Final Drainage Report

Truck Yard – Lone Tree

(JN: 25084)

9070 Maximus Drive
Lone Tree, CO

June 22, 2026
Revised: October 29, 2026

Prepared for:

Brainstorm Shelter
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Certification

ENGINEER CERTIFICATION OF DRAINAGE REPORT

"This report (and plan) for the Phase III drainage design of Truck Yard – Lone Tree was prepared by me or under my direct supervision in accordance with the provisions of City of Lone Tree Storm Draiange Design and Techical Criteria for the owners thereof. I understand that Lone Tree does not and will not assume liability for drainage and erosion control facilities designed by others."

_____
Registered Professional Engineer
State of Colorado PE No. 45332
For and on behalf of Proof Civil Co.

DEVELOPER CERTIFICATION OF DRAINAGE FACILITIES

"Brainstorm Shelter hereby certifies that the drainage facilities for Truck Yard – Lone Tree 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 Truck Yard – Lone Tree, guarantee that final drainage design review will absolve Brainstorm Shelter 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 Plat does not imply approval of my engineer's drainage design."

_____
Name of Developer (please print)

_____
Authorized Signature

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I. Introduction

This final drainage report for Truck Yard – Lone Tree will address the on-site stormwater conveyance and treatment for the development in accordance with criteria set forth by applicable governing agencies as well as previously approved relevant drainage studies.

II. General Location and Description

A. Project Location

The proposed project is located at the south corner of the intersection between South Yosemite Street and Maximus Drive. The proposed site is located at lot 13A1, Park Meadows Filing 2, Amendment 15 within the southwest of Section 3, Township 6 South, Range 67 West of the 6th Principal Meridian. The site is bounded by to the south by bank and medical buildings which share the parking lot. There is a Starbucks to the northeast across Maximus Drive and a retail building to the northwest across South Yosemite.

B. Project Description

The proposed site is 3.36 acres in total and is zoned as PD within the City of Lone Tree. The proposed project includes the development of a single-story restaurant building with an adjoining outdoor patio area in the northwest corner of the proposed lot. The majority of the existing parking lot will remain intact with new curb and gutter along the building elements. An underground water quality system will be installed connecting to the existing underground detention system in the eastern portion of the site. Associated stormsewer will also be installed within the site.

There are no known major drainageways, irrigation facilities, or wetlands onsite.

C. Floodplain Information

According to FEMA Flood Insurance Rate Map Panel #08035C0042G, the subject site is located within flood hazard area Zone X. Zone X is defined as area outside the 0.2-percent-chance (or 500-year) flood. Refer to Appendix A for the applicable FEMA flood map.

D. Soils Description

According to the United States Department of Agriculture Natural Resources Conservation Service (NRCS) National Cooperative Soil Survey, onsite soils are identified as Renohill-Buick complex and are classified as Hydrologic Soil Group D. Group D soils are clay loam, silty clay loam, sandy clay, silty clay or clay. They have very low infiltration rates when thoroughly wetted and consist chiefly of clay soils with a high swelling potential, soils with a permanent high water table, soils with a claypan or clay layer at or near the surface and shallow soils over nearly impervious material.

III. Historic Drainage

A. Existing Drainage Pattern

The site generally drains from south to north at a general slope of 3-4%. Flows are conveyed to existing stormsewer within the site that is tributary to the existing underground detention system in the eastern portion of the site. The site is covered by an existing parking lot with associated landscape islands and a vacant area where the former restaurant stood.

B. Existing Basins

Since the majority of the existing site is intact and the proposed site has been designed to match the general intent of the existing drainage design, the existing basins as reflected in the existing report shall apply for the

purposes of the proposed design. Portions of the proposed designed have been included within the appendix of this report.

IV. Drainage Criteria

A. Regulation

Methods described in the UDFCD Urban Storm Drainage Criteria Manual and in the Douglas County Storm Drainage Design and Technical Criteria Manual were used for the drainage design of the Site.

B. Drainage Studies, Outfall Systems Plans and Site Constraints

This final drainage report has been written in compliance with the Phase III Drainage Study for Darden Restaurants, prepared by Martin/Martin, Inc. dated October, 2000.

Runoff generated within the proposed site will be detained by the existing underground detention pond. A proposed underground water quality system will be installed to connect to the existing detention system. This water quality system is discussed in greater detail later in this report.

The proposed drainage design has also been planned in accordance with the Willow Creek, Little Dry Creek and Greenwood Gulch Outfall Systems Planning Study.

The site grading was constrained by existing grades of existing onsite features and adjacent grades to the north and west.

C. Hydrology

The Rational Method analysis, utilizing the Intensity-Duration-Frequency curves established for the Lone Tree was used to determine the on-site runoff generated for the 5-year (minor), and 100-year (major) storm events. Runoff coefficients were based on the type of proposed development outlined in the UDFCD manual. Runoff coefficients used in the analysis were weighted according to the existing and proposed land uses in each basin or sub-basin and the time of concentration values have been calculated for each of the basins or sub-basins per Douglas County criteria. Detention storage and release rate have been calculated using the UDFCD full-spectrum design criteria. Hydrologic calculations can be found in Appendix B.

D. Hydraulics

Conveyance of on-site generated and tributary off-site flows has been calculated using Manning's equation in accordance with the UDFCD Urban Storm Drainage Criteria Manual and the Douglas County Storm Drainage Design and Technical Criteria Manual.

V. Drainage Design

A. General Concept

Proposed on-site drainage design will generally follow historical drainage patterns. Runoff will be directed to the existing underground detention system via sheet flow, channelized gutter flow, roof drains, curb chases and storm sewer.

The proposed 100-year detention volume required for the proposed site was calculated and compared to the existing available volume. The existing detention volume is 0.44 acre-feet according to the Darden Restaurant study. The proposed site requires 0.36 acre-feet, so no additional volume is required. Since the existing system does not provide water quality, a proposed underground water quality system has been proposed to connect to the existing underground system.

The existing onsite inlets will continue to be utilized in the proposed condition along with a number of proposed inlets. The capacity of the existing inlets has been verified with this report.

B. Proposed Drainage Basins

The improved site is divided into drainage basins that have been designed to reflect the existing conditions as shown in the existing drainage map to the greatest extent possible. The proposed basins are as follows:

a. Basin A

Basin A represents 0.35 acres of primarily landscaping which will cannot vertically drain to the existing detention pond and will release to either South Yosemite or Maximus Drive as it does in the existing condition. Anticipated runoff rates for this basin are 0.2 cfs and 1.3 cfs in the minor and major storm events, respectively.

b. Basin B

Basin B represents 0.0.36 acres and represents the proposed food truck pull out area at the entry to the proposed building on the east side which is tributary to the existing inlet at DP2. Anticipated runoff rates for this basin are 0.9 cfs and 2.2 cfs in the minor and major storm events, respectively.

c. Basin C

Basin C represents 0.41 acres of the proposed building roof. Anticipated runoff rates for this basin are 1.3 cfs and 2.8 cfs in the minor and major storm events, respectively.

d. Basin C1

Basin C1 represents 0.41 acres of the proposed outdoor patio area to the north of the proposed building. This area will drain to the north towards a V-pan which will direct flows to a proposed inlet at DP3.1. Anticipated runoff rates for this basin are 0.1 cfs and 0.5 cfs in the minor and major storm events, respectively.

e. Basin D

Basin D represents 0.08 acres of landscape area to the southwest of the proposed building. This basin will feature and area inlet at DP4 to capture runoff which otherwise would be directed toward the proposed building. Anticipated runoff rates for this basin are 0.1 cfs and 0.4 cfs in the minor and major storm events, respectively.

f. Basin F1

Basin F1 represents 0.0.30 acres of the parking lot and landscaped berm along S. Yosemite Street which is tributary to the proposed inlet at DP5. Anticipated runoff rates for this basin are 0.6 cfs and 1.7 cfs in the minor and major storm events, respectively.

g. Basin OF1

Basin OF1 represents 0.08 acres of existing parking lot and landscape area offsite to the south which is tributary to the proposed site. This basin is tributary to the inlet at DP5. Anticipated runoff rates for this basin are 0.1 cfs and 0.4 cfs in the minor and major storm events, respectively.

h. Basin F2

Basin F2 represents 0.0.34 acres of the parking lot and southern trash enclosure area adjacent to the building which is tributary to the proposed inlet at DP6. Anticipated runoff rates for this basin are 1.0 cfs and 2.2 cfs in the minor and major storm events, respectively.

i. Basin OF2

Basin OF2 represents 0.02 acres of existing parking lot and landscape area offsite to the south which is tributary to the proposed site. This basin is tributary to the inlet at DP6. Anticipated runoff rates for this basin are 0.0 cfs and 0.1 cfs in the minor and major storm events, respectively.

j. Basin G

Basin G represents 0.0.34 acres of the parking lot within the center of the site to the east of the proposed building which is tributary to the existing inlet at DP8. Anticipated runoff rates for this basin are 0.9 cfs and 2.1 cfs in the minor and major storm events, respectively.

k. Basin OG

Basin OG represents 0.03 acres of existing parking lot and landscape area offsite to the south which is tributary to the proposed site. This basin is tributary to the inlet at DP8. Anticipated runoff rates for this basin are 0.0 cfs and 0.1 cfs in the minor and major storm events, respectively.

l. Basin H

Basin H represents 0.18 acres of existing parking lot and the main drive entry off of Maximus Drive. Runoff from this basin will flow out of the entry way and flow west on Maximus drive to the existing inlet at DP9. Anticipated runoff rates for this basin are 0.4 cfs and 1.0 cfs in the minor and major storm events, respectively.

m. Basin I

Basin I represents 0.0.16 acres of the parking lot within the center of the site to the east of the proposed building and east of basin G which is tributary to the existing inlet at DP10. Anticipated runoff rates for this basin are 0.4 cfs and 1.0 cfs in the minor and major storm events, respectively.

n. Basin OI

Basin OI represents 0.03 acres of existing parking lot and landscape area offsite to the south which is tributary to the proposed site. This basin is tributary to the inlet at DP10. Anticipated runoff rates for this basin are 0.1 cfs and 0.2 cfs in the minor and major storm events, respectively.

o. Basin J

Basin J represents 0.0.22 acres of the parking lot within the center of the site to the east of the proposed building and east of basin I which is tributary to the existing inlet at DP11. Anticipated runoff rates for this basin are 0.6 cfs and 1.4 cfs in the minor and major storm events, respectively.

p. Basin OJ

Basin OJ represents 0.26 acres of existing parking lot and the site entry drive to the south of the existing lot. This basin is tributary to the inlet at DP10. Anticipated runoff rates for this basin are 0.7 cfs and 1.6 cfs in the minor and major storm events, respectively.

q. Basin K

Basin K represents 0.0.05 acres of the parking lot on the eastern side of the site which is tributary to the existing inlet at DP12. Anticipated runoff rates for this basin are 0.2 cfs and 0.4 cfs in the minor and major storm events, respectively.

r. Basin OK

Basin OK represents 0.10 acres of existing parking lot and existing medical office building offsite to the south which is tributary to the proposed site. This basin is tributary to the inlet at DP12. Anticipated runoff rates for this basin are 0.3 cfs and 0.7 cfs in the minor and major storm events, respectively.

s. Basin L

Basin L represents 0.0.40 acres of the parking lot on the far eastern side of the site which is tributary to the existing inlet at DP13. Anticipated runoff rates for this basin are 1.1 cfs and 2.6 cfs in the minor and major storm events, respectively.

t. Basin OL1

Basin OL1 represents 0.11 acres of existing parking lot and the western side of the existing medical office building offsite to the south which is tributary to the proposed site. This basin is tributary to the inlet at DP12. Anticipated runoff rates for this basin are 0.3 cfs and 0.7 cfs in the minor and major storm events, respectively.

u. Basin OL2

Basin OL2 represents 0.11 acres of existing parking lot and the eastern side of the existing medical office building offsite to the south which is tributary to the proposed site. This basin is tributary to the inlet at DP12. Anticipated runoff rates for this basin are 0.3 cfs and 0.7 cfs in the minor and major storm events, respectively.

C. Site Specific Hydraulic Design

Onsite generated runoff will be collected on proposed building roofs and piped via PVC leaders to proposed storm sewer. Proposed hardscape and landscape will be graded to sheet flow to curb and gutter. Existing and proposed curb inlets have been designed at designated low points to convey flows to the proposed storm sewer system. The storm sewer system will discharge into the proposed underground water quality system which connects to the existing underground detention system for flow attenuation. Hydraulic calculations can be found in Appendix C.

D. Storage and Water Quality Treatment

The existing site features an existing underground detention pond that was designed by Martin/Martin in 2000. The existing underground facility has a 100-year storage volume of 0.44 acre-feet designated to the improvements for Lot13A1 which accounts for our property. The existing report designated a CxA total of 2.73 for the 100-year condition of the existing site which was used in sizing the existing underground detention facility. The proposed site has an acreage of 3.36 and a C100 value of .79 with a resultant CxA of 2.65 which is below the existing condition. As a result, the existing underground detention system has adequate volume for the proposed development 100-year storm event.

Since there is no existing water quality onsite, an underground ADS water quality chamber system with an isolator row has been proposed. The proposed water quality capture volume is 0.082 acre-feet. The proposed system will connect and drain to the existing underground detention facility. The release will be controlled by a water quality orifice plate within a retrofitted manhole that will act as the outlet structure. This has been detailed within the construction documents. The proposed WQCV provided by the ADS system is 3,794 CF or 0.087 acre-feet.

Storage and Water Quality calculations can be found in Appendix D.

E. Floodplain Impact and Management

There are no known floodplains located onsite.

F. Groundwater Management

No groundwater impacts are anticipated at this time.

VI. Conclusion

A. Compliance with Standards

This report presents the description and calculations for the drainage analysis and design of Truck Yard – Lone Tree. The drainage system was designed in accordance with the Douglas County Storm Drainage Design and Technical Criteria Manual and the UDFCD Urban Storm Drain Criteria Manual.

B. Variances from Criteria

No variances from applicable criteria are being requested as a part of this drainage design.

VII. References

(2016, June). *Urban Storm Drainage Criteria Manual Volumes 1, 2, and 3.* Urban Drainage and Flood Control District.

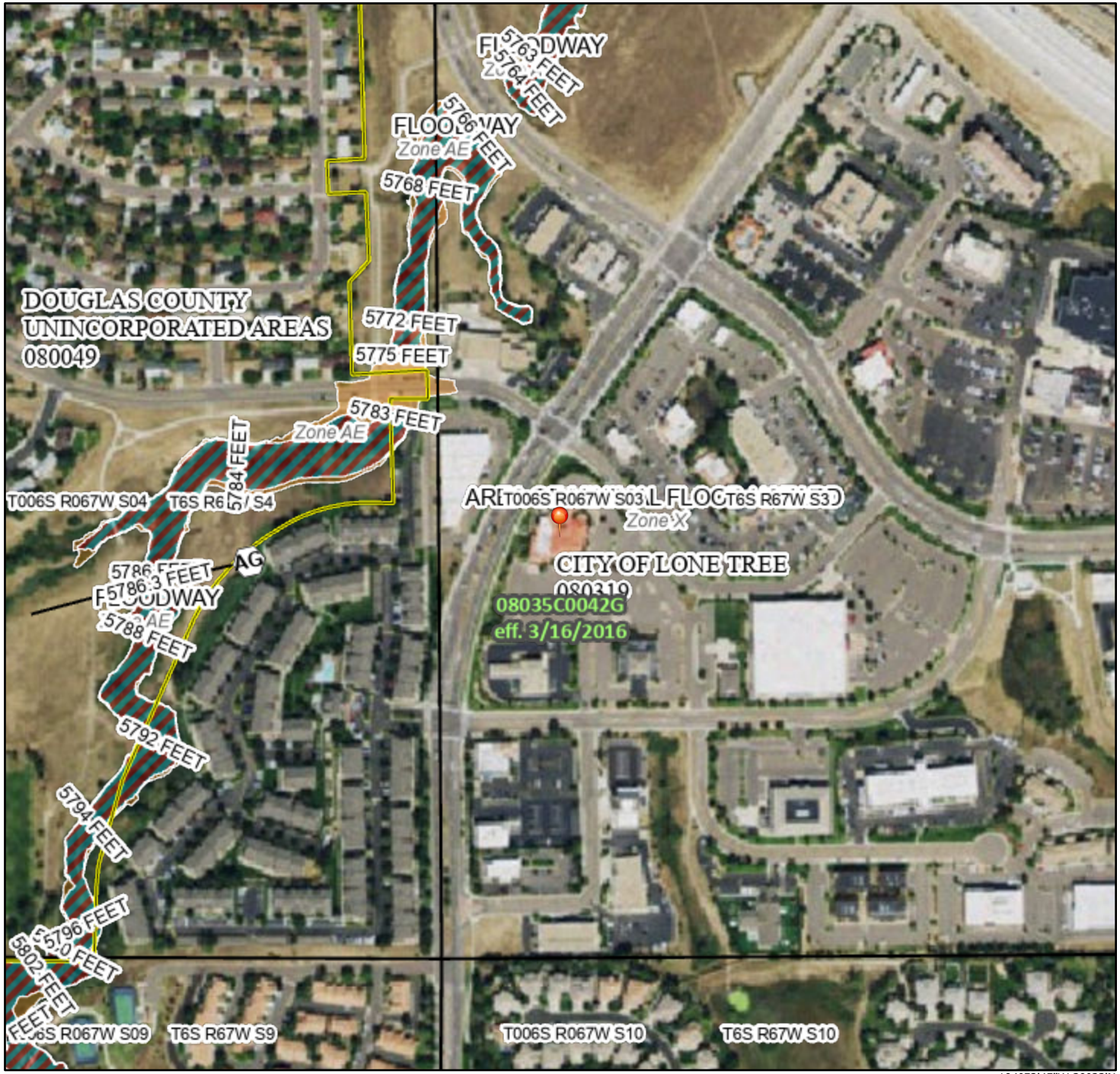
APPENDIX A

- FEMA FIRM MAPS
- WEB SOIL SURVEY RESULTS
- NOAA PRECIPITATION RESULTS
- REFERENCE MATERIAL

National Flood Hazard Layer FIRMette

FEMA

104°53'23"W 39°33'28"N



104°52'45"W 39°33'N

Feet

0 250 500 1,000 1,500 2,000

1:6,000

Basemap Imagery Source: USGS National Map 2023

Legend

SEE FIS REPORT FOR DETAILED LEGEND AND INDEX MAP FOR FIRM PANEL LAYOUT

SPECIAL FLOOD HAZARD AREAS
- Without Base Flood Elevation (BFE) *Zone A, V, A99*
- With BFE or Depth *Zone AE, AO, AH, VE, AR*
- Regulatory Floodway

OTHER AREAS OF FLOOD HAZARD
- 0.2% Annual Chance Flood Hazard, Areas of 1% annual chance flood with average depth less than one foot or with drainage areas of less than one square mile *Zone X*
- Future Conditions 1% Annual Chance Flood Hazard *Zone X*
- Area with Reduced Flood Risk due to Levee. See Notes. *Zone X*
- Area with Flood Risk due to Levee *Zone D*

OTHER AREAS
- NO SCREEN Area of Minimal Flood Hazard *Zone X*
- Effective LOMRs
- Area of Undetermined Flood Hazard *Zone D*

GENERAL STRUCTURES
- Channel, Culvert, or Storm Sewer
- Levee, Dike, or Floodwall

OTHER FEATURES
- 20.2 / 17.5 Cross Sections with 1% Annual Chance / Water Surface Elevation
- Coastal Transect
- Base Flood Elevation Line (BFE)
- Limit of Study
- Jurisdiction Boundary
- Coastal Transect Baseline
- Profile Baseline
- Hydrographic Feature

MAP PANELS
- Digital Data Available
- No Digital Data Available
- Unmapped

N

The pin displayed on the map is an approximate point selected by the user and does not represent an authoritative property location.

This map complies with FEMA's standards for the use of digital flood maps if it is not void as described below. The basemap shown complies with FEMA's basemap accuracy standards

The flood hazard information is derived directly from the authoritative NFHL web services provided by FEMA. This map was exported on 12/29/2025 at 5:46 PM and does not reflect changes or amendments subsequent to this date and time. The NFHL and effective information may change or become superseded by new data over time.

This map image is void if the one or more of the following map elements do not appear: basemap imagery, flood zone labels, legend, scale bar, map creation date, community identifiers, FIRM panel number, and FIRM effective date. Map images for unmapped and unmodernized areas cannot be used for regulatory purposes.



Map Scale: 1:1,190 if printed on A landscape (11" x 8.5") sheet.

