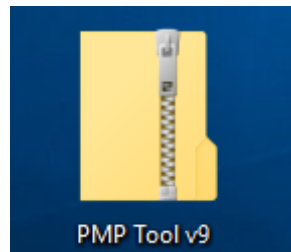


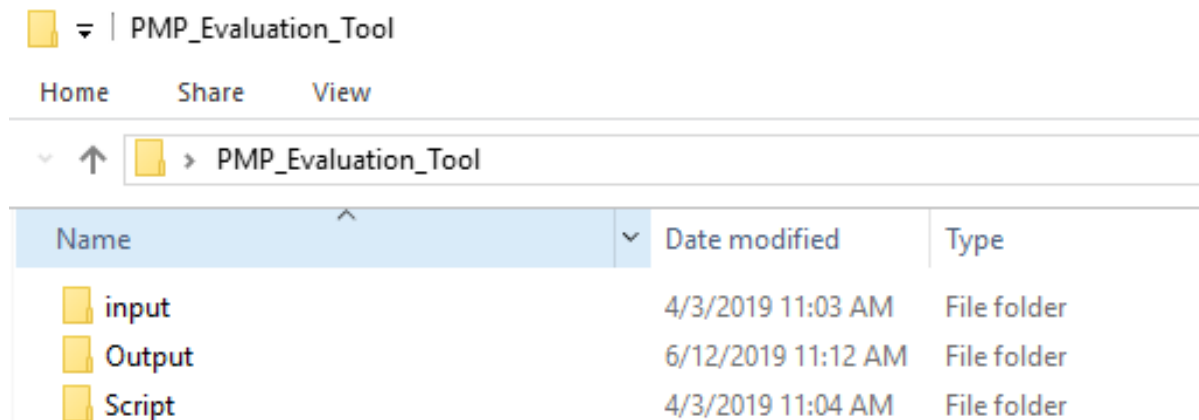
# PADEP DAM SAFETY'S PROBABLE MAXIMUM PRECIPITATION TOOL

## **INSTRUCTIONS AND APPLICATION IN ARCGIS**

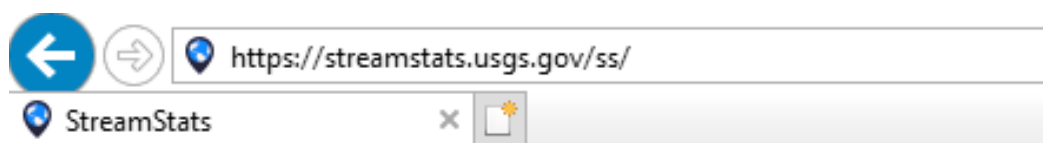
**1. Download the PMP Tool from the DEP Website to your computer:**



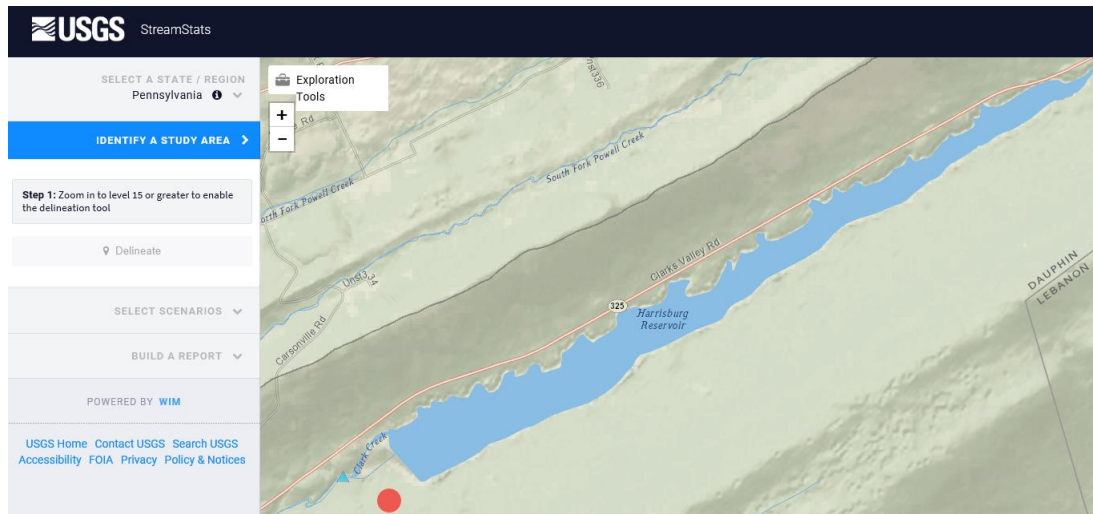
**2. Right click on the zip file and choose the “extract all” option. Open the resulting file called the “PMP Evaluation Tool”. View the contents of the file as shown below:**



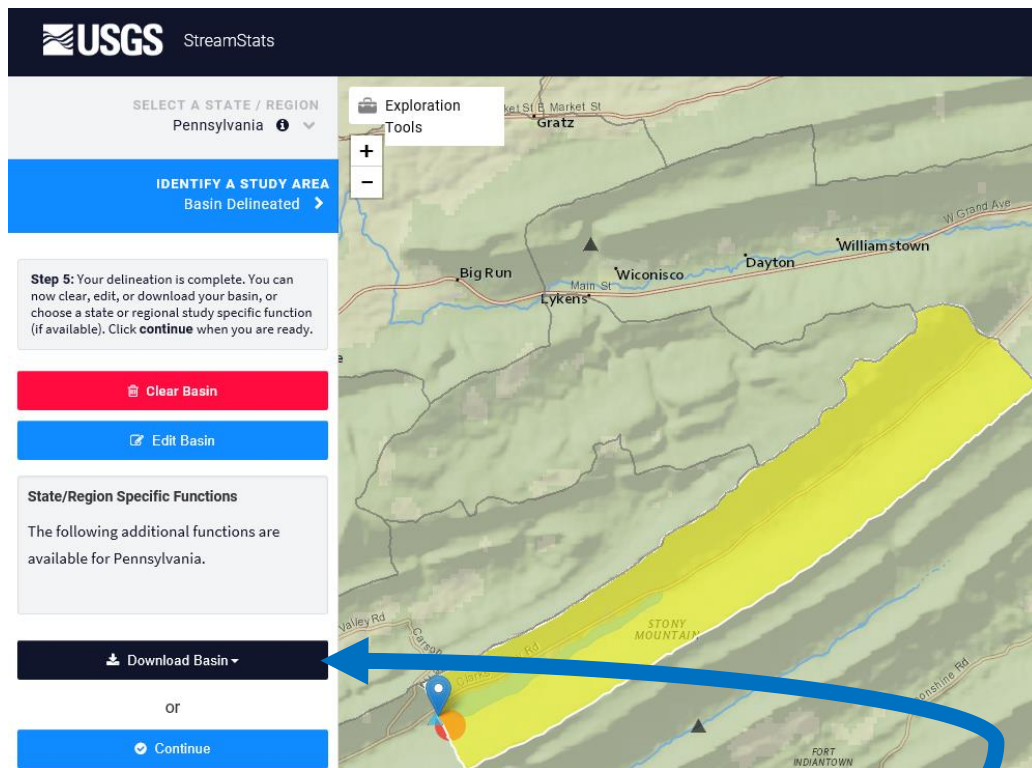
**3. Obtain the shapefile for the watershed of the dam. One option is to use the USGS StreamStats website:**



