Time to Peak Calculations

West Branch Calabacillas Arroyo

Project No.: 20130331
Prepared By: Jonathan Elllison
Edited By: Sarah Ganley
Date: 5/20/2015

(Revised COA DPM procedure)

****for use with SSCAFCA DPM, TP calculated here =TC for input into HEC-HMS***

NOTE - FOR WBCA - COA DMP Method recommended in the AMAFCA White paper, Sept. 2014, (p. 4)

Maximum Overland Reach Length (TR-55) = 300 feet

Per Direction - Lag Time for Pervious and Impervious portions of each basin will be the same for the developed conditions models

User inputs columns in blue: 1,2,3,5,6,10,11,15,16,19,20

Tc min. in TR 55 = 0.1 hr (6 min)

Column Added for WBCA DMP

Developed Conditions

Basin	Area	Total Reach L	Overland Reach L1	Overland K K1	Overland Slope	Overland Slope S1	Adj. Overland Slope S1'	Gully Reach L2	Gully K K2	Gully slope	Gully slope S2	Adj. Gully Slope S2'	Arroyo Reach L3	Arroyo K K3	Arroyo Slope	Arroyo Slope S3	Adj. Arroyo Slope S3'	Lca Lca	Base Discharge Qb	Ground Slope S	Adjusted Slope S'	K K	K_w K_w	K' K'	K'' K''	Kn Kn	Orig. TC TC	Adjusted TC TC'	Lag Time Lg	Time to Peak TP	Lag Time=Tc*0.6 Per White Paper Lag Time for HEC-HMS
	sq ft	Feet	Feet		ft/ft	%	%	Feet		ft/ft	%	%	Feet		ft/ft	%	%	Feet	cfs	%	%						Hrs	Hrs	Hrs	Hrs	Min
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)	(23)	(24)	(25)	(26)	(27)	(28)	(29)	(30)	(31)	(32)
PW1	2,887,224	3,540	300	1	0	2	2	1,600	2	0	3	3	1,640	3	0	3	3	1,282	132.6	3.19	3.19	1.847	1.847	4.075	0.279	0.021	0.298	0.298	-	0.199	10.7
PW10	11,375,216	5,783	300	1	0	2	2	1,600	2	0	2	2	3,883	3	0	2	2	2,180	522.3	2.12	2.12	2.296	2.296	6.396	0.438	0.021	0.351	0.351	-	0.234	12.6
PW10.1	161,512	305	300	1	0	3	3	5	2	0	0	0	0	3	0	0	0	10	7.4	2.72	2.72	0.364	0.364	2.624	0.180	0.021	0.141	0.141	-	0.133	5.1
PW10.2	400,632	533	300	1	0	1	1	233	2	0	0	0	0	3	0	0	0	200	18.4	0.37	0.37	0.643	0.643	8.334	0.571	0.021	0.376	0.376	-	0.251	13.6
PW11	3,537,347	3,717	300	1	0	3	3	1,600	2	0	2	2	1,817	3	0	2	2	1,351	162.4	2.11	2.11	2.064	2.064	5.199	0.356	0.021	0.345	0.345	-	0.230	12.4
PW12	9,636,365	6,140	300	1	0	3	3	1,600	2	0	1	1	4,240	3	0	2	2	2,675	442.4	1.65	1.65	2.361	2.361	7.031	0.482	0.021	0.390	0.390	-	0.260	14.0
PW13	1,535,262	3,224	300	1	0	2	2	1,600	2	0	1	1	1,324	3	0	1	1	1,763	70.5	1.18	1.18	1.991	1.991	5.989	0.410	0.021	0.415	0.415	-	0.276	14.9
PW14	3,320,211	4,723	300	1	0	2	2	1,600	2	0	2	2	2,823	3	0	2	2	2,000	152.4	1.76	1.76	2.177	2.177	5.622	0.385	0.021	0.390	0.390	-	0.260	14.0
PW14.1	5,921,962	7,151	300	1	0	1	1	1,600	2	0	1	1	5,251	3	0	2	2	3,500	271.9	1.72	1.72	2.354	2.354	6.315	0.433	0.021	0.403	0.403	-	0.269	14.5
PW14.2	679,043	793	300	1	0	2	2	493	2	0	0	0	0	3	0	0	0	300	31.2	0.67	0.67	0.767	0.767	6.864	0.471	0.021	0.351	0.351	-	0.234	12.7
PW15	11,182,159	7,566	300	1	0	1	1	1,600	2	0	1	1	5,666	3	0	2	2	3,487	513.4	1.90	1.90	2.331	2.331	6.736	0.462	0.021	0.394	0.394	-	0.262	14.2
PW15.1	649,795	1,214	300	1	0	3	3	914	2	0	1	1	0	3	0	0	0	400	29.8	1.63	1.63	1.421	1.421	4.359	0.299	0.021	0.186	0.186	-	0.133	6.7
PW2	2,801,041	3,242	300	1	0	2	2	1,600	2	0	4	4	1,342	3	0	4	4	1,162	128.6	3.71	3.71	1.812	1.812	3.757	0.258	0.021	0.258	0.258	-	0.172	9.3
PW3	9,631,867	3,689	300	1	0	4	4	1,600	2	0	3	3	1,789	3	0	3	3	2,084	442.2	2.97	2.97	2.051	2.050	5.245	0.360	0.021	0.290	0.290	-	0.193	10.4
PW4	11,768,971	5,986	300	1	0	2	2	1,600	2	0	2	2	4,086	3	0	2	2	3,583	540.4	2.11	2.11	2.316	2.316	6.449	0.442	0.021	0.369	0.369	-	0.246	13.3
PW5	5,036,016	4,874	300	1	0	5	5	1,600	2	0	3	3	2,974	3	0	2	2	1,990	231.2	2.85	2.85	2.272	2.257	4.768	0.327	0.021	0.303	0.303	-	0.202	10.9
PW5.1	459,512	1,511	300	1	0	2	2	1,211	2	0	2	2	0	3	0	0	0	600	21.1	2.44	2.44	1.455	1.455	3.347	0.229	0.021	0.185	0.185	-	0.133	6.7
PW6	12,683,834	9,321	300	1	0	5	5	1,600	2	0	1	1	7,421	3	0	1	1	5,246	582.4	1.32	1.32	2.554	2.552	8.274	0.567	0.021	0.469	0.469	-	0.313	16.9
PW7	13,250,286	6,284	300	1	0	3	3	1,600	2	0	2	2	4,384	3	0	2	2	3,507	608.4	1.97	1.97	2.394	2.394	6.828	0.468	0.021	0.373	0.373	-	0.249	13.4
PW8	3,710,289	7,040	300	1	0	2	2	1,600	2	0	2	2	5,140	3	0	2	2	4,558	170.4	1.91	1.91	2.418	2.418	5.507	0.377	0.021	0.398	0.398	-	0.266	14.3
PW9	3,354,480	2,966	300	1	0	2	2	1,600	2	0	2	2	1,066	3	0	2	2	1,906	154.0	2.00	2.00	1.837	1.837	5.281	0.362	0.021	0.317	0.317	-	0.211	11.4
