SUNDOWN NORTH
MASTER DEVELOPMENT DRAINAGE PLAN (MDDP)

June 1997

Prepared for:

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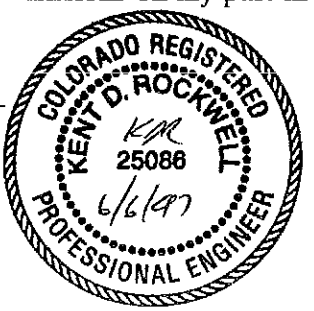
Project# 96-074

SUNDOWN NORTH (MDDP)
DRAINAGE PLAN STATEMENTS

ENGINEER'S STATEMENT

The attached drainage plan and report were prepared under my direction and supervision and are correct to the best of my knowledge and belief. Said drainage report has been prepared according to the criteria established by the City of Colorado Springs for drainage reports, and said drainage report is in conformity with the Master Plan of the drainage basin. I accept responsibility for any liability caused by any negligent acts, errors or omissions on my part in preparing this report.

Kent D. Rockwell, P.E.



DEVELOPER'S STATEMENT

I, the developer, have read and will comply with all the requirements specified in this drainage report and plan.

Development Management, Inc.

BY: _____ DATE 6/6/97

Kent Petre

TITLE: President

ADDRESS: 4065 Sinton Road, Suite 200
Colorado Springs, CO 80907

CITY OF COLORADO SPRINGS

Filed in accordance with Section 15-3-906 of the code of the City of Colorado Springs, 1980, as amended.

_____ June 16 1997

CITY ENGINEER DATE

SUNDOWN NORTH
MASTER DEVELOPMENT DRAINAGE PLAN (MDDP)
June 1997

Purpose

The purpose of this MDDP is to identify the existing and proposed runoff patterns, major drainageways and drainage facilities tributary to the Sundown North Development and to recommend drainage facilities and improvements required to facilitate the future development of the site. This plan should serve only as a guide for future planning and design. Site specific design should be completed with individual drainage plans and reports at the time of platting/development.

Summary of Data

The sources of information used in the development of this study are listed below:

1. City of Colorado Springs and El Paso County "Drainage Criteria Manual", October 1987, revised November 1991.

2. Soil Survey for El Paso County, Colorado, U.S. Department of Agriculture, Soil Conservation Service, June 1980.

3. "Flood Insurance Studies for Colorado Springs and El Paso County, Colorado", prepared by the Federal Emergency Management Agency (FEMA), 1985.

4. "Cottonwood Creek Drainage Basin Planning Study" by URS Consultants, Inc., August 1995.

5. "Cottonwood Creek Prudent Line Study" by Ayres & Associates, 1996.

General Location and Description

The Sundown North Development is located within the City of Colorado Springs, El Paso County, Colorado, encompassing portions of Sections 11, 12 & 13, Township 13 South, Range 66 West of the 6th P.M. (see Vicinity Map - Figure 1). The site is bound on the north by undeveloped land, on the east by Oakwood Boulevard, on the south by Templeton Gap Heights Filing No. 2 and on the west by the Nor'Wood Drainageway. The development contains approximately 100 acres, none of which has been developed to date.

Sundown North will consisting of single family residential development and open space/park tracts.

The entire development lies within the Cottonwood Creek Drainage Basin.

Soils

According to the Soil Survey of El Paso County Area, Colorado, prepared by the U.S. Department of Agriculture Soil Conservation Service, the soils in the Sundown North Development fall under three soils classifications (see Soils Map - Figure 2).

The soils underlying the majority of the site are of the Blakeland Series (Soil 8) and classified under Hydrologic Group "A". Two small areas in the northeast and northwest corners of the site are underlain by the Truckton Series (Soils 96 & 98) and fall under Hydrologic Group "B". Hydrologic Group "B" was used for calculation purposes.

Existing ground cover consists of well established native grasses over the entire site. The land is currently used for pasture purposes.

Climate

This area of El Paso County can be described as the foothills, with total precipitation amounts typical of a semi-arid region. Winters are generally cold and dry, and summers relatively warm and dry. Precipitation ranges from 12 to 14 inches per year, with the majority of this moisture occurring in the spring and summer in the form of rainfall. Thunderstorms are common during the summer months.

Floodplain Statement

According to the Federal Emergency Management Agency (FEMA) Flood Insurance Rate Map (FIRM) Panels #080059 0158 B and #080059 0166 C none of the site lies in a designated floodplain.

Drainage Criteria

The current City of Colorado Springs/El Paso County Drainage Criteria was utilized in this report. Peak runoff quantities were determined using the Rational Method for both the 5 year and 100 year storms, as the drainage basins are less than 100 acres.

Drainage Characteristics

The site consists of gently rolling hills of well established native grass with slopes of 1-10%. The site generally slopes from northeast to southwest to the Nor'Wood Drainageway. The drainageway consists of a wide channel with some exposed sandstone bottom and steep side slopes to the surrounding pasture. The drainageway varies in depth from 8' to 20'. The channel has more than sufficient capacity to handle both historic and developed flows. Development will be held behind the prudent line as described in the Ayres Associates Cottonwood Creek Prudent Line Study.

There are no existing drainage facilities on the site.

Historic Drainage Basin Descriptions

A brief description of each historic drainage basin for the site is provided in this section of the report. A summary of peak historic runoff for the basins is depicted on the Historic Drainage Plan provided in the appendix. The site has been divided into 5 historical drainage basins.

Historic Basin H-1 contains 18.5 acres at the northwest corner of the site that overland flows to an existing minor drainage channel flowing to the Nor'Wood Drainageway. The 5 year and 100 year historic runoff quantities for the Basin are 16.2 cfs and 38.2 cfs, respectively.

Basin H-2 covers 9.7 acres along the west end of the site that currently sheet flow runoff quantities of 8.7 cfs/20.4 cfs towards the Nor'Wood Drainageway to the west.

Basin H-3 encompasses 82.3 acres in the center of the site that sheet and swale flows toward the southwest to the Nor'Wood Drainageway. Existing runoff quantities of 49.4 cfs (5 yr) and 121.0 cfs (100 yr) enter the Drainageway from the Basin.

Encompassing 15.7 acres along the southern edge of the site is Basin H-4, currently sheet flowing runoff quantities of 13.0 cfs/30.8 cfs off-site to the south.

Historic Basin H-5 lies at the eastern end of the site covering 40.2 acres. The historic runoff quantities of 27.1 cfs (5 yr) and 66.1 cfs (100 yr) overland and swale flow southward to the existing north end of Oakwood Boulevard.

Developed Drainage Basin Descriptions

A brief description of each developed drainage basin for the site is provided in this section of the report. Proposed drainage conditions and facilities are described. A summary of peak developed runoff for the basins is depicted on the Developed Drainage Plan provided in the appendix. All proposed drainage facilities are approximate in size and may vary with actual layout and design.

Developed Basin D-1 contains 10.7 acres at the northwest end of the site that will overland and street flow developed runoff quantities of 25.7 cfs (5 yr) and 51.7 cfs (100 yr) to the intersection of Spotted Horse Drive and Granite Peak Drive, a sump condition. Three sump inlets, a 4', 6' and 10', are proposed for the intersection to collect the runoff and discharge to the Nor'Wood Drainageway to the west in a 30" RCP. In the event that the inlets should become plugged, the runoff will overtop the curb and travel to the Drainageway. Granite Peak Drive will be classified as a collector street from Dublin to Spotted Horse.

DP #1 lies at the Basin D-1 outfall and was labeled to show the point discharge to the Nor'Wood Drainageway at this point. The peak developed runoff quantities will be the same as Basin D-1, 25.7 cfs (5 yr) and 51.7 cfs (100 yr).

Basin D-2 encompasses 9.2 acres at the east central portion of the site that will develop runoff quantities of 21.0 cfs (5yr)/41.9 cfs (100yr). The runoff will overland and street flow to a proposed 20' on-grade inlet in Hawk Springs Drive that will collect 13.2 cfs in both the 5 year and 100 year storms. An 18" RCP will exit the inlet and travel up the east side of the street to DP #3.

Basin D-3 also lies in the east central portion of the site, containing 4.3 acres. Runoff quantities from the Basin of 11.6 cfs/23.2 cfs plus the bypass flows from the inlet in Basin D-2 will travel to a proposed 15' sump inlet on the east side of Hawk Springs Drive. All of the 5 year and 100 year flows will be collected. A 24" RCP will exit the inlet to the west down Dunraven Pass Drive.

Developed Basin D-4 covers 6.2 acres in the north central portion of the site that will develop runoff quantities of 14.1 cfs/28.6 cfs. A 15' on grade inlet is proposed at the outfall of the Basin in Lost Springs Drive, and will collect 8.5 cfs/13.2 cfs. An 18" RCP will exit the inlet and tie into a second on-grade inlet (10') in Dunraven Pass Drive that will collect 1.4 cfs/3.9 cfs. The collected runoff will discharge to a proposed 30" RCP in the street via a 24" RCP. The bypass flows of 4.1 cfs/11.5 cfs will travel into Basin D-6 to the west.

Basin D-5 contains 5.0 acres along the south-central portion of the site that will overland and street flow runoff quantities of 12.3 cfs/24.8 cfs to the outfall of the Basin and a proposed 10' on-grade inlet in Dunraven Pass Drive. The inlet will collect 4.3 cfs and 6.3 cfs respectively and discharge to a proposed 30" RCP in the street via an 18" RCP. The bypass flows of 8.0 cfs/18.5 cfs will travel into Basin D-7 to the west.

Basin D-7 lies in the south central portion of the site containing 4.9 acres of proposed homes and open space. The basin will develop runoff quantities of 10.6 cfs/21.6 cfs that will be collected by a proposed 10' on-grade and a 12' sump inlet on the east side of Fossil Butte Drive. Bypass flows from D-5 will also be collected by the inlets. The inlets will tie into a proposed storm sewer pipe in Fossil Butte Drive and discharge to the drainageway to the southwest. In the event that the sump inlet should become plugged, the runoff will overtop the curb to the south and travel to the Nor'Wood Drainageway.

Basin D-9 lies at the south central portion of the site containing 1.0 acres that will overland flow developed runoff quantities of 2.3 cfs/4.6 cfs to a proposed low point in the Fossil Butte Drive opposite the 12' sump inlet in Basin D-7. A 6' sump inlet will collect the runoff and discharge to the Nor'Wood Drainageway to the southwest via a proposed 36" RCP. The peak discharge to the Drainageway (DP-9) via the 36" RCP will be 60.2 cfs (5 yr) and 117.0 cfs (100 yr), respectively.

Basin D-10 encompasses 6.9 acres along the southwest edge of the site. The 5 year and 100 year developed runoff quantities of 21.5 cfs/43.5 cfs will sheet flow off the back of the lots towards the Nor'Wood Drainageway to the southwest.