- For example, below the USGS StreamStats website is centered on Dehart Dam in Dauphin County, PA:

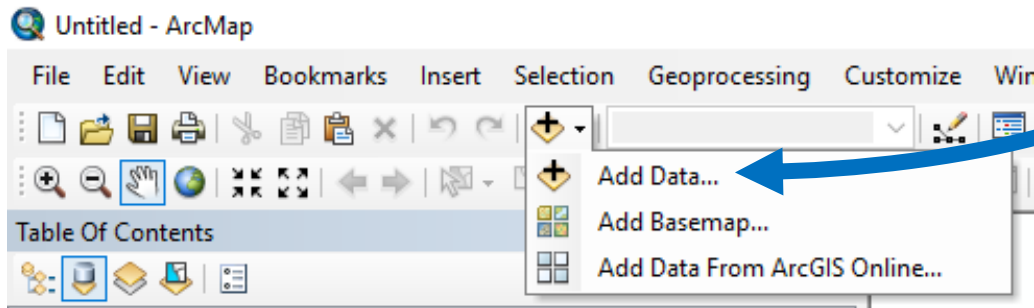


- USGS StreamStats can then be used to delineate the watershed for Dehart Dam:

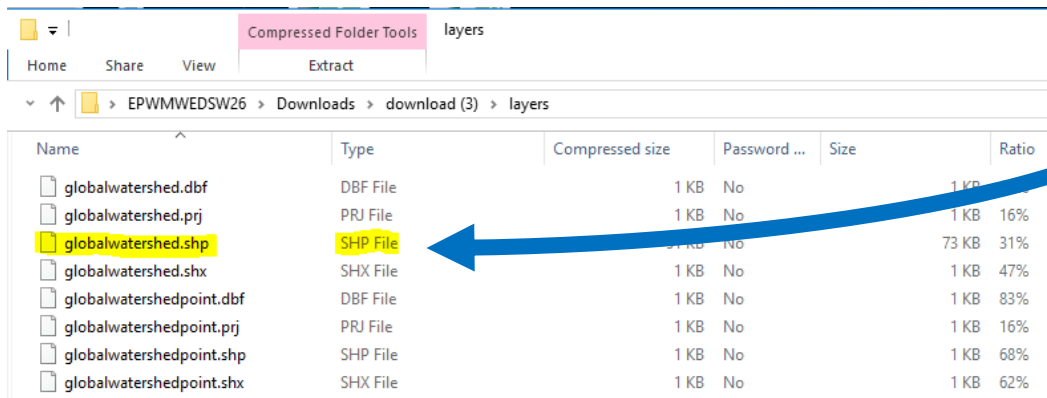


- Then the Basin can be downloaded as a shape file:

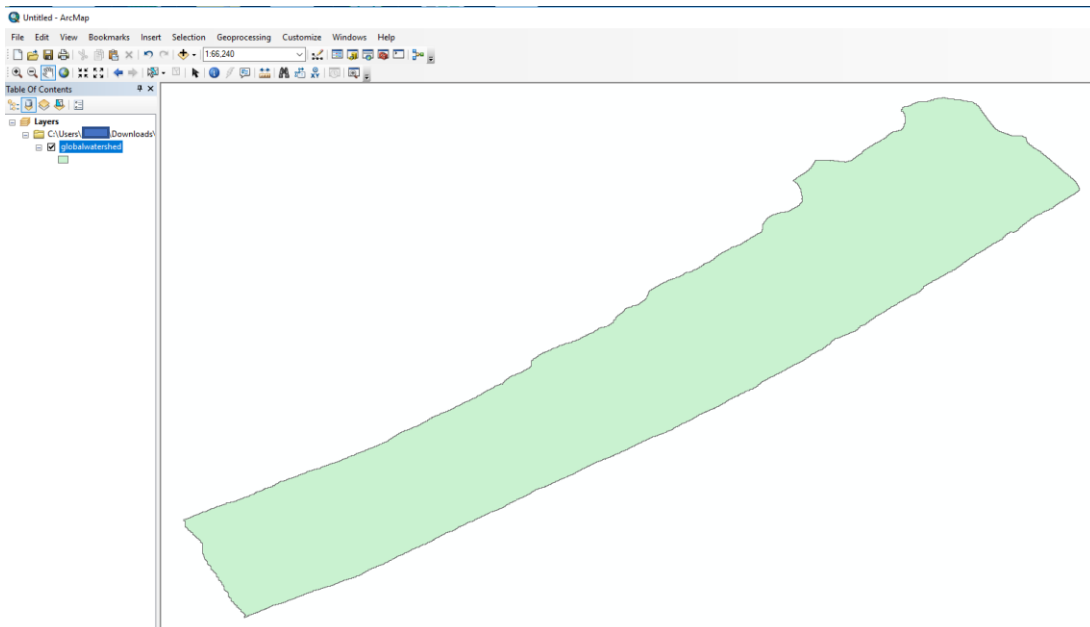
4. After the shape file is downloaded, open the ArcGIS ArcMap program and use the Add Data icon to load the shapefile onto the map:



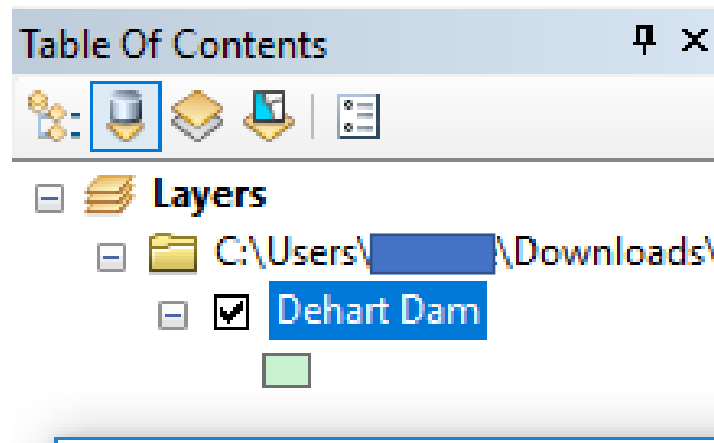
• Select the shape file (.shp) from the downloaded layers:



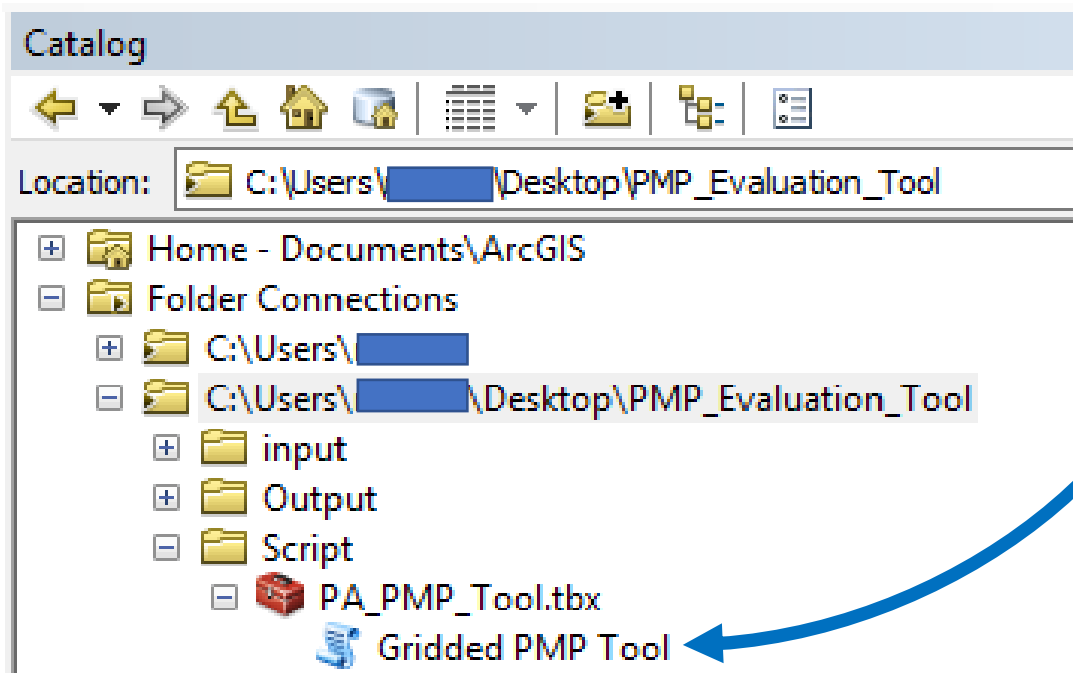
• The shape file will appear on the ArcGIS map as shown below:



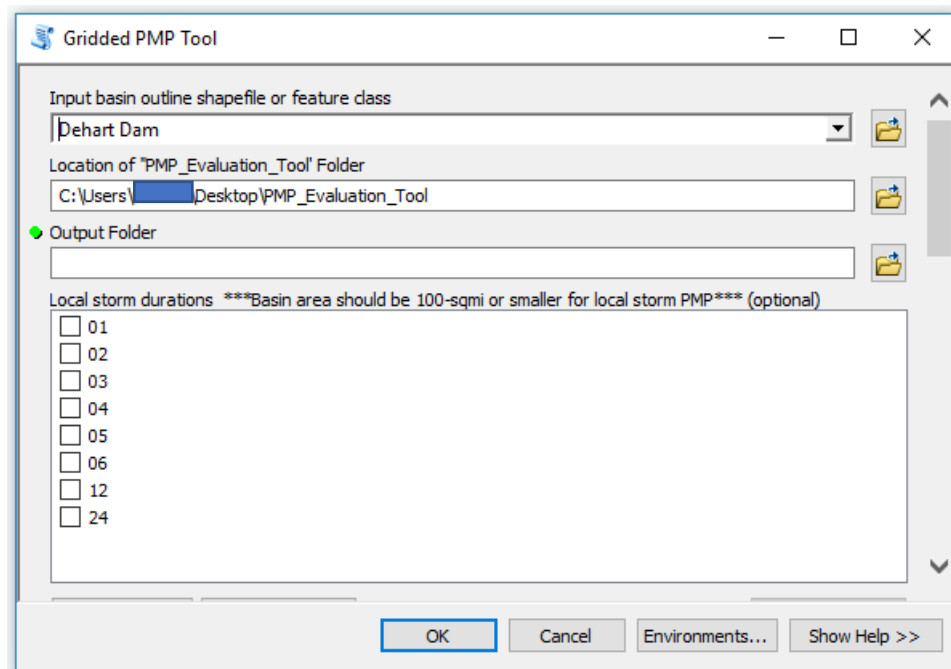
- *The downloaded shape can be renamed. In this example, it is renamed from “global watershed” to “Dehart Dam”:*



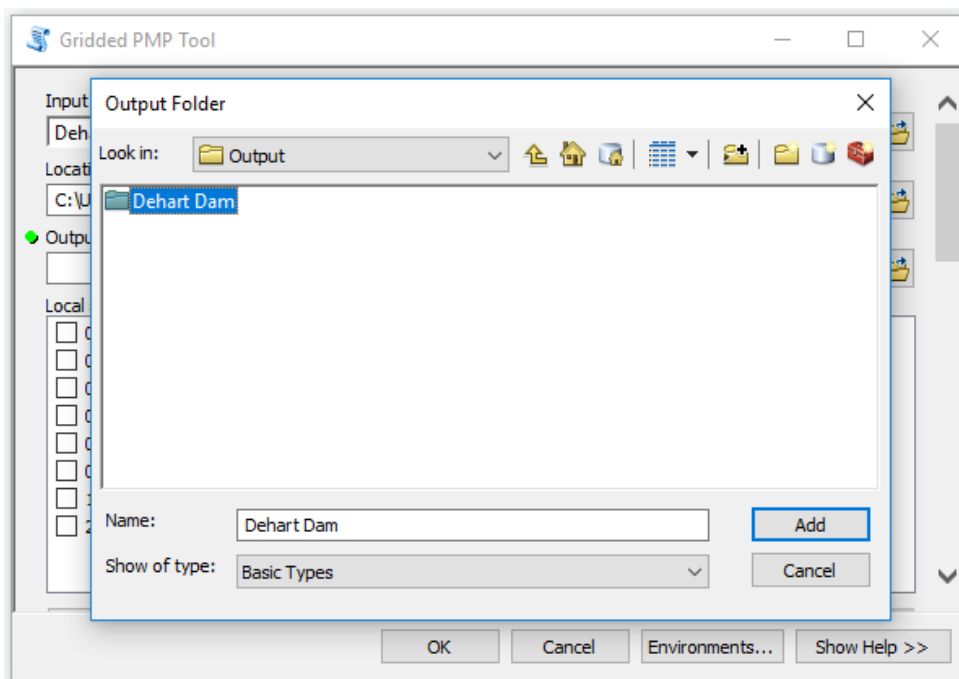
5. *Use the “catalog” icon in ArcGIS to locate the “Gridded PMP Tool”:*



