TEXAS

ENGINEERING TECHNICAL NOTE

Subject *HYDROLOGY*

No. : *210-18-TX6*

Reference : *METHOD OF DETERMINING THE ELEVATION OF LOWEST UNGATED OUTLET AT SINGLE-PURPOSE FLOODWATER RETARDING STRUCTURES*

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SOIL CONSERVATION SERVICE
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METHOD OF DETERMINING THE ELEVATION OF LOWEST UNGATED OUTLET AT SINGLE-PURPOSE FLOODWATER RETARDING STRUCTURES

INTRODUCTION

Soil Conservation Service policy in Texas limits water storage capacity at single-purpose floodwater retarding dams to 200 acre-feet at the lowest ungated outlet. This 200 acre-foot limitation includes an accounting of the borrow excavations occupied by that area of storage. Dewatering to this prescribed level is accomplished by constructing ported openings or outlet facilities in the principal spillway riser, when needed.

Normally, the computed total sediment capacity required at a floodwater retarding dam, and stage associated therewith, does not include the capacity of the borrow. This is due to the uncertainty of the location and quantity of the borrow areas during planning. During final design, borrow locations are more defined. Yet, unforeseen conditions encountered during construction can necessitate relocation of designated borrow areas. Thus, consideration of the borrow pits in determining the 200 acre-foot capacity level should not alter the principal spillway crest elevation. However, the volume of the borrow that is located in the sediment pool will be included in the 200 acre-foot capacity and establishing the level or stage for the ungated outlet facility below the crest of the principal spillway.

This technical note provides instructions for determining if an ungated outlet facility is needed and for establishing the crest elevation of that outlet.

PRELIMINARY CHECK

Each floodwater retarding structure being planned will be examined to see if there is need for an outlet facility below the crest of the principal spillway. A simple check will eliminate the need for further study on many structures. Normally, the stage-storage relationship is computed from the reservoir topography, bounded by a vertical plane at the center-line axis of the dam. If the computed capacity at the principal spillway crest elevation plus 80 percent of the embankment volume is less than 200 acre-feet, no outlet facility below the principal spillway crest is needed. This check is based on a generalized study which shows that on an average about 20 percent of the embankment occupies a volume upstream of the centerline of the dam and below the principal spillway crest elevation and thereby devoids that amount of capacity from the computed storage at the principal spillway crest. This initial check presumes that all of the embankment may be built from borrow excavations within the sediment pool area.

DETAILED ANALYSIS

Some structures not eliminated from further consideration by the above process may not require an outlet facility below the crest of the riser. A more detailed analysis, considering the location of the borrow area, is required to estimate the volume of the borrow pits that potentially may be below the elevation of the principal spillway crest. The following steps should be utilized:

Compute volume of fill. This is the value shown on Table 3 of the watershed work plan. Generally, this figure includes backfilling foundation excavations such as the cutoff trench, channel cleanout, and other site preparation excavations.

2. Subtract the foundation and site preparation excavations that are a part of the embankment yardage figure. The remaining is the above-ground embankment volume normally built from borrow excavations and emergency spillway excavations.

3. Reduce this above-ground embankment volume by 20 percent

4 Subtract the emergency spillway excavation.

5. Subtract the volume of borrow anticipated to be taken from sources other than the sediment pool area. Frequently, borrow areas are located in the sediment pool. However, at some sites the sediment pool materials are not suitable for inclusion in the embankment or may not be available for other reasons. When this condition exists, that part of the borrow anticipated to not be taken from the sediment pool should be estimated.

6. The remaining borrow results in increased storage capacity. This expression in cubic yards should be divided by 1613 to convert to acre-feet of borrow that affects the capacity at the lowest ungated outlet.

7 The amount of this increased storage capacity, created by such anticipated borrow excavations, is subtracted from 200 acre-feet. If the resulting figure is less than the sediment pool capacity, an outlet facility in the riser will be required. The stage for such outlet is that associated with the resulting capacity figure

An illustration of the analysis follows:

Step 1	190,000 cubic yards	- Embankment from work plan Table 3
Step 2	-8,000 cubic yards	- Foundation and site preparation excavations.
	182,000 cubic yards	- Above-ground embankment, taken from borrow and other required excavations

Step 3	-36,400 cubic yards	- 20 percent of above-ground embankment, which occupies sediment pool capacity
	145,600 cubic yards	
Step 4	-90,000 cubic yards	- Emergency spillway excavation to be used in embankment.
	55,600 cubic yards	- Borrow that may come from the sediment pool. This would be further reduced if suitable embankment materials are not totally available in the sediment pool area.
Step 5	-20,000 cubic yards	- Subtract borrow anticipated to be taken from outside the sediment pool
	35,600 cubic yards	
Step 6	35,600 ÷ 1613 = 22 acre-feet borrow taken from sediment pool	
Step 7	200 - 22 = 178	If the sediment pool capacity exceeds 178 acre-feet, an outlet facility in the riser will be required at this capacity.