Basin D-11 covers 1.1 acres along the back of several proposed lots at the southeast end of the site that will sheet flow 3.4 cfs (5 yr) and 6.9 cfs (100 yr) off-site to the south. This release rate is less than historic. The historic release rates are 4.0 cfs/10.0 cfs from that portion of Basin H-4.

Basins OS-1 through OS-4 were created to analyze the future developed runoff on the north side of Dublin Boulevard. The future development is proposed to consist of residential lots in Basins OS-1, OS-2, OS-3 and residential lots plus an area of commercial development in Basin OS-4. The proposed storm sewer system shown on the developed drainage plan is from preliminary analyses and sizing done with this report. A more detailed analyses should be completed prior to roadway construction to assure that city criteria are met and that facility sizes are sufficient.

DP OS-1 was created to determine the peak developed runoff for the north side of Dublin Boulevard for the storm crossing to the south as no flow will be allowed to cross the street. Peak runoff quantities of 114.4 cfs (5yr) and 224.5 cfs (100yr) will be developed and collected on the north side of the street and discharged down Wagon Ridge Drive to the south via a proposed 48" RCP. Dublin Boulevard is classified as a major arterial street and will have minimum 5 year and 100 year street capacity of 24.0 cfs and 50.5 cfs per side, respectively, at 2% grade.

Developed Basin D-12 is located in the northeast portion of the development and will overland and street flow 11.6 cfs/23.2 cfs from 4.6 acres. The runoff will travel to the south side of Dublin Boulevard via Cloud Dancer Drive, a minor collector, into Basin D-13. A 12' on-grade inlet is proposed in Dublin Boulevard just west of the intersection. The inlet will collect 5.3 cfs and 8.5 cfs and discharge to a proposed 36" RCP travelling west in Dublin Boulevard via an 18" RCP.

Basin D-13 contains 9.0 acres along the south side of Dublin Boulevard (major arterial) that will street flow runoff from the back of several lots and travel west down Dublin Boulevard. The Basin will develop runoff quantities of 19.4 cfs (5 yr) and 39.1 cfs (100 yr). A 12' on-grade inlet is proposed on the south side of Dublin Boulevard at the Basin outfall in order to collect a portion of the street flow. The inlet will collect 5.1 cfs and 8.8 cfs and discharge to the proposed 48" RCP travelling south in Wagon Ridge Drive via an 18" RCP. Bypass flows of 3.2 cfs and 13.7 cfs will turn the corner into Wagon Ridge Drive running south.

Basin D-14 contains 1.6 acres along the south side of Dublin Boulevard at the west end of the site. Developed runoff quantities of 5.0 cfs and 10.1 cfs will turn off of Dublin Boulevard and into Wagon Ridge Drive heading south.

Basin D-16 lies at the outfall of Basins D-13 and D-14 and contains 7.0 acres that will overland and street flow to DP-16. The Basin will develop runoff quantities of 16.8 cfs (5 yr) and 33.8 cfs (100 yr) which will travel southward in the Wagon Ridge Drive. A pair of 12' on-grade inlets (one each side) are proposed in Wagon Ridge Drive just north of the intersection with Fossil Butte Drive. The inlets will collect 4.0 cfs (5yr)/7.8 cfs (100yr), respectively, discharging to a proposed 54" RCP. Bypass flows of 2.7 cfs (5yr)/14.3 cfs (100yr) each side will continue southward.

Wagon Ridge Drive is a minor collector street and will have a 36' mat with Type 1 vertical curb and gutter. The street will have a 5 year and 100 year street capacity of approximately 54 cfs/145 cfs, respectively, at the 2.5% grade shown. The street will be within allowable capacity.

East of Basin D-16 lies the 6.1 acres that make up Basin D-6. Runoff quantities of 13.0 cfs (5 yr) and 26.6 cfs (100 yr) (plus Basin D-4 bypass flows) will overland and street flow to the outfall of the Basin and a proposed 16' on-grade inlet in Fossil Butte Drive. The inlet will collect 8.2 cfs/12.6 cfs and discharge to the proposed 54" RCP in Wagon Ridge Drive via an 18" RCP. Bypass flows of 8.8 cfs (5yr)/24.4 cfs (100yr) will turn south into Wagon Ridge Drive.

DP #16 was created to determine the peak developed runoff to the intersection of Wagon Ridge Drive and Fossil Butte Drive (both street and pipe) for downstream facility sizing. Peak runoff quantities of 163.4 cfs (5yr) and 322.2 cfs (100yr) will be developed and travel through the intersection. Of the 322.2 cfs during the 100 year storm, approximately 53 cfs will be as street flow and the remaining 269.2 cfs will travel to the south in a proposed 54" RCP.

Developed Basin D-8 covers 4.1 acres in the south end of the site developing runoff quantities of 10.3 cfs/20.9 cfs from the proposed lots and streets. The runoff will travel to a proposed 20' sump inlet at the northeast corner of Snowy Range Drive and Wagon Ridge Drive. A 30" RCP will outfall the inlet and tie-into the proposed 54" RCP.

Basin D-17 encompasses 5.2 acres at the southwest end of the site that will overland and street flow 12.5 cfs/25.1 cfs to the proposed low point at the above mentioned intersection. The runoff will be collected by a proposed 12' sump inlet at the northwest corner of Snowy Range Drive and Wagon Ridge Drive. A 24" RCP will outfall the inlet and tie-into the proposed 54" RCP.

A 4' sump inlet will be constructed on the south side of the intersection to collect the minor flows on the south side of Snowy Range Drive. The inlet will also discharge to the proposed 54" RCP heading south to Design Point 17 (DP #17). The peak developed runoff to be discharged to the Nor'Wood Drainageway at this point will be 173.0 cfs (5 yr) and 345.0 cfs (100 yr). In the event that the inlets at this intersection should become plugged, the runoff will overtop the curb to the south and travel to the Drainageway.

Basin D-15 lies at the east end of the site and will develop runoff quantities of 19.7 cfs (5 yr) and 39.0 cfs (100 yr) that will travel to the west side of Oakwood Boulevard, a minor collector. The flows are within the half street capacity of 24.0 cfs (5yr)/65.6 cfs (100yr).

Basin OS-5 is located off-site, just east of Basin D-15 and contains approximately 9.3 acres of undetermined use land on the east side of Oakwood Boulevard. Preliminary calculations show that Oakwood Boulevard could be near capacity at the Basin outfall depending on the type and layout of development proposed for the Basin. A 16' on-grade inlet and 24" RCP outfall is therefore proposed on the east side of the street several hundred feet upstream from the Basin outfall.

At this time it is unknown if the URS Drainage Basin Study or the Ayres Prudent Line Study will be utilized as the guideline for the improvements to the Nor'wood Drainageway/Channel between Antelope Creek, Austin Bluffs Parkway and the Sundown North Development. The Prudent Line Study indicates that the channel will remain basically in its current state with a series of grade control structures along this reach. The URS Study calls for the side slopes to be rip-rap lined with several drop structures. The exact details of the required treatment will be described/depicted in the final drainage reports for the individual subdivisions that abut the Drainageway. An addendum will be made to the MDDP once the hydrology (URS or Ayres) is adopted. The addendum will include a basic list of facilities required along the channel, and a drainage plan reflecting such.

All on-site residential and collector streets will remain within street capacities.

Individual lot drainage is the responsibility of the lot owner/builder.

Erosion Control

Erosion control measures will be installed per the approved grading/erosion control plans.

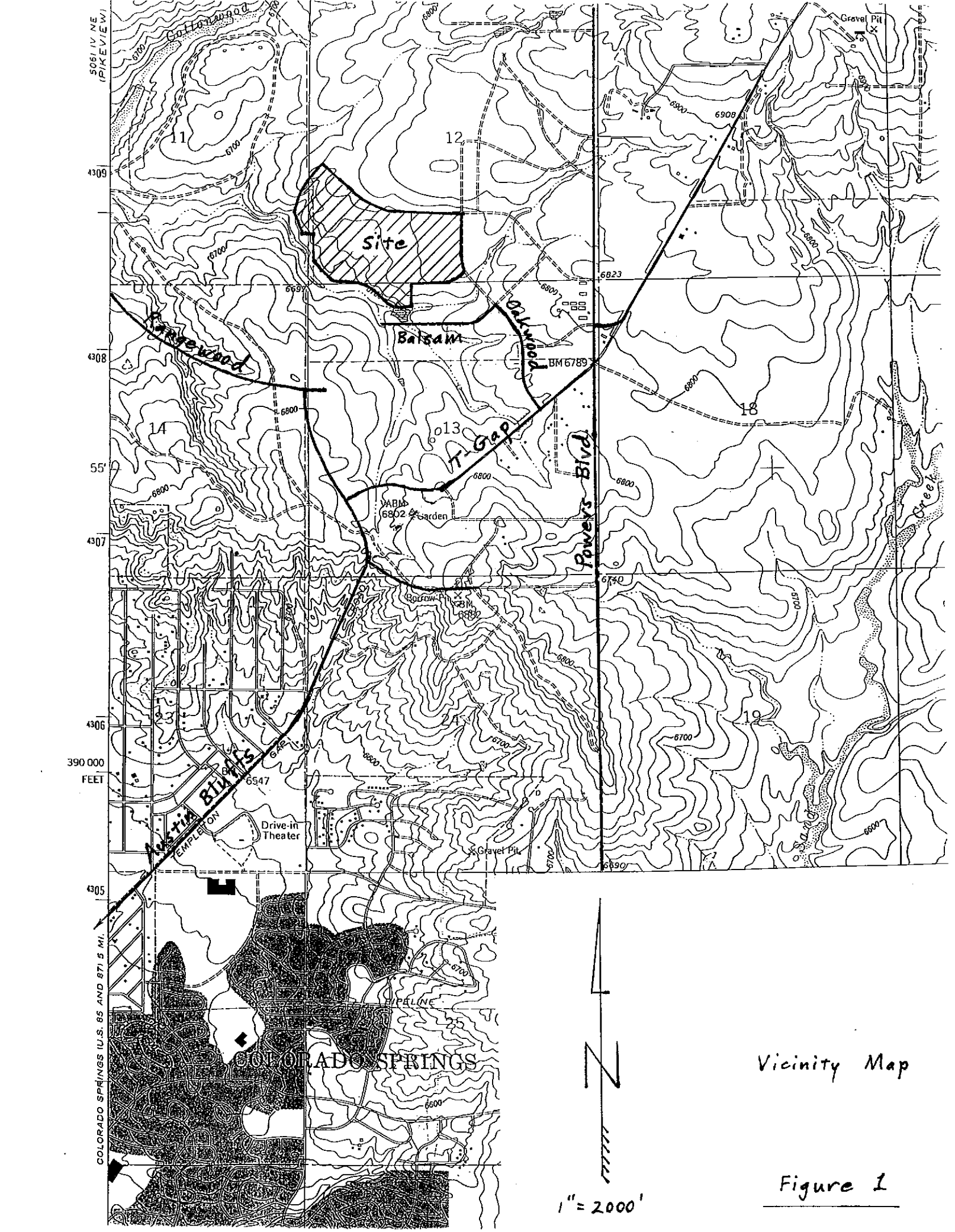
Drainage, Bridge and Pond Fees

The Sundown North Development lies within the Cottonwood Creek Drainage Basin. No Fees are required with the approval of this report, fees will be paid at the time of platting individual developments. The 1997 Drainage, Bridge and Pond Fees for the Basin are listed below:

Cottonwood Creek

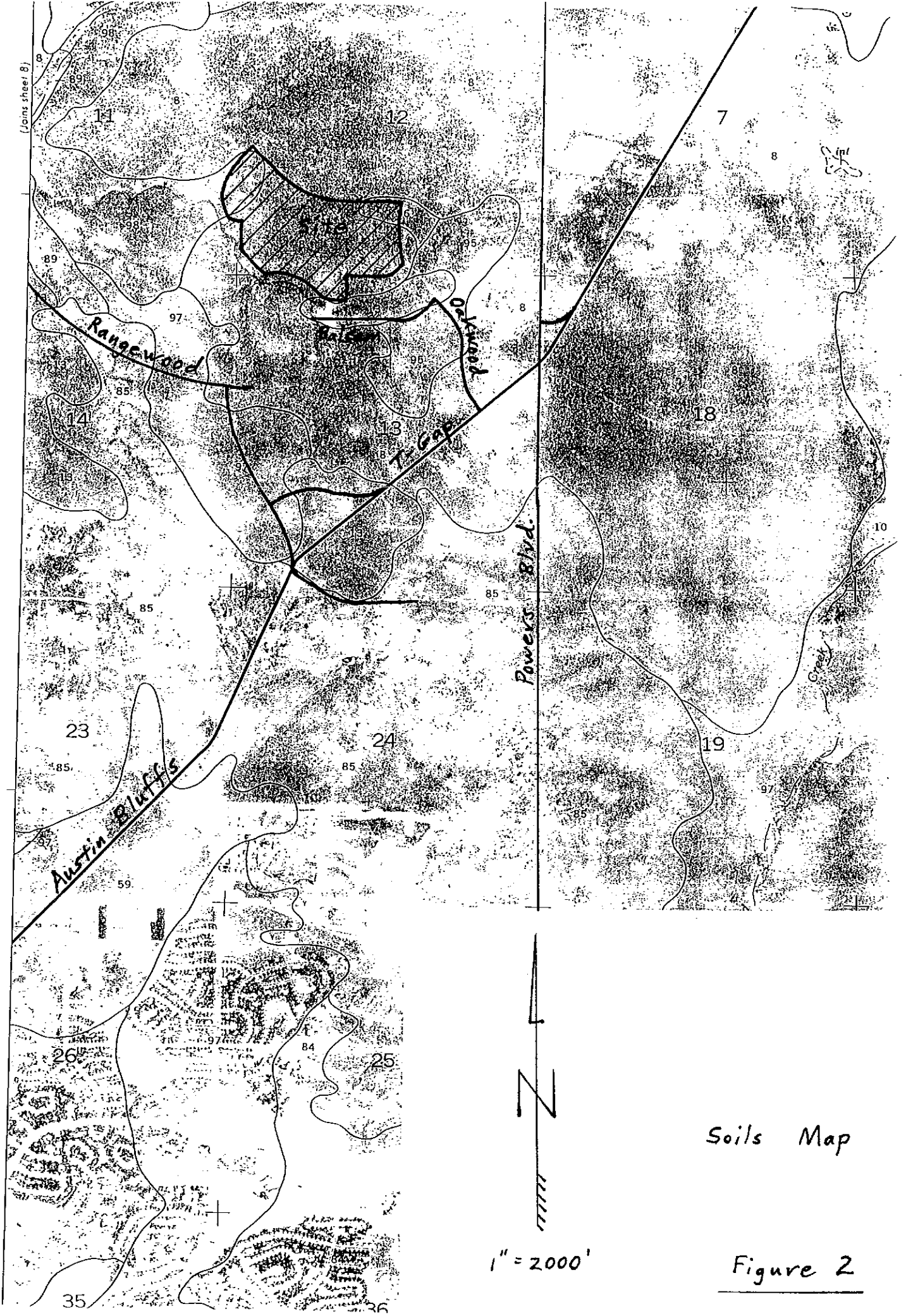
Drainage Fees:	$ 5195/ac.
Additional Drainage Fees (pending Cottonwood Creek Study):	$ 650/ac.
Bridge Fees:	$ 261/ac.
Additional Bridge Fees (pending Cottonwood Creek Study):	$ 256/ac.
Pond Fees (land):	$ 82/ac.
Pond Fees (facilities):	$ 315/ac.

