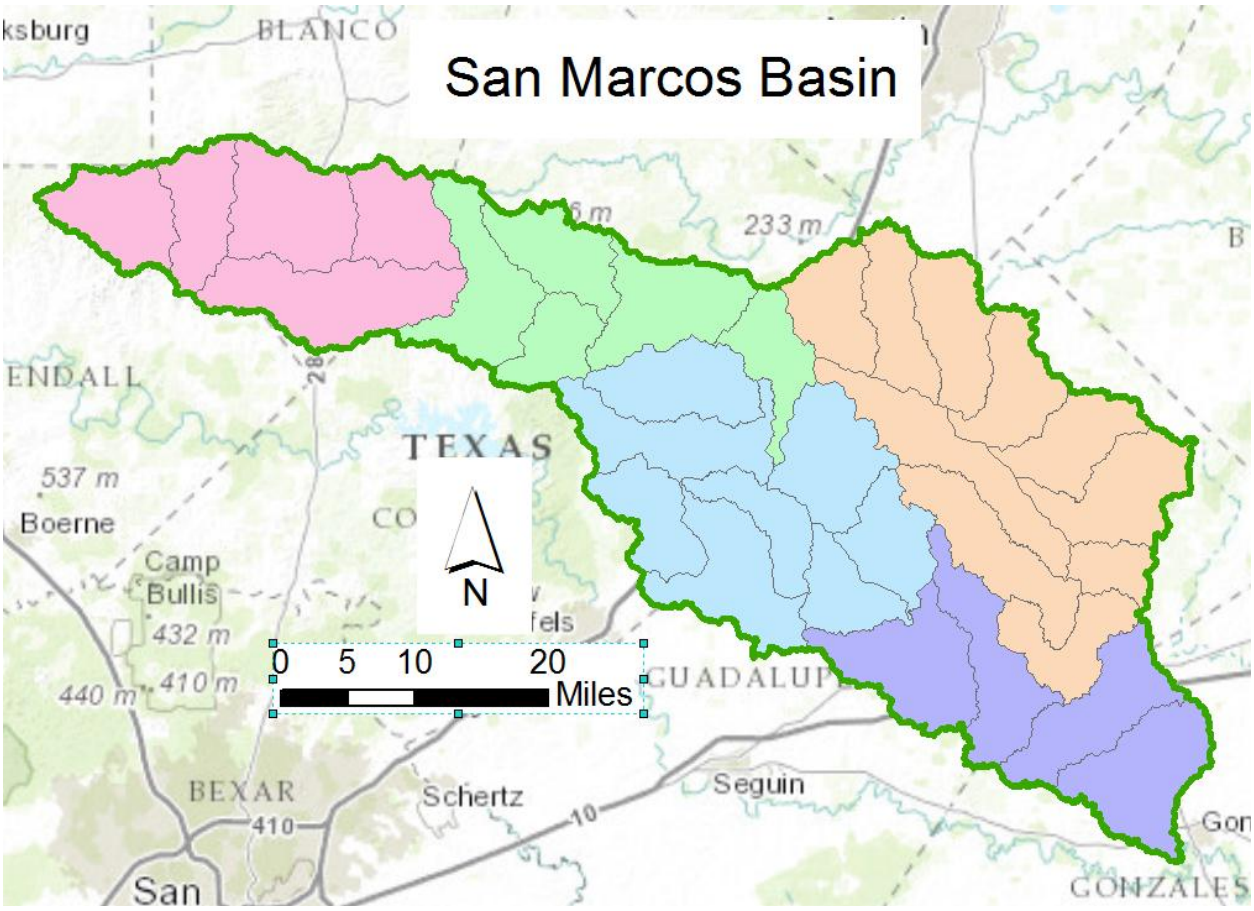
CEE6440 GIS in Water Resources Ex 2 Solution

