FEMA Effective Model as of June 18, 2007

TC&R values for FEMA Effective Model

Brays Bayou Watershed

HCFCD TC&R Excel Template

Subwatershed	Drainage Area (acres)	Drainage Area (sq.mi.)	Watershed Length (mi.) L	Length to Centroid(mi.) Lca	Channel Slope(ft./mi) S	Overland Slope(ft./mi.) So	D	Percent Urban Development 2002 DLU	Percent Channel Improvement DCI	Percent Channel Conveyance DCC	Percent Ponding DPP	DLU affected by Detention DET	Percent Impervious 2002	(TC+R)''	TC''	R''	DLU Minimum	DLU *(Detention)*
D100A	1440.0	2.25	3.15	1.19	3.20	10.00	2.46	51.75	100.00	65.00	0.00	13.91	31.67	9.63	0.79	8.84	32.21	37.84
D132A	883.2	1.38	2.35	1.06	3.20	10.00	2.46	83.04	100.00	65.00	0.00	13.33	50.17	5.17	0.62	4.56	32.21	69.71
D132B	2028.8	3.17	4.23	1.87	3.20	10.00	2.46	78.72	100.00	65.00	0.00	3.53	46.84	7.44	1.10	6.34	32.21	75.19
D100B	850.6	1.33	2.31	1.03	3.41	10.00	2.46	37.02	100.00	80.00	0.00	12.64	25.89	8.34	0.69	7.65	24.06	24.38
D100C	355.2	0.56	1.31	0.82	2.47	10.00	2.46	74.57	100.00	80.00	0.00	0.00	56.86	2.93	0.53	2.41	24.06	74.57
D129A	2050.6	3.20	3.14	1.54	3.60	10.00	2.46	53.20	75.00	100.00	0.00	10.61	37.93	5.61	1.17	4.43	17.59	42.59
D129B	844.2	1.32	2.30	1.12	4.02	10.00	2.46	82.92	100.00	100.00	0.00	3.41	50.72	2.84	0.55	2.28	17.59	79.51
D100D	963.8	1.51	1.96	1.03	3.17	10.00	2.46	34.49	100.00	75.00	0.00	18.92	26.57	7.69	0.71	6.98	26.34	26.34
D100E1	842.9	1.32	2.00	1.13	4.55	10.00	2.46	36.12	100.00	100.00	0.00	5.47	25.27	4.69	0.64	4.05	17.59	30.65
D126A	1178.2	1.84	3.40	1.72	4.48	10.00	2.46	65.15	100.00	100.00	0.00	12.17	49.15	4.74	0.92	3.81	17.59	52.98
D100E2	384.0	0.60	1.44	0.76	4.55	10.00	2.46	92.40	100.00	100.00	0.00	5.00	60.91	1.83	0.33	1.50	17.59	87.40
D124A	1881.6	2.94	3.78	1.47	4.41	10.00	2.46	64.20	100.00	100.00	0.00	4.49	53.40	4.73	0.77	3.96	17.59	59.71
D122A	1943.7	3.04	3.50	1.52	3.70	10.00	2.46	53.84	100.00	100.00	0.00	12.51	36.53	6.12	0.94	5.18	17.59	41.33
D122B	1380.5	2.16	2.95	1.16	7.14	10.00	2.46	78.16	100.00	100.00	0.00	3.34	50.16	2.88	0.43	2.44	17.59	74.82
D100F	497.9	0.78	1.48	0.67	3.46	10.00	2.46	59.30	100.00	100.00	0.00	7.46	49.17	2.93	0.39	2.53	17.59	51.84
D142A	1379.2	2.16	3.23	1.62	4.15	10.00	2.46	91.97	100.00	100.00	0.00	3.85	66.81	3.32	0.78	2.55	17.59	88.12
D120A	844.8	1.32	2.31	0.94	3.70	10.00	2.46	74.07	100.00	100.00	0.00	8.26	40.06	3.33	0.51	2.82	17.59	65.81
D120B	1347.2	2.11	2.87	1.33	6.66	10.00	2.46	72.79	100.00	100.00	0.00	4.13	50.44	3.06	0.53	2.53	17.59	68.66
D100G	863.4	1.35	2.49	1.1	4.41	10.00	2.46	85.25	100.00	100.00	0.00	5.86	57.00	2.90	0.52	2.39	17.59	79.39
CITYA	721.9	1.13	2.44	1.35	3.70	10.00	2.46	95.96	100.00	45.00	0.00	0.00	62.62	5.80	0.65	5.14	53.99	95.96
D100H	327.0	0.51	1.60	0.57	2.35	10.00	2.46	91.45	100.00	100.00	0.00	0.00	62.99	2.41	0.34	2.07	17.59	91.45
D118A	3543.7	5.54	5.30	1.94	3.70	10.00	2.46	48.31	80.00	80.00	10.00	0.00	30.55	9.16	1.40	7.76	24.06	48.31
D118B	1709.4	2.67	2.40	0.82	2.87	10.00	2.46	59.96	100.00	80.00	0.00	1.65	38.04	5.04	0.52	4.52	24.06	58.31
D118C	3168.0	4.95	3.83	1.18	3.78	10.00	2.46	73.69	100.00	100.00	0.00	2.42	48.70	4.47	0.63	3.84	17.59	71.27
