Appendix to Final Report
GISHydro June 2010

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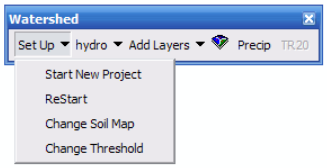
Tools

SET UP MENU



Start New –

Allows user to set up their project and select the desired DEM, Land Use and Soil Type. It is important for the user to verify the path to the GISHydro folder.

Restart-

Resets screen and return user to the whole state view with inferred rivers. For use when need to the initial outlet point selected was incorrect.

Change Soil Map-

Allows user to change soils map

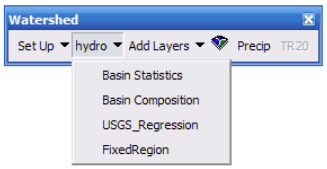
Change Threshold-

Allows user to change threshold

WATERSHED- (BUTTON) 

Delineates a watershed based on the outlet point selected by the user. Each watershed is given a four digit code based on its time of creation, and saved in the project folder.

HYDRO MENU



Basin Statistic-

Creates a listing of the basins features including: drainage area, channel slope, land slope, longest path, time of concentration, average CN, % Forest, %A Soils, %B Soils, %C Soils %D soils and 2yr 24hr precipitation.

Basin Composition -

Creates two tables, these tables are saved in the project folder

Curve Number by Land Use
Soil Type by Land Use

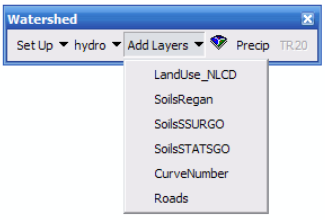
USGS Regression Equations

The Q_2 through Q_{500} discharges estimated from Dillow (1996) are computed

Fixed Region Equations

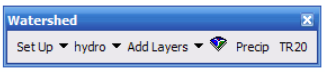
The $Q_{1.25}$ through Q_{500} discharges estimated from the Thomas (Moglen, et al., 2006) equations are computed

ADD LAYERS MENU



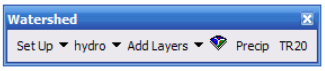
Allows uses to add cuson layers

PRECIP- (BUTTON)



Brings up user form to select Precipitation Frequency and Duration

TR20- (BUTTON)



This option becomes available after both basin statistics is ran and precipitation frequency and durations have been selected. This tool bring us the form for creating a WinTR20 input file.

Step1 Getting Started

After opening GISHydro, select the Project button.

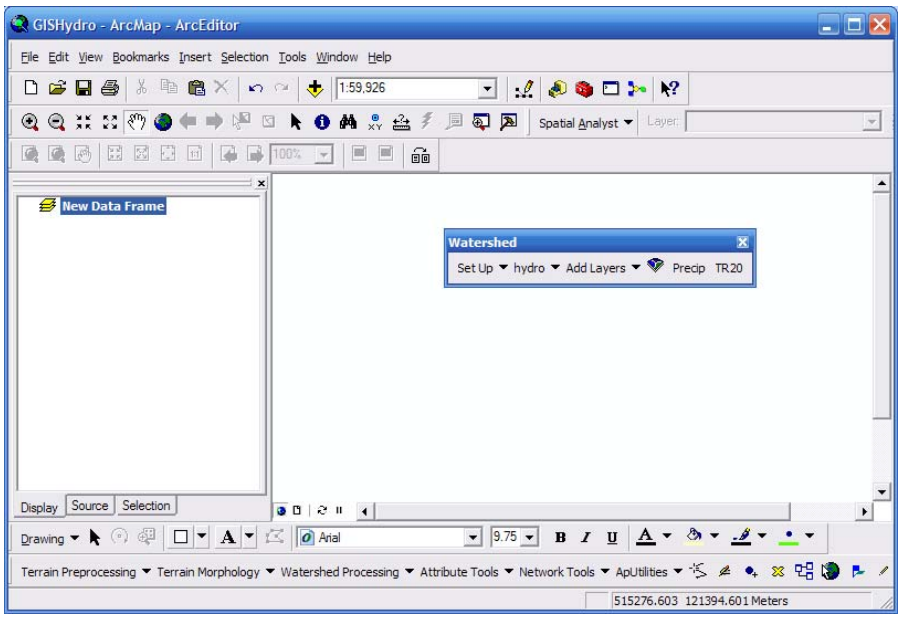


Figure 1 Opening Screen

After selecting the Project button, you will be prompted for information regarding the project.

Project Path: This should be the path of your GISHydro Program Folder.

Project Name: Here you can name your project

Select DEM: Pick the DEM you wish to use for analysis

Select Land use: Pick the Land Use data base you wish to use for analysis

Select Soils: Pick the soils data base you wish to use for analysis

After, selecting a DEM, Land use and Soils pick OK.

