January 6 1917

L. JORGENSEN
ELECTRIC AND HYDRAULIC ENGINEER
1405 CHRONICLE BUILDING
SAN FRANCISCO
TELEPHONE KEARNY 3724

MR. W.S.Post.

924. 8th. Street

San Diego . Cal.

Dear Sir:

Since mailing you the two copies of Dr.E-60.last month,I have studied the details of the dam with a view towards bringing down the total cost.

You will find enclosed two copies of amended drawing E.60.,showing some of these details.

The most important is the building in of the outlet tower with the arch.This will not weaken the arch in the least and it is considerably cheaper, than having this outlet structure as a separate tower ahead of the dam.We need some obstruction in the middle of the dam anyway,to split the sheet of falling water,and make a space for letting in ventilating air underneath the cornice of the arch.

Should the cost of the dam run above the amount desired for the first installation,the amount of concrete required for the overflow tangents may be cut down as shown in dotted lines on Section A--B.,using wooden flashboards for the upper 6 ft. Later, when all the water can be sold,and the arch is raised to Elv.325(which it will stand without any additions on the down stream side),these tangents could be built to Elv.315,and provided with 5 ft.flashboards of some permanent kind.

A few details of the contraction joints are also shown in the different sections on Dr.E-60. For reinforcement,old rails could probably be procured.Very much reinforcement is not required,but some steel is convenient for tying and holding the formwork in place,besides accomplishing its main task,that of keeping out cracks.

If new steel has to be bought,it will very likely be cheaper to put in a few more contraction joints,considering the present price of steel.

Yours very truly

L. Jorgensen

January 8, 1917.

Mr. L. Jorgensen,
1405 CHRONICLE BLDG.?
San Francisco, Cal.

Dear Sir:-

I am very glad to receive your letter of January 6th with enclosures of amended drawing E-60. I quite agree that the outlet tower should be a part of the dam and not a separate structure. The only variation which I might suggest is th follow the construction of the Roosevelt Dam in which the tower is attached to but set in front of the dam proper.

I should like to have from you another letter,as soon as it may be convenient, giving the quantities and your estimated cost in considerable detail. I ask this because the lump sum method does not show exactly what is included in the estimate, particularly as to excavation and other details and my object is to have set aside a sufficient extra amount of money to cover contingencies. Of course we are all anxious to keep down first cost, but I do not propose to accomplish this by deceiving myself and the omission of ~~all the~~ work which should be included during construction.

Very sincerely yours,

WSP:K

Jan. 11. 1917

L. JORGENSEN
ELECTRIC AND HYDRAULIC ENGINEER
1405 CHRONICLE BUILDING
SAN FRANCISCO
TELEPHONE KEARNY 3724

MR. William S. Post.

Fletcher BuildingSan Diego. CAL.

Dear Sir:

I have your letter of Jan. 8th.,and shall soon answer your request for additional estimates.

I should like to have from you a sketch showing the elevations whereat you propose to take the water from the reservoir,also the size of the outlet pipe,that is if you want me to include this tower in the estimate. I note what you say in regard to setting this tower out from the dam a little more,than I have shown, I shall do so,when you have given me the outlet elev.

Mr Faulkner,who was in to day,said I did not have that right. We were also talking about the sand at the dam site, and I said,that if it was aggreeable to you,it would be to me, that you send three or four samples (5lbs,each about) of sand from the damsite to me at the University of California,care of Mr. C.T. Wiskocil. Department of civil engineering. Berkeley Cal. I would then have it tested,and the results would be sent to you. It will take about 10 days to make full set of tests. Please screen sand through a #10 screen,if you can get one or anything finer than quarter inch.

Yours very truly.

L Jorgensen

January 19, 1917.

Mr. L. Jorgensen,
1405 Chronicle Bldg.,
San Francisco, Cal.

Dear Sir:-

Replying to yours of January 11th, the elevation of the bottom of the outlet pipe of Carroll Reservoir will be 254. The pipe line will be designed for a diameter of 52 inches. This may be a little large for the actual apperture through the dam proper and perhaps you would prefer to make this a 48 in. diameter. The location will be on the north side or right hand side looking down stream.

I enclose separately some general specifications which I have suggested for the dam. I am planning, whenever the matter comes to final consideration, to spend several days with you either in San Francisco or in Los Angeles as may be more convenient and go over these matters quite thoroughly. For instance, I think during construction, provision should be made for an outlet and tower on the south side as well as on the north and I believe that outlet sluices of capacity of approximately such as I have suggested in the General Specifications are desirable.

I am in receipt of your letter and Drawings of January 17th and after having digested them, I will write you a letter which will be more satisfactory and definite than this one.

Very sincerely yours,

WSP:K
Enclos.

Carroll Dam

Construction of Dam

Carroll Dam will be constructed of concrete upon Site "C" which is shown in Map No. 605. Plans to be approved hereafter. The height at which water may be permanently stored or "normal high water level" shall be elevation 315 above sea U. S. Geological Survey and Company's datum; provision shall be made for a spillway to discharge with entire safety a maximum flood discharge, superimposed upon the normal high water level of 90,000 cubic feet per second; positive acting sluice gates will be provided with a capacity of 30,000 cubic feet per second under head of normal Reservoir level, and such sluice gates are to be accessible even during maximum spillway discharge; service outlet gates shall be installed in duplicate at approximate elevation 255, upon the north end of Dam, and one service gate on the south end; all sluice gates and service gates will be provided with proper devices for replacement and repair while reservoir is full, and with mechanism sufficient for one man to operate positively and with ease; the plans will include all elements of a completed structure, ready for service, including excavation, foundations, gates and spillway;

L. JORGENSEN
ELECTRIC AND HYDRAULIC ENGINEER
1405 CHRONICLE BUILDING
SAN FRANCISCO
TELEPHONE KEARNY 3724

Jan. 19. 1917.

Mr. W. S. Post
Fletcher, Building.
San Diego. Cal.

Dear Sir:

On Jan. 17. I sent you an estimate of the dams shown on Dr. E-60,and C-62,.I showed this estimate to a contractor, that has considerable experience in this class of work, he seemed to think,I was too low in my figures for the constant angle arch in so far,that I allowed too much saving for plums.

I am now writing you,because he has about convinced me, that he is right,and that the estimate ought to be changed somewhat,

To start with only an excavation of about 1000 yards is necessary,that is the rock contained in the cut off trench. The remaining 4000 yards (from my former estimate of 5000) we will not excavate at present,but let it go until the dam is raised,if it is then found necessary.You will note,that on my Multiple Arch design,C-62. I do not excavate for the present spillway,although this spillway is shorter,than the one for the constant angle arch by about 200 feet.

Before,I thought,I could excavate to advantage,now; but as already stated,I now feel, that the estimated saving due to spalls is too great. If that is actually the case,I pro pose we only excavate the 1000 yards necessary and collect an additional of about 3000 yards of rock from among the boulders laying near the dam. It requires less hand work to get in say only 4000 yards instead of 5000 yards as originally fig ured on.I would figure the 1000 yards excavation and placing at $3,00 per yard,making this item $3000 instead of $10,000. and the saving due to the 4000 yards(solid) of spalls at $ 3,00 instead of $5 per yard would amount to $12,000.~~altogether.~~

Now I have often been thinking of cutting out the hydrated lime,as it does not add to the strength of the concrete,and the single arch is thick enough to be tight without it,espe cially after the grouting of the contraction joints has been accomplished.If the hydrated lime is cut out,the estimate for the Constant Angle Arch as handed you with my letter of Jan 17.th.will still have to be raised $1000.

If this cost is more than you think ought to be spent on the dam,we could make another change. We could use old rails to the amount of 50 tons instead of 20 tons,as now contemplated and cut out the contraction joints,thereby making a saving of 8000-4000=4000 Dollars. After that we have done about as much shaving as we can I believe.

Hoping you will introduce these corrections I remain

Yours very truly

L Jorgensen

JAN. 22. 1917.

L. JORGENSEN
ELECTRIC AND HYDRAULIC ENGINEER
1405 CHRONICLE BUILDING
SAN FRANCISCO
TELEPHONE KEARNY 3724

Mr. W.S.Post.

Fletcher Building. San Diego. Cal.

Dear Sir:

I am enclosing a proposed schedule of unit prices for your perusal and creticism.

The contractor is to state his price for the different items given. The quantities are as near to the actual facts as I believe,it is possible to get them at this time. Such items as the excavating and clearing the dam site are not easy for me to estimate,they do however not amount to much in any case. The single arch takes naturally a good deal more cement(between 8 and 9000 barrels in round numbers)than the multiple arch dam,but you get concrete to show for the money instead of formwork.

Some of the items from 1 to 4 on sheet #1 can be cut out, when it is decided wheather to raise the spillway elevation from 304 to 310 by means of flashboards or concrete.

I have made a few additions to Dr.E-60. and enclose a corrected copy for you.

Awaiting any suggestions you may have to make,

I remain,

Yours very truly. L. Jorgensen

January 22. 1917 Sheet #1

For the Contractor to bid on.

Constant Angle Arch;Drawing E-60.

#1. 28,5oo yards of cyclopean concrete containing 14% spalls.

#2. 28,500 yards of cyclopean concrete containing 20% spalls; 1,25 barrels of cement required per yard of concrete making a total of 30,638 barrels or 28,5000 barrels respectively.

#3 29,700 yards of cyclopean concrete containing 14% spalls.

#4 29,700 yards of cyclopean concrete containing 20% spalls. 1,25 barrels of cement required per yard of the concrete portion,making a total of 31,928 or 29,700 barrels respectively. In all cases the Contractor will be charged $3,00 per barrel of cement at the site including the sacks.

#5 Rock excavation in cut off trench approx. 500 yards along toe of arch and approx. 500 yards of solid rock on dam site in general.

#6 Taking care of water and clearing the dam site,probable depth of gravel on top of rock average 2 ft.and probable yardage to be removed about 1500 yards.

#7 Placing 20 tons of old rails in the dam and building 8 contraction joints of different size as shown on Dr: E-60.

#8 The placing of 50 tons of old rails and no contraction joints.The old rails will be furnished at the site,at $40 per ton.

#9 The setting of the sluice gate with pipe,also gates in outlet tower.Gates and pipes will be furnished by owner.

JANUARY 22. 1917 Sheet #2

Carroll Site

For The Contractor to bid on.

Multiple Arch Dam , Drawing E-50.and E-51,also C-62.

#1. 16500 yards of concrete,1,25 barrels of cement per yard for the buttresses; 1,50 barrels of cement per yard for the arches ,overflow deck and struts,a total of 12500+ 9750= 22,250 barrels. Contractor will be charged $3,00 per barrel of cement at the site,including the sacks.

#2 Rock excavation in cut off trench,for buttresses and on the dam site in general. Approx. 1000 yards of solid rock.

#3 Taking care of water and clearing the dam site ;probable average depth of gravel on top of rock 2 ft. and probable yardage to be removed from arches and buttresses about 2000 yds.

#4 Placing 135 tons of twisted or corrugated reinforcing steel from $\frac{1}{4}$" size to 1" size in arches,deck,struts and buttresses. The Contractor to furnish this steel.

#5 The plastering of the upstream face of dam with a 1:2 cement and sand coat shot on with a cement gun 1" thick at elv.200. and decreasing uniformly to $\frac{1}{2}$" thick at elv.315.

