191 Fed. 875, has held that a value must be placed upon water rights as they are property under the decisions of the Courts of California. The value of water rights are extremely difficult of determination and the writer knows of no logical method whereby these values may be measured. In certain cases within the State these values have been pronounced upon by bodies of competent jurisdiction and the writer considers under the



circumstances that the values found by such bodies are the only index which may be obtained.

In the case of the Spring Valley Water Works vs City and County of San Francisco, before the United States Circuit Court, Judge Farrington found the value of the water rights of the Spring Valley Water Company to be \$60,000. per million gallons. This corresponds approximately to a value of \$775. per miners inch.

In the case of Sierra Madre vs Baldwin ( a condemnation suit) before the Superior Court of Los Angeles County, it was stipulated that a fair value for gravity water, independent of any works, was \$3500.00 per miners inch.

In the case of Hollywood Union Water Company vs City of Los Angeles, before the Superior Court of Los Angeles County, ( a rate case) it was mutually agreed that the value of gravity water was \$2500.00 per miners inch.

The Railroad Commission of California, in decision No.1515, Petition of the City of Glendale to fix the valuation of certain water systems in said City, gave a value of \$2000. per miners inch for gravity water. That decision also lists among others the following values for gravity water:

\$2,000. price reached by one Burr,  
near San Fernando in 1906.

\$2,500. selling price at McClay Rancho in 1902.

\$1,500. - \$1,800. results of sales in this  
vicinity in 1902.



In the recent application of the City of San Diego to fix water rates to consumers without the City, before the Railroad Commission of California, Mr. H. A. Whitney, Hydraulic Engineer of the City of San Diego, placed a value of \$1600. per inch upon the 400 inches of water owned by the City of San Diego.

It will be seen from the above that the value of water rights for gravity water, officially fixed by bodies of competent jurisdiction, has ranged from a minimum of \$775. to a maximum of \$3500. per miners inch.

If it be accepted that water rights have a value, it appears to the writer that that value must vary directly with the demand, scarcity and difficulty of securing the commodity. If this be true, the value of \$775. per inch, found by Judge Farrington in the Spring Valley Case, is not a measure of the value of water in San Diego County where there is much greater scarcity and difficulty in securing the same.

The writer has estimated the value of the water rights of the Volcan Land & Water Company upon three different bases.

First:	\$1,000 per inch;
Second:	\$1,500 per inch as was considered a fair value by the City's Hydraulic Engineer, Mr. Whitney;
Third:	\$2,000 per inch as found by the Railroad Commission in the Glendale case.



In the case of the rights upon the San Luis Rey River, these values have been placed against the safe net yield of the Warner Reservoir penalized by the amount required to support the priorities stated, as the Company has or will acquire and transfer to the City full title to all riparian rights.

Upon the Santa Ysabel River the Company has not acquired all rights and will only transfer to the City such rights as it owns at the present time. The writer estimates that it will cost the Volcan Land & Water Company, or the City of San Diego, the sum of \$459,000. to acquire the balance of these rights. For this reason the value of the water rights per miners inch possible of conservation upon the Santa Ysabel River has been penalized by this amount, and the values given are those for the safe net yield after applying this penalty and also after supplying existing priorities.

The following table shows the value of the property which the Volcan Land & Water Company proposes to transfer to the City of San Diego for the sum of two and one half million dollars, on the basis of water rights at a value of \$1000. per miners inch:







If the value of the water rights be taken at \$1500.  
per miners inch we have the following resulting values:

Water rights on San Luis Rey River, being 1165 inches, less 10% transmission losses, or 1049 inches net delivered, at \$1,500 per inch	\$1,573,500.
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Water rights on Santa Ysabel River developed by a combination of Sutherland and Pamo reservoirs which in combination will yield 620 inches, less 10% transmission losses, or 558 inches net at \$1,500 per inch	\$837,000.
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Water rights from Carroll Reservoir development, being 196 inches, less 10% transmission losses, or 176 inches net at \$1,500 per inch	\$264,000. <u>\$1,101,000.</u>
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Less cost of acquiring balance of riparian rights on Santa Ysabel River, necessary to make these rights effective	<u>\$459,000.</u>
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Net value of rights on Santa Ysabel River	<u>642,000.</u>
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Total value of water rights	\$2,215,500.
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Investment value of lands, Rights of way, Construction, general and all other items except power, which it is proposed to transfer	\$1,325,000.
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Nominal value for power possible of development	<u>10,000.</u>
--	----------------

Total value of the property offered	\$3,550,500.
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In this case the value of the property  
is \$1,050,500. in excess of that sum which the City  
proposes to pay.



Should the value of water rights be placed at \$2,000. per inch we have the following conditions:

Water rights on San Luis Rey River, being 1165 inches, less 10% transmission losses, or 1049 inches net delivered at \$2,000. per inch

\$2,098,000.

Water rights on Santa Ysabel River developed by a combination of Sutherland and Pamo reservoirs which in combination will yield 620 inches, less 10% transmission losses, or 558 inches net, at \$2,000. per inch

\$1,116,000.

Water rights from Carroll Reservoir development, being 196 inches, less 10% transmission losses, or 176 inches net, at \$2,000. per inch

352,000.  
\$1,468,000.

Less cost of acquiring balance of riparian rights on Santa Ysabel River, required to make these rights effective

459,000.

Net value of rights on Santa Ysabel River-

\$1,009,000.

Total value of water rights

\$3,107,000.

Investment value of lands, Rights of way, Construction, general and all other items except power, which it is proposed to transfer

\$1,325,000.

Nominal value for power possible of development

10,000.

Total value of the property offered

\$4,442,000.

In this last case the value of the property is \$1,942,000. in excess of the sum for which it is offered to the City.



**COST OF DEVELOPMENT OF THE SYSTEM REQUIRED TO DELIVER TO  
THE CITY THE SAFE NET YIELD FOUND AND, ALSO, THE COST PER  
THOUSAND GALLONS DELIVERED.**

In presenting estimates of cost of developing the entire system and determining the cost of the commodity which would be furnished therefrom, attention is again called to the fact that at the present time investigations both in the field and office, by the Volcan Land & Water Company, have not proceeded far enough to determine the final and economic design of the system. For this reason these estimates are approximate but are to be accepted as fully justified in the light of the information available.

The studies of the safe net yield of the various reservoirs proposed has shown that the amount of the lands within the reservoir sites which it is proposed to deliver to the City is not sufficient to provide for the requisite storage. This is certainly the case with Warner and Carroll reservoirs and probably upon more complete information will be found to be true of the Pamo and Sutherland reservoirs also. The estimates of the total cost to complete the system therefore have included in them sufficient funds to acquire the additional lands necessary to provide the storage required for the safe net yield found.

The estimated cost of the structures has been entirely on the line of permanent construction.



Conduits and tunnels have been estimated on the basis of concrete construction and lining, and siphons and flumes of steel and concrete. There has been included the cost of a 30" riveted steel pipe line from Carroll Reservoir into the center of the low service distribution district of the City of San Diego. Two 36" riveted steel pipe lines have been estimated for, running from the regulating reservoir of San Clemente to University Heights Reservoir in the City of San Diego. These pipe lines would have an approximate capacity of 50 million gallons daily to meet the maximum daily demands which will be made upon the system.

The inclusion of these elements provides for the complete construction of the entire collecting and transmission system such that the water is brought immediately to the distribution system of the City. On this basis, and taking the value of the water rights at \$1,000. per miners inch, the cost of the complete property would be as shown in the following table:



**Estimate of cost of complete collecting  
and distribution system, to yield 23  
million gallons daily.**

Water Rights		\$1,783,000.
Lands & Rights of Way		1,171,000.
<b>Construction</b>		
Warner Reservoir	\$385,000.	
Warner-Pamo Conduit	429,000.	
Pamo Reservoir	425,000.	
Sutherland Reservoir	345,000.	
Pamo-San Clemente Conduit	862,000.	
Carroll Reservoir	238,000.	
Carroll-San Diego Pipe line - 30" riveted steel	716,000.	
San Clemente - University Heights pipe line - two 36" riveted steel pipes	<u>635,000.</u>	
		\$3,975,000.
General & Miscellaneous		959,000.
Nominal value of power possibility		10,000.
<b>Total</b>		<u>\$7,898,000.</u>

As the City is offered for the sum of two and one half million dollars, property of the value of \$2,659,000. included in the above estimates, the cost to the City of the completed system will therefore be \$159,000. less than the total above arrived at, or \$7,739,000.

Allowing 10% for losses of water in transmission, this system will deliver into the distribution system of the City of San Diego 23 million gallons daily.

The cost of the water delivered into the City on the basis of 4½% interest on the value of the property will therefore be as follows:

**Estimate of cost of water delivered  
to the City of San Diego.**

Interest on \$7,739,000. @ 4½%		\$348,255.00
Depreciation, general repairs, operation and maintenance		<u>93,400.00</u>
<b>Total annual cost</b>		<b>\$441,655.00</b>



These total annual charges amount to 5.261 cents per thousand gallons delivered.

It is interesting to compare the total cost of the property on the basis of its safe net yield per million gallons delivered with the cost of other properties. Mr. H. A. Whitney, Hydraulic Engineer for the City of San Diego, estimates that it would cost the City of San Diego \$1,160,000. to place the City's collecting and transmission system upon the same permanent construction basis as that which has been estimated for the system under consideration. This added to the four millions which it cost the City to acquire the same would make that property have a value of \$5,160,000. The safe net yield of the system owned by the City is taken at  $7\frac{1}{2}$  million gallons daily.

The City of San Francisco has recently offered to the Spring Valley Water Company the sum of \$34,500,000. for its properties. This includes the City distribution system. If we eliminate the City distribution system at the value found by Judge Barrington in his decision in the case we arrive at a value of \$28,000,000. for the balance of the system corresponding to that of the impounding and transmission system of the City of San Diego and that estimated for the Volcan Land & Water Company's system in this report.



The following statement shows the cost of the property in dollars per million gallons of safe net yield:

	Cost of, collecting, and transmission system.	Safe net yield in million gallons daily.	Cost per million gallons daily, of safe net yield.
Spring Valley Water Company	\$28,000,000.	35,000,000.	\$800,000.
City of San Diego	5,160,000.	7,500,000.	688,000.
Volcan Land & Water Company	7,739,000.	23,000,000.	336,500.

The writer is advised by Mr. H. R. Fay, *Aug 1914*

Superintendent of the Department of Water of San Diego, that within the past few days the City has asked the Cuyamaca Water Company to present an offer of that property to the City. Should the City acquire the Cuyamaca Water Company it is very probable that a re-arrangement of the various elements of the system of the Volcan Land & Water Company, above proposed, might be made. In the light of the information available it seems that probably the water from Warner and Sutherland reservoirs might be brought directly into the flume of the Cuyamaca Water Company in the vicinity of the diverting dam and thence transmitted through the flume and pipe line of that system to the University Heights Reservoir. Under these circumstances the waters from Pano Reservoir might be passed to Carroll Reservoir and thence through the proposed pipe line to the low service distribution zone of the City.

Such a combination, if possible, would probably



result in saving several hundred thousand dollars in the total cost of the complete system, but at this time sufficient data is not at hand to determine this question.

CONCLUSIONS.

Finally, it may be said that in the light of the information available the following conclusions are justified:

THAT	the safe net yield of Warner Reservoir will be	15	million	gallons	daily.
THAT	the safe net yield of Sutherland Reservoir will be	5.9	"	"	"
THAT	the safe net yield of Pamo Reservoir will be	2.1	"	"	"
THAT	the safe net yield of Carroll Reservoir will be	<u>2.5</u>	"	"	"
THAT	the safe net yield of the entire system will be	25.5	"	"	"
THAT	Allowing 10% for losses in transmission there will be delivered into the City of San Diego				23 million gallons daily.
THAT	On the basis of \$1,000. per miners inch for water rights, the value of the property offered to the City of San Diego by the Volcan Land & Water Company for the sum of two and one half million dollars is				\$2,659,000.
THAT	On this basis the total cost of the complete development of the system on the basis of permanent construction and such as to deliver to the City of San Diego 23 million gallons daily will be				\$7,739,000.



THAT

Upon the basis of ~~4%~~ interest  
on the value of the property  
together with annual depreciation,  
maintenance and operating cost  
and the delivery of 23 million  
gallons daily, this water will  
cost, delivered into the distri-  
bution system of the City of  
San Diego, per thousand gallons

5.26 cents.

