A Brief History of Emery Dam

Preface

On March 11, 2008, I visited with Larry Ford, Field Engineer and Chuck Wong, Resident Engineer, at the Division of Dam Safety office in Sacramento.

They allowed me access to the documented history of Emery Dam, #491. There is a great deal of material and a complete review of it could not be accomplished in the brief time available. What follows is a chronological listing of the events leading up to it's failure and some comments about the construction of the present dam.

Chronology of the Failure of Emery Dam

The original dam was built in 1850. It was reconstructed and raised over the years, particularly in 1898 and 1948.

July 10, 1965: Seepage was observed from the right abutment groin in the vicinity of the outlet pipe, estimated at eight GPM. The leakage at the left abutment groin was one GPM. The lower third of the downstream slope was saturated.

Mr. Connely, the other partner in the subdivision, had a diver do some repair work. The diver observed a hole in the earth above and to the right of the intake gate. Reaching into the gap he felt a ragged hole in the pipe. This hole was then plugged using burlap, an old army blanket and bentonite!

December 14, 1965: Leakage was observed in a "controllable quantity" by the dam inspector. Mr. Ferhoff, one of the two developers of the subdivision, was requested to lower the lake level by November 1st , 1966 so a thorough inspection could be made.

July 18, 1966: The dam had not yet been lowered, so the Division of Safety of Dams asked what plans had been made to do so.

November 7, 1966: A diver was sent down to to inspect the drain intake area. A hole in the upstream embankment was found five feet from the intake. Mud introduced into the hole appeared emerging from the beneath the outlet pipe on the downstream embankment. At this time the lake level was five feet below the spillway. The leak was believed to be along the outer underside of the pipe or along the concrete encasement of it.

Mr. Ferhoff wanted to delay lowering the lake until the fall 1967 so that improvements at Kid's Beach could be made at the same time.

November 25, 1966: Another inspection was made since the November 1st deadline had been ignored. The outlet gate had not been opened and the leakage had increased. A request was again made for the valve to be opened and the lake to be immediately lowered. Mr. Ferhoff refused because he said the outlet pipe was so deteriorated that the outlet structure would fail.

December 6, 1966: The lake level increased to that of the spillway level and remained at that level until the time of failure.

December 9, 1966: Mrs. Balster, living below Sheep Ranch road bridge, observed at 9:30 AM that there was an abnormally large flow in the creek. She called a neighbor, which resulted in the

Deputy Sheriff being dispatched to the dam. He remained at the site throughout the day and noted that the outlet gate was fully closed.

The flow increased throughout the day and at 11 PM the dam was breached. Flooding of McKinney Creek caused Sheep Ranch Road to be washed away at the bridge. Several minor dams downstream were breached and a considerable amount of silt and debris was deposited around three homes. Approximately 300 acre-feet of water were released in the flood.

Post Failure Events

December 20, 1966: Robert Jansen, Division Engineer, inspected the dam site. A vee notch of about 30 feet was formed where the breach occurred. The foundation was scoured down to bedrock, but it was evident that the dam and outlet pipe had been partially laid on overburden. The lower portion of the outlet pipe had been washed downstream. The upper portion that was encased in concrete and included the gate valve remained. The concrete encasement did not completely extend around the pipe. The bottom of the pipe had been completely rusted away.

September 21, 1967: The court ordered William Verigen, Division Field Engineer, to give a deposition of the events leading up to the dam failure. The subdivion developers denied any responsibility for the dam failure and tried to place the blame on the Division of Dam Safety. Legal wrangling occupied all of 1967 and most of 1968.

February 8, 1968: Mr Gretzinger, consulting engineer for M24, proposed that it was as cheap to do a complete reconstruction as to do a repair of the damaged area.

May 9, 1968: Jack West, secretary of the M24 Board, tried to have the subdivider accept responsibility for the reconstruction, but to no avail.

May 20, 1968: The first notice of an application to rebuild a dam of height 46 feet and 400 acre-feet capacity, was made by Gretzinger.

