

Project:	Carolina Crossroads D/B	By:	DPH	Date:	May 2020
Location:	Richland & Lexington Counties, SC	Checked:	MMD	Date:	May 2020

NRCS Basins - Composite CNs

Basin ID	CND-1		CND-2		COL-1	
	PRE	POST	PRE	POST	PRE	POST
Impervious / Water Area (ac)	12.25	12.71	2.53	2.66	11.30	15.03
Impervious / Water CN	98	98	98	98	98	98
Soil Class A / Zone Group 1 Area (ac)	0.00	0.00	0.00	0.00	0.00	0.00
Soil Class A / Zone Group 1 CN	77	77	77	77	77	77
Soil Class A / Zone Group 2 Area (ac)	0.00	0.00	0.00	0.00	0.00	0.00
Soil Class A / Zone Group 2 CN	57	57	57	57	57	57
Soil Class A / Zone Group 3 Area (ac)	0.00	0.00	0.00	0.00	0.00	0.00
Soil Class A / Zone Group 3 CN	89	89	89	89	89	89
Soil Class A / Zone Group 4 Area (ac)	0.00	0.00	0.00	0.00	0.00	0.00
Soil Class A / Zone Group 4 CN	49	49	49	49	49	49
Soil Class A / Woods Area (ac)	0.00	0.00	0.00	0.00	0.00	0.00
Soil Class A / Woods CN	36	36	36	36	36	36
Soil Class A / Open Space Area (ac)	0.00	0.00	0.00	0.00	0.00	0.00
Soil Class A / Open Space CN	39	39	39	39	39	39
Soil Class B / Zone Group 1 Area (ac)	68.04	68.05	25.04	25.04	15.51	15.51
Soil Class B / Zone Group 1 CN	85	85	85	85	85	85
Soil Class B / Zone Group 2 Area (ac)	14.81	14.81	22.80	22.80	30.87	30.87
Soil Class B / Zone Group 2 CN	72	72	72	72	72	72
Soil Class B / Zone Group 3 Area (ac)	29.83	29.83	32.61	32.61	62.52	62.52
Soil Class B / Zone Group 3 CN	92	92	92	92	92	92
Soil Class B / Zone Group 4 Area (ac)	0.00	0.00	0.00	0.00	0.00	0.00
Soil Class B / Zone Group 4 CN	69	69	69	69	69	69
Soil Class B / Woods Area (ac)	1.19	1.11	0.00	0.00	3.51	2.11
Soil Class B / Woods CN	60	60	60	60	60	60
Soil Class B / Open Space Area (ac)	0.97	1.05	0.67	0.67	3.97	5.15
Soil Class B / Open Space CN	61	61	61	61	61	61
Soil Class C / Zone Group 1 Area (ac)	43.19	43.19	29.61	29.61	2.23	2.23
Soil Class C / Zone Group 1 CN	90	90	90	90	90	90
Soil Class C / Zone Group 2 Area (ac)	9.06	9.06	3.92	3.92	1.64	1.64
Soil Class C / Zone Group 2 CN	81	81	81	81	81	81
Soil Class C / Zone Group 3 Area (ac)	0.61	0.61	1.59	1.59	22.67	22.67
Soil Class C / Zone Group 3 CN	94	94	94	94	94	94
Soil Class C / Zone Group 4 Area (ac)	0.00	0.00	0.00	0.00	0.00	0.00
Soil Class C / Zone Group 4 CN	79	79	79	79	79	79
Soil Class C / Woods Area (ac)	2.36	1.53	0.00	0.00	4.45	0.41
Soil Class C / Woods CN	73	73	73	73	73	73
Soil Class C / Open Space Area (ac)	5.87	6.30	0.64	0.55	5.27	7.21
Soil Class C / Open Space CN	74	74	74	74	74	74
Soil Class D / Zone Group 1 Area (ac)	0.00	0.00	0.00	0.00	0.74	0.74
Soil Class D / Zone Group 1 CN	92	92	92	92	92	92
Soil Class D / Zone Group 2 Area (ac)	0.00	0.00	0.00	0.00	0.00	0.00
Soil Class D / Zone Group 2 CN	86	86	86	86	86	86
Soil Class D / Zone Group 3 Area (ac)	0.00	0.00	0.00	0.00	1.02	1.02
Soil Class D / Zone Group 3 CN	95	95	95	95	95	95
Soil Class D / Zone Group 4 Area (ac)	0.00	0.00	0.00	0.00	0.00	0.00
Soil Class D / Zone Group 4 CN	84	84	84	84	84	84
Soil Class D / Woods Area (ac)	0.00	0.00	0.00	0.00	3.79	0.62
Soil Class D / Woods CN	79	79	79	79	79	79
Soil Class D / Open Space Area (ac)	0.00	0.00	0.00	0.00	1.79	3.51
Soil Class D / Open Space CN	80	80	80	80	80	80
Total Basin Area (ac)	188.18	188.25	119.41	119.45	171.29	171.23
Basin Composite CN	86.14	86.20	85.74	85.76	85.47	86.02

