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CONSULTING ENGINEERS & PLANNERS

96 King Street East
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STORMWATER MANAGEMENT REPORT

FOR

1-STOREY INDUSTRIAL BUILDING ADDITION

1726 BASELINE ROAD WEST

COURTICE, ONTARIO

PROJECT NO. 115160

DATE: October 2025

Revised October 31, 2025
March 25, 2025

Cestoil Chemical Inc.
1726 Baseline Road West
Courtice, ON L1E 2S8

Attention: Mr. Samuel L. Xiong

Re: Stormwater Management Letter / Report
1726 Baseline Road West
Courtice, ON
Our File: 115160

Dear Mr. Xiong:

In support of the Site Plan Application for the above referenced proposal, we herewith submit the following Stormwater Management Letter / Report. This letter / report has been prepared to identify the method in which the proposed development will meet the Municipality of Clarington and Central Lake Ontario Conservation Authority's (CLOCA) stormwater management requirements.

Please contact our office at your convenience, should you have any questions or require additional information on the enclosed report.

Yours Truly,
D.G. Biddle & Associates Limited

LICENSED PROFESSIONAL ENGINEER
T. W. A. WATKINS
100569980
January 23, 2026
PROVINCE OF ONTARIO

S.L. Armstrong, BASc
Intermediate Designer
Civil Group

T.W. Watkins, P. Eng.
Intermediate Engineer
Supervisor, Civil Group

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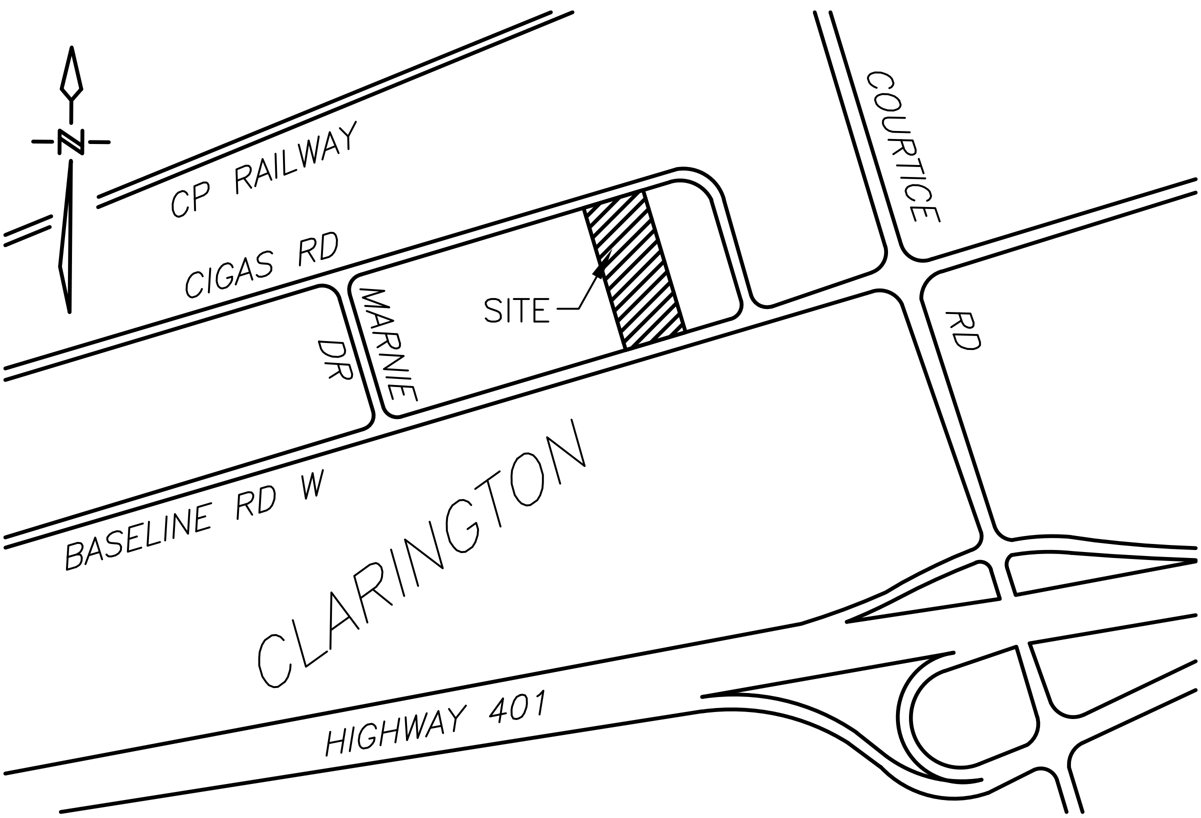
1.0 INTRODUCTION

The subject plan is located on the north side of Baseline Road West, Part of Lot 29, Concession 1 in the Municipality of Clarington, Regional Municipality of Durham. The proposed development will consist of a 1 storey facility, with a building addition with associated driveways and parking area. A Site Location Plan illustrating the subject site is attached as **Figure 1**.

The property is currently developed with a one storey industrial building which was approved for development and construction in 2015 – 2016. Under present conditions, the stormwater runoff from the site is controlled through on-site storm water detention primarily through the use of surface ponding. The site is tributary to the drainage system within Baseline Road West. In very recent days the roadway at Baseline Road has been urbanized on the north boulevard. It is our understanding that the installed storm sewer network from the site development in 2015 – 2016 has been extended to outlet into the open ditch on the south side of Baseline Road. The site drainage is tributary to the Tooley Creek watershed. The site is bounded on the north by Cigas Road, on the south by Baseline Road, and on the east and west by existing industrial properties.

The subject site is within the Regulated Area of Tooley Creek and subject to CLOCA's regulation. During the initial development we understand the regulatory flood elevation of Tooley Creek in this area is 97.91m. In order for CLOCA to permit the proposed development, the building addition and parking area must be flood proofed. As such, all proposed building openings must have a minimum elevation of 98.21m (97.91m + 0.30m free board).



1726 BASELINE ROAD WEST, COURTICE, ON FOR: CESTOIL CHEMICAL INC.

SITE LOCATION PLAN

D.G. BIDDLE & ASSOCIATES
CONSULTING ENGINEERS & PLANNERS

481 Taunton Rd W, Oshawa ON
150 King St, Peterborough ON

Phone: 905-576-8500

info@dgbiddle.com
dgbiddle.com

PROJECT NO.	115160
DRAWING NO.	FIGURE 1
DRAWN BY:	S.L.A.
CHECKED BY:	R.M.L.
DATE:	AUGUST 2025
SCALE:	N.T.S.

2.0 STORMWATER QUANTITY CONTROLS

As noted above, drainage from the site is tributary to the south roadside ditch on Baseline Road. The Municipality of Clarington noted during the pre-consultation notes for the proposed expansion that new storm water management efforts would not be required for the proposed addition. We wish to point out that the proposed building expansion covers over the surface stormwater storage organized for the initial approvals. As such, the stormwater proposal for this development is to attenuate post-development peak flows to the pre-development levels by way of added storm water management efforts for all storm events up to and including the 100-year return frequency, discharging to the drainage network at Baseline Road.

As this proposed development is an addition to an existing development, it shall be noted that the pre-development site condition modelled reflects the greenfield/pervious landscaped site of 2015 - 16 before the initial development. Therefore, the pre-development runoff coefficient used in the model is 0.20. The pre-development drainage area of the site is 0.54 ha. The NASHYD Sub-Routine in the computer model VISUAL OTTHYMO 6.2 was used to simulate the pervious surfaces of the site and calculate the pre-development peak flows for the site. Peak flows were computed using a 4-hour Chicago distribution rainfall for the 2 year to 100 year return frequency events. The results are attached at the end of this report. Tabulated below are the pre-development peak flows discharging to Baseline Road.

TABLE 1: PRE-DEVELOPMENT PEAK FLOWS TO BASELINE ROAD

RETURN FREQUENCY (YEARS)	PRE-DEVELOPMENT PEAK FLOW (L/s)
2	14
5	23
10	29
25	46
50	57
100	67

As indicated on the Lot Grading and Servicing Plan, Drawings 115160-SG-1 and SS-1, the proposed parking lot is to be drained using a conventional storm drainage system consisting of positive draining surfaces intercepted by a minor storm sewer system. The storm sewer system is proposed to outlet to the existing drainage network at Baseline Road. With the implementation of an orifice control device, a stormwater detention tank internal to the proposed building, a 10-unit Armtec Hydrostor HS-75 Chamber Bed, and structure and pipe storage, post-development peak flows will be attenuated to at or below the pre-development levels.

The stormwater detention tank internal to the proposed building is proposed to be sized as 22m long, 10m, wide, and 0.9m high, with 150mm thick walls, made to be watertight and complete with an impermeable barrier. The tank will detain stormwater flows from all rooftop rainwater leaders (clean water) and impervious surface flows after passing through the additional proposed quality control mechanisms (see Section 3.0 of this report). A cleanout or inspection port for the 198m^3 volume tank shall be provided.

To serve as both quantity and quality control, a 10-unit Armtec Hydrostor HS-75 Chamber Bed is proposed to be constructed in the existing gravel drive aisle as part of this proposed development. In regard to quantity control, the chamber bed shall detain up to 28.82m^3 of runoff from the existing asphalt parking area, and the western half of the existing buildings' roof, before conveying flows to the stormwater detention tank internal to the proposed building, or allowing runoff to infiltrate into the native sub surface soils. This addition to the sites' quantity controls allowed for overall head behind the 75mm orifice to be lowered to attain the pre-development peak flow targets, paired with a large stormwater detention tank internal to the proposed building.

The site storm sewer system as proposed has been sized to accommodate a 5-year return frequency post-development event as Municipality of Clarington Design Criteria. A 5-year and 100-year Storm Sewer Design Sheet are attached at the end of this report.

As mentioned above, all flows up to and including the 100-year storm event will be detained on-site to discharge at the pre-development level. The proposed storm sewer system is illustrated on drawing 115160-SS-1.

The post-development drainage area tributary to the proposed internal storm sewer system for attenuation is 0.54 ha. The STANDHYD Sub-Routine in the computer model VISUAL OTTHYMO 6.2 was used to simulate the impervious surfaces of the site and calculate the post-development peak flows for the site. Peak flows were computed using a 4-hour Chicago distribution rainfall for the 2 year to 100 year return frequency events. The results are attached at the end of this report. The ROUTE RESERVOIR Sub-Routine was used to simulate the performance of the surface storage volumes and a 75 mm orifice plate, providing attenuation for the site. The Post-Development Drainage Scheme is illustrated on the Site Servicing Drawing, 115160-SS-1, appended at the end of this report. Tabulated below is a comparison of the attenuated post-development peak flows to pre-development peak flows discharging to Baseline Road.

TABLE 2: PRE VS. POST-DEVELOPMENT PEAK FLOWS TO BASELINE ROAD

RETURN FREQUENCY (YEARS)	PRE-DEVELOPMENT PEAK FLOW (L/s)	POST-DEVELOPMENT ROUTED PEAK FLOW (L/s)	RETAINED VOLUME (cu.m)
2	14	14	78
5	23	19	108
10	29	22	125
25	46	27	181
50	57	33	206
100	67	51	215

As is reported above, post-development peak flows are at or below the pre-development peak flows; therefore, no adverse impact on the existing drainage network is anticipated. The VISUAL OTTHYMO 6.2 output files, the stage-storage-discharge sheet, the site parameters sheet, and the runoff coefficient calculation sheet are appended at the end of this report.

3.0 STORMWATER QUALITY CONTROLS

The area of the site initially proposed to be included as parking lot is reduced with the new building expansion rooftop, to an approximate area of 0.27 ha. Therefore, the TSS in runoff is lowered from the existing site condition to the proposed site condition, as rooftop runoff is considered clean. This impervious area of 0.27 ha is slightly above the threshold of 0.25 ha where storm water quality controls are typically required by CLOCA. During the initial development, a stormwater treatment CDS Technologies unit, model PMSU2015-5-C, was installed to provide storm water cleansing. Refer to drawing 115160-SS-1, Site Servicing Plan, to see EX MH-2 which holds the CDS Unit, downstream of the proposed 75mm plate orifice. The proposed site development will continue to rely on the installed CDS stormwater treatment unit, along with two additional quality control mechanisms described below. First, both the existing catch basin manholes on site, EX CBMH-4 and EX CBMH-3 shown on drawing

115160-SS-1, Site Servicing Plan, are proposed to be equipped with catch basin (CB) shields. CB Shields are recognized by Environmental Technology Verification (ETV) Canada to remove 53% of TSS in stormwater. Second, the 10-unit Armtec Hydrostor HS-75 Chamber Bed features a sediment row that will capture TSS from the north parking lot area runoff before infiltrating into the native sub surface soils or flowing into the detention tank internal to the proposed building. As noted in the report titled “Geotechnical Investigation – Proposed Building Addition” by Pinchin Ltd., the subject site holds grey coloured soils that are indicative of permanent saturated conditions from elevations 94.5 to 96.4 masl, despite no groundwater observation in the boreholes at the time of drilling in September 2025. Furthermore, a direct quote from the report: “Seasonal variations in the water table should be expected, with higher levels occurring during wet weather conditions in the spring and fall and lower levels occurring during dry weather conditions.” As noted on drawing SS-1 Site Servicing Plan, the fluctuating estimated ground water table will saturate the proposed 10-unit Armtec Hydrostor HS-75 Chamber Bed to mid-level of chamber at the maximum elevation of 96.4 in wet weather conditions, whereas the ground water shall be below the chamber bed during the dry weather conditions. As the proposed stormwater sewer design is generally a retrofit of the existing system, the elevations of the proposed chamber bed are dictated by the upstream existing rainwater leaders into *EX CBMH-4*, and ultimately downstream through the detention tank to *EX MH-2*. Therefore, the inevitability of groundwater entering the chamber bed is understood, and because of this, the quality control aspect of the chamber bed can be described as a best-efforts approach. The estimated storage volume loss of 18 m^3 in the 10-unit Armtec Hydrostor HS-75 Chamber Bed during wet weather conditions is accommodated for in the sizing of the 198 m^3 detention tank internal to the proposed building.

4.0 STREAM EROSION / VOLUME CONTROL

The following discussion is in regard to the combined CLOCA and Municipality of Clarington requirement that 27mm of rainfall be captured, retained, or detained from all new and/or fully reconstructed impervious surfaces according to the CLOCA Technical Guidelines for Stormwater Management Submissions (October 2020).

The existing developed site features a stormwater storage system mainly consisting of surface ponding in the southern parking area. This southern parking area is proposed to be built upon with the new building addition, effectively being replaced by another impervious surface. Therefore, the impervious surface of the site is nor increasing or decreasing from the existing site condition to the proposed. However, the sites' stormwater runoff storage is increasing from the previous designed value of 153m^3 to 213m^3. Furthermore, the existing site stormwater management system does not feature infiltration capability, whereas the proposed design features a chamber bed with opportunity to infiltrate both clean and treated runoff back into the native sub surface soils.

5.0 EROSION AND SEDIMENT CONTROLS

During the construction period, open cut excavations for the proposed building foundation, and stormwater infrastructure has potential to create the transport of large amounts of sediment during rainfall events. To minimize the sediment laden storm water leaving the site during construction, the following sediment control techniques are proposed to be implemented. These measures are detailed on the Erosion and Sediment Control Plan included in the site plan submission.

1. Construction Vehicle Access Route (Mud Mat)
2. Catch Basin Filtration
3. Perimeter Enviro Fence
4. Good Engineering Practices

6.0 CONCLUSIONS

The preceding letter/report identifies the stormwater management requirements for the development proposal. The investigations into these requirements have resulted in the following conclusions for the development proposal:

- The quantity control proposal for the development is to control all post-development peak flows to pre-development (greenfield) levels;

- A detention tank internal to the proposed building, a 10-unit Armtec Hydrostor Chamber Bed, structure and pipe storage, in conjunction with a 75mm orifice plate control device is proposed to attenuate all flows to the pre-development level;
- On-site storm sewers have been sized to accommodate a 5-year return frequency post-development event as per Municipality of Clarington Design Criteria;
- As the area of proposed remaining parking area is slightly greater than 0.25ha, hence, permanent stormwater quality controls are proposed through the inclusion of a CDS Technologies stormwater treatment unit, CB shields, and a sediment row in the 10-unit Armtec Hydrostor Chamber Bed
- Temporary sediment controls during construction can be managed by the use of perimeter enviro fence, construction vehicle access route, catch basin filtration and good engineering practices;

We trust the Municipality of Clarington and The Central Lake Ontario Conservation Authority concur with our recommendations. Please provide positive comments on the Site Plan Application to facilitate development. Should you have any questions on the foregoing, please do not hesitate to contact our office.

APPENDIX

5-YEAR STORM SEWER DESIGN SHEET

100-YEAR STORM SEWER DESIGN SHEET

RUNOFF COEFFICIENT CALCULATION SHEET

SITE PARAMETERS SHEET

STAGE-STORAGE-DISCHARGE DESIGN SHEET

VISUAL OTTHYMO SCHEMATIC AND DETAILED RESULTS

INFILTRATION CALCULATION SHEET

CDS TECHNOLOGIES OPERATION, DESIGN, PERFORMANCE, & MAINTENANCE GUIDE

CB SHIELD INFORMATION

ARMTEC HYDROSTOR HS-75 STANDARD DRAWINGS

STORM SEWER DESIGN SHEET

D.G.BIDDLE & ASSOCIATES LTD.

consulting engineers

MUNICPALITY CLARINGTON
PROJECT CESTOIL CHEMICAL INC. - 1726 BASELINE RD WEST
PROJECT # 115160

DESIGN BY S.L.A.
CHK'D BY R.M.L.
DATE 2025-09-05

CRITERIA	
n	0.013
STORM	**5 YEAR**
A	2464
B	16
C	1

RUN OFF CO-EFFICIENTS	
PARK	I=0.20
SINGLE RES	I=0.50
SEMI RES	I=0.55
TOWNHOUSES	I=0.65
SCHOOL	I=0.70
INDUSTRIAL	I=0.80
COMMERCIAL	I=0.90

LOCATION		**DRAINAGE DATA**				**RATIONAL DESIGN**				**PIPE DATA**							
FROM MH	**TO** MH	**AREA** (ha)	**I**	**AxI**	**ACCUM** AxI	**T.C** min	**R** mm/hr	**FLOW** L/sec	**NOTES** *	**SIZE** mm	**GRADE** %	**CAPACITY** L/sec	**VELOCITY** m/s	**LENGTH** m	**TIME** min	**TOTAL TIME**	**% LOAD**
1/2 EX ROOF	CBMH-4	0.028	0.90	0.025	0.025	15.00	79.48	5.47		200	0.50	23.19	0.75	42.83	0.96	15.96	23.58
CBMH-4	MH-A	0.143	0.85	0.122	0.146	15.96	77.10	31.36		300	1.17	104.60	1.50	12.87	0.14	16.10	29.98
MH-A	MH-B	0.000	0.00	0.000	0.146	16.10	76.76	31.22		300	2.00	136.76	1.96	13.24	0.11	16.21	22.83
MH-B	CBMH-3	0.000	0.00	0.000	0.146	16.21	76.49	31.11		300	1.30	110.26	1.58	11.48	0.12	16.33	28.22
CBMH-3	DETENTION TANK	0.112	0.81	0.091	0.237	16.33	76.20	50.21		300	0.50	68.38	0.98	10.57	0.18	16.51	73.43
ROOF	DETENTION TANK	0.117	0.90	0.105	0.105	15.00	79.48	23.27		250	2.00	84.10	1.73	92.53	0.89	15.89	27.67
DETENTION TANK	MH-C	0.000	0.00	0.000	0.342	16.51	75.78	72.12		300	1.13	102.79	1.47	10.58	0.12	16.63	70.16
MH-C	MH-2 CDS UNIT	0.000	0.00	0.000	0.342	16.63	75.50	8.00	1*	375	1.00	175.33	1.60	14.71	0.15	16.79	4.56
MH-2 CDS UNIT	MH-1	0.000	0.00	0.000	0.342	16.79	75.15	8.00	1*	375	0.53	127.64	1.17	20.77	0.30	17.08	6.27

Notes:
1* The flow rate from this structure is attenuated to 8 L/s by the 75mm Orifice Plate for the 5 Year storm event.

STORM SEWER DESIGN SHEET

D.G.BIDDLE & ASSOCIATES LTD.

consulting engineers

MUNICPALITY CLARINGTON
PROJECT CESTOIL CHEMICAL INC. - 1726 BASELINE RD WEST
PROJECT # 115160

DESIGN BY S.L.A.
CHK'D BY R.M.L.
DATE 2025-09-05

CRITERIA

n	0.013
STORM	**100 YEAR**
A	1770
B	4
C	0.82

RUN OFF CO-EFFICIENTS

PARK	I=0.20
SINGLE RES	I=0.50
SEMI RES	I=0.55
TOWNHOUSES	I=0.65
SCHOOL	I=0.70
INDUSTRIAL	I=0.80
COMMERCIAL	I=0.90

LOCATION		DRAINAGE DATA				RATIONAL DESIGN				PIPE DATA							
FROM MH	TO MH	AREA (ha)	I	AxI	ACCUM AxI	T.C min	R mm/hr	FLOW L/sec	NOTES *	SIZE mm	GRADE %	CAPACITY L/sec	VELOCITY m/s	LENGTH m	TIME min	TOTAL TIME	% LOAD
1/2 EX ROOF	CBMH-4	0.028	0.90	0.025	0.025	15.00	158.27	10.89		200	0.50	23.19	0.75	42.83	0.96	15.96	46.95
CBMH-4	MH-A	0.143	0.85	0.122	0.146	15.96	152.02	61.83		300	1.17	104.60	1.50	12.87	0.14	16.10	59.11
MH-A	MH-B	0.000	0.00	0.000	0.146	16.10	151.13	61.47		300	2.00	136.76	1.96	13.24	0.11	16.21	44.95
MH-B	CBMH-3	0.000	0.00	0.000	0.146	16.21	150.44	61.18		300	1.30	110.26	1.58	11.48	0.12	16.33	55.49
CBMH-3	DETENTION TANK	0.112	0.81	0.091	0.237	16.33	149.70	98.64	1*	300	0.50	68.38	0.98	10.57	0.18	16.51	144.26
ROOF	DETENTION TANK	0.117	0.90	0.105	0.105	15.00	158.27	46.33		250	2.00	84.10	1.73	92.53	0.89	15.89	55.09
DETENTION TANK	MH-C	0.000	0.00	0.000	0.342	16.51	148.62	141.43	1*	300	1.13	102.79	1.47	10.58	0.12	16.63	137.59
MH-C	MH-2 CDS UNIT	0.000	0.00	0.000	0.342	16.63	147.91	11.00	2*	375	1.00	175.33	1.60	14.71	0.15	16.79	6.27
MH-2 CDS UNIT	MH-1	0.000	0.00	0.000	0.342	16.79	147.02	11.00	2*	375	0.53	127.64	1.17	20.77	0.30	17.08	8.62

Notes:

1* The pipe data %Load value shows as above 100%. The stage storage system in place behind the orifice includes the detention tank, and structure and pipe storage. Therefore, this %Load is intended.

