E-3

HYDROLOGY REPORT

FOR

EASTRIDGE

UNITS ONE AND TWO

A DENSITY SUBDIVISION AT THE CAUGHLIN RANCH

PREPARED BY:

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- Civil Engineering
- Traffic and Transportation
- City and Regional Planning
- Environmental Studies
- Structural Engineering
- Land Surveying

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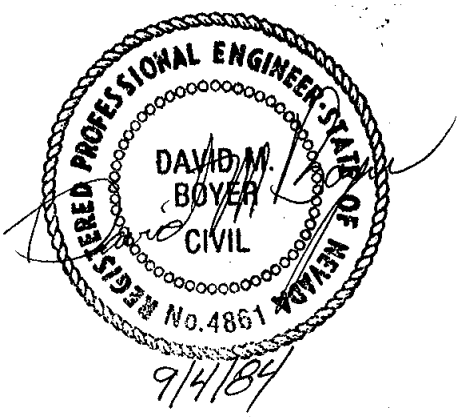

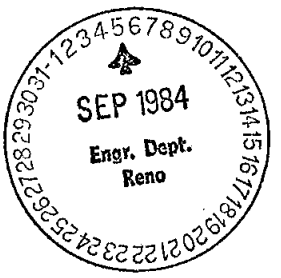

LIST OF APPENDICES

Appendix 1	-	TR55 Analysis For Offsite Drainage Basins
Appendix 2	-	TR55 Analysis For Existing Project Area
Appendix 3	-	TR55 Analysis For Proposed Development
Appendix 4	-	Storm Drain Hydraulic Caculations

The Proposed subdivision lies within the East 1/2 of Section 28 Township 19 North Range 19 East. The area is bounded by Skyline Crest and Skyline View subdivisions to the west and the proposed McCarran Boulevard to the East and South. The area's Assessors parcel numbers are 41-240-06, 41-240-08, 41-240-12, 41-240-12.

The subdivision site consists of rolling hill type terrain with a large canyon area on the north end. There are three major drainage channels crossing the site running generally in an easterly direction. These channels flow seasonally and during heavy rainfall runoff. No evidence of an extreme runoff event in the recent past is apparent in these water courses.

The site is undeveloped and is covered with sparse grass and abundant sagebrush. Numerous drainages cross the site and the surface slopes toward the channels. Slopes across the site range in steepness from less than 10 percent to over 40 percent.

Currently the two northerly most channels combine within the project area and leave the site in one existing drainage channel. The remaining channel to the south flows across the site and is intercepted by an existing structure on the east side of the Skyline View Drive access road. From that point runoff is routed into the City's storm drain system.

Three drainage basins supply the channels above the site. They are; 59 acres, 53 acres and 128 acres in area respectively, moving north to south see Figure 1. The SCS TR55 method was used to analyze the basins and the contributing areas within the subdivision.

With the existing conditions the analysis produced the following results from areas shown in Figures 2 and 3:

5 YEAR STORM 6 HR DURATIION

Drainage Area	Peak Flow From Outside Project Area (CFS)	Peak Flow From Inside Project Area (CFS)	Total (CFS)
1	14.7	4.1	18.9
2	13.4	7.4	20.8
3	27.6	11.4	39.0
4	-	1.5	1.5