Time of Concentration

Basin ID: **CND-1_Pre****Sheet Flow (Applicable to T_c only)**

1. Manning's roughness coefficient, n (table 3-1)	0.24				
2. Flow length, L (total L ≤ 300 ft)	183	ft			
3. Two-year 24-hour rainfall, P ₂	3.7	in	4. Land slope, s	0.016	ft/ft
5. Travel time, T _t = 0.007(nL) ^{0.8} /((P ₂ ^{0.5})(s ^{0.4}))	0.39	hr	=	23.40	min

Shallow concentrated flow

6. Surface description (paved or unpaved)	Unpaved				
7. Flow length, L	188	ft	8. Watercourse slope, s	0.021	ft/ft
9. Average velocity, V (Figure 3-1)	2.34	ft/s			
10. Travel time, T _t = L / 60*V*60 =	0.02	hr	=	1.34	min

Pipe flow 1

11. Flow length, L	1304	ft	12. Assumed Velocity, V	2	ft/s
13. Travel time, T _t = L / 60*V*60 =	0.18	hr	=	10.87	min

Channel flow 1

14. Cross sectional flow area, a	4	ft ²	15. Wetted perimeter, p _w	9	ft
16. Hydraulic radius, r = a/p _w	0.444	ft	17. Channel slope, s	0.033	ft/ft
18. Manning's roughness coefficient, n	0.24				
19. V = 1.49 r ^{2/3} s ^{1/2} / n =	0.66	ft/s	20. Flow length, L	879	ft
21. Travel time, T _t = L / 3600* V =	0.37	hr	=	22.30	min

Pipe flow 2

22. Flow length, L	194	ft	23. Assumed Velocity, V	2	ft/s
24. Travel time, T _t = L / 60*V*60 =	0.03	hr	=	1.62	min

Channel flow 2

25. Cross sectional flow area, a	5	ft ²	26. Wetted perimeter, p _w	10	ft
27. Hydraulic radius, r = a/p _w	0.500	ft	28. Channel slope, s	0.023	ft/ft
29. Manning's roughness coefficient, n	0.15				
30. V = 1.49 r ^{2/3} s ^{1/2} / n =	0.95	ft/s	31. Flow length, L	1539	ft
32. Travel time, T _t = L / 3600* V =	0.45	hr	=	27.03	min

Pipe flow 3

33. Flow length, L	375	ft	34. Assumed Velocity, V	2	ft/s
35. Travel time, T _t = L / 60*V*60 =	0.05	hr	=	3.13	min

Channel flow 3

36. Cross sectional flow area, a	12	ft ²	37. Wetted perimeter, p _w	11	ft
38. Hydraulic radius, r = a/p _w	1.091	ft	39. Channel slope, s	0.022	ft/ft
40. Manning's roughness coefficient, n	0.1				
41. V = 1.49 r ^{2/3} s ^{1/2} / n =	2.34	ft/s	42. Flow length, L	557	ft
43. Travel time, T _t = L / 3600* V =	0.07	hr	=	3.96	min

Pipe flow 4

33. Flow length, L	489	ft	34. Assumed Velocity, V	2	ft/s
35. Travel time, T _t = L / 60*V*60 =	0.07	hr	=	4.08	min
44. Watershed or subarea T _c or T _t , Total =	1.63	hr	=	97.72	min

