





Argonaut Dam, No. 478 (OJ)  
Amador



Linda S. Adams  
Secretary for  
Environmental Protection

## Department of Toxic Substances Control

Maziar Movassaghi  
Acting Director  
8800 Cal Center Drive  
Sacramento, California 95826-3200

Arnold Schwarzenegger  
Governor

September 30, 2010

Mr. Mike Israel  
Amador County Public Works  
810 Court Street  
Jackson, California 95652

Ms. Marilyn Van Horn  
4193 King Author Court  
Palo Alto, California 94306-3826

### ARGONAUT MINE TAILINGS DAM, JACKSON, CALIFORNIA

Dear Mr. Israel and Ms. Van Horn:

The California Department of Toxic Substances Control (DTSC) has been the regulatory agency for the environmental investigation and cleanup of the Argonaut Mine tailings. DTSC has observed the Argonaut mine tailings dam during the last four years of our investigation. At this date, only sampling activities have taken place on the site, no change in drainage of rainwater has occurred. My observations of the current condition of the dam have caused me concern. The integrity of the dam was brought up during Jackson City's site visit with their consultants and DTSC on the proposed Sutter Street Extension that would be located in close proximity to the dam. The apparent disrepair of the dam is of great concern to DTSC.

Assessment of the condition of the dam is not within DTSC's jurisdiction. I contacted the California Department of Water Resources (DWR) which oversees dams within the state. I spoke with Larry Ford at DWR about the Argonaut Dam. Mr. Ford was able to give me a timeline of DWR's action concerning the Argonaut Mine.

- 1917 - Argonaut Mine NO. 478 (OJ) was constructed sometime around 1917.
- 1929 - An application for a prior dam construction was filed with the Division.
- 1932 - A certificate of approval for the dam was issued.
- 1933 - A Legislative Act amended the Division's responsibilities from dams impounding 10 acre-feet to those impounding 1.5 acre feet, which excluded Argonaut Dam.
- 1937 - Argonaut Dam was inspected to confirm that there had been no changes

MW 10/4/10  
AJM 9/5/10  
9/4/10  
LBF  
File

Mr. Mike Israel  
Ms. Marilyn Van Horn  
September 30, 2010  
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- 1975 - Argonaut Dam was inspected to confirm that there had been no changes

Mr. Ford explained that Dams that impound less than 15 acre feet of water are the responsibility of the County in which the dam is located. Amador County should have received a letter from DWR around 1933 when the dam left DWRs jurisdiction and became the responsibility of Amador County.

The Argonaut Dam is listed as being 46 feet in height. It was built to contain the tailings and debris from the Argonaut Mine activities from entering Jackson Creek. At the last site visit in 2009, the material behind the dam was within four feet of the top of the dam. During heavy rains, water circumvents the dam to the south and also pours over the top of the dam (I have enclosed a picture of this happening). DTSC took soil samples from behind the dam to analyze for arsenic contamination. These borings were up to a depth of 35.5 feet below ground surface (bgs). The soil borings indicate that at a depth of 34 feet bgs the tailings were wet which increases the ability of the tailings to flow. The dam is located in a steep ravine/creek bed which ends near Highway 49 and across from the commercial area of the city of Jackson. There is a potential for the dam to fail and tailings to move down gradient along the creek bed or Sutter Road to Highway 49.

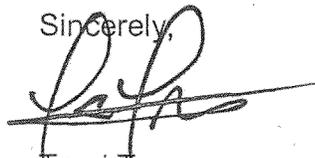
Attached are pictures of the condition of the dam and what happens during heavy rain events.

This letter is to inform both the land owner and the Amador County Public Works Department of the observed condition and possible consequences of a failure of the Argonaut Dam. It may be prudent for responsible entities to assess the need to take preventative measures associated with the condition of the dam.

Attached are pictures of the Argonaut Mine Dam.

If you would have any questions, please contact me at (916) 255-3747.

Sincerely,



Tami Trearse  
Engineering Geologist  
Brownfields and Environmental Restoration Program

Attachments

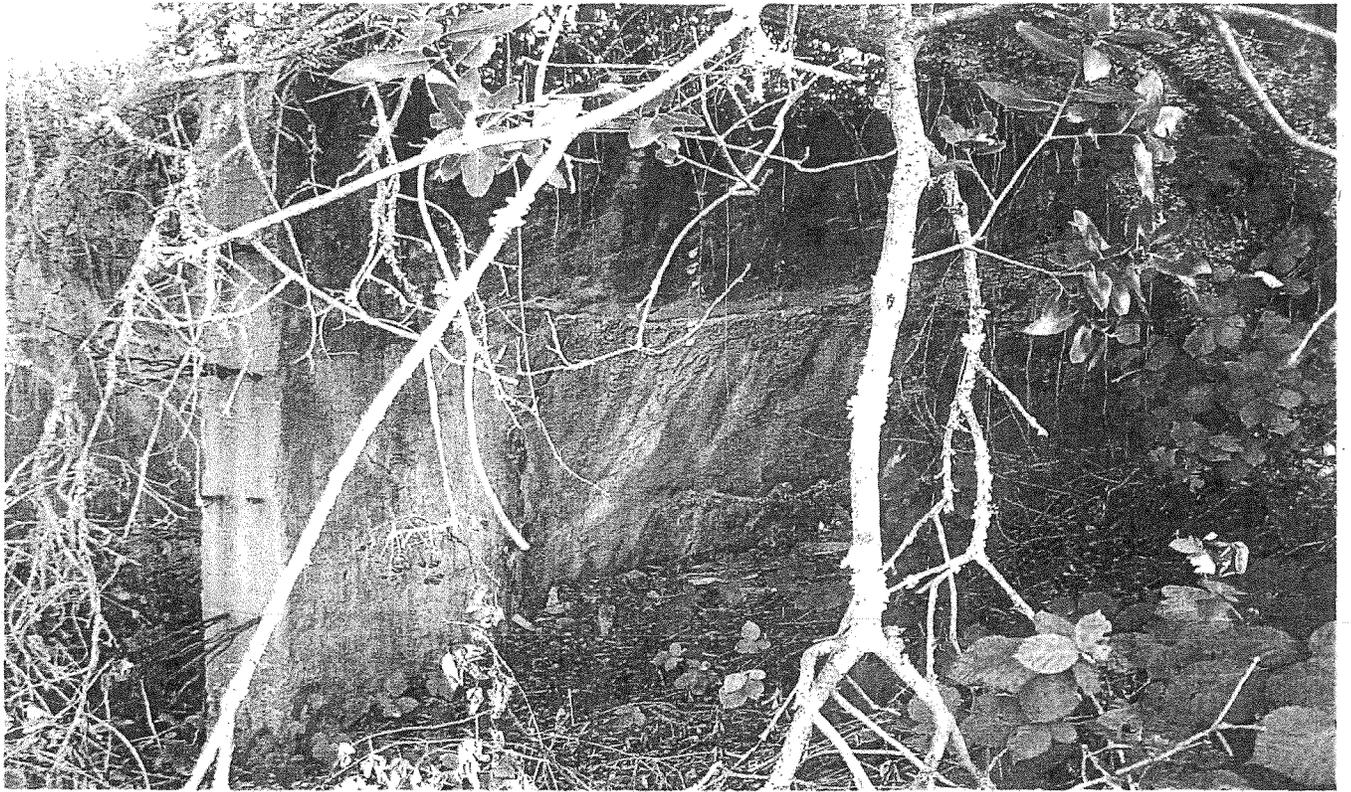
cc: See next page.

Mr. Mike Israel  
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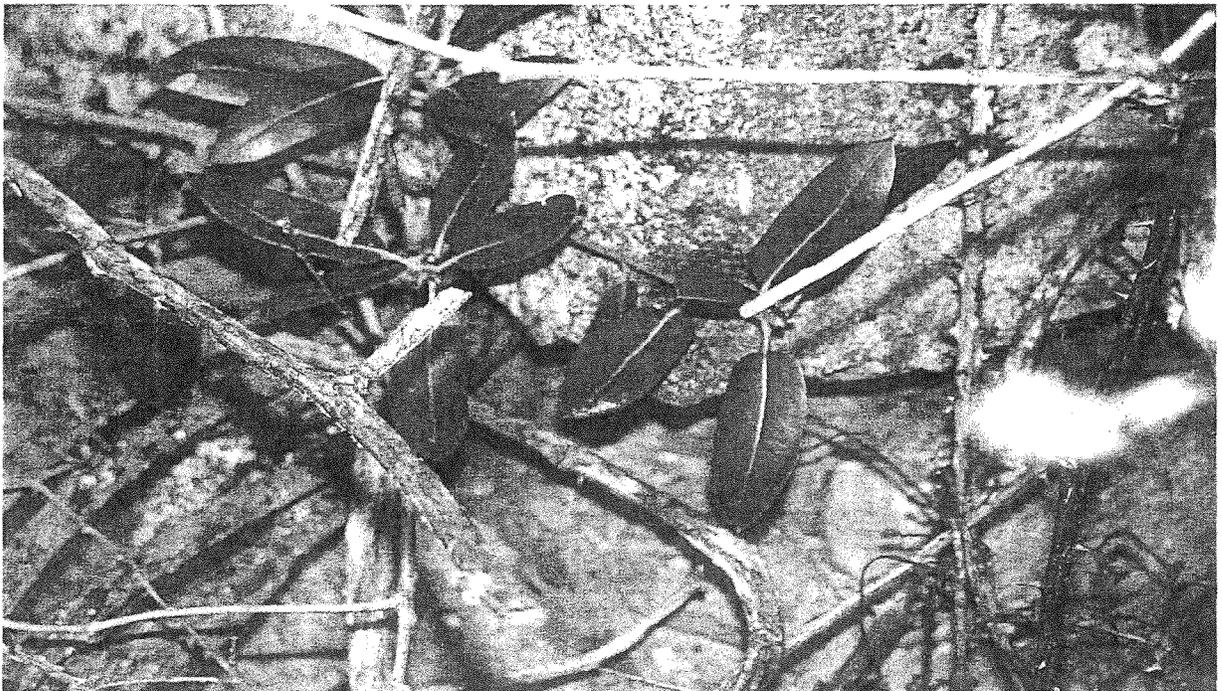
cc: Mr. Larry Ford  
Department of Water Resources  
1416 9th Street  
Sacramento, California 95814

Mr. Mike Daly  
City Manager  
Jackson City Hall  
33 Broadway  
Jackson, California 95642

Mr. Ken Foley  
Attorney at Law  
116 Court Street  
San Andreas, California 95249-1269



Section of Face of Argonaut Mine Dam



Close-up of blackberry bushes growing in cracks in dam.



Rain water runoff flowing over the top of Argonaut Mine, April 4, 2006.



Rain water runoff flowing over the top of Argonaut Mine, April 4, 2006.

Files

JUN 9 2003

Ms. Cynthia K. Holt, P.E., Senior Project Engineer  
Transportation Services  
T.Y. Lin International  
10365 Old Placeville Road, Suite 200  
Sacramento, California 95827

Subject: Argonaut Dam, No. 478 (Out of Jurisdiction)

Dear Ms. Holt,

This is a response to your May 30, 2003 inquiry pertaining to the jurisdictional status of Argonaut Dam.

The Argonaut Dam, No. 478, was removed from the State jurisdiction for safety on May 30, 1933. The dam became non-jurisdictional because inspection found that the reservoir storage capacity was less than 15 acre-feet due to the mine tailings deposits.

If you have any questions, please contact Regional Engineer Richard Baines at (916) 227-4622 or Office Engineer Chuck Wong at (916) 227-4601.

Sincerely,

Original signed by  
David A. Gutierrez

David A. Gutierrez, Acting Chief  
Division of Safety of Dams  
(916) 227-4660

CBWong:tg  
Argonaut Mine.wpd  
Spell Checked 6/6/03

C.B. Wong 6/6/03

*RF Delgado*  
6/6/03

September 25, 1933

Argonaut Mining Company  
Jackson, Amador County  
California

Attention: Mr. W. E. Scott, Jr.  
SUBJECT: ARGONAUT DAM #478

Gentlemen:

There was adopted at the recent session of the State Legislature and approved by the Governor an amendment (Chapter 808, Statutes of 1933) to Section 2 of the Act Governing the Supervision of Dams (Chapter 766, Statutes of 1929) as follows: "The word 'dam' whenever used in this act shall mean any artificial barrier, whether heretofore or hereafter constructed, together with appurtenant works, if any, across a stream channel, water course or natural drainage area, which does or may impound or divert water, which is or will be either twenty-five feet or more in height from natural streambed to crest of spillway, or which has or will have an impounding capacity of fifty acre feet or more; provided, however, that any such barrier which is or will be not in excess of six feet in height, regardless of storage capacity, or which has or will have a storage capacity not in excess of fifteen acre feet, regardless of height, shall not be considered a dam within the meaning of this act; and provided further, that no obstruction in a canal used to raise or lower water therein or divert water therefrom shall be considered a dam within the meaning of this act."

In accordance with the terms of this Act as amended and the information of record in this office the department will no longer have jurisdiction over the above dam after the effective date of this amendment (August 21, 1933). Any orders or approvals previously issued will, on that date, be of no further effect and thereafter no action concerning this dam will be taken by the State Engineer nor be required of you by the State Engineer unless the dam is altered or operated in such a manner as to again bring it under jurisdiction within the terms of the Act as amended.