New Construction

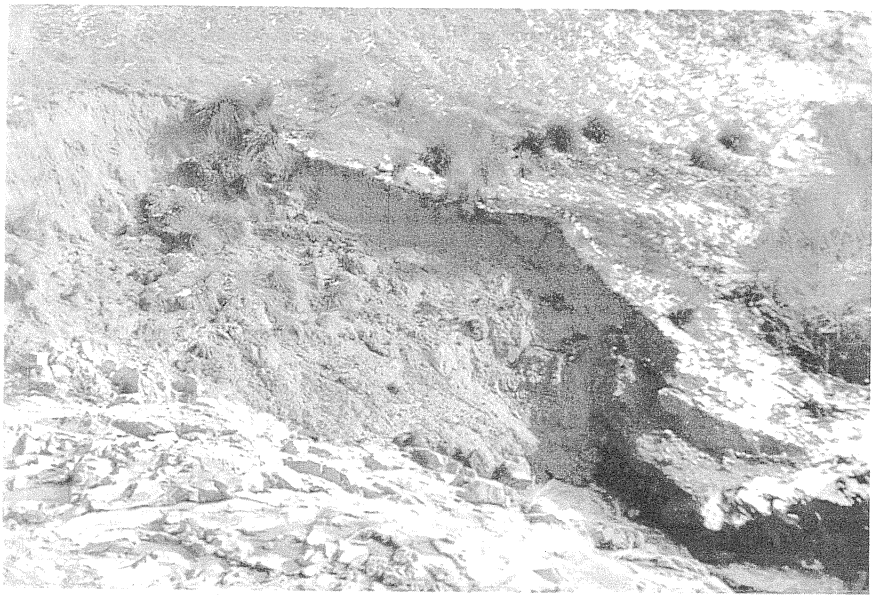
I did not have time to do the research needed to fix the time when actual construction began.

It is known that before the new drain was laid a trench was dug down to bedrock . A galvanized pipe was surrounded radially and axially with rebar and then encased in concrete over it's entire length. Two concrete collars were poured around the pipe to prevent leakage “piping”. This practice is no longer used for new construction.

The dam is still of earthen construction. Some of the original material was retained, but a lot of it came from a “borrow pit” in the adjacent lake bed.

This material was mechanically placed, watered and compacted with sheep's-foot rollers. No hydraulic filling was used. Two internal drains are provided and exit at the toe of the dam. The toe area has been covered with a rip-rap layer of large rock to help stabilize the soil.

Yearly inspections are made by the Division of dam safety and any maintenance recommendations noted. No safety issues have been reported.



Sloughed area at toe of dam showing the amount of material that has been eroded away.

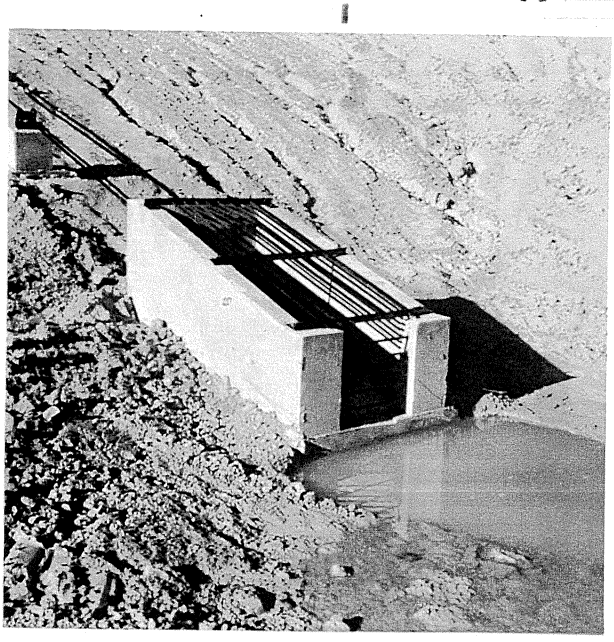
FEB 9 '67 GHS

EMERY DAM, NO. 491
1/25/67 GHS

Breach showing extent of sloughing on the sides.