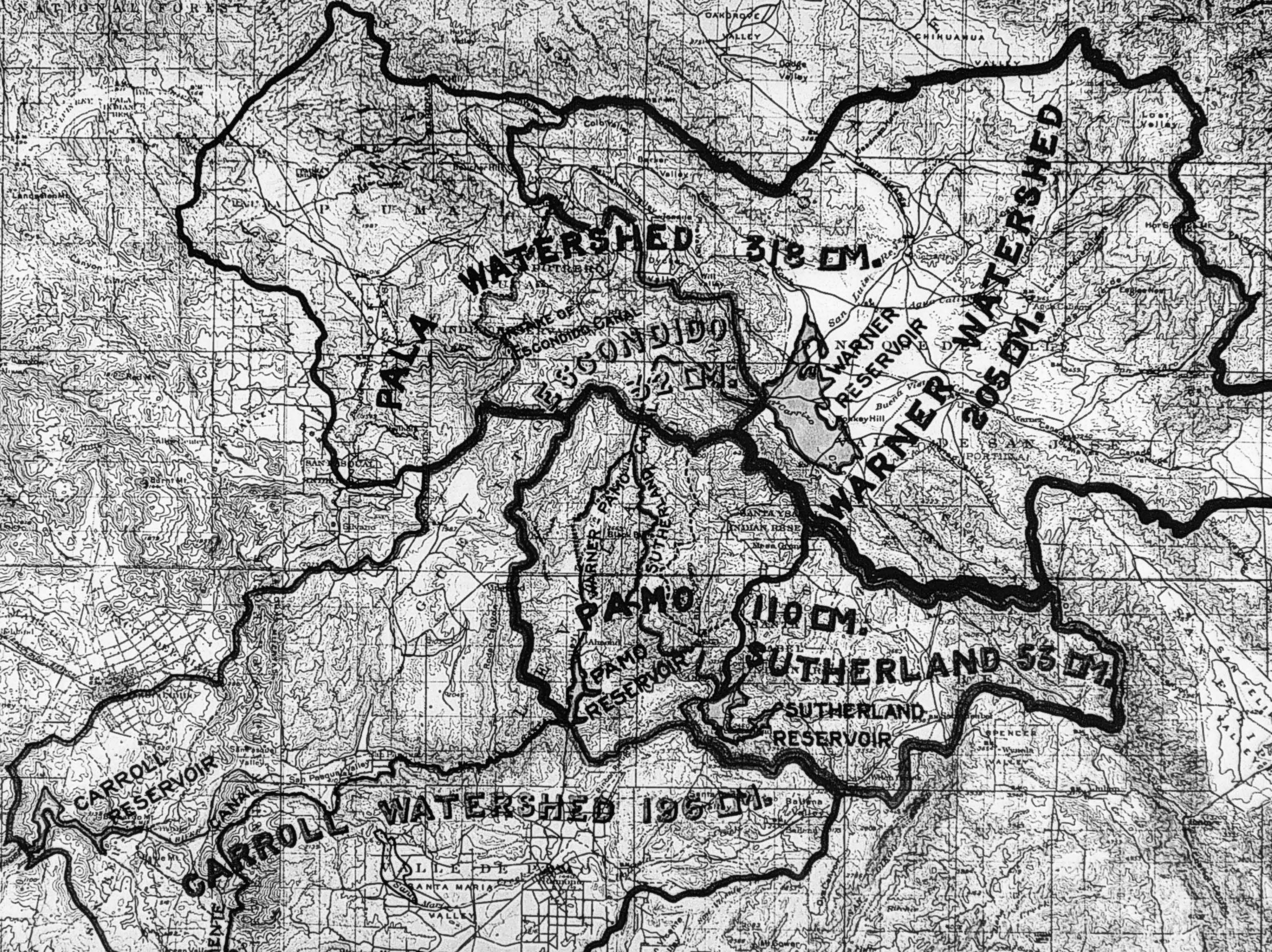
Respectfully presented,

*P. E. Harrow*



PLATES





**PALA WATERSHED 318 DM.**

**ESCONDIDO WATERSHED 530 DM.**

**WARNER RESERVOIR WATERSHED 205 DM.**

**PAMO WATERSHED 110 DM.**

**SUTHERLAND 53 DM.**

**CARROLL WATERSHED 196 DM.**

**CARROLL RESERVOIR**

**SUTHERLAND RESERVOIR**

**NATIONAL FOREST**

**OAKBROOK VALLEY**

**CHIUANUA VALLEY**

**SAN MARCOS VALLEY**

**EXOLITAS**

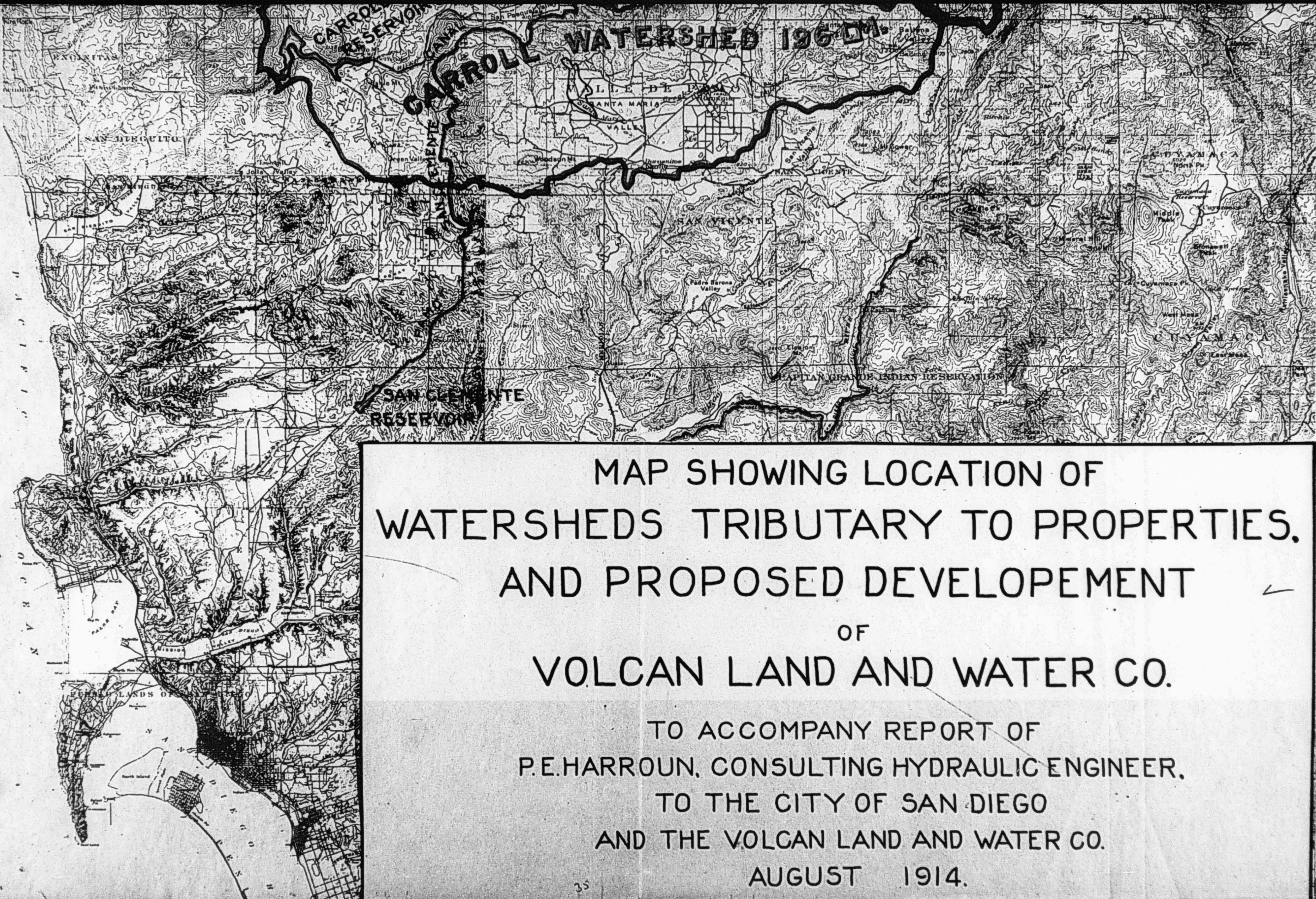
**SAN DIEGUITO**

**L. E. DE P.**

**SANTA MARIA VALLEY**

**ETWANACA**



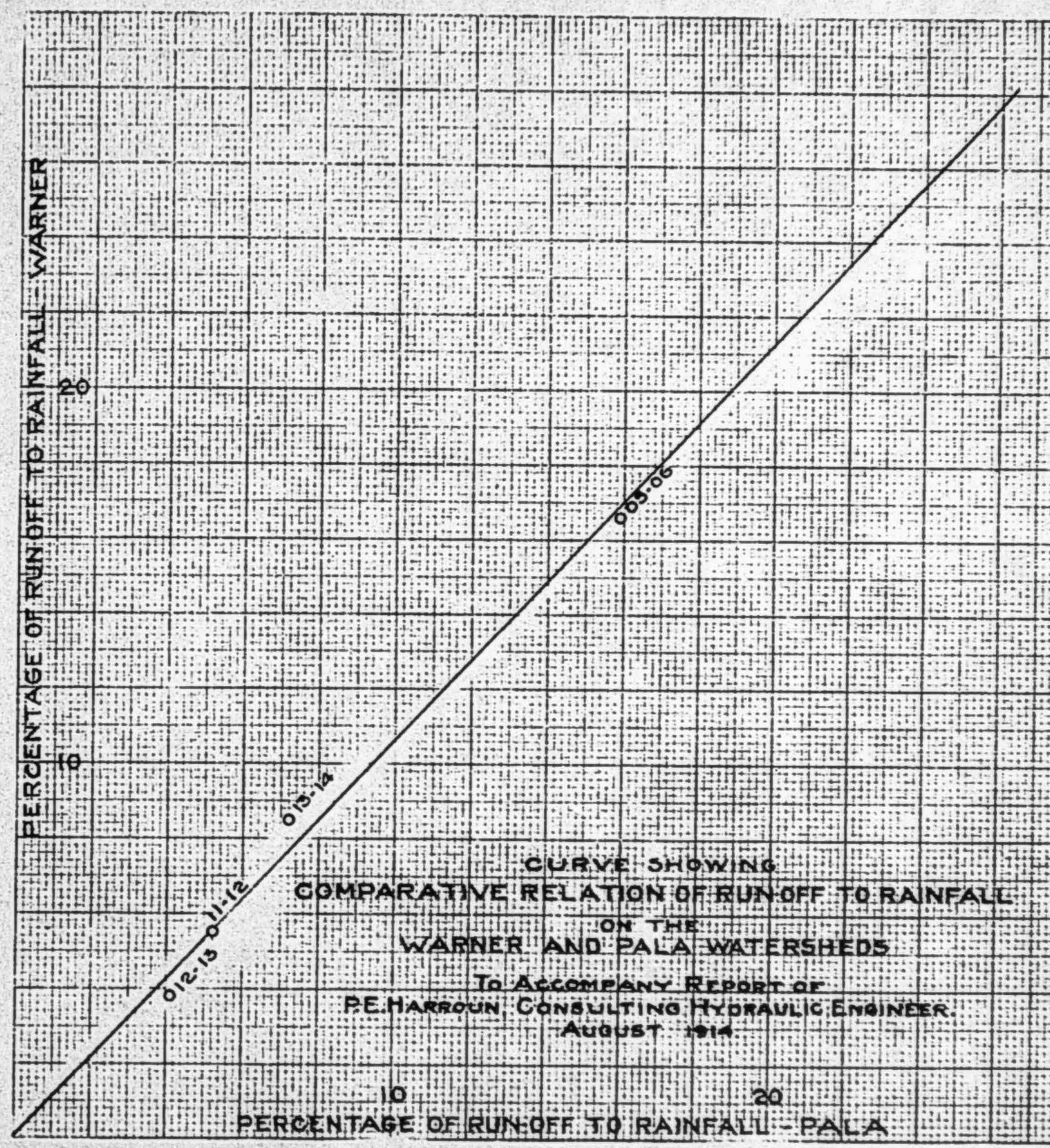
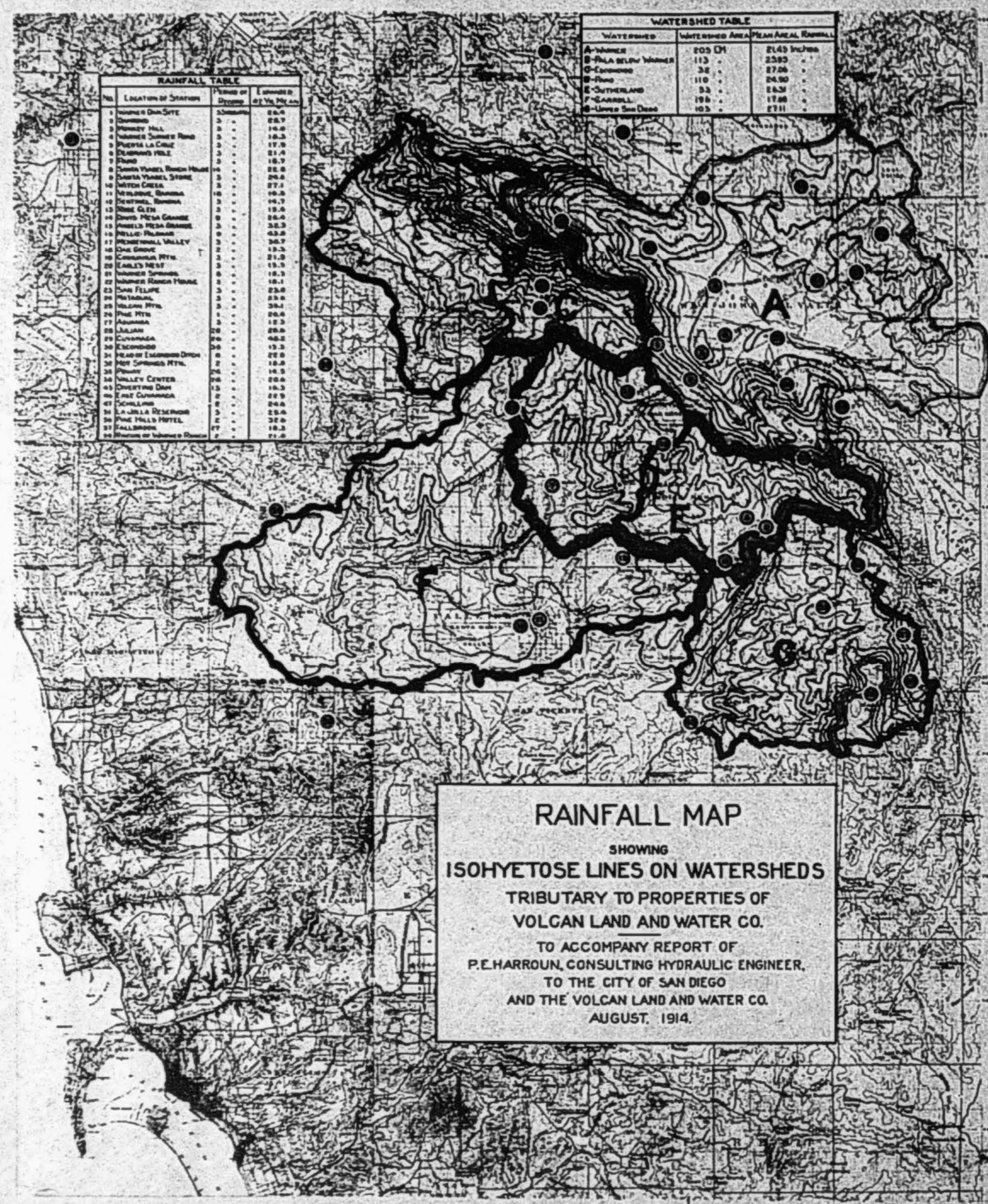


MAP SHOWING LOCATION OF  
WATERSHEDS TRIBUTARY TO PROPERTIES,  
AND PROPOSED DEVELOPEMENT  
OF  
VOLCAN LAND AND WATER CO.

TO ACCOMPANY REPORT OF  
P.E.HARROUN, CONSULTING HYDRAULIC ENGINEER,  
TO THE CITY OF SAN DIEGO  
AND THE VOLCAN LAND AND WATER CO.

