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UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

- - -

HYDRAULIC LABORATORY REPORT NO. 121

- - -

MODEL STUDIES OF THE SPILLWAY

FOR BIG SANDY NO. 2 DAM

EDEN PROJECT
WYOMING

By
E. S. Gray

- - -

Denver, Colorado

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

Branch of Design and Construction
Engineering and Geological Control
and Research Division
Denver, Colorado
February 2, 1943

Laboratory Report No. 121
Hydraulic Laboratory
Compiled by: E. S. Gray

Reviewed by: J. E. Warnock

Subject: Hydraulic studies of spillway for Big Sandy No. 2 Dam - Eden Project - Wyoming.

1. Introduction. Big Sandy No. 2 reservoir site is located on Big Sandy Creek, a tributary of the Green River, about ten miles north of Farson, Wyoming (figure 1). The reservoir basin extends northward along the channel for five or six miles. It is accessible to within 3.2 miles of U. S. Highway 187 and is 51 miles north from Rock Springs, Wyoming, the nearest rail point.

The dam is a clay, sand-and-gravel rolled fill with a maximum height of approximately 70 feet and a length of about 2,300 feet, suitably bounded by riprap. The capacity of the reservoir is 35,000 acre-feet.

In connection with the dam there is to be a dike and a side-channel spillway (figure 2). The dike has a maximum height of 11 feet and is about 6,700 feet long. An emergency spillway is provided in the dike which is an opening 600 feet long in the northern portion of it, protected by rock riprap. The channel of this spillway will be in comparatively stable shale and its infrequent use renders the resistance to erosion adequate. The side-channel spillway is an open, uncontrolled type, adapted to the physical conditions of the right abutment of the dam. The geology indicates that excavation of all classes will be encountered in its construction. The overfall crest is 170 feet long and at the design discharge of 7,500 second-feet has an overflow depth of 5.3 feet which allows a freeboard of 5.2 feet. The crest of the spillway is at elevation 6756.0 and the top of the parapet and the dam crest is at elevation

6766.5. The preliminary design called for a discharge of 5,000 second-feet, but it was later changed to 7,500 second-feet.

The two spillways are expected to provide a total capacity of 17,500 second-feet, with the maximum tolerable encroachment during a maximum flood.

The concrete-lined, trapezodial channel connecting the crest and stilling pool is 240 feet long and varies in width from 13.5 to 50 feet. The chute is of special interest in that a vertical curve is used instead of the usual radii in completing the drop.

2. Problems for model study. Since the design of this spillway incorporated features already used in other similar structures, it was not expected that serious problems would develop in the study of this model. There was the desire, however, to determine the capacity of the spillway, the weir coefficients, the ability of the cross-weir to straighten the flow, and the general operation of the model. As tests proceeded, specific investigations or corrections were instituted as needed.

3. Construction of the model. The model of the side-channel spillway was constructed to a scale of 1 to 30 (figures 3, 4, 5, and 6). This model consisted of a head box which included a rock baffle, the topographical approach to the weir crest, and the weir and cross-weir section of the spillway; the chute connecting the head box to the tailwater box; and the tailwater box, which included the stilling basin, sand and gravel box, tailwater control gate, and overflow channel. The head box and tailwater box were made of wood with sheet-metal lining. The spillway was made of redwood with the exception of the chute floor, which was of fir plywood. The sides of the chute were each made of one piece and along the bent portion were serrated about every inch to make bending relatively easy. The layout of the board was according to the developed plan so that when the board was bent to position, it conformed in all respects to the prototype shape of the sides. The parts were painted with hot linseed oil. Each of the three sections of the spillway were so installed that any one section could be removed for alterations, if necessary, without disturbing the others.

Piezometer openings were placed in the original cross-weir and in the stilling basin floor, and one was placed in the downstream face of the stepped apron. These were connected to water manometers mounted on gage boards. A hook gage, reading to one-thousandth of a foot, mounted in a tank connected to a 1/2-inch screened pipe inlet measured the head on the weir crest. The inlet was centrally located about 30 inches from the crest. Tailwater head measurements were observed by a water manometer connected to a screened box centrally located about 30 inches downstream along the horizontal portion of the gravel bed.

It was found necessary to concrete the side slopes and gravel the bottom of the tailwater channel. Along the outside curve, concreting was carried farther downstream than is indicated as rock in the prototype topography. This section is marked "C" on figure 4.

4. Flow conditions toward weir crest. These were satisfactory except around the point of ground at the upstream end of the excavation for the berm. This point caused disturbance and was consequently rounded to a radius of 6-1/2 inches or 16-1/4 feet in the prototype, at the same time carrying the slopes around the curve. This change gave good flow conditions. Detail "A" of the model plan on figure 4 shows this change.

5. Weir coefficients and head-discharge relations. These were determined for the original design, including the eight cross-weirs listed (figure 4); for change No. 1 (figure 5); and for change No. 2 (figure 5). The results are presented in the form of curves on figures 8, 9, and 10. Figure 11 shows general views of the original spillway action; figure 12 shows the action of the weir and cross-weir for change No. 2; and in figures 13 and 14 the weir and cross-weir action are compared when No. 3 round nose and square nose cross-weirs are respectively interchanged.

At the design discharge of 7,500 second-feet, the head on the crest for the original design was 5.0 feet; for change No. 1 with the floor in the weir channel raised one foot and floor width of 15 feet, the head was 5.1 feet; and for change No. 2 with the floor in the weir channel raised 3 feet and width held to 15 feet, the head was 5.4 feet. The design head

for the original design was 5.3 feet, as shown on figure 7. Below a discharge of 5,000 second-feet, the head was not affected by these changes.

The computed discharge is higher than that obtained for the original design in the model between discharges of 6,000 to 10,000 second-feet and lower for discharges above 10,000 second-feet (figure 8).

On figure 10, the original cross-weir is compared with only one of the eight cross-weirs used, namely, the No. 5R which had maximum crest elevation of the group. The variations in coefficient of discharge and head between the cross-weirs tested were small and the results fell within the limits of these two sets and with respect to their several crest elevations; therefore these intermediate data are not shown. The square-nosed cross-weirs gave slightly lower coefficients and higher heads than the round-nosed type for discharges above about 6,000 second-feet. Below 6,000 second-feet the head was not affected by cross-weir changes.

6. Pressures over cross-weir and in stilling basin, and tailwater profiles. Pressures were obtained at four discharges. The plotted pressures over the cross-weir are shown on figure 15. The same original cross-weir was used in weir spillway changes No. 1 and No. 2, except that the slopes downstream from the crest were respectively changed to 0.015 and 0.045 from the original of 0.005, to become practically tangent to the floor of the chute. This is shown on figure 5.

Pressures and water profiles in the stilling basin and tailwater profiles are plotted on figure 16. Tailwater elevations were held to those called for in the original design in these tests.

No changes were made to the design of the chute, stilling basin, or tailwater channel, as flow conditions were good. However, at 12,000 second-feet discharge the chute filled completely along the central portion. The stilling basin dissipated the energy very well, even at the abnormal flow of 13,800 second-feet. At this flow the steps were exposed, as is seen in figure 11.

7. Maximum water surface and stilling basin super-cut conditions. For spillway change No. 2, the head on the crest at a discharge of 12,000 second-feet was 10.16 feet, making the water surface elevation 6766.16

or 0.34 feet below the top of the parapet and dam crest which are at elevation 6766.5. At a discharge of 13,800 second-feet the head was 12.15 feet or a water surface at elevation 6768.15, which is 1.65 feet over the top of the dam.

In the stilling basin sweep-out tests it was found that the tailwater was always maintained at sufficient depth to prevent sweep-out conditions from occurring at any discharge up to and including 12,000 second-feet. For the highest discharge of 13,800 second-feet, the stilling basin was swept out for half its length, but it still functioned.

8. Water surface cross-sections, profiles, and submergence data. Figure 17 gives the water surfaces and submergence data obtained at section A-A, station 1+22.0, for the three designs of the weir spillway section. In obtaining the average water surface data, the line in the slope of the crest side was extended at the section involved and areas taken up to it. Since the original design at the design discharge of 7,500 second-feet gave a submergence of only 26.6 percent and normally one of 67 percent is considered below critical, it was seen that the spillway was overdesigned, and change No. 1 was made and tested. The submergence for this change was found to be 48.7 percent. This was still low; so that change No. 2 followed, with the result that the submergence rose to 81.35 percent. From visual observation, however, the action of the water was not considered to be dangerous when a trough alternately developed and filled. Figure 12 shows this action.

On figure 18 are plotted water surface cross sections for the original design at nine stations along the weir spillway and chute and for four different discharges; namely, at 7,500, 8,500, 12,000, and 13,800 second-feet.

Figure 19 gives plotted water surface cross sections for change No. 1 at seven stations, together with profiles and data for three different discharges, or at 5,000, 7,500, and 8,500 second-feet.

On figure 20 are plotted water surface cross sections for change No. 2 at nine stations for discharges of 5,000, 6,500, [illegible], and 8,500 second-feet and at section A-A only for discharges of [illegible] second-feet.

Profiles, together with data on elevations of floors and average water surfaces, both in the original design and in change No. 2 and for various discharges, are given on figure 21. The theoretical backwater curves furnished with the original design are also given for two cases: 65 percent submergence and including transition loss and for 59 percent submergence excluding transition loss. Both curves fall close together and are only slightly higher than the profile at a discharge of 7,500 second-feet determined in the model.

Finally, figure 22 gives water surface cross sections and submergence data for several of the cross-weirs tested in the original design and for two discharges, namely, 7,500 and 8,500 second-feet. Not all of the data obtained is given because it falls so close together that it would be confusing; but the original is compared with No. 5R at section A-A, and the No. 4R and 4S cross-weirs are compared at sections A-A, B-B, F-F, and G'-G'. No data was taken at section G'-G' in the original design, therefore it appears only on sections A-A, B-B, and F-F.

9. Conclusions and recommendations. In view of the model tests the following suggestions are made:

(a) The final design of the side-channel spillway may incorporate the design as change No. 2, (figure 5), with the floor and cross-weir crest raised three feet from that in the original design but keeping the widths of both the same, as in the original design. The cross-weir width in the model was inadvertantly made 21.25 feet instead of 20.59 feet. The new design is thus simplified without materially affecting the flow conditions.

(b) Excess height of walls may be reduced in the region of the cross-weir on the side opposite the dam and in the region of the entrance to the stilling basin. The walls of the central portion of the chute should be increased in height in order to take a flow of 12,000 second-feet safely.

(c) It is recommended that the approach to the upstream edge of the bars be improved by further excavation around a curve as shown on figure 4, detail "L."

(d) The conditions of flow should be considered along the outer wall of the tailwater channel and the construction of a retaining wall might be found necessary. The washing by the water along the outer curve was severe. The retaining wall could be placed as in detail "C," figure 4.

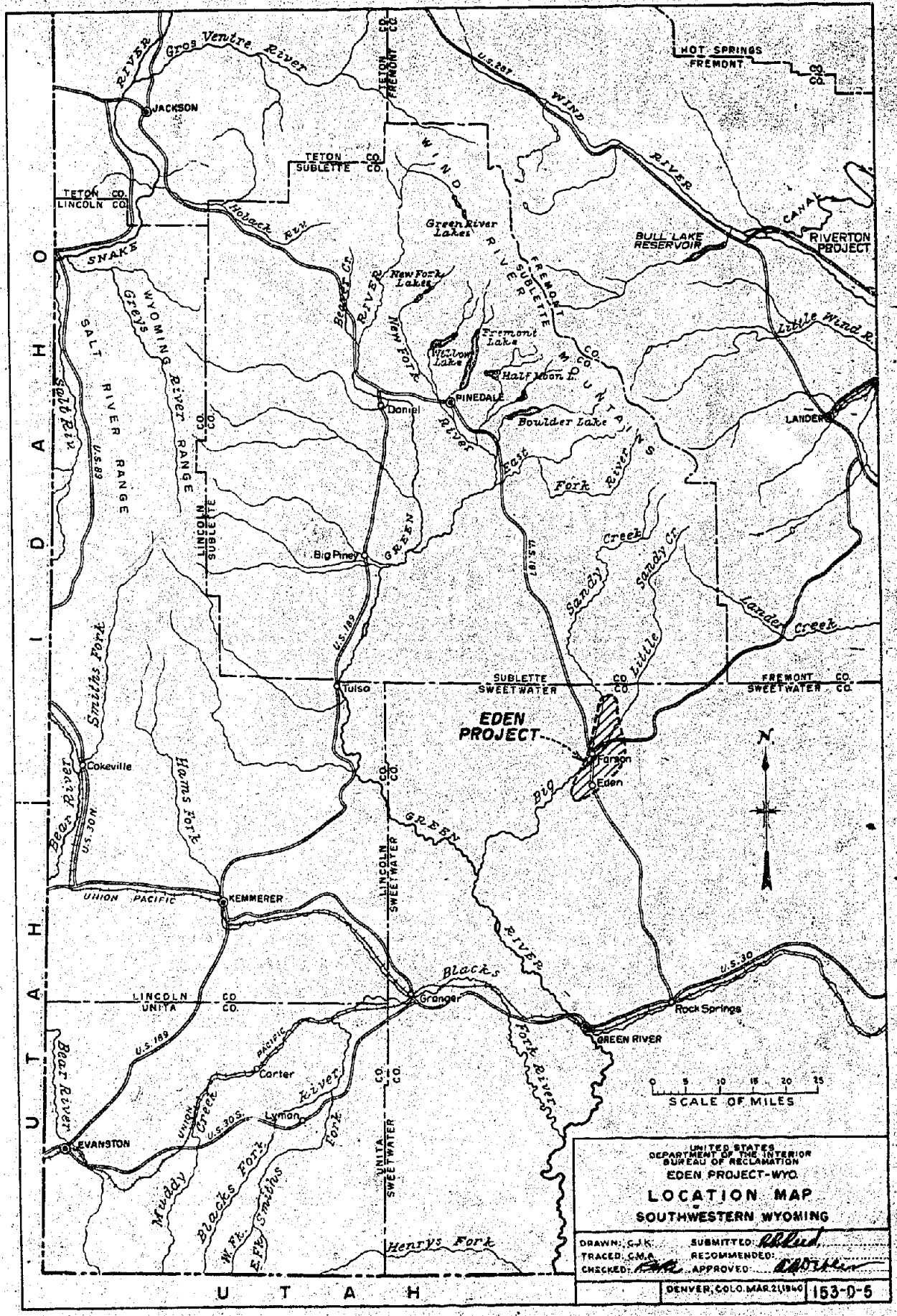
(e) The ability of the original cross-weir to straighten the flow is considered to be satisfactory. A high roll develops at a discharge of about 8,500 second-feet and becomes greater as the discharge is increased, but the flow straightens quite well before going far down the chute.

(f) The original design of the stilling basin works well, and the model design of the steps and sills, together with their layout, may be copied safely. In the original design the steps and sills were not detailed. Figure 4 gives the model details.

