Calculating Hydrologic Parameters for Estimating Surface Water Flow with GIS

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CVEN 689: Applications of GIS to Civil Engineering
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Figure 1. The Brazos River Basin is the chosen study area. 67 control points are selected at USGS gaging stations.
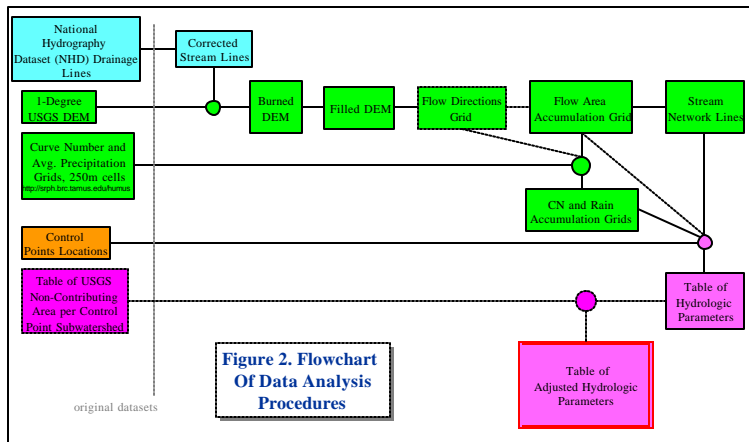

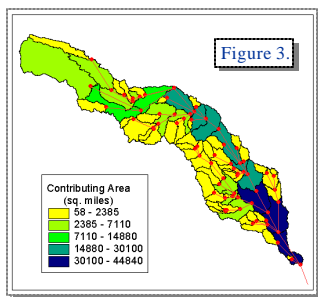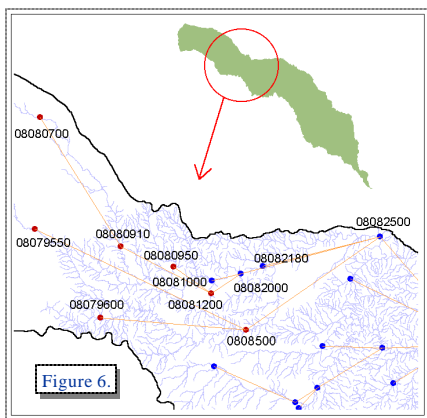**Figure 2. Flowchart Of Data Analysis Procedures**

original datasets

Figure 3.

Contributing Area (sq. miles)
- 58 - 2385
- 2385 - 7110
- 7110 - 14880
- 14880 - 30100
- 30100 - 44840

Figure 4.

Avg Upstream CN
- 59.53 - 65.03
- 65.03 - 69.18
- 69.18 - 72.22
- 72.22 - 76.8
- 76.8 - 81.31

Figure 5.

Avg Upstream Mean Annual Precipitation (mm)
- 444 - 512
- 512 - 671
- 671 - 780
- 780 - 900
- 900 - 1137

Figure 6.

08080700
08079550 08080910
08080950 08082180
08081000 08082000
08079600 08081200
0808500
08082500

Figure 7.

Change in Contributing Area (sq. miles)
- -9218
- -9217 - -6774
- -6773 - -5844
- -5843 - -2242
- -2241 - -772
- -771 - -573
- -572 - -0.01
- 0

Figure 8.

Change in CN
- -9 - -5
- -5 - -3
- -3 - >0
- 0
- 0 - 1.2

Figure 9.

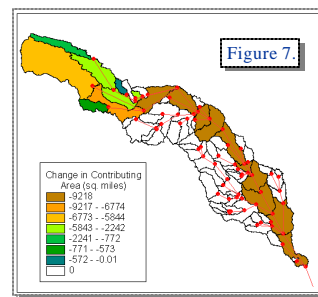Change in Mean Annual Precip (mm)
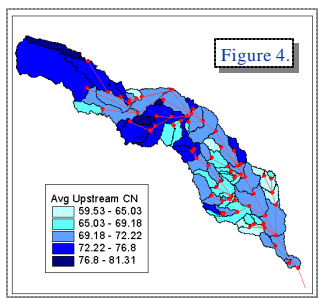- -8.51 - <0
- 0
- 0 - 22
- 22 - 36
- 36 - 45
- 45 - 69

Figures 3, 4 and 5 were generated from the table of hydrologic parameters as noted in the flowchart. Figure 6 identifies the control points (in red) with non-contributing area in their subwatersheds. The right column of Table 1 (% difference) is used as the adjustment factor to reduce contributing area per subwatershed of Figure 1. The result is displayed in Figure 7. The incremental CN and precipitation per subwatershed is calculated. These incremental parameter values are preserved. However, the weighting of the incremental parameters in the calculation of the upstream average parameter is changed. Equation 1 is used to adjust the upstream average parameter values based on the reduced contributing area per subwatershed. The results are displayed in Figures 8 and 9.
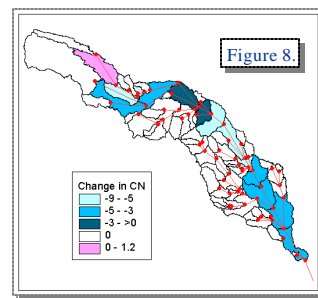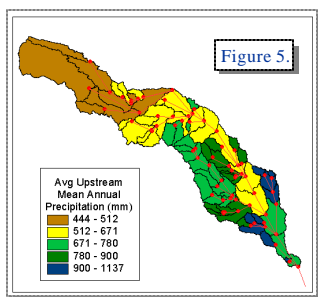
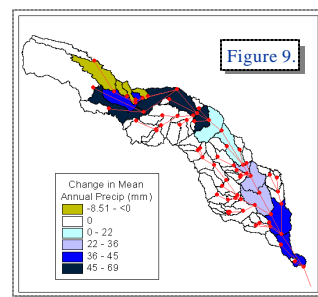| Control Point Id	USGS Total Upstream Area (sq.mi.)	USGS Contributing Area	Incremental Non-Contributing Area	% Diff in Incremental Drainage Area
08079550	5588	236	5352	-95.8
08079600	1466	244	1222	-83.4
08080500	8796	1864	358	-20.6
08080700	1291	382	909	-70.4
08080910	3069	689	1471	-82.7
08080950	431	279	152	-35.3
08081000	4619	1985	102	-9.1

Table 1.

$$\overline{P} = \frac{P_1 A_1 + P_2 A_2 + ... + P_n A_n}{A_T}$$

Equation 1.

$\overline{P}$ = area weighted upstream average parameter value at a control point
P_i = incremental parameter value of a control point upstream of the location of $\overline{P}$
A_i = contributing area corresponding to P_i's subwatershed
A_T = summation of A_i's