APPENDIX



Vicinity Map

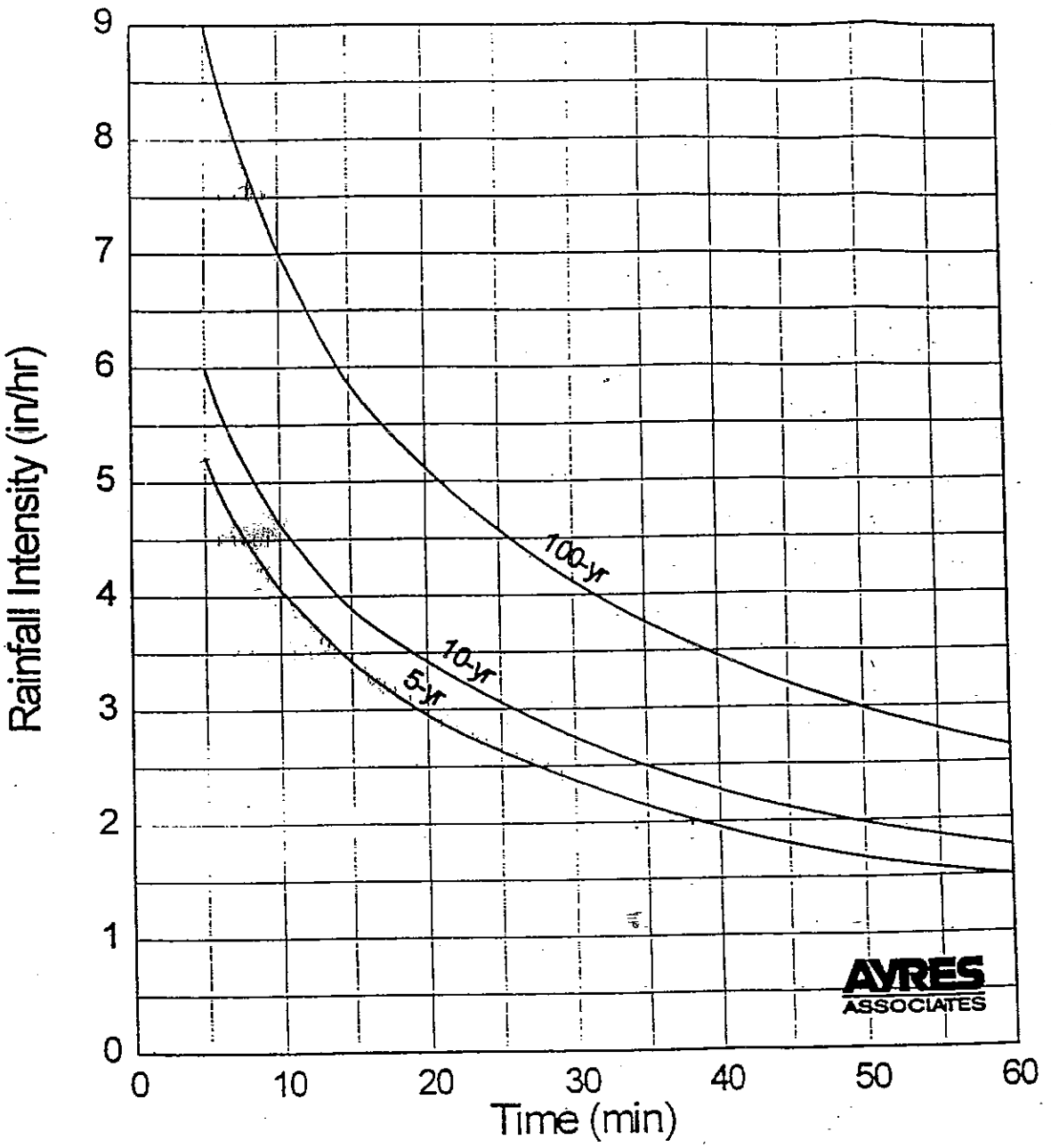
Figure 1



Soils Map

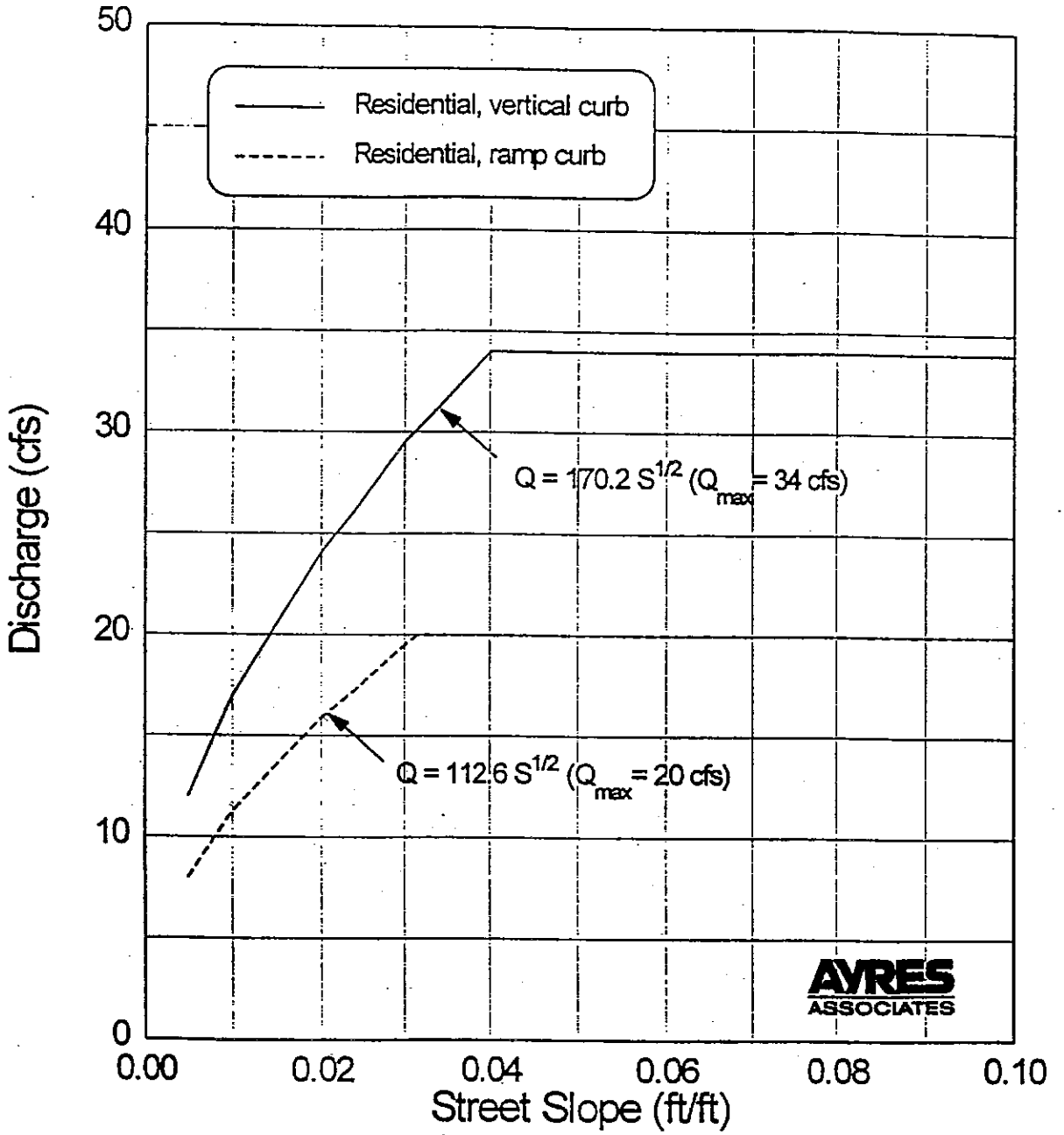
1" = 2000'

Figure 2



Interim Release October 12, 1994 , Rainfall Intensity Curves
City Of Colorado Springs Drainage Criteria Manual

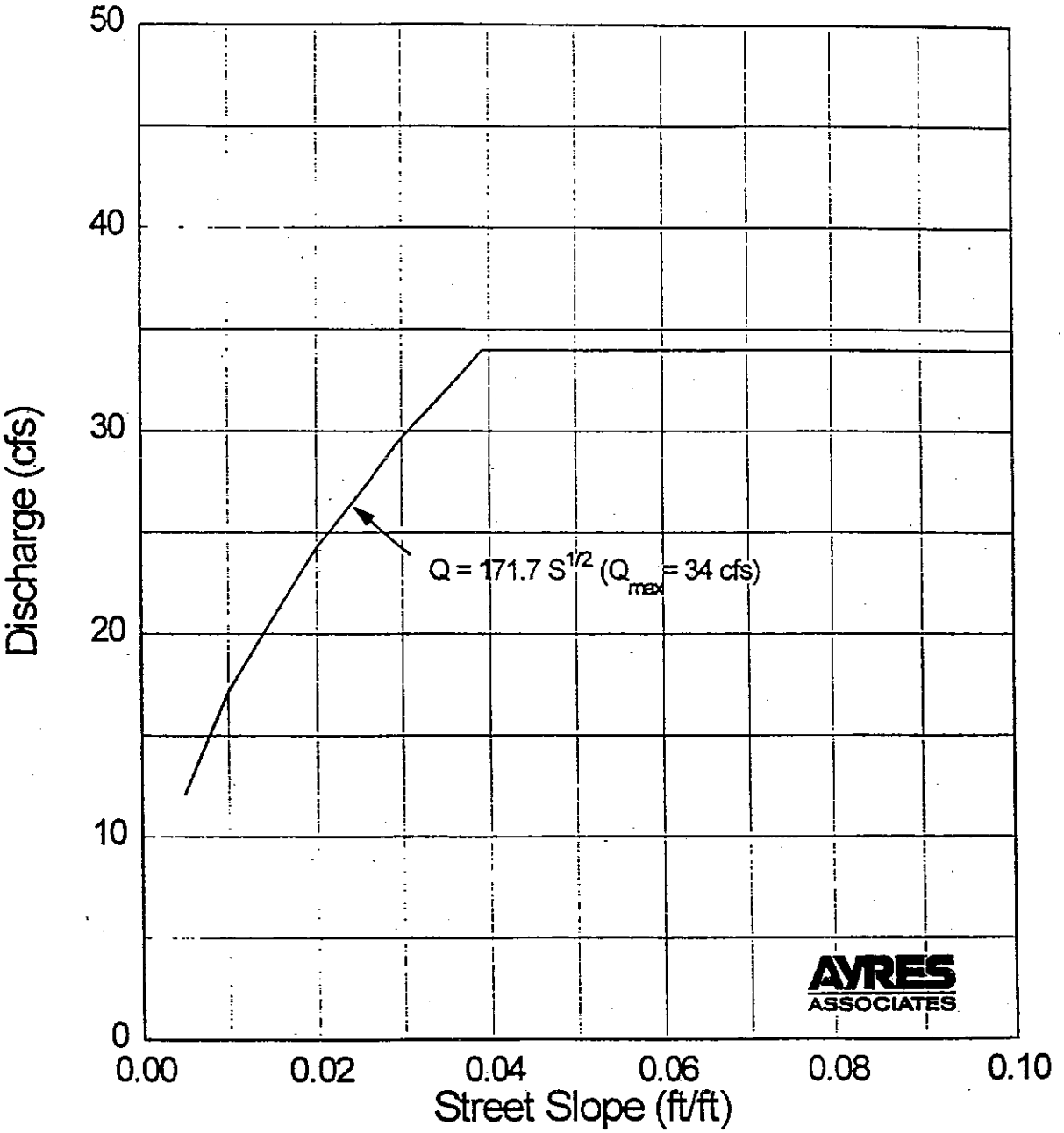
RESIDENTIAL STREET (34' Flowline to flowline)



Interim Release October 12, 1994
City of Colorado Springs

Use this graph to determine the allowable street capacity per side, initial storm, for the typical street section using a 2% crown.

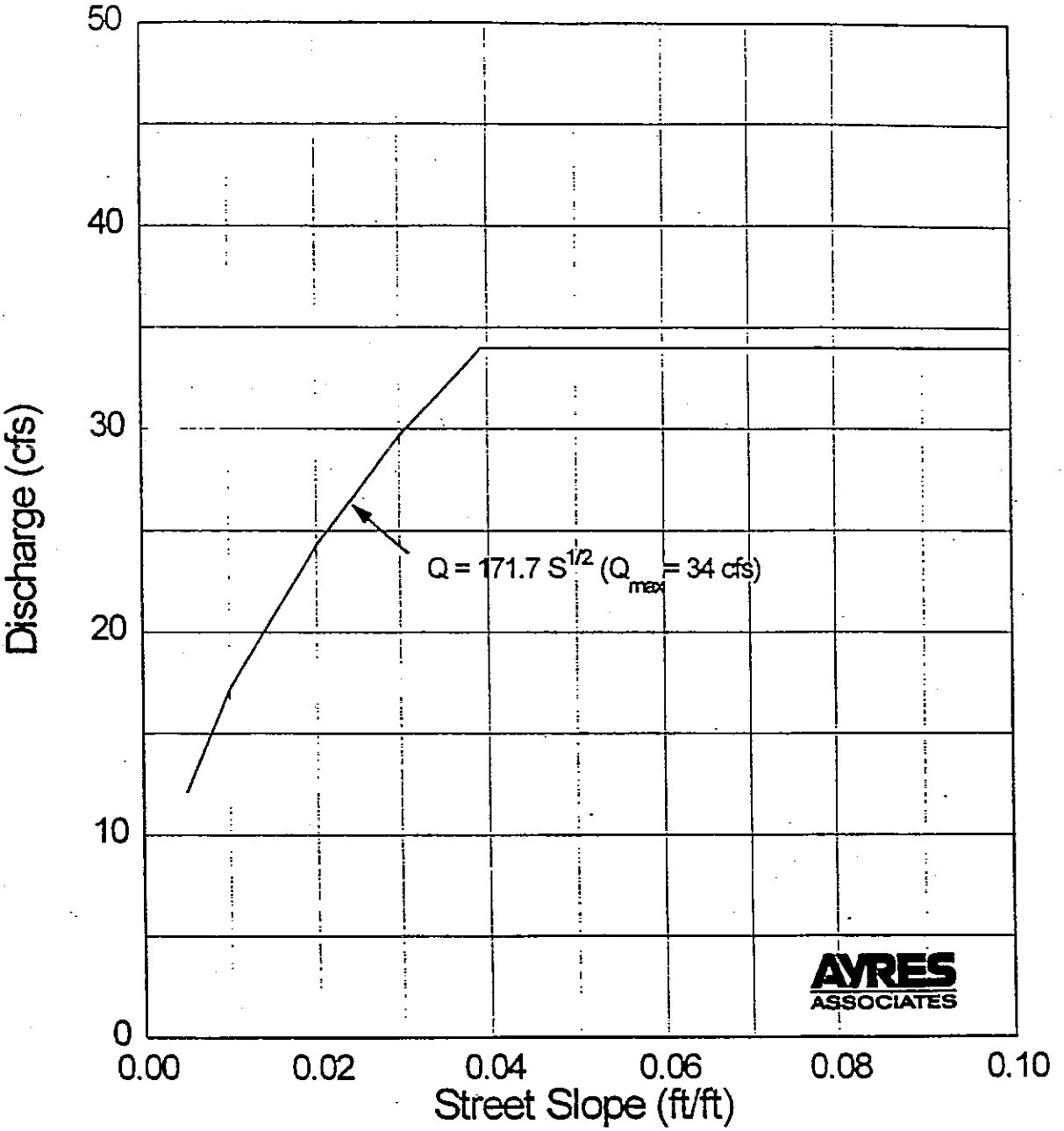
COLLECTOR STREETS (Major and Minor)



Interim Release October 12, 1994
City of Colorado Springs

Use this graph to determine the allowable street capacity per side, initial storm, for the typical street section using a 2% crown. No flow may cross the crown.