- - -

E. B. Gray.

FIGURE 1



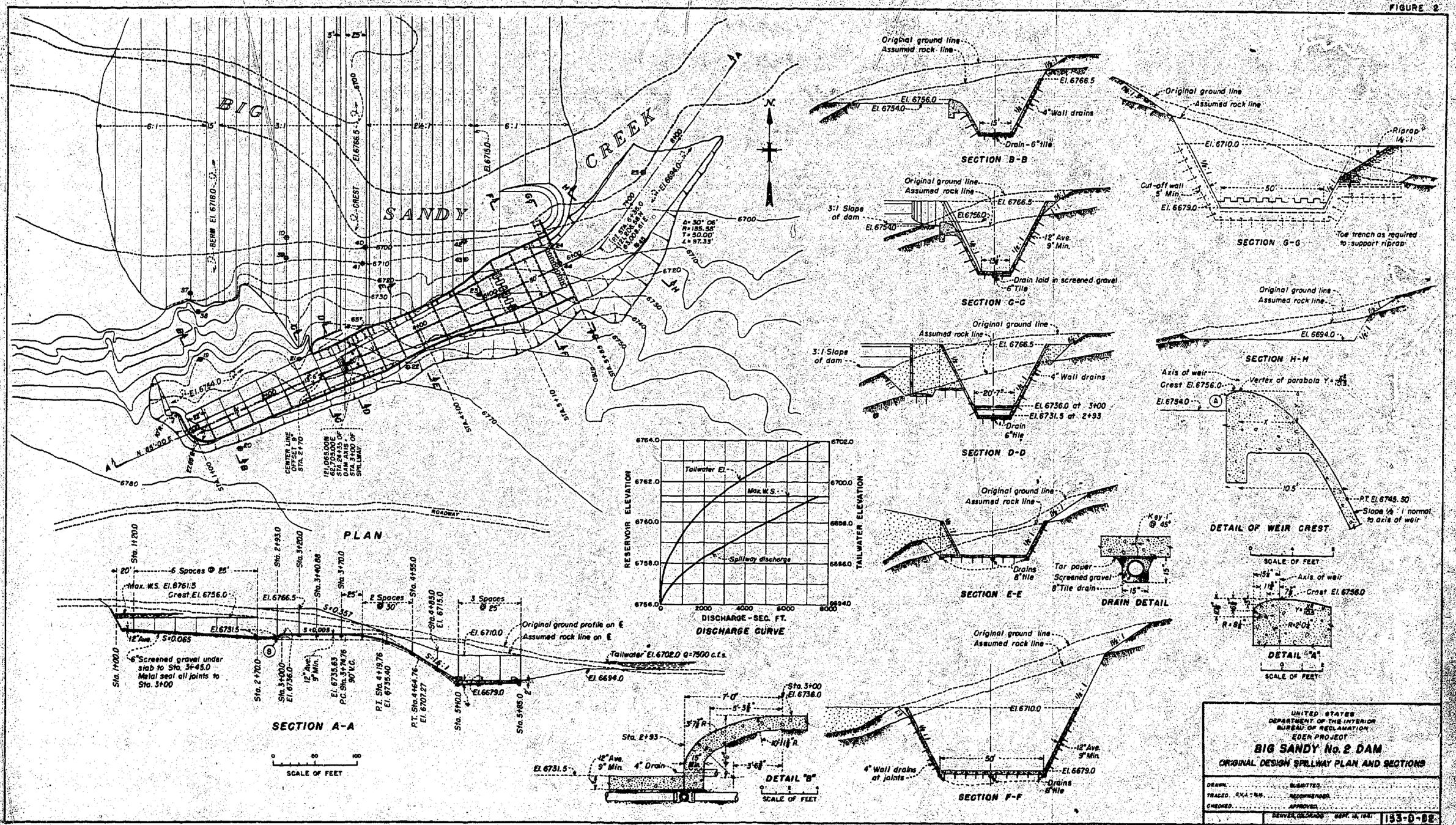
UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION
EDEN PROJECT-WYO.

LOCATION MAP
SOUTHWESTERN WYOMING

DRAWN: C.J.K. SUBMITTED: R.B.Reed
TRACED: C.M.A. RECOMMENDED:
CHECKED: APPROVED: R.A.Walker

DENVER, COLO. MAR. 21, 1940 | 153-D-5

FIGURE 2



BIG SANDY CREEK
PLAN
SECTION A-A
SCALE OF FEET
DISCHARGE CURVE
RESERVOIR ELEVATION
TAILWATER ELEVATION
DISCHARGE - SEC. FT.
Tailwater El.
Max. W.S.
Spillway discharge
SECTION B-B
SECTION C-C
SECTION D-D
SECTION E-E
SECTION F-F
SECTION G-G
SECTION H-H
DRAIN DETAIL
DETAIL "B"
DETAIL "A"
DETAIL OF WEIR CREST
Original ground line
Assumed rock line
Drain - 6" tile
4" Wall drains
3:1 Slope of dam
Drain laid in screened gravel
Cut-off wall 5' Min.
Toe trench as required to support riprap
Riprap
Axis of weir
Crest El. 6756.0
Vertex of parabola
Slope ½ : 1 normal to axis of weir
Tar paper
Screened gravel
8" Tile drain
Key 1" @ 45°
Max. W.S. El. 6761.5
Crest El. 6756.0
6" Screened gravel under slab to Sta. 3+45.0
Metal seal all joints to Sta. 3+00
Original ground profile on ℄
Assumed rock line on ℄
Tailwater El. 6702.0 Q=7500 c.f.s.
UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION
EDEN PROJECT
BIG SANDY No. 2 DAM
ORIGINAL DESIGN SPILLWAY PLAN AND SECTIONS
DENVER, COLORADO
153-D-82

FIGURE 3

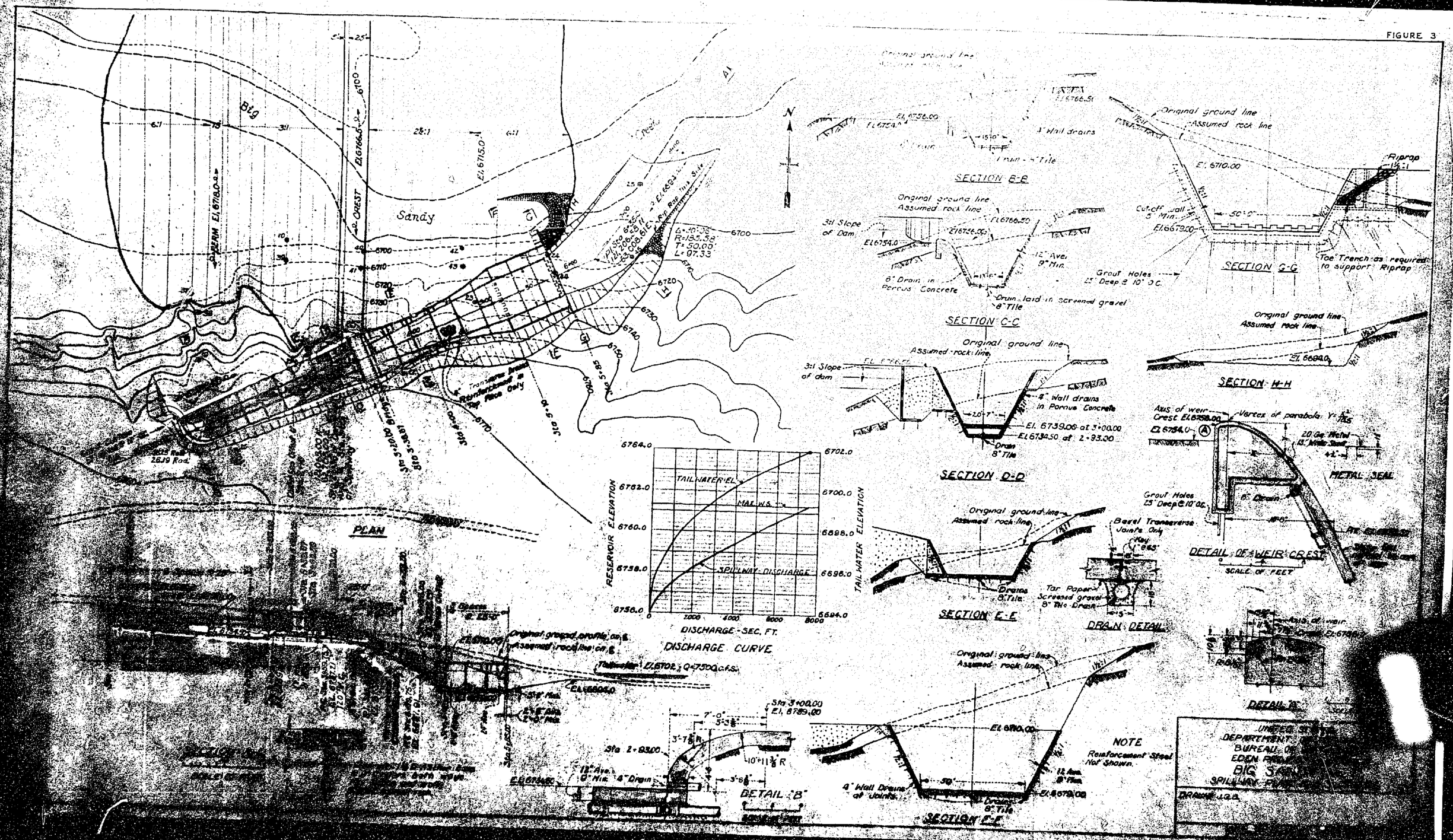
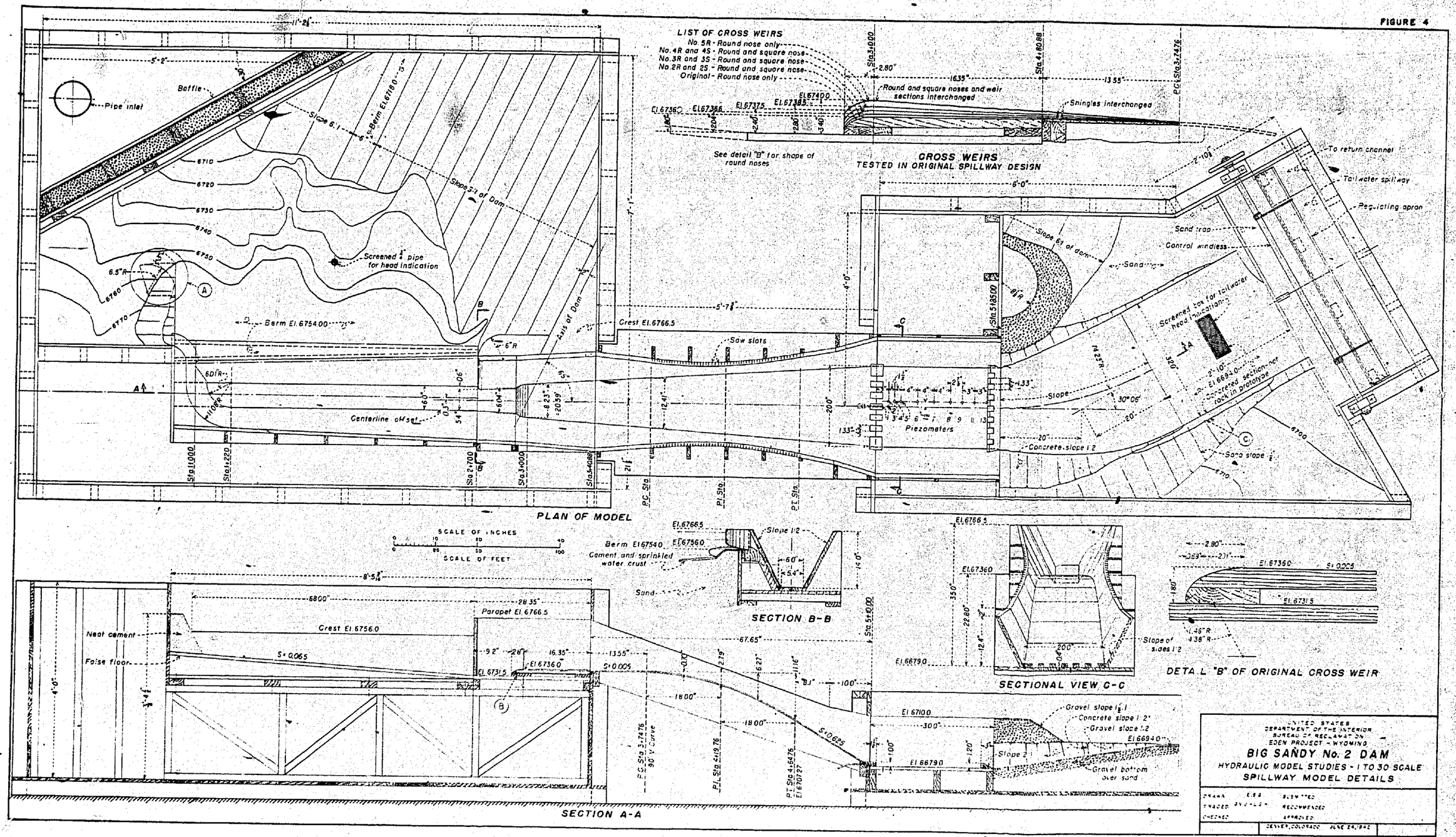
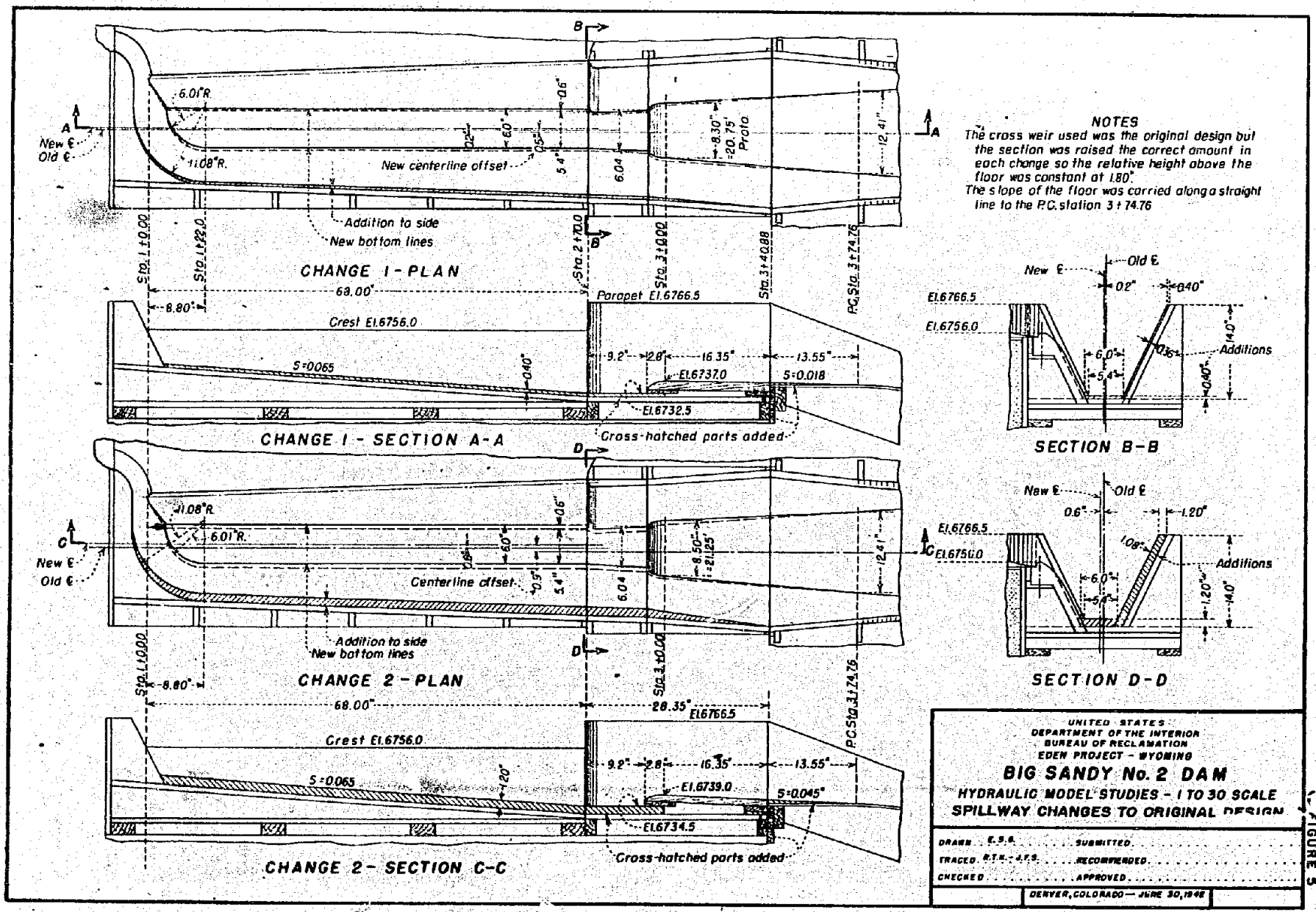