100 YEAR STORM 6 HR DURATION

1	43.0	13.9	56.9
2	47.0	25.4	72.4
3	95.0	42.6	137.6
4	-	4.9	4.9

OFF-SITE DRAINAGE BASINS

EASTRIDGE SITE

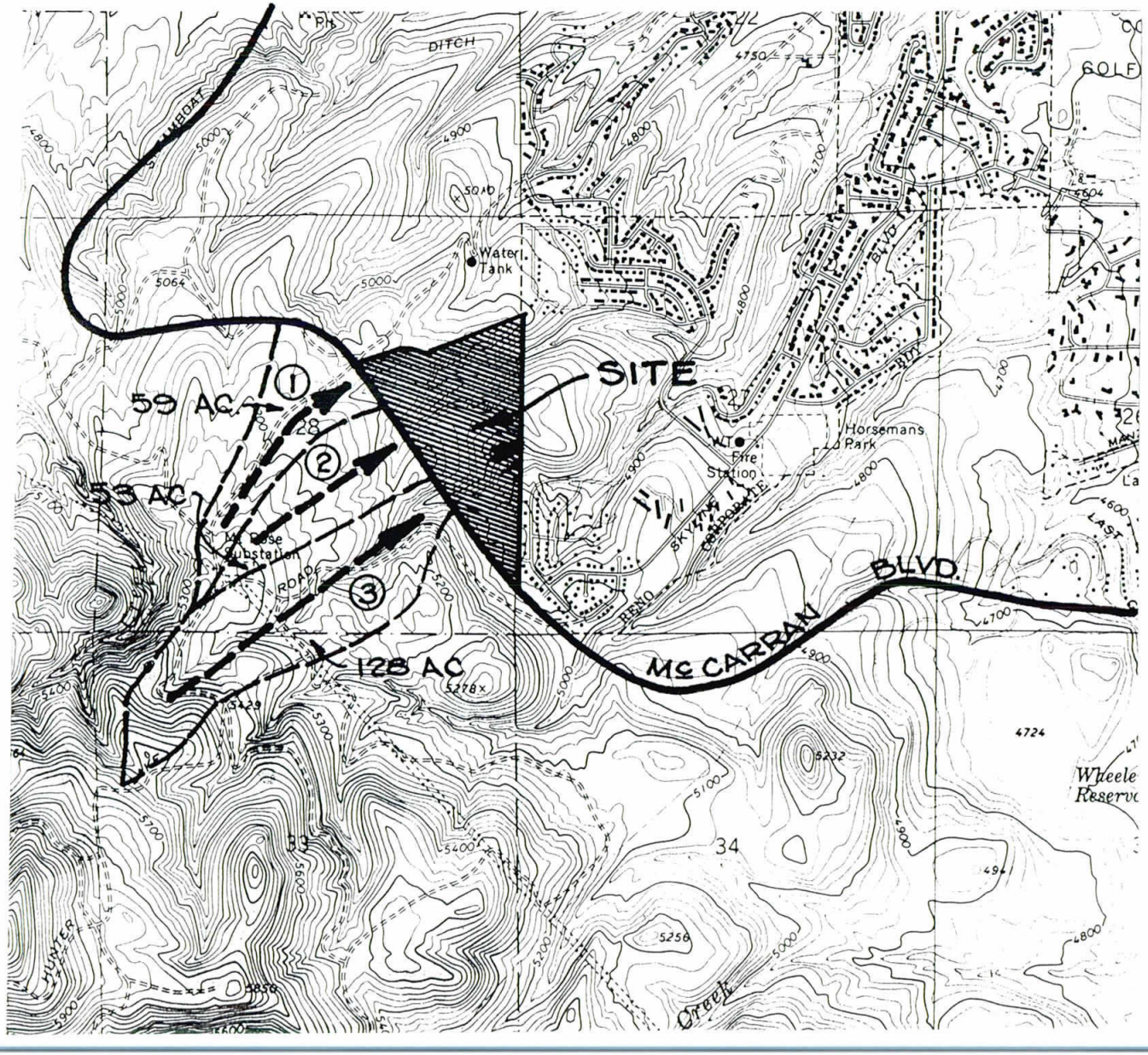

Fig. 1

EASTRIDGE HYDROLOGIC ANALYSIS AREAS EXISTING CONDITIONS

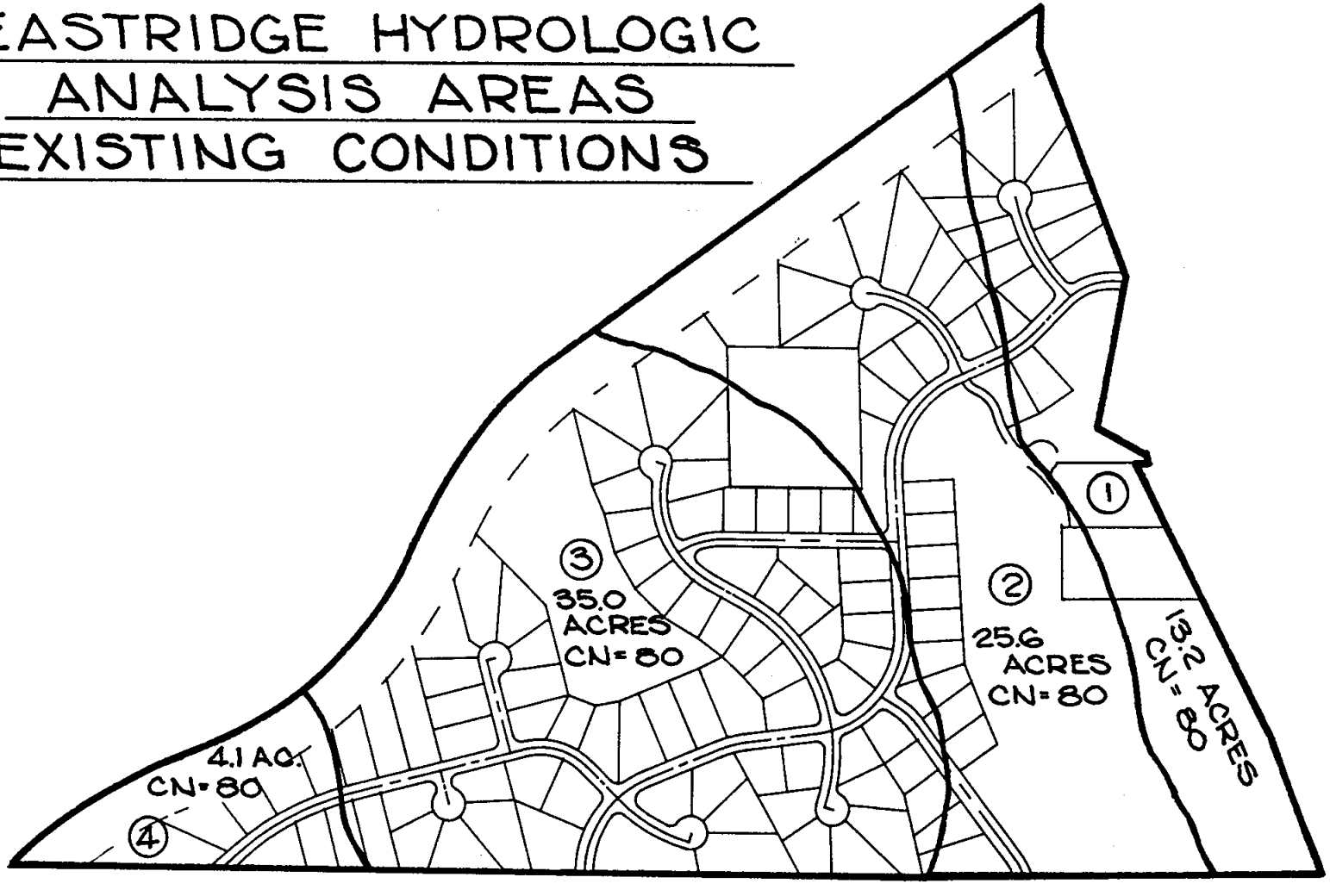

Fig. 2

EASTRIDGE HYDROLOGIC ANALYSIS AREAS PROPOSED CONDITIONS

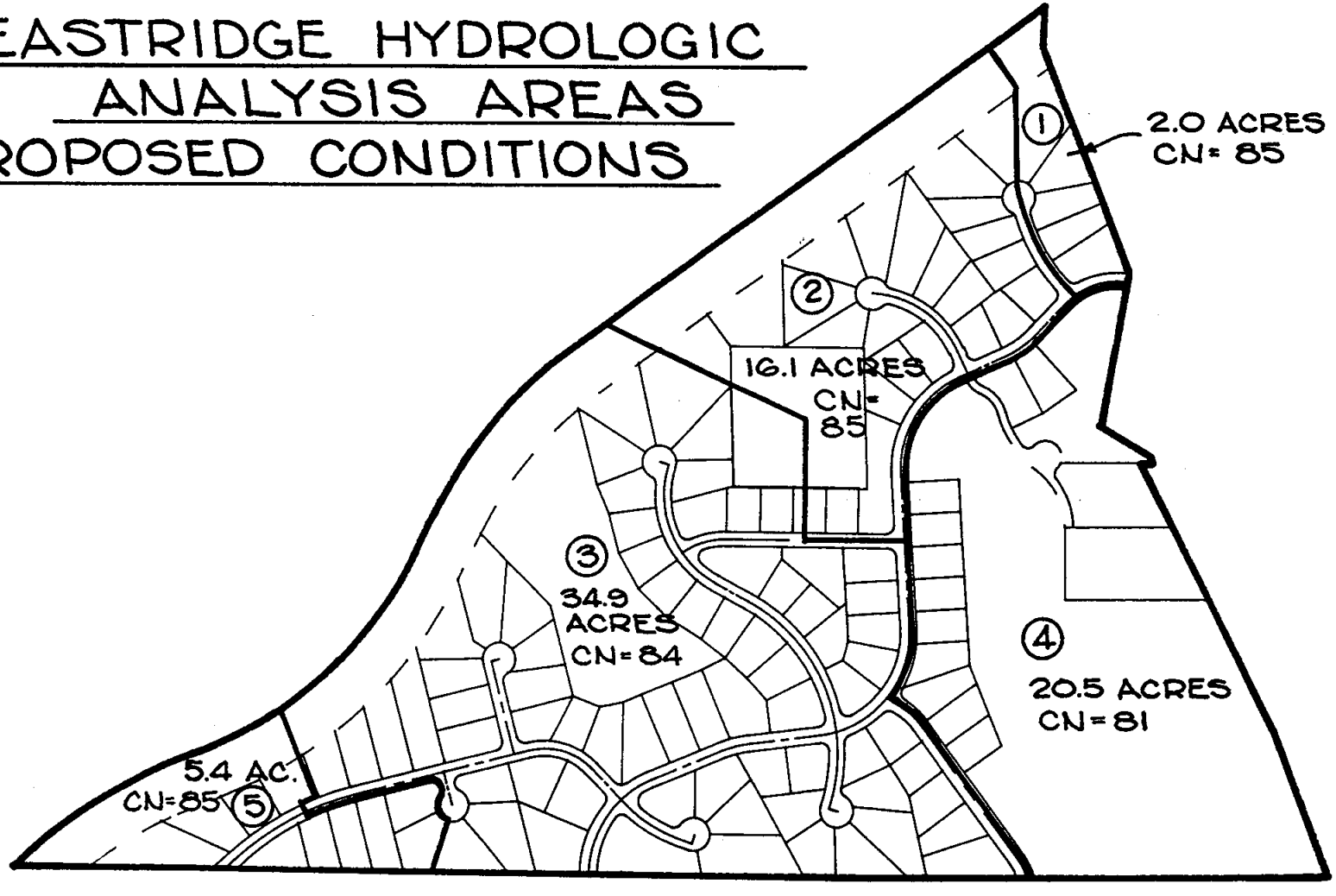

Fig. 3

With proposed conditions the analysis produced the following results:

5 YEAR STORM 6 HR DURATIION

Drainage Area	Peak Flow From Outside Project Area (CFS)	Peak Flow From Inside Project Area (CFS)	Total (CFS)
1	14.7	.12	14.8
2	13.4	9.80	23.2
3	27.6	17.30	44.9
4	-	8.00	8.0
5	-	3.30	3.30

100 YEAR STORM 6 HR DURATION

1	43.0	3.30	46.3
2	47.0	27.50	74.5
3	95.0	49.90	144.9
4	-	25.80	25.8
5	-	8.80	8.0

Stormwater runoff entering the subdivision from the three major drainage basins described will be intercepted and channeled through the subdivision via a ripraped v-ditch, for the northerly most basin (see storm drain parameters), a 24" RCP, Line "E" (see storm drain parameters) for the middle basin and a 24" RCP, Line "A" (see Storm Drain Parameters) for the southerly basin. Water from the north and middle basins will be discharged into the canyon to the north. Water from the south basin will be routed into the City System as it currently is.

Runoff within the Subdivision will be intercepted and transferred by the streets to catch basins located at two intersections: Hemlock Way and Big Bend Lane, and Hemlock Way and Chaparral Drive. From the catch basins located at Hemlock and Big Bend the storm water will travels to and through a 12" RCP (Line "B"). At the intersection of Hemlock Way and Chapparal the 12" RCP (Line "B") joins the 24" RCP (Line "A") carrying water from the southerly drainage basin. The combined flow travels in a 24" RCP (Line "C" see storm drain parameters). A third 12" RCP Storm Drain (Line "D") also joins line "C" with water collected from a catch basin in the north east corner of Lot 8 Block E.

See Figure 4 for Storm Drain locations.

PROPOSED EASTRIDGE STORM DRAIN LINES

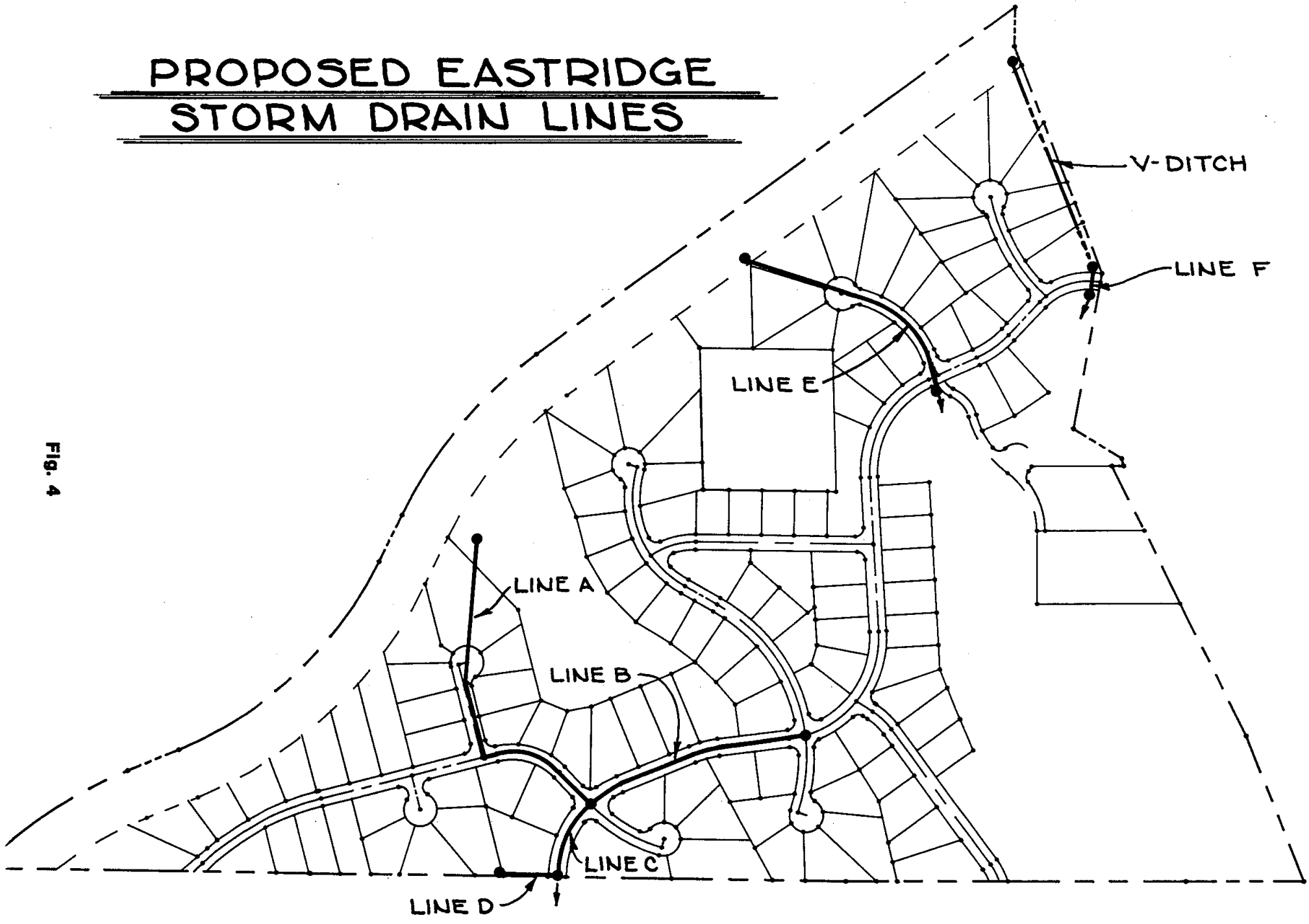

Fig. 4

STORM DRAIN PARAMETERS

V-Ditch Parameters:

