DECEMBER 9, 2014

SUPPLEMENTAL DRAINAGE CALCULATIONS

FOR

THE LEGENDS AT HIGH DESERT

Cortaderia St. & Academy Rd. NE

BY

ISAACSON & ARFMAN, P.A.

Consulting Engineering Associates

Thomas O. Isaacson, PE & LS [Ret.]
Fred C. Arfman, PE
Åsa Nilsson-Weber, PE

I&A Project No. 2044

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Åsa Nilsson-Weber 12-09-14

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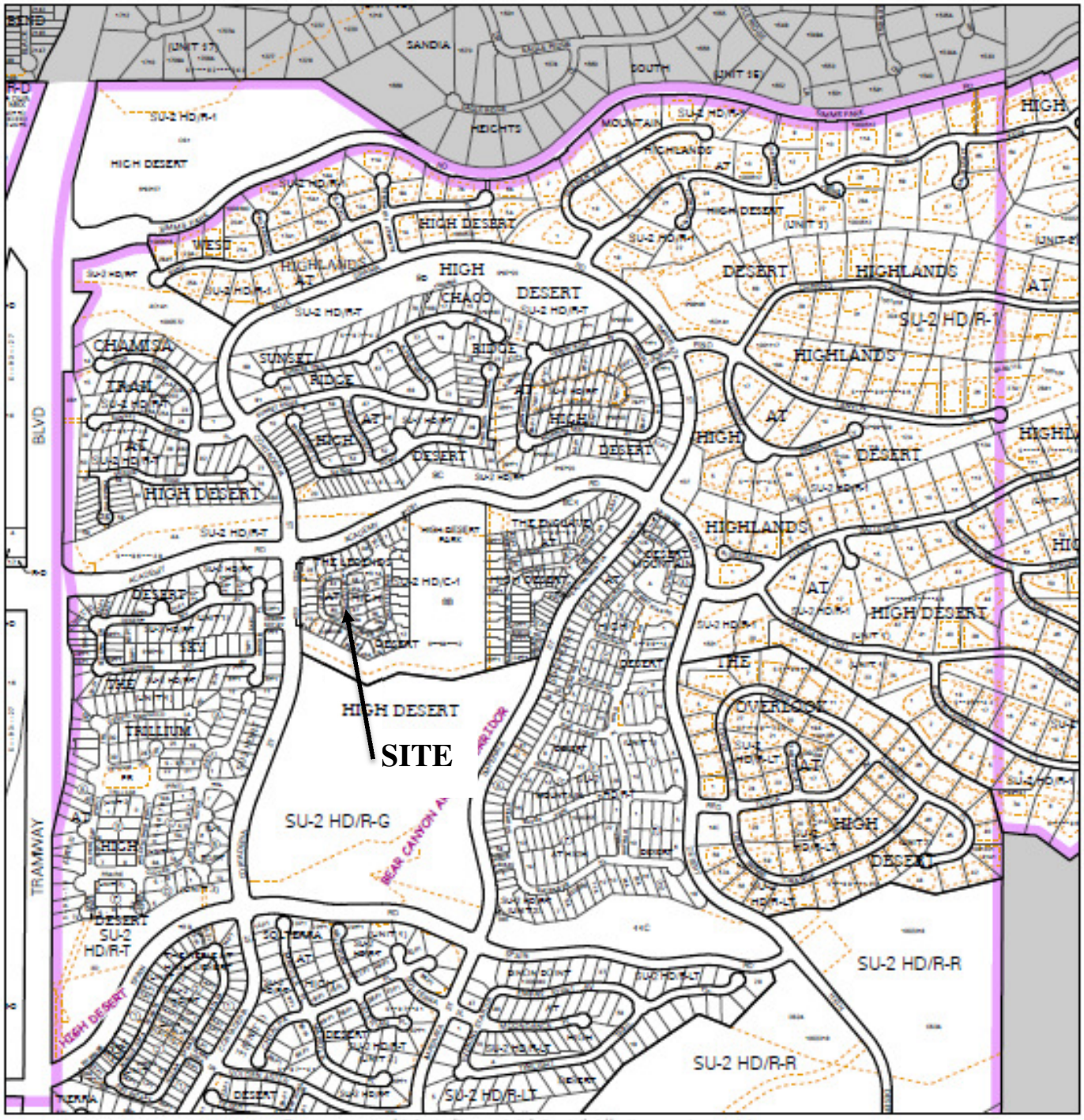
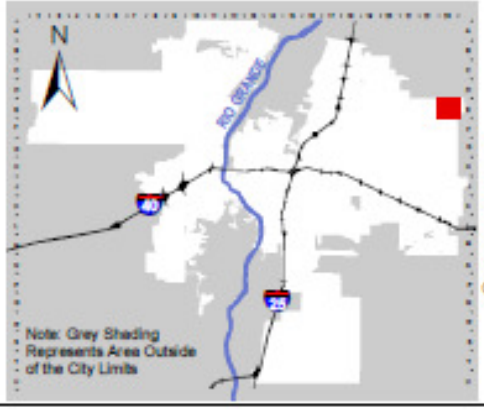


