Stantec

Memo

To:	Kevin Brousseau Waterloo ON Office	From:	Bryan Weersink Waterloo ON Office
File:	1614-13551	Date:	November 17, 2017

Reference: Ingram Drive/Wideman Boulevard – Blocks 41 & 42, R.P. #61M-173
Hydraulic Grade Line Analysis
Guelph, Ontario

This memo has been written to determine the storm sewer hydraulic grade line (HGL) elevations along sections of Ingram Drive, Wideman Boulevard, and Simmonds Drive in Phase 4 of the Northern Heights Subdivision as requested by the City of Guelph in support of development of Blocks 41 and 42 within R.P. #61M-173. Background information on the Subdivision is documented in the following reports:

- *Northview – Ingram Environmental Implementation Report*, North-South Environmental Inc., April 11, 2003
- *Victoriaview North Subdivision, Final Stormwater Management Report,* Stantec Consulting Ltd., 2006

Based on the proposed site plan for Blocks 41 and 42, the units fronting Ingram Drive will require sump pumps as there is no storm sewer that the units can drain to on this section of road. The following sections outline the analysis and results of the HGL analysis to determine if it is possible for the units in Blocks 41 and 42 fronting Wideman Boulevard and Simmonds Drive to be serviced through gravity draining storm laterals.

Flows into the storm sewer system were estimated as the 25-year peak flow rate for catchbasins on a grade and the 100-year peak flow rate for catchbasins at a sag point calculated using the Rational Method. The storm sewer design sheets used to calculate the flows have been appended for reference. Due to the location of the site, storm sewer design sheets from several phases of the Northern Heights, Northview and Victoriaview developments were utilized in order to document all of the relevant storm sewer systems.

Water levels within the storm sewer system were calculated using the hydraulic modeling software EPA-Storm Water Management Model (SWMM) a dynamic rainfall-runoff simulation model. The downstream boundary condition for the model is the 100-year ponding elevation of 344.09 m in the existing downstream Ingram stormwater management (SWM) pond (Environmental Implementation Report, 2003). Building and foundation elevations are taken from the preliminary site servicing and grading plan and are subject to change. Model results are summarized in the tables below with detailed input files, output files, and storm sewer profiles are appended for reference.

Reference: Ingram Drive/Wideman Boulevard – Blocks 41 & 42, R.P. #61M-173
Hydraulic Grade Line Analysis
Guelph, Ontario

Table 1: Block 41 and 42 HGL Results to Wideman Boulevard

Location	Underside of Foundation Elevation (m)	Storm Sewer Inv. Elevation at connection[1] (m)	100- year Hydraulic Grade Line[1]	Distance between U/F and HGL (m)
MH 60	N/A	350.31	350.43	N/A
Block 41: Parts 6, 7 Block 42: Parts 9, 10	349.99	349.27	349.41	0.58
Block 41: Parts 4, 5 Block 42: Parts 10, 11	349.59	348.75	348.89	0.70
Block 41: Parts 2, 3 Block 42: Parts12, 13	348.99	348.23	348.38	0.61
MH 61	N/A	347.98 (U/S) / 345.49 (D/S)	348.13	N/A
Block 41: Part 1 Block 42: Part 14	348.59	345.46	348.08	0.51

Note 1: Storm Sewer inverts and Hydraulic grade line elevations were interpolated between manholes

Table 2: Block 42 HGL Results to Simmonds Drive

Location	Underside of Foundation Elevation (m)	Storm Sewer Inv. Elevation at connection[1] (m)	100- year Hydraulic Grade Line[1] (m)	Distance between U.F. and HGL (m)
MH 12	N/A	344.86	347.00	N/A
Block 42: Parts 6, 7	349.35	344.81	346.94	2.41
Block 42: Parts 4, 5	349.15	344.75	346.87	2.28
Block 42: Parts 2, 3	348.95	344.69	346.80	2.15
Block 42: Part 1	348.75	344.65	346.75	2.00

Note 1: Storm Sewer inverts and Hydraulic grade line elevations were interpolated between manholes

Reference: Ingram Drive/Wideman Boulevard – Blocks 41 & 42, R.P. #61M-173
Hydraulic Grade Line Analysis
Guelph, Ontario

As shown in the above tables, the 100-year HGL is more than 0.5 m below the underside of foundation elevation for all locations along Wideman Boulevard and Simmonds Drive. Therefore, all units can be serviced with gravity draining storm laterals.

Should you have any questions regarding the above please feel free to contact the undersigned at your convenience.

STANTEC CONSULTING LTD.

Bryan Weersink, B.Eng.
Water Resources Engineering Intern
Community Development
Phone: (519) 569-4333
Fax: (519) 579-6733
bryan.weersink@stantec.com

Jayson Innes, M.A.Sc., P.Eng.,
Senior Water Resources Engineer
Community Development
Phone: (519) 585-7282
Fax: (519) 579-6733
jayson.innes@stantec.com

Attachment: Preliminary Site Servicing and Grading Plan: C-100
Flow Calculation Sheets
Hydraulic Model Input, Output and Profiles

c. Mr. Jack Ingram / Mr. Dan Clayton, Artifex Construction

ATTACHMENTS

NOTES AND SPECIFICATIONS

A. GENERAL:

1. THESE PLANS FOR CONSTRUCTION ONLY WHEN APPROVED BY THE CITY OF GUELPH AND SEALED BY THE ENGINEER.
2. THE CONTRACTOR MUST CHECK AND VERIFY DIMENSIONS; OBTAIN ALL UTILITY LOCATES AND OBTAIN ALL REQUIRED PERMITS/LICENSES AND VERIFY ELEVATIONS OF EXISTING SERVICES BEFORE PROCEEDING WITH ANY WORK.
3. ANY PROPOSED CHANGES SHALL BE APPROVED BY THE ENGINEER AND CITY OF GUELPH.
4. ALL UNDERGROUND SERVICING TO BE INSPECTED BY STANTEC CONSULTING LTD. AND CERTIFIED FOR THE CITY OF GUELPH. CONTRACTOR SHALL COORDINATE WITH STANTEC AND SHALL CONTACT SAME AT LEAST 48 HOURS PRIOR TO INSTALLATION OF SERVICES.
5. ALL CONSTRUCTION WORK SHALL BE CARRIED OUT IN ACCORDANCE WITH THE REQUIREMENTS OF THE OCCUPATIONAL HEALTH AND SAFETY ACT AND REGULATIONS FOR CONSTRUCTION PROJECTS (LATEST EDITION).
6. WHERE STORM GRAVITY LATERALS ARE NOT PROVIDED FOUNDATION DRAINS FOR EACH UNIT TO DISCHARGE TO SUMP WITH PUMP DISCHARGES TO GRADE.

B. UNDERGROUND SERVICES:

1. CONTRACTOR SHALL VERIFY ELEVATION AND LOCATION OF EXISTING SANITARY AND STORM SEWERS AND WATERMAINS PRIOR TO COMMENCING SITE WORK AND SHALL NOTIFY THE ENGINEER OF ANY CONFLICTS BETWEEN EXISTING AND PROPOSED SERVICES.
2. ON-SITE SERVICING SHALL NOT BE UNDERTAKEN PRIOR TO COMPLETION OF SERVICE CONNECTIONS WITHIN THE ROAD R.O.W.'s.
3. ALL UNDERGROUND SERVICES TO BE IN COMPLIANCE WITH THE LATEST REVISED BUILDING CODE, CITY OF GUELPH STANDARDS, AND ONTARIO PROVINCIAL STANDARDS (OPSS, OPSD)
4. ALL BEDDING TO BE AS NOTED BELOW. TRENCH BACKFILL TO BE APPROVED NATIVE MATERIAL COMPACTED IN 200mm MAX. LIFTS TO 95% STANDARD PROCTOR DENSITY.
5. ALL SERVICES SHALL BE TESTED AS SPECIFIED IN THE APPLICABLE OPSS
6. ALL SERVICES, UTILITIES AND CATCHBASIN LEADS ARE TO BE SUPPORTED AS PER OPSD 1007.01 DURING TRENCHING ACTIVITIES. THE CONTRACTOR IS RESPONSIBLE FOR LOCATING AND PROTECTING ALL EXISTING UTILITIES PRIOR TO AND DURING CONSTRUCTION. LOCATION OF EXISTING UTILITIES TO BE VERIFIED IN THE FIELD. ANY UTILITY RELOCATION DUE TO THIS DEVELOPMENT TO BE UNDERTAKEN AT THE EXPENSE OF THE OWNER/DEVELOPER.

C. SEWERS/APPURTENANCES:

1. STORM SEWERS:
   - LESS THAN 200mmø – PVC SDR-28
   - 200mmø TO 375mmø – PVC SDR-35 – PVC RIBBED PIPE (ULTRA-RIB OR EQUIVALENT) – CL-3 CONCRETE
   - 450mmø TO 600mmø – PVC RIBBED PIPE (ULTRA-RIB OR EQUIVALENT) – 65-D CONCRETE
   - GREATER THAN 600mmø – 65-D CONCRETE
   - 1.2m MINIMUM COVER
2. SANITARY SEWERS
   - LESS THAN 200mmø – PVC SDR-28
   - 200mmø & LARGER – PVC-SDR-35
   - 2.5m MINIMUM COVER
3. SEWER BEDDING:
   - CITY OF GUELPH SD-29
   - 150mm (MIN) GRAN 'A' TO 98% S.P.D.
4. MANHOLES:
   - CITY OF GUELPH SD-5 (1200mmø MH)
   - CITY OF GUELPH SD-6 (1500mmø MH)
5. MANHOLE BENCHING:
   - CITY OF GUELPH SD-44
6. CATCHBASINS:
   - CITY OF GUELPH SD-11 (SINGLE)-200mmø LEAD
   - CITY OF GUELPH SD-12 (DOUBLE)-250mmø LEAD
   - CITY OF GUELPH SD-13 (DICB)
7. FRAMES AND GRATES/COVERS:
   - CITY OF GUELPH SD-8 (MH'S)
   - OPSD 400.02 (CB'S)
   - CITY OF GUELPH SD-15 (RLCB'S)
   - CITY OF GUELPH SD-16 (DICB'S)
   - ALL FRAMES ON STRUCTURES TO BE SET USING PRECAST CONCRETE ADJUSTMENT UNITS

D. WATERMAIN/SERVICES

1. WATERMAIN/SERVICES
   - 100mmø AND LARGER – AWWA C-900 PVC SDR-18 CLASS 150
   - 2.0m MINIMUM COVER
   - FITTINGS TO AWWA C-907
   - WHERE CONFLICT ARISE AT WATERMAIN/SERVICE CROSSING OTHER UNDERGROUND SERVICES, WATERMAIN/SERVICES SHALL BE LOWERED TO MAINTAIN 0.50m VERTICAL SEPARATION.
2. PIPE BEDDING
   - CITY OF GUELPH SD-29
   - 150mm (MIN) GRANULAR 'A' 98% S.P.D.
3. THRUST BLOCKING
   - CITY OF GUELPH SD-27
4. TRACER WIRE
   - CITY OF GUELPH SD-54A
5. HYDRANTS
   - CITY OF GUELPH SD-25A (OPEN RIGHT)
   - PRIVATE HYDRANTS TO BE PAINTED RED.
6. VALVES AND BOXES
   - AWWA C509 (OPEN LEFT)
   - CITY OF GUELPH SD-24
7. WATER SERVICES
   - 25mmø TYPE K COPPER PIPING WET TAPPED TO PVC WATERMAIN WITH APPROVED SADDLE
   - CITY OF GUELPH SD-54B
8. WATER METERS:
   - BUILDING UNITS TO HAVE INDIVIDUAL WATER METERS TO THE SATISFACTION OF CITY OF GUELPH WATERWORKS DEPARTMENT
9. ALL NEW WATER PIPING INSTALLATIONS AS PER AWWA C651-05

E. GRADING

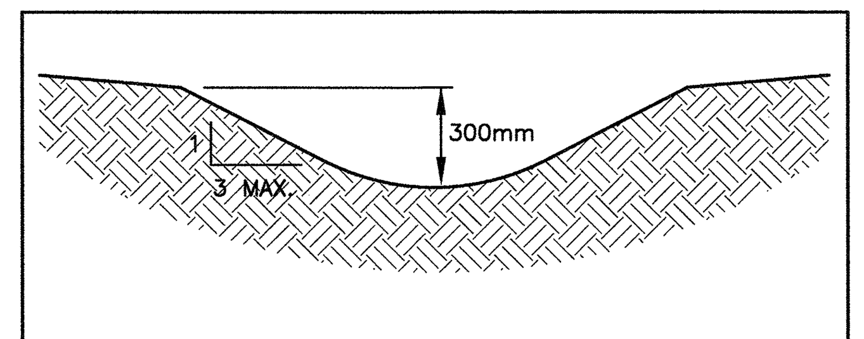
1. COMPLETE ALL EXCAVATION, GRADING, TRIMMING AND COMPACTION AS REQUIRED TO FACILITATE THE WORK. ALL SUBGRADE AREAS SHALL BE PROOF ROLLED TO 98% S.D.P. PRIOR TO GRANULAR SUBBASE PLACEMENT.
2. DISPOSE OF ALL SURPLUS AND UNSUITABLE MATERIALS OFF SITE.
3. SAWCUT ASPHALT IN NEAT LINES AT ALL MATCH LINES.
4. MATCH EXISTING GRADES AT ADJACENT PROPERTY LINES.
5. TRANSITION SLOPES TO BE MAXIMUM 2:1 (HORIZONTAL TO VERTICAL)

