

CALCULATION OF TIME OF CONCENTRATION FOR ALL SUB-BASINS NOT COVERED IN BHI RESTUDY OF THE AMDS

$i := 1 \dots 3$ There are up to 3 reach lengths for each sub-basin j . A 0 length value indicates that that reach is not applicable.

$j := 1 \dots 33$ 32 sub-basins

In the following tables, row numbers represent sub-basins (j) and column numbers represent reach lengths (i).

Basins
 L_w
 L_{Total}
 L_{CA}
 K_w
 K_N
 $Elev_{up}$
 $Elev_{down}$

:=

BASINS	L 1	L 2	L 3	L Tot.	L _{CA}	K 1	K 2	K 3	K _N	Elev US 1	Elev US 2	Elev US 3	Elev DS 1	Elev DS 2	Elev DS 3
AA-1A	400	200	982	1582	NA	0.7	2	3	NA	5100	5091	5070	5091	5070	5049
BB-1A	400	310	1602	2312	NA	1	2	3	NA	5113	5102	5089	5102	5089	5040
BB-1B	400	904	1396	2700	NA	0.7	2	3	NA	5108	5104	5090	5104	5090	5030
BB-2A	400	1310	2180	3890	NA	1	2	3	NA	5165	5163	5140	5163	5150	5106
BB-2B	400	1110		1510	NA	0.7	0.7	0	NA	5192	5178		5178	5156	
CC-2	400	654	2707	3761	NA	1	2	3	NA	5170	5140	5120	5140	5120	5040
CC-3	400	757	1782	2939	NA	0.7	2	3	NA	5128	5120	5110	5120	5110	5040
CC-4	400	1600	200	2200	NA	1	2	3	NA	5100	5092	5034	5092	5034	5030
CC-5	400	1218	2444	4062	1908	1	2	3	0.021	5214	5198	5157	5198	5157	5081
CC-6	3068	0	0	3068	NA	3	0	0	NA	5300	0	0	5165	0	0
CC-8	3999	0	0	3999	NA	3	0	0	NA	5300	0	0	5150	0	0
CC-9	2046	1439	0	3485	NA	3	3	0	NA	5326	5320	0	5320	5275	0
CC-10	400	976	2756	4132	1852	0.7	2	3	0.021	5324	5320	5286	5320	5286	5180
CC-11	3040	0	0	3040	NA	3	0	0	NA	5155	0	0	5050	0	0
CC-12	400	682	3296	4378	2283	1	2	3	0.021	5280	5264	5233	5264	5233	5062
EE-1	400	1149	2571	4120	1010	1	3	3	0.021	5196	5184	5147	5184	5147	5040
EE-2	1776	3988	0	5764	4216	3	3	0	0.021	5325	5324	0	5324	5192	0
EE-4	400	1603	775	2778	NA	1	3	3	NA	5288	5265	5200	5265	5200	5192
EE-5	400	1233	3944	5577	3644	1	2	3	0.021	5320	5318	5310	5318	5310	5210
GG-1	400	3900	0	4300	2150	2	3	0	0.021	5162	5132	0	5132	5000	0
HH-1	400	931	5478	6809	2572	1	2	3	0.021	5314	5310	5270	5310	5270	5000
HH-2	400	3446	2163	6009	2160	1	2	3	0.021	5319	5318	5310	5318	5310	5190
JJ-1	400	1981	0	2381	NA	1	3	0	NA	5100	5078	0	5078	5000	0
KK-1	400	1600	2422	4422	2013	1	2	3	0.025	5190	5171	5084	5171	5084	4990
KK-2	3212	340	1516	5068	2190	3	3	3	0.021	5312	5300	5250	5300	5250	5196
LL-1	400	1600	2781	4781	2025	1	2	3	0.025	5262	5230	5149	5230	5149	5000
MM-1	400	1339	4513	6252	2580	1	2	3	0.021	5310	5295	5250	5295	5250	5000
NN-1	4601	0	0	4601	470	3	0	0	0.021	5268	0	0	4970	0	0
PP-1	685	3354	0	4039	1399	1	3	0	0.021	5270	5160	0	5160	4970	0
QQ-1	400	2225	0	2625	NA	0.7	3	0	NA	5172	5140	0	5140	5000	0
SS-1	1528	655	2713	4896	1686	3	3	3	0.025	5280	5130	5075	5130	5075	4970
TT-1	400	2187	0	2587	NA	1	3	0	0.021	5040	5025	0	5025	4990	0
UU-1	400	1000	0	1400	NA	0.7	2	0	0.021	5000	4992	0	4992	4980	0