For more current information and details visit: http://www.cabq.gov/gis

AGIS
Albuquerque Geographic Information System

Map amended through: 1/10/2013



Zone Atlas Page:

E-23-Z

Selected Symbols

- SECTOR PLANS
- Design Overlay Zones
- City Historic Zones
- H-1 Buffer Zone
- Petroglyph Mon.
- Escarpment
- 2 Mile Airport Zone
- Airport Noise Contours
- Wall Overlay Zone

0 750 1,500 Feet

PROJECT INFORMATION

LEGAL DESCRIPTION:	The Legends at High Desert
ENGINEER:	Isaacson & Arfman, P.A. 128 Monroe Street NE Albuquerque, NM 87108 (505) 268-8828 Attn: Åsa Nilsson-Weber
SURVEYOR:	Cartesian Surveys, Inc. (505) 896-3050 Attn: Will Plotner
DEVELOPER:	Las Ventanas Homes, LLC PO Box 10660 Albuquerque, NM 87184 (505) 362-6824 Attn: Scott Ashcraft

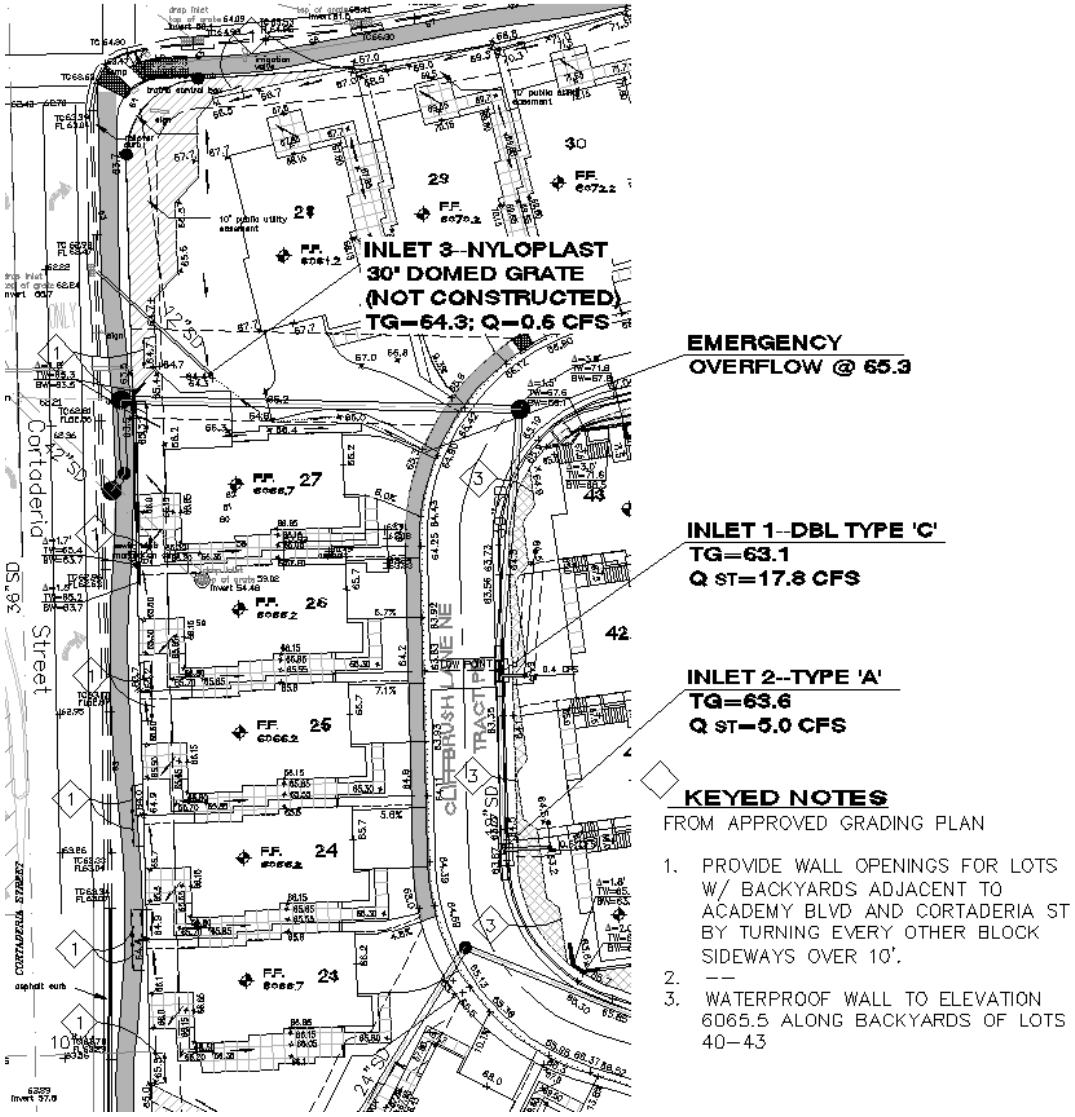
I. INTRODUCTION

The proposed site is located southeast of the intersection of Academy Rd and Cortaderia St. High Desert Park bounds the site to the south and to the east. The drainage report for the subdivision development was prepared by Isaacson & Arfman in September 2005.