STORM	FLOW (CFS)	DEPTH (IN)	VELOCITY (FPS)
Minor	17.9	12	8
Major	49.8	19	10

24" RCP (Line "A")

STORM	FLOW (CFS)	DEPTH (IN)	VELOCITY (FPS)
Minor	28.8	15	14
Major	98.6	Full	31

12" RCP (Line "B")

STORM	FLOW (CFS)	DEPTH (IN)	VELOCITY (FPS)
Minor	7.2	7	15
Major	20.8	Full	26

24" RCP (Line "C")

STORM	FLOW (CFS)	DEPTH (IN)	VELOCITY (FPS)
Minor	42.8	13	24
Major	13.9	Full	44

12" RCP (Line "D")

STORM	FLOW (CFS)	DEPTH (IN)	VELOCITY (FPS)
Minor	1.4	2	12
Major	3.8		

24" RCP (Line "E")

STORM	FLOW (CFS)	DEPTH (IN)	VELOCITY (FPS)
Minor	19.6	12	11
Major	64.4	Full	21

24" RCP (Line "F")

STORM	FLOW (CFS)	DEPTH (IN)	VELOCITY (FPS)
Minor	17.9	12	11
Major	49.8	Full	16

The calculated flows described in this report represent a worst case analysis. Flows in pipes and channels that combine will not reach their peaks at the same time. However we chose to combine peak flows as a conservative approach. Although peak flows will be increased by the proposed development, these flows will be controlled (i.e. channelized) by the streets and storm drain system reducing erosion and thereby sediment travel into the City's storm drain system and subsequent drainage systems. Development of this area will also protect existing development from overland flow flooding by proper yard drainage and the addition of vegetation to the area.

APPENDIX C

TR55 ANALYSIS FOR OFFSITE DRAINAGE BASINS

URBAN HYDROLOGY FOR SMALL WATERSHEDS (TR-55)
PEAK DISCHARGE WORKSHEET
FOR GRAPHICAL (T_c) METHOD (FIGURE 5-2)

Project EASTRIDGE By PS Date 4/2/84

Basin 1 Checked _____ Date _____

Steps Peak Discharge Computation for up to 3 storms: Type II, Duration 6 hours.

1. Data: Watershed Condition = Moderate (present or future).

   Drainage Area (DA) = 59 acres. Ave. Watershed Slope (S) = 6.3 %.

   Ponding and Swampy areas (PND) = _____ acres, _____ % of DA

   Impervious Area (IMP) = _____ acres, _____ % of DA

   Total Hydraulic Length (HL) = 3500 feet

   Hydraulic Length Modified (HLM) = _____ feet, _____ % of HL

	1st Storm	2nd Storm	3rd Storm	
2. Rainfall Frequency (F)	10	5	100	yrs.
3. Rainfall Depth (P)	1.6	1.4	2.4	inches
4. Runoff Curve Number (CN) = 80 (See other side for computation)				
5. Runoff Depth (Q) Use P, CN, and Table 2-1.	.34	.24	.82	inches
6. Time of Concentration (T_c) = .4 hrs. (See other side for computations) (check one) ☒ Velocity Method ☐ Lag-CN Method ☐ Other _____				
		X		
7. Unit Peak Discharge (q) Use T_c and Figure 5-2		680		csm/inch of Q
		X		
8. Drainage Area [DA(acres)/640(ac/sm)] = [59/640] =		.09		sq. miles
		X		
*9. Ponding and Swampy Area Peak Factor Only use % PND, F and Table E-3; when PND is spreadout in watershed and not related to T_c flow path.				
		=		
10. Peak Discharge Area Factor where q_p = Steps #5 x 7 x 8 x 9	21.0	14.7	50.2	cfs

*If the adjustment is not applicable, enter a Factor of 1.0.

TR-55 GRAPHICAL (T_c) METHOD, PEAK DISCHARGE WORKSHEET (CONT.)

Steps from other side

4. Runoff Curve Number (CN)

Hydrologic Soil Group (Appendix B)	Land Use Description Include Treatment, Practice & Condition (Table 2-2)	CN (Table 2-2) (3)	% or Area (acres) (4)	Product (3)x(4) (5)
		80		
	Totals =			

CN (weighted) = $\frac{\text{total col. 5}}{\text{total col. 4}}$ [ ] = ; use CN = 80

5. Time of Concentration (T_c) Select computation method, (a) is recommended.

(a) Velocity Method

Reach	Description of Flow 1/	Length (ft.) (3)	Velocity (ft/sec) (4)	Travel Time (sec.) (3) ÷ (4)
		3500	2.4	1458
	Totals =			

1/ Use Figure 3.1 for overland flow portion of travel time.

sec.

$T_c = \frac{\text{Total Travel Time (sec.)}}{3{,}600 \text{ (sec./hr.)}} = \left[\frac{1458}{3{,}600}\right] =$ .4 hrs.

(b) Lag-CN Method

(1) Unadjusted Lag (L)
Use HL, S, CN, and Figure 3-3. hrs.

x

*(2) Hydraulic Length Modified Lag Factor
Use % HLM, CN, and Figure 3-4.

x

*(3) Impervious Area Lag Factor
Use % IMP, CN, and Figure 3-5.

x

(4) Constant (T_c = 1.67L) 1.67

=

(5) Time of Concentration (T_c)
where T_c = (1)x(2)x(3)x(4) hrs.

(TR NOTICE 55-A, September 1981)

GPO 888-816

URBAN HYDROLOGY FOR SMALL WATERSHEDS (TR-55)
PEAK DISCHARGE WORKSHEET
FOR GRAPHICAL (T_c) METHOD (FIGURE 5-2)

Project EASTRIDGE By PS Date 4/2/84

Basin 2 Checked _____ Date _____

Steps Peak Discharge Computation for up to 3 storms: Type II, Duration ~~24~~ 6 hours.

1. Data: Watershed Condition = Moderate (present or future).

   Drainage Area (DA) = 128 acres. Ave. Watershed Slope (S) = 12 %.

   Ponding and Swampy areas (PND) = _____ acres, _____ % of DA

   Impervious Area (IMP) = _____ acres, _____ % of DA

   Total Hydraulic Length (HL) = 5200 feet

   Hydraulic Length Modified (HLM) = _____ feet, _____ % of HL

	1st Storm	2nd Storm	3rd Storm	
2. Rainfall Frequency (F)	10	5	100	yrs.
3. Rainfall Depth (P)	1.6	1.4	2.4	inches
4. Runoff Curve Number (CN) = 80 (See other side for computation)				
5. Runoff Depth (Q) Use P, CN, and Table 2-1.	.34	.24	.82	inches
6. Time of Concentration (T_c) = .41 hrs. (See other side for computations) (check one) [X] Velocity Method [ ] Lag-CN Method [ ] Other _____		X		
7. Unit Peak Discharge (q) Use T_c and Figure 5-2		575		csm/inch of Q
8. Drainage Area [DA(acres) / 640(ac/sm)] = [128 / 640] =		0.2		sq. miles
*9. Ponding and Swampy Area Peak Factor Only use % PND, F and Table E-3; when PND is spreadout in watershed and not related to T_c flow path.				
10. Peak Discharge Area Factor where q_p = Steps #5 x 7 x 8 x 9	39.1	27.6	94.3	cfs

*If the adjustment is not applicable, enter a Factor of 1.0.

TR-55 GRAPHICAL (T_c) METHOD, PEAK DISCHARGE WORKSHEET (CONT.)

Steps from other side

4. Runoff Curve Number (CN)

Hydrologic Soil Group (Appendix B)	Land Use Description Include Treatment, Practice & Condition (Table 2-2)	CN (Table 2-2) (3)	% or Area (acres) (4)	Product (3)x(4) (5)
D		80		
		Totals =		

CN (weighted) = $\frac{\text{total col. 5}}{\text{total col. 4}}$ [ ] = ; use CN = 80

5. Time of Concentration (T_c) Select computation method, (a) is recommended.

(a) Velocity Method

Reach	Description of Flow 1/	Length (ft.) (3)	Velocity (ft/sec) (4)	Travel Time (sec.) (3) ÷ (4)
		5200	3.5	1486
			Totals =	sec.

1/ Use Figure 3.1 for overland flow portion of travel time.

$T_c = \frac{\text{Total Travel Time (sec.)}}{3{,}600 \text{ (sec./hr.)}} = \left[\frac{1486}{3{,}600}\right] = .41$ hrs.

(b) Lag-CN Method

(1) Unadjusted Lag (L)
Use HL, S, CN, and Figure 3-3. [ ] hrs.

x

*(2) Hydraulic Length Modified Lag Factor
Use % HLM, CN, and Figure 3-4. [ ]

x

*(3) Impervious Area Lag Factor
Use % IMP, CN, and Figure 3-5. [ ]

x

(4) Constant (T_c = 1.67L) 1.67

=

(5) Time of Concentration (T_c)
where T_c = (1)x(2)x(3)x(4) [ ] hrs.

(TR NOTICE 55-A, September 1981)

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URBAN HYDROLOGY FOR SMALL WATERSHEDS (TR-55)
PEAK DISCHARGE WORKSHEET
FOR GRAPHICAL (T_c) METHOD (FIGURE 5-2)

Project EASTRIDGE By PS Date 4/2/84

Basin 3 Checked _____ Date _____

Steps Peak Discharge Computation for up to 3 storms: Type II, Duration ~~XX~~ 6 hours.