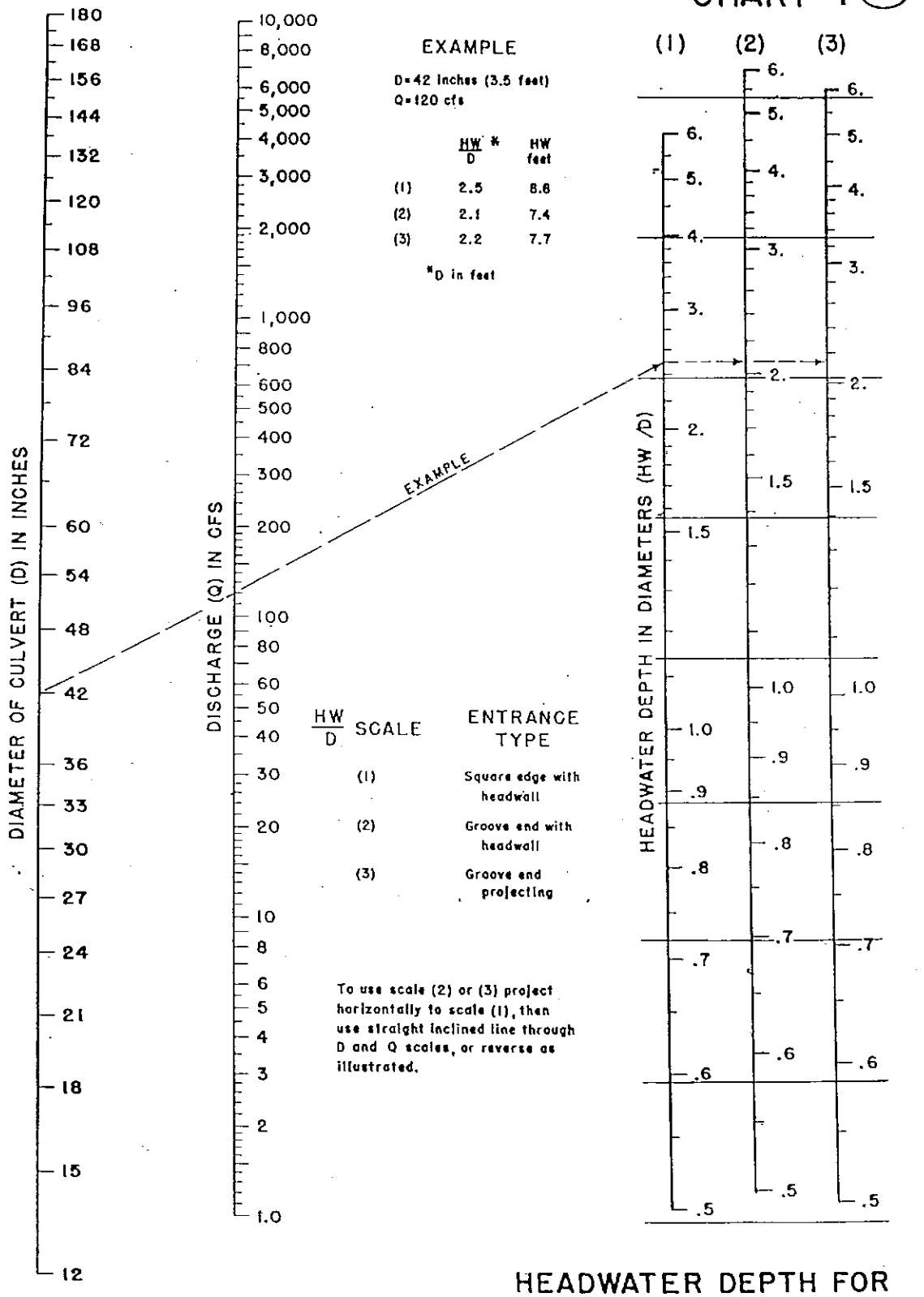
ARTERIAL STREETS (Major and Minor)



Interim Release October 12, 1994
City of Colorado Springs

Use this graph to determine the allowable street capacity per side, initial storm, for the typical street section using a 2% crown. The curve corresponds to 6" depth @ flowline, 20 foot flow spread. No flow may cross the crown. Must keep one ten foot lane free of water in each direction.

CHART 1



HEADWATER DEPTH FOR CONCRETE PIPE CULVERTS WITH INLET CONTROL

HEADWATER SCALES 2&3
REVISED MAY 1964

BUREAU OF PUBLIC ROADS JAN. 1963

SN

Hydrology

Location: H-1
Area: 18.5 Ac.
Soil or Landuse: "B"

Runoff Coefficient, C:

Area Zone	C5	C100	% Area
Pasture	0.25	0.35	100 %

Composite: C5: C100: 100%

Time of Concentration: Tc, in minutes:

Travel Type	L(ft)	s (%)	v (fps)	Tc
Overland	300'	8 %		13.9
Swale	500'	8 %	10	0.8

Tc Total: 14.7

Intensity, I (inches/hr) from Fig 5-1

I5: 3.5 in/hr I100: 5.9 in/hr

Peak Flow: Q = CIA in cfs

Q5: 16.2 cfs Q100: 38.2 cfs

Hydrology

Location: H-2
Area: 9.7 Ac.
Soil or Landuse: "B"

Runoff Coefficient, C:

Area Zone	C5	C100	% Area
Pasture	0.25	0.35	100 %

Composite: C5 C100: 100%

Time of Concentration: Tc, in minutes:

Travel Type	L(ft)	s (%)	v (fps)	Tc
Overland	300'	8 %		13.9

Tc Total: 13.9

Intensity, I (inches/hr) from Fig 5-1

I5 3.6 in/hr I100: 6.0 in/h

Peak Flow: Q = CIA in cfs

Q5 8.7 cfs Q100: 20.4 cfs

Hydrology

Location: H-3
Area: 82.3 Ac.
Soil or Landuse: "B"

Runoff Coefficient, C:

Area Zone	C5	C100	% Area
Pasture	0.25	0.35	100 %

Composite: C5: C100: 100%

Time of Concentration: Tc, in minutes:

Travel Type	L(ft)	s(%)	V(fps)	Tc
Overland	1000'	8 %		25.3
Swale	1800'	3 %	8	3.7

Tc Total: 29.0

Intensity, I (inches/hr) from Fig 5-1

I5: 2.4 in/hr I100: 4.2 in/hr

Peak Flow: Q = CIA in cfs

Q5: 49.4 cfs Q100: 121.0 cfs

Hydrology

Location: H-4
Area: 15.7 Ac.
Soil or Landuse: "B"

Runoff Coefficient, C:

Area Zone	C5	C100	% Area
Pasture	0.25	0.35	100 %

Composite: C5 C100: 100%

Time of Concentration: Tc, in minutes:

Travel Type	L(ft)	s(%)	V(fps)	Tc
Overland	400'	7 %		16.7

Tc Total: 16.7

Intensity, I (inches/hr) from Fig 5-1

I5 3.3 in/hr I100: 5.6 in/h

Peak Flow: Q = CIA in cfs

Q5 13.0 cfs Q100: 30.8 cfs

Hydrology

Location: H-5
Area: 40.2 Ac.
Soil or Landuse: "B"

Runoff Coefficient, C:

Area Zone	C5	C100	% Area
Pasture	0.25	0.35	100 %

Composite: C5: C100: 100%

Time of Concentration: Tc, in minutes:

Travel Type	L (ft)	s (%)	v (fps)	Tc
Overland	700'	8 %		21.2
Swale	1000'	2 %	6	2.8

Tc Total: 24.0

Intensity, I (inches/hr) from Fig 5-1

I5: 2.7 in/hr I100: 4.7 in/hr

Peak Flow: Q = CIA in cfs

Q5: 27.1 cfs Q100: 66.1 cfs

Hydrology

Location:
Area: Ac.
Soil or Landuse:

Runoff Coefficient, C:

Area Zone	C5	C100	% Area

Composite: C5 C100: 100%

Time of Concentration: Tc, in minutes:

Travel Type	L (ft)	s (%)	v (fps)	Tc

Tc Total:

Intensity, I (inches/hr) from Fig 5-1

I5: in/hr I100: in/h

Peak Flow: Q = CIA in cfs

Q5 cfs Q100: cfs

Hydrology

Location: D-1
Area: 10.7 Ac.
Soil or Landuse: "B"

Runoff Coefficient, C:

Area Zone	C5	C100	% Area
1/8 ac. Res.	0.60	0.70	100%

Composite: C5: C100: 100%

Time of Concentration: Tc, in minutes:

Travel Type	L(ft)	s(%)	V(fps)	Tc
Overland	150	3%		8.0
Street	700	3%	5	2.3

Tc Total: 10.3

Intensity, I (inches/hr) from Fig 5-1

I5: 4.0 in/hr I100: 6.9 in/hr

Peak Flow: Q = CIA in cfs

Q5: 25.7 cfs Q100: 51.7 cfs

Hydrology

Location: D-2
Area: 9.2 Ac.
Soil or Landuse: "B"

Runoff Coefficient, C:

Area Zone	C5	C100	% Area
1/8 ac. Res.	0.60	0.70	100%

Composite: C5 C100: 100%

Time of Concentration: Tc, in minutes:

Travel Type	L(ft)	s(%)	V(fps)	Tc
Overland	150	3		8.0
Street	1000	2%	4	4.2

Tc Total: 12.2

Intensity, I (inches/hr) from Fig 5-1

I5: 3.8 in/hr I100: 6.5 in/h

Peak Flow: Q = CIA in cfs

Q5 21.0 cfs Q100: 41.9 cfs

Hydrology

Location: D-3
Area: 4.3 Ac.
Soil or Landuse: "B"

Runoff Coefficient, C:

Area Zone	C5	C100	% Area
1/8 ac. Res.	0.60	0.70	100 %

Composite: C5: C100: 100%

Time of Concentration: Tc, in minutes:

Travel Type	L(ft)	s(%)	V(fps)	Tc
Overland	100'	4%		5.9
Street	500'	4%	5	1.7

Tc Total: 7.6

Intensity, I (inches/hr) from Fig 5-1

I5: 4.5 in/hr I100: 7.7 in/hr

Peak Flow: Q = CIA in cfs

Q5: 11.6 cfs Q100: 23.2 cfs

Hydrology

Location: D-4
Area: 6.2 Ac.
Soil or Landuse: "B"

Runoff Coefficient, C:

Area Zone	C5	C100	% Area
1/8 ac. Res.	0.60	0.70	100 %

Composite: C5 C100: 100%

Time of Concentration: Tc, in minutes:

Travel Type	L(ft)	s(%)	V(fps)	Tc
Overland	150'	3%		8.0
Street	900'	2%	4	3.7

Tc Total: 11.7

Intensity, I (inches/hr) from Fig 5-1

I5: 3.8 in/hr I100: 6.6 in/h

Peak Flow: Q = CIA in cfs

Q5 14.1 cfs Q100: 28.6 cfs

Hydrology

Location: D-5
Area: 5.0 Ac.
Soil or Landuse: "B"

Runoff Coefficient, C:

Area Zone	C5	C100	% Area
1/8 ac. Res.	0.60	0.70	100 %

Composite: C5: C100: 100%

Time of Concentration: Tc, in minutes:

Travel Type	L(ft)	s(%)	v(fps)	Tc
Overland	100'	4%		5.9
Street	900'	2%	4	3.7

Tc Total: 9.6

Intensity, I (inches/hr) from Fig 5-1

I5: 4.1 in/hr I100: 7.1 in/hr

Peak Flow: Q = CIA in cfs

Q5: 12.3 cfs Q100: 24.8 cfs

Hydrology

Location: D-6
Area: 6.1 Ac.
Soil or Landuse: "B"

Runoff Coefficient, C:

Area Zone	C5	C100	% Area
1/8 ac. Res.	0.60	0.70	90 %
Open Space	0.25	0.35	10 %

Composite: C5 0.56 C100: 0.66 100%

Time of Concentration: Tc, in minutes:

Travel Type	L(ft)	s(%)	v(fps)	Tc
Overland	200'	3%		9.9
Street	600'	3%	5	2.0

Tc Total: 11.9

Intensity, I (inches/hr) from Fig 5-1

I5: 3.8 in/hr I100: 6.6 in/h

Peak Flow: Q = CIA in cfs

Q5 13.0 cfs Q100: 26.6 cfs

Hydrology

Location: D-7
Area: 4.9 Ac.
Soil or Landuse: "B"

Runoff Coefficient, C:

Area Zone	C5	C100	% Area
1/8 ac. Res.	0.60	0.70	80 %
Open Space	0.25	0.35	20 %

Composite: C5: 0.53 C100: 0.63 100%

Time of Concentration: Tc, in minutes:

Travel Type	L(ft)	s(%)	V(fps)	Tc
Overland	250	5 %		9.9

Tc Total: 9.9

Intensity, I (inches/hr) from Fig 5-1

I5: 4.1 in/hr I100: 7.0 in/hr

Peak Flow: Q = CIA in cfs

Q5: 10.6 cfs Q100: 21.6 cfs

Hydrology

Location: D-8
Area: 4.1 Ac.
Soil or Landuse: "B"

Runoff Coefficient, C:

Area Zone	C5	C100	% Area
1/8 ac. Res.	0.60	0.70	100 %

Composite: C5 C100: 100%

Time of Concentration: Tc, in minutes:

Travel Type	L(ft)	s(%)	V(fps)	Tc
Overland	150'	4 %		7.2
Street	500'	3 %	5	1.7

Tc Total: 8.9

Intensity, I (inches/hr) from Fig 5-1

I5 4.2 in/hr I100: 7.3 in/h

Peak Flow: Q = CIA in cfs

Q5 10.3 cfs Q100: 20.9 cfs

Hydrology

Location: D-9
Area: 1.0 Ac.
Soil or Landuse: "B"

Runoff Coefficient, C:

Area Zone	C5	C100	% Area
1/8 ac. Res.	0.60	0.70	90
Open Space	0.25	0.35	10

Composite: C5: 0.56 C100: 0.66 100%

Time of Concentration: Tc, in minutes:

Travel Type	L(ft)	s(%)	V(fps)	Tc
Overland	250'	5%		9.9

Tc Total: 9.9

Intensity, I (inches/hr) from Fig 5-1

I5: 4.1 in/hr I100: 7.0 in/hr

Peak Flow: Q = CIA in cfs

Q5: 2.3 cfs Q100: 4.6 cfs

Hydrology

Location: D-1C
Area: 6.9 Ac.
Soil or Landuse: "B"

Runoff Coefficient, C:

Area Zone	C5	C100	% Area
1/8 ac. Res.	0.60	0.70	[illegible]

Composite: C5 C100: 100%

Time of Concentration: Tc, in minutes:

Travel Type	L(ft)	s(%)	V(fps)	Tc
Overland	100'	10%		[illegible]

Tc Total: 5.0

Intensity, I (inches/hr) from Fig 5-1

I5: 5.2 in/hr I100: 9.0 in/h

Peak Flow: Q = CIA in cfs

Q5 21.5 cfs Q100: 43.5 cfs

Hydrology

Location: D-11
Area: 1.1 Ac.
Soil or Landuse: "B"

Runoff Coefficient, C:

Area Zone	C5	C100	% Area
1/8 ac. Res.	0.60	0.70	100 %

Composite: C5: C100: 100%

Time of Concentration: Tc, in minutes:

Travel Type	l (ft)	s (%)	v (fps)	Tc
Overland	70	3		→ 5.0

Tc Total: 5.0

Intensity, I (inches/hr) from Fig 5-1

I5: 5.2 in/hr I100: 9.0 in/hr

Peak Flow: Q = CIA in cfs

Q5: 3.4 cfs Q100: 6.9 cfs

Hydrology

Location: D-12
Area: 4.6 Ac.
Soil or Landuse: "B"

Runoff Coefficient, C:

Area Zone	C5	C100	% Area
1/8 ac. Res.	0.60	0.70	100%

Composite: C5 C100: 100%

Time of Concentration: Tc, in minutes:

Travel Type	l (ft)	s (%)	v (fps)	Tc
Overland	150'	4%		7.2
Street	500'	4%	5	1.7

Tc Total: 8.9

Intensity, I (inches/hr) from Fig 5-1

I5 4.2 in/hr I100: 7.2 in/h

Peak Flow: Q = CIA in cfs

Q5 11.6 cfs Q100: 23.2 cfs

Hydrology

Location: D-13
Area: 9.0 Ac.
Soil or Landuse: "B"

Runoff Coefficient, C:

Area Zone	C5	C100	% Area
1/8 ac. Res.	0.60	0.70	100

Composite: C5: C100: 100%

Time of Concentration: Tc, in minutes:

Travel Type	l (ft)	s (%)	v (fps)	Tc
Overland	100'	4%		5.9
Street	1700'	2.5%	4	7.1

Tc Total: 13.0

Intensity, I (inches/hr) from Fig 5-1

I5: 3.6 in/hr I100: 6.2 in/hr

Peak Flow: Q = CIA in cfs

Q5: 19.4 cfs Q100: 39.1 cfs

Hydrology

Location: D-14
Area: 1.6 Ac.
Soil or Landuse: "B"

Runoff Coefficient, C:

Area Zone	C5	C100	% Area
Street/Open Space...	0.60	0.70	100%

Composite: C5 C100: 100%

Time of Concentration: Tc, in minutes:

Travel Type	l (ft)	s (%)	v (fps)	Tc
Street	700'	1%	3	3.9

Tc Total: 5.0

Intensity, I (inches/hr) from Fig 5-1

I5 5.2 in/hr I100: 9.0 in/h

Peak Flow: Q = CIA in cfs

Q5 5.0 cfs Q100: 10.1 cfs

Hydrology

Location: D-15
Area: 8.2 Ac.
Soil or Landuse: "B"

Runoff Coefficient, C:

Area Zone	C5	C100	% Area
1/8 ac. Res.	0.60	0.70	100 %

Composite: C5: C100: 100%

Time of Concentration: Tc, in minutes:

Travel Type	L (ft)	s (%)	V (fps)	Tc
Overland	150'	4 %		7.2
Street	900'	2 %	4	3.8

Tc Total: 11.0

Intensity, I (inches/hr) from Fig 5-1

I5: 4.0 in/hr I100: 6.8 in/hr

Peak Flow: Q = CIA in cfs

Q5: 19.7 cfs Q100: 39.0 cfs

Hydrology

Location: D-16
Area: 7.0 Ac.
Soil or Landuse: "B"

Runoff Coefficient, C:

Area Zone	C5	C100	% Area
1/8 ac. Res.	0.60	0.70	100 %

Composite: C5 C100: 100%

Time of Concentration: Tc, in minutes:

Travel Type	L (ft)	s (%)	V (fps)	Tc
Overland	100'	3 %		6.5
Street	900'	2.5 %	4	3.8

Tc Total: 10.3

Intensity, I (inches/hr) from Fig 5-1

I5 4.0 in/hr I100: 6.9 in/h

Peak Flow: Q = CIA in cfs

Q5 16.8 cfs Q100: 33.8 cfs

Hydrology

Location: D-17
Area: 5.2 Ac.
Soil or Landuse: "B"

Runoff Coefficient, C:

Area Zone	C5	C100	% Area
1/8 ac lots	0.60	0.70	100%

Composite: C5: C100: 100%

Time of Concentration: Tc, in minutes:

Travel Type	L(ft)	s(%)	V(fps)	Tc
Overland	100'	3%		6.5
Swale	900'	2%	4	3.8

Tc Total: 10.3

Intensity, I (inches/hr) from Fig 5-1

I5: 4.0 in/hr I100: 6.9 in/hr

Peak Flow: Q = CIA in cfs

Q5: 12.5 cfs Q100: 25.1 cfs

Hydrology

Location:
Area: Ac.
Soil or Landuse:

Runoff Coefficient, C:

Area Zone	C5	C100	% Area

Composite: C5 C100: 100%

Time of Concentration: Tc, in minutes:

Travel Type	L(ft)	s(%)	V(fps)	Tc

Tc Total:

Intensity, I (inches/hr) from Fig 5-1

I5: in/hr I100: in/hr

Peak Flow: Q = CIA in cfs

Q5 cfs Q100: cfs

Hydrology

Location: OS-1
Area: 7.5 Ac.
Soil or Landuse: "B"

Runoff Coefficient, C:

Area Zone	C5	C100	% Area
1/8 ac. Res.	0.60	0.70	100 %

Composite: C5: C100: 100%

Time of Concentration: Tc, in minutes:

Travel Type	L(ft)	s(%)	v(fps)	Tc
Overland	150'	5%		6.7
Street	600'	4%	5	2.0

Tc Total: 8.7

Intensity, I (inches/hr) from Fig 5-1 .