Very truly yours,

cc-Debris Commission

  
STATE ENGINEER

Cracks.

MEMORANDUM TO MR. HAWLEY

ARGONAUT DAM #478

Inspected February 6, 1933  
Report written February 16, 1933  
By  
G. F. Engle

This was my first inspection of the dam and was made without having read any of the reports of former inspections by representatives of this department, or in any other manner being familiar with the physical condition of the dam.

Water was flowing over one of the two spillway entrance channels to a depth of 3 inches, the second channel being closed by flashboards.

An examination of the downstream face of the dam disclosed crown cracks in most of the arches and cracks about 1 ft. parallel to the springing line of the extrados. It is significant that these latter occur for the most part near and parallel to the spring line on the right end of the arches (looking upstream). The general condition and location of both crown and "spring line" cracks is shown on the attached sketch in perspective, plan and elevation.

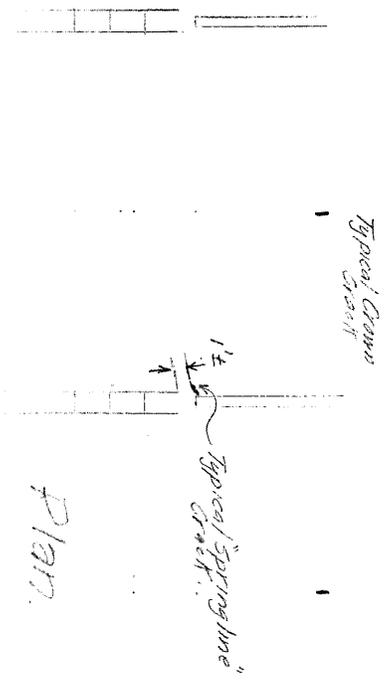
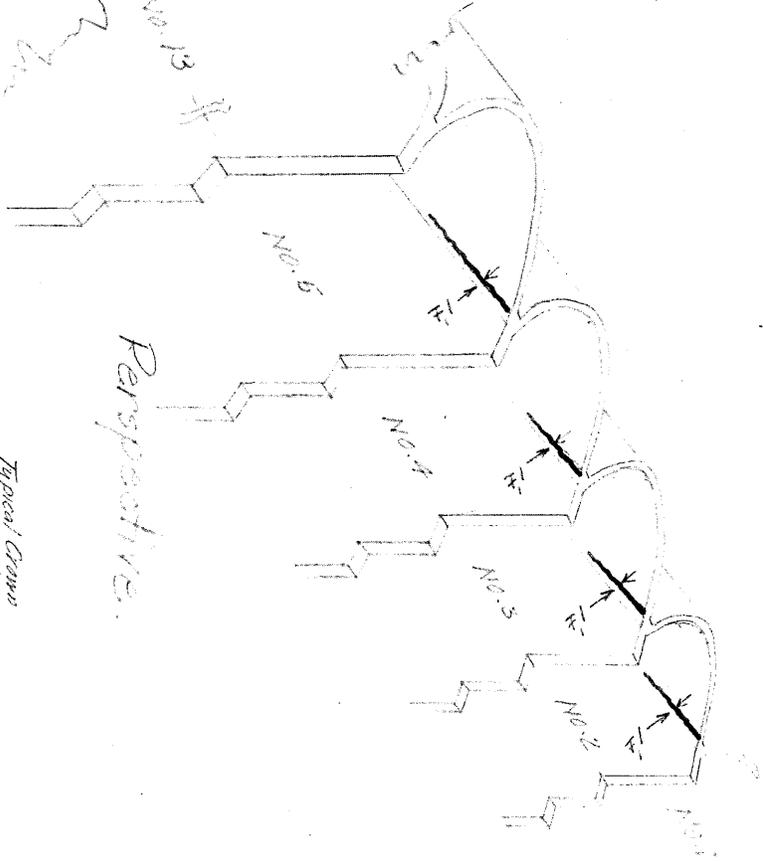
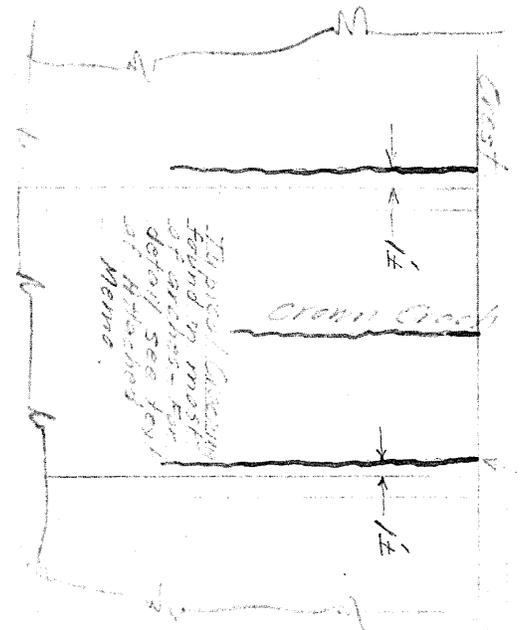
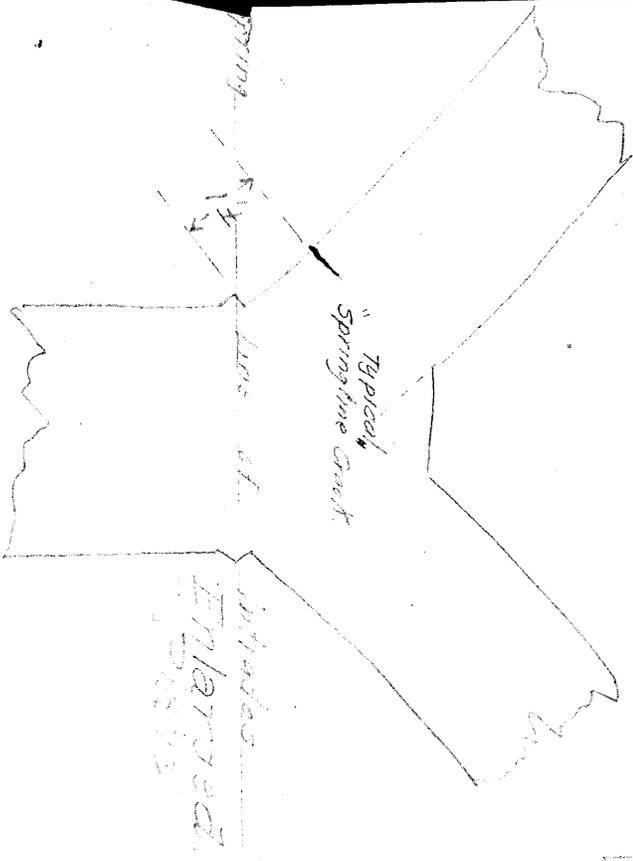
Both crown and "spring line" cracks begin at the crest of dam and extend downward for vertical distances which are more or less indeterminate since the cracks seem to be open a maximum at the crest and gradually play out as hair cracks or terminate at a construction joint or joint between successive concrete pours. They are usually traceable for a distance of 10 feet or more.

Numbering the arches from right to left looking upstream I found in

- Arch #2 - Crown crack and "spring line" cracks at both ends of arch.
- Arch #3 - " " " " " " " " " " " "
- Arch #4 - A skewing crown crack.
- Arch #5 - A partial crown crack.
- Arch #6 - A "spring line" crack on the right from crest about 10 feet down, and a crown crack.
- Arch #7 - "Spring line" crack on right.
- Arch #8 - Crown crack.
- Arch #9 - Slight "spring line" crack at right end. This arch leaks more than any of the others, the face being uniformly wet.
- Arch 10 - Crown crack top to bottom. A typical diagonal buttress crack is found in buttress between arches 9 and 10.
- Arch 11 - "spring line" crack on right end from crest to 15-20' down.
- Arch 12 - "Spring line" crack on right and crown crack.

Had I known, as I subsequently found out upon return to the office, that these cracks apparently represent new developments since prior inspection, I should have measured and diagramed them more closely and attempted to photograph them carefully. This I will do the next time I am in the vicinity of the dam.

If these cracks did not exist at time of former inspections (roughly a year ago) then something has happened to the structure since then. The recent earthquake disturbance centering in Nevada (approximately 2 months ago) may have influenced the present condition. There is also a possibility of local earth movement due to



ARGONAUT DAM - No. A18

Sketch to Accompany  
Report of G.F. Engle.

Feb. 7, 1932

G.E.G.

No Scale.

*Juris  
out*

MEMORANDUM TO MR. HAWLEY

ARGONAUT DAM #478

Inspected May 26, 1933  
Report written June 5, 1933

By  
G. F. Engle

JUN - 5 1933 S.A.H.

Accompanied by Mr. Drew, I made a survey of the reservoir area and obtained a silt profile at the dam.

The water stored above the surface of the silt deposit, which partially fills the reservoir, is found to be less than 15 acre feet. Considering only this free storage, the dam will not remain in jurisdiction under the provisions of the pending amendment to the present law, if and when it becomes effective.

GFE:BM  
(June 5, 1933)

*On Mar. 7, 1937 the undersigned stopped at the dam and noted that there was no material change.*

*W. P. Perkins*

JUN - 6 1933 E.K.B.

Filed by E. W.

STATE OF CALIFORNIA  
DEPARTMENT OF PUBLIC WORKS  
DIVISION OF WATER RESOURCES

MAR 1 1933 S.A.M.

INSPECTION OF DAM

Name of dam Argonaut Dam No. 478  
 Type of dam Multiple arch Type of spillway Overflow channel  
 Water is 0.1 feet above spillway crest and 1.1 feet below dam crest.  
above, below above, below

Contacts made None  
 Detail in question Study of cracks in arches  
 Action taken None necessary

Remarks\*

The inspection was primarily for the purpose of studying the cracks discussed by Mr. Engle in his memorandum of February 16, 1933. Previous memoranda had but casually mentioned cracks and it was thought there might be some new developments. Careful study leads to the conclusion that the cracks are not of recent formation, as indicated by the deposits of lime on the downstream face at the cracks and by the fact that the edges and visible surfaces at the cracks have the appearance of weathering for a considerable period of time.

The downstream view of the cracks at the left end of arches 1-2 and 2-3 counting from the left end of the dam is shown in photos #1 and #2. Arch 2-3 is the only one which shows a similar crack at the right end. Photo #3, at the top of buttress #7, shows the typical appearance of the cracks at the top of the arch. These cracks can be traced for a distance of only 12 or 15 feet downward from the top of the dam.

As they do not conform with the usual stress action in an arch, the most logical explanation that occurs to the writer is that they are caused by temperature action. The axis of the dam runs nearly north and south and the left end of the arches near the t is exposed more directly and for a greater length of time to the direct rays of the sun than any other part of the dam. This causes a much greater range of temperature in this region which may be the reason for the cracking.

As discussed in memo of May 25, 1930, there is a typical crack in most of the higher buttresses, but this typical crack starts at the springing line at about 1/4 the height of the buttress instead of 1/2 as shown in the sketch accompanying the memorandum 2/25/30. In buttress #7, however, there is a second crack starting at about .4 the height of the spring line and extending below the present ground line. The maximum width about the mid length of the crack is 1/16". The apparent movement of the buttress is downward the part upstream and upward for the downstream portion.

The strut extending through the six higher bays (5 to 10, incl.) shows good continuity without cracking except at the two ends, where it has pulled away from its anchorage at the buttresses, leaving a crack of 1/4" in width.

At the left end there is a slight displacement downward and upstream of the strut with respect to the buttress. Photo #4 shows the condition at the left end of the strut.

Typed by EM  
 Date 3/9/33  
 cc for

\*Note any change in conditions since last inspection such as: seepage; erosion; deterioration of materials; cracks; method of operation; use of flashboards; etc.

Inspection by W.A. Perkins & G.F. Engle  
 Date of inspection 2/23/33  
 Date of report 2/24/33  
 Photos taken? Yes  No

Filed by E. W.



Photo #1.  
Crack at left end of arch 1-2.



Crack at left end of arch 2-3. (Photo #2).

Argonaut Dam #478  
Inspected Feb. 23, 1933 by W.A.P.&G.F.E.