This report will analyze the emergency overflow in case the sump inlet in Cliffbrush Ln. clogs.

II. EXISTING CONDITIONS

There is a double Type 'C' sump inlet (Inlet 1) and an upstream Type 'A' inlet (Inlet 2) in Cliffbrush Ln. The intent of the grading plan was to provide emergency overflow via a back-up inlet (Inlet 3) located on Lot 28 with a 12-inch pipe connecting to an inlet in Cortaderia St. along with wall openings in the Cortaderia St. perimeter wall. The 12-inch storm drain has been constructed, but the inlet and wall openings have not been constructed. The wall openings adjacent to Cortaderia St. and Academy Rd. for lots 23-34 have not been constructed either.



GRADING PLAN EXHIBIT

III. PROPOSED CONDITIONS

The inlets were analyzed for two scenarios with the grates being clogged to various degrees. The table below summarizes the inlet and wall opening capacities based on the overflow elevation of 65.3 for the emergency overflow condition (see Appendix A for calculations).

INLET CAPACITIES

SCENARIO 1 - Normal Condition

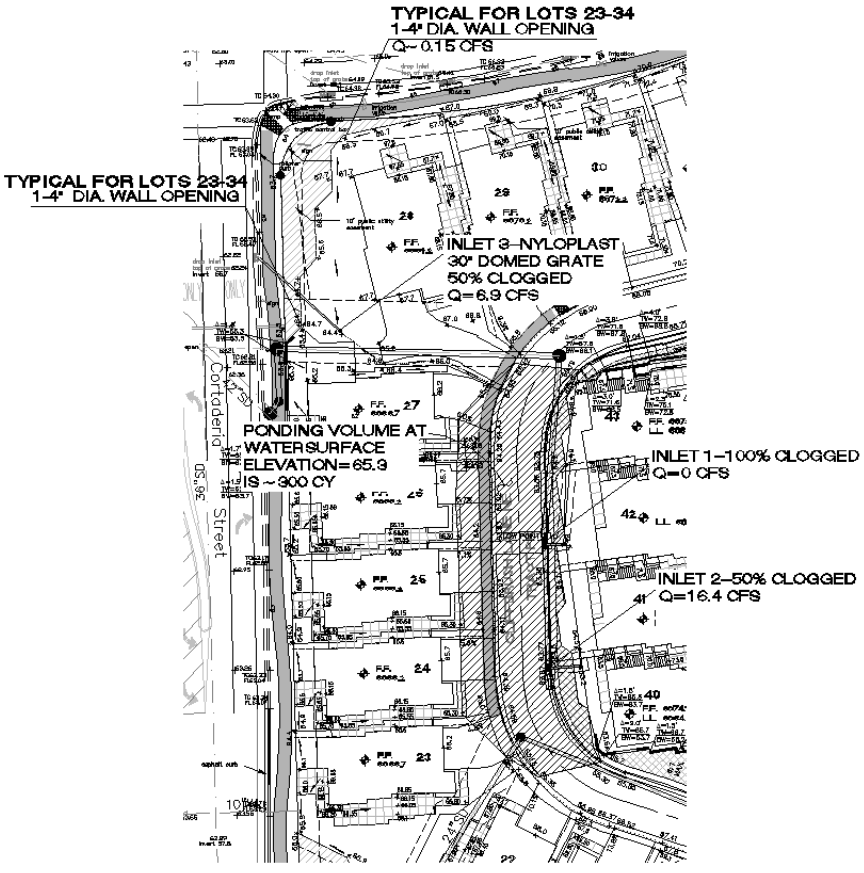
INLET 1 - 50% CLOGGED	17.8	cfs	(sump @ 0.5' head)	
INLET 2 - 0% CLOGGED	5.5	cfs	(on grade)	
	23.3	cfs	Actual=22.8	cfs

SCENARIO 2 -Emergency Overflow Condition

INLET 1 - 100% CLOGGED	0	cfs		
INLET 2 - 50% CLOGGED	16.4	cfs	(sump)	
INLET 3 50% CLOGGED	6.9	cfs	(sump)	
4" DIA. WALL OPENING - 50% CLOGGED	0.4	cfs		
	23.7	cfs	Actual=23.4	cfs

Scenario 1 shows the "normal condition" at a water depth of 0.5' at the sump inlet.

Scenario 2 shows that if the street sump inlet (#1) is completely clogged, the flows will be captured by the upstream street inlet (#2), inlet (#3) and the wall opening on Lot 28—all emergency overflow inlets and wall opening assumed 50% clogged.