I5: 4.2 in/hr I100: 7.3 in/hr

Peak Flow: Q = CIA in cfs

Q5: 18.9 cfs Q100: 38.3 cfs

Hydrology

Location: OS-2
Area: 17.0 Ac.
Soil or Landuse: "B"

Runoff Coefficient, C:

Area Zone	C5	C100	% Area
1/8 ac. Res.	0.60	0.70	100 %

Composite: C5 C100: 100%

Time of Concentration: Tc, in minutes:

Travel Type	L(ft)	s(%)	v(fps)	Tc
Overland	150'	5%		6.7
Street	1100'	4%	5	3.7

Tc Total: 10.4

Intensity, I (inches/hr) from Fig 5-1

I5: 4.0 in/hr I100: 6.9 in/h

Peak Flow: Q = CIA in cfs

Q5 40.8 cfs Q100: 82.1 cfs

Hydrology

Location: 05-3
Area: 16.0 Ac.
Soil or Landuse: "B"

Runoff Coefficient, C:

Area Zone	C5	C100	% Area
1/8 ac. Res.	0.60	0.70	100%

Composite: C5: C100: 100%

Time of Concentration: Tc, in minutes:

Travel Type	L(ft)	s(%)	V(fps)	Tc
Overland	150'	5%		6.7
Street	1000'	4%	5	3.3

Tc Total: 10.0

Intensity, I (inches/hr) from Fig 5-1

I5: 4.0 in/hr I100: 7.0 in/hr

Peak Flow: Q = CIA in cfs

Q5: 38.4 cfs Q100: 78.4 cfs

Hydrology

Location: 05-4
Area: 12.2 Ac.
Soil or Landuse: "B"

Runoff Coefficient, C:

Area Zone	C5	C100	% Area
1/8 ac. Res	0.60	0.70	20%
Bus. Park	0.75	0.75	80%

Composite: C5 0.72 C100: 0.74 100%

Time of Concentration: Tc, in minutes:

Travel Type	L(ft)	s(%)	V(fps)	Tc
Overland	150'	5%		5.1
Street	1100'	4%	5	3.7

Tc Total: 8.8

Intensity, I (inches/hr) from Fig 5-1

I5 4.2 in/hr I100: 7.3 in/h

Peak Flow: Q = CIA in cfs

Q5 36.9 cfs Q100: 65.9 cfs

Hydrology

Location: 05-5
Area: 9.3 Ac.
Soil or Landuse: "B"

Runoff Coefficient, C:

Area Zone	C5	C100	% Area
Bus. Park / ?	0.75	0.75	100%

Composite: C5: C100: 100%

Time of Concentration: Tc, in minutes:

Travel Type	L(ft)	s(%)	v(fps)	Tc
Overland	150'	2%		6.4
Street	1000'	2%	4	4.2

Tc Total: 10.6

Intensity, I (inches/hr) from Fig 5-1

I5: 4.0 in/hr I100: 6.9 in/hr

Peak Flow: Q = CIA in cfs

Q5: 27.9 cfs Q100: 48.1 cfs

Hydrology

Location:
Area: Ac.
Soil or Landuse:

Runoff Coefficient, C:

Area Zone	C5	C100	% Area

Composite: C5 C100: 100%

Time of Concentration: Tc, in minutes:

Travel Type	L(ft)	s(%)	v(fps)	Tc

Tc Total:

Intensity, I (inches/hr) from Fig 5-1

I5 in/hr I100: in/h

Peak Flow: Q = CIA in cfs

Q5 cfs Q100: cfs

On-grade inlet @ D-2 :

$Q_5 = 21.0$ $\quad S = \sim 2\%$

$Q_{100} = 41.9$

$$T = 3.04 \left[\frac{21.0}{(0.02)^{1/2}}\right]^{0.375} = 19.8$$

$$F_w = 16.4 \left[(19.8 - 2)(0.02)\right]^{0.167} (0.02)^{0.5} = 1.95$$

$$L_3 = (19.8)(1.95)(1.65) = 63.7$$

$$L_2 = 3.27 (0.02)^{1/2} (1.95)\ 19.8 = 17.9$$

$$L_1 = 2.49 (0.02)^{.3} (1.95)\ 19.8 = 29.7$$

Try $L_i = 20'$

$L_i > L_2 \therefore$ Use $\dfrac{Q_i}{Q} = \left[\dfrac{L_i}{L_3}\right]^{0.4}$

$$\frac{Q_i}{21.0} = \left[\frac{20}{63.7}\right]^{0.4}$$

$Q_{i_5} = \underline{13.2 \text{ cfs}}$ $\quad Q_{by_5} = 7.8$ cfs

= Same for 100 yr - flow split both sides of street

USE 18" RCP OUT

DP-3 (Sump Inlet)

T_C = D-2 + Street flow = 12.2 min + 200' @ 2% (4fps)

= 12.2 min + 0.8 min

T_C = 13.0 min

I = 3.6/6.2

C = 0.60/0.70

Equivalent Area (D-2) = $\frac{7.8 \text{ cfs}}{(0.60)(3.6)}$ = 3.6 acres

$Q = CIA = (0.60)(3.6)(4.3 + 3.6)$

Q_5 = 17.1 cfs

$Q_{100} = (0.70)(6.2)(4.3+3.6)$

Q_{100} = 34.3 cfs

— Try 15' Inlet —

Depth Above Depressed Area

L_i = 15', w = 3'

$Q_5 = 17.1 = 1.7\left(L_i + 1.8W\right)\left(d_{max} + W/12\right)^{1.85}$

$17.1 = 1.7\left(15 + 1.8(3)\right)\left(d_{max} + 3/12\right)^{1.85}$

d_{max_5} = 0.43'

$d_{max_{100}}$ = 1.0' - 0.23' = 0.77' ← street crown

$Q_{100}(in) = 1.7\left(15 + 1.8(3)\right)\left(0.77 + 3/12\right)^{1.85}$

$Q_{100}(in)$ = 36.0 cfs will collect all 100yr flow

USE 24" RCP OUT

On-grade inlet @ D-4 "1st - on street "G"

$Q_5 = 14.1$ cfs $\qquad S = \sim 2\%$

$Q_{100} = 28.6$ cfs

$$T = 3.04\left[\frac{14.1}{(0.02)^{.5}}\right]^{0.375} = 17.1 \quad (22.3)$$

$$F_w = 16.4\left[(17.1-2)(0.02)\right]^{0.167}(0.02)^{.5} = 1.90 \quad (2.00)$$

$$L_3 = (17.1)(1.90)(1.65) = 53.6 \quad (73.6)$$

$$L_2 = 3.27\,(0.02)^{.5}(1.90)(17.1) = 15.0 \quad (19.6)$$

$$L_1 = 2.49\,(0.02)^{.3}(1.90)(17.1) = 25.0 \quad (32.6)$$

Try $L_i = 15'$

$L_i < L_2 \therefore$ use $\dfrac{Q_i}{Q} = \dfrac{L_i}{L_1}$

$$\frac{Q_i}{14.1} = \frac{15'}{25.0} \qquad \frac{Q_i}{28.6} = \frac{15'}{32.6}$$

$Q_{i_5} = 8.5$ cfs $\qquad Q_{i_{100}} = 13.2$ cfs

$Q_{by} = 5.5 \qquad Q_{by} = 15.4$

USE 18" RCP OUT

2nd Inlet @ ~ 3 % grade $L = 10'$

Assume ~ 25 % collection

$Q_i = 1.4 / 3.9$ cfs

$Q_{by} = 4.1 / 11.5$ cfs

On-grade inlet @ D-5

$Q_5 = 12.3$ cfs $S = \sim 3\%$

$Q_{100} = 24.8$ cfs

$$T = 3.04 \left[\frac{12.3}{(0.02)^{.5}}\right]^{0.375} = 16.2 \quad (21.1)$$

$$F_W = 16.4 \left[(16.2 - 2)(0.02)\right]^{0.167} (0.03)^{.5} = 2.30 \quad (2.42)$$

$$L_3 = (16.2)(2.30)(1.65) = 61.5 \quad (84.3)$$

$$L_2 = (3.27)(0.02)^{.5}(2.30)(16.2) = 17.2 \quad (23.6)$$

$$L_1 = (2.49)(0.02)^{.3}(2.30)(16.2) = 28.7 \quad (39.3)$$

Try $L_i = 10'$

$L_i < L_2$ $\therefore$ Use $\frac{Q_i}{Q} = \frac{L_i}{L_1}$

$$\frac{Q_i}{12.3} = \frac{10}{28.7} \qquad \frac{Q_i}{24.8} = \frac{10}{39.3}$$

$Q_{i_5} = 4.3$ cfs $Q_{i_{100}} = 6.3$ cfs

$Q_{by} = 8.0$ $Q_{by} = 10.5$

USE 18" RCP OUT

Sump Inlet @ D-7 (DP-7)

T_c = D-5 + Street Flow = 9.6 min + 600' @ 3% (4 fps)

= 9.6 min + 2.5

T_c = 12.1 min

I = 3.8/6.5

C = 0.59/0.69

Equivalent Area (D-5) = $\frac{8.0/18.5}{\frac{(0.59)(3.8)}{.69}/6.5}$ = 3.6 ac / 4.1 ac.

$Q = CIA = (0.59)(3.8)(4.9+3.6)$

Q_5 = 19.1 cfs

$Q_{100} = (0.69)(6.5)(4.9+4.1)$

Q_{100} = 40.4 cfs

Use 12' sump inlet and 10' on-grade inlet upstream at grade break.
↑ upsize for future development to east ? ↑

D-7 Outfall Totals (DP-9)

T_c = DP-3 + Pipe Flow = 13.0 min + 1000' @ 15 fps

= 13.0 + 1.1

T_c = 14.1 min

I = 3.5 / 6.0

C = 0.60 / 0.70

A = D-2 + D-3 + D-4 + D-5 + D-7 + D-9

= 9.2 + 4.3 + 6.2 + 5.0 + 4.9 + 1.0

A = 30.6 ac

$Q = CIA$

$Q_5 = (0.60)(3.5)(30.6)$

Q_5 = 64.3 cfs − 4.1 bypass = 60.2 cfs

$Q_{100} = (0.70)(6.0)(30.6)$

Q_{100} = 128.5 cfs − 11.5 bypass = 117.0 cfs

USE 36" RCP OUT TO CHANNEL

Sump Inlets at D-1

Q_5 = 25.7 cfs

Q_{100} = 51.7 cfs ← design for 100 yr

Flow to west side Street "A" = ~ 10%.

= 0.10 × 51.7 = 5.2 cfs

- Construct 4' sump Inlet

Flow to North corner Street "A" & Street "B" = ~ 35%.

= 0.35 × 51.7 = 18.1 cfs

18.1 / 3 = 6.0

- Construct 6' sump Inlet

Flow to South corner Street "A" & Street "B" = ~ 55%.

= 0.55 × 51.7 = 28.4 cfs

28.4 / 3 = 9.5

- Construct 10' Sump Inlet

DP - OS-3

T_c = 10.0 min from OS-3 $\qquad A = 16.0 + 12.2 = 28.2$ ac

$I = 4.0 / 7.0$

$C = 0.65 / 0.72$

$Q = CIA$

$Q_5 = (0.65)(4.0)(28.2)$

$Q_5 = 73.3$

$Q_{100} = (0.72)(7.0)(28.2)$

$Q_{100} = 142.1$

DP - OS-1

T_c = 10.0 min from OS-3 + 1000' street flow @ 2% (4 fps)

= 10.0 + 4.2 min

$T_c = 14.2$ min

$I = 3.5 / 6.0$

$C = 0.63 / 0.71 \qquad (0.62/0.71)$ OS-1

$A(OS\text{-}1)^{DP} = 45.2 + 7.5 = 52.7$ ac.