F. SURFACE WORKS:

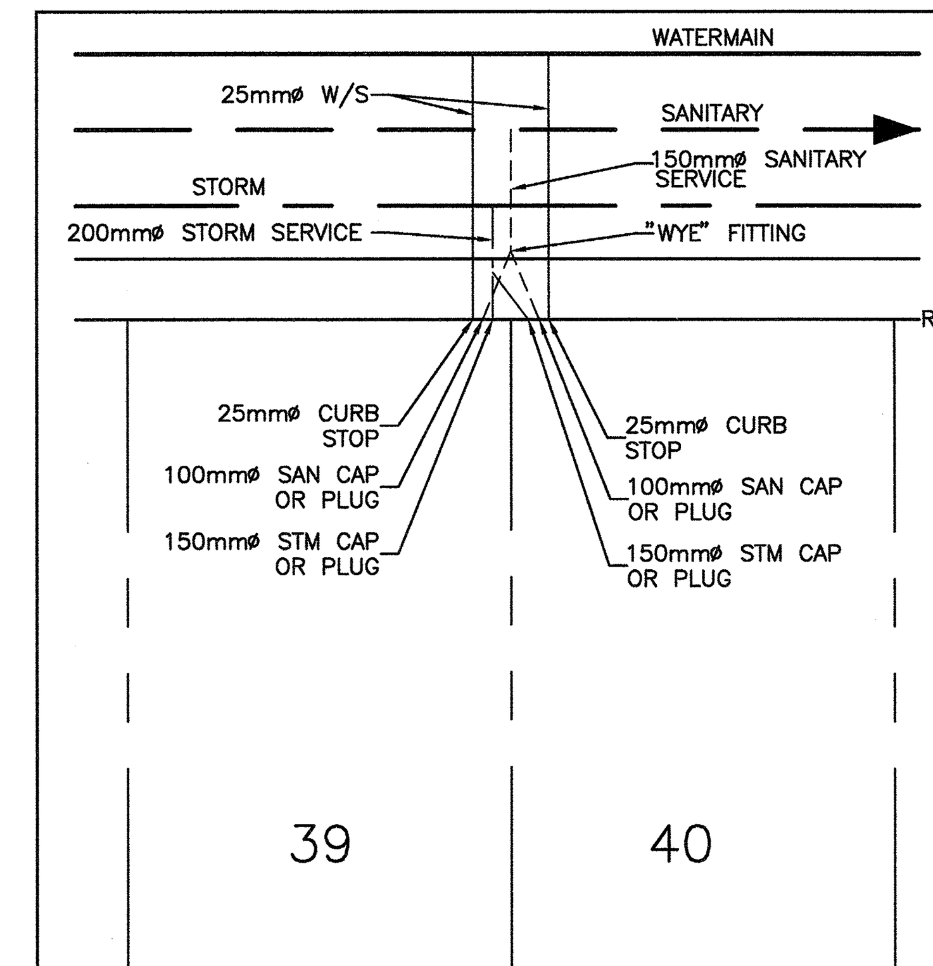
1. CURBS
   - OPSD 600.040 (STANDARD CURB & GUTTER)
2. SIDEWALKS
   - CITY OF GUELPH SD-2, 1.2m WIDE (CONCRETE SIDEWALK)
   - CITY OF GUELPH SD-4 (SIDEWALK RAMPS)
3. ASPHALT PAVEMENT (MIN):
   - 30mm HL-3 SURFACE ASPHALT (97% MARSHALL)
   - 60mm HL-4 BASE ASPHALT (97% MARSHALL)
   - 150mm GRANULAR 'A' (100% S.P.D.)
   - 350mm GRANULAR 'B' SUB-BASE (100% S.P.D.)
4. RESTORATION
   - REFER TO LANDSCAPE PLAN.
5. SITE AREAS DISTURBED BY CONSTRUCTION AND NOT INDICATED FOR REMOVAL TO BE RESTORED TO ORIGINAL CONDITION

G. EROSION AND SEDIMENTATION:

1. ALL SILT FENCING TO BE INSTALLED PRIOR TO ANY GRADING, EXCAVATING, OR DEMOLITION COMMENCING.
2. EROSION CONTROL FENCING TO BE INSTALLED AROUND THE BASE OF ALL STOCKPILES.
3. EROSION PROTECTION TO BE PROVIDED AROUND ALL STORM AND SANITARY MH's AND CB'S.
4. ADDITIONAL EROSION CONTROL MEASURES MAY BE REQUIRED AS SITE DEVELOPMENT PROGRESSES. CONTRACTOR TO PROVIDE ALL ADDITIONAL EROSION CONTROL STRUCTURES.
5. STANTEC CONSULTING LTD. TO MONITOR EROSION CONTROL STRUCTURES TO ENSURE FENCING IS INSTALLED AND MAINTENANCE IS PERFORMED TO CITY REQUIREMENTS.
6. EROSION CONTROL STRUCTURES TO BE MONITORED REGULARLY AND ANY DAMAGE REPAIRED IMMEDIATELY. SEDIMENTS TO BE REMOVED WHEN ACCUMULATIONS REACH A MAXIMUM OF 1/2 THE HEIGHT OF THE FENCE.
7. ALL EROSION CONTROL STRUCTURES TO REMAIN IN PLACE UNTIL ALL DISTURBED GROUND SURFACES HAVE BEEN RESTABILIZED EITHER BY PAVING OR RESTORATION OF VEGETATIVE GROUND COVER.
8. NO ALTERNATE METHODS OF EROSION PROTECTION SHALL BE PERMITTED UNLESS APPROVED BY STANTEC CONSULTING LTD. AND THE CITY OF GUELPH'S WORKS DEPARTMENT
9. CONTRACTOR IS RESPONSIBLE FOR MUNICIPAL ROADWAY AND SIDEWALK TO BE CLEANED OF ALL SEDIMENTS FROM VEHICULAR TRACKING, ETC., AT THE END OF EACH WORK DAY.

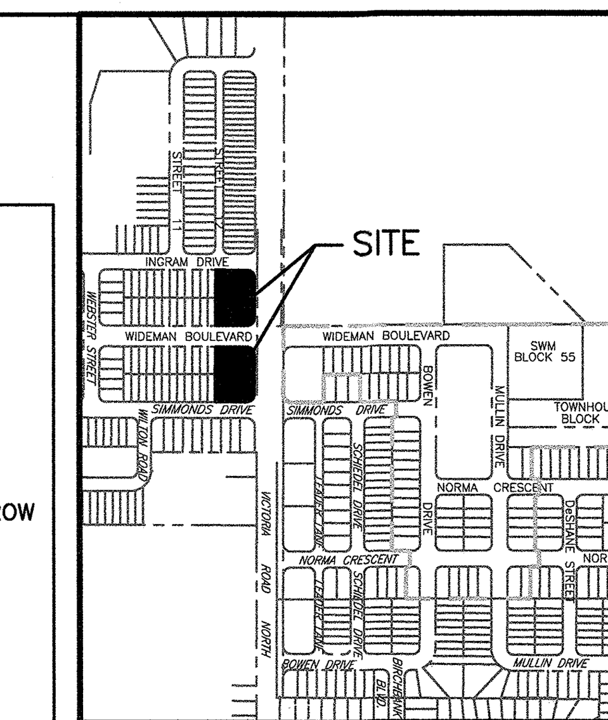


TYPICAL SWALE DETAIL
NTS

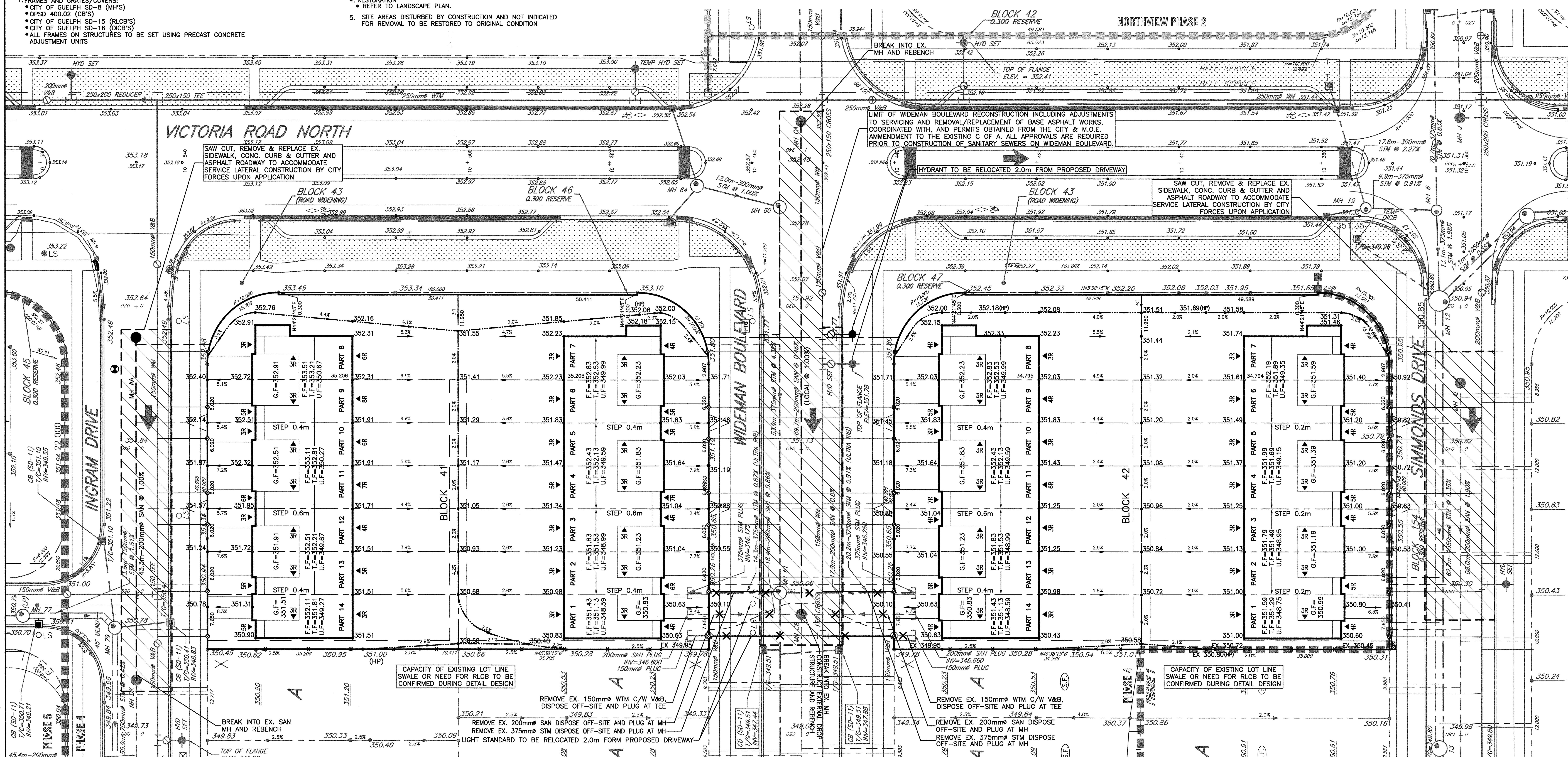


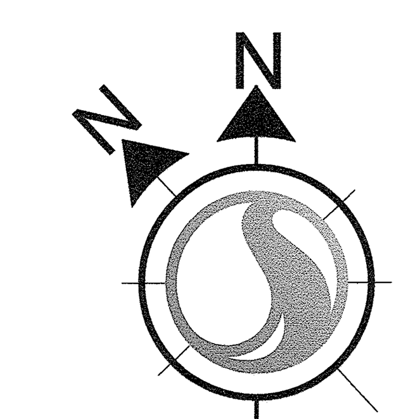
NOTE
PROVIDE 50mm X 100mm (2" X 4") MARKERS FOR SANITARY (FLOURESCENT GREEN), WATER (BLUE), STORM (RED) @ ℄ (TYP)

TYPICAL "WYE" SERVICING DETAILS
NTS



KEY PLAN Scale : NOT TO SCALE





Stantec

300 Hagey Blvd. Suite 100
Waterloo, ON, N2L 0A4
Tel. 519.579.4410
www.stantec.com

Notes

BENCHMARK:

1. GUELPH BENCHMARK #91. #493 VICTORIA ROAD NORTH ELEVATION=351.060m
2. TOPOGRAPHICAL SURVEY BY STANTEC CONSULTING LTD. DATED MAY 2000. ADDITIONAL TOPOGRAPHICAL SURVEY BY STANTEC CONSULTING LTD. DATED JUNE 2002, DECEMBER 2005, MARCH 2006 AND FEBRUARY 2007.
3. LEGAL INFORMATION TAKEN FROM BLACK, SHOEMAKER, ROBINSON & DONALDSON LIMITED PROJECT # 16-14-206-00-A DATED JUNE 07, 2017.
4. SITE PLAN DRAWINGS PREPARED BY BLACK, SHOEMAKER, ROBINSON & DONALDSON LIMITED DATED NOVEMBER, 2017.
5. ALL WORK WITHIN THE CITY RIGHT-OF-WAY TO BE COMPLETED BY CITY FORCES UPON APPLICATION

Legend

- STORM MANHOLE
- CATCHBASIN MANHOLE
- CATCHBASIN
- SANITARY MANHOLE
- VALVE & BOX
- HYDRANT
- WATER SERVICE VALVE
- FENCE
- LIGHT STANDARD
- TRANSFORMER
- APPROXIMATE LOCATION OF EX ROGERS PEDESTAL
- APPROXIMATE LOCATION OF EX BELL PEDESTAL
- APPROXIMATE LOCATION OF EX BELL FLUSH-TO-GRADE BOX
- 10 UNIT REFERENCE NUMBER
- DRAINAGE SWALE
- REMAOVALS
- 352.13 EXISTING ELEVATION
- 352.92 PROPOSED ELEVATION
- 5.0% 2.0% FLOW DIRECTION
- PROPOSED DRAINAGE SWALE
- OVERLAND FLOW DIRECTION
- HYD HYDRANT
- V&B VALVE & BOX
- VC VALVE CHANBER
- MH STORM MANHOLE
- SANITARY MANHOLE
- CB CATCHBASIN
- FENCE
- HP HYDRO POLE
- CURB AND STANDARD GUTER (OPSD 600.040)

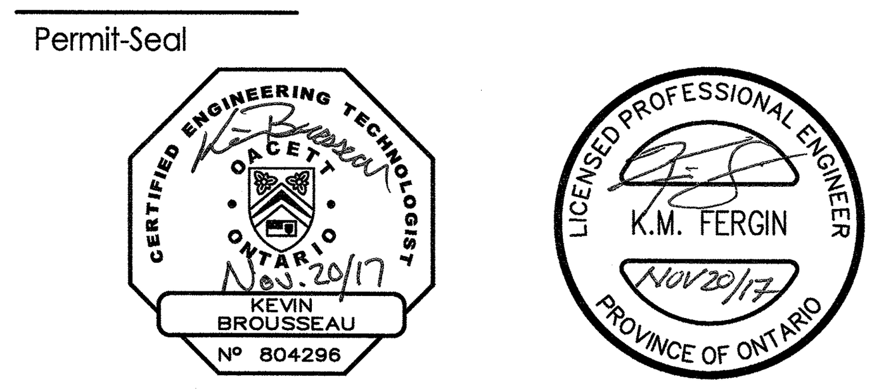
BUILDING ELEVATION REFERENCE:

DESCRIPTION	ELEVATION RELATIVE TO UNDERSIDE OF FOOTING
FINISHED FLOOR	2.84m
TOP OF FOUNDATION	2.54m
UNDERSIDE OF FOOTING	0.00m

Revision	By	Appd.	YY.MM.DD
0. PRELIMINARY SUBMISSION FOR ZONE CHANGE APPLICATION	MHH	KRB	17.11.17

File Name: 161413551_C-UP-GP.dwg	MHH	KRB	KRB	17.11.17
	Dwn.	Chkd.	Dsgn.	YY.MM.DD

Permit-Seal



Client/Project
ARTIFEX CONSTRUCTION LIMITED

BLOCK 41 & BLOCK 42, 61M-173
SITE PLAN: SP
Guelph ON Canada

Title
PRELIMINARY SITE SERVICING AND GRADING PLAN

Project No. 161413551
Scale 1:300 0 3 9 15m
Drawing No. C-100
Sheet
Revision 0

V:\01614\active\161413551\design\drawing_06\civil\sheet_files\161413551_C-UP-GP.dwg
2017/11/20 2:42 PM By: Huisman, Michael

