1241

#2400

CONSULTANTS, INC.

PHASE III DRAINAGE REPORT

For

THE MEADOWS
Filing No. 17, Lots 5 and 6

Located northeast of Meadows Boulevard and Prairie Hawk Drive
Section 34, Township 7 South, Range 67 West,
Town of Castle Rock

Prepared for:

Castle Rock Development Company
3033 E. First Avenue Ste. 410
Denver, CO 80206

Prepared by:

CVL Consultants of Colorado, Inc.
7901 E. Belleview Ave, Suite 150
Englewood, CO 80111
Phone (720) 482-9526

February 15, 2005

Engineer's Statement:

The enclosed Phase III Drainage Report and exhibits were prepared by me, or under my direct supervision, and are correct to the best of my knowledge and belief. Said Phase III Drainage Report has been prepared in accordance with applicable Town of Castle Rock criteria and is in conformance with the master plan of drainage for the affected area. I accept responsibility for any liability caused by negligent acts, errors or omissions on my part in preparing the report.

COLORADO REGISTERED KURT A. LANG 32249 02-15-05 PROFESSIONAL ENGINEER

Kurt A. Lang — Date

Colorado P.E. No. 32249

Owner's/Developer's Statement:

As Owner/Developer of land(s) identified within this report; I agree to proceed, implement, and comply with all recommendations and requirements outlined herein.

Mark T Nickel — 2-15-05

Castle Rock Development — Date

Town of Castle Rock Approvals:

Approved Development Services FEB 22 2005 Town of Castle Rock

Engineering Division — Date

Development Services Director — Date

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I. GENERAL LOCATION AND DESCRIPTION

A. Location

1. The Meadows Filing No. 17 contains Lot 5 and Lot 6 of Block 1 with a total area of approximately 48.5 acres; offsite basins from Outfall 4 and Outfall 5 are 9.0 acres and 43.6 acres respectively. Please refer to the vicinity map located in the appendices.

2. The project is located in the northwest quarter section of Section 34, Township 7 South, Range 67 West of the 6th Principle Meridian.

3. Meadows Parkway (146' ROW) is adjacent to western boundary of the property and Prairie Hawk Drive (120' ROW) is adjacent to the southern boundary. The site is bound on the northeast by the AT&SF railroad (100' ROW).

4. Lot 5 and Lot 6 are a part of the Meadows Filing No. 17 proposed development. Filing 17 is designated for commercial, office, or industrial uses which covers the northwest and northeast sides. Filing 18, south of Prairie Hawk Drive, is designated as single-family and multi-family uses.

B. Description of Property

1. Generally the existing topography slopes vary from 3% to 10% draining in a northerly direction. The landscape is void of trees and shrubs and covered in natural grasses. The property soil is a well-drained, sandy loam of the Bresser series.

2. There are no existing drainageways that traverse through the site; however two small natural swales are present, one draining to the existing 72" culvert under the railroad and the other that terminates approximately 300 feet upstream of the previously-stated swale. Plum Creek is located northeast of the project boundary.

3. The proposed development of Lot 5 & Lot 6 will consist overlot grading, installation of water, sewer, and storm drainage utilities, private drives and minor access improvements to Prairie Hawk Driven and Meadows Parkway. This is in anticipation for the development of a movie theater and other commercial, office, or industrial uses that are unknown at this time.

C. Irrigation facilities

There are no known irrigation facilities present on the site or near the project boundary.

D. Existing and Proposed Land Uses

Currently the land is vacant and unused; previously it was utilized for agricultural purposes. The proposed development will consist of commercial, office, or industrial uses. Generally, the site will be overlot graded to create pad sites with slopes varying from 1% to 3% draining in a northerly direction.

II. DRAINAGE BASINS AND SUB-BASINS

A. Major Basin Description

1. The Phase II Drainage Study for The Meadows Filing 17, by CVL Consultants addressed the development of the entire Filing and was referenced in the drainage design of Lots 5 & 6. However, the proposed design herein differs from the underlying Phase II Drainage Report. Engineering Partners Inc.'s Phase III Drainage Report for Meadows Filing 18 describes the basins upstream of lots 5 and 6. Flood Insurance Rate Maps (FIRM) Community Panel Numbers 080050 0170 C and 080050 0188 C show the site is in Zone "X" which is classified as areas determined to be outside the 500-year floodplain.

2. East Plum Creek is east of the subject property and the 6400 South Tributary is located to the west. The property drains to East Plum Creek, a tributary of Plum Creek that feeds Chatfield Reservoir.

3. According to the U.S. Department of Agriculture Soil Conservation Service's "Soil Survey of Castle Rock Area, Colorado", the soil is made up of Bresser sandy loam (Br B), classified as hydrologic soil group "B".

B. Sub-basin Description

1. Historically, the site drains east and northeast toward the Atchison Topeka and Sante Fe (AT & SF) railroad. The east half of the property drains to an existing 72" culvert under the railroad and is further conveyed to East Plum Creek via channel on the other side of the railroad tracks. The west half drains to the ditch along side the railroad, which conveys storm water to a storm drain system in

Meadows Parkway. Said storm drain outlets into East Plum Creek approximately one-quarter mile northeast.

2. Currently, Filing 18 releases undeveloped flows from the land lying south of lots 5 and 6 onto the site via culverts under Prairie Hawk Drive at Outlet 4 & Outlet 5. Per the Filing 18 Phase III drainage report, it is anticipated that with the development of Filing 18, that both of these off-site basins will provide their own detention and water quality to maintain release at historic rates. The design of the downstream storm drain system accounts for handling the 100-year release rates for both of these outfalls.

III. DRAINAGE DESIGN CRITIERIA

A. Regulations

Because the project site is smaller than 160 acres, the Rational Method as opposed to the Colorado Urban Hydrographic Procedure (CUHP) is used to calculate runoff. The detention volume calculations are performed in accordance with the Town of Castle Rock Public Works Regulations (TOCRPWR). Water quality volumes and outlet structure are designed per Urban Drainage and Flood Control District (UDFCD) criteria.

B. Development Criteria Reference and Constraints

1. The "Phase II Drainage Report for Meadows Filing 18" by Engineering Partners, Inc. is referenced with respect to the offsite basins that are tributary to the project site via two existing 36" storm drains under Prairie Hawk Drive. "Phase II Drainage Report, The Meadows Filing No. 17" by CVL Consultants of Colorado, Inc. describes a preliminary plan that includes the project site. However, the horizontal layout and drainage design presented in that report varies from this report.

2. The Phase III Drainage Study for Filing 18 describes the off-site basins, Outfall 4 and Outfall 5, located in Filing 18 that impact Lot 5 & Lot 6 drainage designs. This information is taken into account in this design.

3. The surrounding area is mainly undeveloped at this time; consequently there are few existing conditions that affect the development of this site. Development of Lot 5 & 6 will connect the existing 36" storm drains crossing Prairie Hawk Drive to the proposed storm drain system that is proposed throughout the site. Filing 18 intends to provide detention and water quality for the off-site basins prior to releasing the flows at historic rates. Developed flows and will be passed through

the existing 72" culvert under the tracks into the proposed regional detention facility where detention will be provided for the development of Lot 5 & 6. Water quality will be provided for the entire upstream basin in the regional facility as well.

C. Hydrological Criteria

1. One-hour point values were obtained from Table 401 of the Town of Castle Rock Public Works Regulations.

2. The Rational Method was utilized to calculate storm runoff through the use of Standard Form SF-3 and StormCAD.

3. Required detention volumes were computed for the 10-year and 100-year events per the TOCR PWR. UDFCD was used to determine water quality volumes based on a 40-hour drain time. Stage-storage tables and graphs are used to determine associated storage elevations. Historic release rates are determined per the TOCR PWR for the applicable soil type and contributing basin area.

4. The 5-year event was used for minor storm analysis; the 100-year event was used for the major storm analysis.

5. Water quality capture volume is calculated per the Urban Drainage and Flood Control District's criteria, Volume III.

D. Hydraulic Criteria

1. The storm drain network onsite is designed to convey the developed 100-year runoff, as well as the 100-year historic discharge from the upstream basins, west of Prairie Hawk Drive (designated as Outfalls 4 and 5 per the Filing 18, Phase III Drainage Report). Storm drain stubs to each pad site are sized for the 100-year event. This network of pipe will convey runoff to the regional detention and water quality facility located east of the tracks. The pond is sized for the detention and water quality volume required for lots 5 and 6 and the water quality volume for the upstream basins at Outfall 4 and Outfall 5. StormCAD is used to determine hydraulic grade lines, pipe sizing, and flow routing.

2. Urban Drainage criteria are used to design the pond's water quality control features and outlet structure design.

E. Variances from Criteria

No variances from criteria are being requested at this time.

IV. DRAINAGE FACILITY DESIGN

A. General Concept

1. Typically, storm water will sheet flow across the landscape at shallow slopes of 1% to 3%, into a storm drain system sized for the 100-year event. Approximately 43.9 ac. of the total Lot 5 & 6 property's 48.5 ac. will be treated in the regional pond.

2. The site is isolated from tributary off-site drainage on three of the four boundaries. Drainage from Filing 18, across Prairie Hawk Drive, is tributary to this site. Said storm water is conveyed through two existing 36" culverts. These culverts will be connected to the proposed storm drain network on site. This design is in compliance with the improvements proposed in the "Phase II Drainage Report, The Meadows, Filing No.17" by CVL Consultants of Colorado, Inc.

3. The Appendix includes a FIRM, a soil survey, hydrological and hydraulic computations and a developed drainage map showing basin boundaries.

4. Generally, storm water will sheet flow across the parcels between the roadways into a storm drain stub, sized for the 100-year storm. This typical drainage pattern applies to sub-basins, E, F, G, H, I, L and K. Sub-basins A through D are located on the east half of Prairie Hawk Drive. These drainage basins will be routed into inlets within the street. Basin K is the future theater site, described in the Phase III Drainage Report for the Meadows Theater by CVL Consultants of Colorado, Inc., compiled in conjunction with this report for lots 5 and 6. Basin K is further sub-divided into basins K1, K2, K3, K4, and K5 representing the sump inlets in the parking lot area for the theater. Inlets are sized using the TOCR PWR Figure 803. StormCAD is used in conjunction with Standard Form SF-3 to determine pipe sizing and flow routing and results are included in the appendices.

   OS-1 through OS-7 are onsite areas that cannot be routed into the regional pond. These basins will drain along the railroad ditch into an existing culvert at Meadows Parkway or onto Meadows Parkway itself. However, these basins will have very low impervious values are much smaller than the original historic basins. Eventually, surface runoff from these basins is conveyed to East Plum Creek via overland flow or existing storm drain systems in Meadows Parkway. The last basin, OS-8, is the area including the regional pond facility.

5. At locations of the stubs at design points 3, 12, 19, 28, 32 and 37 temporary sediment ponds will be constructed. Temporary diversion dikes will be graded along the boundaries of the site to direct drainage to these sediment ponds. Permanent water quality will be provided in the regional detention facility.

B. Specific Details

1. Currently, the existing 72" culvert under the railroad daylights at existing ground into an existing swale. However, the installation of a downstream detention and water quality facility required that these flows be conveyed to the bottom of the pond at 4:1 slope. To ensure prevent erosion and slope stability, a grouted sloping boulder drop of 11.5' with a stilling basin will be used to carry flows to the pond bottom.

2. The required detention and water quality volumes for lots 5 and 6, as well as the required water quality volumes for the upstream, offsite basins west of Prairie Hawk Drive are provided in the regional detention and water quality pond. The total required water quality volume is 3.062 ac-ft, including 1.967 ac-ft for the onsite basin, 0.315 ac-ft for Outfall 4, and 0.780 for Outfall 5. This volume is achieved at elevation 6090.00. Approximately 3.918 ac-ft and 6.546 ac-ft of storage are required for the 10-year storm and 100-year storms respectively.

   Per the TOCR PWR for regional facilities, water quality volumes are permitted to be inclusive within the 100-year volume and additive to the 10-year volume. The entire upstream contributing watershed determined the water quality volume required and the upstream basins that required detainment of developed flows determined the detention volume.

   In this case, however, when the already detained off-site basins (Outlet 4 & 5) are added to the on-site water quality volumes and 10-year detention volume, the total is greater than the 100-year volume and an outlet structure cannot be designed to provide a 10-year and 100-year release rate. Hence, it is proposed to "stack" the off-site water quality volume below the additive on-site water quality volume and 10-year storm elevation and below the 100-year detention volume. This allows the 100-year volume to remain larger than the additive 10-year and water quality volume and an outlet structure can be designed to release the 10-year and 100-year historic flows. Including the water quality volumes, the 10-year volume is thus attained at elevation 6093.46, the 100-year volume at 6093.97. The top of berm is at elevation 6095.5, allowing for 1.5 feet of freeboard. The emergency spillway elevation is at elevation 6094.00.

The pond water quality outlet structure is designed per Urban Drainage, including a water quality restrictor plate, a notch for the restricted 10-year discharge and an orifice plate on the outlet pipe sized for the restricted 100-year discharge. The 100-year and 10-year historic release rates, based on Type B soils, are 38.0 cfs and 10.3 cfs respectively. An emergency spillway sized for the developed 100-year rate is provided.

3. The proposed drainage improvements will be privately owned and maintained. Storm drain will be located in drainage easements or in public right-of-way, so maintenance access is simplified. An access road will be provided specifically for the pond.

4. The storm drain system and regional detention facility, when located outside public right-of-way, will be located within easements dedicated to the Town.

V. CONCLUSIONS

A. Compliance with Standards

1. This drainage report is in compliance with the standards set forth in the TCRPWR.

2. The design for The Meadows Filing No. 17, Lot 5 and Lot 6 site complies with the major drainageway planning studies described in section II.A.1 of this report.

3. Urban Drainage and Flood Control District's criteria manual was complied with for this report.

B. Drainage Concept

1. Because off-site flow is confined to the storm drain system upon entering the site and the major event drainage pertaining to the onsite flow is conveyed within the storm drain pipes, local damage from storm water runoff is not anticipated. The regional detention pond will reduce release rates to historic flows to minimize the effects of the increase in post-development imperviousness. Combined, the above-mentioned measures reduce the effects of detrimental runoff impacts downstream.

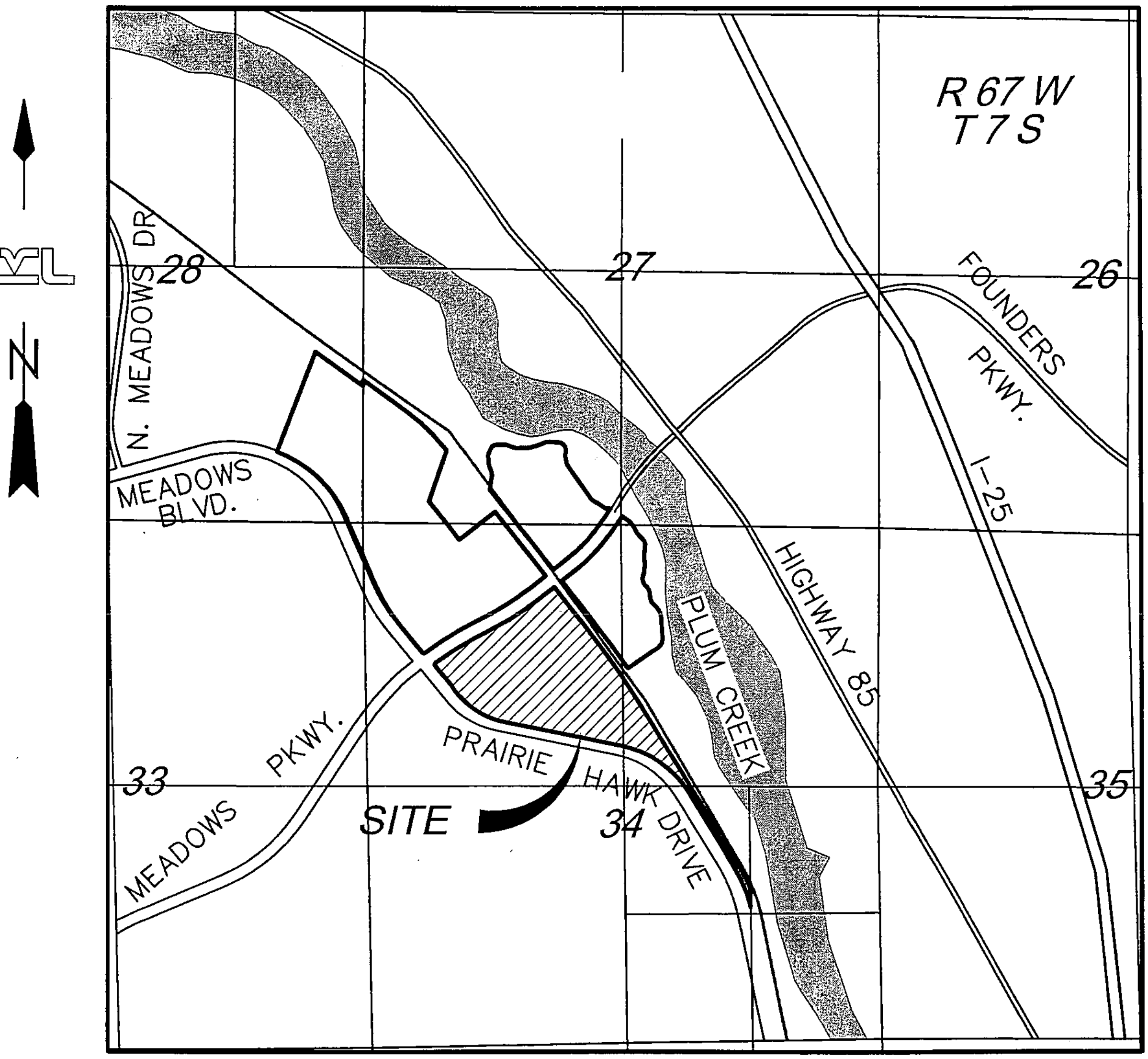
2. The influence of the proposed development on major drainageway planning studies is minimal as there is insignificant impact to downstream drainageways.

VI. REFERENCES

1. Public Works Regulations, Town of Castle Rock Public Works Department, Effective October 1998, Reprinted February 1999.
2. Urban Storm Drainage Criteria Manual, Volumes 1,2,3, Urban Drainage and Flood Control District, prepared by Urban Drainage and Flood Control District and CH2MHill, March 1969, Volumes 1&2 revised 2001, Volume 3 revised 1999.
3. Flood Insurance Rate Map Town of Castle Rock, Colorado Douglas County, National Flood Insurance Program, Federal Emergency Management Agency, Community-Panel Numbers 080050 0170 C and 080050 0188 C, Maps Revised: September 30, 1987.
4. Soil Survey of Castle Rock, Colorado, U.S. Department of Agriculture, Soil Conservation Service, Issued November 1974.
5. Phase III Drainage Report for Meadows Filing 18, Engineering Partners, Inc., September 28, 2004.
6. Phase II Drainage Report, The Meadows Filing No. 17, CVL Consultants of Colorado, Inc., March 16, 2004.

Appendix A

Hydrological Computations



VICINITY MAP

1" = 2000'

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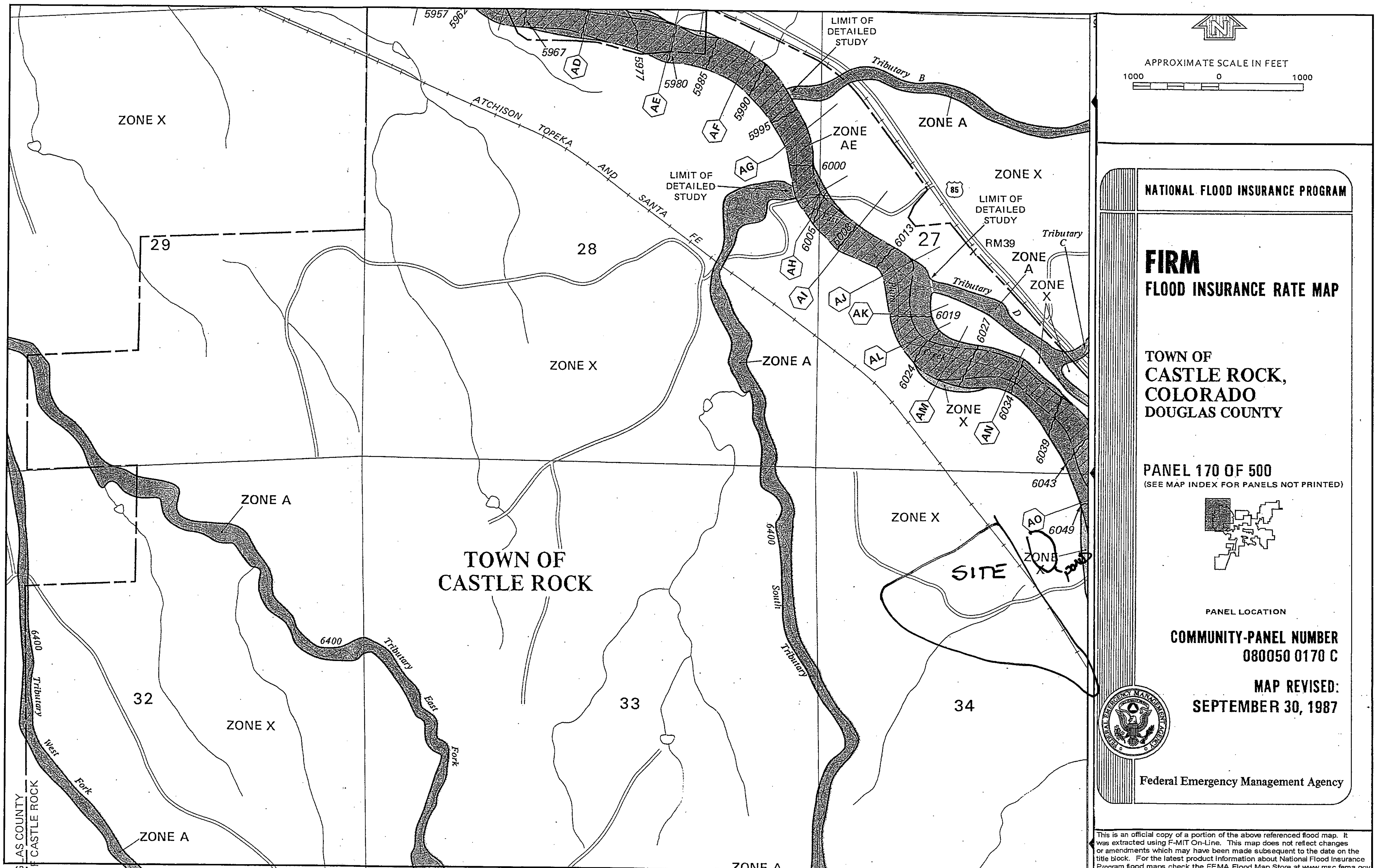
NATIONAL FLOOD INSURANCE PROGRAM
FIRM
FLOOD INSURANCE RATE MAP
TOWN OF
CASTLE ROCK,
COLORADO
DOUGLAS COUNTY
PANEL 170 OF 500
(SEE MAP INDEX FOR PANELS NOT PRINTED)
PANEL LOCATION
COMMUNITY-PANEL NUMBER
080050 0170 C
MAP REVISED:
SEPTEMBER 30, 1987
Federal Emergency Management Agency
FEDERAL EMERGENCY MANAGEMENT AGENCY
APPROXIMATE SCALE IN FEET
1000
0
1000
N
This is an official copy of a portion of the above referenced flood map. It was extracted using F-MIT On-Line. This map does not reflect changes or amendments which may have been made subsequent to the date on the title block. For the latest product information about National Flood Insurance Program flood maps check the FEMA Flood Map Store at www.msc.fema.gov
TOWN OF
CASTLE ROCK
ZONE X
ZONE A
ZONE AE
ZONE X
ZONE A
ZONE X
ZONE A
ZONE X
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STUDY
ATCHISON TOPEKA AND SANTA FE
Tributary B
Tributary C
Tributary D
South Tributary
East Fork Tributary
West Fork Tributary
85
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AH
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6000
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SITE
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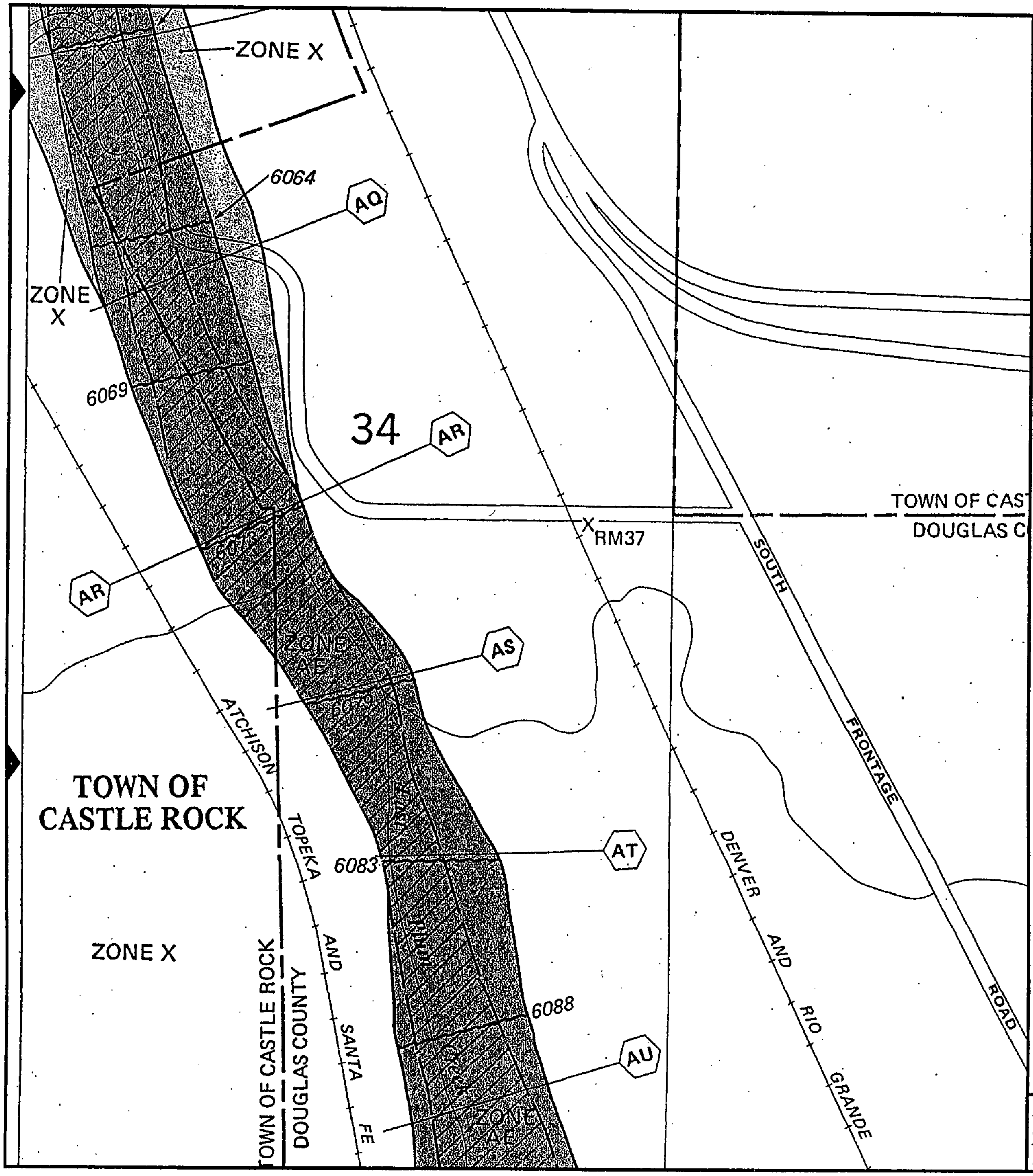
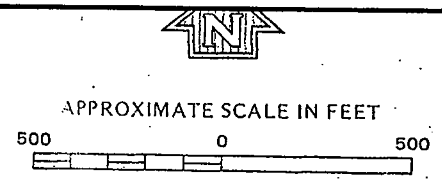
POND
AS COUNTY
CASTLE ROCK





NATIONAL FLOOD INSURANCE PROGRAM

FIRM
FLOOD INSURANCE RATE MAP

TOWN OF
CASTLE ROCK,
COLORADO
DOUGLAS COUNTY

PANEL 188 OF 500
(SEE MAP INDEX FOR PANELS NOT PRINTED)

PANEL LOCATION

COMMUNITY-PANEL NUMBER
080050 0188 C

MAP REVISED:
SEPTEMBER 30, 1987

Federal Emergency Management Agency

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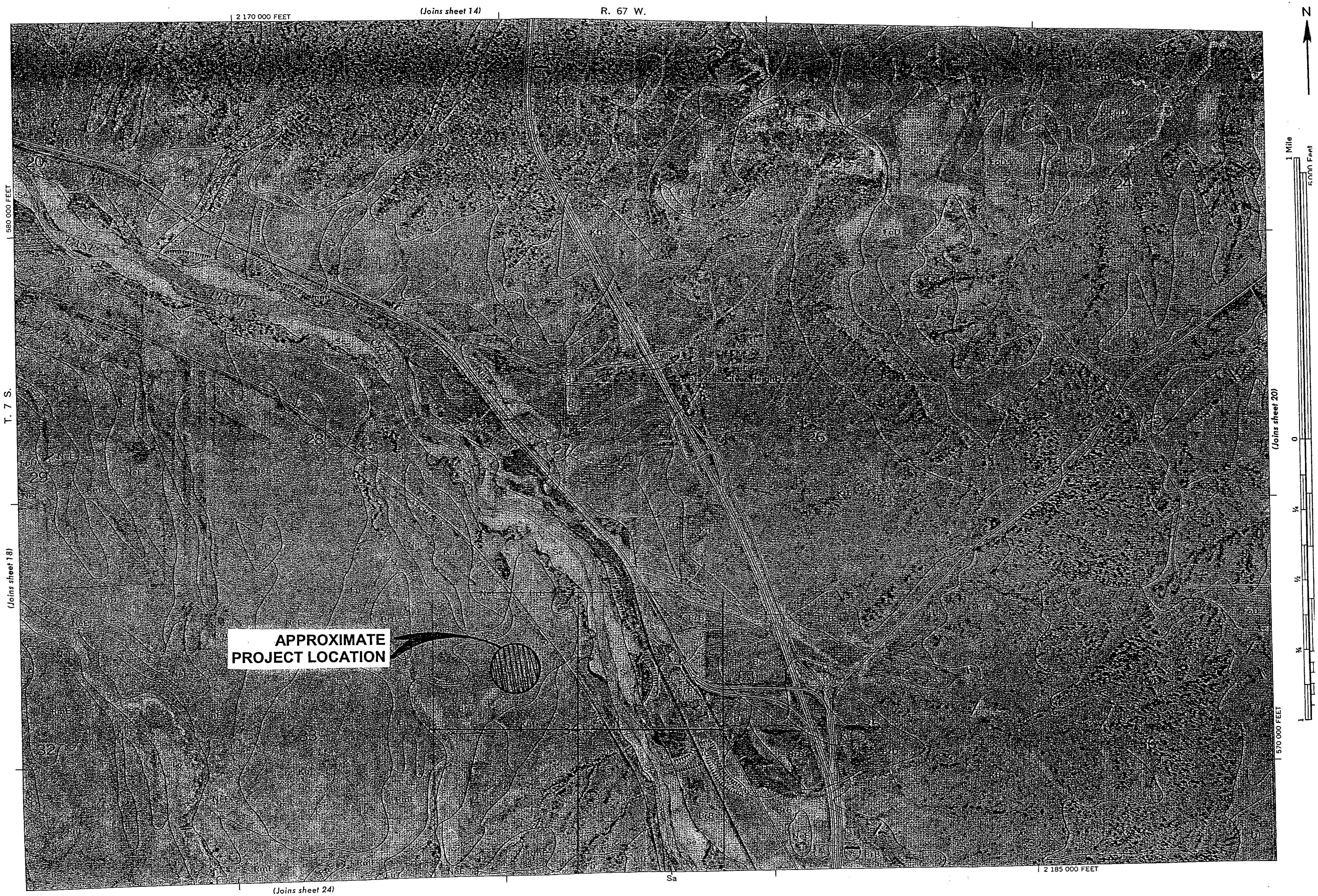

2 170 000 FEET
(Joins sheet 14)
R. 67 W.
N
580 000 FEET
T. 7 S.
(Joins sheet 18)
(Joins sheet 20)
1 Mile
5000 Feet
570 000 FEET
APPROXIMATE
PROJECT LOCATION
2 185 000 FEET
Sa
(Joins sheet 24)

[An asterisk in the first column indicates that at least one mapping unit in this series is made up of two or this reason it is necessary to follow carefully the instructions for referring to

Soil series and map symbols	Hydro-logic soil group	Depth to bedrock	Depth from surface	Classification: Dominant USDA texture	Classification: Unified	Classification: AASHO
		Inches	Inches			
*Blakeland: BlE, Bo-------- For Orsa part of Bo, see Orsa series.	A	>60	0-60	Loamy coarse sand and sand.	SM or SP-SM	A-3
*Bresser: BrB, BrD, BsE, BtE, BuD2. For Louviers part of BsE, see Louviers series; for Truckton parts of BtE and BuD2, see Truckton series.	B	>60	0-8	Sandy loam---------------	SM	A2
			8-30	Sandy clay loam----------	SC or CL	A-4 or A-6
			30-60	Sandy loam or loamy sand-	SM	A-2
Brussett: BvB, BvD---------	B	>60	0-26	Clay loam----------------	CL	A-6
			26-60	Loam---------------------	CL	A-6
*Buick: BwD---------------- For Satanta part of BwD, see Satanta series.	C	>60	0-22	Silty clay loam----------	CL	A-6
			22-60	Sandy clay loam or clay loam.	SC or CL	A-4, A-6
Chaseville----------------- Mapped only with Redridge soils.	A	>60	0-60	Very gravelly loamy sand-	SP	A-1
Cheeseman------------------ Mapped only with Tinytown soils.	B	20-40	0-31	Clay loam----------------	SC	A-6
			31	Shale and sandstone.		
Coni: CoG------------------	D	10-20	0-17	Clay loam----------------	CL	A-6
*Crowfoot: CrE------------- For Tomah part of CrE, see Tomah series.	B	>60	0-19	Loamy sand---------------	SM	A-2
			19-43	Sandy clay loam----------	SC	A-2
			43-60	Coarse sand--------------	SC or SP-SM	A-1
*Cruckton: CsD, CtE-------- For Peyton part of CtE, see Peyton series.	B	>60	0-60	Sandy loam---------------	SM or SC	A-2 or A-4
Denver: DeD----------------	C	>40	0-55	Clay or clay loam--------	CH or CL	A-7
Englewood: En--------------	C	>60	0-60	Clay---------------------	CH or CL	A-6 or A-7
Falcon--------------------- Mapped only with Kettle soils.	D	4-20	0-14	Gravelly sandy loam------	SM	A-2

TABLE RO-3

Recommended Percentage Imperviousness Values

Land Use or Surface Characteristics	Percentage Imperviousness
Business:	
Commercial areas	95
Neighborhood areas	85
Residential:	
Single-family	*
Multi-unit (detached)	60
Multi-unit (attached)	75
Half-acre lot or larger	*
Apartments	80
Industrial:	
Light areas	80
Heavy areas	90
Parks, cemeteries	5
Playgrounds	10
Schools	50
Railroad yard areas	15
Undeveloped Areas:	
Historic flow analysis	2
Greenbelts, agricultural	2
Off-site flow analysis (when land use not defined)	45
Streets:	
Paved	100
Gravel (packed)	40
Drive and walks	90
Roofs	90
Lawns, sandy soil	0
Lawns, clayey soil	0

* See Figures RO-3 through RO-5 for percentage imperviousness.