2* The flow rate from this structure is attenuated to 11 L/s by the 75mm Orifice Plate for the 100 Year storm event.

PROJECT	Cestoil Chemical Inc. - 1726 Baseline Road West, Courtice, ON			
PROJECT #	115160			
DATE	2025-09-05			

Runoff Coefficient Calculations

Pre-Development: (Pre - 2015-16 Construction)

Controlled

Total Area:		0.538	ha
Item	Runoff Coefficient 'c'	Area (ha)	A*c
Rooftops	0.90		0
Driveways	0.90		0
Landscape	0.20	0.534	0.10676
Runoff Coefficient 'c' =	**0.20**		
T_{imp} =	**-0.2**		

Post-Development:

Controlled

Total Area:		0.401	ha
Item	Runoff Coefficient 'c'	Area (ha)	A*c
Rooftops	0.90	0.146	0.1305
Driveways	0.90	0.230	0.20668095
Landscape	0.20	0.026	0.00515092
Runoff Coefficient 'c' =	**0.85**		
T_{imp} =	**93.3**		

Uncontrolled

Total Area:		0.137	ha
Item	Runoff Coefficient 'c'	Area (ha)	A*c
Rooftops	0.90	0	0
Driveways	0.90	0.04035728	0.03632155
Landscape	0.20	0.097	0.01941829
Runoff Coefficient 'c' =	**0.41**		
T_{imp} =	**29.4**		

Total	Runoff Coefficient 'c'	Area (ha)	A*c
Controlled	0.85	0.401	0.34233187
Uncontrolled	0.41	0.137	0.05573984
Combined Runoff Coefficient		**0.74**	

SITE PARAMETERS CHART

1726 Baseline Rd West, Courtice, ON

Cestoil Chemical Inc.

Project Number: 115160

Date: 2025-09-05

Name	Node	Hydrograph Type	CN Value	Area (ha)	Length	Slope (%)	Run Off Coefficient	IA (mm)	XIMP	TIMP	tc (hr)	tp (hr)
Existing Site Condition	1	NASHHYD	80	0.538	110	2	0.2	1.50			0.40800483	0.27200322
Post-Development												
Controlled	3	STANDHYD	98	0.401	N/A	N/A	0.85	1.04	93.3%	93.3%	N/A	N/A
Uncontrolled	2	STANDHYD	98	0.137	N/A	N/A	0.41	1.04	29.4%	29.4%	N/A	N/A

1. Pre-development area evaluated as single entity for determination of tp for analysis

tc calculated with the airport method

tc= (3.26*(1.1 - C)*L^(0.5))/(S^(1/3) min

Imperviousness = (C - 0.2)/0.7

tp is taken to be 2/3 of tc

Cestoil Chemical Inc.
1726 Baseline Rd West, Courtice, ON
Project No. 115160
2025-10-30

Storage/Discharge

							Orifice Plate	
Elevation	Delta H	Depth	Cumulative Structure and Pipe Storage	HS-75 Chamber Bed Storage	Detention Tank Storage	Total Storage	Head	Orifice Discharge
	(mm)	(mm)	(m^3)	(m^3)	(m^3)	(m^3)	(m)	(m^3/s)
95.7	0	-230	0.00	0.00	0.00	0.00	-0.340	0.0000
95.8	100	-230	0.00	1.63	0.00	1.63	-0.240	0.0000
95.93	130	-130	0.00	3.66	0.00	3.66	-0.110	0.0000
96.04	0	0	0.00	6.67	0.00	6.67	0.000	0.0000
96.05	10	10	0.09	6.95	0.00	7.03	0.010	0.0012
96.06	10	20	0.17	7.22	2.20	9.59	0.020	0.0017
96.18	120	140	1.22	11.06	28.60	40.88	0.140	0.0045
96.31	130	270	2.35	14.74	57.20	74.29	0.270	0.0062
96.44	130	400	3.49	18.22	85.80	107.51	0.400	0.0075
96.56	120	520	4.53	21.4	112.20	138.13	0.520	0.0086
96.69	130	650	5.67	23.94	140.80	170.41	0.650	0.0096
96.82	130	780	6.80	25.97	169.40	202.17	0.780	0.0105
96.95	130	910	7.93	28.01	198.00	233.94	0.910	0.0114
97.00	50	960	8.37	28.82	198.00	235.19	0.96	0.0117

MH-C Orifice Plate

$Q=CA(2gh)^{0.5}$		
Type	Plate	
Diameter=	0.075	m
Area=	0.0044	m2
C=	0.61	
C/L Elev=	96.040	m

Orifice Plate Rating Curve

m3/s	ha.m
0.00000000000	0.0000000000
0.00000000000	0.0001630000
0.00000000000	0.0003660000
0.00000000000	0.0006672308
0.00119369052	0.0007033327
0.00168813332	0.0009594346
0.00446638095	0.0040880421
0.00620259789	0.0074293669
0.00754956173	0.0107506917
0.00860782475	0.0138132992
0.00962384064	0.0170406240
0.01054238922	0.0202169487
0.01138708181	0.0233942735
0.01169573074	0.0235188600

Detention Tank Storage

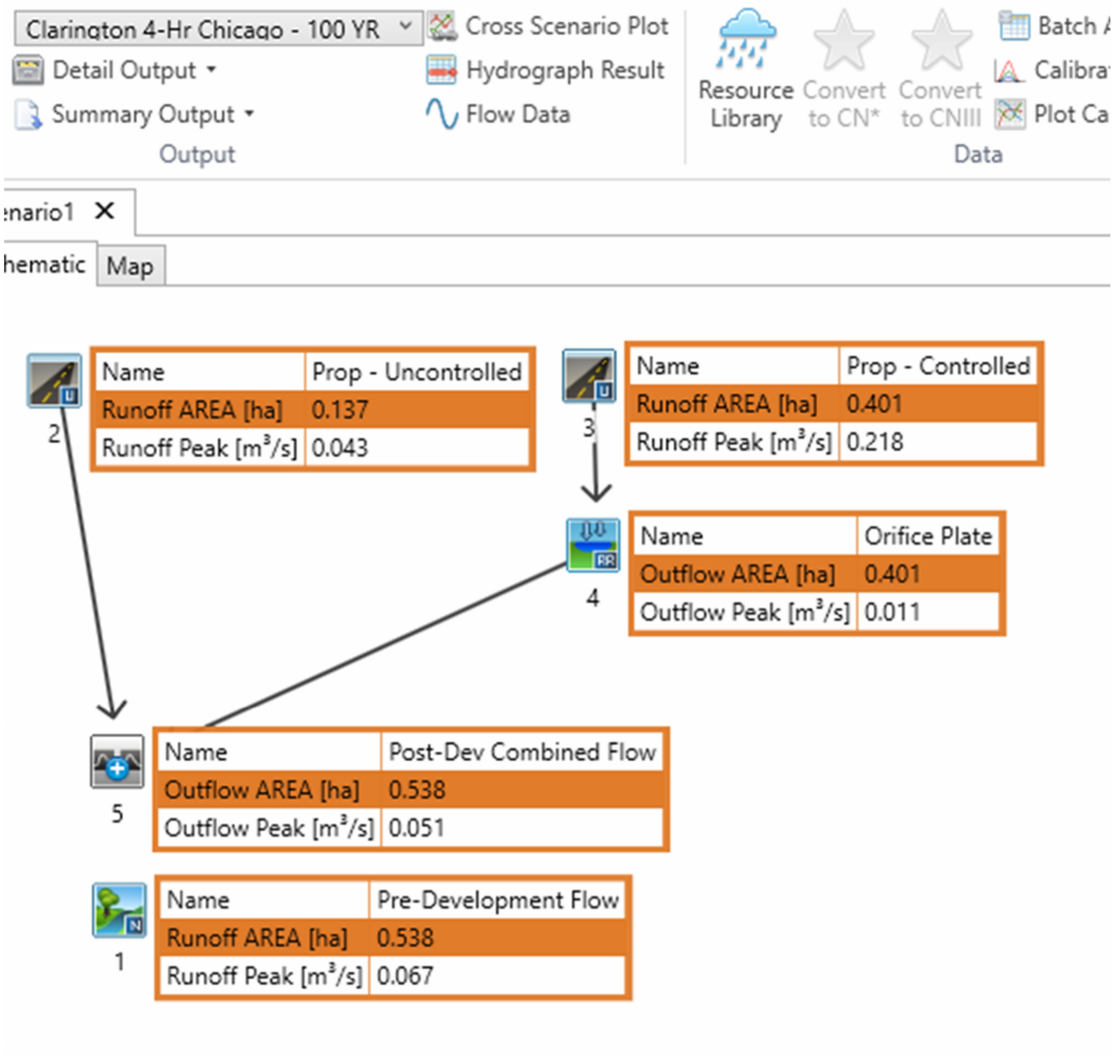
Elevation	Delta (m)	Volume (m^3)	Net Vol
96.05	0.000	0.00	0.00
96.06	0.01	2.20	2.20
96.18	0.12	26.40	28.60
96.31	0.13	28.60	57.20
96.44	0.13	28.60	85.80
96.56	0.12	26.40	112.20
96.69	0.13	28.60	140.80
96.82	0.13	28.60	169.40
96.95	0.13	28.60	198.00

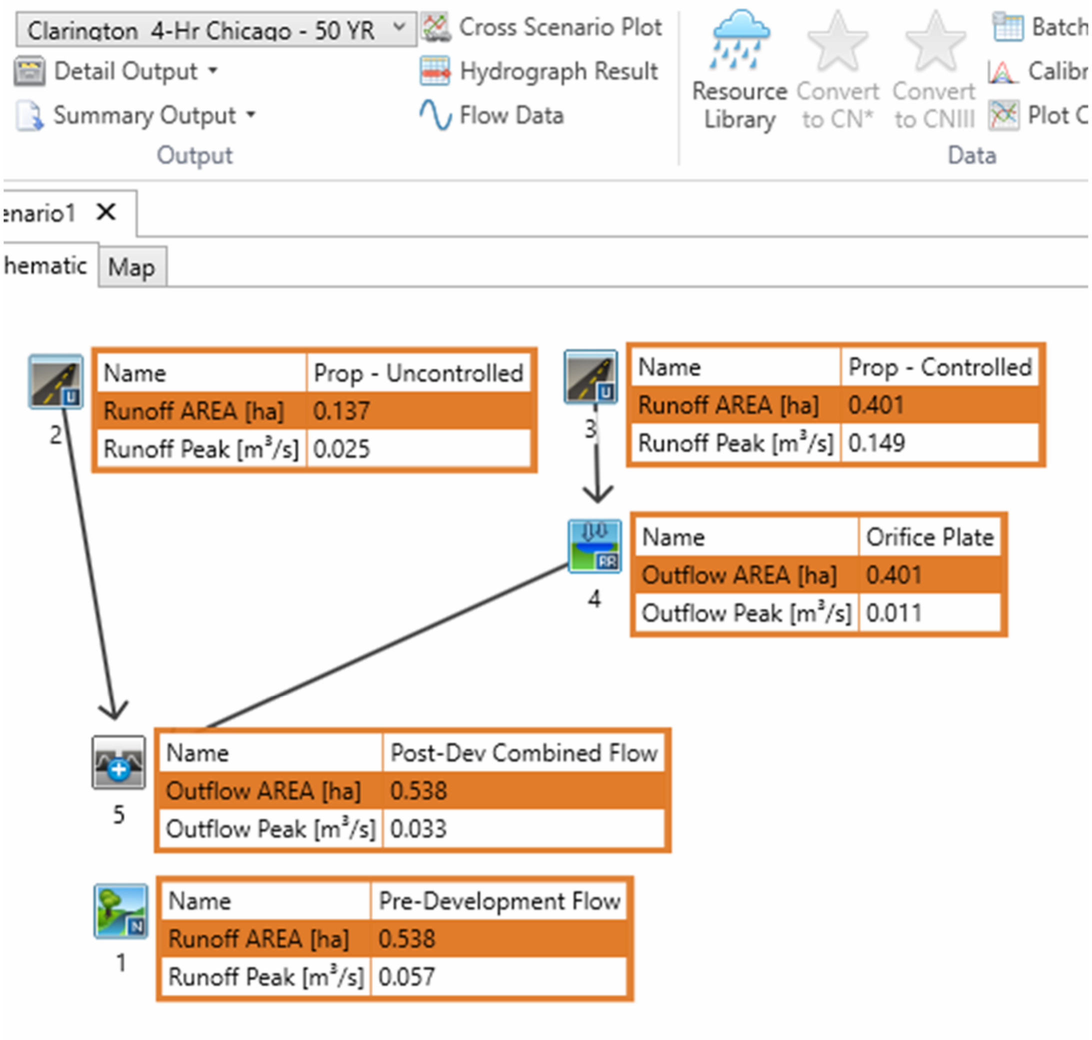
Structure Storage

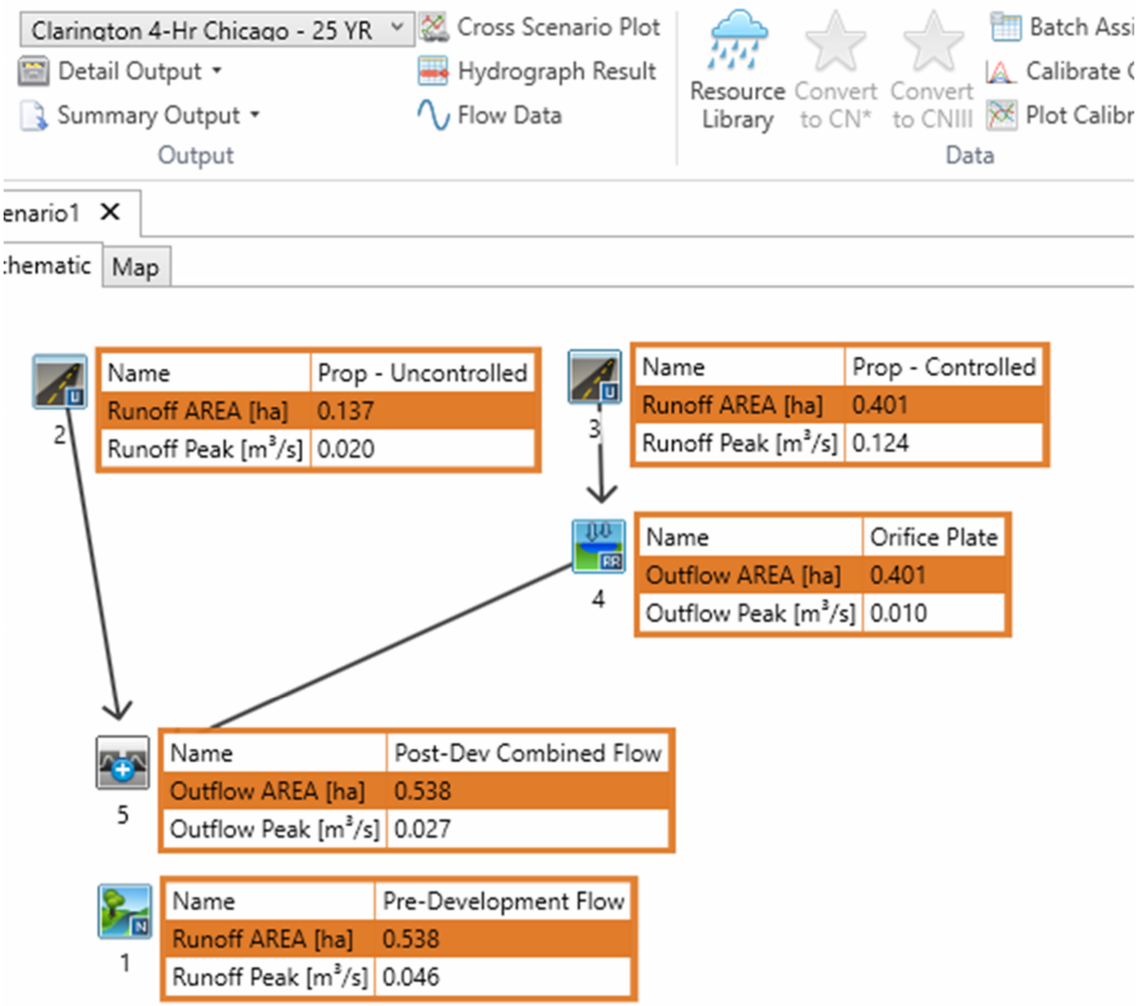
Structure	Cross Section Area	Depth	Volume (m3)
CBMH ST-4	1.130	0.14	0.16
MH ST-A	1.130	0.43	0.49
MH ST-B	1.130	0.7	0.79
CBMH ST-3	1.130	0.85	0.96
MH ST-C	1.130	1.1	1.24
Total			3.64

Pipe Storage

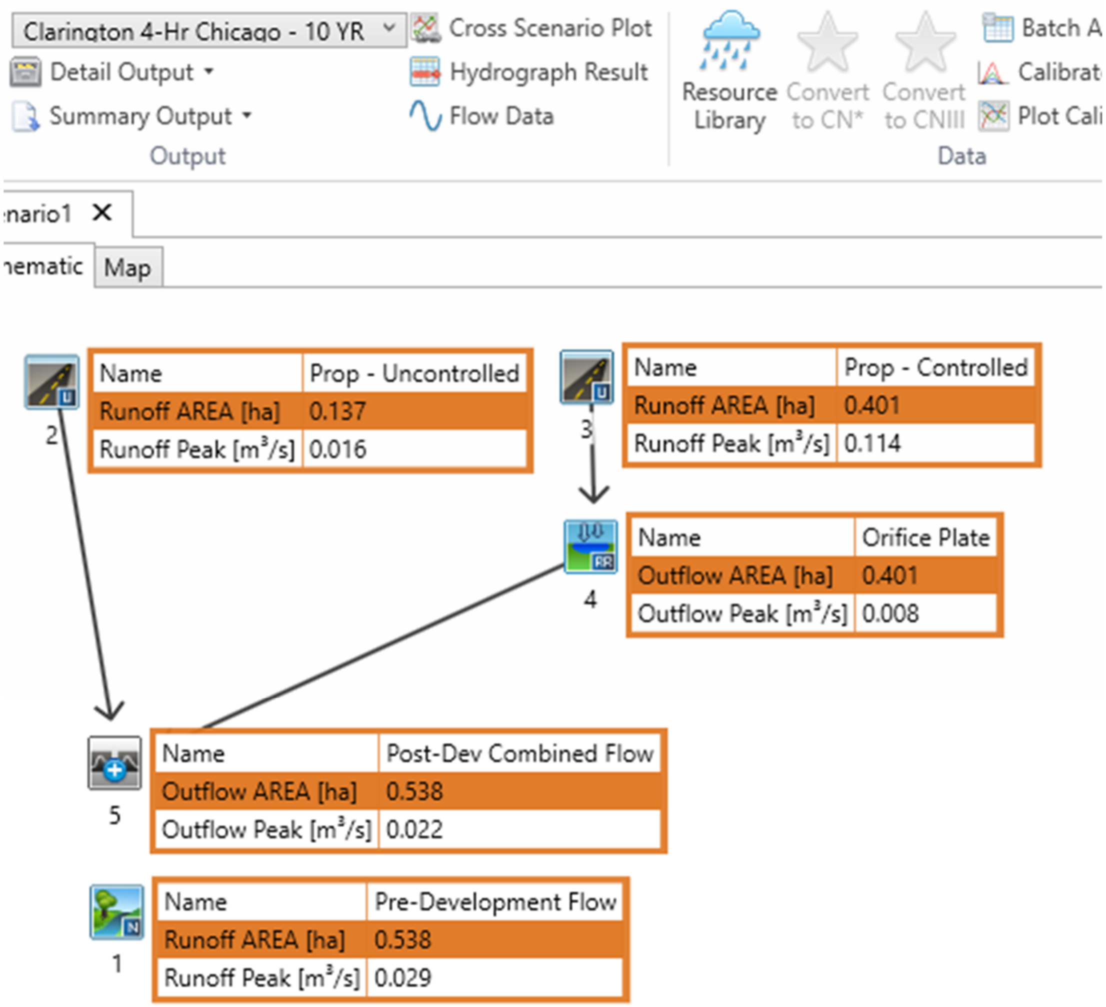
Size	Length	Area	Volume
(mm)	(m)	(m2)	(m3)
300	66.85	0.0707	4.73
Total			4.73


Clarington 4-Hr Chicago - 100 YR
Cross Scenario Plot
Detail Output
Hydrograph Result
Summary Output
Flow Data
Output
Resource Library
Convert to CN*
Convert to CNIII
Data
Map
Name
Prop - Uncontrolled
Runoff AREA [ha]
0.137
Runoff Peak [m³/s]
0.043
Name
Prop - Controlled
Runoff AREA [ha]
0.401
Runoff Peak [m³/s]
0.218
Name
Orifice Plate
Outflow AREA [ha]
0.401
Outflow Peak [m³/s]
0.011
Name
Post-Dev Combined Flow
Outflow AREA [ha]
0.538
Outflow Peak [m³/s]
0.051
Name
Pre-Development Flow
Runoff AREA [ha]
0.538
Runoff Peak [m³/s]
0.067
1
2
3
4
5