ORIGINAL SHEET - ARCH D

Stantec

SUBDIVISION

NORTHVIEW ESTATES SUBDIVISION - PHASE 1

DATE: November 16, 2017
DESIGNED BY: KRB
CHECKED BY: SGP

STORM SEWER DESIGN SHEET

CONTRACT: 3-

DESIGN PARAMETERS

DESIGN STORM 1 IN 5 Years

I = a / ((tc + b) ^c)
a= 1593 MANNING'S n = 0.013
b= 11 MINIMUM COVER: 2.700 m
c= 0.8789 TIME OF ENTRY 10 min

DESIGN PARAMETERS

1 IN 25 Years	1 IN 100 Years
I = a / ((tc + b) ^c)	I = a / ((tc + b) ^c)
a= 3158	a= 4688
b= 15	b= 17
c= 0.9355	c= 0.9624

LOCATION	FROM M.H.	TO M.H.	DRAINAGE AREA AREA (ha)	C	A x C (ha)	ACCUM. AREA (ha)	T of C (min)	I (mm/h)	Q (m3/s)	PIPE SELECTION LENGTH (m)	PIPE SIZE (mm)	SLOPE %	CAP. (FULL) (m3/s)	VEL. (FULL) (m/S)	(ACT) (m/S)	TIME OF FLOW (min)
Schiedel Drive	1	2	0.00	0.70	0.00	0.00	10.00	109.68	0.000	27.0	300	1.00	0.097	1.368	0.000	2.53
	2	3	0.00	0.70	0.00	0.00	12.53	99.24	0.000	56.0	300	0.50	0.068	0.967	0.000	2.41
	3	4	0.50	0.70	0.35	0.35	12.53	99.24	0.096	20.0	375	0.50	0.124	1.123	1.246	0.27
	4					0.35	12.80									
Wideman Boulevard	4	5	0.00	0.70	0.00	0.35	12.80	140.78	0.137	44.8	375	0.50	0.124	1.123	1.280	0.58
	5	6	0.41	0.75	0.31	0.66	13.38	138.07	0.252	70.2	375	0.80	0.157	1.420	1.619	0.72
	6					0.66	14.10								0.723	
			Storm system designed to pickup / convey 25 year runoff from Victoria Road													
Victoria Road	19	6	0.39	0.75	0.29	0.29	10.00	155.47	0.126	10.0	375	1.00	0.175	1.587	1.746	0.10
	6					0.29	10.10								0.095	
	6	Ex (MH12)	0.00	0.75	0.00	0.29	14.10	134.86	0.110	25 Year Storm						
			0.00	0.65	0.00	0.66	14.10	134.86	0.246	25 Year Storm						
									0.356	13.1	375	2.45	0.274	2.485	2.833	0.08
	Ex (MH12)			25 Year Storm		0.95										
				5 Year Storm			14.18									
Norma Crescent	7	9	0.25	0.65	0.16	0.16	10.00	155.47	0.070	88.0	300	1.00	0.097	1.368	1.505	0.97
	9					0.16	10.97									
Schiedel Drive	1	9	0.40	0.70	0.28	0.28	10.00	155.47	0.121	84.5	300	1.00	0.097	1.368	1.560	0.90
	9					0.28	10.90									
Schiedel Drive	RLCB 1	8	0.10	0.65	0.07	0.07	10.00	155.47	0.028	12.5	300	1.00	0.097	1.368	1.163	0.18
	8	9	0.12	0.65	0.08	0.14	10.18	154.43	0.061	50.0	300	0.50	0.068	0.967	1.103	0.76
	9					0.14	10.93								0.756	
Norma Crescent	9	13	0.13	0.65	0.08	0.67	10.97	150.00	0.279	44.8	450	0.50	0.202	1.268	1.445	0.52
	13					0.67	11.49									
Leader Lane	5	10	0.00	0.75	0.00	0.00	10.00	155.47	0.000	60.0	300	1.80	0.130	1.835	0.000	1.83
	10	11	0.31	0.75	0.23	0.23	11.83	145.52	0.094	67.4	375	0.50	0.124	1.123	1.240	0.91
	11	13	0.43	0.75	0.32	0.56	12.74	141.07	0.217	60.0	450	0.50	0.202	1.268	1.464	0.68
	13					0.56	13.42								-89.317	
Leader Lane	12	13	0.13	0.75	0.10	0.10	10.00	155.47	0.042	48.2	300	1.00	0.097	1.368	1.300	0.62
	13					0.10	10.62									

Stantec

SUBDIVISION

NORTHVIEW ESTATES SUBDIVISION - PHASE 1

DATE: November 16, 2017
DESIGNED BY: KRB
CHECKED BY: SGP

STORM SEWER DESIGN SHEET

CONTRACT: 3-

DESIGN PARAMETERS

DESIGN STORM 1 IN 5 Years

I = a / ((tc + b) ^c)
a= 1593 MANNING'S n = 0.013
b= 11 MINIMUM COVER: 2.700 m
c= 0.8789 TIME OF ENTRY 10 min

DESIGN PARAMETERS

1 IN 25 Years
I = a / ((tc + b) ^c)
a= 3158
b= 15
c= 0.9355

1 IN 100 Years
I = a / ((tc + b) ^c)
a= 4688
b= 17
c= 0.9624

LOCATION			DRAINAGE AREA							PIPE SELECTION						
	FROM M.H.	TO M.H.	AREA (ha)	C	A x C (ha)	ACCUM. AREA (ha)	T of C (min)	I (mm/h)	Q (m3/s)	LENGTH (m)	PIPE SIZE (mm)	SLOPE %	CAP. (FULL) (m3/s)	VEL. (FULL) (m/S)	(ACT) (m/S)	TIME OF FLOW (min)
Norma Crescent	13	14	0.24	0.75	0.18	1.50	13.42	137.90	0.576	49.5	600	0.45	0.412	1.457	1.661	0.50
	14	16	0.26	0.75	0.20	0.20	13.92	135.68	0.073	25 Year Storm						
			0.00	0.60	0.00	1.50	13.92	135.68	0.566	25 Year Storm						
									0.640	29.3	675	0.35	0.497	1.390	1.584	0.31
	16			25 Year Storm		1.70										
				5 Year Storm			14.22									
			Storm system designed to pickup / convey 100 year runoff from upstream (less local storm capacity) + 25 year runoff from Victoria Road													
Victoria Road	DICB	15	16.46	0.52	8.56	8.56	33.00	108.62	2.582	100 Year Storm - See attached for calculation of C and T of C						
			14.57	0.55	8.01	8.01	33.00	57.25	1.274	5 Year Storm						
			1.89	0.75	1.42	1.42	33.00	84.45	0.333	25 Year Storm						
									0.976	100 -25 -5 Year Storms (ie 100 year net runoff)						
						3.24	33.00	108.62	0.976	Equivalent Accum. AC						
			0.80	0.75	0.60	0.60	33.00	84.45	0.141	25 Year Storm						
									1.117	13.8	750	1.05	1.141	2.582	2.995	0.08
	15	16	0.00	0.70	0.00	3.24	33.08	108.46	0.975	100 Year Storm						
			0.00	0.80	0.00	0.60	33.08	84.33	0.141	25 Year Storm						
									1.115	50.20	900	0.50	1.280	2.012	2.284	0.37
	16			100 Year Storm		3.24										
				25 Year Storm		0.60	33.44									
	16	17	0.00	0.70	0.00	3.24	33.44	107.70	0.968	100 Year Storm						
			0.37	0.75	0.28	2.58	33.44	83.73	0.599	25 Year Storm						
			0.00	0.60	0.00	0.00	33.44	56.75	0.000	5 Year Storm						
									1.567	83.5	975	0.50	1.585	2.122	2.462	0.57
	17	18	0.00	0.70	0.00	3.24	34.01	106.55	0.957	100 Year Storm						
			0.20	0.75	0.15	2.73	34.01	82.83	0.627	25 Year Storm						
			0.00	0.60	0.00	0.00	34.01	56.12	0.000	5 Year Storm						
									1.584	69.8	1050	0.35	1.616	1.866	2.164	0.54
	18	Ex (MH12)	0.00	0.70	0.00	3.24	34.55	105.48	0.948	100 Year Storm						
			0.00	0.75	0.00	2.73	34.55	81.98	0.621	25 Year Storm						
			0.00	0.60	0.00	0.00	34.55	55.54	0.000	5 Year Storm						
									1.568	18.6	1050	0.35	1.616	1.866	2.164	0.14
	Ex (MH12)			100 Year Storm		3.24										
				25 Year Storm		2.73										
				5 Year Storm		0.00	34.69									

Stantec

SUBDIVISION

NORTHVIEW ESTATES SUBDIVISION - PHASE 1

DATE: November 16, 2017
DESIGNED BY: KRB
CHECKED BY: SGP

STORM SEWER DESIGN SHEET

CONTRACT: 3-

DESIGN PARAMETERS

DESIGN STORM 1 IN 5 Years

I = a / ((tc + b) ^c)
a= 1593 MANNING'S n = 0.013
b= 11 MINIMUM COVER: 2.700 m
c= 0.8789 TIME OF ENTRY 10 min

DESIGN PARAMETERS

1 IN 25 Years
I = a / ((tc + b) ^c)
a= 3158
b= 15
c= 0.9355

1 IN 100 Years
I = a / ((tc + b) ^c)
a= 4688
b= 17
c= 0.9624

LOCATION			DRAINAGE AREA							PIPE SELECTION							
	FROM M.H.	TO M.H.	AREA (ha)	C	A x C (ha)	ACCUM. AREA (ha)	T of C (min)	I (mm/h)	Q (m3/s)	LENGTH (m)	PIPE SIZE (mm)	SLOPE %	CAP. (FULL) (m3/s)	VEL. (FULL) (m/S)	(ACT) (m/S)	TIME OF FLOW (min)	
	Ex (MH12)	FUT	0.00	0.70	0.00	3.24	34.69	105.20	0.945	100 Year Storm							
	10606 ph1		0.00	0.75	0.00	3.68	34.69	81.76	0.835	25 Year Storm							
			0.00	0.60	0.00	0.00	34.69	55.39	0.000	5 Year Storm							
									1.780	62.7	1050	0.35	1.616	1.866	2.127	0.49	
Wideman Boulevard	4	21	0.02	0.65	0.01	0.01	10.00	109.68	0.004	52.5	300	3.00	0.167	2.370	0.948	0.92	
	21	FUT	0.42	0.65	0.27	0.29	10.92	105.61	0.084	35.5	375	0.50	0.124	1.123	1.207	0.49	
	FUT					0.29	11.41										

Stantec

SUBDIVISION

NORTHERN HEIGHTS SUBDIVISION - PHASE 1

DATE: November 16, 2017
DESIGNED BY: KRB
CHECKED BY: SGP

STORM SEWER DESIGN SHEET

FILE NUMBER: 30T-

DESIGN PARAMETERS

DESIGN STORM 1 IN 5 Years

I = a / ((tc + b) ^c)

a=	1593	MANNING'S n =	0.013	
b=	11	MINIMUM COVER:	2.700	m
c=	0.8789	TIME OF ENTRY	10	min

DESIGN PARAMETERS

1 IN 25 Years

I = a / ((tc + b) ^c)

a=	3158
b=	15
c=	0.9355

1 IN 100 Years

I = a / ((tc + b) ^c)

a=	4688
b=	17
c=	0.9624

LOCATION			DRAINAGE AREA							PIPE SELECTION							
	FROM M.H.	TO M.H.	AREA (ha)	C	A x C (ha)	ACCUM. AREA (ha)	T of C (min)	I (mm/h)	Q (m3/s)	LENGTH (m)	PIPE SIZE (mm)	SLOPE %	CAP. (FULL) (m3/s)	VEL. (FULL) (m/S)	(ACT) (m/S)	TIME OF FLOW (min)	
Wilton East																	
	20	21	0.00	0.65	0.00	0.00	10.00	155.47	0.000	52.1	300	1.20	0.106	1.499	0.000	1.45	
	21	22	0.47	0.65	0.31	0.31	11.45	147.48	0.125	66.6	300	1.00	0.097	1.368	1.560	0.71	
	22					0.31	12.16										
	RLCB 2	22	0.33	0.65	0.21	0.21	10.00	155.47	0.093	48.6	300	0.50	0.068	0.967	1.103	0.73	
	22					0.21	10.73										
	22	24	0.30	0.65	0.20	0.72	12.16	143.86	0.286	70.0	525	0.35	0.254	1.175	1.340	0.87	
	24					0.72	13.03										

Stantec

SUBDIVISION

NORTHERN HEIGHTS SUBDIVISION - PHASE 1

DATE: November 16, 2017
DESIGNED BY: KRB
CHECKED BY: SGP

STORM SEWER DESIGN SHEET

FILE NUMBER: 30T-

DESIGN PARAMETERS

DESIGN STORM 1 IN 5 Years

I = a / ((tc + b) ^c)

a=	1593	MANNING'S n =	0.013	
b=	11	MINIMUM COVER:	2.700	m
c=	0.8789	TIME OF ENTRY	10	min

