PHASE III DRAINAGE REPORT
FOR

Chick-fil-A #05190

A Replat of Lot 1A, Block 2, Parkway Subdivision Filing No. 3 – 3rd Amendment Located in the West Half of Section 3 Township 6 South, Range 67 West of the 6th P.M City of Lone Tree, County of Douglas, State of Colorado

LONE TREE, COLORADO

Prepared For:

Chick-fil-A, Inc.
105 Progress
Irvine, California 92618
303-519-7206
Contact: Steve Schwartz

Prepared By:

MERRICK®

Merrick & Company
5970 Greenwood Plaza Blvd.
Greenwood Village, CO 80111
(303) 353-3926
Contact: Kristofer K. Wiest, P.E.
Phone: 303-353-3695
Project No. 65121141

August 2023

ENGINEER'S CERTIFICATION STATEMENT

"This report and plan for the Phase III drainage design of Chick-fil-A #05274 was prepared by me (or under my direct supervision) in accordance with the provisions of the *City of Lone Tree Storm Drainage Design and Technical Criteria* for the owners thereof. I understand that the City of Lone Tree does not and will not assume liability for drainage and erosion control facilities done by others."

08/18/2023

SIGNATURE: ______________________________

Kellan D. Black, PE
Registered Professional Engineer State of Colorado
#57201
For and on Behalf of Merrick & Company

DEVELOPER'S CERTIFICATION STATEMENT

"Chick-fil-A, Inc. hereby certifies that the drainage facilities for Chick-fil-A #05274 shall be constructed according to the design presented in this report. I understand that the City of Lone Tree does not and will not assume liability for the drainage facilities designed and/or certified by my engineer and that the City of Lone Tree reviews drainage plans pursuant to Lone Tree Municipal Code, Chapter 15, Article 1; but cannot, on behalf of Chick-fil-A #05274, guarantee that final drainage design review will absolve Chick-fil-A, Inc. and/or their successors and/or assigns of future liability for improper design. I further understand that approval of the Site Improvement Plan and/or Final Plan does not imply approval of my engineer's drainage design."

____
Name of Developer

____
Authorized Signature

TABLE OF CONTENTS

APPENDIX

I. GENERAL LOCATION AND DESCRIPTION

A. SITE LOCATION

This Phase III Drainage Report is being prepared for the fast-food restaurant Chick-fil-A #05274 located within a portion of Lot 1A, Block 2 Parkway Subdivision Filing No. 3, 3rd Amendment located in the West half of Section 3 Township 6 South, Range 67 West of the 6th P.M. City of Lone Tree, County of Douglas, State of Colorado. The Site is located just North of the C-470 Interstate and South Yosemite Street intersection and directly South of an At Home – Home Goods store. The Site is zoned C – Commercial, Subzone C2.

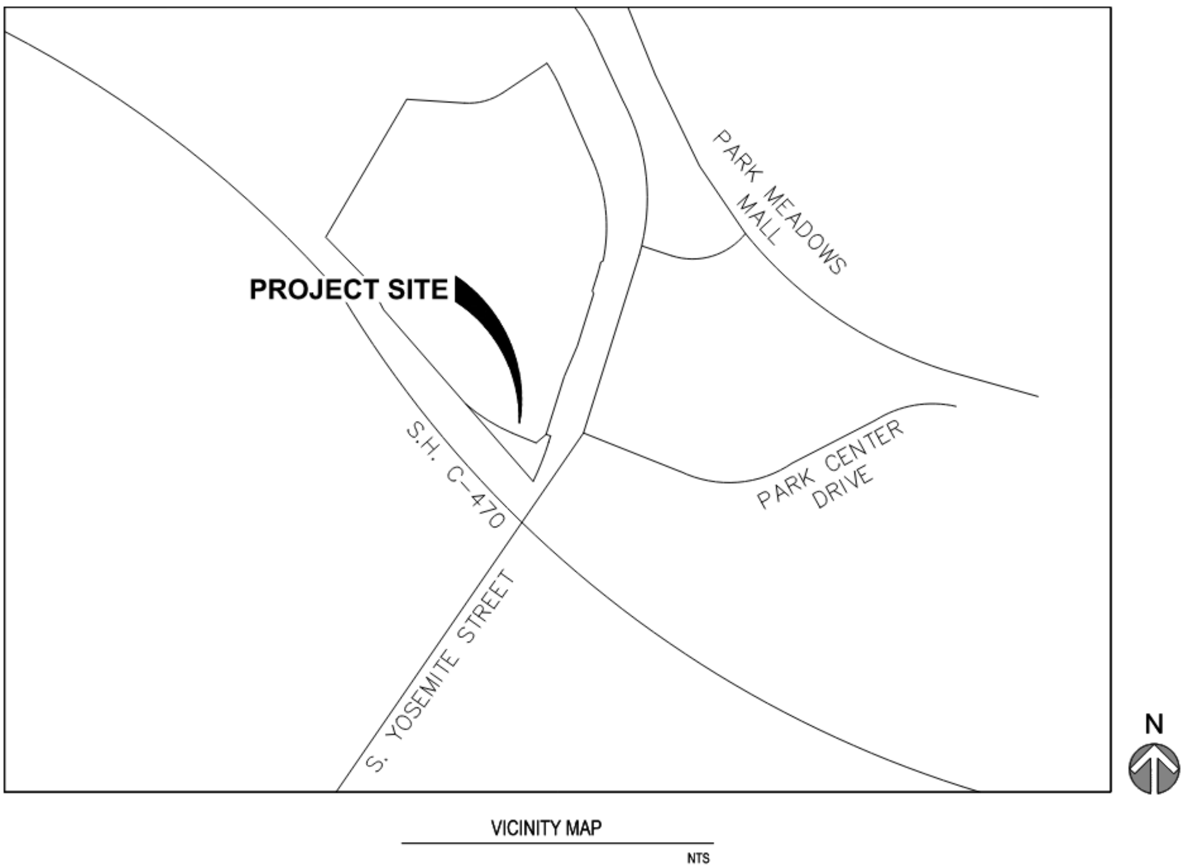


FIGURE 1

B. DESCRIPTION OF PROPERTY

The proposed development is 1.33 acres, with a total disturbance area of 1.80 acres, more or less. The Site lies within Lot 1A-1 Block 2 (16.06 acres +/-) which is to be re-platted to divide the Lot into Lot 1A-1 (14.728 acres +/-) and Lot 1A-2 (1.333 acres +/-). The development resides within an existing parking lot for the At Home – Home Goods store consisting of parking islands, drive aisles, and landscaping. Generally the existing Site slopes from North to South at approximately 2.0%.

According to the Natural Resources Conservation Service (NRCS) Soils Classification Map the Site consists 97.3% of Fondis clay loam, Hydrologic Soil Group C, and 2.7% of Renohill-Buick complex soils, Hydrologic Soil Group C and D. A copy of the soils classification report is included in Appendix A. Soils classified as Group C have moderately high runoff potential and have lower rates of infiltration than Groups A and B which will result in slightly higher runoff rates.

There are no known major or minor drainageways located adjacent to the development. Existing storm infrastructure captures and conveys peak storm runoff to a regional detention pond located northwest of the Site, and just west of the existing parking lot. The Site is as described on the FEMA's Flood Insurance Rate Map 08035C0042G, dated March 16, 2016. As indicated on FEMA's FIRM Map the closest drainageway is the Willow Creek (at Lone Tree) and located on the south side of the C-470 Interstate and west of South Yosemite Street.

There are no known existing irrigation canals or ditches on or near the proposed Site.

The proposed Site will include a commercial drive-thru Chick-fil-A restaurant located at the southeast corner of the existing At Home – Home Goods store parking lot. The proposed structure will be 5,380 square feet more or less containing 140 interior seats and 12 exterior. The drive-thru entrance will be at the southwest corner of the building wrapping around the south and along the eastern side of the building containing two lanes, an order point canopy, and a meal delivery canopy attached to the building. There will be landscaping along the South Yosemite Street and C-470 on-ramp street frontages, as well as landscaping within the parking islands and screening the trash enclosure. The Site will maintain the overall drainage patterns and convey peak storm runoff south where it will be capture by two proposed storm sewer inlets and two existing storm sewer inlets.

II. DRAINAGE BASINS AND SUB-BASINS

A. <u>MAJOR DRAINAGE BASINS</u>

The proposed development lies within the *Phase III Drainage Study Project Majestic* revised December 1994 completed by Martin/Martin. The Study depicts the entire 16.81 acres of Lot 1A storm runoff being conveyed via curb and gutter and storm sewer infrastructure to a detention pond located just west of the At Home – Home Goods store and it's parking lot. The detention pond has been designed to detain the 100-year storm, providing a volume of 2.08 acre feet, and releasing at 14.47 cfs. Flows from the detention pond will be released to a swale designed within the Studies improvements conveying flows to an existing pond designed by others. The Study has been provided in Appendix D for reference.

B. <u>MINOR DRAINAGE BASINS</u>

The Site is comprised of 5 on-site drainage basins and 7 off-site drainage basins. The proposed basins and design points are depicted on the associated drainage plan included in Appendix A. Below is a summary table of the basin Peak Storm Runoff:

SUMMARY RUNOFF TABLE (cfs)					
Basin	**Design Point**	**Area (ac)**	**Imp (%)**	**5-YR Peak Runoff**	**100-YR Peak Runoff**
A1	3	0.19	90%	0.7	1.4
A2	4	0.10	81%	0.3	0.7
B1	2	0.92	78%	3.0	6.5
C1	1	0.03	90%	0.1	0.2
D1	7	0.11	2%	0.0	0.4
OS1	4	1.41	94%	4.8	9.4
OS2	5	0.55	94%	2.0	3.9
OS3	2	2.23	95%	8.1	15.9
OS4	7	0.12	2%	0.1	0.4
OS5	4	0.03	97%	0.1	0.2
OS6	4	0.09	2%	0.0	0.3
OS7	7	0.17	2%	0.1	0.7
Total to EX Pond	1-5	5.55	90%	19.2	38.6
Total to Off-Site	7-8	0.40	2%	0.2	1.6

The following basins are conveyed and collected on-site by proposed and existing storm sewer infrastructure.

BASIN A1 (Q5=0.7 cfs, Q100=1.4 cfs)
Basin A1 is approximately 0.19 acres and consists entirely of the proposed building roof top as well as the attached meal delivery canopy roof top. Developed runoff from the basin will sheet flow across the rooftop and collected by localized roof drains. The roof drains will tie-in to the proposed on-site storm sewer infrastructure at design point 3.

BASIN A2 (Q5=0.3 cfs, Q100=0.7 cfs)
Basin A2 is approximately 0.10 acres and consists of the proposed private drive, drive-thru lane, and pedestrian walk. Developed runoff from the basin will sheet flow across the hardscape where it will be conveyed via curb and gutter to an off-site storm sewer inlet located at design point 4.

BASIN B1 (Q5=3.0 cfs, Q100=6.5 cfs)
Basin B1 is approximately 0.92 acres and consists of the proposed parking lot to include hardscaping and landscaping. Developed runoff from the basin will sheet flow across the rooftop and collected by localized roof drains. The roof drains will tie-in to the proposed on-site storm sewer infrastructure at design point 2.

BASIN C1 (Q5= 0.1 cfs, Q100=0.2 cfs)
Basin C1 is approximately 0.03 acres and consists entirely of the proposed order point canopy roof top. Developed runoff from the basin will sheet flow across the rooftop and collected by localized roof drains. The roof drains will tie-in to the proposed on-site storm sewer infrastructure at design point 1.

BASIN OS1 (Q5=4.8 cfs, Q100=9.4 cfs)
Basin OS1 is approximately 1.41 acres and consists of the existing parking lot to include hardscaping and landscaping. Developed runoff from the basin will sheet flow across the rooftop and collected by localized roof drains. The roof drains will tie-in to the proposed on-site storm sewer infrastructure at design point 4.

BASIN OS2 (Q5=2.0 cfs, Q100=3.9 cfs)
Basin OS2 is approximately 0.55 acres and consists of the existing parking lot to include hardscaping and landscaping. Developed runoff from the basin will sheet flow across the rooftop and collected by localized roof drains. The roof drains will tie-in to the proposed on-site storm sewer infrastructure at design point 5.

BASIN OS3 (Q5=8.1 cfs, Q100=15.9 cfs)
Basin OS3 is approximately 2.23 acres and consists of the existing parking lot to include hardscaping and landscaping. Developed runoff from the basin will sheet flow across the rooftop and collected by localized roof drains. The roof drains will tie-in to the proposed on-site storm sewer infrastructure at design point 2.

BASIN OS5 (Q5=0.1 cfs, Q100=0.2 cfs)
Basin OS5 is approximately 0.03 acres and consists of the proposed private drive. Developed runoff from the basin will sheet flow across the hardscape where it will be conveyed via curb and gutter to an off-site storm sewer inlet located at design point 4.

BASIN OS6 (Q5=0.0 cfs, Q100=0.3 cfs)
Basin OS6 is approximately 0.09 acres consisting of landscaping along South Yosemite Street. Developed runoff will sheet flow north to the private drive curb and gutter where it will be conveyed to a proposed off-site storm sewer inlet located at design point 4.

The following basins are conveyed off-site and collected by existing off-site storm sewer infrastructure.

BASIN D1 (Q5=0.0 cfs, Q100=0.4 cfs)
Basin D1 is approximately 0.11 acres consisting of landscaping along South Yosemite Street and the C-470 on-ramp street frontages. Developed runoff will sheet flow southeast and into South Yosemite Street and the C-470 on-ramp, ultimately being captured by an existing storm sewer inlet located along the western curb of South Yosemite Street near the intersection at design point 7.

BASIN OS4 (Q5=0.1 cfs, Q100=0.4 cfs)
Basin OS4 is approximately 0.12 acres consisting of existing landscaping along the C-470 on-ramp street frontage. Developed runoff will sheet flow southeast and into South Yosemite Street and the C-470 on-ramp, ultimately being captured by an existing storm sewer inlet located along the western curb of South Yosemite Street near the intersection at design point 7.

BASIN OS7 (Q5=0.1 cfs, Q100=0.7 cfs)
Basin OS7 is approximately 0.17 acres consisting of landscaping along South Yosemite Street. Developed runoff will sheet flow southeast and into South Yosemite Street and the C-470 on-ramp, ultimately being captured by an existing storm sewer inlet located along the western curb of South Yosemite Street near the intersection at design point 7.

C. DRAINAGE DESIGN CRITERIA

A. REGULATIONS

The *Douglas County Storm Drainage Design and Technical Criteria Manual* (DC Manual) amended July 8, 2008, and the Mile High Flood District (MHFD) *Urban Storm Drainage* (MHFD Manual) (Updated: Vol. 1-Mar. 2017; Vol. 2-Sept. 2017; Vol. 3-Apr. 2018). These documents shall be referred to as the "Manual".

B. DRAINAGE STUDIES, MASTER PLANS, and SITE CONSTRAINTS

The following Drainage Reports involving the project site were considered in this study:

1. *Phase III Drainage Study Project Majestic* prepared by Martin/Martin Inc., revised December 1994.

C. HYDROLOGIC CRITERIA

Five-year and 100-year storm event runoff was calculated using the Rational method. Percent imperviousness values are from Table 6-3 of the *MHFD Manual*.
Runoff coefficients are from Table 6-4 of the *MHFD Manual* using hydrologic soil group C. Times of concentration were based on land use imperviousness values as well as distance and slope of runoff travel. Runoff conveyance coefficients were determined using Table 6-2 from the *Criteria.*
Rainfall intensities (I) for the area are approximated by the equation:

$$I = \frac{28.5P_1}{(10 + Tc)^{0.786}}$$

P_1 represents the 1-hour design rainfall values in inches per table 6-1 Zone 1 of the *DC Manual*. T_c represents the time of concentration in minutes and consists of overland flow time plus travel time. Time of concentration is calculated as the sum of the overland flow time and travel time. Overland flow time is calculated over a maximum 300 foot distance using the FAA equation:

$$T_C = \frac{0.395(1.1 - C_5)\sqrt{L_i}}{S_O^{0.33}}$$

C_5 = basin composite runoff coefficient for the five-year storm event

L = length of overland flow in feet
S = slope of flow path in percent
T_i = travel time in minutes

Travel time is calculated as the flow time through a length of street gutter or channel by multiplying the average flow velocity by the travel length. The minimum time of concentration used for urbanized basins was 5 minutes.

All hydrological calculations, including a summary of the 5-year and 100-year storm event flows, are provided in Appendix B. Sub-basin maps are also included in Appendix D.

D. HYDRAULIC CRITERIA

Hydraulic calculations in compliance with the Manual for street capacity, inlet calculations, pipe sizes, etc. will be included as part of the Phase III drainage report. Bentley StormCAD will be used to analyze the hydraulic grade line of the stormwater conveyances. The Urban Drainage Inlet Sizing spreadsheet will be used to size proposed site inlets, as well as analyze existing street flow capacity and existing inlet capacity.

E. WATER QUALITY ENHANCEMENT

Water quality treatment will be provided within the existing detention pond located northwest of the Site, no additional water quality treatment is required.

D. STOMWATER MANAGEMENT FACILITY DESIGN

A. STORMWATER CONVEYANCE FACILITIES

The proposed development developed runoff will generally sheet flow from north to south and be collected by private storm sewer infrastructure, some will be routed to existing storm sewer infrastructure. 92% of the Site's developed runoff will be collected and conveyed to the existing detention pond. Total developed flows to the existing detention pond are as calculated Q_5=19.2 cfs (EX Q_5=21.92) and Q_{100}=38.6 cfs (EX Q_{100}=40.10 cfs) [See Reference #1 for Existing Flow data]. 8% of the Site's developed runoff will be conveyed off-site and routed to existing curb and gutter near the intersection of C-470 on-ramp and South Yosemite Street where it will be captured by an existing storm sewer inlet. Total developed flows to the existing inlet are calculated as Q_5=0.2 cfs and Q_{100}=1.6 cfs.

B. STORMWATER STORAGE FACILITIES

This Site is tributary to the existing detention and water quality pond located northwest of the Site and as described within the Phase III Drainage Study Project Majestic referenced earlier. There are no new on-site water quality or detention facilities anticipated for this site.

The landlord of the proposed site is currently working on modifying the existing pond to ensure that the facility up to City Code.

C. WATER QUALITY ENHACEMENT BEST MANAGEMENT PRACTICES

The existing regional detention pond as mentioned above will provide permanent water quality for the Site. Temporary erosion control measures will be installed during construction to mitigate sediment leaving the Site. Prior to construction, a Grading, Erosion, and Sediment Control (GESC) Plan will need to be approved and a GESC permit obtained. In addition, a state stormwater discharge permit will be required.

D. FLOODPLAIN MODIFICATIONS

It is not anticipated that any floodplain modifications will be required as a result of the development of the proposed Site.

E. POTENTIAL PERMITTING REQUIREMENTS

The City of Lone Tree will require a Grading, Erosion, and Sediment Control (GESC) approved plan and permit prior to construction. In addition, a state stormwater discharge permit will be required.

F. GENERAL

All tables, figures, and charts discussed above comply with the *DC Manual* and *MHFD Manual*.

E. CONCLUSIONS

A. COMPLIANCE WITH STANDARDS

The proposed drainage concept complies with the current City of Lone Tree Drainage Criteria, as well as the *DC Manual*, *MHFD Manual*, and Drainage Studies previously mentioned within this report.

B. VARIANCES

No variances were necessary for this report.

C. DRAINAGE CONCEPT

Development of the proposed site will not adversely affect surrounding developments. A majority of the developed site runoff will be captured by proposed and existing inlets. The proposed and existing storm sewer infrastructure will convey developed site runoff to the existing regional detention pond, where it will be treated and detained.

F. REFERENCES

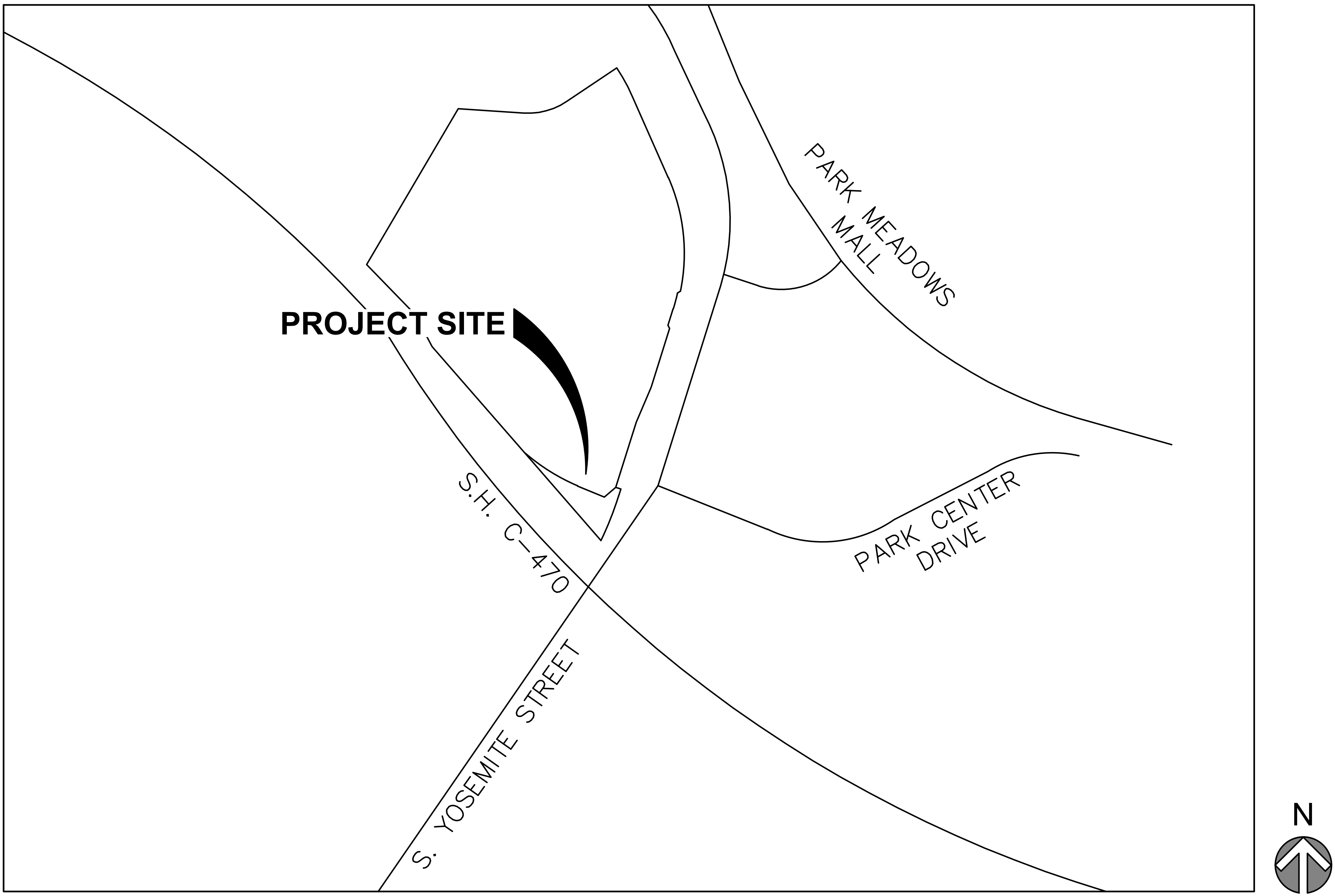
1. *Phase III Drainage Study Project Majestic* prepared by Martin/Martin Inc., revised December 1994.

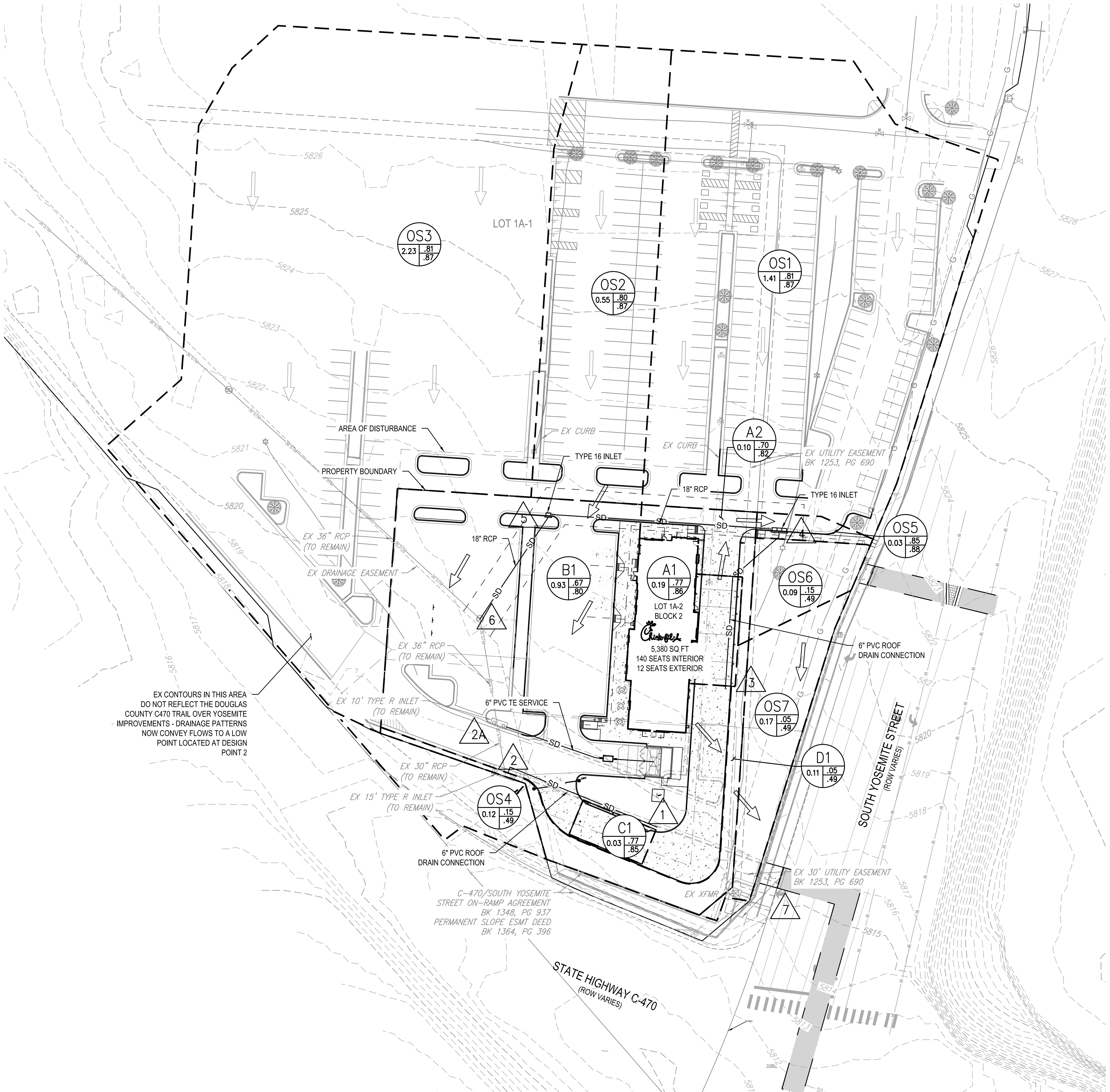
2. FEMA, *FIRM Panel Map No. 08035C0042G,* Revised March 16, 2016.

3. Urban Drainage and Flood Control District, *Urban Storm Drainage Criteria Manual*, Updated: Vol. 1-August 2018; Vol. 2-September 2017; Vol. 3-April 2018.