1. Data: Watershed Condition = Moderate (present or future).

   Drainage Area (DA) = 53 acres. Ave. Watershed Slope (S) = 9 %.

   Ponding and Swampy areas (PND) = _____ acres, _____ % of DA

   Impervious Area (IMP) = _____ acres, _____ % of DA

   Total Hydraulic Length (HL) = 3000 feet

   Hydraulic Length Modified (HLM) = _____ feet, _____ % of HL

	1st Storm	2nd Storm	3rd Storm	
2. Rainfall Frequency (F)	10	5	100	yrs.
3. Rainfall Depth (P)	1.6	1.4	2.4	inches
4. Runoff Curve Number (CN) = 80 (See other side for computation)				
5. Runoff Depth (Q) Use P, CN, and Table 2-1.	.34	.24	.82	inches
6. Time of Concentration (T_c) = .28 hrs. (See other side for computations) [X] Velocity Method [ ] Lag-CN Method [ ] Other _____ (check one)		X		
7. Unit Peak Discharge (q) Use T_c and Figure 5-2	700			csm/inch of Q
8. Drainage Area [DA(acres)/640(ac/sm)] = [53/640] =	.08			sq. miles
*9. Ponding and Swampy Area Peak Factor Only use % PND, F and Table E-3; when PND is spreadout in watershed and not related to T_c flow path.				
10. Peak Discharge Area Factor where q_p = Steps #5 x 7 x 8 x 9	19.0	13.4	45.9	cfs

*If the adjustment is not applicable, enter a Factor of 1.0.

TR-55 GRAPHICAL (T_c) METHOD, PEAK DISCHARGE WORKSHEET (CONT.)

Steps from other side

4. Runoff Curve Number (CN)

Hydrologic Soil Group (Appendix B)	Land Use Description Include Treatment, Practice & Condition (Table 2-2)	CN (Table 2-2) (3)	% or Area (acres) (4)	Product (3)x(4) (5)
D		80		
		Totals =		

CN (weighted) = $\frac{\text{total col. 5}}{\text{total col. 4}}$ [———] = ———; use CN = 80

5. Time of Concentration (T_c) Select computation method, (a) is recommended.

(a) Velocity Method

Reach	Description of Flow 1/	Length (ft.) (3)	Velocity (ft/sec) (4)	Travel Time (sec.) (3) ÷ (4)
		3000	3.00	1000
		Totals =		

1/ Use Figure 3.1 for overland flow portion of travel time.

$T_c = \frac{\text{Total Travel Time (sec.)}}{3{,}600 \text{ (sec./hr.)}} = \left[\frac{1000}{3{,}600}\right] =$ .28 hrs.

(sec.)

(b) Lag-CN Method

(1) Unadjusted Lag (L)
Use HL, S, CN, and Figure 3-3. ____ hrs.

*(2) Hydraulic Length Modified Lag Factor
Use % HLM, CN, and Figure 3-4. x ____

*(3) Impervious Area Lag Factor
Use % IMP, CN, and Figure 3-5. x ____

(4) Constant (T_c = 1.67L) x 1.67

(5) Time of Concentration (T_c)
where T_c = (1)x(2)x(3)x(4) = ____ hrs.

(TR NOTICE 55-A, September 1981)

GPO 888-814

TR55 ANALYSIS FOR EXISTING PROJECT AREA

APPENDIX 2

EXISTING

URBAN HYDROLOGY FOR SMALL WATERSHEDS (TR-55)
PEAK DISCHARGE WORKSHEET
FOR GRAPHICAL (T_c) METHOD (FIGURE 5-2)

#1

Project EASTRIDGE (Undev.) By PS Date 4/2/84

Area 1 Checked _____ Date _____

Steps Peak Discharge Computation for up to 3 storms: Type II, Duration ~~24~~ 6 hours.

1. Data: Watershed Condition = _____ (present or future).

   Drainage Area (DA) = 13.2 acres. Ave. Watershed Slope (S) = 11 %.

   Ponding and Swampy areas (PND) = _____ acres, _____ % of DA

   Impervious Area (IMP) = _____ acres, _____ % of DA

   Total Hydraulic Length (HL) = 2000 feet

   Hydraulic Length Modified (HLM) = _____ feet, _____ % of HL

	1st Storm	2nd Storm	3rd Storm	
2. Rainfall Frequency (F)	5	100		yrs.
3. Rainfall Depth (P)	1.4	2.4		inches
4. Runoff Curve Number (CN) = 80 (See other side for computation)				
5. Runoff Depth (Q) Use P, CN, and Table 2-1.	0.24	.82		inches
6. Time of Concentration (T_c) = .17 hrs. (See other side for computations) [X] Velocity Method [ ] Lag-CN Method [ ] Other _____ (check one)		X		
7. Unit Peak Discharge (q) Use T_c and Figure 5-2		850		csm/inch of Q
		X		
8. Drainage Area [DA(acres) / 640(ac/sm)] = [13.2 / 640] =		.02		sq. miles
		X		
*9. Ponding and Swampy Area Peak Factor Only use % PND, F and Table E-3; when PND is spreadout in watershed and not related to T_c flow path.				
		=		
10. Peak Discharge Area Factor where q_p = Steps #5 x 7 x 8 x 9	4.1	13.9		cfs

*If the adjustment is not applicable, enter a Factor of 1.0.

TR-55 GRAPHICAL (T_c) METHOD, PEAK DISCHARGE WORKSHEET (CONT.)

Steps from other side

4. Runoff Curve Number (CN)

Hydrologic Soil Group (Appendix B)	Land Use Description Include Treatment, Practice & Condition (Table 2-2)	CN (Table 2-2) (3)	% or Area (acres) (4)	Product (3)x(4) (5)
		Totals =		

CN (weighted) = $\frac{\text{total col. 5}}{\text{total col. 4}}$ [———] = ———; use CN = 80

5. Time of Concentration (T_c) Select computation method, (a) is recommended.

(a) Velocity Method

Reach	Description of Flow 1/	Length (ft.) (3)	Velocity (ft/sec) (4)	Travel Time (sec.) (3) ÷ (4)
		2000	3.3	606
		Totals =		sec.

1/ Use Figure 3.1 for overland flow portion of travel time.

$T_c = \frac{\text{Total Travel Time (sec.)}}{3{,}600 \text{ (sec./hr.)}} = \left[\frac{606}{3{,}600}\right] = .17$ hrs.

(b) Lag-CN Method

(1) Unadjusted Lag (L)
Use HL, S, CN, and Figure 3-3. ____ hrs.

x

*(2) Hydraulic Length Modified Lag Factor
Use % HLM, CN, and Figure 3-4. ____

x

*(3) Impervious Area Lag Factor
Use % IMP, CN, and Figure 3-5. ____

x

(4) Constant (T_c = 1.67L) 1.67

=

(5) Time of Concentration (T_c)
where T_c = (1)x(2)x(3)x(4) ____ hrs.

(TR NOTICE 55-A, September 1981)

GPO 888-816

EXISTING

URBAN HYDROLOGY FOR SMALL WATERSHEDS (TR-55)
PEAK DISCHARGE WORKSHEET
FOR GRAPHICAL (T_c) METHOD (FIGURE 5-2)

#2

Project EASTRIDGE (Undev) By PS Date 4/2/84

Area 2 Checked _____ Date _____

Steps Peak Discharge Computation for up to 3 storms: Type II, Duration 6 hours.

1. Data: Watershed Condition = _____ (present or future).

   Drainage Area (DA) = 25.6 acres. Ave. Watershed Slope (S) = 9 %.

   Ponding and Swampy areas (PND) = _____ acres, _____ % of DA

   Impervious Area (IMP) = _____ acres, _____ % of DA

   Total Hydraulic Length (HL) = 2400 feet

   Hydraulic Length Modified (HLM) = _____ feet, _____ % of HL

		1st Storm	2nd Storm	3rd Storm	
2.	Rainfall Frequency (F)	5	100		yrs.
3.	Rainfall Depth (P)	1.4	2.4		inches
4.	Runoff Curve Number (CN) = 80 See other side for computation				
5.	Runoff Depth (Q) Use P, CN, and Table 2-1.	0.24	.82		inches
6.	Time of Concentration (T_c) = .22 hrs. See other side for computations (check one): [X] Velocity Method; [ ] Lag-CN Method; [ ] Other _____		X		
7.	Unit Peak Discharge (q) Use T_c and Figure 5-2		775		csm/inch of Q
8.	Drainage Area [DA(acres)/640(ac/sm)] = [25.6/640] =		0.04		sq. miles
*9.	Ponding and Swampy Area Peak Factor Only use % PND, F and Table E-3; when PND is spreadout in watershed and not related to T_c flow path.				
10.	Peak Discharge Area Factor where q_p = Steps #5 x 7 x 8 x 9	7.4	25.4		cfs

*If the adjustment is not applicable, enter a Factor of 1.0.

TR-55 GRAPHICAL (T_c) METHOD, PEAK DISCHARGE WORKSHEET (CONT.)

Steps from other side

4. Runoff Curve Number (CN)

Hydrologic Soil Group (Appendix B)	Land Use Description Include Treatment, Practice & Condition (Table 2-2)	CN (Table 2-2) (3)	% or Area (acres) (4)	Product (3)x(4) (5)
		Totals =		

CN (weighted) = $\frac{\text{total col. 5}}{\text{total col. 4}}$ [———] = ———; use CN = 80

5. Time of Concentration (T_c) Select computation method, (a) is recommended.

(a) Velocity Method

Reach	Description of Flow 1/	Length (ft.) (3)	Velocity (ft/sec) (4)	Travel Time (sec.) (3) ÷ (4)
		2400	3.0	800
			Totals =	sec.

1/ Use Figure 3.1 for overland flow portion of travel time.

$T_c = \frac{\text{Total Travel Time (sec.)}}{3{,}600 \text{ (sec./hr.)}} = \left[\frac{800}{3{,}600}\right] =$ .22 hrs.

