STORMWATER MANAGEMENT REPORT

Ball & Socket Arts
493 West Main Street
Cheshire, Connecticut

May 19, 2014

MMI #5233-01

Existing Conditions

The project site is the former Ball & Socket Manufacturing Company. It is a 3.29-acre parcel located at 493 West Main Street in the town of Cheshire, Connecticut, which abuts the Farmington Canal to the west, West Main Street to the north, Willow Street to the east, and residential properties to the south. The fully developed site consists of a large manufacturing building, five smaller storage buildings and garages, and several parking areas with interconnected driveways.

Currently, stormwater is discharged to the Farmington Canal via both overland flow and an existing drainage system with several discharge points. The existing system is in poor condition and appears to be inadequate to capture and route most storm events.

Proposed Conditions

The project proposes to renovate the main manufacturing building and selectively remove a couple of the smaller buildings. There will also be improvements to pedestrian walkways, driveway circulation, and the parking lot layout including a new parking lot added to the southern section of the parcel.

Most of the existing on-site stormwater drainage network will be completely removed, and a new system will be constructed. The new system will include adding two more discharge points into the Farmington Canal while continuing to utilize the existing discharge points to maintain the

current drainage patterns as much as possible. Stormwater runoff from the parking lots and driveways will be routed to the new discharge points while most of the roof leaders will continue to drain to the existing discharge points.

The proposed stormwater management system includes a small underground detention area and water quality control measures. The detention area will provide peak flow attenuation for the 2-, 10-, 25-, 50-, and 100-year storm events and provide water quality by settling out sediment in the stone base. Additional water quality will be provided by two hydrodynamic separators added prior to the discharges from the parking lot and driveway areas. The hydrodynamic separators will be sized using the water quality flow rate as stated in the *2004 Connecticut Stormwater Quality Manual*.

Analysis Point A (AP-A) was used as the point of analysis for the existing and proposed peak flow rates. AP-A is located in the Farmington Canal at the edge of the southern property line. Under the postdevelopment condition, there was a slight increase in the impervious coverage on site. To mitigate this increase, a small underground detention area will be constructed beneath the area of proposed additional parking. The table below lists the anticipated peak flow rates for the predevelopment and postdevelopment conditions of each storm event.

AP-A (Farmington Canal):

Peak Flow Rates (cfs*)

Storm Frequency (years)	2	10	25	50	100
Predevelopment	6.6	11.2	12.8	14.6	16.8
Postdevelopment	6.5	10.8	12.3	14.1	16.2

*cfs = cubic feet per second

The principal method of predicting the surface water runoff rates utilized in this analysis is a computer program entitled *Hydraflow Hydrographs Extension for AutoCAD Civil 3D 2014,* by

Autodesk, Inc., Version 10.3. The *Hydrographs* program is a computer model that utilizes the methodologies set forth in the *Technical Release No. 55* (TR-55).

Stormwater runoff from the project site will be collected and conveyed via a subsurface pipe and catch basin drainage system routing the runoff to hydrodynamic separators and an underground detention area. The proposed storm drainage system was designed according to the town's standards to provide adequate pipe capacity to convey at least the 10-year storm event. The 10-year stormwater drainage computations are included in this report.

The computer program entitled *Hydraflow Storm Sewers Extension for AutoCAD Civil 3D 2014* by Autodesk, Inc., Version 10.30, was used for designing the proposed storm collection system. Storm drainage computations performed include pipe capacity calculations and hydraulic grade line calculations. The overall watershed was divided into subbasins to determine the drainage area and land coverage to each individual catch basin inlet. These values were used to determine the stormwater runoff to each inlet using the rational method. The rainfall intensities utilized in the storm drainage computations were obtained from the Connecticut Department of Transportation (CTDOT) *2000 Drainage Manual.*

As the above table illustrates, the peak flow rates for the 2-, 10-, 25-, 50-, and 100-year storm events will be reduced as a result of the proposed underground detention area. In addition, water quality will be provided through the use of hydrodynamic separators sized in accordance with the Connecticut Department of Energy & Environmental Protection (CTDEEP) *Connecticut Stormwater Quality Manual.* This proposed stormwater design will result in an enhancement to water quality and reduce the peak discharges from existing conditions.

5233-01-3-m1914-rpt

APPENDIX

Hydrographs Peak Flowrate Summary (cfs)
Existing vs. Proposed

Storm Event	2yr		10yr		25yr		50yr		100yr	
	Ex	Pr	Ex	Pr	Ex	Pr	Ex	Pr	Ex	Pr
Analysis Point 'A'	6.6	6.5	11.2	10.8	12.8	12.3	14.6	14.1	16.8	16.2

Worksheet 2: Runoff curve number and runoff

Project:	Ball & Socket Arts	By:	KPG	Date:	05/19/14
Location:	493 West Main Street, Cheshire CT	Checked:	RJM	Date:	05/19/14
Circle one:	***Present*** Developed	Watershed:	WS 10 - Existing Conditions		

1.) Runoff curve number (CN)

Soil Name and Hydrologic Group (appendix A)	Cover Description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio)	CN Value [1.] Table 2-2	Figure 2-3	Figure 2-4	Area Acres / Sq. Ft. / %	Product of CN x Area
B soil	Woods - fair condition	60			0.36	21.65
B soil	Lawn/Open Space - good condition	61			0.00	0.00
B soil	Lawn/Open Space - fair condition	69			0.55	37.63
B soil	Gravel	85			0.03	2.46
N/A	Impervious (Buildings)	98			1.14	112.09
N/A	Impervious (Pavement)	98			1.21	118.22
					0.00	0.00
					0.00	0.00
					0.00	0.00
					0.00	0.00
					0.00	0.00
					0.00	0.00
					0.00	0.00
[1.] Use only one CN value source per line.				Totals =	3.29	292.05
					(0.00513	sq mi)

CN (weighted) = $\frac{\text{total product}}{\text{total area}} = \frac{292.05}{3.29}$ Use CN = **89**

Worksheet 2: Runoff curve number and runoff

Project: Ball & Socket Arts | By: KPG | Date: 05/19/14
Location: 493 West Main Street, Cheshire CT | Checked: RJM | Date: 05/19/14
Circle one: Present ***Developed*** | Watershed: WS 10 - Proposed Conditions

1.) Runoff curve number (CN)

Soil Name and Hydrologic Group (appendix A)	Cover Description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio)	CN Value [1.] Table 2-2	Figure 2-3	Figure 2-4	Area Acres / Sq. Ft. / %	Product of CN x Area
B soil	Woods - fair condition	60			0.00	0.00
B soil	Lawn/Open Space - good condition	61			0.03	2.10
B soil	Lawn/Open Space - fair condition	69			0.00	0.00
B soil	Gravel	85			0.00	0.00
N/A	Impervious (Buildings)	98			0.00	0.00
N/A	Impervious (Pavement)	98			0.26	25.87
					0.00	0.00
					0.00	0.00
					0.00	0.00
					0.00	0.00
					0.00	0.00
					0.00	0.00
					0.00	0.00
[1.] Use only one CN value source per line.				Totals =	0.30	27.97
					(0.00047	sq mi)

CN (weighted) = $\frac{\text{total product}}{\text{total area}} = \frac{27.97}{0.30}$ Use CN = **94**

Worksheet 2: Runoff curve number and runoff

Project:	Ball & Socket Arts	By:	KPG	Date:	05/19/14
Location:	493 West Main Street, Cheshire CT	Checked:	RJM	Date:	05/19/14
Circle one:	Present ***Developed***	Watershed:	WS 11 - Proposed Conditions		