Based in part on the data collected by the District since 1969, an empirical relationship between C and the percentage imperviousness for various storm return periods was developed. Thus, values for C can be determined using the following equations (Urbonas, Guo and Tucker 1990).

$$C_A = K_A + \left(1.31i^3 - 1.44i^2 + 1.135i - 0.12\right) \text{ for } C_A \geq 0, \text{ otherwise } C_A = 0 \qquad \text{(RO-6)}$$

$$C_{CD} = K_{CD} + \left(0.858i^3 - 0.786i^2 + 0.774i + 0.04\right) \qquad \text{(RO-7)}$$

$$C_B = (C_A + C_{CD})/2$$

in which:

i = % imperviousness/100 expressed as a decimal (see Table RO-3)

TABLE RO-5

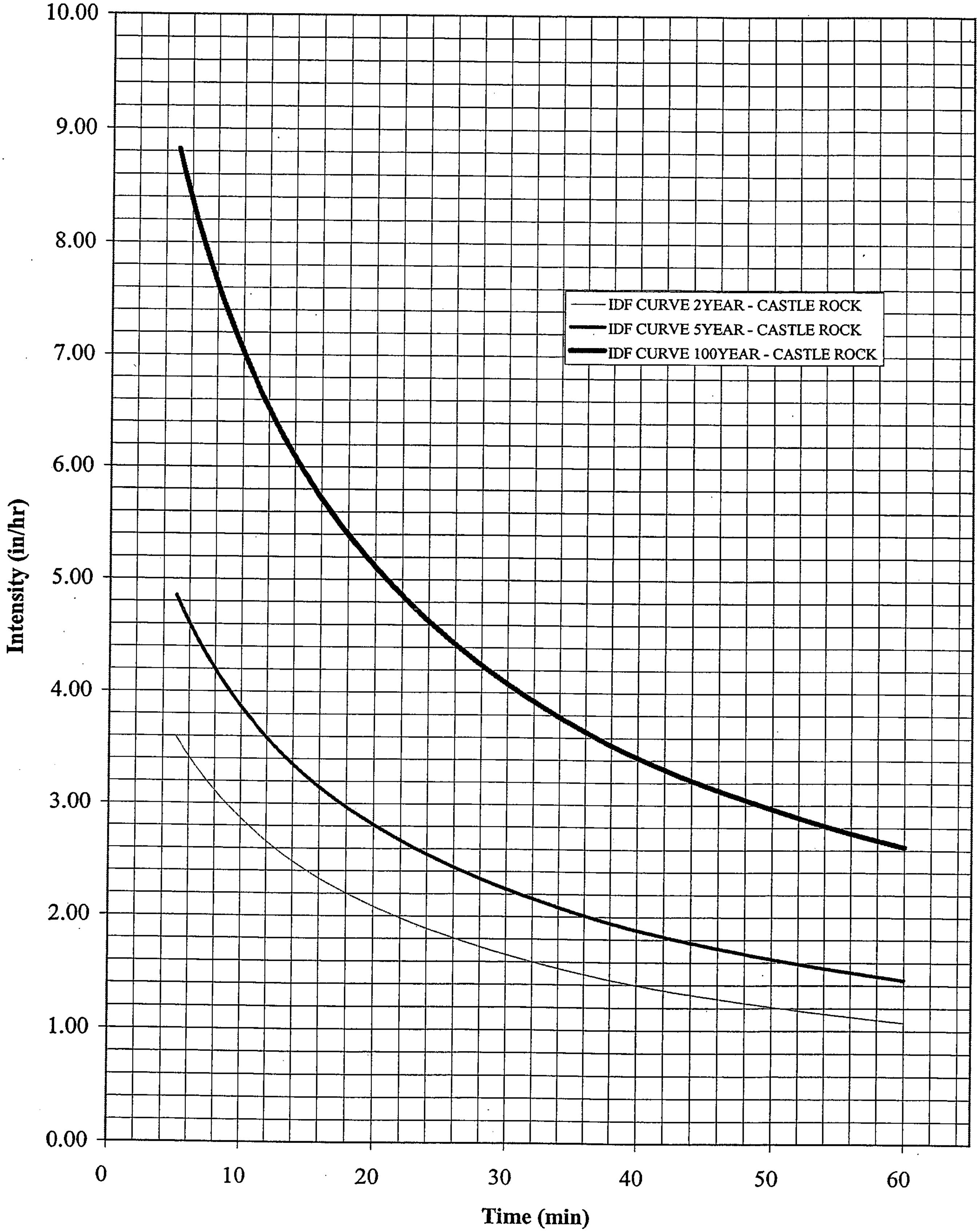
Runoff Coefficients, *C*

Percentage Imperviousness	Type C and D NRCS Hydrologic Soil Groups					
	2-yr	5-yr	10-yr	25-yr	50-yr	100-yr
0%	0.04	0.15	0.25	0.37	0.44	0.50
5%	0.08	0.18	0.28	0.39	0.46	0.52
10%	0.11	0.21	0.30	0.41	0.47	0.53
15%	0.14	0.24	0.32	0.43	0.49	0.54
20%	0.17	0.26	0.34	0.44	0.50	0.55
25%	0.20	0.28	0.36	0.46	0.51	0.56
30%	0.22	0.30	0.38	0.47	0.52	0.57
35%	0.25	0.33	0.40	0.48	0.53	0.57
40%	0.28	0.35	0.42	0.50	0.54	0.58
45%	0.31	0.37	0.44	0.51	0.55	0.59
50%	0.34	0.40	0.46	0.53	0.57	0.60
55%	0.37	0.43	0.48	0.55	0.58	0.62
60%	0.41	0.46	0.51	0.57	0.60	0.63
65%	0.45	0.49	0.54	0.59	0.62	0.65
70%	0.49	0.53	0.57	0.62	0.65	0.68
75%	0.54	0.58	0.62	0.66	0.68	0.71
80%	0.60	0.63	0.66	0.70	0.72	0.74
85%	0.66	0.68	0.71	0.75	0.77	0.79
90%	0.73	0.75	0.77	0.80	0.82	0.83
95%	0.80	0.82	0.84	0.87	0.88	0.89
100%	0.89	0.90	0.92	0.94	0.95	0.96
	Type B NRCS Hydrologic Soils Group					
0%	0.02	0.08	0.15	0.25	0.30	0.35
5%	0.04	0.10	0.19	0.28	0.33	0.38
10%	0.06	0.14	0.22	0.31	0.36	0.40
15%	0.08	0.17	0.25	0.33	0.38	0.42
20%	0.12	0.20	0.27	0.35	0.40	0.44
25%	0.15	0.22	0.30	0.37	0.41	0.46
30%	0.18	0.25	0.32	0.39	0.43	0.47
35%	0.20	0.27	0.34	0.41	0.44	0.48
40%	0.23	0.30	0.36	0.42	0.46	0.50
45%	0.26	0.32	0.38	0.44	0.48	0.51
50%	0.29	0.35	0.40	0.46	0.49	0.52
55%	0.33	0.38	0.43	0.48	0.51	0.54
60%	0.37	0.41	0.46	0.51	0.54	0.56
65%	0.41	0.45	0.49	0.54	0.57	0.59
70%	0.45	0.49	0.53	0.58	0.60	0.62
75%	0.51	0.54	0.58	0.62	0.64	0.66
80%	0.57	0.59	0.63	0.66	0.68	0.70
85%	0.63	0.66	0.69	0.72	0.73	0.75
90%	0.71	0.73	0.75	0.78	0.80	0.81
95%	0.79	0.81	0.83	0.85	0.87	0.88
100%	0.89	0.90	0.92	0.94	0.95	0.96

COUNTY	ZONE	ONE HOUR POINT VALUES 2-YR	5-YR	10-YR	50-YR	100-YR
DOUGLAS CASTLE ROCK	I	1.06	1.43	1.66	2.26	2.60

DRAWN BY: RBD	TOWN OF CASTLE ROCK PUBLIC WORKS	STD. DWG NO.
APPROVED BY:	STORM DRAINAGE CRITERIA DESIGN POINT RAINFALL VALUES	TABLE 401
DATE: 10/1/98		

Castle Rock - Intensity Duration Curves



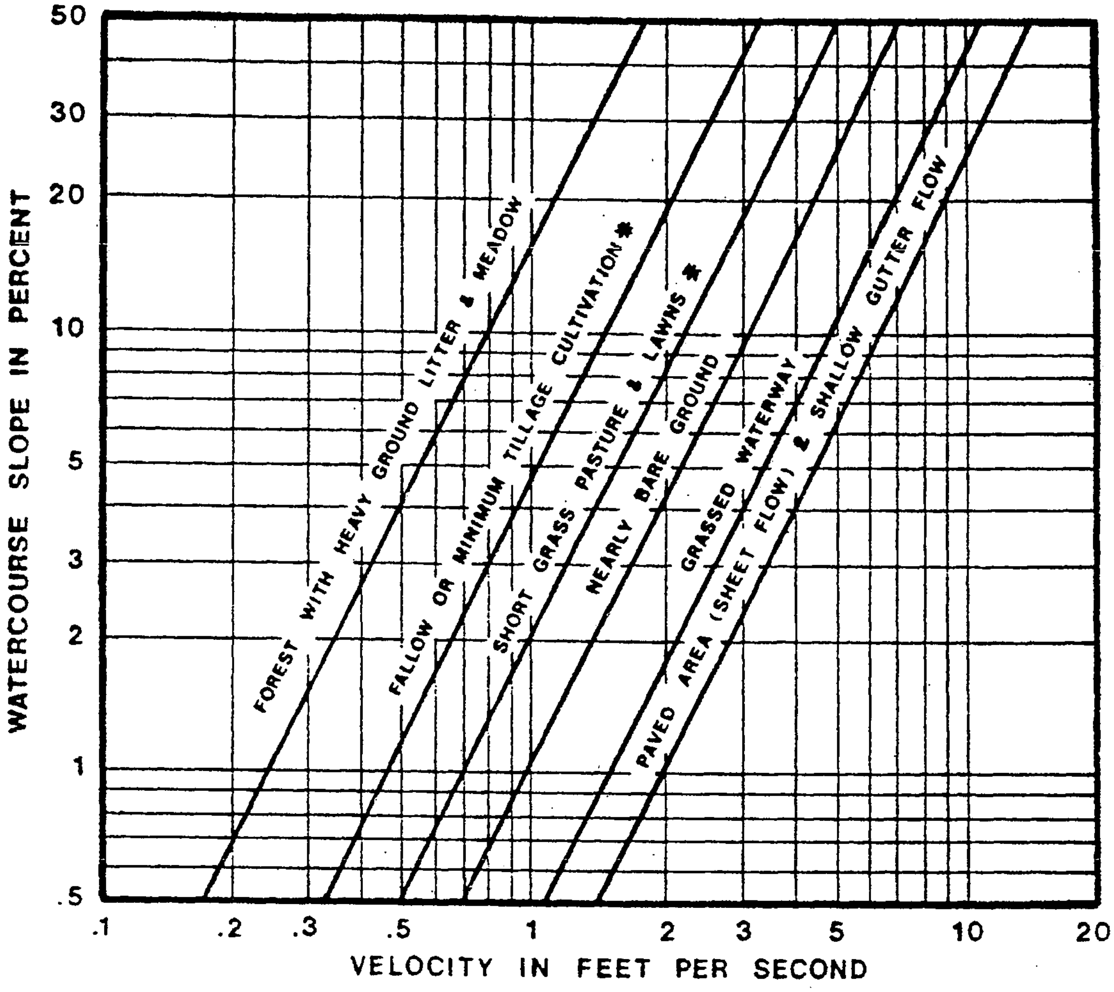


FIGURE RO-1

Estimate of Average Overland Flow Velocity for Use With the Rational Formula

CVL

CONSULTANTS OF COLORADO, INC.
CIVIL ENGINEERING
LAND SURVEYING
LAND PLANNING

Project Name/Number: MEADOWS EXISTING CONDITIONS DRAINAGE
Date: 1-25-05
Sheet: 1 of 1

Telephone Log ☐
Meeting Record ☐
Calculations ☐
Other ☐ DRAINAGE INFO & ASSUMPTIONS

DESIGN POINT RAINFALL VALUES
TABLE 401 (CASTLE ROCK PUBLIC WORKS REGULATIONS)
5 YR = 1.43
100-YR = 2.60

– INTENSITY-DURATION CURVES FOR RATIONAL METHOD EQN RA-3 (PG. RA-6 VOL. 2)

$$I = \frac{28.5 \cdot P_1}{(10+T_c)^{0.786}}$$ WHERE P_1 = 1.43 (5-YR) & 2.60 (100-YR)

– RECOMMENDED PERCENTAGE IMPERVIOUSNESS VALUE
UNDEVELOPED AREA:
HISTORIC FLOW ANALYSIS = 2% IMPERVIOUSNESS

– C VALUES FOR TYPE B SOIL AND 2% IMPERVIOUSNESS (UDFCD):
5-YR = 0.08
100-YR = 0.36

BASIN	INITIAL DIST (ft.)	SLOPE	TRAVEL DIST (ft.)	SLOPE
EX-1	115.24	10.4%	680.92	3.5%
EX-2	197.74	5.6%	1157.91	4.2%
EX-3	300.00	3.8%	854.70	3.4%
EX-4	300.00	2.8%	1370.74	5.0%

7901 E. BELLEVIEW AVE., STE 150 • ENGLEWOOD, CO 80111 • TEL. (720) 482-9526 FAX (720) 482-9546

STANDARD FORM SF-2
TIME OF CONCENTRATION- 5 yr

Project Name: Meadows Master Plan
Project No. 4811401
Calculated By: MRR
Checked By: AMV
Date: 2/7/2005

SUB-BASIN DATA			INITIAL/OVERLAND (T_i)			TRAVEL TIME (T_t)				Tc CHECK (URBANIZED BASINS)			FINAL
BASIN ID	D.A. (AC)	C_5	L (FT)	S (%)	T_i (MIN)	L (FT)	S (%)	VEL. (FPS)	T_t (MIN)	COMP. T_c (MIN)	TOTAL LENGTH(FT)	MAX T_c (MIN)	T_c (MIN)
EX-1	7.55	0.08	115	10.4	9.0	681	4.0	1.0	11.3	UNURBANIZED			20.4
EX-2	21.89	0.08	198	5.6	14.5	1158	2.2	0.7	26.0	UNURBANIZED			40.6
EX-3	7.08	0.08	300	3.8	20.4	855	1.2	0.5	26.0	UNURBANIZED			46.4
EX-4	15.89	0.08	300	2.8	22.6	1371	2.0	0.7	32.3	UNURBANIZED			54.9

NOTES:
$T_i = (1.8*(1.1 - C_5)*(L)^{\wedge}0.5)/(S^{\wedge}0.33)$
T_t=L/60V (Velocity From UDFCD Fig. RO-1)
Tc Check = 10+L/180

STANDARD FORM SF-3
STORM DRAINAGE SYSTEM DESIGN
(RATIONAL METHOD PROCEDURE)

Design Storm 5 year

Project Name: Meadows Master Plan
Project No. 4811401
Calculated By: MRR
Checked By: AMV
Date: 1/25/2005

	DIRECT RUNOFF							TOTAL RUNOFF				STREET		PIPE			TRAVEL TIME			
Design Point	Area Design.	Area (Ac)	Runoff Coeff.	Tc (min)	C*A (Ac)	I (in/hr)	Q (cfs)	Tc (min)	C*A (Ac)	I (in/hr)	Q (cfs)	Slope (%)	Street Flow (cfs)	Design Flow (cfs)	Slope (%)	Pipe Size (inches)	Length (ft)	Velocity (fps)	Tt (min)	REMARKS
1	EX-1	7.55	0.08	20.4	0.60	2.8	1.7													
2	EX-2	21.89	0.08	40.6	1.75	1.9	3.3													
3	EX-3	7.08	0.08	46.4	0.57	1.7	1.0													
4	EX-4	15.89	0.08	54.9	1.27	1.6	2.1													

STANDARD FORM SF-3

STORM DRAINAGE SYSTEM DESIGN

(RATIONAL METHOD PROCEDURE)

Design Storm 100 year

Project Name: Meadows Master Plan
Project No. 4811401
Calculated By: MRR
Checked By: AMV
Date: 1/26/2005

	DIRECT RUNOFF							TOTAL RUNOFF				STREET		PIPE			TRAVEL TIME			
Design Point	Area Design.	Area (Ac)	Runoff Coeff.	Tc (min)	C*A (Ac)	I (in/hr)	Q (cfs)	Tc (min)	C*A (Ac)	I (in/hr)	Q (cfs)	Slope (%)	Street Flow (cfs)	Design Flow (cfs)	Slope (%)	Pipe Size (inches)	Length (ft)	Velocity (fps)	Tt (min)	REMARKS
1	EX-1	7.55	0.36	20.4	2.72	5.1	13.9													
2	EX-2	21.89	0.36	40.6	7.88	3.4	27.0													
3	EX-3	7.08	0.36	46.4	2.55	3.2	8.1													
4	EX-4	15.89	0.36	54.9	5.72	3.0	17.0													

COMPOSITE BASIN COEFFICIENTS

Project Name: Meadows Master Plan
Project No. 4811401
Calculated By: MEL
Checked By: AMZ
Date: 2/4/2005

Basin K1 **1.46** **acres**

Land Use	Imp.	C_2	C_5	C_{10}	C_{100}	Area	% Imp.	% C_2	% C_5	% C_{10}	% C_{100}
Roofs	90%	0.71	0.73	0.75	0.81	1.03	63%	0.50	0.52	0.53	0.57
Pavement	100%	0.89	0.90	0.92	0.96	0.05	3%	0.03	0.03	0.03	0.03
Lawns, clayey soil	0%	0.02	0.08	0.15	0.35	0.38	0%	0.01	0.02	0.04	0.09
TOTAL						**1.46**	**67%**	**0.54**	**0.57**	**0.60**	**0.70**

Basin K2 **0.55** **acres**

Land Use	Imp.	C_2	C_5	C_{10}	C_{100}	Area	% Imp.	% C_2	% C_5	% C_{10}	% C_{100}
Pavement	100%	0.89	0.90	0.92	0.96	0.45	82%	0.73	0.74	0.75	0.79
Lawns, clayey soil	0%	0.02	0.08	0.15	0.35	0.10	0%	0.00	0.01	0.03	0.06
TOTAL						**0.55**	**82%**	**0.73**	**0.75**	**0.78**	**0.85**

Basin K3 **0.55** **acres**

Land Use	Imp.	C_2	C_5	C_{10}	C_{100}	Area	% Imp.	% C_2	% C_5	% C_{10}	% C_{100}
Pavement	100%	0.89	0.90	0.92	0.96	0.51	93%	0.83	0.83	0.85	0.89
Lawns, clayey soil	0%	0.02	0.08	0.15	0.35	0.04	0%	0.00	0.01	0.01	0.03
TOTAL						**0.55**	**93%**	**0.83**	**0.84**	**0.86**	**0.92**

COMPOSITE BASIN COEFFICIENTS

Project Name: Meadows Master Plan
Project No. 4811401
Calculated By: MEL
Checked By: AMZ
Date: 2/4/2005

Basin K4 **2.41** **acres**

Land Use	Imp.	C_2	C_5	C_{10}	C_{100}	Area	% Imp.	% C_2	% C_5	% C_{10}	% C_{100}
Pavement	100%	0.89	0.90	0.92	0.96	2.2	91%	0.81	0.82	0.84	0.88
Lawns, clayey soil	0%	0.02	0.08	0.15	0.35	0.21	0%	0.00	0.01	0.01	0.03
TOTAL						**2.41**	**91%**	**0.81**	**0.83**	**0.85**	**0.91**

Basin K5 **2.07** **acres**

Land Use	Imp.	C_2	C_5	C_{10}	C_{100}	Area	% Imp.	% C_2	% C_5	% C_{10}	% C_{100}
Pavement	100%	0.89	0.90	0.92	0.96	1.91	92%	0.82	0.83	0.85	0.89
Lawns, clayey soil	0%	0.02	0.08	0.15	0.35	0.15	0%	0.00	0.01	0.01	0.03
TOTAL						**2.06**	**92%**	**0.82**	**0.84**	**0.86**	**0.91**

STANDARD FORM SF-2
TIME OF CONCENTRATION- 5 yr

Project Name: Meadows Master Plan
Project No. 4811401
Calculated By: MRR
Checked By: AMV
Date: 2/7/2005

SUB-BASIN DATA			INITIAL/OVERLAND (T_i)			TRAVEL TIME (T_t)				Tc CHECK (URBANIZED BASINS)			FINAL
BASIN ID	D.A. (AC)	C_5	L (FT)	S (%)	T_i (MIN)	L (FT)	S (%)	VEL. (FPS)	T_t (MIN)	COMP. T_c (MIN)	TOTAL LENGTH(FT)	MIN. T_c (MIN)	T_c (MIN)
A1	0.50	0.90	22	2.0	1.3	354	1.4	2.4	2.5	3.8	376	12.1	5.0
B1	0.76	0.90	22	2.0	1.3	532	2.2	3.0	3.0	4.3	554	13.1	5.0
D1	0.59	0.90	22	2.0	1.3	408	1.2	2.2	3.1	4.4	430	12.4	5.0
E1	4.84	0.81	75	25.0	1.5	433	2.0	2.8	2.6	4.1	508	12.8	5.0
E2	0.88	0.90	107	2.0	3.0	770	1.8	2.7	4.8	7.7	877	14.9	7.7
E3	0.54	0.90	35	2.0	1.7	719	3.4	3.7	3.2	4.9	754	14.2	5.0
G1	5.63	0.81	58	25.0	1.4	691	1.5	2.4	4.7	6.1	749	14.2	6.1
G2	0.55	0.90	67	2.0	2.3	981	2.4	3.0	5.4	7.7	1048	15.8	7.7
H1	3.92	0.81	60	25.0	1.4	570	1.6	2.5	3.8	5.1	630	13.5	5.1
H2	0.71	0.90	15	2.0	1.1	680	2.7	3.3	3.4	4.6	695	13.9	5.0
H3	0.31	0.90	15	2.0	1.1	375	3.9	3.8	1.6	2.7	390	12.2	5.0
I1	7.82	0.81	80	20.0	1.7	850	1.0	2.0	7.1	8.8	930	15.2	8.8
I2	0.39	0.90	15	2.0	1.1	685	2.7	3.3	3.5	4.6	700	13.9	5.0
J1	4.55	0.81	200	2.0	5.9	610	1.5	2.4	4.2	10.0	810	14.5	10.0
J2	0.43	0.90	37	2.0	1.7	1012	1.1	2.1	8.0	9.8	1049	15.8	9.8
J3	0.31	0.90	64	2.0	2.3	572	3.3	3.6	2.6	4.9	636	13.5	5.0
K1	1.46	0.57	36	25.0	2.0	55	1.4	1.7	0.5	2.5	91	10.5	5.0
K2	0.55	0.75	22	2.0	2.3	113	2.2	3.0	0.6	3.0	135	10.8	5.0
K3	0.55	0.84	50	2.0	2.6	239	2.8	3.3	1.2	3.8	289	11.6	5.0
K4	2.41	0.83	17	25.3	0.7	614	1.6	2.4	4.2	4.9	631	13.5	5.0
K5	2.07	0.84	46	2.0	2.5	457	2.9	3.3	2.3	4.8	503	12.8	5.0
L	4.55	0.81	34	1.8	2.5	921	1.7	2.5	6.1	8.6	955	15.3	8.6
OS-1	1.05	0.09	180	8.9	11.8	415	3.4	1.3	5.4	17.1	595	13.3	13.3
OS-2	0.58	0.09	55	30.0	4.3	35	2.8	1.2	0.5	4.8	90	10.5	5.0

NOTES:
$T_i = (1.8*(1.1 - C_5)*(L)^{0.5})/(S^{0.33})$
T_t=L/60V (Velocity From UDFCD Fig. RO-1)
Tc Check = 10+L/180

STANDARD FORM SF-2
TIME OF CONCENTRATION- 5 yr

Project Name: Meadows Master Plan
Project No. 4811401
Calculated By: MRR
Checked By: AMV
Date: 2/7/2005

SUB-BASIN DATA			INITIAL/OVERLAND (T_i)			TRAVEL TIME (T_t)				Tc CHECK (URBANIZED BASINS)			FINAL
BASIN ID	D.A. (AC)	C_5	L (FT)	S (%)	T_i (MIN)	L (FT)	S (%)	VEL. (FPS)	T_t (MIN)	COMP. T_c (MIN)	TOTAL LENGTH(FT)	MIN. T_c (MIN)	T_c (MIN)
OS-3	1.72	0.09	67	3.0	10.3	915	2.0	1.0	15.4	25.7	982	15.5	15.5
OS-4	0.71	0.09	30	20.0	3.7	680	2.8	1.2	9.7	13.3	710	13.9	13.3
OS-5a	0.16	0.90	15	2.0	1.1	336	1.6	2.5	2.2	3.3	351	12.0	5.0
OS-5b	0.22	0.90	15	2.0	1.1	336	1.6	2.5	2.2	3.3	351	12.0	5.0
OS-6	0.97	0.85	20	0.2	3.8	431	3.2	3.6	2.0	5.8	451	12.5	5.8
OS-7	1.52	0.09	80	20.0	6.0	680	4.7	1.3	8.4	14.4	760	14.2	14.2
OS-8	1.99	0.09	300	8.0	15.8	16	0.5	0.5	0.5	16.3	316	11.8	11.8

NOTES:
$T_i = (1.8*(1.1 - C_5)*(L)^{0.5})/(S^{0.33})$
T_t=L/60V (Velocity From UDFCD Fig. RO-1)
Tc Check = 10+L/180

STANDARD FORM SF-3
STORM DRAINAGE SYSTEM DESIGN
(RATIONAL METHOD PROCEDURE)

Design Storm 5 year

Project Name: Meadows Master Plan
Project No. 4811401
Calculated By: MRR
Checked By: AMV
Date: 2/3/2005

	DIRECT RUNOFF							TOTAL RUNOFF				STREET		PIPE			TRAVEL TIME			
Design Point	Area Design.	Area (Ac)	Runoff Coeff.	Tc (min)	C*A (Ac)	I (in/hr)	Q (cfs)	Tc (min)	C*A (Ac)	I (in/hr)	Q (cfs)	Slope (%)	Street Flow (cfs)	Design Flow (cfs)	Slope (%)	Pipe Size (inches)	Length (ft)	Velocity (fps)	Tt (min)	REMARKS
1											15									Flow from offsite area
2	A1	0.50	0.90	5.0	0.45	4.9	2.2				17.2	total flow with offsite contributing		17.2	2.8	36	464	3.3	0.66	to dp 8
3	H1	3.92	0.81	5.1	3.18	4.9	15.4							15.4	1.2	30	12	2.1	0.02	to dp 5
	H2	0.71	0.90	5.0	0.64	4.9	3.1													
4	H3	0.31	0.90	5.0	0.28	4.9	1.4	5.00	0.92	4.9	4.5									
5								5.16	4.09	4.9	19.9			19.9	1.2	30	15	2.1	0.06	to dp 6
6	I2	0.39	0.90	5.0	0.35	4.9	1.7	5.22	4.44	4.9	21.6			21.6	1.2	30	41	2.1	0.05	to dp 8
8								5.66	4.89	4.9	38.7			38.7	3.8	42	157	3.8	0.25	to dp 13
9	OS-5a	0.16	0.90	5.0	0.14	4.9	0.7							0.7	1.2	18	17	2.1	0.08	to dp 11
10	OS-5b	0.22	0.90	5.0	0.20	4.9	1.0							1.0	1.2	18	17	2.1	0.07	to dp 11
11								5.08	0.34	4.9	1.7			1.7	0.5	18	179	1.4	0.67	to dp 13
12	I1	7.82	0.81	8.8	6.33	4.2	26.6							26.6	1.8	24	28	2.6	0.05	to dp 13
13								8.81	11.57	4.2	63.6			63.6	1.2	48	90	2.2	0.09	to dp 14
14	K1	1.46	0.57	5.0	0.83	4.9	4.0	8.90	12.40	4.2	67.1			67.1	1.2	48	505	2.2	0.85	to dp 24
15											25.0									Flow from offsite area
16	B1	0.76	0.90	5.0	0.68	4.9	3.3				28.3	total flow with offsite contributing		28.3	1.0	36	93	2.0	0.17	to dp 18
17	D1	0.59	0.90	5.0	0.53	4.9	2.6							2.6	2.4	18	62	3.1	0.14	to dp 18

