SOARING EAGLES II - RESIDENTIAL
MASTER DEVELOPMENT DRAINAGE PLAN (MDDP)

September 2002

Prepared for:

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Prepared by:

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Project #01-076

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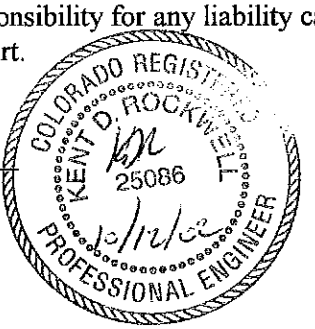
ENGINEER'S STATEMENT

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.

Elite Properties of America, Inc.

BY: _____ DATE 9/26/02

Ron O'Canna
Development Manager
6385 Corporate Drive, Suite 200
Colorado Springs, CO 80919

CITY OF COLORADO SPRINGS

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

BY: _____ 10/17/02

For CITY ENGINEER DATE

EL PASO COUNTY

Filed in accordance with Section 51.1 of the El Paso County Land Development Code, 1980, as amended.

BY: _____ 10-16-02

John A. McCarty, P.E. DATE
COUNTY ENGINEER/DIRECTOR

SOARING EAGLES II - RESIDENTIAL
MASTER DEVELOPMENT DRAINAGE PLAN (MDDP)

Purpose

The purpose of this MDDP is to identify the existing runoff patterns, major drainage ways and drainage facilities tributary to the Soaring Eagles II - Residential Development and to recommend drainage facilities and improvements such as channels, detention ponds and major culvert locations 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), 1997.

4. "Windmill Gulch Drainage Basin Planning Study", Wilson & Company, January 1991; revised June 1991, February 1992.

5. "Little Johnson/Security Creek Drainage Basin Planning Study", Simons, Li & Associates, April 1988.

6. "Peterson Field Drainage Basin Master Plan Update", URS Consultants, Inc., August 1984.

7. "Soaring Eagles Residential Master Development Drainage Plan (MDDP)", Rockwell-Minchow Consultants, Inc., April 2001.

8. "Soaring Eagles Subdivision Filing No. 1 Final Drainage Report", Rockwell-Minchow Consultants, Inc., February 2001.

9. "Soaring Eagles Subdivision Filing No. 2 Final Drainage Report", Rockwell-Minchow Consultants, Inc., May 2001.

10. "Soaring Eagles Subdivision Filing No. 3 Final Drainage Report", Rockwell-Minchow Consultants, Inc., July 2001.

11. "Soaring Eagles Subdivision Filing No. 4 Final Drainage Report", Rockwell-Minchow Consultants, Inc., February 2002.

General Location and Description

The Soaring Eagles II - Residential Development is located within the City of Colorado Springs, El Paso County, Colorado, encompassing a portion of the south 1/2 of Section 36, Township 14 South, Range 65 West of the 6th P.M. (see Vicinity Map - Figure 1). The site is bound on the east by Powers Boulevard, on the south by Drennan Road and on the west and north by Soaring Eagles Filings 1-4 and Hancock Expressway. The total development contains approximately 250 acres, of which about 70 acres have been developed as single-family residential already. The new residential development contains approximately 57 acres, none of which has been developed to date.

Soaring Eagles will be a multi-use development consisting of open space, park, school, residential, multi-family and commercial areas.

This MDDP is for the proposed residential areas only, but encompasses the surrounding area to show how the entire site is affected. The future areas to be developed surrounding the Soaring Eagles II – Residential Development will require additional Drainage Reports as they are developed.

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 Soaring Eagles Development fall under two soils classifications and two hydrologic 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", while a small area in the south central portion of the site is underlain by the Truckton Series (Soil 95 & 96) and falls under Hydrologic Group "B". Hydrologic Group "B" was used for calculation purposes.

Existing ground cover consists of well established native grasses over the undeveloped portion of the site.

Floodplain Statement

According to the Federal Emergency Management Agency (FEMA) Flood Insurance Rate Map (FIRM) Panel #08041C0761 F none of the proposed Soaring Eagles II – Residential Development lies within a designated floodplain.

Drainage Criteria

The current City of Colorado Springs/El Paso County Drainage Criteria was utilized for this report. The Rational Method was used for the on site areas. The majority of the areas are less than 100 acres. In the Windmill Gulch Drainage Basin, the rational method was used to determine on site flows.

The TR-20 flows from the Windmill Gulch DBPS were used for the overall area reaching the proposed detention pond. The model should be updated when a plan is determined for the airport property east of Powers Boulevard since this is the largest contributor of runoff to the pond.

The development lies within two major Drainage Basins. The southeast portion of the site lies in the Windmill Gulch Drainage Basin, and the southwest portion of the site lies in the Little Johnson Drainage Basin.

Drainage Characteristics

The site consists of gently rolling hills of well established native grass with slopes of 1-8%. The site generally slopes from north to south in the Windmill Gulch Drainage Basin area to the existing Drennan Road culvert crossing at the southeast end of the site. In the Little Johnson Drainage Basin area, the site generally slopes from northeast to southwest to the Drennan Road/Hancock Expressway intersection. The drainageways consist of wide swales with well established vegetation.

HISTORIC DRAINAGE PATTERNS

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 four on-site historical basins plus two off-site basins.

Historic Basin H-1 covers the bulk of the eastern half of the site and contains approximately 104.3 acres between Powers Boulevard and Drennan Road. Runoff quantities of 41.7 cfs/105.9 cfs historically overland and swale flow from the proposed residential development to the south where an existing 68" X 43" elliptical RCP crosses Drennan Road. A roadside ditch runs along Powers Boulevard and Drennan Road on the east and south ends of the Basin, collecting runoff from the roadways and associated culverts. This Basin lies in the Windmill Gulch Drainage Basin.

According to the DBPS for Windmill Gulch, there are two off site basins east of Powers Boulevard. These basins are shown as 60 and 62 in the report. The runoff from these two basins travel in a roadside ditch along Powers Boulevard and Drennan Road mentioned above, combining with basin H-1 at the existing elliptical pipe crossing under Drennan Road. The total combined flows at this point (DP-I) are 50/230 cfs for the 368.5 acres. The flows appear low compared to the flows from H-1 due to the difference between routing with the TR-20 model in the DBPS and the use of the rational method being used for this site. The existing pipe under Drennan Road has a total capacity of approximately 190 cfs in its current condition based on inlet control. The remaining portion of the 100 year flows overtop the roadway to the south and continue south in a wide natural grass swale.

Basin H-2 is in the Little Johnson Basin and historically overland flows to the northeast corner of Drennan Road and Hancock (Chelton). The 60.6 acre basin developed peak runoff of 26.8 cfs during the 5 year storm and 65.4 cfs during the 100 year storm. Historically, the water built up in a low area near the intersection, then overtopped to the south along the east side of Hancock Expressway.

DEVELOPED DRAINAGE PATTERNS

A brief description of each developed drainage basin and proposed detention ponds is provided in this section of the report. Proposed drainage conditions are described, including detention areas. A summary of peak developed runoff for the basins is depicted on the Developed Drainage Plan provided in the appendix. The site has been divided into two major drainage basins. All proposed major drainage facilities are approximate and may vary with actual layout and design. As discussed previously, the site is in two major drainage basins. Each major basin is described separately. Little Johnson has descriptors LJ-1 through LJ-4 and Windmill Gulch has descriptors W-1 through W-20.

With the development of the Residential Areas included in this MDDP, there will be no adverse impact on downstream facilities and properties in the Little Johnson and Windmill Gulch Basins. The release of developed runoff will be held to at or below historic levels through the use of detention facilities to be installed by the developer. The future areas to be developed surrounding Soaring Eagles Residential will require additional Drainage Reports as they are developed. Additional issues, including the possible expansion of Drennan Road and Powers Boulevard to a Freeway/Expressway have not been resolved at this time, and will affect future ultimate drainage and regional detention facilities.

WINDMILL GULCH

The southeast corner of the development, located in this basin, will be developed into single family (~6,000s.f.) lots and a community park covering approximately 24 acres. A preliminary storm sewer layout is shown on the enclosed developed drainage plan (Basins W-1 thru W-20) and itemized in the cost estimate. Inlet and piping systems will be designed with individual plats and may vary with actual design.

The area will drain to the existing low point on the north side of Drennan Road where a 20.7 acre foot public (regional) detention pond is proposed by the DBPS. According to the DBPS for Windmill Gulch the total developed flows reaching the pond will be 440/780 cfs. The outlet rate will not exceed 230 cfs during the 100 year storm. A 10'x10'drop inlet with a 5' diameter orifice plate will be installed in the pond and outlet by a new 84" RCP. The design of the road crossing of Drennan Road will need to be completed when the configuration of the Drennan Road Freeway is finalized.