N

Meters: 0 15 30 60 90

Feet: 0 50 100 200 300

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 Rating Polygons

- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Soil Rating Lines

- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Soil Rating Points

- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

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 18, Aug 29, 2025

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

Date(s) aerial images were photographed: Mar 1, 2023—Sep 1, 2023

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.

Hydrologic Soil Group

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
RmE	Renohill-Buick complex, 5 to 25 percent slopes	D	3.4	100.0%
Totals for Area of Interest			**3.4**	**100.0%**

Description

Hydrologic soil groups are based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms.

The soils in the United States are assigned to four groups (A, B, C, and D) and three dual classes (A/D, B/D, and C/D). The groups are defined as follows:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

If a soil is assigned to a dual hydrologic group (A/D, B/D, or C/D), the first letter is for drained areas and the second is for undrained areas. Only the soils that in their natural condition are in group D are assigned to dual classes.

Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher

NOAA Atlas 14, Volume 8, Version 2
Location name: Lone Tree, Colorado, USA*
Latitude: 39.5539°, Longitude: -104.8844°
Elevation: 5809 ft**
* source: ESRI Maps
** source: USGS

POINT PRECIPITATION FREQUENCY ESTIMATES

Sanja Perica, Deborah Martin, Sandra Pavlovic, Ishani Roy, Michael St. Laurent, Carl Trypaluk, Dale Unruh, Michael Yekta, Geoffery Bonnin

NOAA, National Weather Service, Silver Spring, Maryland

PF_tabular | PF_graphical | Maps_&_aerials

PF tabular

PDS-based point precipitation frequency estimates with 90% confidence intervals (in inches)[1]

Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	**0.222** (0.175-0.283)	**0.276** (0.218-0.352)	**0.369** (0.290-0.472)	**0.450** (0.352-0.579)	**0.568** (0.431-0.765)	**0.664** (0.491-0.905)	**0.764** (0.545-1.07)	**0.869** (0.595-1.25)	**1.02** (0.669-1.51)	**1.13** (0.724-1.70)
10-min	**0.326** (0.257-0.415)	**0.405** (0.319-0.516)	**0.541** (0.425-0.691)	**0.659** (0.515-0.847)	**0.832** (0.631-1.12)	**0.972** (0.719-1.32)	**1.12** (0.799-1.57)	**1.27** (0.872-1.84)	**1.49** (0.979-2.21)	**1.66** (1.06-2.49)
15-min	**0.397** (0.313-0.506)	**0.493** (0.389-0.629)	**0.659** (0.518-0.843)	**0.804** (0.628-1.03)	**1.01** (0.769-1.36)	**1.18** (0.876-1.62)	**1.36** (0.974-1.91)	**1.55** (1.06-2.24)	**1.81** (1.19-2.70)	**2.02** (1.29-3.04)
30-min	**0.539** (0.426-0.687)	**0.670** (0.528-0.854)	**0.894** (0.702-1.14)	**1.09** (0.851-1.40)	**1.37** (1.04-1.85)	**1.60** (1.19-2.19)	**1.84** (1.32-2.58)	**2.10** (1.44-3.03)	**2.45** (1.61-3.64)	**2.73** (1.75-4.11)
60-min	**0.686** (0.542-0.875)	**0.835** (0.659-1.06)	**1.10** (0.862-1.40)	**1.33** (1.04-1.71)	**1.68** (1.28-2.27)	**1.97** (1.46-2.69)	**2.28** (1.63-3.20)	**2.60** (1.79-3.77)	**3.07** (2.02-4.57)	**3.44** (2.20-5.17)
2-hr	**0.834** (0.664-1.05)	**1.00** (0.796-1.26)	**1.30** (1.03-1.65)	**1.57** (1.24-2.00)	**1.99** (1.53-2.66)	**2.33** (1.75-3.16)	**2.71** (1.96-3.77)	**3.11** (2.16-4.45)	**3.68** (2.45-5.42)	**4.15** (2.68-6.16)
3-hr	**0.935** (0.748-1.17)	**1.11** (0.885-1.39)	**1.42** (1.13-1.79)	**1.71** (1.36-2.17)	**2.16** (1.67-2.89)	**2.54** (1.92-3.43)	**2.95** (2.15-4.09)	**3.40** (2.37-4.85)	**4.05** (2.71-5.93)	**4.57** (2.97-6.75)
6-hr	**1.14** (0.919-1.42)	**1.34** (1.08-1.67)	**1.71** (1.37-2.13)	**2.05** (1.64-2.56)	**2.57** (2.01-3.39)	**3.01** (2.29-4.01)	**3.48** (2.56-4.77)	**4.00** (2.82-5.63)	**4.75** (3.21-6.86)	**5.35** (3.51-7.80)
12-hr	**1.39** (1.13-1.71)	**1.66** (1.35-2.04)	**2.12** (1.72-2.62)	**2.53** (2.04-3.14)	**3.14** (2.47-4.08)	**3.64** (2.79-4.79)	**4.18** (3.09-5.63)	**4.74** (3.37-6.57)	**5.54** (3.78-7.89)	**6.18** (4.10-8.89)
24-hr	**1.71** (1.40-2.08)	**2.02** (1.66-2.46)	**2.55** (2.09-3.12)	**3.02** (2.45-3.71)	**3.69** (2.92-4.72)	**4.24** (3.27-5.49)	**4.81** (3.59-6.39)	**5.42** (3.88-7.40)	**6.26** (4.31-8.78)	**6.92** (4.63-9.83)
2-day	**2.05** (1.70-2.47)	**2.37** (1.96-2.86)	**2.93** (2.42-3.54)	**3.42** (2.80-4.15)	**4.13** (3.29-5.22)	**4.71** (3.66-6.03)	**5.31** (4.00-6.97)	**5.96** (4.30-8.03)	**6.85** (4.76-9.49)	**7.56** (5.11-10.6)
3-day	**2.20** (1.83-2.63)	**2.56** (2.13-3.08)	**3.19** (2.64-3.84)	**3.73** (3.07-4.50)	**4.50** (3.60-5.64)	**5.12** (4.00-6.50)	**5.76** (4.35-7.49)	**6.43** (4.67-8.59)	**7.35** (5.13-10.1)	**8.07** (5.49-11.2)
4-day	**2.31** (1.93-2.76)	**2.71** (2.27-3.24)	**3.39** (2.83-4.07)	**3.98** (3.29-4.78)	**4.80** (3.85-5.98)	**5.45** (4.27-6.88)	**6.12** (4.64-7.91)	**6.81** (4.96-9.04)	**7.76** (5.44-10.6)	**8.49** (5.80-11.7)
7-day	**2.65** (2.23-3.13)	**3.10** (2.61-3.67)	**3.85** (3.23-4.57)	**4.48** (3.74-5.35)	**5.38** (4.35-6.64)	**6.09** (4.82-7.61)	**6.82** (5.21-8.72)	**7.57** (5.56-9.94)	**8.58** (6.07-11.6)	**9.36** (6.45-12.8)
10-day	**2.98** (2.53-3.52)	**3.44** (2.91-4.06)	**4.21** (3.55-4.98)	**4.86** (4.08-5.77)	**5.79** (4.71-7.10)	**6.52** (5.18-8.11)	**7.28** (5.59-9.26)	**8.06** (5.95-10.5)	**9.12** (6.48-12.2)	**9.94** (6.89-13.5)
20-day	**3.98** (3.40-4.64)	**4.46** (3.80-5.20)	**5.25** (4.47-6.14)	**5.93** (5.02-6.97)	**6.90** (5.67-8.37)	**7.68** (6.16-9.42)	**8.47** (6.58-10.6)	**9.30** (6.94-12.0)	**10.4** (7.49-13.8)	**11.3** (7.91-15.2)
30-day	**4.76** (4.09-5.52)	**5.31** (4.56-6.16)	**6.22** (5.32-7.23)	**6.98** (5.94-8.15)	**8.04** (6.64-9.66)	**8.88** (7.16-10.8)	**9.72** (7.59-12.1)	**10.6** (7.94-13.5)	**11.8** (8.50-15.4)	**12.6** (8.91-16.8)
45-day	**5.67** (4.90-6.53)	**6.39** (5.52-7.37)	**7.56** (6.50-8.73)	**8.50** (7.28-9.86)	**9.78** (8.09-11.6)	**10.7** (8.70-12.9)	**11.7** (9.16-14.4)	**12.6** (9.51-16.0)	**13.8** (10.0-17.9)	**14.7** (10.5-19.4)
60-day	**6.38** (5.54-7.32)	**7.32** (6.34-8.40)	**8.79** (7.59-10.1)	**9.95** (8.55-11.5)	**11.5** (9.50-13.5)	**12.6** (10.2-15.0)	**13.7** (10.7-16.7)	**14.7** (11.1-18.4)	**15.9** (11.6-20.5)	**16.8** (12.0-22.1)

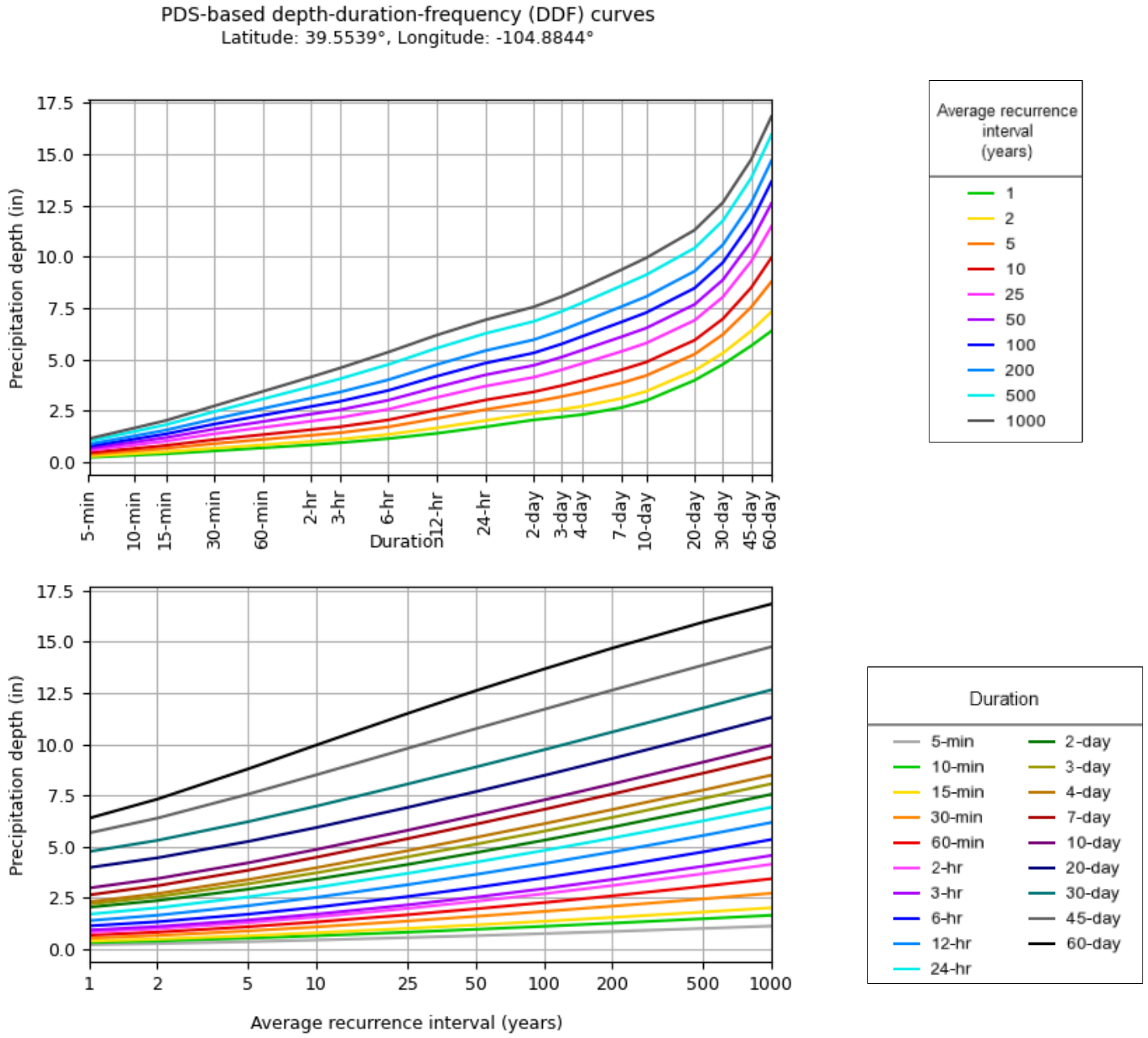
[1] Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS).

Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values.

Please refer to NOAA Atlas 14 document for more information.

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PF graphical



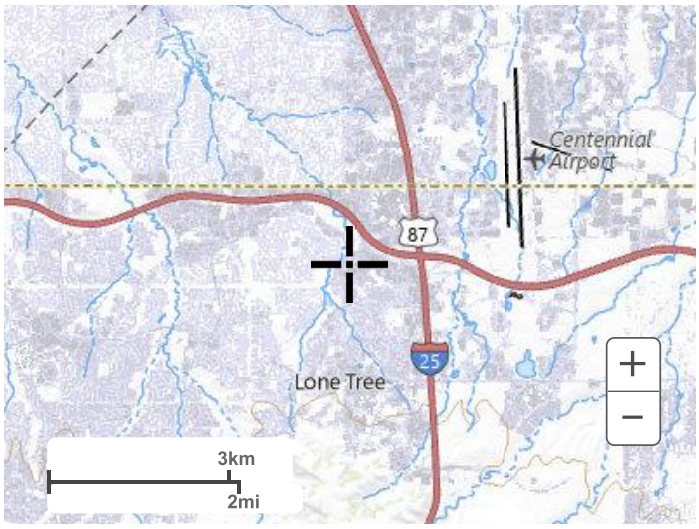
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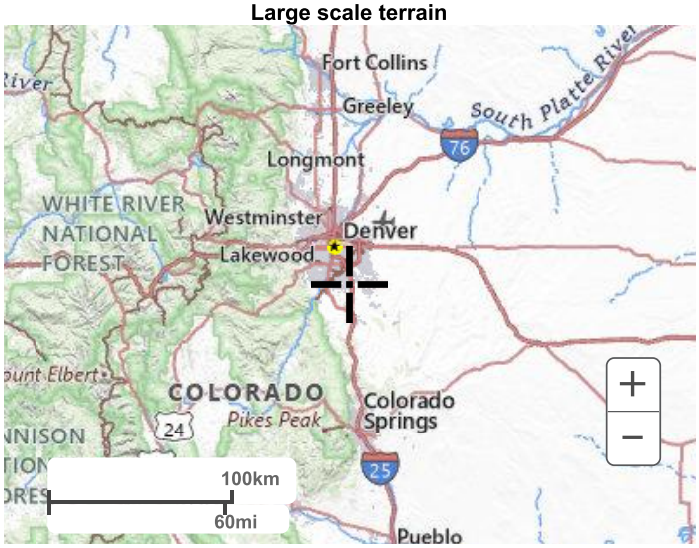
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Maps & aerials

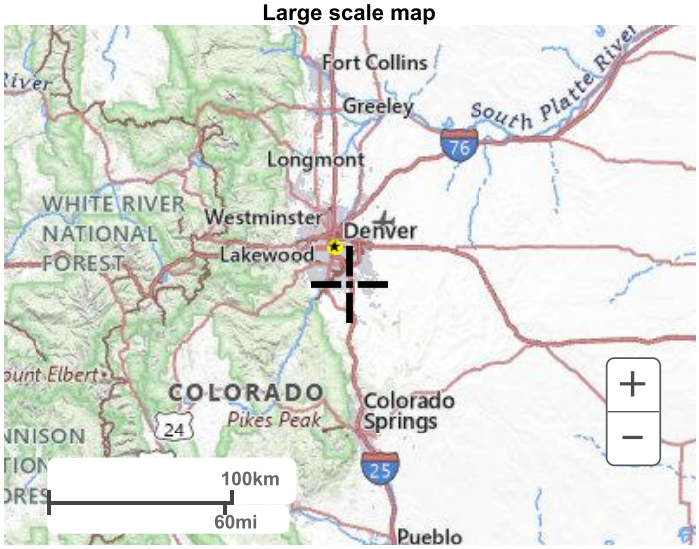
Small scale terrain



Large scale terrain



Large scale map



Large scale aerial



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National Oceanic and Atmospheric Administration
National Weather Service
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Disclaimer

DARDEN RESTAURANTS
130 L.L.C. PHASE II DEVELOPMENT - LOTS 13A1 – 13A2
PHASE III DRAINAGE STUDY
LONE TREE, COLORADO

SEPTEMBER, 2000
REV. OCTOBER, 2000

PREPARED FOR: BAHAMA BREEZE DESIGN AND CONSTRUCTION
5900 ELLENOR DRIVE
ORLANDO, FLORIDA 32809

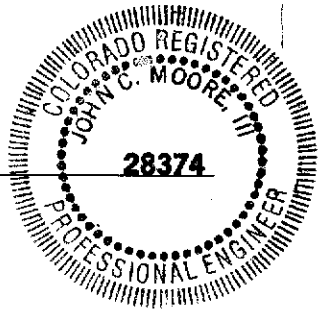
PREPARED BY: MARTIN/MARTIN, INC.
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PRINCIPAL-IN-CHARGE: GARY A. THOMAS, P.E.

PROJECT ENGINEER: JOE C. COCO, P.E.

CERTIFICATIONS

This report (plan) for the Phase III Drainage Design of Park Meadows – Filing No. 2 – 8TH Amendment Phase II Development Lots 13A1 and 13A2 was prepared by me (or under my direct supervision) in accordance with the provisions of Douglas County (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 facilities designed by others.



John C. Moore, III, P.E.
Colorado No. 28374

For and on behalf of MARTIN/MARTIN Consulting Engineers, Inc.

GMRI, INC.
~~Darden Restaurants, Corp. Inc~~., hereby certifies that the drainage facilities for Park Meadows – Filing No. 2 –8th Amendment Phase II Development Lots 13A1 and 13A2 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 Colorado Revised Statutes, Title 30, Article 28; but cannot, on behalf of Park Meadows – Filing No. 2 – 8th Amendment – Phase II Development Lots 13A1 and 13A2, guarantee the final drainage design review will absolve Darden Restaurants, 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.

GMRI, INC.
Name of Ownership

Jack DeHaan, SITE DEVELOPMENT MANAGER
Authorized Signature

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INTRODUCTION:

This report represents a Phase III Drainage Study for the 130 L.L.C. Phase II Development Lots 13A1 and 13A2 and was prepared meeting the regulatory requirements of City of Lone Tree, Colorado. This study was prepared following the guidelines and regulatories set forth by the "Douglas County Storm Drainage Design and Technical Criteria", and the "Urban Storm Drainage Criteria Manual". This study of the 130 L.L.C. Phase II Development, Lots 13A1 and 13A2 was created in reference to the 130 L.L.C. Phase II Development, Lots 13A through 13H Phase III Drainage Study completed by MARTIN/MARTIN, Inc. revised September, 1999; 130 L.L.C. Phase II Master Drainage and Park Meadows Drive/Entertainment Drive Phase III Drainage Study (herein referred to as the "Master Drainage Study") revised October 1997; Westbrook Development – 130 LLC Phase I Development Phase III Drainage Study dated June 1998; and Westbrook Development – 130 LLC Teddy Lane Phase III Drainage Study revised August 4, 1999. For all erosion and sediment control activities due to construction of Lots 13A through 13H, refer to the "Storm Water Management Plan for Westbrook Development 130 Douglas County, Colorado" prepared by HydroDynamics Inc., May 1997 and the "Erosion and Sediment Control Plan" prepared by MARTIN/MARTIN, Inc., September 19, 2000.

Requirements for Lots 13A1 and 13A2 (formerly Lot 13A) were determined in the 130 L.L.C. Phase II Development, Lots 13A through 13H Phase III Drainage Study. Additionally, the Master Report for the entire 130 acre development was completed using the 10-year event for the minor storm for Douglas County. All storm sewer systems in the entire development were designed to capture the 100-year event with few exceptions. In those cases, the 10-year storm event was captured. So it can be concluded that the 5-year storm event would be captured in all locations throughout the site. In an effort to remain consistent with the Master Drainage Study, this study will address the 10-year event for the minor storm in addition to the 100-year major storm event.

This study will also address detention issues for Lots 13A1 and 13A2, and Detention Facility No. 6. This detention facility will serve Lots 13A1 and 13A2 and detain on-site flow to accommodate releasing peak runoff flows at historic rates.

