DRAINAGE REPORT

FOR THE CASALINI COMMERCIAL RETAIL DEVELOPMENT
AT E. HENDRI DE TONTI BLVD.
TONTITOWN, ARKANSAS

CDE Project No. 1044

February 2, 2015

LARGE SCALE DEVELOPMENT SUBMITTAL

REVISION 0

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FOR THE CASALINI COMMERCIAL RETAIL DEVELOPMENT
AT HENRI DE TONTI BLVD.
TONTITOWN, ARKANSAS

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DRAINAGE STUDY
FOR THE CASALINI COMMERCIAL RETAIL DEVELOPMENT
AT E. HENRI DE TONTI BLVD.
TONTITOWN, AR

INTRODUCTION

The proposed Casalini Court Commercial Development is proposed on Lot 1 of the Caslini Addition which contains 3.52 acres and is located along Henri De Tonti Blvd (US Highway 412) near the Maestri Road (US 112) intersection, as shown on the Vicinity Map (Appendix 1).

SITE DESCRIPTION

The site previously consisted of vegetative cover and is generally sloped to drain towards the north. Approximately 1.5-feet of topsoil was previously removed in some areas of the property. This will be backfilled with acceptable import material, as part of the proposed grading required for this project.

Only approximately 1.84 acre of the 3.52 acre property will be disturbed under this project.

No portion of the site is located within any regulatory flood plain, as indicated on the Flood Insurance Rate Map for Washington County Number 05143C0065F, effective May 16, 2008. Appendix 3 contains the Flood Insurance Map, and indicates the location of the site.

The hydrologic soil conditions of the site in the pre-development condition, is summarized in the following table:

Soil Group	Area (acre)	Curve Number
Captina	1.84	C
Total Area of Interest	**1.84**	

Appendix 2 contains the soil map for the area of interest.

RUNOFF CONTROL

A regional detention pond was constructed under the adjacent Iron Hand Liquor Store project. This detention pond was originally designed under the previously approved Casalini Commercial project that consisted of the entire 5.08 acre property (Lot 1 and Lot 2). Therefore this proposed project will provide a underground drainage system to convey the 100-year runoff amount to the detention pond.

DRAINAGE RESULTS – UNDERGROUND STORM DRAINAGE SYSTEM

The underground storm drainage system has been designed to convey drainage from the 100-year storm event without overflowing. Calculations for the 100-Year event are included in Appendix 7.

Clogging factors have been applied by reducing the inlet opening area by the appropriate clogging factor. The following table is a summary of clogging factors applied:

Inlet Type	Condition	Clogging Factor	Inlet Area or Length	Effective Area
Grate Inlet	Sag	0.5	2.7	1.35
Area Inlet	Sag	0.5	14.0	7.00

CONCLUSION

As indicated in this report, the post-developed runoff from the site will increase due to the addition of impervious area. However, appropriate drainage structures and improvements will be constructed to control the flow to prevent any downstream or upstream adverse impact from the developed site.

CERTIFICATION

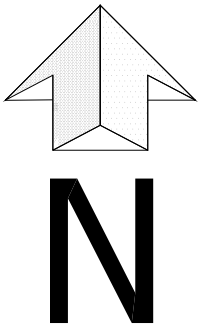
I, Ferdinand Fourie, Registered Professional Engineer No. 12538 in the State of Arkansas, hereby certify that the drainage studies, reports, calculations, designs, and specifications contained in this report have been prepared in accordance with the requirements of the City of Tontitown. Further, I hereby acknowledge that the review of the drainage studies, reports, calculations, designs, and specifications by the City of Tontitown or its representatives cannot and does not relieve me from any professional responsibility or liability.

02-03-15

Signed & Sealed

APPENDIX 1
VICINITY MAP

SITE LATITUDE: 36°10'35" N
SITE LONGITUDE: 94°13'05" W



VICINITY MAP

N.T.S.

APPENDIX 2
HYDROLOGIC SOIL MAP

Soil Map—Washington County, Arkansas
(CASALINI COMMERCIAL)

Map Scale: 1:674 if printed on A portrait (8.5" x 11") sheet.

N

Meters
0 5 10 20 30

Feet
0 30 60 120 180

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 15N WGS84

MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

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

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

Water Features
- Streams and Canals

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

Background
- Aerial Photography

MAP INFORMATION

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

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

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

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

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov
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: Washington County, Arkansas
Survey Area Data: Version 11, Sep 22, 2014