#6 The setting of the sluice gate with pipe also gates in outlet tower. Gates and pipes will be furnished by owner.

Cost estimate of North-Outlet tower

180 yards of concrete @	$ 15 ---	$ 2700
6 tons of steel in place @	$120	$ 720
		$ 3420
2 - Valves @ $1000 installed		$ 2000
4 - Gates with screens @ $500 installed		$ 2000
	total $	7420

South Outlet tower $ 6420

total for 2 towers $ 13,840

Dam + Outlet towers + Bridges to grating platform

234,825 + 13,840 + 1,335 = $250,000

Cost estimate for sluicing arrangement

Excavation for 10 draft tubes 2300 yds. @ $3 =	$ 6,900
10 - 7' butterfly valves @ $ 1500 installed	$ 15,000
10 - 7'x10' Slip valves installed @ $750	$ 7,500
Concrete for backfilling 10 draft tubes 500 yds @ $10	$ 5,000
Concrete in tunnel and ~~and~~ at intake 1000 yds @	$ 10,000
Lining of 10 draft tubes with ¼" plate 112,000 lbs @ 6 cts	$ 6720
total	$ 51,120

L. JORGENSEN
ELECTRIC AND HYDRAULIC ENGINEER
1405 CHRONICLE BUILDING
SAN FRANCISCO
TELEPHONE KEARNY 3724

JANUARY. 25. 1917.

Mr. William S.Post.
Fletcher Building.
San Diego. CAL.

Dear Sir:

I am enclosing a copy of the technical part of the Specifications and shall soon send you the business part, or at least my suggestions for same.

Trusting you have received all recent correspondence I have sent you, I remain.

Yours very truly.

L Jorgensen

Specifications for Building Carroll Reservoir Dam for the Volcan Land & Water Co.

THE SINGLE ARCH DAM.

Scope. 1. It is the object and intent of these specifications, and of any drawings that may be furnished and of the contract made hereunder with the contractor, to cover or provide for all materials and labor necessary to equip, install in the best manner, and put into good and operative working condition the equipment or installation herein provided for.

2. Whenever the word " Engineer" is used herein, it means the Chief Engineer of the above mentioned Company, or his properly authorized agent, limeted by the particular duties entrusted to them. Whenever the word "Company" is used herein, it means the Volcan Land & Water Co., one of the parties to the contract covering the work specified herein.

Drawings. 3. The specifications and drawings are intended to co-operate so that any works exhibited in the drawings and not mentioned in the specifications,or vice versa, are to be executed to the true intent and meaning thereof the same as if both were mentioned in the specifications and set forth in the drawings.

4. Figured dimentions on drawings are in all cases to be followed; scaling of drawingsis expressly forbidden and any dimensions needed but not given can and must be obtained from the Engineer.

5. Should anything be omitted from the drawings or specifications which is necessary to a clear understanding of the work, or should any error appear either in the various instruments or in the work done by other contractors affecting the work included in the specifications, it shall be the duty of the Contractor to notify the Engineer. In the event of the Contractor failing to give such notice, he shall make good any damage or defect in his work caused thereby,

6. The Engineer may and will furnish to the Contractor such further detailed explanations as may be necessary,and the Contractor shall conform to same in so far as consistent with the signed drawings and specifications,and the execution or beginning of work so detailed or explaned without a previous written agreement for specified extra compensation therefor shall constitute an acceptance by the Contractor that the work or material so furnished or executed is covered by the contract,

Changes

7. The Contractor is expressly forbidden to comply with any major changes,additions,or ommissions from the work or materials to be done or furnished,except such order be signed by the Engineer and specifically state the compensation allowed therefor,and no such order can change the time,when the whole work shall be completed.

Material and Workmanship

8. All material and workmanship is to be of the best of the kind and the quality specified.The contractor shall produce and allow inspection by the Engineer of all bills,statements and vouchers showing the quality and amount and cost of all material used.

9. All materials delivered at or near the site of the works are to be considered the property of the Company and cannot be removed without the Company's consent.

Undesirable Employees

10. The Contractor must at once discharge and irrevocably dismiss from this work any foreman or employee whomsoever,when so requested by the Engineer.

Inspection of Material

11. All materials and supplies delivered at or near the site of the works are subject to inspection and condemnation at any time by the Engineer,and may be so branded,and shall upon demand be removed at once to a satisfactory distance.

12. No inspection of any work or materials shall constitute an acceptance of same prior to the final acceptance of full completion of this contract,and all work or materials rejected by the Engineer at any time prior to final acceptance shall be at once made good by the Contractor.

Supervision of Work.

13. The Contractor must give this work his personal attention and at all times have a competent foreman,experienced in this class of work,on the ground,authorized to accept orders from the Engineers.

14. The Engineer or his representative alone is authorized to explain the specifications and drawings,and his explanation or finding and decision is binding upon both the Company and the C ontractor. 3

Quantities.

15. All concrete will be measured in the finally completed dam,and reinforcing steel will be paid for to the amount ac tually placed in the dam,.No allowance will be made for the amount used for refilling any part of the excavation made in excess of that called for by the drawings or specifications.

Work to be done

16. The work to be done consists in a general way of:

(a) Stripping the site of the dam.

(b) Excavation for toe trench,which must be carried to fresh solid rock.

(c) Building forms,placing steel,and pouring concrete in dam intake tower,etc. also setting valves and pipes.

(d) Removing forms.

(e) Doing all clearing,quarrying,crushing,mixing,placing, laying out,assembling and construction work,whether tempo rary or permanent,in connection with the permanent work, and delivering over to the said Volcan Land and Water Co. the entire structure in a safe condition,complete and rea dy to use.

Location.

17. The site of the dam is on the San Dieguito River about 7 miles south of the Sante Fe Railroad station at Escondido, San Diego Co. Cal. The complete structure comprises a com pletely finished concrete dam with intake tower and draw-off pipes.

18. The character of materials and the site to be met with as shown on the plans,or in any way represented by the Comp any or its Engineers,are the results of examinations made in behalf of the Company,but no guarantee is made as to the accuracy of any of the representations made herein or hereto fore made.

19. The plans and drawings herewith furnished by the Compa ny and its Engineer are deemed sufficient for the purpose of explaning the general nature and the details of the work to be done,but these plans and specifications are subject to changes by the said Company or its Engineer as the work progresses,and such changes shall not be deemed as changing the essential design of the structure,and changes ,if any are made,shall be compensated for at the pro rate set out in the contract.

20. If there is anything in these specifications or in the plans or specifications as now or hereinafter furnished which is not clear and intelligible to the Contractor,he shall not proceed with such work so ordered until he shall have drawn the attention of the Engineer to the element of doubt or misunder standing,in writing,and have had the same explaned to him,but it is the duty of the Contractor to examine the plans and site of the work far enough in advance to anticipate any needed ex planation,and he will not be granted extention of time for mis understanding or failing to understand any instructions.

21. The Contractor is to furnish all the material,tools and labor to complete the work except as hereinafter specified. The Company will furnish all cement at a cost to the Contrac tor of $3,00 per barrel at the site,also all valves and pipes necessary for the outlet tower and sluicing outlet. The Contrac tor is to set these valves and pipes in place as work progresses The Company will furnish electric power at the dam site for the use of the Contractor free of charge. This power will be furnished at 440 Volts 3 phase 60 cycles. The Contractor is to furnish his own motors.

22. The dam is to be built as a concrete arch structure with a maximum height of about 120 ft. above the present riverbottom. If character of material or circumstances render it advisable to change the location of the dam,or to change the plans of the dam,the Company expressly reserves the right to do so without payment of any damages or anticipated profits to the Contractor, but all work actually completed as part of the structure shown on the drawings will be paid for at the unit prices as set out in the contract.

23. A trench is to be excavater at the upstream toe of the dam entirely accross the site,so as to expose fresh solid rock,the width and depth of this cut will vary somewhat with the depth of water and quality of the rock,and it shall be as directed by the Engineer. The amount of this excavation shall be at least as great as called for by the Engineer,but if the Contractor, for any reason,excavates a greater quantity than directed by the Engineer,he shall not be compensated for such excess excavation nor shall he be compensated for concrete used in backfilling such excess excavation.

Intake Tower.

24. A concrete Intake Tower shall be constructed in position and as shown on drawings.The material,except as hereinafter provided,must be furnished and the work done at unit prices named in the contract.All valves and operating mechanism and pipes for this tower will be furnished to the Contractor,by the Company.

Proportion of Mix.

25. Concrete for the arch and spillway is to be mixed in the proportion by volume of one part of cement,two and one half parts of sand,and five parts of broken stone.One yard of concrete in place shall contain one and one quarter(1 1/4) barrels

of cement. Concrete for the portion of the outlet tower projecting outside the main dam body shall be mixed in the proportion by volume of one part of cement,two parts of sand and four parts of broken stone,or stone screened from the river gravel. One yard of concrete in place shall contain one and one half (1 1/2) barrels of cement.The cement,sand and course aggregate shall meet with the requirements hereinafter specified.

Cement.

26. The cement shall be first class Portland cement of reputable brand,which shall conform in all respects to the requirements of the Specifications and Method of tests for Portland cement drawn up by the special committees of the American Soc. Civil Engineers, American Soc. for Testing Materials, American Railway Engineering Association,and the United States Government. It shall be stored so as to be protected from the weather,and so as to permit of access for inspection and identification of each shipment. a sufficient quantity shall be kept on hand at all times,so that the Engineer may have opportunity to make tests to determine its quality. At least eight(8) days shall be allowed for inspection and tests.

Sand.

27. The fine aggregate shall consist of sand or screenings of gravel or crushed stone,graded from fine to course and passing when dry a screen having quarter(1/4") inch diameter holes,it preferably shall be of siliceous material,and not more than 30% by weight shall pass a sieve having 50 meshes per linear inch,it shall be clean,and free from soft particles,lumps of clay,vegetable loam or other organic matter. If the strength developed by the fine aggregate in a 1: 3 mortar is less than 70% of the strength of a 1:3 Ottawa-sand mortar,the material shall be rejected.

Course Aggregate.

28. Course aggregate shall consist of gravel ar crushed stone, which is retained on a screen having quarter($\frac{1}{4}$") inch dia holes,and shall be graded from the smallest to the largest particles, it shall be clean,hard,durable,and free from all deleterious matter.Aggregates containing dust and soft,flat, or elongated particles,shall be excluded. The gravel or crus hed stone shall be separated into two sizes and remixed in the proper proportion,in case it is not found uniformly graded, from the min. size of quarter inch to the max. size which will pass a 2$\frac{1}{2}$ inch ring.

Water. 29. The water used in mixing concrete shall be free from oil, acid,alkali,or organic matter.

Reinforcing Steel. 30. The reinforcing steel shall either consist of old rails, where such are called for in the plans,or it may be either Bessemer or OpenHearth,and shall be corrugated or twisted in order to provide mechanical bond with the concrete.Elastic limit shall be from 50,000 to 60,000 pounds per square inch,and ultim ate strength not less than one and one third times the elastic limit.