GENERAL LOCATION AND DESCRIPTION:

The proposed 130 L.L.C., Lots 13A1 and 13A2 is located in the southwest quarter of Section 3, Township 6 South, Range 67 West of the Sixth Principal Meridian, County of Douglas, State of Colorado (see Vicinity Map, Appendix C). Lots 13A1 and 13A2 consist of approximately 7.53 acres of the entire 130 acres, which has been subdivided into a retail commercial lots. The entire 130 acre development site is bordered to the north by the Gerald Starika and C-470 Joint Venture parcel and Colorado State Highway C-470, to the east by Starika Investments, Colorado State Highway C-470 and Interstate 25 beyond, to the south by Omnivest P.D. and Heritage Hills Filing No. 1, and to the west by existing South Yosemite Street.

Since being overlot graded (apart of the Phase II Development), the site is currently not being used and is covered with native grasses and slopes generally from south to north. The Soil Conservation Service "Soil Survey of Castle Rock Area, Colorado" (see Appendix C) indicates soils are dominated by Category C which have moderately high runoff characteristics.

An existing channel conveys outflow from Heritage Hills Filing No. 1 Detention Facility in addition to a portion of the 130 LLC site. Runoff flows beneath Kimmer Drive (existing 3-42" RCP) north through Lots 13A1 through 12A3 by means of an existing 66-inch RCP pipe to South Yosemite Street. Here flows exit the development, crossing South Yosemite Street.

CRITERIA:

The basis for this Phase III Drainage Study is the "Douglas County Storm Drainage Design and Technical Criteria", and the most recent Urban Drainage and Flood Control District's (UDFCD) Storm Drainage Manual.

The Rational Method was used to determine runoff for the on-site basins as well as for the entire historic basin. The Rational Method was used to determine the time of concentration (Tc) for determining peak runoff flows for the developed basins.

Release rates for Lots 13A1 and 13A2 were determined in the Phase II Development – Lots 13A through 13H Phase III Drainage Study. To meet these designated release rates and allow various

basins to flow off-site undetained, Detention Facility No 6 will be oversized. Thus, this facility will be sized using the FAA Method as opposed to the V=KA method as outlined in the Douglas County Storm Drainage Design and Technical Criteria Manual. Again, this procedure is consistent with the Master Drainage Study. This facility sized by the FAA Method is greater in size than using V=KA, providing a conservative result.

This development lies within Rainfall Zone I as shown on Figure 501 in the Douglas County Storm Drainage Design and Technical Criteria Manual. Rainfall data from this zone was used in the calculations.

FLOODPLAINS/MAJOR DRAINAGEWAYS:

The Westbrook Development lies within the Willow Creek Watershed, a tributary of Little Dry Creek, and is conveyed to the South Platte River. Willow Creek is located west of South Yosemite Street and does not flow through the Westbrook Development site.

The Federal Emergency Management Agency (FEMA) Flood Insurance Rate Maps (see Appendix C) depicts a 100-year floodplain along a portion of Willow Creek. The Westbrook Development does not lie within the 100-year floodplain of Willow Creek and should not pose any problem for the site.

Lots 13A1 and 13A2 will release runoff as designated by the Phase II Development, Lots 13A through 13H Phase III Drainage Study such that the entire 130 acre development will release historic runoff flow rates into Willow Creek.

REQUIREMENTS DESIGNATED BY THE "PHASE II DEVELOPMENT, LOTS 13A THROUGH 13H PHASE III STUDY":

From the Phase II Development Drainage Study, detention pond sizing, release rates and master drainage basins were determined as follows:

Based on the outflow analysis for the entire Westbrook Development, Lot 13A can release a maximum of 1.98 cfs undetained in the 10-year storm event and 3.12 cfs undetained in the 100-year

storm event. The remainder of this lot is detained in Detention Facility No. 6. Detention Facility No. 6 detention volumes (V_{100}=1.04 Ac.ft and V_{10}=0.76 Ac.ft) were determined based on the sizes of Master Basins L and M (see 130 LLC Phase II Development, Lots 13A through 13H Phase III Drainage Study Drainage Map). Release rates for Detention Pond No. 6 are 4.00 cfs in the major event and 1.20 cfs in the minor event. A storm sewer stub has been provided for the outfall of Detention Facility No. 6 for Lot 13A (Design Point 1). Refer to "130 LLC Entertainment District – Phase II Restaurant Park Storm Sewer Improvement Plans" for the storm sewer stub size, horizontal and vertical alignment.

In summary, Lots 13A1 and 13A2 can release a total of 7.12 cfs in the 100-year event and 3.18 cfs in the 10-year event. Additionally, detention volumes for Lots 13A1 and 13A2 were recalculated based on the proposed development and resulted in a required detention volume of 1.07 Ac.ft in the major 100-year event and 0.72 Ac.ft in the minor 10-year event. These volumes are similar to those calculated in the Phase II Development, Lots 13A through 13H Phase III Drainage Study. Release rates and detention volumes for individual Lots 13A1 and 13A2 will be discussed further in the detention section of this report.

DRAINAGE BASINS:

Off-Site Runoff:

Flow from off-site Basin No. 1 – Heritage Hills Filing No. 1 bypasses Lots 13A1 through 13A3 by means of an existing 66" RCP. Runoff from this basin does not effect the overall storm water management system for these lots.

Historic Runoff:

Three Historic Basins have been determined for the entire 130 acre development. All proposed basins in this report are a part of Historic Basin No. 1. Refer to the Phase II Master Drainage Study for additional information on historic basins.

On-Site:

Basins for Lots 13A1 and 13A2 were determined in two (2) cases; first, with the development of both Lots 13A1 and 13A2 to properly size the detention facility and storm sewer system. Secondly, for the immediate case where only Lot 13A1 is developed so that the required detention facility for

Lot 13A1 is sized properly and runoff from Lot 13A2 can be captured in a detention/sedimentation pond and discharged properly.

Developed flows for on-site basins have been calculated using runoff coefficients of 0.88 and 0.89 for commercial areas, 0.90 and 0.90 for proposed rooftops; 0.90 and 0.93 for roadways; and 0.25 and 0.50 for lawns. These coefficients are designated for the 10-year and 100-year events.

All basins are captured and detained in Detention Facility No. 6 with the exception of Basins A and H, which flow off-site undetained. Refer to Appendix "A" for flow calculations for both development cases.

DETENTION:

Detention Facility Concept:

An underground detention facility will be constructed for Lot 13A1's portion of the required detention. A sedimentation pond will be constructed to capture the 100-year runoff and detention volume for Lot 13A2. The outflow from the sedimentation pond will discharge into Lot 13A1's underground detention system and the systems outfall will be designed to discharge flow from the entire site. Once Lot 13A2 is developed either the underground detention system is expanded or an above ground detention pond will be constructed, which outfall into Lot 13A1's underground detention facility.

Outlet Structure Release:

All flows for the entire site discharge through the outlet structure of Lot 13A1's underground detention facility, thus this structure has been designed to release flows for the entire site. If the underground detention system is expanded in the development of Lot 13A2, revised 10-year and 100-year stages must be determined for the combined system. In addition, 10-year and 100-year orifices must be recalculated and the outlet structure modified. Without knowing the 10-year and 100-year stages in advance, it is not possible to prepare the structure for this scenario in advance.

Emergency Overflow:

In the event the outlet structure for the underground detention system fails, relief to the system would occur in the following manner. The undeveloped flow for the development of both Lots

13A1 and 13A2 is 55.70 cfs. The emergency overflow weir with 1-foot of head releases 33.20 cfs. However, the 18-inch outfall pipe can only release 27.58 cfs under pressure. (refer to Sheet 3 of 3 of the outlet structure design in Appendix "A"). Thus, the outfall pipe is the controlling factor. In this emergency scenario storm water will stage up through inlets B-3A and C-2 at the lowest point on the site and the remaining 28.12 cfs would then release into Maximus Drive (private) where a portion of these flows are captured by the existing inlets in Maximus Drive. These flows are conveyed to Pond 5A in the Restaurant Park. The remainder of the flows are conveyed to inlets at the low point in South Yosemite Street where they discharge into the existing culvert beneath this street, which happens to be the outfall for the majority of the Entertainment District. The damage to this site and surrounding developments would be minimal in the event detention facility No. 6 fails.

Throughout the 130 LLC Entertainment District ponds were oversized to allow various basins to flow off-site undetained. Detention Facility No. 6 is no exception and thus sized using the FAA method.

Detention Pond No. 6 is designed to serve Lots 13A1 and 13A2 as an underground detention facility. This facility was determined to detain 0.72 Ac.ft in the 10-year event and 1.07 Ac.ft in the 100-year event. However, Lot 13A1 will be constructed prior to Lot 13A2. Thus, a facility has been designed to detain Lot 13A1's portion of the overall volume (0.29 Ac.ft and 0.44 Ac.ft) in such a manner that the underground detention facility can be expanded into Lot 13A2 to provide its portion of the detention volume (0.43 Ac.ft and 0.63 Ac.ft).

In the interim, a sedimentation pond will be constructed to capture the runoff from Lot 13A2 with a volume to detain the 100-year event plus 10% for sediment, minimum 0.69 Ac.ft. This sedimentation pond will discharge into the Lot 13A1 underground detention system where flows from the entire site will be discharged.

Lots No. 13A1 and 13A2 are designated to discharge a total of 3.18 cfs in the minor 10-year event and 7.12 cfs in the major 100-year event. After Basins A and H flow off-site undetained (1.26 cfs and 2.98 cfs) the underground detention facility can discharge 1.92 cfs and 4.14 cfs respectively. Since Lot 13A2 discharges into Lot 13A1's detention facility, it is designed to release the full 1.92 cfs in the 10-year event and 4.14 cfs in the 100-year event. In the event Lot 13A2 decides not to extend the underground detention facility in Lot 13A1 and have its own above or underground

facility, it must discharge its portion of the release rates into the Lot 13A1 system as follows: Lot 13A1 is 43% of the total site resulting in 0.83 cfs in the 10-year event and 1.78 cfs in the 100-year event. Lot 13A2, 57% of the total site, can release 1.09 cfs in the 10-year event and 2.36 cfs in the 100-year event. In addition, these release rates were used to determine the required detention volumes for each lot. Refer to the detention calculations in Appendix "A" for required detention volumes, release rates and underground detention sizing. Calculations have also been provided to size the underground detention expansion for Lot 13A2. Please note the maximum stage the underground facility can have is 5802.85 in the 100-year event so that inlets in Lot 13A1 are not flooded to the extent of flowing off-site.

STORM SEWER AND INLETS:

Refer to the Entertainment District Bahama Breeze Storm Sewer Improvement Plans for Storm Sewer and Underground Detention design.

All inlets and storm sewer pipe systems will be sized to convey the 100-year flows with all hydraulic grade lines contained below final grade, with the exception of Inlet B-3A. This inlet will pond 0.5' in the 100-year event but floodwaters will remain on-site. However, Inlet B-3A will not flood in the 10-year event.

Storm sewer lines A through F convey flows from all basins on-site with the exception of Lots A and H. Flows will be conveyed to the on-site detention facility (Design Point 2). These storm sewer lines will be sized for the 100-year storm event. Refer to Appendix "A" for inlet calculations and Appendix "D" for storm sewer calculations.

SUMMARY AND CONCLUSIONS:

The purpose of this Phase III Drainage Study was to develop a storm water management system for Lots 13A1 and 13A2 of the Master Development. This study complies with Douglas County Drainage Design and Technical Criteria Manual and the Urban Drainage Flood Control District Storm Drainage Criteria. The 130 L.L.C. Phase II Development, Lots 13A1 and 13A2 was completed in reference to the Phase II Development Lots 13A through 13H Phase III Study; the 130 LLC Phase II Master Drainage Study; the Phase I Development Phase III Study and the Phase

III Development Teddy Lane Phase III Study.

Historical conditions were used to establish maximum allowable release rates as determined in the Master Drainage Study. Due to minor modifications from the Master Drainage Study in the Phase I and Phase III Developments, an analysis was completed to verify release rates from all detained and undetained flows from the entire Westbrook Development site. From this analysis, the Phase II Development was modified such that the release rates for the entire Westbrook Development is at or below that of historic in the 10-year minor and 100-year major storm event. It should be noted that flows will not be detained from off-site basins within the Westbrook Development with the exception of the off-site area of park Meadows Drive, which is captured and detained in Detention Pond No. 3 of the Phase I Development.

Lots 13A1 and 13A2 of the Entertainment District includes the construction of an underground detention facility for Lot 13A1. This facility was sized using the FAA Method. Once Lot 13A2 is developed, a Phase III Drainage Study must be completed for this lot, which meets the requirements set forth in this report.

Fully developed flows were calculated using the Rational Method for all basins. In addition, all storm sewers and inlets were designed to convey 100-year flows with exception of one inlet, which captures the minor 10-year event.

FLOW CALCULATIONS

CASE II:

Lot 13A1 Only

STANSARD FORM SF-2
TIME OF CONCENTRAION
SUBDIVISION: 130 LLC-Bahama Breeze
CALCULATED BY: JAW DATE: 09/20/2000

SUB-BASIN DATA			INITIAL/OVERLAND TIME (t_i)			TRAVEL TIME (t_t)				t_c CHECK (URBANIZED BASINS)			FINAL t_c	REMARKS
DESIG:	C_5	AREA Ac	LENGTH Ft	SLOPE %	t_i Min	LENGTH Ft	SLOPE %	VEL. FPS	t_t Min	COMP. t_c	TOT. LENGTH Ft	tc=(L/180)+10 Min	Min	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	
A	0.25	0.37	70	15.75	5.11				0.00	5.11		10.00	5.11	
B	0.88	0.46	145	2.07	3.74	203	1.48	2.3	1.50	5.25		10.00	5.25	
C	0.9	0.15	78	2.00	2.53				0.00	2.53		10.00	5.00	
C1	0.9	0.12	98	2.00	2.83				0.00	2.83		10.00	5.00	
D	0.88	0.10	40	2.50	1.84	27	3.75	3.75	0.12	1.96		10.00	5.00	
E	0.88	0.10	28	1.76	1.73	86	3.90	3.90	0.37	2.09		10.00	5.00	
F	0.88	0.68	154	3.74	3.16	266	3.39	3.55	1.25	4.41		10.00	5.00	
G	0.88	0.34	290	3.54	4.42	65	4.09	4.00	0.27	4.69		10.00	5.00	
H	0.66	0.19	100	4.09	4.95	20	4.00	3.20	0.10	5.06		10.00	5.06	
I	0.88	0.26	216	3.24	3.93	257	3.95	3.95	1.08	5.02		10.00	5.02	
J	0.88	0.26	91	3.41	2.51	326	4.02	3.99	1.36	3.87		10.00	5.00	
K	0.88	0.05	142	2.61	3.43	206	3.67	3.70	0.93	4.36		10.00	5.00	
L	0.88	0.57	341	3.93	4.64	126	3.67	3.70	0.57	5.20		10.00	5.20	
M	0.88	0.04	126	1.39	3.98	165	3.28	3.50	0.79	4.76		10.00	5.00	
OS-1	0.47	1.44	226	6.19	9.28	140	5.43	2.2	1.06	10.35	366	12.03	10.35	
OS-2	0.47	2.39	238	4.20	10.84	149	1.81	1.4	2.00	12.84	387	12.15	12.15	

CALCULATED BY : JAW
DATE: 09/20/2000
CHECKED BY:

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

JOB NO: 12900.11
PROJECT: Bahama Breeze
DESIGN STORM: 10-Year

BASIN		DESIGN POINT	DIRECT RUNOFF							TOTAL RUNOFF				STREET		PIPE			TRAVEL TIME			
			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)	REMARKS
(1)		(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)
1	A			0.37	0.25	5.11	0.09	5.70	0.53													
2	B			0.46	0.88	5.25	0.40	5.65	2.29													
3	C			0.15	0.90	5.00	0.14	5.76	0.78													
4	C1			0.12	0.90	5.00	0.11	5.76	0.62													
5	D			0.10	0.88	5.00	0.08	5.76	0.49													
6	E			0.10	0.88	5.00	0.09	5.76	0.53													
7	F			0.68	0.88	5.00	0.60	5.76	3.45													
8	G			0.34	0.88	5.00	0.30	5.76	1.72													
9	H			0.19	0.66	5.07	0.13	5.76	0.73													
10	I			0.26	0.88	5.02	0.23	5.76	1.32													
11	J			0.26	0.88	5.00	0.23	5.76	1.32													
12	K			0.05	0.88	5.00	0.04	5.76	0.25													
13	L			0.57	0.88	5.20	0.50	5.68	2.85													
14	M			0.04	0.88	5.00	0.04	5.76	0.20													

CALCULATED BY : JAW
DATE: 09/20/2000
CHECKED BY:

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

JOB NO: 12900.11
PROJECT: Bahama Breeze
DESIGN STORM: 10-Year

BASIN	DESIGN POINT	DIRECT RUNOFF							TOTAL RUNOFF				STREET		PIPE			TRAVEL TIME			
		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)	REMARKS
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)
15 N			0.00	0.90	5.00	0.00	5.76	0.00					X X	X X	X X	X X	X X	X X	X X	X X	X X X X X
OS-1			1.44	0.47	0.00	0.68	4.70	3.18													
OS-2			2.39	0.47	0.00	1.12	4.35	4.89													

CALCULATED BY : JAW
DATE: 09/20/2000
CHECKED BY:

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

JOB NO: 12900.11
PROJECT: Bahama Breeze
DESIGN STORM: 100-Year

BASIN		DESIGN POINT	DIRECT RUNOFF							TOTAL RUNOFF				STREET		PIPE			TRAVEL TIME			
			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)	REMARKS
(1)		(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)
1	A			0.37	0.50	5.11	0.19	8.90	1.65													
2	B			0.46	0.89	5.25	0.41	8.75	3.58													
3	C			0.15	0.90	5.00	0.14	9.05	1.22													
4	C1			0.12	0.90	5.00	0.11	9.05	0.98													
5	D			0.10	0.89	5.00	0.09	9.05	0.77													
6	E			0.10	0.89	5.00	0.09	9.05	0.84													
7	F			0.68	0.89	5.00	0.61	9.05	5.48													
8	G			0.34	0.89	5.00	0.30	9.05	2.74													
9	H			0.19	0.77	5.07	0.15	9.05	1.33													
10	I			0.26	0.89	5.02	0.23	9.05	2.09													
11	J			0.26	0.89	5.00	0.23	9.05	2.09													
12	K			0.05	0.89	5.00	0.04	9.05	0.40													
13	L			0.57	0.89	5.20	0.51	8.80	4.46													
14	M			0.04	0.89	5.00	0.04	9.05	0.32													
X X		X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X	X X

CALCULATED BY : JAW
DATE: 09/20/2000
CHECKED BY:

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

JOB NO: 12900.11
PROJECT: Bahama Breeze
DESIGN STORM: 100-Year

BASIN		DESIGN POINT	DIRECT RUNOFF: AREA DESIGN	DIRECT RUNOFF: AREA (AC)	DIRECT RUNOFF: RUNOFF COEFF	DIRECT RUNOFF: t_c (MIN)	DIRECT RUNOFF: C * A (AC)	DIRECT RUNOFF: I IN/HR	DIRECT RUNOFF: Q (CFS)	TOTAL RUNOFF: t_c (MIN)	TOTAL RUNOFF: Σ (C * A) (AC)	TOTAL RUNOFF: I (IN/HR)	TOTAL RUNOFF: Q (CFS)	STREET: SLOPE (%)	STREET: STREET FLOW (CFS)	PIPE: DESIGN FLOW (CFS)	PIPE: SLOPE (%)	PIPE: PIPE SIZE	TRAVEL TIME: LENGTH (FT)	TRAVEL TIME: VELOCITY (FPS)	TRAVEL TIME: t_t (MIN)	REMARKS
(1)		(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)
15														X	X	X	X	X	X	X	X	X	X	X	X	X	X	XXXXX
16																						
17	OS-1			1.44	0.65	0.00	0.94	7.40	6.93													
18	OS-2			2.39	0.65	0.00	1.55	6.85	10.64													
19																						
20																						
21																						
22																						
23																						
24																						
25																						
26																						
27																						
28																						

LOT 13A1 PROPOSED SYSTEM:

- 482 LF of 96" Cmp
- PIPE INVERT @ Bottom 5794.50
- Pipe INVERT @ Top 5795.69

BASED ON THE STORM SEWER / INLET DESIGN THE MAX STAGE IN THE UNDERGROUND SYSTEM W/O FLOODWATER EXITING THE SITE AT INLET B-3A = 5802.85

Refer TO APPENDIX 'D' FOR STORM SEWER CALCS.

(SEE SHEET 2/3) →
- 10-YR STAGE = 5799.20 (0.29 AC-Ft STORED)
- 100-YR STAGE = 5801.00 (0.44 AC-Ft STORED)

LOT 13A2 EXTENDED SYSTEM:

- USING A MAXIMUM STAGE OF 5802.85 AND THE Additional STORAGE IN LOT 13A1 SYSTEM,
- WHAT IS THE MINIMUM LENGTH OF PIPE REQUIRED EXTENDED OFF THE EXISTING SYSTEM @ 1% SLOPE to Detain 1.07 AC-Ft.

