15 HIGH STREET

Norwell, MA

Application for Comprehensive Permit

Supplemental Materials

Submitted to the Norwell Zoning Board of Appeals

April 30, 2021

Sponsor: Northland Residential Corporation

SUPPLEMENTAL MATERIALS TABLE OF CONTENTS

S.1 Transportation Impact Assessment Appendix
S.2 Stormwater Management Appendix

- S.2.a Drainage Calculations
- S.2.b. Soil Testing Forms for Drainage & Septic Systems
- S.2.c. Operation & Maintenance Manual

S.3 Cut and Fill Calculations

APPENDIX

SITE PLAN
TURNING MOVEMENT COUNTS
VEHICLE TRAVEL SPEED MEASUREMENTS
TRAFFIC ADJUSTMENTS
PUBLIC TRANSPORTATION SCHEDULES
MOTOR VEHICLE CRASH DATA
GROWTH RATE CALCULATIONS
GENERAL BACKGROUND
US CENSUS
TRIP DISTRIBUTION – JOURNEY TO WORK DATA
TRIP GENERATION
CAPACITY ANALYSIS

SITE PLAN

15 HIGH STREET, NORWELL, MA

ILLUSTRATIVE SITE PLAN

JANUARY 29, 2021

SCALE: 1"=50'-0"

0 25' 50' 75' 100'

UNION STUDIO
ARCHITECTURE & COMMUNITY DESIGN

TURNING MOVEMENT COUNTS

Study Name	207637-A Washington Street (Route 53) @ Grove Street/High Street TMC
Project	PDI Projects: 207637-Norwell
Project Code	
Legs and Movements	All Processed Legs & Movements
Bin Size	1 hour
Time Zone	America/New_York
Start Time	2020-10-08 06:00:00
End Time	2020-10-10 14:00:00
Location	207637-A Washington Street (Route 53) @ Grove Street/High Street
Latitude and Longitude	42.1721,-70.878832

AM Peak	Oct 08 2020 8:15AM - 9:15 AM (0.983)
PM Peak (Overall Peak Hour)	Oct 08 2020 4:45PM - 5:45 PM (0.986)
AM Peak (WKND)	Oct 10 2020 10AM - 11 AM (0.900)
Midday Peak (WKND)	Oct 10 2020 12PM - 1 PM (0.993)
PM Peak (WKND)	Oct 10 2020 1PM - 2 PM (0.981)

	Motorcycles																						
Leg	Washington Street (Route 53)						Washington Street (Route 53)						High Street						Grove Street				
Direction	Northbound						Southbound						Eastbound						Westbound				
Start Time	Left	Thru	Right	U-Turn	Peds CW	Peds CCW	Left	Thru	Right	U-Turn	Peds CW	Peds CCW	Left	Thru	Right	U-Turn	Peds CW	Peds CCW	Left	Thru	Right	U-Turn	Peds CW	Peds CCW
2020-10-08 06:00:00	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
2020-10-08 07:00:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2020-10-08 08:00:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2020-10-08 09:00:00	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2020-10-08 14:00:00	0	1	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2020-10-08 15:00:00	0	2	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
2020-10-08 16:00:00	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2020-10-08 17:00:00	0	0	0	0	0	0	1	2	2	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
2020-10-10 10:00:00	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2020-10-10 11:00:00	0	1	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2020-10-10 12:00:00	0	4	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0
2020-10-10 13:00:00	0	4	1	0	0	0	1	7	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0

	Lights																							
Leg	Washington Street (Route 53)						Washington Street (Route 53)						High Street						Grove Street					
Direction	Northbound						Southbound						Eastbound						Westbound					
Start Time	Left	Thru	Right	U-Turn	Peds CW	Peds CCV	Left	Thru	Right	U-Turn	Peds CW	Peds CCV	Left	Thru	Right	U-Turn	Peds CW	Peds CCV	Left	Thru	Right	U-Turn	Peds CW	Peds CCW
2020-10-08 06:00:00	2	180	9	0	0	0	53	94	26	0	0	0	101	6	4	0	0	0	10	8	231	0	0	0
2020-10-08 07:00:00	7	300	22	0	0	0	139	208	104	0	0	0	166	38	4	0	0	0	32	65	348	0	0	0
2020-10-08 08:00:00	19	335	34	0	0	0	177	300	179	0	0	0	190	55	18	0	0	0	59	101	359	0	0	0
2020-10-08 09:00:00	10	363	49	0	0	0	203	357	142	0	0	0	139	41	20	0	0	0	54	48	324	0	0	0
2020-10-08 14:00:00	20	511	75	0	0	0	301	541	259	0	0	0	182	45	33	0	0	0	70	54	243	1	0	0
2020-10-08 15:00:00	22	479	80	0	0	0	323	555	310	0	0	0	226	100	29	0	0	0	81	76	281	0	0	0
2020-10-08 16:00:00	15	502	102	0	0	0	336	548	275	0	0	0	215	100	22	0	0	0	85	53	245	0	0	0
2020-10-08 17:00:00	12	621	64	0	0	0	382	552	273	0	0	0	233	111	20	0	0	0	69	63	295	0	0	0
2020-10-10 10:00:00	10	425	45	0	0	0	219	438	152	0	0	0	145	40	14	0	0	0	41	21	317	0	0	0
2020-10-10 11:00:00	14	501	57	0	0	0	305	539	183	0	0	0	189	37	12	0	0	0	80	50	353	0	0	0
2020-10-10 12:00:00	12	524	72	0	0	0	308	620	221	0	0	0	167	40	14	0	0	0	63	50	335	0	0	0
2020-10-10 13:00:00	13	540	75	0	0	0	332	639	230	0	0	0	184	46	17	0	0	0	63	54	322	0	0	0

	Single Unit																							
Leg	Washington Street (Route 53)						Washington Street (Route 53)						High Street						Grove Street					
Direction	Northbound						Southbound						Eastbound						Westbound					
Start Time	Left	Thru	Right	U-Turn	Peds CW	Peds CC	Left	Thru	Right	U-Turn	Peds CW	Peds CC	Left	Thru	Right	U-Turn	Peds CW	Peds CC	Left	Thru	Right	U-Turn	Peds CW	Peds CCW
2020-10-08 06:00:00	0	6	0	0	0	0	6	3	1	0	0	0	2	1	0	0	0	0	1	0	1	0	0	0
2020-10-08 07:00:00	0	12	0	0	0	0	6	8	2	0	0	0	6	2	0	0	0	0	0	0	3	0	0	0
2020-10-08 08:00:00	0	9	4	0	0	0	8	10	4	0	0	0	4	0	0	0	0	0	2	1	8	0	0	0
2020-10-08 09:00:00	0	14	2	0	0	0	5	7	5	0	0	0	5	5	2	0	0	0	3	2	1	0	0	0
2020-10-08 14:00:00	0	10	0	0	0	0	4	13	4	0	0	0	7	2	0	0	0	0	2	1	8	0	0	0
2020-10-08 15:00:00	0	6	0	0	0	0	4	5	3	0	0	0	3	0	0	0	0	0	1	4	8	0	0	0
2020-10-08 16:00:00	0	2	1	0	0	0	3	4	1	0	0	0	6	0	0	0	0	0	2	0	7	0	0	0
2020-10-08 17:00:00	0	4	0	0	0	0	3	12	3	0	0	0	0	0	0	0	0	0	0	1	5	0	0	0
2020-10-10 10:00:00	0	9	2	0	0	0	2	8	3	0	0	0	0	1	0	0	0	0	1	1	1	0	0	0
2020-10-10 11:00:00	0	5	0	0	0	0	0	3	2	0	0	0	2	0	0	0	0	0	1	0	2	0	0	0
2020-10-10 12:00:00	0	0	1	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0
2020-10-10 13:00:00	0	2	1	0	0	0	0	3	2	0	0	0	1	1	0	0	0	0	0	2	0	0	0	0

	Articulated Trucks																							
Leg	Washington Street (Route 53)						Washington Street (Route 53)						High Street						Grove Street					
Direction	Northbound						Southbound						Eastbound						Westbound					
Start Time	Left	Thru	Right	U-Turn	Peds CW	Peds CCW	Left	Thru	Right	U-Turn	Peds CW	Peds CCW	Left	Thru	Right	U-Turn	Peds CW	Peds CCW	Left	Thru	Right	U-Turn	Peds CW	Peds CCW
2020-10-08 06:00:00	0	4	0	0	0	0	1	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2020-10-08 07:00:00	0	1	0	0	0	0	1	1	0	0	0	0	0	2	0	0	0	0	0	0	1	0	0	0
2020-10-08 08:00:00	0	1	2	0	0	0	0	2	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
2020-10-08 09:00:00	0	2	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
2020-10-08 14:00:00	0	0	2	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0
2020-10-08 15:00:00	0	0	1	0	0	0	2	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2020-10-08 16:00:00	0	2	0	0	0	0	0	3	4	0	0	0	1	0	0	0	0	0	1	1	0	0	0	0
2020-10-08 17:00:00	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
2020-10-10 10:00:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
2020-10-10 11:00:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2020-10-10 12:00:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2020-10-10 13:00:00	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0

	Buses																							
Leg	Washington Street (Route 53)						Washington Street (Route 53)						High Street						Grove Street					
Direction	Northbound						Southbound						Eastbound						Westbound					
Start Time	Left	Thru	Right	U-Turn	Peds C\	Peds C(	Left	Thru	Right	U-Turn	Peds C\	Peds C(	Left	Thru	Right	U-Turn	Peds C\	Peds C(	Left	Thru	Right	U-Turn	Peds C\	Peds CCW
2020-10-08 06:00:00	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2020-10-08 07:00:00	0	1	1	0	0	0	0	1	2	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
2020-10-08 08:00:00	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	2	0	0	0
2020-10-08 09:00:00	0	0	0	0	0	0	0	1	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0
2020-10-08 14:00:00	0	0	1	0	0	0	0	1	0	0	0	0	2	0	0	0	0	0	0	0	1	0	0	0
2020-10-08 15:00:00	0	1	0	0	0	0	0	0	1	0	0	0	1	1	0	0	0	0	1	4	1	0	0	0
2020-10-08 16:00:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2020-10-08 17:00:00	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2020-10-10 10:00:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2020-10-10 11:00:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2020-10-10 12:00:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2020-10-10 13:00:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

	Pedestrian																							
Leg	Washington Street (Route 53)						Washington Street (Route 53)						High Street						Grove Street					
Direction	Northbound						Southbound						Eastbound						Westbound					
Start Time	Left	Thru	Right	U-Turn	Peds C	Peds C	Left	Thru	Right	U-Turn	Peds C	Peds C	Left	Thru	Right	U-Turn	Peds C	Peds C	Left	Thru	Right	U-Turn	Peds C	Peds CCW
2020-10-08 06:00:00	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
2020-10-08 07:00:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2020-10-08 08:00:00	0	0	0	0	3	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
2020-10-08 09:00:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
2020-10-08 14:00:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
2020-10-08 15:00:00	0	0	0	0	4	10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2020-10-08 16:00:00	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	1	2	0	0	0	0	0	0
2020-10-08 17:00:00	0	0	0	0	2	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2020-10-10 10:00:00	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	2
2020-10-10 11:00:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2020-10-10 12:00:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
2020-10-10 13:00:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1

	Bicycle on Road																							
Leg	Washington Street (Route 53)						Washington Street (Route 53)						High Street						Grove Street					
Direction	Northbound						Southbound						Eastbound						Westbound					
Start Time	Left	Thru	Right	U-Turn	Peds C	Peds C	Left	Thru	Right	U-Turn	Peds C	Peds C	Left	Thru	Right	U-Turn	Peds C	Peds C	Left	Thru	Right	U-Turn	Peds C	Peds CCW
2020-10-08 06:00:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2020-10-08 07:00:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2020-10-08 08:00:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2020-10-08 09:00:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2020-10-08 14:00:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2020-10-08 15:00:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
2020-10-08 16:00:00	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2020-10-08 17:00:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2020-10-10 10:00:00	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
2020-10-10 11:00:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2020-10-10 12:00:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2020-10-10 13:00:00	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

	Bicycles on Crosswalk																							
Leg	Washington Street (Route 53)						Washington Street (Route 53)						High Street						Grove Street					
Direction	Northbound						Southbound						Eastbound						Westbound					
Start Time	Left	Thru	Right	U-Turn	Peds CW	Peds CC'	Left	Thru	Right	U-Turn	Peds CW	Peds CC'	Left	Thru	Right	U-Turn	Peds CW	Peds CC'	Left	Thru	Right	U-Turn	Peds CW	Peds CCW
2020-10-08 06:00:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
2020-10-08 07:00:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2020-10-08 08:00:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2020-10-08 09:00:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2020-10-08 14:00:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2020-10-08 15:00:00	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
2020-10-08 16:00:00	0	0	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2020-10-08 17:00:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2020-10-10 10:00:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2020-10-10 11:00:00	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
2020-10-10 12:00:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2020-10-10 13:00:00	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

	Total Volume																														
Leg	Washington Street (Route 53)							Washington Street (Route 53)							High Street							Grove Street								
Direction	Northbound							Southbound							Eastbound							Westbound								
Start Time	Left	Thru	Right	U-Turn	App Tota	Peds CW	Peds CC	Left	Thru	Right	U-Turn	App Tota	Peds CW	Peds CC	Left	Thru	Right	U-Turn	App Tota	Peds CW	Peds CC	Left	Thru	Right	U-Turn	App Tota	Peds CW	Peds CC	Int Total
2020-10-08 06:00:00	2	190	10	0	**202**	1	0	61	99	28	0	**188**	0	0	103	7	4	0	**114**	1	0	11	8	233	0	**252**	1	0	**756**
2020-10-08 07:00:00	7	314	23	0	**344**	0	0	146	218	108	0	**472**	0	0	172	42	4	0	**218**	0	0	32	65	353	0	**450**	0	0	**1484**
2020-10-08 08:00:00	19	345	41	0	**405**	3	1	185	313	183	0	**681**	0	0	194	56	18	0	**268**	0	0	62	102	369	0	**533**	0	1	**1887**
2020-10-08 09:00:00	10	380	52	0	**442**	0	0	209	366	147	0	**722**	0	0	145	46	23	0	**214**	0	0	58	50	325	0	**433**	1	0	**1811**
2020-10-08 14:00:00	20	522	78	0	**620**	0	0	306	557	263	0	**1126**	0	0	191	47	33	0	**271**	1	0	73	55	253	1	**382**	0	0	**2399**
2020-10-08 15:00:00	22	488	81	0	**591**	5	10	329	562	315	0	**1206**	0	0	230	101	29	0	**360**	0	0	83	85	291	0	**459**	1	0	**2616**
2020-10-08 16:00:00	15	507	103	0	**625**	4	2	340	555	281	0	**1176**	0	0	222	100	22	0	**344**	1	2	88	54	252	0	**394**	0	0	**2539**
2020-10-08 17:00:00	12	626	64	0	**702**	2	3	386	567	279	0	**1232**	0	0	233	112	20	0	**365**	0	0	69	64	301	0	**434**	0	0	**2733**
2020-10-10 10:00:00	10	436	47	0	**493**	1	1	221	446	155	0	**822**	0	0	146	41	14	0	**201**	0	0	42	22	319	0	**383**	2	2	**1899**
2020-10-10 11:00:00	14	507	57	0	**578**	1	0	305	544	185	0	**1034**	0	0	191	37	12	0	**240**	1	0	81	50	355	0	**486**	0	0	**2338**
2020-10-10 12:00:00	12	528	73	0	**613**	0	0	308	621	224	0	**1153**	0	0	167	40	14	0	**221**	0	1	64	50	338	0	**452**	0	0	**2439**
2020-10-10 13:00:00	13	546	78	0	**637**	1	0	333	649	232	0	**1214**	0	0	187	47	17	0	**251**	0	0	63	57	323	0	**443**	0	1	**2545**
Grand Total	156	5389	707	0	**6252**	18	17	3129	5497	2400	0	**11026**	0	0	2181	676	210	0	**3067**	4	3	726	662	3712	1	**5101**	5	4	**25446**
% Approach	2.5%	86.2%	11.3%	0.0%				28.4%	49.9%	21.8%	0.0%				71.1%	22.0%	6.8%	0.0%				14.2%	13.0%	72.8%	0.0%				
% Total	0.6%	21.2%	2.8%	0.0%	**24.6%**			12.3%	21.6%	9.4%	0.0%	**43.3%**			8.6%	2.7%	0.8%	0.0%	**12.1%**			2.9%	2.6%	14.6%	0.0%	**20.0%**			
Motorcycles	0	15	1	0	**16**			5	15	4	0	**24**			0	1	0	0	**1**			0	2	4	0	**6**			**47**
% Motorcycles	0.0%	0.3%	0.1%	0.0%	**0.3%**			0.2%	0.3%	0.2%	0.0%	**0.2%**			0.0%	0.1%	0.0%	0.0%	**0.0%**			0.0%	0.3%	0.1%	0.0%	**0.1%**			**0.2%**
Lights	156	5281	684	0	**6121**			3078	5391	2354	0	**10823**			2137	659	207	0	**3003**			707	643	3653	1	**5004**			**24951**
% Lights	100.0%	98.0%	96.7%	0.0%	**97.9%**			98.4%	98.1%	98.1%	0.0%	**98.2%**			98.0%	97.5%	98.6%	0.0%	**97.9%**			97.4%	97.1%	98.4%	100.0%	**98.1%**			**98.1%**
Single-Unit Trucks	0	79	11	0	**90**			41	76	32	0	**149**			36	12	2	0	**50**			14	12	45	0	**71**			**360**
% Single-Unit Trucks	0.0%	1.5%	1.6%	0.0%	**1.4%**			1.3%	1.4%	1.3%	0.0%	**1.4%**			1.7%	1.8%	1.0%	0.0%	**1.6%**			1.9%	1.8%	1.2%	0.0%	**1.4%**			**1.4%**
Articulated Trucks	0	10	6	0	**16**			5	11	6	0	**22**			3	3	0	0	**6**			3	1	4	0	**8**			**52**
% Articulated Trucks	0.0%	0.2%	0.8%	0.0%	**0.3%**			0.2%	0.2%	0.3%	0.0%	**0.2%**			0.1%	0.4%	0.0%	0.0%	**0.2%**			0.4%	0.2%	0.1%	0.0%	**0.2%**			**0.2%**
Buses	0	3	4	0	**7**			0	4	4	0	**8**			4	1	1	0	**6**			2	4	5	0	**11**			**32**
% Buses	0.0%	0.1%	0.6%	0.0%	**0.1%**			0.0%	0.1%	0.2%	0.0%	**0.1%**			0.2%	0.1%	0.5%	0.0%	**0.2%**			0.3%	0.6%	0.1%	0.0%	**0.2%**			**0.1%**
Bicycles on Road	0	1	1	0	**2**			0	0	0	0	**0**			1	0	0	0	**1**			0	0	1	0	**1**			**4**
% Bicycles on Road	0.0%	0.0%	0.1%	0.0%	**0.0%**			0.0%	0.0%	0.0%	0.0%	**0.0%**			0.0%	0.0%	0.0%	0.0%	**0.0%**			0.0%	0.0%	0.0%	0.0%	**0.0%**			**0.0%**
Pedestrians						11	17						0	0						3	3						3	4	
% Pedestrians						61.1%	100.0%						0.0%	0.0%						75.0%	100.0%						60.0%	100.0%	
Bicycles on Crosswalk						7	0						0	0						1	0						2	0	
% Bicycles on Crosswalk						38.9%	0.0%						0.0%	0.0%						25.0%	0.0%						40.0%	0.0%	

AM Peak Class Breakdown

Leg	Washington Street (Route 53)							Washington Street (Route 53)							High Street							Grove Street							
Direction	Northbound							Southbound							Eastbound							Westbound							
Start Time	Left	Thru	Right	U-Turn	**App Total**	Peds CW	Peds CCW	Left	Thru	Right	U-Turn	**App Total**	Peds CW	Peds CCW	Left	Thru	Right	U-Turn	**App Total**	Peds CW	Peds CCW	Left	Thru	Right	U-Turn	**App Total**	Peds CW	Peds CCW	**Int Total**
2020-10-08 08:15:00	6	88	11	0	**105**	0	0	40	71	51	0	**162**	0	0	56	9	6	0	**71**	0	0	15	24	126	0	**165**	0	1	**503**
2020-10-08 08:30:00	4	92	10	0	**106**	3	0	48	80	47	0	**175**	0	0	47	8	6	0	**61**	0	0	16	35	81	0	**132**	0	0	**474**
2020-10-08 08:45:00	6	88	12	0	**106**	0	1	51	100	34	0	**185**	0	0	48	22	5	0	**75**	0	0	20	29	85	0	**134**	0	0	**500**
2020-10-08 09:00:00	0	99	20	0	**119**	0	0	57	100	36	0	**193**	0	0	43	15	7	0	**65**	0	0	14	5	108	0	**127**	0	0	**504**
Grand Total	16	367	53	0	**436**	3	1	196	351	168	0	**715**	0	0	194	54	24	0	**272**	0	0	65	93	400	0	**558**	0	1	**1981**
% Approach	3.7%	84.2%	12.2%	0.0%				27.4%	49.1%	23.5%	0.0%				71.3%	19.9%	8.8%	0.0%				11.6%	16.7%	71.7%	0.0%				
% Total	0.8%	18.5%	2.7%	0.0%	**22.0%**			9.9%	17.7%	8.5%	0.0%	**36.1%**			9.8%	2.7%	1.2%	0.0%	**13.7%**			3.3%	4.7%	20.2%	0.0%	**28.2%**			
PHF (Oct 08 2020 8:15AM - 9:15 AM)	0.667	0.927	0.663	0	**0.916**			0.86	0.878	0.824	0	**0.926**			0.866	0.614	0.857	0	**0.907**			0.813	0.664	0.794	0	**0.845**			**0.983**
Motorcycles	0	0	0	0	**0**			0	0	0	0	**0**			0	0	0	0	**0**			0	0	0	0	**0**			**0**
% Motorcycles	0.0%	0.0%	0.0%	0.0%	**0.0%**			0.0%	0.0%	0.0%	0.0%	**0.0%**			0.0%	0.0%	0.0%	0.0%	**0.0%**			0.0%	0.0%	0.0%	0.0%	**0.0%**			**0.0%**
Lights	16	353	49	0	**418**			186	338	162	0	**686**			189	54	23	0	**266**			62	92	393	0	**547**			**1917**
% Lights	100.0%	96.2%	92.5%	0.0%	**95.9%**			94.9%	96.3%	96.4%	0.0%	**95.9%**			97.4%	100.0%	95.8%	0.0%	**97.8%**			95.4%	98.9%	98.3%	0.0%	**98.0%**			**96.8%**
Single-Unit Trucks	0	13	2	0	**15**			9	10	6	0	**25**			5	0	0	0	**5**			2	1	6	0	**9**			**54**
% Single-Unit Trucks	0.0%	3.5%	3.8%	0.0%	**3.4%**			4.6%	2.8%	3.6%	0.0%	**3.5%**			2.6%	0.0%	0.0%	0.0%	**1.8%**			3.1%	1.1%	1.5%	0.0%	**1.6%**			**2.7%**
Articulated Trucks	0	1	1	0	**2**			1	2	0	0	**3**			0	0	0	0	**0**			0	0	0	0	**0**			**5**
% Articulated Trucks	0.0%	0.3%	1.9%	0.0%	**0.5%**			0.5%	0.6%	0.0%	0.0%	**0.4%**			0.0%	0.0%	0.0%	0.0%	**0.0%**			0.0%	0.0%	0.0%	0.0%	**0.0%**			**0.3%**
Buses	0	0	1	0	**1**			0	1	0	0	**1**			0	0	1	0	**1**			1	0	1	0	**2**			**5**
% Buses	0.0%	0.0%	1.9%	0.0%	**0.2%**			0.0%	0.3%	0.0%	0.0%	**0.1%**			0.0%	0.0%	4.2%	0.0%	**0.4%**			1.5%	0.0%	0.3%	0.0%	**0.4%**			**0.3%**
Bicycles on Road	0	0	0	0	**0**			0	0	0	0	**0**			0	0	0	0	**0**			0	0	0	0	**0**			**0**
% Bicycles on Road	0.0%	0.0%	0.0%	0.0%	**0.0%**			0.0%	0.0%	0.0%	0.0%	**0.0%**			0.0%	0.0%	0.0%	0.0%	**0.0%**			0.0%	0.0%	0.0%	0.0%	**0.0%**			**0.0%**
Pedestrians						3	1						0	0						0	0						0	1	
% Pedestrians						100.0%	100.0%						0.0%	0.0%						0.0%	0.0%						0.0%	100.0%	
Bicycles on Crosswalk						0	0						0	0						0	0						0	0	
% Bicycles on Crosswalk						0.0%	0.0%						0.0%	0.0%						0.0%	0.0%						0.0%	0.0%	

PM Peak Class Breakdown

Leg	Washington Street (Route 53)							Washington Street (Route 53)							High Street							Grove Street							
Direction	Northbound							Southbound							Eastbound							Westbound							
Start Time	Left	Thru	Right	U-Turn	**App Total**	Peds CW	Peds CCW	Left	Thru	Right	U-Turn	**App Total**	Peds CW	Peds CCW	Left	Thru	Right	U-Turn	**App Total**	Peds CW	Peds CCW	Left	Thru	Right	U-Turn	**App Total**	Peds CW	Peds CCW	**Int Total**
2020-10-08 16:45:00	4	140	28	0	**172**	0	0	85	155	73	0	**313**	0	0	58	18	2	0	**78**	0	0	27	12	81	0	**120**	0	0	**683**
2020-10-08 17:00:00	1	135	18	0	**154**	0	3	95	143	69	0	**307**	0	0	49	32	9	0	**90**	0	0	22	21	76	0	**119**	0	0	**670**
2020-10-08 17:15:00	6	164	12	0	**182**	2	0	93	145	77	0	**315**	0	0	60	18	6	0	**84**	0	0	21	19	72	0	**112**	0	0	**693**
2020-10-08 17:30:00	3	167	18	0	**188**	0	0	105	143	55	0	**303**	0	0	64	31	3	0	**98**	0	0	15	13	78	0	**106**	0	0	**695**
Grand Total	14	606	76	0	**696**	2	3	378	586	274	0	**1238**	0	0	231	99	20	0	**350**	0	0	85	65	307	0	**457**	0	0	**2741**
% Approach	2.0%	87.1%	10.9%	0.0%				30.5%	47.3%	22.1%	0.0%				66.0%	28.3%	5.7%	0.0%				18.6%	14.2%	67.2%	0.0%				
% Total	0.5%	22.1%	2.8%	0.0%	**25.4%**			13.8%	21.4%	10.0%	0.0%	**45.2%**			8.4%	3.6%	0.7%	0.0%	**12.8%**			3.1%	2.4%	11.2%	0.0%	**16.7%**			
PHF (Oct 08 2020 4:45PM - 5:45 PM)	0.583	0.906	0.679	0	**0.924**			0.9	0.945	0.89	0	**0.983**			0.902	0.773	0.556	0	**0.893**			0.787	0.774	0.948	0	**0.952**			**0.986**
Motorcycles	0	0	0	0	**0**			1	2	2	0	**5**			0	0	0	0	**0**			0	0	0	0	**0**			**5**
% Motorcycles	0.0%	0.0%	0.0%	0.0%	**0.0%**			0.3%	0.3%	0.7%	0.0%	**0.4%**			0.0%	0.0%	0.0%	0.0%	**0.0%**			0.0%	0.0%	0.0%	0.0%	**0.0%**			**0.2%**
Lights	14	600	76	0	**690**			374	568	269	0	**1211**			230	99	20	0	**349**			85	64	299	0	**448**			**2698**
% Lights	100.0%	99.0%	100.0%	0.0%	**99.1%**			98.9%	96.9%	98.2%	0.0%	**97.8%**			99.6%	100.0%	100.0%	0.0%	**99.7%**			100.0%	98.5%	97.4%	0.0%	**98.0%**			**98.4%**
Single-Unit Trucks	0	4	0	0	**4**			3	14	2	0	**19**			1	0	0	0	**1**			0	1	8	0	**9**			**33**
% Single-Unit Trucks	0.0%	0.7%	0.0%	0.0%	**0.6%**			0.8%	2.4%	0.7%	0.0%	**1.5%**			0.4%	0.0%	0.0%	0.0%	**0.3%**			0.0%	1.5%	2.6%	0.0%	**2.0%**			**1.2%**
Articulated Trucks	0	0	0	0	**0**			0	2	1	0	**3**			0	0	0	0	**0**			0	0	0	0	**0**			**3**
% Articulated Trucks	0.0%	0.0%	0.0%	0.0%	**0.0%**			0.0%	0.3%	0.4%	0.0%	**0.2%**			0.0%	0.0%	0.0%	0.0%	**0.0%**			0.0%	0.0%	0.0%	0.0%	**0.0%**			**0.1%**
Buses	0	1	0	0	**1**			0	0	0	0	**0**			0	0	0	0	**0**			0	0	0	0	**0**			**1**
% Buses	0.0%	0.2%	0.0%	0.0%	**0.1%**			0.0%	0.0%	0.0%	0.0%	**0.0%**			0.0%	0.0%	0.0%	0.0%	**0.0%**			0.0%	0.0%	0.0%	0.0%	**0.0%**			**0.0%**
Bicycles on Road	0	1	0	0	**1**			0	0	0	0	**0**			0	0	0	0	**0**			0	0	0	0	**0**			**1**
% Bicycles on Road	0.0%	0.2%	0.0%	0.0%	**0.1%**			0.0%	0.0%	0.0%	0.0%	**0.0%**			0.0%	0.0%	0.0%	0.0%	**0.0%**			0.0%	0.0%	0.0%	0.0%	**0.0%**			**0.0%**
Pedestrians						2	3						0	0						0	0						0	0	
% Pedestrians						100.0%	100.0%						0.0%	0.0%						0.0%	0.0%						0.0%	0.0%	
Bicycles on Crosswalk						0	0						0	0						0	0						0	0	
% Bicycles on Crosswalk						0.0%	0.0%						0.0%	0.0%						0.0%	0.0%						0.0%	0.0%	

Study Name	207637-B Washington Street (Route 53) @ Oak Street/Driveway TMC
Project	PDI Projects: 207637-Norwell
Project Code	
Legs and Movements	All Processed Legs & Movements
Bin Size	1 hour
Time Zone	America/New_York
Start Time	2020-10-08 06:00:00
End Time	2020-10-10 14:00:00
Location	207637-B Washington Street (Route 53) @ Oak Street/Driveway
Latitude and Longitude	42.168512,-70.874877

AM Peak	Oct 08 2020 8:30AM - 9:30 AM (0.823)
PM Peak (Overall Peak Hour)	Oct 08 2020 5PM - 6 PM (0.907)
AM Peak (WKND)	Oct 10 2020 10AM - 11 AM (0.834)
Midday Peak (WKND)	Oct 10 2020 12PM - 1 PM (0.956)
PM Peak (WKND)	Oct 10 2020 1PM - 2 PM (0.954)

	Motorcycles																							
Leg	Washington Street (Route 53)						Washington Street (Route 53)						Oak Street						Driveway					
Direction	Northbound						Southbound						Eastbound						Westbound					
Start Time	Left	Thru	Right	U-Turn	Peds CW	Peds CCW	Left	Thru	Right	U-Turn	Peds CW	Peds CCW	Left	Thru	Right	U-Turn	Peds CW	Peds CCW	Left	Thru	Right	U-Turn	Peds CW	Peds CCW
2020-10-08 06:00:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2020-10-08 07:00:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2020-10-08 08:00:00	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2020-10-08 09:00:00	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2020-10-08 14:00:00	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2020-10-08 15:00:00	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2020-10-08 16:00:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2020-10-08 17:00:00	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2020-10-10 10:00:00	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2020-10-10 11:00:00	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2020-10-10 12:00:00	0	3	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2020-10-10 13:00:00	0	4	0	0	0	0	0	7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

	Lights																							
Leg	Washington Street (Route 53)						Washington Street (Route 53)						Oak Street						Driveway					
Direction	Northbound						Southbound						Eastbound						Westbound					
Start Time	Left	Thru	Right	U-Turn	Peds CW	Peds CCW	Left	Thru	Right	U-Turn	Peds CW	Peds CCW	Left	Thru	Right	U-Turn	Peds CW	Peds CCW	Left	Thru	Right	U-Turn	Peds CW	Peds CCW
2020-10-08 06:00:00	5	179	0	0	0	0	0	92	2	0	0	0	8	0	7	0	0	0	0	0	0	0	0	0
2020-10-08 07:00:00	32	327	1	0	0	0	4	212	9	0	0	0	11	1	21	0	0	0	0	0	1	0	0	0
2020-10-08 08:00:00	71	392	3	0	0	0	1	319	15	0	0	0	24	3	55	0	0	0	2	3	3	0	0	0
2020-10-08 09:00:00	22	387	0	0	0	0	4	379	15	0	0	0	7	1	28	0	0	0	1	0	3	0	0	0
2020-10-08 14:00:00	35	579	0	1	0	0	4	590	26	0	0	0	11	0	32	0	0	0	1	0	7	0	0	0
2020-10-08 15:00:00	46	525	0	0	0	0	2	614	32	0	0	0	11	0	69	0	0	0	1	1	1	0	0	0
2020-10-08 16:00:00	28	549	0	0	0	0	0	599	27	0	0	0	10	0	11	0	0	0	5	2	5	0	0	0
2020-10-08 17:00:00	40	682	0	1	0	0	1	576	37	0	0	0	7	0	32	0	0	0	2	2	7	0	0	0
2020-10-10 10:00:00	10	434	0	0	0	0	1	454	16	0	0	0	10	0	16	0	0	0	0	0	1	0	0	0
2020-10-10 11:00:00	13	543	1	0	0	0	0	600	20	0	0	0	10	0	17	0	0	0	0	1	1	0	0	0
2020-10-10 12:00:00	10	572	0	0	0	0	1	650	16	0	0	0	5	0	26	0	0	0	1	0	3	0	0	0
2020-10-10 13:00:00	16	594	0	0	0	0	0	671	29	0	0	0	11	0	15	0	0	0	0	0	2	0	0	0

	Single Unit Truck																							
Leg	Washington Street (Route 53)						Washington Street (Route 53)						Oak Street						Driveway					
Direction	Northbound						Southbound						Eastbound						Westbound					
Start Time	Left	Thru	Right	U-Turn	Peds CW	Peds CCW	Left	Thru	Right	U-Turn	Peds CW	Peds CCW	Left	Thru	Right	U-Turn	Peds CW	Peds CCW	Left	Thru	Right	U-Turn	Peds CW	Peds CCW
2020-10-08 06:00:00	0	7	0	0	0	0	0	4	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0
2020-10-08 07:00:00	0	11	0	0	0	0	0	7	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
2020-10-08 08:00:00	1	14	0	0	0	0	0	12	0	0	0	0	1	0	2	0	0	0	0	0	0	0	0	0
2020-10-08 09:00:00	4	17	0	0	0	0	0	18	1	0	0	0	2	0	2	0	0	0	0	0	1	0	0	0
2020-10-08 14:00:00	1	7	0	0	0	0	0	13	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2020-10-08 15:00:00	0	3	0	0	0	0	0	7	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2020-10-08 16:00:00	0	5	0	0	0	0	0	8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2020-10-08 17:00:00	0	2	0	0	0	0	0	11	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2020-10-10 10:00:00	0	13	0	0	0	0	1	7	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
2020-10-10 11:00:00	0	7	0	0	0	0	0	3	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2020-10-10 12:00:00	0	2	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2020-10-10 13:00:00	0	2	0	0	0	0	0	4	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0

	Articulated Truck+B:Y																							
Leg	Washington Street (Route 53)						Washington Street (Route 53)						Oak Street						Driveway					
Direction	Northbound						Southbound						Eastbound						Westbound					
Start Time	Left	Thru	Right	U-Turn	Peds C'	Peds C	Left	Thru	Right	U-Turn	Peds C'	Peds C	Left	Thru	Right	U-Turn	Peds C'	Peds C	Left	Thru	Right	U-Turn	Peds C'	Peds CCW
2020-10-08 06:00:00	0	3	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2020-10-08 07:00:00	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2020-10-08 08:00:00	5	1	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2020-10-08 09:00:00	1	3	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2020-10-08 14:00:00	0	2	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2020-10-08 15:00:00	0	1	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
2020-10-08 16:00:00	0	1	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2020-10-08 17:00:00	0	1	0	0	0	0	0	2	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2020-10-10 10:00:00	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2020-10-10 11:00:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2020-10-10 12:00:00	0	2	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
2020-10-10 13:00:00	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

	Buses																							
Leg	Washington Street (Route 53)						Washington Street (Route 53)						Oak Street						Driveway					
Direction	Northbound						Southbound						Eastbound						Westbound					
Start Time	Left	Thru	Right	U-Turn	Peds CW	Peds CCW	Left	Thru	Right	U-Turn	Peds CW	Peds CCW	Left	Thru	Right	U-Turn	Peds CW	Peds CCW	Left	Thru	Right	U-Turn	Peds CW	Peds CCW
2020-10-08 06:00:00	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2020-10-08 07:00:00	2	2	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2020-10-08 08:00:00	0	1	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2020-10-08 09:00:00	1	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2020-10-08 14:00:00	3	1	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2020-10-08 15:00:00	2	2	0	0	0	0	0	1	0	0	0	0	0	0	5	0	0	0	0	0	0	0	0	0
2020-10-08 16:00:00	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2020-10-08 17:00:00	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2020-10-10 10:00:00	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2020-10-10 11:00:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2020-10-10 12:00:00	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2020-10-10 13:00:00	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

	Pedestrian																							
Leg	Washington Street (Route 53)						Washington Street (Route 53)						Oak Street						Driveway					
Direction	Northbound						Southbound						Eastbound						Westbound					
Start Time	Left	Thru	Right	U-Turn	Peds CW	Peds CCV	Left	Thru	Right	U-Turn	Peds CW	Peds CCV	Left	Thru	Right	U-Turn	Peds CW	Peds CCV	Left	Thru	Right	U-Turn	Peds CW	Peds CCW
2020-10-08 06:00:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
2020-10-08 07:00:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	1
2020-10-08 08:00:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	3
2020-10-08 09:00:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2020-10-08 14:00:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
2020-10-08 15:00:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2020-10-08 16:00:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
2020-10-08 17:00:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
2020-10-10 10:00:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	2
2020-10-10 11:00:00	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
2020-10-10 12:00:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
2020-10-10 13:00:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1

	Bicycle on Road																							
Leg	Washington Street (Route 53)						Washington Street (Route 53)						Oak Street						Driveway					
Direction	Northbound						Southbound						Eastbound						Westbound					
Start Time	Left	Thru	Right	U-Turn	Peds CW	Peds CCW	Left	Thru	Right	U-Turn	Peds CW	Peds CCW	Left	Thru	Right	U-Turn	Peds CW	Peds CCW	Left	Thru	Right	U-Turn	Peds CW	Peds CCW
2020-10-08 06:00:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2020-10-08 07:00:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2020-10-08 08:00:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2020-10-08 09:00:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2020-10-08 14:00:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2020-10-08 15:00:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2020-10-08 16:00:00	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2020-10-08 17:00:00	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2020-10-10 10:00:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2020-10-10 11:00:00	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2020-10-10 12:00:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2020-10-10 13:00:00	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Total Volume Breakdown

Leg	Washington Street (Route 53)							Washington Street (Route 53)							Oak Street							Driveway							
Direction	Northbound							Southbound							Eastbound							Westbound							
Start Time	Left	Thru	Right	U-Turn	**App Tota**	Peds CW	Peds CCW	Left	Thru	Right	U-Turn	**App Tota**	Peds CW	Peds CCW	Left	Thru	Right	U-Turn	**App Tota**	Peds CW	Peds CCW	Left	Thru	Right	U-Turn	**App Tota**	Peds CW	Peds CCW	**Int Total**
2020-10-08 06:00:00	5	190	0	0	**195**	0	0	0	98	2	0	**100**	0	0	8	1	8	0	**17**	0	0	0	0	0	0	**0**	2	1	**312**
2020-10-08 07:00:00	34	341	1	0	**376**	0	0	4	221	9	0	**234**	0	0	12	1	21	0	**34**	0	0	0	0	1	0	**1**	2	1	**645**
2020-10-08 08:00:00	77	408	4	0	**489**	0	0	1	336	15	0	**352**	0	0	25	3	57	0	**85**	1	0	2	3	3	0	**8**	1	3	**934**
2020-10-08 09:00:00	28	407	0	0	**435**	0	0	4	401	16	0	**421**	0	0	9	1	30	0	**40**	0	0	1	0	4	0	**5**	0	0	**901**
2020-10-08 14:00:00	39	590	0	1	**630**	0	0	4	607	28	0	**639**	0	0	11	0	32	0	**43**	0	0	1	0	7	0	**8**	0	1	**1320**
2020-10-08 15:00:00	48	532	0	0	**580**	0	0	2	624	33	0	**659**	0	0	12	0	74	0	**86**	0	0	1	1	1	0	**3**	0	0	**1328**
2020-10-08 16:00:00	28	556	0	0	**584**	0	0	0	610	27	0	**637**	0	0	10	0	11	0	**21**	0	0	5	2	5	0	**12**	1	1	**1254**
2020-10-08 17:00:00	40	686	0	1	**727**	0	0	1	591	39	0	**631**	0	0	7	0	32	0	**39**	0	0	2	2	7	0	**11**	1	0	**1408**
2020-10-10 10:00:00	10	449	0	0	**459**	0	0	2	461	18	0	**481**	0	0	10	0	17	0	**27**	0	0	0	0	1	0	**1**	1	2	**968**
2020-10-10 11:00:00	13	552	1	0	**566**	0	1	0	604	21	0	**625**	0	0	10	0	17	0	**27**	0	0	0	1	1	0	**2**	1	1	**1220**
2020-10-10 12:00:00	10	579	0	0	**589**	0	0	1	655	16	0	**672**	0	0	5	0	27	0	**32**	0	0	1	0	3	0	**4**	0	1	**1297**
2020-10-10 13:00:00	16	602	0	0	**618**	0	0	0	683	29	0	**712**	0	0	11	0	17	0	**28**	0	0	0	0	2	0	**2**	1	4	**1360**
Grand Total	348	5892	6	2	**6248**	0	1	19	5891	253	0	**6163**	0	0	130	6	343	0	**479**	1	0	13	9	35	0	**57**	10	15	**12947**
% Approach	5.6%	94.3%	0.1%	0.0%				0.3%	95.6%	4.1%	0.0%				27.1%	1.3%	71.6%	0.0%				22.8%	15.8%	61.4%	0.0%				
% Total	2.7%	45.5%	0.0%	0.0%	**48.3%**			0.1%	45.5%	2.0%	0.0%	**47.6%**			1.0%	0.0%	2.6%	0.0%	**3.7%**			0.1%	0.1%	0.3%	0.0%	**0.4%**			
Motorcycles	0	12	1	0	**13**			0	14	0	0	**14**			0	0	0	0	**0**			0	0	0	0	**0**			**27**
% Motorcycles	0.0%	0.2%	16.7%	0.0%	**0.2%**			0.0%	0.2%	0.0%	0.0%	**0.2%**			0.0%	0.0%	0.0%	0.0%	**0.0%**			0.0%	0.0%	0.0%	0.0%	**0.0%**			**0.2%**
Lights	328	5763	5	2	**6098**			18	5756	244	0	**6018**			125	5	329	0	**459**			13	9	34	0	**56**			**12631**
% Lights	94.3%	97.8%	83.3%	100.0%	**97.6%**			94.7%	97.7%	96.4%	0.0%	**97.6%**			96.2%	83.3%	95.9%	0.0%	**95.8%**			100.0%	100.0%	97.1%	0.0%	**98.2%**			**97.6%**
Single-Unit Trucks	6	90	0	0	**96**			1	95	5	0	**101**			4	1	8	0	**13**			0	0	1	0	**1**			**211**
% Single-Unit Trucks	1.7%	1.5%	0.0%	0.0%	**1.5%**			5.3%	1.6%	2.0%	0.0%	**1.6%**			3.1%	16.7%	2.3%	0.0%	**2.7%**			0.0%	0.0%	2.9%	0.0%	**1.8%**			**1.6%**
Articulated Trucks	6	16	0	0	**22**			0	12	3	0	**15**			1	0	1	0	**2**			0	0	0	0	**0**			**39**
% Articulated Trucks	1.7%	0.3%	0.0%	0.0%	**0.4%**			0.0%	0.2%	1.2%	0.0%	**0.2%**			0.8%	0.0%	0.3%	0.0%	**0.4%**			0.0%	0.0%	0.0%	0.0%	**0.0%**			**0.3%**
Buses	8	8	0	0	**16**			0	13	1	0	**14**			0	0	5	0	**5**			0	0	0	0	**0**			**35**
% Buses	2.3%	0.1%	0.0%	0.0%	**0.3%**			0.0%	0.2%	0.4%	0.0%	**0.2%**			0.0%	0.0%	1.5%	0.0%	**1.0%**			0.0%	0.0%	0.0%	0.0%	**0.0%**			**0.3%**
Bicycles on Road	0	3	0	0	**3**			0	1	0	0	**1**			0	0	0	0	**0**			0	0	0	0	**0**			**4**
% Bicycles on Road	0.0%	0.1%	0.0%	0.0%	**0.0%**			0.0%	0.0%	0.0%	0.0%	**0.0%**			0.0%	0.0%	0.0%	0.0%	**0.0%**			0.0%	0.0%	0.0%	0.0%	**0.0%**			**0.0%**
Pedestrians						0	1						0	0						1	0						9	12	
% Pedestrians						0.0%	100.0%						0.0%	0.0%						100.0%	0.0%						90.0%	80.0%	
Bicycles on Crosswalk						0	0						0	0						0	0						1	3	
% Bicycles on Crosswalk						0.0%	0.0%						0.0%	0.0%						0.0%	0.0%						10.0%	20.0%	

AM Peak Class Breakdown

Leg	Washington Street (Route 53)							Washington Street (Route 53)							Oak Street							Driveway							
Direction	Northbound							Southbound							Eastbound							Westbound							
Start Time	Left	Thru	Right	U-Turn	**App Total**	Peds CW	Peds CCW	Left	Thru	Right	U-Turn	**App Total**	Peds CW	Peds CCW	Left	Thru	Right	U-Turn	**App Total**	Peds CW	Peds CCW	Left	Thru	Right	U-Turn	**App Total**	Peds CW	Peds CCW	**Int Total**
2020-10-08 08:30:00	27	105	0	0	**132**	0	0	1	78	4	0	**83**	0	0	8	0	8	0	**16**	0	0	0	0	1	0	**1**	1	1	**232**
2020-10-08 08:45:00	29	111	1	0	**141**	0	0	0	119	5	0	**124**	0	0	6	2	36	0	**44**	1	0	0	0	1	0	**1**	0	0	**310**
2020-10-08 09:00:00	12	117	0	0	**129**	0	0	1	106	5	0	**112**	0	0	1	1	10	0	**12**	0	0	1	0	0	0	**1**	0	0	**254**
2020-10-08 09:15:00	7	90	0	0	**97**	0	0	0	108	5	0	**113**	0	0	3	0	10	0	**13**	0	0	0	0	1	0	**1**	0	0	**224**
Grand Total	75	423	1	0	**499**	0	0	2	411	19	0	**432**	0	0	18	3	64	0	**85**	1	0	1	0	3	0	**4**	1	1	**1020**
% Approach	15.0%	84.8%	0.2%	0.0%				0.5%	95.1%	4.4%	0.0%				21.2%	3.5%	75.3%	0.0%				25.0%	0.0%	75.0%	0.0%				
% Total	7.4%	41.5%	0.1%	0.0%	**48.9%**			0.2%	40.3%	1.9%	0.0%	**42.4%**			1.8%	0.3%	6.3%	0.0%	**8.3%**			0.1%	0.0%	0.3%	0.0%	**0.4%**			
PHF (Oct 08 2020 8:30AM - 9:30 AM)	0.647	0.904	0.25	0	**0.885**			0.5	0.863	0.95	0	**0.871**			0.563	0.375	0.444	0	**0.483**			0.25	0	0.75	0	**1**			**0.823**
Motorcycles	0	0	0	0	**0**			0	1	0	0	**1**			0	0	0	0	**0**			0	0	0	0	**0**			**1**
% Motorcycles	0.0%	0.0%	0.0%	0.0%	**0.0%**			0.0%	0.2%	0.0%	0.0%	**0.2%**			0.0%	0.0%	0.0%	0.0%	**0.0%**			0.0%	0.0%	0.0%	0.0%	**0.0%**			**0.1%**
Lights	65	406	1	0	**472**			2	386	19	0	**407**			15	3	61	0	**79**			1	0	3	0	**4**			**962**
% Lights	86.7%	96.0%	100.0%	0.0%	**94.6%**			100.0%	93.9%	100.0%	0.0%	**94.2%**			83.3%	100.0%	95.3%	0.0%	**92.9%**			100.0%	0.0%	100.0%	0.0%	**100.0%**			**94.3%**
Single-Unit Trucks	3	15	0	0	**18**			0	17	0	0	**17**			3	0	3	0	**6**			0	0	0	0	**0**			**41**
% Single-Unit Trucks	4.0%	3.5%	0.0%	0.0%	**3.6%**			0.0%	4.1%	0.0%	0.0%	**3.9%**			16.7%	0.0%	4.7%	0.0%	**7.1%**			0.0%	0.0%	0.0%	0.0%	**0.0%**			**4.0%**
Articulated Trucks	6	2	0	0	**8**			0	2	0	0	**2**			0	0	0	0	**0**			0	0	0	0	**0**			**10**
% Articulated Trucks	8.0%	0.5%	0.0%	0.0%	**1.6%**			0.0%	0.5%	0.0%	0.0%	**0.5%**			0.0%	0.0%	0.0%	0.0%	**0.0%**			0.0%	0.0%	0.0%	0.0%	**0.0%**			**1.0%**
Buses	1	0	0	0	**1**			0	5	0	0	**5**			0	0	0	0	**0**			0	0	0	0	**0**			**6**
% Buses	1.3%	0.0%	0.0%	0.0%	**0.2%**			0.0%	1.2%	0.0%	0.0%	**1.2%**			0.0%	0.0%	0.0%	0.0%	**0.0%**			0.0%	0.0%	0.0%	0.0%	**0.0%**			**0.6%**
Bicycles on Road	0	0	0	0	**0**			0	0	0	0	**0**			0	0	0	0	**0**			0	0	0	0	**0**			**0**
% Bicycles on Road	0.0%	0.0%	0.0%	0.0%	**0.0%**			0.0%	0.0%	0.0%	0.0%	**0.0%**			0.0%	0.0%	0.0%	0.0%	**0.0%**			0.0%	0.0%	0.0%	0.0%	**0.0%**			**0.0%**
Pedestrians						0	0						0	0						1	0						1	1	
% Pedestrians						0.0%	0.0%						0.0%	0.0%						100.0%	0.0%						100.0%	100.0%	
Bicycles on Crosswalk						0	0						0	0						0	0						0	0	
% Bicycles on Crosswalk						0.0%	0.0%						0.0%	0.0%						0.0%	0.0%						0.0%	0.0%	

AM Peak Class Breakdown

Leg	Washington Street (Route 53)							Washington Street (Route 53)							Oak Street							Driveway							
Direction	Northbound							Southbound							Eastbound							Westbound							
Start Time	Left	Thru	Right	U-Turn	**App Total**	Peds CW	Peds CCW	Left	Thru	Right	U-Turn	**App Total**	Peds CW	Peds CCW	Left	Thru	Right	U-Turn	**App Total**	Peds CW	Peds CCW	Left	Thru	Right	U-Turn	**App Total**	Peds CW	Peds CCW	**Int Total**
2020-10-08 17:00:00	3	149	0	0	**152**	0	0	0	159	14	0	**173**	0	0	2	0	15	0	**17**	0	0	0	1	4	0	**5**	1	0	**347**
2020-10-08 17:15:00	5	206	0	0	**211**	0	0	0	160	9	0	**169**	0	0	3	0	3	0	**6**	0	0	0	1	1	0	**2**	0	0	**388**
2020-10-08 17:30:00	18	175	0	1	**194**	0	0	1	138	6	0	**145**	0	0	2	0	6	0	**8**	0	0	2	0	1	0	**3**	0	0	**350**
2020-10-08 17:45:00	14	156	0	0	**170**	0	0	0	134	10	0	**144**	0	0	0	0	8	0	**8**	0	0	0	0	1	0	**1**	0	0	**323**
Grand Total	40	686	0	1	**727**	0	0	1	591	39	0	**631**	0	0	7	0	32	0	**39**	0	0	2	2	7	0	**11**	1	0	**1408**
% Approach	5.5%	94.4%	0.0%	0.1%				0.2%	93.7%	6.2%	0.0%				17.9%	0.0%	82.1%	0.0%				18.2%	18.2%	63.6%	0.0%				
% Total	2.8%	48.7%	0.0%	0.1%	**51.6%**			0.1%	42.0%	2.8%	0.0%	**44.8%**			0.5%	0.0%	2.3%	0.0%	**2.8%**			0.1%	0.1%	0.5%	0.0%	**0.8%**			
PHF (Oct 08 2020 5PM - 6 PM)	0.556	0.833	0	0.25	**0.861**			0.25	0.922	0.696	0	**0.91**			0.583	0	0.533	0	**0.574**			0.25	0.5	0.438	0	**0.55**			**0.907**
Motorcycles	0	0	0	0	**0**			0	1	0	0	**1**			0	0	0	0	**0**			0	0	0	0	**0**			**1**
% Motorcycles	0.0%	0.0%	0.0%	0.0%	**0.0%**			0.0%	0.2%	0.0%	0.0%	**0.2%**			0.0%	0.0%	0.0%	0.0%	**0.0%**			0.0%	0.0%	0.0%	0.0%	**0.0%**			**0.1%**
Lights	40	682	0	1	**723**			1	576	37	0	**614**			7	0	32	0	**39**			2	2	7	0	**11**			**1387**
% Lights	100.0%	99.4%	0.0%	100.0%	**99.4%**			100.0%	97.5%	94.9%	0.0%	**97.3%**			100.0%	0.0%	100.0%	0.0%	**100.0%**			100.0%	100.0%	100.0%	0.0%	**100.0%**			**98.5%**
Single-Unit Trucks	0	2	0	0	**2**			0	11	1	0	**12**			0	0	0	0	**0**			0	0	0	0	**0**			**14**
% Single-Unit Trucks	0.0%	0.3%	0.0%	0.0%	**0.3%**			0.0%	1.9%	2.6%	0.0%	**1.9%**			0.0%	0.0%	0.0%	0.0%	**0.0%**			0.0%	0.0%	0.0%	0.0%	**0.0%**			**1.0%**
Articulated Trucks	0	1	0	0	**1**			0	2	1	0	**3**			0	0	0	0	**0**			0	0	0	0	**0**			**4**
% Articulated Trucks	0.0%	0.1%	0.0%	0.0%	**0.1%**			0.0%	0.3%	2.6%	0.0%	**0.5%**			0.0%	0.0%	0.0%	0.0%	**0.0%**			0.0%	0.0%	0.0%	0.0%	**0.0%**			**0.3%**
Buses	0	1	0	0	**1**			0	0	0	0	**0**			0	0	0	0	**0**			0	0	0	0	**0**			**1**
% Buses	0.0%	0.1%	0.0%	0.0%	**0.1%**			0.0%	0.0%	0.0%	0.0%	**0.0%**			0.0%	0.0%	0.0%	0.0%	**0.0%**			0.0%	0.0%	0.0%	0.0%	**0.0%**			**0.1%**
Bicycles on Road	0	0	0	0	**0**			0	1	0	0	**1**			0	0	0	0	**0**			0	0	0	0	**0**			**1**
% Bicycles on Road	0.0%	0.0%	0.0%	0.0%	**0.0%**			0.0%	0.2%	0.0%	0.0%	**0.2%**			0.0%	0.0%	0.0%	0.0%	**0.0%**			0.0%	0.0%	0.0%	0.0%	**0.0%**			**0.1%**
Pedestrians						0	0						0	0						0	0						1	0	
% Pedestrians						0.0%	0.0%						0.0%	0.0%						0.0%	0.0%						100.0%	0.0%	
Bicycles on Crosswalk						0	0						0	0						0	0						0	0	
% Bicycles on Crosswalk						0.0%	0.0%						0.0%	0.0%						0.0%	0.0%						0.0%	0.0%	

Accurate Counts

978-664-2565

N/S Street : High Street
E/W Street : Washington Square Driveway
City/State : Norwell, MA
Weather : Cloudy

File Name : 88900001
Site Code : 88900001
Start Date : 3/31/2021
Page No : 1

Groups Printed- Cars - Trucks

	High St From North		High St From South		Washington Square Dwy From West		
Start Time	Thru	Right	Left	Thru	Left	Right	Int. Total
07:00 AM	24	1	2	39	0	0	66
07:15 AM	33	4	5	47	1	0	90
07:30 AM	58	1	4	58	2	0	123
07:45 AM	74	8	2	62	2	1	149
Total	189	14	13	206	5	1	428
08:00 AM	67	7	5	64	0	0	143
08:15 AM	71	8	2	52	2	0	135
08:30 AM	67	8	9	57	2	3	146
08:45 AM	68	15	6	77	0	2	168
Total	273	38	22	250	4	5	592
Grand Total	462	52	35	456	9	6	1020
Apprch %	89.9	10.1	7.1	92.9	60	40	
Total %	45.3	5.1	3.4	44.7	0.9	0.6	
Cars	452	52	35	448	9	6	1002
% Cars	97.8	100	100	98.2	100	100	98.2
Trucks	10	0	0	8	0	0	18
% Trucks	2.2	0	0	1.8	0	0	1.8

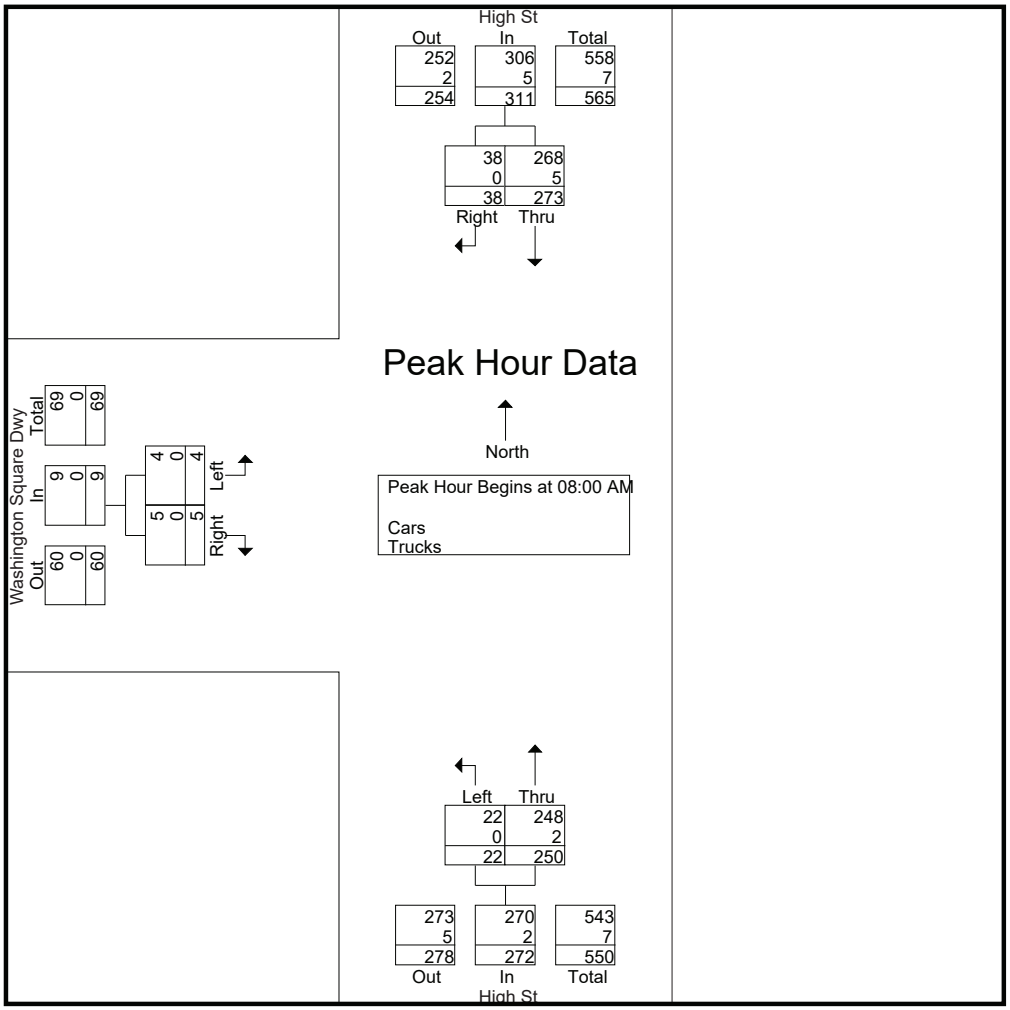
	High St From North			High St From South			Washington Square Dwy From West			
Start Time	Thru	Right	App. Total	Left	Thru	App. Total	Left	Right	App. Total	Int. Total
Peak Hour Analysis From 07:00 AM to 08:45 AM - Peak 1 of 1										
Peak Hour for Entire Intersection Begins at 08:00 AM										
08:00 AM	67	7	74	5	64	69	0	0	0	143
08:15 AM	**71**	8	79	2	52	54	**2**	0	2	135
08:30 AM	67	8	75	**9**	57	66	2	**3**	**5**	146
08:45 AM	68	**15**	**83**	6	**77**	**83**	0	2	2	**168**
Total Volume	273	38	311	22	250	272	4	5	9	592
% App. Total	87.8	12.2		8.1	91.9		44.4	55.6		
PHF	.961	.633	.937	.611	.812	.819	.500	.417	.450	.881
Cars	268	38	306	22	248	270	4	5	9	585
% Cars	98.2	100	98.4	100	99.2	99.3	100	100	100	98.8
Trucks	5	0	5	0	2	2	0	0	0	7
% Trucks	1.8	0	1.6	0	0.8	0.7	0	0	0	1.2

Accurate Counts

978-664-2565

N/S Street : High Street
E/W Street : Washington Square Driveway
City/State : Norwell, MA
Weather : Cloudy

File Name : 88900001
Site Code : 88900001
Start Date : 3/31/2021
Page No : 2



Peak Hour Analysis From 07:00 AM to 08:45 AM - Peak 1 of 1

Peak Hour for Each Approach Begins at:

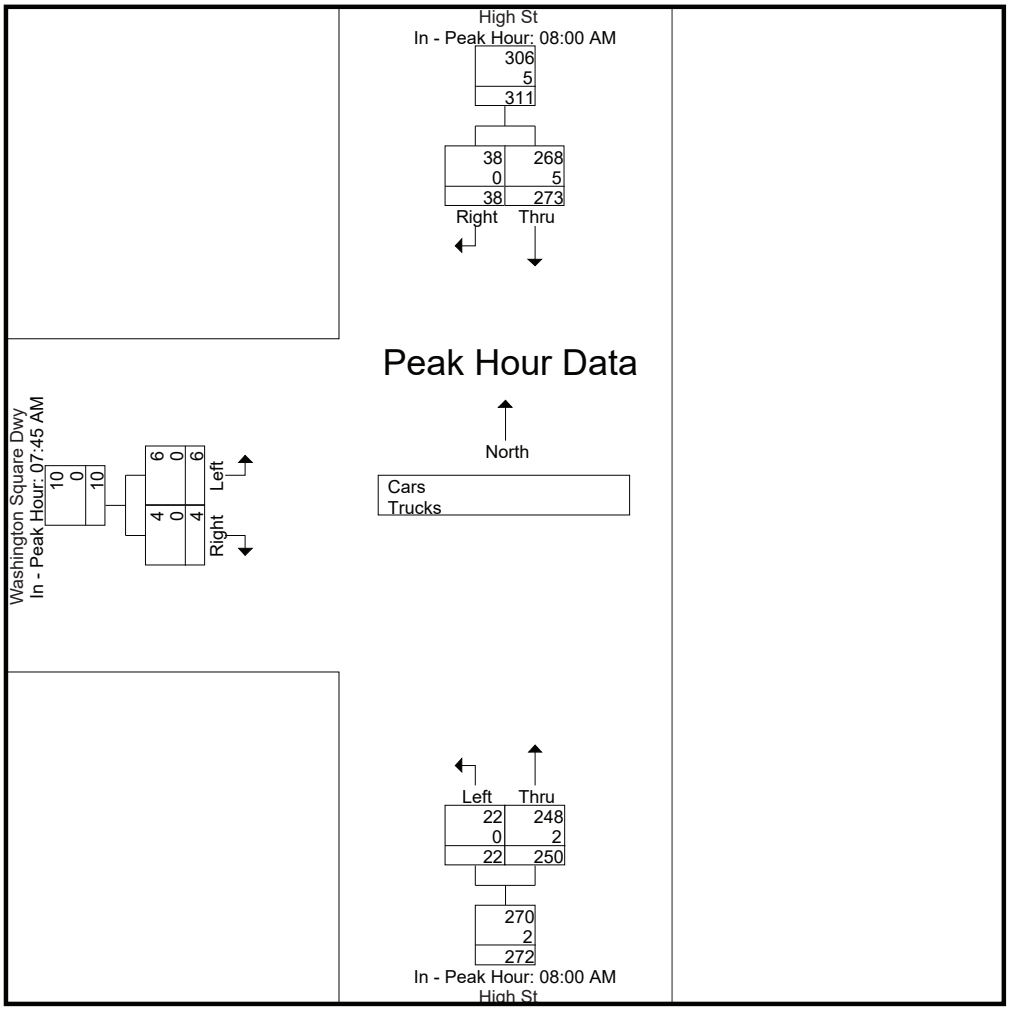
	08:00 AM			08:00 AM			07:45 AM		
+0 mins.	67	7	74	5	64	69	**2**	1	3
+15 mins.	**71**	8	79	2	52	54	0	0	0
+30 mins.	67	8	75	**9**	57	66	2	0	2
+45 mins.	68	**15**	**83**	6	**77**	**83**	2	**3**	**5**
Total Volume	273	38	311	22	250	272	6	4	10
% App. Total	87.8	12.2		8.1	91.9		60	40	
PHF	.961	.633	.937	.611	.812	.819	.750	.333	.500
Cars	268	38	306	22	248	270	6	4	10
% Cars	98.2	100	98.4	100	99.2	99.3	100	100	100
Trucks	5	0	5	0	2	2	0	0	0
% Trucks	1.8	0	1.6	0	0.8	0.7	0	0	0

Accurate Counts

978-664-2565

N/S Street : High Street
E/W Street : Washington Square Driveway
City/State : Norwell, MA
Weather : Cloudy

File Name : 88900001
Site Code : 88900001
Start Date : 3/31/2021
Page No : 3



Accurate Counts

978-664-2565

N/S Street : High Street
E/W Street : Washington Square Driveway
City/State : Norwell, MA
Weather : Cloudy

File Name : 88900001
Site Code : 88900001
Start Date : 3/31/2021
Page No : 4

Groups Printed- Cars

	High St From North		High St From South		Washington Square Dwy From West		
Start Time	Thru	Right	Left	Thru	Left	Right	Int. Total
07:00 AM	22	1	2	37	0	0	62
07:15 AM	33	4	5	46	1	0	89
07:30 AM	58	1	4	56	2	0	121
07:45 AM	71	8	2	61	2	1	145
Total	184	14	13	200	5	1	417
08:00 AM	65	7	5	63	0	0	140
08:15 AM	70	8	2	52	2	0	134
08:30 AM	65	8	9	56	2	3	143
08:45 AM	68	15	6	77	0	2	168
Total	268	38	22	248	4	5	585
Grand Total	452	52	35	448	9	6	1002
Apprch %	89.7	10.3	7.2	92.8	60	40	
Total %	45.1	5.2	3.5	44.7	0.9	0.6	

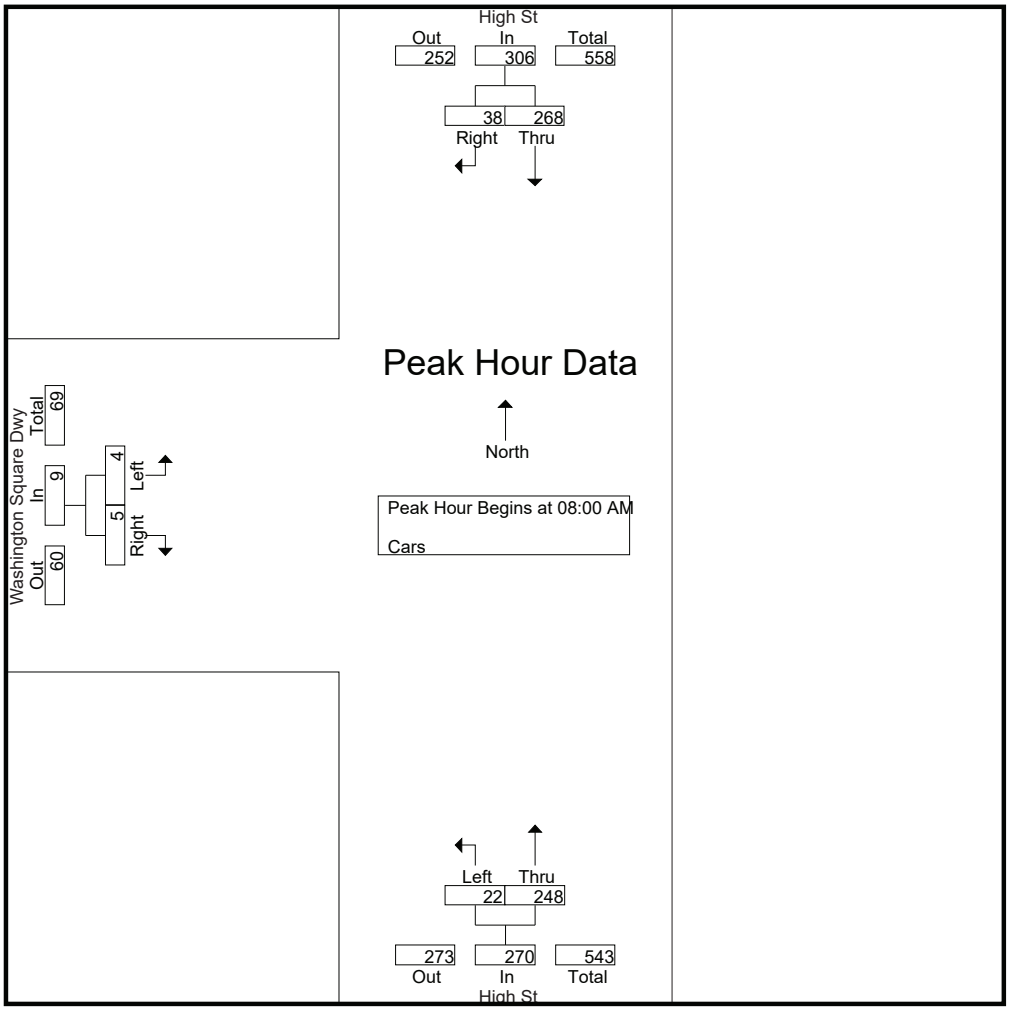
	High St From North			High St From South			Washington Square Dwy From West			
Start Time	Thru	Right	App. Total	Left	Thru	App. Total	Left	Right	App. Total	Int. Total
Peak Hour Analysis From 07:00 AM to 08:45 AM - Peak 1 of 1										
Peak Hour for Entire Intersection Begins at 08:00 AM										
08:00 AM	65	7	72	5	63	68	0	0	0	140
08:15 AM	**70**	8	78	2	52	54	**2**	0	2	134
08:30 AM	65	8	73	**9**	56	65	2	**3**	**5**	143
08:45 AM	68	**15**	**83**	6	**77**	**83**	0	2	2	**168**
Total Volume	268	38	306	22	248	270	4	5	9	585
% App. Total	87.6	12.4		8.1	91.9		44.4	55.6		
PHF	.957	.633	.922	.611	.805	.813	.500	.417	.450	.871

Accurate Counts

978-664-2565

N/S Street : High Street
E/W Street : Washington Square Driveway
City/State : Norwell, MA
Weather : Cloudy

File Name : 88900001
Site Code : 88900001
Start Date : 3/31/2021
Page No : 5



Peak Hour Analysis From 07:00 AM to 08:45 AM - Peak 1 of 1

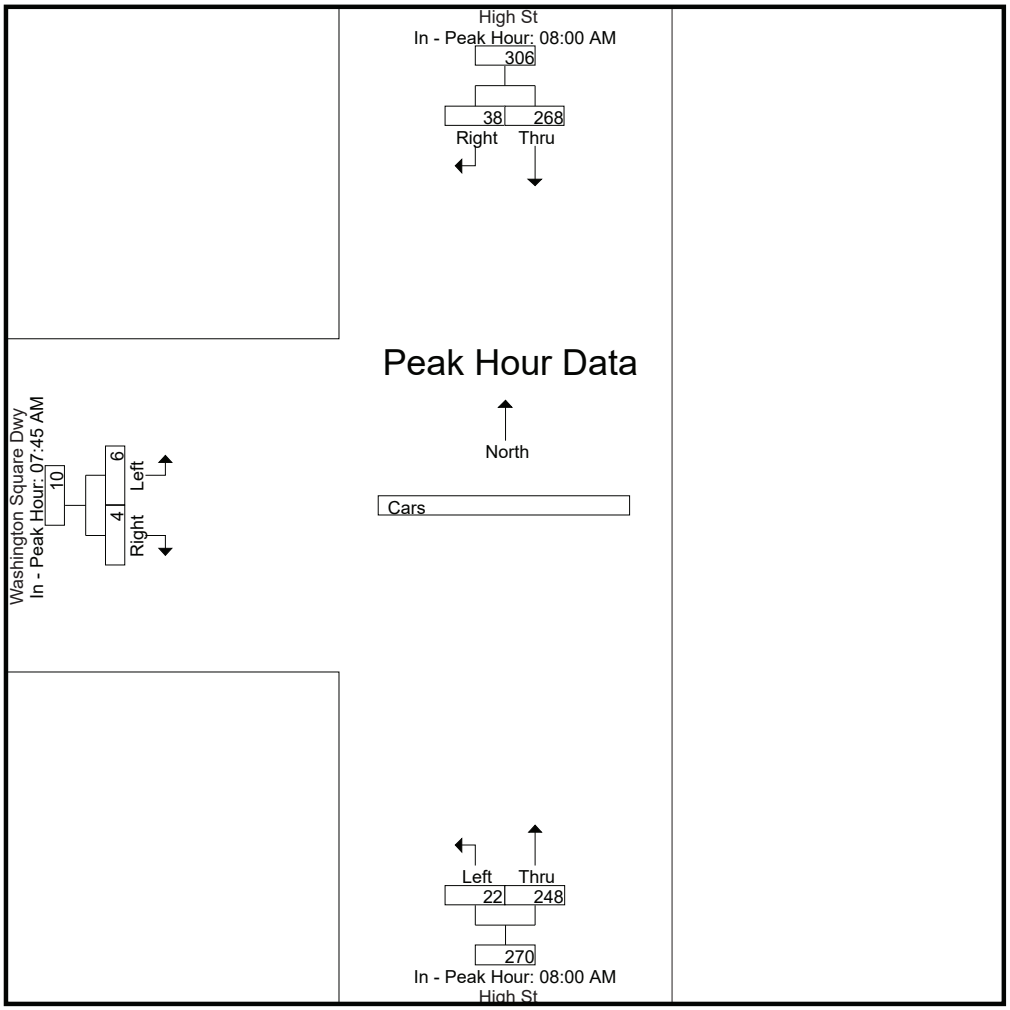
Peak Hour for Each Approach Begins at:

	08:00 AM			08:00 AM			07:45 AM		
+0 mins.	65	7	72	5	63	68	**2**	1	3
+15 mins.	**70**	8	78	2	52	54	0	0	0
+30 mins.	65	8	73	**9**	56	65	2	0	2
+45 mins.	68	**15**	**83**	6	**77**	**83**	2	**3**	**5**
Total Volume	268	38	306	22	248	270	6	4	10
% App. Total	87.6	12.4		8.1	91.9		60	40	
PHF	.957	.633	.922	.611	.805	.813	.750	.333	.500

Accurate Counts
978-664-2565

N/S Street : High Street
E/W Street : Washington Square Driveway
City/State : Norwell, MA
Weather : Cloudy

File Name : 88900001
Site Code : 88900001
Start Date : 3/31/2021
Page No : 6



Accurate Counts

978-664-2565

N/S Street : High Street
E/W Street : Washington Square Driveway
City/State : Norwell, MA
Weather : Cloudy

File Name : 88900001
Site Code : 88900001
Start Date : 3/31/2021
Page No : 7

Groups Printed- Trucks

	High St From North		High St From South		Washington Square Dwy From West		
Start Time	Thru	Right	Left	Thru	Left	Right	Int. Total
07:00 AM	2	0	0	2	0	0	4
07:15 AM	0	0	0	1	0	0	1
07:30 AM	0	0	0	2	0	0	2
07:45 AM	3	0	0	1	0	0	4
Total	5	0	0	6	0	0	11
08:00 AM	2	0	0	1	0	0	3
08:15 AM	1	0	0	0	0	0	1
08:30 AM	2	0	0	1	0	0	3
08:45 AM	0	0	0	0	0	0	0
Total	5	0	0	2	0	0	7
Grand Total	10	0	0	8	0	0	18
Apprch %	100	0	0	100	0	0	
Total %	55.6	0	0	44.4	0	0	

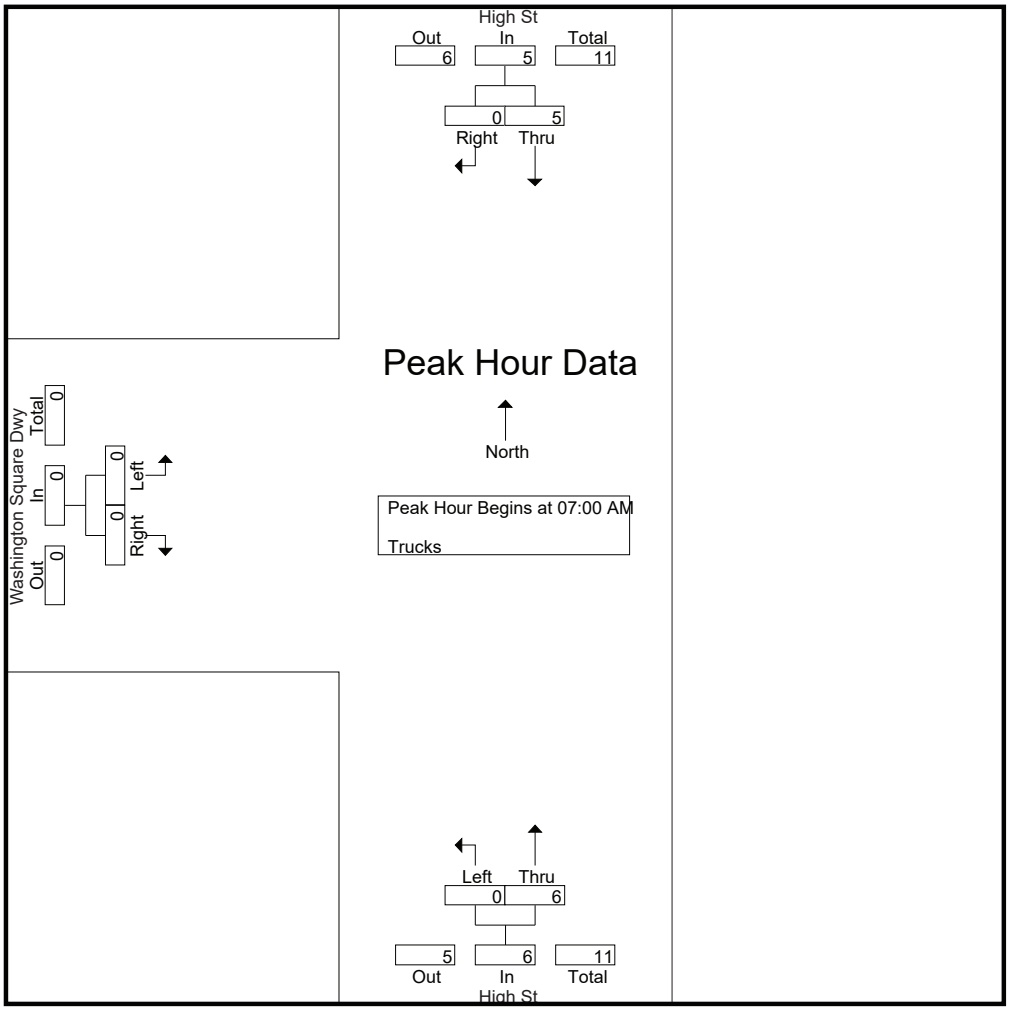
	High St From North			High St From South			Washington Square Dwy From West			
Start Time	Thru	Right	App. Total	Left	Thru	App. Total	Left	Right	App. Total	Int. Total
Peak Hour Analysis From 07:00 AM to 08:45 AM - Peak 1 of 1										
Peak Hour for Entire Intersection Begins at 07:00 AM										
07:00 AM	2	0	2	0	**2**	**2**	0	0	0	**4**
07:15 AM	0	0	0	0	1	1	0	0	0	1
07:30 AM	0	0	0	0	2	2	0	0	0	2
07:45 AM	**3**	0	**3**	0	1	1	0	0	0	4
Total Volume	5	0	5	0	6	6	0	0	0	11
% App. Total	100	0		0	100		0	0		
PHF	.417	.000	.417	.000	.750	.750	.000	.000	.000	.688

Accurate Counts

978-664-2565

N/S Street : High Street
E/W Street : Washington Square Driveway
City/State : Norwell, MA
Weather : Cloudy

File Name : 88900001
Site Code : 88900001
Start Date : 3/31/2021
Page No : 8



Peak Hour Analysis From 07:00 AM to 08:45 AM - Peak 1 of 1

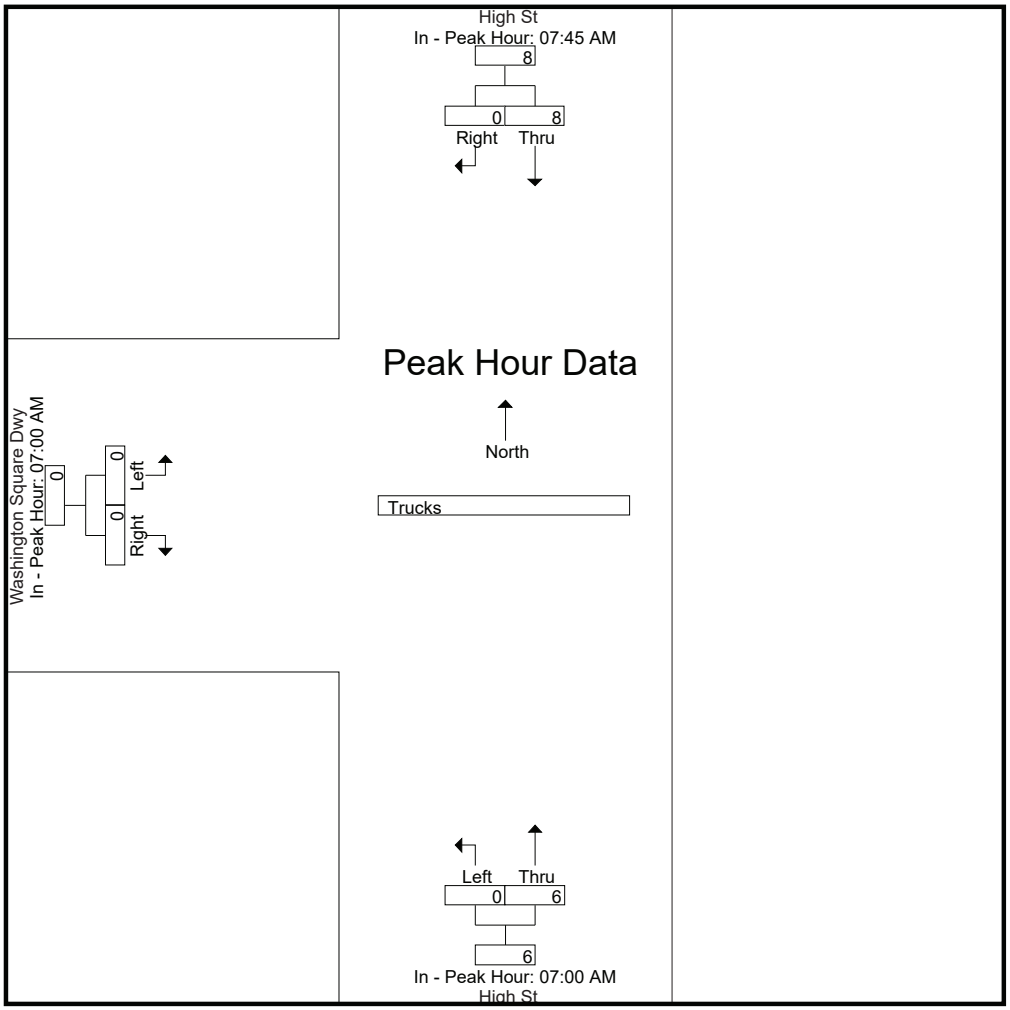
Peak Hour for Each Approach Begins at:

	07:45 AM			07:00 AM			07:00 AM		
+0 mins.	**3**	0	**3**	0	**2**	**2**	0	0	0
+15 mins.	2	0	2	0	1	1	0	0	0
+30 mins.	1	0	1	0	2	2	0	0	0
+45 mins.	2	0	2	0	1	1	0	0	0
Total Volume	8	0	8	0	6	6	0	0	0
% App. Total	100	0		0	100		0	0	
PHF	.667	.000	.667	.000	.750	.750	.000	.000	.000

Accurate Counts
978-664-2565

N/S Street : High Street
E/W Street : Washington Square Driveway
City/State : Norwell, MA
Weather : Cloudy

File Name : 88900001
Site Code : 88900001
Start Date : 3/31/2021
Page No : 9



Accurate Counts

978-664-2565

N/S Street : High Street
E/W Street : Washington Square Driveway
City/State : Norwell, MA
Weather : Cloudy

File Name : 88900001
Site Code : 88900001
Start Date : 3/31/2021
Page No : 10

Groups Printed- Bikes Peds

	High St From North			High St From South			Washington Square Dwy From West					
Start Time	Thru	Right	Peds	Left	Thru	Peds	Left	Right	Peds	Exclu. Total	Inclu. Total	Int. Total
07:00 AM	0	0	0	0	0	0	0	0	0	0	0	0
07:15 AM	0	0	0	0	0	1	0	0	0	1	0	1
07:30 AM	0	0	0	0	0	2	0	0	0	2	0	2
07:45 AM	0	0	0	0	0	0	0	0	0	0	0	0
Total	0	0	0	0	0	3	0	0	0	3	0	3
08:00 AM	0	0	0	0	0	0	0	0	0	0	0	0
08:15 AM	0	0	0	0	0	0	0	0	0	0	0	0
08:30 AM	0	0	0	0	0	19	0	0	0	19	0	19
08:45 AM	0	0	0	0	0	6	0	0	0	6	0	6
Total	0	0	0	0	0	25	0	0	0	25	0	25
Grand Total	0	0	0	0	0	28	0	0	0	28	0	28
Apprch %	0	0		0	0		0	0				
Total %										100	0	

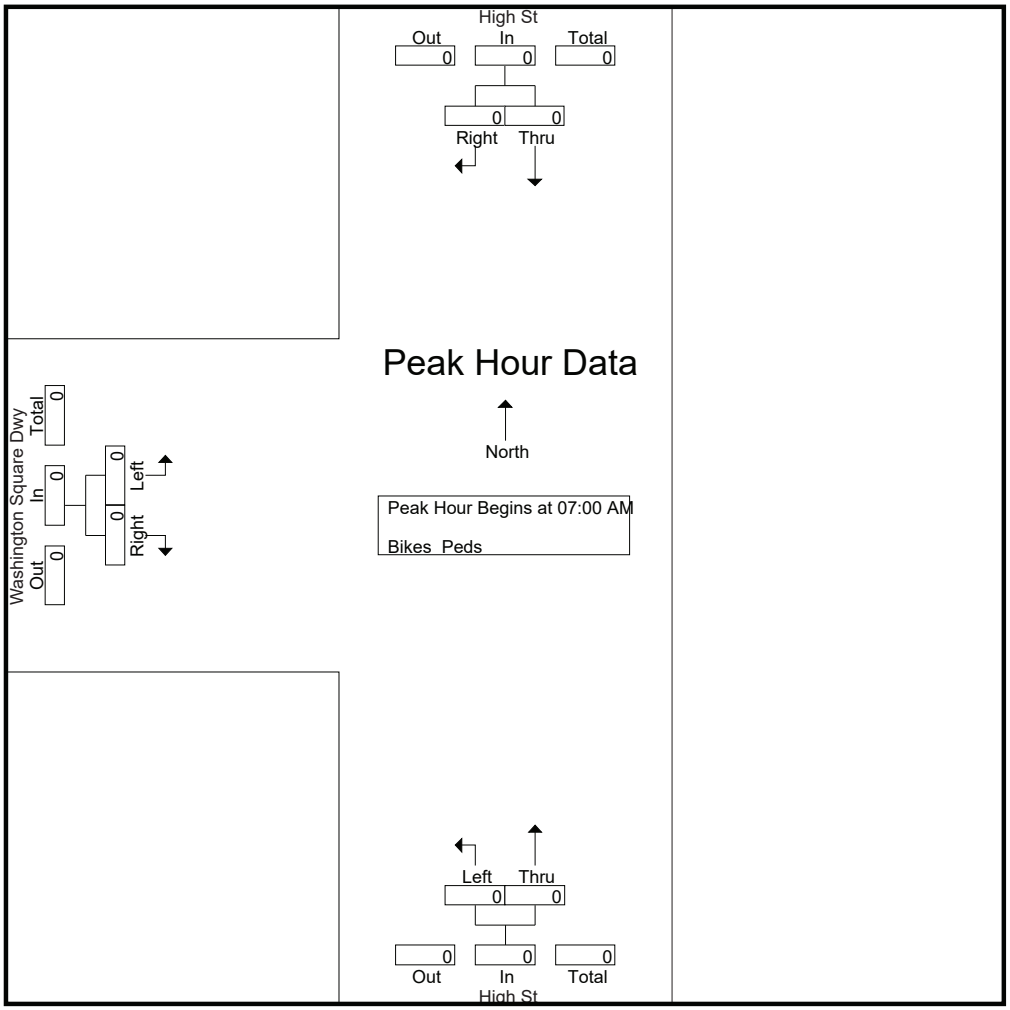
	High St From North			High St From South			Washington Square Dwy From West			
Start Time	Thru	Right	App. Total	Left	Thru	App. Total	Left	Right	App. Total	Int. Total
Peak Hour Analysis From 07:00 AM to 08:45 AM - Peak 1 of 1										
Peak Hour for Entire Intersection Begins at 07:00 AM										
07:00 AM	0	0	0	0	0	0	0	0	0	0
07:15 AM	0	0	0	0	0	0	0	0	0	0
07:30 AM	0	0	0	0	0	0	0	0	0	0
07:45 AM	0	0	0	0	0	0	0	0	0	0
Total Volume	0	0	0	0	0	0	0	0	0	0
% App. Total	0	0		0	0		0	0		
PHF	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000

Accurate Counts

978-664-2565

N/S Street : High Street
E/W Street : Washington Square Driveway
City/State : Norwell, MA
Weather : Cloudy

File Name : 88900001
Site Code : 88900001
Start Date : 3/31/2021
Page No : 11



Peak Hour Analysis From 07:00 AM to 08:45 AM - Peak 1 of 1
Peak Hour for Each Approach Begins at:

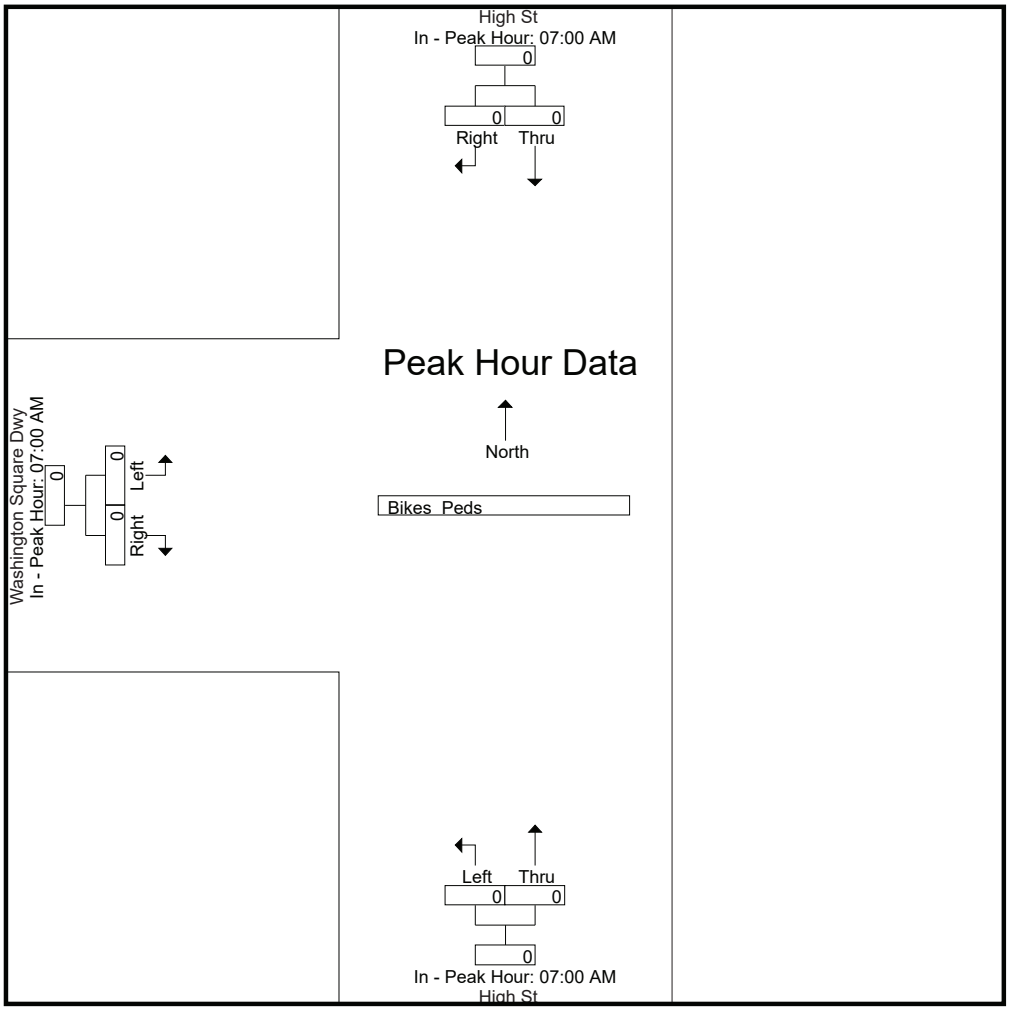
	07:00 AM			07:00 AM			07:00 AM		
+0 mins.	0	0	0	0	0	0	0	0	0
+15 mins.	0	0	0	0	0	0	0	0	0
+30 mins.	0	0	0	0	0	0	0	0	0
+45 mins.	0	0	0	0	0	0	0	0	0
Total Volume	0	0	0	0	0	0	0	0	0
% App. Total	0	0		0	0		0	0	
PHF	.000	.000	.000	.000	.000	.000	.000	.000	.000

Accurate Counts

978-664-2565

N/S Street : High Street
E/W Street : Washington Square Driveway
City/State : Norwell, MA
Weather : Cloudy

File Name : 88900001
Site Code : 88900001
Start Date : 3/31/2021
Page No : 12



Accurate Counts

978-664-2565

N/S Street : High Street
E/W Street : Washington Square Driveway
City/State : Norwell, MA
Weather : Cloudy

File Name : 88900001
Site Code : 88900001
Start Date : 3/31/2021
Page No : 1

Groups Printed- Cars - Trucks

	High St From North		High St From South		Washington Square Dwy From West		
Start Time	Thru	Right	Left	Thru	Left	Right	Int. Total
04:00 PM	94	2	0	69	5	6	176
04:15 PM	99	3	1	71	12	11	197
04:30 PM	73	6	2	60	14	2	157
04:45 PM	77	5	1	64	15	7	169
Total	343	16	4	264	46	26	699
05:00 PM	87	4	2	95	20	4	212
05:15 PM	78	2	2	67	10	6	165
05:30 PM	77	3	1	55	4	2	142
05:45 PM	56	2	1	45	8	3	115
Total	298	11	6	262	42	15	634
Grand Total	641	27	10	526	88	41	1333
Apprch %	96	4	1.9	98.1	68.2	31.8	
Total %	48.1	2	0.8	39.5	6.6	3.1	
Cars	635	27	10	522	88	41	1323
% Cars	99.1	100	100	99.2	100	100	99.2
Trucks	6	0	0	4	0	0	10
% Trucks	0.9	0	0	0.8	0	0	0.8

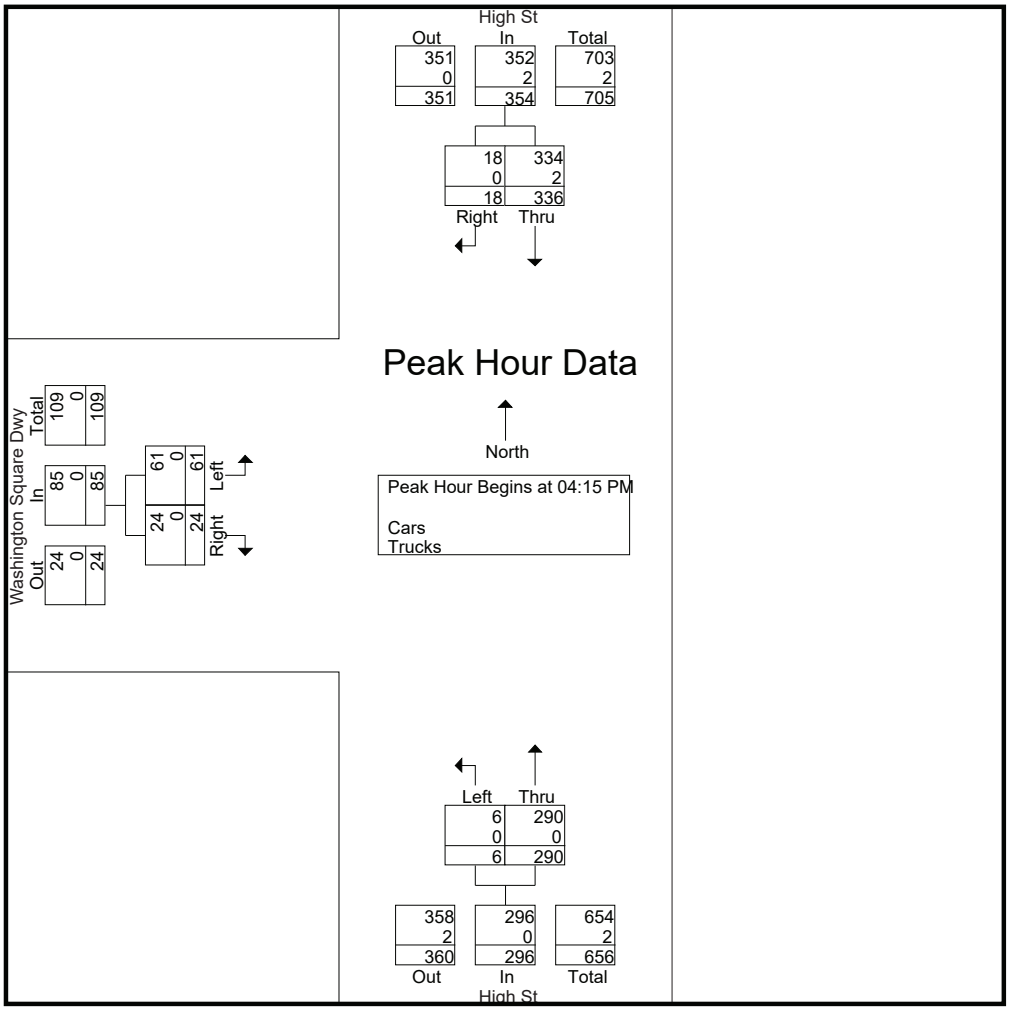
	High St From North			High St From South			Washington Square Dwy From West			
Start Time	Thru	Right	App. Total	Left	Thru	App. Total	Left	Right	App. Total	Int. Total
Peak Hour Analysis From 04:00 PM to 05:45 PM - Peak 1 of 1										
Peak Hour for Entire Intersection Begins at 04:15 PM										
04:15 PM	**99**	3	**102**	1	71	72	12	**11**	23	197
04:30 PM	73	**6**	79	**2**	60	62	14	2	16	157
04:45 PM	77	5	82	1	64	65	15	7	22	169
05:00 PM	87	4	91	2	**95**	**97**	**20**	4	**24**	**212**
Total Volume	336	18	354	6	290	296	61	24	85	735
% App. Total	94.9	5.1		2	98		71.8	28.2		
PHF	.848	.750	.868	.750	.763	.763	.763	.545	.885	.867
Cars	334	18	352	6	290	296	61	24	85	733
% Cars	99.4	100	99.4	100	100	100	100	100	100	99.7
Trucks	2	0	2	0	0	0	0	0	0	2
% Trucks	0.6	0	0.6	0	0	0	0	0	0	0.3

Accurate Counts

978-664-2565

N/S Street : High Street
E/W Street : Washington Square Driveway
City/State : Norwell, MA
Weather : Cloudy

File Name : 88900001
Site Code : 88900001
Start Date : 3/31/2021
Page No : 2



Peak Hour Analysis From 04:00 PM to 05:45 PM - Peak 1 of 1

Peak Hour for Each Approach Begins at:

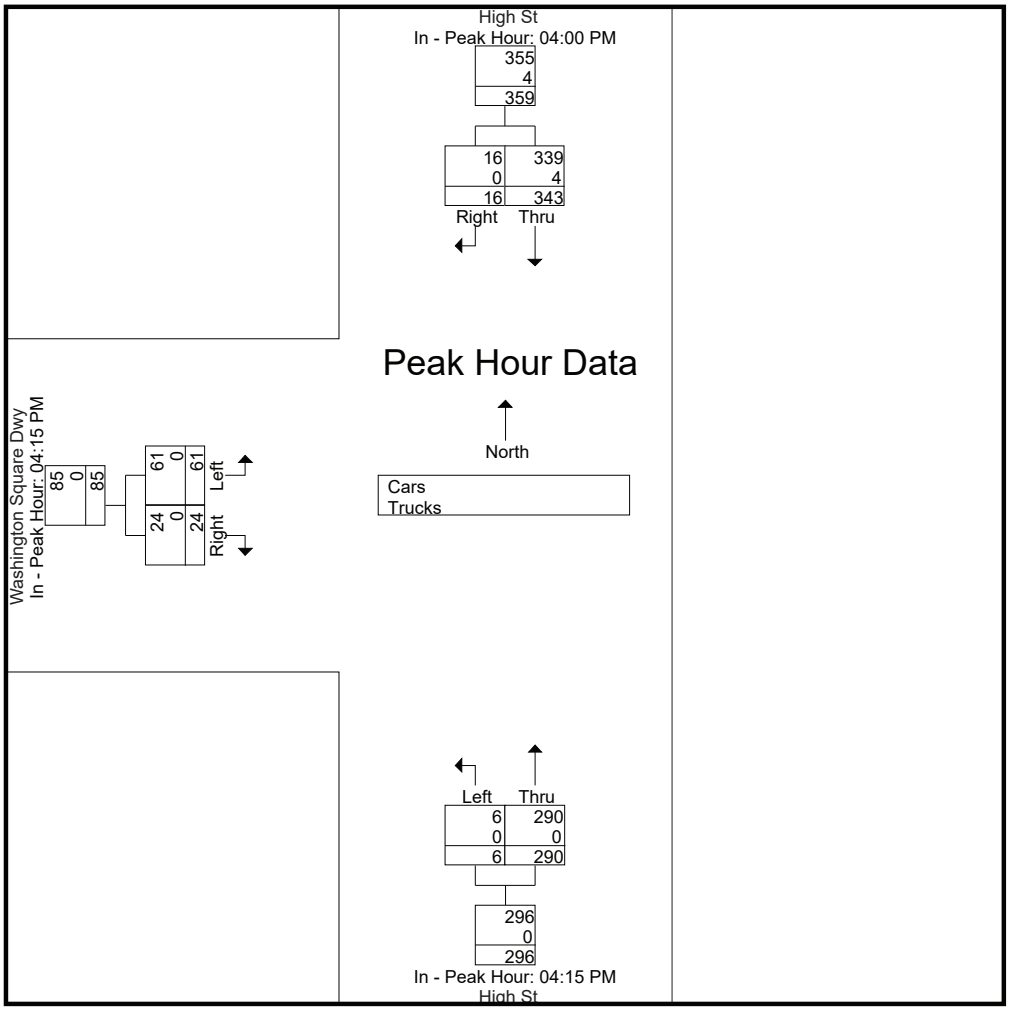
	04:00 PM			04:15 PM			04:15 PM		
+0 mins.	94	2	96	1	71	72	12	**11**	23
+15 mins.	**99**	3	**102**	**2**	60	62	14	2	16
+30 mins.	73	**6**	79	1	64	65	15	7	22
+45 mins.	77	5	82	2	**95**	**97**	**20**	4	**24**
Total Volume	343	16	359	6	290	296	61	24	85
% App. Total	95.5	4.5		2	98		71.8	28.2	
PHF	.866	.667	.880	.750	.763	.763	.763	.545	.885
Cars	339	16	355	6	290	296	61	24	85
% Cars	98.8	100	98.9	100	100	100	100	100	100
Trucks	4	0	4	0	0	0	0	0	0
% Trucks	1.2	0	1.1	0	0	0	0	0	0