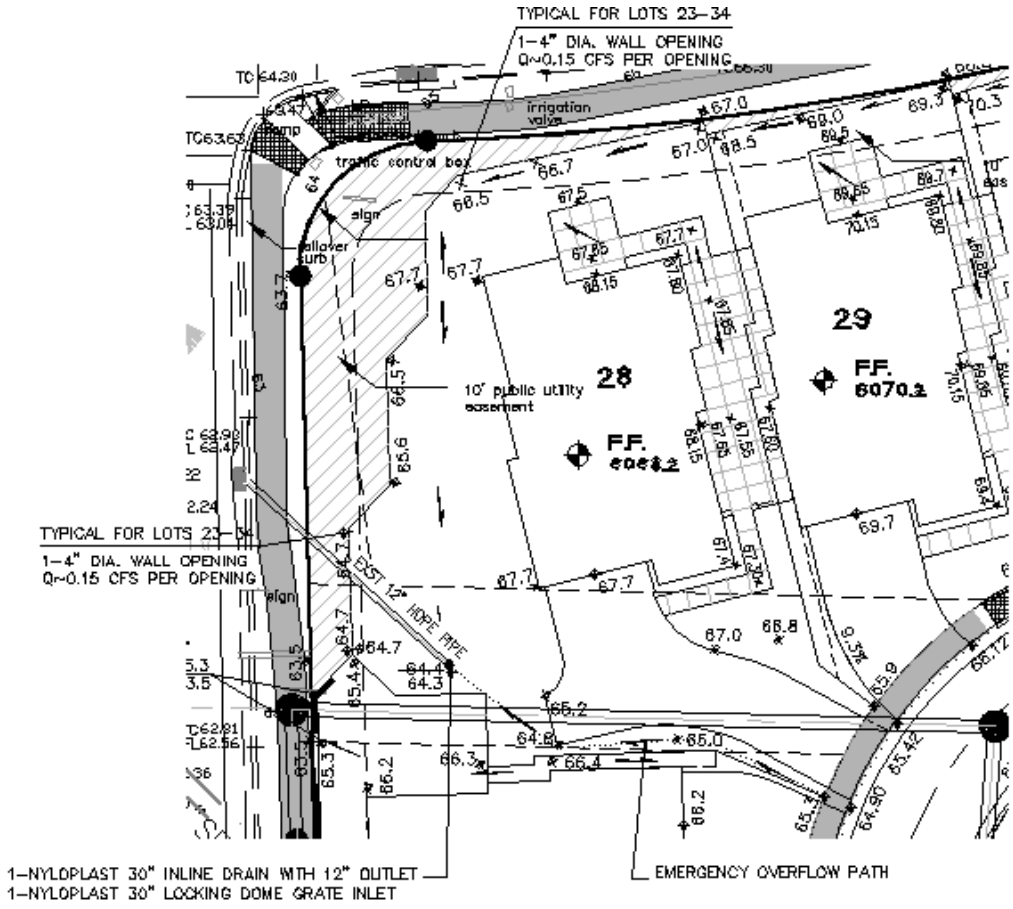
SCENARIO 2

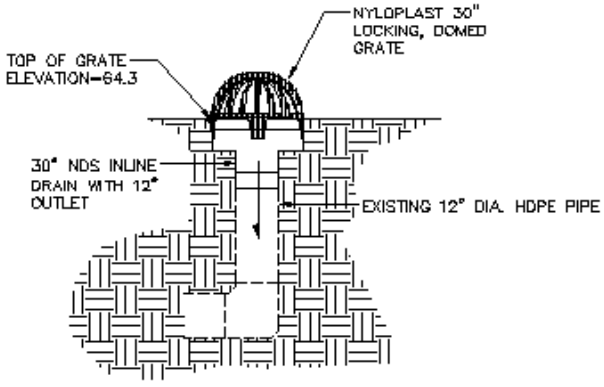
There is also a storage volume of approximately 8,000 cubic feet in the street should the water rise to the emergency overflow elevation of 65.3.

The 30" domed grate, emergency overflow path and 4" dia. wall opening on Lot 28 adjacent to the domed grate inlet (#3) shall be constructed prior to grading certification for lots 23-28.

The 4" dia backyard wall openings on lots 23-34 shall also be constructed on each lot prior to grading certification for each lot.

See below for an enlarged view of Lot 28 grading and inlet detail.





IN-LINE DRAIN WITH DOMED GRATE

IV. SUMMARY

In case the double type ‘C’ sump inlet in Cliffbrush Ln. would completely clog, the upstream Type ‘A’ inlet and the domed grate inlet on Lot 28 (both inlets assumed 50% clogged), the 4” diameter wall opening (assumed 50% clogged) along with ponding in the street would capture the flows.

The 30” domed grate inlet, emergency overflow path and 4” dia. wall opening on Lot 28 adjacent to the domed grate inlet (#3) shall be constructed prior to grading certification for lots 23-28.

The backyard wall openings (4” dia.) on lots 23-34 shall also be constructed on each lot prior to grading certification for that lot.