Time of Concentration

Basin ID: **CND-1_Post**

Sheet Flow (Applicable to Tc only)

1. Manning's roughness coefficient, n (table 3-1)	0.24			
2. Flow length, L (total L ≤ 300 ft)	183	ft		
3. Two-year 24-hour rainfall, P ₂	3.7	in	4. Land slope, s	0.016 ft/ft
5. Travel time, T _t = 0.007(nL) ^{0.8} /((P ₂ ^{0.5})(s ^{0.4}))	0.39	hr	=	23.40 min

Shallow concentrated flow

6. Surface description (paved or unpaved)	Unpaved			
7. Flow length, L	188	ft	8. Watercourse slope, s	0.021 ft/ft
9. Average velocity, V (Figure 3-1)	2.34	ft/s		
10. Travel time, T _t = L / 60*V*60 =	0.02	hr	=	1.34 min

Pipe flow 1

11. Flow length, L	1304	ft	12. Assumed Velocity, V	2 ft/s
13. Travel time, T _t = L / 60*V*60 =	0.18	hr	=	10.87 min

Channel flow 1

14. Cross sectional flow area, a	4	ft ²	15. Wetted perimeter, p _w	9 ft
16. Hydraulic radius, r = a/p _w	0.444	ft	17. Channel slope, s	0.033 ft/ft
18. Manning's roughness coefficient, n	0.24			
19. V = 1.49 r ^{2/3} s ^{1/2} / n =	0.66	ft/s	20. Flow length, L	879 ft
21. Travel time, T _t = L / 3600* V =	0.37	hr	=	22.30 min

Pipe flow 2

22. Flow length, L	194	ft	23. Assumed Velocity, V	2 ft/s
24. Travel time, T _t = L / 60*V*60 =	0.03	hr	=	1.62 min

Channel flow 2

25. Cross sectional flow area, a	5	ft ²	26. Wetted perimeter, p _w	10 ft
27. Hydraulic radius, r = a/p _w	0.500	ft	28. Channel slope, s	0.023 ft/ft
29. Manning's roughness coefficient, n	0.15			
30. V = 1.49 r ^{2/3} s ^{1/2} / n =	0.95	ft/s	31. Flow length, L	1539 ft
32. Travel time, T _t = L / 3600* V =	0.45	hr	=	27.03 min

Pipe flow 3

33. Flow length, L	375	ft	34. Assumed Velocity, V	2 ft/s
35. Travel time, T _t = L / 60*V*60 =	0.05	hr	=	3.13 min

Channel flow 3

36. Cross sectional flow area, a	12	ft ²	37. Wetted perimeter, p _w	11 ft
38. Hydraulic radius, r = a/p _w	1.091	ft	39. Channel slope, s	0.022 ft/ft
40. Manning's roughness coefficient, n	0.1			
41. V = 1.49 r ^{2/3} s ^{1/2} / n =	2.34	ft/s	42. Flow length, L	538 ft
43. Travel time, T _t = L / 3600* V =	0.06	hr	=	3.83 min

Pipe flow 4

33. Flow length, L	508	ft	34. Assumed Velocity, V	2 ft/s
35. Travel time, T _t = L / 60*V*60 =	0.07	hr	=	4.23 min
44. Watershed or subarea T _c or T _t , Total =	1.63	hr	=	97.74 min

Time of Concentration

Basin ID: **CND-2_Pre****Sheet Flow (Applicable to T_c only)**

1. Manning's roughness coefficient, n (table 3-1)	0.4				
2. Flow length, L (total L ≤ 300 ft)	300	ft			
3. Two-year 24-hour rainfall, P ₂	3.7	in	4. Land slope, s	0.033	ft/ft
5. Travel time, T _t = 0.007(nL) ^{0.8} /((P ₂ ^{0.5})(s ^{0.4}))	0.66	hr	=	39.60	min

Shallow concentrated flow

6. Surface description (paved or unpaved)	Unpaved				
7. Flow length, L	180	ft	8. Watercourse slope, s	0.028	ft/ft
9. Average velocity, V (Figure 3-1)				2.70	ft/s
10. Travel time, T _t = L / 60*V*60 =				0.02	hr
					=
				1.11	min