PLAN
Big
Sandy
Creek
Crest
El. 6715.0
El. 6718.0
El. 6766.5
6700
6710
6720
6730
6740
6750
6760
6770
Rip Rap Trim Slope
Δ=30°06'
R=135.58'
T=50.00'
L=97.33'
Transverse Joints Reinforced in Top Face Only
Sta 5+20.00 Grade 5+00.81
Sta 5+85
Sta 3+00
Sta 2+93.00
El. 6789.00
El. 6734.50
Original ground profile on ℄
Assumed rock line on ℄
Tailwater El. 6702, Q=7500 c.f.s.
El. 6690.0
El. 6674.50
12" Ave. 9" Min.
4" Drain
3'-7½" R
10'-11⅛" R
3'-6"
7'-0"
3'-3⅛"
DETAIL "B"
RESERVOIR ELEVATION
TAILWATER ELEVATION
TAILWATER EL.
MAX. W.S.
SPILLWAY DISCHARGE
DISCHARGE - SEC. FT.
DISCHARGE CURVE
SECTION E-E
Original ground line
Assumed rock line
El. 6739.00 at 3+00.00
El. 6734.50 at 2+93.00
4" Wall drains in Porous Concrete
Drain 8" Tile
SECTION D-D
Drains 8" Tile
Barrel Transverse Joints Only
Tar Paper
Screened gravel
8" Tile Drain
DRAIN DETAIL
El. 6710.00
El. 6679.00
4" Wall Drains at Joints
SECTION F-F
NOTE
Reinforcement Steel Not Shown.
El. 6754.0
El. 6756.00
El. 6766.50
El. 6766.51
3:1 Slope of dam
4" Wall drains
1 min. - 8" Tile
SECTION B-B
Cut-off Wall 5' Min.
El. 6679.00
50'-0"
Riprap
Toe Trench as required to support Riprap
SECTION G-G
El. 6690.0
SECTION H-H
Axis of weir Crest El. 6758.00
Vertex of parabola Y=X²/4a
El. 6754.0
20 Ga. Metal
12" Wide Seal
METAL SEAL
Grout Holes 25' Deep @ 10' O.C.
6" Drain
DETAIL OF WEIR CREST
SCALE OF FEET
DETAIL A
UNITED STATES
DEPARTMENT
BUREAU OF
EDEN PROJ
BIG SAN
SPILLWAY
DRAWN J.G.B.

FIGURE 4



LIST OF CROSS WEIRS
No. 5R - Round nose only
No. 4R and 4S - Round and square nose
No. 3R and 3S - Round and square nose
No. 2R and 2S - Round and square nose
Original - Round nose only
Round and square noses and weir sections interchanged
Shingles interchanged
See detail "B" for shape of round noses
CROSS WEIRS
TESTED IN ORIGINAL SPILLWAY DESIGN
Pipe inlet
Baffle
Slope 6:1
Berm El. 6718.0
Slope 3:1 of Dam
Screened ¾" pipe for head indication
Berm El. 6754.00
Axis of Dam
Crest El. 6766.5
Saw slots
Centerline offset
Piezometers
Concrete slope 1:2
Slope
Sand trap
Control windless
Sand
Screened box for tailwater head indication
Concreted section not rock in prototype
To return channel
Tailwater spillway
Regulating apron
Sand slope
PLAN OF MODEL
SCALE OF INCHES
SCALE OF FEET
Berm El. 6754.0
Cement and sprinkled water crust
Sand
Slope 1:2
SECTION B-B
Neat cement
False floor
Crest El. 6756.0
Parapet El. 6766.5
S=0.065
S=0.005
S=0.625
Gravel slope 1:2
Concrete slope 1:2
Gravel bottom over sand
SECTION A-A
SECTIONAL VIEW C-C
Slope of sides 1:2
DETAIL "B" OF ORIGINAL CROSS WEIR
UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION
EDEN PROJECT - WYOMING
BIG SANDY No. 2 DAM
HYDRAULIC MODEL STUDIES - 1 TO 30 SCALE
SPILLWAY MODEL DETAILS
DENVER, COLORADO JUNE 24, 1942



NOTES

The cross weir used was the original design but the section was raised the correct amount in each change so the relative height above the floor was constant at 1.80".

The slope of the floor was carried along a straight line to the P.C. station 3+74.76

UNITED STATES
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EDEN PROJECT - WYOMING