The 84" RCP outlet will be constructed under the pond embankment by the developer at the time the first Filing is constructed. The extension of the 84" RCP under the proposed Drennan Freeway will be the responsibility of the City of Colorado Springs or that entity which constructs the proposed roadway. The 84" RCP will be extended when the proposed roadway is constructed. In the meantime, the runoff release from the pond will be held to less than historic rates and discharge on the upstream (north) side of the existing Drennan Road (ex. 43"X68" HERCP). The developer is providing additional right-of-way for the Drennan Freeway.

Elite Properties of America, Inc. proposes to construct the 20.7 acre foot pond and outlet structure mentioned above at this time. The orifice plate, however, will be modified with a smaller orifice opening in order to maintain historic runoff rates from the Soaring Eagles II Residential Development, until such time that more of the tributary area is developed. At that time, the orifice plate can be expanded to accommodate additional flows. The total developed flows at Design Point #12 (from Soaring Eagles II – Residential Development) are 138.7 cfs for the 5 year storm and 305.1 cfs for the 100 year storm. This compares with historic flows of 41.7/105.9 cfs respectively. The release rates will be held at or below said historic rates with the modified orifice plate.

The proposed detention pond will require approximately 5 acres of land dedication. Final acreage will be determined when the pond design is completed. The proposed detention pond will be owned and maintained by the City of Colorado Springs Public Works Department upon completion. The pond is proposed to be constructed in order to be used for ball fields (soccer/softball) with low flow trickle channels, as the pond will be located adjacent to/in a proposed regional park.

There will be no adverse affect to the areas downstream of Drennan Road with the development of the residential property, and the discharge being limited to at or below peak historic rates.

The detention pond, 84" RCP and associated inlet and outlet structures are reimbursable against drainage fees. The pond is eligible for reimbursement from the Pond Land Fee for this basin. According to the DBPS, initial systems within the development are not reimbursable.

LITTLE JOHNSON

The southwest corner of the development, located in this basin, will be developed into single family (~6,000s.f.) lots, multi-family and a portion of a school site. An existing 4.5 acre-foot detention pond is located at the northeast corner of Drennan/Hancock(Chelton). The pond is outlet by a 24" RCP/HDPE along the east side of Hancock(Chelton) approximately 1300' south to an existing 60" RCP crossing under Hancock(Chelton). The release rate is held to approximately 20cfs or less.

The total combined flows at Design Point #13 (the northeast corner of Drennan and Hancock(Chelton)) are 113.4 cfs for the 5 year storm and 228.6 cfs for the 100 year storm. This compares with historic flows of 26.8/65.4 cfs respectively. A 4' high by 6' wide concrete box culvert was proposed in the Little Johnson DBPS to be installed under Drennan Road that would be outlet by a 5'high by 5' wide concrete channel along the east side of Chelton to the south. Given the study of the Drennan Road Freeway taking place at this time with a possible interchange located south of Drennan and Hancock. The Soaring Eagles Residential Development is proposing to expand the existing pond to 7.3 acre-feet by raising the existing embankment by two feet. The pond will be owned and maintained by the Soaring Eagles Home Owner's Association. This pond may be removed in the future when the ultimate system is constructed under Drennan Road.

The 24" RCP outlet from the pond was constructed with Soaring Eagles Subdivision Filing No. 2. The 24" RCP will remain. The box culvert, or whatever drainage facility is deemed necessary, will be the responsibility of the City of Colorado Springs or that entity which constructs the proposed Interchange to the south. In the meantime, the runoff release from the pond will be held to less than historic rates and discharge to an existing 60" RCP crossing Hancock to the south. The existing pond may also become a permanent facility if determined a reasonable solution in the design of the interchange.

The ultimate drainage system under Drennan Road and the outfall are shown in the DBPS as being reimbursable against drainage fees. The initial public systems within the project are not reimbursable according to the DBPS. The Pond and outfall are not reimbursable items.

PROPOSED DRAINAGE FACILITIES

Following are the preliminary estimates of cost for the drainage facilities being proposed in the two major drainage basins. All permanent facilities proposed are public. Pipe sizes and inlet sizes are subject to final drainage reports and final design.

LITTLE JOHNSON: Public Non-reimbursable

Description	Quantity	Unit Cost	Total Cost
18" RCP	200 l.f.	$26.00/lf	$ 5,200.00
Type II Manhole	1 ea.	$1,700.00/ea	1,700.00
4' Inlet	1 ea.	$2,850.00/ea	2,850.00
Pond re-grading	1 ea.	$20,000.00/ea	20,000.00
		Subtotal	$ 29,750.00
		Engineering & Contingency (15%)	4,462.50
		TOTAL	$34,212.50

WINDMILL GULCH: Public Non-reimbursable

Description	Quantity	Unit Cost	Total Cost
54" RCP	325 l.f.	$109.00/lf	35,425.00
48" RCP	900 l.f.	$71.00/lf	63,900.00
42" RCP	50 l.f.	$61.00/lf	3,050.00
36" RCP	825 l.f.	$51.00/lf	42,075.00
30" RCP	800 l.f.	$40.00/lf	32,000.00
24" RCP	270 l.f.	$32.00/lf	8,640.00
18" RCP	650 l.f.	$26.00/lf	16,900.00
Type I Manhole	4 ea.	$5,100.00/ea	20,400.00
20' Inlet	1 ea.	$6,100.00/ea.	6,100.00
16' Inlet	2 ea.	$5,600.00/ea.	11,200.00
10' Inlet	1 ea.	$3,750.00/ea	3,750.00
8' Inlet	3 ea.	$3,450.00/ea	10,350.00
6' Inlet	5 ea.	$3,100.00/ea.	15,500.00
4' Inlet	2 ea.	$2,850.00/ea.	5,700.00
		Subtotal	$274,990.00
		Engineering & Contingency (15%)	41,248.50
		TOTAL	$316,238.50

WINDMILL GULCH: Public Reimbursable

Description	Quantity	Unit Cost	Total Cost
84" RCP	120 l.f.	$200.00/lf	$ 24,000.00
Earthwork-Pond	70,000 cy	$2.00/cy	140,000.00
Outlet Structure	1 ea.	$25,000.00/ea	25,000.00
Low-flow/trickle channel	800 l.f.	$40.00/lf	32,000.00
Dissipator	2 ea.	$17,500.00/ea	35,000.00
		Subtotal	$ 256,000.00
		Engineering & Contingency (15%)	38,400.00
		TOTAL	$ 294,400.00