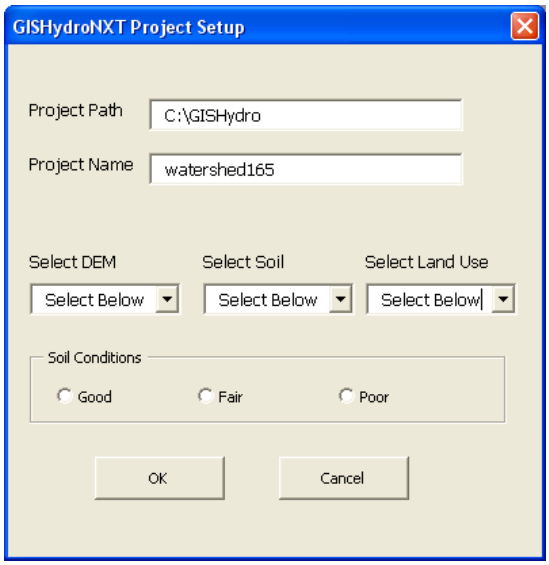


Figure 2 Project Setup

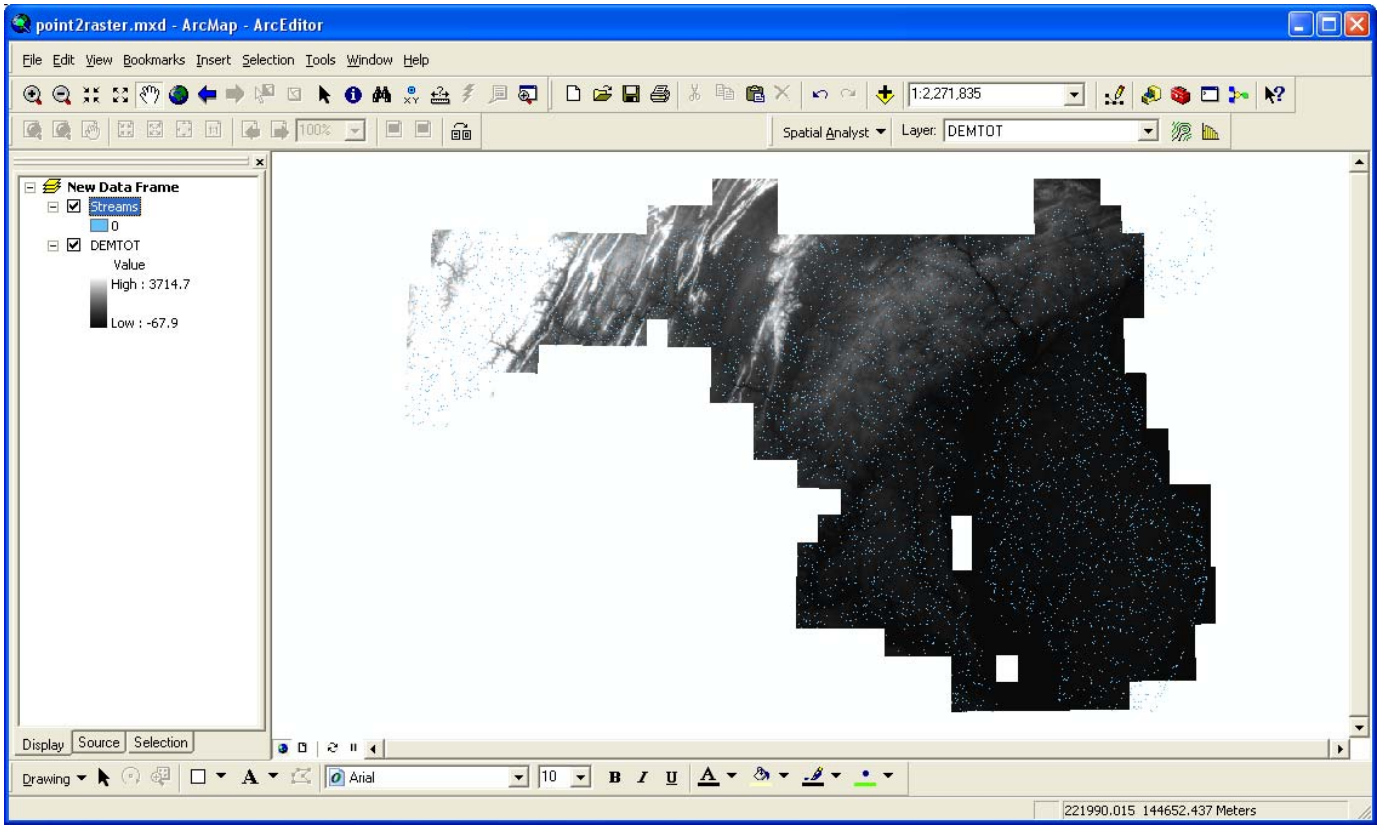


Figure 3 State View with Rivers

After selecting ok, the DEM and Inferred streams for the state will be displayed.

From her you can use zoom, to find your specific outlet location.

Step 2 Creating your Watershed

Start by selecting the basin delineation button  on the watershed tool bar.

Zoom into a level where your mouse point is clearly on a single pixel.

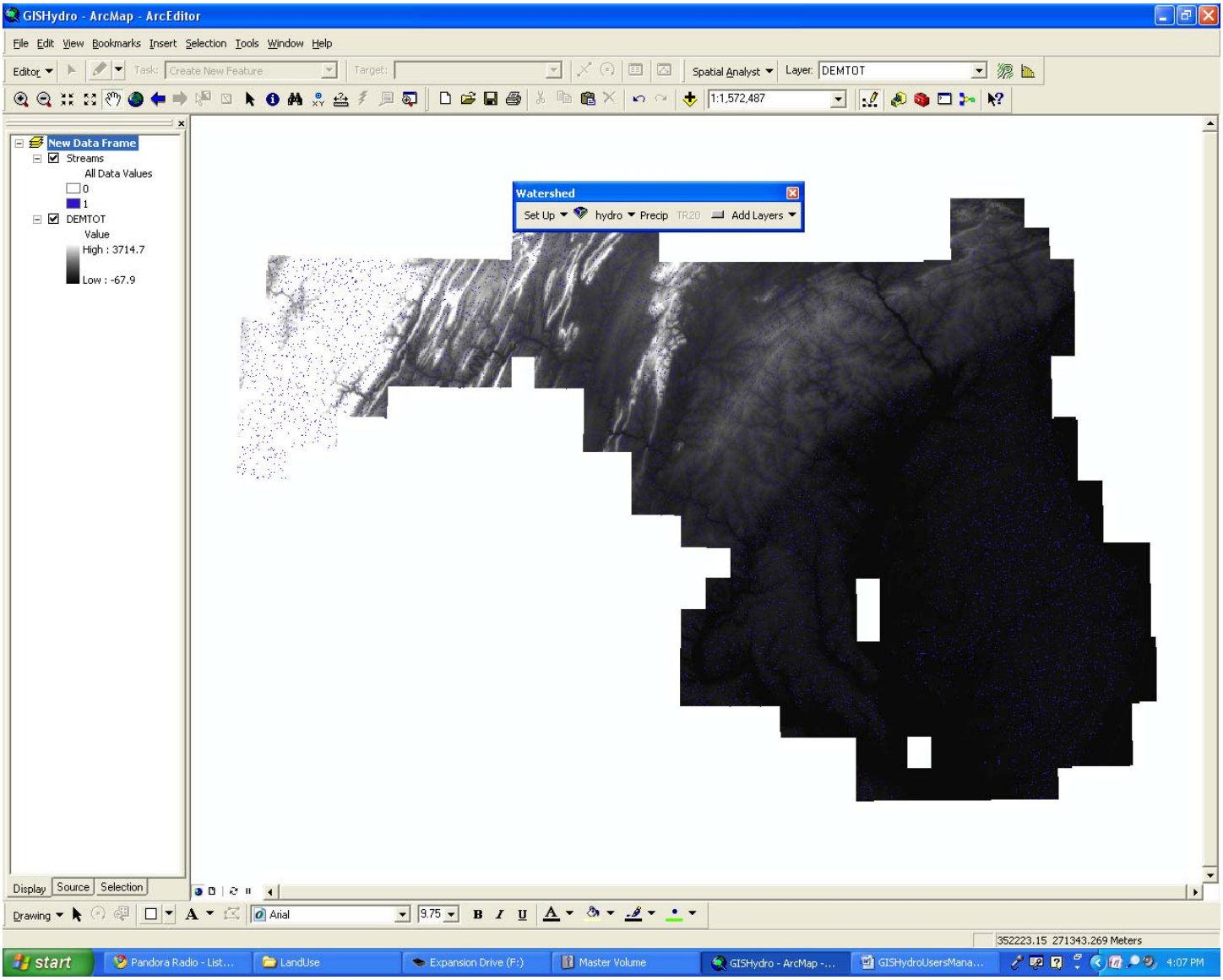


Figure 4 Starting your Watershed

During the creation of your watershed you will be asked to confirm your watershed.

If the watershed looks similar to what you were expecting, select YES and

If the watershed is not what you were expecting select NO, you will then be instructed to use the restart button on the watershed tool, this will remove the watershed. Then Repeat Step 2, with a closer zoom.

