

Overview and General Guidance of the Probable Maximum Precipitation Study and GIS Tool for New Jersey

A PMP Tool (Tool) which determines the Probable Maximum Precipitation (PMP) for drainage areas to dams in New Jersey has been developed for the NJDEP - Bureau of Dam Safety (Bureau). ArcGIS and ArcGIS Pro versions of the Tool were developed by Applied Weather Associates (AWA) in conjunction with the New Jersey PMP Study (Study). The Tool provides a series of updated estimates of the PMP depths, as well as associated temporal rainfall distributions for each storm type and time duration (PMP events). The Bureau has published both the Tool and Study to be used by a dam owner's engineer (Engineer). Instructions and application of the Tool have also been developed and can be found on the Bureau's website. The Army Corps of Engineers' HEC-HMS computer software is well-suited for hydrologic and hydraulic (H&H) modeling utilizing the data outputs from the Tool.

The precipitation data provided by the Tool is to be applied by the Engineer in H&H modeling of storm runoff to the dam. Due to variations in watershed sizes and locations, the Bureau has determined that multiple runs of the H&H model are necessary to apply and compare a selection of PMP events. The resulting water surface elevations (WSEL's) in the reservoir provide a basis for determining the ability of a dam to safely pass the required spillway design storm (SDS) as per the New Jersey Dam Safety Standards (N.J.A.C. 7:20 – 1.9(a)). The PMP event that results in the highest WSEL in the reservoir is selected as the critical PMP storm and the associated inflow hydrograph becomes the SDS. Please note the following project-specific items related to the Tool:

- The Tool can only be used to determine Full PMP events. Modeling percentages of the Full PMP for any purpose (i.e. Class II (Significant Hazard) Dam studies, Incremental Dam Failure/Design Storm Reduction studies, etc.) will first require running the Tool, followed by reducing the resulting rainfall hyetographs by the desired percentage, and lastly determining the SDS based on the resulting peak WSEL in the reservoir from the H&H model.
- During a dam rehabilitation design, if the dam hydraulics are to be modified with the proposed design, then the above process will need to be repeated to either verify the previous SDS or determine a new appropriate SDS.

Unlike HMR 51 and HMR 52, the current PMP methodology recognizes that major storm events cannot be categorized into a single storm classification but rather into three categories of events: Local, General, and Tropical. Local Storms are characterized by short duration (6-hours or less) and high intensity rainfall accumulations over a small area. General Storms produce precipitation over longer durations (greater than 6-hours) and cover larger areas with comparatively lower intensity rainfall accumulations. Tropical Storms rely on warm water from the Gulf of Mexico and the Gulf Stream in the Atlantic just off the East Coast typically associated with tropical or hurricane events. Therefore, the Tool includes output for each of these events for specific durations and the associated temporal distributions.

All temporal patterns evaluated in this Study are available from the Tool for use as needed; however, only the events shown in the following table are required to be evaluated. Please see Appendix K of the Study for information regarding the Bureau's selection of these events. Also note the Bureau may ask that other temporal patterns or events be evaluated in individual circumstances based on the site-specific characteristics of a given location.

Local Storm*	General Storm	Tropical Storm
2-Hour Local Storm Synthetic 6-Hour Local Storm 10th-Percentile 12-Hour Local Storm 10th-Percentile 24-Hour Local Storm 10th-Percentile 6-Hour Local Controlling Storm 12-Hour Local Controlling Storm	24-Hour General Storm 10th-Percentile 12-Hour General Controlling Storm	24-Hour Tropical Storm 10th-Percentile 12-Hour Tropical Controlling Storm

*Local storm application in hydrologic modeling is limited to drainage areas less than 100 square miles.

A Pass/Fail Test is also included in the Tool output to eliminate rainfall distributions that exceed theoretical maximum precipitation values for a given time interval. The Tool generates one consolidated Excel file for each storm type (Local, General and Tropical). Each Excel file includes a “Pass/Fail” table. If an exceedance occurs, that cell in the check table will have “Fail” as the assigned value; otherwise, a “Pass” will be assigned. If a given temporal pattern has at least one “Fail” value in the table, it is deemed invalid and is not recommended to be applied to the hydrological model.

The Tool does automatically allow exceedance of any interim PMP depth by up to 5% when applying the “Pass/Fail” testing in order to ensure sufficient patterns are available for each storm type for all locations. Please refer to Chapter 12 of the Study for additional details.

The following information must be submitted in addition to a detailed report of the H&H analysis:

- Excel PMP Worksheet (hardcopy and electronic formats)
- Electronic copy of the Tool Output Zip File which includes all required storm events.
- Electronic copies of the H&H modeling files for all storm events passing the “Pass/Fail” test.
- Hard copy of the SDS H&H modeling files.