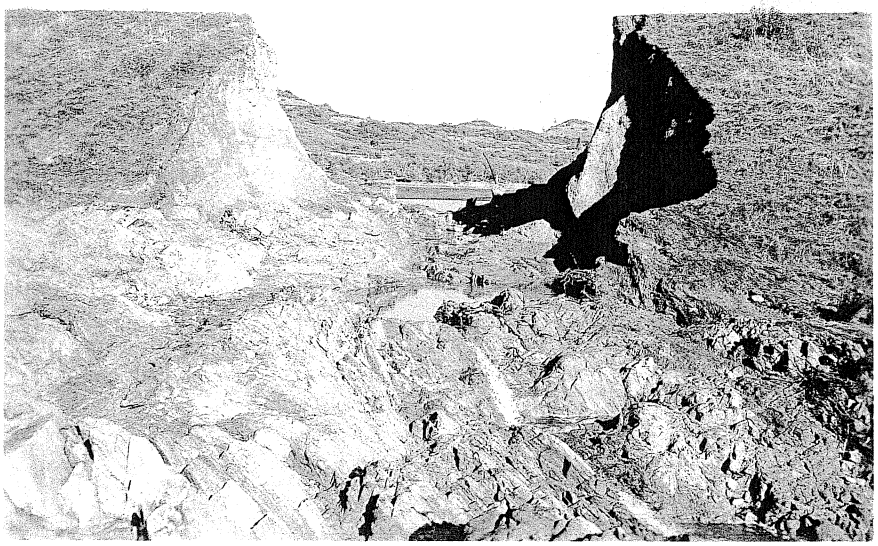
Toe area after placement of the riprap protection.

Outlet headgate.

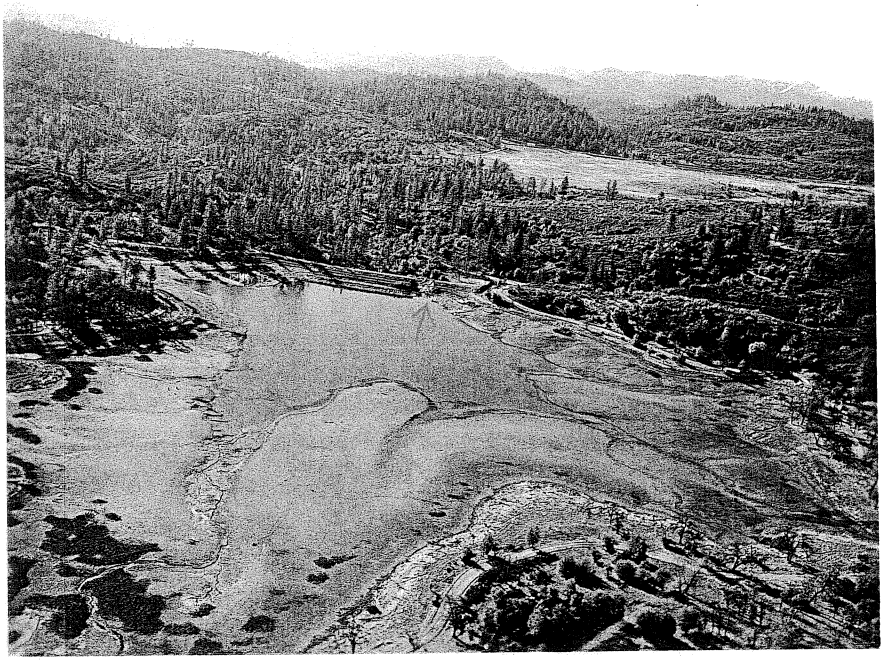


Outlet inlet structure.

EMERY DAM AND RESERVOIR, NO. 491
11/28/69 GHSwanson



View looking upstream through breach.



View of breached dam and reservoir.

State of California
The Resources Agency
DEPARTMENT OF WATER RESOURCES
SUPERVISION OF DAM SAFETY OFFICE

INSPECTION OF DAM IN APPROVED STATUS

Name of dam Emery Dam No. 491
Type of dam earth Type of Spillway open channel
Water is _____ feet _____ (above, below) spillway crest and 8.8 feet below (above, below) dam crest.

Contacts made Mr. Connely was present during the inspection.
Detail in question Periodic inspection
Action taken See remarks

Remarks *

There were a few seedling trees on the dam and brush is beginning to grow along the toe. Removal of the trees and brush is not yet necessary.

DEC 8 '65 D.E.B.

The seepage from the right abutment groin, in the vicinity of the outlet, was estimated as 8 gpm. Some of this seepage was leakage from the outlet. The seepage from the left abutment groin was estimated as 1 gpm. The lower third of the downstream slope of the dam was saturated.

The spillway was unobstructed. There was a small roadfill across the channel, 200 feet downstream and 6.5 feet below the spillway control. It appeared that should any flow occur in the spillway the roadfill would immediately wash out. It was judged not to affect the safety of the dam. Mr. Connely said there were plans to construct a bridge across the spillway. He was informed the Department would require review of the proposed bridge. Mr. Connely said that he had informed Mr. Fernhoff, the owner, of this requirement at an earlier date.