APPENDIX A

Calculations

- **Wall Opening Capacity Calculations**
- **Inlet Capacity Calculations**
- **Hydraflow Storm Sewer Calculations**
  - **12” storm drain calculations**
  - **18”–30” storm drain calculations**

LEGENDS AT HIGH DESERT

4" Dia. Wall opening--Applies to Lots 23-34. Actual Q=0.15 cfs per opening

Assumed 0.2' from midpoint of wall opening to wsel

ORIFICE EQUATION - WALL OPENING 4" dia. opening

Q = C*A * (2*g*h) ^ 0.5
Where

C	=	0.6		
A	=	0.3490659	sq.ft.	
g	=	32.2	ft/sec^2	
h	=	0.2	ft	depth of flow at opening from the center of culvert

Using orifice equation Q=CA * (2gh)^0.5 **Q = 0.75 cfs per wall opening**

SUMP INLET CALCULATIONS

GRATE OPEN AREA:
(per COA std dwg #2220, single grate)

GROSS AREA FOR ONE GRATE =	(25 in/12)(40 in/12) =	6.94 SF
LESS BEARING BARS =	(0.5 in/12)(3.33 ft)(13) =	1.80 SF
LESS CROSS BARS =	(0.5 in/12)(7)[(25 in/12)-(13)(0.5 in/12)] =	0.45 SF
	GRATE OPEN AREA (assuming 0% clogging factor) =	**4.69 SF**
	GRATE OPEN AREA (assuming 50% clogging factor) =	***2.35 SF***

ORIFICE EQUATION:

$$Q = CA(2gh)^{1/2}$$

Where:

C =	0.67	
A =	2.35 ft^2	50% clogging
A =	4.69 ft^2	0% clogging
g =	32.2 ft/sec^2	
h =	height of the water surface above the grate	

ELEVATION AT OVERFLOW=65.3

TOP GRATE INLET 1=63.1	HEAD INLET 1=	2.2'	Q=17.8 cfs street	0.4 cfs
TOP GRATE INLET 2=63.6	HEAD INLET 2=	1.7'	Q= 5.0 cfs street	0.5 cfs
			Q=22.8 cfs total street	
			Q=23.7 cfs total SD (0.9 cfs from Lots 40-43)	
TOP GRATE INLET 3=64.3	HEAD INLET 3=	1.0'	**Q=0.6 cfs (lot 28 yard)**	

Assuming a 50% clogging factor

CAPACITY CALCULATIONS:

INLET # 1
LOCATION: CLIFFBRUSH LN - NORTH TYPE DBL 'C' SUMP INLET

h =	0.50 ft	
$Q_{(capacity)}$ =	8.92 cfs	
# Grates =	2	
Total $Q_{(capacity)}$ =	17.8 cfs	with 50% clogging factor

INLET # 2
LOCATION: CLIFFBRUSH LN - SOUTH ON-GRADE TYPE 'A' INLET
ACTING AS A SUMP INLET IF INLET 1 IS 100% CLOGGED

h =	1.70 ft	
$Q_{(capacity)}$ =	16.44 cfs	
# Grates =	1	
Total $Q_{(capacity)}$ =	16.4 cfs	with 50% clogging factor

INLET # 3
LOCATION: LOT 28 ESMT TYPE 'D' SUMP INLET (TG=64.3; WSEL=65.3)

h =	1.00 ft	
$Q_{(capacity)}$ =	13.80 cfs	**See Nyloplast Inlet Capacity Chart**
Total $Q_{(capacity)}$ =	6.9 cfs	with 50% clogging factor

INLET CAPACITIES

SCENARIO 1 - Normal Condition

INLET 1 - 50% CLOGGED	17.8 cfs	(sump @ 0.5' head)
INLET 2 - 0% CLOGGED	5.5 cfs	(on grade)
	23.3 cfs	Actual=22.8 cfs

SCENARIO 2 - Emergency Overflow Condition

INLET 1 - 100% CLOGGED	0 cfs	
INLET 2 - 50% CLOGGED	16.4 cfs	(sump)
INLET 3 50% CLOGGED	6.9 cfs	(sump)
4" DIA. WALL OPENING - 50% CLOGGED	0.4 cfs	
	23.7 cfs	Actual=23.4 cfs

Ponding Volume in street @ wsel=65.3 is 300 cy

Nyloplast Dome Grate Inlet Capacity Chart

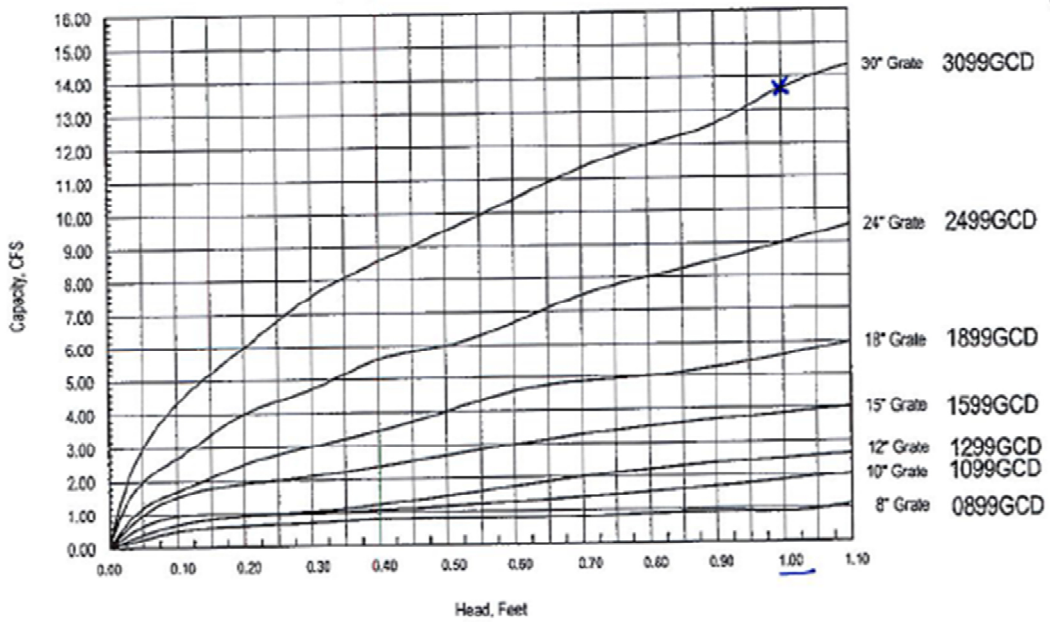
This chart is based on equations from the FAA Airport Drainage AC 150/5320-5B, 1970, Page 35. Certain assumptions have been made and no two installations will necessarily perform the same way. Safety factors should change with site conditions such that a safety factor 1.25 should be used for an inlet in pavement, and a safety factor of 2.0 should be used in turf areas.