Accurate Counts

978-664-2565

N/S Street : High Street
E/W Street : Washington Square Driveway
City/State : Norwell, MA
Weather : Cloudy

File Name : 88900001
Site Code : 88900001
Start Date : 3/31/2021
Page No : 3



Accurate Counts

978-664-2565

N/S Street : High Street
E/W Street : Washington Square Driveway
City/State : Norwell, MA
Weather : Cloudy

File Name : 88900001
Site Code : 88900001
Start Date : 3/31/2021
Page No : 4

Groups Printed- Cars

	High St From North		High St From South		Washington Square Dwy From West		
Start Time	Thru	Right	Left	Thru	Left	Right	Int. Total
04:00 PM	92	2	0	68	5	6	173
04:15 PM	99	3	1	71	12	11	197
04:30 PM	72	6	2	60	14	2	156
04:45 PM	76	5	1	64	15	7	168
Total	339	16	4	263	46	26	694
05:00 PM	87	4	2	95	20	4	212
05:15 PM	77	2	2	65	10	6	162
05:30 PM	76	3	1	54	4	2	140
05:45 PM	56	2	1	45	8	3	115
Total	296	11	6	259	42	15	629
Grand Total	635	27	10	522	88	41	1323
Apprch %	95.9	4.1	1.9	98.1	68.2	31.8	
Total %	48	2	0.8	39.5	6.7	3.1	

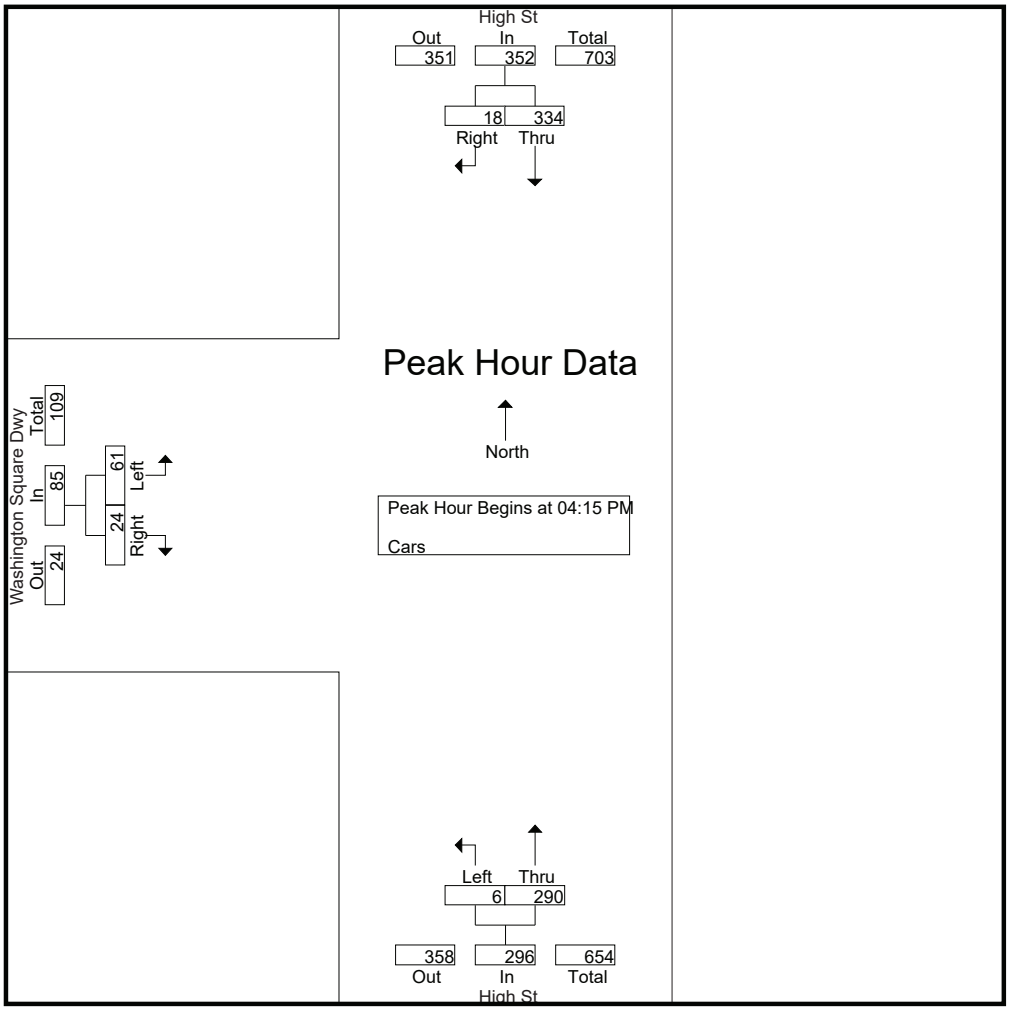
	High St From North			High St From South			Washington Square Dwy From West			
Start Time	Thru	Right	App. Total	Left	Thru	App. Total	Left	Right	App. Total	Int. Total
Peak Hour Analysis From 04:00 PM to 05:45 PM - Peak 1 of 1										
Peak Hour for Entire Intersection Begins at 04:15 PM										
04:15 PM	**99**	3	**102**	1	71	72	12	**11**	23	197
04:30 PM	72	**6**	78	**2**	60	62	14	2	16	156
04:45 PM	76	5	81	1	64	65	15	7	22	168
05:00 PM	87	4	91	2	**95**	**97**	**20**	4	**24**	**212**
Total Volume	334	18	352	6	290	296	61	24	85	733
% App. Total	94.9	5.1		2	98		71.8	28.2		
PHF	.843	.750	.863	.750	.763	.763	.763	.545	.885	.864

Accurate Counts

978-664-2565

N/S Street : High Street
E/W Street : Washington Square Driveway
City/State : Norwell, MA
Weather : Cloudy

File Name : 88900001
Site Code : 88900001
Start Date : 3/31/2021
Page No : 5



Peak Hour Analysis From 04:00 PM to 05:45 PM - Peak 1 of 1
Peak Hour for Each Approach Begins at:

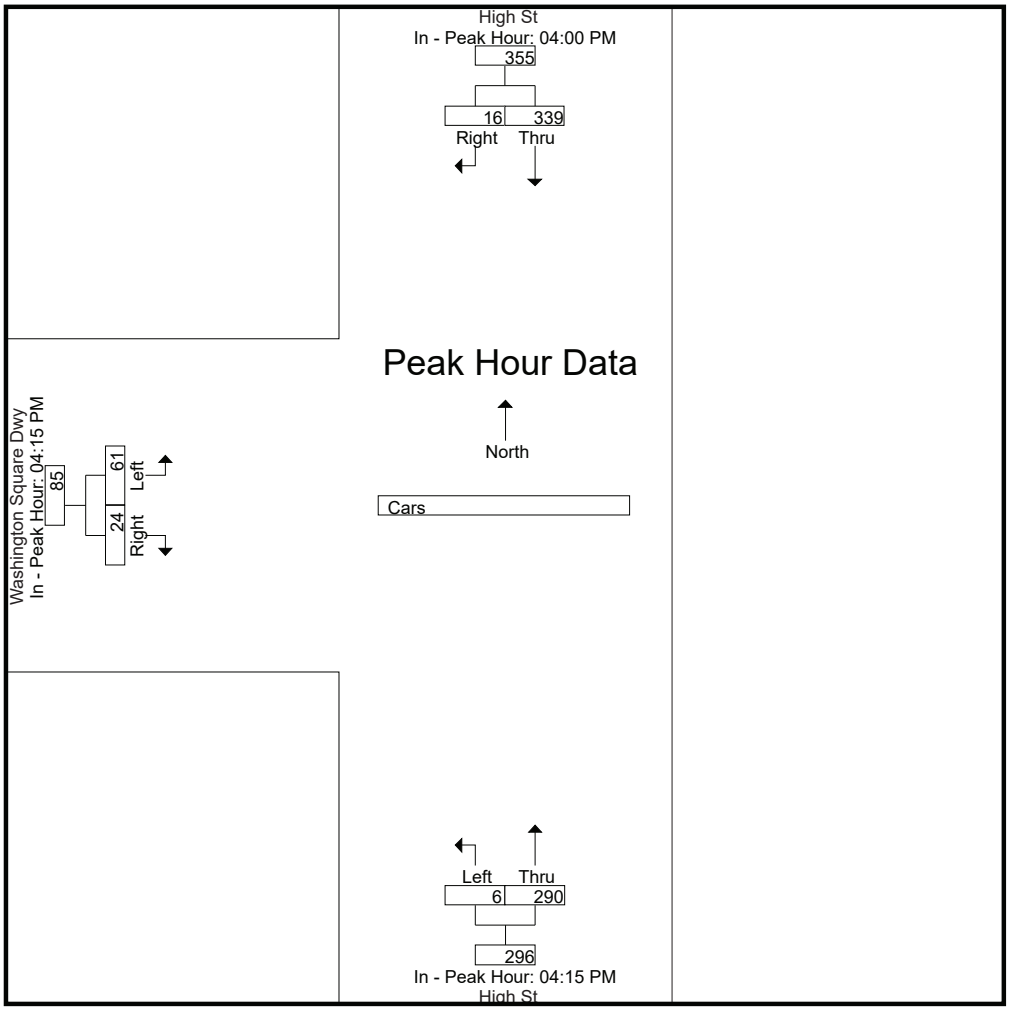
	04:00 PM			04:15 PM			04:15 PM		
+0 mins.	92	2	94	1	71	72	12	**11**	23
+15 mins.	**99**	3	**102**	**2**	60	62	14	2	16
+30 mins.	72	**6**	78	1	64	65	15	7	22
+45 mins.	76	5	81	2	**95**	**97**	**20**	4	**24**
Total Volume	339	16	355	6	290	296	61	24	85
% App. Total	95.5	4.5		2	98		71.8	28.2	
PHF	.856	.667	.870	.750	.763	.763	.763	.545	.885

Accurate Counts

978-664-2565

N/S Street : High Street
E/W Street : Washington Square Driveway
City/State : Norwell, MA
Weather : Cloudy

File Name : 88900001
Site Code : 88900001
Start Date : 3/31/2021
Page No : 6



Accurate Counts

978-664-2565

N/S Street : High Street
E/W Street : Washington Square Driveway
City/State : Norwell, MA
Weather : Cloudy

File Name : 88900001
Site Code : 88900001
Start Date : 3/31/2021
Page No : 7

Groups Printed- Trucks

	High St From North		High St From South		Washington Square Dwy From West		
Start Time	Thru	Right	Left	Thru	Left	Right	Int. Total
04:00 PM	2	0	0	1	0	0	3
04:15 PM	0	0	0	0	0	0	0
04:30 PM	1	0	0	0	0	0	1
04:45 PM	1	0	0	0	0	0	1
Total	4	0	0	1	0	0	5
05:00 PM	0	0	0	0	0	0	0
05:15 PM	1	0	0	2	0	0	3
05:30 PM	1	0	0	1	0	0	2
05:45 PM	0	0	0	0	0	0	0
Total	2	0	0	3	0	0	5
Grand Total	6	0	0	4	0	0	10
Apprch %	100	0	0	100	0	0	
Total %	60	0	0	40	0	0	

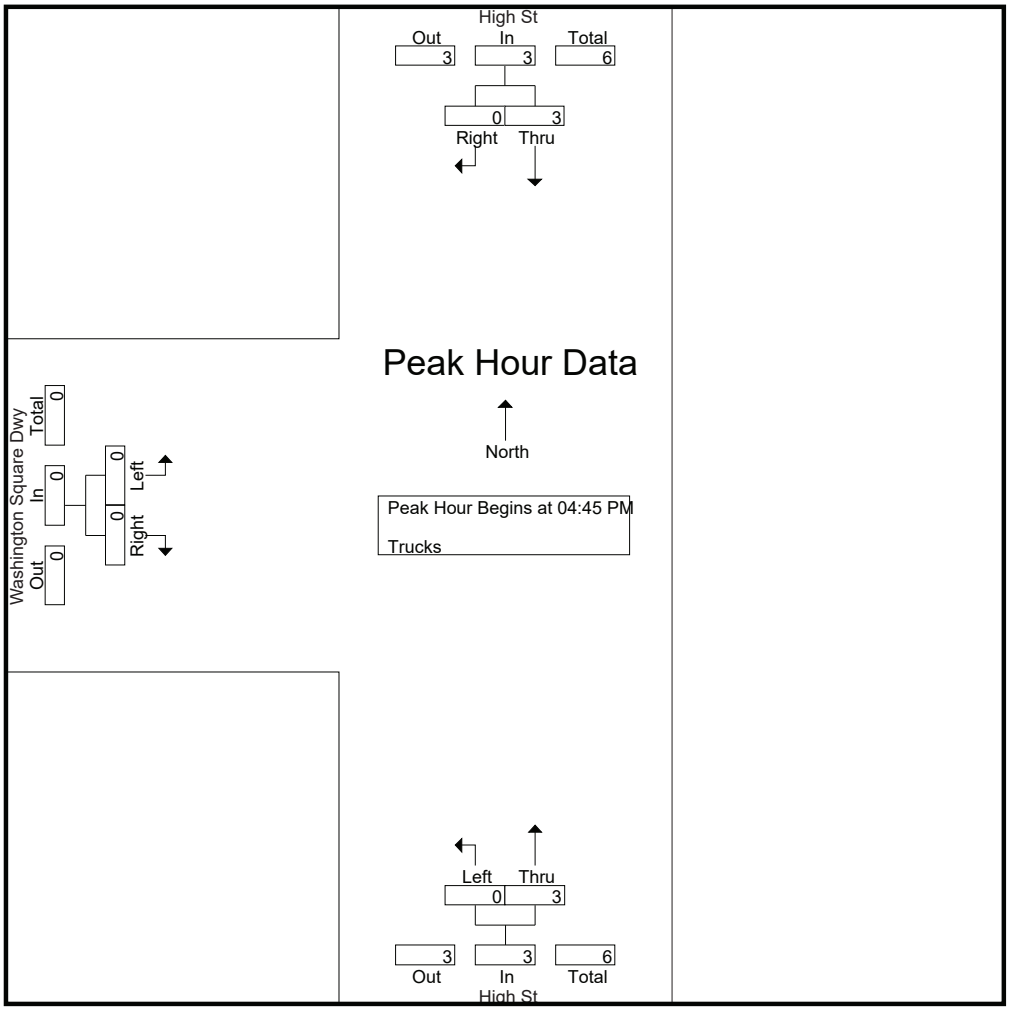
	High St From North			High St From South			Washington Square Dwy From West			
Start Time	Thru	Right	App. Total	Left	Thru	App. Total	Left	Right	App. Total	Int. Total
Peak Hour Analysis From 04:00 PM to 05:45 PM - Peak 1 of 1										
Peak Hour for Entire Intersection Begins at 04:45 PM										
04:45 PM	**1**	0	**1**	0	0	0	0	0	0	1
05:00 PM	0	0	0	0	0	0	0	0	0	0
05:15 PM	1	0	1	0	**2**	**2**	0	0	0	**3**
05:30 PM	1	0	1	0	1	1	0	0	0	2
Total Volume	3	0	3	0	3	3	0	0	0	6
% App. Total	100	0		0	100		0	0		
PHF	.750	.000	.750	.000	.375	.375	.000	.000	.000	.500

Accurate Counts

978-664-2565

N/S Street : High Street
E/W Street : Washington Square Driveway
City/State : Norwell, MA
Weather : Cloudy

File Name : 88900001
Site Code : 88900001
Start Date : 3/31/2021
Page No : 8



Peak Hour Analysis From 04:00 PM to 05:45 PM - Peak 1 of 1

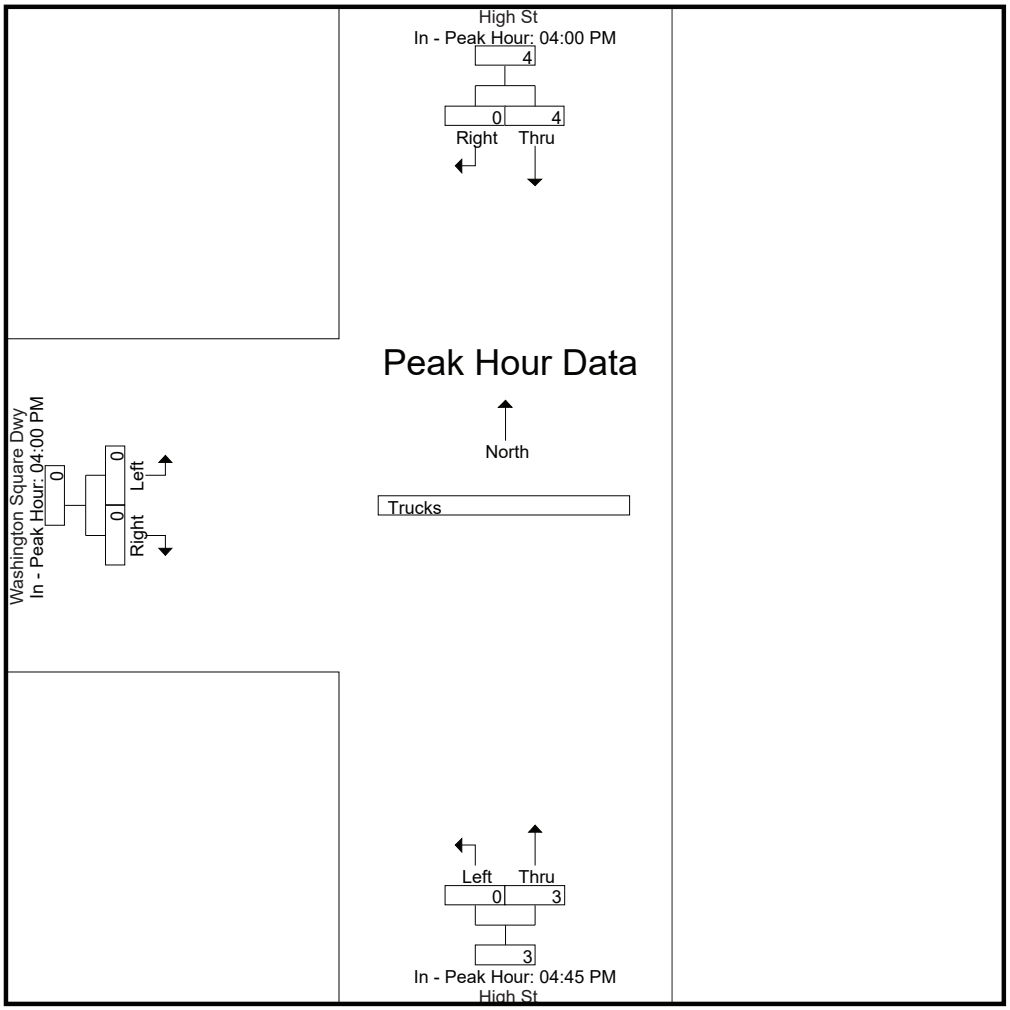
Peak Hour for Each Approach Begins at:

	04:00 PM			04:45 PM			04:00 PM		
+0 mins.	**2**	0	**2**	0	0	0	0	0	0
+15 mins.	0	0	0	0	0	0	0	0	0
+30 mins.	1	0	1	0	**2**	**2**	0	0	0
+45 mins.	1	0	1	0	1	1	0	0	0
Total Volume	4	0	4	0	3	3	0	0	0
% App. Total	100	0		0	100		0	0	
PHF	.500	.000	.500	.000	.375	.375	.000	.000	.000

Accurate Counts
978-664-2565

N/S Street : High Street
E/W Street : Washington Square Driveway
City/State : Norwell, MA
Weather : Cloudy

File Name : 88900001
Site Code : 88900001
Start Date : 3/31/2021
Page No : 9



Accurate Counts

978-664-2565

N/S Street : High Street
E/W Street : Washington Square Driveway
City/State : Norwell, MA
Weather : Cloudy

File Name : 88900001
Site Code : 88900001
Start Date : 3/31/2021
Page No : 10

Groups Printed- Bikes Peds

	High St From North			High St From South			Washington Square Dwy From West					
Start Time	Thru	Right	Peds	Left	Thru	Peds	Left	Right	Peds	Exclu. Total	Inclu. Total	Int. Total
04:00 PM	0	0	0	0	0	2	0	0	0	2	0	2
04:15 PM	1	0	0	0	0	0	0	0	0	0	1	1
04:30 PM	0	1	0	0	0	2	2	0	0	2	3	5
04:45 PM	0	0	0	0	0	2	0	0	2	4	0	4
Total	1	1	0	0	0	6	2	0	2	8	4	12
05:00 PM	0	0	0	0	0	1	0	0	0	1	0	1
05:15 PM	0	0	0	0	0	1	0	0	1	2	0	2
05:30 PM	0	0	0	0	0	0	0	0	0	0	0	0
05:45 PM	0	0	0	0	0	0	0	0	0	0	0	0
Total	0	0	0	0	0	2	0	0	1	3	0	3
Grand Total	1	1	0	0	0	8	2	0	3	11	4	15
Apprch %	50	50		0	0		100	0				
Total %	25	25		0	0		50	0		73.3	26.7	

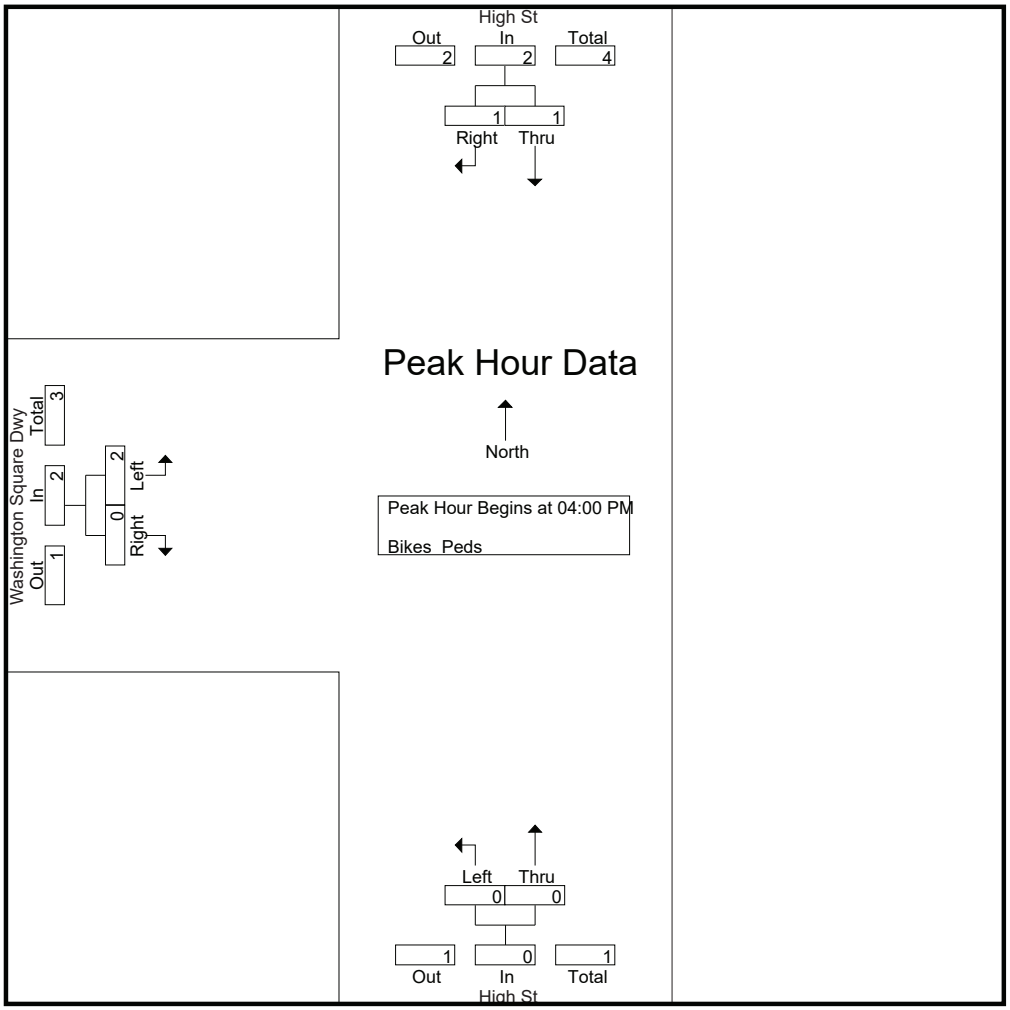
	High St From North			High St From South			Washington Square Dwy From West			
Start Time	Thru	Right	App. Total	Left	Thru	App. Total	Left	Right	App. Total	Int. Total
Peak Hour Analysis From 04:00 PM to 05:45 PM - Peak 1 of 1										
Peak Hour for Entire Intersection Begins at 04:00 PM										
04:00 PM	0	0	0	0	0	0	0	0	0	0
04:15 PM	**1**	0	**1**	0	0	0	0	0	0	1
04:30 PM	0	**1**	1	0	0	0	**2**	0	**2**	**3**
04:45 PM	0	0	0	0	0	0	0	0	0	0
Total Volume	1	1	2	0	0	0	2	0	2	4
% App. Total	50	50		0	0		100	0		
PHF	.250	.250	.500	.000	.000	.000	.250	.000	.250	.333

Accurate Counts

978-664-2565

N/S Street : High Street
E/W Street : Washington Square Driveway
City/State : Norwell, MA
Weather : Cloudy

File Name : 88900001
Site Code : 88900001
Start Date : 3/31/2021
Page No : 11



Peak Hour Analysis From 04:00 PM to 05:45 PM - Peak 1 of 1

Peak Hour for Each Approach Begins at:

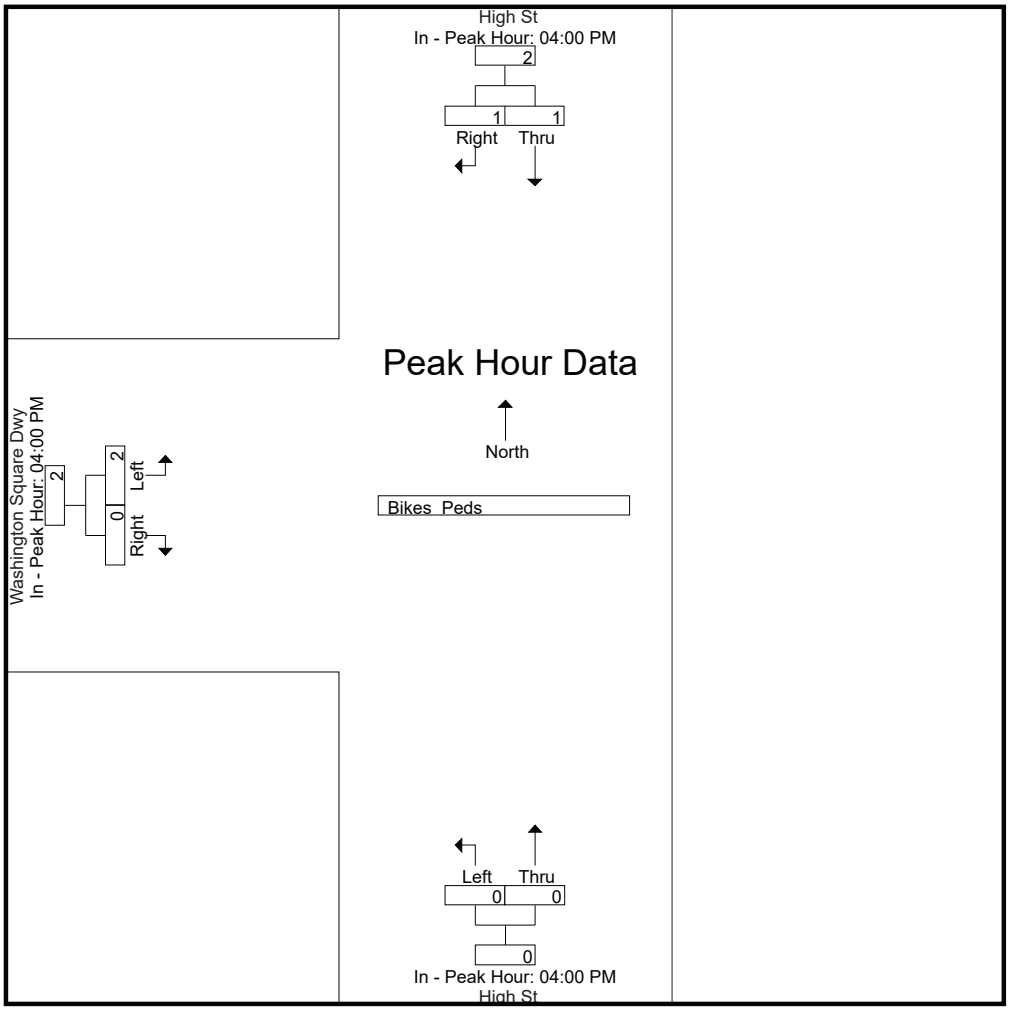
	04:00 PM			04:00 PM			04:00 PM		
+0 mins.	0	0	0	0	0	0	0	0	0
+15 mins.	**1**	0	**1**	0	0	0	0	0	0
+30 mins.	0	**1**	1	0	0	0	**2**	0	**2**
+45 mins.	0	0	0	0	0	0	0	0	0
Total Volume	1	1	2	0	0	0	2	0	2
% App. Total	50	50		0	0		100	0	
PHF	.250	.250	.500	.000	.000	.000	.250	.000	.250

Accurate Counts

978-664-2565

N/S Street : High Street
E/W Street : Washington Square Driveway
City/State : Norwell, MA
Weather : Cloudy

File Name : 88900001
Site Code : 88900001
Start Date : 3/31/2021
Page No : 12



Accurate Counts

978-664-2565

N/S Street : High Street
E/W Street : Oak Street
City/State : Norwell, MA
Weather : Cloudy

File Name : 88900002
Site Code : 88900002
Start Date : 3/31/2021
Page No : 1

Groups Printed- Cars - Trucks

	High St From North		Oak St From East		High St From South		
Start Time	Left	Thru	Left	Right	Thru	Right	Int. Total
07:00 AM	2	23	3	0	44	5	77
07:15 AM	0	29	1	4	46	6	86
07:30 AM	2	57	3	2	61	15	140
07:45 AM	4	74	15	4	57	13	167
Total	8	183	22	10	208	39	470
08:00 AM	0	61	9	1	67	6	144
08:15 AM	3	66	14	2	56	6	147
08:30 AM	1	65	34	6	57	6	169
08:45 AM	0	64	46	3	84	46	243
Total	4	256	103	12	264	64	703
Grand Total	12	439	125	22	472	103	1173
Apprch %	2.7	97.3	85	15	82.1	17.9	
Total %	1	37.4	10.7	1.9	40.2	8.8	
Cars	9	435	119	22	464	99	1148
% Cars	75	99.1	95.2	100	98.3	96.1	97.9
Trucks	3	4	6	0	8	4	25
% Trucks	25	0.9	4.8	0	1.7	3.9	2.1

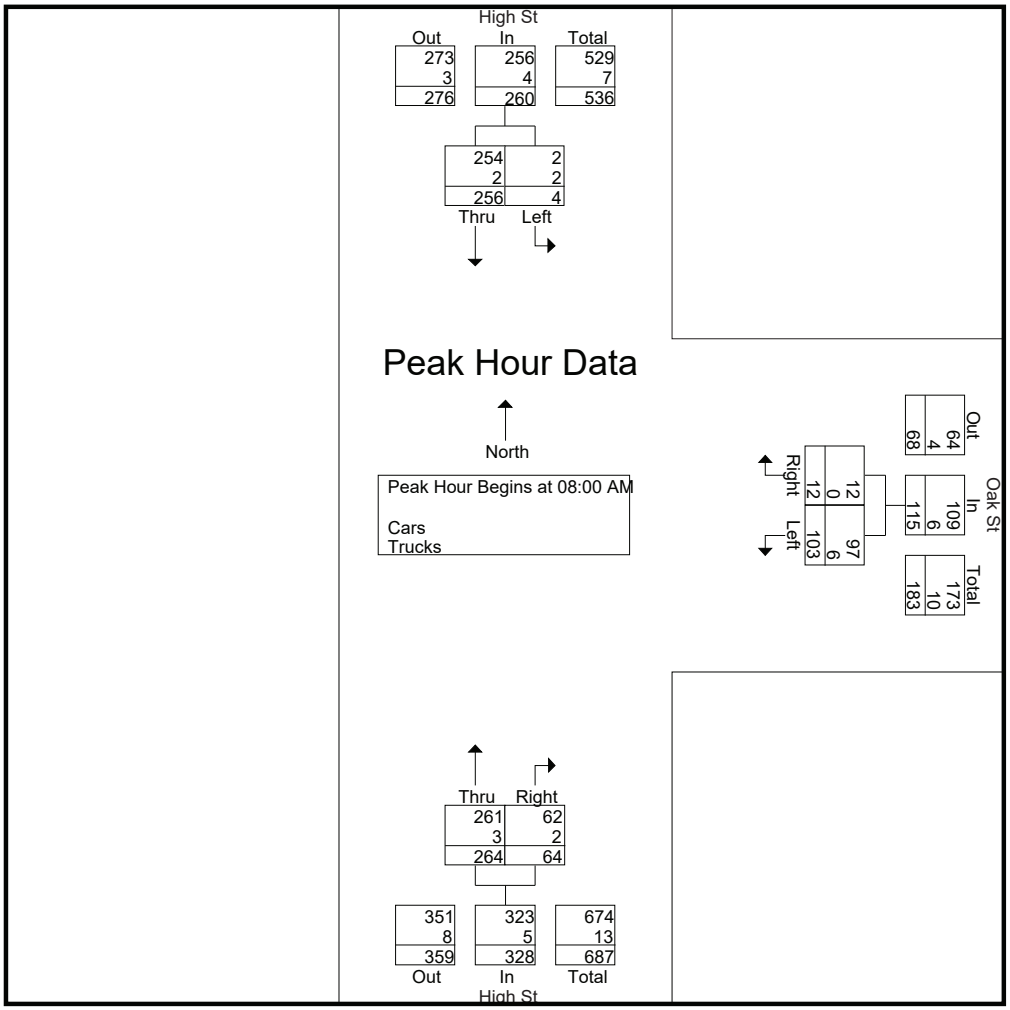
	High St From North			Oak St From East			High St From South			
Start Time	Left	Thru	App. Total	Left	Right	App. Total	Thru	Right	App. Total	Int. Total
Peak Hour Analysis From 07:00 AM to 08:45 AM - Peak 1 of 1										
Peak Hour for Entire Intersection Begins at 08:00 AM										
08:00 AM	0	61	61	9	1	10	67	6	73	144
08:15 AM	**3**	**66**	**69**	14	2	16	56	6	62	147
08:30 AM	1	65	66	34	**6**	40	57	6	63	169
08:45 AM	0	64	64	**46**	3	**49**	**84**	**46**	**130**	**243**
Total Volume	4	256	260	103	12	115	264	64	328	703
% App. Total	1.5	98.5		89.6	10.4		80.5	19.5		
PHF	.333	.970	.942	.560	.500	.587	.786	.348	.631	.723
Cars	2	254	256	97	12	109	261	62	323	688
% Cars	50.0	99.2	98.5	94.2	100	94.8	98.9	96.9	98.5	97.9
Trucks	2	2	4	6	0	6	3	2	5	15
% Trucks	50.0	0.8	1.5	5.8	0	5.2	1.1	3.1	1.5	2.1

Accurate Counts

978-664-2565

N/S Street : High Street
E/W Street : Oak Street
City/State : Norwell, MA
Weather : Cloudy

File Name : 88900002
Site Code : 88900002
Start Date : 3/31/2021
Page No : 2



Peak Hour Analysis From 07:00 AM to 08:45 AM - Peak 1 of 1

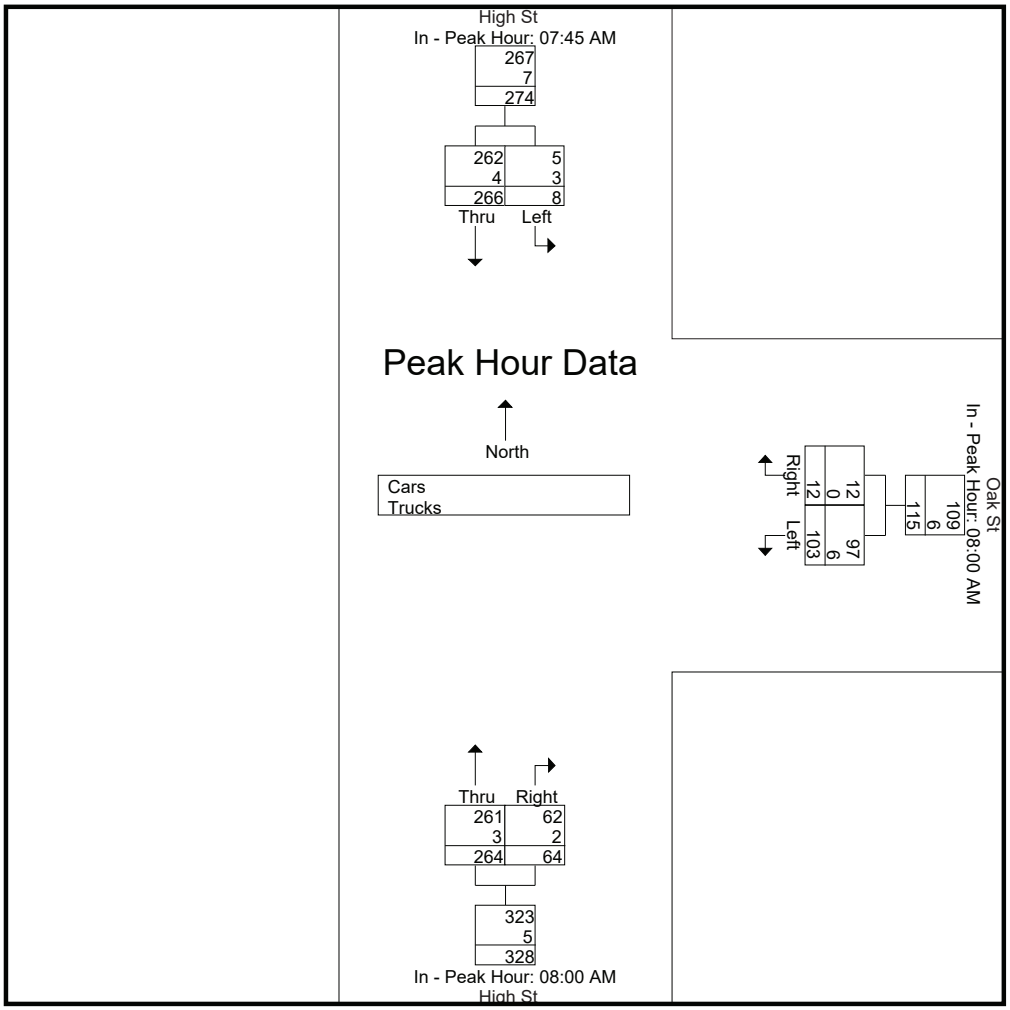
Peak Hour for Each Approach Begins at:

	07:45 AM			08:00 AM			08:00 AM		
+0 mins.	**4**	**74**	**78**	9	1	10	67	6	73
+15 mins.	0	61	61	14	2	16	56	6	62
+30 mins.	3	66	69	34	**6**	40	57	6	63
+45 mins.	1	65	66	**46**	3	**49**	**84**	**46**	**130**
Total Volume	8	266	274	103	12	115	264	64	328
% App. Total	2.9	97.1		89.6	10.4		80.5	19.5	
PHF	.500	.899	.878	.560	.500	.587	.786	.348	.631
Cars	5	262	267	97	12	109	261	62	323
% Cars	62.5	98.5	97.4	94.2	100	94.8	98.9	96.9	98.5
Trucks	3	4	7	6	0	6	3	2	5
% Trucks	37.5	1.5	2.6	5.8	0	5.2	1.1	3.1	1.5

Accurate Counts
978-664-2565

N/S Street : High Street
E/W Street : Oak Street
City/State : Norwell, MA
Weather : Cloudy

File Name : 88900002
Site Code : 88900002
Start Date : 3/31/2021
Page No : 3



Accurate Counts

978-664-2565

N/S Street : High Street
E/W Street : Oak Street
City/State : Norwell, MA
Weather : Cloudy

File Name : 88900002
Site Code : 88900002
Start Date : 3/31/2021
Page No : 4

Groups Printed- Cars

	High St From North		Oak St From East		High St From South		
Start Time	Left	Thru	Left	Right	Thru	Right	Int. Total
07:00 AM	2	23	3	0	42	4	74
07:15 AM	0	29	1	4	45	6	85
07:30 AM	2	57	3	2	60	14	138
07:45 AM	3	72	15	4	56	13	163
Total	7	181	22	10	203	37	460
08:00 AM	0	60	9	1	65	6	141
08:15 AM	2	66	13	2	56	6	145
08:30 AM	0	64	33	6	56	5	164
08:45 AM	0	64	42	3	84	45	238
Total	2	254	97	12	261	62	688
Grand Total	9	435	119	22	464	99	1148
Apprch %	2	98	84.4	15.6	82.4	17.6	
Total %	0.8	37.9	10.4	1.9	40.4	8.6	

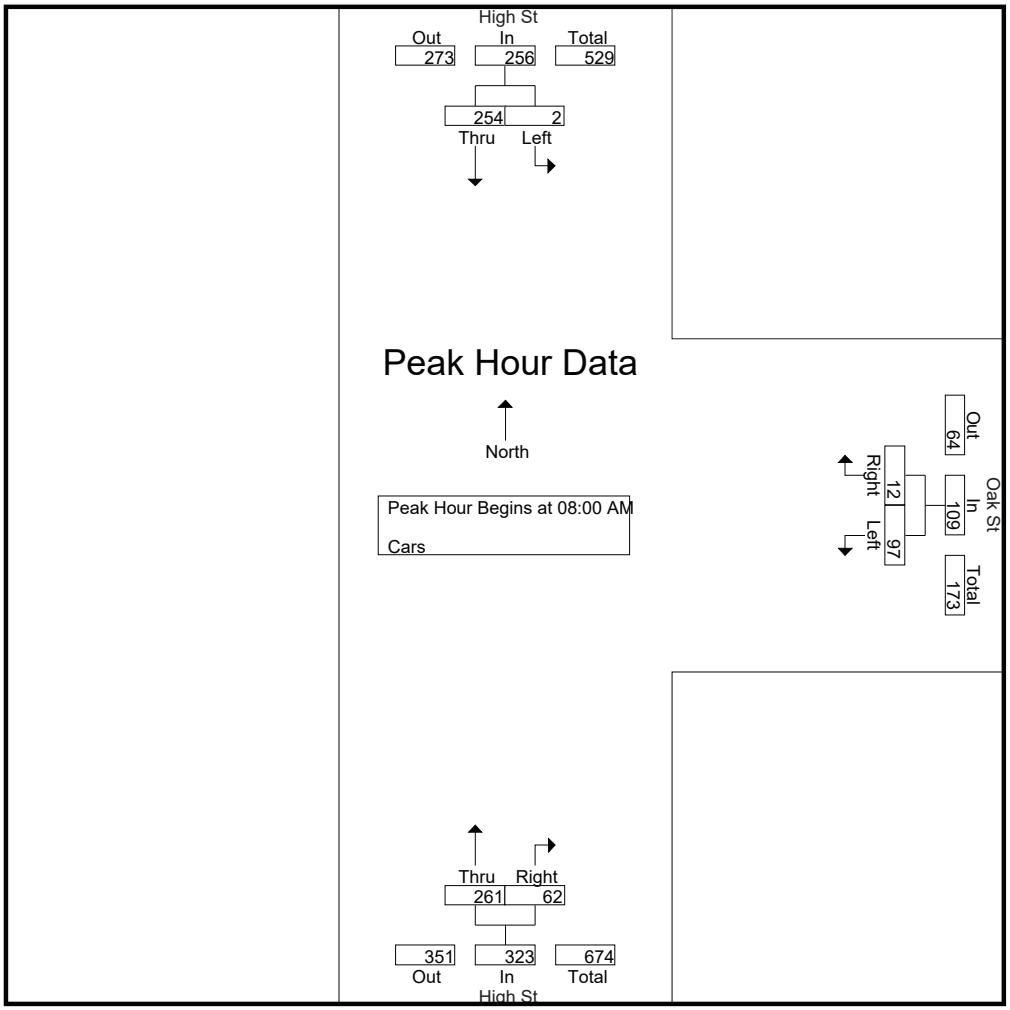
	High St From North			Oak St From East			High St From South			
Start Time	Left	Thru	App. Total	Left	Right	App. Total	Thru	Right	App. Total	Int. Total
Peak Hour Analysis From 07:00 AM to 08:45 AM - Peak 1 of 1										
Peak Hour for Entire Intersection Begins at 08:00 AM										
08:00 AM	0	60	60	9	1	10	65	6	71	141
08:15 AM	**2**	**66**	**68**	13	2	15	56	6	62	145
08:30 AM	0	64	64	33	**6**	39	56	5	61	164
08:45 AM	0	64	64	**42**	3	**45**	**84**	**45**	**129**	**238**
Total Volume	2	254	256	97	12	109	261	62	323	688
% App. Total	0.8	99.2		89	11		80.8	19.2		
PHF	.250	.962	.941	.577	.500	.606	.777	.344	.626	.723

Accurate Counts

978-664-2565

N/S Street : High Street
E/W Street : Oak Street
City/State : Norwell, MA
Weather : Cloudy

File Name : 88900002
Site Code : 88900002
Start Date : 3/31/2021
Page No : 5



Peak Hour Analysis From 07:00 AM to 08:45 AM - Peak 1 of 1

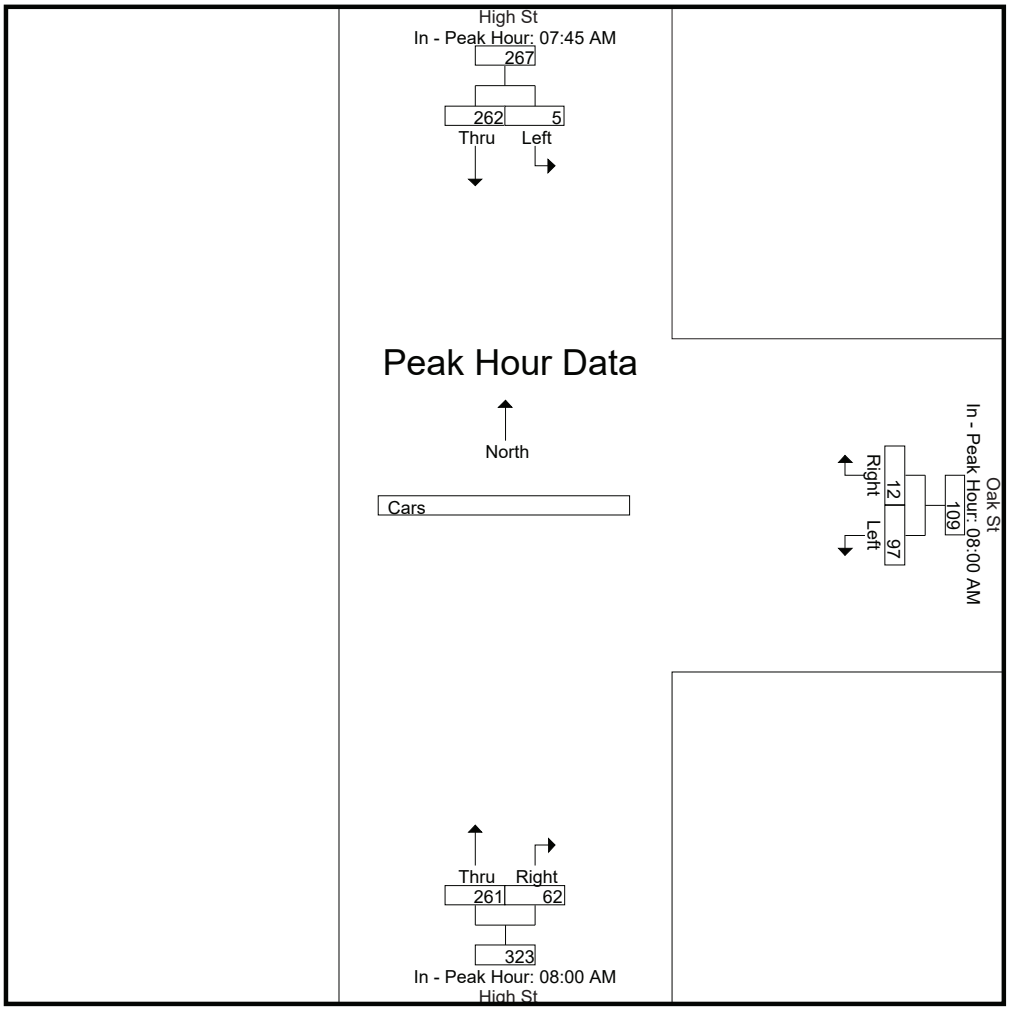
Peak Hour for Each Approach Begins at:

	07:45 AM			08:00 AM			08:00 AM		
+0 mins.	**3**	**72**	**75**	9	1	10	65	6	71
+15 mins.	0	60	60	13	2	15	56	6	62
+30 mins.	2	66	68	33	**6**	39	56	5	61
+45 mins.	0	64	64	**42**	3	**45**	**84**	**45**	**129**
Total Volume	5	262	267	97	12	109	261	62	323
% App. Total	1.9	98.1		89	11		80.8	19.2	
PHF	.417	.910	.890	.577	.500	.606	.777	.344	.626

Accurate Counts
978-664-2565

N/S Street : High Street
E/W Street : Oak Street
City/State : Norwell, MA
Weather : Cloudy

File Name : 88900002
Site Code : 88900002
Start Date : 3/31/2021
Page No : 6



Accurate Counts

978-664-2565

N/S Street : High Street
E/W Street : Oak Street
City/State : Norwell, MA
Weather : Cloudy

File Name : 88900002
Site Code : 88900002
Start Date : 3/31/2021
Page No : 7

Groups Printed- Trucks

	High St From North		Oak St From East		High St From South		
Start Time	Left	Thru	Left	Right	Thru	Right	Int. Total
07:00 AM	0	0	0	0	2	1	3
07:15 AM	0	0	0	0	1	0	1
07:30 AM	0	0	0	0	1	1	2
07:45 AM	1	2	0	0	1	0	4
Total	1	2	0	0	5	2	10
08:00 AM	0	1	0	0	2	0	3
08:15 AM	1	0	1	0	0	0	2
08:30 AM	1	1	1	0	1	1	5
08:45 AM	0	0	4	0	0	1	5
Total	2	2	6	0	3	2	15
Grand Total	3	4	6	0	8	4	25
Apprch %	42.9	57.1	100	0	66.7	33.3	
Total %	12	16	24	0	32	16	

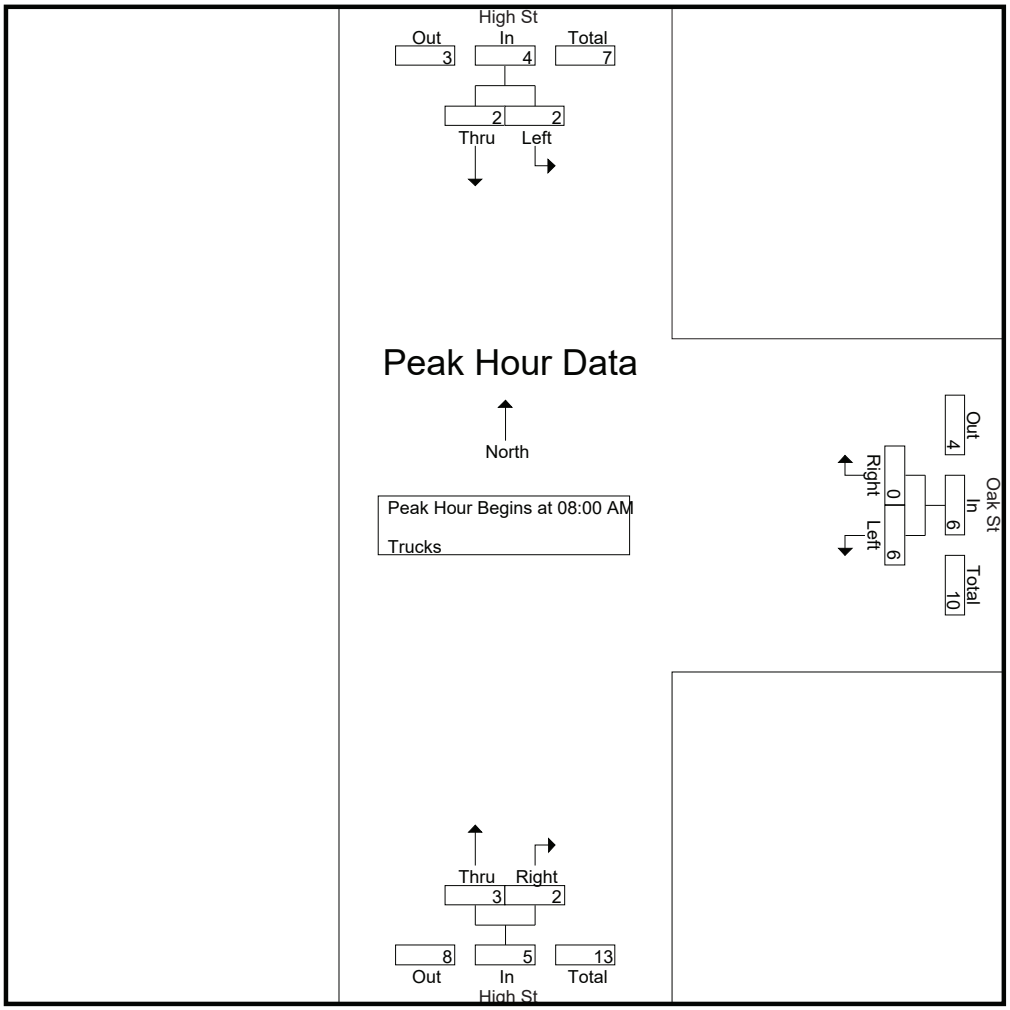
	High St From North			Oak St From East			High St From South			
Start Time	Left	Thru	App. Total	Left	Right	App. Total	Thru	Right	App. Total	Int. Total
Peak Hour Analysis From 07:00 AM to 08:45 AM - Peak 1 of 1										
Peak Hour for Entire Intersection Begins at 08:00 AM										
08:00 AM	0	**1**	1	0	0	0	**2**	0	**2**	3
08:15 AM	**1**	0	1	1	0	1	0	0	0	2
08:30 AM	1	1	**2**	1	0	1	1	**1**	2	**5**
08:45 AM	0	0	0	**4**	0	**4**	0	1	1	5
Total Volume	2	2	4	6	0	6	3	2	5	15
% App. Total	50	50		100	0		60	40		
PHF	.500	.500	.500	.375	.000	.375	.375	.500	.625	.750

Accurate Counts

978-664-2565

N/S Street : High Street
E/W Street : Oak Street
City/State : Norwell, MA
Weather : Cloudy

File Name : 88900002
Site Code : 88900002
Start Date : 3/31/2021
Page No : 8



Peak Hour Analysis From 07:00 AM to 08:45 AM - Peak 1 of 1

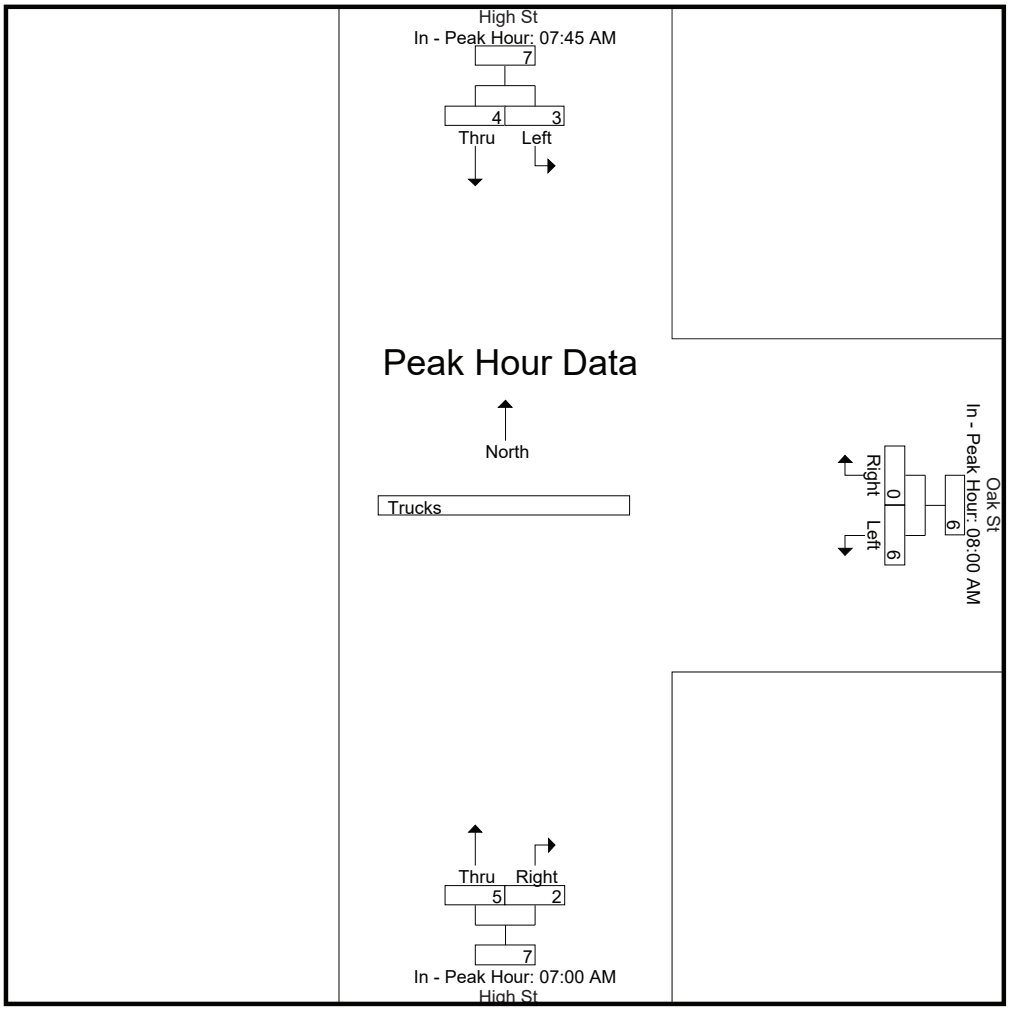
Peak Hour for Each Approach Begins at:

	07:45 AM			08:00 AM			07:00 AM		
+0 mins.	**1**	**2**	**3**	0	0	0	**2**	**1**	**3**
+15 mins.	0	1	1	1	0	1	1	0	1
+30 mins.	1	0	1	1	0	1	1	1	2
+45 mins.	1	1	2	**4**	0	**4**	1	0	1
Total Volume	3	4	7	6	0	6	5	2	7
% App. Total	42.9	57.1		100	0		71.4	28.6	
PHF	.750	.500	.583	.375	.000	.375	.625	.500	.583

Accurate Counts
978-664-2565

N/S Street : High Street
E/W Street : Oak Street
City/State : Norwell, MA
Weather : Cloudy

File Name : 88900002
Site Code : 88900002
Start Date : 3/31/2021
Page No : 9



Accurate Counts

978-664-2565

N/S Street : High Street
E/W Street : Oak Street
City/State : Norwell, MA
Weather : Cloudy

File Name : 88900002
Site Code : 88900002
Start Date : 3/31/2021
Page No : 10

Groups Printed- Bikes Peds

	High St From North			Oak St From East			High St From South					
Start Time	Left	Thru	Peds	Left	Right	Peds	Thru	Right	Peds	Exclu. Total	Inclu. Total	Int. Total
07:00 AM	0	0	0	0	0	0	0	0	0	0	0	0
07:15 AM	0	0	0	0	0	0	0	0	0	0	0	0
07:30 AM	0	0	0	0	0	0	0	0	0	0	0	0
07:45 AM	0	0	0	0	0	0	0	0	0	0	0	0
Total	0	0	0	0	0	0	0	0	0	0	0	0
08:00 AM	0	0	0	0	0	0	0	1	0	0	1	1
08:15 AM	0	0	0	1	0	0	0	0	2	2	1	3
08:30 AM	0	0	0	1	0	0	0	0	0	0	1	1
08:45 AM	0	0	0	0	0	0	0	0	1	1	0	1
Total	0	0	0	2	0	0	0	1	3	3	3	6
Grand Total	0	0	0	2	0	0	0	1	3	3	3	6
Apprch %	0	0		100	0		0	100				
Total %	0	0		66.7	0		0	33.3		50	50	

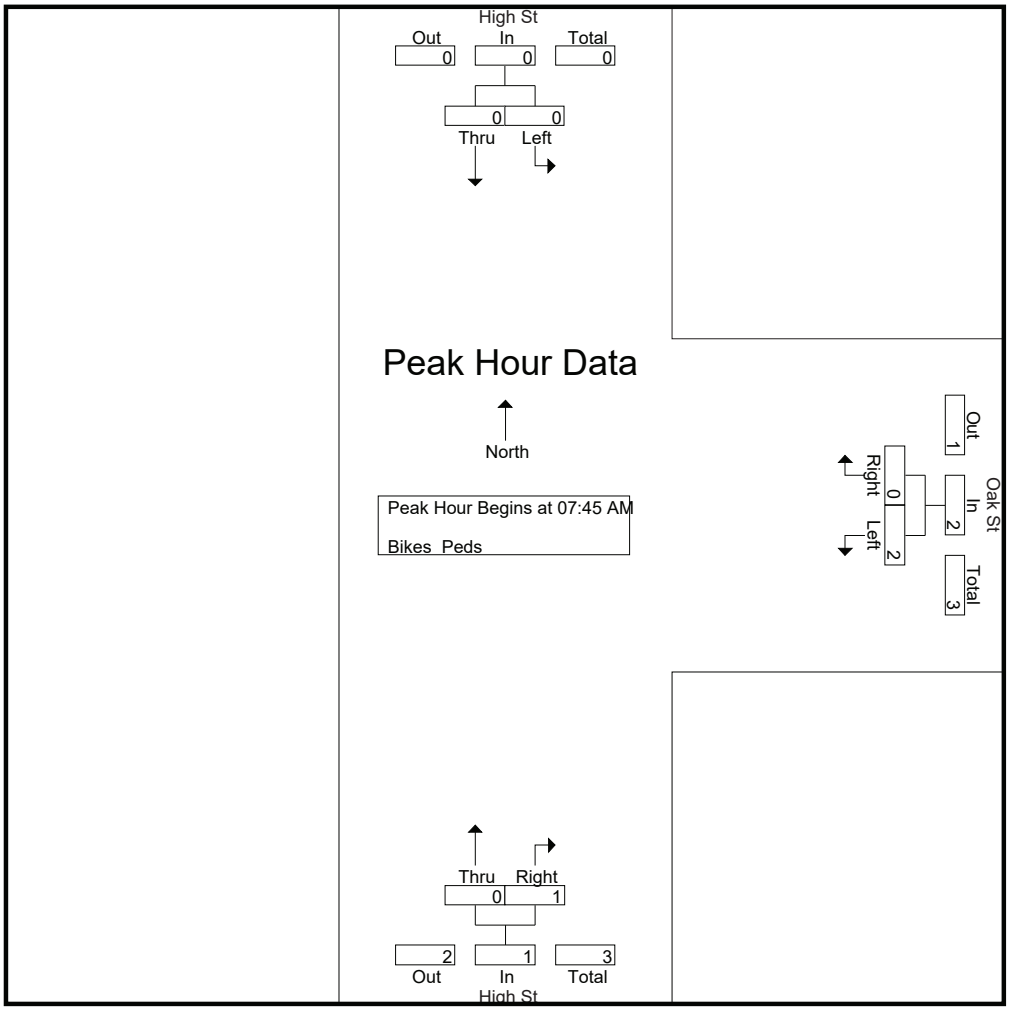
	High St From North			Oak St From East			High St From South			
Start Time	Left	Thru	App. Total	Left	Right	App. Total	Thru	Right	App. Total	Int. Total
Peak Hour Analysis From 07:00 AM to 08:45 AM - Peak 1 of 1										
Peak Hour for Entire Intersection Begins at 07:45 AM										
07:45 AM	0	0	0	0	0	0	0	0	0	0
08:00 AM	0	0	0	0	0	0	0	**1**	**1**	**1**
08:15 AM	0	0	0	**1**	0	**1**	0	0	0	1
08:30 AM	0	0	0	1	0	1	0	0	0	1
Total Volume	0	0	0	2	0	2	0	1	1	3
% App. Total	0	0		100	0		0	100		
PHF	.000	.000	.000	.500	.000	.500	.000	.250	.250	.750

Accurate Counts

978-664-2565

N/S Street : High Street
E/W Street : Oak Street
City/State : Norwell, MA
Weather : Cloudy

File Name : 88900002
Site Code : 88900002
Start Date : 3/31/2021
Page No : 11



Peak Hour Analysis From 07:00 AM to 08:45 AM - Peak 1 of 1

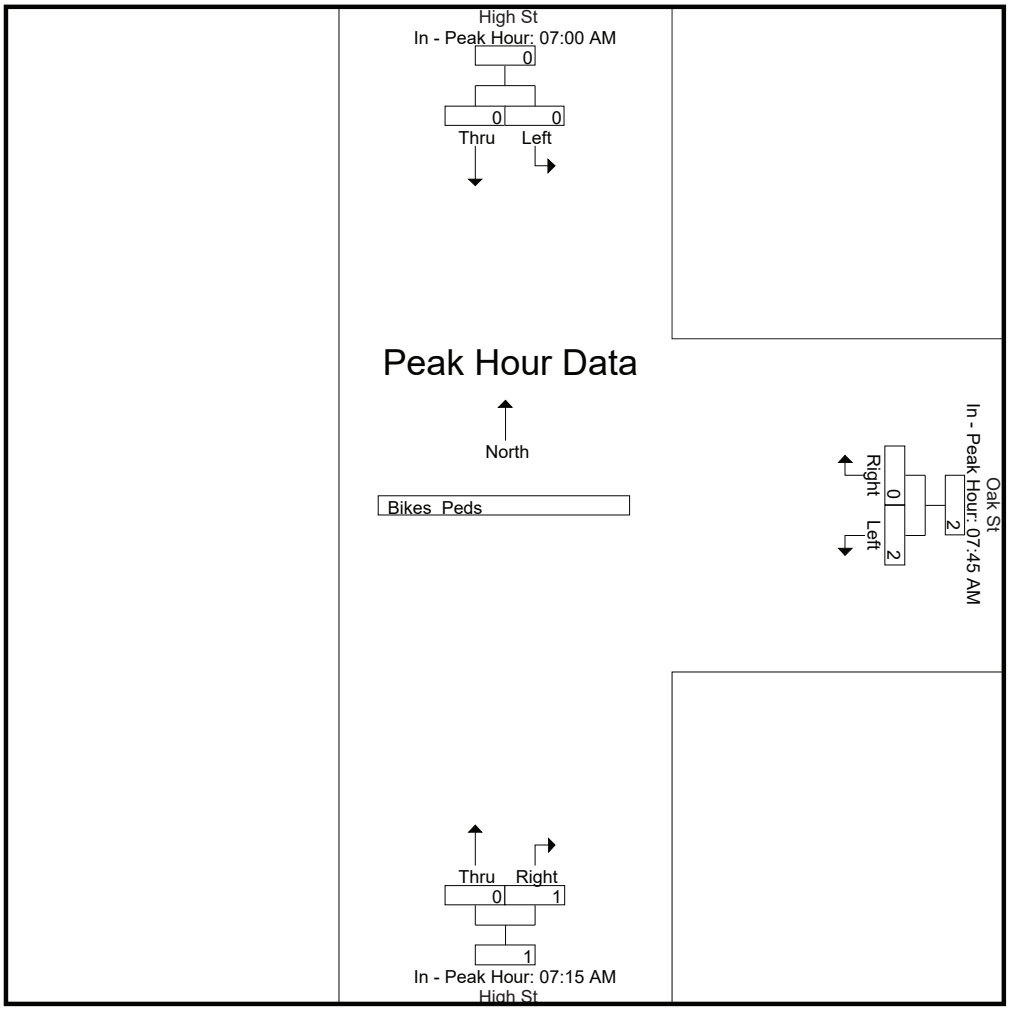
Peak Hour for Each Approach Begins at:

	07:00 AM			07:45 AM			07:15 AM		
+0 mins.	0	0	0	0	0	0	0	0	0
+15 mins.	0	0	0	0	0	0	0	0	0
+30 mins.	0	0	0	**1**	0	**1**	0	0	0
+45 mins.	0	0	0	1	0	1	0	**1**	**1**
Total Volume	0	0	0	2	0	2	0	1	1
% App. Total	0	0		100	0		0	100	
PHF	.000	.000	.000	.500	.000	.500	.000	.250	.250

Accurate Counts
978-664-2565

N/S Street : High Street
E/W Street : Oak Street
City/State : Norwell, MA
Weather : Cloudy

File Name : 88900002
Site Code : 88900002
Start Date : 3/31/2021
Page No : 12



Accurate Counts

978-664-2565

N/S Street : High Street
E/W Street : Oak Street
City/State : Norwell, MA
Weather : Cloudy

File Name : 88900002
Site Code : 88900002
Start Date : 3/31/2021
Page No : 1

Groups Printed- Cars - Trucks

	High St From North		Oak St From East		High St From South		
Start Time	Left	Thru	Left	Right	Thru	Right	Int. Total
04:00 PM	7	82	8	0	67	9	173
04:15 PM	5	92	4	3	57	7	168
04:30 PM	7	60	13	2	60	3	145
04:45 PM	5	71	8	1	62	6	153
Total	24	305	33	6	246	25	639
05:00 PM	3	75	15	4	85	4	186
05:15 PM	7	66	8	1	63	8	153
05:30 PM	4	72	11	4	53	6	150
05:45 PM	2	51	6	1	46	4	110
Total	16	264	40	10	247	22	599
Grand Total	40	569	73	16	493	47	1238
Apprch %	6.6	93.4	82	18	91.3	8.7	
Total %	3.2	46	5.9	1.3	39.8	3.8	
Cars	40	562	73	16	490	47	1228
% Cars	100	98.8	100	100	99.4	100	99.2
Trucks	0	7	0	0	3	0	10
% Trucks	0	1.2	0	0	0.6	0	0.8

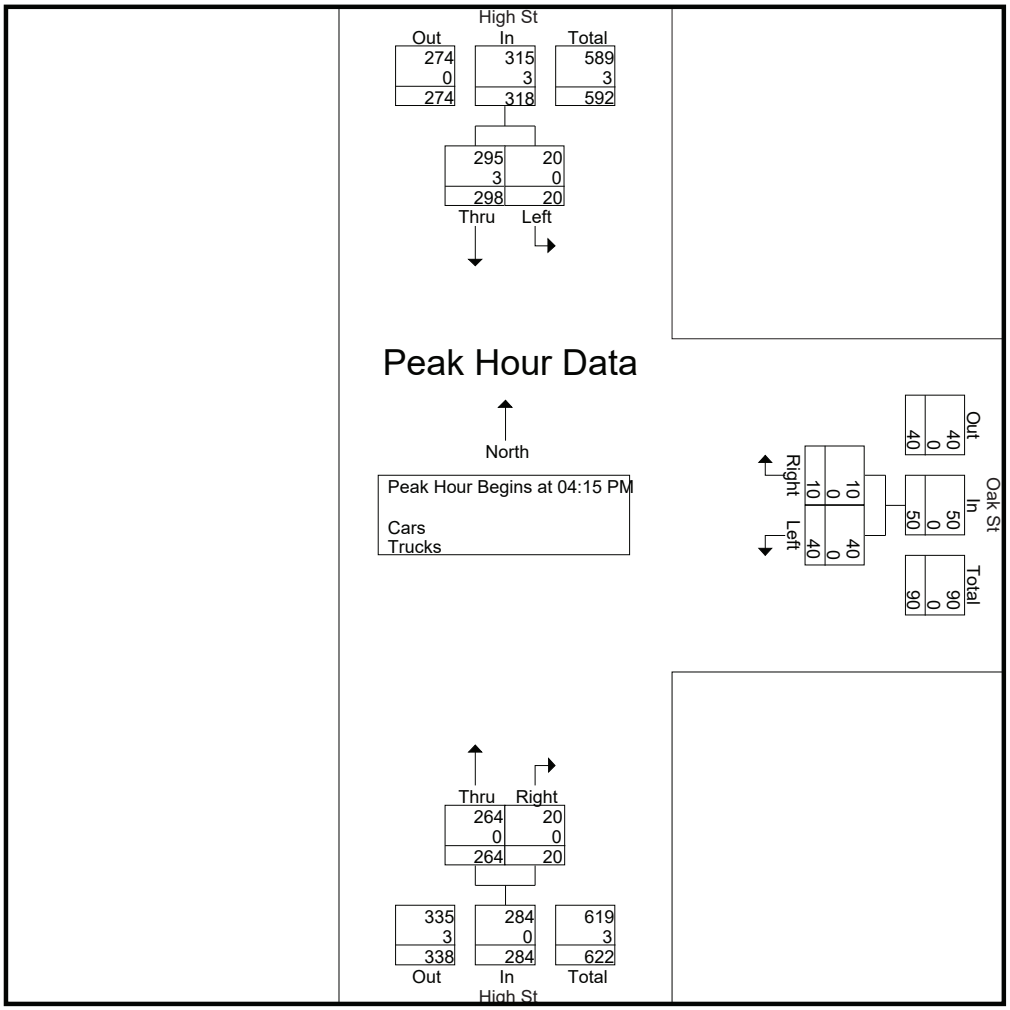
	High St From North			Oak St From East			High St From South			
Start Time	Left	Thru	App. Total	Left	Right	App. Total	Thru	Right	App. Total	Int. Total
Peak Hour Analysis From 04:00 PM to 05:45 PM - Peak 1 of 1										
Peak Hour for Entire Intersection Begins at 04:15 PM										
04:15 PM	5	**92**	**97**	4	3	7	57	**7**	64	168
04:30 PM	**7**	60	67	13	2	15	60	3	63	145
04:45 PM	5	71	76	8	1	9	62	6	68	153
05:00 PM	3	75	78	**15**	**4**	**19**	**85**	4	**89**	**186**
Total Volume	20	298	318	40	10	50	264	20	284	652
% App. Total	6.3	93.7		80	20		93	7		
PHF	.714	.810	.820	.667	.625	.658	.776	.714	.798	.876
Cars	20	295	315	40	10	50	264	20	284	649
% Cars	100	99.0	99.1	100	100	100	100	100	100	99.5
Trucks	0	3	3	0	0	0	0	0	0	3
% Trucks	0	1.0	0.9	0	0	0	0	0	0	0.5

Accurate Counts

978-664-2565

N/S Street : High Street
E/W Street : Oak Street
City/State : Norwell, MA
Weather : Cloudy

File Name : 88900002
Site Code : 88900002
Start Date : 3/31/2021
Page No : 2



Peak Hour Analysis From 04:00 PM to 05:45 PM - Peak 1 of 1

Peak Hour for Each Approach Begins at:

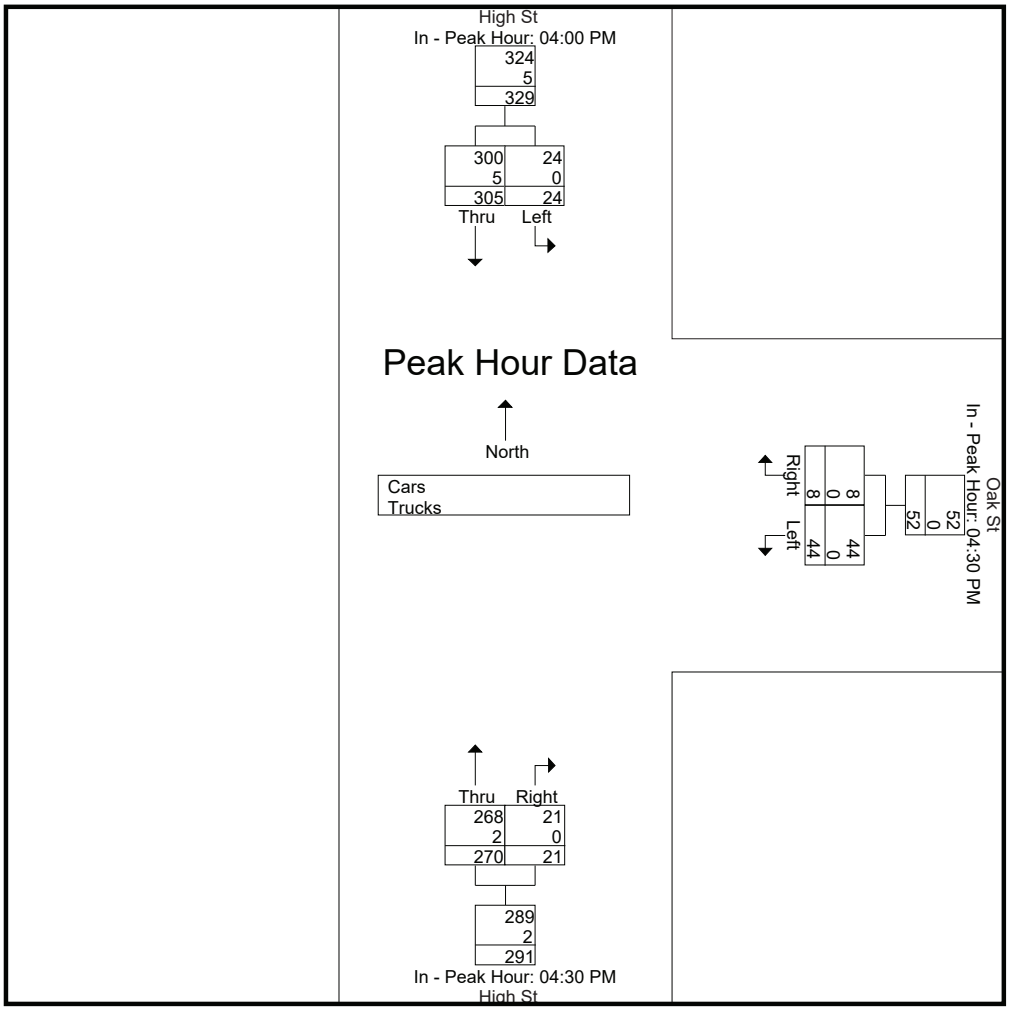
	04:00 PM			04:30 PM			04:30 PM		
+0 mins.	**7**	82	89	13	2	15	60	3	63
+15 mins.	5	**92**	**97**	8	1	9	62	6	68
+30 mins.	7	60	67	**15**	**4**	**19**	**85**	4	**89**
+45 mins.	5	71	76	8	1	9	63	**8**	71
Total Volume	24	305	329	44	8	52	270	21	291
% App. Total	7.3	92.7		84.6	15.4		92.8	7.2	
PHF	.857	.829	.848	.733	.500	.684	.794	.656	.817
Cars	24	300	324	44	8	52	268	21	289
% Cars	100	98.4	98.5	100	100	100	99.3	100	99.3
Trucks	0	5	5	0	0	0	2	0	2
% Trucks	0	1.6	1.5	0	0	0	0.7	0	0.7

Accurate Counts

978-664-2565

N/S Street : High Street
E/W Street : Oak Street
City/State : Norwell, MA
Weather : Cloudy

File Name : 88900002
Site Code : 88900002
Start Date : 3/31/2021
Page No : 3



Accurate Counts

978-664-2565

N/S Street : High Street
E/W Street : Oak Street
City/State : Norwell, MA
Weather : Cloudy

File Name : 88900002
Site Code : 88900002
Start Date : 3/31/2021
Page No : 4

Groups Printed- Cars

	High St From North		Oak St From East		High St From South		
Start Time	Left	Thru	Left	Right	Thru	Right	Int. Total
04:00 PM	7	80	8	0	66	9	170
04:15 PM	5	92	4	3	57	7	168
04:30 PM	7	58	13	2	60	3	143
04:45 PM	5	70	8	1	62	6	152
Total	24	300	33	6	245	25	633
05:00 PM	3	75	15	4	85	4	186
05:15 PM	7	65	8	1	61	8	150
05:30 PM	4	71	11	4	53	6	149
05:45 PM	2	51	6	1	46	4	110
Total	16	262	40	10	245	22	595
Grand Total	40	562	73	16	490	47	1228
Apprch %	6.6	93.4	82	18	91.2	8.8	
Total %	3.3	45.8	5.9	1.3	39.9	3.8	

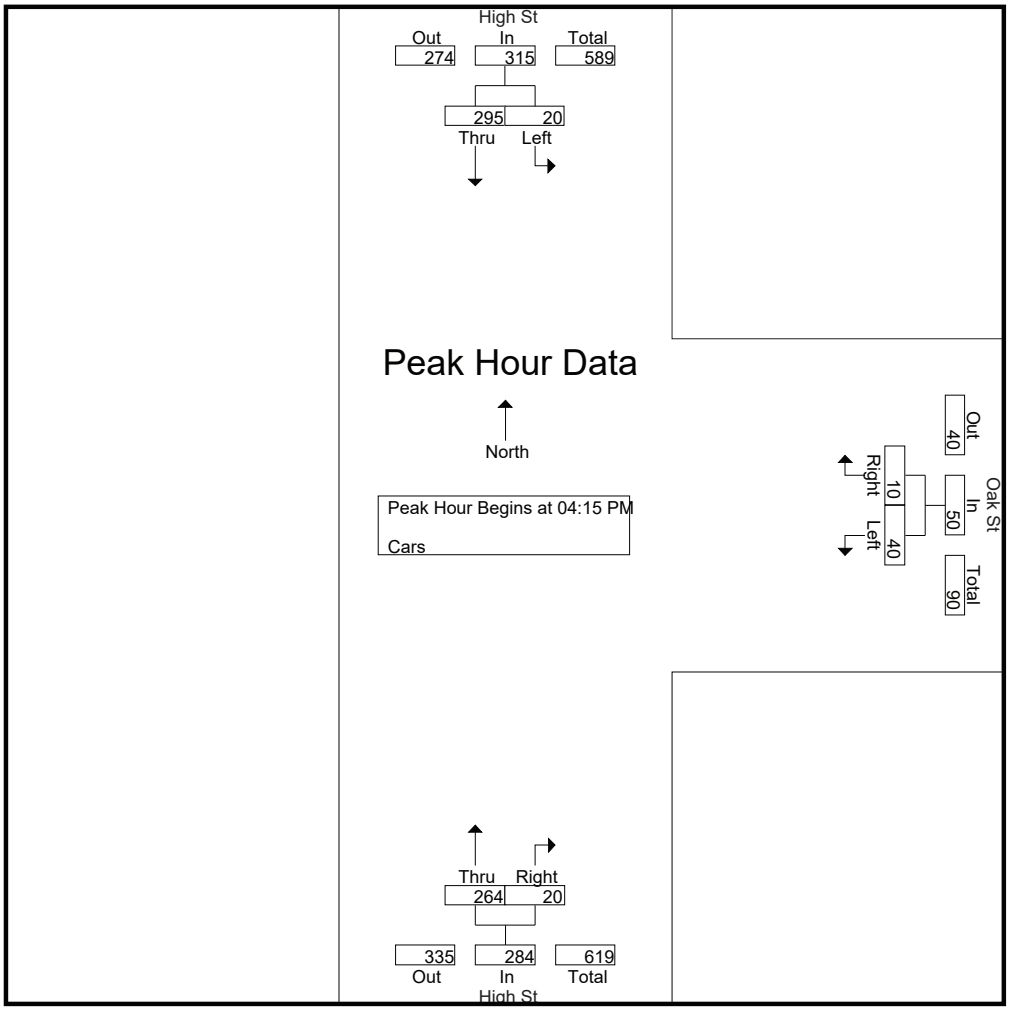
	High St From North			Oak St From East			High St From South			
Start Time	Left	Thru	App. Total	Left	Right	App. Total	Thru	Right	App. Total	Int. Total
Peak Hour Analysis From 04:00 PM to 05:45 PM - Peak 1 of 1										
Peak Hour for Entire Intersection Begins at 04:15 PM										
04:15 PM	5	**92**	**97**	4	3	7	57	**7**	64	168
04:30 PM	**7**	58	65	13	2	15	60	3	63	143
04:45 PM	5	70	75	8	1	9	62	6	68	152
05:00 PM	3	75	78	**15**	**4**	**19**	**85**	4	**89**	**186**
Total Volume	20	295	315	40	10	50	264	20	284	649
% App. Total	6.3	93.7		80	20		93	7		
PHF	.714	.802	.812	.667	.625	.658	.776	.714	.798	.872

Accurate Counts

978-664-2565

N/S Street : High Street
E/W Street : Oak Street
City/State : Norwell, MA
Weather : Cloudy

File Name : 88900002
Site Code : 88900002
Start Date : 3/31/2021
Page No : 5



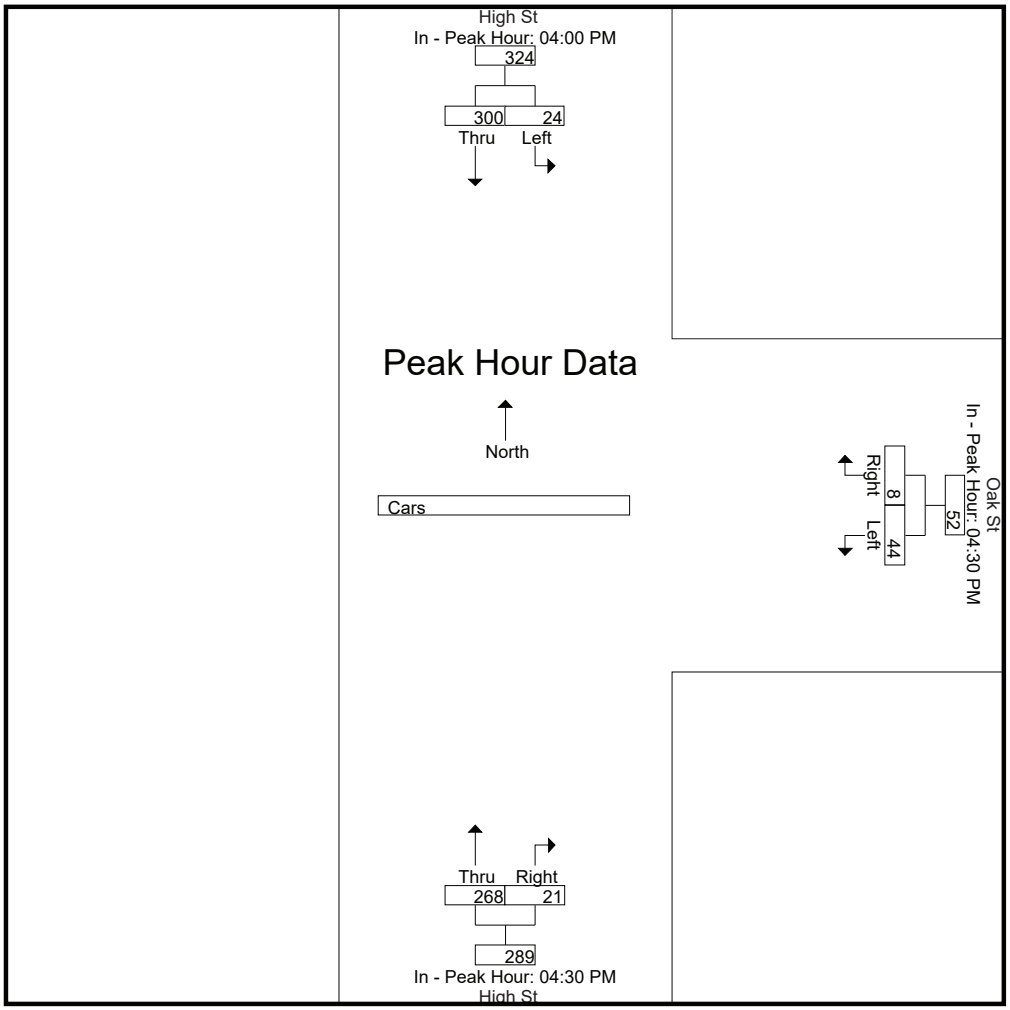
Peak Hour Analysis From 04:00 PM to 05:45 PM - Peak 1 of 1
Peak Hour for Each Approach Begins at:

	04:00 PM			04:30 PM			04:30 PM		
+0 mins.	**7**	80	87	13	2	15	60	3	63
+15 mins.	5	**92**	**97**	8	1	9	62	6	68
+30 mins.	7	58	65	**15**	**4**	**19**	**85**	4	**89**
+45 mins.	5	70	75	8	1	9	61	**8**	69
Total Volume	24	300	324	44	8	52	268	21	289
% App. Total	7.4	92.6		84.6	15.4		92.7	7.3	
PHF	.857	.815	.835	.733	.500	.684	.788	.656	.812

Accurate Counts
978-664-2565

N/S Street : High Street
E/W Street : Oak Street
City/State : Norwell, MA
Weather : Cloudy

File Name : 88900002
Site Code : 88900002
Start Date : 3/31/2021
Page No : 6



Accurate Counts

978-664-2565

N/S Street : High Street
E/W Street : Oak Street
City/State : Norwell, MA
Weather : Cloudy

File Name : 88900002
Site Code : 88900002
Start Date : 3/31/2021
Page No : 7

Groups Printed- Trucks

	High St From North		Oak St From East		High St From South		
Start Time	Left	Thru	Left	Right	Thru	Right	Int. Total
04:00 PM	0	2	0	0	1	0	3
04:15 PM	0	0	0	0	0	0	0
04:30 PM	0	2	0	0	0	0	2
04:45 PM	0	1	0	0	0	0	1
Total	0	5	0	0	1	0	6
05:00 PM	0	0	0	0	0	0	0
05:15 PM	0	1	0	0	2	0	3
05:30 PM	0	1	0	0	0	0	1
05:45 PM	0	0	0	0	0	0	0
Total	0	2	0	0	2	0	4
Grand Total	0	7	0	0	3	0	10
Apprch %	0	100	0	0	100	0	
Total %	0	70	0	0	30	0	

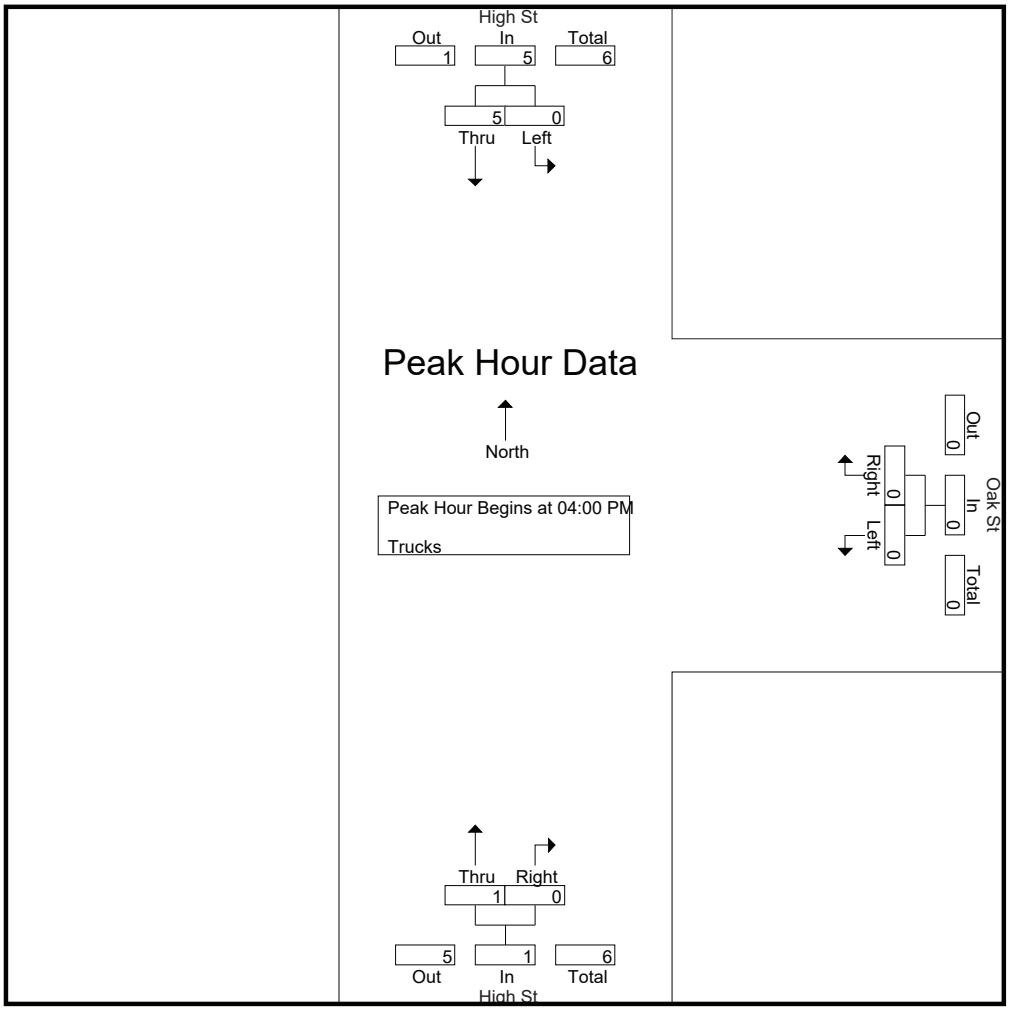
	High St From North			Oak St From East			High St From South			
Start Time	Left	Thru	App. Total	Left	Right	App. Total	Thru	Right	App. Total	Int. Total
Peak Hour Analysis From 04:00 PM to 05:45 PM - Peak 1 of 1										
Peak Hour for Entire Intersection Begins at 04:00 PM										
04:00 PM	0	**2**	**2**	0	0	0	**1**	0	**1**	**3**
04:15 PM	0	0	0	0	0	0	0	0	0	0
04:30 PM	0	2	2	0	0	0	0	0	0	2
04:45 PM	0	1	1	0	0	0	0	0	0	1
Total Volume	0	5	5	0	0	0	1	0	1	6
% App. Total	0	100		0	0		100	0		
PHF	.000	.625	.625	.000	.000	.000	.250	.000	.250	.500

Accurate Counts

978-664-2565

N/S Street : High Street
E/W Street : Oak Street
City/State : Norwell, MA
Weather : Cloudy

File Name : 88900002
Site Code : 88900002
Start Date : 3/31/2021
Page No : 8



Peak Hour Analysis From 04:00 PM to 05:45 PM - Peak 1 of 1

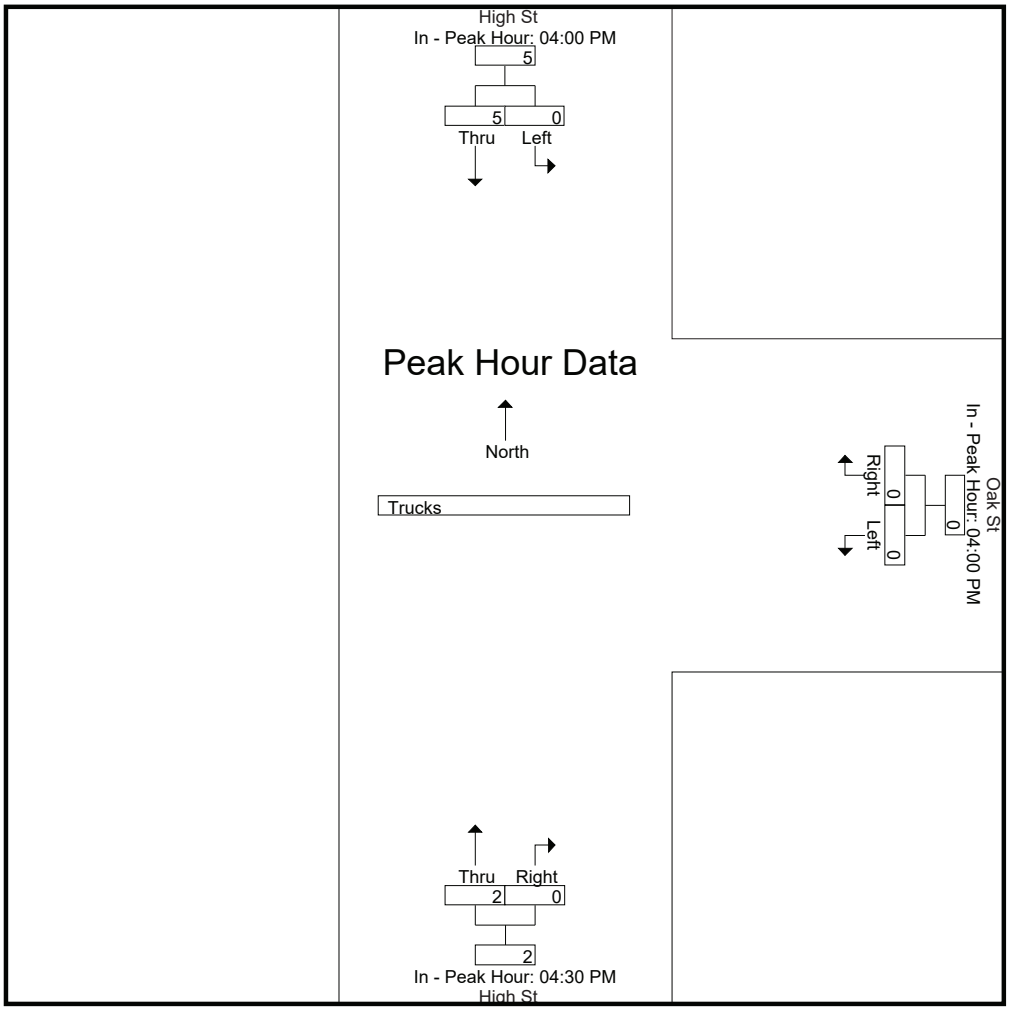
Peak Hour for Each Approach Begins at:

	04:00 PM			04:00 PM			04:30 PM		
+0 mins.	0	**2**	**2**	0	0	0	0	0	0
+15 mins.	0	0	0	0	0	0	0	0	0
+30 mins.	0	2	2	0	0	0	0	0	0
+45 mins.	0	1	1	0	0	0	**2**	0	**2**
Total Volume	0	5	5	0	0	0	2	0	2
% App. Total	0	100		0	0		100	0	
PHF	.000	.625	.625	.000	.000	.000	.250	.000	.250

Accurate Counts
978-664-2565

N/S Street : High Street
E/W Street : Oak Street
City/State : Norwell, MA
Weather : Cloudy

File Name : 88900002
Site Code : 88900002
Start Date : 3/31/2021
Page No : 9



Accurate Counts

978-664-2565

N/S Street : High Street
E/W Street : Oak Street
City/State : Norwell, MA
Weather : Cloudy

File Name : 88900002
Site Code : 88900002
Start Date : 3/31/2021
Page No : 10

Groups Printed- Bikes Peds

	High St From North			Oak St From East			High St From South					
Start Time	Left	Thru	Peds	Left	Right	Peds	Thru	Right	Peds	Exclu. Total	Inclu. Total	Int. Total
04:00 PM	0	0	0	0	0	0	0	0	0	0	0	0
04:15 PM	0	1	0	0	0	0	0	0	0	0	1	1
04:30 PM	0	0	0	0	0	0	0	0	0	0	0	0
04:45 PM	0	0	0	0	0	0	0	0	1	1	0	1
Total	0	1	0	0	0	0	0	0	1	1	1	2
05:00 PM	0	0	0	0	0	0	0	0	0	0	0	0
05:15 PM	0	0	0	0	0	0	0	0	1	1	0	1
05:30 PM	0	0	1	0	0	0	0	0	0	1	0	1
05:45 PM	0	0	0	0	0	0	0	0	0	0	0	0
Total	0	0	1	0	0	0	0	0	1	2	0	2
Grand Total	0	1	1	0	0	0	0	0	2	3	1	4
Apprch %	0	100		0	0		0	0				
Total %	0	100		0	0		0	0		75	25	

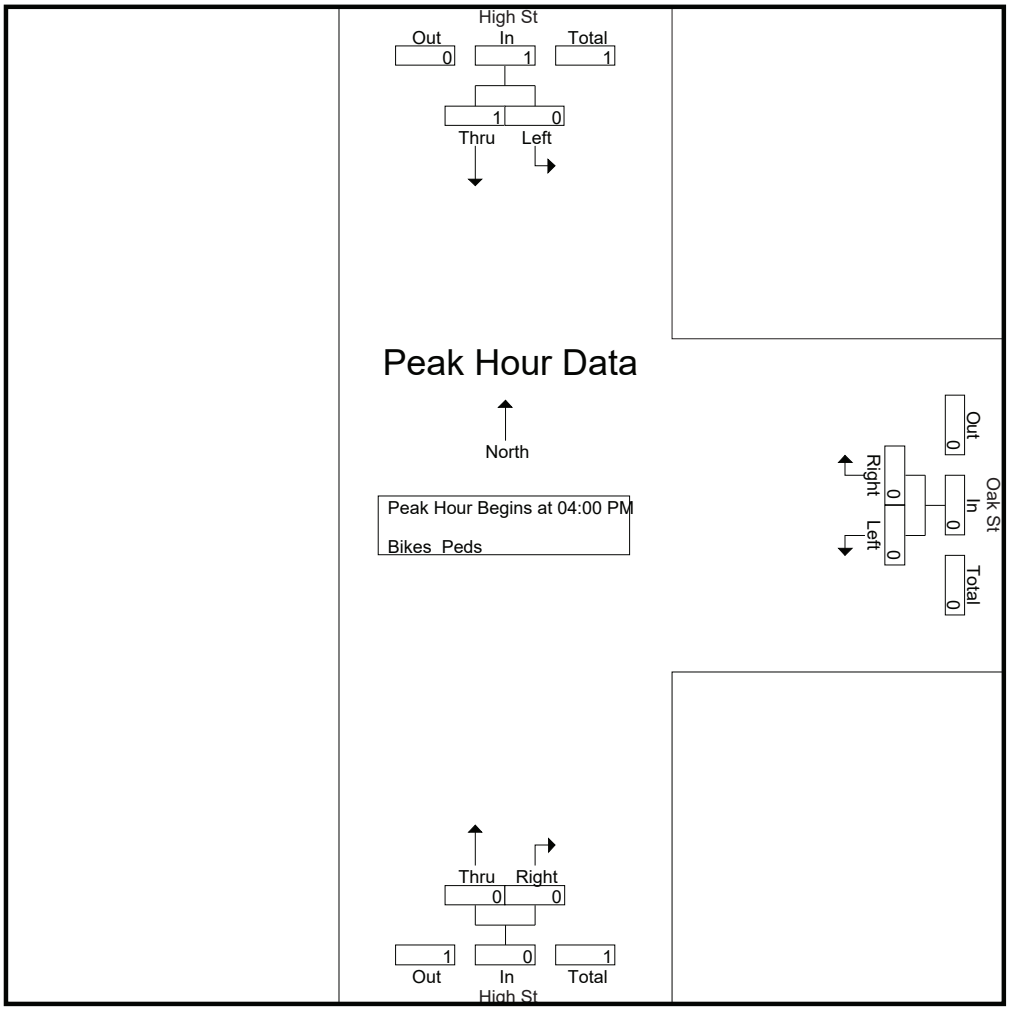
	High St From North			Oak St From East			High St From South			
Start Time	Left	Thru	App. Total	Left	Right	App. Total	Thru	Right	App. Total	Int. Total
Peak Hour Analysis From 04:00 PM to 05:45 PM - Peak 1 of 1										
Peak Hour for Entire Intersection Begins at 04:00 PM										
04:00 PM	0	0	0	0	0	0	0	0	0	0
04:15 PM	0	**1**	**1**	0	0	0	0	0	0	**1**
04:30 PM	0	0	0	0	0	0	0	0	0	0
04:45 PM	0	0	0	0	0	0	0	0	0	0
Total Volume	0	1	1	0	0	0	0	0	0	1
% App. Total	0	100		0	0		0	0		
PHF	.000	.250	.250	.000	.000	.000	.000	.000	.000	.250

Accurate Counts

978-664-2565

N/S Street : High Street
E/W Street : Oak Street
City/State : Norwell, MA
Weather : Cloudy

File Name : 88900002
Site Code : 88900002
Start Date : 3/31/2021
Page No : 11



Peak Hour Analysis From 04:00 PM to 05:45 PM - Peak 1 of 1

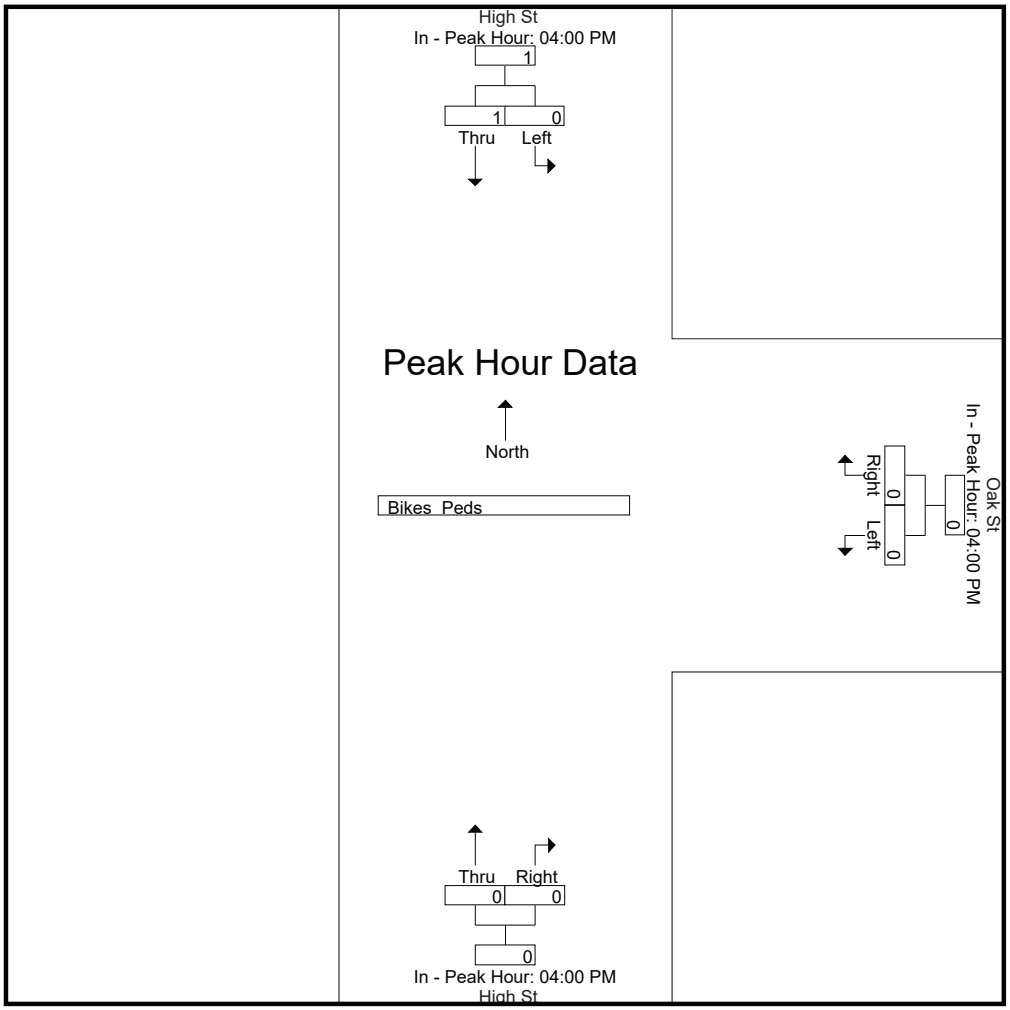
Peak Hour for Each Approach Begins at:

	04:00 PM			04:00 PM			04:00 PM		
+0 mins.	0	0	0	0	0	0	0	0	0
+15 mins.	0	**1**	**1**	0	0	0	0	0	0
+30 mins.	0	0	0	0	0	0	0	0	0
+45 mins.	0	0	0	0	0	0	0	0	0
Total Volume	0	1	1	0	0	0	0	0	0
% App. Total	0	100		0	0		0	0	
PHF	.000	.250	.250	.000	.000	.000	.000	.000	.000

Accurate Counts
978-664-2565

N/S Street : High Street
E/W Street : Oak Street
City/State : Norwell, MA
Weather : Cloudy

File Name : 88900002
Site Code : 88900002
Start Date : 3/31/2021
Page No : 12



VEHICLE TRAVEL SPEED MEASUREMENTS

Vanasse & Associates, Inc.
Transportation Engineers & Planners

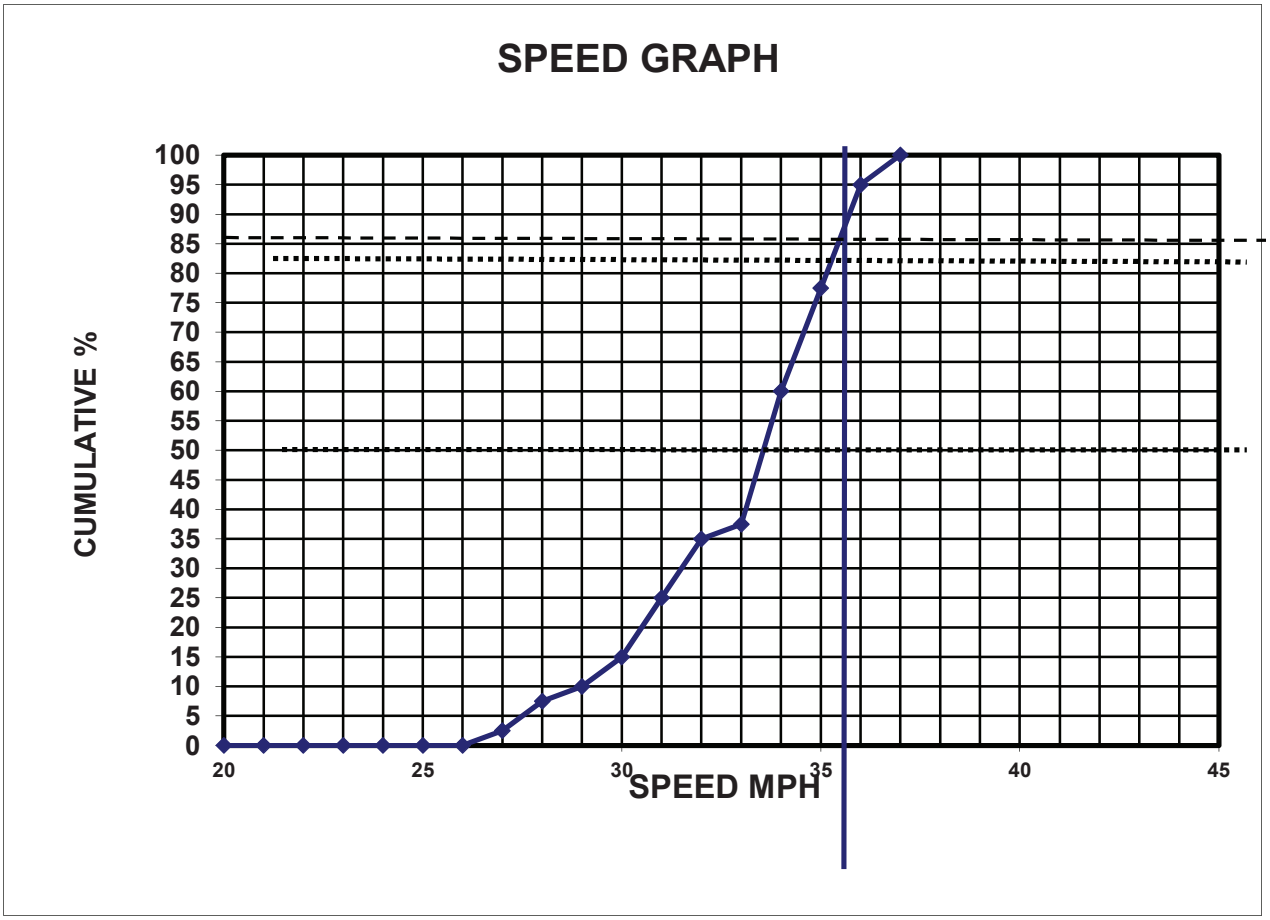
Job	Norwell, MA	Job #	8890
Location	Between Site Drivew	Date	3/30/2021
Calculated By:	S.R.F.		
Checked By:			

Street:	High Street	Speed Limit:	30
Direction:	Northbound	Time of Day	12:45 p.m.
		Observations	40

Speed	# of Observation	CUM. # Of OBS	% OF TOTAL OBS	CUM %
55				
54				
53				
52				
51				
50				
49				
48				
47				
46				
45				
44				
43				
42				
41				
40				
39				
38				
37	2	2	5	100
36	7	9	17.5	95
35	7	16	17.5	77.5
34	9	25	22.5	60
33	1	26	2.5	37.5
32	4	30	10	35
31	4	34	10	25
30	2	36	5	15
29	1	37	2.5	10
28	2	39	5	7.5
27	1	40	2.5	2.5
26				
25				
24				
23				
22				
21				
20				

Average: 33.35
Comments: 85% = 35.4 m.p.h.