PW9.1	264,912	729	300	1	0	3	3	429	2	0	1	1	0	3	0	0	0	320	12.2	1.58	1.58	1.067	1.067	3.762	0.258	0.021	0.151	0.151	-	0.133	5.4
QR15	3,609,358	4,190	300	1	0	3	3	1,600	2	0	2	2	2,290	3	0	1	1	1,560	165.7	1.21	1.21	2.152	2.152	6.894	0.473	0.021	0.469	0.469	-	0.313	16.9
QR20	8,930,474	6,059	300	1	0	0	0	1,600	2	0	1	1	4,159	3	0	1	1	3,177	410.0	0.55	0.55	2.261	2.261	12.041	0.825	0.021	0.642	0.642	-	0.428	23.1
QR21	8,150,879	6,592	300	1	0	1	1	1,600	2	0	0	0	4,692	3	0	1	1	3,248	374.2	0.47	0.47	2.133	2.133	12.752	0.874	0.021	0.701	0.701	-	0.467	25.2
QR23	12,949,048	10,047	300	1	0	2	2	1,600	2	0	0	0	8,147	3	0	1	1	5,540	594.5	1.11	1.11	2.402	2.402	9.043	0.620	0.021	0.504	0.504	-	0.336	18.1
QR24	11,320,345	11,025	300	1	0	1	1	1,600	2	0	0	0	9,125	3	0	1	1	4,252	519.8	1.17	1.17	2.422	2.422	8.613	0.590	0.021	0.458	0.458	-	0.306	16.5
QR25	6,511,246	3,498	300	1	0	2	2	1,600	2	0	2	2	1,598	3	0	3	3	2,095	299.0	2.48	2.48	1.948	1.948	5.349	0.367	0.021	0.317	0.317	-	0.211	11.4
QR26	6,532,488	8,050	300	1	0	2	2	1,600	2	0	1	1	6,150	3	0	1	1	2,636	299.9	0.82	0.82	2.516	2.516	9.318	0.639	0.021	0.476	0.476	-	0.318	17.2
QR27	3,911,408	7,116	300	1	0	2	2	1,600	2	0	1	1	5,216	3	0	1	1	2,958	179.6	0.88	0.88	2.428	2.428	8.186	0.561	0.021	0.491	0.491	-	0.327	17.7
QR1	7,499,198	9,517	300	1	0	4	4	1,600	2	0	2	2	7,617	3	0	2	2	3,500	344.3	2.06	2.06	2.573	2.573	6.017	0.412	0.021	0.379	0.379	-	0.253	13.7
QR2	1,775,044	3,054	300	1	0	4	4	1,600	2	0	2	2	1,154	3	0	2	2	1,500	81.5	2.20	2.20	1.959	1.959	4.499	0.308	0.021	0.292	0.292	-	0.195	10.5
QR3	5,451,236	8,183	300	1	0	4	4	1,600	2	0	2	2	6,283	3	0	2	2	4,635	250.3	2.46	2.46	2.483	2.482	5.198	0.356	0.021	0.379	0.379	-	0.253	13.6
QR4	13,063,526	12,408	300	1	0	8	6	1,600	2	0	2	2	10,508	3	0	2	2	6,148	599.8	2.33	2.33	2.662	2.636	6.260	0.429	0.021	-	-	0.344	0.306	20.6
QR6	7,821,436	11,238	300	1	0	5	5	1,600	2	0	3	3	9,338	3	0	2	2	6,015	359.1	2.24	2.24	2.638	2.635	5.817	0.399	0.021	0.446	0.446	-	0.297	16.1
QR7	13,109,890	11,733	300	1	0	6	5	1,600	2	0	3	3	9,833	3	0	2	2	6,790	601.9	2.32	2.32	2.655	2.647	6.276	0.430	0.021	0.466	0.466	-	0.311	16.8
QR8	8,902,376	11,832	300	1	0	6	5	1,600	2	0	4	4	9,932	3	0	2	2	7,650	408.7	2.19	2.19	2.639	2.629	6.028	0.413	0.021	0.491	0.491	-	0.327	17.7
QR9	17,593,734	10,095	300	1	0	3	3	1,600	2	0	3	3	8,195	3	0	1	1	3,957	807.8	1.60	1.60	2.580	2.580	7.970	0.546	0.021	0.418	0.418	-	0.279	15.0
SEV1	4,729,477	3,165	300	1	0	1	1	1,600	2	0	2	2	1,265	3	0	2	2	1,399	217.1	1.60	1.60	1.798	1.798	6.280	0.430	0.021	0.386	0.386	-	0.257	13.9
SEV2	1,540,259	2,776	300	1	0	6	5	1,600	2	0	2	2	876	3	0	3	3	1,413	70.7	2.65	2.65	1.819	1.801	3.994	0.274	0.021	0.260	0.260	-	0.174	9.4
TVI1	2,674,388	2,902	300	1	0	1	1	1,600	2	0	1	1	1,002	3	0	1	1	1,500	122.8	1.38	1.38	1.788	1.788	6.122	0.420	0.021	0.384	0.384	-	0.256	13.8
TVI1.1	1,774,024	2,328	300	1	0	2	2	1,600	2	0	1	1	428	3	0	2	2	1,100	81.5	1.54	1.54	1.732	1.732	5.377	0.369	0.021	0.301	0.301	-	0.201	10.8
VR1	2,386,863	4,371	300	1	0	4	4	1,600	2	0	3	3	2,471	3	0	2	2	1,760	109.6	2.60	2.60	2.191	2.189	4.359	0.299	0.021	0.319	0.319	-	0.213	11.5
VR2	6,978,249	5,335	300	1	0	12	6	1,600	2	0	1	1	3,435	3	0	1	1	2,334	320.4	1.94	1.94	2.127	2.069	6.120	0.419	0.021	0.386	0.386	-	0.257	13.9
VR3	9,131,815	7,705	300	1	0	3	3	1,600	2	0	4	4	5,805	3	0	1	1	3,959	419.3	1.57	1.57	2.278	2.278	7.154	0.490	0.021	0.434	0.434	-	0.289	15.6
VR4	7,057,689	4,141	300	1	0	1	1	1,600	2	0	1	1	2,241	3	0	1	1	2,290	324.0	0.85	0.85	2.082	2.082	9.287	0.637	0.021	0.579	0.579	-	0.386	20.8
VR5	7,182,580	5,101	300	1	0	1	1	1,600	2	0	1	1	3,201	3	0	1	1	2,385	329.8	1.07	1.07	2.248	2.248	8.305	0.569	0.021	0.482	0.482	-	0.321	17.3
VR6	5,373,082	3,556	300	1	0	1	1	1,600	2	0	1	1	1,656	3	0	1	1	3,026	246.7	0.86	0.86	1.978	1.978	8.778	0.602	0.021	0.538	0.538	-	0.359	19.4
VR7	5,403,875	4,390	300	1	0	2	2	1,600	2	0	1	1	2,490	3	0	1	1	2,083	248.1	0.97	0.97	2.183	2.183	8.279	0.567	0.021	0.517	0.517	-	0.345	18.6
VRW1	9,246,252	4,607	300	1	0	1	1	1,600	2	0	3	3	2,707	3	0	2	2	2,350	424.5	2.11	2.11	2.032	2.032	6.176	0.423	0.021	0.383	0.383	-	0.255	13.8
VRW2	5,584,381	4,779	300	1	0	1	1	1,600	2	0	2	2	2,879	3	0	2	2	2,434	256.4	1.70	1.70	2.146	2.146	6.288	0.431	0.021	0.405	0.405	-	0.270	14.6
VRW3	9,765,721	5,313	300	1	0	2	2	1,600	2	0	1	1	3,413	3	0	2	2	2,647	448.4	1.82	1.82	2.116	2.116	6.722	0.461	0.021	0.402	0.402	-	0.268	14.5

