

J. A. Libby, State Conservationist

July 27, 1962

George A. Lawrence, State Conservation Engineer

DRAINAGE & IRRIGATION - Little Deer Creek Reservoir Dam

On July 19, 1962 at 1:00 p.m., Gilbert Searle and I visited the subject dam. We found conditions substantially as reported in Felker's memorandum to you.

A dozer was being used on the front face to flatten the slope. Some cut was being made near the top and some fill was being made farther down the slope. No compaction equipment was being used. However, most of the earth being moved while we were there was being wasted beyond the sides and toe of the dam.

In my opinion, the downstream section has a definite shear failure which is serious. To correct it the slope of the downstream face should be flattened enough to allow complete removal of the material on top of the shear, and placement of it in compacted layers starting from a new downstream position.

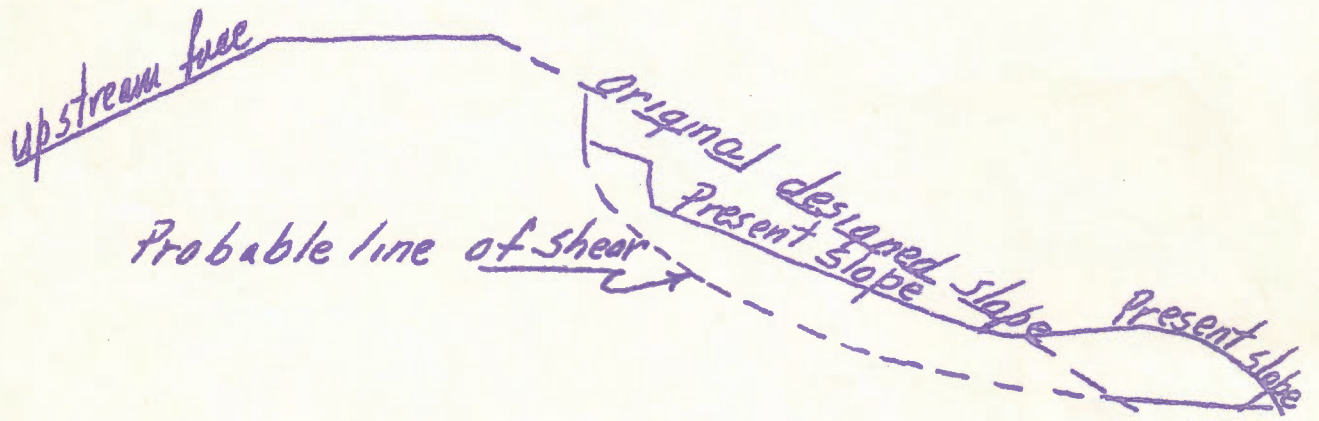
Attached are sketches showing type of failure and corrective construction.

The outlet conduit extension should be carefully placed so that no leaks can occur within the dam.

The downstream toe drain should be carefully designed and placed.

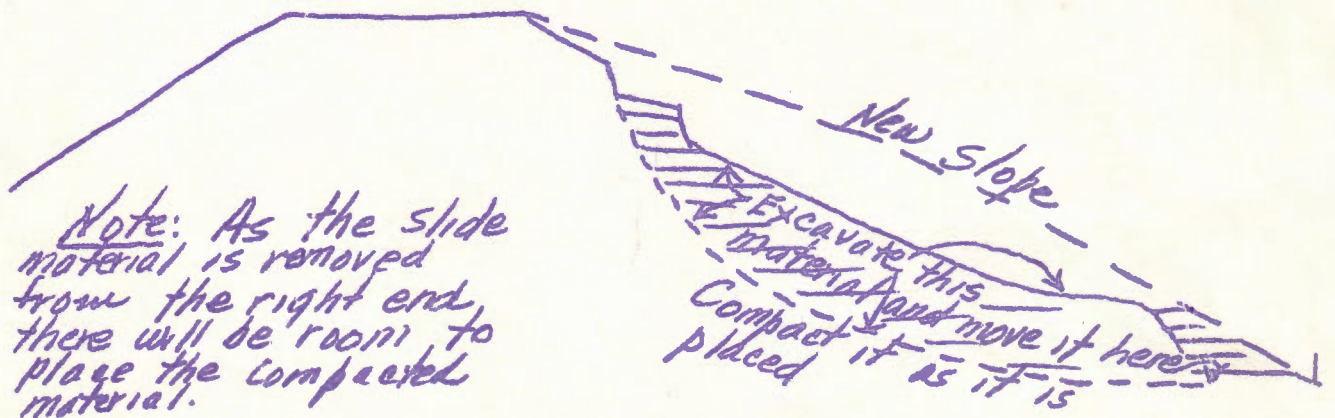
George A. Lawrence
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ATTACHMENT



Probable line of shear

Sketch showing Type of Failure



Note: As the slide material is removed from the right end, there will be room to place the compacted material.

Sketch showing Corrective Construction

222 South West Temple, Room 220
Salt Lake City 1, Utah
July 27, 1962

Jay Bingham, Executive Director
Utah Water and Power Board
425 State Capitol Building
Salt Lake City, Utah

Wayne D. Criddle
State Engineer
403 Capitol Building
Salt Lake City, Utah

Gentlemen:

A few days ago, our field office reported to me that the Little Deer Creek Reservoir dam had a partial failure which they considered serious. They were very concerned about this failure due to their responsibility for certification for the ACP cost sharing payment which had been requested.

In view of their concern and the apparent seriousness of the situation, I requested George Lawrence to check on the matter in order to advise and assist our field staff. He visited the reservoir site on July 19th and has since supplied me with a brief report and recommendations. George is out of the office this week and next but mailed his report to me. I attempted to call you earlier in the week to review the situation and determine what might be done, but because both of you were out of town I had the attached letter reproduced in order to provide you a copy.

In view of the fact that there may be a question as to this structure qualifying for ACP cost sharing, I believe it is very important that the situation be reviewed at the earliest possible date. If it can be arranged I would like to have Gilbert Searle visit the reservoir site with you on July 30th. If this is not feasible, please suggest a date when he could meet with you to review the situation in the field. We need to be up-to-date on plans or possible plans for repair.

Sincerely yours,

J. A. Libby

J. A. Libby,
State Conservationist

Enclosure

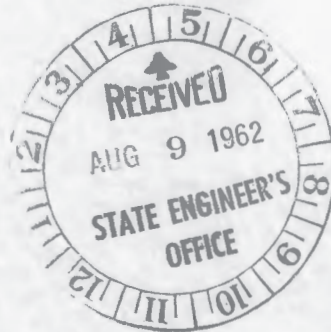
Aug 1
Scheduled for July 31.



THE STATE OF UTAH
UTAH WATER AND POWER BOARD
SALT LAKE CITY 14, UTAH

State Engineer

JAY R. BINGHAM
EXECUTIVE DIRECTOR



August 8, 1962

Mr. J. A. Libby
State Conservationist
222 South West Temple, Room 220
Salt Lake City 1, Utah

Dear Mr. Libby:

This will acknowledge receipt of your letter of July 27th transmitting the memorandum of Mr. George A. Lawrence's visit to the Little Deer Creek Dam on July 19, 1962. As suggested in your letter, a visit to the Reservoir site was made on August 1st, at which time Mr. Bradshaw and Mr. Saerle of your office were present. Mr. Wayne D. Criddle and Donald Norseth represented the State Engineer's office, Jess Tuttle, and John Gillman represented the State A. S. C. Committee. The sponsors were represented by John Lambert and T. W. McNeil. Our Water & Power Board representatives included Daniel F. Lawrence, myself and Dr. D. F. Peterson, Consultant.

At the time of the visit, riprap material was being placed on the upstream face of the Dam. In accordance with our plans previously discussed with Mr. Lawrence, the outlet pipe had been extended 24 feet and a heavy rock fill had been placed near the downstream toe.



THE STATE OF UTAH
UTAH WATER AND POWER BOARD
SALT LAKE CITY 14, UTAH

JAY R. BINGHAM
EXECUTIVE DIRECTOR

J. A. Libby

-2-

August 8, 1962

The conclusions concurred in by all present were:

1. To flatten both the upstream and downstream slopes of the Dam as proposed by the Water and Power Board.
2. Recompact the downstream face to give a smooth compacted surface conforming with the modified slope.
3. To carry a rock fill addition to the downstream toe from elevation 9150 to elevation 9178 on 2.5 : 1 slope. Above elevation 9178 extending to the top of the Dam, a minimum thickness of 12" of fine rock riprap would be placed on the recompactd downstream surface. 2
4. To provide drainage ditches in the vicinity of the borrow area and the right abutment to prevent snow melt water from saturating the downstream face.

The attached drawings indicate the cross section of the original design, the cross section of the Dam as modified and a cross section of the downstream face after the occurrence on June 20th of the slippage. There is also attached, a photograph taken on June 23, showing the remnants of the large snow drift which contributed to the surface mudrock flow.