BIG SANDY No. 2 DAM

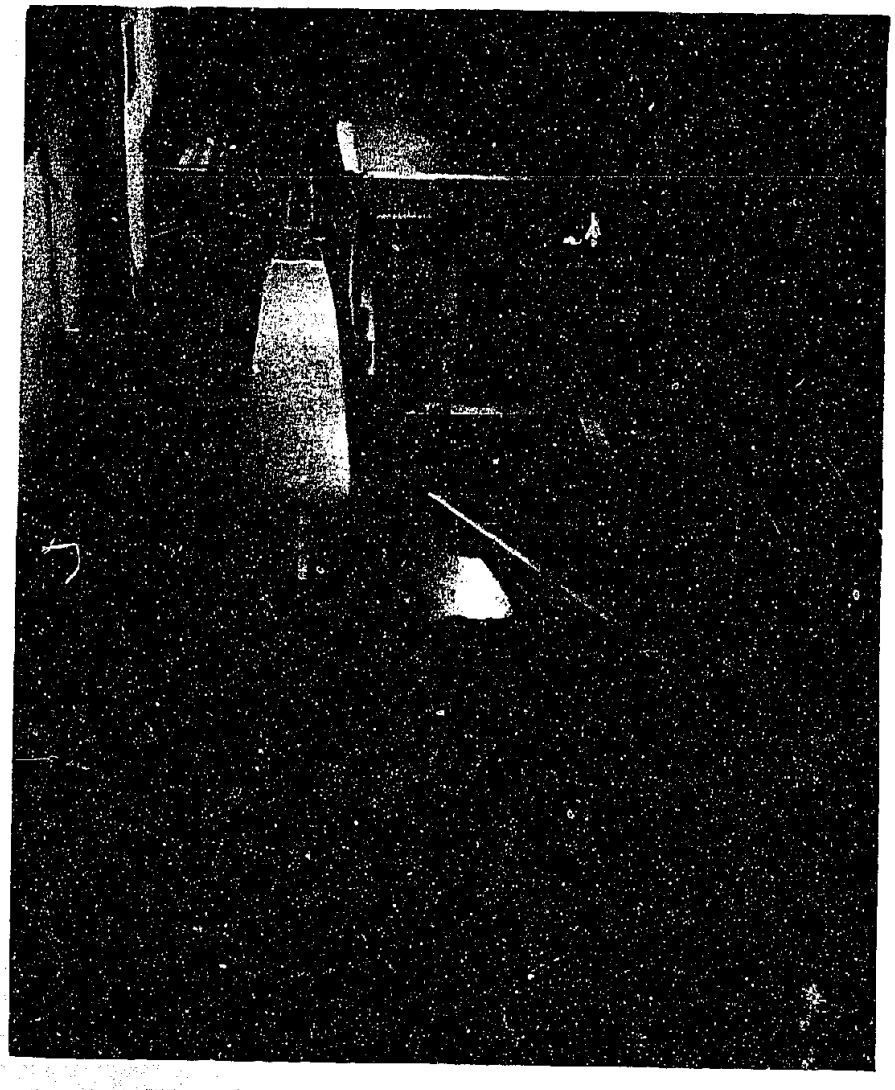
HYDRAULIC MODEL STUDIES - 1 TO 30 SCALE

SPILLWAY CHANGES TO ORIGINAL DESIGN

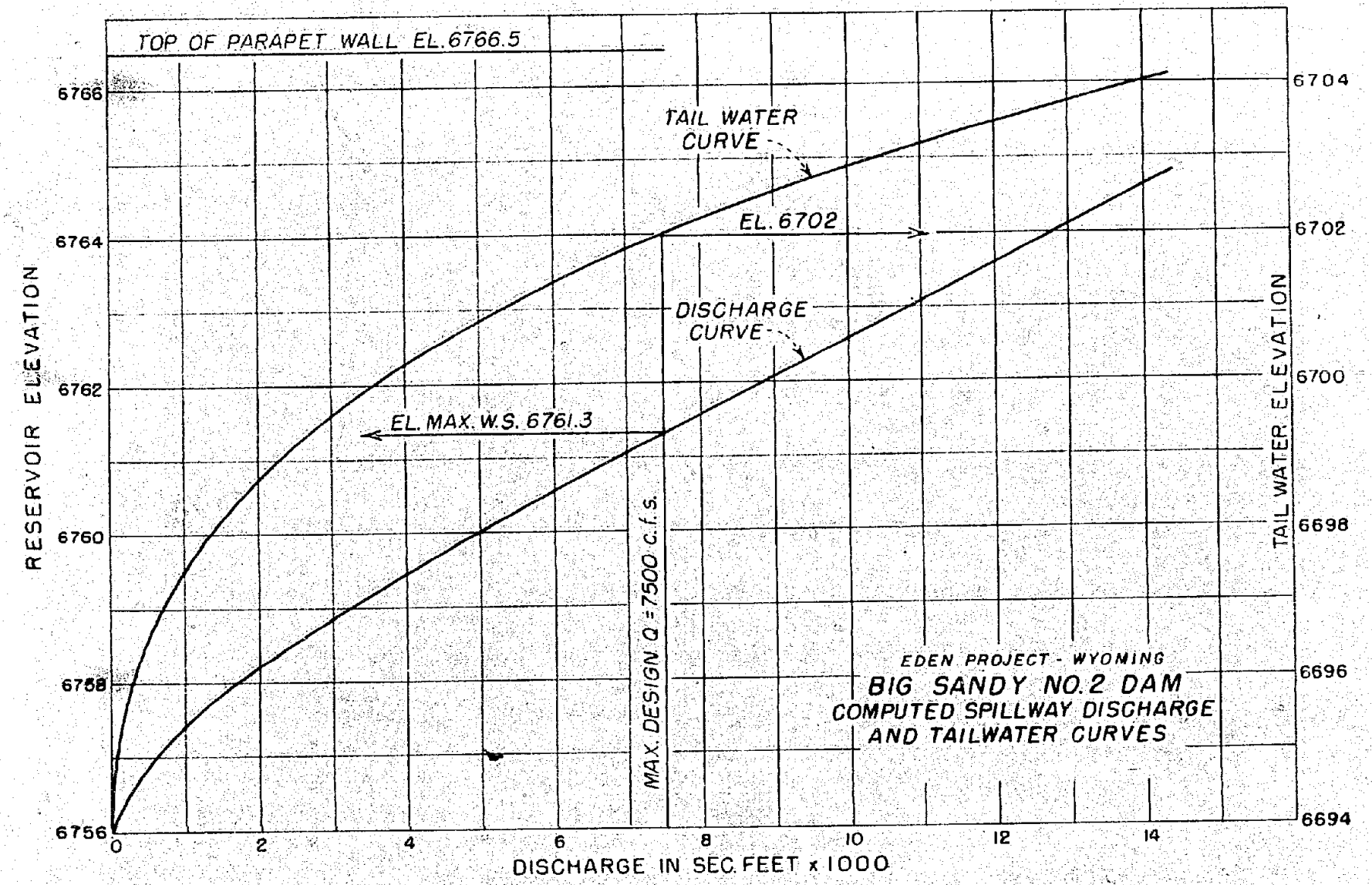
DRAWN E.S.G. SUBMITTED
TRACED R.T.H. - J.F.S. RECOMMENDED
CHECKED APPROVED

DENVER, COLORADO — JUNE 30, 1942

FIGURE 5



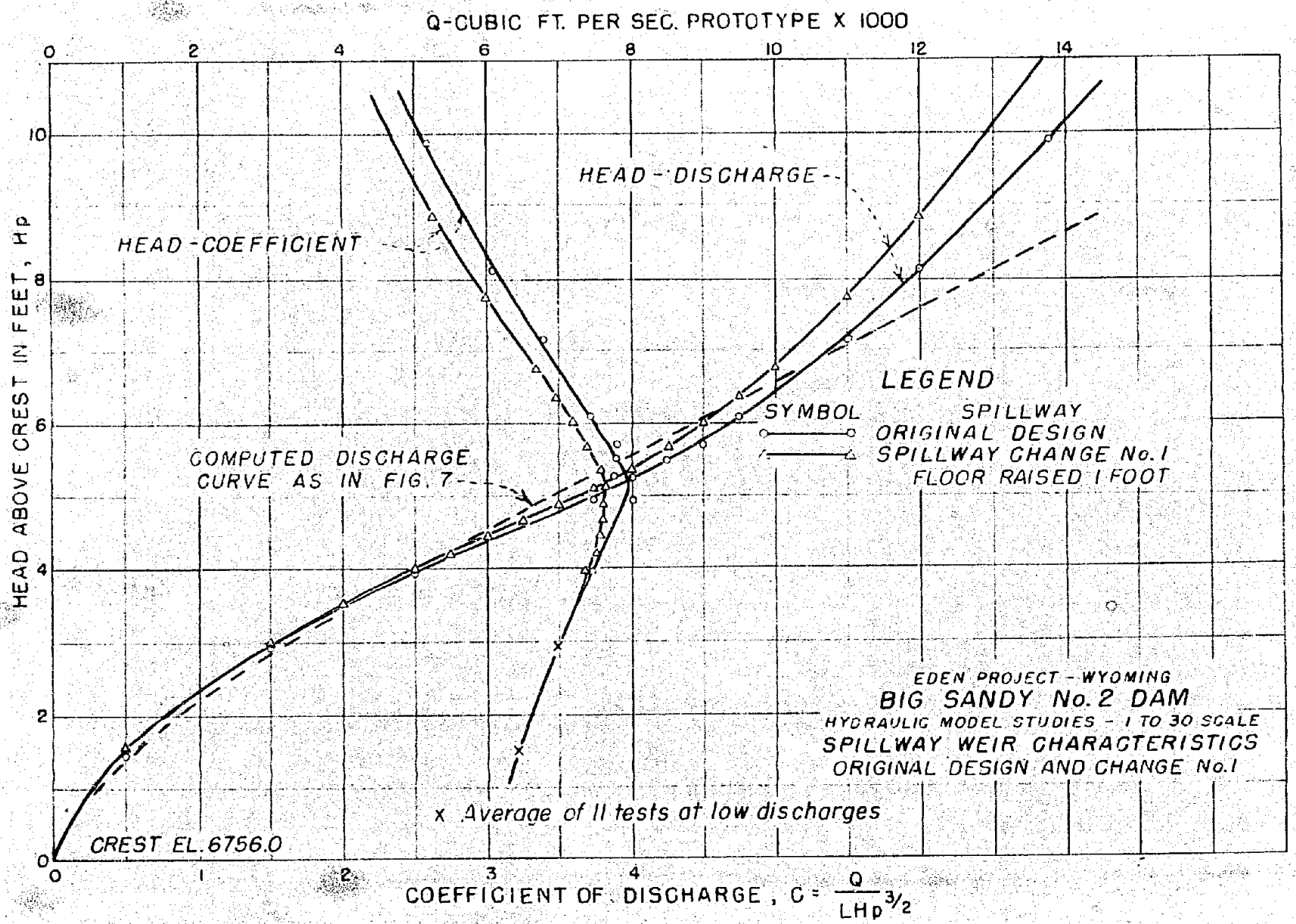
MODEL OF ORIGINAL DESIGN OF BIG SANDY No. 2 DAM SPILLWAY
Tailwater channel later stabilized by concrete to prevent erosion and sheet metal on slope replaced with gravel riprap.



EDEN PROJECT - WYOMING
BIG SANDY NO. 2 DAM
COMPUTED SPILLWAY DISCHARGE AND TAILWATER CURVES

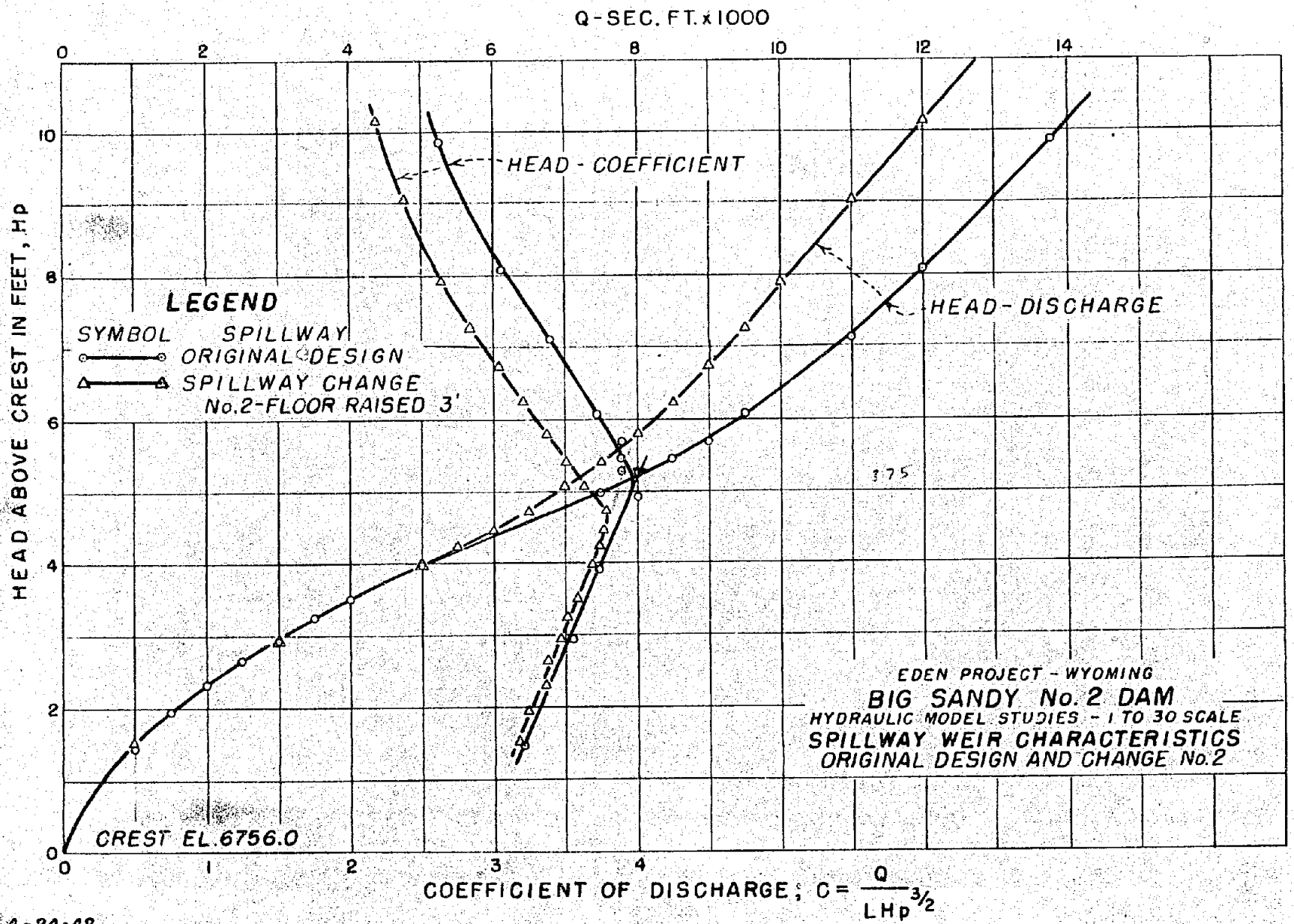
FIGURE 7

E.S.G. 6-16-42



E.S.G. 5-14-42

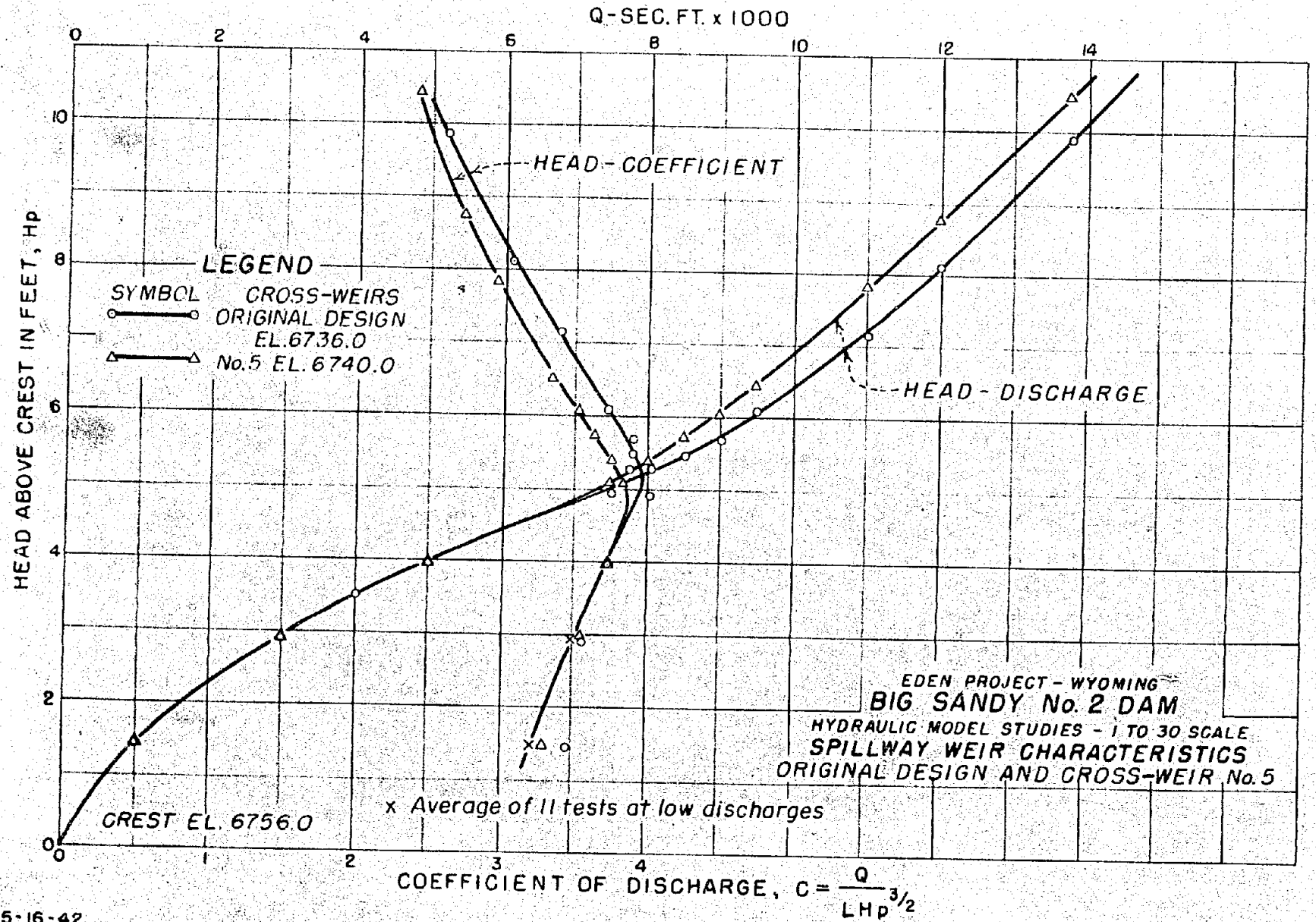
FIGURE 8



EDEN PROJECT - WYOMING
BIG SANDY No. 2 DAM
HYDRAULIC MODEL STUDIES - 1 TO 30 SCALE
SPILLWAY WEIR CHARACTERISTICS
ORIGINAL DESIGN AND CHANGE No.2

E.S.G. 4-24-42

FIGURE 9



EDEN PROJECT - WYOMING
BIG SANDY No. 2 DAM
HYDRAULIC MODEL STUDIES - 1 TO 30 SCALE
SPILLWAY WEIR CHARACTERISTICS
ORIGINAL DESIGN AND CROSS-WEIR No. 5

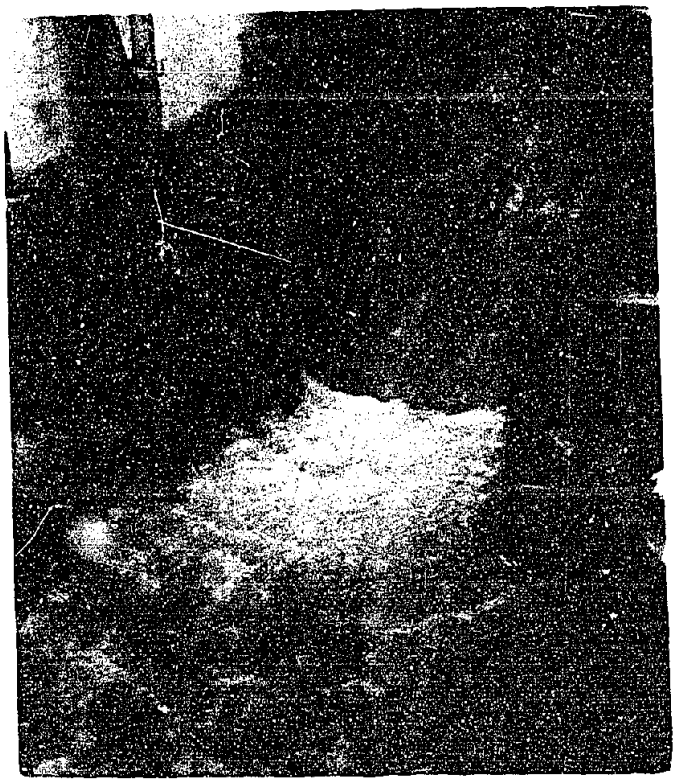
E.S.G. 5-16-42

FIGURE 10

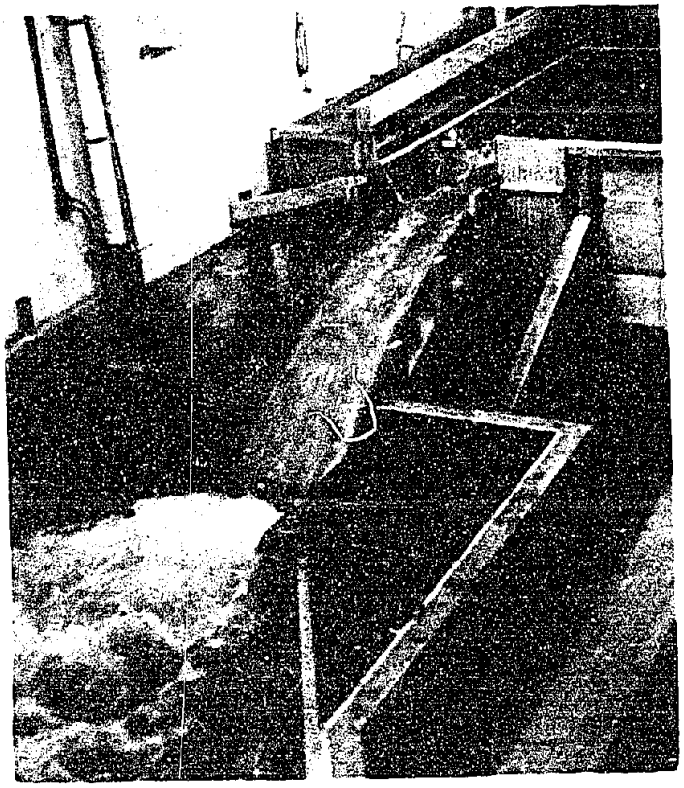
FIGURE 11

Discharge-7,500 Sec.-ft.

Discharge-8,500 Sec.-ft.