4. "Douglas County Storm Drainage Design and Technical Criteria Manual" amended July 8, 2008

Appendix A
(Maps)


PROJECT SITE
PARK MEADOWS MALL
PARK CENTER DRIVE
S.H. C-470
S. YOSEMITE STREET
N



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LEGEND:

- PROPERTY BOUNDARY
- PROPOSED MAJOR CONTOUR
- PROPOSED MINOR CONTOUR
- EXISTING MAJOR CONTOUR
- EXISTING MINOR CONTOUR
- DRAINAGE BASIN BOUNDARY
- DESIGN POINT
- PROPOSED FLOW ARROWS
- EXISTING FLOW ARROWS
- STORM SEWER
- STORM INLET
- STORM MANHOLE
- EX SANITARY MANHOLE
- EX STORM MANHOLE
- EX STORM SERVICE
- EX STORM INLET

PROPOSED BASIN:

A-2 0.10 .44 .59 — BASIN IDENTIFICATION; BASIN C5 VALUE; BASIN C100 VALUE; BASIN AREA (ACRES)

N

20' 0 10' 20' 40'

1" = 20' HOR.

Know what's below. Call before you dig.

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Chick-fil-A
5200 Buffington Road
Atlanta, Georgia 30349-2998

MERRICK®
5970 GREENWOOD PLAZA BLVD
GREENWOOD VILLAGE, CO 80111
303-751-0741

FOR AND AND ON-BEHALF OF MERRICK AND COMPANY

CITY OF LONE TREE APPROVAL
CITY OF LONE TREE
DATE
THESE CONSTRUCTION PLANS HAVE BEEN REVIEWED BY THE CITY OF LONE TREE FOR SIP IMPROVEMENTS ONLY.
ENGINEERING DIVISION ACCEPTANCE BLOCK

CONSTRUCTION DOCUMENTS

CHICK-FIL-A
HWY 470 & YOSEMITE
NWC OF HWY 470 & YOSEMITE
LONE TREE, CO 80124
LOTS 4 AND 5, NINE MILE CORNER AMENDMENT NO. 1

FSR#05190

BUILDING TYPE / SIZE: P13 LS LRG (MOD)
RELEASE: 22.05

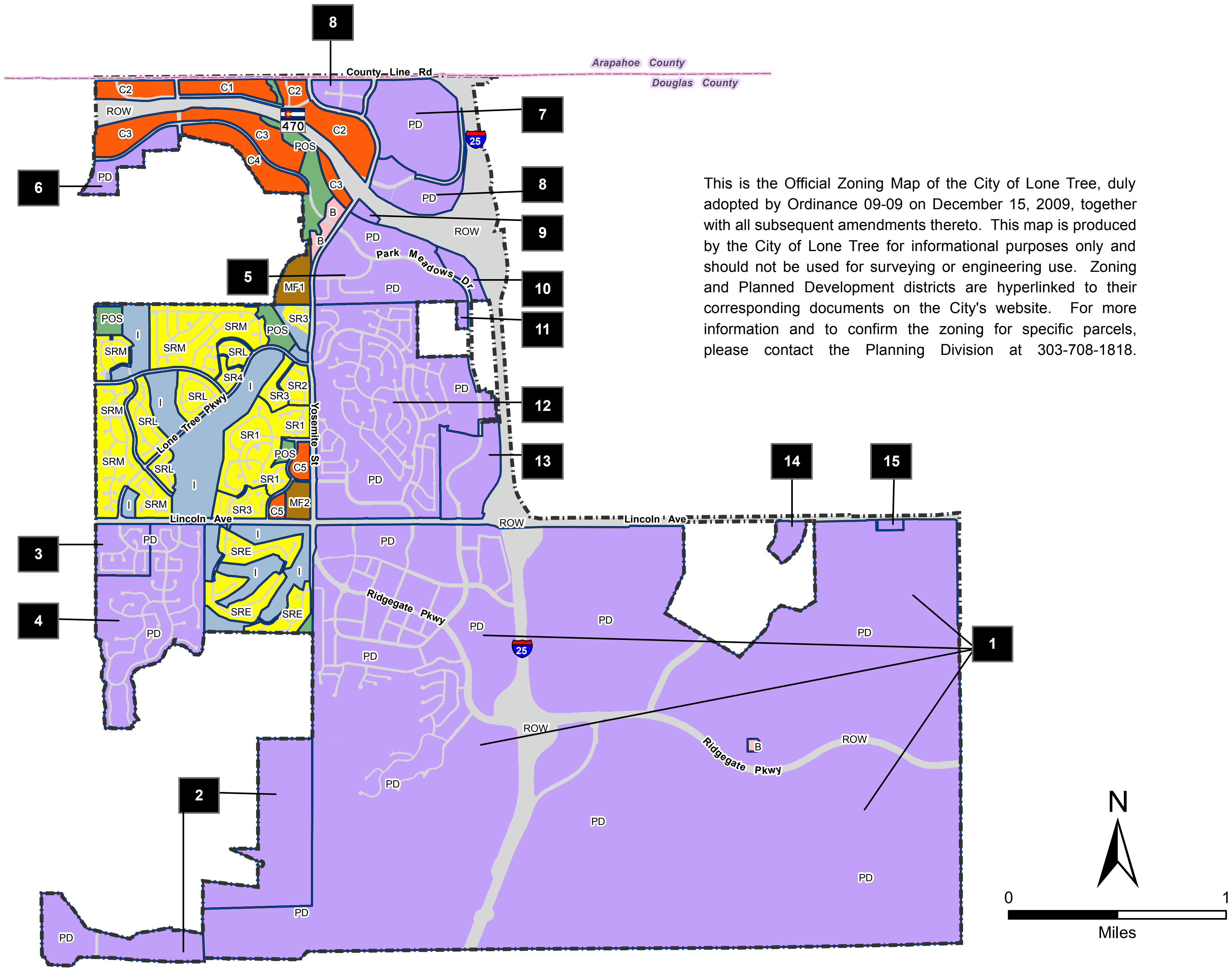
REVISION SCHEDULE

NO.	DATE	DESCRIPTION

CONSULTANT PROJECT # 65121141
PRINTED FOR: FOR CONSTRUCTION
DATE: 05/24/23
DRAWN BY: KEA
SHEET: DRAINAGE MAP
SHEET NUMBER: 16

City of Lone Tree Zoning Map

CITY OF LONE TREE



This is the Official Zoning Map of the City of Lone Tree, duly adopted by Ordinance 09-09 on December 15, 2009, together with all subsequent amendments thereto. This map is produced by the City of Lone Tree for informational purposes only and should not be used for surveying or engineering use. Zoning and Planned Development districts are hyperlinked to their corresponding documents on the City's website. For more information and to confirm the zoning for specific parcels, please contact the Planning Division at 303-708-1818.

Zoning Districts

- SR – Suburban Residential, all Subzones
- MF – Multi-Family Residential
- B – Business
- C – Commercial, Subzones C1-C5
- I – Institutional
- PD – Planned Development Districts (see below for list)
- POS – Parks & Open Space
- ROW – Right of Way
- Not In City Limits

Planned Development Districts

1. RidgeGate PD
2. SouthRidge Preserve PD
3. Centennial Ridge PD
4. Carriage Club PD
5. Westbrook Entertainment & Sports District PD
6. Lone Tree Town Center PD
7. Park Meadows PD
8. Park Meadows Town Center PD
9. Applebee's at Lone Tree PD
10. C-470 Joint Venture PD
11. Lyeth-Burk PD
12. Heritage Hills PD
13. Omnipark PD
14. Meridian International Business Center PD
15. Lincoln Self Storage PD

Current as of October 3, 2018

NOTES TO USERS

This map is for use in administering the National Flood Insurance Program. It does not necessarily identify all areas subject to flooding, particularly from local drainage sources of small size. The **community map repository** should be consulted for possible updated or additional flood hazard information.

To obtain more detailed information in areas where **Base Flood Elevations** (BFEs) and/or **floodways** have been determined, users are encouraged to consult the Flood Profiles and Floodway Data and/or Summary of Stillwater Elevations tables shown on this FIRM. Users should be aware that BFEs shown on the FIRM represent rounded whole-foot elevations. These BFEs are intended for flood insurance rating purposes only and should not be used as the sole source of flood elevation information. Accordingly, flood elevation data presented in the Flood Profiles and Floodway Data and/or Summary of Stillwater Elevations tables should be utilized in conjunction with the FIRM for purposes of construction and/or floodplain management.

Boundaries of the **floodways** were computed at cross sections and interpolated between cross sections. The floodways were based on hydraulic considerations with regard to requirements of the National Flood Insurance Program. Floodway widths and other pertinent floodway data are provided in the Floodway Data table shown on this FIRM.

The **projection** used in the preparation of this map was Universal Transverse Mercator (UTM) zone 13. The **horizontal datum** was NAD 83, GRS 1980 spheroid. Differences in datum, spheroid, projection or UTM zones used in the production of FIRMs for adjacent jurisdictions may result in slight positional differences in map features across jurisdiction boundaries. These differences do not affect the accuracy of this FIRM.

Flood elevations on this map are referenced to the North American Vertical Datum of 1988. These flood elevations must be compared to structure and ground elevations referenced to the same **vertical datum**. For information regarding conversion between the National Geodetic Vertical Datum of 1929 and the North American Vertical Datum of 1988, visit the National Geodetic Survey website at http://www.ngs.noaa.gov or contact the National Geodetic Survey at the following address:

NGS Information Services
NOAA, N/NGS12
National Geodetic Survey
SSMC-3, #9202
1315 East-West Highway
Silver Spring, Maryland 20910-3282
(301) 713-3242

To obtain current elevation, description, and/or location information for **bench marks** shown on this map, please contact the Information Services Branch of the National Geodetic Survey at **(301) 713- 3242**, or visit its website at http://www.ngs.noaa.gov.

Base map information shown on this FIRM was provided by the Douglas County GIS Department and the Town of Castle Rock GIS Department. Additional input was provided by the City of Lone Tree and Town of Parker. These data are current as of 2010.

Certain areas not in Special Flood Hazard Areas may be protected by **flood control structures**. Refer to Section 2.4 "Flood Protection Measures" of the Flood Insurance Study report for information on flood control structures for this jurisdiction.

The **profile baselines** depicted on this map represent the hydraulic modeling baselines that match the flood profiles in the FIS report. As a result of improved topographic data, the **profile baseline**, in some cases, may deviate significantly from the channel centerline or appear outside the SFHA.

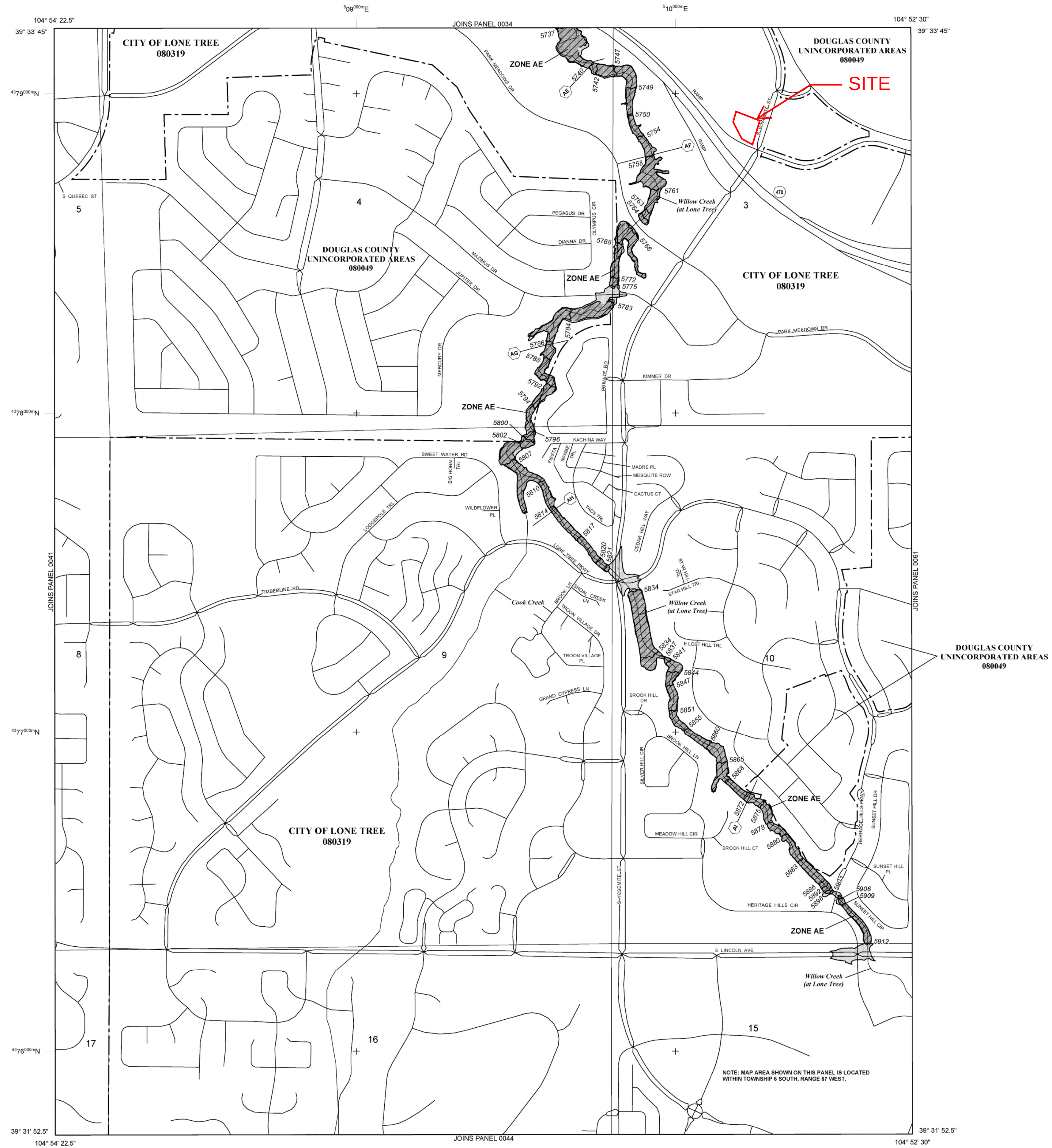
Based on updated topographic information, this map reflects more detailed and up-to-date **stream channel configurations and floodplain delineations** than those shown on the previous FIRM for this jurisdiction. As a result, the Flood Profiles and Floodway Data tables for multiple streams in the Flood Insurance Study Report (which contains authoritative hydraulic data) may reflect stream channel distances that differ from what is shown on the map. Also, the road to floodplain relationships for unrevised streams may differ from what is shown on previous maps.

Corporate limits shown on this map are based on the best data available at the time of publication. Because changes due to annexations or de-annexations may have occurred after this map was published, map users should contact appropriate community officials to verify current corporate limit locations.

Please refer to the separately printed **Map Index** for an overview map of the county showing the layout of map panels; community map repository addresses; and a Listing of Communities table containing National Flood Insurance Program dates for each community as well as a listing of the panels on which each community is located.

For information on available products associated with this FIRM visit the **Map Service Center (MSC)** website at http://msc.fema.gov. Available products may include previously issued Letters of Map Change, a Flood Insurance Study Report, and/or digital versions of this map. Many of these products can be ordered or obtained directly from the MSC website.

If you have **questions about this map,** how to order products, or the National Flood Insurance Program in general, please call the **FEMA Map Information eXchange (FMIX)** at **1-877-FEMA-MAP** (1-877-336-2627) or visit the FEMA website at http://www.fema.gov/business/nfip.



LEGEND

SPECIAL FLOOD HAZARD AREAS (SFHAs) SUBJECT TO INUNDATION BY THE 1% ANNUAL CHANCE FLOOD

The 1% annual chance flood (100-year flood), also known as the base flood, is the flood that has a 1% chance of being equaled or exceeded in any given year. The Special Flood Hazard Area is the area subject to flooding by the 1% annual chance flood. Areas of Special Flood Hazard include Zones A, AE, AH, AO, AR, A99, V, and VE. The Base Flood Elevation is the water-surface elevation of the 1% annual chance flood.

ZONE A	No Base Flood Elevations determined.
ZONE AE	Base Flood Elevations determined.
ZONE AH	Flood depths of 1 to 3 feet (usually areas of ponding); Base Flood Elevations determined.
ZONE AO	Flood depths of 1 to 3 feet (usually sheet flow on sloping terrain); average depths determined. For areas of alluvial fan flooding, velocities also determined.
ZONE AR	Special Flood Hazard Areas formerly protected from the 1% annual chance flood by a flood control system that was subsequently decertified. Zone AR indicates that the former flood control system is being restored to provide protection from the 1% annual chance or greater flood.
ZONE A99	Area to be protected from 1% annual chance flood by a Federal flood protection system under construction; no Base Flood Elevations determined.
ZONE V	Coastal flood zone with velocity hazard (wave action); no Base Flood Elevations determined.
ZONE VE	Coastal flood zone with velocity hazard (wave action); Base Flood Elevations determined.

FLOODWAY AREAS IN ZONE AE

The floodway is the channel of a stream plus any adjacent floodplain areas that must be kept free of encroachment so that the 1% annual chance flood can be carried without substantial increases in flood heights.

OTHER FLOOD AREAS

ZONE X Areas of 0.2% annual chance flood; areas of 1% annual chance flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 1% annual chance flood.

OTHER AREAS

ZONE X Areas determined to be outside the 0.2% annual chance floodplain.

ZONE D Areas in which flood hazards are undetermined, but possible.

COASTAL BARRIER RESOURCES SYSTEM (CBRS) AREAS

OTHERWISE PROTECTED AREAS (OPAs)

CBRS areas and OPAs are normally located within or adjacent to Special Flood Hazard Areas.

1% Annual Chance Floodplain Boundary

0.2% Annual Chance Floodplain Boundary

Floodway boundary

Zone D boundary

CBRS and OPA boundary

Boundary dividing Special Flood Hazard Area Zones and boundary dividing Special Flood Hazard Areas of different Base Flood Elevations, flood depths, or flood velocities.

513 — Base Flood Elevation line and value; elevation in feet*

(EL 987) — Base Flood Elevation value where uniform within zone; elevation in feet*

*Referenced to the North American Vertical Datum of 1988

A — A Cross section line

23 - - - - 23 Transect line

45° 02' 08", 93° 02' 12" — Geographic coordinates referenced to the North American Datum of 1983 (NAD 83) Western Hemisphere

$^{49}89^{000m}$ N — 1000-meter Universal Transverse Mercator grid values, zone 13

DX5510 × — Bench mark (see explanation in Notes to Users section of this FIRM panel)

• M1.5 — River Mile

MAP REPOSITORIES
Refer to Map Repositories list on Map Index

EFFECTIVE DATE OF COUNTYWIDE
FLOOD INSURANCE RATE MAP

SEPTEMBER 30, 2005

EFFECTIVE DATE(S) OF REVISION(S) TO THIS PANEL

MARCH 16, 2016: to update corporate limits, to change base flood elevations, to add base flood elevations, to add special flood hazard areas, to update map format, to add roads and road names, to reflect updated topographic information, to incorporate previously issued letters of map revision.

For community map revision history prior to countywide mapping, refer to the Community Map History table located in the Flood Insurance Study report for this jurisdiction.

To determine if flood insurance is available in this community, contact your insurance agent or call the National Flood Insurance Program at 1-800-638-6620.

MAP SCALE 1" = 500'

250 0 500 1000 FEET
150 0 150 300 METERS

NFIP

NATIONAL FLOOD INSURANCE PROGRAM

PANEL 0042G

FIRM

FLOOD INSURANCE RATE MAP

DOUGLAS COUNTY, COLORADO
AND INCORPORATED AREAS

PANEL 42 OF 495

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
DOUGLAS COUNTY	080049	0042	G
LONE TREE, CITY OF	080319	0042	G

Notice to User: The **Map Number** shown below should be used when placing map orders; the **Community Number** shown above should be used on insurance applications for the subject community.

MAP NUMBER
08035C0042G
MAP REVISED
MARCH 16, 2016

Federal Emergency Management Agency

United States Department of Agriculture

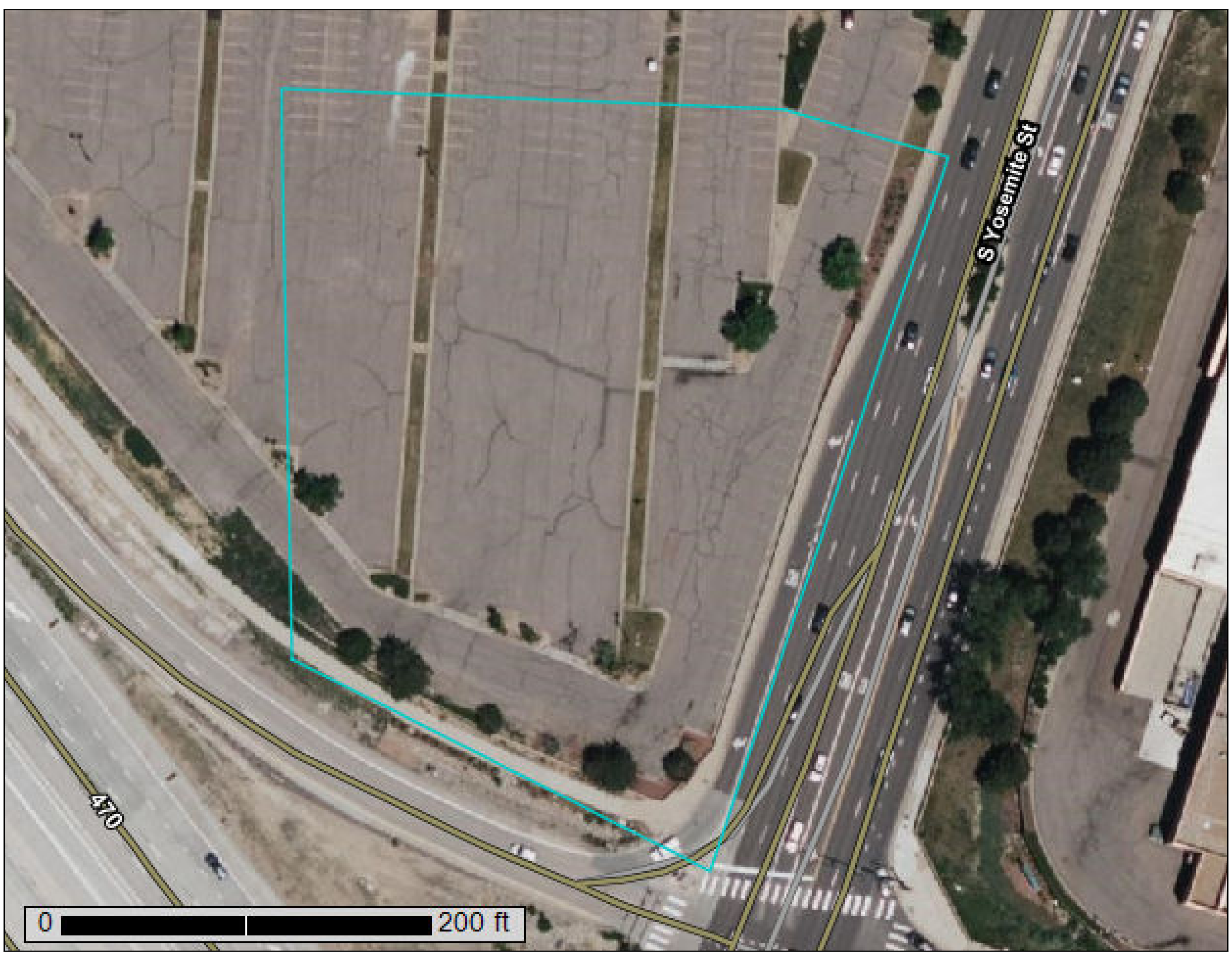
NRCS

Natural Resources Conservation Service

A product of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local participants

Custom Soil Resource Report for

Castle Rock Area, Colorado



January 19, 2023

Preface

Soil surveys contain information that affects land use planning in survey areas. They highlight soil limitations that affect various land uses and provide information about the properties of the soils in the survey areas. Soil surveys are designed for many different users, including farmers, ranchers, foresters, agronomists, urban planners, community officials, engineers, developers, builders, and home buyers. Also, conservationists, teachers, students, and specialists in recreation, waste disposal, and pollution control can use the surveys to help them understand, protect, or enhance the environment.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. Soil surveys identify soil properties that are used in making various land use or land treatment decisions. The information is intended to help the land users identify and reduce the effects of soil limitations on various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

Although soil survey information can be used for general farm, local, and wider area planning, onsite investigation is needed to supplement this information in some cases. Examples include soil quality assessments (http://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/health/) and certain conservation and engineering applications. For more detailed information, contact your local USDA Service Center (https://offices.sc.egov.usda.gov/locator/app?agency=nrcs) or your NRCS State Soil Scientist (http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/contactus/?cid=nrcs142p2_053951).

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

The National Cooperative Soil Survey is a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (NRCS) has leadership for the Federal part of the National Cooperative Soil Survey.

Information about soils is updated periodically. Updated information is available through the NRCS Web Soil Survey, the site for official soil survey information.

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Contents

How Soil Surveys Are Made

Soil surveys are made to provide information about the soils and miscellaneous areas in a specific area. They include a description of the soils and miscellaneous areas and their location on the landscape and tables that show soil properties and limitations affecting various uses. Soil scientists observed the steepness, length, and shape of the slopes; the general pattern of drainage; the kinds of crops and native plants; and the kinds of bedrock. They observed and described many soil profiles. A soil profile is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed or from the surface down to bedrock. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

Currently, soils are mapped according to the boundaries of major land resource areas (MLRAs). MLRAs are geographically associated land resource units that share common characteristics related to physiography, geology, climate, water resources, soils, biological resources, and land uses (USDA, 2006). Soil survey areas typically consist of parts of one or more MLRA.

The soils and miscellaneous areas in a survey area occur in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the area. Each kind of soil and miscellaneous area is associated with a particular kind of landform or with a segment of the landform. By observing the soils and miscellaneous areas in the survey area and relating their position to specific segments of the landform, a soil scientist develops a concept, or model, of how they were formed. Thus, during mapping, this model enables the soil scientist to predict with a considerable degree of accuracy the kind of soil or miscellaneous area at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-vegetation-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. Soil taxonomy, the system of taxonomic classification used in the United States, is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

The objective of soil mapping is not to delineate pure map unit components; the objective is to separate the landscape into landforms or landform segments that have similar use and management requirements. Each map unit is defined by a unique combination of soil components and/or miscellaneous areas in predictable proportions. Some components may be highly contrasting to the other components of the map unit. The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The delineation of such landforms and landform segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, onsite investigation is needed to define and locate the soils and miscellaneous areas.

Soil scientists make many field observations in the process of producing a soil map. The frequency of observation is dependent upon several factors, including scale of mapping, intensity of mapping, design of map units, complexity of the landscape, and experience of the soil scientist. Observations are made to test and refine the soil-landscape model and predictions and to verify the classification of the soils at specific locations. Once the soil-landscape model is refined, a significantly smaller number of measurements of individual soil properties are made and recorded. These measurements may include field measurements, such as those for color, depth to bedrock, and texture, and laboratory measurements, such as those for content of sand, silt, clay, salt, and other components. Properties of each soil typically vary from one point to another across the landscape.

Observations for map unit components are aggregated to develop ranges of characteristics for the components. The aggregated values are presented. Direct measurements do not exist for every property presented for every map unit component. Values for some properties are estimated from combinations of other properties.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses and under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management are assembled from farm records and from field or plot experiments on the same kinds of soil.

Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree of accuracy that a given soil will have a high water table within certain depths in most years, but they cannot predict that a high water table will always be at a specific level in the soil on a specific date.