Street: High Street **Job #** 8890
Direction: Northbound **Date** 3/30/2021



Vanasse & Associates, Inc.
Transportation Engineers & Planners

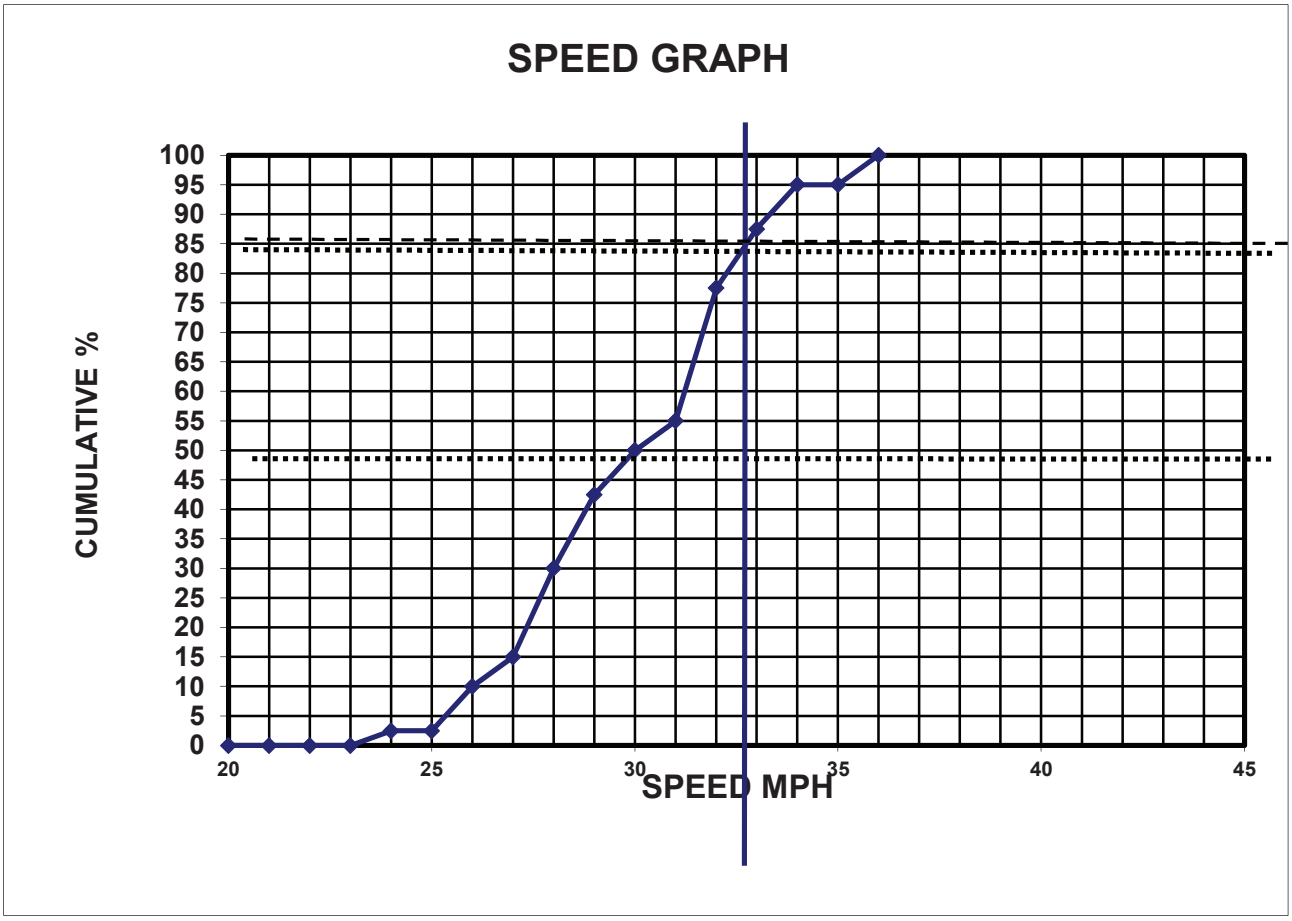
Job	Norwell, MA	Job #	8890
Location	Between Site Drives	Date	3/30/2021
Calculated By:	S.R.F.		
Checked By:			

Street:	High Street	Speed Limit:	35
Direction:	Southbound	Time of Day	12:45 p.m.
		Observations	40

Speed	# of Observation	CUM. # Of OBS	% OF TOTAL OBS	CUM %
55				
54				
53				
52				
51				
50				
49				
48				
47				
46				
45				
44				
43				
42				
41				
40				
39				
38				
37				
36	2	2	5	100
35	0	2	0	95
34	3	5	7.5	95
33	4	9	10	87.5
32	9	18	22.5	77.5
31	2	20	5	55
30	3	23	7.5	50
29	5	28	12.5	42.5
28	6	34	15	30
27	2	36	5	15
26	3	39	7.5	10
25	0	39	0	2.5
24	1	40	2.5	2.5
23				
22				
21				
20				

Average: 30.375
Comments: 85% = 32.8 m.p.h.

Street: High Street **Job #** 8890
Direction: Southbound **Date** 3/30/2021



TRAFFIC ADJUSTMENTS

2018 Average Count Data – Sta. 6255

October ADT: 134,133

Growth Rate: 1.0%/Year

$134{,}133 \times (1.010^2) = 136{,}829$

2020 Average Count Data – Sta. 6255

October ADT: 125,067

COVID Adjustment

$\frac{136{,}829}{125{,}067} = 1.09$

2019 Average Count Data – Sta. 6255

March ADT: 126,899

Growth Rate: 1.0%/Year

$126{,}899 \times (1.010^2) = 129{,}450$

2021 Average Count Data – Sta. 6255

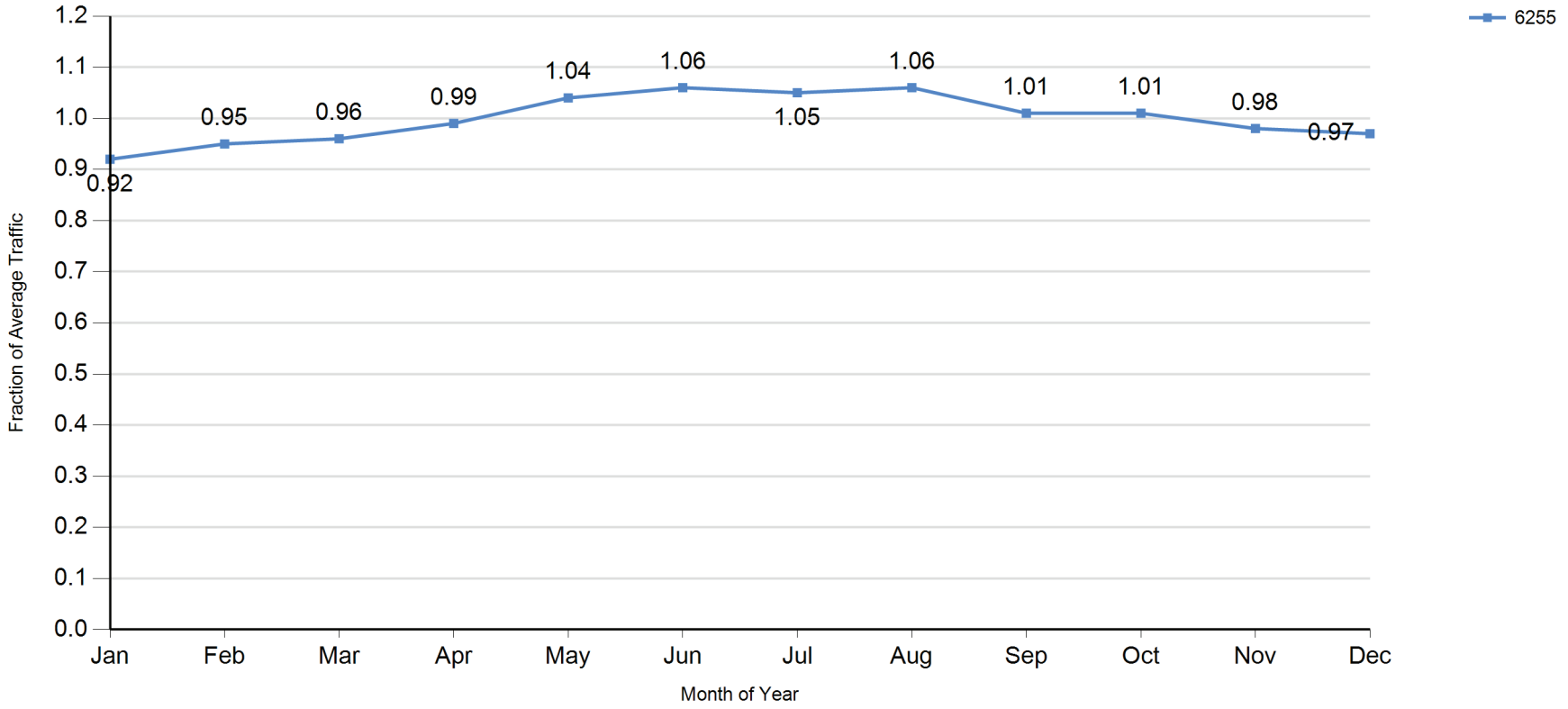
March ADT: 122,489

COVID Adjustment

$\frac{129{,}450}{122{,}489} = 1.05$

Massachusetts Highway Department

Traffic Pattern by Month for 1/1/2018 - 12/31/2018



Traffic Pattern by Month for 1/1/2018 - 12/31/2018

Factor Group	Station	Weight	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
U2	6255	1	0.917	0.948	0.963	0.994	1.041	1.061	1.054	1.056	1.008	1.007	0.976	0.969
	Average of Weighted Factors		**0.917**	**0.948**	**0.963**	**0.994**	**1.041**	**1.061**	**1.054**	**1.056**	**1.008**	**1.007**	**0.976**	**0.969**

Massachusetts Highway Department
6255: Monthly Hourly Volume for March 2019

Location ID: 6255
County: Norfolk
Functional Class 2
Location: PILGRIM HIGHWAY

Seasonal Factor Group: U2
Daily Factor Group:
Axle Factor Group: U2
Growth Factor Group:

	0:00	1:00	2:00	3:00	4:00	5:00	6:00	7:00	8:00	9:00	10:00	11:00	12:00	13:00	14:00	15:00	16:00	17:00	18:00	19:00	20:00	21:00	22:00	23:00	TOTAL	QC Status
1																										
2	1827	1167	772	780	1045	1747	2312	3004	3256	3275	3945	4116	4369	5091	5272	5484	5180	5989	5150	4058	3577	3089	3216	2300	80021	Accepted
3	1585	1079	728	645	572	1204	2466	3152	3976	4600	6586	8133	8753	8561	8380	7942	7732	6453	6257	4770	3364	2523	1919	1324	102704	Accepted
4	722	505	417	534	1102	2331	2508	2659	3553	4396	5128	4813	4717	4942	5822	5992	5929	6331	5103	4200	3349	2721	2065	1540	81379	Accepted
5	1029	676	737	843	2255	6423	7818	8070	8034	7744	7197	7105	7247	7760	8450	8403	7946	8132	7336	6422	5046	4262	3258	2195	134388	Accepted
6	1395	713	534	756	2196	6494	7802	7871	8193	7723	7104	7400	7238	7632	8135	8135	8010	8294	7361	6181	5312	3918	2970	1894	133261	Accepted
7	1161	611	503	766	2124	6343	8285	8372	8370	7802	7366	7393	7591	7570	8356	8389	8234	8353	7828	6380	5176	4321	3704	2341	137339	Accepted
8	1343	819	657	811	2108	5926	7959	8727	8264	7575	7446	7789	7992	8076	8805	8540	9004	8120	7892	6522	5029	4379	3812	2777	140372	Accepted
9	1845	1129	762	712	1020	2196	3784	5058	6540	7428	7427	8722	8848	8906	8962	8908	8947	8886	7294	6018	4890	4359	4054	3339	130034	Accepted
10	2236	1313	1008	833	1098	2051	2640	3300	3900	4947	6007	6964	7325	7341	7227	6687	6667	5702	4751	4200	2949	2324	1645	925	94040	Accepted
11	618	488	746	2134	6255	5659	7513	8170	7558	6865	7153	7138	7379	8345	8236	8059	8713	7303	5672	4589	3457	2440	1767	1016	127273	Accepted
12	584	457	754	2207	4908	7959	8387	8433	7675	7388	7332	7539	7574	8473	8248	8193	8201	7445	6039	4891	3722	2929	2066	1279	132683	Accepted
13	649	496	714	2166	6291	8071	8460	8449	7695	7217	7284	7686	7782	8318	8667	8560	8795	7815	6102	5167	3913	2921	1961	1053	136232	Accepted
14	648	534	693	2138	6404	7813	8515	8457	8000	7220	7508	7737	7887	8923	9347	9191	8968	7877	6136	5251	4079	3185	2491	1431	140433	Accepted
15	872	599	807	1989	5826	7660	8708	8409	7730	7580	7849	7930	8438	8743	8702	8777	8580	8000	6276	5096	4064	3506	2776	1810	140727	Accepted
16	1172	881	723	959	2062	3320	4937	6342	7530	8539	9003	9124	8991	9199	8612	9000	8491	7434	6301	5265	4242	4128	3214	2020	131489	Accepted
17	1316	871	645	625	1050	2074	3174	4151	6164	7118	8537	8802	8359	7982	8134	7977	7571	6869	5826	4672	3331	2566	1685	1206	110705	Accepted
18	589	445	727	2215	6397	8133	8400	8364	7498	7181	7209	7387	7385	8149	8447	8244	8214	7552	5807	4478	3528	2633	1918	1070	131970	Accepted
19	597	435	690	2276	6423	8167	8588	8425	7897	7427	7204	7411	7786	8132	8156	8116	8563	7435	6200	4934	3597	2686	2026	1094	134265	Accepted
20	511	436	715	2109	6554	7843	8199	8277	7890	7431	7470	7589	7909	8488	8613	8277	8668	8025	6452	5311	4040	2948	2105	1284	137144	Accepted
21	686	500	722	2161	6406	8325	8706	8590	7951	7527	7630	7610	7702	8138	8621	8813	9062	7667	6206	4974	4205	2961	1985	1274	138422	Accepted
22	723	522	728	1927	5590	7348	8248	8094	7562	7275	7398	7757	7922	8190	8411	8318	8319	7484	6093	4938	3981	3604	2748	1841	135021	Accepted
23	1107	837	721	934	2119	3456	4974	6420	7351	8218	8788	9177	8910	8775	8916	8555	8068	7116	6014	5035	4407	4087	2971	1891	128847	Accepted
24	1233	793	622	646	1094	2189	3242	4287	6286	7383	8336	9149	8528	8446	8759	8416	8193	6643	5520	4581	3207	2451	1446	901	112351	Accepted
25	504	433	672	2129	6438	8288	8870	8488	7520	7157	6961	7256	7525	8222	8246	8350	8478	7549	5722	4532	3324	2559	1856	1067	132146	Accepted
26	567	433	666	2227	6515	8129	8473	8313	7869	7451	7601	7360	7758	8803	8602	8414	8487	7646	6194	5031	3752	2828	2064	1233	136416	Accepted
27	609	480	680	2117	6492	8280	8643	8049	7939	7501	7425	7601	8012	8856	8619	8586	9307	7925	6454	5310	4026	3166	2427	1295	139799	Accepted
28	693	496	664	2300	6464	8279	8482	7982	6992	7823	7749	7877	7881	8460	8399	8691	9013	7928	6537	5549	4391	3248	2117	1263	139278	Accepted
29	728	510	750	2136	6096	8065	9193	8440	7888	7834	7974	8078	8226	8427	8401	8581	9034	8036	6315	5044	4443	3967	2905	1798	142869	Accepted
30	1066	713	665	970	2140	3580	5449	6970	8033	9024	9153	9293	9173	8770	9288	9118	8652	7659	6229	5364	4743	4211	3047	1992	135302	Accepted
31	1276	787	611	586	990	2021	3311	4418	6193	7527	8528	9285	8914	8817	8348	7885	7332	6210	4913	4097	2883	2288	1912	927	110059	Accepted
																							March Average		126899	

Massachusetts Highway Department
6255: Monthly Hourly Volume for March 2021

Location ID: 6255
County: Norfolk
Functional Class 2
Location: PILGRIM HIGHWAY

Seasonal Factor Group: U2
Daily Factor Group:
Axle Factor Group: U2
Growth Factor Group:

	0:00	1:00	2:00	3:00	4:00	5:00	6:00	7:00	8:00	9:00	10:00	11:00	12:00	13:00	14:00	15:00	16:00	17:00	18:00	19:00	20:00	21:00	22:00	23:00	TOTAL	QC Status
1	487	324	254	412	1614	4850	6904	8292	7863	6424	6379	6384	6904	7197	8250	9314	8683	8186	6055	4175	2981	2075	1451	1104	116562	Accepted
2	523	310	247	450	1648	4875	6850	8837	7924	6568	6540	6490	7036	7255	8592	9064	8661	8322	6428	4248	3056	2088	1509	1128	118649	Accepted
3	548	298	277	451	1709	4896	7065	8667	8231	6889	6984	7134	7545	7859	8974	9665	9628	8947	6894	4828	3556	2565	1643	1281	126534	Accepted
4	541	305	264	444	1683	4984	7270	8808	8303	7126	6911	7208	7445	7836	8888	9229	9131	9061	7114	4798	3457	2552	1716	1285	126359	Accepted
5	633	331	256	445	1640	4810	6786	8504	7837	7086	7305	7549	8382	8847	9232	9251	9358	8775	7608	5214	3691	2725	2230	1614	130109	Accepted
6	886	458	335	367	666	1623	3036	3939	5460	6747	8351	9246	9343	9223	8696	8763	8411	7559	6233	4746	3644	2740	2192	1599	114263	Accepted
7	864	666	400	302	397	880	1836	2486	3365	4985	6717	8093	8796	8831	8905	8237	8055	6669	5623	4273	3153	2056	1429	1115	98133	Accepted
8	508	297	265	407	1658	5056	7055	8405	7766	6564	6436	6651	6996	7300	8455	9016	8870	8700	6437	4320	3205	2162	1521	1109	119159	Accepted
9	514	321	230	426	1733	5066	7212	9076	8102	6947	7044	7099	7501	7727	8901	9370	8824	8675	6970	4599	3288	2242	1557	1158	124582	Accepted
10	550	298	275	447	1731	5115	7208	8769	8358	7260	7178	7351	7647	8006	9010	8926	9483	9344	7189	4924	3554	2525	1626	1227	128001	Accepted
11	555	315	292	485	1702	5103	6980	9034	8395	7415	7342	7626	8074	8212	9129	9767	9761	9669	7372	5109	3636	2618	1761	1226	131578	Accepted
12	643	380	320	439	1601	4956	6856	8286	8050	7479	7723	7770	8591	8922	9040	9627	8504	9132	8398	5865	4202	2958	2265	1699	133706	Accepted
13	891	524	333	362	669	1687	3092	4531	5899	7649	8779	9649	9660	9540	9478	9071	8605	7838	6591	4892	3639	2886	2206	1699	120170	Accepted
14																										
15	534	344	271	435	1660	4841	6479	8282	7830	6643	6551	6831	7138	7536	8352	8552	8734	8218	6147	4614	3264	2256	1637	1157	118306	Accepted
16	547	314	241	455	1641	4964	6739	8576	8108	6940	6868	6857	7406	7613	8960	9469	9396	9026	6483	4822	3346	2418	1616	1171	123976	Accepted
17	532	309	299	465	1669	5029	6746	8467	8150	7108	6959	7325	7773	7996	9041	9349	9076	8776	7192	5165	3889	2804	1842	1382	127343	Accepted
18	653	387	336	504	1734	5050	6900	8724	8439	7349	7283	7361	7610	7995	9128	9100	8540	8405	7022	4727	3482	2494	1783	1356	126362	Accepted
19	631	381	331	485	1619	4580	6193	7905	7586	6693	7132	7217	7618	8615	9265	9551	9315	8986	7620	5607	4193	2925	2449	1693	128590	Accepted
20	1016	575	375	377	679	1671	2848	4275	5762	7317	9002	9734	9730	9403	9387	8714	8933	7784	6700	5447	4317	3101	2507	1848	121502	Accepted
21	1088	640	371	343	376	844	1840	2656	3743	5613	7338	8672	9460	9004	9108	9176	8419	7681	6642	5578	4025	2484	1667	1086	107854	Accepted
22	573	347	275	407	1669	5106	6896	7701	8736	6730	6734	7120	7256	7765	8773	9202	8737	8850	6679	4737	3498	2360	1565	1192	122908	Accepted
23	549	352	262	484	1726	5183	7046	9031	8418	7356	7185	7246	7730	7968	9357	9615	9410	9201	6707	5062	3587	2387	1662	1181	128705	Accepted
24	551	337	292	460	1668	5212	6994	8857	8265	7470	7212	7558	7678	8195	9055	9753	9308	9240	7301	5183	3766	2659	1680	1255	129949	Accepted
25	612	347	273	473	1706	5079	7067	8683	8522	7334	7255	7674	7915	8368	9271	9509	9429	9065	7581	5468	4005	2517	1939	1417	131509	Accepted
26	859	428	293	523	1666	4811	6570	6997	7198	6834	7266	7781	8234	8761	9458	9221	9565	9246	7557	5837	4293	3120	2452	1744	130714	Accepted
27	908	549	367	347	674	1581	3063	4686	6397	8179	9593	9776	9528	9581	9256	9707	9358	8501	7273	5580	4478	3431	2537	1769	127119	Accepted
28	1091	663	417	349	397	812	1797	2933	3351	5360	6969	8422	9168	8078	7769	7729	6863	6007	4828	3912	3150	2040	1493	952	94550	Accepted
29																							**March**	**Average**	122489	
30																										
31																										

Massachusetts Highway Department
6255: Monthly Hourly Volume for October 2018

Location ID: 6255
County: Norfolk
Functional Class 2
Location: PILGRIM HIGHWAY

Seasonal Factor Group: U2
Daily Factor Group:
Axle Factor Group: U2
Growth Factor Group:

	0:00	1:00	2:00	3:00	4:00	5:00	6:00	7:00	8:00	9:00	10:00	11:00	12:00	13:00	14:00	15:00	16:00	17:00	18:00	19:00	20:00	21:00	22:00	23:00	TOTAL	QC Status
1																										
2	1057	646	422	629	2222	6344	7587	7531	7773	7982	7502	7726	7485	7689	8208	8466	8112	8222	7534	6482	4714	3735	2769	2067	132904	Accepted
3	1094	587	447	674	2233	6408	7577	8194	8357	7996	7736	7690	7962	8277	8547	8776	8666	8893	7956	6663	5286	4054	2944	2226	139243	Accepted
4	1179	664	550	729	2312	6647	7847	8583	8903	7919	8152	8152	8093	8275	9021	9124	9197	9170	7936	7052	5362	4188	3190	2496	144741	Accepted
5	1952	1210	723	715	2171	6108	7953	8915	8485	8127	8116	8706	8636	8682	8429	8243	8674	8826	8067	6372	4857	4628	3890	3242	145727	Accepted
6	2504	1259	850	710	1099	2348	3971	5373	6945	8084	8855	8243	8549	8577	8632	8541	8515	8364	7526	6491	5298	4153	3993	3259	132139	Accepted
7	2297	1830	1016	595	689	1227	2472	3354	4705	6505	8029	8610	9170	8582	8457	8677	8002	7640	7263	6102	4859	3828	2940	2305	119154	Accepted
8	1315	718	517	609	1286	3311	5022	6428	6677	7228	8133	8668	8630	8301	8954	8611	8623	8506	7577	6187	4886	3567	2578	1761	128093	Accepted
9	1097	618	486	622	2304	6722	7841	8458	8608	7899	7659	8102	8001	8163	8987	9213	8863	9240	8405	6601	5022	3884	2787	2367	141949	Accepted
10	1336	596	486	643	2329	6596	7928	8364	7660	7894	7589	8127	7960	7861	8549	8660	8955	9157	8284	6986	5357	4225	3049	2051	140642	Accepted
11	1313	656	480	738	2281	5197	6996	8032	8409	8067	7808	7919	7825	7993	8429	7953	8031	8412	7364	6505	5290	4158	3437	2213	135506	Accepted
12	1440	902	641	777	2137	6238	7114	7611	8033	7452	7608	7902	8261	8324	8654	8218	8417	8601	8072	6882	5388	4297	3890	3116	139975	Accepted
13	2025	1191	783	687	1093	2394	3824	5273	6813	7523	8346	8671	8294	8484	8646	8788	8615	8545	7792	6348	5038	4630	3977	3159	130939	Accepted
14	2562	1774	910	627	684	1286	2512	3724	4956	6983	8234	8921	8941	8744	9203	9227	8535	8383	7945	6007	4735	3063	2472	2315	122743	Accepted
15	1983	978	626	701	2252	6641	8067	8185	8678	7769	7498	7704	7690	8113	8745	8765	8615	8292	7909	5789	4504	3386	2461	1640	136991	Accepted
16	961	531	462	675	2226	6500	7728	8071	8150	7783	7685	7721	7497	7757	8653	8350	8510	8919	7942	6667	4923	4119	2848	2434	137112	Accepted
17	1316	686	473	738	2327	6690	8048	8393	8167	7860	7693	7394	7942	8330	8720	8869	8662	8742	7867	6613	5395	4264	2930	2186	140305	Accepted
18	1229	699	576	740	2288	6742	8195	8395	8061	8069	7874	8090	7933	8097	8931	8689	8300	8794	7937	6909	5713	4549	3212	2484	142506	Accepted
19	1763	867	639	758	2067	6228	8062	8785	8724	7999	8174	7948	8349	8529	8361	7621	8539	8936	8116	6929	5360	4461	3849	2975	144039	Accepted
20	1944	1194	802	710	1077	2479	3817	5468	6890	7891	8873	9145	9384	8604	9122	9002	8884	8431	8001	6505	5188	4389	4113	3204	135117	Accepted
21	2377	1420	907	607	676	1190	2361	3357	4685	6412	7960	9059	9112	8682	8016	7825	7831	7898	7293	5703	4473	3138	2360	1693	115035	Accepted
22	911	574	451	688	2348	6663	7806	8250	8197	7714	7420	7515	7636	8295	8366	8759	8491	9106	7827	5867	4562	3441	2762	1836	135485	Accepted
23	1179	632	493	674	2260	6671	7792	7853	8388	6088	7898	7264	7436	7924	8606	7839	7862	8127	7703	6540	5012	3686	2717	1938	132582	Accepted
24	1249	1126	587	675	2179	6496	7791	8323	8548	7972	7327	7644	7929	8022	8272	8836	8551	8541	7930	6097	4915	3940	2932	2164	138046	Accepted
25	1925	1046	528	726	2218	6510	7782	8465	8635	8104	7848	7834	7947	8127	8747	9176	8801	8923	7631	6814	5512	4374	3749	2451	143873	Accepted
26	1485	816	673	779	2168	6235	8109	8868	8597	8104	7973	8278	8197	8325	8775	8871	8895	8827	8201	6540	5422	4448	3896	3095	145577	Accepted
27	2293	1456	1001	877	1029	2043	3154	4270	5476	6066	6582	7307	7485	7534	7571	7428	7194	6795	5855	4921	3895	3542	3571	2656	110001	Accepted
28	2080	1379	941	679	635	1115	2293	3298	4529	6208	7698	9017	9521	9012	8996	8953	8513	7719	6862	5685	4164	2977	2303	1557	116134	Accepted
29	1093	829	536	708	2258	6164	7479	8221	7509	7250	7070	7069	7457	7583	7741	8458	8551	8875	7875	5820	4283	3250	2315	1764	130158	Accepted
30	1087	612	445	663	2211	6739	7789	8286	7822	8052	7579	7761	7255	8095	8449	8790	8844	8944	7799	6697	4973	4037	2904	2393	138226	Accepted
31	1246	606	492	717	2218	6597	7912	8108	7643	8079	7374	7170	7300	7920	8470	7116	8681	8189	6326	4608	4474	3463	2546	1784	129039	Accepted
																							October Average		134133	

Massachusetts Highway Department
6255: Monthly Hourly Volume for October 2020

Location ID: 6255
County: Norfolk
Functional Class 2
Location: PILGRIM HIGHWAY

Seasonal Factor Group: U2
Daily Factor Group:
Axle Factor Group: U2
Growth Factor Group:

	0:00	1:00	2:00	3:00	4:00	5:00	6:00	7:00	8:00	9:00	10:00	11:00	12:00	13:00	14:00	15:00	16:00	17:00	18:00	19:00	20:00	21:00	22:00	23:00	TOTAL	QC Status
1	843	451	377	545	1864	5542	7506	9009	8507	7668	7552	7807	7919	8282	8707	8885	8799	9393	8015	6131	4579	3182	2444	1645	135652	Accepted
2	942	518	410	590	1846	5237	7220	8490	8225	7422	7846	8240	8512	8750	8836	9186	9046	8991	7566	6044	4621	3393	2822	2143	136896	Accepted
3	1271	683	521	521	866	1963	3638	5059	6349	7729	8694	8954	9196	8949	8995	8861	8580	8207	7355	6112	4803	3873	3118	2255	126552	Accepted
4	1274	735	520	390	516	1182	2263	3171	4318	6124	7836	8835	9029	8923	8570	8735	8301	7975	7344	5823	4623	2961	1876	1313	112637	Accepted
5	696	384	322	502	1832	5561	6819	8563	8325	6990	6934	7076	7298	7514	8290	8500	8489	8416	7035	5160	3536	2463	1849	1387	123941	Accepted
6	740	404	385	559	1880	5728	7394	9034	8487	7306	7357	7365	7656	7833	8472	7953	8627	8978	7175	5485	3964	2756	1968	1443	128949	Accepted
7	796	440	394	564	1792	5543	7325	8742	8300	7469	7360	7555	7686	7921	8980	9158	8895	8558	6700	5218	3815	2637	2003	1553	129404	Accepted
8	778	472	339	668	1819	5514	7478	8838	8272	7754	7789	7837	8059	8082	8807	8861	8643	8631	8459	6152	4617	3315	2301	1699	135184	Accepted
9	944	553	422	584	1817	5180	7242	8468	8055	7768	8031	8445	8751	8876	8501	8740	8757	8647	8099	6519	4712	3521	2849	2182	137663	Accepted
10	1212	728	476	472	828	1765	3394	5073	6386	8202	9049	9041	8990	7976	8574	8667	8484	8170	7481	6171	4780	3647	2843	2130	124539	Accepted
11	1273	689	488	373	451	1077	2110	3299	4355	6188	7688	8859	8545	9091	8773	8365	8036	7936	6984	5670	4494	3243	2247	1552	111786	Accepted
12	839	487	341	403	1034	2653	4610	6056	6355	6937	7893	8498	8964	8985	9059	9027	8820	7947	6686	5298	3995	2628	1818	1376	120709	Accepted
13	674	405	358	490	1820	5184	6994	8369	7954	6927	6834	7031	7260	7292	7796	7722	7941	7763	6370	4700	3337	2424	1841	1487	118973	Accepted
14	752	389	308	488	1804	5546	7502	7035	6525	7422	7520	7570	8075	7923	8634	8826	8845	8962	7673	5714	4065	2995	2147	1594	128314	Accepted
15	859	479	382	580	1843	5719	7637	8846	8001	7691	7720	7803	7906	8234	8884	8900	8716	9179	7907	5900	4501	3085	2239	1806	134817	Accepted
16	895	491	433	537	1819	5001	6886	8389	7925	7293	7678	7866	8355	8336	8145	8347	8421	8350	7293	5434	3971	2958	2573	1932	129328	Accepted
17	1128	704	513	434	754	1632	2896	4270	5237	6566	7994	8734	8593	8916	8654	8392	8130	7965	7062	5627	4297	3569	2807	2236	117110	Accepted
18	1351	795	526	478	555	1190	2325	3358	3950	6162	7852	8860	9162	8610	8204	7918	8371	8091	7125	5821	4163	2822	1986	1298	110973	Accepted
19	743	399	393	511	1919	5623	7349	8656	8269	7274	7132	7127	7471	7769	8552	8733	8696	8758	6927	5108	3489	2567	1889	1423	126777	Accepted
20	760	449	365	513	1886	5518	7275	8619	8202	7145	7105	7242	7348	7540	8536	8950	8696	8818	7168	5000	3663	2658	1815	1456	126727	Accepted
21	742	438	377	524	1796	5158	6753	8500	8051	7193	7117	7215	7492	7822	8215	8805	8489	8895	7309	5456	4026	2792	2075	1533	126773	Accepted
22	803	473	374	586	1868	5504	7532	8955	8578	7661	7620	7619	7896	7821	8511	9096	9052	9291	7770	6035	4170	2973	2163	1736	134087	Accepted
23	890	519	424	620	1799	5201	7042	8381	8132	7734	7841	8186	8482	8689	8715	8938	8965	8725	7180	6295	4378	3320	2749	2221	135426	Accepted
24	1240	822	518	523	862	1892	3473	4806	6034	7341	8888	8855	9191	8678	8714	8896	8366	7991	6143	5861	4454	3564	2896	2206	122214	Accepted
25	1289	780	526	406	501	977	2145	3000	4002	5765	7123	8416	8910	8800	8719	8710	7882	6995	6198	5257	4008	2690	1909	1272	106280	Accepted
26	769	395	370	494	1777	5513	6786	8060	7857	6845	7098	6999	7302	7682	8184	8967	8417	7705	6389	4657	3305	2296	1695	1314	120876	Accepted
27	697	365	365	515	1866	5565	7458	8697	7979	7195	7139	7088	7460	7559	8380	9103	8886	8467	7095	4968	3543	2638	1925	1470	126423	Accepted
28	788	428	322	499	1833	5437	7139	8234	7920	7012	7192	7258	7320	7796	8216	8675	8374	8172	6784	5014	3703	2624	1913	1526	124179	Accepted
29	770	438	368	565	1864	5454	7378	8450	8138	7290	7185	7485	7629	7838	8293	8241	7964	7995	6785	4899	3654	2723	2080	1580	125066	Accepted
30	880	478	353	550	1680	4800	6218	7656	7149	6346	6042	6332	6589	6816	7317	7704	7500	7446	6449	4889	3588	2826	2338	1815	113761	Accepted
31																								**October Average**	125067	

PUBLIC TRANSPORTATION SCHEDULES

GREENBUSH LINE

2021 Winter Schedule
Effective January 23, 2021

Ride Safer. mbta.com/ridesafer — Wear a face covering — Maintain a healthy distance — Practice good hygiene

On Weekends, no Commuter Rail trains operate on the Greenbush Line

Monday to Friday

Inbound to Boston			AM				PM				
ZONE	STATION	TRAIN #	7070	1070	1072	1074	1076	1078	1080	1082	1084
	Bikes Allowed										
6	Greenbush		6:15	7:15	9:30	11:08	12:20	2:10	3:55	6:30	9:30
5	North Scituate		6:22	7:22	9:37	11:15	12:27	2:17	4:02	6:37	9:37
4	Cohasset		6:29	7:29	9:44	11:22	12:34	2:23	4:09	6:44	9:44
4	Nantasket Junction		6:32	7:32	9:47	11:26	12:37	2:26	4:12	6:47	9:47
3	West Hingham		6:37	7:37	9:52	11:31	12:42	2:31	4:17	6:52	9:52
2	East Weymouth		6:41	7:41	9:56	11:38	12:46	2:35	4:21	6:56	9:56
2	Weymouth Landing/East Braintree		6:47	7:47	10:02	11:44	12:52	2:41	4:27	7:02	10:02
1	Quincy Center		6:56	7:56	10:12	11:53	1:01	2:50	4:36	7:11	10:11
1A	JFK/UMass		7:04	8:04	10:20	12:01	1:09	2:59	4:44	7:19	10:19
1A	South Station		7:12	8:12	10:28	12:07	1:18	3:07	4:53	7:27	10:26

Monday to Friday

Outbound from Boston			AM			PM					
ZONE	STATION	TRAIN #	1071	1073	1075	1077	1079	7071	1081	1083	1085
	Bikes Allowed										
1A	South Station		8:05	9:45	11:03	12:55	2:45	3:45	5:10	8:00	10:55
1A	JFK/UMass		8:12	9:51	11:09	1:01	2:51	3:51	5:16	8:06	11:01
1	Quincy Center		8:19	9:59	11:17	1:09	2:59	3:59	5:24	8:14	11:09
2	Weymouth Landing/East Braintree		8:28	10:08	11:26	1:18	3:08	4:08	5:33	8:23	11:18
2	East Weymouth		8:33	10:14	11:32	1:24	3:13	4:14	5:39	8:29	11:24
3	West Hingham		8:37	10:18	11:36	1:28	3:17	4:20	5:43	8:33	11:28
4	Nantasket Junction		8:42	10:22	11:41	1:33	3:22	4:25	5:48	8:38	11:33
4	Cohasset		8:45	10:25	11:44	1:36	3:25	4:28	5:51	8:41	11:37
5	North Scituate		8:53	10:33	11:52	1:44	3:33	4:36	5:59	8:49	11:45
6	Greenbush		9:03	10:43	12:03	1:55	3:43	4:46	6:09	8:59	11:55

Keep in Mind:

This schedule will be effective from January 23, 2021 and will replace the schedule of November 2, 2020.

Bikes: Bicycles are allowed on all trains.

High level platform and bridge plate available. Visit **mbta.com/accessibility** for more information.

GREENBUSH LINE

2021 Spring Schedule
Effective April 5, 2021

Moving Forward Together.
In response to COVID-19, we continue to adapt our service to meet your needs.

On Weekends, no trains operate on the Greenbush Line

Monday to Friday

Inbound to Boston			AM							PM					
ZONE	STATION	TRAIN #	070	072	074	076	078	080	082	084	086	088	090	092	094
6	Greenbush	♿	5:10	6:10	7:10	8:15	9:22	10:32	11:47	1:02	2:17	3:55	5:40	6:48	9:45
5	North Scituate	♿	5:17	6:17	7:17	8:22	9:29	10:39	11:54	1:09	2:24	4:02	5:47	6:55	9:52
4	Cohasset	♿	5:23	6:23	7:23	8:28	9:35	10:45	12:00	1:15	2:30	4:14	5:59	7:07	9:58
4	Nantasket Junction	♿	5:26	6:26	7:26	8:31	9:38	10:48	12:03	1:18	2:33	4:17	6:02	7:10	10:01
3	West Hingham	♿	5:31	6:31	7:31	8:36	9:43	10:53	12:08	1:23	2:38	4:22	6:07	7:15	10:06
2	East Weymouth	♿	5:36	6:36	7:36	8:41	9:48	11:03	12:18	1:33	2:48	4:27	6:12	7:20	10:11
2	Weymouth Landing/East Braintree	♿	5:42	6:42	7:42	8:47	9:54	11:09	12:24	1:39	2:54	4:33	6:18	7:26	10:17
1	Quincy Center	♿	L 5:52	L 6:52	L 7:52	L 8:57	L 10:04	L 11:19	L 12:34	L 1:49	L 3:04	-	L 6:28	L 7:36	L 10:27
1A	JFK/UMass	♿	L 6:01	L 7:01	L 8:01	L 9:06	L 10:13	L 11:28	L 12:43	L 1:58	L 3:13	-	L 6:37	L 7:47	L 10:36
1A	South Station	♿	6:09	7:09	8:09	9:14	10:21	11:36	12:51	2:06	3:21	4:58	6:45	7:54	10:43

Monday to Friday

Outbound from Boston			AM					PM							
ZONE	STATION	TRAIN #	071	073	075	077	079	081	083	085	087	089	091	093	095
1A	South Station	♿	6:27	8:07	9:12	10:30	11:45	1:00	2:15	3:30	4:20	5:15	6:23	8:30	10:50
1A	JFK/UMass	♿	6:33	8:13	9:18	10:36	11:51	1:06	2:21	3:36	4:26	5:21	6:29	8:36	10:56
1	Quincy Center	♿	6:41	8:21	9:26	10:44	11:59	1:14	2:29	3:44	4:34	5:29	6:37	8:44	11:04
2	Weymouth Landing/East Braintree	♿	6:50	8:29	9:34	10:53	12:08	1:23	2:38	3:53	4:43	5:38	6:46	8:53	11:13
2	East Weymouth	♿	6:55	8:34	9:39	10:58	12:13	1:28	2:43	3:58	4:48	5:43	6:51	8:58	11:18
3	West Hingham	♿	7:00	8:41	9:48	11:03	12:18	1:33	2:48	4:03	4:53	5:48	6:56	9:03	11:22
4	Nantasket Junction	♿	7:04	8:45	9:52	11:07	12:22	1:37	2:52	4:07	4:57	5:52	7:00	9:07	11:26
4	Cohasset	♿	7:07	8:48	9:55	11:10	12:25	1:40	2:55	4:10	5:00	5:55	7:03	9:10	11:29
5	North Scituate	♿	7:24	8:56	10:03	11:18	12:33	1:48	3:03	4:18	5:08	6:03	7:11	9:18	11:37
6	Greenbush	♿	7:36	9:08	10:15	11:30	12:45	2:00	3:15	4:30	5:20	6:15	7:23	9:30	11:49

Keep in Mind:

This schedule will be effective from April 5, 2021 and will replace the schedule of January 23, 2021.

Holiday Service
For holiday service, please visit MBTA.com/holidays or pick up the dedicated holiday schedule at North Station, South Station or Back Bay three weeks prior to the holiday.

Masks are federally required on board and in station. Visit MBTA.com/covid19 for the latest updates

Times in blue indicate an early departure (L stop): The train may leave ahead of schedule at these stops.

Bikes: Bicycles are allowed on all trains.

High level platform and bridge plate available. Visit mbta.com/accessibility for more information.

MOTOR VEHICLE CRASH DATA

MassHighway

CRASH RATE WORKSHEET

CITY/TOWN : Norwell COUNT DATE : 2020/2021

DISTRICT : 5 UNSIGNALIZED : SIGNALIZED : X

MHD USE ONLY

Source #

~ INTERSECTION DATA ~

MAJOR STREET : Washington St (Route 53) ST #

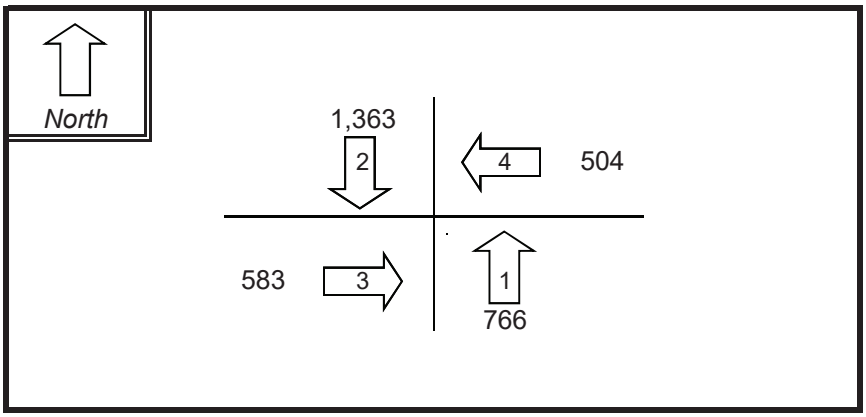
MINOR STREET(S) : High Street ST #

Grove Street ST #

ST #

ST #

INTERSECTION DIAGRAM
(Label Approaches)



INTERSECTION REF #

Peak Hour Volumes

APPROACH :	1	2	3	4		Total Entering Vehicles
DIRECTION :	NB	SB	EB	WB		
VOLUMES (PM) :	766	1,363	583	504		3,216

" K " FACTOR : **0.080** APPROACH ADT : **40,200** **ADT** = TOTAL VOL/"K" FACT.

TOTAL # OF ACCIDENTS : 54 # OF YEARS : 5 AVERAGE # OF ACCIDENTS (**A**) : **10.80**

CRASH RATE CALCULATION : 0.74

$$\text{RATE} = \frac{(A * 1{,}000{,}000)}{(ADT * 365)}$$

Comments : Accident Rate for District 5 signalized intersections = 0.75

Accident Rate for District 5 unsignalized intersections = 0.57

Statewide = Signalized Intersection - 0.78 Unsignalized - 0.57

MassHighway

CRASH RATE WORKSHEET

CITY/TOWN : Norwell COUNT DATE : 2020/2021

DISTRICT : 5 UNSIGNALIZED : X SIGNALIZED :

MHD USE ONLY

Source #

~ INTERSECTION DATA ~

MAJOR STREET : High Street ST #

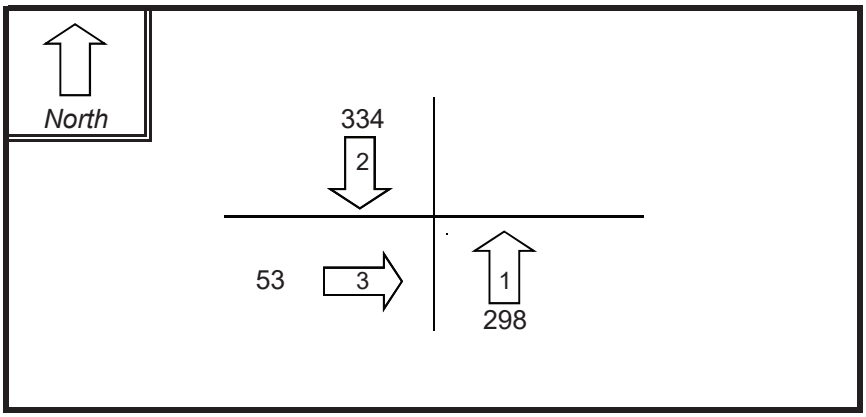
MINOR STREET(S) : Oak Street ST #

ST #

ST #

ST #

INTERSECTION DIAGRAM
(Label Approaches)



INTERSECTION REF #

Peak Hour Volumes

APPROACH :	1	2	3	4	5	Total Entering Vehicles
DIRECTION :	NB	SB	EB			
VOLUMES (PM) :	298	334	53			685

" K " FACTOR : 0.080 APPROACH ADT : 8,563 **ADT** = TOTAL VOL/"K" FACT.

TOTAL # OF ACCIDENTS : 2 # OF YEARS : 5 AVERAGE # OF ACCIDENTS (**A**) : 0.40

CRASH RATE CALCULATION : 0.13

RATE = $\frac{(A * 1{,}000{,}000)}{(ADT * 365)}$

Comments : Accident Rate for District 5 signalized intersections = 0.75
Accident Rate for District 5 unsignalized intersections = 0.57
Statewide = Signalized Intersection - 0.78 Unsignalized - 0.57

MassHighway

CRASH RATE WORKSHEET

CITY/TOWN : Norwell COUNT DATE : 2020/2021

DISTRICT : 5 UNSIGNALIZED : x SIGNALIZED :

MHD USE ONLY

Source #

~ INTERSECTION DATA ~

MAJOR STREET : Washington St (Route 53) ST #

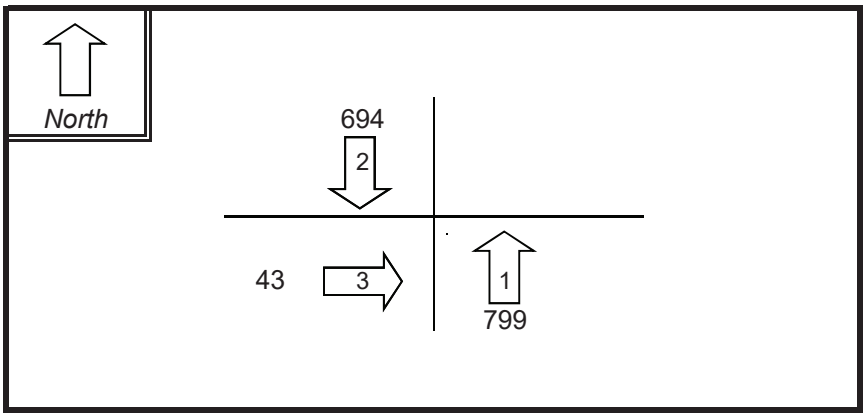
MINOR STREET(S) : Oak Street ST #

ST #

ST #

ST #

INTERSECTION DIAGRAM
(Label Approaches)



INTERSECTION REF #

Peak Hour Volumes

APPROACH :	1	2	3	4	5	Total Entering Vehicles
DIRECTION :	NB	SB	EB	WB		
VOLUMES (PM) :	799	694	43			1,536

" K " FACTOR : **0.080** APPROACH ADT : **19,200** **ADT** = TOTAL VOL/"K" FACT.

TOTAL # OF ACCIDENTS : 5 # OF YEARS : 5 AVERAGE # OF ACCIDENTS (**A**) : **1.00**

CRASH RATE CALCULATION : 0.14

$$\text{RATE} = \frac{(A * 1{,}000{,}000)}{(ADT * 365)}$$

Comments : Accident Rate for District 5 signalized intersections = 0.75
Accident Rate for District 5 unsignalized intersections = 0.57
Statewide = Signalized Intersection - 0.78 Unsignalized - 0.57

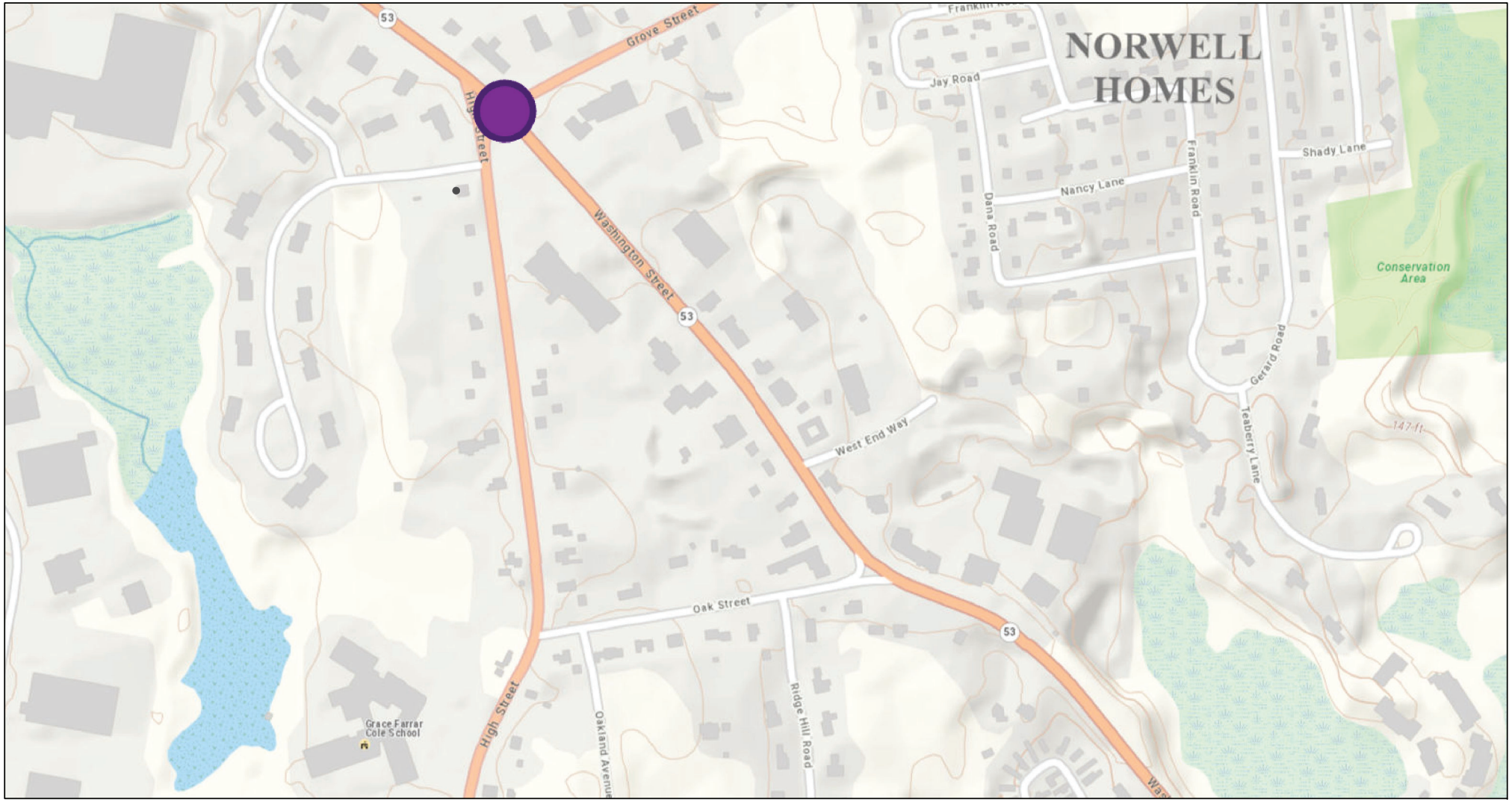
Crash Number	City Town Name	Crash Date	Crash Severity	Crash Status	Crash Time	Max Injury Severity Reporte	Number of Vehicles	Driver Contributing Circumstances (All Drivers)	Driver Distracted By (All Vehicles)	First Harmful Event	Light Conditions	Manner of Collision	MassDOT District	Road Surface Condition	Roadway Junction Type	Total Fatalities	Total Non-Fatal Injuries	Traffic Control Device Type	Trafficway Description	Vehicle Actions Prior to Crash (All Vehicles)	Vehicle Travel Directions (All	Weather Conditions	Crash Report IDs	First Harmful Event Location	Hit and Run	Latitude	Longitude	Street Number	Roadway	Near Intersection Roadway/ Landmark
WASHINGTON ST AT HIGH ST																														
3992106	NORWELL	10/16/2014	Property damage only (none injured)	Closed	2:25 PM	No injury	2	D1: (Other improper action) / D2: (No improper driving)		Collision with motor vehicle in traffic	Daylight	Angle	5	Wet	Not at junction	0	0	No controls	Two-way, divided, unprotected median	V1: Entering traffic lane / V2: Travelling straight ahead	V1: E / V2: S	Rain/Cloudy	14-196-ac	Roadway	No hit and run	42.1719	-70.879	95	WASHINGTON STREET	CVS
4006102	NORWELL	09/23/2014	Non-fatal injury	Closed	9:01 AM	Non-fatal injury - Non-incapacitating	3	D1: (No improper driving) / D2: (No improper driving) / D3: (Glare)	D1: Manually operating an electronic device	Collision with motor vehicle in traffic	Daylight	Rear-end	5	Dry	Not at junction	0	1	Traffic control signal	Two-way, not divided	V1: Slowing or stopped in traffic / V2: Slowing or stopped in traffic / V3: Travelling straight ahead	V1: S / V2: S / V3: S	Clear	14-173-ac	Roadway	No hit and run	42.1724	-70.879	80	WASHINGTON STREET	
4042853	NORWELL	02/25/2015	Property damage only (none injured)	Closed	1:39 PM	No injury	2	D1: (No improper driving) / D2: (No improper driving)		Collision with motor vehicle in traffic	Daylight	Angle	5	Dry	Not at junction	0	0	No controls	Two-way, not divided	V1: Travelling straight ahead / V2: Turning right	V1: S / V2: E	Clear/Unknown	15-38-ac	Roadway	No hit and run	42.1724	-70.879	80	WASHINGTON STREET	CVS PHARMACY
4042876	NORWELL	03/13/2015	Property damage only (none injured)	Closed	7:47 AM	No injury	2	D1: (No improper driving) / D2: (Other improper action)		Collision with motor vehicle in traffic	Daylight	Angle	5	Dry	Not at junction	0	0	No controls	Two-way, divided, unprotected median	V1: Travelling straight ahead / V2: Turning left	V1: N / V2: N	Clear	15-49-AC / 15-49-AC	Roadway	No hit and run	42.1719	-70.879	95	WASHINGTON STREET	
4053132	NORWELL	03/29/2015	Property damage only (none injured)	Closed	7:37 PM	No injury	2	D1: (No improper driving) / D2: (Failed to yield right of way)		Collision with motor vehicle in traffic	Dark - lighted roadway	Angle	5	Dry	Not at junction	0	0	No controls	Two-way, divided, unprotected median	V1: Travelling straight ahead / V2: Turning left	V1: S / V2: E	Clear	15-61-AC / 15-61-ac	Roadway	No hit and run	42.1724	-70.879	80	WASHINGTON STREET	MOBIL GAS STATION
4111629	NORWELL	11/02/2015	Non-fatal injury	Closed	2:59 PM	Non-fatal injury - Incapacitating	2			Collision with motor vehicle in traffic	Daylight	Rear-end	5	Dry	Four-way intersection	0	2	Traffic control signal	Two-way, not divided	V1: Slowing or stopped in traffic / V2: Travelling straight ahead	V1: S / V2: S	Clear/Rain	15-186-AC / 15-186-AC	Roadway	No hit and run	42.1724	-70.879	80	WASHINGTON ST	
4120402	NORWELL	12/04/2015	Property damage only (none injured)	Closed	5:01 PM	No injury	2	D1: (Failed to yield right of way) / D2: (No improper driving)		Collision with motor vehicle in traffic	Dark - lighted roadway	Angle	5	Dry	Not at junction	0	0	No controls	Two-way, divided, unprotected median	V1: Turning left / V2: Travelling straight ahead	V1: S / V2: N	Clear	15-209-AC	Roadway	No hit and run	42.1719	-70.879	95	WASHINGTON ST	
4123266	NORWELL	07/08/2015	Non-fatal injury	Closed	11:42 AM	Non-fatal injury - Non-incapacitating	2	D1: (Unknown) / D2: (Unknown)		Collision with motor vehicle in traffic	Daylight	Angle	5	Dry	Not at junction	0	2	No controls	Two-way, not divided	V1: Turning left / V2: Travelling straight ahead	V1: S / V2: N	Clear	15-111-AC	Roadway	No hit and run	42.1719	-70.879	95	WASHINGTON STREET	
4156225	NORWELL	02/25/2016	Property damage only (none injured)	Closed	10:34 AM	No injury	2	D1: (Other improper action),(Failed to yield right of way)		Collision with motor vehicle in traffic	Daylight	Sideswipe, opposite direction	5	Dry	Four-way intersection	0	0	Traffic control signal	Two-way, divided, unprotected median	V1: Turning left / V2: Travelling straight ahead	V1: E / V2: W	Clear	16-50-AC / 16-50-AC	Roadway	No hit and run	42.1724	-70.879	80	WASHINGTON ST	
4165627	NORWELL	01/17/2016	Property damage only (none injured)	Closed	12:38 AM	No injury	1	D1: (Unknown)		Collision with other light pole or other post/support	Dark - lighted roadway	Single vehicle crash	5	Wet	Not at junction	0	0	No controls	Two-way, not divided	V1: Turning left	V1: W	Fog, smog, smoke	16-19-AC	Roadside	No hit and run	42.1719	-70.879	95	WASHINGTON ST	
4177442	NORWELL	03/26/2016	Non-fatal injury	Closed	1:28 PM	Non-fatal injury - Possible	2	D1: (Other improper action) / D2: (No improper driving)		Collision with motor vehicle in traffic	Daylight	Rear-end	5	Dry	Not at junction	0	1	No controls	Two-way, divided, unprotected median	V1: Travelling straight ahead / V2: Travelling straight ahead	V1: N / V2: N	Clear	16-70-AC	Roadway	No hit and run	42.1719	-70.879	95	WASHINGTON ST	
4210027	NORWELL	06/28/2016	Property damage only (none injured)	Closed	4:54 PM	No injury	4	D1: (No improper driving) / D2: (No improper driving) / D3: (No improper driving) / D4: (Unknown)		Collision with motor vehicle in traffic	Daylight	Rear-end	5	Dry	Not at junction	0	0	Traffic control signal	Two-way, not divided	V1: Slowing or stopped in traffic / V2: Slowing or stopped in traffic / V3: Slowing or stopped in traffic / V4: Travelling straight ahead	V1: S / V2: S / V3: S / V4: S	Clear	16-148-AC	Roadway	No hit and run	42.1724	-70.879	80	WASHINGTON ST	
4217172	NORWELL	07/08/2016	Property damage only (none injured)	Closed	12:31 PM	No injury	2	D1: (Other improper action) / D2: (No improper driving)	D1: Other activity (searching, eating, personal hygiene, etc.)	Collision with motor vehicle in traffic	Daylight	Rear-end	5	Dry	Not at junction	0	0	No controls	Two-way, divided, unprotected median	V1: Travelling straight ahead / V2: Slowing or stopped in traffic	V1: N / V2: N	Clear	16-154-AC	Roadway	No hit and run	42.1719	-70.879	95	WASHINGTON ST	
4242770	NORWELL	09/06/2016	Property damage only (none injured)	Closed	11:01 AM	No injury	2	D1: (Other improper action) / D2: (No improper driving)		Collision with motor vehicle in traffic	Daylight	Rear-end	5	Dry	T-intersection	0	0	Not reported	Two-way, divided, unprotected median	V1: Travelling straight ahead / V2: Travelling straight ahead	V1: N / V2: N	Clear	16-193-AC	Roadway	No hit and run	42.1721	-70.879	89	WASHINGTON ST	
4249620	NORWELL	09/16/2016	Property damage only (none injured)	Closed	4:32 PM	No injury	2	D1: (No improper driving) / D2: (Followed too closely)		Collision with motor vehicle in traffic	Daylight	Rear-end	5	Dry	Not at junction	0	0	Traffic control signal	Two-way, not divided	V1: Slowing or stopped in traffic / V2: Travelling straight ahead	V1: S / V2: S	Clear/Cloudy	16-200-AC	Roadway	No hit and run	42.1724	-70.879	80	WASHINGTON ST	
4278726	NORWELL	10/28/2016	Non-fatal injury	Closed	1:35 PM	Non-fatal injury - Possible	2	D1: (No improper driving) / D2: (Unknown)		Collision with motor vehicle in traffic	Daylight	Rear-end	5	Dry	Not at junction	0	1	Flashing traffic control signal	Two-way, not divided	V1: Slowing or stopped in traffic / V2: Parked	V1: S / V2: S	Cloudy	16-232-AC	Roadway	No hit and run	42.1724	-70.879	80	WASHINGTON ST	
4278832	NORWELL	11/04/2016	Property damage only (none injured)	Closed	4:41 PM	No injury	2	D1: (No improper driving) / D2: (No improper driving)		Collision with motor vehicle in traffic	Daylight	Head-on	5	Dry	Not at junction	0	0	No controls	Two-way, not divided	V1: Turning left / V2: Slowing or stopped in traffic	V1: S / V2: N	Clear	16-241-AC	Roadway	No hit and run	42.1719	-70.879	95	WASHINGTON ST	

Crash Number	City Town Name	Crash Date	Crash Severity	Crash Status	Crash Time	Max Injury Severity Reporte	Number of Vehicles	Driver Contributing Circumstances (All Drivers)	Driver Distracted By (All Vehicles)	First Harmful Event	Light Conditions	Manner of Collision	MassDOT District	Road Surface Condition	Roadway Junction Type	Total Fatalities	Total Non-Fatal Injuries	Traffic Control Device Type	Trafficway Description	Vehicle Actions Prior to Crash (All Vehicles)	Vehicle Travel Directions (All	Weather Conditions	Crash Report IDs	First Harmful Event Location	Hit and Run	Latitude	Longitude	Street Number	Roadway	Near Intersection Roadway/ Landmark
4281665	NORWELL	11/08/2016	Non-fatal injury	Closed	4:10 PM	Non-fatal injury - Non-incapacitating	2	D1: (No improper driving) / D2: (No improper driving)		Collision with motor vehicle in traffic	Daylight	Rear-end	5	Dry	Four-way intersection	0	1	Traffic control signal	Two-way, not divided	V1: Travelling straight ahead / V2: Travelling straight ahead	V1: S / V2: S	Clear	16-243-AC	Roadway	No hit and run	42.1724	-70.879	80	WASHINGTON ST	
4323213	NORWELL	02/07/2017	Property damage only (none injured)	Closed	9:19 AM	No injury	2	D1: (No improper driving) / D2: (No improper driving)		Collision with motor vehicle in traffic	Daylight	Angle	5	Wet	Not at junction	0	0	No controls	Two-way, not divided	V1: Turning right / V2: Making U-turn	V1: N / V2: W	Rain/Snow	17-24-AC	Roadway	No hit and run	42.1719	-70.879	95	WASHINGTON ST	711 CONVENIENCE STORE
4382896	NORWELL	06/08/2017	Property damage only (none injured)	Closed	8:17 AM	No injury	2	D1: (No improper driving) / D2: (Other improper action)		Collision with motor vehicle in traffic	Daylight	Angle	5	Dry	T-intersection	0	0	No controls	Two-way, divided, unprotected median	V1: Turning left / V2: Travelling straight ahead	V1: E / V2: N	Clear	17-105-AC	Roadway	No hit and run	42.1719	-70.879	95	WASHINGTON ST	
4382908	NORWELL	04/30/2017	Property damage only (none injured)	Closed	5:44 PM	No injury	2	D1: (Unknown) / D2: (Visibility obstructed)		Collision with motor vehicle in traffic	Daylight	Angle	5	Dry	Not at junction	0	0	No controls	Two-way, not divided	V1: Travelling straight ahead / V2: Turning left	V1: N / V2: S	Clear	17-74-AC	Roadway	No hit and run	42.1719	-70.879	95	WASHINGTON ST	
4416480	NORWELL	08/01/2017	Property damage only (none injured)	Closed	2:45 PM	No injury	2	D1: (No improper driving) / D2: (Unknown)		Collision with motor vehicle in traffic	Daylight	Rear-end	5	Dry	Not at junction	0	0	No controls	Unknown	V1: Travelling straight ahead / V2: Travelling straight ahead	V1: N / V2: N	Clear	17-146-AC	Roadway	No hit and run	42.1721	-70.879	89	WASHINGTON ST	
4456095	NORWELL	11/01/2017	Property damage only (none injured)	Closed	1:43 PM	No injury	2	D1: (Unknown) / D2: (Unknown)		Collision with motor vehicle in traffic	Dark - roadway not lighted	Angle	5	Wet	Not at junction	0	0	No controls	Two-way, not divided	V1: Turning right / V2: Turning left	V1: E / V2: E	Rain	17-212-AC	Roadway	No hit and run	42.1724	-70.878	6	GROVE ST	
4482573	NORWELL	12/22/2017	Property damage only (none injured)	Closed	11:19 AM	No injury	2	D1: (No improper driving) / D2: (Other improper action)		Collision with motor vehicle in traffic	Daylight	Angle	5	Dry	Driveway	0	0	No controls	Two-way, divided, unprotected median	V1: Travelling straight ahead / V2: Turning left	V1: S / V2: S	Cloudy	17-236-AC	Roadway	No hit and run	42.1724	-70.879	80	WASHINGTON ST	
4497704	NORWELL	01/17/2018	Property damage only (none injured)	Closed	6:28 AM	No injury	1	D1: (No improper driving)		Collision with animal - deer	Dark - lighted roadway	Single vehicle crash	5	Wet	Not at junction	0	0	No controls	Two-way, not divided	V1: Travelling straight ahead	V1: W	Cloudy /Snow	18-13-AC	Roadway	No hit and run	42.1723	-70.879	5	GROVE ST	
4524538	NORWELL	03/29/2018	Property damage only (none injured)	Closed	11:59 AM	No injury	2	D1: (Other improper action) / D2: (No improper driving)		Collision with motor vehicle in traffic	Daylight	Rear-end	5	Dry	T-intersection	0	0	Traffic control signal	Two-way, divided, unprotected median	V2: Slowing or stopped in traffic / V1: Slowing or stopped in traffic	V2: S / V1: S	Clear	18NOW-82-AC	Roadway	No hit and run	42.1719	-70.879	95	WASHINGTON STREET	
4541633	NORWELL	05/18/2018	Property damage only (none injured)	Closed	9:59 AM	No injury	2	D1: (Other improper action) / D2: (No improper driving)		Collision with motor vehicle in traffic	Daylight	Rear-end	5	Dry	T-intersection	0	0	No controls	Two-way, divided, unprotected median	V1: Travelling straight ahead / V2: Travelling straight ahead	V1: N / V2: N	Clear	18NOW-110-AC	Roadway	No hit and run	42.1721	-70.879	89	WASHINGTON ST	
4584614	NORWELL	07/20/2018	Property damage only (none injured)	Closed	2:36 PM	No injury	2	D1: (Unknown) / D2: (Visibility obstructed)		Collision with motor vehicle in traffic	Daylight	Angle	5	Dry	Not at junction	0	0	No controls	Two-way, not divided	V1: Travelling straight ahead / V2: Turning left	V1: S / V2: S	Clear	18NOW-148-AC	Roadway	No hit and run	42.1719	-70.879	95	WASHINGTON ST	
3813849	NORWELL	05/14/2014	Non-fatal injury	Closed	9:32 AM	Non-fatal injury - Possible	2	D1: (No improper driving)		Collision with motor vehicle in traffic	Daylight	Angle	5	Dry	Not reported	0	2	Traffic control signal	Two-way, not divided	V1: Travelling straight ahead / V2: Travelling straight ahead	V1: S / V2: W	Clear	2014-0D1-001788	Roadway	No hit and run	42.1721	-70.879		WASHINGTON STREET / GROVE STREET	
3988257	NORWELL	02/04/2014	Property damage only (none injured)	Closed	7:34 PM	No injury	2	D1: (No improper driving) / D2: (No improper driving)		Collision with motor vehicle in traffic	Dark - lighted roadway	Rear-end	5	Wet	Four-way intersection	0	0	Traffic control signal	Two-way, not divided	V1: Slowing or stopped in traffic / V2: Travelling straight ahead	V1: N / V2: N	Clear	14-31-ac / 14-31-ac	Roadway	No hit and run	42.1721	-70.879		GROVE STREET / WASHINGTON STREET / HIGH STREET	
3988275	NORWELL	01/15/2014	Non-fatal injury	Closed	6:02 PM	Non-fatal injury - Possible	2	D1: (No improper driving) / D2: (Glare),(No improper driving)		Collision with motor vehicle in traffic	Daylight	Angle	5	Dry	Four-way intersection	0	2	Traffic control signal	Two-way, not divided	V1: Travelling straight ahead / V2: Travelling straight ahead	V1: E / V2: S	Clear	14-9-ac / 14-9-ac	Roadway	No hit and run	42.1721	-70.879		GROVE STREET / WASHINGTON STREET	
3991184	NORWELL	08/23/2014	Non-fatal injury	Closed	10:16 AM	Non-fatal injury - Possible	2	D1: (No improper driving) / D2: (No improper driving)		Collision with motor vehicle in traffic	Daylight	Rear-end	5	Dry	Four-way intersection	0	1	Traffic control signal	Two-way, not divided	V1: Travelling straight ahead / V2: Travelling straight ahead	V1: S / V2: S	Clear	14-159-ac	Roadway	No hit and run	42.1721	-70.879		WASHINGTON STREET / GROVE STREET	
3991518	NORWELL	07/28/2014	Property damage only (none injured)	Closed	12:33 AM	No injury	2	D1: (No improper driving) / D2: (Other improper action)		Collision with motor vehicle in traffic	Daylight	Rear-end	5	Dry	Not at junction	0	0	Traffic control signal	Two-way, divided, unprotected median	V1: Travelling straight ahead / V2: Travelling straight ahead	V1: S / V2: S	Clear	14-141-AC	Roadway	No hit and run	42.1721	-70.879		WASHINGTON STREET / GROVE STREET	
3992129	NORWELL	10/14/2014	Property damage only (none injured)	Closed	3:25 PM	No injury	3	D1: (No improper driving) / D2: (No improper driving) / D3: (Other improper action)		Collision with motor vehicle in traffic	Daylight	Rear-end	5	Dry	T-intersection	0	0	Traffic control signal	Two-way, divided, unprotected median	V1: Slowing or stopped in traffic / V2: Slowing or stopped in traffic / V3: Travelling straight ahead	V1: S / V2: S / V3: S	Clear	14-193-ac	Roadway	No hit and run	42.1721	-70.879		WASHINGTON STREET / GROVE STREET	
4003538	NORWELL	04/30/2014	Property damage only (none injured)	Closed	5:01 PM	No injury	2	D1: (No improper driving) / D2: (Disregarded traffic signs, signals, road markings),(Failed to yield right of way)		Collision with motor vehicle in traffic	Daylight	Angle	5	Wet	T-intersection	0	0	Stop signs	Two-way, not divided	V1: Travelling straight ahead / V2: Entering traffic lane	V1: W / V2: S	Cloudy /Rain	14-93-ac	Roadway	No hit and run	42.1721	-70.879		HIGH STREET / WASHINGTON STREET	
4003556	NORWELL	04/15/2014	Non-fatal injury	Closed	3:29 PM	Non-fatal injury - Possible	2	D1: (Unknown) / D2: (Unknown)		Collision with motor vehicle in traffic	Daylight	Rear-end	5	Wet	Not at junction	0	1	No controls	Two-way, not divided	V1: Turning left / V2: Travelling straight ahead	V1: N / V2: N	Cloudy /Rain	14-86-ac	Roadway	No hit and run	42.1721	-70.879		WASHINGTON STREET / GROVE STREET	
4006110	NORWELL	09/18/2014	Property damage only (none injured)	Closed	5:00 PM	No injury	2	D1: (Unknown) / D2: (Unknown)		Collision with motor vehicle in traffic	Daylight	Rear-end	5	Dry	T-intersection	0	0	Traffic control signal	Two-way, not divided	V1: Slowing or stopped in traffic / V2: Travelling straight ahead	V1: W / V2: W	Clear	14-169-ac	Roadway	No hit and run	42.1721	-70.879		WASHINGTON STREET / HIGH STREET / GROVE STREET /	

Crash Number	City Town Name	Crash Date	Crash Severity	Crash Status	Crash Time	Max Injury Severity Reporte	Number of Vehicles	Driver Contributing Circumstances (All Drivers)	Driver Distracted By (All Vehicles)	First Harmful Event	Light Conditions	Manner of Collision	MassDOT District	Road Surface Condition	Roadway Junction Type	Total Fatalities	Total Non-Fatal Injuries	Traffic Control Device Type	Trafficway Description	Vehicle Actions Prior to Crash (All Vehicles)	Vehicle Travel Directions (All	Weather Conditions	Crash Report IDs	First Harmful Event Location	Hit and Run	Latitude	Longitude	Street Number	Roadway	Near Intersection Roadway/ Landmark
4006120	NORWELL	09/02/2014	Property damage only (none injured)	Closed	8:30 PM	No injury	2	D1: (No improper driving) / D2: (No improper driving)		Collision with motor vehicle in traffic	Dark - lighted roadway	Rear-end	5	Dry	Four-way intersection	0	0	Traffic control signal	Two-way, not divided	V1: Slowing or stopped in traffic / V2: Slowing or stopped in traffic	V1: N / V2: N	Clear	14-167-ac	Roadway	No hit and run	42.1721	-70.879		WASHINGTON STREET / GROVE STREET	
4006158	NORWELL	08/21/2014	Property damage only (none injured)	Closed	2:37 PM	No injury	2	D1: (No improper driving) / D2: (No improper driving)		Collision with motor vehicle in traffic	Daylight	Rear-end	5	Dry	Four-way intersection	0	0	Traffic control signal	Two-way, not divided	V1: Travelling straight ahead / V2: Travelling straight ahead	V1: S / V2: S	Clear	14-158-ac	Roadway	No hit and run	42.1721	-70.879		WASHINGTON STREET / GROVE STREET / HIGH STREET	
4006778	NORWELL	11/03/2014	Property damage only (none injured)	Closed	8:51 AM	No injury	2	D1: (No improper driving) / D2: (Inattention)		Collision with motor vehicle in traffic	Daylight	Rear-end	5	Dry	Four-way intersection	0	0	Yield signs	Two-way, not divided	V1: Slowing or stopped in traffic / V2: Slowing or stopped in traffic	V1: W / V2: W	Clear	14-210-ac	Roadway	No hit and run	42.1721	-70.879		WASHINGTON STREET / GROVE STREET	
4042878	NORWELL	03/17/2015	Non-fatal injury	Closed	11:29 AM	Non-fatal injury - Possible	2	D1: (No improper driving) / D2: (No improper driving)		Collision with motor vehicle in traffic	Daylight	Rear-end	5	Wet	Four-way intersection	0	2	Traffic control signal	Two-way, not divided	V1: Slowing or stopped in traffic / V2: Turning right	V1: W / V2: W	Rain/Cloudy	15-52-AC	Roadway	No hit and run	42.1721	-70.879		GROVE STREET / WASHINGTON STREET	
4114578	NORWELL	11/21/2015	Property damage only (none injured)	Closed	1:29 PM	No injury	2	D1: (No improper driving) / D2: (Operating defective equipment),(Unknown)		Collision with motor vehicle in traffic	Daylight	Sideswipe, opposite direction	5	Dry	Not at junction	0	0	No controls	Two-way, not divided	V1: Travelling straight ahead / V2: Entering traffic lane	V1: E / V2: N	Clear	15-196-AC	Roadway	No hit and run	42.1721	-70.879		GROVE STREET / WASHINGTON STREET	
4278727	NORWELL	10/30/2016	Property damage only (none injured)	Closed	6:28 PM	No injury	2	D1: (No improper driving) / D2: (No improper driving)		Collision with motor vehicle in traffic	Dark - lighted roadway	Rear-end	5	Wet	Four-way intersection	0	0	Traffic control signal	Two-way, not divided	V1: Travelling straight ahead / V2: Travelling straight ahead	V1: S / V2: S	Rain/Cloudy	16-234-AC	Roadway	No hit and run	42.1721	-70.879		WASHINGTON ST / HIGH ST	
4482568	NORWELL	11/26/2017	Unknown	Closed	10:52 AM	Unknown	2	D1: (Unknown) / D2: (Unknown)		Collision with motor vehicle in traffic	Daylight	Rear-end	5	Dry	Four-way intersection	0	0	Traffic control signal	Two-way, divided, unprotected median	V1: Slowing or stopped in traffic / V2: Slowing or stopped in traffic	V1: S / V2: S	Clear	17-222-AC	Roadway	No hit and run	42.1721	-70.879		WASHINGTON ST Rte 53 S / GROVE ST	
4634437	NORWELL	12/05/2018	Property damage only (none injured)	Closed	7:40 AM	No injury	3			Collision with motor vehicle in traffic	Daylight	Rear-end	5	Dry	Four-way intersection	0	0	Traffic control signal	Two-way, not divided	V1: Slowing or stopped in traffic / V2: Slowing or stopped in traffic / V3: Slowing or stopped in traffic	V1: S / V2: S / V3: S	Clear	18NOW-253-AC / 18NOW-253-AC	Roadway	No hit and run	42.1721	-70.879		WASHINGTON ST / HIGH ST	
4634917	NORWELL	11/23/2018	Property damage only (none injured)	Closed	4:07 PM	No injury	4	D1: (No improper driving) / D2: (No improper driving) / D3: (Unknown) / D4: (No improper driving)		Collision with motor vehicle in traffic	Dusk	Rear-end	5	Dry	Four-way intersection	0	0	Traffic control signal	Two-way, not divided	V1: Slowing or stopped in traffic / V2: Slowing or stopped in traffic / V3: Travelling straight ahead / V4: Travelling straight ahead	V1: S / V2: S / V3: S / V4: S	Clear	18NOW-243-AC	Roadway	No hit and run	42.1724	-70.879		HIGH ST / WASHINGTON ST	
4635744	NORWELL	12/11/2018	Non-fatal injury	Closed	5:53 PM	Non-fatal injury - Possible	2	D1: (Operating vehicle in erratic, reckless, careless, negligent or aggressive manner),(Failed to yield right of way)		Collision with motor vehicle in traffic	Dark - lighted roadway	Angle	5	Dry	Four-way intersection	0	2	Traffic control signal	Two-way, not divided	V1: Travelling straight ahead / V2: Travelling straight ahead	V1: W / V2: S	Clear	18NOW-260-AC / 18NOW-260-AC	Roadway	No hit and run	42.1721	-70.879		GROVE ST / WASHINGTON ST	
3991517	NORWELL	07/31/2014	Non-fatal injury	Closed	2:40 PM	Non-fatal injury - Possible	2	D1: (No improper driving) / D2: (Visibility obstructed)	D1: Talking on hand-held electronic device	Collision with motor vehicle in traffic	Daylight	Angle	5	Dry	Not at junction	0	1	Traffic control signal	Two-way, not divided	V1: Travelling straight ahead / V2: Entering traffic lane	V1: S / V2: E	Clear	14-142-ac	Roadway	No hit and run	42.1721	-70.879	80	WASHINGTON STREET	GROVE STREET
4042387	NORWELL	01/21/2015	Property damage only (none injured)	Closed	8:14 PM	No injury	2	D1: (No improper driving) / D2: (Other improper action)	D1: Other activity (searching, eating, personal hygiene, etc.)	Collision with motor vehicle in traffic	Dark - lighted roadway	Rear-end	5	Dry	Four-way intersection	0	0	Traffic control signal	Two-way, not divided	V1: Slowing or stopped in traffic / V2: Travelling straight ahead	V1: N / V2: N	Clear	15-14-AC	Roadway	No hit and run	42.1721	-70.879		WASHINGTON STREET	GROVE STREET
4099684	NORWELL	05/11/2015	Property damage only (none injured)	Closed	2:27 PM	No injury	2	D1: (No improper driving) / D2: (Other improper action)		Collision with motor vehicle in traffic	Daylight	Rear-end	5	Dry	T-intersection	0	0	Traffic control signal	Two-way, divided, unprotected median	V1: Travelling straight ahead / V2: Travelling straight ahead	V1: S / V2: S	Clear	15-81-AC	Roadway	No hit and run	42.1721	-70.879		GROVE STREET	WASHINGTON STREET
4099738	NORWELL	06/12/2015	Property damage only (none injured)	Closed	1:24 PM	No injury	2	D1: (No improper driving) / D2: (Other improper action)		Collision with motor vehicle in traffic	Daylight	Sideswipe, same direction	5	Dry	Not at junction	0	0	Traffic control signal	Two-way, divided, unprotected median	V1: Travelling straight ahead / V2: Travelling straight ahead	V1: S / V2: S	Clear	15-102-AC	Roadway	No hit and run	42.1721	-70.879	104	WASHINGTON STREET	GROVE STREET
4416484	NORWELL	08/15/2017	Not Reported	Closed	1:34 PM	Unknown	3	D1: (No improper driving) / D2: (No improper driving) / D3: (Unknown)	D1: Other activity (searching, eating, personal hygiene, etc.)	Collision with motor vehicle in traffic	Daylight	Rear-end	5	Dry	Not at junction	0	0	Traffic control signal	Two-way, divided, unprotected median	V1: Slowing or stopped in traffic / V2: Slowing or stopped in traffic / V3: Travelling straight ahead	V1: S / V2: S / V3: S	Cloudy	17-153-AC	Roadway	No hit and run	42.1723	-70.879		WASHINGTON STREET Rte 53 S	GROVE STREET 50 feet N of
4482577	NORWELL	01/05/2018	Non-fatal injury	Closed	3:19 PM	Non-fatal injury - Possible	2	D1: (No improper driving) / D2: (Distracted)	D1: Passenger	Collision with motor vehicle in traffic	Daylight	Rear-end	5	Snow	Y-intersection	0	1	Traffic control signal	Unknown	V1: Slowing or stopped in traffic / V2: Travelling straight ahead	V1: S / V2: S	Clear	18-4-AC	Roadway	No hit and run	42.1722	-70.879		WASHINGTON STREET Rte SR53 S	MOBILE MART GAS STATION
4536857	NORWELL	05/05/2018	Property damage only (none injured)	Closed	1:15 PM	No injury	2	D1: (No improper driving) / D2: (No improper driving)		Collision with motor vehicle in traffic	Daylight	Sideswipe, same direction	5	Dry	Not at junction	0	0	No controls	Two-way, not divided	V2: Travelling straight ahead / V1: Travelling straight ahead	V2: N / V1: N	Clear	18NOW-104-AC	Roadway	No hit and run	42.1722	-70.879		WASHINGTON STREET Rte SR53 N	GROVE STREET
HIGH ST AT OAK ST																														
4497705	NORWELL	01/17/2018	Property damage only (none injured)	Closed	8:10 AM	No injury	1	D1: (Unknown)		Collision with other movable object	Daylight	Single vehicle crash	5	Snow	Not at junction	0	0	No controls	Two-way, not divided	V1: Travelling straight ahead	V1: N	Snow	18-14-AC	Roadway	No hit and run	42.1679	-70.878	81	HIGH ST	

Crash Number	City Town Name	Crash Date	Crash Severity	Crash Status	Crash Time	Max Injury Severity Reporte	Number of Vehicles	Driver Contributing Circumstances (All Drivers)	Driver Distracted By (All Vehicles)	First Harmful Event	Light Conditions	Manner of Collision	MassDOT District	Road Surface Condition	Roadway Junction Type	Total Fatalities	Total Non-Fatal Injuries	Traffic Control Device Type	Trafficway Description	Vehicle Actions Prior to Crash (All Vehicles)	Vehicle Travel Directions (All	Weather Conditions	Crash Report IDs	First Harmful Event Location	Hit and Run	Latitude	Longitude	Street Number	Roadway	Near Intersection Roadway/ Landmark
4545222	NORWELL	05/29/2018	Property damage only (none injured)	Closed	3:35 PM	No injury	2	D1: (Other improper action) / D2: (No improper driving)		Collision with motor vehicle in traffic	Daylight	Angle	5	Dry	T-intersection	0	0	Stop signs	Two-way, divided, unprotected median	V1: Turning left / V2: Travelling straight ahead	V1: W / V2: N	Clear	18NOW-116-AC	Roadway	No hit and run	42.1679	-70.878	81	HIGH ST	
WASHINGTON ST AT OAK ST																														
4098648	NORWELL	07/22/2015	Property damage only (none injured)	Closed	12:12 PM	No injury	2	D1: (No improper driving) / D2: (No improper driving)		Collision with motor vehicle in traffic	Daylight	Sideswipe, same direction	5	Dry	Four-way intersection	0	0	Traffic control signal	Two-way, not divided	V1: Travelling straight ahead / V2: Travelling straight ahead	V1: N / V2: N	Clear	15-121-AC	Roadway	No hit and run	42.1686	-70.875	167	WASHINGTON STREET	
4556752	NORWELL	06/17/2018	Property damage only (none injured)	Closed	11:48 AM	No injury	2	D1: (No improper driving) / D2: (Unknown)		Collision with motor vehicle in traffic	Daylight	Sideswipe, opposite direction	5	Dry	Not at junction	0	0	No controls	Two-way, divided, unprotected median	V1: Travelling straight ahead / V2: Travelling straight ahead	V1: S / V2: N	Clear	18NOW-131-AC	Roadway	No hit and run	42.1685	-70.875	164	WASHINGTON ST	
4584825	NORWELL	08/15/2018	Property damage only (none injured)	Closed	8:55 AM	No injury	2	D1: (No improper driving) / D2: (Failed to yield right of way)		Collision with motor vehicle in traffic	Daylight	Angle	5	Dry	T-intersection	0	0	No controls	Two-way, not divided	V1: Travelling straight ahead / V2: Turning left	V1: S / V2: E	Clear/ Unknown	18NOW-168-AC	Roadway	No hit and run	42.1687	-70.875	167	WASHINGTON ST	
3992133	NORWELL	10/14/2014	Property damage only (none injured)	Closed	7:15 AM	No injury	2	D1: (No improper driving) / D2: (No improper driving)		Collision with motor vehicle in traffic	Daylight	Rear-end	5	Dry	T-intersection	0	0	No controls	Two-way, not divided	V1: Slowing or stopped in traffic / V2: Travelling straight ahead	V1: N / V2: N	Clear	14-192-ac	Roadway	No hit and run	42.1684	-70.875	154	WASHINGTON STREET	OAK STREET
4233165	NORWELL	08/10/2016	Property damage only (none injured)	Closed	2:11 PM	No injury	2	D1: (No improper driving) / D2: (Unknown)		Collision with motor vehicle in traffic	Daylight	Head-on	5	Wet	T-intersection	0	0	No controls	Two-way, divided, unprotected median	V1: Entering traffic lane / V2: Travelling straight ahead	V1: N / V2: S	Cloudy /Rain	16-175-AC	Roadway	No hit and run	42.1684	-70.875		OAK ST	WASHINGTON STREET

MassDOT Top Crash Locations



4/2/2021, 10:38:31 AM

2013-2015 HSIP Cluster

1:4,514

0 0.04 0.08 0.16 mi

0 0.05 0.1 0.2 km

MassGIS

MassDOT
MassGIS |

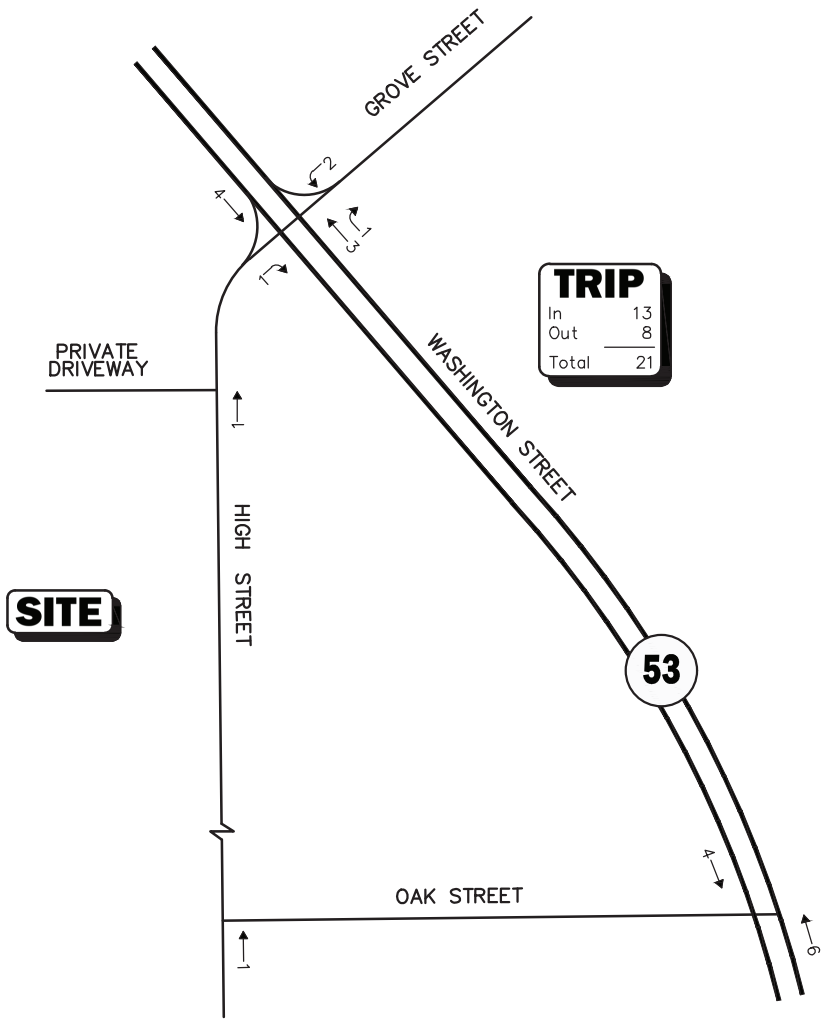
GROWTH RATE CALCULATIONS

General Background Traffic Growth - Daily Traffic Volumes

ID	CITY/TOWN	ROUTE/STREET	LOCATION	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	Average
28	Waymount	WHITING STREET	EAST OF WEYMOUTH TOWN LINE						13,277	14,100	14,269	14,430	14,372	**1.88%**
6255	Waymount	PILGRIM HIGHWAY	NORTH OF RTE.18		131,978	132,053	131,271	132,623	127,190	133,245	133,570	133,238	130,967	**0.04%**
7318	Norwell	SOUTHEAST EXPRESSWAY	NORTH OF RAMP-RT 3 SB TO RT 228	92,983	89,680	90,993	90,738	92,478	96,218	94,644	96,013	94,947	93,915	**0.50%**
36	Norwell	PILGRIM HIGHWAY	SOUTH OF RIVER ST. (REPLACES STA 7000)	71,958	70,770	68,198	72,958	70,137	74,108	71,125	72,476	74,315	69,956	**0.17%**
														0.65%
													SAY	1%

GENERAL BACKGROUND

WEEKDAY MORNING PEAK HOUR



WEEKDAY EVENING PEAK HOUR

Note: The traffic study for this project evaluated retail expansion for two possible options: Drive-Through Bank Use and Drive-Through Pharmacy Use. As part of this study the highest trip generator (Drive-Through Bank Use) was assumed.

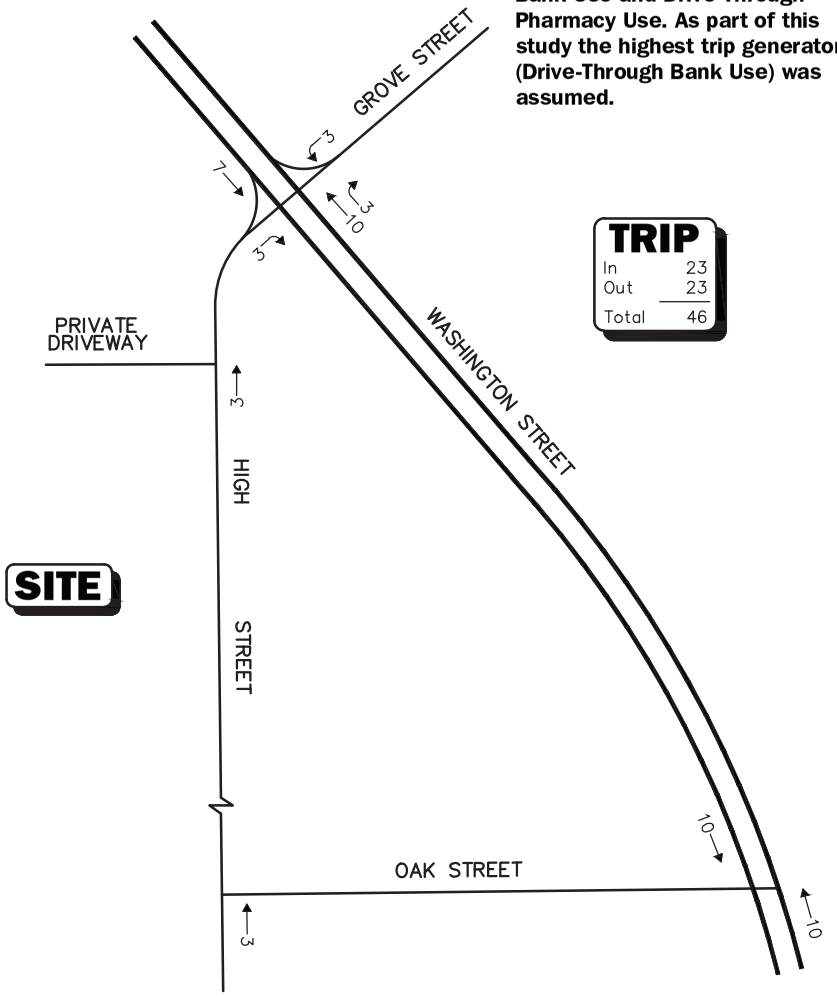


Figure A-1

Proposed Commercial Building Expansion
119 Washington Street
Peak Hour Traffic Volumes

Vanasse & Associates inc

R:\8890\8890nt1.dwg, Thu Apr 1 16:54:32 2021

Copyright © 2021 by VAi. All Rights Reserved.

US CENSUS

COMMUTING CHARACTERISTICS BY SEX

United States Census Bureau

Note: This is a modified view of the original table produced by the U.S. Census Bureau. This download or printed version may have missing information from the original table.

	Census Tract 5041.01, Plymouth County, Massachusetts	
	Total	
Label	Estimate	Margin of Erro
Workers 16 years and over	2,806	±23
MEANS OF TRANSPORTATION TO WORK		
Car, truck, or van	83.0%	±4.
Drove alone	79.9%	±4.
Carpooled	3.1%	±1.
In 2-person carpool	2.0%	±1.
In 3-person carpool	0.4%	±0.
In 4-or-more person carpool	0.7%	±1.
Workers per car, truck, or van	1.02	±0.0
Public transportation (excluding taxicab)	9.9%	±3.
Walked	0.9%	±1.
Bicycle	0.0%	±1.
Taxicab, motorcycle, or other means	0.9%	±1.
Worked from home	5.3%	±3.
PLACE OF WORK		
Worked in state of residence	98.9%	±1.
Worked in county of residence	47.4%	±5.
Worked outside county of residence	51.5%	±5.
Worked outside state of residence	1.1%	±1.
Living in a place	0.0%	±1.
Worked in place of residence	0.0%	±1.
Worked outside place of residence	0.0%	±1.
Not living in a place	100.0%	±1.
Living in 12 selected states	100.0%	±1.
Worked in minor civil division of residence	21.7%	±5.
Worked outside minor civil division of residence	78.3%	±5.

Table Notes

COMMUTING CHARACTERISTICS BY SEX

Survey/Program:
American Community Survey
Year:
2019
Estimates:
5-Year
Table ID:
S0801

Although the American Community Survey (ACS) produces population, demographic and housing unit estimates, it is the Census Bureau's Population Estimates Program that produces and disseminates the official estimates of the population for the nation, states, counties, cities, and towns and estimates of housing units for states and counties.