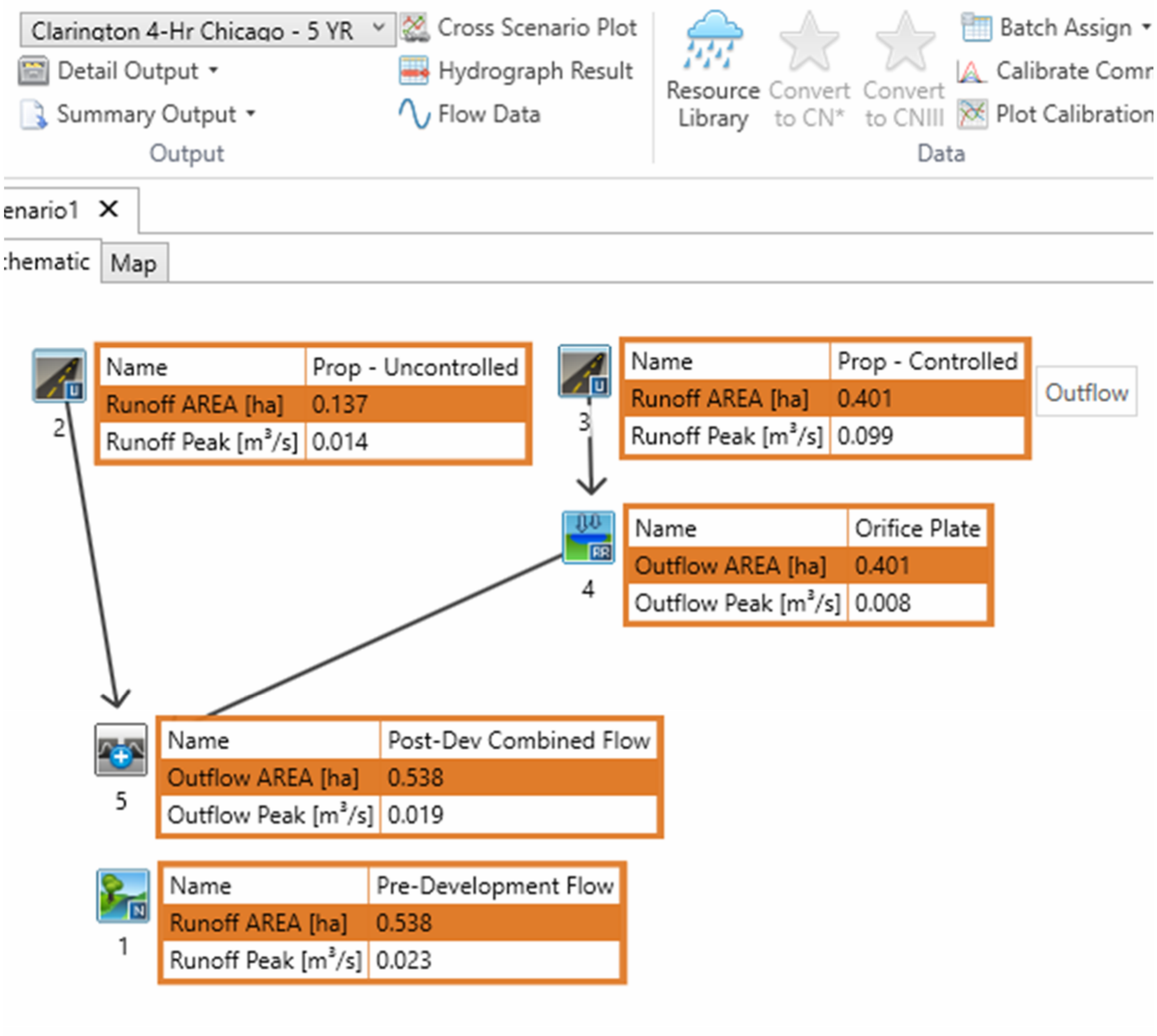

Clarington 4-Hr Chicago - 50 YR
Cross Scenario Plot
Detail Output
Hydrograph Result
Summary Output
Flow Data
Output
Resource Library
Convert to CN*
Convert to CNIII
Data
Map
Name | Prop - Uncontrolled
Runoff AREA [ha] | 0.137
Runoff Peak [m³/s] | 0.025
2
Name | Prop - Controlled
Runoff AREA [ha] | 0.401
Runoff Peak [m³/s] | 0.149
3
Name | Orifice Plate
Outflow AREA [ha] | 0.401
Outflow Peak [m³/s] | 0.011
4
Name | Post-Dev Combined Flow
Outflow AREA [ha] | 0.538
Outflow Peak [m³/s] | 0.033
5
Name | Pre-Development Flow
Runoff AREA [ha] | 0.538
Runoff Peak [m³/s] | 0.057
1

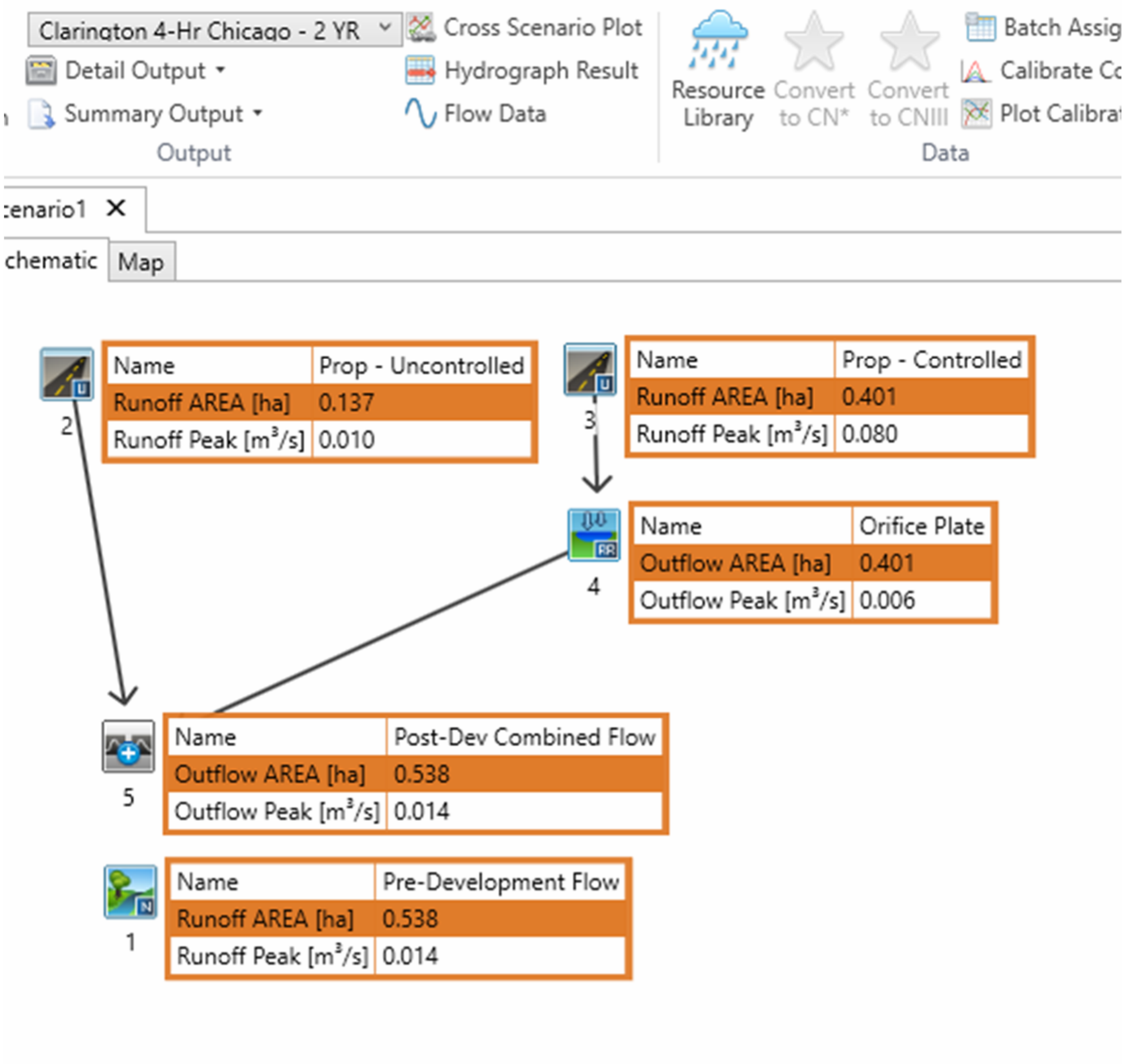


Clarington 4-Hr Chicago - 25 YR
Cross Scenario Plot
Detail Output
Hydrograph Result
Summary Output
Flow Data
Output
Resource Library
Convert to CN*
Convert to CNIII
Batch Assi
Calibrate
Plot Calibr
Data
enario1
hematic
Map
2
Name | Prop - Uncontrolled
Runoff AREA [ha] | 0.137
Runoff Peak [m³/s] | 0.020
3
Name | Prop - Controlled
Runoff AREA [ha] | 0.401
Runoff Peak [m³/s] | 0.124
4
Name | Orifice Plate
Outflow AREA [ha] | 0.401
Outflow Peak [m³/s] | 0.010
5
Name | Post-Dev Combined Flow
Outflow AREA [ha] | 0.538
Outflow Peak [m³/s] | 0.027
1
Name | Pre-Development Flow
Runoff AREA [ha] | 0.538
Runoff Peak [m³/s] | 0.046



Clarington 4-Hr Chicago - 10 YR
Cross Scenario Plot
Detail Output
Hydrograph Result
Summary Output
Flow Data
Output
Resource Library
Convert to CN*
Convert to CNIII
Data
Map
2
Name | Prop - Uncontrolled
Runoff AREA [ha] | 0.137
Runoff Peak [m³/s] | 0.016
3
Name | Prop - Controlled
Runoff AREA [ha] | 0.401
Runoff Peak [m³/s] | 0.114
4
Name | Orifice Plate
Outflow AREA [ha] | 0.401
Outflow Peak [m³/s] | 0.008
5
Name | Post-Dev Combined Flow
Outflow AREA [ha] | 0.538
Outflow Peak [m³/s] | 0.022
1
Name | Pre-Development Flow
Runoff AREA [ha] | 0.538
Runoff Peak [m³/s] | 0.029


Clarington 4-Hr Chicago - 5 YR
Cross Scenario Plot
Detail Output
Hydrograph Result
Summary Output
Flow Data
Output
Resource Library
Convert to CN*
Convert to CNIII
Batch Assign
Calibrate Comr
Plot Calibration
Data
enario1
hematic
Map
2
Name | Prop - Uncontrolled
Runoff AREA [ha] | 0.137
Runoff Peak [m³/s] | 0.014
3
Name | Prop - Controlled
Runoff AREA [ha] | 0.401
Runoff Peak [m³/s] | 0.099
Outflow
4
Name | Orifice Plate
Outflow AREA [ha] | 0.401
Outflow Peak [m³/s] | 0.008
5
Name | Post-Dev Combined Flow
Outflow AREA [ha] | 0.538
Outflow Peak [m³/s] | 0.019
1
Name | Pre-Development Flow
Runoff AREA [ha] | 0.538
Runoff Peak [m³/s] | 0.023



Clarington 4-Hr Chicago - 2 YR
Cross Scenario Plot
Detail Output
Hydrograph Result
Summary Output
Flow Data
Output
Resource Library
Convert to CN*
Convert to CNIII
Batch Assig
Calibrate Co
Plot Calibrat
Data
cenario1
chematic
Map
2
Name | Prop - Uncontrolled
Runoff AREA [ha] | 0.137
Runoff Peak [m³/s] | 0.010
3
Name | Prop - Controlled
Runoff AREA [ha] | 0.401
Runoff Peak [m³/s] | 0.080
4
Name | Orifice Plate
Outflow AREA [ha] | 0.401
Outflow Peak [m³/s] | 0.006
5
Name | Post-Dev Combined Flow
Outflow AREA [ha] | 0.538
Outflow Peak [m³/s] | 0.014
1
Name | Pre-Development Flow
Runoff AREA [ha] | 0.538
Runoff Peak [m³/s] | 0.014

```
*************************************************
** SIMULATION:Clarington  4-Hr Chicago - 50 YR **
*************************************************
--------------------
| CHICAGO STORM    |    IDF curve parameters: A=4750.000
| Ptotal= 71.95 mm |                          B=  24.000
--------------------                          C=   1.000
                        used in:   INTENSITY =  A / (t + B)^C

                        Duration of storm  =  4.00 hrs
                        Storm time step    = 10.00 min
                        Time to peak ratio =  0.33

                 TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                  hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
                 0.00    2.18 |  1.00   52.37 |  2.00   11.13 |  3.00    3.12
                 0.17    2.89 |  1.17  139.71 |  2.17    8.44 |  3.17    2.68
                 0.33    4.02 |  1.33   68.44 |  2.33    6.62 |  3.33    2.33
                 0.50    5.96 |  1.50   36.37 |  2.50    5.33 |  3.50    2.04
                 0.67    9.77 |  1.67   22.56 |  2.67    4.38 |  3.67    1.81
                 0.83   18.93 |  1.83   15.36 |  2.83    3.67 |  3.83    1.61

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  0002)|   Area    (ha)=   0.14
|ID= 1 DT= 5.0 min |   Total Imp(%)=  29.40   Dir. Conn.(%)=  29.40
--------------------
                            IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.04         0.10
     Dep. Storage     (mm)=       1.00         1.50
     Average Slope     (%)=       2.00         3.80
     Length            (m)=      30.22        20.97
     Mannings n          =       0.013        0.250

         NOTE:  RAINFALL WAS TRANSFORMED TO   5.0 MIN. TIME STEP.


                                  ---- TRANSFORMED HYETOGRAPH ----
                 TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                  hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
                0.083    2.18 | 1.083   52.37 | 2.083   11.13 |  3.08    3.12
                0.167    2.18 | 1.167   52.37 | 2.167   11.13 |  3.17    3.12
                0.250    2.89 | 1.250  139.71 | 2.250    8.44 |  3.25    2.68
                0.333    2.89 | 1.333  139.71 | 2.333    8.44 |  3.33    2.68
                0.417    4.02 | 1.417   68.44 | 2.417    6.62 |  3.42    2.33
                0.500    4.02 | 1.500   68.44 | 2.500    6.62 |  3.50    2.33
                0.583    5.96 | 1.583   36.37 | 2.583    5.33 |  3.58    2.04
                0.667    5.96 | 1.667   36.37 | 2.667    5.33 |  3.67    2.04
                0.750    9.77 | 1.750   22.56 | 2.750    4.38 |  3.75    1.81
                0.833    9.77 | 1.833   22.56 | 2.833    4.38 |  3.83    1.81
                0.917   18.93 | 1.917   15.36 | 2.917    3.67 |  3.92    1.61
                1.000   18.93 | 2.000   15.36 | 3.000    3.67 |  4.00    1.61

     Max.Eff.Inten.(mm/hr)=     139.71        49.88
                over (min)        5.00        10.00
     Storage Coeff.  (min)=       0.89 (ii)    5.79 (ii)
     Unit Hyd. Tpeak (min)=       5.00        10.00
     Unit Hyd. peak  (cms)=       0.34         0.15
                                                         *TOTALS*
     PEAK FLOW       (cms)=       0.02         0.01         0.025 (iii)
     TIME TO PEAK    (hrs)=       1.33         1.42          1.33
     RUNOFF VOLUME    (mm)=      70.95        28.49         40.94
     TOTAL RAINFALL   (mm)=      71.95        71.95         71.95
     RUNOFF COEFFICIENT   =       0.99         0.40          0.57

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  71.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  0003)|   Area    (ha)=   0.40
|ID= 1 DT= 5.0 min |   Total Imp(%)=  93.30   Dir. Conn.(%)=  93.30
--------------------
                            IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.37         0.03
     Dep. Storage     (mm)=       1.00         1.50
```

```
     Average Slope     (%)=       0.40         2.00
     Length            (m)=      51.70         3.50
     Mannings n          =       0.013        0.250

         NOTE:  RAINFALL WAS TRANSFORMED TO   5.0 MIN. TIME STEP.


                                  ---- TRANSFORMED HYETOGRAPH ----
                 TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                  hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
                0.083    2.18 | 1.083   52.37 | 2.083   11.13 |  3.08    3.12
                0.167    2.18 | 1.167   52.37 | 2.167   11.13 |  3.17    3.12
                0.250    2.89 | 1.250  139.71 | 2.250    8.44 |  3.25    2.68
                0.333    2.89 | 1.333  139.71 | 2.333    8.44 |  3.33    2.68
                0.417    4.02 | 1.417   68.44 | 2.417    6.62 |  3.42    2.33
                0.500    4.02 | 1.500   68.44 | 2.500    6.62 |  3.50    2.33
                0.583    5.96 | 1.583   36.37 | 2.583    5.33 |  3.58    2.04
                0.667    5.96 | 1.667   36.37 | 2.667    5.33 |  3.67    2.04
                0.750    9.77 | 1.750   22.56 | 2.750    4.38 |  3.75    1.81
                0.833    9.77 | 1.833   22.56 | 2.833    4.38 |  3.83    1.81
                0.917   18.93 | 1.917   15.36 | 2.917    3.67 |  3.92    1.61
                1.000   18.93 | 2.000   15.36 | 3.000    3.67 |  4.00    1.61

     Max.Eff.Inten.(mm/hr)=     139.71        49.88
                over (min)        5.00         5.00
     Storage Coeff.  (min)=       1.98 (ii)    2.48 (ii)
     Unit Hyd. Tpeak (min)=       5.00         5.00
     Unit Hyd. peak  (cms)=       0.31         0.29
                                                         *TOTALS*
     PEAK FLOW       (cms)=       0.14         0.00         0.149 (iii)
     TIME TO PEAK    (hrs)=       1.33         1.33          1.33
     RUNOFF VOLUME    (mm)=      70.95        28.49         68.10
     TOTAL RAINFALL   (mm)=      71.95        71.95         71.95
     RUNOFF COEFFICIENT   =       0.99         0.40          0.95

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  71.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
--------------------
| RESERVOIR(  0004)|     OVERFLOW IS OFF
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          0.0000     0.0000   |    0.0062     0.0074
                          0.0000     0.0002   |    0.0075     0.0108
                          0.0000     0.0004   |    0.0086     0.0138
                          0.0000     0.0007   |    0.0096     0.0170
                          0.0012     0.0007   |    0.0105     0.0202
                          0.0017     0.0010   |    0.0114     0.0234
                          0.0045     0.0041   |    0.0117     0.0235

                                 AREA     QPEAK     TPEAK       R.V.
                                 (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0003)      0.401      0.149      1.33       68.10
   OUTFLOW: ID= 1 (  0004)      0.401      0.011      2.25       66.43

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)=  7.16
                   TIME SHIFT OF PEAK FLOW        (min)= 55.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=  0.0206

--------------------------------------------------------------------------------

--------------------
| ADD HYD  (  0005)|
|   1 +  2 =  3    |        AREA    QPEAK    TPEAK     R.V.
--------------------        (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0002):     0.14    0.025     1.33    40.94
      + ID2= 2 (  0004):     0.40    0.011     2.25    66.43
        ===============================================
        ID = 3 (  0005):     0.54    0.033     1.33    59.94

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
--------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD   (  0001)|   Area    (ha)=   0.54   Curve Number   (CN)= 80.0
|ID= 1 DT= 5.0 min |   Ia      (mm)=   1.50   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.27
```

```
        NOTE:  RAINFALL WAS TRANSFORMED TO   5.0 MIN. TIME STEP.


                              ---- TRANSFORMED HYETOGRAPH ----
                TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                 hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
               0.083    2.18 | 1.083   52.37 | 2.083   11.13 |  3.08    3.12
               0.167    2.18 | 1.167   52.37 | 2.167   11.13 |  3.17    3.12
               0.250    2.89 | 1.250  139.71 | 2.250    8.44 |  3.25    2.68
               0.333    2.89 | 1.333  139.71 | 2.333    8.44 |  3.33    2.68
               0.417    4.02 | 1.417   68.44 | 2.417    6.62 |  3.42    2.33
               0.500    4.02 | 1.500   68.44 | 2.500    6.62 |  3.50    2.33
               0.583    5.96 | 1.583   36.37 | 2.583    5.33 |  3.58    2.04
               0.667    5.96 | 1.667   36.37 | 2.667    5.33 |  3.67    2.04
               0.750    9.77 | 1.750   22.56 | 2.750    4.38 |  3.75    1.81
               0.833    9.77 | 1.833   22.56 | 2.833    4.38 |  3.83    1.81
               0.917   18.93 | 1.917   15.36 | 2.917    3.67 |  3.92    1.61
               1.000   18.93 | 2.000   15.36 | 3.000    3.67 |  4.00    1.61

    Unit Hyd Qpeak  (cms)=   0.076

    PEAK FLOW       (cms)=   0.057 (i)
    TIME TO PEAK    (hrs)=   1.667
    RUNOFF VOLUME    (mm)=  37.029
    TOTAL RAINFALL   (mm)=  71.949
    RUNOFF COEFFICIENT   =   0.515

    (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
************************************************
** SIMULATION:Clarington 4-Hr Chicago - 10 YR **
************************************************
--------------------
| CHICAGO STORM    |    IDF curve parameters: A=2819.000
| Ptotal= 44.04 mm |                          B=  16.000
--------------------                          C=   1.000
                        used in:   INTENSITY =  A / (t + B)^C

                        Duration of storm  =  4.00 hrs
                        Storm time step    = 10.00 min
                        Time to peak ratio =  0.33

                TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                 hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
                0.00    0.93 |  1.00   30.96 |  2.00    5.20 |  3.00    1.34
                0.17    1.24 |  1.17  108.42 |  2.17    3.85 |  3.17    1.15
                0.33    1.75 |  1.33   42.32 |  2.33    2.97 |  3.33    0.99
                0.50    2.66 |  1.50   19.65 |  2.50    2.36 |  3.50    0.87
                0.67    4.51 |  1.67   11.35 |  2.67    1.92 |  3.67    0.76
                0.83    9.35 |  1.83    7.39 |  2.83    1.59 |  3.83    0.68


--------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  0002)|   Area    (ha)=   0.14
|ID= 1 DT= 5.0 min |   Total Imp(%)=  29.40   Dir. Conn.(%)=  29.40
--------------------
                           IMPERVIOUS    PERVIOUS (i)
    Surface Area     (ha)=       0.04         0.10
    Dep. Storage     (mm)=       1.00         1.50
    Average Slope     (%)=       2.00         3.80
    Length            (m)=      30.22        20.97
    Mannings n          =      0.013        0.250

        NOTE:  RAINFALL WAS TRANSFORMED TO   5.0 MIN. TIME STEP.


                              ---- TRANSFORMED HYETOGRAPH ----
                TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                 hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
               0.083    0.93 | 1.083   30.96 | 2.083    5.20 |  3.08    1.34
               0.167    0.93 | 1.167   30.96 | 2.167    5.20 |  3.17    1.34
               0.250    1.24 | 1.250  108.42 | 2.250    3.85 |  3.25    1.15
               0.333    1.24 | 1.333  108.42 | 2.333    3.85 |  3.33    1.15
               0.417    1.75 | 1.417   42.32 | 2.417    2.97 |  3.42    0.99
               0.500    1.75 | 1.500   42.32 | 2.500    2.97 |  3.50    0.99
               0.583    2.66 | 1.583   19.65 | 2.583    2.36 |  3.58    0.87
               0.667    2.66 | 1.667   19.65 | 2.667    2.36 |  3.67    0.87
               0.750    4.51 | 1.750   11.35 | 2.750    1.92 |  3.75    0.76
               0.833    4.51 | 1.833   11.35 | 2.833    1.92 |  3.83    0.76
               0.917    9.35 | 1.917    7.39 | 2.917    1.59 |  3.92    0.68
```

```
               1.000    9.35 | 2.000    7.39 | 3.000    1.59 |  4.00    0.68

    Max.Eff.Inten.(mm/hr)=     108.42        26.71
               over (min)       5.00        10.00
    Storage Coeff.  (min)=       0.98 (ii)    7.68 (ii)
    Unit Hyd. Tpeak (min)=       5.00        10.00
    Unit Hyd. peak  (cms)=       0.34         0.13
                                                         *TOTALS*
    PEAK FLOW       (cms)=       0.01         0.01         0.016 (iii)
    TIME TO PEAK    (hrs)=       1.33         1.42          1.33
    RUNOFF VOLUME    (mm)=      43.04        12.37         21.35
    TOTAL RAINFALL   (mm)=      44.04        44.04         44.04
    RUNOFF COEFFICIENT   =       0.98         0.28          0.48

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
             CN*  =  71.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
            THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  0003)|   Area    (ha)=   0.40
|ID= 1 DT= 5.0 min |   Total Imp(%)=  93.30   Dir. Conn.(%)=  93.30
--------------------
                           IMPERVIOUS    PERVIOUS (i)
    Surface Area     (ha)=       0.37         0.03
    Dep. Storage     (mm)=       1.00         1.50
    Average Slope     (%)=       0.40         2.00
    Length            (m)=      51.70         3.50
    Mannings n          =      0.013        0.250

        NOTE:  RAINFALL WAS TRANSFORMED TO   5.0 MIN. TIME STEP.


                              ---- TRANSFORMED HYETOGRAPH ----
                TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                 hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
               0.083    0.93 | 1.083   30.96 | 2.083    5.20 |  3.08    1.34
               0.167    0.93 | 1.167   30.96 | 2.167    5.20 |  3.17    1.34
               0.250    1.24 | 1.250  108.42 | 2.250    3.85 |  3.25    1.15
               0.333    1.24 | 1.333  108.42 | 2.333    3.85 |  3.33    1.15
               0.417    1.75 | 1.417   42.32 | 2.417    2.97 |  3.42    0.99
               0.500    1.75 | 1.500   42.32 | 2.500    2.97 |  3.50    0.99
               0.583    2.66 | 1.583   19.65 | 2.583    2.36 |  3.58    0.87
               0.667    2.66 | 1.667   19.65 | 2.667    2.36 |  3.67    0.87
               0.750    4.51 | 1.750   11.35 | 2.750    1.92 |  3.75    0.76
               0.833    4.51 | 1.833   11.35 | 2.833    1.92 |  3.83    0.76
               0.917    9.35 | 1.917    7.39 | 2.917    1.59 |  3.92    0.68
               1.000    9.35 | 2.000    7.39 | 3.000    1.59 |  4.00    0.68

    Max.Eff.Inten.(mm/hr)=     108.42        26.71
               over (min)       5.00         5.00
    Storage Coeff.  (min)=       2.19 (ii)    2.74 (ii)
    Unit Hyd. Tpeak (min)=       5.00         5.00
    Unit Hyd. peak  (cms)=       0.31         0.28
                                                         *TOTALS*
    PEAK FLOW       (cms)=       0.11         0.00         0.114 (iii)
    TIME TO PEAK    (hrs)=       1.33         1.33          1.33
    RUNOFF VOLUME    (mm)=      43.04        12.37         40.98
    TOTAL RAINFALL   (mm)=      44.04        44.04         44.04
    RUNOFF COEFFICIENT   =       0.98         0.28          0.93

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
             CN*  =  71.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
            THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
--------------------
| RESERVOIR(  0004)|     OVERFLOW IS OFF
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          0.0000     0.0000   |    0.0062     0.0074
                          0.0000     0.0002   |    0.0075     0.0108
                          0.0000     0.0004   |    0.0086     0.0138
                          0.0000     0.0007   |    0.0096     0.0170
```

```
                         0.0012      0.0007   |    0.0105      0.0202
                         0.0017      0.0010   |    0.0114      0.0234
                         0.0045      0.0041   |    0.0117      0.0235

                              AREA     QPEAK     TPEAK       R.V.
                              (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0003)    0.401     0.114     1.33      40.98
   OUTFLOW: ID= 1 (  0004)    0.401     0.008     2.00      39.30

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)=  7.15
                  TIME SHIFT OF PEAK FLOW        (min)= 40.00
                  MAXIMUM  STORAGE   USED       (ha.m.)=  0.0125

--------------------------------------------------------------------------------

--------------------
| ADD HYD  (  0005)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0002):     0.14   0.016     1.33     21.35
      + ID2= 2 (  0004):     0.40   0.008     2.00     39.30
        ================================================
        ID = 3 (  0005):     0.54   0.022     1.33     34.73

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
--------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD   (  0001)|   Area    (ha)=   0.54   Curve Number   (CN)= 80.0
|ID= 1 DT= 5.0 min |   Ia      (mm)=   1.50   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.27

         NOTE:  RAINFALL WAS TRANSFORMED TO   5.0 MIN. TIME STEP.


                                ---- TRANSFORMED HYETOGRAPH ----
                  TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                   hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
                 0.083    0.93 | 1.083   30.96 | 2.083    5.20 |  3.08    1.34
                 0.167    0.93 | 1.167   30.96 | 2.167    5.20 |  3.17    1.34
                 0.250    1.24 | 1.250  108.42 | 2.250    3.85 |  3.25    1.15
                 0.333    1.24 | 1.333  108.42 | 2.333    3.85 |  3.33    1.15
                 0.417    1.75 | 1.417   42.32 | 2.417    2.97 |  3.42    0.99
                 0.500    1.75 | 1.500   42.32 | 2.500    2.97 |  3.50    0.99
                 0.583    2.66 | 1.583   19.65 | 2.583    2.36 |  3.58    0.87
                 0.667    2.66 | 1.667   19.65 | 2.667    2.36 |  3.67    0.87
                 0.750    4.51 | 1.750   11.35 | 2.750    1.92 |  3.75    0.76
                 0.833    4.51 | 1.833   11.35 | 2.833    1.92 |  3.83    0.76
                 0.917    9.35 | 1.917    7.39 | 2.917    1.59 |  3.92    0.68
                 1.000    9.35 | 2.000    7.39 | 3.000    1.59 |  4.00    0.68

     Unit Hyd Qpeak  (cms)=   0.076

     PEAK FLOW       (cms)=   0.029 (i)
     TIME TO PEAK    (hrs)=   1.583
     RUNOFF VOLUME    (mm)=  17.053
     TOTAL RAINFALL   (mm)=  44.038
     RUNOFF COEFFICIENT   =   0.387

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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**************************************************
** SIMULATION:Clarington 4-Hr Chicago - 100 YR **
**************************************************
--------------------
| CHICAGO STORM    |    IDF curve parameters: A=1770.000
| Ptotal= 78.03 mm |                          B=   4.000
--------------------                          C=   0.820
                        used in:   INTENSITY =  A / (t + B)^C

                        Duration of storm  =  4.00 hrs
                        Storm time step    = 10.00 min
                        Time to peak ratio =  0.33

                  TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                   hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
                  0.00    4.34 |  1.00   38.21 |  2.00   10.60 |  3.00    5.19
                  0.17    5.00 |  1.17  203.31 |  2.17    8.96 |  3.17    4.81
                  0.33    5.92 |  1.33   50.96 |  2.33    7.78 |  3.33    4.48
                  0.50    7.33 |  1.50   25.51 |  2.50    6.90 |  3.50    4.20
                  0.67    9.77 |  1.67   17.18 |  2.67    6.21 |  3.67    3.96
                  0.83   15.10 |  1.83   13.06 |  2.83    5.65 |  3.83    3.74
```