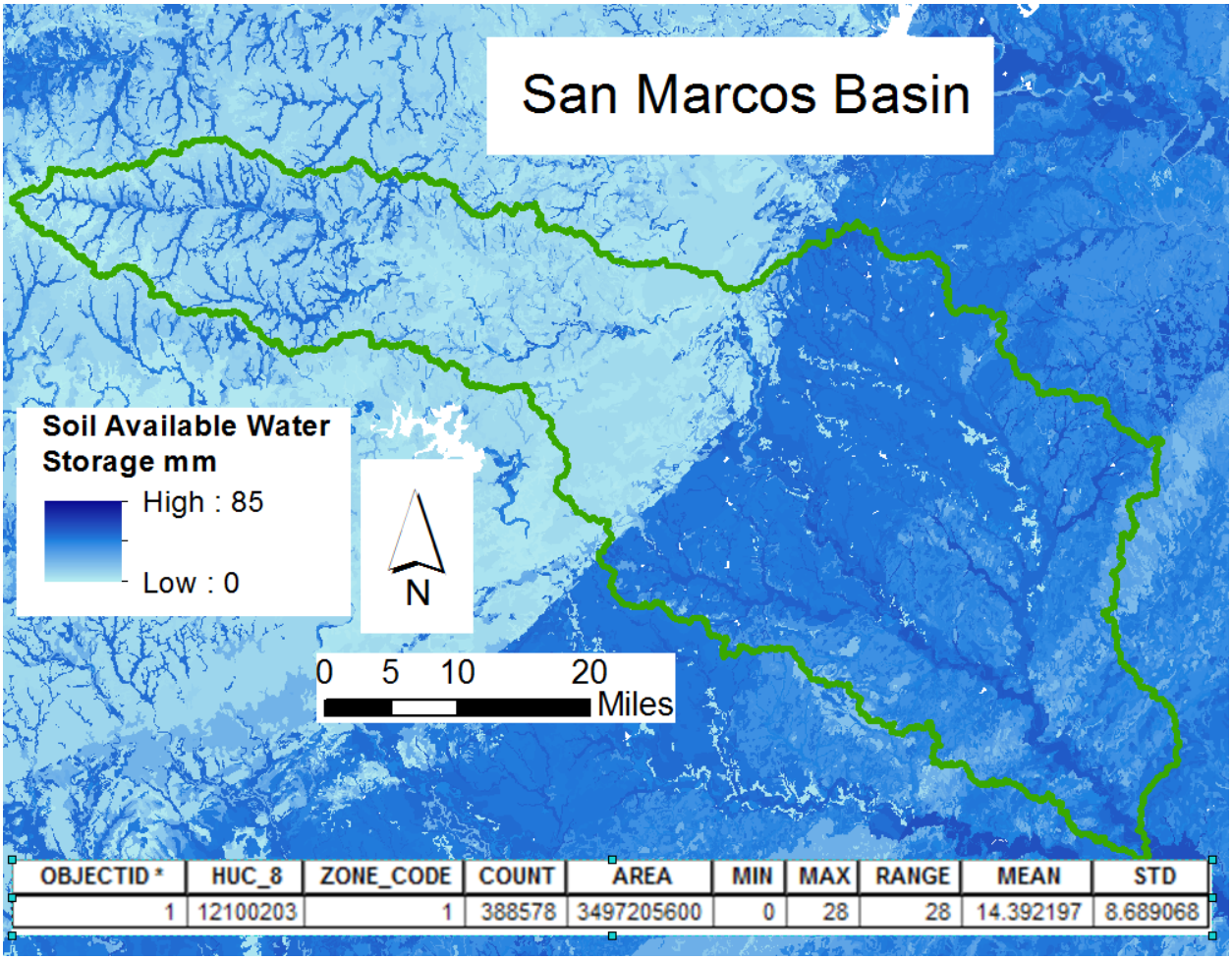


San Marcos Basin with Watersheds (HUC10) colored and Subwatersheds (HUC12) delineated as lines

There are 5 HUC10 watersheds and 32 HUC12 subwatersheds.