DESIGN PARAMETERS

1 IN 25 Years

I = a / ((tc + b) ^c)

a=	3158
b=	15
c=	0.9355

1 IN 100 Years

I = a / ((tc + b) ^c)

a=	4688
b=	17
c=	0.9624

LOCATION	FROM M.H.	TO M.H.	DRAINAGE AREA AREA (ha)	C	A x C (ha)	ACCUM. AREA (ha)	T of C (min)	I (mm/h)	Q (m3/s)	PIPE SELECTION LENGTH (m)	PIPE SIZE (mm)	SLOPE %	CAP. (FULL) (m3/s)	VEL. (FULL) (m/S)	(ACT) (m/S)	TIME OF FLOW (min)
Wilton	RLCB 3	24	0.24	0.65	0.16	0.16	10.00	155.47	0.067	46.5	300	0.50	0.068	0.967	1.122	0.69
	24					0.16	10.69								-89.309	
Wilton	24	30	0.63	0.65	0.41	1.28	13.03	139.67	0.497	68.5	600	0.35	0.363	1.285	1.465	0.78
	30	31	0.00	0.65	0.00	1.28	13.81	136.14	0.484	18.4	600	0.35	0.363	1.285	1.465	0.21
	31					1.28	14.02								0.210	
Inverness	RLCB 4	25	0.08	0.65	0.05	0.05	10.00	155.47	0.022	8.5	300	1.00	0.097	1.368	1.067	0.13
	25					0.05	10.13								-89.867	
Inverness	25	29	0.09	0.65	0.06	0.11	10.13	154.70	0.047	47.0	300	0.50	0.068	0.967	1.050	0.75
	29					0.11	10.88								0.746	
Wilton	26	27	0.01	0.65	0.01	0.01	10.00	155.47	0.003	8.7	300	1.00	0.097	1.368	0.547	0.26
	27					0.01	10.26								0.265	
Wilton	RLCB 5	27	0.08	0.65	0.05	0.05	10.00	155.47	0.022	46.9	300	0.80	0.086	1.224	0.979	0.80
	27					0.05	10.80								-89.201	
Wilton	27	28	0.00	0.65	0.00	0.05	10.80	150.96	0.022	57.8	300	0.50	0.068	0.967	0.842	1.14
	28	29	0.59	0.75	0.44	0.49	11.94	144.95	0.199	51.0	375	0.65	0.141	1.280	1.459	0.58
	29					0.49	12.53								-89.417	
Inverness	29	31	0.00	0.65	0.00	0.61	12.53	142.08	0.239	13.0	450	0.40	0.180	1.134	1.292	0.17
	31					0.61	12.69								0.168	
Inverness	31	32	0.00	0.65	0.00	1.89	14.02	135.21	0.708	30.0	600	0.70	0.514	1.817	2.071	0.24
	32					1.89	14.26								0.241	
	RLCB 6	32	0.14	0.75	0.11	0.11	10.00	155.47	0.045	8.5	300	1.00	0.097	1.368	1.341	0.11
	32					0.11	10.11								0.106	
	32	33	0.24	0.65	0.16	2.15	14.26	134.17	0.800	38.0	675	0.50	0.594	1.661	1.894	0.33
	33	34	0.00	0.65	0.00	2.15	14.60	132.75	0.792	18.4	675	0.50	0.594	1.661	1.894	0.16
	34					2.15	14.76								0.162	
Simmonds FUT	35	36	0.42	0.65	0.27	0.27	10.00	155.47	0.118	37.2	300	2.30	0.147	2.075	2.324	0.27
	36	34	0.35	0.65	0.23	0.50	10.27	153.93	0.214	86.6	375	0.80	0.157	1.420	1.619	0.89
	34					0.50	11.16									

Stantec

SUBDIVISION

NORTHERN HEIGHTS SUBDIVISION - PHASE 1

DATE: November 16, 2017
DESIGNED BY: KRB
CHECKED BY: SGP

STORM SEWER DESIGN SHEET

FILE NUMBER: 30T-

DESIGN PARAMETERS

DESIGN STORM 1 IN 5 Years

I = a / ((tc + b) ^c)

a= 1593 MANNING'S n = 0.013
b= 11 MINIMUM COVER: 2.700 m
c= 0.8789 TIME OF ENTRY 10 min

DESIGN PARAMETERS

1 IN 25 Years

I = a / ((tc + b) ^c)

a= 3158
b= 15
c= 0.9355

1 IN 100 Years

I = a / ((tc + b) ^c)

a= 4688
b= 17
c= 0.9624

LOCATION			DRAINAGE AREA							PIPE SELECTION							
	FROM M.H.	TO M.H.	AREA (ha)	C	A x C (ha)	ACCUM. AREA (ha)	T of C (min)	I (mm/h)	Q (m3/s)	LENGTH (m)	PIPE SIZE (mm)	SLOPE %	CAP. (FULL) (m3/s)	VEL. (FULL) (m/S)	(ACT) (m/S)	TIME OF FLOW (min)	
Simmonds	34	37	0.06	0.90	0.05	2.70	14.76	132.07	0.991	29.5	825	0.35	0.849	1.589	1.811	0.27	
	37	19	0.00	0.65	0.00	2.70	15.03	130.96	0.983	11.4	825	0.35	0.849	1.589	1.811	0.10	
	19					2.70	15.14										
						1.89	A*C draining south during 100yr										
			(REFER TO NORTHVIEW ESTATES SUBDIVISION - PHASE 1 FOR CALCULATIONS OF INFLOW FROM UPSTREAM)														
VICTORIA ROAD			100 Year Storm			3.24											
NORTHVIEW			25 Year Storm			3.68											
			5 Year Storm			0.00	34.71			18.6	1050	0.35					
Simmonds	12	13	0.00	0.60	0.00	3.24	34.71	105.17	0.945	100 Year Storm							
			0.00	0.75	0.00	3.68	34.71	81.74	0.834	25 Year Storm							
			0.00	0.65	0.00	0.00	34.71	55.37	0.000	5 Year Storm							
									1.779	62.7	1050	0.35	1.616	1.866	2.127	0.49	
	13	17	0.00	0.60	0.00	3.24	35.20	104.21	0.936	100 Year Storm							
			0.90	0.65	0.59	4.26	35.20	80.99	0.958	25 Year Storm							
			0.00	0.65	0.00	0.00	35.20	54.85	0.000	5 Year Storm							
									1.895	90.0	1050	0.40	1.727	1.995	2.274	0.66	
	17		100 Year Storm			3.24											
			25 Year Storm			4.26											
			5 Year Storm			0.00	35.86										
			Storm system designed to pickup / convey 100 year runoff from upstream (less local storm capacity) + 5 year runoff from church site														
Church Land	DCB	14	5.07	0.40	2.03	2.03	29.00	117.69	0.663	100 Year Storm - See attached for calculation of C and T of C							
			5.07	0.45	2.28	2.28	29.00	62.25	0.395	5 Year Storm							
									0.268	100 -5 Year Storm (ie 100 year net runoff)							
						0.82	29.00	117.69	0.268	Equivalent Accum. AC							
			1.21	0.75	0.91	0.91	29.00	117.69	0.297	100 Year Storm							
									0.565	24.1	600	1.00	0.614	2.172	2.487	0.16	
Wilton	14	15	0.00	0.60	0.00	1.73	29.16	117.30	0.563	100 Year Storm							
			0.00	0.65	0.00	0.00	29.16	62.03	0.000	5 Year Storm							
									0.563	7.8	675	0.35	0.497	1.390	1.584	0.08	
	15		100 Year Storm			1.73											
			5 Year Storm			0.00	29.24										
Wilton	RLCB 8	15	0.26	0.60	0.16	0.16	10.00	155.47	0.067	25.2	300	1.00	0.097	1.368	1.477	0.28	
	15					0.16	10.28										
Wilton	RLCB 7	15	0.15	0.75	0.11	0.11	10.00	155.47	0.049	7.4	300	1.00	0.097	1.368	1.477	0.08	
	15					0.11	10.08										

Stantec

SUBDIVISION

NORTHERN HEIGHTS SUBDIVISION - PHASE 1

DATE: November 16, 2017
DESIGNED BY: KRB
CHECKED BY: SGP

STORM SEWER DESIGN SHEET

FILE NUMBER: 30T-

DESIGN PARAMETERS

DESIGN STORM 1 IN 5 Years

I = a / ((tc + b) ^c)

a= 1593 MANNING'S n = 0.013
b= 11 MINIMUM COVER: 2.700 m
c= 0.8789 TIME OF ENTRY 10 min

DESIGN PARAMETERS

1 IN 25 Years

I = a / ((tc + b) ^c)

a= 3158
b= 15
c= 0.9355

1 IN 100 Years

I = a / ((tc + b) ^c)

a= 4688
b= 17
c= 0.9624

LOCATION			DRAINAGE AREA							PIPE SELECTION							
	FROM M.H.	TO M.H.	AREA (ha)	C	A x C (ha)	ACCUM. AREA (ha)	T of C (min)	I (mm/h)	Q (m3/s)	LENGTH (m)	PIPE SIZE (mm)	SLOPE %	CAP. (FULL) (m3/s)	VEL. (FULL) (m/S)	(ACT) (m/S)	TIME OF FLOW (min)	
Wilton	15	16	0.00	0.60	0.00	1.73	29.24	117.10	0.562	100 Year Storm							
			0.31	0.65	0.20	0.47	29.24	91.14	0.119	25 Year Storm							
			0.00	0.65	0.00	0.00	29.24	61.92	0.000	5 Year Storm							
									0.681	40.1	675	0.40	0.532	1.486	1.604	0.42	
	16	17	0.00	0.60	0.00	1.73	29.66	116.09	0.557	100 Year Storm							
			0.00	0.60	0.00	0.47	29.66	90.35	0.118	25 Year Storm							
			0.00	0.60	0.00	0.00	29.66	61.36	0.000	5 Year Storm							
									0.675	17.9	675	0.40	0.532	1.486	1.604	0.19	
	17			100 Year Storm		1.73											
				25 Year Storm		0.47											
				5 Year Storm		0.00	29.85										
Simmonds	17	18 TEE	0.00	0.60	0.00	4.96	35.86	102.96	1.419	100 Year Storm							
			0.15	0.65	0.10	4.83	35.86	80.01	1.073	25 Year Storm							
			0.00	0.65	0.00	0.00	35.86	54.17	0.000	5 Year Storm							
									2.492	44.2	1350	0.30	2.923	2.042	2.206	0.33	
	18 TEE	19	0.00	0.60	0.00	4.96	36.19	102.34	1.411	100 Year Storm							
			0.37	0.65	0.24	5.07	36.19	79.52	1.119	25 Year Storm							
			0.00	0.65	0.00	0.00	36.19	53.83	0.000	5 Year Storm							
									2.530	13.9	1350	0.30	2.923	2.042	2.206	0.11	
	19			100 Year Storm		4.96											
				25 Year Storm		5.07											
				5 Year Storm		0.00	36.30										
Street Six	19	35	0.00	0.60	0.00	4.96	36.30	102.15	1.408	100 Year Storm							
			0.30	0.20	0.06												
			0.30	0.65	0.20	8.02	36.30	79.37	1.769	25 Year Storm							
				0.65	0.00	0.00	36.30	53.73	0.000	5 Year Storm							
									3.177	95.6	1350	0.35	3.158	2.206	2.382	0.67	
	35			100 Year Storm		4.96											
				25 Year Storm		8.02											
				5 Year Storm		0.00	36.96										

Stantec

SUBDIVISION

NORTHERN HEIGHTS SUBDIVISION - PHASE 1

DATE: November 16, 2017
DESIGNED BY: KRB
CHECKED BY: SGP

STORM SEWER DESIGN SHEET

FILE NUMBER: 30T-

DESIGN PARAMETERS

DESIGN STORM 1 IN 5 Years

I = a / ((tc + b) ^c)

a=	1593	MANNING'S n =	0.013	
b=	11	MINIMUM COVER:	2.700	m
c=	0.8789	TIME OF ENTRY	10	min

DESIGN PARAMETERS

1 IN 25 Years

I = a / ((tc + b) ^c)

a=	3158
b=	15
c=	0.9355

DESIGN PARAMETERS

1 IN 100 Years

I = a / ((tc + b) ^c)

a=	4688
b=	17
c=	0.9624

LOCATION	FROM M.H.	TO M.H.	DRAINAGE AREA AREA (ha)	C	A x C (ha)	ACCUM. AREA (ha)	T of C (min)	I (mm/h)	Q (m3/s)	PIPE SELECTION LENGTH (m)	PIPE SIZE (mm)	SLOPE %	CAP. (FULL) (m3/s)	VEL. (FULL) (m/S)	(ACT) (m/S)	TIME OF FLOW (min)
Phase 4																
Victoria Road	64	60	0.24	0.75	0.18	0.18	10.00	155.47	0.078	25 Year Storm						
									0.078	12.0	300	1.00	0.097	1.368	1.532	0.13
Wideman Blvd.	60	61	0.00	0.90	0.00	0.18	10.13	154.71	0.077	54.0	375	4.20	0.359	3.253	2.473	0.36
	61					0.18	10.49									
	Blk 41	61	0.32	0.65	0.21	0.21	10.00	155.47	0.090	13.0	375	1.00	0.175	1.587	1.587	0.14
	61					0.21	10.14									
	Blk 42	61	0.30	0.65	0.20	0.20	10.00	155.47	0.084	19.0	375	1.00	0.175	1.587	1.572	0.20
	61					0.20	10.20									
Wideman Blvd.	61	62														
			0.20	0.90	0.18	0.58										
			0.72	0.65	0.47	1.23	10.49	152.64	0.522	25 Year Storm						
									0.522	90.0	525	1.10	0.451	2.084	2.375	0.63
				0.65		1.23	11.13	188.96	0.646	100 Year Storm						
				0.65		1.23	11.13	149.19	0.510	25 Year Storm						
									0.136							
				0.65		0.25	11.13	188.96	0.131	Equivalent Accum. AC						
Phase 3																
Wideman Blvd.	62	63														
			0.73	0.65	0.47	0.72	11.13	188.96	0.380	100 Year Storm						
			0.00	0.65	0.00	1.23	11.13	149.19	0.510	25 Year Storm						
									0.890	65.9	675	0.39	0.525	1.467	1.672	0.66
Webster Street	63	35														
			0.00	0.65	0.00	0.72	11.78	184.81	0.372	100 Year Storm						
			0.00	0.65	0.00	1.23	11.78	145.76	0.498	25 Year Storm						
									0.870	15.0	675	0.61	0.657	1.835	2.091	0.12
				0.65		1.66	11.78	184.81	0.850	Equivalent Accum. AC						
	35			100 Year Storm		1.66	11.90			all 100-year in pipe					0.120	
				25 Year Storm		0.00	11.90									

Stantec

SUBDIVISION

NORTHERN HEIGHTS SUBDIVISION - PHASE 1

DATE: November 16, 2017
DESIGNED BY: KRB
CHECKED BY: SGP

STORM SEWER DESIGN SHEET

FILE NUMBER: 30T-

DESIGN PARAMETERS

DESIGN STORM 1 IN 5 Years

I = a / ((tc + b) ^c)

a=	1593	MANNING'S n =	0.013	
b=	11	MINIMUM COVER:	2.700	m
c=	0.8789	TIME OF ENTRY	10	min

DESIGN PARAMETERS

1 IN 25 Years

I = a / ((tc + b) ^c)

a=	3158
b=	15
c=	0.9355

1 IN 100 Years

I = a / ((tc + b) ^c)

a=	4688
b=	17
c=	0.9624

LOCATION			DRAINAGE AREA							PIPE SELECTION							
	FROM M.H.	TO M.H.	AREA (ha)	C	A x C (ha)	ACCUM. AREA (ha)	T of C (min)	I (mm/h)	Q (m3/s)	LENGTH (m)	PIPE SIZE (mm)	SLOPE %	CAP. (FULL) (m3/s)	VEL. (FULL) (m/S)	(ACT) (m/S)	TIME OF FLOW (min)	
Phase 1																	
Webster Street	35			100 Year Storm		6.62	36.96										
				25 Year Storm		8.02											
				5 Year Storm		0.00											
				0.65		2.46	36.96	100.93	0.689	100 Year Storm from area draining overland here and not already in STM sewer							
				0.65		2.46	36.96	78.41	0.535	25 Year Storm from area above that is accounted for in STM sewer							
									0.154								
				0.65		0.59	36.96	100.93	0.165	Equivalent Accum. AC							
Webster Street	35	36	0.56	0.20	0.11												
			0.38	0.65	0.25	7.57	36.96	100.93	2.121	100 Year Storm							
			0.00	0.20	0.00	8.02											
			0.00	0.65	0.00	8.02	36.96	78.41	1.748	25 Year Storm							
				0.65	0.00	0.00	36.96	53.07	0.000	5 Year Storm							
									3.869	83.9	1350	0.24	2.615	1.827	2.082	0.67	
	36	HW	0.59	0.65	0.38	7.95	37.64	99.73	2.202	100 Year Storm							
			0.00	0.65	0.00	8.02	37.64	77.47	1.727	25 Year Storm							
				0.65	0.00	0.00	37.64	52.43	0.000	5 Year Storm							
									3.929	11.9	1350	0.30	2.923	2.042	2.328	0.09	