DRAINAGE, BRIDGE and POND FEES

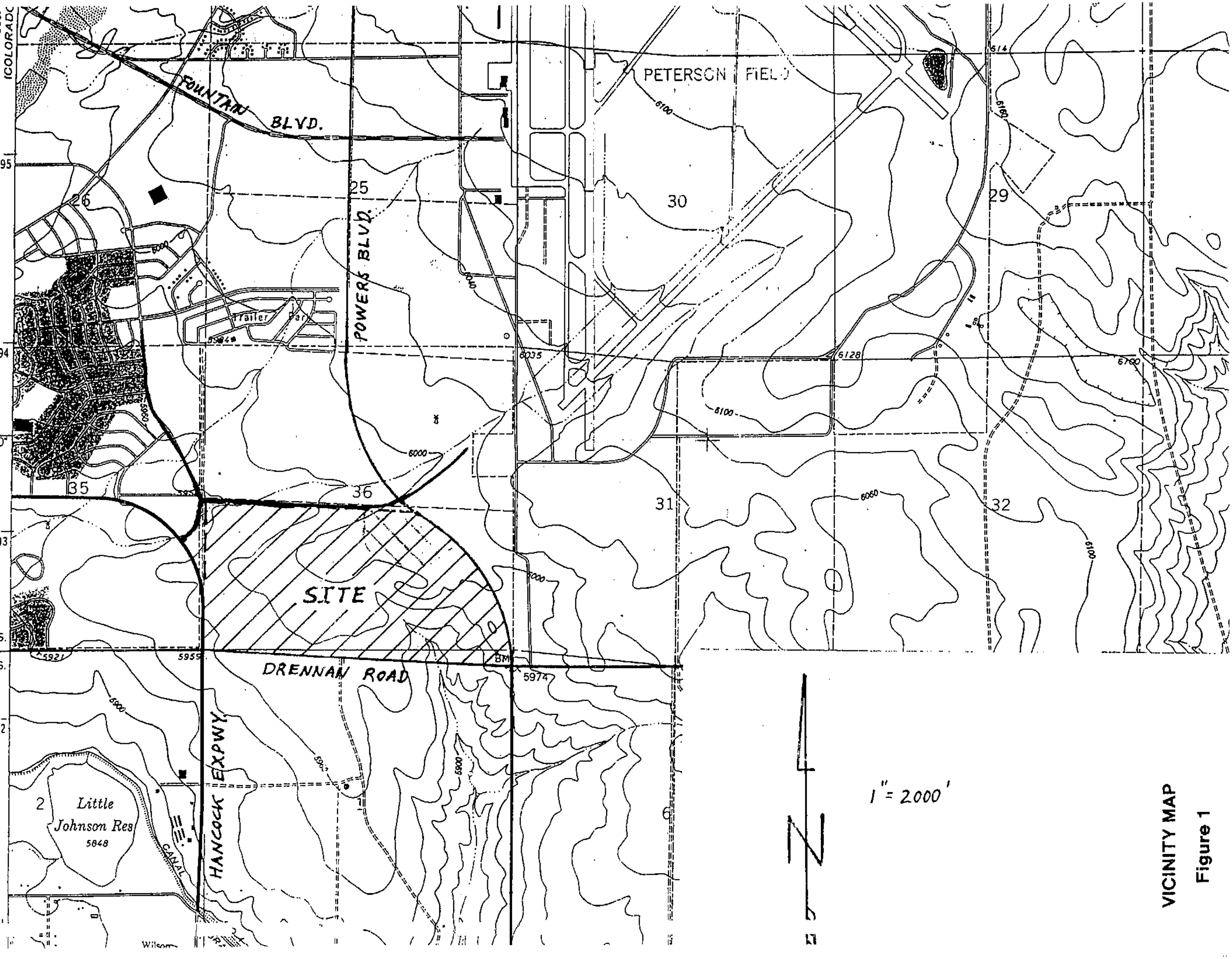
The Soaring Eagles II – Residential Development lies within two Major Drainage Basins. The Drainage, Bridge and Pond Fees for Windmill Gulch and Little Johnson Basins are listed below. No Fees are required with the approval of this report, fees will be paid at the time of final platting individual phases. The 2002 Drainage, Bridge and Pond Fees for these basins are listed below:

Windmill Gulch -	Drainage:	$ 8,170/ac.
	Bridge:	$ 166/ac.
	Pond (land):	$ 1,524/ac.
Little Johnson -	Drainage:	$ 7,751/ac.
	Pond (land):	$ 612/ac.

CONCLUSION

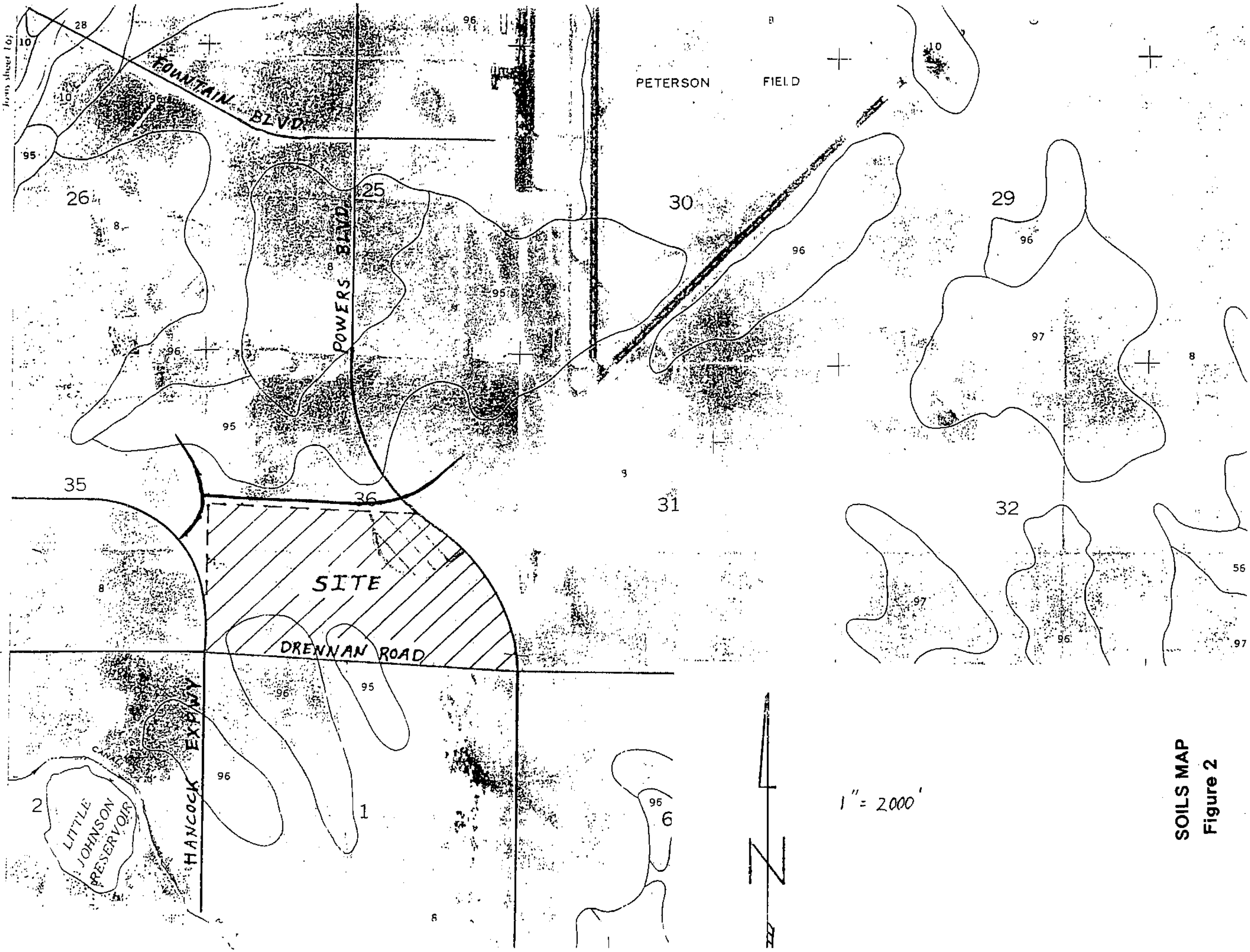
The Soaring Eagles II - Residential Development is in compliance with the Drainage Basin Planning Studies for the respective basins. The development of this project will not present an adverse effect on downstream properties.

APPENDIX



VICINITY MAP

Figure 1



SOILS MAP
Figure 2

TABLE 5-1

RECOMMENDED AVERAGE RUNOFF COEFFICIENTS AND PERCENT IMPERVIOUS

LAND USE OR SURFACE CHARACTERISTICS	PERCENT IMPERVIOUS	"C" FREQUENCY 10 A&B* (Sandy)	"C" FREQUENCY 10 C&D* (Clay)	"C" FREQUENCY 100 A&B*	"C" FREQUENCY 100 C&D*
Business					
Commercial Areas	95	0.90	0.90	0.90	0.90
Neighborhood Areas	70	0.75	0.75	0.80	0.80
Residential					
1/8 Acre or less	65	0.60	0.70	0.70	0.80
1/4 Acre	40	0.50	0.60	0.60	0.70
1/3 Acre	30	0.40	0.50	0.55	0.60
1/2 Acre	25	0.35	0.45	0.45	0.55
1 Acre	20	0.30	0.40	0.40	0.50
Industrial					
Light Areas	80	0.70	0.70	0.80	0.80
Heavy Areas	90	0.80	0.80	0.90	0.90
Parks and Cemeteries	7	0.30	0.35	0.55	0.60
Playgrounds	13	0.30	0.35	0.60	0.65
Railroad Yard Areas	40	0.50	0.55	0.60	0.65
Undeveloped Areas					
Historic Flow Analysis- Greenbelts, Agricultural	2	0.15	0.25	0.20	0.30
Pasture/Meadow	0	0.25	0.30	0.35	0.45
Forest	0	0.10	0.15	0.15	0.20
Exposed Rock	100	0.90	0.90	0.95	0.95
Offsite Flow Analysis (when land use not defined)	45	0.55	0.60	0.65	0.70
Streets					
Paved	100	0.90	0.90	0.95	0.95
Gravel	80	0.80	0.80	0.85	0.85
Drive and Walks	100	0.90	0.90	0.95	0.95
Roofs	90	0.90	0.90	0.95	0.95
Lawns	0	0.25	0.30	0.35	0.45