(SEE SHEET 3/3) → = 520 LF

It HAS BEEN DETERMINED THAT THE LOT 13A2 EXPANDED SYSTEM Will WORK. THE Remainder OF the DETENTION CALCULATIONS will be BASED ON THE LOT 13A1 SYSTEM only.

STAGE - STORAGE CALCULATIONS:
(Underground Detention)

10-Year Event:

Required Detention Volume: **0.29 Ac-Ft**
Water Surface Elevation: 5799.20

	Lower Pipe:	Upper Pipe:
Pipe Invert	5794.50	5795.69
Pipe Crown	5802.50	5803.69
Storm Water Depth	4.70 Ft	3.51 Ft
Average Depth	4.11 Ft	
Pipe Flow Area	26.00 Ft^2	
Length of Pipe	482.00 Ft	
Volume Detained	12532.00 Ft^3	**0.29 Ac-Ft**

100-Year Event:

Required Detention Volume: **0.44 Ac-ft**
Water Surface Elevation: 5801.00

	Lower Pipe:	Upper Pipe:
Pipe Invert	5794.50	5795.69
Pipe Crown	5802.50	5803.69
Storm Water Depth	6.50 Ft	5.31 Ft
Average Depth	5.91 Ft	
Pipe Flow Area	39.80 Ft^2	
Length of Pipe	482.00 Ft	
Volume Detained	19183.60 Ft^3	**0.44 Ac-Ft**

STAGE - STORAGE CALCULATIONS:
(Underground Detention)

Determine the minimum pipe length for lot 13A2 Underground Detention Expansion.
Total Lot 13A Detention Volume: 1.07 Ac-Ft

Lot 13A1 Detention Facility - 100-Year Event @ Maximum WSE:

Max. Water Surface Elevation: 5802.85

	Lower Pipe:	Upper Pipe:
Pipe Invert	5794.50	5795.69
Pipe Crown	5802.50	5803.69
Storm Water Depth	8.00 Ft	7.16 Ft
Average Depth	7.58 Ft	
Pipe Flow Area	49.40 Ft^2	
Length of Pipe	482.00 Ft	
Volume Detained	23810.80 Ft^3	**0.55 Ac-Ft**

Lot 13A2 Detention Facility - 100-Year Event:

Required Detention Volume: **0.52 Ac-ft** (1.07 - 0.55 = 0.52 Ac-Ft)
Water Surface Elevation: 5802.85

	Lower Pipe:	Upper Pipe:
Pipe Invert	5795.69	5797.19
Pipe Crown	5803.69	5805.19
Storm Water Depth	7.16 Ft	5.66 Ft
Average Depth	6.41 Ft	
Pipe Flow Area	43.80 Ft^2	
Length of Pipe	520.00 Ft	
Volume Detained	22776.00 Ft^3	**0.52 Ac-Ft**

OUTLET STRUCTURE DESIGN

Lot 13A1 Detention System Only

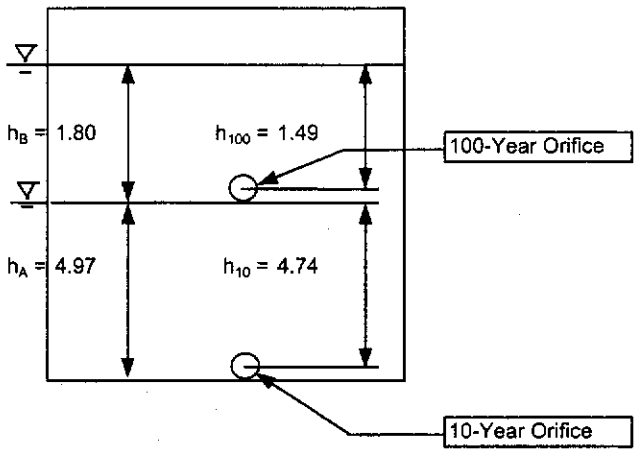
Note:
Modifications to the outlet structure will be necessary if and when the Lot 13A2 expansion is added to the underground detention system.

1. Revised 10-year and 100-year stages must be determined.
2. 10 year and 100-year orifice sizes must be re-calculated.

Note: The maximum 100-year stage allowed in this system is 5802.85

OUTLET ORIFICE DESIGN - 10-YEAR STORM
LOT 13A1 DETENTION FACILITY

Top of Structure Elevation =	5806.48
Weir Elevation =	5802.85
100- Year W.S. Elevation =	5801.00
10 - Year W.S. Elevation =	5799.20
Bottom of Structure Elev =	5794.23



Storm Event: 10-Yr

$Q_{Release}$ = 1.92 Cfs
Pipe Size = 1.50 Ft

A.) Verify adequate flow through outflow pipe:

$Q = C*A*(2*G*H)^{1/2}$

Q = 18.94 Cfs > 1.92 Cfs
OK

C: 0.65
A: 1.77 Ft^2
G: 32.20 Ft/S^2
H: 4.22 Ft

B.) Determine the inflow orifice diameter for 10-Yr Event:

Formulas:
$Q = C\ A\ (2\ G\ H)^{1/2}$

D =	0.46 Ft	A =	0.17 Ft^2
D =	5.57 in	G =	32.20 Ft/s^2
C =	0.65	H =	4.74 Ft

Q = 1.92 CFS

Use D = **D = 0.46 Ft or 5.50 In**

C = 0.65
A = 0.16 Ft^2
G = 32.20 Ft/s^2
H = 4.74 Ft

Q = 1.87 CFS

OUTLET ORIFICE DESIGN - 100-YEAR STORM
LOT 13A1 DETENTION FACILITY

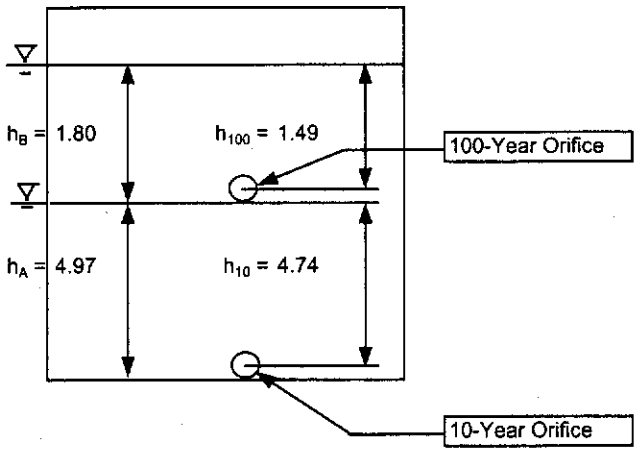
Top of Structure Elevation = 5806.48

Weir Elevation = 5802.85

100- Year W.S. Elevation = 5801.00

10 - Year W.S. Elevation = 5799.20

Bottom of Structure Elev = 5794.23



Storm Event: 100-Yr

$Q_{Release}$ = 4.14 Cfs

Pipe Size = 1.50 Ft

A.) Verify adequate flow through outflow pipe:

$Q = C*A*(2*G*H)^{1/2}$

Q = 22.62 Cfs > 4.14 Cfs

OK

C: 0.65

A: 1.77 Ft^2

G: 32.20 Ft/S^2

H: 6.02 Ft

B.) Determine the flow through the 10-Yr orifice:

Formulas:

$Q = C\ A\ (2\ G\ H)^{1/2}$

D =	0.46 Ft	A =	0.16 Ft^2
D =	5.50 in	G =	32.20 Ft/s^2
C =	0.65	H =	6.54 Ft

Q = 2.20 CFS

C.) Determine the size of the 100-Yr orifice:

Q_{100} = 4.14 - 2.20 Cfs
= 1.94 Cfs

Formulas:
$Q = C\ A\ (2\ G\ H)^{1/2}$

D =	0.62 Ft	A =	0.30 Ft^2
D =	7.48 in	G =	32.20 Ft/s^2
C =	0.65	H =	1.49 Ft

Q = 1.94 CFS

Use D = **D = 0.62 Ft or 7.48 In**

C = 0.65
A = 0.30 Ft^2
G = 32.20 Ft/s^2
H = 1.49 Ft

Q = 1.94 CFS

OVERFLOW WEIR DESIGN
LOT 13A1 DETENTION FACILITY

$Q_{100Undetained}$= 55.70 Cfs

Weir invert = 5802.85

Determine the flow over the weir with 1 foot of head.

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

L: 10.00 Ft
C: 3.32
H: 1.00 Ft

Q_{Weir} = 33.20 Cfs

Determine the maximum flow through the 18" outfall pipe.

$Q = C*A*(2*G*H)^{.5}$

C: 0.65
A: 1.77 Ft^2
G: 32.2 Ft/S^2

Q_{Pipe}= 27.58 Cfs H: 8.96 Ft 803.85 - 794.14

The outfall pipe controls

DETENTION CALCULATIONS

MARTIN/MARTIN
Consulting Engineers

Title BAHAMA BREEZE Date 8/10/00 Job no. 14522.01

Subject RELEASE RATE CALCULATIONS By QC Sheet 1 of 1

	Q_{10}	Q_{100}
LOT 13A RELEASE RATES: (PER GMTD CORP. - 130 L.L.C. PHASE II DEVELOPMENT - LOTS 13A-13H PHASE III DRAINAGE STUDY)	3.18 CFS	7.12 CFS
UNDETAINED FLOWS OFF-SITE: (BASINS A & H)	1.26 CFS	2.98 CFS
TOTAL DETENTION FACILITY #6 RELEASE RATES.	1.92 CFS	4.14 CFS

TO SIZE LOT 13A1's PORTION of the UNDERGROUND Detention FACILITY.

LOT 13A1 = $\frac{3.25 AC}{7.53 AC}$ = 43% TOTAL AREA

LOT 13A2 = $\frac{4.28 AC}{7.53 AC}$ = 57% TOTAL AREA

LOT 13A1 RELEASE RATES: (43%)	0.83 CFS	1.78 CFS
LOT 13A2 RELEASE RATES: (57%)	1.09 CFS	2.36 CFS

- THESE VALUES WILL BE USED TO DETERMINE EACH LOTS VOLUME TO DETAIN IN DETENTION FACILITY NO 6.

MARTIN/MARTIN
Consulting Engineers

Title BANAMA BREEZE Date 8/10/00 Job no. 14522.01

Subject C.A CALCULATIONS By QC Sheet 1 of 1

LOT 13A1:

BASIN	10-YEAR	100-YEAR
ALL OTHERS	2.42 × 0.88	2.42 × 0.89
A	0.37 × 0.25	0.37 × 0.59
H	0.19 × 0.66	0.19 × 0.77
C, C1	0.27 × 0.90	0.27 × 0.90
Σ C.A =	2.59	2.73

LOT 13A2:

SINCE LOT 13A2 IS A FUTURE DEVELOPMENT AND THE SITE PLAN FOR LOT 13A2 IS NOT FINALIZED, C-VALUES OF 0.88 AND 0.89 (COMMERCIAL AREAS) WILL BE USED FOR THE 10-YEAR AND 100-YEAR RUNOFF COEFFICIENTS RESPECTIVELY.

THUS... AREA = 4.28 AC. C_{10} = 0.88
C_{100} = 0.89

CA_{10} = 3.78 CA_{100} = 3.81

LOT 13A TOTAL:

	10-YEAR	100-YEAR
LOT 13A1	2.59	2.73
LOT 13A2	3.78	3.81
Σ CA =	6.37	6.54

DETENTION POND VOLUME

PROJECT: WESTBROOK DEVELOPMENT

Pond No: 6

Design Storm: 10-Year

On-Site Basin:

C*A: 2.59

Release Rate: 0.83 Cfs

MASS DIAGRAM

Time (Min)	Time (Sec)	CA	Intensity (In/Hr)	Inflow (Cfs)	Rainfall Volume (Ft^3)	Outflow (Cfs)	Outflow Volume (Ft^3)	Storage Volume (Ft^3)
0	0	2.59	0.00	0.00	0	0.00	0.00	0.00
5	300	2.59	5.76	14.92	4476	0.83	249	4227
10	600	2.59	4.50	11.66	6993	0.83	498	6495
15	900	2.59	3.80	9.84	8858	0.83	747	8111
20	1200	2.59	3.30	8.55	10256	0.83	996	9260
25	1500	2.59	3.00	7.77	11655	0.83	1245	10410
30	1800	2.59	2.62	6.79	12214	0.83	1494	10720
35	2100	2.59	2.30	5.96	12510	0.83	1743	10767
40	2400	2.59	2.20	5.70	13675	0.83	1992	11683
45	2700	2.59	2.00	5.18	13986	0.83	2241	11745
50	3000	2.59	1.85	4.79	14375	0.83	2490	11885
55	3300	2.59	1.70	4.40	14530	0.83	2739	11791
60	3600	2.59	1.66	4.30	15478	0.83	2988	12490

Required Storage: 12490 Ft^3

0.29 Ac-Ft

PONDVOL.xls

Lot 13A1 - 100-YR

DETENTION POND VOLUME

PROJECT: WESTBROOK DEVELOPMENT

Pond No: 6

Design Storm: 100-Year

On-Site Basin:

C*A: 2.73

Release Rate: 1.78 Cfs

MASS DIAGRAM

Time (Min)	Time (Sec)	CA	Intensity (In/Hr)	Inflow (Cfs)	Rainfall Volume (Ft^3)	Outflow (Cfs)	Outflow Volume (Ft^3)	Storage Volume (Ft^3)
0	0	2.73	0.00	0.00	0	0.00	0.00	0.00
5	300	2.73	9.05	24.71	7412	1.78	534	6878
10	600	2.73	7.02	19.16	11499	1.78	1068	10431
15	900	2.73	5.93	16.19	14570	1.78	1602	12968
20	1200	2.73	5.00	13.65	16380	1.78	2136	14244
25	1500	2.73	4.50	12.29	18428	1.78	2670	15758
30	1800	2.73	4.11	11.22	20197	1.78	3204	16993
35	2100	2.73	3.75	10.24	21499	1.78	3738	17761
40	2400	2.73	3.50	9.56	22932	1.78	4272	18660
45	2700	2.73	3.25	8.87	23956	1.78	4806	19150
50	3000	2.73	3.00	8.19	24570	1.78	5340	19230
55	3300	2.73	2.80	7.64	25225	1.78	5874	19351
60	3600	2.73	2.60	7.10	25553	1.78	6408	19145

Required Storage: 19351 Ft^3

0.44 Ac-Ft

PONDVOL.xls

*** Information: Subsurface analysis iterations: 1
*** Information: Convergence was achieved.

*** Information: B-2A2 Hydraulic jump formed.
*** Information: B-2A2 Critical depth assumed upstream.
*** Information: A-21 Hydraulic jump formed.
*** Information: A-21 Critical depth assumed upstream.

CALCULATION SUMMARY FOR SURFACE NETWORKS

Label	Inlet Type	Inlet	Total Intercepted Flow (cfs)	Total Bypassed Flow (cfs)	Capture Efficiency (%)	Gutter Spread (ft)	Gutter Depth (ft)
B-2	Generic Inlet	Generic Default 100%	0.00	0.00	100.0	0.00	0.00
B-3	Generic Inlet	Generic Default 100%	0.00	0.00	100.0	0.00	0.00
B-3A	Generic Inlet	Generic Default 100%	0.00	0.00	100.0	0.00	0.00
B-2A	Generic Inlet	Generic Default 100%	0.00	0.00	100.0	0.00	0.00
B-5	Generic Inlet	Generic Default 100%	0.00	0.00	100.0	0.00	0.00
A-2	Generic Inlet	Generic Default 100%	0.00	0.00	100.0	0.00	0.00
C-1	Generic Inlet	Generic Default 100%	0.00	0.00	100.0	0.00	0.00
C-2	Generic Inlet	Generic Default 100%	0.00	0.00	100.0	0.00	0.00
D-2	Generic Inlet	Generic Default 100%	0.00	0.00	100.0	0.00	0.00
D-1	Generic Inlet	Generic Default 100%	0.00	0.00	100.0	0.00	0.00

CALCULATION SUMMARY FOR SUBSURFACE NETWORK WITH ROOT: O-1

Label	Number of Sections	Section Size	Section Shape	Length (ft)	Total System Flow (cfs)	Average Velocity (ft/s)	Hydraulic Grade Upstream (ft)	Hydraulic Grade Downstream (ft)
B-10	1	30 inch	Circular	54.00	12.99	2.65	5,802.90	5,802.85
B-21	1	24 inch	Circular	22.00	12.99	4.13	5,803.04	5,802.97
B-2A2	1	18 inch	Circular	73.00	0.84	1.63	5,803.34	5,803.25
B-32	1	24 inch	Circular	26.00	9.87	3.14	5,803.30	5,803.25
B-3A3	1	24 inch	Circular	52.00	5.05	1.61	5,803.45	5,803.43
B-43	1	18 inch	Circular	78.00	1.75	1.25	5,803.43	5,803.43
B-54	1	18 inch	Circular	15.00	1.75	2.29	5,803.54	5,803.63

Label	Total System Flow (cfs)	Ground Elevation (ft)	Hydraulic Grade In (ft)	Hydraulic Grade Out (ft)
O-1	12.99	5,807.25	5,802.85	5,802.85
B-1	12.99	5,805.60	5,802.97	5,802.90
B-2	12.99	5,805.33	5,803.25	5,803.04
B-2A	0.84	5,806.00	5,803.59	5,803.34
B-3	9.87	5,804.43	5,803.43	5,803.30
B-3A	5.05	5,803.50	5,803.48	5,803.45
B-4	1.75	5,806.40	5,803.63	5,803.43
B-5	1.75	5,806.00	5,804.04	5,803.54

CALCULATION SUMMARY FOR SUBSURFACE NETWORK WITH ROOT: O-2

Label	Number of Sections	Section Size	Section Shape	Length (ft)	Total System Flow (cfs)	Average Velocity (ft/s)	Hydraulic Grade Upstream (ft)	Hydraulic Grade Downstream (ft)
A-10	1	24 inch	Circular	198.00	16.04	5.27	5,803.79	5,802.85
A-21	1	24 inch	Circular	83.00	16.04	6.02	5,805.33	5,803.99

Label	Total System Flow (cfs)	Ground Elevation (ft)	Hydraulic Grade In (ft)	Hydraulic Grade Out (ft)
O-2	16.04	5,807.40	5,802.85	5,802.85
A-1	16.04	5,809.70	5,803.99	5,803.79
A-2	16.04	5,808.14	5,805.88	5,805.33

CALCULATION SUMMARY FOR SUBSURFACE NETWORK WITH ROOT: O-3

Label	Number of Sections	Section Size	Section Shape	Length (ft)	Total System Flow (cfs)	Average Velocity (ft/s)	Hydraulic Grade Upstream (ft)	Hydraulic Grade Downstream (ft)
C-10	1	24 inch	Circular	23.00	19.26	6.13	5,803.02	5,802.85
C-21	1	24 inch	Circular	61.00	15.47	4.92	5,803.65	5,803.37

Label	Total System Flow (cfs)	Ground Elevation (ft)	Hydraulic Grade In (ft)	Hydraulic Grade Out (ft)
O-3	19.26	5,806.90	5,802.85	5,802.85
C-1	19.26	5,805.85	5,803.37	5,803.02
C-2	15.47	5,804.00	5,803.95	5,803.65

CALCULATION SUMMARY FOR SUBSURFACE NETWORK WITH ROOT: O-4

Label	Number of Sections	Section Size	Section Shape	Length (ft)	Total System Flow (cfs)	Average Velocity (ft/s)	Hydraulic Grade Upstream (ft)	Hydraulic Grade Downstream (ft)
D-10	1	18 inch	Circular	40.00	7.40	4.19	5,803.05	5,802.85
D-21	1	18 inch	Circular	90.00	4.42	2.50	5,803.37	5,803.21

Label	Total System Flow (cfs)	Ground Elevation (ft)	Hydraulic Grade In (ft)	Hydraulic Grade Out (ft)