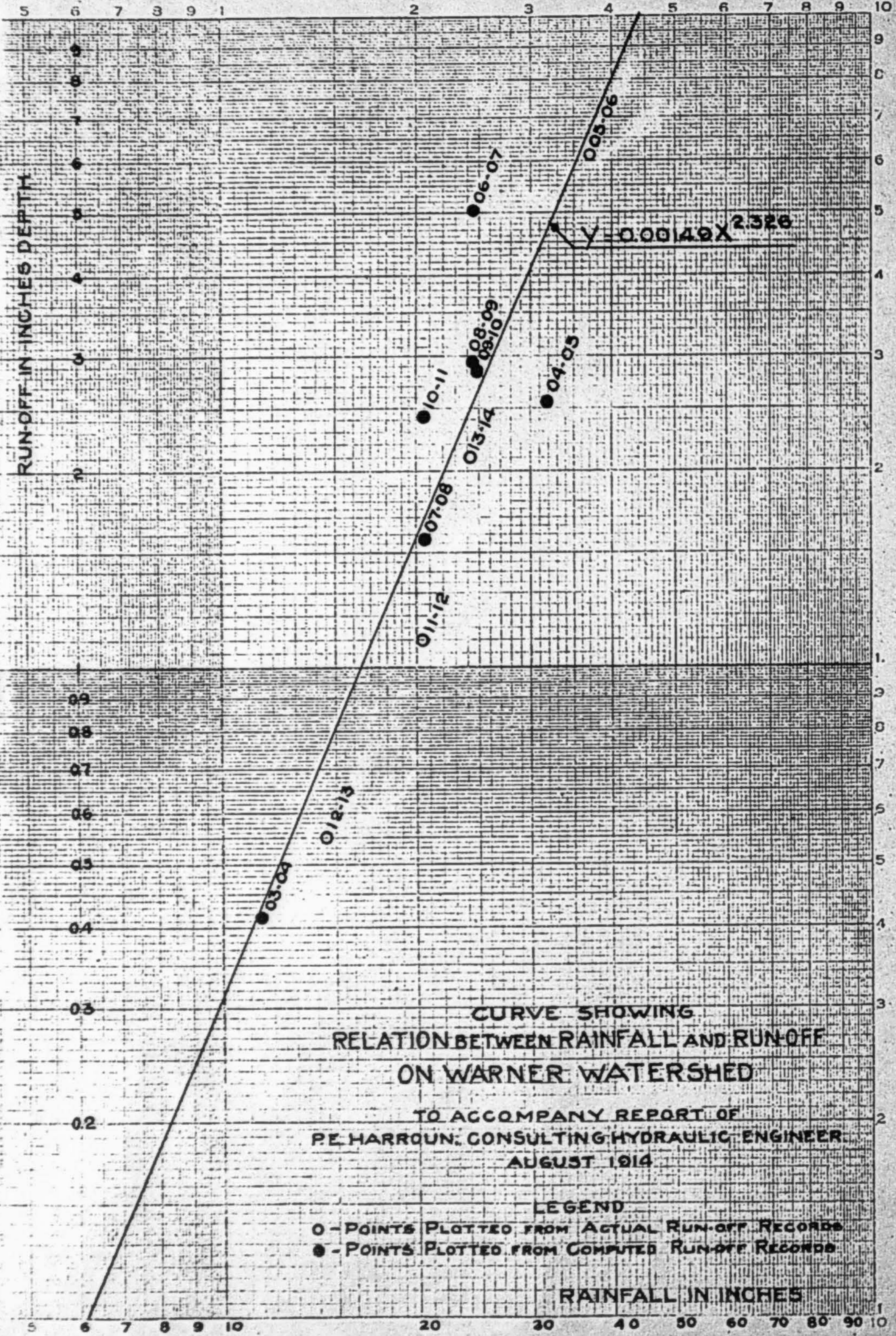
AUGUST 1914.



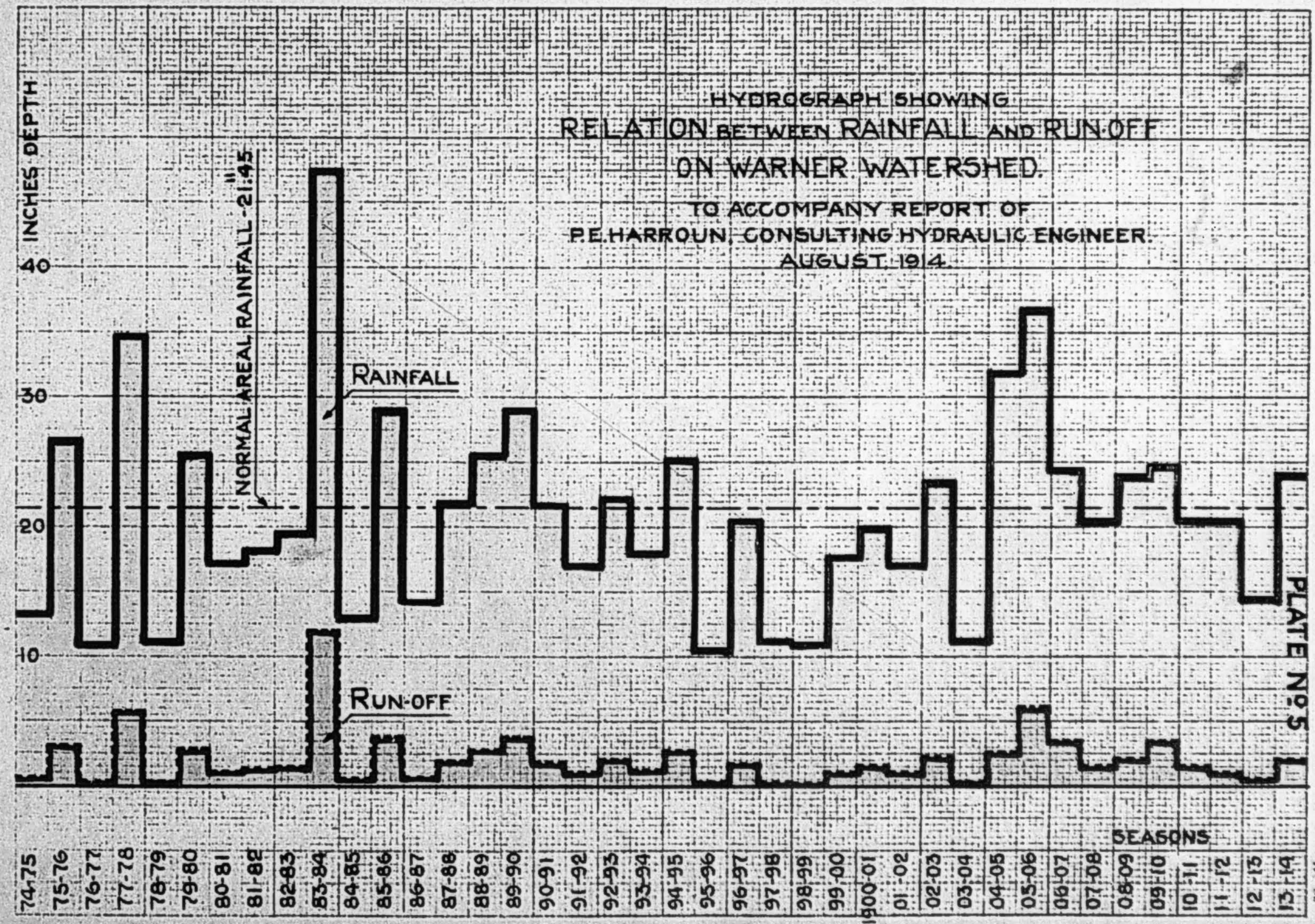




RUN-OFF IN INCHES DEPTH



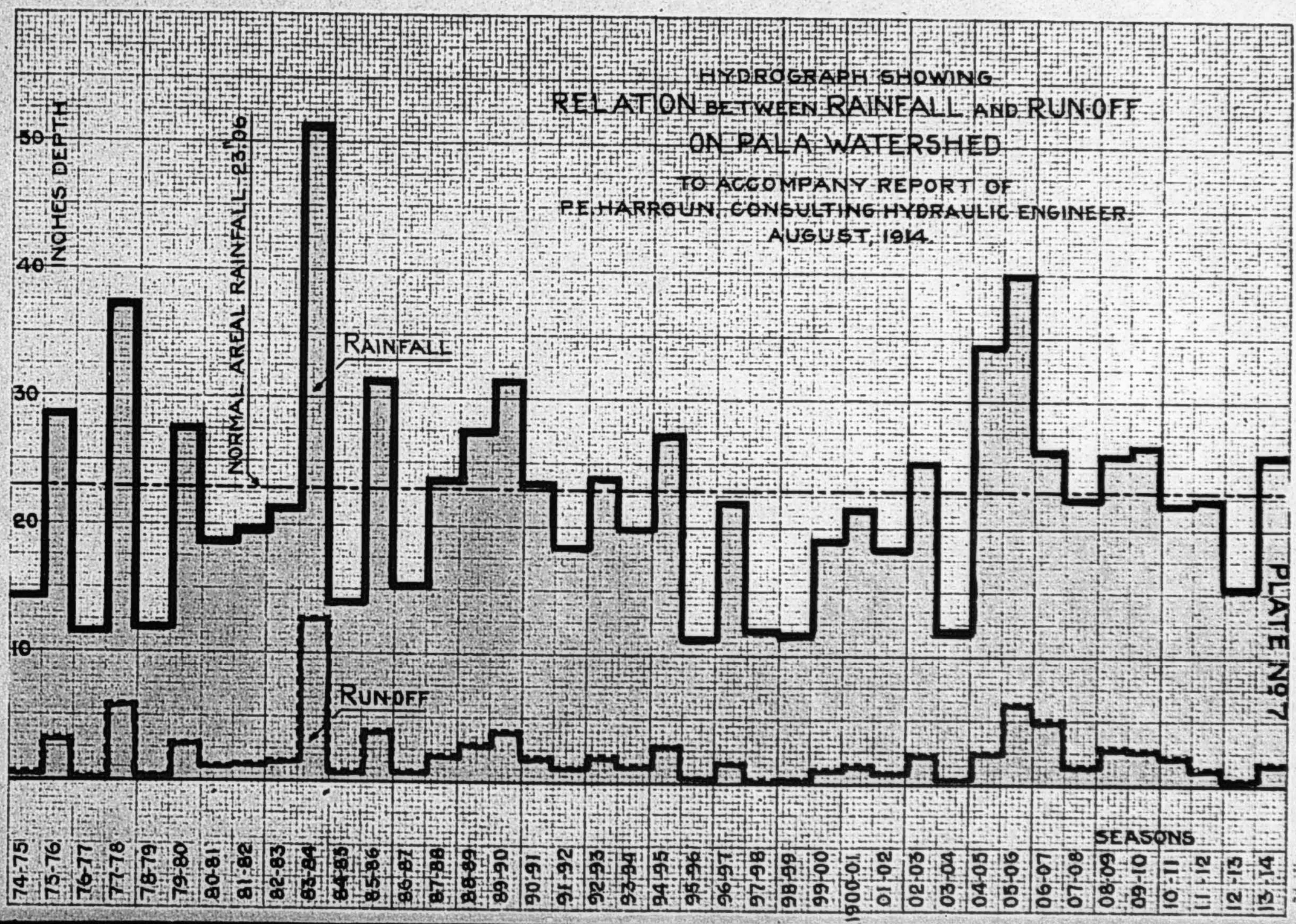
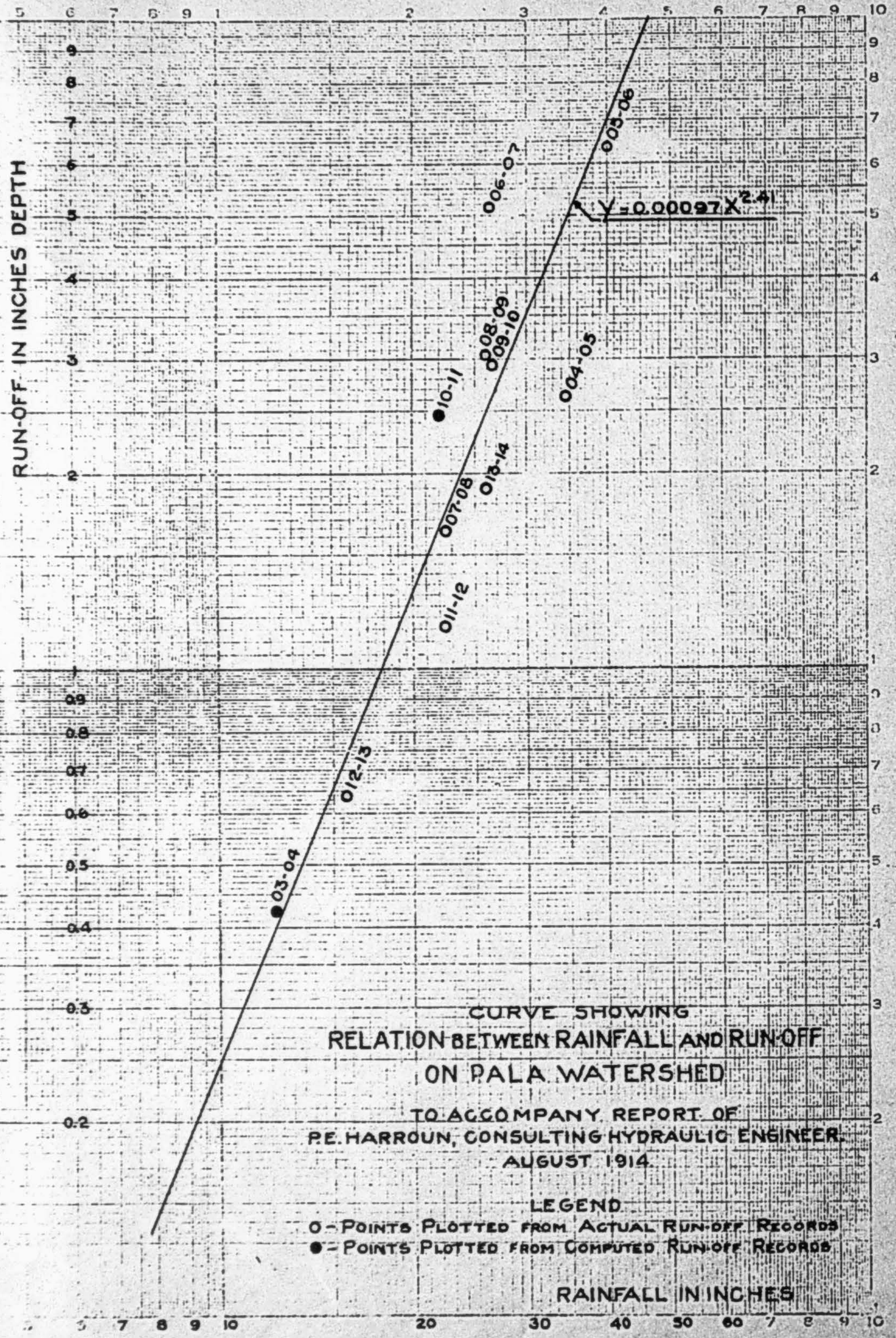
HYDROGRAPH SHOWING  
RELATION BETWEEN RAINFALL AND RUN-OFF  
ON WARNER WATERSHED.  
TO ACCOMPANY REPORT OF  
P.E. HARROUN, CONSULTING HYDRAULIC ENGINEER.  
AUGUST 1914



