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December 5, 1939

Hopi
Wepo Wash

File 9056-D WJT

78304

December 5, 1939

Mr. Seth Wilson
Superintendent
Hopi Indian Agency
Keams Canyon, Ariz.

Dear Mr. Wilson:

Reference is made to your letter of November 10, and subsequent correspondence, relative to the design of a diversion dam for the Wepo Wash Project.

We have reviewed the plans submitted by your office as prepared by the Soil Conservation Service, which utilized second-hand steel rails as the principal material of construction. The structure proposed by this office utilizes interlocking steel sheet piling.

Careful consideration of the rail-type plans, particularly in the light of our observation of the Oraibi Wash structure, leads to the definite conclusion that there is an inherent weakness in the apron, and consequently in the whole structure, which would be difficult to overcome at reasonable expense. The estimated cost, adjusted to the 130' crest length, based upon unit prices which you submitted, is already about the same as for the plan we are submitting for your consideration.

Studies also were made of a concrete, floating-type diversion dam for the same site. The estimated cost appears to eliminate this type in view of the small acreage that can be irrigated.

The results of these studies indicate that a diversion dam constructed of interlocking steel sheet piling would be the most economican structure and well suited for the site. The total estimated costs for the three types are as follows, all based on a crest length of 130':

Steel Sheet Piling Dam	$25,373
Steel Rail Dam	25,587
Concrete Dam	37,137

The detailed estimates are attached hereto for reference.

It is suggested that the dam be located approximately 625 feet upstream from the line shown on the topographical map submitted by you. This change will require the construction of a longer canal.

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but the increased cost of the canal is offset by the decreased cost of the embankments required at the upper site, due to the shorter length of embankment.

Your letter of the 10th of November gives the drainage area as 128.66 square miles above the proposed site. Your letter of the 21st states that the Soil Conservation Service engineers estimate that a probable maximum-flood flow of 60 c.f.s. per square mile may be expected from this area. From the above, the probable maximum-flood flow to be expected is 128.66 sq. mi. x 60 c.f.s. = 7719.6 c.f.s. The required length of spillway crest was determined to be 130 feet, using a flood flow of 8000 c.f.s., which, when corrected for submergence, indicates that the depth of flow over the weir crest would be approximately 8 feet. The total discharge for various depths of flow is shown in graphical form on sheet No. 1 of the plans.

The proposed dam consists of an upstream weir wall and a downstream protection wall, flanked on both ends by wing-walls. The canal intake structure, constructed of concrete, is located at the west end of the dam. Earthen embankments or dikes extend from the wing-walls to the adjoining high ground on the east and west sides of the valley. The space between the upstream weir-wall and the downstream protection wall is to be filled with heavy, loose rock, forming a stilling pool for the overflow. In order to maintain the low flows of the stream close to the diversion structure, the crest of the upstream weir-wall is sloped 0.5 feet from the east end to the west end. A sluiceway is provided adjacent to the intake to remove the "bed load" of the stream during operation. The flows into the canal and through the sluiceway are to be controlled by steel gates, manually operated. The details of construction, dimensions and elevations are shown on the accompanying plans.

In order to obtain a comparison of cost between the various types of proposed dams, all were reduced to a crest length approximating 130 feet. The details and methods of arriving at the unit prices are shown in the estimates, and were based on the manufacturers' quotations, commercial freight rates, and unit costs submitted in your letter of November 21, 1939. The unit prices appear to be about right, with the exception of that for the loose-rock fills given in your letter as $4.10 per cu. yd. We are of the opinion that this unit price is exceptionally high and that this material should be secured and placed at a maximum cost of not to exceed $3.00 per cu. yd. If I remember correctly, suitable rock is available near by. If your price can be reduced it will reflect a large saving in total costs.

It will be noted that estimates have been prepared to show the cost of materials and cost of labor for the construction of each type of structure. The estimated cost of materials for the sheet-piling dam is $10,235, and while it is realized that this amount exceeds the available funds it may be that the materials can be purchased for somewhat less than estimated, and it is thought that possibly a joint project might be made with the CCC-ID in which they would furnish the labor.

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For the purpose of preparing specifications for the purchase of steel-sheet piling the following description is submitted:

Item	Description	Quantity	Units
1	Interlocking steel-sheet piling having a section modulus per foot of wall of not less than 5.4 cubic inches, in lengths of 14 and 20 feet.	178,400	Lbs.
2	Interlocking steel-sheet piling having a modulus per foot of wall of not less than 8.9 cubic inches, in lengths of 40 feet.	25,700	Lbs.
3	Interlocking steel piling, rolled corners and T sections.	10,000	Lbs.

Specifications:

Type: Steel-sheet piling shall be of the continuous interlocking type of approved form, having a minimum thickness of web and flange metal of 3/8 inch. The section moduli shall not be less than those shown in the schedule. The interlocked joint shall develop a strength in direct tension of not less than 8000 pounds per inch of interlock, using specimens having a joint length of approximately 3 inches. The steel shall be made by the open-hearth process and shall meet the following chemical and physical properties:

Chemical Composition		Physical Properties	
Phosphorous	not over 0.06 per cent	Tensile strength, min.	- 70,000 lbs./in^2
Sulphur	" " 0.06 " "	Elongation in 8 inches min. percentage	- $\frac{1,400,000}{\text{Tensile Strength}}$

All piling shall conform to standard specification for structural steel buildings of the A.S.T.M.-designation A-9 and the Federal Master specifications, as are applicable (Q-Q-S-721a).

There are only a minimum of details shown on the plans. It is to be remembered that the overall dimension of the wall may change, dependent upon the piling used. The dimensions shown are those based upon the use of piling as manufactured by the United States Steel Corporation. Because of the above, it will be necessary to furnish additional details after the steel piling contract is awarded. Also a correct list of pieces, lengths and other necessary data for the ordering will be provided.

Prints of the five drawings are attached; additional prints may be had upon request.

Your topographic map is being returned under separate cover.

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It is suggested that a combined sluice and wasteway be provided in the canal at about station 8+90 to remove sand from the canal and to release excess water if a flood occurs while the canal headgate is open.

I regret that the estimated cost is higher than anticipated, but in view of the large flood flows to be expected I do not see how a cheaper structure can be devised. We feel that it is necessary to design the structure to fit conditions, rather than the available funds.

If we can be of further assistance, please call upon us.

Very truly yours,

Herbert V. Clotts,
Assistant Director

Encs.

CC Mr. Nathan
" Westerman
" Keesee

HVC:AO

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