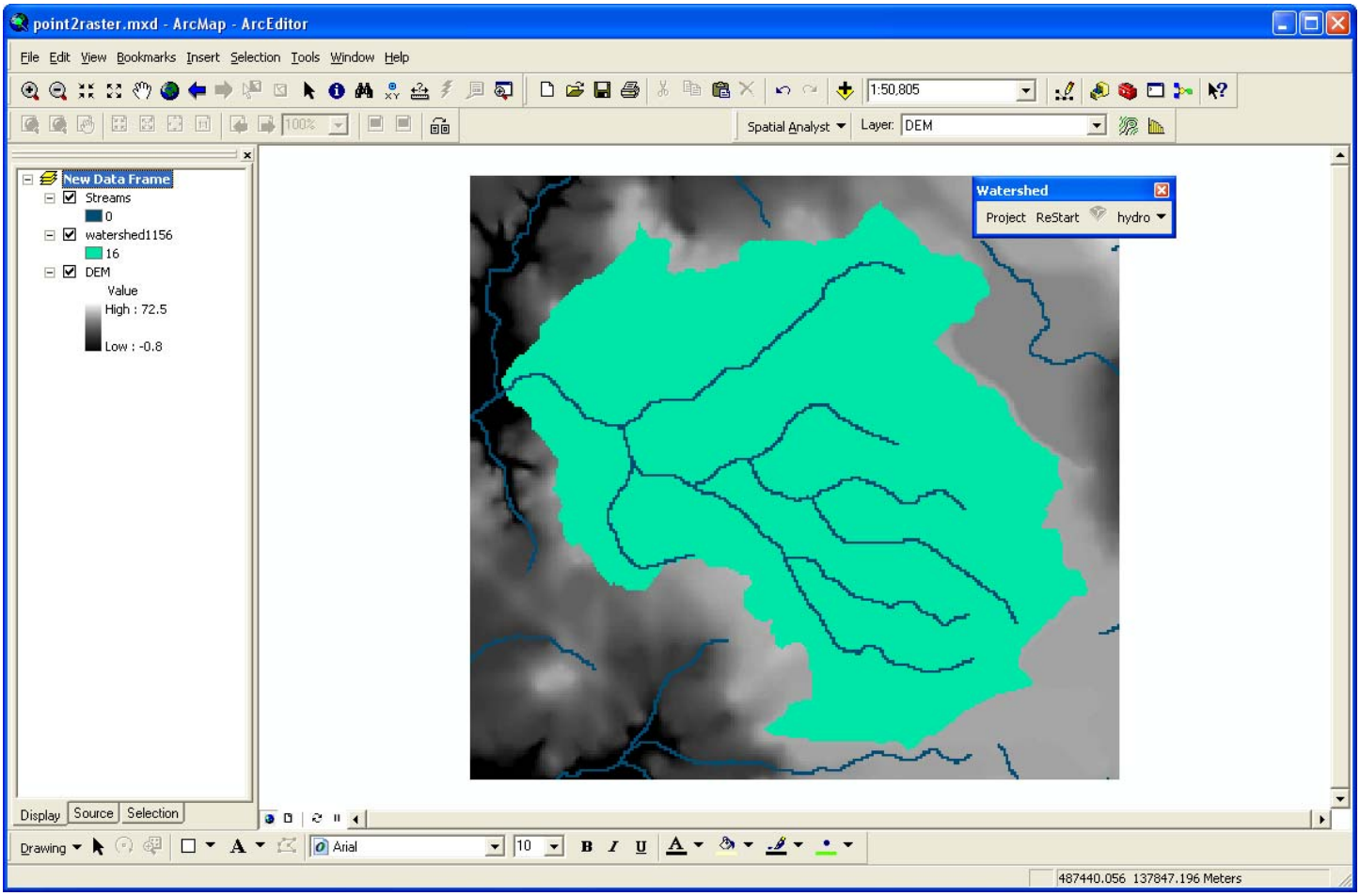


Figure 5 Watershed

Step 3 Hydro Menu

Once you have created your watershed you can use the “hydro menu” to calculate Basin Statistics, Basin Composition., and calculate the peak discharges

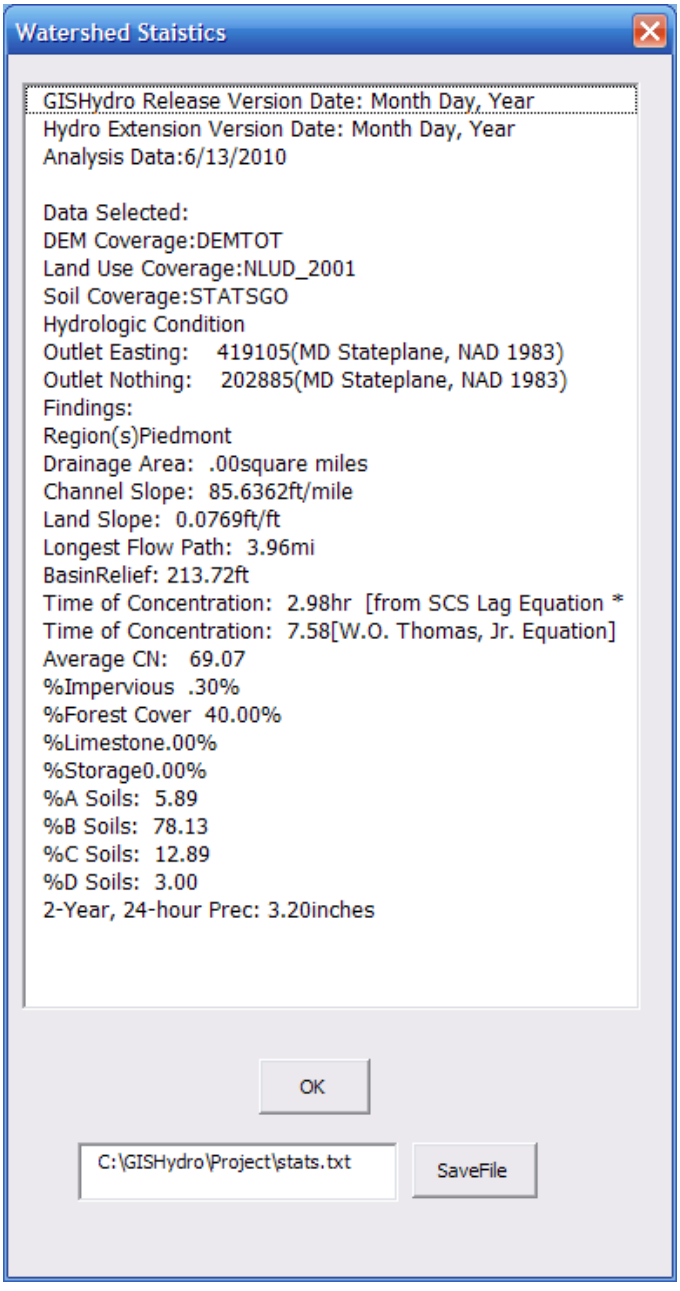


Figure 7 Basin Statistics

Attributes of CurveNumber_by_LandUse4

OID	LU	Land_Use	Area	Percent	A	B	C	D
0	11	Open Water	1462810	0.533682	10	10	10	10
1	21	Developed Open	3855617	1.406659	39	61	74	80
2	22	Developed Low I	1714684	0.625574	61	75	83	87
3	23	Developed Mediu	426249	0.15551	77	85	90	92
4	24	Developed High	48437	0.017671	98	98	98	98
5	31	Barren Land	368124	0.134304	77	86	91	94
6	41	Deciduous Fores	56148638	20.484909	30	55	70	77
7	42	Evergreen Fores	571561	0.208525	30	55	70	77
8	81	Pasture/Hay	90442319	32.996395	72	81	88	91
9	82	Cultivated Crop	111464152	40.665866	72	81	88	91
10	90	Woody Wetlands	3109681	1.134516	10	10	10	10
11	95	Emergent Herbac	4485303	1.636389	10	10	10	10