Sincerely,

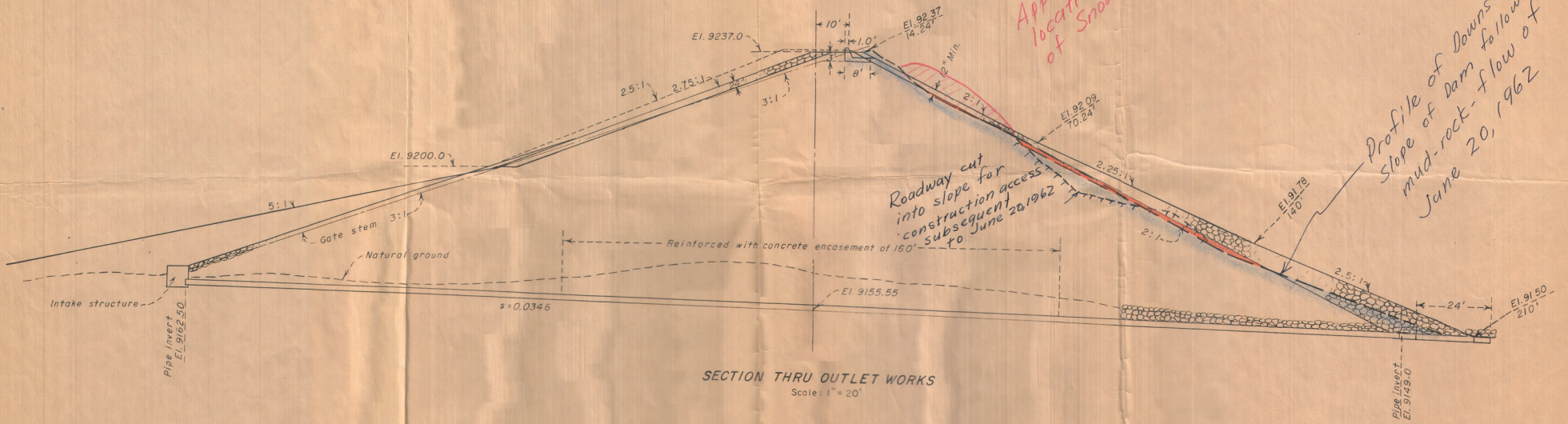
Jay R. Bingham
Executive Director

JRB:jms

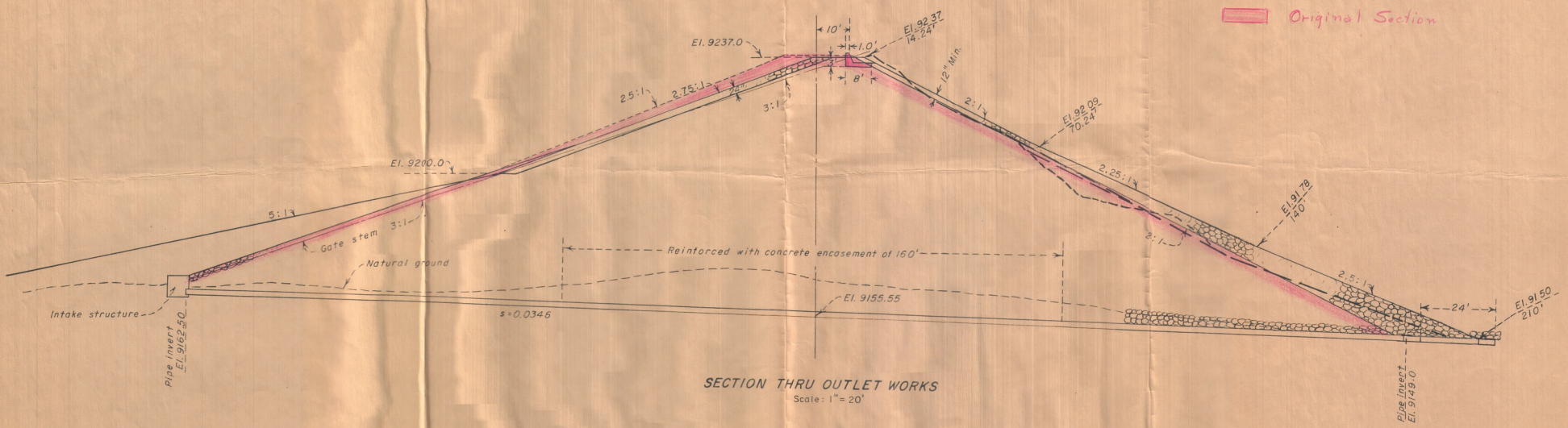
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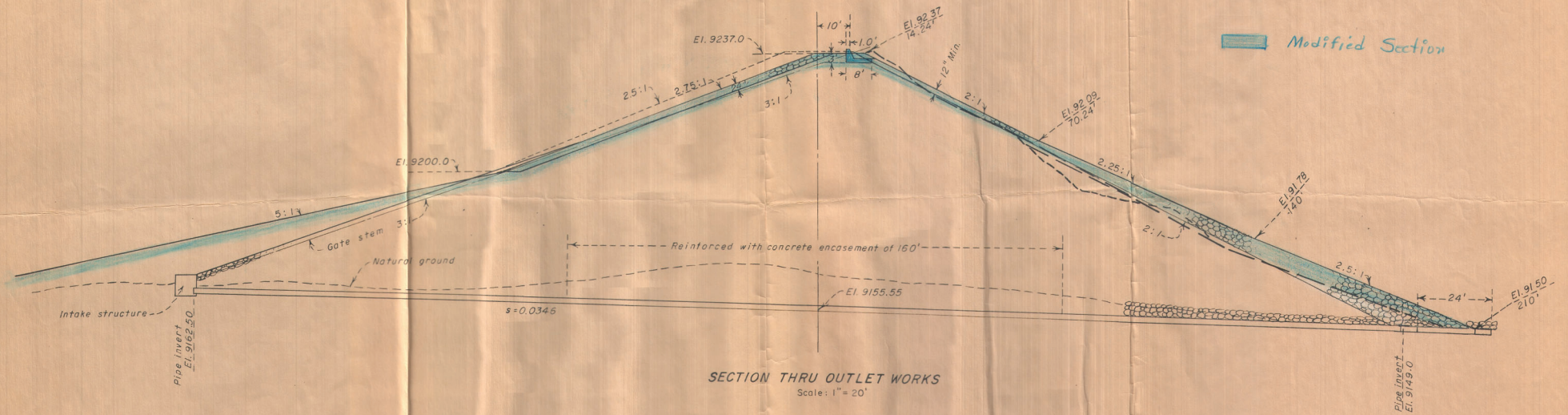
cc:

Wayne D. Criddle
D. F. Peterson
John Lambert



SECTION THRU OUTLET WORKS
Scale: 1" = 20'





SECTION THRU OUTLET WORKS
Scale: 1" = 20'

M E M O R A N D U M

TO; Mr. Wayne D. Criddle

October 24, 1962

FROM: Donald C. Norseth

SUBJECT; LITTLE DEER CREEK DAM

* * * * *

The inspection reports of the construction of Little Deer Creek Reservoir were received October ~~30~~²², 1962 after construction was completed. The reports set forth the general construction problems and progress but lack sufficient details for good analysis of construction methods. It is noted that reports of compaction and soil moisture are not included. These reports are filed as part of the record of Little Deer Creek Dam.



THE STATE OF UTAH
OFFICE OF STATE ENGINEER
SALT LAKE CITY

WAYNE D. CRIDDLE
STATE ENGINEER

April 23, 1963

MEMO

TO: Don Norseth
FROM: Wayne D. Criddle
SUBJECT: Administration of Little Deer Creek Reservoir on
Duchesne River

Last week Leo Brady, Water Commissioner on the Duchesne, was in and discussed with me the problem of administering the waters on the Duchesne River because of the operation of Little Deer Creek. With the short water supply year facing us, it seems quite probable that the diversion to Duchesne Tunnel may have to be removed and the natural flow by-passed through Little Deer Creek and the Duchesne Tunnel diversion to meet prior rights on the Duchesne proper.

Since we have not had this new reservoir integrated into the system in the past, there are certain actions which I feel this office must take immediately:

- 1 - Check on gaging stations and devices essential to river administration.
- 2 - Revise distribution schedule to show Little Deer Creek rights.
- 3 - Assessment costs for administration must be set against this right. As with other transbasin diversions, there are distribution costs on both sides of the mountain and the water user must be so assessed. Assessment should begin for 1963 on an estimated storage and delivery.

We should request a meeting of interested parties at this office in the near future.

Wayne D. Criddle

Wayne D. Criddle

WDC/eca

cc: Leo Brady
R. Keith Higginson
Frank Reese
Utah Water & Power Board
Roy Lambert, Pres. Kamas Irrig. Co.



Replied to
this on 6/28-63 from Tel Aviv.
W.D.C.

THE STATE OF UTAH
OFFICE OF STATE ENGINEER
SALT LAKE CITY

WAYNE D. CRIDDLE
STATE ENGINEER

(1)

6-19-63

Notes with respect to Little Deer Creek Dam
by L. T. Mayo

6-17-63

1- Called Joe L. By and inquired as to any inspection that may be made by S. E. S. He advised that no plans were being made to inspect the dam failure or the damage. This does not seem reasonable to me in view of their previous involvement in recommending correction of partial failure last winter.

2- Called Bud Phelps, Dept. of Fish and Game, and was advised that they intended to investigate only the fisheries damage.

3- Talked with Paul Willmore's office, U.S.B.C. and was advised that they plan an investigation of their diversion works and streamgaging facilities and did not plan to investigate the dam failure. This is my personal opinion that they or the Provo River Water Users Assoc. will investigate the failure because of extensive damage to the diversion facilities.



- 4- Arrangements were made with Mill Wilson to get a summary of discharge data for stations on the Duchesne River together a summary of damage to any of the stations.
- 5- Obtained preliminary precipitation data from the Weather Bureau for Hanna, Fruitland and Hiber. The data does not confirm early reports that unusually high precipitation may have contributed to the failure.
- 6- Governor's Office was advised that Higginson and Norseth were visiting the dam site.
- 7- Gov. Clyde called from Wash., D.C. seeking information on No. 500 Project and was briefly advised of the situation on Little Deer Creek. He did not specifically recall the project.
- 8- Talked with Hurst of Forest Service, Ogden, and he provided the following information:
- They investigated early report of cloud burst in the area and could not substantiate it.
 - They have assigned engineering personnel to the dam site to check on the failure and



THE STATE OF UTAH
OFFICE OF STATE ENGINEER
SALT LAKE CITY

WAYNE D. CRIDDLE
STATE ENGINEER

(3)

resulting damage.

c- They will investigate damage to Forest Serv. facilities along the river.

d- They will investigate the failure of the dam because of their prior approval of plans and specification.

6-19-63

Talked with Joe Novak about damage to Bureau and Forest Serv. facilities. He provided the following information:

1- No significant damage to the diversion structure for Duchesne Tunnel although a great deal of debris was deposited in the forebay.

2- The diversion structure ~~and~~ a portion of the pipeline that carries Little Deer Creek water to the tunnel ~~was~~ wash away and the remaining portion of the pipeline plugged with debris.