Source: U.S. Census Bureau, 2015-2019 American Community Survey 5-Year Estimates

When information is missing or inconsistent, the Census Bureau logically assigns an acceptable value using the response to a related question or questions. If a logical assignment is not possible, data are filled using a statistical process called allocation, which uses a similar individual or household to provide a donor value. The "Allocated" section is the number of respondents who received an allocated value for a particular subject.

2019 ACS data products include updates to several categories of the existing means of transportation question. For more information, see: Change to Means of Transportation.

Data are based on a sample and are subject to sampling variability. The degree of uncertainty for an estimate arising from sampling variability is represented through the use of a margin of error. The value shown here is the 90 percent margin of error. The margin of error can be interpreted roughly as providing a 90 percent probability that the interval defined by the estimate minus the margin of error and the estimate plus the margin of error (the lower and upper confidence bounds) contains the true value. In addition to sampling variability, the ACS estimates are subject to nonsampling error (for a discussion of nonsampling variability, see ACS Technical Documentation). The effect of nonsampling error is not represented in these tables.

The 12 selected states are Connecticut, Maine, Massachusetts, Michigan, Minnesota, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, Vermont, and Wisconsin.

Workers include members of the Armed Forces and civilians who were at work last week.

The 2015-2019 American Community Survey (ACS) data generally reflect the September 2018 Office of Management and Budget (OMB) delineations of metropolitan and micropolitan statistical areas. In certain instances, the names, codes, and boundaries of the principal cities shown in ACS tables may differ from the OMB delineation lists due to differences in the effective dates of the geographic entities.

Estimates of urban and rural populations, housing units, and characteristics reflect boundaries of urban areas defined based on Census 2010 data. As a result, data for urban and rural areas from the ACS do not necessarily reflect the results of ongoing urbanization.

Explanation of Symbols:

> An "**" entry in the margin of error column indicates that either no sample observations or too few sample observations were available to compute a standard error and thus the margin of error. A statistical test is not appropriate.

An "-" entry in the estimate column indicates that either no sample observations or too few sample observations were available to compute an estimate, or a ratio of medians cannot be calculated because one or both of the median estimates falls in the lowest interval or upper interval of an open-ended distribution, or the margin of error associated with a median was larger than the median itself.
An "-" following a median estimate means the median falls in the lowest interval of an open-ended distribution.
An "+" following a median estimate means the median falls in the upper interval of an open-ended distribution.
An "***" entry in the margin of error column indicates that the median falls in the lowest interval or upper interval of an open-ended distribution. A statistical test is not appropriate.
An "*****" entry in the margin of error column indicates that the estimate is controlled. A statistical test for sampling variability is not appropriate.
An "N" entry in the estimate and margin of error columns indicates that data for this geographic area cannot be displayed because the number of sample cases is too small.
An "(X)" means that the estimate is not applicable or not available.

Supporting documentation on code lists, subject definitions, data accuracy, and statistical testing can be found on the American Community Survey website in the Technical Documentation section.

Sample size and data quality measures (including coverage rates, allocation rates, and response rates) can be found on the American Community Survey website in the Methodology section.

TRIP DISTRIBUTION – JOURNEY TO WORK DATA

Table 3. Residence MCD/County to Workplace MCD/County Commuting Flows for the United States and

For more information on sampling and estimation methods, confidentiality protection, and sampling and nonsampling errors, see

Universe: Workers 16 years and over.

Commuting flows are sorted by residence state, residence county, and residence minor civil division.

Residence	Place of Work	Commuting Flow		Exiting				%	Entering				%		Exiting					Entering				
				Matrix %					Matrix %						Trip Distribution					Trip Distribution				
Minor Civil Division Name	Minor Civil Division Name	Workers in Commut	%	Route 53 (North)	Route 53 (South)	High Street (South)	Grove Street (North)		Route 53 (North)	Route 53 (South)	High Street (South)	Grove Street (North)			Route 53 (North)	Route 53 (South)	High Street (South)	Grove Street (North)		Route 53 (North)	Route 53 (South)	High Street (South)	Grove Street (North)	
Norwell town	Boston city	1235	25.1%	1				1	1				1		1235	0	0	0	1235	1235	0	0	0	1235
Norwell town	Norwell town	948	19.2%	0.1	0.5	0.1	0.3	1	0.1	0.5	0.1	0.3	1		94.8	474	94.8	284.4	948	94.8	474	94.8	284.4	948
Norwell town	Hanover town	282	5.7%		0.4	0.6		1		0.4	0.6		1		0	112.8	169.2	0	282	0	112.8	169.2	0	282
Norwell town	Hingham town	262	5.3%	1				1	1				1		262	0	0	0	262	262	0	0	0	262
Norwell town	Weymouth Town city	175	3.6%	1				1	1				1		175	0	0	0	175	175	0	0	0	175
Norwell town	Quincy city	165	3.3%	1				1	1				1		165	0	0	0	165	165	0	0	0	165
Norwell town	Brockton city	159	3.2%			1		1	0.2		0.8		1		0	0	159	0	159	31.8	0	127.2	0	159
Norwell town	Braintree Town city	138	2.8%	1				1	1				1		138	0	0	0	138	138	0	0	0	138
Norwell town	Newton city	118	2.4%	1				1	1				1		118	0	0	0	118	118	0	0	0	118
Norwell town	Rockland town	99	2.0%	0.2		0.8		1	0.2		0.8		1		19.8	0	79.2	0	99	19.8	0	79.2	0	99
Norwell town	Cambridge city	79	1.6%	1				1	1				1		79	0	0	0	79	79	0	0	0	79
Norwell town	Scituate town	74	1.5%		0.5		0.5	1		0.5		0.5	1		0	37	0	37	74	0	37	0	37	74
Norwell town	Canton town	68	1.4%	1				1	1				1		68	0	0	0	68	68	0	0	0	68
Norwell town	Pembroke town	64	1.3%		0.5	0.5		1		0.5	0.5		1		0	32	32	0	64	0	32	32	0	64
Norwell town	Bridgewater town	63	1.3%	0.3		0.7		1	0.3		0.7		1		18.9	0	44.1	0	63	18.9	0	44.1	0	63
Norwell town	Plymouth town	60	1.2%		0.7	0.3		1	0.7		0.3		1		0	42	18	0	60	42	0	18	0	60
Norwell town	West Bridgewater town	60	1.2%			1		1	0.1		0.9		1		0	0	60	0	60	6	0	54	0	60
Norwell town	Malden city	54	1.1%	1				1	1				1		54	0	0	0	54	54	0	0	0	54
Norwell town	Waltham city	52	1.1%	1				1	1				1		52	0	0	0	52	52	0	0	0	52
Norwell town	Norwood town	48	1.0%	1				1	1				1		48	0	0	0	48	48	0	0	0	48
Norwell town	Marshfield town	48	1.0%		0.7	0.3		1	0.7		0.3		1		0	33.6	14.4	0	48	33.6	0	14.4	0	48
		4926													2527.5	731.4	670.7	321.4	4251	2640.9	655.8	632.9	321.4	4251
															59%	17%	16%	8%		62%	15%	15%	8%	
														SAY	60	15	15	10	100	60	15	15	10	100

TRIP GENERATION

Land Use: 220
Multifamily Housing (Low-Rise)

Description

Low-rise multifamily housing includes apartments, townhouses, and condominiums located within the same building with at least three other dwelling units and that have one or two levels (floors). Multifamily housing (mid-rise) (Land Use 221), multifamily housing (high-rise) (Land Use 222), and off-campus student apartment (Land Use 225) are related land uses.

Additional Data

In prior editions of *Trip Generation Manual*, the low-rise multifamily housing sites were further divided into rental and condominium categories. An investigation of vehicle trip data found no clear differences in trip making patterns between the rental and condominium sites within the ITE database. As more data are compiled for future editions, this land use classification can be reinvestigated.

For the three sites for which both the number of residents and the number of occupied dwelling units were available, there were an average of 2.72 residents per occupied dwelling unit.

For the two sites for which the numbers of both total dwelling units and occupied dwelling units were available, an average of 96.2 percent of the total dwelling units were occupied.

This land use included data from a wide variety of units with different sizes, price ranges, locations, and ages. Consequently, there was a wide variation in trips generated within this category. Other factors, such as geographic location and type of adjacent and nearby development, may also have had an effect on the site trip generation.

Time-of-day distribution data for this land use are presented in Appendix A. For the 10 general urban/suburban sites with data, the overall highest vehicle volumes during the AM and PM on a weekday were counted between 7:15 and 8:15 a.m. and 4:45 and 5:45 p.m., respectively. For the one site with Saturday data, the overall highest vehicle volume was counted between 9:45 and 10:45 a.m. For the one site with Sunday data, the overall highest vehicle volume was counted between 11:45 a.m. and 12:45 p.m.

For the one dense multi-use urban site with 24-hour count data, the overall highest vehicle volumes during the AM and PM on a weekday were counted between 7:00 and 8:00 a.m. and 6:15 and 7:15 p.m., respectively.

For the three sites for which data were provided for both occupied dwelling units and residents, there was an average of 2.72 residents per occupied dwelling unit.

The average numbers of person trips per vehicle trip at the five general urban/suburban sites at which both person trip and vehicle trip data were collected were as follows:

- 1.13 during Weekday, Peak Hour of Adjacent Street Traffic, one hour between 7 and 9 a.m.
- 1.21 during Weekday, Peak Hour of Adjacent Street Traffic, one hour between 4 and 6 p.m.

The sites were surveyed in the 1980s, the 1990s, the 2000s, and the 2010s in British Columbia (CAN), California, District of Columbia, Florida, Georgia, Illinois, Indiana, Maine, Maryland, Minnesota, New Jersey, New York, Ontario, Oregon, Pennsylvania, South Dakota, Tennessee, Texas, Utah, Virginia, and Washington.

It is expected that the number of bedrooms and number of residents are likely correlated to the number of trips generated by a residential site. Many of the studies included in this land use did not indicate the total number of bedrooms. To assist in the future analysis of this land use, it is important that this information be collected and included in trip generation data submissions.

Source Numbers

168, 187, 188, 204, 211, 300, 305, 306, 319, 320, 321, 357, 390, 412, 418, 525, 530, 571, 579, 583, 864, 868, 869, 870, 896, 903, 918, 946, 947, 948, 951

Multifamily Housing (Low-Rise)
(220)

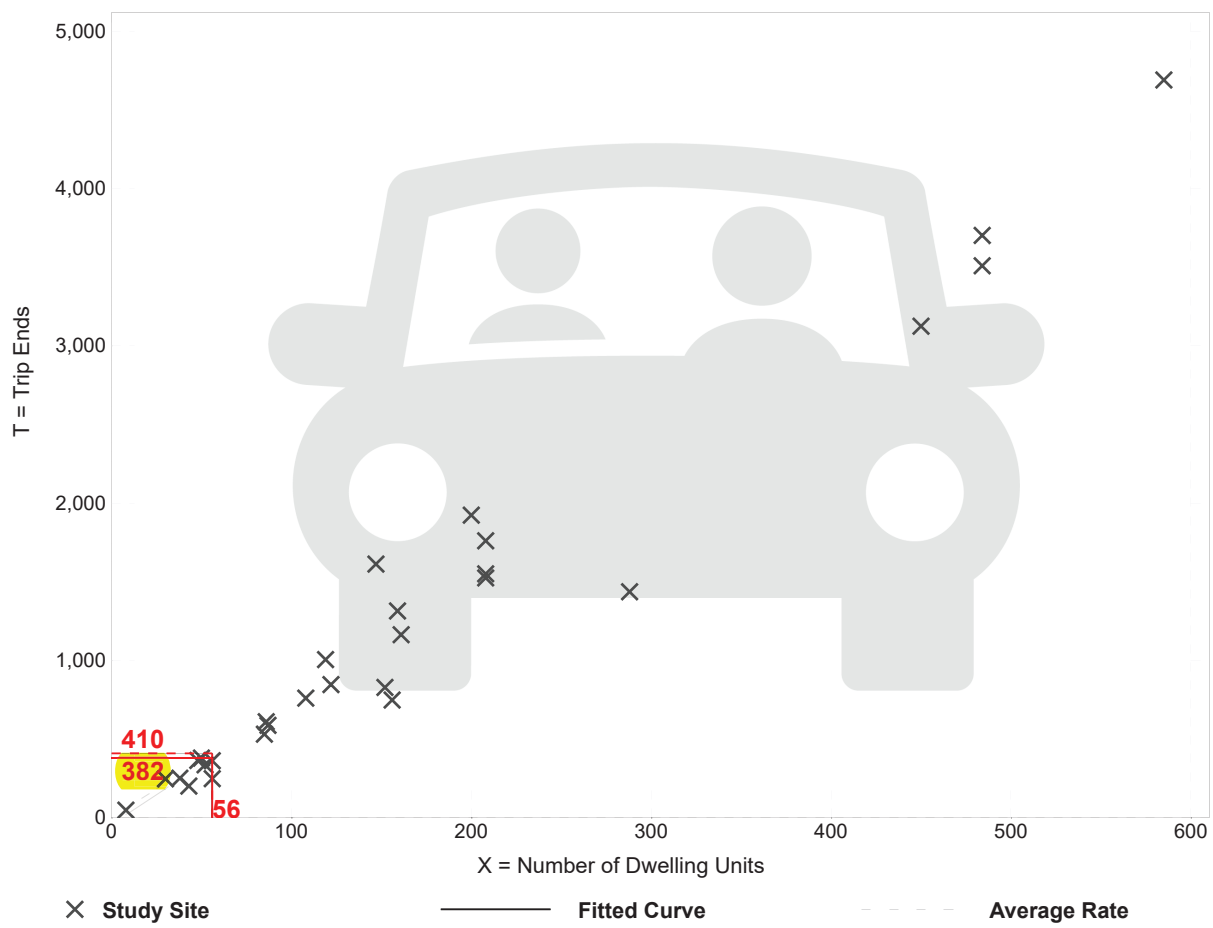
Vehicle Trip Ends vs: **Dwelling Units**
On a: **Weekday**

Setting/Location: **General Urban/Suburban**
Number of Studies: 29
Avg. Num. of Dwelling Units: 168
Directional Distribution: 50% entering, 50% exiting

Vehicle Trip Generation per Dwelling Unit

Average Rate	Range of Rates	Standard Deviation
7.32	4.45 - 10.97	1.31

Data Plot and Equation



Fitted Curve Equation: T = 7.56(X) - 40.86

R^2= 0.96

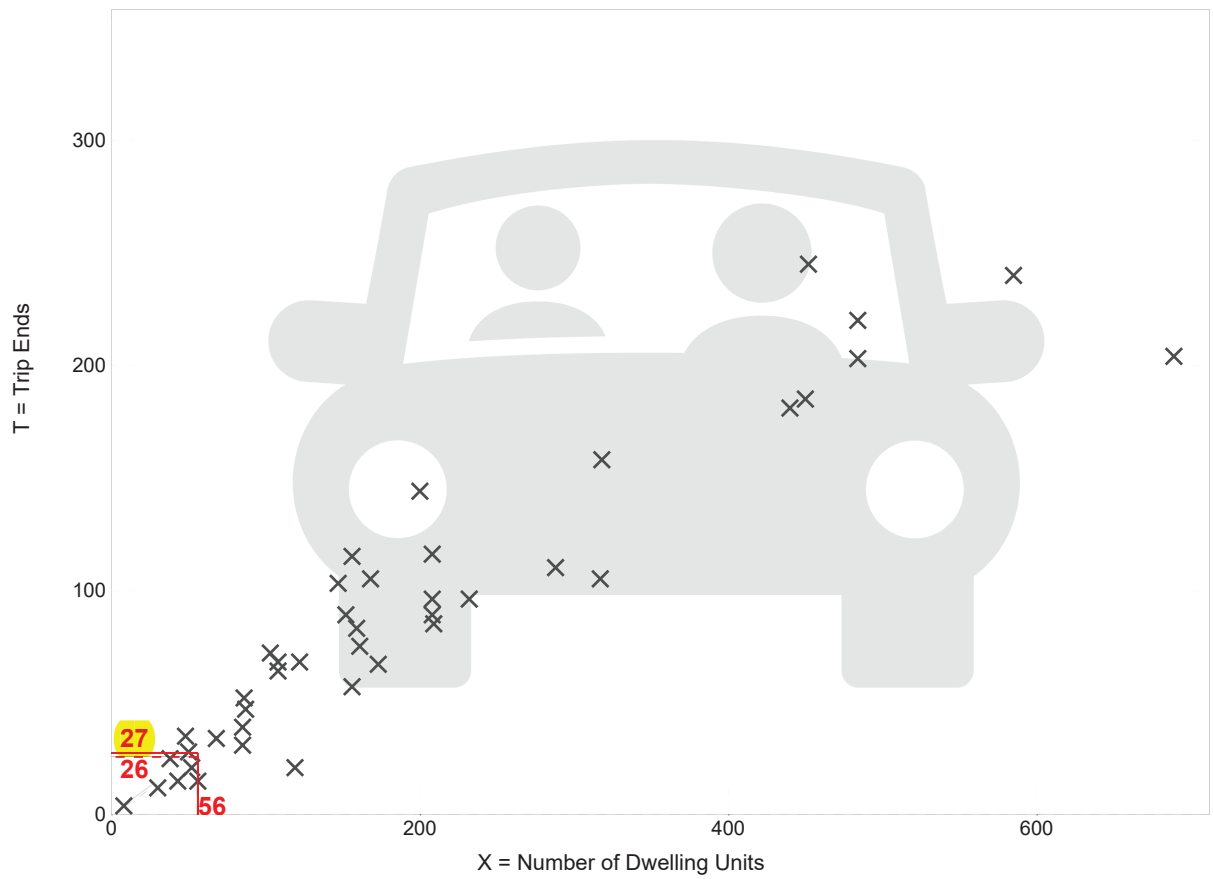
Multifamily Housing (Low-Rise)
(220)

Vehicle Trip Ends vs:	**Dwelling Units**
On a:	**Weekday,**
	Peak Hour of Adjacent Street Traffic,
	One Hour Between 7 and 9 a.m.
Setting/Location:	**General Urban/Suburban**
Number of Studies:	42
Avg. Num. of Dwelling Units:	199
Directional Distribution:	23% entering, 77% exiting

Vehicle Trip Generation per Dwelling Unit

Average Rate	Range of Rates	Standard Deviation
0.46	0.18 - 0.74	0.12

Data Plot and Equation



Fitted Curve Equation: Ln(T) = 0.95 Ln(X) - 0.51

R^2= 0.90

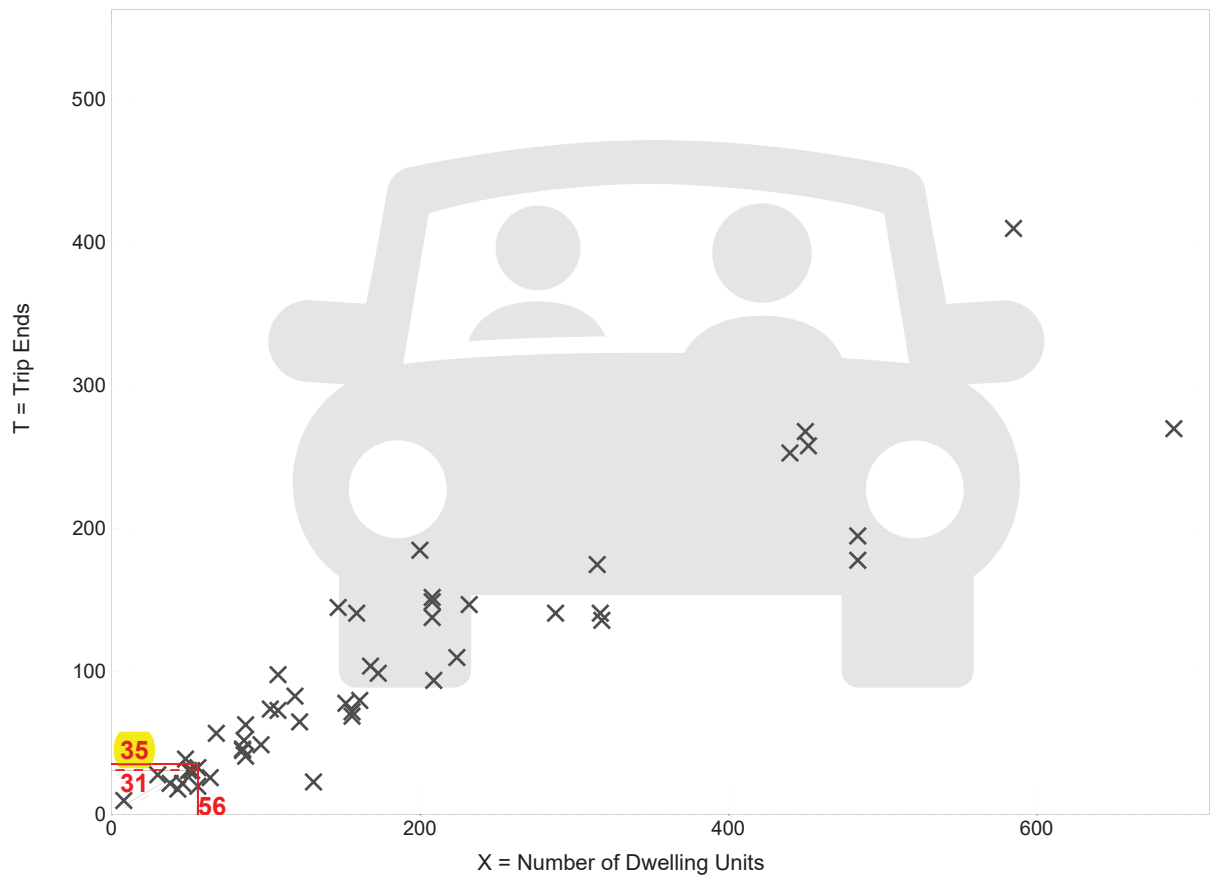
Multifamily Housing (Low-Rise)
(220)

Vehicle Trip Ends vs:	**Dwelling Units**
On a:	**Weekday,**
	Peak Hour of Adjacent Street Traffic,
	One Hour Between 4 and 6 p.m.
Setting/Location:	**General Urban/Suburban**
Number of Studies:	50
Avg. Num. of Dwelling Units:	187
Directional Distribution:	63% entering, 37% exiting

Vehicle Trip Generation per Dwelling Unit

Average Rate	Range of Rates	Standard Deviation
0.56	0.18 - 1.25	0.16

Data Plot and Equation



Fitted Curve Equation: Ln(T) = 0.89 Ln(X) - 0.02

R^2= 0.86

CAPACITY ANALYSIS

Washington Street (Route 53) at High Street/Grove Street
High Street at Private driveway (Washington square Condominium Complex)
High Street at Oak Street
Washington Street (Route 53) at Oak Street
High Street at Site Drive A
High Street at Site Drive B

Washington Street (Route 53) at High Street/Grove Street

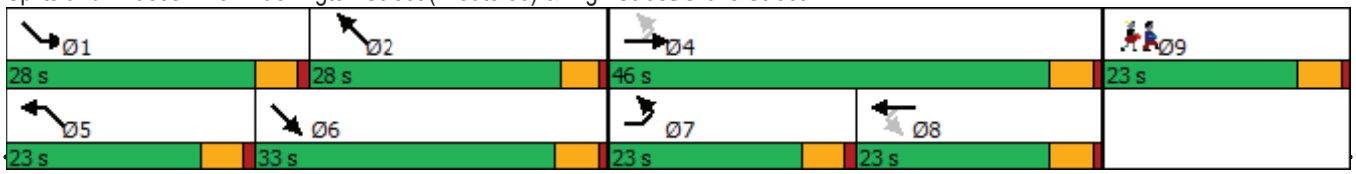
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	SEL	SET	SER	NWL	NWT	NWR
Lane Configurations												
Traffic Volume (vph)	214	59	26	72	110	440	216	386	201	18	404	58
Future Volume (vph)	214	59	26	72	110	440	216	386	201	18	404	58
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (ft)	12	14	12	11	11	15	12	12	15	12	12	12
Storage Length (ft)	150		0	140		140	280		280	200		200
Storage Lanes	1		0	1		1	1		1	1		0
Taper Length (ft)	25			25			25			25		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.95	0.95
Frt		0.954				0.850			0.850		0.981	
Flt Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	1752	1933	0	1694	1818	1742	1719	1845	1708	1805	3397	0
Flt Permitted	0.397			0.696			0.950			0.950		
Satd. Flow (perm)	732	1933	0	1241	1818	1742	1719	1845	1708	1805	3397	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		19				524			192		11	
Link Speed (mph)		40			40			40			40	
Link Distance (ft)		383			551			440			365	
Travel Time (s)		6.5			9.4			7.5			6.2	
Peak Hour Factor	0.91	0.91	0.91	0.84	0.84	0.84	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles (%)	3%	0%	0%	3%	1%	2%	5%	3%	4%	0%	4%	6%
Adj. Flow (vph)	235	65	29	86	131	524	235	420	218	20	439	63
Shared Lane Traffic (%)												
Lane Group Flow (vph)	235	94	0	86	131	524	235	420	218	20	502	0
Number of Detectors	1	2		1	2	1	1	2	1	1	2	
Detector Template	Left	Thru		Left	Thru	Right	Left	Thru	Right	Left	Thru	
Leading Detector (ft)	20	100		20	100	20	20	100	20	20	100	
Trailing Detector (ft)	0	0		0	0	0	0	0	0	0	0	
Detector 1 Position(ft)	0	0		0	0	0	0	0	0	0	0	
Detector 1 Size(ft)	20	6		20	6	20	20	6	20	20	6	
Detector 1 Type	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Detector 1 Queue (s)	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Detector 1 Delay (s)	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Detector 2 Position(ft)		94			94			94			94	
Detector 2 Size(ft)		6			6			6			6	
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex			Cl+Ex	
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0			0.0	
Turn Type	pm+pt	NA		Perm	NA	Free	Prot	NA	Free	Prot	NA	
Protected Phases	7	4			8		1	6		5	2	
Permitted Phases	4			8		Free			Free			
Detector Phase	7	4		8	8		1	6		5	2	
Switch Phase												
Minimum Initial (s)	5.0	5.0		5.0	5.0		5.0	5.0		5.0	5.0	
Minimum Split (s)	23.0	23.0		23.0	23.0		10.0	23.0		23.0	22.5	
Total Split (s)	23.0	46.0		23.0	23.0		28.0	33.0		23.0	28.0	
Total Split (%)	18.4%	36.8%		18.4%	18.4%		22.4%	26.4%		18.4%	22.4%	

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	SEL	SET	SER	NWL	NWT	NWR
Maximum Green (s)	18.0	41.0		18.0	18.0		23.0	28.0		18.0	23.5	
Yellow Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	3.5	
All-Red Time (s)	1.0	1.0		1.0	1.0		1.0	1.0		1.0	1.0	
Lost Time Adjust (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Total Lost Time (s)	5.0	5.0		5.0	5.0		5.0	5.0		5.0	4.5	
Lead/Lag	Lead			Lag	Lag		Lead	Lag		Lead	Lag	
Lead-Lag Optimize?	Yes			Yes	Yes		Yes	Yes		Yes	Yes	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Recall Mode	None	None		None	None		None	Max		Max	Max	
Walk Time (s)												
Flash Dont Walk (s)												
Pedestrian Calls (#/hr)												
Act Effct Green (s)	33.6	33.6		12.3	12.3	99.2	17.9	28.5	99.2	18.3	29.3	
Actuated g/C Ratio	0.34	0.34		0.12	0.12	1.00	0.18	0.29	1.00	0.18	0.30	
v/c Ratio	0.57	0.14		0.56	0.58	0.30	0.76	0.79	0.13	0.06	0.50	
Control Delay	31.9	19.9		57.9	53.8	0.4	56.2	47.3	0.2	39.7	33.9	
Queue Delay	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Total Delay	31.9	19.9		57.9	53.8	0.4	56.2	47.3	0.2	39.7	33.9	
LOS	C	B		E	D	A	E	D	A	D	C	
Approach Delay		28.5			16.6			37.9			34.1	
Approach LOS		C			B			D			C	
Queue Length 50th (ft)	104	30		50	76	0	136	235	0	10	130	
Queue Length 95th (ft)	223	84		112	153	0	#294	#562	0	38	264	
Internal Link Dist (ft)		303			471			360			285	
Turn Bay Length (ft)	150			140		140	280		280	200		
Base Capacity (vph)	435	822		228	335	1742	404	529	1708	332	1012	
Starvation Cap Reductn	0	0		0	0	0	0	0	0	0	0	
Spillback Cap Reductn	0	0		0	0	0	0	0	0	0	0	
Storage Cap Reductn	0	0		0	0	0	0	0	0	0	0	
Reduced v/c Ratio	0.54	0.11		0.38	0.39	0.30	0.58	0.79	0.13	0.06	0.50	

Intersection Summary

Area Type: Other
Cycle Length: 125
Actuated Cycle Length: 99.2
Natural Cycle: 115
Control Type: Actuated-Uncoordinated
Maximum v/c Ratio: 0.79
Intersection Signal Delay: 29.4 Intersection LOS: C
Intersection Capacity Utilization 55.6% ICU Level of Service B
Analysis Period (min) 15
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 3: Washington Street (Route 53) & High Street/Grove Street



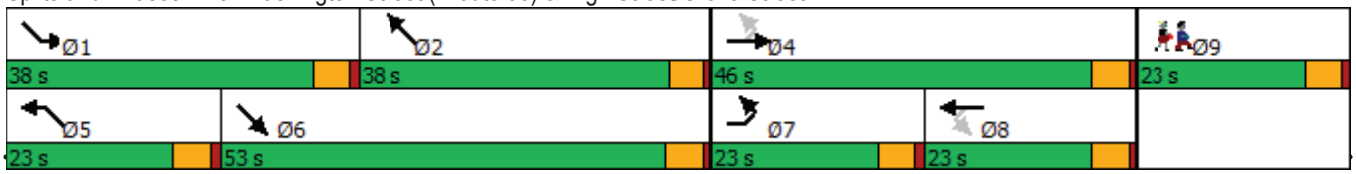
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	SEL	SET	SER	NWL	NWT	NWR
Lane Configurations												
Traffic Volume (vph)	254	109	22	94	72	338	416	645	302	15	667	84
Future Volume (vph)	254	109	22	94	72	338	416	645	302	15	667	84
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (ft)	12	14	12	11	11	15	12	12	15	12	12	12
Storage Length (ft)	150		0	140		140	280		280	200		200
Storage Lanes	1		0	1		1	1		1	1		0
Taper Length (ft)	25			25			25			25		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.95	0.95
Frt		0.974				0.850			0.850		0.983	
Flt Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	1805	1974	0	1745	1801	1725	1787	1845	1759	1805	3517	0
Flt Permitted	0.524			0.663			0.950			0.950		
Satd. Flow (perm)	996	1974	0	1218	1801	1725	1787	1845	1759	1805	3517	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		7				367			203		9	
Link Speed (mph)		40			40			40			40	
Link Distance (ft)		383			551			440			365	
Travel Time (s)		6.5			9.4			7.5			6.2	
Peak Hour Factor	0.89	0.89	0.89	0.92	0.92	0.92	0.98	0.98	0.98	0.92	0.92	0.92
Heavy Vehicles (%)	0%	0%	0%	0%	2%	3%	1%	3%	1%	0%	1%	0%
Adj. Flow (vph)	285	122	25	102	78	367	424	658	308	16	725	91
Shared Lane Traffic (%)												
Lane Group Flow (vph)	285	147	0	102	78	367	424	658	308	16	816	0
Number of Detectors	1	2		1	2	1	1	2	1	1	2	
Detector Template	Left	Thru		Left	Thru	Right	Left	Thru	Right	Left	Thru	
Leading Detector (ft)	20	100		20	100	20	20	100	20	20	100	
Trailing Detector (ft)	0	0		0	0	0	0	0	0	0	0	
Detector 1 Position(ft)	0	0		0	0	0	0	0	0	0	0	
Detector 1 Size(ft)	20	6		20	6	20	20	6	20	20	6	
Detector 1 Type	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Detector 1 Queue (s)	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Detector 1 Delay (s)	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Detector 2 Position(ft)		94			94			94			94	
Detector 2 Size(ft)		6			6			6			6	
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex			Cl+Ex	
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0			0.0	
Turn Type	pm+pt	NA		Perm	NA	Free	Prot	NA	Free	Prot	NA	
Protected Phases	7	4			8		1	6		5	2	
Permitted Phases	4			8		Free			Free			
Detector Phase	7	4		8	8		1	6		5	2	
Switch Phase												
Minimum Initial (s)	5.0	5.0		5.0	5.0		5.0	5.0		5.0	5.0	
Minimum Split (s)	23.0	23.0		23.0	23.0		10.0	23.0		23.0	22.5	
Total Split (s)	23.0	46.0		23.0	23.0		38.0	53.0		23.0	38.0	
Total Split (%)	15.9%	31.7%		15.9%	15.9%		26.2%	36.6%		15.9%	26.2%	

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	SEL	SET	SER	NWL	NWT	NWR
Maximum Green (s)	18.0	41.0		18.0	18.0		33.0	48.0		18.0	33.5	
Yellow Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	3.5	
All-Red Time (s)	1.0	1.0		1.0	1.0		1.0	1.0		1.0	1.0	
Lost Time Adjust (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Total Lost Time (s)	5.0	5.0		5.0	5.0		5.0	5.0		5.0	4.5	
Lead/Lag	Lead			Lag	Lag		Lead	Lag		Lead	Lag	
Lead-Lag Optimize?	Yes			Yes	Yes		Yes	Yes		Yes	Yes	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Recall Mode	None	None		None	None		None	Max		Max	Max	
Walk Time (s)												
Flash Dont Walk (s)												
Pedestrian Calls (#/hr)												
Act Effct Green (s)	37.5	37.5		14.7	14.7	123.1	33.3	48.4	123.1	18.1	33.8	
Actuated g/C Ratio	0.30	0.30		0.12	0.12	1.00	0.27	0.39	1.00	0.15	0.27	
v/c Ratio	0.68	0.24		0.70	0.36	0.21	0.88	0.91	0.18	0.06	0.84	
Control Delay	45.8	32.8		78.9	56.5	0.3	64.2	54.1	0.2	50.7	51.5	
Queue Delay	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Total Delay	45.8	32.8		78.9	56.5	0.3	64.2	54.1	0.2	50.7	51.5	
LOS	D	C		E	E	A	E	D	A	D	D	
Approach Delay		41.4			22.9			45.3			51.5	
Approach LOS		D			C			D			D	
Queue Length 50th (ft)	176	79		76	56	0	312	467	0	11	307	
Queue Length 95th (ft)	323	162		#179	123	0	#648	#932	0	38	#550	
Internal Link Dist (ft)		303			471			360			285	
Turn Bay Length (ft)	150			140		140	280		280	200		
Base Capacity (vph)	422	667		179	265	1725	483	725	1759	266	971	
Starvation Cap Reductn	0	0		0	0	0	0	0	0	0	0	
Spillback Cap Reductn	0	0		0	0	0	0	0	0	0	0	
Storage Cap Reductn	0	0		0	0	0	0	0	0	0	0	
Reduced v/c Ratio	0.68	0.22		0.57	0.29	0.21	0.88	0.91	0.18	0.06	0.84	

Intersection Summary

Area Type: Other
Cycle Length: 145
Actuated Cycle Length: 123.1
Natural Cycle: 145
Control Type: Actuated-Uncoordinated
Maximum v/c Ratio: 0.91
Intersection Signal Delay: 42.5 Intersection LOS: D
Intersection Capacity Utilization 78.6% ICU Level of Service D
Analysis Period (min) 15
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 3: Washington Street (Route 53) & High Street/Grove Street



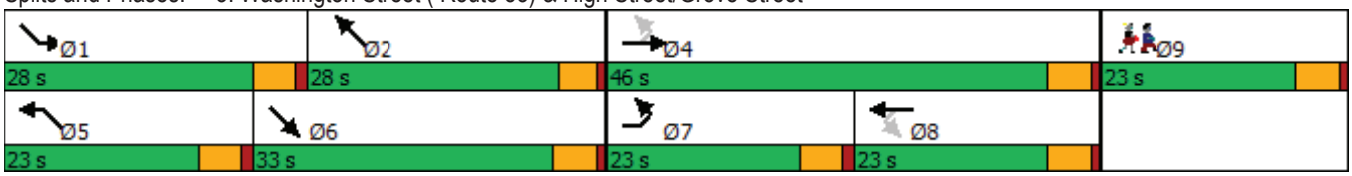
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	SEL	SET	SER	NWL	NWT	NWR
Lane Configurations												
Traffic Volume (vph)	229	63	29	79	118	472	232	418	215	19	436	63
Future Volume (vph)	229	63	29	79	118	472	232	418	215	19	436	63
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (ft)	12	14	12	11	11	15	12	12	15	12	12	12
Storage Length (ft)	150		0	140		140	280		280	200		200
Storage Lanes	1		0	1		1	1		1	1		0
Taper Length (ft)	25			25			25			25		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.95	0.95
Frt		0.952				0.850			0.850		0.981	
Flt Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	1752	1929	0	1694	1818	1742	1719	1845	1708	1805	3397	0
Flt Permitted	0.379			0.692			0.950			0.950		
Satd. Flow (perm)	699	1929	0	1234	1818	1742	1719	1845	1708	1805	3397	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		20				562			192		11	
Link Speed (mph)		40			40			40			40	
Link Distance (ft)		383			551			440			365	
Travel Time (s)		6.5			9.4			7.5			6.2	
Peak Hour Factor	0.91	0.91	0.91	0.84	0.84	0.84	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles (%)	3%	0%	0%	3%	1%	2%	5%	3%	4%	0%	4%	6%
Adj. Flow (vph)	252	69	32	94	140	562	252	454	234	21	474	68
Shared Lane Traffic (%)												
Lane Group Flow (vph)	252	101	0	94	140	562	252	454	234	21	542	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		12			12			12			12	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane												
Headway Factor	1.00	0.92	1.00	1.04	1.04	0.88	1.00	1.00	0.88	1.00	1.00	1.00
Turning Speed (mph)	15		9	15		9	15		9	15		9
Turn Type	pm+pt	NA		Perm	NA	Free	Prot	NA	Free	Prot	NA	
Protected Phases	7	4			8		1	6		5	2	
Permitted Phases	4			8		Free			Free			
Detector Phase	7	4		8	8		1	6		5	2	
Switch Phase												
Minimum Initial (s)	5.0	5.0		5.0	5.0		5.0	5.0		5.0	5.0	
Minimum Split (s)	23.0	23.0		23.0	23.0		10.0	23.0		23.0	22.5	
Total Split (s)	23.0	46.0		23.0	23.0		28.0	33.0		23.0	28.0	
Total Split (%)	18.4%	36.8%		18.4%	18.4%		22.4%	26.4%		18.4%	22.4%	
Maximum Green (s)	18.0	41.0		18.0	18.0		23.0	28.0		18.0	23.5	
Yellow Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	3.5	
All-Red Time (s)	1.0	1.0		1.0	1.0		1.0	1.0		1.0	1.0	
Lost Time Adjust (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Total Lost Time (s)	5.0	5.0		5.0	5.0		5.0	5.0		5.0	4.5	
Lead/Lag	Lead			Lag	Lag		Lead	Lag		Lead	Lag	
Lead-Lag Optimize?	Yes			Yes	Yes		Yes	Yes		Yes	Yes	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	SEL	SET	SER	NWL	NWT	NWR
Recall Mode	None	None		None	None		None	Max		Max	Max	
Walk Time (s)												
Flash Dont Walk (s)												
Pedestrian Calls (#/hr)												
Act Effct Green (s)	34.4	34.4		12.7	12.7	100.0	19.1	28.4	100.0	18.3	28.1	
Actuated g/C Ratio	0.34	0.34		0.13	0.13	1.00	0.19	0.28	1.00	0.18	0.28	
v/c Ratio	0.61	0.15		0.60	0.61	0.32	0.77	0.87	0.14	0.06	0.56	
Control Delay	33.1	19.8		59.8	54.6	0.5	56.0	53.9	0.2	39.8	36.1	
Queue Delay	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Total Delay	33.1	19.8		59.8	54.6	0.5	56.0	53.9	0.2	39.8	36.1	
LOS	C	B		E	D	A	E	D	A	D	D	
Approach Delay		29.3			17.0			41.1			36.2	
Approach LOS		C			B			D			D	
Queue Length 50th (ft)	112	32		55	82	0	146	262	0	11	147	
Queue Length 95th (ft)	240	89		121	162	0	#328	#624	0	40	#305	
Internal Link Dist (ft)		303			471			360			285	
Turn Bay Length (ft)	150			140		140	280		280	200		
Base Capacity (vph)	432	814		225	332	1742	401	524	1708	329	962	
Starvation Cap Reductn	0	0		0	0	0	0	0	0	0	0	
Spillback Cap Reductn	0	0		0	0	0	0	0	0	0	0	
Storage Cap Reductn	0	0		0	0	0	0	0	0	0	0	
Reduced v/c Ratio	0.58	0.12		0.42	0.42	0.32	0.63	0.87	0.14	0.06	0.56	

Intersection Summary

Area Type: Other
Cycle Length: 125
Actuated Cycle Length: 100
Natural Cycle: 125
Control Type: Actuated-Uncoordinated
Maximum v/c Ratio: 0.87
Intersection Signal Delay: 31.3 Intersection LOS: C
Intersection Capacity Utilization 58.4% ICU Level of Service B
Analysis Period (min) 15
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 3: Washington Street (Route 53) & High Street/Grove Street



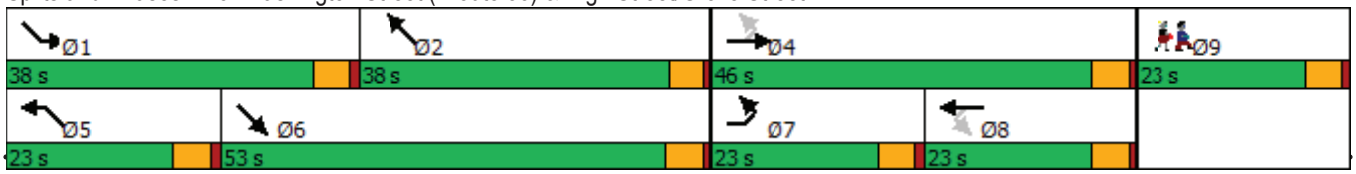
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	SEL	SET	SER	NWL	NWT	NWR
Lane Configurations												
Traffic Volume (vph)	272	117	27	104	77	362	446	699	324	16	725	93
Future Volume (vph)	272	117	27	104	77	362	446	699	324	16	725	93
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (ft)	12	14	12	11	11	15	12	12	15	12	12	12
Storage Length (ft)	150		0	140		140	280		280	200		200
Storage Lanes	1		0	1		1	1		1	1		0
Taper Length (ft)	25			25			25			25		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.95	0.95
Frt		0.972				0.850			0.850		0.983	
Flt Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	1805	1970	0	1745	1801	1725	1787	1845	1759	1805	3517	0
Flt Permitted	0.516			0.655			0.950			0.950		
Satd. Flow (perm)	980	1970	0	1203	1801	1725	1787	1845	1759	1805	3517	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		8				393			203		9	
Link Speed (mph)		40			40			40			40	
Link Distance (ft)		383			551			440			365	
Travel Time (s)		6.5			9.4			7.5			6.2	
Peak Hour Factor	0.89	0.89	0.89	0.92	0.92	0.92	0.98	0.98	0.98	0.92	0.92	0.92
Heavy Vehicles (%)	0%	0%	0%	0%	2%	3%	1%	3%	1%	0%	1%	0%
Adj. Flow (vph)	306	131	30	113	84	393	455	713	331	17	788	101
Shared Lane Traffic (%)												
Lane Group Flow (vph)	306	161	0	113	84	393	455	713	331	17	889	0
Number of Detectors	1	2		1	2	1	1	2	1	1	2	
Detector Template	Left	Thru		Left	Thru	Right	Left	Thru	Right	Left	Thru	
Leading Detector (ft)	20	100		20	100	20	20	100	20	20	100	
Trailing Detector (ft)	0	0		0	0	0	0	0	0	0	0	
Detector 1 Position(ft)	0	0		0	0	0	0	0	0	0	0	
Detector 1 Size(ft)	20	6		20	6	20	20	6	20	20	6	
Detector 1 Type	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Detector 1 Queue (s)	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Detector 1 Delay (s)	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Detector 2 Position(ft)		94			94			94			94	
Detector 2 Size(ft)		6			6			6			6	
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex			Cl+Ex	
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0			0.0	
Turn Type	pm+pt	NA		Perm	NA	Free	Prot	NA	Free	Prot	NA	
Protected Phases	7	4			8		1	6		5	2	
Permitted Phases	4			8		Free			Free			
Detector Phase	7	4		8	8		1	6		5	2	
Switch Phase												
Minimum Initial (s)	5.0	5.0		5.0	5.0		5.0	5.0		5.0	5.0	
Minimum Split (s)	23.0	23.0		23.0	23.0		10.0	23.0		23.0	22.5	
Total Split (s)	23.0	46.0		23.0	23.0		38.0	53.0		23.0	38.0	
Total Split (%)	15.9%	31.7%		15.9%	15.9%		26.2%	36.6%		15.9%	26.2%	

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	SEL	SET	SER	NWL	NWT	NWR
Maximum Green (s)	18.0	41.0		18.0	18.0		33.0	48.0		18.0	33.5	
Yellow Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	3.5	
All-Red Time (s)	1.0	1.0		1.0	1.0		1.0	1.0		1.0	1.0	
Lost Time Adjust (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Total Lost Time (s)	5.0	5.0		5.0	5.0		5.0	5.0		5.0	4.5	
Lead/Lag	Lead			Lag	Lag		Lead	Lag		Lead	Lag	
Lead-Lag Optimize?	Yes			Yes	Yes		Yes	Yes		Yes	Yes	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Recall Mode	None	None		None	None		None	Max		Max	Max	
Walk Time (s)												
Flash Dont Walk (s)												
Pedestrian Calls (#/hr)												
Act Effct Green (s)	38.9	38.9		15.7	15.7	124.4	33.2	48.3	124.4	18.1	33.7	
Actuated g/C Ratio	0.31	0.31		0.13	0.13	1.00	0.27	0.39	1.00	0.15	0.27	
v/c Ratio	0.72	0.26		0.74	0.37	0.23	0.95	1.00	0.19	0.06	0.93	
Control Delay	47.4	32.8		81.6	56.2	0.3	76.9	71.2	0.2	50.8	60.2	
Queue Delay	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Total Delay	47.4	32.8		81.6	56.2	0.3	76.9	71.2	0.2	50.8	60.2	
LOS	D	C		F	E	A	E	E	A	D	E	
Approach Delay		42.4			23.8			57.3			60.0	
Approach LOS		D			C			E			E	
Queue Length 50th (ft)	192	87		85	60	0	350	546	0	12	353	
Queue Length 95th (ft)	#375	176		#206	131	0	#712	#1045	0	40	#628	
Internal Link Dist (ft)		303			471			360			285	
Turn Bay Length (ft)	150			140		140	280		280	200		
Base Capacity (vph)	426	659		175	262	1725	477	716	1759	263	960	
Starvation Cap Reductn	0	0		0	0	0	0	0	0	0	0	
Spillback Cap Reductn	0	0		0	0	0	0	0	0	0	0	
Storage Cap Reductn	0	0		0	0	0	0	0	0	0	0	
Reduced v/c Ratio	0.72	0.24		0.65	0.32	0.23	0.95	1.00	0.19	0.06	0.93	

Intersection Summary

Area Type: Other
Cycle Length: 145
Actuated Cycle Length: 124.4
Natural Cycle: 145
Control Type: Actuated-Uncoordinated
Maximum v/c Ratio: 1.00
Intersection Signal Delay: 50.3 Intersection LOS: D
Intersection Capacity Utilization 83.2% ICU Level of Service E
Analysis Period (min) 15
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 3: Washington Street (Route 53) & High Street/Grove Street



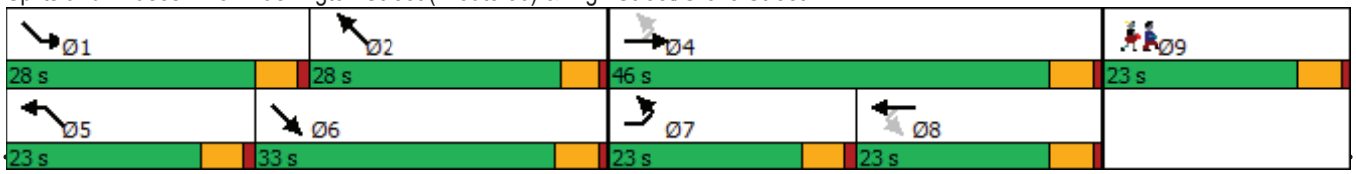
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	SEL	SET	SER	NWL	NWT	NWR
Lane Configurations												
Traffic Volume (vph)	242	65	31	79	119	472	232	418	217	20	436	63
Future Volume (vph)	242	65	31	79	119	472	232	418	217	20	436	63
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (ft)	12	14	12	11	11	15	12	12	15	12	12	12
Storage Length (ft)	150		0	140		140	280		280	200		200
Storage Lanes	1		0	1		1	1		1	1		0
Taper Length (ft)	25			25			25			25		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.95	0.95
Frt		0.951				0.850			0.850		0.981	
Flt Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	1752	1927	0	1694	1818	1742	1719	1845	1708	1805	3397	0
Flt Permitted	0.375			0.689			0.950			0.950		
Satd. Flow (perm)	692	1927	0	1229	1818	1742	1719	1845	1708	1805	3397	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		21				562			192		11	
Link Speed (mph)		40			40			40			40	
Link Distance (ft)		383			551			440			365	
Travel Time (s)		6.5			9.4			7.5			6.2	
Peak Hour Factor	0.91	0.91	0.91	0.84	0.84	0.84	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles (%)	3%	0%	0%	3%	1%	2%	5%	3%	4%	0%	4%	6%
Adj. Flow (vph)	266	71	34	94	142	562	252	454	236	22	474	68
Shared Lane Traffic (%)												
Lane Group Flow (vph)	266	105	0	94	142	562	252	454	236	22	542	0
Number of Detectors	1	2		1	2	1	1	2	1	1	2	
Detector Template	Left	Thru		Left	Thru	Right	Left	Thru	Right	Left	Thru	
Leading Detector (ft)	20	100		20	100	20	20	100	20	20	100	
Trailing Detector (ft)	0	0		0	0	0	0	0	0	0	0	
Detector 1 Position(ft)	0	0		0	0	0	0	0	0	0	0	
Detector 1 Size(ft)	20	6		20	6	20	20	6	20	20	6	
Detector 1 Type	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Detector 1 Queue (s)	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Detector 1 Delay (s)	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Detector 2 Position(ft)		94			94			94			94	
Detector 2 Size(ft)		6			6			6			6	
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex			Cl+Ex	
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0			0.0	
Turn Type	pm+pt	NA		Perm	NA	Free	Prot	NA	Free	Prot	NA	
Protected Phases	7	4			8		1	6		5	2	
Permitted Phases	4			8		Free			Free			
Detector Phase	7	4		8	8		1	6		5	2	
Switch Phase												
Minimum Initial (s)	5.0	5.0		5.0	5.0		5.0	5.0		5.0	5.0	
Minimum Split (s)	23.0	23.0		23.0	23.0		10.0	23.0		23.0	22.5	
Total Split (s)	23.0	46.0		23.0	23.0		28.0	33.0		23.0	28.0	
Total Split (%)	18.4%	36.8%		18.4%	18.4%		22.4%	26.4%		18.4%	22.4%	

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	SEL	SET	SER	NWL	NWT	NWR
Maximum Green (s)	18.0	41.0		18.0	18.0		23.0	28.0		18.0	23.5	
Yellow Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	3.5	
All-Red Time (s)	1.0	1.0		1.0	1.0		1.0	1.0		1.0	1.0	
Lost Time Adjust (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Total Lost Time (s)	5.0	5.0		5.0	5.0		5.0	5.0		5.0	4.5	
Lead/Lag	Lead			Lag	Lag		Lead	Lag		Lead	Lag	
Lead-Lag Optimize?	Yes			Yes	Yes		Yes	Yes		Yes	Yes	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Recall Mode	None	None		None	None		None	Max		Max	Max	
Walk Time (s)												
Flash Dont Walk (s)												
Pedestrian Calls (#/hr)												
Act Effct Green (s)	34.8	34.8		12.8	12.8	100.4	19.1	28.4	100.4	18.3	28.1	
Actuated g/C Ratio	0.35	0.35		0.13	0.13	1.00	0.19	0.28	1.00	0.18	0.28	
v/c Ratio	0.64	0.15		0.60	0.61	0.32	0.77	0.87	0.14	0.07	0.57	
Control Delay	34.2	19.6		60.0	55.0	0.5	56.2	54.4	0.2	39.8	36.3	
Queue Delay	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Total Delay	34.2	19.6		60.0	55.0	0.5	56.2	54.4	0.2	39.8	36.3	
LOS	C	B		E	E	A	E	D	A	D	D	
Approach Delay		30.1			17.2			41.3			36.4	
Approach LOS		C			B			D			D	
Queue Length 50th (ft)	120	34		55	84	0	146	263	0	11	147	
Queue Length 95th (ft)	253	91		121	164	0	#328	#624	0	41	#305	
Internal Link Dist (ft)		303			471			360			285	
Turn Bay Length (ft)	150			140		140	280		280	200		
Base Capacity (vph)	432	811		223	330	1742	399	522	1708	328	957	
Starvation Cap Reductn	0	0		0	0	0	0	0	0	0	0	
Spillback Cap Reductn	0	0		0	0	0	0	0	0	0	0	
Storage Cap Reductn	0	0		0	0	0	0	0	0	0	0	
Reduced v/c Ratio	0.62	0.13		0.42	0.43	0.32	0.63	0.87	0.14	0.07	0.57	

Intersection Summary

Area Type: Other
Cycle Length: 125
Actuated Cycle Length: 100.4
Natural Cycle: 125
Control Type: Actuated-Uncoordinated
Maximum v/c Ratio: 0.87
Intersection Signal Delay: 31.5 Intersection LOS: C
Intersection Capacity Utilization 59.1% ICU Level of Service B
Analysis Period (min) 15
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 3: Washington Street (Route 53) & High Street/Grove Street



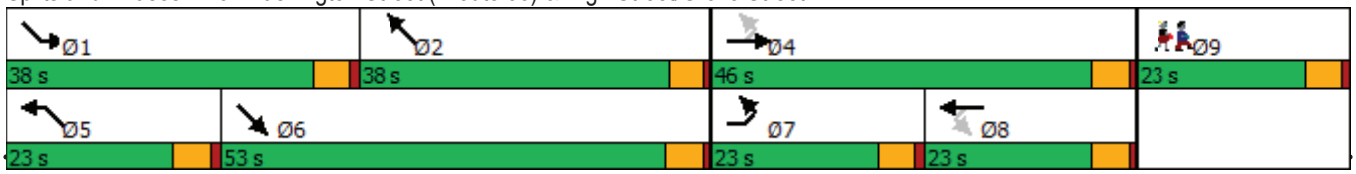
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	SEL	SET	SER	NWL	NWT	NWR
Lane Configurations												
Traffic Volume (vph)	279	118	28	104	79	362	446	699	338	18	725	93
Future Volume (vph)	279	118	28	104	79	362	446	699	338	18	725	93
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width (ft)	12	14	12	11	11	15	12	12	15	12	12	12
Storage Length (ft)	150		0	140		140	280		280	200		200
Storage Lanes	1		0	1		1	1		1	1		0
Taper Length (ft)	25			25			25			25		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.95	0.95
Frt		0.972				0.850			0.850		0.983	
Flt Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	1805	1970	0	1745	1801	1725	1787	1845	1759	1805	3517	0
Flt Permitted	0.511			0.653			0.950			0.950		
Satd. Flow (perm)	971	1970	0	1199	1801	1725	1787	1845	1759	1805	3517	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		8				393			203		9	
Link Speed (mph)		40			40			40			40	
Link Distance (ft)		383			551			440			365	
Travel Time (s)		6.5			9.4			7.5			6.2	
Peak Hour Factor	0.89	0.89	0.89	0.92	0.92	0.92	0.98	0.98	0.98	0.92	0.92	0.92
Heavy Vehicles (%)	0%	0%	0%	0%	2%	3%	1%	3%	1%	0%	1%	0%
Adj. Flow (vph)	313	133	31	113	86	393	455	713	345	20	788	101
Shared Lane Traffic (%)												
Lane Group Flow (vph)	313	164	0	113	86	393	455	713	345	20	889	0
Number of Detectors	1	2		1	2	1	1	2	1	1	2	
Detector Template	Left	Thru		Left	Thru	Right	Left	Thru	Right	Left	Thru	
Leading Detector (ft)	20	100		20	100	20	20	100	20	20	100	
Trailing Detector (ft)	0	0		0	0	0	0	0	0	0	0	
Detector 1 Position(ft)	0	0		0	0	0	0	0	0	0	0	
Detector 1 Size(ft)	20	6		20	6	20	20	6	20	20	6	
Detector 1 Type	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Detector 1 Queue (s)	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Detector 1 Delay (s)	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Detector 2 Position(ft)		94			94			94			94	
Detector 2 Size(ft)		6			6			6			6	
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex			Cl+Ex	
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0			0.0	
Turn Type	pm+pt	NA		Perm	NA	Free	Prot	NA	Free	Prot	NA	
Protected Phases	7	4			8		1	6		5	2	
Permitted Phases	4			8		Free			Free			
Detector Phase	7	4		8	8		1	6		5	2	
Switch Phase												
Minimum Initial (s)	5.0	5.0		5.0	5.0		5.0	5.0		5.0	5.0	
Minimum Split (s)	23.0	23.0		23.0	23.0		10.0	23.0		23.0	22.5	
Total Split (s)	23.0	46.0		23.0	23.0		38.0	53.0		23.0	38.0	
Total Split (%)	15.9%	31.7%		15.9%	15.9%		26.2%	36.6%		15.9%	26.2%	

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	SEL	SET	SER	NWL	NWT	NWR
Maximum Green (s)	18.0	41.0		18.0	18.0		33.0	48.0		18.0	33.5	
Yellow Time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	3.5	
All-Red Time (s)	1.0	1.0		1.0	1.0		1.0	1.0		1.0	1.0	
Lost Time Adjust (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Total Lost Time (s)	5.0	5.0		5.0	5.0		5.0	5.0		5.0	4.5	
Lead/Lag	Lead			Lag	Lag		Lead	Lag		Lead	Lag	
Lead-Lag Optimize?	Yes			Yes	Yes		Yes	Yes		Yes	Yes	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Recall Mode	None	None		None	None		None	Max		Max	Max	
Walk Time (s)												
Flash Dont Walk (s)												
Pedestrian Calls (#/hr)												
Act Effct Green (s)	38.9	38.9		15.8	15.8	124.4	33.2	48.3	124.4	18.1	33.7	
Actuated g/C Ratio	0.31	0.31		0.13	0.13	1.00	0.27	0.39	1.00	0.15	0.27	
v/c Ratio	0.74	0.26		0.75	0.38	0.23	0.95	1.00	0.20	0.08	0.93	
Control Delay	48.4	32.9		81.9	56.4	0.3	77.1	71.3	0.2	50.9	60.3	
Queue Delay	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Total Delay	48.4	32.9		81.9	56.4	0.3	77.1	71.3	0.2	50.9	60.3	
LOS	D	C		F	E	A	E	E	A	D	E	
Approach Delay		43.1			24.0			56.8			60.1	
Approach LOS		D			C			E			E	
Queue Length 50th (ft)	197	88		85	62	0	351	547	0	14	353	
Queue Length 95th (ft)	#395	179		#207	134	0	#712	#1045	0	44	#628	
Internal Link Dist (ft)		303			471			360			285	
Turn Bay Length (ft)	150			140		140	280		280	200		
Base Capacity (vph)	425	658		174	262	1725	477	716	1759	262	959	
Starvation Cap Reductn	0	0		0	0	0	0	0	0	0	0	
Spillback Cap Reductn	0	0		0	0	0	0	0	0	0	0	
Storage Cap Reductn	0	0		0	0	0	0	0	0	0	0	
Reduced v/c Ratio	0.74	0.25		0.65	0.33	0.23	0.95	1.00	0.20	0.08	0.93	

Intersection Summary

Area Type: Other
Cycle Length: 145
Actuated Cycle Length: 124.4
Natural Cycle: 145
Control Type: Actuated-Uncoordinated
Maximum v/c Ratio: 1.00
Intersection Signal Delay: 50.2 Intersection LOS: D
Intersection Capacity Utilization 83.6% ICU Level of Service E
Analysis Period (min) 15
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 3: Washington Street (Route 53) & High Street/Grove Street



High Street at Private driveway (Washington square Condominium Complex)

Intersection	
Int Delay, s/veh	0.6

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	4	5	22	295	292	37
Future Vol, veh/h	4	5	22	295	292	37
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	45	45	82	82	93	94
Heavy Vehicles, %	0	0	0	1	2	0
Mvmt Flow	9	11	27	360	314	39

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	748	334	353	0	-	0
Stage 1	334	-	-	-	-	-
Stage 2	414	-	-	-	-	-
Critical Hdwy	6.4	6.2	4.1	-	-	-
Critical Hdwy Stg 1	5.4	-	-	-	-	-
Critical Hdwy Stg 2	5.4	-	-	-	-	-
Follow-up Hdwy	3.5	3.3	2.2	-	-	-
Pot Cap-1 Maneuver	383	712	1217	-	-	-
Stage 1	730	-	-	-	-	-
Stage 2	671	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	372	712	1217	-	-	-
Mov Cap-2 Maneuver	372	-	-	-	-	-
Stage 1	710	-	-	-	-	-
Stage 2	671	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	12.4	0.6	0
HCM LOS	B		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	1217	-	506	-	-
HCM Lane V/C Ratio	0.022	-	0.04	-	-
HCM Control Delay (s)	8	0	12.4	-	-
HCM Lane LOS	A	A	B	-	-
HCM 95th %tile Q(veh)	0.1	-	0.1	-	-

Intersection	
Int Delay, s/veh	1.8

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	61	24	6	324	371	18
Future Vol, veh/h	61	24	6	324	371	18
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	89	89	76	76	87	87
Heavy Vehicles, %	0	0	0	0	1	0
Mvmt Flow	69	27	8	426	426	21

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	879	437	447	0	-	0
Stage 1	437	-	-	-	-	-
Stage 2	442	-	-	-	-	-
Critical Hdwy	6.4	6.2	4.1	-	-	-
Critical Hdwy Stg 1	5.4	-	-	-	-	-
Critical Hdwy Stg 2	5.4	-	-	-	-	-
Follow-up Hdwy	3.5	3.3	2.2	-	-	-
Pot Cap-1 Maneuver	321	624	1124	-	-	-
Stage 1	655	-	-	-	-	-
Stage 2	652	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	318	624	1124	-	-	-
Mov Cap-2 Maneuver	318	-	-	-	-	-
Stage 1	649	-	-	-	-	-
Stage 2	652	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	18.1	0.1	0
HCM LOS	C		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	1124	-	369	-	-
HCM Lane V/C Ratio	0.007	-	0.259	-	-
HCM Control Delay (s)	8.2	0	18.1	-	-
HCM Lane LOS	A	A	C	-	-
HCM 95th %tile Q(veh)	0	-	1	-	-

Intersection	
Int Delay, s/veh	0.6

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	4	5	22	317	314	38
Future Vol, veh/h	4	5	22	317	314	38
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	45	45	82	82	93	94
Heavy Vehicles, %	0	0	0	1	2	0
Mvmt Flow	9	11	27	387	338	40

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	799	358	378	0	-	0
Stage 1	358	-	-	-	-	-
Stage 2	441	-	-	-	-	-
Critical Hdwy	6.4	6.2	4.1	-	-	-
Critical Hdwy Stg 1	5.4	-	-	-	-	-
Critical Hdwy Stg 2	5.4	-	-	-	-	-
Follow-up Hdwy	3.5	3.3	2.2	-	-	-
Pot Cap-1 Maneuver	357	691	1192	-	-	-
Stage 1	712	-	-	-	-	-
Stage 2	653	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	347	691	1192	-	-	-
Mov Cap-2 Maneuver	347	-	-	-	-	-
Stage 1	691	-	-	-	-	-
Stage 2	653	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	12.8	0.5	0
HCM LOS	B		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	1192	-	480	-	-
HCM Lane V/C Ratio	0.023	-	0.042	-	-
HCM Control Delay (s)	8.1	0	12.8	-	-
HCM Lane LOS	A	A	B	-	-
HCM 95th %tile Q(veh)	0.1	-	0.1	-	-

Intersection	
Int Delay, s/veh	1.9

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	61	24	6	355	399	18
Future Vol, veh/h	61	24	6	355	399	18
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	89	89	76	76	87	87
Heavy Vehicles, %	0	0	0	0	1	0
Mvmt Flow	69	27	8	467	459	21

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	953	470	480	0	-	0
Stage 1	470	-	-	-	-	-
Stage 2	483	-	-	-	-	-
Critical Hdwy	6.4	6.2	4.1	-	-	-
Critical Hdwy Stg 1	5.4	-	-	-	-	-
Critical Hdwy Stg 2	5.4	-	-	-	-	-
Follow-up Hdwy	3.5	3.3	2.2	-	-	-
Pot Cap-1 Maneuver	290	598	1093	-	-	-
Stage 1	633	-	-	-	-	-
Stage 2	625	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	287	598	1093	-	-	-
Mov Cap-2 Maneuver	287	-	-	-	-	-
Stage 1	627	-	-	-	-	-
Stage 2	625	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	19.9	0.1	0
HCM LOS	C		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	1093	-	336	-	-
HCM Lane V/C Ratio	0.007	-	0.284	-	-
HCM Control Delay (s)	8.3	0	19.9	-	-
HCM Lane LOS	A	A	C	-	-
HCM 95th %tile Q(veh)	0	-	1.1	-	-

Intersection	
Int Delay, s/veh	0.6

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	4	5	22	334	318	38
Future Vol, veh/h	4	5	22	334	318	38
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	45	45	82	82	93	94
Heavy Vehicles, %	0	0	0	1	2	0
Mvmt Flow	9	11	27	407	342	40

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	823	362	382	0	-	0
Stage 1	362	-	-	-	-	-
Stage 2	461	-	-	-	-	-
Critical Hdwy	6.4	6.2	4.1	-	-	-
Critical Hdwy Stg 1	5.4	-	-	-	-	-
Critical Hdwy Stg 2	5.4	-	-	-	-	-
Follow-up Hdwy	3.5	3.3	2.2	-	-	-
Pot Cap-1 Maneuver	346	687	1188	-	-	-
Stage 1	709	-	-	-	-	-
Stage 2	639	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	336	687	1188	-	-	-
Mov Cap-2 Maneuver	336	-	-	-	-	-
Stage 1	688	-	-	-	-	-
Stage 2	639	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	13	0.5	0
HCM LOS	B		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	1188	-	469	-	-
HCM Lane V/C Ratio	0.023	-	0.043	-	-
HCM Control Delay (s)	8.1	0	13	-	-
HCM Lane LOS	A	A	B	-	-
HCM 95th %tile Q(veh)	0.1	-	0.1	-	-

Intersection	
Int Delay, s/veh	1.9

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	61	24	6	364	417	18
Future Vol, veh/h	61	24	6	364	417	18
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	89	89	76	76	87	87
Heavy Vehicles, %	0	0	0	0	1	0
Mvmt Flow	69	27	8	479	479	21

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	985	490	500	0	-	0
Stage 1	490	-	-	-	-	-
Stage 2	495	-	-	-	-	-
Critical Hdwy	6.4	6.2	4.1	-	-	-
Critical Hdwy Stg 1	5.4	-	-	-	-	-
Critical Hdwy Stg 2	5.4	-	-	-	-	-
Follow-up Hdwy	3.5	3.3	2.2	-	-	-
Pot Cap-1 Maneuver	277	582	1075	-	-	-
Stage 1	620	-	-	-	-	-
Stage 2	617	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	274	582	1075	-	-	-
Mov Cap-2 Maneuver	274	-	-	-	-	-
Stage 1	614	-	-	-	-	-
Stage 2	617	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	20.8	0.1	0
HCM LOS	C		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	1075	-	322	-	-
HCM Lane V/C Ratio	0.007	-	0.297	-	-
HCM Control Delay (s)	8.4	0	20.8	-	-
HCM Lane LOS	A	A	C	-	-
HCM 95th %tile Q(veh)	0	-	1.2	-	-

High Street at Oak Street

Intersection	
Int Delay, s/veh	5.5

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	110	13	282	68	4	274
Future Vol, veh/h	110	13	282	68	4	274
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	59	59	63	63	94	94
Heavy Vehicles, %	6	0	1	3	50	1
Mvmt Flow	186	22	448	108	4	291

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	801	502	0	0	556	0
Stage 1	502	-	-	-	-	-
Stage 2	299	-	-	-	-	-
Critical Hdwy	6.46	6.2	-	-	4.6	-
Critical Hdwy Stg 1	5.46	-	-	-	-	-
Critical Hdwy Stg 2	5.46	-	-	-	-	-
Follow-up Hdwy	3.554	3.3	-	-	2.65	-
Pot Cap-1 Maneuver	348	573	-	-	814	-
Stage 1	600	-	-	-	-	-
Stage 2	743	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	346	573	-	-	814	-
Mov Cap-2 Maneuver	346	-	-	-	-	-
Stage 1	600	-	-	-	-	-
Stage 2	739	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	27.7	0	0.1
HCM LOS	D		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	361	814	-
HCM Lane V/C Ratio	-	-	0.577	0.005	-
HCM Control Delay (s)	-	-	27.7	9.4	0
HCM Lane LOS	-	-	D	A	A
HCM 95th %tile Q(veh)	-	-	3.5	0	-

Intersection	
Int Delay, s/veh	1.8

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	43	11	282	21	21	319
Future Vol, veh/h	43	11	282	21	21	319
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	66	66	80	80	82	82
Heavy Vehicles, %	0	0	0	0	0	1
Mvmt Flow	65	17	353	26	26	389

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	807	366	0	0	379	0
Stage 1	366	-	-	-	-	-
Stage 2	441	-	-	-	-	-
Critical Hdwy	6.4	6.2	-	-	4.1	-
Critical Hdwy Stg 1	5.4	-	-	-	-	-
Critical Hdwy Stg 2	5.4	-	-	-	-	-
Follow-up Hdwy	3.5	3.3	-	-	2.2	-
Pot Cap-1 Maneuver	354	684	-	-	1191	-
Stage 1	706	-	-	-	-	-
Stage 2	653	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	344	684	-	-	1191	-
Mov Cap-2 Maneuver	344	-	-	-	-	-
Stage 1	706	-	-	-	-	-
Stage 2	635	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	16.9	0	0.5
HCM LOS	C		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	383	1191	-
HCM Lane V/C Ratio	-	-	0.214	0.022	-
HCM Control Delay (s)	-	-	16.9	8.1	0
HCM Lane LOS	-	-	C	A	A
HCM 95th %tile Q(veh)	-	-	0.8	0.1	-

Intersection	
Int Delay, s/veh	6.9

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	118	14	303	73	4	294
Future Vol, veh/h	118	14	303	73	4	294
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	59	59	63	63	94	94
Heavy Vehicles, %	6	0	1	3	50	1
Mvmt Flow	200	24	481	116	4	313

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	860	539	0	0	597	0
Stage 1	539	-	-	-	-	-
Stage 2	321	-	-	-	-	-
Critical Hdwy	6.46	6.2	-	-	4.6	-
Critical Hdwy Stg 1	5.46	-	-	-	-	-
Critical Hdwy Stg 2	5.46	-	-	-	-	-
Follow-up Hdwy	3.554	3.3	-	-	2.65	-
Pot Cap-1 Maneuver	321	546	-	-	783	-
Stage 1	577	-	-	-	-	-
Stage 2	726	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	319	546	-	-	783	-
Mov Cap-2 Maneuver	319	-	-	-	-	-
Stage 1	577	-	-	-	-	-
Stage 2	722	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	35.1	0	0.1
HCM LOS	E		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	334	783	-
HCM Lane V/C Ratio	-	-	0.67	0.005	-
HCM Control Delay (s)	-	-	35.1	9.6	0
HCM Lane LOS	-	-	E	A	A
HCM 95th %tile Q(veh)	-	-	4.6	0	-

Intersection	
Int Delay, s/veh	2

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	46	12	305	23	23	342
Future Vol, veh/h	46	12	305	23	23	342
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	66	66	80	80	82	82
Heavy Vehicles, %	0	0	0	0	0	1
Mvmt Flow	70	18	381	29	28	417

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	869	396	0	0	410	0
Stage 1	396	-	-	-	-	-
Stage 2	473	-	-	-	-	-
Critical Hdwy	6.4	6.2	-	-	4.1	-
Critical Hdwy Stg 1	5.4	-	-	-	-	-
Critical Hdwy Stg 2	5.4	-	-	-	-	-
Follow-up Hdwy	3.5	3.3	-	-	2.2	-
Pot Cap-1 Maneuver	325	658	-	-	1160	-
Stage 1	684	-	-	-	-	-
Stage 2	631	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	315	658	-	-	1160	-
Mov Cap-2 Maneuver	315	-	-	-	-	-
Stage 1	684	-	-	-	-	-
Stage 2	611	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	18.5	0	0.5
HCM LOS	C		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	353	1160	-
HCM Lane V/C Ratio	-	-	0.249	0.024	-
HCM Control Delay (s)	-	-	18.5	8.2	0
HCM Lane LOS	-	-	C	A	A
HCM 95th %tile Q(veh)	-	-	1	0.1	-

Intersection	
Int Delay, s/veh	7.1

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	118	14	305	73	5	297
Future Vol, veh/h	118	14	305	73	5	297
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	59	59	63	63	94	94
Heavy Vehicles, %	6	0	1	3	50	1
Mvmt Flow	200	24	484	116	5	316

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	868	542	0	0	600	0
Stage 1	542	-	-	-	-	-
Stage 2	326	-	-	-	-	-
Critical Hdwy	6.46	6.2	-	-	4.6	-
Critical Hdwy Stg 1	5.46	-	-	-	-	-
Critical Hdwy Stg 2	5.46	-	-	-	-	-
Follow-up Hdwy	3.554	3.3	-	-	2.65	-
Pot Cap-1 Maneuver	318	544	-	-	781	-
Stage 1	575	-	-	-	-	-
Stage 2	723	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	315	544	-	-	781	-
Mov Cap-2 Maneuver	315	-	-	-	-	-
Stage 1	575	-	-	-	-	-
Stage 2	717	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	36.1	0	0.2
HCM LOS	E		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	330	781	-
HCM Lane V/C Ratio	-	-	0.678	0.007	-
HCM Control Delay (s)	-	-	36.1	9.6	0
HCM Lane LOS	-	-	E	A	A
HCM 95th %tile Q(veh)	-	-	4.7	0	-

Intersection	
Int Delay, s/veh	2

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	46	13	308	23	24	345
Future Vol, veh/h	46	13	308	23	24	345
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	66	66	80	80	82	82
Heavy Vehicles, %	0	0	0	0	0	1
Mvmt Flow	70	20	385	29	29	421

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	879	400	0	0	414	0
Stage 1	400	-	-	-	-	-
Stage 2	479	-	-	-	-	-
Critical Hdwy	6.4	6.2	-	-	4.1	-
Critical Hdwy Stg 1	5.4	-	-	-	-	-
Critical Hdwy Stg 2	5.4	-	-	-	-	-
Follow-up Hdwy	3.5	3.3	-	-	2.2	-
Pot Cap-1 Maneuver	321	654	-	-	1156	-
Stage 1	681	-	-	-	-	-
Stage 2	627	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	310	654	-	-	1156	-
Mov Cap-2 Maneuver	310	-	-	-	-	-
Stage 1	681	-	-	-	-	-
Stage 2	606	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	18.7	0	0.5
HCM LOS	C		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	351	1156	-
HCM Lane V/C Ratio	-	-	0.255	0.025	-
HCM Control Delay (s)	-	-	18.7	8.2	0
HCM Lane LOS	-	-	C	A	A
HCM 95th %tile Q(veh)	-	-	1	0.1	-

Washington Street (Route 53) at Oak Street

Intersection	
Int Delay, s/veh	4.9

Movement	EBL	EBR	SET	SER	NWL	NWT
Lane Configurations						
Traffic Vol, veh/h	23	70	452	21	83	467
Future Vol, veh/h	23	70	452	21	83	467
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	48	48	87	87	89	89
Heavy Vehicles, %	17	5	5	0	12	4
Mvmt Flow	48	146	520	24	93	525

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	1243	532	0	0	544	0
Stage 1	532	-	-	-	-	-
Stage 2	711	-	-	-	-	-
Critical Hdwy	6.57	6.25	-	-	4.22	-
Critical Hdwy Stg 1	5.57	-	-	-	-	-
Critical Hdwy Stg 2	5.57	-	-	-	-	-
Follow-up Hdwy	3.653	3.345	-	-	2.308	-
Pot Cap-1 Maneuver	179	542	-	-	976	-
Stage 1	560	-	-	-	-	-
Stage 2	460	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	155	542	-	-	976	-
Mov Cap-2 Maneuver	155	-	-	-	-	-
Stage 1	560	-	-	-	-	-
Stage 2	398	-	-	-	-	-

Approach	EB	SE	NW
HCM Control Delay, s	29.5	0	1.4
HCM LOS	D		

Minor Lane/Major Mvmt	NWL	NWT	EBLn1	SET	SER
Capacity (veh/h)	976	-	335	-	-
HCM Lane V/C Ratio	0.096	-	0.578	-	-
HCM Control Delay (s)	9.1	0	29.5	-	-
HCM Lane LOS	A	A	D	-	-
HCM 95th %tile Q(veh)	0.3	-	3.4	-	-

Intersection	
Int Delay, s/veh	1.4

Movement	EBL	EBR	SET	SER	NWL	NWT
Lane Configurations						
Traffic Vol, veh/h	8	35	651	43	44	755
Future Vol, veh/h	8	35	651	43	44	755
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	57	57	91	91	86	86
Heavy Vehicles, %	0	0	2	5	0	0
Mvmt Flow	14	61	715	47	51	878

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	1719	739	0	0	762	0
Stage 1	739	-	-	-	-	-
Stage 2	980	-	-	-	-	-
Critical Hdwy	6.4	6.2	-	-	4.1	-
Critical Hdwy Stg 1	5.4	-	-	-	-	-
Critical Hdwy Stg 2	5.4	-	-	-	-	-
Follow-up Hdwy	3.5	3.3	-	-	2.2	-
Pot Cap-1 Maneuver	100	421	-	-	859	-
Stage 1	476	-	-	-	-	-
Stage 2	367	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	88	421	-	-	859	-
Mov Cap-2 Maneuver	88	-	-	-	-	-
Stage 1	476	-	-	-	-	-
Stage 2	324	-	-	-	-	-

Approach	EB	SE	NW
HCM Control Delay, s	25.9	0	0.5
HCM LOS	D		

Minor Lane/Major Mvmt	NWL	NWT	EBLn1	SET	SER
Capacity (veh/h)	859	-	247	-	-
HCM Lane V/C Ratio	0.06	-	0.305	-	-
HCM Control Delay (s)	9.5	0	25.9	-	-
HCM Lane LOS	A	A	D	-	-
HCM 95th %tile Q(veh)	0.2	-	1.2	-	-

Intersection	
Int Delay, s/veh	6.5

Movement	EBL	EBR	SET	SER	NWL	NWT
Lane Configurations						
Traffic Vol, veh/h	25	75	489	23	89	507
Future Vol, veh/h	25	75	489	23	89	507
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	48	48	87	87	89	89
Heavy Vehicles, %	17	5	5	0	12	4
Mvmt Flow	52	156	562	26	100	570

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	1345	575	0	0	588	0
Stage 1	575	-	-	-	-	-
Stage 2	770	-	-	-	-	-
Critical Hdwy	6.57	6.25	-	-	4.22	-
Critical Hdwy Stg 1	5.57	-	-	-	-	-
Critical Hdwy Stg 2	5.57	-	-	-	-	-
Follow-up Hdwy	3.653	3.345	-	-	2.308	-
Pot Cap-1 Maneuver	155	512	-	-	940	-
Stage 1	534	-	-	-	-	-
Stage 2	431	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	131	512	-	-	940	-
Mov Cap-2 Maneuver	131	-	-	-	-	-
Stage 1	534	-	-	-	-	-
Stage 2	364	-	-	-	-	-

Approach	EB	SE	NW
HCM Control Delay, s	41.6	0	1.4
HCM LOS	E		

Minor Lane/Major Mvmt	NWL	NWT	EBLn1	SET	SER
Capacity (veh/h)	940	-	296	-	-
HCM Lane V/C Ratio	0.106	-	0.704	-	-
HCM Control Delay (s)	9.3	0	41.6	-	-
HCM Lane LOS	A	A	E	-	-
HCM 95th %tile Q(veh)	0.4	-	4.9	-	-

Intersection	
Int Delay, s/veh	1.7

Movement	EBL	EBR	SET	SER	NWL	NWT
Lane Configurations						
Traffic Vol, veh/h	9	38	708	46	47	819
Future Vol, veh/h	9	38	708	46	47	819
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	57	57	91	91	86	86
Heavy Vehicles, %	0	0	2	5	0	0
Mvmt Flow	16	67	778	51	55	952

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	1866	804	0	0	829	0
Stage 1	804	-	-	-	-	-
Stage 2	1062	-	-	-	-	-
Critical Hdwy	6.4	6.2	-	-	4.1	-
Critical Hdwy Stg 1	5.4	-	-	-	-	-
Critical Hdwy Stg 2	5.4	-	-	-	-	-
Follow-up Hdwy	3.5	3.3	-	-	2.2	-
Pot Cap-1 Maneuver	81	386	-	-	811	-
Stage 1	444	-	-	-	-	-
Stage 2	335	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	69	386	-	-	811	-
Mov Cap-2 Maneuver	69	-	-	-	-	-
Stage 1	444	-	-	-	-	-
Stage 2	287	-	-	-	-	-

Approach	EB	SE	NW
HCM Control Delay, s	33.9	0	0.5
HCM LOS	D		

Minor Lane/Major Mvmt	NWL	NWT	EBLn1	SET	SER
Capacity (veh/h)	811	-	205	-	-
HCM Lane V/C Ratio	0.067	-	0.402	-	-
HCM Control Delay (s)	9.8	0	33.9	-	-
HCM Lane LOS	A	A	D	-	-
HCM 95th %tile Q(veh)	0.2	-	1.8	-	-

Intersection	
Int Delay, s/veh	6.7

Movement	EBL	EBR	SET	SER	NWL	NWT
Lane Configurations						
Traffic Vol, veh/h	25	76	491	23	89	508
Future Vol, veh/h	25	76	491	23	89	508
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	48	48	87	87	89	89
Heavy Vehicles, %	17	5	5	0	12	4
Mvmt Flow	52	158	564	26	100	571

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	1348	577	0	0	590	0
Stage 1	577	-	-	-	-	-
Stage 2	771	-	-	-	-	-
Critical Hdwy	6.57	6.25	-	-	4.22	-
Critical Hdwy Stg 1	5.57	-	-	-	-	-
Critical Hdwy Stg 2	5.57	-	-	-	-	-
Follow-up Hdwy	3.653	3.345	-	-	2.308	-
Pot Cap-1 Maneuver	154	511	-	-	938	-
Stage 1	533	-	-	-	-	-
Stage 2	431	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	130	511	-	-	938	-
Mov Cap-2 Maneuver	130	-	-	-	-	-
Stage 1	533	-	-	-	-	-
Stage 2	364	-	-	-	-	-

Approach	EB	SE	NW
HCM Control Delay, s	42.2	0	1.4
HCM LOS	E		

Minor Lane/Major Mvmt	NWL	NWT	EBLn1	SET	SER
Capacity (veh/h)	938	-	296	-	-
HCM Lane V/C Ratio	0.107	-	0.711	-	-
HCM Control Delay (s)	9.3	0	42.2	-	-
HCM Lane LOS	A	A	E	-	-
HCM 95th %tile Q(veh)	0.4	-	5	-	-

Intersection	
Int Delay, s/veh	1.8

Movement	EBL	EBR	SET	SER	NWL	NWT
Lane Configurations						
Traffic Vol, veh/h	9	39	709	46	48	821
Future Vol, veh/h	9	39	709	46	48	821
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	57	57	91	91	86	86
Heavy Vehicles, %	0	0	2	5	0	0
Mvmt Flow	16	68	779	51	56	955

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	1872	805	0	0	830	0
Stage 1	805	-	-	-	-	-
Stage 2	1067	-	-	-	-	-
Critical Hdwy	6.4	6.2	-	-	4.1	-
Critical Hdwy Stg 1	5.4	-	-	-	-	-
Critical Hdwy Stg 2	5.4	-	-	-	-	-
Follow-up Hdwy	3.5	3.3	-	-	2.2	-
Pot Cap-1 Maneuver	80	386	-	-	811	-
Stage 1	443	-	-	-	-	-
Stage 2	334	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	68	386	-	-	811	-
Mov Cap-2 Maneuver	68	-	-	-	-	-
Stage 1	443	-	-	-	-	-
Stage 2	285	-	-	-	-	-

Approach	EB	SE	NW
HCM Control Delay, s	34.1	0	0.5
HCM LOS	D		

Minor Lane/Major Mvmt	NWL	NWT	EBLn1	SET	SER
Capacity (veh/h)	811	-	206	-	-
HCM Lane V/C Ratio	0.069	-	0.409	-	-
HCM Control Delay (s)	9.8	0	34.1	-	-
HCM Lane LOS	A	A	D	-	-
HCM 95th %tile Q(veh)	0.2	-	1.9	-	-

High Street at Site Drive A

Intersection	
Int Delay, s/veh	0.2

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	9	2	1	347	321	2
Future Vol, veh/h	9	2	1	347	321	2
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	10	2	1	377	349	2

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	729	350	351	0	-	0
Stage 1	350	-	-	-	-	-
Stage 2	379	-	-	-	-	-
Critical Hdwy	6.42	6.22	4.12	-	-	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	2.218	-	-	-
Pot Cap-1 Maneuver	390	693	1208	-	-	-
Stage 1	713	-	-	-	-	-
Stage 2	692	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	390	693	1208	-	-	-
Mov Cap-2 Maneuver	390	-	-	-	-	-
Stage 1	712	-	-	-	-	-
Stage 2	692	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	13.7	0	0
HCM LOS	B		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	1208	-	424	-	-
HCM Lane V/C Ratio	0.001	-	0.028	-	-
HCM Control Delay (s)	8	0	13.7	-	-
HCM Lane LOS	A	A	B	-	-
HCM 95th %tile Q(veh)	0	-	0.1	-	-

Intersection	
Int Delay, s/veh	0.1

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	5	2	2	365	432	9
Future Vol, veh/h	5	2	2	365	432	9
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	5	2	2	397	470	10

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	876	475	480	0	-	0
Stage 1	475	-	-	-	-	-
Stage 2	401	-	-	-	-	-
Critical Hdwy	6.42	6.22	4.12	-	-	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	2.218	-	-	-
Pot Cap-1 Maneuver	319	590	1082	-	-	-
Stage 1	626	-	-	-	-	-
Stage 2	676	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	318	590	1082	-	-	-
Mov Cap-2 Maneuver	318	-	-	-	-	-
Stage 1	625	-	-	-	-	-
Stage 2	676	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	15	0	0
HCM LOS	C		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	1082	-	366	-	-
HCM Lane V/C Ratio	0.002	-	0.021	-	-
HCM Control Delay (s)	8.3	0	15	-	-
HCM Lane LOS	A	A	C	-	-
HCM 95th %tile Q(veh)	0	-	0.1	-	-

High Street at Site Drive B

Intersection	
Int Delay, s/veh	0.2

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	8	2	1	340	321	2
Future Vol, veh/h	8	2	1	340	321	2
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	9	2	1	370	349	2

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	722	350	351	0	-	0
Stage 1	350	-	-	-	-	-
Stage 2	372	-	-	-	-	-
Critical Hdwy	6.42	6.22	4.12	-	-	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	2.218	-	-	-
Pot Cap-1 Maneuver	394	693	1208	-	-	-
Stage 1	713	-	-	-	-	-
Stage 2	697	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	394	693	1208	-	-	-
Mov Cap-2 Maneuver	394	-	-	-	-	-
Stage 1	712	-	-	-	-	-
Stage 2	697	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	13.6	0	0
HCM LOS	B		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	1208	-	431	-	-
HCM Lane V/C Ratio	0.001	-	0.025	-	-
HCM Control Delay (s)	8	0	13.6	-	-
HCM Lane LOS	A	A	B	-	-
HCM 95th %tile Q(veh)	0	-	0.1	-	-

Intersection	
Int Delay, s/veh	0.1

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	4	2	2	363	425	9
Future Vol, veh/h	4	2	2	363	425	9
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	4	2	2	395	462	10

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	866	467	472	0	-	0
Stage 1	467	-	-	-	-	-
Stage 2	399	-	-	-	-	-
Critical Hdwy	6.42	6.22	4.12	-	-	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	2.218	-	-	-
Pot Cap-1 Maneuver	324	596	1090	-	-	-
Stage 1	631	-	-	-	-	-
Stage 2	678	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	323	596	1090	-	-	-
Mov Cap-2 Maneuver	323	-	-	-	-	-
Stage 1	630	-	-	-	-	-
Stage 2	678	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	14.6	0	0
HCM LOS	B		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	1090	-	381	-	-
HCM Lane V/C Ratio	0.002	-	0.017	-	-
HCM Control Delay (s)	8.3	0	14.6	-	-
HCM Lane LOS	A	A	B	-	-
HCM 95th %tile Q(veh)	0	-	0.1	-	-

Drainage Calculations

- Existing Conditions Model
- Proposed Conditions Model
- Supplemental Drainage Calculations
    - Groundwater Recharge Volume
    - Infiltration System Drawdown
    - Water Quality Volume
    - TSS Removal Rate
    - Closed Drainage System Sizing
- Soil Testing Results

EXISTING CONDITIONS WATERSHED

SUBCATCHMENT 1S

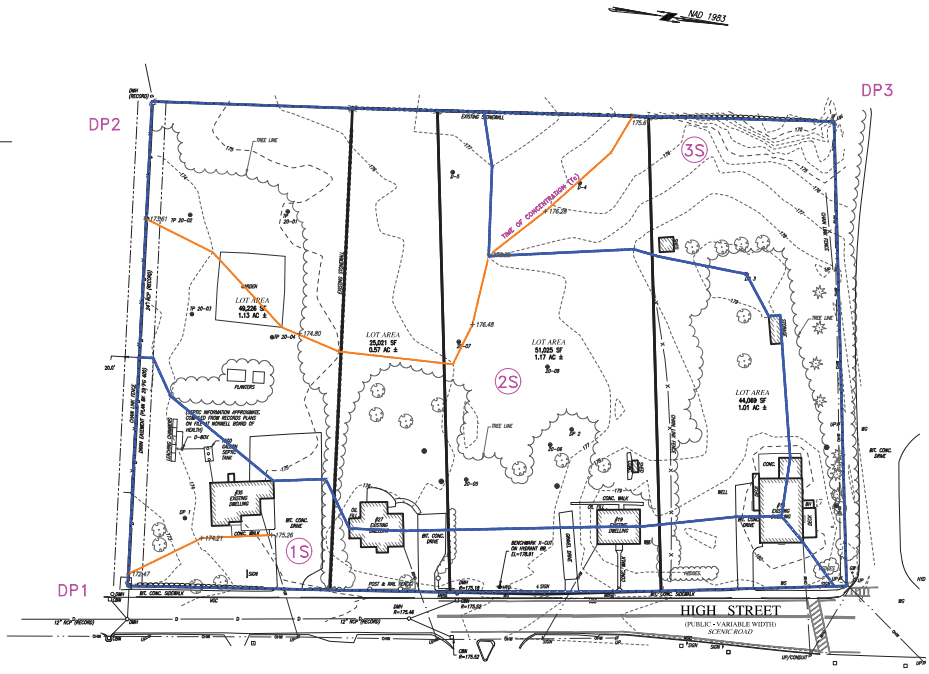
DESCRIPTION	AREA (S.F.)	
WOODS (HSG A)	2,321	S.F.
GRASS (HSG A)	21,690	S.F.
PAVEMENT (HSG A)	4,644	S.F.
ROOFS (HSG A)	2,377	S.F.
TOTAL AREA FOR 1S	31,032	S.F.

SUBCATCHMENT 2S

DESCRIPTION	AREA (S.F.)	
WOODS (HSG A)	57,084	S.F.
GRASS (HSG A)	42,279	S.F.
PAVEMENT (HSG A)	2,748	S.F.
ROOFS (HSG A)	1,641	S.F.
TOTAL AREA FOR 2S	104,202	S.F.

SUBCATCHMENT 3S

DESCRIPTION	AREA (S.F.)	
WOODS (HSG A)	28,340	S.F.
GRASS (HSG A)	4,777	S.F.
PAVEMENT (HSG A)	24	S.F.
ROOFS (HSG A)	967	S.F.
TOTAL AREA FOR 3S	34,108	S.F.



SCALE IN FEET

COPYRIGHT © BY MERRILL CORPORATION
NO PART OF THIS DOCUMENT MAY BE REPRODUCED, STORED IN A RETRIEVAL SYSTEM, OR TRANSMITTED IN ANY FORM OR BY ANY MEANS, ELECTRONIC, MECHANICAL, PHOTOCOPYING, RECORDING OR OTHERWISE, WITHOUT THE PRIOR WRITTEN PERMISSION OF MERRILL CORPORATION. THIS DOCUMENT IS PROPRIETARY TO MERRILL CORPORATION. IF ANY REGULATORY AUTHORITY WISHES ANY REVIEWERS, IN CONJUNCTION WITH THE PERFORMANCE OF OFFICIAL BUSINESS UNDER ITS JURISDICTION, ANY MODIFICATIONS MADE TO THE DOCUMENT WITHOUT THE EXPRESS WRITTEN CONSENT OF MERRILL CORPORATION SHALL RENDER IT UNUSABLE.