(b) Lag-CN Method

(1) Unadjusted Lag (L)
Use HL, S, CN, and Figure 3-3. ——— hrs.

x

*(2) Hydraulic Length Modified Lag Factor
Use % HLM, CN, and Figure 3-4. ———

x

*(3) Impervious Area Lag Factor
Use % IMP, CN, and Figure 3-5. ———

x

(4) Constant (T_c = 1.67L) 1.67

=

(5) Time of Concentration (T_c)
where T_c = (1)x(2)x(3)x(4) ——— hrs.

(TR NOTICE 55-A, September 1981)

GPO 888-816

EXISTING

URBAN HYDROLOGY FOR SMALL WATERSHEDS (TR-55)
PEAK DISCHARGE WORKSHEET
FOR GRAPHICAL (T_c) METHOD (FIGURE 5-2)

#3

Project EASTRIDGE (Undev) By PS Date 4/2/84

Area 3 Checked _____ Date _____

Steps Peak Discharge Computation for up to 3 storms: Type II, Duration ~~24~~ 6 hours.

1. Data: Watershed Condition = _____ (present or future).

   Drainage Area (DA) = 35. acres. Ave. Watershed Slope (S) = 12 %.

   Ponding and Swampy areas (PND) = _____ acres, _____ % of DA

   Impervious Area (IMP) = _____ acres, _____ % of DA

   Total Hydraulic Length (HL) = 1400 feet

   Hydraulic Length Modified (HLM) = _____ feet, _____ % of HL

	1st Storm	2nd Storm	3rd Storm	
2. Rainfall Frequency (F)	5	100		yrs.
3. Rainfall Depth (P)	1.4	2.4		inches
4. Runoff Curve Number (CN) = _____ See other side for computation				
5. Runoff Depth (Q) Use P, CN, and Table 2-1.	0.24	.82		inches
6. Time of Concentration (T_c) = .12 hrs. See other side for computations (check one): [X] Velocity Method [ ] Lag-CN Method [ ] Other _____		X		
7. Unit Peak Discharge (q) Use T_c and Figure 5-2		950		csm/inch of Q
8. Drainage Area [DA(acres) / 640(ac/sm)] = [35 / 640] =		.05		sq. miles
		X		
*9. Ponding and Swampy Area Peak Factor Only use % PND, F and Table E-3; when PND is spreadout in watershed and not related to T_c flow path.				
		=		
10. Peak Discharge Area Factor where q_p = Steps #5 x 7 x 8 x 9	11.4	42.6		cfs

*If the adjustment is not applicable, enter a Factor of 1.0.

TR-55 GRAPHICAL (T_c) METHOD, PEAK DISCHARGE WORKSHEET (CONT.)

Steps from other side

4. Runoff Curve Number (CN)

Hydrologic Soil Group (Appendix B)	Land Use Description Include Treatment, Practice & Condition (Table 2-2)	CN (Table 2-2) (3)	% or Area (acres) (4)	Product (3)x(4) (5)
		Totals =		

CN (weighted) = $\frac{\text{total col. 5}}{\text{total col. 4}}$ [ ] = ; use CN = 80

5. Time of Concentration (T_c) Select computation method, (a) is recommended.

(a) Velocity Method

Reach	Description of Flow 1/	Length (ft.) (3)	Velocity (ft/sec) (4)	Travel Time (sec.) (3) ÷ (4)
		1400	3.3	424
			Totals =	sec.

1/ Use Figure 3.1 for overland flow portion of travel time.

$T_c = \frac{\text{Total Travel Time (sec.)}}{3{,}600 \text{ (sec./hr.)}} = \left[\frac{424}{3{,}600}\right] =$ .12 hrs.

(b) Lag-CN Method

(1) Unadjusted Lag (L)
Use HL, S, CN, and Figure 3-3. hrs.

x

*(2) Hydraulic Length Modified Lag Factor
Use % HLM, CN, and Figure 3-4.

x

*(3) Impervious Area Lag Factor
Use % IMP, CN, and Figure 3-5.

x

(4) Constant (T_c = 1.67L) 1.67

=

(5) Time of Concentration (T_c)
where T_c = (1)x(2)x(3)x(4) hrs.

(TR NOTICE 55-A, September 1981)

EXISTING

URBAN HYDROLOGY FOR SMALL WATERSHEDS (TR-55)
PEAK DISCHARGE WORKSHEET
FOR GRAPHICAL (T_c) METHOD (FIGURE 5-2)

#4

Project EASTRIDGE (Undev) By PS Date 4/2/84

Area 4 Checked _____ Date _____

Steps Peak Discharge Computation for up to 3 storms: Type II, Duration ~~24~~ 6 hours.

1. Data: Watershed Condition = _____ (present or future).

   Drainage Area (DA) = 4.1 acres. Ave. Watershed Slope (S) = 5 %.

   Ponding and Swampy areas (PND) = _____ acres, _____ % of DA

   Impervious Area (IMP) = _____ acres, _____ % of DA

   Total Hydraulic Length (HL) = 400 feet

   Hydraulic Length Modified (HLM) = _____ feet, _____ % of HL

	1st Storm	2nd Storm	3rd Storm	
2. Rainfall Frequency (F)	5	100		yrs.
3. Rainfall Depth (P)	1.4	2.4		inches
4. Runoff Curve Number (CN) = 80 See other side for computation				
5. Runoff Depth (Q) Use P, CN, and Table 2-1.	0.24	.82		inches
6. Time of Concentration (T_c) = .05 hrs. See other side for computations (check one) ☒ Velocity Method ☐ Lag-CN Method ☐ Other _____				
		X		
7. Unit Peak Discharge (q) Use T_c and Figure 5-2		1000		csm/inch of Q
		X		
8. Drainage Area [DA(acres) / 640(ac/sm)] = [4.1 / 640] =		.0006		sq. miles
		X		
*9. Ponding and Swampy Area Peak Factor Only use % PND, F and Table E-3; when PND is spreadout in watershed and not related to T_c flow path.				
		=		
10. Peak Discharge Area Factor where q_p = Steps #5 x 7 x 8 x 9	1.5	4.9		cfs

*If the adjustment is not applicable, enter a Factor of 1.0.

TR-55 GRAPHICAL (T_c) METHOD, PEAK DISCHARGE WORKSHEET (CONT.)

Steps from other side

4. Runoff Curve Number (CN)

Hydrologic Soil Group (Appendix B)	Land Use Description Include Treatment, Practice & Condition (Table 2-2)	CN (Table 2-2) (3)	% or Area (acres) (4)	Product (3)x(4) (5)
		80		
		Totals =		

CN (weighted) = $\frac{\text{total col. 5}}{\text{total col. 4}}$ [———] = ———; use CN = 80

5. Time of Concentration (T_c) Select computation method, (a) is recommended.

(a) Velocity Method

Reach	Description of Flow 1/	Length (ft.) (3)	Velocity (ft/sec) (4)	Travel Time (sec.) (3) ÷ (4)
		400	2.3	175
		Totals =		sec.

1/ Use Figure 3.1 for overland flow portion of travel time.

$T_c = \frac{\text{Total Travel Time (sec.)}}{3{,}600 \text{ (sec./hr.)}} = \left[\frac{175}{3{,}600}\right] =$ .05 hrs.

(b) Lag-CN Method

(1) Unadjusted Lag (L)
Use HL, S, CN, and Figure 3-3. ——— hrs.

x

*(2) Hydraulic Length Modified Lag Factor
Use % HLM, CN, and Figure 3-4. ———

x

*(3) Impervious Area Lag Factor
Use % IMP, CN, and Figure 3-5. ———

x

(4) Constant (T_c = 1.67L) 1.67

=

(5) Time of Concentration (T_c)
where T_c = (1)x(2)x(3)x(4) ——— hrs.

(TR NOTICE 55-A, September 1981)

GPO 000-016

TR55 ANALYSIS FOR PROPOPOSED DEVELOPMENT AREA

APPENDIX

URBAN HYDROLOGY FOR SMALL WATERSHEDS (TR-55)
PEAK DISCHARGE WORKSHEET
FOR GRAPHICAL (T_c) METHOD (FIGURE 5-2)

Project EASTRIDGE (Dev) By PS Date 4/3/84

Area (1) Checked _____ Date _____

Steps Peak Discharge Computation for up to 3 storms: Type II, Duration 6 hours.

1. Data: Watershed Condition = Good (present or future).

   Drainage Area (DA) = 2.0 acres. Ave. Watershed Slope (S) = 12.5 %.

   Ponding and Swampy areas (PND) = _____ acres, _____ % of DA

   Impervious Area (IMP) = _____ acres, _____ % of DA

   Total Hydraulic Length (HL) = 600 feet

   Hydraulic Length Modified (HLM) = _____ feet, _____ % of HL

	1st Storm	2nd Storm	3rd Storm	
2. Rainfall Frequency (F)	5	100		yrs.
3. Rainfall Depth (P)	1.4	2.4		inches
4. Runoff Curve Number (CN) = 85 See other side for computation				
5. Runoff Depth (Q) Use P, CN, and Table 2-1.	0.39	1.10		inches
6. Time of Concentration (T_c) = .05 hrs. See other side for computations (check one) [X] Velocity Method [ ] Lag-CN Method [ ] Other _____				
		X		
7. Unit Peak Discharge (q) Use T_c and Figure 5-2		1000		csm/inch of Q
		X		
8. Drainage Area [DA(acres) / 640(ac/sm)] = [2 / 640] =		.0003		sq. miles
		X		
*9. Ponding and Swampy Area Peak Factor Only use % PND, F and Table E-3; when PND is spreadout in watershed and not related to T_c flow path.				
		=		
10. Peak Discharge Area Factor where q_p = Steps #5 x 7 x 8 x 9	.12	3.3		cfs

*If the adjustment is not applicable, enter a Factor of 1.0.

TR-55 GRAPHICAL (T_c) METHOD, PEAK DISCHARGE WORKSHEET (CONT.)