1.) Runoff curve number (CN)

Soil Name and Hydrologic Group (appendix A)	Cover Description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio)	CN Value [1.] Table 2-2	Figure 2-3	Figure 2-4	Area Acres / Sq. Ft. / %	Product of CN x Area
B soil	Woods - fair condition	60			0.00	0.00
B soil	Lawn/Open Space - good condition	61			0.62	37.59
B soil	Lawn/Open Space - fair condition	69			0.00	0.00
B soil	Gravel	85			0.00	0.00
N/A	Impervious (Buildings)	98			1.02	99.66
N/A	Impervious (Pavement)	98			1.35	132.66
					0.00	0.00
					0.00	0.00
					0.00	0.00
					0.00	0.00
					0.00	0.00
					0.00	0.00
					0.00	0.00
[1.] Use only one CN value source per line.				Totals =	2.99	269.91
					(0.00467	sq mi)

CN (weighted) = $\frac{\text{total product}}{\text{total area}} = \frac{269.91}{2.99}$ Use CN = **90**

Time of Concentration (T_c) or Travel Time (T_t) Worksheet

Project: Ball & Socket Arts | By: KPG | Date: 05/19/14
Location: 493 W. Main Street, Cheshire, CT | Checked: RJM | Date: 05/19/14
Circle one: ***Present*** Developed | Watershed: WS-10 - Existing Conditions
Circle one: ***T_c*** T_t | Subwatershed:

Sheet flow (applicable to T_c only)

		Segment ID	A-B		
1.	Surface description (Table 3-1)		GRSS		
2.	Manning's roughness coeff. for sheet flow, n (Table 3-1)		0.240		
3.	Flow Length, L (< 300ft)	ft.	60		
4.	Two-year 24-hr rainfall, P_2	in.	3.30		
5.	Land slope, s	ft./ft.	0.050		
6.	$T_t = \frac{0.007(nL)^{0.8}}{P_2^{0.5}(s^{0.4})}$	hr.	0.108	0.000	= 0.108

Shallow concentrated flow (assume hyd. radius = depth of flow)

		Segment ID	B-C	C-D				
7.	Surface description		ASPH	GRSS				
8.	Manning's roughness coeff., n		0.015	0.080				
9.	Paved or unpaved		PVD	UNPVD				
10.	Depth of flow, d (default: d=.4 unpaved, d=.2 pav	ft.	0.20	0.40				
11.	Flow Length, L	ft.	20	120				
12.	Watercourse slope, s	ft./ft.	0.020	0.010				
13.	Average velocity, $V = \frac{1.49}{n}(d^{2/3})(s^{1/2})$	fps.	4.80	1.01	0.00	0.00	0.00	
14.	$T_t = \frac{L}{3600 * V}$	hr.	0.001	+ 0.033	+ 0.000	+ 0.000	+ 0.000	= 0.034

Channel flow

			Channel	Pipe	Pipe	Pipe	Pipe	
		Segment ID	D-E					
15.	Channel Bot. Width (ft) or Pipe Diam. (in)	ft./in.	6.0					
16.	Horizontal side slope component, z (z horiz:1 vert)							
17.	Depth of flow, d	ft.	1.0					
18.	Cross sectional flow area, A (assume trapazoi	$ft.^2$	6.00	0.00	0.00	0.00	0.00	
19.	Wetted perimeter, P_w	ft.	8.00	0.00	0.00	0.00	0.00	
20.	Hydraulic Radius, $R = \frac{A}{P_w}$	ft.	0.75	0.00	0.00	0.00	0.00	
21.	Channel slope, s	ft./ft.	0.005					
22.	Manning's roughness coeff., n		0.030					
23.	$V = \frac{1.49}{n}(R^{2/3})(s^{1/2})$	fps.	2.90	0.00	0.00	0.00	0.00	
24.	Flow length, L	ft.	720					
25.	$T_t = \frac{L}{3600 * V}$	hr.	0.069	+ 0.000	+ 0.000	+ 0.000	+ 0.000	= 0.069

26. Watershed or subarea T_c or T_t (add T_t in steps 6, 14 & 25) hr. 0.211

Time of Concentration (T_c) or Travel Time (T_t) Worksheet

Project: Ball & Socket Arts | By: KPG | Date: 05/19/14
Location: 493 W. Main Street, Cheshire, CT | Checked: RJM | Date: 05/19/14
Circle one: Present ***Developed*** | Watershed: WS -10 - Proposed Conditions
Circle one: ***T_c*** T_t | Subwatershed:

Sheet flow (applicable to T_c only)

	Segment ID		**A-B**		
1. Surface description (Table 3-1)			GRSS		
2. Manning's roughness coeff. for sheet flow, n (Table 3-1)			0.240		
3. Flow Length, L (< 300ft)		ft.	25		
4. Two-year 24-hr rainfall, P_2		in.	3.30		
5. Land slope, s		ft./ft.	0.080		
6. $T_t = \frac{0.007(nL)^{0.8}}{P_2^{0.5}(s^{0.4})}$		hr.	0.044	0.000	= 0.044

Shallow concentrated flow (assume hyd. radius = depth of flow)

	Segment ID		**B-C**							
7. Surface description			ASPH							
8. Manning's roughness coeff., n			0.015							
9. Paved or unpaved			PVD							
10. Depth of flow, d (default: d=.4 unpaved, d=.2 pav		ft.	0.20							
11. Flow Length, L		ft.	135							
12. Watercourse slope, s		ft./ft.	0.050							
13. Average velocity, $V = \frac{1.49}{n}(d^{2/3})(s^{1/2})$		fps.	7.60	0.00		0.00		0.00		0.00
14. $T_t = \frac{L}{3600 * V}$		hr.	0.005	+ 0.000	+	0.000	+	0.000	+	0.000 = 0.005

Channel flow

			Channel	Pipe	Pipe	Pipe	Pipe
	Segment ID						
15. Channel Bot. Width (ft) or Pipe Diam. (in)		ft./in.					
16. Horizontal side slope component, z (z horiz:1 vert)							
17. Depth of flow, d		ft.					
18. Cross sectional flow area, A (assume trapazoi		$ft.^2$	0.00	0.00	0.00	0.00	0.00
19. Wetted perimeter, P_w		ft.	0.00	0.00	0.00	0.00	0.00
20. Hydraulic Radius, $R = \frac{A}{P_w}$		ft.	0.00	0.00	0.00	0.00	0.00
21. Channel slope, s		ft./ft.					
22. Manning's roughness coeff., n							
23. $V = \frac{1.49}{n}(R^{2/3})(s^{1/2})$		fps.	0.00	0.00	0.00	0.00	0.00
24. Flow length, L		ft.					
25. $T_t = \frac{L}{3600 * V}$		hr.	0.000	+ 0.000	+ 0.000	+ 0.000	+ 0.000 = 0.000

26. Watershed or subarea T_c or T_t (add T_t in steps 6, 14 & 25) hr. 0.083

Time of Concentration (T_c) or Travel Time (T_t) Worksheet

Project: Ball & Socket Arts | By: KPG | Date: 05/19/14
Location: 493 W. Main Street, Cheshire, CT | Checked: RJM | Date: 05/19/14
Circle one: Present ***Developed*** | Watershed: WS -11 - Proposed Conditions
Circle one: ***T_c*** T_t | Subwatershed:

Sheet flow (applicable to T_c only)