STANDARD FORM SF-3
STORM DRAINAGE SYSTEM DESIGN
(RATIONAL METHOD PROCEDURE)

Design Storm 5 year

Project Name: Meadows Master Plan
Project No. 4811401
Calculated By: MRR
Checked By: AMV
Date: 2/3/2005

	DIRECT RUNOFF							TOTAL RUNOFF				STREET		PIPE			TRAVEL TIME			
Design Point	Area Design.	Area (Ac)	Runoff Coeff.	Tc (min)	C*A (Ac)	I (in/hr)	Q (cfs)	Tc (min)	C*A (Ac)	I (in/hr)	Q (cfs)	Slope (%)	Street Flow (cfs)	Design Flow (cfs)	Slope (%)	Pipe Size (inches)	Length (ft)	Velocity (fps)	Tt (min)	REMARKS
18								5.2	1.22	4.9	30.9			30.9	1.5	36	414	2.4	0.72	to dp 21
19	G1	5.63	0.81	6.1	4.56	4.6	21.0							21.0	2.1	30	15	2.8	0.02	to dp 20
20	G2	0.55	0.90	7.7	0.50	4.4	**2.2**	7.7	5.06	4.4	22.2			22.2	2.2	30	9	2.9	0.02	to dp 21
21								7.7	6.27	4.4	52.6			52.6	1.1	42	364	2.0	0.61	to dp 23
22	K2	0.55	0.75	5.0	0.41	4.9	**2.0**							2.0	5.9	18	26	4.9	0.04	to dp 23
23								8.4	6.68	4.2	53.1			53.1	1.1	42	129	2.0	0.23	to dp 24
24								9.7	19.09	4.0	116.9			116.9	2.0	48	120	2.8	0.11	to dp 26
25	K3	0.55	0.84	5.0	0.46	4.9	**2.2**							2.2	8.5	18	26	5.8	0.05	to dp 26
26								9.86	19.55	4.0	118.7			118.7	2.0	48	215	2.8	0.15	to dp 31
27	K4	2.41	0.83	5.0	2.00	4.9	**9.7**							9.7	2.2	18	182	2.9	0.31	to dp 29
28	L	4.55	0.81	8.6	3.69	4.2	15.5							15.5	1.0	24	130	2.0	0.09	to dp 29
29								8.66	5.69	4.2	23.9			23.9	2.8	24	81	3.3	0.18	to dp 30
30	K5	2.07	0.84	5.0	1.74	4.9	**8.4**	8.8	7.42	4.2	31.2			31.2	8.6	30	89	5.9	0.05	to dp 31
31								10.01	26.97	3.9	144.3			144.3	5.0	48	150	4.5	0.13	to dp 38
32	E1	4.84	0.81	5.0	3.92	4.9	19.0							19.0	1.0	30	15	2.0	0.05	to dp 34
	E2	0.88	0.90	7.7	0.79	4.4	3.5													
33	E3	0.54	0.90	5.0	0.49	4.9	2.4	7.7	1.28	4.4	**5.6**									
34								7.7	5.20	4.4	22.9			22.9	1.0	30	28	2.0	0.08	to dp 36
	J2	0.43	0.90	9.8	0.39	4.0	1.6													

STANDARD FORM SF-3
STORM DRAINAGE SYSTEM DESIGN
(RATIONAL METHOD PROCEDURE)

Design Storm 5 year

Project Name: Meadows Master Plan
Project No. 4811401
Calculated By: MRR
Checked By: AMV
Date: 2/3/2005

	DIRECT RUNOFF							TOTAL RUNOFF				STREET		PIPE			TRAVEL TIME			
Design Point	Area Design.	Area (Ac)	Runoff Coeff.	Tc (min)	C*A (Ac)	I (in/hr)	Q (cfs)	Tc (min)	C*A (Ac)	I (in/hr)	Q (cfs)	Slope (%)	Street Flow (cfs)	Design Flow (cfs)	Slope (%)	Pipe Size (inches)	Length (ft)	Velocity (fps)	Tt (min)	REMARKS
35	J3	0.31	0.90	5.0	0.28	4.9	1.4	9.8	0.67	4.0	**2.7**									
36								9.8	5.86	4.0	23.6			23.6	2.1	30	746	2.9	1.65	to dp 38
37	J1	4.55	0.81	10.0	3.69	3.9	14.3							14.3	9.8	24	40	6.2	0.04	to dp 38
38								11.43	36.52	3.72	175.98									
	OS-1	1.05	0.09	13.3	0.09	3.5	0.3													
	OS-2	0.58	0.09	5.0	0.05	4.9	0.3													
	OS-3	1.72	0.09	15.5	0.15	3.2	0.5													
	OS-4	0.71	0.09	13.3	0.06	3.5	0.2													
	OS-6	0.97	0.85	5.8	0.82	4.9	4.0													
	OS-7	1.52	0.09	14.2	0.14	3.4	0.5													
	OS-8	1.99	0.09	11.8	0.18	3.7	0.7													

STANDARD FORM SF-3
STORM DRAINAGE SYSTEM DESIGN
(RATIONAL METHOD PROCEDURE)

Design Storm 100 year

Project Name: Meadows Master Plan
Project No. 4811401
Calculated By: MRR
Checked By: AMV
Date: 2/3/2005

	DIRECT RUNOFF							TOTAL RUNOFF				STREET		PIPE			TRAVEL TIME			
Design Point	Area Design.	Area (Ac)	Runoff Coeff.	Tc (min)	C*A (Ac)	I (in/hr)	Q (cfs)	Tc (min)	C*A (Ac)	I (in/hr)	Q (cfs)	Slope (%)	Street Flow (cfs)	Design Flow (cfs)	Slope (%)	Pipe Size (inches)	Length (ft)	Velocity (fps)	Tt (min)	REMARKS
1											39.4									Flow from offsite area
2	A1	0.50	0.96	5.0	0.48	8.8	**4.2**				43.6	total flow with offsite contributing								
														43.6	2.8	36	464	3.3	0.70	to dp 8
3	H1	3.92	0.88	5.1	3.45	8.8	30.4							30.4	1.2	30	12	2.1	0.02	to dp 5
	H2	0.71	0.96	5.0	0.68	8.8	6.0													
4	H3	0.31	0.96	5.0	0.30	8.8	2.6	5.0	0.98	8.8	**8.6**									
5								5.2	4.43	8.8	39.1			39.1	1.2	30	15	2.1	0.04	to dp 6
6	I2	0.39	0.96	5.0	0.37	8.8	**3.3**	5.2	4.80	8.8	42.4			42.4	1.2	30	41	2.1	0.05	to dp 8
8								5.7	5.28	8.8	86.0			86.0	3.8	42	157	3.8	0.22	to dp 13
9	OS-5a	0.16	0.96	5.0	0.15	8.8	**1.4**							1.4	1.2	18	17	2.1	0.37	to dp 11
10	OS-5b	0.22	0.96	5.0	0.21	8.8	**1.9**							1.9	1.2	18	17	2.1	0.27	to dp 11
11								5.4	0.36	8.8	3.2			3.2	0.5	18	179	1.4	1.19	to dp 13
12	I1	7.82	0.88	8.8	6.88	7.6	52.6							52.6	1.8	24	28	2.6	0.03	to dp 13
13								8.81	12.53	7.6	135.1			135.1	1.2	48	90	2.2	0.06	to dp 14
14	K1	1.46	0.70	5.0	1.02	8.8	9.0	8.87	13.55	7.6	143.0			143.0	1.2	48	505	2.2	0.62	to dp 24
15											54.6									Flow from offsite area
16	B1	0.76	0.96	5.0	0.73	8.8	**6.4**				61.0	total flow with offsite contributing								
														61.0	1.0	36	93	2.0	0.14	to dp 18
17	D1	0.59	0.96	5.0	0.57	8.8	**5.0**							5.0	2.4	18	62	3.1	0.12	to dp 18

STANDARD FORM SF-3
STORM DRAINAGE SYSTEM DESIGN
(RATIONAL METHOD PROCEDURE)

Design Storm 100 year

Project Name: Meadows Master Plan
Project No. 4811401
Calculated By: MRR
Checked By: AMV
Date: 2/3/2005

	DIRECT RUNOFF							TOTAL RUNOFF				STREET		PIPE			TRAVEL TIME			
Design Point	Area Design.	Area (Ac)	Runoff Coeff.	Tc (min)	C*A (Ac)	I (in/hr)	Q (cfs)	Tc (min)	C*A (Ac)	I (in/hr)	Q (cfs)	Slope (%)	Street Flow (cfs)	Design Flow (cfs)	Slope (%)	Pipe Size (inches)	Length (ft)	Velocity (fps)	Tt (min)	REMARKS
18								5.1	1.30	8.8	66.0			66.0	1.5	36	414	2.4	0.66	to dp 21
19	G1	5.63	0.88	6.1	4.95	8.4	41.5							41.5	2.1	30	15	2.8	0.02	to dp 20
20	G2	0.55	0.96	7.7	0.53	8.0	4.2	7.7	5.48	8.0	43.8			43.8	2.2	30	9	2.9	0.02	to dp 21
21								7.75	6.78	8.0	108.8			108.8	1.1	42	364	2.0	0.54	to dp 23
22	K2	0.55	0.85	5.0	0.47	8.8	4.1							4.1	5.9	18	26	4.9	0.03	to dp 23
23								8.3	7.25	7.6	110.0			110.0	1.1	42	129	2.0	0.20	to dp 24
24								9.5	20.80	7.3	246.3			246.3	2.0	48	120	2.8	0.09	to dp 26
25	K3	0.55	0.92	5.0	0.51	8.8	4.5							4.5	8.5	18	26	5.8	0.04	to dp 26
26								9.6	21.30	7.3	250.0			250.0	2.0	48	215	2.8	0.13	to dp 31
27	K4	2.41	0.91	5.0	2.19	8.8	19.3							19.3	2.2	18	182	2.9	0.26	to dp 29
28	L	4.55	0.88	8.6	4.00	7.6	30.6							30.6	1.0	24	130	2.0	0.07	to dp 29
29								8.6	6.20	7.6	47.4			47.4	2.8	24	81	3.3	0.15	to dp 30
30	K5	2.07	0.92	5.0	1.90	8.8	16.8	8.8	8.10	7.6	61.9			61.9	8.6	30	89	5.9	0.05	to dp 31
31								9.7	29.41	7.3	309.3			309.3	5.0	48	150	4.5	0.56	to dp 38
32	E1	4.84	0.88	5.0	4.26	8.8	37.6							37.6	1.0	30	15	2.0	0.02	to dp 34
	E2	0.88	0.96	7.7	0.84	8.0	6.8													
33	E3	0.54	0.96	5.0	0.52	8.8	4.6	7.7	1.36	8.0	10.9									
34								7.7	5.62	8.0	44.9			44.9	1.0	30	28	2.0	0.03	to dp 36
	J2	0.43	0.96	9.8	0.41	7.3	3.0													

STANDARD FORM SF-3
STORM DRAINAGE SYSTEM DESIGN
(RATIONAL METHOD PROCEDURE)

Design Storm 100 year

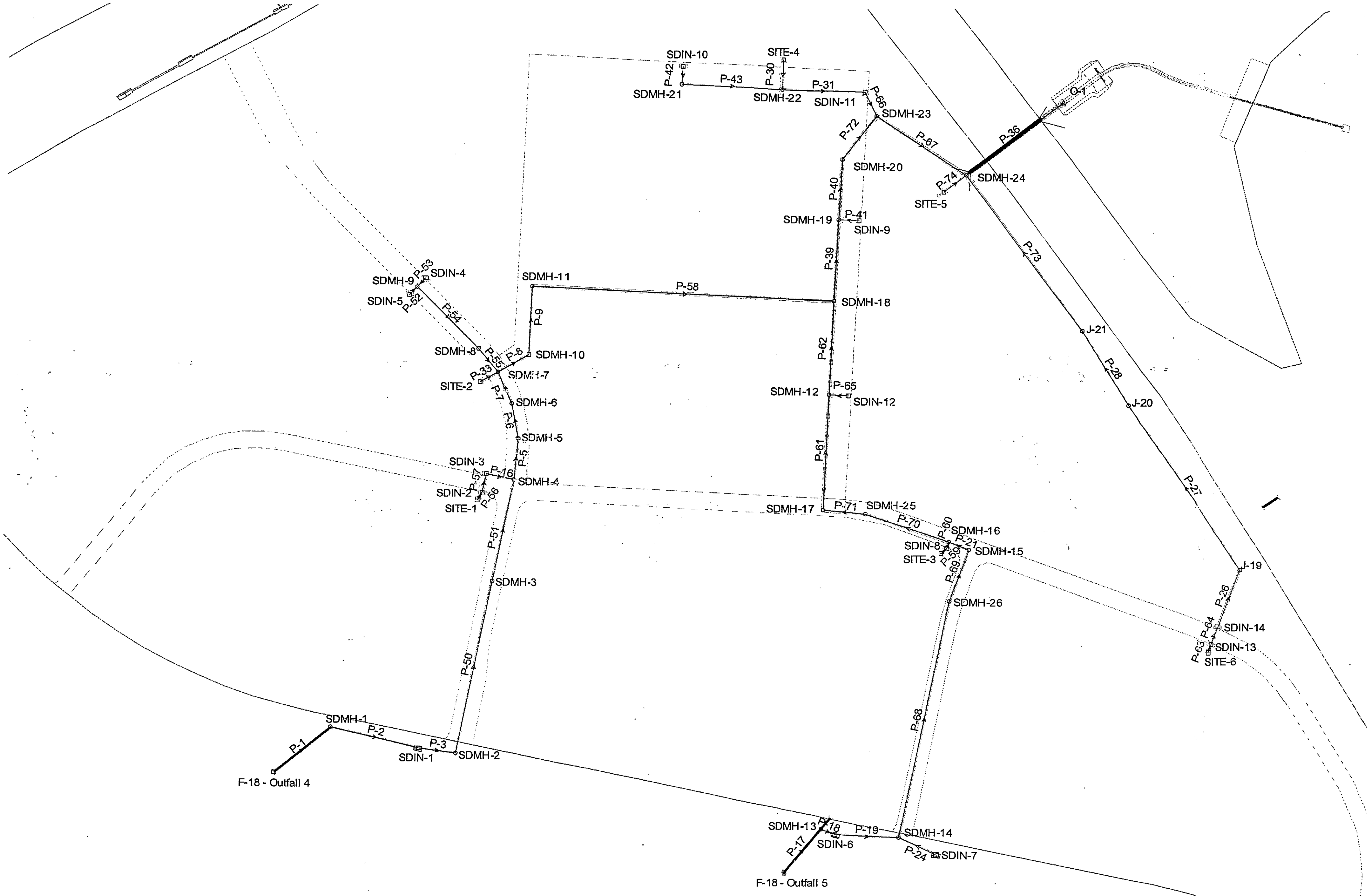
Project Name: Meadows Master Plan
Project No. 4811401
Calculated By: MRR
Checked By: AMV
Date: 2/3/2005

	DIRECT RUNOFF							TOTAL RUNOFF				STREET		PIPE			TRAVEL TIME			
Design Point	Area Design.	Area (Ac)	Runoff Coeff.	Tc (min)	C*A (Ac)	I (in/hr)	Q (cfs)	Tc (min)	C*A (Ac)	I (in/hr)	Q (cfs)	Slope (%)	Street Flow (cfs)	Design Flow (cfs)	Slope (%)	Pipe Size (inches)	Length (ft)	Velocity (fps)	Tt (min)	REMARKS
35	J3	0.31	0.96	5.0	0.30	8.8	2.6	9.8	0.71	7.3	5.2									
36								9.8	6.33	7.3	46.4			46.4	2.1	30	746	2.9	1.14	to dp 38
37	J1	4.55	0.88	10.0	4.00	7.0	28.2							28.2	9.8	24	40	6.2	0.03	to dp 38
38								10.92	39.74	7.0	373.5									
	OS-1	1.05	0.36	13.3	0.38	6.3	2.4													
	OS-2	0.58	0.36	5.0	0.21	8.8	1.8													
	OS-3	1.72	0.36	15.5	0.62	5.9	3.7													
	OS-4	0.71	0.36	13.3	0.26	6.3	1.6													
	OS-6	0.97	0.92	5.8	0.89	8.8	7.9													
	OS-7	1.52	0.36	14.2	0.55	6.1	3.3													
	OS-8	1.99	0.36	11.8	0.72	6.8	4.8													

Appendix B

Hydraulic Computations

Scenario: 100-YEAR



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Coe & Van Loo Consultants
© Haestad Methods, Inc. 37 Brookside Road Waterbury, CT 06708 USA +1-203-755-1666

Project Engineer: CVL
StormCAD v5.0 [5.0010]

Scenario: 5-YEAR

Junction Report

Label	Ground Elevation (ft)	Rim Elevation (ft)	Total Flow Out (cfs)	Invert Out Elevation (ft)	Invert In Elevation 1 (ft)	Invert In Elevation 2 (ft)	Invert In Elevation 3 (ft)	Hydraulic Grade Line In (ft)	Hydraulic Grade Line Out (ft)
SDMH-24	6,116.00	6,116.00	176.64	6,098.06	6,102.10	6,102.10	6,102.00	6,100.62	6,100.62
SDMH-23	6,120.60	6,120.60	145.32	6,106.00	6,106.20	6,108.50	N/A	6,108.14	6,108.14
SDMH-22	6,122.00	6,122.00	23.39	6,111.85	6,113.85	6,112.05	N/A	6,112.95	6,112.95
SDMH-21	6,123.70	6,123.70	9.75	6,117.30	6,117.50	N/A	N/A	6,118.14	6,118.14
SDMH-20	6,123.10	6,123.10	116.53	6,108.45	6,108.65	N/A	N/A	6,110.41	6,110.41
SDMH-19	6,125.40	6,125.40	116.76	6,111.15	6,115.30	6,111.35	N/A	6,113.11	6,113.11
SDMH-18	6,128.50	6,128.50	115.26	6,114.70	6,116.35	6,115.20	N/A	6,116.65	6,116.65
SDMH-11	6,130.70	6,130.70	65.24	6,119.85	6,120.05	N/A	N/A	6,121.87	6,121.87
SDMH-7	6,133.60	6,133.60	62.28	6,122.25	6,122.45	6,124.50	6,125.00	6,124.00	6,124.00
SDMH-6	6,134.60	6,134.60	37.93	6,123.10	6,123.30	N/A	N/A	6,124.60	6,124.60
SDMH-5	6,135.60	6,135.60	38.02	6,124.10	6,124.30	N/A	N/A	6,125.53	6,125.53
SDMH-4	6,136.70	6,136.70	38.12	6,125.20	6,125.40	6,129.20	N/A	6,126.65	6,126.65
SDMH-3	6,139.40	6,139.40	17.16	6,127.60	6,131.60	N/A	N/A	6,128.54	6,128.54
SDMH-2	6,152.10	6,152.10	17.19	6,145.00	6,145.20	N/A	N/A	6,145.68	6,145.68
SDMH-1	6,157.10	6,157.10	15.00	6,149.74	6,149.94	N/A	N/A	6,150.53	6,150.53
SDMH-8	6,132.80	6,132.80	1.62	6,125.75	6,125.95	N/A	N/A	6,126.10	6,126.10
SDMH-9	6,131.40	6,131.40	1.67	6,127.10	6,127.30	6,127.30	N/A	6,127.52	6,127.52
SDMH-12	6,130.10	6,130.10	52.85	6,117.50	6,120.85	6,117.70	N/A	6,119.40	6,119.40
SDMH-17	6,130.60	6,130.60	51.45	6,119.10	6,119.30	N/A	N/A	6,120.98	6,120.98
SDMH-25	6,130.00	6,130.00	51.57	6,119.80	6,120.00	N/A	N/A	6,121.69	6,121.69
SDMH-16	6,128.60	6,128.60	51.83	6,121.05	6,121.65	6,122.05	N/A	6,122.94	6,122.94
SDMH-15	6,128.30	6,128.30	30.69	6,122.00	6,122.20	N/A	N/A	6,123.19	6,123.19
SDMH-26	6,129.10	6,129.10	30.73	6,123.10	6,123.30	N/A	N/A	6,124.49	6,124.49
SDMH-14	6,139.60	6,139.60	30.89	6,128.90	6,133.10	6,129.10	N/A	6,130.16	6,130.16
SDMH-13	6,138.70	6,138.70	25.00	6,130.50	6,130.70	N/A	N/A	6,131.67	6,131.67
J-21	6,118.50	6,118.50	22.24	6,111.90	6,111.90	N/A	N/A	6,112.83	6,112.83
J-20	6,126.40	6,126.40	22.40	6,115.10	6,115.10	N/A	N/A	6,116.12	6,116.12
J-19	6,127.00	6,127.00	22.90	6,118.00	6,118.00	N/A	N/A	6,119.34	6,119.34

Scenario: 5-YEAR

Pipe Report

Label	Upstream Node	Downstream Node	Length (ft)	Section Size	Constructed Slope (%)	Mannings n	Upstream Ground Elevation (ft)	Downstream Ground Elevation (ft)	Total System Flow (cfs)	Full Capacity (cfs)	Upstream Invert Elevation (ft)	Downstream Invert Elevation (ft)	Hydraulic Grade Line In (ft)	Hydraulic Grade Line Out (ft)	Average Velocity (ft/s)
P-36	SDMH-24	O-1	175.00	72 inch	1.21	0.013	6,116.00	6,110.00	176.64	465.01	6,098.06	6,095.95	6,100.62	6,098.51	15.32
P-30	SITE-4	SDMH-22	42.00	24 inch	1.07	0.013	6,119.00	6,122.00	15.22	23.42	6,112.50	6,112.05	6,113.67	6,113.22	7.93
P-31	SDMH-22	SDIN-11	120.00	30 inch	2.00	0.013	6,122.00	6,119.75	23.39	58.00	6,111.85	6,109.45	6,112.95	6,110.55	11.18
P-42	SDIN-10	SDMH-21	27.00	18 inch	1.85	0.013	6,123.00	6,123.70	9.78	14.29	6,118.00	6,117.50	6,118.91	6,118.41	8.71
P-43	SDMH-21	SDMH-22	148.00	18 inch	2.33	0.013	6,123.70	6,122.00	9.75	16.04	6,117.30	6,113.85	6,118.14	6,114.69	9.52
P-66	SDIN-11	SDMH-23	38.00	30 inch	1.97	0.013	6,119.75	6,120.60	30.31	57.62	6,109.25	6,108.50	6,110.54	6,109.79	11.89
P-67	SDMH-23	SDMH-24	154.00	54 inch	2.60	0.013	6,120.60	6,116.00	145.32	316.91	6,106.00	6,102.00	6,108.14	6,104.14	19.50
P-39	SDMH-18	SDMH-19	120.00	48 inch	2.79	0.013	6,128.50	6,125.40	115.26	239.99	6,114.70	6,111.35	6,116.65	6,113.30	18.91
P-40	SDMH-19	SDMH-20	89.00	48 inch	2.81	0.013	6,125.40	6,123.10	116.76	240.73	6,111.15	6,108.65	6,113.11	6,110.61	19.01
P-41	SDIN-9	SDMH-19	28.00	18 inch	8.93	0.013	6,124.87	6,125.40	2.26	31.39	6,117.80	6,115.30	6,118.07	6,115.57	10.31
P-5	SDMH-4	SDMH-5	61.00	36 inch	1.48	0.013	6,136.70	6,135.60	38.12	81.01	6,125.20	6,124.30	6,126.65	6,125.75	11.29
P-6	SDMH-5	SDMH-6	52.00	36 inch	1.54	0.013	6,135.60	6,134.60	38.02	82.72	6,124.10	6,123.30	6,125.53	6,124.73	11.46
P-7	SDMH-6	SDMH-7	50.00	36 inch	1.30	0.013	6,134.60	6,133.60	37.93	76.04	6,123.10	6,122.45	6,124.60	6,124.00	10.75
P-8	SDMH-7	SDMH-10	52.00	42 inch	1.54	0.013	6,133.60	6,131.50	62.28	124.78	6,122.25	6,121.45	6,124.00	6,123.20	12.96
P-9	SDMH-10	SDMH-11	101.00	42 inch	1.19	0.013	6,131.50	6,130.70	65.54	109.66	6,121.25	6,120.05	6,123.20	6,122.00	11.90
P-16	SDIN-3	SDMH-4	41.00	24 inch	3.66	0.013	6,137.15	6,136.70	21.53	43.27	6,130.70	6,129.20	6,131.70	6,130.20	13.76
P-33	SITE-2	SDMH-7	29.00	24 inch	1.72	0.013	6,132.50	6,133.60	25.93	29.70	6,125.00	6,124.50	6,126.45	6,125.95	10.66
P-1	F-18 - Outfall 4	SDMH-1	105.00	36 inch	0.88	0.013	6,157.00	6,157.10	15.00	62.43	6,150.86	6,149.94	6,151.86	6,150.94	7.26
P-2	SDMH-1	SDIN-1	131.00	36 inch	2.17	0.013	6,157.10	6,153.40	15.00	98.20	6,149.74	6,146.90	6,150.53	6,147.69	10.04
P-3	SDIN-1	SDMH-2	56.00	36 inch	2.68	0.013	6,153.40	6,152.10	17.20	109.15	6,146.70	6,145.20	6,147.51	6,146.01	11.27
P-50	SDMH-2	SDMH-3	258.00	36 inch	5.19	0.013	6,152.10	6,139.40	17.19	152.00	6,145.00	6,131.60	6,145.68	6,132.28	14.25
P-51	SDMH-3	SDMH-4	153.00	36 inch	1.44	0.013	6,139.40	6,136.70	17.16	79.98	6,127.60	6,125.40	6,128.54	6,126.65	9.01
P-52	SDIN-5	SDMH-9	17.00	18 inch	1.18	0.013	6,131.17	6,131.40	0.97	11.39	6,127.50	6,127.30	6,127.80	6,127.60	3.93
P-53	SDIN-4	SDMH-9	17.00	18 inch	1.18	0.013	6,131.17	6,131.40	0.70	11.39	6,127.50	6,127.30	6,127.75	6,127.55	3.58
P-54	SDMH-9	SDMH-8	129.00	18 inch	0.89	0.013	6,131.40	6,132.80	1.67	9.92	6,127.10	6,125.95	6,127.52	6,126.37	4.17
P-55	SDMH-8	SDMH-7	45.00	18 inch	1.67	0.013	6,132.80	6,133.60	1.62	13.56	6,125.75	6,125.00	6,126.10	6,125.35	5.17
P-56	SITE-1	SDIN-2	13.00	24 inch	1.54	0.013	6,138.00	6,137.15	15.44	28.06	6,131.60	6,131.40	6,132.66	6,132.62	9.15
P-57	SDIN-2	SDIN-3	28.00	24 inch	1.07	0.013	6,137.15	6,137.15	19.88	23.42	6,131.20	6,130.90	6,132.62	6,132.32	8.37
P-58	SDMH-11	SDMH-18	439.00	42 inch	1.06	0.013	6,130.70	6,128.50	65.24	103.54	6,119.85	6,115.20	6,121.87	6,117.22	11.38
P-61	SDMH-17	SDMH-12	170.00	42 inch	0.82	0.013	6,130.60	6,130.10	51.45	91.30	6,119.10	6,117.70	6,120.98	6,119.58	9.77
P-62	SDMH-12	SDMH-18	138.00	42 inch	0.83	0.013	6,130.10	6,128.50	52.85	91.84	6,117.50	6,116.35	6,119.40	6,118.25	9.88
P-65	SDIN-12	SDMH-12	28.00	18 inch	9.11	0.010	6,129.43	6,130.10	2.02	41.21	6,123.40	6,120.85	6,123.63	6,121.08	12.08
P-21	SDMH-15	SDMH-16	31.00	36 inch	1.13	0.010	6,128.30	6,128.60	30.69	92.13	6,122.00	6,121.65	6,123.19	6,122.94	11.72
P-59	SITE-3	SDIN-8	12.00	30 inch	2.08	0.013	6,130.00	6,128.28	21.01	59.20	6,122.70	6,122.45	6,123.73	6,123.48	11.03
P-60	SDIN-8	SDMH-16	10.00	30 inch	2.00	0.013	6,128.28	6,128.60	21.63	58.00	6,122.25	6,122.05	6,123.31	6,123.11	10.95

Scenario: 5-YEAR

Pipe Report

Label	Upstream Node	Downstream Node	Length (ft)	Section Size	Constructed Slope (%)	Mannings n	Upstream Ground Elevation (ft)	Downstream Ground Elevation (ft)	Total System Flow (cfs)	Full Capacity (cfs)	Upstream Invert Elevation (ft)	Downstream Invert Elevation (ft)	Hydraulic Grade Line In (ft)	Hydraulic Grade Line Out (ft)	Average Velocity (ft/s)
P-17	F-18 - Outfall 5	SDMH-13	84.00	36 inch	0.86	0.013	6,137.50	6,138.70	25.00	61.75	6,131.42	6,130.70	6,132.75	6,132.03	8.28
P-18	SDMH-13	SDIN-6	22.00	36 inch	1.36	0.013	6,138.70	6,138.40	25.00	77.88	6,130.50	6,130.20	6,131.67	6,131.37	9.81
P-19	SDIN-6	SDMH-14	91.00	36 inch	0.99	0.013	6,138.40	6,139.60	28.34	66.33	6,130.00	6,129.10	6,131.37	6,130.47	9.02
P-24	SDIN-7	SDMH-14	59.00	18 inch	2.54	0.013	6,139.50	6,139.60	2.60	16.75	6,134.60	6,133.10	6,135.00	6,133.50	6.88
P-68	SDMH-14	SDMH-26	353.00	36 inch	1.59	0.013	6,139.60	6,129.10	30.89	84.00	6,128.90	6,123.30	6,130.16	6,124.56	10.98
P-69	SDMH-26	SDMH-15	82.00	36 inch	1.10	0.013	6,129.10	6,128.30	30.73	69.87	6,123.10	6,122.20	6,124.49	6,123.59	9.57
P-70	SDMH-16	SDMH-25	127.00	42 inch	0.83	0.013	6,128.60	6,130.00	51.83	91.48	6,121.05	6,120.00	6,122.94	6,121.89	9.80
P-71	SDMH-25	SDMH-17	61.00	42 inch	0.82	0.013	6,130.00	6,130.60	51.57	91.08	6,119.80	6,119.30	6,121.69	6,121.19	9.76
P-72	SDMH-20	SDMH-23	80.00	48 inch	2.81	0.013	6,123.10	6,120.60	116.53	240.88	6,108.45	6,106.20	6,110.41	6,108.16	19.01
P-26	SDIN-14	J-19	90.00	30 inch	1.11	0.013	6,124.43	6,127.00	23.05	43.23	6,119.00	6,118.00	6,120.30	6,119.34	8.95
P-27	J-19	J-20	292.00	30 inch	0.99	0.013	6,127.00	6,126.40	22.90	40.87	6,118.00	6,115.10	6,119.34	6,116.44	8.56
P-28	J-20	J-21	130.00	30 inch	2.46	0.013	6,126.40	6,118.50	22.40	64.35	6,115.10	6,111.90	6,116.12	6,112.92	11.93
P-63	SITE-6	SDIN-13	13.00	24 inch	1.00	0.013	6,126.50	6,124.43	19.17	22.62	6,119.80	6,119.67	6,121.31	6,121.31	8.08
P-64	SDIN-13	SDIN-14	27.00	24 inch	0.74	0.013	6,124.43	6,124.43	22.32	19.47	6,119.40	6,119.20	6,121.31	6,121.04	7.10
P-73	J-21	SDMH-24	285.00	30 inch	3.44	0.013	6,118.50	6,116.00	22.24	76.06	6,111.90	6,102.10	6,112.83	6,103.03	13.45
P-74	SITE-5	SDMH-24	40.00	24 inch	10.00	0.013	6,121.00	6,116.00	14.37	71.53	6,106.10	6,102.10	6,106.71	6,102.71	17.80

