RUNOFF FROM POTHOLE TOPOGRAPHY

The pothole topography in north central Iowa must be treated as a special case when determining the peak rate of flow and volume of runoff. The procedure described on these pages is for use in designing dams for which an IDNR permit is required. This type of topography is flat to gently undulating with depressional areas that may store the entire storm runoff. Sufficient survey must be made to evaluate the volume of pothole storage available. Design frequency will be based upon total drainage area. There are three situations that may occur. All three conditions may be present in the area contributing runoff to a dam or other point.

1. Potholes Store Entire Runoff Volume

   If the potholes have sufficient capacity to store the entire runoff volume of the design storm, that portion of the watershed may be excluded from the drainage area for estimating peak flow and temporary storage volume. If the potholes are subsurface drained, runoff from the pothole area shall be treated as base flow using a ½-inch drainage coefficient or the actual drainage coefficient, whichever is greater.

2. Potholes Store Partial Runoff Volume

   The runoff from the total drainage area may be reduced to allow for pothole storage. If the potholes have capacity to store a portion of the runoff volume of the design storm, measure the drainage area contributing to and controlled by potholes, estimate the available storage in the potholes, and convert to inches from the contributing watershed. The reduced or adjusted runoff is computed by use of the formula:

   $$Q_A = Q - \left(\frac{\text{Pothole Drainage Area}}{\text{Total Drainage Area}}\right)(\text{Inches Pothole Storage})$$

   The peak discharge rate for the total drainage area may be reduced by the same percentage as the reduction in runoff volume using the formula:
   $q_{pA} = q_p(Q_A/Q)$.

   Where:

   Q_A = Adjusted runoff depth (inches)
   Q = Runoff depth (inches) for total drainage area
   q_{pA} = Adjusted peak discharge rate (cfs)
   q_p = Peak discharge rate (cfs) for total D.A.

   A base flow equivalent to a ½-inch drainage coefficient (or actual drainage coefficient, if larger) from the pothole area shall also be used. For large full-flow structures, contact the state hydrologist for more sophisticated procedures.

3. Extremely Flat Topography

Some watersheds have areas with steeper topography which contribute runoff which concentrates and then runs through an extremely flat area either into floodwater retarding pools or into a steeper channel or waterway and then into floodwater retarding pools. These areas have positive drainage without potholes. Develop a hydrograph for the runoff from the steeper areas and then route it downstream using GO, REACH in Sites. Add it to hydrographs for other areas and route through the proposed site. A sample Sites job is shown below. This sample job develops the runoff hydrograph from two areas, adds baseflow, routes through a steeper area, develops a runoff hydrograph from the areas draining directly into the structure site, adds an additional base flow, adds the two hydrographs, and routes them through structure “Pond.”

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SITES     05/01/2000000        Pond
SAVMOV    0    101
SAVMOV    101  1
*         Subwatershed 1 reduced for ponded soils 1:1
*         1903 total acres; 159.5 ponded soils
*         Quite a bit of area may be blocked by old railroad bed not
*         accounted for in this analysis.
WSDATA    5S 3 1 AC 78        1743.5    5.16
BASEFLOW            4
PDIRECT             5.3       6.6
GO,DESIGN
SAVMOV    2    101  3                   3
SAVMOV    0    101
SAVMOV    101  1
*         Area 2 subwatershed reduced for ponded acres 1:1
*         925.2 total acres; 488.7 ponded soils
WSDATA    5S 2 1 AC 78        436.5     3.68
BASEFLOW            4
PDIRECT             5.3       6.6
GO,DESIGN
SAVMOV    2    101  5                   2
ADDMOV
SAVMOV    101  2
*         Channel from centerline to jct w/ Rhoades lateral
GO,REACH  1    A1             8000      0.4       1.4
SAVMOV    2    101  2                   1
SAVMOV    101  1
*         Subwatershed 1 area reduced for ponded soils
*         1427.3 total acres; 129.8 acres ponded soils
STRUCTURE 000       Pond Site
                    80        0
                    82        0.04
                    84        0.13
                    86        0.35
                    88        1.01
                    90        1.99
                    92        3.26
                    94        5.09
                    96        7.49
                    98        9.84
                    100       12.47
                    102       15.35
                    104       19.7
                    106       24.28
ENDTABLE
WSDATA    5S 1   AC 78        1287.5    3.38
BASEFLOW            4
PDIRECT             5.3       6.6
POOLDATA  ELEV                98        98
PSINLET             1         19
PSDATA    1         120       48                  .025      85
GRAPHICS  I
GO,DESIGN QLN
SAVMOV    2    101  1                   000
ENDJOB
ENDRUN
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