Segment ID		**A-B**				
1. Surface description (Table 3-1)		GRSS				
2. Manning's roughness coeff. for sheet flow, n (Table 3-1)		0.240				
3. Flow Length, L (< 300ft)	ft.	40				
4. Two-year 24-hr rainfall, P_2	in.	3.30				
5. Land slope, s	ft./ft.	0.020				
6. $T_t = \frac{0.007(nL)^{0.8}}{P_2^{0.5}(s^{0.4})}$	hr.	0.113	+ 0.000		=	0.113

Shallow concentrated flow (assume hyd. radius = depth of flow)

Segment ID										
7. Surface description										
8. Manning's roughness coeff., n										
9. Paved or unpaved										
10. Depth of flow, d (default: d=.4 unpaved, d=.2 pav	ft.									
11. Flow Length, L	ft.									
12. Watercourse slope, s	ft./ft.									
13. Average velocity, $V = \frac{1.49}{n}(d^{2/3})(s^{1/2})$	fps.	0.00	0.00	0.00	0.00	0.00				
14. $T_t = \frac{L}{3600 * V}$	hr.	0.000	+ 0.000	+ 0.000	+ 0.000	+ 0.000	=	0.000		

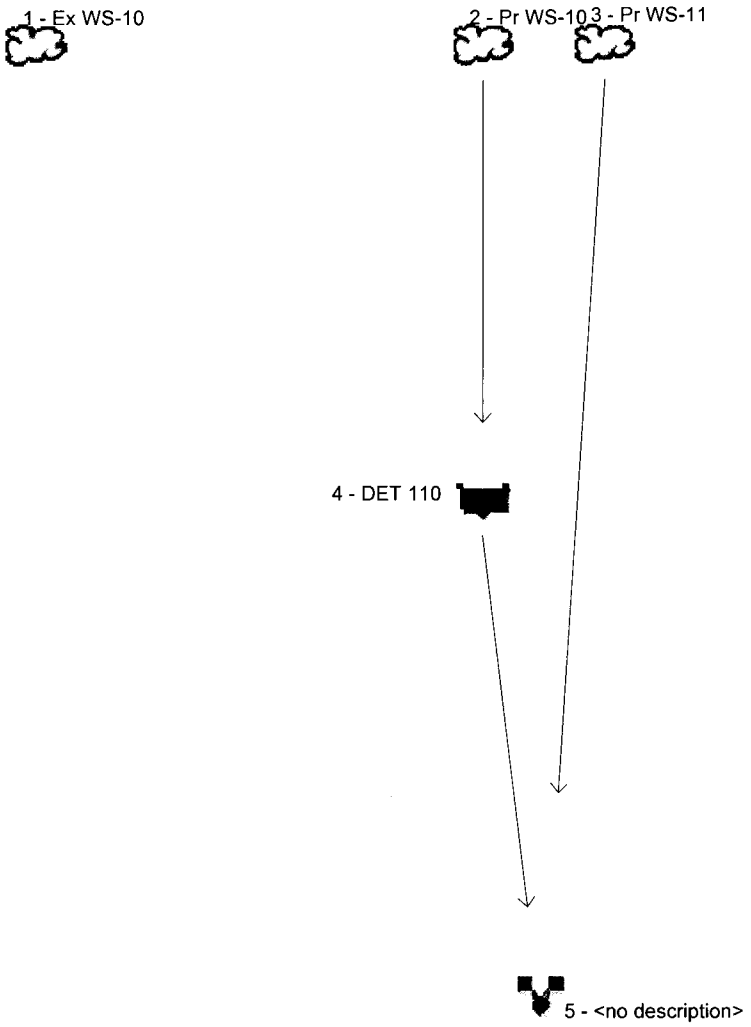
Channel flow

		Channel	Pipe	Pipe	Pipe	Pipe		
Segment ID		**C-D**	**B-C**					
15. Channel Bot. Width (ft) or Pipe Diam. (in)	ft./in.	6.0	12.0					
16. Horizontal side slope component, z (z horiz:1 vert)								
17. Depth of flow, d	ft.	1.0						
18. Cross sectional flow area, A (assume trapazoi	$ft.^2$	6.00	0.79	0.00	0.00	0.00		
19. Wetted perimeter, P_w	ft.	8.00	2.64	0.00	0.00	0.00		
20. Hydraulic Radius, $R = \frac{A}{P_w}$	ft.	0.75	0.30	0.00	0.00	0.00		
21. Channel slope, s	ft./ft.	0.005	0.005					
22. Manning's roughness coeff., n		0.030	0.013					
23. $V = \frac{1.49}{n}(R^{2/3})(s^{1/2})$	fps.	2.90	3.61	0.00	0.00	0.00		
24. Flow length, L	ft.	720	140					
25. $T_t = \frac{L}{3600 * V}$	hr.	0.069	+ 0.011	+ 0.000	+ 0.000	+ 0.000	=	0.080

26. Watershed or subarea T_c or T_t (add T_t in steps 6, 14 & 25) hr. 0.192

Watershed Model Schematic

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2014 by Autodesk, Inc. v10.3



Legend

Hyd.	Origin	Description
1	SCS Runoff	Ex WS-10
2	SCS Runoff	Pr WS-10
3	SCS Runoff	Pr WS-11
4	Reservoir	DET 110
5	Combine	<no description>

Hydrograph Return Period Recap

Hyd. No.	Hydrograph type (origin)	Inflow hyd(s)	Peak Outflow (cfs)							Hydrograph Description
			1-yr	2-yr	3-yr	5-yr	10-yr	25-yr	50-yr	100-yr	
1	SCS Runoff	------	-------	6.555	-------	-------	11.15	12.76	14.64	16.78	Ex WS-10
2	SCS Runoff	------	-------	0.770	-------	-------	1.221	1.378	1.561	1.770	Pr WS-10
3	SCS Runoff	------	-------	6.173	-------	-------	10.34	11.81	13.51	15.44	Pr WS-11
4	Reservoir	2	-------	0.354	-------	-------	0.495	0.542	0.710	1.435	DET 110
5	Combine	3, 4	-------	6.504	-------	-------	10.80	12.30	14.05	16.21	<no description>

Hydrograph Summary Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2014 by Autodesk, Inc. v10.3

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	SCS Runoff	6.555	3	729	25,952	------	------	------	Ex WS-10
2	SCS Runoff	0.770	3	726	2,696	------	------	------	Pr WS-10
3	SCS Runoff	6.173	3	729	24,544	------	------	------	Pr WS-11
4	Reservoir	0.354	3	738	2,260	2	160.98	782	DET 110
5	Combine	6.504	3	729	26,804	3, 4	------	------	<no description>

Hydrograph Summary Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2014 by Autodesk, Inc. v10.3

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	SCS Runoff	11.15	3	729	45,047	------	------	------	Ex WS-10
2	SCS Runoff	1.221	3	726	4,398	------	------	------	Pr WS-10
3	SCS Runoff	10.34	3	729	42,072	------	------	------	Pr WS-11
4	Reservoir	0.495	3	738	3,936	2	161.66	1,193	DET 110
5	Combine	10.80	3	729	46,008	3, 4	------	------	<no description>

Hydrograph Summary Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2014 by Autodesk, Inc. v10.3

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	SCS Runoff	12.76	3	729	51,935	------	------	------	Ex WS-10
2	SCS Runoff	1.378	3	726	5,003	------	------	------	Pr WS-10
3	SCS Runoff	11.81	3	729	48,374	------	------	------	Pr WS-11
4	Reservoir	0.542	3	741	4,534	2	161.94	1,344	DET 110
5	Combine	12.30	3	729	52,909	3, 4	------	------	<no description>