Scenario: 100-YEAR

Junction Report

Label	Ground Elevation (ft)	Rim Elevation (ft)	Total Flow Out (cfs)	Invert Out Elevation (ft)	Invert In Elevation 1 (ft)	Invert In Elevation 2 (ft)	Invert In Elevation 3 (ft)	Hydraulic Grade Line In (ft)	Hydraulic Grade Line Out (ft)
SDMH-24	6,116.00	6,116.00	365.76	6,098.06	6,102.10	6,102.10	6,102.00	6,102.07	6,102.07
SDMH-23	6,120.60	6,120.60	304.69	6,106.00	6,106.20	6,108.50	N/A	6,109.54	6,109.54
SDMH-22	6,122.00	6,122.00	46.38	6,111.85	6,113.85	6,112.05	N/A	6,113.54	6,113.54
SDMH-21	6,123.70	6,123.70	19.45	6,117.30	6,117.50	N/A	N/A	6,120.41	6,120.41
SDMH-20	6,123.10	6,123.10	247.02	6,108.45	6,108.65	N/A	N/A	6,112.53	6,112.53
SDMH-19	6,125.40	6,125.40	247.44	6,111.15	6,115.30	6,111.35	N/A	6,115.26	6,115.26
SDMH-18	6,128.50	6,128.50	244.35	6,114.70	6,116.35	6,115.20	N/A	6,118.79	6,118.79
SDMH-11	6,130.70	6,130.70	139.40	6,119.85	6,120.05	N/A	N/A	6,127.22	6,127.22
SDMH-7	6,133.60	6,133.60	132.55	6,122.25	6,122.45	6,124.50	6,125.00	6,130.07	6,130.07
SDMH-6	6,134.60	6,134.60	84.34	6,123.10	6,123.30	N/A	N/A	6,130.87	6,130.87
SDMH-5	6,135.60	6,135.60	84.50	6,124.10	6,124.30	N/A	N/A	6,131.71	6,131.71
SDMH-4	6,136.70	6,136.70	84.69	6,125.20	6,125.40	6,129.20	N/A	6,132.69	6,132.69
SDMH-3	6,139.40	6,139.40	43.60	6,127.60	6,131.60	N/A	N/A	6,133.34	6,133.34
SDMH-2	6,152.10	6,152.10	43.65	6,145.00	6,145.20	N/A	N/A	6,146.10	6,146.10
SDMH-1	6,157.10	6,157.10	39.40	6,149.74	6,149.94	N/A	N/A	6,151.06	6,151.06
SDMH-8	6,132.80	6,132.80	3.00	6,125.75	6,125.95	N/A	N/A	6,130.11	6,130.11
SDMH-9	6,131.40	6,131.40	3.18	6,127.10	6,127.30	6,127.30	N/A	6,130.23	6,130.23
SDMH-12	6,130.10	6,130.10	109.80	6,117.50	6,120.85	6,117.70	N/A	6,121.33	6,121.33
SDMH-17	6,130.60	6,130.60	106.81	6,119.10	6,119.30	N/A	N/A	6,123.24	6,123.24
SDMH-25	6,130.00	6,130.00	107.02	6,119.80	6,120.00	N/A	N/A	6,123.93	6,123.93
SDMH-16	6,128.60	6,128.60	107.46	6,121.05	6,121.65	6,122.05	N/A	6,125.38	6,125.38
SDMH-15	6,128.30	6,128.30	65.69	6,122.00	6,122.20	N/A	N/A	6,125.56	6,125.56
SDMH-26	6,129.10	6,129.10	65.78	6,123.10	6,123.30	N/A	N/A	6,126.36	6,126.36
SDMH-14	6,139.60	6,139.60	66.04	6,128.90	6,133.10	6,129.10	N/A	6,130.90	6,130.90
SDMH-13	6,138.70	6,138.70	54.60	6,130.50	6,130.70	N/A	N/A	6,132.35	6,132.35
J-21	6,118.50	6,118.50	43.79	6,111.90	6,111.90	N/A	N/A	6,113.26	6,113.26
J-20	6,126.40	6,126.40	44.05	6,115.10	6,115.10	N/A	N/A	6,116.62	6,116.62
J-19	6,127.00	6,127.00	44.97	6,118.00	6,118.00	N/A	N/A	6,120.97	6,120.97

Scenario: 100-YEAR

Pipe Report

Label	Upstream Node	Downstream Node	Length (ft)	Section Size	Constructed Slope (%)	Mannings n	Upstream Ground Elevation (ft)	Downstream Ground Elevation (ft)	Total System Flow (cfs)	Full Capacity (cfs)	Upstream Invert Elevation (ft)	Downstream Invert Elevation (ft)	Hydraulic Grade Line In (ft)	Hydraulic Grade Line Out (ft)	Average Velocity (ft/s)
P-36	SDMH-24	O-1	175.00	72 inch	1.21	0.013	6,116.00	6,110.00	365.76	465.01	6,098.06	6,095.95	6,102.07	6,099.96	18.22
P-30	SITE-4	SDMH-22	42.00	24 inch	1.07	0.013	6,119.00	6,122.00	30.06	23.42	6,112.50	6,112.05	6,114.72	6,113.98	9.57
P-31	SDMH-22	SDIN-11	120.00	30 inch	2.00	0.013	6,122.00	6,119.75	46.38	58.00	6,111.85	6,109.45	6,113.54	6,111.77	13.13
P-42	SDIN-10	SDMH-21	27.00	18 inch	1.85	0.013	6,123.00	6,123.70	19.50	14.29	6,118.00	6,117.50	6,121.34	6,120.41	11.03
P-43	SDMH-21	SDMH-22	148.00	18 inch	2.33	0.013	6,123.70	6,122.00	19.45	16.04	6,117.30	6,113.85	6,120.41	6,115.33	11.01
P-66	SDIN-11	SDMH-23	38.00	30 inch	1.97	0.013	6,119.75	6,120.60	60.24	57.62	6,109.25	6,108.50	6,111.77	6,110.95	13.31
P-67	SDMH-23	SDMH-24	154.00	54 inch	2.60	0.013	6,120.60	6,116.00	304.69	316.91	6,106.00	6,102.00	6,109.54	6,105.54	22.69
P-39	SDMH-18	SDMH-19	120.00	48 inch	2.79	0.013	6,128.50	6,125.40	244.35	239.99	6,114.70	6,111.35	6,118.79	6,115.31	21.75
P-40	SDMH-19	SDMH-20	89.00	48 inch	2.81	0.013	6,125.40	6,123.10	247.44	240.73	6,111.15	6,108.65	6,115.26	6,112.62	21.80
P-41	SDIN-9	SDMH-19	28.00	18 inch	8.93	0.013	6,124.87	6,125.40	4.50	31.39	6,117.80	6,115.30	6,118.18	6,115.68	12.61
P-5	SDMH-4	SDMH-5	61.00	36 inch	1.48	0.013	6,136.70	6,135.60	84.69	81.01	6,125.20	6,124.30	6,132.69	6,131.71	11.98
P-6	SDMH-5	SDMH-6	52.00	36 inch	1.54	0.013	6,135.60	6,134.60	84.50	82.72	6,124.10	6,123.30	6,131.71	6,130.87	11.95
P-7	SDMH-6	SDMH-7	50.00	36 inch	1.30	0.013	6,134.60	6,133.60	84.34	76.04	6,123.10	6,122.45	6,130.87	6,130.07	11.93
P-8	SDMH-7	SDMH-10	52.00	42 inch	1.54	0.013	6,133.60	6,131.50	132.55	124.78	6,122.25	6,121.45	6,130.07	6,129.17	13.78
P-9	SDMH-10	SDMH-11	101.00	42 inch	1.19	0.013	6,131.50	6,130.70	139.89	109.66	6,121.25	6,120.05	6,129.17	6,127.22	14.54
P-16	SDIN-3	SDMH-4	41.00	24 inch	3.66	0.013	6,137.15	6,136.70	42.34	43.27	6,130.70	6,129.20	6,134.13	6,132.69	13.48
P-33	SITE-2	SDMH-7	29.00	24 inch	1.72	0.013	6,132.50	6,133.60	51.22	29.70	6,125.00	6,124.50	6,131.56	6,130.07	16.31
P-1	F-18 - Outfall 4	SDMH-1	105.00	36 inch	0.88	0.013	6,157.00	6,157.10	39.40	62.43	6,150.86	6,149.94	6,152.59	6,151.67	9.34
P-2	SDMH-1	SDIN-1	131.00	36 inch	2.17	0.013	6,157.10	6,153.40	39.40	98.20	6,149.74	6,146.90	6,151.06	6,148.22	13.13
P-3	SDIN-1	SDMH-2	56.00	36 inch	2.68	0.013	6,153.40	6,152.10	43.67	109.15	6,146.70	6,145.20	6,148.02	6,146.52	14.58
P-50	SDMH-2	SDMH-3	258.00	36 inch	5.19	0.013	6,152.10	6,139.40	43.65	152.00	6,145.00	6,131.60	6,146.10	6,133.34	18.57
P-51	SDMH-3	SDMH-4	153.00	36 inch	1.44	0.013	6,139.40	6,136.70	43.60	79.98	6,127.60	6,125.40	6,133.34	6,132.69	6.17
P-52	SDIN-5	SDMH-9	17.00	18 inch	1.18	0.013	6,131.17	6,131.40	1.88	11.39	6,127.50	6,127.30	6,130.23	6,130.23	1.06
P-53	SDIN-4	SDMH-9	17.00	18 inch	1.18	0.013	6,131.17	6,131.40	1.37	11.39	6,127.50	6,127.30	6,130.23	6,130.23	0.77
P-54	SDMH-9	SDMH-8	129.00	18 inch	0.89	0.013	6,131.40	6,132.80	3.18	9.92	6,127.10	6,125.95	6,130.23	6,130.11	1.80
P-55	SDMH-8	SDMH-7	45.00	18 inch	1.67	0.013	6,132.80	6,133.60	3.00	13.56	6,125.75	6,125.00	6,130.11	6,130.07	1.70
P-56	SITE-1	SDIN-2	13.00	24 inch	1.54	0.013	6,138.00	6,137.15	30.51	28.06	6,131.60	6,131.40	6,135.20	6,134.96	9.71
P-57	SDIN-2	SDIN-3	28.00	24 inch	1.07	0.013	6,137.15	6,137.15	39.12	23.42	6,131.20	6,130.90	6,134.96	6,134.13	12.45
P-58	SDMH-11	SDMH-18	439.00	42 inch	1.06	0.013	6,130.70	6,128.50	139.40	103.54	6,119.85	6,115.20	6,127.22	6,118.79	14.49
P-61	SDMH-17	SDMH-12	170.00	42 inch	0.82	0.013	6,130.60	6,130.10	106.81	91.30	6,119.10	6,117.70	6,123.24	6,121.33	11.10
P-62	SDMH-12	SDMH-18	138.00	42 inch	0.83	0.013	6,130.10	6,128.50	109.80	91.84	6,117.50	6,116.35	6,121.33	6,119.68	11.41
P-65	SDIN-12	SDMH-12	28.00	18 inch	9.11	0.010	6,129.43	6,130.10	4.16	41.21	6,123.40	6,120.85	6,123.72	6,121.33	14.95
P-21	SDMH-15	SDMH-16	31.00	36 inch	1.13	0.010	6,128.30	6,128.60	65.69	92.13	6,122.00	6,121.65	6,125.56	6,125.38	9.29
P-59	SITE-3	SDIN-8	12.00	30 inch	2.08	0.013	6,130.00	6,128.28	41.66	59.20	6,122.70	6,122.45	6,125.62	6,125.49	8.49
P-60	SDIN-8	SDMH-16	10.00	30 inch	2.00	0.013	6,128.28	6,128.60	42.79	58.00	6,122.25	6,122.05	6,125.49	6,125.38	8.72

Scenario: 100-YEAR

Pipe Report

Label	Upstream Node	Downstream Node	Length (ft)	Section Size	Constructed Slope (%)	Mannings n	Upstream Ground Elevation (ft)	Downstream Ground Elevation (ft)	Total System Flow (cfs)	Full Capacity (cfs)	Upstream Invert Elevation (ft)	Downstream Invert Elevation (ft)	Hydraulic Grade Line In (ft)	Hydraulic Grade Line Out (ft)	Average Velocity (ft/s)
P-17	F-18 - Outfall 5	SDMH-13	84.00	36 inch	0.86	0.013	6,137.50	6,138.70	54.60	61.75	6,131.42	6,130.70	6,133.61	6,132.89	9.86
P-18	SDMH-13	SDIN-6	22.00	36 inch	1.36	0.013	6,138.70	6,138.40	54.60	77.88	6,130.50	6,130.20	6,132.35	6,132.27	11.93
P-19	SDIN-6	SDMH-14	91.00	36 inch	0.99	0.013	6,138.40	6,139.60	61.09	66.33	6,130.00	6,129.10	6,132.27	6,131.37	10.65
P-24	SDIN-7	SDMH-14	59.00	18 inch	2.54	0.013	6,139.50	6,139.60	5.03	16.75	6,134.60	6,133.10	6,135.16	6,133.66	8.29
P-68	SDMH-14	SDMH-26	353.00	36 inch	1.59	0.013	6,139.60	6,129.10	66.04	84.00	6,128.90	6,123.30	6,130.90	6,126.36	13.16
P-69	SDMH-26	SDMH-15	82.00	36 inch	1.10	0.013	6,129.10	6,128.30	65.78	69.87	6,123.10	6,122.20	6,126.36	6,125.56	9.31
P-70	SDMH-16	SDMH-25	127.00	42 inch	0.83	0.013	6,128.60	6,130.00	107.46	91.48	6,121.05	6,120.00	6,125.38	6,123.93	11.17
P-71	SDMH-25	SDMH-17	61.00	42 inch	0.82	0.013	6,130.00	6,130.60	107.02	91.08	6,119.80	6,119.30	6,123.93	6,123.24	11.12
P-72	SDMH-20	SDMH-23	80.00	48 inch	2.81	0.013	6,123.10	6,120.60	247.02	240.88	6,108.45	6,106.20	6,112.53	6,110.17	21.82
P-26	SDIN-14	J-19	90.00	30 inch	1.11	0.013	6,124.43	6,127.00	45.26	43.23	6,119.00	6,118.00	6,122.07	6,120.97	9.22
P-27	J-19	J-20	292.00	30 inch	0.99	0.013	6,127.00	6,126.40	44.97	40.87	6,118.00	6,115.10	6,120.97	6,117.46	9.16
P-28	J-20	J-21	130.00	30 inch	2.46	0.013	6,126.40	6,118.50	44.05	64.35	6,115.10	6,111.90	6,116.62	6,113.42	14.12
P-63	SITE-6	SDIN-13	13.00	24 inch	1.00	0.013	6,126.50	6,124.43	37.86	22.62	6,119.80	6,119.67	6,123.45	6,123.08	12.05
P-64	SDIN-13	SDIN-14	27.00	24 inch	0.74	0.013	6,124.43	6,124.43	43.88	19.47	6,119.40	6,119.20	6,123.08	6,122.07	13.97
P-73	J-21	SDMH-24	285.00	30 inch	3.44	0.013	6,118.50	6,116.00	43.79	76.06	6,111.90	6,102.10	6,113.26	6,103.46	16.04
P-74	SITE-5	SDMH-24	40.00	24 inch	10.00	0.013	6,121.00	6,116.00	28.39	71.53	6,106.10	6,102.10	6,106.98	6,102.98	21.46

Detention Pond Volume Calculations

Equations:	$V = K(A)$	Calc. for required pond volume
	$K_{100} = [1.78(i)-0.002(i)^2-3.56] / 1000$	Calc. of constant for volume calculation per TOCR
	$K_{10} = [0.95(i)-1.90]/1000$	
	i = basin imperviousness (percent)	
	Required Storage = $.91*I^3-1.19*I^2+0.78I$	
	WQCV= (required storage)/12 x (basin area) x (1.2)	
	required storage from Urban Drainage Volume 3 Fig EDB-2 (ac-ft)	

	Area	Weighted I%	Req'd Storage (ft.)	WQCV (ac.ft.)
Onsite	44.70	94.26	0.440	1.967
Offsite-Outfall 4*	9.05	83.00	0.348	0.315
Offsite-Outfall 5*	43.64			0.78

** Outfall 4 and 5 area, imperviousness and storage WQCV per Phase III Drainage Report for Meadows Filing 18 by Engineering Partners, Inc. dated 9-28-04.*

Water Quality Control Volume

Onsite	WQCV=	1.967 ac-ft
Outfall 4 (Offsite)	WQCV=	0.315 ac-ft
Outfall 5(Offsite)	WQCV=	0.780 ac-ft
Total Offsite	WQCV=	1.095 ac-ft
Total	WQCV=	**3.062** ac-ft
	$K_{10}=$	0.088
	$V_{10}=$	3.918 ac-ft
	$V_{10}=$	170,654 c.f.
V_{10} + Total WQCV =		**6.979** ac-ft
V_{10} + Total WQCV =		**304,022** c.f.
	$K_{100}=$	0.146
	$V_{100}=$	**6.546** ac-ft
	$V_{100}=$	**285,154** c.f.
V_{100} + Offsite WQCV =		**7.641** ac-ft
V_{100} + Offsite WQCV =		**332,847** c.f.

Note: Water Quality volumes are permitted to be inclusive within the 100-year volume and additive to the 10-year volume per the TOCR PWR for regional facilities. However, when the already detained off-site basins are added to the on-site water quality volumes and 10-year detention volume, the total is greater than the 100-year volume and an outlet structure cannot be designed to provide a 10-year and 100-year release rate. Hence, it is proposed to "stack" the off-site water quality volume below the additive on-site water quality volume and 10-year storm elevation and below the 100-year detention volume. This allows the 100-year volume to remain larger than the additive 10-year and water quality volume and an outlet structure can be designed to release the 10-year and 100-year historic flows.

ONSITE WEIGHTED IMPERVIOUSNESS

LAND USE	AREA	IMP	WEIGHTED IMP.
A1	0.5	100.00%	0.50
B1	0.76	100.00%	0.76
D1	0.59	100.00%	0.59
E1	4.84	95.00%	4.60
E2	0.88	100.00%	0.88
E3	0.54	100.00%	0.54
G1	5.63	95.00%	5.35
G2	0.55	100.00%	0.55
H1	3.92	95.00%	3.72
H2	0.71	100.00%	0.71
H3	0.31	100.00%	0.31
I1	7.82	95.00%	7.43
I2	0.39	100.00%	0.39
J1	4.55	95.00%	4.32
J2	0.43	100.00%	0.43
J3	0.31	100.00%	0.31
K1	1.46	67.00%	0.98
K2	0.55	82.00%	0.45
K3	0.55	93.00%	0.51
K4	2.41	91.00%	2.19
K5	2.07	92.00%	1.90
L	4.55	95.00%	4.32
OS5a	0.16	100.00%	0.16
OS5b	0.22	100.00%	0.22
TOTAL=	44.70		
ONSITE % IMP. WEIGHTED=			94.26

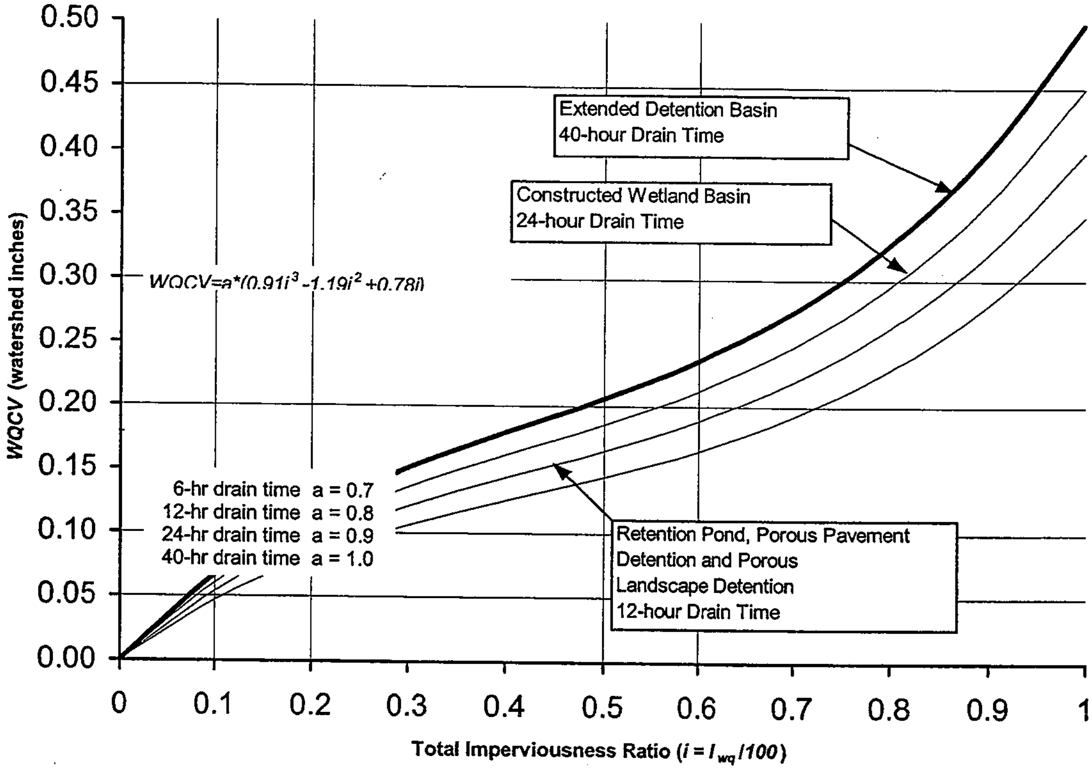


FIGURE EDB-2

Water Quality Capture Volume (WQCV), 80th Percentile Runoff Event

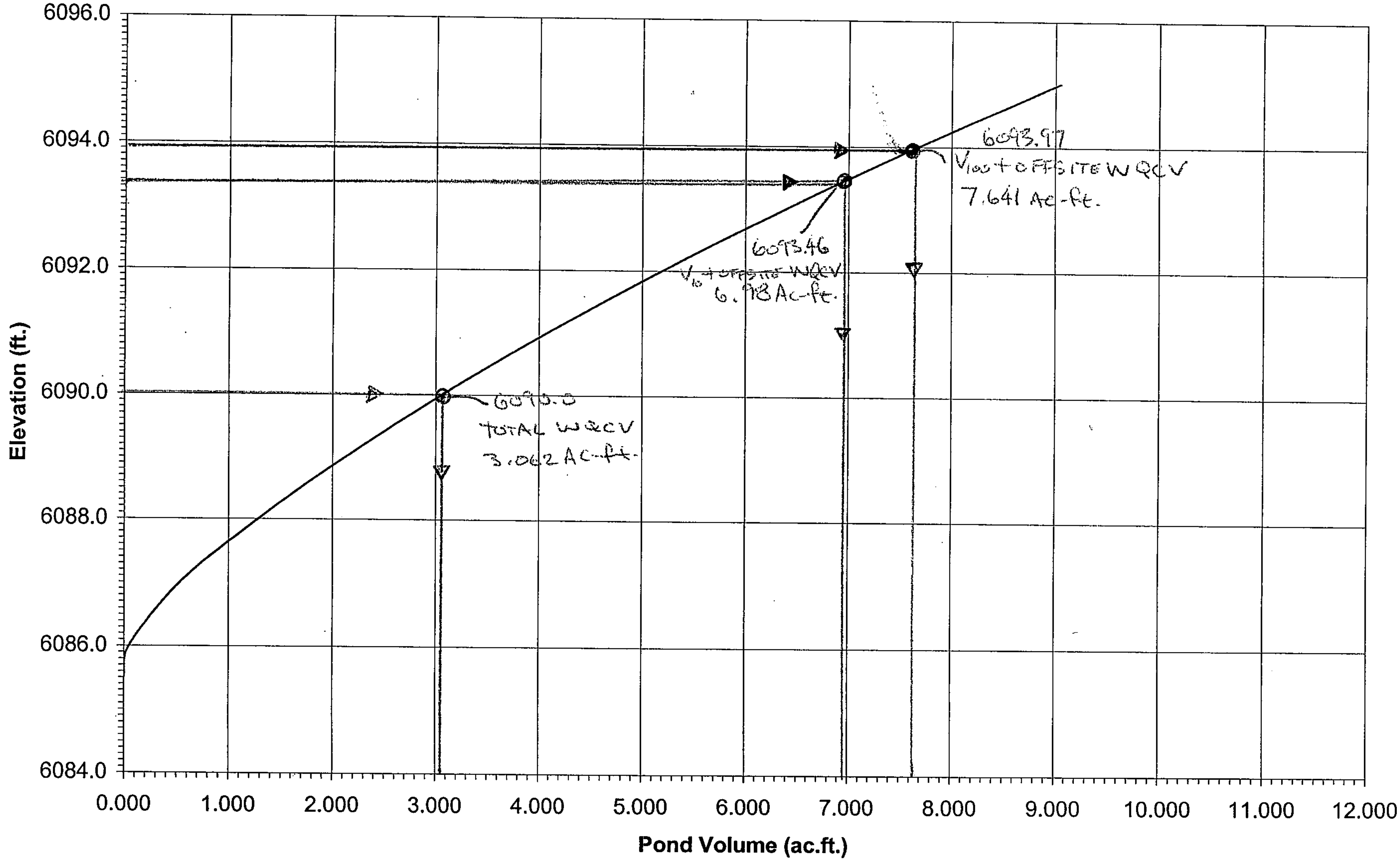
Pond Volume
(Conical Volume Method)

Project Name: Meadows Master Plan
Project No. 4811401
By: JDS
Checked By: AMV
Date: 2/7/2005

Volume=1/3 x Depth x (A+B+(A*B)^0.5)
A - Upper Surface
B - Lower Surface

Elevation	Surface Area (square feet)	A+B+(A*B)^0.5	1/3	Depth (feet)	Volume (cubic feet)	CumulativeVolume (cubic feet)	CumulativeVolume (acre feet)
6085.5	0	0	0	0.0	0	0	0.000
6086.0	12,891	12,891	4,297	0.5	2,149	2,149	0.049
6087.0	30,897	63,746	21,249	1.0	21,249	23,397	0.537
6088.0	34,447	97,968	32,656	1.0	32,656	56,053	1.287
6089.0	38,793	109,795	36,598	1.0	36,598	92,651	2.127
6090.0	42,741	122,253	40,751	1.0	40,751	133,402	3.062
6091.0	46,406	133,682	44,561	1.0	44,561	177,963	4.085
6092.0	50,171	144,828	48,276	1.0	48,276	226,239	5.194
6093.0	54,037	156,276	52,092	1.0	52,092	278,331	6.390
6094.0	58,003	168,025	56,008	1.0	56,008	334,339	7.675
6095.0	62,120	180,150	60,050	1.0	60,050	394,389	9.054

Regional Pond
Stage-Storage



Meadows
Project No. 04811401
2/4/2005

DETENTION POND RELEASE RATES

Project Name:	Meadows Master Plan
Project No.	4811401
By:	MRR
Checked By:	AMV
Date:	2/5/2005

$Q_{10R} = Q_{10} \times A$
$Q_{100R} = Q_{100} \times A$

CONTRIBUTING AREA =	44.7	**Ac.**
SOIL GROUP =	B	
Q_{10} RELEASE RATE MULTIPLIER=	0.23	
Q_{100} RELEASE RATE MULTIPLIER=	0.85	
Q_{10R} =	10.3	cfs.
Q_{100R} =	38.0	cfs.

10 year Outlet Design - Wier Calculation

Project Name: Meadows Master Plan
Project No. 4811401
Calculated By: MRR
Checked By: AMV
Date: 2/5/05

Rectangular Sharp-crested Weir Equation

$Q = CL^{1.02}H^{1.47}$ C=3.10

	10 yr. W.S.	WQCV W. S.	Allowable $Q_{10yr.}$ (cfs)	H (ft)	L (ft)
Regional Pond	6093.20	6089.85	10.3	3.35	0.59

100-Year Circular Orifice Sizing

Project Name:	Meadows Master Plan
Project No.	4811401
Calculated By:	MRR
Checked By:	AMV
Date:	02/05/05

100yr. Orifice Plate Sizing

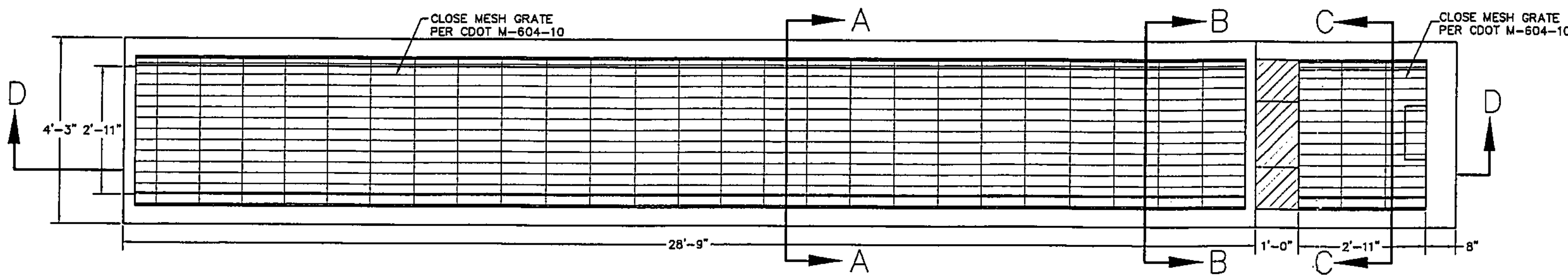
Flow Rate (Q) =	**38.00**	**cfs**
Overflow Crest Elevation =	**6094.00**	**feet**
Invert of Orifice =	**6084.20**	**feet**
Height of water surface = to invert of orifice (Y)	9.80	feet
Diameter of Orifice (D) =	1.75	feet
Height of water surface = to centroid of orifice (h)	9.80	feet
C_d =	0.65	for circular orifices
g =	32.20	ft/s^2

Orifice Equation:

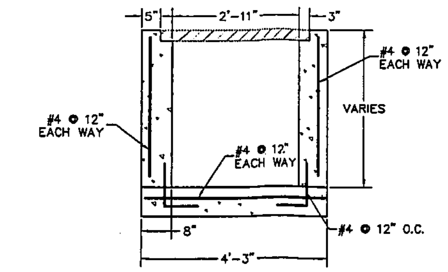
$$Q = C_d*A*(2gh)^{1/2}$$
$$Q = C_d*3.1415*D^2/4*(2gh)^{1/2}$$
$$Q = 0.65*3.1415*D^2/4*(2*32.2*h)^{1/2}$$
$$D = (Q/(.5105*(64.4*h)^{1/2}))^{1/2}$$

Calculation Table for Orifice Size

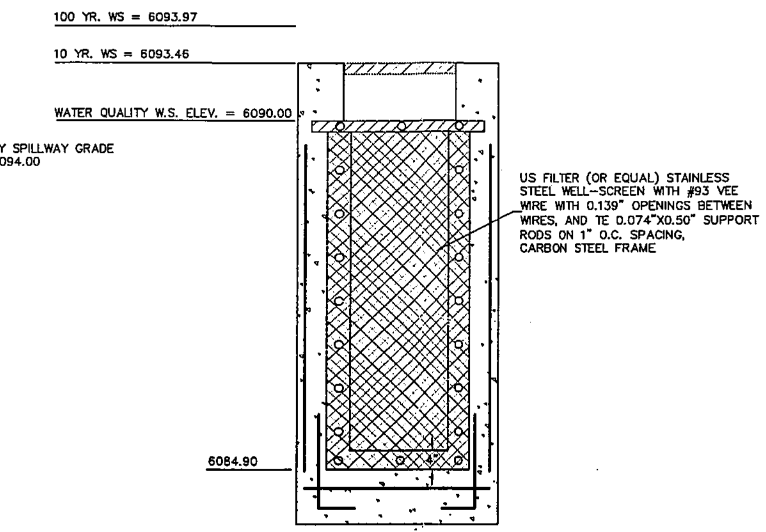
%	h = %*Y	Diam. (D)	Actual h	h/Y
98%	9.60	1.73	8.94	91%
97%	9.51	1.73	8.93	91%
96%	9.41	1.74	8.93	91%
95%	9.31	1.74	8.93	91%
94%	9.21	1.75	8.93	91%
93%	9.11	1.75	8.92	91%
92%	9.02	1.76	8.92	91%
91%	8.92	1.76	8.92	91%
90%	8.82	1.77	8.92	91%
89%	8.72	1.77	8.91	91%
88%	8.62	1.78	8.91	91%
87%	8.53	1.78	8.91	91%
86%	8.43	1.79	8.91	91%
85%	8.33	1.79	8.90	91%
84%	8.23	1.80	8.90	91%
83%	8.13	1.80	8.90	91%
82%	8.04	1.81	8.90	91%
81%	7.94	1.81	8.89	91%
80%	7.84	1.82	8.89	91%
79%	7.74	1.83	8.89	91%
78%	7.64	1.83	8.88	91%