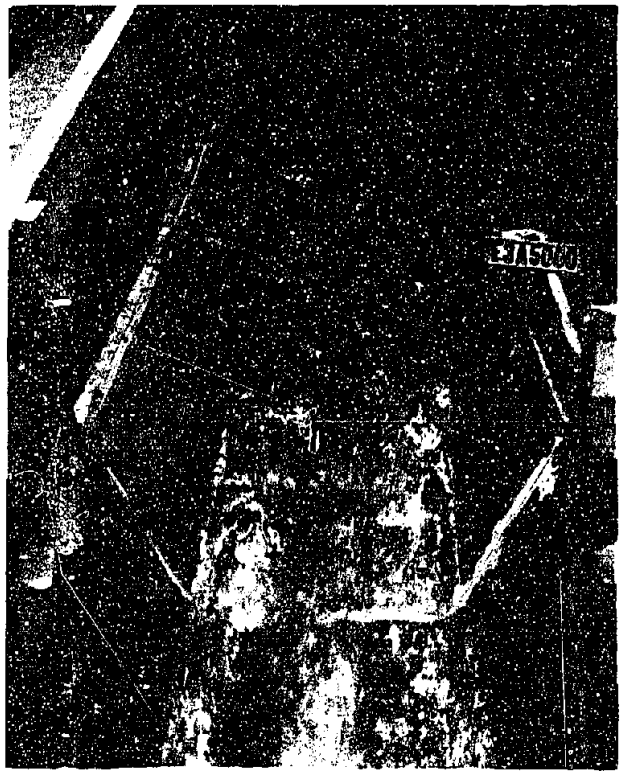
Discharge-12,000 Sec.-ft.



Discharge-13,800 Sec.-ft.

BIG SANDY No. 2 DAM SPILLWAY
FLOW CONDITIONS IN ORIGINAL DESIGN

FIGURE 12



Discharge-5,000 Sec.-ft.

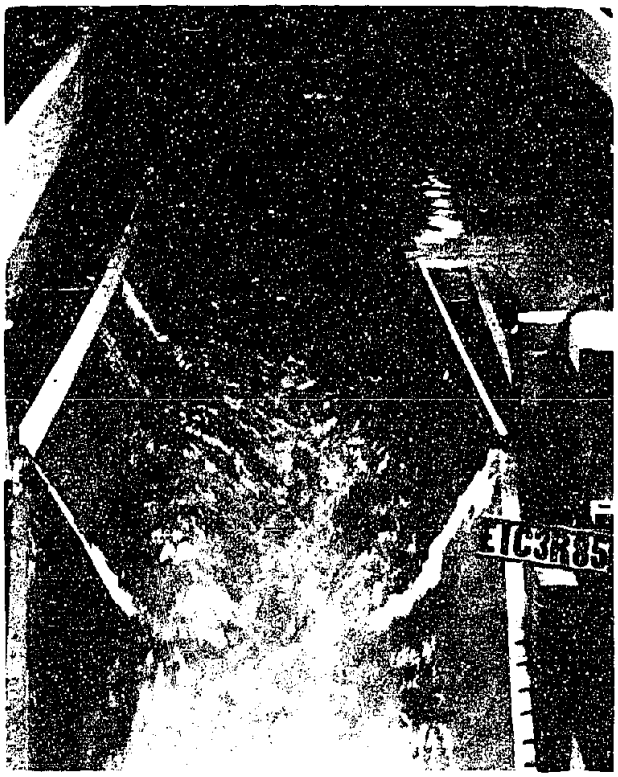
Discharge-6,500 Sec.-ft.

Discharge-7,900 Sec.-ft.

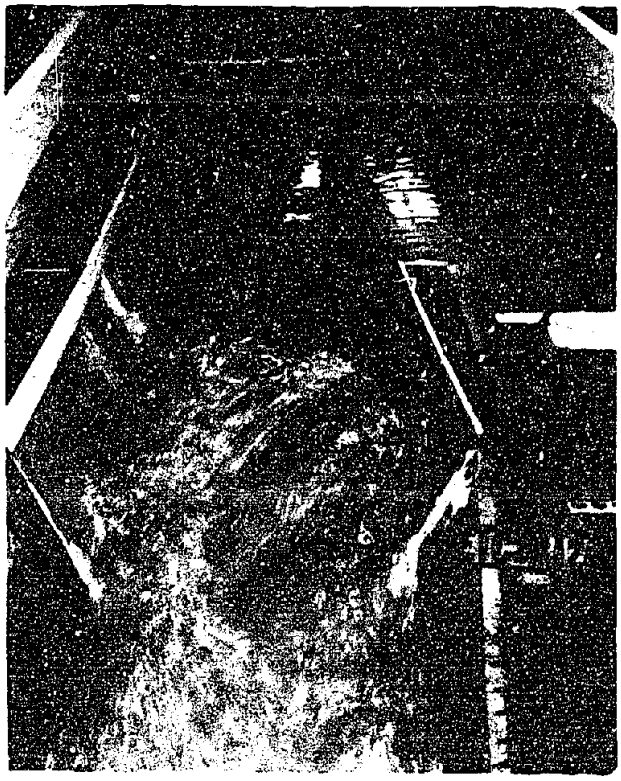
Discharge-8,500 Sec.-ft.

BIG SANDY No. 2 DAM SPILLWAY
WEIR & CROSS-WEIR ACTION----SPILLWAY CHANGE No. 2

Discharge-7,500 Sec.-ft.



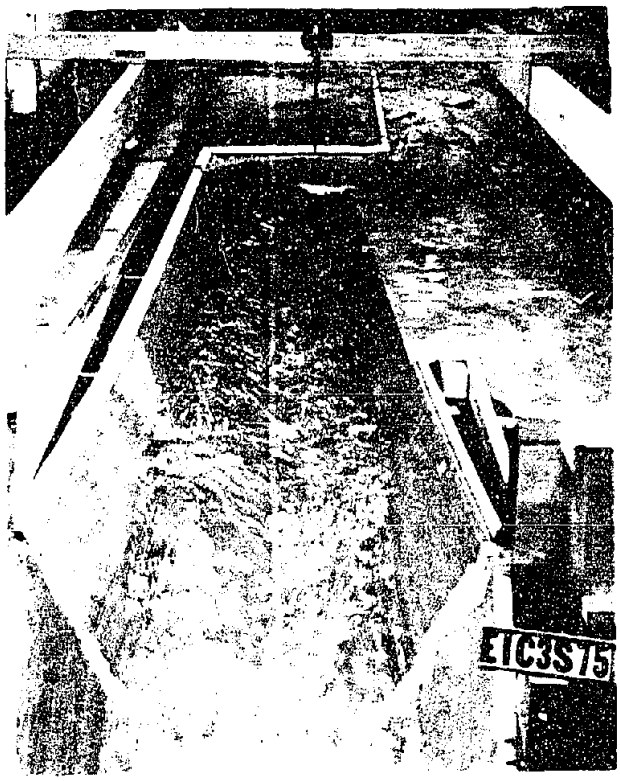
Discharge-8,500 Sec.-ft.



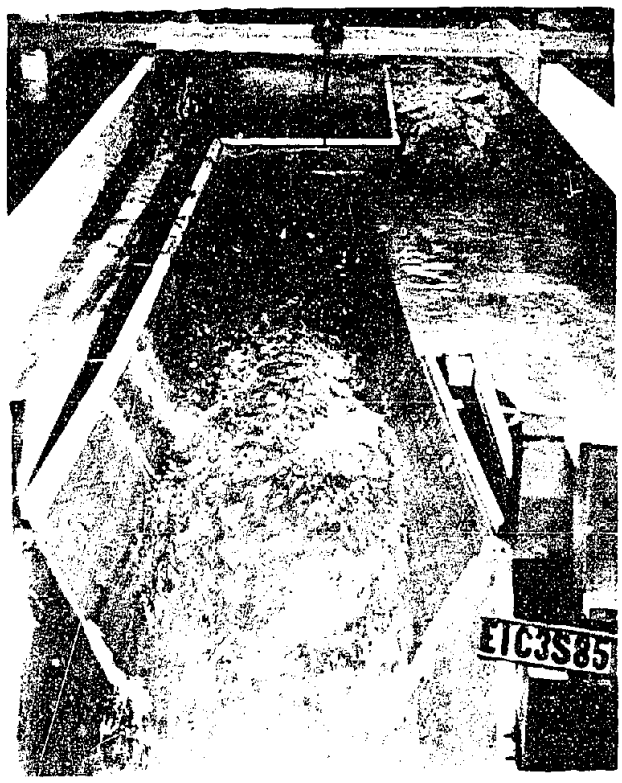
Discharge-12,000 Sec.-ft.

Discharge-12,800 Sec.-ft.

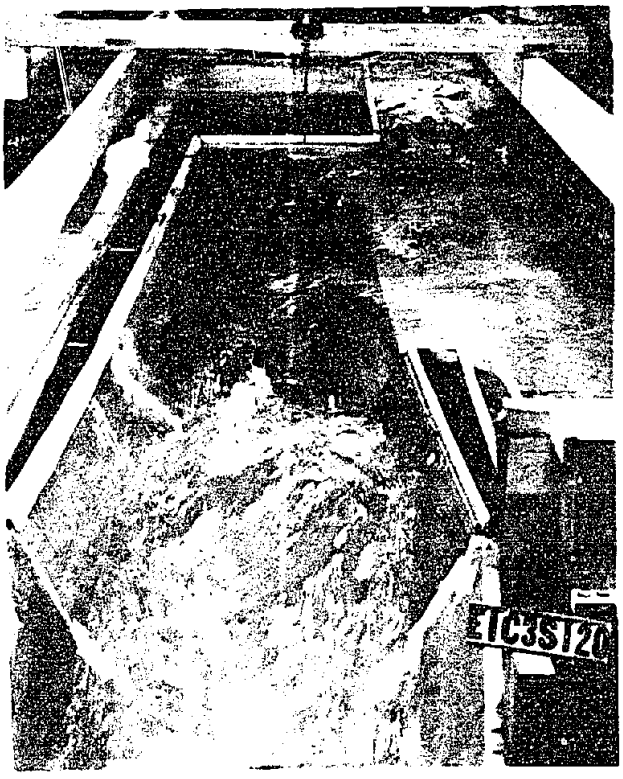
BIG SANDY No. 2 DAM SPILLWAY
WEIR & CROSS-WEIR ACTION
ORIGINAL SPILLWAY DESIGN WITH ROUND-NOSE
CROSS-WEIR No. 3R. AND CREST EL. 6737.5 INSTEAD OF 6736.0



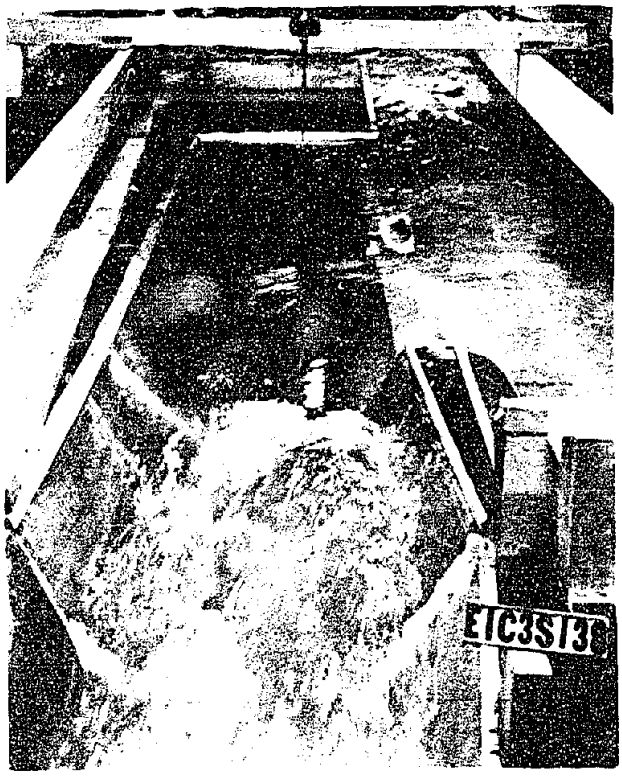
Discharge-7,500 Sec.-ft.



Discharge-8,500 Sec.-ft.



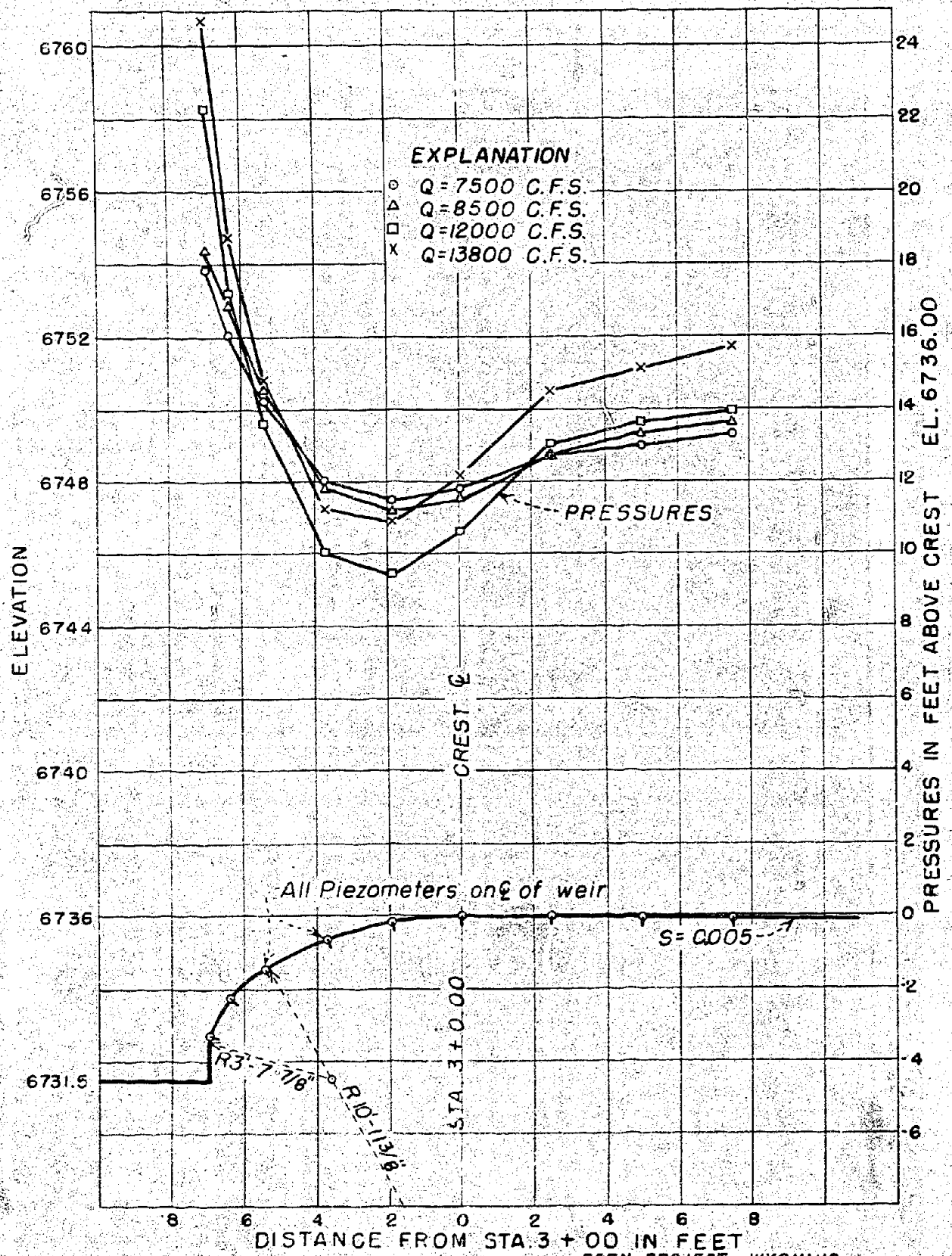
Discharge-12,000 Sec.-ft.