$Q = CIA$

OS-1 : $Q_5 = (0.62)(3.5)(52.7)$

$= 114.4$

$Q_{100} = (0.71)(6.0)(52.7)$

$= 224.5$

Total flow north side of Dublin

On-grade inlet @ D-12 outfall in Dublin

Runoff = D-12 + ½ D-13 $S = \sim 2\%$

$Q_5 = 4.6 + \frac{9.0}{2} = 9.1$ cfs

$Q_{100} = 11.6 + \frac{19.4}{2} = 21.3$ cfs

		(5_{yr})	(100_{yr})
$T = 3.04\left[\frac{Q}{(0.02)^{.5}}\right]^{.375}$	=	14.5	19.9
$F_w = 16.4\left[(T-2)(0.02)\right]^{0.167}(0.02)^{.5}$	=	1.84	1.95
$L_3 = 1.65\ F_w\ T$	=	44.0	64.0
$L_2 = 3.27\ (0.02)^{.5}\ F_w\ T$	=	12.3	17.9
$L_1 = 2.49(0.02)^{.3}\ F_w\ T$	=	20.5	29.9

Try $L_i = 12'$

$L_i < L_2$ $\therefore$ use $\frac{Q_i}{Q} = \frac{L_i}{L_1}$

$Q_{i_5} = 5.3$ cfs

$Q_{b_5} = 3.8$ cfs

$Q_{i_{100}} = 8.5$ cfs

$Q_{b_1} = 12.8$ cfs

On-grade inlet @ D-13 outfall in Dublin

Runoff = ½ D-13 + D-12 inlet bypass S = ~2%

$Q_5 = 9.0/2 + 3.8 = 8.3$ cfs

$Q_{100} = 19.4/2 + 12.8 = 22.5$ cfs

		(5_{yr})	(100_{yr})
$T = 3.04 \left[\frac{Q}{(0.02)^{.5}}\right]^{0.375}$	=	14.0	20.3
$F_w = 16.4 \left[(T-2)(0.02)\right]^{0.167} (0.02)^{.5}$	=	1.83	1.96
$L_3 = 1.65\ F_w\ T$	=	42.3	65.6
$L_2 = 3.27\ (0.02)^{.5}\ F_w\ T$	=	11.8	18.4
$L_1 = 2.49\ (0.02)^{.3}\ F_w\ T$	=	19.7	30.6

Try $L_i = 12'$

$L_i < \tilde{L}_2$ ∴ use $\frac{Q_i}{Q} = \frac{L_i}{L_1}$

$Q_{i_5} = 5.1$ cfs

$Q_{by} = 3.2$ cfs

$Q_{i_{100}} = 8.8$ cfs

$Q_{by} = 13.7$ cfs

On-grade inlet @ D-6 (DP-6)

T_c = D-4 + Street Flow = 11.7_{min} + 800' @ (5 fps) min

= 11.7 min + 2.7 min

T_c = 14.4 min

I = 3.5/6.0

C = 0.60/0.70

Equivalent Area (D-4) = $\frac{(4.1\ 5yr)/(11.5\ 100yr)}{(0.60)(3.5)^{5}/6.0_{100}}$ = 2.0 ac (5yr) / 2.7 ac. 100yr)
(0.70)

$Q = CIA = (0.60)(3.5)(6.1+2.0)$

Q_5 = 17.0 cfs

$Q_{100} = (0.70)(6.0)(6.1+2.7)$

Q_{100} = 37.0 cfs

$S = \sim 3\%$

	(5yr)	(100yr)
$T = 3.04\left[\frac{17.0}{(0.02)^{.5}}\right]^{0.375}$ =	18.3	24.5
$F_w = 16.9\left[(18.3-2)(0.02)\right]^{0.167}(0.03)^{.5}$ =	2.36	2.49
$L_3 = (1.65)(18.3)(2.36)$ =	71.3	101.0
$L_2 = 3.27(0.02)^{.5}(2.36)(18.3)$ =	20.0	28.2
$L_1 = 2.49(0.02)^{.3}(2.36)(18.3)$ =	33.3	47.0

Try L_i = 16' $L_i < L_2$ ∴ Use $\frac{Q_i}{Q} = \frac{L_i}{L_1}$

$\frac{Q_i}{17} = \frac{16}{33.3}$ $\frac{Q_i}{37} = \frac{16}{47}$

Q_{i_5} = 8.2 cfs $Q_{i_{100}}$ = 12.6 cfs

Q_{by_5} = 8.8 cfs $Q_{by_{100}}$ = 24.4 cfs

USE 18" RCP OUT

On-grade inlets @ D-16 outfall (east side) worst case

Runoff = ½ D-16 + D-13 bypass $S = \sim 2.5\%$

$Q_5 = 7.0/2 + 3.2 = 6.7$ cfs

$Q_{100} = 16.8/2 + 13.7 = 22.1$ cfs

		(5_{yr})	(100_{yr})
$T = 3.04 \left[\frac{Q}{(0.02)^{.5}}\right]^{0.375}$	=	12.9	20.2
$F_w = 16.4\left[(T-2)(0.02)\right]^{0.167}\left(\frac{S}{0.025}\right)^{.5}$	=	2.01	2.19
$L_3 = 1.65\ F_w\ T$	=	42.8	73.0
$L_2 = 3.27\ (0.02)^{0.5}\ F_w\ T$	=	12.0	20.5
$L_1 = 2.49\ (0.02)^{0.3}\ F_w\ T$	=	20.0	34.1

Try $L_i = 12'$

$L_i < L_2$ ∴ use $\frac{Q_i}{Q} = \frac{L_i}{L_1}$

$Q_{i_5} = 4.0$ cfs

$Q_{by} = 2.7$ cfs

$Q_{i_{100}} = 7.8$ cfs

$Q_{by} = 14.3$ cfs

Sump Inlets at Snowy Range / Wagon Ridge Int.

Design for 100 year flows

Flow to Northwest Corner of Int. = $\frac{3}{4}$ D-17 + Wagon Ridge bypass

$= \left(\frac{3}{4}\right) 25.1$ cfs + 14.3 cfs

= 33.1 cfs 33.1/3 = 11

- Construct 12' inlet

Flow to Northeast Corner of Int. = 90% D-8 + Wagon Ridge bypass

= 0.90(20.9) + 14.3 + 24.4

= 57.5 cfs 57.5/3 = 19.1

- Construct 20' inlet

Flow to South side (sump) of Snowy Range Dr. = 1/4 D-17 + 10% D-8

= 1/4 (25.1) + 0.10 (20.9

= 8.4 cfs 8.4/3 = 2.3

- Construct 4' inlet

DP-16

T_c = 14.2 min + 700' Street @ 2.5% (4 fps) = 14.2 + 2.9

= 17.1 min

I = 3.2 / 5.5

C = 0.61 / 0.70

A = DP 05-1: 52.7 + D-12: 4.6 + D-13: 9.0 + D-14: 1.6 + D-16: 7.0 + D-6: 6.1 + 2.7

= 83.7 ac

$Q = CIA$

$Q_5 = (0.61)(3.2)(83.7)$

= 163.4 cfs

$Q_{100} = (0.70)(5.5)(83.7)$

= 322.2 cfs

DP-17

T_c = 17.1 min + 300' Street Flow @ 2.5% (4 fps) = 17.1 + 1.2

= 18.3 min

I = 3.1 / 5.3

C = 0.60 / 0.70

A = 83.7 + 4.1 + 5.2

= 93.0 ac.

$Q = CIA$

$Q_5 = (0.60)(3.1)(93.0)$

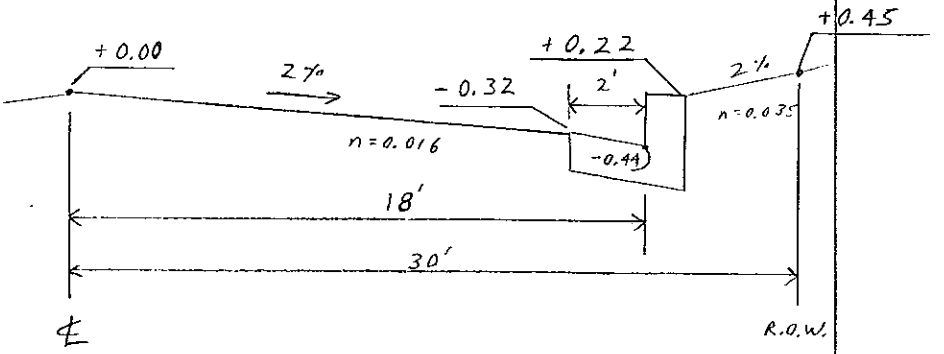
= 173.0 cfs

$Q_{100} = (0.70)(5.3)(93.0)$

= 345.0 cfs

Minor
Collector Street Capacity (100yr)

36' Mat / 60' R.O.W
Type 1 C & G



$A = 2.56 + 7.20 + 0.12 + 1.54 + 1.38$

$A = 12.8\ ft^2$

$n = 0.023$

$R = 0.42$

$$Q = AV = \frac{1.486}{n} A R^{2/3} S^{1/2}$$

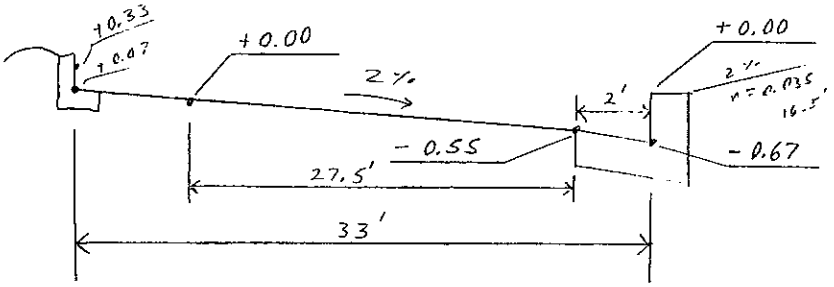
$$Q = 463.8\, S^{1/2} \quad (\text{per side})$$

S (%)	Q (cfs)	Q (Total)
1	46.4	= 92.8
2	65.6	= 131.2
3	80.3	= 160.6
4	92.8	= 185.6

Dublin Blvd. Street Capacity (100yr)

33' Per side
Type I C & G

No Curb Overtop



1' depth @ ℄

$A = 7.56 + 0.12 + 1.10$ 7.12 + .91 + 9.9 + 2.72

$A = 8.78 \ ft^2$ (22.43)

$n = 0.016$ (0.022)

$R = 0.29$ (0.44)

$$Q = AV = \frac{1.486}{n} A R^{2/3} S^{1/2}$$

$Q = 357.3 \ S^{1/2}$

1' @ ℄

$Q = 876.5 \ S^{1/2}$

S (%)	Q (cfs)	
1	35.7	87.6
½	50.5	124.0 *
3	61.9	151.8
4	71.5	175.3