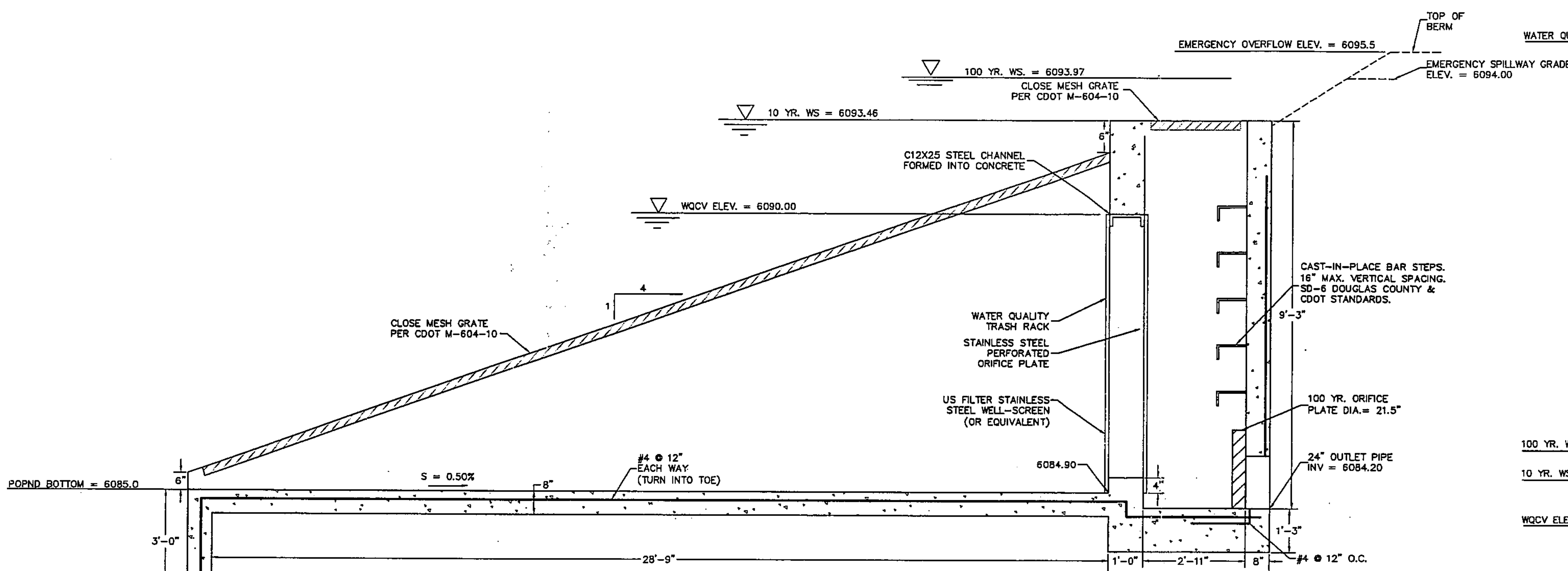
PLAN VIEW
NTS



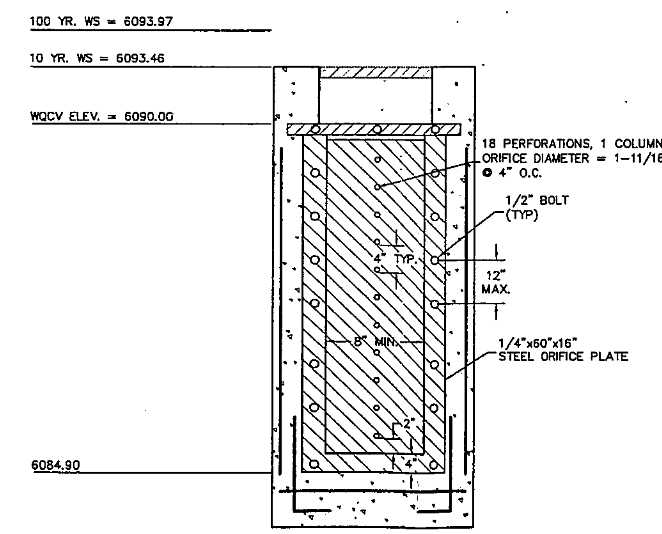
SECTION A-A
NTS



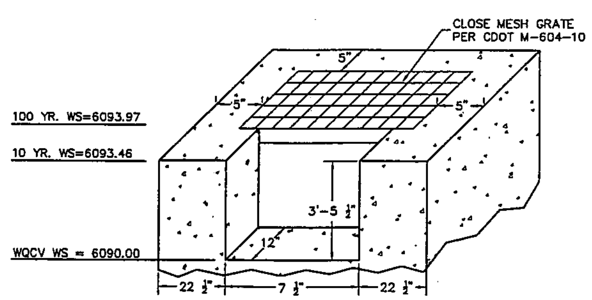
SECTION B-B
NTS



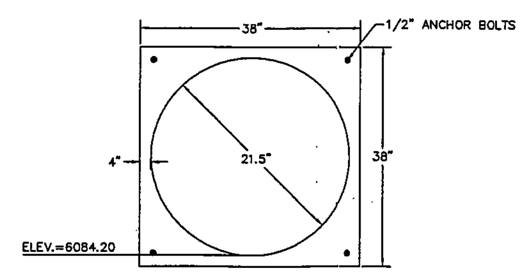
SECTION D-D
NTS



SECTION C-C
NTS



10 YR. RECTANGULAR WEIR
NTS



100 YR. ORIFICE PLATE
NTS

I HEREBY AFFIRM THAT THESE FINAL CONSTRUCTION PLANS WERE PREPARED UNDER MY DIRECT SUPERVISION, IN ACCORDANCE WITH ALL APPLICABLE TOWN OF CASTLE ROCK AND STATE OF COLORADO STANDARDS AND STATUTES, RESPECTIVELY; AND THAT I AM FULLY REPONSIBLE FOR ALL DESIGN AND REVISIONS RELATIVE TO SAID PLANS.

KURT A. LANG, COLORADO P.E. 32249 DATE

TOWN OF CASTLE ROCK APPROVALS
THESE PLANS ARE HEREBY APPROVED FOR ONE YEAR FROM DATE OF DEVELOPMENT SERVICES DIRECTOR APPROVAL

RECOMMEND APPROVAL BY:

ENGINEERING DIVISION DATE

APPROVED BY:

DEVELOPMENT SERVICES DIRECTOR DATE

No.	Revisions	Date	Init.	Appr.	Date
1	ISSUED FOR CONSTRUCTION	02/15/05	KAL		

CVL CONSULTANTS OF COLORADO, INC.
CIVIL ENGINEERING · LAND SURVEYING · LAND PLANNING
7901 E. Belleview Avenue, Suite 150
Englewood, CO 80111
Tel: (720) 482-9526
Fax: (720) 482-9546

CASTLE ROCK LAND COMPANY
3033 EAST 1ST AVENUE, #410
DENVER, CO 80206

THE MEADOWS FILING 17
LOT 5 AND 6
DETENTION POND DETAIL SHEET

SCALE: AS SHOWN
FILE NO: 04811401
DRAWN BY: ACS
CHECKED BY: AMZ
DATE: FEB.15, 2004

SHEET NUMBER 17

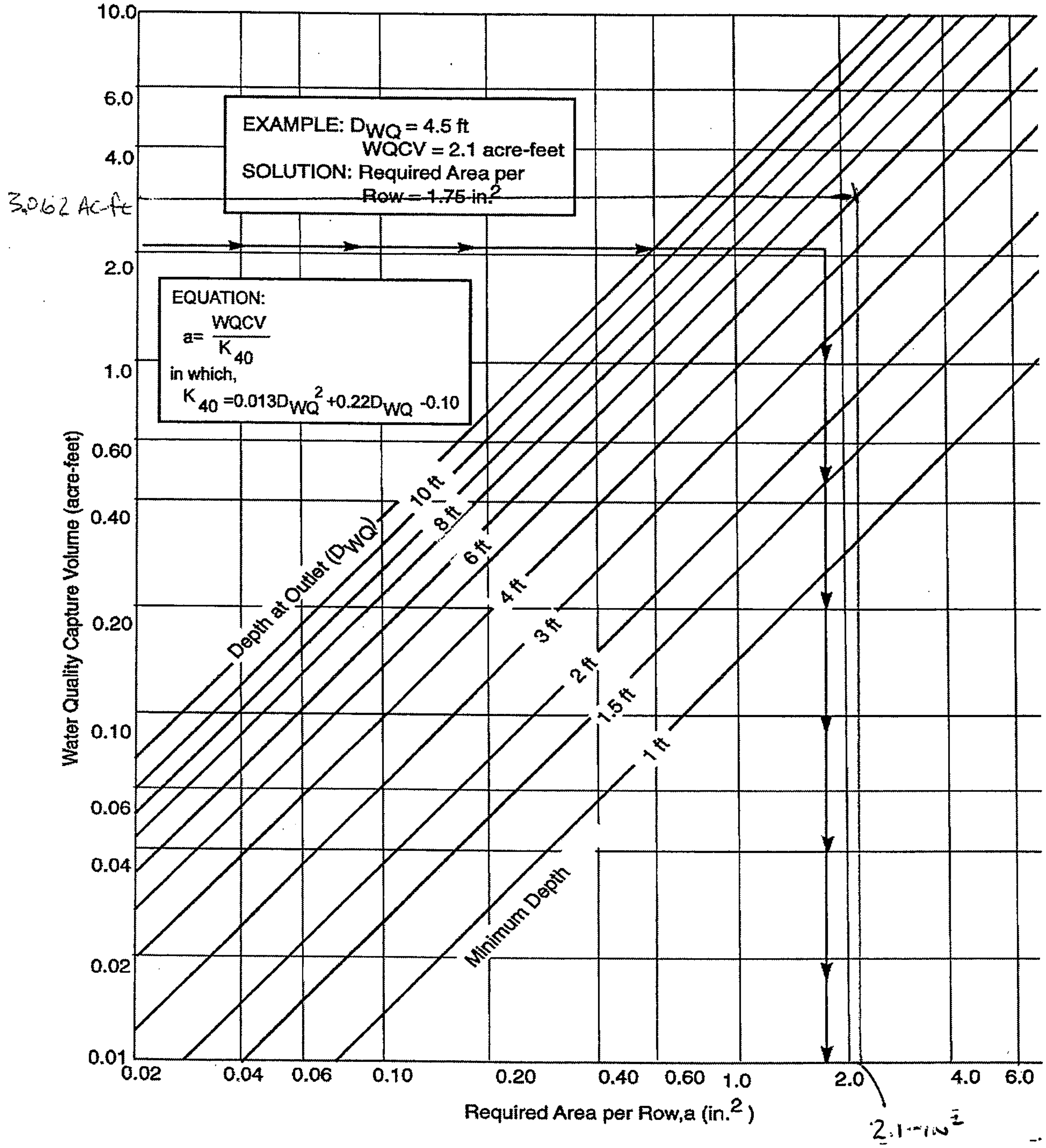


FIGURE EDB-3

Water Quality Outlet Sizing:
Extended Detention Basin (Dry) With 40-hour Drain Time for Capture Volume

Orifice Plate Perforation Sizing

Circular Perforation Sizing

Chart may be applied to orifice plate or vertical pipe outlet.

Hole Dia (in) *	Hole Dia (in)	Min. Sc (in)	Area per Row (sq in)		
			n=1	n=2	n=3
1/4	0.250	1	0.05	0.10	0.15
5/16	0.313	2	0.08	0.15	0.23
3/8	0.375	2	0.11	0.22	0.33
7/16	0.438	2	0.15	0.30	0.45
1/2	0.500	2	0.20	0.39	0.59
9/16	0.563	3	0.25	0.50	0.75
5/8	0.625	3	0.31	0.61	0.92
11/16	0.688	3	0.37	0.74	1.11
3/4	0.750	3	0.44	0.88	1.33
13/16	0.813	3	0.52	1.04	1.56
7/8	0.875	3	0.60	1.20	1.80
15/16	0.938	3	0.69	1.38	2.07
1	1.000	4	0.79	1.57	2.36
1 1/16	1.063	4	0.89	1.77	2.66
1 1/8	1.125	4	0.99	1.99	2.98
1 3/16	1.188	4	1.11	2.22	3.32
1 1/4	1.250	4	1.23	2.45	3.68
1 5/16	1.313	4	1.35	2.71	4.06
1 3/8	1.375	4	1.48	2.97	4.45
1 7/16	1.438	4	1.62	3.25	4.87
1 1/2	1.500	4	1.77	3.53	5.50
1 9/16	1.563	4	1.92	3.83	5.75
1 5/8	1.625	4	2.07	4.15	6.22
1 11/16	1.688	4	2.24	4.47	6.71
1 3/4	1.750	4	2.41	4.81	7.22
1 13/16	1.813	4	2.58	5.16	7.74
1 7/8	1.875	4	2.76	5.52	8.28
1 15/16	1.938	4	2.95	5.90	8.84
2	2.000	4	3.14	6.28	9.42
n = Number of columns of perforations					
Minimum steel plate thickness			1/4 "	5/16 "	3/8 "

USE 1-11/16 ϕ

* Designer may interpolate to the nearest 32nd inch to better match the required area, if desired.

Rectangular Perforation Sizing

Only one column of rectangular perforations allowed.

Rectangular Height = 2 inches

$$\text{Rectangular Width (inches)} = \frac{\text{Required Area per Row (sq in)}}{2''}$$

Rectangular Hole Width	Min. Steel Thickness
5"	1/4 "
6"	1/4 "
7"	5/32 "
8"	5/16 "
9"	11/32 "
10"	3/8 "
>10"	1/2 "

Urban Drainage and Flood Control District Drainage Criteria Manual (V.3) File: V3-Outlet Details.dwg	Figure 5 WQCV Outlet Orifice Perforation Sizing

Figure 5. WQCV Outlets Orifice Perforation Sizing.

Emergency Spillway Weir Calculations

Project Name:	Meadows Master Plan
Project No.	4811401
Calculated By:	MRR
Checked By:	AMV
Date:	2/5/05

Weir Equation:

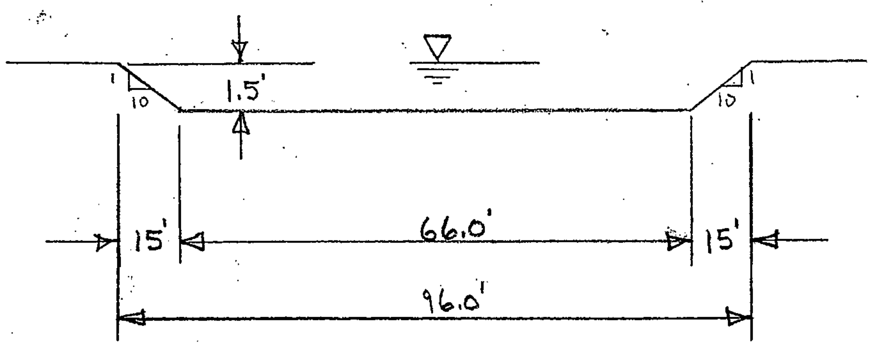
$Q = C*L*(H)^{3/2}$

$C_d =$ 3.10

Note: Weirs are designed to pass the developed 100yr. tributary flow. (Refer to SF-3 form)

Pond Emergency Spillway

Flow Rate $Q_{100yr.}$ =	**374 cfs**	Developed Flow
Top of Berm Elevation =	**6095.50 feet**	**Freeboard = 1.50**
Overflow Crest Elevation =	**6094.00 feet**	
Height (H)=	**1.50** feet	
Length (D) =	65.58 feet	



OUTLET STRUCTURE
DESIGN WORKSHEET

Detention Pond - Emergency Spillway

UDFCD SPREADSHEET

RIPRAP CHANNEL DESIGN

A. Design Information

Channel Invert Slope	So =	0.1000	ft/ft
Bottom Width	B =	66.00	ft
Left Side Slope	Z1 =	10.00	ft/ft
Right Side Slope	Z2 =	10.00	ft/ft
Design Flow rate	Q=	373.5	cfs
Specific Weight of Rock	Ss =	2.50	

Design Gudeline:

Range of Resistance: K	Riprap
1.50 to 4.00	VL
4.00 to 5.00	L
5.00 to 5.80	M
5.80 to 7.10	H
7.10 to 8.20	VH

B. Determination of Riprap Roughness

Intermediate Rock Diameter	D50=	12.00	inches	**Guess**
Calculated Manning's N	N =	0.0395		

USE STANDARD TYPE-M

C. Flow Condition

Water Depth	Y =	1.47	ft	**Guess**
Top Width	T=	0.66	ft	
Flow Area	A=	49.00	sq ft	
Wetted Perimeter	P=	95.55	ft	
Hydraulic Radius	R=	0.51	ft	
Flow Velocity	U=	7.64	fps	
Hydraulic Depth	D=	74.12	ft	
Froude Number	Fr =	0.16		
Difference in Q	dQ=	0.89	cfs	**Check if dQ=0**

D. Check on Rock Size for Riprap

Resistance Indicator	K=	3.95	**Check**	**If K is not within the range for the sele enter another D50 to calculate K agair**

Trickle Channel Capacity
Worksheet for Trapezoidal Channel

Project Description	
Worksheet	Trapezoidal Cha
Flow Element	Trapezoidal Cha
Method	Manning's Formı
Solve For	Channel Depth

Input Data		
Mannings Coeffic	0.030	
Channel Slope	005000	ft/ft
Left Side Slope	4.00	H : V
Right Side Slope	4.00	H : V
Bottom Width	0.00	ft
Discharge	3.70	cfs

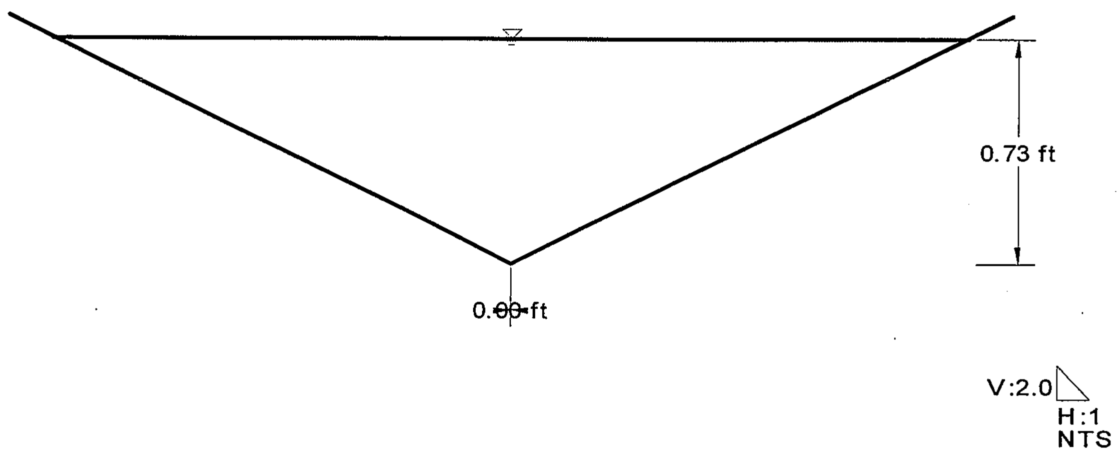
Results		
Depth	0.73	ft
Flow Area	2.1	ft²
Wetted Perim	6.00	ft
Top Width	5.82	ft
Critical Depth	0.56	ft
Critical Slope	0.020920	ft/ft
Velocity	1.75	ft/s
Velocity Head	0.05	ft
Specific Enerç	0.77	ft
Froude Numb	0.51	
Flow Type	Subcritical	

Notes: 1% of 100-year = 3.7 cfs

Trickle Channel X-section
Cross Section for Trapezoidal Channel

Project Description	
Worksheet	Trapezoidal Cha
Flow Element	Trapezoidal Cha
Method	Manning's Formı
Solve For	Channel Depth

Section Data		
Mannings Coeffic	0.030	
Channel Slope	005000	ft/ft
Depth	0.73	ft
Left Side Slope	4.00	H : V
Right Side Slope	4.00	H : V
Bottom Width	0.00	ft
Discharge	3.70	cfs



Outlet Protection Riprap Sizing

February 7, 2005

Calculated By: MEL
Location: Pond Outlet
Flow Rate: $Q(100) =$ 38.0 cfs
Pipe Diameter: $D =$ 2.0 ft.
supercritical flow: $Da=0.5(D+Y_n)=$ 2.0 ft
Critical Depth: $Y_n=$ 1.94 ft
Tailwater Depth: $Y_t =$ 0.59 ft.
Allowable Velocity: $V=$ 12.2 ft/sec.

$Y_t/D =$ = 0.30
$Y_t/D_a =$ = 0.30

Q/D_a^1.5 = 13.7

Q/D_a^2.5 = 7.0

From Figure MD-21 use riprap type: H

From Table MD-10: (d50) = 18 in = 1.50 ft.

From Figure 10-23 (1/2 tan θ): 0.9

req. area of flow = $A_t = Q/V =$ 3.11 s.f.

$L = (1/2 \tan\theta)*(A_t/Y_t - D_a) =$ 2.98 ft.

Minimum Length (ft) = 3(D) = 6.0 ft.

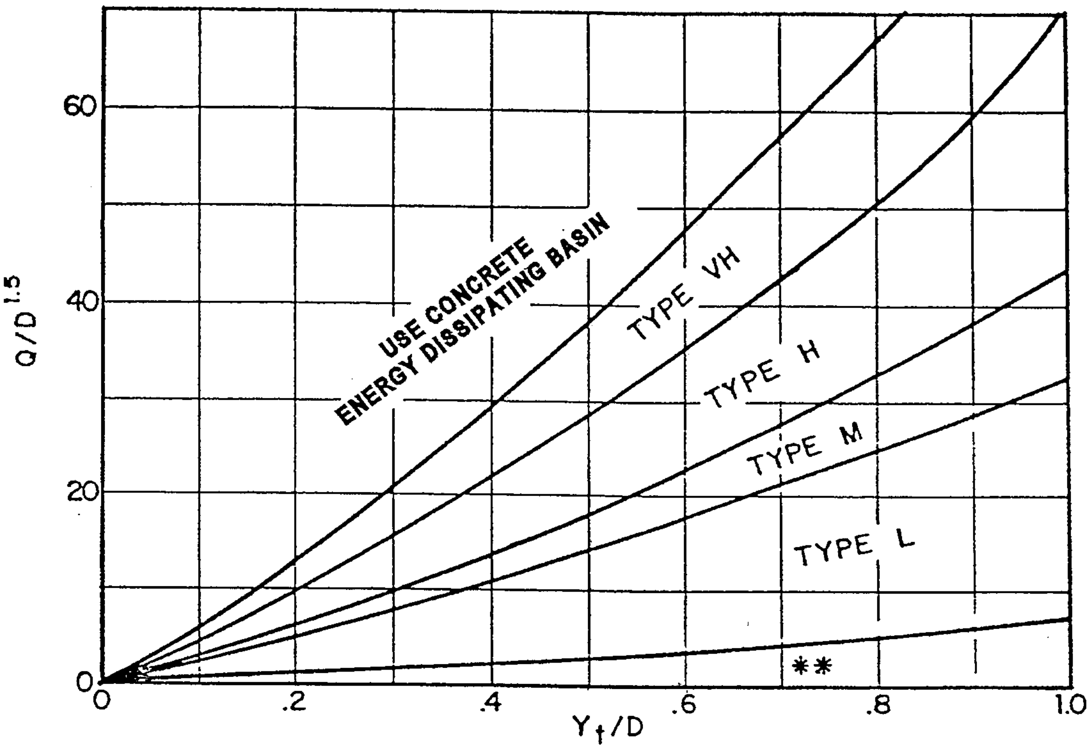
Width (ft) = = 6.0

Depth (ft) = 1.5*d50= 2.3

Volume: 3.0 c.y.

Select Type H Rip-Rap with 6" Granular Bedding.
Bury with 4" topsoil, and reseed or resod.

Length=	**6.00 ft.**
Width=	**6.00 ft**
Depth=	**2.25 ft**



Use D_a instead of D whenever flow is supercritical in the barrel.
** Use Type L for a distance of 3D downstream.

FIGURE MD-21

Riprap Erosion Protection at Circular Conduit Outlet Valid for $Q/D^{2.5} \leq 6.0$

S = longitudinal channel slope (ft/ft)

d_{50} = mean rock size (ft)

G_s = specific gravity of stone (minimum = 2.50)

Note that Equation MD-13 is applicable for sizing riprap for channel lining. This equation is not intended for use in sizing riprap for rundowns or culvert outlet protection. Information on rundowns is provided in Section 7.0 of the HYDRAULIC STRUCTURES chapter of this *Manual*, and protection downstream of culverts is discussed in Section 7.0 of this chapter, as well as in the HYDRAULIC STRUCTURES chapter, Section 3.0.

Table MD-10 shall be used to determine the minimum size of rock type required. Note that rock types for ordinary riprap, including gradation, are presented in Table MD-7 and Figure MD-11.

TABLE MD-10

Riprap Requirements for Channel Linings*

$\dfrac{VS^{0.17}}{(G_s-1)^{0.66}}$ **	Rock Type
< 3.3	VL** (d_{50} = 6 inches)
≥ 3.3 to < 4.0	L** (d_{50} = 9 inches)
≥ 4.0 to < 4.6	M (d_{50} = 12 inches)
≥ 4.6 to < 5.6	H (d_{50} = 18 inches)
≥ 5.6 to 6.4	VH (d_{50} = 24 inches)

* Applicable only for a Froude number of < 0.8 and side slopes no steeper than 2H:1V.

** Use G_s = 2.5 unless the source of rock and its density are known at time of design.

Table MD-10 indicates that rock size does not need to be increased for steeper channel side slopes, provided the side slopes are no steeper than 2H:1V (District 1982). Rock-lined side slopes steeper than 2H:1V are considered unacceptable under any circumstances because of stability, safety, and maintenance considerations. Proper bedding is required both along the side slopes and the channel bottom for a stable lining. The riprap blanket thickness should be at least 1.75 times d_{50} (at least 2.0 times d_{50} in sandy soils) and should extend up the side slopes at least 1 foot above the design water surface. At the upstream and downstream termination of a riprap lining, the thickness should be increased 50% for at least 3 feet to prevent undercutting.

4.4.2.4 Riprap Toes. Where only the channel sides are to be lined, additional riprap is needed to provide for long-term stability of the lining. In this case, the riprap blanket should extend at least 3 feet below the channel thalweg (invert), and the thickness of the blanket below the existing channel bed

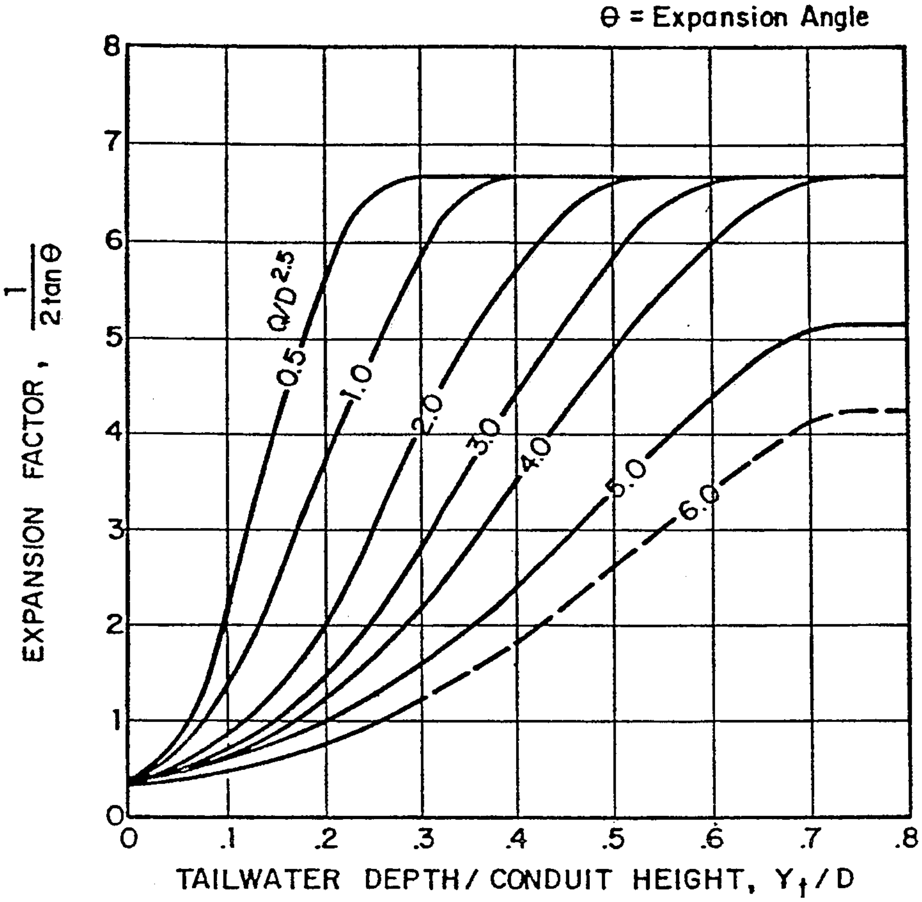
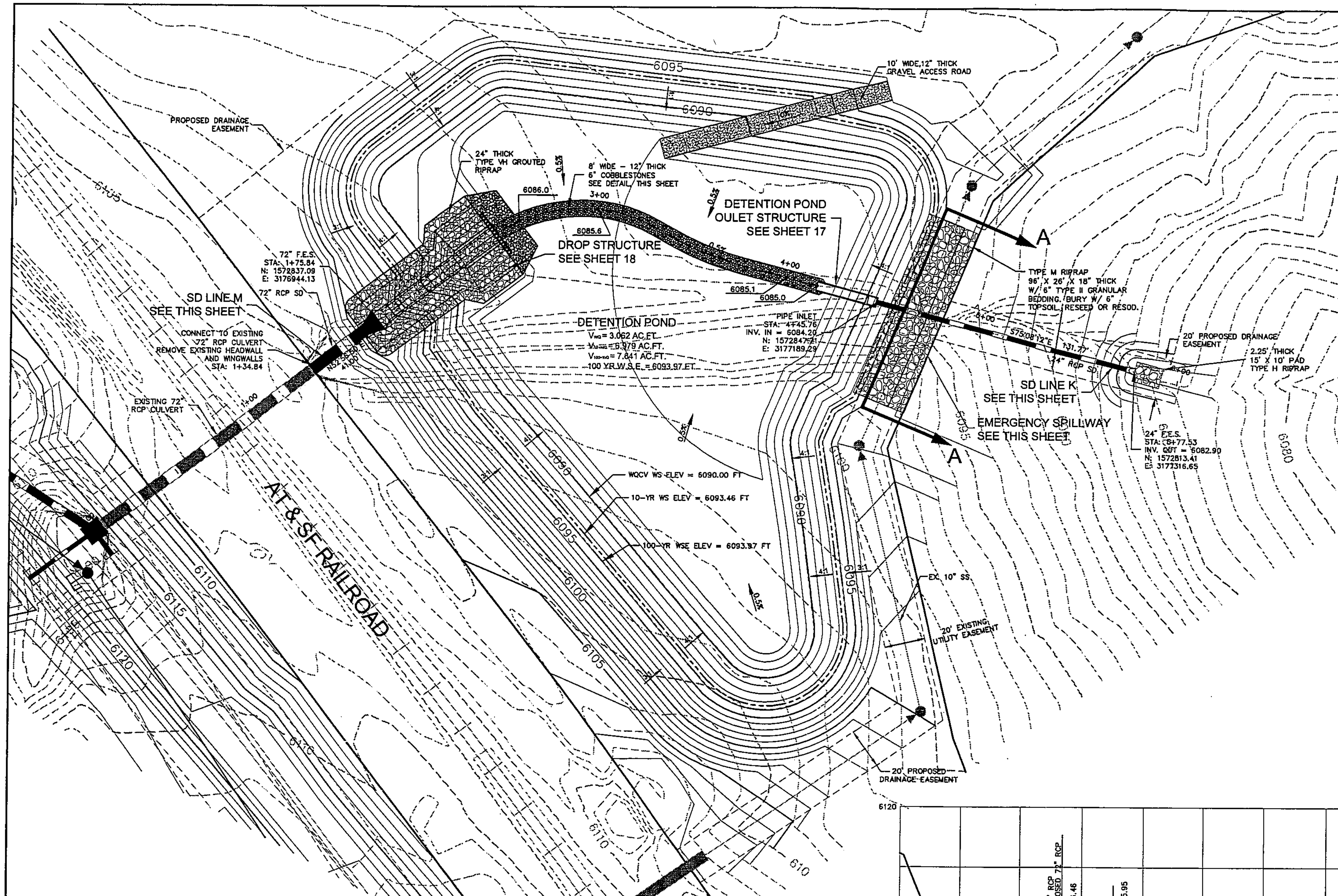


FIGURE MD-23

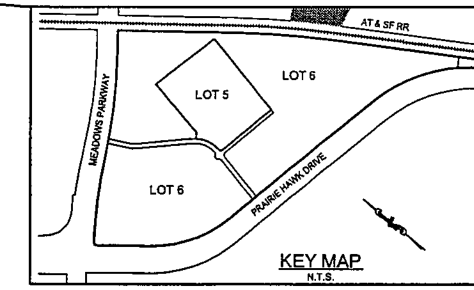
Expansion Factor for Circular Conduits



PLAN: DETENTION POND

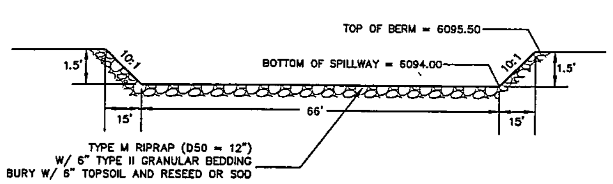
HORIZONTAL SCALE: 1" = 30'

SCALE: 1" = 30'



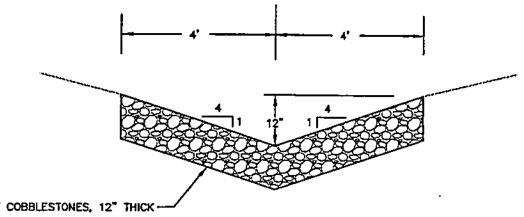
KEY MAP

N.T.S.