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--------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  0002)|   Area    (ha)=   0.14
|ID= 1 DT= 5.0 min |   Total Imp(%)=  29.40   Dir. Conn.(%)=  29.40
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.04         0.10
     Dep. Storage     (mm)=       1.00         1.50
     Average Slope     (%)=       2.00         3.80
     Length            (m)=      30.22        20.97
     Mannings n          =      0.013        0.250

         NOTE:  RAINFALL WAS TRANSFORMED TO   5.0 MIN. TIME STEP.


                                ---- TRANSFORMED HYETOGRAPH ----
                  TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                   hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
                 0.083    4.34 | 1.083   38.21 | 2.083   10.60 |  3.08    5.19
                 0.167    4.34 | 1.167   38.21 | 2.167   10.60 |  3.17    5.19
                 0.250    5.00 | 1.250  203.30 | 2.250    8.96 |  3.25    4.81
                 0.333    5.00 | 1.333  203.31 | 2.333    8.96 |  3.33    4.81
                 0.417    5.92 | 1.417   50.96 | 2.417    7.78 |  3.42    4.48
                 0.500    5.92 | 1.500   50.96 | 2.500    7.78 |  3.50    4.48
                 0.583    7.33 | 1.583   25.51 | 2.583    6.90 |  3.58    4.20
                 0.667    7.33 | 1.667   25.51 | 2.667    6.90 |  3.67    4.20
                 0.750    9.77 | 1.750   17.18 | 2.750    6.21 |  3.75    3.96
                 0.833    9.77 | 1.833   17.18 | 2.833    6.21 |  3.83    3.96
                 0.917   15.10 | 1.917   13.06 | 2.917    5.65 |  3.92    3.74
                 1.000   15.10 | 2.000   13.06 | 3.000    5.65 |  4.00    3.74

     Max.Eff.Inten.(mm/hr)=     203.31        78.45
                over (min)        5.00         5.00
     Storage Coeff.  (min)=       0.76 (ii)    4.99 (ii)
     Unit Hyd. Tpeak (min)=       5.00         5.00
     Unit Hyd. peak  (cms)=       0.34         0.22
                                                          *TOTALS*
     PEAK FLOW       (cms)=       0.02         0.02          0.043 (iii)
     TIME TO PEAK    (hrs)=       1.33         1.33           1.33
     RUNOFF VOLUME    (mm)=      77.03        32.49          45.55
     TOTAL RAINFALL   (mm)=      78.03        78.03          78.03
     RUNOFF COEFFICIENT   =       0.99         0.42           0.58

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  71.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  0003)|   Area    (ha)=   0.40
|ID= 1 DT= 5.0 min |   Total Imp(%)=  93.30   Dir. Conn.(%)=  93.30
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.37         0.03
     Dep. Storage     (mm)=       1.00         1.50
     Average Slope     (%)=       0.40         2.00
     Length            (m)=      51.70         3.50
     Mannings n          =      0.013        0.250

         NOTE:  RAINFALL WAS TRANSFORMED TO   5.0 MIN. TIME STEP.


                                ---- TRANSFORMED HYETOGRAPH ----
                  TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                   hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
                 0.083    4.34 | 1.083   38.21 | 2.083   10.60 |  3.08    5.19
                 0.167    4.34 | 1.167   38.21 | 2.167   10.60 |  3.17    5.19
                 0.250    5.00 | 1.250  203.30 | 2.250    8.96 |  3.25    4.81
                 0.333    5.00 | 1.333  203.31 | 2.333    8.96 |  3.33    4.81
                 0.417    5.92 | 1.417   50.96 | 2.417    7.78 |  3.42    4.48
                 0.500    5.92 | 1.500   50.96 | 2.500    7.78 |  3.50    4.48
                 0.583    7.33 | 1.583   25.51 | 2.583    6.90 |  3.58    4.20
                 0.667    7.33 | 1.667   25.51 | 2.667    6.90 |  3.67    4.20
                 0.750    9.77 | 1.750   17.18 | 2.750    6.21 |  3.75    3.96
                 0.833    9.77 | 1.833   17.18 | 2.833    6.21 |  3.83    3.96
                 0.917   15.10 | 1.917   13.06 | 2.917    5.65 |  3.92    3.74
                 1.000   15.10 | 2.000   13.06 | 3.000    5.65 |  4.00    3.74
```

```
    Max.Eff.Inten.(mm/hr)=     203.31        78.45
              over (min)         5.00         5.00
    Storage Coeff.  (min)=       1.70 (ii)    2.13 (ii)
    Unit Hyd. Tpeak (min)=       5.00         5.00
    Unit Hyd. peak  (cms)=       0.32         0.31
                                                          *TOTALS*
    PEAK FLOW       (cms)=       0.21         0.01          0.218 (iii)
    TIME TO PEAK    (hrs)=       1.33         1.33           1.33
    RUNOFF VOLUME    (mm)=      77.03        32.49          74.04
    TOTAL RAINFALL   (mm)=      78.03        78.03          78.03
    RUNOFF COEFFICIENT   =       0.99         0.42           0.95

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

      (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN*  =  71.0    Ia = Dep. Storage  (Above)
     (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
          THAN THE STORAGE COEFFICIENT.
    (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
--------------------
| RESERVOIR(  0004)|     OVERFLOW IS OFF
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          0.0000     0.0000   |     0.0062      0.0074
                          0.0000     0.0002   |     0.0075      0.0108
                          0.0000     0.0004   |     0.0086      0.0138
                          0.0000     0.0007   |     0.0096      0.0170
                          0.0012     0.0007   |     0.0105      0.0202
                          0.0017     0.0010   |     0.0114      0.0234
                          0.0045     0.0041   |     0.0117      0.0235

                               AREA     QPEAK     TPEAK       R.V.
                               (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0003)     0.401     0.218     1.33       74.04
   OUTFLOW: ID= 1 (  0004)     0.401     0.011     2.17       72.37

                PEAK   FLOW   REDUCTION [Qout/Qin](%)=  5.00
                TIME SHIFT OF PEAK FLOW         (min)= 50.00
                MAXIMUM  STORAGE   USED       (ha.m.)=  0.0215

--------------------------------------------------------------------------------
--------------------
| ADD HYD  (  0005)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0002):     0.14   0.043     1.33    45.55
      + ID2= 2 (  0004):     0.40   0.011     2.17    72.37
        ===================================================
        ID = 3 (  0005):     0.54   0.051     1.33    65.54

    NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
--------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD   (  0001)|   Area    (ha)=   0.54   Curve Number   (CN)= 80.0
|ID= 1 DT= 5.0 min |   Ia      (mm)=   1.50   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.27

        NOTE:  RAINFALL WAS TRANSFORMED TO   5.0 MIN. TIME STEP.


                           ---- TRANSFORMED HYETOGRAPH ----
                TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                 hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
               0.083    4.34 | 1.083   38.21 | 2.083   10.60 |  3.08    5.19
               0.167    4.34 | 1.167   38.21 | 2.167   10.60 |  3.17    5.19
               0.250    5.00 | 1.250  203.30 | 2.250    8.96 |  3.25    4.81
               0.333    5.00 | 1.333  203.31 | 2.333    8.96 |  3.33    4.81
               0.417    5.92 | 1.417   50.96 | 2.417    7.78 |  3.42    4.48
               0.500    5.92 | 1.500   50.96 | 2.500    7.78 |  3.50    4.48
               0.583    7.33 | 1.583   25.51 | 2.583    6.90 |  3.58    4.20
               0.667    7.33 | 1.667   25.51 | 2.667    6.90 |  3.67    4.20
               0.750    9.77 | 1.750   17.18 | 2.750    6.21 |  3.75    3.96
               0.833    9.77 | 1.833   17.18 | 2.833    6.21 |  3.83    3.96
               0.917   15.10 | 1.917   13.06 | 2.917    5.65 |  3.92    3.74
               1.000   15.10 | 2.000   13.06 | 3.000    5.65 |  4.00    3.74

    Unit Hyd Qpeak  (cms)=   0.076
```

```
    PEAK FLOW       (cms)=   0.067 (i)
    TIME TO PEAK    (hrs)=   1.583
    RUNOFF VOLUME    (mm)=  41.798
    TOTAL RAINFALL   (mm)=  78.027
    RUNOFF COEFFICIENT   =   0.536

    (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
************************************************
** SIMULATION:Clarington 4-Hr Chicago - 2 YR **
************************************************
--------------------
| CHICAGO STORM    |    IDF curve parameters: A=1778.000
| Ptotal= 28.11 mm |                          B=  13.000
--------------------                          C=   1.000
                        used in:   INTENSITY =  A / (t + B)^C

                        Duration of storm  =  4.00 hrs
                        Storm time step    = 10.00 min
                        Time to peak ratio =  0.33

                TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                 hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
                0.00    0.49 |  1.00   18.95 |  2.00    2.84 |  3.00    0.71
                0.17    0.66 |  1.17   77.30 |  2.17    2.09 |  3.17    0.61
                0.33    0.93 |  1.33   26.45 |  2.33    1.60 |  3.33    0.52
                0.50    1.43 |  1.50   11.48 |  2.50    1.26 |  3.50    0.46
                0.67    2.46 |  1.67    6.42 |  2.67    1.02 |  3.67    0.40
                0.83    5.25 |  1.83    4.10 |  2.83    0.85 |  3.83    0.35


--------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  0002)|   Area    (ha)=   0.14
|ID= 1 DT= 5.0 min |   Total Imp(%)=  29.40   Dir. Conn.(%)=  29.40
--------------------
                            IMPERVIOUS    PERVIOUS (i)
    Surface Area     (ha)=       0.04         0.10
    Dep. Storage     (mm)=       1.00         1.50
    Average Slope     (%)=       2.00         3.80
    Length            (m)=      30.22        20.97
    Mannings n           =      0.013        0.250

        NOTE:  RAINFALL WAS TRANSFORMED TO   5.0 MIN. TIME STEP.


                           ---- TRANSFORMED HYETOGRAPH ----
                TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                 hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
               0.083    0.49 | 1.083   18.95 | 2.083    2.84 |  3.08    0.71
               0.167    0.49 | 1.167   18.95 | 2.167    2.84 |  3.17    0.71
               0.250    0.66 | 1.250   77.30 | 2.250    2.09 |  3.25    0.61
               0.333    0.66 | 1.333   77.30 | 2.333    2.09 |  3.33    0.61
               0.417    0.93 | 1.417   26.45 | 2.417    1.60 |  3.42    0.52
               0.500    0.93 | 1.500   26.45 | 2.500    1.60 |  3.50    0.52
               0.583    1.43 | 1.583   11.48 | 2.583    1.26 |  3.58    0.46
               0.667    1.43 | 1.667   11.48 | 2.667    1.26 |  3.67    0.46
               0.750    2.46 | 1.750    6.42 | 2.750    1.02 |  3.75    0.40
               0.833    2.46 | 1.833    6.42 | 2.833    1.02 |  3.83    0.40
               0.917    5.25 | 1.917    4.10 | 2.917    0.85 |  3.92    0.35
               1.000    5.25 | 2.000    4.10 | 3.000    0.85 |  4.00    0.35

    Max.Eff.Inten.(mm/hr)=      77.30        12.75
              over (min)         5.00        15.00
    Storage Coeff.  (min)=       1.12 (ii)   10.13 (ii)
    Unit Hyd. Tpeak (min)=       5.00        15.00
    Unit Hyd. peak  (cms)=       0.34         0.10
                                                          *TOTALS*
    PEAK FLOW       (cms)=       0.01         0.00          0.010 (iii)
    TIME TO PEAK    (hrs)=       1.33         1.50           1.33
    RUNOFF VOLUME    (mm)=      27.11         5.43          11.70
    TOTAL RAINFALL   (mm)=      28.11        28.11          28.11
    RUNOFF COEFFICIENT   =       0.96         0.19           0.42

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

      (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
           CN*  =  71.0    Ia = Dep. Storage  (Above)
     (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
          THAN THE STORAGE COEFFICIENT.
    (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
```

```
--------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  0003)|   Area    (ha)=   0.40
|ID= 1 DT= 5.0 min |   Total Imp(%)=  93.30   Dir. Conn.(%)=  93.30
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.37         0.03
     Dep. Storage     (mm)=       1.00         1.50
     Average Slope     (%)=       0.40         2.00
     Length            (m)=      51.70         3.50
     Mannings n          =       0.013        0.250

         NOTE:  RAINFALL WAS TRANSFORMED TO   5.0 MIN. TIME STEP.


                               ---- TRANSFORMED HYETOGRAPH ----
                 TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                  hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
                0.083    0.49 | 1.083   18.95 | 2.083    2.84 |  3.08    0.71
                0.167    0.49 | 1.167   18.95 | 2.167    2.84 |  3.17    0.71
                0.250    0.66 | 1.250   77.30 | 2.250    2.09 |  3.25    0.61
                0.333    0.66 | 1.333   77.30 | 2.333    2.09 |  3.33    0.61
                0.417    0.93 | 1.417   26.45 | 2.417    1.60 |  3.42    0.52
                0.500    0.93 | 1.500   26.45 | 2.500    1.60 |  3.50    0.52
                0.583    1.43 | 1.583   11.48 | 2.583    1.26 |  3.58    0.46
                0.667    1.43 | 1.667   11.48 | 2.667    1.26 |  3.67    0.46
                0.750    2.46 | 1.750    6.42 | 2.750    1.02 |  3.75    0.40
                0.833    2.46 | 1.833    6.42 | 2.833    1.02 |  3.83    0.40
                0.917    5.25 | 1.917    4.10 | 2.917    0.85 |  3.92    0.35
                1.000    5.25 | 2.000    4.10 | 3.000    0.85 |  4.00    0.35

     Max.Eff.Inten.(mm/hr)=      77.30        12.75
                over (min)        5.00         5.00
     Storage Coeff.  (min)=       2.51 (ii)    3.14 (ii)
     Unit Hyd. Tpeak (min)=       5.00         5.00
     Unit Hyd. peak  (cms)=       0.29         0.27
                                                         *TOTALS*
     PEAK FLOW       (cms)=       0.08         0.00         0.080 (iii)
     TIME TO PEAK    (hrs)=       1.33         1.33          1.33
     RUNOFF VOLUME    (mm)=      27.11         5.43         25.65
     TOTAL RAINFALL   (mm)=      28.11        28.11         28.11
     RUNOFF COEFFICIENT   =       0.96         0.19          0.91

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  71.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
--------------------
| RESERVOIR(  0004)|     OVERFLOW IS OFF
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          0.0000      0.0000   |    0.0062      0.0074
                          0.0000      0.0002   |    0.0075      0.0108
                          0.0000      0.0004   |    0.0086      0.0138
                          0.0000      0.0007   |    0.0096      0.0170
                          0.0012      0.0007   |    0.0105      0.0202
                          0.0017      0.0010   |    0.0114      0.0234
                          0.0045      0.0041   |    0.0117      0.0235

                               AREA     QPEAK     TPEAK        R.V.
                               (ha)     (cms)     (hrs)        (mm)
   INFLOW : ID= 2 (  0003)     0.401     0.080      1.33       25.65
   OUTFLOW: ID= 1 (  0004)     0.401     0.006      1.83       23.98

                   PEAK   FLOW   REDUCTION [Qout/Qin](%)=  7.90
                   TIME SHIFT OF PEAK FLOW        (min)= 30.00
                   MAXIMUM  STORAGE   USED       (ha.m.)=  0.0078

--------------------------------------------------------------------------------
--------------------
| ADD HYD  (  0005)|
|   1 +  2 =  3    |         AREA    QPEAK    TPEAK     R.V.
--------------------         (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0002):     0.14    0.010     1.33    11.70
      + ID2= 2 (  0004):     0.40    0.006     1.83    23.98
        ================================================

        ID = 3 (  0005):     0.54   0.014     1.33    20.85

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
--------------------------------------------------------------------------------
--------------------
| CALIB            |
| NASHYD   (  0001)|   Area    (ha)=   0.54   Curve Number   (CN)= 80.0
|ID= 1 DT= 5.0 min |   Ia      (mm)=   1.50   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.27

         NOTE:  RAINFALL WAS TRANSFORMED TO   5.0 MIN. TIME STEP.