* Hydrologic Soil Group

9/30/90

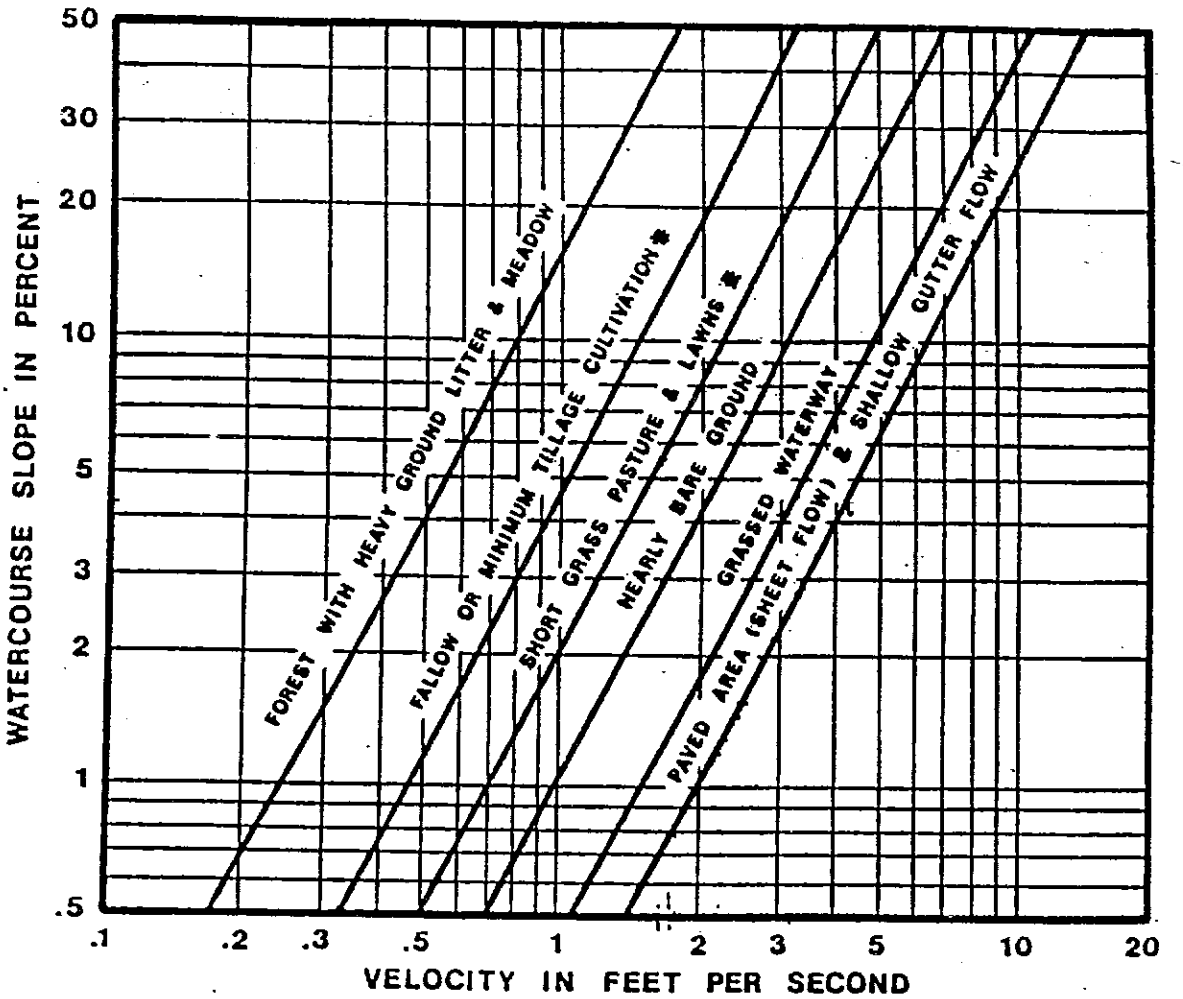


FIGURE 3-2. ESTIMATE OF AVERAGE FLOW VELOCITY FOR USE WITH THE RATIONAL FORMULA.

*MOST FREQUENTLY OCCURRING "UNDEVELOPED" LAND SURFACES IN THE DENVER REGION.

REFERENCE: "Urban Hydrology For Small Watersheds" Technical Release No. 55, USDA, SCS Jan. 1975.

$$T_c = 1.87\ (1.1 - C_{10})L^{0.5}\ S^{-0.33}$$

where:

C_{10} = adjusted runoff coefficient for ten-year flow;

L = length of overland flow in feet;

S = slope of flow path in percent; and

T_c = travel time in minutes

Times of concentration calculated for fully developed land use should not be less than five (5) minutes to avoid the oversizing of inlets, storm drains and open channels. Overland flow lengths should not exceed 300 feet for developed areas or 1,000 feet for undeveloped areas before being intercepted by a channel or storm sewer inlet. Beyond these distances, gutter flow or channel flow velocities calculated by Manning's Formula must be used. Refer to Section III for discussion on Manning's Formula.

Storm Drain or Road Gutter Flow

Travel time through a storm drain or road gutter system to an open channel is the sum of travel times in each individual component of the drainage system between the uppermost inlet and the outlet. In most cases, average velocities can be used without a significant loss of accuracy. During major storm events, the sewer system may be full and additional channel flow may occur, generally at a significantly lower velocity than the flow in the storm drains. By using the average conduit size and the average slope (excluding any vertical drops in the system), the average velocity can be estimated using Manning's Formula.

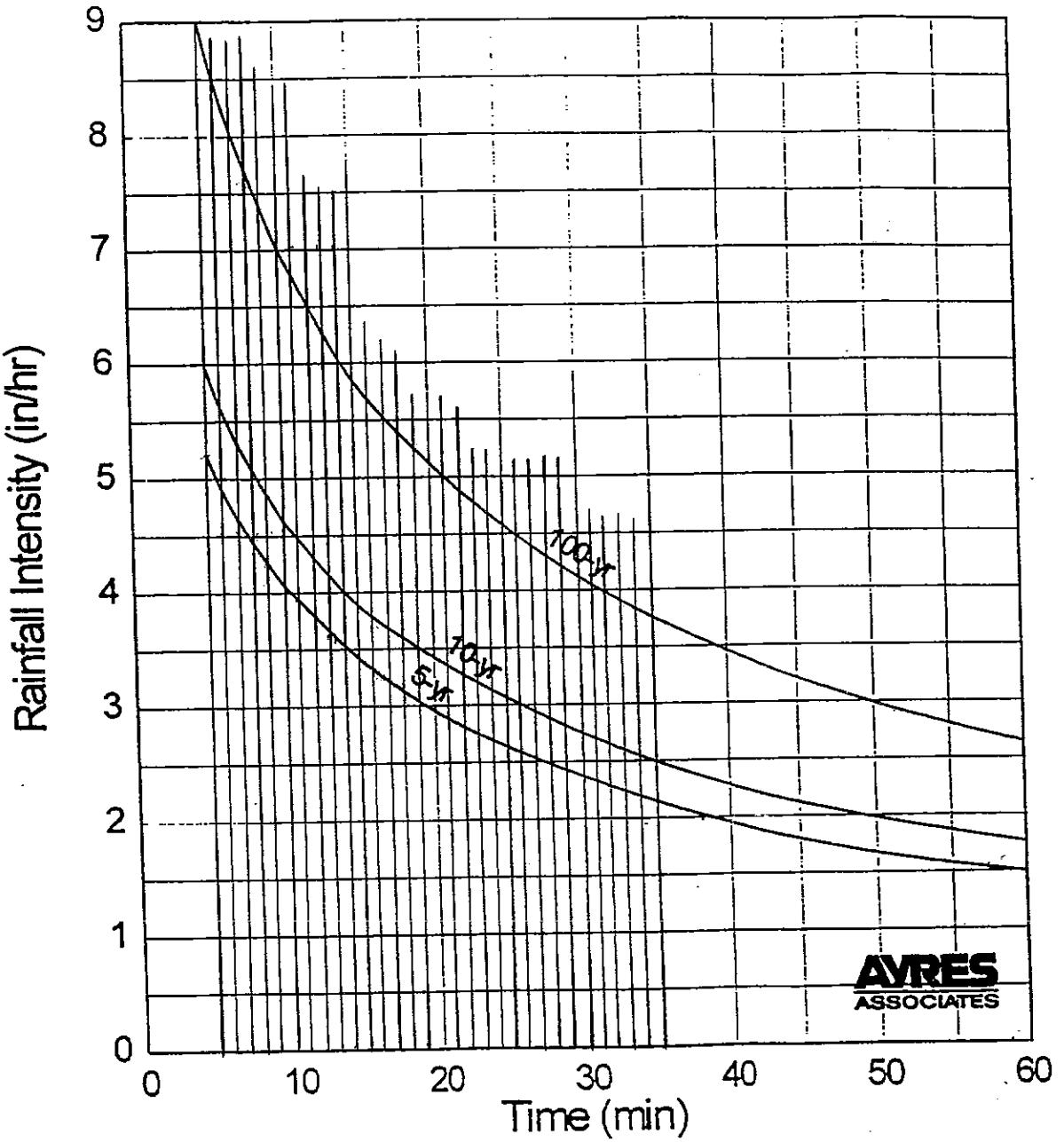
Since the hydraulic radius of a pipe flowing half full is the same as that for a pipe flowing full, the respective velocities are equal. Therefore, travel time may be based on the pipe flowing full or half full. The travel time through a storm sewer is computed by dividing the length of pipe by the average velocity of flow.