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

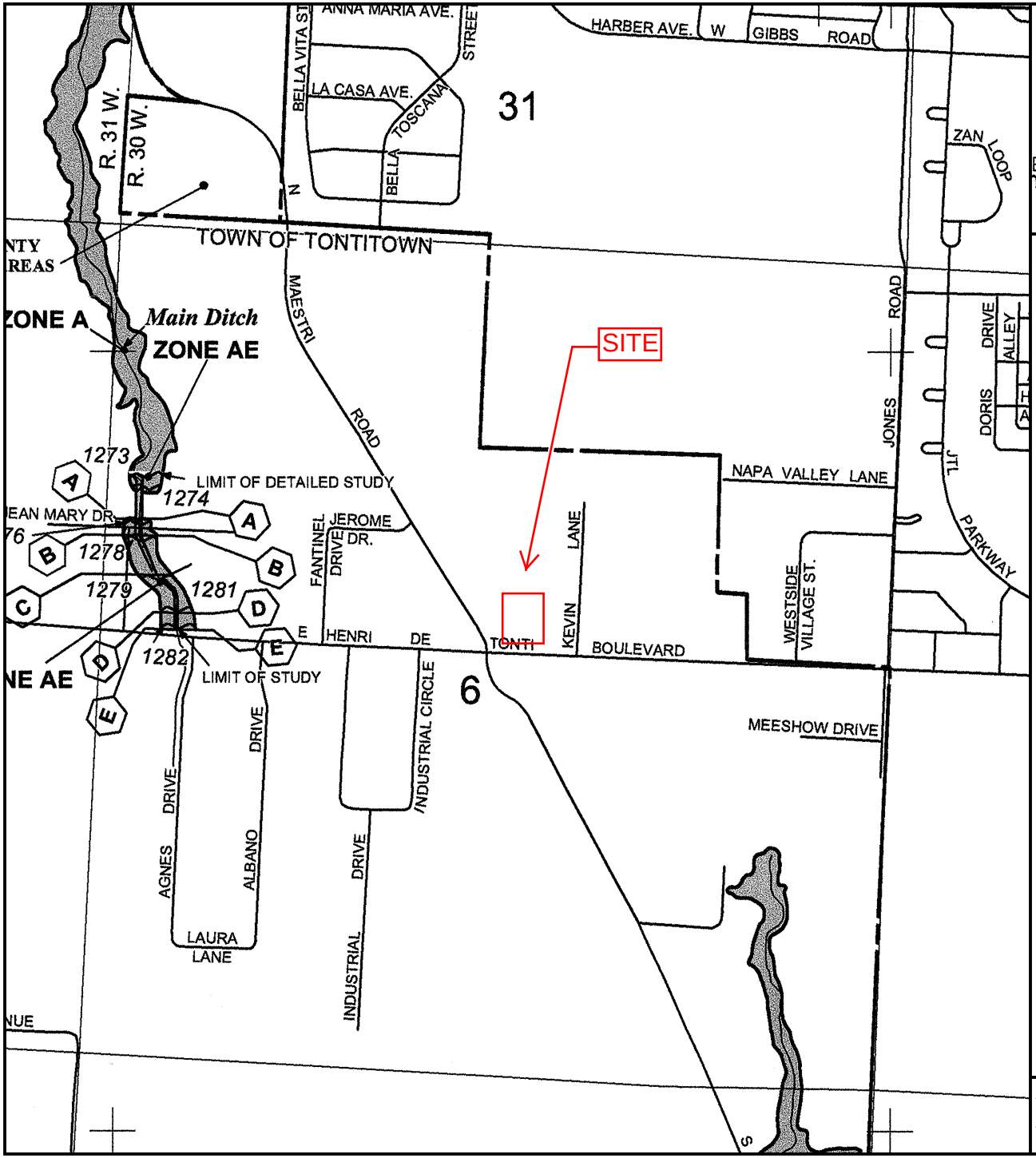
Date(s) aerial images were photographed: Sep 19, 2010—Oct 30, 2010

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

Map Unit Legend

Washington County, Arkansas (AR143)			
Map Unit Symbol	**Map Unit Name**	**Acres in AOI**	**Percent of AOI**
CaB	Captina silt loam, 1 to 3 percent slopes	1.8	100.0%
Totals for Area of Interest		**1.8**	**100.0%**

APPENDIX 3
FLOOD INSURANCE RATE MAP



MAP SCALE 1" = 1000'

500 0 1000 2000 FEET

00 0 300 600 M

NATIONAL FLOOD INSURANCE PROGRAM

PANEL 0065F

FIRM

FLOOD INSURANCE RATE MAP

WASHINGTON COUNTY, ARKANSAS

AND INCORPORATED AREAS

PANEL 65 OF 575

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
WASHINGTON COUNTY	050212	0065	F
JOHNSON, CITY OF	050218	0065	F
SPRINGDALE, CITY OF	050219	0065	F
TONTITOWN, TOWN OF	050293	0065	F

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

MAP NUMBER
05143C0065F

MAP REVISED
MAY 16, 2008

Federal Emergency Management Agency

APPENDIX 4

DRAINAGE MAP

N: 678485.145
E: 657893.377

S87°29'58"E 230.55'

P.O.B.

FLARED END SECTION
FL 1285.50

FLARED END SECTION (EXISTING)
FL 1285.50

20' B.S./U.E.