                               ---- TRANSFORMED HYETOGRAPH ----
                 TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                  hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
                0.083    0.49 | 1.083   18.95 | 2.083    2.84 |  3.08    0.71
                0.167    0.49 | 1.167   18.95 | 2.167    2.84 |  3.17    0.71
                0.250    0.66 | 1.250   77.30 | 2.250    2.09 |  3.25    0.61
                0.333    0.66 | 1.333   77.30 | 2.333    2.09 |  3.33    0.61
                0.417    0.93 | 1.417   26.45 | 2.417    1.60 |  3.42    0.52
                0.500    0.93 | 1.500   26.45 | 2.500    1.60 |  3.50    0.52
                0.583    1.43 | 1.583   11.48 | 2.583    1.26 |  3.58    0.46
                0.667    1.43 | 1.667   11.48 | 2.667    1.26 |  3.67    0.46
                0.750    2.46 | 1.750    6.42 | 2.750    1.02 |  3.75    0.40
                0.833    2.46 | 1.833    6.42 | 2.833    1.02 |  3.83    0.40
                0.917    5.25 | 1.917    4.10 | 2.917    0.85 |  3.92    0.35
                1.000    5.25 | 2.000    4.10 | 3.000    0.85 |  4.00    0.35

     Unit Hyd Qpeak  (cms)=   0.076

     PEAK FLOW      (cms)=   0.014 (i)
     TIME TO PEAK   (hrs)=   1.583
     RUNOFF VOLUME    (mm)=   7.850
     TOTAL RAINFALL   (mm)=  28.106
     RUNOFF COEFFICIENT   =   0.279

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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************************************************
** SIMULATION:Clarington 4-Hr Chicago - 25 YR **
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--------------------
| CHICAGO STORM    |     IDF curve parameters: A=4318.000
| Ptotal= 64.67 mm |                           B=  27.000
--------------------                           C=   1.000
                         used in:   INTENSITY =  A / (t + B)^C

                         Duration of storm  =  4.00 hrs
                         Storm time step    = 10.00 min
                         Time to peak ratio =  0.33

                 TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                  hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
                 0.00    2.17 |  1.00   47.01 |  2.00   10.74 |  3.00    3.09
                 0.17    2.87 |  1.17  116.70 |  2.17    8.20 |  3.17    2.66
                 0.33    3.96 |  1.33   60.60 |  2.33    6.47 |  3.33    2.32
                 0.50    5.84 |  1.50   33.48 |  2.50    5.23 |  3.50    2.04
                 0.67    9.45 |  1.67   21.23 |  2.67    4.32 |  3.67    1.80
                 0.83   17.92 |  1.83   14.67 |  2.83    3.63 |  3.83    1.61


--------------------------------------------------------------------------------
--------------------
| CALIB            |
| STANDHYD (  0002)|   Area    (ha)=   0.14
|ID= 1 DT= 5.0 min |   Total Imp(%)=  29.40   Dir. Conn.(%)=  29.40
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.04         0.10
     Dep. Storage     (mm)=       1.00         1.50
     Average Slope     (%)=       2.00         3.80
     Length            (m)=      30.22        20.97
     Mannings n          =       0.013        0.250

         NOTE:  RAINFALL WAS TRANSFORMED TO   5.0 MIN. TIME STEP.


                               ---- TRANSFORMED HYETOGRAPH ----
                 TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                  hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
                0.083    2.17 | 1.083   47.01 | 2.083   10.74 |  3.08    3.09
                0.167    2.17 | 1.167   47.01 | 2.167   10.74 |  3.17    3.09
```

```
              0.250    2.87 | 1.250  116.70 | 2.250    8.20 |  3.25    2.66
              0.333    2.87 | 1.333  116.70 | 2.333    8.20 |  3.33    2.66
              0.417    3.96 | 1.417   60.60 | 2.417    6.47 |  3.42    2.32
              0.500    3.96 | 1.500   60.60 | 2.500    6.47 |  3.50    2.32
              0.583    5.84 | 1.583   33.48 | 2.583    5.23 |  3.58    2.04
              0.667    5.84 | 1.667   33.48 | 2.667    5.23 |  3.67    2.04
              0.750    9.45 | 1.750   21.23 | 2.750    4.32 |  3.75    1.80
              0.833    9.45 | 1.833   21.23 | 2.833    4.32 |  3.83    1.80
              0.917   17.92 | 1.917   14.67 | 2.917    3.63 |  3.92    1.61
              1.000   17.92 | 2.000   14.67 | 3.000    3.63 |  4.00    1.61

     Max.Eff.Inten.(mm/hr)=     116.70        38.17
                over (min)        5.00        10.00
     Storage Coeff.  (min)=       0.95 (ii)    6.76 (ii)
     Unit Hyd. Tpeak (min)=       5.00        10.00
     Unit Hyd. peak  (cms)=       0.34         0.14
                                                          *TOTALS*
     PEAK FLOW      (cms)=        0.01         0.01         0.020 (iii)
     TIME TO PEAK    (hrs)=       1.33         1.42          1.33
     RUNOFF VOLUME    (mm)=      63.67        23.91         35.58
     TOTAL RAINFALL   (mm)=      64.67        64.67         64.67
     RUNOFF COEFFICIENT   =       0.98         0.37          0.55

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN* =  71.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
--------------------
| CALIB              |
| STANDHYD ( 0003)|   Area    (ha)=   0.40
|ID= 1 DT= 5.0 min |   Total Imp(%)=  93.30   Dir. Conn.(%)=  93.30
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.37         0.03
     Dep. Storage     (mm)=       1.00         1.50
     Average Slope     (%)=       0.40         2.00
     Length            (m)=      51.70         3.50
     Mannings n          =       0.013        0.250

         NOTE:  RAINFALL WAS TRANSFORMED TO   5.0 MIN. TIME STEP.


                              ---- TRANSFORMED HYETOGRAPH ----
               TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
              0.083    2.17 | 1.083   47.01 | 2.083   10.74 |  3.08    3.09
              0.167    2.17 | 1.167   47.01 | 2.167   10.74 |  3.17    3.09
              0.250    2.87 | 1.250  116.70 | 2.250    8.20 |  3.25    2.66
              0.333    2.87 | 1.333  116.70 | 2.333    8.20 |  3.33    2.66
              0.417    3.96 | 1.417   60.60 | 2.417    6.47 |  3.42    2.32
              0.500    3.96 | 1.500   60.60 | 2.500    6.47 |  3.50    2.32
              0.583    5.84 | 1.583   33.48 | 2.583    5.23 |  3.58    2.04
              0.667    5.84 | 1.667   33.48 | 2.667    5.23 |  3.67    2.04
              0.750    9.45 | 1.750   21.23 | 2.750    4.32 |  3.75    1.80
              0.833    9.45 | 1.833   21.23 | 2.833    4.32 |  3.83    1.80
              0.917   17.92 | 1.917   14.67 | 2.917    3.63 |  3.92    1.61
              1.000   17.92 | 2.000   14.67 | 3.000    3.63 |  4.00    1.61

     Max.Eff.Inten.(mm/hr)=     116.70        38.17
                over (min)        5.00         5.00
     Storage Coeff.  (min)=       2.13 (ii)    2.66 (ii)
     Unit Hyd. Tpeak (min)=       5.00         5.00
     Unit Hyd. peak  (cms)=       0.31         0.29
                                                          *TOTALS*
     PEAK FLOW      (cms)=        0.12         0.00         0.124 (iii)
     TIME TO PEAK    (hrs)=       1.33         1.33          1.33
     RUNOFF VOLUME    (mm)=      63.67        23.91         61.00
     TOTAL RAINFALL   (mm)=      64.67        64.67         64.67
     RUNOFF COEFFICIENT   =       0.98         0.37          0.94

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN* =  71.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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--------------------
| RESERVOIR( 0004)|      OVERFLOW IS OFF
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |      OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------       (cms)     (ha.m.)   |   (cms)     (ha.m.)
                           0.0000     0.0000   |    0.0062     0.0074
                           0.0000     0.0002   |    0.0075     0.0108
                           0.0000     0.0004   |    0.0086     0.0138
                           0.0000     0.0007   |    0.0096     0.0170
                           0.0012     0.0007   |    0.0105     0.0202
                           0.0017     0.0010   |    0.0114     0.0234
                           0.0045     0.0041   |    0.0117     0.0235

                                AREA     QPEAK     TPEAK       R.V.
                                (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0003)      0.401     0.124      1.33       61.00
   OUTFLOW: ID= 1 (  0004)      0.401     0.010      2.25       59.33

                  PEAK   FLOW   REDUCTION [Qout/Qin](%)=  8.02
                  TIME SHIFT OF PEAK FLOW          (min)= 55.00
                  MAXIMUM  STORAGE   USED       (ha.m.)=  0.0181

--------------------------------------------------------------------------------

--------------------
| ADD HYD  (  0005)|
|   1 +  2 =  3    |          AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0002):      0.14    0.020     1.33    35.58
      + ID2= 2 (  0004):      0.40    0.010     2.25    59.33
        ===============================================
        ID = 3 (  0005):      0.54    0.027     1.33    53.28

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
--------------------------------------------------------------------------------
--------------------
| CALIB              |
| NASHYD   (  0001)|   Area    (ha)=   0.54   Curve Number   (CN)= 80.0
|ID= 1 DT= 5.0 min |   Ia      (mm)=   1.50   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.27

         NOTE:  RAINFALL WAS TRANSFORMED TO   5.0 MIN. TIME STEP.


                              ---- TRANSFORMED HYETOGRAPH ----
               TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
                hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
              0.083    2.17 | 1.083   47.01 | 2.083   10.74 |  3.08    3.09
              0.167    2.17 | 1.167   47.01 | 2.167   10.74 |  3.17    3.09
              0.250    2.87 | 1.250  116.70 | 2.250    8.20 |  3.25    2.66
              0.333    2.87 | 1.333  116.70 | 2.333    8.20 |  3.33    2.66
              0.417    3.96 | 1.417   60.60 | 2.417    6.47 |  3.42    2.32
              0.500    3.96 | 1.500   60.60 | 2.500    6.47 |  3.50    2.32
              0.583    5.84 | 1.583   33.48 | 2.583    5.23 |  3.58    2.04
              0.667    5.84 | 1.667   33.48 | 2.667    5.23 |  3.67    2.04
              0.750    9.45 | 1.750   21.23 | 2.750    4.32 |  3.75    1.80
              0.833    9.45 | 1.833   21.23 | 2.833    4.32 |  3.83    1.80
              0.917   17.92 | 1.917   14.67 | 2.917    3.63 |  3.92    1.61
              1.000   17.92 | 2.000   14.67 | 3.000    3.63 |  4.00    1.61

     Unit Hyd Qpeak  (cms)=   0.076

     PEAK FLOW       (cms)=   0.046 (i)
     TIME TO PEAK    (hrs)=   1.667
     RUNOFF VOLUME    (mm)=  31.482
     TOTAL RAINFALL   (mm)=  64.668
     RUNOFF COEFFICIENT   =   0.487

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

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**********************************************
** SIMULATION:Clarington 4-Hr Chicago - 5 YR **
**********************************************
--------------------
| CHICAGO STORM    |     IDF curve parameters: A=2464.000
| Ptotal= 38.49 mm |                           B=  16.000
--------------------                           C=   1.000
                         used in:   INTENSITY =  A / (t + B)^C

                         Duration of storm  =  4.00 hrs
                         Storm time step    = 10.00 min
                         Time to peak ratio =  0.33
```

```
            TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
             hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
            0.00    0.81 |  1.00   27.06 |  2.00    4.54 |  3.00    1.17
            0.17    1.09 |  1.17   94.77 |  2.17    3.37 |  3.17    1.00
            0.33    1.53 |  1.33   36.99 |  2.33    2.60 |  3.33    0.87
            0.50    2.32 |  1.50   17.18 |  2.50    2.06 |  3.50    0.76
            0.67    3.95 |  1.67    9.92 |  2.67    1.68 |  3.67    0.67
            0.83    8.18 |  1.83    6.46 |  2.83    1.39 |  3.83    0.59

--------------------------------------------------------------------------------
--------------------
| CALIB              |
| STANDHYD (  0002)|   Area    (ha)=   0.14
|ID= 1 DT= 5.0 min |   Total Imp(%)=  29.40   Dir. Conn.(%)=  29.40
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.04         0.10
     Dep. Storage     (mm)=       1.00         1.50
     Average Slope     (%)=       2.00         3.80
     Length            (m)=      30.22        20.97
     Mannings n          =       0.013        0.250

         NOTE:  RAINFALL WAS TRANSFORMED TO   5.0 MIN. TIME STEP.


                               ---- TRANSFORMED HYETOGRAPH ----
            TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
             hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
           0.083    0.81 | 1.083   27.06 | 2.083    4.54 |  3.08    1.17
           0.167    0.81 | 1.167   27.06 | 2.167    4.54 |  3.17    1.17
           0.250    1.09 | 1.250   94.77 | 2.250    3.37 |  3.25    1.00
           0.333    1.09 | 1.333   94.77 | 2.333    3.37 |  3.33    1.00
           0.417    1.53 | 1.417   36.99 | 2.417    2.60 |  3.42    0.87
           0.500    1.53 | 1.500   36.99 | 2.500    2.60 |  3.50    0.87
           0.583    2.32 | 1.583   17.18 | 2.583    2.06 |  3.58    0.76
           0.667    2.32 | 1.667   17.18 | 2.667    2.06 |  3.67    0.76
           0.750    3.95 | 1.750    9.92 | 2.750    1.68 |  3.75    0.67
           0.833    3.95 | 1.833    9.92 | 2.833    1.68 |  3.83    0.67
           0.917    8.18 | 1.917    6.46 | 2.917    1.39 |  3.92    0.59
           1.000    8.18 | 2.000    6.46 | 3.000    1.39 |  4.00    0.59

     Max.Eff.Inten.(mm/hr)=      94.77        20.72
                over (min)        5.00        10.00
     Storage Coeff.  (min)=       1.03 (ii)    8.45 (ii)
     Unit Hyd. Tpeak (min)=       5.00        10.00
     Unit Hyd. peak  (cms)=       0.34         0.12
                                                          *TOTALS*
     PEAK FLOW       (cms)=       0.01         0.00         0.014 (iii)
     TIME TO PEAK    (hrs)=       1.33         1.42          1.33
     RUNOFF VOLUME    (mm)=      37.49         9.72         17.86
     TOTAL RAINFALL   (mm)=      38.49        38.49         38.49
     RUNOFF COEFFICIENT   =       0.97         0.25          0.46

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  71.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
--------------------
| CALIB              |
| STANDHYD (  0003)|   Area    (ha)=   0.40
|ID= 1 DT= 5.0 min |   Total Imp(%)=  93.30   Dir. Conn.(%)=  93.30
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area     (ha)=       0.37         0.03
     Dep. Storage     (mm)=       1.00         1.50
     Average Slope     (%)=       0.40         2.00
     Length            (m)=      51.70         3.50
     Mannings n          =       0.013        0.250

         NOTE:  RAINFALL WAS TRANSFORMED TO   5.0 MIN. TIME STEP.


                               ---- TRANSFORMED HYETOGRAPH ----
            TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
             hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
           0.083    0.81 | 1.083   27.06 | 2.083    4.54 |  3.08    1.17
           0.167    0.81 | 1.167   27.06 | 2.167    4.54 |  3.17    1.17
           0.250    1.09 | 1.250   94.77 | 2.250    3.37 |  3.25    1.00
```

```
           0.333    1.09 | 1.333   94.77 | 2.333    3.37 |  3.33    1.00
           0.417    1.53 | 1.417   36.99 | 2.417    2.60 |  3.42    0.87
           0.500    1.53 | 1.500   36.99 | 2.500    2.60 |  3.50    0.87
           0.583    2.32 | 1.583   17.18 | 2.583    2.06 |  3.58    0.76
           0.667    2.32 | 1.667   17.18 | 2.667    2.06 |  3.67    0.76
           0.750    3.95 | 1.750    9.92 | 2.750    1.68 |  3.75    0.67
           0.833    3.95 | 1.833    9.92 | 2.833    1.68 |  3.83    0.67
           0.917    8.18 | 1.917    6.46 | 2.917    1.39 |  3.92    0.59
           1.000    8.18 | 2.000    6.46 | 3.000    1.39 |  4.00    0.59

     Max.Eff.Inten.(mm/hr)=      94.77        20.72
                over (min)        5.00         5.00
     Storage Coeff.  (min)=       2.31 (ii)    2.90 (ii)
     Unit Hyd. Tpeak (min)=       5.00         5.00
     Unit Hyd. peak  (cms)=       0.30         0.28
                                                          *TOTALS*
     PEAK FLOW       (cms)=       0.10         0.00         0.099 (iii)
     TIME TO PEAK    (hrs)=       1.33         1.33          1.33
     RUNOFF VOLUME    (mm)=      37.49         9.72         35.63
     TOTAL RAINFALL   (mm)=      38.49        38.49         38.49
     RUNOFF COEFFICIENT   =       0.97         0.25          0.93

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR PERVIOUS LOSSES:
            CN*  =  71.0    Ia = Dep. Storage  (Above)
      (ii) TIME STEP (DT) SHOULD BE SMALLER OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
--------------------
| RESERVOIR(  0004)|     OVERFLOW IS OFF
| IN= 2---> OUT= 1 |
| DT=  5.0 min     |     OUTFLOW    STORAGE   |  OUTFLOW    STORAGE
--------------------      (cms)     (ha.m.)   |   (cms)     (ha.m.)
                          0.0000     0.0000   |     0.0062      0.0074
                          0.0000     0.0002   |     0.0075      0.0108
                          0.0000     0.0004   |     0.0086      0.0138
                          0.0000     0.0007   |     0.0096      0.0170
                          0.0012     0.0007   |     0.0105      0.0202
                          0.0017     0.0010   |     0.0114      0.0234
                          0.0045     0.0041   |     0.0117      0.0235

                               AREA     QPEAK     TPEAK       R.V.
                               (ha)     (cms)     (hrs)       (mm)
   INFLOW : ID= 2 (  0003)     0.401      0.099      1.33      35.63
   OUTFLOW: ID= 1 (  0004)     0.401      0.008      1.92      33.96

                PEAK   FLOW   REDUCTION [Qout/Qin](%)=  7.61
                TIME SHIFT OF PEAK FLOW        (min)= 35.00
                MAXIMUM  STORAGE   USED       (ha.m.)=  0.0108

--------------------------------------------------------------------------------

--------------------
| ADD HYD  (  0005)|
|   1 +  2 =  3    |          AREA    QPEAK    TPEAK     R.V.
--------------------          (ha)    (cms)    (hrs)     (mm)
        ID1= 1 (  0002):      0.14    0.014     1.33    17.86
      + ID2= 2 (  0004):      0.40    0.008     1.92    33.96
        ================================================
        ID = 3 (  0005):      0.54    0.019     1.33    29.86

     NOTE:  PEAK FLOWS DO NOT INCLUDE BASEFLOWS IF ANY.
--------------------------------------------------------------------------------
--------------------
| CALIB              |
| NASHYD   (  0001)|   Area    (ha)=   0.54   Curve Number   (CN)= 80.0
|ID= 1 DT= 5.0 min |   Ia      (mm)=   1.50   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=   0.27

         NOTE:  RAINFALL WAS TRANSFORMED TO   5.0 MIN. TIME STEP.


                               ---- TRANSFORMED HYETOGRAPH ----
            TIME    RAIN |  TIME    RAIN |'  TIME    RAIN |  TIME    RAIN
             hrs   mm/hr |   hrs   mm/hr |'   hrs   mm/hr |   hrs   mm/hr
           0.083    0.81 | 1.083   27.06 | 2.083    4.54 |  3.08    1.17
           0.167    0.81 | 1.167   27.06 | 2.167    4.54 |  3.17    1.17
           0.250    1.09 | 1.250   94.77 | 2.250    3.37 |  3.25    1.00
           0.333    1.09 | 1.333   94.77 | 2.333    3.37 |  3.33    1.00
           0.417    1.53 | 1.417   36.99 | 2.417    2.60 |  3.42    0.87
           0.500    1.53 | 1.500   36.99 | 2.500    2.60 |  3.50    0.87
```

0.583	2.32	1.583	17.18	2.583	2.06	3.58	0.76
0.667	2.32	1.667	17.18	2.667	2.06	3.67	0.76
0.750	3.95	1.750	9.92	2.750	1.68	3.75	0.67
0.833	3.95	1.833	9.92	2.833	1.68	3.83	0.67
0.917	8.18	1.917	6.46	2.917	1.39	3.92	0.59
1.000	8.18	2.000	6.46	3.000	1.39	4.00	0.59

```
Unit Hyd Qpeak  (cms)=   0.076

PEAK FLOW       (cms)=   0.023 (i)
TIME TO PEAK    (hrs)=   1.583
RUNOFF VOLUME    (mm)=  13.608
TOTAL RAINFALL   (mm)=  38.492
RUNOFF COEFFICIENT   =   0.354