Pipe flow 1

11. Flow length, L	534	ft	12. Assumed Velocity, V	2	ft/s
13. Travel time, T _t = L / 60*V*60 =				0.07	hr
					=
				4.45	min

Channel flow

14. Cross sectional flow area, a	6	ft ²	15. Wetted perimeter, p _w	13	ft
16. Hydraulic radius, r = a/p _w	0.462	ft	17. Channel slope, s	0.027	ft/ft
18. Manning's roughness coefficient, n		0.15			
19. V=1.49 r ^{2/3} s ^{1/2} / n =		0.97	ft/s		
20. Flow length, L				2415	ft
21. Travel time, T _t = L / 3600* V =				0.69	hr
					=
				41.29	min

Pipe flow 2

22. Flow length, L	927	ft	23. Assumed Velocity, V	2	ft/s
24. Travel time, T _t = L / 60*V*60 =				0.13	hr
					=
				7.73	min
25. Watershed or subarea T _c or T _t , Total =				1.57	hr
					=
				94.18	min

Sheet Flow (Applicable to T_c only)

1. Manning's roughness coefficient, n (table 3-1)	0.4				
2. Flow length, L (total L ≤ 300 ft)	300	ft			
3. Two-year 24-hour rainfall, P ₂	3.7	in	4. Land slope, s	0.033	ft/ft
5. Travel time, T _t = 0.007(nL) ^{0.8} /((P ₂ ^{0.5})(s ^{0.4}))	0.66	hr	=	39.60	min

Shallow concentrated flow

6. Surface description (paved or unpaved)	Unpaved				
7. Flow length, L	180	ft	8. Watercourse slope, s	0.028	ft/ft
9. Average velocity, V (Figure 3-1)	2.70	ft/s			
10. Travel time, T _t = L / 60*V*60 =	0.02	hr	=	1.11	min

Pipe flow 1

11. Flow length, L	534	ft	12. Assumed Velocity, V	2	ft/s
13. Travel time, T _t = L / 60*V*60 =	0.07	hr	=	4.45	min

Channel flow

14. Cross sectional flow area, a	6	ft ²	15. Wetted perimeter, p _w	13	ft
16. Hydraulic radius, r = a/p _w	0.462	ft	17. Channel slope, s	0.027	ft/ft
18. Manning's roughness coefficient, n	0.15				
19. V=1.49 r ^{2/3} s ^{1/2} / n =	0.97	ft/s	20. Flow length, L	2415	ft
21. Travel time, T _t = L / 3600* V =	0.69	hr	=	41.29	min

Pipe flow 2

22. Flow length, L	927	ft	23. Assumed Velocity, V	2	ft/s
24. Travel time, T _t = L / 60*V*60 =	0.13	hr	=	7.73	min
25. Watershed or subarea T _c or T _t , Total =	1.57	hr	=	94.18	min

Sheet Flow (Applicable to T_c only)

1. Manning's roughness coefficient, n (table 3-1)	0.4				
2. Flow length, L (total L ≤ 300 ft)	300	ft			
3. Two-year 24-hour rainfall, P ₂	3.7	in	4. Land slope, s	0.040	ft/ft
5. Travel time, T _t = 0.007(nL) ^{0.8} /((P ₂ ^{0.5})(s ^{0.4}))	0.61	hr	=	36.60	min

Shallow concentrated flow

6. Surface description (paved or unpaved)	Unpaved				
7. Flow length, L	215	ft	8. Watercourse slope, s	0.070	ft/ft
9. Average velocity, V (Figure 3-1)	4.27	ft/s			
10. Travel time, T _t = L / 60*V*60 =	0.01	hr	=	0.84	min

Total pipe flow

11. Flow length, L	2945	ft	12. Assumed Velocity, V	2	ft/s
13. Travel time, T _t = L / 60*V*60 =	0.41	hr	=	24.54	min

Channel flow 1

14. Cross sectional flow area, a	6.5	ft ²	15. Wetted perimeter, p _w	9	ft
16. Hydraulic radius, r = a/p _w	0.722	ft	17. Channel slope, s	0.008	ft/ft
18. Manning's roughness coefficient, n	0.1				
19. V = 1.49 r ^{2/3} s ^{1/2} / n =	1.07	ft/s	20. Flow length, L	526	ft
21. Travel time, T _t = L / 3600* V =	0.14	hr	=	8.17	min