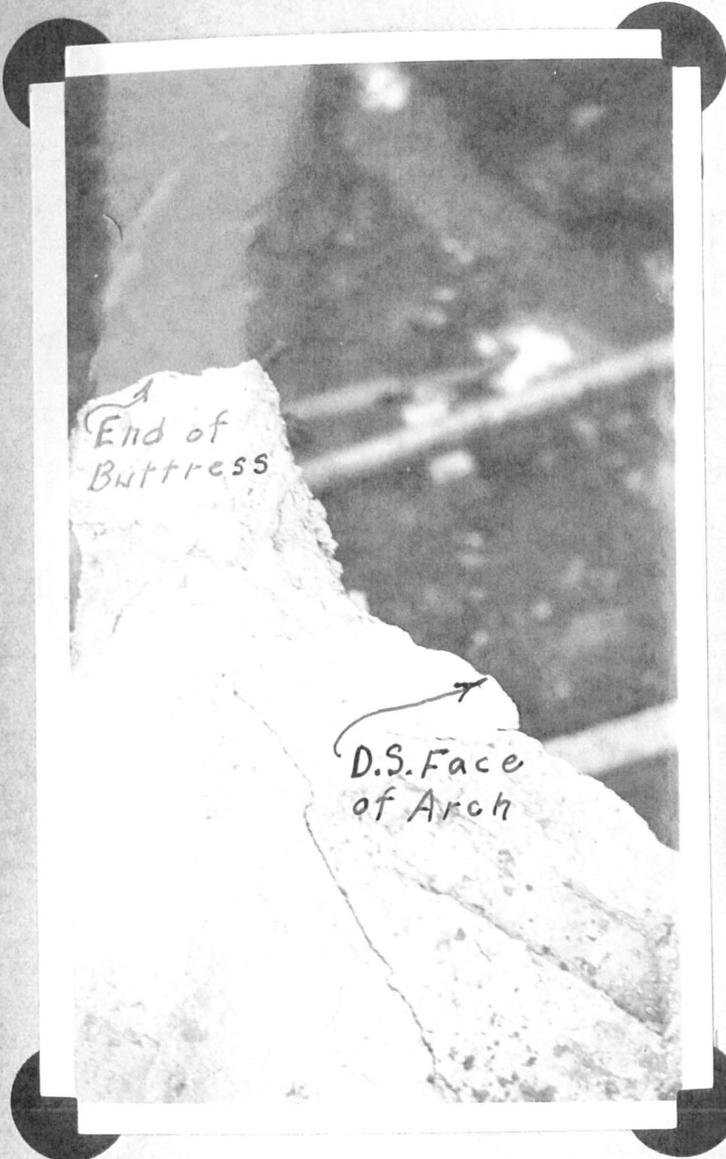


Photo #3. Crack at top of buttress # which is typical of the cracked condition of the left end of the arches.

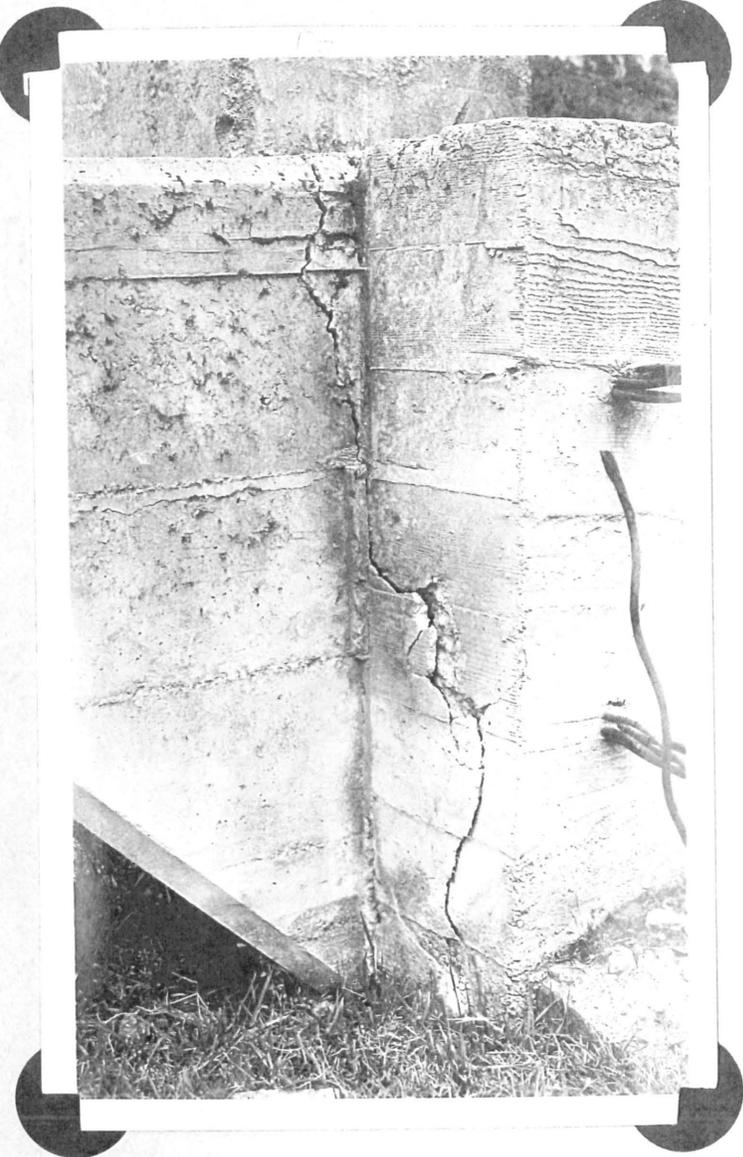


Photo #4. Crack at left end of strut between buttresses.

Argonaut Dam #478  
Inspected Feb. 23, 1933 by W.A.P. & G.F.E.

State of California  
Department of Public Works  
Division of Water Resources

# Certificate of Approval

of

ARGONAUT DAM

(Constructed prior to August 14, 1929)

This Is To Certify, That ARGONAUT MINING COMPANY

of Jackson County of Anador State of California, on November 12, 1929

filed Application Number 478, for approval

of the Argonaut dam located in S<sup>W</sup> 4, Sec. 20, T6N., R1E., M.D.B. & M. in Anador County,

State of California; that the State Engineer caused an examination to be made of said dam and finds the same to be safe for use to the full extent for which use will be made as stated in said application.

Now, Therefore, The said dam is hereby declared safe for use in accordance with the findings as hereinabove set forth.

Witness my hand and the Seal of the Department of Public Works of the State of California

this 27th day of July 19 32

EDWARD HYATT, State Engineer

*General  
Further Investigation*

JUL 17 1932 S.A.H.

MEMORANDUM TO MR. HAWLEY

ARGONAUT DAM #478

Inspected July 13, 1932

By  
S.A. Hart

I inspected the above structure in company with Mr. Holsinger on the above date and find that the water surface is within approximately 1 foot of the crest of the dam and that flashboards are being used in the spillway. The entrance to the spillway has been cleaned out.

In attempting to locate the muck in the reservoir with a stick, I find that apparently there is some density of the same approximately 6 feet below the surface. This is not definite as it is impossible to determine the point at which the material begins to thicken up.

There appeared to be a slight increase in leakage from the toe of one of the arches. I believe that it is advisable for Mr. Engle to make a more thorough inspection of this feature than it was possible for me to do. It may be advisable to request the owner to drain this particular arch in order that we may observe the location of the leakage. From appearances I would say that it was issuing from under the arch probably in the blocky material which constitutes the foundation.

SAH:BM

Form 41  
Cert. No. 414

State of California  
Department of Public Works  
DIVISION OF WATER RESOURCES

Dam No. 478

JUN 3 - 1932 E. K. R.

Resume of Investigations Leading to Approval of Dam

GENERAL DATA

Name of Dam Argonaut Owner Argonaut Mining Company  
Type Multiple Arch Date Completed 1916  
Legal Height 46 Reservoir Capacity small Drainage Area 0.05  
acre-feet square miles

APPLICATIONS

For Approval	: Old Dam	: Construction:	:	:
Received	: <u>11-12-29</u>	:	:	:
Approved	:	:	:	:
Work Completed	:	:	:	:
Estimated Cost	:	Fee Paid	Final Cost	Extra Fee Pd.

APPLICANTS DATA SUBMITTED

Maps and Plans Yes Consultants Reports -----  
Capacity Curve of Reservoir ----- Geological Reports -----  
Final Construction Drawings ----- Record of Gauge Heights -----  
Foundation Record ----- Grouting Record -----  
Concrete Tests ----- Map of Location Points & Bench Marks -----  
Other Data -----

COOPERATING AGENCIES

Water Rights. Clearance Received Unnecessary  
R. R. Com. notified of approval of Plans "  
U. S. Forest Service. Clearance Received "  
Federal Power Commission. Clearance Received "  
California Debris Commission. Clearance Received " (See letter 5-4-31)  
Other Federal Agencies -----

OFFICE ANALYSIS

Stress Analysis satisfactory Yes Summary Attached -----  
Made by D. W. Morrison, J. C. Monaghan and D. S. Cleavinger  
Spillway Analysis Satisfactory Yes Summary Attached -----  
Made by L. E. Millerd

FIELD INVESTIGATIONS BY STATE

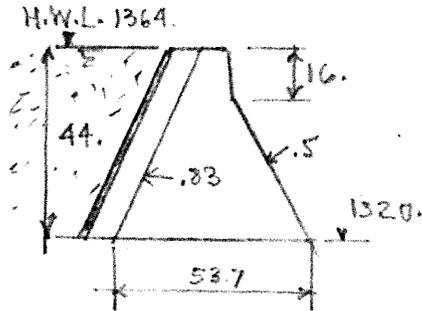
Geological Investigations satisfactory Not necessary  
Made by -----  
Engineering Investigations satisfactory Yes  
Made by I. Nelidov, W. H. Holmes, G. E. Goodall, S. A. Hart  
Other Field Investigations -----

REMARKS

MULTIPLE ARCH OR FLAT DECK DAM  
ANALYSIS

Name of dam ARGONAUT Type BUTTRESS MULTIPLE ARCH

Weight of concrete per cu. ft. 144. :  
Length of crest overall 390.1 :  
UNIT WT OF DEBRIS PER C.F.T. 90. # C.F.T. :  
BUTTRESS DETAILS :  
Ctr. to ctr. buttresses 32. :  
Percentage horiz. steel 1 1/2" cables @ 1' c/c :  
Percentage vert. steel :  
SLAB OR ARCH DETAILS :  
Central angle 100° :  
Radius to extrados 20.89 :  
Percentage of horiz. steel :  
REF. DWGS: SHEET #2 OF BPT SET. :



Sketch of maximum section  
SEA LEVEL DATUM

METHOD OF ANALYSIS LINEAR DIST. OF VERT. NORMAL STRESSES. RECTANGULAR BASE OF BUTTRESS WAS USED IN STRESS COMPUTATIONS.  
DEBRIS TO ELEV 1364 (90.# C.F.)

Elev. of section considered	Concrete stresses in buttress				Principal Stress Up-Down	Max shear down-stream	Stability factor	Overturn factor	Steel stresses in buttress	
	Vertical Nor-mal stress	Up-Down	stream-f min.	stream-f max.					Horiz. steel	Vert. steel
No Debris 1320	127	90	+13	113	56	.8	3.6	-	-	
Debris 1320	155	125	-11	156	78	.9	3.3	-	-	

All stresses in lbs. per sq. inch. Compressive stresses indicated by plus (+)

Elev. of section considered	Slab Stresses			
	Stress in conc. fc	Stress in steel fg	Bond stress W	Shear stress V
:	:	:	:	:
:	:	:	:	:
:	:	:	:	:
:	:	:	:	:
:	:	:	:	:
:	:	:	:	:
:	:	:	:	:

REMARKS: INSPECTIONS: W.H. HOLMES, G.E. GOUDALL  
1/16/30 - 5-25-30. - NEARLY ALL ARCHES SHOW CRACKS AT EXTRADOS AT ABUTMENTS; SEVERAL BUTTRESSES SHOW DIAGONAL CRACKS STARTING FROM HAUNCHES OF ARCHES AND EXTENDING INTO BUTTRESSES FOR ABOUT HALF OF LENGTH FEW LEAKS THRU ARCHES & SOFTENED SOIL AT BUTTRESSES  
S.A. HART - 5-14 & 15-30 - LEAKAGE THRU THE DAM FACE. SPILLWAY CHOKED WITH GROWTH.

RECOMMENDATIONS: TO BE APPROVED, AS THE STRESSES ARE CONCERNED. NOTE CRACKS IN BUTTRESSES. GEOLOGY STUDY SUGGESTS

Computed by D.W. MORRISON 7-22-1931.  
J.C. M. (Debris Load)

Checked by J. Monaghan  
H. Von Bergen 4-16-31/1931.  
I.N. 4-16-31

Files

STATE OF CALIFORNIA  
DEPARTMENT OF PUBLIC WORKS  
DIVISION OF WATER RESOURCES

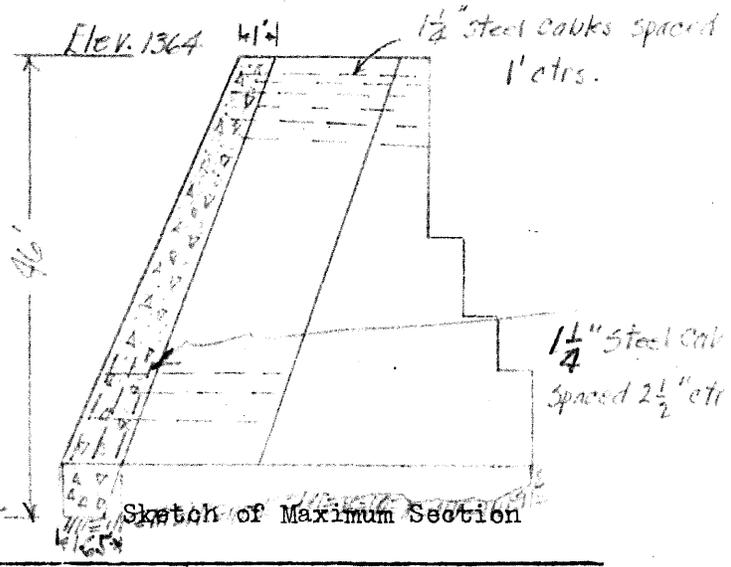
FEB 26 1931 S.A.H.