Channel Flow

The travel time for flow in an open channel can be determined by using Manning's formula to compute average velocities. Bankfull velocities should be used to compute these averages. Channels may be either natural or in an improved condition.

Example 1

A model urbanized drainage basin is shown on Figure 5-3. Three types of flow exists from the furthermost point of the basin to the outlet. Compute time of concentration (t_c) based on the following data:



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

2002 DRAINAGE, BRIDGE AND POND FEES -- CITY OF COLORADO SPRINGS

Code No.	Basin Name		Drainage Fee/Acre	Bridge Fee/Acre	Pond Fees/Acre	
					Land	Facilities
01	Sand Creek	1995	$6,915	$412	$448	$1543*
02	Spring Creek	1977	$6,153			
03	Templeton Gap	1977	$4,057	$44		
04	Douglas Creek	1981	$7,461	$165		
05	19th Street	1964	$2,337			
06	Pope's Bluff	1976	$2,376	$406		
07	Camp Creek	1964	$1,315			
08	Peterson Field	1984	$7,494	$347		
09	South Rockrimmon	1976	$2,789			
10	Pulpit Rock	1968	$3,934			
11	Dry Creek	1966	$3,384			
12	North Rockrimmon	1973	$3,569			
13	Cottonwood Creek**	2000	$7,653	$656		
14	Miscellaneous	n/a	$6,904			
15	Mesa	1986	$6,204			
16	21st Street	1977	$3,569			
17	Bear Creek	1980	$2,296	$215		
18	Southwest Area	1984	$7,767			
19	Windmill Gulch	1991	$8,170	$166	$1,524	
20	Black Squirrel Creek	1989	$8,136	$929	$392	
21	Monument Branch	1987	$5,481		$442	
22	Middle Tributary	1987	$4,056		$559	
23	Little Johnson	1988	$7,751		$612	
25	Big Johnson, Crews	1991	$8,883	$729	$120	
26	Fishers Canyon	1991	$7,441		$590	

Notes for 2002 Fees:

All Drainage, Bridge and Detention Pond Facility Fees are increased by 3% over 2001; 1/08/02 City Council Resolution.
Land Fees are based on the Park Land Dedication Fee of $38,220.00 per acre for 2002 (+ 5% over 2001).

*Detention Pond Surcharge:
Pond #1 (per Springs Ranch/U.S. Home Agreement) = $1018.00/acre
Pond #2 (per Ridgeview MDDP) = $773.00/acre

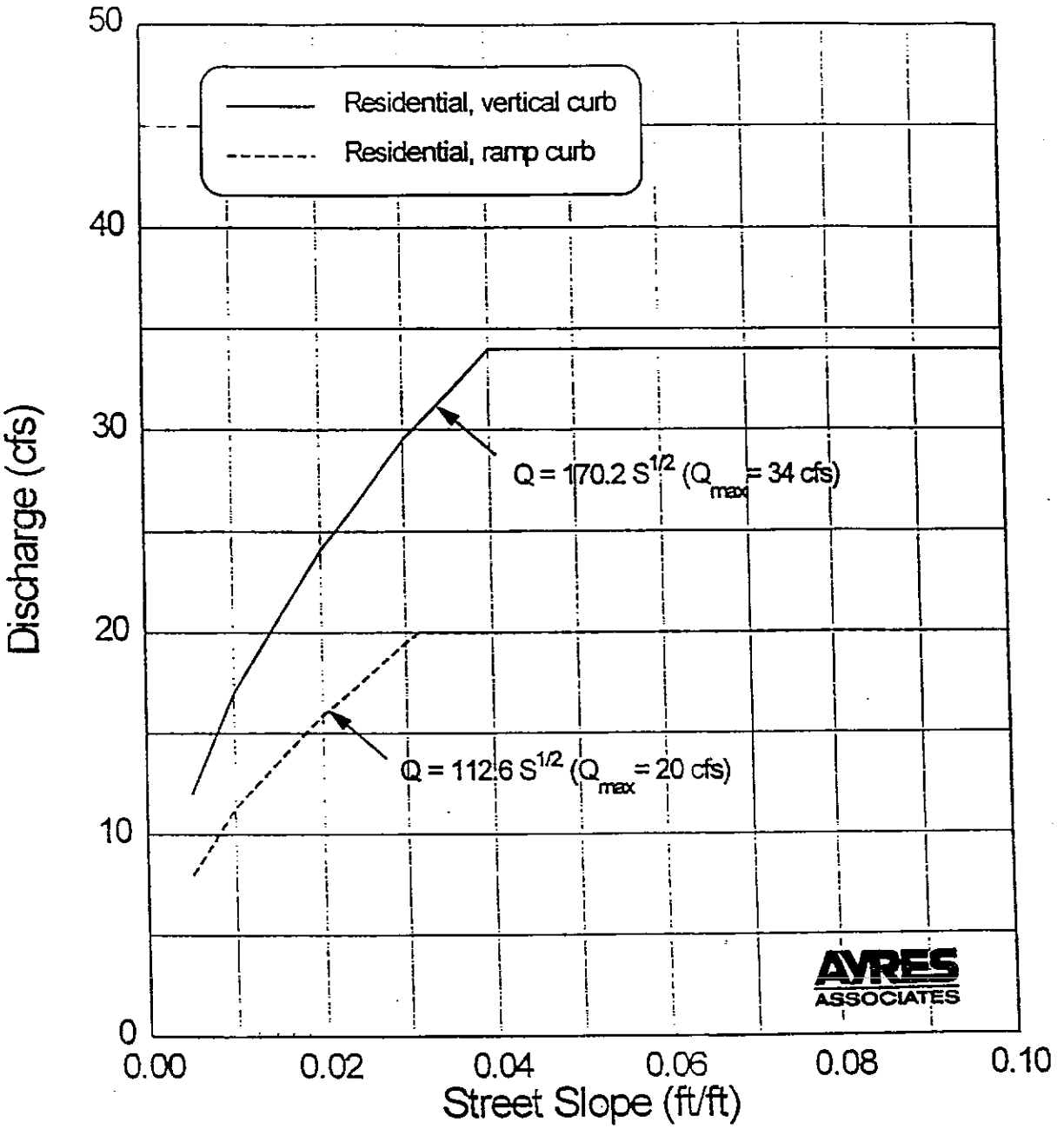
** 2000 Cottonwood Creek Drainage and Bridge Fees were amended and the Detention Pond Fees were eliminated by City Council Resolution on 7/11/00. The $6714/ac. drainage fee consists of $5215/ac. for capital improvements and $1499/acre for land; the two components will be annually adjusted using different standard procedures but combined together for collection purposes. The $6714/ac. drainage fee includes $372/ac. to be paid to the City in cash for cost-sharing of improvements as outlined in the Drainage Basin Planning Study. 2000 Cottonwood Creek Drainage and Bridge Fees were increased by City Council Resolution on 11/28/00, Drainage Fee = $7037/ac., Bridge Fee = $606/ac. 2000 Drainage Fee increased by $36/ac. to $7073/ac. by City Council Resolution on 1/9/01. **The 2002 Cottonwood Creek Drainage Fee = $7653/ac. with $6029/ac. for capital improvements (incl. $403/ac. to be paid to the City in cash) + $1624/ac. for land.**

METEX = $575/ac. (2002)

CONCRETE PIPE
Capacity (Velocity)