(i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.
```

PROJECT	Cestoil Chemical Inc. - 1726 Baseline Road West, Courtice, ON
PROJECT #	115160
DATE	2025-08-22

Infiltration Below HS-75 Bed

Infiltration Rate		20	mm/hr	*Conservative Estimate
Runoff Area		1710	m^2	(Ex. West Side Sloped Roof and Ex. Asphalt Parking)
Capture		27	mm	
WQV		**46.17**	m^3	
vr		0.4		
ts		24	hours	
Max depth	i*ts/vr			Max Depth of infiltration Bed
		1200	mm	
Therefore Use dc =		300	mm	
Af	WQV/(dc*vr)			Minimum Footprint Area Required
		384.8	m^2	

PROPOSED SYSTEM DIMENSIONS

[1] Footprint Area Provided	40.00	m^2
[2] Depth	0.30	m
Clearsonte Volume	12.00	m^3
Water Volume	4.80	m^3

Total Site Water Quality Storage Volume = 4.80 m^3

[1] Refer to Drawing SS-1 for footprint area
[2] Functional Depth

CDS Guide
Operation, Design, Performance and Maintenance

CDS®

Using patented continuous deflective separation technology, the CDS system screens, separates and traps debris, sediment, and oil and grease from stormwater runoff. The indirect screening capability of the system allows for 100% removal of floatables and neutrally buoyant material without blinding. Flow and screening controls physically separate captured solids, and minimize the re-suspension and release of previously trapped pollutants. Inline units can treat up to 6 cfs, and internally bypass flows in excess of 50 cfs (1416 L/s). Available precast or cast-in-place, offline units can treat flows from 1 to 300 cfs (28.3 to 8495 L/s). The pollutant removal capacity of the CDS system has been proven in lab and field testing.

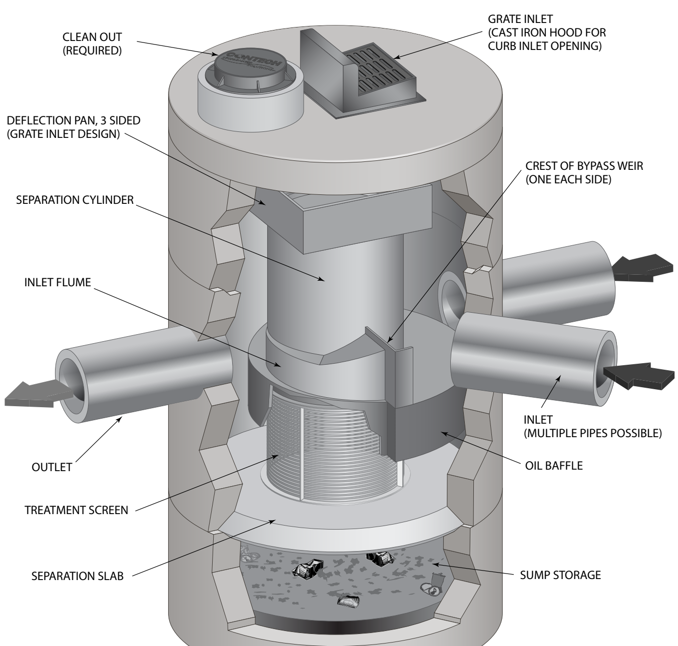
Operation Overview

Stormwater enters the diversion chamber where the diversion weir guides the flow into the unit's separation chamber and pollutants are removed from the flow. All flows up to the system's treatment design capacity enter the separation chamber and are treated.

Swirl concentration and screen deflection force floatables and solids to the center of the separation chamber where 100% of floatables and neutrally buoyant debris larger than the screen apertures are trapped.

Stormwater then moves through the separation screen, under the oil baffle and exits the system. The separation screen remains clog free due to continuous deflection.

During the flow events exceeding the treatment design capacity, the diversion weir bypasses excessive flows around the separation chamber, so captured pollutants are retained in the separation cylinder.



Design Basics

There are three primary methods of sizing a CDS system. The Water Quality Flow Rate Method determines which model size provides the desired removal efficiency at a given flow rate for a defined particle size. The Rational Rainfall Method™ or the and Probabilistic Method is used when a specific removal efficiency of the net annual sediment load is required.

Typically in the Unites States, CDS systems are designed to achieve an 80% annual solids load reduction based on lab generated performance curves for a gradation with an average particle size (d50) of 125 microns (*μ*m). For some regulatory environments, CDS systems can also be designed to achieve an 80% annual solids load reduction based on an average particle size (d50) of 75 microns (*μ*m) or 50 microns (*μ*m).

Water Quality Flow Rate Method

In some cases, regulations require that a specific treatment rate, often referred to as the water quality design flow (WQQ), be treated. This WQQ represents the peak flow rate from either an event with a specific recurrence interval, e.g. the six-month storm, or a water quality depth, e.g. 1/2-inch (13 mm) of rainfall.

The CDS is designed to treat all flows up to the WQQ. At influent rates higher than the WQQ, the diversion weir will direct most flow exceeding the WQQ around the separation chamber. This allows removal efficiency to remain relatively constant in the separation chamber and eliminates the risk of washout during bypass flows regardless of influent flow rates.

Treatment flow rates are defined as the rate at which the CDS will remove a specific gradation of sediment at a specific removal efficiency. Therefore the treatment flow rate is variable, based on the gradation and removal efficiency specified by the design engineer.

Rational Rainfall Method™

Differences in local climate, topography and scale make every site hydraulically unique. It is important to take these factors into consideration when estimating the long-term performance of any stormwater treatment system. The Rational Rainfall Method combines site-specific information with laboratory generated performance data, and local historical precipitation records to estimate removal efficiencies as accurately as possible.

Short duration rain gauge records from across the United States and Canada were analyzed to determine the percent of the total annual rainfall that fell at a range of intensities. US stations' depths were totaled every 15 minutes, or hourly, and recorded in 0.01-inch increments. Depths were recorded hourly with 1-mm resolution at Canadian stations. One trend was consistent at all sites; the vast majority of precipitation fell at low intensities and high intensity storms contributed relatively little to the total annual depth.

These intensities, along with the total drainage area and runoff coefficient for each specific site, are translated into flow rates using the Rational Rainfall Method. Since most sites are relatively small and highly impervious, the Rational Rainfall Method is appropriate. Based on the runoff flow rates calculated for each intensity, operating rates within a proposed CDS system are determined. Performance efficiency curve determined from full scale laboratory tests on defined sediment PSDs is applied to calculate solids removal efficiency. The relative removal efficiency at each operating rate is added to produce a net annual pollutant removal efficiency estimate.

Probabilistic Rational Method

The Probabilistic Rational Method is a sizing program Contech developed to estimate a net annual sediment load reduction for a particular CDS model based on site size, site runoff coefficient, regional rainfall intensity distribution, and anticipated pollutant characteristics.

The Probabilistic Method is an extension of the Rational Method used to estimate peak discharge rates generated by storm events of varying statistical return frequencies (e.g. 2-year storm event). Under the Rational Method, an adjustment factor is used to adjust the runoff coefficient estimated for the 10-year event, correlating a known hydrologic parameter with the target storm event. The rainfall intensities vary depending on the return frequency of the storm event under consideration. In general, these two frequency dependent parameters (rainfall intensity and runoff coefficient) increase as the return frequency increases while the drainage area remains constant.

These intensities, along with the total drainage area and runoff coefficient for each specific site, are translated into flow rates using the Rational Method. Since most sites are relatively small and highly impervious, the Rational Method is appropriate. Based on the runoff flow rates calculated for each intensity, operating rates within a proposed CDS are determined. Performance efficiency curve on defined sediment PSDs is applied to calculate solids removal efficiency. The relative removal efficiency at each operating rate is added to produce a net annual pollutant removal efficiency estimate.

Treatment Flow Rate

The inlet throat area is sized to ensure that the WQQ passes through the separation chamber at a water surface elevation equal to the crest of the diversion weir. The diversion weir bypasses excessive flows around the separation chamber, thus preventing re-suspension or re-entrainment of previously captured particles.

Hydraulic Capacity

The hydraulic capacity of a CDS system is determined by the length and height of the diversion weir and by the maximum allowable head in the system. Typical configurations allow hydraulic capacities of up to ten times the treatment flow rate. The crest of the diversion weir may be lowered and the inlet throat may be widened to increase the capacity of the system at a given water surface elevation. The unit is designed to meet project specific hydraulic requirements.

Performance

Full-Scale Laboratory Test Results

A full-scale CDS system (Model CDS2020-5B) was tested at the facility of University of Florida, Gainesville, FL. This CDS unit was evaluated under controlled laboratory conditions of influent flow rate and addition of sediment.

Two different gradations of silica sand material (UF Sediment & OK-110) were used in the CDS performance evaluation. The particle size distributions (PSDs) of the test materials were analyzed using standard method "Gradation ASTM D-422 "Standard Test Method for Particle-Size Analysis of Soils" by a certified laboratory.

UF Sediment is a mixture of three different products produced by the U.S. Silica Company: "Sil-Co-Sil 106", "#1 DRY" and "20/40 Oil Frac". Particle size distribution analysis shows that the UF Sediment has a very fine gradation (d50 = 20 to 30 μm) covering a wide size range (Coefficient of Uniformity, C averaged at 10.6). In comparison with the hypothetical TSS gradation specified in the NJDEP (New Jersey Department of Environmental Protection) and NJCAT (New Jersey Corporation for Advanced Technology) protocol for lab testing, the UF Sediment covers a similar range of particle size but with a finer d50 (d50 for NJDEP is approximately 50 μm) (NJDEP, 2003).

The OK-110 silica sand is a commercial product of U.S. Silica Sand. The particle size distribution analysis of this material, also included in Figure 1, shows that 99.9% of the OK-110 sand is finer than 250 microns, with a mean particle size (d50) of 106 microns. The PSDs for the test material are shown in Figure 1.

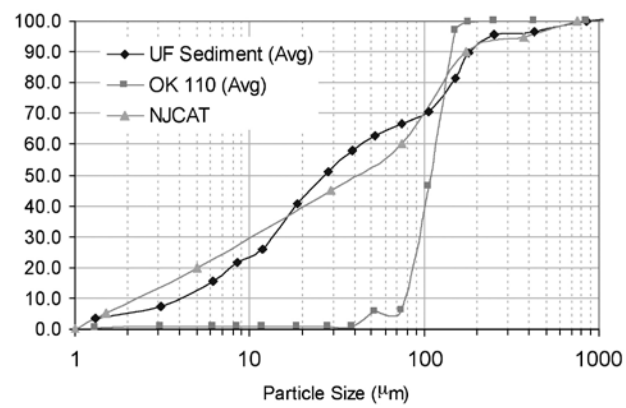


Figure 1. Particle size distributions

Tests were conducted to quantify the performance of a specific CDS unit (1.1 cfs (31.3-L/s) design capacity) at various flow rates, ranging from 1% up to 125% of the treatment design capacity of the unit, using the 2400 micron screen. All tests were conducted with controlled influent concentrations of approximately 200 mg/L. Effluent samples were taken at equal time intervals across the entire duration of each test run. These samples were then processed with a Dekaport Cone sample splitter to obtain representative sub-samples for Suspended Sediment Concentration (SSC) testing using ASTM D3977-97 "Standard Test Methods for Determining Sediment Concentration in Water Samples", and particle size distribution analysis.

Results and Modeling

Based on the data from the University of Florida, a performance model was developed for the CDS system. A regression analysis was used to develop a fitting curve representative of the scattered data points at various design flow rates. This model, which demonstrated good agreement with the laboratory data, can then be used to predict CDS system performance with respect to SSC removal for any particle size gradation, assuming the particles are inorganic sandy-silt. Figure 2 shows CDS predictive performance for two typical particle size gradations (NJCAT gradation and OK-110 sand) as a function of operating rate.

