CALCULATIONS TO DETERMINE THE IMPERVIOUS AREA TO BE USED FOR EXISTING CONDITIONS MODEL

The Multi-Resolution Land Characteristics Consortium (MRLC) produced a database of impervious surfaces fro the entire United States from 2001 satellite imagery. These data consist of 30m by 30 m resolution raster data (Pate).

In 2009 Travis Pate evaluated the accuracy of this data base by comparing the values of imperviousness from the MRLC data base, as queried using GIS, to values for the same area (Chapel Hill, NC) using digitized planimetric maps.

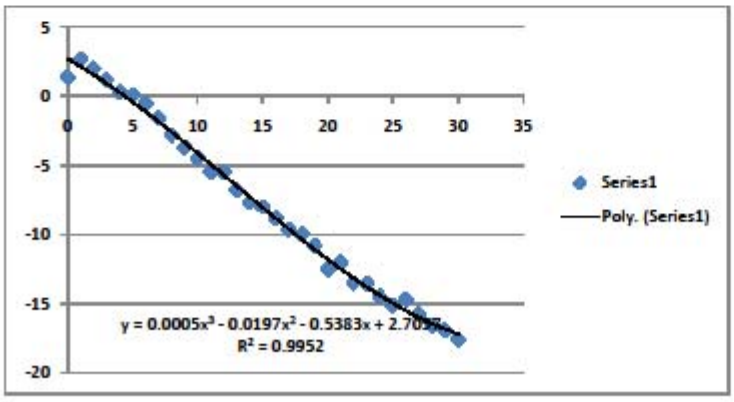
His findings showed that as the imperviousness increased, the MRLC data constantly under reported the percentage of imperviousness by an increasing amount as the actual percentage of imperviousness increased.

Using his data, as provided in this paper "Error Analysis of Impervious Surface Imagery in North Carolina", a best fit equation is developed to adjust MRLC data to more accurately report the percentage of impervious area for a watershed.

The following calculations show this the curve fitting, and verification tests in Sub-basins CC-3 and W-4 of the South Diversion Channel Watershed.

DATA FROM TRAVIS PATE'S PAPER

% Imperviousness	Mean Error
0	1.4
1	2.7
2	2
3	1.2
4	0.3
5	0.1
6	-0.5
7	-1.6
8	-2.8
9	-3.7
10	-4.5
11	-5.5
12	-5.5
13	-6.8
14	-7.7
15	-8
16	-8.8
17	-9.6
18	-10
19	-10.8
20	-12.5
21	-12
22	-13.5
23	-13.5
24	-14.5
25	-15.1
26	-14.7
27	-15.8
28	-16.6
29	-16.9
30	-17.6



	Percent D- Satellite	Estimated Error	Perc. D- Sat. Adjusted	BHI Stadium	AMDS II
V-1	38	-19	57	35	45
V-2	37	-19	56	35	45
W-1	54	-5	59	35	45
V-3	50	-11	61	35	45
W-2	57	0	57	35	45
X-1	42	-17	60	35	45
Y-1	47	-14	61	35	45
Y-2	46	-15	61	35	45
W-4	43	-17	60	35	45
W-3	44	-17	60	35	45
W-5	30	-17	47	35	45
Z-1	36	-19	54	35	12
BB-3	43	-17	60	35	14
BB-4	42	-17	60	35	45
BB-6	32	-18	51	35	45
CC-3	39	-19	57	35	5
BB-2	40	-18	58	60	5
BB-5	32	-18	50	35	45
BB-7	31	-18	49	35	45
BB-1A	41	-18	59	60	11
BB-1B	19	-11	30	60	11
BB-8	48	-14	61	65	6
BB-9	38	-19	56	35	45
BB-10	37	-19	56	35	45
CC-4	3	1	2		0
CC-5	35	-19	53		16
CC-7	13	-7	20		0
CC-6	41	-18	59		45
BB-11	24	-15	39	35	7
BB-12	43	-17	60	35	45
CC-2	30	-18	47		20
CC-8	45	-16	61		9
CC-10	42	-18	59		5
CC-9	29	-17	46		10
EE-1	47	-15	61		9
EE-2	47	-14	61		16
EE-4	54	-5	59		45
CC-11	43	-17	60		15
CC-1	10	-4	14		45
CC-12	40	-18	58		4
EE-5	43	-17	60		16
GG-1	18	-11	29		6
HH-2	40	-18	58		8
HH-1	4	0	4		0
JJ-1	11	-5	15		0
KK-1	15	-8	22		0
KK-2	38	-19	57		9
LL-1	10	-4	14		2
MM-1	16	-9	25		12
NN-1	21	-13	34		0
PP-1	6	-1	6		
QQ-1	22	-13	35		
RR-1	26	-16	42		
SS-1	18	-10	28		

Analysis of Sub-Basin CC-3 to determine the validity of the Adjusted Satellite impervios value of 57