After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

Soil Map

The soil map section includes the soil map for the defined area of interest, a list of soil map units on the map and extent of each map unit, and cartographic symbols displayed on the map. Also presented are various metadata about data used to produce the map, and a description of each soil map unit.

Soil Map

Map Scale: 1:853 if printed on A portrait (8.5" x 11") sheet.

Meters: 0, 10, 20, 40, 60

Feet: 0, 40, 80, 160, 240

N

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 13N WGS84

MAP LEGEND

Area of Interest (AOI)

- Area of Interest (AOI)

Soils

- Soil Map Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points

Special Point Features

- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line Features

Water Features

- Streams and Canals

Transportation

- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background

- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:20,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Castle Rock Area, Colorado
Survey Area Data: Version 15, Sep 1, 2022

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Jun 9, 2021—Jun 12, 2021

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
FoD	Fondis clay loam, 3 to 9 percent slopes	2.5	97.3%
RmE	Renohill-Buick complex, 5 to 25 percent slopes	0.1	2.7%
Totals for Area of Interest		**2.5**	**100.0%**

Map Unit Descriptions

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however, onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

Castle Rock Area, Colorado

FoD—Fondis clay loam, 3 to 9 percent slopes

Map Unit Setting

National map unit symbol: jqyp
Elevation: 5,500 to 6,800 feet
Mean annual precipitation: 15 to 19 inches
Mean annual air temperature: 47 to 50 degrees F
Frost-free period: 120 to 135 days
Farmland classification: Not prime farmland

Map Unit Composition

Fondis and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Fondis

Setting

Landform: Ridges, buttes, mesas
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Eolian deposits over coarse-silty outwash derived from arkose

Typical profile

H1 - 0 to 7 inches: clay loam
H2 - 7 to 24 inches: clay
H3 - 24 to 60 inches: sandy clay loam

Properties and qualities

Slope: 3 to 9 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Runoff class: High
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 15 percent
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: High (about 9.4 inches)

Interpretive groups

Land capability classification (irrigated): 4e
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: C
Ecological site: R049XB208CO - Clayey Foothill
Hydric soil rating: No

Minor Components

Kutch

Percent of map unit: 5 percent
Hydric soil rating: No

Englewood

Percent of map unit: 5 percent
Hydric soil rating: No

Denver

Percent of map unit: 4 percent
Hydric soil rating: No

Aquic haplustolls

Percent of map unit: 1 percent
Landform: Swales
Hydric soil rating: Yes

RmE—Renohill-Buick complex, 5 to 25 percent slopes

Map Unit Setting

National map unit symbol: jqzy
Elevation: 5,500 to 6,200 feet
Mean annual precipitation: 15 to 17 inches
Mean annual air temperature: 48 to 50 degrees F
Frost-free period: 120 to 135 days
Farmland classification: Not prime farmland

Map Unit Composition

Renohill and similar soils: 50 percent
Buick and similar soils: 30 percent
Minor components: 20 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Renohill

Setting

Landform: Hills
Landform position (three-dimensional): Side slope, base slope
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Weathered, calcareous clayey shale

Typical profile

H1 - 0 to 3 inches: clay loam
H2 - 3 to 12 inches: clay loam
H3 - 12 to 24 inches: clay loam
H4 - 24 to 28 inches: unweathered bedrock

Properties and qualities

Slope: 5 to 25 percent
Depth to restrictive feature: 20 to 40 inches to paralithic bedrock
Drainage class: Well drained
Runoff class: High
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)

Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 15 percent
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: Low (about 4.3 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: D
Ecological site: R049XC202CO - Loamy Foothill 14-19 PZ
Hydric soil rating: No

Description of Buick

Setting

Landform: Hills
Landform position (three-dimensional): Base slope, side slope
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Eolian deposits over silty alluvium

Typical profile

H1 - 0 to 4 inches: loam
H2 - 4 to 15 inches: silty clay loam
H3 - 15 to 22 inches: loam
H4 - 22 to 60 inches: sandy clay loam

Properties and qualities

Slope: 5 to 8 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.60 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 10 percent
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: High (about 9.9 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: C
Ecological site: R049XC202CO - Loamy Foothill 14-19 PZ
Hydric soil rating: No

Minor Components

Manzanola

Percent of map unit: 6 percent
Hydric soil rating: No

Satanta

Percent of map unit: 6 percent

Hydric soil rating: No

Fondis

Percent of map unit: 6 percent
Hydric soil rating: No

Aquic haplustolls

Percent of map unit: 2 percent
Landform: Swales
Hydric soil rating: Yes

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Appendix B
(Hydrologic Calculations)

MERRICK & COMPANY

MERRICK & COMPANY
Developed Composite C-Factor and Impervious Analysis

CFA 470 & Yosemite #05190

Calculated by: KB
Checked by: KW
Date: 3/1/2023

UDFCD - TABLE 6-4, SOIL GROUP C/D

Basin	Land Use	Area (acres)	I value	C2	C5	C100
A1	PROPOSED LANDSCAPE	0.00	0.02	0.01	0.05	0.49
	PROPOSED BUILDING AND WALKS	0.19	0.90	0.73	0.77	0.85
	PROPOSED PAVEMENT	0.00	1.00	0.82	0.86	0.89
		0.19	**0.90**	**0.73**	**0.77**	**0.86**
A2	PROPOSED LANDSCAPE	0.02	0.02	0.01	0.05	0.49
	PROPOSED BUILDING AND WALKS	0.02	0.90	0.73	0.77	0.85
	PROPOSED PAVEMENT	0.06	1.00	0.82	0.86	0.89
		0.10	**0.81**	**0.65**	**0.70**	**0.82**
B1	PROPOSED LANDSCAPE	0.18	0.02	0.01	0.05	0.49
	PROPOSED BUILDING AND WALKS	0.24	0.90	0.73	0.77	0.85
	PROPOSED PAVEMENT	0.50	1.00	0.82	0.86	0.89
		0.92	**0.78**	**0.62**	**0.68**	**0.80**
C1	PROPOSED LANDSCAPE	0.00	0.02	0.01	0.05	0.49
	PROPOSED BUILDING AND WALKS	0.03	0.90	0.73	0.77	0.85
	PROPOSED PAVEMENT	0.00	1.00	0.82	0.86	0.89
		0.03	**0.90**	**0.73**	**0.77**	**0.85**
D1	PROPOSED LANDSCAPE	0.11	0.02	0.01	0.05	0.49
	PROPOSED BUILDING AND WALKS	0.00	0.90	0.73	0.77	0.85
	PROPOSED PAVEMENT	0.00	1.00	0.82	0.86	0.89
		0.11	**0.02**	**0.01**	**0.05**	**0.49**
OS1	PROPOSED LANDSCAPE	0.08	0.02	0.01	0.05	0.49
	PROPOSED BUILDING AND WALKS	0.00	0.90	0.73	0.77	0.85
	PROPOSED PAVEMENT	1.33	1.00	0.82	0.86	0.89
		1.41	**0.94**	**0.77**	**0.81**	**0.87**
OS2	PROPOSED LANDSCAPE	0.03	0.02	0.01	0.77	0.49
	PROPOSED BUILDING AND WALKS	0.00	0.90	0.73	0.86	0.85
	PROPOSED PAVEMENT	0.52	1.00	0.82	0.81	0.89
		0.55	**0.94**	**0.77**	**0.80**	**0.87**
OS3	PROPOSED LANDSCAPE	0.11	0.02	0.05	0.77	0.49
	PROPOSED BUILDING AND WALKS	0.00	0.90	0.77	0.86	0.85
	PROPOSED PAVEMENT	2.12	1.00	0.86	0.81	0.89
		2.23	**0.95**	**0.81**	**0.81**	**0.87**
OS4	PROPOSED LANDSCAPE	0.12	0.02	0.05	0.15	0.49
	PROPOSED BUILDING AND WALKS	0.00	0.90	0.77	0.80	0.85
	PROPOSED PAVEMENT	0.00	1.00	0.86	0.87	0.89
		0.12	**0.02**	**0.05**	**0.15**	**0.49**
OS5	PROPOSED LANDSCAPE	0.00	0.02	0.05	0.15	0.49
	PROPOSED BUILDING AND WALKS	0.01	0.90	0.77	0.80	0.85
	PROPOSED PAVEMENT	0.02	1.00	0.86	0.87	0.89
		0.03	**0.97**	**0.83**	**0.85**	**0.88**
OS6	PROPOSED LANDSCAPE	0.09	0.02	0.05	0.15	0.49
	PROPOSED BUILDING AND WALKS	0.00	0.90	0.77	0.80	0.85
	PROPOSED PAVEMENT	0.00	1.00	0.86	0.87	0.89
		0.09	**0.02**	**0.05**	**0.15**	**0.49**
OS7	PROPOSED LANDSCAPE	0.17	0.02	0.05	0.15	0.49
	PROPOSED BUILDING AND WALKS	0.00	0.90	0.77	0.80	0.85
	PROPOSED PAVEMENT	0.00	1.00	0.86	0.87	0.89
		0.17	**0.02**	**0.05**	**0.15**	**0.49**

MERRICK & COMPANY

STANDARD FORM SF-2
TIME OF CONCENTRATION

CALCULATED BY: *KB*
CHECKED BY: *KW*
PROJECT: CFA 470 & Yosemite #05190
BASIN:
JOB NO: 65121141
LOCATION: City of Lone Tree

SUB-BASIN DATA				INITIAL/OVERLAND TIME (Tc)			TRAVEL TIME Gutter (Tt)						Tc CHECK (Urbanized Basins)			FINAL Tc	CONVEYANCE REMARKS
DESIGNATION	AREA (acres)	IMPERVIOUS %	C_5	LENGTH (ft)	SLOPE (%)	Ti (min)	LENGTH (ft)	AVG. SLOPE ΔY	(%)	Conv. Type*	VEL (fps)	Tt (min)	COMP Tc (min)	TOTAL LENGTH (ft)	Tc=(26-17i)+L/(60*(14i+9)*sqrt(S)) (min)	(min)**	
A1	0.19	90%	0.77	25	2.0	2.3	25	0.3	1.0	6	2.0	0.2	2.6	50	10.8	**5.0**	Paved Gutter
A2	0.10	81%	0.70	25	2.0	2.9	25	0.3	1.0	6	2.0	0.2	3.1	50	12.3	**5.0**	Paved Gutter
B1	0.92	78%	0.68	30	2.0	3.3	125	1.0	0.8	6	1.8	1.2	4.5	155	12.8	**5.0**	Paved Gutter
C1	0.03	90%	0.77	15	1.0	2.3	15	0.2	1.0	6	2.0	0.1	2.4	30	10.8	**5.0**	Paved Gutter
D1	0.11	2%	0.05	30	4.0	6.6	20	0.6	3.0	3	1.2	0.3	6.8	50	25.8	**6.8**	Pasture
OS1	1.41	94%	0.81	30	1.0	2.9	600	6.0	1.0	6	2.0	5.0	7.9	630	10.2	**7.9**	Paved Gutter
OS2	0.55	94%	0.80	30	1.0	2.9	400	3.3	0.8	6	1.8	3.7	6.6	430	10.2	**6.6**	Paved Gutter
OS3	2.23	95%	0.81	30	1.0	2.9	400	3.3	0.8	6	1.8	3.7	6.6	430	10.0	**6.6**	Paved Gutter
OS4	0.12	2%	0.15	15	1.0	6.7	100	3.3	3.3	3	1.3	1.3	8.0	115	25.8	**8.0**	Pasture
OS5	0.03	97%	0.85	15	1.0	1.8	15	3.3	22.0	6	9.4	0.0	1.8	30	9.6	**5.0**	Paved Gutter
OS6	0.09	2%	0.15	30	1.0	9.4	150	3.3	2.2	3	1.0	2.4	11.8	180	25.8	**11.8**	Pasture
OS7	0.17	2%	0.87	30	1.0	2.3	150	3.3	2.2	3	1.0	2.4	4.7	180	25.8	**5.0**	Pasture

Q:\DEN\Projects\1141-00 CFA 470 & Yosemite 5190\DESIGN\Drainage\Hydrology\Rational\[1141 CFA 470 & Yosemite_REV.xls]tc1 Merrick & Company

* Note: Conveyance Coefficients - Type 1-Heavy Meadow, Type 2-Tillage/Field, Type 3-Short Pasture and lawns, Type 4-Nearly Bare Soil, Type 5-Grassed Waterway, Type 6-Paved areas and shallow paved swales.

The maximum initial/overland length shall not exceed 300 feet.

** Based on Assumption that Building roofs will take 5 min to fully contribute to storm system

MERRICK & COMPANY

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Job Name: CFA 470 & Yosemite #05190
Job Number: 65121141
Date: 6/14/2023
By: K. Black

CFA 470 & Yosemite #05190

Developed Storm Runoff Calculations

Design Storm : **5 Year**

Point Hour Rainfall (P_1) : **1.43**

I = (28.5 P1) / ((10 + TC)^0.786)

	Direct Runoff							Total Runoff				Inlets			Pipe					Pipe/Swale Travel Time				
Basin Name	Design Point	Area (ac)	Runoff Coeff	tc (min)	C*A (ac)	I (in/hr)	Q (cfs)	Total tc (min)	ΣC*A (ac)	I (in/hr)	Q (cfs)	Inlet Type	Q intercepted	Q carryover (Qco)	Pipe Size (in) or equivalent	Pipe Material	Slope (%)	Pipe Flow (cfs)	Approx. Max Pipe Capacity (cfs)	Length (ft)	Velocity (fps)	tt (min)	Total Time (min)	Notes
C1	1	0.03	0.77	5.0	0.03	4.85	0.1	5.00	0.03	4.85	0.1			-										TOTAL TO DP1
															6 in	PVC	2.0%	0.1	1.03	114.6	5.3	0.36	5.36	CANOPY ROOF DRAIN PIPED TO DP2
OS3	2	2.23	0.81	6.6	1.80	4.48	8.1	6.59	1.80	4.48	8.1													BASIN OS3 CONVEYED TO DP2
B1	2	0.92	0.68	5.0	0.62	4.85	3.0	5.00	0.62	4.85	3.0													BASIN B2 CONVEYED TO DP2
-	2							6.59	2.45	4.48	11.0													TOTAL CONVEYED TO DP2 MINUS CARRYOVER
											0.6													CARRYOVER FROM DP5
											11.5													TOTAL CONVEYED TO DP2 W/ CARRYOVER
DP2A	2A											10' TYPE R	6.6	4.9										TOTAL CAPTURED BY 10' INLET AT DP2A
DP2	2											15' TYPE R	4.9	0.0										TOTAL CAPTURED BY 15' INLET AT DP2
	2										4.9				36 in	RCP	0.6%	4.9	67.34	35.7	9.5	0.06	6.65	TOTAL PIPED FROM DP2 TO DP2A
	2A										11.5				36 in	RCP	0.6%	11.5	67.34	71.5	9.5	0.13	6.77	TOTAL PIPED FROM DP2A TO DP6
A1	3	0.19	0.77	5.0	0.14	4.85	0.7	5.00	0.14	4.85	0.7			-										BASIN A1 CONVEYED TO DP3
														-	8 in	PVC	1.5%	0.7	1.93	123.6	5.5	0.37	5.37	DP3 PIPED TO DP4
A2	4	0.10	0.70	5.0	0.07	4.85	0.3	5.00	0.07	4.85	0.3			-										BASIN A2 CONVEYED TO DP4
OS1	4	1.41	0.81	7.9	1.14	4.22	4.8	7.90	1.14	4.22	4.8			-										BASIN OS1 CONVEYED TO DP4
OS5	4	0.03	0.85	5.0	0.02	4.85	0.1	5.00	0.02	4.85	0.1			-										BASIN OS5 CONVEYED TO DP4
OS6	4	0.09	0.15	11.8	0.01	3.61	0.0	11.83	0.01	3.61	0.0			-										BASIN OS6 CONVEYED TO DP4
-								11.83	1.25	3.61	4.5	TYPE 16 COMBO	4.5	0.0										TOTAL CAPTURED BY TYPE 16 COMBO INLET AT DP4
								11.83	1.39	3.61	5.0													TOTAL PIPED FROM DP4 TO DP5
														-	18 in	RCP	0.5%	5.0	9.68	153	5.5	0.47	12.30	TOTAL PIPED FROM DP4 TO DP5
OS2	5	0.55	0.80	6.6	0.44	4.48	2.0	6.59	0.44	4.48	2.0	TYPE 16 COMBO	1.4	0.6										TOTAL CAPTURED BY TYPE 16 COMBO INLET AT DP5
								12.30	1.83	3.55	6.5			-	18 in	RCP	0.5%	6.5	9.68	85	5.5	0.26	12.56	TOTAL PIPED FROM DP5 TO DP6
														-										
	6							12.56	4.28	3.52	15.1			-										TOTAL CONVEYED TO EX WEST POND
														-										
D1	7	0.11	0.05	6.8	0.01	4.43	0.0	6.84	0.01	4.43	0.0			-										BASIN D1 CONVEYED TO DP7
OS4	7	0.12	0.15	8.0	0.02	4.21	0.1	7.98	0.02	4.21	0.1			-										BASIN OS4 CONVEYED TO DP7
OS7	7	0.17	0.15	5.0	0.03	4.85	0.1	5.00	0.03	4.85	0.1			-										BASIN OS7 CONVEYED TO DP7
								7.98	0.05	4.21	0.2	EX 5' TYPE R	0.2	0.0										TOTAL CONVEYED TO DP7 TO BE ACCOUNTED AS CARRYOVER AT EX INLET
														-										
														-										
														-										
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Job Name: CFA 470 & Yosemite #05190
Job Number: 65121141
Date: 6/14/2023
By: K. Black

CFA 470 & Yosemite #05190

Developed Storm Runoff Calculations

Design Storm : **100 Year**

Point Hour Rainfall (P_1) : **2.60**

I = (28.5 P1) / ((10 + TC)^0.786)

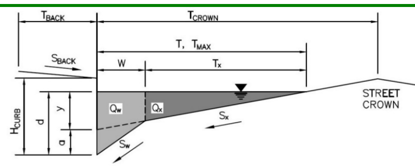
	Direct Runoff							Total Runoff				Inlets			Pipe					Pipe/Swale Travel Time				
Basin Name	Design Point	Area (ac)	Runoff Coeff	tc (min)	C*A (ac)	I (in/hr)	Q (cfs)	Total tc (min)	ΣC*A (ac)	I (in/hr)	Q (cfs)	Inlet Type	Q intercepted	Q carryover (Qco)	Pipe Size (in) or equivalent	Pipe Material	Slope (%)	Pipe Flow (cfs)	Approx. Max Pipe Capacity (cfs)	Length (ft)	Velocity (fps)	tt (min)	Total Time (min)	Notes
C1	1	0.03	0.85	5.0	0.03	8.82	0.2	5.00	0.03	8.82	0.2			-										TOTAL TO DP1
															6 in	PVC	2.0%	0.2	1.03	114.6	5.3	0.36	5.36	CANOPY ROOF DRAIN PIPED TO DP2
OS3	2	2.23	0.87	6.6	1.95	8.15	15.9	6.59	1.95	8.15	15.9													BASIN OS3 CONVEYED TO DP2
B1	2	0.92	0.80	5.0	0.74	8.82	6.5	5.00	0.74	8.82	6.5													BASIN B2 CONVEYED TO DP2
-	2							6.59	2.72	8.15	22.2													TOTAL CONVEYED TO DP2 MINUS CARRYOVER
											1.7													CARRYOVER FROM DP5
											23.9													TOTAL CONVEYED TO DP2 W/ CARRYOVER
DP2A	2A											10' TYPE R	8.8	15.1										TOTAL CAPTURED BY 10' INLET AT DP2A
DP2	2											15' TYPE R	15.1	0.0										TOTAL CAPTURED BY 15' INLET AT DP2
	2										15.1				36 in	RCP	0.6%	15.1	67.34	35.7	9.5	0.06	6.65	TOTAL PIPED FROM DP2 TO DP2A
	2A										23.9				36 in	RCP	0.6%	23.9	67.34	71.5	9.5	0.13	6.77	TOTAL PIPED FROM DP2A TO DP6
A1	3	0.19	0.86	5.0	0.16	8.82	1.4	5.00	0.16	8.82	1.4			-										BASIN A1 CONVEYED TO DP3
														-	8 in	PVC	1.5%	1.4	1.93	123.6	5.5	0.37	5.37	DP3 PIPED TO DP4
A2	4	0.10	0.82	5.0	0.08	8.82	0.7	5.00	0.08	8.82	0.7			-										BASIN A2 CONVEYED TO DP4
OS1	4	1.41	0.87	7.9	1.23	7.68	9.4	7.90	1.23	7.68	9.4			-										BASIN OS1 CONVEYED TO DP4
OS5	4	0.03	0.88	5.0	0.02	8.82	0.2	5.00	0.02	8.82	0.2			-										BASIN OS5 CONVEYED TO DP4
OS6	4	0.09	0.49	11.8	0.04	6.57	0.3	11.83	0.04	6.57	0.3			-										BASIN OS6 CONVEYED TO DP4
-								11.83	1.38	6.57	9.0	TYPE 16 COMBO	9.0	0.0										TOTAL CAPTURED BY TYPE 16 COMBO INLET AT DP4
								11.83	1.54	6.57	10.1													TOTAL PIPED FROM DP4 TO DP5
														-	18 in	RCP	0.5%	10.1	9.68	153	5.5	0.47	12.30	TOTAL PIPED FROM DP4 TO DP5
OS2	5	0.55	0.87	6.6	0.48	8.15	3.9	6.59	0.48	8.15	3.9	TYPE 16 COMBO	2.2	1.7										TOTAL CAPTURED BY TYPE 16 COMBO INLET AT DP5
								12.30	2.02	6.46	13.0			-	18 in	RCP	0.5%	13.0	9.68	85	5.5	0.26	12.56	TOTAL PIPED FROM DP5 TO DP6
														-										
	6							12.56	4.74	6.40	30.3			-										TOTAL CONVEYED TO EX WEST POND
														-										
D1	7	0.11	0.49	6.8	0.05	8.05	0.4	6.84	0.05	8.05	0.4			-										BASIN D1 CONVEYED TO DP7
OS4	7	0.12	0.49	8.0	0.06	7.65	0.4	7.98	0.06	7.65	0.4			-										BASIN OS4 CONVEYED TO DP7
OS7	7	0.17	0.49	5.0	0.08	8.82	0.7	5.00	0.08	8.82	0.7			-										BASIN OS7 CONVEYED TO DP7
								7.98	0.20	7.65	1.5	EX 5' TYPE R	1.5	0.0										TOTAL CONVEYED TO DP7 TO BE ACCOUNTED AS CARRYOVER AT EX INLET
														-										
														-										
														-										
														-										
														-										
														-										
														-										

Appendix C
(Hydraulic Calculations)

ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)

(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project:
Inlet ID: DP2



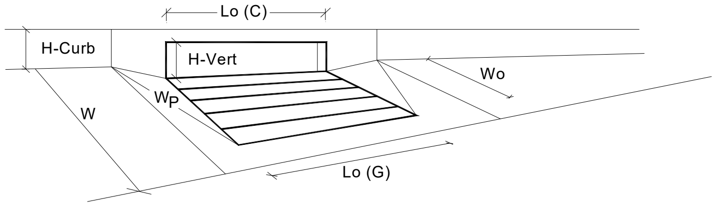
Gutter Geometry:

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	5.0		ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020		ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.020		
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00		inches
Distance from Curb Face to Street Crown	T_{CROWN} =	24.0		ft
Gutter Width	W =	2.00		ft
Street Transverse Slope	S_X =	0.034		ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083		ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.000		ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.013		
		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	15.0	24.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	6.0	inches
Check boxes are not applicable in SUMP conditions		☐	☐	

		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is not applicable to Sump Condition				
MAJOR STORM Allowable Capacity is not applicable to Sump Condition	**Q_{allow} =**	**SUMP**	**SUMP**	**cfs**

INLET IN A SUMP OR SAG LOCATION

MHFD-Inlet, Version 5.02 (August 2022)



Design Information (Input)		MINOR	MAJOR	
Type of Inlet (CDOT Type R Curb Opening)	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from above)	a_{local} =	3.00	3.00	inches
Number of Unit Inlets (Grate or Curb Opening)	No =	1	1	
Water Depth at Flowline (outside of local depression)	Ponding Depth =	6.0	8.1	inches
Grate Information		MINOR	MAJOR	☑ Override Depths
Length of a Unit Grate	L_o (G) =	N/A	N/A	feet
Width of a Unit Grate	W_o =	N/A	N/A	feet
Open Area Ratio for a Grate (typical values 0.15-0.90)	A_{ratio} =	N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)	C_f (G) =	N/A	N/A	
Grate Weir Coefficient (typical value 2.15 - 3.60)	C_w (G) =	N/A	N/A	
Grate Orifice Coefficient (typical value 0.60 - 0.80)	C_o (G) =	N/A	N/A	
Curb Opening Information		MINOR	MAJOR	
Length of a Unit Curb Opening	L_o (C) =	15.00	15.00	feet
Height of Vertical Curb Opening in Inches	H_{vert} =	6.00	6.00	inches
Height of Curb Orifice Throat in Inches	H_{throat} =	6.00	6.00	inches
Angle of Throat (see USDCM Figure ST-5)	Theta =	63.40	63.40	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)	W_p =	2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)	C_f (C) =	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)	C_w (C) =	3.60	3.60	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)	C_o (C) =	0.67	0.67	

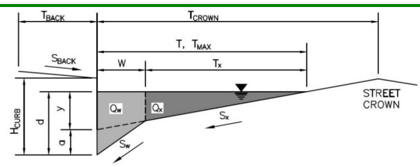
Low Head Performance Reduction (Calculated)		MINOR	MAJOR	
Depth for Grate Midwidth	d_{Grate} =	N/A	N/A	ft
Depth for Curb Opening Weir Equation	d_{Curb} =	0.33	0.51	ft
Grated Inlet Performance Reduction Factor for Long Inlets	RF_{Grate} =	N/A	N/A	
Curb Opening Performance Reduction Factor for Long Inlets	RF_{Curb} =	0.79	0.90	
Combination Inlet Performance Reduction Factor for Long Inlets	$RF_{Combination}$ =	N/A	N/A	

		MINOR	MAJOR	
Total Inlet Interception Capacity (assumes clogged condition)	**Q_a =**	**7.8**	**16.8**	**cfs**
Inlet Capacity IS GOOD for Minor and Major Storms (>Q Peak)	$Q_{PEAK\ REQUIRED}$ =	4.9	15.1	cfs

ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)

(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project:
Inlet ID: DP2A



Gutter Geometry:

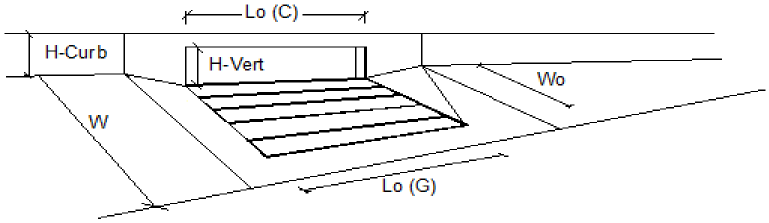
Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	5.0		ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.020		ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.020		
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00		inches
Distance from Curb Face to Street Crown	T_{CROWN} =	24.0		ft
Gutter Width	W =	2.00		ft
Street Transverse Slope	S_X =	0.010		ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083		ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.030		ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.013		
		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	15.0	15.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	6.0	inches
Allow Flow Depth at Street Crown (check box for yes, leave blank for no)		☐	☐	