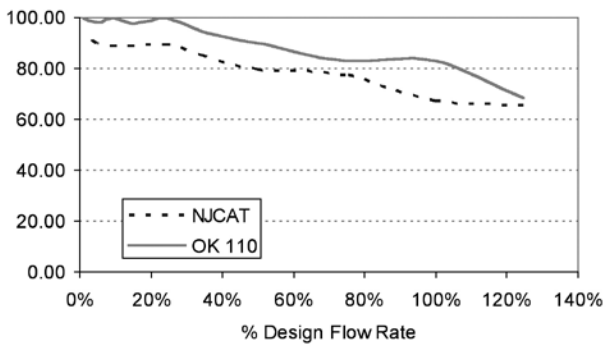


Figure 2. CDS stormwater treatment predictive performance for various particle gradations as a function of operating rate.

Many regulatory jurisdictions set a performance standard for hydrodynamic devices by stating that the devices shall be capable of achieving an 80% removal efficiency for particles having a mean particle size (d50) of 125 microns (e.g. Washington State Department of Ecology — WASDOE - 2008). The model can be used to calculate the expected performance of such a PSD (shown in Figure 3). The model indicates (Figure 4) that the CDS system with 2400 micron screen achieves approximately 80% removal at the design (100%) flow rate, for this particle size distribution (d50 = 125 μm).

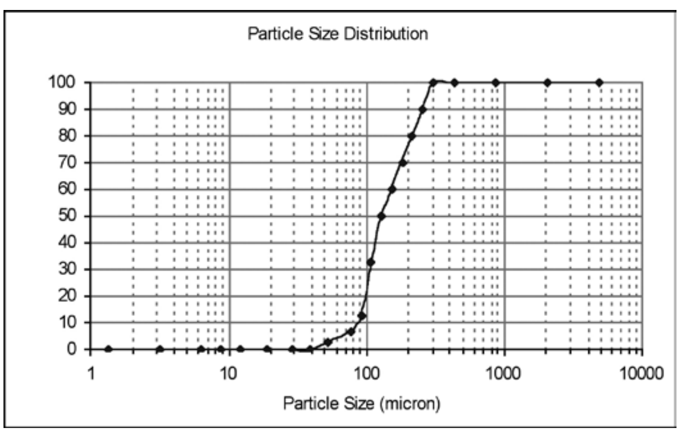


Figure 3. WASDOE PSD

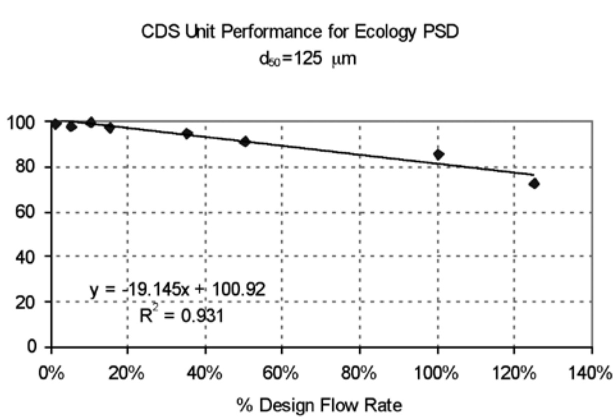


Figure 4. Modeled performance for WASDOE PSD.

Maintenance

The CDS system should be inspected at regular intervals and maintained when necessary to ensure optimum performance. The rate at which the system collects pollutants will depend more heavily on site activities than the size of the unit. For example, unstable soils or heavy winter sanding will cause the grit chamber to fill more quickly but regular sweeping of paved surfaces will slow accumulation.

Inspection

Inspection is the key to effective maintenance and is easily performed. Pollutant transport and deposition may vary from year to year and regular inspections will help ensure that the system is cleaned out at the appropriate time. At a minimum, inspections should be performed twice per year (e.g. spring and fall) however more frequent inspections may be necessary in climates where winter sanding operations may lead to rapid accumulations, or in equipment washdown areas. Installations should also be inspected more frequently where excessive amounts of trash are expected.

The visual inspection should ascertain that the system components are in working order and that there are no blockages or obstructions in the inlet and separation screen. The inspection should also quantify the accumulation of hydrocarbons, trash, and sediment in the system. Measuring pollutant accumulation can be done with a calibrated dipstick, tape measure or other measuring instrument. If absorbent material is used for enhanced removal of hydrocarbons, the level of discoloration of the sorbent material should also be identified

during inspection. It is useful and often required as part of an operating permit to keep a record of each inspection. A simple form for doing so is provided.

Access to the CDS unit is typically achieved through two manhole access covers. One opening allows for inspection and cleanout of the separation chamber (cylinder and screen) and isolated sump. The other allows for inspection and cleanout of sediment captured and retained outside the screen. For deep units, a single manhole access point would allows both sump cleanout and access outside the screen.

The CDS system should be cleaned when the level of sediment has reached 75% of capacity in the isolated sump or when an appreciable level of hydrocarbons and trash has accumulated. If absorbent material is used, it should be replaced when significant discoloration has occurred. Performance will not be impacted until 100% of the sump capacity is exceeded however it is recommended that the system be cleaned prior to that for easier removal of sediment. The level of sediment is easily determined by measuring from finished grade down to the top of the sediment pile. To avoid underestimating the level of sediment in the chamber, the measuring device must be lowered to the top of the sediment pile carefully. Particles at the top of the pile typically offer less resistance to the end of the rod than consolidated particles toward the bottom of the pile. Once this measurement is recorded, it should be compared to the as-built drawing for the unit to determine weather the height of the sediment pile off the bottom of the sump floor exceeds 75% of the total height of isolated sump.

Cleaning

Cleaning of a CDS systems should be done during dry weather conditions when no flow is entering the system. The use of a vacuum truck is generally the most effective and convenient method of removing pollutants from the system. Simply remove the manhole covers and insert the vacuum hose into the sump. The system should be completely drained down and the sump fully evacuated of sediment. The area outside the screen should also be cleaned out if pollutant build-up exists in this area.

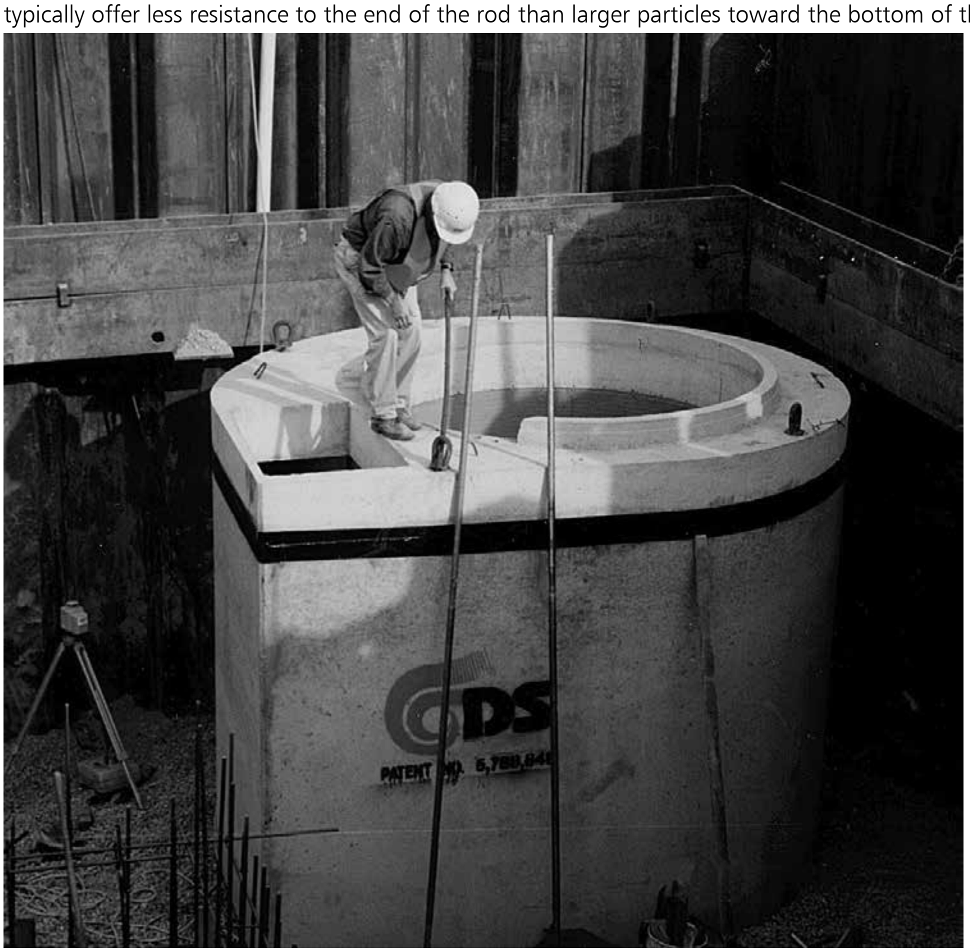
In installations where the risk of petroleum spills is small, liquid contaminants may not accumulate as quickly as sediment. However, the system should be cleaned out immediately in the event of an oil or gasoline spill. Motor oil and other hydrocarbons that accumulate on a more routine basis should be removed when an appreciable layer has been captured. To remove these pollutants, it may be preferable to use absorbent pads since they are usually less expensive to dispose than the oil/water emulsion that may be created by vacuuming the oily layer. Trash and debris can be netted out to separate it from the other pollutants. The screen should be cleaned to ensure it is free of trash and debris.

Manhole covers should be securely seated following cleaning activities to prevent leakage of runoff into the system from above and also to ensure that proper safety precautions have been followed. Confined space entry procedures need to be followed if physical access is required. Disposal of all material removed from the CDS system should be done in accordance with local regulations. In many jurisdictions, disposal of the sediments may be handled in the same manner as the disposal of sediments removed from catch basins or deep sump manholes. Check your local regulations for specific requirements on disposal.

CDS Model	Diameter		Distance from Water Surface to Top of Sediment Pile		Sediment Storage Capacity	
	ft	m	ft	m	y^3	m^3
CDS1515	3	0.9	3.0	0.9	0.5	0.4
CDS2015	4	1.2	3.0	0.9	0.9	0.7
CDS2015	5	1.5	3.0	0.9	1.3	1.0
CDS2020	5	1.5	3.5	1.1	1.3	1.0
CDS2025	5	1.5	4.0	1.2	1.3	1.0
CDS3020	6	1.8	4.0	1.2	2.1	1.6
CDS3025	6	1.8	4.0	1.2	2.1	1.6
CDS3030	6	1.8	4.6	1.4	2.1	1.6
CDS3035	6	1.8	5.0	1.5	2.1	1.6
CDS4030	8	2.4	4.6	1.4	5.6	4.3
CDS4040	8	2.4	5.7	1.7	5.6	4.3
CDS4045	8	2.4	6.2	1.9	5.6	4.3
CDS5640	10	3.0	6.3	1.9	8.7	6.7
CDS5653	10	3.0	7.7	2.3	8.7	6.7
CDS5668	10	3.0	9.3	2.8	8.7	6.7
CDS5678	10	3.0	10.3	3.1	8.7	6.7

Table 1: CDS Maintenance Indicators and Sediment Storage Capacities

Note: To avoid underestimating the volume of sediment in the chamber, carefully lower the measuring device to the top of the sediment pile. Finer silty particles at the top of the pile may be more difficult to feel with a measuring stick. These finer particles typically offer less resistance to the end of the rod than larger particles toward the bottom of the pile.



CDS Inspection & Maintenance Log

CDS Model: ______________________ Location: ______________________

Date	Water depth to sediment[1]	Floatable Layer Thickness[2]	Describe Maintenance Performed	Maintenance Personnel	Comments

1. The water depth to sediment is determined by taking two measurements with a stadia rod: one measurement from the manhole opening to the top of the sediment pile and the other from the manhole opening to the water surface. If the difference between these measurements is less than the values listed in table 1 the system should be cleaned out. **Note: to avoid underestimating the volume of sediment in the chamber, the measuring device must be carefully lowered to the top of the sediment pile**.

2. For optimum performance, the system should be cleaned out when the floating hydrocarbon layer accumulates to an appreciable thickness. In the event of an oil spill, the system should be cleaned immediately.

SUPPORT

- Drawings and specifications are available at www.ContechES.com.
- Site-specific design support is available from our engineers.

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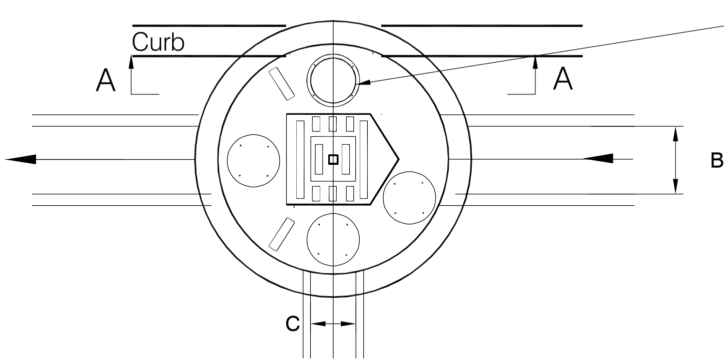
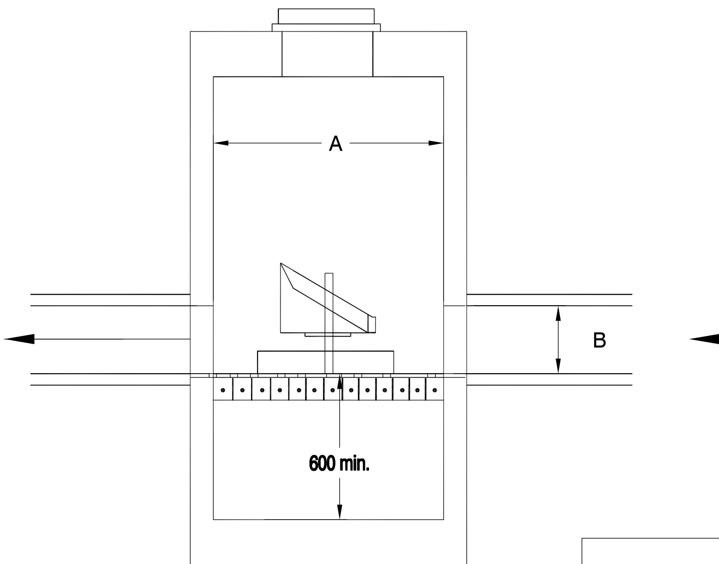
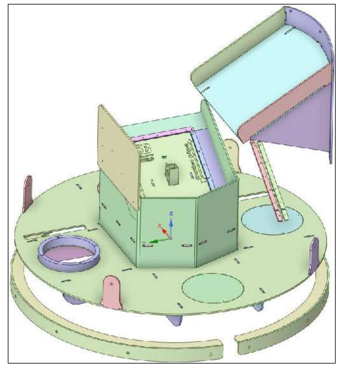
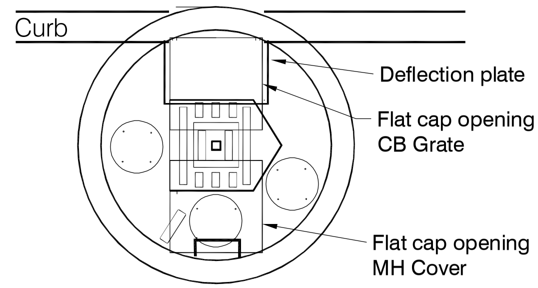


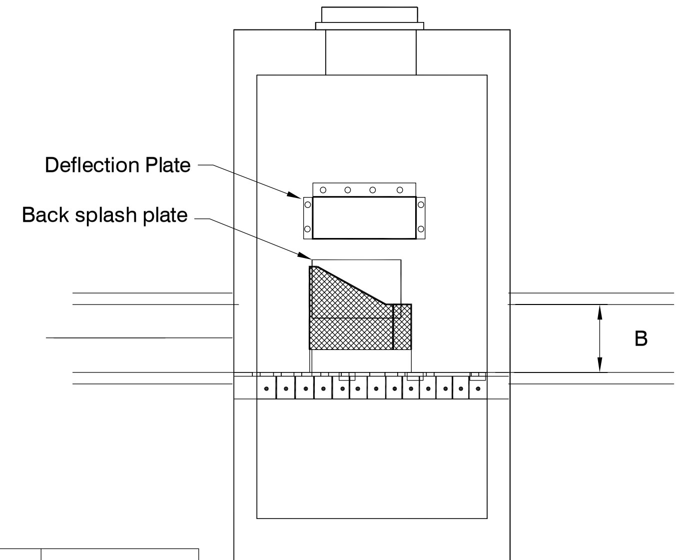


Section A-A





Twin linlet Flat cap



Inlet deflection wall

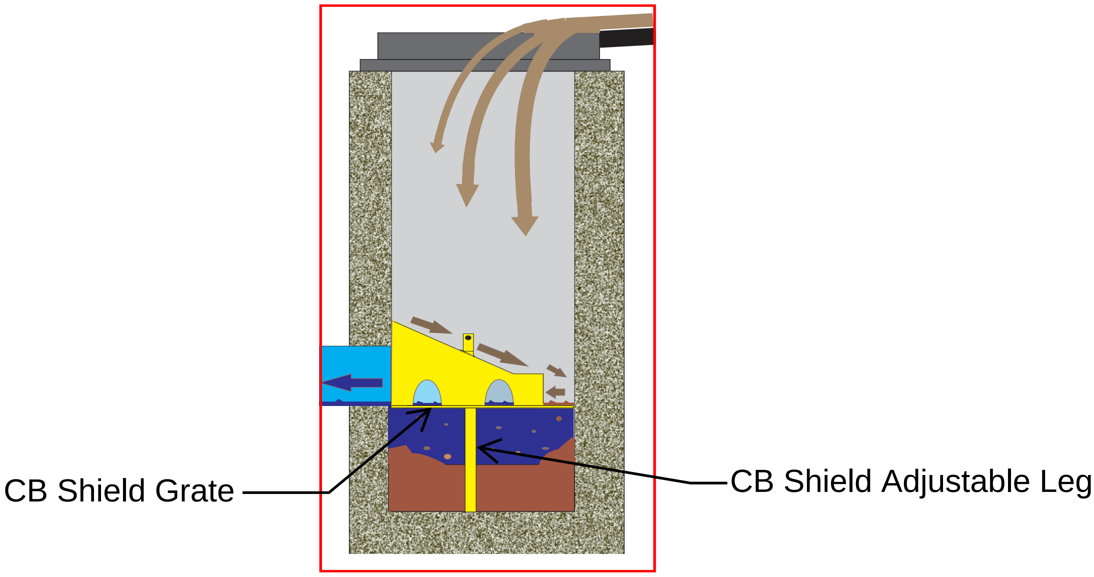
Sizing				
A	B	C	min depth	Cap type
1200	600mm max pipe	450mm max pipe	1.35m t/g to inv	Standard
1500	825	600	1.5m	Standard
1800	1050	825	1.8m	Standard
2400	1200	600	2.1m	Standard
1800 DCBMH	See detail dwg	see detail dwg	1.5m	Twin Inlet

CBMH Shield-Information Chart

CB Shield Operations Manual

Installing CB Shield

It is important the catch basin frame and cover is aligned properly with the catch basin below
If it is misaligned it may be difficult to install the CB Shield insert
Determine the depth of the sump (i.e. the distance from the invert of the outlet pipe to the bottom of the catch basin). If the catch basin is in service the sump depth will be the depth of the water. The grate section of the CB Shield insert should be the same elevation as the water depth in the sump.



Adjust the leg of the CB Shield to achieve the appropriate elevation
The CB Shield is lowered into place with the rope attached to the top of the leg. The high side of the sloped plate should face the wall with the outlet pipe. (The incoming water should be directed to the wall furthest from the outlet)
The flexible plastic skirt around the outer edges of the CB Shield insert may interfere with some misaligned frame and grates. If so a slice can be cut into the skirt with a utility knife at the point of interference.
Make sure the grate is at the desired level or remove CB Shield and re-adjust the leg length.

Inspecting a CB Shield Enhanced Catch Basin

Open grate
A lifting rope is attached to the top of the centered leg of the CB Shield insert. Lift and remove the insert.
Inspect CB Shield for any possible damage. Quite often leaves will accumulate on the grate. This can actually improve the Shield's ability to capture sediment and assist in preventing leave litter from being washed down stream.
Use a Sludge Judge to measure the sediment depth in 4 - 6 locations of the sump.
If the sediment depth is 300mm – 600mm deep it is recommended that the unit be cleaned.

Cleaning a CB Shield Enhanced Catch Basin

Open grate and remove CB Shield with lift rope.
Clean catch basin as usual with a Vacuum truck.
Clean CB Shield (if needed) and re-install into catch basin.
If there is any significant damage to a CB Shield please send a picture and its location to CB Shield Inc. (info@cbshield.com).

GENERAL DESIGN NOTES

1. DIMENSIONS

1.1. THE FOLLOWING DIMENSIONAL CONVENTIONS ARE FOLLOWED, UNLESS OTHERWISE NOTED:
1.2. ALL DIMENSIONS ARE IN MILLIMETERS (mm)
1.3. ALL ELEVATIONS ARE IN METERS (m)
1.4. ALL DIMENSIONS ARE SUBJECT TO MANUFACTURING TOLERANCES