Notes:

Notes:

(1) Basin ID name

(2) Area of basin. Obtained from basin delineation on layer 'N-Basin' in the following file: P:\070203\WR\design\control\070203Dsgn01.dwg

(3) Length of longest flow path possible in drainage basin, determined using linework on layer 'N-FL' in the following file: P:\070203\WR\design\control\070203Dsgn01.dwg

(4) Length assumed for sheet flow. Maximum length of 400 used per COA DPM 22-22.

(5) Conveyance condition for L1. Conditions in COA DPM table B-1 on pg. 22-22.

(6) L1 slope in decimal

(7) L1 slope in percentage

(8) S1 adjustment for slopes considered 'steep' per COA DPM.

* Adjustment should only be used if the slope is greater than 4%, developed channels, or for hydraulic design of channels or channel elements

if S1 is greater than 4

S1' = 5.2467+(0.062627*s1)-(18.197*e^(-0.62375*s1) per DPM 22-26, equation b-10

if S1 is less than or equal to 4

S1' = S1

(9) length assumed for Gully flow.

if L1>2000 ft

L2 = 1600

if L1<2000 ft

L2 = L1-400

(10) Conveyance condition for L2. Conditions in COA DPM table B-1 on pg. 22-22.

(11) L2 slope in decimal

(12) L2 slope in percentage

(13) adjusted s2

if S2 is greater than 4

S2' = 5.2467+(0.062627*s2)-(18.197*e^(-0.62375*s2) per DPM 22-26, equation b-10

if S2 is less than or equal to 4%

S2' = S2

(14) Length of arroyo flow along L.

L3 = L-(L1+L2)

(15) Conveyance condition for L3. Conditions in COA DPM table B-1 on pg. 22-22.

(16) L3 slope in decimal

(17) L3 slope in percentage

(18) adjusted S3

if S3 is greater than 4%

S3' = 5.2467+(0.062627*s3)-(18.197*e^(-0.62375*s3) per DPM 22-26, equation b-10

If S3 is less than or equal to 4%

S3' = S3

(19) Distance along L from point of concentration to a point opposite centroid of drainage basin (only necessary for basins with reach lengths greater than 4,000 ft).