Proportions

31. The proportions of the raw materials for the concrete shall be accurately determined by density experiments made by the Engineer from time to time to ascertain the relative courseness of the aggregate in order to fix the proportions necessary to a concrete of maximum density. The Contractor shall use such pro portions until notified by the Engineer to change,due to changes in the aggregate,and in the event more cement is used,than is required to give the proportion hereinbefore specified,such ex cess shall be paid for at cost plus 10%. The cement shall be

measured by the sack as packed by the manufacturer containing approx.94 pounds net,and considered equivalent to one qubic ft. Other aggregate shall be measured as showeled loose into a measuring box.or barrel.

Hand Mixing. 32. If the concrete,or any part of it,is mixed by hand,the cement and aggregate must be thoroughly mixed dry until mixture is of uniform color,and the water added on a thoroughly water tight platform. the amount of mixing shall be sufficient to produce a concrete of uniform color and appearance,with the stones thoroughly incorporated into the mortar and the consistency uniform throughout.

Machine Mixing. 33. If the concrete is mixed in a machine mixer,the machine shall be so arranged that the materials,including the water,can be regularly and precisely proportioned,and which will produce a concrete of uniform consistency and color with the stones thorough ly mixed and incorporated with the mortar.The aggregate shall be turned in the mixer for the minimum length of time of one and one quarter($1\frac{1}{4}$)minute after all the ingredients are assembled in the mixer. The number of revolutions of the mixer shall be so so regulated,as to give at the periphery of the drum a uni form speed of about 200 ft. per minute.If the mixer is of two yards capacity or more ,the time a batch is to be turned shall not be less than two minutes.

Consistency.

34. The materials shall be mixed wet enough to produce a con crete of such a consistency,that it will flow sluggisly into the forms,and which at the same time can be conveyed from the mixer to the forms without separation of the course aggregate from the mortar.Excess water shall be avoided,as it tends to a separation of the parts.

Placing.

35. Concrete after completion of the mixing shall be conveyed rapidly to the place of final deposit,under no circumstances shall concrete be used,that has partly set. Concrete shall be deposited in such a manner,that will permit the most thorough compacting,such as can be obtained by working with a straight showel or slicing tool kept moving up and down until all the ingredients are in their proper place. Special care shall be exercised to prevent the formation of laitance,where laitance has formed after the day's work or after any form has been filled,spaded and allowed an interval of settling not greater than one half ($\frac{1}{2}$) hour,and while the concrete yet remains in a semi-fluid condition,the top portion shall be removed,and thrown out,to such a depth as will expose coarse aggregate in the mass. When placing fresh concrete upon an old concrete surface,the latter shall be roughened,cleansed of all foreign material and laitance,thoroughly wetted and then slushed with a neat cement mortar or a 1:1 cement and sand mortar,as the Engineer may direct.This wash or coat to be immediatedly fol lowed by the fresh concrete.The concrete is to be deposited in blocks rather than in slices. Alternate portions between contrac tion joints are to be carried up in advance,leaving low portions between to be filled in later. At least three(3) weeks shall be given the concrete in which to set and shrink,before fresh concrete is placed in the low portions up against the stripped walls of the adjacent contraction joints.Where concrete is de livered and conveyed by spouting,the delivery from the spout shall be as close as possible to the point of deposit.The angle of the spout with the horizontal shall be such as to allow the concrete to flow without separation of the ingredients,one ver tical to two horizontal in general. The surfaces of concrete

exposed to premature drying shall be kept covered and wet for a period of at least 7 days after it is deposited.

Plumstones.

36. Hard stones af any suitable size may be embedded in the concre te up to the amount of 20% (solid) of the mass. These stones shall be saturated with water,clean and thoroughly embedded in and entire ly surrounded by concrete. Some stones shall be placed in such a way,that they project through the concrete from one days work to the next to insure a good bond between old and new concrete. Not more than 300 yards,including plumstones,of concrete shall be placed in any one day.

Surfaces.

37. Noticeable voids and stone pockets discovered when forms are struck,shall be immidiately filled with mortar mixed in the same proportion as the mortar in the concrete. No allowance for labor or material over and above the normal unit price will be allowed for preparation of joints or filling of voids or stone pockets. The surfaces shall have no special treatment other than care in placing the concrete to avoid voids or stone pockets.

Forms.

38. The lumber for the forms and the design of the forms shall be adapted to the structure. The forms shall be sufficiently tight to prevent loss of mortar. They shall be thoroughly braced or tied together so that the pressure of concrete or the movement of men,machinery or materials,shall not throw them out of place. Forms shall be left in place until in the judgment of the Engineer the concrete has attained sufficient strength.

Steel.

39. All reinforcing steel must occupy the exact position called for on the drawings,and method of placing must be such, that the reinforcement can not be displaced by the operation of placing concrete, Bars nearest the water side must have 2" of cover.

Water tightness. 40. Grout pipes shall be inserted in the contraction joints, as called for on the drawings. The ends and slots on these pipes shall be protected by a light covering that will prevent the wet concrete from flowing into the pipes. At the same time this covering must be weak enough to allow the grout pressure to burst it open,when,later; grout is forced into the pipes. The vertical slot straddling the contraction joints near the up stream face shall be filled with hot asphaltum as the work progresses,and great care shall be taken,that no mortar runs in between successive layers of asphaltum.

Grades & Lines 41. Grades and lines will be given by the Engineer,and the Contractor is thereafter responsible for their safe keeping.

Quarries. 42. Quarries and borrow pits may be opened only on sites approved by the Engineer,and excavated only to the extent approved by the Engineer.

Sequence of Work. 43. The Engineer may direct the Contractor to work a greater or less portion of his force on any specified part of the work,and the Contractor shall obey such orders without extra compensation therefor,and the terms and conditions of this contract and the specifications shall not be otherwise changed thereby. The Contractor shall do such other work,semilar in general character to this,as the Engineer may direct,and re ceive therefor compensation at the unit prices set out in the contract or equivalent rates.

L. JORGENSEN
ELECTRIC AND HYDRAULIC ENGINEER
1405 CHRONICLE BUILDING
SAN FRANCISCO
TELEPHONE KEARNY 3724

FEBRUARY 1. 1917.

Mr. W. S. Post.
Fletcher Building, 8th. St.
San Diego. Cal.

Dear Sir:

Enclosed you will find copy of Dr. B-63. showing details of the outlet tower,which I believe,will meet the specifi cations attached to your letter of Jan. 19.

Dr.E-60. has been brought up to date accordingly.
The large sluice gate proposition,I am still working on, I have one scheme sketched out,but am going to try several others,as this is not so easy to work out; it is also rather expensive. With the two outlet towers and the large sluice gates,the cost of the dam will surely be closer to $300,000 than to $200,000.

I was at the University laboratory yesterday,when the sand tests were discussed and started. Some tension briquettes and some 2"x 6" mortar cylinders for compression tests are being made from all four sands. Some of them will be tested at the age of 7 days,and the remaining at 28 days.
If any of the sand shows up poor at 7 days,we will ask you for more,together with some rock,and then test the combina tion as concrete and watch the result before finally discar ding it. In case the poor sand should not be the sand found nearest the dam site,we would not have to pay any attention to it.

Yours very truly. L. Jorgensen

February 5, 1917.

Mr. L. Jorgensen,
1405 Chronicle Bldg.,
San Francisco, Cal.

Dear Sir:-

Samples of sand were sent you by the foreman at Carroll Dam. As his letter is not clear to me, I am quoting his report as to the numbering of the samples. It may be that in opening the box you can understand it.

"Dear Sir:

I have sent this day by express a box ofn-taining 4 samples of sand to Mr. L. Jorgensen, c/o C T Wiskocil, Dept. Engr, University of California, Berkely, Cal., they are marked from 1 to 4.
No. 1 contains samples 1-2-3 of flat at bend opposite James Carroll's house, 1½ mile from Dam.
No. 2 sample No. 4 opposite Bartl's house.
No. 3 samples No. 1 & 2 south of Bartl's house.
No. 4 samples No. 3 & 4 further south of House or 1½ mile from Dam.
Samples were sifted through No. 10 screen left here for the purpose. The percentage of sand is from 90 to 95%. The rest is from 10 to 1/4 inch and good."

Yours truly,

WSP:K

L. JORGENSEN
ELECTRIC AND HYDRAULIC ENGINEER
1405 CHRONICLE BUILDING
SAN FRANCISCO
TELEPHONE KEARNY 3724

Feb. 6 1917.

Mr. W. S. Post.
Fletcher Building, San Diego, Cal.

Dear Sir:

I am enclosing copy of two drawings B-64 and B-65, showing proposed sluice gate arrangement. Of the two, B-64, is the best I believe. It shows 10 butter fly valves of 7' net diameter each, arranged in a row between the two outlet towers. Butter fly valves are the cheapest balanced valves on the market, they are not absolutely tight, but taken in connection with the flap valves in front of them, the combination can be expected to be practically tight.

If a liberal amount of money is at the disposal for this sluicing arrangement, something better than butter fly valves may be instal led. The most elaborate balanced valves, that I know of, are the needle valves controlling the water from the Roosevelt dam. The Pelton Water Wheel Co. of San Francisco constructed these valves and they cost about $10,000 each, and are only 58" in diameter.

Sketch B-65, shows an arrangement using two large balanced valves. This arrangement id copied after a proposed scheme for regulating the water in the Sacramento River at Iron Canyon; it has not been built, and I do not know how these large valves would work; but if they do work, this scheme is very likely the cheapest.

Yours very truly.

L. Jorgensen

P.s. I just received your letter about the sand, I think we ought to have some samples taken at the dam site.

San Diego, Calif. Feb. 10, 1917

Mr. L. Jorgensen,
1405 Chronicle Bldg.,
San Francisco, Calif.

Dear Sir:-

I am in receipt of two communications from you, Feb. 1st and Feb. 6th, and it happens that I have been unable to give this matter any attention on account of preliminary negotiations. Your letter of the 1st seems to show that you are somewhat discouraged by the severe conditions which I have put on the matter. I should not feel that way about it because it seems to me that the general feature should be discussed quite fully before going too far. My understanding is that the approval of the plans eventually is to come to me and I have already made the suggestion verbally to my principals that before you have proceeded too far, we meet somewhere and discuss the matter fully. I hope to have some leisure within the next three or four weeks and if it happens that you are in Southern California I would very much like to have you spend a few days at my office and discuss this proposition thoroughly. I made this suggestion some weeks ago but my principals hesitate to suggest your going to any special expense until the preliminaries are finally settled. However, as it is obvious that you are already at work on the plans I think it would save you a great deal of labor to do this, and I hope that you may perhaps be going to Riverside at any event, and include a trip to San Diego relative to these plans. I should much prefer to defer any discussion of the plans until we could get together. If this is not feasible, however, I shall attempt to carry on the consultation by correspondence.

If you decide to come to San Diego I should be glad to have early notice of the date.

Very sincerely yours,

WSP/bm

UNIVERSITY OF CALIFORNIA
DEPARTMENT OF CIVIL ENGINEERING
BERKELEY

TESTING LABORATORY
C. DERLETH, JR., DIRECTOR

February
Tenth
1917

Mr. L. Jorgensen,
Chronicle Building,
San Francisco, California.

Dear Mr. Jorgensen:-

The following data were taken in the 7 day test of the mortar cylinders and briquettes made from the sand sent to our laboratory by the Volcan Land and Water Company of Escondido, California.