PLBTP, LLC.
±3.52 ACRES

137 LF 18" PIPE
@ 0.6% SLOPE

AREA INLET 1
24" FL IN 1289.90
24" FL OUT 1289.88
RIM 1292.90

W.D. 2011-00034280
P.N. 830-37575-000
ZONE C-2

18" RCP
@ 3.07% SLOPE

SHALLOW CONCENTRATED FLOW
180 LF @ 1.3% SLOPE

AREA INLET 1
0.67 ACRE
C = 0.9

SHALLOW CONCENTRATED FLOW
180 LF @ 1.2%

S02°32'57"W
165.80'

5/8" Rebar

S85°33'44"E
13.91'

S02°31'47"W
223.88'

RETAIL BUILDING
±12,620 SQ. FT. (GROSS)
FFE = 1297.20

LOT 1
±3.52 ACRE

EXISTING RETAIL BUILDING
FFE = 1297.00

LOADING

LOADING

CURB INLET
18" FL OUT 1291.50
RIM 1295.20

EXISTING CURB
INLET
18" FL OUT 1291.50
RIM 1295.20

LOT 2
±1.56 ACRE (NOT INCL DEDICATED ROW)
±0.04 ACRE DEDICATED ROW

177 LF 18" PIPE
@ 0.6% SLOPE

GRATE INLET 1
0.41 ACRE
C = 0.9

145 LF 18" PIPE
@ 1.0% SLOPE

GRATE INLET 2
18" FL OUT 1292.50
RIM 1295.50

SHALLOW CONCENTRATED
FLOW
150 LF @ 2.2%

GRATE INLET 1
18" FL IN 1291.00
18" FL OUT 1290.96
RIM 1295.20

GRATE INLET 3
0.44 ACRE
C=0.9

SHALLOW CONCENTRATED FLOW
156 LF @ 3.0% SLOPE

S02°28'09"W
265.18'

830-37582-000
SALERNO, ANTHONY F JR & CAROL
10176 Nichols Rd
Springdale AR 72762-4108

C-2

FIREHYDRANT
(APPROX LOC)

S87°28'44"E 165.45'

S87°27'38"E 254.45'

GRAPHIC SCALE

40 0 20 40

(IN FEET)
1 INCH = 40 FEET

SEAL:

STATE OF ARKANSAS
REGISTERED PROFESSIONAL ENGINEER
No. 12538
FERDINAND FOURIE

DATE: _____

CERTIFICATE OF AUTHORIZATION
CIVIL DESIGN ENGINEERS, INC.
#1642
ARKANSAS - ENGINEER

CASALINI COURT COMMERCIAL

TONTITOWN, AR

INLET MAP

SHEET:

SHEET NUMBER:
1

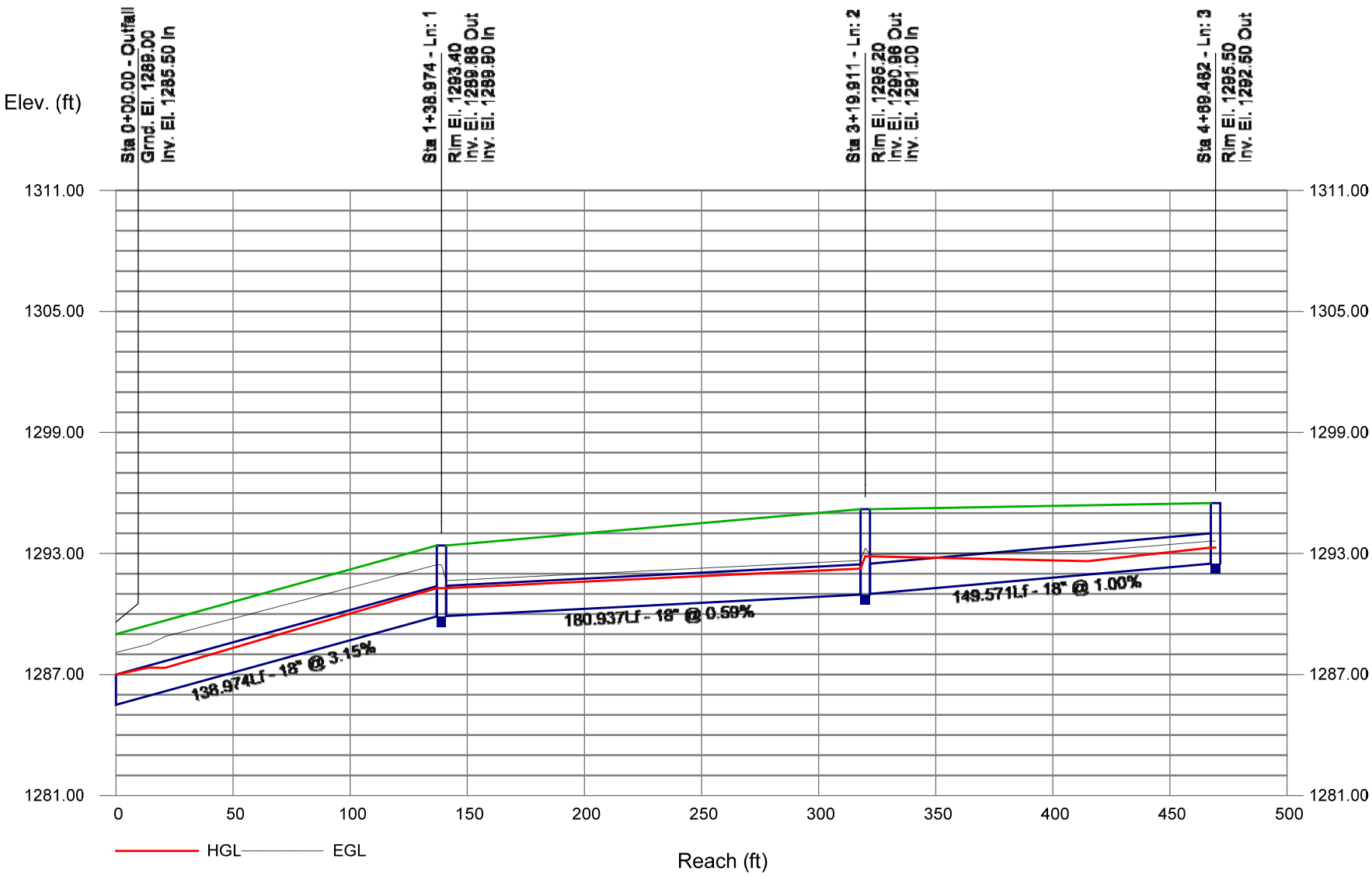
APPENDIX 5

UNDERGROUND STORM SYSTEM CALCULATIONS

Storm Sewer Profile

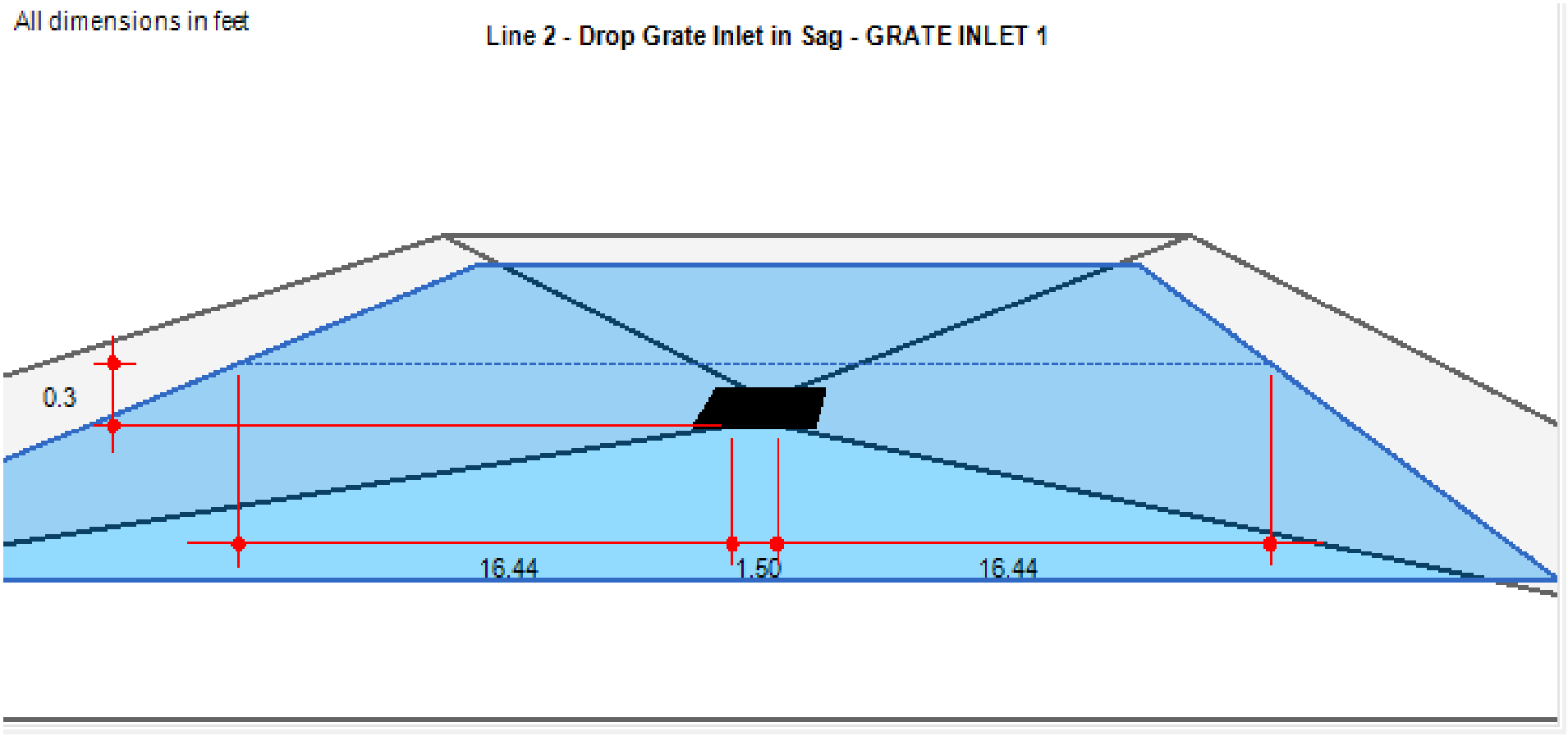
100-YEAR STORM EVENT

Proj. file: Storm2.stm



Inlet Section (Line 2 - Drop Grate Inlet) - GRATE INLET 1

All dimensions in feet

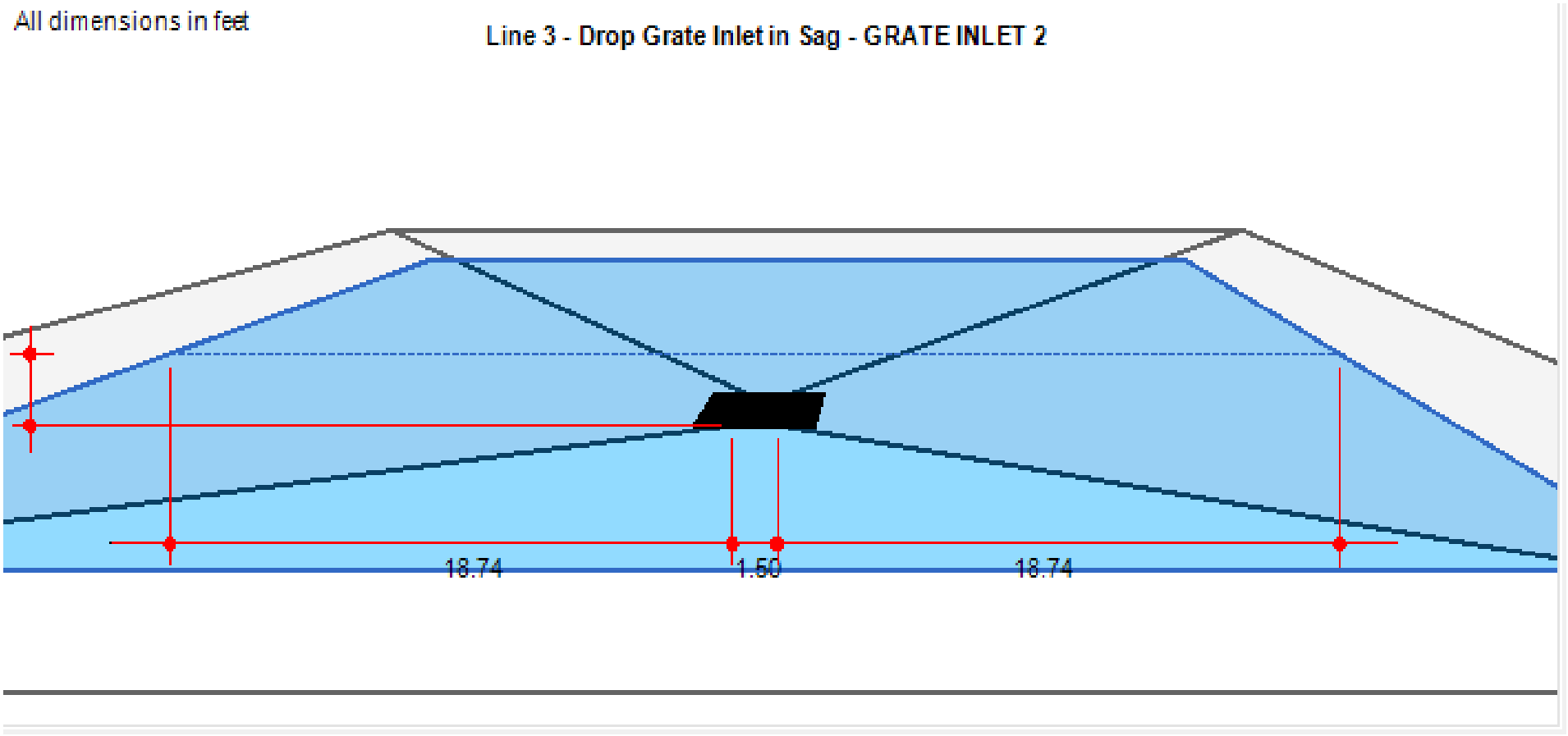


Line #	Q				Inlet			Gutter				Depth		Spread		Byp
	Catch (cfs)	Carry (cfs)	Capt (cfs)	Byp (cfs)	Length (ft)	Depr (in)	Area (sqft)	Width (ft)	Slope (ft/ft)	Sw (ft/ft)	Sx (ft/ft)	Gutter (ft)	Inlet (ft)	Gutter (ft)	Inlet (ft)	Line (ft)
2	4.00	0.00	4.00	0.00	4.00	....	1.35	1.50	Sag	0.020	0.020	0.30	0.30	34.37	34.37	Sag