Record: 1 Show: All Selected Records (of 12)

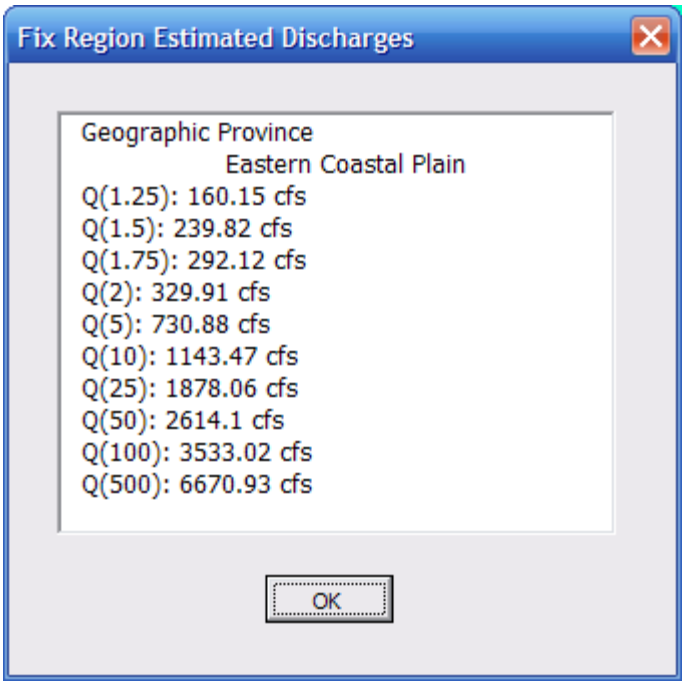
Figure 8 Basin Composition, Curve Number by Land Use

Attributes of SoilType_by_LandUse11563

OID	LU	Land_Use	A_Soil	B_Soil	C_Soil	D_Soil
0	11	Open Water	0	736249	697499	29062
1	21	Developed Open	0	1995621	1017185	842811
2	22	Developed Low I	0	920311	484374	309999
3	23	Developed Mediu	0	164687	222812	38750
4	24	Developed High	0	19375	29062	0
5	31	Barren Land	0	251874	58125	58125
6	41	Deciduous Fores	193750	32704935	13484973	9764980
7	42	Evergreen Fores	0	87187	474687	9687
8	81	Pasture/Hay	426249	59858943	18909962	11247165
9	82	Cultivated Crop	155000	72084543	21273707	17950902
10	90	Woody Wetlands	0	1695309	794373	619999
11	95	Emergent Herbac	0	2305620	1714684	464999

Record: 1 Show: All Selected Records (of 12) Options

Figure 9Basin Composition, Soil Type by Land Use



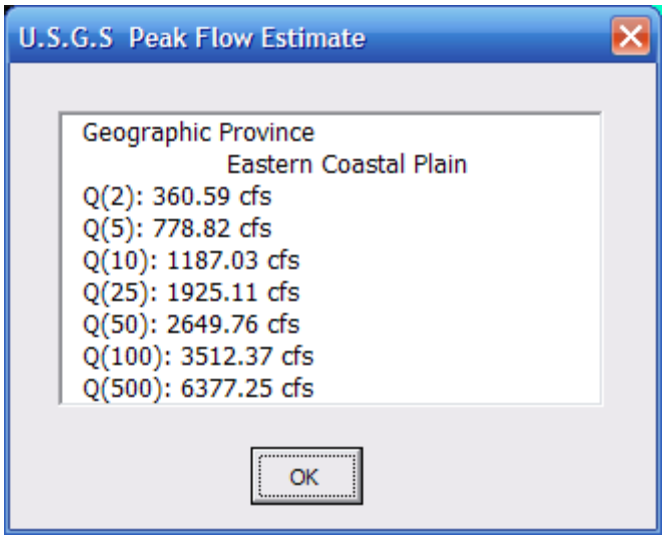


Figure 10 Peak Discharges

Step 4 Precipitation Duration and Frequency Selection

From the menu bar, select the precip button. The following screen will appear, chose the event and select OK.

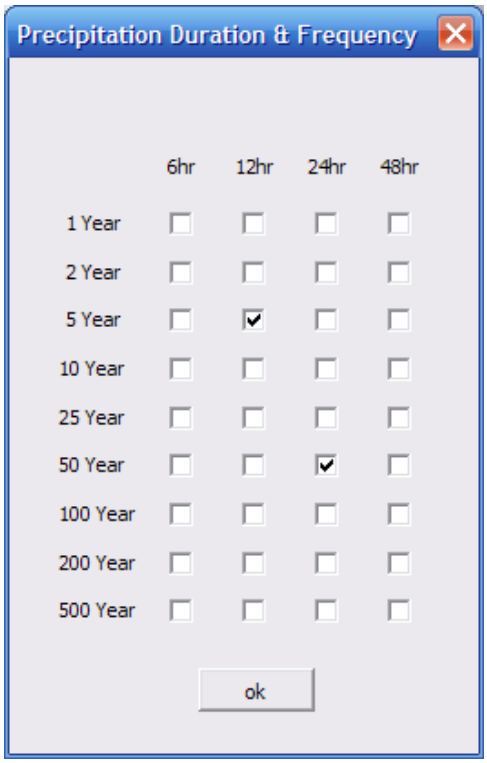


Figure 11 Precipitation Frequency and Duration Selection

The following screen will appear listing the depth of the selected event.

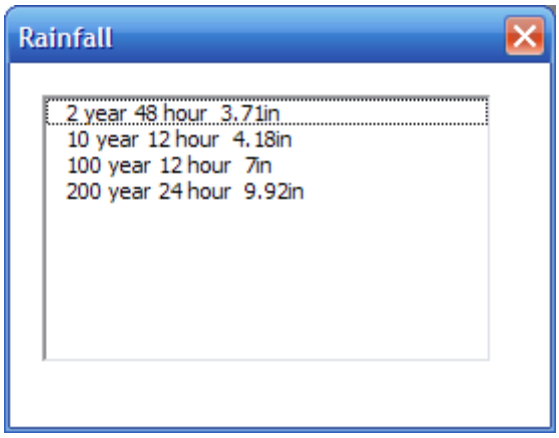


Figure 12 Precipitation Frequency and Duration Output

Step 5 WinTR20

After running both Basin Stats and Precip the TR-20 option will appear. The WinTR20 Input Creator allows the user to select the time of concentration method and the desired precipitation event.