Stantec

SUBDIVISION

NORTHERN HEIGHTS SUBDIVISION - PHASE 5

DATE: November 16, 2017
DESIGNED BY: KRB
CHECKED BY: SGP

STORM SEWER DESIGN SHEET

FILE NUMBER: 23T-01501
First Submission Comments

DESIGN PARAMETERS

DESIGN STORM 1 IN 5 Years
I = a / ((tc + b) ^c)
a= 1593 MANNING'S n = 0.013
b= 11 MINIMUM COVER: 2.700 m
c= 0.8789 TIME OF ENTRY 10 min

1 IN 25 Years		1 IN 100 Years	
I = a / ((tc + b) ^c)		I = a / ((tc + b) ^c)	
a=	3158	a=	4688
b=	15	b=	17
c=	0.9355	c=	0.9624

LOCATION			DRAINAGE AREA							PIPE SELECTION							
	FROM M.H.	TO M.H.	AREA (ha)	C	A x C (ha)	ACCUM. AREA (ha)	T of C (min)	I (mm/h)	Q (m3/s)	LENGTH (m)	PIPE SIZE (mm)	SLOPE %	CAP. (FULL) (m3/s)	VEL. (FULL) (m/S)	(ACT) (m/S)	TIME OF FLOW (min)	
Phase 5																	
Victoria Road	70	71	0.32	0.75	0.24	0.24	10.00	155.47	0.104	84.0	300	2.20	0.143	2.029	2.232	0.63	
	71	72	0.38	0.75	0.29	0.53	10.63	151.90	0.222	84.0	375	3.90	0.346	3.135	3.323	0.42	
	72					0.53	11.05										
			0.68	0.65	0.44	0.44	11.05	189.46	0.233								
			0.23	0.75	0.17	0.17	11.05	189.46	0.091								
			0.68	0.65	0.44	0.45	11.05	149.61	0.187								
			0.23	0.75	0.17	0.18	11.05	149.61	0.075								
									0.062	100yr - 25yr from US areas to MH72							
				0.65		0.12	11.05	189.46	0.062	Equivalent Accum. AC							
Goldenview Drive	72	74	0.25	0.65	0.16	0.28	11.05	189.46	0.148	100 Year Storm							
			0.45	0.75	0.34	0.87	11.05	149.61	0.362	25 Year Storm							
									0.509	57.5	600	0.50	0.432	1.529	1.744	0.55	
						0.28	11.60	100 Year Storm									
		74				0.87	11.60	25 Year Storm									
Laurie Lane	74	75	0.00	0.65	0.00	0.28	11.60	185.95	0.145	100 Year Storm							
			0.68	0.65	0.44	1.31	11.60	146.71	0.534	25 Year Storm							
			0.00	0.65	0.00	0.00	11.60	102.83	0.000	5 Year Storm							
									0.679	90.0	675	0.50	0.594	1.661	1.894	0.79	
	75	76	0.00	0.75	0.00	0.28	12.39	181.14	0.141	100 Year Storm							
			0.23	0.75	0.17	1.48	12.39	142.75	0.588	25 Year Storm							
			0.00	0.75	0.00	0.00	12.39	99.77	0.000	5 Year Storm							
									0.729	90.0	675	0.50	0.594	1.661	1.894	0.79	
	76	77	0.00	0.75	0.00	0.28	13.18	176.57	0.138	100 Year Storm							
			0.00	0.75	0.00	1.48	13.18	139.00	0.572	25 Year Storm							
			0.00	0.75	0.00	0.00	13.18	96.90	0.000	5 Year Storm							
									0.710	54.2	675	0.50	0.594	1.661	1.894	0.48	
	77	Plug	0.00	0.75	0.00	0.28	13.66	173.91	0.136	100 Year Storm							
			0.38	0.75	0.29	1.77	13.66	136.82	0.672	25 Year Storm							
			0.00	0.75	0.00	0.00	13.66	95.24	0.000	5 Year Storm							
									0.807	7.6	750	0.57	0.841	1.903	2.207	0.06	
	Plug	79	0.00	0.75	0.00	0.28	13.72	173.59	0.135	100 Year Storm							
			0.00	0.65	0.00	1.77	13.72	136.55	0.670	25 Year Storm							
			0.00	0.65	0.00	0.00	13.72	95.04	0.000	5 Year Storm							
									0.806	6.0	750	0.57	0.840	1.901	2.195	0.05	

Stantec

SUBDIVISION

NORTHERN HEIGHTS SUBDIVISION - PHASE 5

DATE: November 16, 2017
DESIGNED BY: KRB
CHECKED BY: SGP

STORM SEWER DESIGN SHEET

FILE NUMBER: 23T-01501
First Submission Comments

DESIGN PARAMETERS

DESIGN STORM 1 IN 5 Years
I = a / ((tc + b) ^c)
a= 1593 MANNING'S n = 0.013
b= 11 MINIMUM COVER: 2.700 m
c= 0.8789 TIME OF ENTRY 10 min

1 IN 25 Years		1 IN 100 Years	
I = a / ((tc + b) ^c)		I = a / ((tc + b) ^c)	
a=	3158	a=	4688
b=	15	b=	17
c=	0.9355	c=	0.9624

LOCATION	FROM M.H.	TO M.H.	DRAINAGE AREA AREA (ha)	C	A x C (ha)	ACCUM. AREA (ha)	T of C (min)	I (mm/h)	Q (m3/s)	PIPE SELECTION LENGTH (m)	PIPE SIZE (mm)	SLOPE %	CAP. (FULL) (m3/s)	VEL. (FULL) (m/S)	VEL. (ACT) (m/S)	TIME OF FLOW (min)
	79					0.28	13.76	100 Year Storm								
						1.77	13.76	25 Year Storm								
						0.00	13.76	5 Year Storm								
Phase 4																
Ingram Drive	79	83	0.00	0.65	0.00	0.28	13.76	173.34	0.135	100 Year Storm						
			0.22	0.65	0.14	1.91	13.76	136.35	0.724	25 Year Storm						
			0.00	0.65	0.00	0.00	13.76	94.88	0.000	5 Year Storm						
									0.859	55.9	750	0.42	0.723	1.637	1.866	0.50
	83					0.28	14.26	100 Year Storm								
						1.91	14.26	25 Year Storm								
						0.00	14.26	5 Year Storm								
Phase 5																
Goldenview Drive	80	81	0.24	0.65	0.16	0.16	10.00	155.47	0.067	15.7	300	6.00	0.237	3.351	2.848	0.09
	81					0.16	10.09									
Future Phase										Time of Concentration based on an entry time of 10 Mins + (145m of 375mm Dia. Storm Sewer @ 0.5% @ 1.28m/s = 11.88min.)						
TH Blk 40	Plug	MH 81	0.87	0.75	0.65	0.65	11.88	145.27	0.263	6.5	525	0.50	0.304	1.405	1.594	0.07
	81					0.65	11.88									
Phase 5																
Goldenview Drive	81	82	0.43	0.65	0.28	1.09	11.88	145.27	0.440	89.3	525	0.50	0.304	1.405	1.601	0.93
							12.81									
Phase 4																
				0.65	0.86	0.86	12.81	178.68	0.429	Overland flow to MH 82 from US areas						
				0.65	0.86	0.87	12.81	140.73	0.340							
									0.088	100yr - 25yr from US areas to MH82						
				0.65		0.19	12.81	178.68	0.094	Equivalent Accum. AC						
Goldenview Drive	82	83	0.50	0.65	0.33	0.51	12.81	178.68	0.255	100 Year Storm						
			0.00	0.65	0.00	1.09	12.81	140.73	0.426	25 Year Storm						
						1.09	13.08		0.681	39.2	525	1.10	0.451	2.082	2.373	0.28
	83														0.275	
Ingram Drive	83	HW	0.00	0.75	0.00	0.80	14.26	170.67	0.379	100 Year Storm						
			0.61	0.65	0.40	3.40	14.26	134.17	1.267	25 Year Storm						
			0.00	0.65	0.00	0.00	14.26	93.23	0.000	5 Year Storm						
									1.646	97.6	825	0.28	0.760	1.421	1.620	1.00

Stantec

SUBDIVISION
Northview Estates Subdivision Phase 2

DATE: November 16, 2017
DESIGNED BY: KRB
CHECKED BY: SGP

STORM SEWER DESIGN SHEET

FILE NUMBER: 23T-01502

DESIGN PARAMETERS

DESIGN STORM 1 IN 25 Years

I = a / ((tc + b) ^c)

a=	3158	MANNING'S n =	0.013	
b=	15	MINIMUM COVER:	2.700	m
c=	0.9355	TIME OF ENTRY	10	min

LOCATION			DRAINAGE AREA							MH Flows	PIPE SELECTION						
	FROM M.H.	TO M.H.	AREA (ha)	C	A x C (ha)	ACCUM. AREA (ha)	T of C (min)	I (mm/h)	Q (m3/s)		LENGTH (m)	PIPE SIZE (mm)	SLOPE %	CAP. (FULL) (m3/s)	VEL. (FULL) (m/S)	(ACT) (m/S)	TIME OF FLOW (min)
From Storm Sewer Design Sheet for Victoriaview North Subdivision (contract #2-0611)						6.37	14.67										
Mullin Drive	*23*	*24*	1.09	0.65	0.71	6.37	14.67	132.45	2.344		74.0	1050	0.40	1.727	1.995	2.274	0.54
	24	29	0.23	0.65	0.15	6.52	15.21	130.23	2.358		49.2	1050	0.40	1.727	1.995	2.274	0.36
	29					6.52	15.57										
Norma Crescent	25	*29*	0.46	0.65	0.30	0.30	10.00	155.47	0.129		75.4	300	1.00	0.097	1.368	1.560	0.81
	29					0.30	10.81										
Norma Crescent	28	*29*	0.54	0.65	0.35	0.35	10.00	155.47	0.152		82.1	300	1.40	0.114	1.619	1.845	0.74
	29					0.35	10.74										
Mullin Drive	*29*	*38*	0.60	0.65	0.39	7.56	15.57	128.79	2.704		92.5	1200	0.33	2.240	1.980	2.258	0.68
	38					7.56	16.26										
Norma Crescent	26	27	0.07	0.65	0.05	0.05	10.00	155.47	0.020		44.6	300	1.00	0.097	1.368	1.040	0.71
(future)	27	28	0.49	0.65	0.32	0.36	10.71	151.42	0.153		39.3	300	1.30	0.110	1.560	1.778	0.37
	28					0.36	11.08										
DeShane Street	28	36	0.49	0.65	0.32	0.68	11.08	149.42	0.283		84.0	450	0.85	0.263	1.653	1.909	0.73
(future)	36					0.68	11.82										
Norma Crescent	26	30	0.07	0.65	0.05	0.05	10.00	155.47	0.020		30.1	300	1.00	0.097	1.368	1.040	0.48
(future)	30	31	0.00	0.65	0.00	0.05	10.48	152.71	0.019		15.0	300	0.50	0.068	0.967	0.822	0.30
	31	32	0.44	0.60	0.26	0.31	10.79	151.03	0.130		62.7	300	0.90	0.092	1.298	1.480	0.71

Stantec

SUBDIVISION

Northview Estates Subdivision Phase 2

DATE: November 16, 2017
DESIGNED BY: KRB
CHECKED BY: SGP

STORM SEWER DESIGN SHEET

FILE NUMBER: 23T-01502

DESIGN PARAMETERS

DESIGN STORM 1 IN 25 Years

I = a / ((tc + b) ^c)

a=	3158	MANNING'S n =	0.013	
b=	15	MINIMUM COVER:	2.700	m
c=	0.9355	TIME OF ENTRY	10	min

LOCATION			DRAINAGE AREA							MH Flows	PIPE SELECTION						
	FROM M.H.	TO M.H.	AREA (ha)	C	A x C (ha)	ACCUM. AREA (ha)	T of C (min)	I (mm/h)	Q (m3/s)		LENGTH (m)	PIPE SIZE (mm)	SLOPE %	CAP. (FULL) (m3/s)	VEL. (FULL) (m/S)	(ACT) (m/S)	TIME OF FLOW (min)
	32	33	0.00	0.60	0.00	0.31	11.49	147.26	0.127		15.0	300	0.90	0.092	1.298	1.480	0.17
	33	34	0.46	0.65	0.30	0.61	11.66	146.38	0.247		57.6	450	0.45	0.191	1.203	1.371	0.70
	34	36	0.28	0.65	0.18	0.79	12.36	142.88	0.314		56.4	450	0.80	0.255	1.603	1.828	0.51
	36					0.79	12.88										
Norma Crescent	36	37	0.50	0.65	0.33	1.80	12.88	140.41	0.701		74.0	675	0.36	0.504	1.409	1.607	0.77
	37	*38*	0.00	0.60	0.00	1.80	13.64	136.89	0.684		12.0	675	0.35	0.497	1.390	1.584	0.13
	38					1.80	13.77										
Mullin Drive	*38*	*39*	0.48	0.65	0.31												
			0.52	0.25	0.13												
				0.60	0.44	9.80	16.26	126.15	3.434		105.3	1200	0.40	2.466	2.180	2.485	0.71
	39					9.80	16.96										
T-house Blk 110	T1	T2	0.31	0.75	0.23	0.23	5.00	191.56	0.124		47.5	375	0.50	0.124	1.123	1.302	0.61
	T2	T3	0.00	0.75	0.00	0.23	5.61	186.27	0.120		14.0	375	0.45	0.118	1.065	1.241	0.19
	T3	T4	0.09	0.75	0.07	0.30	5.80	184.69	0.154		96.0	375	0.45	0.118	1.065	1.214	1.32
	T4	T5	0.77	0.25	0.19												
			0.11	0.75	0.08	0.58	7.11	174.37	0.279		40.6	525	0.45	0.288	1.333	1.546	0.44
	T5	39	0.00	0.75	0.00	0.58	7.55	171.20	0.273		9.9	525	0.45	0.288	1.333	1.539	0.11
	39					0.00	7.66										
Mullin Drive	39	40	0.24	0.25	0.06	9.86											
			0.09	0.90	0.08	9.94	16.96	123.55	3.411		60.5	1200	0.45	2.615	2.312	2.636	0.38
	40	*48*	0.23	0.25	0.06												
			0.28	0.90	0.25												
				0.60	0.31	10.25	17.34	122.18	3.479		14.4	1350	0.26	2.722	1.901	2.168	0.11
	48					10.25	17.46										