Dam No. 478

ARCH DAM ANALYSIS

Name of Dam ARGONAUT Type of Dam MULTIPLE ARCH

Height foundation to dam crest 46'  
 Elevation Crest of Dam 1364  
 Water surface elev. used for analysis 1364  
 Length of Crest 392'  
 Crest Thickness 1.0'  
 Base thickness 1.65'  
 Upstream radius at crest 20.89'  
 Upstream radius at base 20.89'  
 Central angle at crest 100°  
 Central angle at base 100°  
 Reinforcing steel As shown in the sketch  
 Contraction joints None  
 Contraction joints grouted  
 Debris storage to elev. 1364  
 Reference Drawings No. 1-2-3-4 Date Dec. 30, 1930  
Gravity Abutments: 12 @ 32 ft. centers



Method of Analysis : Elastic Theory for water load, dead load, and  $\pm 20^\circ$  Temp. change.  $1/2$ " steel cables were used for the steel reinforcing and the calculations for the stresses in the steel have been omitted.

Maximum Arch Stresses	Concrete	Steel	Elev.
Crown Extrados	+52.8		1318
Crown Intrados	+190		1318
Abutment Extrados	-58		1354
Abutment Intrados	+75.5		1318
Abutment Shear	21		1318
Maximum Cantilever Stresses			
Extrados			
Intrados			

NOTE: All stresses in lbs. per sq. in. and compression unless preceded by minus sign indicating tension.

Remarks: Arch design satisfactory.

*[Handwritten signature]* 2-26-31

Computed by D.C. 7-3-1930. Checked by JCM 2-11-1931.

STATE OF CALIFORNIA  
DEPARTMENT OF PUBLIC WORKS  
DIVISION OF WATER RESOURCES

Files  
MAR - 1931 S.A.H.

ANALYSIS OF SPILLWAY

No. 478

Name of Dam Argonaut Type Multiple Arch

Flooded Area Spillway Crest \_\_\_\_\_ Acres:

Sketch of Spillway

Drainage Area 0.05 Sq. Mi.:

Res. Capacity to Spillway \_\_\_\_\_ A. F.:

Res. Capacity above Spillway \_\_\_\_\_ A. F.:

Minimum Allowable Freeboard \_\_\_\_\_ Feet:

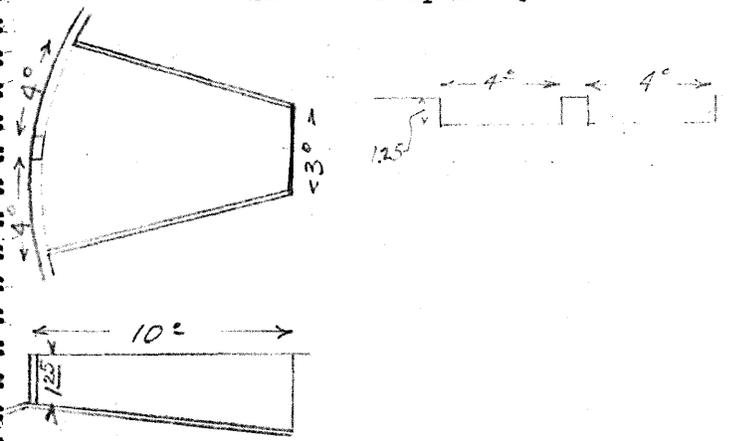
Maximum Detention Available \_\_\_\_\_ A. F.:

Spillway Discharging Formula  $Q = 3.09 LH^3$

Authority for coefficient

Maximum Discharge to Elevation \_\_\_\_\_ c.f.s.:

Crest is 34 Elevations \_\_\_\_\_ Datum  
Elev. of Dam = 1500 ±



HYDROGRAPHIC DATA

	1/100 Year		1/1000 Year	
	Total	Per Sq. Mi.	Total	Per Sq. Mi.
Mean Daily Run-off	5	92	7	136
Peak run-off	23	462	28	560
Hydrograph of Inflow made:	Tabular		Tabular	
Curve of Spillway Discharge	No		No	
Detention Curve				
Water Elevation Curve				

CONCLUSIONS OR RECOMMENDED ALTERATIONS

Does the Spillway have Sufficient Capacity 1/100 yes ; 1/1000 yes

Elevation of Highest Water..... 1/100 Crest ± ; 1/1000 Crest ±

Peak Discharge..... 1/100 23 ; 1/1000 28

Remarks Spillway Capacity is about equal to the peak flood flows.

Calculated by L.E.M. 9-26-1930, Checked by D.C. 3-4-1931.

MEMORANDUM TO MR. HAWLEY  
ON  
JURISDICTION

Argument NO. 478

MAR 8 - 1932 E. K. R.

By  
E. K. Rabitte  
Date 2-26-32

Height (original streambed on downstream side to spillway crest) 46 feet

Present Storage Capacity (water above debris) . . . . . probably over 10 ac.ft.

Depth of water above debris . . . . . 9 1/2 feet

Character of debris liquid for depth of 20 ft.

Stream runoff

Mean Daily (1-100) Flood Flow . . . . . 5 c.f.s.

Peak (1-100) Flood Flow . . . . . 23 c.f.s.

Character of country immediately below dam 200 yards above highway

Inspected by: Hart, Goodall, McKimley, Helms, (Helms)

Based on Mr. Robert Reed's memorandum on "Suggested rules for determining whether or not a given structure is a dam within the meaning of Chapter 766, Statutes of 1929" dated January 29, 1932, and also upon the discussion at the meeting held on February 23, 1932, at which were present Messrs. Burroughs, Holsinger, Reed, Hawley, Hart and Rabitte, it is the writer's opinion that the above structure

is a dam within the meaning of Chapter 766, Statutes of 1929.

Reasons for opinion: probably over 10 ac of water, and many times that amount of liquid mud (see Goodall memo 5-14-31)

Concurred in by:  
FEB 27 1932 S.A.H.  
Date Name

Approved by:  
[Signature]  
Date Name

MEMO CONCERNING GEOLOGY  
AT MULTIPLE ARCH DAM SITES

By  
Chester Marliave  
July 24, 1931

ARGONAUT DAM #478

Argonaut dam rests upon a hard dense diabasic rock of good quality, being tough, massive, and fairly resistant to the action of percolating water. For the type and height of dam the footings appear to be resting upon satisfactory material.

EW  
9/7/32

*Files  
478*

SEP 19 1932 E. K. R.

Filed by E. W.

# 478  
file

MEMORANDUM

June 19, 1931

Kennedy Dam #477  
Argonaut Dam #478

Mr. T. S. Stanton:

In compliance with Mr. Hyatt's request of May 20 tests have been made on samples of mining debris from the Kennedy and Argonaut Dams which were delivered to the Laboratory by Mr. Goodall of the Division of Water Resources.

The following tests were made on samples and a composite sample from each of the dams was turned over to Mr. Lichthardt for chemical analysis of soluble matter:

1. Moisture Content
2. Volume Weight Ratio
3. Weight per Cubic Foot
4. Sieve Analysis
5. Specific Gravity of Dry Material
6. Lateral Pressure

The percent of water reported is by weight and is based on the dry weight of material.

The volume weight ratio and the weight per cubic foot tests are for the semi liquid and plastic state of the samples as received. The results of these tests are as follows:

Tests on Samples as Received

<u>Sample No</u>	<u>% Water</u>	<u>Volume Weight Ratio</u>	<u>Wt. Per. Cu. Ft.--Lbs.</u>
478-1	89.1	1.48	92.2
478-2	68.5	1.58	98.6
477-A	93.2	1.49	93.0
477-B	64.1	1.63	101.7
477-C	52.8	1.67	104.2

Grading analysis and specific gravity tests were made on a composite sample from each of the dams. The apparent specific gravity shown is of course for dry material.

Tests on Average Samples

Grading Analysis

<u>Sieve</u>	<u>Total Percent Passing</u>	
	<u>Sample #478</u>	<u>Sample #477</u>
325 mesh	72.2	99.8
250	74.8	
200	75.6	
100	80.8	
80	82.6	
50	87.8	
40	90.4	
30	93.4	
20	97.8	
10	99.8	
3	100.00	

<u>Sample No.</u>	<u>Specific Gravity</u>
478	2.63
477	2.70

The lateral pressure tests were made in a 6" cylindrical mold 6" high which is cut or split to allow expansion. The mold is reinforced along the vertical wall on each side of the opening with angle irons which are fitted to conform with the cylindrical sides. Suitable bearing blocks are attached to these angle iron fittings and a hydraulic jack equipped with a gauge and fitted in a frame attaches to the bearing blocks holding the mold closed and measuring the expanding pressure. Load is applied to the material in the mold through a piston from a testing machine and gauge readings taken at various pressures.

The samples of mud varied from almost a semi liquid to a plastic state. It was necessary, therefore, that a water-tight expanding container be used for holding the material within the mold. A container consisting of a rubber tube held with steel plates top and bottom was used for this purpose.

The equipment was first calibrated by obtaining the pressures for water and then the various samples of debris, with the exception of 477 C, were tested in the same manner. Insufficient material of sample 477 C was available for test and, even after material from 477 A was reduced to the water content of sample 477 C, there was not enough material to make the test using the rubber container. An attempt was made to run the test on the limited amount of material available by placing a rubber gasket between the material and the piston. The mud, however, under pressure went past the rubber and escaped. A few readings were obtained in this unsatisfactory manner which were somewhat higher than those for water. The rubber gaskets crushed into the cracks between the piston and the cylinder wall and this may account for the increased lateral pressures obtained.

Altho not requested by the Division of Water Resources, additional tests were made on material from the Kennedy Dam #477 with lesser amount of water than contained in the samples as received in order to determine what condition or state of this material would be necessary to obtain a considerable reduction in lateral pressures.

One test was made on material containing 20% of water and another with 30% of water. The sample with 20% of water did not contain sufficient moisture to be called damp and was very crumbly and mealy. The sample with 30% of water was moistened sufficiently so that it would pack fairly well in the hand, but would not stick to the hands or leave them moist.

Both of these samples were run in the mold without the rubber gaskets and were compacted before testing with a total load of 6000 pounds or 212 pounds per square inch.

The lateral pressures in pounds per inch of height and percent of that obtained with water are as follows:

## LATERAL PRESSURE

Vertical Load		Pounds per Inch of Height						
Total	Lbs. per		478.1	478.2	477-A	477-C	477	477
Lbs.	Sq. In.	Water	89.1%	68.5%	93.2%	52.8%	20%	30%
			Water	Water	Water	Water	Water	Water
400	14	85	75	90	90			
600	21	100	100	100	100	100		
800	28	120	115	130	115	135		
1000	35	135	125	140	140	200	90	
1200	42	150	140	155	150		90	
1400	50	170	165	165	165		90	105
1500	53					205		
1600	57	185	175	180	175		90	145
1800	64	205	190	190	200		90	145
2000	71	230	215	205	225	255	130	145
2200	78	240	225	230	240		130	145
2400	85	270	250	255	265		130	145
2500	89					325		
2600	92	280	280	270	290		135	145
2800	98	300	290	295	300		140	160
3000	106	325	305	305	330	390	145	160
3500	124	385	355	370	380		155	160
4000	141	450	405	420	455		170	180
4500	158	500	465	470	500		185	180
5000	177	560	520	535	550		200	215
5500	194	615	570	560	620		230	215
6000	212	680	620	610	680		250	230
Height Spile. Tested 3.94"			3.96"	3.92"	3.97"	2.94"	2.73"	2.80"

## LATERAL PRESSURE

Vertical Load	Percent of Hydrostatic					
	476-1	476-2	477-A	477-C	477	477
Lbs. per Sq. In.	89.1% Water	68.5% Water	93.2% Water	52.8% Water	20% Water	20% Water
14	88	106	106			
21	100	100	100			
28	96	108	96	113		
35	93	104	104	148	67	
42	93	103	100		60	
50	97	97	97		53	62
53				116		
57	95	97	95		49	78
64	93	93	98		44	71
71	94	89	98	111	57	63
78	94	96	100		54	61
85	93	95	98		48	54
89				118		
92	100	97	104		48	52
98	97	98	100		47	53
106	94	94	102	120	45	49
124	92	96	99		40	42
141	90	93	101		38	40
158	93	94	100		37	36
177	93	96	98		36	38
194	93	91	101		37	35
212	91	90	100		37	34

Figure I. Hydraulic Jack, Expanding Mold  
and Rubber Walled Container used in lateral  
pressure determinations

*See next page  
include for pictures*

Figure II. Equipment assembled ready for  
placing in the testing machine.

Our equipment is not particularly adapted for this work, as explained to Mr. Goodall before the request for testing was made, due to the fact that it was designed to handle higher pressures.

More consistent and accurate results would have, no doubt, been obtained with a one ton jack and a 2000 pound gauge instead of the seven ton jack and the 6000 pound gauge used.