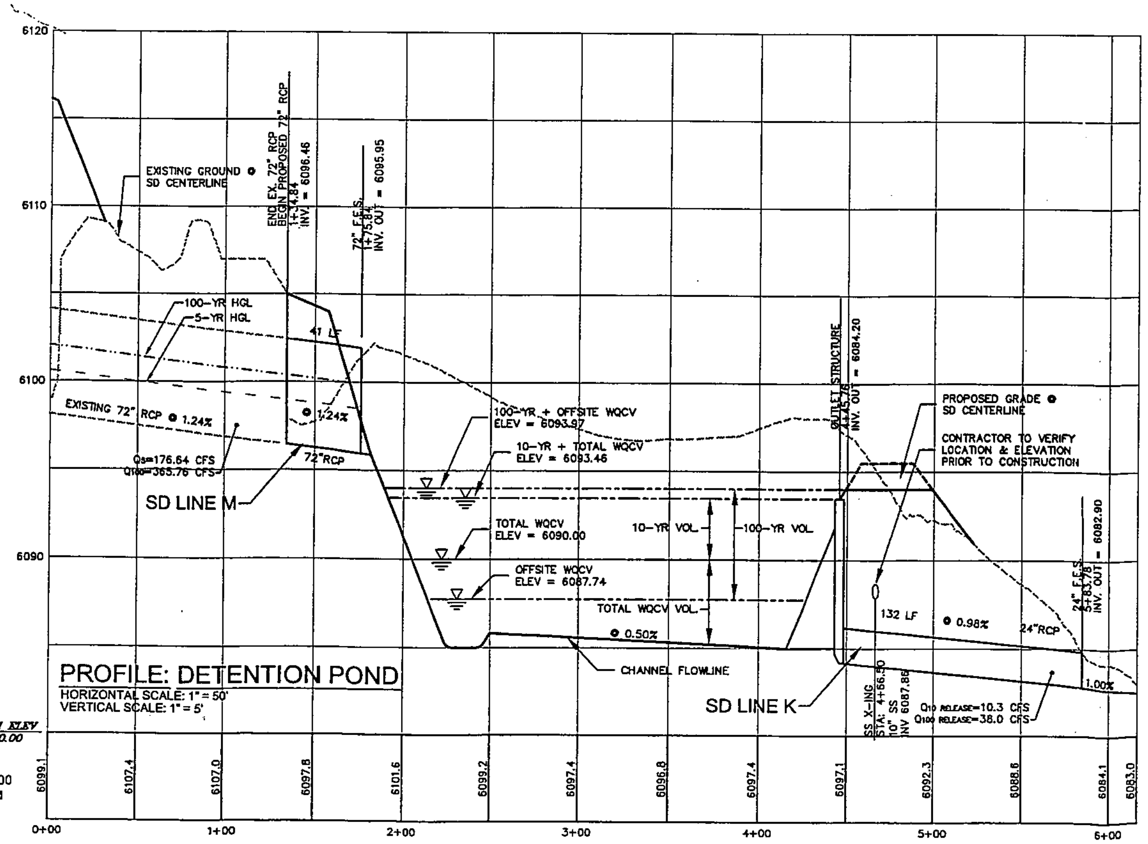
EMERGENCY SPILLWAY SECTION A-A

N.T.S.



COBBLESTONE TRICKLE CHANNEL

N.T.S.



PROFILE: DETENTION POND

HORIZONTAL SCALE: 1" = 50'
VERTICAL SCALE: 1" = 5'

SCALE: 1" = 50'

CALL UNCC
TWO WORKING DAYS
BEFORE YOU DIG
1-800-922-1987
534-6700 METRO DENVER AREA
UTILITY NOTIFICATION CENTER OF COLORADO

LEGEND

- EXISTING FIRE HYDRANT
- EXISTING VALVE
- PROPOSED VALVE
- EXISTING MANHOLE
- PROPOSED MANHOLE
- EXISTING LIGHT STANDARD
- EXISTING FENCE
- EXISTING ELECTRIC LINE
- EXISTING TELEPHONE LINE
- EXISTING GAS LINE
- EXISTING SANITARY LINE
- PROPOSED SANITARY LINE
- EXISTING WATER/FIRE LINE
- PROPOSED WATERLINE
- EXISTING STORM DRAINAGE LINE
- EXISTING POWER POLE W/ O.H. LINES
- PROPERTY LINE
- EXISTING MAJOR CONTOURS
- PARCEL BOUNDARY
- EXISTING R.R. TRACKS
- LIMITS OF GRADING

I HEREBY AFFIRM THAT THESE FINAL CONSTRUCTION PLANS WERE PREPARED UNDER MY DIRECT SUPERVISION, IN ACCORDANCE WITH ALL APPLICABLE TOWN OF CASTLE ROCK AND STATE OF COLORADO STANDARDS AND STATUTES, RESPECTIVELY; AND THAT I AM FULLY REPONSIBLE FOR ALL DESIGN AND REVISIONS RELATIVE TO SAID PLANS.

KURT A. LANG, COLORADO P.E. 32249 DATE

TOWN OF CASTLE ROCK APPROVALS
THESE PLANS ARE HEREBY APPROVED FOR ONE YEAR FROM DATE OF DEVELOPMENT SERVICES DIRECTOR APPROVAL

RECOMMEND APPROVAL BY:

ENGINEERING DIVISION DATE

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DEVELOPMENT SERVICES DIRECTOR DATE

No.	Revisions	Date	Init.	Appr.	Date
1	ISSUED FOR CONSTRUCTION	02/15/05	KAL		

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3033 EAST 1ST AVENUE, #410
DENVER, CO 80206

THE MEADOWS FILING 17
LOT 5 AND 6
DETENTION POND GRADING

DRAWN BY: ACS
CHECKED BY: AMZ
DATE: FEB.15, 2004
SCALE: AS SHOWN
FILE NO: 04811401

SHEET NUMBER 16

GROUTED SLOPING BOULDER DROP

DESIGN FORM

Project: Meadows - Filing 17 - Lot 5 & 6
Location: Regional Detention Pond - 72" Outfall
Designer: AMZ
Date: 2/6/2005

GSB drop height= 11.5 ft

1. Determine the critical velocity (Vcr)

Vcr = 7.5 ft/s   see attached Critical Flow Analysis worksheet

2. Calculate rock-sizing parameter:

$$Rp = \frac{Vcr*S\text{^}0.17}{(Ss-1)\text{^}0.66}$$

For: S is longitudinal slope along direction of flow
Ss is Specific gravity of rock

Given: Ss = 2.55
Slope = 0.25

Rp = 4.44

Use Table HS-5, from UD Vol 2
to determine GSB boulder size

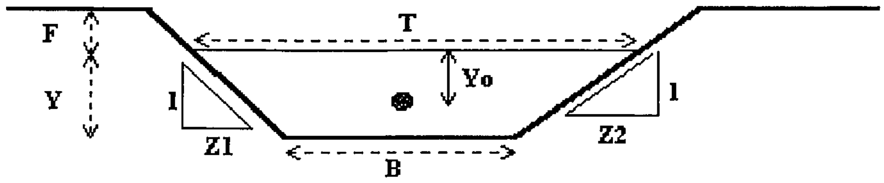
Use B24 - 24" boulders

3. Per Table HS-4, from UD Vol 2, to determine GSB parameters

	Urban Drainage Criteria	GSB Design
Design Parameter	Drop height greater then 5 feet	11.5' drop
Maximum drop slope	4H to 1V	4:1
Minimum boulder depth, Dr	Use Vcr to size	24"
Grout Thickness - Dg	1/2 Dr	12"
Basin Depression	Sequential depth analysis	2'
Basin width	Erosive = 20' Non-erosive = 15'	20'
Other provisions	A buried zone should be installed for 2*Hd (10' min)	10' buried zone

Critical Flow Analysis - Trapezoidal Channel

Project:
Channel ID:



Design Information (Input)			
Bottom Width	B =	6.0	ft
Left Side Slope	Z1 =	4.0	ft/ft
Right Side Slope	Z2 =	4.0	ft/ft
Design Discharge	Q=	365.8	cfs

Critical Flow Condition (Calculated)			
Critical Flow Depth	**Y=**	**2.83**	ft
Critical Flow Area	A =	49.0	sq ft
Critical Top Width	T=	28.6	ft
Critical Hydraulic Depth	D =	1.7	ft
Critical Flow Velocity	V=	7.5	fps
Froude Number	**Fr =**	**1.0**	
Critical Wetted Perimeter	P=	29.3	ft
Critical Hydraulic Radius	R=	1.7	ft
Critical (min) Specific Energy	Esc=	3.7	ft
Centroid on the Critical Flow Area	Yoc=	0.8	ft
Critical (min) Specific Force	Fsc=	7.7	kip

TABLE HS-5

Boulder Sizes for Various Rock Sizing Parameters

Rock Sizing Parameter, R_p	Minimum Dimensions of Boulder, D_B	Boulder Classification
Less than 4.50	18 inches	B18
4.50 to 4.99	24 inches	B24
5.00 to 5.59	30 inches	B30
5.60 to 6.39	36 inches	B36
6.40 to 6.99	42 inches	B42
7.00 to 7.50	48 inches	B48

GSB CROSS-SECTION
Worksheet for Trapezoidal Channel

Project Description	
Worksheet	Trapezoidal Channe
Flow Element	Trapezoidal Channe
Method	Manning's Formula
Solve For	Channel Depth

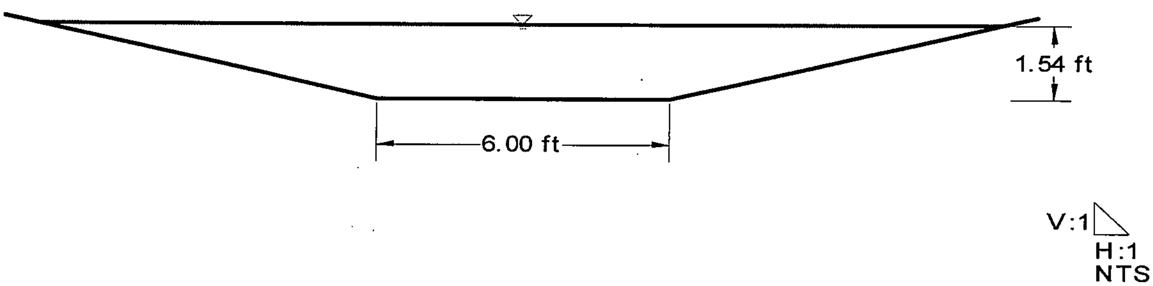
Input Data		
Mannings Coeffic	0.040	
Channel Slope	250000	ft/ft
Left Side Slope	4.50	H : V
Right Side Slope	4.50	H : V
Bottom Width	6.00	ft
Discharge	365.80	cfs

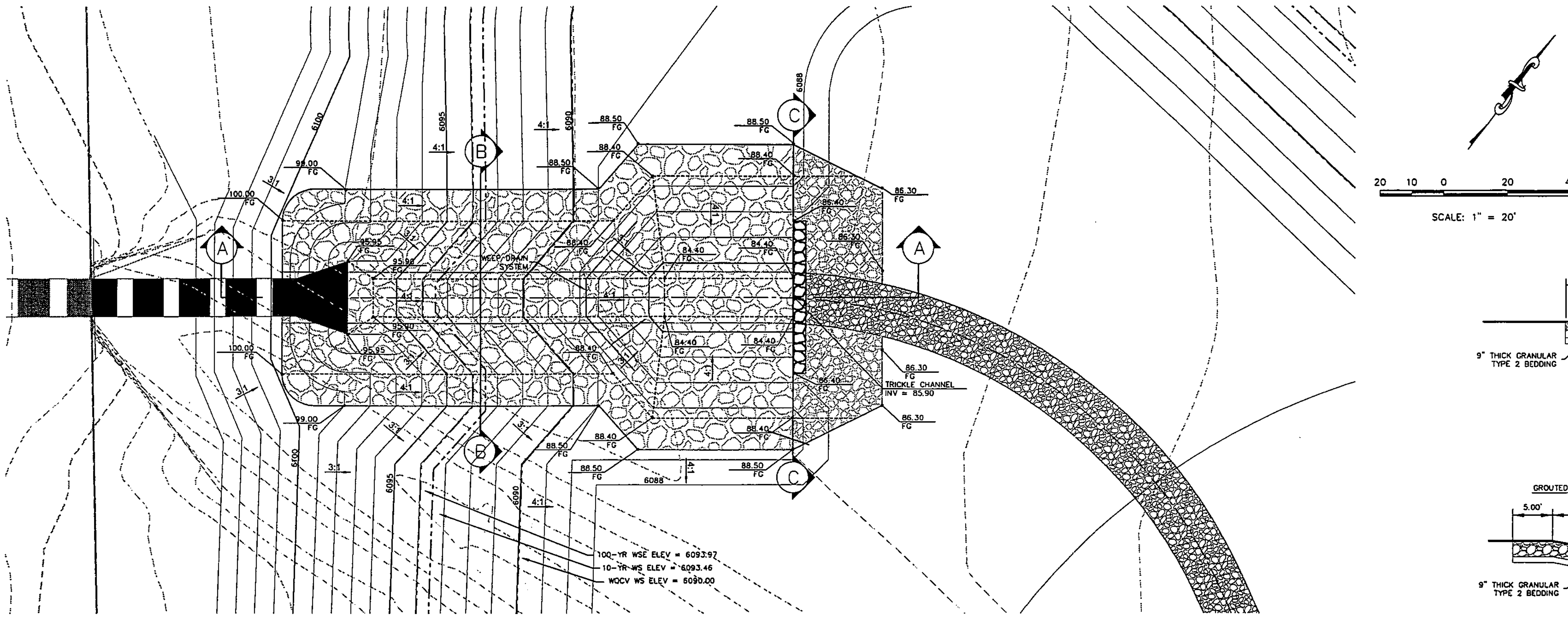
Results		
Depth	1.54	ft
Flow Area	19.9	ft²
Wetted Perim	20.19	ft
Top Width	19.85	ft
Critical Depth	2.74	ft
Critical Slope	0.020296	ft/ft
Velocity	18.39	ft/s
Velocity Head	5.26	ft
Specific Energ	6.80	ft
Froude Numb	3.24	
Flow Type	Supercritical	

Cross Section
Cross Section for Trapezoidal Channel

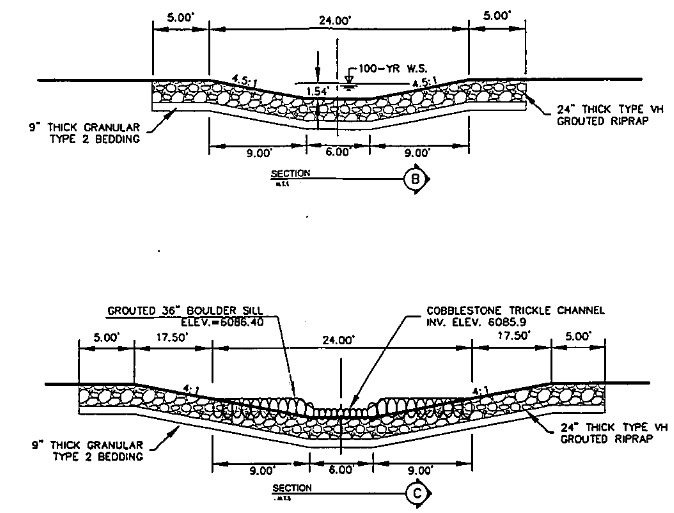
Project Description	
Worksheet	Trapezoidal Channe
Flow Element	Trapezoidal Channe
Method	Manning's Formula
Solve For	Channel Depth

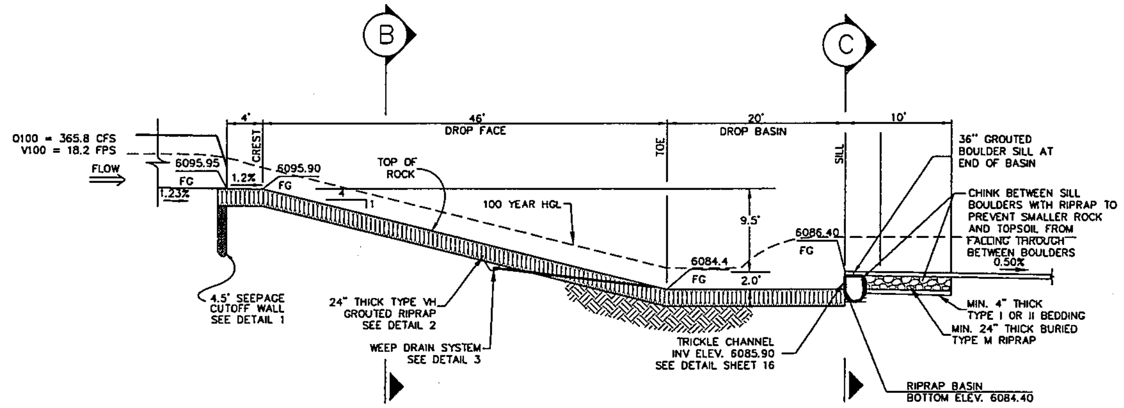
Section Data		
Mannings Coeffic	0.040	
Channel Slope	250000	ft/ft
Depth	1.54	ft
Left Side Slope	4.50	H : V
Right Side Slope	4.50	H : V
Bottom Width	6.00	ft
Discharge	365.80	cfs





PLAN: DROP STRUCTURE
HORIZONTAL SCALE: 1" = 10'





DROP STRUCTURE PROFILE (A)
1" = 10'

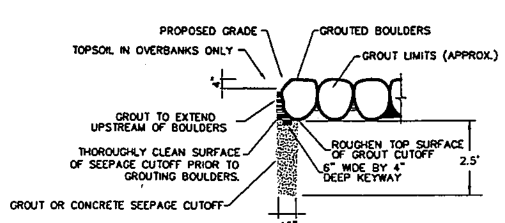
GROUT NOTES

MATERIAL SPECIFICATIONS

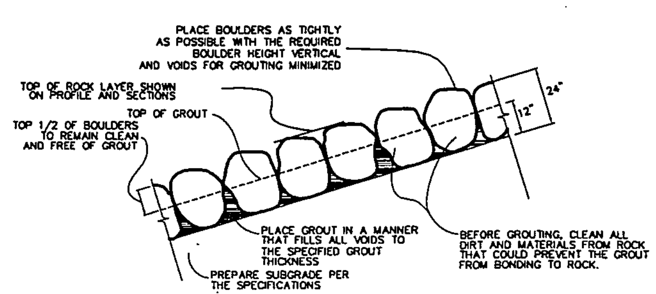
1. ALL GROUT SHALL HAVE A MINIMUM 28-DAY COMPRESSIVE STRENGTH EQUAL TO 3200 PSI.
2. ONE CUBIC YARD OF GROUT SHALL HAVE A MINIMUM OF SIX (6) SACKS OF TYPE II PORTLAND CEMENT.
3. A MAXIMUM OF 25% TYPE F FLY ASH MAY BE SUBSTITUTED FOR THE PORTLAND CEMENT.
4. FOR TYPE A GROUT, THE AGGREGATE SHALL BE COMPRISED OF 70% NATURAL SAND (FINES) AND 30% 3/8-INCH ROCK (COARSE).
5. FOR TYPE B GROUT, THE AGGREGATE SHALL BE COMPRISED OF 3/8-INCH MAXIMUM GRAVEL, STRUCTURAL CONCRETE AGGREGATE.
6. TYPE B GROUT SHALL BE USED IN STREAMS WITH SIGNIFICANT PERENNIAL FLOWS.
7. THE GROUT SLUMP SHALL BE 4-INCHES TO 6-INCHES.
8. AIR ENTRAINMENT SHALL BE 5.5%-7.5%
9. TO CONTROL SHRINKAGE AND CRACKING, 1.5 POUNDS OF FIBERMESH, OR EQUIVALENT, SHALL BE USED PER CUBIC YARD OF GROUT.
10. COLOR ADDITIVE IN REQUIRED AMOUNTS SHALL BE USED WHEN SO SPECIFIED BY CONTRACT.

PLACEMENT SPECIFICATIONS

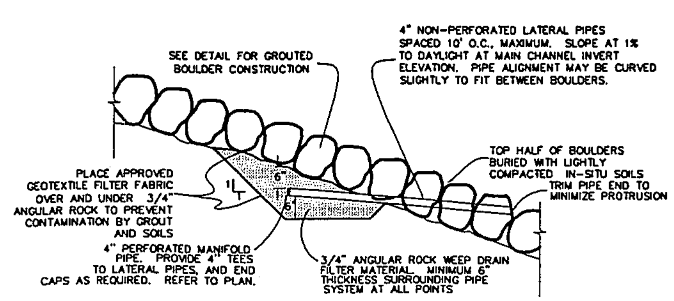
1. ALL TYPE A GROUT SHALL BE DELIVERED BY MEANS OF A LOW PRESSURE (LESS THAN 10 PSI) GROUT PUMP USING A 2-INCH DIAMETER NOZZLE.
2. ALL TYPE B GROUT SHALL BE DELIVERED BY MEANS OF A LOW PRESSURE (LESS THAN 10 PSI) CONCRETE PUMP USING A 3-INCH DIAMETER NOZZLE
3. FULL DEPTH PENETRATION OF THE GROUT INTO THE BOULDER VOIDS SHALL BE ACHIEVED BY INJECTING GROUT STARTING WITH THE NOZZLE NEAR THE BOTTOM AND RAISING IT AS GROUT FILLS, WHILE VIBRATING GROUT INTO PLACE USING A PENCIL VIBRATOR.
4. AFTER GROUT PLACEMENT, EXPOSED BOULDER FACES SHALL BE CLEANED WITH A WET BROOM.
5. ALL GROUT BETWEEN BOULDERS SHALL BE TREATED WITH A BROOM FINISH.
6. ALL FINISHED GROUT SURFACES SHALL BE SPRAYED WITH A CLEAR LIQUID MEMBRANE CURING COMPOUND AS SPECIFIED IN ASTM C-309.
7. SPECIAL PROCEDURES SHALL BE REQUIRED FOR GROUT PLACEMENT WHEN THE AIR TEMPERATURES ARE LESS THAN 40°F OR GREATER THAN 90°F. CONTRACTOR SHALL OBTAIN PRIOR APPROVAL FROM THE DESIGN ENGINEER OF THE PROCEDURES TO BE USED FOR PROTECTING THE GROUT.
8. CLEAN BOULDERS BY BRUSHING AND WASHING BEFORE GROUTING.



SEEPAGE CUTOFF DETAIL (1)
NTS



GROUTED BOULDER PLACEMENT DETAIL (2)
NTS



WEEP DRAIN SYSTEM DETAIL (3)
NTS

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THE MEADOWS FILING 17
LOT 5 AND 6
DETENTION POND DETAIL SHEET

DRAWN BY: ACS
CHECKED BY: AMZ
DATE: FEB.15, 2004
SCALE: AS SHOWN
FILE NO: 04811401
SHEET NUMBER 18

Project Name/Number: 04811407
Date: 2-4-05
Sheet: 1 of 9

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SDIN-1 DESIGN POINT 2

GIVEN:

STARTING FLOW = 4.2 CFS
MAX ALLOWABLE DEPTH = 0.5'

FIND:

DEPTH OF PONDING

SOLUTION:

$Q_{TOTAL} = Q_{STREET} + Q_{CO} \rightarrow Q_{TOTAL} = 4.2 + 0 = \underline{4.2\ CFS}$

FROM FIG 803:

4.2 CFS
DEPTH OF PONDING = 0.18'

DEPTH = 0.18' < 0.50'

∴ TYPE-C INLET WORKS

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Project Name/Number: 04811401
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SDIN-1 DESIGN POINT 2 (ON GRADE)

* FUTURE CONDITION
↳ CONVERT FROM TYPE-C to TYPE-R

GIVEN:

STREET TYPE = LOCAL TYPE-A CURVE #1
SLOPE = 2.1%
MAX FLOW DEPTH = 0.5'
MAX ALLOWABLE GUTTER CAPACITY = 15 CFS (FIG. 903)
STARTING GUTTER FLOW = 4.2 CFS

FIND: INTERCEPTION AND CARRY OVER FLOW AMOUNTS FOR INLET SIZING

SOLUTION:

FROM FIG. 802: 2.1% SLOPE
0.5' DEPTH
ASSUME 10' TYPE-R INLET

ALLOWABLE INLET CAPACITY = 8 CFS

$$R = \frac{\text{ALLOWABLE INLET CAPACITY}}{\text{ALLOWABLE STREET CAPACITY}} \rightarrow \frac{8.0}{15.0} \rightarrow R = 0.53$$

$$Q_{INT} = R(Q\ \text{STREET}) \rightarrow 0.53(4.2) \rightarrow Q_{INT} = 2.2\ \text{CFS}$$

$$Q_{CO} = Q_{STREET} - Q_{INT} \rightarrow 4.2 - 2.2 \rightarrow Q_{CO} = 2.0\ \text{CFS}$$

2.0 CFS FLOW TO SDIN-2 (DP-4)

∴ USE 10' TYPE-R INLET

* INLET DESIGNED TO ALLOWABLE GUTTER CAPACITY FOR MINOR STORMS (FIG. 904) USING 100-YR FLOWS, THEREFORE ADEQUATE GUTTER AND STREET CAPACITY HAS BEEN PROVIDED FOR 100-YR FLOWS.

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SDIN-2 DESIGN POINT 4
(SUMP)

GIVEN:

FLOW IN GUTTER = 8.6 CFS

MAX. ALLOWABLE STREET DEPTH = 0.5'

FIND:

DEPTH OF PONDING

SOLUTION:

$Q_{TOTAL} = Q_{STREET} + Q_{CO}$ (FROM SDIN-1) → 8.6 + 2.0 → Q_{TOTAL} = 10.6 CFS

FROM FIG. 803: 0.5 DEPTH
10.5 CFS CAPACITY
ASSUME 10' TYPE-R INLET
DEPTH OF PONDING = 0.5'

DEPTH = 0.5' ≤ 0.5' (MAX DEPTH) CAPTURES ALL FLOW

∴ USE 10' TYPE-R

* INLET DESIGNED TO ALLOWABLE INLET CAPACITY SUMP CONDITIONS (FIG. 803) USING 100-YR FLOWS AND FALL WELL WITHIN ACCEPTABLE FLOW DEPTHS.

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Date: 1-28-05
Sheet: 3 of 9

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Meeting Record ☐
Calculations ☒ INLET SIZING
Other ☐

SDIN-3 (DESIGN POINT 6)
(ON GRADE)
GIVEN:

STREET TYPE: LOCAL TYPE-A CURVE #5
SLOPE = 1.0%
MAX. FLOW DEPTH = 0.5'
MAX. ALLOWABLE GUTTER CAPACITY = 6 CFS (FIG. 903)
STARTING GUTTER FLOW = 3.3 CFS

FIND:

INTERCEPTION AND CARRY OVER FLOW AMOUNTS FOR INLET SIZING.

SOLUTION:

FROM FIG. 802: 1.0% SLOPE
0.5' DEPTH
ASSUME 10' TYPE-R INLET

ALLOWABLE INLET CAPACITY = 7.4 CFS

$R = \frac{\text{ALLOWABLE INLET CAPACITY}}{\text{ALLOWABLE STREET CAPACITY}} = \frac{7.4}{6.0} \rightarrow R = 1.23 > 1.0$ EFFICIENCY $\therefore R = 1.0$

$Q_{INT} = R(Q_{STREET}) \rightarrow 1.0(3.3) \rightarrow Q_{INT} = 3.3$ CFS

$Q_{CO} = Q_{STREET} - Q_{INT} \rightarrow 3.3 - 3.3 \rightarrow Q_{CO} = 0.0$ CFS

SDIN-3 CAPTURES ALL UPSTREAM FLOW WITH NO Q_{CO}.

$\therefore$ USE 10' TYPE-R INLET

* INLET DESIGNED TO ALLOWABLE GUTTER CAPACITY FOR MINOR STORMS (FIG. 904) USING 100-YR FLOWS, THEREFORE ADEQUATE GUTTER AND STREET CAPACITY HAS BEEN PROVIDED FOR 100-YR FLOWS

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Project Name/Number: 04811401
Date: 1-27-05
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- [x] Calculations — INLET SIZING
- [ ] Other

SDIN-4 DESIGN POINT 9
(ON GRADE)

GIVEN:

STREET TYPE-A CURVE #1
SLOPE = 1.0%
MAX. FLOW DEPTH = 0.5'
MAX. ALLOWABLE GUTTER CAPACITY = 6 CFS (FIG. 903)
STARTING GUTTER FLOW = 1.4 CFS

FIND:

INTERCEPTION AND CARRY OVER FLOW AMOUNTS FOR INLET SIZING

SOLUTION:

FROM FIG. 802: 1.0% SLOPE
0.5' DEPTH
ASSUME 10' TYPE-R INLET

ALLOWABLE INLET CAPACITY = 7.4 CFS

$R = \frac{\text{ALLOWABLE INLET CAPACITY}}{\text{ALLOWABLE STREET CAPACITY}} \rightarrow \frac{7.4}{6.0} \rightarrow R = 1.23 > 1.0$ EFFICIENCY $\therefore R = 1.0$

$Q_{INT} = R(Q_{STREET}) \rightarrow 1.0\ (1.4) \rightarrow Q_{INT} = 1.4$ CFS

$Q_{CO} = Q_{STREET} - Q_{INT} \rightarrow 1.4 - 1.4 \rightarrow Q_{CO} = 0.0$ CFS

SDIN-4 CAPTURES ALL UPSTREAM FLOW WITH NO Q_{CO}

∴ USE 10' TYPE-R INLET

* INLET DESIGNED TO ALLOWABLE GUTTER CAPACITY FOR MINOR STORMS (FIG. 904) USING 100-YR FLOWS, THEREFORE ADEQUATE GUTTER AND STREET CAPACITY HAS BEEN PROVIDED FOR 100-YR FLOWS.