Mr. Connely said some repair work had been done on the outlet. He introduced a diver who had done the repair work.

The diver gave the following information:

1. The slide gate and seals were in good repair and were not worked on.

2. There was a hole in the earth dam above and slightly to the right of the outlet. He was able to reach in the hole with his arm and with his hand feel a ragged hole in a metal pipe. He said the hole in the earth dam was plugged using burlap, an old army blanket and bentonite.

A hole in the earthfill below the outlet handwheel block was observed. The extent of the hole could not be determined.

The dam can not be judged safe until the condition of the hole in the fill above and to the right of the outlet has been investigated and proven not to be a hazard.

Typed by maf
Date 10/7/65
cc for _____

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

Inspection by D. E. Bowes
Date of inspection 9/10/65
Date of report 9/28/65
Photos taken? Yes ☐ No ☒

State of California
The Resources Agency
DEPARTMENT OF WATER RESOURCES
DIVISION OF SAFETY OF DAMS

INSPECTION OF DAM AND RESERVOIR IN APPROVED STATUS

Name of dam Emery Dam No. 491
Type of dam Earth Type of Spillway Open channel
Water is _____ feet _____ (above, below) spillway crest and about 10 feet below (above, below) dam crest.

Contacts made Mr. James Fernhoff
Detail in question Underwater inspection of outlet
Action taken See remarks

*Remarks**

Conditions found during the underwater inspection are as follows:

The slide gate was fully closed. It could not be ascertained if there was any leakage past the gate. A heavy growth of aquatic weeds was all around the gate and trashrack structure.

A hole was found in the embankment about five feet downstream and slightly to the right of the trashrack. The sides of this hole were steep. Depth was in excess of five feet.

The leakage appearing beneath the outlet pipe at the toe of the dam became murky after loose material was disturbed in the hole found on the upstream slope. Consequently at least a portion of the 10+ gpm leakage must originate from this hole. It could not be determined if the leakage was passing through the outlet pipe or along the underside of the pipe. The irrigation pipe connected to the outlet at the toe of the dam is rusted through at several locations.

It appears that the hole on the upstream slope was caused by material piping either through a hole in the outlet pipe or along the outside of the conduit. This is a potentially dangerous condition and further investigation should be made. I recommend the reservoir be drained to allow a thorough inspection and repairs as necessary on the outlet in the vicinity of the hole. It is also recommended the downstream end of the outlet be uncovered so the path of leakage can be determined. The records indicate the outlet is encased throughout.

Mr. Fernhoff said he planned to lower the reservoir next fall so the swimming beach could be improved by grading and bringing in sand. He indicated the reservoir would be lowered to about the level of the outlet for this work and requested that further investigation of the outlet be permitted to be delayed until next fall. I told Mr. Fernhoff that requirements of this office would be outlined to him in a letter.

Maintenance requested previously, including removal of the deteriorated irrigation pipe from the outlet and cleaning and filling

NOV 17 '66 R.E.

Typed by ejs
Date 11-14-66
cc for

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

Inspection by R. E. Thronson ~~G. H. Swanson~~
Date of inspection ~~11-7-66~~
Date of report 11-10-66
Photos taken? Yes ☐ No ☒

DWR 1261 (Rev. 11/65)

NOV 14 '66 GHS

Sheet _____ of _____ Sheets

GLENN F. SUDMAN
CONSULTING ENGINEER
1321 HOWE AVENUE, RM. 105, SACRAMENTO, CALIFORNIA 95825
TELEPHONE 922-7024 AREA CODE 916

RESIDENCE
3222 NORRIS AVENUE, SACRAMENTO, CALIFORNIA 95821
TELEPHONE 487-8396

December 31, 1966

Mr. Robert B. Jansen, Division Engineer
Division of Safety of Dams
Department of Water Resources
Sacramento, California

Dear Mr. Jansen:

At your request, on December 20, 1966, I accompanied Mr. A. M. McClure of your staff to Emery Dam in Calaveras County and observed conditions at the site; and on the following day met with you and your staff, reviewing past historical records and discussed the circumstances connected with the failure of this dam.