Note the terminology used for the HUC hierarchy in the Watershed Boundary Dataset is

- Region - HUC2
- Subregion - HUC4
- Basin - HUC6
- Subbasin - HUC8
- Watershed - HUC10
- Subwatershed - HUC 12



OBJECTID *	HUC_8	ZONE_CODE	COUNT	AREA	MIN	MAX	RANGE	MEAN	STD
1	12100203	1	388578	3497205600	0	28	28	14.392197	8.689068

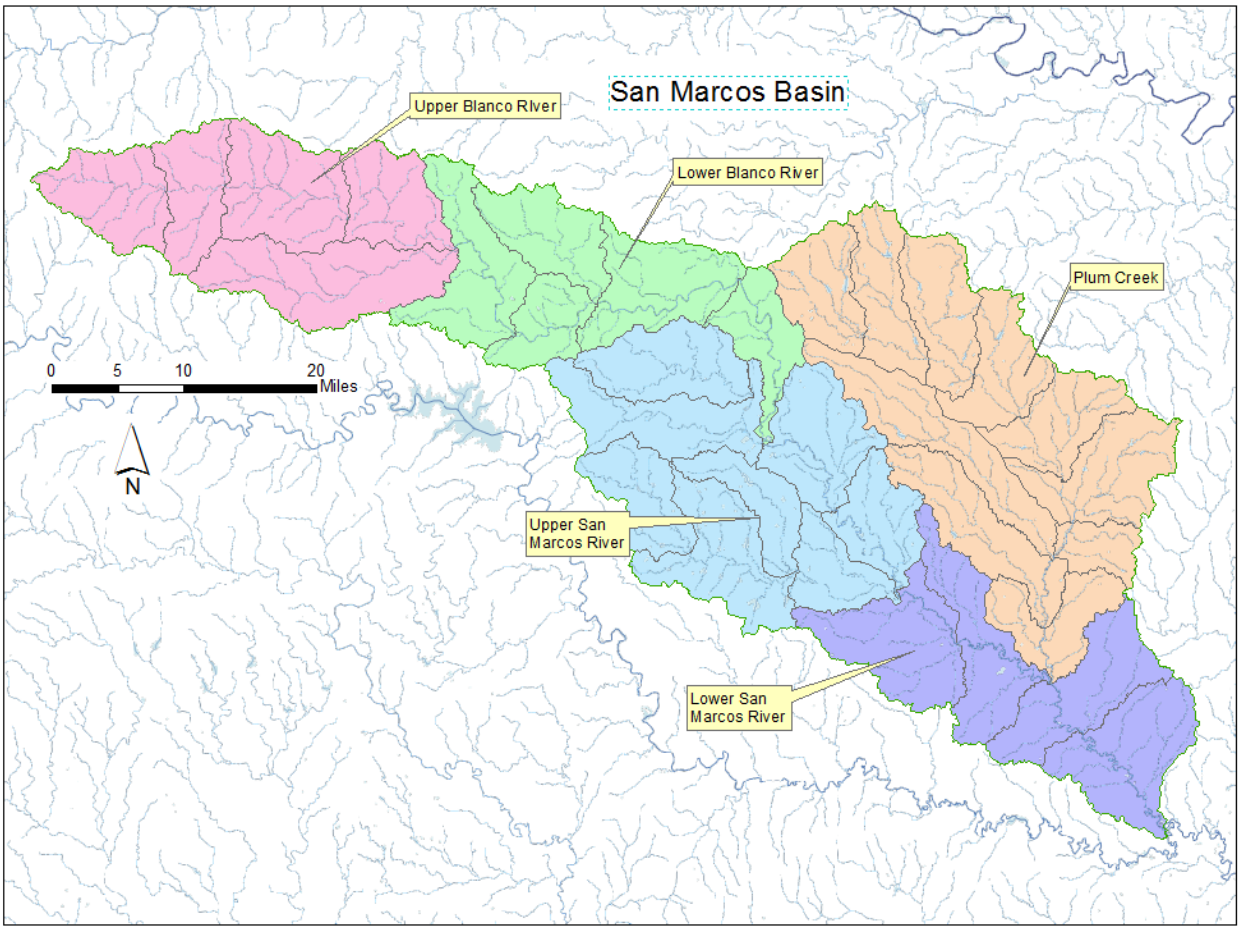
San Marcos Soil Available Water Map

Note the higher storage due to deeper soils in river valleys due to alluvial accumulations. Note that in the area to the SE soils are deeper as the topography is flatter.