Hydrograph Summary Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2014 by Autodesk, Inc. v10.3

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	SCS Runoff	14.64	3	729	60,029	------	------	------	Ex WS-10
2	SCS Runoff	1.561	3	726	5,711	------	------	------	Pr WS-10
3	SCS Runoff	13.51	3	729	55,771	------	------	------	Pr WS-11
4	Reservoir	0.710	3	738	5,235	2	162.25	1,495	DET 110
5	Combine	14.05	3	729	61,006	3, 4	------	------	<no description>

Hydrograph Summary Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2014 by Autodesk, Inc. v10.3

Hyd. No.	Hydrograph type (origin)	Peak flow (cfs)	Time interval (min)	Time to Peak (min)	Hyd. volume (cuft)	Inflow hyd(s)	Maximum elevation (ft)	Total strge used (cuft)	Hydrograph Description
1	SCS Runoff	16.78	3	729	69,336	------	------	------	Ex WS-10
2	SCS Runoff	1.770	3	726	6,521	------	------	------	Pr WS-10
3	SCS Runoff	15.44	3	729	64,267	------	------	------	Pr WS-11
4	Reservoir	1.435	3	732	6,039	2	162.41	1,537	DET 110
5	Combine	16.21	3	729	70,306	3, 4	------	------	<no description>

Pond Report

Hydraflow Hydrographs Extension for AutoCAD® Civil 3D® 2014 by Autodesk, Inc. v10.3 — Thursday, 05 / 15 / 2014

Pond No. 2 - DET 110

Pond Data

UG Chambers -Invert elev. = 160.00 ft, Rise x Span = 2.50 x 4.25 ft, Barrel Len = 7.12 ft, No. Barrels = 21, Slope = 0.00%, Headers = No
Encasement -Invert elev. = 159.50 ft, Width = 4.75 ft, Height = 3.00 ft, Voids = 40.00%

Stage / Storage Table

Stage (ft)	Elevation (ft)	Contour area (sqft)	Incr. Storage (cuft)	Total storage (cuft)
0.00	159.50	n/a	0	0
0.30	159.80	n/a	85	85
0.60	160.10	n/a	123	209
0.90	160.40	n/a	199	408
1.20	160.70	n/a	197	604
1.50	161.00	n/a	193	797
1.80	161.30	n/a	187	984
2.10	161.60	n/a	178	1,162
2.40	161.90	n/a	167	1,329
2.70	162.20	n/a	150	1,479
3.00	162.50	n/a	122	1,601

Culvert / Orifice Structures

	[A]	[B]	[C]	[PrfRsr]
Rise (in)	= 12.00	4.00	0.00	0.00
Span (in)	= 12.00	4.00	0.00	0.00
No. Barrels	= 1	1	0	0
Invert El. (ft)	= 159.50	160.10	0.00	0.00
Length (ft)	= 50.00	0.00	0.00	0.00
Slope (%)	= 0.50	0.00	0.00	n/a
N-Value	= .012	.013	.013	n/a
Orifice Coeff.	= 0.60	0.60	0.60	0.60
Multi-Stage	= n/a	Yes	No	No

Weir Structures

	[A]	[B]	[C]	[D]
Crest Len (ft)	= 6.00	0.00	0.00	0.00
Crest El. (ft)	= 162.20	0.00	0.00	0.00
Weir Coeff.	= 2.60	3.33	3.33	3.33
Weir Type	= Broad	---	---	---
Multi-Stage	= Yes	No	No	No

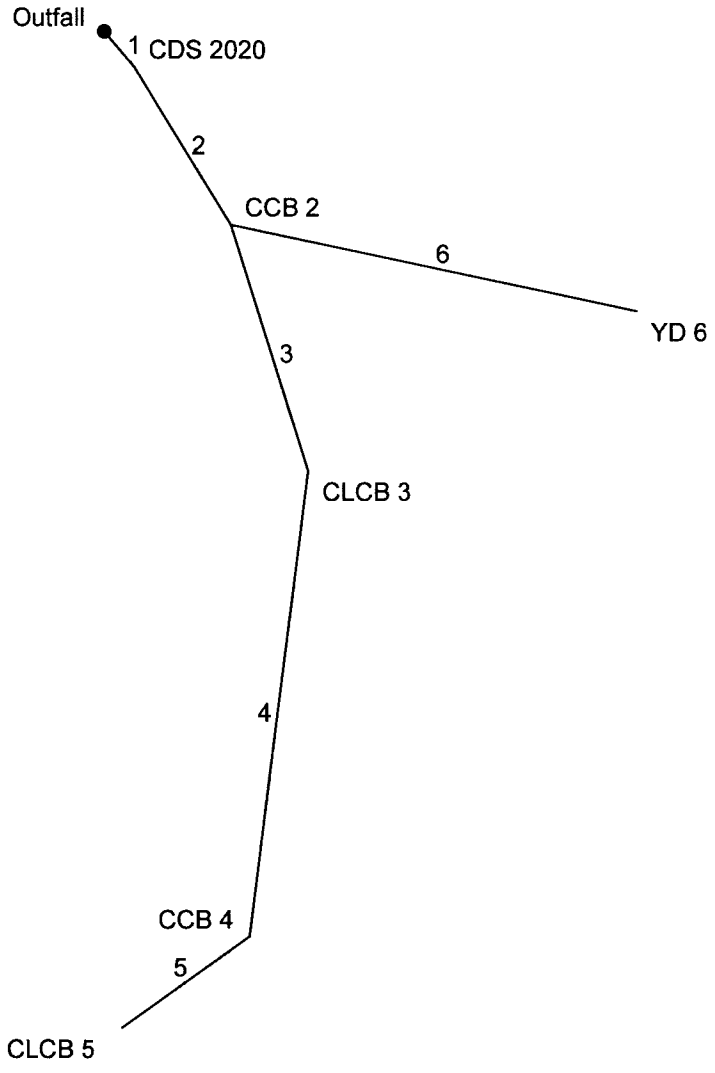
Exfil.(in/hr) = 0.150 (by Wet area)
TW Elev. (ft) = 0.00

Note: Culvert/Orifice outflows are analyzed under inlet (ic) and outlet (oc) control. Weir risers checked for orifice conditions (ic) and submergence (s).

Stage / Storage / Discharge Table

Stage ft	Storage cuft	Elevation ft	Clv A cfs	Clv B cfs	Clv C cfs	PrfRsr cfs	Wr A cfs	Wr B cfs	Wr C cfs	Wr D cfs	Exfil cfs	User cfs	Total cfs
0.00	0	159.50	0.00	0.00	---	---	0.00	---	---	---	0.000	---	0.000
0.30	85	159.80	0.00	0.00	---	---	0.00	---	---	---	0.003	---	0.003
0.60	209	160.10	0.00	0.00	---	---	0.00	---	---	---	0.003	---	0.003
0.90	408	160.40	0.16 ic	0.15 ic	---	---	0.00	---	---	---	0.003	---	0.158
1.20	604	160.70	0.28 ic	0.28 ic	---	---	0.00	---	---	---	0.004	---	0.280
1.50	797	161.00	0.37 ic	0.36 ic	---	---	0.00	---	---	---	0.004	---	0.364
1.80	984	161.30	0.44 ic	0.43 ic	---	---	0.00	---	---	---	0.004	---	0.431
2.10	1,162	161.60	0.50 ic	0.49 ic	---	---	0.00	---	---	---	0.005	---	0.490
2.40	1,329	161.90	0.54 ic	0.54 ic	---	---	0.00	---	---	---	0.005	---	0.542
2.70	1,479	162.20	0.60 ic	0.58 ic	---	---	0.00	---	---	---	0.005	---	0.589
3.00	1,601	162.50	3.09 oc	0.53 ic	---	---	2.56	---	---	---	0.006	---	3.096