		2 In. Diameter Cylinders		Briquettes	
Sand	Specimen	Total Crushing Load, in lb.		Tensile Strength in lb. per sq. in.	
Standard Ottowa	A	8,250		348	
	B	10,900		370	
	C	9,500		335	
		average 9550	3,044	av. 351	
#1	A	6,550		297	
	B	6,900		269	
	C	6,650		264	
		av. 6 700,	2,130 per sq in	283	80%
#2	A	7,450		285	
	B	6,350		316	
	C	7,500		338	
		av. 7,100	2,260 " "	313	89%
#3	A	5,150		300	
	B	6,700		290	
	C	6,200		329	
		av. 6010	1,910 " "	306	87%
#4	A	8,000		327	
	B	7,400		355	
	C	--		350	
		av. 7 700	2,450 lbs per sq in	344	98%

Very truly yours,
C. F. Wirkeil
Instructor in Charge

L. JORGENSEN
ELECTRIC AND HYDRAULIC ENGINEER
1405 CHRONICLE BUILDING
SAN FRANCISCO
TELEPHONE KEARNY 3724

Feb. 13. 1917.

Mr. William S.Post.

Fletcher Building 8th. St.

San Diego, Cal.

Dear Sir:

Enclosed you will find report giving results of the 7 day sand tests. You will note,that the tensile strength of the 1:3 bri quettes is well above 70% of that of the standard sand. This sand is therefore very acceptable.

We would of course like to use the sand right at the dam site,and it therefore seems to me ,we ought to have say two samples tested from this place.

I am in receipt of your letter of Feb. 10. I expect to go on a trip to Arizona within the next month,and will come to San Diego on my way back; we can then discuss matters more fully. I shall let you know the date in advance.

Yours very truly.

L. Jorgensen

March 2, 1917.

Mr. L. Jorgensen,
1405 Chronicle Bldg.,
San Francisco, Cal.

Dear Sir:-

I send, under separate cover, a profile of the San Dieguito Reservoir. You can assume that the buttress sections will be nearly horizontal in accord with the profile and that the average excavation to bed rock will be 5 feet. The water lever is shown on the map and I think the dam should be 1 foot higher.

The special spillway, as I call it, would be say 60 linear feet with the crest at elevation 250, while the remainder of the dam would have elevation 251. If the service gates or outlets will have a head of only 15 feet, I think sliding gates are entirely sufficient.

Yours very truly,

WSP:K

260
250
240
230
220
210
200
190

South End
Left Bank

North End
Right Bank

Top of Dam 251

250 Foot Contour

℄ Course N 12° 45' E

Water Level

2 - 2x3 Sliding gates

Outlet gates elevation 235

1 - 2x3 Sliding gate

Special Spilling capacity
200 Sec ft

Entire length of Dam to be capable of Passing 1.000 sec ft

24" Valve

Office Copy

0+00 0+50 0+75 1+00 1+50 1+57 1+65 2+00 2+35 2+50 2+65 3+00 3+25 3+45 3+50 3+65 3+80 3+85 3+94 4+00 4+20 4+50 5+00 5+50 6+00 6+50 7+00

VOLCAN LAND & WATER CO.
PROFILE OF DAMSITE
UPPER SAN DIEGUITO RES'R

SCALE { Vertical 1 in = 10 ft.
Horizontal 1 in = 50 ft

W. S. POST Chief Engr
DATE Oct 1916

FIELD BOOK No. 61 - P 25
DRAWN BY T.H.K.
CHECKED BY

DRAWING No. 665
FILE No. T 2

L. JORGENSEN
ELECTRIC AND HYDRAULIC ENGINEER
1405 CHRONICLE BUILDING
SAN FRANCISCO
TELEPHONE KEARNY 3724

March 3rd, 1917.

Mr. W. S. Post,

Fletcher Building,

San Diego, Calif.

Dear Sir:-

Enclosed you will find single arch design for the Carroll site. It now conforms to the requirements as laid down by you, I believe. The six sluice gates as shown will, however, only discharge about 3,000 second feet, and if you insist on 4,000 second feet, we had better increase the size from 36" to, say 40", (or 42" and use only five valves.)

On this new design the arch has been moved upstream twenty feet, and both arch and spillways have been made five feet higher. The South tangent has been made shorter on account of the steepness of the side hill. The North tangent has been made longer and swung up on higher ground by starting it farther out on the arch.

While the dam has been made five feet higher, it has at the same time been moved up on higher ground and the yardage has not been materially changed. The total contents of the dam is very close to 30,000 yards, and that of the outlet tower 180 yards.

I am also enclosing a drawing showing an automatic spillway gate. If mounted along the upstream face of the spillway this gate would hold the water at any elevation within 4 ft, depending upon the weight of the counterweight, and curvature of the lower

arm. It does not obstruct the overflow. By installing this gate later you can utilize the upper four or five feet storage.

The specifications have been changed (shown in red ink on enclosed copy) as per our last conversation, and a copy is enclosed for your perusal.

Please let me know if you find anything you would like to have changed on this design.

I am now working on the small multiple arch design, and expect to receive the map from you soon. I received your map just now.

Yours very truly,

L. Jorgensen

UNIVERSITY OF CALIFORNIA
DEPARTMENT OF CIVIL ENGINEERING
BERKELEY

TESTING LABORATORY
C. DERLETH, JR., DIRECTOR

March 5, 1917

Mr. L. Jorgensen
Chronicle Bldg.
San Francisco

Dear Mr. Jorgensen:

The following data were taken in the 7-day and 28-day tests of mortar cylinders and briquettes made from the sand sent to our laboratory by the Volcan Land & Water Company of Escondido, California. Table No. 1 shows the test results, while Table No. 2 gives a comparison of the average compressive and tensile strengths of the specimens made from the sands as received, with the corresponding strengths of the specimens made from Standard Ottowa Sand.

Every sample of sand contained some mica. This mica, however, does not seem to have affected the strengths of the specimens made with these various sands. Using the results of tests on the Compressive Strengths of Portland Cement Mortars made at this Laboratory in 1914 as a criterion, any of the sands examined should make a satisfactory aggregate for concrete if the samples sent to us for testing represent the composition of the supply from which they were taken. In the tests referred to, the average strength of 2-in. mortar cubes composed of one part cement and three parts washed siliceous beach sand (by weight), at the age of 49 days, was 2860 lbs. per sq. in. It should be noted that a specimen in the form of a cube will have a greater unit compressive strength than a specimen of the same material in the form of a cylinder whose length is at least twice its diameter.

The material in which you are particularly interested, sand sample No. 5 taken from the river 0.4 miles below Dam "C", was received here on Feb. 24. The data from the 7-day test of specimens made with this material are included in Tables Nos. 1 and 2. The results of the tests on the specimens to be tested at

the age of 28-days will not be available before March 27. The final report will be mailed to you at that time.

Very truly yours,

C. T. Wiskocil

Instructor in Charge.

Charles Gilman Hyde

Acting Head of the Department.

Table No. 1

Strengths of Specimens Made from Several Sands Furnished by the Volcan Land and Water Company and Standard Ottowa Sand as Determined by Tests Made at the Testing Laboratory of the Department of Civil Engineering University of California

Sand	Specimen	2-in. Diameter Cylinders, 4" in Length — Crushing Load, lb. per sq. in. 7-days	28-days	Briquettes — Tensile strength, lb. per sq.in. 7-days	28-days
Standard Ottowa	A	2630	4040	347	451
	B	3470	3820	370	383
	C	3020	3630	335	501
#1	A	2090	3120	297	350
	B	2200	2790	289	354
	C	2120	----	264	350
#2	A	2370	3270	285	400
	B	2020	3410	316	412
	C	2390	---	338	386
#3	A	1640	----	300	392
	B	2130	----	290	400
	C	1970	----	329	390
#4	A	2550	3440	327	398
	B	2370	3330	355	353
	C	---	----	350	405
#5	A	1780	----	345	---
	B	1940	----	321	---
	C	2200	----	319	---

Note: Specimens composed of one part cement and three parts sand, by weight.

Table No. 2

Comparison of Average Tensile and Compressive Strengths of Mortar Specimens Made with Several Sands from the Volcan Land and Water Company with Corresponding Strengths of Similar Specimens Made from Standard Ottowa Sand.
Testing Laboratory of the Department of Civil Engineering
University of California.

Sand	2-In. Diameter Cylinders 4" in Length — Avg. Crushing Strength #□" 7-days	28-days	Strength Compared to Standard Sand Cylinders in per cent. 7-days	28-days	Briquettes — Average Tensile Strength #□" 7-days	28-days	Strength Compared to Standard Sand Briquettes in per cent. 7-days	28-days
Standard Ottowa	3040	3830	100	100	351	445	100	100
#1	2137	2955	70.4	77.2	283	351	80.6	78.9
#2	2260	3340	74.4	87.2	313	399	89.2	89.6
#3	1913	----*	63.5	----*	306	394	87.2	88.5
#4	2460	3385	80.3	88.1	344	385	98.0	86.5
#5	1973	----	64.9	----	328	----	93.5	----

* There was not enough sand in Sample #3 to make these cylinders

March 7, 1917.

Mr. L. Jorgensen,
1405 Chronicle Bldg.,
San Francisco, Cal.

Dear Sir:-

Your letter of March 3rd with enclosures, is received. Mr. Sellew will work on the matter some this week and you may expect a letter from us about next Monday. We have a little more time than originally suggested, but the sooner we are ready, the better.

The following change is suggested at this time:

Make the elevation of under side of 36" sluice gates 210. This fits more nearly the actual ground conditions.

I shall incline to reduce the number of 36" gates from 4 to 2 at the bottom, and go to my original idea of several additional gates near the water tower. Of this I shall write further. I am obliged to be out of town for a couple of days.

Very sincerely yours,

WSP:K

L. JORGENSEN
ELECTRIC AND HYDRAULIC ENGINEER
1405 CHRONICLE BUILDING
SAN FRANCISCO
TELEPHONE KEARNY 3724

March 8th, 1917.

Mr. W. S. Post,
Fletcher Bldg.,
San Diego, Calif.

Dear Sir:-

Enclosed you will find copy of Drawings C-67 and B-68 showing the multiple arch dam for Upper San Dieguito River, also list of quantities to be inserted on Page 3 of the legal part of the specifications. In a day or two I will mail you such additions to the specifications as are necessary to take care of this multiple arch dam also.

For checking over quantities of material you may use two drawings sent you some time ago, namely E-50 and E-51. They are provided with tables of quantities of material and stress, enabling an approximate check to be made quickly.

In estimating the amount of excavation some guesses had to be made and I have simply done the best I knew how. On Drawing B-68 has been indicated the average height of each individual arch. The rock foundation has been assumed to be 5 feet below the ground surface, as indicated on your Drawing 665, and in accordance with your letter of March 2nd. You will note (See Drawing E-50) that the stresses are low. The arch thickness, however, should not be less than 1 foot minimum. On Diagram C-26 is shown that the resultant of the buttress stresses on such a low dam (50 Ft.) cuts the base upstream of the centerline. The stresses near the downstream edge

of the buttresses are therefore very low, and this edge does not need any strut stiffening. I would suggest that the railing along the arch, and the small bridges out to the operating platforms be covered later by another contract; some plumber in San Diego may make this railing, and some structural shop may make these small bridges, if we do not decide to make them of concrete. The drawings call for boxes for the railing supports, but not for the railings.

