MATTERS TO COME BEFORE THE BOARD OF DIRECTORS OF
TARRANT COUNTY WATER CONTROL AND IMPROVEMENT DISTRICT NUMBER ONE
HELD IN THE DISTRICT OFFICE AT FORT WORTH, TEXAS, ON
THE 1ST DAY OF JUNE, 1957 AT 9:30 A. M.

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The call of the roll disclosed the presence or absence of Directors as follows:

PRESENT

Joe B. Hogsett
Houston Hill
Lacy Boggess
W. L. Pier
A. T. Seymour, Jr.

Also present were Messrs. Marvin C. Nichols, Engineer for the District and Ben Hickey, General Manager of the District.

Director Hogsett acted in his capacity as President, and Director Boggess acted in his capacity as Secretary, whereupon proceedings were had and done as follows:

1.

President Hogsett stated that the purpose of this meeting was for a general discussion of the flood condition, and after discussing the situation both within and without the District boundaries, the conversation turned to remedial measures needed to be taken by some Agency for the prevention of future flooding of unprotected areas; whereupon Mr. Marvin C. Nichols, engineer for the District, stated that at the request of Mr. J. Frank Davis, City Manager of the City of Fort Worth, he had prepared an outline of work yet needed

#9

to be done for presentation by Mr. Davis to the Special Sub-Committee on Floods and Flood Control from Washington, D. C., for the further protection against floods; and recommended in the presentation were:

A. That the Corps of Engineers be directed and authorized to make a survey of the West and Clear Forks of the Trinity River above the mouth of Village Creek for the purpose of determing improvements needed to assure Fort Worth and its Metropolitan Area of adequate flood protection.

B. That funds be made immediately available to the Corps of Engineers on an emergency basis in order that the survey can begin immediately, in addition the following suggestions:

1. Flood control reservoir and levee system on Big Fossil Creek.
2. Extension of the Fort Worth Floodway downstream to some point below East First Street.
3. Flood control reservoir on Mary's Creek and extension of the Fort Worth Floodway upstream on the Clear Fork of Mary's Creek.
4. Flood control reservoir on Silver Creek and extension of the Fort Worth Floodway upstream on the West Fork to Lake Worth Dam.
5. Flood control reservoir on the West Fork between Eagle Mountain and Bridgeport dams.

#10

6. Installation of pumps for interior drainage in the existing Fort Worth floodway.

7. Further bank protection of the Channel Slopes of the Fort Worth Floodway, and that local interests stand ready to assume their share of the cost of flood control improvements as may be determined by the policies of the Congress in respect to the responsibilities of the Federal Government in flood control; and that the record was good both as to facilities heretofore built at the sole expense of local interests, as well as in the cooperation with the Government in the construction of the Fort Worth Floodway.

Mr. Nichols further stated that statistics from the U. S. Corps of Engineers now show that current conditions have now produced over eight (8) times the volume of the May, 1949 flood at Fort Worth, and in his opinion (Mr. Nichols'), had not Benbrook Reservoir and the Fort Worth Floodway been constructed, this flood of date would have washed Fort Worth away. This discussion brought up the maintenance and protective measures being used by the District at this time, whereupon Mr. Nichols stated that there was a 24 hour per day patrol and maintenance crew on duty at the Fort Worth Floodway, operating from the District Central Warehouse; and at Lakes Bridgeport and Eagle Mountain, a 24 hour per day patrol was also in effect, with hourly readings from various river gaging stations, lake elevation

#11

and other data compiled in record form by the maintenance flood control crews, with a copy of all data furnished his offices for all readings, and Mr. Nichols explained that in line with maintenance and inspection of facilities of the District, that on May 24, after a report from District's maintenance department, that he had sent one of his engineers to Lake Eagle Mountain for a further inspection, and upon the report of his engineer, thought it timely to call in Mr. Bramlette McClelland, a consulting engineer specializing in soils and embankments, for study of Eagle Mountain dam; conditions being as they were, would warrant a thorough check, as the water elevation of Eagle Mountain was now some nine (9) feet above the spillway elevation. Mr. Nichols also stated that he had conferred with Mr. W. J. Turnbull, Chief of the Embankment Division of the U.S. Waterways Station, Vicksburg, Mississippi, as consultant for a study and report on conditions found, and at that time exhibited a letter from Mr. Turnbull, same is attached to these minutes, outlining recommended remedial measures. It was the unanimous opinion of the Directors that the maintenance and safety of Eagle Mountain and other facilities of the District be maintained at the highest degree of efficiency; whereupon Mr. Nichols stated that he had also conferred with two (2) soil and embankment specialists employed by the U. S. Corps of Engineers, and had taken them on a site inspection of Eagle Mountain and Bridgeport reservoirs on May 26, and from time to time would