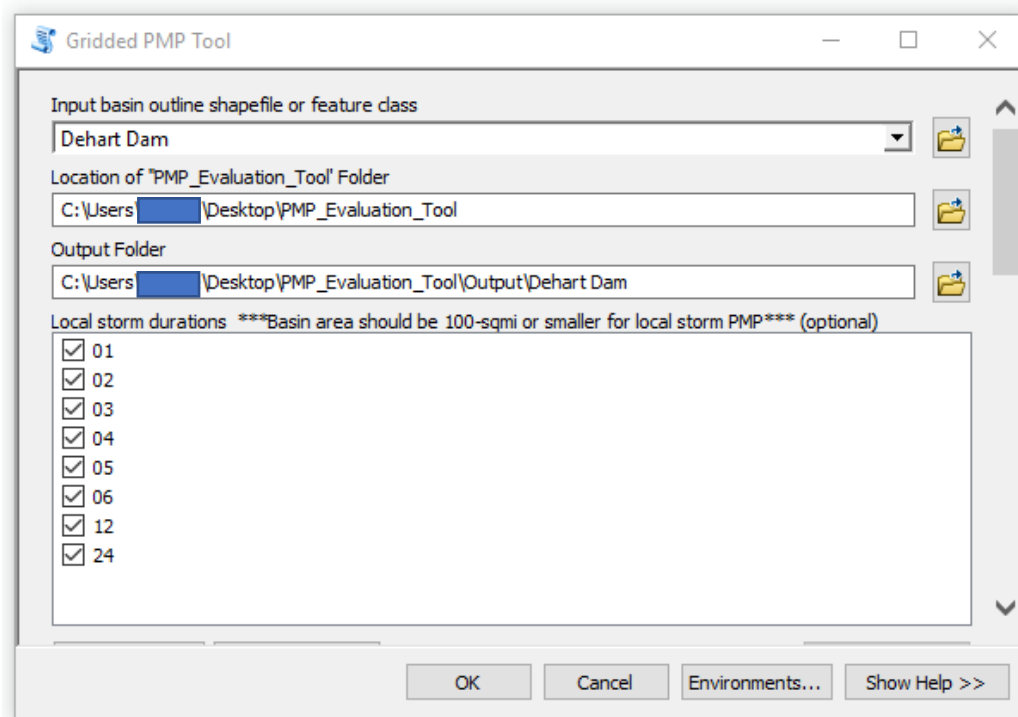
- **Click on “Gridded PMP Tool” to start the tool. Then from the dropdown list, Dehart Dam is selected for the “Input basin outline shapefile”:**



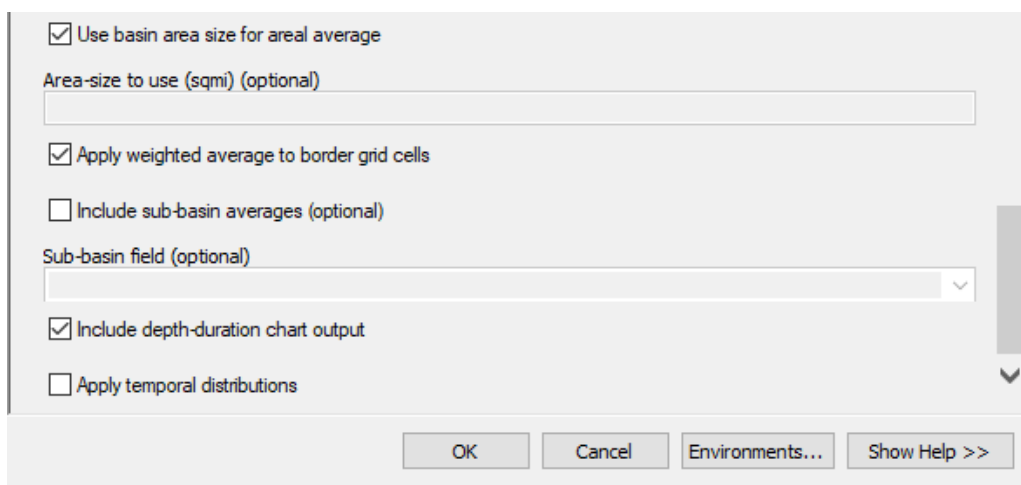
- **Using the dropdown menu, a new output folder is created and called “Dehart Dam”:**



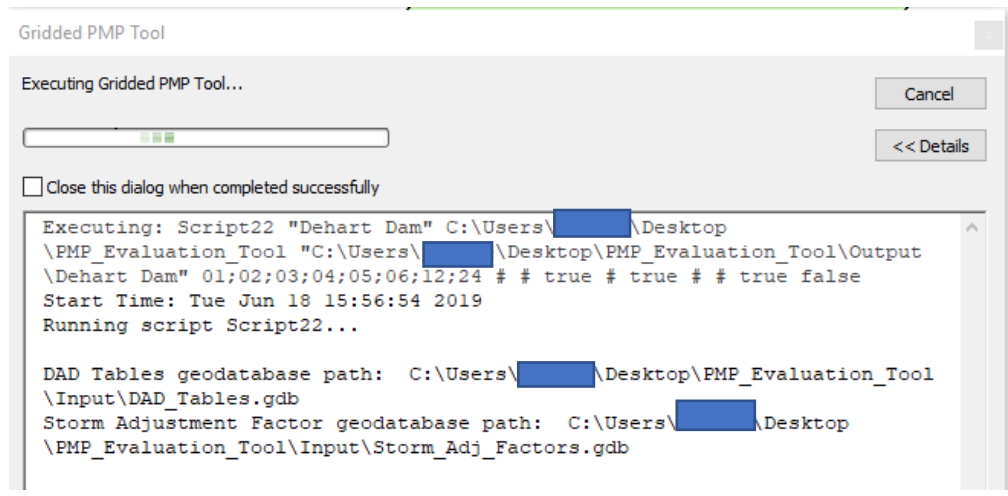
- **All Local storm durations, from 1 hour to 24 hours, are checked off for computation.** (When scrolling down, note that the computations for general storms, tropical storms and temporal distributions are not normally needed for Pennsylvania Dam Safety.)