Steps from other side

4. Runoff Curve Number (CN)

Hydrologic Soil Group (Appendix B)	Land Use Description Include Treatment, Practice & Condition (Table 2-2)	CN (Table 2-2) (3)	% or Area (acres) (4)	Product (3)x(4) (5)
		85		
			Totals =	

CN (weighted) = $\frac{\text{total col. 5}}{\text{total col. 4}}$ [———] = ———; use CN = 85

5. Time of Concentration (T_c) Select computation method, (a) is recommended.

(a) Velocity Method

Reach	Description of Flow 1/	Length (ft.) (3)	Velocity (ft/sec) (4)	Travel Time (sec.) (3) ÷ (4)
		600	3.5	171
			Totals =	

1/ Use Figure 3.1 for overland flow portion of travel time.

sec.

$T_c = \frac{\text{Total Travel Time (sec.)}}{3{,}600 \text{ (sec./hr.)}} = \left[\frac{171}{3{,}600}\right] =$ .05 hrs.

(b) Lag-CN Method

(1) Unadjusted Lag (L)
Use HL, S, CN, and Figure 3-3. ——— hrs.

*(2) Hydraulic Length Modified Lag Factor
Use % HLM, CN, and Figure 3-4. ——— x

*(3) Impervious Area Lag Factor
Use % IMP, CN, and Figure 3-5. ——— x

(4) Constant (T_c = 1.67L) 1.67 =

(5) Time of Concentration (T_c)
where T_c = (1)x(2)x(3)x(4) ——— hrs.

(TR NOTICE 55-A, September 1981)

URBAN HYDROLOGY FOR SMALL WATERSHEDS (TR-55)
PEAK DISCHARGE WORKSHEET
FOR GRAPHICAL (T_c) METHOD (FIGURE 5-2)

Project EASTRIDGE (Dev) By PS Date 4/3/84

Area (2) Checked _____ Date _____

Steps Peak Discharge Computation for up to 3 storms: Type II, Duration 6 hours.

1. Data: Watershed Condition = Good (present or future).

Drainage Area (DA) = 16.1 acres. Ave. Watershed Slope (S) = 14 %.
Ponding and Swampy areas (PND) = _____ acres, _____ % of DA
Impervious Area (IMP) = _____ acres, _____ % of DA
Total Hydraulic Length (HL) = 800 feet
Hydraulic Length Modified (HLM) = _____ feet, _____ % of HL

	1st Storm	2nd Storm	3rd Storm	
2. Rainfall Frequency (F)	5	100		yrs.
3. Rainfall Depth (P)	1.4	2.4		inches

4. Runoff Curve Number (CN) = 85
See other side for computation

5. Runoff Depth (Q) Use P, CN, and Table 2-1.	0.39	1.10		inches
		X		
7. Unit Peak Discharge (q) Use T_c and Figure 5-2	1000			csm/inch of Q
		X		
8. Drainage Area [DA(acres)/640(ac/sm)] = [16.1/640] =	.025			sq. miles
		X		
*9. Ponding and Swampy Area Peak Factor Only use % PND, F and Table E-3; when PND is spreadout in watershed and not related to T_c flow path.				
		=		
10. Peak Discharge Area Factor where q_p = Steps #5 x 7 x 8 x 9	9.8	27.5		cfs

6. Time of Concentration (T_c) = .06 hrs.
See other side for computations (check one)
☒ Velocity Method
☐ Lag-CN Method
☐ Other _____

*If the adjustment is not applicable, enter a Factor of 1.0.

TR-55 GRAPHICAL (T_c) METHOD, PEAK DISCHARGE WORKSHEET (CONT.)

Steps from other side

4. Runoff Curve Number (CN)

Hydrologic Soil Group (Appendix B)	Land Use Description Include Treatment, Practice & Condition (Table 2-2)	CN (Table 2-2) (3)	% or Area (acres) (4)	Product (3)x(4) (5)
		85		
		Totals =		

CN (weighted) = $\frac{\text{total col. 5}}{\text{total col. 4}}$ [ ] = ; use CN = 85

5. Time of Concentration (T_c) Select computation method, (a) is recommended.

(a) Velocity Method

Reach	Description of Flow 1/	Length (ft.) (3)	Velocity (ft/sec) (4)	Travel Time (sec.) (3) ÷ (4)
		800	3.75	213
			Totals =	sec.

1/ Use Figure 3.1 for overland flow portion of travel time.

$T_c = \frac{\text{Total Travel Time (sec.)}}{3{,}600 \text{ (sec./hr.)}} = \left[\frac{213}{3{,}600}\right] =$ .06 hrs.

(b) Lag-CN Method

(1) Unadjusted Lag (L)
Use HL, S, CN, and Figure 3-3. hrs.

x

*(2) Hydraulic Length Modified Lag Factor
Use % HLM, CN, and Figure 3-4.

x

*(3) Impervious Area Lag Factor
Use % IMP, CN, and Figure 3-5.

x

(4) Constant (T_c = 1.67L) 1.67

=

(5) Time of Concentration (T_c)
where T_c = (1)x(2)x(3)x(4) hrs.

(TR NOTICE 55-A, September 1981)

GPO 000-000

URBAN HYDROLOGY FOR SMALL WATERSHEDS (TR-55)
PEAK DISCHARGE WORKSHEET
FOR GRAPHICAL (T_c) METHOD (FIGURE 5-2)

Project EASTRIDGE (Dev) By PS Date 4/3/84

Area (3) Checked _____ Date _____

Steps Peak Discharge Computation for up to 3 storms: Type II, Duration 6 hours.

1. Data: Watershed Condition = Good (present or future).

   Drainage Area (DA) = 34.9 acres. Ave. Watershed Slope (S) = 12 %.

   Ponding and Swampy areas (PND) = _____ acres, _____ % of DA

   Impervious Area (IMP) = _____ acres, _____ % of DA

   Total Hydraulic Length (HL) = _____ feet

   Hydraulic Length Modified (HLM) = _____ feet, _____ % of HL

	1st Storm	2nd Storm	3rd Storm	
2. Rainfall Frequency (F)	5	100		yrs.
3. Rainfall Depth (P)	1.4	2.4		inches
4. Runoff Curve Number (CN) = 84 (See other side for computation)				
5. Runoff Depth (Q) Use P, CN, and Table 2-1.	.36	1.04		inches
6. Time of Concentration (T_c) = .11 hrs. (See other side for computations) (check one) [X] Velocity Method [ ] Lag-CN Method [ ] Other _____				
		X		
7. Unit Peak Discharge (q) Use T_c and Figure 5-2		960		csm/inch of Q
		X		
8. Drainage Area [DA(acres)/640(ac/sm)] = [34.9/640] =		.05		sq. miles
		X		
*9. Ponding and Swampy Area Peak Factor Only use % PND, F and Table E-3; when PND is spreadout in watershed and not related to T_c flow path.				
		=		
10. Peak Discharge Area Factor where q_p = Steps #5 x 7 x 8 x 9	17.3	49.9		cfs

*If the adjustment is not applicable, enter a Factor of 1.0.

TR-55 GRAPHICAL (T_c) METHOD, PEAK DISCHARGE WORKSHEET (CONT.)

Steps from other side

4. Runoff Curve Number (CN)

Hydrologic Soil Group (Appendix B)	Land Use Description Include Treatment, Practice & Condition (Table 2-2)	CN (Table 2-2) (3)	% or Area (acres) (4)	Product (3)x(4) (5)
	4.3 AC	80	.12	9.6
	30.6 AC	85	.88	74.8
		Totals =	1	84.4

CN (weighted) = $\frac{\text{total col. 5}}{\text{total col. 4}} \left[\frac{84.4}{1}\right] = 84.4$; use CN = **84**

5. Time of Concentration (T_c) Select computation method, (a) is recommended.

(a) Velocity Method

Reach	Description of Flow 1/	Length (ft.) (3)	Velocity (ft/sec) (4)	Travel Time (sec.) (3) ÷ (4)
		1400	3.5	400
		Totals =		sec.

1/ Use Figure 3.1 for overland flow portion of travel time.

$T_c = \frac{\text{Total Travel Time (sec.)}}{3{,}600 \text{ (sec./hr.)}} = \left[\frac{400}{3{,}600}\right] =$ **.11** hrs.

(b) Lag-CN Method

(1) Unadjusted Lag (L)
Use HL, S, CN, and Figure 3-3. _____ hrs.

*(2) Hydraulic Length Modified Lag Factor
Use % HLM, CN, and Figure 3-4. x _____

*(3) Impervious Area Lag Factor
Use % IMP, CN, and Figure 3-5. x _____

(4) Constant (T_c = 1.67L) x 1.67

(5) Time of Concentration (T_c)
where T_c = (1)x(2)x(3)x(4) = _____ hrs.

(TR NOTICE 55-A, September 1981)

URBAN HYDROLOGY FOR SMALL WATERSHEDS (TR-55)
PEAK DISCHARGE WORKSHEET
FOR GRAPHICAL (T_c) METHOD (FIGURE 5-2)

Project EASTRIDGE (Dev) By PS Date 4/3/84

Area (4) Checked _____ Date _____

Steps Peak Discharge Computation for up to 3 storms: Type II, Duration ~~XX~~ 6 hours.

1. Data: Watershed Condition = Good (present or future).

   Drainage Area (DA) = 20.5 acres. Ave. Watershed Slope (S) = 8 %.

   Ponding and Swampy areas (PND) = _____ acres, _____ % of DA

   Impervious Area (IMP) = _____ acres, _____ % of DA

   Total Hydraulic Length (HL) = 1300 feet

   Hydraulic Length Modified (HLM) = _____ feet, _____ % of HL

		1st Storm	2nd Storm	3rd Storm	
2.	Rainfall Frequency (F)	5	100		yrs.
3.	Rainfall Depth (P)	1.4	2.4		inches
4.	Runoff Curve Number (CN) = 81 (See other side for computation)				
5.	Runoff Depth (Q) Use P, CN, and Table 2-1.	.27	.87		inches
6.	Time of Concentration (T_c) = .13 hrs. (See other side for computations) [X] Velocity Method [ ] Lag-CN Method [ ] Other _____ (check one)				
			X		
7.	Unit Peak Discharge (q) Use T_c and Figure 5-2		925		csm/inch of Q
			X		
8.	Drainage Area $\left[\frac{DA(acres)}{640(ac/sm)}\right] = \left[\frac{20.5}{640}\right]$ =		.032		sq. miles
			X		
*9.	Ponding and Swampy Area Peak Factor Only use % PND, F and Table E-3; when PND is spreadout in watershed and not related to T_c flow path.				
			=		
10.	Peak Discharge Area Factor where q_p = Steps #5 x 7 x 8 x 9	8.0	25.8		cfs

*If the adjustment is not applicable, enter a Factor of 1.0.