#12

make inspections and report to the Directors.

2.

There being no further business before the Board of Directors, the meeting adjourned.

President.

Secretary.

#13

AIR MAIL

Waterways Experiment Station
P. O. Box 631
Vicksburg, Mississippi
29 May 1957

Mr. M. C Nichols
Freese & Nichols, Consulting Engineers
Danciger Building
Fort Worth, Texas

Dear Mr. Nichols:

Reference is made to the telephone call to me on 25 May 1957 requesting an inspection of Eagle Mountain Dam and to my arrangements with Mr. Eeds and Mr. McClelland for the inspection on 28 May. Discussions were held in your office yesterday morning, 28 May, and subsequent inspection was made of Eagle Mountain Dam accompanied by Messrs. W. L. Eeds, Bramlette McClelland, and J. B. Mapes.

The discussion in your office developed the general background of the through seepage being experienced at Eagle Mountain Dam as a result of the present high water. The following paragraphs briefly state the results of the inspection and my opinions with respect to the current problem.

During the day two large auger borings were made to a depth of about 42 ft on the center line of the dam. One hole was in the vicinity of the larger seep area at station 24+60 and the other was in the vicinity of the smaller seep area at station 13+70. An inspection of these holes was made by being lowered into them. Generally, the two holes indicated a layer of 4 to 6 ft of silts and clays at the surface underlain by 10 to 12 ft of clean sand and sandy materials. Below this, the core material appears to consist mostly of clay and silt materials with some interbedding of thin sand layers to a depth of, say, about 25 ft. Between the 25- and 42-ft depth, the core seems to be primarily of clay materials. The two borings which were made on 27 May show approximately the same thing. Seepage into the holes developed in some of the sand layers which were several feet above the present elevation of the water in the reservoir. This indicates that the shell and core material has been absorbing water from the recent rainfall and as a result is pretty well saturated above the water table.

The seepage area at station 24+60 showed some minor drainage onto the downstream face, while that at station 13+70 was pretty well dried up as far as free surface water was concerned. The exit of the water in both areas is at or only a few feet below the water ~~in the water~~ in the reservoir. This is indicative of two things: one, there are some fairly free-draining sand lenses through the core at this elevation; and, two, there are some relatively

tight layers running horizontally through the downstream shell at approximately the same elevation or slightly below. In view of this, it is entirely probable that a perched water table exists in the seepage areas. The only other visible sign of seepage is at the toe of the dam in a shallow ditch opposite the area on eastward of the small seep area. It is also quite possible that there is some seepage into the bottom of the fish ponds; however, indications are that no sand boils have developed in the bottom of these ponds. In view of the above, it is considered that the immediate effort should be directed toward discovering the true water table through the dam and definitely determining whether there are perched water tables at the two seepage areas. It was agreed that three lines of piezometers should be installed to determine the water-table conditions through the dam. One line would be through the larger seep area at station 24+60, another at station 13+70, and another at station 35 where no seepage indications are apparent on the downstream surface. Four piezometer stations will be established in each line, one on the center line of the dam, one on the downstream berm, one approximately midway between the downstream berm and the downstream toe, and one at the downstream toe or a short distance therefrom. In addition to this, a piezometer should be placed at a shallow depth on the slope above the downstream berm to determine the possibility of perched water table. In each case there would be two piezometers placed at the center-line station on each line, one to indicate the perched water-table conditions and one at greater depth to determine the probable true phreatic surface. The piezometer on each line on the berm would also have to go quite deep in order to be sure that the true phreatic surface was reached. The above may not be completely in agreement with the actual placement of piezometers by Mr. McClelland; however, it represents the general picture.