I cannot make up my mind whether the 20 tons of old rails put in the Carroll arch is necessary or not, if we use plums. Perhaps we better use the rails in the concrete put in during the hottest part of the season, and cut it out during the colder weather; the amount of money involved is not large in any case.

Yours very truly,

L. Jorgensen

ADDITIONAL SPECIFICATIONS TO COVER THE BUILDING OF THE

MULTIPLE ARCH DAM ON THE UPPER SAN DIEGUITO RIVER.

These additional specifications are to take care of all points not covered by the specifications specifically written for the Carroll dam. All items and paragraphs included under the Carroll dam specifications shall be considered also to apply on the Multiple Arch dam for the Upper San Dieguito River except parts of the following paragraphs #22-#24-#25-#28-#36-#40. These do not apply due to the difference in the design of the two dams.

1. The dam is to be built as a reinforced concrete multiple arch structure with a maximum height of about 53 ft. above bedrock and a length across the crest of about 700 ft.

2. One main outlet shall be constructed close to the bottom of the river ,consisting of a short piece of pipe through the dam provided with a wire screen or grizzly at the upstream end and with a gatevalve at the down stream end.
Three sluicing outlets shall also be constructed in position as indicated on drawings at higher elevations. All valves,pipes,screens and operating mechanism will be furnished to the contractor,he to set them in their proper places.

3. Concrete for the buttresses shall be mixed in the proportion by volume of one part of cement,two and one half(2,5)parts of sand and five(5) parts of broken stone. One yard of concrete in place shall contain one and one quarter(1,25) barrels of cement.Concrete for the arches and struts shall be mixed in the proportion by volume of one part of cement,two(2) parts of sand and four(4) parts of broken stone or stone screened from the river gravel. One yard

of concrete in place shall contain one and one half(1,5) barrels of cement.

4. Course aggregate shall consist of gravel or crushed stone, which is retained on a screen having quarter inch dia. holes,and shall be graded from the smallest to the largest particles.The gravel or crushed stone shall be separated into two sizes and re mixed in the proper proportion,in case it is not found uniformly graded from the min.size of one quarter inch to the max. size, which will pass a one and one half(1,5) ring.

5. Plumstones shall not be used inthe concrete,except that at the end of each days work some stones shall be placed in the green con crete in such a way,that they project through the concrete from one days work to the next to insure a good bond between old and new concrete. Workjoints on the arches shall be approximately horizontal and not vertical.

6. The upstream face of the arches shall be provided with a plaster put on with a cement gun. The dry mixture for this plaster shall be in the proportion of one cement to two and one half(2,5)of sand by volume mixed together before being introduced into the gun.

The rock bottom shall also be plastered to the extent of one ft. ~~foot~~ ahead of the arches in an upstream direction,after having been cleaned for dirt and loose rock. The thickness of the plaster coat shall be three eights of an inch($\frac{3}{8}$) at the crest increasing uni formly to three quarters of an inch($\frac{3}{4}$)at 50 ft. below the crest in elevation.

7. The lumber for the forms and the design of the forms shall be adapted to the structure. The forms shall be thoroughly braced and tied together to prevent loss of mortar.For the arches the tie wires

shall not be allowed to go through the arches in an unbroken line but shall be tied to the longitudinal reinforcement from both faces,the offset shall be at least 2 inches. The downstream face form shall be battened on the outside and shall be built up some what in advance of the upstream face and the longitudinal rein forcement supported thereon in proper position by means of steel brackets of $\frac{3}{8}$ " size.These brackets shall be removed or turned away from the downstream face just before the concrete covers them,so as not to be at all visible when the forms are removed.

L. JORGENSEN
ELECTRIC AND HYDRAULIC ENGINEER
1405 CHRONICLE BUILDING
SAN FRANCISCO
TELEPHONE KEARNY 3724

March 9. 1917.

Mr. W.S.Post.

Fletcher Building,

San Diego. Cal.

Dear Sir:

I have your letter of March 7. and note what you say about the valves and their locations.

Enclosed you will find data pertaining to sand tests indicating that the quality of the deposit near the damsite is very satisfactory.

You will also find copy of additions to the specifications, these additions are to cover the small dam.

Yours very truly.

L. Jorgensen

March 12. 1917.

L. JORGENSEN
ELECTRIC AND HYDRAULIC ENGINEER
1405 CHRONICLE BUILDING
SAN FRANCISCO
TELEPHONE KEARNY 3724

Mr. W.S.Post.

Fletcher Building, San Diego. Cal.

Dear Sir:

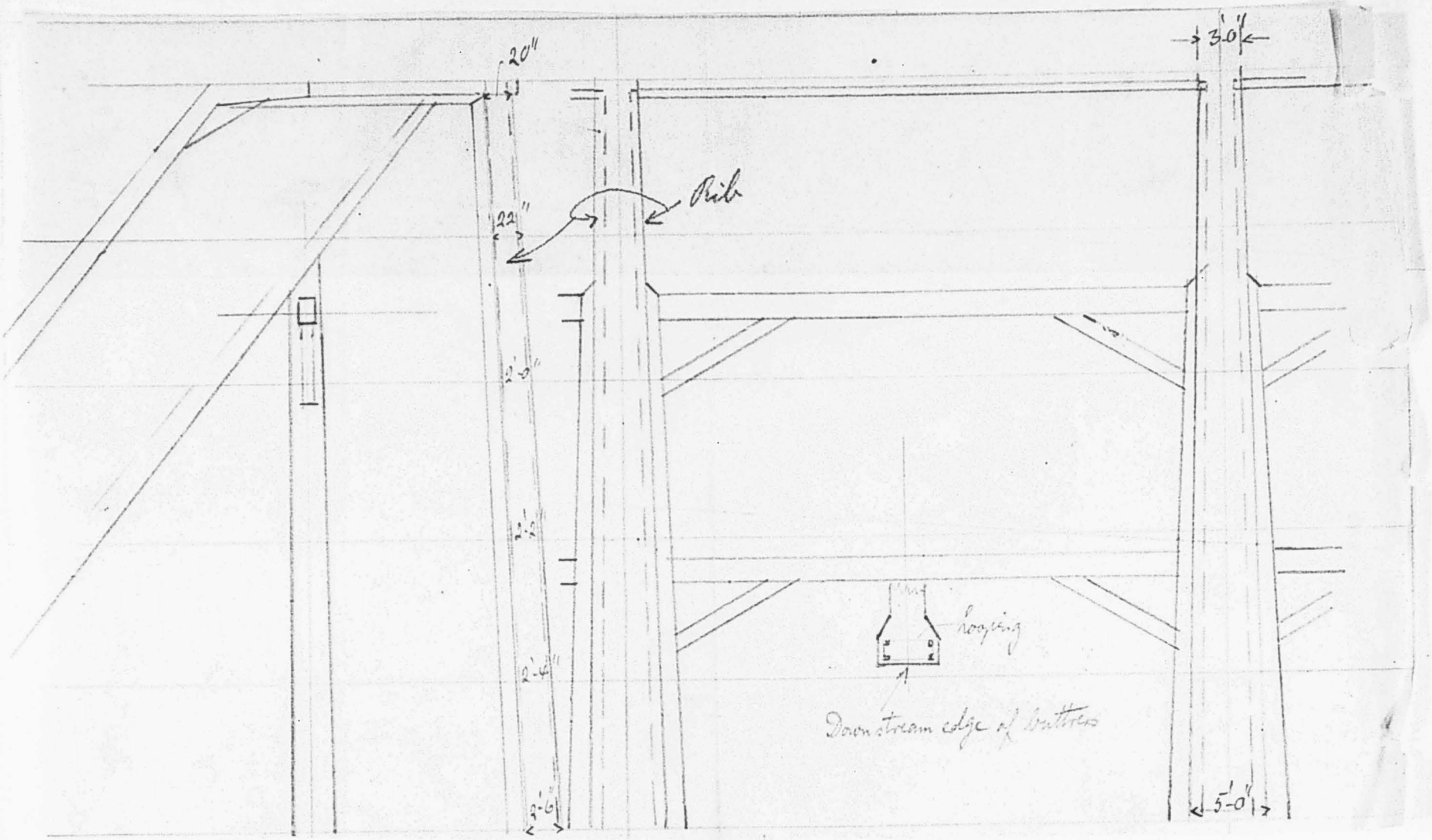
I am enclosing a sketch showing a rib ,that I am putting on both sides of the buttresses at the dawnstream edge. This is to take care of any possible windstresses. While these may be somewhat problematical,they ought not to be neglected. This adds 2,5 tons of steel and 60 yards of concrete. I think the ribs will also add to the appearance of the structure.

Enclosed you will find paragraph 8 of the specifications for the small Multiple arch dam,this was simply forgotten in the hurry to get them out.

I have made the change on drawing E-66. suggested by you, that of moving the underside of the 36" sluice gate to elv. 210. Detail drawing C-67.of Multiple arch dam is not supposed to be a working drawing,but it is supposed to show everything necessary for the contractor to know at this time.

Yours very truly

L. Jorgensen



"8. At the ends of all struts, the reinforcement shall be grouted into holes in the solid rock canyon sides for a depth of at least 24". The struts shall be poured in sets of three or less lengthwise, and the fourth left out. All the gaps thus left shall be closed in one day, and this shall be a day of comparatively low temperature.

Estimate of
San Dieguito Jorgensen Buttress.

Hgt.	Area		
5	½×13×5 = 37.5	1.6	= 59.
9	½×17×9 = 76.5	1.8	= 137.
13	½×21×13 = 137	1.9	= 260.
17	½×25×17 = 212	2.1	= 445.
21	½×28×21 = 294	2.2	= 650.
28	½×33×28 = 462	2.3	= 1060.
35	½×39×35 = 682	2.3	= 1570.
44	½×47×44 = 1034	2.5	= 2600
53	½×51×53 = 1356	2.5	= 3400
51	½×40×51 = 1020	2.5	= 2550
43	½×46×44 = 1012	2.5	= 2530
37	½×41×37 = 758	2.4	= 1820
33	½×37×33 = 610	2.3	= 1400
30	½×34×30 = 510	2.3	= 1170
25	½×31×25 = 387	2.3	= 890
21	½×28×21 = 294	2.2	= 645
11	½×18×11 = 99	1.9	= 185
			21371
			773

$\frac{21371}{27}$ = 790 Say 800 buttress
2000

March 12, 1917.

Mr. L. Jorgensen,
1405 Chronicle Bldg.,
San Francisco, Cal.

My dear Mr. Jorgensen:

We are satisfied with drawing E * 66 Feb. 28, 1917 with the following exceptions:

a) Already noted in my prévious letter, - the elevation of of the under side of the sluice gates to be 210 instead of as shown.

b) As stated hereafter largo valves in the towers are to be omitted, and ~~tunnelXXXXXXX~~ shown on downstream side should be as large as practicable perhaps 48" and preferably operated from the tower platform instead of from below.

c) It is suggested that the utilitarian aspect of the design may be relieved by a little ornamental work on the abutments at the extreme end of the arch. These abutments can be given dimensions somewhat more massive a support a figure of pleasing proportions, perhaps a lion in concrete or if this is too expensive one of pressed metal which could be treated with a cement gun. Space for a pedestal might be indicated as apier say 5' X 7' on each abutment. Decision on this point is not urgent, and I shall ask an artistic friend if mine to submit a detail for this, which can be tried on an elevation drawing to get the effect.