O-4	7.40	5,807.90	5,802.85	5,802.85
D-1	7.40	5,807.73	5,803.21	5,803.05
D-2	4.42	5,809.65	5,803.43	5,803.37

**** Calculation Completed: 09/20/00 07:44:29 PM

APPENDIX B

- HYDROLOGIC CALCULATIONS

Project : Truck Yard - Lone Tree
Project No. : 25084

Date : 10/27/2026
By : TJG

Drainage Basin Imperviousness

Soil Type : **C or D**

	Roof	Concrete	Asphalt	Landscape	PICP	Gravel	Undeveloped				Runoff Coefficients			
Imperviousness :	95%	95%	95%	20%	45%	40%	5%	Total Area (ac.)	Total Area (sq.ft.)	Composite % Imp.				
Basin Name	Areas (sq.ft.)										C_2	C_5	C_{10}	C_{100}
A				15,523				0.36	15,523	20%	0.14	0.20	0.28	0.57
B		828	5,433	1,253	146			0.18	7,661	82%	0.67	0.70	0.73	0.82
C	15,785							0.36	15,785	95%	0.79	0.81	0.83	0.87
C1					4,496			0.10	4,496	45%	0.34	0.40	0.46	0.67
D		124		3,343				0.08	3,467	23%	0.16	0.22	0.30	0.58
F1		195	7,143	5,513				0.30	12,851	63%	0.50	0.55	0.59	0.74
OF1			1,746	1,599				0.08	3,345	59%	0.46	0.52	0.57	0.73
F2		1,992	11,590	1,848				0.35	15,430	86%	0.70	0.74	0.76	0.84
OF2			675	158				0.02	833	81%	0.66	0.69	0.73	0.81
G		3,251	15,822	3,120	1,688			0.55	23,880	82%	0.66	0.70	0.73	0.82
OG			1,442	35				0.03	1,477	93%	0.77	0.79	0.82	0.87
H		2,636	3,919	2,456				0.21	9,011	75%	0.60	0.64	0.68	0.79
I		614	5,840	660				0.16	7,114	88%	0.72	0.75	0.78	0.84
OI			1,075	359				0.03	1,434	76%	0.61	0.66	0.69	0.80
J			8,708	708				0.22	9,416	89%	0.74	0.76	0.79	0.85
OJ			9,359	1,762				0.26	11,121	83%	0.68	0.71	0.74	0.82
K			2,293	85				0.05	2,378	92%	0.76	0.79	0.81	0.86
OK	2,577		1,681					0.10	4,258	95%	0.79	0.81	0.83	0.87
L			15,110	2,138				0.40	17,248	86%	0.70	0.73	0.76	0.83
OL1			4,202	449				0.11	4,651	88%	0.72	0.75	0.78	0.84
OL2	1,474		3,029	194				0.11	4,697	92%	0.76	0.78	0.81	0.86
To Detention	15,785	7,004	71,939	18,667	6,330	0	0	2.75	119,726	81%	0.66	0.69	0.72	0.81
Total On Site	15,785	9,641	75,858	36,646	6,330	0	0	3.31	144,260	74%	0.59	0.64	0.67	0.79

PROOFCIVIL consulting engineers

Project : Truck Yard - Lone Tree
Project No. : 25084

Date : 10/27/2026
By : TJG

SF2 - Time of Concentration

				Initial/Overland Time			Travel Time					Time of Concentration		Final
Basin ID	Area (ac.)	Area (sq.ft.)	C_5	L_i (ft.)	S (%)	T_i (min.)	L_t (ft.)	S (%)	Conveyance Factor	Vel (fps)	T_t (min.)	Comp. T_C (min.)	Regional T_C (Min.)	T_C (Min.)
A	0.36	15,523	0.20	72	5.00	8.1	85	5.5	15	3.5	0.4	8.5	23.1	8.5
B	0.18	7,661	0.70	91	3.30	4.6	192	2.0	20	2.8	1.1	5.8	13.2	5.8
C	0.36	15,785	0.81	50	1.00	3.7	52	1.0	20	2.0	0.4	4.1	10.2	5.0
C1	0.10	4,496	0.40	53	1.00	9.2	86	1.0	20	2.0	0.7	9.9	19.3	9.9
D	0.08	3,467	0.22	22	10.00	3.5	61	1.0	20	2.0	0.5	4.0	23.0	5.0
F1	0.30	12,851	0.55	78	15.00	3.6	109	4.5	20	4.2	0.4	4.0	15.8	5.0
OF1	0.08	3,345	0.52	61	15.00	3.4	20	4.0	20	4.0	0.1	3.4	16.0	5.0
F2	0.35	15,430	0.74	165	4.20	5.3	72	0.5	20	1.4	0.8	6.1	12.2	6.1
OF2	0.02	833	0.69	5	10.00	0.8	20	4.0	20	4.0	0.1	0.9	12.4	5.0
G	0.55	23,880	0.70	207	3.40	6.9	120	3.5	20	3.7	0.5	7.5	12.6	7.5
OG	0.03	1,477	0.79	5	5.00	0.7	20	4.0	20	4.0	0.1	0.8	10.2	5.0
H	0.21	9,011	0.64	130	3.10	6.5	122	6.0	20	4.9	0.4	6.9	13.8	6.9
I	0.16	7,114	0.75	71	3.40	3.5	123	3.1	20	3.5	0.6	4.1	11.6	5.0
OI	0.03	1,434	0.66	15	5.00	1.8	35	4.0	20	4.0	0.1	2.0	13.2	5.0
J	0.22	9,416	0.76	85	4.00	3.5	111	4.4	20	4.2	0.4	4.0	11.2	5.0
OJ	0.26	11,121	0.71	32	4.00	2.5	200	3.5	20	3.7	0.9	3.4	12.7	5.0
K	0.05	2,378	0.79	72	1.00	4.8	113	3.5	20	3.7	0.5	5.3	10.8	5.3
OK	0.10	4,258	0.81	72	1.00	4.5	24	3.0	20	3.5	0.1	4.6	10.0	5.0
L	0.40	17,248	0.73	24	2.90	2.3	56	3.7	20	3.8	0.2	2.5	11.7	5.0
OL1	0.11	4,651	0.75	61	2.90	3.5	24	3.0	20	3.5	0.1	3.6	11.2	5.0
OL2	0.11	4,697	0.78	72	1.00	4.8	24	3.0	20	3.5	0.1	5.0	10.5	5.0

Project : Truck Yard - Lone Tree
Project No. : 25084

Date : 10/27/2026
By : TJG

SF3 - Minor Storm

1-hr Point Rainfall **1.1** in. (5-year Event)

		Direct Runoff							Total Runoff				Street		Travel Time			
Description	Design Point	Area (ac.)	Area (sq.ft.)	C_5	Tc (min.)	CA (ac.)	I (in/hr)	Q (cfs)	Tc (min.)	CA (ac.)	I (in/hr)	Q (cfs)	Slope (%)	Flow (cfs)	Length (ft)	Vel. (fps)	tt (min.)	Comments
A	1	0.36	15,523	0.20	8.5	0.07	3.16	0.2										Runoff offsite to Yosemite
B	2	0.18	7,661	0.70	5.8	0.12	3.59	0.4										Runoff to the existing inlet at DP2
C	3	0.36	15,785	0.81	5.0	0.29	3.73	1.1										Runoff from building roof
C1	3	0.10	4,496	0.40	9.9	0.04	2.99	0.1										Runoff from gravel to inlet at DP3.1
D	4	0.08	3,467	0.22	5.0	0.02	3.73	0.1										Runoff to the prop. Inlet at DP4
F1	5	0.30	12,851	0.55	5.0	0.16	3.73	0.6										Runoff to the prop. Inlet at DP5
OF1	5.1	0.08	3,345	0.52	5.0	0.04	3.73	0.1	5.0	0.20	3.73	0.8						Combined runoff to inlet at DP5
F2	6	0.35	15,430	0.74	6.1	0.26	3.53	0.9										Runoff to the prop. Inlet at DP6
OF2	6.1	0.02	833	0.69	5.0	0.01	3.73	0.0	6.1	0.27	3.53	1.0						Combined runoff to inlet at DP6
G	8	0.55	23,880	0.70	7.5	0.38	3.31	1.3										Runoff to the existing inlet at DP8
OG	8.1	0.03	1,477	0.79	5.0	0.03	3.73	0.1	7.5	0.41	3.31	1.4						Combined runoff to inlet at DP8
H	9	0.21	9,011	0.64	6.9	0.13	3.40	0.5										Runoff to the existing inlet at DP9
I	10	0.16	7,114	0.75	5.0	0.12	3.73	0.5										Runoff to the existing inlet at DP10
OI	10.1	0.03	1,434	0.66	5.0	0.02	3.73	0.1	5.0	0.14	3.73	0.5						Combined runoff to inlet at DP10
J	11	0.22	9,416	0.76	5.0	0.16	3.73	0.6										Runoff to the existing inlet at DP11
OJ	11.1	0.26	11,121	0.71	5.0	0.18	3.73	0.7	5.0	0.35	3.73	1.3						Combined runoff to inlet at DP11
K	12	0.05	2,378	0.79	5.3	0.04	3.67	0.2										Runoff to the existing inlet at DP12
OK	12.1	0.10	4,258	0.81	5.0	0.08	3.73	0.3	5.3	0.12	3.67	0.4						Combined runoff to inlet at DP12
L	13	0.40	17,248	0.73	5.0	0.29	3.73	1.1										Runoff to the existing inlet at DP13
OL1	13.1	0.11	4,651	0.75	5.0	0.08	3.73	0.3										Runoff from basin OL1 to DP13
OL2	13.2	0.11	4,697	0.78	5.0	0.08	3.73	0.3	5.0	0.46	3.73	1.7						Combined runoff to inlet at DP5

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Project : Truck Yard - Lone Tree
Project No. : 25084

Date : 10/27/2026
By : TJG

SF3 - Major Storm

1-hr Point Rainfall **2.28** in. (100-year Event)

		Direct Runoff							Total Runoff				Street		Travel Time			
Description	Design Point	Area (ac.)	Area (sq.ft.)	C_{100}	Tc (min.)	CA (ac.)	I (in/hr)	Q (cfs)	Tc (min.)	CA (ac.)	I (in/hr)	Q (cfs)	Slope (%)	Flow (cfs)	Length (ft)	Vel. (fps)	tt (min.)	Comments
A	1	0.36	15,523	0.57	8.5	0.20	6.55	1.3										Runoff offsite to Yosemite
B	2	0.18	7,661	0.82	5.8	0.14	7.44	1.1										Runoff to the existing inlet at DP2
C	3	0.36	15,785	0.87	5.0	0.32	7.73	2.4										Runoff from building roof
C1	3	0.10	4,496	0.67	9.9	0.07	6.19	0.4										Runoff from gravel to inlet at DP3.1
D	4	0.08	3,467	0.58	5.0	0.05	7.73	0.4										Runoff to the prop. Inlet at DP4
F1	5	0.30	12,851	0.74	5.0	0.22	7.73	1.7										Runoff to the prop. Inelt at DP5
OF1	5.1	0.08	3,345	0.73	5.0	0.06	7.73	0.4	5.0	0.27	7.73	2.1						Combined runoff to inlet at DP5
F2	6	0.35	15,430	0.84	6.1	0.30	7.31	2.2										Runoff to the prop. Inlet at DP6
OF2	6.1	0.02	833	0.81	5.0	0.02	7.73	0.1	6.1	0.31	7.31	2.3						Combined runoff to inlet at DP6
G	8	0.55	23,880	0.82	7.5	0.45	6.86	3.1										Runoff to the existing inlet at DP8
OG	8.1	0.03	1,477	0.87	5.0	0.03	7.73	0.2	7.5	0.48	6.86	3.3						Combined runoff to inlet at DP8
H	9	0.21	9,011	0.79	6.9	0.16	7.04	1.1										Runoff to the existing inlet at DP9
I	10	0.16	7,114	0.84	5.0	0.14	7.73	1.1										Runoff to the existing inlet at DP10
OI	10.1	0.03	1,434	0.80	5.0	0.03	7.73	0.2	5.0	0.16	7.73	1.3						Combined runoff to inlet at DP10
J	11	0.22	9,416	0.85	5.0	0.18	7.73	1.4										Runoff to the existing inlet at DP11
OJ	11.1	0.26	11,121	0.82	5.0	0.21	7.73	1.6	5.0	0.39	7.73	3.0						Combined runoff to inlet at DP11
K	12	0.05	2,378	0.86	5.3	0.05	7.62	0.4										Runoff to the existing inlet at DP12
OK	12.1	0.10	4,258	0.87	5.0	0.09	7.73	0.7	5.3	0.13	7.62	1.0						Combined runoff to inlet at DP12
L	13	0.40	17,248	0.83	5.0	0.33	7.73	2.6										Runoff to the existing inlet at DP13
OL1	13.1	0.11	4,651	0.84	5.0	0.09	7.73	0.7										Runoff from basin OL1 to DP13
OL2	13.2	0.11	4,697	0.86	5.0	0.09	7.73	0.7	5.0	0.51	7.73	4.0						Combined runoff to inlet at DP5

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APPENDIX C

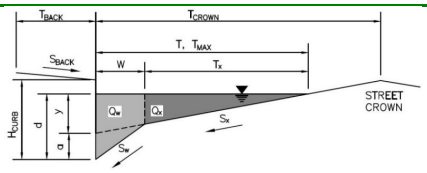
- HYDRAULIC CALCULATIONS

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

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

Project: **Truck Yard - Lone Tree**

Inlet ID: **DP2**



Gutter Geometry:

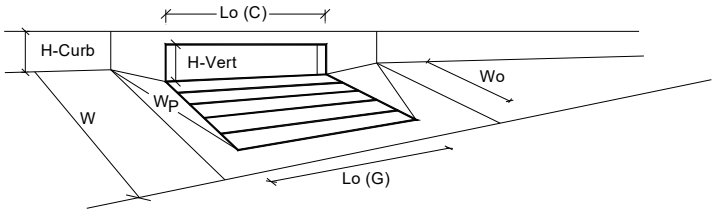
Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	0.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.000	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.012	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	24.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.040	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} =	0.012	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	24.0	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 6.00 (August 2025)



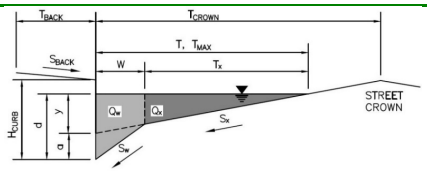
Design Information (Input)		MINOR	MAJOR	
Type of Inlet (CDOT Type R Curb Opening)	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from above)	a_{local} =	3.00	3.00	inches
Number of Unit Inlets (Grate or Curb Opening)	No =	1	1	
Water Depth at Flowline (outside of local depression)	Ponding Depth =	6.0	6.0	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) =	5.00	5.00	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	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	0.33	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} =	1.00	1.00	
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 =**	**5.4**	**5.4**	**cfs**
Inlet Capacity IS GOOD for Minor and Major Storms (>Q Peak)	$Q_{PEAK\ REQUIRED}$ =	0.4	1.1	cfs

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

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

Project: **Truck Yard - Lone Tree**

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} =	0.020	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.012	
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 =	0.040	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} =	0.012	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	24.0	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		☐	☐	

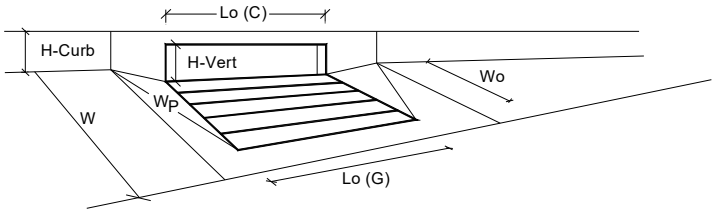
MINOR STORM Allowable Capacity is not applicable to Sump Condition

MAJOR STORM Allowable Capacity is not applicable to Sump Condition

	Minor Storm	Major Storm	
Q_{allow} =	**SUMP**	**SUMP**	**cfs**

INLET IN A SUMP OR SAG LOCATION

MHFD-Inlet, Version 6.00 (August 2025)



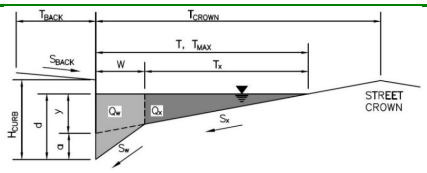
Design Information (Input)		MINOR	MAJOR	
Type of Inlet (CDOT Type R Curb Opening)	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from above)	a_{local} =	3.00	3.00	inches
Number of Unit Inlets (Grate or Curb Opening)	No =	1	1	
Water Depth at Flowline (outside of local depression)	Ponding Depth =	6.0	6.0	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) =	5.00	5.00	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	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	0.33	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} =	1.00	1.00	
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 =**	**5.4**	**5.4**	**cfs**
Inlet Capacity IS GOOD for Minor and Major Storms (>Q Peak)	$Q_{PEAK\ REQUIRED}$ =	0.6	1.7	cfs

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

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

Project: **Truck Yard - Lone Tree**

Inlet ID: **DP6**



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} =	0.012	
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 =	0.040	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} =	0.012	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	24.0	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		☐	☐	

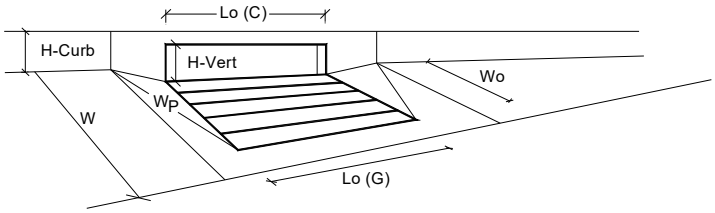
MINOR STORM Allowable Capacity is not applicable to Sump Condition

MAJOR STORM Allowable Capacity is not applicable to Sump Condition

	Minor Storm	Major Storm	
Q_{allow} =	**SUMP**	**SUMP**	**cfs**

INLET IN A SUMP OR SAG LOCATION

MHFD-Inlet, Version 6.00 (August 2025)



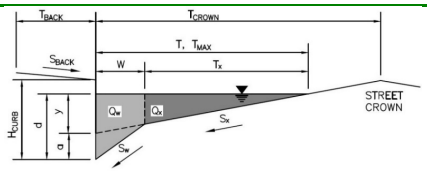
Design Information (Input)		MINOR	MAJOR	
Type of Inlet (CDOT Type R Curb Opening)	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from above)	a_{local} =	3.00	3.00	inches
Number of Unit Inlets (Grate or Curb Opening)	No =	1	1	
Water Depth at Flowline (outside of local depression)	Ponding Depth =	6.0	6.0	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) =	5.00	5.00	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	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	0.33	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} =	1.00	1.00	
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 =**	**5.4**	**5.4**	**cfs**
Inlet Capacity IS GOOD for Minor and Major Storms (>Q Peak)	$Q_{PEAK\ REQUIRED}$ =	0.9	2.2	cfs

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

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

Project: **Truck Yard - Lone Tree**

Inlet ID: **DP8**



Gutter Geometry:

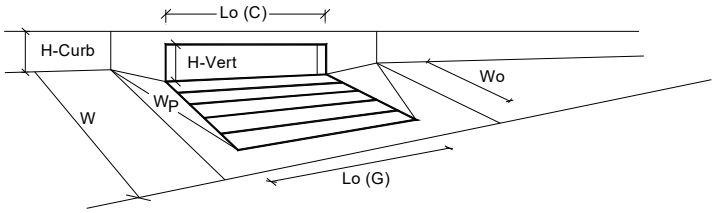
Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	0.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.000	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.012	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	24.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.030	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 =	0.000	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.012	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	24.0	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 6.00 (August 2025)



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	6.0	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) =	5.00	5.00	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	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	0.33	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} =	1.00	1.00	
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 =**	**5.4**	**5.4**	**cfs**
Inlet Capacity IS GOOD for Minor and Major Storms (>Q Peak)	$Q_{PEAK\ REQUIRED}$ =	1.3	3.1	cfs

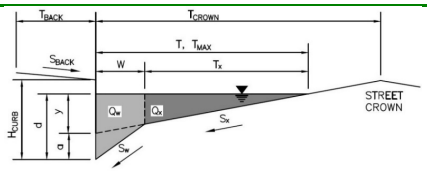
MHFD-Inlet, Version 6.00 (August 2025)

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

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

Project: **Truck Yard - Lone Tree**

Inlet ID: **DP10 (EX.)**



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} =	0.050	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.012	
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 =	0.040	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} =	0.012	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	24.0	24.0	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)		☐	☐	

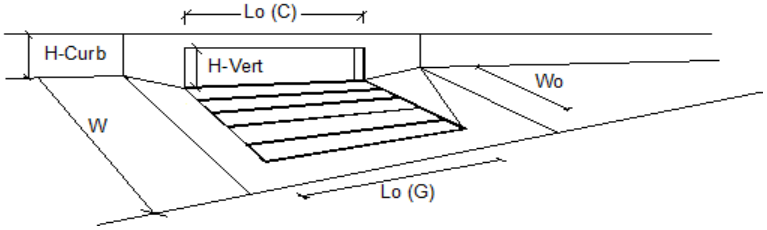
		Minor Storm	Major Storm	
MINOR STORM Allowable Capacity is based on Depth Criterion				
MAJOR STORM Allowable Capacity is based on Depth Criterion	Q_{allow} =	**15.6**	**15.6**	**cfs**