3- More than a mile of road from the

THE STATE OF UTAH
OFFICE OF STATE ENGINEER
SALT LAKE CITY

WAYNE D. BRIDGLE
STATE ENGINEER



Little Deer Creek Dam to the tunnel has been washed out and will be difficult to replace because of severe scour.

4- Estimates damage of at least \$25,000

5- Indicated that no specific plans had yet been made for an investigation of the failure - that this will likely hinge on the question of restitution for damages and the possibility of litigation

I strongly suspect that the Bureau is already started on its own confidential investigation - this certainly would be consistent with the Bureau's previous involvement and the extent of the damage that has taken place.

6-19-63

Personal Observations

With the loss of one life and property damage, including the loss of the dam, likely to exceed \$300,000 the event is certainly a disaster and invites a close examination of the events preceding the failure and the administrative procedures involved. At the moment everyone seems to be catching his breath and digesting the events. It should not be very long.



THE STATE OF UTAH
OFFICE OF STATE ENGINEER
SALT LAKE CITY

WAYNE D. CRIDDLE
STATE ENGINEER

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but however, until some very pointed questions are asked.

It seems very clear that the dam went out because of a structural failure. The maximum water surface behind the dam was several feet below the spillway crest and early reports of unusual precipitation in the area have not been confirmed. The dam itself seems a complete loss. Those who have suffered the damage will soon begin to look for restitution and at that point the serious probing will begin. Attempts to pinpoint responsibilities will lead to specific inquiries. The failure was in the area in which the partial failure occurred last winter.

In examining our files on Little Deer Creek Dam there seems to be enough information on questionable practices, the partial failure last winter with comments on ^{the} seriousness of the situation at that time, to really put the fat in the fire. Some of the data, especially S.C.S. comments and recommendations for remedial action, must also be in files of other agencies. I have no idea of the extent to which S.C.S. involvement will be influenced by the agency relationship

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WAYNE D. CRIDDLE
STATE ENGINEER

THE STATE OF UTAH
OFFICE OF STATE ENGINEER
SALT LAKE CITY



between the Lawrence brothers. As far as the Forest Service is concerned this can only lead to greater control of this type of development on forest lands. They can use this situation very effectively as the justification for strict administrative control.

You might want to consider obtaining the services of a consultant to examine the dam and prepare a report on the possible cause or causes of failure. This would create the risk of leaving us somewhat suspect - but would at least be straight forward. The use of our staff for this purpose might prove inadequate and interpreted to have a self serving influence with respect to any conclusions.

To my knowledge none of us has had any conversation with the Governor, Jay Byrgen or any members of the Board.

June 25, 1963

MEMORANDUM

TO: Hubert C. Lambert

RE: Little Deer Creek Reservoir

On Monday morning June 17, 1963, an inspection was made of the Little Deer Creek damsite at which time the following items were noted:

- 1 - From the high water mark in the reservoir (at 62' on gage), it held about 1,150 acre-feet at time of failure. This was some seven feet below spillway.
- 2 - The break is ninety-five feet inside the spillway near the right abutment. The bedrock is exposed for almost the entire height of the dam. A small amount of fill is all that remains capping the bedrock.
- 3 - Several areas within the reservoir and on the upstream face of the dam have sloughed probably because of the sudden drawdown.
- 4 - No evidence could be seen of a cutoff trench which is just upstream from the centerline of the dam.
- 5 - The spillway channel was apparently not built to the specifications.
- 6 - Water and material were sloughing from a small wet area on the right abutment probably from local surface melt.
- 7 - The material remaining in the north half of the dam appears to be of even quality with no areas or zones of weakness.
- 8 - The area below the dam is thoroughly scoured.
- 9 - From appearances the dam probably failed suddenly releasing a surge of water which "bounced" from one side to the other in the canyon below the dam. Water levels about one mile downstream appear to have been many feet higher on the north side than on the south.

*See Photos Attached
To File.*



THE STATE OF UTAH
OFFICE OF STATE ENGINEER
SALT LAKE CITY

WAYNE D. CRIDDLE
STATE ENGINEER

June 26, 1963

Dear Wayne:

Since the disaster at Little Deer Creek is about a week old now it has begun to crystalize as to what faces us in this matter.

The newspapers have made quite a flair of this disaster as ~~might be~~ expected. In the earlier phases most newspaper talk was directed to the Water and Power Board. However, the last several days there have been articles appearing in the newspapers with barbed statements that the State Engineer is responsible for dams and reservoirs.

I had a long conference with the Governor relative to this failure and at the present time am preparing a detailed report of everything that we can find relative to it. I have made no statements to the press because at the present time it has appeared inadvisable. However, as soon as the detailed report is prepared we undoubtedly will be quizzed relative to our position in this matter.

We are sending what articles have been printed, that have not already been sent to you by Elva, so that you can see what the newspapers' statements are like.

The matter that is worrying me more than the Little Deer Creek investigation at the present time is the condition at Porcupine Reservoir. We have been watching this reservoir very carefully and a wet spot has developed on the downstream slope of the dam which has increased in size but has apparently stabilized in the last 24 hours. In addition a flow of clear water has increased through the fractured limestone in the lower part of the spillway. I think you were aware of the condition of the spillway before you left. I sent Don Norseth to check this dam yesterday and apparently the situation is getting worse. I have ordered the water out of the dam at full outlet capacity and, yesterday, ordered that a man be kept at the dam day and night to watch it in case there is any indication of failure. I hope to get the water down and the pressure off before anything serious happens. I am going up to examine the dam today and may know more after my return. I am going to report to the Governor the results of Don's investigation.

A third problem is on Red Creek Reservoir where leaks have again developed to a size as large, or possibly larger, than the ones last year. At the moment it doesn't appear that this is going to be in immediate danger but will have to be watched very carefully.

I have sent an approval of the extension of time in the Gooseberry matter to all parties and, of course, will expect an appeal in due time. Art Nielson has moved to dismiss Skeen's complaint in the matter before the court. I have not decided yet whether to join in this move or to sit back and watch developments.

The Ogden City trial is now completed and the temporary order issued that indicates the Judge is thinking pretty much along our line and we may have secured a sanction of the action which we took.

Other than these special matters most of the work of the office is going about as usual.

Hope you are enjoying your trip and the work you are doing. I will occasionally inform you as to the progress of the matters which are before us at this time.

Sincerely,

A handwritten signature in cursive script, appearing to read "Hubert".

HCL/le
Enclosures

LITTLE DEER CREEK RESERVOIR
June 26, 1963

Little Deer Creek Reservoir was created by the construction of Little Deer Creek Dam during 1961 and 1962. This dam failed June 16, 1963. This report is a summary of the activities of this office in regard to this dam from project initiation to failure as the records so indicate.

Application 16063 was filed August 30, 1944. It was approved October 16, 1958, and is presently in good standing with an extension of time, within which to submit proof, having been granted until June 30, 1965.

Preliminary plans to construct Little Deer Creek Dam were submitted March 31, 1961. These plans were given tentative approval May 23, 1961, to allow their submission to the Forest Service and Soil Conservation Service for their review. After review by the other agencies the plans were returned to our office and approval of the plans, as revised, (see Sheet 1), was given August 31, 1961. Specifications were requested at this time. No approval of these specifications is noted.

Construction was started August 7, 1961, as indicated in the inspection report of August 13, 1961, for the period August 7 through August 11. On August 31, 1961, the date of the approval of the revised plans, work was being done on the cutoff trench. The outlet had already been installed. No further indication of contact by this office or participation in the project is indicated until the letter of July 27, 1962, concerning the partial failure of Little Deer Creek Dam.

An inspection of the almost completed dam was made and remedies for the problem resolved. See Jay Bingham's letter of August 8, 1962. On October 24, 1962, the inspection reports, covering the building of the dam, were requested and received.

Early in 1963, the plans on file in the office were borrowed by the Water and Power Board and the construction changes were being added at time of failure.

UTAH SOCIETY OF PROFESSIONAL ENGINEERS

UTAH SECTION AMERICAN SOCIETY OF CIVIL ENGINEERS

CONSULTING ENGINEER'S COUNCIL OF UTAH

June 28, 1963

Honorable George D. Clyde
Governor, State of Utah
State Capitol Building
Salt Lake City, Utah

Dear Governor Clyde:

The Engineering Profession must view with concern the recent failure of an earth dam in the Duchesne River Basin. Such an event is certain to incur criticism and adverse public opinion, and to reflect upon the ability, integrity, and motives of engineers in general. We recognize as one of our prime responsibilities the protection of the public against physical injury and financial loss. This recent failure indicates a need for a careful review of practices and policies controlling the safety of such structures. The adequacy of several existing dams should be investigated and any necessary precautions taken to insure their stability and useful service. The action of the Utah Water and Power Board in engaging the services of a private engineering firm to investigate the causes of failure of the Little Deer Creek Dam, is commendable and meets with the whole-hearted support of the organizations herein represented.

In recognition of the problems which have developed, a joint committee of engineering organizations has met for the purpose of considering what steps might logically be taken to alleviate some of the difficulties. It has been proposed that a standing committee be formed for the purpose of developing recommendations and standards of design and practice to safeguard the public interest in the future. At the present time, it is desired to offer the services of the Engineering Profession in any way that might be beneficial. Our principal concerns are to serve the public interest and uphold the reputation of the Engineering Profession.

Sincerely yours,

Utah Society of Professional Engineers

Hugh Thomson
Hugh Thomson, President

Utah Section American Society of Civil Engineers

George Whitaker
George Whitaker, President

Consulting Engineer's Council of Utah

Vernon Proctor
Vernon Proctor, President



7 Photostatic

STATE OF UTAH
OFFICE OF THE GOVERNOR
SALT LAKE CITY

GEORGE D. CLYDE
GOVERNOR

July 2, 1963

The Honorable A. Pratt Kesler
Attorney General
Building

Dear Mr. Kesler:

As you are aware, the Little Deer Creek Dam on the Duchesne River burst some days ago with resulting damage to private property located in the area beneath the damsite. The dam was constructed as a project of the Utah Water and Power Board, an agency of state government. Investigations are currently underway to determine the cause of the dam failure, but as of this date, such investigations are inconclusive.