Basin Outlet Pipe Size	Flow Rate CFS *
4"	0.229
6"	0.662
8"	1.441
10"	2.612
12"	4.152
15"	7.126
18"	12.163
24"	25.821
30"	52.173

* Maximum flow capacity before drain basin begins to backfill. Calculation based on an average pipe slope of 1%.

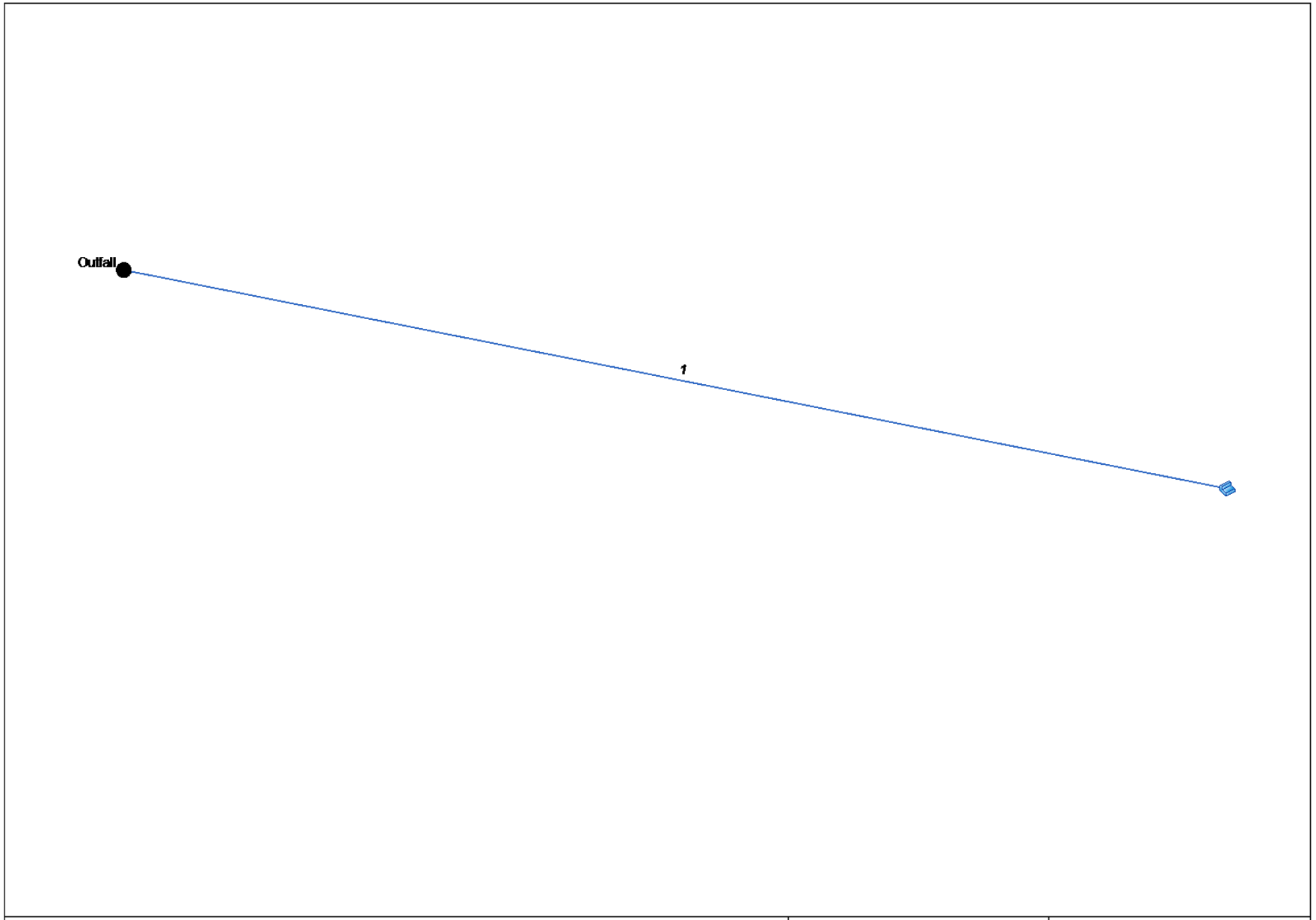
H = 1.0'
Q = 13.8 cfs
Q @ 50% clogged = 6.9 cfs.