D118D	1704.3	2.66	3.48	1.73	3.70	10.00	2.46	63.58	100.00	100.00	0.00	2.40	47.48	4.67	0.99	3.68	17.59	61.18
D118E	1465.6	2.29	2.45	1.14	3.70	10.00	2.46	70.62	100.00	100.00	0.00	3.80	48.23	3.43	0.62	2.81	17.59	66.82
D100I	1098.9	1.72	2.50	0.84	3.56	10.00	2.46	89.92	100.00	100.00	0.00	2.91	53.17	2.95	0.42	2.53	17.59	87.01
D133A	2912.0	4.55	4.53	2.56	4.04	10.00	2.46	89.21	100.00	33.00	0.00	0.18	63.29	12.36	1.27	11.08	83.48	89.03
D140A	2235.5	3.49	2.71	1.39	3.70	10.00	2.46	45.37	100.00	77.00	0.00	2.15	35.04	6.38	0.85	5.53	25.39	43.22
D140B	1536.6	2.40	3.00	1.1	3.57	10.00	2.46	73.75	100.00	57.00	0.00	9.00	45.05	7.06	0.62	6.44	38.74	64.75
D140C1	490.9	0.77	1.99	0.77	2.68	10.00	2.46	77.37	100.00	90.00	0.00	0.91	48.61	3.36	0.47	2.89	20.39	76.46
D11202	238.1	0.37	1.66	0.8	3.42	10.00	2.46	78.85	100.00	90.00	0.00	0.00	46.65	2.65	0.42	2.23	20.39	78.85
D11209	115.8	0.18	0.98	0.45	3.42	10.00	2.46	90.16	100.00	90.00	0.00	0.00	52.95	1.67	0.22	1.45	20.39	90.16
D140C2	888.3	1.39	2.78	1.5	2.68	10.00	2.46	85.32	100.00	90.00	0.00	0.50	60.72	3.96	0.92	3.05	20.39	84.82
D100J	4069.1	6.36	4.45	2.32	4.37	10.00	2.46	92.70	100.00	99.00	0.00	0.05	63.39	3.99	1.08	2.91	17.84	92.65
D13904	565.8	0.88	1.46	0.56	5.01	10.00	2.46	96.38	100.00	100.00	0.00	0.00	57.62	1.67	0.22	1.45	17.59	96.38
D139A	340.5	0.53	1.69	0.72	5.01	10.00	2.46	99.73	100.00	100.00	0.00	0.19	60.86	1.81	0.28	1.53	17.59	99.54
D100K	866.6	1.35	2.30	1.25	3.41	10.00	2.46	92.10	100.00	88.00	0.00	4.21	60.11	3.18	0.65	2.52	21.05	87.89
D112A1	189.4	0.30	0.94	0.39	2.64	10.00	2.46	99.93	100.00	85.00	0.00	0.00	55.52	1.75	0.21	1.55	22.10	99.93
D112A2	247.7	0.39	1.15	0.54	2.64	10.00	2.46	93.47	100.00	85.00	0.00	0.00	56.58	2.11	0.30	1.81	22.10	93.47
D112A3	87.0	0.14	0.56	0.21	3.70	10.00	2.46	100.00	100.00	85.00	0.00	0.00	52.83	1.08	0.09	0.99	22.10	100.00
D112A4	142.7	0.22	0.83	0.35	3.70	10.00	2.46	95.25	100.00	85.00	0.00	0.00	53.45	1.47	0.16	1.31	22.10	95.25
D112A5	134.4	0.21	0.98	0.4	3.70	10.00	2.46	90.99	100.00	85.00	0.00	0.00	59.00	1.71	0.18	1.52	22.10	90.99
D112B1	490.9	0.77	1.51	0.64	5.23	10.00	2.46	60.63	90.00	90.00	0.00	0.00	47.35	2.55	0.32	2.24	20.39	60.63
D112B2	179.8	0.28	0.89	0.3	3.70	10.00	2.46	96.90	90.00	100.00	0.00	0.00	60.04	1.31	0.15	1.16	17.59	96.90
D112B3	366.7	0.57	1.40	0.57	3.70	10.00	2.46	53.38	90.00	100.00	0.00	1.22	34.11	2.74	0.35	2.39	17.59	52.16
D112B4	1033.6	1.62	2.86	1.01	5.23	10.00	2.46	84.81	90.00	95.00	0.00	0.19	51.36	3.04	0.47	2.57	18.90	84.62
D115A	2384.0	3.73	4.02	2.44	3.70	10.00	2.46	91.65	100.00	50.00	0.00	2.39	59.90	7.83	1.27	6.56	46.56	89.26
D113A	922.2	1.44	3.21	1.82	3.70	10.00	2.46	93.91	100.00	50.00	0.00	1.39	59.70	6.52	0.91	5.60	46.56	92.52
D100L	2407.0	3.76	3.70	1.98	3.65	10.00	2.46	79.47	100.00	96.00	0.00	2.31	52.61	4.36	1.08	3.28	18.62	77.16
D111A	1329.9	2.08	2.93	1.64	3.70	10.00	2.46	95.27	100.00	50.00	0.00	0.00	58.22	5.99	0.81	5.18	46.56	95.27
D100M	533.1	0.83	1.58	0.52	4.20	10.00	2.46	90.84	100.00	96.00	0.00	1.08	61.39	2.05	0.23	1.82	18.62	89.76