Friction of the piston, sluggishness of the gauge, and accuracy in reading were such that we obtained a variation of 50 to 100 gauge reading or about 10 to 30 lbs. per inch of height on successive runs with the same sample. This is, of course, a considerable percentage in the lower range of pressure.

The lateral pressures shown, however, are averages for four or more runs in all cases, except for sample 477-C, and indicate, in my opinion, that material submitted (#478-1, 478-2, 477-A-B-C) would have practically hydrostatic properties in respect to transmission of pressures under loads of 20 or more pounds per square inch. This is confirmed somewhat by tests we have made previously showing stability of 5% to 15% or lateral pressures of 85% to 95% of that with water for stiff clays under loads of 75 to 2000 pounds per square inch. The load and pressure with such sands would, of course, be higher at a given depth than with water due to the increased weight of the material.

Mr. Goodall was present during the performance of a large number of these tests and is, I believe, familiar with any additional details regarding the work.

O. J. Porter,  
Jr. Testing Engineer

OJP:TIM

STATE OF CALIFORNIA  
DEPARTMENT OF PUBLIC WORKS  
DIVISION OF HIGHWAYS

TESTING AND RESEARCH LABORATORY

REPORT OF TESTS

OF

Mining Lebris from Argonaut Dam #478

Test No. 59485

Div. of Water Resources Date reported June 19 19 31  
Division County Route Section  
Contract No. Federal Aid Project No.  
Contractor  
Source of supply Argonaut Dam

Manufactured by  
Sampled from Argonaut Dam  
Sampled by Title  
Sampled May 20 19 31 Received May 28 19 31  
Quantity represented  
Being used or proposed for use  
To be used for

Examined for

TEST RESULTS

477 A

Original Material

Moisture 54.52%  
Dry material 55.48%  
Water soluble original material

Water soluble original material

Total soluble Material .0710%  
Carbonates as CO<sub>2</sub> Nil  
Bicarbonates " HCO<sub>3</sub> .0405%  
Sulphates " SO<sub>4</sub> .0083%  
Chlorides " Cl .0032%  
Alkalis " Na .0033%

Remarks: This material should not effect concrete (Soluble Material)

DIV.

NOTE.—Original (White) to Div. Eng'r. or Bridge Dept.  
Duplicate (White) in Test. Lab. File.  
Triplicate (Blue) to Hdqrs. Const. Dept.  
Quadruplicate (Orange) to Res. Eng'r.

*W. G. Lentz*  
Testing Engineer

STATE OF CALIFORNIA  
DEPARTMENT OF PUBLIC WORKS  
DIVISION OF HIGHWAYS

TESTING AND RESEARCH LABORATORY

REPORT OF TESTS

OF

Water

H478

Test No. 59595

Div. of Water Resources Date reported June 19 1931  
Division County Route Section

Contract No. Federal Aid Project No.

Contractor

Source of supply Argonaut Reservoir

Manufactured by

Sampled from Argonaut Reservoir

Sampled by Title

Sampled 19 Received May 29 1931

Quantity represented

Being used or proposed for use

To be used for

Examined for

TEST RESULTS

Parts per 1 000 000

Dissolved Solids 257 Suspended Solids

Dissolved Solids

Carbonates	as CaCO <sub>3</sub>	5
Bicarbonates	" HCO <sub>3</sub>	102
Total Hardness	" CaCO <sub>3</sub>	175
Temp. Hardness	" "	92
Perm. Hardness	" "	82
Sulphates	" SO <sub>4</sub>	157
Chlorides	" Cl	26
Alkalis calculated as Na		44
Alkali coefficient in ccs		11
Alkali rating		fair

Iron	as Fe <sub>2</sub> O <sub>3</sub>	
Alumina	" Al <sub>2</sub> O <sub>3</sub>	143
Silica	" SiO <sub>2</sub>	

DIV. WATER RESOURCES

Remarks:

NOTE.—Original (White) to Div. Eng'r. or Bridge Dept.  
Duplicate (White) in Test. Lab. File.  
Triplicate (Blue) to Hdqrs. Const. Dept.  
Quadruplicate (Orange) to Res. Eng'r.

*W. J. Henry*  
Testing Engineer

*Debris Conditions,  
Samples Obtained.*

*File*

MEMORANDUM TO MR. HAWLEY

ARGONAUT DAM NO. 478 AND KENNEDY DAM NO 477

Inspected by G. E. Goodall

May 14, 1931

*478*

MAY 29 1931 S.A.H.

The purpose of this inspection was to obtain samples of the mining debris stored at these dams in order that a determination of the loading conditions might be made.

ARGONAUT DAM

At the time of the inspection, the water surface was one foot below crest of dam. The first solid matter was encountered 8.5 feet below the crest but was too plastic to obtain a sample.

The first sample was obtained 20.6 feet below the crest.

The sample was obtained by pushing soil sampling tubing down into the material. In order that the samples might be as representative as possible of the actual conditions at the particular depth, 15 feet of tubing (3 sections) were connected and corked at the upper end and pressed down until the upper end of the tubing was level with the crest of dam. The next joint of tubing was corked at its upper end, the cork removed from the upper end of the first three sections, the new section screwed on and then the whole length of pipe pushed down another 5 feet with the cork in place. This method was continued until the desired depth was reached. The cork at the upper end was then removed to release any air pressure and the tubing pushed down again into the material. After a short pause the cork was inserted in the tubing and the process of withdrawal started. This was just the reverse operation of adding sections in going down. The sample would run out of the tube into the sample can when the tube was held in a vertical position and the cork removed from the upper end of the tube.

When the first sample was taken it was noticed that at a depth of 20.6 feet the tube could be pushed down with one hand.

The second sample was taken at a depth of 33.1 feet below the crest in the same manner. When the tubing reached this depth, it had required light driving with the hammer for the last 4 feet.

The depths were computed from the length of pipe and angle of inclination as read by a clinometer.

As soon as the samples were taken, they were placed in cans and sealed to prevent the loss of moisture.

#### KENNEDY DAM

At the time of inspection, the water surface was 1.5 feet below crest of dam. The debris was at the water surface along the face of the dam beginning at the right end and extending to the fourth arch from the left end. From this point to the right end of the arch, water was standing above the debris varying in depth gradually to about a foot and a half immediately in front of the spillway which is at the extreme left end of the dam. Along most of the front of the dam, it was noticeable that the debris stood on a very flat slope back from the dam. It is worthy of note that at the time of my previous inspection (a year ago) the debris was from 2 to 4.5 feet below the water surface.

The first sample "A" was taken from the upper 4 feet of debris. It was found that if a 5 ft. section of tubing was held with its lower end just at the debris surface and then suddenly released, that the tube dropped rapidly until it had penetrated 3 feet and then settled slowly until the penetration reached 4 feet and stopped.

The second sample was taken at a depth of 30 feet below the crest. In taking this sample, firm material was encountered at a depth of 22 feet and from that depth on, driving was resorted to. At the 30 ft. depth, the tube had been driven to refusal. When the tube was withdrawn, it was found that the lower end was stopped up with very firm material which was removed with considerable <sup>difficulty</sup> material. This was removed and placed in a can labeled Sample "C". This Sample "C" had the consistency of a nearly dry clay and would crumble between the fingers.

Above Sample "C" in the tube was a sample of plastic material quite similar to Sample "A" which was removed and sealed in cans labeled Sample "B".

It was found that in taking samples "B" and "C" that jacking was necessary to withdraw the tube.

#### Test Procedure

The debris specimens were all tested at the California Highway Commission's Testing Laboratory.

Specimens were tested to determine the weight in lbs. per cu. ft. and percentage of moisture. Sieve analyses were also made of the various specimens as well as chemical analyses of the soluble matter. Tests were also made to determine the lateral pressure exerted by the specimens for different vertical loads. As the last of these tests is the only one not in common usage and has the greatest bearing on the problem presented, it will be described in detail.

The apparatus consisted of a number of special pieces as follows. A mould constructed of rubber tubing 6 inches in diameter and 4 inches net height the ends of which were closed by circular steel plates. The upper of these steel plates was provided with a screw plug for filling and emptying the mould. (Fig. 1)

The rubber mould was inserted into a steel cylinder open at both ends. (Fig. 2) This cylinder was split along a vertical element so that lateral expansion of the material in the rubber mould would tend to increase the opening along this split side. On both sides of the split, angles were riveted to the walls of the cylinder and a small hydraulic jack provided with a pressure gage was used to measure the magnitude of the force tending to enlarge the cylinder. The split steel cylinder with rubber mould were placed in the testing machine and lateral pressures read from the pressure gage of the jack were recorded together with the corresponding vertical loads due to the testing machine.

As a means of calibrating the apparatus the first test was made with the

rubber mould filled with water. The later tests were then run on the various samples from the two dams.

All of the tests are not completed as yet and the final results will be submitted as soon as tests have been carried to completion.

### Results

The results presented herewith are those completed to date and give the weight in lbs. per cu. ft., percentage of moisture and the results of lateral pressure tests.

#### KENNEDY DAM NO. 477

Sample	Wgt./ft. <sup>3</sup>	Moisture	Apparent Sp. Gr. Dry material	Lateral Pressure
A	93#	93.2%	2.72	100%
B				
C	104#	52.8%	2.69	

#### ARGONAUT DAM NO. 478

Sample	Wgt./ft. <sup>3</sup>	Moisture	Lateral Pressure
1	92.2#		100%
2	98.6#		100%

The percentage of moisture is the weight of water divided by the dry weight of material.

Sample "C" from the Kennedy Dam presented many difficulties during the lateral pressure tests. The material was too firm to go into the small opening in the rubber mould and to be able to entirely fill the mould. It was then placed directly in the split cylinder as is done by the Highway in their tests. Because of the presence of over 50% moisture, it was anticipated that some leakage might occur. To prevent or minimize the leakage, rubber gaskets were placed between the debris and the steel pistons. The loading then proceeded as for the other specimens. Although some leakage did occur which detracts from the accuracy of the work it seemed that for exceedingly low loads the material did not exert lateral pressures as great as a liquid of the same weight but for vertical

pressures as great as existed on this debris in place, the lateral pressure was apparently as great as for a perfect fluid.

Although all of the tests are, as yet not completed, some findings of importance can be stated:

1. The unit debris weight used in the stress analyses, while not exact, is fairly representative. The unit weight used in the Kennedy analysis was 100 lbs. while the actual varied between 93 and 104. The unit weight for the Argonaut analysis was 90 with the actual weight ranging from 92.2 to 98.6.

2. It seems probable that the assumption that this debris exerted lateral pressures equal to the vertical pressures is approximately true.

3. The Argonaut dam was analyzed for a greater load than is now imposed on it due to the fact that the analysis assumed debris to the crest but it is, at present, about 8.5 feet below the crest. Should mining operations continue however, it will eventually be subjected to the load used in the analysis.