$$S_{j,i} := \begin{cases} 0 & \text{if } L_{j,i} = 0 \\ \frac{[\text{Elev}_{\text{up}(j,i)} - \text{Elev}_{\text{down}(j,i)}]}{L_{j,i}} & \text{otherwise} \end{cases} \quad S_{\text{Overall},j} := \frac{[L_{j,1} \cdot S_{j,1} + L_{j,2} \cdot S_{j,2} + L_{j,3} \cdot (S_{j,3})]}{L_{\text{Total},j}}$$

Calculate Composite K for those Subbasins with flow paths greater than 4000'

$$K_{\text{Composite},j} := \left(\frac{L_{\text{Total},j}}{\sqrt{S_{\text{Overall},j}}} \right) \left[\frac{L_{j,1}}{(K_{j,1} \cdot \sqrt{S_{j,1}})} + \begin{cases} 0 & \text{if } K_{j,2} = 0 \\ 0 & \text{if } S_{j,2} = 0 \\ \frac{L_{j,2}}{(K_{j,2} \cdot \sqrt{S_{j,2}})} & \text{otherwise} \end{cases} + \begin{cases} 0 & \text{if } K_{j,3} = 0 \\ 0 & \text{if } S_{j,3} = 0 \\ \frac{L_{j,3}}{(K_{j,3} \cdot \sqrt{S_{j,3}})} & \text{otherwise} \end{cases} \right]$$

Calculate the Tc for each segment for those flow paths less than 4000'

$$T_{c,j,i} := \begin{cases} 0 & \text{if } K_{j,i} = 0 \\ 0 & \text{if } S_{j,i} = 0 \\ \left(\frac{L_{j,i}}{36000 \cdot K_{j,i} \cdot \sqrt{S_{j,i}}} \right) & \text{otherwise} \end{cases}$$

$$T_{ct,j} := \left[\begin{aligned} &\text{if } (L_{\text{Total},j}) < 4000 \\ &\quad \left[\begin{aligned} &0.133 \text{ if } \sum_i T_{c,j,i} < 0.133 \\ &\sum_i T_{c,j,i} \text{ otherwise} \end{aligned} \right] \\ &\quad \frac{12000 - L_{\text{Total},j}}{72000 \cdot K_{\text{Composite},j} \cdot (\sqrt{S_{\text{Overall},j}})} + \frac{(L_{\text{Total},j} - 4000) \cdot K_{N,j} \cdot \left(\frac{L_{CA,j}}{L_{\text{Total},j}} \right)^{0.33}}{552.2 \cdot (S_{\text{Overall},j})^{0.165}} \text{ otherwise} \end{aligned} \right]$$