Stantec

SUBDIVISION
Northview Estates Subdivision Phase 2

DATE: November 16, 2017
DESIGNED BY: KRB
CHECKED BY: SGP

STORM SEWER DESIGN SHEET

FILE NUMBER: 23T-01502

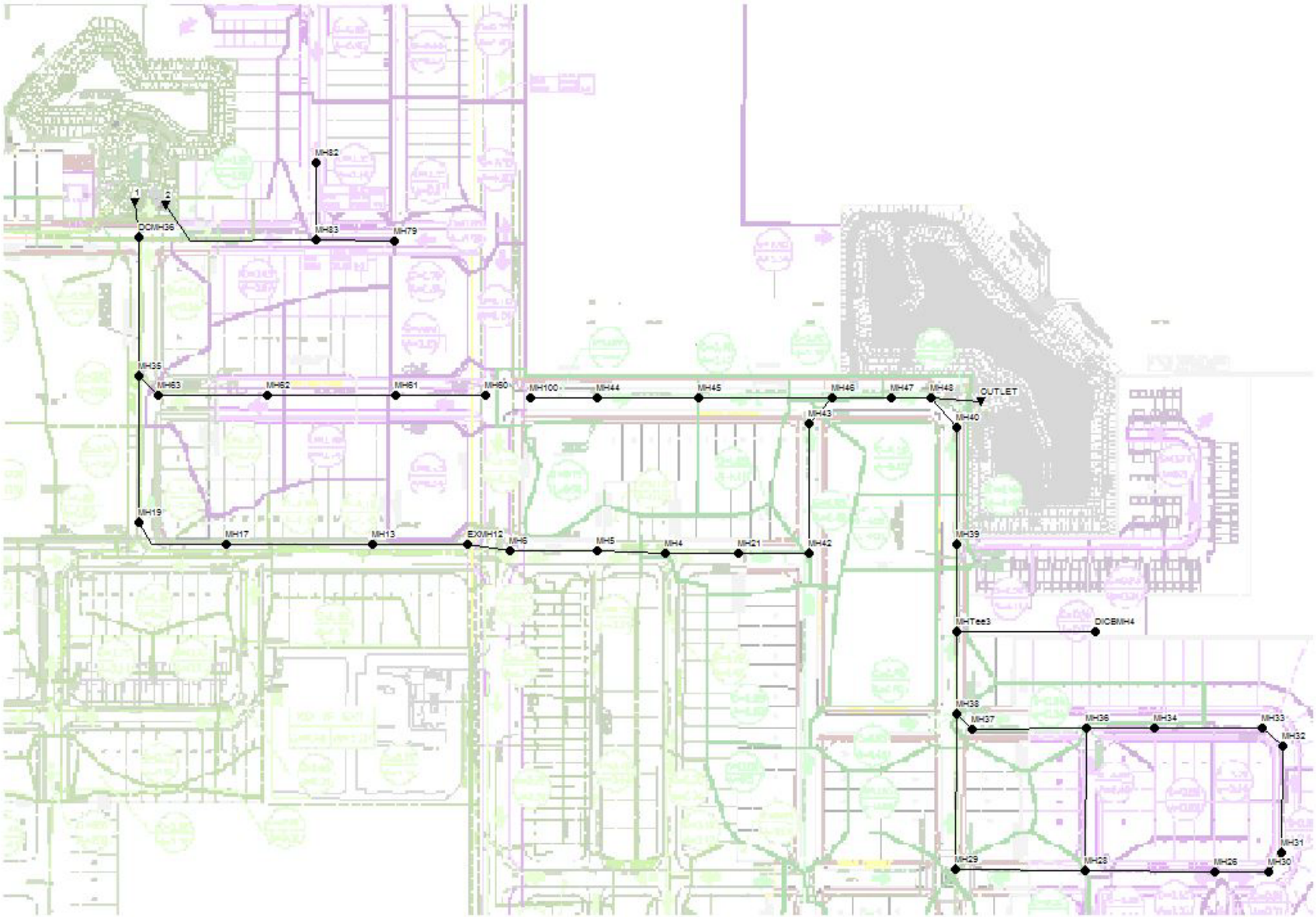
DESIGN PARAMETERS

DESIGN STORM 1 IN 25 Years

I = a / ((tc + b) ^c)

a=	3158	MANNING'S n =	0.013	
b=	15	MINIMUM COVER:	2.700	m
c=	0.9355	TIME OF ENTRY	10	min

LOCATION			DRAINAGE AREA							MH Flows	PIPE SELECTION						
	FROM M.H.	TO M.H.	AREA (ha)	C	A x C (ha)	ACCUM. AREA (ha)	T of C (min)	I (mm/h)	Q (m3/s)		LENGTH (m)	PIPE SIZE (mm)	SLOPE %	CAP. (FULL) (m3/s)	VEL. (FULL) (m/S)	(ACT) (m/S)	TIME OF FLOW (min)
Bowen Drive	*7*	41	0.24	0.65	0.16												
			0.51	0.65	0.33												
				0.65	0.49	0.49	10.00	155.47	0.211		84.1	375	1.20	0.192	1.739	1.982	0.71
	41	42	0.69	0.65	0.45	0.94	10.71	151.46	0.394	0.394	103.6	450	1.20	0.312	1.964	2.239	0.77
	42					0.94	11.48										
Simmonds Drive	*4*	*21*	0.02	0.65	0.01	0.01	10.00	155.47	0.006	0.006	53.1	300	2.99	0.167	2.366	0.946	0.94
	21	42	0.41	0.65	0.27	0.28	10.94	150.22	0.117	0.111	34.5	375	0.45	0.118	1.065	1.235	0.47
	42					0.28	11.40										
Bowen Drive	42	43	0.42	0.65	0.27	1.49	11.48	147.33	0.609		76.3	675	0.35	0.497	1.390	1.584	0.80
	43	46	0.00	0.60	0.00	1.49	12.28	143.27	0.592	0.476	23.1	675	0.35	0.497	1.390	1.584	0.24
	46					1.49	12.52										
Wideman Blvd.	100	44	0.05	0.75	0.04	0.04	10.00	155.47	0.016	0.016	41.1	300	1.00	0.097	1.368	0.985	0.70
	44	45	0.17	0.75	0.13	0.17											
			0.67	0.65	0.44	0.60	10.70	151.53	0.253	0.237	66.5	450	1.00	0.285	1.793	2.044	0.54
	45	46	0.42	0.65	0.27	0.87	11.24	148.60	0.361	0.124	83.8	525	0.45	0.288	1.333	1.519	0.92
	46					0.87	12.16										
Wideman Blvd.	46	47	0.08	0.90	0.07	2.43	12.52	142.09	0.961		62.8	750	0.40	0.704	1.594	1.817	0.58
	47	48	0.00	0.60	0.00	2.43	13.10	139.36	0.942		24.6	750	0.40	0.704	1.594	1.817	0.23
	48					2.43	13.33										
Outlet	*48*	*HW*	0.00	0.60	0.00	12.68	17.46	121.79	4.291		11.6	1350	0.35	3.158	2.206	2.515	0.08


MH82
1
2
DCMH36
MH83
MH79
MH35
MH63
MH62
MH61
MH60
MH100
MH44
MH45
MH46
MH47
MH48
OUTLET
MH43
MH40
MH19
MH17
MH13
EXMH12
MH6
MH5
MH4
MH21
MH42
MH39
MHTee3
DICBMH4
MH38
MH37
MH36
MH34
MH33
MH32
MH31
MH29
MH28
MH26
MH30

EPA STORM WATER MANAGEMENT MODEL - VERSION 5.1 (Build 5.1.012)

WARNING 03: negative offset ignored for Link 22
WARNING 03: negative offset ignored for Link 24
WARNING 03: negative offset ignored for Link 25
WARNING 03: negative offset ignored for Link 26
WARNING 03: negative offset ignored for Link 27
WARNING 03: negative offset ignored for Link 28
WARNING 03: negative offset ignored for Link 29
WARNING 03: negative offset ignored for Link 30
WARNING 03: negative offset ignored for Link 32
WARNING 03: negative offset ignored for Link 33
WARNING 03: negative offset ignored for Link 34
WARNING 03: negative offset ignored for Link 34
WARNING 03: negative offset ignored for Link 41
WARNING 07: routing time step reduced to the wet weather time step

****
Element Count
****
Number of rain gages 0
Number of subcatchments ... 0
Number of nodes 43
Number of links 43
Number of pollutants 0
Number of land uses 0

****
Node Summary
****

Name	Type	Invert Elev.	Max. Depth	Ponded Area	Externa Inflow
MH26	JUNCTION	348.87	3.72	0.0	Yes
MH28	JUNCTION	347.55	3.81	0.0	Yes
MH29	JUNCTION	346.08	5.10	0.0	Yes
MH38	JUNCTION	345.72	4.00	0.0	Yes
MH34	JUNCTION	348.08	3.88	0.0	Yes
MH33	JUNCTION	348.39	3.99	0.0	Yes
MH36	JUNCTION	346.58	4.04	0.0	Yes
MH37	JUNCTION	346.32	3.31	0.0	
MH30	JUNCTION	349.07	3.80	0.0	Yes
MH31	JUNCTION	348.92	3.87	0.0	Yes
MH32	JUNCTION	348.55	3.92	0.0	
MH39	JUNCTION	345.27	3.60	0.0	Yes
MH40	JUNCTION	344.85	3.50	0.0	Yes
MH48	JUNCTION	344.71	3.60	0.0	
MH44	JUNCTION	347.11	3.79	0.0	Yes
MH45	JUNCTION	346.31	3.08	0.0	Yes
MH46	JUNCTION	345.67	3.20	0.0	
MH47	JUNCTION	345.37	3.11	0.0	
MH43	JUNCTION	346.12	2.67	0.0	
MH42	JUNCTION	346.38	3.51	0.0	Yes
MH21	JUNCTION	346.90	3.31	0.0	Yes
MH4	JUNCTION	347.89	3.84	0.0	Yes
MH5	JUNCTION	347.63	3.96	0.0	Yes
MH6	JUNCTION	346.96	4.23	0.0	Yes
EXMH12	JUNCTION	344.86	6.04	0.0	Yes

MH60	JUNCTION	350.31	1.99	0.0	Yes
MH61	JUNCTION	345.49	4.47	0.0	Yes
MH62	JUNCTION	344.33	3.44	0.0	Yes
MH63	JUNCTION	343.93	3.45	0.0	
MH35	JUNCTION	342.95	4.29	0.0	
DCMH36	JUNCTION	342.58	5.00	0.0	Yes
MH83	JUNCTION	343.07	5.54	0.0	Yes
MH82	JUNCTION	345.32	3.49	0.0	Yes
MH79	JUNCTION	343.42	7.04	0.0	Yes
MH13	JUNCTION	344.50	5.40	0.0	Yes
MH17	JUNCTION	343.80	4.89	0.0	Yes
MH19	JUNCTION	343.21	5.10	0.0	Yes
MH100	JUNCTION	347.37	4.53	0.0	Yes
DICBMH4	JUNCTION	346.27	0.76	0.0	Yes
MHTee3	JUNCTION	345.50	3.80	0.0	
OUTLET	OUTFALL	343.00	1.35	0.0	
1	OUTFALL	341.00	2.90	0.0	
2	OUTFALL	341.00	2.60	0.0	

****
Link Summary
****

Name	From Node	To Node	Type	Length	%
16	MH29	MH38	CONDUIT	92.5	0
17	MH28	MH29	CONDUIT	81.7	1
18	MH26	MH28	CONDUIT	83.0	1
22	MH33	MH34	CONDUIT	56.8	0
23	MH26	MH30	CONDUIT	31.0	1
24	MH30	MH31	CONDUIT	15.0	0
25	MH31	MH32	CONDUIT	62.7	0
26	MH32	MH33	CONDUIT	15.0	0
27	MH34	MH36	CONDUIT	57.1	1
28	MH28	MH36	CONDUIT	84.0	0
29	MH36	MH37	CONDUIT	74.2	0
30	MH37	MH38	CONDUIT	11.6	0
31	DICBMH4	MHTee3	CONDUIT	70.9	0
32	MH39	MH40	CONDUIT	60.5	0
33	MH40	MH48	CONDUIT	14.4	0
34	MH48	OUTLET	CONDUIT	11.6	14
1	MH44	MH45	CONDUIT	66.5	1
2	MH45	MH46	CONDUIT	84.7	0
3	MH46	MH47	CONDUIT	62.4	0
4	MH47	MH48	CONDUIT	25.3	0
5	MH43	MH46	CONDUIT	23.7	0
6	MH21	MH42	CONDUIT	34.8	0
7	MH42	MH43	CONDUIT	67.5	0
8	MH4	MH21	CONDUIT	53.1	2
9	MH4	MH5	CONDUIT	45.0	0
10	MH5	MH6	CONDUIT	70.7	0
11	MH6	EXMH12	CONDUIT	13.1	1
12	MH79	MH83	CONDUIT	53.5	0
13	MH83	2	CONDUIT	98.6	0
14	MH82	MH83	CONDUIT	41.9	0
15	MH60	MH61	CONDUIT	53.9	4
19	MH61	MH62	CONDUIT	89.3	1
20	MH62	MH63	CONDUIT	67.9	0
21	MH63	MH35	CONDUIT	15.0	0
35	MH35	DCMH36	CONDUIT	83.9	0
36	DCMH36	1	CONDUIT	11.5	0

37	EXMH12	MH13	CONDUIT	62.7	0
38	MH13	MH17	CONDUIT	90.4	0
39	MH17	MH19	CONDUIT	58.1	0
40	MH19	MH35	CONDUIT	95.6	0
41	MH100	MH44	CONDUIT	41.1	0
42	MH38	MHTee3	CONDUIT	54.5	0
43	MHTee3	MH39	CONDUIT	50.8	0