One or two of the deep piezometer holes on the dam centerline should be carefully logged and sampled for laboratory determination of grain size.

The piezometers when installed should be flushed to be sure that they are reading properly and readings should be taken at the earliest date when the piezometers are stabilized. Subsequent to this, all piezometers should be read at approximately every 5-ft change in reservoir stage. The data thus accumulated will furnish a possible background of information for extrapolating the effect of water stage approximately 17 ft higher than the present water level. This latter item is in accordance with your request at the meeting in your office prior and subsequent to the inspection.

You will note I indicated in the preceding paragraph that the piezometric data would possibly furnish the basis for extrapolating and predicting conditions for a 17-ft higher stage. The reason I use the word "possibly" is due to the presence of the 6- to 10-ft layer of sand which apparently exists in the rolled-fill portion of the top of the dam. At the highest possible stage of the reservoir, this free-draining sand layer (assuming it exists through the dam section) would produce quite free seepage on the downstream face of the dam in a prolonged flood stage. I would regard the maintenance of the flood stage at elevation 675 for a period longer than three or four days

as being a prolonged stage. I feel that at such a prolonged stage all the attendant hazards and difficulty in maintaining a free-seeping downstream surface would be encountered. The hazard, of course, is the possibility of piping and crevassing due to concentration of seepage at some localized point. It is my opinion that this constitutes the main problem to be considered in connection with Eagle Mountain Dam. I do not feel that at the present flood stage there is any hazard in connection with the two through seepage areas previously noted or the one seepage area at the downstream toe. The latter is undoubtedly a combination of through seepage and underseepage.

A corrective measure for through seepage and underseepage at the downstream toe of the dam would be pressure relief wells. I do not believe consideration of these is warranted at the present time. A measure of relief for the two seepage areas presently existing would be drain wells located immediately downstream from the crest of the dam which would penetrate through the tight layers of the shell, relieving the perched water and letting it drain into the shell below. This is assuming, of course, that a perched water table exists. Such drain wells in the relatively short stretches of through seepage presently existing could be placed quite rapidly, say on initial spacing at 50-ft centers. However, unless there are definite indications that the reservoir stage will go materially higher than that presently existing, I do not feel that the installation of such drain wells is needed.

Since it is believed that the main problem at Eagle Mountain Dam lies in determining the possible severity of seepage conditions which might develop as a result of the presence of the rather thick free-draining sand layer under the roadway, a decision with respect to the necessity for a cut-off through this layer should be made. Before such a decision can be made, it is believed more detailed shallow borings should be made after subsidence of the present reservoir level to determine the true soil profile along the crest of the dam to a depth of about 30 ft. Borings to determine this should be made with the view of getting samples which correctly show the materials present. Also, definite information on the true phreatic surface existing in the dam will assist in making this determination.

Should it be decided that a cut-off is desirable, consideration might be given to driving sheet piling or to establishing a positive cut-off. In the case of the latter, the digging of an open trench is almost out of the question due to the limited working space. Consideration might be given to trenching with a mechanical trencher to a depth of say about 25 ft and backfilling with impervious material. The impervious material might consist of the excavated materials to a large extent, with possibly some Bentonite added.

In agreement with the verbal discussion in your office, I will get in touch with Mr. Eeds later in the week and inform him concerning the day I can be present for further inspection and discussion of Eagle Mountain Dam and an inspection and discussion of Bridgeport Dam.

Sincerely,

W. J. TURNBULL

cc to Mr. McClelland

AIR MAIL

Waterways Experiment Station
P. O. Box 631
Vicksburg, Mississippi
24 June 1957

Mr. M. C. Nichols
Freese & Nichols, Consulting Engineers
Danciger Building
Fort Worth, Texas

Dear Mr. Nichols:

I am sorry that I was unable to write you a confirmation letter of my comments on Eagle Mountain and Bridgeport Dams as result of the inspections on 1 and 2 June 1957. The following is a brief summary of the inspections and discussion in your office concerning the two dams.