		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Spread Criterion				
MAJOR STORM Allowable Capacity is based on Spread Criterion	Q_{allow} =	**6.3**	**6.3**	**cfs**

WARNING: MINOR STORM max. allowable capacity is less than the design peak flow of 11.50 cfs on sheet 'Inlet Management'
WARNING: MAJOR STORM max. allowable capacity is less than the design peak flow of 23.90 cfs on sheet 'Inlet Management'

INLET ON A CONTINUOUS GRADE

MHFD-Inlet, Version 5.02 (August 2022)



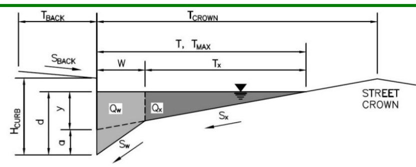
Design Information (Input)	CDOT Type R Curb Opening		MINOR	MAJOR	
Type of Inlet		Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a')		a_{LOCAL} =	3.0	3.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)		No =	2	2	
Length of a Single Unit Inlet (Grate or Curb Opening)		L_o =	5.00	5.00	ft
Width of a Unit Grate (cannot be greater than W, Gutter Width)		W_o =	N/A	N/A	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)		C_f (G) =	N/A	N/A	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)		C_f (C) =	0.10	0.10	

Street Hydraulics: WARNING: Q > ALLOWABLE Q FOR MINOR & MAJOR STORM		MINOR	MAJOR	
Total Inlet Interception Capacity	**Q =**	**6.6**	**8.8**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)	**Q_b =**	**4.9**	**15.1**	**cfs**
Capture Percentage = Q_a/Q_o	**C% =**	**57**	**37**	**%**

ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)

(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project:
Inlet ID: **DP4**



Gutter Geometry:

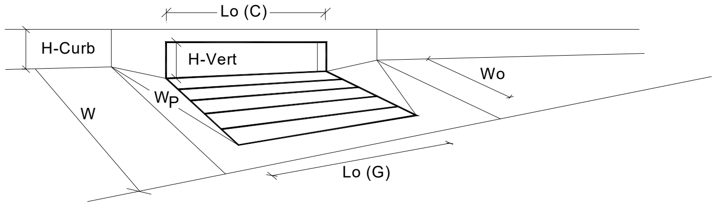
Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	5.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.010	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.013	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	21.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.035	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.000	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.013	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	6.0	6.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	5.0	10.0	inches
Check boxes are not applicable in SUMP conditions		☐	☐	

		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is not applicable to Sump Condition MAJOR STORM Allowable Capacity is not applicable to Sump Condition	**Q_{allow} =**	**SUMP**	**SUMP**	**cfs**

INLET IN A SUMP OR SAG LOCATION

MHFD-Inlet, Version 5.02 (August 2022)

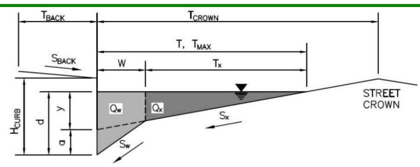


		MINOR	MAJOR	
Design Information (Input) — Denver No. 16 Combination				
Type of Inlet	Type =	Denver No. 16 Combination		
Local Depression (additional to continuous gutter depression 'a' from above)	a_{local} =	2.00	2.00	inches
Number of Unit Inlets (Grate or Curb Opening)	No =	3	3	
Water Depth at Flowline (outside of local depression)	Ponding Depth =	6.0	6.1	inches
Grate Information		MINOR	MAJOR	☑ Override Depths
Length of a Unit Grate	L_o (G) =	3.00	3.00	feet
Width of a Unit Grate	W_o =	1.73	1.73	feet
Open Area Ratio for a Grate (typical values 0.15-0.90)	A_{ratio} =	0.31	0.31	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)	C_f (G) =	0.50	0.50	
Grate Weir Coefficient (typical value 2.15 - 3.60)	C_w (G) =	3.60	3.60	
Grate Orifice Coefficient (typical value 0.60 - 0.80)	C_o (G) =	0.60	0.60	
Curb Opening Information		MINOR	MAJOR	
Length of a Unit Curb Opening	L_o (C) =	3.00	3.00	feet
Height of Vertical Curb Opening in Inches	H_{vert} =	6.50	6.50	inches
Height of Curb Orifice Throat in Inches	H_{throat} =	5.25	5.25	inches
Angle of Throat (see USDCM Figure ST-5)	Theta =	0.00	0.00	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)	W_p =	2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)	C_f (C) =	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.3-3.7)	C_w (C) =	3.70	3.70	
Curb Opening Orifice Coefficient (typical value 0.60 - 0.70)	C_o (C) =	0.66	0.66	
Low Head Performance Reduction (Calculated)		MINOR	MAJOR	
Depth for Grate Midwidth	d_{Grate} =	0.52	0.53	ft
Depth for Curb Opening Weir Equation	d_{Curb} =	0.33	0.34	ft
Grated Inlet Performance Reduction Factor for Long Inlets	RF_{Grate} =	0.57	0.58	
Curb Opening Performance Reduction Factor for Long Inlets	RF_{Curb} =	N/A	N/A	
Combination Inlet Performance Reduction Factor for Long Inlets	$RF_{Combination}$ =	0.57	0.58	
		MINOR	MAJOR	
Total Inlet Interception Capacity (assumes clogged condition)	Q_a =	**8.7**	**9.2**	**cfs**
Inlet Capacity IS GOOD for Minor and Major Storms (>Q Peak)	$Q_{PEAK\ REQUIRED}$ =	4.5	9.0	cfs

ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)

(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)

Project:
Inlet ID: DP5



Gutter Geometry:

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	5.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.010	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.020	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	10.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.030	ft/ft
Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft)	S_W =	0.083	ft/ft
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.006	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.013	

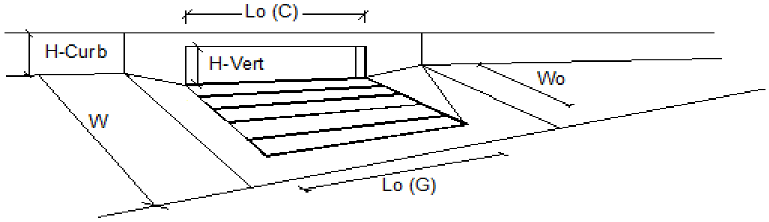
		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	10.0	10.0	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	6.0	inches
Allow Flow Depth at Street Crown (check box for yes, leave blank for no)		☐	☐	

		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Spread Criterion				
MAJOR STORM Allowable Capacity is based on Spread Criterion	**Q_{allow} =**	**5.2**	**5.2**	**cfs**

Minor storm max. allowable capacity GOOD - greater than the design peak flow of 2.00 cfs on sheet 'Inlet Management'
Major storm max. allowable capacity GOOD - greater than the design peak flow of 3.90 cfs on sheet 'Inlet Management'

INLET ON A CONTINUOUS GRADE

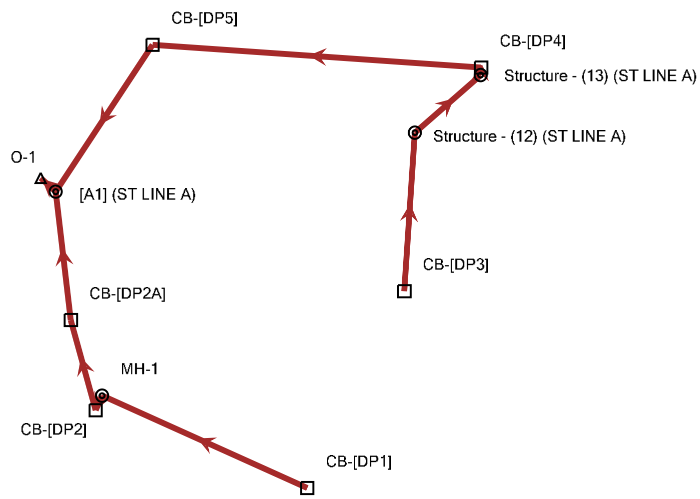
MHFD-Inlet, Version 5.02 (August 2022)



Design Information (Input)	Denver No. 16 Combination		MINOR	MAJOR	
Type of Inlet		Type =	Denver No. 16 Combination		
Local Depression (additional to continuous gutter depression 'a')		a_{LOCAL} =	2.0	2.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)		No =	1	1	
Length of a Single Unit Inlet (Grate or Curb Opening)		L_o =	3.00	3.00	ft
Width of a Unit Grate (cannot be greater than W, Gutter Width)		W_o =	1.73	1.73	ft
Clogging Factor for a Single Unit Grate (typical min. value = 0.5)		C_f (G) =	0.50	0.50	
Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1)		C_f (C) =	0.10	0.10	

Street Hydraulics: OK - Q < Allowable Street Capacity'		MINOR	MAJOR	
Total Inlet Interception Capacity	**Q =**	**1.4**	**2.2**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)	**Q_b =**	**0.6**	**1.7**	**cfs**
Capture Percentage = Q_a/Q_o	**C% =**	**71**	**55**	**%**

Scenario: 5YR
5YR



Conduit FlexTable: Combined Pipe/Node Report

5YR

Start Node	Invert (Start) (ft)	Stop Node	Rim Elevation (Start) (ft)	Invert (Stop) (ft)	Length (Unified) (ft)	Slope (Calculated) (ft/ft)	Froude Number (Normal)	Diameter (in)
Structure - (12) (ST LINE A)	5,818.87	Structure - (13) (ST LINE A)	5,821.76	5,818.35	42.8	0.012	0.889	6.0
Structure - (13) (ST LINE A)	5,818.35	CB-[DP4]	5,821.57	5,818.01	3.7	0.091	3.495	6.0
[A1] (ST LINE A)	5,812.59	O-1	5,820.54	5,812.54	10.0	0.005	1.111	36.0
CB-[DP1]	5,817.19	MH-1	5,821.38	5,814.98	110.7	0.020	1.679	6.0
CB-[DP3]	5,819.84	Structure - (12) (ST LINE A)	5,821.38	5,818.87	77.8	0.012	0.889	6.0
CB-[DP4]	5,817.03	CB-[DP5]	5,821.06	5,816.22	161.5	0.005	0.905	18.0
CB-[DP5]	5,816.02	[A1] (ST LINE A)	5,821.76	5,815.59	86.2	0.005	1.033	24.0
CB-[DP2]	5,813.46	CB-[DP2A]	5,819.56	5,813.04	45.8	0.009	1.508	36.0
CB-[DP2A]	5,813.04	[A1] (ST LINE A)	5,820.01	5,812.59	63.3	0.007	1.349	36.0
MH-1	5,814.98	CB-[DP2]	5,815.55	5,814.90	4.0	0.020	1.679	6.0

Manning's n	Velocity (ft/s)	Hydraulic Grade Line (In) (ft)	Hydraulic Grade Line (Out) (ft)	Energy Grade Line (In) (ft)	Energy Grade Line (Out) (ft)	Capacity (Design) (cfs)	Flow (cfs)	Capacity (Full Flow) (cfs)
0.013	3.57	5,819.45	5,818.77	5,819.65	5,819.01	0.62	0.70	0.62
0.013	8.21	5,818.77	5,818.29	5,819.01	5,818.90	1.69	0.70	1.69
0.013	6.24	5,813.96	5,813.85	5,814.48	5,814.44	47.16	18.20	47.16
0.013	2.77	5,817.35	5,815.10	5,817.41	5,815.22	0.79	0.10	0.79
0.013	3.57	5,820.66	5,819.45	5,820.86	5,819.65	0.63	0.70	0.63
0.013	4.55	5,817.95	5,817.10	5,818.28	5,817.46	7.43	5.20	7.43
0.013	4.85	5,816.93	5,816.49	5,817.28	5,816.85	16.00	6.60	16.00
0.013	5.38	5,814.16	5,814.12	5,814.41	5,814.19	63.90	5.00	63.90
0.013	6.26	5,814.12	5,813.96	5,814.52	5,814.17	56.11	11.60	56.11
0.013	2.77	5,815.14	5,815.02	5,815.19	5,815.13	0.79	0.10	0.79

Scenario Summary Report
Scenario: 5YR
5YR

Scenario Summary

ID	70
Label	5YR
Notes	
Active Topology	Base Active Topology
User Data Extensions	Base User Data Extensions
Physical	Base Physical
Boundary Condition	Base Boundary Condition
Initial Settings	Base Initial Settings
Hydrology	Base Hydrology
Output	Base Output
Infiltration and Inflow	Base Infiltration and Inflow
Rainfall Runoff	Base Rainfall Runoff
Water Quality	Base Water Quality
Sanitary Loading	Base Sanitary Loading
Headloss	Base Headloss
Operational	Base Operational
Design	Base Design
System Flows	5YR
SCADA	Base SCADA
Energy Cost	Base Energy Cost
Solver Calculation Options	Base Calculation Options

Gravity Hydraulics

Maximum Network Traversals	5	Structure Loss Mode	Hydraulic Grade
Flow Convergence Test	0.001	Include Conduit Flow Travel Time in Design	True
Flow Profile Method	Backwater Analysis	Save Detailed Headloss Data?	False
Number of Flow Profile Steps	5	Gravity Friction Method	Manning's
Hydraulic Grade Convergence Test	0.00 ft	Use Explicit Depth and Slope Equations?	False
Average Velocity Method	Actual Uniform Flow Velocity	Ignore Pipe Travel Time in Carrier Pipes?	False
Minimum Structure Headloss	0.00 ft	Correct for Partial Area Effects?	False
Governing Upstream Pipe Selection Method	Pipe with Maximum QV		

Inlets

Active Components for Combination Inlets on Grade	Grate and Curb	Neglect Gutter Cross Slope For Side Flow?	False
Active Components for Combination Inlets In Sag	Grate and Curb	Neglect Side Flow?	False

Scenario Summary Report
Scenario: 5YR
5YR

Grating Parameters (United Kingdom)

Grating Type	Grating Parameter
P	30.000
Q	45.000
R	60.000
S	80.000
T	110.000

Pressure Hydraulics

Liquid Label	Water at 20C (68F)	Pressure Friction Method	Hazen-Williams

Rational Method

Use Rational Method Frequency Factors	False	Carryover Modeling Method	As CA (Traditional)
Allow Runoff Coefficient to Exceed 1.0?	False		

Headloss (AASHTO)

Expansion, Ke	0.350	Shaping Adjustment, Cs	0.500
Contraction, Kc	0.250	Non-Piped Flow Adjustment, Cn	1.300

Bend Angle vs. Bend Loss Curve

Bend Angle (degrees)	Bend Loss Coefficient, Kb
0.00	0.000
15.00	0.190
30.00	0.350
45.00	0.470
60.00	0.560
75.00	0.640
90.00	0.700

HEC-22 Energy Losses

Consider Non-Piped Plunging Flow?	True

HEC-22 Energy Losses (Second Edition)

Elevations Considered Equal Within	0.50 ft	Half Bench Submerged Factor	0.950
Flat Unsubmerged Factor	1.000	Full Bench Unsubmerged Factor	0.070
Flat Submerged Factor	1.000	Full Bench Submerged Factor	0.750

Scenario Summary Report
Scenario: 5YR
5YR

HEC-22 Energy Losses (Second Edition)

Depressed Unsubmerged Factor	1.000	Improved Bench Unsubmerged Factor	0.035
Depressed Submerged Factor	1.000	Improved Bench Submerged Factor	0.375
Half Bench Unsubmerged Factor	0.150		

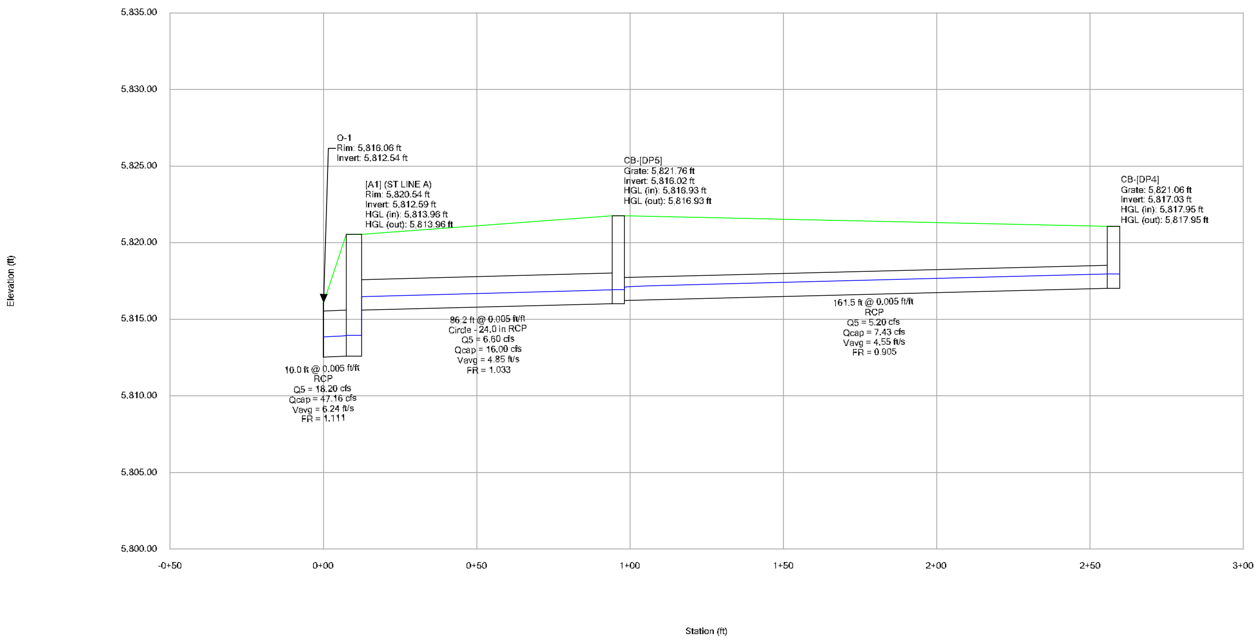
HEC-22 Energy Losses (Third Edition)

Flat Submerged Coefficient	-0.050	Half Bench Unsubmerged Coefficient	-0.850
Flat Unsubmerged Coefficient	-0.050	Full Bench Submerged Coefficient	-0.250
Depressed Submerged Coefficient	0.000	Full Bench Unsubmerged Coefficient	-0.930
Depressed Unsubmerged Coefficient	0.000	Improved Submerged Coefficient	-0.600
Half Bench Submerged Coefficient	-0.050	Improved Unsubmerged Coefficient	-0.980

Modified Rational (United Kingdom)

Apply Areal Reduction Factor?	False	Pipe Flow Includes Pipe Travel Time?	False
Runoff Routing Coefficient (Cr)	1.300		

Profile Report
Engineering Profile - ST LINE A (1141-CFA Yosemite.stsw)
5YR



Conduit FlexTable: Combined Pipe/Node Report

100YR

Start Node	Invert (Start) (ft)	Stop Node	Rim Elevation (Start) (ft)	Invert (Stop) (ft)	Length (Unified) (ft)	Slope (Calculated) (ft/ft)	Froude Number (Normal)	Diameter (in)
Structure - (12) (ST LINE A)	5,818.87	Structure - (13) (ST LINE A)	5,821.76	5,818.35	42.8	0.012	1.778	6.0
Structure - (13) (ST LINE A)	5,818.35	CB-[DP4]	5,821.57	5,818.01	3.7	0.091	3.016	6.0
[A1] (ST LINE A)	5,812.59	O-1	5,820.54	5,812.54	10.0	0.005	0.981	36.0
CB-[DP1]	5,817.19	MH-1	5,821.38	5,814.98	110.7	0.020	1.682	6.0
CB-[DP3]	5,819.84	Structure - (12) (ST LINE A)	5,821.38	5,818.87	77.8	0.012	1.778	6.0
CB-[DP4]	5,817.03	CB-[DP5]	5,821.06	5,816.22	161.5	0.005	0.847	18.0
CB-[DP5]	5,816.02	[A1] (ST LINE A)	5,821.76	5,815.59	86.2	0.005	0.913	24.0
CB-[DP2]	5,813.46	CB-[DP2A]	5,819.56	5,813.04	45.8	0.009	1.533	36.0
CB-[DP2A]	5,813.04	[A1] (ST LINE A)	5,820.01	5,812.59	63.3	0.007	1.310	36.0
MH-1	5,814.98	CB-[DP2]	5,815.55	5,814.90	4.0	0.020	1.682	6.0

Manning's n	Velocity (ft/s)	Hydraulic Grade Line (In) (ft)	Hydraulic Grade Line (Out) (ft)	Energy Grade Line (In) (ft)	Energy Grade Line (Out) (ft)	Capacity (Design) (cfs)	Flow (cfs)	Capacity (Full Flow) (cfs)
0.013	7.13	5,822.06	5,819.40	5,822.85	5,820.19	0.62	1.40	0.62
0.013	7.13	5,819.40	5,819.17	5,820.19	5,819.96	1.69	1.40	1.69
0.013	7.37	5,814.58	5,814.51	5,815.43	5,815.38	47.16	36.70	47.16
0.013	3.37	5,817.42	5,815.15	5,817.50	5,815.33	0.79	0.20	0.79
0.013	7.13	5,826.61	5,821.76	5,827.40	5,822.55	0.63	1.40	0.63
0.013	5.89	5,819.17	5,817.46	5,819.71	5,818.15	7.43	10.40	7.43
0.013	5.64	5,817.36	5,816.87	5,817.85	5,817.42	16.00	12.60	16.00
0.013	7.42	5,814.71	5,814.62	5,815.18	5,814.88	63.90	15.30	63.90
0.013	7.64	5,814.62	5,814.58	5,815.25	5,814.95	56.11	24.10	56.11
0.013	3.37	5,815.21	5,815.08	5,815.29	5,815.24	0.79	0.20	0.79

Scenario Summary Report
Scenario: 100YR
100YR

Scenario Summary

ID	71
Label	100YR
Notes	
Active Topology	Base Active Topology
User Data Extensions	Base User Data Extensions
Physical	Base Physical
Boundary Condition	Base Boundary Condition
Initial Settings	Base Initial Settings
Hydrology	Base Hydrology
Output	Base Output
Infiltration and Inflow	Base Infiltration and Inflow
Rainfall Runoff	Base Rainfall Runoff
Water Quality	Base Water Quality
Sanitary Loading	Base Sanitary Loading
Headloss	Base Headloss
Operational	Base Operational
Design	Base Design
System Flows	100YR
SCADA	Base SCADA
Energy Cost	Base Energy Cost
Solver Calculation Options	Base Calculation Options

Gravity Hydraulics

Maximum Network Traversals	5	Structure Loss Mode	Hydraulic Grade
Flow Convergence Test	0.001	Include Conduit Flow Travel Time in Design	True
Flow Profile Method	Backwater Analysis	Save Detailed Headloss Data?	False
Number of Flow Profile Steps	5	Gravity Friction Method	Manning's
Hydraulic Grade Convergence Test	0.00 ft	Use Explicit Depth and Slope Equations?	False
Average Velocity Method	Actual Uniform Flow Velocity	Ignore Pipe Travel Time in Carrier Pipes?	False
Minimum Structure Headloss	0.00 ft	Correct for Partial Area Effects?	False
Governing Upstream Pipe Selection Method	Pipe with Maximum QV		

Inlets

Active Components for Combination Inlets on Grade	Grate and Curb	Neglect Gutter Cross Slope For Side Flow?	False
Active Components for Combination Inlets In Sag	Grate and Curb	Neglect Side Flow?	False

Scenario Summary Report
Scenario: 100YR
100YR

Grating Parameters (United Kingdom)

Grating Type	Grating Parameter
P	30.000
Q	45.000
R	60.000
S	80.000
T	110.000

Pressure Hydraulics

Liquid Label	Water at 20C (68F)	Pressure Friction Method	Hazen-Williams

Rational Method

Use Rational Method Frequency Factors	False	Carryover Modeling Method	As CA (Traditional)
Allow Runoff Coefficient to Exceed 1.0?	False		

Headloss (AASHTO)

Expansion, Ke	0.350	Shaping Adjustment, Cs	0.500
Contraction, Kc	0.250	Non-Piped Flow Adjustment, Cn	1.300

Bend Angle vs. Bend Loss Curve

Bend Angle (degrees)	Bend Loss Coefficient, Kb
0.00	0.000
15.00	0.190
30.00	0.350
45.00	0.470
60.00	0.560
75.00	0.640
90.00	0.700

HEC-22 Energy Losses

Consider Non-Piped Plunging Flow?	True

HEC-22 Energy Losses (Second Edition)

Elevations Considered Equal Within	0.50 ft	Half Bench Submerged Factor	0.950
Flat Unsubmerged Factor	1.000	Full Bench Unsubmerged Factor	0.070
Flat Submerged Factor	1.000	Full Bench Submerged Factor	0.750

Scenario Summary Report
Scenario: 100YR
100YR

HEC-22 Energy Losses (Second Edition)

Depressed Unsubmerged Factor	1.000	Improved Bench Unsubmerged Factor	0.035
Depressed Submerged Factor	1.000	Improved Bench Submerged Factor	0.375
Half Bench Unsubmerged Factor	0.150		

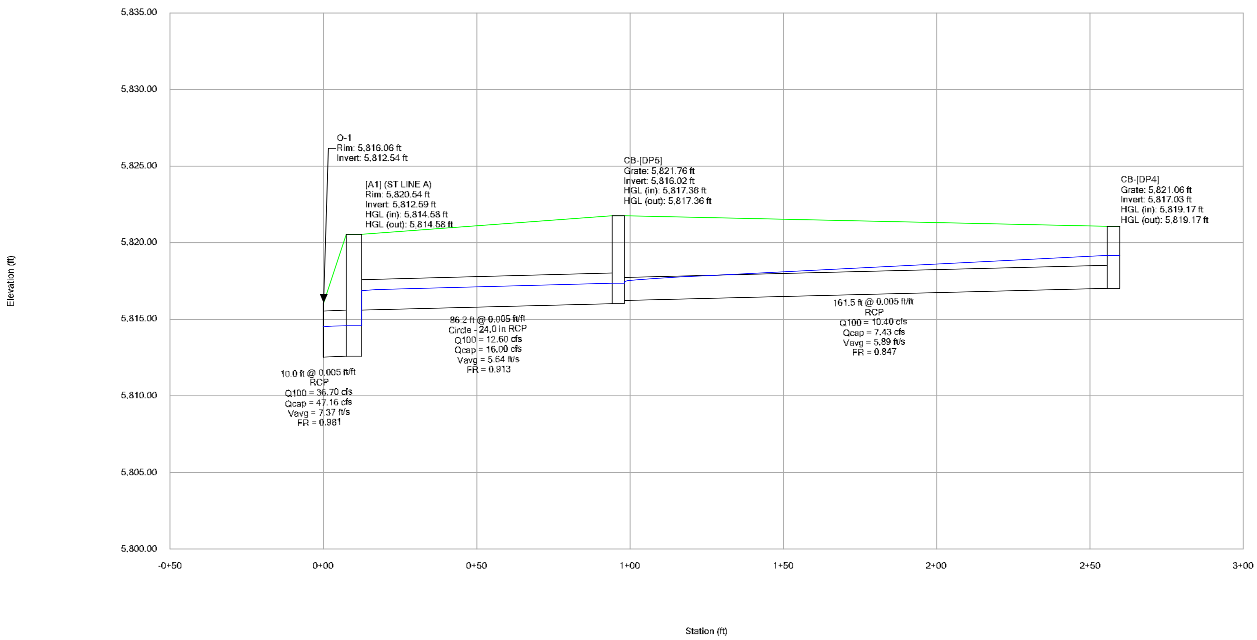
HEC-22 Energy Losses (Third Edition)

Flat Submerged Coefficient	-0.050	Half Bench Unsubmerged Coefficient	-0.850
Flat Unsubmerged Coefficient	-0.050	Full Bench Submerged Coefficient	-0.250
Depressed Submerged Coefficient	0.000	Full Bench Unsubmerged Coefficient	-0.930
Depressed Unsubmerged Coefficient	0.000	Improved Submerged Coefficient	-0.600
Half Bench Submerged Coefficient	-0.050	Improved Unsubmerged Coefficient	-0.980

Modified Rational (United Kingdom)

Apply Areal Reduction Factor?	False	Pipe Flow Includes Pipe Travel Time?	False
Runoff Routing Coefficient (Cr)	1.300		

Profile Report
Engineering Profile - ST LINE A (1141-CFA Yosemite.stsw)
100YR



Appendix D
(Reference Studies)

MARTIN/MARTIN

PHASE III DRAINAGE STUDY
PROJECT MAJESTIC
DOUGLAS COUNTY, COLORADO
OCTOBER 1994
REV. DECEMBER 1994

DV 94-184

PHASE III DRAINAGE STUDY
PROJECT MAJESTIC
DOUGLAS COUNTY, COLORADO
OCTOBER 1994
REV. DECEMBER 1994

PREPARED FOR: TANDY CORPORATION
800 TWO TANDY CENTER
FORT WORTH, TEXAS 76102

PREPARED BY: MARTIN/MARTIN, INC.
4251 KIPLING STREET
WHEAT RIDGE, COLORADO 80033

JOHN C. MOORE III, P.E.
PROJECT ENGINEER

GARY A. THOMAS, P.E.
PRINCIPAL

"THIS REPORT AND PLAN FOR THE PHASE III DRAINAGE DESIGN OF PROJECT MAJESTIC WAS PREPARED UNDER MY DIRECT SUPERVISION IN ACCORDANCE WITH THE PROVISIONS OF DOUGLAS COUNTY DRAINAGE DESIGN AND TECHNICAL CRITERIA FOR THE OWNERS THEREOF. I UNDERSTAND THAT DOUGLAS COUNTY DOES NOT AND WILL NOT ASSUME LIABILITY FOR DRAINAGE FACILITIES DESIGNED BY OTHERS."