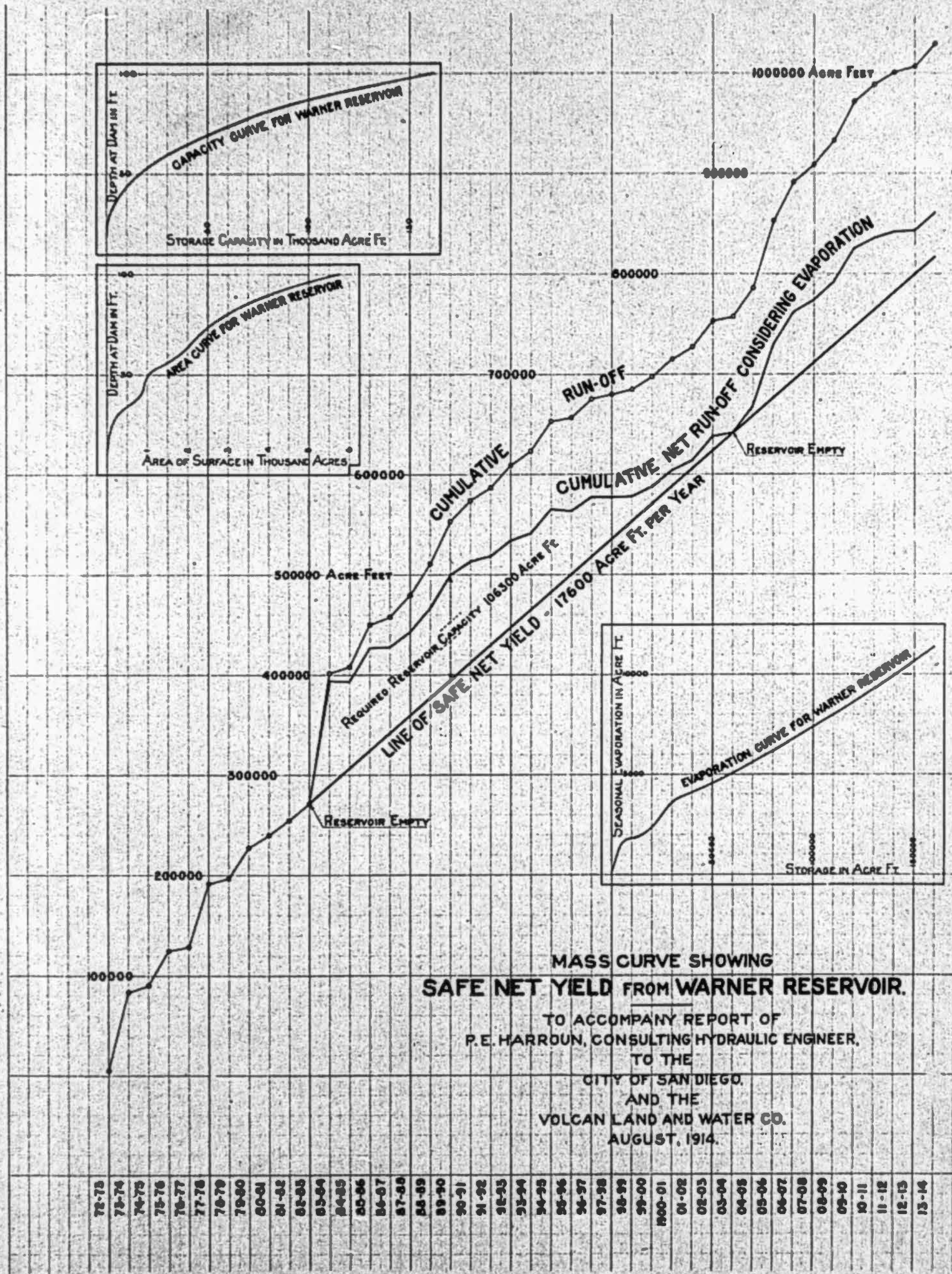
65

PLATE No 5





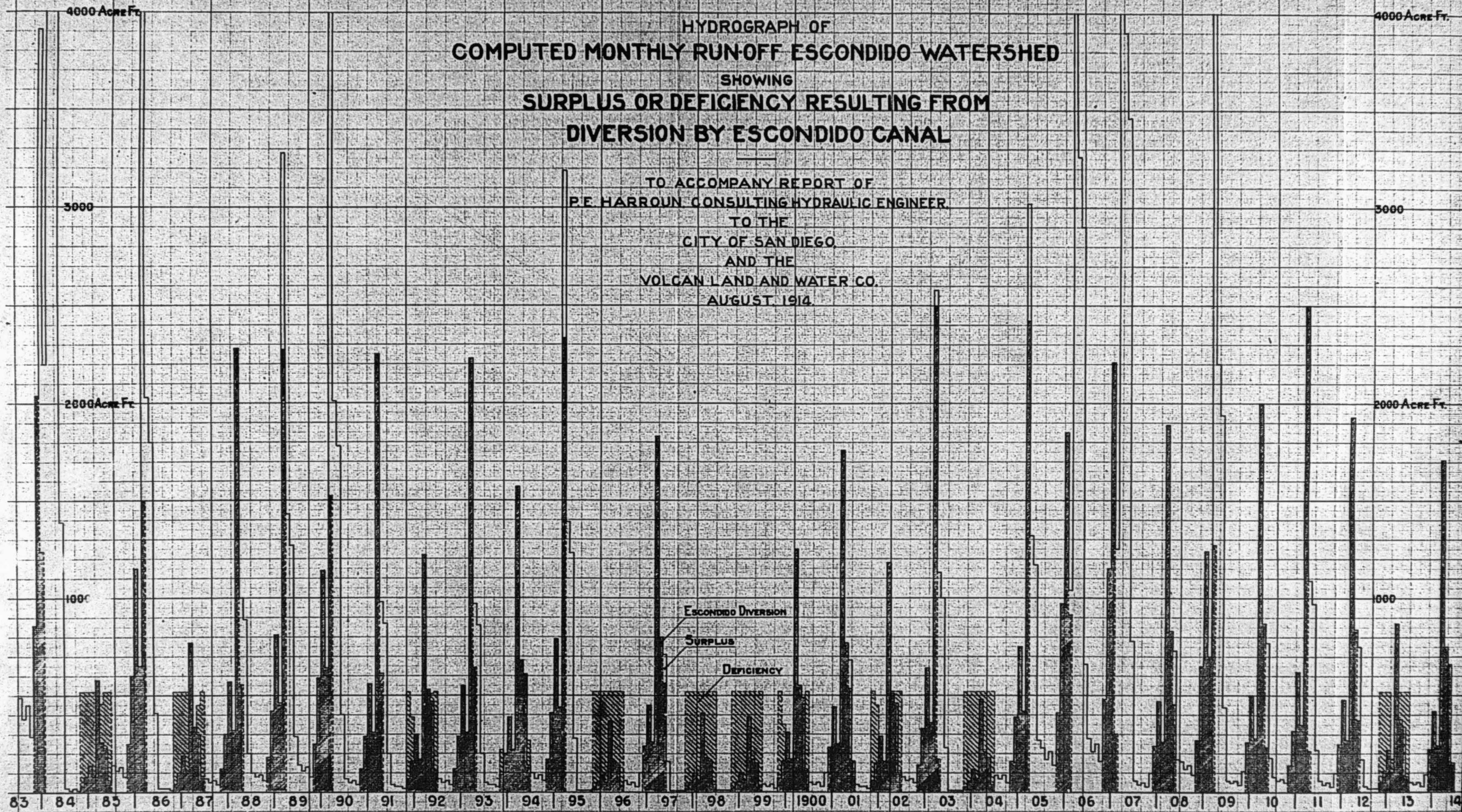




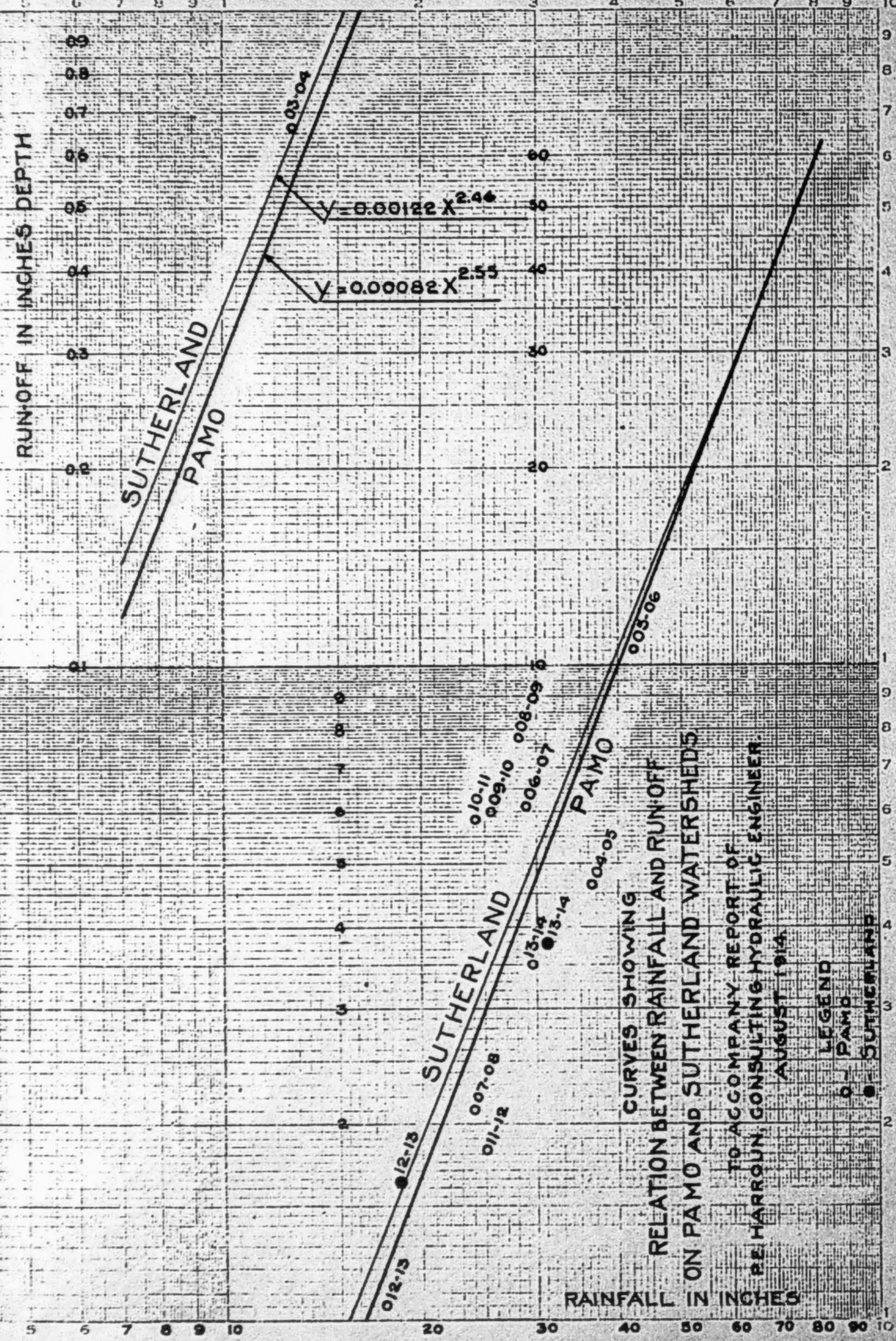


HYDROGRAPH OF  
**COMPUTED MONTHLY RUN-OFF ESCONDIDO WATERSHED**  
 SHOWING  
**SURPLUS OR DEFICIENCY RESULTING FROM**  
**DIVERSION BY ESCONDIDO CANAL**

TO ACCOMPANY REPORT OF  
 P.E. HARROUN CONSULTING HYDRAULIC ENGINEER,  
 TO THE  
 CITY OF SAN DIEGO  
 AND THE  
 VOLCAN LAND AND WATER CO.  
 AUGUST, 1914.