Average depth = 14.39 cm

Area = 3497 km^2

Volume = 3497 x 10^6 m^2 x 0.1439 m = 5.03 x 10^8 m^3 = **0.503 km^3**



5 HUC-10 Watersheds in San Marcos Basin

Watershed	Total Drainage Area (km^2)	Incremental Area	Mean Annual Flow (cfs)	Temperature (C)	Precipitation (mm)	Mean Annual Flow per unit area (mm)
Upper Blanco*	618.96	618.96	68.137	19.29	912.35	98.3715
Lower Blanco	1129.57	510.61	123.757	19.98	930.23	97.90514
Upper San Marcos*	1965.32	835.75	311.907	20.12	921.96	141.8211
Plum Creek	1007.48	1007.48	152.817	20.28	933.12	135.5452
Lower San Marcos	3520.44	547.64	577.063	20.42	933.36	146.4789

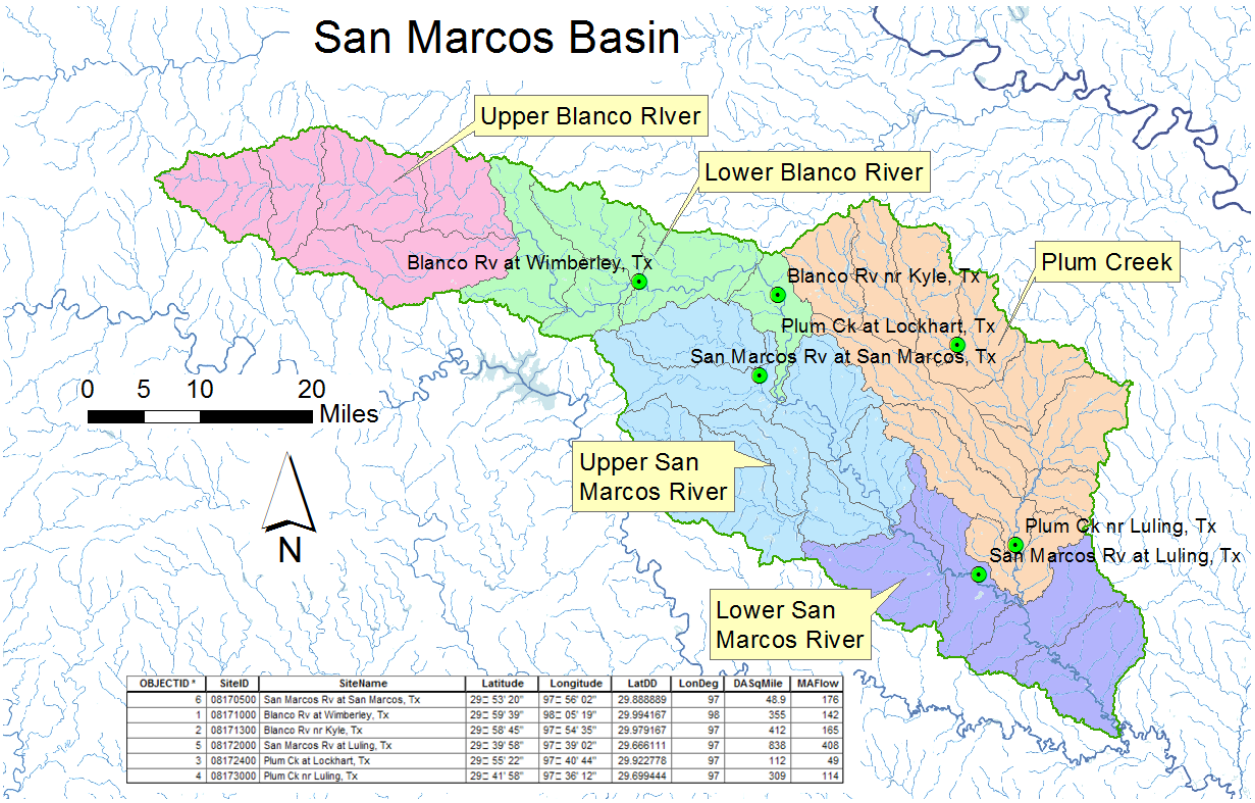
* Note that for the Upper Blanco and Upper San Marcos the reach downstream of the two that join at the outlet was chosen to get the aggregate result. There is a small error due to inclusion of the catchment draining directly to the downstream reach.