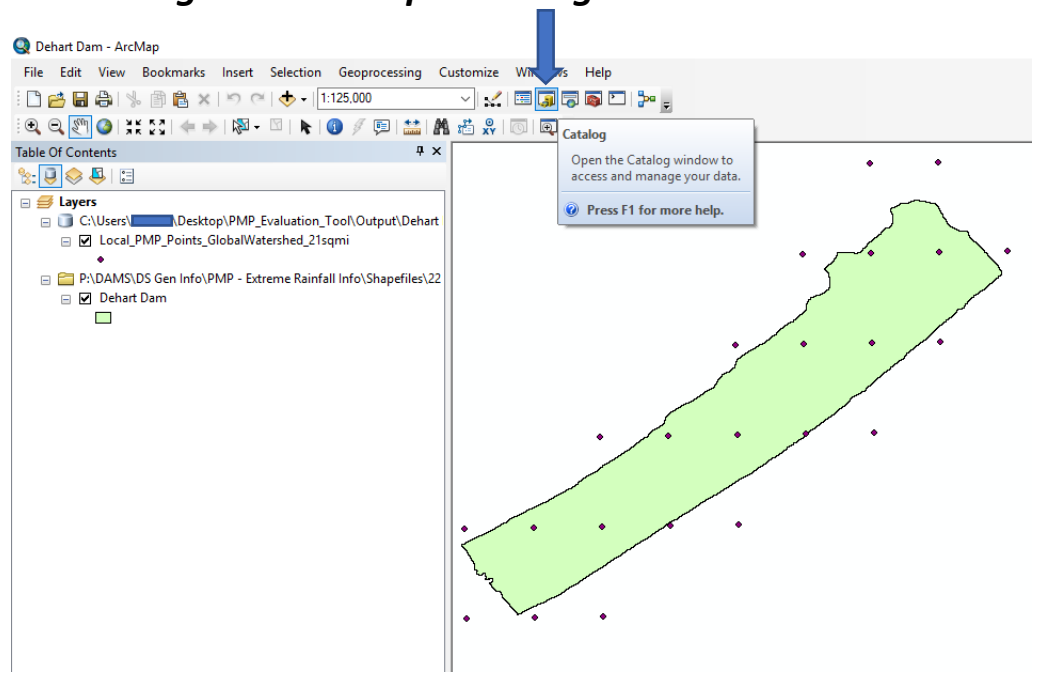
- **Scroll down and complete the PMP tool input with the boxes checked as shown below.** (Note that PADEP Dam Safety requires the determination of alternate temporal distributions as provided in a temporal distribution spread sheet):



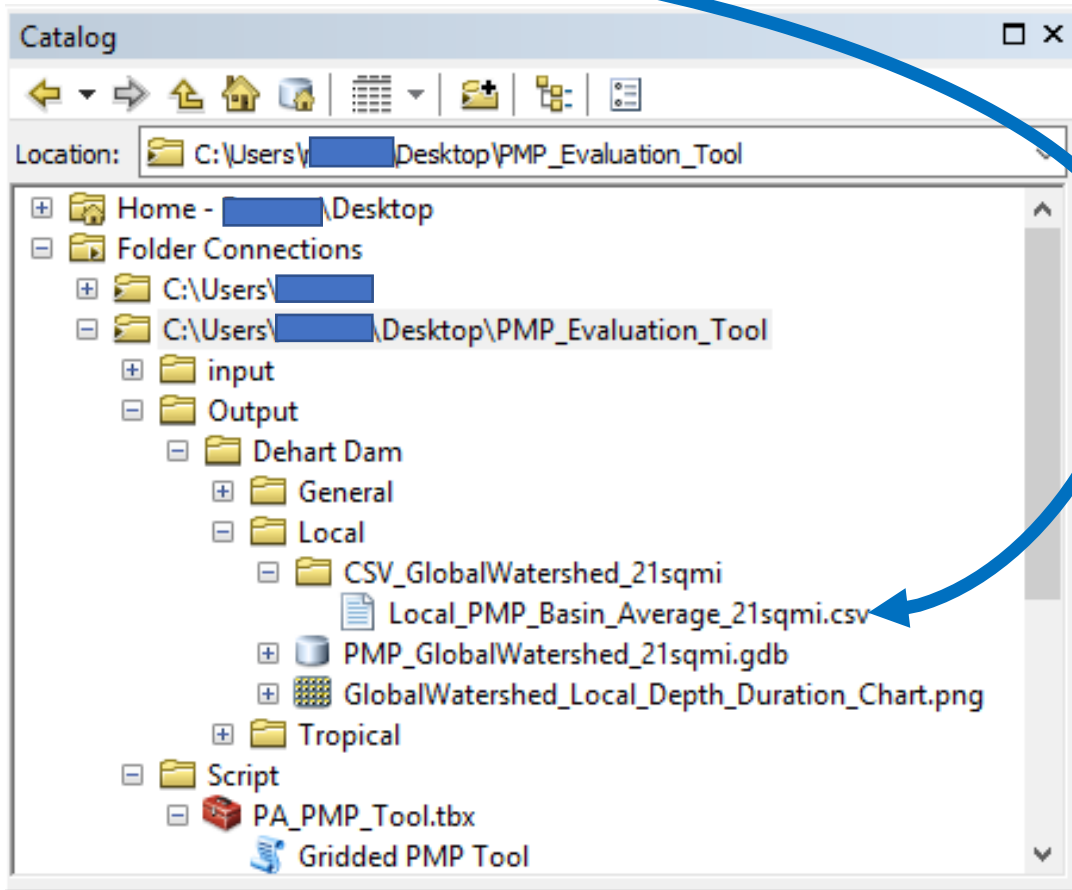
6. **Click on OK and the PMP tool will compute the PMP depths and durations applicable specifically to the watershed of the dam.** (This is based on the transposition of historical storms to the watershed of a dam; historic storms are transposed only to regions of the state where the same storm could have occurred. The tool will then calculate the maximum precipitation depths for the storm durations that were checked.)



- **After the PMP tool completes the computations, the results can be obtained using the Arc-Map "Catalog" icon:**



7. Using the ArcMap Catalog, find and open the “Local PMP Basin Average” file under the Output folder. The location of this file is shown below:



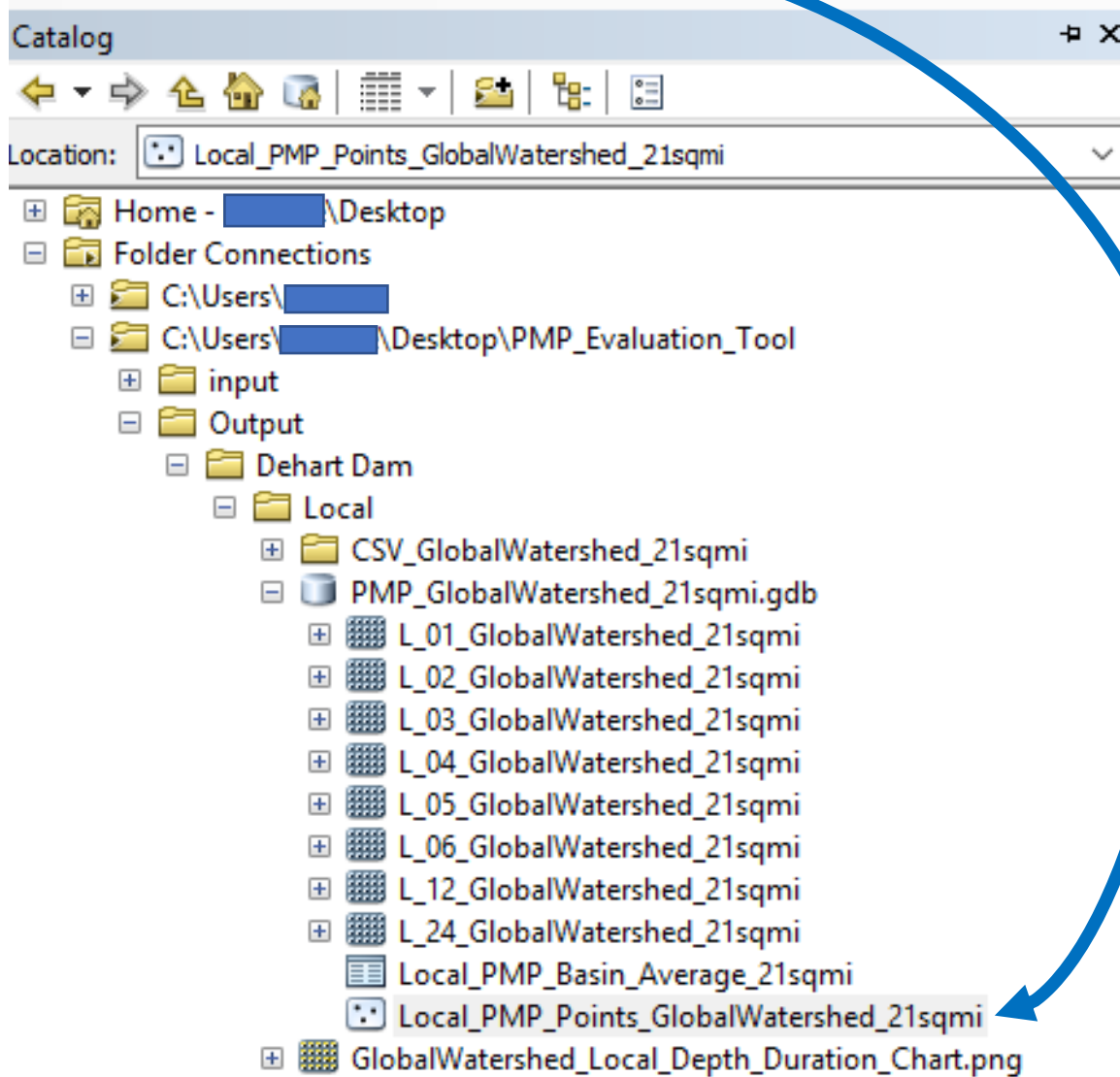
8.

- The “Local PMP Basin Average” file provides an average of PMP rainfall depths and durations for all the points in the watershed that are analyzed by the PMP tool. (This data is used in the PADEP Dam Safety’s PMP Distribution Spreadsheet.) The contents of the opened file are shown below:

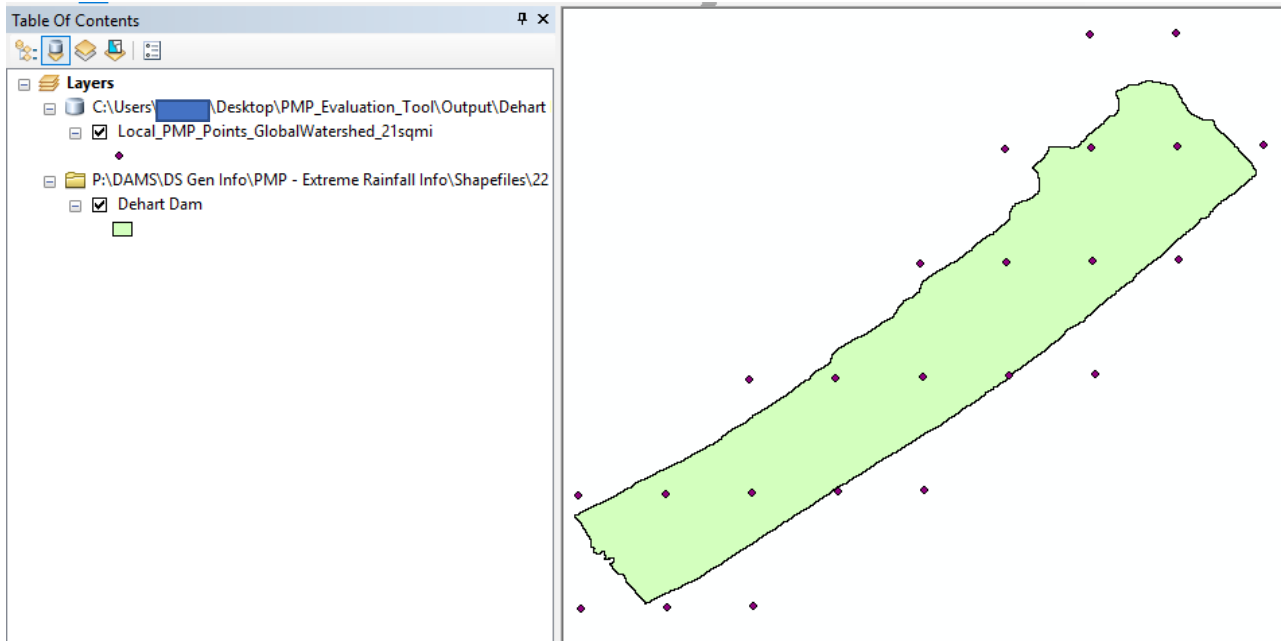
	A	B	C	D	E	F	G	H	I	J
1	OID	STORM_TYPE	PMP_01	PMP_02	PMP_03	PMP_04	PMP_05	PMP_06	PMP_12	PMP_24
2	-1	Local	7.94	10.33	11.1	11.89	15.66	20.96	22.7	23.52