Project File: | No. Lines: 3 | Run Date: 2/3/2015

Inlet Section (Line 3 - Drop Grate Inlet) - GRATE INLET 2

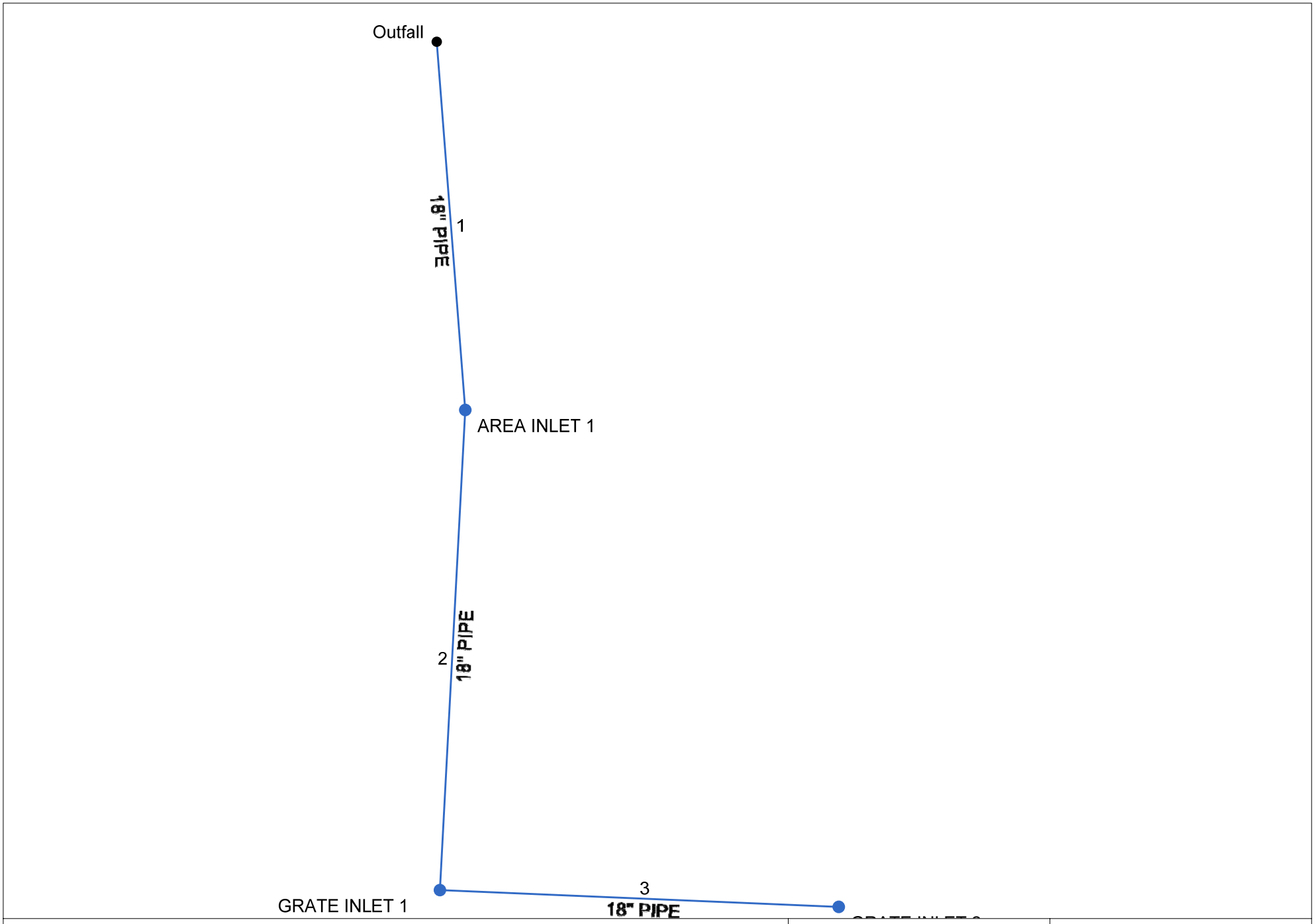
All dimensions in feet



Line #	Q				Inlet			Gutter				Depth		Spread		Byp
	Catch (cfs)	Carry (cfs)	Capt (cfs)	Byp (cfs)	Length (ft)	Depr (in)	Area (sqft)	Width (ft)	Slope (ft/ft)	Sw (ft/ft)	Sx (ft/ft)	Gutter (ft)	Inlet (ft)	Gutter (ft)	Inlet (ft)	Line (ft)
3	4.29	0.00	4.29	0.00	4.00	....	1.35	1.50	Sag	0.020	0.020	0.35	0.35	38.98	38.98	Sag

Project File: | No. Lines: 3 | Run Date: 2/3/2015

Hydraflow Storm Sewers Extension for AutoCAD® Civil 3D® 2012 Plan



Project File: Storm2.stm	Number of lines: 3	Date: 2/3/2015

Storm Sewer Inventory Report

Line No.	Alignment				Flow Data				Physical Data								Line ID
	Dnstr Line No.	Line Length (ft)	Defl angle (deg)	Junc Type	Known Q (cfs)	Drng Area (ac)	Runoff Coeff (C)	Inlet Time (min)	Invert El Dn (ft)	Line Slope (%)	Invert El Up (ft)	Line Size (in)	Line Shape	N Value (n)	J-Loss Coeff (K)	Inlet/ Rim El (ft)	
1	End	138.974	85.589	DrCrb	0.00	0.67	0.90	3.0	1285.50	3.15	1289.88	18	Cir	0.013	0.50	1293.40	18" PIPE
2	1	180.937	7.420	DrGrt	0.00	0.41	0.90	0.8	1289.90	0.59	1290.96	18	Cir	0.013	1.50	1295.20	18" PIPE
3	2	149.571	-90.591	DrGrt	0.00	0.44	0.90	0.7	1291.00	1.00	1292.50	18	Cir	0.013	1.00	1295.50	18" PIPE