(20) Basin discharge of the drainage basin

If discharge is unknown:

Undeveloped -assume 0.5-1 cfs/ac **Q = (0.5-1) * A**

Developed- assume 2-3 cfs/ac **Q = (2-3) * A**

If the computed basin discharge is within 10 percent of Q_b *the estimate is sufficiently accurate. If not, repeat the process using the computed basin discharge.*

(21) Average slope over entire reach length

S = ((L1*S1)+(L2*S2)+(L3*S3))/L per DPM 22-26, equation b-5

(22) Adjusted Slope

if S is greater than 4%

S' = 5.2467+(0.062627*S)-(18.197*e^(-0.62375*S) per DPM 22-26, equation b-10

if S is less than or equal to 4%

S' = S

(23) average K

K = ((L1/(K1*S1^.5))+ (L2/(K2*S2^.5))+(L3/(K3*S3^.5))*(S^.5/L))^-1 per DPM 22-23, equation b-4

(24) K_w

eqn to find K value for the weighted overall slope and reach length

K_w = (L/((S'^.5)*(L1/(K1*(S1^.5)) + L2/(K2*(S2^.5)) + L3/(K3*(S3'^.5)))

(25) K'

* K' and K'' are calculated for adjusted slopes

K'= 0.302*(S'/100)^-.5*(Qb^0.18) per DPM 22-26, equation b-11

(26) K''

K''= 0.207*(S'^-.5)*(Qb^0.18) per DPM 22-26, equation b-12

(27) a basin factor based on an estimate of weighted, by stream length, average Manning's n value for the principal watercourses in the drainage basin. For the Albuquerque area, values of Kn may be estimated from COA DPM Table B-2,

(28) TC

if the total Reach is less than 4000 ft

TC = per DPM 22-22 equation B-1 and B-2

If the total Reach is greater than 12000 ft TC does not apply

If the total reach is greater than 4000 ft and less than 12000

TC = ((12000-L)/(120*K*S^.5) + ((L-4000)*Kn*(Lca/L)^.33)/(4.305*S^0.165))/60

(29) TC'

adjusted TC value for natural channels and steep slopes

* variences to compensate for using a non decimal slope

If the Ground Slope<4 *TC= ((12000-L)/(72000*K*S^.5) + ((L-4000)*Kn*(Lca/L)^.33)/(552.2*S^0.165))* eq. from DPM 22-23

TC' = TC

If the Ground Slope>4

*if L <4000 **determine which K value*

TC' = L/(K*S^.5)/3600) per DPM 22-22 equation B-1 and B-2

If L>12000 TC' does not apply

*If L is between 4000 and 12000 **determine which K value*

TC' = ((12000-L)/(120*K*S^.5) + ((L-4000)*Kn*((Lca/L)^.33)/(4.305*S^.165))/60

* variences from DPM equation to compensate for using a non decimal slope

*TC= ((12000-L)/(72000*K*S^.5) + ((L-4000)*Kn*(Lca/L)^.33)/(552.2*S^0.165))* eq. from DPM 22-23

***K value determination:*

If K' <Kw

Use K'

If Kw < K''

Use K''

If Kw > K' & K''

Use Kw

(30) Lag Time

for steep slope adjustment for L>12000

If L > 12000

LG= 26*Kn*((L*Lca/(5280^2*(S'*5280)^0.5))^0.33) eq from DPM 22-24 eq. B-7

(31) Time to Peak

If TC' is greater or equal to TC

If TC'< 0.2

If TC' is equal to zero

TP = Lg*(4/3)*0.6667 eq from DPM 22-24 eq. B-8 and B-9

If TC' is not equal to zero

TP = 0.1333 Minimum requirement

If TC'> 0.2

TP = TC' *0.6667 eq from DPM 22-24 eq. B-9

If TC' is less than TC

*If TC*2/3<0.133*

TP = 0.133 Minimum requirement

*If TC*2/3>0.133*

TP = TC*2/3 eq from DPM 22-24 eq. B-9

(32) Lag Time = 0.6*Tc'

for input into HEC-HMS model using the AMAFCA White Paper Process(p. 13).

Lag Time Calculations

West Branch Calabacillas Arroyo

Project No.: 20130331
Prepared By: Sarah Ganley
Date: 8/14/2015

(Revised COA DPM procedure)

NOTE - FOR WBCA - COA DMP Method recommended in the AMAFCA White paper, Sept. 2014, (p. 4)
Maximum Overland Reach Length (TR-55) = 300 feet
Per AMAFCA's Direction - Lag Time for Pervious and Impervious portions of each basin will be the same for the developed conditions models

User inputs columns in blue: 1,2,3,5,6,10,11,15,16,19

Tc min. in TR 55 = 0.1 hr (6 min)

Column Added for WBCA DMP

Several Basins Split - to model to compare exisiting conditions for sizing small ponds in DCM#4
Added Two Basins - to model to compare exisiting conditions for sizing small ponds in DCM#4
Existing Conditions- Revised to Model using the AMAFCA White Paper