Nyloplast Dome Grates 8" - 30"



DRAWN BY AWA	MATERIAL	Nyloplast	3130 VERONA AVE BUFORD, GA 30518 PHN (770) 932-2643 FAX (770) 932-2490 www.nyloplast-us.com
DATE 07MAR00			
APPD BY CJA	PROJECT NO./NAME GRATE / COVER	TITLE 8" - 30" DOME INLET CAPACITY	
DATE 07MAR00			
DWG SIZE A	SCALE 1:2 SHEET 1 OF 1	DWG NO. 7001-110-000	REV C

1454 12-inch sd



Project File: 1454 12-in SD.stm	Number of lines: 1	Date: 12/2/2014

Storm Sewer Summary Report

Line No.	Line ID	Flow rate (cfs)	Line Size (in)	Line shape	Line length (ft)	Invert EL Dn (ft)	Invert EL Up (ft)	Line Slope (%)	HGL Down (ft)	HGL Up (ft)	Minor loss (ft)	HGL Junct (ft)	Dns Line No.	Junction Type
1		6.90	12	Cir	51.500	55.90	61.40	10.680	58.90	62.37	n/a	62.37 j	End	Generic

Number of lines: 1 | Run Date: 12/8/2014

NOTES: Return period = 100 Yrs. ; j - Line contains hyd. jump.

Storm Sewer Tabulation

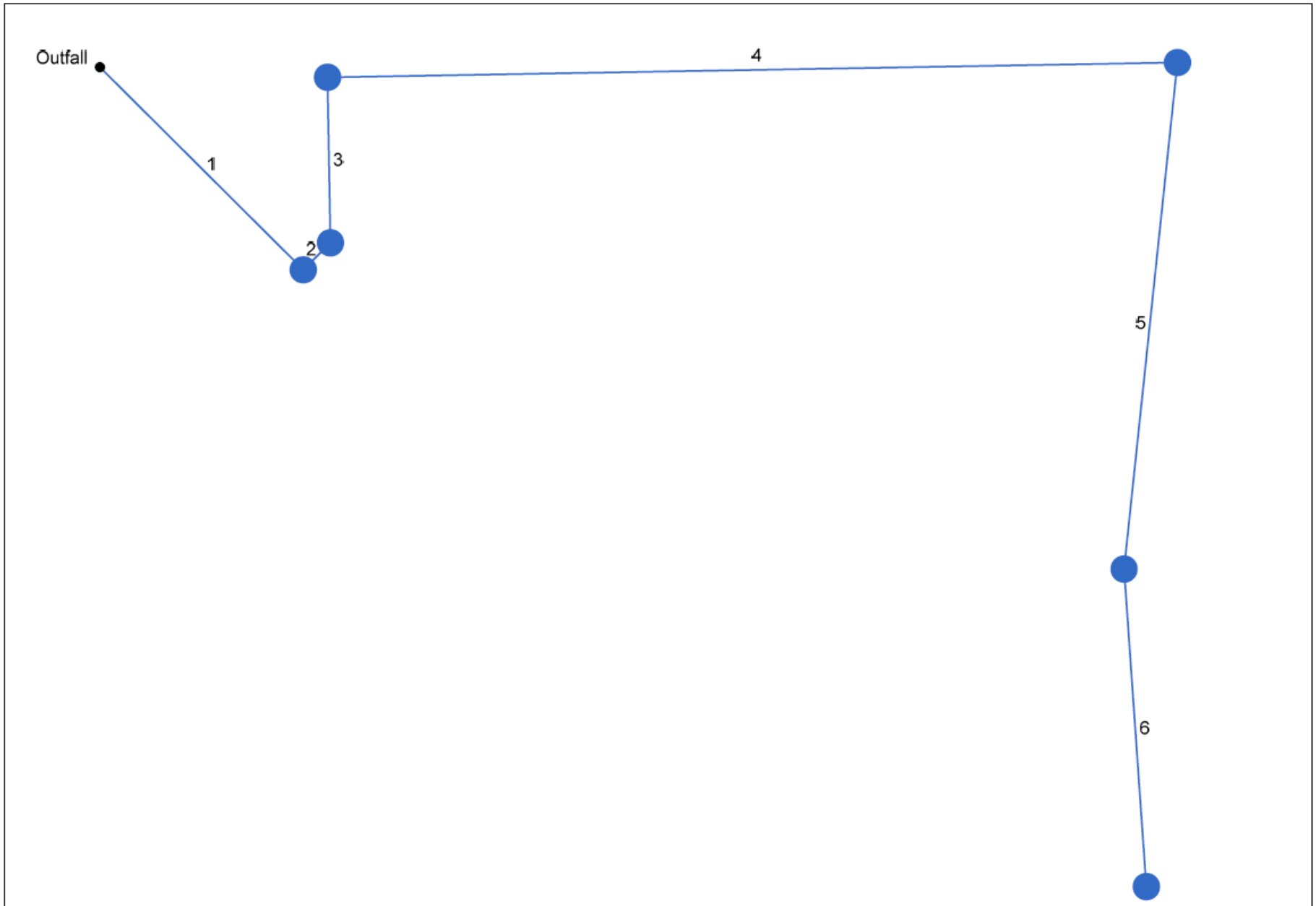
Station		Len	Drng Area		Rnoff coeff	Area x C		Tc		Rain (I)	Total flow	Cap full	Vel	Pipe		Invert Elev		HGL Elev		Grnd / Rim Elev		Line ID
Line	To Line	(ft)	Incr (ac)	Total (ac)	(C)	Incr	Total	Inlet (min)	Syst (min)	(in/hr)	(cfs)	(cfs)	(ft/s)	Size (in)	Slope (%)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	
1	End	51.500	0.00	0.00	0.00	0.00	0.00	0.0	0.0	0.0	6.90	11.64	8.82	12	10.68	55.90	61.40	58.90	62.37	62.20	64.40	

