UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

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HYDRAULIC LABORATORY REPORT NO. 57

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HYDRAULIC MODEL STUDIES FOR DESIGN OF PERCHA ARROYO DIVERSION DROP

By

R. A. Goodpasture

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July 5, 1939

HYD 57

Denver, Colorado, July 5, 1939.

MEMORANDUM TO CHIEF DESIGNING ENGINEER
(R. A. Goodpasture)

Subject: Hydraulic model studies for design of Percha Arroyo Diversion Drop.

1. Introduction. The Percha Arroyo Diversion canal carries the flow of the Percha Arroyo into the reservoir of Caballo Dam. Because of the large variation in the reservoir level (elevation 4125 to 4182) recession occurred in the diversion channel and proceeded progressively upstream. This condition would eventually endanger the footings of the highway bridge located near the upper end of the channel. Accordingly, it was decided to build a drop in the canal and limit the retrogression to that portion of the channel downstream from the drop. Because of the uncertainty of the behavior of the proposed structure, it was decided to study the flow characteristics by means of a hydraulic model.

2. The model. The 1:50 model was constructed in a metal lined flume properly fitted with the canal entrance and a tailwater control gate. The model was molded from concrete using metal templates as guides (figure 1). The model discharge was measured through one of the laboratory venturi meters.

3. Model tests. The structure was designed for a normal flow of 18,000 second-feet with the expectation that it would carry 25,000 second-feet for a short period of time. However, at 25,000 second-feet, water overtopped the sides of the chute immediately downstream from the crest. This would remove the backfill from behind the side walls and endanger the structure. Lowering the ogee shape downstream from the crest eliminated this undesirable condition (figure 1).

The stilling pool operated satisfactorily at medium and high tailwater elevations. At maximum tailwater elevation, the flow always went through critical depth at the crest. Accordingly, the water level in the canal upstream will never be affected by the tailwater elevation. At low tailwater elevations, the channel sides and bed downstream were rapidly eroded indicating that the reservoir would eventually extend back to the toe of the bucket. The intensity of the horizontal rollers would be less on the prototype than indicated by the model since they were confined by the model flume walls. The most excessive scour occurred at the minimum tailwater elevation. Heavy rock dumped immediately downstream from the lip of the bucket was found to give sufficient protection against undercutting the structure. With this rock in place watersurface and

scour profiles were taken at discharges of 6,000, 12,000, 18,000 and 25,000 second-feet and minimum tailwater (figure 2). Flow pictures of the pool at minimum tailwater are shown on figures 3 and 4.

4. Conclusions. The chute with the revised crest will operate satisfactorily for all discharges and tailwater elevations. Since only enough excavation will be made to allow construction of the structure there will be a large obstruction in the channel downstream which will gradually be removed by scouring action. The rock can be dumped on the upstream slope of this obstruction and allowed to settle into place as the finer material is washed away.