Basin	Area	Area	Area	Total Reach	Overland Reach	Overland K	Overland Slope	Overland Slope	Adj. Overland Slope	Gully Reach	Gully K	Gully slope	Gully slope	Adj. Gully Slope	Arroyo Reach	Arroyo K	Arroyo Slope	Arroyo Slope	Adj. Arroyo Slope	Lca	Base Discharge	Ground Slope	Adjusted Slope	K	K_w	K'	K''	Kn	Orig. TC	Adjusted TC	Lag Time	Time to Peak	Lag Time=Tc*0.6 Per White Paper Lag Time for HEC-HMS
	sq. mi.	sq ft	acres	Feet	Feet		ft/ft	%	%	Feet		ft/ft	%	%	Feet		ft/ft	%	%	Feet	cfs	%	%						Hrs	Hrs	Hrs	Hrs	Min
(1)	(2)	(2)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)	(23)	(24)	(25)	(26)	(27)	(28)	(29)	(30)	(31)	(32)
PW1	0.099948144	2,786,354	64	3,540	300	0.7	0.016	2	2	1,600	2	0.034	3	3	1,640	3	0.033	3	3	1,282	53	3.19	3.19	1.847	1.847	3.450	0.236	0.033	0.298	0.298	-	0.199	10.7
PW10	0.408029733	11,375,053	261	5,783	300	0.7	0.021	2	2	1,600	2	0.023	2	2	3,883	3	0.021	2	2	2,180	101	2.12	2.12	2.296	2.296	4.760	0.326	0.033	0.404	0.404	-	0.269	14.5
PW10.1	0.005793449	161,510	4	305	300	0.7	0.028	3	3	5	2	0.000	0	0	0	3	0.000	0	0	10	0	2.72	2.72	0.364	0.364	1.369	0.094	0.033	0.141	0.141	-	0.133	5.1
PW10.2	0.014370705	400,627	9	533	300	0.7	0.007	1	1	233	2	0.000	0	0	0	3	0.000	0	0	200	1	0.37	0.37	0.643	0.643	4.501	0.309	0.033	0.376	0.376	-	0.251	13.6
PW11	0.120070078	3,347,314	77	3,717	300	0.7	0.025	3	3	1,600	2	0.024	2	2	1,817	3	0.018	2	2	1,351	215	2.11	2.11	2.064	2.064	5.468	0.375	0.033	0.345	0.345	-	0.230	12.4
PW12	0.34565703	9,636,227	221	6,140	300	0.7	0.032	3	3	1,600	2	0.014	1	1	4,240	3	0.016	2	2	2,675	147	1.65	1.65	2.361	2.361	5.764	0.395	0.033	0.459	0.459	-	0.306	16.5
PW13	0.05506994	1,535,240	35	3,224	300	0.7	0.019	2	2	1,600	2	0.011	1	1	1,324	3	0.011	1	1	1,763	14	1.18	1.18	1.991	1.991	4.453	0.305	0.033	0.415	0.415	-	0.276	14.9
PW14	0.119096166	3,320,163	76	4,723	300	0.7	0.017	2	2	1,600	2	0.020	2	2	2,823	3	0.016	2	2	2,000	38	1.76	1.76	2.177	2.177	4.380	0.300	0.033	0.413	0.413	-	0.275	14.9
PW14.1	0.212421148	5,921,877	136	7,151	300	0.7	0.014	1	1	1,600	2	0.015	1	1	5,251	3	0.018	2	2	3,500	68	1.72	1.72	2.354	2.354	4.920	0.337	0.033	0.509	0.509	-	0.339	18.3
PW14.2	0.02435731	679,033	16	793	300	0.7	0.017	2	2	493	2	0.001	0	0	0	3	0.000	0	0	300	8	0.67	0.67	0.767	0.767	5.348	0.367	0.033	0.351	0.351	-	0.234	12.7
PW15 N	0.338771443	9,444,270	217	7,566	300	0.7	0.013	1	1	1,600	2	0.014	1	1	5,666	3	0.021	2	2	3,487	108	1.90	1.90	2.331	2.331	5.091	0.349	0.033	0.509	0.509	-	0.339	18.3
PW15 S	0.062333306	1,737,728	40	3,600	300	0.7	0.013	1	1	1,600	2	0.014	1	1	1,700	3	0.021	2	2	3,487	20	1.72	1.72	1.912	1.912	3.943	0.270	0.033	0.398	0.398	-	0.266	14.3
PW15.1	0.023308195	649,786	15	1,214	300	0.7	0.031	3	3	914	2	0.012	1	1	0	3	0.000	0	0	400	7	1.63	1.63	1.421	1.421	3.397	0.233	0.033	0.186	0.186	-	0.133	6.7
PW2	0.100473534	2,801,001	64	3,242	300	0.7	0.021	2	2	1,600	2	0.041	4	4	1,342	3	0.036	4	4	1,162	32	3.71	3.71	1.812	1.812	2.927	0.201	0.033	0.258	0.258	-	0.172	9.3
PW3	0.34549568	9,631,729	221	3,689	300	0.7	0.043	4	4	1,600	2	0.026	3	3	1,789	3	0.031	3	3	2,084	111	2.97	2.97	2.051	2.050	4.087	0.280	0.033	0.290	0.290	-	0.193	10.4
PW4 N	0.340444433	9,490,910	218	5,986	300	0.7	0.021	2	2	1,600	2	0.022	2	2	4,086	3	0.021	2	2	3,583	109	2.11	2.11	2.316	2.316	4.834	0.331	0.033	0.437	0.437	-	0.292	15.7
PW4 S	0.081709324	2,277,893	52	5,570	300	0.7	0.021	2	2	1,600	2	0.022	2	2	3,670	3	0.021	2	2	3,583	26	2.12	2.12	2.277	2.277	3.736	0.256	0.033	0.423	0.423	-	0.282	15.2
PW5	0.180642229	5,035,944	116	4,874	300	0.7	0.055	5	5	1,600	2	0.032	3	3	2,974	3	0.024	2	2	1,990	58	2.85	2.85	2.272	2.257	3.715	0.255	0.033	0.328	0.328	-	0.219	11.8
