

**NEW JERSEY DEPARTMENT OF AGRICULTURE  
STATE SOIL CONSERVATION COMMITTEE  
Chapter 251, PL 1975 as amended,  
Engineering Policies- Technical Bulletin**

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| <b><u>Technical Bulletin:</u></b><br>2018-4 replaces 2004-2 (Delmarva) | <b><u>Effective Date:</u></b><br>September 2018                                 |
| <b><u>Subject:</u></b><br>Usage of the Delmarva Unit Hydrograph        | <b><u>From:</u></b><br>John E. Showler, P.E.,<br>State Erosion Control Engineer |

**1.01 PURPOSE**

To provide current guidance on the proper use of the USDA-NRCS Delmarva unit hydrograph for runoff modeling using the USDA TR-55/TR-20 modeling methods.

**1.02 SUMMARY**

In 2004, the New Jersey Department of Agriculture (NJDA) issued Technical Bulletin 2004-2 which allowed the use of the Delmarva Unit Hydrograph (DUH) for the first time to model runoff for land disturbance activities governed by the New Jersey Soil Erosion and Sediment Control Act, N.J.S.A. 4:24-39 et seq. The scope of usage was restricted at that time to conditions without urbanized areas due to limited experience using this unit hydrograph to model runoff for erosion control practices required by the New Jersey Soil Erosion and Sediment Control Standards.

Since that time, NJDA has gained much experience in the usage of the DUH and has conducted two separate watershed studies (the Wreck Pond Brook in lower Monmouth County, and the Upper Maurice River in Gloucester County) which included the development of specific, regional unit hydrographs reflective of the conditions of each watershed. One of the purposes of these studies was to evaluate the use of the DUH in varying degrees of urbanization in the coastal regions of New Jersey. Peak rate factors of 230 (Wreck Pond) and 214 (Upper Maurice River) were determined from those studies which compare favorably with that of the Delmarva with a factor of 285.

These results indicate that the degree of urbanization has limited influence on the overall distribution of flow, and hence the peak rate factor. NRCS sensitivity studies show no one characteristic of a watershed by itself has a strong correlation to the unit hydrograph shape (peak rate factor). NJDA study results appear to be consistent with NRCS data.

Based on these studies, continued guidance from NRCS and the ongoing experience by NJDA in the use of the DUH, the following guidance should be followed when modeling runoff in the coastal plain areas of New Jersey:

1. The DUH may be used in those portions of New Jersey generally contained within the regions identified by NRCS (see attachment):
  - a. Watershed slope (not simply the general slope of the project site) should be 5% or less.
  - b. Geology should be representative of New Jersey coastal plain physiography.
  - c. Streams which exhibit a relatively flat longitudinal channel slope.
  - d. Land use characterized as rural, agricultural or urban can be modeled effectively.
2. The DUH should be used for both pre and post development runoff modeling. Current NRCS research and guidance does not support changing unit hydrographs between pre and post-development runoff estimation.
3. Projects which lie on or near the boundary between the Standard and Delmarva regions identified by NRCS should be modeled with both the Standard (484) and Delmarva (285) unit hydrographs and results compared with actual field conditions to determine which unit hydrograph offers a best fit.

## Dimensionless Unit Hydrograph

The dimensionless unit hydrograph is one of several watershed related parameters incorporated into NRCS hydrologic modeling procedures. The unit hydrograph influences the shape of the runoff hydrograph generated by the model, particularly the peak rate of discharge. It does not affect the volume of runoff, which is determined by curve number. Unit hydrographs vary by watershed based on many factors including watershed size, slope and length; geomorphic and geologic characteristics; amount of storage; and degree of urbanization. A standard unit hydrograph has typically been used that represents an average condition for much of the country. It has been felt to be sufficiently accurate for the hydrologic design of conservation practices.

Detailed studies, however, have been conducted in some watersheds or regions to develop more representative dimensionless unit hydrographs. With the enhancement of NRCS modeling tools, it is now easier to incorporate these unique unit hydrographs into more routine hydrologic analyses.

The following dimensionless unit hydrographs are applicable to New Jersey:

**Delmarva Unit Hydrograph:** Applies to watersheds in the Coastal Plain physiographic region that are characterized by flat topography (average watershed slope less than 5 percent), low relief, and significant surface storage in swales and depressions.

**Standard Unit Hydrograph:** Applies to watersheds in all other physiographic regions and to watersheds in the Coastal Plain that are not characterized by the Delmarva Unit Hydrograph.

When supported by detailed watershed studies, other unit hydrographs may be used. Study procedures are discussed in Chapter 16 of National Engineering Handbook Part 630, Hydrology.