0.5%		1%	2%	3%	4%	5%	6%	7%	8%
5.0	18"	11.3 (6.6)	16.0 (9.3)	19.6 (11.4)	22.6 (13.2)	25.3 (14.7)	27.7 (16.1)	29.9 (17.4)	32.0 (18.6)
17.2	24"	24.3 (8.1)	34.4 (11.2)	42.2 (13.7)	48.7 (15.8)	54.4 (17.6)	59.6 (19.3)	64.4 (20.9)	68.8 (22.3)
31.2	30"	44.1 (9.5)	62.4 (13.4)	76.4 (16.4)	88.2 (19.0)	98.7 (21.2)	108.1 (23.2)	116.8 (25.1)	124.8 (26.8)
50.7	36"	71.8 (10.3)	101.5 (14.6)	124.3 (17.8)	143.5 (20.6)	160.4 (23.0)	175.8 (25.2)	189.8 (27.2)	202.9 (29.1)
76.5	42"	108.2 (10.8)	153.1 (15.3)	187.5 (18.7)	216.5 (21.6)	242.0 (24.2)	265.1 (26.5)	286.3 (28.6)	306.1 (30.6)
109.3	48"	154.5 (11.2)	218.5 (15.8)	267.6 (19.4)	309.0 (22.4)	345.5 (25.0)	378.5 (27.4)	408.8 (29.6)	437.0 (31.6)
149.6	54"	211.5 (11.5)	299.2 (16.2)	366.4 (19.8)	423.1 (22.9)	473.0 (25.6)	518.2 (28.1)	559.7 (30.3)	598.3 (32.4)
198.1	60"	280.2 (11.7)	396.2 (16.5)	485.3 (20.2)	560.3 (23.3)	626.5 (26.1)	686.3 (28.6)	741.2 (30.9)	792.4 (33.0)
255.4	66"	361.2 (11.8)	510.9 (16.7)	625.7 (20.5)	722.5 (23.7)	807.8 (26.5)	884.8 (29.0)	955.7 (31.3)	1021.7 (33.5)
322.1	72"	455.6 (12.0)	644.3 (17.0)	789.1 (20.8)	911.1 (24.0)	1018.7 (26.8)	1115.9 (29.3)	1205.3 (31.7)	1288.6 (33.9)

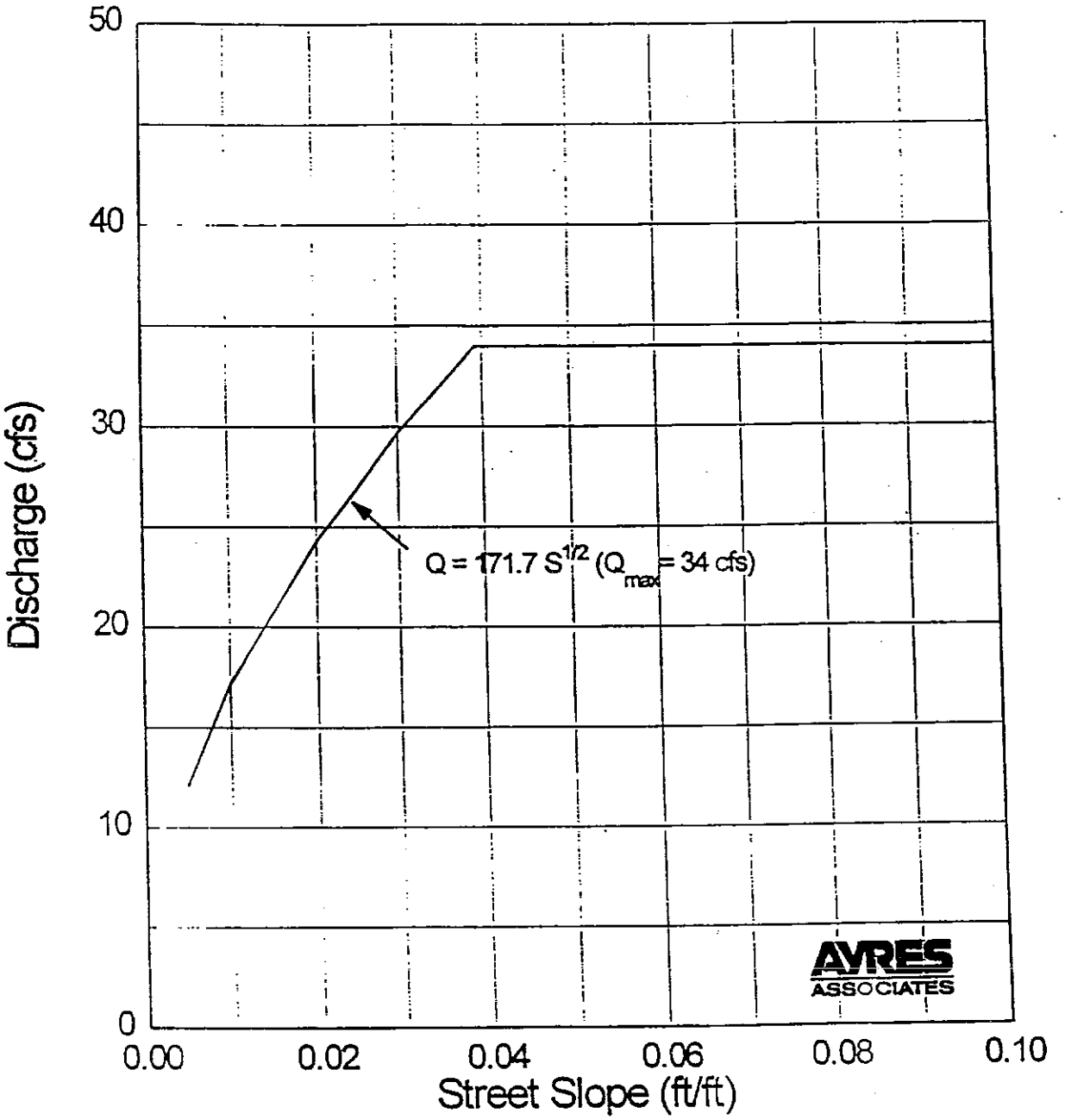
RESIDENTIAL STREET (34' Flowline to flowline)



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)



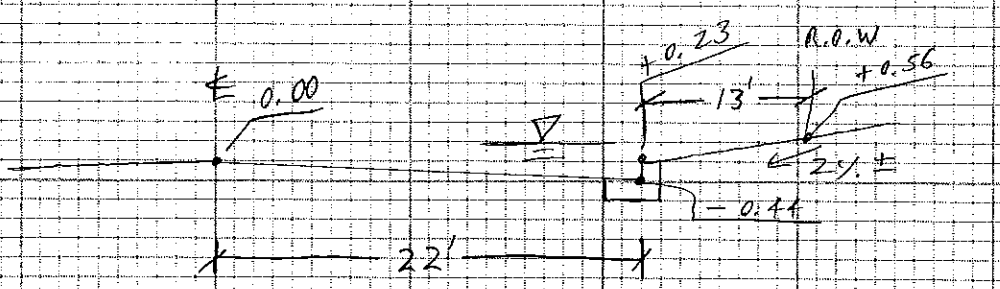
Interim Release October 12, 1994
City of Colorado Springs

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.

ROCKWELL MINCHOW
CONSULTANTS, INC.

Soaring Eagles MDDP
Street Capacity (100 yr) 44 ft-ft

DATE 4/3/01 PAGE of



1' depth @ ℄ max

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

$Q = 1188\ S^{1/2}$

$n = 0.016$

$A = 19.3\ ft^2$

$R = \frac{A}{P} = \frac{19.3}{35.67} = 0.54$

Q(cfs)	S(%)
118.8	1%
168.0	2%
205.8	3%

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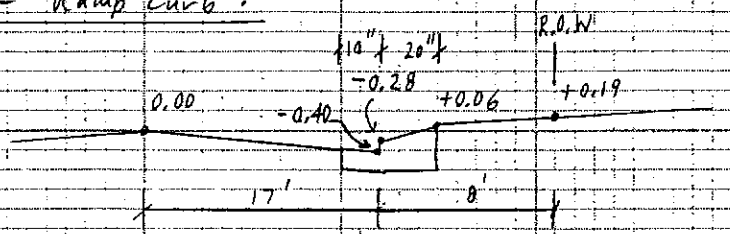
2928 Straus Lane, Suite #100 Colorado Springs, CO 80907 (719) 475-2575 Fax (719) 475-9223

ROCKWELL MINCHOW
CONSULTANTS, INC.