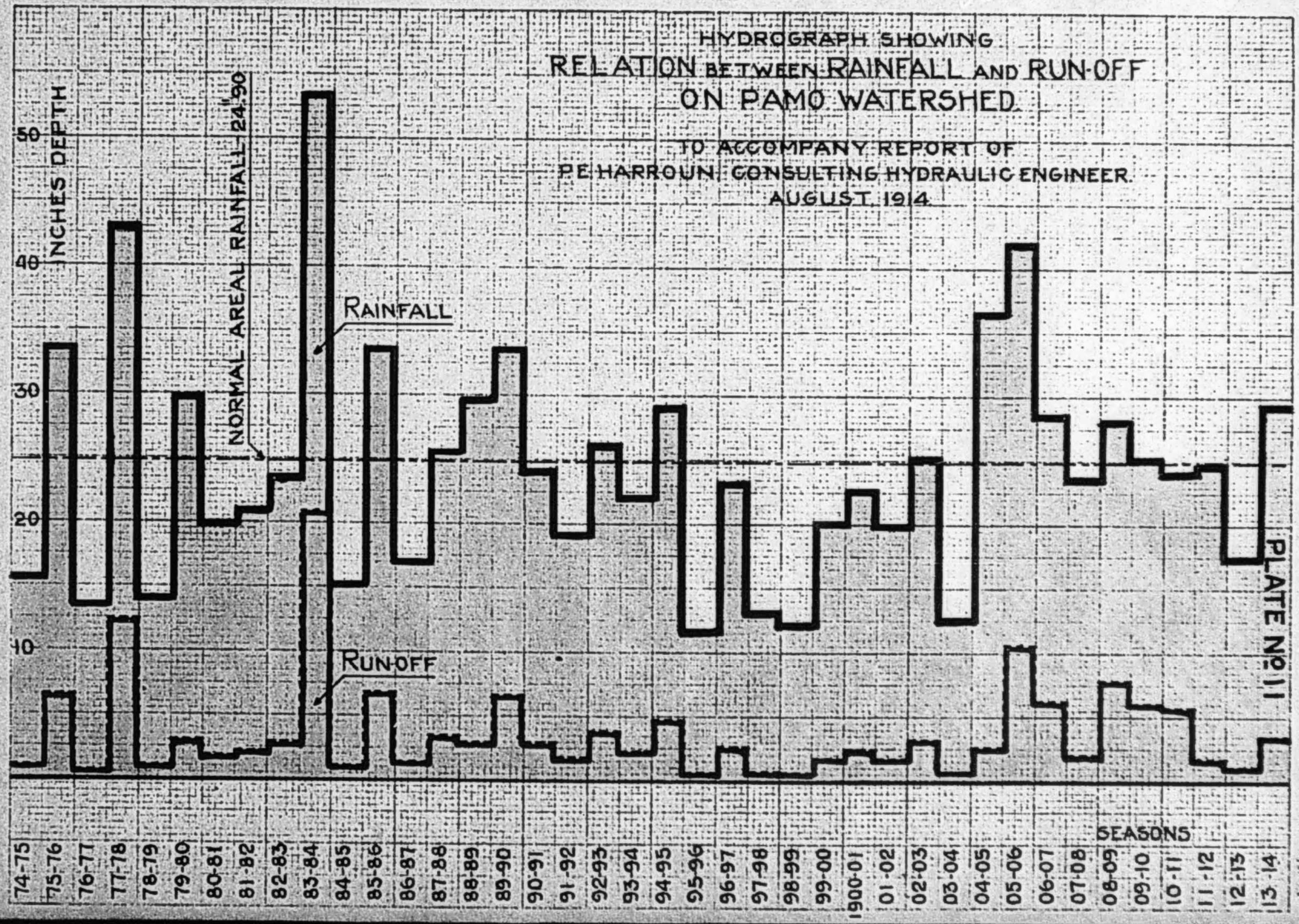






CURVES SHOWING  
RELATION BETWEEN RAINFALL AND RUN-OFF  
ON PAMO AND SUTHERLAND WATERSHEDS  
TO ACCOMPANY REPORT OF  
PE HARRON, CONSULTING HYDRAULIC ENGINEER  
AUGUST 1914

HYDROGRAPH SHOWING  
RELATION BETWEEN RAINFALL AND RUN-OFF  
ON PAMO WATERSHED  
TO ACCOMPANY REPORT OF  
PE HARRON, CONSULTING HYDRAULIC ENGINEER  
AUGUST 1914

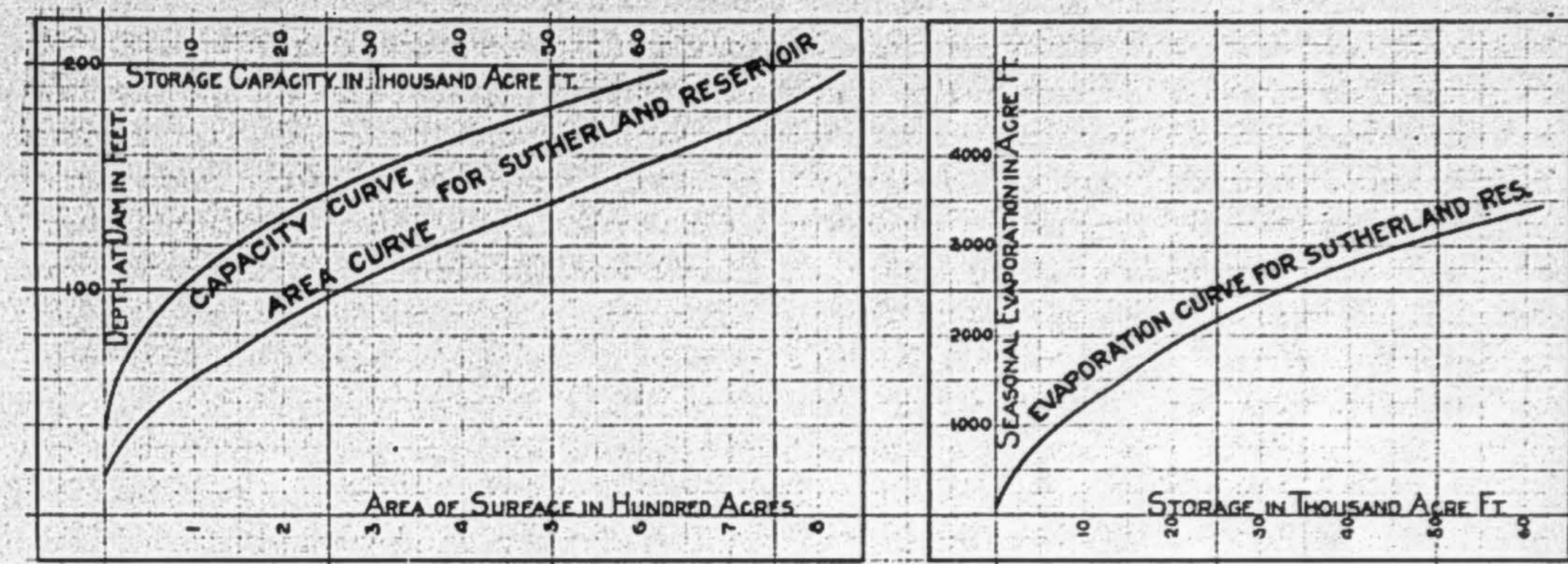
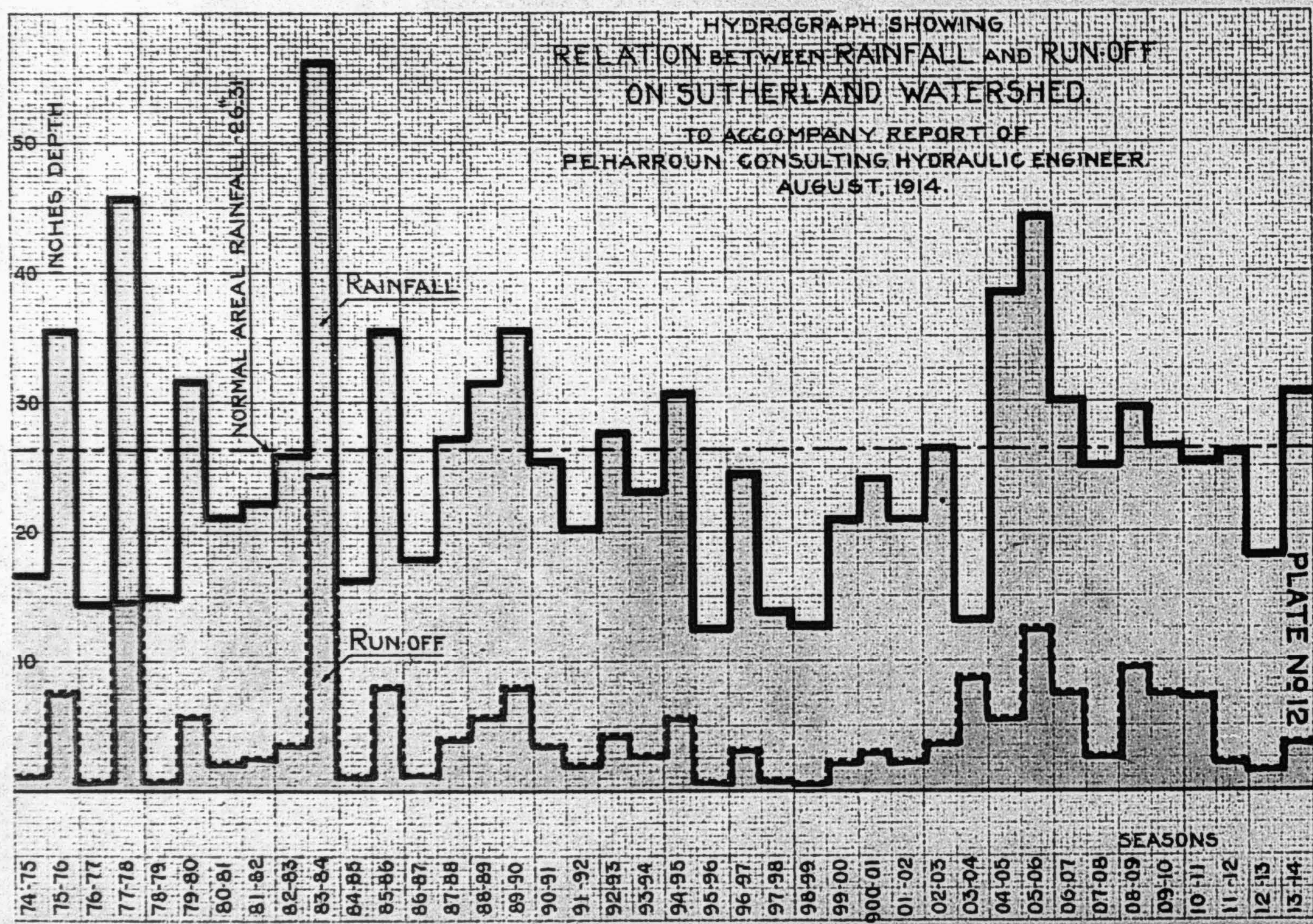


74-75	75-76	76-77	77-78	78-79	79-80	80-81	81-82	82-83	83-84	84-85	85-86	86-87	87-88	88-89	89-90	90-91	91-92	92-93	93-94	94-95	95-96	96-97	97-98	98-99	99-00	1900-01	01-02	02-03	03-04	04-05	05-06	06-07	07-08	08-09	09-10	10-11	11-12	12-13	13-14
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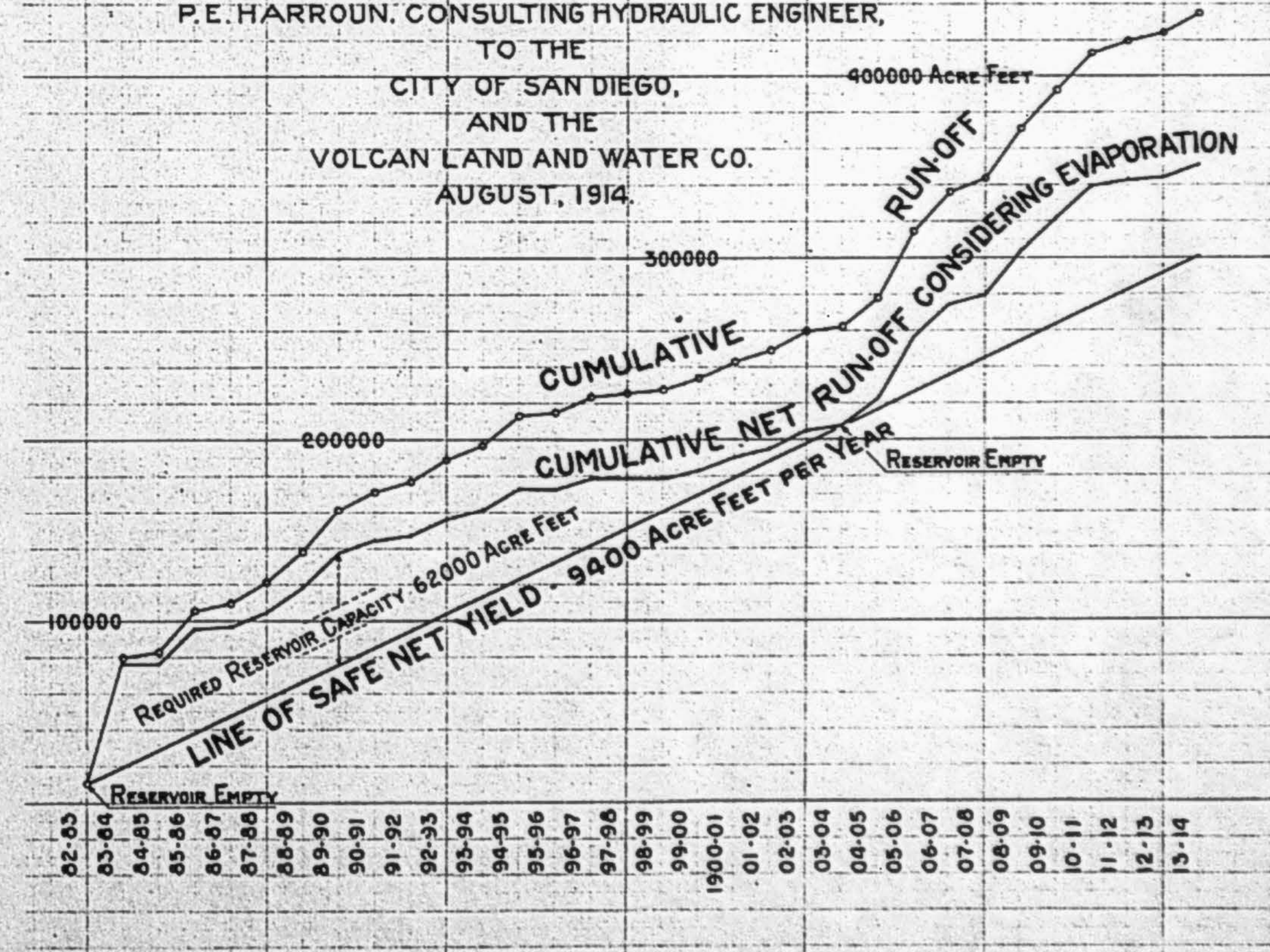
54