PW5.1	0.01648271	459,505	11	1,511	300	0.7	0.024	2	2	1,211	2	0.025	2	2	0	3	0.000	0	0	600	5	2.44	2.44	1.455	1.455	2.608	0.179	0.033	0.185	0.185	-	0.133	6.7
PW6	0.454969938	12,683,652	291	9,321	300	0.7	0.046	5	5	1,600	2	0.012	1	1	7,421	3	0.012	1	1	5,246	146	1.32	1.32	2.554	2.552	6.447	0.442	0.033	0.664	0.664	-	0.443	23.9
PW7	0.475288597	13,250,095	304	6,284	300	0.7	0.031	3	3	1,600	2	0.025	2	2	4,384	3	0.017	2	2	3,507	152	1.97	1.97	2.394	2.394	5.320	0.365	0.033	0.452	0.452	-	0.301	16.3
PW8N	0.039256505	1,094,393	25	6,180	300	0.7	0.022	2	2	1,600	2	0.022	2	2	4,280	3	0.018	2	2	4,558	13	1.93	1.93	2.353	2.353	3.430	0.235	0.033	0.473	0.473	-	0.316	17.0
PW8S1	0.062096811	1,731,135	40	3,375	300	0.7	0.022	2	2	1,600	2	0.022	2	2	1,475	3	0.018	2	2	1,500	20	2.03	2.03	1.985	1.985	3.635	0.249	0.033	0.332	0.332	-	0.221	11.9
PW8S2	0.031734991	884,708	20	4,060	300	0.7	0.022	2	2	1,600	2	0.022	2	2	2,160	3	0.018	2	2	1,300	10	1.99	1.99	2.110	2.110	3.252	0.223	0.033	0.375	0.375	-	0.250	13.5
PW9	0.120325423	3,354,432	77	2,966	300	0.7	0.019	2	2	1,600	2	0.018	2	2	1,066	3	0.024	2	2	1,906	39	2.00	2.00	1.837	1.837	4.115	0.282	0.033	0.317	0.317	-	0.211	11.4
PW9.1	0.009502408	264,908	6	729	300	0.7	0.031	3	3	429	2	0.005	1	1	0	3	0.000	0	0	320	3	1.58	1.58	1.067	1.067	2.931	0.201	0.033	0.151	0.151	-	0.133	5.4
QR15	0.129467891	3,609,306	83	4,190	300	0.7	0.025	3	3	1,600	2	0.016	2	2	2,290	3	0.008	1	1	1,560	41	1.21	1.21	2.152	2.152	5.372	0.368	0.033	0.476	0.476	-	0.317	17.1
QR20 N	0.12040595	3,356,677	77	6,059	300	0.7	0.004	0	0	1,600	2	0.006	1	1	4,159	3	0.006	1	1	3,177	39	0.55	0.55	2.261	2.261	7.867	0.539	0.033	0.727	0.727	-	0.485	26.2
QR20 S	0.199931516	5,573,691	128	4,910	300	0.7	0.004	0	0	1,600	2	0.006	1	1	3,010	3	0.006	1	1	3,177	64	0.55	0.55	2.139	2.139	8.632	0.592	0.033	0.734	0.734	-	0.489	26.4
QR21	0.292372548	8,150,762	187	6,592	300	0.7	0.009	1	1	1,600	2	0.002	0	0	4,692	3	0.005	1	1	3,248	94	0.47	0.47	2.133	2.133	9.936	0.681	0.033	0.808	0.808	-	0.539	29.1
QR23 N	0.191189817	5,329,990	122	7,020	300	0.7	0.015	2	2	1,600	2	0.005	0	0	5,120	3	0.017	2	2	5,540	61	1.38	1.38	2.106	2.106	5.384	0.369	0.033	0.617	0.617	-	0.412	22.2
QR23 S	0.273293349	7,618,872	175	10,047	300	0.7	0.015	2	2	1,600	2	0.005	0	0	8,147	3	0.012	1	1	5,540	87	1.11	1.11	2.402	2.402	6.404	0.439	0.033	0.731	0.731	-	0.487	26.3
QR24	0.40606149	11,320,182	260	11,025	300	0.7	0.012	1	1	1,600	2	0.005	0	0	9,125	3	0.013	1	1	4,252	130	1.17	1.17	2.422	2.422	6.711	0.460	0.033	0.691	0.691	-	0.460	24.9
QR25	0.23355882	6,511,153	149	3,498	300	0.7	0.022	2	2	1,600	2	0.023	2	2	1,598	3	0.027	3	3	2,095	75	2.48	2.48	1.948	1.948	4.168	0.286	0.033	0.317	0.317	-	0.211	11.4
QR26	0.147993329	4,125,758	95	8,050	300	0.7	0.020	2	2	1,600	2	0.008	1	1	6,150	3	0.008	1	1	2,636	47	0.82	0.82	2.516	2.516	6.684	0.458	0.033	0.611	0.611	-	0.407	22.0
QR27	0.140302456	3,911,352	90	7,116	300	0.7	0.018	2	2	1,600	2	0.007	1	1	5,216	3	0.009	1	1	2,958	45	0.88	0.88	2.428	2.428	6.378	0.437	0.033	0.602	0.602	-	0.401	21.7
QR3	0.195536196	5,451,158	125	8,183	300	0.7	0.043	4	4	1,600	2	0.020	2	2	6,283	3	0.025	2	2	4,635	63	2.46	2.46	2.483	2.482	4.050	0.278	0.033	0.518	0.518	-	0.345	18.6
QR4	0.468590374	13,063,362	300	12,408	300	0.7	0.081	8	6	1,600	2	0.024	2	2	10,508	3	0.022	2	2	6,148	150	2.33	2.33	2.662	2.636	4.877	0.334	0.033	-	-	0.541	0.481	32.4
QR6	0.280555397	7,821,323	180	11,238	300	0.7	0.048	5	5	1,600	2	0.031	3	3	9,338	3	0.020	2	2	6,015	90	2.24	2.24	2.638	2.635	4.533	0.311	0.033	0.685	0.685	-	0.457	24.7
QR7	0.470252613	13,109,702	301	11,733	300	0.7	0.056	6	5	1,600	2	0.031	3	3	9,833	3	0.021	2	2	6,790	150	2.32	2.32	2.655	2.647	4.890	0.335	0.033	0.727	0.727	-	0.485	26.2