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TC&R values for FEMA Effective Model

Brays Bayou Watershed

HCFCD TC&R Excel Template

Subwatershed	Drainage Area (acres)	Drainage Area (sq.mi.)	Watershed Length (mi.) L	Length to Centroid(mi.) Lca	Channel Slope(ft./mi) S	Overland Slope(ft./mi.) So	D	Percent Urban Development 2002 DLU	Percent Channel Improvement DCI	Percent Channel Conveyance DCC	Percent Ponding DPP	DLU affected by Detention DET	Percent Impervious 2002	(TC+R)''	TC''	R''	DLU Minimum	DLU *(Detention)*
D100N	2757.1	4.31	4.49	2.46	3.92	10.00	2.46	71.95	100.00	99.00	0.00	5.32	58.70	5.22	1.37	3.85	17.84	66.63
D109-01	1081.6	1.69	3.09	1.24	3.77	10.00	2.46	89.86	100.00	50.00	40.00	0.00	65.12	6.43	0.61	5.82	46.56	89.86
D109-02	612.5	0.96	2.90	1.3	3.44	10.00	2.46	96.86	100.00	50.00	40.00	0.00	62.90	6.03	0.65	5.38	46.56	96.86
D109-03	195.8	0.31											56.92					
D109-04	196.5	0.31											60.00					
D109-05	206.7	0.32											57.71					
D109-06	52.5	0.08											78.78					
D109-07	273.3	0.43											61.39					
D109-08	298.9	0.47											65.91					
D109-09	62.1	0.10											60.31					
D109-10	30.1	0.05											70.43					
D109-11	71.7	0.11											72.68					
D109-12	73.6	0.12											43.15					
D109-13	115.8	0.18											75.63					
D109-14	88.3	0.14											23.48					
D109-15	147.8	0.23											43.65					
D109-16	55.0	0.09											24.70					
D109-17	65.3	0.10											31.87					
D100O	4641.3	7.25	5.15	2.44	4.12	10.00	2.46	83.27	100.00	99.00	0.00	0.47	60.50	4.88	1.23	3.65	17.84	82.80
D100P	2554.9	3.99	4.89	2.21	4.02	10.00	2.46	71.56	100.00	99.00	0.00	1.40	50.58	5.31	1.19	4.12	17.84	70.16
D105A	3369.0	5.26	4.28	1.64	3.69	10.00	2.46	84.62	0.00	50.00	0.00	0.59	58.14	8.53	1.76	6.77	46.56	84.03
D100Q	944.0	1.48	2.14	1.22	2.93	10.00	2.46	59.38	100.00	98.00	0.00	0.00	44.08	3.74	0.78	2.96	18.09	59.38
D103A	2906.2	4.54	4.71	2.15	3.69	10.00	2.46	82.45	0.00	50.00	0.00	0.20	60.27	9.26	2.35	6.91	46.56	82.25
D100R	1149.4	1.80	3.28	1.36	2.36	10.00	2.46	78.42	90.00	99.85	0.00	0.00	52.61	4.44	1.00	3.44	17.62	78.42