****
Cross Section Summary
****

Conduit	Shape	Full Depth	Full Area	Hyd. Rad.	Max. Width	No. of Barrels
16	CIRCULAR	1.20	1.13	0.30	1.20	1
17	CIRCULAR	0.30	0.07	0.07	0.30	1
18	CIRCULAR	0.38	0.11	0.09	0.38	1
22	CIRCULAR	0.45	0.16	0.11	0.45	1
23	CIRCULAR	0.30	0.07	0.07	0.30	1
24	CIRCULAR	0.30	0.07	0.07	0.30	1
25	CIRCULAR	0.38	0.11	0.09	0.38	1
26	CIRCULAR	0.38	0.11	0.09	0.38	1
27	CIRCULAR	0.45	0.16	0.11	0.45	1
28	CIRCULAR	0.45	0.16	0.11	0.45	1
29	CIRCULAR	0.68	0.36	0.17	0.68	1
30	CIRCULAR	0.68	0.36	0.17	0.68	1
31	CIRCULAR	0.38	0.11	0.09	0.38	1
32	CIRCULAR	1.20	1.13	0.30	1.20	1
33	CIRCULAR	1.35	1.43	0.34	1.35	1
34	CIRCULAR	1.35	1.43	0.34	1.35	1
1	CIRCULAR	0.45	0.16	0.11	0.45	1
2	CIRCULAR	0.53	0.22	0.13	0.53	1
3	CIRCULAR	0.75	0.44	0.19	0.75	1
4	CIRCULAR	0.75	0.44	0.19	0.75	1
5	CIRCULAR	0.68	0.36	0.17	0.68	1
6	CIRCULAR	0.38	0.11	0.09	0.38	1
7	CIRCULAR	0.68	0.36	0.17	0.68	1
8	CIRCULAR	0.30	0.07	0.07	0.30	1
9	CIRCULAR	0.38	0.11	0.09	0.38	1
10	CIRCULAR	0.38	0.11	0.09	0.38	1
11	CIRCULAR	0.38	0.11	0.09	0.38	1
12	CIRCULAR	0.75	0.44	0.19	0.75	1
13	CIRCULAR	0.82	0.53	0.21	0.82	1
14	CIRCULAR	0.53	0.22	0.13	0.53	1
15	CIRCULAR	0.38	0.11	0.09	0.38	1
19	CIRCULAR	0.53	0.22	0.13	0.53	1
20	CIRCULAR	0.68	0.36	0.17	0.68	1
21	CIRCULAR	0.68	0.36	0.17	0.68	1
35	CIRCULAR	1.35	1.43	0.34	1.35	1
36	CIRCULAR	1.35	1.43	0.34	1.35	1
37	CIRCULAR	1.05	0.87	0.26	1.05	1
38	CIRCULAR	1.05	0.87	0.26	1.05	1
39	CIRCULAR	1.35	1.43	0.34	1.35	1
40	CIRCULAR	1.35	1.43	0.34	1.35	1
41	CIRCULAR	0.30	0.07	0.07	0.30	1
42	CIRCULAR	1.20	1.13	0.30	1.20	1
43	CIRCULAR	1.20	1.13	0.30	1.20	1

```
************************************************************
NOTE: The summary statistics displayed in this report are
based on results found at every computational time step,
not just on results from each reporting time step.
************************************************************

***************
Analysis Options
***************
Flow Units ..............  CMS
Process Models:
  Rainfall/Runoff ........  NO
  RDII ...................  NO
  Snowmelt ...............  NO
  Groundwater ............  NO
  Flow Routing ...........  YES
  Ponding Allowed ........  NO
  Water Quality ..........  NO
Flow Routing Method ......  DYNWAVE
Starting Date ............  03/15/2007 00:00:00
Ending Date ..............  03/16/2007 00:00:00
Antecedent Dry Days ......  0.0
Report Time Step .........  00:15:00
Routing Time Step ........  1.00 sec
Variable Time Step .......  YES
Maximum Trials ...........  8
Number of Threads ........  1
Head Tolerance ...........  0.001500 m


*********************
Control Actions Taken
*********************


**************************        Volume        Volume
Flow Routing Continuity        hectare-m      10^6 ltr
**************************     ---------     ---------
Dry Weather Inflow .......         0.000         0.000
Wet Weather Inflow .......         0.000         0.000
Groundwater Inflow .......         0.000         0.000
RDII Inflow ..............         0.000         0.000
External Inflow ..........        90.278       902.786
External Outflow .........        88.040       880.409
Flooding Loss ............         2.104        21.044
Evaporation Loss .........         0.000         0.000
Exfiltration Loss ........         0.000         0.000
Initial Stored Volume ....         0.004         0.044
Final Stored Volume ......         0.118         1.182
Continuity Error (%) .....         0.022


***************************
Time-Step Critical Elements
***************************
None


*******************************
Highest Flow Instability Indexes
*******************************
```

All links are stable.

****
Routing Time Step Summary
****
Minimum Time Step : 0.54 sec
Average Time Step : 1.00 sec
Maximum Time Step : 1.00 sec
Percent in Steady State : 0.35
Average Iterations per Step : 1.99
Percent Not Converging : 0.28

****
Node Depth Summary
****

Node	Type	Average Depth Meters	Maximum Depth Meters	Maximum HGL Meters	Time of Max Occurrence days	hr:min	Repor Max De Met
MH26	JUNCTION	1.56	1.57	350.43	0	00:05	1
MH28	JUNCTION	1.73	1.73	349.29	0	00:05	1
MH29	JUNCTION	2.50	2.51	348.58	0	00:05	2
MH38	JUNCTION	2.32	2.33	348.05	0	00:05	2
MH34	JUNCTION	1.39	1.40	349.48	0	00:05	1
MH33	JUNCTION	1.51	1.52	349.92	0	00:05	1
MH36	JUNCTION	2.18	2.19	348.77	0	00:05	2
MH37	JUNCTION	1.91	1.92	348.23	0	00:05	1
MH30	JUNCTION	1.35	1.36	350.43	0	00:05	1
MH31	JUNCTION	1.46	1.47	350.39	0	00:05	1
MH32	JUNCTION	1.47	1.47	350.03	0	00:05	1
MH39	JUNCTION	1.95	1.96	347.23	0	00:05	1
MH40	JUNCTION	1.80	1.81	346.66	0	00:05	1
MH48	JUNCTION	1.76	1.77	346.47	0	00:05	1
MH44	JUNCTION	1.69	1.69	348.80	0	00:05	1
MH45	JUNCTION	1.93	1.94	348.25	0	00:05	1
MH46	JUNCTION	1.75	1.76	347.43	0	00:05	1
MH47	JUNCTION	1.43	1.44	346.81	0	00:05	1
MH43	JUNCTION	1.59	1.60	347.72	0	00:05	1
MH42	JUNCTION	1.76	1.77	348.15	0	00:05	1
MH21	JUNCTION	1.73	1.74	348.64	0	00:05	1
MH4	JUNCTION	0.99	0.99	348.88	0	00:05	0
MH5	JUNCTION	1.15	1.15	348.78	0	00:05	1
MH6	JUNCTION	0.91	0.91	347.87	0	00:05	0
EXMH12	JUNCTION	2.13	2.14	347.00	0	01:05	2
MH60	JUNCTION	0.12	0.12	350.43	0	00:06	0
MH61	JUNCTION	2.63	2.64	348.13	0	01:10	2
MH62	JUNCTION	2.42	2.43	346.76	0	18:24	2
MH63	JUNCTION	1.95	1.96	345.89	0	14:37	1
MH35	JUNCTION	2.37	2.38	345.32	0	19:15	2
DCMH36	JUNCTION	2.02	2.03	344.61	0	18:43	2
MH83	JUNCTION	3.03	3.04	346.11	0	00:05	3
MH82	JUNCTION	2.39	2.40	347.72	0	00:05	2
MH79	JUNCTION	3.29	3.30	346.72	0	00:05	3
MH13	JUNCTION	2.13	2.13	346.63	0	10:54	2
MH17	JUNCTION	2.37	2.37	346.17	0	18:08	2
MH19	JUNCTION	2.68	2.69	345.89	0	18:08	2
MH100	JUNCTION	1.44	1.44	348.81	0	00:05	1

DICBMH4	JUNCTION	0.76	0.76	347.03	0	00:05	0
MHTee3	JUNCTION	2.02	2.03	347.53	0	00:05	2
OUTLET	OUTFALL	2.73	2.74	345.74	0	00:05	2
1	OUTFALL	3.08	3.09	344.09	0	00:05	3
2	OUTFALL	3.08	3.09	344.09	0	00:05	3

****
Node Inflow Summary
****

Node	Type	Maximum Lateral Inflow CMS	Maximum Total Inflow CMS	Time of Max Occurrence days	hr:min	Lateral Inflow Volume 10^6 ltr	1
MH26	JUNCTION	0.194	0.194	0	00:05	16.7	
MH28	JUNCTION	0.135	0.321	0	00:05	11.6	
MH29	JUNCTION	2.698	2.781	0	00:05	232	
MH38	JUNCTION	0.024	3.437	0	00:05	2.07	
MH34	JUNCTION	0.054	0.293	0	00:05	4.65	
MH33	JUNCTION	0.112	0.239	0	00:05	9.64	
MH36	JUNCTION	0.101	0.631	0	00:05	8.7	
MH37	JUNCTION	0.000	0.632	0	00:05	0	
MH30	JUNCTION	0.034	0.043	0	00:05	2.93	
MH31	JUNCTION	0.084	0.127	0	00:05	7.23	
MH32	JUNCTION	0.000	0.127	0	00:05	0	
MH39	JUNCTION	0.166	3.459	0	00:05	14.3	
MH40	JUNCTION	0.065	3.524	0	00:05	5.6	
MH48	JUNCTION	0.000	4.491	0	00:05	0	
MH44	JUNCTION	0.237	0.253	0	00:05	20.4	
MH45	JUNCTION	0.124	0.377	0	00:05	10.7	
MH46	JUNCTION	0.000	0.967	0	00:05	0	
MH47	JUNCTION	0.000	0.967	0	00:05	0	
MH43	JUNCTION	0.000	0.590	0	00:05	0	
MH42	JUNCTION	0.416	0.590	0	00:05	35.8	
MH21	JUNCTION	0.117	0.174	0	00:05	10.1	
MH4	JUNCTION	0.137	0.137	0	00:05	11.8	
MH5	JUNCTION	0.115	0.195	0	00:05	9.9	
MH6	JUNCTION	0.104	0.299	0	00:05	8.95	
EXMH12	JUNCTION	1.424	1.723	0	00:05	123	
MH60	JUNCTION	0.078	0.078	0	00:05	6.72	
MH61	JUNCTION	0.444	0.522	0	00:07	38.2	
MH62	JUNCTION	0.368	0.890	0	20:45	31.7	
MH63	JUNCTION	0.000	0.890	0	06:34	0	
MH35	JUNCTION	0.000	4.010	0	02:25	0	
DCMH36	JUNCTION	0.060	4.070	0	22:16	5.17	
MH83	JUNCTION	0.106	1.646	0	00:05	9.13	
MH82	JUNCTION	0.681	0.681	0	00:05	58.6	
MH79	JUNCTION	0.859	0.859	0	00:05	74	
MH13	JUNCTION	0.115	1.838	0	02:26	9.9	
MH17	JUNCTION	0.597	2.435	0	21:36	51.4	
MH19	JUNCTION	0.685	3.120	0	03:14	59	
MH100	JUNCTION	0.016	0.016	0	00:05	1.38	
DICBMH4	JUNCTION	0.100	0.244	0	00:05	8.61	
MHTee3	JUNCTION	0.000	3.437	0	00:05	0	
OUTLET	OUTFALL	0.000	4.491	0	00:05	0	
1	OUTFALL	0.000	4.070	0	23:10	0	
2	OUTFALL	0.000	1.646	0	00:05	0	

****
Node Surcharge Summary
****

Surcharging occurs when water rises above the top of the highest conduit.

Node	Type	Hours Surcharged	Max. Height Above Crown Meters	Min. Depth Below Rim Meters
MH26	JUNCTION	23.92	0.692	2.155
MH28	JUNCTION	23.92	0.767	2.076
MH29	JUNCTION	23.92	1.133	2.598
MH38	JUNCTION	23.92	1.079	1.666
MH34	JUNCTION	23.92	0.918	2.482
MH33	JUNCTION	23.92	1.072	2.468
MH36	JUNCTION	23.92	1.327	1.852
MH37	JUNCTION	23.92	1.210	1.396
MH30	JUNCTION	23.92	0.999	2.443
MH31	JUNCTION	23.92	1.096	2.399
MH32	JUNCTION	23.92	1.049	2.446
MH39	JUNCTION	23.92	0.757	1.643
MH40	JUNCTION	23.92	0.460	1.690
MH48	JUNCTION	23.92	0.307	1.832
MH44	JUNCTION	23.92	1.244	2.101
MH45	JUNCTION	23.92	1.385	1.140
MH46	JUNCTION	23.92	0.773	1.441
MH47	JUNCTION	23.92	0.679	1.668
MH43	JUNCTION	23.92	0.909	1.071
MH42	JUNCTION	23.92	1.089	1.735
MH21	JUNCTION	23.92	1.194	1.574
MH5	JUNCTION	23.92	0.736	2.809
MH6	JUNCTION	23.92	0.456	3.319
MH62	JUNCTION	23.92	1.718	1.013
MH63	JUNCTION	23.92	1.084	1.490
MH35	JUNCTION	23.92	0.815	1.914
DCMH36	JUNCTION	23.92	0.680	2.970
MH83	JUNCTION	23.92	0.603	2.502
MH82	JUNCTION	23.92	1.873	1.092
MH79	JUNCTION	23.92	2.547	3.743
MH13	JUNCTION	23.92	1.031	3.270
MH17	JUNCTION	23.92	0.948	2.515
MH19	JUNCTION	23.92	0.950	2.418
MH100	JUNCTION	23.92	1.143	3.091
DICBMH4	JUNCTION	23.92	0.385	0.000
MHTee3	JUNCTION	23.92	0.832	1.768

****
Node Flooding Summary
****

Flooding refers to all water that overflows a node, whether it ponds or not.