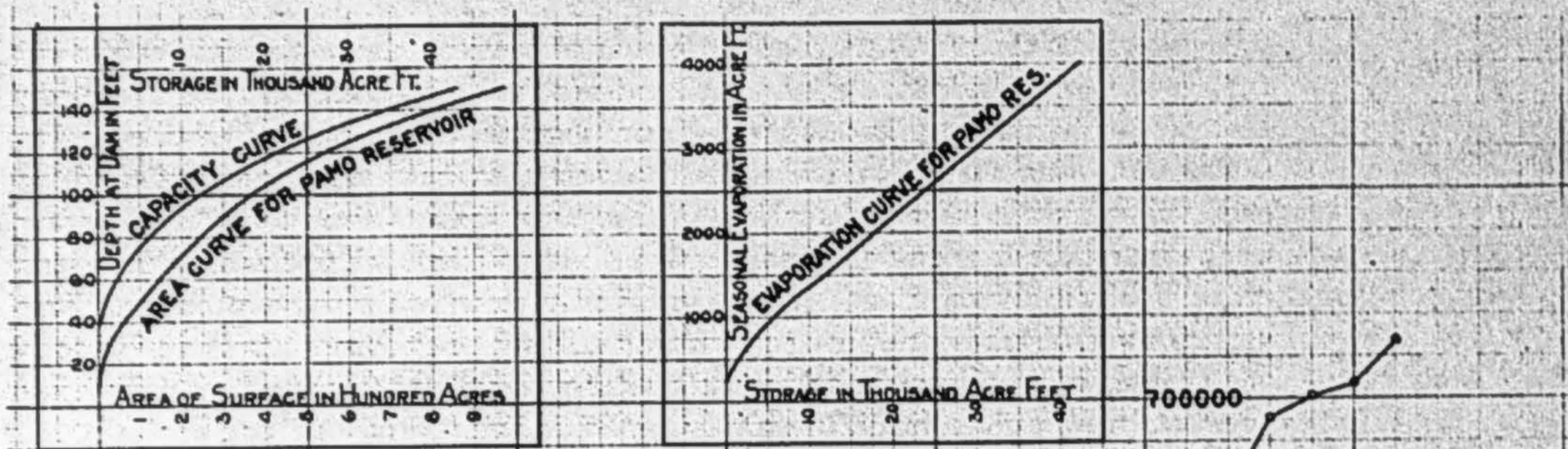


### MASS CURVE SHOWING SAFE NET YIELD FROM SUTHERLAND RESERVOIR.

TO ACCOMPANY REPORT OF  
P. E. HARROUN, CONSULTING HYDRAULIC ENGINEER,  
TO THE  
CITY OF SAN DIEGO,  
AND THE  
VOLCAN LAND AND WATER CO.  
AUGUST, 1914.

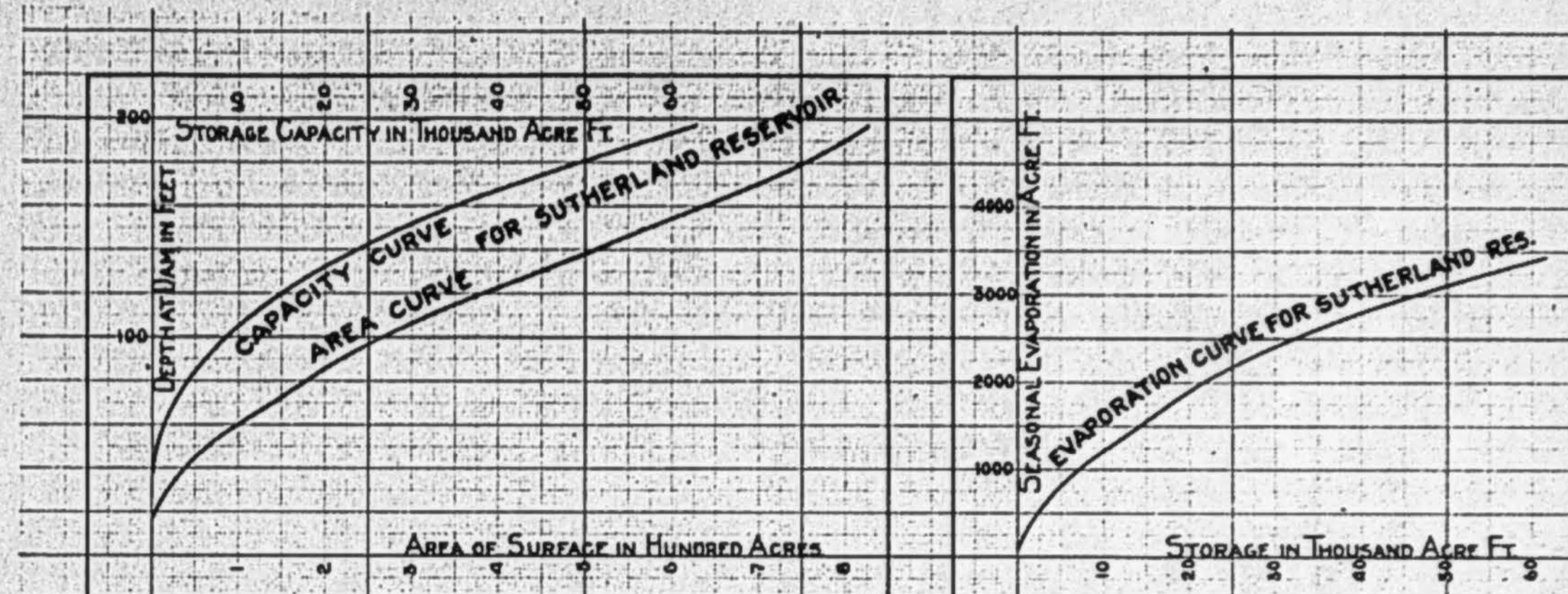
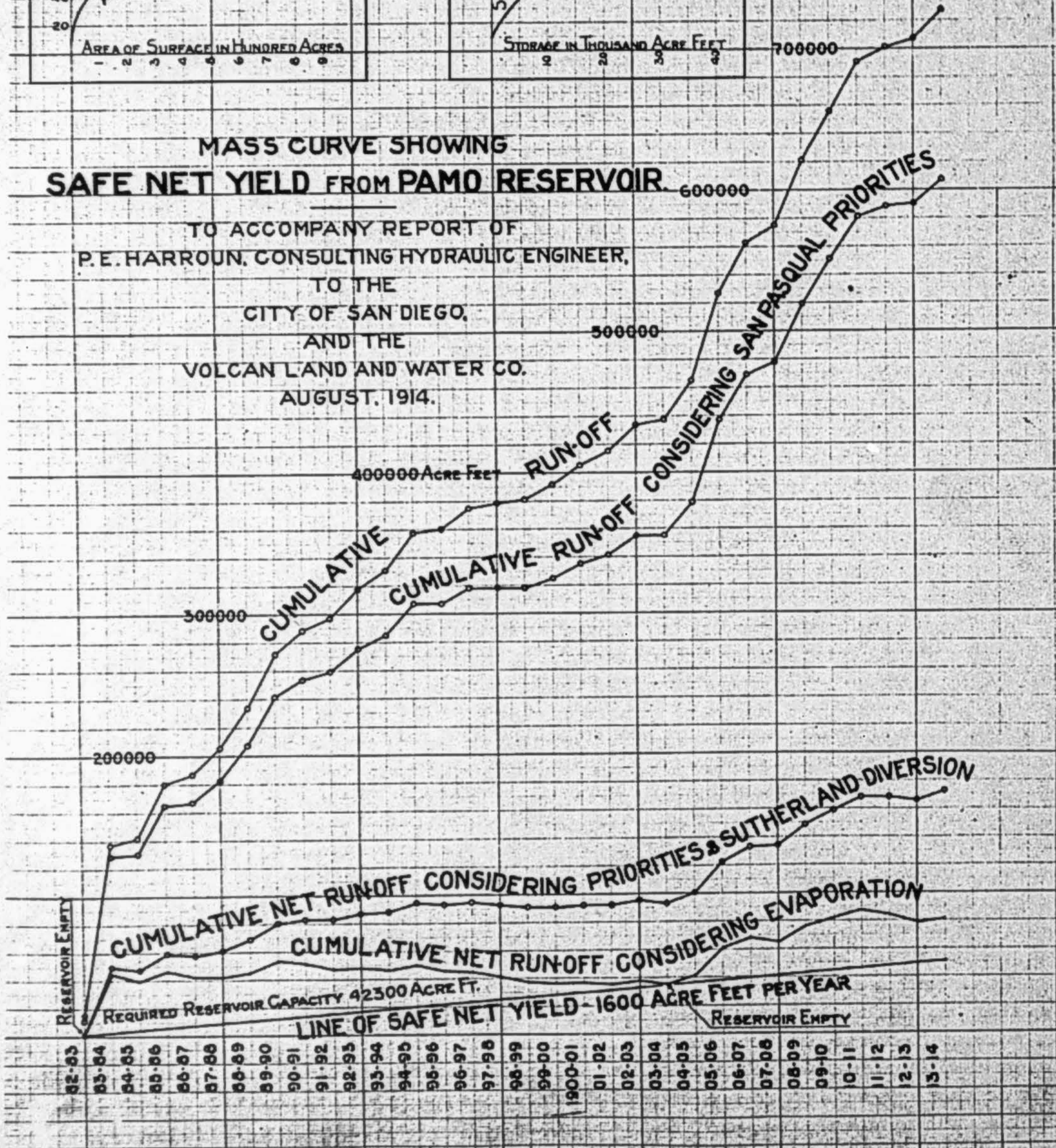






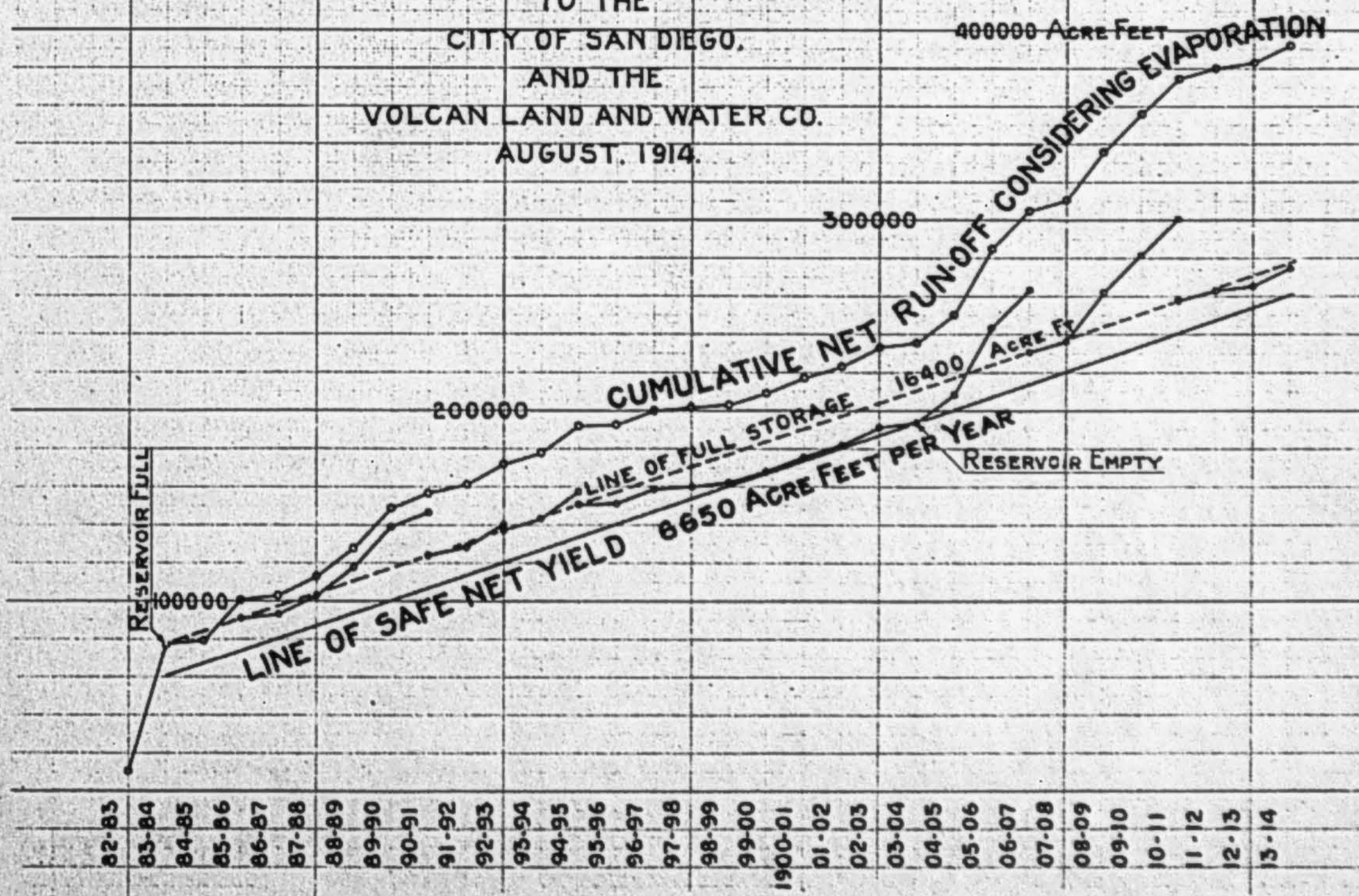
**MASS CURVE SHOWING SAFE NET YIELD FROM PAMO RESERVOIR**

TO ACCOMPANY REPORT OF  
P. E. HARROUN, CONSULTING HYDRAULIC ENGINEER,  
TO THE  
CITY OF SAN DIEGO,  
AND THE  
VOLCAN LAND AND WATER CO.  
AUGUST, 1914.