CCRLC  
GEG:MM

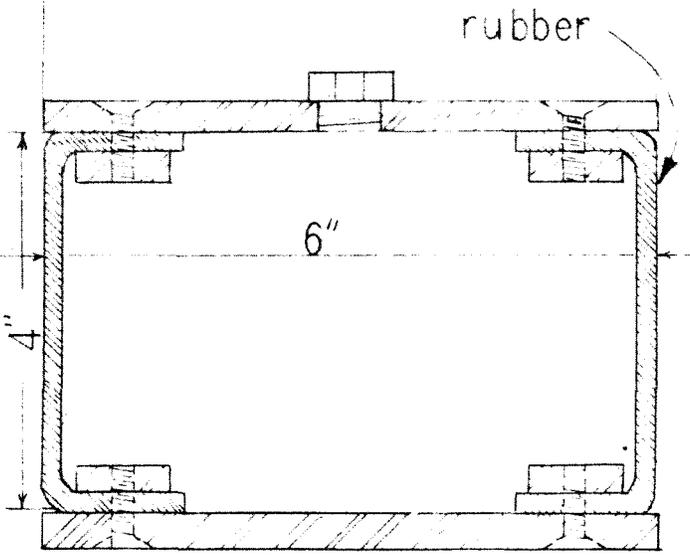
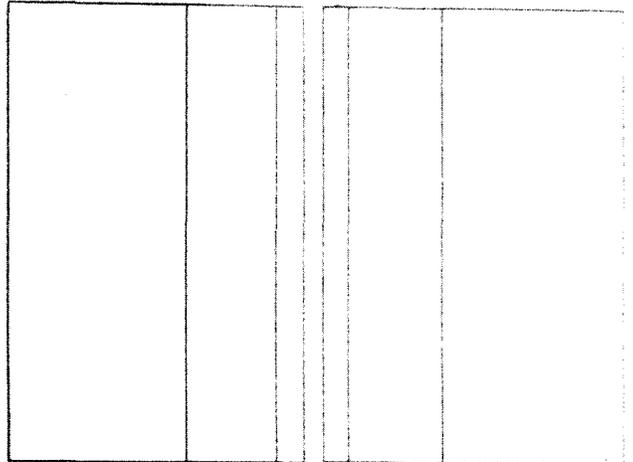
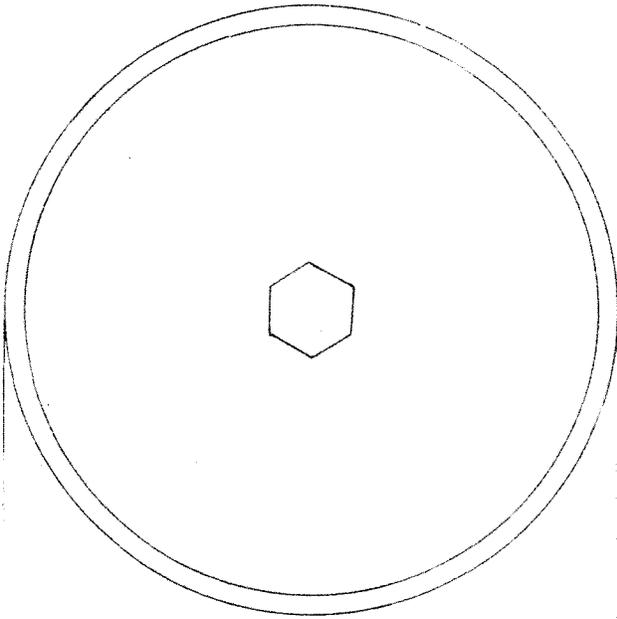
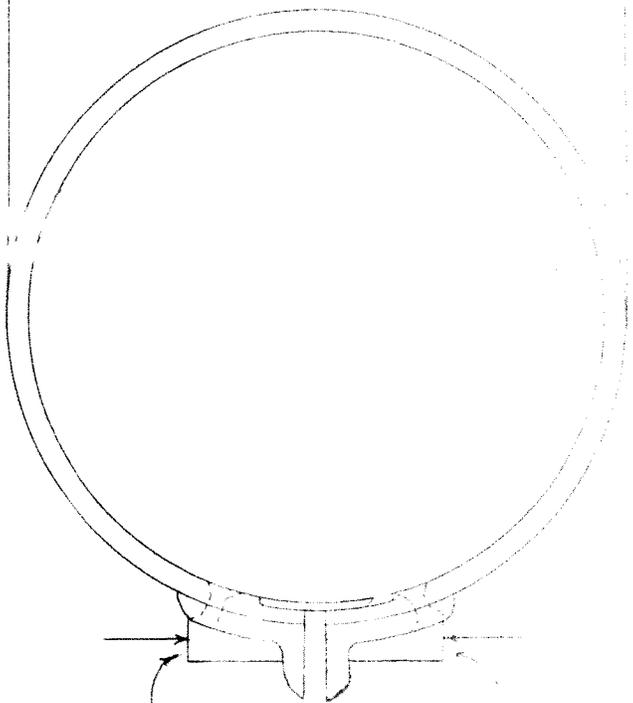


Fig 1



jack applied here  
Fig 2

May 12, 1931

*File  
Argonaut Dam 478*

Mr. W. L. Huber  
Crocker First National Bank Building  
San Francisco, California

SUBJECT: ~~MULTIPLE ARCH DAMS~~

Dear Mr. Huber:

*Copy in  
477  
Original in  
file  
(see comment)*

Replying to your letter of May 7, 1931, relative to physical conditions of debris at the Argonaut and Kennedy Dams, we will endeavor to get reliable information as to the specific gravity and degree of solidification of the materials behind both of these dams at an early date. The matter will also be taken up with Mr. R. L. Egonhoff of the California Debris Commission to ascertain what data he has regarding the same matter.

As soon as the desired information is obtained it will be forwarded to yourself and the other members of the committee.

Very truly yours,

RM

Deputy in Charge of Dams

May 9, 1931

*Call up*  
*May 15, 1931*

California Debris Commission  
California Fruit Building  
4th and J Streets  
Sacramento, California

SUBJECT: ARGONAUT DAM #478  
KENNEDY DAM #477

Gentlemen:

We have been requested by a consulting board to obtain for them, if possible, some information on the character of the material against the above dams, particularly as to possible solidification.

We discussed with your Mr. Egenhoff, informally, the matter of acquiring some such information and would appreciate a further discussion and any suggestions you may offer us on the best method of obtaining this information.

Very truly yours,

SCH

---

Deputy in Charge of Dams

ADDRESS REPLY TO  
DISTRICT ENGINEER

WAR DEPARTMENT  
U. S. ENGINEER OFFICE  
CALIFORNIA FRUIT BLDG., 4TH & J STS.,  
SACRAMENTO, CALIFORNIA

REFER TO FILE  
No.

May 4, 1931.

Subject: Argonaut Dam No. 478.

Department of Public Works,  
To: State of California,  
Sacramento, Calif.

ATTENTION: Mr. Geo. W. Hawley, Deputy  
in charge of dams.

Gentlemen:

Receipt of your letter of May 1, 1931 is acknowledged.

The Argonaut Dam is not subject to the jurisdiction of the California Debris Commission, as it is not connected with hydraulic mining. However, this office as an Engineer Office has jurisdiction over operations which place debris such as mill tailings, so that they interfere with the interests of navigation or so that they are liable to be washed to where they will offer interference.

The Argonaut Dam is considered satisfactory as regards the interests of this office.

Very truly yours,

  
J. R. D. Metheson  
Major, Corps of Engineers, U.S.A.

MEMORANDUM TO MR. HAWLEY

ARGONAUT DAM #478

MAY - 1 1931 S.A.H.

Summary of Field Reports

By

S. A. Hart

April 30, 1931

The dam was completed in 1916.

Inspection by S. A. Hart May 14, 1930.

Water surface at spillway lip.

Some leakage through the structure, minor in quantity. Evidence of previous leakage of greater quantity which, for the most part, has ceased, probably due to silt from the slimes. There is some leakage beneath the toe, particularly at the center of the structure. There was no opportunity to observe the foundation as it is not exposed. Only very minor checking in the arch and buttresses. Reported as fair condition.

Inspected by W. H. Holmes, G. E. Goodall and I. M. Nelidov May 25, 1930.

Calls attention that nearly all arches show cracks at extrados at abutments. Also, several buttresses show diagonal cracks starting from haunches of arches and extending into buttresses for about half of length of the latter. Leakage same as described by Hart in memorandum of May 14, 1931.

Inspected by Gerald McKinlay March 24, 1931.

Cracks as previously noted were observed and are not considered serious.

Office Studies - Studies of stresses in buttresses and in the arches together with the results of spillway studies are contained on summary sheets attached.

There is no geological report on this site.

SAH:BM

*S. McKinlay*  
*Satisfactory*

Memorandum to Mr. Hawley

ARGONAUT DAM NO. 478

Inspected March 24, 1931

MAR 27 1931 S.A.H.

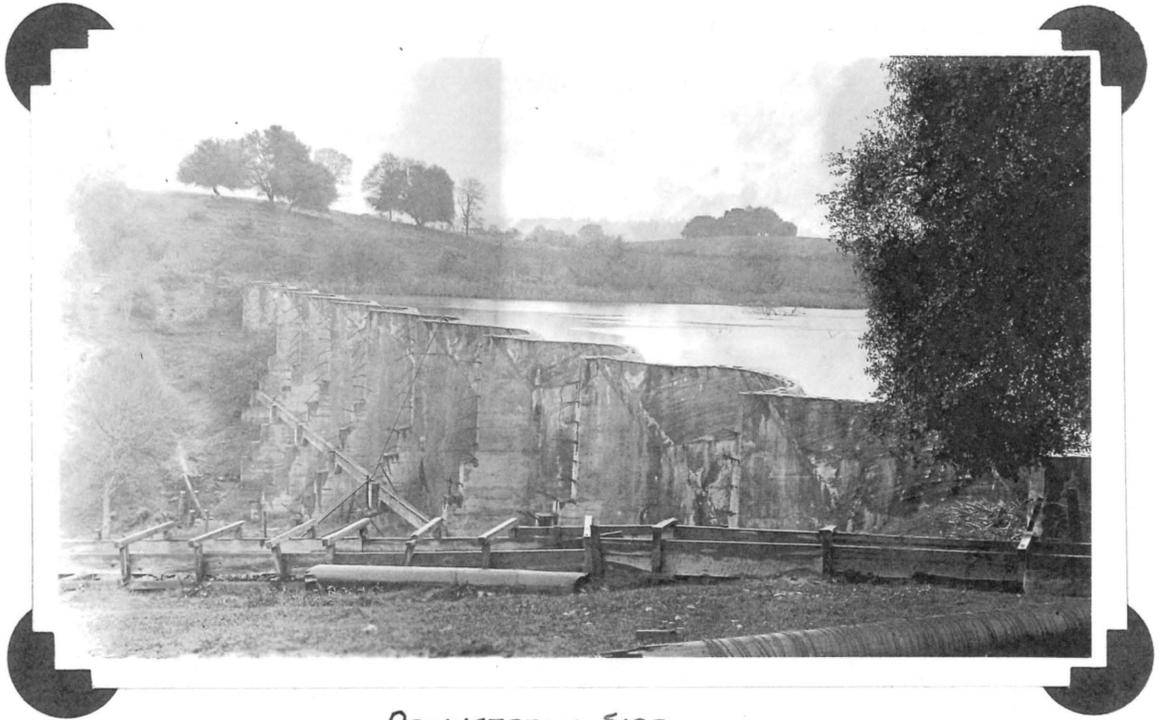
By Gerald McKinlay

This inspection was made to verify the owners communication stating that the spillway had been rendered serviceable by cleaning out tules in the entrance. Such was found to be the case and it is believed that nothing stands in the way of the approval of this structure.

Cracks in the arches and buttresses were observed to exist as described in an inspection memo. of May 25, 1930 by Holmes, Goodall and Nelidov. These are not serious and have undoubtedly reached their maximum extent since the storage space is nearly filled with debris at this time.

CC to Mr. Egenhoff

AT



*DOWNSTREAM SIDE.*

ARGONAUT MINE DAM.  
No. 478  
March 24, 1931.  
G.M.C.



*DOWNSTREAM SIDE.*

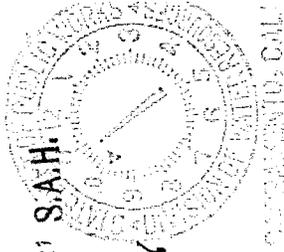
MINE OFFICE

ARGONAUT MINING CO.

JACKSON, CALIFORNIA

77-100-1

REC'D



MAR 20 1931 S.F.H.

March 19<sup>th</sup> 1931

Mr Geo. W Hawley  
Dear Sir

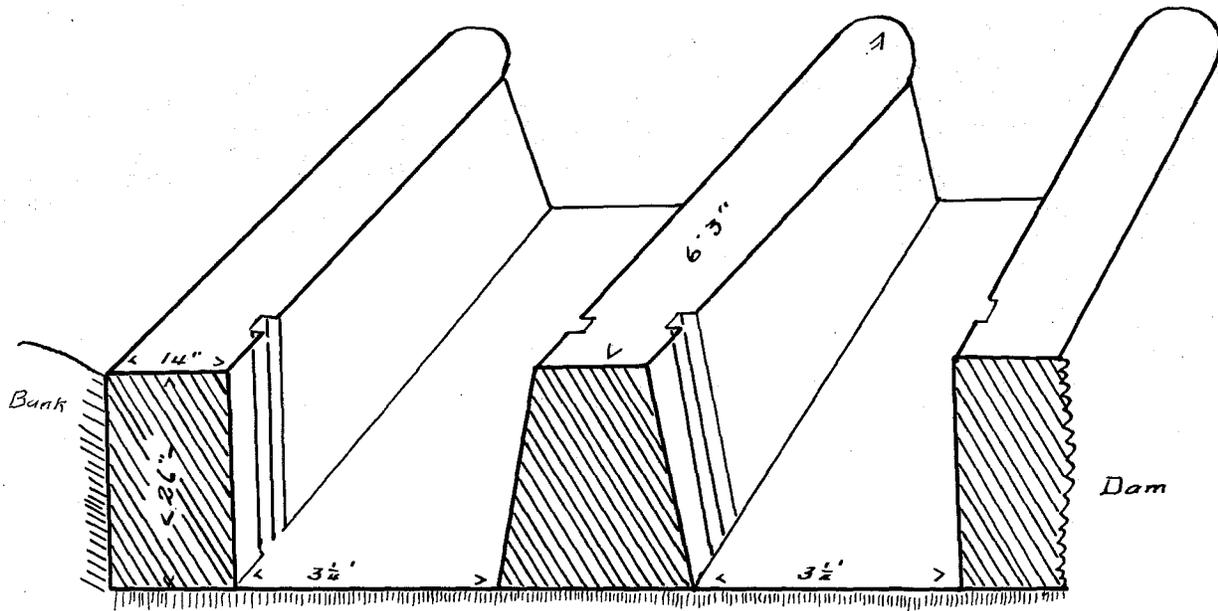
Replying to your favor of March 6<sup>th</sup>

re. Argonaut Dam (# 478) the spillway has been cleared  
and a new floor put in by-pass to spillway

Enclosed find sketch as per request-

Very truly yours  
Argonaut-Mining Co  
per

SEP 20 31



Sketch of  
SPILLWAY  
ARGONAUT DAM

MEMORANDUM TO MR. HAWLEY

ARGONAUT MULTIPLE ARCH DAM #478

Inspected May 25, 1930

By

Messrs. W. H. Holmes, G.E. Goodall & I. Nelidov

Field observations - At the time of inspection water level was within 1 foot of the top of the arches which is also the top of the dam, no footbridge or parapet wall being put on top of arches.