During the night of December 9, 1966, this dam failed. The form of the failure was a V-notch at the location of the outlet conduit as shown in the accompanying pictures Nos. 1, 2, and 3. The height of the fill at the breach was about 30 feet. The breaching resulted in the release of about 300 acre-feet of water. The damage observed consisted of partial destruction of a county road bridge about one-half mile downstream, breaching and partial destruction of two downstream dams forming small ponds, partial washout adjacent to the spillway of another small dam, and deposition of considerable amounts of silt and debris around two or three homesites.

At the breach, the foundation has been scoured down to bedrock, but it appears that the dam and outlet conduit may have been partially founded on overburden. The outlet pipe has all been washed downstream, except for about the upstream 40 feet. This section is encased in concrete and includes the intake control gate. (Picture No. 4)

The outlet pipe has been disrupted at the downstream end of this section as shown in picture No. 5. At the point of rupture and for several feet upstream, the concrete encasement does not now extend completely around the steel pipe. Over this same length the bottom of the steel pipe has been completely eaten away, and a cavity several inches deep is scoured in the material underlying the pipe.

The control gate at the intake of this outlet pipe section is now in the open position. The operating stem, consisting of a 2-inch steel pipe, has been broken off several feet above the top of the gate. The operating hoist with its associated concrete lies in the streambed several hundred feet downstream, and shows the gate to have been closed prior to the time of failure. For the operating stem to rupture, when the hoist and dam suddenly moved downstream, a restraining force would be required at the gate. For this restraining force to have sufficient magnitude to rupture the stem, the gate would need to be pulled to its fully open position and be forced against the top of the gate frame.

Downstream from the failure, there are several larger blocks of concrete which appear to have been associated with the gate stem and operating hoist supports. Smaller pieces can be found which would appear to be part of a concrete encasement around the outlet pipe.

There are a number of steel pipe remnants downstream from the failure. All of these are collapsed and badly bent out of shape. Those in the streambed of the canyon below the dam are rusted and discolored, and appear to be part of an extension to the outlet pipe leading away from the dam.

About one-half mile downstream from the dam and below the County road, the canyon widens out into a small valley where at least three pipe remnants were observed which appeared to be part of the outlet under the dam. The exterior of these remnants has not been exposed to the elements and is not rusted and discolored.

One of these remnants is shown in pictures Nos. 6 to 10. The pipe is of thin sheet metal and is badly bent and distorted. It is apparent that the bottom has been completely corroded away for the entire length, and holes appear up on the sides. There are no large remnants of concrete encasement remaining on these pipe sections. There appears to have been a thin asphaltic coating applied to the exterior of the pipe. There is little corrosion on the exterior of the upper half of the pipe. Extensive corrosion in the bottom and adjacent sides indicates that the concrete encasement over this portion was of a poor quality. This condition would be similar to that shown in picture No. 5.

This dam, located on McKinneys Creek, is listed as Dam No. 491 by your Division. It was originally constructed in 1850, and has been reconstructed and raised several times in the past century. The original outlet is buried within the

dam, and that portion of the outlet destroyed at this time was installed during a later enlargement of the dam, probably in 1898.

Your office has well documented the events prior to the failure of the structure and obtained statements from those having pertinent information as to the events at the time of the failure.

There has been sufficient leakage at the location of the outlet conduit for some time to occasion some concern to your staff. One year ago, this had progressed to the extent that you directed the owner to drain the reservoir prior to this year's runoff season to enable your staff to make an inspection.

This was not done and there have been a number of exchanges between your office and the owner with reference to his refusal to comply with your directives.

On November 7 of this year, the dam was inspected by your staff. This included an underwater inspection by a diver in the vicinity of the intake to the outlet conduit. A hole in the upstream face of the dam fill was found, about 5 feet downstream from the intake. Earth or mud thrown into this hole appeared as discoloration in the leakage emerging from beneath the outlet extension. At the time of this inspection, the water level was about 10 feet below the dam crest, or 5 feet below the spillway.

On December 6, 1966, water was reported to be at the spillway level and remained near that level until the time of the failure.

I interviewed a Mrs. Balster, living in the property below the road bridge. She stated that at about 9:30 a.m. on December 9, she observed an abnormally large flow in the stream and suspicioned difficulty at the dam. She called a neighbor, which resulted in a Deputy Sheriff being dispatched to the dam. This officer observed large flows emerging at the outlet of the conduit and remained at the site throughout the day. He verifies that the control gate at the intake remained closed at all times. It was observed that the rate of flow increased during the day.