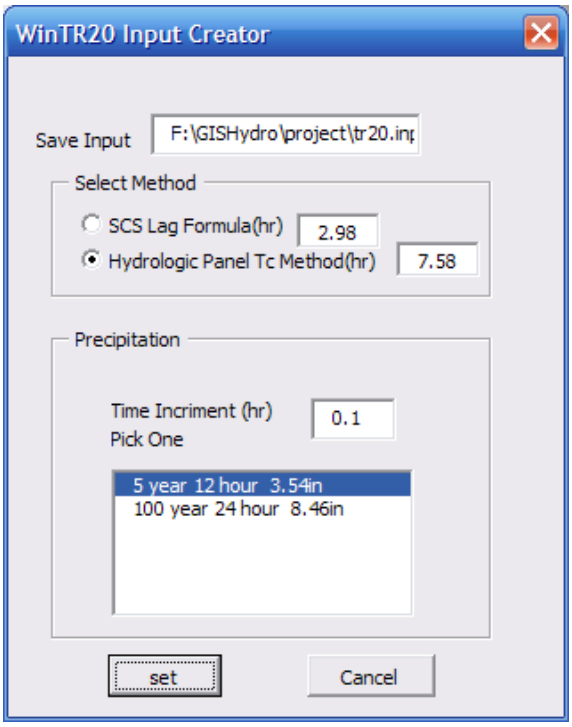


Figure 13 WinTR20 Creator

After running the WinTR20 Creator a message will appear indicating the file has been created. You can view the file in notepad (Figure 14) or proceed to WinTR20 (Figure 15)

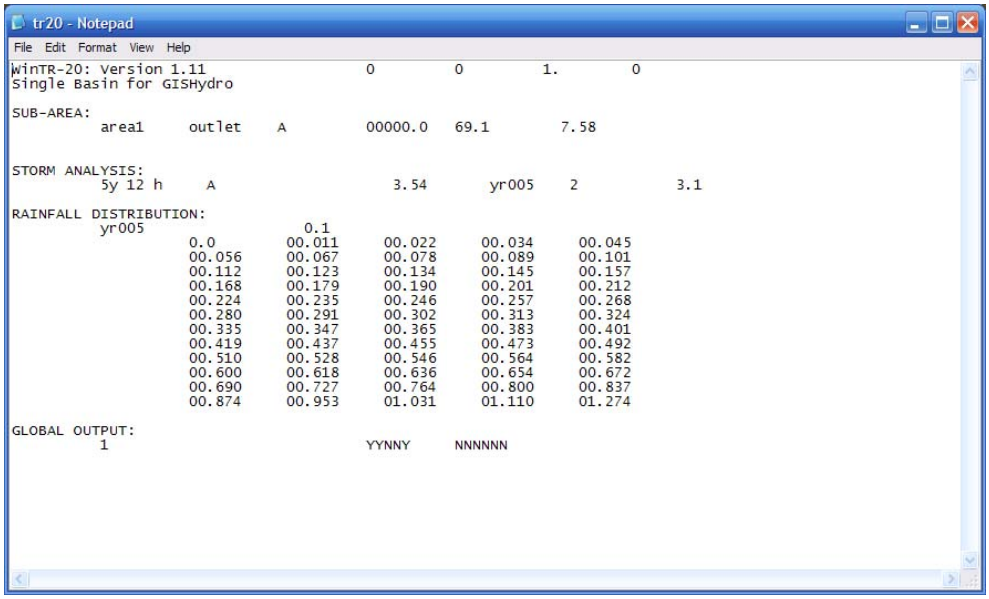


Figure 14 WinTR20 Input File

Open WinTR20 and from the file menu choose “Open Existing WinTR-20 File”

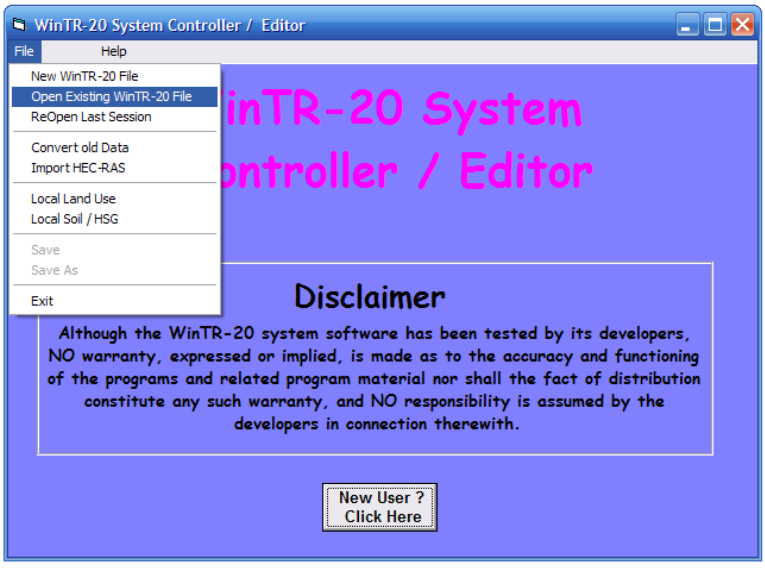


Figure 15 WinTR-20

Leave in English units, you can edit description if you desire. Chose “Accept Changes and Close”. From the file menu choose save. After saving the “run” option will appear on the menu bar. Choose run.

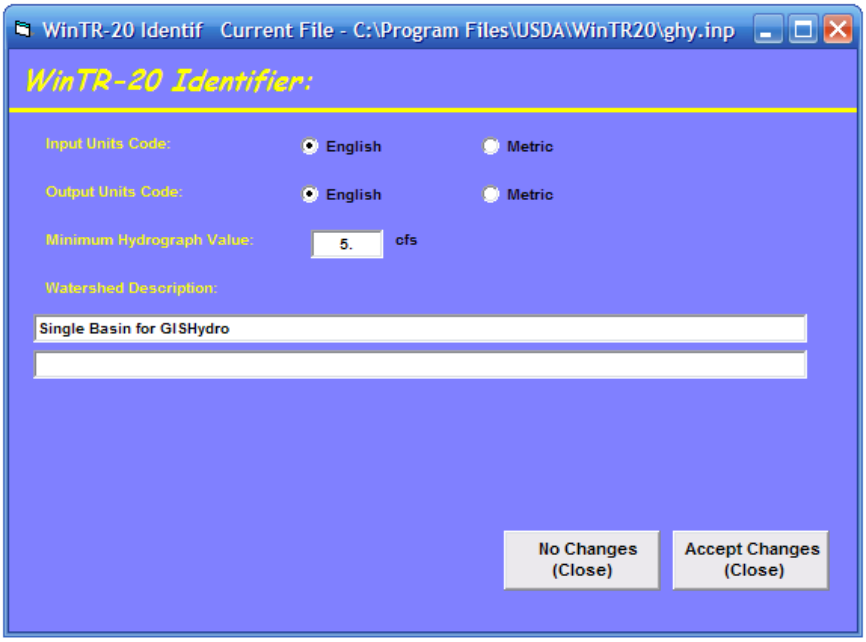


Figure 16 Accept Changes

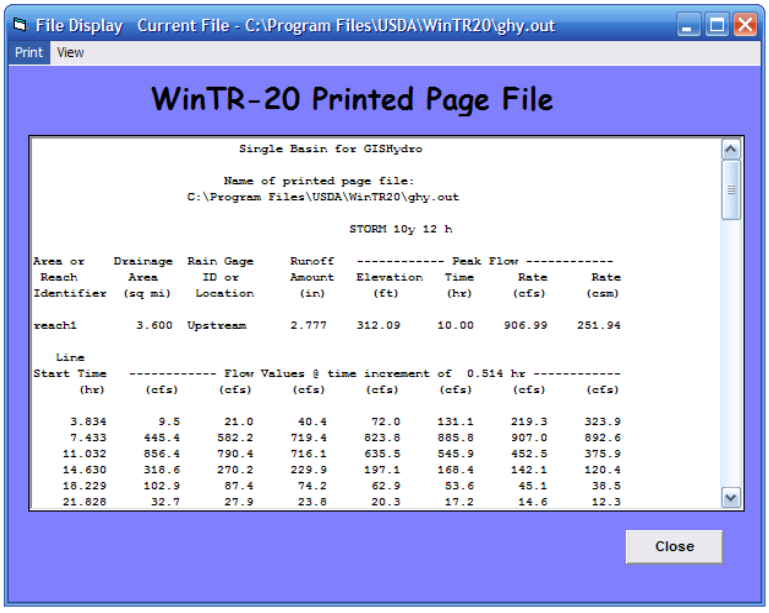


Figure 17 TR-20 Output

Download

1. Go to http://www.gishydro.umd.edu.edu

2. Click on the “Download” link along the left margin. If you have not already registered, please do so. (Registration is free).

