10.14 Land-Locked Retention

10.14.1   Introduction

Watershed areas that drain to a central depression with no positive outlet can be evaluated using a mass flow routing procedure to estimate flood elevations. Although this procedure is fairly straightforward, the evaluation of basin outflow is a complex hydrogeologic phenomenon that requires good field measurements and a thorough understanding of local conditions. Since outflow rates for flooded conditions are difficult to calculate, field measurements are desirable.

10.14.2   Mass Routing

The steps presented below for the mass routing procedure are illustrated by the example given in Figure 10-33.

Step 1 Obtain cumulative rainfall data for the 100-year frequency, 10-day duration design event from Figure 10-34.

Step 2 Calculate the cumulative inflow to the land-locked retention basin using the rainfall data from Step 1 and runoff procedure from the Hydrology Chapter. Plot the mass inflow to the retention basin.

Step 3 Develop the basin outflow from field measurements of hydraulic conductivity, taking into consideration worst-case water table conditions. Hydraulic conductivity should be established using insitu test methods, then results compared to observed performance characteristics of the site. Plot the mass outflow as a straight line with a slope corresponding to worst-case outflow in centimeters (inches) per hour.

Step 4 Draw a line tangent to the mass inflow curve from Step 2, which has a slope parallel to the mass outflow line from Step 3.

Step 5 Locate the point of tangency between the mass inflow curve of step 2 and the tangent line drawn for Step 4. The distance from this point of tangency and the mass outflow line represents the maximum storage required for the design runoff.

Step 6 Determine the flood elevation associated with the maximum storage volume determined in Step 5. Use this flood elevation to evaluate flood protection requirements of the project. The zero volume elevation shall be established as the normal wet season water surface or water table elevation or the pit bottom, whichever is highest.

Step 7 If runoff from the project area discharges into a drainage system tributary to the land-locked depression, detention storage facilities are required to comply with the pre-development discharge requirements for the project.

Unless the storage facility is designed as a retention facility, including water budget calculations, environmental needs and provisions for preventing anaerobic conditions, relief structures shall be provided to prevent standing water conditions.
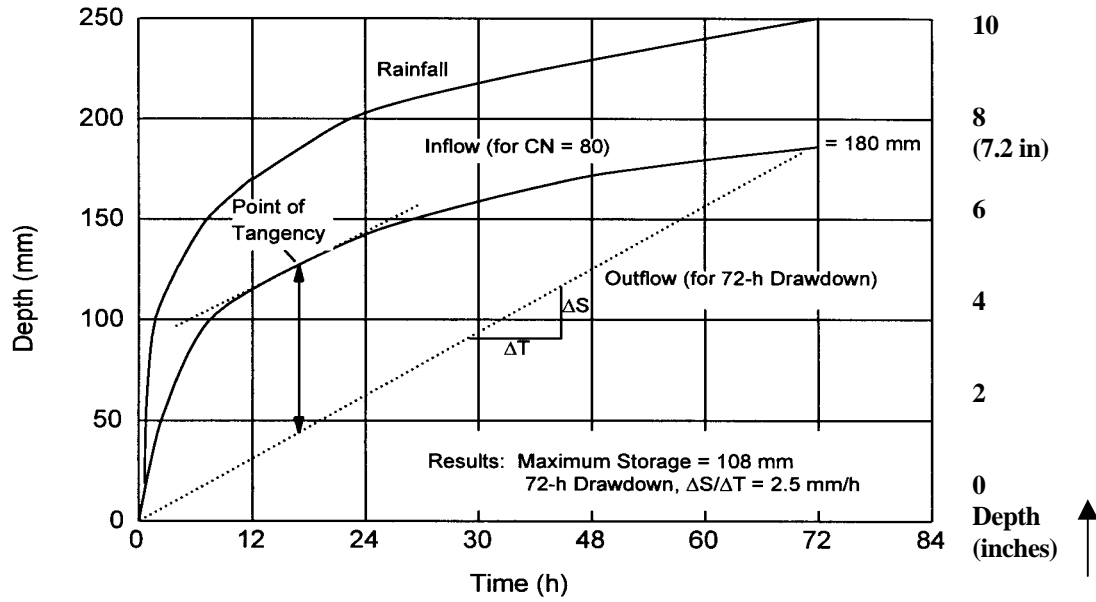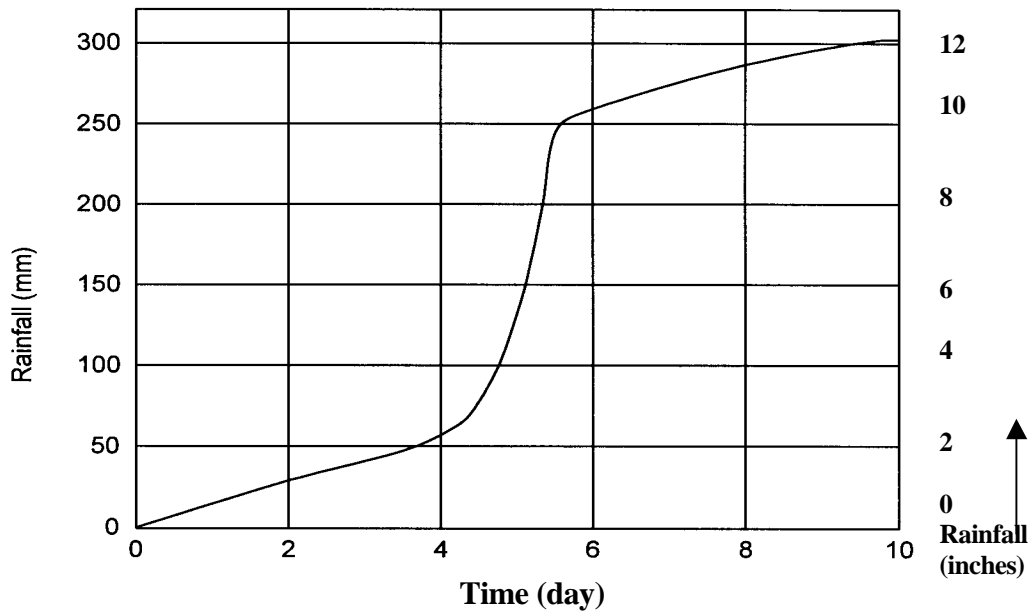
Figure 10-33 Mass Routing Curve

Figure 10-34 Cumulative Rainfall Data For 100-Year 10-day Design Storm