Based on
Equation
F-7 from the

South Diversion Channel
Time of Concentration Determination

Basin	Slope 1	Slope 2	Slope 3	Slope Tot.	Tc 1	Tc 2	Tc 3	Tc Total
	(ft/ft)	(ft/ft)	(ft/ft)	(ft/ft)	(hrs)	(hrs)	(hrs)	(hrs)
AA-1A	0.023	0.105	0.021	0.032	0.11	0.01	0.06	0.177
BB-1A	0.028	0.042	0.031	0.032	0.07	0.02	0.08	0.173
BB-1B	0.010	0.015	0.043	0.029	0.16	0.10	0.06	0.322
BB-2A	0.005	0.010	0.016	0.013	0.16	0.18	0.16	0.501
BB-2B	0.035	0.020	0.000	0.024	0.08	0.31	0.00	0.398
CC-2	0.075	0.031	0.030	0.035	0.04	0.05	0.15	0.238
CC-3	0.020	0.013	0.039	0.030	0.11	0.09	0.08	0.287
CC-4	0.020	0.036	0.020	0.032	0.08	0.12	0.01	0.208
CC-5	0.040	0.034	0.031	0.033	0.06	0.09	0.13	0.273
CC-6	0.044	0.000	0.000	0.044	0.14	0.00	0.00	0.135
CC-8	0.038	0.000	0.000	0.038	0.19	0.00	0.00	0.191
CC-9	0.003	0.031	0.000	0.015	0.35	0.08	0.00	0.425
CC-10	0.010	0.035	0.038	0.035	0.16	0.07	0.13	0.351
CC-11	0.035	0.000	0.000	0.035	0.15	0.00	0.00	0.151
CC-12	0.040	0.045	0.052	0.050	0.06	0.04	0.13	0.223
EE-1	0.030	0.032	0.042	0.038	0.06	0.06	0.12	0.235
EE-2	0.001	0.033	0.000	0.023	0.69	0.20	0.00	0.597
EE-4	0.058	0.041	0.010	0.035	0.05	0.07	0.07	0.191
EE-5	0.005	0.006	0.025	0.020	0.16	0.21	0.23	0.445
GG-1	0.075	0.034	0.000	0.038	0.02	0.20	0.00	0.209
HH-1	0.010	0.043	0.049	0.046	0.11	0.06	0.23	0.282
HH-2	0.003	0.002	0.055	0.021	0.22	0.99	0.09	0.751
JJ-1	0.055	0.039	0.000	0.042	0.05	0.09	0.00	0.140
KK-1	0.048	0.054	0.039	0.045	0.05	0.10	0.11	0.247
KK-2	0.004	0.147	0.036	0.023	0.49	0.01	0.07	0.447
LL-1	0.080	0.051	0.054	0.055	0.04	0.10	0.11	0.231
MM-1	0.038	0.000	0.055	0.042	0.06	0.00	0.18	0.216
NN-1	0.065	0.000	0.000	0.065	0.17	0.00	0.00	0.152
PP-1	0.161	0.057	0.000	0.074	0.05	0.13	0.00	0.177
QQ-1	0.080	0.063	0.000	0.066	0.06	0.08	0.00	0.138
SS-1	0.098	0.084	0.039	0.063	0.05	0.02	0.13	0.19
TT-1	0.038	0.016	0.000	0.019	0.06	0.16	0.00	0.22
UU-1	0.020	0.012	0.000	0.014	0.11	0.13	0.00	0.24
0								

(Basins S S_{Overall} T_c T_{ct})

Velocity Check

Velocity in each segment

$$Vel_{Seg,j,i} := \begin{cases} 0 & \text{if } T_{c,j,i} = 0 \\ \frac{L_{j,i}}{T_{c,j,i} \cdot 3600} & \text{otherwise} \end{cases}$$

BASIN	Vel. Seg. 1	Vel. Seg. 2	Vel. Seg. 3
	(ft/s)	(ft/s)	(ft/s)
AA-1A	1.05	6.48	4.39
BB-1A	1.66	4.10	5.25
BB-1B	0.70	2.49	6.22
BB-2A	0.71	1.99	3.75
BB-2B	1.31	0.99	0.00
CC-2	2.74	3.50	5.16
CC-3	0.99	2.30	5.95
CC-4	1.41	3.81	4.24
CC-5	2.00	3.67	5.29
CC-6	6.29	0.00	0.00
CC-8	5.81	0.00	0.00
CC-9	1.62	5.31	0.00
CC-10	0.70	3.73	5.88
CC-11	5.58	0.00	0.00
CC-12	2.00	4.26	6.83
EE-1	1.73	5.38	6.12
EE-2	0.71	5.46	0.00
EE-4	2.40	6.04	3.05
EE-5	0.71	1.61	4.78
GG-1	5.48	5.52	0.00
HH-1	1.00	4.15	6.66
HH-2	0.50	0.96	7.07
JJ-1	2.35	5.95	0.00
KK-1	2.18	4.66	5.91
KK-2	1.83	11.50	5.66
LL-1	2.83	4.50	6.94
MM-1	1.94	0.00	7.06
NN-1	7.63	0.00	0.00
PP-1	4.01	7.14	0.00
QQ-1	1.98	7.53	0.00
SS-1	9.40	8.69	5.90