1.5. ALL DIMENSIONS ARE TO THE INSIDE CREST OF THE CHAMBERS

2. DESIGN STANDARDS

2.1. AMERICAN ASSOCIATION OF STATE HIGHWAY TRANSPORTATION OFFICIALS (AASHTO) LRFD BRIDGE DESIGN SECTION 12
2.2. ASTM F2787-13 (REAPPROVED 2018) STRUCTURAL DESIGN OF THERMOPLASTIC CORRUGATED WALL STORMWATER COLLECTION CHAMBERS

3. DESIGN PARAMETERS

3.1. SERVICE LOADS
3.1.1. LIVE LOAD: AASHTO TRUCK DESIGN HS-20 VEHICLES WITH ADDITIONAL CONSIDERATION FOR LANE LOADING HL-93
3.2. BACKFILL LOADS
3.2.1. MINIMUM SOIL COVER FROM TOP OF HS75 CHAMBER IS 450 mm FOR LIVE LOAD APPLICATIONS
3.2.2. MAXIMUM SOIL COVER FROM TOP OF CHAMBER IS 2440 mm
3.3. CONSTRUCTION LOADS (ASSUMED CONFIGURATION)
3.3.1. MINIMUM COVER OVER HS75 CHAMBER 150 mm
3.3.2. SMALL DOZER OR SKID STEER LOADER WITH LESS THAN 30 kPa (4.5 PSI) APPLIED GROUND PRESSURE
3.3.3. EQUIPMENT SHALL TRAVEL PARALLEL TO CHAMBER ROWS
3.4. UNIT WEIGHT OF ENGINEERED SOIL 19 kN/m^3
3.5. UNIT WEIGHT OF RANDOM FILL SOIL 19 kN/m^3
3.6. MAINTAIN MINIMUM SPACING OF 150 mm BETWEEN HS75 CHAMBERS.

4. MATERIAL SPECIFICATIONS

4.1. HYDROSTOR CHAMBER MATERIAL SHALL CONFORM TO ASTM F2418-19
4.2. CHAMBER MATERIAL IS VIRGIN, IMPACT-MODIFIED POLYPROPYLENE COPOLYMERS

5. FOUNDATION

5.1. MAXIMUM APPLIED BEARING PRESSURE ON NATIVE SOIL = 195 kPa FOR HS75 CHAMBERS WITH MAXIMUM 2440 mm COVER
5.2. HYDROSTOR STORMWATER SYSTEM SHALL BE INSTALLED ON DRY, STABLE AND LEVEL SUBGRADE
5.3. CONFORMATION OF ADEQUATE SOIL BEARING CAPACITY IS THE RESPONSIBILITY OF THE CONTRACTOR'S/OWNER'S GEOTECHNICAL ENGINEER
5.4. ALL UNSUITABLE MATERIAL WITHIN THE FOUNDATION ZONE SHALL BE REMOVED AND REPLACED WITH SUITABLE MATERIAL AS DETERMINED AND APPROVED BY THE CONTRACTOR'S/OWNER'S GEOTECHNICAL ENGINEER

6. GEOTEXTILE

6.1. FOUNDATION AND EMBEDMENT MATERIAL
6.1.1. NON-WOVEN GEOTEXTILE FILTER FABRIC SHALL BE PLACED AROUND THE SYSTEM TO PREVENT SURROUNDING SOIL MATERIAL FROM MIGRATING INTO THE FOUNDATION AND EMBEDMENT BACKFILL MATERIAL.
6.1.2. SUITABILITY OF THE NON-WOVEN GEOTEXTILE FABRIC WITH IN SITU SOILS SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR'S OR OWNER'S GEOTECHNICAL ENGINEER
6.1.3. MINIMUM 136 g/m^2 (4 oz/yd^2) NON-WOVEN GEOTEXTILE SHALL BE USED FOR EMBEDMENT BACKFILL MATERIAL SIZED 19 mm TO 38 mm (¾" TO 1 ½") GRADATION
6.1.4. MINIMUM 203 g/m^2 (6 oz/yd^2) NON-WOVEN GEOTEXTILE SHALL BE USED FOR EMBEDMENT BACKFILL MATERIAL SIZED 38 mm TO 51 mm (1 ½" TO 2") GRADATION
6.2. SEDIMENT ROW
6.2.1. TWO LAYERS OF WOVEN GEOTEXTILE IS PLACED BETWEEN THE FOUNDATION STONE AND THE BOTTOM OF THE CHAMBER TO CREATE THE SEDIMENT ROW
6.2.2. MINIMUM 203 g/m^2 (6 oz/yd^2) WOVEN GEOTEXTILE SHALL BE PLACED WITHOUT JOINTS WITHIN THE CHAMBERS
6.3. INLET SCOUR PROTECTION
6.3.1. CHAMBER ROWS CONNECTED TO AN INLET MANIFOLD SHALL HAVE A WOVEN GEOTEXTILE PLACED BETWEEN THE FOUNDATION STONE AND THE BOTTOM OF THE CHAMBER TO PREVENT SCOUR
6.3.2. MINIMUM 203 g/m^2 (6 oz/yd^2) WOVEN GEOTEXTILE SHALL BE PLACED WITHOUT JOINTS WITHIN THE CHAMBERS, ALL OVERLAPS ON GEOTEXTILE SHALL LAY FLAT AND HAVE A MINIMUM 600 mm OVERLAP

7. ASSEMBLY

7.1. EACH CHAMBER IS INSTALLED ON TOP OF THE PREVIOUS CHAMBER BY OVERLAPPING THE END CORRUGATION
7.2. MINIMUM SPACING BETWEEN HS75 CHAMBERS MUST BE 150 mm.
7.3. CHAMBER ROWS SHALL PROVIDE CONTINUOUS, UNOBSTRUCTED INTERNAL SPACE WITH NO INTERNAL SUPPORT PANELS THAT WOULD IMPEDE FLOW OR LIMIT ACCESS FOR INSPECTION.

8. ENGINEERED BACKFILL & FOUNDATION

8.1. HYDROSTOR CHAMBERS AND THE ENGINEERING/FOUNDATION BACKFILL ARE A COMPOSITE SYSTEM MADE UP OF THE CHAMBERS AND SOIL ENVELOPE. BOTH ELEMENTS PLAY A VITAL PART IN THE STRUCTURAL INTEGRITY AND WATER STORAGE OF THE SYSTEM THROUGHOUT THE SERVICE LIFE.
8.2. FOUNDATIONS STONE AND EMBEDMENT BACKFILL
8.2.1. GRADATION SHALL BE 19 mm TO 51 mm (¾" TO 2") WASHED, CRUSHED, ANGULAR STONE
8.2.2. STONE MUST HAVE A MINIMUM 40% POROSITY
8.2.3. STONE SHALL BE UNIFORM IN SHAPE; FLAT OR ELONGATED STONE IS NOT ALLOWED.
8.2.4. L.A. ABRASION RATING LESS THAN 30
8.2.5. FOUNDATION STONE DEPTH SHALL BE MINIMUM OF 150 mm FOR HS75 CHAMBERS OR AS DETAILED ON LAYOUT DRAWING.
8.2.6. EMBEDMENT STONE COVER SHALL BE MINIMUM OF 150 mm ABOVE THE TOP OF THE HS75 CHAMBER
8.3. INITIAL BACKFILL
8.3.1. ENGINEERING BACKFILL MATERIAL SHALL BE CLEAN, GRANULAR, NON-FROST SUSCEPTIBLE, AND POSSESS TIME-INDEPENDENT PROPERTIES.
8.3.2. BACKFILL MATERIAL SHALL CONSISTS OF A WELL GRADED GRANULAR MATERIAL WITH ANGULAR GRAINS CLASSIFYING AS "GRANULAR A" OR "GRANULAR B TYPE II" IN OPSS 1010 AND MEETING THE FOLLOWING REQUIREMENTS.
8.3.3. MATERIAL GRADATION (ASTM C136 AND C117):

SIEVE NUMBER	SIEVE SIZE (mm)	PERCENT PASSING
	75.00	100
	37.50	80 - 100
	26.50	70 - 100
	19.00	60 - 95
4	4.75	25 - 65
16	1.18	10 - 35
50	0.30	5 - 20
200	0.075	0 - 10

8.3.4. SHALL EXTEND FROM THE TOP OF EMBEDMENT BACKFILL TO A MINIMUM OF 450 mm ABOVE THE TOP OF THE CHAMBER
8.4. FINAL BACKFILL
8.4.1. MATERIAL AND PLACEMENT SHALL BE DONE IN ACCORDANCE WITH THE CONTRACT REQUIREMENTS
8.4.2. SHALL EXTEND FROM THE TOP OF THE INITIAL BACKFILL TO A MAXIMUM OF 2440 mm ABOVE THE TOP OF THE CHAMBER
8.5. DELETERIOUS MATERIAL
8.5.1. BACKFILL SHALL BE FREE FROM FOREIGN MATTER
8.5.2. SHALES AND CLAYSTONES ARE GENERALLY CONSIDERED DELETERIOUS MATERIALS AND SHALL NOT BE ALLOWED IN THE ENGINEERED BACKFILL
8.5.3. FROZEN MATERIAL SHALL NOT BE ALLOWED IN THE BACKFILL
8.6. COMPACTION
8.6.1. MAXIMUM UNCOMPACTED LIFT HEIGHT SHALL BE 150 mm
8.6.2. FOUNDATION LAYER SHALL BE COMPACTED TO 95% STANDARD PROCTOR DENSITY
8.6.3. EMBEDMENT BACKFILL SHALL BE COMPACTED TO MINIMUM 95% STANDARD PROCTOR DENSITY AND AN EFFORT SHALL BE MADE TO HAND KNIFE STONE IN BETWEEN ALL CORRUGATIONS
8.6.4. INITIAL BACKFILL SHALL BE COMPACTED TO 95% STANDARD PROCTOR DENSITY
8.6.5. FINAL BACKFILL SHALL BE COMPACTED IN ACCORDANCE WITH THE CONTRACT REQUIREMENTS
8.7. BALANCED BACKFILL MUST BE PROVIDED FOR EACH CHAMBER TO PREVENT IMBALANCED LOAD CONDITION

9. QUALITY ASSURANCE AND INSPECTION

9.1. QUALITY ASSURANCE OF THE COMPLETED PROJECT INCLUDING FOUNDATION AND BACKFILL MATERIAL AND PLACEMENT SHALL BE COMPLETED IN ACCORDANCE WITH THE CONTRACT REQUIREMENTS AND NOT BE THE RESPONSIBILITY OF ARMTEC
9.2. THE CONTRACTOR'S/OWNER'S REPRESENTATIVE SHALL ALSO BE RESPONSIBLE FOR ENSURING THAT THE FLOWING ITEMS HAVE BEEN ACHIEVED WITHIN THE REQUIRED TOLERANCES
9.2.1. SATISFACTORY BEDDING AND/OR FOUNDATION
9.2.2. SYMMETRY OF THE CHAMBERS
9.2.3. ENGINEERED BACKFILL REQUIREMENTS
9.2.4. ENGINEERED BACKFILL LIFT HEIGHT AND COMPACTION
9.2.5. CLEAR STONE POROSITY
9.2.6. CONFORMATION OF LAYOUT AND DIMENSION CHECKS OF THE CHAMBER SYSTEM PRIOR TO AND AFTER BACKFILLING
9.2.7. CONFORMATION OF THE MINIMUM AND MAXIMUM COVERS FOR EACH SPECIFIC LAYER

10. HYDRAULIC CAPACITY AND SCOUR PROTECTION

10.1. REQUIRED WATER STORAGE VOLUME IS THE RESPONSIBILITY OF THE OWNER'S HYDROTECHNICAL ENGINEER
10.2. SCOUR, EROSION AND SEDIMENT CONTROL MEASURES TO PROTECT THE CHAMBER SYSTEM DURING ALL PHASES OF CONSTRUCTION IS THE RESPONSIBILITY OF THE CONTRACTOR

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DRAFT CHECK SM/SP	----

CUSTOMER: ARMTECH CHAMBER STD DRAWINGS
PROJECT NAME: STANDARD DETAIL ----
DRAWING TITLE: DESIGN NOTES

SALES ORDER NO.	SHEET NO.	SCALE	PROJECT NO.	DRAWING NO.
TBD	1 OF 4	AS NOTED	---	001

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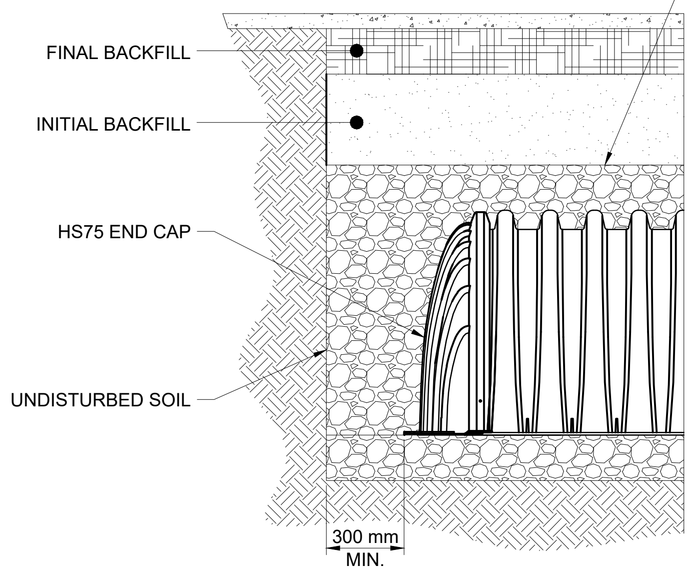
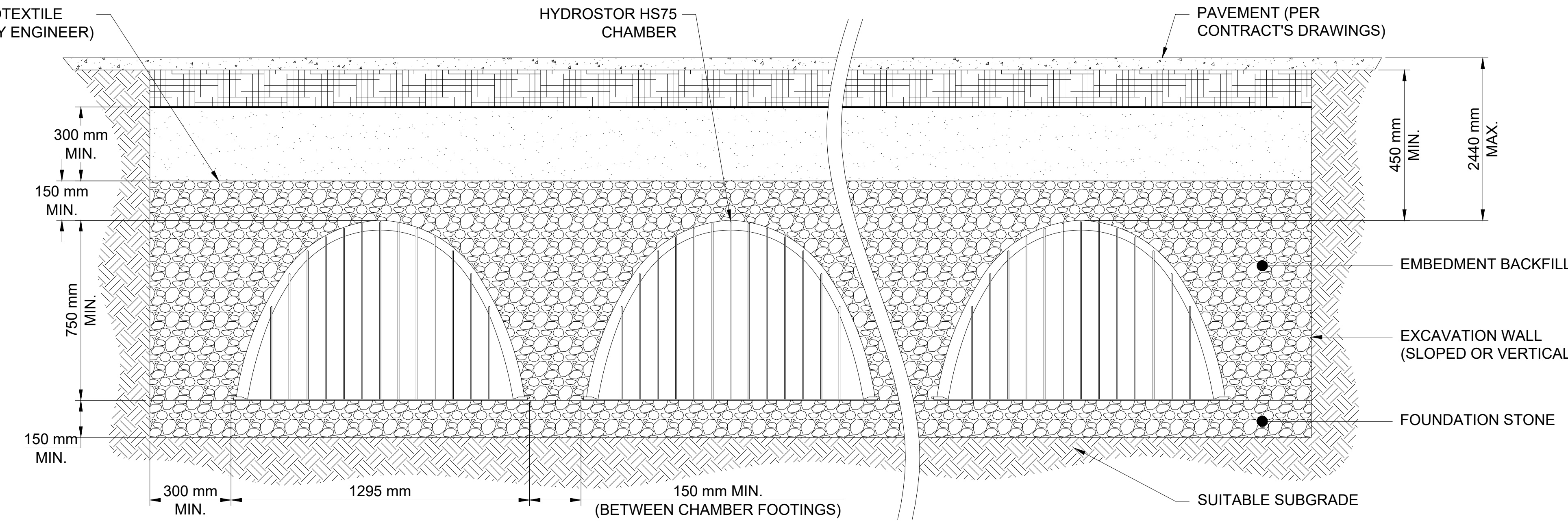


TYPICAL END VIEW

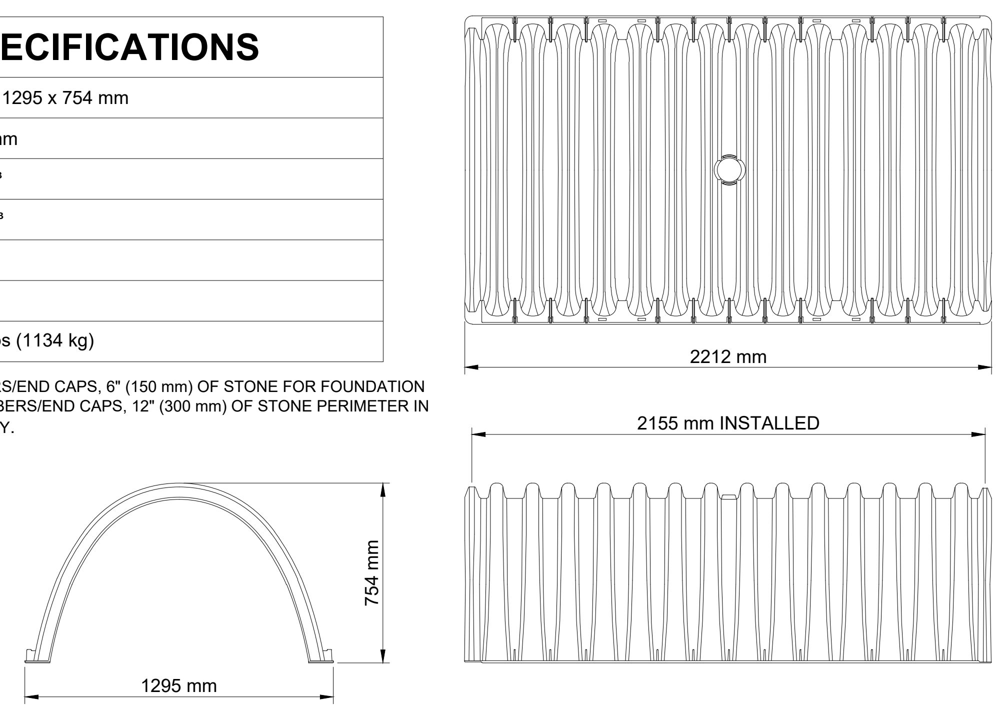


TYPICAL CROSS SECTION
(SEE LAYOUT DRAWINGS FOR PROJECT SPECIFIC DETAILS)

CHAMBER SPECIFICATIONS

CHAMBER SIZE (L x W x H)	2212 x 1295 x 754 mm
INSTALLED LENGTH	2155 mm
CHAMBER STORAGE	1.31 m³
MIN. INSTALLED STORAGE *	2.12 m³
WEIGHT / CHAMBER	32 kg
CHAMBERS / PALLET	33
APPROX. WEIGHT / PALLET	2500 lbs (1134 kg)

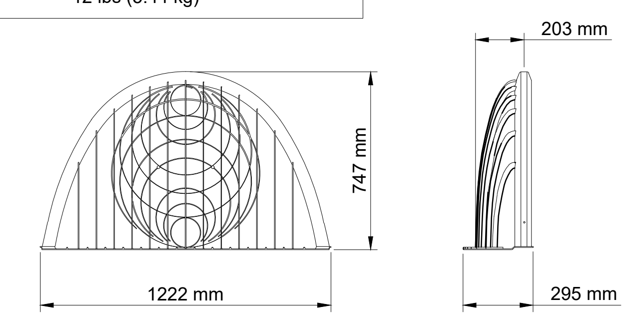
*ASSUMES 6" (150 mm) STONE ABOVE CHAMBERS/END CAPS, 6" (150 mm) OF STONE FOR FOUNDATION STONE, 6" (150 mm) OF STONE BETWEEN CHAMBERS/END CAPS, 12" (300 mm) OF STONE PERIMETER IN FRONT OF END CAPS AND 40% STONE POROSITY.



CHAMBER

END CAP SPECIFICATIONS

END CAP SIZE (L x W x H)	295 x 1222 x 747 mm
INSTALLED LENGTH	203 mm
END CAP STORAGE	0.08 m³
MIN. INSTALLED STORAGE *	0.34 m³
WEIGHT	12 lbs (5.44 kg)



END CAP

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CUSTOMER
ARMTECH CHAMBER STD DRAWINGS

PROJECT NAME
STANDARD DETAIL

DRAWING TITLE
HYDROSTOR HS75- TYPICAL CROSS SECTION
DETAILS AND CHAMBER & END CAP SPECIFICATIONS

SALES ORDER NO.	SHEET NO.	SCALE	PROJECT NO.	DRAWING NO.
TBD	2 OF 4	AS NOTED	---	002

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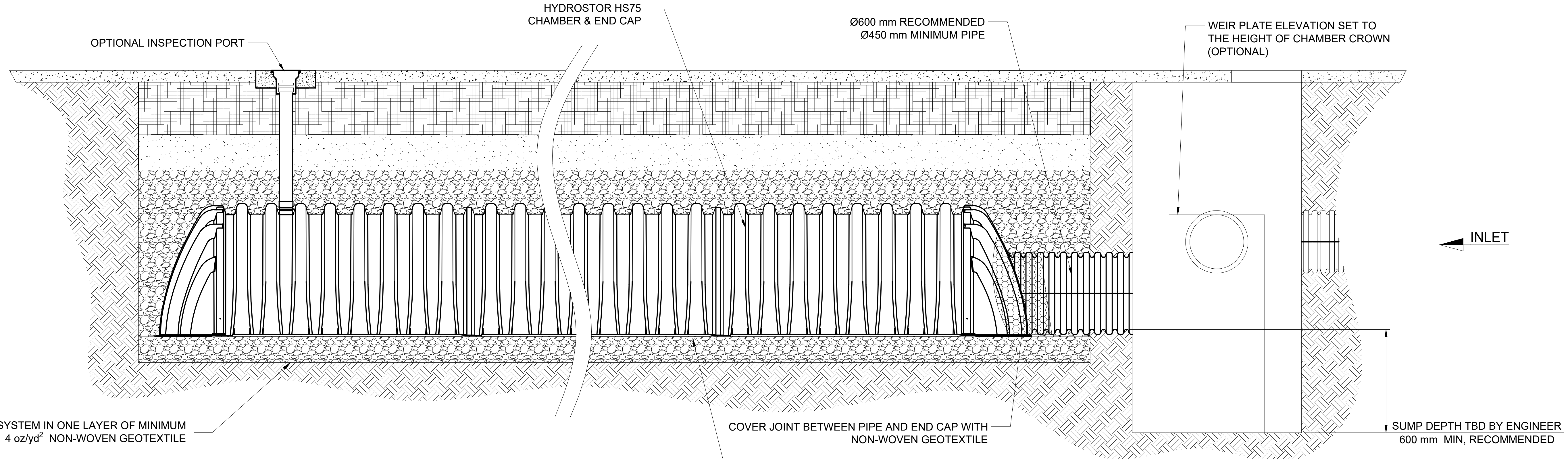
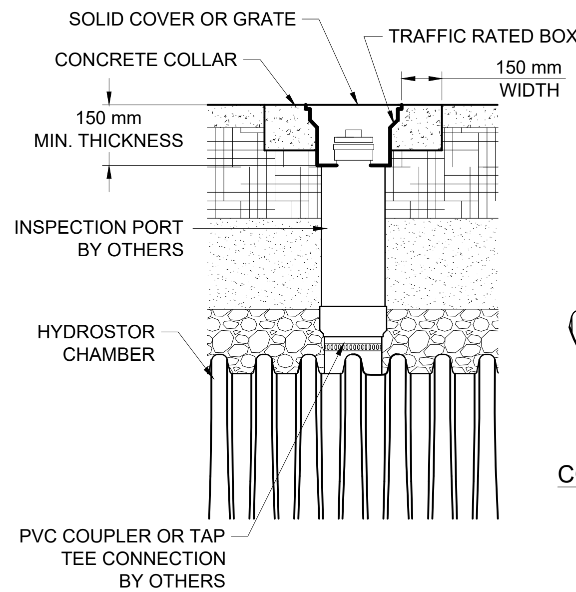
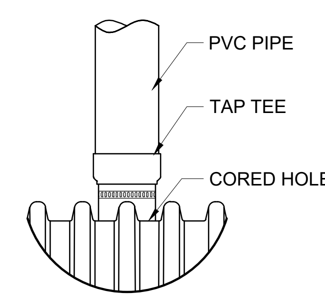


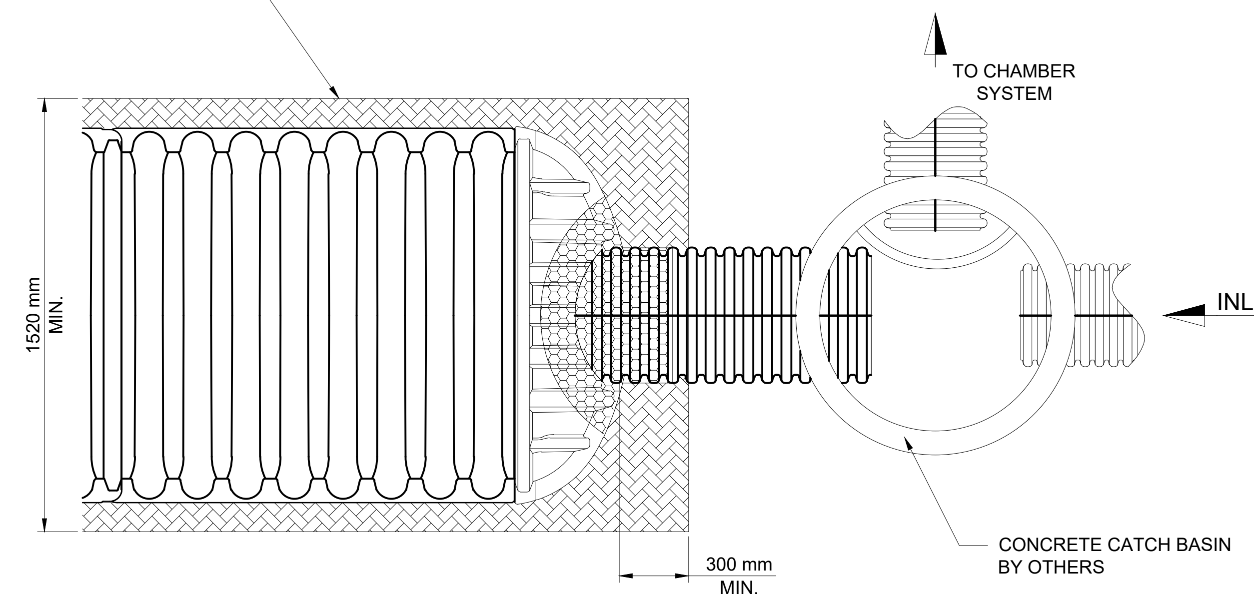
TYPICAL SEDIMENT ROW CROSS SECTION
(SEE LAYOUT DRAWINGS FOR PROJECT SPECIFIC DETAILS)





150 mm TAP TEE
CONNECTION DETAIL

INSPECTION PORT DETAILS



TYPICAL SEDIMENT ROW - PLAN VIEW
(SEE LAYOUT DRAWINGS FOR PROJECT SPECIFIC DETAILS)

SEDIMENT ROW NOTES (IF REQUIRED):

1. INSPECTION AND MAINTENANCE: INSPECTION OF THE SYSTEM SHOULD OCCUR BIANNUALLY TO ENSURE LARGE AMOUNTS OF SEDIMENT OR DEBRIS HAVE NOT BEEN DEPOSITED IN THE SEDIMENT ROW. DURING THE FIRST YEAR, INSPECTION SHOULD OCCUR MORE FREQUENTLY DUE TO CONSTRUCTION SEDIMENT LOADING. TO CLEAN THE SYSTEM, A JET/VAC PROCESS CAN BE USED TO REMOVE SEDIMENT AND DEBRIS FROM THE SEDIMENT ROW.
2. ACCESS PIPE: PRINSCO RECOMMENDS A 600 mm DIAMETER ACCESS PIPE TO THE SEDIMENT ROW.

INSPECTION PORT NOTES (IF REQUIRED):

1. LOCATED AT THE CENTER OF CHAMBER. 150 mm INSPECTION PORTS MAY BE CONNECTED THROUGH A CORED HOLE, CENTERED ON A CORRUGATION. CORED HOLE SIZES AS FOLLOWS: 150 mm CUT TO 180 mm
2. TAP TEE CONNECTION CAN CONSIST OF QWICKSEAL, INSERTA TEE OR APPROVED EQUIVALENT BY OTHERS.
3. ALL PVC FITTINGS TO BE SOLVENT CEMENTED.
4. PVC MAY BE EITHER SDR 35 OR SCH 40

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CUSTOMER
ARMTECH CHAMBER STD DRAWINGS

PROJECT NAME
STANDARD DETAIL

DRAWING TITLE
HYDROSTOR HS75
TYPICAL SEDIMENT ROW DETAILS

SALES ORDER NO.	SHEET NO.	SCALE	PROJECT NO.	DRAWING NO.
TBD	3 OF 4	AS NOTED	---	003

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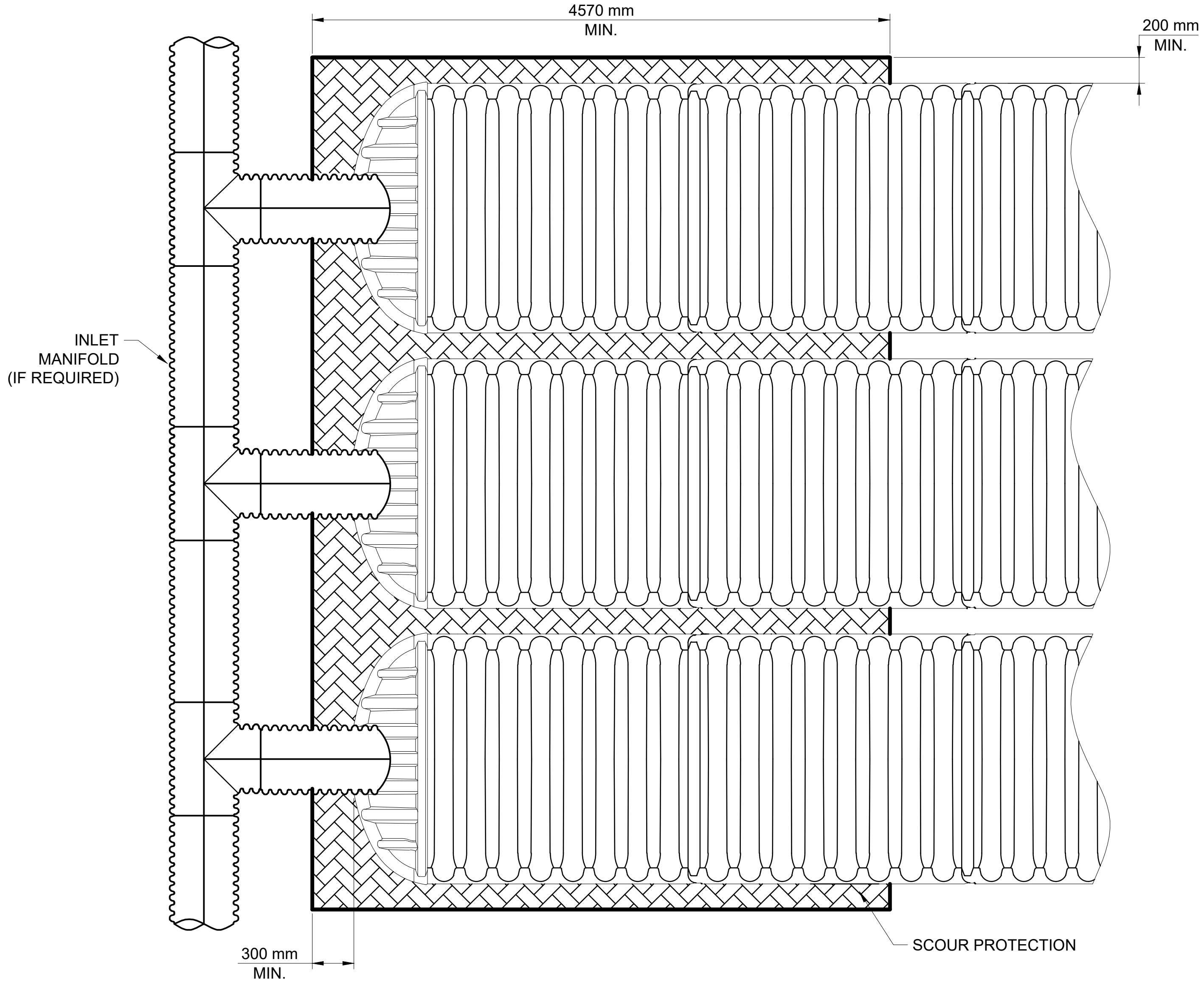
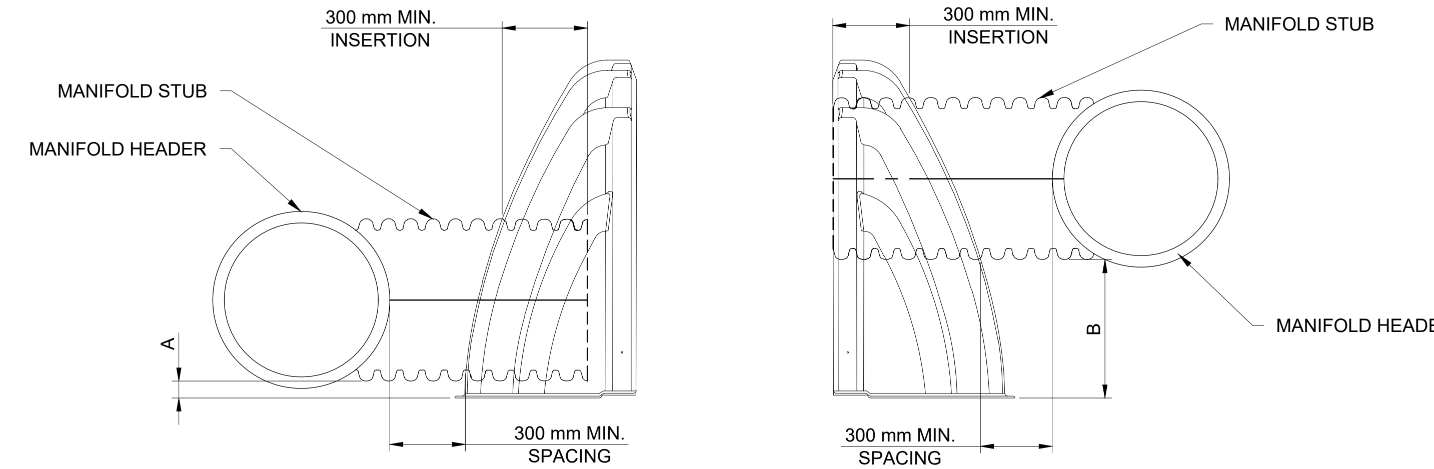
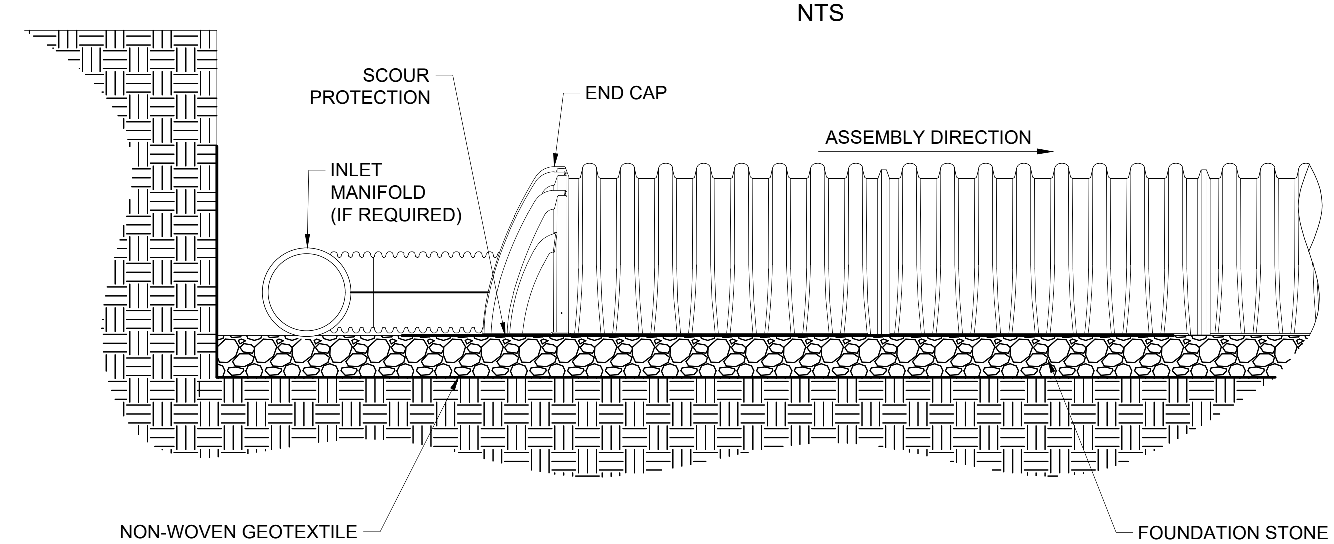


SCOUR PROTECTION - PLAN VIEW
(SEE LAYOUT DRAWINGS FOR PROJECT SPECIFIC DETAILS)



STUB SIZE (mm)	BOTTOM INVERT CONNECTION "A" (mm)	TOP INVERT CONNECTION "B" (mm)
100	21	564
150	24	518
200	27	460
300	40	344
375	43	259
450	55	180
600	12	-

END CAP INSERTION DETAILS
NTS



TYPICAL SCOUR PROTECTIN - CROSS SECTION
(SEE LAYOUT DRAWINGS FOR PROJECT SPECIFIC DETAILS)

SCOUR PROTECTION NOTES (IF REQUIRED):

1. SCOUR PROTECTION SHOULD USE A MIN 6 oz/yd² (203 g/m²) WOVEN GEOTEXTILE.
   GEOTEXTILE SHOULD MEET AASHTO M288 CLASS 1 SPECIFICATION.
2. SCOUR PROTECTION IS ONLY NEEDED WITH CHAMBER ROWS CONNECTED TO THE INLET MANIFOLD.

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CUSTOMER
ARMTECH CHAMBER STD DRAWINGS

PROJECT NAME
STANDARD DETAIL

DRAWING TITLE
HYDROSTOR HS75
TYPICAL SCOUR PROTECTION DETAILS

SALES ORDER NO.	SHEET NO.	SCALE	PROJECT NO.	DRAWING NO.
TBD	4 OF 4	AS NOTED	---	004