QR8	0.319328813	8,902,249	204	11,832	300	0.7	0.058	6	5	1,600	2	0.036	4	4	9,932	3	0.019	2	2	7,650	102	2.19	2.19	2.639	2.629	4.697	0.322	0.033	0.768	0.768	-	0.512	27.6
QR9	0.429163262	11,964,213	275	10,095	300	0.7	0.029	3	3	1,600	2	0.026	3	3	8,195	3	0.014	1	1	3,957	137	1.60	1.60	2.580	2.580	5.794	0.397	0.033	0.610	0.610	-	0.407	22.0
SEV1 N	0.102795605	2,865,736	66	2,240	300	0.7	0.010	1	1	1,600	2	0.016	2	2	340	3	0.018	2	2	1,399	132	1.52	1.52	1.567	1.567	5.904	0.405	0.021	0.323	0.323	-	0.215	11.6
SEV1 S	0.066851049	1,863,674	43	3,165	300	0.7	0.010	1	1	1,600	2	0.016	2	2	1,265	3	0.018	2	2	1,399	86	1.60	1.60	1.798	1.798	5.311	0.364	0.021	0.386	0.386	-	0.257	13.9
SEV2 N	0.020502156	571,559	13	2,776	300	0.7	0.056	6	5	1,600	2	0.018	2	2	876	3	0.031	3	3	1,413	26	2.65	2.65	1.819	1.801	3.341	0.229	0.021	0.260	0.260	-	0.174	9.4
SEV2 S	0.034747026	968,678	22	2,266	300	0.7	0.056	6	5	1,600	2	0.018	2	2	366	3	0.031	3	3	1,413	44	2.54	2.54	1.690	1.671	3.754	0.257	0.021	0.234	0.234	-	0.156	8.4
TVI1	0.095930456	2,674,349	61	2,902	300	0.7	0.010	1	1	1,600	2	0.014	1	1	1,002	3	0.015	1	1	1,500	123	1.38	1.38	1.788	1.788	6.122	0.420	0.021	0.384	0.384	-	0.256	13.8
TVI1.1	0.063634338	1,773,998	41	2,328	300	0.7	0.020	2	2	1,600	2	0.015	1	1	428	3	0.015	2	2	1,100	81	1.54	1.54	1.732	1.732	5.377	0.369	0.033	0.301	0.301	-	0.201	10.8
VR1	0.085617108	2,386,834	55	4,371	300	0.7	0.044	4	4	1,600	2	0.033	3	3	2,471	3	0.019	2	2	1,760	110	2.60	2.60	2.191	2.189	4.359	0.299	0.021	0.319	0.319	-	0.213	11.5
VR2	0.250310242	6,978,149	160	5,335	300	0.7	0.118	12	6	1,600	2	0.013	1	1	3,435	3	0.014	1	1	2,334	320	1.94	1.94	2.127	2.069	6.120	0.419	0.021	0.386	0.386	-	0.257	13.9
VR3	0.327558782	9,131,684	210	7,705	300	0.7	0.032	3	3	1,600	2	0.037	4	4	5,805	3	0.009	1	1	3,959	419	1.57	1.57	2.278	2.278	7.154	0.490	0.025	0.477	0.477	-	0.318	17.2
VR4	0.253159987	7,057,594	162	4,141	300	0.7	0.007	1	1	1,600	2	0.010	1	1	2,241	3	0.008	1	1	2,290	324	0.85	0.85	2.082	2.082	9.287	0.637	0.021	0.579	0.579	-	0.386	20.8
VR5	0.257639606	7,182,477	165	5,101	300	0.7	0.012	1	1	1,600	2	0.012	1	1	3,201	3	0.010	1	1	2,385	330	1.07	1.07	2.248	2.248	8.305	0.569	0.025	0.495	0.495	-	0.330	17.8
VR6	0.192732785	5,373,005	123	3,556	300	0.7	0.007	1	1	1,600	2	0.010	1	1	1,656	3	0.008	1	1	3,026	247	0.86	0.86	1.978	1.978	8.778	0.602	0.025	0.538	0.538	-	0.359	19.4
VR7	0.193837359	5,403,798	124	4,390	300	0.7	0.015	2	2	1,600	2	0.009	1	1	2,490	3	0.009	1	1	2,083	248	0.97	0.97	2.183	2.183	8.279	0.567	0.021	0.517	0.517	-	0.345	18.6
VRW1	0.301606882	8,408,197	193	4,607	300	0.7	0.011	1	1	1,600	2	0.029	3	3	2,707	3	0.018	2	2	2,350	193	2.11	2.11	2.032	2.032	5.359	0.367	0.025	0.389	0.389	-	0.260	14.0
VRW2	0.200312111	5,584,301	128	4,779	300	0.7	0.014	1	1	1,600	2	0.017	2	2	2,879	3	0.017	2	2	2,434	256	1.70	1.70	2.146	2.146	6.288	0.431	0.021	0.405	0.405	-	0.270	14.6
VRW3 N	0.195393186	5,447,171	125	5,313	300	0.7	0.024	2	2	1,600	2	0.010	1	1	3,413	3	0.022	2	2	2,647	125	1.82	1.82	2.116	2.116	5.341	0.366	0.025	0.417	0.417	-	0.278	15.0
VRW3 S	0.154903867	4,318,410	99	4,125	300	0.7	0.024	2	2	1,600	2	0.010	1	1	2,225	3	0.025	3	3	2,647	99	1.90	1.90	1.921	1.921	5.013	0.344	0.025	0.423	0.423	-	0.282	15.2
QR1	0.268996833	7,499,094	172	7,595	300	0.7	0.005	1	1	1,600	2	0.005	1	1	5,695	3	0.025	3	3	4,000	172	2.00	2.00	1.828	1.828	5.395	0.370	0.025	0.488	0.488	-	0.325	17.6
QR2	0.063670938	1,775,018	41	3,470	300	0.7	0.022	2	2	1,600	2	0.022	2	2	1,570	3	0.029	3	3	1,440	41	2.53	2.53	1.921	1.921	3.698	0.253	0.025	0.315	0.315	-	0.210	11.4