(Basins Vel_{Seg})

STADIUM DRAINAGE ANALYSIS
Calculation of Time to Peak
Revised DPM procedure

16-Sep-04

Description	Var.	Unit	Baseline											
Basin			BB-1	BB-2	BB-3	BB-4	BB-5	BB-6	BB-7	BB-8	BB-9	BB-10	BB-11	BB-12
Basin Area		Sq. Mi.	0.0032	0.2187	0.0325	0.0576	0.1706	0.1112	0.1854	0.1009	0.1103	0.0898	0.0784	0.074
Total Reach	L	Feet	2250.0	5500.0	1800.0	2750.0	6000.0	4375.0	6000.0	3750.0	3750.0	2750.0	2375.0	2500.0
Overland Reach	L1	Feet	400.0	400.0	400.0	400.0	400.0	400.0	250.0	375.0	375.0	0.0	350.0	125.0
Overland K	K1		1	1	1	1	1	1	1	1	1	1	1	1
Overland Slope	S1	Percent	2.20	1.50	0.80	1.00	2.00	2.20	0.40	2.40	3.70	4.00	0.90	0.80
Adj. Overland Slope	S1*	Percent	2.200	1.500	0.800	1.000	2.000	2.200	0.400	2.400	3.700	4.000	0.900	0.800
Gully Reach	L2	Feet	0.0	3100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Gully K	K2		2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000	2.000
Gully Slope	S2	Percent	2.200	0.700	0.800	1.000	4.000	4.000	4.000	4.000	4.000	4.000	4.000	3.000
Adj. Gully Slope	S2*	Percent	2.200	0.700	0.800	1.000	4.000	4.000	4.000	4.000	4.000	4.000	4.000	3.000
Arroyo Reach	L3	Feet	1850.0	2000.0	1400.0	2350.0	5800.0	3975.0	5750.0	3375.0	3375.0	2750.0	2025.0	2375.0
Arroyo K	K3		3.000	3.000	3.000	3.000	3.000	3.000	3.000	3.000	3.000	3.000	3.000	3.000
Arroyo Slope	S3	Percent	3.300	1.600	2.400	0.900	2.500	2.400	2.100	1.900	2.600	3.000	3.000	0.320
Adj. Arroyo Slope	S3*	Percent	3.300	1.600	2.400	0.900	2.500	2.400	2.100	1.900	2.600	3.000	3.000	0.320
Loc	Loc	Feet	1200.0	2000.0	1000.0	1400.0	2125.0	2825.0	3000.0	2000.0	1500.0	1350.0	1050.0	1250.0
Base Discharge	Qb	cts	95.0	125.0	45.0	85.0	130.0	100.0	120.0	100.0	100.0	90.0	95.0	95.0
Ground Slope S	S	Percent	3.104	1.085	2.044	0.915	2.467	2.382	2.029	1.950	2.710	3.000	2.691	0.344
Adjusted Slope S'	S'	Percent	3.104	1.085	2.044	0.915	2.467	2.382	2.029	1.950	2.710	3.000	2.691	0.344
K	K		2.086	1.951	1.682	2.346	2.611	2.520	2.452	2.538	2.552	3.000	1.909	2.789
K'	K'		2.086	1.951	1.682	2.346	2.611	2.520	2.452	2.538	2.552	3.000	1.909	2.789
K''	K''		3.890	6.913	4.191	7.026	4.618	4.483	5.019	4.954	4.203	3.919	4.179	11.687
Kn	Kn		2.887	4.738	2.873	4.816	3.165	3.073	3.440	3.398	2.881	2.888	2.884	8.011
Orig. TC	TC	Hrs.	0.021	0.021	0.021	0.021	0.021	0.021	0.021	0.021	0.021	0.021	0.021	0.021
Adjusted TC	TC*	Hrs.	0.169	0.530	0.208	0.340	0.303	0.295	0.354	0.294	0.248	0.147	0.211	0.428
Time Lag	Lg	Hrs.	0.169	0.530	0.208	0.340	0.303	0.295	0.354	0.294	0.248	0.147	0.211	0.428
Time to Peak	TP	Hrs.	0.133	0.354	0.130	0.227	0.202	0.195	0.236	0.195	0.165	0.133	0.140	0.285