See SCS Uplands Table for Values

See SCS Uplands Table for Values

TIME OF CONCENTRATION CALCULATIONS USING VELOCITY METHODS																
Sub-Area		D109-03	D109-04	D109-05	D109-06	D109-07	D109-08	D109-09	D109-10	D109-11	D109-12	D109-13	D109-14	D109-15	D109-16	D109-17
Basin Drainage Area																
Drainage Area	acres	195.97	196.19	206.48	52.68	273.31	298.96	62.21	29.85	71.36	73.73	116.00	88.07	147.74	54.99	65.70
Drainage Area	sq. mi.	0.306	0.307	0.323	0.082	0.427	0.467	0.097	0.047	0.112	0.115	0.181	0.138	0.231	0.086	0.103
Impervious Cover																
Impervious Cover	%	56.9%	60.0%	57.7%	78.8%	61.4%	65.9%	60.3%	70.4%	72.7%	43.2%	75.6%	23.5%	43.7%	24.7%	31.9%
Time of Concentration		3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
SCS Uplands Method Curve C - Overland Flow in Grassy Areas																
Distance	feet	150	0	150	0	150	150	150	150	300	150	0	200	150	150	150
Slope	percent	1.00	0.00	1.00	0.00	1.00	1.00	0.20	1.00	1.00	1.00	0.00	0.20	1.00	0.20	0.20
Velocity	ft/sec	0.70	0.00	0.70	0.00	0.70	0.70	0.31	0.70	0.70	0.70	0.00	0.31	0.70	0.31	0.31
Travel Time	minutes	3.57	0.00	3.57	0.00	3.57	3.57	8.00	3.57	7.14	3.57	0.00	10.67	3.57	8.00	8.00
SCS Uplands Method Curve F - Shallow Concentrated Flow in Grassed Waterway																
Distance	feet	0	0	0	0	0	0	350	0	0	0	0	500	0	0	300
Slope	percent	0.00	0.00	0.00	0.00	0.00	0.00	0.20	0.00	0.00	0.00	0.00	0.20	0.00	0.00	0.20
Velocity	ft/sec	0.00	0.00	0.00	0.00	0.00	0.00	0.67	0.00	0.00	0.00	0.00	0.67	0.00	0.00	0.67
Travel Time	minutes	0.00	0.00	0.00	0.00	0.00	0.00	8.77	0.00	0.00	0.00	0.00	12.53	0.00	0.00	7.52
SCS Uplands Method Curve G - Paved Areas (Sheet Flow) and Upland Gullies																
Distance	feet	300	250	300	200	200	300	1200	200	300	1000	400	1200	400	2100	0
Slope	percent	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.00
Velocity	ft/sec	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.00
Travel Time	minutes	5.04	4.20	5.04	3.36	3.36	5.04	20.14	3.36	5.04	16.79	6.71	20.14	6.71	35.25	0.00
Flow in Storm Sewer (Segment #1)																
Distance	feet	1050	1300	1400	1200	1250	1250	800	450	500	3200	1150	0	800	0	400
Average Pipe Diameter	inches	24	24	24	24	24	36	36	24	24	36	24	0	24	0	24
Estimated Pipe Slope	ft/ft	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