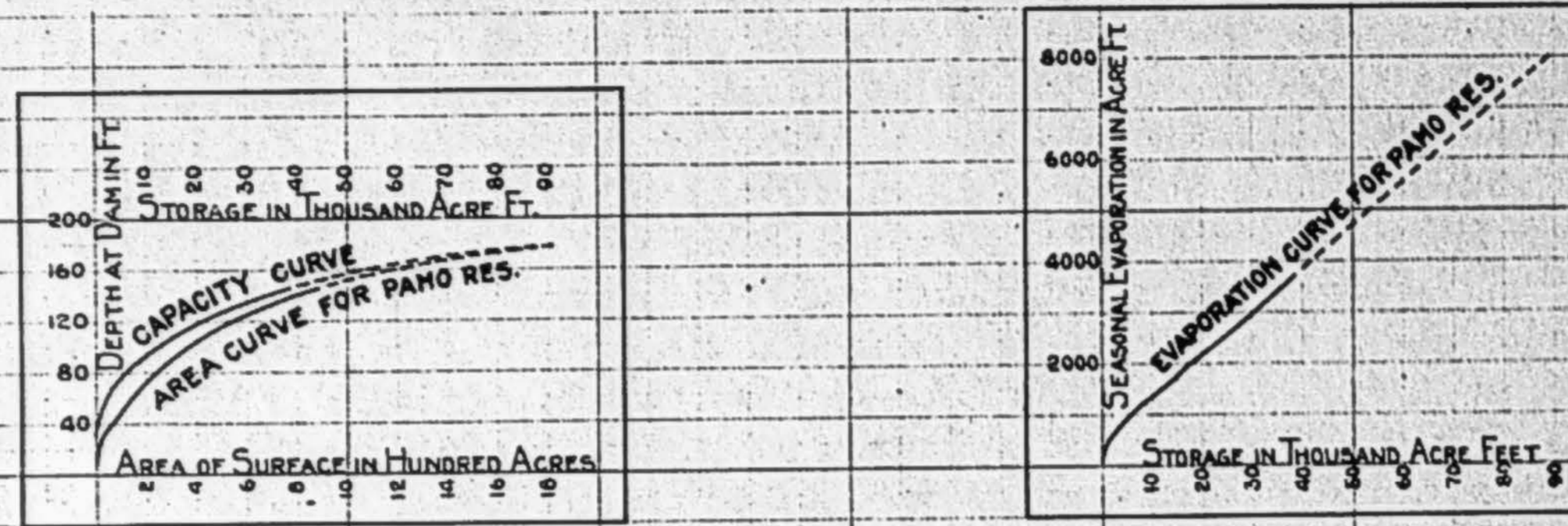


**MASS CURVE SHOWING SAFE NET YIELD FROM SUTHERLAND RESERVOIR.**

TO ACCOMPANY REPORT OF  
P. E. HARROUN, CONSULTING HYDRAULIC ENGINEER,  
TO THE  
CITY OF SAN DIEGO,  
AND THE  
VOLCAN LAND AND WATER CO.  
AUGUST, 1914.

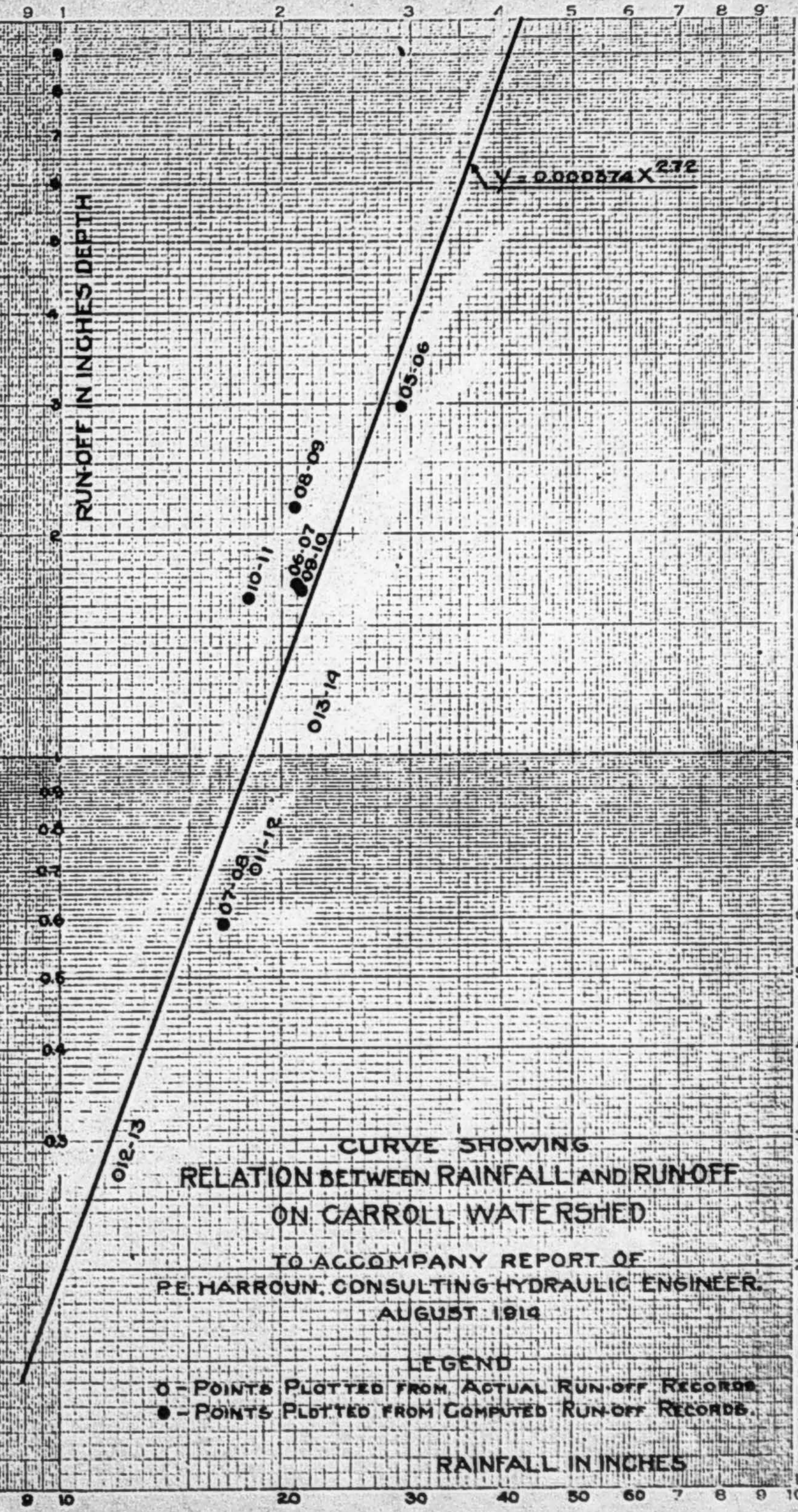
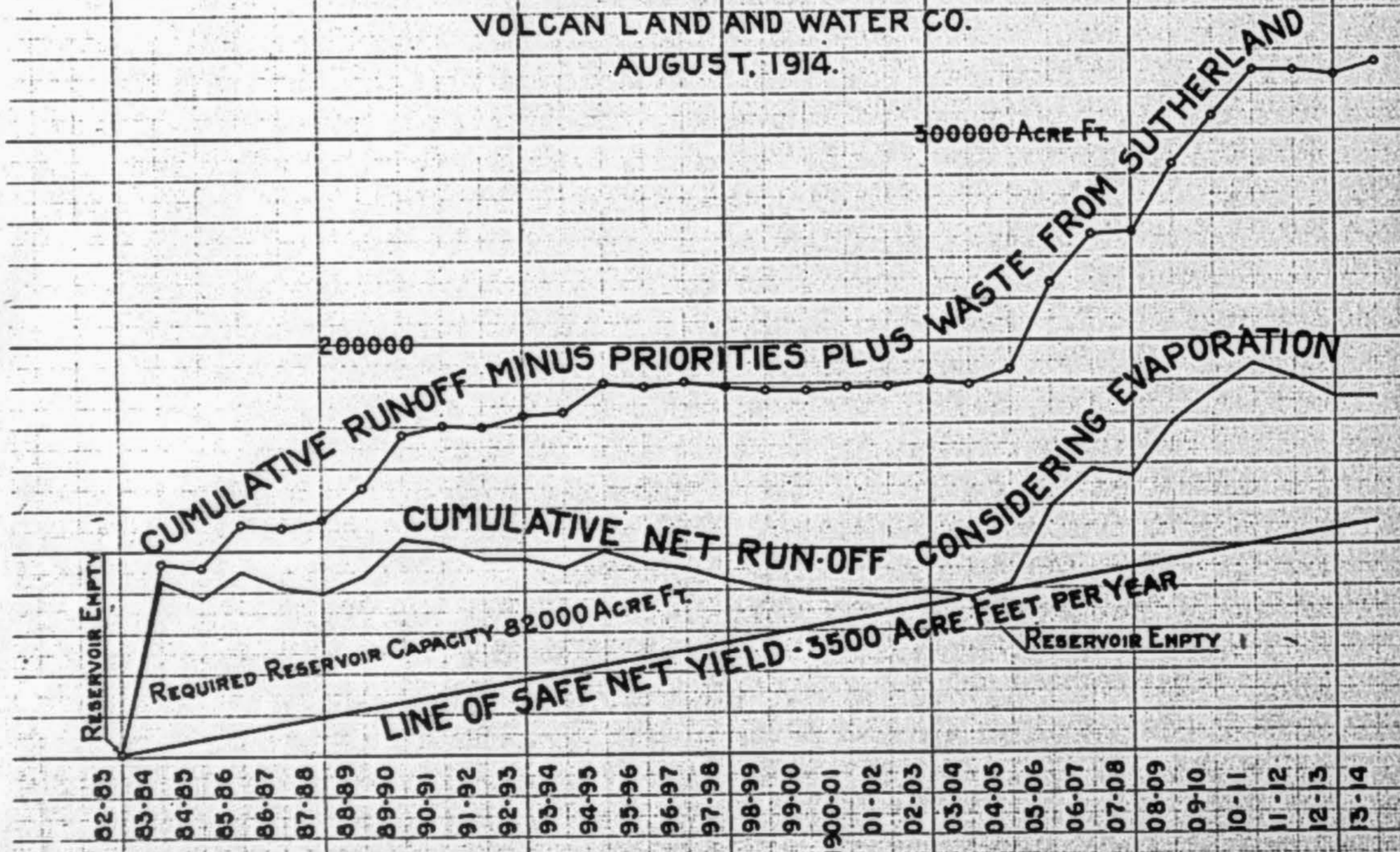






**MASS CURVE SHOWING  
SAFE NET YIELD FROM PAMO RESERVOIR.**

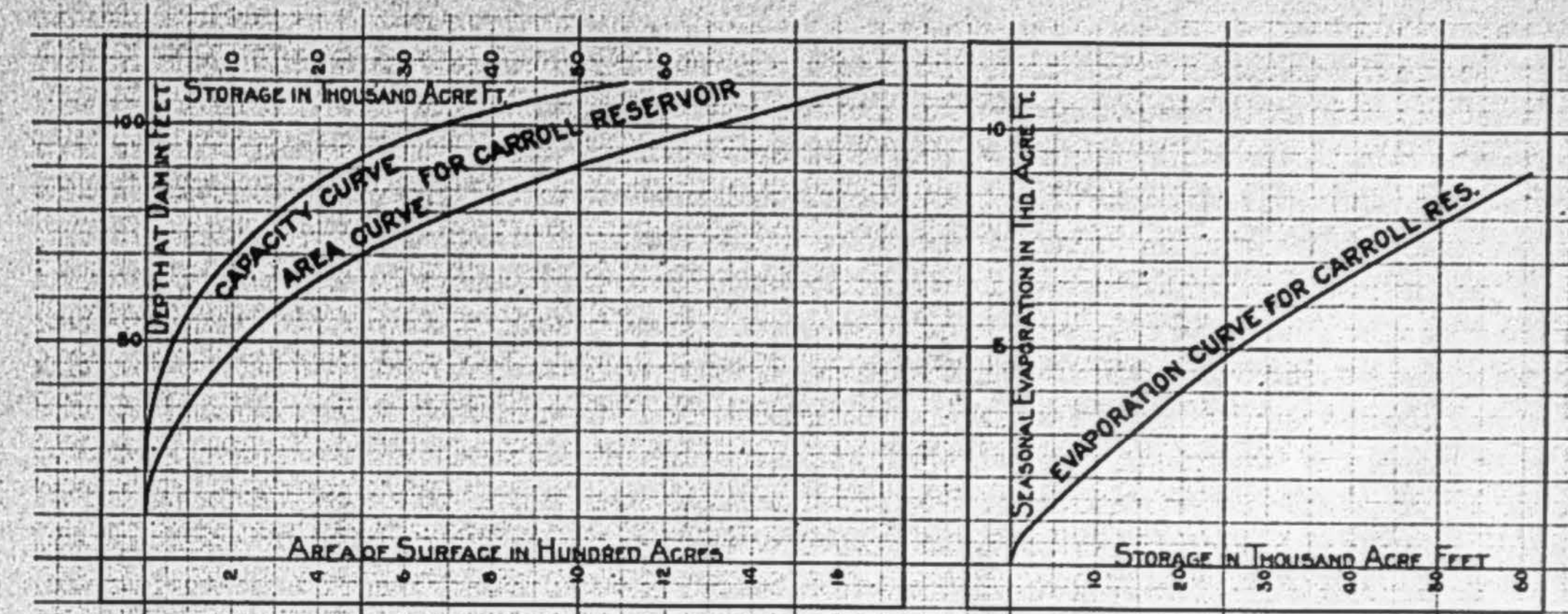
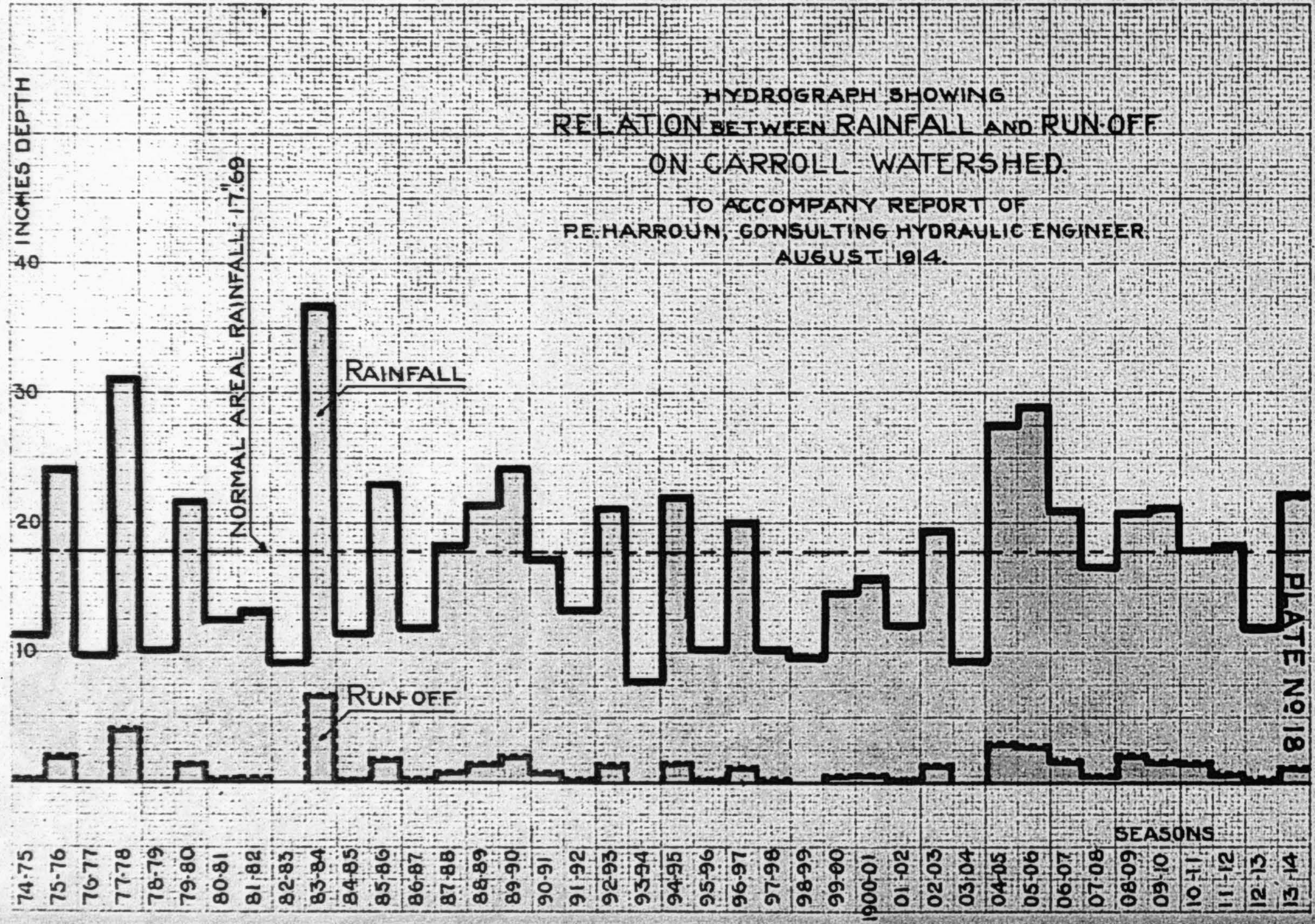
TO ACCOMPANY REPORT OF  
P. E. HARROUN, CONSULTING HYDRAULIC ENGINEER,  
TO THE  
CITY OF SAN DIEGO,  
AND THE  
VOLCAN LAND AND WATER CO.  
AUGUST, 1914.