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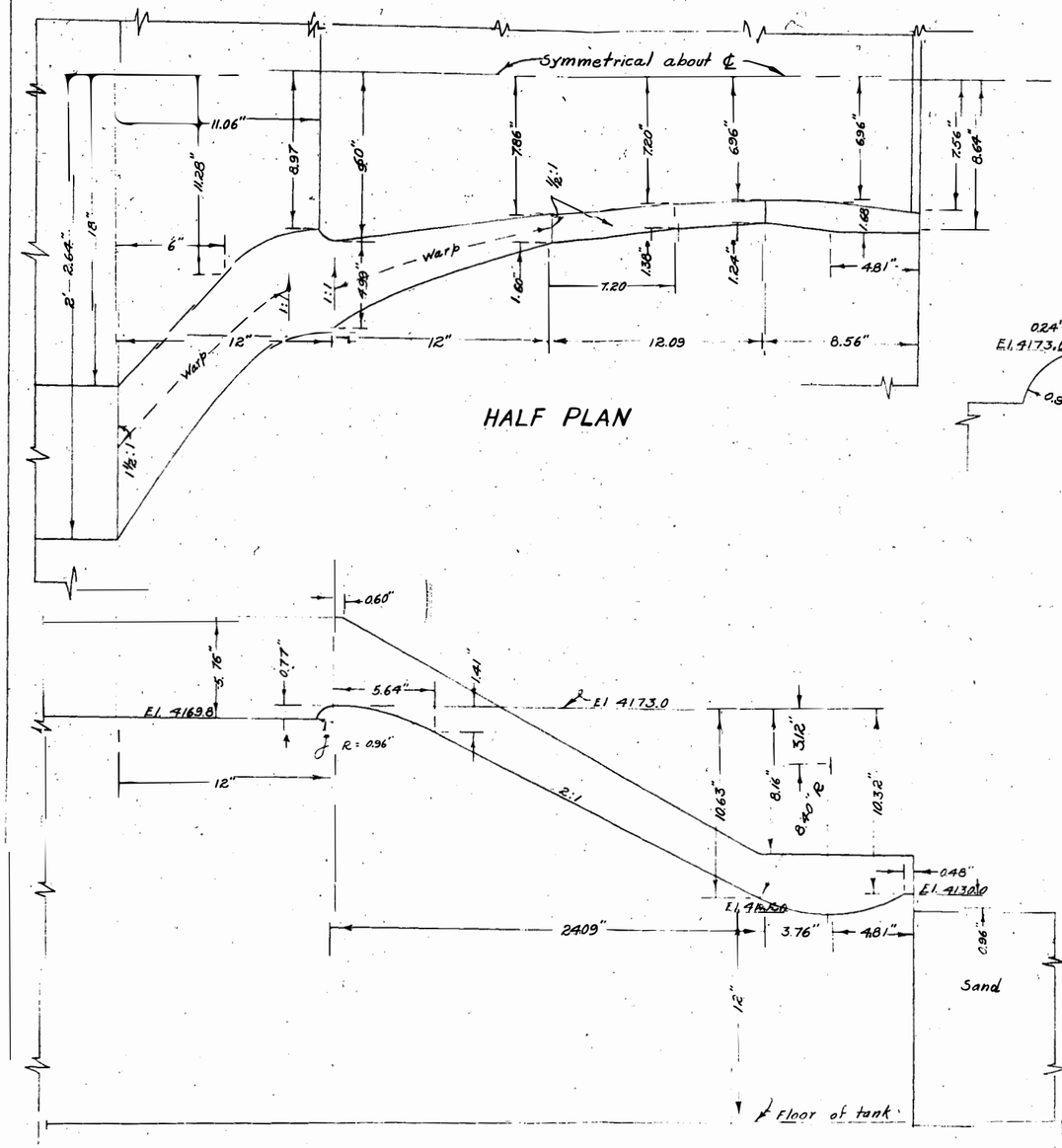
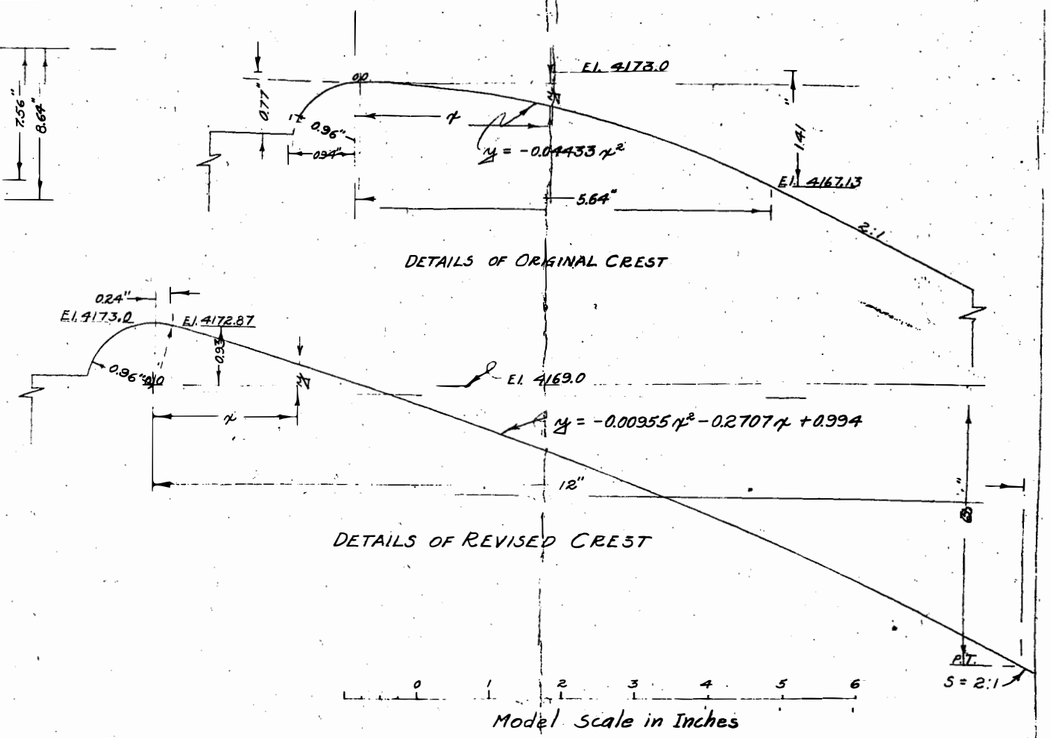
R. A. Goodpasture.