Discharge-13,000 Sec.-ft.

BIG SANDY No. 2 DAM
WEIR - CROSS-WEIR ACTION----ORIGINAL SPILLWAY DESIGN WITH
SQUARE-NOSE CROSS-WEIR No. 3S, CREST EL. 6737.5

FIGURE 15



EDEN PROJECT - WYOMING

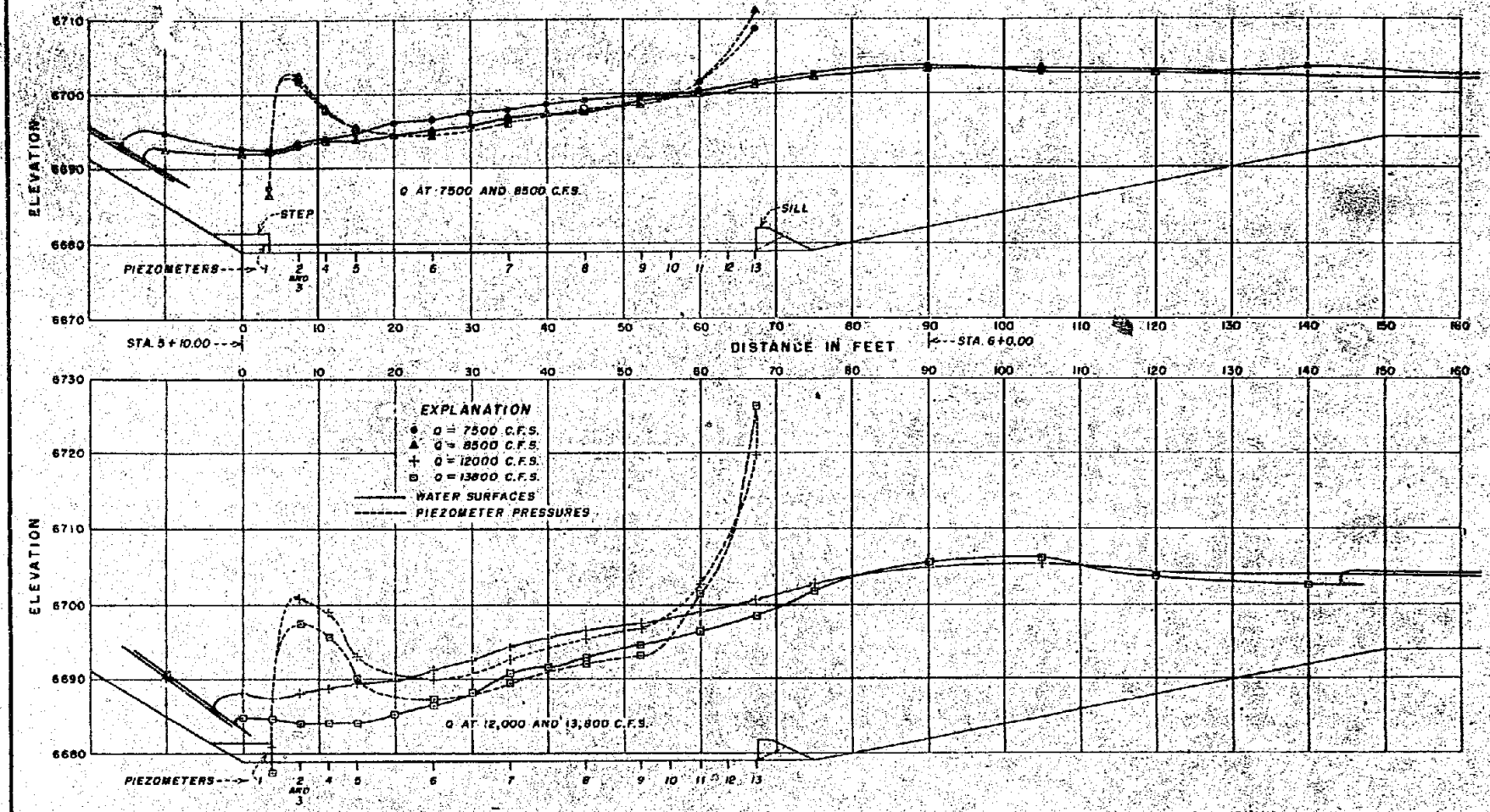
BIG SANDY No. 2 DAM

HYDRAULIC MODEL STUDIES - 1 TO 30 SCALE

PRESSURE OVER SPILLWAY CROSS-WEIR

ORIGINAL DESIGN

E.S.G. 1-6-42



Piezometer No. 1 located in center step on centerline of stilling pool.
Piezometer No. 2 located on centerline of floor.
Piezometers No. 3 to 13 inclusive located 3.13' from centerline of floor.
Piezometer No. 13 located in front of sill step.

EDEN PROJECT - WYOMING

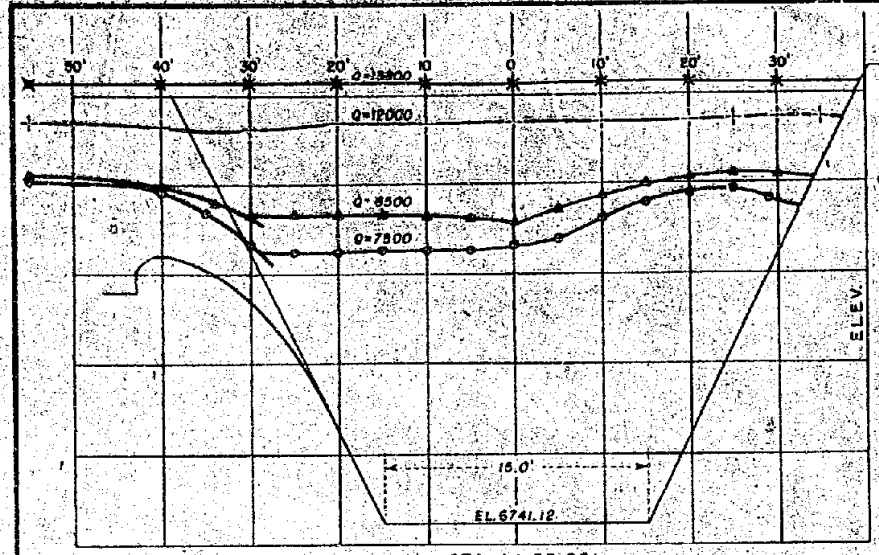
BIG SANDY No. 2 DAM

HYDRAULIC MODEL STUDIES - 1 TO 30 SCALE

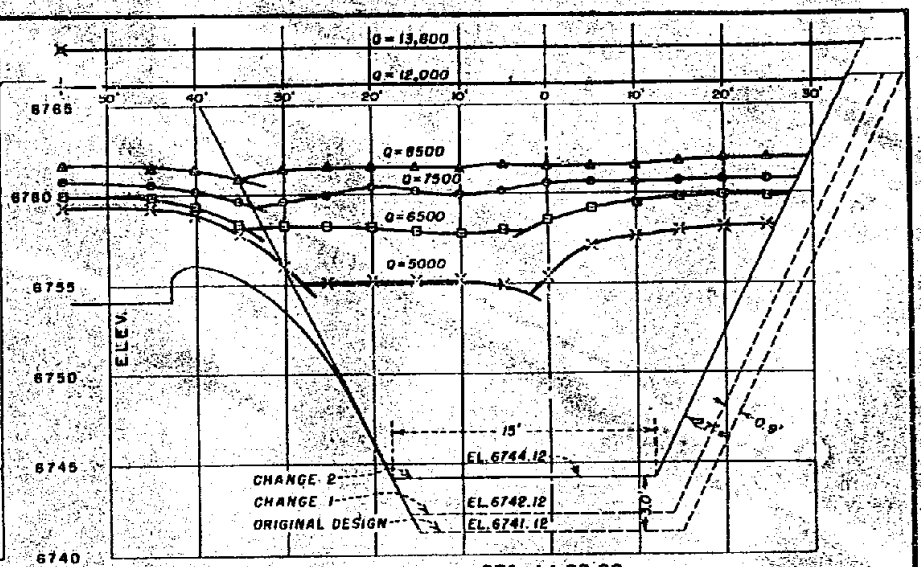
TAILWATER PROFILES AND PIEZOMETER PRESSURES

ORIGINAL SPILLWAY DESIGN

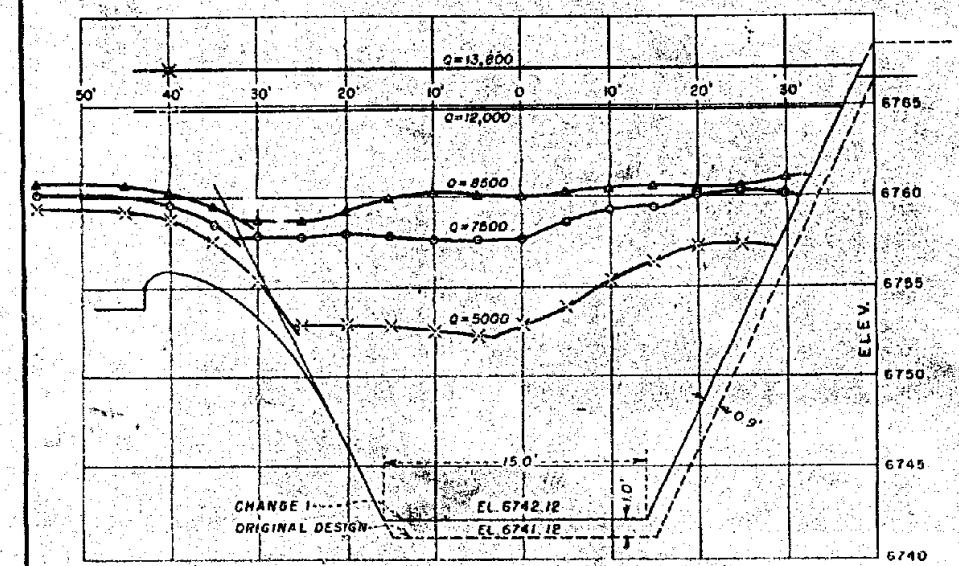
FIGURE 18



STA. 1+22.00
WATER SURFACES - ORIGINAL DESIGN



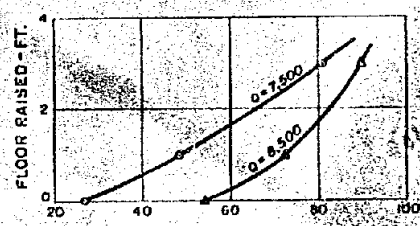
STA. 1+22.00
WATER SURFACES FOR CHANGE No. 2



STA. 1+22.00
WATER SURFACES FOR CHANGE No. 1

Q-C.F.S.	CROSS WEIR ELEVATION			AVE. WATER SURFACE EL.		
	ORIGINAL	CHANGE No. 1	CHANGE No. 2	ORIGINAL	CHANGE No. 1	CHANGE No. 2
5,000		6737.00	6739.00		6754.15	6756.25
6,500			6739.00			6758.75
7,500	6736.00	6737.00	6739.00	6757.33	6758.80	6760.40
8,500	6736.00	6737.00	6739.00	6759.01	6760.14	6761.60

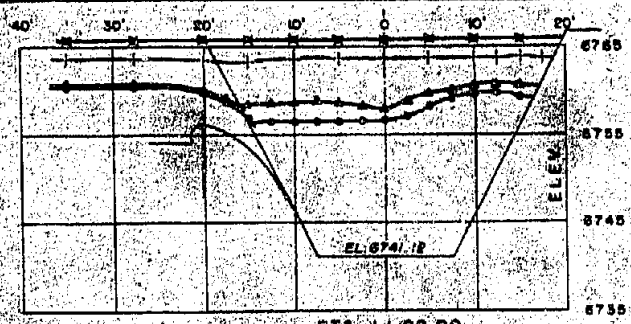
Q-C.F.S.	HEAD ON CREST			PERCENT SUBMERGENCE		
	ORIGINAL	CHANGE No. 1	CHANGE No. 2	ORIGINAL	CHANGE No. 1	CHANGE No. 2
5,000		-1.85	3.99		BELOW CREST	8.27
6,500			4.72			38.33
7,500	5.00	5.13	5.41	28.6	48.7	61.35
8,500	5.49	5.67	6.24	54.7	73.0	69.80



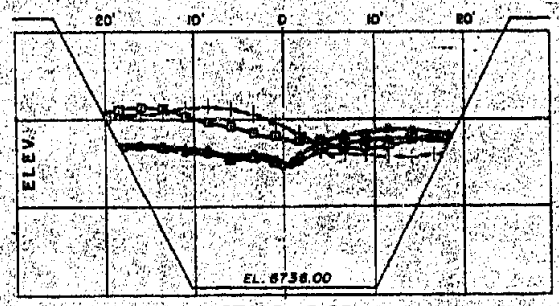
EDEN PROJECT - WYOMING
BIG SANDY No. 2 DAM
HYDRAULIC MODEL STUDIES - 1 TO 30 SCALE
SPILLWAY WATER SURFACES AND SUBMERGENCE
ORIGINAL DESIGN AND CHANGES 1 AND 2