SIGNATURE: ______________________________

REGISTERED PROFESSIONAL ENGINEER STATE
OF COLORADO NO. 15586

(SEAL)

"TANDY CORPORATION HEREBY CERTIFIES THAT THE DRAINAGE FACILITIES FOR PROJECT MAJESTIC SHALL BE CONSTRUCTED ACCORDING TO THE DESIGN PRESENTED IN THIS REPORT. I UNDERSTAND THAT DOUGLAS COUNTY DOES NOT AND WILL NOT ASSUME LIABILITY FOR THE DRAINAGE FACILITIES DESIGNED AND/OR CERTIFIED BY MY ENGINEER AND THAT DOUGLAS COUNTY REVIEWS DRAINAGE PLANS PURSUANT TO COLORADO REVISED STATUES, TITLE 30, ARTICLE 28; BUT CANNOT, ON BEHALF OF PROJECT MAJESTIC, GUARANTEE THAT FINAL DRAINAGE DESIGN REVIEW WILL ABSOLVE TANDY CORPORATION AND/OR THEIR SUCCESSORS AND/OR ASSIGNS OF FUTURE LIABILITY FOR IMPROPER DESIGN. I FURTHER UNDERSTAND THAT APPROVAL OF THE FINAL PLAT DOES NOT IMPLY APPROVAL OF MY ENGINEER'S DRAINAGE DESIGN."

____
NAME OF DEVELOPER

____
AUTHORIZED SIGNATURE   TITLE   DATE

____
COUNTY ENGINEER

____
DATE

THESE CONSTRUCTION PLANS HAVE BEEN REVIEWED BY DOUGLAS COUNTY FOR STREET AND DRAINAGE IMPROVEMENTS ONLY.

ENGINEERING DIVISION ACCEPTANCE BLOCK

TABLE OF CONTENTS

I GENERAL LOCATION AND DESCRIPTION

The proposed development is approximately a 16.81 acre site located in the easterly portion of Lot 1, Block 2 of the Parkway Subdivision Filing Number 3, on the west half of Section 3, Township 6 South, Range 67 West of the Sixth Principal Meridian, Douglas County, Colorado. The parcel is bounded to the north by undeveloped land, on the east by the right-of-way line for South Yosemite Street. On the south by the crossing of South Yosemite Street under State Highway No. C-470, and to the east by State Highway No. C-470. The site is located upon native grasses and weeds. The development consists of a building with parking and landscaped areas. The purpose of this study is to outline a storm water management system for the development.

II DESIGN CRITERIA

On-site flows were calculated using the Rational Method as described in the Urban Drainage Flood Control District's "Urban Storm Drainage Manual, Volume 1", revised May 1984. Runoff flows were calculated for the 5-year and 100-year design storms. A minimum time of concentration (Tc) of five minutes was used when applicable. Street and gutter capacity was done in accordance with Douglas County Drainage Criteria Manual. It was determined that no off-site flows would enter the site. Detention will be provided on-site. The proposed detention pond will release into a proposed swale that flows to an existing detention pond that was designed and detailed in a previous Drainage Study entitled "Parkway Master Drainage Study", prepared by Costin Engineering Company, July 1984.

III DRAINAGE FACILITY DESIGN

Storm drainage for the site will be accomplished by a system of curbs and gutters, inlets, and storm pipes. The site has been divided into ten on-site basins. All proposed storm mains curb and gutters, and inlets have been analyzed to verify capacity.

Basin A has a time of concentration (Tc) of 7.27 minutes with a minor and major runoff flow of 21.92 cfs and 40.10 cfs. Runoff flows south to Inlet DD (Design Point 1A) which is located in a pan at the south side of Basin A. Runoff captured then flows through pipes to the detention pond. Runoff not captured by Inlet DD flows to Inlet CC (Design Point 1) which is located in a sump at the south side of Basin A. Runoff captured then flows through pipes to the detention pond. Basin B has a time of concentration (Tc) of 5:00 minutes with a minor and major runoff flow of 8.00 cfs and 15.76 cfs. Runoff flows south to Inlet BB (Design Point 2A) which is located in a pan on the southwest side of Basin B. Runoff captured then flows through pipes to the detention pond. Runoff not captured by Inlet BB flows to Inlet AA Design Point 2) which is located in a sump on the southwest side of Basin B. Runoff captured then flows through pipes to the detention pond. Basin C has a time of concentration (Tc) of 7.33 minutes with a minor and major runoff flow of 0.48 cfs and 1.75 cfs. Basin D has a time of concentration (Tc) of 5:00 minutes with a minor and major runoff flow of 4.90 cfs and 10.08 cfs. Runoff flows west to Inlet EE (Design Point 3) which is located on a sump on the west side of Basin D. Runoff captured then flows through pipes to the detention pond. Basin E has a concentration time (Tc) of 5:00 minutes with a minor and major runoff flow of 7.35 cfs and 14.22 cfs. Runoff flows west where it is captured by roof drains and routed through pipes to the detention pond. Basin F has a time of concentration (Tc) of 5:00 minutes with a minor and major runoff flow of 7.35 cfs and 14.22 cfs. Runoff flows east where it is captured by roof drains and routed through pipes to the detention pond. Basin G has a time of concentration (Tc) of 7.75 minutes with a minor and major flow of 1.68 cfs and 2.24 cfs. Runoff flows southeast to Inlet HH (Design Point 6) which is located in a sump on the southwest side of Basin G. Runoff captured then flows through pipes to the detention pond. Basin H has a concentration time (Tc) of 7.58 minutes with minor and major runoff flow of 2.16 cfs and 2.89 cfs. Runoff flows north to Inlet GG (Design Point 7) which is located in a sump on the north side of Basin H. Runoff captured then flows through pipes to the detention pond. Basin I has a time of concentration (Tc) of 5:00 minutes with a minor and major runoff flow of 2.65 cfs and 5.58 cfs. Runoff flows north to Inlet FF (Design Point 8) which is located in a sump on the north side of Basin I. Runoff captured then flows the detention pond. Basin J has a concentration time (Tc) of 5.00 minutes with a minor and major runoff flow of 1.23 cfs and 2.34 cfs. Runoff flows undetained northeast to South Yosemite Street.

Detention for the site will be provided on the site. It was determined that the detention volume needed for the 10-year storm was 1.22 acre ft. and 2.08 acre ft. for the 100-year storm. The detention pond will release at a rate of 3.61 cfs for the minor storm and 14.47 cfs for the major storm.

None of the developed or historic flows outlined above exceed the street/gutter capacities outlined in the Douglas County Storm Drainage and Technical Criteria Manual (see Appendix B).

IV CONCLUSION

The proposed development is approximately a 16.81 acre site consisting of a building with parking and landscaped areas. The purpose of this study was to outline a storm water management system to accommodate the runoff from this development. The on-site drainage basins for this development were analyzed using the Rational Method. The entire storm sewer system was designed to convey all the major (100-year) storm. The proposed detention pond will accommodate the volume required for the developed site and will release to a swale which flows to an existing pond previously designed site. All existing and developed flows from the site are consistent with the Parkway Master Drainage Study" proposed by Costin Engineering Company, July 1984.

During construction and grading, erosion control measures will be taken to reduce sediment transport to adjacent property and to prevent clogging of storm sewers. Once development is completed, local sediment transport should not be a problem because all of the site will be paved or landscaped.

APPENDIX A

TABLE A

PROPOSED BASIN SUMMARY

BASIN DESIGNATION	AREA (AC)	C_5	C_{100}	Tc (MIN)	Q_5 (CFS)	Q_{100} (CFS)
A	6.01	.81	.87	7.27	21.92	40.10
B	1.99	.82	.88	5.00	8.00	15.76
C	1.08	.01	.20	7.33	0.48	1.75
D	1.49	.67	.75	5.00	4.90	10.08
E	1.76	.85	.90	5.00	7.35	14.22
F	1.76	.85	.90	5.00	7.35	14.22
G	0.45	.51	.62	7.75	1.68	2.24
H	0.64	.46	.58	7.58	2.16	2.89
I	0.88	.61	.71	5.00	2.65	5.58
J	0.28	.88	.93	5.00	1.23	2.34

TABLE B

DESIGN POINT SUMMARY

DESIGN POINT	CONTRIBUTING BASINS	AREA (AC)	Q_5 (CFS)	Q_{100} (CFS)
1A	A	6.01	2.50	2.50
1	A	6.01	19.42	37.60
2A	B	1.99	2.50	2.50
2	B	1.99	5.50	13.26
3	D	1.49	4.90	10.08
4	E	1.76	7.35	14.22
5	F	1.76	7.35	14.22
6	G	0.45	1.68	2.24
7	H	0.64	2.16	2.89
8	I	0.88	2.65	5.58

TABLE C

INLET DESIGN INFORMATION

INLET	DESIGN POINT	STREET SLOPE %	INLET SIZE	INLET CAP	GUTTER CAP	Q_{CO} (PREV)	Q_{ST}	Q_D	Q_I	Q_{CO}	DESIGN STORM
AA	2	SUMP	5' TYPE R	12.0	1.0' POND	5.50	5.50	5.50	5.50	0	5 YR
BB	2A	SUMP	SINGLE NO.16	2.5	.17'POND	0	8.00	8.00	2.50	5.50	5 YR
CC	1	SUMP	15' TYPE R	38.0	1.0' POND	19.42	19.42	19.42	6.06	0	5 YR
DD	1A	SUMP	SINGLE NO.16	2.5	.17' POND	0	21.92	21.92	8.88	19.42	5 YR
EE	3	SUMP	10' TYPE R	10.50	0.5' POND	0	4.90	4.90	4.90	0	5 YR
FF	8	SUMP	10' TYPE R	10.50	0.5' POND	0	2.65	2.65	2.65	0	5 YR
GG	7	SUMP	5' TYPE R	12.0	1.0' POND	0	2.16	2.16	2.16	0	5 YR
HH	6	SUMP	5' TYPE R	12.0	1.0' POND	0	1.68	1.68	1.68	0	5 YR
AA	2	SUMP	5' TYPE R	12.0	1.0' POND	13.26	13.26	13.26	13.26	0	100 YR
BB	2A	SUMP	SINGLE NO.16	2.5	.17' POND	0	15.76	15.76	2.50	13.26	100 YR
CC	1	SUMP	15' TYPE R	38.0	1.0' POND	37.60	37.60	37.60	37.60	0	100 YR
DD	1A	SUMP	SINGLE NO.16	2.5	.17' POND	0	40.10	40.10	2.50	37.60	100 YR
EE	3	SUMP	10'TYPE R	10.50	0.5' POND	0	10.08	10.08	10.08	0	100 YR
FF	8	SUMP	10' TYPE R	10.50	0.5' POND	0	5.58	5.58	5.58	0	100 YR
GG	7	SUMP	5' TYPE R	12.0	1.0' POND	0	2.89	2.89	2.89	0	100 YR
HH	6	SUMP	5' TYPE R	12.0	1.0' POND	0	2.24	2.24	2.24	0	100 YR

APPENDIX B

STANDARD FORM SF-2

TIME OF CONCENTRATION

SUBDIVISION MAJESTIC (TANDY)

CALCULATED BY D LOVATO **DATE** ~~8-19-94~~ REV 12-19-94

$t_c = t_i + t_t$

SUB-BASIN DATA			INITIAL/OVERLAND TIME (t_i)			TRAVEL TIME (t_t)				t_c CHECK (URBANIZED BASINS)		FINAL t_c	REMARKS
DESIG: (1)	C_5 (2)	AREA Ac (3)	LENGTH Ft (4)	SLOPE % (5)	t_i Min (6)	LENGTH Ft (7)	SLOPE % (8)	VEL. FPS (9)	t_t Min (10)	TOTAL LENGTH Ft (11)	$t_c = (L/180)+10$ Min (12)	Min (13)	
A	0.81	6.01	30	2.00	2.27	720	1.50	2.40	5.00	750	14.17	7.27	
B	0.82	1.99	–	–	–	380	2.45	3.30	2.11	380	12.11	5.00	USE MIN TC
C	0.30	1.08	60	2.00	5.98	300	3.33	3.70	1.35	360	12.00	7.33	
D	0.67	1.49	40	15.00	1.98	330	1.30	2.30	2.39	370	12.06	5.00	USE MIN TC
E	0.85	1.76	–	–	–	200	2.00	2.90	1.15	200	11.11	5.00	USE MIN TC
F	0.85	1.76	–	–	–	200	2.00	2.90	1.15	200	11.11	5.00	USE MIN TC
G	0.51	0.45	55	2.00	6.25	135	0.50	1.50	1.50	190	11.06	7.75	
H	0.46	0.64	55	2.00	6.25	160	1.00	2.00	1.33	215	11.19	7.58	
I	0.61	0.88	35	6.67	2.77	190	2.34	3.20	0.99	225	11.25	5.00	USE MIN TC
J	0.88	0.28	–	–	–	230	4.00	4.00	0.96	230	11.27	5.00	USE MIN TC=5.0

CALCULATED BY D LOVATO
DATE 8-19-94 REV 12-19-94
CHECKED BY

STANDARD FORM SF-3

STORM DRAINAGE SYSTEM DESIGN
(RATIONAL METHOD PROCEDURE)

JOB NO
PROJECT MAJESTIC STANL
DESIGN STORM 5YR

	STREET	DESIGN POINT	DIRECT RUNOFF							TOTAL RUNOFF				STREET		PIPE			TRAVEL TIME			REMARKS
			AREA DESIGN	AREA (AC)	RUNOFF COEFF	t_c (MIN)	C·A (AC)	I IN/HR	Q (CFS)	t_c (MIN)	Σ(C·A) (AC)	I (IN/HR)	Q (CFS)	SLOPE (%)	STREET FLOW (CFS)	DESIGN FLOW (CFS)	SLOPE (%)	PIPE SIZE	LENGTH (FT)	VELOCITY (FPS)	t_t (MIN)	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)
1	A	1		6.01	.81	7.27	4.87	4.50	21.92													
2	B	2		1.99	.82	5.00	1.63	4.90	8.00													
3	C			1.08	.01	7.33	.01	4.48	0.48													
4	D	3		1.49	.67	5.00	1.00	4.90	4.90													
5	E	4		1.76	.85	5.00	1.50	4.90	7.35													
6	F	5		1.76	.85	5.00	1.50	4.90	7.35													
7	G	6		0.45	.51	7.75	.23	7.30	1.68													
8	H	7		0.64	.46	7.58	.29	7.35	2.16													
9	I	8		0.88	.61	5.00	.54	4.90	2.65													
10	J			0.28	.88	5.00	.25	4.90	1.23													
11																						

CALCULATED BY D LOVATO
DATE 8-19-94 REV 12-19-94
CHECKED BY ____

STANDARD FORM SF-3

STORM DRAINAGE SYSTEM DESIGN (RATIONAL METHOD PROCEDURE)

JOB NO ____
PROJECT MAJESTIC [illegible]
DESIGN STORM 100 YR

	BASIN	DESIGN POINT	DIRECT RUNOFF							TOTAL RUNOFF				STREET		PIPE			TRAVEL TIME			REMARKS
			AREA DESIGN	AREA (AC)	RUNOFF COEFF	t_c (MIN)	C·A (AC)	I IN/HR	Q (CFS)	t_c (MIN)	Σ(C·A) (AC)	I (IN/HR)	Q (CFS)	SLOPE (%)	STREET FLOW (CFS)	DESIGN FLOW (CFS)	SLOPE (%)	PIPE SIZE	LENGTH (FT)	VELOCITY (FPS)	t_t (MIN)	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)
1	A	1		6.01	.87	7.27	5.23	8.05	40.10													
2	B	2		1.99	.88	5.00	1.75	9.00	15.76													
3	C			1.08	.20	7.33	.22	7.95	1.75													
4	D	3		1.49	.75	5.00	1.12	9.00	10.08													
5	E	4		1.76	.90	5.00	1.58	9.00	14.22													
6	F	5		1.76	.90	5.00	1.58	9.00	14.22													
7	G	6		0.45	.62	7.75	.29	7.75	2.24													
8	H	7		0.64	.58	7.58	.37	7.80	2.89													
9	I	8		0.88	.71	5.00	.62	9.00	5.58													
10	J			0.28	.93	5.00	.26	9.00	2.34													
11																						

BASIN A

$A_T = 6.01$ AC

$A_{SW} = 0.30$ AC	$C_5 = 0.87$	$C_{100} = 0.89$
$A_L = 0.44$ AC	$C_5 = 0.01$	$C_{100} = 0.20$
$A_P = 5.27$ AC	$C_5 = 0.88$	$C_{100} = 0.93$

$$C_5 = \frac{(0.87)(0.30) + (0.01)(0.44) + (0.88)(5.27)}{6.01} = \underline{\underline{0.81}}$$

$$C_{100} = \frac{(0.89)(0.30) + (0.20)(0.44) + (0.93)(5.27)}{6.01} = \underline{\underline{0.87}}$$

BASIN B

$A_T = 1.99$ AC

$A_{SW} = 0.05$ AC	$C_5 = 0.87$	$C_{100} = 0.89$
$A_L = 0.12$ AC	$C_5 = 0.01$	$C_{100} = 0.20$
$A_P = 1.82$ AC	$C_5 = 0.88$	$C_{100} = 0.93$

$$C_5 = \frac{(0.87)(0.05) + (0.01)(0.12) + (0.88)(1.82)}{1.99} = \underline{\underline{0.82}}$$

$$C_{100} = \frac{(0.89)(0.05) + (0.20)(0.12) + (0.93)(1.82)}{1.99} = \underline{\underline{0.88}}$$

BASIN C

$A_T = 1.08$ Ac

$A_L = 1.08$ Ac $C_5 = 0.01$ $C_{100} = 0.20$

$A_P = 0.00$ AC $C_5 = 0.88$ $C_{100} = 0.93$

$$C_5 = \frac{(.01)(1.08)}{1.08} = \underline{\underline{0.01}}$$

$$C_{100} = \frac{(.20)(1.08)}{1.08} = \underline{\underline{0.20}}$$

BASIN D

$A_T = 1.49$ AC

$A_L = 0.36$ AC $C_5 = 0.01$ $C_{100} = 0.20$

$A_P = 1.13$ AC $C_5 = 0.88$ $C_{100} = 0.93$

$$C_5 = \frac{(0.01)(0.36) + (0.88)(1.13)}{1.49} = \underline{\underline{0.67}}$$

$$C_{100} = \frac{(0.20)(0.36) + (0.93)(1.13)}{1.49} = \underline{\underline{0.75}}$$

BASIN E

$A_T = 1.76$ AC $\underline{\underline{C_5 = 0.85}}$

$A_R = 1.76$ AC $\underline{\underline{C_{100} = 0.90}}$

BASIN F

$A_T = 1.76$ AC $\underline{\underline{C_5 = 0.85}}$

$A_R = 1.76$ AC $\underline{\underline{C_{100} = 0.90}}$

BASIN G

A_T = 0.45 AC

A_L = 0.19 AC — C_5 = 0.01 — C_{100} = 0.20

A_P = 0.23 AC — C_5 = 0.88 — C_{100} = 0.93

A_{SW} = 0.03 AC — C_5 = 0.87 — C_{100} = 0.89

$$C_5 = \frac{(0.01)(0.19) + (0.88)(0.23) + (0.87)(0.03)}{0.45} = \underline{\underline{0.51}}$$

$$C_{100} = \frac{(0.20)(0.19) + (0.93)(0.23) + (0.89)(0.03)}{0.45} = \underline{\underline{0.62}}$$

BASIN H

A_T = 0.64 AC

A_L = 0.31 AC — C_5 = 0.01 — C_{100} = 0.20

A_P = 0.33 AC — C_5 = 0.88 — C_{100} = 0.93

$$C_5 = \frac{(0.01)(0.31) + (0.88)(0.33)}{0.64} = \underline{\underline{0.46}}$$

$$C_{100} = \frac{(0.20)(0.31) + (0.93)(0.33)}{0.64} = \underline{\underline{0.58}}$$

BASIN I

A_T = 0.88 AC

A_L = 0.27 AC — C_5 = 0.01 — C_{100} = 0.20

A_P = 0.61 AC — C_5 = 0.88 — C_{100} = 0.93

$$C_5 = \frac{(0.01)(0.27) + (0.88)(0.61)}{0.88} = \underline{\underline{0.61}}$$

$$C_{100} = \frac{(0.20)(0.27) + (0.93)(0.61)}{0.88} = \underline{\underline{0.71}}$$

BASIN J

$\underline{\underline{C_5 = 0.88}}$ — $\underline{\underline{C_{100} = 0.93}}$

INLET DD (DESIGN POINT 1A)

TOTAL FLOW IS RUNOFF TO DESIGN POINT 1.
INLET IN PAN WILL CAPTURE MINIMAL FLOW

Q_5 = 21.92 CAN POND TO PAN DEPTH OF 0.17 FT
Q_{100} = 40.10

USE TYPE 16 COMBINATION

Q_A = 2.5 CFS *

Q_{CO5} = 21.92 − 2.5 = 19.42 CFS

Q_{CO100} = 40.10 − 2.5 = 37.60 CFS

CARRY OVER TO D.P. 1 INLET CC

INLET CC (DESIGN POINT 1)

CARRY OVER FLOW FROM INLET DD

Q_5 = 19.42 CFS
Q_{100} = 37.60 CFS

PONDING DEPTH = 1.0' (SUMP CONDITION)

USE [redacted]

Q_A [redacted]

Q_{IN5} = 19.42 CFS *
Q_{IN100} = 37.60 CFS *

NO CARRYOVER

FLOW @ ST MH 3

→ Q_5 = 19.42 + 2.50 = 21.92 CFS
→ Q_{100} = 37.60 + 2.50 = 40.10 CFS

INLET BB (DESIGN POINT 2A)

TOTAL FLOW IS RUNOFF TO DESIGN POINT 2A
INLET IN PAN WILL CAPTURE MINIMAL FLOW

Q_5 = 8.00 CFS   CAN POND TO PAN DEPTH OF 0.17'
Q_{100} = 15.76 CFS

USE TYPE 16 COMBINATION

Q_A = 2.5 CFS *

Q_{CO5} = 8.00 − 2.5 = 5.50 CFS

Q_{CO100} = 15.76 − 2.5 = 13.26 CFS

CARRY OVER TO D.P. 2 INLET AA

INLET AA (DESIGN POINT 2)

CARRY OVER FLOW FROM INLET BB

Q_5 = 5.50 CFS
Q_{100} = 13.26 CFS

PONDING DEPTH = 1.0'± (SUMP CONDITION)

USE 5' TYPE R

Q_A = 12[redacted] CFS

Q_{IN5} = [redacted] CFS *

Q_{IN100} = 13.26 CFS *

FLOW @ ST MH 1

→ Q_5 = 21.92 + 2.5 + 5.50 = 29.92

→ Q_{100} = 40.10 + 2.5 + 13.26 = 55.86

FLOW INTO POND

INLET EE (DESIGN POINT 3)

Q_5 = 4.90 CFS

Q_{100} = 10.08 CFS

PONDING DEPTH = 0.5' (SUMP CONDITION)
HEIGHT OF CURB

USE 10' TYPE R

QA = 10.50 CFS

Q_{INS} = 4.90 CFS *

Q_{IN100} = 10.08 CFS *

NO CARRY OVER

FLOW @ ST MH 4

Q_5 = 13.85 + 4.90 + 7.35 = 26.10 CFS

Q_{100} = 24.93 + 10.08 + 14.22 = 49.23 CFS

FLOW INTO POND

INLET FF (DESIGN POINT 8)

Q_5 = 2.65 CFS

Q_{100} = 5.58 CFS

PONDING DEPTH = 0.5' (SUMP CONDITION)
HEIGHT OF CURB

USE 10' TYPE R

QA = [illegible] CFS

Q_{INS} = [illegible] CFS *

Q_{IN100} = 5.58 CFS *

NO CARRY OVER

FLOW @ ST MH 7

→ Q_5 = 11.20 + 2.65 = 13.85 CFS

→ Q_{100} = 19.35 + 5.58 = 24.93 CFS

INLET GG (DESIGN POINT 7)

Q_5 = 2.16 CFS
Q_{100} = 2.89 CFS

PONDING DEPTH = 1.0' (SUMP CONDITION)

USE 5' TYPE R

Q_A = 12.0 CFS

Q_{IN5} = 2.16 CFS *
Q_{IN100} = 2.89 CFS *

NO CARRYOVER

FLOW @ ST MH 9

→ Q_5 = 5.36 + 2.16 + 3.68 = 11.20 CFS

→ Q_{100} = 9.35 + 2.89 + 7.11 = 19.35 CFS

INLET HH (DESIGN POINT 6)

Q_5 = 1.68 CFS
Q_{100} = 2.24 CFS

PONDING DEPTH = 1.0 (SUMP CONDITION)

USE 5' TYPE R

Q_A = 12.0 CFS

Q_{IN5} = [illegible] CFS *
Q_{IN100} = 2.24 CFS *

NO CARRY OVER

FLOW @ ST MH 10

→ Q_5 = 1.68 + 3.68 = 5.36 CFS

→ Q_{100} = 2.24 + 7.11 = 9.35 CFS

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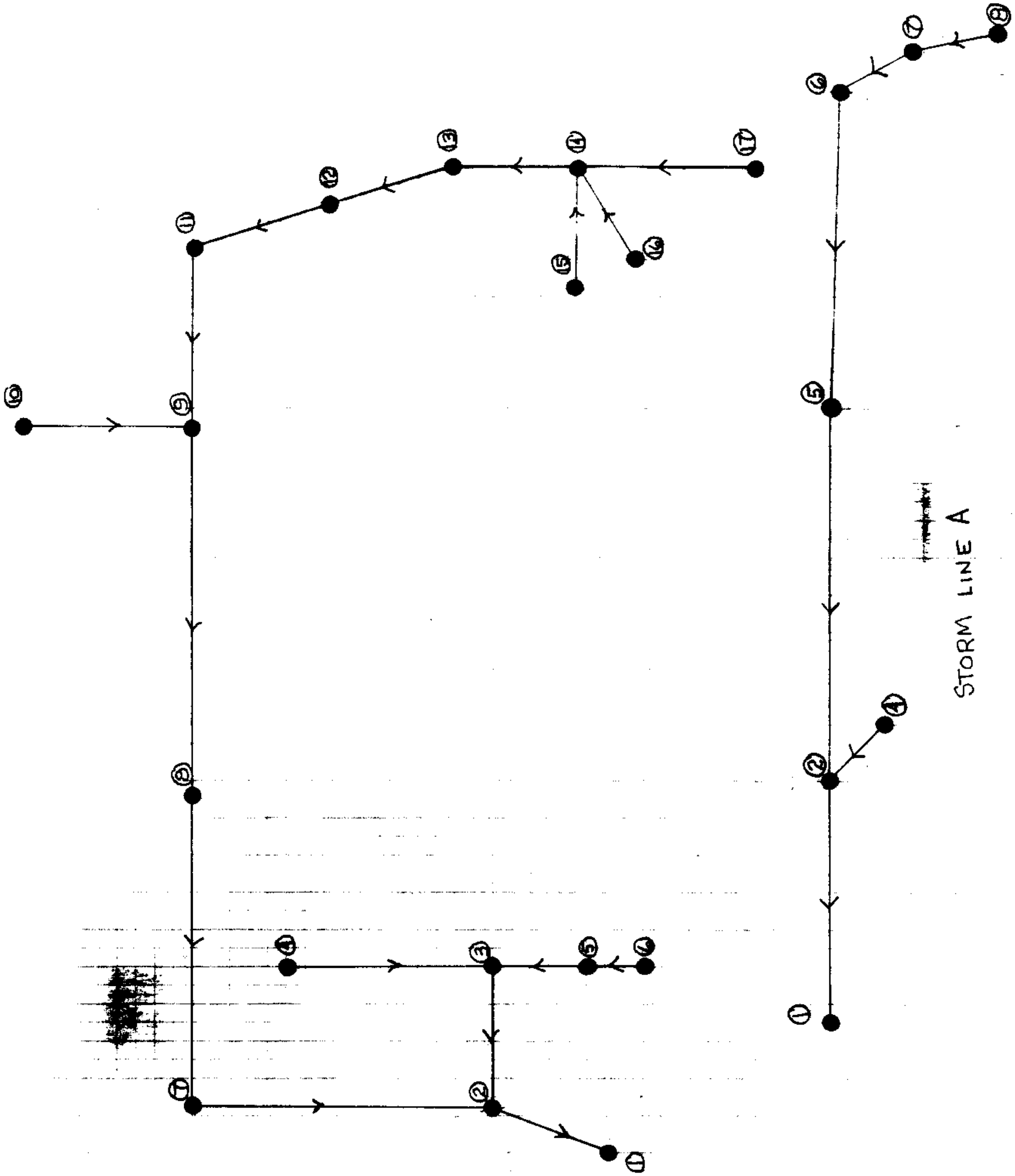
Title MAJESTIC TANDY — Date 12-20-94 (REV 1-9-95) — Job no.