Residential Street Capacity
(100 year storm)

DATE 5/1/02 PAGE of

Residential - Ramp Curb:



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

$n = 0.016$

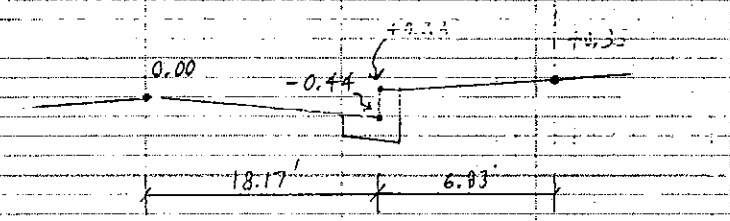
$A = 3.23 + 2.89 + 0.50 + 0.41 = 7.03$ ft²

$\rightarrow Q = 278.3\ S^{1/2}$ (½ street)

$R = A/P = 7.03/25' = 0.28$

1% = 27.8 cfs 2% = 39.4 cfs 3% = 48.2 cfs

Residential - Vertical Curb:



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

$n = 0.016$

$A = 3.30 + 6.36 + 0.41 = 10.07$ ft²

$\rightarrow Q = 497.7\ S^{1/2}$ (½ street)

$R = A/P = 10.07/25.7 = 0.39$

1% = 49.8 cfs 2% = 70.4 cfs 3% = 86.2 cfs

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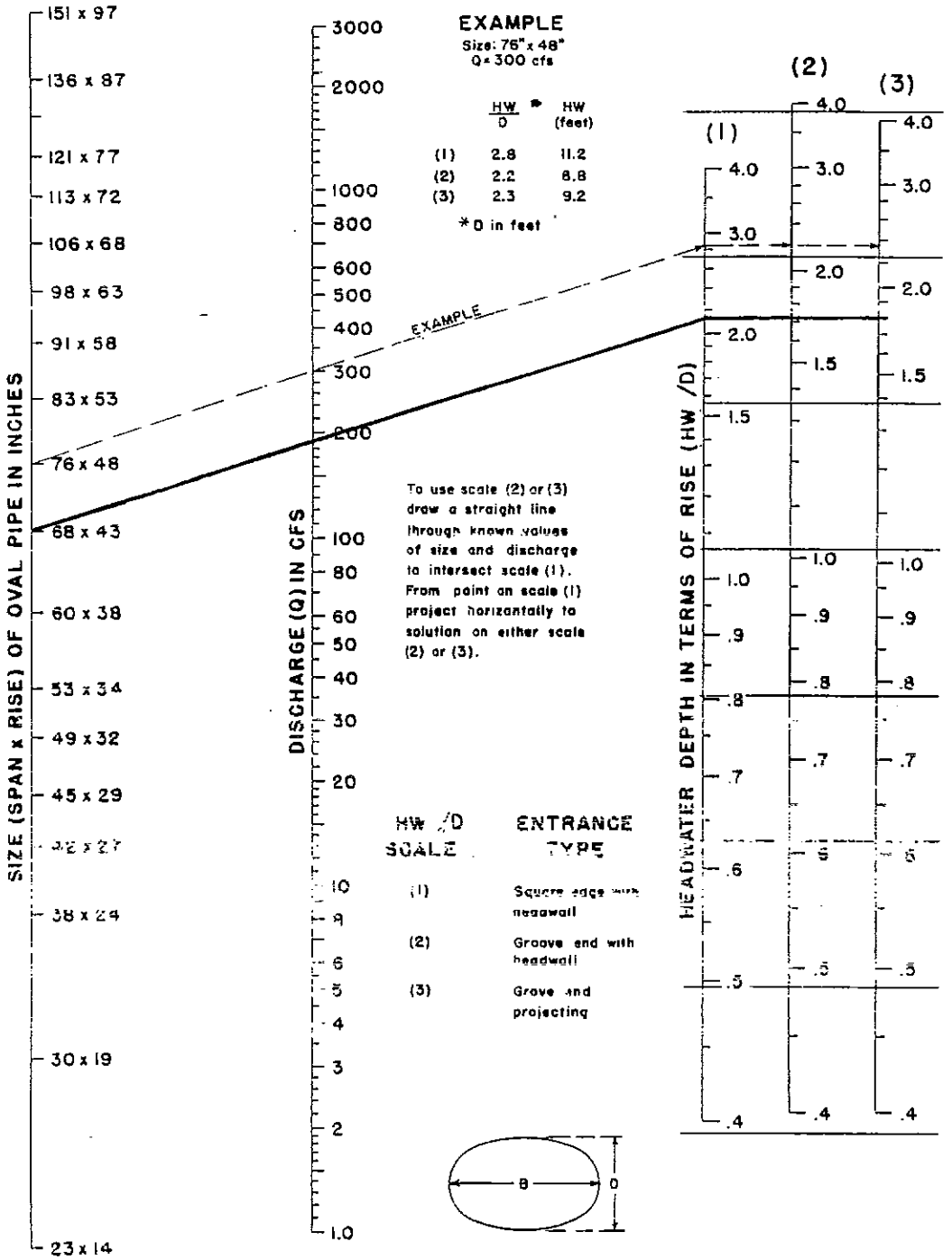
CHART 29



HEADWATER DEPTH FOR OVAL CONCRETE PIPE CULVERTS LONG AXIS HORIZONTAL WITH INLET CONTROL

BUREAU OF PUBLIC ROADS JAN. 1963

Exist. 68" x 43" RCP
Drennan Road

MAJOR BASIN	SUB BASIN	AREA PLANIMETER READING	AREA Ac.	BASIN LENGTH	BASIN HEIGHT	TC Min.	SOIL GROUP	DEV TYPE	C	BASIN Q	BASIN Qp	RETURN PERIOD
W-1			6.3	Over 100' @ 2% 700' @ 3%	5.2 3.9	9.1	4.2 7.2	"B"	Commercial	0.75 0.80	19.8 36.3		
W-2			6.2	Over 100' @ 2% 700' @ 3%	5.2 3.9	13.1	3.6 6.2	"B"	1/8 ac. lots	0.60 0.70	13.4 26.9		
W-3			3.8	Over 100' @ 2% 700' @ 3%	7.4 3.9	11.3	3.9 6.7				8.9 17.8		
W-4			3.8	Over 100' @ 2% 500' @ 3%	7.4 2.8	10.2	4.0 6.9				9.1 18.3		
W-5			3.8	Over 100' @ 2% 500' @ 3%	7.4 2.8	10.2	4.0 6.9				9.1 18.3		
W-6			3.6	Over 100' @ 4% 700' @ 3%	5.9 6.7	12.6	3.7 6.3				8.0 15.9		
W-7			2.1	Over 100' @ 4% 500' @ 3%	8.5 1.7	10.2	4.0 6.9				5.0 10.1		
W-8			1.7	Over 100' @ 4% 500' @ 3%	9.1 1.7	10.8	3.9 6.8				4.0 8.1		

HYDROLOGIC COMPUTATION BASIC DATA
RATIONAL METHOD Q=CIA

PAGE 1 OF ___

ROCKWELL MINCHOW CONSULTANTS, INC.

PROJECT: Soaring Eagles II 01-076
BY: TOM DATE: 5/1/02

MAJOR BASIN	SUB BASIN	AREA PLANIMETER READING	AREA Ac.	BASIN LENGTH	BASIN HEIGHT	Tc Min.		SOIL GROUP	DEV TYPE		BASIN Q	BASIN qp	RETURN PERIOD
W-9			1.2	Over 50' @ 2% Storm 700' @ 5%	5.2 3.9	9.1	4.2 7.2	"B"	1/8 ac. Res.	0.60 0.70	3.0 6.0		
W-10			4.3	Over 150' @ 2% Storm 500' @ 3%	9.1 2.8	11.9	3.8 6.5				9.8 19.6		
W-11			1.4	Over 150' @ 2% Storm 400' @ 3%	9.1 2.2	11.3	3.9 6.7				3.3 6.6		
W-12			2.2	Over 150' @ 2% Storm 600' @ 4%	9.1 1.7	10.8	3.9 6.8				5.1 10.5		
W-13			3.7	Over 150' @ 2% Storm 1100' @ 3%	7.4 5.0	12.4	3.7 6.3				8.2 16.3		
W-14			2.6	Over 50' @ 2% Storm 600' @ 5%	5.2 3.3	8.5	4.3 7.5				6.7 13.6		
W-15			3.1	Over 100' @ 2% Storm 600' @ 5%	7.4 3.3	10.7	3.9 6.8				7.2 14.7		
W-16			4.4	Over 200' @ 2% Storm 400' @ 4%	10.5 2.2	12.7	3.7 6.3				9.8 19.4		

HYDROLOGIC COMPUTATION BASIC DATA
RATIONAL METHOD Q=CIA

PAGE 2 OF ___

ROCKWELL MINCHOW CONSULTANTS, INC.