FIGURE 17

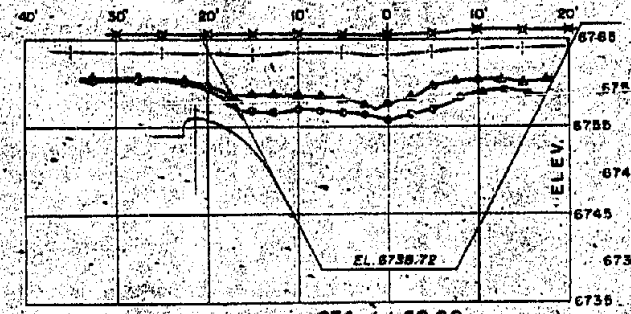
FIGURE 18



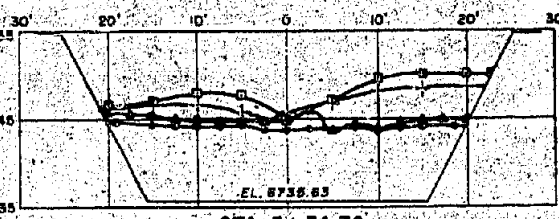
STA. 1+22.00



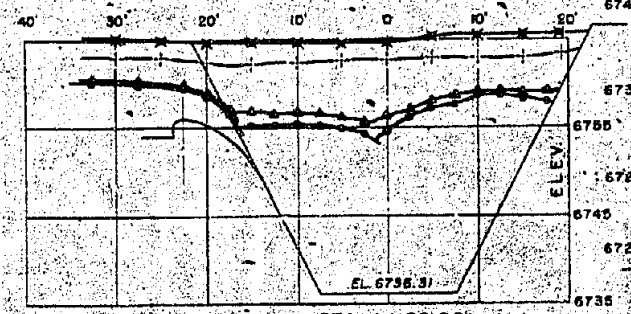
STA. 3+0.00



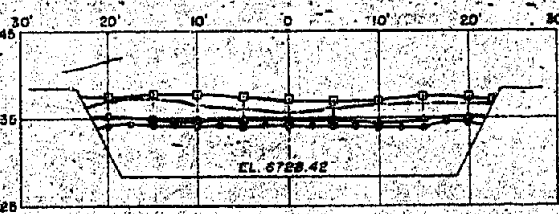
STA. 1+59.00



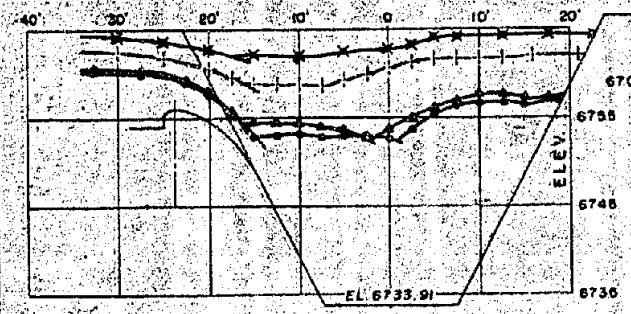
STA. 3+74.76



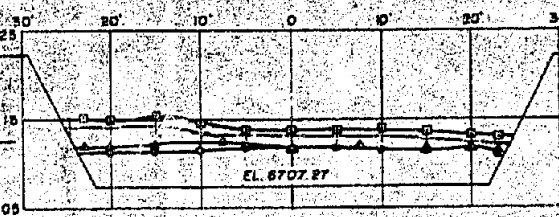
STA. 1+96.00



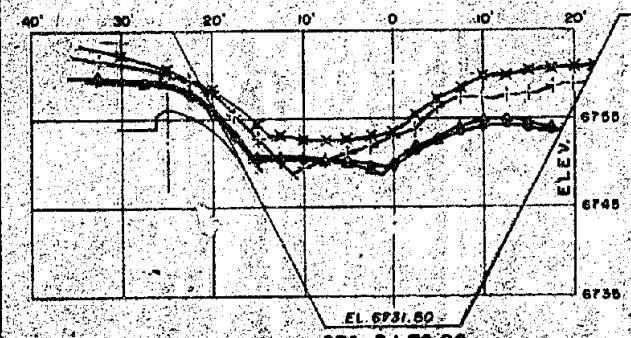
STA. 4+19.76



STA. 2+33.00



STA. 4+64.76



STA. 2+70.00

EXPLANATION

SYMBOL	DISCHARGE - C.F.S.
	7,500
	8,500
	12,000
	13,800

EDEN PROJECT - WYOMING

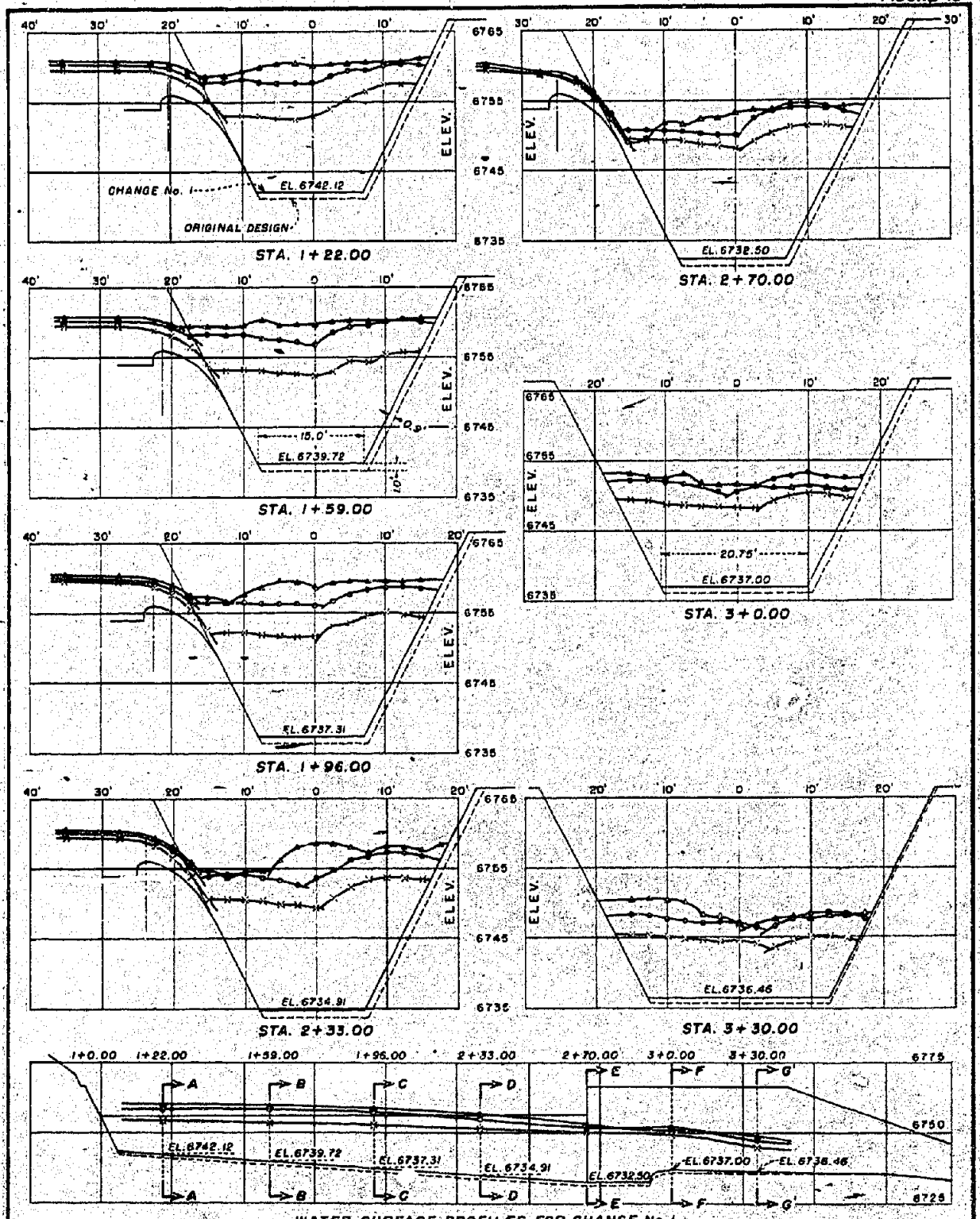
BIG SANDY No. 2 DAM

HYDRAULIC MODEL STUDIES - 1 TO 30 SCALE

WATER SURFACE CROSS-SECTIONS

ORIGINAL SPILLWAY DESIGN

FIGURE 19



WATER SURFACE PROFILES FOR CHANGE No. 1
AVERAGE WATER SURFACE ELEVATIONS

SYMBOL	Q C.F.S.	SECTIONS AND FLOOR ELEVATIONS AT SECTIONS						
		A	B	C	D	E	F	G'
		6742.12	6739.72	6737.31	6734.91	6732.50	6737.00	6736.46
	5,000	6754.36	6753.60	6752.91	6751.43	6750.04	6749.02	6744.92
	7,500	6758.58	6758.52	6757.10	6754.94	6752.31	6751.95	6747.61
	8,500	6760.07	6759.89	6758.71	6756.81	6752.91	6751.64	6748.28

EDEN PROJECT - WYOMING

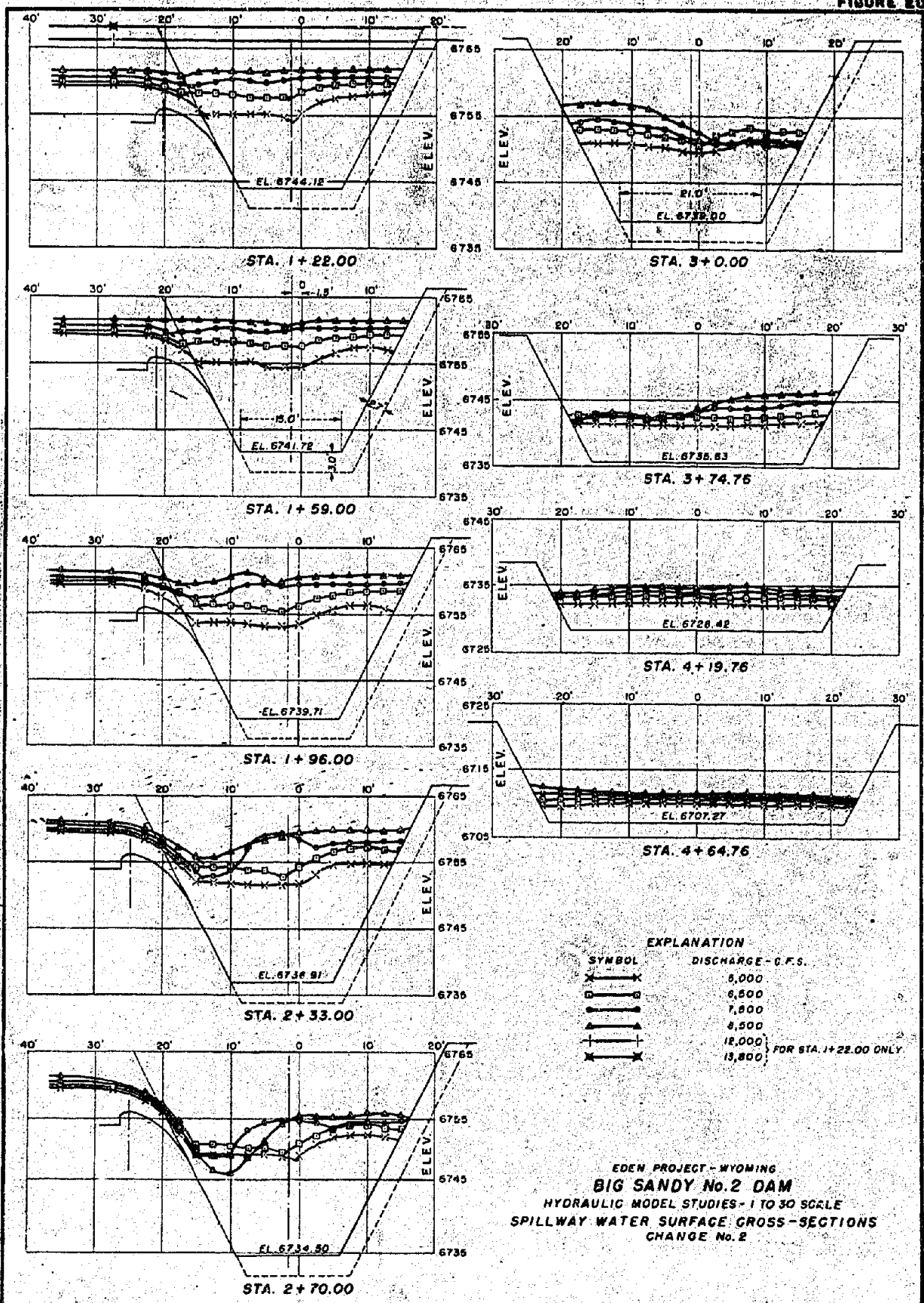
BIG SANDY No. 2 DAM

HYDRAULIC MODEL STUDIES - 1 TO 30 SCALE

SPILLWAY WATER SURFACE CROSS-SECTIONS AND PROFILES

CHANGE No. 1

FIGURE 20



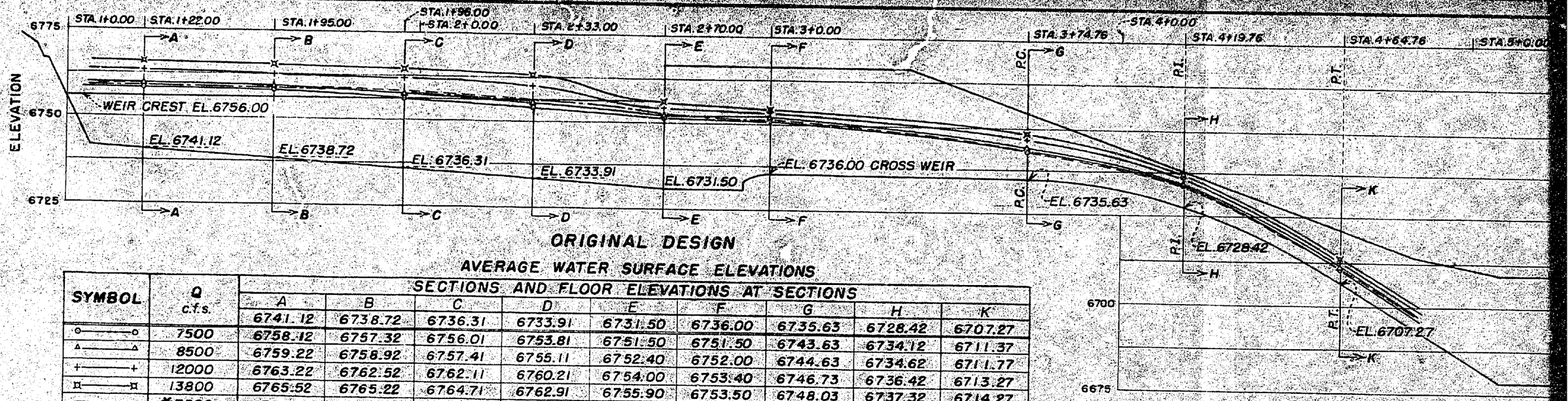
EDEN PROJECT - WYOMING

BIG SANDY No. 2 DAM

HYDRAULIC MODEL STUDIES - 1 TO 30 SCALE

SPILLWAY WATER SURFACE CROSS-SECTIONS

CHANGE No. 2



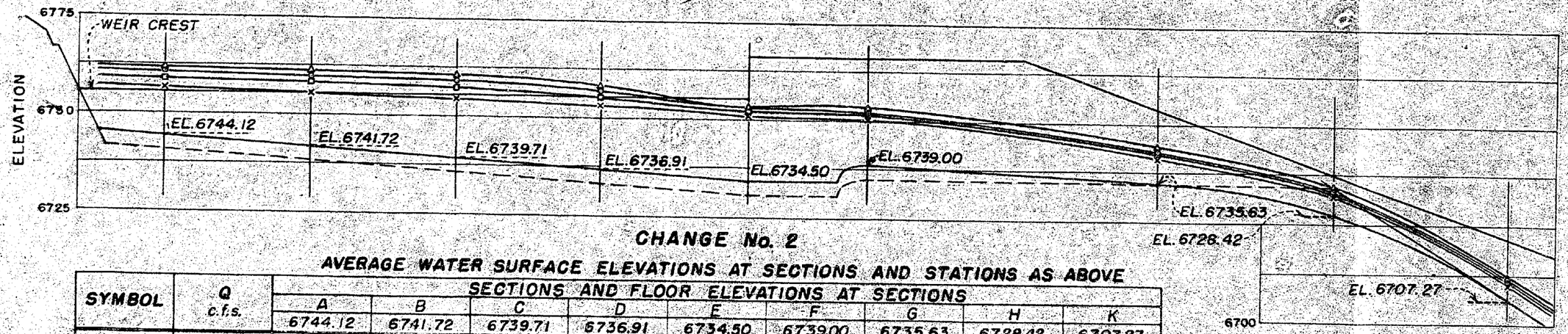
ORIGINAL DESIGN

AVERAGE WATER SURFACE ELEVATIONS

SYMBOL	Q c.f.s.	SECTIONS AND FLOOR ELEVATIONS AT SECTIONS								
		A	B	C	D	E	F	G	H	K
		6741.12	6738.72	6736.31	6733.91	6731.50	6736.00	6735.63	6728.42	6707.27
○——○	7500	6758.12	6757.32	6756.01	6753.81	6751.50	6751.50	6743.63	6734.12	6711.37
△——△	8500	6759.22	6758.92	6757.41	6755.11	6752.40	6752.00	6744.63	6734.62	6711.77
+——+	12000	6763.22	6762.52	6762.11	6760.21	6754.00	6753.40	6746.73	6736.42	6713.27
¤——¤	13800	6765.52	6765.22	6764.71	6762.91	6755.90	6753.50	6748.03	6737.32	6714.27
———	*7500	6759.22	6758.62	6757.61	6755.91	6751.50	6750.20	6743.23	6733.42	6710.97
———	†7500	6759.02	6758.61	6757.11	6755.11	6752.40	6750.20			