Node	Hours Flooded	Maximum Rate CMS	Time of Max Occurrence days hr:min	Total Flood Volume 10^6 ltr	Maximum Ponded Depth Meters
DICBMH4	23.92	0.244	0 00:05	20.975	0.000

****
Outfall Loading Summary
****

Outfall Node	Flow Freq Pcnt	Avg Flow CMS	Max Flow CMS	Total Volume 10^6 ltr
OUTLET	99.65	4.490	4.491	387.483
1	99.65	4.070	4.070	351.311
2	99.65	1.646	1.646	142.131
System	99.65	10.206	10.206	880.925

****
Link Flow Summary
****

Link	Type	Maximum |Flow| CMS	Time of Max Occurrence days	hr:min	Maximum |Veloc| m/sec	Max/ Full Flow	Max/ Full Depth
16	CONDUIT	2.781	0	00:05	2.46	1.24	1.00
17	CONDUIT	0.083	0	00:05	1.17	0.75	1.00
18	CONDUIT	0.186	0	00:05	1.68	0.89	1.00
22	CONDUIT	0.239	0	00:05	1.50	1.18	1.00
23	CONDUIT	0.009	0	00:05	0.12	0.09	1.00
24	CONDUIT	0.043	0	00:05	0.60	0.62	1.00
25	CONDUIT	0.127	0	00:05	1.15	1.02	1.00
26	CONDUIT	0.127	0	00:05	1.15	0.96	1.00
27	CONDUIT	0.293	0	00:05	1.84	0.75	1.00
28	CONDUIT	0.238	0	00:05	1.49	0.70	1.00
29	CONDUIT	0.632	0	00:05	1.76	1.33	1.00
30	CONDUIT	0.632	0	00:05	1.77	1.33	1.00
31	CONDUIT	0.144	0	00:05	1.30	1.15	1.00
32	CONDUIT	3.459	0	00:05	3.06	1.32	1.00
33	CONDUIT	3.524	0	00:05	2.46	1.38	1.00
34	CONDUIT	4.491	0	00:05	3.14	0.22	1.00
1	CONDUIT	0.253	0	00:05	1.59	0.87	1.00
2	CONDUIT	0.377	0	00:05	1.74	1.07	1.00
3	CONDUIT	0.967	0	00:05	2.19	1.27	1.00
4	CONDUIT	0.967	0	00:05	2.19	1.61	1.00
5	CONDUIT	0.590	0	00:05	1.65	0.92	1.00
6	CONDUIT	0.174	0	00:05	1.57	1.29	1.00
7	CONDUIT	0.590	0	00:05	1.65	1.16	1.00
8	CONDUIT	0.057	0	00:05	1.00	0.34	0.75
9	CONDUIT	0.080	0	00:05	0.73	0.66	1.00
10	CONDUIT	0.195	0	00:05	1.77	1.22	1.00
11	CONDUIT	0.299	0	00:05	2.71	1.22	1.00
12	CONDUIT	0.859	0	00:05	1.94	1.08	1.00
13	CONDUIT	1.646	0	00:05	3.08	2.09	1.00
14	CONDUIT	0.681	0	00:05	3.15	1.77	1.00
15	CONDUIT	0.078	0	00:07	2.58	0.21	0.36
19	CONDUIT	0.522	0	20:45	2.41	1.16	1.00
20	CONDUIT	0.890	0	06:34	2.49	1.94	1.00
21	CONDUIT	0.890	0	01:22	2.49	1.35	1.00

35	CONDUIT	4.010	0	22:16	2.80	1.14	1.00
36	CONDUIT	4.070	0	23:10	2.84	1.38	1.00
37	CONDUIT	1.723	0	02:26	1.99	0.89	1.00
38	CONDUIT	1.838	0	21:36	2.12	1.13	1.00
39	CONDUIT	2.435	0	03:14	1.70	0.76	1.00
40	CONDUIT	3.120	0	01:05	2.18	1.17	1.00
41	CONDUIT	0.016	0	00:05	0.23	0.21	1.00
42	CONDUIT	3.437	0	00:05	3.04	1.40	1.00
43	CONDUIT	3.293	0	00:05	2.91	0.97	1.00

****
Flow Classification Summary
****

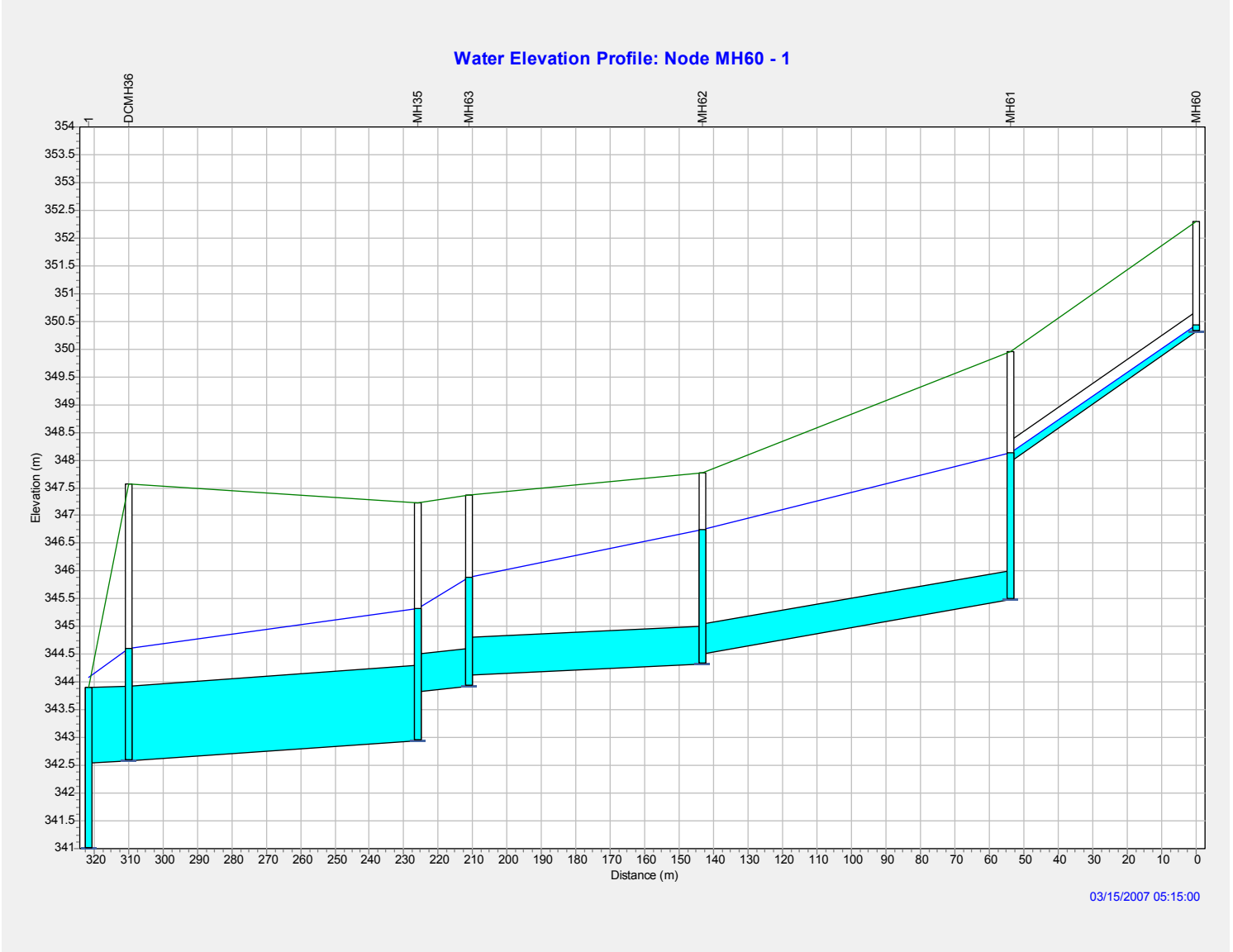
	Adjusted	Fraction of Time in Flow Class							
	/Actual		Up	Down	Sub	Sup	Up	Down	Norm
Conduit	Length	Dry	Dry	Dry	Crit	Crit	Crit	Crit	Ltd
16	1.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00
17	1.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00
18	1.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00
22	1.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00
23	1.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00
24	1.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00
25	1.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00
26	1.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00
27	1.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00
28	1.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00
29	1.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00
30	1.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00
31	1.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00
32	1.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00
33	1.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00
34	1.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00
1	1.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00
2	1.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00
3	1.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00
4	1.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00
5	1.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00
6	1.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00
7	1.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00
8	1.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00
9	1.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00
10	1.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00
11	1.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00
12	1.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00
13	1.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00
14	1.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00
15	1.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00	0.99
19	1.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00
20	1.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00
21	1.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00
35	1.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00
36	1.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00
37	1.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00
38	1.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00
39	1.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00
40	1.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00
41	1.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00

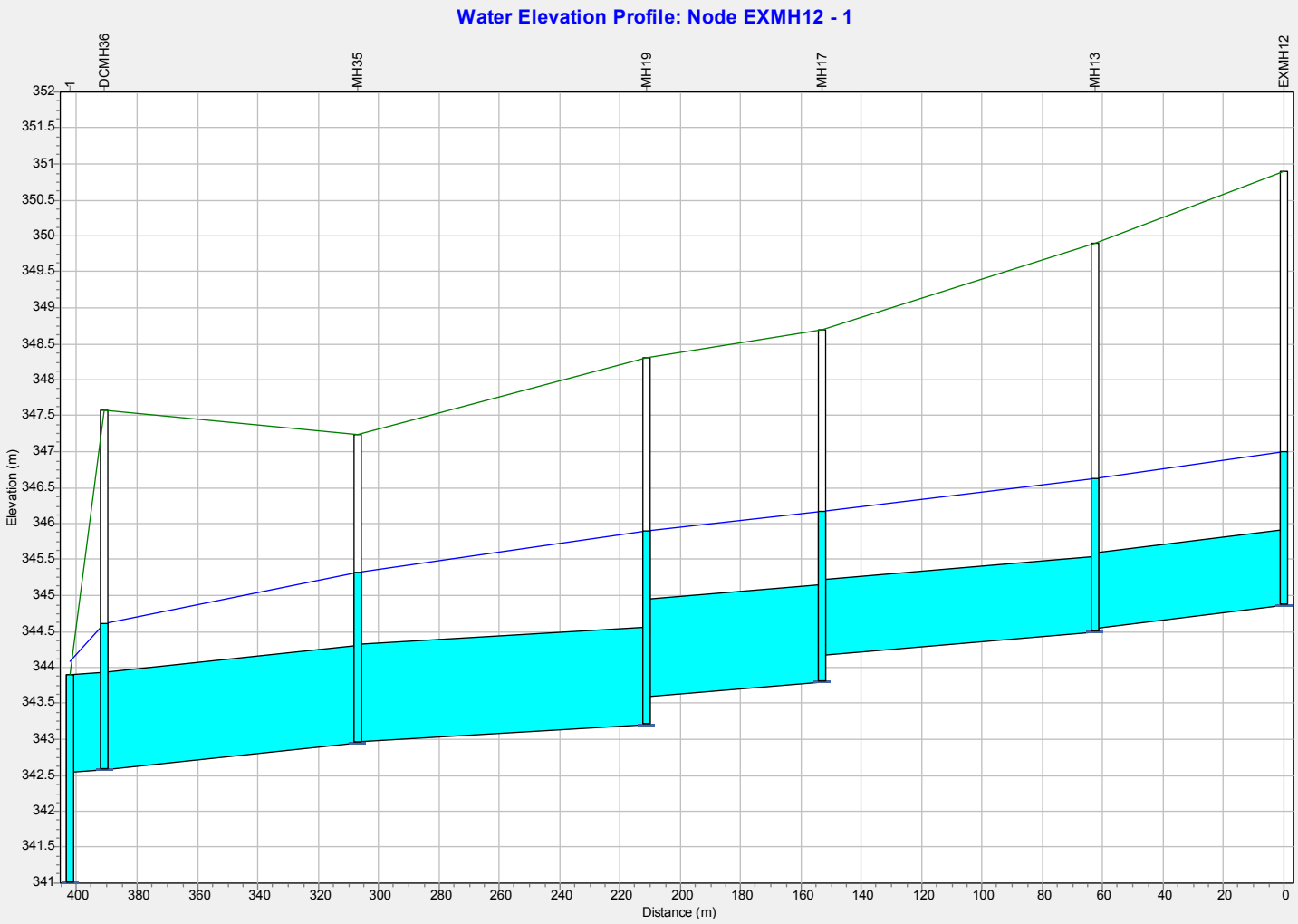
42	1.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00
43	1.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00

****
Conduit Surcharge Summary
****

Conduit	Hours Full: Both Ends	Hours Full: Upstream	Hours Full: Dnstream	Hours Above Full Normal Flow	Hours Capacity Limited
16	23.92	23.92	23.92	23.92	23.92
17	23.92	23.92	23.92	0.01	0.01
18	23.92	23.92	23.92	0.01	0.01
22	23.92	23.92	23.92	23.92	23.92
23	23.92	23.92	23.92	0.01	0.01
24	23.92	23.92	23.92	0.01	0.01
25	23.92	23.92	23.92	23.92	23.92
26	23.92	23.92	23.92	0.01	23.92
27	23.92	23.92	23.92	0.01	0.01
28	23.92	23.92	23.92	0.01	0.01
29	23.92	23.92	23.92	23.92	23.92
30	23.92	23.92	23.92	23.92	23.92
31	23.92	23.92	23.92	23.92	0.01
32	23.92	23.92	23.92	23.92	23.92
33	23.92	23.92	23.92	23.92	23.92
34	23.92	23.92	23.92	0.01	0.01
1	23.92	23.92	23.92	0.01	0.01
2	23.92	23.92	23.92	23.92	23.92
3	23.92	23.92	23.92	23.92	23.92
4	23.92	23.92	23.92	23.92	23.92
5	23.92	23.92	23.92	0.01	23.92
6	23.92	23.92	23.92	23.92	23.92
7	23.92	23.92	23.92	23.92	23.92
8	0.01	0.01	23.92	0.01	0.01
9	23.92	23.92	23.92	0.01	0.01
10	23.92	23.92	23.92	23.92	23.92
11	23.92	23.92	23.92	23.92	23.92
12	23.92	23.92	23.92	23.92	23.92
13	23.92	23.92	23.92	23.92	23.92
14	23.92	23.92	23.92	23.92	23.92
19	23.92	23.92	23.92	23.92	23.92
20	23.92	23.92	23.92	23.92	23.92
21	23.92	23.92	23.92	23.92	23.92
35	23.92	23.92	23.92	23.92	23.92
36	23.92	23.92	23.92	23.92	23.92
37	23.92	23.92	23.92	0.01	23.92
38	23.92	23.92	23.92	23.92	23.92
39	23.92	23.92	23.92	0.01	23.92
40	23.92	23.92	23.92	23.92	23.92
41	23.92	23.92	23.92	0.01	0.01
42	23.92	23.92	23.92	23.92	23.92
43	23.92	23.92	23.92	0.01	23.92

Analysis begun on: Thu Nov 02 14:20:40 2017
Analysis ended on: Thu Nov 02 14:20:44 2017
Total elapsed time: 00:00:04


Water Elevation Profile: Node MH60 - 1
1
DCMH36
MH35
MH63
MH62
MH61
MH60
Elevation (m)
354
353.5
353
352.5
352
351.5
351
350.5
350
349.5
349
348.5
348
347.5
347
346.5
346
345.5
345
344.5
344
343.5
343
342.5
342
341.5
341
320 310 300 290 280 270 260 250 240 230 220 210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0
Distance (m)
03/15/2007 05:15:00


Water Elevation Profile: Node EXMH12 - 1
1
DCMH36
MH35
MH19
MH17
MH13
EXMH12
Elevation (m)
352
351.5
351
350.5
350
349.5
349
348.5
348
347.5
347
346.5
346
345.5
345
344.5
344
343.5
343
342.5
342
341.5
341
400
380
360
340
320
300
280
260
240
220
200
180
160
140
120
100
80
60
40
20
0
Distance (m)
03/15/2007 05:15:00