Minor storm max. allowable capacity GOOD - greater than the design peak flow of 0.50 cfs on sheet 'Inlet Management'

Major storm max. allowable capacity GOOD - greater than the design peak flow of 1.10 cfs on sheet 'Inlet Management'

INLET ON A CONTINUOUS GRADE

MHFD-Inlet, Version 6.00 (August 2025)



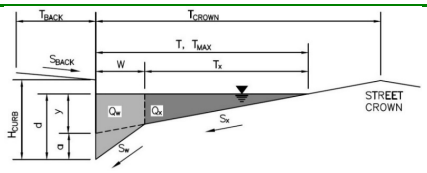
Design Information (Input)		MINOR	MAJOR	
Type of Inlet (CDOT Type R Curb Opening)	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a')	a_{LOCAL} =	3.0	3.0	inches
Total Number of Units in the Inlet (Grate or Curb Opening)	No =	2	2	
Length of a Single Unit 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: OK - Q < Allowable Street Capacity'		MINOR	MAJOR	
Total Inlet Interception Capacity	**Q_a =**	**0.5**	**1.1**	**cfs**
Total Inlet Carry-Over Flow (flow bypassing inlet)	**Q_b =**	**0.0**	**0.0**	**cfs**
Capture Percentage = Q_a/Q_o	**C% =**	**100**	**100**	**%**

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

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

Project: **Truck Yard - Lone Tree**

Inlet ID: **DP11 (EX.)**



Gutter Geometry:

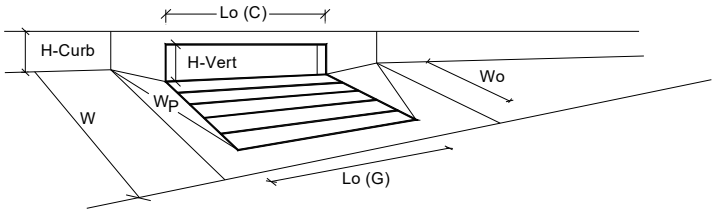
Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	0.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.000	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.012	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	24.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.035	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} =	0.012	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	24.0	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 6.00 (August 2025)



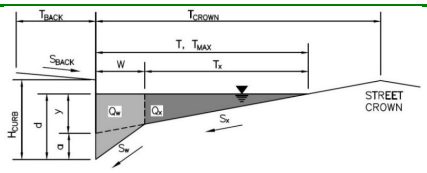
Design Information (Input)		MINOR	MAJOR	
Type of Inlet (CDOT Type R Curb Opening)	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from above)	a_{local} =	3.00	3.00	inches
Number of Unit Inlets (Grate or Curb Opening)	No =	1	1	
Water Depth at Flowline (outside of local depression)	Ponding Depth =	6.0	6.0	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) =	5.00	5.00	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	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	0.33	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} =	1.00	1.00	
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 =**	**5.4**	**5.4**	**cfs**
Inlet Capacity IS GOOD for Minor and Major Storms (>Q Peak)	$Q_{PEAK\ REQUIRED}$ =	1.3	3.0	cfs

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

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

Project: **Truck Yard - Lone Tree**

Inlet ID: **DP12 (EX.)**



Gutter Geometry:

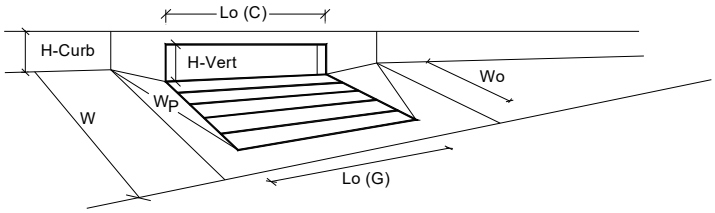
Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	0.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.000	ft/ft
Manning's Roughness Behind Curb (typically between 0.012 and 0.020)	n_{BACK} =	0.012	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	24.0	ft
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.030	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 =	0.000	ft/ft
Manning's Roughness for Street Section (typically between 0.012 and 0.020)	n_{STREET} =	0.012	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	24.0	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 6.00 (August 2025)



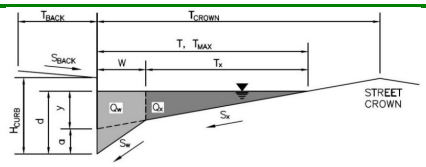
Design Information (Input)		MINOR	MAJOR	
Type of Inlet (CDOT Type R Curb Opening)	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from above)	a_{local} =	3.00	3.00	inches
Number of Unit Inlets (Grate or Curb Opening)	No =	1	1	
Water Depth at Flowline (outside of local depression)	Ponding Depth =	6.0	6.0	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) =	5.00	5.00	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	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	0.33	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} =	1.00	1.00	
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 =**	**5.4**	**5.4**	**cfs**
Inlet Capacity IS GOOD for Minor and Major Storms (>Q Peak)	$Q_{PEAK\ REQUIRED}$ =	0.4	1.0	cfs

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

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

Project: **Truck Yard - Lone Tree**

Inlet ID: **DP13 (EX)**



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} =	0.012	
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 =	0.037	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} =	0.012	

		Minor Storm	Major Storm	
Max. Allowable Spread for Minor & Major Storm	T_{MAX} =	16.2	16.2	ft
Max. Allowable Depth at Gutter Flowline for Minor & Major Storm	d_{MAX} =	6.0	7.2	inches
Check boxes are not applicable in SUMP conditions		☐	☐	

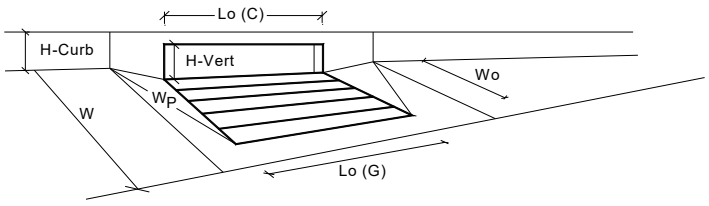
MINOR STORM Allowable Capacity is not applicable to Sump Condition

MAJOR STORM Allowable Capacity is not applicable to Sump Condition

	Minor Storm	Major Storm	
Q_{allow} =	**SUMP**	**SUMP**	**cfs**

INLET IN A SUMP OR SAG LOCATION

MHFD-Inlet, Version 6.00 (August 2025)



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	7.2	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) =	5.00	5.00	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	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	0.43	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} =	1.00	1.00	
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 =**	**5.4**	**8.0**	**cfs**
Inlet Capacity IS GOOD for Minor and Major Storms (>Q Peak)	$Q_{PEAK\ REQUIRED}$ =	1.7	4.0	cfs

INLET @ DP4 CAPACITY CHECK

Nyloplast Inlet Capacity Table

DISCLAIMER: SAFETY FACTORS ARE NOT INCLUDED IN THESE CALCULATIONS. ACTUAL CALCULATIONS SHOULD BE CARRIED OUT AND VERIFIED BY THE DESIGN ENGINEER TAKING INTO ACCOUNT ALL LOCAL CONDITIONS. NYLOPLAST RECOMMENDS USING A MINIMUM SAFETY FACTOR OF 1.25 FOR PAVED AREAS AND 2.0 FOR TURF AREAS. ADS/NYLOPLAST IS NOT RESPONSIBLE FOR MISUSE OF THIS TOOL.

Input	
Type of Grate	24" Dome
Head (ft)	0.25

Properties	
Orifice Flow Area (in)	**265.19**
Orifice Flow Area (ft)	**1.83**
Weir Flow Perimeter (in)	**71.47**
Weir Flow Perimeter (ft)	**5.96**

Solution		
Capacity (cfs)	**2.48**	DP4 = 0.4 CFS. CAPACITY OK
Capacity (gpm)	**1112.64**	

$$Q_{weir} = CLH^{3/2}$$

$C = 3.33\ Weir\ Discharge\ Coefficient$

$L = Perimeter\ of\ Grate\ Opening\ (ft)$

$H = Flow\ Height\ of\ Water\ Surface\ Above\ Weir\ (ft)$

$$Q_{orifice} = CA\sqrt{2gh}$$

$C = 0.60\ Orifice\ Discharge\ Coefficient$

$A = Area\ of\ the\ Orifice\ (ft^2)$

$g = Gravitational\ Constant\ \left(32.2\frac{ft}{s^2}\right)$

$H = Depth\ of\ Water\ Above\ Center\ of\ Orifice\ (ft)$

REV 2.1.21

APPENDIX D

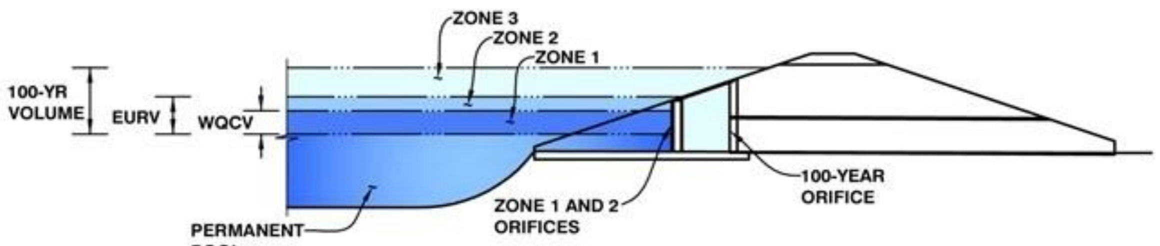
- DETENTION CALCULATIONS
- DETENTION DETAILS

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.06 (July 2022)

Project: **Truck Yard - Lone Tree**

Basin ID: **Underground WQ**



Example Zone Configuration (Retention Pond)

Watershed Information

Selected BMP Type =	**EDB**	
Watershed Area =	2.75	acres
Watershed Length =	652	ft
Watershed Length to Centroid =	320	ft
Watershed Slope =	0.040	ft/ft
Watershed Imperviousness =	81.00%	percent
Percentage Hydrologic Soil Group A =	0.0%	percent
Percentage Hydrologic Soil Group B =	0.0%	percent
Percentage Hydrologic Soil Groups C/D =	100.0%	percent
Target WQCV Drain Time =	40.0	hours
Location for 1-hr Rainfall Depths =	Lone Tree - Municipal Court	

After providing required inputs above including 1-hour rainfall depths, click 'Run CUHP' to generate runoff hydrographs using the embedded Colorado Urban Hydrograph Procedure.

			Optional User Overrides	
Water Quality Capture Volume (WQCV) =	0.077	acre-feet		acre-feet
Excess Urban Runoff Volume (EURV) =	0.219	acre-feet		acre-feet
2-yr Runoff Volume (P1 = 0.84 in.) =	0.139	acre-feet		inches
5-yr Runoff Volume (P1 = 1.1 in.) =	0.194	acre-feet		inches
10-yr Runoff Volume (P1 = 1.33 in.) =	0.245	acre-feet		inches
25-yr Runoff Volume (P1 = 1.68 in.) =	0.328	acre-feet		inches
50-yr Runoff Volume (P1 = 1.97 in.) =	0.395	acre-feet		inches
100-yr Runoff Volume (P1 = 2.28 in.) =	0.470	acre-feet		inches
500-yr Runoff Volume (P1 = 3.07 in.) =	0.654	acre-feet		inches
Approximate 2-yr Detention Volume =	0.139	acre-feet		
Approximate 5-yr Detention Volume =	0.198	acre-feet		
Approximate 10-yr Detention Volume =	0.236	acre-feet		
Approximate 25-yr Detention Volume =	0.277	acre-feet		
Approximate 50-yr Detention Volume =	0.295	acre-feet		
Approximate 100-yr Detention Volume =	0.322	acre-feet		

Define Zones and Basin Geometry

Zone 1 Volume (WQCV) =	0.077	acre-feet
Select Zone 2 Storage Volume (Optional) =		acre-feet
Select Zone 3 Storage Volume (Optional) =		acre-feet
Total Detention Basin Volume =	0.077	acre-feet
Initial Surcharge Volume (ISV) =	user	ft^3
Initial Surcharge Depth (ISD) =	user	ft
Total Available Detention Depth (H_{total}) =	user	ft
Depth of Trickle Channel (H_{TC}) =	user	ft
Slope of Trickle Channel (S_{TC}) =	user	ft/ft
Slopes of Main Basin Sides (S_{main}) =	user	H:V
Basin Length-to-Width Ratio ($R_{L/W}$) =	user	

Total detention volume is less than 100-year volume.

Initial Surcharge Area (A_{ISV}) =	user	ft^2
Surcharge Volume Length (L_{ISV}) =	user	ft
Surcharge Volume Width (W_{ISV}) =	user	ft
Depth of Basin Floor (H_{FLOOR}) =	user	ft
Length of Basin Floor (L_{FLOOR}) =	user	ft
Width of Basin Floor (W_{FLOOR}) =	user	ft
Area of Basin Floor (A_{FLOOR}) =	user	ft^2
Volume of Basin Floor (V_{FLOOR}) =	user	ft^3
Depth of Main Basin (H_{MAIN}) =	user	ft
Length of Main Basin (L_{MAIN}) =	user	ft
Width of Main Basin (W_{MAIN}) =	user	ft
Area of Main Basin (A_{MAIN}) =	user	ft^2
Volume of Main Basin (V_{MAIN}) =	user	ft^3
Calculated Total Basin Volume (V_{total}) =	**user**	acre-feet

Depth Increment = 0.25 ft

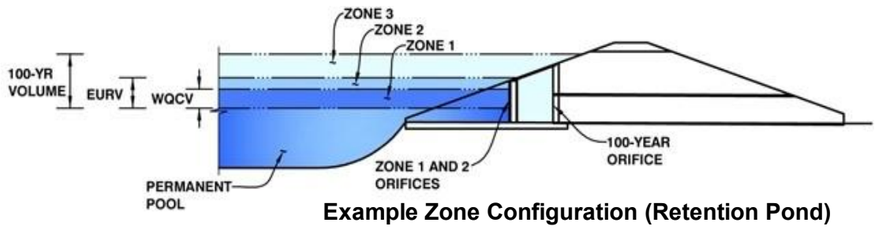
Stage - Storage Description	Stage (ft)	Optional Override Stage (ft)	Length (ft)	Width (ft)	Area (ft^2)	Optional Override Area (ft^2)	Area (acre)	Volume (ft^3)	Volume (ac-ft)
Top of Micropool	--	0.00	--	--	--	573	0.013		
	--	0.25	--	--	--	573	0.013	143	0.003
	--	0.50	--	--	--	573	0.013	287	0.007
	--	0.75	--	--	--	573	0.013	430	0.010
	--	1.00	--	--	--	573	0.013	573	0.013
	--	1.25	--	--	--	573	0.013	716	0.016
	--	1.50	--	--	--	573	0.013	860	0.020
	--	1.75	--	--	--	573	0.013	1,003	0.023
	--	2.00	--	--	--	573	0.013	1,146	0.026
	--	2.25	--	--	--	573	0.013	1,289	0.030
	--	2.50	--	--	--	573	0.013	1,433	0.033
	--	2.75	--	--	--	573	0.013	1,576	0.036
	--	3.00	--	--	--	573	0.013	1,719	0.039
	--	3.25	--	--	--	573	0.013	1,862	0.043
	--	3.50	--	--	--	573	0.013	2,006	0.046
	--	3.75	--	--	--	573	0.013	2,149	0.049
	--	4.00	--	--	--	573	0.013	2,292	0.053
	--	4.25	--	--	--	573	0.013	2,435	0.056
	--	4.50	--	--	--	573	0.013	2,579	0.059
	--	4.75	--	--	--	573	0.013	2,722	0.062
	--	5.00	--	--	--	573	0.013	2,865	0.066
	--	5.25	--	--	--	573	0.013	3,008	0.069
	--	5.50	--	--	--	573	0.013	3,152	0.072
	--	5.75	--	--	--	573	0.013	3,295	0.076
	--	6.00	--	--	--	573	0.013	3,438	0.079
	--	6.25	--	--	--	573	0.013	3,581	0.082
	--	6.50	--	--	--	573	0.013	3,725	0.086
	--	6.75	--	--	--	573	0.013	3,868	0.089
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DETENTION BASIN OUTLET STRUCTURE DESIGN

MHFD-Detention, Version 4.06 (July 2022)

Project: **Truck Yard - Lone Tree**

Basin ID: **Underground WQ**



Example Zone Configuration (Retention Pond)

	Estimated Stage (ft)	Estimated Volume (ac-ft)	Outlet Type
Zone 1 (WQCV)	5.84	0.077	Orifice Plate
Zone 2			
Zone 3			
Total (all zones)		0.077	

User Input: Orifice at Underdrain Outlet (typically used to drain WQCV in a Filtration BMP)

Underdrain Orifice Invert Depth =	N/A	ft (distance below the filtration media surface)
Underdrain Orifice Diameter =	N/A	inches

Calculated Parameters for Underdrain

Underdrain Orifice Area =	N/A	ft^2
Underdrain Orifice Centroid =	N/A	feet

User Input: Orifice Plate with one or more orifices or Elliptical Slot Weir (typically used to drain WQCV and/or EURV in a sedimentation BMP)

Centroid of Lowest Orifice =	0.00	ft (relative to basin bottom at Stage = 0 ft)
Depth at top of Zone using Orifice Plate =	6.27	ft (relative to basin bottom at Stage = 0 ft)
Orifice Plate: Orifice Vertical Spacing =	20.00	inches
Orifice Plate: Orifice Area per Row =	0.41	sq. inches (diameter = 11/16 inch)

Calculated Parameters for Plate

WQ Orifice Area per Row =	2.847E-03	ft^2
Elliptical Half-Width =	N/A	feet
Elliptical Slot Centroid =	N/A	feet
Elliptical Slot Area =	N/A	ft^2

User Input: Stage and Total Area of Each Orifice Row (numbered from lowest to highest)

	Row 1 (required)	Row 2 (optional)	Row 3 (optional)	Row 4 (optional)	Row 5 (optional)	Row 6 (optional)	Row 7 (optional)	Row 8 (optional)
Stage of Orifice Centroid (ft)	0.00	2.09	4.18					
Orifice Area (sq. inches)	0.41	0.41	0.41					

	Row 9 (optional)	Row 10 (optional)	Row 11 (optional)	Row 12 (optional)	Row 13 (optional)	Row 14 (optional)	Row 15 (optional)	Row 16 (optional)
Stage of Orifice Centroid (ft)								
Orifice Area (sq. inches)								

User Input: Vertical Orifice (Circular or Rectangular)

	Not Selected	Not Selected	
Invert of Vertical Orifice =			ft (relative to basin bottom at Stage = 0 ft)
Depth at top of Zone using Vertical Orifice =			ft (relative to basin bottom at Stage = 0 ft)
Vertical Orifice Diameter =			inches

Calculated Parameters for Vertical Orifice

	Not Selected	Not Selected	
Vertical Orifice Area =			ft^2
Vertical Orifice Centroid =			feet

User Input: Overflow Weir (Dropbox with Flat or Sloped Grate and Outlet Pipe OR Rectangular/Trapezoidal Weir and No Outlet Pipe)

	Not Selected	Not Selected	
Overflow Weir Front Edge Height, Ho =	6.27		ft (relative to basin bottom at Stage = 0 ft)
Overflow Weir Front Edge Length =	5.00		feet
Overflow Weir Grate Slope =	0.00		H:V
Horiz. Length of Weir Sides =	0.00		feet
Overflow Grate Type =	No Grate		
Debris Clogging % =	0%		%

Calculated Parameters for Overflow Weir

	Not Selected	Not Selected	
Height of Grate Upper Edge, H_t =	6.27		feet
Overflow Weir Slope Length =	0.00		feet
Grate Open Area / 100-yr Orifice Area =	0.00		
Overflow Grate Open Area w/o Debris =	0.00		ft^2
Overflow Grate Open Area w/ Debris =	0.00		ft^2

User Input: Outlet Pipe w/ Flow Restriction Plate (Circular Orifice, Restrictor Plate, or Rectangular Orifice)

	Not Selected	Not Selected	
Depth to Invert of Outlet Pipe =	0.00		ft (distance below basin bottom at Stage = 0 ft)
Circular Orifice Diameter =	18.00		inches

Calculated Parameters for Outlet Pipe w/ Flow Restriction Plate

	Not Selected	Not Selected	
Outlet Orifice Area =	1.77		ft^2
Outlet Orifice Centroid =	0.75		feet
Half-Central Angle of Restrictor Plate on Pipe =	N/A	N/A	radians

User Input: Emergency Spillway (Rectangular or Trapezoidal)

Spillway Invert Stage=	12.31	ft (relative to basin bottom at Stage = 0 ft)
Spillway Crest Length =	4.00	feet
Spillway End Slopes =	0.00	H:V
Freeboard above Max Water Surface =	0.00	feet

Calculated Parameters for Spillway

Spillway Design Flow Depth=	0.89	feet
Stage at Top of Freeboard =	13.20	feet
Basin Area at Top of Freeboard =	0.01	acres
Basin Volume at Top of Freeboard =	0.09	acre-ft

Routed Hydrograph Results

The user can override the default CUHP hydrographs and runoff volumes by entering new values in the Inflow Hydrographs table (Columns W through AF).