TR-55 GRAPHICAL (T_c) METHOD, PEAK DISCHARGE WORKSHEET (CONT.)

Steps from other side

4. Runoff Curve Number (CN)

Hydrologic Soil Group (Appendix B)	Land Use Description Include Treatment, Practice & Condition (Table 2-2)	CN (Table 2-2) (3)	% or Area (acres) (4)	Product (3)x(4) (5)
	4.9 @ 85 cn	85	.24	20.4
	15.6 @ 80	80	.76	60.8
		Totals =	1	81

CN (weighted) = $\frac{\text{total col. 5}}{\text{total col. 4}} \left[\frac{81.2}{1}\right] = 81.2$; use CN = 81

5. Time of Concentration (T_c) Select computation method, (a) is recommended.

(a) Velocity Method

Reach	Description of Flow 1/	Length (ft.) (3)	Velocity (ft/sec) (4)	Travel Time (sec.) (3) ÷ (4)
		1300	2.7	481
			Totals =	

1/ Use Figure 3.1 for overland flow portion of travel time. sec.

$T_c = \frac{\text{Total Travel Time (sec.)}}{3{,}600 \text{ (sec./hr.)}} = \left[\frac{481}{3{,}600}\right] =$ .13 hrs.

(b) Lag-CN Method

(1) Unadjusted Lag (L)
Use HL, S, CN, and Figure 3-3. hrs.

x

*(2) Hydraulic Length Modified Lag Factor
Use % HLM, CN, and Figure 3-4.

x

*(3) Impervious Area Lag Factor
Use % IMP, CN, and Figure 3-5.

x

(4) Constant (T_c = 1.67L) 1.67

=

(5) Time of Concentration (T_c)
where T_c = (1)x(2)x(3)x(4) hrs.

(TR NOTICE 55-A, September 1981)

URBAN HYDROLOGY FOR SMALL WATERSHEDS (TR-55)
PEAK DISCHARGE WORKSHEET
FOR GRAPHICAL (T_c) METHOD (FIGURE 5-2)

Project EASTRIDGE (Dev) By PS Date 4/3/84

Area (5) Checked _____ Date _____

Steps Peak Discharge Computation for up to 3 storms: Type II, Duration 6 ~~24~~ hours.

1. Data: Watershed Condition = Good (present or future).

   Drainage Area (DA) = 5.4 acres. Ave. Watershed Slope (S) = 7 %.

   Ponding and Swampy areas (PND) = _____ acres, _____ % of DA

   Impervious Area (IMP) = _____ acres, _____ % of DA

   Total Hydraulic Length (HL) = 500 feet

   Hydraulic Length Modified (HLM) = _____ feet, _____ % of HL

	1st Storm	2nd Storm	3rd Storm	
2. Rainfall Frequency (F)	5	100		yrs.
3. Rainfall Depth (P)	1.4	2.4		inches
4. Runoff Curve Number (CN) = 85 See other side for computation				
5. Runoff Depth (Q) Use P, CN, and Table 2-1.	.39	1.10		inches
6. Time of Concentration (T_c) = .05 hrs. See other side for computations (check one) ☒ Velocity Method ☐ Lag-CN Method ☐ Other _____				
		X		
7. Unit Peak Discharge (q) Use T_c and Figure 5-2	1000			csm/inch of Q
		X		
8. Drainage Area [DA(acres) / 640(ac/sm)] = [5.4 / 640] =	.0008			sq. miles
		X		
*9. Ponding and Swampy Area Peak Factor Only use % PND, F and Table E-3; when PND is spreadout in watershed and not related to T_c flow path.				
		=		
10. Peak Discharge Area Factor where q_p = Steps 5 x 7 x 8 x 9	3.3	8.8		cfs

*If the adjustment is not applicable, enter a Factor of 1.0.

TR-55 GRAPHICAL (T_c) METHOD, PEAK DISCHARGE WORKSHEET (CONT.)

Steps from other side

4. Runoff Curve Number (CN)

Hydrologic Soil Group (Appendix B)	Land Use Description Include Treatment, Practice & Condition (Table 2-2)	CN (Table 2-2) (3)	% or Area (acres) (4)	Product (3)x(4) (5)
	All Ac.	85		
		Totals =		

CN (weighted) = $\frac{\text{total col. 5}}{\text{total col. 4}}$ [———] = ———; use CN = 85

5. Time of Concentration (T_c) Select computation method, (a) is recommended.

(a) Velocity Method

Reach	Description of Flow 1/	Length (ft.) (3)	Velocity (ft/sec) (4)	Travel Time (sec.) (3) ÷ (4)
		500	2.7	185
			Totals =	sec.

1/ Use Figure 3.1 for overland flow portion of travel time.

$T_c = \frac{\text{Total Travel Time (sec.)}}{3{,}600 \text{ (sec./hr.)}} = \left[\frac{185}{3{,}600}\right] = .05$ hrs.

(b) Lag-CN Method

(1) Unadjusted Lag (L)
Use HL, S, CN, and Figure 3-3. ____ hrs.

x

*(2) Hydraulic Length Modified Lag Factor
Use % HLM, CN, and Figure 3-4. ____

x

*(3) Impervious Area Lag Factor
Use % IMP, CN, and Figure 3-5. ____

x

(4) Constant (T_c = 1.67L) 1.67

=

(5) Time of Concentration (T_c)
where T_c = (1)x(2)x(3)x(4) ____ hrs.

(TR NOTICE 55-A, September 1981)

STORM DRAIN HYDRAULIC CALCULATIONS

APPENDIX 4

HYDROLOGY CALCULATIONS

EASTRIDGE SUBDIVISION, UNIT 1 & 2
1642-0002
8/30/84

STORM DRAIN A

* M DENOTES FLOW FROM McCARREN & ABOVE.

** E DENOTES FLOW PICKED UP FROM EASTRIDGE SUBDIVISION - NUMBER CIRCLED IS AREA USED (RED ON MAP).

5 YEAR STORM

$Q_{M_A}^{*} = 27.6$ cfs

③ $Q_{E_A}^{**} = (17.3 \text{ cfs})\left(\frac{2.5 \text{ Acres}}{34.9 \text{ Acres}}\right)$

$= 1.2$ cfs

$Q_{T_A} = Q_{M_A} + Q_{E_A} = 27.6 + 1.2 = \underline{28.8 \text{ cfs}}$ (5 year)

WORST CASE 24" ϕ
S = 2.95%
n = 0.013

$Q_{CAP} = 40$ cfs

DEPTH OF FLOW = (.63)(24") = 15.1"

VELOCITY = 14 Fps

100 YEAR STORM

Q_{M_A} = 95 cfs

③ $Q_{E_A} = 49.9 \text{ cfs} \left(\frac{2.5}{34.9}\right) = 3.6 \text{ cfs}$

Q_{T_A} = 98.6 cfs (100 year)

STORM DRAIN B

5 YEAR STORM

③ $Q_{E_B} = (17.3)\left(\frac{13.1 \text{ Acres}}{34.9 \text{ Acres}}\right) = 6.5 \text{ cfs}$

② $Q_{E_B} = (9.8 \text{ cfs})\left(\frac{1.2 \text{ Acres}}{16.1 \text{ Acres}}\right) = 0.7 \text{ cfs}$

Q_{T_B} = 7.2 cfs (5 year)

ASSUME WORST CASE $S = 9.5\%$ $n = 0.013$ 12" ϕ

Q_{CAP} = 11.3 cfs

VELOCITY = 15 fps

depth of flow (.58)(12") = 7.0"

100 YEAR STORM

③ $Q_{E_B} = (49.9\ cfs)\left(\frac{13.1}{34.9}\right) = 18.7\ cfs$

② $Q_{E_B} = (27.5\ cfs)\left(\frac{1.2}{16.1}\right) = 2.1\ cfs$

$Q_{T_B} = \underline{20.8\ cfs}$ (100 year)

STORM DRAIN C

5 YEAR STORM

⑤ $Q_{E_C} = (17.3\ cfs)\left(\frac{13.7}{34.9}\right) = 6.8\ cfs$

$Q_{T_B} = 7.2\ cfs$

$Q_{T_A} = 28.8\ cfs$

$Q_{T_C} = \underline{42.8\ cfs}$ (5 year)

Min. Slope = [illegible]

n = .013

D = 24"

Max Capacity (full) = 73.9 cfs
Velocity = 23.5 fps
Depth of Flow = (.55)(24") = 13.2"

STORM DRAIN C, Cont.

100 YEAR STORM

③ $Q_{E_C} = (49.9\ cfs)\left(\frac{13.7}{34.9}\right) = 19.6\ cfs$

$Q_{T_B} = 20.8\ cfs$

$Q_{T_A} = 98.6\ cfs$

$Q_{T_C} = 139.0\ cfs$ (100 year)

STORM DRAIN D

5 YEAR STORM

⑤ $Q_{E_D} = (17.3\ cfs)\left(\frac{1.2}{34.9}\right) = .6\ cfs$

⑥ $Q_{E_D} = (3.3)\left(\frac{1.3}{5.4}\right) = .8\ cfs$

$Q_{T_D} = 1.4\ cfs$ (5 year)

12 ϕ S = 20.5%

$Q_{CAP} = 16.2\ cfs$

VELOCITY (ACTUAL) = 12 fps

depth of flow = (.17)(12) = 2.0"

STORM DRAIN D, cont.