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



Project File: Storm Line (North).stm	Number of lines: 6	Date: 5/19/2014

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	10.00	49.64	MH	0.00	0.00	0.00	5.0	158.40	1.00	158.50	15	Cir	0.012	0.19	167.70	OUT - CDS 2020
2	1	40.00	9.12	Comb	0.00	0.14	0.77	5.0	158.50	0.50	158.70	15	Cir	0.012	1.15	161.70	CDS 2020 - CCB 2
3	2	56.00	13.98	Comb	0.00	0.29	0.89	5.0	158.70	0.54	159.00	15	Cir	0.012	0.71	161.50	CCB 2 - CLCB 3
4	3	102.00	24.54	Comb	0.00	0.19	0.88	5.0	159.00	0.49	159.50	12	Cir	0.012	1.16	162.30	CLCB 3 - CCB 4
5	4	34.00	47.22	Comb	0.00	0.04	0.63	5.0	159.50	0.88	159.80	12	Cir	0.012	1.00	162.00	CCB 4 - CLCB 5
6	2	90.00	-46.70	Grate	0.00	0.05	0.35	5.0	158.80	0.89	159.60	12	Cir	0.012	1.00	162.80	CCB 2 - YD 6

Project File: Storm Line (North).stm | Number of lines: 6 | Date: 5/19/2014

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	10.00	0.00	0.71	0.00	0.00	0.58	5.0	16.5	3.9	2.23	7.00	4.46	15	1.00	158.40	158.50	158.88	159.10	0.00	167.70	OUT - CDS 2020
2	1	40.00	0.14	0.71	0.77	0.11	0.58	5.0	16.2	3.9	2.24	4.95	3.88	15	0.50	158.50	158.70	159.10	159.30	167.70	161.70	CDS 2020 - CCB
3	2	56.00	0.29	0.52	0.89	0.26	0.45	5.0	9.1	5.0	2.24	5.12	3.87	15	0.54	158.70	159.00	159.30	159.60	161.70	161.50	CCB 2 - CLCB 3
4	3	102.00	0.19	0.23	0.88	0.17	0.19	5.0	7.9	5.2	1.00	2.70	2.35	12	0.49	159.00	159.50	159.76	159.93	161.50	162.30	CLCB 3 - CCB 4
5	4	34.00	0.04	0.04	0.63	0.03	0.03	5.0	5.0	6.0	0.15	3.62	1.09	12	0.88	159.50	159.80	160.10	159.96	162.30	162.00	CCB 4 - CLCB 5
6	2	90.00	0.05	0.05	0.35	0.02	0.02	5.0	5.0	6.0	0.10	3.64	0.99	12	0.89	158.80	159.60	159.30	159.73	161.70	162.80	CCB 2 - YD 6

Project File: Storm Line (North).stm

Number of lines: 6

Run Date: 5/19/2014

NOTES:Intensity = 54.74 / (Inlet time + 10.80) ^ 0.80; Return period =Yrs. 10 ; 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	CDS 2020	0.00	0.00	0.00	0.00	MH	0.0	0.00	0.00	0.00	0.00	Sag	2.53	0.050	0.020	0.013	0.00	0.00	0.00	0.00	0.0	Off
2	CCB 2	0.65	0.00	0.65	0.00	Comb	4.0	2.73	3.13	3.15	1.64	Sag	2.53	0.050	0.020	0.000	0.15	3.71	0.15	3.71	0.0	Off
3	CLCB 3	1.55	0.00	1.55	0.00	Comb	4.0	2.73	3.13	3.15	1.64	Sag	2.53	0.050	0.020	0.000	0.24	8.01	0.24	8.01	0.0	Off
4	CCB 4	1.00	0.00	1.00	0.00	Comb	4.0	2.73	3.13	3.15	1.64	Sag	2.53	0.050	0.020	0.000	0.19	5.56	0.19	5.56	0.0	Off
5	CLCB 5	0.15	0.00	0.15	0.00	Comb	4.0	2.73	3.13	3.15	1.64	Sag	2.53	0.050	0.020	0.000	0.08	1.66	0.08	1.66	0.0	Off
6	YD 6	0.10	0.00	0.10	0.00	Grate	0.0	0.00	1.44	1.20	1.20	Sag	2.53	0.050	0.020	0.000	0.08	1.51	0.08	1.51	0.0	Off

Project File: Storm Line (North).stm | Number of lines: 6 | Run Date: 5/19/2014

NOTES: Inlet N-Values = 0.016; Intensity = 54.74 / (Inlet time + 10.80) ^ 0.80; Return period = 10 Yrs. ; * Indicates Known Q added. All curb inlets are throat.