NOTE * Theoretical backwater curve, 65% submergence and including transition loss

NOTE † Theoretical backwater curve 50% submergence and excluding transition loss



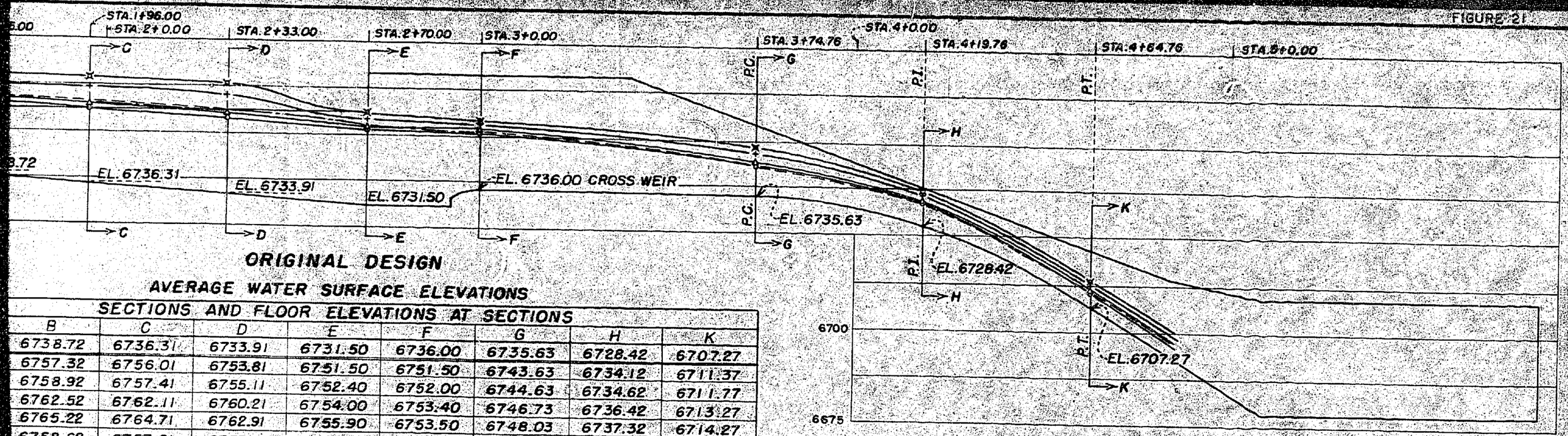
CHANGE No. 2

AVERAGE WATER SURFACE ELEVATIONS AT SECTIONS AND STATIONS AS ABOVE

SYMBOL	Q c.f.s.	SECTIONS AND FLOOR ELEVATIONS AT SECTIONS								
		A	B	C	D	E	F	G	H	K
		6744.12	6741.72	6739.71	6736.91	6734.50	6739.00	6735.63	6728.42	6707.27
×——×	5000	6758.90	6755.55	6754.71	6753.41	6750.95	6750.30	6741.35	6732.49	6710.02
□——□	6500	6758.69	6758.15	6757.45	6755.06	6752.10	6752.12	6742.53	6733.42	6710.67
○——○	7500	6760.40	6759.98	6759.39	6756.83	6753.53	6752.16	6743.34	6734.03	6711.23
△——△	8500	6761.68	6761.22	6760.72	6758.41	6753.21	6753.50	6744.23	6734.61	6711.65

E.S.G. 6-8-42

FIGURE 21



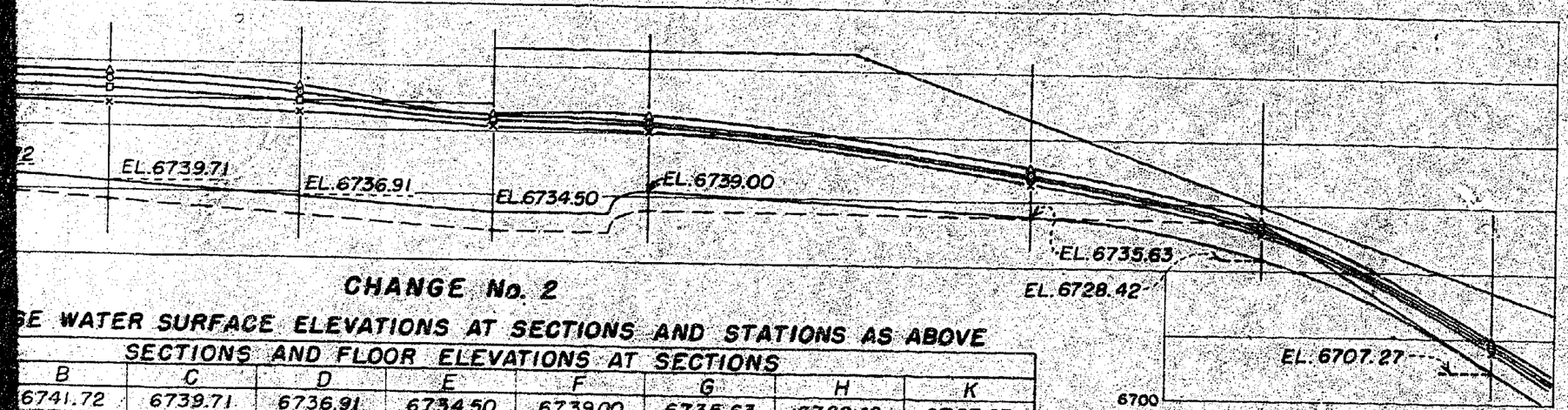
ORIGINAL DESIGN

AVERAGE WATER SURFACE ELEVATIONS

SECTIONS AND FLOOR ELEVATIONS AT SECTIONS

B	C	D	E	F	G	H	K
6738.72	6736.31	6733.91	6731.50	6736.00	6735.63	6728.42	6707.27
6757.32	6756.01	6753.81	6751.50	6751.50	6743.63	6734.12	6711.37
6758.92	6757.41	6755.11	6752.40	6752.00	6744.63	6734.62	6711.77
6762.52	6762.11	6760.21	6754.00	6753.40	6746.73	6736.42	6713.27
6765.22	6764.71	6762.91	6755.90	6753.50	6748.03	6737.32	6714.27
6758.62	6757.61	6755.91	6751.50	6750.20	6743.23	6733.42	6710.97
6758.61	6757.11	6755.11	6752.40	6750.20			

urve, 65% submergence and including transition loss
urve 59% submergence and excluding transition loss



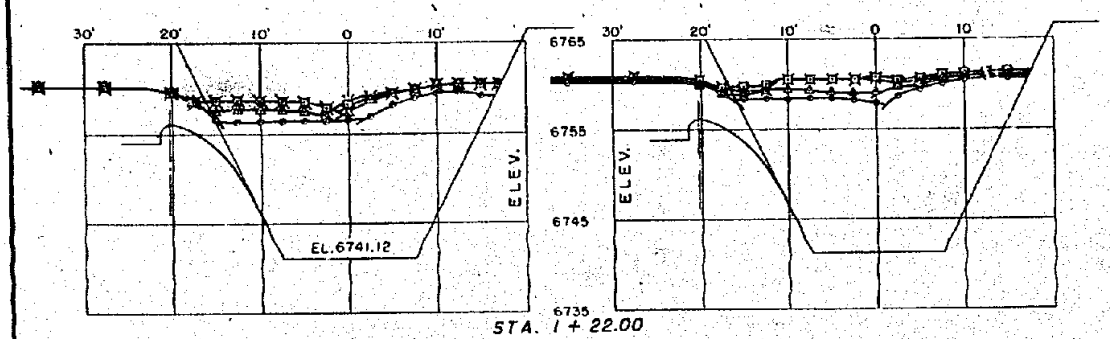
CHANGE No. 2

E WATER SURFACE ELEVATIONS AT SECTIONS AND STATIONS AS ABOVE

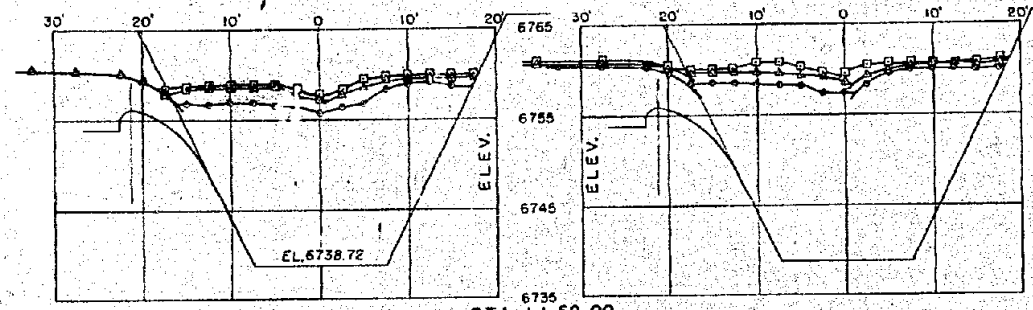
SECTIONS AND FLOOR ELEVATIONS AT SECTIONS

B	C	D	E	F	G	H	K
6741.72	6739.71	6736.91	6734.50	6739.00	6735.63	6728.42	6707.27
6755.55	6754.71	6753.41	6750.95	6750.30	6741.35	6732.49	6710.02
6758.15	6757.45	6755.06	6752.10	6752.12	6742.53	6733.42	6710.67
6759.98	6759.39	6756.83	6753.53	6752.16	6743.34	6734.03	6711.23
6761.22	6760.72	6758.41	6753.21	6753.50	6744.23	6734.61	6711.65

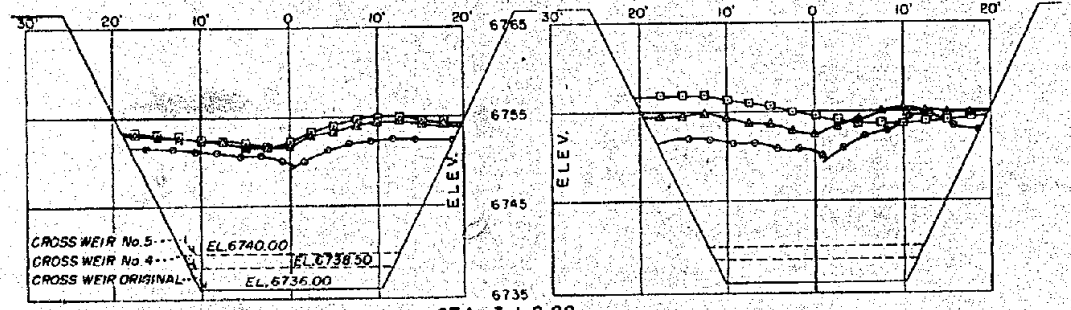
EDEN PROJECT - WYOMING
BIG SANDY No. 2 DAM
HYDRAULIC MODEL STUDIES - 1 TO 30 SCALE
SPILLWAY WATER SURFACE PROFILES
ORIGINAL DESIGN AND CHANGE No. 2



STA. 1 + 22.00



STA. 1 + 59.00



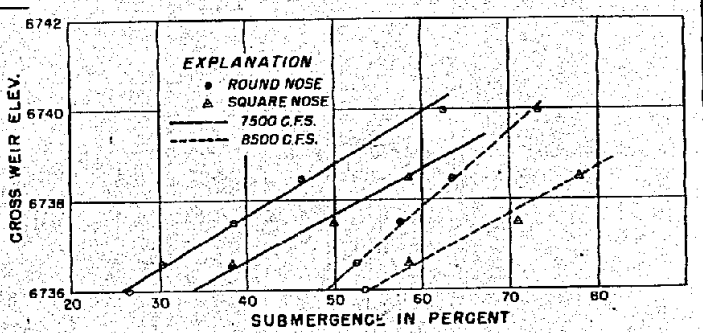
STA. 3 + 0.00

WATER SURFACE CROSS SECTIONS AT 7500 C.F.S. WATER SURFACE CROSS SECTIONS AT 8500 C.F.S.

SUBMERGENCE DATA FOR SECTION A-A

ROUND NOSED CROSS WEIRS							
		Q = 7500 C.F.S.			Q = 8500 C.F.S.		
WEIR No.	CREST EL.	AVE. W.S. EL.	H=HEAD ON CREST	SUBMERGENCE %	AVE. W.S. EL.	H=HEAD ON CREST	SUBMERGENCE %
ORIGINAL	6736.00	6757.33	5.00	26.6	6758.95	5.49	53.7
#2	6736.60	6757.55	5.16	30.4	6758.95	5.61	52.6
#3	6737.50	6757.97	5.10	38.6	6759.22	5.58	57.7
4	6738.50	6758.37	5.07	46.5	6759.57	5.61	63.6
5	6740.00	6759.15	5.10	62.6	6760.20	5.73	73.3
SQUARE NOSED CROSS WEIRS							
1	NO TESTS						
#2	6736.60	6757.97	5.16	38.2	6759.27	5.61	58.3
#3	6737.50	6758.50	5.01	49.9	6760.00	5.64	70.9
4	6738.50	6759.00	5.10	58.8	6760.47	5.73	78.0
5	NO TESTS						

* WATER SURFACES NOT PLOTTED.



EXPLANATION

- ORIGINAL CROSS WEIR. EL.6736.00
- No.4 ROUND NOSE CROSS WEIR. . . . EL.6738.50
- No.4 SQUARE NOSE CROSS WEIR. . . EL.6738.50
- No.5 ROUND NOSE CROSS WEIR. . . . EL.6740.00

EDEN PROJECT - WYOMING

BIG SANDY No.2 DAM

HYDRAULIC MODEL STUDIES - 1 TO 30 SCALE

SPILLWAY WATER SURFACES AND SUBMERGENCE COMPARISON OF ROUND AND SQUARE NOSE CROSS-WIERS IN ORIGINAL SPILLWAY DESIGN

FIGURE 22