Notes:

Notes:

(1) Basin ID name
(2) Area of basin.
(3) Length of longest flow path possible in drainage basin.
(4) Length assumed for sheet flow. Maximum length of 300 ft. used per TR-55, Chapter 3.
(5) Conveyance condition for L1. Conditions in COA DPM table B-1 on pg. 22-22.
(6) L1 slope in decimal
(7) L1 slope in percentage
(8) S1 adjustment for slopes considered 'steep' per COA DPM.

* Adjustment should only be used if the slope is greater than 4%, developed channels, or for hydraulic design of channels or channel elements

if S1 is greater than 4
S1' = 5.2467+(0.062627*s1)-(18.197*e^(-0.62375*s1) per DPM 22-26, equation b-10
if S1 is less than or equal to 4
S1' = S1

(9) length assumed for Gully flow.

if L1>2000 ft
L2 = 1600
if L1<2000 ft
L2 = L1-400

(10) Conveyance condition for L2. Conditions in COA DPM table B-1 on pg. 22-22.
(11) L2 slope in decimal
(12) L2 slope in percentage
(13) adjusted s2

if S2 is greater than 4
S2' = 5.2467+(0.062627*s2)-(18.197*e^(-0.62375*s2) per DPM 22-26, equation b-10
if S2 is less than or equal to 4%
S2' = S2

(14) Length of arroyo flow along L.

L3 = L-(L1+L2)

(15) Conveyance condition for L3. Conditions in COA DPM table B-1 on pg. 22-22.
(16) L3 slope in decimal
(17) L3 slope in percentage
(18) adjusted S3

if S3 is greater than 4%
S3' = 5.2467+(0.062627*s3)-(18.197*e^(-0.62375*s3) per DPM 22-26, equation b-10
If S3 is less than or equal to 4%
S3' = S3

(19) Distance along L from point of concentration to a point opposite centroid of drainage basin (only necessary for basins with reach lengths greater than 4,000 ft).
(20) Basin discharge of the drainage basin 0.5 used for undeveloped. 1 used for basins VRW1 and VRW2 2 used for basins SEV1, SEV2, TVI1, VRW2, VR1 - VR7

If discharge is unknown:
Undeveloped -assume 0.5-1 cfs/ac **Q = (0.5-1) * A**
Developed- assume 2-3 cfs/ac **Q = (2-3) * A**
If the computed basin discharge is within 10 percent of Q_b the estimate is sufficiently accurate. If not, repeat the process using the computed basin discharge.

(21) Average slope over entire reach length

S = ((L1*S1)+(L2*S2)+(L3*S3))/L per DPM 22-26, equation b-5

(22) Adjusted Slope

if S is greater than 4%
S' = 5.2467+(0.062627*S)-(18.197*e^(-0.62375*S) per DPM 22-26, equation b-10
if S is less than or equal to 4%
S' = S

(23) average K

K = ((L1/(K1*S1^.5))+ (L2/(K2*S2^.5))+(L3/(K3*S3^.5))*(S^.5/L))^-1 per DPM 22-23, equation b-4

(24) K_w
eqn to find K value for the weighted overall slope and reach length

K_w = (L/((S'^.5)*(L1/(K1*(S1^.5)) + L2/(K2*(S2^.5)) + L3/(K3*(S3'^.5)))

(25) K'
* K' and K" are calculated for adjusted slopes

K'= 0.302*(S'/100)^-.5*(Qb^0.18) per DPM 22-26, equation b-11

(26) K"

K"= 0.207*(S'^-.5)*(Qb^0.18) per DPM 22-26, equation b-12

(27) a basin factor based on an estimate of weighted, by stream length, average Manning's n value for the principal watercourses in the drainage basin. For the Albuquerque area, values of Kn may be estimated from COA DPM Table B-2, pg. 22-23
(28) TC

if the total Reach is less than 4000 ft
TC = per DPM 22-22 equation B-1 and B-2

If the total Reach is greater than 12000 ft TC does not apply

If the total reach is greater than 4000 ft and less than 12000 ft
TC = ((12000-L)/(120*K*S^.5) + ((L-4000)*Kn*(Lca/L)^.33))/(4.305*S^0.165))/60

(29) TC'
adjusted TC value for natural channels and steep slopes

* variances to compensate for using a non decimal slope
If the Ground Slope<4 *TC= ((12000-L)/(72000*K*S^.5) + ((L-4000)*Kn*(Lca/L)^.33)/(552.2*S^0.165))* eq. from DPM 22-23
TC' = TC
If the Ground Slope>4 ***K value determination:*
*if L <4000 **determine which K value* *If K' <Kw* *Use K'*
TC' = L/(K*S'^.5)/3600) per DPM 22-22 equation B-1 and B-2
If L>12000 TC' does not apply *If Kw < K"* *Use K"*
*If L is between 4000 and 12000 **determine which K value* *If Kw > K' & K"* *Use Kw*
TC' = ((12000-L)/(120*K*S'^.5) + ((L-4000)*Kn*((Lca/L)^.33))/(4.305*S'^0.165))/60
* variances from DPM equation to compensate for using a non decimal slope

(30) Lag Time
for steep slope adjustment for L>12000

*TC= ((12000-L)/(72000*K*S^.5) + ((L-4000)*Kn*(Lca/L)^.33)/(552.2*S^0.165))* eq. from DPM 22-23
If L > 12000 - This applies to Basin QR4
LG= 26*Kn*((L*Lca/(5280^2*(S'*5280)^0.5))^0.33) eq from DPM 22-24 eq. B-7

(31) Time to Peak

If TC' is greater or equal to TC
If TC'< 0.2
If TC' is equal to zero
TP = Lg*(4/3)*0.6667 eq from DPM 22-24 eq. B-8 and B-9
If TC' is not equal to zero
TP = 0.1333 Minimum requirement
If TC'> 0.2
TP = TC' *0.6667 eq from DPM 22-24 eq. B-9

If TC' is less than TC
*If TC*2/3<0.133*
TP = 0.133 Minimum requirement
*If TC*2/3>0.133*
TP = TC*2/3 eq from DPM 22-24 eq. B-9

(32) Lag Time = 0.6*Tc'
for input into HEC-HMS model using the AMAFCA White Paper Process(p. 13).