Eagle Mountain Dam

The inspection was made on 1 June 1957 in the company of Messrs. McClelland, Eeds, and Acker.

The inspection at the dam revealed that all piezometers had been placed on the three sections with the exception of two or three. Readings had been taken as rapidly as the water levels in the piezometers stabilized. The water in the reservoir had fallen about 2 ft since Tuesday, 28 May, and the seepage areas on the downstream slope at stations 24+60 and 13+70 had pretty well dried up.

The discussions in your office in the afternoon concerning the information developed by the piezometric lines brought out that there are perched water tables at the two seepage areas. The piezometer line at station 34 shows what is considered a normal water table. I have no drawings of the data which were discussed in your office; however, Mr. Eeds undoubtedly has this material as well as Mr. McClelland.

Further discussion of the piezometers indicated that possibly two more lines were desirable, with one being at the maximum section of the dam. Mr. McClelland has these details.

The seepage conditions and preliminary information obtained from borings demonstrate that more information is needed concerning the make-up of the core and downstream shell of the dam. All were in agreement concerning this need. As result, one line of borings along the center line of the dam approximately 50 ft deep should be taken. The main consideration in taking these borings should be to get good samples for gradation determination and thus, indirectly, permeability. In addition to this, an effort should be made to get some

relatively undisturbed samples of the borderline sandy materials for direct determination of permeability. The latter is considered necessary in order to fix definitely what the permeability is of the borderline materials to assist in final determination of the need for a positive cut-off. The borings on center line should be taken about every 250 ft station.

In addition to the borings along the center line, borings should be taken at the downstream berm at about 500-ft centers to approximately the original ground surface. As along the center line, samples from these borings should be taken primarily for determining gradation.

In addition to the above core and shell borings, two borings should be made in the core at the 500-ft stations, one upstream and one downstream from the center-line borings. These will furnish a better idea of the transverse make-up of the core.

I find that my notes are a bit sketchy concerning the above three types of borings, and if there is any disagreement with notes kept by Mr. McClelland or Mr. Eeds, their notes should be given preference.

When the additional information indicated above is obtained, it is believed that a conference should be held and a decision made as to the need for a positive cut-off.

Considerable discussion took place concerning the perched water table and the possibility of perched water tables existing at any other points in the dam, particularly at higher reservoir heads. In view of the fact that the perched water tables do exist at the two seepage areas and that they may exist to considerably greater extent at higher water levels, it was considered desirable that information be gathered concerning perforated penetration wells which would relieve this condition. These wells were described generally in my letter to you dated 29 May. The information which should be obtained includes the suppliers of perforated wooden pipe and discussions with contractors who might be interested in putting in the wells. In connection with the latter, details should be obtained concerning the contractor's equipment and his proposed methods and technique of installation. In other words, it was considered desirable that the capabilities of installing the wells should be developed. This capability will be very valuable in times of emergency. It was further discussed that the capability should be developed to the extent of actually placing a few of the wells in the two seepage areas noted. Trial installations of the wells could be placed approximately as mentioned in my letter of 29 May 1957.

Bridgeport Dam

Inspection of Bridgeport Dam was made on 2 June in the company of Messrs. McClelland, Eeds, and Hutcheson.

The general seepage area at the left abutment was examined. Mr. Hutcheson described the drainage system at the point where the dam contacts the abutment and also further back along the abutment face through the slide area. The drainage system is considered a bit on the patched and haphazard side; however, it is considered adequate for the reservoir stages experienced to date. It

should be carefully watched, however, and the system augmented if higher reservoir stages indicate the need. Mr. Hutcheson stated that the seepage has always remained clear; however, it apparently varies directly with the head in the reservoir. Mr. Hutcheson further stated that he has never seen the seepage water at the various exits the least bit cloudy. This, of course, is a good sign that the seepage, at least under heads experienced to date, has stabilized and probably will never cause any trouble.

In general, it is considered that the seepage at Bridgeport Dam is direct seepage through the abutment and is well stabilized and therefore does not represent a serious condition. However, during flood stages the embankment, particularly in the seepage area, should be patrolled several times daily and careful watch maintained.