100 year storm

③ $Q_{E_D} = (49.9\ cfs)\left(\frac{1.2}{34.9}\right) = 1.7\ cfs$

⑤ $Q_{E_D} = (8.8\ cfs)\left(\frac{1.3}{5.4}\right) = 2.1\ cfs$

$Q_{T_D} = 3.8\ cfs$ (5 year)

$Q_{CAP} = 16.2\ cfs$
VELOCITY = 17 fps
depth = (.33)(12) = 4"

STORM DRAIN, FROM Q_C & Q_D INTO HEMLOCK

5 YEAR STORM

$Q_{T_{HEM}} = Q_{T_D} + Q_{T_C}$

$= 31.4 + 42.8 = 44.2\ cfs$

24" ϕ S = 10.69%
$Q_{CAP} = 74.2\ cfs$
V

100 year storm

$Q_{T_{HEM}} = Q_{T_D} + Q_{T_C}$

$= 3.8 + 139.0 = 142.8\ cfs$

Velocity = 23.6 fps
depth of flow = (.56)(24) = 13.4"

STORM DRAIN E

5 year storm

Q_{M_E} = 13.4 cfs

② $Q_{E_E} = (9.8\ cfs)\left(\frac{10.2}{16.1}\right) = 6.2\ cfs$

Q_{T_E} = 19.6 cfs (5 year)

IN RCP

Min S = 2.71% 24" RCP n = 0.013
Q_{CAP} = 38.2 cfs
Velocity = 11fps
depth of flow = (.5)(24) = 12"

100 year storm

Q_{M_E} = 47 cfs

② $Q_{E_E} = 27.5\ cfs\left(\frac{10.2}{16.1}\right) = 17.4\ cfs$

Q_{T_E} = 64.4 cfs (100 year)

STORM DRAIN F

5 YEAR STORM

Q_{M_F} = 14.7 cfs

Q_{E_F} = 3.2 cfs

Q_{T_F} = 17.9 cfs (5 year)

S = 11.0% n = 0.026 (CMP) 24" ∅

Q_{CAP} = 37.6 cfs
Velocity = 11 fps
depth = (.5)(24") = 12"

100 year storm

Q_{M_F} = 43 cfs

Q_{E_F} = 6.8 cfs

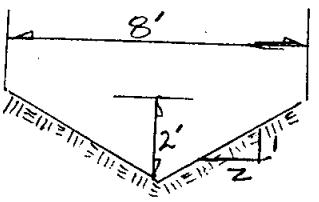
Q_{T_F} = 49.8 cfs (100 year)

STORM DRAIN CHANNEL (ABOVE SD F)

5 YEAR STORM

Q_{T_F} = 17.9 cfs (From SD F calcs.)

USE N = 0.030 (CITY OF RENO, PUBLIC WORKS DESIGN MANUEL)



V-DITCH w/ 2:1 side slopes

S = 4.6 % (WORST CASE)

Yn depth = 1.15 ft VELOCITY = 6.8 fps

CAPACITY = 79.1 cfs $VELOCITY_{MAX}$ = 9.9 fps

SUPER CRITICAL FLOW

100 YEAR STORM

Q_{T_F} = 49.8 cfs

N = 0.03

S = 4.6%

Yn depth = 1.68 ft Velocity = 8.8 fps

STORM DRAIN CALCULATION

PHASE 2

STORM DRAIN CHANNEL

Q_5 FROM ABOVE PROPERTY = 14.7 cfs

Q FROM CONTRIBUTING AREA

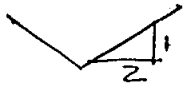
A = 4.5 ACRES $Q = CiA$

t = 20 mins

$i_5 = 1.4$

C = 0.5 Q = 3.2 cfs

$Q_T = 17.9$

V-DITCH 

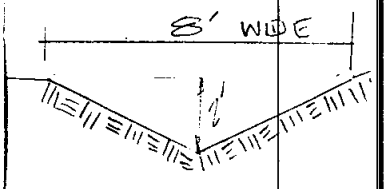
TRAPEZOIDAL CHANNEL

17.9000	Q
0.0000	B
2.0000	Z
0.0600	S
0.0300	N
1.3792	YC
4.7049	VC
1.0913	YN
7.5147	VN

SUPERCRITICAL FLOW

ie. RIPRAP DITCH

V-DITCH CAPACITY



TRAPEZOIDAL CHANNEL

0.0600	S
0.0300	N
0.0000	B
2.0000	D
2.0000	Z
90.3495	Q

STORM SEWER PIPE – PHASE 2

$Q = 17.9$ cfs

IE = 58.0 IE = 28.0 L = 200'

$S = \frac{58-28}{200}(100) = 15\%$

ASSUME $N = 0.013$ – RCP

USING 18" RCP → $Q_{CAP} = 40.8$ cfs

$V_{FP} = 22$ fps $V_{CAP} = 23.1$ fps

CMP → $N = 0.026$

USING 18" CMP $N = 0.026$

$V_{Q=17.9} = 13$ fps $Q_{CAP} = 20.4$ cfs

$V_{CAP} = 11.54$ fps

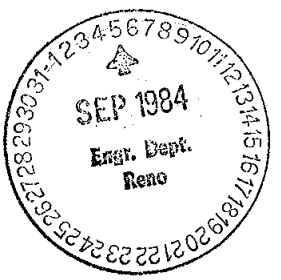
Using 24" CMP $Q_{CAP} = 43.9$ cfs

$V_{CAP} = 14.0$ fps

$V_{Q=17.9} = 14$ fps

RECOMMENDATION — TRY DIFFERENT [illegible]

[illegible] & VELOCITY.


SEP 1984
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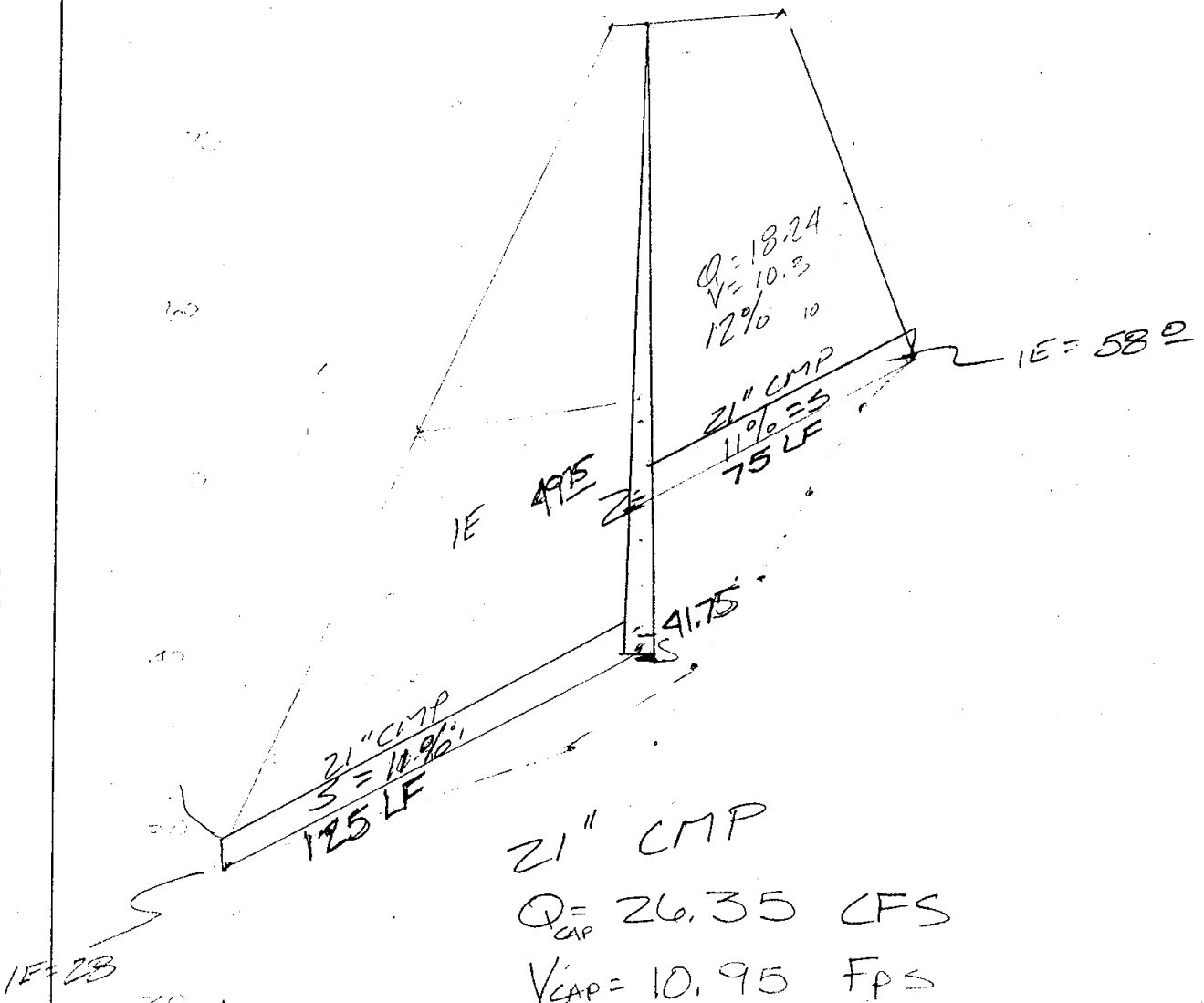
Reno

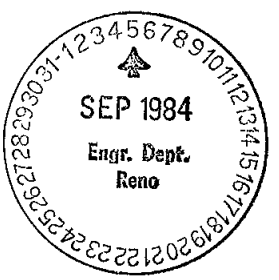


21" CMP

Q_{CAP} = 26.35 CFS

V_{CAP} = 10.95 Fps

$V_{Q=17.9}$ = 12.0 Fps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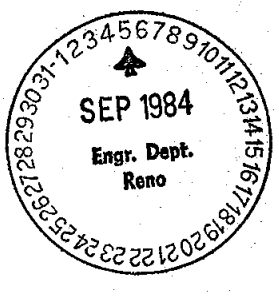
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