REVISIONS

DRAWN BY:	JG
DESIGNED BY:	DK
CHECKED BY:	DK

Merrill
Engineers and Land Surveyors
427 COLUMBIA ROAD, HANOVER, MA 02339 / T: (781) 826-8200
26 UNION STREET, PLYMOUTH, MA 02360 / T: (508) 746-6060
WWW.MERRILLENGINEERS.COM

SITE PLAN

#15, 19, 27 & 35 HIGH STREET

NORWELL, MASSACHUSETTS 02061

OWNER/APPLICANT
NORTHLAND RESIDENTIAL CORPORATION
100 CONSTITUTION PLAZA, 17TH FLOOR
CONCORD, MASSACHUSETTS 01742

JANUARY 29, 2021

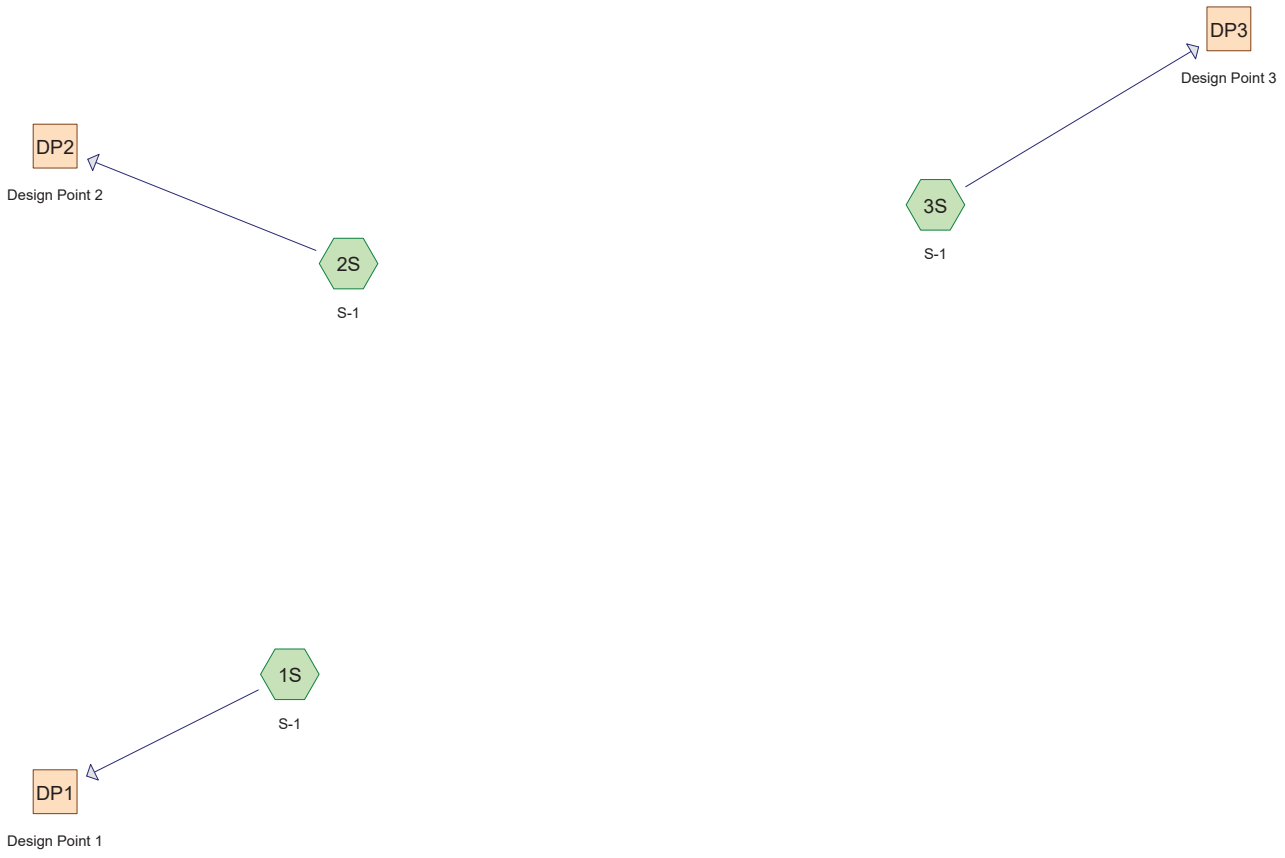
SCALE:

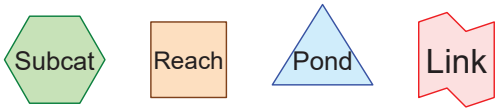
JOB NO. 20-127

LATEST REVISION:
APRIL 30, 2021

EXISTING CONDITIONS WATERSHED PLAN

SHEET 1 OF 1





Routing Diagram for 20-127 Pre Dev
Prepared by Merrill Engineers and Land Surveyors, Printed 4/22/2021
HydroCAD® 10.00-25 s/n 02159 © 2019 HydroCAD Software Solutions LLC

Time span=0.00-72.00 hrs, dt=0.05 hrs, 1441 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 1S: S-1 Runoff Area=31,032 sf 22.63% Impervious Runoff Depth=0.21"
Flow Length=108' Tc=6.0 min CN=52 Runoff=0.05 cfs 0.012 af

Subcatchment 2S: S-1 Runoff Area=104,202 sf 4.21% Impervious Runoff Depth=0.00"
Flow Length=332' Tc=18.7 min CN=37 Runoff=0.00 cfs 0.000 af

Subcatchment 3S: S-1 Runoff Area=34,108 sf 2.91% Impervious Runoff Depth=0.00"
Flow Length=265' Tc=18.7 min CN=33 Runoff=0.00 cfs 0.000 af

Reach DP1: Design Point 1 Inflow=0.05 cfs 0.012 af
Outflow=0.05 cfs 0.012 af

Reach DP2: Design Point 2 Inflow=0.00 cfs 0.000 af
Outflow=0.00 cfs 0.000 af

Reach DP3: Design Point 3 Inflow=0.00 cfs 0.000 af
Outflow=0.00 cfs 0.000 af

Total Runoff Area = 3.888 ac Runoff Volume = 0.012 af Average Runoff Depth = 0.04"
92.68% Pervious = 3.603 ac 7.32% Impervious = 0.285 ac

Summary for Subcatchment 1S: S-1

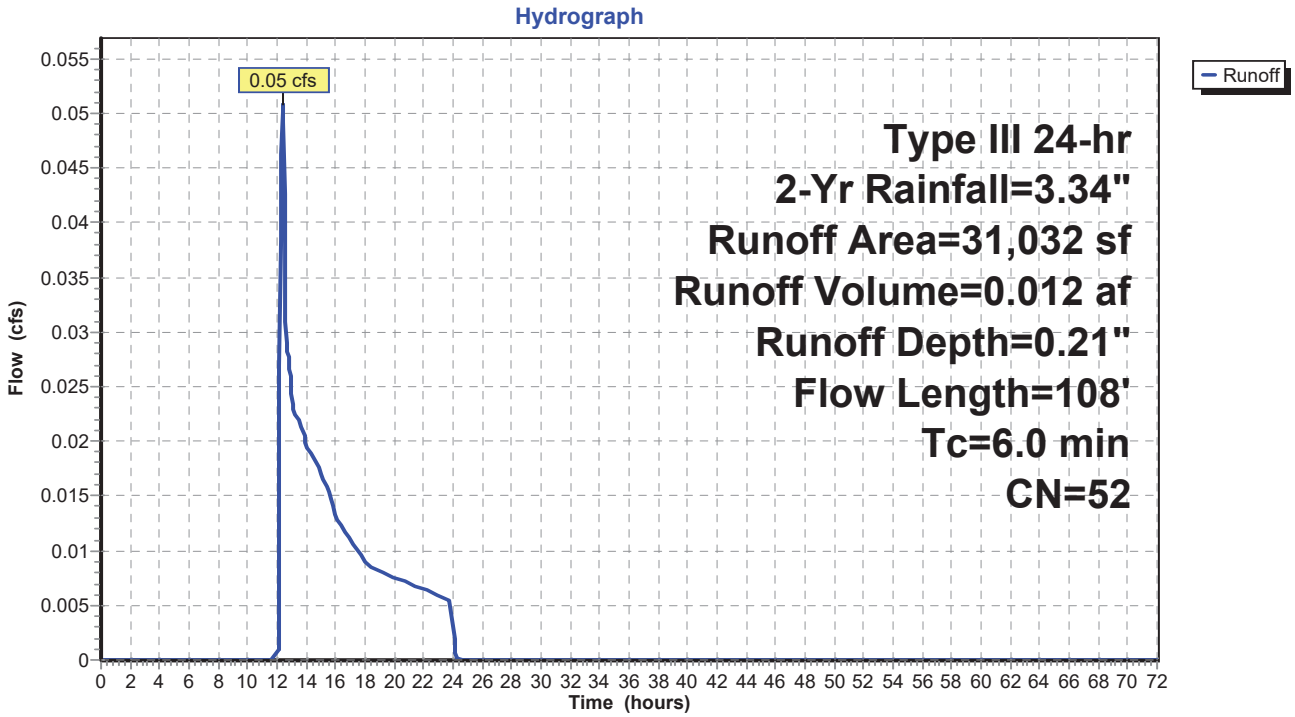
Runoff = 0.05 cfs @ 12.38 hrs, Volume= 0.012 af, Depth= 0.21"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Yr Rainfall=3.34"

Area (sf)	CN	Description
2,321	30	Woods, Good, HSG A
21,690	39	>75% Grass cover, Good, HSG A
4,644	98	Paved parking, HSG A
2,377	98	Roofs, HSG A
31,032	52	Weighted Average
24,011		77.37% Pervious Area
7,021		22.63% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.4	50	0.0210	0.15		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.34"
0.3	58	0.0300	2.79		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
5.7	108	Total, Increased to minimum Tc = 6.0 min			

Subcatchment 1S: S-1



Summary for Subcatchment 2S: S-1

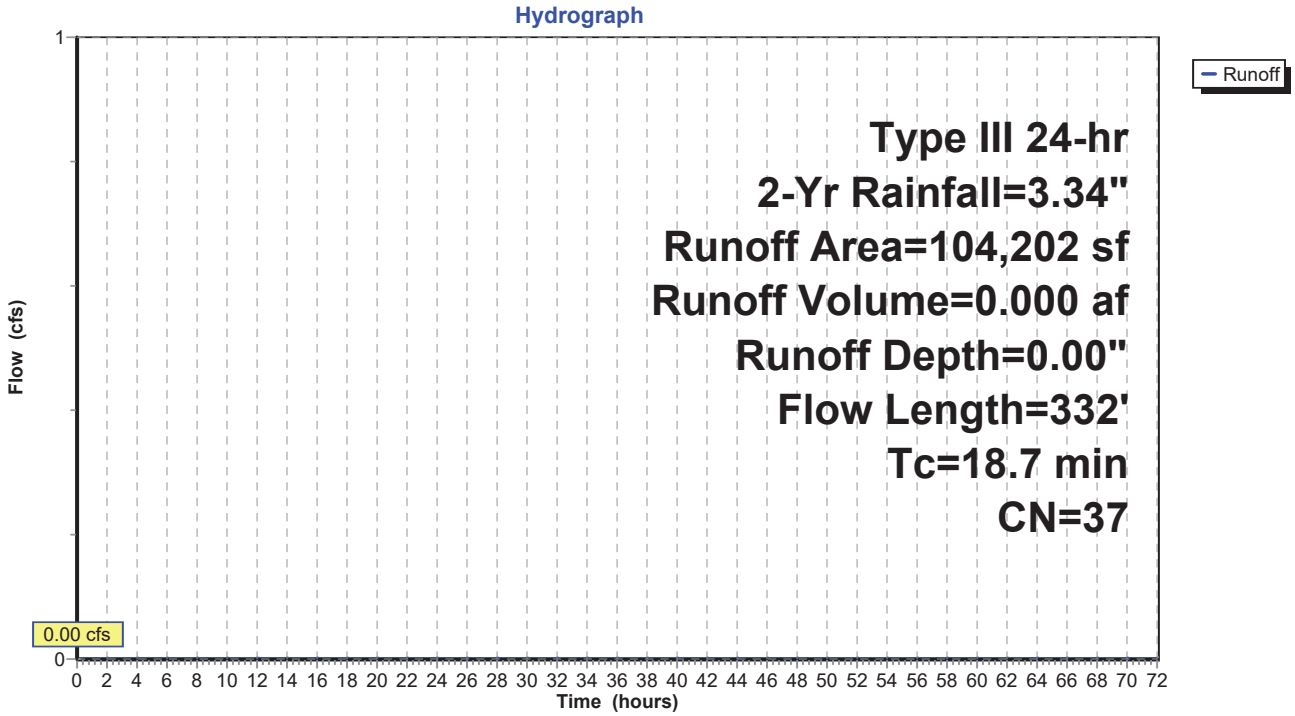
Runoff = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Depth= 0.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Yr Rainfall=3.34"

Area (sf)	CN	Description
57,084	30	Woods, Good, HSG A
42,729	39	>75% Grass cover, Good, HSG A
2,748	98	Paved parking, HSG A
1,641	98	Roofs, HSG A
104,202	37	Weighted Average
99,813		95.79% Pervious Area
4,389		4.21% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
15.8	50	0.0102	0.05		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.34"
1.4	143	0.0120	1.76		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
1.5	139	0.0090	1.53		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
18.7	332	Total			

Subcatchment 2S: S-1



Summary for Subcatchment 3S: S-1

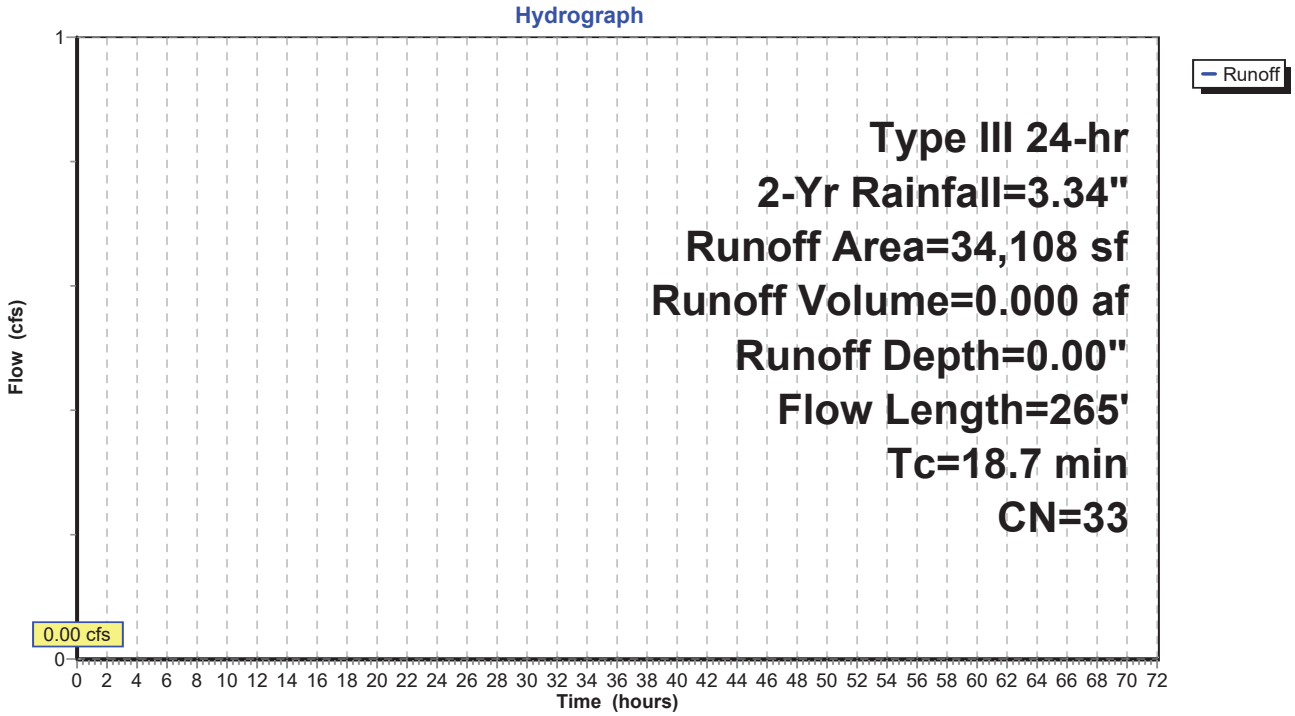
Runoff = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Depth= 0.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Yr Rainfall=3.34"

Area (sf)	CN	Description
28,340	30	Woods, Good, HSG A
4,777	39	>75% Grass cover, Good, HSG A
24	98	Paved parking, HSG A
967	98	Roofs, HSG A
34,108	33	Weighted Average
33,117		97.09% Pervious Area
991		2.91% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
14.8	50	0.0120	0.06		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.34"
1.2	93	0.0070	1.35		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
2.7	122	0.0120	0.77		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
18.7	265	Total			

Subcatchment 3S: S-1

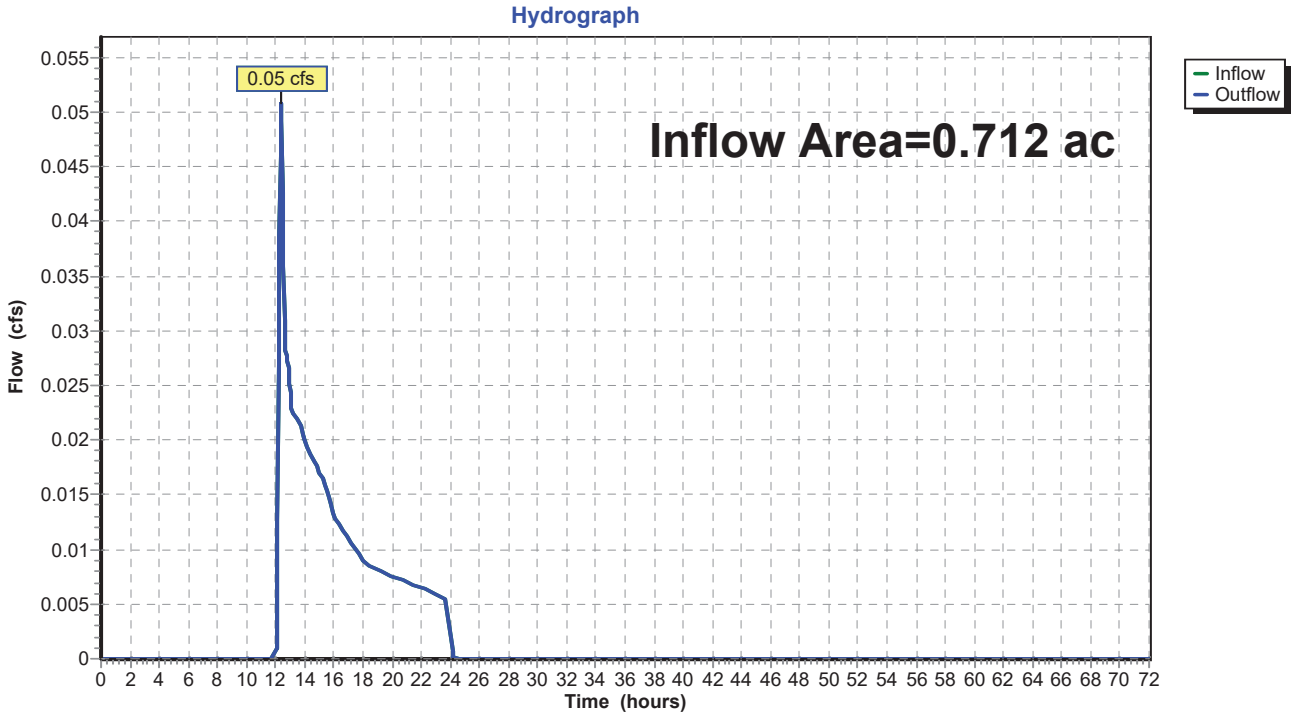


Summary for Reach DP1: Design Point 1

Inflow Area = 0.712 ac, 22.63% Impervious, Inflow Depth = 0.21" for 2-Yr event
Inflow = 0.05 cfs @ 12.38 hrs, Volume= 0.012 af
Outflow = 0.05 cfs @ 12.38 hrs, Volume= 0.012 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

Reach DP1: Design Point 1

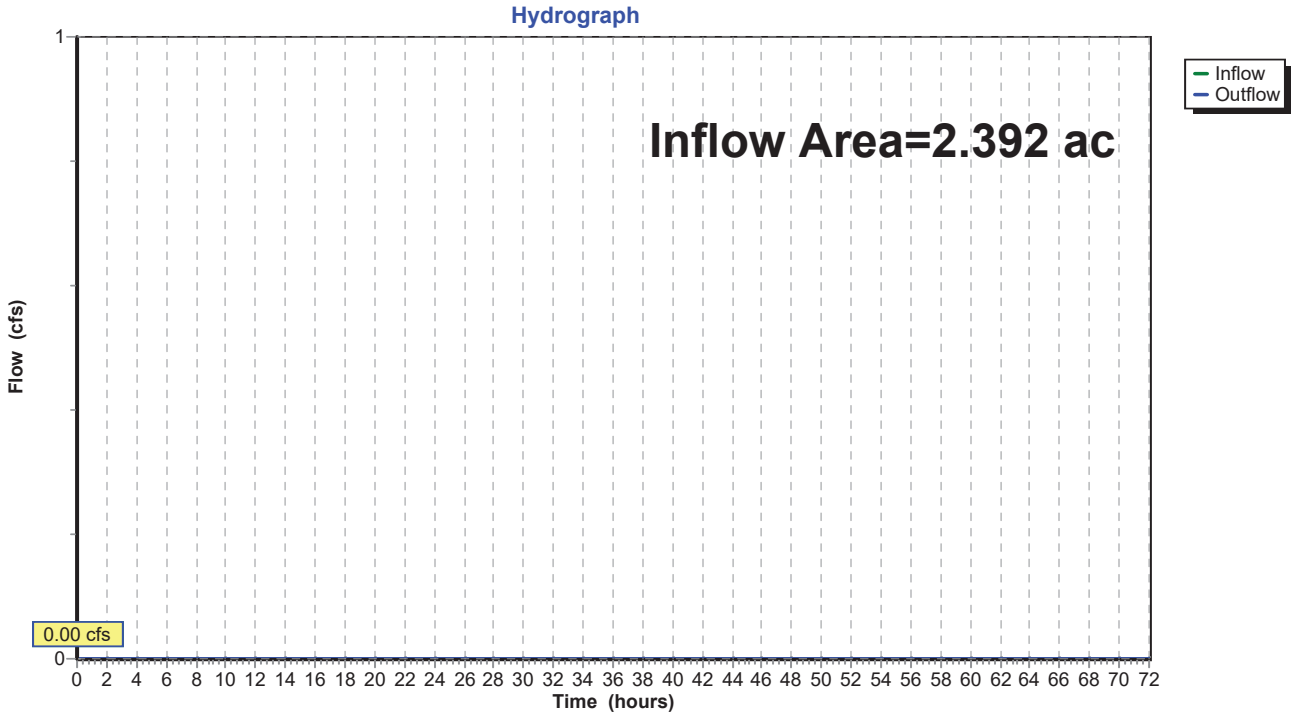


Summary for Reach DP2: Design Point 2

Inflow Area = 2.392 ac, 4.21% Impervious, Inflow Depth = 0.00" for 2-Yr event
Inflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

Reach DP2: Design Point 2

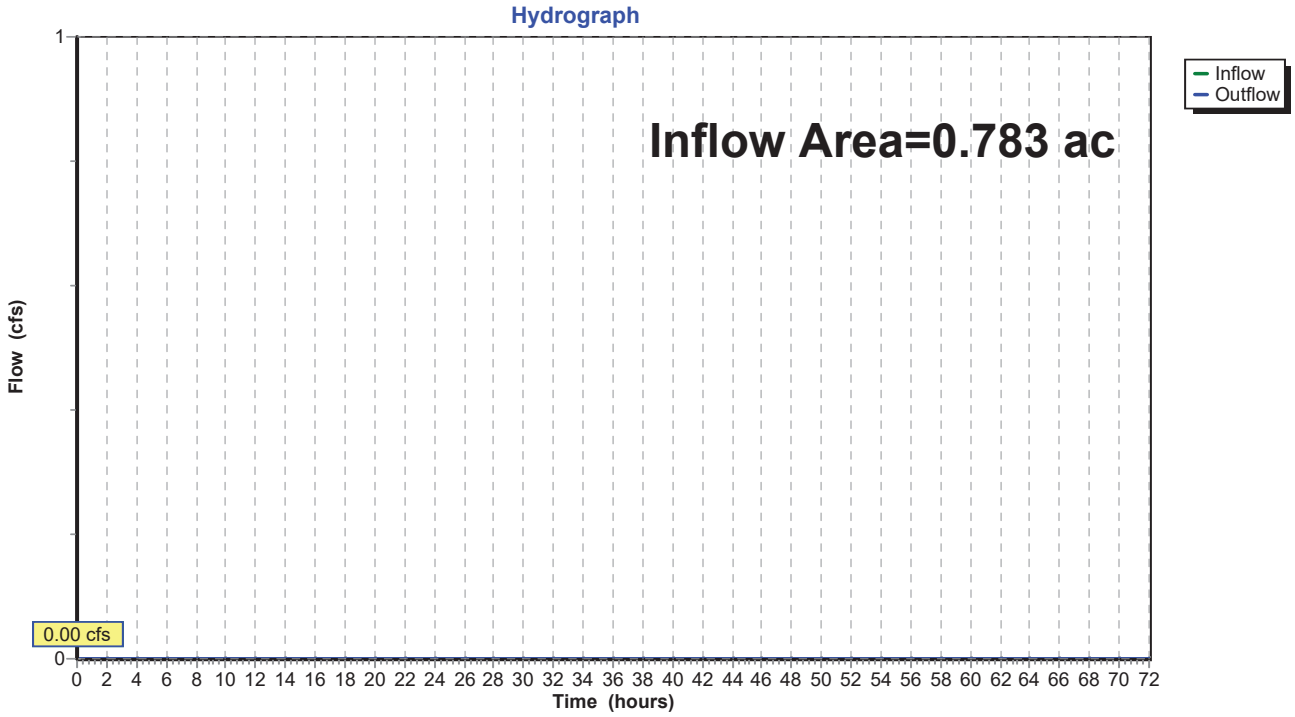


Summary for Reach DP3: Design Point 3

Inflow Area = 0.783 ac, 2.91% Impervious, Inflow Depth = 0.00" for 2-Yr event
Inflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af
Outflow = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

Reach DP3: Design Point 3



Time span=0.00-72.00 hrs, dt=0.05 hrs, 1441 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 1S: S-1 Runoff Area=31,032 sf 22.63% Impervious Runoff Depth=0.77"
Flow Length=108' Tc=6.0 min CN=52 Runoff=0.44 cfs 0.046 af

Subcatchment 2S: S-1 Runoff Area=104,202 sf 4.21% Impervious Runoff Depth=0.13"
Flow Length=332' Tc=18.7 min CN=37 Runoff=0.04 cfs 0.025 af

Subcatchment 3S: S-1 Runoff Area=34,108 sf 2.91% Impervious Runoff Depth=0.04"
Flow Length=265' Tc=18.7 min CN=33 Runoff=0.00 cfs 0.002 af

Reach DP1: Design Point 1 Inflow=0.44 cfs 0.046 af
Outflow=0.44 cfs 0.046 af

Reach DP2: Design Point 2 Inflow=0.04 cfs 0.025 af
Outflow=0.04 cfs 0.025 af

Reach DP3: Design Point 3 Inflow=0.00 cfs 0.002 af
Outflow=0.00 cfs 0.002 af

Total Runoff Area = 3.888 ac Runoff Volume = 0.073 af Average Runoff Depth = 0.23"
92.68% Pervious = 3.603 ac 7.32% Impervious = 0.285 ac

Summary for Subcatchment 1S: S-1

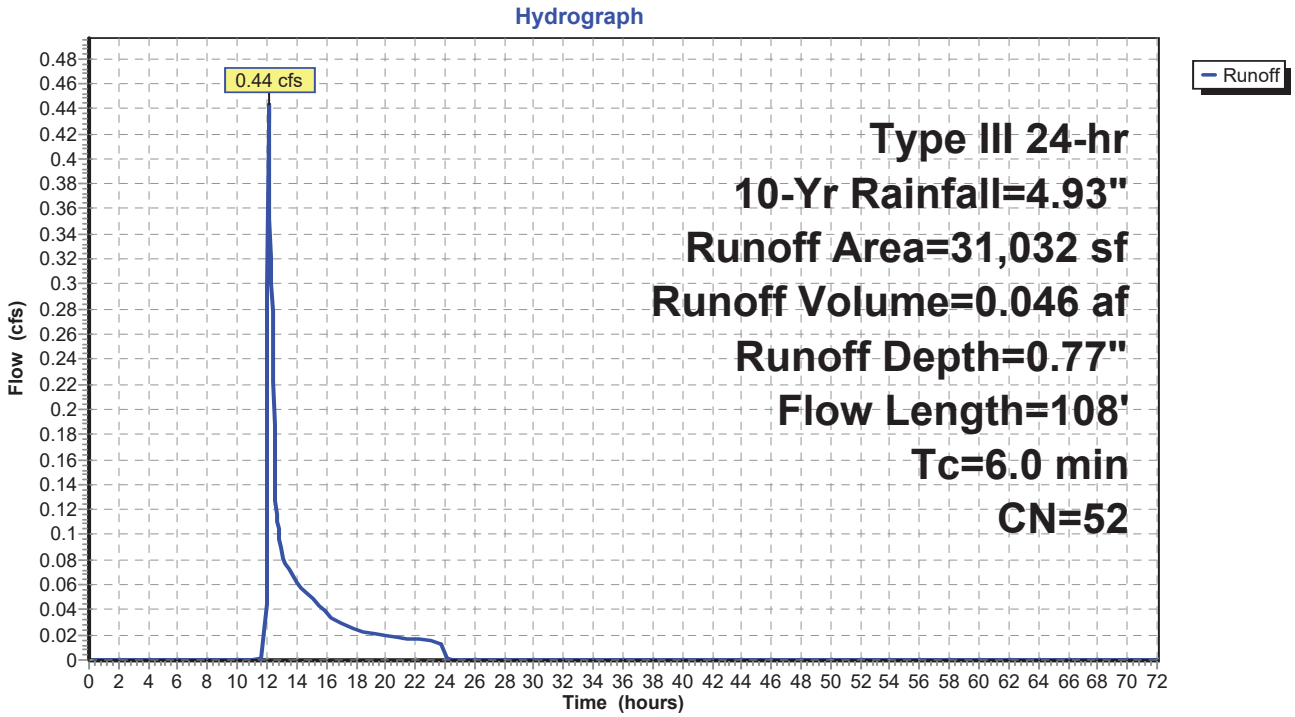
Runoff = 0.44 cfs @ 12.12 hrs, Volume= 0.046 af, Depth= 0.77"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Yr Rainfall=4.93"

Area (sf)	CN	Description
2,321	30	Woods, Good, HSG A
21,690	39	>75% Grass cover, Good, HSG A
4,644	98	Paved parking, HSG A
2,377	98	Roofs, HSG A
31,032	52	Weighted Average
24,011		77.37% Pervious Area
7,021		22.63% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.4	50	0.0210	0.15		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.34"
0.3	58	0.0300	2.79		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
5.7	108	Total, Increased to minimum Tc = 6.0 min			

Subcatchment 1S: S-1



Summary for Subcatchment 2S: S-1

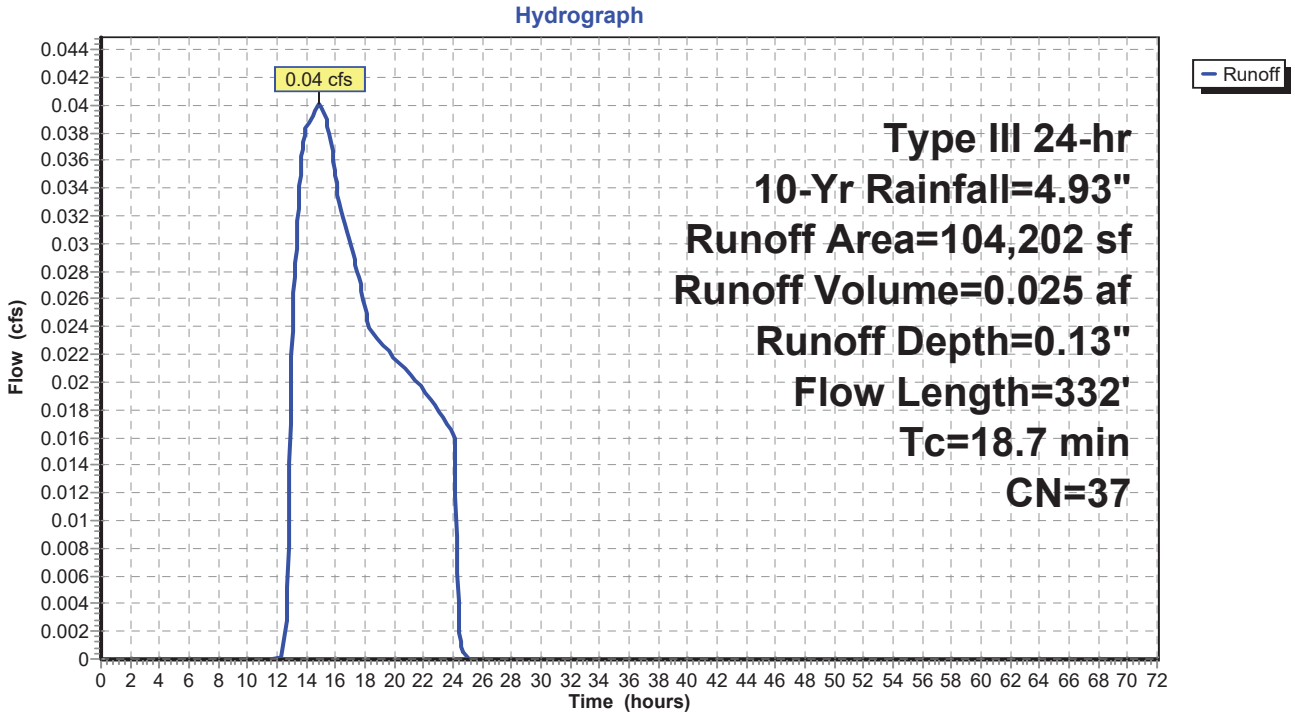
Runoff = 0.04 cfs @ 14.86 hrs, Volume= 0.025 af, Depth= 0.13"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Yr Rainfall=4.93"

Area (sf)	CN	Description
57,084	30	Woods, Good, HSG A
42,729	39	>75% Grass cover, Good, HSG A
2,748	98	Paved parking, HSG A
1,641	98	Roofs, HSG A
104,202	37	Weighted Average
99,813		95.79% Pervious Area
4,389		4.21% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
15.8	50	0.0102	0.05		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.34"
1.4	143	0.0120	1.76		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
1.5	139	0.0090	1.53		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
18.7	332	Total			

Subcatchment 2S: S-1



Summary for Subcatchment 3S: S-1

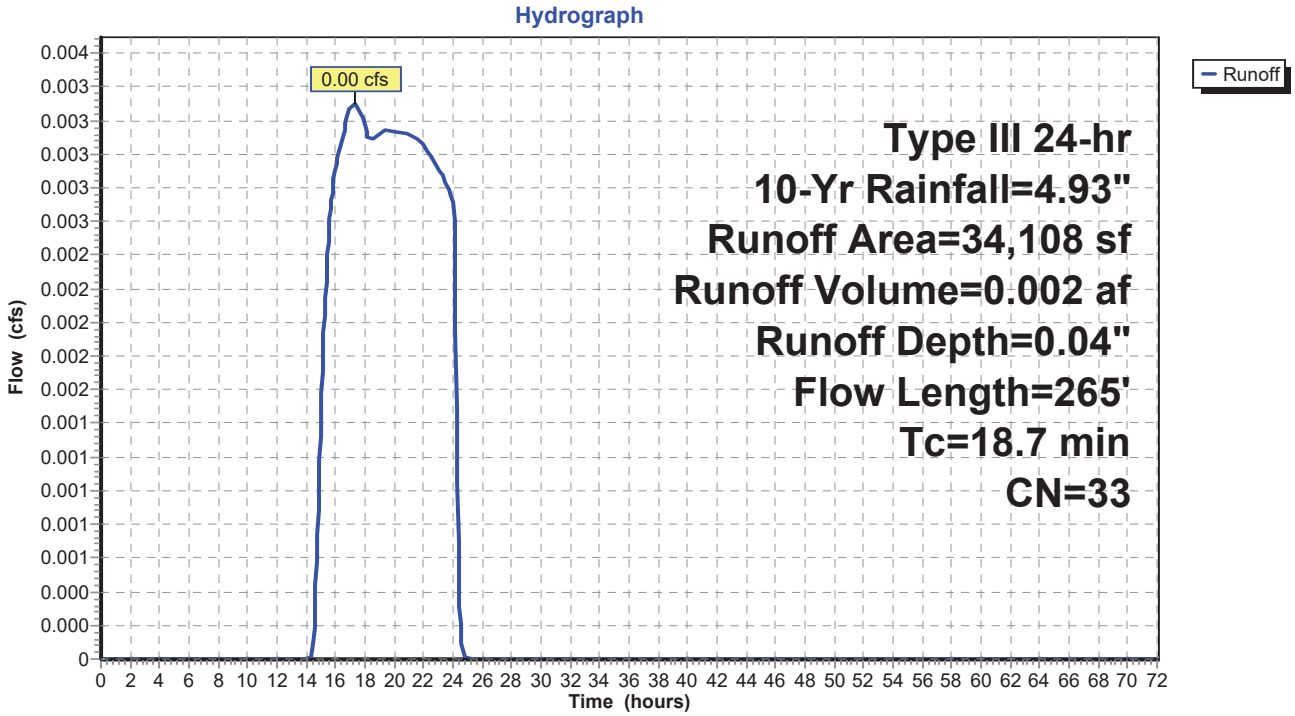
Runoff = 0.00 cfs @ 17.27 hrs, Volume= 0.002 af, Depth= 0.04"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Yr Rainfall=4.93"

Area (sf)	CN	Description
28,340	30	Woods, Good, HSG A
4,777	39	>75% Grass cover, Good, HSG A
24	98	Paved parking, HSG A
967	98	Roofs, HSG A
34,108	33	Weighted Average
33,117		97.09% Pervious Area
991		2.91% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
14.8	50	0.0120	0.06		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.34"
1.2	93	0.0070	1.35		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
2.7	122	0.0120	0.77		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
18.7	265	Total			

Subcatchment 3S: S-1

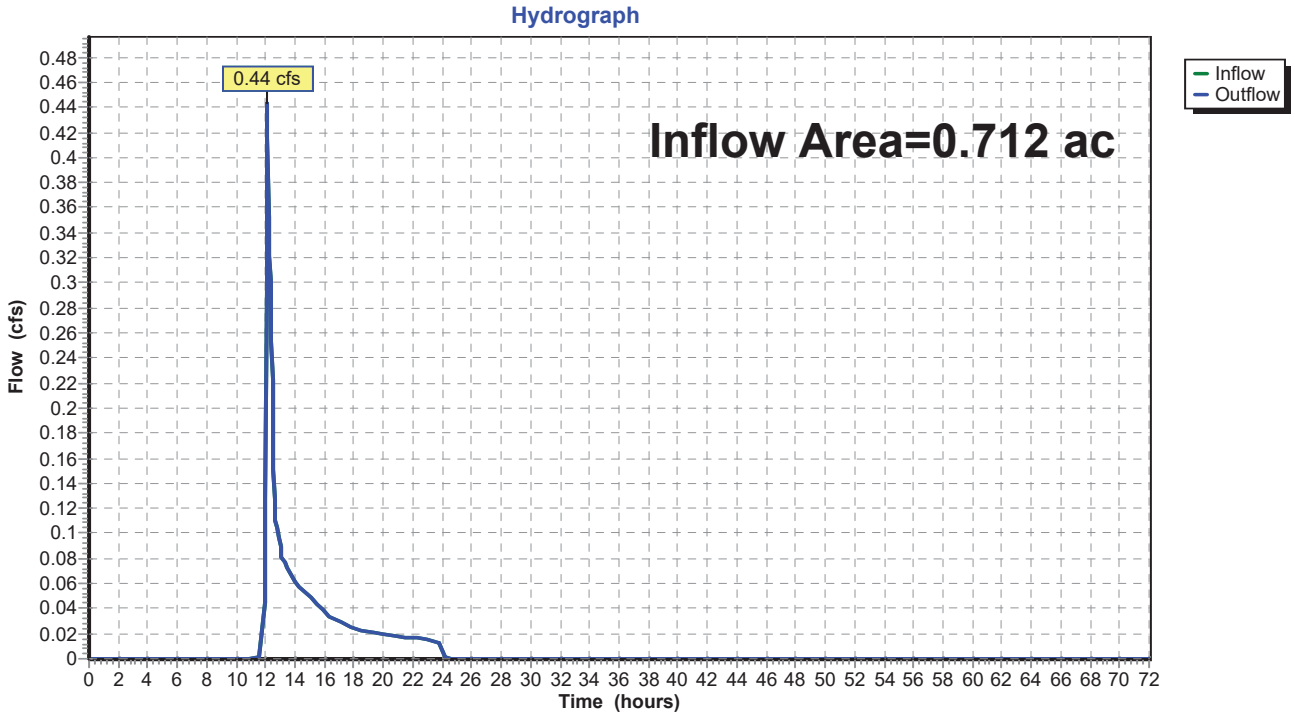


Summary for Reach DP1: Design Point 1

Inflow Area = 0.712 ac, 22.63% Impervious, Inflow Depth = 0.77" for 10-Yr event
Inflow = 0.44 cfs @ 12.12 hrs, Volume= 0.046 af
Outflow = 0.44 cfs @ 12.12 hrs, Volume= 0.046 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

Reach DP1: Design Point 1

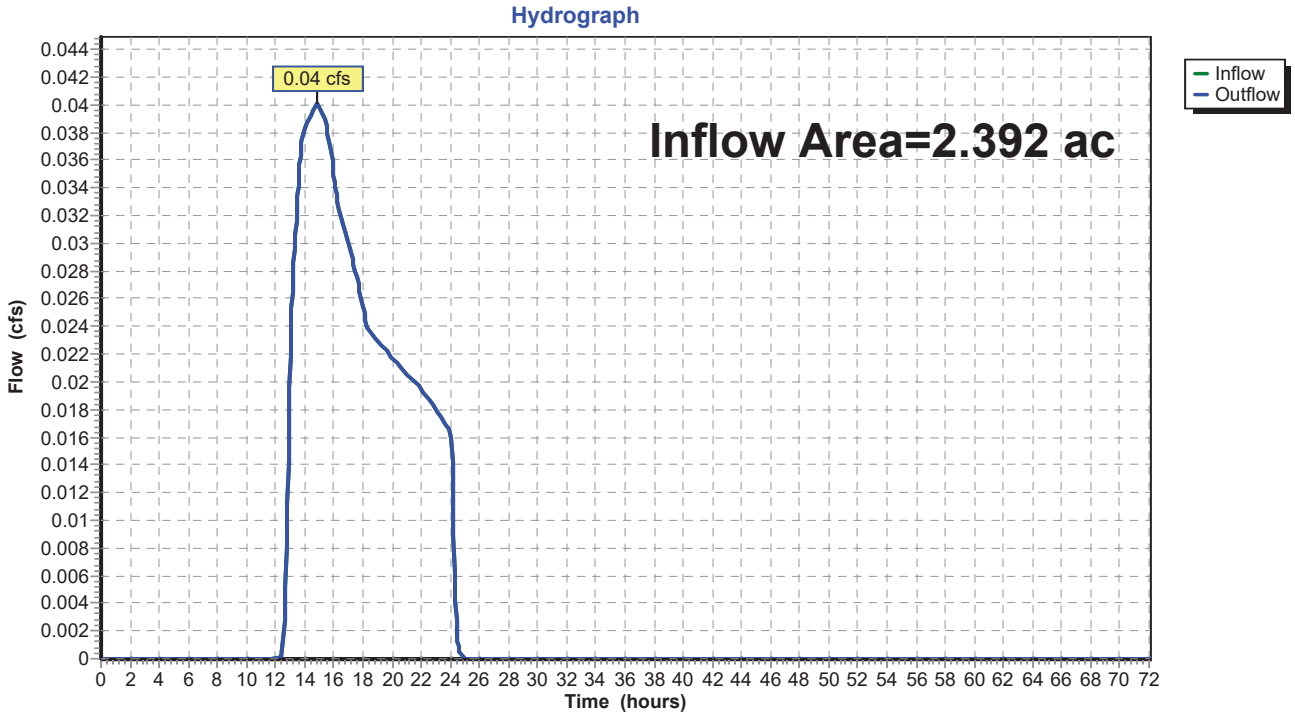


Summary for Reach DP2: Design Point 2

Inflow Area = 2.392 ac, 4.21% Impervious, Inflow Depth = 0.13" for 10-Yr event
Inflow = 0.04 cfs @ 14.86 hrs, Volume= 0.025 af
Outflow = 0.04 cfs @ 14.86 hrs, Volume= 0.025 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

Reach DP2: Design Point 2

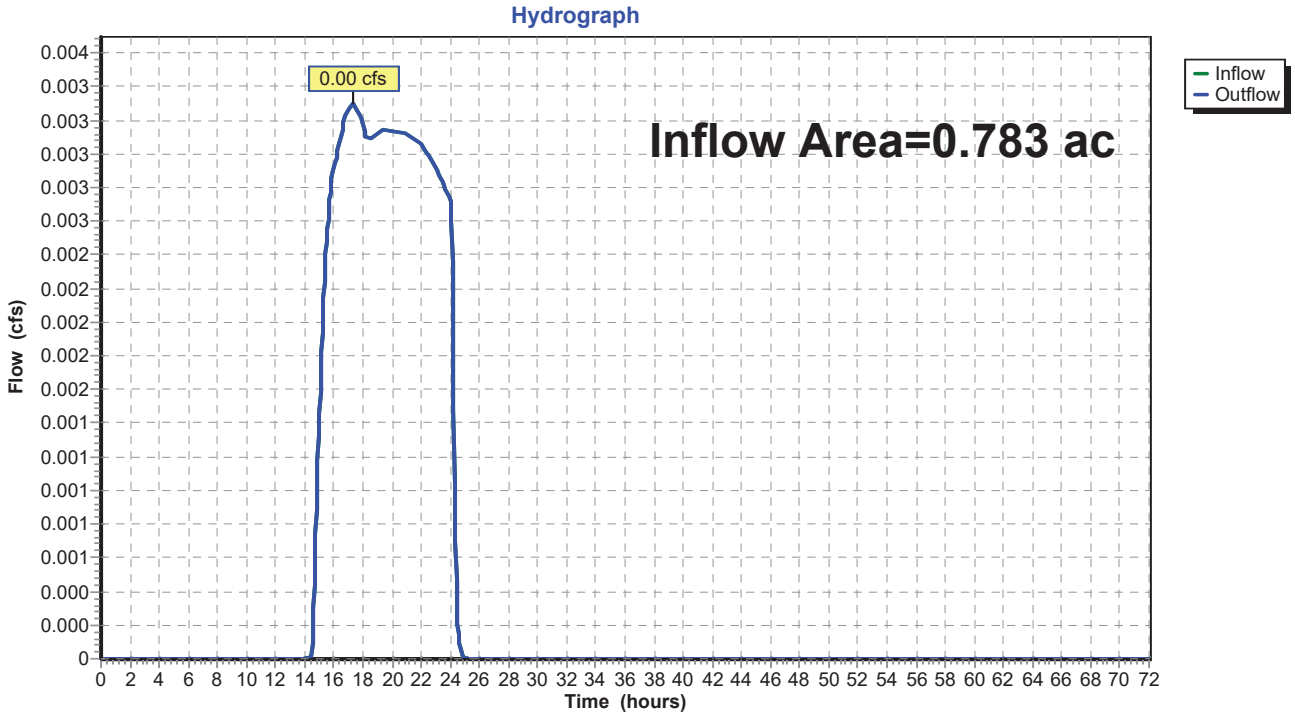


Summary for Reach DP3: Design Point 3

Inflow Area = 0.783 ac, 2.91% Impervious, Inflow Depth = 0.04" for 10-Yr event
Inflow = 0.00 cfs @ 17.27 hrs, Volume= 0.002 af
Outflow = 0.00 cfs @ 17.27 hrs, Volume= 0.002 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

Reach DP3: Design Point 3



Time span=0.00-72.00 hrs, dt=0.05 hrs, 1441 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 1S: S-1 Runoff Area=31,032 sf 22.63% Impervious Runoff Depth=1.38"
Flow Length=108' Tc=6.0 min CN=52 Runoff=0.97 cfs 0.082 af

Subcatchment 2S: S-1 Runoff Area=104,202 sf 4.21% Impervious Runoff Depth=0.39"
Flow Length=332' Tc=18.7 min CN=37 Runoff=0.27 cfs 0.077 af

Subcatchment 3S: S-1 Runoff Area=34,108 sf 2.91% Impervious Runoff Depth=0.20"
Flow Length=265' Tc=18.7 min CN=33 Runoff=0.02 cfs 0.013 af

Reach DP1: Design Point 1 Inflow=0.97 cfs 0.082 af
Outflow=0.97 cfs 0.082 af

Reach DP2: Design Point 2 Inflow=0.27 cfs 0.077 af
Outflow=0.27 cfs 0.077 af

Reach DP3: Design Point 3 Inflow=0.02 cfs 0.013 af
Outflow=0.02 cfs 0.013 af

Total Runoff Area = 3.888 ac Runoff Volume = 0.172 af Average Runoff Depth = 0.53"
92.68% Pervious = 3.603 ac 7.32% Impervious = 0.285 ac

Summary for Subcatchment 1S: S-1

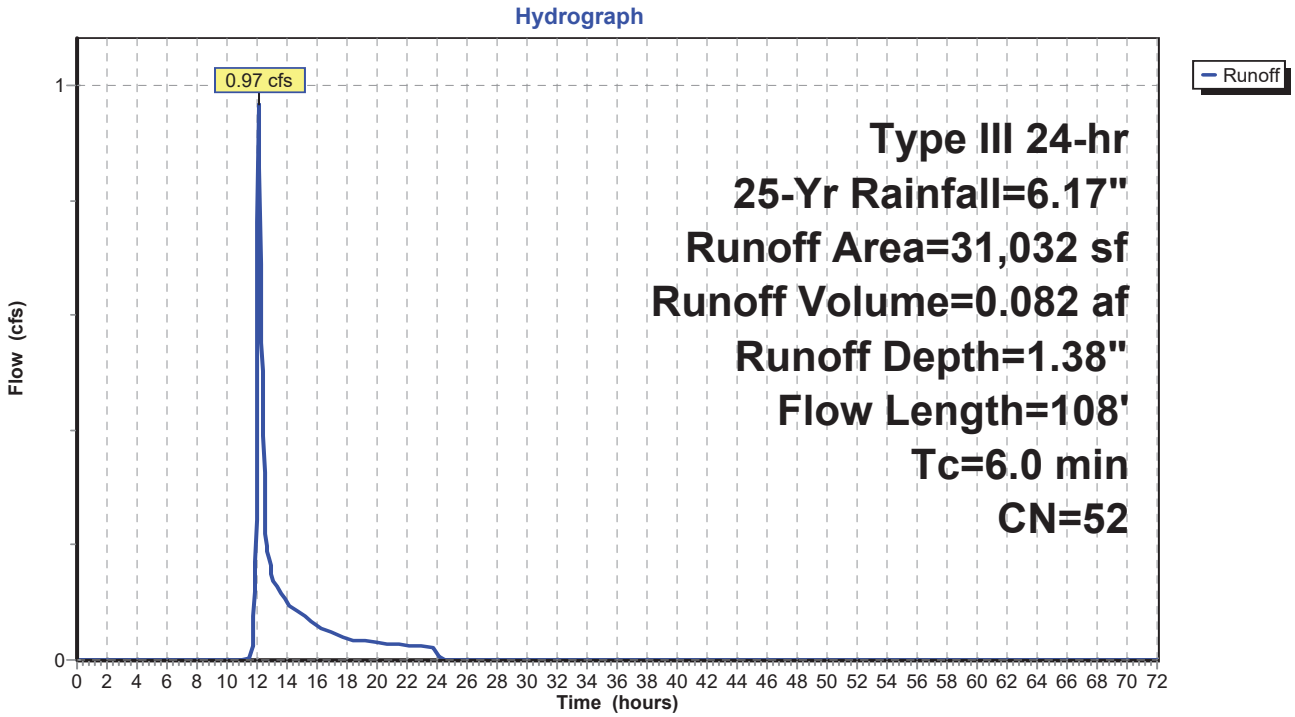
Runoff = 0.97 cfs @ 12.11 hrs, Volume= 0.082 af, Depth= 1.38"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Yr Rainfall=6.17"

Area (sf)	CN	Description
2,321	30	Woods, Good, HSG A
21,690	39	>75% Grass cover, Good, HSG A
4,644	98	Paved parking, HSG A
2,377	98	Roofs, HSG A
31,032	52	Weighted Average
24,011		77.37% Pervious Area
7,021		22.63% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.4	50	0.0210	0.15		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.34"
0.3	58	0.0300	2.79		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
5.7	108	Total, Increased to minimum Tc = 6.0 min			

Subcatchment 1S: S-1



Summary for Subcatchment 2S: S-1

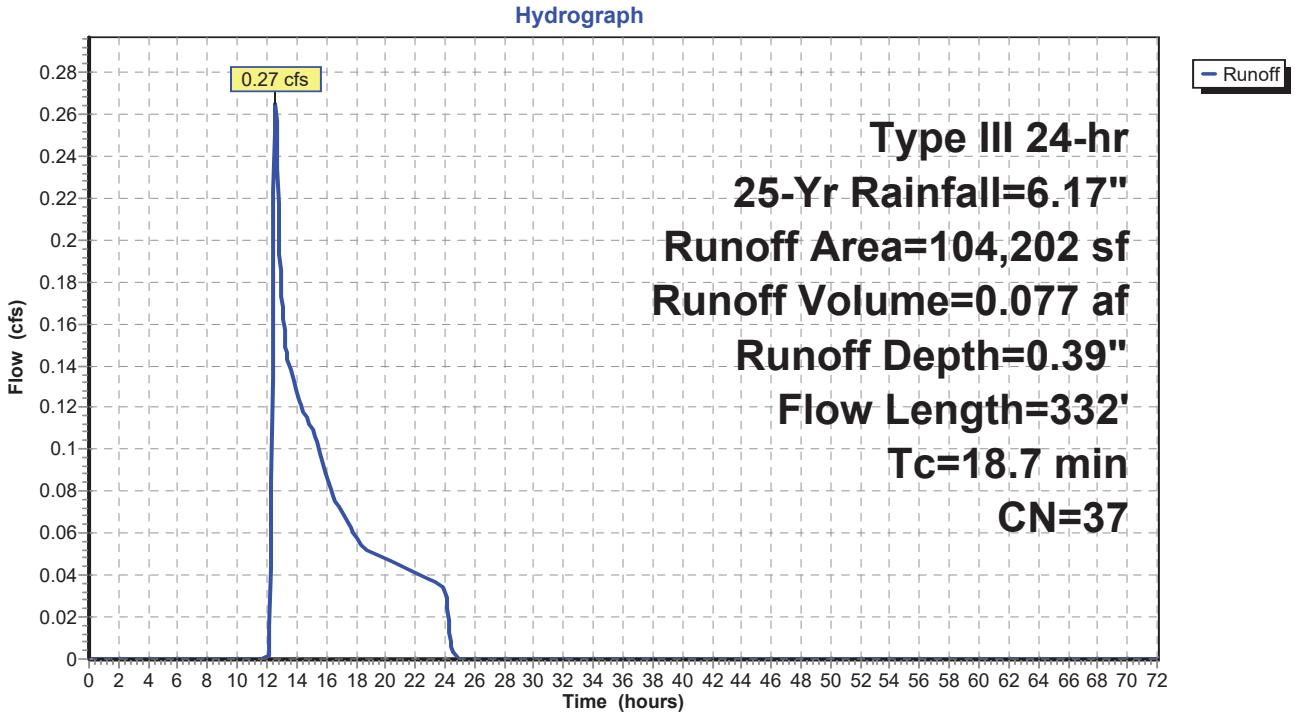
Runoff = 0.27 cfs @ 12.57 hrs, Volume= 0.077 af, Depth= 0.39"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Yr Rainfall=6.17"

Area (sf)	CN	Description
57,084	30	Woods, Good, HSG A
42,729	39	>75% Grass cover, Good, HSG A
2,748	98	Paved parking, HSG A
1,641	98	Roofs, HSG A
104,202	37	Weighted Average
99,813		95.79% Pervious Area
4,389		4.21% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
15.8	50	0.0102	0.05		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.34"
1.4	143	0.0120	1.76		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
1.5	139	0.0090	1.53		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
18.7	332	Total			

Subcatchment 2S: S-1



Summary for Subcatchment 3S: S-1

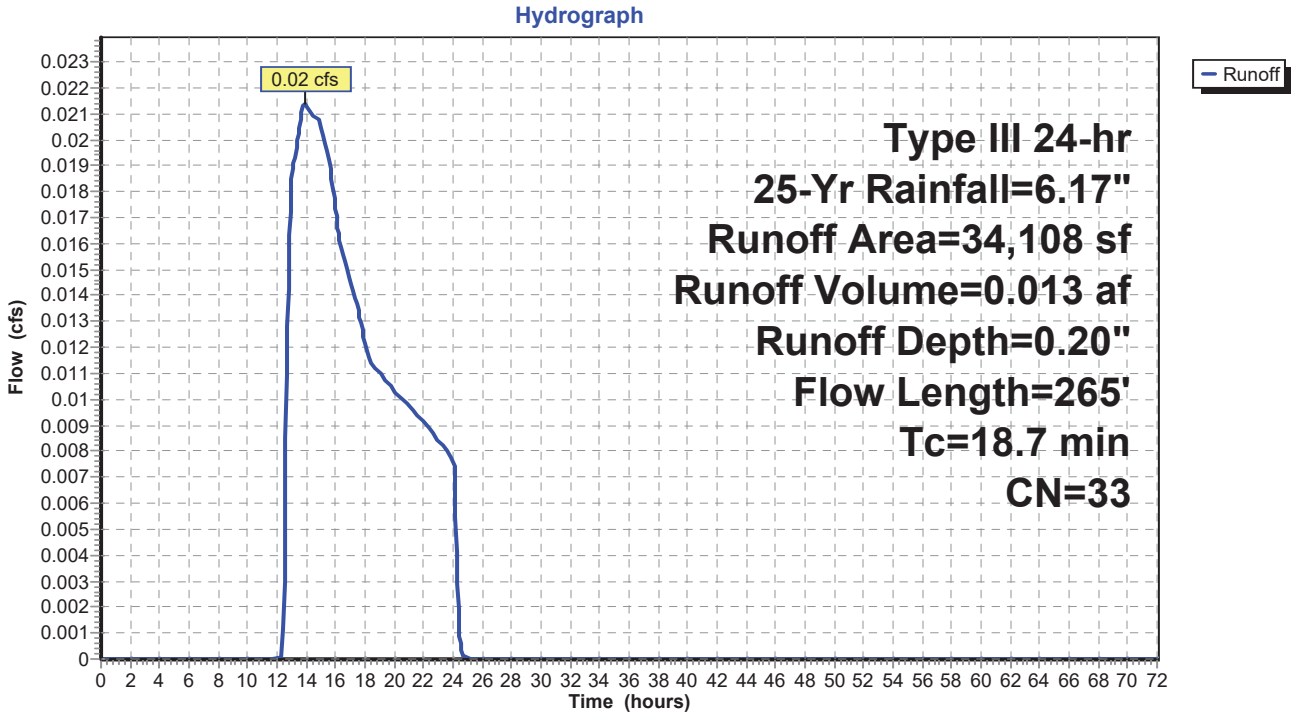
Runoff = 0.02 cfs @ 13.91 hrs, Volume= 0.013 af, Depth= 0.20"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Yr Rainfall=6.17"

Area (sf)	CN	Description
28,340	30	Woods, Good, HSG A
4,777	39	>75% Grass cover, Good, HSG A
24	98	Paved parking, HSG A
967	98	Roofs, HSG A
34,108	33	Weighted Average
33,117		97.09% Pervious Area
991		2.91% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
14.8	50	0.0120	0.06		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.34"
1.2	93	0.0070	1.35		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
2.7	122	0.0120	0.77		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
18.7	265	Total			

Subcatchment 3S: S-1

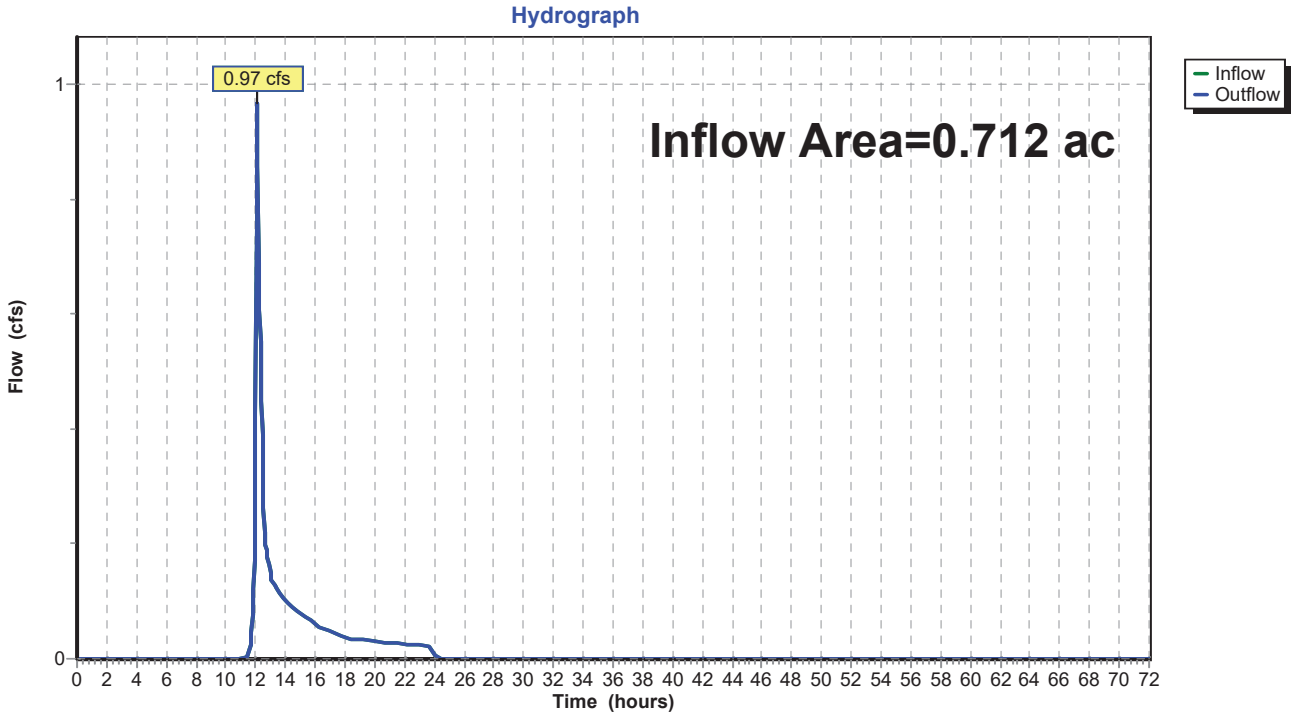


Summary for Reach DP1: Design Point 1

Inflow Area = 0.712 ac, 22.63% Impervious, Inflow Depth = 1.38" for 25-Yr event
Inflow = 0.97 cfs @ 12.11 hrs, Volume= 0.082 af
Outflow = 0.97 cfs @ 12.11 hrs, Volume= 0.082 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

Reach DP1: Design Point 1

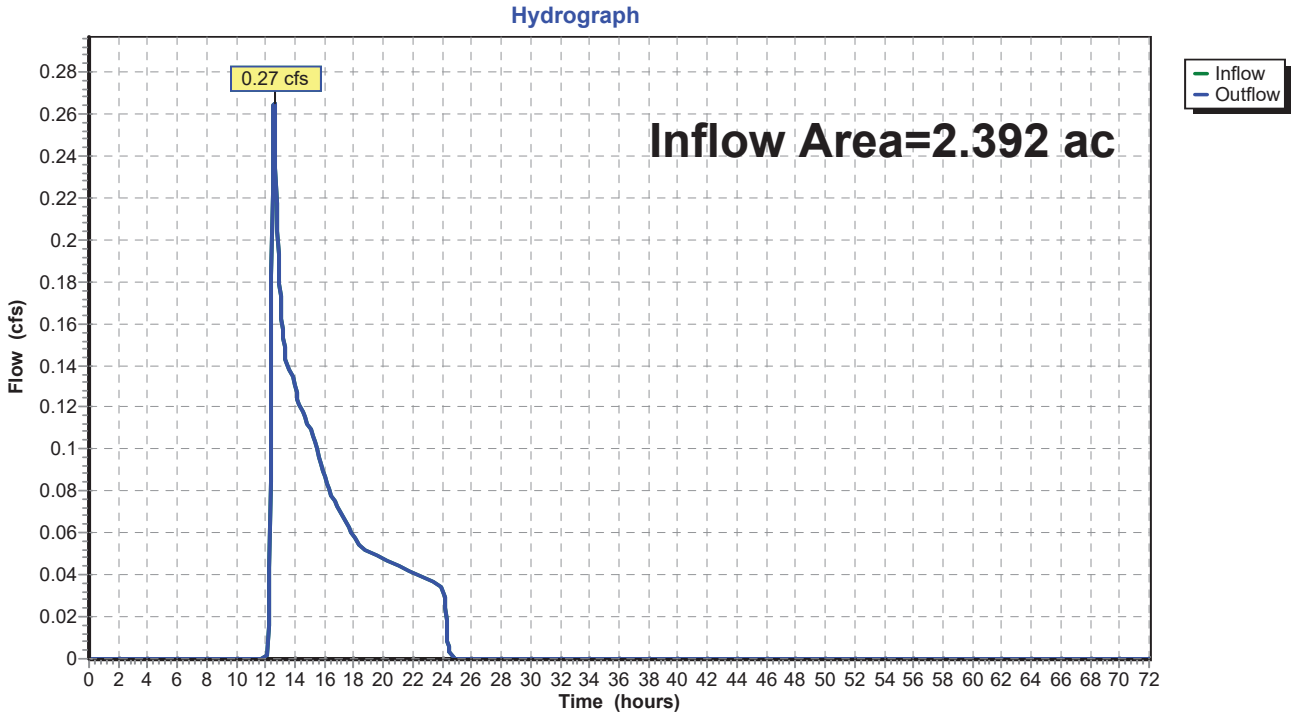


Summary for Reach DP2: Design Point 2

Inflow Area = 2.392 ac, 4.21% Impervious, Inflow Depth = 0.39" for 25-Yr event
Inflow = 0.27 cfs @ 12.57 hrs, Volume= 0.077 af
Outflow = 0.27 cfs @ 12.57 hrs, Volume= 0.077 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

Reach DP2: Design Point 2

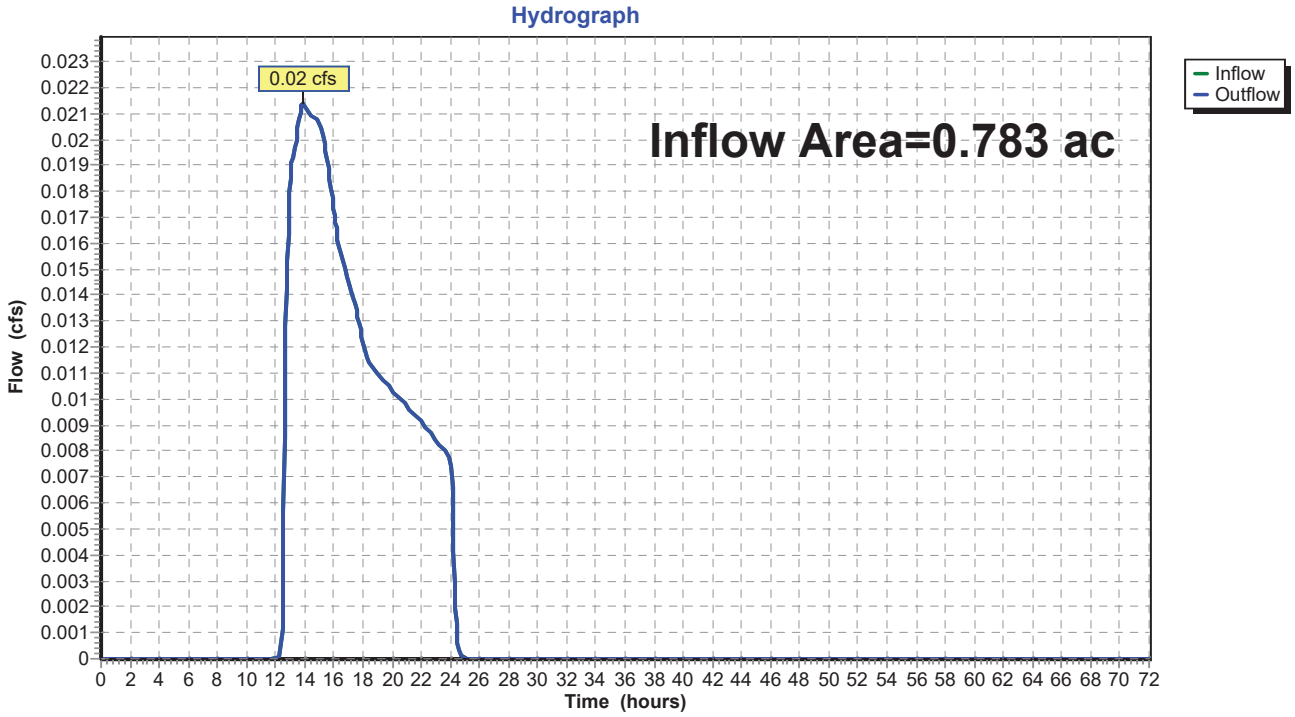


Summary for Reach DP3: Design Point 3

Inflow Area = 0.783 ac, 2.91% Impervious, Inflow Depth = 0.20" for 25-Yr event
Inflow = 0.02 cfs @ 13.91 hrs, Volume= 0.013 af
Outflow = 0.02 cfs @ 13.91 hrs, Volume= 0.013 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

Reach DP3: Design Point 3



Time span=0.00-72.00 hrs, dt=0.05 hrs, 1441 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 1S: S-1 Runoff Area=31,032 sf 22.63% Impervious Runoff Depth=2.91"
Flow Length=108' Tc=6.0 min CN=52 Runoff=2.28 cfs 0.173 af

Subcatchment 2S: S-1 Runoff Area=104,202 sf 4.21% Impervious Runoff Depth=1.25"
Flow Length=332' Tc=18.7 min CN=37 Runoff=1.61 cfs 0.249 af

Subcatchment 3S: S-1 Runoff Area=34,108 sf 2.91% Impervious Runoff Depth=0.86"
Flow Length=265' Tc=18.7 min CN=33 Runoff=0.28 cfs 0.056 af

Reach DP1: Design Point 1 Inflow=2.28 cfs 0.173 af
Outflow=2.28 cfs 0.173 af

Reach DP2: Design Point 2 Inflow=1.61 cfs 0.249 af
Outflow=1.61 cfs 0.249 af

Reach DP3: Design Point 3 Inflow=0.28 cfs 0.056 af
Outflow=0.28 cfs 0.056 af

Total Runoff Area = 3.888 ac Runoff Volume = 0.477 af Average Runoff Depth = 1.47"
92.68% Pervious = 3.603 ac 7.32% Impervious = 0.285 ac

Summary for Subcatchment 1S: S-1

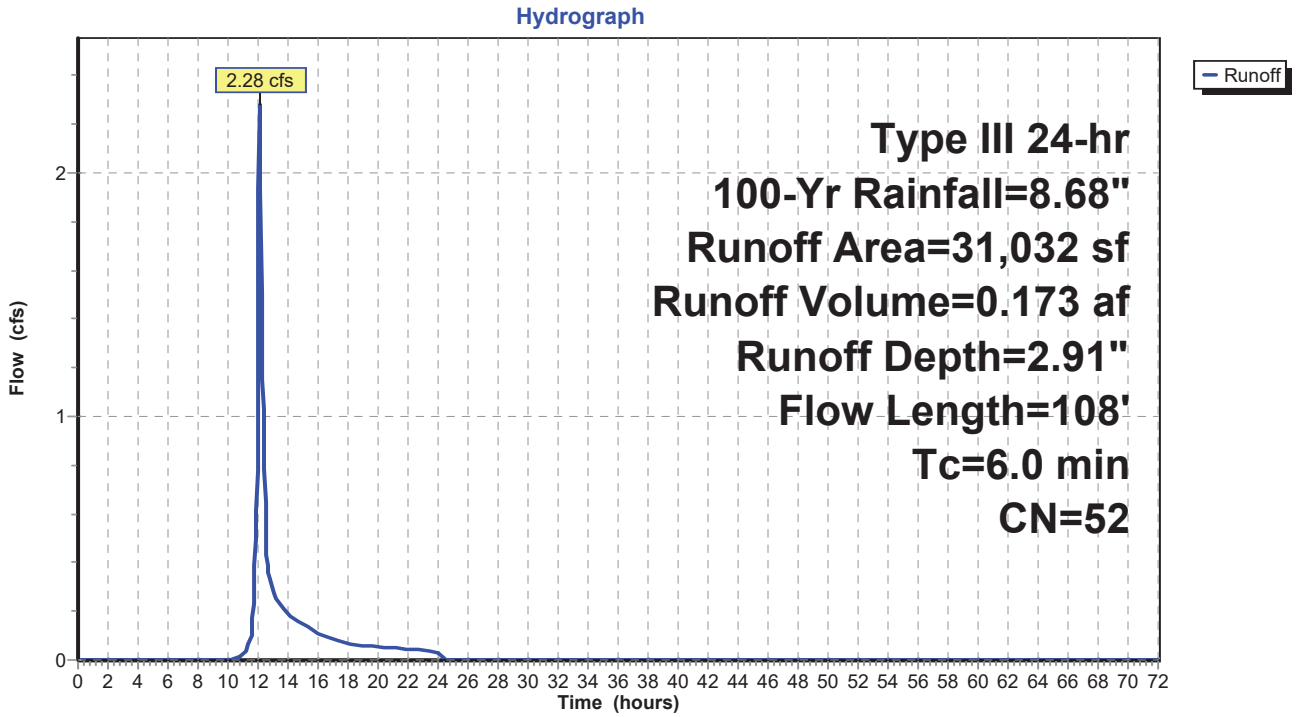
Runoff = 2.28 cfs @ 12.10 hrs, Volume= 0.173 af, Depth= 2.91"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Yr Rainfall=8.68"

Area (sf)	CN	Description
2,321	30	Woods, Good, HSG A
21,690	39	>75% Grass cover, Good, HSG A
4,644	98	Paved parking, HSG A
2,377	98	Roofs, HSG A
31,032	52	Weighted Average
24,011		77.37% Pervious Area
7,021		22.63% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.4	50	0.0210	0.15		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.34"
0.3	58	0.0300	2.79		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
5.7	108	Total, Increased to minimum Tc = 6.0 min			

Subcatchment 1S: S-1



Summary for Subcatchment 2S: S-1

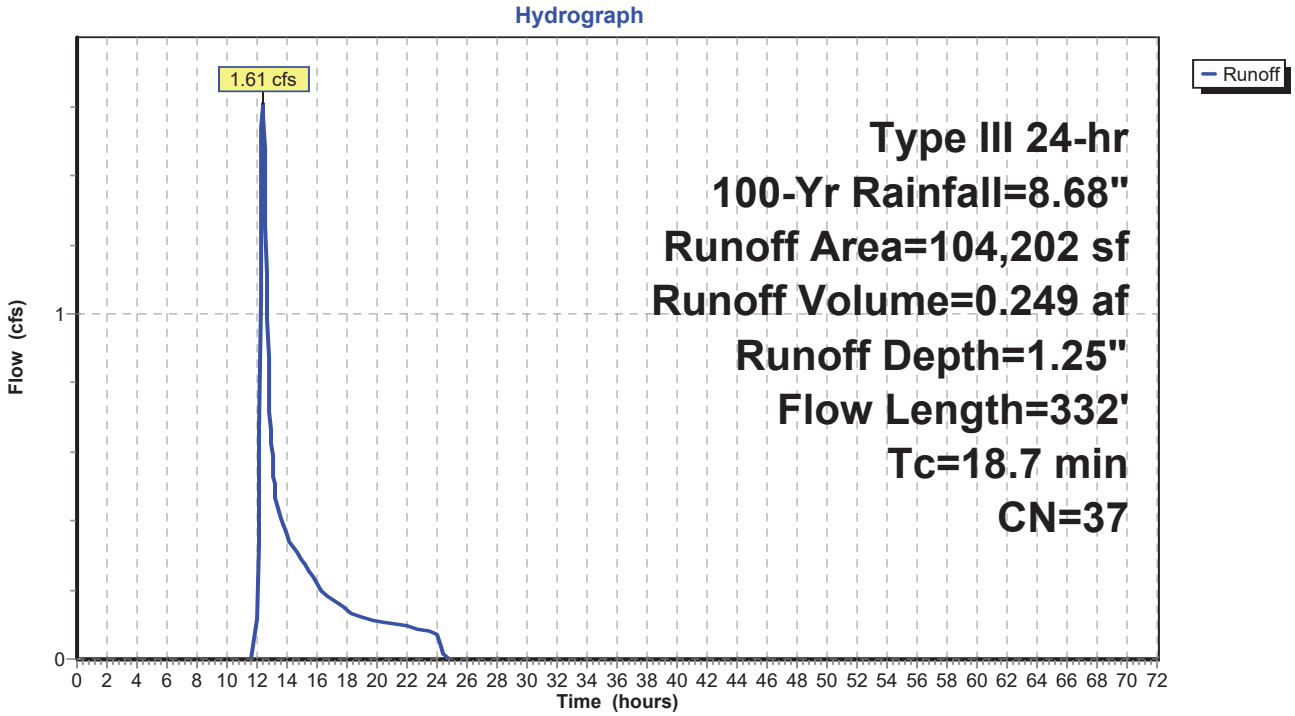
Runoff = 1.61 cfs @ 12.37 hrs, Volume= 0.249 af, Depth= 1.25"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Yr Rainfall=8.68"

Area (sf)	CN	Description
57,084	30	Woods, Good, HSG A
42,729	39	>75% Grass cover, Good, HSG A
2,748	98	Paved parking, HSG A
1,641	98	Roofs, HSG A
104,202	37	Weighted Average
99,813		95.79% Pervious Area
4,389		4.21% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
15.8	50	0.0102	0.05		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.34"
1.4	143	0.0120	1.76		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
1.5	139	0.0090	1.53		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
18.7	332	Total			

Subcatchment 2S: S-1



Summary for Subcatchment 3S: S-1

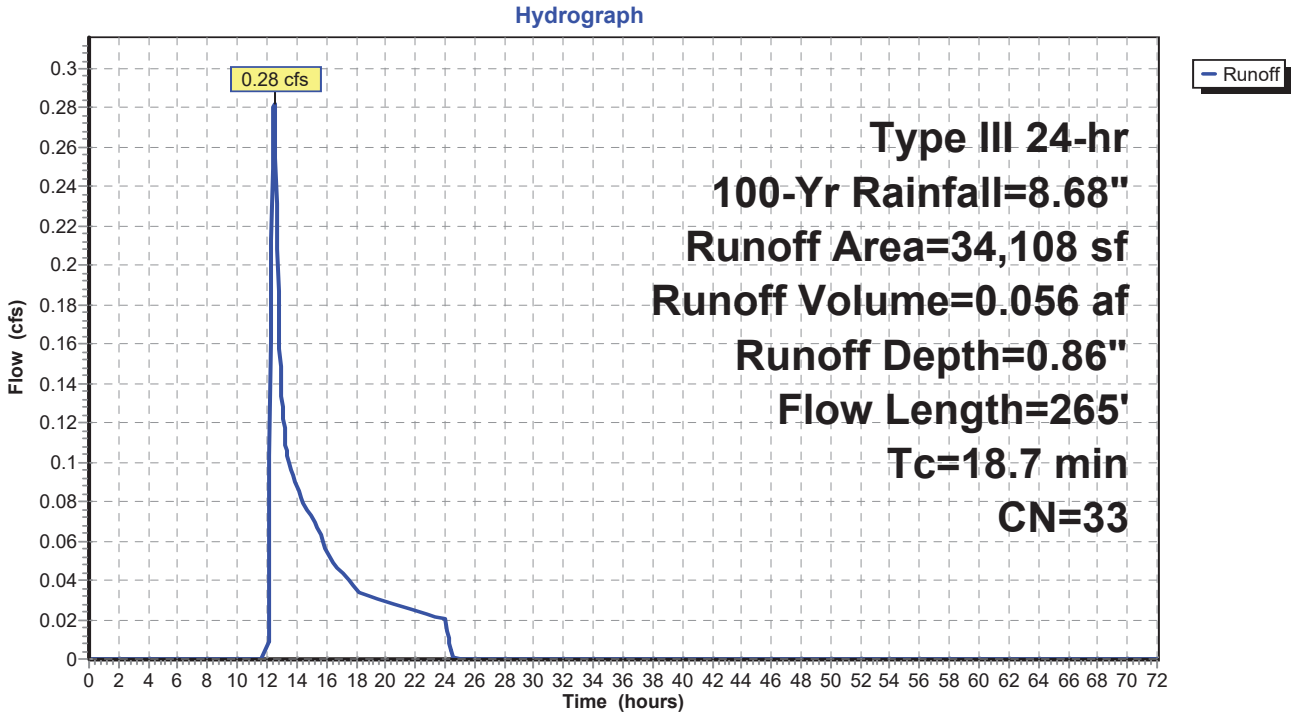
Runoff = 0.28 cfs @ 12.48 hrs, Volume= 0.056 af, Depth= 0.86"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Yr Rainfall=8.68"

Area (sf)	CN	Description
28,340	30	Woods, Good, HSG A
4,777	39	>75% Grass cover, Good, HSG A
24	98	Paved parking, HSG A
967	98	Roofs, HSG A
34,108	33	Weighted Average
33,117		97.09% Pervious Area
991		2.91% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
14.8	50	0.0120	0.06		**Sheet Flow,** Woods: Light underbrush n= 0.400 P2= 3.34"
1.2	93	0.0070	1.35		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
2.7	122	0.0120	0.77		**Shallow Concentrated Flow,** Short Grass Pasture Kv= 7.0 fps
18.7	265	Total			

Subcatchment 3S: S-1

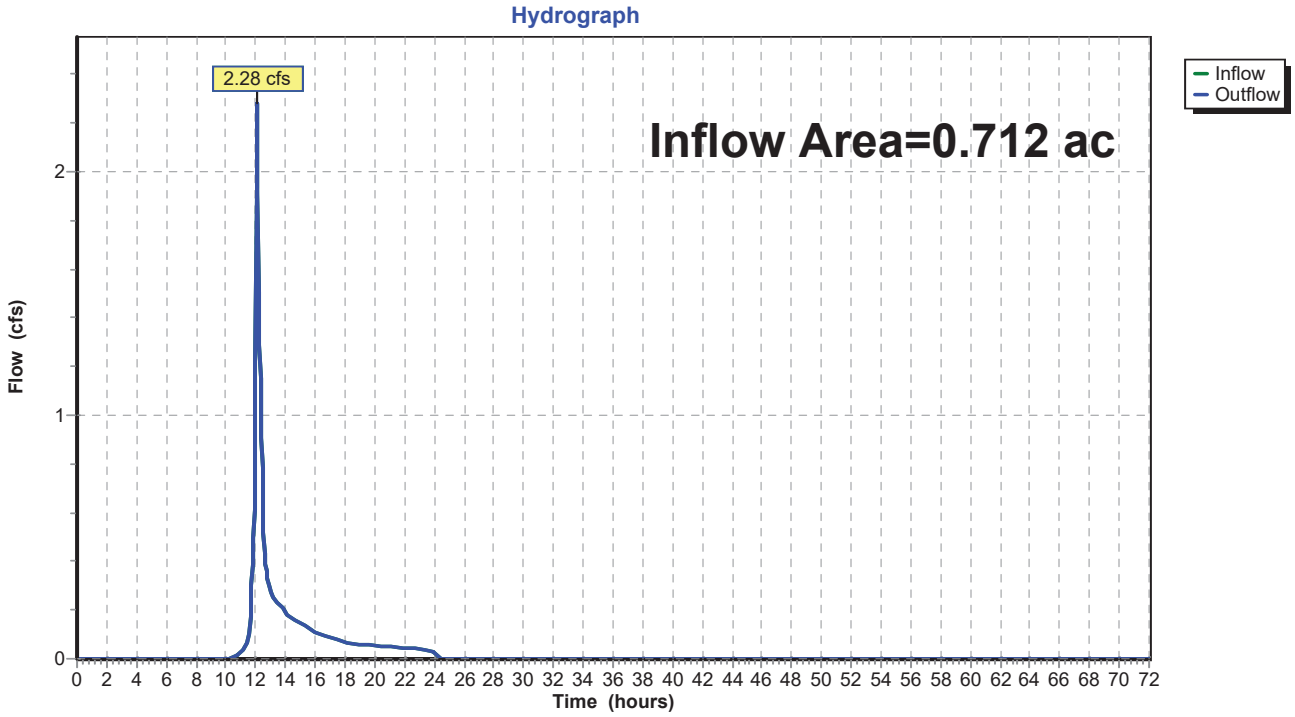


Summary for Reach DP1: Design Point 1

Inflow Area = 0.712 ac, 22.63% Impervious, Inflow Depth = 2.91" for 100-Yr event
Inflow = 2.28 cfs @ 12.10 hrs, Volume= 0.173 af
Outflow = 2.28 cfs @ 12.10 hrs, Volume= 0.173 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

Reach DP1: Design Point 1

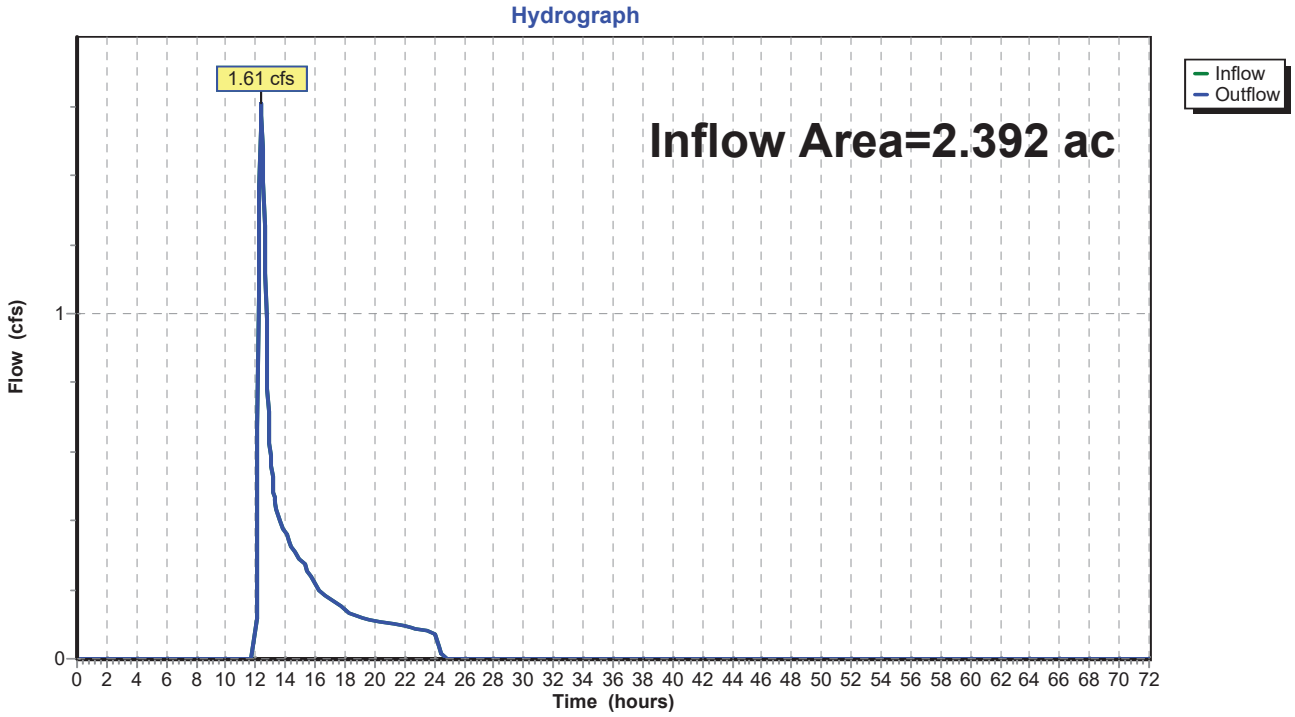


Summary for Reach DP2: Design Point 2

Inflow Area = 2.392 ac, 4.21% Impervious, Inflow Depth = 1.25" for 100-Yr event
Inflow = 1.61 cfs @ 12.37 hrs, Volume= 0.249 af
Outflow = 1.61 cfs @ 12.37 hrs, Volume= 0.249 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

Reach DP2: Design Point 2

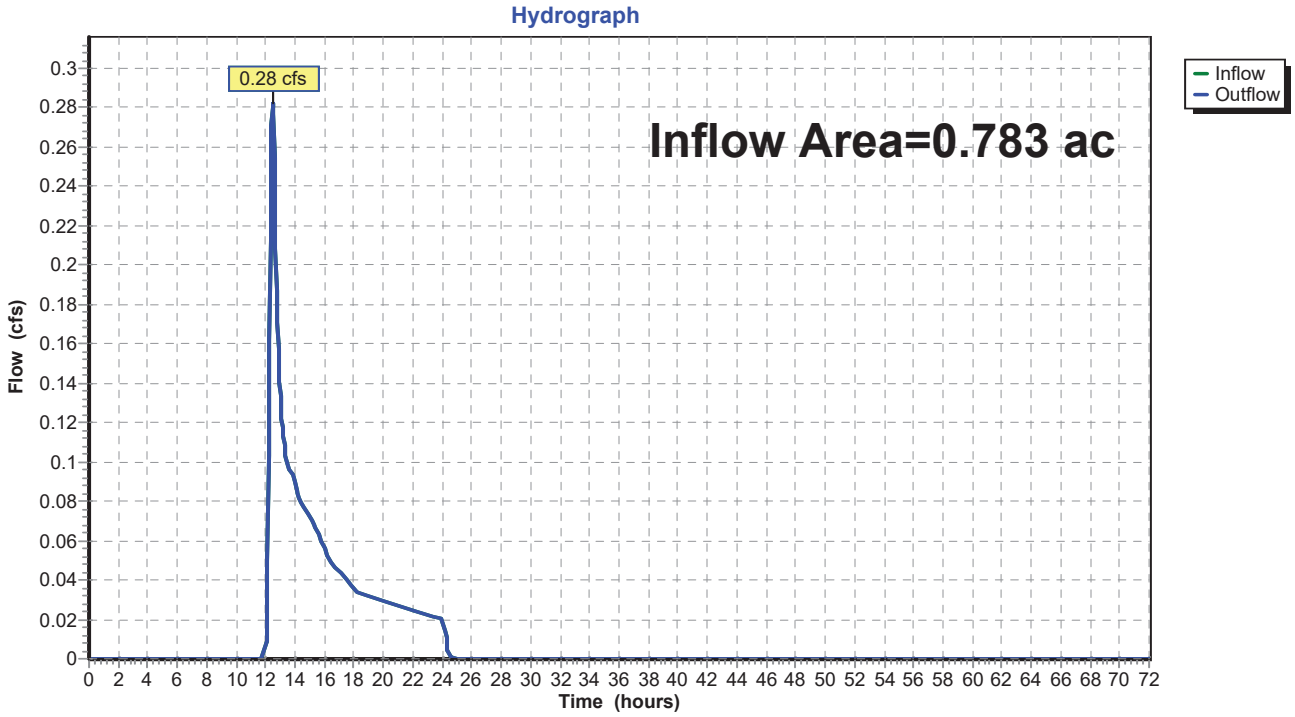


Summary for Reach DP3: Design Point 3

Inflow Area = 0.783 ac, 2.91% Impervious, Inflow Depth = 0.86" for 100-Yr event
Inflow = 0.28 cfs @ 12.48 hrs, Volume= 0.056 af
Outflow = 0.28 cfs @ 12.48 hrs, Volume= 0.056 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

Reach DP3: Design Point 3



POST-DEVELOPMENT WATERSHED

SUBCATCHMENT 1S

DESCRIPTION	AREA (S.F.)	
WOODS (HSG A)	0	S.F.
GRASS (HSG A)	9,452	S.F.
PAVEMENT (HSG A)	2,323	S.F.
ROOFS (HSG A)	0	S.F.
TOTAL AREA FOR 1S	11,775	S.F.

SUBCATCHMENT 2S

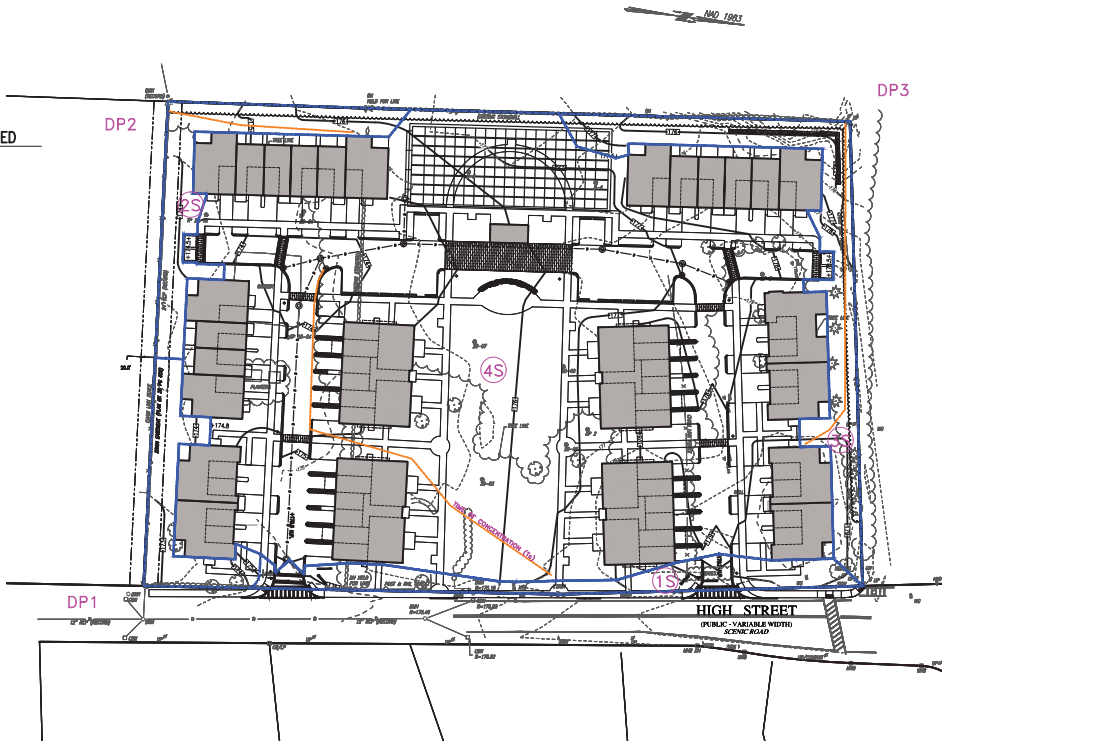
DESCRIPTION	AREA (S.F.)	
WOODS (HSG A)	0	S.F.
GRASS (HSG A)	7,061	S.F.
PAVEMENT (HSG A)	0	S.F.
ROOFS (HSG A)	0	S.F.
TOTAL AREA FOR 2S	7,061	S.F.

SUBCATCHMENT 3S

DESCRIPTION	AREA (S.F.)	
WOODS (HSG A)	867	S.F.
GRASS (HSG A)	10,042	S.F.
PAVEMENT (HSG A)	0	S.F.
ROOFS (HSG A)	0	S.F.
TOTAL AREA FOR 3S	10,909	S.F.

SUBCATCHMENT 4S

DESCRIPTION	AREA (S.F.)	
WOODS (HSG A)	0	S.F.
GRASS (HSG A)	50,268	S.F.
PAVEMENT (HSG A)	45,338	S.F.
ROOFS (HSG A)	44,007	S.F.
TOTAL AREA FOR 4S	139,613	S.F.



30 0 30 60 90
SCALE IN FEET

COPYRIGHT © BY MERRILL CORPORATION
NO PART OF THIS DOCUMENT MAY BE REPRODUCED, STORED IN A RETRIEVAL SYSTEM, OR TRANSMITTED IN ANY FORM OR BY ANY MEANS, ELECTRONIC, MECHANICAL, PHOTOCOPYING, RECORDING OR OTHERWISE, WITHOUT THE PRIOR WRITTEN PERMISSION OF MERRILL CORPORATION. THIS DOCUMENT IS PROPRIETARY TO MERRILL CORPORATION. IF ANY REGULATORY AUTHORITY WHICH MAY REVIEW, OR IN CONJUNCTION WITH THE PERFORMANCE OF OFFICIAL BUSINESS UNDER ITS JURISDICTION, ANY MODIFICATIONS MADE TO THE DOCUMENT WITHOUT THE EXPRESS WRITTEN CONSENT OF MERRILL CORPORATION SHALL RENDER IT UNUSABLE.

REVISIONS

DRAWN BY: JG
DESIGNED BY: DK
CHECKED BY: DK

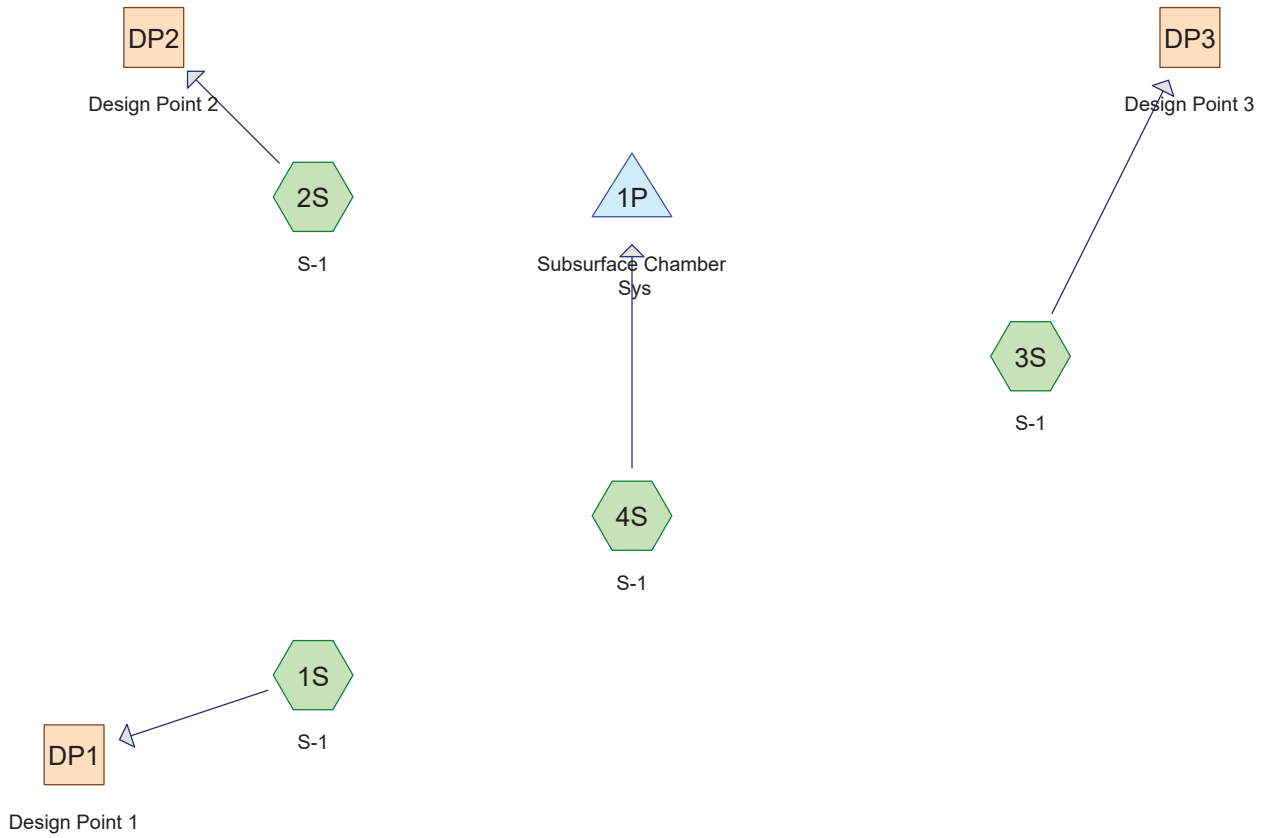
Merrill
Engineers and Land Surveyors
427 COLUMBIA ROAD, HANOVER, MA 02339 / T: (781) 826-8200
26 UNION STREET, PLYMOUTH, MA 02360 / T: (508) 746-6060
WWW.MERRILLENGINEERS.COM

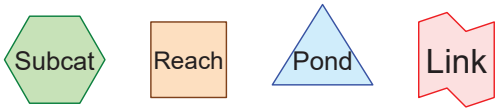
SITE PLAN
#15, 19, 27 & 35 HIGH STREET
NORWELL, MASSACHUSETTS 02061
OWNER/APPLICANT
NORTHLAND RESIDENTIAL CORPORATION
100 BEAVER STREET, SUITE 401
CONCORD, MASSACHUSETTS 01742

JANUARY 29, 2021
SCALE:
JOB NO. 20-127
LATEST REVISION:
APRIL 30, 2021

POST-DEVELOPMENT WATERSHED PLAN

SHEET 1 OF 1





Routing Diagram for 20-127 Post Dev
Prepared by Merrill Engineers and Land Surveyors, Printed 4/22/2021
HydroCAD® 10.00-25 s/n 02159 © 2019 HydroCAD Software Solutions LLC

Time span=0.00-72.00 hrs, dt=0.05 hrs, 1441 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 1S: S-1 Runoff Area=11,775 sf 19.73% Impervious Runoff Depth=0.18"
Flow Length=30' Slope=0.0330 '/' Tc=6.0 min CN=51 Runoff=0.01 cfs 0.004 af

Subcatchment 2S: S-1 Runoff Area=7,061 sf 0.00% Impervious Runoff Depth=0.00"
Flow Length=131' Tc=6.8 min CN=39 Runoff=0.00 cfs 0.000 af

Subcatchment 3S: S-1 Runoff Area=10,909 sf 0.00% Impervious Runoff Depth=0.00"
Flow Length=237' Tc=7.5 min CN=38 Runoff=0.00 cfs 0.000 af

Subcatchment 4S: S-1 Runoff Area=139,613 sf 63.99% Impervious Runoff Depth=1.31"
Flow Length=320' Tc=7.8 min CN=77 Runoff=4.47 cfs 0.351 af

Reach DP1: Design Point 1 Inflow=0.01 cfs 0.004 af
Outflow=0.01 cfs 0.004 af

Reach DP2: Design Point 2 Inflow=0.00 cfs 0.000 af
Outflow=0.00 cfs 0.000 af

Reach DP3: Design Point 3 Inflow=0.00 cfs 0.000 af
Outflow=0.00 cfs 0.000 af

Pond 1P: Subsurface Chamber Sys Peak Elev=166.66' Storage=2,135 cf Inflow=4.47 cfs 0.351 af
Outflow=1.79 cfs 0.351 af

Total Runoff Area = 3.888 ac Runoff Volume = 0.355 af Average Runoff Depth = 1.10"
45.87% Pervious = 1.784 ac 54.13% Impervious = 2.104 ac

Summary for Subcatchment 1S: S-1

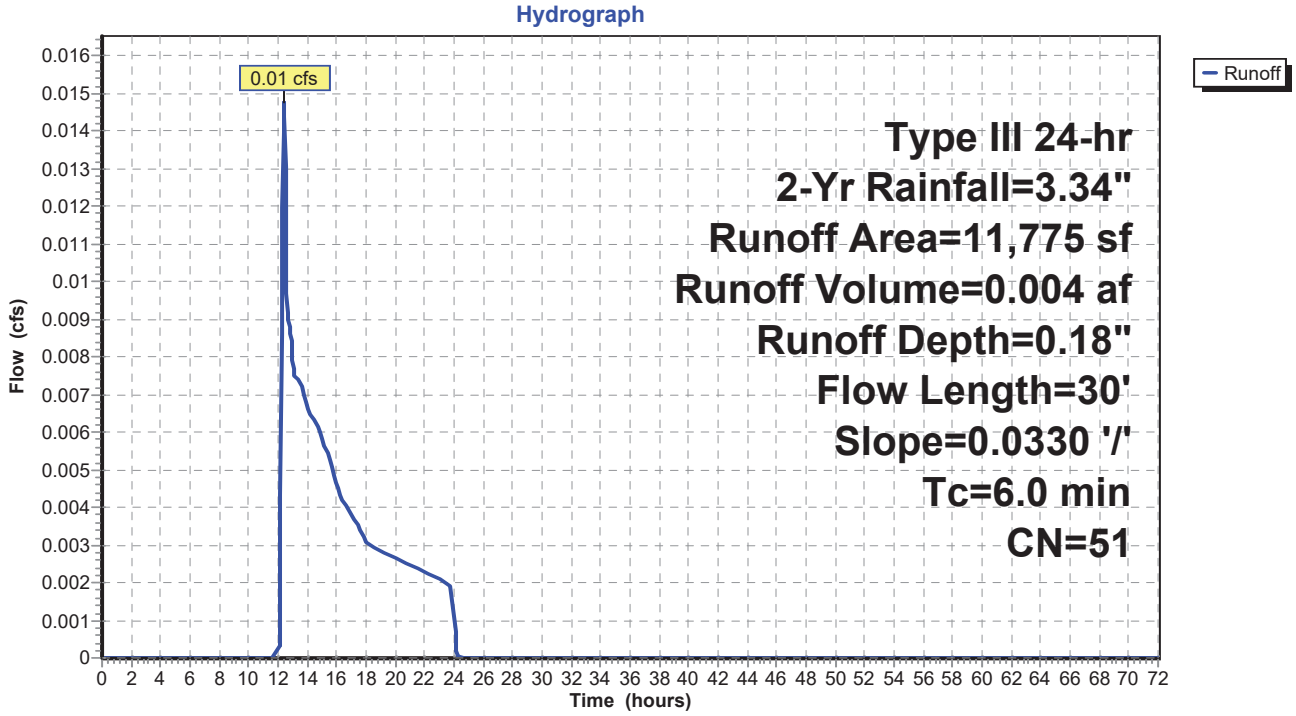
Runoff = 0.01 cfs @ 12.41 hrs, Volume= 0.004 af, Depth= 0.18"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Yr Rainfall=3.34"

Area (sf)	CN	Description
0	30	Woods, Good, HSG A
9,452	39	>75% Grass cover, Good, HSG A
2,323	98	Paved parking, HSG A
0	98	Roofs, HSG A
11,775	51	Weighted Average
9,452		80.27% Pervious Area
2,323		19.73% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.0	30	0.0330	0.17		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.34"
3.0	30	Total, Increased to minimum Tc = 6.0 min			

Subcatchment 1S: S-1



Summary for Subcatchment 2S: S-1

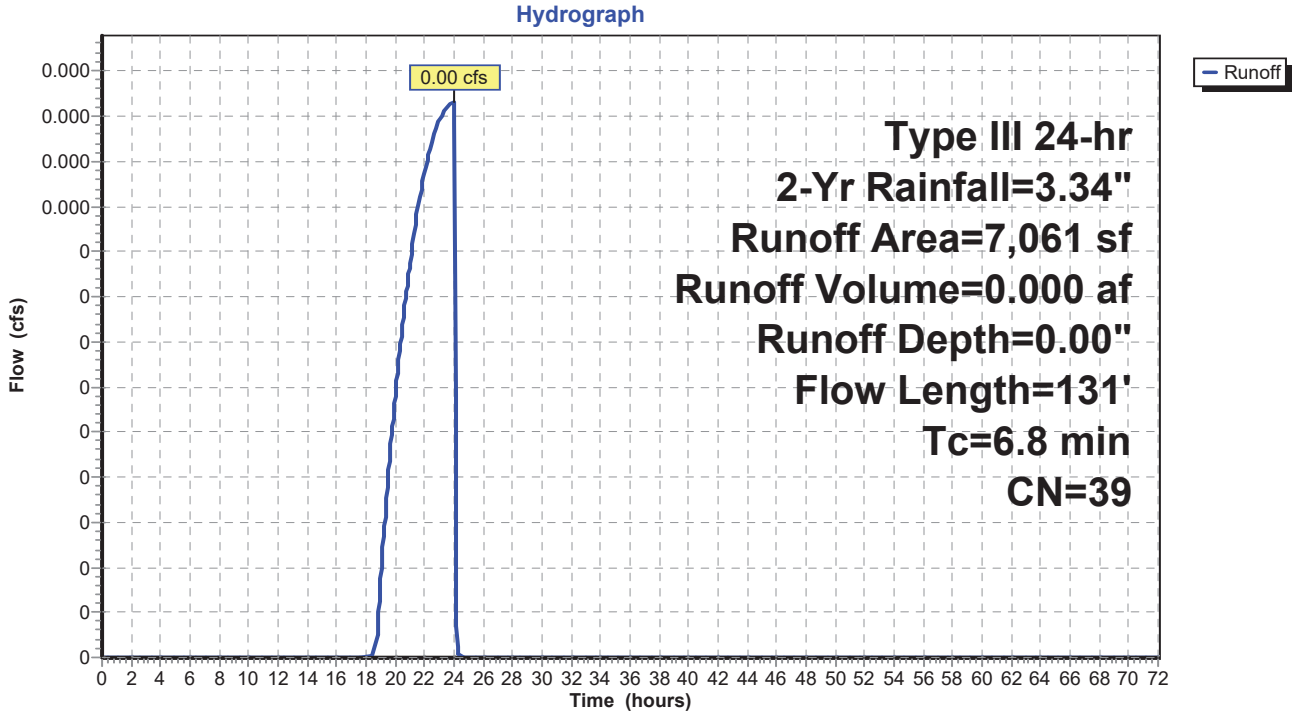
Runoff = 0.00 cfs @ 23.95 hrs, Volume= 0.000 af, Depth= 0.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Yr Rainfall=3.34"

Area (sf)	CN	Description
0	30	Woods, Good, HSG A
7,061	39	>75% Grass cover, Good, HSG A
0	98	Paved parking, HSG A
0	98	Roofs, HSG A
7,061	39	Weighted Average
7,061		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0	50	0.0160	0.14		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.34"
0.8	81	0.0120	1.76		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
6.8	131	Total			

Subcatchment 2S: S-1



Summary for Subcatchment 3S: S-1

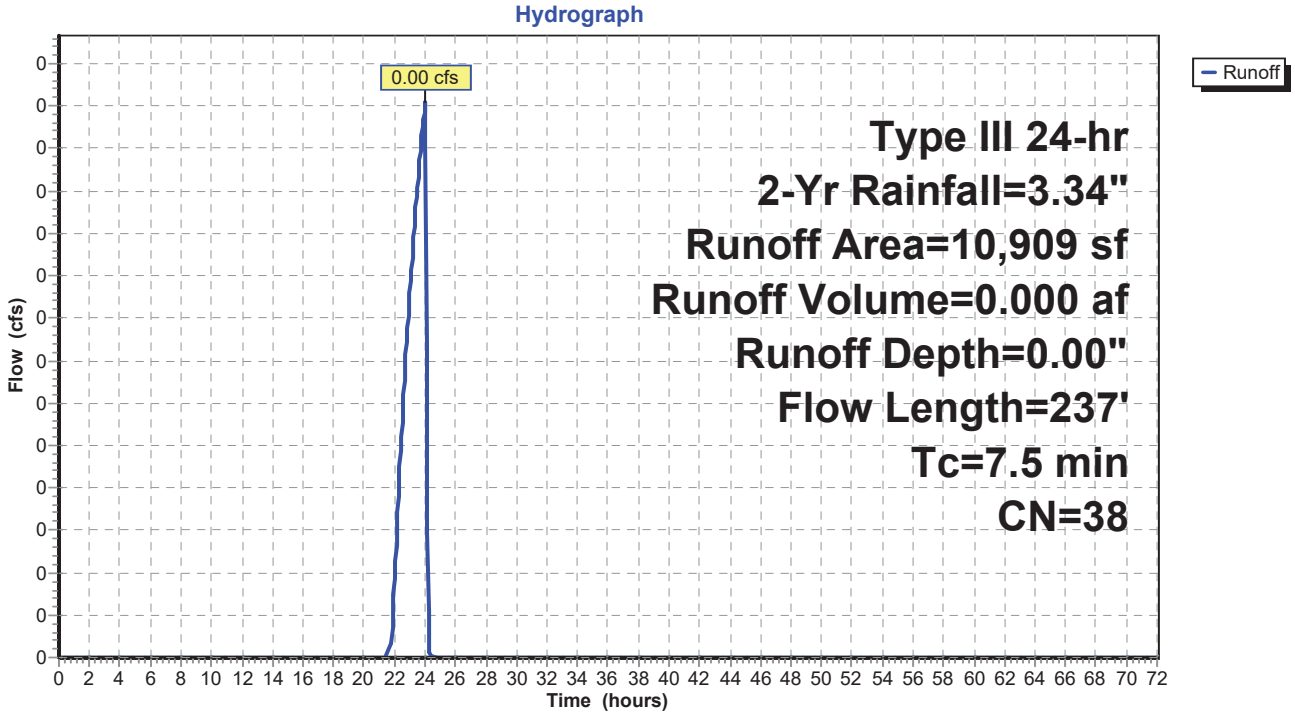
Runoff = 0.00 cfs @ 23.98 hrs, Volume= 0.000 af, Depth= 0.00"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Yr Rainfall=3.34"

Area (sf)	CN	Description
867	30	Woods, Good, HSG A
10,042	39	>75% Grass cover, Good, HSG A
0	98	Paved parking, HSG A
0	98	Roofs, HSG A
10,909	38	Weighted Average
10,909		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.1	40	0.0100	0.11		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.34"
1.0	97	0.0100	1.61		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
0.4	100	0.0800	4.55		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
7.5	237	Total			

Subcatchment 3S: S-1



Summary for Subcatchment 4S: S-1

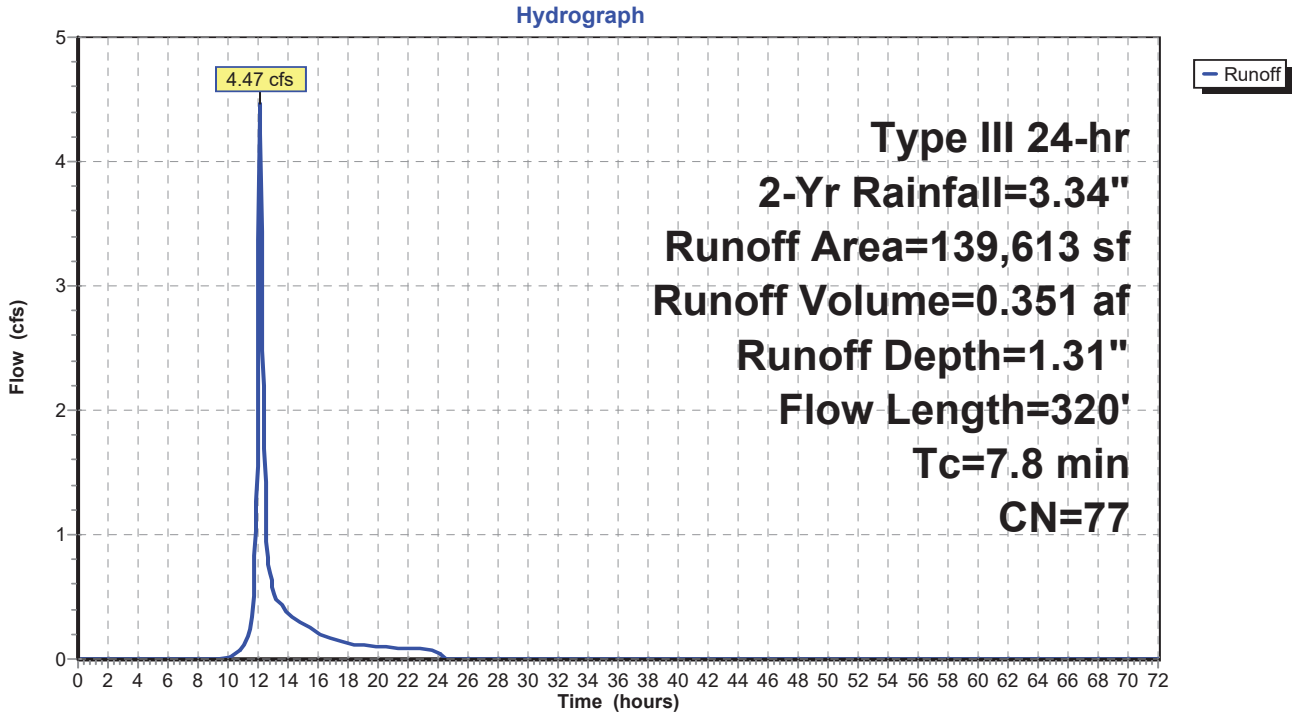
Runoff = 4.47 cfs @ 12.12 hrs, Volume= 0.351 af, Depth= 1.31"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 2-Yr Rainfall=3.34"