It was obvious from the location at the breach, and observed conditions prior to the actual breach, that failure was due to water passing through the dam at the location of the outlet conduit.

The exact circumstances are not known and cannot be ascertained, but it appears that:

1. There had been sufficient past leakage in the vicinity of the outlet works to cause concern to your staff.

2. This had advanced by November 7 of this year to the point that there was a hole in the upstream face of the dam and free passage along the outlet to the downstream side of the dam. This channel, through which water was flowing, could either have been under the pipe or along the concrete encasement. It is very probable that the condition of the pipe invert and the questionable quality of concrete under the invert were major contributors to this free passage of water.

3. The water level increased about 5 feet in early December. This increased head unquestionably increased the rate of leakage, enlarging the hole in the face of the dam and the passageway through the dam. At some time early in the morning of December 9, the velocities apparently became high enough to start rapid removal of the material in the dam. This became progressively worse during the day, as indicated by the increased leakage. At some time in the night, the hole became large enough that the dam collapsed and breached.

   The outlet conduit, with the metal in the invert completely eroded away and with a deteriorated or low quality concrete encasement under the invert, would have small resistance to collapsing under external pressures. It is possible that the sudden increase on December 9 may have been triggered by collapsing of some portions of the outlet.

4. The actual breaching of the dam at the outlet conduit is certainly definite proof that you and your staff took proper action when you directed that the reservoir be drained to permit an inspection.

GLENN F. SUDMAN
CONSULTING ENGINEER

5. The structure would not have failed if the water had been drawn down to the level of the conduit and maintained as near to that level as possible.

This failure demonstrates that your policy of continual inspection of dams and of investigating and requiring repair of defects is correct; also it emphasizes the necessity for compliance with directives you issue with respect to the investigation of questionable features and repair of dangerous defects.

Very truly yours,

Glenn F. Sudman

Glenn F. Sudman

State of California

Memorandum

NOTED W.R.G.

file

The Resources Agency

To : 1. Mr. Alfred R. Golze
2. ~~Mr. William R. Gianelli~~

Date : January 13, 1967

File No.:

Subject: Failure of Emery Dam, No. 491: Legal Action and Liability

Robert B. Jansen, Division Engineer
Division of Safety of Dams

From : **Department of Water Resources**

This responds to Mr. Gianelli's memorandum of January 9, 1967, regarding the failure of Emery Dam.

The Attorney General, upon our request, is now preparing for prosecution of the owner of Emery Dam for his noncompliance with requirements of this Department. Specifically, when our inspectors found evidence of undesirable leakage, we directed that the reservoir be lowered to investigate and to effect necessary remedies. These requests were made as follows:

By letter on December 14, 1965:

> Although leakage appeared to be in controllable quantities, we requested that precautionary lowering of the reservoir be accomplished by November 1, 1966.

By letter on July 18, 1966:

> We asked what plans had been made for lowering the reservoir as directed.

By letter on November 25, 1966:

> Inspection was made soon after the deadline of November 1, and we found that the outlet was still closed and that leakage had increased. We directed that the reservoir be lowered immediately.

By letter of December 9, 1966:

> Having ascertained that the owner was making no effort to comply, we reaffirmed our directive and informed him that our next step would be legal action.

Golze wants

SURNAME				
DWR 155 (REV. 4-62)	Jansen 1/13	Fisher 1/13	[illegible] 1/13	Towner 1-13

In addition, our engineers reminded the owner orally of our requirements during October 1966.

The owner failed to respond favorably to any of these communications. Under Section 6425 of the Water Code he therefore is guilty of a misdemeanor and punishable by a fine of not more than $2,000 or by imprisonment in the county jail not exceeding six months, or both. For a continuing violation, each day of noncompliance constitutes a separate and distinct offense.

What we have here is a flagrant violation of the law on safety of dams--an open defiance of the State's authority and a disregard for the public interest.

In prosecuting this case, the State must make its point that maintenance of safe dams is a serious responsibility that an owner cannot take lightly. This should set a precedent which will encourage better cooperation from reluctant operators. We would be remiss in our duties if we turned our backs on such violations.

Regarding liability, Section 6028 of the Water Code provides statutory immunity. Moreover, the records of this case will show clearly that the Department acted prudently and with sound judgment in urging the lowering of the reservoir for investigation and necessary remedial action.