I appreciate, of course, that until the cause or causes of the failure have been determined, responsibility for same cannot be fixed. Taking this into account, however, I request that your office prepare a tentative legal opinion as to the possible liability, if any, of the State of Utah for damages to private property resulting from the dam failure.

Yours sincerely,

Governor



GDC: ag

August 27, 1963

MEMORANDUM

TO: A. Pratt Kesler, Attorney General
FROM: Dallin W. Jensen, Assistant Attorney General
RE: STATE LIABILITY ON THE LITTLE DEER CREEK DAM

Pursuant to a request of Governor Clyde I have prepared a tentative legal opinion concerning the possibility of state liability for damages which resulted in the failure of the Little Deer Creek Dam.

This opinion must necessarily be very general in scope since it is virtually impossible to foresee the exact nature of any contemplated lawsuit that might be filed against the state or an agency. Also since only limited facts are available at this time I have not attempted to define a specific fact situation upon which a lawsuit could be filed. Rather, I predicted this opinion on the following general facts. The Utah Water and Power Board entered into a contract with the South Kamas-Washington Irrigation Company on September 1, 1961, subsequently amended on August 22, 1962, for the construction of the Little Deer Creek Dam and the Board also designed the structure and provided engineering services during the construction. The dam failed in June 1963, resulting in the loss of one life and damage to property, and I would assume that any party seeking relief for damages sustained as a result of the dam failing would allege that there was negligent conduct involved either in the design and/or construction of the project. I have, therefore, concerned myself only with the general propositions which would probably form the basis for any action by a party who suffered damage, and not attempted to define what particular acts may constitute negligence in the building of a dam.

WHETHER THE STATUTE PROVIDING THAT THE UTAH WATER AND POWER BOARD MAY SUE OR BE SUED IS A WAIVER OF SOVEREIGN IMMUNITY ALLOWING AN ACTION FOR DAMAGES FOR A TORT.

When considering whether an action may be maintained against the State of Utah we begin with the assumption that the state as a sovereign cannot be sued unless it gives its consent or otherwise waived its immunity.

This proposition is fundamental in our system of jurisprudence and to my knowledge there is no authority to the contrary either in federal or state courts.

Palmer v. Ohio, 248 U.S. 32, 63 L. Ed. 108 (1918).

In dismissing an action against the state and a state agency the Supreme Court of the State of Utah in a very early decision supported this proposition, Wilkinson v. State, 42 U. 483, 134 P. 626 (1913), with this authoritative pronouncement:

We shall first take up the question of whether appellants were suable in the courts of this state. We have neither a statute nor a constitutional provision authorizing a suit against the state . . . The action therefore was in fact against the state in whatever form it may have been commenced, and in the absence of either express constitutional or statutory authority an action against a sovereign state cannot be maintained. The doctrine is elementary and of universal application, and so far as we are aware there is not a single authority to the contrary.

However, it is unlikely in this situation that any contemplated action would be filed directly against the state, rather the action will probably be filed against the Utah Water and Power Board since this was the agency which, by contract, assisted the water users with the financing of the dam; and also assisted them with engineering work involved in design and construction. Section 73-10-4, U.C.A., 1953, in setting out the powers and duties of the Board provides, under subsection (3), that the board may sue or be sued. This section of the water and power board act has never been brought before our Supreme Court so we have no cases specifically interpreting this language as it applies to the board. However, this same phrase has been used by the legislature in setting out the powers and duties of counties and municipalities, and the Utah Supreme Court has, on a number of occasions, construed these specific words as not being broad enough to allow for suits in tort for damage to persons or property. This doctrine is based upon public policy in that there would be danger in adopting a rule which would allow the sovereign to be sued by each and every individual who imagined himself injured by a public servant. This would be too great a liability on public service. In Cobia v. Roy City, 12 U. 2d 375, 366 P. 2d 986 (1961), which was an action against the city for damage to property, the court, speaking through Justice Henrcid, affirmed the dismissal of a lawsuit on the grounds of sovereign immunity and reiterated the position our court has consistently taken on this subject:

Utah constantly has adhered to the principle of governmental immunity where the sovereign has been attacked on account of injury to property, which principle has been applied to state activity or that of its agencies, such as school boards, cities, counties, the highway department and the like.

Also in an action against a board of education, whose statutory authorization provides that they may sue or be sued, the court held that this was not authorization to sue such an organization for tort when it was performing a governmental function.

However, under our constitution, the power to make departments of the state respond in damages for torts rests with the legislature, and without legislative enactment we are unable to impose any liability or obligation upon school districts. Bingham v. Board of Education of Ogden City, 118 U. 582, 223 P. 2d 423 (1951).

It has been repeatedly held that the State Road Commission cannot be sued for damages, Campbell Building Company v. State Road Commission, 95 U. 242, 70 P. 2d 857 (1938); Springville Banking Co. v. Burton, 10 U. 2d 100, 349 P. 2d 157 (1960); Fairclough v. Salt Lake County, 10 U. 2d 417, 354 P. 2d 105 (1960).

In all of these cases the claims were denied because the statute providing for suits against the Road Commission limited such actions to suits on contracts.

The court in the Campbell case, supra, held:

It may be helpful in determining what is within the scope of a statute to consider what is clearly not within the operation. It is undoubtedly true that the waiver of immunity from suit does not of itself create any new liability against the state or prevent it from setting up any defense it may have to the suit. Consent to be sued on certain contracts has certainly not opened the door to liability on account of the negligence or misconduct or wilful conduct or unauthorized acts of officers or agents of the state. There is no permission for a suit on account of tort.

While the provision which provides for suit against the board does not contain the language limiting the actions to contract it is obvious that it was the intent of the legislature to limit actions to those necessary to carry out the purpose for which the board was created and not for tort liability.

This same rule has been applied to counties. In the case of Shaw v. Salt Lake County, 119 U. 50, 224 P. 2d 1037, (1950), our court clearly expressed this same fundamental concept that such statutes are not blanket authorization to suits:

Section 19-4-3, U.C.A., 1943, covering counties indicates that "A county has power: (1) To sue and be sued." This

however, is but a general grant constituting the county an entity to sue and be sued, where it may under other applicable statutes or principles, properly be sued or sue. It is not a blanket authorization for suits to be brought against the counties.

The Utah cases are in accord with the decisions from other states and all have uniformly sustained this proposition. These cases are collected in 13 A.L.R. 1276 and 169 A.L.R. 105. A decision from the State of Virginia is representative of these cases and this proposition is well stated by the Supreme Court of that state in the case of Elizabeth River Tunnel District v. Beecher, 117 S.E. 2d 685, (1961), where the court announced:

The fact that the Elizabeth River Tunnel District Act provides that it "may sue and be sued" cannot be advanced as an assertion of state waiver of immunity or state consent to suit for torts. We have consistently held that waiver of immunity cannot be implied from general statutory language or by implication. Statutory language granting consent to suit must be explicitly and expressly announced . . .

The language "sue and be sued," . . . are words affording a procedural right only and do not constitute a waiver of immunity or a consent to suit.

It should be pointed out that the specific action in this case might be to enjoin an alleged nuisance and the consequent recovery of damage for the prior dam failure. Without going into the merits of such a claim a plaintiff would be advocating this approach in order to bring him under those cases which have held that sovereign immunity does not apply to the enjoining of a nuisance.

In the Shaw case, supra, the court held that sovereign immunity did not extend to the county when it was creating or maintaining a nuisance and affirmed the ruling of the trial court enjoining the continuing nuisance. However, the court specifically pointed out that it was not called upon to decide the question of damages arising out of a nuisance injuring property rights. So assuming arguendo that a plaintiff could get by the defense of sovereign immunity on a nuisance theory he would still be faced with the question of whether the court would allow his suit for damages to property.

As far as personal injuries are concerned I think the court has already decided that in such a case sovereign immunity applies whether the activity is characterized as maintaining a nuisance or merely performing an activity in a negligent manner, Bingham, supra. Whether the court would attempt to distinguish between damages for personal injury and damages to property is not known

at this time. However, the Cobia case, supra, indicates that the court would sustain the defense of sovereign immunity in an action for damages to real property where the damage is an isolated case as opposed to a continuing nuisance. Cobia involved an isolated situation of a sewer overflowing and injuring property and subsequent lawsuit for damages. The court denied the claim against the city on the grounds of sovereign immunity stating:

Our concern is whether an incorporated city is liable for damage resulting from a sewer stoppage on a theory of 1) negligence or 2) nuisance, in an isolated case, where the question pointed up is whether operation of a sewer is governmental or proprietary. Under the facts of this case, and because of what we have said before, we think the result is the same whether it is urged on negligence or nuisance grounds.

In my opinion the Cobia case is good authority for the proposition that the defense of sovereign immunity should apply to a dam failure whether the action is filed on a nuisance or negligence theory.

Also, the fact that the action may be brought against the Water and Power Board, its members, or employees in their official capacity, does not make it any less an action against the state. In Wilkinson, supra, which involved an action against the State Board of Land Commissioners, the court stated:

Respondents' counsel do not in terms contend that an action against the state can be maintained, but what they contend is that this action is not against the state. We cannot see how counsel can seriously make such a claim, since the very judgment they seek to uphold requires that it be paid out of funds belonging exclusively to the state. It is idle to contend that an action is not against the state when it and no one else is held responsible, and its funds are directed to be appropriated in satisfaction of the judgment without even a right to recoup its loss. To say that under such circumstances the action is merely against state officials or state agencies is to ignore the very essence of things. In this case the acts complained of and attributed to appellants were done for and in behalf of the state, and the canal, in part at least, belongs to, and all of the work was paid for by state funds. The action therefore was in fact against the state in whatever form it may have been commenced,
. . . .

Again in Campbell Bldg. Co., supra, the court found:

Proposition No. (3), to the effect that the State Road Commission is an arm or agency of the state, is also not disputed and may be affirmed. Indeed, the statute seems clearly to contemplate that this is true.

(It should be noted that the statute referred to is in many respects

similar to the one setting up the Utah Water and Power Board.)

It would follow, therefore, that where the State Road Commission is sued as in this case, not individually, but in its official capacity, the action is, in effect, one against the state.