Mr. Hutcheson pointed out some superficial seepage existing at the right abutment but indicated that it apparently had no connection with the reservoir and was due to the accumulation of water in the downstream shell of the embankment.

I shall try to make myself available for any further discussion in which you would like for me to participate.

Sincerely,

W. J. TURNBULL
Engineer

cc to Mr. McClelland

FREESE AND NICHOLS
DANCIGER BUILDING
FORT WORTH 2, TEXAS

July 1, 1957

COPY

Mr. W. J. Turnbull
Waterways Experiment Station
P. O. Box 631
Vicksburg, Mississippi

Dear Mr. Turnbull:

This will acknowledge receipt of your letter of June 24, 1957 together with statement of your expenses and fee in connection with inspection of Eagle Mountain and Bridgeport Dams on May 26, and June 1 and 2, 1957. This statement has been presented to the Board of Directors of the Tarrant County Water Control and Improvement Distruct Number One and you should receive their check in the near future.

We have just about completed the test hole work at Eagle Mountain Dam but have not as yet received the report of Mr. McClellan. We have, from our files, developed some information relative to the emplacement of embankment during construction of the Eagle Mountain Dam.

A little later this summer we will desire you to make an additional trip or trips to Fort Worth to discuss with us the results of the studies being made.

Eagle Mountain Dam is now down to about spillway level and Bridgeport is about 2-1/2 feet above spillway. We dropped the two gates in the spillway at Bridgeport in order to conserve some of the water for beneficial uses.

With best personal regards to yourself and Mrs. Turnbull, we are

Yours very truly,

FREESE AND NICHOLS

Marvin C. Nichols

Marvin C. Nichols

MCN:cd

Blind copy to
Mr. Ben Hickey ✓

TURNBULL, Willard Jay, Chf., Embankment Fndn. and Pavement Div., U. S. Waterways Expr. Sta., Vicksburg, Miss.; res. Quarters No. 5, U. S. Waterways Exper. Sta.

Civil Engr. (Soil Mechs.); b. Burchard, Neb., Mar. 19, 1903; s. William and Maud Turnbull. ed. Univ. of Neb., B. S., 1925; C.E., 1942; m. July 18, 1946, Mary Lea McCay. Deck Off., U. S. Coast and Geodetic Survey, Wilmington, N. C., 1925; ensign, U. S. Coast and Geodetic Survey, transferred to Philippine Is. via Honolulu and Guam, 1926-27; proj. engr., Neb. State Highway Dept., 1927-28; in chg. of operations on 320 acre farm, Pawnee County, Neb., 1928-31; asst. state testing engr. Highway Testing Lab., Univ. of Neb., 1931-33; halfptime leave of absence from Univ. of Neb. to act as state representative in chg. field and off. work at Fed. C.W.A. State Control Surveys of Neb., sponsored by U. S. Coast and Geodetic Survey, Washington, 1933-34; asst. testing engr., Neb. University, Testing Laboratory 1934-35; soils engr., chf., of Lab., Central Neb. Public Power and Irrigation Dist., 1935-41; chf., Embankment Fndn. and Pavement Div., U. S. Waterways Exper. Sta., Vicksburg, Miss., 1941-. Author: 3 arts. on Plane Coordinates for Nebraska, "Nebraska Blueprint," off. mag. of N. E. S.; 2 arts, if Central Nebraska Public Power and Irrigation District, "Civil Engrg." 1 art. on a special soils development of the Central Neb. Pub. Power and Irrigation Dist., Engrg. News Record; several reports of soils investigations and stability analysis on the Central Neb. Public Power and Irrigation Dist.; Thesis entitled "Investigation, Design, and Construction of Jeffrey Dam"; several arts. and papers and contbns. to symposia covering flexible pavement design for mil. airports, trafficability of mil. vehicles, engrg. geol., and embankment fndn problems. Member: Sigma Tau; Sigma Xi; A.S.C.E. (mem., Exec. Com., Soil Mechanics Div.). A.S.M.E.; Profl. Engr. of Neb.; mem. Highway Research Board; A.S.T.M.; Miss. Soc. of Profl. Engrs. Received War Dept. Exceptional Civilian Service Award, 1946.