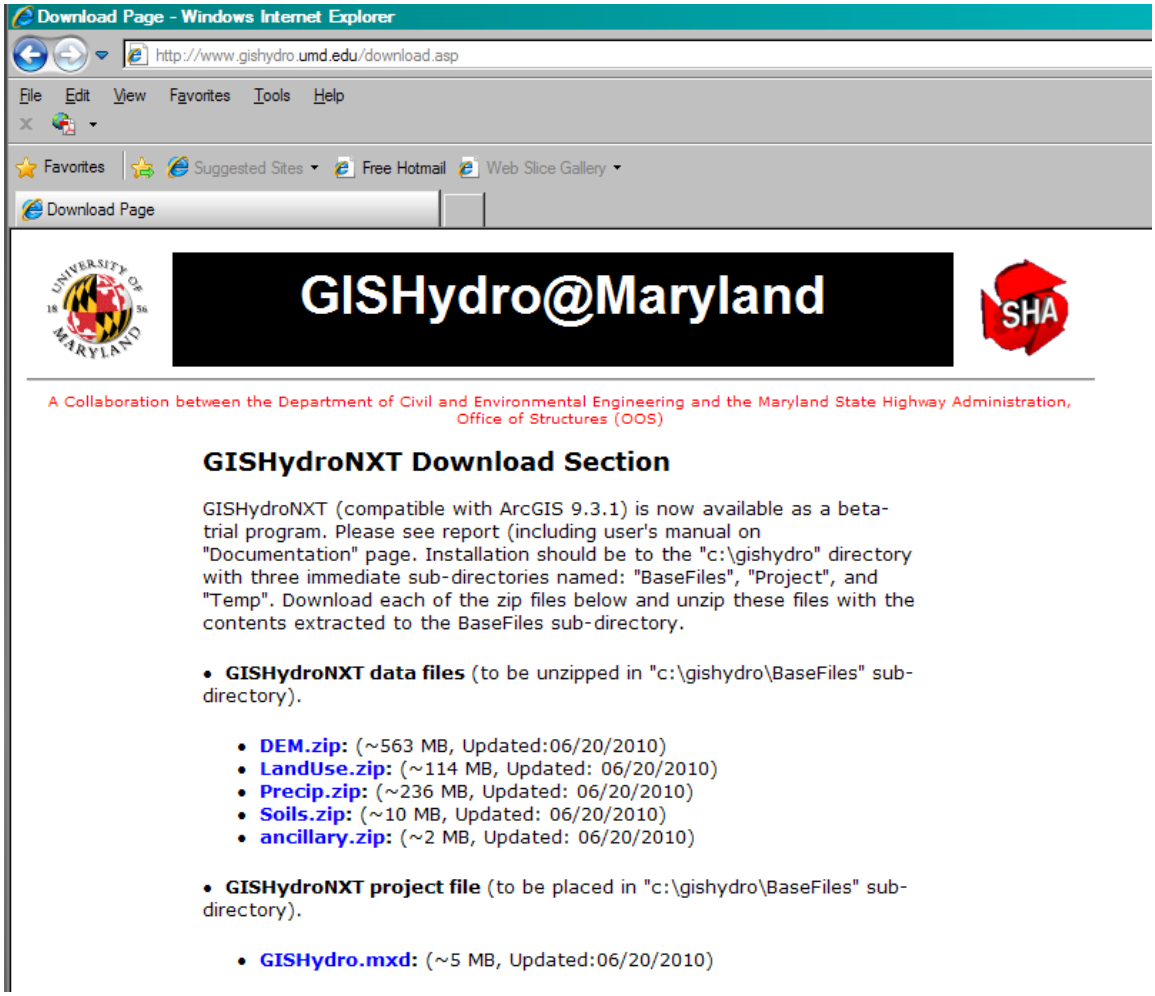
3. Once you have registered, you will be at the GISHydro download page. You will need to download several (5) zip files and the GISHydro.mxd project file (see screen capture below).

4. Create a directory called “c:\gishydro\” on your local machine.

    a. Create three sub-directories off the “c:\gishydro\” directory called “BaseFiles”, “Project”, and “Temp”.

    b. Unzip the zip files from Step 3 above to the “c:\gishydro\BaseFiles” sub-directory

    c. Place the “GISHydro.mxd” file in the “c:\gishydro” directory.



File System

C:\GISHydro

GisHydro.mxd

BaseFiles

- **DEM**
  - Demtot
  - Flowacc
  - Flowlenup
  - Flowdir
  - Rivers
  - Info
- **Precip**
- **LandUse**
  - LUD
  - LandUse_Key_NLUD.txt
  - landuse_names.dbf
  - imp (impervious area)
- **Soils**
  - Ragan
  - Ssurgo
  - Statsgo
- **Limestone**
- **MDProv**
- **Mjr_rdsstpm**

Project – stores watershed and other important data from program

Temp – stores information necessary to run program

Regression Equations

Fixed Region Equations, Thomas (Moglen, et al., 2006)

Piedmont Region

Q1p25 = 202.9 * DA ^ 0.682 * (F + 1) ^ -0.222
Q1p5 = 262 * DA ^ 0.683 * (F + 1) ^ -0.217
Q1p75 = 308.9 * DA ^ 0.679 * (F + 1) ^ -0.219
Q2 = 349 * DA ^ 0.674 * (F + 1) ^ -0.224
Q5 = 673.8 * DA ^ 0.659 * (F + 1) ^ -0.228
Q10 = 992.6 * DA ^ 0.649 * (F + 1) ^ -0.23
Q25 = 1556 * DA ^ 0.635 * (F + 1) ^ -0.231
Q50 = 2146 * DA ^ 0.624 * (F + 1) ^ -0.235
Q100 = 2897 * DA ^ 0.613 * (F + 1) ^ -0.238
Q200 = 3847 * DA ^ 0.603 * (F + 1) ^ -0.239
Q500 = 5519 * DA ^ 0.589 * (F + 1) ^ -0.242

Piedmont urban

Q1p25 = 17.85 *DA^0.652 *(IA+1)^0.635
Q1p50 = 24.66 *DA^0.648 *(IA+1)^0.631
Q1p75 = 30.82* DA^0.643 *(IA+1)^0.611
Q2 = 37.01 *DA^0.635 *(IA+1)^0.588
Q5 = 94.76* DA^0.624 *(IA+1)^0.499
Q10 = 169.2 *DA^0.622 *(IA+1)^0.435
Q25 = 341.0 *DA^0.619 *(IA+1)^0.349
Q50 = 562.4 *DA^0.619 *(IA+1)^0.284
Q100 = 898.3* DA^0.619 *(IA+1)^0.222
Q200 = 1413* DA^0.621 *(IA+1)^0.160
Q500 = 2529* DA^0.623 *(IA+1)^0.079