Design Storm Return Period =	WQCV	EURV	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year	500 Year
One-Hour Rainfall Depth (in) =	N/A	N/A	0.84	1.10	1.33	1.68	1.97	2.28	3.07
CUHP Runoff Volume (acre-ft) =	0.077	0.219	0.139	0.194	0.245	0.328	0.395	0.470	0.654
Inflow Hydrograph Volume (acre-ft) =	N/A	N/A	0.139	0.194	0.245	0.328	0.395	0.470	0.654
CUHP Predevelopment Peak Q (cfs) =	N/A	N/A	0.0	0.3	0.7	1.7	2.3	3.2	4.9
OPTIONAL Override Predevelopment Peak Q (cfs) =	N/A	N/A							
Predevelopment Unit Peak Flow, q (cfs/acre) =	N/A	N/A	0.01	0.09	0.24	0.62	0.85	1.15	1.80
Peak Inflow Q (cfs) =	N/A	N/A	2.5	3.3	4.1	5.7	6.8	8.3	11.5
Peak Outflow Q (cfs) =	0.1	5.1	1.0	3.1	4.7	5.1	5.1	5.1	5.1
Ratio Peak Outflow to Predevelopment Q =	N/A	N/A	N/A	12.0	7.0	3.0	2.2	1.6	1.0
Structure Controlling Flow =	Plate	N/A	Overflow Weir 1	Overflow Weir 1	Overflow Weir 1	N/A	N/A	N/A	N/A
Max Velocity through Grate 1 (fps) =	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Max Velocity through Grate 2 (fps) =	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Time to Drain 97% of Inflow Volume (hours) =	37	32	37	35	33	30	28	26	22
Time to Drain 99% of Inflow Volume (hours) =	**41**	39	43	41	40	39	38	36	34
Maximum Ponding Depth (ft) =	5.86	6.75	6.43	6.61	6.73	6.75	6.75	6.75	6.75
Area at Maximum Ponding Depth (acres) =	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Maximum Volume Stored (acre-ft) =	0.077	0.089	0.084	0.087	0.088	0.089	0.089	0.089	0.089

User Inputs

Chamber Model:	MC-7200
Outlet Control Structure:	No
Project Name:	Truck Yard
Engineer:	Tucker Gates
Project Location:	Colorado
Measurement Type:	Imperial
Required Storage Volume:	3354 cubic ft.
Stone Porosity:	40%
Stone Foundation Depth:	9 in.
Stone Above Chambers:	12 in.
Design Constraint Dimensions:	(36 ft. x 50 ft.)

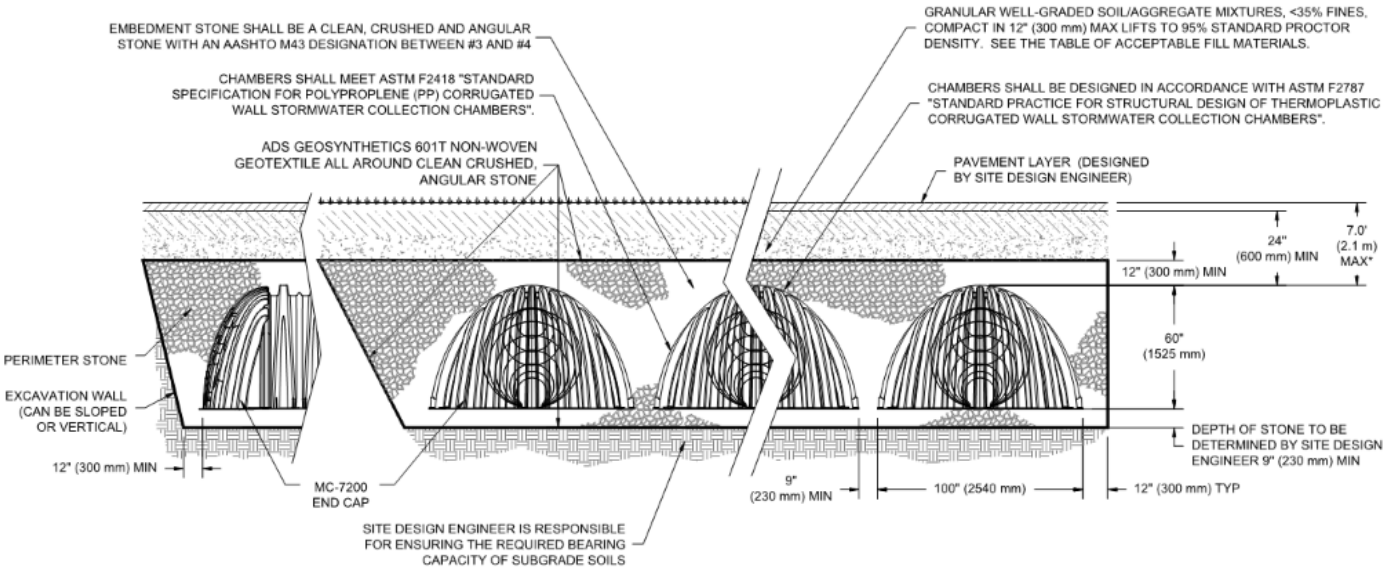
Results

System Volume and Bed Size

Installed Storage Volume:	3794.27 cubic ft.
Storage Volume Per Chamber:	175.90 cubic ft.
Number Of Chambers Required:	11
Number Of End Caps Required:	4
Chamber Rows:	2
Maximum Length:	51.50 ft.
Maximum Width:	19.42 ft.
Approx. Bed Size Required:	940.15 square ft.
Average Cover Over Chambers:	N/A .

System Components

Amount Of Stone Required (0% Overage):	158 cubic yards
(Cubic yard to ton factor:1.4):	220.53 tons
Volume Of Excavation (Not Including Fill):	236 cubic yards
Total Non-woven Geotextile Required:	379 square yards
Woven Geotextile Required (excluding Isolator Row):	30 square yards
Woven Geotextile Required (Isolator Row):	106 square yards
Total Woven Geotextile Required:	135 square yards
Impervious Liner Required:	0 square yards



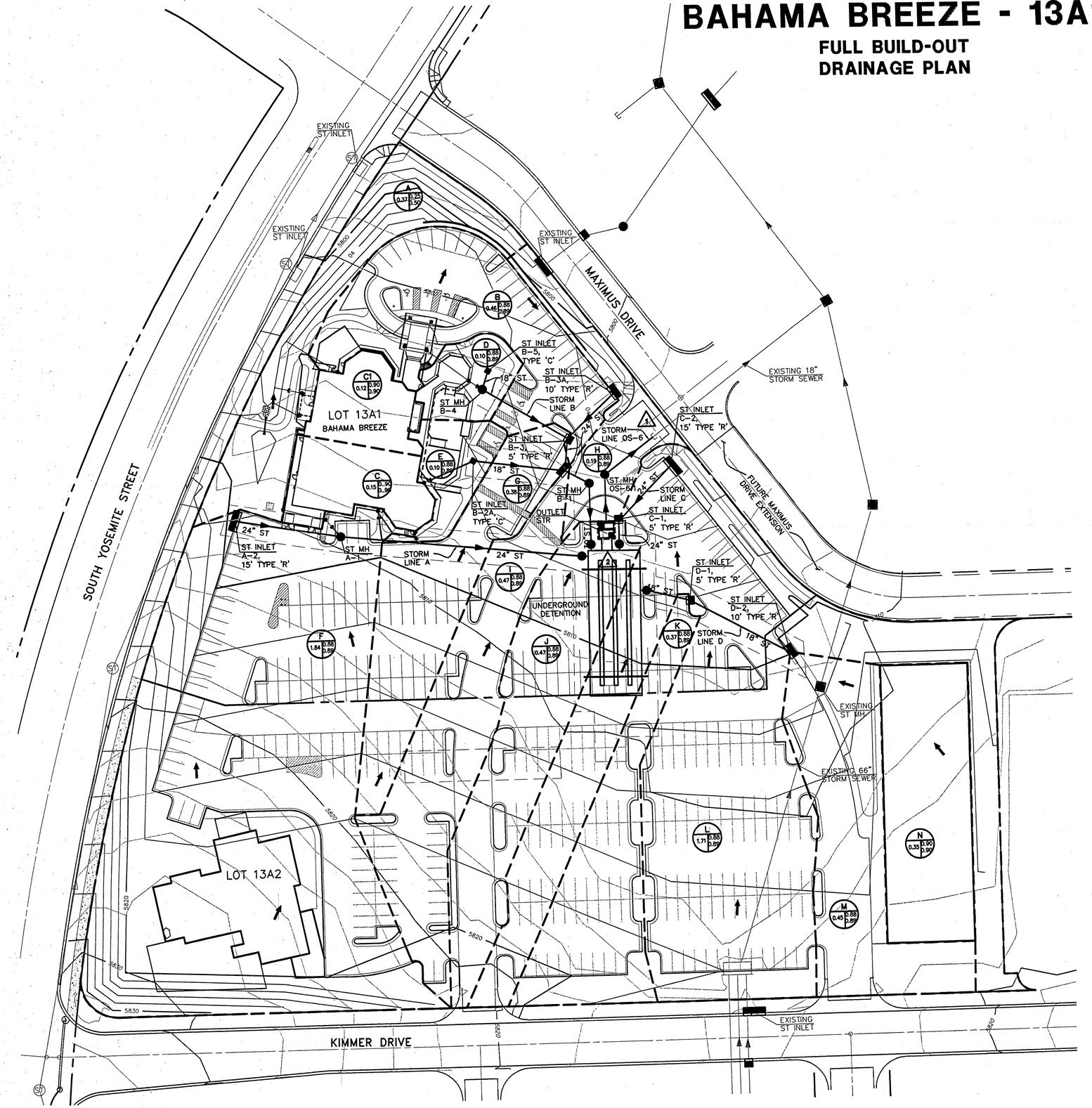
*MINIMUM COVER TO BOTTOM OF FLEXIBLE PAVEMENT. FOR UNPAVED INSTALLATIONS WHERE RUTTING FROM VEHICLES MAY OCCUR, INCREASE COVER TO 30" (750 mm).

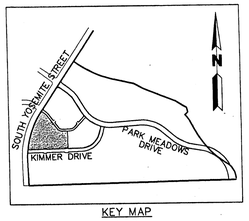
APPENDIX E

- DRAINAGE MAPS

130 L.L.C. ENTERTAINMENT DISTRICT
BAHAMA BREEZE - 13A1

FULL BUILD-OUT
DRAINAGE PLAN





KEY MAP
N.T.S.

BASIN		Tc MIN	C10	C100	Q10 CFS	Q100 CFS
A	DEVELOPED	5.11	0.25	0.50	0.53	1.65
B	DEVELOPED	5.25	0.88	0.89	2.29	3.58
C	DEVELOPED	5.00	0.90	0.90	0.78	1.22
C1	DEVELOPED	5.00	0.90	0.90	0.62	0.98
D	DEVELOPED	5.00	0.88	0.89	0.49	0.77
E	DEVELOPED	5.00	0.88	0.89	0.53	0.84
F	DEVELOPED	5.00	0.88	0.89	9.33	14.82
G	DEVELOPED	5.00	0.88	0.89	1.93	3.07
H	DEVELOPED	5.07	0.66	0.77	0.73	1.33
I	DEVELOPED	5.02	0.88	0.89	2.37	3.76
J	DEVELOPED	5.00	0.88	0.89	2.38	3.79
K	DEVELOPED	5.00	0.88	0.89	1.88	2.98
L	DEVELOPED	5.20	0.88	0.89	8.55	13.39
M	DEVELOPED	5.00	0.88	0.89	2.28	3.62
N	DEVELOPED	5.00	0.90	0.90	1.84	2.88

LEGEND

BASIN BOUNDARY

DIRECTION OF FLOW

DESIGN POINT 1

BASIN B — C10 .88
AREA IN ACRES 1.25 — C100 .93

N

40 20 0 40 80
SCALE 1"= 40'

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.

CITY ENGINEER

DATE

THESE CONSTRUCTION PLANS HAVE BEEN REVIEWED BY THE CITY OF LONE TREE FOR DRAINAGE IMPROVEMENTS ONLY.

ENGINEERING DIVISION ACCEPTANCE BLOCK

MARTIN/MARTIN
Consulting Engineers
4251 Kipling St. Fax: (303) 431-4028
Wheat Ridge, CO (303) 431-6100
Email: civ@martinmartin.com

THE ENTERTAINMENT DISTRICT
BAHAMA BREEZE

FULL BUILD-OUT
DRAINAGE PLAN

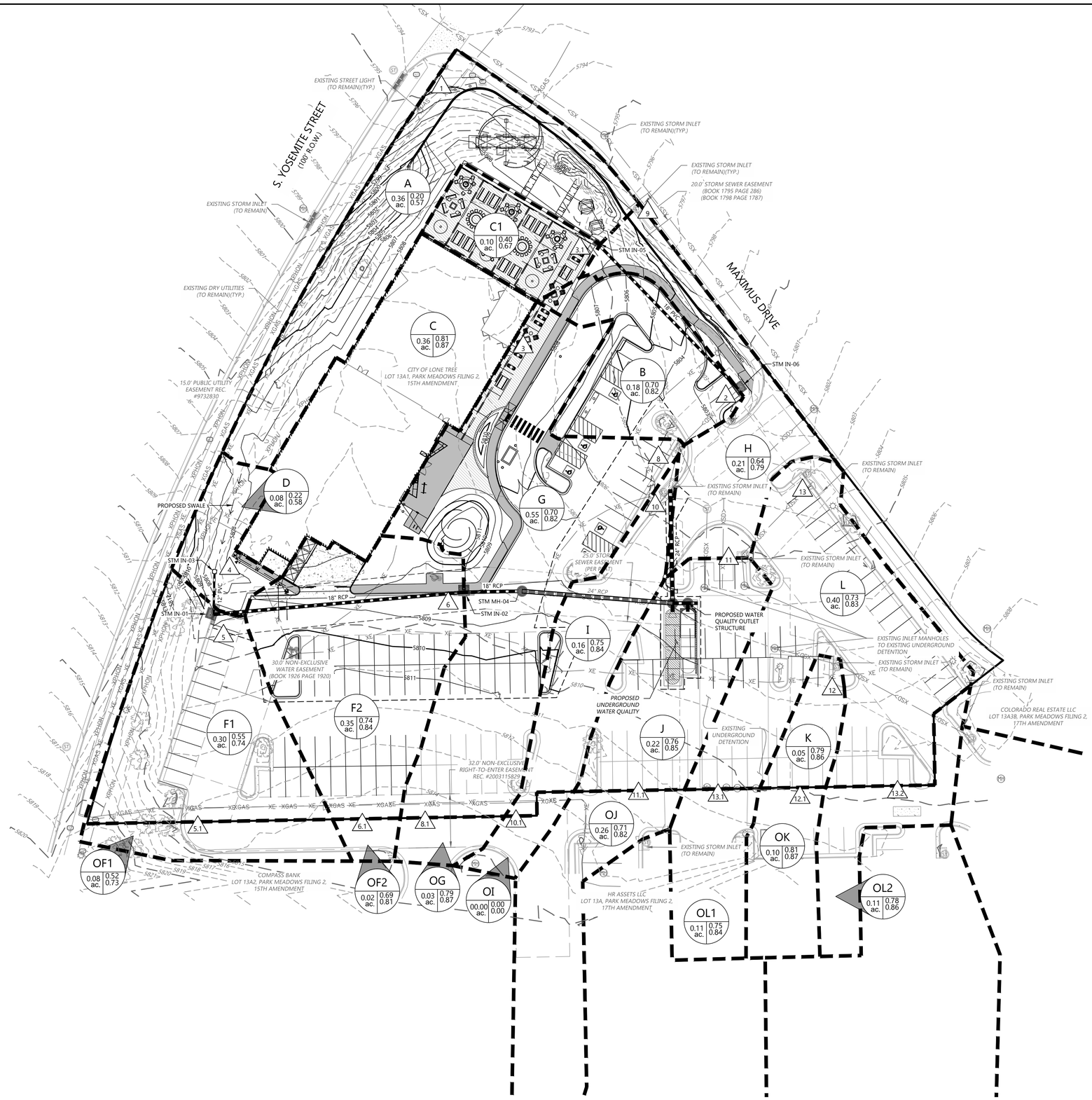
no	description of revisions	date	name
1	SUBMITTED FOR 1ST	09/20/00	JCM
2	SUBMITTED FOR SIGNATURE	12/01/00	JCM

date JUNE 14, 2000
job number 14522.01
design by JCC
drawn by NRL
checked by JCM

sheet number
D1

project WB130\PHASE2\13a\CDS\
project manager JCM
designed by JCC job no. 14522.01
drawn by NRL sheet no. 4

cad information
model space
plot date 06/26/00
paper space
main file DRAIN.DWG xreference



LEGEND:

- PROPERTY LINE
- PROPOSED BUILDING
- EXISTING BUILDING
- PROPOSED EASEMENT
- EXISTING EASEMENT
- PROPOSED BASIN BOUNDARY
- HISTORICAL BASIN BOUNDARY
- 5400 — PROPOSED 5' CONTOUR
- 5401 — PROPOSED 1' CONTOUR
- 5400 — EXISTING 5' CONTOUR
- 5401 — EXISTING 1' CONTOUR
- SD> — PROPOSED STORM LINE W/F.E.S.
- XSD> — EXISTING STORM LINE W/F.E.S.
- PROPOSED SAWCUT
- PROPOSED STORM INLET
- EXISTING STORM INLET
- FLOW DIRECTION
- OVERFLOW PATH
- 25.25 — PROPOSED SPOT GRADE
- 25.25 — EXISTING SPOT GRADE
- 2.00% — SLOPE AND DIRECTION
- HP — HIGH POINT
- LP — LOW POINT
- GB — GRADE BREAK

A1 — BASIN ID
1.50 ac. — BASIN ACREAGE
0.80 0.90 — BASIN IDENTIFICATION TAG
5-YR RUNOFF COEFFICIENT
100-YR RUNOFF COEFFICIENT

PROOFCIVIL
consulting engineers
1531 Market Street | Denver, CO

SEAL:

FOR AND ON BEHALF OF PROOF CIVIL CO.

REVISIONS

NO.	DATE	DESCRIPTION
1	10/29/2026	REVISED PER COMMENTS

PROJ. NO: 28054
DATE: 5/22/2026
DRAWN BY: TJG
CHECKED BY: JGD

DRAINAGE PLAN

TRUCK YARD - LONE TREE

LONE TREE CO

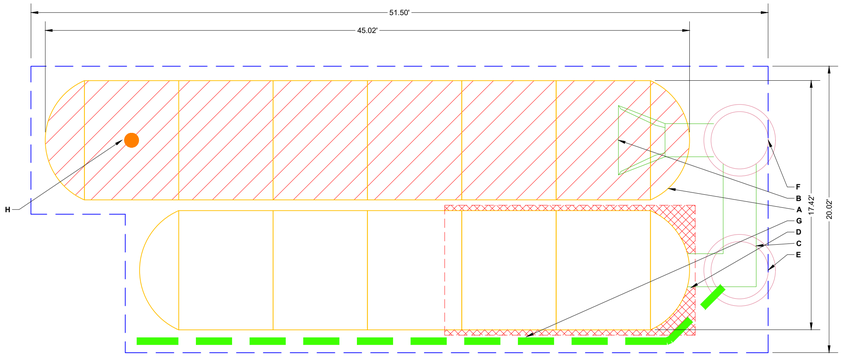
DRAWING NO.