Nearly all arches show cracks at extrados at abutments.

Several buttresses show diagonal cracks starting from haunches of arches and extending into buttresses for about half of length of the latter. The same condition as spillway at left end of dam is *u* described by Mr. S. Hart.

The dam has few leaks through arches and the soil around central buttresses is somewhat softened.

The accompanying sketch shows typical buttress.

The quality of concrete can be determined by tests.

Attached: Pencil sketch of buttress.

CC-R.L.E.  
September 4, 1930  
BM

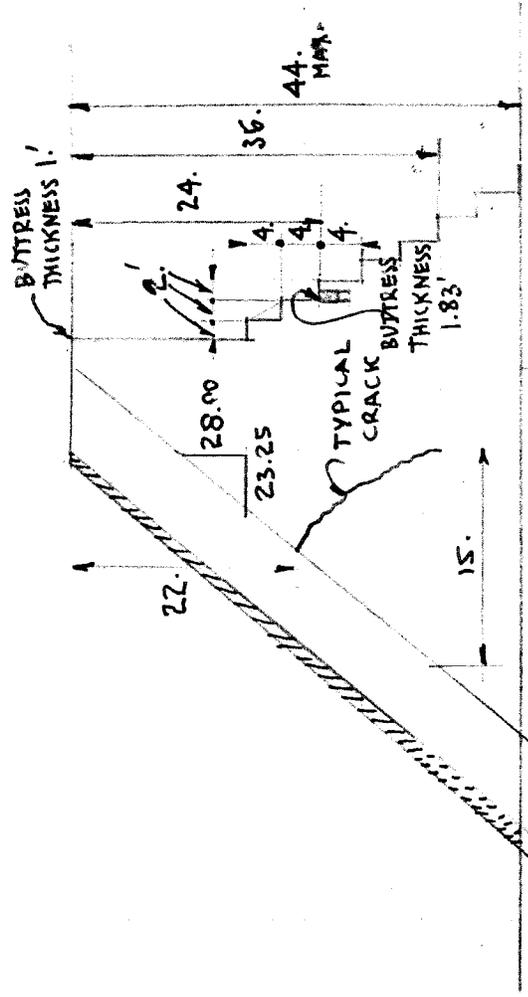
SKETCHES TO ACCOMPANY

REPORT ON ARGONAUT MULTIPLE

ARCH DAM

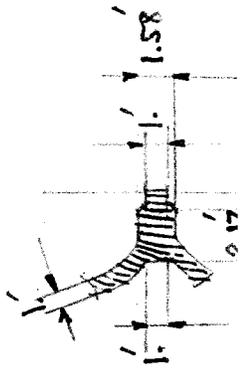
BY MESSRS W. HOLMES, G. GOODALL & J. MELHEDDY

DATED 5-25-30.



ARCH REINFORCING  $1\frac{1}{8}'' \phi$   
CABLES HEMP CORE.

BUTRESSES #7 & 8 ARE THE  
HIGHEST.



Department of Dams

99

Division of Water Resources

Argonaut Dam No 478

Request to Mr. Edmanston..... Date 7/28/30.....

It is requested that the following hydrographic data be supplied in connection with the spillway capacity of.....

Dam on.....No Stream.....River.

Owner of Dam.....Argonaut Mining Co.....

Location of Dam.....To 6 P.U.F.M.D.....

Height of Dam.....46'.....

Type of Dam.....Multi Arch.....

Capacity of Reservoir.....      .....

Flooded Area.....      .....

Elevation of Crest of Dam.....1364.....

Elevation of Crest of Spillway.....      .....

Depth of water over spillway.....      .....

Drainage Area above Dam.....105.....square miles between Elevs.  
.....1364.....and.....1500.....

Maximum Flood of Record, Peak Flood Flow.....      .....

Flood Flow for.....hrs.....

Flood Flow for.....hrs.....

AUG 13 1930 W.H.W. Flood Flow for.....hrs.....

Flood Flow for.....hrs.....

Shape of Flood Hydrograph.....      .....

Estimated Spillway Discharge Required.....cu.ft.per.sec.

Recommendations and conclusions.....      .....

.....      .....  
.....      .....

Jackson

DIVISION OF WATER RESOURCES  
 ESTIMATE OF SPILLWAY REQUIREMENTS  
 For  
 ARGONAUT DAM NO. 478

July 31, 1930

Location of Dam:- On a tributary to Jackson Creek about  $\frac{1}{2}$  mile west of the town of Jackson, in T 6 N., R. 11 E., M.D.B. & M.

Drainage Basin above Dam:- 0.05 square miles ranging in elevation from 1364 to 1500 feet above sea level.

Description of Dam and Reservoir:- A multiple Arch dam 46 feet high. Storage capacity and flooded area not given.

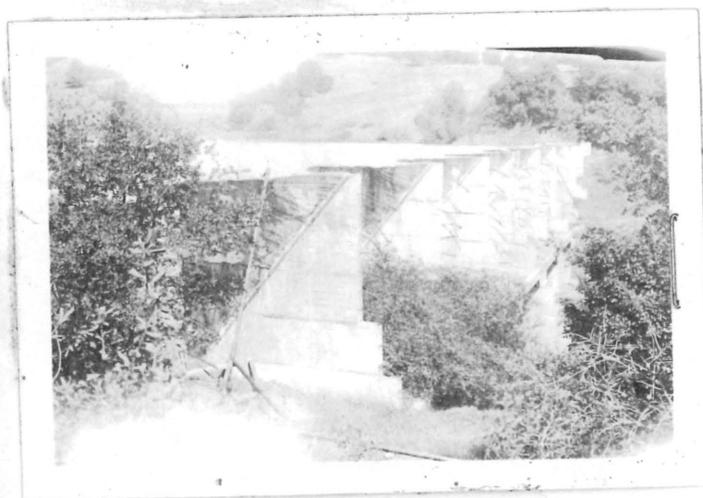
Hydrographic Data Available:- There are no records of flood flows from this area available.

Estimate of Flood Flows:- See report on Kennedy Dam No. 477.

Spillway Requirements:- Tabular hydrographs of the probable 1 in 100 year and 1 in 1000 year floods are listed below. They show a probable 1 in 100 year flood with a mean daily flow of 92 and a crest flow of 362 second feet per square mile and a probable 1 in 1000 year flood with a mean daily flow of 136 and a crest flow of 560 second feet per square mile.

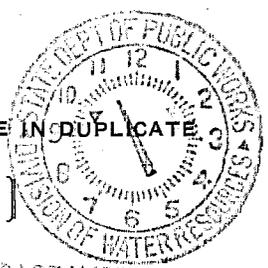
Hour	Estimate Flow in Second Feet	
	1 in 100 year	1 in 1000 year
0	3	5
7	5	7
8	<del>30</del> <sup>23</sup>	28
9	5	7
24	3	5

Submitted by  
*Robert L. Winslow*



*ARGONAUT No. 478 MAY 24, 1930*

AM RECD



FORM 2

[ For full information concerning the filling out and filing of this form send for Rules and Regulations of the Division of Water Resources Governing the Supervision of Dams ]

STATE OF CALIFORNIA  
DEPARTMENT OF PUBLIC WORKS  
DIVISION OF WATER RESOURCES

SACRAMENTO, CALIF.  
NOV 12 29

Application No. D 478 Filed 11/12/29  
Applicant must not fill in the above blanks

APPLICATION FOR APPROVAL OF DAM BUILT PRIOR TO  
AUGUST 14, 1929

[ This application involves in no way the right to appropriate water  
To secure the right to appropriate water, application should be made to this department  
on forms which will be furnished upon request. ]

I, W. E. Scott, Jr., of Jackson  
Name of applicant Post office  
County of Amador State of California, hereby make application for the approval of the  
Argonaut Mining Company's dam, which was completed 1916  
Name of dam Date  
The owner of the dam is Argonaut Mining Company  
Name of owner  
of Jackson County of Amador State of California  
Post office  
Is the owner a Public Utility? No  
Yes or no  
If the owner is a corporation, give name and address of president and secretary—  
John T. Smith, President, 251 West 57th Street, New York City  
Jos. B. Smith, Secretary, 1404 Humboldt Bank Bldg, San Francisco, Calif.  
The applicant is acting for the owner in the legal capacity of Superintendent  
Agent, Lessee, Trustee, etc.

Location of Dam

1. The dam is located on \_\_\_\_\_ which is a tributary of Jackson Creek  
Creek or river  
in Amador County and in the 1/4, Sec. \_\_\_\_\_, Tp. 6, R. 11 E, M.D. B. & M.

Description and Dimensions of Dam

2. Type of dam Eastwood Concrete Multiple Arch 3. Length of crest 390 ft.  
Concrete arch or gravity, earth, rockfill, etc.  
4. Height streambed to spillway crest \_\_\_\_\_ ft. 5. Height foundation to spillway crest 46 ft.  
6. Freeboard \_\_\_\_\_ ft. 7. Thickness at top 12" 8. Thickness at bottom 29-3/32"  
Spillway crest to top  
9. Slope upstream\* \_\_\_\_\_ 10. Slope downstream\* \_\_\_\_\_ 11. Upstream facing\* \_\_\_\_\_  
\*This information to be supplied for earth or rockfill dams. Concrete or rock paving, etc.  
12. Amount of material in dam \_\_\_\_\_ cu. yds. 13. Approximate cost, if available, \$ \_\_\_\_\_  
14. Spillway data \_\_\_\_\_  
Type, capacity, etc.  
15. Outlet data Water drains from bottom thru 16" iron pipe  
Type, capacity, etc. Sea  
16. Elevation of crest of dam 1364 above Level datum. 17. Area of reservoir at spillway level \_\_\_\_\_ acres  
Approximate elevation to be given if true elevation not available  
18. Capacity of reservoir \_\_\_\_\_ acre feet. 19. Drainage area \_\_\_\_\_ sq. mi.

Precipitation and Flood Data

20. Rainfall. If records of rainfall other than those published by the U. S. weather bureau are available, state the location and names of the stations and the maximum intensity of rainfall for 1, 12, 24 or 48 hours. (Use extra sheets or exhibits if necessary.)  
21. State the estimated maximum rainfall on watershed \_\_\_\_\_ inches of rain in \_\_\_\_\_ hours

22. **Flood data.** If records of flood flow other than those published by the U.S.G.S. are available state: location and dates of measurements; maximum flow in cubic feet per second; duration in hours of crest flow and of the flood. (Use extra sheets or exhibits if necessary.)

23. State the **maximum** depth of water over spillway \_\_\_\_\_ feet on \_\_\_\_\_ Date \_\_\_\_\_

24. State the **estimated** maximum flood flow in cubic feet per second and duration of flood and of crest flow in hours

### Historical Data

25. If any important **repairs** or **alterations** have been made on the dam since its construction, describe the repairs and state the reason for making them. (Use extra sheets or exhibits if necessary.)

26. If the dam was **enlarged** after construction describe the work that was done. (Use extra sheets or exhibits if necessary.)

27. **Leakage.** Give all available data both past and present concerning leakage through and around the dam, special attention being given to the amount through the dam, through the foundation and through the abutments; whether leakage is clear or turbid; the effect of depth of water in reservoir on leakage; the effect of temperature; and whether the leakage is increasing or decreasing from year to year. (Use additional sheets or exhibits if necessary.)

28. Describe in full any **weaknesses** in the dam, foundation or abutments, discovered during construction or that have developed since. (Use extra sheets or exhibits if necessary.)

### General Information

29. State the purpose of the dam (Mining) Storage of tailings  
Diversion only; storage only; storage and diversion; mining; debris storage, etc.

30. State the use that is made of water \_\_\_\_\_  
\*Storage and/or diversion\* municipal, domestic, irrigation, power, mining or recreation

31. Engineers \_\_\_\_\_; \_\_\_\_\_  
Chief Engineer Resident Engineer  
John S. Kastwood  
Consulting Engineer

32. If the dam was built under Federal license or permit, state what department had jurisdiction \_\_\_\_\_

[SIGNED] \_\_\_\_\_  
Argonaut Mining Co.  
W. Scott W. Supt.  
Applicant  
this 11th day of November 1924

### CERTIFICATE OF APPROVAL OF DAM NO. D \_\_\_\_\_

This is to certify that the \_\_\_\_\_ dam, for which application for approval was made on \_\_\_\_\_ has been examined and said dam is hereby approved as to safety.

Witness my hand and the seal of the Department of Public Works of the State of California  
this \_\_\_\_\_ day of \_\_\_\_\_ 19 \_\_\_\_\_

\_\_\_\_\_  
State Engineer

MEMORANDUM TO MR. HAWLEY

ARGONAUT DAM NO. 478

MAY 23 1930 W.H.H.

Inspected May 14 and 15, 1930

By  
S. A. Hart.

Location:

The dam is located on a small ravine about 200 yards west of the Jackson-Sutter Creek road approximately one mile north of Jackson, Amador County.

Purpose:

The reservoir is used as a settling basin to remove the slimes from the water from the mill. Heavy tailings are deposited some distance above the dam.