Project File: Storm2.stm

Number of lines: 3

Date: 2/3/2015

Structure Report

Struct No.	Structure ID	Junction Type	Rim Elev (ft)	Structure			Line Out			Line In		
				Shape	Length (ft)	Width (ft)	Size (in)	Shape	Invert (ft)	Size (in)	Shape	Invert (ft)
1	AREA INLET 1	DropCurb	1293.40	Cir	4.00	4.00	18	Cir	1289.88	18	Cir	1289.90
2	GRATE INLET 1	DropGrate	1295.20	Cir	4.00	4.00	18	Cir	1290.96	18	Cir	1291.00
3	GRATE INLET 2	DropGrate	1295.50	Cir	4.00	4.00	18	Cir	1292.50			

Project File: Storm2.stm | Number of Structures: 3 | Run Date: 2/3/2015

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	18" PIPE	14.82	18	Cir	138.974	1285.50	1289.88	3.152	1287.00	1291.28	n/a	1291.28 j	End	DropCurb
2	18" PIPE	8.29	18	Cir	180.937	1289.90	1290.96	0.586	1291.28	1292.25	0.61	1292.86	1	DropGrate
3	18" PIPE	4.29	18	Cir	149.571	1291.00	1292.50	1.003	1292.86	1293.29	n/a	1293.29 j	2	DropGrate

Project File: Storm2.stm | Number of lines: 3 | Run Date: 2/3/2015

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	138.974	0.67	1.52	0.90	0.60	1.37	3.0	3.0	10.8	14.82	18.64	8.50	18	3.15	1285.50	1289.88	1287.00	1291.28	1289.00	1293.40	18" PIPE
2	1	180.937	0.41	0.85	0.90	0.37	0.77	0.8	1.5	10.8	8.29	8.04	4.99	18	0.59	1289.90	1290.96	1291.28	1292.25	1293.40	1295.20	18" PIPE
3	2	149.571	0.44	0.44	0.90	0.40	0.40	0.7	0.7	10.8	4.29	10.52	3.49	18	1.00	1291.00	1292.50	1292.86	1293.29	1295.20	1295.50	18" PIPE

Project File: Storm2.stm | Number of lines: 3 | Run Date: 2/3/2015

NOTES:Intensity = 42.64 / (Inlet time + 4.70) ^ 0.60; Return period =Yrs. 100 ; c = cir e = ellip b = box

Inlet Report

Line No	Inlet ID	Q = CIA (cfs)	Q carry (cfs)	Q capt (cfs)	Q Byp (cfs)	Junc Type	Curb Inlet		Grate Inlet			Gutter							Inlet			Byp Line No
							Ht (in)	L (ft)	Area (sqft)	L (ft)	W (ft)	So (ft/ft)	W (ft)	Sw (ft/ft)	Sx (ft/ft)	n	Depth (ft)	Spread (ft)	Depth (ft)	Spread (ft)	Depr (in)	
1	AREA INLET 1	6.53	0.00	6.53	0.00	DrCrb	6.0	7.00	0.00	0.00	0.00	Sag	0.00	0.020	0.020	0.013	0.46	22.87	0.46	22.87	0.0	Off
2	GRATE INLET 1	4.00	0.00	4.00	0.00	DrGrt	0.0	0.00	1.35	4.00	4.00	Sag	1.50	0.020	0.020	0.013	0.30	34.37	0.30	34.37	0.0	1
3	GRATE INLET 2	4.29	0.00	4.29	0.00	DrGrt	0.0	0.00	1.35	4.00	4.00	Sag	1.50	0.020	0.020	0.013	0.35	38.98	0.35	38.98	0.0	2

Project File: Storm2.stm

Number of lines: 3

Run Date: 2/3/2015

NOTES: Inlet N-Values = 0.016; Intensity = 42.64 / (Inlet time + 4.70) ^ 0.60; Return period = 100 Yrs. ; * Indicates Known Q added. All curb inlets are Horiz throat.

Storm Sewer Inlet Time Tabulation

Line No.	Line ID	Tc Method	Sheet Flow					Shallow Concentrated Flow					Channel Flow							Total Travel Time (min)
			n-Value	flow Length (ft)	2-yr 24h P (in)	Land Slope (%)	Travel Time (min)	flow Length (ft)	Water Slope (%)	Surf Descr	Ave Vel (ft/s)	Travel Time (min)	X-sec Area (sqft)	Wetted Perim (ft)	Chan Slope (%)	n-Value	Vel	flow Length (ft)	Travel Time (min)	
1	18" PIPE	TR55						180.00	1.30	UnPaved	1.84	1.63								
								180.00	1.20	Paved	2.23	1.35								2.98
2	18" PIPE	TR55						150.00	2.20	Paved	3.02	0.83								0.83
3	18" PIPE	TR55						156.00	3.00	Paved	3.52	0.74								0.74

Project File: Storm2.stm | Min. Tc used for intensity calculations = 5 min | Number of lines: 3 | Date: 2/3/2015