Mean Annual flow is the Gage Adjusted Flow

Mean annual flow per unit area is Mean annual flow in cfs divided by area in km^2 times

0.3048^3 m^3/ft^3 *3600*24*365.25 s/yr /1000000 m^2/km^2 * 1000 mm/m = 893.6

It is interesting to see that the per unit area flow increases as we move downstream, while the precipitation remains about the same. This is likely due to inputs from the St Edwards Aquifer. Note that runoff ratios are between 0.1 and 0.15 which is expected for this part of the world.



OBJECTID *	SiteID	SiteName	Latitude	Longitude	LatDD	LonDeg	DASqMile	MAFlow
6	08170500	San Marcos Rv at San Marcos, Tx	29□ 53' 20"	97□ 56' 02"	29.888889	97	48.9	176
1	08171000	Blanco Rv at Wimberley, Tx	29□ 59' 39"	98□ 05' 19"	29.994167	98	355	142
2	08171300	Blanco Rv nr Kyle, Tx	29□ 58' 45"	97□ 54' 35"	29.979167	97	412	165
5	08172000	San Marcos Rv at Luling, Tx	29□ 39' 58"	97□ 39' 02"	29.666111	97	838	408
3	08172400	Plum Ck at Lockhart, Tx	29□ 55' 22"	97□ 40' 44"	29.922778	97	112	49
4	08173000	Plum Ck nr Luling, Tx	29□ 41' 58"	97□ 36' 12"	29.699444	97	309	114

Map of Labeled Gages

Table of flow and area at gages

SiteID (1)	SiteName (2)	Latitude (3)	Longitude (4)	DA SqMile (5)	MAFlow (cfs) (6)	NHD Area (sq km) (7)	NHD Flow (cfs) (8)	NHD Area Sq mi (9)
08171000	Blanco Rv at Wimberley, Tx	29° 59' 39"	98° 05' 19"	355	142	922.07	166.4	360.2
08171300	Blanco Rv nr Kyle, Tx	29° 58' 45"	97° 54' 35"	412	165	1074	166.48	419.5
08172400	Plum Ck at Lockhart, Tx	29° 55' 22"	97° 40' 44"	112	49	318.03	56.8	124.2
08173000	Plum Ck nr Luling, Tx	29° 41' 58"	97° 36' 12"	309	114	808.35	139.6	315.8
08172000	San Marcos Rv at Luling, Tx	29° 39' 58"	97° 39' 02"	838	408	2189.7	451.87	855.4
08170500	San Marcos Rv at San Marcos, Tx	29° 53' 20"	97° 56' 02"	48.9	176	129.09	21.51	50.4

Column (7) gives the NHD area corresponding to each gage. This is converted to sq miles by dividing by $(1.6)^2$ in column 9. These areas are slightly larger than column 5 reflecting that they are at the downstream end of the reach where the gage occurs.

Column (8) gives the NHD flow. These are mostly slightly larger than the observed flow in column (6) for the same reason (slightly larger area). The exception is the San Marcos River at San Marcos where the mean annual flow of 176 cfs is significantly larger than the NHD value. This is due to springs that supply this flow that are not part of the NHD calculations.