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CABALLO DAM
PERCHA ARROYO CHUTE DROP
HYDRAULIC MODEL STUDIES
MODEL SCALE 1:50
MODEL DETAILS

DRAWN R.A.G.	SUBMITTED
TRACED	RECOMMENDED
CHECKED	APPROVED

DENVER, COLO. 630-39

ELEVATION IN FEET PROTOTYPE

4120
4110
4100
4090
4080
4070

20+30 21+00 +10 +20 +30 +40 +50 +60 +70 +80 +90 23+00 +10 +20 +30 +40 +50 +60 +70 +80 +90 24+00 +10

STATIONS ALONG CANAL IN FEET PROTOTYPE

WATER SURFACE PROFILES ALONG CENTER-LINE

ELEVATION IN FEET PROTOTYPE

4130
4120
4110
4100
4090
4080

Sand surface before test

22+50 +60 +70 +80 +90 23+00 +10 +20 +30 +40 +50 +60 +70 +80 +90 24+00 +10 +20 +30 +40 +50 +60 +70 +80 +90 25+00 +10

STATIONS ALONG CANAL IN FEET PROTOTYPE

SCOUR PROFILES ALONG CENTER-LINE

EXPLANATION

- Discharge 6,000 Second-Feet
- Discharge 12,000 Second-Feet
- Discharge 18,000 Second-Feet
- Discharge 25,000 Second-Feet

NOTES

The initial bed included a 10 foot depth of dumped rock extending 33 feet downstream from the lip of the bucket.

Scour runs were made in the order of increasing discharges.

Each discharge ran for 1^h-30^m.

Accumulative scour is shown.

Tailwater elevation 4125 for all runs.

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RIO GRANDE PROJECT ~ NEW MEXICO - TEXAS

CABALLO DAM

HYDRAULIC MODEL STUDIES

PERCHA ARROYO DROP ~ MODEL SCALE 1:50
WATER SURFACE AND SCOUR PROFILES

DRAWN P.A.G.	SUBMITTED
TRACED	RECOMMENDED
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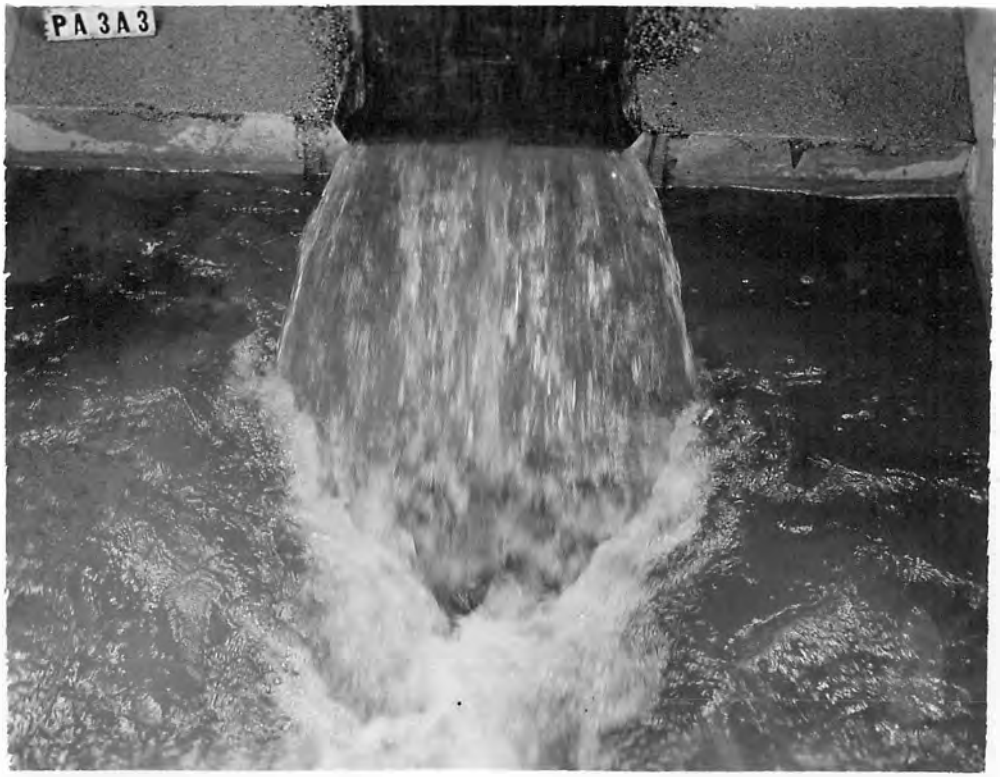
DENVER, COLORADO 6-29-38

PERCHA ARROYO DROP
1:50

Figure 3

Discharge 6,000 Second-Feet



Discharge 12,000 Second-Feet

TAILWATER ELEVATION 4125

PERCHA ARROYO DROP
1:50

Figure 4

Discharge 18,000 Second-Feet

Discharge 25,000 Second-Feet

TAILWATER ELEVATION 4125