Subject STORM DRAIN ANALYSIS — By D. LOVATO — Sheet 1 of



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Consulting Engineers

Title [illegible] Date 12-21-94 Job no.

Subject DETENTION VOLUME By D LOVATO Sheet 1 of 2

BASIN I NOT DETAINED, FLOWING OFFSITE (A = 0.28 AC)

$A_T = 16.81 - 0.28$

$A_T = 16.53$ AC

100 YEAR -

$V_{100} = K_{100} A_T$

$K_{100} = (1.78 I - 0.002 I^2 - 3.56)/100$

$I = 80\%$ IMPERVIOUS

$K_{100} = 0.126$

$A_T = 16.53$ AC

$V_{100} = (0.126)(16.53)$

$V_{100} = 2.08$ AC·FT (90605 CF)

10 YEAR -

$V_{10} = K_{10} A_T$

$K_{10} = (0.95 I - 1.90)/1000$

$I = 80\%$

~~$K_{10} = 0.074$~~

$A_T = 16.53$

$V_{10} = (0.074)(16.53)$

$V_{10} = 1.22$ AC·FT (53143 CF)

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Consulting Engineers

Title [illegible] Date [illegible] Job no.

Subject DETENTION VOLUME By D LOVATO Sheet 2 of 2

V_{100} = 90605 CF V_{10} = 53143 CF

ELEV (FT)	AREA (SF)	VOLUME (CF)	Σ VOLUME (CF)
6	0		
		3610	3610
7	7220		
		10040	13650
8	12860		
		16463	30113
9	20,066		
		21518	51631
10	22,970		
		24440	76071
11	25884		

10	51,631
10.1	54075
10.09	53831
10.07	53343
* 10.06	

10 YR POND ELEV

11	76071
11.6	92136
11.1	78749
11.2	81427
11.4	86783
11.5	89461
* 11.54	

100 YR POND ELEV

BASIN J NOT DETAINED

Q_{10} = 1.43 CFS

Q_{100} = 2.34 CFS

A_T = 16.81

=> FROM DOUGLAS COUNTY STORM DRAINAGE DESIGN AND TECHNICAL CRITERIA

Q_{100R} = 1.0 CFS/AC

Q_{10R} = 0.30 CFS/AC

100YR - $Q_R = (1.0)(16.81) - 2.34$

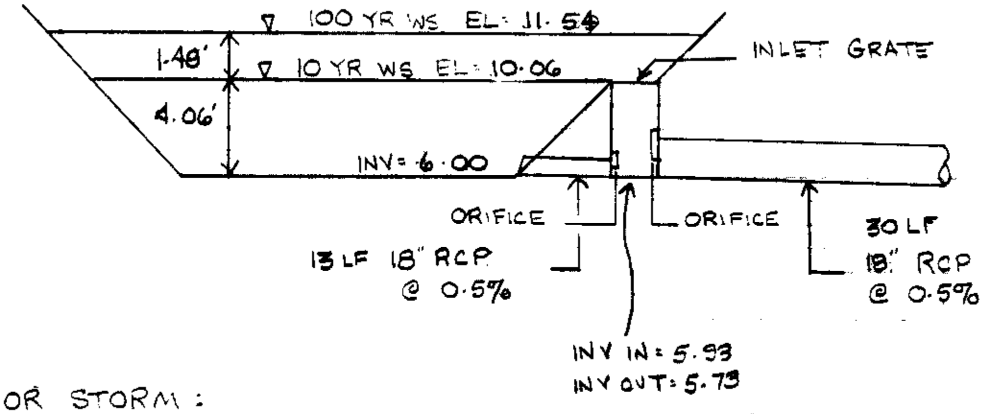
Q_{100R} = 14.47 CFS *

10 YR - $Q_R = (.30)(16.81) - 1.43$

= 3.61 CFS *

* NOTE

BASIN J DEVELOPED RUNOFF SUBTRACTED FROM RELEASE RATE FOR TOTAL AREA.



MINOR STORM:

Q_{10R} = 3.61 CFS

FLOW THROUGH 18 RCP

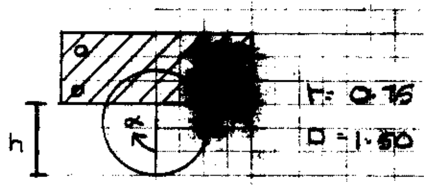
A = 1.76 SF
C = 0.65
H = 3.38

$Q = CA\sqrt{2gh}$

$= (0.65)(1.76)\sqrt{64.4(3.31)}$

= 14.70 CFS > 3.61 CFS

⇒ USE ORIFICE PLATE



h (FT)	α (RAD)	AREA (FT²)	H (FT)	Q (CFS)
1.50	3.14	1.77	3.31	16.77
1.25	2.30	1.57	3.31	14.93
0.5	1.23	0.52	3.38	4.95
0.4	1.08	0.38	3.77	3.83
0.3	0.92	0.25	3.77	2.55
0.39	1.07	0.37	3.77	3.70

$\alpha = \cos^{-1}\left[\frac{0.75 - h}{0.75}\right]$

$A = r^2(\alpha - \sin\alpha\cos\alpha)$

$H = 3.31 + 2/3\, r\left[\frac{\sin\alpha^3}{\alpha - \sin\alpha\cos\alpha}\right]$

h = 0.39

MAJOR STORM

Q_{100R} = 14.47 CFS

FLOW IN 18" (MINOR STORM)

A = 0.37

H = 3.77 + 1.48 = 5.25'

$Q = CA\sqrt{2gh}$

Q = 4.42 CFS   GRATE NEEDS TO BE SIZED FOR A FLOW Q = 14.47 − 4.42

Q = 10.05   (SEE SHT 4 OF 6

FLOW THROUGH 18" (MAJOR STORM)

A = 1.77 SF

C = 0.65

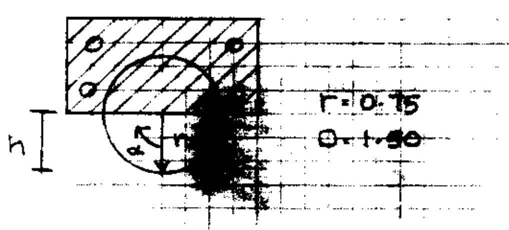
H = 5.06

$Q = CA\sqrt{2gh}$

$= (0.65)(1.77)\sqrt{64.4(5.06)}$

Q = 20.77 CFS > 14.47 CFS

⇒ USE ORIFICE PLATE



$\alpha = \cos^{-1}\left[\frac{0.75 - h}{0.75}\right]$

$A = r^2(\alpha - \sin\alpha\cos\alpha)$

$H = 5.06 + 2/3\, r\left[\frac{\sin\alpha^3}{\alpha - \sin\alpha\cos\alpha}\right]$

h (FT)	α (RAD)	AREA (FT²)	H (FT)	Q (CFS)
1.50	3.14	1.77	5.06	20.77
1.00	1.91	1.25	5.24	14.78
0.99	1.89	1.23	5.25	14.70
0.96	1.85	1.18	5.27	14.13
0.97	1.86	1.20	5.26	14.35 *

USE h = 0.97'

SIZE INLET GRATE

Q = 10.05 CFS
H = 1.48
C = 0.65

$$A = \frac{Q}{C\sqrt{2gh}}$$

AREA NEEDED

A = 1.58 SF

TRY 2 x 2.5 W/ 1" BARS ON 3" CENTERS

AREA = 4 SF

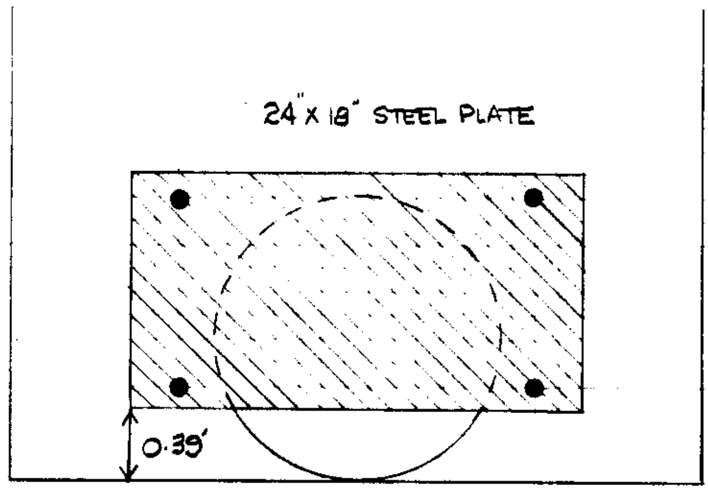
\# OF BARS $\frac{30}{3}$ = 10

AREA OF BARS 1/12 x 2 x 10 = 1.67 SF

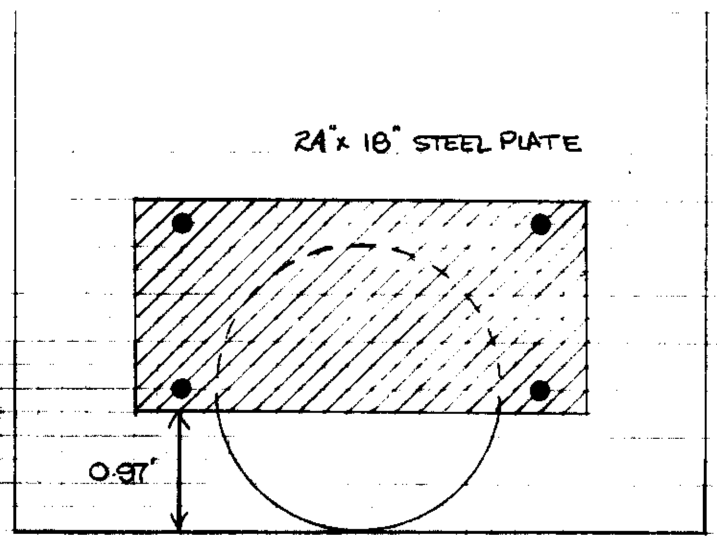
AREA OPEN = 4.0 - 1.67
= 2.33

FLOW THROUGH INLET
Q = 14.78 CFS > 10.05 OK

=> ORIFICE PLATE WILL CONTROL OUTLET FLOW.



MINOR STORM CONTROL ORIFICE PLATE



MAJOR STORM CONTROL ORIFICE PLATE

OVERFLOW WEIR CALC. (DETENTION POND)

$Q_O = 14.47$ CFS
1.0' FREE BOARD

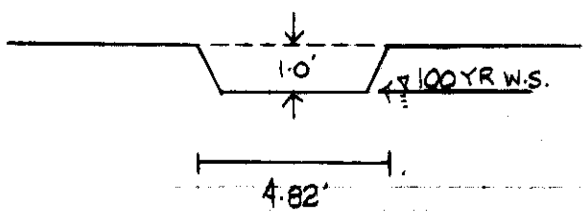
$Q = CLH^{3/2}$

$C = 3.0$

$L = \frac{Q}{CH^{3/2}} = \frac{14.47}{(3.00)(1.0)^{3/2}}$

$L = 4.82'$

LENGTH MUST NOT BE LESS THAN 4.82'



SIZING INTO POND FROM STORM LINE A

Q_D = 55.86 CFS
S_o = 0.63%
n = .013
D = 36"

DETERMINE CRITICAL DEPTH:

$$Z = \frac{Q}{\sqrt{g}} = \frac{55.86}{\sqrt{32.2}} = 9.84 \qquad \frac{Z}{D^{2.5}} = \frac{9.84}{3^{2.5}} = 0.63$$

FIG 2-3 Y_c/d = 0.80 Y_c = 0.80(3) = 2.4'

DETERMINE NORMAL DEPTH:

$$AR^{2/3} = \frac{nQ}{1.49\sqrt{S}} = \frac{(.013)(55.86)}{1.49\sqrt{.0063}} = 6.14 \qquad \frac{AR^{2/3}}{D^{8/3}} = \frac{6.14}{18.72} = 0.32$$

FIG 2-2 Y_n/d = 0.84 Y_n = 0.84 (3) = 2.52

$Y_n > Y_c$ SUBCRITICAL

$Da = 1/2(D+Y_n) = 2.76$ $\frac{Q}{Da^{1.5}} = 12.18$ ASSUME Y_T/d = 0.40

⇒ FIG 5-7 USE TYPE M Ø = 12"

DETERMIN[illegible]GTH:

$$L = \left(\frac{1}{2\tan\text{[illegible]}}\right)\left(\frac{\text{[illegible]}}{Y_T} - W\right) \qquad \frac{Q}{Da^{2.5}} = \frac{55.86}{2.76^{2.5}} = 4.41 \qquad \frac{Y_T}{H} = .40 \qquad \text{FIG 5-9} = \frac{1}{2\tan Ø} = 3.0$$

A = 7.06 Y_T = .40(3) = 1.20

$$L = 3.0\left(\frac{7.07}{1.20} - 3\right) = 8.66$$

USE 9 LF TYPE M RIPRAP Ø = 12"

SIZING INTO POND FROM STORM LINE B

$Q_D = 49.23$ CFS

$S_o = 0.50\%$

$n = .013$

$D = 36''$

DETERMINE CRITICAL DEPTH:

$Z = \frac{Q}{\sqrt{g}} = \frac{49.23}{\sqrt{32.2}} = 8.67 \qquad \frac{Z}{d_o^{2.5}} = \frac{8.67}{3^{2.5}} = 0.55$

FIG 2-3 $Y_c/d = 0.75 \qquad Y_c = 0.75(3) = 2.25'$

DETERMINE NORMAL DEPTH:

$AR^{2/3} = \frac{nQ}{1.49\sqrt{S}} = \frac{(.013)(49.23)}{1.49\sqrt{0.005}} = 6.07 \qquad \frac{AR^{2/3}}{D^{8/3}} = \frac{6.07}{18.72} = 0.32$

FIG 2-2 $Y_n/d = 0.84 \qquad Y_n = 0.84(3.0) = 2.52$

$Y_n > Y_c$ => SUBCRITICAL

$D_a = 1/2(D+Y_n) = 2.76 \qquad \frac{Q}{D_a^{1.5}} = 10.73$ ASSUME $Y_t/d = .40$

=> FIG 5-7 USE TYPE M RIPRAP $\phi = 12''$

DETERMINE LENGTH:

$L = \left(\frac{1}{2\tan\phi}\right)\left(\frac{A_T}{Y_T} - W\right) \qquad \frac{Q}{D_a^{2.5}} = \frac{49.23}{12.65} = 3.89 \qquad \frac{Y_T}{H} = 0.40$

FIG 5-9 $\frac{L}{2\tan\phi} = 3.90$

$A = 7.06 \qquad Y_T = 0.40(3) = 1.20$

$L = 3.90\left(\frac{7.06}{1.20} - 3\right) = 11.25$

USE 12 LF TYPE M RIPRAP $\phi = 12''$

SIZING OUT OF POND

$Q_D = 14.47$ CFS
$S_0 = 0.5\%$
$n = .013$
$D = 18''$

DETERMINE CRITICAL DEPTH:

$Z = \frac{Q}{\sqrt{g}} = \frac{14.47}{\sqrt{32.2}} = 2.55 \qquad \frac{Z}{D^{2.5}} = \frac{2.55}{1.5^{2.5}} = 0.92$

FIG 2-3 $Y_c/d = 0.94 \qquad Y_c = 0.94(1.5) = 1.41$

DETERMINE NORMAL DEPTH:

$AR^{2/3} = \frac{nQ}{1.49\sqrt{S}} = \frac{(.013)(14.47)}{1.49\sqrt{0.005}} = 1.78 \qquad \frac{AR^{2/3}}{D^{8/3}} = \frac{1.78}{1.5^{8/3}} = 0.60$

FIG 2-2 $Y_n/d = 1.0 \qquad Y_n = 1.0(1.5) = 1.50$

$Y_n > Y_c$

$D_a = 1/2(D + Y_n) = 1.50 \qquad Q/D_a^{1.5} = 7.88 \qquad$ ASSUME $Y_T/d = 0.40$

=> FIG 5-7 USE TYPE L $\phi = 9''$

DETERMINE LENGTH:

$L = \left(\frac{1}{2\tan\phi}\right)\left(\frac{A_T}{Y_T} - W\right) \qquad \frac{Q}{D_a^{2.5}} = 5.25 \qquad Y_T/H = 0.40 \qquad$ FIG 5-9 $\frac{1}{2\tan\phi} = 2.20$

$A = 1.77 \qquad Y_T = 0.40(1.5) = 0.60$

$L = (2.20)\left(\frac{1.77}{.60} - 1.5\right) = 3.19$

USE 5 LF TYPE L RIPRAP $\phi = 9''$

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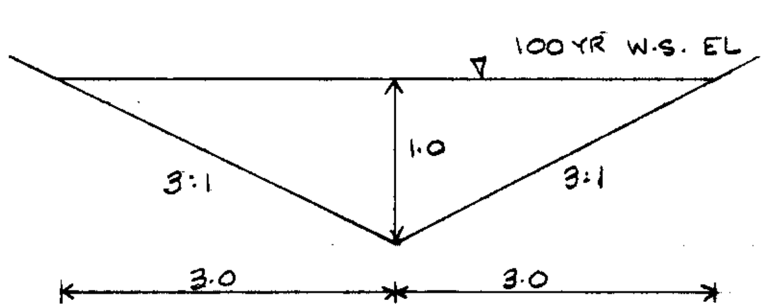
REV 2-22-95

Title MAJESTIC TA[illegible] Date [illegible]-22-94 Job no.

Subject SWALE DESIGN By D. LOVATO Sheet 1 of 1

SWALE BELOW DETENTION POND
SECTION AA ON DRAINAGE PLAN

Q_D = 14.47
S_o = 4.31%
n = .035



A = 3.0 SF
WP = 6.32

Q = 16.14 CFS > 14.47 CFS OK

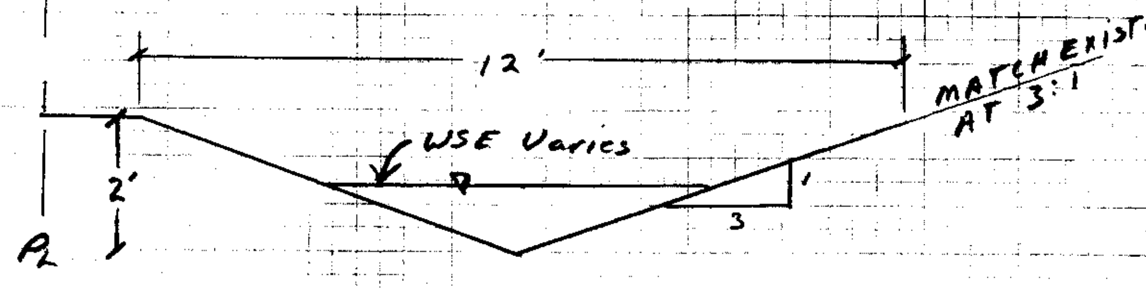
* NOTE
SWALE WILL BE TEMPORARY
AND WILL FLOW DOWN TO
DETENTION POND FROM MASTER
DRAINAGE STUDY

MARTIN/MARTIN
Consulting Engineers

Title: Tandy Date: 2/22/95 Job no. 12426

Subject: Varying Slope Drainage Swale By: AMK Sheet 1 of

Q Req'd = 14.47 CFS
Length of swale = 908 LF
Change in Elevation = 38'
S_{Avg} = 4.19%



Channel Cross Section

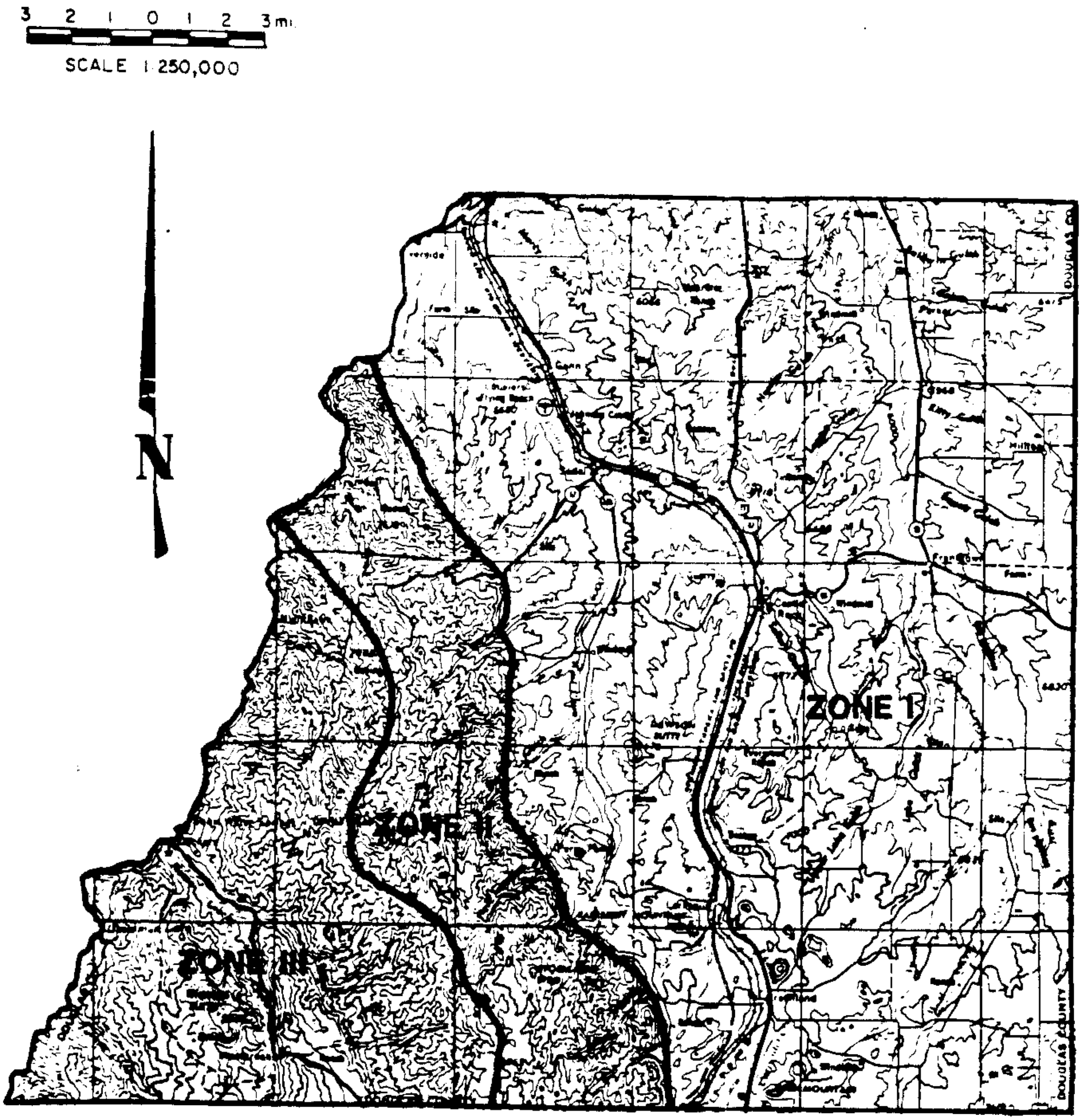
$S_{Avg} = 4.19\%$
$n = 0.035$
$V = 1.49/n \; R_h^{2/3} S^{1/2}$
$A = 2.80$
$W_p = 6.11$
$R_h = 0.458$
V = 5.18 FPS
D = 0.97'

$S_{max} = 6.32\%$
$n = 0.035$
$A = 2.40$
$W_p = 5.66$
$R_h = 0.424$
V = 6.04 FPS
D = 0.89 FEET

$S_{min} = 1.00\%$
$n = 0.035$
$A = 4.79$
$W_p = 7.97$
$R_h = 0.60$
V = 3.02 FPS
D = 1.26 FEET

Maximum Velocity = 6.0 FPS
Minimum Freeboard = 0.74'