Western Coastal Plain

Q1p25 = 18.62 * DA ^ 0.611 * (IA + 1) ^ 0.419 * (SD + 1) ^ 0.165
Q1p50 = 21.97 * DA ^ 0.612 * (IA + 1) ^ 0.399 * (SD + 1) ^ 0.226
Q1p75 = 24.42 * DA ^ 0.612 * (IA + 1) ^ 0.391 * (SD + 1) ^ 0.246
Q2 = 26.32 * DA ^ 0.612 * (IA + 1) ^ 0.386 * (SD + 1) ^ 0.256
Q5 = 42.64 * DA ^ 0.607 * (IA + 1) ^ 0.347 * (SD + 1) ^ 0.34
Q10 = 58.04 * DA ^ 0.603 * (IA + 1) ^ 0.323 * (SD + 1) ^ 0.382
Q25 = 86.25 * DA ^ 0.582 * (IA + 1) ^ 0.295 * (SD + 1) ^ 0.421
Q50 = 111.5 * DA ^ 0.584 * (IA + 1) ^ 0.27 * (SD + 1) ^ 0.457
Q100 = 143.56 * DA ^ 0.586 * (IA + 1) ^ 0.26 * (SD + 1) ^ 0.469
Q200 = 185.15 * DA ^ 0.58 * (IA + 1) ^ 0.243 * (SD + 1) ^ 0.488
Q500 = 256.02 * DA ^ 0.573 * (IA + 1) ^ 0.222 * (SD + 1) ^ 0.51

Blue Ridge and Great Valley

Q1p25 = 57.39 * DA ^ 0.784 * (LIME + 1) ^ -0.19
Q1p50 = 81.45 * DA ^ 0.764 * (LIME + 1) ^ -0.193
Q1p75 = 96.33 * DA ^ 0.755 * (LIME + 1) ^ -0.194
Q2 = 107.2 * DA ^ 0.75 * (LIME + 1) ^ -0.194
Q5 = 221.28 * DA ^ 0.71 * (LIME + 1) ^ -0.202
Q10 = 336.84 * DA ^ 0.687 * (LIME + 1) ^ -0.207
Q25 = 545.62 * DA ^ 0.66 * (LIME + 1) ^ -0.214
Q50 = 759.45 * DA ^ 0.641 * (LIME + 1) ^ -0.219
Q100 = 1034.7 * DA ^ 0.624 * (LIME + 1) ^ -0.224
Q200 = 1387.6 * DA ^ 0.608 * (LIME + 1) ^ -0.229
Q500 = 2008.6 * DA ^ 0.587 * (LIME + 1) ^ -0.235

"Appalachian Plateau"

Q1p25 = 70.25 * DA ^ 0.837 * LSLOPE ^ 0.327
Q1p50 = 87.42 * DA ^ 0.837 * LSLOPE ^ 0.321
Q1p75 = 96.37 * DA ^ 0.836 * LSLOPE ^ 0.307
Q2 = 101.41 * DA ^ 0.834 * LSLOPE ^ 0.3
Q5 = 179.13 * DA ^ 0.826 * LSLOPE ^ 0.314
Q10 = 255.75 * DA ^ 0.821 * LSLOPE ^ 0.34
Q25 = 404.22 * DA ^ 0.812 * LSLOPE ^ 0.393
Q50 = 559.8 * DA ^ 0.806 * LSLOPE ^ 0.435
Q100 = 766.28 * DA ^ 0.799 * LSLOPE ^ 0.478
Q200 = 1046.9 * DA ^ 0.793 * LSLOPE ^ 0.525
Q500 = 1565 * DA ^ 0.784 * LSLOPE ^ 0.589

Eastern Coastal Plain

Q1p25 = 19.85 * DA ^ 0.796 * BR ^ 0.066 * (SA + 1) ^ -0.106
Q1p50 = 20.48 * DA ^ 0.795 * BR ^ 0.156 * (SA + 1) ^ -0.14
Q1p75 = 20.81 * DA ^ 0.799 * BR ^ 0.197 * (SA + 1) ^ -0.146
Q2 = 20.95 * DA ^ 0.803 * BR ^ 0.222 * (SA + 1) ^ -0.144
Q5 = 25.82 * DA ^ 0.793 * BR ^ 0.368 * (SA + 1) ^ -0.19
Q10 = 31.17 * DA ^ 0.777 * BR ^ 0.439 * (SA + 1) ^ -0.215
Q25 = 40.26 * DA ^ 0.751 * BR ^ 0.511 * (SA + 1) ^ -0.242
Q50 = 50# * DA ^ 0.732 * BR ^ 0.549 * (SA + 1) ^ -0.261
Q100 = 63.44 * DA ^ 0.711 * BR ^ 0.576 * (SA + 1) ^ -0.279
Q200 = 79.81 * DA ^ 0.689 * BR ^ 0.601 * (SA + 1) ^ -0.296
Q500 = 108.7 * DA ^ 0.66 * BR ^ 0.628 * (SA + 1) ^ -0.316

DA Drainage Area
BR Basin Relief
IA Percent of Impervious Area
F Percent Forest
LIME Percent Limestone
SA Percent Soil Type A
SD Percent Soil Type D

USGS Regression Equations (Dillow 1996)

Appalachian Plateaus and Allegheny Ridges region
Q2 = (106 * A ^ 0.851 * (F + 10) ^ -0.223 * BR ^ 0.056)
Q5 = (109 * A ^ 0.858 * (F + 10) ^ -0.143 * BR ^ 0.064)
Q10 = (113 * A ^ 0.859 * (F + 10) ^ -0.106 * BR ^ 0.072)'
Q25 = (118 * A ^ 0.858 * (F + 10) ^ -0.072 * BR ^ 0.087)'
Q50 = (121 * A ^ 0.858 * (F + 10) ^ -0.051 * BR ^ 0.099)
Q100 = (124 * A ^ 0.858 * (F + 10) ^ -0.033 * BR ^ 0.111)
Q500 = (127 * A ^ 0.859 * (F + 10) ^ 0.004 * BR ^ 0.14)

Piedmont
Q2 = (451 * A ^ 0.635 * (F + 10) ^ -0.266)
Q5 = (839 * A ^ 0.606 * (F + 10) ^ -0.248)
Q10 = (1210 * A ^ 0.589 * (F + 10) ^ -0.242)
Q25 = (1820 * A ^ 0.574 * (F + 10) ^ -0.239)
Q50 = (2390 * A ^ 0.565 * (F + 10) ^ -0.24
Q100 = (3060 * A ^ 0.557 * (F + 10) ^ -0.241)
Q500 = (5190 * A ^ 0.543 * (F + 10) ^ -0.245)

Blue Ridge and Great Valley region
Q2 = (4260 * A ^ 0.774 * (LI + 10) ^ -0.549 * BR ^ -0.405)
Q5 = (6670 * A ^ 0.752 * (LI + 10) ^ -0.564 * BR ^ -0.354)
Q10 = (8740 * A ^ 0.741 * (LI + 10) ^ -0.579 * BR ^ -0.326)
Q25 = (12000 * A ^ 0.73 * (LI + 10) ^ -0.602 * BR ^ -0.295)
Q50 = (15100 * A ^ 0.723 * (LI + 10) ^ -0.62 * BR ^ -0.276)'
Q100 = (18900 * A ^ 0.719 * (LI + 10) ^ -0.639 * BR ^ -0.261)
Q500 = (31800 * A ^ 0.712 * (LI + 10) ^ -0.686 * BR ^ -0.241)