Area (sf)	CN	Description
0	30	Woods, Good, HSG A
50,268	39	>75% Grass cover, Good, HSG A
45,338	98	Paved parking, HSG A
44,007	98	Roofs, HSG A
139,613	77	Weighted Average
50,268		36.01% Pervious Area
89,345		63.99% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0	50	0.0250	0.17		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.34"
2.0	155	0.0065	1.30		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
0.8	115	0.0130	2.31		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
7.8	320	Total			

Subcatchment 4S: S-1

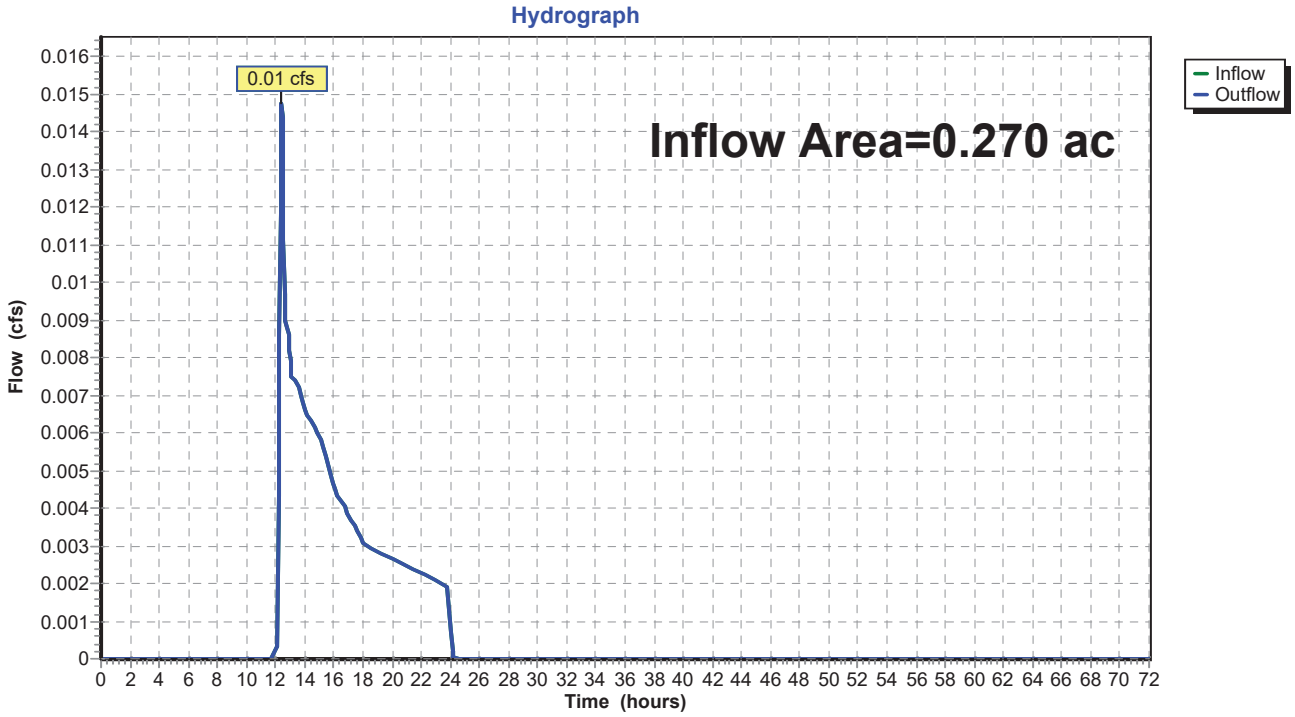


Summary for Reach DP1: Design Point 1

Inflow Area = 0.270 ac, 19.73% Impervious, Inflow Depth = 0.18" for 2-Yr event
Inflow = 0.01 cfs @ 12.41 hrs, Volume= 0.004 af
Outflow = 0.01 cfs @ 12.41 hrs, Volume= 0.004 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

Reach DP1: Design Point 1

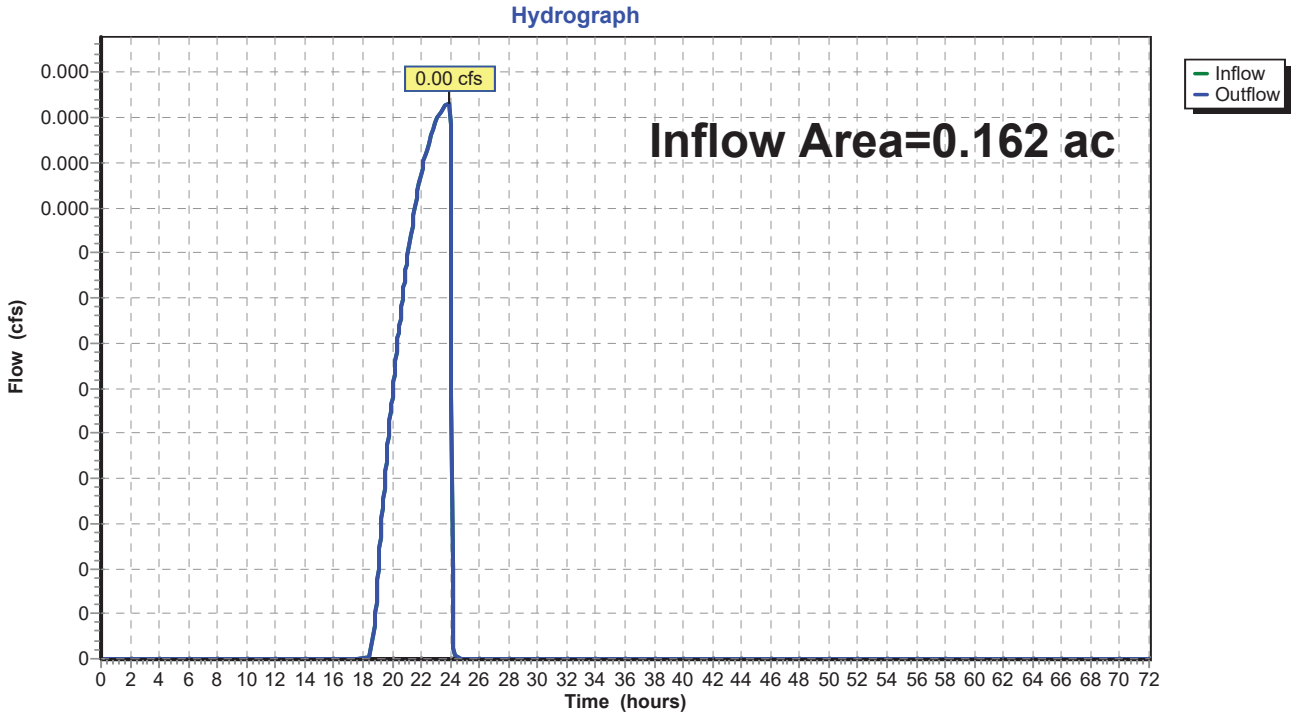


Summary for Reach DP2: Design Point 2

Inflow Area = 0.162 ac, 0.00% Impervious, Inflow Depth = 0.00" for 2-Yr event
Inflow = 0.00 cfs @ 23.95 hrs, Volume= 0.000 af
Outflow = 0.00 cfs @ 23.95 hrs, Volume= 0.000 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

Reach DP2: Design Point 2

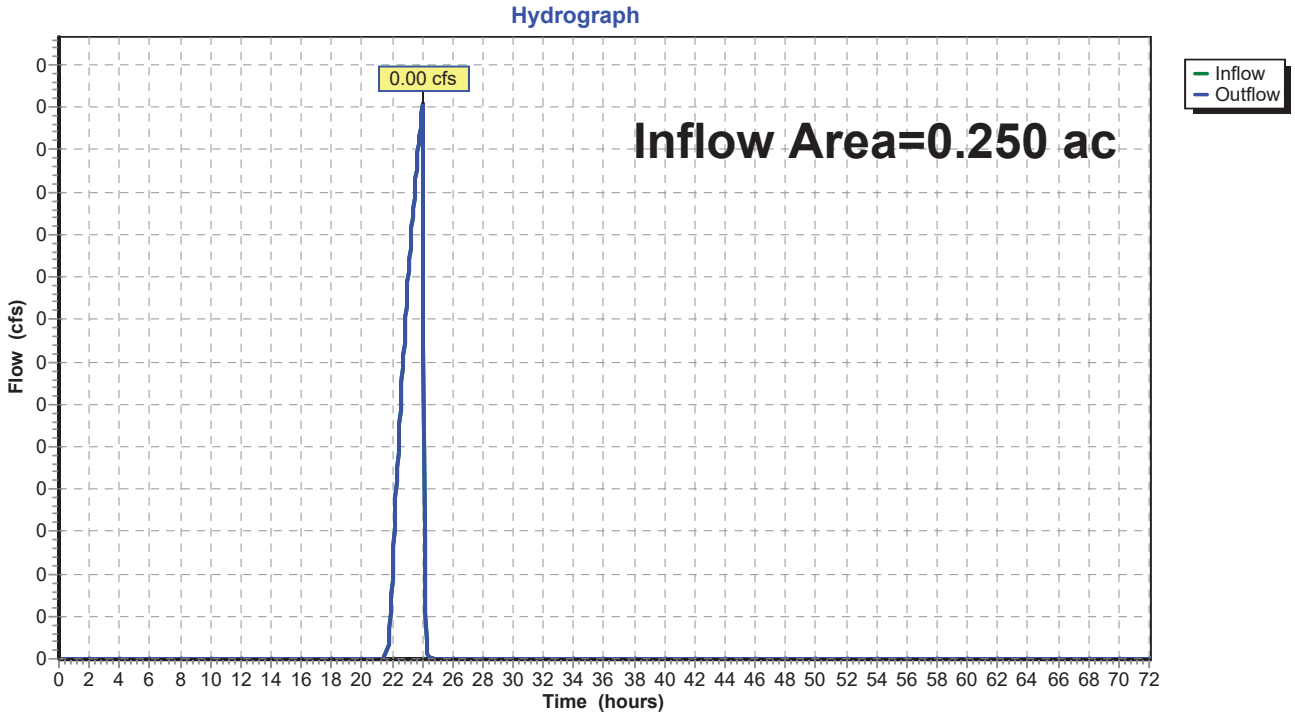


Summary for Reach DP3: Design Point 3

Inflow Area = 0.250 ac, 0.00% Impervious, Inflow Depth = 0.00" for 2-Yr event
Inflow = 0.00 cfs @ 23.98 hrs, Volume= 0.000 af
Outflow = 0.00 cfs @ 23.98 hrs, Volume= 0.000 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

Reach DP3: Design Point 3



Summary for Pond 1P: Subsurface Chamber Sys

Inflow Area = 3.205 ac, 63.99% Impervious, Inflow Depth = 1.31" for 2-Yr event
Inflow = 4.47 cfs @ 12.12 hrs, Volume= 0.351 af
Outflow = 1.79 cfs @ 12.43 hrs, Volume= 0.351 af, Atten= 60%, Lag= 18.7 min
Discarded = 1.79 cfs @ 12.43 hrs, Volume= 0.351 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 166.66' @ 12.43 hrs Surf.Area= 8,066 sf Storage= 2,135 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 5.8 min (857.5 - 851.6)

Volume	Invert	Avail.Storage	Storage Description
#1A	166.00'	10,159 cf	**56.83'W x 141.93'L x 5.25'H Field A** 42,348 cf Overall - 16,951 cf Embedded = 25,397 cf x 40.0% Voids
#2A	166.75'	16,951 cf	**ADS_StormTech MC-3500 d +Cap** x 152 Inside #1 Effective Size= 70.4"W x 45.0"H => 15.33 sf x 7.17'L = 110.0 cf Overall Size= 77.0"W x 45.0"H x 7.50'L with 0.33' Overlap 152 Chambers in 8 Rows Cap Storage= +14.9 cf x 2 x 8 rows = 238.4 cf
		27,110 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	166.00'	**8.270 in/hr Exfiltration over Surface area** Conductivity to Groundwater Elevation = 161.80'

Discarded OutFlow Max=1.79 cfs @ 12.43 hrs HW=166.66' (Free Discharge)
└**1=Exfiltration** (Controls 1.79 cfs)

Pond 1P: Subsurface Chamber Sys - Chamber Wizard Field A

Chamber Model = ADS_StormTech MC-3500 d +Cap (ADS StormTech® MC-3500 d rev 03/14 with Cap volume)
Effective Size= 70.4"W x 45.0"H => 15.33 sf x 7.17'L = 110.0 cf
Overall Size= 77.0"W x 45.0"H x 7.50'L with 0.33' Overlap
Cap Storage= +14.9 cf x 2 x 8 rows = 238.4 cf

77.0" Wide + 6.0" Spacing = 83.0" C-C Row Spacing

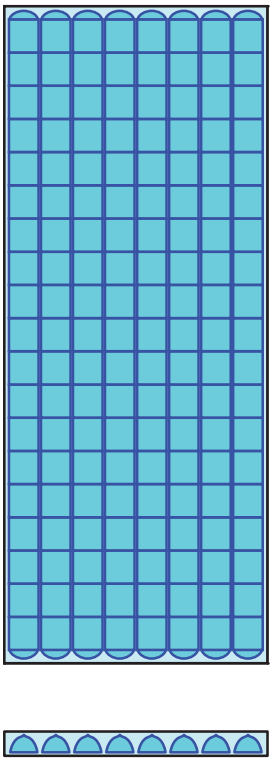
19 Chambers/Row x 7.17' Long +1.85' Cap Length x 2 = 139.93' Row Length +12.0" End Stone x 2 = 141.93' Base Length
8 Rows x 77.0" Wide + 6.0" Spacing x 7 + 12.0" Side Stone x 2 = 56.83' Base Width
9.0" Base + 45.0" Chamber Height + 9.0" Cover = 5.25' Field Height

152 Chambers x 110.0 cf + 14.9 cf Cap Volume x 2 x 8 Rows = 16,951.1 cf Chamber Storage

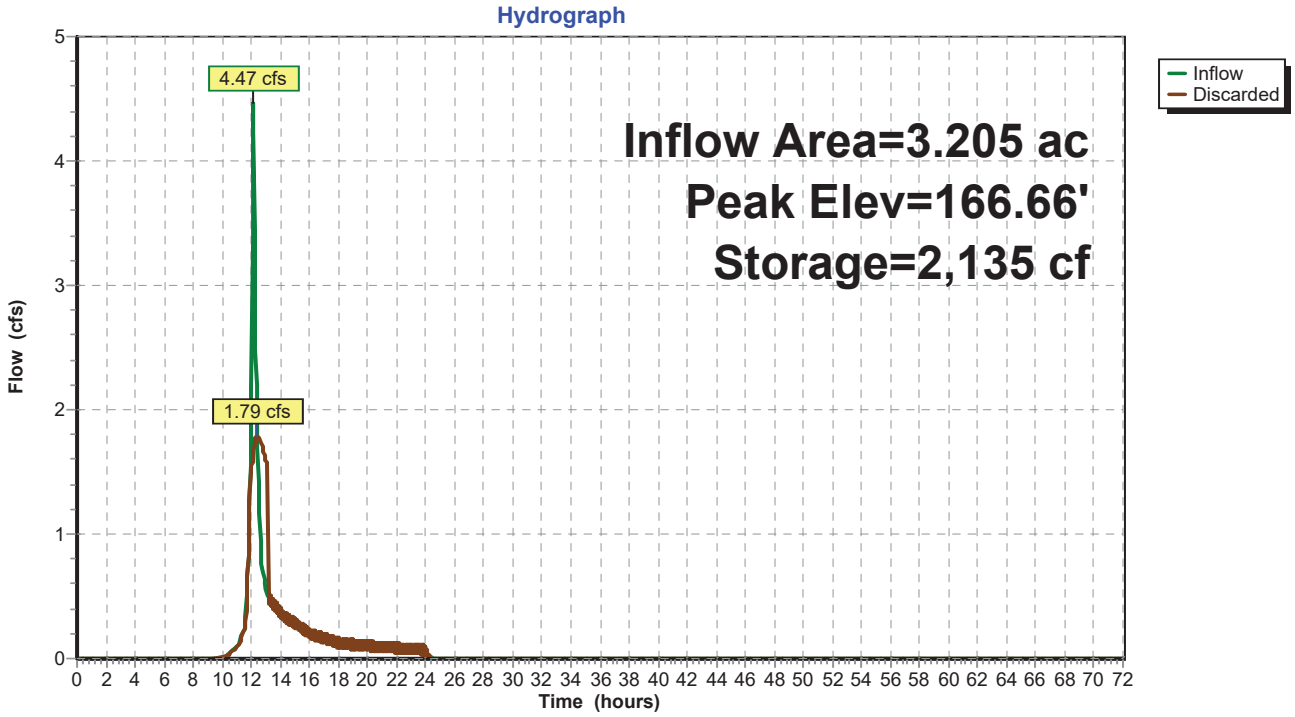
42,348.4 cf Field - 16,951.1 cf Chambers = 25,397.3 cf Stone x 40.0% Voids = 10,158.9 cf Stone Storage

Chamber Storage + Stone Storage = 27,110.0 cf = 0.622 af
Overall Storage Efficiency = 64.0%
Overall System Size = 141.93' x 56.83' x 5.25'

152 Chambers
1,568.5 cy Field
940.6 cy Stone



Pond 1P: Subsurface Chamber Sys



Time span=0.00-72.00 hrs, dt=0.05 hrs, 1441 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 1S: S-1 Runoff Area=11,775 sf 19.73% Impervious Runoff Depth=0.72"
Flow Length=30' Slope=0.0330 '/' Tc=6.0 min CN=51 Runoff=0.15 cfs 0.016 af

Subcatchment 2S: S-1 Runoff Area=7,061 sf 0.00% Impervious Runoff Depth=0.19"
Flow Length=131' Tc=6.8 min CN=39 Runoff=0.00 cfs 0.003 af

Subcatchment 3S: S-1 Runoff Area=10,909 sf 0.00% Impervious Runoff Depth=0.15"
Flow Length=237' Tc=7.5 min CN=38 Runoff=0.01 cfs 0.003 af

Subcatchment 4S: S-1 Runoff Area=139,613 sf 63.99% Impervious Runoff Depth=2.56"
Flow Length=320' Tc=7.8 min CN=77 Runoff=8.93 cfs 0.685 af

Reach DP1: Design Point 1 Inflow=0.15 cfs 0.016 af
Outflow=0.15 cfs 0.016 af

Reach DP2: Design Point 2 Inflow=0.00 cfs 0.003 af
Outflow=0.00 cfs 0.003 af

Reach DP3: Design Point 3 Inflow=0.01 cfs 0.003 af
Outflow=0.01 cfs 0.003 af

Pond 1P: Subsurface Chamber Sys Peak Elev=167.49' Storage=7,586 cf Inflow=8.93 cfs 0.685 af
Outflow=2.09 cfs 0.687 af

Total Runoff Area = 3.888 ac Runoff Volume = 0.707 af Average Runoff Depth = 2.18"
45.87% Pervious = 1.784 ac 54.13% Impervious = 2.104 ac

Summary for Subcatchment 1S: S-1

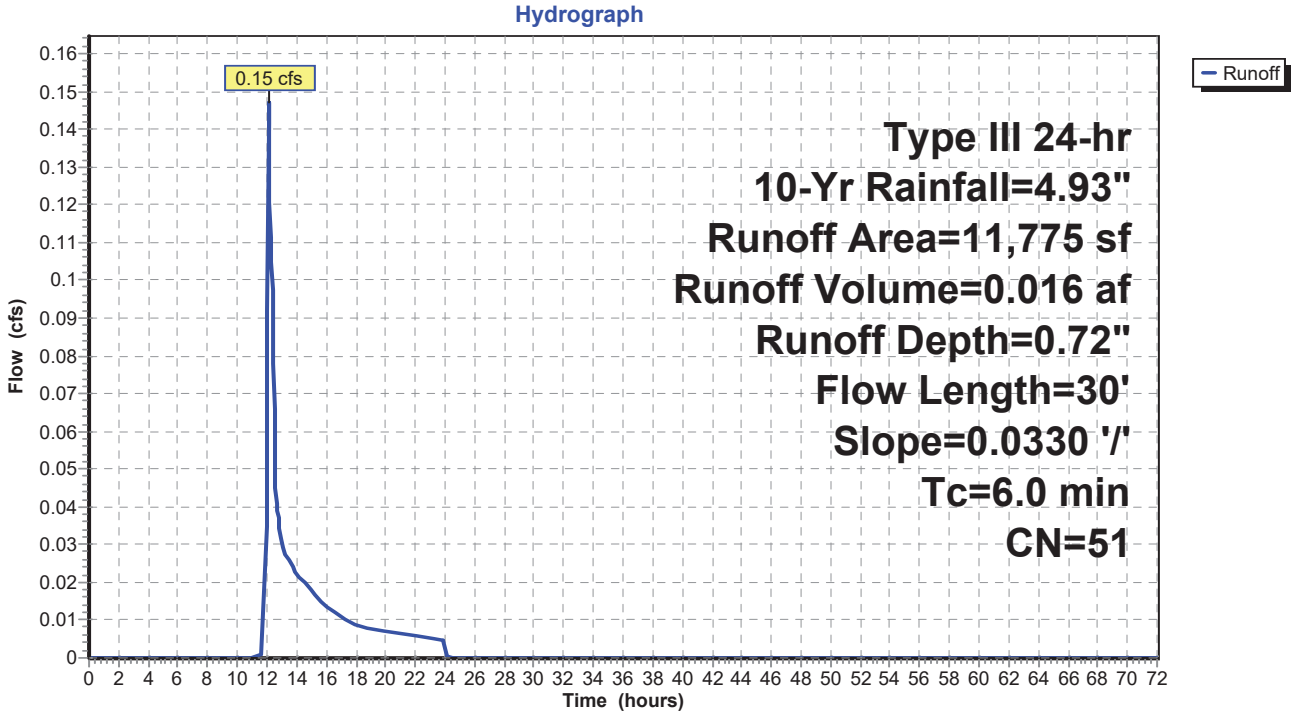
Runoff = 0.15 cfs @ 12.12 hrs, Volume= 0.016 af, Depth= 0.72"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Yr Rainfall=4.93"

Area (sf)	CN	Description
0	30	Woods, Good, HSG A
9,452	39	>75% Grass cover, Good, HSG A
2,323	98	Paved parking, HSG A
0	98	Roofs, HSG A
11,775	51	Weighted Average
9,452		80.27% Pervious Area
2,323		19.73% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.0	30	0.0330	0.17		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.34"
3.0	30	Total, Increased to minimum Tc = 6.0 min			

Subcatchment 1S: S-1



Summary for Subcatchment 2S: S-1

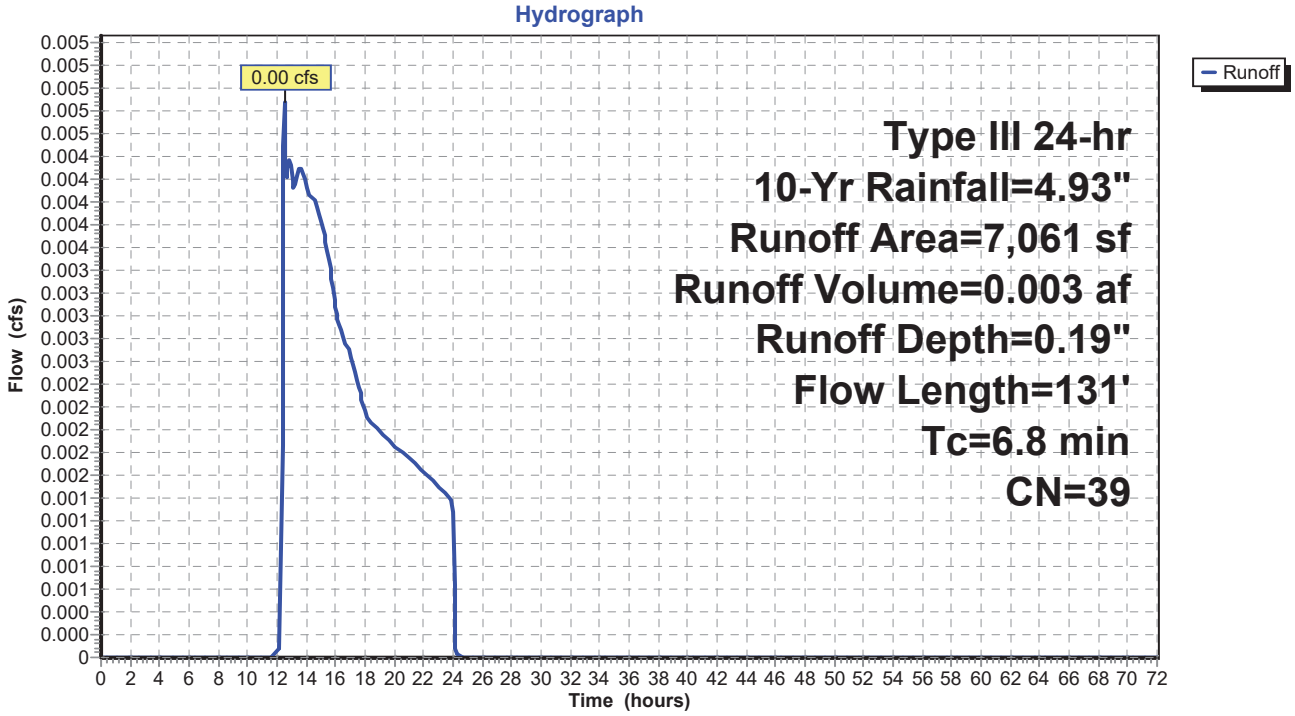
Runoff = 0.00 cfs @ 12.51 hrs, Volume= 0.003 af, Depth= 0.19"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Yr Rainfall=4.93"

Area (sf)	CN	Description
0	30	Woods, Good, HSG A
7,061	39	>75% Grass cover, Good, HSG A
0	98	Paved parking, HSG A
0	98	Roofs, HSG A
7,061	39	Weighted Average
7,061		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0	50	0.0160	0.14		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.34"
0.8	81	0.0120	1.76		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
6.8	131	Total			

Subcatchment 2S: S-1



Summary for Subcatchment 3S: S-1

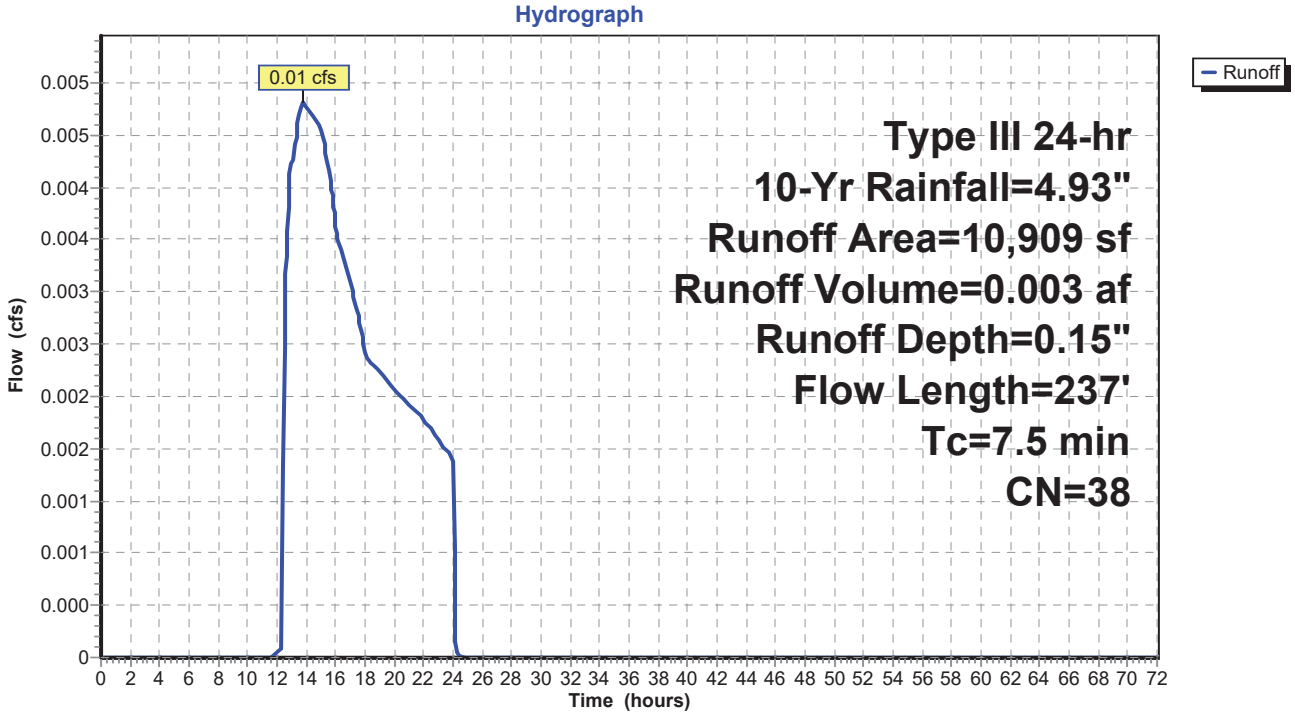
Runoff = 0.01 cfs @ 13.76 hrs, Volume= 0.003 af, Depth= 0.15"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Yr Rainfall=4.93"

Area (sf)	CN	Description
867	30	Woods, Good, HSG A
10,042	39	>75% Grass cover, Good, HSG A
0	98	Paved parking, HSG A
0	98	Roofs, HSG A
10,909	38	Weighted Average
10,909		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.1	40	0.0100	0.11		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.34"
1.0	97	0.0100	1.61		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
0.4	100	0.0800	4.55		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
7.5	237	Total			

Subcatchment 3S: S-1



Summary for Subcatchment 4S: S-1

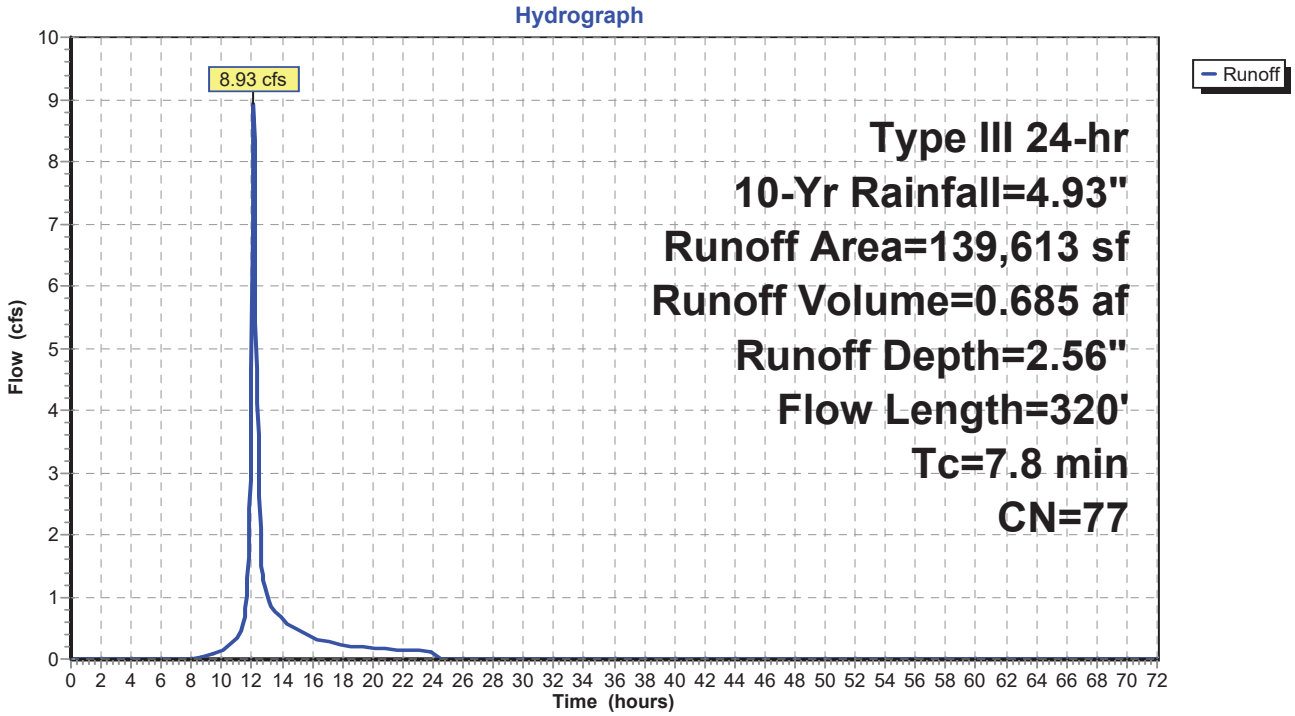
Runoff = 8.93 cfs @ 12.11 hrs, Volume= 0.685 af, Depth= 2.56"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 10-Yr Rainfall=4.93"

Area (sf)	CN	Description
0	30	Woods, Good, HSG A
50,268	39	>75% Grass cover, Good, HSG A
45,338	98	Paved parking, HSG A
44,007	98	Roofs, HSG A
139,613	77	Weighted Average
50,268		36.01% Pervious Area
89,345		63.99% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0	50	0.0250	0.17		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.34"
2.0	155	0.0065	1.30		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
0.8	115	0.0130	2.31		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
7.8	320	Total			

Subcatchment 4S: S-1

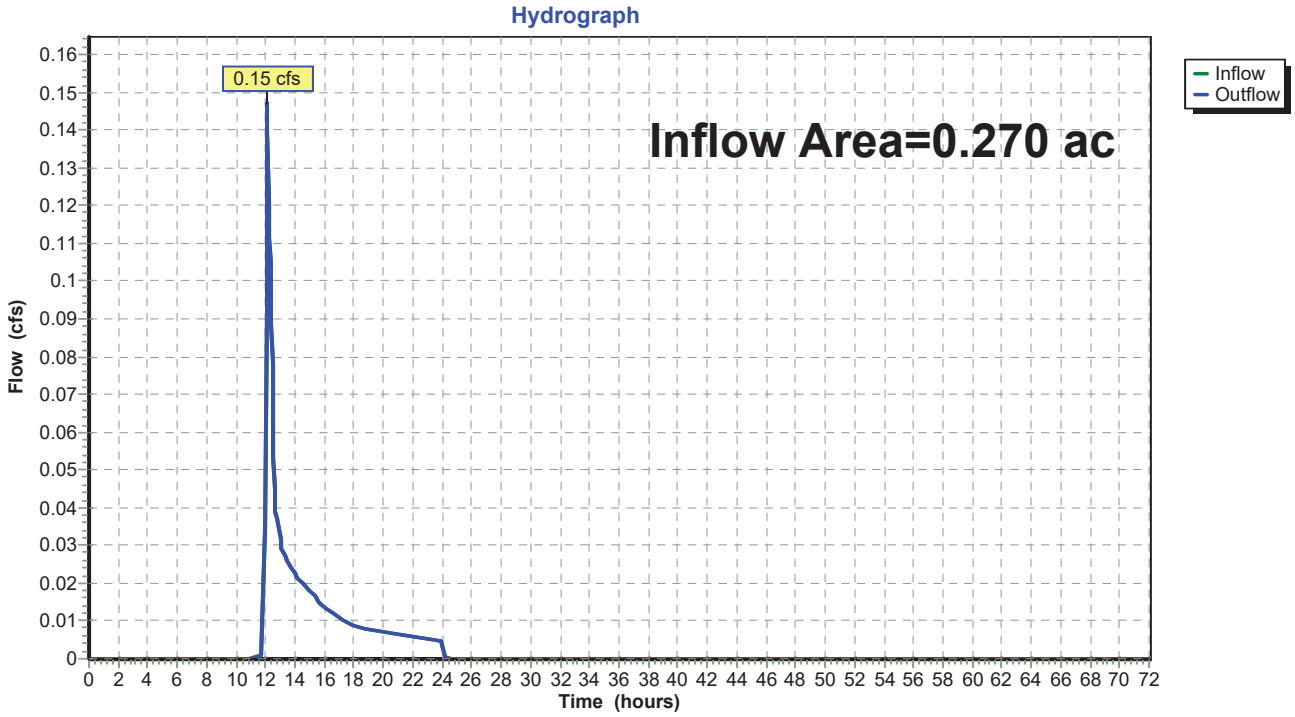


Summary for Reach DP1: Design Point 1

Inflow Area = 0.270 ac, 19.73% Impervious, Inflow Depth = 0.72" for 10-Yr event
Inflow = 0.15 cfs @ 12.12 hrs, Volume= 0.016 af
Outflow = 0.15 cfs @ 12.12 hrs, Volume= 0.016 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

Reach DP1: Design Point 1

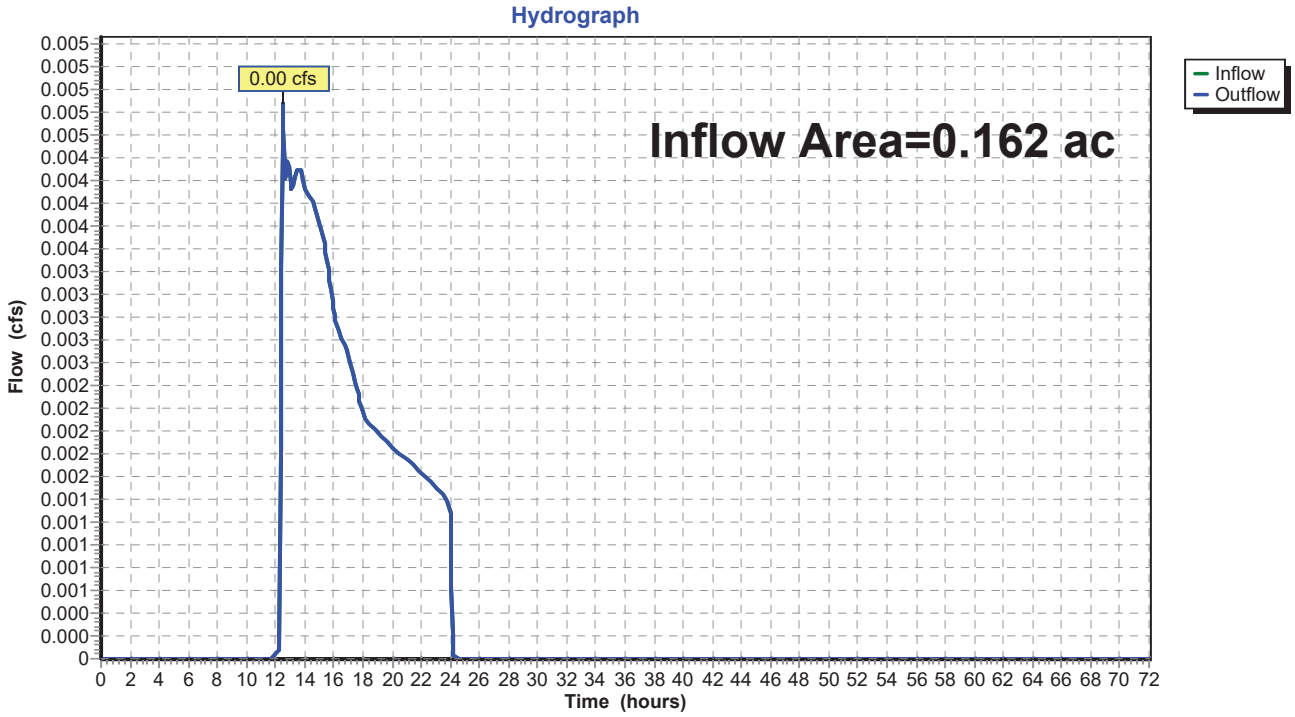


Summary for Reach DP2: Design Point 2

Inflow Area = 0.162 ac, 0.00% Impervious, Inflow Depth = 0.19" for 10-Yr event
Inflow = 0.00 cfs @ 12.51 hrs, Volume= 0.003 af
Outflow = 0.00 cfs @ 12.51 hrs, Volume= 0.003 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

Reach DP2: Design Point 2

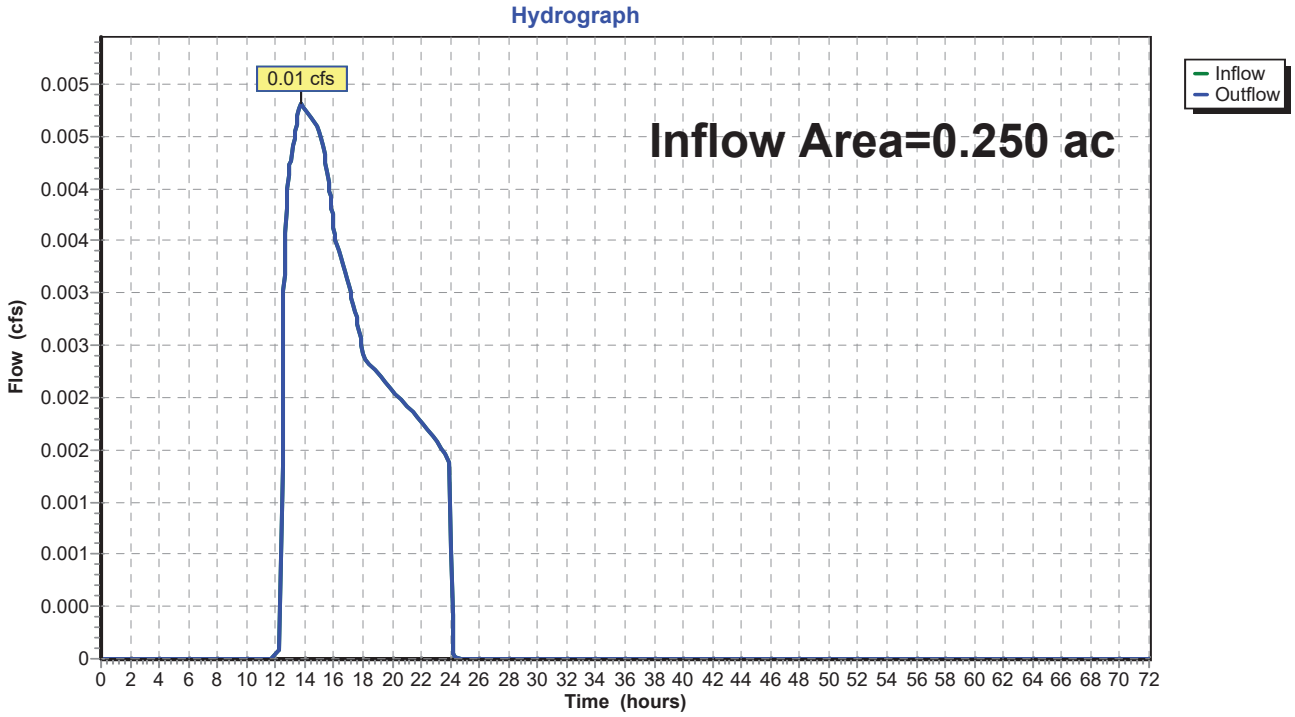


Summary for Reach DP3: Design Point 3

Inflow Area = 0.250 ac, 0.00% Impervious, Inflow Depth = 0.15" for 10-Yr event
Inflow = 0.01 cfs @ 13.76 hrs, Volume= 0.003 af
Outflow = 0.01 cfs @ 13.76 hrs, Volume= 0.003 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

Reach DP3: Design Point 3



Summary for Pond 1P: Subsurface Chamber Sys

Inflow Area = 3.205 ac, 63.99% Impervious, Inflow Depth = 2.56" for 10-Yr event
Inflow = 8.93 cfs @ 12.11 hrs, Volume= 0.685 af
Outflow = 2.09 cfs @ 12.56 hrs, Volume= 0.687 af, Atten= 77%, Lag= 26.5 min
Discarded = 2.09 cfs @ 12.56 hrs, Volume= 0.687 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 167.49' @ 12.56 hrs Surf.Area= 8,066 sf Storage= 7,586 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 23.2 min (855.3 - 832.0)

Volume	Invert	Avail.Storage	Storage Description
#1A	166.00'	10,159 cf	**56.83'W x 141.93'L x 5.25'H Field A** 42,348 cf Overall - 16,951 cf Embedded = 25,397 cf x 40.0% Voids
#2A	166.75'	16,951 cf	**ADS_StormTech MC-3500 d +Cap** x 152 Inside #1 Effective Size= 70.4"W x 45.0"H => 15.33 sf x 7.17'L = 110.0 cf Overall Size= 77.0"W x 45.0"H x 7.50'L with 0.33' Overlap 152 Chambers in 8 Rows Cap Storage= +14.9 cf x 2 x 8 rows = 238.4 cf
		27,110 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	166.00'	**8.270 in/hr Exfiltration over Surface area** Conductivity to Groundwater Elevation = 161.80'

Discarded OutFlow Max=2.09 cfs @ 12.56 hrs HW=167.49' (Free Discharge)
└**1=Exfiltration** (Controls 2.09 cfs)

Pond 1P: Subsurface Chamber Sys - Chamber Wizard Field A

Chamber Model = ADS_StormTech MC-3500 d +Cap (ADS StormTech® MC-3500 d rev 03/14 with Cap volume)
Effective Size= 70.4"W x 45.0"H => 15.33 sf x 7.17'L = 110.0 cf
Overall Size= 77.0"W x 45.0"H x 7.50'L with 0.33' Overlap
Cap Storage= +14.9 cf x 2 x 8 rows = 238.4 cf

77.0" Wide + 6.0" Spacing = 83.0" C-C Row Spacing

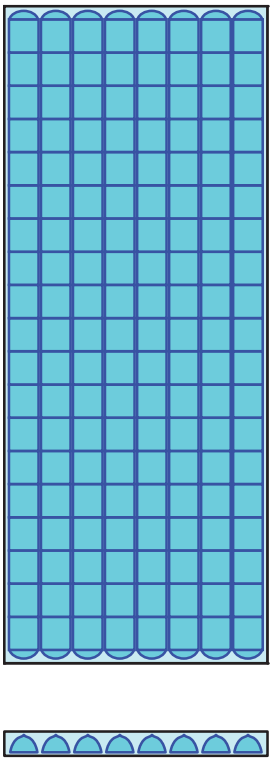
19 Chambers/Row x 7.17' Long +1.85' Cap Length x 2 = 139.93' Row Length +12.0" End Stone x 2 = 141.93' Base Length
8 Rows x 77.0" Wide + 6.0" Spacing x 7 + 12.0" Side Stone x 2 = 56.83' Base Width
9.0" Base + 45.0" Chamber Height + 9.0" Cover = 5.25' Field Height

152 Chambers x 110.0 cf + 14.9 cf Cap Volume x 2 x 8 Rows = 16,951.1 cf Chamber Storage

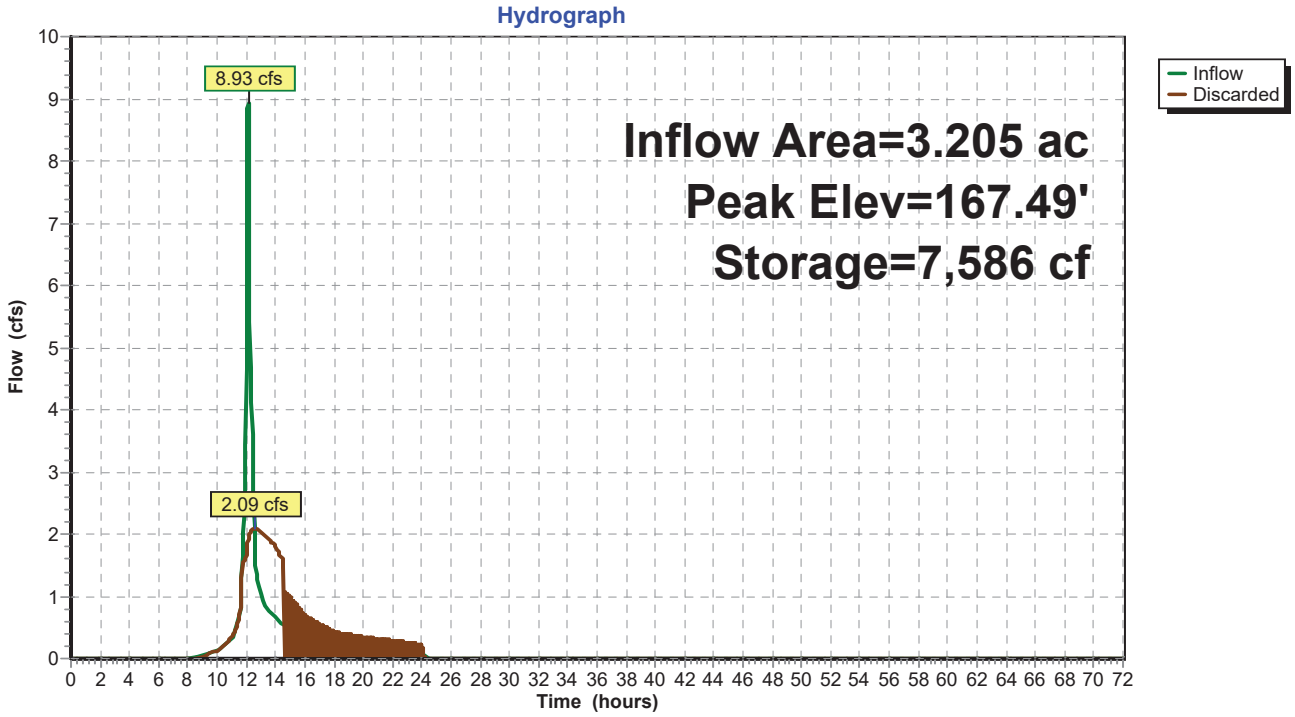
42,348.4 cf Field - 16,951.1 cf Chambers = 25,397.3 cf Stone x 40.0% Voids = 10,158.9 cf Stone Storage

Chamber Storage + Stone Storage = 27,110.0 cf = 0.622 af
Overall Storage Efficiency = 64.0%
Overall System Size = 141.93' x 56.83' x 5.25'

152 Chambers
1,568.5 cy Field
940.6 cy Stone



Pond 1P: Subsurface Chamber Sys



Time span=0.00-72.00 hrs, dt=0.05 hrs, 1441 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 1S: S-1 Runoff Area=11,775 sf 19.73% Impervious Runoff Depth=1.30"
Flow Length=30' Slope=0.0330 '/' Tc=6.0 min CN=51 Runoff=0.34 cfs 0.029 af

Subcatchment 2S: S-1 Runoff Area=7,061 sf 0.00% Impervious Runoff Depth=0.50"
Flow Length=131' Tc=6.8 min CN=39 Runoff=0.03 cfs 0.007 af

Subcatchment 3S: S-1 Runoff Area=10,909 sf 0.00% Impervious Runoff Depth=0.44"
Flow Length=237' Tc=7.5 min CN=38 Runoff=0.04 cfs 0.009 af

Subcatchment 4S: S-1 Runoff Area=139,613 sf 63.99% Impervious Runoff Depth=3.63"
Flow Length=320' Tc=7.8 min CN=77 Runoff=12.65 cfs 0.969 af

Reach DP1: Design Point 1 Inflow=0.34 cfs 0.029 af
Outflow=0.34 cfs 0.029 af

Reach DP2: Design Point 2 Inflow=0.03 cfs 0.007 af
Outflow=0.03 cfs 0.007 af

Reach DP3: Design Point 3 Inflow=0.04 cfs 0.009 af
Outflow=0.04 cfs 0.009 af

Pond 1P: Subsurface Chamber Sys Peak Elev=168.24' Storage=12,694 cf Inflow=12.65 cfs 0.969 af
Outflow=2.37 cfs 0.970 af

Total Runoff Area = 3.888 ac Runoff Volume = 1.014 af Average Runoff Depth = 3.13"
45.87% Pervious = 1.784 ac 54.13% Impervious = 2.104 ac

Summary for Subcatchment 1S: S-1

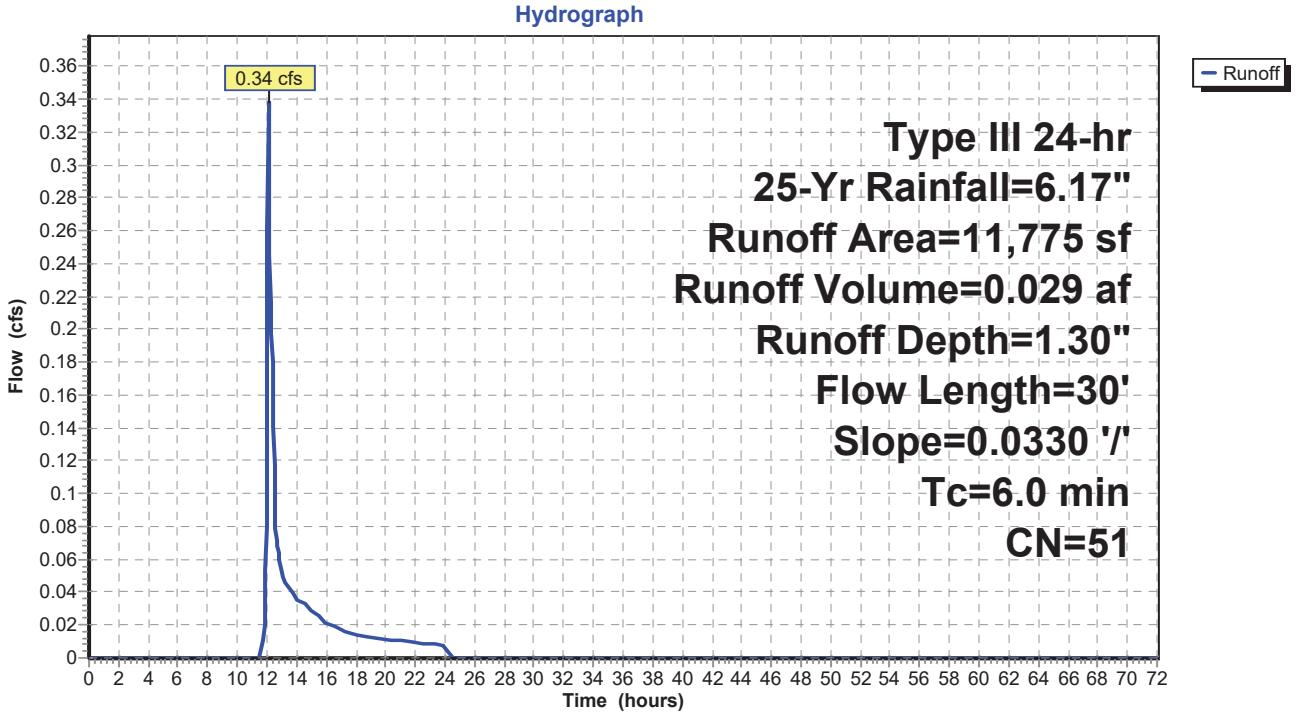
Runoff = 0.34 cfs @ 12.11 hrs, Volume= 0.029 af, Depth= 1.30"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Yr Rainfall=6.17"

Area (sf)	CN	Description
0	30	Woods, Good, HSG A
9,452	39	>75% Grass cover, Good, HSG A
2,323	98	Paved parking, HSG A
0	98	Roofs, HSG A
11,775	51	Weighted Average
9,452		80.27% Pervious Area
2,323		19.73% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.0	30	0.0330	0.17		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.34"
3.0	30	Total, Increased to minimum Tc = 6.0 min			

Subcatchment 1S: S-1



Summary for Subcatchment 2S: S-1

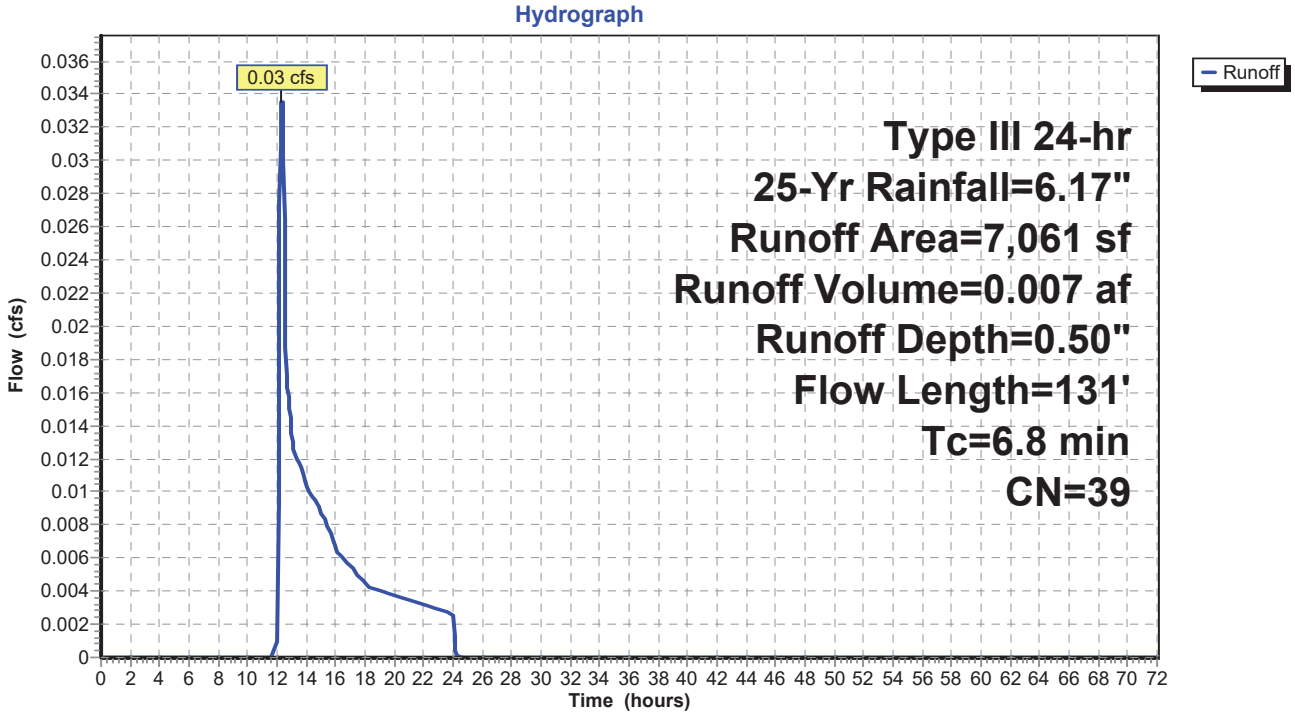
Runoff = 0.03 cfs @ 12.34 hrs, Volume= 0.007 af, Depth= 0.50"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Yr Rainfall=6.17"

Area (sf)	CN	Description
0	30	Woods, Good, HSG A
7,061	39	>75% Grass cover, Good, HSG A
0	98	Paved parking, HSG A
0	98	Roofs, HSG A
7,061	39	Weighted Average
7,061		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0	50	0.0160	0.14		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.34"
0.8	81	0.0120	1.76		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
6.8	131	Total			

Subcatchment 2S: S-1



Summary for Subcatchment 3S: S-1

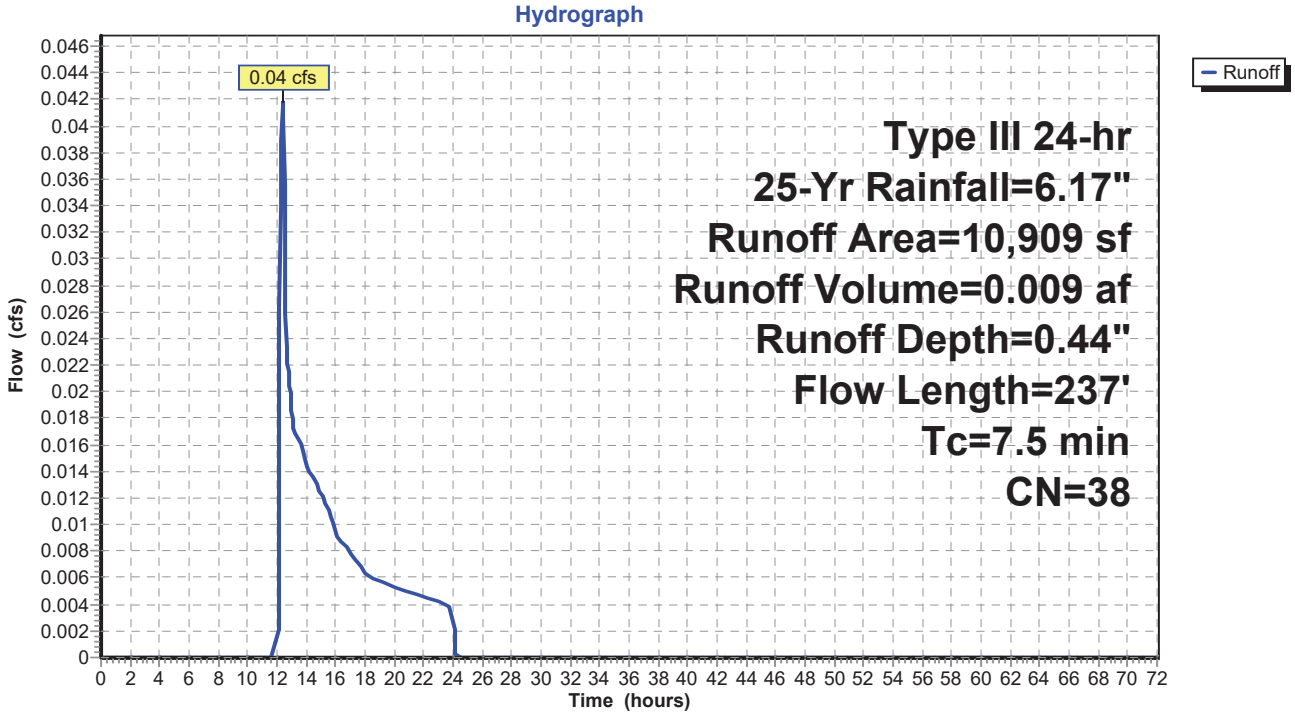
Runoff = 0.04 cfs @ 12.38 hrs, Volume= 0.009 af, Depth= 0.44"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Yr Rainfall=6.17"

Area (sf)	CN	Description
867	30	Woods, Good, HSG A
10,042	39	>75% Grass cover, Good, HSG A
0	98	Paved parking, HSG A
0	98	Roofs, HSG A
10,909	38	Weighted Average
10,909		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.1	40	0.0100	0.11		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.34"
1.0	97	0.0100	1.61		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
0.4	100	0.0800	4.55		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
7.5	237	Total			

Subcatchment 3S: S-1



Summary for Subcatchment 4S: S-1

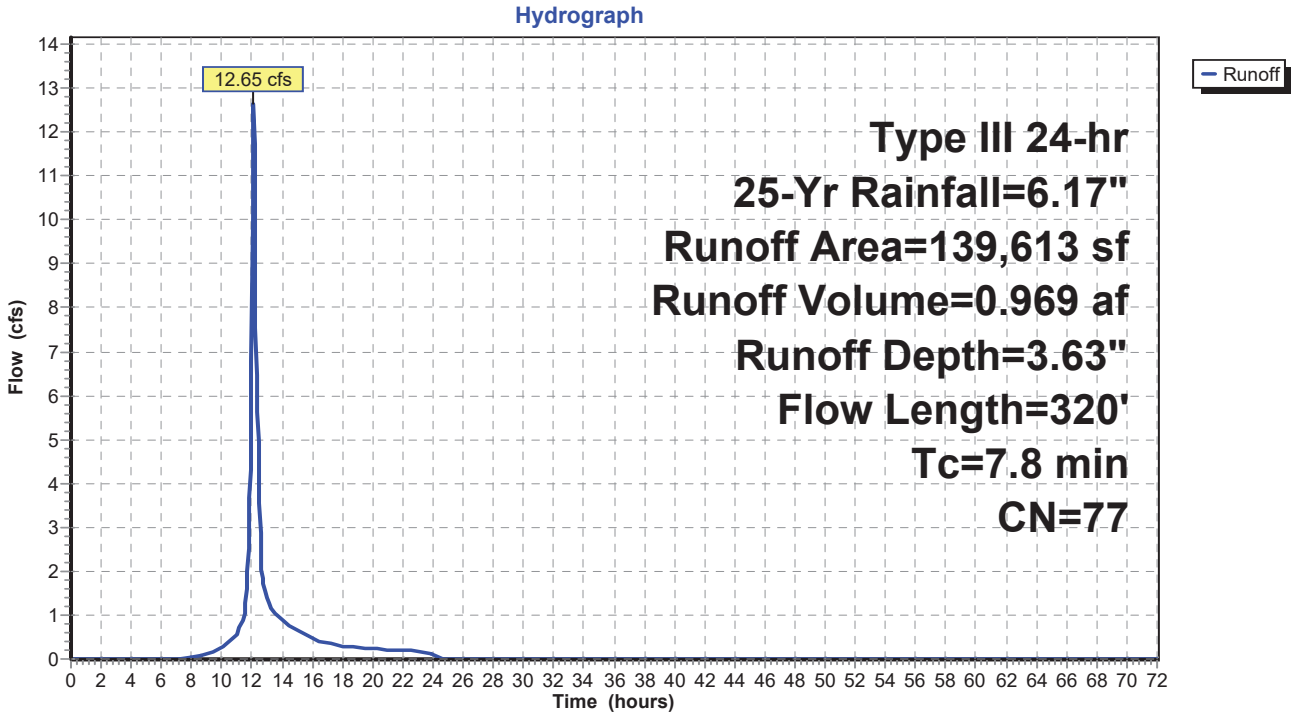
Runoff = 12.65 cfs @ 12.11 hrs, Volume= 0.969 af, Depth= 3.63"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Yr Rainfall=6.17"

Area (sf)	CN	Description
0	30	Woods, Good, HSG A
50,268	39	>75% Grass cover, Good, HSG A
45,338	98	Paved parking, HSG A
44,007	98	Roofs, HSG A
139,613	77	Weighted Average
50,268		36.01% Pervious Area
89,345		63.99% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0	50	0.0250	0.17		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.34"
2.0	155	0.0065	1.30		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
0.8	115	0.0130	2.31		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
7.8	320	Total			

Subcatchment 4S: S-1

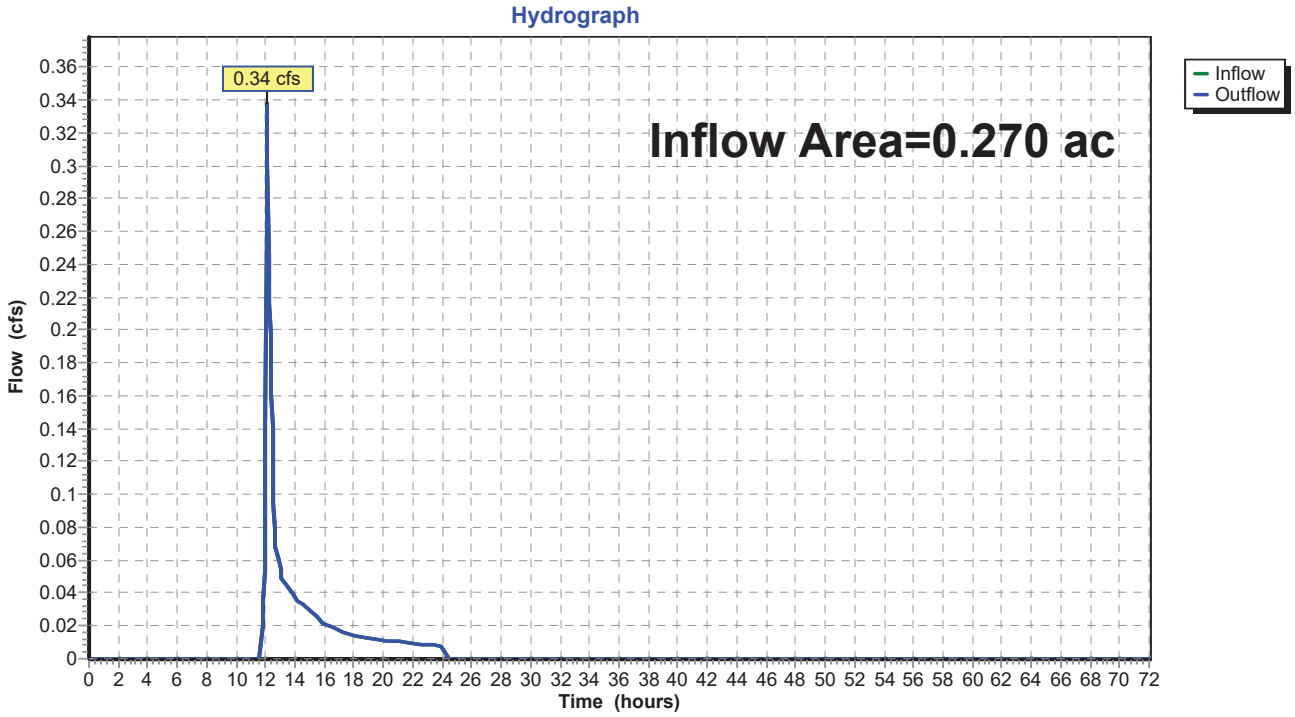


Summary for Reach DP1: Design Point 1

Inflow Area = 0.270 ac, 19.73% Impervious, Inflow Depth = 1.30" for 25-Yr event
Inflow = 0.34 cfs @ 12.11 hrs, Volume= 0.029 af
Outflow = 0.34 cfs @ 12.11 hrs, Volume= 0.029 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

Reach DP1: Design Point 1

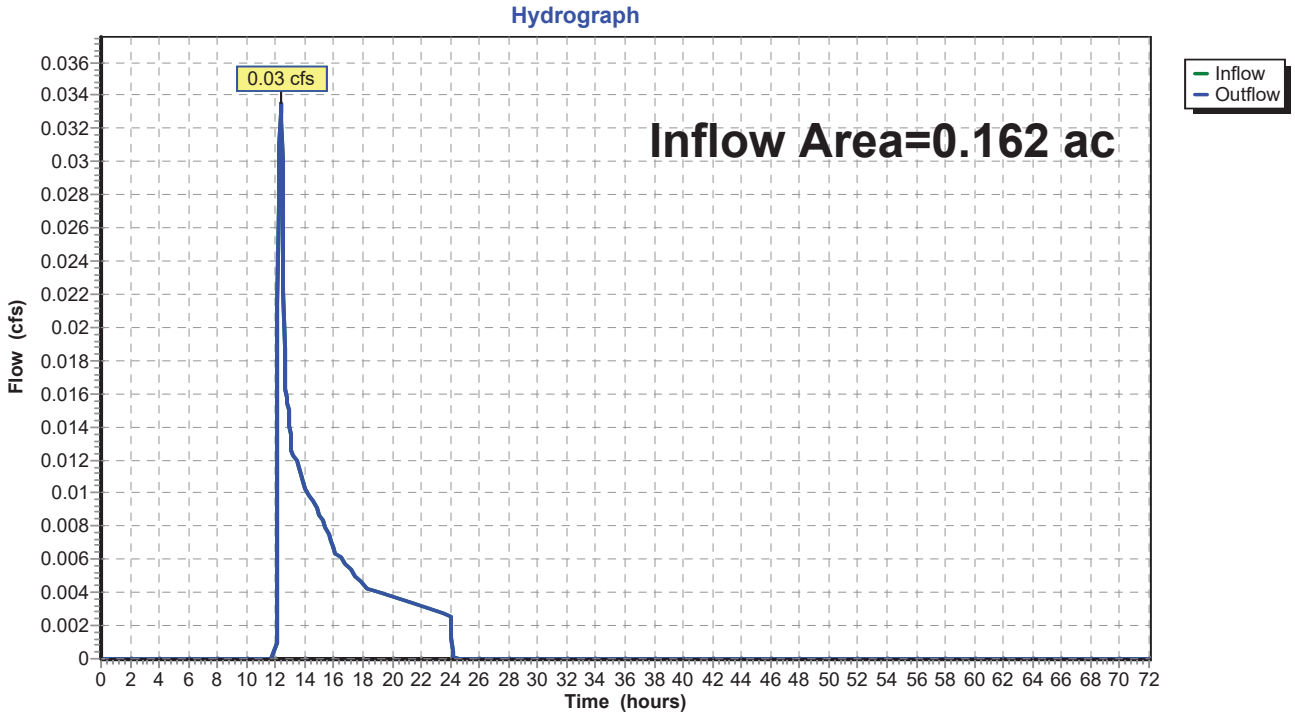


Summary for Reach DP2: Design Point 2

Inflow Area = 0.162 ac, 0.00% Impervious, Inflow Depth = 0.50" for 25-Yr event
Inflow = 0.03 cfs @ 12.34 hrs, Volume= 0.007 af
Outflow = 0.03 cfs @ 12.34 hrs, Volume= 0.007 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

Reach DP2: Design Point 2

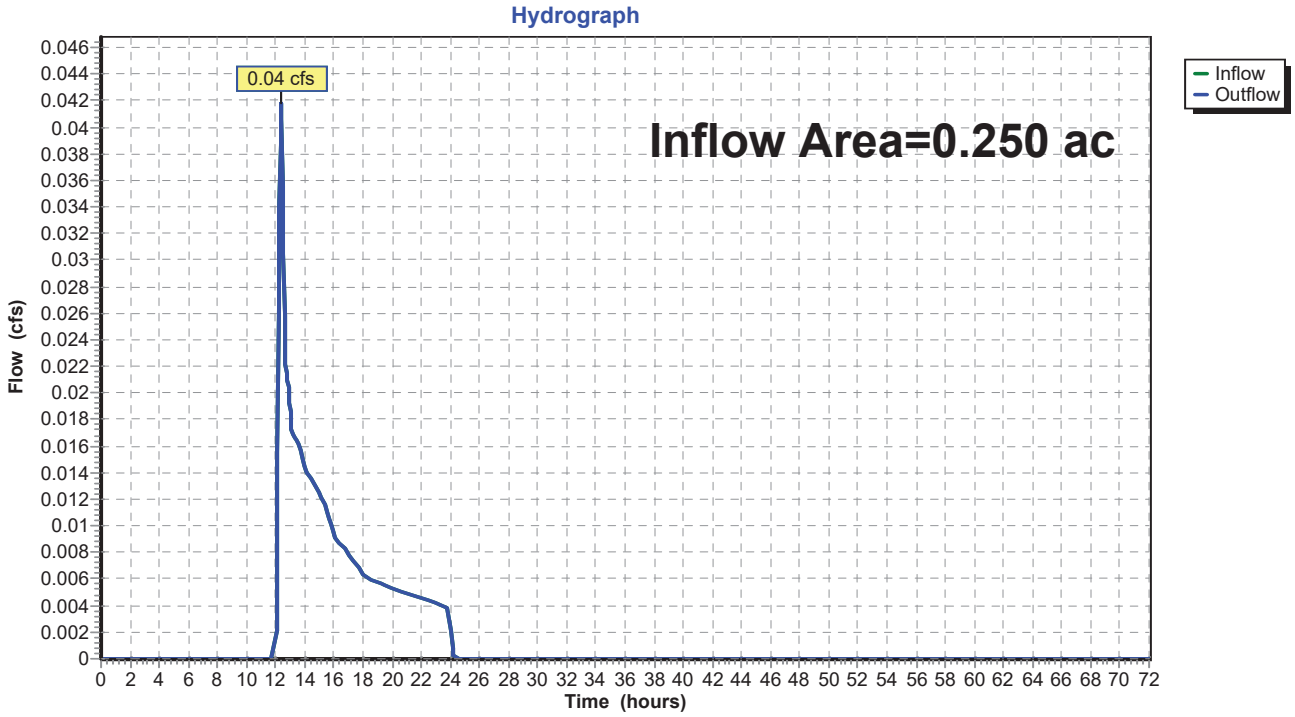


Summary for Reach DP3: Design Point 3

Inflow Area = 0.250 ac, 0.00% Impervious, Inflow Depth = 0.44" for 25-Yr event
Inflow = 0.04 cfs @ 12.38 hrs, Volume= 0.009 af
Outflow = 0.04 cfs @ 12.38 hrs, Volume= 0.009 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

Reach DP3: Design Point 3



Summary for Pond 1P: Subsurface Chamber Sys

Inflow Area = 3.205 ac, 63.99% Impervious, Inflow Depth = 3.63" for 25-Yr event
Inflow = 12.65 cfs @ 12.11 hrs, Volume= 0.969 af
Outflow = 2.37 cfs @ 12.60 hrs, Volume= 0.970 af, Atten= 81%, Lag= 29.5 min
Discarded = 2.37 cfs @ 12.60 hrs, Volume= 0.970 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 168.24' @ 12.60 hrs Surf.Area= 8,066 sf Storage= 12,694 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 39.2 min (861.3 - 822.1)

Volume	Invert	Avail.Storage	Storage Description
#1A	166.00'	10,159 cf	**56.83'W x 141.93'L x 5.25'H Field A** 42,348 cf Overall - 16,951 cf Embedded = 25,397 cf x 40.0% Voids
#2A	166.75'	16,951 cf	**ADS_StormTech MC-3500 d +Cap** x 152 Inside #1 Effective Size= 70.4"W x 45.0"H => 15.33 sf x 7.17'L = 110.0 cf Overall Size= 77.0"W x 45.0"H x 7.50'L with 0.33' Overlap 152 Chambers in 8 Rows Cap Storage= +14.9 cf x 2 x 8 rows = 238.4 cf
		27,110 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	166.00'	**8.270 in/hr Exfiltration over Surface area** Conductivity to Groundwater Elevation = 161.80'

Discarded OutFlow Max=2.37 cfs @ 12.60 hrs HW=168.24' (Free Discharge)
└**1=Exfiltration** (Controls 2.37 cfs)

Pond 1P: Subsurface Chamber Sys - Chamber Wizard Field A

Chamber Model = ADS_StormTech MC-3500 d +Cap (ADS StormTech® MC-3500 d rev 03/14 with Cap volume)
Effective Size= 70.4"W x 45.0"H => 15.33 sf x 7.17'L = 110.0 cf
Overall Size= 77.0"W x 45.0"H x 7.50'L with 0.33' Overlap
Cap Storage= +14.9 cf x 2 x 8 rows = 238.4 cf

77.0" Wide + 6.0" Spacing = 83.0" C-C Row Spacing

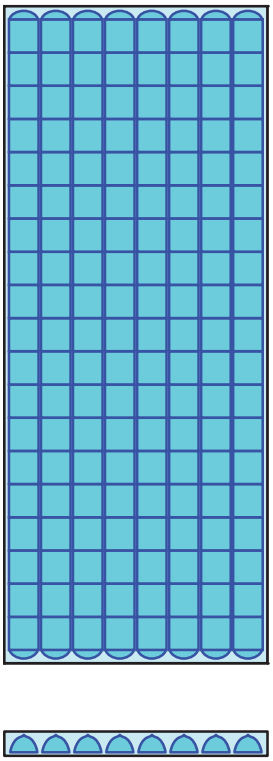
19 Chambers/Row x 7.17' Long +1.85' Cap Length x 2 = 139.93' Row Length +12.0" End Stone x 2 = 141.93' Base Length
8 Rows x 77.0" Wide + 6.0" Spacing x 7 + 12.0" Side Stone x 2 = 56.83' Base Width
9.0" Base + 45.0" Chamber Height + 9.0" Cover = 5.25' Field Height

152 Chambers x 110.0 cf + 14.9 cf Cap Volume x 2 x 8 Rows = 16,951.1 cf Chamber Storage

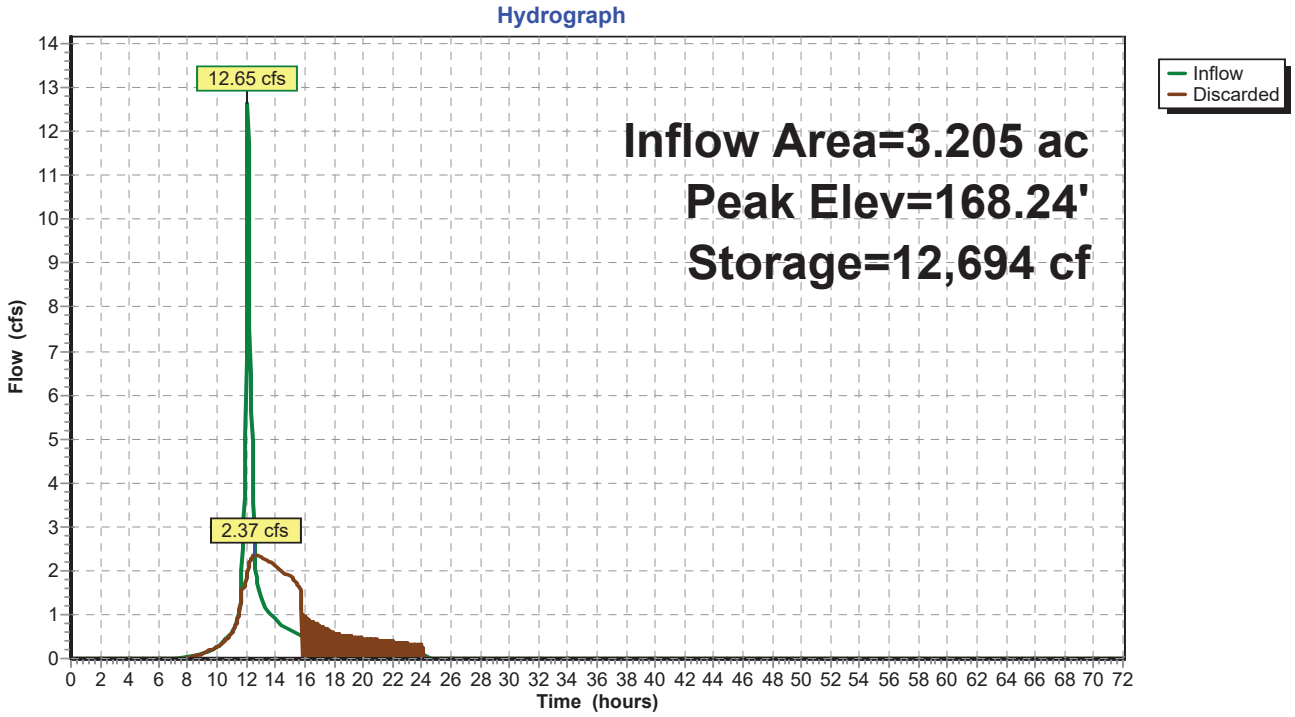
42,348.4 cf Field - 16,951.1 cf Chambers = 25,397.3 cf Stone x 40.0% Voids = 10,158.9 cf Stone Storage

Chamber Storage + Stone Storage = 27,110.0 cf = 0.622 af
Overall Storage Efficiency = 64.0%
Overall System Size = 141.93' x 56.83' x 5.25'

152 Chambers
1,568.5 cy Field
940.6 cy Stone



Pond 1P: Subsurface Chamber Sys



Time span=0.00-72.00 hrs, dt=0.05 hrs, 1441 points
Runoff by SCS TR-20 method, UH=SCS, Weighted-CN
Reach routing by Dyn-Stor-Ind method - Pond routing by Dyn-Stor-Ind method

Subcatchment 1S: S-1 Runoff Area=11,775 sf 19.73% Impervious Runoff Depth=2.79"
Flow Length=30' Slope=0.0330 '/' Tc=6.0 min CN=51 Runoff=0.82 cfs 0.063 af

Subcatchment 2S: S-1 Runoff Area=7,061 sf 0.00% Impervious Runoff Depth=1.45"
Flow Length=131' Tc=6.8 min CN=39 Runoff=0.19 cfs 0.020 af

Subcatchment 3S: S-1 Runoff Area=10,909 sf 0.00% Impervious Runoff Depth=1.35"
Flow Length=237' Tc=7.5 min CN=38 Runoff=0.25 cfs 0.028 af

Subcatchment 4S: S-1 Runoff Area=139,613 sf 63.99% Impervious Runoff Depth=5.90"
Flow Length=320' Tc=7.8 min CN=77 Runoff=20.36 cfs 1.576 af

Reach DP1: Design Point 1 Inflow=0.82 cfs 0.063 af
Outflow=0.82 cfs 0.063 af

Reach DP2: Design Point 2 Inflow=0.19 cfs 0.020 af
Outflow=0.19 cfs 0.020 af

Reach DP3: Design Point 3 Inflow=0.25 cfs 0.028 af
Outflow=0.25 cfs 0.028 af

Pond 1P: Subsurface Chamber Sys Peak Elev=170.27' Storage=23,889 cf Inflow=20.36 cfs 1.576 af
Outflow=3.11 cfs 1.577 af

Total Runoff Area = 3.888 ac Runoff Volume = 1.687 af Average Runoff Depth = 5.21"
45.87% Pervious = 1.784 ac 54.13% Impervious = 2.104 ac

Summary for Subcatchment 1S: S-1

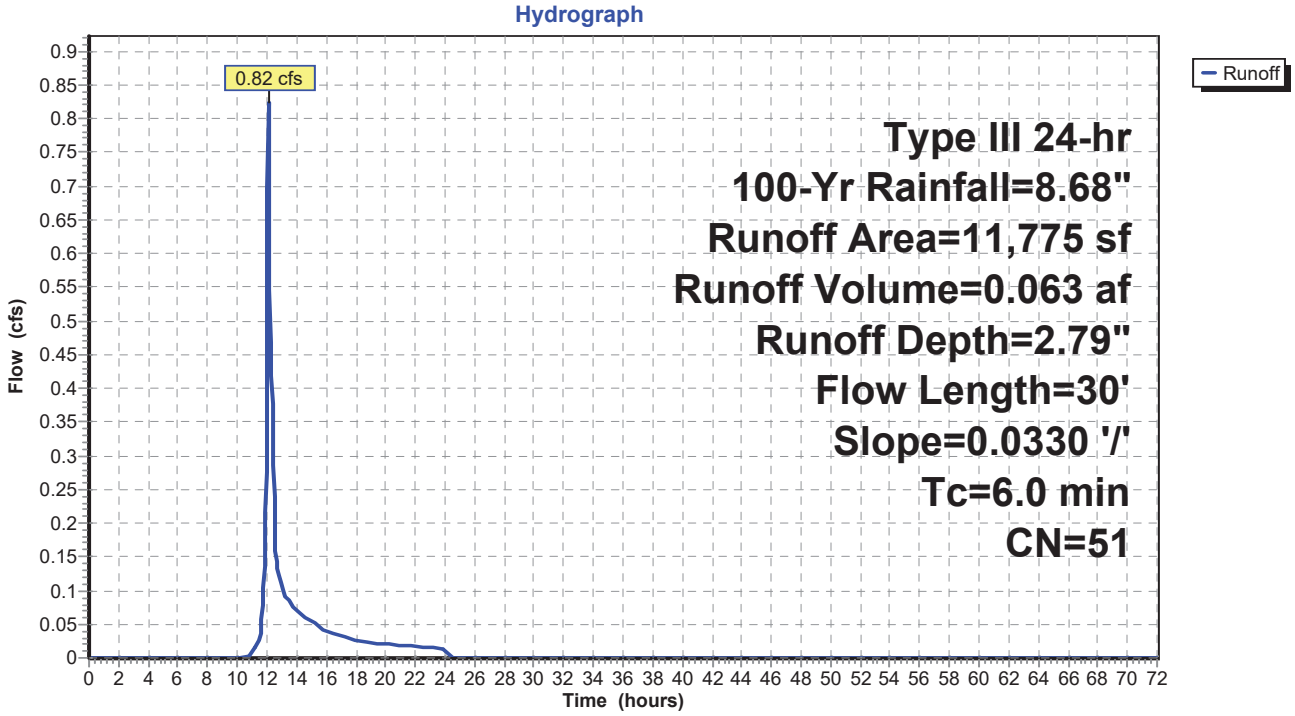
Runoff = 0.82 cfs @ 12.10 hrs, Volume= 0.063 af, Depth= 2.79"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Yr Rainfall=8.68"

Area (sf)	CN	Description
0	30	Woods, Good, HSG A
9,452	39	>75% Grass cover, Good, HSG A
2,323	98	Paved parking, HSG A
0	98	Roofs, HSG A
11,775	51	Weighted Average
9,452		80.27% Pervious Area
2,323		19.73% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
3.0	30	0.0330	0.17		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.34"
3.0	30	Total, Increased to minimum Tc = 6.0 min			

Subcatchment 1S: S-1



Summary for Subcatchment 2S: S-1

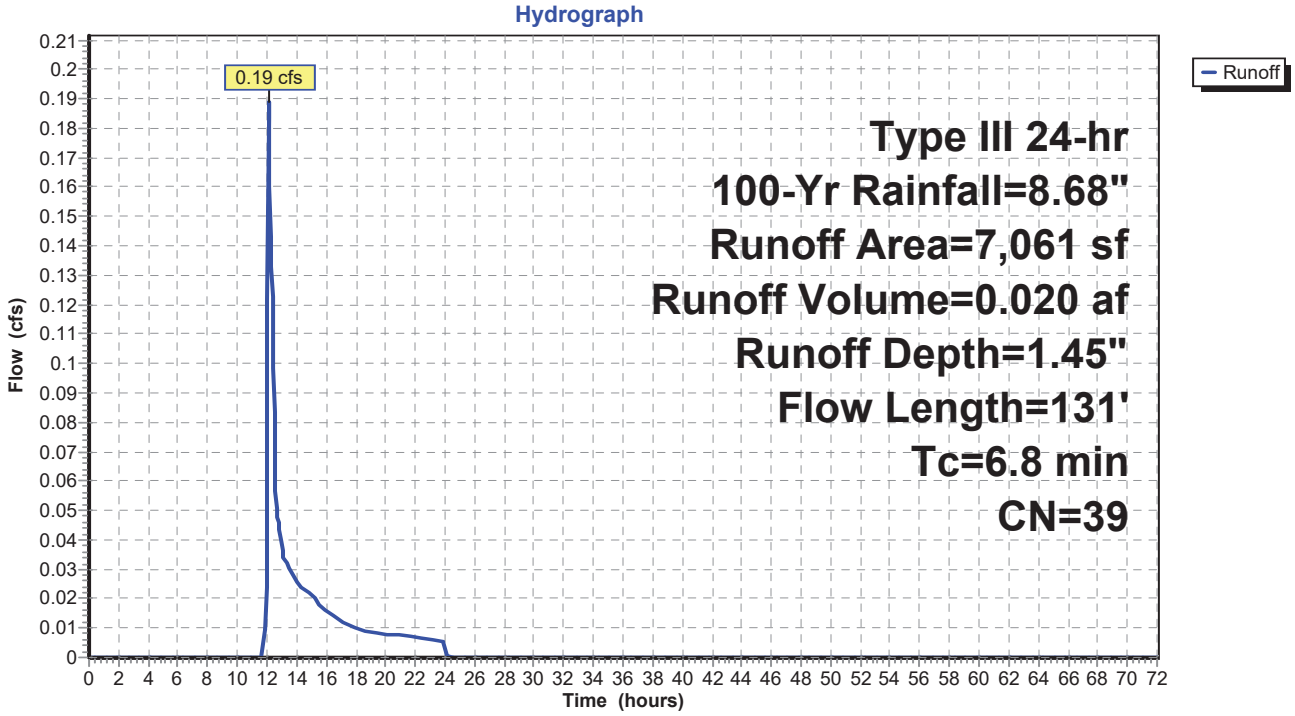
Runoff = 0.19 cfs @ 12.13 hrs, Volume= 0.020 af, Depth= 1.45"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Yr Rainfall=8.68"

Area (sf)	CN	Description
0	30	Woods, Good, HSG A
7,061	39	>75% Grass cover, Good, HSG A
0	98	Paved parking, HSG A
0	98	Roofs, HSG A
7,061	39	Weighted Average
7,061		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.0	50	0.0160	0.14		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.34"
0.8	81	0.0120	1.76		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
6.8	131	Total			

Subcatchment 2S: S-1



Summary for Subcatchment 3S: S-1

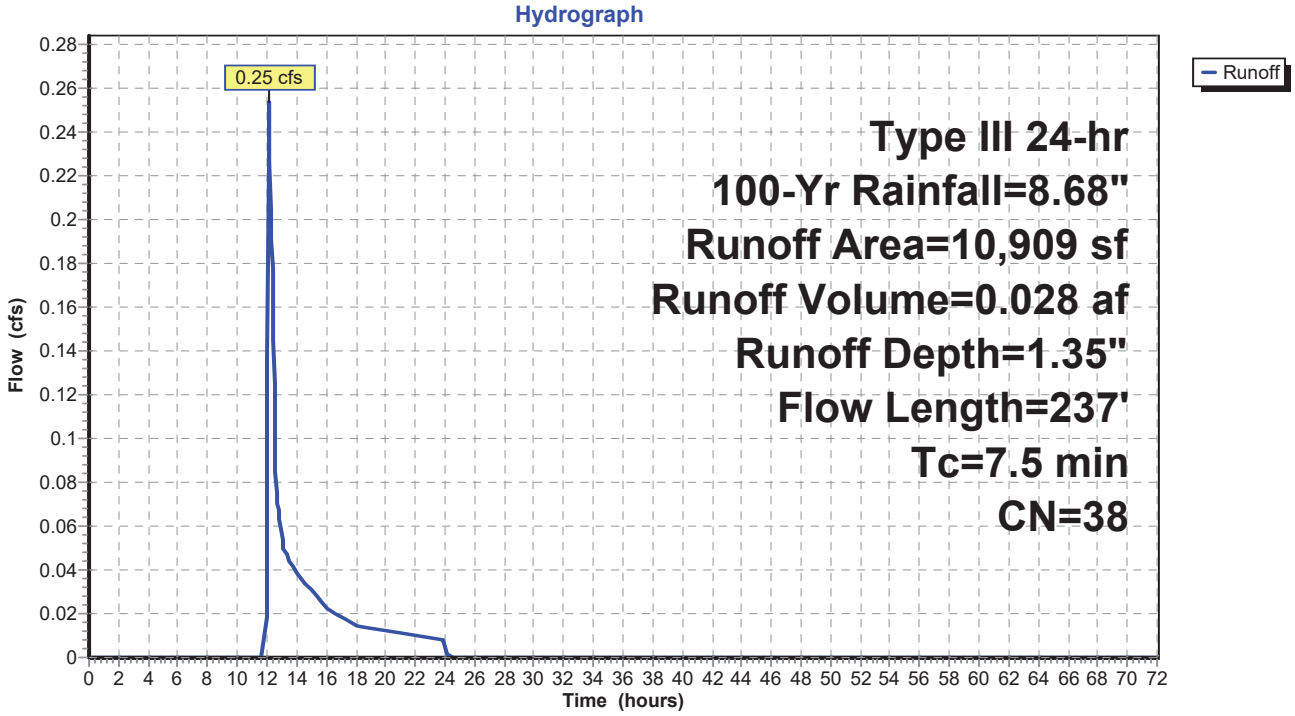
Runoff = 0.25 cfs @ 12.15 hrs, Volume= 0.028 af, Depth= 1.35"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Yr Rainfall=8.68"

Area (sf)	CN	Description
867	30	Woods, Good, HSG A
10,042	39	>75% Grass cover, Good, HSG A
0	98	Paved parking, HSG A
0	98	Roofs, HSG A
10,909	38	Weighted Average
10,909		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
6.1	40	0.0100	0.11		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.34"
1.0	97	0.0100	1.61		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
0.4	100	0.0800	4.55		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
7.5	237	Total			

Subcatchment 3S: S-1



Summary for Subcatchment 4S: S-1

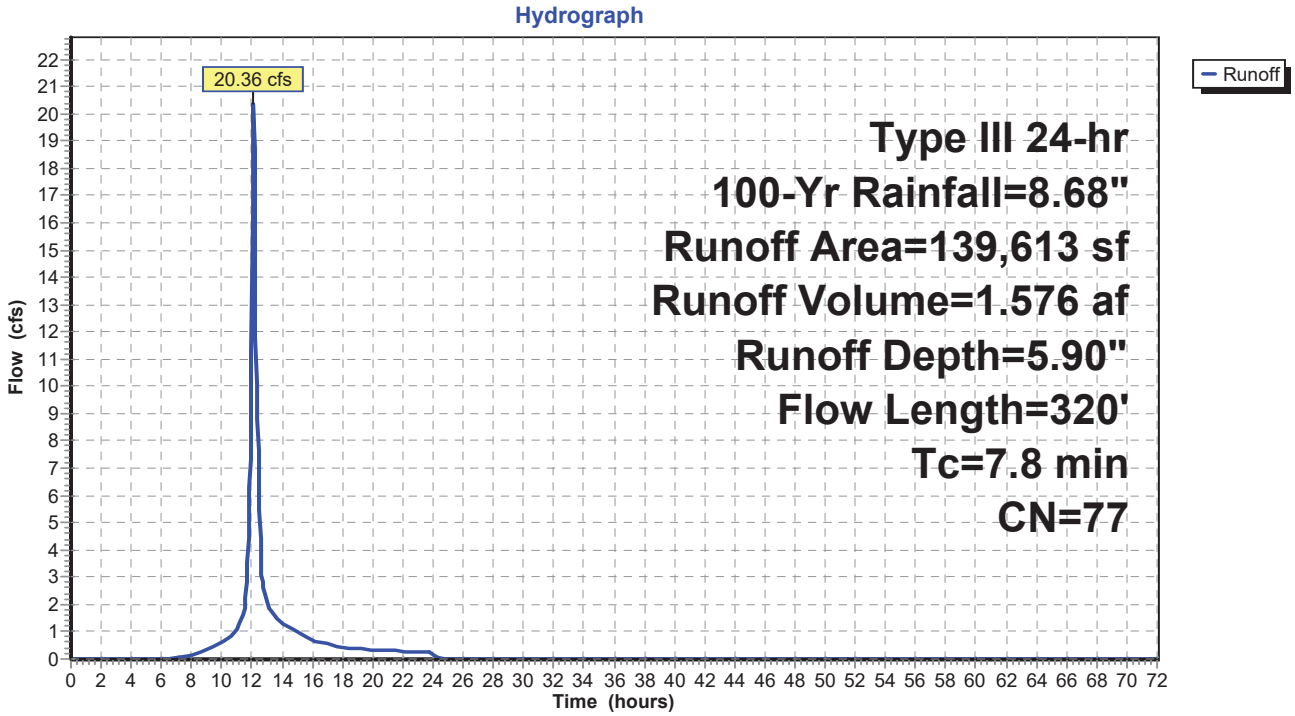
Runoff = 20.36 cfs @ 12.11 hrs, Volume= 1.576 af, Depth= 5.90"

Runoff by SCS TR-20 method, UH=SCS, Weighted-CN, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Type III 24-hr 100-Yr Rainfall=8.68"

Area (sf)	CN	Description
0	30	Woods, Good, HSG A
50,268	39	>75% Grass cover, Good, HSG A
45,338	98	Paved parking, HSG A
44,007	98	Roofs, HSG A
139,613	77	Weighted Average
50,268		36.01% Pervious Area
89,345		63.99% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0	50	0.0250	0.17		**Sheet Flow,** Grass: Short n= 0.150 P2= 3.34"
2.0	155	0.0065	1.30		**Shallow Concentrated Flow,** Unpaved Kv= 16.1 fps
0.8	115	0.0130	2.31		**Shallow Concentrated Flow,** Paved Kv= 20.3 fps
7.8	320	Total			

Subcatchment 4S: S-1

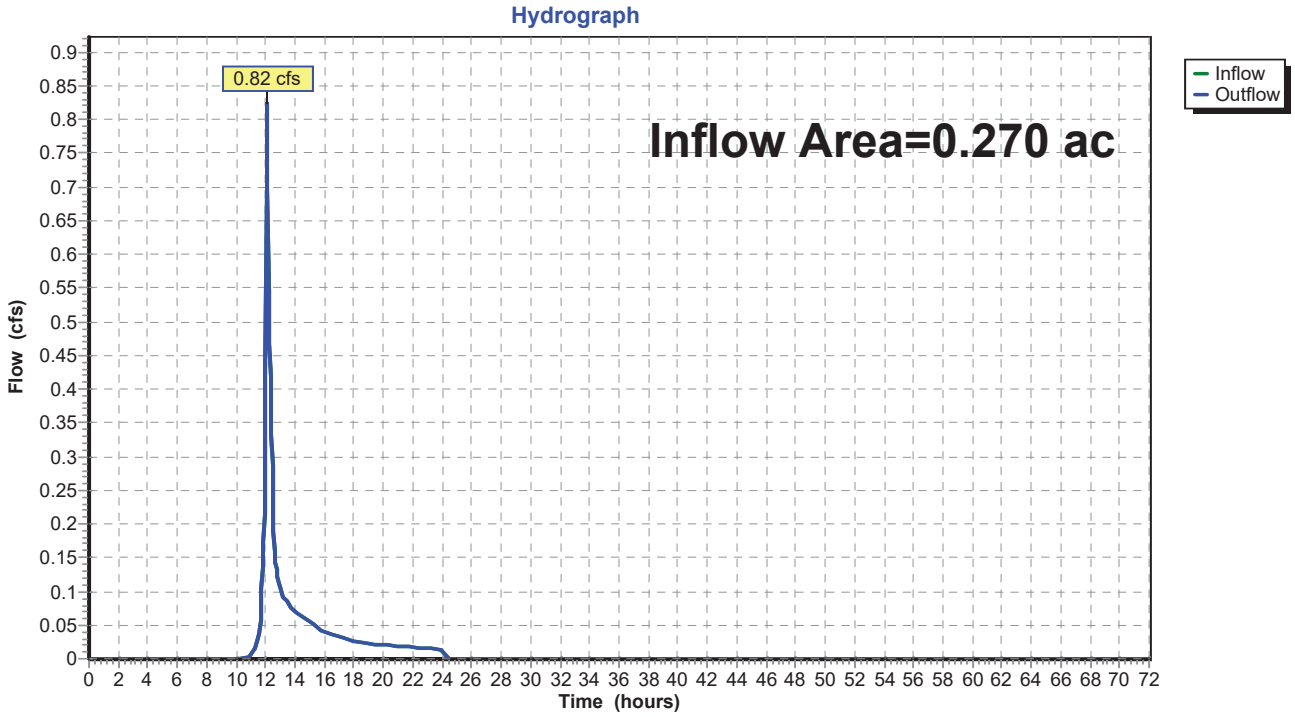


Summary for Reach DP1: Design Point 1

Inflow Area = 0.270 ac, 19.73% Impervious, Inflow Depth = 2.79" for 100-Yr event
Inflow = 0.82 cfs @ 12.10 hrs, Volume= 0.063 af
Outflow = 0.82 cfs @ 12.10 hrs, Volume= 0.063 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

Reach DP1: Design Point 1

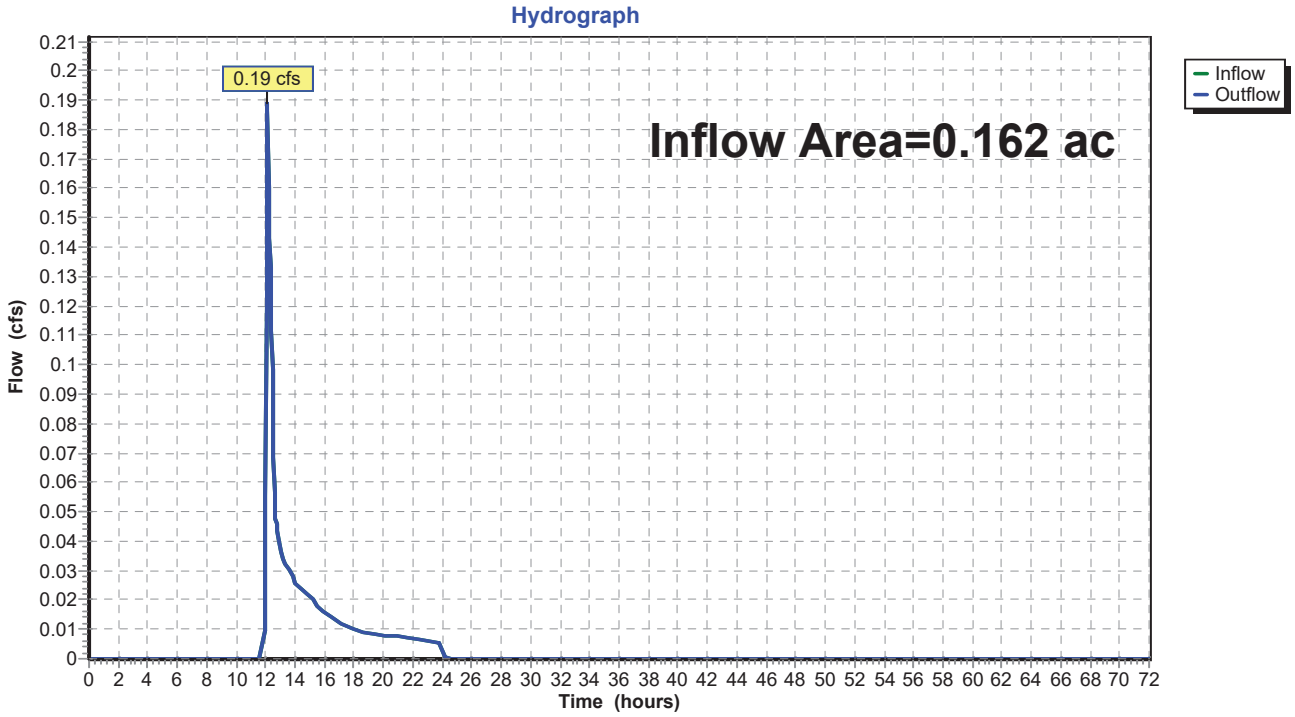


Summary for Reach DP2: Design Point 2

Inflow Area = 0.162 ac, 0.00% Impervious, Inflow Depth = 1.45" for 100-Yr event
Inflow = 0.19 cfs @ 12.13 hrs, Volume= 0.020 af
Outflow = 0.19 cfs @ 12.13 hrs, Volume= 0.020 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

Reach DP2: Design Point 2

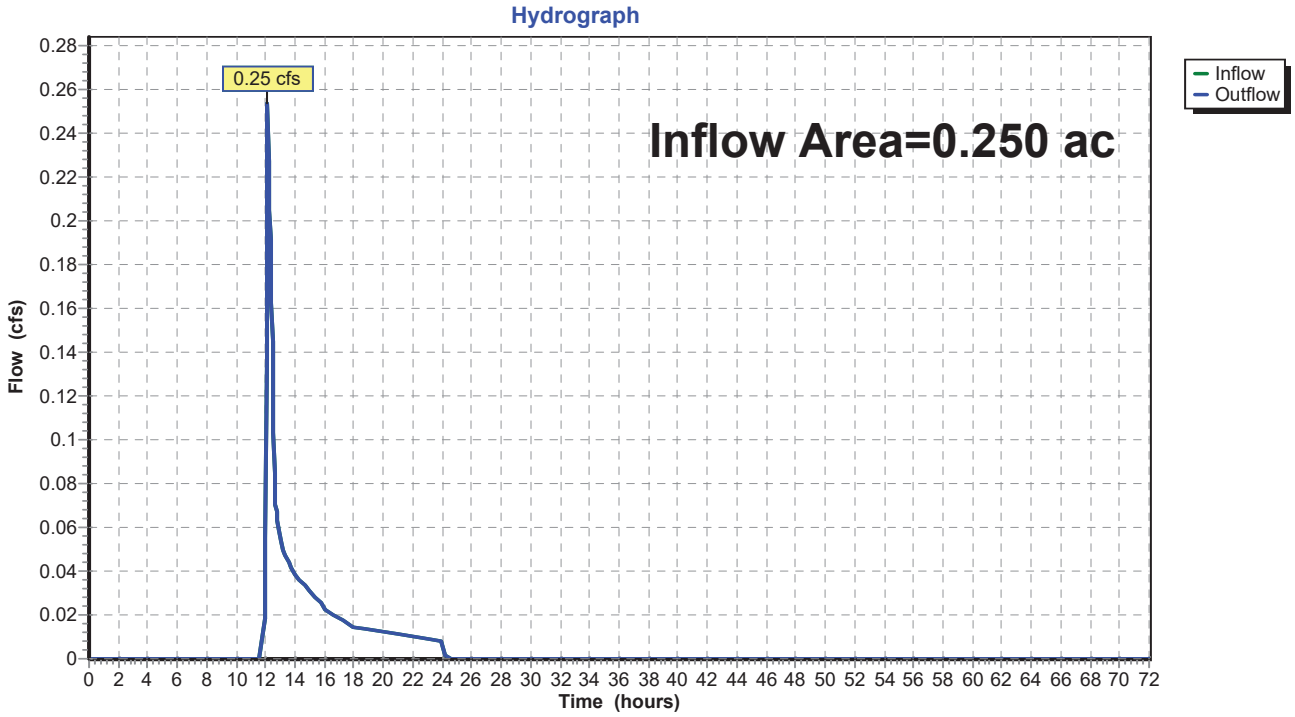


Summary for Reach DP3: Design Point 3

Inflow Area = 0.250 ac, 0.00% Impervious, Inflow Depth = 1.35" for 100-Yr event
Inflow = 0.25 cfs @ 12.15 hrs, Volume= 0.028 af
Outflow = 0.25 cfs @ 12.15 hrs, Volume= 0.028 af, Atten= 0%, Lag= 0.0 min

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs

Reach DP3: Design Point 3



Summary for Pond 1P: Subsurface Chamber Sys

Inflow Area = 3.205 ac, 63.99% Impervious, Inflow Depth = 5.90" for 100-Yr event
Inflow = 20.36 cfs @ 12.11 hrs, Volume= 1.576 af
Outflow = 3.11 cfs @ 12.66 hrs, Volume= 1.577 af, Atten= 85%, Lag= 32.8 min
Discarded = 3.11 cfs @ 12.66 hrs, Volume= 1.577 af

Routing by Dyn-Stor-Ind method, Time Span= 0.00-72.00 hrs, dt= 0.05 hrs
Peak Elev= 170.27' @ 12.66 hrs Surf.Area= 8,066 sf Storage= 23,889 cf

Plug-Flow detention time= (not calculated: outflow precedes inflow)
Center-of-Mass det. time= 66.7 min (874.9 - 808.2)

Volume	Invert	Avail.Storage	Storage Description
#1A	166.00'	10,159 cf	**56.83'W x 141.93'L x 5.25'H Field A** 42,348 cf Overall - 16,951 cf Embedded = 25,397 cf x 40.0% Voids
#2A	166.75'	16,951 cf	**ADS_StormTech MC-3500 d +Cap** x 152 Inside #1 Effective Size= 70.4"W x 45.0"H => 15.33 sf x 7.17'L = 110.0 cf Overall Size= 77.0"W x 45.0"H x 7.50'L with 0.33' Overlap 152 Chambers in 8 Rows Cap Storage= +14.9 cf x 2 x 8 rows = 238.4 cf
		27,110 cf	Total Available Storage

Storage Group A created with Chamber Wizard

Device	Routing	Invert	Outlet Devices
#1	Discarded	166.00'	**8.270 in/hr Exfiltration over Surface area** Conductivity to Groundwater Elevation = 161.80'

Discarded OutFlow Max=3.11 cfs @ 12.66 hrs HW=170.26' (Free Discharge)
└**1=Exfiltration** (Controls 3.11 cfs)

Pond 1P: Subsurface Chamber Sys - Chamber Wizard Field A

Chamber Model = ADS_StormTech MC-3500 d +Cap (ADS StormTech® MC-3500 d rev 03/14 with Cap volume)
Effective Size= 70.4"W x 45.0"H => 15.33 sf x 7.17'L = 110.0 cf
Overall Size= 77.0"W x 45.0"H x 7.50'L with 0.33' Overlap
Cap Storage= +14.9 cf x 2 x 8 rows = 238.4 cf

77.0" Wide + 6.0" Spacing = 83.0" C-C Row Spacing

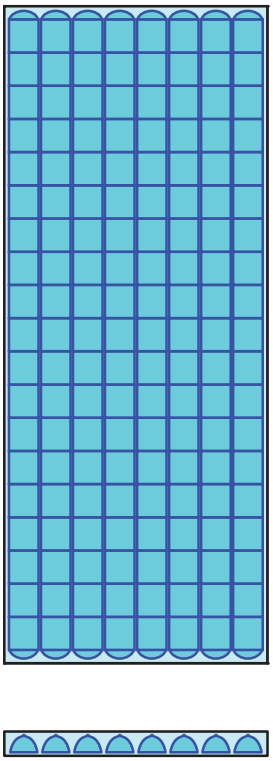
19 Chambers/Row x 7.17' Long +1.85' Cap Length x 2 = 139.93' Row Length +12.0" End Stone x 2 = 141.93' Base Length
8 Rows x 77.0" Wide + 6.0" Spacing x 7 + 12.0" Side Stone x 2 = 56.83' Base Width
9.0" Base + 45.0" Chamber Height + 9.0" Cover = 5.25' Field Height

152 Chambers x 110.0 cf + 14.9 cf Cap Volume x 2 x 8 Rows = 16,951.1 cf Chamber Storage

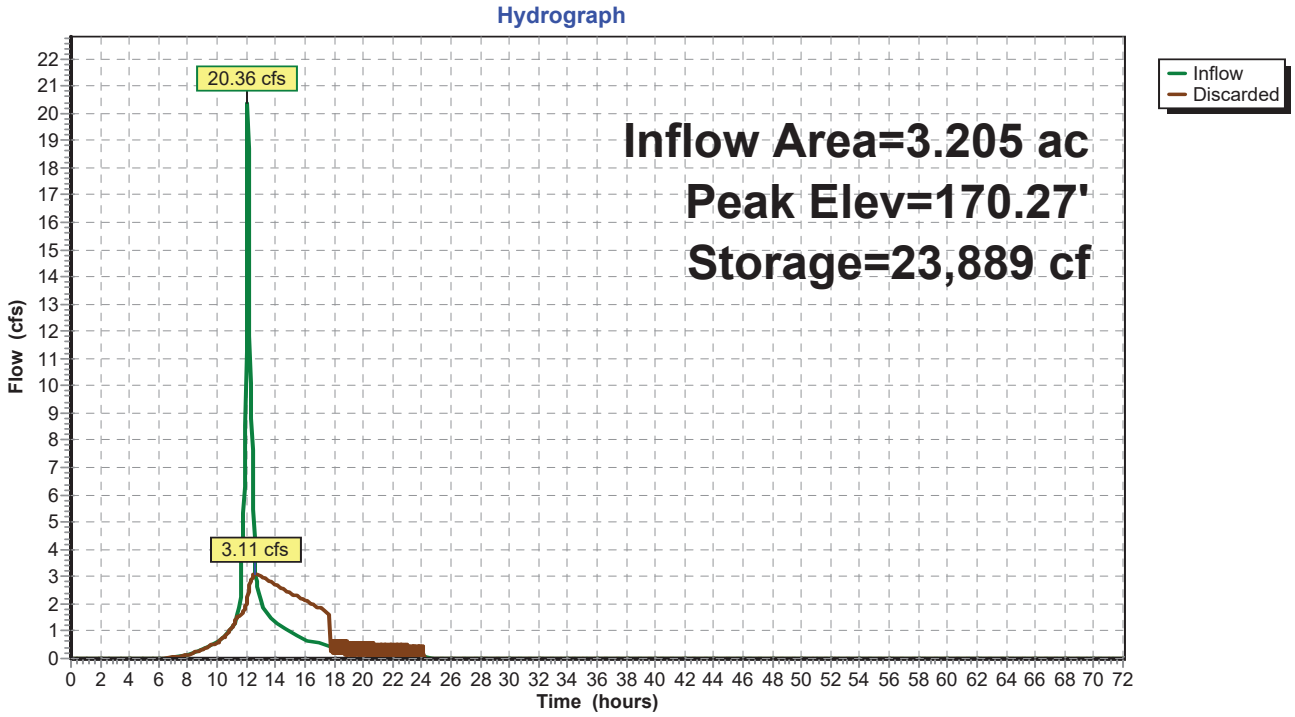
42,348.4 cf Field - 16,951.1 cf Chambers = 25,397.3 cf Stone x 40.0% Voids = 10,158.9 cf Stone Storage

Chamber Storage + Stone Storage = 27,110.0 cf = 0.622 af
Overall Storage Efficiency = 64.0%
Overall System Size = 141.93' x 56.83' x 5.25'

152 Chambers
1,568.5 cy Field
940.6 cy Stone



Pond 1P: Subsurface Chamber Sys



MERRILL ENGINEERS AND LAND SURVEYORS
427 COLUMBIA ROAD, HANOVER, MA. 02339
TEL. (781) 826-9200

JOB	20-127		
SHEET N0.	1	of 2	
CALCULATED BY	JG		
CHECKED BY	DK		4/30/2021

GROUNDWATER RECHARGE VOLUMES (STANDARD #3)

Location: **High Street, Norwell MA**

Total Area (Ac.)=	2.10	(Total impervious watershed area)
Total Impervious Area A Soil (Ac.)=	2.10	
Total Impervious Area B Soil (Ac.)=	0.00	
Total Impervious Area C Soil (Ac.)=	0.00	
Total Impervious Area D Soil (Ac.)=	0.00	Roofs, Drives, Road and Sidewalk

	Vol. To Recharge (inches per Imp. Acre)	Volume (Imp. Area x inches per Acre)
Recharge Volume (A soil)	0.60	1.26
Recharge Volume (B soil)	0.35	0.00
Recharge Volume (C soil)	0.25	0.00
Recharge Volume (D soil)	0.10	0.00

	1.26	AC-IN
Total Required Recharge Volume:	0.105	AC-FT
	4583	C.F.

Recharge volume provided within Infiltration Facilities (basin and subsurface chambers)	**27,110**	C.F.