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Date: 1-28-05
Sheet: 5 of 9

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- [ ] Meeting Record
- [x] Calculations — INLET SIZING
- [ ] Other

SDIN-5 DESIGN POINT 10
(ON GRADE)

GIVEN:

STREET TYPE-A CURVE #1
SLOPE = 1.0%
MAX. FLOW DEPTH = 0.5'
MAX. ALLOWABLE GUTTER CAPACITY = 6 CFS (FIG. 903)
STARTING GUTTER FLOW = 1.9 CFS

FIND:

INTERCEPTION AND CARRY OVER FLOW AMOUNTS FOR INLET SIZING

SOLUTION:

FROM FIG. 802: 1.0% SLOPE
0.5' DEPTH
ASSUME 10' TYPE-R INLET

ALLOWABLE INLET CAPACITY = 7.4 CFS

$R = \frac{\text{ALLOWABLE INLET CAPACITY}}{\text{ALLOWABLE STREET CAPACITY}} = \frac{7.4}{6.0} \rightarrow R = 1.23 > 1.0$ EFFICIENCY
$\therefore R = 1.0$

$Q_{INT} = R(Q_{STREET}) \rightarrow 1.0(1.9) \rightarrow Q_{INT} = 1.9$ CFS

$Q_{CO} = Q_{STREET} - Q_{INT} \rightarrow 1.9 - 1.9 \rightarrow Q_{CO} = 0.0$ CFS

SDIN-5 CAPTURES ALL UPSTREAM FLOW WITH NO Q_{CO}

$\therefore$ USE 10' TYPE-R INLET

* INLET DESIGNED TO ALLOWABLE GUTTER CAPACITY FOR MINOR STORMS (FIG. 904) USING 100-YR FLOWS, THEREFORE ADEQUATE GUTTER AND STREET CAPACITY HAS BEEN PROVIDED FOR 100-YR FLOWS.

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Project Name/Number: 04811401
Date: 2-4-05
Sheet: 6 of 9

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Meeting Record ☐
Calculations ☒ INLET SIZING.
Other ☐

SDIN-6 DESIGN POINT 16

GIVEN:

STARTING FLOW = 6.4 CFS
MAX ALLOWABLE DEPTH = 0.5'

FIND:

DEPTH OF PONDING

SOLUTION:

$Q_{TOTAL} = Q_{STREET} + Q_{CO} = 6.4 + 0 \rightarrow Q_{TOTAL} = 6.4$ CFS

FROM FIG 803:

6.4 CFS
DEPTH OF PONDING = 0.26'

DEPTH = 0.26' < 0.50

∴ TYPE-C INLET WORKS

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Date: 6
Sheet: 6 of 9

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Meeting Record ☐
Calculations ☒ INLET SIZING
Other ☐

SDIN-6 (SUMP) DESIGN POINT 16 ☆ FUTURE CONDITION
→ CONVERT FROM TYPE-C TO TYPE-R

GIVEN:

FLOW IN GUTTER = 6.4 CFS

MAX. ALLOWABLE STREET DEPTH = 0.5'

FIND:

DEPTH OF PONDING

SOLUTION:

$Q_{TOTAL} = Q_{STREET} + Q_{CO} = 6.7 + 0 \rightarrow Q_{TOTAL} = 6.4$ CFS ◄

FROM FIG. 803: 0.5' DEPTH
6.4 CFS CAPACITY
ASSUME 10' TYPE-R INLET
DEPTH OF PONDING FOR 6.7 CFS = 0.37' ◄

DEPTH 0.37' < 0.5' (MAX DEPTH) CAPTURES ALL FLOW

∴ 10' TYPE-R INLET ◄

* INLET DESIGNED TO ALLOWABLE INLET CAPACITY SUMP CONDITIONS (FIG. 803) USING 100-YR FLOWS AND FALL WELL WITHIN ACCEPTABLE FLOW DEPTHS.

Project Name/Number: 04811401
Date: 1-27-05
Sheet: 7 of 9

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- [x] Calculations — INLET SIZING
- [ ] Other

SDIN-7 DESIGN POINT 17 * FUTURE CONDITION
(ON GRADE)

GIVEN:

STREET TYPE = LOCAL TYPE-A CURVE #1
SLOPE = 2.0%
MAX FLOW DEPTH = 0.5'
MAX ALLOWABLE GUTTER CAPACITY = 15 CFS (FIG. 903)
STARTING GUTTER FLOW = 5.0 CFS

FIND:

INTERCEPTION AND CARRY OVER FLOW AMOUNTS FOR INLET SIZING

SOLUTION:

FROM FIG. 802 : 2.0% SLOPE
0.5' DEPTH
ASSUME 10' TYPE-R INLET
ALLOWABLE INLET CAPACITY = 8.1 CFS

$R = \frac{\text{ALLOWABLE INLET CAPACITY}}{\text{ALLOWABLE STREET CAPACITY}} \rightarrow \frac{8.1}{15} \rightarrow R = 0.54$

$Q_{INT} = R(Q_{STREET}) = 0.54(5.0) \rightarrow Q_{INT} = 2.7$ CFS

$Q_{CO} = Q_{STREET} - Q_{INT} \rightarrow 5.0 - 2.7$ CFS $\rightarrow Q_{CO} = 2.3$ CFS

2.3 CFS FLOW TO SDIN FUTURE INLET AT DESIGN POINT 32

∴ USE 10' TYPE-R INLET

* INLET DESIGNED TO ALLOWABLE GUTTER CAPACITY FOR MINOR STORMS (FIG. 904) USING 100-YR FLOWS, THEREFORE ADEQUATE GUTTER AND STREET CAPACITY HAS BEEN PROVIDED FOR 100-YR FLOWS.

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Project Name/Number: 04811401
Date: 1-27-05
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Meeting Record ☐
Calculations ☒ INLET SIZING
Other ☐

SDIN-8 DESIGN POINT 20
(ON GRADE)
GIVEN:
STREET TYPE = LOCAL TYPE-A CURVE #5
SLOPE = 1.0%
MAX FLOW DEPTH = 0.5'
MAX ALLOWABLE GUTTER CAPACITY = 6. CFS (FIG 902)
STARTING GUTTER FLOW = 4.2 CFS

FIND:
INTERCEPTION AND CARRY OVER FLOW AMOUNTS FOR INLET SIZING

SOLUTION:
FROM FIG 802: 1.0% SLOPE
0.5' DEPTH
ASSUME 10' TYPE-R INLET
ALLOWABLE INLET CAPACITY = 7.4 CFS

$R = \frac{\text{ALLOWABLE INLET CAPACITY}}{\text{ALLOWABLE STREET CAPACITY}} \rightarrow \frac{7.4}{6.0} = \rightarrow R = 1.23 > 1.0$ EFFICIENCY
$\therefore R = 1.0$

$Q_{INT} = R(Q_{STREET}) \rightarrow 1.0(4.2) \rightarrow Q_{INT} = 4.2$ CFS

$Q_{CO} = Q_{STREET} - Q_{INT} \rightarrow 4.2 - 4.2 \rightarrow Q_{CO} = 0$ CFS

SDIN-8 CAPTURES ALL UPSTREAM FLOW WITH NO Q_{CO}

∴ USE 10'-TYPE-R INLET

* INLET DESIGNED TO ALLOWABLE GUTTER CAPACITY FOR MINOR STORMS (FIG. 904) USING 100-YR FLOWS, THEREFORE ADEQUATE GUTTER AND STREET CAPACITY HAS BEEN PROVIDED FOR 100-YR FLOWS.

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LAND PLANNING

Project Name/Number: 04811401
Date: 1-27-05
Sheet: 9 of 9

Telephone Log ☐
Meeting Record ☐
Calculations ☒ INLET SIZING
Other ☐

SDIN-10 DESIGN POINT 30
(SUMP)

GIVEN:

FLOW IN GUTTER = 16.8 CFS

MAX. ALLOWABLE STREET DEPTH = 0.87' (CURB + INLET THROAT + 10'@ 2% BUFFER)

FIND:

DEPTH OF PONDING

SOLUTION:

$Q_{TOTAL} = Q_{STREET} + Q_{CO} \rightarrow 16.8 + 0 \rightarrow Q_{TOTAL} = 16.8$ CFS

FROM FIG. 803: 0.87' DEPTH

22.0 CFS CAPACITY

ASSUME 10' TYPE-R INLET

DEPTH OF PONDING = 0.71'

DEPTH = 0.71' ≤ 0.87' (MAX DEPTH) CAPTURES ALL FLOW

∴ USE 10'-TYPE-R

* INLET DESIGNED TO ALLOWABLE INLET CAPACITY SUMP CONDITIONS (FIG. 803) USING 100-YR FLOWS AND FALL WELL WITHIN ACCEPTABLE FLOW DEPTHS.

from Figure 903 by interpolating between the velocity lines (V = 3.0 fps).

Step 3: Determine the allowable major storm gutter capacity:
From Figure 904 for a "Minor Arterial" with a slope of 1.0 percent, read the allowable capacity of 110 cfs per gutter assuming the street is symmetrical. If the street cross-section is not symmetrical, (i.e., one gutter flowline higher than the other), the capacity of the upper gutter would have to be reduced so that the lower gutter capacity is not exceeded by street cross flow from the upper gutter (see Fig. 905).

9.6 CHECKLIST

To aid the Consultant Engineer, the following checklist has been prepared:

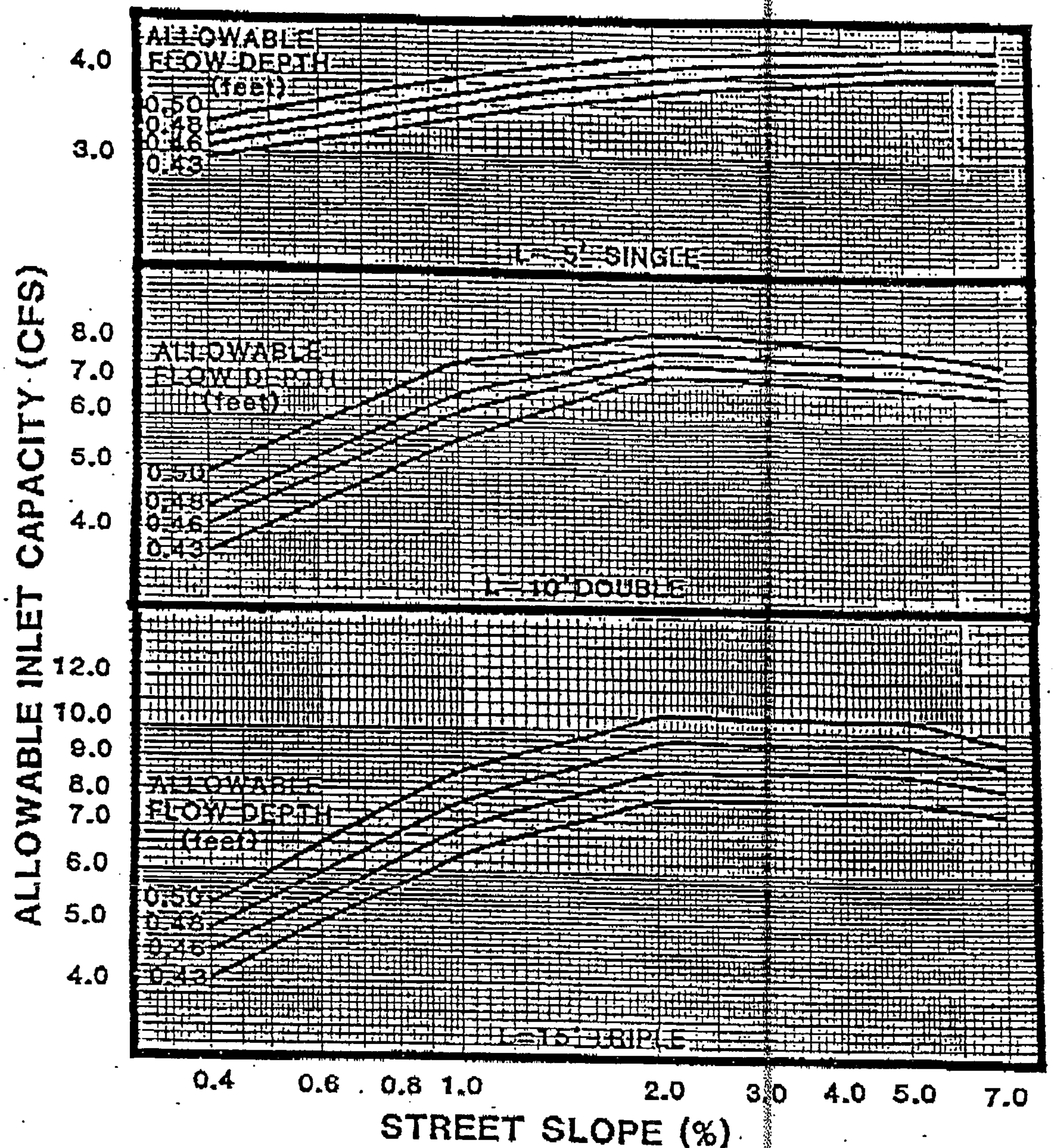
(1) Use the flattest street slope to calculate the allowable gutter capacity.

(2) Determine street classification first, then the curve number and gutter capacity.

STORM DRAINAGE DESIGN AND TECHNICAL CRITERIA
TABLE 901

STREET CLASSIFICATION

TRAFFIC CLASSIFICATION	DRAINAGE CLASSIFICATION	FLOWLINE WIDTH	CURB TYPE	MINOR STORM CURVE NO. (FOR USE WITH FIGURE 903)
Major Arterial	Type C	68'	6"VC	1
Minor Arterial	Type B	61'	6"VC	1
Collector	Type B	44'	6"VC	2
Local	Type A	40'	6"VC	1
Local	Type A	36'	6"VC	2
Local	Type A	34'	6"VC	3
Local	Type A	32'	6"VC	4
Local	Type A	28'	6"VC	5
Local	Type A	36'	4"CG/SW	6
Local	Type A	34'	4"CG/SW	6
Local	Type A	32'	4"CG/SW	6
Local	Type A	28'	4"CG/SW	6



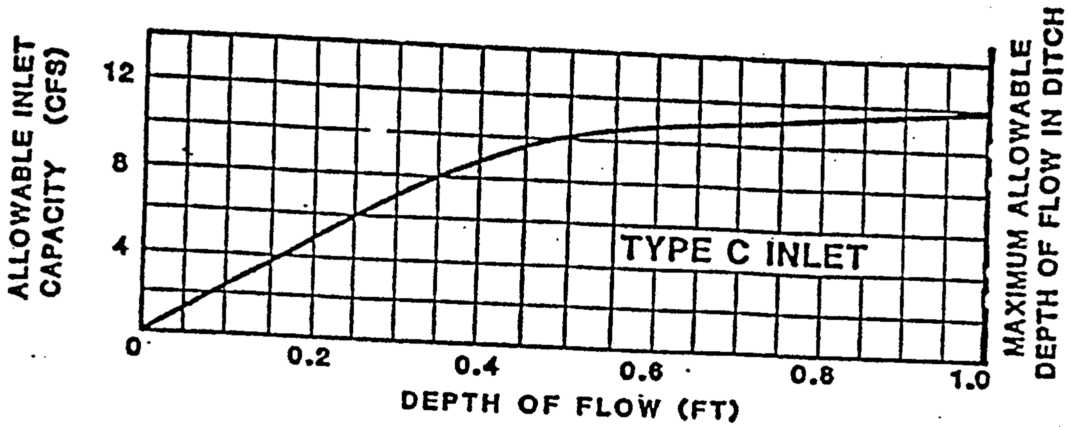
NOTES: 1. Maximum inlet capacity at maximum allowable flow depth. Proportionally reduce for other depths.

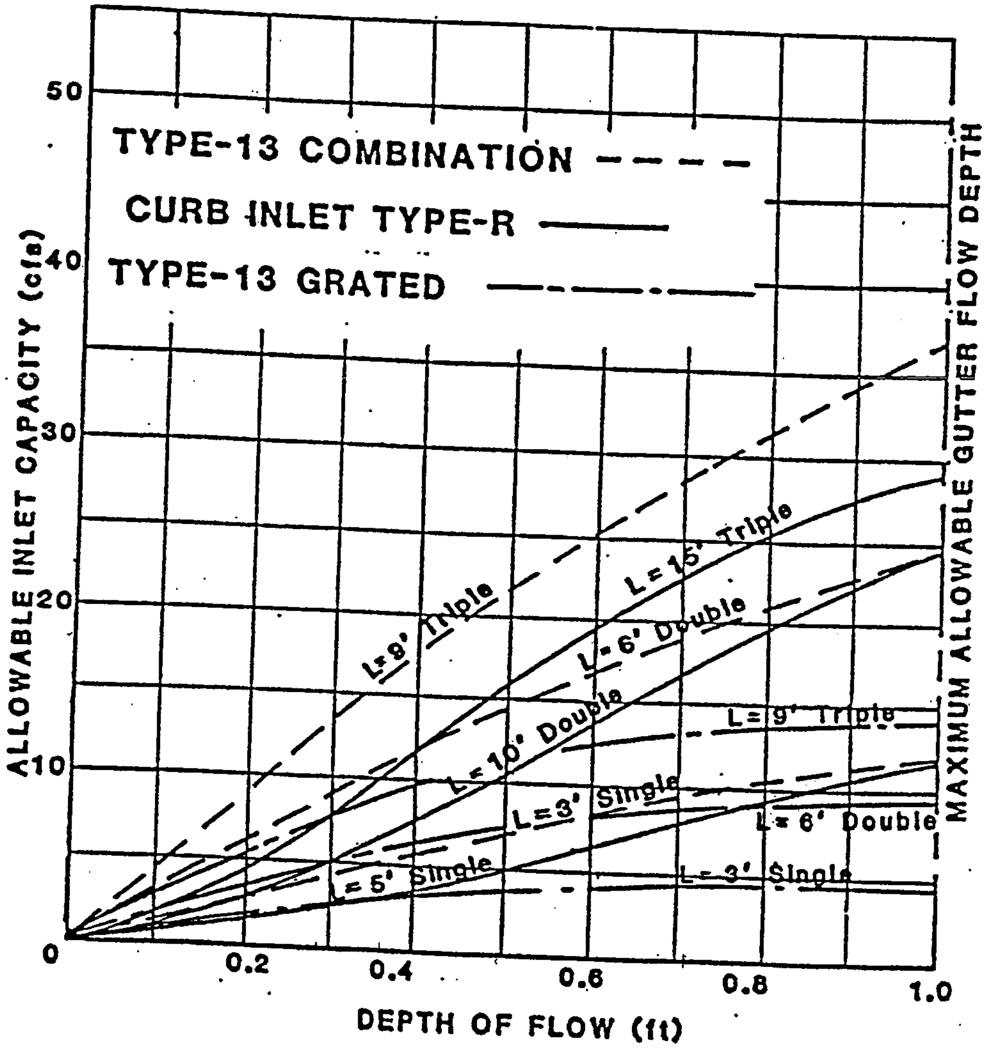
2. Allowable Capacity =
88% (L = 5')
92% (L = 10')
95% (L = 15')
of Theoretical Capacity

3. Interpolate for other inlet lengths.

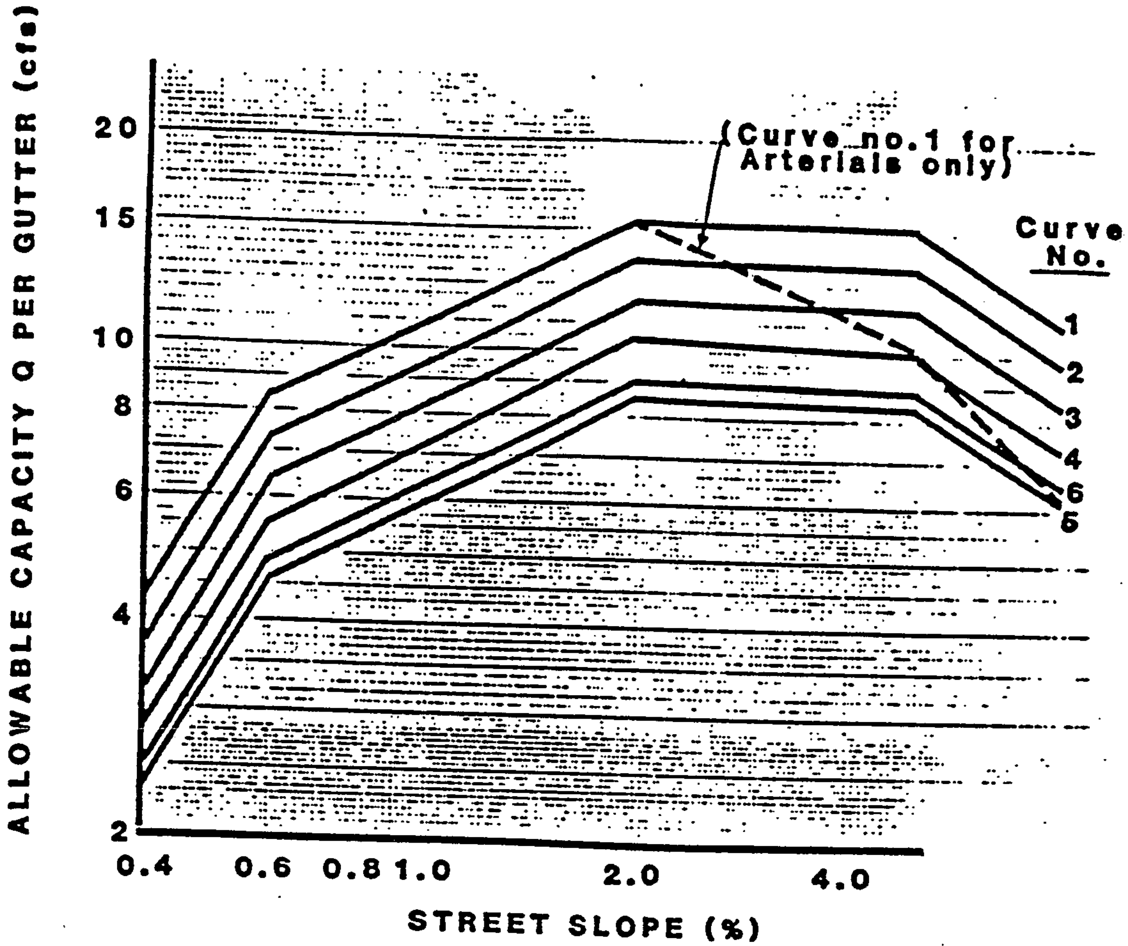
TYPE - R CURB OPENING ON A CONTINUOUS GRADE

DRAWN BY: RBD	TOWN OF CASTLE ROCK PUBLIC WORKS	STD. DWG NO.
APPROVED BY:	ALLOWABLE INLET CAPACITY TYPE R	FIGURE 802
DATE: 10/1/98		





DRAWN BY: RBD	TOWN OF CASTLE ROCK PUBLIC WORKS	STD. DWG NO.
APPROVED BY:	ALLOWABLE INLET CAPACITY SUMP CONDITIONS — ALL INLETS	FIGURE 803
DATE: 10/1/98		



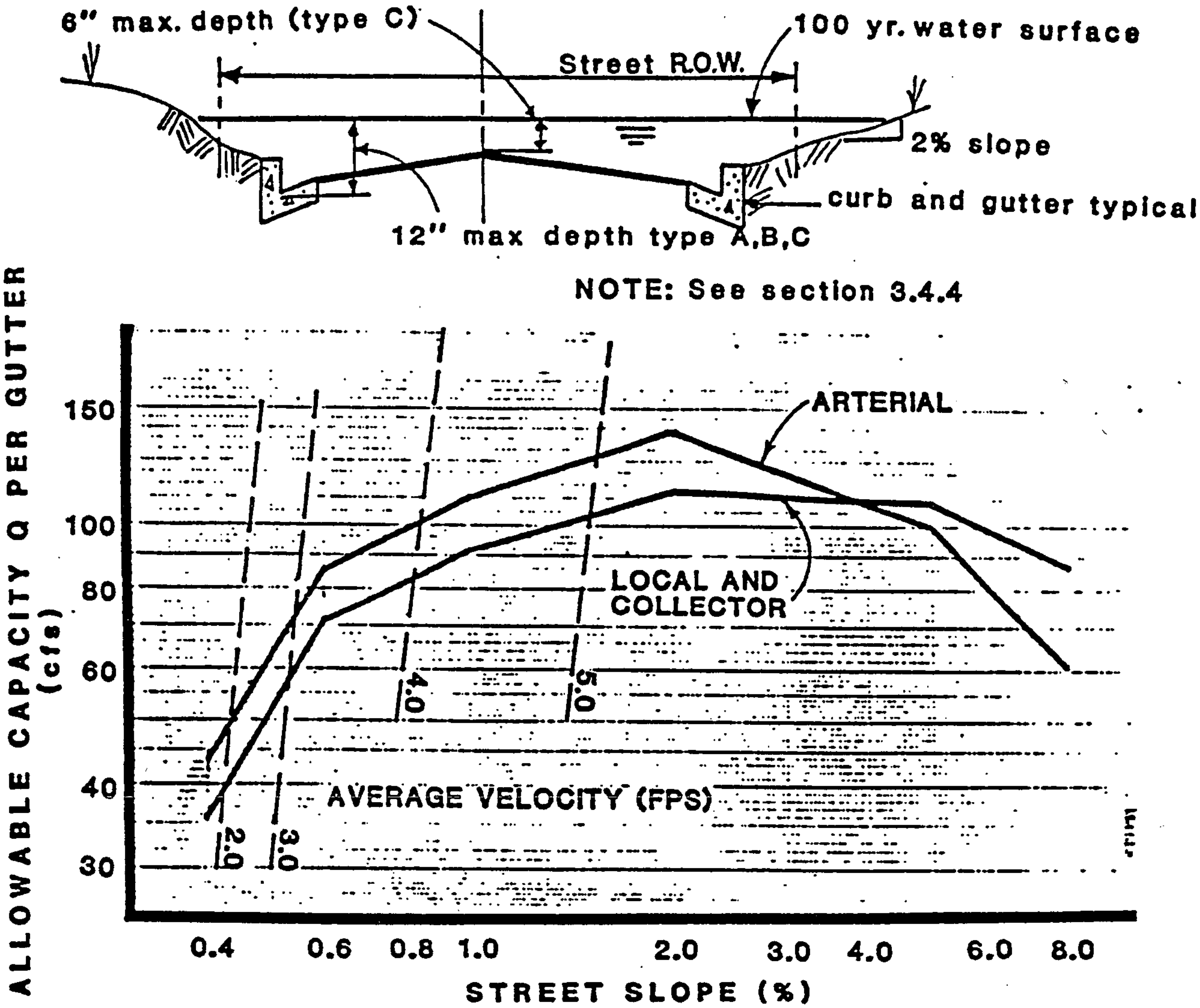
NOTES:

1. DESIGN CONDITIONS
   Q = F(0.54(z/n)S1/2d8/3
   F = (From Fig. 6-2, 8.2, Ref. 1)
   n = 0.016 for streets

2. Figure includes reduction factor for allowable capacity.

3. Curve numbers for specific street sections are listed on Table 901.

DRAWN BY: RBD	TOWN OF CASTLE ROCK PUBLIC WORKS	STD. DWG NO.
APPROVED BY:	ALLOWABLE GUTTER CAPACITY MINOR STORM	FIGURE 903
DATE: 10/1/98		



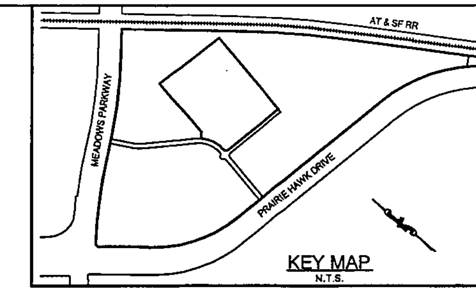
NOTES:

1. <u>DESIGN CONDITIONS</u>
   Q = F(0.56(z/n)S1/2d8/3)
   F = (From Fig. 6-2, 8.2, Ref. 1)
   n = 0.016 for streets
   n = 0.025 for grass

2. Figure includes reduction factor for allowable capacity.

3. Curve numbers for specific street sections are listed on Table 901.

DRAWN BY: RBD	TOWN OF CASTLE ROCK PUBLIC WORKS	STD. DWG NO.
APPROVED BY:	ALLOWABLE GUTTER CAPACITY MAJOR STORM	FIGURE 904
DATE: 10/1/98		

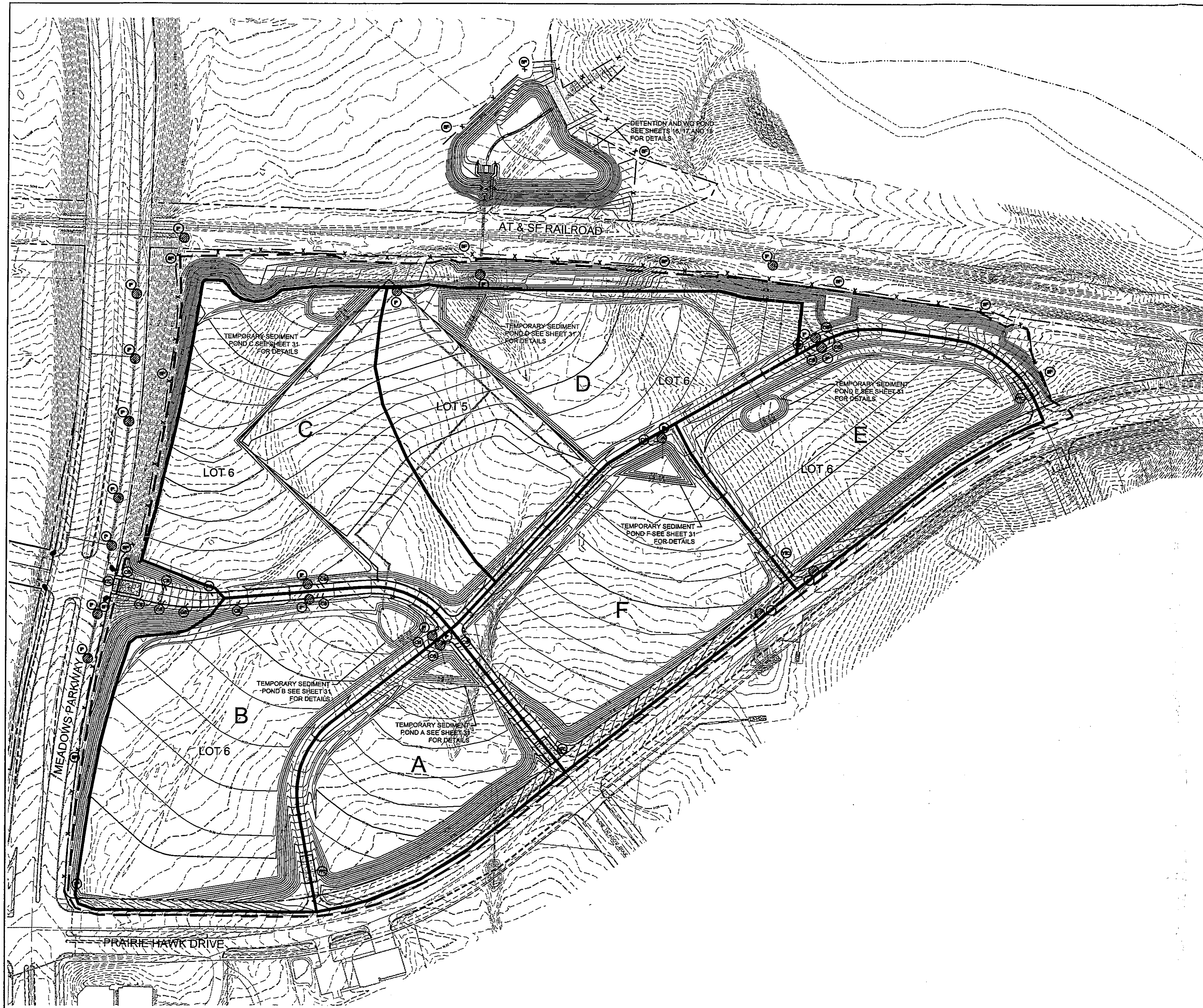


KEY MAP
N.T.S.