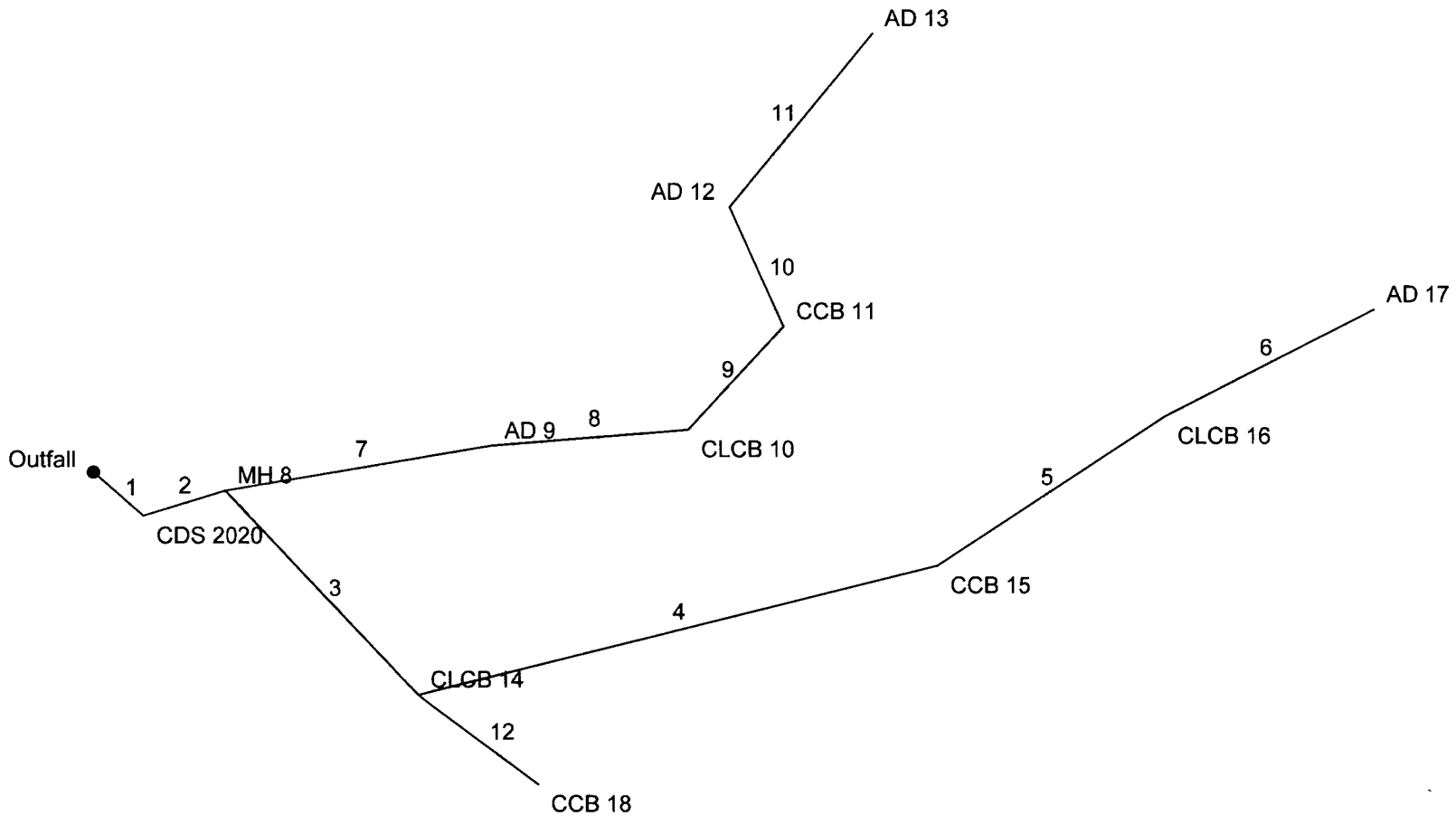
Hydraulic Grade Line Computations

Line	Size	Q	Downstream								Len	Upstream								Check		JL coeff	Minor loss
			Invert elev	HGL elev	Depth	Area	Vel	Vel head	EGL elev	Sf		Invert elev	HGL elev	Depth	Area	Vel	Vel head	EGL elev	Sf	Ave Sf	Enrgy loss		
	(in)	(cfs)	(ft)	(ft)	(ft)	(sqft)	(ft/s)	(ft)	(ft)	(%)	(ft)	(ft)	(ft)	(ft)	(sqft)	(ft/s)	(ft)	(ft)	(%)	(%)	(ft)	(K)	(ft)
1	15	2.23	158.40	158.88	0.48	0.44	5.06	0.23	159.12	0.000	10.00	158.50	159.10	0.60**	0.58	3.86	0.23	159.33	0.000	0.000	n/a	0.19	n/a
2	15	2.24	158.50	159.10	0.60	0.58	3.89	0.23	159.33	0.000	40.00	158.70	159.30	0.60**	0.58	3.87	0.23	159.53	0.000	0.000	n/a	1.15	0.27
3	15	2.24	158.70	159.30	0.60	0.58	3.87	0.23	159.53	0.000	56.00	159.00	159.60	0.60**	0.58	3.87	0.23	159.83	0.000	0.000	n/a	0.71	n/a
4	12	1.00	159.00	159.76	0.76	0.31	1.56	0.04	159.80	0.078	102.00	159.50	159.93 j	0.43**	0.32	3.13	0.15	160.08	0.467	0.273	0.278	1.16	0.18
5	12	0.15	159.50	160.10	0.60	0.08	0.30	0.06	160.16	0.000	34.00	159.80	159.96	0.16**	0.08	1.88	0.06	160.01	0.000	0.000	n/a	1.00	n/a
6	12	0.10	158.80	159.30	0.50	0.06	0.27	0.05	159.34	0.000	90.00	159.60	159.73 j	0.13**	0.06	1.71	0.05	159.78	0.000	0.000	n/a	1.00	n/a

Project File: Storm Line (North).stm | Number of lines: 6 | Run Date: 5/19/2014

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

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



Project File: Storm Line (South).stm	Number of lines: 12	Date: 5/19/2014

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	14.00	41.39	MH	0.00	0.00	0.00	5.0	158.40	0.71	158.50	18	Cir	0.013	0.88	162.00	OUT - CDS 2020
2	1	18.00	-58.66	MH	0.00	0.00	0.00	5.0	158.50	0.56	158.60	18	Cir	0.013	0.91	162.10	CDS 2020 - MH - 8
3	2	60.00	63.71	Comb	0.00	0.20	0.78	5.0	158.60	0.50	158.90	15	Cir	0.013	1.34	166.30	MH 8 - CLCB 14
4	3	114.00	-60.43	Comb	0.00	0.19	0.77	5.0	158.90	0.53	159.50	15	Cir	0.013	0.57	163.50	CLCB 14 - CCB 15
5	4	58.00	-19.28	Comb	0.00	0.04	0.88	5.0	159.50	1.21	160.20	15	Cir	0.013	0.50	163.77	CCB 15 - CCB 16
6	5	50.00	6.01	Grate	0.00	0.12	0.63	5.0	160.20	0.60	160.50	12	Cir	0.013	1.00	163.50	CCB 16 - AD 17
7	2	58.00	7.74	Grate	0.00	0.03	0.90	5.0	158.60	0.52	158.90	15	Cir	0.013	0.50	162.00	MH 8 - AD 9
8	7	42.00	4.85	Comb	0.00	0.13	0.86	5.0	158.90	0.71	159.20	15	Cir	0.013	1.09	163.00	AD 9 - CLCB 10
9	8	30.00	-42.79	Comb	0.00	0.32	0.87	5.0	159.20	0.67	159.40	15	Cir	0.013	1.40	161.70	CLCB 10 - CCB 11
10	9	28.00	-66.49	Grate	0.00	0.03	0.90	5.0	159.40	0.71	159.60	8	Cir	0.013	1.37	161.90	CCB 11 - AD 12
11	10	48.00	63.31	Grate	0.00	0.11	0.90	5.0	159.60	0.62	159.90	8	Cir	0.012	1.00	162.10	AD 12 - AD 13
12	3	32.00	-9.72	Comb	0.00	0.19	0.79	5.0	158.90	0.63	159.10	15	Cir	0.013	1.00	168.80	CLCB 14 - CCB 18

Project File: Storm Line (South).stm | Number of lines: 12 | Date: 5/19/2014

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	14.00	0.00	1.36	0.00	0.00	1.11	5.0	10.3	4.8	5.26	8.88	5.05	18	0.71	158.40	158.50	159.23	159.38	0.00	162.00	OUT - CDS 2020
2	1	18.00	0.00	1.36	0.00	0.00	1.11	5.0	10.2	4.8	5.27	7.83	3.58	18	0.56	158.50	158.60	159.71	159.73	162.00	162.10	CDS 2020 - MH -
3	2	60.00	0.20	0.74	0.78	0.16	0.56	5.0	9.8	4.8	2.73	4.57	2.29	15	0.50	158.60	158.90	159.92	160.02	162.10	166.30	MH 8 - CLCB 14
4	3	114.00	0.19	0.35	0.77	0.15	0.26	5.0	8.3	5.2	1.33	4.68	1.50	15	0.53	158.90	159.50	160.13	160.19	166.30	163.50	CLCB 14 - CCB 1
5	4	58.00	0.04	0.16	0.88	0.04	0.11	5.0	6.4	5.6	0.62	7.09	1.75	15	1.21	159.50	160.20	160.22	160.51	163.50	163.77	CCB 15 - CCB 16
6	5	50.00	0.12	0.12	0.63	0.08	0.08	5.0	5.0	6.0	0.45	2.76	2.38	12	0.60	160.20	160.50	160.51	160.78	163.77	163.50	CCB 16 - AD 17
7	2	58.00	0.03	0.62	0.90	0.03	0.54	5.0	6.2	5.6	3.06	4.64	2.55	15	0.52	158.60	158.90	159.92	160.04	162.10	162.00	MH 8 - AD 9
8	7	42.00	0.13	0.59	0.86	0.11	0.52	5.0	5.9	5.7	2.95	5.46	3.35	15	0.71	158.90	159.20	160.09	159.89	162.00	163.00	AD 9 - CLCB 10
9	8	30.00	0.32	0.46	0.87	0.28	0.40	5.0	5.7	5.8	2.34	5.27	3.65	15	0.67	159.20	159.40	159.89	160.01	163.00	161.70	CLCB 10 - CCB 1
10	9	28.00	0.03	0.14	0.90	0.03	0.13	5.0	5.5	5.9	0.74	1.02	2.11	8	0.71	159.40	159.60	160.35	160.45	161.70	161.90	CCB 11 - AD 12
11	10	48.00	0.11	0.11	0.90	0.10	0.10	5.0	5.0	6.0	0.59	1.03	1.70	8	0.62	159.60	159.90	160.55	160.64	161.90	162.10	AD 12 - AD 13
12	3	32.00	0.19	0.19	0.79	0.15	0.15	5.0	5.0	6.0	0.90	5.11	1.84	15	0.63	158.90	159.10	160.13	159.47	166.30	168.80	CLCB 14 - CCB 1