Total Area of Sub-basin CC-3

$T_A := 2614535.7\,ft^2 = 60.021\cdot acre$

Area in Industrial/Commercial Use Based on Orthophoto

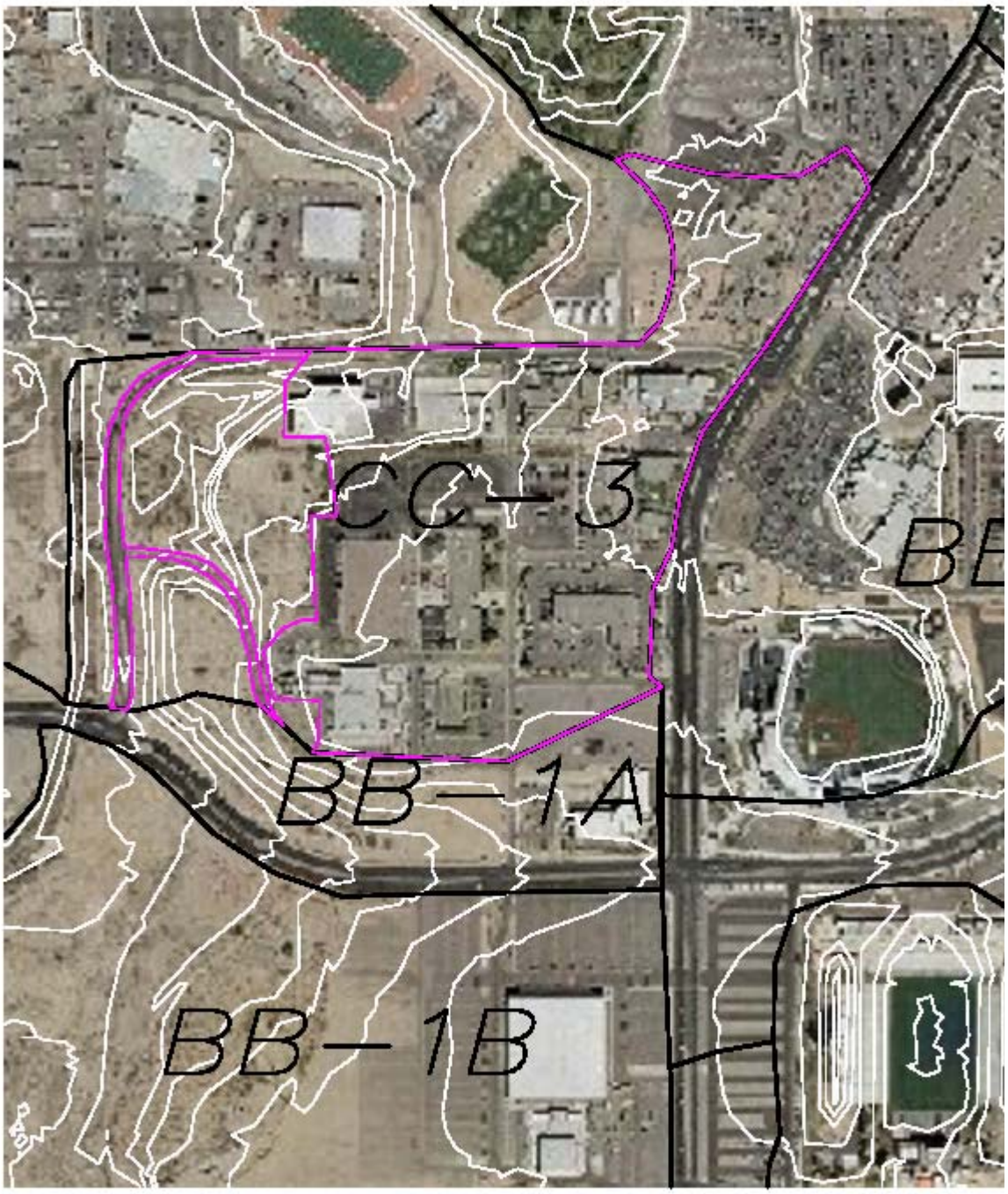
$T_I := 89161.16\,ft^2 + 1783050.81\,ft^2 = 43\cdot acre$ Measured in AutoCad -The following page shows this measurement

Calculate Percentage of Area in Industrial/Commercial Use

$P_I := \frac{T_I}{T_A}\cdot 100 = 71.6$

Using an 85% imperviosness for Industrial/Commercial - Calculate the percentage Impervious

$P_{Impervious} := P_I\cdot 0.85 = 61$


CC—3
BB—1A
BB—1B

Analysis of Sub-basin W-4

The Satellite Derived Imperviousness after adjustment is 60 and before adjustment was 43

Based on Orthophotography and the COA GIS website the lots generally appear to be of the same size within this sub-basin.

A lot measured in Google Earth on Stanford Street between Lead and Silver

$$\text{Area} := 180\,\text{ft} \cdot 50\,\text{ft} = 9000\,\text{ft}^2$$

$$\frac{\text{DU}}{\text{Acre}} = \blacksquare \qquad N := \frac{43560}{9000} = 4.84 \qquad N := 5$$

Use Equation from Table A-5 of Section 2, Chapter 22 of the COA DPM to calculate are of impervious using the traditional method for residential areas.

$$D_{Percent} := 7 \cdot \sqrt{[(N \cdot N) + (5 \cdot N)]} = 49$$

The Orthopoto on the next page shows the general area where this measurement was taken. It can be seen that there are apartment complexes and lots with multiple structures intermixed with residential lots. This makes since as the area is zoned SU-2. In light of these facts an adjusted value of 60 seems reasonable

Based on the Analysis of these two basins the Adjusted Satellite Values appear to be a valid means of estimating the impervious area within the watershed. Some of the Sub-basins will need to be further adjusted as development has occured since 2001 when the impervious data was gathered.


SILVER
STANFORD
LEAD
Google