WHETHER THE STATE THROUGH THE UTAH WATER AND POWER BOARD WAS ENGAGED IN A GOVERNMENTAL OR A PROPRIETARY FUNCTION DURING THE CONSTRUCTION OF THE LITTLE DEER CREEK DAM.

In an attempt to avoid the concept of sovereign immunity a plaintiff may advocate that the state, through the Board, is not performing acts of a governmental nature but rather is functioning in a proprietary capacity since the projects are for the benefit of a few individuals and are not for the benefit of the general public. There is a large body of law, which has built up largely involving municipalities, that supports the proposition that sovereign immunity doesn't apply to a proprietary function of a sovereign. So far as I am aware the Utah court has not squarely concerned itself with this question in any case involving a state agency.

However, since the action of the board in this case is the performance of duties expressly set forth in the statute creating the board it would certainly seem that such action can only be governmental in nature. The Board is a direct arm of state government performing a public purpose. There are a number of states which have expressly rejected the test of governmental or proprietary function in determining state liability for tort. These cases are predicated on the proposition that the state by its very nature can only act in its sovereign governmental capacity. These cases are collected and discussed in 40 A.L.R. 2d 932.

In Price v. Sims, 58 S.E. 2d 657, (1950), the Supreme Court of Appeals of West Virginia announced in a clear statement the rule in that state concerning governmental functions:

The state or any of its constituent agencies, in the exercise of its sovereign powers and in the performance of its duties, is generally engaged in the discharge of a governmental function. The governmental character of its acts in the discharge of its duties is the same whether the duties are created by contract or are imposed by constitutional or valid statutory provisions.

If the court adopts this position the defense of sovereign immunity would automatically apply.

However, this annotation points out that there are a number of states recognizing the distinction between governmental and proprietary functions, 40 A.L.R. 2d 928. Assuming for the purposes of this brief that a plaintiff could get the court to adopt this distinction I still think the court would reach the conclusion that the activities of the board are governmental in nature.

The general test the Utah court has applied to governmental functions of municipalities is that the activity must be something done for the public good and, further, whether there is a special pecuniary benefit to the city and whether the activity is of such a nature as to be a real competition with free enterprise, Ramirez v. Ogden City, 3 U. 2d 102, 279 P. 2d 463, (1955). I assume the contention would be, if counsel could get the court to adopt the above standards for a state agency, is that the Board by contracting with a small group of individuals is not something done for the public and, further, that by constructing such projects the Board is in actual competition with free enterprise. Our defense to this proposition could best be predicated on the concept of water use and development in Utah. Water has always occupied a unique position in the legislature and courts of this state. Section 73-1-5, U.C.A., 1953, provides:

The use of water for beneficial purposes as provided in this title, is hereby declared a public use.

Our Supreme Court adopted this view early in the history of this state and this approach has served as one of the cornerstones of development in the west. In the case of Clark v. Nash, 27 U. 158, 75 P. 371 (1904), the court held:

This is evident from the fact that there are two lines of authorities, neither of which attempt to lay down any fixed rule as a guide to be followed in all cases. One class of authorities, in a general way, holds that by public use is meant a use by the public or its agencies--that is, the public must have the right to the actual use in some way of the property appropriated; whereas the other line of decisions holds that it is a public use within the meaning of the law when the taking is for a use that will promote the public interest, and which use tends to develop the great natural resources of the commonwealth. After a careful examination of the leading cases on this subject, we are of the opinion that the class of decisions last mentioned is more in harmony with enlightened public policy and that the liberal interpretation given the

term "public use" which the legislature has in effect, declared shall be followed in this State is far more conducive to individual public advancement than the restricted construction adopted and followed by the line of decisions first referred to.

Again on page 165 of the Utah Reporter:

In view of the physical and climatic conditions in this State, and in the light of the history of the arid west, which shows the marvelous results accomplished by irrigation, to hold that the use of water for irrigation is not in any sense a public use, and thereby place it within the power of a few individuals to place insurmountable barriers in the way of the future welfare and prosperity of the State would be giving to the term "public use" altogether too strict and narrow an interpretation, and one we do not think is contemplated by the Constitution.

The Supreme Court of Oregon has taken a similar position in the case of Petition of Board of Directors, etc., 86 P. 2d 460, (1939), at page 464:

The conservation of water and power resources of the state for the benefit of the people is unquestionably a governmental function of great importance.

A prospective plaintiff will probably assert those cases which have held that a municipality when engaged in the business of selling water to private citizens and receiving payment therefor is liable for any negligence in the operation of such a system. The Utah cases have adopted this rule. In Egelhoff v. Ogden City, 71 U. 511, 267 P. 1011, (1928), they reiterated this proposition with this announcement:

The law relating to the liability of a municipal corporation for negligence in the construction and management of its waterworks system is thus stated in 6 McQuillin, Mun. Corps. § 2880, p. 5514:

The furnishing of water to private citizens is a corporate rather than a governmental function, and hence it is liable to its customers for negligence in furnishing water the same as a proprietor of a private waterworks would be, except that where the property of a customer is destroyed by fire because of an inadequate supply of water no recovery can be had, the theory being that the negligence is in connection with the fire department, and that in maintaining a fire department the municipality is discharging a governmental function. But with this exception, where the water system of a municipal corporation is conducted by the municipality in part for profit, even if principally used for public purposes, the municipality acts in its corporate or private capacity and is liable for damages caused by its negligent construction or management, to its employees or the public generally, to the same extent as a private individual or corporation would be under like circumstances. But, there is a distinction between furnishing water to

individuals for compensation and furnishing it for fire purposes. The former is the exercise of a private, and the latter a governmental, function; and there is no liability if the negligent act was done in the extinguishment of fire, or in connection with flushing hydrants solely to better fire protection, or the like.

On the other hand, a municipality which supplies water to its citizens, and charges therefor, is liable for negligence although its waterworks system is also used for the extinguishment of fires.

In my opinion the functions of the Board do not come within this rule since it is not engaged in the business of selling water for profit and its activities are for the benefit of the public as a whole.

I think it can be concluded, that because of the public nature of water use and development in this state, the activities of the Utah Water and Power Board are strictly governmental in nature when it enters into contracts for the construction of water conservation and utilization projects with water users. This is a duty and responsibility specifically imposed upon the board by statute.

LIABILITY FOR INDIVIDUAL BOARD MEMBERS OR STAFF EMPLOYEES IN THEIR INDIVIDUAL CAPACITIES.

It is conceivable, although unlikely, that an action may be filed against the members of the Board and/or members of the staff in their individual capacities and not as officers and employees of the state. It would seem that such an action could not be maintained unless the activities were outside the scope of the Board's jurisdiction or without authorization of law. As stated in 43 Am. Jur. at page 85:

As a rule, a public officer, whether judicial, quasi-judicial, or executive, is not personally liable to one injured in consequence of an act performed within the scope of his official authority, and in line of his official duty. In order that acts may be done within the scope of official authority, it is not necessary that they be prescribed by statute, or even that they be specifically directed or requested by a superior officer, but it is sufficient if they are done by an officer in relation to matters committed by law to his control or supervision, or that they have more or less connection with such matters, or that they are governed by a lawful requirement of the department under whose authority the officer is acting.

Subordinates are also within the rule protecting public officers from civil liabilities for official acts, Cooper v. O'Conner, 99 F. 2d 135, (1938).

Mechem in his work on Public Officers states the rule in regard to

Boards on page 397 with supporting authority:

The individual members are, therefore, not liable to private action for the results of the due and proper exercise of the powers lawfully conferred upon them; nor can they be held liable for the doing or not doing of those things which the law has confided to their official discretion. Neither, in the absence of any personal negligences, can they be held personally liable for the defaults or neglects of the servants or agents whom they are officially required to employ.

Neither is an officer liable in a private suit for acts done with care in the honest performance of his duties, and negligence in the exercise of discretionary power will not render him individually liable, McQuillin on Municipal Corporations, Volume 4, page 141. The Utah Supreme Court in the case of Roe v. Lundstrom, 89 U. 520, 57 P. 2d 1128, (1936), in discussing this point stated:

If the defendant commissioners are to be charged with liability it must be on the theory that they are joint tortfeasors. It is a general rule that a municipal officer is immune from liability in a private suit for his acts in the discharge of corporate duties in the absence of wilful negligence, malice or corruption constituting misfeasance . . . and it is often asserted that where a public officer is by law vested with discretionary ministerial powers, and acts within the scope of his authority, he is not liable in damages for an error in judgment unless guilty of corruption or wilful violation of the law.

Without going into the Utah Water and Power Board Act in detail it is apparent from a review of the act as a whole that the Board is invested with broad discretionary powers in the development and utilization of the water resources of this state. Two of the provisions setting out the powers and duties of the Board forcefully spell this out. Section 73-10-4, U.C.A., 1953, provides in subsection (1):

To make studies, investigations, and plans for the full development, and utilization and promotion of the water and power resources of the state, including preliminary surveys, stream gauging, examinations, tests, and cost estimates either separately or in consultation with federal, state and other agencies.

and in subsection (2):

To enter into contracts subject to the provisions of this act for the construction of conservation projects which in the opinion of the board will conserve and utilize for the best advantage of the people of this state the water and power resources of the state.

Since the procedure for the construction of water conservation pro-

jects is left to the discretion of the Board there would seem to be little doubt that the Board was well within its authority when it authorized the design and construction of the Little Deer Creek Dam.

, In order to avoid the prohibition against liability discussed above it might be contended that the act which created the Utah Water and Power Board is unconstitutional. This would be an attempt to bring themselves under that line of authority which holds that a public officer who acts under an unconstitutional statute is without any authority and is thereby liable to any party whom he damages. However, a more approved line of authority holds that until the statute has been declared unconstitutional the officer is entitled to its protection, 43 Am. Jur. P. 97. At this time I have not researched these authorities more since in my opinion the act is constitutional. The contention that it is not would be predicated on Article VI, Section 31 of the Utah Constitution which provides:

The Legislature shall not authorize the State, or any county, city, town, township, district or other political subdivision of the State to lend its credit or subscribe to stock or bonds in aid of any railroad, telegraph or other private or corporate enterprise or undertaking.