Please order for me six additional sets of the drawings for Fletcher and others, and it will be well for you to send me a negative when changes are complete so that I can make up some sets of blue lines for bidders.

Referring to drawing B-83 I am quite sure the large valve in the tower is unnessary. It is not needed for the control of the water for the pipe line, which will be done byb hte small sliding gates. Further these towers are to serve as additional waste outlets. I now suggest the following changes in drawing B-63:

a) Omit the large gate and its opera ting well.

b) Increase diameter of outlet of tower to 52".

c) Place a sliding gate 3' X $' opposite the outlet and at the bottom of the tower. This would be operated only when water was low.

d) Make but one well in the tower say 6 ft in diameter, Section S-T would lokk somewhat in the sketch.

e) 18X 24 inch sliding gates will be six in number either arranged in pairs as shown or to be arranged spirally with say about 7 feet rise of eleavtion between gates.

I am notifying my principals that your plans are

March 12, 1917.

Mr. L. Jorgensen,
1405 Chronicle Bldg.,
San Francisco, Cal.

My dear Mr. Jorgensen:

We are satisfied with drawing E ± 66 Feb. 28, 1917 with the following exceptions:

a) Already noted in my previous letter, - the elevation of of the under side of the sluice gates to be 210 instead of as shown.

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c) It is suggested that the utilitarian aspect of the design may be relieved by a little ornamental work on the abutments at the extreme end of the arch. These abutments can be given dimensions somewhat more massive a support a figure of pleasing proportions, perhaps a lion in concrete or if this is too expensive one of pressed metal which could be treated with a cement gun. Space for a pedestal might be indicated as apier say 5' X 7' on each abutment. Decision on this point is not urgent, and I shall ask an artistic friend if mine to submit a detail for this, which can be tried on an elevation drawing to get the effect.

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Referring to drawing B-83 I am quite sure the large valve in the tower is unnessary. It is not needed for the control of the water for the pipe line, which will be done byb hte small sliding gates. Further these towers are to serve as additional waste outlets. I now suggest the following changes in drawing B-63:

a) Omit the large gate and its opera ting well.
b) Increase diameter of outlet of tower to 52".
c) Place a sliding gate 3' X 4' opposite the outlet and at the bottom of the tower. This would be operated only when water was low.
d) Make but one well in the tower say 6 ft in diameter, Section S-T would lokk somewhat in the sketch.
e) 18X 24 inch sliding gates will be six in number either arranged in pairs as shown or to be arranged spirally with say about 7 feet rise of elcavtion between gates.

I am notifying my principals that your plans are

practically ready, and checked by my office, and that a form of proposal can be sent out to prospective bidders within a week.

Some question has been raised as to the need of core drilling. I have quoted you as being entirely satisfied with surface excavation, and that the decision of the exact position of the dam can then be finally decided and set out. This matter of the core drilling may be brought to your attention by someone calling at your office. I should much prefer to open up the cut than to delay for core drillings, and if you agree with me I should be glad to have you say so.

The specifications are in very good shape. I shall go over them within a few days and make such additions as are suggested, and send you a copy, for your approval.

I think there is a great desire to secure bias to check the estimated costs on the part of our principals, and barring some unforseen delay, I think the proposal to selected bidders will go out within 10 days.

Very sincerely yours,

practically ready, and checked by my office, and that a form of proposal can be sent out to prospective bidders within a week.

Some question has been raised as to the need of core drilling. I have quoted you as being entirely satisfied with surface excavation, and that the decision of the exact position of the dam can then be finally decided and set out. This matter of the core drilling may be brought to your attention by someone calling at your office. I should much prefer to open up the cut than to delay for core drillings, and if you agree with me I should be glad to have you say so.

The specifications are in very good shape. I shall go over them within a few days and make such additions as are suggested, and send you a copy, for your approval.

I think there is a great desire to secure bids to check the estimated costs on the part of our principals, and barring some unforseen delay, I think the proposal to selected bidders will go out within 10 days.

Very sincerely yours,

L. JORGENSEN
ELECTRIC AND HYDRAULIC ENGINEER
1405 CHRONICLE BUILDING
SAN FRANCISCO
TELEPHONE KEARNY 3724

March 14th, 1917.

Mr. W. S. Post,

Fletcher Bldg., San Diego, Cal.

Dear Sir:-

I have your letter of March 12th, and have made the changes suggested. The four valves in the middle should actually be spaced further apart than shown, but we can decide upon the best spacing later on the ground.

The river bottom needs no drilling for bedrock. Hard rock is shown everywhere, and only a small amount of blasting will be necessary to expose fresh rock for bonding purposes. On the sides. the overburden will have to be removed first, and some blasting done to expose fresh rock. Should any seams or soft spots show up, we would have to do some drilling and grouting, but it is better to excavate and see first, as the possibility for the existence of unexpected soft spots on the sides is very remote. The rock around the dam site appeared very hard and solid to me.

I am sending you under separate cover six copies of each of the three drawings E-66, C-67, B-68. The fourth, B-63, you will get in a day or two. This I will change according to your first suggestion at the top of the yellow sheet you sent me. Later I will redraw this to scale, but it will answer all present purposes.

If I hear nothing further from you about changes I will mail the negatives to you on Saturday, the 17th of March.

Yours very truly,

L. Jorgensen

L. JORGENSEN
ELECTRIC AND HYDRAULIC ENGINEER
1405 CHRONICLE BUILDING
SAN FRANCISCO
TELEPHONE KEARNY 3724

March 16th, 1917.

Mr. W. S. Post,
Fletcher Bldg.,
San Diego, Cal.

Dear Sir:-

Under separate cover I am mailing you today the four negatives of the two dams as requested. The six blue prints of each have already been mailed. I cannot think of any more changes. Since the diameter of the outlet tower has been enlarged I have cut out the steel lining inside.

Should I be successful in getting the work, I would ask as my fee 4½% of construction cost of the two dams.

Yours very truly,

L. Jorgensen

March 20th, 1917.

Mr. L. Jorgensen,
1405 Chronicle Bldg.,
San Francisco, Cal.

Dear Sir:-

I think you should write me a letter stating again that your fee would be four and one-half percent of the construction cost of the two dams. Please state quite clearly the amount of service which you would propose to give in this connection. I am inclined to think that a liberal statement in this regard will create a favorable impression. I should prefer to have a clear understanding as to this matter and that this fee would include your traveling and other expenses in reaching the site.

I am sending up tonight a complete set of your plans and specifications for the inspection of Mr. Faulkner and will keep you advised of progress.

Mr. Sellew and I have made some changes in the specifications which I think will meet with your approval and I will send you tomorrow a copy of them. There will still be some time before they are formally issued to confer regarding specifications.

Very sincerely yours,

WSP:K

L. JORGENSEN
ELECTRIC AND HYDRAULIC ENGINEER
1405 CHRONICLE BUILDING
SAN FRANCISCO
TELEPHONE KEARNY 3724

March 23. 1917.

Mr. W. S. Post.

Fletcher Bldg. San Diego, Cal.

Dear Sir:

As requested in your letter of March 20th.,I will again state,that the fee I will ask in case I am sucessful in getting the dam work on the San Dieguito River,will be four and one half per cent of the construction cost of the dams.

Besides delivering complete designs for the two dams,I intend to spend one third of my time on this job,or more if necessary. I intend to spend most of this at the start,as later on,a job of this kind should run more or less automatical. I furnish my own traveling expenses in going and coming to the site,but I expect you to take care of me on the ground,the same as you do the surveyors and inspectors.

I take it for granted,that you will be the chief engineer of the whole development,and I expect that you will ask me to come on the job,whenever in your opinion I ought to be there,and am not.

I expect to be paid a certain amount per month,say $ 350.and whatever expenses I might have incurred during the preceeding month;these amounts to be deducted from my fee,when final settlement is made at the time the dams are finished and turned over to the owners by the contractor.

Hoping this will meet with general approval I remain.

Yours very truly.

L. Jorgensen

L. Jorgensen
1405 Chronicle Bldg.,
San Francisco.

March 23, 1917.

Mr. W. S. Post,
Fletcher Bldg.
San Diego, Cal.

Dear Sir:-

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Besides delivering complete designs for the two dams, I intend to spend one third of my time on this job, or more if necessary. I intend to spend most of this at the start, as later on, a job of this kind should run more or less automatical, I furnish my own traveling expenses in going and coming to the site, but I expect you to take care of me on the ground, the same as you do the surveyors and inspectors.

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Hoping this will meet with general approval I remain,

Yours very truly,

L. Jorgensen.

UNIVERSITY OF CALIFORNIA
DEPARTMENT OF CIVIL ENGINEERING
BERKELEY

TESTING LABORATORY
C. DERLETH, JR., DIRECTOR

March 29, 1917.

Mr. L. Jorgensen,
Chronicle Bldg.,
San Francisco, California.

Dear Mr. Jorgensen:-

This is the final report on test #1705, an investigation of several sands sent to our laboratory by the Volcan Land and Water Company of Escondido, California. Table #1 shows the results of the 7-day and 28-day tests of mortar cylinders and briquettes made from these sands, while table #2 gives a comparison of the average compressive and tensile strengths of specimens made from the sands as received, with the corresponding strengths of specimens made from standard Ottowa sand.

The sand, in which you are particularly interested, sample #5, taken from the river 0.4 mile below Dam "C", apparently contained about the same amounts of mica as the other samples. In all the sands examined the mica was well graded from coarse to fine particles and a determination of its exact proportions therefore was not made. The method of test procedure had your approval before any specimens were molded.

At the age of 28 days the specimens made with sand #5 had an average tensile strength of 328 lbs. per sq. in., which was 83 per cent. of the average strength of similar specimens made with standard Ottowa sand, while in compression the specimens made with sand #5, which failed at an average load of 2553 lbs. per sq. in., had only 67 per cent. of the average strength of similar standard Ottowa sand specimens.

The following statement has been taken from Taylor and Thompson "A Treatise on Concrete", third edition 1916, page 117: "If the strength developed by the aggregate in the 1:3 mortar is less than 70 per cent. of the strength of the Ottowa sand mortar, the material shall be rejected." However, the relative value of several fine aggregates to be used in concrete cannot be determined by testing them in mortar mixtures. They must be tested in the combined state with the coarse aggregate. (See Technologic Paper #58 of the Bureau of Standards, page 86.)

On the basis of our tests and the investigation made at the Bureau of Standards, reported in Paper #58, it is our judgment that further tests should be made on Sand #5 to determine its value as a fine aggregate for concrete before its use in the construction of any structure would be justified.

Very truly yours,

C. T. Wiskocil

Instructor in Charge.

Charles Gilman Hyde

Acting Head of the Department.

Table No. 1

Strengths of Specimens Made from Several Sands Furnished
by the Volcan Land and Water Company and Standard
Ottowa Sand as Determined by Tests Made at
the Testing Laboratory of the
Department of Civil
Engineering
University of California.