Velocity	ft/sec	2.28	2.28	2.28	2.28	2.28	2.99	2.99	2.28	2.28	2.99	2.28	0.00	2.28	0.00	2.28
Travel Time	minutes	7.66	9.49	10.22	8.76	9.12	6.96	4.46	3.28	3.65	17.83	8.39	0.00	5.84	0.00	2.92
Flow in Storm Sewer (Segment #2)																
Distance	feet	1950	2650	1500	500	2000	2600	0	700	2200	0	1200	0	4400	0	300
Average Pipe Diameter	inches	36	36	36	36	36	60	0	36	30	0	36	0	84	0	36
Estimated Pipe Slope	ft/ft	0.001	0.001	0.001	0.001	0.001	0.0007	0.001	0.001	0.001	0.001	0.001	0.001	0.0005	0.001	0.001
Velocity	ft/sec	2.99	2.99	2.99	2.99	2.99	3.52	0.00	2.99	2.65	0.00	2.99	0.00	3.72	0.00	2.99
Travel Time	minutes	10.86	14.76	8.36	2.79	11.14	12.31	0.00	3.90	13.84	0.00	6.68	0.00	19.70	0.00	1.67
Flow in Storm Sewer (Segment #3)																
Distance	feet	2250	1800	2700	800	5000	2350	0	500	0	0	1900	0	0	0	1200
Average Pipe Diameter	inches	48	144	48	48	60	84	0	48	0	0	144	0	0	0	48
Estimated Pipe Slope	ft/ft	0.0008	0.0005	0.0008	0.0008	0.0007	0.0005	0.001	0.0008	0.001	0.001	0.0005	0.001	0.001	0.001	0.0008
Velocity	ft/sec	3.24	5.33	3.24	3.24	3.52	3.72	0.00	3.24	0.00	0.00	5.33	0.00	0.00	0.00	3.24
Travel Time	minutes	11.57	5.63	13.88	4.11	23.68	10.52	0.00	2.57	0.00	0.00	5.94	0.00	0.00	0.00	6.17
TC	minutes	38.70	34.08	41.06	19.01	50.88	38.41	41.37	16.68	29.67	38.18	27.73	43.34	35.83	43.25	26.28
TC	hours	0.65	0.57	0.68	0.32	0.85	0.64	0.69	0.28	0.49	0.64	0.46	0.72	0.60	0.72	0.44
R = 3 x TC	hours	1.94	1.70	2.05	0.95	2.54	1.92	2.07	0.83	1.48	1.91	1.39	2.17	1.79	2.16	1.31
		D109-03	D109-04	D109-05	D109-06	D109-07	D109-08	D109-09	D109-10	D109-11	D109-12	D109-13	D109-14	D109-15	D109-16	D109-17

24" - 36" --> S = 0.10%
48" --> S = 0.08%
60" --> S = 0.07%
72" --> S = 0.06%
84" + --> S = 0.05%

HCFCD STANDARD HYDROLOGIC METHODOLOGY
Upper Harris Gully Watershed
14-Aug-02

PARAMETER	UNITS	SYMBOL	SUBAREA D109-01	SUBAREA D109-01	SUBAREA D109-01	SUBAREA D109-01	SUBAREA D109-01
Drainage Area	acres	A	1082	1082	1082	1082	1082
Watershed Length	miles	L	3.09	3.09	3.09	3.09	3.09
Length to Centroid	miles	Lca	1.24	1.24	1.24	1.24	1.24
Channel Slope	ft./mi.	S	3.77	3.77	3.77	3.77	3.77
Watershed Slope	ft./mi.	So	10	10	10	10	10
Urban Development	%	UD	89.86	89.86	89.86	89.86	89.86
Channel Improvement	%	CI	100	100	100	100	100
Channel Conveyance	%	CC	50	50	50	50	50
Ponding	%	P	0	10	20	30	40