FILE: STADB81.WK3

STADIUM DRAINAGE ANALYSIS

Calculation of Time to Peak

Revised DPM procedure

Z1-Sep-93

Description	Vaz	Unit	Basins															
	V-1	V-2	V-3	W-1	W-2	W-3	W-4	W-5	X-1	Y-1	Y-2	Z-1	AA-1					
Basin	Sq. Mi.																	
Basin Area	0.196	0.0527	0.0576	0.1776	0.1301	0.0532	0.1105	0.0831	0.0819	0.0498	0.0999	0.0634	0.1235					
Total Reach	3375.0	7280.0	2730.0	4625.0	5375.0	3000.0	4750.0	3125.0	2675.0	1500.0	3750.0	3250.0	3625.0					
Overland Reach	400.0	400.0	400.0	400.0	0.0	300.0	400.0	400.0	200.0	250.0	400.0	400.0	400.0					
Overland K	1	1	1	1	1	1	1	1	1	1	1	1	1					
Overland Slope	2.50	2.00	1.00	2.00	1.00	3.70	1.00	3.50	1.00	6.40	1.00	6.00	4.00					
Adj. Overland Slope	2.50	2.00	1.00	2.00	1.00	3.70	1.00	3.50	1.00	5.318	1.00	5.197	4.000					
Gully Reach	0.0	250.0	1600.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1600.0	1600.0					
Gully K	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00					
Gully Slope	2.00	1.00	1.00	4.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	3.00	3.200					
Adj. Gully Slope	2.00	1.00	1.00	4.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	3.00	3.200					
Arroyo Reach	2975.0	1600.0	750.0	4225.0	5375.0	2700.0	4350.0	2725.0	2675.0	1250.0	3350.0	1250.0	1625.0					
Arroyo K	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.000					
Arroyo Slope	3.300	1.250	1.900	2.600	1.700	2.100	1.100	2.800	2.800	4.200	2.600	2.600	2.100					
Adj. Arroyo Slope	3.300	1.250	1.900	2.600	1.700	2.100	1.100	2.800	2.800	4.189	2.600	2.600	2.100					
Lea	1700.0	1200.0	1500.0	1600.0	2000.0	1500.0	1600.0	1600.0	1500.0	750.0	2000.0	1600.0	2000.0					
Base Discharge	130.0	85.0	85.0	130.0	110.0	85.0	100.0	95.0	80.0	60.0	100.0	90.0	110.0					
Ground Slope S	1.205	1.356	1.304	2.548	1.700	2.260	1.092	2.890	2.675	4.567	2.429	3.215	2.795					
Adjusted Slope S'	1.205	1.356	1.304	2.548	1.700	2.260	1.092	2.890	2.675	4.483	2.429	3.215	2.795					
K	2.540	2.184	1.792	2.506	3.000	2.568	2.551	2.630	2.399	2.323	2.202	2.051	2.124					
K'	2.540	2.184	1.792	2.506	3.000	2.568	2.551	2.630	2.399	2.271	2.202	2.023	2.124					
K''	4.051	5.771	5.885	4.544	5.398	4.469	6.022	4.033	4.064	2.980	4.639	3.786	4.210					
K'''	2.777	3.956	4.094	3.114	3.700	3.063	4.539	2.764	2.785	2.043	3.042	2.595	2.885					
Ka	0.021	0.021	0.021	0.021	0.021	0.021	0.021	0.021	0.021	0.021	0.021	0.021	0.021					
Orig. TC	0.222	0.246	0.373	0.287	0.309	0.216	0.420	0.210	0.204	0.084	0.303	0.245	0.284					
Adjusted TC	0.222	0.246	0.373	0.287	0.309	0.216	0.420	0.210	0.204	0.085	0.303	0.245	0.284					
Time Lag																		
Time to Peak	0.148	0.164	0.249	0.191	0.206	0.144	0.280	0.140	0.136	0.133	0.202	0.164	0.189					