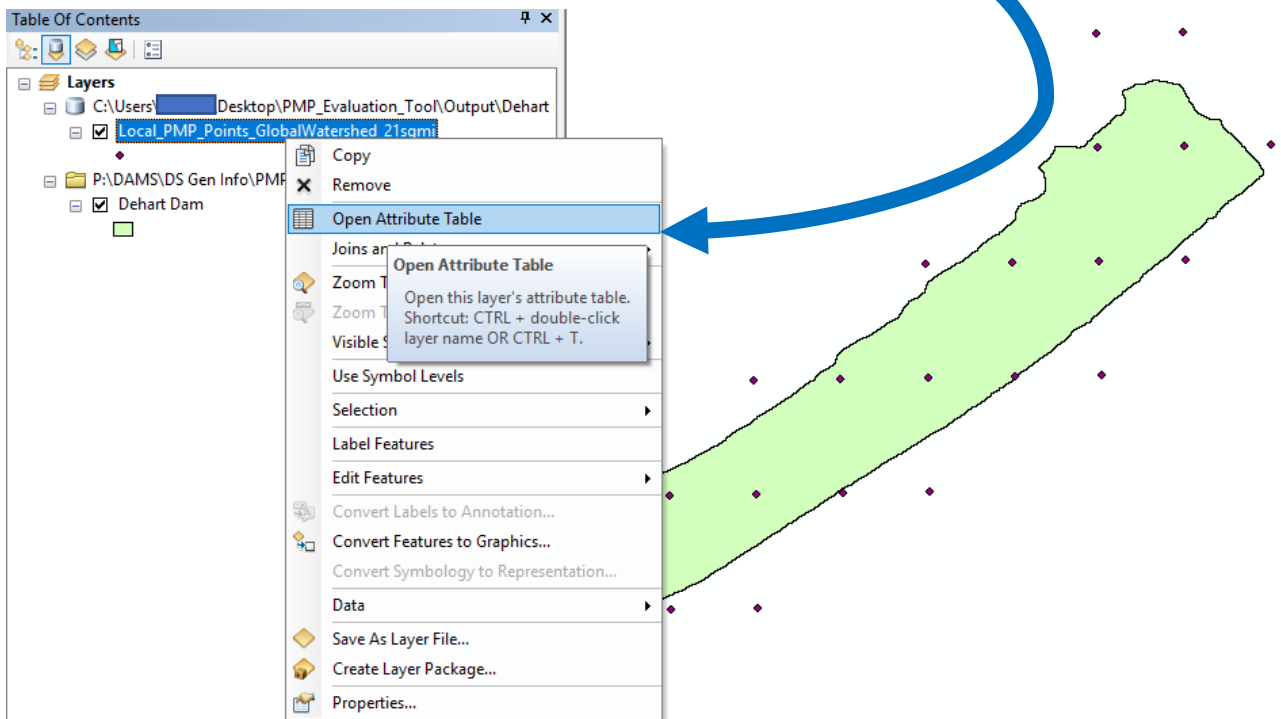
8. **The PMP tool output also identifies the historic storms that were transposed to determine the PMP depth at each point and at each storm duration.** (The identity of these storms is also required for DEP Dam Safety's PMP Distribution Spreadsheet.) **Under the ArcMap Catalog, find the Local PMP Points file under the Output folder, and then drag it into the map area in Arc-Map:**



- ***On ArcMap, the “points file” appears as shown below:***



- ***Under the Table of Contents, right click on “Local\_PMP\_Points” and then double click on the “Open Attribute Table”:***



- The "Attribute Table" shows the probable maximum inches of rainfall and the controlling storm at each point and each duration:

OBJECTID	Shape	Id	POINT_X	POINT_Y	ELEV_FT	Grid_Id	ZON	PMP_01	PMP_02	PMP_03	PMP_04	PMP_05	PMP_06	PMP_12	PMP_24	Storm ID 01-hour	Storm ID 02-hour	Storm ID 03-hour	Storm ID 04-hour	Storm ID 05-hour	Storm ID 06-hour	Storm ID 12-hour	Storm ID 24-hour
1	Point	13242	-76.75	40.45	1192.26372	13242		7.9	10.3	11.1	11.8	15.5	20.8	22.5	23.3	SPAS_1406_1	SPAS_1406_1	SPAS_1406_1	SPAS_1406_1	SPAS_1406_1	SPAS_1406_1	SPAS_1406_1	SPAS_1406_1
2	Point	13243	-76.725	40.45	1192.40354	13243		7.9	10.3	11.1	11.9	15.6	20.9	22.6	23.3	SPAS_1406_1	SPAS_1406_1	SPAS_1406_1	SPAS_1406_1	SPAS_1406_1	SPAS_1406_1	SPAS_1406_1	SPAS_1406_1
3	Point	13244	-76.7	40.45	1023.34877	13244		8	10.3	11.1	11.9	15.7	21	22.7	23.6	SPAS_1406_1	SPAS_1406_1	SPAS_1406_1	SPAS_1406_1	SPAS_1406_1	SPAS_1406_1	SPAS_1406_1	SPAS_1406_1
4	Point	13457	-76.75	40.475	1128.373291	13457		7.9	10.2	11	11.8	15.5	20.7	22.5	23.3	SPAS_1406_1	SPAS_1406_1	SPAS_1406_1	SPAS_1406_1	SPAS_1406_1	SPAS_1406_1	SPAS_1406_1	SPAS_1406_1
5	Point	13489	-76.725	40.475	761.46051	13489		7.9	10.3	11.1	11.8	15.6	20.9	22.6	23.4	SPAS_1406_1	SPAS_1406_1	SPAS_1406_1	SPAS_1406_1	SPAS_1406_1	SPAS_1406_1	SPAS_1406_1	SPAS_1406_1
6	Point	13489	-76.7	40.475	930.81924	13489		7.9	10.3	11.1	11.9	15.7	21	22.7	23.5	SPAS_1406_1	SPAS_1406_1	SPAS_1406_1	SPAS_1406_1	SPAS_1406_1	SPAS_1406_1	SPAS_1406_1	SPAS_1406_1
7	Point	13490	-76.675	40.475	1511.853398	13490		8	10.4	11.1	11.9	15.7	21	22.8	23.6	SPAS_1406_1	SPAS_1406_1	SPAS_1406_1	SPAS_1406_1	SPAS_1406_1	SPAS_1406_1	SPAS_1406_1	SPAS_1406_1
8	Point	13491	-76.65	40.475	1176.516724	13491		8	10.4	11.2	11.9	15.7	21.1	22.8	23.6	SPAS_1406_1	SPAS_1406_1	SPAS_1406_1	SPAS_1406_1	SPAS_1406_1	SPAS_1406_1	SPAS_1406_1	SPAS_1406_1
9	Point	13736	-76.7	40.5	1058.337402	13736		7.9	10.3	11.1	11.9	15.6	20.9	22.6	23.3	SPAS_1406_1	SPAS_1406_1	SPAS_1406_1	SPAS_1406_1	SPAS_1406_1	SPAS_1406_1	SPAS_1406_1	SPAS_1406_1
10	Point	13737	-76.675	40.5	990.92345	13737		7.9	10.3	11.1	11.9	15.7	21	22.7	23.5	SPAS_1406_1	SPAS_1406_1	SPAS_1406_1	SPAS_1406_1	SPAS_1406_1	SPAS_1406_1	SPAS_1406_1	SPAS_1406_1
11	Point	13738	-76.65	40.5	833.442444	13738		8	10.4	11.1	11.9	15.7	21	22.8	23.6	SPAS_1406_1	SPAS_1406_1	SPAS_1406_1	SPAS_1406_1	SPAS_1406_1	SPAS_1406_1	SPAS_1406_1	SPAS_1406_1
12	Point	13739	-76.625	40.5	1534.428382	13739		8	10.4	11.2	11.9	15.7	21	22.8	23.6	SPAS_1406_1	SPAS_1406_1	SPAS_1406_1	SPAS_1406_1	SPAS_1406_1	SPAS_1406_1	SPAS_1406_1	SPAS_1406_1
13	Point	13740	-76.6	40.5	1079.02197	13740		8	10.4	11.2	11.9	15.7	21.1	22.8	23.6	SPAS_1406_1	SPAS_1406_1	SPAS_1406_1	SPAS_1406_1	SPAS_1406_1	SPAS_1406_1	SPAS_1406_1	SPAS_1406_1
14	Point	13865	-76.65	40.525	1622.120728	13865		7.9	10.3	11.1	11.9	15.6	20.9	22.7	23.5	SPAS_1406_1	SPAS_1406_1	SPAS_1406_1	SPAS_1406_1	SPAS_1406_1	SPAS_1406_1	SPAS_1406_1	SPAS_1406_1
15	Point	13866	-76.625	40.525	858.584961	13866		7.9	10.3	11.1	11.9	15.7	21	22.7	23.5	SPAS_1406_1	SPAS_1406_1	SPAS_1406_1	SPAS_1406_1	SPAS_1406_1	SPAS_1406_1	SPAS_1406_1	SPAS_1406_1
16	Point	13867	-76.6	40.525	984.074939	13867		7.9	10.3	11.1	11.9	15.6	20.9	22.6	23.4	SPAS_1406_1	SPAS_1406_1	SPAS_1406_1	SPAS_1406_1	SPAS_1406_1	SPAS_1406_1	SPAS_1406_1	SPAS_1406_1
17	Point	13868	-76.575	40.525	1437.129395	13868	3	8	10.4	11.1	11.9	15.7	21	22.8	23.6	SPAS_1406_1	SPAS_1406_1	SPAS_1406_1	SPAS_1406_1	SPAS_1406_1	SPAS_1406_1	SPAS_1406_1	SPAS_1406_1
18	Point	14232	-76.625	40.55	1551.087891	14232	3	7.9	10.3	11.1	11.8	15.6	20.9	22.6	23.4	SPAS_1406_1	SPAS_1406_1	SPAS_1406_1	SPAS_1406_1	SPAS_1406_1	SPAS_1406_1	SPAS_1406_1	SPAS_1406_1
19	Point	14233	-76.6	40.55	1565.309105	14233	3	7.9	10.3	11.1	11.9	15.6	20.9	22.6	23.3	SPAS_1406_1	SPAS_1406_1	SPAS_1406_1	SPAS_1406_1	SPAS_1406_1	SPAS_1406_1	SPAS_1406_1	SPAS_1406_1
20	Point	14234	-76.575	40.55	819.39562	14234	3	7.9	10.3	11.1	11.9	15.6	20.9	22.7	23.5	SPAS_1406_1	SPAS_1406_1	SPAS_1406_1	SPAS_1406_1	SPAS_1406_1	SPAS_1406_1	SPAS_1406_1	SPAS_1406_1
21	Point	14235	-76.55	40.55	1421.792969	14235	3	7.9	10.3	11.1	11.9	15.7	21	22.7	23.5	SPAS_1406_1	SPAS_1406_1	SPAS_1406_1	SPAS_1406_1	SPAS_1406_1	SPAS_1406_1	SPAS_1406_1	SPAS_1406_1
22	Point	14479	-76.6	40.575	1116.231201	14479	3	7.9	10.3	11.1	11.8	15.6	20.8	22.6	23.4	SPAS_1406_1	SPAS_1406_1	SPAS_1406_1	SPAS_1406_1	SPAS_1406_1	SPAS_1406_1	SPAS_1406_1	SPAS_1406_1
23	Point	14480	-76.575	40.575	1226.696045	14480	3	7.9	10.3	11.1	11.8	15.6	20.9	22.6	23.4	SPAS_1406_1	SPAS_1406_1	SPAS_1406_1	SPAS_1406_1	SPAS_1406_1	SPAS_1406_1	SPAS_1406_1	SPAS_1406_1

(enlarged box from the "Attribute Table" above)

PMP_01	PMP_02	PMP_03	PMP_04	PMP_05	PMP_06	PMP_12	PMP_24	Storm ID 01-hour	Storm ID 02-hour	Storm ID 03-hour
7.9	10.3	11.1	11.8	15.5	20.8	22.5	23.3	SPAS_1406_1	SPAS_1406_1	SPAS_1406_1
7.9	10.3	11.1	11.9	15.6	20.9	22.6	23.5	SPAS_1406_1	SPAS_1406_1	SPAS_1406_1
8	10.3	11.1	11.9	15.7	21	22.7	23.6	SPAS_1406_1	SPAS_1406_1	SPAS_1406_1
7.9	10.2	11	11.8	15.5	20.7	22.5	23.3	SPAS_1406_1	SPAS_1406_1	SPAS_1406_1
7.9	10.3	11.1	11.8	15.6	20.9	22.6	23.4	SPAS_1406_1	SPAS_1406_1	SPAS_1406_1
7.9	10.3	11.1	11.9	15.7	21	22.7	23.5	SPAS_1406_1	SPAS_1406_1	SPAS_1406_1
8	10.4	11.1	11.9	15.7	21	22.8	23.6	SPAS_1406_1	SPAS_1406_1	SPAS_1406_1
8	10.4	11.2	11.9	15.7	21.1	22.8	23.6	SPAS_1406_1	SPAS_1406_1	SPAS_1406_1
7.9	10.3	11.1	11.9	15.6	20.9	22.6	23.5	SPAS_1406_1	SPAS_1406_1	SPAS_1406_1
7.9	10.3	11.1	11.9	15.7	21	22.7	23.5	SPAS_1406_1	SPAS_1406_1	SPAS_1406_1
8	10.4	11.1	11.9	15.7	21	22.8	23.6	SPAS_1406_1	SPAS_1406_1	SPAS_1406_1
8	10.4	11.2	11.9	15.7	21	22.8	23.6	SPAS_1406_1	SPAS_1406_1	SPAS_1406_1

- Note that the Storm ID (for this example: SPAS\_1406\_1) is recorded for each point at each storm duration. (The IDs of the storms, which control the PMP depth at durations of 3, 6, 12, and 24 hours, are needed as input in DEP Dam Safety's PMP Distribution Spreadsheet. For some watersheds, there may be more than one controlling storm at the same duration for different points in the watershed.)
- Proceed to apply the PMP Tool data for a dam using PADEP's Spreadsheet for Temporal Distribution of the PMP.
- Both the spreadsheet and the associated guidance document can be downloaded from the DEP website. In addition to the guidance document, the spreadsheet includes basic instructions.