(Rv will be total storage volume below lowest outlet elevation)

Groundwater Recharge Volume Calculation Per Infiltration System:

Subsurface Infiltration Chamber

Total Impervious Area A Soil (SF.)=	89345	
Total Impervious Area B Soil (SF.)=	0	
Total Impervious Area C Soil (SF.)=	0	
Total Impervious Area D Soil (SF.)=	0	Roofs, Drives, Road and Sidewalk

	Vol. To Recharge (inches per Imp. SF)	Volume (Imp. Area x inches per SF)	
Recharge Volume (A soil)	0.60	53607	SF-IN
Recharge Volume (B soil)	0.35	0	
Recharge Volume (C soil)	0.25	0	
Recharge Volume (D soil)	0.10	0	

Required Recharge Volume:	**4467**	C.F.
Proposed Recharge Volume:	**27,110**	C.F.

Drawdown Calculations for Infiltration Systems:

Drawdown Time = Rv/(k)(basin bottom area) where Rv will be total storage volume below lowest outlet elevation

Subsurface Infiltration System			4.88	< 72 hrs.
	Rv =	27110	cf	
	k=	8.27	in/hr (convert to ft)	
	Bot. Area=	8066	sf	

Minimum Bottom Area Calculation

A = Rv / (D+kT)

Rv = Required Recharge Volume — k = Saturated hydraulic conductivity rate

D = Depth of facility (ft) — T = Allowable drawdown during peak, Use 2 hrs

Subsurface Infiltration System	Rv =	4467	cf	
	D =	5.25		
	k=	8.27	in/hr (convert to ft)	
	T =	2		
	A (Min. Bottom Area) =	674	sf	
	Proposed Bottom Area =	8066	sf	Ok

MERRILL ENGINEERS AND LAND SURVEYORS	JOB	20-127		
427 COLUMBIA ROAD, HANOVER, MA. 02339	SHEET N0.	1	of	1
TEL. (781) 826-9200	CALCULATED BY	JG		
	CHECKED BY	DK		4/30/2021

WATER QUALITY VOLUME (STANDARD #4)

Location: **High Street, Norwell, MA**

Subsurface Chamber System

First Defense Unit (DMH-4):

Proprietary Treatment Unit: Q=(qu)(A)(WQV)

qu for Tc of 8 min.	739	(csm/in)	
Impervious Area: AC*0.0015625mi^2/AC	0.0032	mi^2	2.05 AC
WQV Treated:	1.00	in	
Q (Peak flow rate for 1" WQV):	**2.37**	cfs	
Proposed FD-6HC Max. Treated Flow Rate:	**3.38**	cfs	

Max flow rate = 32 cfs

Volume using: 0.5 or 1.0 inch x Imp. Area (per S.W. Mgmt Policy)

1 inch x Imp. Area **7,445** CF (min)

WQ Treatment within FD Unit = **= included in total system**

Recharge volume provided by Infiltration System = **27,110**

Total Walter Quality Volume Provided = **27,110** CF (Proposed)

Water Quality Volume - Total Site Improvements

Total Impervious Area:

Proposed Roof	1.01	
Proposed Pavement/Sidewalk	1.09	
Total Area:	2.10	AC

Water Quality Volume using: 0.5 or 1.0 inch x Imp. Area (per S.W. Mgmt Policy)

1 inch x Imp. Area **7,623** CF (min)

Total Walter Quality Volume Provided = **27,110** CF

INSTRUCTIONS:
1. In BMP Column, click on Blue Cell to Activate Drop Down Menu
2. Select BMP from Drop Down Menu
3. After BMP is selected, TSS Removal and other Columns are automatically completed.

Version 1, Automated: Mar. 4, 2008

Location: High Street, Norwell MA

TSS Removal Calculation Worksheet

B BMP[1]	C TSS Removal Rate[1]	D Starting TSS Load*	E Amount Removed (C*D)	F Remaining Load (D-E)
Deep Sump and Hooded Catch Basin	**0.25**	**1.00**	**0.25**	**0.75**
Proprietary Treatment Practice	**0.00**	**0.75**	**0.00**	**0.75**
Subsurface Infiltration Structure	**0.80**	**0.75**	**0.60**	**0.15**
	0.00	**0.15**	**0.00**	**0.15**
	0.00	**0.15**	**0.00**	**0.15**

Total TSS Removal = **85%**

Separate Form Needs to be Completed for Each Outlet or BMP Train

Project: 20-127
Prepared By: DWK
Date: 4/30/2021

*Equals remaining load from previous BMP (E) which enters the BMP

Non-automated TSS Calculation Sheet must be used if Proprietary BMP Proposed
1. From MassDEP Stormwater Handbook Vol. 1

TSS Removal Calculation Worksheet

For Pretreatment: Subsurface Chamber System Proj. No.: 20-127
Date: 4/30/2021
Location: Wolcott Woods, Milton MA Computed by: DWK

A BMP	B TSS Removal Rate	C Starting TSS Load*	D Amount Removed (BxC)	E Remaining Load (C-D)
Deep Sump & Hooded Catch Basin	25	1.00	0.25	0.75
First Defense Unit	50	0.75	0.38	0.38

Total TSS Removal= **63%** > 44% Pre-treatment

Notes:
*Starting TSS Load for first BMP= 1.00. TSS load for subsequent BMP's is equal to the Remaining Load (E) from the previous BMP.

First Defense® High Capacity

A Simple Solution for your Trickiest Sites

Verified by NJCAT and NJDEP

Product Profile

The First Defense® High Capacity is an enhanced vortex separator that combines an effective stormwater treatment chamber with an integral peak flow bypass. It efficiently removes sediment total suspended solids (TSS), trash and hydrocarbons from stormwater runoff without washing out previously captured pollutants. The First Defense® High Capacity is available in several model configurations to accommodate a wide range of pipe sizes, peak flows and depth constraints (**Table 1**, next page).

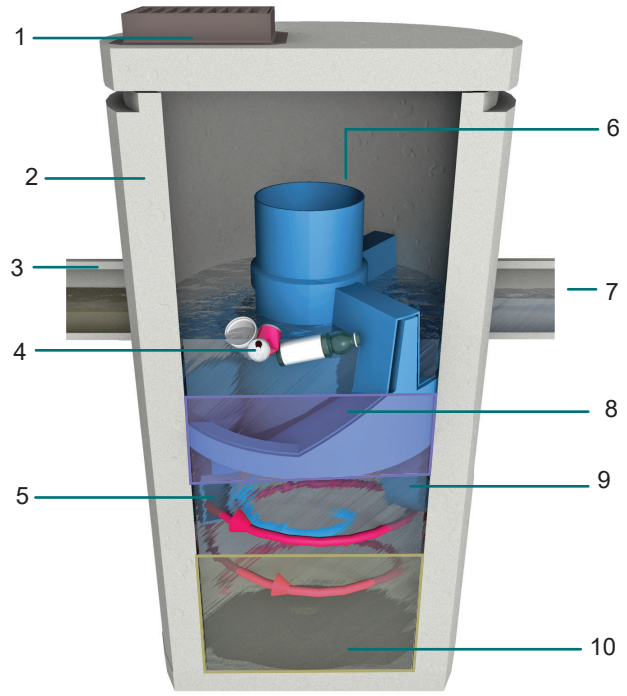
Applications

- Stormwater treatment at the point of entry into the drainage line
- Sites constrained by space, topography or drainage profiles with limited slope and depth of cover
- Retrofit installations where stormwater treatment is placed on or tied into an existing storm drain line
- Pretreatment for filters, infiltration and storage

Advantages

- Inlet options include surface grate or multiple inlet pipes
- Integral high capacity bypass conveys large peak flows without the need for "offline" arrangements using separate junction manholes
- Proven to prevent pollutant washout at up to 450% of its treatment flow
- Long flow path through the device ensures a long residence time within the treatment chamber, enhancing pollutant settling
- Delivered to site pre-assembled and ready for installation

Fig.1 The First Defense® High Capacity has internal components designed to efficiently capture pollutants and prevent washout at peak flows.



Components

1. Inlet Grate (optional)
2. Precast chamber
3. Inlet Pipe (optional)
4. Floatables Draw Off Slot (not pictured)
5. Inlet Chute
6. Internal Bypass
7. Outlet pipe
8. Oil and Floatables Storage
9. Outlet chute
10. Sediment Storage Sump

How it Works

The First Defense® High Capacity has internal components designed to remove and retain gross debris, total suspended solids (TSS) and hydrocarbons (**Fig.1**).

Contaminated stormwater runoff enters the inlet chute from a surface grate and/or inlet pipe. The inlet chute introduces flow into the chamber tangentially to create a low energy vortex flow regime (magenta arrow) that directs sediment into the sump while oils, floating trash and debris rise to the surface.

Treated stormwater exits through a submerged outlet chute located opposite to the direction of the rotating flow (blue arrow). Enhanced vortex separation is provided by forcing the rotating flow within the vessel to follow the longest path possible rather than directly from inlet to outlet.

Higher flows bypass the treatment chamber to prevent turbulence and washout of captured pollutants. An internal bypass conveys infrequent peak flows directly to the outlet eliminating the need for, and expense of, external bypass control structures. A floatables draw off slot functions to convey floatables into the treatment chamber prior to bypass.

Hydro International, 94 Hutchins Drive, Portland, ME 04102
Tel: (207) 756-6200 Fax: (207) 756-6212
Email: stormwaterinquiry@hydro-int.com Web: www.hydro-int.com

First Defense® High Capacity

Sizing & Design

This adaptable online treatment system works easily with large pipes, multiple inlet pipes, inlet grates and now, contains a high capacity bypass for the conveyance of large peak flows. Designed with site flexibility in mind, the First Defense® High Capacity allows engineers to maximize available site space without compromising treatment level.

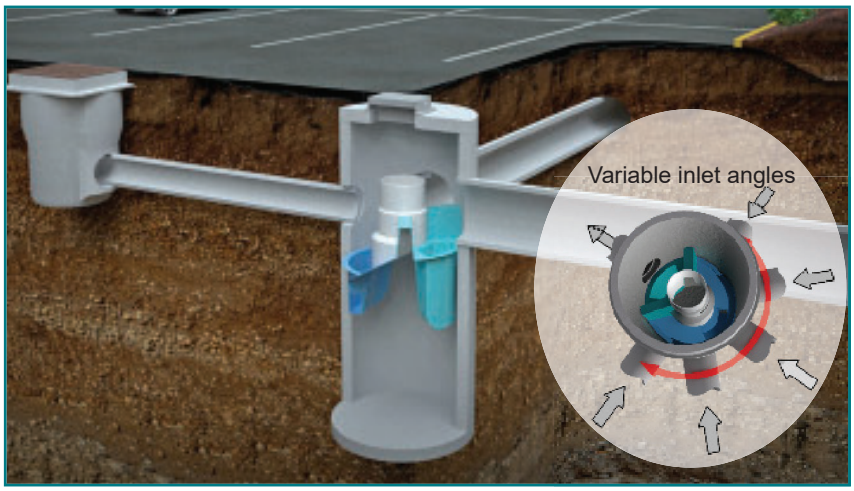


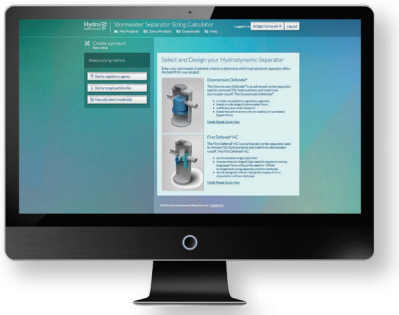
Fig 2. Works with multiple inlet pipes and grates

Inspection and Maintenance

Nobody maintains our systems better than we do. To ensure optimal, ongoing device performance, be sure to recommend Hydro International as a preferred service and maintenance provider to your clients.

Call **1 (800) 848-2706** to schedule an inspection and cleanout or learn more at **hydro-int.com/service**

Sizing Calculator for Engineers



This simple online tool will recommend the best separatror, model size and online/offline arrangement based on site-specific data entered by the user.

Go to hydro-int.com/sizing to access the tool.

Fig 3. Maintenance is done with a vactor truck

Table 1. First Defense® High Capacity Design Criteria.

First Defense® High Capacity Model Number	Diameter	Typical TSS Treatment Flow Rates		Peak Online Flow Rate	Maximum Pipe Diameter[1]	Oil Storage Capacity	Typical Sediment Storage Capacity[2]	Minimum Distance from Outlet Invert to Top of Rim[3]	Standard Distance from Outlet Invert to Sump Floor
		NJDEP Certified	110µm						
	(ft / m)	(cfs / L/s)	(cfs / L/s)	(cfs / L/s)	(in / mm)	(gal / L)	(yd^3 / m^3)	(ft / m)	(ft / m)
FD-3HC	3 / 0.9	0.84 / 23.7	1.06 / 30.0	15 / 424	18 / 457	125 / 473	0.4 / 0.3	2.0 - 3.5 / 0.6 - 1.0	3.71 / 1.13
FD-4HC	4 / 1.2	1.50 / 42.4	1.88 / 53.2	18 / 510	24 / 600	191 / 723	0.7 / 0.5	2.3 - 3.9 / 0.7 - 1.2	4.97 / 1.5
FD-5HC*	5 / 1.5	2.34 / 66.2	2.94 / 83.2	20 / 566	24 / 600	300 / 1135	1.1 / .84	2.5 - 4.5 / 0.7 - 1.3	5.19 / 1.5
FD-6HC	6 / 1.8	3.38 / 95.7	4.23 / 119.8	32 / 906	30 / 750	496 / 1,878	1.6 / 1.2	3.0 - 5.1 / 0.9 - 1.6	5.97 / 1.8
FD-8HC	8 / 2.4	6.00 / 169.9	7.52 / 212.9	50 / 1,415	48 / 1219	1120 / 4239	2.8 / 2.1	3.0 - 6.0 / 0.9 -1.8	7.40 / 2.2

***Coming soon**
[1]Contact Hydro International when larger pipe sizes are required.
[2]Contact Hydro International when custom sediment storage capacity is required.
[3]Minimum distance for models depends on pipe diameter.

Hydro International, 94 Hutchins Drive, Portland, ME 04102
Tel: (207) 756-6200 Fax: (207) 756-6212
Email: stormwaterinquiry@hydro-int.com Web: www.hydro-int.com

Stormwater Solutions
hydro-int.com/firstdefensehc

Center for Environmental Systems
Stevens Institute of Technology
One Castle Point
Hoboken, NJ 07030-0000

January 9, 2016

Titus Magnanao
NJDEP
Division of Water Quality
Bureau of Non-Point Pollution Control
401-02B
PO Box 420
Trenton, NJ 08625-0420

Dear Mr. Magnanao,

Based on my review, evaluation and assessment of the testing conducted on the First Defense® HC (FDHC) Stormwater Treatment Device by Hydro International and observed by FB Environmental Associates, the test protocol requirements contained in the "New Jersey Laboratory Testing Protocol to Assess Total Suspended Solids Removal by a Hydrodynamic Sedimentation Manufactured Treatment Device" (NJDEP HDS Protocol) were met or exceeded. Specifically:

Test Sediment Feed

The mean PSD of Hydro Internationals test sediments comply with the PSD criteria established by the NJDEP HDS protocol. The Hydro International removal efficiency test sediment PSD analysis was plotted against the NJDEP removal efficiency test PSD specification. The test sediment was shown to be slightly finer than the sediment blend specified by the protocol. The Hydro International scour test sediment PSD analysis was plotted against the NJDEP removal efficiency test PSD specification and shown to be much finer than specified by the protocol.

Removal Efficiency Testing

In accordance with the NJDEP HDS Protocol, removal efficiency testing was executed on the 4-ft. laboratory unit in order to establish the ability of the FDHC to remove the specified test sediment at 25%, 50%, 75%, 100% and 125% of the target MTFR. Prior to the start of testing Hydro International reviewed existing data and decided to utilize a target MTFR of 675 gpm (1.50 cfs). This target was chosen based on the ultimate goal of demonstrating greater than 50% annualized weighted solids removal as defined in the NJDEP HDS Protocol. The flow rates, feed rates and influent concentration all met the NJDEP HDS test protocol's coefficient of variance requirements and the background concentration for all five test runs never exceeded 20 mg/L.

Scour Testing

In order to demonstrate the ability of the FDHC to be used as an online treatment device scour testing was conducted at greater than 200% of MTFR in accordance with the NJDEP HDS Protocol. The average flow rate during the online scour test was 3.24 cfs, which represents 216% of the MTFR (MTFR = 1.50 cfs). Background concentrations were 2 mg/L throughout the scour testing, which complies with the 20 mg/L maximum background concentration specified by the test protocol. Unadjusted effluent concentrations ranged from 2 mg/L to 4 mg/L with a mean of 2.1 mg/L. When adjusted for background concentrations, the effluent concentrations range from 0 to 2 mg/L with a mean of 0.1 mg/L. These results confirm that the 4-ft. FDHC did not scour at 216% MTFR and meets the criteria for online use.

Maintenance Frequency

The predicted maintenance frequency for all models is 44 months.

Sincerely,

Richard S. Magee, Sc.D., P.E., BCEE

Stormwater Solutions

Hydro International

Turning Water Around...®

December 21, 2015

Dr. Richard Magee, Sc.D., P.E., BCEE
Technical Director
New Jersey Corporation for Advanced Technology
c/o Center for Environmental Systems
Stevens Institute of Technology
One Castle Point on Hudson
Hoboken, NJ 07030

Re: Verification of First Defense® HC to NJDEP HDS Laboratory Testing Protocol

Dear Dr. Magee:

Hydro International's First Defense® HC (FDHC) vortex separator for stormwater treatment recently underwent verification testing according to the NJDEP HDS Laboratory Testing Protocol. As required by the "Procedure for Obtaining Verification of a Stormwater Manufactured Treatment Device from New Jersey Corporation for Advanced Technology", this letter serves as Hydro International's statement that all procedures and requirements identified in the aforementioned protocol and process document were met or exceeded. The 4-ft FDHC removal efficiency and scour tests conducted at Hydro International's laboratory facility in Portland, Maine were done so under the direct supervision of FB Environmental Associates. All water quality samples were analyzed by the independent analytical lab, Maine Environmental Laboratory. The removal efficiency particle size distribution was analyzed by the independent analytical laboratory, GeoTesting Express. The scour test particle size distribution was analyzed at Hydro International's facility under the supervision of FB Environmental Associates. Additionally, the preparation of the verification report and the documentation contained therein fulfill the submission requirements of the process document and protocol.

If you have any questions or comments regarding the verification of the FDHC, please do not hesitate to contact us.

Sincerely,

Lisa Lemont, CPSWQ
Business Development Manager

Hydro International (Stormwater), 94 Hutchins Drive, Portland ME 04102
Tel: (207) 756-6200 Fax: (207) 756-6212 Web: www.hydro-int.com

Statement of Third Party Observer

STATEMENT OF THIRD PARTY OBSERVER

To: Lisa Lemont, Hydro International, Portland, Maine

From: Forrest Bell, FB Environmental Associates

Subject: Third Party Review under *Procedure for Obtaining Verification of a Stormwater Manufactured Treatment Device from New Jersey Corporation for Advanced Technology* (NJDEP, January 25 2013)[1]

Date: December 31, 2015

cc: Andrew Anastasio, Hydro International; Jeremy Fink, Hydro International
Margaret Burns, FB Environmental Associates

Statement of Third Party Observer

FB Environmental has served as the third-party observer for tests performed by Hydro International in October through December 2015. The tests assessed the First Defense HC Stormwater Treatment Device as a 50% Total Suspended Solids (TSS) removal device under the New Jersey Department of Environmental Protection certification. Tests were performed by Hydro International staff at their laboratory located at 94 Hutchinson Drive in Portland, Maine, to meet the standards described in *Procedure for Obtaining Verification of a Stormwater Manufactured Treatment Device from New Jersey Corporation for Advanced Technology* (NJDEP, January 25 2013)[1]. On May 10, 2014, we also submitted a statement of qualifications, as required by NJCAT MTD process.

A member of our staff verified compliance with the laboratory test protocol above, and our staff member was physically present to observe the full duration of all laboratory testing. We have also reviewed the data, calculations, and conclusions associated with the removal efficiency testing in the *Verification Testing Report for the First Defense® HC Stormwater Treatment Device* by Hydro International, dated December 29, 2015, and state that they conform to what we saw during our supervision as third-party observer.

Forrest Bell

Signed: Date: December 31, 2015

[1] Available at http://www.nj.gov/dep/stormwater/treatment.html

1 of 1

Statement of Disclosure

STATEMENT OF DISCLOSURE – THIRD PARTY OBSERVER

To: Lisa Lemont, Hydro International, Portland, Maine

From: Forrest Bell, FB Environmental Associates

Subject: Third Party Observer Statement of Disclosure under *Procedure for Obtaining Verification of a Stormwater Manufactured Treatment Device from New Jersey Corporation for Advanced Technology* (NJDEP, January 25 2013)[1]

Date: December 31, 2015

cc: Andrew Anastasio, Hydro International
Margaret Burns, FB Environmental Associates

Statement of Disclosure – Third Party Observer

FB Environmental has no financial conflict of interest regarding the test results of the stormwater device testing outlined in the *Verification Testing Report for the First Defense ® HC Stormwater Treatment Device* by Hydro International, dated December 29, 2015.

Disclosure Record

FB Environmental has provided the service of third party observer for tests performed by Hydro International in October through December of 2015. The tests assessed the First Defense HC Stormwater Treatment Device as a 50% Total Suspended Solids (TSS) removal device under the New Jersey Department of Environmental Protection certification as outlined in the *Verification Testing Report for the First Defense ® HC Stormwater Treatment Device* by Hydro International, dated December 29, 2015. Beyond this, FB Environmental and Hydro International have no relationships that would constitute a conflict of interest, as outlined in *Procedure for Obtaining Verification of a Stormwater Manufactured Treatment Device from New Jersey Corporation for Advanced Technology* (NJDEP 2013). For example, we have no ownership stake, do not receive commissions, do not have licensing agreements, and do not receive funds or grants beyond those associated with the testing program.

Forrest Bell

Signed: Date: December 31, 2015

[1] Available at http://www.nj.gov/dep/stormwater/treatment.html

1 of 1

Weighted Runoff Coefficients

Name:	15 High Street Norwell, MA	Proj. No.:	20-127
		Date:	4/30/2021
Client:	Northland Residential Corp	Computed by:	JG
		Checked by:	DK

Description of Area CB1	Area (acres)	Runoff Coefficient	A x C
Impervious	0.024	0.90	0.02
Pervious (G)	0.004	0.30	0.00
Pervious (W)	0.000	0.20	0.00
Totals =	0.028		0.02

Weighted Runoff Coefficient = Σ(AxC) / ΣA = **0.81**

Description of Area CB2	Area (acres)	Runoff Coefficient	A x C
Impervious	0.026	0.90	0.02
Pervious (G)	0.006	0.30	0.00
Pervious (W)	0.000	0.20	0.00
Totals =	0.032		0.03

Weighted Runoff Coefficient = Σ(AxC) / ΣA = **0.79**

Description of Area CB3	Area (acres)	Runoff Coefficient	A x C
Impervious	0.492	0.90	0.44
Pervious (G)	0.936	0.30	0.28
Pervious (W)	0.000	0.20	0.00
Totals =	1.428		0.72

Weighted Runoff Coefficient = Σ(AxC) / ΣA = **0.51**

Description of Area CB4	Area (acres)	Runoff Coefficient	A x C
Impervious	0.204	0.90	0.18
Pervious (G)	0.092	0.30	0.03
Pervious (W)	0.000	0.20	0.00
Totals =	0.296		0.21

Weighted Runoff Coefficient = Σ(AxC) / ΣA = **0.71**

Description of Area CB5	Area (acres)	Runoff Coefficient	A x C
Impervious	0.155	0.90	0.14
Pervious (G)	0.058	0.30	0.02
Pervious (W)	0.000	0.20	0.00
Totals =	0.213		0.16

Weighted Runoff Coefficient = Σ(AxC) / ΣA = **0.74**

Description of Area CB6	Area (acres)	Runoff Coefficient	A x C
Impervious	0.153	0.90	0.14
Pervious (G)	0.082	0.30	0.02
Pervious (W)	0.000	0.20	0.00
Totals =	0.235		0.16

Weighted Runoff Coefficient = Σ(AxC) / ΣA = **0.69**

Time of Concentration

Name:	15 High Street Norwell, MA	Proj. No.:	20-127
		Date:	4/30/2021
Client:	Northland Residential Corp	Computed by:	JG
		Checked by:	DK

CB 1	Slope (%)	Length (feet)	Velocity* (ft/sec)	Travel Time, Tt (L/V) / 60 (min)
Sheet Flow (Impervious)	2.20%	22	-	0.34
Shallow Concentrated Flow (Impervious)	1.20%	36	2.3	0.26
			Time of Concentration, T_c =	0.60
			Use T_c =	6.00

CB 2	Slope (%)	Length (feet)	Velocity* (ft/sec)	Travel Time, Tt (L/V) / 60 (min)
Sheet Flow (Impervious)	1.70%	13	-	3.00
Shallow Concentrated Flow (Impervious)	1.20%	49	2.3	0.36
			Time of Concentration, T_c =	3.36
			Use T_c =	6.00

CB 3	Slope (%)	Length (feet)	Velocity* (ft/sec)	Travel Time, Tt (L/V) / 60 (min)
Sheet Flow (Pervious)	2.50%	50	-	7.56
Shallow Concentrated Flow (Pervious)	0.65%	155	1.4	1.85
Shallow Concentrated Flow (Impervious)	1.30%	115	2.4	0.80
			Time of Concentration, T_c =	10.20
			Use T_c =	10.20

CB 4	Slope (%)	Length (feet)	Velocity* (ft/sec)	Travel Time, Tt (L/V) / 60 (min)
Sheet Flow (Pervious)	1.70%	13	-	3.00
Shallow Concentrated Flow (Imervious)	1.00%	172	2	1.43
			Time of Concentration, T_c =	4.44
			Use T_c =	6.00

CB 5	Slope (%)	Length (feet)	Velocity* (ft/sec)	Travel Time, Tt (L/V) / 60 (min)
Sheet Flow (Pervious)	2.30%	13	-	2.66
Shallow Concentrated Flow (Impervious)	1.00%	192	2	1.60
			Time of Concentration, T_c =	4.26
			Use T_c =	6.00

CB 6	Slope (%)	Length (feet)	Velocity* (ft/sec)	Travel Time, Tt (L/V) / 60 (min)
Sheet Flow (pervious)	1.00%	31	-	7.44
Shallow Concentrated Flow (Impervious)	1.00%	110	2	0.92
			Time of Concentration, T_c =	8.36
			Use T_c =	8.36

Storm Drainage Computations

Name: 15, 19, 27 & 35 High Street
Norwell MA

Client: Northland Residential Corp.

Proj. No.: **20-127**
Date: 4/30/2021
Computed by: **JG**
Checked by: **DK**

Design Parameters:
7 **Year Storm** Boston MA

k_e= **0.5**

DESCRIPTION	LOCATION FROM	LOCATION TO	AREA (AC.)	C	C x A	SUM C x A	FLOW TIME (MIN) PIPE	FLOW TIME (MIN) CONC TIME	i*	DESIGN Q cfs	DESIGN V fps	DESIGN n	DESIGN PIPE SIZE	DESIGN SLOPE	CAPACITY Q full ft^3/s	CAPACITY V full ft/s	PROFILE LENGTH ft	PROFILE FALL ft	PROFILE RIM	PROFILE INV UPPER	PROFILE INV LOWER	PROFILE W.S.E. ft	PROFILE Freeboard ft
	CB 1	DMH1	0.03	0.81	0.02	0.02	0.08	6.0	7.0	0.2	2.1	0.013	12	0.0200	5.0	6.4	10	0.20	174.70	170.70	170.50	170.6	4.1
	CB 2	DMH1	0.03	0.79	0.03	0.03	0.06	6.0	7.0	0.2	2.4	0.013	12	0.0250	5.6	7.2	8	0.20	174.70	170.70	170.50	170.6	4.1
	DMH1	DMH2	0.17	0.90	0.15	0.20	0.98	6.1	7.0	1.4	3.0	0.013	12	0.0062	2.8	3.6	177	1.10	175.00	170.50	169.40	170.4	4.6
	DMH2	DMH3	0.19	0.90	0.17	0.37	0.13	7.1	6.7	2.5	4.1	0.013	12	0.0090	3.4	4.3	33	0.30	173.85	169.40	169.10	169.2	4.7
	CB 3	DMH3	1.43	0.51	0.72	0.72	0.01	10.2	6.0	4.4	8.7	0.013	12	0.0500	8.0	10.1	4	0.20	173.50	169.50	169.30	168.6	4.9
	CB 4	DMH3	0.30	0.71	0.21	0.21	0.11	6.0	7.0	1.5	3.6	0.013	12	0.0100	3.6	4.5	23	0.23	173.50	169.50	169.27	169.3	4.2
	DMH3	DMH4	0.15	0.90	0.13	1.31	0.12	10.2	6.0	7.9	6.7	0.013	15	0.0148	7.9	6.4	47	0.70	173.60	168.85	168.15	168.3	5.3
	DMH4	DMH5	---	---	---	2.07	0.03	10.3	6.0	12.5	7.6	0.013	18	0.0150	12.9	7.3	14	0.21	174.40	167.90	167.69	167.2	7.2
	DMH5	DMH6	---	---	---	2.07	0.03	10.4	6.0	12.5	7.6	0.013	18	0.0150	12.9	7.3	12	0.18	174.70	167.69	167.51	167.0	7.7
	CB 5	DMH 6	0.21	0.74	0.16	0.16	0.19	6.0	7.0	1.1	3.9	0.013	12	0.0158	4.5	5.7	44	0.70	177.50	173.50	172.80	173.3	4.2
	CB 6	DMH6	0.24	0.69	0.16	0.16	0.08	8.4	6.4	1.0	3.5	0.013	12	0.0120	3.9	5.0	16	0.19	177.00	173.00	172.80	172.8	4.2
	DMH7	DMH4	0.50	0.90	0.45	0.76	0.47	8.4	6.4	4.9	6.9	0.013	12	0.0219	5.3	6.7	196	4.29	177.00	172.70	168.40	172.1	4.9

Merrill
Engineers and Land Surveyors

April 22, 2021

Soil Testing Forms for Drainage and Septic Systems

15,19,27 & 35 High Street, Norwell MA

Merrill Engineers- Land Surveyors
427 Columbia Rd., Hanover, MA. 02339
781-826-9200
26 Union St., Plymouth, MA. 02360
508-746-6060

Project No. 20-127

Date: 18-Jun-20
Revision:

Commonwealth of Massachusetts
Norwell , Massachusetts

Soil Suitability Assessment for On-site Sewage Disposal

Performed By: Joshua Green — Test Dates: Thursday, June 18, 2020
Performed By: — Test Dates: Sunday, December 20, 2020
Witnessed By: Ralph Cole — Testhole #:
Witnessed By: — Testhole #:

FACILITY INFORMATION

Site Location:
Builder's lot #:
Street Address: 15,19,27,35 High Street
Town, State, Zip: Norwell, MA
Assessor's Map:

Owner/ Applicant Information:
Name:
Address:
Town, State, Zip:
Telephone no.:

SITE INFORMATION

Construction Type:

New Construction: [X] Repair: [ ] Upgrade: [ ] Drainage: [ ]

Published Soil Survey Available: No: [ ] Yes: [X]

Year Published: 2020 Publication Scale: 1:1,950 a. Soil Map Unit: 420B Drainage Class: B
b. Soil Map Unit: Drainage Class:

Soil Name: a. Canton F.S.L. b. Soil Limitations: None

Surficial Geologic Report Available: No: [ ] Yes: [X]

Year Published: 2018 Publication Scale: 1:24,000

Geological Material/map unit: Coarse Deposits

Landform: Hills, Ridges, Moraines

Flood Insurance Rate Map:

Above 500 year flood boundary? No: [ ] Yes: [X] Within a velocity zone? No: [X] Yes: [ ]

Within 500 year flood boundary? No: [X] Yes: [ ] Within 100 year flood boundary? No: [X] Yes: [ ]

Wetland Area:

National Wetland Inventory Map: (map unit) n/a Name:

Wetlands Conservancy Program Map: (map unit) n/a Name:

Current Water Resource Conditions (USGS): (Month/year) May-2020

Range: Above Normal: [X] Normal: [ ] Below Normal: [ ]

Other References Reviewed:
Comments:

Merrill Engineers Land Surveyors
427 Columbia Rd., Hanover, MA. 02339
26 Union St., Plymouth, MA. 02360

Project No.: 20-127

Date: 6/18/20
Revised:

***Deep Hole #** 20-01
Builder's lot #:
Street Address: 15,19,27,35 High Street
Town: Norwell, MA
Assessor's Map:

DETERMINATION OF HIGH GROUNDWATER ELEVATION

Method Used:

- [X] Depth observed standing in observation hole: A: 210 inches B: ____ inches
- [ ] Depth weeping from side of observation hole: A: ____ inches B: ____ inches
- [ ] Depth to soil mottles: ____ inches
- [ ] Ground water adjustment: ____ inches

Index Well Number: ____ Reading Date: ____ Index well level: ____

Adjustment factor: None Adjustment groundwater level: _

DEPTH OF PERVIOUS MATERIAL

Depth of Naturally Occurring Pervious Material

Does at least four feet of naturally occurring pervious material exist in all areas observed throughout the area proposed for the soil absorption system? Yes: [x] No: [ ]

If yes, at what depth was it observed? Upper Boundary (inches): see logs
Lower Boundary (inches): see logs

CERTIFICATION

I certify that I have passed the soil evaluator examination approved by the Department of Environtmental Protection and that the above analysis was performed by me conistent with the required training, expertise and experience described in 310 CMR 15.017.

Signature of Soil Evaluator: Date: June 18, 2020
Typed or Printed Name of Soil Evaluator: Joshua Green
Date of Soil Evaluator Exam: May 2019

Name of Board of Health Witness: Ralph Cole
Board of Health: Norwell Board of Health

*If applicable, only deep hole with shallowest ESHGW listed.

Merrill Engineers- Land Surveyors
427 Columbia Rd., Hanover, MA. 02339
781-826-9200
26 Union St., Plymouth, MA. 02360
508-746-6060

FORMS 11 AND 12
SOIL EVALUATOR FORM

ON-SITE REVIEW

DEEP HOLE #: 20-01 DATE: 18-Jun-20 TIME: 8:00 WEATHER: Sunny 75°
SITE ADDRESS or MAP/LOT #: 15,19,27,35 High Street Norwell, MA
OWNER: JOB NO.: 20-127
LOCATION (Identify on Plan): GROUND ELEVATION AT SURFACE OF HOLE:

LAND USE: Residential SURFACE STONES: Yes: [ ] No: [X] SLOPE (%): 0-3%

VEGETATION: Lawn LANDFORM: Hills/Moraine
DISTANCES FROM:
OPEN WATER BODY: >100 ft PROPERTY LINE: 45 ft POSSIBLE WET AREA: >100 ft DRAINAGEWAY: >100 ft
DRINKING WATER WELL: >100 ft OTHER:
DEEP OBSERVATION HOLE LOG

Depth (inches)	Soil Hor./ Layer	Soil Texture (USDA)	Soil Color (Munsell)	Redoximorphic Features	Other (Structure, Consistency,% Gravels, Stones, Boulders
0-9	Ap	Loamy Sand	10YR 3/2		Massive, Friable
9-20	Bw	Loamy Sand	10YR 5/6		Massive, Friable
20-210	C	Medium Sand	2.5Y 5/4		Loose, Single Grain, 10% Gravel 10% Stone, Large Boulders present in face of test pit

PARENT MATERIAL: Till Unsuitable Material Present? Yes: [ ] No: [X] If Yes:
Disturbed Soil: [ ] Fill Mat'l: [ ] Impervious Layer(s): [ ] Weathered/Fractured Rock: [ ] Bedrock: [ ]

GROUNDWATER OBSERVED: Yes: [X] No: [ ] If Yes: What is the depth of Groundwater:
Standing in Hole: 210" Weeping from Face: Saturating the Face: Mottling:
Estimated Depth to Seasonal High Ground Water : 210"

PERCOLATION TEST

Percolation Hole #:	20-01		Percolation Hole #:		
Test Date:	6/18/2020		Test Date:		
Depth of Perc:	33"-51"		Depth of Perc:		
Start of Presoak:	8:19 AM		Start of Presoak:		
End of Presoak:	8:26 AM		End of Presoak:		
Time @ 12":			Time @ 12":		
Time @ 9":			Time @ 9":		
Time Elapse:(12"-9")			Time Elapse:(12"-9")		
Time AT 6":			Time AT 6":		
Time Elapse: (9"-6"):			Time Elapse: (9"-6"):		
Rate: (min/in.):	<2 min/in		Rate: (min/in.):		
Test Passed/ Failed/ Discon/ Add. Test Req'd:			Test Passed/ Failed/ Discon/ Add. Testing Req'd:		

Performed By: Joshua Green Witnessed By: Ralph Cole Mach./Oper.: T. A. Iaria
Comments:

An indication that the "site passed" indicates only that the basic criteria for a soil evaluation and percolation test under Title 5 have been met in the area tested. Further soil evaluations and design work are necessary to determine whether a septic system for a particular use, meeting the requirements of Title5 and applicable local bylaws, will in fact be feasible on this site.

An indication that the "site failed" indicates only that the area tested did not meet the minimum criteria (at the time of testing) for a successful soil evaluation and/or percolation test in the area tested. Additional testing at another depth or other areas may result in passing results.

Merrill Engineers- Land Surveyors
427 Columbia Rd., Hanover, MA. 02339
781-826-9200
26 Union St., Plymouth, MA. 02360
508-746-6060

FORMS 11 AND 12
SOIL EVALUATOR FORM

ON-SITE REVIEW

DEEP HOLE #: 20-02 DATE: 18-Jun-20 TIME: 8:35 WEATHER: Sunny 75°
SITE ADDRESS or MAP/LOT #: 15,19,27,35 High Street Norwell, MA
OWNER: JOB NO.: 20-127
LOCATION (Identify on Plan): GROUND ELEVATION AT SURFACE OF HOLE:

LAND USE: Residential SURFACE STONES: Yes: ☐ No: ☒ SLOPE (%): 0-3%

VEGETATION: Lawn LANDFORM: Hills/Moraine
DISTANCES FROM:
OPEN WATER BODY: >100 ft PROPERTY LINE: 45 ft POSSIBLE WET AREA: >100 ft DRAINAGEWAY: >100 ft
DRINKING WATER WELL: >100 ft OTHER:
DEEP OBSERVATION HOLE LOG

Depth (inches)	Soil Hor./ Layer	Soil Texture (USDA)	Soil Color (Munsell)	Redoximorphic Features	Other (Structure, Consistency,% Gravels, Stones, Boulders
0-13	Ap	Loamy Sand	10YR 3/2		Massive, Friable
13-37	Bw	Loamy Sand	10YR 5/6		Massive, Friable
37-144	C	Medium Sand	2.5Y 5/4		Loose, Single Grain, 10% Gravel 10% Stone, Large Boulders present in face of test pit

PARENT MATERIAL: Till Unsuitable Material Present? Yes: ☐ No: ☒ If Yes:
Disturbed Soil: ☐ Fill Mat'l: ☐ Impervious Layer(s): ☐ Weathered/Fractured Rock: ☐ Bedrock: ☐

GROUNDWATER OBSERVED: Yes: ☐ No: ☒ If Yes: What is the depth of Groundwater:
Standing in Hole: Weeping from Face: Saturating the Face: Mottling:
Estimated Depth to Seasonal High Ground Water :

PERCOLATION TEST

Percolation Hole #:	20-02		Percolation Hole #:		
Test Date:	6/18/2020		Test Date:		
Depth of Perc:	34"-52"		Depth of Perc:		
Start of Presoak:	8:38 AM		Start of Presoak:		
End of Presoak:	8:43 AM		End of Presoak:		
Time @ 12":			Time @ 12":		
Time @ 9":			Time @ 9":		
Time Elapse:(12"-9")			Time Elapse:(12"-9")		
Time AT 6":			Time AT 6":		
Time Elapse: (9"-6"):			Time Elapse: (9"-6"):		
Rate: (min/in.):	<2 min/in		Rate: (min/in.):		
Test Passed/ Failed/ Discon/ Add. Test Req'd:			Test Passed/ Failed/ Discon/ Add. Testing Req'd:		

Performed By: Joshua Green Witnessed By: Ralph Cole Mach./Oper.: T. A. Iaria
Comments:

An indication that the "site passed" indicates only that the basic criteria for a soil evaluation and percolation test under Title 5 have been met in the area tested. Further soil evaluations and design work are necessary to determine whether a septic system for a particular use, meeting the requirements of Title5 and applicable local bylaws, will in fact be feasible on this site.

An indication that the "site failed" indicates only that the area tested did not meet the minimum criteria (at the time of testing) for a successful soil evaluation and/or percolation test in the area tested. Additional testing at another depth or other areas may result in passing results.

Merrill Engineers- Land Surveyors
427 Columbia Rd., Hanover, MA. 02339
781-826-9200
26 Union St., Plymouth, MA. 02360
508-746-6060

FORMS 11 AND 12
SOIL EVALUATOR FORM

ON-SITE REVIEW

DEEP HOLE #: 20-03 DATE: 18-Jun-20 TIME: 9:00 WEATHER: Sunny 80°
SITE ADDRESS or MAP/LOT #: 15,19,27,35 High Street Norwell, MA
OWNER: JOB NO.: 20-127
LOCATION (Identify on Plan): GROUND ELEVATION AT SURFACE OF HOLE:

LAND USE: Residential SURFACE STONES: Yes: ☐ No: ☒ SLOPE (%): 0-3%

VEGETATION: Lawn LANDFORM: Hills/Moraine
DISTANCES FROM:
OPEN WATER BODY: >100 ft PROPERTY LINE: 45 ft POSSIBLE WET AREA: >100 ft DRAINAGEWAY: >100 ft
DRINKING WATER WELL: >100 ft OTHER:
DEEP OBSERVATION HOLE LOG

Depth (inches)	Soil Hor./ Layer	Soil Texture (USDA)	Soil Color (Munsell)	Redoximorphic Features	Other (Structure, Consistency,% Gravels, Stones, Boulders
0-8	Ap	Loamy Sand	10YR 3/2		Massive, Friable
8-23	Bw	Loamy Sand	10YR 5/6		Massive, Friable
23-138	C	Medium Sand	2.5Y 5/4		Loose, Single Grain, 10% Gravel 45% Stone, Large Boulders present in face of test pit

PARENT MATERIAL: Till Unsuitable Material Present? Yes: ☐ No: ☒ If Yes:
Disturbed Soil: ☐ Fill Mat'l: ☐ Impervious Layer(s): ☐ Weathered/Fractured Rock: ☐ Bedrock: ☐

GROUNDWATER OBSERVED: Yes: ☐ No: ☒ If Yes: What is the depth of Groundwater:
Standing in Hole: Weeping from Face: Saturating the Face: Mottling:
Estimated Depth to Seasonal High Ground Water :

PERCOLATION TEST

Percolation Hole #:	20-03		Percolation Hole #:		
Test Date:	6/18/2020		Test Date:		
Depth of Perc:	29"-47"		Depth of Perc:		
Start of Presoak:	9:21 AM		Start of Presoak:		
End of Presoak:	9:36 AM		End of Presoak:		
Time @ 12":	9:36 AM		Time @ 12":		
Time @ 9":	9:38 AM		Time @ 9":		
Time Elapse:(12"-9")	2 min		Time Elapse:(12"-9")		
Time AT 6":	9:42 AM		Time AT 6":		
Time Elapse: (9"-6"):	4 min		Time Elapse: (9"-6"):		
Rate: (min/in.):	<2 min/in		Rate: (min/in.):		
Test Passed/ Failed/ Discon/ Add. Test Req'd:			Test Passed/ Failed/ Discon/ Add. Testing Req'd:		

Performed By: Joshua Green Witnessed By: Ralph Cole Mach./Oper.: T. A. Iaria
Comments: This test pit conisted of mostly stone and gravel. The C layer had varying size stones through out and boulders down at the bottom of the test pit.

An indication that the "site passed" indicates only that the basic criteria for a soil evaluation and percolation test under Title 5 have been met in the area tested. Further soil evaluations and design work are necessary to determine whether a septic system for a particular use, meeting the requirements of Title5 and applicable local bylaws, will in fact be feasible on this site.

An indication that the "site failed" indicates only that the area tested did not meet the minimum criteria (at the time of testing) for a successful soil evaluation and/or percolation test in the area tested. Additional testing at another depth or other areas may result in passing results.

Merrill Engineers- Land Surveyors
427 Columbia Rd., Hanover, MA. 02339
781-826-9200
26 Union St., Plymouth, MA. 02360
508-746-6060

FORMS 11 AND 12
SOIL EVALUATOR FORM

ON-SITE REVIEW

DEEP HOLE #: 20-04 DATE: 18-Jun-20 TIME: 10:00 WEATHER: Sunny 75°
SITE ADDRESS or MAP/LOT #: 15,19,27,35 High Street Norwell, MA
OWNER: JOB NO.: 20-127
LOCATION (Identify on Plan): GROUND ELEVATION AT SURFACE OF HOLE:

LAND USE: Residential SURFACE STONES: Yes: ☐ No: ☒ SLOPE (%): 0-3%

VEGETATION: Lawn LANDFORM: Hills/Moraine
DISTANCES FROM:
OPEN WATER BODY: >100 ft PROPERTY LINE: 45 ft POSSIBLE WET AREA: >100 ft DRAINAGEWAY: >100 ft
DRINKING WATER WELL: >100 ft OTHER:
DEEP OBSERVATION HOLE LOG

Depth (inches)	Soil Hor./ Layer	Soil Texture (USDA)	Soil Color (Munsell)	Redoximorphic Features	Other (Structure, Consistency,% Gravels, Stones, Boulders
0-7	Ap	Loamy Sand	10YR 3/2		Massive, Friable
7-26	Bw	Loamy Sand	10YR 5/6		Massive, Friable
26-127	C1	Medium Sand	2.5Y 5/4		Loose, Single Grain, 10% Gravel 10% Stone, Large Boulders present in face of test pit
127-150	C2	Medium Sand	2.5Y 5/4		Clean Sand layer, No stones present 0-2% gravel

PARENT MATERIAL: Till Unsuitable Material Present? Yes: ☐ No: ☒ If Yes:
Disturbed Soil: ☐ Fill Mat'l: ☐ Impervious Layer(s): ☐ Weathered/Fractured Rock: ☐ Bedrock: ☐

GROUNDWATER OBSERVED: Yes: ☐ No: ☒ If Yes: What is the depth of Groundwater:
Standing in Hole: Weeping from Face: Saturating the Face: Mottling:
Estimated Depth to Seasonal High Ground Water :

PERCOLATION TEST

Percolation Hole #:	20-04		Percolation Hole #:		
Test Date:	6/18/2020		Test Date:		
Depth of Perc:	27"-45"		Depth of Perc:		
Start of Presoak:	10:05 AM		Start of Presoak:		
End of Presoak:	10:12 AM		End of Presoak:		
Time @ 12":			Time @ 12":		
Time @ 9":			Time @ 9":		
Time Elapse:(12"-9")			Time Elapse:(12"-9")		
Time AT 6":			Time AT 6":		
Time Elapse: (9"-6"):			Time Elapse: (9"-6"):		
Rate: (min/in.):	<2 min/in		Rate: (min/in.):		
Test Passed/ Failed/ Discon/ Add. Test Req'd:			Test Passed/ Failed/ Discon/ Add. Testing Req'd:		

Performed By: Joshua Green Witnessed By: Ralph Cole Mach./Oper.: T. A. Iaria
Comments:

An indication that the "site passed" indicates only that the basic criteria for a soil evaluation and percolation test under Title 5 have been met in the area tested. Further soil evaluations and design work are necessary to determine whether a septic system for a particular use, meeting the requirements of Title5 and applicable local bylaws, will in fact be feasible on this site.

An indication that the "site failed" indicates only that the area tested did not meet the minimum criteria (at the time of testing) for a successful soil evaluation and/or percolation test in the area tested. Additional testing at another depth or other areas may result in passing results.

Merrill Engineers- Land Surveyors
427 Columbia Rd., Hanover, MA. 02339
781-826-9200
26 Union St., Plymouth, MA. 02360
508-746-6060

FORMS 11 AND 12
SOIL EVALUATOR FORM

ON-SITE REVIEW

DEEP HOLE #: D1 DATE: 18-Jun-20 TIME: 10:20 WEATHER: Sunny 80°
SITE ADDRESS or MAP/LOT #: 15,19,27,35 High Street Norwell, MA
OWNER: JOB NO.: 20-127
LOCATION (Identify on Plan): GROUND ELEVATION AT SURFACE OF HOLE:

LAND USE: Residential SURFACE STONES: Yes: ☐ No: ☒ SLOPE (%): 0-3%

VEGETATION: Lawn LANDFORM: Hills/Moraine
DISTANCES FROM:
OPEN WATER BODY: >100 ft PROPERTY LINE: 100 ft POSSIBLE WET AREA: >100 ft DRAINAGEWAY: >100 ft
DRINKING WATER WELL: >100 ft OTHER:
DEEP OBSERVATION HOLE LOG

Depth (inches)	Soil Hor./ Layer	Soil Texture (USDA)	Soil Color (Munsell)	Redoximorphic Features	Other (Structure, Consistency,% Gravels, Stones, Boulders
0-8	Ap	Loamy Sand	10YR 3/3		Massive, Friable
8-24	Bw	Loamy Sand	10YR 5/6		Massive, Friable
24-150	C	Sand	2.5Y 5/3		Loose Single Grain, pockets firm in face of of test pit, 10% Gravel 10% Stone

PARENT MATERIAL: Till Unsuitable Material Present? Yes: ☐ No: ☒ If Yes:
Disturbed Soil: ☐ Fill Mat'l: ☐ Impervious Layer(s): ☐ Weathered/Fractured Rock: ☐ Bedrock: ☐

GROUNDWATER OBSERVED: Yes: ☐ No: ☒ If Yes: What is the depth of Groundwater:
Standing in Hole: Weeping from Face: Saturating the Face: Mottling:
Estimated Depth to Seasonal High Ground Water :

PERCOLATION TEST

Percolation Hole #:			Percolation Hole #:		
Test Date:			Test Date:		
Depth of Perc:			Depth of Perc:		
Start of Presoak:			Start of Presoak:		
End of Presoak:			End of Presoak:		
Time @ 12":			Time @ 12":		
Time @ 9":			Time @ 9":		
Time Elapse:(12"-9")			Time Elapse:(12"-9")		
Time AT 6":			Time AT 6":		
Time Elapse: (9"-6"):			Time Elapse: (9"-6"):		
Rate: (min/in.):			Rate: (min/in.):		
Test Passed/ Failed/ Discon/ Add. Test Req'd:			Test Passed/ Failed/ Discon/ Add. Testing Req'd:		

Performed By: Joshua Green Witnessed By: Ralph Cole Mach./Oper.: T. A. Iaria
Comments:

An indication that the "site passed" indicates only that the basic criteria for a soil evaluation and percolation test under Title 5 have been met in the area tested. Further soil evaluations and design work are necessary to determine whether a septic system for a particular use, meeting the requirements of Title5 and applicable local bylaws, will in fact be feasible on this site.

An indication that the "site failed" indicates only that the area tested did not meet the minimum criteria (at the time of testing) for a successful soil evaluation and/or percolation test in the area tested. Additional testing at another depth or other areas may result in passing results.

Merrill Engineers- Land Surveyors
427 Columbia Rd., Hanover, MA. 02339
781-826-9200
26 Union St., Plymouth, MA. 02360
508-746-6060

FORMS 11 AND 12
SOIL EVALUATOR FORM

ON-SITE REVIEW

DEEP HOLE #: D2 DATE: 18-Jun-20 TIME: 10:40 WEATHER: Sunny 80°
SITE ADDRESS or MAP/LOT #: 15,19,27,35 High Street Norwell, MA
OWNER: JOB NO.: 20-127
LOCATION (Identify on Plan): GROUND ELEVATION AT SURFACE OF HOLE:

LAND USE: Residential SURFACE STONES: Yes: ☐ No: ☒ SLOPE (%): 0-3%

VEGETATION: Lawn LANDFORM: Hills/Moraine
DISTANCES FROM:
OPEN WATER BODY: >100 ft PROPERTY LINE: 100 ft POSSIBLE WET AREA: >100 ft DRAINAGEWAY: >100 ft
DRINKING WATER WELL: >100 ft OTHER:
DEEP OBSERVATION HOLE LOG

Depth (inches)	Soil Hor./ Layer	Soil Texture (USDA)	Soil Color (Munsell)	Redoximorphic Features	Other (Structure, Consistency,% Gravels, Stones, Boulders
0-10	Ap	Loamy Sand	10YR 3/2		Massive, Friable
10-18	Bw	Loamy Sand	10YR 4/6		Massive, Friable
18-80	C1	Sand	2.5Y 5/4		Loose, Single Grain, 10% Gravel 10% Stone
80-100	Cd	Loamy Sand	2.5Y 6/2		Massive, Friable 10% Gravel 5% Stone

PARENT MATERIAL: Till Unsuitable Material Present? Yes: ☐ No: ☒ If Yes:
Disturbed Soil: ☐ Fill Mat'l: ☐ Impervious Layer(s): ☐ Weathered/Fractured Rock: ☐ Bedrock: ☐

GROUNDWATER OBSERVED: Yes: ☐ No: ☒ If Yes: What is the depth of Groundwater:
Standing in Hole: Weeping from Face: Saturating the Face: Mottling:
Estimated Depth to Seasonal High Ground Water :

PERCOLATION TEST

Percolation Hole #:			Percolation Hole #:		
Test Date:			Test Date:		
Depth of Perc:			Depth of Perc:		
Start of Presoak:			Start of Presoak:		
End of Presoak:			End of Presoak:		
Time @ 12":			Time @ 12":		
Time @ 9":			Time @ 9":		
Time Elapse:(12"-9")			Time Elapse:(12"-9")		
Time AT 6":			Time AT 6":		
Time Elapse: (9"-6"):			Time Elapse: (9"-6"):		
Rate: (min/in.):			Rate: (min/in.):		
Test Passed/ Failed/ Discon/ Add. Test Req'd:			Test Passed/ Failed/ Discon/ Add. Testing Req'd:		

Performed By: Joshua Green Witnessed By: Ralph Cole Mach./Oper.: T. A. Iaria
Comments:

An indication that the "site passed" indicates only that the basic criteria for a soil evaluation and percolation test under Title 5 have been met in the area tested. Further soil evaluations and design work are necessary to determine whether a septic system for a particular use, meeting the requirements of Title5 and applicable local bylaws, will in fact be feasible on this site.

An indication that the "site failed" indicates only that the area tested did not meet the minimum criteria (at the time of testing) for a successful soil evaluation and/or percolation test in the area tested. Additional testing at another depth or other areas may result in passing results.

Merrill Engineers- Land Surveyors
427 Columbia Rd., Hanover, MA. 02339
781-826-9200
26 Union St., Plymouth, MA. 02360
508-746-6060

FORMS 11 AND 12
SOIL EVALUATOR FORM

ON-SITE REVIEW

DEEP HOLE #: D3 DATE: 18-Jun-20 TIME: 11:10 WEATHER: Sunny 80°
SITE ADDRESS or MAP/LOT #: 15,19,27,35 High Street Norwell, MA
OWNER: JOB NO.: 20-127
LOCATION (Identify on Plan): GROUND ELEVATION AT SURFACE OF HOLE:

LAND USE: Residential SURFACE STONES: Yes: ☐ No: ☒ SLOPE (%): 0-3%

VEGETATION: Lawn LANDFORM: Hills/Moraine
DISTANCES FROM:
OPEN WATER BODY: >100 ft PROPERTY LINE: 100 ft POSSIBLE WET AREA: >100 ft DRAINAGEWAY: >100 ft
DRINKING WATER WELL: >100 ft OTHER:
DEEP OBSERVATION HOLE LOG

Depth (inches)	Soil Hor./ Layer	Soil Texture (USDA)	Soil Color (Munsell)	Redoximorphic Features	Other (Structure, Consistency,% Gravels, Stones, Boulders
0-7	Ap	Loamy Sand	10YR 3/3		Massive, Friable
7-20	Bw	Loamy Sand	10YR 5/6		Massive, Friable
20-84	C1	Sand	2.5Y 5/4		Loose, Single Grain, 10% Gravel 10% Stone
84-108	C2	Medium Sand	2.5Y 5/2		Loose, Single Grain, 5% Gravel 2% Stone
108-124	Cd	Loamy Sand	2.5Y 5/2		Massive, Firm, 10% Gravel 10% Stone

PARENT MATERIAL: Till Unsuitable Material Present? Yes: ☐ No: ☒ If Yes:
Disturbed Soil: ☐ Fill Mat'l: ☐ Impervious Layer(s): ☐ Weathered/Fractured Rock: ☐ Bedrock: ☐

GROUNDWATER OBSERVED: Yes: ☐ No: ☒ If Yes: What is the depth of Groundwater:
Standing in Hole: Weeping from Face: Saturating the Face: Mottling:
Estimated Depth to Seasonal High Ground Water :

PERCOLATION TEST

Percolation Hole #:			Percolation Hole #:		
Test Date:			Test Date:		
Depth of Perc:			Depth of Perc:		
Start of Presoak:			Start of Presoak:		
End of Presoak:			End of Presoak:		
Time @ 12":			Time @ 12":		
Time @ 9":			Time @ 9":		
Time Elapse:(12"-9")			Time Elapse:(12"-9")		
Time AT 6":			Time AT 6":		
Time Elapse: (9"-6"):			Time Elapse: (9"-6"):		
Rate: (min/in.):			Rate: (min/in.):		
Test Passed/ Failed/ Discon/ Add. Test Req'd:			Test Passed/ Failed/ Discon/ Add. Testing Req'd:		

Performed By: Joshua Green Witnessed By: Ralph Cole Mach./Oper.: T. A. Iaria
Comments:

An indication that the "site passed" indicates only that the basic criteria for a soil evaluation and percolation test under Title 5 have been met in the area tested. Further soil evaluations and design work are necessary to determine whether a septic system for a particular use, meeting the requirements of Title5 and applicable local bylaws, will in fact be feasible on this site.

An indication that the "site failed" indicates only that the area tested did not meet the minimum criteria (at the time of testing) for a successful soil evaluation and/or percolation test in the area tested. Additional testing at another depth or other areas may result in passing results.

Merrill Engineers- Land Surveyors
427 Columbia Rd., Hanover, MA. 02339
781-826-9200
26 Union St., Plymouth, MA. 02360
508-746-6060

FORMS 11 AND 12
SOIL EVALUATOR FORM

ON-SITE REVIEW

DEEP HOLE #: D4 DATE: 10-Dec-20 TIME: WEATHER:
SITE ADDRESS or MAP/LOT #: 15,19,27,35 High Street Norwell, MA
OWNER: JOB NO.: 20-127
LOCATION (Identify on Plan): GROUND ELEVATION AT SURFACE OF HOLE:

LAND USE: Residential SURFACE STONES: Yes: ☐ No: ☒ SLOPE (%): 0-3%

VEGETATION: Lawn LANDFORM: Hills/Moraine
DISTANCES FROM:
OPEN WATER BODY: >100 ft PROPERTY LINE: 100 ft POSSIBLE WET AREA: >100 ft DRAINAGEWAY: >100 ft
DRINKING WATER WELL: >100 ft OTHER:
DEEP OBSERVATION HOLE LOG

Depth (inches)	Soil Hor./ Layer	Soil Texture (USDA)	Soil Color (Munsell)	Redoximorphic Features	Other (Structure, Consistency,% Gravels, Stones, Boulders
0-8	Ap	Loamy Sand	10YR 3/2		Massive, Friable
8-27	Bw	Loamy Sand	10YR 5/6		Massive, Friable
27-108	C1	Medium Sand	2.5Y 5/4		Loose, Single Grain, 15% Gravel 10% Stone
108-216	C2	Medium Sand	2.5Y 6/3		Loose, Single Grain, 10% Gravel 5% Stone

PARENT MATERIAL: Till Unsuitable Material Present? Yes: ☐ No: ☒ If Yes:
Disturbed Soil: ☐ Fill Mat'l: ☐ Impervious Layer(s): ☐ Weathered/Fractured Rock: ☐ Bedrock: ☐

GROUNDWATER OBSERVED: Yes: ☐ No: ☒ If Yes: What is the depth of Groundwater:
Standing in Hole: - Weeping from Face: - Saturating the Face: - Mottling: -
Estimated Depth to Seasonal High Ground Water :

PERCOLATION TEST

Percolation Hole #:			Percolation Hole #:		
Test Date:			Test Date:		
Depth of Perc:			Depth of Perc:		
Start of Presoak:			Start of Presoak:		
End of Presoak:			End of Presoak:		
Time @ 12":			Time @ 12":		
Time @ 9":			Time @ 9":		
Time Elapse:(12"-9")			Time Elapse:(12"-9")		
Time AT 6":			Time AT 6":		
Time Elapse: (9"-6"):			Time Elapse: (9"-6"):		
Rate: (min/in.):			Rate: (min/in.):		
Test Passed/ Failed/ Discon/ Add. Test Req'd:			Test Passed/ Failed/ Discon/ Add. Testing Req'd:		

Performed By: Joshua Green Witnessed By: Ralph Cole Mach./Oper.: T. A. Iaria
Comments:

An indication that the "site passed" indicates only that the basic criteria for a soil evaluation and percolation test under Title 5 have been met in the area tested. Further soil evaluations and design work are necessary to determine whether a septic system for a particular use, meeting the requirements of Title5 and applicable local bylaws, will in fact be feasible on this site.

An indication that the "site failed" indicates only that the area tested did not meet the minimum criteria (at the time of testing) for a successful soil evaluation and/or percolation test in the area tested. Additional testing at another depth or other areas may result in passing results.

Merrill Engineers- Land Surveyors
427 Columbia Rd., Hanover, MA. 02339
781-826-9200
26 Union St., Plymouth, MA. 02360
508-746-6060

FORMS 11 AND 12
SOIL EVALUATOR FORM

ON-SITE REVIEW

DEEP HOLE #: D5 DATE: 10-Dec-20 TIME: WEATHER:
SITE ADDRESS or MAP/LOT #: 15,19,27,35 High Street Norwell, MA
OWNER: JOB NO.: 20-127
LOCATION (Identify on Plan): GROUND ELEVATION AT SURFACE OF HOLE:

LAND USE: Residential SURFACE STONES: Yes: ☐ No: ☒ SLOPE (%): 0-3%

VEGETATION: Lawn LANDFORM: Hills/Moraine
DISTANCES FROM:
OPEN WATER BODY: >100 ft PROPERTY LINE: 100 ft POSSIBLE WET AREA: >100 ft DRAINAGEWAY: >100 ft
DRINKING WATER WELL: >100 ft OTHER:
DEEP OBSERVATION HOLE LOG

Depth (inches)	Soil Hor./ Layer	Soil Texture (USDA)	Soil Color (Munsell)	Redoximorphic Features	Other (Structure, Consistency,% Gravels, Stones, Boulders
0-7	Ap	Loamy Sand	10YR 3/2		Massive, Friable
7-21	Bw	Loamy Sand	10YR 5/6		Massive, Friable
21-98	C1	Medium Sand	2.5Y 5/4		Loose, Single Grain, 15% Gravel 5% Stone
98-180	C2	Medium Sand	2.5Y 5/4		Loose, Single Grain, 10% Gravel 5% Stone

PARENT MATERIAL: Till Unsuitable Material Present? Yes: ☐ No: ☒ If Yes:
Disturbed Soil: ☐ Fill Mat'l: ☐ Impervious Layer(s): ☐ Weathered/Fractured Rock: ☐ Bedrock: ☐

GROUNDWATER OBSERVED: Yes: ☐ No: ☒ If Yes: What is the depth of Groundwater:
Standing in Hole: - Weeping from Face: - Saturating the Face: - Mottling: -
Estimated Depth to Seasonal High Ground Water :

PERCOLATION TEST

Percolation Hole #:			Percolation Hole #:		
Test Date:			Test Date:		
Depth of Perc:			Depth of Perc:		
Start of Presoak:			Start of Presoak:		
End of Presoak:			End of Presoak:		
Time @ 12":			Time @ 12":		
Time @ 9":			Time @ 9":		
Time Elapse:(12"-9")			Time Elapse:(12"-9")		
Time AT 6":			Time AT 6":		
Time Elapse: (9"-6"):			Time Elapse: (9"-6"):		
Rate: (min/in.):			Rate: (min/in.):		
Test Passed/ Failed/ Discon/ Add. Test Req'd:			Test Passed/ Failed/ Discon/ Add. Testing Req'd:		

Performed By: Joshua Green Witnessed By: Ralph Cole Mach./Oper.: T. A. Iaria
Comments: Less defined difference between C1 and C2.

An indication that the "site passed" indicates only that the basic criteria for a soil evaluation and percolation test under Title 5 have been met in the area tested. Further soil evaluations and design work are necessary to determine whether a septic system for a particular use, meeting the requirements of Title5 and applicable local bylaws, will in fact be feasible on this site.

An indication that the "site failed" indicates only that the area tested did not meet the minimum criteria (at the time of testing) for a successful soil evaluation and/or percolation test in the area tested. Additional testing at another depth or other areas may result in passing results.

Merrill Engineers- Land Surveyors
427 Columbia Rd., Hanover, MA. 02339
781-826-9200
26 Union St., Plymouth, MA. 02360
508-746-6060

FORMS 11 AND 12
SOIL EVALUATOR FORM

ON-SITE REVIEW

DEEP HOLE #: 20-05 DATE: 10-Dec-20 TIME: WEATHER:
SITE ADDRESS or MAP/LOT #: 15,19,27,35 High Street Norwell, MA
OWNER: JOB NO.: 20-127
LOCATION (Identify on Plan): GROUND ELEVATION AT SURFACE OF HOLE:

LAND USE: Residential SURFACE STONES: Yes: ☐ No: ☒ SLOPE (%): 0-3%

VEGETATION: Lawn LANDFORM: Hills/Moraine

DISTANCES FROM:
OPEN WATER BODY: >100 ft PROPERTY LINE: 100 ft POSSIBLE WET AREA: >100 ft DRAINAGEWAY: >100 ft
DRINKING WATER WELL: >100 ft OTHER:

DEEP OBSERVATION HOLE LOG

Depth (inches)	Soil Hor./ Layer	Soil Texture (USDA)	Soil Color (Munsell)	Redoximorphic Features	Other (Structure, Consistency,% Gravels, Stones, Boulders
0-7	Ap	Loamy Sand	10YR 3/2		Massive, Granular
7-25	Bw	Loamy Sand	10YR 5/6		Massive, Friable
25-84	C1	Medium Sand	2.5Y 5/4		Loose, Single Grain, 15% Gravel 5% Stone
84-156	C2	Medium Sand	2.5Y 6/3		Loose, Single Grain, 10% Gravel 5% Stone

PARENT MATERIAL: Till Unsuitable Material Present? Yes: ☐ No: ☒ If Yes:
Disturbed Soil: ☐ Fill Mat'l: ☐ Impervious Layer(s): ☐ Weathered/Fractured Rock: ☐ Bedrock: ☐

GROUNDWATER OBSERVED: Yes: ☐ No: ☒ If Yes: What is the depth of Groundwater:
Standing in Hole: - Weeping from Face: - Saturating the Face: - Mottling: -
Estimated Depth to Seasonal High Ground Water :

PERCOLATION TEST

Percolation Hole #:	5		Percolation Hole #:		
Test Date:	12/10/2020		Test Date:		
Depth of Perc:	45"-63"		Depth of Perc:		
Start of Presoak:	9:18 AM		Start of Presoak:		
End of Presoak:	9:24 AM		End of Presoak:		
Time @ 12":	24 gal		Time @ 12":		
Time @ 9":			Time @ 9":		
Time Elapse:(12"-9")			Time Elapse:(12"-9")		
Time AT 6":			Time AT 6":		
Time Elapse: (9"-6"):			Time Elapse: (9"-6"):		
Rate: (min/in.):	52 min/in		Rate: (min/in.):		
Test Passed/ Failed/ Discon/ Add. Test Req'd:			Test Passed/ Failed/ Discon/ Add. Testing Req'd:		

Performed By: Joshua Green Witnessed By: Ralph Cole Mach./Oper.: T. A. Iaria
Comments:

An indication that the "site passed" indicates only that the basic criteria for a soil evaluation and percolation test under Title 5 have been met in the area tested. Further soil evaluations and design work are necessary to determine whether a septic system for a particular use, meeting the requirements of Title5 and applicable local bylaws, will in fact be feasible on this site.

An indication that the "site failed" indicates only that the area tested did not meet the minimum criteria (at the time of testing) for a successful soil evaluation and/or percolation test in the area tested. Additional testing at another depth or other areas may result in passing results.

Merrill Engineers- Land Surveyors
427 Columbia Rd., Hanover, MA. 02339
781-826-9200
26 Union St., Plymouth, MA. 02360
508-746-6060

FORMS 11 AND 12
SOIL EVALUATOR FORM

ON-SITE REVIEW

DEEP HOLE #: 20-06 DATE: 10-Dec-20 TIME: WEATHER:
SITE ADDRESS or MAP/LOT #: 15,19,27,35 High Street Norwell, MA
OWNER: JOB NO.: 20-127
LOCATION (Identify on Plan): GROUND ELEVATION AT SURFACE OF HOLE:

LAND USE: Residential SURFACE STONES: Yes: ☐ No: ☒ SLOPE (%): 0-3%

VEGETATION: Lawn LANDFORM: Hills/Moraine
DISTANCES FROM:
OPEN WATER BODY: >100 ft PROPERTY LINE: 100 ft POSSIBLE WET AREA: >100 ft DRAINAGEWAY: >100 ft
DRINKING WATER WELL: >100 ft OTHER:
DEEP OBSERVATION HOLE LOG

Depth (inches)	Soil Hor./ Layer	Soil Texture (USDA)	Soil Color (Munsell)	Redoximorphic Features	Other (Structure, Consistency,% Gravels, Stones, Boulders
0-6	Ap	Loamy Sand	10YR 3/2		Massive, Granular
6-18	Bw	Loamy Sand	10YR 5/6		Massive, Friable
18-80	C1	Medium Sand	2.5Y 5/4		25% Gravel 15% Stone
68-80	C2	Loamy Sand	10YR 5/4		0%-0% Massive
80-176	C2	Medium Sand	2.5Y 6/3		10% Gravel 5% Stone

PARENT MATERIAL: Till Unsuitable Material Present? Yes: ☐ No: ☒ If Yes:
Disturbed Soil: ☐ Fill Mat'l: ☐ Impervious Layer(s): ☐ Weathered/Fractured Rock: ☐ Bedrock: ☐

GROUNDWATER OBSERVED: Yes: ☐ No: ☒ If Yes: What is the depth of Groundwater:
Standing in Hole: 176 weeping Weeping from Face: - Saturating the Face: - Mottling: -
Estimated Depth to Seasonal High Ground Water :

PERCOLATION TEST

Percolation Hole #:	6		Percolation Hole #:		
Test Date:	12/10/2020		Test Date:		
Depth of Perc:	48"-66"		Depth of Perc:		
Start of Presoak:	9:54 AM		Start of Presoak:		
End of Presoak:			End of Presoak:		
Time @ 12":	10:09 AM		Time @ 12":		
Time @ 9":	10:22 AM		Time @ 9":		
Time Elapse:(12"-9")	13		Time Elapse:(12"-9")		
Time AT 6":	10:36 AM		Time AT 6":		
Time Elapse: (9"-6"):	14		Time Elapse: (9"-6"):		
Rate: (min/in.):	5		Rate: (min/in.):		
Test Passed/ Failed/ Discon/ Add. Test Req'd:			Test Passed/ Failed/ Discon/ Add. Testing Req'd:		

Performed By: Joshua Green Witnessed By: Ralph Cole Mach./Oper.: T. A. Iaria
Comments:

An indication that the "site passed" indicates only that the basic criteria for a soil evaluation and percolation test under Title 5 have been met in the area tested. Further soil evaluations and design work are necessary to determine whether a septic system for a particular use, meeting the requirements of Title5 and applicable local bylaws, will in fact be feasible on this site.

An indication that the "site failed" indicates only that the area tested did not meet the minimum criteria (at the time of testing) for a successful soil evaluation and/or percolation test in the area tested. Additional testing at another depth or other areas may result in passing results.

Merrill Engineers- Land Surveyors
427 Columbia Rd., Hanover, MA. 02339
781-826-9200
26 Union St., Plymouth, MA. 02360
508-746-6060

FORMS 11 AND 12
SOIL EVALUATOR FORM

ON-SITE REVIEW

DEEP HOLE #: 20-07 DATE: 10-Dec-20 TIME: WEATHER:
SITE ADDRESS or MAP/LOT #: 15,19,27,35 High Street Norwell, MA
OWNER: JOB NO.: 20-127
LOCATION (Identify on Plan): GROUND ELEVATION AT SURFACE OF HOLE:

LAND USE: Residential SURFACE STONES: Yes: ☐ No: ☒ SLOPE (%): 0-3%

VEGETATION: Lawn LANDFORM: Hills/Moraine
DISTANCES FROM:
OPEN WATER BODY: >100 ft PROPERTY LINE: 100 ft POSSIBLE WET AREA: >100 ft DRAINAGEWAY: >100 ft
DRINKING WATER WELL: >100 ft OTHER:
DEEP OBSERVATION HOLE LOG

Depth (inches)	Soil Hor./ Layer	Soil Texture (USDA)	Soil Color (Munsell)	Redoximorphic Features	Other (Structure, Consistency,% Gravels, Stones, Boulders
0-8	Ap	Loamy Sand	10YR 3/2		Massive, Granular
8-28	Bw	Loamy Sand	10YR 5/6		Massive, Friable
28-96	C1	Medium Sand	2.5Y 5/4		Friable, 15% Gravel 5% Stone
96-200	C2	Medium Sand	2.5Y 6/3		Friable, 10% Gravel 5% Stone

PARENT MATERIAL: Till Unsuitable Material Present? Yes: ☐ No: ☒ If Yes:
Disturbed Soil: ☐ Fill Mat'l: ☐ Impervious Layer(s): ☐ Weathered/Fractured Rock: ☐ Bedrock: ☐

GROUNDWATER OBSERVED: Yes: ☐ No: ☒ If Yes: What is the depth of Groundwater:
Standing in Hole: - Weeping from Face: - Saturating the Face: - Mottling: -
Estimated Depth to Seasonal High Ground Water :

PERCOLATION TEST

Percolation Hole #:	7		Percolation Hole #:		
Test Date:	12/10/2020		Test Date:		
Depth of Perc:	38"-56"		Depth of Perc:		
Start of Presoak:	11:20 AM		Start of Presoak:		
End of Presoak:	11:26 AM		End of Presoak:		
Time @ 12":			Time @ 12":		
Time @ 9":			Time @ 9":		
Time Elapse:(12"-9")	24		Time Elapse:(12"-9")		
Time AT 6":			Time AT 6":		
Time Elapse: (9"-6"):			Time Elapse: (9"-6"):		
Rate: (min/in.):	<2 min		Rate: (min/in.):		
Test Passed/ Failed/ Discon/ Add. Test Req'd:			Test Passed/ Failed/ Discon/ Add. Testing Req'd:		

Performed By: Joshua Green Witnessed By: Ralph Cole Mach./Oper.: T. A. Iaria
Comments:

An indication that the "site passed" indicates only that the basic criteria for a soil evaluation and percolation test under Title 5 have been met in the area tested. Further soil evaluations and design work are necessary to determine whether a septic system for a particular use, meeting the requirements of Title5 and applicable local bylaws, will in fact be feasible on this site.

An indication that the "site failed" indicates only that the area tested did not meet the minimum criteria (at the time of testing) for a successful soil evaluation and/or percolation test in the area tested. Additional testing at another depth or other areas may result in passing results.

Merrill Engineers- Land Surveyors
427 Columbia Rd., Hanover, MA. 02339
781-826-9200
26 Union St., Plymouth, MA. 02360
508-746-6060

FORMS 11 AND 12
SOIL EVALUATOR FORM

ON-SITE REVIEW

DEEP HOLE #: 20-08 DATE: 10-Dec-20 TIME: WEATHER:
SITE ADDRESS or MAP/LOT #: 15,19,27,35 High Street Norwell, MA
OWNER: JOB NO.: 20-127
LOCATION (Identify on Plan): GROUND ELEVATION AT SURFACE OF HOLE:

LAND USE: Residential SURFACE STONES: Yes: ☐ No: ☒ SLOPE (%): 0-3%

VEGETATION: Lawn LANDFORM: Hills/Moraine
DISTANCES FROM:
OPEN WATER BODY: >100 ft PROPERTY LINE: 100 ft POSSIBLE WET AREA: >100 ft DRAINAGEWAY: >100 ft
DRINKING WATER WELL: >100 ft OTHER:
DEEP OBSERVATION HOLE LOG

Depth (inches)	Soil Hor./ Layer	Soil Texture (USDA)	Soil Color (Munsell)	Redoximorphic Features	Other (Structure, Consistency,% Gravels, Stones, Boulders
0-8	Ap	Loamy Sand	10YR 3/2		Massive, Granular
8-20	Bw	Loamy Sand	10YR 5/6		Massive, Friable
20-101	C1	Medium Sand	2.5Y 5/4		15% Gravel 5% Stone
101-204	C2	Medium Sand	2.5Y 6/3		10% Gravel 5% Stone

PARENT MATERIAL: Till Unsuitable Material Present? Yes: ☐ No: ☒ If Yes:
Disturbed Soil: ☐ Fill Mat'l: ☐ Impervious Layer(s): ☐ Weathered/Fractured Rock: ☐ Bedrock: ☐

GROUNDWATER OBSERVED: Yes: ☐ No: ☒ If Yes: What is the depth of Groundwater:
Standing in Hole: - Weeping from Face: - Saturating the Face: - Mottling: -
Estimated Depth to Seasonal High Ground Water :

PERCOLATION TEST

Percolation Hole #:	8		Percolation Hole #:		
Test Date:	12/10/2020		Test Date:		
Depth of Perc:	38"-56"		Depth of Perc:		
Start of Presoak:	11:52 AM		Start of Presoak:		
End of Presoak:	11:59 AM		End of Presoak:		
Time @ 12":			Time @ 12":		
Time @ 9":			Time @ 9":		
Time Elapse:(12"-9")			Time Elapse:(12"-9")		
Time AT 6":			Time AT 6":		
Time Elapse: (9"-6"):			Time Elapse: (9"-6"):		
Rate: (min/in.):	<2 min		Rate: (min/in.):		
Test Passed/ Failed/ Discon/ Add. Test Req'd:			Test Passed/ Failed/ Discon/ Add. Testing Req'd:		

Performed By: Joshua Green Witnessed By: Ralph Cole Mach./Oper.: T. A. Iaria
Comments:

An indication that the "site passed" indicates only that the basic criteria for a soil evaluation and percolation test under Title 5 have been met in the area tested. Further soil evaluations and design work are necessary to determine whether a septic system for a particular use, meeting the requirements of Title5 and applicable local bylaws, will in fact be feasible on this site.

An indication that the "site failed" indicates only that the area tested did not meet the minimum criteria (at the time of testing) for a successful soil evaluation and/or percolation test in the area tested. Additional testing at another depth or other areas may result in passing results.

Merrill Engineers- Land Surveyors
427 Columbia Rd., Hanover, MA. 02339
781-826-9200
26 Union St., Plymouth, MA. 02360
508-746-6060

Project No.: 19-055

Date: 8/7/20
Revised:

PROBABLE HIGH GROUNDWATER LEVELS IN MASSACHUSETTS

FACILITY INFORMATION

Site Location:		Owner/ Applicant Information:	
Builder's lot #:		Name:	985 Plain Street Realty Trust
Street Address:	985 Plain Street	Address:	40 Lone Street
Town, State, Zip:	Marshfield, MA 02050	Town, State, Zip:	Marshfield, MA 02050
Assessor's Map:	C10	Telephone no.:	

REFERENCE:

Probable High Groundwater Levels in Massachusetts
U.S. Geological Survey
Water Resource and Investigation
Open File Report 80 - 1205

FIELD DATA:

Date of Test/ Reading:
Use Test Area:

Ground Elevation =	176.80
Depth of Water =	14.70
Observed Water Table Elev=	162.10

REFERENCE WELL DATA:

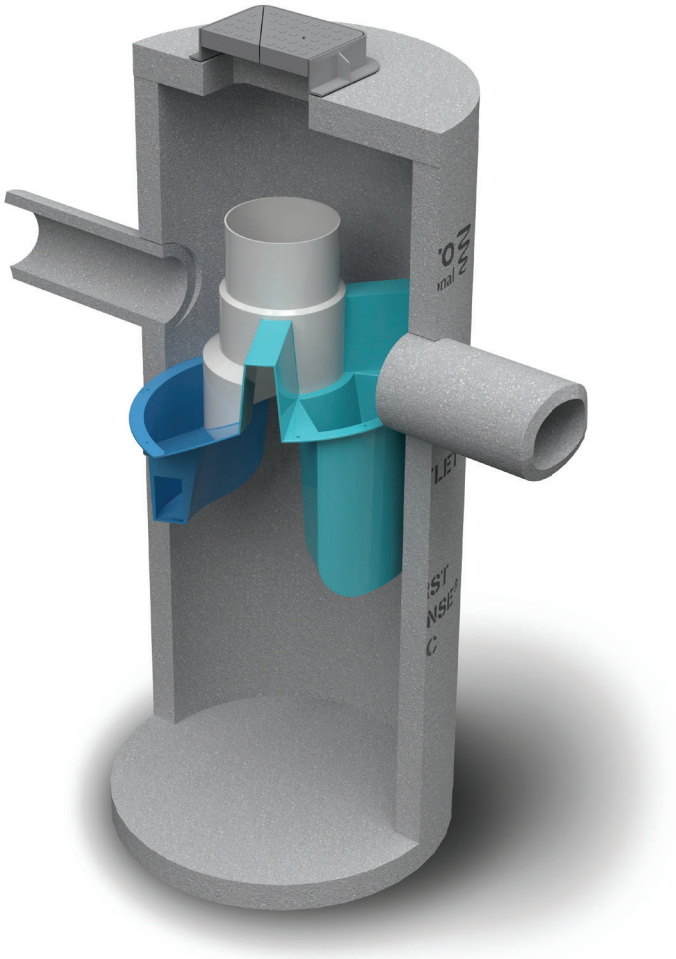
Reference Well:	D4W 79 Duxbury
Data Category:	Real - Time Data for USGS (Refer to attachments)
Topographic setting:	Valley
Lithology:	Sand
Date of Reading:	

FORMULA:

Sh=Sc-[(Sr/Owr)(OWc-OWmax)]

Where:

Sc =	14.70	ft.	Measured depth to water at site
Owc =	9.55	ft.	Measured depth to water in observation well
Owmax =	5.86	ft.	Depth to recorded maximum water level in observation well
Sr =	4.20	ft.	Range in water level at site (see charts) USE: 5% Exceedence
Owr =	4.11	ft.	Recorded upper limit of annual range at observation well
Adjustment =	3.77	ft.	
Sh=	#####	ft.	Estimated depth to probable high water level at the site
E.S.H.G.W =	**165.87**	**MSL**	**(Adjusted- Assumed)**



Operation and Maintenance Manual

First Defense® and First Defense® High Capacity

Vortex Separator for Stormwater Treatment

Table of Contents

3 First Defense® by Hydro International
- Introduction
- Operation
- Pollutant Capture and Retention

4 Model Sizes & Configurations
- First Defense® Components

5 Maintenance
- Overview
- Maintenance Equipment Considerations
- Determining Your Maintenance Schedule

6 Maintenance Procedures
- Inspection
- Floatables and Sediment Clean Out

8 First Defense® Installation Log

9 First Defense® Inspection and Maintenance Log

COPYRIGHT STATEMENT: The contents of this manual, including the graphics contained herein, are intended for the use of the recipient to whom the document and all associated information are directed. Hydro International plc owns the copyright of this document, which is supplied in confidence. It must not be used for any purpose other than that for which it is supplied and must not be reproduced, in whole or in part stored in a retrieval system or transmitted in any form or by any means without prior permission in writing from Hydro International plc. First Defense® is a trademarked hydrodynamic vortex separation device of Hydro International plc. A patent covering the First Defense® has been granted.

DISCLAIMER: Information and data contained in this manual is exclusively for the purpose of assisting in the operation and maintenance of Hydro International plc's First Defense®. No warranty is given nor can liability be accepted for use of this information for any other purpose. Hydro International plc has a policy of continuous product development and reserves the right to amend specifications without notice.

I. First Defense® by Hydro International

Introduction

The First Defense® is an enhanced vortex separator that combines an effective and economical stormwater treatment chamber with an integral peak flow bypass. It efficiently removes total suspended solids (TSS), trash and hydrocarbons from stormwater runoff without washing out previously captured pollutants. The First Defense® is available in several model configurations (refer to *Section II. Model Sizes & Configurations*, page 4) to accommodate a wide range of pipe sizes, peak flows and depth constraints.

Operation

The First Defense® operates on simple fluid hydraulics. It is self-activating, has no moving parts, no external power requirement and is fabricated with durable non-corrosive components. No manual procedures are required to operate the unit and maintenance is limited to monitoring accumulations of stored pollutants and periodic clean-outs. The First Defense® has been designed to allow for easy and safe access for inspection, monitoring and clean-out procedures. Neither entry into the unit nor removal of the internal components is necessary for maintenance, thus safety concerns related to confined-space-entry are avoided.

Pollutant Capture and Retention

The internal components of the First Defense® have been designed to optimize pollutant capture. Sediment is captured and retained in the base of the unit, while oil and floatables are stored on the water surface in the inner volume (Fig.1).

The pollutant storage volumes are isolated from the built-in bypass chamber to prevent washout during high-flow storm events. The sump of the First Defense® retains a standing water level between storm events. This ensures a quiescent flow regime at the onset of a storm, preventing resuspension and washout of pollutants captured during previous events.

Accessories such as oil absorbent pads are available for enhanced oil removal and storage. Due to the separation of the oil and floatable storage volume from the outlet, the potential for washout of stored pollutants between clean-outs is minimized.

Applications

- Stormwater treatment at the point of entry into the drainage line
- Sites constrained by space, topography or drainage profiles with limited slope and depth of cover
- Retrofit installations where stormwater treatment is placed on or tied into an existing storm drain line
- Pretreatment for filters, infiltration and storage

Advantages

- Inlet options include surface grate or multiple inlet pipes
- Integral high capacity bypass conveys large peak flows without the need for "offline" arrangements using separate junction manholes
- Proven to prevent pollutant washout at up to 500% of its treatment flow
- Long flow path through the device ensures a long residence time within the treatment chamber, enhancing pollutant settling
- Delivered to site pre-assembled and ready for installation

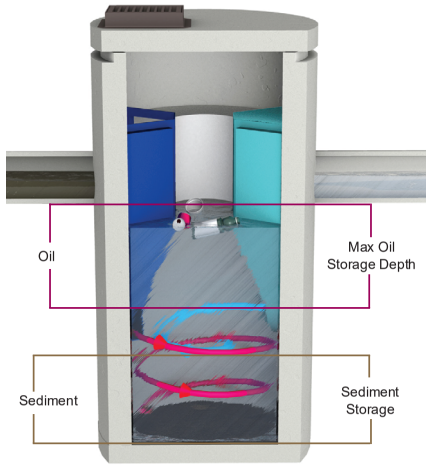


Fig.1 Pollutant storage volumes in the First Defense®.

II. Model Sizes & Configurations

The First Defense® inlet and internal bypass arrangements are available in several model sizes and configurations. The components of the First Defense®-4HC and First Defense®-6HC have modified geometries as to allow greater design flexibility needed to accommodate various site constraints.

All First Defense® models include the internal components that are designed to remove and retain total suspended solids (TSS), gross solids, floatable trash and hydrocarbons (Fig.2a - 2b). First Defense® model parameters and design criteria are shown in Table 1.

First Defense® Components

1. **Built-In Bypass**
2. **Inlet Pipe**
3. **Inlet Chute**
4. **Floatables Draw-off Port**
5. **Outlet Pipe**
6. **Floatables Storage**
7. **Sediment Storage**
8. **Inlet Grate or Cover**

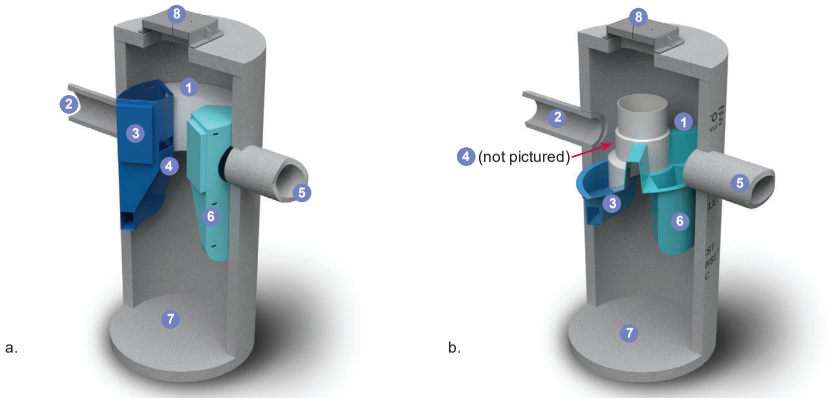


Fig.2a) First Defense®-4 and First Defense®-6; b) First Defense®-4HC and First Defense®-6HC, with higher capacity dual internal bypass and larger maximum pipe diameter.

First Defense® High Capacity Model Number	Diameter	Typical TSS Treatment Flow Rates NJDEP Certified	Peak Online Flow Rate	Maximum Pipe Diameter[1]	Oil Storage Capacity	Typical Sediment Storage Capacity[2]	Minimum Distance from Outlet Invert to Top of Rim[3]	Chamber Depth
	(ft / m)	(cfs / L/s)	(cfs / L/s)	(in / mm)	(gal / L)	(yd^3 / m^3)	(ft / m)	(ft / m)
FD-3HC	3 / 0.9	0.85 / 24.0	15 / 424	18 / 457	125 / 473	0.4 / 0.3	2.0 - 3.5 / 0.6 - 1.0	3.75 / 1.14
FD-4HC	4 / 1.2	1.50 / 42.4	18 / 510	24 / 600	191 / 723	0.7 / 0.5	2.3 - 3.9 / 0.7 - 1.2	5.00 / 1.52
FD-5HC	5 / 1.5	2.35 / 66.2	20 / 566	24 / 609	300 / 1135	1.1 / .84	2.5 - 4.5 / 0.7 - 1.3	5.25 / 1.60
FD-6HC	6 / 1.8	3.38 / 95.7	32 / 906	30 / 750	496 / 1878	1.6 / 1.2	3.0 - 5.1 / 0.9 - 1.6	6.25 / 1.90
FD-7HC	7 / 2.1	4.60 / 130.2	40 / 1133	42 / 1067	750 / 2839	2.1 / 1.9	3.0 - 5.5 / 0.9 - 1.7	7.25 / 2.20
FD-8HC	8 / 2.4	6.00 / 169.9	50 / 1,415	48 / 1219	1120 / 4239	2.8 / 2.1	3.0 - 6.0 / 0.9 -1.8	8.00 / 2.43

[1]Contact Hydro International when larger pipe sizes are required.
[2]Contact Hydro International when custom sediment storage capacity is required.
[3]Minimum distance for models depends on pipe diameter.

III. Maintenance

Overview

The First Defense® protects the environment by removing a wide range of pollutants from stormwater runoff. Periodic removal of these captured pollutants is essential to the continuous, long-term functioning of the First Defense®. The First Defense® will capture and retain sediment and oil until the sediment and oil storage volumes are full to capacity. When sediment and oil storage capacities are reached, the First Defense® will no longer be able to store removed sediment and oil. Maximum pollutant storage capacities are provided in Table 1.

The First Defense® allows for easy and safe inspection, monitoring and clean-out procedures. A commercially or municipally owned sump-vac is used to remove captured sediment and floatables. Access ports are located in the top of the manhole.

Maintenance events may include Inspection, Oil & Floatables Removal, and Sediment Removal. Maintenance events do not require entry into the First Defense®, nor do they require the internal components of the First Defense® to be removed. In the case of inspection and floatables removal, a vactor truck is not required. However, a vactor truck is required if the maintenance event is to include oil removal and/or sediment removal.