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Sand	Specimen	2-in. Diameter Cylinders, 4" in Length Crushing Load, lb. per sq. in. 7-days	28-days	Briquettes Tensile Strength, lb. per sq. in. 7-days	28-days
Standard	A	2630	4040	347	451
	B	3470	3820	370	383
	C	3020	3630	335	501
	A	2090	3120	297	350
#1	B	2200	2790	289	354
	C	2120	----*	264	350
	A	2370	3270	285	400
#2	B	2020	3410	316	412
	C	2390	----*	338	386
	A	1640	----*	300	392
#3	B	2130	----*	290	400
	C	1970	----*	329	390
	A	2550	3440	327	398
#4	B	2370	3330	355	353
	C	----*	----*	350	405
	A	1780	2390	345	356
#5	B	1940	2500	321	370
	C	2200	2770	319	380

Note: Specimens composed of one part cement and three parts sand, by weight.

* There was not enough sand to make these specimens.

(All specimens made of 1:3 mortar.)

Table No. 2

Comparison of Average Tensile and Compressive Strengths
of Mortar Specimens Made with Several Sands from
the Volcan Land and Water Company with Corresponding Strengths of Similar Specimens Made from Standard Ottowa Sand.
Testing Laboratory of the Department of Civil Engineering,
University of California.

---o---

Sand	2-in. Diameter Cylinders 4" in Length				Briquettes			
	Ave. Crushing Strength lbs. per sq. in.		Strength Compared to Standard Sand Cylinders, in per cent.		Average Tensile Strength, lb. per sq. in.		Strength Compared to Standard Sand Briquettes, in per cent.	
	7-days	28-days	7-days	28-days	7-days	28-days	7-days	28-days
Standard Ottowa	3040	3830	100	100	351	445	100	100
#1	2137	2955	70.4	77.2	283	351	80.6	78.9
#2	2260	3340	74.4	87.2	313	399	89.2	89.6
#3	1913	----*	63.5	----*	306	394	87.2	88.5
#4	2460	3385	80.3	88.1	344	385	98.0	86.5
#5	1973	2553	64.9	66.7	328	369	93.5	83.0

*There was not enough sand in Sample #3 to make these cylinders.

Table No. 3.

Ratio of Unit Compressive Strengths of Mortar Cylinders
to Unit Tensile Strengths of Mortar Briquettes
Made from Various Sands.*

-----o-----

Sand Sample	Ratio	
	7 days	28 days
Standard Ottowa	8.66	8.61
1	7.58	8.42
2	7.22	8.37
3	6.26	----
4	7.15	8.79
5	6.02	6.92

* To accompany report to the Volcan Land and Water Company of Escondido California.
Testing Laboratory of the Department of Civil Engineering,
University of California.

L. JORGENSEN
ELECTRIC AND HYDRAULIC ENGINEER
1405 CHRONICLE BUILDING
SAN FRANCISCO
TELEPHONE KEARNY 3724

April 3. 1917.

Mr. W.s.Pest

Fletcher Bldg.

San Diego, Cal.

Dear Sir:

Enclosed you will find final report on sand tests made by the University,also copy of letter to the state engineer written by me in connection with the filing of the plans.

The sand seems to be very satisfactory. #3 and #5 are not as high as the others and need more investigation mixed with course aggregate as ordinary concrete,but we can do this later. It has to be done as the work progresses anyway.

Yours very truly.

L. Jorgensen

P.S. I sent you a new negative of dr. E-66. last night.

March 30, 1917.

Mr. L. Jorgensen,
1405 Chronicle Bldg.,
San Francisco, Cal.

Dear Sir:-

The Hydraulic Engineer of the Santa Fe makes the following criticism of the plans as drawn. The disposition of the rails is not shown clearly on the plan view. They should also be shown in section. This is of course not an essential matter inasmuch as you specify the tonnage of steel rails to be put in, but I should be glad if you would explain in a letter to me exactly your idea of how the rails will be placed so that I can answer questions more intelligently.

He also suggests that another section of the arch ring should be introduced say about the quarter point as the shape of the arch is changing and the middle section alone seems to him somewhat misleading. I do not know that there is any time to make these changes. However if you think the suggestion has merit, you might send me a new negative with these additions and I will use that in putting out the blueprints to the contractors. It is desirable of course to accept, as far as possible, any suggestinns coming from the Santa Fe Engineering Department.

The Santa Fe Engineer also thinks that a cutoff should be shown in Section A-B and deeper excavation shown on the middle section C-D. He says that otherwise it suggests no trenching whatever. This of course is not important, but while the other changes are being made, the excavation could be emphasized a little.

Very sincerely yours,

WSP:K

March 30, 1917.

Mr. L. Jorgensen,
1405 Chronicle Bldg.,
San Francisco, Cal.

Dear Sir:-

The approval of the State Engineer is required for mutual water companies. I enclose a formal application for approval of your plans and ask you to present it to the State Engineer as soon as possible and make arrangements for a conference with whomever the State Engineer assigns to review the plans.

The first meeting of the Company will be held on April 2nd and I am instructed at that time to have ready for delivery to contractors the plans and specifications of the various types of dam. The important thing being to get the plans in the hands of the contractors so that they will have time to make careful estimates. Probably no contract can be let until after the approval of the State Engineer is received.

I enclose the specifications as rewritten by myself which I had failed to send you. The changes were largely to conform to certain standard specifications. Mr. Faulkner has also suggested that the standard steel specifications of the Santa Fe should be introduced. He has promised to send me a copy and I have no particular objection to using this as well as the general clauses as used by the Railway and I presume it will be satisfactory to you as well. However, I know that specifications which are compiled in this way are liable to be inconsistent and I will try to send you by Monday or Tuesday all of the data suggested by Mr. Faulkner for your approval and it will be these final specifications which will go to contractors.

On this account please say to the State Engineer that the specifications will be furnished as soon as possible and in the meantime you can use your former specifications as illustrating your work.

Very sincerely yours,

WSP:K
Enclos.

Colonel Fletcher

April 2nd, 1917.

Mr. E. O. Faulkner,

Manager, Tie & Timber Department,

A.T. & S.F. Ry., Los Angeles, Cal.

Dear Sir:-

I have received your letter of March 31st, also copy of a letter addressed to Colonel Fletcher from you, and some engineering calculations made by Mr. Geo. L. Davenport, Asst. Engineer in the Santa Fe office.

In answer to the second page of your letter to Mr. Fletcher, I may state that the stresses in the arch were given at points 10 ft. apart in elevation on my drawing E-60. They were not repeated on Drawing E-66, which is evidently the one you have, and is the one intended for the contractors. They, of course, do not care to know the stresses. You will note that the stresses given by me on Drawing E-60 corresponds very closely to those given by Mr. Davenport. The small discrepancy that actually exists is due to the fact that he assumes the water standing at elevation 327, while I assume it at elevation 325.

I am sending a reprint of an article in the Canadian Engineer by me which I will ask you to hand to Mr. Davenport. It is a later one than the one referred to by him. Using the information given on Page 5 of the article, he will find that the toe pressure will be such that a factor of safety between 5 and 6 can be depended upon, as desired by him. It should be kept in mind that after the grout pipes inserted in the contraction joints have

been filled under pressure, there will be very little cantilever action. What little there will be left will tend to bring the arch stresses down to, or below 25 tons per square foot. Without any help from the cantilever they will be 27½ tons per square foot.

Perhaps it will interest you to know that the arch stresses in the upper Otay dam is 62 tons per square foot toward the bottom with reservoir full, but not overflowing.

Columns made of sand from the Carroll dam site of a mix 1 cement to 3 sand, have withstood when seven days old, 150 tons per square foot before crushing. The Carroll dam, as shown on Drawing E-66 should, therefore, possess a factor of safety of not less than 5, with water at elevation 327. Ordinary gravity dams are designed with a factor of safety of 2, therefore the Carroll design should surely be considered a very safe one.

I am going to incorporate some of the suggestions made on Page 3 of Mr. Davenport's letter. Suggestion "e" it seems to me should be left out until we see if it is necessary. Of course the gunning looks nice, but I do not believe it is necessary, and it will cost some money. The other suggestions will cost little, or nothing, they were mostly contemplated. I will send Mr. Post a new negative of Drawing E-66 right away. Drawings E-66 and B-63, taken in connection with the specifications, contain all the information the contractors need, and all it is possible to give them at this time.

Trusting the above explanation will be satisfactory to you, I remain Yours very truly,

Mr Post

April 2nd, 1917.

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Manager, Tie & Timber Department,

A.T. & S.F. Ry., Los Angeles, Cal.

Dear Sir:-

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been filled under pressure, there will be very little cantilever action. What little there will be left will tend to bring the arch stresses down to, or below 25 tons per square foot. Without any help from the cantilever they will be 27½ tons per square foot.

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Trusting the above explanation will be satisfactory to you, I remain Yours very truly,

L. JORGENSEN
ELECTRIC AND HYDRAULIC ENGINEER
1405 CHRONICLE BUILDING
SAN FRANCISCO
TELEPHONE KEARNY 3724

April 2nd, 1917.

Mr. W. S. Post,
Fletcher Bldg.,
San Diego, Calif.

Dear Sir:-

I have your two letters dated March 30th, also copy of re-written specifications. These specifications cover the subject as far as I can see. In this connection I refer to my letter of March 26th to you.

I am also enclosing two copies of a letter I wrote to Mr. Faulkner today. Please hand one copy to Mr. Fletcher and keep the other one yourself. Tomorrow I will send you a new negative of Drawing E-66. Some suggestions made by the Santa Fe engineering office have been incorporated. On one of the sections I give the dimensions for the steel spacing (old rails), but this is subject to change, as on work done during cold weather the spacing should not be the same as on work done during hot weather.

I shall attend to the application for approval of plans with the State Engineer right away. I will use the copy of specifications you sent me.

Yours very truly,

L. Jorgensen

April 3rd, 1917.

Mr. W. F. McClure,

State Engineer,

Sacramento, Calif.

Dear Sir:-

Enclosed you will find plans (Drawings E-66 and B-63) and specifications for the proposed Carroll dam eight miles South of Escondido in San Diego County, also an application for approval of these plans and specifications signed by the President of the San Dieguito Mutual Water Company, Mr. E. Fletcher. I have been requested to hand you these plans for your inspection.

I am also enclosing copy of results of sand tests just received from the University of California. This sand is from five different deposits near the site. You will please note that the crushing strength of the 1:3 mortar cylinders 28 days old is above 3,200 lbs. per sq. inch for the sand from deposits 1, 2 and 4, and above 2,500 lbs. per sq. inch for deposit 5. The maximum compression in the dam is 382 lbs. per sq. inch, which exists at elevation 260. For method of calculation I may refer to a paper in the Transactions of the Am. Soc. Civil Engineers, Volume LXXVIII, 1915, Page 685, also to enclosed reprint from the "Canadian Engineer".

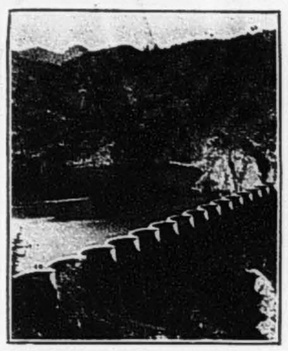
The purpose of the grout pipe system shown inserted in all the contraction joints is to facilitate the closing of all parts of the joints under pressure during cold weather when the reservoir is empty, and the joints have opened up a maximum amount. The arch

action afterward will then always be most complete, leaving very little load for the cantilever to take up. A smaller diameter movable pipe is to be inserted inside the 2½" vertical pipe, and the grouting is forced through this smaller diameter pipe; the space between the two pipes being closed by means of a packing at the lower end of the small diameter pipe. The grouting progresses from the bottom up, in order to better expel confined air, water, etc., the smaller diameter pipe being pulled upward at intervals.