Project File: Storm Line (South).stm

Number of lines: 12

Run Date: 5/19/2014

NOTES:Intensity = 54.74 / (Inlet time + 10.80) ^ 0.80; Return period =Yrs. 10 ; 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	CDS 2020	0.00	0.00	0.00	0.00	MH	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.000	0.00	0.00	0.00	0.00	0.0	Off
2	MH 8	0.00	0.00	0.00	0.00	MH	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.000	0.00	0.00	0.00	0.00	0.0	Off
3	CLCB 14	0.93	0.00	0.81	0.13	Comb	4.0	2.73	0.00	3.15	1.64	0.050	2.53	0.050	0.020	0.013	0.14	3.01	0.14	3.01	0.0	8
4	CCB 15	0.88	0.00	0.88	0.00	Comb	4.0	2.73	3.13	3.15	1.64	Sag	2.53	0.050	0.020	0.000	0.18	4.96	0.18	4.96	0.0	Off
5	CLCB 16	0.21	0.00	0.21	0.00	Comb	4.0	2.73	0.00	3.15	1.64	0.022	2.53	0.050	0.020	0.013	0.09	1.82	0.09	1.82	0.0	9
6	AD 17	0.45	0.00	0.45	0.00	Grate	0.0	0.00	1.00	1.00	1.00	Sag	1.00	0.050	0.020	0.000	0.16	6.56	0.16	6.56	0.0	Off
7	AD 9	0.16	0.00	0.16	0.00	Grate	0.0	0.00	1.00	1.00	1.00	Sag	1.00	0.050	0.020	0.000	0.09	3.18	0.09	3.18	0.0	Off
8	CLCB 10	0.67	0.13	0.72	0.08	Comb	4.0	2.73	0.00	3.15	1.64	0.050	2.53	0.050	0.020	0.013	0.13	2.66	0.13	2.66	0.0	9
9	CCB 11	1.67	0.08	1.75	0.00	Comb	4.0	2.73	3.13	3.15	1.64	Sag	2.53	0.050	0.020	0.000	0.25	8.86	0.25	8.86	0.0	Off
10	AD 12	0.16	0.00	0.16	0.00	Grate	0.0	0.00	1.00	1.00	1.00	Sag	1.00	0.050	0.020	0.000	0.09	3.18	0.09	3.18	0.0	Off
11	AD 13	0.59	0.00	0.59	0.00	Grate	0.0	0.00	1.00	1.00	1.00	Sag	1.00	0.050	0.020	0.000	0.19	7.90	0.19	7.90	0.0	Off
12	CCB 18	0.90	0.00	0.90	0.00	Comb	4.0	2.73	3.13	3.15	1.64	Sag	2.53	0.050	0.020	0.000	0.18	5.06	0.18	5.06	0.0	Off

Project File: Storm Line (South).stm | Number of lines: 12 | Run Date: 5/19/2014

NOTES: Inlet N-Values = 0.016; Intensity = 54.74 / (Inlet time + 10.80) ^ 0.80; Return period = 10 Yrs. ; * Indicates Known Q added. All curb inlets are throat.