APPENDIX C

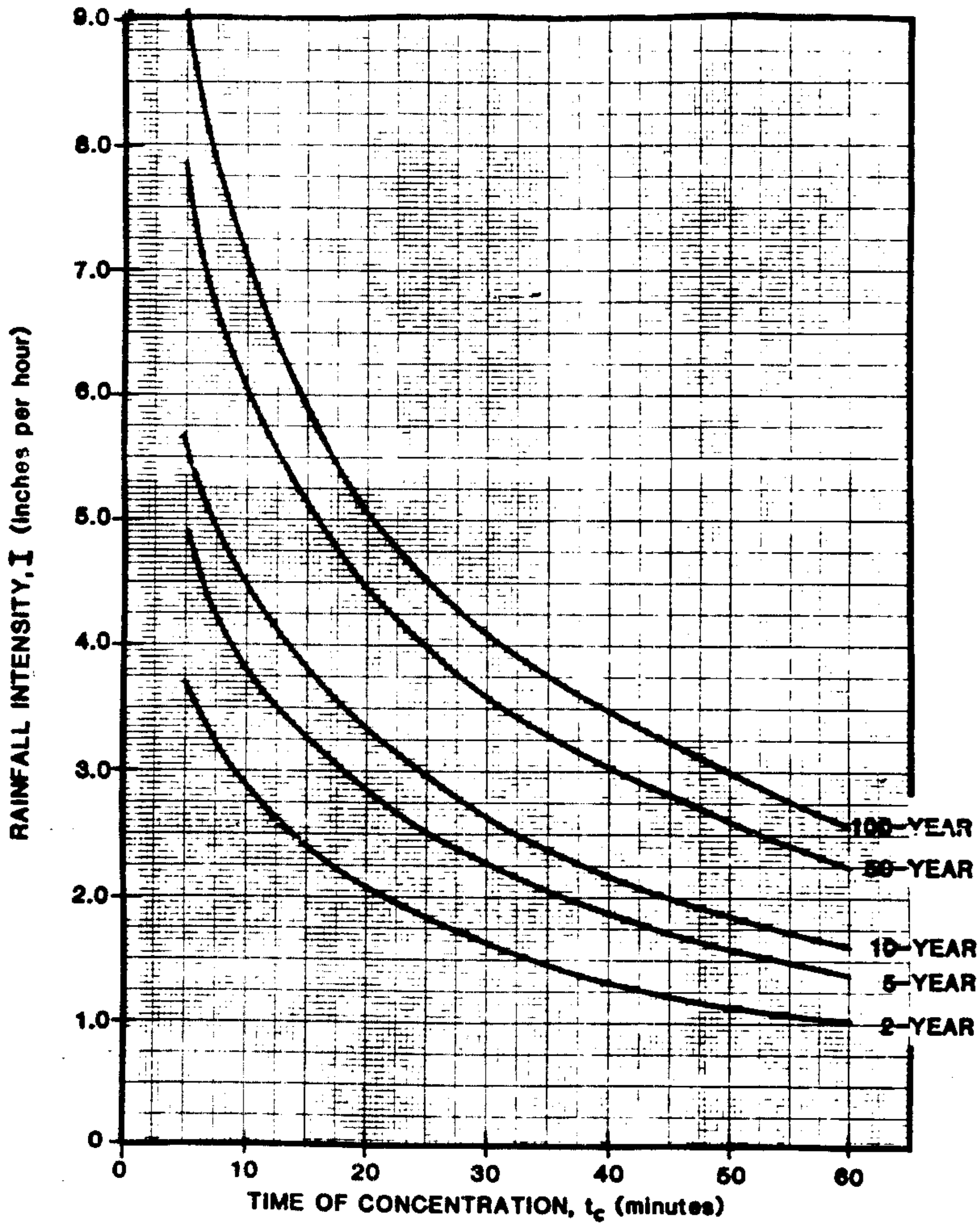


RAINFALL ZONES

Date: NOV 1984
Rev:

REFERENCE: WRC TM-1, 5-24-84

TIME - INTENSITY - FREQUENCY CURVES
ZONE I



Date: NOV 1984 Rev:	REFERENCE: WRC TM-1, 5-24-1984

TABLE 3-1 (42)

RECOMMENDED RUNOFF COEFFICIENTS AND PERCENT IMPERVIOUS

LAND USE OR SURFACE CHARACTERISTICS	PERCENT IMPERVIOUS	FREQUENCY 2	5	10	100
Business:					
Commercial Areas	95	.87	.87	.88	.89
Neighborhood Areas	70	.60	.65	.70	.80
Residential:					
Single-Family	*	.40	.45	.50	.60
Multi-Unit (detached)	50	.45	.50	.60	.70
Multi-Unit (attached)	70	.60	.65	.70	.80
1/2 Acre Lot or Larger	*	.30	.35	.40	.60
Apartments	70	.65	.70	.70	.80
Industrial:					
Light Areas	80	.71	.72	.76	.82
Heavy Acres	90	.80	.80	.85	.90
Parks, Cemetaries:	7	.10	.18	.25	.45
Playgrounds:	13	.15	.20	.30	.50
Schools:	50	.45	.50	.60	.70
Railroad Yard Areas	20	.20	.25	.35	.45
Undeveloped Areas:					
Historic Flow Analysis- Greenbelts, Agricultural	2	(See "Lawns")			
Offsite Flow Analysis (when land use not defined)	45	.43	.47	.55	.65
Streets:					
Paved	100	.87	.88	.90	.93
Gravel (Packed)	40	.40	.45	.50	.60
Drive and Walks:	96	.87	.87	.88	.89
Roofs:	90	.80	.85	.90	.90
Lawns, Sandy Soil	0	.00	.01	.05	.20
Lawns, Clayey Soil	0	.05	.15	.25	.50

NOTE: These Rational Formula coefficients may not be valid for large basins.

*See Figure 2-1 for percent impervious.

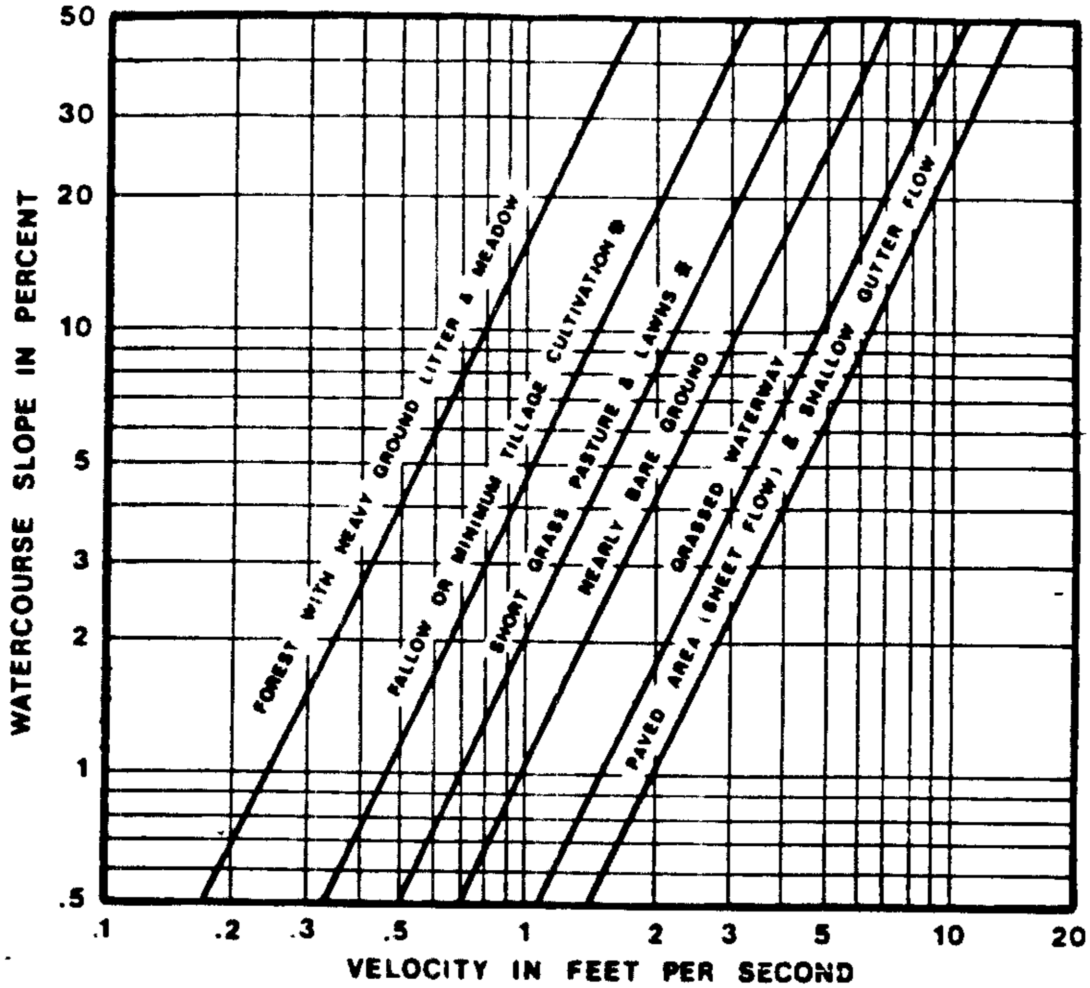


FIGURE 3-2. ESTIMATE OF AVERAGE FLOW VELOCITY FOR USE WITH THE RATIONAL FORMULA.

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

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

runoff coefficients recommended in this manual. As a result these recommendations need to be used with a great deal of caution whenever working outside the Denver region.

For urban areas, the time of concentration consists of an inlet time or overland flow time (t_i) plus the travel time (t_t) in the storm sewer, paved gutter, roadside drainage ditch, or drainage channel. For non-urban areas, the time of concentration consists of an overland flow time (t_i) plus the time of travel in a combined form, such as a small swale, channel, or drainageway. The travel portion (t_t) of the time of concentration can be estimated from the hydraulic properties of the storm sewer, gutter, swale, ditch, or drainageway. Inlet time, on the other hand, will vary with surface slope, depression storage, surface cover, antecedent rainfall, and infiltration capacity of the soil, as well as distrance of surface flow. The time of concentration can be represented by Equation 3-2 for both urban and non-urban areas:

$$t_c = t_i + t_t \qquad (3\text{-}2)$$

In which t_c = time of concentration (minutes)
t_i = initial, inlet, or overland flow time (minutes)
t_t = travel time in the ditch, channel, gutter, storm, etc. (minutes)

3.4.1 Time of Concentration In Non-Urbanized Basins

The initial or overland flow time (t_i) in non-urbanized watersheds may be calculated using Equation 3-3:

$$t_i = \frac{1.8\,(1.1 - C_5)\sqrt{L}}{\sqrt[3]{S}} \qquad (3\text{-}3)$$

In which t_i = initial or overland flow time (minutes)
C_5 = runoff coefficient for 5-year frequency (from Table 3-1)
L = length of overland flow, (feet., 500' maximum)
S = average basin slope (percent)

Equation 3-3 is considered adequate for distances up to 500 feet and has been reduced to a graph in Figure 3-1. For longer basin lengths, the time of

$$V = 0.47 \text{ ft/sec.}$$

The travel time can then be calculated using this velocity and 2100 feet of travel length.

$$t_t = \frac{L}{60V} = \frac{2100 \text{ ft.}}{(60 \text{ sec/min})(0.47 \text{ ft/sec})}$$

$$t_t = 75 \text{ minutes}$$

Step 4: Combine t_i and t_t to find the estimated time of concentration t_c.

$$t_c = t_i + t_t \qquad \text{(Equation 3-2)}$$

$$t_c = 31 + 75 = 106 \text{ minutes}$$

3.4.2 Time of Concentration In Urbanized Basins

Overland flow in urbanized basins can occur from the back of the lot to the street, in parking lots, in greenbelt area, or within park areas. It can be calculated using the procedure described in Section 3.4.1 except the travel time t_t to the first design point or inlet is estimated using the "Paved Area (Sheet Flow) & Shallow Gutter Flow" line in Figure 3-2 and the over land flow distance should not exceed 300 feet. Also, the time of concentration at the first design point in an urbanized basins using this procedure should not exceed the time of concentration calculated using Equation 3-4. Equation 3-4 was developed using the rainfall/runoff data collected in the Denver region and, in essence, represents regional "calibration" of the Rational Method.

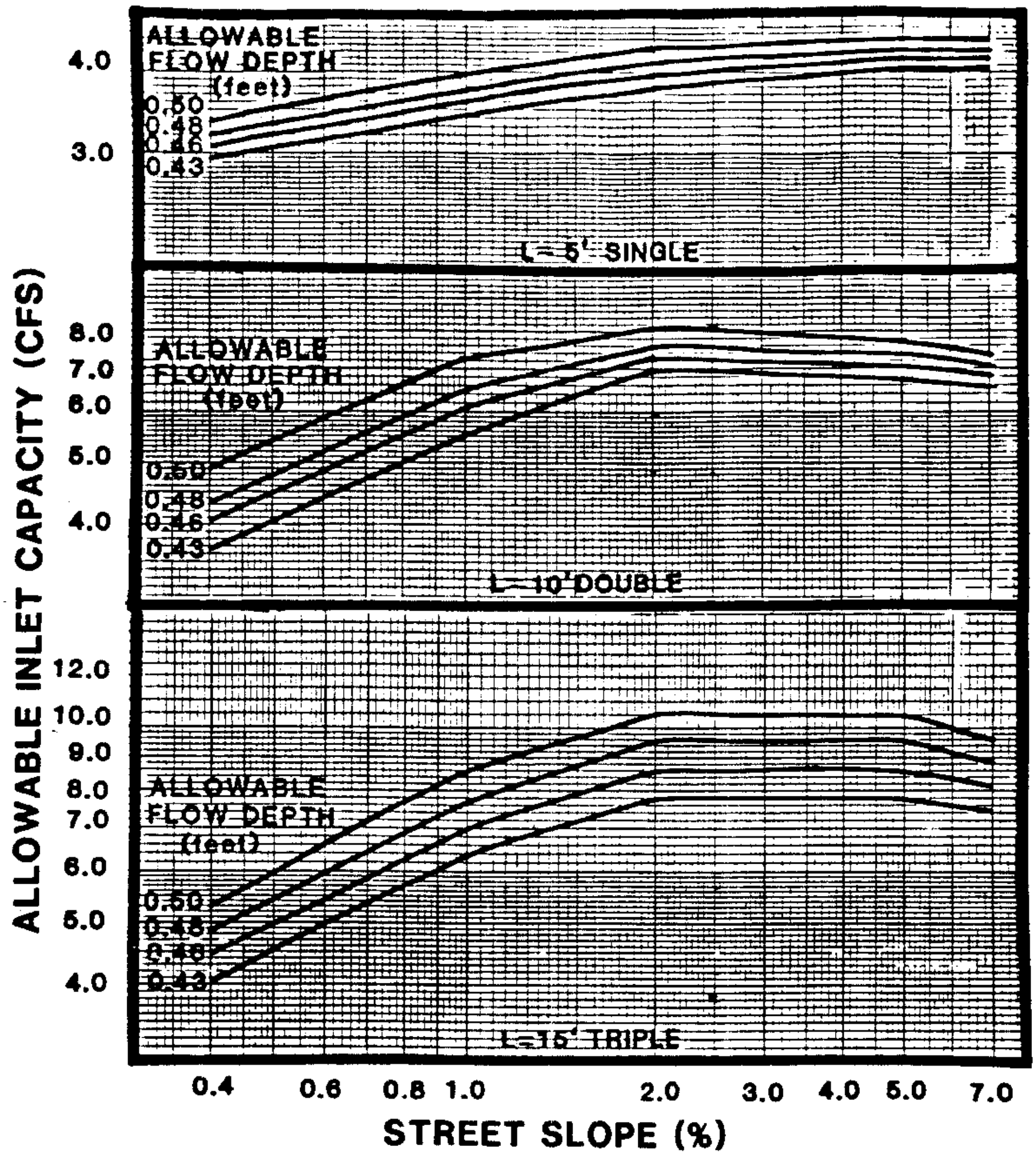
$$t_c = \frac{L}{180} + 10 \qquad (3\text{-}4)$$

In which t_c = time of concentration at the first design point in an urban watershed (minutes)

L = watershed length (feet)

Normally, Equation 3-4 will result in a lesser time of concentration at the first design point and will govern in an urbanized watershed. For subsequent design points, the time of concentration is calculated by accumulating the travel times in downstream drainageway reaches. The minimum

ALLOWABLE INLET CAPACITY
TYPE - R CURB OPENING ON A CONTINUOUS GRADE

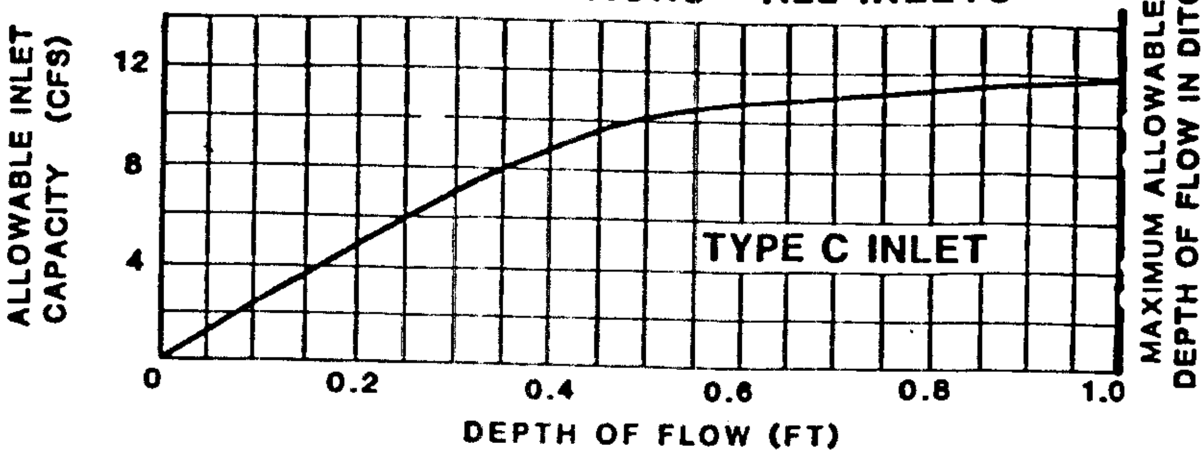


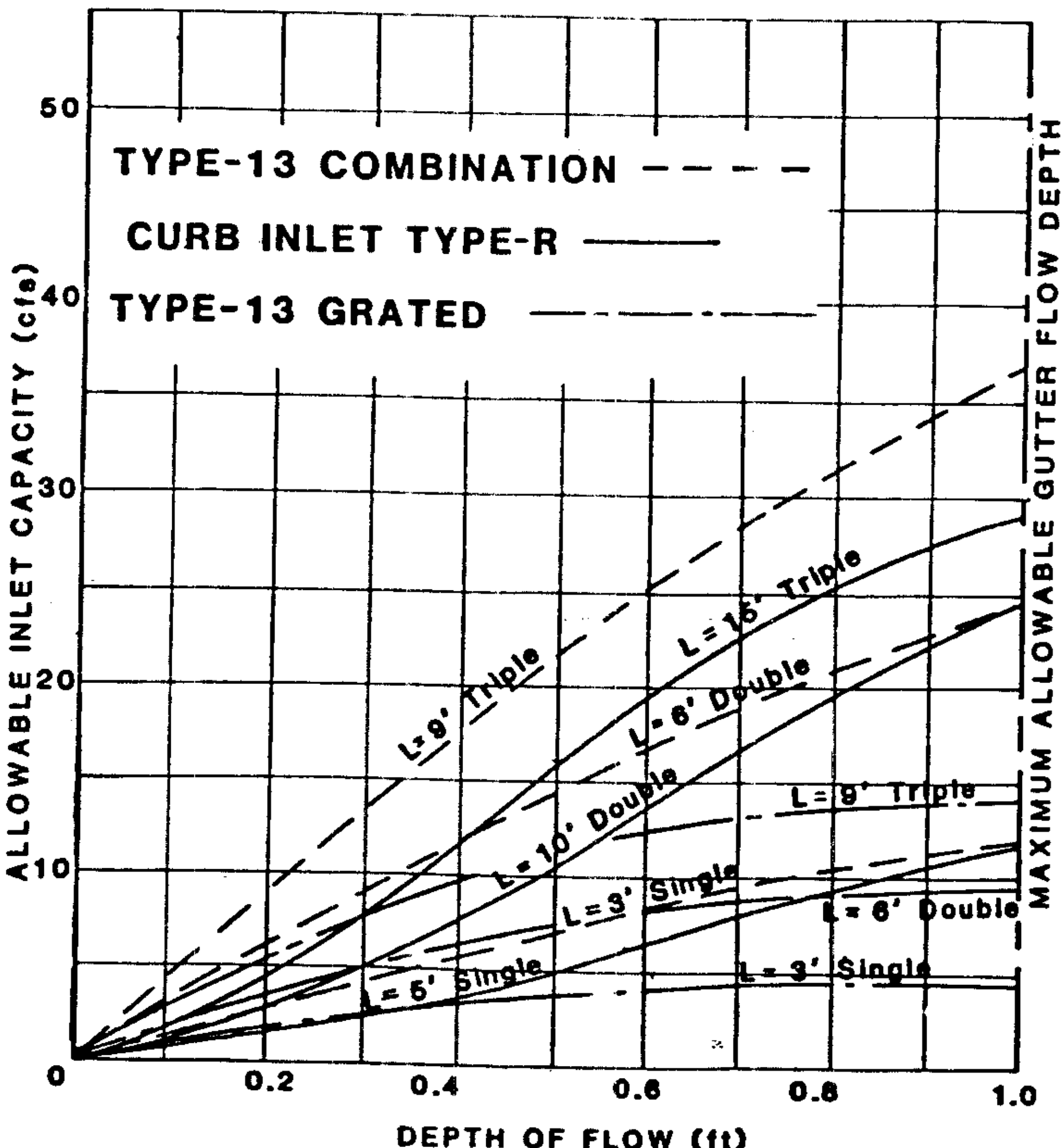
NOTES:
1. Maximum inlet capacity at maximum allowable flow depth. Proportionally reduce for other depths.
2. Allowable Capacity =
   88% (L = 5')
   92% (L = 10')
   95% (L = 15')
   of Theoretical Capacity
3. Interpolate for other inlet lengths.

Date: NOV 1984
Rev:

REFERENCE: WRC ENGINEERING, INC., TM-2 AUG. 1984

ALLOWABLE INLET CAPACITY
SUMP CONDITIONS - ALL INLETS



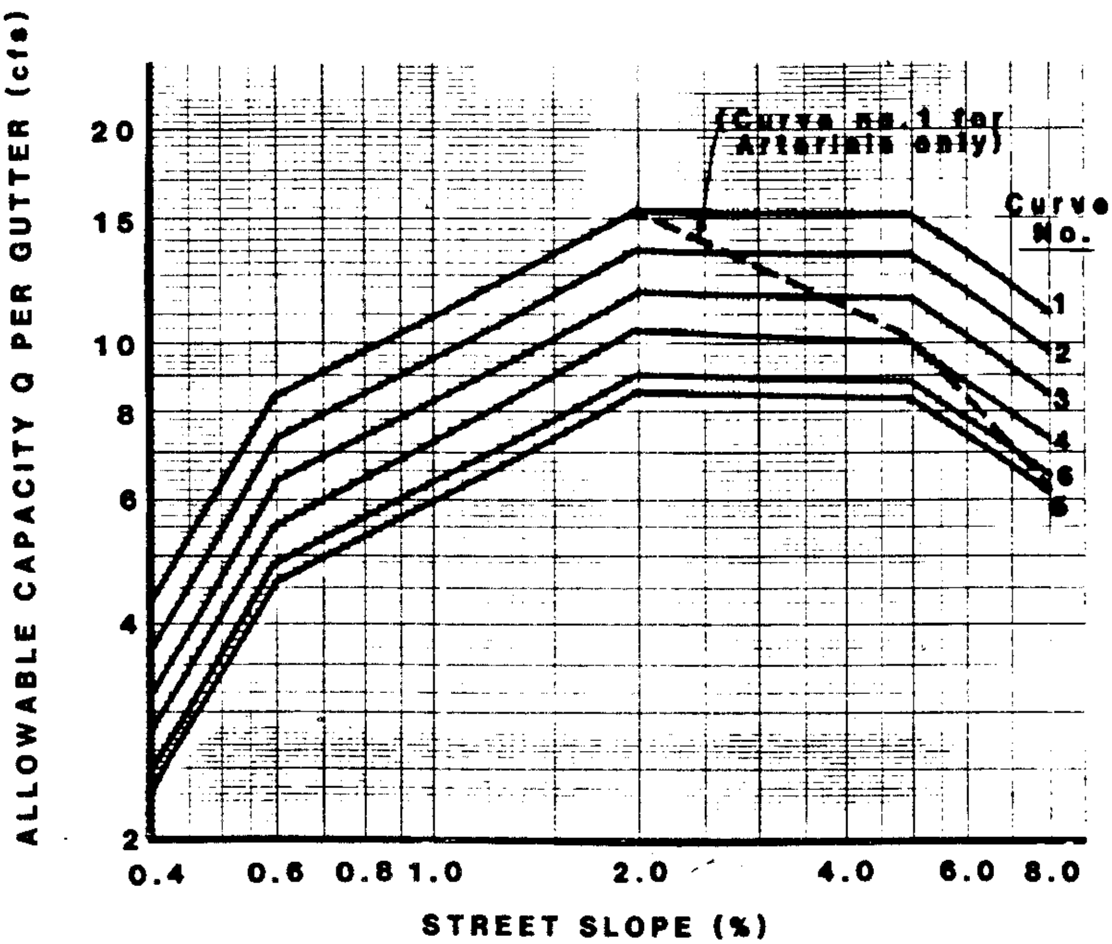


Date: NOV 1984
Rev: JULY 1985

REFERENCE:
WRC ENGINEERING, INC., TM-2 AUG. 1984

ALLOWABLE GUTTER CAPACITY

MINOR STORM



NOTES:

1. DESIGN CONDITIONS

   $Q = F(0.54(z/n)S^{1/2}d^{8/3})$
   F = (From Fig. 6-2, 8.2, Ref. 1)
   n = 0.016 for STREETS

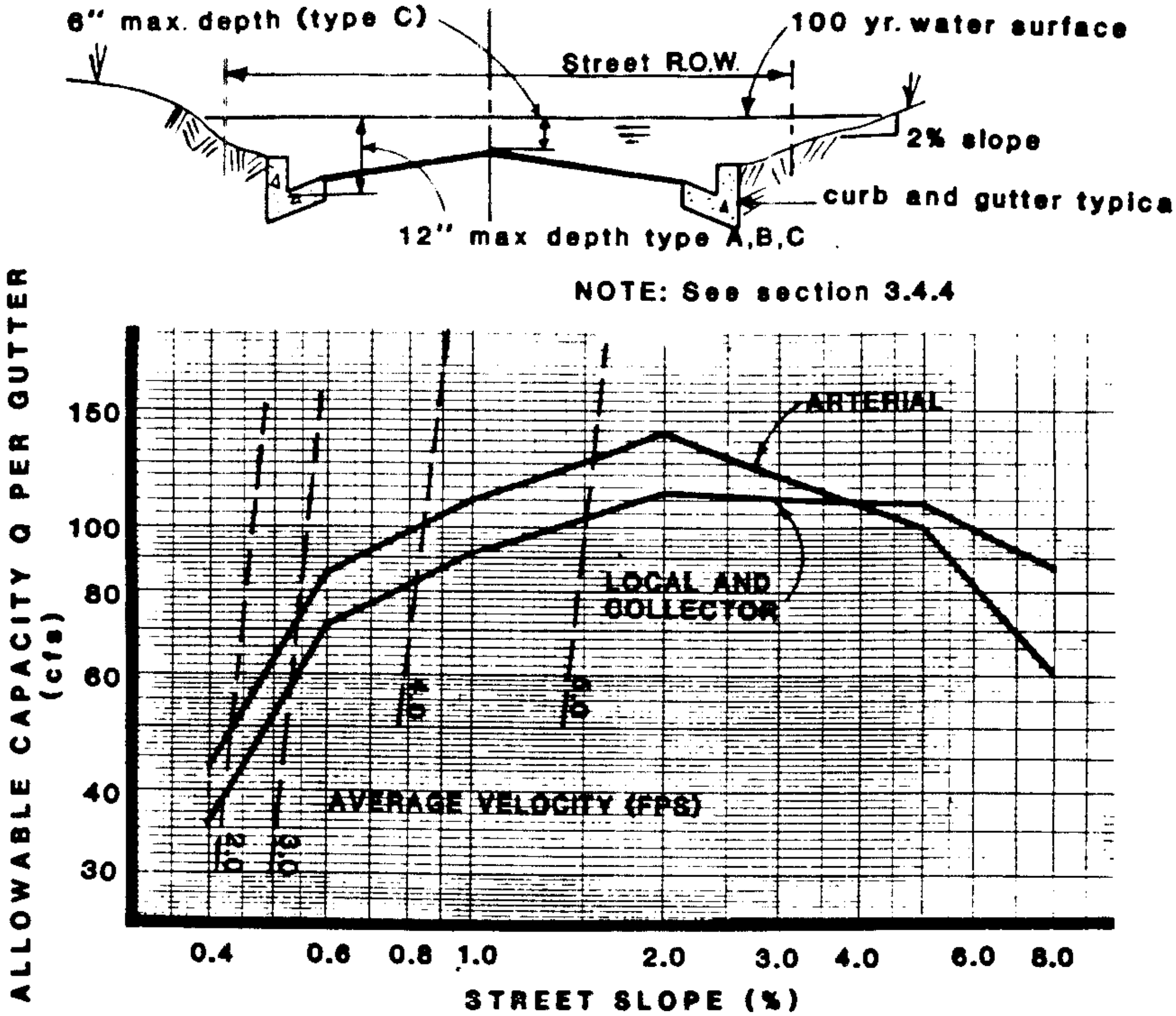
2. Figure includes reduction factor for allowable capacity.