**CURVE SHOWING  
RELATION BETWEEN RAINFALL AND RUNOFF  
ON CARROLL WATERSHED**  
TO ACCOMPANY REPORT OF  
P. E. HARROUN, CONSULTING HYDRAULIC ENGINEER,  
AUGUST 1914

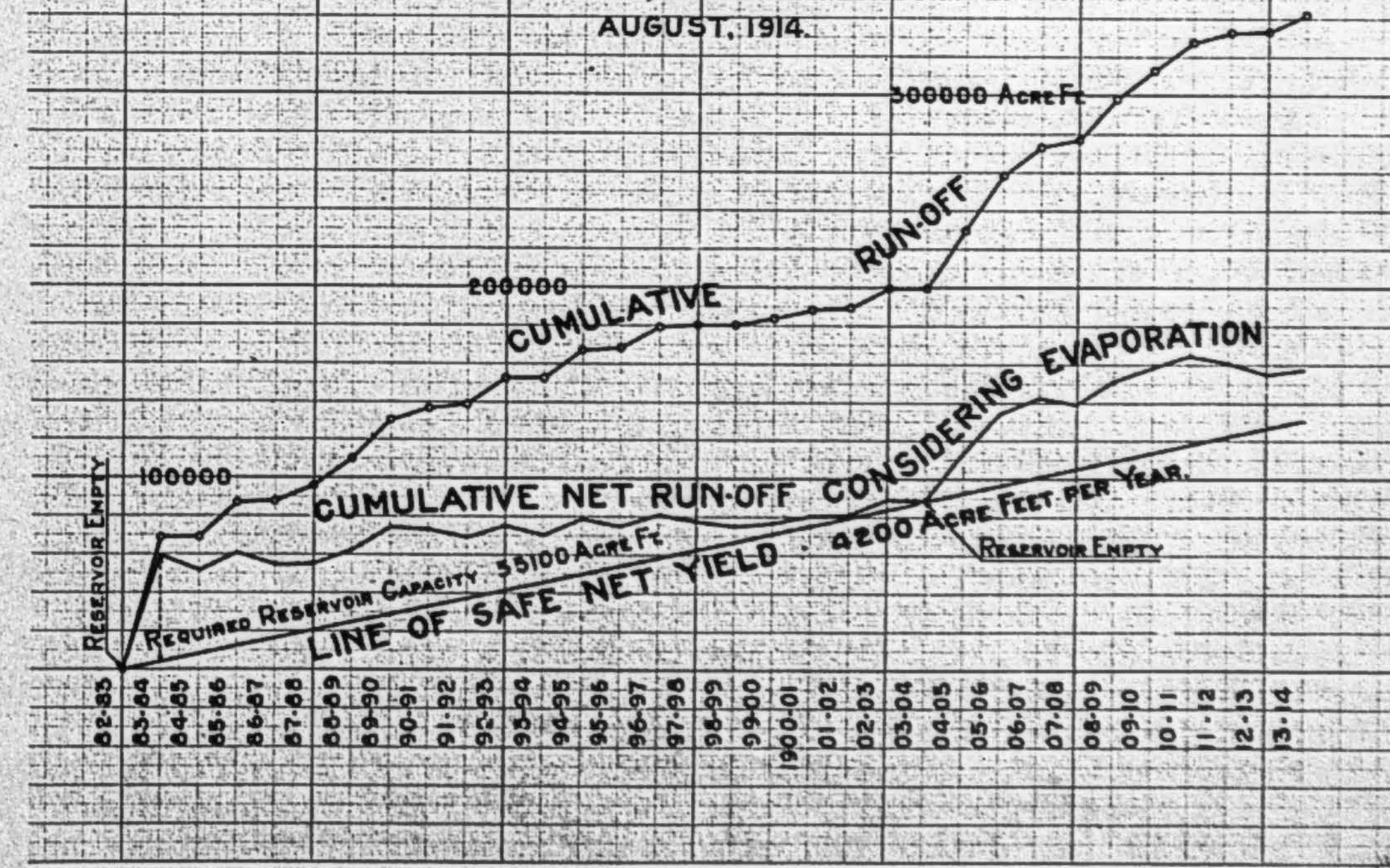
**LEGEND**  
○ - POINTS PLOTTED FROM ACTUAL RUN-OFF RECORDS  
● - POINTS PLOTTED FROM COMPUTED RUN-OFF RECORDS.





**MASS CURVE SHOWING  
SAFE NET YIELD FROM CARROLL RESERVOIR.**

TO ACCOMPANY REPORT OF  
P.E. HARROUN, CONSULTING HYDRAULIC ENGINEER,  
TO THE  
CITY OF SAN DIEGO,  
AND THE  
VOLCAN LAND AND WATER CO.  
AUGUST, 1914.





ED FLETCHER COMPANY  
FLETCHER BUILDING  
SAN DIEGO, CALIF.

San Diego, California, March 1, 1918.

Mr. J. B. Lippincott,  
1100 Central Bldg.,  
Los Angeles, Calif.

My dear Mr. Lippincott:

As per your request, I write you in relation to the cost of lands and riparian rights of the Volcan Project, as follows:

There has been invested in the Volcan project by the purchase of lands to the amount of \$2,633,000. This includes interest to date. Of the above amount \$1,013,350 was used in the purchase of riparian lands below Warners Ranch on the San Luis Rey River alone.

You have asked me to give you my estimate of the cost of the riparian rights on both streams. That amount I have determined as \$823,540. Part of that is actual cost for the purchase of riparian rights; part of it is determined by estimating the value of the riparian rights at one-fourth the purchase price of the lands. In some cases it will reach as high as 50%; in other cases it is less than 25%.

Mr. Harroun was furnished with complete data, and gave us the following:

Investment value of lands, rights of way, construction, general, and all other items except power,	\$1,325,000
Cost value of riparian rights, as per my statement,	823,540
Total,	<u>\$2,148,540</u>

#2

This estimate does not include, however, any charge for my services for several years, excepting actual expenses, nor any charge for services of William G. Henshaw.

Nor have I added in that amount the continued losses from date of the purchase of the Warners Ranch. Mr. Henshaw's interest losses by the purchase of this ranch alone amount to between \$40,000 and \$50,000 a year. This ranch had to be purchased in order to carry out the Volcan Water Company's scheme for water development.

Also, my understanding is that Mr. Harroun gave only a valuation of \$100 an acre for the Warners Reservoir site. I consider this value extremely low, as practically all of it is firstclass bottom land.

Again, in Mr. Harroun's report was not included all the costs of the Pacific Light and Power Co. for services, etc., amounting to many thousands of dollars, before the Volcan system was acquired by Mr. Henshaw, and necessarily a part of the project.

This also does not include any promoter's profit. Certainly, Mr. Henshaw has taken many risks, and is entitled to a liberal reward. Most of this property was acquired without the public knowing our object. Bear in mind that if nothing had been done; that if the City of San Diego was now going out to acquire the water rights of these 300 or 400 ranches, also 60 or 70 miles of rights of way; and the different reservoir sites, and taking into consideration the many years of hard work in determining where the reservoir sites are, and which are the best, - all of this



Cost of Riparian Rights.

Interest on Warner Ranch purchase	\$ 150,000 ✓	
Uninterrupted flow into Warners	100,000	
25% cost of lands purchased below Dam	253,340	
Government and Escondido Rights	75,000	
Putebaugh Grant - Water rights	15,000	
Parcel 2-6-8	1,000	
" 2-5-15	900	
" 2-5-17 and 2-5-18	500	
" 2-4-2	2,000	
" 2-3-19	15,000	
" 2-3-15	1,000	
" 2-3-7	4,000	
" 2-2-36	30,000	
" 2-2-28	2,200	
" 2-2-23 and 2-2-21	15,000	
" 2-2-22	2,000	
" 2-2-5 and 2-2-4	10,000	
" 2-2-3 and 2-2-1	35,000	
" 2-1-44	5,000	
" 2-1-42, 2-1-37, 2-1-36 and 2-1-18	4,000	
" 2-1-40	1,000	
" 2-1-28	2,200	
" 2-1-15, 2-1-14 and 2-1-13	15,000	
" 2-1-10 and 2-1-9	10,000	
" 2-1-2 and 2-1-1	4,000	
Pamo Riparian Rights - 1/3 cost lands	61,400	
Parcel 10-1-23 Nominal charge	1,000	
Pamo Water Co. Riparian rights	10,000	\$ 823,540

*Mich 1/2/915*  
*Letter to Lippencott*

Warner

Warner Ranch with interest, etc.,	\$ 850,000
Parcel 2-6-1 and 2-6-2	10,000
" 2-6-4	5,000
" 2-6-5 and 2-6-7	11,000
" 2-5-10	7,000
" 2-5-15	3,000
" 2-5-19	100,000
" 2-4-9, 2-4-10, 2-4-11, 2-4-12 and 2-4-13	30,000
" 2-4-5 and 2-4-6	22,000
" 2-4-3	8,000
" 2-3-14, 2-3-18, 2-3-20 and 2-3-21	32,000
" 2-3-17	1,600
" 2-3-13 and 2-3-8	7,000
" 2-3-9, 2-3-10, 2-3-11 and 2-3-12	9,000
" 2-3-2, 2-3-3 and 2-3-4	162,500
" 2-2-35	1,800
" 2-2-34	12,500
" 2-2-33	1,900
" 2-2-32	10,500
" 2-2-31	27,000
" 2-2-30	9,500
" 2-2-26 and 2-2-27	36,000
" 2-2-25	4,000
" 2-2-24	1,400
" 2-2-19	1,300
" 2-2-17	800
" 2-2-7, 2-2-12 and 2-2-16	12,000
" 2-2-15	800
" 2-2-14	1,850
" 2-2-13	1,000
" 2-2-10 and 2-2-11	24,000
" 2-2-9	10,500
" 2-2-8	16,000
" 2-2-6	7,500
" 2-2-2	35,000
" 2-1-54	13,000
" 2-1-53 and 2-1-54	10,400
" 2-1-52	900
" 2-1-49, 2-1-48 and 2-1-47	11,000
" 2-1-46	5,800
" 2-1-41	6,200
" 2-1-39	50,000
" 2-1-38 and 2-1-35	15,000
" 2-1-34	3,500
" 2-1-32	6,300
" 2-1-31	11,000
" 2-1-30, 2-1-29 and 2-1-26	5,000
" 2-1-27	16,500
" 2-1-20, 2-1-23 and 2-1-25	92,000
" 2-1-22	2,800
" 2-1-21	2,900
" 2-1-19	42,000
" 2-1-16 and 2-1-17	54,000
" 2-1-12	5,500
" 2-1-11, 2-1-8, 2-1-7, 2-1-6 and 2-1-5	36,100
	\$ 1,863,350



## Brought Forward

\$1,863,350

Right of Way Warners to Pamo	\$ 4,000	
Pamo Reservoir and Linda Vista Bonds	100,000	
Pamo Riparian Rights - 10-3-29, 10-3-30, 10-3-25, 10-3-24, 10-3-58 and 10-3-59	<u>52,000</u>	156,000

Pamo

Parcel 10-2-9	16,000	
" 10-2-6, 10-2-8, 10-2-17 and 10-2-7	65,000	
" 10-2-5	26,000	
" 10-2-19	22,500	
" 10-2-18	1,200	
" 10-1-23	450	
" 10-1-30	<u>1,500</u>	132,650

San Clemente Reservoir	35,000	
Sutherland Reservoir	26,000	
West Property	175,000	
Garetson property	125,000	
Lockwood Mesa	<u>120,000</u>	<u>481,000</u>

\$2,633,000  
=====

*Let's  
Let's  
Let's*



**Ed Fletcher Papers**

**1870-1955**

**MSS.81**

**Box: 37 Folder: 12**

**Business Records - Reports - Harroun, Philip  
E - "Report to the City of San Diego and to  
the Volcan Land and Water Company on..."**



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