PROJECT: Sonoma Estates II 01-076
BY: TOM DATE: 5/1/02

MAJOR BASIN	SUB BASIN	AREA PLANIMETER READING	AREA Ac.	BASIN LENGTH	BASIN HEIGHT	Tc Min.		SOIL GROUP	DEV TYPE		BASIN		RETURN PERIOD
											C	Q_p	
W-1			2.0	Over 100' 2% Swale 700' 3%	7.4 1.7	9.1	4.2 7.2	"B"	1/8 ac. Res	0.60 0.70	5.0 10.1		
W-2			2.6	Over 50' 2%	5.2	5.2	5.2 9.0		1/8 ac. Res	0.60 0.70	8.1 16.4		
W-3			23.8	Over 300' 2% Swale 600' 3%	20.6 3.3	23.9	2.7 4.7		Park	0.30 0.55	19.3 61.5		
W-4			0.9	Over 50' 2%	5.2	5.2	5.2 9.0		1/8 ac. Res	0.60 0.70	2.5 5.0		
L-1			1.3	Over 50' 2% Swale 700' 3%	5.2 3.9	9.1	4.2 7.2		1/8 ac. Res	0.60 0.70	3.3 6.5		
L-2			1.5	Over 150' 2% Swale 700' 3%	9.1 1.4	10.5	4.0 6.9				3.6 7.2		
L-3			4.5	Over 150' 2% Swale 800' 3%	9.1 4.4	13.5	3.6 6.2				9.7 19.5		
L-4			50.0	Over 100' 2% Swale 1200' 3%	8.3 6.1 1.5	15.9	3.3 5.7			0.60 0.70	99.0 199.5		

HYDROLOGIC COMPUTATION BASIC DATA
RATIONAL METHOD Q=CIA

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ROCKWELL MINCHOW CONSULTANTS, INC.

PROJECT: Soaring Eagles II 01-076
BY: TOM DATE: 5/1/02

MAJOR BASIN	SUB BASIN	AREA PLANIMETER READING	AREA Ac.	BASIN LENGTH	BASIN HEIGHT	Tc Min.	C	SOIL GROUP	DEV TYPE	BASIN Q	BASIN Qp	RETURN PERIOD
DP#1		W-1 + W-2	12.5	From W-2		13.1	3.6 / 6.2			0.67 / 0.75	30.1 / 58.1	
DP#2		DP#1 + W-3	16.3	DP#1 + Pipe	+ 1.6	13.7	3.6 / 6.1			0.65 / 0.74	38.1 / 73.6	
DP#3		DP#2 + W-4	20.1	DP#2 + Pipe	+ 0.5	14.2	3.5 / 6.0			0.64 / 0.73	45.0 / 88.0	
DP#4		DP#3 + W-5	27.5	DP#3 + Pipe 250 + 10%	+ 0.5	14.7	3.5 / 5.9			0.63 / 0.72	60.6 / 116.8	
DP#5		DP#4 + W-6	29.6	DP#4 + Pipe 410' @ 5.4%	+ 0.5	15.2	3.4 / 5.8			0.63 / 0.72	63.4 / 123.6	
DP#6		W-7 + St #2 Pipe W-2 + W-3	24.2	From W-3 Pipe @ 10.0%	= 17.1 + 0.4	17.5	3.2 / 5.5			0.60 / 0.70	46.5 / 93.2	
DP#7		DP#6 + W-13	27.9	Same as DP#6		17.5	3.2 / 5.5			0.60 / 0.70	53.6 / 107.4	
DP#8		DP#7 + W-14	30.5	From W-14 Pipe 30.0 W/S	+ 0.5	18.0	3.1 / 5.4			0.60 / 0.70	56.7 / 115.3	

HYDROLOGIC COMPUTATION BASIC DATA
RATIONAL METHOD Q=CIA

PAGE 4 OF ___

ROCKWELL MINCHOW CONSULTANTS, INC.

PROJECT: Soaring Eagles #2 01-076
BY: TOM DATE: 5/11/02

MAJOR BASIN	SUB BASIN	AREA PLANIMETER READING	AREA Ac.	BASIN LENGTH	BASIN HEIGHT	Tc Min.	SOIL GROUP	DEV TYPE	C	BASIN Q	BASIN Q_D	RETURN PERIOD
			7.5		10.7 12.5	13.5	3.6 6.2	F	0.60 0.70	16.2 32.5		
			36.0		8.0 10.5	18.5	3.1 5.3		0.60 0.70	70.7 141.0		
			70.5		10.5	19.0	3.0 5.2		0.61 0.71	129.0 260.3		
			96.9			23.9	2.7 4.7		0.53 0.67	138.7 305.1		
			57.2			15.9	3.3 5.7		0.60 0.70	113.4 228.6		
H-1		104.2		Over 1000' @ 2 % Sum to 1500' @ 2 %	40.0 12.5	52.5	1.6 2.9		0.25 0.35	41.7 105.9		
H-2		60.6		Over 1000' @ 2 % Sum to 1400' @ 2 %	40.0 9.2	49.3	1.7 3.0		0.25 0.35	26.8 65.4		

HYDROLOGIC COMPUTATION BASIC DATA
RATIONAL METHOD Q=CIA

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ROCKWELL MINCHOW CONSULTANTS, INC.

PROJECT: Sooview Estates #2 01-076
BY: TOM DATE: 5/1/02

ROCKWELL MINCHOW
CONSULTANTS, INC.

Soaring Eagles II 01-076
Preliminary Detention Pond Size
DATE 5/1/02 PAGE of

SE II Pond (Southeast Pond)

$Q = CIA$ $C_5 = 0.53$, $C_{100} = 0.67$ $A = 96.9$ acres

Q_5 max release = 41.7 cfs Q_{100} max release = 105.9 cfs

Required Volume : $V = (Q - \text{max release})(60 \text{ sec/min})(\text{Storm Duration (min)})$

Storm Duration (min)	Intensity (in/hr)	$Q = CIA$ (Q_c (cfs))	$Q - \text{Max}_R$ (Q_d (cfs))	V (ft^3)	V (ac-ft)	
10	4.0	205.4	163.7	98,236	2.3	
20	3.0	154.1	112.4	134,880	3.1	
30	2.3	118.1	76.4	137,558	3.2	
40	1.95	100.1	58.4	140,271	3.2	←
50	1.7	87.3	45.6	136,821	3.1	
60	1.5	77.0	35.3	127,208	2.9	
10	7.0	454.5	348.6	209,137	4.8	
20	5.2	337.6	231.7	278,040	6.4	
30	4.2	272.7	166.8	300,198	6.9	←
40	3.5	227.2	121.3	291,193	6.7	
50	3.0	194.8	88.9	266,607	6.1	
60	2.7					

ROCKWELL MINCHOW
CONSULTANTS, INC.

Soaring Eagles II 01-076
Preliminary Detention Pond Size

DATE PAGE of

SE II Pond (Southwest Pond)

$Q = CIA$ $C_5 = 0.60$, $C_{100} = 0.70$ $A = 57.3$ ac.

$Q_{max\ release} = 20$ cfs (5yr & 100yr) = Max_R

Required Volume: $V = (Q - max\ release)(60\ sec/min)(Storm\ Duration\ in\ min)$

Storm Duration (min)	Intensity (in/hr)	Q (cfs)	Q - Max_R (cfs)	Volume (ft^3)	Volume (ac-ft)	
5yr → 10	4.0	137.5	117.5	70,500	1.6	
20	3.0	103.1	83.1	99,720	2.3	
30	2.3	79.1	59.1	106,380	2.4	
40	1.95	67.0	47.0	112,800	2.6	
50	1.7	58.4	38.4	115,200	2.6	←
60	1.5	51.6	31.6	113,760	2.6	
100yr → 10	7.0	280.8	260.8	156,480	3.6	
20	5.2	208.6	188.6	226,320	5.2	
30	4.2	168.5	148.5	267,300	6.1	
40	3.5	140.4	120.4	288,960	6.6	
50	3.0	120.3	100.3	300,900	6.9	
60	2.7	108.3	88.3	317,880	7.3	←
65	2.5	100.3	80.3	313,170	7.2	