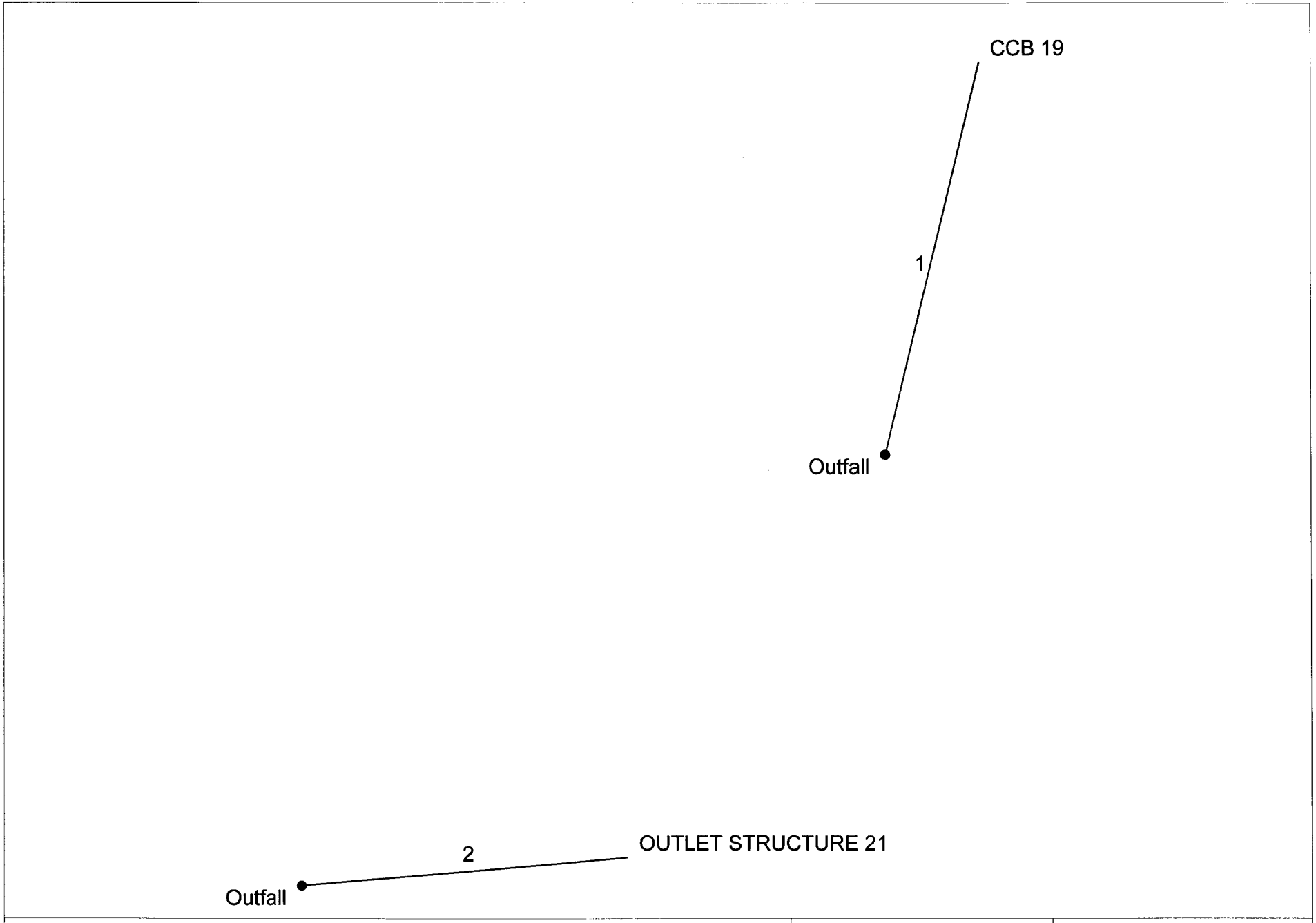
Hydraulic Grade Line Computations

Line	Size	Q	Downstream								Len	Upstream								Check		JL coeff	Minor loss
			Invert elev	HGL elev	Depth	Area	Vel	Vel head	EGL elev	Sf		Invert elev	HGL elev	Depth	Area	Vel	Vel head	EGL elev	Sf	Ave Sf	Enrgy loss		
	(in)	(cfs)	(ft)	(ft)	(ft)	(sqft)	(ft/s)	(ft)	(ft)	(%)	(ft)	(ft)	(ft)	(ft)	(sqft)	(ft/s)	(ft)	(ft)	(%)	(%)	(ft)	(K)	(ft)
1	18	5.26	158.40	159.23	0.83	1.00	5.23	0.37	159.60	0.000	14.00	158.50	159.38	0.88**	1.08	4.86	0.37	159.75	0.000	0.000	n/a	0.88	0.32
2	18	5.27	158.50	159.71	1.21	1.52	3.46	0.19	159.89	0.262	18.00	158.60	159.73	1.13	1.43	3.69	0.21	159.94	0.299	0.280	0.050	0.91	0.19
3	15	2.73	158.60	159.92	1.25	1.23	2.22	0.08	160.00	0.178	60.00	158.90	160.02	1.12	1.16	2.36	0.09	160.10	0.158	0.168	0.101	1.34	0.12
4	15	1.33	158.90	160.13	1.23	1.22	1.08	0.02	160.15	0.038	114.00	159.50	160.19	0.69	0.69	1.92	0.06	160.24	0.123	0.081	0.092	0.57	0.03
5	15	0.62	159.50	160.22	0.72	0.23	0.85	0.11	160.33	0.000	58.00	160.20	160.51 j	0.31**	0.23	2.65	0.11	160.62	0.000	0.000	n/a	0.50	n/a
6	12	0.45	160.20	160.51	0.31	0.18	2.22	0.10	160.61	0.000	50.00	160.50	160.78 j	0.28**	0.18	2.54	0.10	160.88	0.000	0.000	n/a	1.00	0.10
7	15	3.06	158.60	159.92	1.25	1.23	2.50	0.10	160.02	0.225	58.00	158.90	160.04	1.14	1.17	2.61	0.11	160.14	0.197	0.211	0.122	0.50	0.05
8	15	2.95	158.90	160.09	1.19	0.69	2.45	0.28	160.37	0.000	42.00	159.20	159.89	0.69**	0.69	4.25	0.28	160.17	0.000	0.000	n/a	1.09	n/a
9	15	2.34	159.20	159.89	0.69	0.60	3.37	0.24	160.13	0.000	30.00	159.40	160.01 j	0.61**	0.60	3.93	0.24	160.25	0.000	0.000	n/a	1.40	0.34
10	8	0.74	159.40	160.35	0.67	0.35	2.11	0.07	160.42	0.373	28.00	159.60	160.45	0.67	0.35	2.11	0.07	160.52	0.373	0.373	0.104	1.37	0.09
11	8	0.59	159.60	160.55	0.67	0.35	1.70	0.04	160.59	0.206	48.00	159.90	160.64	0.67	0.35	1.70	0.04	160.69	0.205	0.205	0.099	1.00	0.04
12	15	0.90	158.90	160.13	1.23	0.31	0.73	0.13	160.27	0.000	32.00	159.10	159.47	0.37**	0.31	2.94	0.13	159.61	0.000	0.000	n/a	1.00	0.13

Project File: Storm Line (South).stm | Number of lines: 12 | Run Date: 5/19/2014

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

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



Project File: Storm Line (Det Area).stm	Number of lines: 2	Date: 5/19/2014

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	52.00	-76.60	Comb	0.00	0.30	0.81	5.0	160.00	1.92	161.00	12	Cir	0.013	1.00	163.80	MH 20 - CCB 19
2	End	42.00	-4.94	None	0.50	0.00	0.00	5.0	159.00	1.19	159.50	12	Cir	0.013	1.00	166.80	OUT - OUTLET STRUC

Project File: Storm Line (Det Area).stm

Number of lines: 2

Date: 5/19/2014

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	52.00	0.30	0.30	0.81	0.24	0.24	5.0	5.0	6.0	1.46	4.94	4.21	12	1.92	160.00	161.00	160.41	161.51	165.80	163.80	MH 20 - CCB 19
2	End	42.00	0.00	0.00	0.00	0.00	0.00	5.0	5.0	0.0	0.50	3.89	3.00	12	1.19	159.00	159.50	159.24	159.79	0.00	166.80	OUT - OUTLET S

Project File: Storm Line (Det Area).stm

Number of lines: 2

Run Date: 5/19/2014

NOTES:Intensity = 54.74 / (Inlet time + 10.80) ^ 0.80; Return period =Yrs. 10 ; 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	CCB 19	1.46	0.00	1.46	0.00	Comb	4.0	2.73	3.13	3.15	1.64	Sag	2.53	0.050	0.020	0.000	0.23	7.61	0.23	7.61	0.0	Off
2	OUTLET STRUCT	0.50*	0.00	0.00	0.50	None	0.0	0.00	0.00	0.00	0.00	Sag	0.00	0.000	0.000	0.000	0.00	0.00	0.00	0.00	0.0	Off

Project File: Storm Line (Det Area).stm | Number of lines: 2 | Run Date: 5/19/2014

NOTES: Inlet N-Values = 0.016; Intensity = 54.74 / (Inlet time + 10.80) ^ 0.80; Return period = 10 Yrs. ; * Indicates Known Q added. All curb inlets are throat.

Hydraulic Grade Line Computations

Line	Size	Q	Downstream								Len	Upstream								Check		JL coeff	Minor loss
			Invert elev	HGL elev	Depth	Area	Vel	Vel head	EGL elev	Sf		Invert elev	HGL elev	Depth	Area	Vel	Vel head	EGL elev	Sf	Ave Sf	Enrgy loss		
	(in)	(cfs)	(ft)	(ft)	(ft)	(sqft)	(ft/s)	(ft)	(ft)	(%)	(ft)	(ft)	(ft)	(ft)	(sqft)	(ft/s)	(ft)	(ft)	(%)	(%)	(ft)	(K)	(ft)
1	12	1.46	160.00	160.41	0.41	0.30	4.80	0.20	160.61	0.000	52.00	161.00	161.51	0.51**	0.40	3.61	0.20	161.71	0.000	0.000	n/a	1.00	0.20
2	12	0.50	159.00	159.24	0.24*	0.15	3.40	0.11	159.35	0.000	42.00	159.50	159.79	0.29**	0.19	2.61	0.11	159.90	0.000	0.000	n/a	1.00	0.11

Project File: Storm Line (Det Area).stm | Number of lines: 2 | Run Date: 5/19/2014

Notes: * depth assumed.; ** Critical depth. ; c = cir e = ellip b = box