3. Curve numbers for specific street sections are listed on Table 1001.

DATE: REV:	REFERENCE: WRC ENGINEERING, INC. TM-2, MARCH 1985

STORM DRAINAGE DESIGN AND TECHNICAL CRITERIA	FIGURE 1004

ALLOWABLE GUTTER CAPACITY
MAJOR STORM



NOTES:

1. DESIGN CONDITIONS

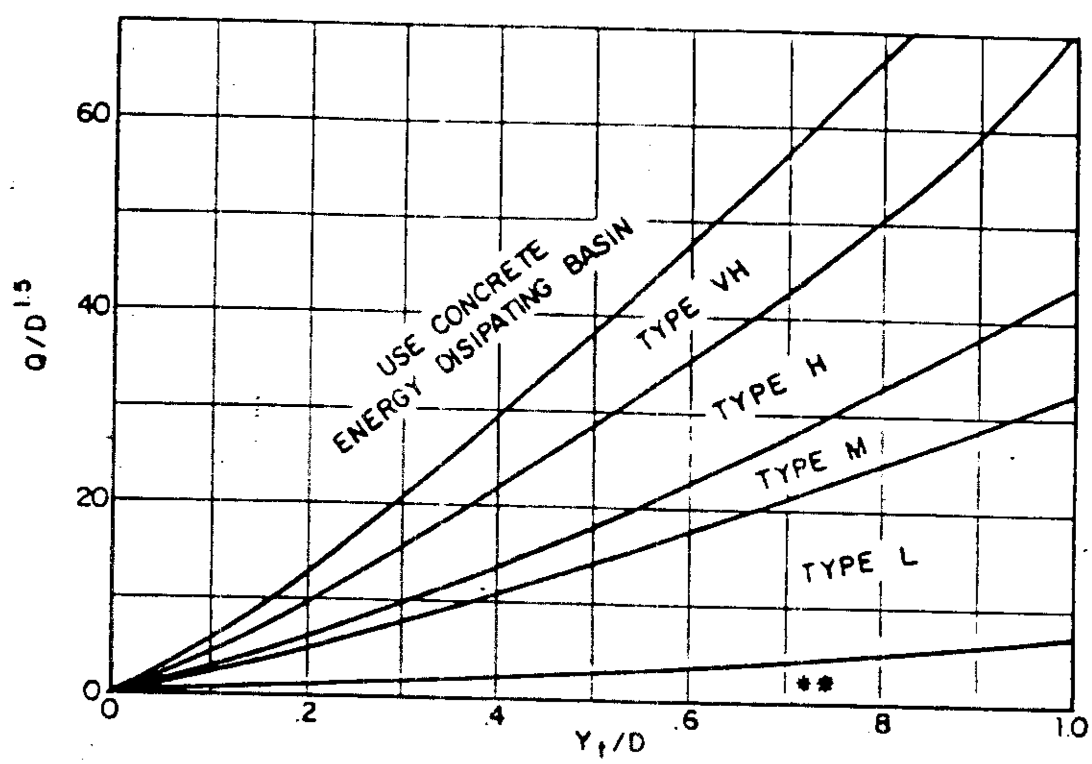
   $Q = F(0.56\frac{z}{n}S^{1/2}d^{8/3})$

   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. This figure is applicable only for the street sections listed on Table 1001.

Date: NOV 1984 Rev:	REFERENCE: WRC ENGINEERING, INC. TM-2 JULY 1984



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

FIGURE 5-7. RIPRAP EROSION PROTECTION AT CIRCULAR CONDUIT OUTLET.

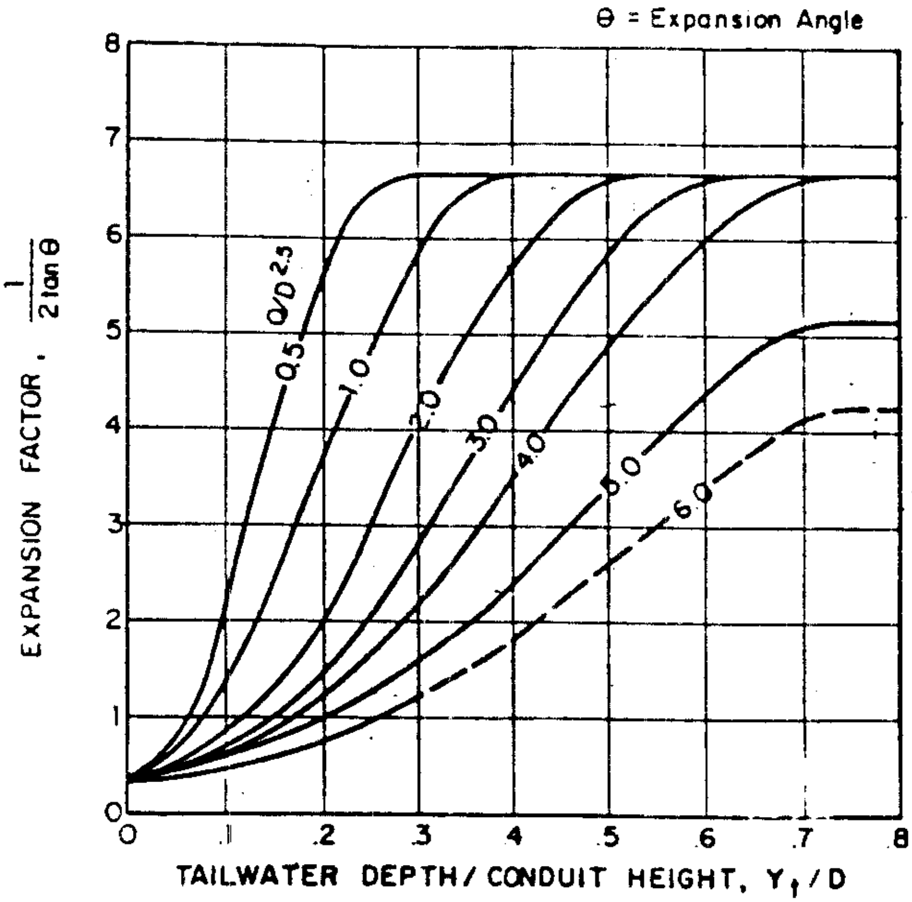


FIGURE 5-9. EXPANSION FACTOR FOR CIRCULAR CONDUITS

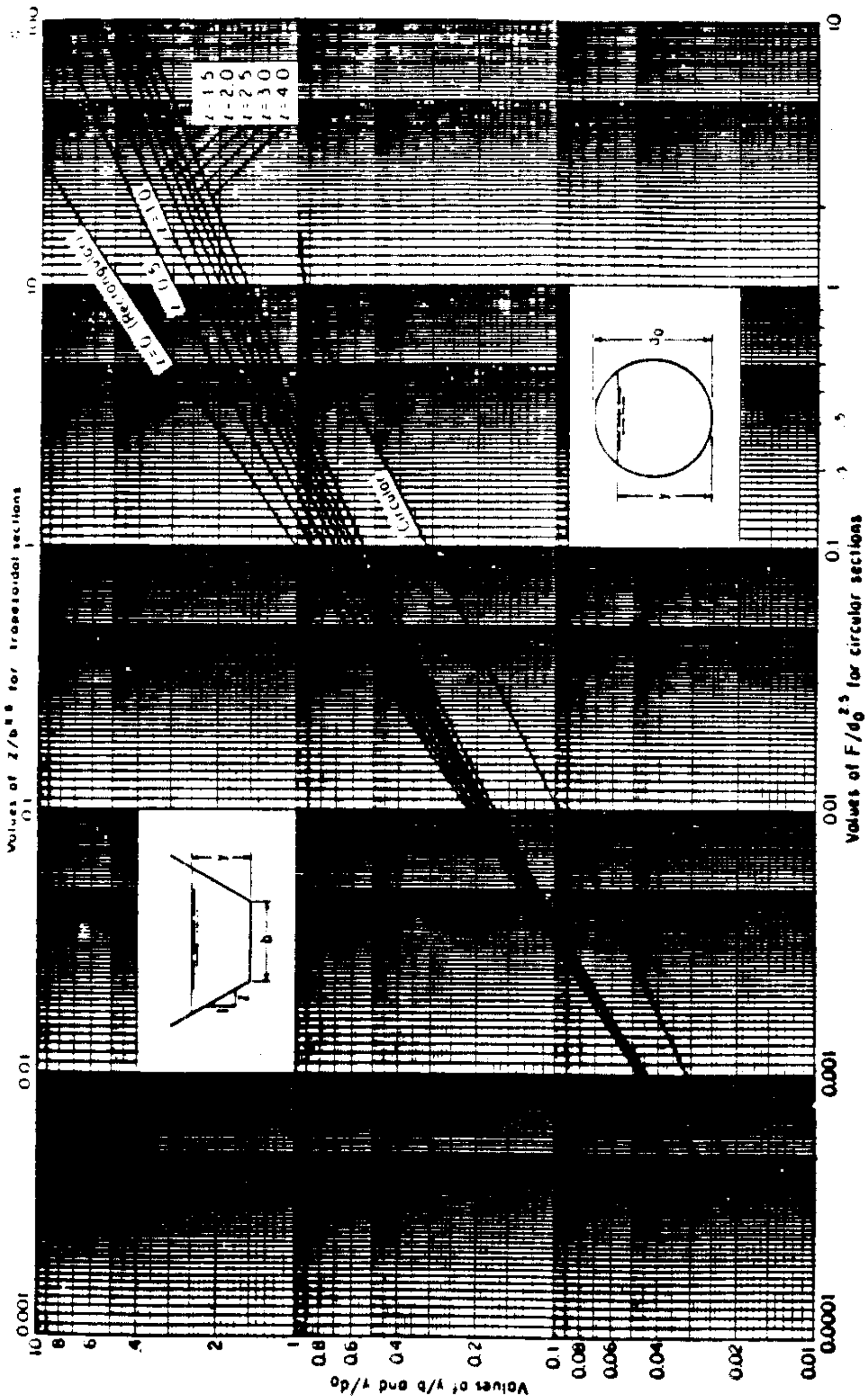


FIGURE 2-3. CURVES FOR DETERMINING THE CRITICAL DEPTH IN OPEN CHANNELS (5)

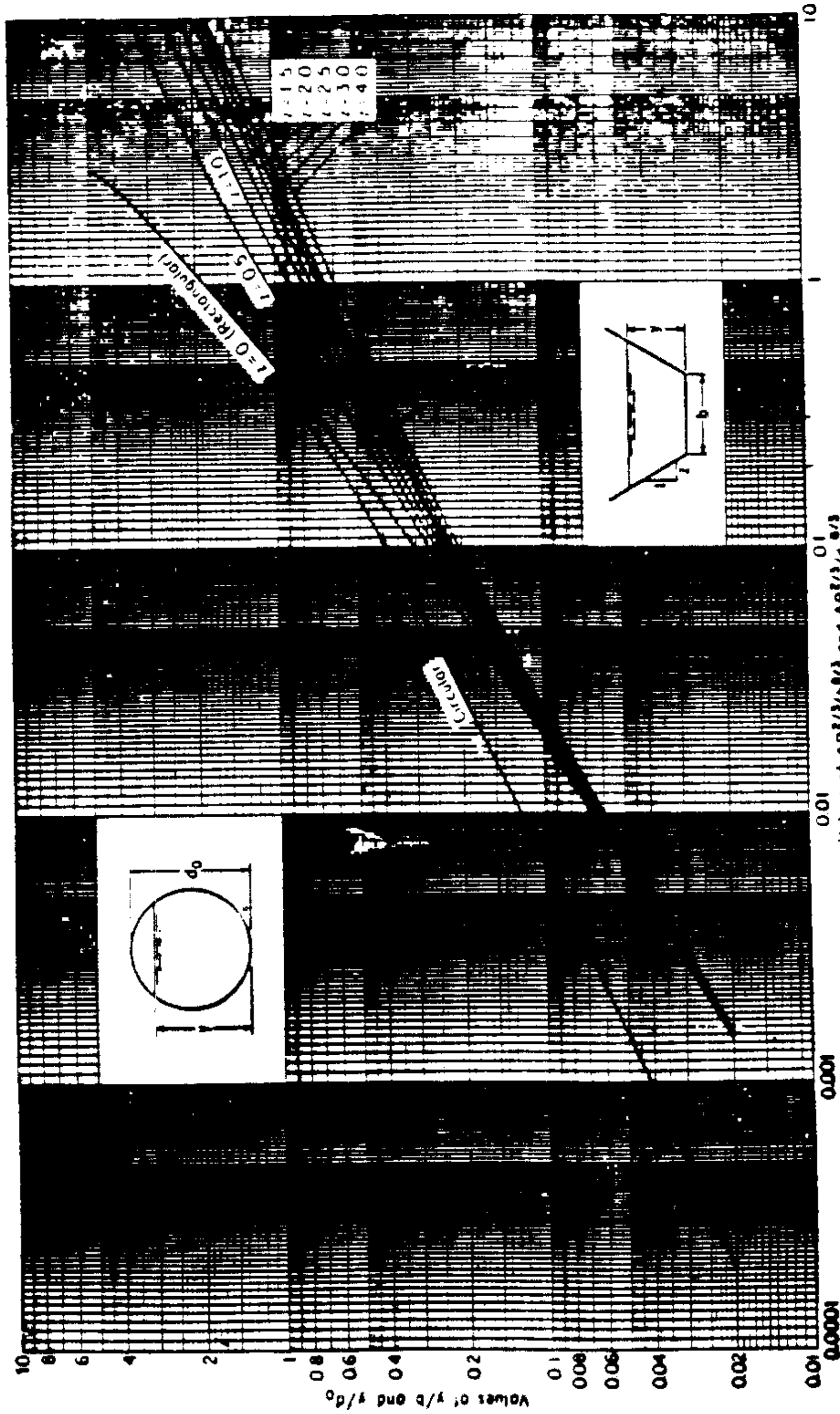


FIGURE 2-2. NORMAL DEPTH FOR UNIFORM FLOW IN OPEN CHANNELS (5)

Table 5-1

CLASSIFICATION AND GRADATION OF ORDINARY RIPRAP

Riprap Designation	% Smaller Than Given Size By Weight	Intermediate Rock Dimension (Inches)	d_{50}* (Inches)
Type VL	70-100	12	
	50-70	9	
	35-50	6	6**
	2-10	2	
Type L	70-100	15	
	50-70	12	
	35-50	9	9**
	2-10	3	
Type M	70-100	21	
	50-70	18	
	35-50	12	12
	2-10	4	
Type H	100	30	
	50-70	24	
	35-50	18	18
	2-10	6	
Type VH	100	42	
	50-70	33	
	35-50	24	24
	2-10	9	

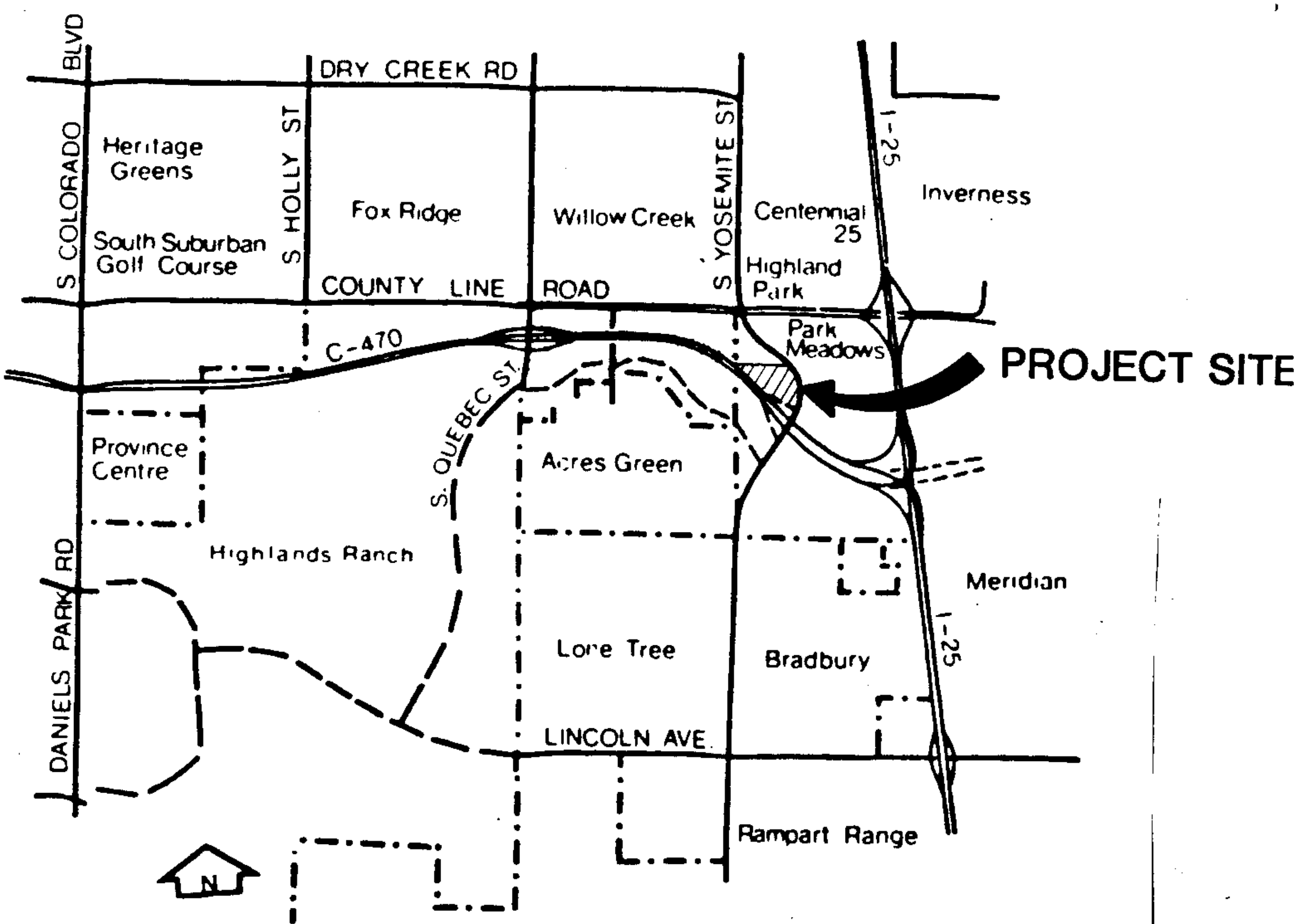
*d_{50} = Mean particle size

** Bury types VL and L with native top soil and revegetate to protect from vandalism.

5.2 Wire Enclosed Rock

Wire enclosed rock refers to rocks that are bound together in a wire basket so that they act as a single unit. One of the major advantages of wire enclosed rock is that it provides an alternative in situations where available rock sizes are too small for ordinary riprap. Another advantage is the versatility that results from the regular geometric shapes of wire enclosed rock. The rectangular blocks and mats can be fashioned into almost any shape that can be

APPENDIX D



VICINITY MAP

Click

OBJECTS

In the Query Window to
View Available Plans

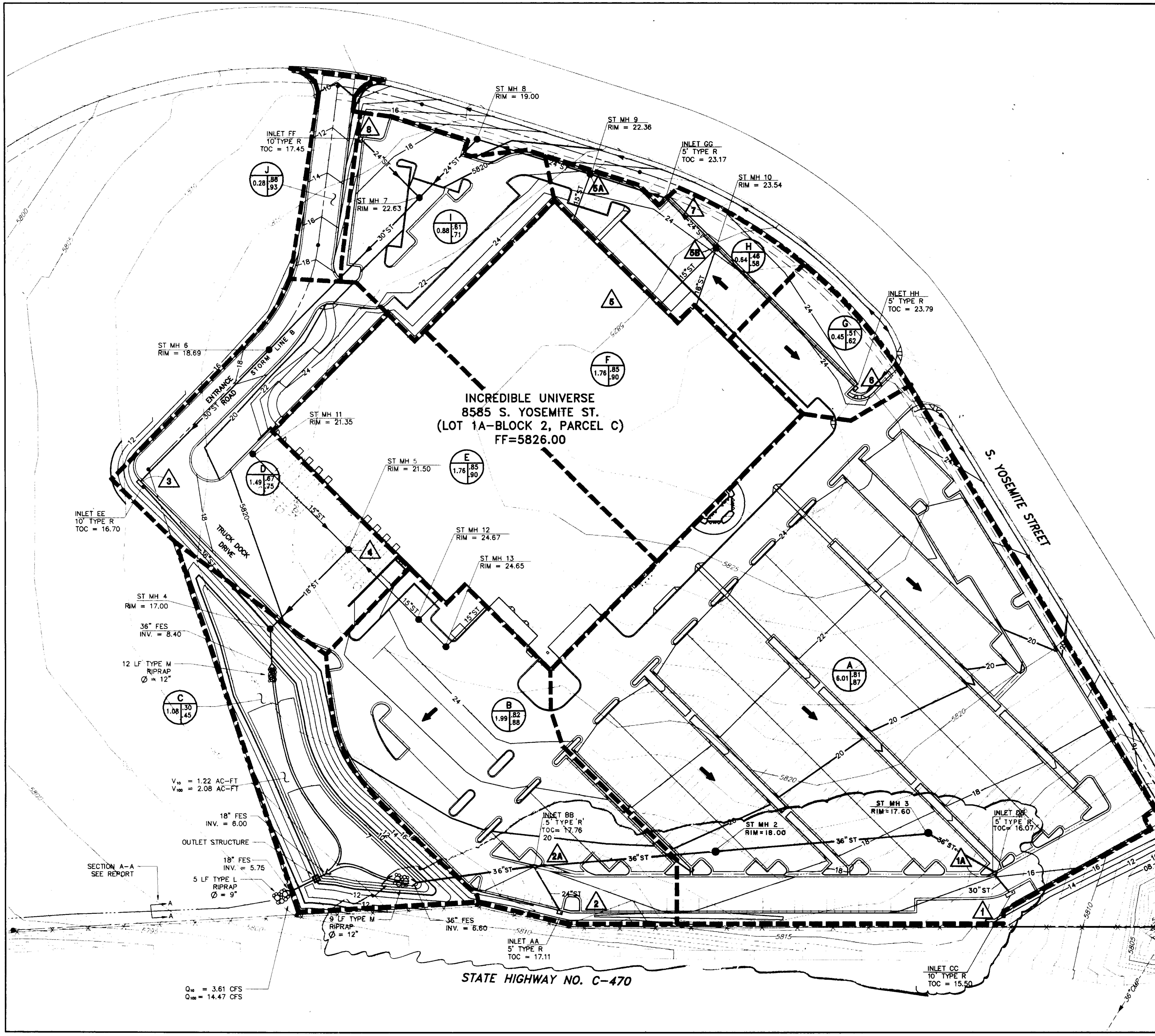


TABLE A

PROPOSED BASIN SUMMARY

BASIN DESIGNATION	AREA (AC)	C_5	C_{100}	Tc (MIN)	Q_5 (CFS)	Q_{100} (CFS)
A	6.01	.81	.87	7.27	21.98	40.30
B	1.99	.82	.88	5.00	8.00	15.76
C	1.08	.30	.30	7.38	0.48	1.75
D	1.49	.67	.75	5.00	4.90	10.08
E	1.76	.85	.90	5.00	7.35	14.22
F	1.76	.85	.90	5.00	7.35	14.22
G	0.45	.51	.62	7.75	1.68	2.24
H	0.64	.46	.58	7.50	2.16	2.89
I	0.88	.61	.71	5.00	2.65	5.58
J	0.28	.88	.93	5.00	1.23	2.34

TABLE B

DESIGN POINT SUMMARY

DESIGN POINT	CONTRIBUTING BASINS	AREA (AC)	Q_5 (CFS)	Q_{100} (CFS)
1A	A	6.01	2.50	2.50
1	A	6.01	19.42	37.60
2A	B	1.99	2.50	2.50
2	B	1.99	5.50	13.26
3	D	1.49	4.90	10.08
4	E	1.76	7.35	14.22
5	F	1.76	7.35	14.22
6	G	0.45	1.68	2.24
7	H	0.64	2.16	2.89
8	I	0.88	2.65	5.58

N

50 0 50 100
SCALE 1" = 50'

LEGEND

- PROP. CONTOUR —— 5510 ——
- EXIST. CONTOUR —— 5500 ——
- BASIN BOUNDARY
- SUB-BASIN BOUNDARY
- DIRECTION OF FLOW
- DESIGN POINT
- BASIN — AREA IN ACRES — C5 CFS — C100 CFS (B 1.25 .88 .93)

COUNTY ENGINEER

DATE

THESE CONSTRUCTION PLANS HAVE BEEN REVIEWED BY DOUGLAS COUNTY FOR STREET AND DRAINAGE IMPROVEMENTS ONLY.

ENGINEERING DIVISION ACCEPTANCE BLOCK

MARTIN/MARTIN assumes no responsibility for utility locations. The utilities shown on this drawing have been plotted from the best available information. It is, however, the contractors responsibility to field verify the location of all utilities prior to the commencement of any construction.

MARTIN/MARTIN

Consulting Engineers

4251 Kipling St.
Wheat Ridge, Co.
(303) 431-6100

PROJECT MAJESTIC

DRAINAGE PLAN

no	description of revisions	date	name
	DETENTION POND RELOCATION	12-13-94	DAL
	REVISED PER COUNTY COMMENTS	02-22-95	JCM

date	AUGUST 24, 1994
job number	12426.01
design by	A.KELLY
drawn by	A. KELLY
checked by	G.THOMAS

sheet number

D1

Appendix E
(Site Detail Information)