Even in the absence of a constitutional prohibition many cases have held that a legislature is without authority to use tax monies to aid private industry. Cases to this effect are collected in 14 A.L.R. 1151 and 115 A.L.R. 1456. However, where the state itself is engaged in a business the courts have tended to broaden the scope of those activities that are considered a public purpose, 115 A.L.R. 1459. In the present situation it would be urged that the contracts which the Board enters into are in reality nothing more than a no-interest loan to a private individual or corporation. Again referring to the statutory authority of the Board which, in addition to the provision quoted above, provides that title to all the projects shall become vested in the State, 73-10-7, U.C.A., 1953:

Title of all projects constructed with funds made available by Section 73-10-8 hereof under the terms of this act shall become vested in the state of Utah. The Board is empowered to enter into contracts which are, in its opinion, necessary for the maintenance and continued operation of such projects.

Because the Board takes title to the project and is engaging in the enterprise itself I am of the opinion that we do not come within the purview of the constitutional prohibition. Under the Utah Act the State itself is engaged in the conserving and developing of water and, as discussed previously, the use of water in Utah for beneficial purposes is a public use 73-1-5, supra, and Clark v. Nash, supra, and this is probably the most important factor involved in the support of this Act. The United States Supreme Court in Fallbrook Irr. Dist. v. Bradley, 164 U.S. 112. (1896), which was an appeal from a California statute involving the reclamation and use of arid lands in that state and involved the question of the use of public funds for private enterprise, the court held the use of water is a public use, page 160:

To provide for the irrigation of lands in States where there is no color of necessity therefor within any fair meaning of the term, and simply for the purpose of gratifying the taste of the owner, or his desire to enter upon the cultivation of an entirely new kind of crop, not necessary for the purpose of rendering the ordinary cultivation of the land reasonably remunerative, might be regarded by courts as an improper exercise of legislative will, and the use might not be held to be public in any constitutional sense, no matter how many owners were interested in the scheme. On the other hand, in a state like California, which confessedly embraces millions of acres of arid lands, an act of the legislature providing for their irrigation might well be regarded as an act devoting the water to a public use, and therefore as a valid exercise of the legislative power. The people of California and the members of her legislature must in the nature of things be more familiar with the facts and circumstances which surround the subject and with the necessities and the occasion for the irrigation of the lands than can any one be who is a stranger to her soil. This knowledge and familiarity must have their due weight with the state courts which are to pass upon the question of public use in the light of the facts which surround the subject in their own state. For these reasons, while not regarding the matter as concluded by these various declarations and acts and decisions of the people and legislature and courts of California, we yet, in the consideration of the subject, accord to and treat them with very great respect, and we regard the decisions as embodying the deliberate judgment and matured thought of the courts of that state on this question.

Again on page 161:

The fact that the use of the water is limited to the landowner is not therefore a fatal objection to this legislation. It is not essential that the entire community or even any considerable portion thereof shall directly enjoy or participate in an improvement in order to constitute a public use.

^{City}
In Lehi/v. Meiling, 87 U. 237, 48 P. 2d 530. (1935), the Utah Supreme Court in holding that the Metropolitan Water District Act did not conflict

Section 31 of Article 6 of the Constitution stated that the broad powers granted such a district to acquire and develop water was a public purpose and the provision authorizing the district to loan credit to private corporations was expressly upheld:

The purposes for which the broad powers are granted the district are for the acquiring, developing, and use of water for public benefit We may assume that the district will exercise this power in furtherance of the public purposes for which it was organized, and that in any contract of this kind the district will protect itself by providing that if it is required to pay the obligation of another district or corporation it will become owner of the water rights or other property for which it will have paid, and not be required to pay for something it does not get.

In the recent case of Utah State Land Board v. Utah State Finance Comm., 12 U. 2d 265, 365 P. 2d 213, (1961), the Supreme Court was again faced with an attack upon a statute because it was allegedly in violation of Section 31 of Article 6 of the Constitution. The court in upholding the constitutionality of the statute in question stated with respect to the question of public enterprise:

When the underlying purpose is to invest for the benefit of the state or a political subdivision thereof, there is no lending of credit or expenditure of funds "in aid of" such enterprise or undertaking.

Also see Barlow v. Clearfield City Corp., 1 U. 2d 419, 268 P. 2d 682, (1954).

Since the beneficial use of water is so tied to our economic and general welfare as to be classified as a public use and since the state itself is engaged in enterprise of developing, conserving, and placing the waters of the state to a beneficial use it follows that the act creating the board is constitutional.

LIABILITY FOR DAMAGES CAUSED BY THE BREAKING OF A DAM CONSTRUCTED ACROSS A NATURAL CHANNEL.

Turning briefly to the question of liability for the construction of a dam across a natural watercourse which subsequently fails. This discussion presupposes that the court has jurisdiction of all the parties and that there is no defense because of the grounds of sovereign immunity discussed previously. Again I wish to point out that this discussion will be very general in nature and does not purport to cover any specific acts that

may or may not be considered negligent. There are two lines of cases on this subject. One line which holds that the individual who impounds water is liable without any proof of negligence. In other words absolute liability is imposed upon the impounder of water, Fletcher v. Rylands, (1866), L.R. 1 Ex Ch 265. This is an old English case but the rule has been adopted in a number of the states, 169 A.L.R. 517. This A.L.R. citation points out, however, that the overwhelming weight of authority favors the rule that liability depends upon proof of some act of negligence, 169 A.L.R. 523 and places Utah among those states which have adopted this rule.

The early Utah case of Lisonbee v. Monroe Irr. Co., 18 U. 343, 54 P. 1009, (1899), involved the complaint, by the owner of land situated below defendants' canals, that said canals had been improperly constructed and negligently maintained. The plaintiff alleged that the consequence of this was that his land was flooded and soil washed away. The court in discussing the question of what is required of a water user who constructs a ditch states on page 347:

The law requires canal companies to use reasonable skill, and judgment and care in the construction of their ditches and in their maintenance and repair, and imposes upon proprietors of irrigated lands like skill, judgment, and care in the use and control of irrigating water. If such water flows upon the surface of irrigated lands onto adjoining lands of another, to his injury, the person whose negligence causes or permits it must respond in damages.

Again the Utah Court in an opinion, Jensen v. Canal Co., 44 U. 10, 137 P. 635, (1913), faced the question of damage to property from water escaping a canal and followed the rule that recovery must be based upon negligence in construction or maintenance:

This court has, in several cases, held that owners of irrigating canals or ditches are liable for injuries or damages which are directly caused by their acts of omission or commission, if such acts constitute negligence and damage follows. In other words, if by the exercise of ordinary care and prudence, as those terms are ordinarily defined in negligence cases, the damage could have been avoided, a failure to exercise such care and prudence may constitute actionable negligence. (Jenkins v. Hooper, 13 Utah, 100, 44 Pac. 829; Lisonbee v. Monroe Irr. Co., 18 Utah, 343, 54 Pac. 1009, 72 Am. St. Rep. 784; Belnap v. Widdison, 32 Utah, 246, 90 Pac. 393; Wiel, Water Rights, etc. (3 Ed.) Section 461.) We are of the opinion that there was sufficient evidence to take the case to the jury. Upon the question of negligence, therefore, the court did not err in refusing to grant a nonsuit.

Also see Jenkins v. Hooper Irr. Co., 13 U. 100, 44 P. 829, (1896),
and Chipman v. American Fork City, 54 U. 93, 179 P. 742, (1919).

The principles announced above have been followed by our Supreme Court in a number of recent cases, Knight v. Utah Power & Light Co., 116 U. 195, 209 P. 2d 221, (1949), and West Union Canal Co. v. Provo Bench Canal & Irr. Co., 116 U. 128, 208 P. 2d 1119, (1949).

It should be made clear that none of these cases involved the failure of a dam and it is possible that the court will not accept the reasoning of these cases on such a situation because the danger to loss of life and property is much greater when a dam fails. Assuming at this point, however, that the court will require some proof of negligence in order to find liability the standard of engineering case which is required to construct a dam the size of Little Deer Creek will be determined from a review of such things as the size of the structure, its proximity to property downstream, etc. This general proposition is well stated by Kinney in his works on Irrigation and Water Rights, Volume 3, 2nd Ed. page 3073:

In any event, whether the strict rule of liability under the common law, as discussed in the previous section, is adopted or not as to rule of decision in any State, any person storing water upon his land is liable for all injuries caused by the escape of the same and due to actual negligence, or from the want of reasonable or ordinary care in the construction or maintenance of the works used for the storage of the water. But the interchangeable terms "reasonable care" or "ordinary care" used in this connection are relative. That is to say, it does not take the same degree of engineering skill to construct a small reservoir as it does a large one. And, therefore, what would be reasonable care in the construction of a small reservoir, where the water is retained by a natural depression of the earth and a brush and earthen dam, but where, even if it does break out it will do little or no damage, might be the most flagrant negligence in the construction of a large reservoir covering perhaps thousands of acres of land, and where the water pressure is very great upon the dam and natural embankments. Therefore, the degree of care which must be exercised in the construction and maintenance of these works is not the same in all cases of stored water. No rule can be stated which will be applicable to all cases; but, in those states which hold that the liability for injuries caused by the escape of the water depends upon the question of negligence or ordinary care exercised by the owners of such works in their construction and maintenance, it must also depend upon the facts and circumstances surrounding each particular case.

As a final matter I would like to point out that in the contract between the Board and water users there is the following provision:

The water company hereby agrees to assume the full obligation for any claim or liability for any injury or death of persons, or for any property loss or damage that may arise in accomplishing the construction of this project for the state, and further, the water company agrees to hold the state immune for all such claims for damages, injury, or death of persons during the life of this agreement.

Since there has been no action filed at this time there has been no discussion with the water users concerning this provision in the contract.

CONCLUSION

An action against the State of Utah or the Utah Water and Power Board for damages resulting from the failure of the Little Deer Creek cannot be maintained because of the defense of sovereign immunity. The Utah cases have recognized that authorization to sue a state agency does not allow an action in tort for damages.