100 50 0 100 200
SCALE: 1" = 100'

LEGEND

	EXISTING CONTOUR
	PROPOSED CONTOUR
	PARCEL BOUNDARY
	EXISTING R.R. TRACKS
	LIMITS OF CONSTRUCTION
	STORM DRAIN PIPE
	STORM DRAIN INLET
	STORM DRAIN MANHOLE
	RIPRAP
VTC	VEHICLE TRACKING CONTROL
SF — X —	SILT FENCE
IP	INLET PROTECTION
CS //	CURB SOCK



SEDIMENT POND BASINS

No.	Revisions	Date	Init.	Appr.	Date

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CASTLE ROCK LAND COMPANY
3033 EAST 1ST AVENUE, #410
DENVER, CO 80206

THE MEADOWS FILING 17
LOT 5 AND 6
EROSION CONTROL PLAN

CONSULTANT ENGINEER CERTIFICATION

I HEREBY AFFIRM THAT THESE FINAL CONSTRUCTION PLANS WERE PREPARED UNDER MY DIRECT SUPERVISION, IN ACCORDANCE WITH ALL APPLICABLE TOWN OF CASTLE ROCK AND STATE OF COLORADO STANDARDS AND STATUTES, RESPECTIVELY; AND THAT I AM FULLY REPONSIBLE FOR ALL DESIGN AND REVISIONS RELATIVE TO SAID PLANS.

KURT A. LANG, COLORADO P.E. 32249 DATE

TOWN OF CASTLE ROCK APPROVALS
THESE PLANS ARE HEREBY APPROVED FOR ONE YEAR FROM DATE OF PUBLIC WORKS DIRECTOR APPROVAL

RECOMMEND APPROVAL BY:

ENGINEERING DIVISION DATE

APPROVED BY:

DEVELOPMENT SERVICES DIRECTOR DATE

DRAWN BY: ACS	CHECKED BY: AMZ	DATE: JAN. 4, 2004	
SCALE: AS SHOWN		FILE NO: 04811401	

SHEET NUMBER 6

SEDIMENT POND A

Area = 5.01 acres

Sediment Volume = 1800*5.01= 9018 ft^3 = 0.21 ac.ft.

HWL = 6138.0

1/2 Sediment Volume HWL= 6136.5

D_{WQ}= 6138-6136.5= 1.5 ft

Pond Bottom = 6135.0

Required Area per ROW = 0.75 in^2 (Per Fig. EDB-3)

Orifice Perforation Sizing = 1 columns
5 rows (4" ctr. to ctr.)
1" diameter

SEDIMENT POND B

Area = 8.52 acres

Sediment Volume = 1800*8.52= 15336 ft^3 = 0.35 ac.ft.

HWL = 6133.0

D_{WQ}= 6133-6131.5= 1.5 ft

1/2 Sediment Volume HWL= 6131.5

Pond Bottom = 6130.0

Required Area per ROW = 1.2 in^2 (Per Fig. EDB-3)

Orifice Perforation Sizing = 1 columns
5 rows (4" ctr. to ctr.)
1 5/16" diameter

SEDIMENT POND C

Area = 8.50 acres

Sediment Volume = 1800*8.5= 15300 ft^3 = 0.35 ac.ft.

HWL = 6116.0

$D_{WQ=}$ 6116-6114.5= 1.5 ft

1/2 Sediment Volume HWL= 6114.5

Pond Bottom = 6113.0

Required Area per ROW = 1.8 in^2 (Per Fig. EDB-3)

Orifice Perforation Sizing = 1 columns
5 rows (4" ctr. to ctr.)
1 5/16" diameter

SEDIMENT POND D

Area = 8.41 acres

Sediment Volume = 1800*8.41= 15138 ft^3 = 0.35 ac.ft.

HWL = 6121.0

$D_{WQ=}$ 6121-6119.5= 1.5 ft

1/2 Sediment Volume HWL= 6119.5

Pond Bottom = 6118.0

Required Area per ROW = 1.1 in^2 (Per Fig. EDB-3)

Orifice Perforation Sizing = 1 columns
5 rows (4" ctr. to ctr.)
1 5/16" diameter

SEDIMENT POND E

Area = 6.03 acres

Sediment Volume = 1800*6.03= 10854 ft^3 = 0.25 ac.ft.

HWL = 6129.0

1/2 Sediment Volume HWL= 6127.5

D_{WQ}= 6129-6127.5= 1.5 ft

Pond Bottom = 6126.0

Required Area per ROW = 0.9 in^2 (Per Fig. EDB-3)

Orifice Perforation Sizing = 1 columns
5 rows (4" ctr. to ctr.)
1 1/16" diameter

SEDIMENT POND F

Area = 6.94 acres

Sediment Volume = 1800*6.94= 12492 ft^3 = 0.29 ac.ft.

HWL = 6130.0

1/2 Sediment Volume HWL= 6128.5

$D_{WQ=}$ 6130-6128.5= 1.5 ft

Pond Bottom = 6127.0

Required Area per ROW = 0.9 in^2 (Per Fig. EDB-3)

Orifice Perforation Sizing = 1 columns
5 rows (4" ctr. to ctr.)
1 3/16" diameter

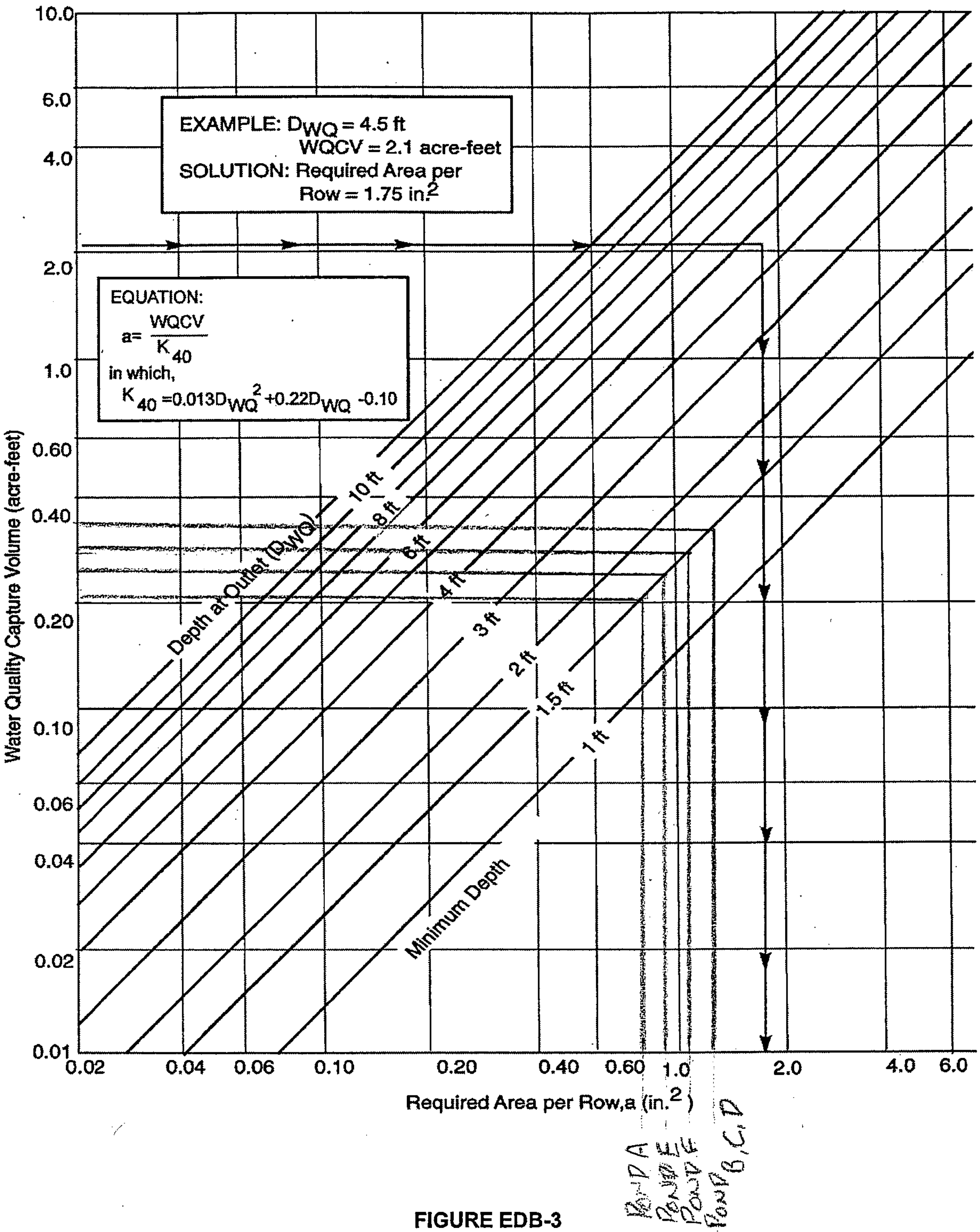


FIGURE EDB-3

Water Quality Outlet Sizing:
Extended Detention Basin (Dry) With 40-hour Drain Time for Capture Volume

Orifice Plate Perforation Sizing

Circular Perforation Sizing

Chart may be applied to orifice plate or vertical pipe outlet.

Hole Dia (in) *	Hole Dia (in)	Min. S_c (in)	Area per Row (sq in) n=1	n=2	n=3
1/4	0.250	1	0.05	0.10	0.15
5/16	0.313	2	0.08	0.15	0.23
3/8	0.375	2	0.11	0.22	0.33
7/16	0.438	2	0.15	0.30	0.45
1/2	0.500	2	0.20	0.39	0.59
9/16	0.563	3	0.25	0.50	0.75
5/8	0.625	3	0.31	0.61	0.92
11/16	0.688	3	0.37	0.74	1.11
3/4	0.750	3	0.44	0.88	1.33
13/16	0.813	3	0.52	1.04	1.56
7/8	0.875	3	0.60	1.20	1.80
15/16	0.938	3	0.69	1.38	2.07
1	1.000	4	0.79	1.57	2.36
1 1/16	1.063	4	0.89	1.77	2.66
1 1/8	1.125	4	0.99	1.99	2.98
1 3/16	1.188	4	1.11	2.22	3.32
1 1/4	1.250	4	1.23	2.45	3.68
1 5/16	1.313	4	1.35	2.71	4.06
1 3/8	1.375	4	1.48	2.97	4.45
1 7/16	1.438	4	1.62	3.25	4.87
1 1/2	1.500	4	1.77	3.53	5.30
1 9/16	1.563	4	1.92	3.83	5.75
1 5/8	1.625	4	2.07	4.15	6.22
1 11/16	1.688	4	2.24	4.47	6.71
1 3/4	1.750	4	2.41	4.81	7.22
1 13/16	1.813	4	2.58	5.16	7.74
1 7/8	1.875	4	2.76	5.52	8.28
1 15/16	1.938	4	2.95	5.90	8.84
2	2.000	4	3.14	6.28	9.42
n = Number of columns of perforations					
Minimum steel plate thickness			1/4 "	5/16 "	3/8 "

* Designer may interpolate to the nearest 32nd inch to better match the required area, if desired.

Rectangular Perforation Sizing

Only one column of rectangular perforations allowed.

Rectangular Height = 2 inches

$$\text{Rectangular Width (inches)} = \frac{\text{Required Area per Row (sq in)}}{2''}$$

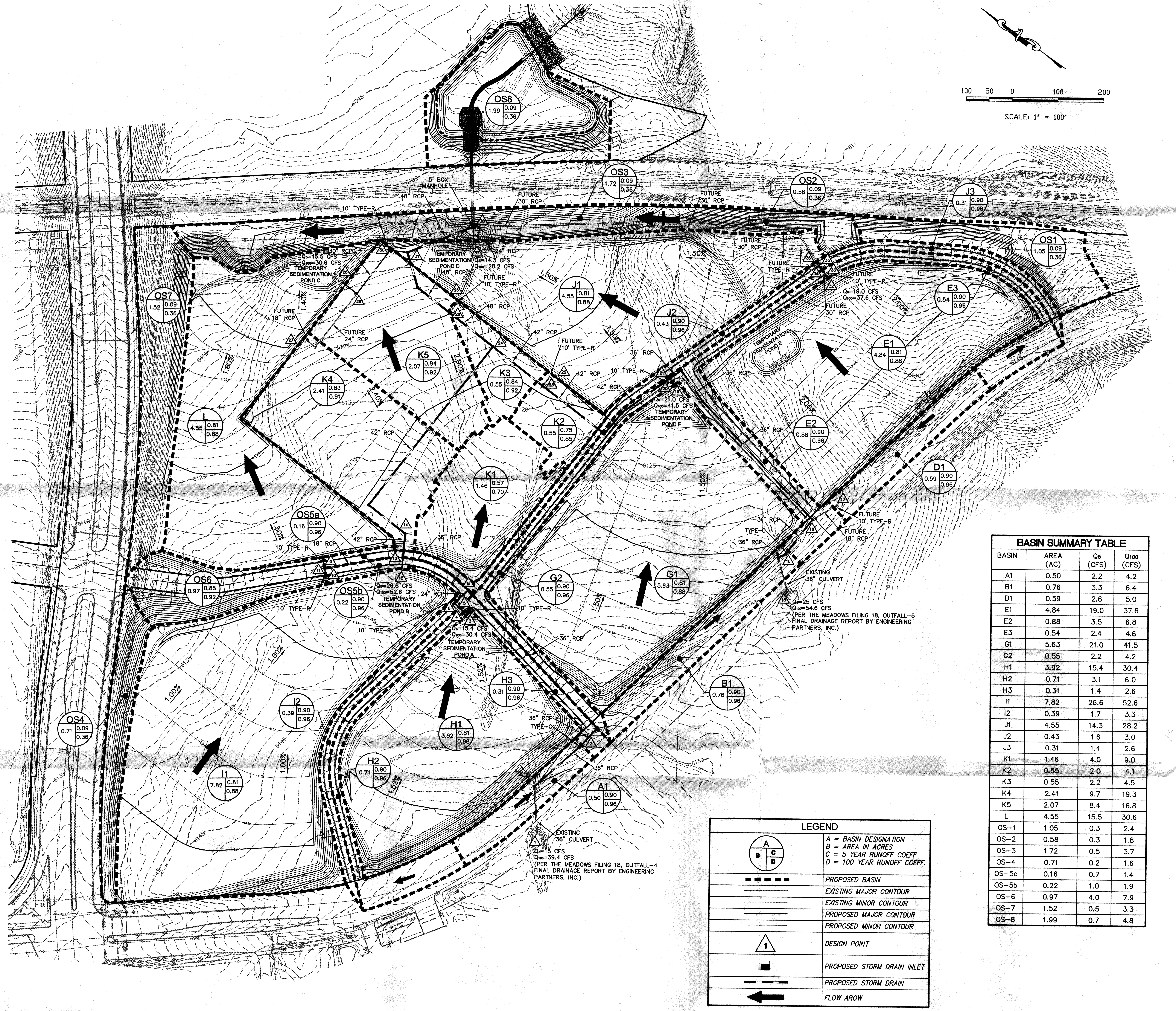
Rectangular Hole Width	Min. Steel Thickness
5"	1/4 "
6"	1/4 "
7"	5/32 "
8"	5/16 "
9"	11/32 "
10"	3/8 "
>10"	1/2 "

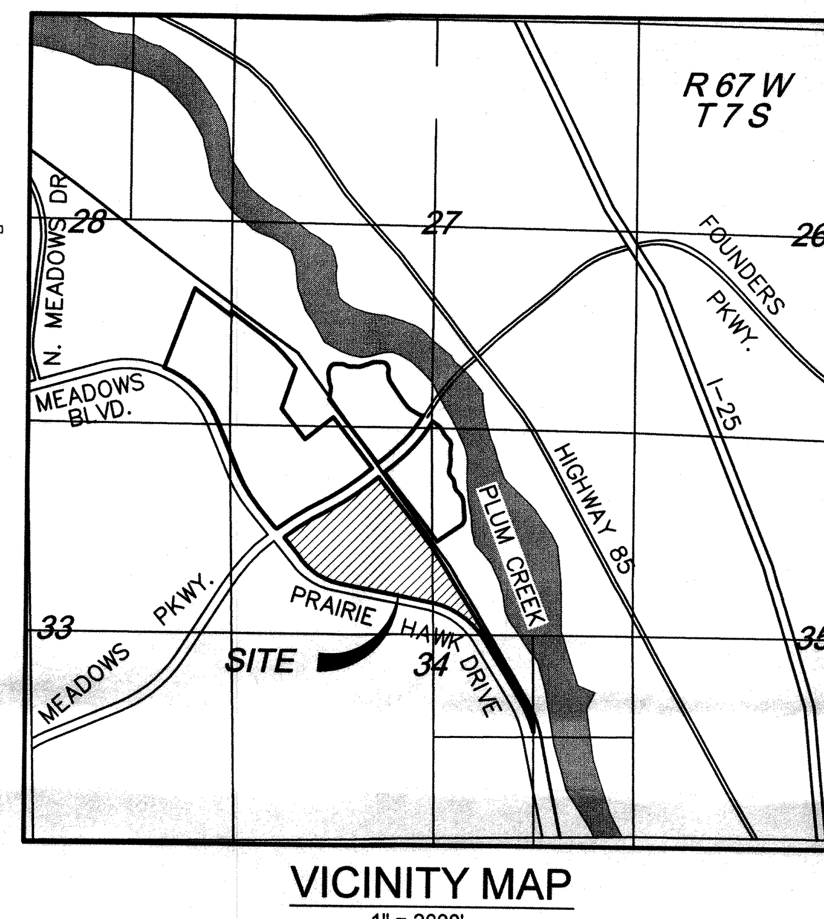
Urban Drainage and Flood Control District Drainage Criteria Manual (V.3) File: V3-Outlet Details.dwg	Figure 5 WQCV Outlet Orifice Perforation Sizing

Figure 5. WQCV Outlets Orifice Perforation Sizing.

Appendix C

Maps/Plans





VICINITY MAP
1" = 2000'

LEGEND

A / B C D	A = BASIN DESIGNATION B = AREA IN ACRES C = 5 YEAR RUNOFF COEFF. D = 100 YEAR RUNOFF COEFF.
	PROPOSED BASIN
	EXISTING MAJOR CONTOUR
	EXISTING MINOR CONTOUR
	PROPOSED MAJOR CONTOUR
	PROPOSED MINOR CONTOUR
1	DESIGN POINT
	PROPOSED STORM DRAIN INLET
	PROPOSED STORM DRAIN
	FLOW ARROW

BASIN SUMMARY TABLE

BASIN	AREA (AC)	Q_5 (CFS)	Q_{100} (CFS)
A1	0.50	2.2	4.2
B1	0.76	3.3	6.4
D1	0.59	2.6	5.0
E1	4.84	19.0	37.6
E2	0.88	3.5	6.8
E3	0.54	2.4	4.6
G1	5.63	21.0	41.5
G2	0.55	2.2	4.2
H1	3.92	15.4	30.4
H2	0.71	3.1	6.0
H3	0.31	1.4	2.6
I1	7.82	26.6	52.6
I2	0.39	1.7	3.3
J1	4.55	14.3	28.2
J2	0.43	1.6	3.0
J3	0.31	1.4	2.6
K1	1.46	4.0	9.0
K2	0.55	2.0	4.1
K3	0.55	2.2	4.5
K4	2.41	9.7	19.3
K5	2.07	8.4	16.8
L	4.55	15.5	30.6
OS–1	1.05	0.3	2.4
OS–2	0.58	0.3	1.8
OS–3	1.72	0.5	3.7
OS–4	0.71	0.2	1.6
OS–5a	0.16	0.7	1.4
OS–5b	0.22	1.0	1.9
OS–6	0.97	4.0	7.9
OS–7	1.52	0.5	3.3
OS–8	1.99	0.7	4.8

SUMMARY RUNOFF TABLE

DESIGN POINT	CONTRIBUTING AREA (AC)	Q_5 (CFS)	Q_{100} (CFS)	CONTRIBUTING BASIN(S)
1	OFFSITE	15.0	39.4	OS
2	0.50	17.2	43.6	A1, OS
3	3.92	15.4	30.4	H1
4	1.02	4.5	8.6	H2, H3
5	4.94	19.9	39.1	H1, H2, H3
6	0.39	1.7	3.3	I2
7	DESIGN POINT 7 NOT USED			
8	5.33	38.7	86.0	H1–H3, I2, OS
9	0.16	0.7	1.4	OS5a
10	0.22	1.0	1.9	OS5b
11	0.38	1.7	3.2	OS5a, OS5b
12	7.82	26.6	52.6	I1
13	13.53	63.6	135.1	H1–H3, I1, I2, OS5a, OS5b, OS
14	14.99	67.1	143.0	H1–H3, I1, I2, OS5a, OS5b, OS, K1
15	OFFSITE	25.0	54.6	OS
16	0.76	28.3	61.0	B1, OS
17	0.59	2.6	5.0	D1
18	1.35	30.9	66.0	B1, D1, OS
19	5.63	21.0	41.5	G1
20	6.18	22.2	43.8	G1, G2
21	7.53	52.6	108.8	B1, D1, G1, G2, OS
22	0.55	2.0	4.1	K2
23	8.08	53.1	110.0	B1, D1, G1, G2, K2, OS
24	23.07	116.9	246.3	BASINS FOR D.P.'S 14 AND 23
25	0.55	2.2	4.5	K3
26	23.62	118.7	250.0	BASINS FOR D.P. 24, K3
27	2.41	9.7	19.3	K4
28	4.55	15.5	30.6	L
29	6.96	23.9	47.4	K4, L
30	9.03	31.2	61.9	K4, K5, L
31	32.65	108.6	215.3	BASINS FOR D.P.'S 30 AND 26
32	4.84	19.0	37.6	E1
33	1.42	5.6	10.9	E2, E3
34	6.26	22.9	44.9	E1, E2, E3
35	0.74	2.7	5.2	J2, J3
36	7.0	23.6	46.4	E1, E2, E3, J2, J3
37	4.55	14.3	28.2	J1
38	44.2	141.3	279.5	BASINS FOR D.P.'S 31, 36 AND 37

I HEREBY AFFIRM THAT THESE FINAL CONSTRUCTION PLANS WERE PREPARED UNDER MY DIRECT SUPERVISION, IN ACCORDANCE WITH ALL APPLICABLE TOWN OF CASTLE ROCK AND STATE OF COLORADO STANDARDS AND STATUTES, RESPECTIVELY; AND THAT I AM FULLY REPONSIBLE FOR ALL DESIGN AND REVISIONS RELATIVE TO SAID PLANS.

COLORADO REGISTERED PROFESSIONAL ENGINEER KURT A. LANG 32249 02-15-05

KURT A. LANG, COLORADO P.E. DATE

TOWN OF CASTLE ROCK APPROVALS
THESE PLANS ARE HEREBY APPROVED FOR ONE YEAR FROM DATE OF DEVELOPMENT SERVICES DIRECTOR APPROVAL

RECOMMEND APPROVAL BY:

ENGINEERING DIVISION DATE

APPROVED BY:

DEVELOPMENT SERVICES DIRECTOR DATE

No.	Revisions	Date	Init.	Appr.	Date
1	ISSUED FOR CONSTRUCTION	02/15/05	KAL		

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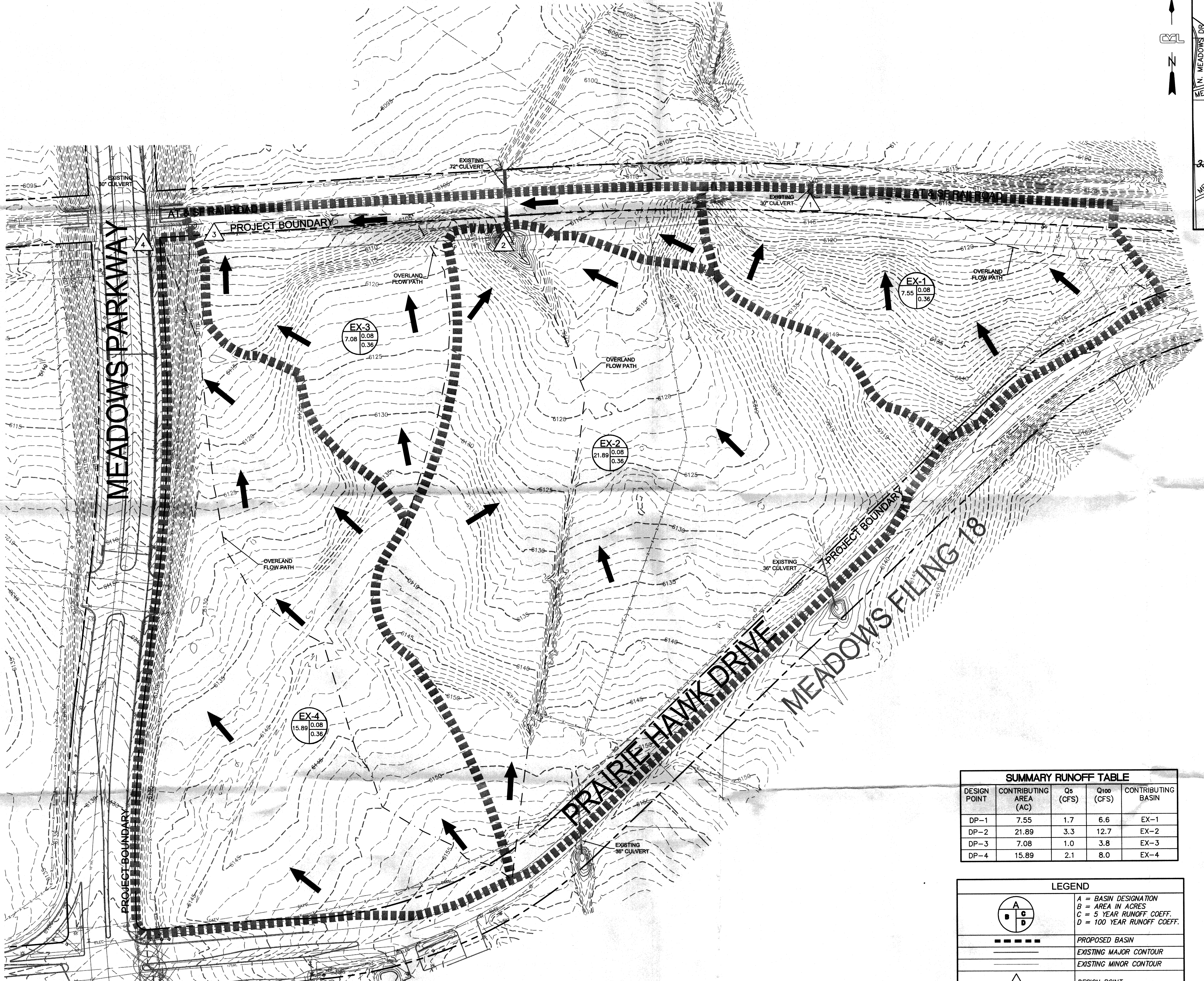
CASTLE ROCK LAND COMPANY
3033 EAST 1ST AVENUE, #410
DENVER, CO 80206

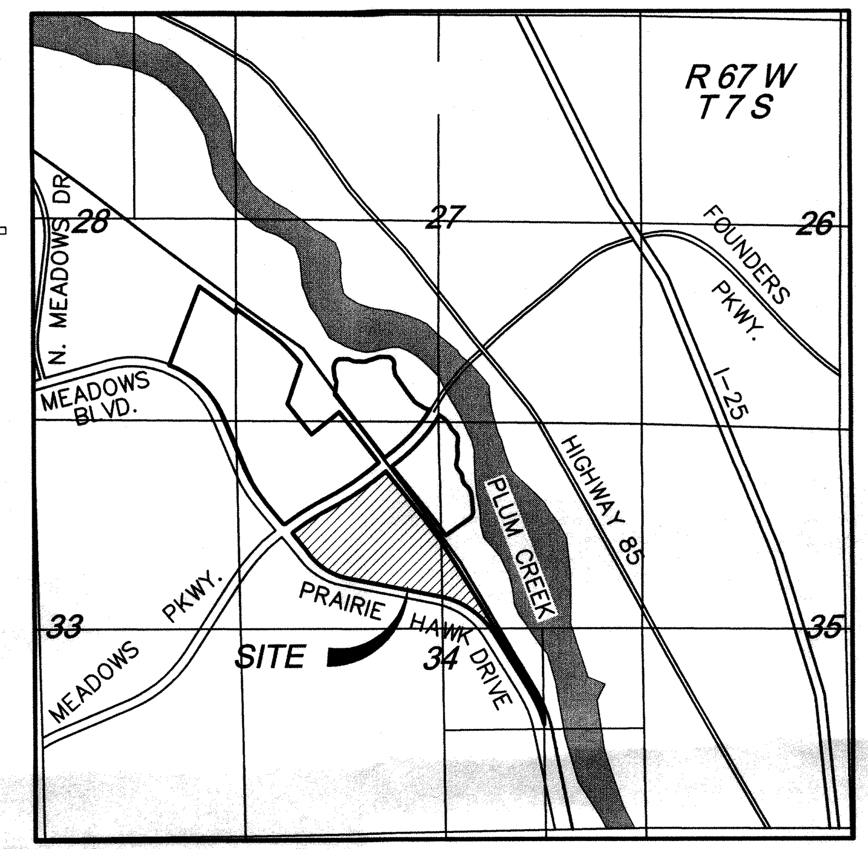
THE MEADOWS FILING 17
LOT 5 AND 6

DEVELOPED DRAINAGE MAP

SCALE: AS SHOWN
FILE NO: 04811401
DRAWN BY: ACS
CHECKED BY: AMZ
DATE: FEB.15, 2004

SHEET NUMBER
1





VICINITY MAP
1" = 2000'

100 50 0 100 200

SCALE: 1" = 100'

SUMMARY RUNOFF TABLE

DESIGN POINT	CONTRIBUTING AREA (AC)	Q_5 (CFS)	Q_{100} (CFS)	CONTRIBUTING BASIN
DP-1	7.55	1.7	6.6	EX-1
DP-2	21.89	3.3	12.7	EX-2
DP-3	7.08	1.0	3.8	EX-3
DP-4	15.89	2.1	8.0	EX-4

LEGEND

A B C D	A = BASIN DESIGNATION B = AREA IN ACRES C = 5 YEAR RUNOFF COEFF. D = 100 YEAR RUNOFF COEFF.
	PROPOSED BASIN
	EXISTING MAJOR CONTOUR
	EXISTING MINOR CONTOUR
1	DESIGN POINT
	PROPOSED STORM DRAIN
	FLOW AROW

I HEREBY AFFIRM THAT THESE FINAL CONSTRUCTION PLANS WERE PREPARED UNDER MY DIRECT SUPERVISION, IN ACCORDANCE WITH ALL APPLICABLE TOWN OF CASTLE ROCK AND STATE OF COLORADO STANDARDS AND STATUTES, RESPECTIVELY; AND THAT I AM FULLY REPONSIBLE FOR ALL DESIGN AND REVISIONS RELATIVE TO SAID PLANS.

COLORADO REGISTERED PROFESSIONAL ENGINEER KURT A. LANG 32249 02-15-05

KURT A. LANG, COLORADO P.E. 32249 DATE

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ENGINEERING DIVISION DATE

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1	ISSUED FOR CONSTRUCTION	02/15/05	KAL		

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DENVER, CO 80206

THE MEADOWS FILING 17
LOT 5 AND 6
EXISTING CONDITIONS DRAINAGE MAP

SCALE: AS SHOWN
FILE NO: 04811401
DRAWN BY: ACS
CHECKED BY: AMZ
DATE: FEB.15, 2004
SHEET NUMBER 1