Channel flow 2

22. Cross sectional flow area, a	6.5	ft ²	23. Wetted perimeter, p _w	9	ft
24. Hydraulic radius, r = a/p _w	0.722	ft	25. Channel slope, s	0.015	ft/ft
26. Manning's roughness coefficient, n	0.24				
27. V = 1.49 r ^{2/3} s ^{1/2} / n =	0.61	ft/s	28. Flow length, L	655	ft
29. Travel time, T _t = L / 3600* V =	0.30	hr	=	17.84	min

Channel flow 3

30. Cross sectional flow area, a	26	ft ²	31. Wetted perimeter, p _w	20	ft
32. Hydraulic radius, r = a/p _w	1.300	ft	33. Channel slope, s	0.006	ft/ft
34. Manning's roughness coefficient, n	0.24				
35. V = 1.49 r ^{2/3} s ^{1/2} / n =	0.57	ft/s	36. Flow length, L	492	ft
37. Travel time, T _t = L / 3600* V =	0.24	hr	=	14.32	min

Channel flow 4

38. Cross sectional flow area, a	32.5	ft ²	39. Wetted perimeter, p _w	23	ft
40. Hydraulic radius, r = a/p _w	1.413	ft	41. Channel slope, s	0.019	ft/ft
42. Manning's roughness coefficient, n	0.1				
43. V = 1.49 r ^{2/3} s ^{1/2} / n =	2.59	ft/s	44. Flow length, L	160	ft
45. Travel time, T _t = L / 3600* V =	0.02	hr	=	1.03	min
46. Watershed or subarea T _c or T _t , Total =	1.72	hr	=	103.34	min

Sheet Flow (Applicable to Tc only)

1. Manning's roughness coefficient, n (table 3-1)	0.4				
2. Flow length, L (total L ≤ 300 ft)	300	ft			
3. Two-year 24-hour rainfall, P ₂	3.7	in	4. Land slope, s	0.040	ft/ft
5. Travel time, $T_t = 0.007(nL)^{0.8}/((P_2^{0.5})(s^{0.4}))$	0.61	hr	=	36.60	min

Shallow concentrated flow

6. Surface description (paved or unpaved)	Unpaved				
7. Flow length, L	215	ft	8. Watercourse slope, s	0.070	ft/ft
9. Average velocity, V (Figure 3-1)	4.27	ft/s			
10. Travel time, $T_t = L / 60 * V * 60$	=	0.01	hr	=	0.84 min

Total pipe flow

11. Flow length, L	3289	ft	12. Assumed Velocity, V	2	ft/s
13. Travel time, $T_t = L / 60 * V * 60$	=	0.46	hr	=	27.41 min

Channel flow 1

14. Cross sectional flow area, a	6.5	ft ²	15. Wetted perimeter, p _w	9	ft
16. Hydraulic radius, r = a/p _w	0.722	ft	17. Channel slope, s	0.008	ft/ft
18. Manning's roughness coefficient, n	0.1				
19. $V = 1.49 r^{2/3} s^{1/2} / n$	1.07	ft/s	20. Flow length, L	526	ft
21. Travel time, $T_t = L / 3600 * V$	=	0.14	hr	=	8.17 min

Channel flow 2

22. Cross sectional flow area, a	6.5	ft ²	23. Wetted perimeter, p _w	9	ft
24. Hydraulic radius, r = a/p _w	0.722	ft	25. Channel slope, s	0.015	ft/ft
26. Manning's roughness coefficient, n	0.24				
27. $V = 1.49 r^{2/3} s^{1/2} / n$	0.61	ft/s	28. Flow length, L	467	ft
29. Travel time, $T_t = L / 3600 * V$	=	0.21	hr	=	12.72 min

Channel flow 3

30. Cross sectional flow area, a	26	ft ²	31. Wetted perimeter, p _w	20	ft
32. Hydraulic radius, r = a/p _w	1.300	ft	33. Channel slope, s	0.006	ft/ft
34. Manning's roughness coefficient, n	0.24				
35. $V = 1.49 r^{2/3} s^{1/2} / n$	0.57	ft/s	36. Flow length, L	442	ft
37. Travel time, $T_t = L / 3600 * V$	=	0.21	hr	=	12.86 min