Contact:

The first inspection was made with Mr. E. A. Stent, Vice-president and acting Superintendent. Mr. W. E. Scott, Jr., who made out the application, is no longer with the company. I returned the next day to complete the inspection.

Structure:

The dam conforms in general to the dimensions shown upon the plans. It apparently is intended to raise at some later date. Concrete work seems to be of good quality. There has been some leakage through the dam face. For the most part it was minor and there are now very few wet spots or seeps. Probably this is partly due to the slimes the water carries.

There is some leakage beneath the toe, particularly at the center of the structure. Mr. Stent stated that they uncovered springs at this point during construction and that there appears to be no change in the quantity of flow.

Spillway:

The spillway is on the left end of the dam and consists of 2 flashboards openings approximately four feet in width each and a concrete box section approximat

10 feet in length, converging to a 3' width, 16" deep where it empties into a wooden flume. The concrete section has a drop of 1' in 10. All dimensions are estimates only as it would require an hour or two work with shovel and axe before measurement could be taken. The entrance is badly choked with cat tails, willows, etc.

This condition was called to Mr. Stent's attention, and he stated that they were contemplating the installation of a 4" siphon at this point for use at the high school and they would clean out at this time.

Outlet:

The application states that a 16" pipe drains from the bottom of the dam. There is an old 16" steel pipe lying in the rubbish at the toe of the dam, but it does not appear to act as a drain. No evidence of a gate could be found. It has probably been filled and is no longer used.

Conclusions:

Except for the condition of the spillway the dam appears in very good condition. Cable reinforcing extends from the buttresses, apparently intended as ties when the dam is raised. At its present height the dam is felt to be safe. A suggested letter relative to spillway has been prepared.

SAH:MT

May 21, 1930.



ARGONAUT 478



Spillway Entrance ARGONAUT 478

W. E. SCOTT, JR.  
SUPERINTENDENT

AM RECD



MINE OFFICE

ARGONAUT MINING CO.

JACKSON, CALIFORNIA

November 11th, 1929.

SACRAMENTO, CALIF.

NOV 12 29

*Mr. J. J. Haley*

State of California,  
Division of Water Resources,  
401 Public Works Bldg.,  
Sacramento, Calif.

Attn: Mr. J. J. Haley, Jr.

Gentlemen:

Enclosed is our application for Argonaut Dam-#380.

We find that we have practically no information regarding this dam in our files. There have been no changes in the dam since its construction, and the drawings and information which you have on file, will no doubt cover everything needed for the application.

We regret this lack of information, but trust the information you already have will be sufficient.

Yours very truly,

ARGONAUT MINING COMPANY,

*W. E. Scott, Jr.*  
Superintendent.

WES:F  
encl 2

STATE OF CALIFORNIA  
DEPARTMENT OF PUBLIC WORKS  
DIVISION OF ENGINEERING AND IRRIGATION

SUPERVISION OF DAMS

DATA SHEET

DAM No. \_\_\_\_\_

1. Name ARGONAUT 2. Application dated \_\_\_\_\_ 19\_\_\_\_
3. Owner Argonaut Mining Co.
4. In \_\_\_\_\_  $\frac{1}{4}$ , Sec. \_\_\_\_\_, T. 6 N R. 11 E., \_\_\_\_\_ M. D. B. & M.
5. County Amador 6. Stream Not named.
7. Type of dam Multiple Arch
8. Crest elevation About 1500 ft. 9. Crest length \_\_\_\_\_ 208 ft.
10. Height above streambed \_\_\_\_\_ 40 ft. 11. Height above foundation \_\_\_\_\_ 46 ft.
12. Freeboard \_\_\_\_\_ 1 ft. 13. Facing \_\_\_\_\_
14. Top thickness \_\_\_\_\_ 1.00 ft. 15. Bottom thickness \_\_\_\_\_ 1.65 ft.
16. Slope, upstream \_\_\_\_\_ 10:12 17. Slope, downstream \_\_\_\_\_
18. Contents of dam \_\_\_\_\_ C.Y. 19. Cost, \$ \_\_\_\_\_
20. Reservoir capacity \_\_\_\_\_ A.F. 21. Drainage area \_\_\_\_\_ 1 sq. mi.
22. Spillway data \_\_\_\_\_  
\_\_\_\_\_
23. Outlet data \_\_\_\_\_  
\_\_\_\_\_
24. Purpose Mining Debris Storage
25. Engineers John S. Eastwood.
26. Contractors \_\_\_\_\_
27. Consultants of State Engineer \_\_\_\_\_
28. Plans approved by \_\_\_\_\_ State Engineer \_\_\_\_\_ 19\_\_\_\_
29. Remarks Plans submitted. Letter Feb. 17, 1916.  
Plans and construction approved by California Debris Comm.
30. Plans in map file. Nos. 1 set of blue prints on file.
31. Photos in photo file. Nos. \_\_\_\_\_
32. Information compiled to (dates) 7/17/28 DC.

STATE OF CALIFORNIA  
DEPARTMENT OF PUBLIC WORKS  
DIVISION OF ENGINEERING AND IRRIGATION

**SUPERVISION OF DAMS**

DAM No. \_\_\_\_\_

Name ARGONAUT \_\_\_\_\_ DAM

Owner Argonaut Mining Co. \_\_\_\_\_

**RECORD OF INSPECTION OF PLANS AND CONSTRUCTION**

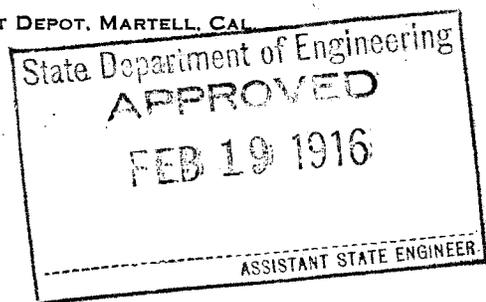
DATE	BY WHOM	REMARKS
Feb. 11, 1916	P. M. Norboe	Letter to Debris Commission in regard to permit to build dam.
Feb. 12, 1916	L.H. Rand, Major U.S. Engineers	Letter stating no permit had been given.
Feb. 14, 1916	P. M. Norboe	Letter to Argonaut Mining Co. requesting copy of plans and specifications.
Feb. 17, 1916	N. S. Kelsey	Letter stating construction about to be started on Eastwood multiple arch dam. Plans and specifications were being submitted.
June 18, 1928	D. S. Cleavinger	This dam was constructed during 1917 under the supervision of the California Debris Commission. See data filed under California Debris Commission Dams.

Construction started \_\_\_\_\_ 19\_\_\_\_ Dam completed \_\_\_\_\_ 19\_\_\_\_

Final approval by \_\_\_\_\_ State Engineer \_\_\_\_\_ 19\_\_\_\_

ARGONAUT MINING COM. AN,

FREIGHT DEPOT, MARTELL, CAL



JACKSON, CALIFORNIA, February 17, 1916.

California State Department of Engineering,  
Sacramento, California.

Attention: Mr. Paul M. Horboe.

Gentlemen:

We have your letter of February 14th, calling our attention to Section 2 of Chapter 394, Statutes of 1915, for which we thank you.

Your information to the effect that this company is engaged in constructing a dam is incorrect.

We are, however, about to start such construction and our engineer, Mr. John B. Eastwood, of the Eastwood Construction Company has been requested to furnish you with a set of plans and specifications.

Our dam is to be a multiple arch reinforced concrete dam of the "Eastwood" type.

We are

Yours very truly,

Argonaut Mining Company.

per

*W. Kelsey*  
Gen'l Mgr.

N.S.K./VPJ

WAR DEPARTMENT,  
3RD SAN FRANCISCO DISTRICT ENGINEER OFFICE, UNITED STATES ARMY,  
AND  
CALIFORNIA DEBRIS COMMISSION,  
ROOM 405 CUSTOM HOUSE, BATTERY STREET AT WASHINGTON AND JACKSON,  
SAN FRANCISCO, CALIFORNIA.

IN REPLY PLEASE  
REFER TO FILE  
NO. 4509

February 12, 1916.

Mr. Paul M. Norboe, Asst. State Engineer,  
Department of Engineering,  
State of California,  
Sacramento, Cal.

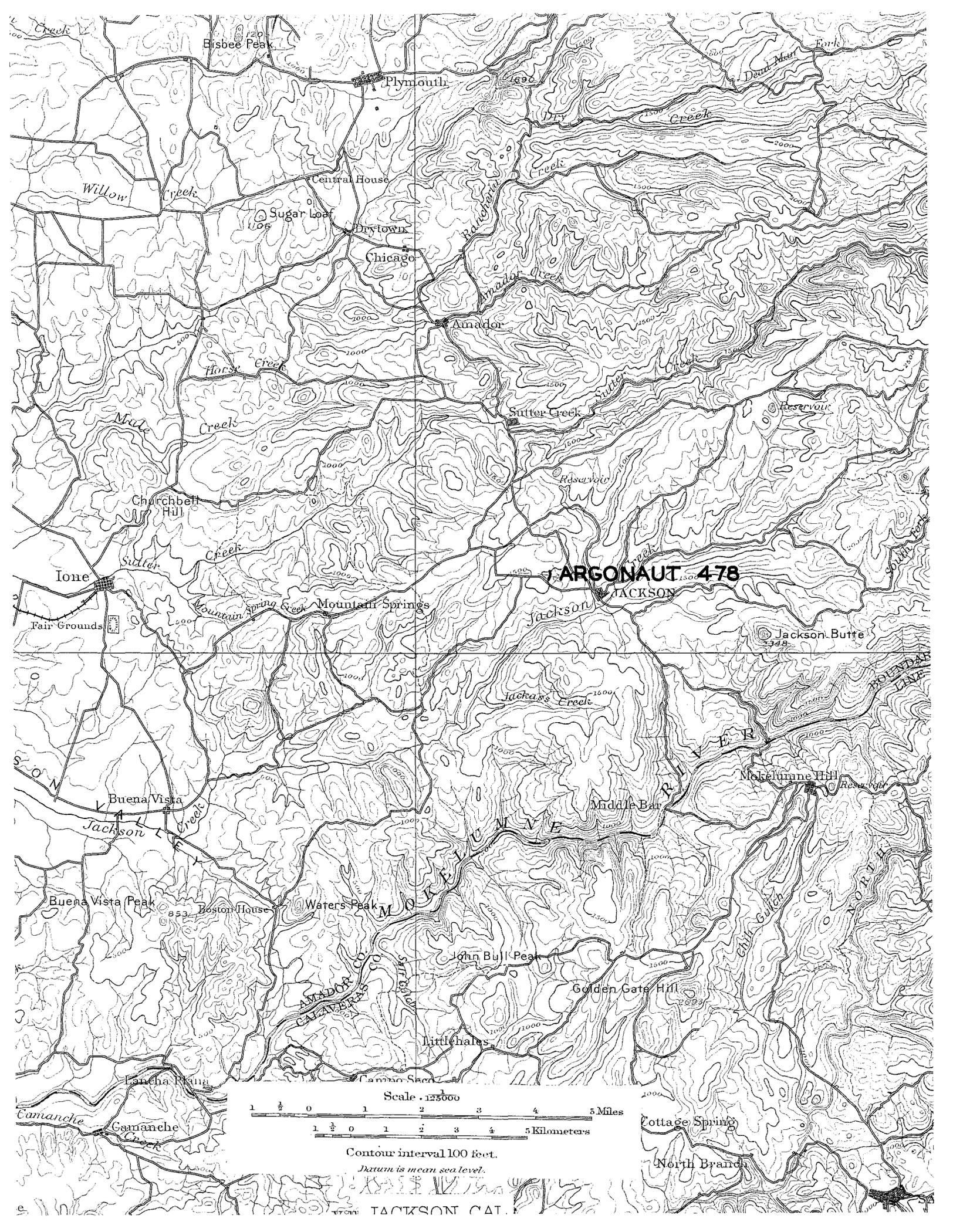
Dear Sir:-

Having reference to your letter of Feb. 11, 1916, requesting information as to whether the Argonaut Mine near Jackson, Amador County, Cal., has been given a permit to construct a debris impounding dam, you are hereby advised that this office has no record of any Argonaut Mine to which a permit was granted. You might possibly have reference to Acqueduct Mine (now Ludekens), which is at Pine Grove, about 9 miles above Jackson. License for this mine was issued December 28, 1915.

Respectfully,<sup>SAC</sup>



L. H. Rand,  
Major, Corps of Engineers.  
Secretary.



Bisbee Peak

Plymouth

Dead Man Fork

Willow Creek

Central House

Sugar Loaf

Drytown

Chicago

Amador

Horsy Creek

Sutter Creek

Churchbell Hill

Ione

Mountain Springs

JARGONAUT 478

JACKSON

Fair Grounds

Jackson Butte

Buena Vista

Middle Bar

Mokelumne Hill

Buena Vista Peak

Boston House

Waters Peak

John Bull Peak

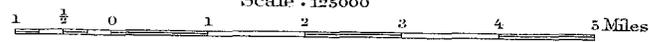
Golden Gate Hill

Lancha Point

Campo Saca

Camanche

Scale 1:25000



Contour interval 100 feet.

Datum is mean sea level.

Cottage Springs

North Branch

JACKSON CALIF.