The Board is an arm of state government and its action in contracting with a water users' organization for the construction of a dam is purely governmental in nature and hence the defense of sovereign immunity will apply to the Board, its members and employees.

While the law in Utah is not clear as to the duty of one who builds a dam it seems reasonably certain that the court will require some showing of negligence in order to find liability for a dam failure.

October 11, 1963

Mr. Jay R. Bingham, Director
Water and Power Board
425 State Capitol

Dear Jay:

Now that all reports relative to the failure of the Little Deer Creek Dam have been received, I believe it would be in the best interest of the State and all concerned to have the Water and Power Board meet at an early date, preferably in October, and consider said reports. I suggest that a meeting for this purpose be scheduled.

I am aware that the Forest Service has participated in arranging for some of the reports and I therefore suggest that officials in that agency be consulted before the reports are considered by the Board.

Yours sincerely,

George D. Clyde
G o v e r n o r

GDC:mb
cc: Wayne D. Criddle

Please return → WDC
Hebert H.C.
Keith R.M.
Francis F.T.M.

(ABSTRACT OF)

MATERIALS INVESTIGATION

OF THE LITTLE DEER CREEK DAM

WASATCH NATIONAL FOREST, UTAH

JULY AND AUGUST

1963

Sub - 9-10-63
**Service Receives Soil Report
In Duchesne's Dam Break**

The investigative report undertaken as a result of the breaking of Little Deer Creek Dam in Duchesne County June 16 which claimed the life of a young boy was submitted to the U.S. Forest Service Monday.

THE STUDY WAS made by Fuhrman Rollins Co., an engineering firm of Provo, under a joint contract of the Forest Service, the Utah Water and Power Board and the water users, said William D. Hurst, deputy regional forester.

"The report will be made public as soon as it is checked by our soil expert to be certain that it is complete in that the specifications of the contract have been met," he said.

THE CONTRACT authorizing the investigation into the tragic dam failure did not call for any conclusions or analysis as to why the earth-fill dam failed, according to Mr. Hurst.

This is a soil analysis, accomplished by core drilling and other techniques, which will provide the facts from which other experts may draw the conclusions, he said.

NO ARRANGEMENTS have been made for a joint analysis of the report by the three agencies participating in the investigation.

Jay R. Bingham, director of the Utah Water and Power Board, has said that the report would be submitted to Gov. George D. Clyde. The dam was built under the supervision of the board.

"THE REPORT will be made available to the board as soon as it has been checked to be sure the contract has been fulfilled," Mr. Hurst said.

The dam broke early on Sunday, June 16, sending a deluge through Duchesne County wiping out 11 bridges and taking the life of a 4-year-old boy.

s and Company
Engineers
St., Provo, Ut.



MATERIALS INVESTIGATION
OF THE LITTLE DEER CREEK DAM
WASATCH NATIONAL FOREST, UTAH

1. INTRODUCTION

This report is prepared to summarize the results of an investigation associated with the Failure of Little Deer Creek Dam. This study was authorized by the United States Forest Service

It was specifically requested by the Forest Service that no conclusions as to the resulting Failure be made in this report

The scope of the work as outlined in the contract between the United States Forest Service and our organization is as follows:

1. Field Investigation

A. Sample remaining embankment at sufficient places to provide representative densities at different elevations between the Dam foundation and the upstream slope, crest, and downstream slope. Densities are to be expressed in terms of percentage of laboratory density

B. Provide sufficient and representative samples of the remaining embankment in Zones I and II and the foundation for laboratory analysis

C. Provide undisturbed samples, standard penetration counts, field permeability, and exploration log in both the embankment and foundation.

D. Estimate of Plus 3-inch material, plus 9-inch material, and plus 12-inch material in each zone.

Laboratory Analysis

Laboratory analysis of samples obtained in the field will include the following:

- A. Unified Classification.
 - (1) Mechanical Analysis complete to 2 micron fraction.
 - (2) Atterberg limits.
- B. Maximum laboratory density
- C. Permeability.
- D. Triaxial Shear. Tests to develop Mohr envelopes in the free draining and undrained conditions.

3. Stability Analysis

Provide minimum safety factor of dam structure as constructed, based on field and laboratory evidence.

II. FIELD INVESTIGATIONS

The remaining embankment and the foundation conditions at the site were explored using both a rotary drill rig and a bulldozer. A total of 10 borings were performed in the remaining embankment and the foundation area. The borings were made primarily for the purpose of determining the in-place permeability of the embankment and the foundation materials.

The remaining embankment in the vicinity of the left abutment was excavated from top to bottom with the bulldozer during which time in-place densities and large scale samples for mechanical analysis were obtained.

1. Field In-Place Density Analysis

A total of 37 in-place densities were performed throughout the embankment from top to bottom.

in-place densities were computed on the basis of the unit weight of the total sample as well as the density of that portion smaller than the No. 4 sieve.

Natural moisture contents were also determined for each in-place density sample. The natural moisture content of the total sample as well as the moisture content for the material passing the No. 4 sieve were determined.

.....The in-place densities on the basis of the total sample unit weight are also shown in profile in Figure IX. The results of the in-place density tests and the natural moisture contents are presented in Table IX.

2. Field Mechanical Analysis Results

A total of 16 bulk samples varying in weights from 2000 to 3000 pounds were taken in a random fashion throughout the embankment area to ascertain the particle size distribution of the embankment material.

.....
The plus 3-inch, 6-inch, and 12-inch material was separated from the sample by hand and the remainder of the sample was passed through a No. 4 sieve The results of these tests are summarized in Table 2X.

3. Drilling Program and Field Permeability Testing

The embankment was sampled at approximately every 5 feet and standard penetration tests were performed

In-place permeability tests were conducted
An estimate of the permeability in feet per year has been made.

.....It should be noted that a number of vertical cracks existed throughout the remaining portion of the embankment. In several

instances the flow rate into the drill hole in the embankment exceeded 25 gallons per minute. In most cases it could not be ascertained where the flow represented an actual percolation into the embankment material or where the water escaped through cracks in the embankment. It is believed that water losses associated with all holes drilled in the foundation material, including both overburden and bedrock, are valid losses.

III. LABORATORY ANALYSIS

1. Compaction Tests

Samples were selected for compaction tests as to cover the range of the particle size distribution associated with the embankment material. The maximum densities associated with the minus No. 4 material vary only by approximately 2 pounds per cubic foot with minimum and maximum values of 132 and 134 pounds per cubic foot respectively. The maximum density for the sample containing the minus 3/4 material was 137.8 pounds per cubic foot. The optimum moisture content of all samples tested was just slightly in excess of 6 percent.

2. Laboratory Permeability Tests

Laboratory permeability tests were performed. A vertical pressure corresponding to an embankment height of 65 feet was placed on the sample. Two samples, representing the extremes in the percentage of material passing the minus No. 4 sieve, were selected for the permeability tests. A total of four tests were performed on each sample at percentages of maximum density ranging from 98 to 85. It is significant

to note the rapid change in permeability between materials compacted at 98 percent of the maximum density and 95 percent of the maximum density.

3. Triaxial Shear Tests

A total of 12 Mohr Failure Envelopes were determined for the embankment material using the triaxial shear apparatus. These materials correspond to the extremes of the maximum and minimum material passing the No. 4 sieve. Densities of the materials varied from 98 percent of the maximum density to 85 percent.

All samples were saturated Moisture contents at failure were determined for each sample. The resulting moisture contents varied from 8 to 10 percent.

..... It will be noted that the friction angle becomes the sensitive function of the density beyond a point of 90 percent of the maximum density.

IV. FIELD OBSERVATIONS

Several aspects associated with this investigation which are not an inherent part of the data discussed so far are considered in this section.

During the investigation substantial seepage was observed flowing out of the right abutment. Several seeps were measured during the investigation in this area and it is believed that a total seepage quantity of 20 gallons per minute would not be an excessive estimate of the seepage occurring at the time of drilling.

.....The material at the top of boring 10 consisted of approximately 2 feet of shale On penetrating the shale water flowed up the casing and out of the hole. Water appeared to be present beneath each of the shale layers and water was observed to be trickling out of the region of the shale lenses into the hole following the completion of drilling.....

.....Water losses in the material overlying the bedrock were of substantial magnitude...It is further noted that the estimated permeability of these materials, including the bedrock in the right abutment, is greater than any permeability value obtained in the laboratory, even for samples compacted at 85 percent of the maximum density.

.....
It was not possible in this investigation to make any differentiation between the character of the material on the downstream portion of the dam and the center of the dam. It should be kept in mind, however, that the major portion of the dam was removed during the failure and that there was no opportunity to observe the nature of the materials in the canyon on the downstream portion of the Dam.

V. STABILITY ANALYSIS

A stability study of the embankment has been made using both the circular arc method of failure as well as the sliding block procedure. Four cases have been considered as outlined below:

Case No. 1 - The assumption has been made in this case that hydrostatic pressures were built up along the contact face between the abutment and the earth embankment. The basis for this assumption lies in the fact that considerable seepage was noted flowing out of the right abutment.

Results of the permeability tests in both the bedrock and the overburden in the right abutment substantially exceed the expected permeability of the embankment on the basis of laboratory tests of materials compacted at 85 percent of the maximum density. Such a condition is favorable to the build-up of hydrostatic pressures along the contact face.

It has also been assumed that a flow of 20 gallons per minute or more out of the right abutment is of sufficient quantity to saturate a substantial portion of the embankment within the period after the embankment was completed until failure occurred.

It has been further assumed that the overburden overlying the bedrock is sufficiently permeable that water in this zone would flow back into the reservoir should hydrostatic pressures build up to such an extent. This means that the hydrostatic pressure along the contact face would not exceed that corresponding to the water level in the reservoir.
The factors of safety are all less than 1.

Case No. 2 - Case 2 is in essence a modification of Case 1. An approximate estimate of the upper seepage surface in the right abutment was ascertained in the field. The assumption is made that pore pressures would exist along the contact face between the right abutment and the earth embankment. The assumption has been made that sufficient water exists to penetrate the embankment and that penetration occurs to a sufficient distance to approximately saturate a zone of the embankment in the immediate area of the right abutment. The minimum factor of safety for this condition is 1.06.