Channel flow 4

38. Cross sectional flow area, a	32.5	ft ²	39. Wetted perimeter, p _w	23	ft
40. Hydraulic radius, r = a/p _w	1.413	ft	41. Channel slope, s	0.019	ft/ft
42. Manning's roughness coefficient, n	0.1				
43. $V = 1.49 r^{2/3} s^{1/2} / n$	2.59	ft/s	44. Flow length, L	160	ft
45. Travel time, $T_t = L / 3600 * V$	=	0.02	hr	=	1.03 min
46. Watershed or subarea T _c or T _t , Total =		1.66	hr	=	99.63 min

Project:	Carolina Crossroads D/B	By:	DPH	Date:	May 2020
Location:	Richland & Lexington Counties, SC	Checked:	MMD	Date:	May 2020

NRCS Peak Flow Interpolation Calculations

			Minimum Interpolation Values			Actual Values			Maximum Interpolation Values		
Basin ID	Area (ac)	Time of Concentration (hr)	C Value	Design Storm Event	Discharge (cfs)	C Value	Design Storm Event	Discharge (cfs)	C Value	Design Storm Event	Discharge (cfs)
CND-1	PRE	188.18	86.00	2-Year	185.78	86.14	2-Year	186.65	87.00	2-Year	191.93
				5-Year	257.42		5-Year	258.34		5-Year	263.91
				10-Year	324.62		10-Year	325.51		10-Year	330.91
				25-Year	407.52		25-Year	408.62		25-Year	415.31
				50-Year	480.00		50-Year	481.05		50-Year	487.43
				100-Year	553.57		100-Year	554.30		100-Year	558.75
	POST	188.25	86.00	2-Year	185.85	86.20	2-Year	187.09	87.00	2-Year	192.00
				5-Year	257.52		5-Year	258.82		5-Year	264.01
				10-Year	324.75		10-Year	326.01		10-Year	331.04
				25-Year	407.67		25-Year	409.24		25-Year	415.47
				50-Year	480.18		50-Year	481.67		50-Year	487.61
				100-Year	553.78		100-Year	554.82		100-Year	558.96
CND-2	PRE	119.41	85.00	2-Year	117.12	85.74	2-Year	119.77	86.00	2-Year	120.70
				5-Year	163.68		5-Year	166.91		5-Year	168.05
				10-Year	207.23		10-Year	210.23		10-Year	211.28
				25-Year	262.02		25-Year	264.29		25-Year	265.09
				50-Year	307.91		50-Year	311.50		50-Year	312.76
				100-Year	356.28		100-Year	358.19		100-Year	358.86
	POST	119.45	85.00	2-Year	117.16	85.76	2-Year	119.89	86.00	2-Year	120.74
				5-Year	163.74		5-Year	167.06		5-Year	168.10
				10-Year	207.30		10-Year	210.38		10-Year	211.34
				25-Year	262.11		25-Year	264.44		25-Year	265.17
				50-Year	308.01		50-Year	311.70		50-Year	312.86
				100-Year	356.40		100-Year	358.37		100-Year	358.98
COL-1	PRE	171.29	85.00	2-Year	158.09	85.47	2-Year	160.37	86.00	2-Year	162.91
				5-Year	221.37		5-Year	223.94		5-Year	226.81
				10-Year	279.31		10-Year	281.80		10-Year	284.57
				25-Year	354.05		25-Year	356.31		25-Year	358.82
				50-Year	417.55		50-Year	419.88		50-Year	422.47
				100-Year	480.02		100-Year	482.32		100-Year	484.88
	POST	171.23	86.00	2-Year	166.99	86.02	2-Year	167.08	87.00	2-Year	172.50
				5-Year	231.80		5-Year	231.88		5-Year	236.82
				10-Year	291.84		10-Year	291.92		10-Year	296.93
				25-Year	367.96		25-Year	368.03		25-Year	372.14
				50-Year	432.78		50-Year	432.84		50-Year	436.39
				100-Year	495.93		100-Year	496.00		100-Year	500.52