Prior to the deadline of November 1, 1966, our field engineers and our geologist who assessed conditions at the dam judged that the orderly investigative program which we had requested would be adequate--and it certainly would have been if the owner had complied. The dam was not in immediate jeopardy until late in the fall of 1966.

We discovered in November, 1966, that conditions at the dam were worsening and that the owner was still refusing to accept his responsibilities. We then gave him our final notification and were preparing to seek a court order--when the failure occurred.

I have critically examined the Division's actions in retrospect and believe that all of our men acted in a reasonably proper and timely manner. We now can ask what alternative courses of action could have been taken. We could have inspected the dam on a monthly basis and might have detected the worsening conditions earlier than in November. If so, we likely would have been involved in the first stages of court proceedings at time of failure. But the physical result probably would have been the same. Furthermore, with 52 dams currently on our critical list--including Emery, which was added to the list for November, 1966--manpower requirements for such close frequency of inspection would have been greater than our program provides.

Another alternative would have been to have our field engineers open the gate. Code Sections 6110 and 6111 give us this authority in an emergency, but such action could be challenged and could complicate considerations of liability.

One essential part of any program to prevent future occurrences such as at Emery Dam is establishment of strong precedent by court action to discourage willful violators in the future.

EXHIBIT C

M-24 RANCH, UNIT NO. 1 - SUBDIVISION
TRACT #136
CALAVERAS COUNTY
LOT SALES AND RELATED DATA AS NOTED

LOT NO.	NAME AND ADDRESS	DEED RECORDED	INSTRUMENT
1	A. W. & C. M. Sears ½ M. G. & A. S. Kruse ½	3/9/66	210 OR 318
2	John & Henrietta Munoz	5/4/66	214 OR 3
4	John E. & Jean L. Stuart 2235 Romey Lane Hayward, California	9/16/65	202 OR 574
5	Oliver & Francis A. Fernandez 1064 Devon Drive Hayward, California	9/16/65	202 OR 575
6 & 7	James D. & Betty A. Calvin 1021 Calhoun Street Hayward, California	9/16/65	202 OR 578
8	Audry I. & John D. Braydis Mt. Ranch, California	9/16/65	202 OR 571
9 (PTN)	James C. Calvin, et ux	10/26/66	222 OR 111
9 (PTN)	Mary Cox		222 OR 113
9 (PTN)	Karl R. Malotte		222 OR 114
9 (PTN)	Densel W. Cox		222 OR 116
9 (PTN)	M-24 Ranch Association		222 OR 118
10 & 11	Lis. Pendens	8/2/65	200 OR 506
13	Estelle Reese Arroyo 944 Reliez Station Road Lafayette, California	10/15/65	204 OR 311
15	Amzi E. & Carolyn J. Miller 258 Newhall Street Hayward, California	10/7/65 10/25/65	204 OR 12 204 OR 470
18	√ J. B. & M. J. West 1770 Helena Street Reno, Nevada	1/6/66	208 OR 18
19	F. J. & N. Baron √ T. S. & A. Blake C. E. Lewis & H. E. Lewis 25 Wanda Way Martinez, California	9/29/65 12/22/65	203 OR 351 207 OR 242
20	Edgar A. Sawyer	3/28/66 3/28/66	211 OR 310 211 OR 311
21	James A. & Margaret V. Masterson 1771 Landana Drive Concord, California	10/14/65	204 OR 275
23	√ Walter & A. Aileen Scheufler 7129 Oak Creek Drive Stockton, California	9/16/65	202 OR 576

LOT NO.	NAME AND ADDRESS	DEED RECORDED	INSTRUMENT
24	J. R. & S. A. Sprecher	10/21/66	222 OR 21
26	V. J. Gretzinnger L. L. McMinn P. O. Box 481 Jackson, California	2/9/66	209 OR 240
31	Lis. Pendens	8/2/65	200 OR 506
33	Lester G. & Germain Kent 22315 Western Boulevard Hayward, California		204 OR 416
34	Benjamin M. & Virginia L. Owens 17120 Via Piedras San Lorenzo, California	9/16/65	202 OR 573
35	W. G. & E. B. Moore		212 OR 17
36	B. R. & N. A. Marhenke 166 Plaza Circle Danville, California		208 OR 97