1454 12-inch sd

Number of lines: 1

Run Date: 12/8/2014

NOTES:Intensity = 127.16 / (Inlet time + 17.80) ^ 0.82 ; Return period =Yrs. 100 ; c = cir e = ellip b = box



Project File: 1454SDALT2NW.stm	Number of lines: 6	Date: 12/2/2014

Storm Sewer Summary Report

Line No.	Line ID	Flow rate (cfs)	Line Size (in)	Line shape	Line length (ft)	Invert EL Dn (ft)	Invert El. Up (ft)	Line Slope (%)	HGL Down (ft)	HGL Up (ft)	Minor loss (ft)	HGL Junct (ft)	Dns Line No.	Junction Type
1	EX MH-MH2A	16.40	42	Cir	45.000	6052.87	6053.32	0.999	6056.60	6056.61	0.05	6056.66	End	Manhole
2	MH2A-3A	16.40	30	Cir	6.000	6053.42	6053.54	2.002	6056.66*	6056.67*	0.13	6056.80	1	Manhole
3	MH3A-4A	16.40	30	Cir	26.000	6053.64	6054.42	2.999	6056.80	6056.83	0.18	6057.01	2	Manhole
4	MH4A-1	16.40	30	Cir	133.000	6054.52	6057.49	2.233	6057.01	6058.86	n/a	6058.86 j	3	Manhole
5	INLET 1	16.40	30	Cir	80.000	6057.59	6058.39	1.000	6058.86	6059.76	0.28	6060.04	4	Generic
6	INLET 2	16.40	18	Cir	50.000	6058.59	6059.40	1.620	6060.09*	6061.31*	1.34	6062.65	5	Generic

Number of lines: 6

Run Date: 12/2/2014

NOTES: Return period = 100 Yrs. ; *Surcharged (HGL above crown). ; j - Line contains hyd. jump.

Storm Sewer Tabulation

Station		Len	Drng Area		Rnoff coeff	Area x C		Tc		Rain (I)	Total flow	Cap full	Vel	Pipe		Invert Elev		HGL Elev		Grnd / Rim Elev		Line ID
Line	To Line	(ft)	Incr (ac)	Total (ac)	(C)	Incr	Total	Inlet (min)	Syst (min)	(in/hr)	(cfs)	(cfs)	(ft/s)	Size (in)	Slope (%)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	Dn (ft)	Up (ft)	
1	End	45.000	0.00	0.00	0.00	0.00	0.00	0.0	1.3	0.0	16.40	100.6	1.73	42	1.00	6052.87	6053.32	6056.60	6056.61	6062.21	6062.90	EX MH-MH2A
2	1	6.000	0.00	0.00	0.00	0.00	0.00	0.0	1.3	0.0	16.40	58.03	3.34	30	2.00	6053.42	6053.54	6056.66	6056.67	6062.90	6062.95	MH2A-3A
3	2	26.000	0.00	0.00	0.00	0.00	0.00	0.0	1.2	0.0	16.40	71.02	3.36	30	3.00	6053.64	6054.42	6056.80	6056.83	6062.95	6063.50	MH3A-4A
4	3	133.000	0.00	0.00	0.00	0.00	0.00	0.0	0.5	0.0	16.40	61.29	4.65	30	2.23	6054.52	6057.49	6057.01	6058.86	6063.50	6065.44	MH4A-1
5	4	80.000	0.00	0.00	0.00	0.00	0.00	0.0	0.1	0.0	16.40	41.02	6.26	30	1.00	6057.59	6058.39	6058.86	6059.76	6065.44	6063.08	INLET 1
6	5	50.000	0.00	0.00	0.00	0.00	0.00	0.0	0.0	0.0	16.40	13.37	9.28	18	1.62	6058.59	6059.40	6060.09	6061.31	6063.08	6063.59	INLET 2

Number of lines: 6

Run Date: 12/2/2014

NOTES:Intensity = 127.16 / (Inlet time + 17.80) ^ 0.82 ; Return period =Yrs. 100 ; c = cir e = ellip b = box