If there should be anything I could do in the way of further explanations, I will always be glad to do so.

Yours very truly,

Signed L. Jorgensen



MULTIPLE ARCH

Constant Angle Arch Dam Company

Water Power Developments
Irrigation Projects

Chronicle Building

CONSTANT ANGLE ARCH

San Francisco, Cal., April 5th. 1921.

Colonel Ed.Fletcher
920 Eight Street
San Diego, Cal.
My dear Colonel:

Enclosed you will find 2 blueprints showing a proposed Constant Angle Arch Dam laid out to fit your Mission Gorge dam site.

The arch is provided with a gravity tangent at each end. These two tangents can be used as overflow spillways or syphon spillways. I naturally assume,that at times there will be flood water in the San Diego River which must be safely passed over or through the dam.

In making the estimate of the amount of concrete in this dam,allowance was made for a 10 ft. excavation as per your letter of March 30th.

The total amount of concrete in this dam is 75,500 cubic yards,of which 5700 yards are in the tangents.

This concrete should have 5 sacks or 1¼ barrel of cement per cubic yard,except in case the material on the ground is found to be very excellent,then 1,1 barrel per yard may do.

As far as cost is concerned,the best I can do now is to compare this dam with one we are figuring on in detail,located 4 miles above San Fernando on the Pacoima Creek. This dam is estimated to cost $ 10.00 per cubic yard including everything. I believe your dam can be built for the same amount,or not over $11.00 per cub. yard including excavation and everything. The total cost of your dam should be about $ 800,000.

I expect to be in Los Angeles part of the time in a near future,and will be glad to get in touch with you,should anything come up about this project.

Our usual charge for furnishing complete designs is 1/5 of what the design saves in cost over an ordinary arch dam.

I should be glad to receive your check to the amount of $125.00 to cover the expence of the preliminary design enclosed, and oblige,with best regards.

Yours very truly
Constant Angle Arch Dam Company.

L. Jorgenson

CONSTANT ANGLE ARCH DAM COMPANY

Chronicle Building

San Francisco, Calif.

April 5th, 1921.

Colonel Ed. Flotcher
920 Eighth Street
San Diego Calif.

My dear Colonel:

Enclosed you will find 2 blueprints showing a proposed Constant Angle Arch Dam laid out to fit your Mission Gorge dam site.

The arch is provided with a gravity tangent at each end. These two tangents can be used as overflow spillways or syphon spillways. I naturally assume, that at times there will be flood water in the San Diego River which must be safely passed over or through the dam.

In making the estimte of the amount of concrete in this dam, allowance was made for a 10 ft. excavation as per your letter of March 30th.

The total amount of concrete in this dam is 75,500 cubic yards, of which 5700 yards are in the tangents.

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I should be glad to receive your check to the amount of $125.00 to cover the expense of the preliminary design enclosed, and oblige, with best regards,

Yours very truly,
Constant Angle Arch Dam Company
(Signed) L. Jorgenson.

CONSTANT ANGLE ARCH DAM COMPANY

Chronicle Building

San Francisco, Calif.

April 5th, 1921.

Colonel M.J. Tyrholder
980 Eighth Street
San Diego Calif.

My dear Colonel:

Enclosed you will find 3 blueprints showing a proposed Constant Angle Arch Dam laid out to fit your Mission Gorge dam site.

The arch is provided with a gravity tangent at each end. These two tangents can be used as overflow spillways or Ogee spillways. I naturally assume, that at times there will be flood water in the San Diego River which must be safely passed over or through the dam.

In making the outside of the amount of concrete in this dam, allowance was made for a 10 ft. excavation as per your letter of March 30th.

The total amount of concrete in this dam is 75,300 cubic yards, of which 8700 yards are in the tangents.

This concrete should have 6 sacks or 1½ barrel of cement per cubic yard, except in case the is buried entbe ground is found to be very excellent, then 1.2 barrel per yad may do.

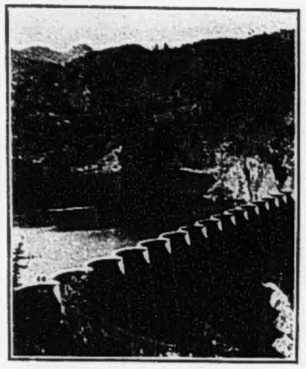
As far as cost is concerned, the best I can do now is to compare this dam with one we are figuring on in detail, located 6 miles above San Fernando on the Pacoima Creek. This dam is estimated to cost $10.00 per cubic yard including everything. I believe your dam can be built for the same amount, or not over $11.00 per cub. yard including excavation and everything. The total cost of your dam should be about $800,000.

I expect to be in Los Angeles part of the time in a near future and will be glad to get in touch with you, should anything come up about this project.

Our usual charge for furnishing complete designs is 1/3 of what the design saves in cost over an ordinary arch dam.

I should be glad to receive your check to the amount of $125.00 to cover the expense of the preliminary design enclosed, and oblige, with best regards,

Yours very truly,
Constant Angle Arch Dam Company
L. Torgenson,
(Signed)



MULTIPLE ARCH

Constant Angle Arch Dam Company

Water Power Developments
Irrigation Projects

Chronicle Building

CONSTANT ANGLE ARCH

San Francisco, Cal., April 9th.
1921.

Colonel Ed.Fletcher
920 Eight Street
San Diego, Cal.

My dear Colonel:

Yours of April 7th with enclosed check for $125. received with thanks.

The arch stresses in lbs per sq.inch are given in a column on the drawing sent you,and you will note these stresses are kept around 300 lbs per sq. inch,the max. being 310. Now the concrete in this dam with a 1:2½:5 mix should not crush below a stress of 1800 lbs per sq. inch in such a big body.That would give an apparent factor of safety of 6.

Due to inequalities of temperature etc. during the construction period,this will be lowered to between 4 and 5,which is ample,in fact it would not be economical nor necessary for any purpose to make it more.

We have a contract now with the City & County of Los Angeles for a dam 375 ft. high for the purpose of flood control of the Los Angeles River.This dam is designed for practically the same factor of safety as yours. It is located above the City of Los Angeles,and it is therefore of great importance that this dam be as safe as can be made.

The Director and Chief Engineer of the U.S.Reclamation Service,Mr.A.P.Davis was engaged as consulting engineer by the Los Angeles Flood Control District to report on this project. After having thoroughly examined the site,and various designs, he recommended the Constant Angle Arch design,we had furnished.

I am simply explaining this to you for the purpose of setting your mind at rest as to the safety of your proposed dam,drawing E-174. There are now about 12 such dams in existence in various parts of the country,so there is nothing new about this kind of dam any more.

Several details such as syphons and contraction joints are not shown on dr. E-174, this drawing was made for estimating purposes and not for construction purposes.

Yours very truly.

L. Jorgensen

LJ/RL

CONSTANT ANGLE ARCH DAM COMPANY

Chronicle Bldg.
San Francisco, Calif.

April 9th, 1921.

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920 Eighth Street,
San Diego, Calif.

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We have a contract now with the City & County of Los Angeles for a dam 375 feet high for the purpose of flood control of the Los Angeles River. This dam is designed for practically the same factor of safety as yours. It is located above the City of Los Angeles, and it is therefore of great importance that this dam be as safe as can be made,

The Director and Chief Engineer of the U. S. Reclamation Service, Mr. A. P. Davis was engaged as consulting engineer by the Los Angeles Flood Control District to report on this project. After having thoroughly examined the site, and various designs, he recommended the Constant Angle Arch design, we had furnished.

I am simply explaining this to you for the prupose of setting your mind at rest as to the safety of your proposed dam, drawing E-174. There are now about 12 such dams in existence in various parts of the country, so there is nothing new about this kind of dam any more.

Several details such as syphons and contractions joints are not shown on dr. E-174, this drawing was made for estimating purposes and not for construction purposes.

Yours very truly,

L. JORGENSON

LJ/RL

CONSTANT ANGLE ARCH DAM COMPANY

Chronicle Bldg.
San Francisco, Calif.

April 9th, 1921.

Colonel Ed Fletcher
920 Eighth Street,
San Diego, Calif.

My dear Colonel:

Yours of April 7th with enclosed check for $125 received with thanks.

The arch stresses in lbs per sq. inch are given in a column on the drawing sent you, and you will note these stresses are kept around 300 lbs per sq. inch, the max. being 310. Now the concrete in this dam with a 1:2½:5 mix should not crush below a stress of 1800 lbs per sq. inch in such a big body. That would give an apparent factor of safety of 6.

Due to inequalities of temperature etc. during the construction period, this will be lowered to between 4 and 5, which is amply, in fact it would not be economical nor necessary for any purpose to make it more.

We have a contract now with the City & County of Los Angeles for a dam 275 feet high for the purpose of flood control of the Los Angeles River. This dam is designed for practically the same factor of safety as yours. It is located above the City of Los Angeles, and it is therefore of great importance that this dam be as safe as can be made.

The Director and Chief Engineer of the U. S. Reclamation Service, Mr. A. P. Davis was engaged as consulting engineer by the Los Angeles Flood Control District to report on this project. After having thoroughly examined the site, and various designs, he recommended the Constant Angle Arch design, we had furnished.

I am simply explaining this to you for the purpose of setting your mind at rest as to the safety of your proposed dam, drawing E-174. There are now about 12 such dams in existence in various parts of the country, so there is nothing new about this kind of dam any more.

Several details such as syphons and contractions joints are not shown on dr. E-174, this drawing was made for estimating purposes and not for construction purposes.

Yours very truly,

L. JORGENSON

LJ/FL

CONSTANT ANGLE ARCH DAM COMPANY

Water Power Developments
Irrigation Projects
Chronicle Building

San Francisco, Cal.,
April 9th, 1921.

Colonel Ed. Fletcher
920 Eight Street
San Diego, Cal.

My dear Colonel:

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Due to inequalities of temperature etc. during the construction period, this will be lowered to between 4 and 5, which is ample, in fact it would not be economical nor necessary for any purpose to make it more.

We have a contract now with the City & County of Los Angeles for a dam 375 ft. high for the purpose of flood control of the Los Angeles River. This dam is designed for practically the same factor of safety as yours. It is located above the City of Los Angeles, and it is therefore of great importance that this dam be as safe as can be made.

The Director and Chief Engineer of the U.S.Reclamation Service, Mr. A.P. Davis was engaged as consulting engineer by the Los Angeles Flood Control District to report on this project. After having thoroughly examined the site, and various designs, he recommended the Constant Angle Arch design, we had furnished.

I am simply explaining this to you for the purpose of setting your mind at rest as to the safety of your proposed dam,drawing E-174. There are now about 12 such dams in existence in various parts of the country, so there is nothing new about this kind of dam any more.

Several details such as syphons and contraction joints are not shown on dr. E-174, this drawing was made for estimating purposes and not for construction purposes.

Yours very truly.

(Signed) L. Jorgensen

LJ/RL

Ed Fletcher Papers

1870-1955

MSS.81

Box: 14 Folder: 10

General Correspondence - Jorgensen, Lars - 1917 - 1921