DR-1

PROPOSED LAYOUT		PROPOSED ELEVATIONS	
11	STORMTECH MC-7200 CHAMBERS	MAXIMUM ALLOWABLE GRADE (TOP OF PAVEMENT/UNPAVED):	5808.75
4	STORMTECH MC-7200 END CAPS	MINIMUM ALLOWABLE GRADE (UNPAVED WITH TRAFFIC):	5804.25
12	STONE ABOVE (in)	MINIMUM ALLOWABLE GRADE (UNPAVED NO TRAFFIC):	5803.75
9	STONE BELOW (in)	MINIMUM ALLOWABLE GRADE (TOP OF RIGID CONCRETE PAVEMENT):	5803.75
40	STONE VOID	MINIMUM ALLOWABLE GRADE (BASE OF FLEXIBLE PAVEMENT):	5803.75
3867	INSTALLED SYSTEM VOLUME (CF) (PERIMETER STONE INCLUDED) (COVER STONE INCLUDED) (BASE STONE INCLUDED)	TOP OF STONE:	5802.75
		TOP OF MC-7200 CHAMBER:	5801.75
		24" x 24" TOP MANIFOLD INVERT:	5798.67
		24" ISOLATOR ROW PLUS INVERT:	5796.94
967	SYSTEM AREA (SF)	24" BOTTOM CONNECTION INVERT:	5796.94
143.0	SYSTEM PERIMETER (ft)	BOTTOM OF MC-7200 CHAMBER:	5796.75
		UNDERDRAIN INVERT:	5796.00
		BOTTOM OF STONE:	5796.00

*INVERT ABOVE BASE OF CHAMBER

PART TYPE	ITEM ON LAYOUT	DESCRIPTION	INVERT*	MAX FLOW
PREFABRICATED END CAP	A	24" BOTTOM PARTIAL CUT END CAP, PART#: MC4500IEPP24B / TYP OF ALL 24" BOTTOM CONNECTIONS AND ISOLATOR PLUS ROWS		
	B	INSTALL FLAMP ON 24" ACCESS PIPE / PART#: MCFLAMP		
MANIFOLD	C	24" x 24" TOP MANIFOLD, ADS N-12	23.05"	
PIPE CONNECTION	D	24" BOTTOM CONNECTION	2.26"	
CONCRETE STRUCTURE	E	OCS (DESIGN BY ENGINEER / PROVIDED BY OTHERS)		7.0 CFS OUT
CONCRETE STRUCTURE	F	(DESIGN BY ENGINEER / PROVIDED BY OTHERS)		9.5 CFS IN
UNDERDRAIN	G	6" ADS N-12 DUAL WALL PERFORATED HDPE UNDERDRAIN		
INSPECTION PORT	H	10" SEE DETAIL		



ISOLATOR ROW PLUS (SEE DETAIL)

PLACE MINIMUM 17.50' OF ADSPLUS125 WOVEN GEOTEXTILE OVER BEDDING STONE AND UNDERNEATH CHAMBER FEET FOR SCOUR PROTECTION AT ALL CHAMBER INLET ROWS

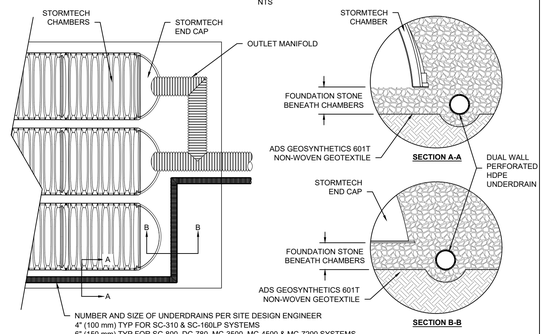
BED LIMITS

NOTES

- THE SITE DESIGN ENGINEER MUST REVIEW ELEVATIONS AND IF NECESSARY ADJUST GRADING TO ENSURE THE CHAMBER COVER REQUIREMENTS ARE MET.
- **NOT FOR CONSTRUCTION**: THIS LAYOUT IS FOR DIMENSIONAL PURPOSES ONLY TO PROVE CONCEPT & THE REQUIRED STORAGE VOLUME CAN BE ACHIEVED ON SITE.

UNDERDRAIN DETAIL

NTS

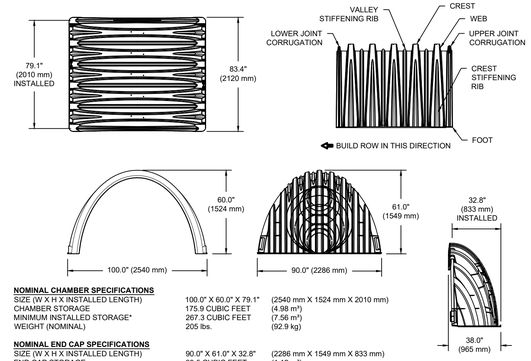


5 UNDERDRAIN DETAIL

SPACE INTENTIONALLY LEFT BLANK

MC-7200 TECHNICAL SPECIFICATION

NTS



NOMINAL CHAMBER SPECIFICATIONS

SIZE (W X H X INSTALLED LENGTH)	100.0" X 60.0" X 79.1"	(2540 mm X 1524 mm X 2010 mm)
CHAMBER STORAGE	175.9 CUBIC FEET	(4.98 m³)
MINIMUM INSTALLED STORAGE*	267.3 CUBIC FEET	(7.56 m³)
WEIGHT (NOMINAL)	205 lbs.	(92.9 kg)

NOMINAL END CAP SPECIFICATIONS

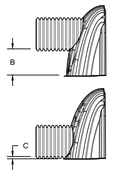
SIZE (W X H X INSTALLED LENGTH)	90.0" X 61.0" X 32.8"	(2286 mm X 1549 mm X 833 mm)
END CAP STORAGE	39.5 CUBIC FEET	(1.12 m³)
MINIMUM INSTALLED STORAGE*	115.3 CUBIC FEET	(3.26 m³)
WEIGHT (NOMINAL)	90 lbs.	(40.8 kg)

*ASSUMES 12" (305 mm) STONE ABOVE, 9" (229 mm) STONE FOUNDATION AND BETWEEN CHAMBERS, 12" (305 mm) STONE PERIMETER IN FRONT OF END CAPS AND 40% STONE POROSITY.

PARTIAL CUT HOLES AT BOTTOM OF END CAP FOR PART NUMBERS ENDING WITH "B"
PARTIAL CUT HOLES AT TOP OF END CAP FOR PART NUMBERS ENDING WITH "T"
END CAPS WITH A PREFABRICATED WELDED STUB END WITH "W"

PART #	STUB	B	C
MC4500IEPP06T	6" (150 mm)	42.54" (1081 mm)	---
MC4500IEPP06B		---	0.86" (22 mm)
MC4500IEPP08T	8" (200 mm)	40.50" (1029 mm)	---
MC4500IEPP08B		---	1.01" (26 mm)
MC4500IEPP10T	10" (250 mm)	38.37" (975 mm)	---
MC4500IEPP10B		---	1.33" (34 mm)
MC4500IEPP12T	12" (300 mm)	35.69" (907 mm)	---
MC4500IEPP12B		---	1.55" (39 mm)
MC4500IEPP15T	15" (375 mm)	32.72" (831 mm)	---
MC4500IEPP15B		---	1.70" (43 mm)
MC4500IEPP18T	18" (450 mm)	29.36" (746 mm)	---
MC4500IEPP18TW			
MC4500IEPP18B		---	1.97" (50 mm)
MC4500IEPP18BW			
MC4500IEPP24T	24" (600 mm)	23.05" (585 mm)	---
MC4500IEPP24TW			
MC4500IEPP24B		---	2.26" (57 mm)
MC4500IEPP24BW			
MC4500IEPP30BW	30" (750 mm)	---	2.95" (75 mm)
MC4500IEPP36BW	36" (900 mm)	---	3.25" (83 mm)
MC4500IEPP42BW	42" (1050 mm)	---	3.55" (90 mm)

NOTE: ALL DIMENSIONS ARE NOMINAL



CUSTOM PREFABRICATED INVERTS ARE AVAILABLE UPON REQUEST. INVENTORIED MANIFOLDS INCLUDE 12-24" (300-600 mm) SIZE ON SIZE AND 15-48" (375-1200 mm) ECCENTRIC MANIFOLDS. CUSTOM INVERT LOCATIONS ON THE MC-7200 END CAP CUT IN THE FIELD ARE NOT RECOMMENDED FOR PIPE SIZES GREATER THAN 10" (250 mm). THE INVERT LOCATION IN COLUMN 'B' ARE THE HIGHEST POSSIBLE FOR THE PIPE SIZE.

2 MC-7200 TECHNICAL SPECIFICATION

INSPECTION & MAINTENANCE

STEP 1) INSPECT ISOLATOR ROW PLUS FOR SEDIMENT
- A. INSPECTION PORTS (IF PRESENT)
  - A.1. REMOVE/OPEN LID ON NYLOPLAST INLINE DRAIN
  - A.2. REMOVE AND CLEAN FLEXSTORM FILTER IF INSTALLED
  - A.3. USING A FLASHLIGHT AND STADIA ROD, MEASURE DEPTH OF SEDIMENT AND RECORD ON MAINTENANCE LOG
  - A.4. LOWER A CAMERA INTO ISOLATOR ROW PLUS FOR VISUAL INSPECTION OF SEDIMENT LEVELS (OPTIONAL)
  - A.5. IF SEDIMENT IS AT, OR ABOVE, 3" (80 mm) PROCEED TO STEP 2. IF NOT, PROCEED TO STEP 3.
- B. ALL ISOLATOR PLUS ROWS
  - B.1. REMOVE COVER FROM STRUCTURE AT UPSTREAM END OF ISOLATOR ROW PLUS
  - B.2. USING A FLASHLIGHT, INSPECT DOWN THE ISOLATOR ROW PLUS THROUGH OUTLET PIPE
    - i) MIRRORS ON POLES OR CAMERAS MAY BE USED TO AVOID A CONFINED SPACE ENTRY
    - ii) FOLLOW OSHA REGULATIONS FOR CONFINED SPACE ENTRY IF ENTERING MANHOLE
  - B.3. IF SEDIMENT IS AT, OR ABOVE, 3" (80 mm) PROCEED TO STEP 2. IF NOT, PROCEED TO STEP 3.

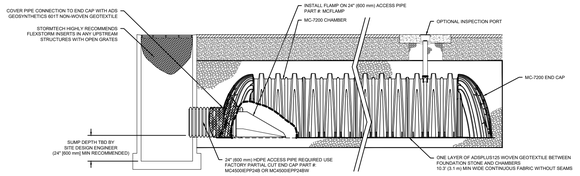
STEP 2) CLEAN OUT ISOLATOR ROW PLUS USING THE JETVAC PROCESS
- A. A FIXED CULVERT CLEANING NOZZLE WITH REAR FACING SPREAD OF 45° (1.1 m) OR MORE IS PREFERRED
- B. APPLY MULTIPLE PASSES OF JETVAC UNTIL BACKFLUSH WATER IS CLEAN
- C. VACUUM STRUCTURE SUMP AS REQUIRED

STEP 3) REPLACE ALL COVERS, GRATES, FILTERS, AND LIDS; RECORD OBSERVATIONS AND ACTIONS.

STEP 4) INSPECT AND CLEAN BASINS AND MANHOLES UPSTREAM OF THE STORMTECH SYSTEM.

NOTES

1. INSPECT EVERY 6 MONTHS DURING THE FIRST YEAR OF OPERATION. ADJUST THE INSPECTION INTERVAL BASED ON PREVIOUS OBSERVATIONS OF SEDIMENT ACCUMULATION AND HIGH WATER ELEVATIONS.
2. CONDUCT JETTING AND VACTORING ANNUALLY OR WHEN INSPECTION SHOWS THAT MAINTENANCE IS NECESSARY.



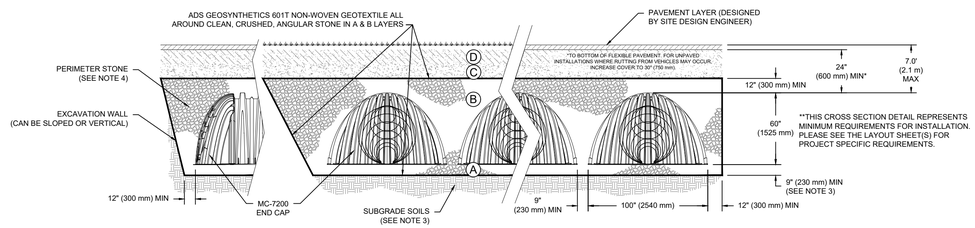
MC-7200 ISOLATOR ROW PLUS DETAIL
NTS

3 MC-7200 ISOLATOR ROW PLUS DETAIL

ACCEPTABLE FILL MATERIALS: STORMTECH MC-7200 CHAMBER SYSTEMS

	MATERIAL LOCATION	DESCRIPTION	AASHTO MATERIAL CLASSIFICATIONS	COMPACTION / DENSITY REQUIREMENT
D	**FINAL FILL:** FILL MATERIAL FOR LAYER 'D' STARTS FROM THE TOP OF THE 'C' LAYER TO THE BOTTOM OF FLEXIBLE PAVEMENT OR UNPAVED FINISHED GRADE ABOVE. NOTE THAT PAVEMENT SUBBASE MAY BE PART OF THE 'D' LAYER	ANY SOIL/ROCK MATERIALS, NATIVE SOILS, OR PER ENGINEER'S PLANS. CHECK PLANS FOR PAVEMENT SUBGRADE REQUIREMENTS.	N/A	PREPARE PER SITE DESIGN ENGINEER'S PLANS. PAVED INSTALLATIONS MAY HAVE STRINGENT MATERIAL AND PREPARATION REQUIREMENTS.
C	**INITIAL FILL:** FILL MATERIAL FOR LAYER 'C' STARTS FROM THE TOP OF THE EMBEDMENT STONE ('B' LAYER) TO 24" (600 mm) ABOVE THE TOP OF THE CHAMBER. NOTE THAT PAVEMENT SUBBASE MAY BE A PART OF THE 'C' LAYER.	GRANULAR WELL-GRADED SOIL/AGGREGATE MIXTURES, <35% FINES OR PROCESSED AGGREGATE. MOST PAVEMENT SUBBASE MATERIALS CAN BE USED IN LIEU OF THIS LAYER.	AASHTO M145[1] A-1, A-2-4, A-3 OR AASHTO M43[1] 3, 357, 4, 467, 5, 56, 57, 6, 67, 68, 7, 78, 8, 89, 9, 10	BEGIN COMPACTIONS AFTER 24" (600 mm) OF MATERIAL OVER THE CHAMBERS IS REACHED. COMPACT ADDITIONAL LAYERS IN 12" (300 mm) MAX LIFTS TO A MIN. 95% PROCTOR DENSITY FOR WELL GRADED MATERIAL AND 95% RELATIVE DENSITY FOR PROCESSED AGGREGATE MATERIALS.
B	**EMBEDMENT STONE:** FILL SURROUNDING THE CHAMBERS FROM THE FOUNDATION STONE ('A' LAYER) TO THE 'C' LAYER ABOVE.	CLEAN, CRUSHED, ANGULAR STONE OR RECYCLED CONCRETE[2]	AASHTO M43[1] 3, 357, 4, 467, 5, 56, 57	NO COMPACTION REQUIRED.
A	**FOUNDATION STONE:** FILL BELOW CHAMBERS FROM THE SUBGRADE UP TO THE FOOT (BOTTOM) OF THE CHAMBER.	CLEAN, CRUSHED, ANGULAR STONE OR RECYCLED CONCRETE[2]	AASHTO M43[1] 3, 357, 4, 467, 5, 56, 57	PLATE COMPACT OR ROLL TO ACHIEVE A FLAT SURFACE.[2,3]

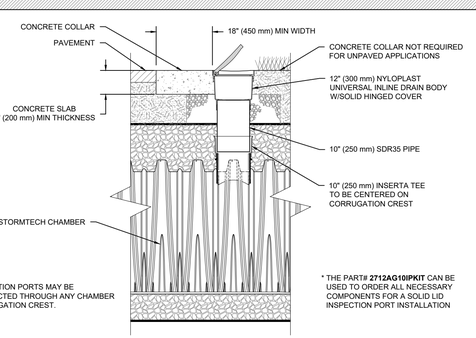
PLEASE NOTE:
1. THE LISTED AASHTO DESIGNATIONS ARE FOR GRADATIONS ONLY. THE STONE MUST ALSO BE CLEAN, CRUSHED, ANGULAR. FOR EXAMPLE, A SPECIFICATION FOR #4 STONE WOULD STATE; "CLEAN, CRUSHED, ANGULAR NO. 4 (AASHTO M43) STONE".
2. STORMTECH COMPACTION REQUIREMENTS ARE MET FOR 'A' LOCATION MATERIALS WHEN PLACED AND COMPACTED IN 9" (230 mm) (MAX) LIFTS USING TWO FULL COVERAGES WITH A VIBRATORY COMPACTOR.
3. WHERE INFILTRATION SURFACES MAY BE COMPROMISED BY COMPACTION, FOR STANDARD DESIGN LOAD CONDITIONS, A FLAT SURFACE MAY BE ACHIEVED BY RAKING OR DRAGGING WITHOUT COMPACTION EQUIPMENT. FOR SPECIAL LOAD DESIGNS, CONTACT STORMTECH FOR COMPACTION REQUIREMENTS.
4. ONCE LAYER 'C' IS PLACED, ANY SOIL/MATERIAL CAN BE PLACED IN LAYER 'D' UP TO THE FINISHED GRADE. MOST PAVEMENT SUBBASE SOILS CAN BE USED TO REPLACE THE MATERIAL REQUIREMENTS OF LAYER 'C' OR 'D' AT THE SITE DESIGN ENGINEER'S DISCRETION.
5. WHERE RECYCLED CONCRETE AGGREGATE IS USED IN LAYERS 'A' OR 'B' THE MATERIAL SHOULD ALSO MEET THE ACCEPTABILITY CRITERIA OUTLINED IN TECHNICAL NOTE 6.20 "RECYCLED CONCRETE STRUCTURAL BACKFILL".



NOTES:

1. CHAMBERS SHALL MEET THE REQUIREMENTS OF ASTM F2418, "STANDARD SPECIFICATION FOR POLYPROPYLENE (PP) CORRUGATED WALL STORMWATER COLLECTION CHAMBERS" CHAMBER CLASSIFICATION 60x101
2. MC-7200 CHAMBERS SHALL BE DESIGNED IN ACCORDANCE WITH ASTM F2787 "STANDARD PRACTICE FOR STRUCTURAL DESIGN OF THERMOPLASTIC CORRUGATED WALL STORMWATER COLLECTION CHAMBERS".
3. THE SITE DESIGN ENGINEER IS RESPONSIBLE FOR ASSESSING THE BEARING RESISTANCE (ALLOWABLE BEARING CAPACITY) OF THE SUBGRADE SOILS AND THE DEPTH OF FOUNDATION STONE WITH CONSIDERATION FOR THE RANGE OF EXPECTED SOIL MOISTURE CONDITIONS. REFERENCE STORMTECH DESIGN MANUAL FOR BEARING CAPACITY GUIDANCE.
4. PERIMETER STONE MUST BE EXTENDED HORIZONTALLY TO THE EXCAVATION WALL FOR BOTH VERTICAL AND SLOPED EXCAVATION WALLS.
5. REQUIREMENTS FOR HANDLING AND INSTALLATION:
   - TO MAINTAIN THE WIDTH OF CHAMBERS DURING SHIPPING AND HANDLING, CHAMBERS SHALL HAVE INTEGRAL, INTERLOCKING STACKING LUGS.
   - TO ENSURE A SECURE JOINT DURING INSTALLATION AND BACKFILL, THE HEIGHT OF THE CHAMBER JOINT SHALL NOT BE LESS THAN 3".
   - TO ENSURE THE INTEGRITY OF THE ARCH SHAPE DURING INSTALLATION, a) THE ARCH STIFFNESS CONSTANT SHALL BE GREATER THAN OR EQUAL TO 500 LBS/FT/%. THE ASC IS DEFINED IN SECTION 6.2.8 OF ASTM F2418. AND b) TO RESIST CHAMBER DEFORMATION DURING INSTALLATION AT ELEVATED TEMPERATURES (ABOVE 73° F / 23° C), CHAMBERS SHALL BE PRODUCED FROM REFLECTIVE GOLD OR YELLOW COLORS.

1 MC-7200 CROSS SECTION DETAIL

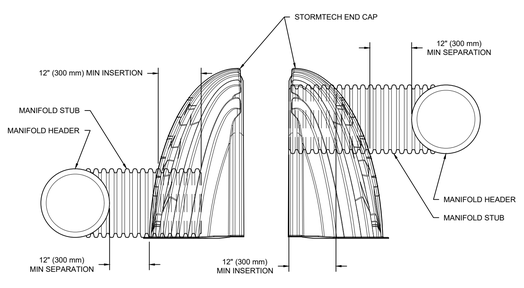


10" (250 mm) PVC INSPECTION PORT DETAIL (MC SERIES CHAMBER)
NTS

4 MC-7200 10" INSPECTION PORT DETAIL

MC-SERIES END CAP INSERTION DETAIL

NTS



NOTE: MANIFOLD STUB MUST BE LAID HORIZONTAL FOR A PROPER FIT IN END CAP OPENING.

6 MC-SERIES END CAP INSERTION DETAIL

DRAWN: JM | DATE: 05/25/2026
CHECKED: N/A | PROJECT #:
REV: | NOT TO SCALE

TRUCK YARD

LONE TREE, CO, USA

StormTech® Chamber System

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SHEET 1 OF 1

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