COMPUTED RESULTS

Drainage Area	sq. mi.	A	1.69	1.69	1.69	1.69	1.69
Watershed Development	%	WD	96.96	96.96	96.96	96.96	96.96
C	n/a	C	4.63	4.63	4.63	4.63	4.63
TC + R	hours	TC+R	6.43	6.43	6.43	6.43	6.43
Time of Concentration	hours	TC	0.61	0.61	0.61	0.61	0.61
Storage Coefficient	hours	R	5.81	5.81	5.81	5.81	5.81
Storage Multipliers							
5-Year	n/a	RM	1.00	2.14	2.49	2.71	2.88
10-Year	n/a	RM	1.00	2.02	2.32	2.52	2.67
25-Year	n/a	RM	1.00	1.85	2.09	2.24	2.35
50-Year	n/a	RM	1.00	1.75	1.95	2.07	2.16
100-Year	n/a	RM	1.00	1.64	1.80	1.90	1.97
500-Year	n/a	RM	1.00	1.43	1.51	1.57	1.61
Adj. Storage Coefficients							
5-Year	hours	Rp	5.81	12.47	14.46	15.77	16.77
10-Year	hours	Rp	5.81	11.77	13.51	14.64	15.51
25-Year	hours	Rp	5.81	10.77	12.13	13.00	13.66
50-Year	hours	Rp	5.81	10.17	11.31	12.03	12.57
100-Year	hours	Rp	5.81	9.53	10.45	11.02	11.45
500-Year	hours	Rp	5.81	8.29	8.80	9.11	9.34

HCFCD STANDARD HYDROLOGIC METHODOLOGY
Upper Harris Gully Watershed
14-Aug-02

PARAMETER	UNITS	SYMBOL	SUBAREA D109-02	SUBAREA D109-02	SUBAREA D109-02	SUBAREA D109-02	SUBAREA D109-02
Drainage Area	acres	A	614	614	614	614	614
Watershed Length	miles	L	2.90	2.90	2.90	2.90	2.90
Length to Centroid	miles	Lca	1.30	1.30	1.30	1.30	1.30
Channel Slope	ft./mi.	S	3.44	3.44	3.44	3.44	3.44
Watershed Slope	ft./mi.	So	10	10	10	10	10
Urban Development	%	UD	96.86	96.86	96.86	96.86	96.86
Channel Improvement	%	CI	100	100	100	100	100
Channel Conveyance	%	CC	50	50	50	50	50
Ponding	%	P	0	10	20	30	40

COMPUTED RESULTS

Drainage Area	sq. mi.	A	0.96	0.96	0.96	0.96	0.96
Watershed Development	%	WD	99.06	99.06	99.06	99.06	99.06
C	n/a	C	4.40	4.40	4.40	4.40	4.40
TC + R	hours	TC+R	6.03	6.03	6.03	6.03	6.03
Time of Concentration	hours	TC	0.65	0.65	0.65	0.65	0.65
Storage Coefficient	hours	R	5.38	5.38	5.38	5.38	5.38
Storage Multipliers							
5-Year	n/a	RM	1.00	2.14	2.49	2.71	2.88
10-Year	n/a	RM	1.00	2.02	2.32	2.52	2.67
25-Year	n/a	RM	1.00	1.85	2.09	2.24	2.35
50-Year	n/a	RM	1.00	1.75	1.95	2.07	2.16
100-Year	n/a	RM	1.00	1.64	1.80	1.90	1.97
500-Year	n/a	RM	1.00	1.43	1.51	1.57	1.61
Adj. Storage Coefficients							
5-Year	hours	Rp	5.38	11.53	13.38	14.59	15.51
10-Year	hours	Rp	5.38	10.88	12.49	13.54	14.34
25-Year	hours	Rp	5.38	9.97	11.22	12.03	12.63
50-Year	hours	Rp	5.38	9.41	10.46	11.13	11.63
100-Year	hours	Rp	5.38	8.82	9.66	10.19	10.59
500-Year	hours	Rp	5.38	7.67	8.14	8.43	8.64