Western Coastal Plain
Q2 = (1410 * A ^ 0.761 * (F + 10) ^ -0.782)
Q5 = (1780 * A ^ 0.769 * (F + 10) ^ -0.687)
Q10 = (1910 * A ^ 0.771 * (F + 10) ^ -0.613)
Q25 = (2000 * A ^ 0.772 * (F + 10) ^ -0.519)
Q50 = (2060 * A ^ 0.771 * (F + 10) ^ -0.452)
Q100 = (2140 * A ^ 0.77 * (F + 10) ^ -0.391)
Q500 = (2380 * A ^ 0.765 * (F + 10) ^ -0.263)

Eastern Coastal Plain region
Q2 = (0.25 * A ^ 0.591 * (RCN - 33) ^ 1.7 * BR ^ 0.31 * (F + 10) ^ -0.464 * (ST + 10) ^ -0.148)
Q5 = (1.05 * A ^ 0.595 * (RCN - 33) ^ 1.74 * BR ^ 0.404 * (F + 10) ^ -0.586 * (ST + 10) ^ -0.498)
Q10 = (3.24 * A ^ 0.597 * (RCN - 33) ^ 1.71 * BR ^ 0.436 * (F + 10) ^ -0.667 * (ST + 10) ^ -0.694)
Q25 = (13.1 * A ^ 0.597 * (RCN - 33) ^ 1.66 * BR ^ 0.457 * (F + 10) ^ -0.77 * (ST + 10) ^ -0.892)
Q50 = (35 * A ^ 0.594 * (RCN - 33) ^ 1.62 * BR ^ 0.465 * (F + 10) ^ -0.847 * (ST + 10) ^ -1.01)
Q100 = (87.6 * A ^ 0.589 * (RCN - 33) ^ 1.58 * BR ^ 0.47 * (F + 10) ^ -0.923 * (ST + 10) ^ -1.11)
Q500 = (627 * A ^ 0.573 * (RCN - 33) ^ 1.49 * BR ^ 0.478 * (F + 10) ^ -1.1 * (ST + 10) ^ -1.29)

A Area
RCN Runoff Curve Number
BR Basin Relief
F Percent Forest
ST Percent Storage
LI Percent Limestone

Curve Number Tables

GOOD CONDITIONS

NLCD ID	Land Use Name	A	B	C	D
11	Open Water	100	100	100	100
12	Perennial Ice/Snow	100	100	100	100
21	Developed, Open Space	39	61	74	80
22	Developed, Low Intensity	61	76	84	88
23	Developed, Medium Intensity	68	80	86	89
24	Developed, High Intensity	81	88	91	93
31	Barren Land (Rock/Sand/Clay)	77	86	91	94
32	Unconsolidated Shore* -	77	86	91	94
41	Deciduous Forest -	30	55	70	77
42	Evergreen Forest -	30	55	70	77
43	Mixed Forest -	30	55	70	77
51	Dwarf Scrub –	35	56	70	77
52	Shrub/Scrub –	35	56	70	77
71	Grassland/Herbaceous.	49	69	79	84
72	Sedge/Herbaceous	49	69	79	84
81	Pasture/Hay -	67	78	85	89
82	Cultivated Crops -	67	78	85	89
90	Woody Wetlands -	100	100	100	100
91	Palustrine Forested Wetland*	100	100	100	100
92	Palustrine Scrub/Shrub Wetland*	100	100	100	100
93	Estuarine Forested Wetland*	100	100	100	100
94	Estuarine Scrub/Shrub Wetland*	100	100	100	100
95	Emergent Herbaceous Wetlands	100	100	100	100
96	Palustrine Emergent Wetland (Persistent)*	100	100	100	100
97	Estuarine Emergent Wetland*	100	100	100	100
98	Palustrine Aquatic Bed*	100	100	100	100
99	Estuarine Aquatic Bed*	100	100	100	100

FAIR CONDITIONS

NLCD ID	Land Use Name	A	B	C	D
11	Open Water	100	100	100	100
12	Perennial Ice/Snow	100	100	100	100
21	Developed, Open Space	49	69	79	84
22	Developed, Low Intensity	66	79	86	89
23	Developed, Medium Intensity	86	91	94	95
24	Developed, High Intensity	95	96	97	98
31	Barren Land (Rock/Sand/Clay)	77	86	91	94
32	Unconsolidated Shore* -	77	86	91	94
41	Deciduous Forest -	36	60	73	79
42	Evergreen Forest -	36	60	73	79
43	Mixed Forest -	36	60	73	79
51	Dwarf Scrub –	48	56	70	77
52	Shrub/Scrub –	48	56	70	77
71	Grassland/Herbaceous.	54	74	84	87
72	Sedge/Herbaceous	54	74	84	87
81	Pasture/Hay -	70	80	87	90
82	Cultivated Crops -	70	80	87	90
90	Woody Wetlands -	100	100	100	100
91	Palustrine Forested Wetland*	100	100	100	100
92	Palustrine Scrub/Shrub Wetland*	100	100	100	100
93	Estuarine Forested Wetland*	100	100	100	100
94	Estuarine Scrub/Shrub Wetland*	100	100	100	100
95	Emergent Herbaceous Wetlands	100	100	100	100
96	Palustrine Emergent Wetland (Persistent)*	100	100	100	100
97	Estuarine Emergent Wetland*	100	100	100	100
98	Palustrine Aquatic Bed*	100	100	100	100
99	Estuarine Aquatic Bed*	100	100	100	100

POOR CONDITIONS

NLCD ID	Land Use Name	A	B	C	D
11	Open Water	100	100	100	100
12	Perennial Ice/Snow	100	100	100	100
21	Developed, Open Space	68	79	86	89
22	Developed, Low Intensity	76	84	89	91
23	Developed, Medium Intensity	79	86	91	92
24	Developed, High Intensity	88	91	94	95
31	Barren Land (Rock/Sand/Clay)	77	86	91	94
32	Unconsolidated Shore* -	77	86	91	94
41	Deciduous Forest -	45	66	77	83
42	Evergreen Forest -	45	66	77	83
43	Mixed Forest -	45	66	77	83
51	Dwarf Scrub –	48	67	77	83
52	Shrub/Scrub –	48	67	77	83
71	Grassland/Herbaceous.	58	78	88	91
72	Sedge/Herbaceous	58	78	88	91
81	Pasture/Hay -	72	81	88	91
82	Cultivated Crops -	72	81	88	91
90	Woody Wetlands -	100	100	100	100
91	Palustrine Forested Wetland*	100	100	100	100
92	Palustrine Scrub/Shrub Wetland*	100	100	100	100
93	Estuarine Forested Wetland*	100	100	100	100
94	Estuarine Scrub/Shrub Wetland*	100	100	100	100
95	Emergent Herbaceous Wetlands	100	100	100	100
96	Palustrine Emergent Wetland (Persistent)*	100	100	100	100
97	Estuarine Emergent Wetland*	100	100	100	100
98	Palustrine Aquatic Bed*	100	100	100	100
99	Estuarine Aquatic Bed*	100	100	100	100