Case No. 3 - The basic assumptions associated with this analysis are that the dam was more or less homogeneous throughout the cross section and that no highly pervious downstream zone existed. It was also assumed that the horizontal filter drain at the bottom of the dam did not function as contemplated in the dam design. Based on these assumptions eventual saturation of the downstream face was assumed.

.....Factors of safety as low as 0.7 occurred for this condition. It should be pointed out that such a stability analysis as discussed in this case actually represents a long-term stability situation. If one assumes that the overall permeability of the dam was at least equal to that corresponding to 85 percent of the maximum density, it does not appear possible that water could flow from the upstream face of the structure to the downstream face of the structure within the time after construction and before failure occurred.

Case No. 4 - This case considers an embankment failure due to sliding block type action. Pore pressures in the vicinity of the right abutment have been assumed equal to the water level in the reservoir. If one assumes that the lateral earth pressures at rest are approximately one-half of the vertical pressures, then the intergranular stresses in the embankment in the region of the right abutment are small because of the high hydrostatic pressures. Under these conditions shearing resistance along a vertical plane throughout the embankment would also be relatively small. On the basis of these assumptions a sliding block stability analysis has been performed.

The results of the analysis indicate a minimum factor of safety of 1.35 for a friction angle of 33 degrees and 1.10 for a friction angle of 28 degrees. Failure under these conditions does not appear likely.

VI. CONCLUDING COMMENTS

The data collected and recorded in this report were obtained during a two-month period from July 1 to September 1, 1963. A considerable effort has been made to obtain the best factual information possible in accordance with the program of investigation decided upon by the consulting organization and the United States Forest Service. It should be emphasized that the investigation was necessarily restricted to the remaining portions of the embankment and that a considerable amount of the evidence associated with any failure went down the canyon when failure occurred.

It should also be emphasized that this investigation is primarily a fact-finding survey and that no conclusions are recorded as a part of this report.

TABLE 1X
SUMMARY OF IN-PLACE DENSITIES AND MOISTURE CONTENTS^x
OF THE REMAINING EMBANKMENT
LITTLE DEER CREEK DAM

Test No.	Total Dry Density	% Moisture Based On Total	% Of Maximum xx
3-1	122.5	6.20	89
3-2	126.3	4.40	92
8-1	130.9	6.60	95
8-2	129.5	6.26	94
8-3	130.1	6.30	94
10-1	130.7	6.50	95
10-2	132.1	10.50	96
10-3	128.9	6.45	94
10-4	126.7	6.01	92
10-5	125.0	5.90	91
10-6	130.8	7.60	95
11-1	137.3	7.74	100
11-2	124.7	7.45	90
11-3	111.6	9.00	81
12-1	119.4	17.80	87
17-1	112.1	8.72	81
19-1	111.1	7.90	81
19-2	118.6	7.70	86
19-3	127.1	5.90	92
19-4	108.0	7.30	78
19-5	107.2	7.80	78
19-6	114.1	6.70	83
23-1	128.0	6.84	93
23-2	129.2	7.11	94
23-3	114.4	4.56	83
27-1	119.5	8.41	87
27-2	115.8	5.27	84
27-3	140.6	6.52	102
29-1	116.0	7.01	84
30-1	132.2	5.25	96
30-2	135.5	7.12	98
30-3	127.2	8.15	92
31-1	134.7	6.03	98
31-2	146.3	8.12	106
31-3	124.3	4.47	90
31-4	117.5	4.38	85
31-5	141.9	0.60	103

x -See Figure 1 for Location of Tests.

xx -Maximum Density of 137.8 LB/FT³ Used. Values Tabulated to the Nearest One Percent

TABLE 2X

PARTICLE SIZE DISTRIBUTION TABLE*

Sieve Analysis Sample No.	8"	3"	#4	#200		
	Percent Boulders	Percent Cobbles	Percent Gravel	Percent Sand	Percent Silt	Percent Clay
S1	10	8	25	41	14	2
S2	16	23	28	26	6	1
S3	3	4	34	41	14	4
S4	5	8	33	39	11	4
S5	15	13	29	33	8	2
S6	23	7	28	30	9	3
S7	4	8	38	33	13	4
S8	2	2	29	47	13	7
S9	14	8	24	39	10	5
S10	35	6	21	28	7	3
S11	14	12	32	33	6	3
S12	1	4	32	44	13	6
S13	5	11	38	35	7	4
S14	7	12	35	32	9	5
S15	23	9	35	23	7	3
S16	4	17	45	27	5	2

*Taken from Curves in Figures NO. 4, 5, 6, and 7.

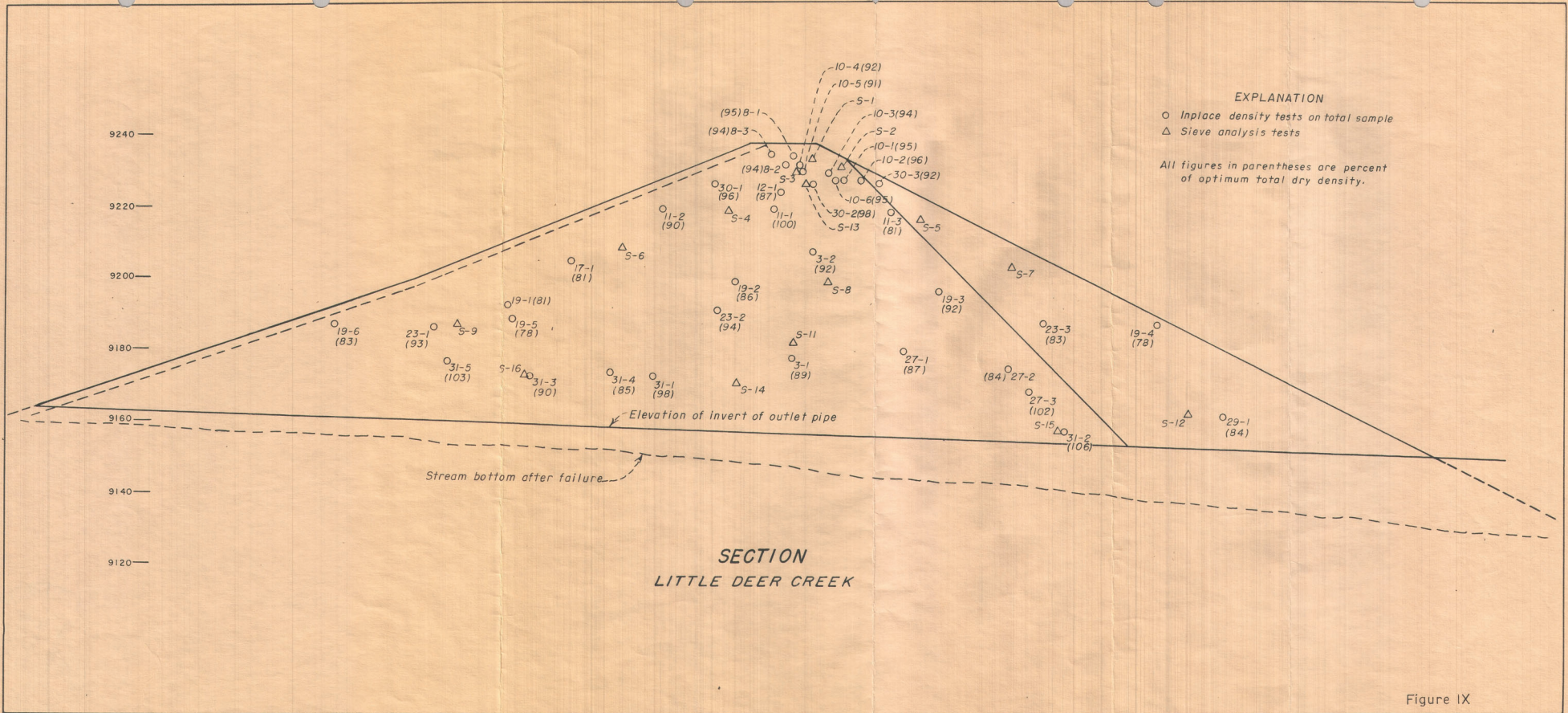


Figure IX

Robert L. Morgan, State Engineer
1594 W. North Temple Suite 220
P.O. Box 146300
Salt Lake City, UT 84116-6300

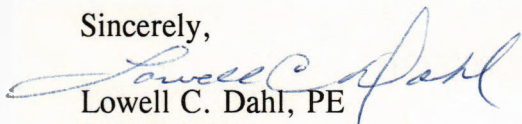
RECEIVED
SEP 28 1998
WATER RIGHTS
SALT LAKE

This letter is an inquiry about the history of the Little Rock Creek Dam located in the north-east corner of Section 29 T 3 N, R 9 W, USBM.. I ran across this structure, which has failed years ago, while making a visit to the East Portal of the Duchesne Tunnel. I am a retired professional engineer and much of my career was involved with earth dam construction. Discovering this failed structure has peaked my interest and I would like to know more about its history.

I noticed on one of the concrete works there is a State Engineers marker. Using the Internet, I searched your databases for a water right in this location and found one had been filed in 1985 under No. 43-9672. The description indicates the applicants wanted to re-build the Little Rock Creek Dan as part of a hydroelectric project. The application appears to have been rejected.

If it would not be too much trouble I would be interested in knowing such things as when the Little Rock Creek Dam was originally constructed, when it failed, who was the entity that it did the construction and for what purpose it was built. I understand the workload that your office undoubtedly has, but would appreciate any information you could furnish me at you convenience. If it would be helpful you may send the information by e-mail. My e-mail address is listed below with my mailing address. Thanks in advance.

Sincerely,



Lowell C. Dahl, PE
850 W 100 S
Orem UT 84058
lowell@slkc.uswest.net

43-9672

Allan Carter

Winn Templeton

E. O. Larson

Review of Little Deer Creek dam & Earth Fell dams
in general.

Utah Soc. of Prof. Engrs.

Ut. Chapt. ASCE.

Ut. Consulting Engrs. Council.

Interested in safety, etc.

Purpose:

Discuss work underway at Porcupine Dam
offer support of action.

42 dam failures