Hydraulic Grade Line Computations

Line	Size	Q	Downstream								Len	Upstream								Check		JL coeff	Minor loss
			Invert elev (ft)	HGL elev (ft)	Depth (ft)	Area (sqft)	Vel (ft/s)	Vel head (ft)	EGL elev (ft)	Sf (%)		Invert elev (ft)	HGL elev (ft)	Depth (ft)	Area (sqft)	Vel (ft/s)	Vel head (ft)	EGL elev (ft)	Sf (%)	Ave Sf (%)	Enrgy loss (ft)		
(1)	(in) (2)	(cfs) (3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(ft) (12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)	(K) (23)	(ft) (24)
1	18	14.82	1285.50	1287.00	1.50	1.72	8.39	1.09	1288.09	1.993	138.974	1289.88	1291.28 j	1.40**	1.72	8.62	1.16	1292.44	1.722	1.857	n/a	0.50	n/a
2	18	8.29	1289.90	1291.28	1.38	1.70	4.86	0.37	1291.65	0.540	180.937	1290.96	1292.25	1.29	1.62	5.12	0.41	1292.66	0.575	0.558	1.009	1.50	0.61
3	18	4.29	1291.00	1292.86	1.50	1.77	2.43	0.09	1292.96	0.167	149.571	1292.50	1293.29 j	0.79**	0.94	4.54	0.32	1293.61	0.559	0.363	n/a	1.00	0.32

Project File: Storm2.stm | Number of lines: 3 | Run Date: 2/3/2015

Notes: ; ** Critical depth.; j-Line contains hyd. jump. ; c = cir e = ellip b = box

Hydraflow HGL Computation Procedure

General Procedure:

Hydraflow computes the HGL using the Bernoulli energy equation. Manning's equation is used to determine energy losses due to pipe friction. In a standard step, iterative procedure, Hydraflow assumes upstream HGLs until the energy equation balances. If the energy equation cannot balance, supercritical flow exists and critical depth is temporarily assumed at the upstream end. A supercritical flow Profile is then computed using the same procedure in a downstream direction using momentum principles.

Col. 1 The line number being computed. Calculations begin at Line 1 and proceed upstream.

Col. 2 The line size. In the case of non-circular pipes, the line rise is printed above the span.

Col. 3 Total flow rate in the line.

Col. 4 The elevation of the downstream invert.

Col. 5 Elevation of the hydraulic grade line at the downstream end. This is computed as the upstream HGL + Minor loss of this line's downstream line.

Col. 6 The downstream depth of flow inside the pipe (HGL - Invert elevation) but not greater than the line size.

Col. 7 Cross-sectional area of the flow at the downstream end.

Col. 8 The velocity of the flow at the downstream end, (Col. 3 / Col. 7).

Col. 9 Velocity head (Velocity squared / 2g).

Col. 10 The elevation of the energy grade line at the downstream end, HGL + Velocity head, (Col. 5 + Col. 9).

Col. 11 The friction slope at the downstream end (the S or Slope term in Manning's equation).

Col. 12 The line length.

Col. 13 The elevation of the upstream invert.

Col. 14 Elevation of the hydraulic grade line at the upstream end.

Col. 15 The upstream depth of flow inside the pipe (HGL - Invert elevation) but not greater than the line size.

Col. 16 Cross-sectional area of the flow at the upstream end.

Col. 17 The velocity of the flow at the upstream end, (Col. 3 / Col. 16).

Col. 18 Velocity head (Velocity squared / 2g).

Col. 19 The elevation of the energy grade line at the upstream end, HGL + Velocity head, (Col. 14 + Col. 18) .

Col. 20 The friction slope at the upstream end (the S or Slope term in Manning's equation).

Col. 21 The average of the downstream and upstream friction slopes.

Col. 22 Energy loss. Average Sf/100 x Line Length (Col. 21/100 x Col. 12). Equals (EGL upstream - EGL downstream) +/- tolerance.

Col. 23 The junction loss coefficient (K).

Col. 24 Minor loss. (Col. 23 x Col. 18). Is added to upstream HGL and used as the starting HGL for the next upstream line(s).

APPENDIX 6

REFERENCE INFORMATION

DRAINAGE METHODS

Watershed Size Applicability for Peak Runoff Calculations

Watershed Size (acres)	Applicable Drainage Method
0 to 30	Rational Method
30 to 2000	SCS Method
2000 +	Computer models (such as HEC-HMS, TR-20, or equivalent)

Rational Method

- Refer to Section 2.0 for more detailed information/explanation
- Rational Method Formula: $Q = k_i * C * I * A$
- Refer to Table RO-2, Table RO-3, and Table RO-4 for more detailed information

Runoff Coefficient, C, for Specific Rogers Zoning

Rogers Zoning	Description	Runoff Coefficient, C
A-1	Agricultural	0.40
R-E	Residential Estate	0.45
R-SF	Residential Single Family	0.55
R-AF	Residential Affordable Housing	0.60
R-DP	Residential Duplex and Patio Home	0.65
R-MF	Residential MultiFamily	0.75
N-R	Neighborhood Residential	0.60
R-MHC	Manufactured Home Community	0.70
R-RVP	Recreational Vehicle	0.70
R-O	Residential Office	0.80
O	Office	0.90
C-1	Central Business District	0.90
C-2	Highway Commercial	0.90
C-3	Neighborhood Commercial	0.80
C-4	Open Display Commercial	0.90
W-O	Warehouse Office	0.90
I-1	Light Industrial	0.90
I-2	Heavy Industrial	0.95
CU	Condominium Unit	0.80
Church		0.80
School		0.80
Park		0.40
Cemetery		0.40