Maintenance Equipment Considerations

The internal components of the First Defense®-HC have a centrally located circular shaft through which the sediment storage sump can be accessed with a sump vac hose. The open diameter of this access shaft is 15 inches in diameter (Fig.3). Therefore, the nozzle fitting of any vactor hose used for maintenance should be less than 15 inches in diameter.

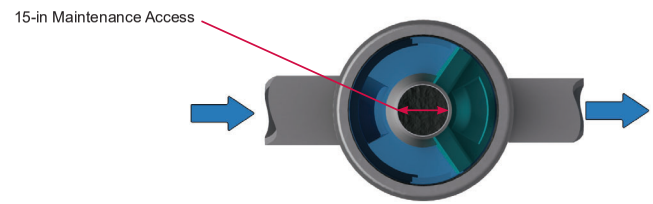


Fig.3 The central opening to the sump of the First Defense®-HC is 15 inches in diameter.

Determining Your Maintenance Schedule

The frequency of clean out is determined in the field after installation. During the first year of operation, the unit should be inspected every six months to determine the rate of sediment and floatables accumulation. A simple probe such as a Sludge-Judge® can be used to determine the level of accumulated solids stored in the sump. This information can be recorded in the maintenance log (see page 9) to establish a routine maintenance schedule.

The vactor procedure, including both sediment and oil / flotables removal, for a 6-ft First Defense® typically takes less than 30 minutes and removes a combined water/oil volume of about 765 gallons.

Inspection Procedures

1. Set up any necessary safety equipment around the access port or grate of the First Defense® as stipulated by local ordinances. Safety equipment should notify passing pedestrian and road traffic that work is being done.

2. Remove the grate or lid to the manhole.

3. Without entering the vessel, look down into the chamber to inspect the inside. Make note of any irregularities. Fig.4 shows the standing water level that should be observed.

4. Without entering the vessel, use the pole with the skimmer net to remove floatables and loose debris from the components and water surface.

5. Using a sediment probe such as a Sludge Judge®, measure the depth of sediment that has collected in the sump of the vessel.

6. On the Maintenance Log (see page 9), record the date, unit location, estimated volume of floatables and gross debris removed, and the depth of sediment measured. Also note any apparent irregularities such as damaged components or blockages.

7. Securely replace the grate or lid.

8. Take down safety equipment.

9. Notify Hydro International of any irregularities noted during inspection.

Floatables and Sediment Clean Out

Floatables clean out is typically done in conjunction with sediment removal. A commercially or municipally owned sump-vac is used to remove captured sediment and floatables (Fig.5).

Floatables and loose debris can also be netted with a skimmer and pole. The access port located at the top of the manhole provides unobstructed access for a vactor hose and skimmer pole to be lowered to the base of the sump.

Scheduling

- Floatables and sump clean out are typically conducted once a year during any season.

- Floatables and sump clean out should occur as soon as possible following a spill in the contributing drainage area.

Fig.4 Floatables are removed with a vactor hose (First Defense model FD-4, shown).

Recommended Equipment

- Safety Equipment (traffic cones, etc)

- Crow bar or other tool to remove grate or lid

- Pole with skimmer or net (if only floatables are being removed)

- Sediment probe (such as a Sludge Judge®)

- Vactor truck (flexible hose recommended)

- First Defense® Maintenance Log

Floatables and sediment Clean Out Procedures

1. Set up any necessary safety equipment around the access port or grate of the First Defense® as stipulated by local ordinances. Safety equipment should notify passing pedestrian and road traffic that work is being done.

2. Remove the grate or lid to the manhole.

3. Without entering the vessel, look down into the chamber to inspect the inside. Make note of any irregularities.

4. Remove oil and floatables stored on the surface of the water with the vactor hose (Fig.5) or with the skimmer or net (not pictured).

5. Using a sediment probe such as a Sludge Judge®, measure the depth of sediment that has collected in the sump of the vessel and record it in the Maintenance Log (page 9).

6. Once all floatables have been removed, drop the vactor hose to the base of the sump. Vactor out the sediment and gross debris off the sump floor (Fig.5).

7. Retract the vactor hose from the vessel.

8. On the Maintenance Log provided by Hydro International, record the date, unit location, estimated volume of floatables and gross debris removed, and the depth of sediment measured. Also note any apparent irregularities such as damaged components, blockages, or irregularly high or low water levels.

9. Securely replace the grate or lid.

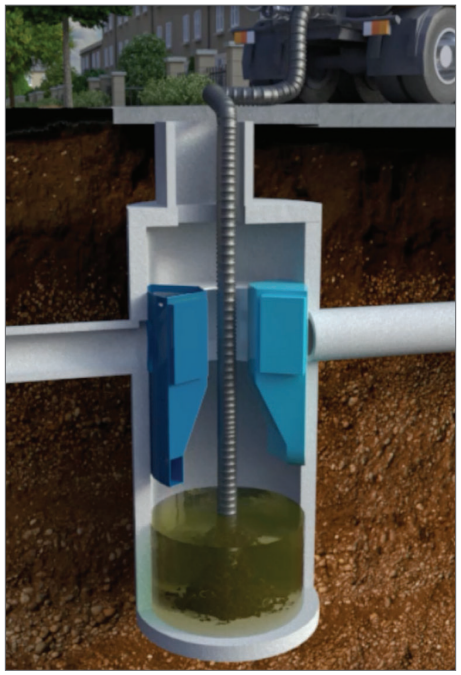


Fig.5 Sediment is removed with a vactor hose (First Defense model FD-4, shown).

Maintenance at a Glance

Inspection	- Regularly during first year of installation - Every 6 months after the first year of installation
Oil and Floatables Removal	- Once per year, with sediment removal - Following a spill in the drainage area
Sediment Removal	- Once per year or as needed - Following a spill in the drainage area
NOTE: For most clean outs the entire volume of liquid does not need to be removed from the manhole. Only remove the first few inches of oils and floatables from the water surface to reduce the total volume of liquid removed during a clean out.	

First Defense® Installation Log

HYDRO INTERNATIONAL REFERENCE NUMBER:	
SITE NAME:	
SITE LOCATION:	
OWNER:	CONTRACTOR:
CONTACT NAME:	CONTACT NAME:
COMPANY NAME:	COMPANY NAME:
ADDRESS:	ADDRESS:
TELEPHONE:	TELEPHONE:
FAX:	FAX:

INSTALLATION DATE: / /

MODEL SIZE (CIRCLE ONE): **FD-3HC** **FD-4** **FD-4HC** **FD-5HC** **FD-6** **FD-6HC** **FD-7HC** **FD-8HC**

INLET (CIRCLE ALL THAT APPLY): **GRATED INLET (CATCH BASIN)** **INLET PIPE (FLOW THROUGH)**

Hydro International (Stormwater), 94 Hutchins Drive, Portland ME 04102
Tel: (207) 756-6200 Fax: (207) 756-6212 Web: www.hydro-int.com

First Defense® Inspection and Maintenance Log

Date	Initials	Depth of Floatables and Oils	Sediment Depth Measured	Volume of Sediment Removed	Site Activity and Comments

Hydro International (Stormwater), 94 Hutchins Drive, Portland ME 04102
Tel: (207) 756-6200 Fax: (207) 756-6212 Web: www.hydro-int.com

Hydro International®

Stormwater Solutions

94 Hutchins Drive
Portland, ME 04102

Tel: (207) 756-6200
Fax: (207) 756-6212
stormwaterinquiry@hydro-int.com

www.hydro-int.com

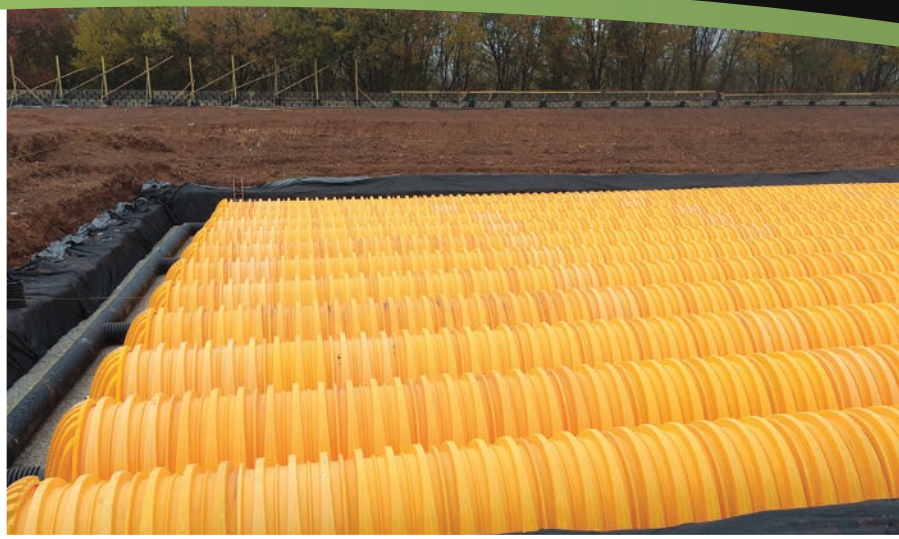
Turning Water Around...®

FDHC_O+M_H_1703

StormTech®

MC-3500 & MC-4500 Design Manual

StormTech® Chamber Systems for Stormwater Management



*THE MOST **ADVANCED** NAME IN WATER MANAGEMENT SOLUTIONS™*

ADS®

Table of Contents

1.0 Product Information 2

2.0 Foundation for Chambers 8

3.0 Required Materials/Row Separation 11

4.0 Hydraulics 13

5.0 Cumulative Storage Volume 15

6.0 System Sizing 20

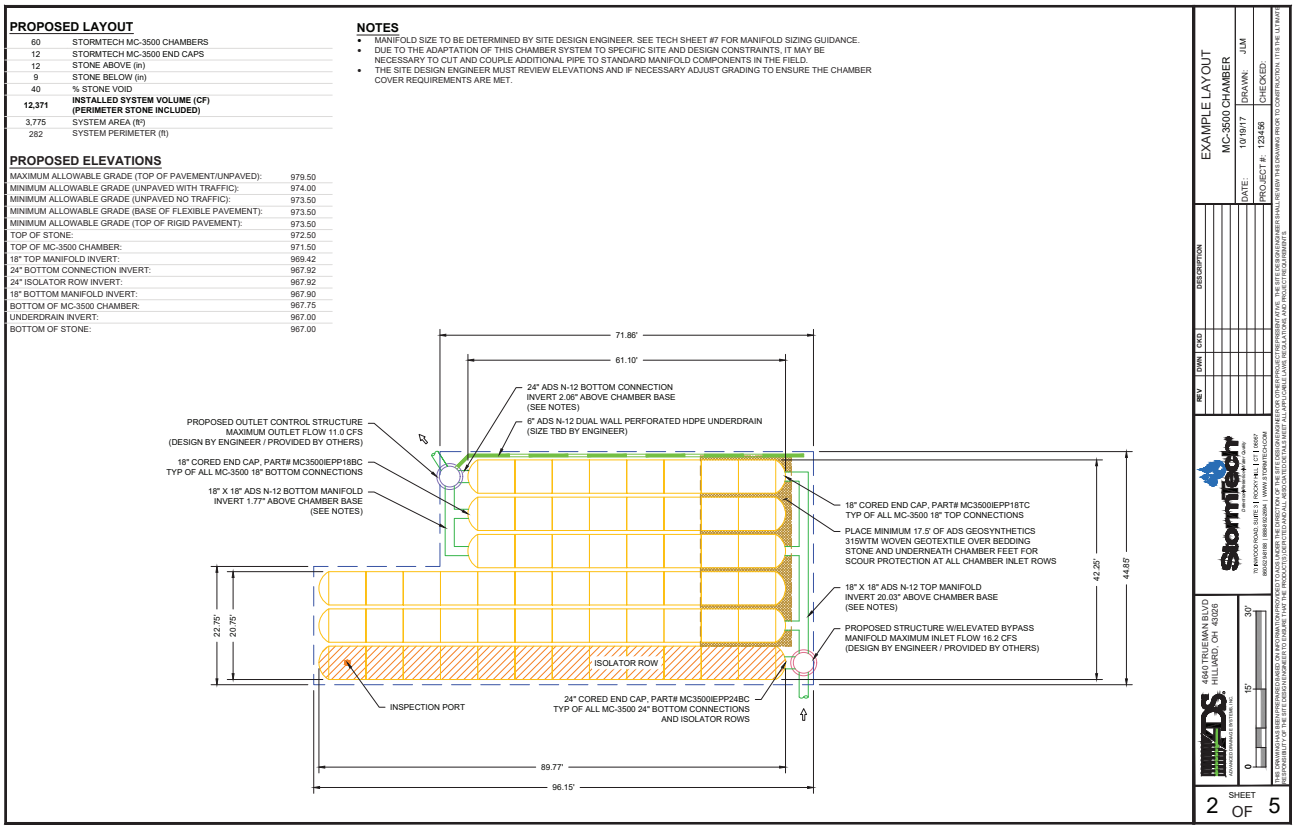
7.0 Structural Cross Sections and Specifications 22

8.0 General Notes 24

9.0 Inspection and Maintenance 25

***For SC-310, SC-740 & DC-780 designs, please refer to the SC-310/SC-740/DC-780 Design Manual.**

StormTech Engineering Services assists design professionals in specifying StormTech stormwater systems. This assistance includes the layout of chambers to meet the engineer's volume requirements and the connections to and from the chambers. They can also assist converting and cost engineering projects currently specified with ponds, pipe, concrete vaults and other manufactured stormwater detention/retention products. Please note that it is the responsibility of the site design engineer to ensure that the chamber bed layout meets all design requirements and is in compliance with applicable laws and regulations governing a project.



This manual is exclusively intended to assist engineers in the design of subsurface stormwater systems using StormTech chambers.

StormTech MC-3500 Chamber

MC-3500 Chamber

Designed to meet the most stringent industry performance standards for superior structural integrity while providing designers with a cost-effective method to save valuable land and protect water resources. The StormTech system is designed primarily to be used under parking lots, thus maximizing land usage for commercial and municipal applications.

StormTech MC-3500 Chamber (not to scale)

Nominal Chamber Specifications

Size (L x W x H)	90” (2286 mm) x 77” (1956 mm) x 45” (1143 mm)
Chamber Storage	109.9 ft^3 (3.11 m^3)
Min. Installed Storage*	178.9 ft^3 (5.06 m^3)
Weight	134 lbs (60.8 kg)

*This assumes a minimum of 12” (300 mm) of stone above, 9” (230 mm) of stone between chambers/end caps and 40% stone porosity.

StormTech MC-3500 End Cap (not to scale)

Nominal Chamber Specifications

Size (L x W x H)	26.5” (673 mm) x 71” (1803 mm) x 45.1” (1145 mm)
Chamber Storage	14.9 ft^3 (0.42 m^3)
Min. Installed Storage*	46.0 ft^3 (1.30 m^3)
Weight	49 lbs (22.2 kg)

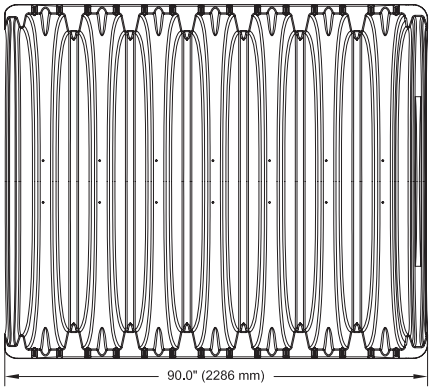
*This assumes a minimum of 12” (300 mm) of stone above, 9” (230 mm) of stone below, 6” (150 mm) of stone perimeter, 9” (230 mm) between chambers/end caps and 40% stone porosity.

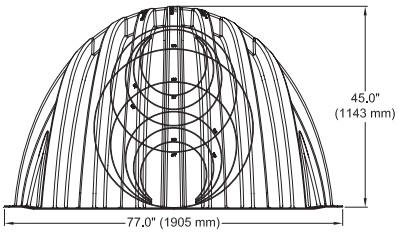
Shipping

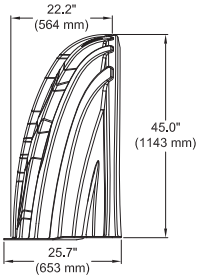
15 chambers/pallet

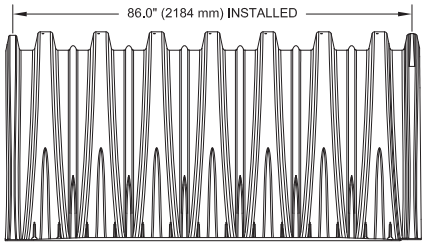
16 end caps/pallet

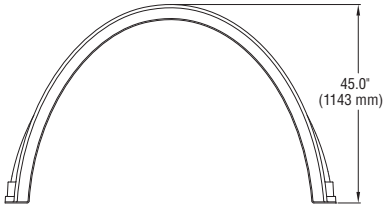
7 pallets/truck











StormTech MC-3500 Chamber

Storage Volume Per Chamber/End Cap ft³ (m³)

	Bare Unit Storage ft³ (m³)	Chamber/End Cap and Stone Volume — Stone Foundation Depth in. (mm)			
		9 (230)	12 (300)	15 (375)	18 (450)
MC-3500 Chamber	109.9 (3.11)	178.9 (5.06)	184.0 (5.21)	189.2 (5.36)	194.3 (5.5)
MC-3500 End Cap	14.9 (0.42)	46.0 (1.33)	47.7 (1.35)	49.4 (1.40)	51.1 (1.45)

NOTE: Assumes 9" (230 mm) row spacing, 40% stone porosity, 12" (300 mm) stone above and includes the bare chamber/end cap volume. End cap volume assumes 6" (150 mm) stone perimeter.

Amount of Stone Per Chamber

ENGLISH tons (yd³)	Stone Foundation Depth			
	9"	12"	15"	18"
MC-3500	9.1 (6.4)	9.7 (6.9)	10.4 (7.3)	11.1 (7.8)
End Cap	4.1 (2.9)	4.3 (3.0)	4.5 (3.2)	4.7 (3.3)
METRIC kg (m³)	**230 mm**	**300 mm**	**375 mm**	**450 mm**
MC-3500	8220 (4.9)	8831 (5.3)	9443 (5.6)	10054 (6.0)
End Cap	3699 (2.2)	3900(2.3)	4100 (2.5)	4301 (2.6)

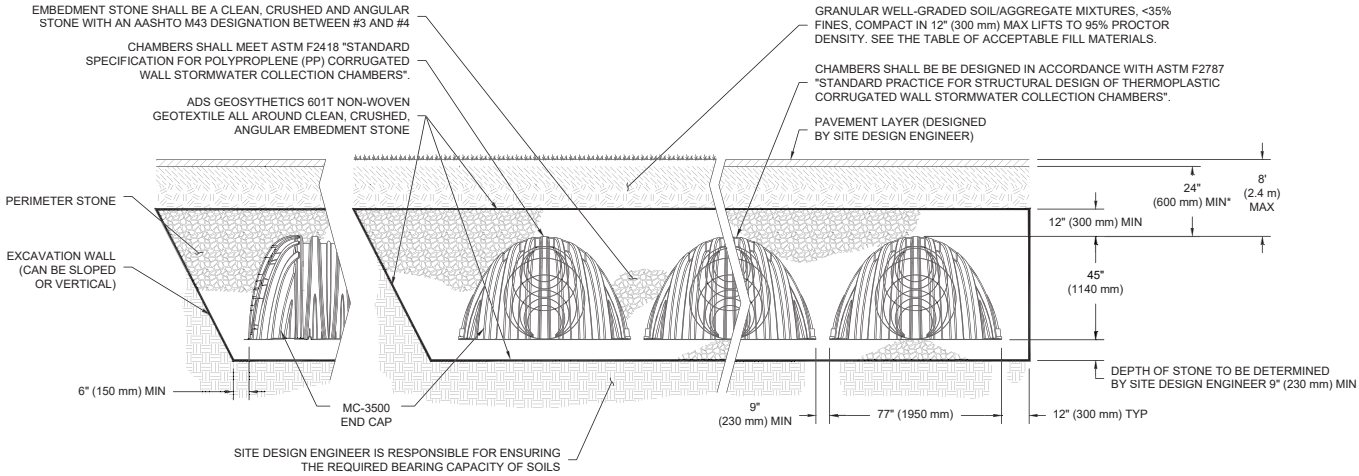
NOTE: Assumes 12" (300 mm) of stone above, and 9" (230 mm) row spacing, and 6" (150 mm) of perimeter stone in front of end caps.

Volume of Excavation Per Chamber/End Cap yd³ (m³)

	Stone Foundation Depth			
	9" (230 mm)	12" (300 mm)	15"(375 mm)	18"(450 mm)
MC-3500	12.4 (9.5)	12.8 (9.8)	13.3 (10.2)	13.8 (10.5)
End Cap	4.1 (3.1)	4.2 (3.2)	4.4 (3.3)	4.5 (3.5)

NOTE: Assumes 9" (230 mm) separation between chamber rows and 24" (600 mm) of cover. The volume of excavation will vary as the depth of cover increases.

General Cross Section



*MINIMUM COVER TO BOTTOM OF FLEXIBLE PAVEMENT. FOR UNPAVED INSTALLATIONS WHERE RUTTING FROM VEHICLES MAY OCCUR, INCREASE COVER TO 30" (750 mm).

Special applications will be considered on a project by project basis. Please contact our application department should you have a unique application for our team to evaluate.

StormTech MC-4500 Chamber

MC-4500 Chamber

Designed to meet the most stringent industry performance standards for superior structural integrity while providing designers with a cost-effective method to save valuable land and protect water resources. The StormTech system is designed primarily to be used under parking lots, thus maximizing land usage for commercial and municipal applications.

StormTech MC-3500 Chamber (not to scale)

Nominal Chamber Specifications

Size (L x W x H)	52” (1321 mm) x 100” (2540 mm) x 60” (1524 mm)
Chamber Storage	106.5 ft^3 (3.01 m^3)
Min. Installed Storage*	162.6 ft^3 (4.60 m^3)
Weight	120 lbs (54.4 kg)

*This assumes a minimum of 12” (300 mm) of stone above, 9” (230 mm) of stone below chambers, 9” (230)mm between chambers/end caps and 40% stone porosity.

StormTech MC-3500 End Cap (not to scale)

Nominal Chamber Specifications

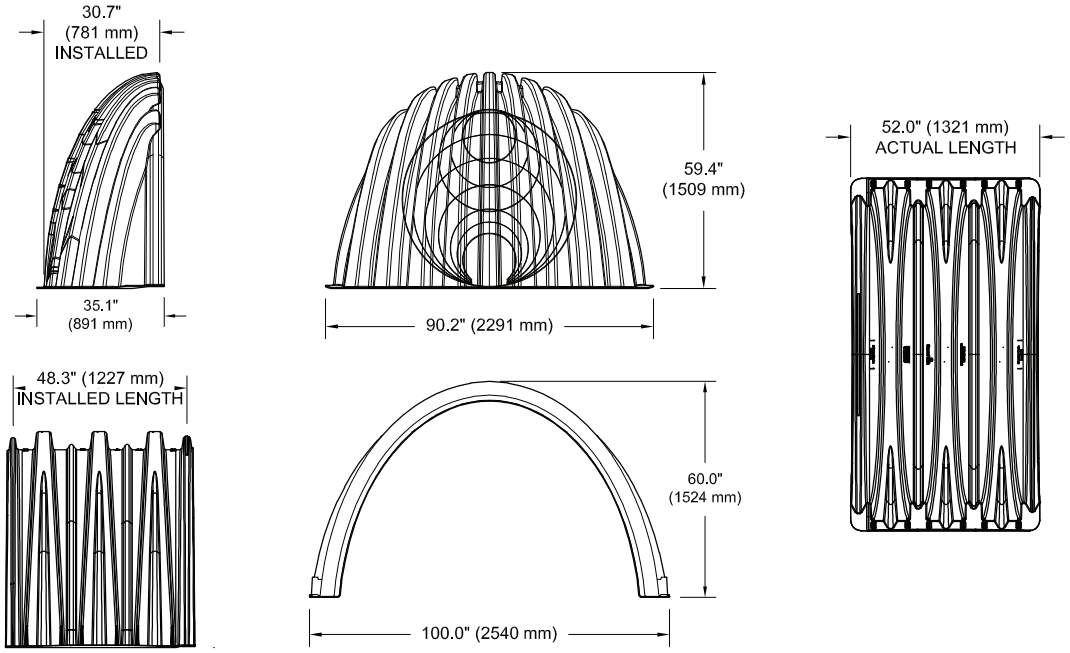
Size (L x W x H)	35.1” (891 mm) x 90.2” (2291 mm) x 59.4” (1509 mm)
Chamber Storage	35.7 ft^3 (1.01 m^3)
Min. Installed Storage*	108.7 ft^3 (3.08 m^3)
Weight	120 lbs (54.4 kg)

*This assumes a minimum of 12” (300 mm) of stone above, 9” (230 mm) of stone below, 6” (150 mm) of stone perimeter, 9” (230 mm) between chambers/end caps and 40% stone porosity.

Shipping

7 chambers/pallet

11 pallets/truck



StormTech MC-4500 Chamber

Storage Volume Per Chamber/End Cap ft³ (m³)

	Bare Unit Storage ft³ (m³)	Chamber/End Cap and Stone Volume — Stone Foundation Depth in. (mm)			
		9 (230)	12 (300)	15 (375)	18 (450)
MC-4500 Chamber	106.5 (3.02)	162.6 (4.60)	166.3 (4.71)	169.9 (4.81)	173.6 (4.91)
MC-4500 End Cap	35.7 (1.01)	108.7 (3.08)	111.9 (3.17)	115.2 (3.26)	118.4 (3.35)

NOTE: Assumes 9" (230 mm) row spacing, 40% stone porosity, 12" (300 mm) stone above and includes the bare chamber/end cap volume. End cap volume assumes 12" (300 mm) stone perimeter.

Amount of Stone Per Chamber

ENGLISH tons (yd³)	Stone Foundation Depth			
	9"	12"	15"	18"
MC-4500	7.4 (5.2)	7.8 (5.5)	8.3 (5.9)	8.8 (6.2)
End Cap	9.6 (6.8)	10.0 (7.1)	10.4 (7.4)	10.9 (7.7)
METRIC kg (m³)	**230 mm**	**300 mm**	**375 mm**	**450 mm**
MC-4500	6681 (4.0)	7117 (4.2)	7552 (4.5)	7987 (4.7)
End Cap	8691 (5.2)	9075 (5.4)	9460 (5.6)	9845 (5.9)

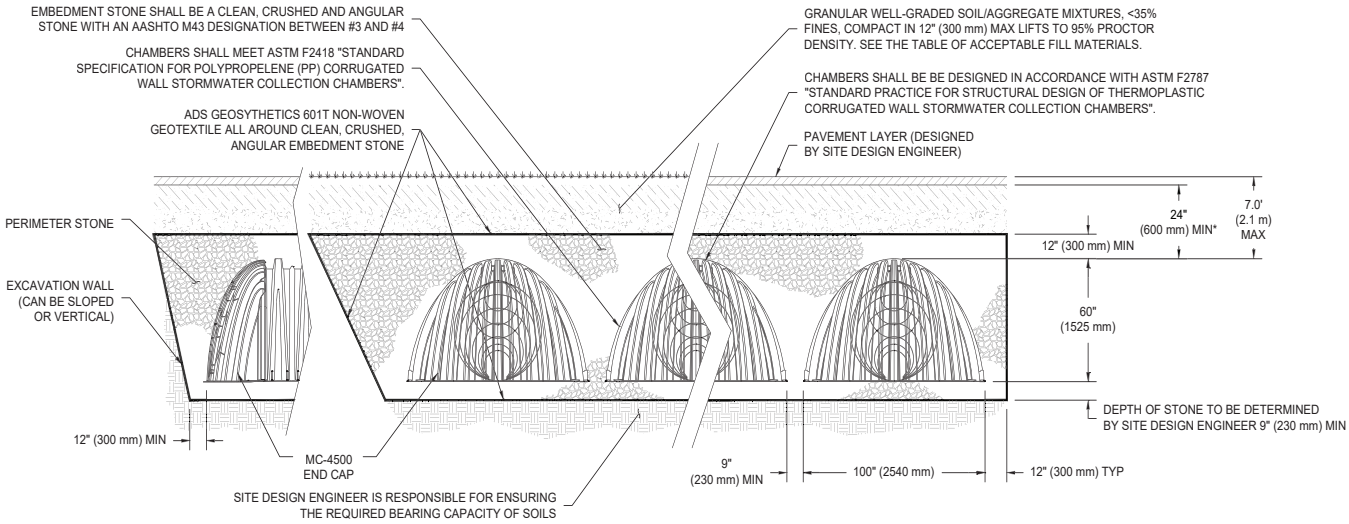
NOTE: Assumes 12" (300 mm) of stone above, and 9" (230 mm) row spacing, and 12" (300 mm) of perimeter stone in front of end caps.

Volume of Excavation Per Chamber/End Cap yd³ (m³)

	Stone Foundation Depth			
	9" (230 mm)	12" (300 mm)	15"(375 mm)	18"(450 mm)
MC-4500	10.5 (8.0)	10.8 (8.3)	11.2 (8.5)	11.5 (8.8)
End Cap	9.3 (7.1)	9.6 (7.3)	9.9 (7.6)	10.2 (7.8)

NOTE: Assumes 9" (230 mm) separation between chamber rows, 12" (300 mm) of perimeter in front of end caps, and 24" (600 mm) of cover. The volume of excavation will vary as the depth of cover increases.

General Cross Section



*MINIMUM COVER TO BOTTOM OF FLEXIBLE PAVEMENT. FOR UNPAVED INSTALLATIONS WHERE RUTTING FROM VEHICLES MAY OCCUR, INCREASE COVER TO 30" (750 mm).

Special applications will be considered on a project by project basis. Please contact our application department should you have a unique application for our team to evaluate.

1.0 Product Information

1.1 PRODUCT DESIGN

StormTech's commitment to thorough product testing programs, materials evaluation and adherence to national standards has resulted in two more superior products. Like other StormTech chambers, the MC-3500 and MC-4500 are designed to meet the full scope of design requirements of the American Society of Testing Materials (ASTM) International specification F2787 "Standard Practice for Structural Design of Thermoplastic Corrugated Wall Stormwater Collection Chambers" and produced to the requirements of the ASTM F 2418 "Standard Specification for Polypropylene (PP) Corrugated Stormwater Collection Chambers".

The StormTech MC-3500 and MC-4500 chambers provide the full AASHTO safety factors for live loads and permanent earth loads. The ASTM F 2787 standard provides specific guidance on how to design thermoplastic chambers in accordance with AASHTO Section 12.12. of the AASHTO LRFD Bridge Design Specifications. ASTM F 2787 requires that the safety factors included in the AASHTO guidance are achieved as a prerequisite to meeting ASTM F 2418. The three standards provide both the assurance of product quality and safe structural design.

The design of larger chambers in the same tradition of our other chambers required the collaboration of experts in soil-structure interaction, plastics and manufacturing. Years of extensive research, including laboratory testing and field verification, were required to produce chambers that are ready to meet both the rigors of installation and the longevity expected by engineers and owners.

This Design Manual provides the details and specifications necessary for consulting engineers to design stormwater management systems using the MC-3500 and MC-4500 chambers. It provides specifications for storage capacities, layout dimensions as well as requirements for design to ensure a long service life. The basic design concepts for foundation and backfill materials, subgrade bearing capacities and row spacing remain equally as pertinent for the MC-3500 and MC-4500 as the SC-740, SC-310 and DC-780 chamber systems. However, since many design values and dimensional requirements are different for these larger chambers than the SC-740, SC-310 and DC-780 chambers, design manuals and installation instructions are not interchangeable.

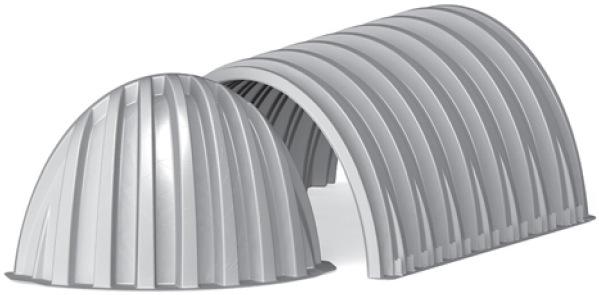
This manual includes only those details, dimensions, cover limits, etc for the MC-3500 and MC-4500 and is intended to be a stand-alone design guide for the MC-3500 and MC-4500 chambers. A Construction Guide specifically for these two chamber models has also been published.

1.2 TECHNICAL SUPPORT

The StormTech Technical Services Department is available to assist the engineer with the layout of MC-3500 and MC-4500 chamber systems and answer questions regarding all the StormTech chamber models. Call the Technical Services Department, email us at info@stormtech.com or contact your local StormTech representative.

1.3 MC-3500 AND MC-4500 CHAMBERS

All StormTech chambers are designed to the full scope of AASHTO requirements without repeating end walls or other structural reinforcing. StormTech's continuously curved, elliptical arch and the surrounding angular backfill are the key components of the structural system. With the addition of patent pending integral stiffening ribs **(Figure 5)**, the MC-3500 and MC-4500 are assured to provide a long, safe service life. Like other StormTech chambers, the MC-3500 and MC-4500 are produced from high quality, impact modified resins which are tested for short-term and long-term mechanical properties.



With all StormTech chambers, one chamber type is used for the start, middle and end of rows. Rows are formed by overlapping the upper joint corrugation of the next chamber over the lower joint corrugation of the previous chamber **(Figure 6)**.

1.4 CHAMBER JOINTS

All StormTech chambers are designed with an optimized joining system. The height and width of the end corrugations have been designed to provide the required structural safety factors while providing an unobstructed flow path down each row.

To assist the contractor, StormTech chambers are molded with simple assembly instructions and arrows that indicate the direction in which to build rows. The corrugation valley immediately adjacent to the lower joint corrugation is marked “Overlap Here - Lower Joint.” The corrugation valley immediately adjacent to the upper joint corrugation is marked “Build This Direction - Upper Joint.”

Two people can safely and efficiently carry and place chambers without cumbersome connectors, special tools or heavy equipment. Each row of chambers must begin and end with a joint corrugation. Since joint corrugations are of a different size than the corrugations along the body of the chamber, chambers cannot be field cut and installed. Only whole MC-3500 and MC-4500 chambers can be used. For system layout assistance contact StormTech.

1.5 MC-3500 AND MC-4500 END CAPS

The MC-3500 and MC-4500 end caps are easy to install. These end caps are designed with a corrugation joint that fits over the top of either end of the chamber. The end cap joint is simply set over the top of either of the upper or lower chamber joint corrugations **(Figure 7)**.

The MC-3500 end cap has pipe cutting guides for 12”–24” (300 mm–600 mm) top inverts **(Figure 9)**.

The MC-4500 end cap has pipe cutting guides for 12”–42” (300 mm–1050 mm) bottom inverts and 12”–24” (300 mm–600 mm) top inverts **(Figure 8)**.

Standard and custom pre-cored end caps are available. Pre-cored end caps, 18” in diameter and larger include a welded crown plate.

FIGURE 5—Chamber and End Cap Components

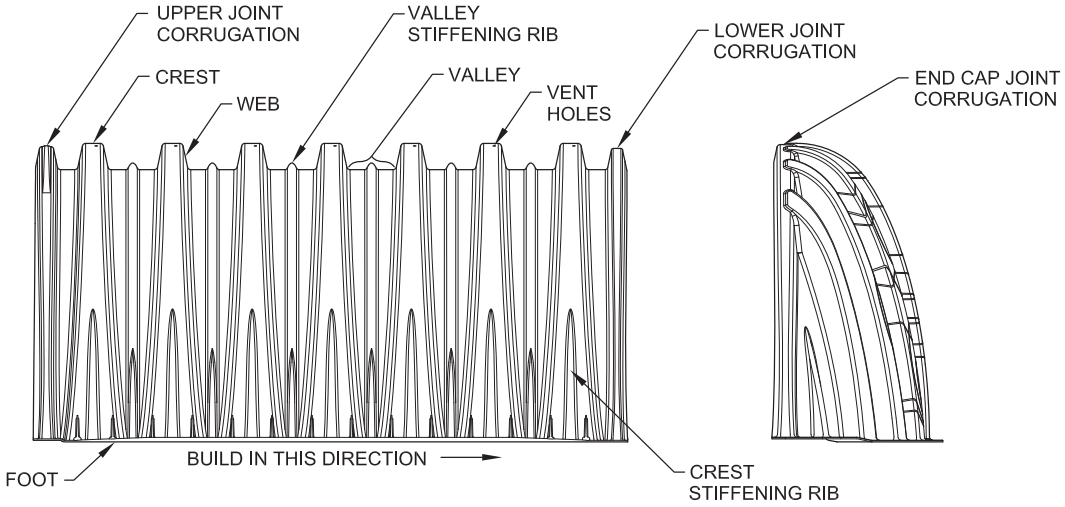


FIGURE 6—Chamber Joint Overlap

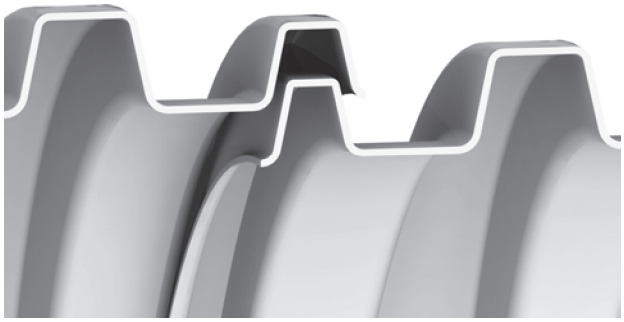


FIGURE 6—End Cap Joint Overlap

FIGURE 8—MC-4500 End Cap Inverts

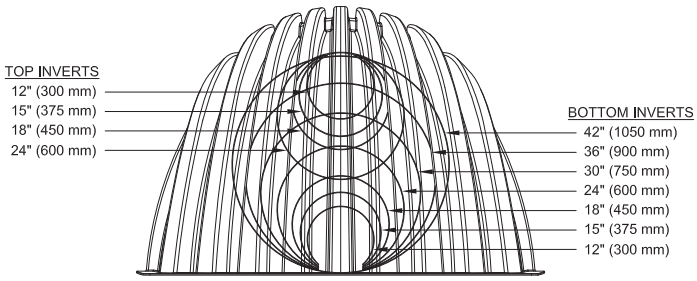
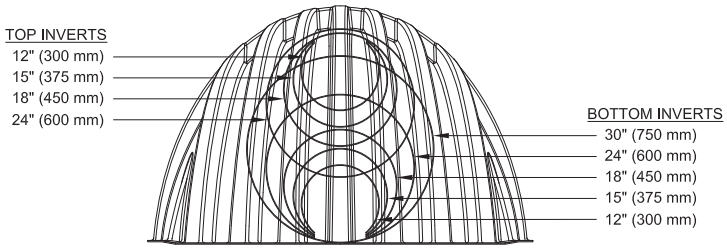


FIGURE 9—MC-4500 End Cap Inverts



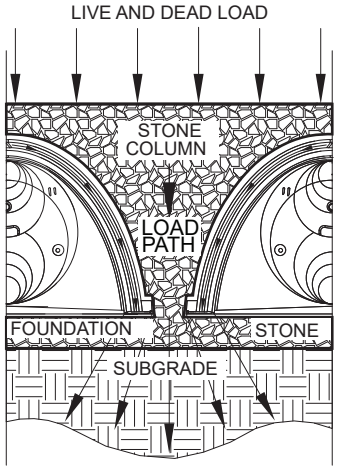
2.0 Foundations for Chambers

2.1 FOUNDATION REQUIREMENTS

StormTech chamber systems can be installed in various soil types. The subgrade bearing capacity and the cover height over the chambers determine the required depth of clean, crushed, angular foundation stone below the chambers. Foundation stone, also called bedding,

is the stone between the subgrade soils and the feet of the chamber. Flexible structures are designed to transfer a significant portion of both live and dead loads through the surrounding soils. Chamber systems accomplish this by creating load paths through the columns of embedment stone between and around the rows of chambers. This creates load concentrations at the base of the columns between the rows. The foundation stone spreads out the concentrated loads to distributed loads that can be supported by the subgrade soils.

Since increasing the cover height (top of chamber to finished grade) causes increasing soil load, a greater depth of foundation stone is necessary to distribute the load to the subgrade soils. **Table 1** and **2** specify the minimum required foundation depths for varying cover heights and allowable subgrade bearing capacities. These tables are based on StormTech service loads. The minimum required foundation depth is 9” (230 mm) for both chambers.



2.2 WEAKER SOILS

StormTech has not provided guidance for subgrade bearing capacities less than 2000 pounds per square foot [(2.0 ksf) (96 kPa)]. These soils are often highly variable, may contain organic materials and could be more sensitive to moisture. A geotechnical engineer must be consulted if soils with bearing capacities less than 2000 psf (96 kPa) are present.

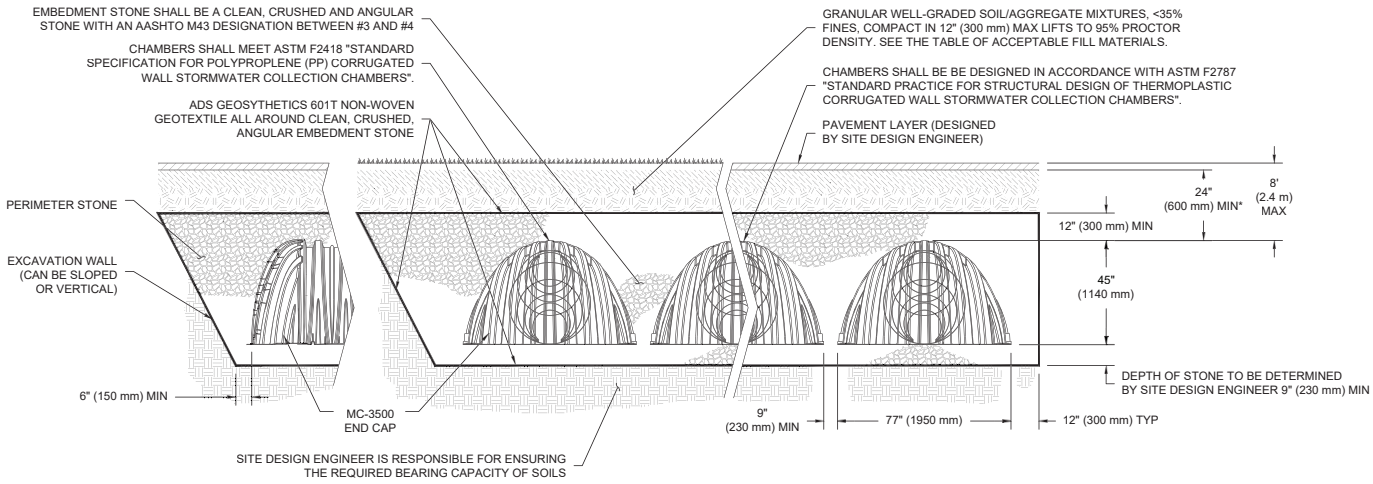
2.0 Foundations for Chambers

TABLE 1—MC-3500 Minimum Required Foundation Depth in inches (millimeters)
Assumes 9” (230 mm) row spacing.

Cover Hgt. ft. (m)	Minimum Bearing Resistance for Service Loads ksf (kPa)																								
	4.4 (211)	4.3 (206)	4.2 (201)	4.1 (196)	4.0 (192)	3.9 (187)	3.8 (182)	3.7 (177)	3.6 (172)	3.5 (168)	3.4 (163)	3.3 (158)	3.2 (153)	3.1 (148)	3.0 (144)	2.9 (139)	2.8 (134)	2.7 (129)	2.6 (124)	2.5 (120)	2.4 (115)	2.3 (110)	2.2 (105)	2.1 (101)	2.0 (96)
2.0 (0.61)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	12 (300)	12 (300)	12 (300)	15 (375)	15 (375)	15 (375)
2.5 (0.76)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	12 (300)	12 (300)	12 (300)	12 (300)	15 (375)	15 (375)	15 (375)	18 (450)
3.0 (0.91)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	12 (300)	12 (300)	12 (300)	15 (375)	15 (375)	15 (375)	18 (450)	18 (450)	18 (450)
3.5 (1.07)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	12 (300)	12 (300)	12 (300)	12 (300)	15 (375)	15 (375)	15 (375)	18 (450)	18 (450)	24 (600)	24 (600)
4.0 (1.22)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	12 (300)	12 (300)	12 (300)	12 (300)	15 (375)	15 (375)	15 (375)	15 (375)	18 (450)	18 (450)	24 (600)	24 (600)	24 (600)
4.5 (1.37)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	12 (300)	12 (300)	12 (300)	12 (300)	15 (375)	15 (375)	15 (375)	18 (450)	18 (450)	18 (450)	24 (600)	24 (600)	24 (600)	30 (750)
5.0 (1.52)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	12 (300)	12 (300)	12 (300)	12 (300)	15 (375)	15 (375)	15 (375)	15 (375)	18 (450)	18 (450)	18 (450)	24 (600)	24 (600)	24 (600)	24 (600)	30 (750)
5.5 (1.68)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	12 (300)	12 (300)	12 (300)	12 (300)	12 (300)	15 (375)	15 (375)	15 (375)	18 (450)	18 (450)	18 (450)	24 (600)	24 (600)	24 (600)	24 (600)	24 (600)	30 (750)	30 (750)
6.0 (1.83)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	12 (300)	12 (300)	12 (300)	12 (300)	12 (300)	15 (375)	15 (375)	15 (375)	15 (375)	18 (450)	18 (450)	18 (450)	24 (600)	24 (600)	24 (600)	24 (600)	30 (750)	30 (750)	30 (750)
6.5 (1.98)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	12 (300)	12 (300)	12 (300)	12 (300)	12 (300)	15 (375)	15 (375)	15 (375)	15 (375)	18 (450)	18 (450)	18 (450)	24 (600)	24 (600)	24 (600)	24 (600)	30 (750)	30 (750)	30 (750)	30 (750)
7.0 (2.13)	9 (230)	9 (230)	9 (230)	9 (230)	12 (300)	12 (300)	12 (300)	12 (300)	12 (300)	12 (300)	15 (375)	15 (375)	15 (375)	18 (450)	18 (450)	18 (450)	24 (600)	24 (600)	24 (600)	24 (600)	30 (750)	30 (750)	30 (750)	30 (750)	36 (900)
7.5 (2.30)	9 (230)	9 (230)	12 (300)	12 (300)	12 (300)	12 (300)	12 (300)	15 (375)	15 (375)	15 (375)	15 (375)	18 (450)	18 (450)	18 (450)	18 (450)	24 (600)	24 (600)	24 (600)	24 (600)	24 (600)	30 (750)	30 (750)	30 (750)	36 (900)	36 (900)
8.0 (2.44)	9 (230)	12 (300)	12 (300)	12 (300)	12 (300)	12 (300)	15 (375)	15 (375)	15 (375)	15 (375)	18 (450)	18 (450)	18 (450)	18 (450)	24 (600)	24 (600)	24 (600)	24 (600)	24 (600)	30 (750)	30 (750)	30 (750)	36 (900)	36 (900)	36 (900)

NOTE: The design engineer is solely responsible for assessing the bearing resistance (allowable bearing capacity) of the subgrade soils and determining the depth of foundation stone. Subgrade bearing resistance should be assessed with consideration for the range of soil moisture conditions expected under a stormwater system.

FIGURE 10A—MC-3500 Structural Cross Section Detail (Not to Scale)



*MINIMUM COVER TO BOTTOM OF FLEXIBLE PAVEMENT. FOR UNPAVED INSTALLATIONS WHERE RUTTING FROM VEHICLES MAY OCCUR, INCREASE COVER TO 30" (750 mm).

Special applications will be considered on a project by project basis. Please contact our application department should you have a unique application for our team to evaluate.

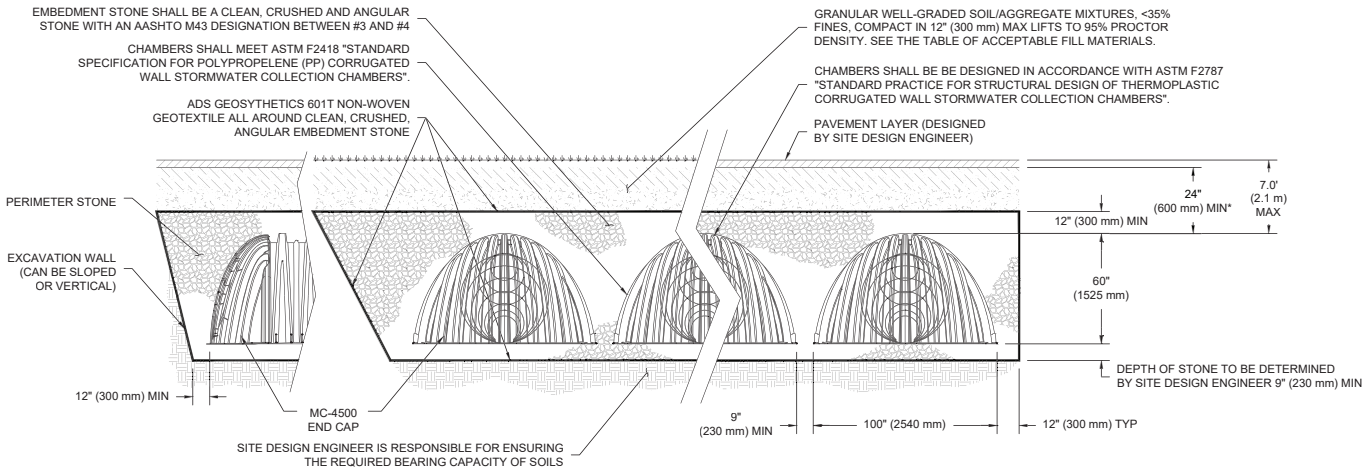
2.0 Foundations for Chambers

TABLE 2—MC-4500 Minimum Required Foundation Depth in inches (millimeters)
Assumes 9” (230 mm) row spacing.

Cover Hgt. ft. (m)	Minimum Bearing Resistance for Service Loads ksf (kPa)																								
	4.4 (211)	4.3 (206)	4.2 (201)	4.1 (196)	4.0 (192)	3.9 (187)	3.8 (182)	3.7 (177)	3.6 (172)	3.5 (168)	3.4 (163)	3.3 (158)	3.2 (153)	3.1 (148)	3.0 (144)	2.9 (139)	2.8 (134)	2.7 (129)	2.6 (124)	2.5 (120)	2.4 (115)	2.3 (110)	2.2 (105)	2.1 (101)	2.0 (96)
2.0 (0.61)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	12 (300)	12 (300)	12 (300)	15 (375)	15 (375)	15 (375)	18 (450)
2.5 (0.76)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	12 (300)	12 (300)	12 (300)	15 (375)	15 (375)	18 (450)	18 (450)	24 (600)
3.0 (0.91)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	12 (300)	12 (300)	12 (300)	15 (375)	15 (375)	18 (450)	18 (450)	18 (450)	24 (600)	24 (600)
3.5 (1.07)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	12 (300)	12 (300)	12 (300)	15 (375)	15 (375)	15 (375)	18 (450)	18 (450)	24 (600)	24 (600)	24 (600)	24 (600)
4.0 (1.22)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	12 (300)	12 (300)	12 (300)	15 (375)	15 (375)	15 (375)	18 (450)	18 (450)	18 (450)	24 (600)	24 (600)	24 (600)	24 (600)	30 (750)
4.5 (1.37)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	12 (300)	12 (300)	12 (300)	12 (300)	15 (375)	15 (375)	15 (375)	18 (450)	18 (450)	24 (600)	24 (600)	24 (600)	24 (600)	30 (750)	30 (750)	30 (750)
5.0 (1.52)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	12 (300)	12 (300)	12 (300)	12 (300)	15 (375)	15 (375)	15 (375)	18 (450)	18 (450)	18 (450)	24 (600)	24 (600)	24 (600)	24 (600)	30 (750)	30 (750)	30 (750)	36 (900)
5.5 (1.68)	9 (230)	9 (230)	9 (230)	9 (230)	9 (230)	12 (300)	12 (300)	12 (300)	12 (300)	15 (375)	15 (375)	15 (375)	18 (450)	18 (450)	18 (450)	24 (600)	24 (600)	24 (600)	24 (600)	24 (600)	30 (750)	30 (750)	30 (750)	36 (900)	36 (900)
6.0 (1.83)	9 (230)	9 (230)	9 (230)	12 (300)	12 (300)	12 (300)	12 (300)	15 (375)	15 (375)	15 (375)	15 (375)	18 (450)	18 (450)	18 (450)	24 (600)	24 (600)	24 (600)	24 (600)	30 (750)	30 (750)	30 (750)	30 (750)	36 (900)	36 (900)	36 (900)
6.5 (1.98)	9 (230)	12 (300)	12 (300)	12 (300)	12 (300)	15 (375)	15 (375)	15 (375)	15 (375)	18 (450)	18 (450)	18 (450)	24 (600)	24 (600)	24 (600)	24 (600)	24 (600)	30 (750)	30 (750)	30 (750)	30 (750)	36 (900)	36 (900)	36 (900)	42 (1050)
7.0 (2.13)	12 (300)	12 (300)	12 (300)	12 (300)	15 (375)	15 (375)	15 (375)	15 (375)	18 (450)	18 (450)	18 (450)	24 (600)	24 (600)	24 (600)	24 (600)	24 (600)	30 (750)	30 (750)	30 (750)	30 (750)	36 (900)	36 (900)	36 (900)	42 (1050)	42 (1050)

NOTE: The design engineer is solely responsible for assessing the bearing resistance (allowable bearing capacity) of the subgrade soils and determining the depth of foundation stone. Subgrade bearing resistance should be assessed with consideration for the range of soil moisture conditions expected under a stormwater system.

FIGURE 10B—MC-4500 Structural Cross Section Detail (Not to Scale)



*MINIMUM COVER TO BOTTOM OF FLEXIBLE PAVEMENT. FOR UNPAVED INSTALLATIONS WHERE RUTTING FROM VEHICLES MAY OCCUR, INCREASE COVER TO 30" (750 mm).

Special applications will be considered on a project by project basis. Please contact our application department should you have a unique application for our team to evaluate.

3.1 Foundation and Embedment Stone

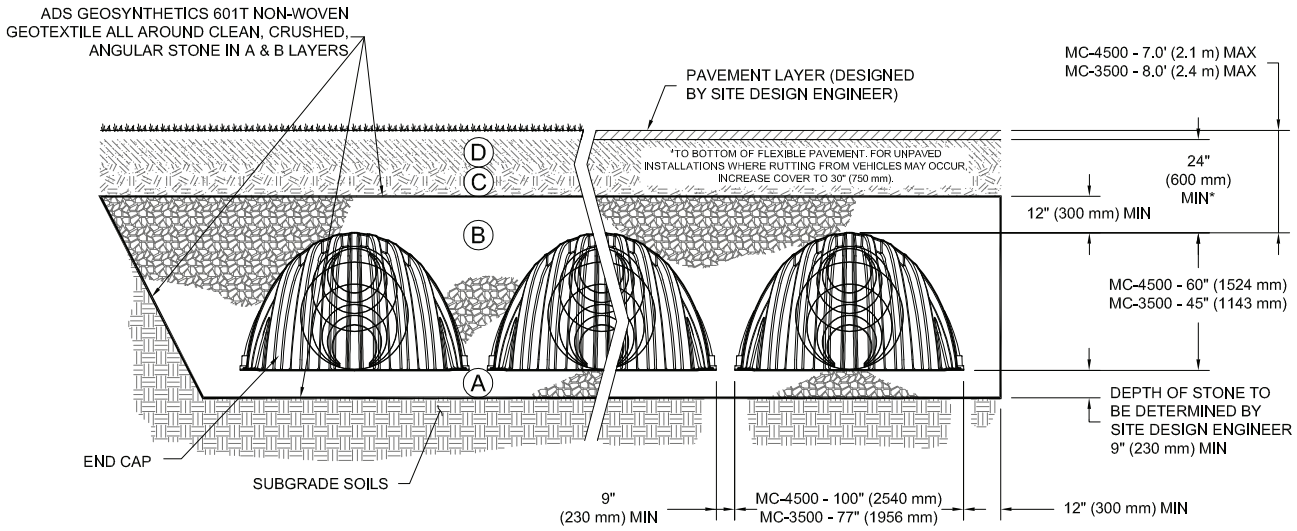
The stone surrounding the chambers consists of the foundation stone below the chambers and embedment stone surrounding the chambers. The foundation stone and embedment stone are important components of the structural system and also provide open void space for stormwater storage. **Table 3** provides the stone specifications that achieve both structural requirements and a porosity of 40% for stormwater storage. **Figure 11** specifies the extents of each backfill stone location.

TABLE 3—Acceptable Fill Materials

MATERIAL LOCATION		DESCRIPTION	AASHTO DESIGNATION	COMPACTION/DENSITY REQUIREMENT
D	**FINAL FILL:** FILL MATERIAL FOR LAYER 'D' STARTS FROM THE TOP OF THE 'C' LAYER TO THE BOTTOM OF FLEXIBLE PAVEMENT OR UNPAVED FINISHED GRADE ABOVE. NOTE THAT PAVEMENT SUBBASE MAY BE PART OF THE 'D' LAYER	ANY SOIL/ROCK MATERIALS, NATIVE SOILS, OR PER ENGINEER'S PLANS. CHECK PLANS FOR PAVEMENT SUBGRADE REQUIREMENTS.	N/A	PREPARE PER SITE DESIGN ENGINEER'S PLANS. PAVED INSTALLATIONS MAY HAVE STRINGENT MATERIAL AND PREPARATION REQUIREMENTS.
C	**INITIAL FILL:** FILL MATERIAL FOR LAYER 'C' STARTS FROM THE TOP OF THE EMBEDMENT STONE ('B' LAYER) TO 24" (600 mm) ABOVE THE TOP OF THE CHAMBER. NOTE THAT PAVEMENT SUBBASE MAY BE A PART OF THE 'C' LAYER.	GRANULAR WELL-GRADED SOIL/AGGREGATE MIXTURES, <35% FINES OR PROCESSED AGGREGATE. MOST PAVEMENT SUBBASE MATERIALS CAN BE USED IN LIEU OF THIS LAYER.	AASHTO M145[1] A-1,A-2-4,A-3 OR AASHTO M43[1] 3, 357, 4, 467, 5, 56, 57, 6, 67, 68, 7, 78, 8, 89, 9, 10	BEGIN COMPACTOINS AFTER 24" (600 mm) OF MATERIAL OVER THE CHAMBERS IS REACHED. COMPACT ADDTIONAL LAYERS IN 12" (300 mm) MAX LIFTS TO A MIN. 95% PROCTOR DENSITY FOR WELL-GRADED MATERIAL AND 95% RELATIVE DENSITY FOR PROCESSED AGGREGATE MATERIALS.
B	**EMBEDMENT STONE:** FILL SURROUNDING THE CHAMBERS FORM THE FOUDATION STONE ('A' LAYER) TO THE 'C' LAYER ABOVE.	CLEAN, CRUSHED, ANGULAR STONE	AASHTO M43[1] 3, 4	NO COMPACTION REQUIRED
A	**FOUNDATION STONE:** FILL BELOW CHAMBERS FROM THE SUBGRADE UP TO THE FOOT (BOTTOM) OF THE CHAMBER.	CLEAN, CRUSHED, ANGULAR STONE	AASHTO M43[1] 3, 4	PLATE COMPACT OR ROLL TO ACHIEVE A FLAT SURFACE. [2 3]

PLEASE NOTE:
1. THE LISTED AASHTO DESIGNATIONS ARE FOR GRADATIONS ONLY. THE STONE MUST ALSO BE CLEAN, CRUSHED, ANGULAR. FOR EXAMPLE, A SPECIFICATION FOR #4 STONE WOULD STATE: "CLEAN, CRUSHED, ANGULAR NO. 4 (AASHTO M43) STONE".
2. STORMTECH COMPACTION REQUIREMENTS ARE MET FOR 'A' LOCATION MATERIALS WHEN PLACED AND COMPACTED IN 9" (230 mm) (MAX) LIFTS USING TWO FULL COVERAGES WITH A VIBRATORY COMPACTOR.
3. WHERE INFILTRATION SURFACES MAY BE COMPROMISED BY COMPACTION, FOR STANDARD DESIGN LOAD CONDITIONS, A FLAT SURFACE MAY BE ACHIEVED BY RAKING OR DRAGGING WITHOUT COMPACTION EQUIPMENT. FOR SPECIAL LOAD DESIGNS, CONTACT STORMTECH FOR COMPACTION REQUIREMENTS.

FIGURE 11—Fill Material Locations



Once layer 'C' is placed, any soil/material can be placed in layer 'D' up to the finished grade. Most pavement subbase soils can be used to replace the materials of layer 'C' or 'D' at the design engineer's discretion.

3.0 Required Materials/Row Separation

3.2 FILL ABOVE CHAMBERS

Refer to **Table 3** and **Figure 11** for acceptable fill material above the clean, crushed, angular stone. StormTech requires a minimum of 24" (600 mm) from the top of the chamber to the bottom of flexible pavement. For non-paved installations where rutting from vehicles may occur StormTech requires a minimum of 30" (750 mm) from top of chamber to finished grade.

3.3 GEOTEXTILE SEPARATION

A non-woven geotextile meeting AASHTO M288 Class 2 separation requirements must be installed to completely envelope the system and prevent soil intrusion into the crushed, angular stone. Overlap adjacent geotextile rolls per AASHTO M288 separation guidelines. Contact StormTech for a list of acceptable geotextiles.

3.4 PARALLEL ROW SEPARATION/ PERPENDICULAR BED SEPARATION

Parallel Row Separation

The minimum installed spacing between parallel rows after backfilling is 9" (230 mm) for the MC-3500 and MC-4500 chambers (measurement taken between the outside edges of the feet). Spacers may be used for layout convenience. Row spacing wider than the minimum spacing above may be specified.

Perpendicular Bed Separation

When beds are laid perpendicular to each other, a minimum installed spacing of 36" (900 mm) between beds is required.

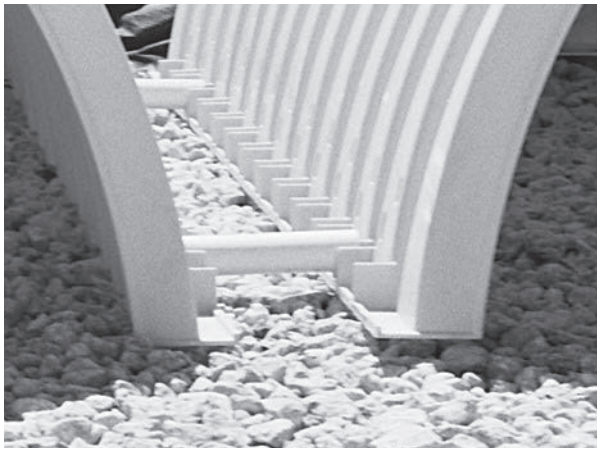
3.5 Special Structural Designs

StormTech engineers may provide special structural designs to enable deeper cover depths or increase the capacity to carry higher live loads. Special designs may utilize the additional strength that can be achieved by compaction of embedment stone or by increasing the spacing between rows.

Increasing the spacing between chamber rows may also facilitate the application of StormTech chambers with either less foundation stone or with weaker subgrade soils. This may be a good option where vertical restrictions on site prevent the use of a deeper foundation.

Contact ADS Engineering Services for more information on special structural designs.

System Cross Section



Minimum Row Spacing 9" (230 mm)

4.1 GENERAL

StormTech subsurface chamber systems offer the flexibility for a variety of inlet and outlet configurations. Contact the StormTech Technical Services Department or your local StormTech representative for assistance configuring inlet and outlet connections.

The open graded stone around and under the chambers provides a significant conveyance capacity ranging from approximately 0.8 cfs (23 l/s) to 13 cfs (368 l/s) per MC-3500 chamber and 0.54 cfs (15 l/s) to 8.5 cfs (240 l/s) for the MC-4500 chamber. The actual conveyance capacity is dependent upon stone size, depth of foundation stone and head of water. Although the high conveyance capacity of the open graded stone is an important component of the flow network, StormTech recommends that a system of inlet and outlet manifolds be designed to distribute and convey the peak flow through the chamber system.

It is the responsibility of the design engineer to provide the design flow rates and storage volumes for the stormwater system and to ensure that the final design meets all conveyance and storage requirements. However, StormTech will work with the design engineer to assist with manifold and chamber layouts that meet the design objectives.

4.2 THE ISOLATOR® ROW

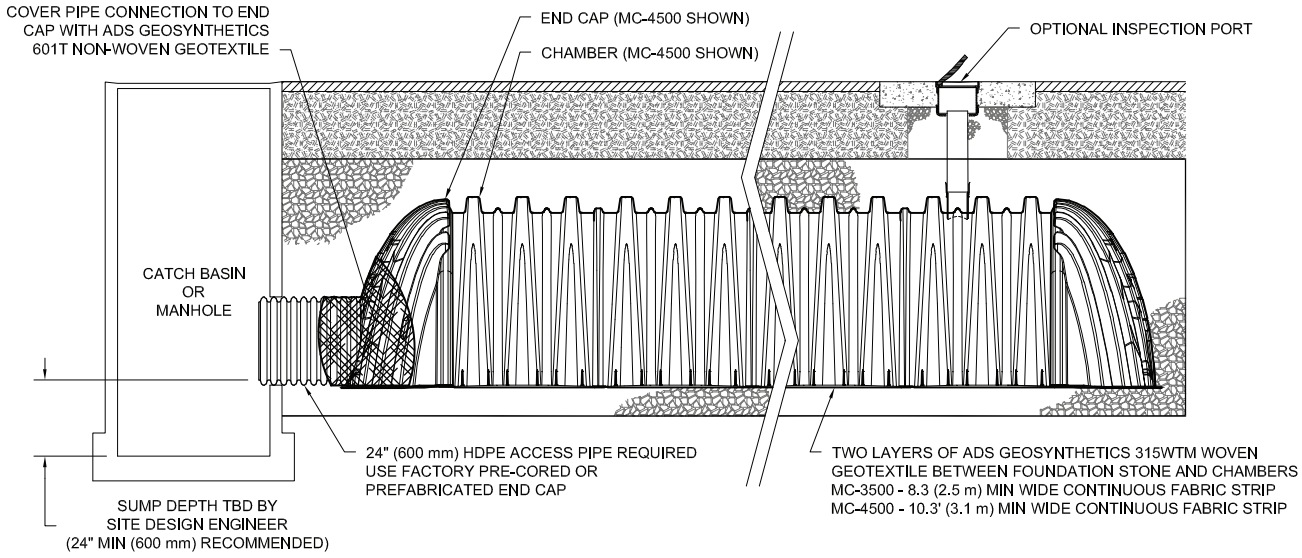
The Isolator Row is a patented system that inexpensively captures total suspended solids (TSS) and debris and provides easy access for inspection and maintenance. A double layer of woven geotextile between the bottom of the chambers and the foundation stone provides the filter media that satisfies most contaminant removal objectives. Each installed MC-3500 chamber and MC-3500 end cap provides 42.9 ft2 (4.0 m2) and 7.5 ft2 (0.7 m2) of bottom filter area respectively. Each installed MC-4500 chamber and MC-4500 end cap provides 30.1 ft^2 (2.80 m^2) and 12.8 ft^2 (1.19 m^2) of bottom filter area respectively.

The Isolator Row can be configured for maintenance objectives or, in some regulatory jurisdictions, for water quality objectives. For water quality applications, Isolator Rows can be sized based on water quality volume or flow rate.

All Isolator Rows require: 1) a manhole for maintenance access, 2) a means of diversion of flows to the Isolator Row and 3) a high flow bypass. Flow diversion can be accomplished by either a weir in the upstream access manhole or simply by feeding the Isolator Row at a lower elevation than the high flow bypass. Contact StormTech for assistance sizing Isolator Rows.

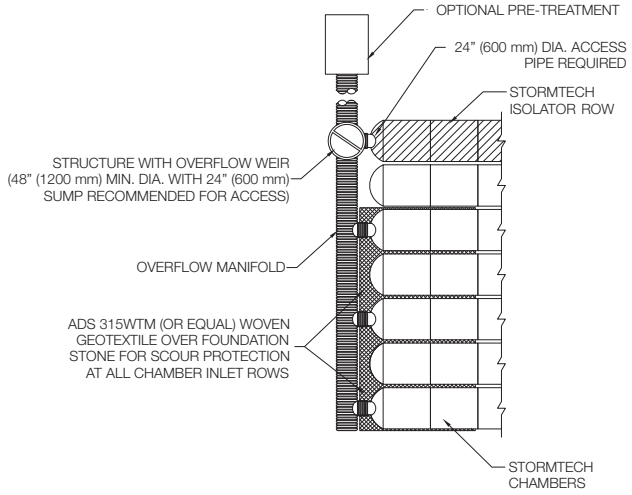
When additional stormwater treatment is required, StormTech systems can be configured using a treatment train approach where other stormwater BMPs are located in series.

FIGURE 12—StormTech Isolator Row Detail



4.0 Hydraulics

FIGURE 13—Typical Inlet Configuration With Isolator Row and Scour Protection



4.3 INLET MANIFOLDS

The primary function of the inlet manifold is to convey and distribute flows to a sufficient number of rows in the chamber bed such that there is ample conveyance capacity to pass the peak flows without creating an unacceptable backwater condition in upstream piping or scour the foundation stone under the chambers.

Manifolds are connected to the end caps either at the top or bottom of the end cap. Standard distances from the base of chamber to the invert of inlet and outlet manifolds connecting to StormTech end caps can be found in table 6. High inlet flow rates from either connection location produce a shear scour potential of the foundation stone. Inlet flows from top inlets also produce impingement scour potential. Scour potential is reduced when standing water is present over the foundation stone. However, for safe design across the wide range of applications, StormTech assumes minimal standing water at the time the design flow occurs.

To minimize scour potential, StormTech recommends the installation of woven scour protection fabric at each inlet row. This enables a protected transition zone from the concentrated flow coming out of the inlet pipe to a uniform flow across the entire width of the chamber for both top and bottom connections.

Allowable flow rates for design are dependent upon: the elevation of inlet pipe, foundation stone size and scour protection. With an appropriate scour protection geotextile installed from the end cap to at least 14.5 ft (4.42 m) in front of the inlet pipe for the MC-3500 and for the MC-4500, for both top and bottom feeds, the flow rates listed in **Table 4** can be used for all StormTech specified foundation stone gradations.

***See StormTech's Tech Sheet #7 for manifold sizing guidance.**

Table 4—Allowable Inlet Flows*

Inlet Pipe Diameter Inches (mm)	Allowable Maximum Flow Rate cfs (l/s)
12 (300)	2.48 (70)
15 (375)	3.5 (99)
18 (450)	5.5 (156)
24 (600)	8.5 (241) [MC-3500]
24 (600)	9.5 (269) [MC-4500]

*Assumes appropriate length of scour fabric per section 4.3

Table 5—Maximum Outlet Flow Rate Capacities From StormTech Oulet Manifolds

PIPE DIA.	FLOW (CFS)	FLOW (L/S)
6" (150 mm)	0.4	11.3
8" (200 mm)	0.7	19.8
10" (250 mm)	1.0	28.3
12" (300 mm)	2.0	56.6
15" (375 mm)	2.7	76.5
18" (450 mm)	4.0	113.3
24" (600 mm)	7.0	198.2
30" (750 mm)	11.0	311.5
36" (900 mm)	16.0	453.1
42" (1050 mm)	22.0	623.0
48" (1200 mm)	28.0	792.9

Table 6—Standard Distances From Base of Chamber to Invert of Inlet and Outlet Manifolds on StormTech End Caps

MC-3500 ENDCAPS			
	PIPE DIA.	INV. (IN)	INV. (MM)
TOP	6" (150 mm)	33.21	841
TOP	8" (200 mm)	31.16	789
TOP	10" (250 mm)	29.04	738
TOP	12" (300 mm)	26.36	671
TOP	15" (375 mm)	23.39	594
TOP	18" (450 mm)	20.03	509
TOP	24" (600 mm)	14.48	369
BOTTOM	12" (750 mm)	1.35	34
BOTTOM	15" (900 mm)	1.5	40
BOTTOM	18" (1050 mm)	1.77	46
BOTTOM	24" (1200 mm)	2.06	52

MC-4500 ENDCAPS			
	PIPE DIA.	INV. (IN)	INV. (MM)
	12" (300 mm)	35.69	907
	15" (375 mm)	32.72	831
	18" (450 mm)	29.36	746
	24" (600 mm)	23.05	585
BOTTOM	12" (750 mm)	1.55	34
BOTTOM	15" (900 mm)	1.7	43
BOTTOM	18" (1050 mm)	1.97	50
BOTTOM	24" (1200 mm)	2.26	57

4.4 OUTLET MANIFOLDS

The primary function of the outlet manifold is to convey peak flows from the chamber system to the outlet control structure. Outlet manifolds are often sized for attenuated flows. They may be smaller in diameter and have fewer row connections than inlet manifolds. In some applications however, the intent of the outlet piping is to convey an unattenuated bypass flow rate and manifolds may be sized similar to inlet manifolds.

Since chambers are generally flowing at or near full at the time of the peak outlet flow rate, scour is generally not governing and outlet manifold sizing is based on pipe flow equations. In most cases, StormTech recommends that outlet manifolds connect the same rows that are connected to an inlet manifold. This provides a continuous flow path through open conduits to pass the peak flow without dependence on passing peak flows through stone.

The primary function of the underdrains is to draw down water stored in the stone below the invert of the manifold. Underdrains are generally not sized for conveyance of the peak flow.

4.5 INSERTA TEE INLET CONNECTIONS

The maximum outlet flow rate capacities from StormTech outlet manifolds can be found in **Table 5.**

FIGURE 14—Typical Inlet, Outlet and Underdrain Configuration

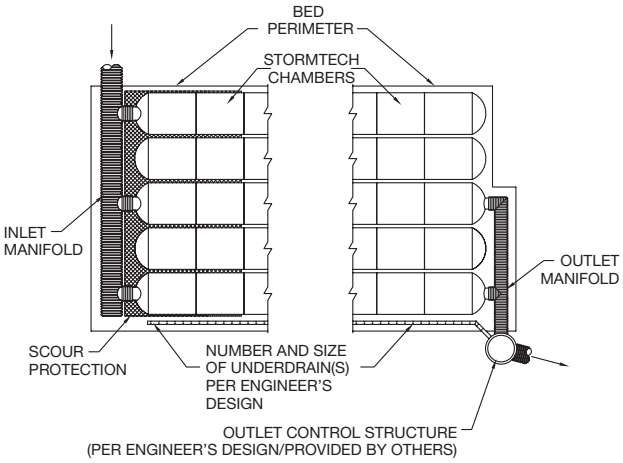
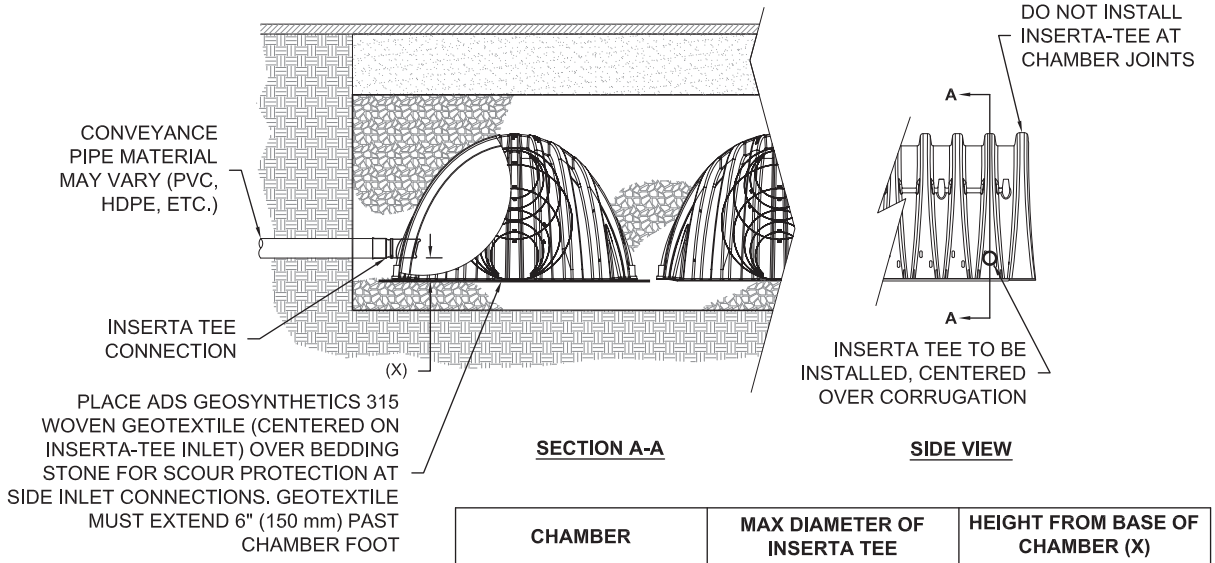


FIGURE 15—Inserta Tee Detail



CHAMBER	MAX DIAMETER OF INSERTA TEE	HEIGHT FROM BASE OF CHAMBER (X)
MC-3500	12" (250 mm)	6" (150 mm)
MC-4500	12" (250 mm)	8" (200 mm)
INSERTA TEE FITTINGS AVAILABLE FOR SDR 26, SDR 35, SCH 40 IPS GASKETED & SOLVENT WELD, N-12, HP STORM, C-900 OR DUCTILE IRON		

NOTE:
PART NUMBERS WILL VARY BASED ON INLET PIPE MATERIALS. CONTACT STORMTECH FOR MORE INFORMATION.

5.0 Cumulative Storage Volumes

Tables 7 and **8** provide cumulative storage volumes for the MC-3500 chamber and end cap. These tables can be used to calculate the stage-storage relationship for the retention or detention system. Digital spreadsheets in which the number of chambers and end caps can be input for quick cumulative storage calculations are available at www.stormtech.com. For assistance with site-specific calculations or input into routing software, contact the StormTech Technical Services Department.

TABLE 7 – MC-3500 Incremental Storage Volume Per Chamber

Assumes 40% stone porosity. Calculations are based upon a 9" (230 mm) stone base under the chambers, 12" (300 mm) of stone above chambers, and 9" (230 mm) of spacing between chambers.

Depth of Water in System Inches (mm)	Cumulative Chamber Storage ft³ (m³)	Total System Cumulative Storage ft³ (m³)
66 (1676)	0.00	178.96 (5.068)
65 (1651)	0.00	177.25 (5.019)
64 (1626)	0.00	175.54 (4.971)
63 (1600)	Stone 0.00	173.83 (4.922)
62 (1575)	Cover 0.00	172.11 (4.874)
61 (1549)	0.00	170.40 (4.825)
60 (1524)	0.00	168.69 (4.777)
59 (1499)	0.00	166.98 (4.728)
58 (1473)	0.00	165.27 (4.680)
57 (1448)	0.00	163.55 (4.631)
56 (1422)	0.00	161.84 (4.583)
55 (1397)	0.00	160.13 (4.534)
54 (1372)	109.95 (3.113)	158.42 (4.486)
53 (1346)	109.89 (3.112)	156.67 (4.436)
52 (1321)	109.69 (3.106)	154.84 (4.385)
51 (1295)	109.40 (3.098)	152.95 (4.331)
50 (1270)	109.00 (3.086)	151.00 (4.276)
49 (1245)	108.31 (3.067)	148.88 (4.216)
48 (1219)	107.28 (3.038)	146.55 (4.150)
47 (1194)	106.03 (3.003)	144.09 (4.080)
46 (1168)	104.61 (2.962)	141.52 (4.007)
45 (1143)	103.04 (2.918)	138.86 (3.932)
44 (1118)	101.33 (2.869)	136.13 (3.855)
43 (1092)	99.50 (2.818)	133.32 (3.775)
42 (1067)	97.56 (2.763)	130.44 (3.694)
41 (1041)	95.52 (2.705)	127.51 (3.611)
40 (1016)	93.39 (2.644)	124.51 (3.526)
39 (991)	91.16 (2.581)	121.47 (3.440)
38 (965)	88.86 (2.516)	118.37 (3.352)
37 (948)	86.47 (2.449)	115.23 (3.263)
36 (914)	84.01 (2.379)	112.04 (3.173)
35 (889)	81.49 (2.307)	108.81 (3.081)
34 (864)	78.89 (2.234)	105.54 (2.989)
33 (838)	76.24 (2.159)	102.24 (2.895)
32 (813)	73.52 (2.082)	98.90 (2.800)
31 (787)	70.75 (2.003)	95.52 (2.705)
30 (762)	67.92 (1.923)	92.12 (2.608)
29 (737)	65.05 (1.842)	88.68 (2.511)
28 (711)	62.12 (1.759)	85.21 (2.413)
27 (686)	59.15 (1.675)	81.72 (2.314)
26 (680)	56.14 (1.590)	78.20 (2.214)
25 (635)	53.09 (1.503)	74.65 (2.114)
24 (610)	49.99 (1.416)	71.09 (2.013)
23 (584)	46.86 (1.327)	67.50 (1.911)
22 (559)	43.70 (1.237)	63.88 (1.809)
21 (533)	40.50 (1.147)	60.25 (1.706)
20 (508)	37.27 (1.055)	56.60 (1.603)
19 (483)	34.01 (0.963)	52.93 (1.499)
18 (457)	30.72 (0.870)	49.25 (1.395)
17 (432)	27.40 (0.776)	45.54 (1.290)
16 (406)	24.05 (0.681)	41.83 (1.184)
15 (381)	20.69 (0.586)	38.09 (1.079)
14 (356)	17.29 (0.490)	34.34 (0.973)
13 (330)	13.88 (0.393)	30.58 (0.866)
12 (305)	10.44 (0.296)	26.81 (0.759)
11 (279)	6.98 (0.198)	23.02 (0.652)
10 (254)	3.51 (0.099)	19.22 (0.544)
9 (229)	0.00	15.41 (0.436)
8 (203)	0.00	13.70 (0.388)
7 (178)	0.00	11.98 (0.339)
6 (152)	Stone 0.00	10.27 (0.291)
5 (127)	Foundation 0.00	8.56 (0.242)
4 (102)	0.00	6.85 (0.194)
3 (76)	0.00	5.14 (0.145)
2 (51)	0.00	3.42 (0.097)
1 (25)	0.00	1.71 (0.048)

NOTE: Add 1.71 ft³ (0.030 m³) of storage for each additional inch (25 mm) of stone foundation.
Contact StormTech for cumulative volume spreadsheets in digital format.

TABLE 8 – MC-3500 Incremental Storage Volume Per End Cap

Assumes 40% stone porosity. Calculations are based upon a 9" (230 mm) stone base under the chambers, 12" (300 mm) of stone above end caps, and 9" (230 mm) of spacing between end caps and 6" (150 mm) of stone perimeter.

Depth of Water in System Inches (mm)	Cumulative End Cap Storage ft³ (m³)	Total System Cumulative Storage ft³ (m³)
66 (1676)	0.00	46.96 (1.330)
65 (1651)	0.00	46.39 (1.314)
64 (1626)	0.00	45.82 (1.298)
63 (1600)	Stone 0.00	45.25 (1.281)
62 (1575)	Cover 0.00	44.68 (1.265)
61 (1549)	0.00	44.11 (1.249)
60 (1524)	0.00	43.54 (1.233)
59 (1499)	0.00	42.98 (1.217)
58 (1473)	0.00	42.41 (1.201)
57 (1448)	0.00	41.84 (1.185)
56 (1422)	0.00	41.27 (1.169)
55 (1397)	0.00	40.70 (1.152)
54 (1372)	15.64 (0.443)	40.13 (1.136)
53 (1346)	15.64 (0.443)	39.56 (1.120)
52 (1321)	15.63 (0.443)	38.99 (1.104)
51 (1295)	15.62 (0.442)	38.41 (1.088)
50 (1270)	15.60 (0.442)	37.83 (1.071)
49 (1245)	15.56 (0.441)	37.24 (1.054)
48 (1219)	15.51 (0.439)	36.64 (1.037)
47 (1194)	15.44 (0.437)	36.02 (1.020)
46 (1168)	15.35 (0.435)	35.40 (1.003)
45 (1143)	15.25 (0.432)	34.77 (0.985)
44 (1118)	15.13 (0.428)	34.13 (0.966)
43 (1092)	14.99 (0.424)	33.48 (0.948)
42 (1067)	14.83 (0.420)	32.81 (0.929)
41 (1041)	14.65 (0.415)	32.13 (0.910)
40 (1016)	14.45 (0.409)	31.45 (0.890)
39 (991)	14.24 (0.403)	30.75 (0.871)
38 (965)	14.00 (0.396)	30.03 (0.850)
37 (948)	13.74 (0.389)	29.31 (0.830)
36 (914)	13.47 (0.381)	28.58 (0.809)
35 (889)	13.18 (0.373)	27.84 (0.788)
34 (864)	12.86 (0.364)	27.08 (0.767)

Depth of Water in System Inches (mm)	Cumulative Chamber Storage ft³ (m³)	Total System Cumulative Storage ft³ (m³)
33 (838)	12.53 (0.355)	26.30 (0.745)
32 (813)	12.18 (0.345)	25.53 (0.723)
31 (787)	11.81 (0.335)	24.74 (0.701)
30 (762)	11.42 (0.323)	23.93 (0.678)
29 (737)	11.01 (0.312)	23.12 (0.655)
28 (711)	10.58 (0.300)	22.29 (0.631)
27 (686)	10.13 (0.287)	21.45 (0.607)
26 (680)	9.67 (0.274)	20.61 (0.583)
25 (635)	9.19 (0.260)	19.75 (0.559)
24 (610)	8.70 (0.246)	18.88 (0.559)
23 (584)	8.19 (0.232)	18.01 (0.510)
22 (559)	7.67 (0.217)	17.13 (0.485)
21 (533)	7.13 (0.202)	16.24 (0.460)
20 (508)	6.59 (0.187)	15.34 (0.434)
19 (483)	6.03 (0.171)	14.43 (0.409)
18 (457)	5.46 (0.155)	13.52 (0.383)
17 (432)	4.88 (0.138)	12.61 (0.357)
16 (406)	4.30 (0.122)	11.69 (0.331)
15 (381)	3.70 (0.105)	10.76 (0.305)
14 (356)	3.10 (0.088)	9.83 (0.278)
13 (330)	2.49 (0.071)	8.90 (0.252)
12 (305)	1.88 (0.053)	7.96 (0.225)
11 (279)	1.26 (0.036)	7.02 (0.199)
10 (254)	0.63 (0.018)	6.07 (0.172)
9 (229)	0.00	5.12 (0.145)
8 (203)	0.00	4.55 (0.129)
7 (178)	0.00	3.99 (0.113)
6 (152)	Stone 0.00	3.42 (0.097)
5 (127)	Foundation 0.00	2.85 (0.081)
4 (102)	0.00	2.28 (0.064)
3 (76)	0.00	1.71 (0.048)
2 (51)	0.00	1.14 (0.032)
1 (25)	0.00	0.56 (0.016)

NOTE: Add 0.56 ft³ (0.016 m³) of storage for each additional inch (25 mm) of stone foundation.
Contact StormTech for cumulative volume spreadsheets in digital format.

5.0 Cumulative Storage Volumes

Tables 9 and **10** provide cumulative storage volumes for the MC-4500 chamber and end cap. These tables can be used to calculate the stage-storage relationship for the retention or detention system. Digital spreadsheets in which the number of chambers and end caps can be input for quick cumulative storage calculations are available at www.stormtech.com. For assistance with site-specific calculations or input into routing software, contact the StormTech Technical Services Department.

TABLE 9 – MC-4500 Incremental Storage Volume Per Chamber

Assumes 40% stone porosity. Calculations are based upon a 9" (230 mm) stone base under the chambers, 12" (300 mm) of stone above chambers, and 9" (230 mm) of spacing between chambers.

Depth of Water in System Inches (mm)	Cumulative Chamber Storage ft³ (m³)	Total System Cumulative Storage ft³ (m³)
81 (2057)	0.00	162.62 (4.065)
80 (2032)	0.00	161.40 (4.570)
79 (2007)	0.00	160.18 (4.536)
78 (1981)	Stone 0.00	158.98 (4.501)
77 (1956)	Cover 0.00	157.74 (4.467)
76 (1930)	0.00	156.62 (4.432)
75 (1905)	0.00	155.30 (4.398)
74 (1880)	0.00	154.09 (4.363)
73 (1854)	0.00	152.87 (4.329)
72 (1829)	0.00	151.65 (4.294)
71 (1803)	0.00	150.43 (4.294)
70 (1778)	0.00	149.21 (4.225)
69 (1753)	106.51 (3.016)	147.99 (4.191)
68 (1727)	106.47 (3.015)	146.75 (4.156)
67 (1702)	106.35 (3.012)	145.46 (4.119)
66 (1676)	106.18 (3.007)	144.14 (4.082)
65 (1651)	105.98 (3.001)	142.80 (4.044)
64 (1626)	105.71 (2.993)	141.42 (4.005)
63 (1600)	105.25 (2.981)	139.93 (3.962)
62 (1575)	104.59 (2.962)	138.31 (3.917)
61 (1549)	103.79 (2.939)	136.61 (3.869)
60 (1524)	102.88 (2.913)	134.85 (3.819)
59 (1499)	101.88 (2.885)	133.03 (3.767)
58 (1473)	100.79 (2.854)	131.16 (3.714)
57 (1448)	99.63 (2.821)	129.24 (3.660)
56 (1422)	98.39 (2.786)	127.28 (3.604)
55 (1397)	97.10 (2.749)	125.28 (3.548)
54 (1372)	95.73 (2.711)	123.25 (3.490)
53 (1346)	94.32 (2.671)	121.18 (3.490)
52 (1321)	92.84 (2.629)	119.08 (3.372)
51 (1295)	91.32 (2.586)	116.94 (3.311)
50 (1270)	89.74 (2.541)	114.78 (3.250)
49 (1245)	88.12 (2.495)	112.59 (3.188)
48 (1219)	86.45 (2.448)	110.37 (3.125)
47 (1194)	84.75 (2.400)	108.13 (3.062)
46 (1168)	83.00 (2.350)	105.86 (2.998)
45 (1143)	81.21 (2.300)	103.56 (2.933)
44 (1118)	79.38 (2.248)	101.25 (2.867)
43 (1092)	77.52 (2.195)	98.91 (2.801)

Depth of Water in System Inches (mm)	Cumulative Chamber Storage ft³ (m³)	Total System Cumulative Storage ft³ (m³)
42 (1067)	75.62 (2.141)	96.55 (2.734)
41 (1041)	73.69 (2.087)	94.18 (2.667)
40 (1016)	71.72 (2.031)	91.78 (2.599)
39 (991)	69.73 (1.974)	89.36 (2.531)
38 (965)	67.70 (1.917)	86.93 (2.462)
37 (948)	65.65 (1.859)	84.48 (2.392)
36 (914)	63.57 (1.800)	82.01 (2.322)
35 (889)	61.46 (1.740)	79.53 (2.252)
34 (864)	59.32 (1.680)	77.03 (2.181)
33 (838)	57.17 (1.619)	74.52 (2.110)
32 (813)	54.98 (1.557)	71.99 (2.038)
31 (787)	52.78 (1.495)	69.45 (1.966)
30 (762)	50.55 (1.431)	66.89 (1.894)
29 (737)	48.30 (1.368)	64.32 (1.821)
28 (711)	46.03 (1.303)	61.74 (1.748)
27 (686)	43.74 (1.239)	59.19 (1.675)
26 (680)	41.43 (1.173)	56.55 (1.601)
25 (610)	39.11 (1.107)	53.93 (1.527)
24 (609)	36.77 (1.041)	51.31 (1.453)
23 (584)	34.41 (0.974)	48.67 (1.378)
22 (559)	32.03 (0.907)	46.03 (1.303)
21 (533)	29.64 (0.839)	43.38 (1.228)
20 (508)	27.23 (0.771)	40.71 (1.153)
19 (483)	24.81 (0.703)	38.04 (1.077)
18 (457)	22.38 (0.634)	35.37 (1.001)
17 (432)	19.94 (0.565)	32.68 (0.925)
16 (406)	17.48 (0.495)	29.99 (0.849)
15 (381)	15.01 (0.425)	27.29 (0.773)
14 (356)	12.53 (0.355)	24.58 (0.696)
13 (330)	10.05 (0.284)	21.87 (0.619)
12 (305)	7.55 (0.214)	19.15 (0.542)
11 (279)	5.04 (0.143)	16.43 (0.465)
10 (254)	2.53 (0.072)	13.70 (0.388)
9 (229)	0.00	10.97 (0.311)
8 (203)	0.00	9.75 (0.276)
7 (178)	0.00	8.53 (0.242)
6 (152)	Stone 0.00	7.31 (0.207)
5 (127)	Foundation 0.00	6.09 (0.173)
4 (102)	0.00	4.87 (0.138)
3 (76)	0.00	3.66 (0.104)
2 (51)	0.00	2.44 (0.069)
1 (25)	0.00	1.22 (0.035)

NOTE: Add 1.22 ft³ (0.035 m³) of storage for each additional inch (25 mm) of stone foundation. Contact StormTech for cumulative volume spreadsheets in digital format.

TABLE 10 – MC-4500 Incremental Storage Volume Per End Cap

Assumes 40% stone porosity. Calculations are based upon a 9" (230 mm) stone base under the chambers, 12" (300 mm) of stone above end caps, and 9" (230 mm) of spacing between end caps and 6" (150 mm) of stone perimeter.

Depth of Water in System Inches (mm)	Cumulative End Cap Storage ft³ (m³)	Total System Cumulative Storage ft³ (m³)
81 (2057)	0.00	108.69 (3.078)
80 (2032)	0.00	107.62 (3.047)
79 (2007)	0.00	106.54 (3.017)
78 (1981)	Stone 0.00	105.46 (2.986)
77 (1956)	Cover 0.00	104.38 (2.956)
76 (1930)	0.00	103.31 (2.925)
75 (1905)	0.00	102.23 (2.895)
74 (1880)	0.00	101.15 (2.864)
73 (1854)	0.00	100.07 (2.834)
72 (1829)	0.00	99.00 (2.803)
71 (1803)	0.00	97.92 (2.773)
70 (1778)	0.00	96.84 (2.742)
69 (1753)	35.71 (1.011)	95.76 (2.712)
68 (1727)	35.71 (1.011)	94.69 (2.681)
67 (1702)	35.70 (1.011)	93.60 (2.651)
66 (1676)	35.67 (1.010)	92.51 (2.620)
65 (1651)	35.62 (1.009)	91.40 (2.588)
64 (1626)	35.56 (1.007)	90.29 (2.557)
63 (1600)	35.47 (1.004)	89.16 (2.525)
62 (1575)	35.36 (1.001)	88.01 (2.492)
61 (1549)	35.21 (0.997)	86.85 (2.459)
60 (1524)	35.05 (0.992)	85.67 (2.426)
59 (1499)	34.86 (0.987)	84.48 (2.392)
58 (1473)	34.64 (0.981)	83.27 (2.358)
57 (1448)	34.40 (0.974)	82.05 (2.323)
56 (1422)	34.13 (0.966)	80.81 (2.288)
55 (1397)	33.83 (0.958)	79.55 (2.253)
54 (1372)	33.51 (0.949)	78.28 (2.217)
53 (1346)	33.16 (0.939)	77.00 (2.180)
52 (1321)	32.79 (0.928)	75.70 (2.144)
51 (1295)	32.39 (0.917)	74.38 (2.106)
50 (1270)	31.98 (0.906)	73.06 (2.069)
49 (1245)	31.54 (0.893)	71.71 (2.031)
48 (1219)	31.07 (0.880)	70.36 (1.992)
47 (1194)	30.59 (0.866)	68.99 (1.954)
46 (1168)	30.09 (0.852)	67.61 (1.915)
45 (1143)	29.56 (0.837)	66.22 (1.875)
44 (1118)	29.02 (0.822)	64.81 (1.835)
43 (1092)	28.45 (0.806)	63.40 (1.795)

NOTE: Add 1.08 ft³ (0.031 m³) of storage for each additional inch (25 mm) of stone foundation. Contact StormTech for cumulative volume spreadsheets in digital format.

Depth of Water in System Inches (mm)	Cumulative Chamber Storage ft³ (m³)	Total System Cumulative Storage ft³ (m³)
42 (1067)	27.87 (0.789)	61.97 (1.755)
41 (1041)	27.27 (0.772)	60.53 (1.714)
40 (1016)	26.65 (0.755)	59.08 (1.673)
39 (991)	26.01 (0.736)	57.62 (1.632)
38 (965)	25.35 (0.718)	56.15 (1.590)
37 (948)	24.68 (0.699)	54.67 (1.548)
36 (914)	23.99 (0.679)	53.18 (1.506)
35 (889)	23.28 (0.659)	51.68 (1.463)
34 (864)	22.56 (0.639)	50.17 (1.421)
33 (838)	21.82 (0.618)	48.64 (1.377)
32 (813)	21.06 (0.596)	47.11 (1.334)
31 (787)	20.29 (0.575)	45.57 (1.290)
30 (762)	19.50 (0.552)	44.02 (1.247)
29 (737)	18.70 (0.530)	42.46 (1.202)
28 (711)	17.88 (0.506)	40.89 (1.158)
27 (686)	17.04 (0.483)	39.31 (1.113)
26 (680)	16.19 (0.459)	37.73 (1.068)
25 (610)	15.33 (0.434)	36.14 (1.023)
24 (609)	14.46 (0.410)	34.53 (.0978)
23 (584)	13.58 (0.384)	32.93 (0.932)
22 (559)	12.68 (0.359)	31.31 (0.887)
21 (533)	11.77 (0.333)	29.69 (0.841)
20 (508)	10.85 (0.307)	26.06 (0.794)
19 (483)	9.91 (0.281)	26.42 (0.748)
18 (457)	8.97 (0.254)	24.77 (0.702)
17 (432)	8.01 (0.227)	23.12 (0.655)
16 (406)	7.04 (0.199)	21.46 (0.608)
15 (381)	6.07 (0.172)	19.80 (0.561)
14 (356)	5.08 (0.144)	18.13 (0.513)
13 (330)	4.08 (0.116)	16.45 (0.466)
12 (305)	3.07 (0.087)	14.77 (0.418)
11 (279)	2.06 (0.058)	13.09 (0.371)
10 (254)	1.03 (0.029)	11.39 (0.323)
9 (229)	0.00	9.70 (0.275)
8 (203)	0.00	8.62 (0.244)
7 (178)	0.00	7.54 (0.214)
6 (152)	Stone 0.00	6.46 (0.183)
5 (127)	Foundation 0.00	5.39 (0.153)
4 (102)	0.00	4.31 (0.122)
3 (76)	0.00	3.23 (0.092)
2 (51)	0.00	2.15 (0.061)
1 (25)	0.00	1.08 (0.031)

6.0 MC-3500 Chamber System Sizing

The following steps provide the calculations necessary for preliminary sizing of an MC-3500 chamber system. For custom bed configurations to fit specific sites, contact the StormTech Technical Services Department or your local StormTech representative.

1) Determine the amount of storage volume (VS) required. It is the design engineer's sole responsibility to determine the storage volume required.

TABLE 11—Storage Volume Per Chamber/End Cap ft³ (m³)

	Bare Unit Storage ft³ (m³)	Chamber/End Cap and Stone Volume — Stone Foundation Depth in. (mm)			
		9 (230)	12 (300)	15 (375)	18 (450)
MC-3500 Chamber	109.9 (3.11)	178.9 (5.06)	184.0 (5.21)	189.2 (5.36)	194.3 (5.5)
MC-3500 End Cap	14.9 (0.42)	46.0 (1.30)	47.7 (1.35)	49.4 (1.40)	51.1 (1.45)

NOTE: Assumes 9" (230 mm) row spacing, 40% stone porosity, 12" (300 mm) stone above and includes the bare chamber/end cap volume. End cap volume assumes 6" (150 mm) stone perimeter.

2) Determine the number of chambers (C) required. To calculate the number of chambers required for adequate storage, divide the storage volume (Vs) by the storage volume of the chamber (from **Table 11**), as follows: **C = Vs / Storage Volume per Chamber**

3) Determine the number of end caps required. The number of end caps (EC) required depends on the number of rows required by the project. Once the number of chamber rows is determined, multiply the number of chamber rows by 2 to determine the number of end caps required. **EC = No. of Chamber Rows x 2**

NOTE: Additional end caps may be required for systems having inlet locations within the chamber bed.

4) Determine additional storage provided by end caps. End Caps will provide additional storage to the project. Multiply the number of end caps (EC) by the storage volume per end cap (ECS) to determine the additional storage (As) provided by the end caps. **As = EC x ECs**

5) Adjust number of chambers (C) to account for additional end cap storage (As). The original number of chambers (C) can now be reduced due to the additional storage in the end caps. Divide the additional storage (As) by the storage volume per chamber to determine the number of chambers that can be removed. **Number of chambers to remove = As/ volume per chamber**

NOTE: Additional storage exists in the stone perimeter as well as in the inlet and outlet manifold systems. Contact StormTech's Technical Services Department for assistance with determining the number of chambers and end caps required for your project.

6) Determine the required bed size (S). The size of the bed will depend on the number of chambers and end caps required:

MC-3500 area per chamber = 51.4 ft² (4.8 m²)
MC-3500 area per end cap = 13.5 ft² (1.3 m²)

S = (C x area per chamber) + (EC x area per end cap)

NOTE: It is necessary to add 12" (300 mm) of stone perimeter parallel to the chamber rows and 6" (150 mm) of stone perimeter from the base of all end caps. The additional area due to perimeter stone is not included in the area numbers above.

7) Determine the amount of stone (Vst) required. To calculate the total amount of clean, crushed, angular stone required, multiply the number of chambers (C) and the number of end caps (EC) by the selected weight of stone from **Table 12.**

NOTE: Clean, crushed, angular stone is also required around the perimeter of the system.

TABLE 12—Amount of Stone Per Chamber/End Cap

ENGLISH tons (yd³)	Stone Foundation Depth			
	9"	12"	15"	18"
MC-3500	9.1 (6.4)	9.7 (6.9)	10.4 (7.3)	11.1 (7.8)
End Cap	4.1 (2.9)	4.3 (3.1)	4.6 (3.2)	4.8 (3.4)
METRIC kg (m³)	230 mm	300 mm	375 mm	450 mm
MC-3500	8220 (4.9)	8831 (5.3)	9443 (5.6)	10054 (6.0)
End Cap	3699 (2.2)	3900 (2.3)	4100 (2.5)	4301 (2.6)

NOTE: Assumes 12" (300 mm) of stone above, and 9" (230 mm) row spacing, and 6" (150 mm) of perimeter stone in front of end caps.

8) Determine the volume of excavation (Ex) required. Each additional foot of cover will add a volume of excavation of 1.9 yd³ (1.5 m³) per MC-3500 chamber and 0.6 yd³ (0.5 m³) per MC-3500 end cap.

TABLE 13—Volume of Excavation Per Chamber/End Cap yd³ (m³)

	Stone Foundation Depth			
	9" (230 mm)	12" (300 mm)	15"(375 mm)	18"(450 mm)
MC-3500	12.4 (9.5)	12.8 (9.8)	13.3 (10.2)	13.8 (10.5)
End Cap	4.1 (3.1)	4.3 (3.3)	4.4 (3.4)	4.5 (3.5)

NOTE: Assumes 9" (230 mm) separation between chamber rows, 6" (150 mm) of perimeter in front of end caps, and 24" (600 mm) of cover. The volume of excavation will vary as the depth of cover increases.

9) Determine the area of geotextile (F) required. The bottom, top and sides of the bed must be covered with a non-woven geotextile (filter fabric) that meets AASHTO M288 Class 2 requirements. The area of the sidewalls must be calculated and a 24" (600 mm) overlap must be included for all seams. Geotextiles typically come in 15 foot (4.57 m) wide rolls.

6.0 MC-4500 Chamber System Sizing

The following steps provide the calculations necessary for preliminary sizing of an MC-4500 chamber system. For custom bed configurations to fit specific sites, contact the StormTech Technical Services Department or your local StormTech representative.

1) Determine the amount of storage volume (VS) required. It is the design engineer's sole responsibility to determine the storage volume required.

TABLE 14—Storage Volume Per Chamber/End Cap ft³ (m³)

	Bare Unit Storage ft³ (m³)	Chamber/End Cap and Stone Volume — Stone Foundation Depth in. (mm)			
		9 (230)	12 (300)	15 (375)	18 (450)
MC-4500 Chamber	106.5 (3.01)	162.6 (4.60)	166.3 (4.71)	169.9 (4.81)	173.6 (4.91)
MC-4500 End Cap	35.7 (1.01)	108.7 (3.08)	111.9 (3.17)	115.2 (3.26)	118.4 (3.35)

NOTE: Assumes 9" (230 mm) row spacing, 40% stone porosity, 12" (300 mm) stone above and includes the bare chamber/end cap volume. End cap volume assumes 12" (300 mm) stone perimeter.

2) Determine the number of chambers (C) required. To calculate the number of chambers required for adequate storage, divide the storage volume (Vs) by the storage volume of the chamber (from **Table 14**), as follows: **C = Vs / Storage Volume per Chamber**

3) Determine the number of end caps required. The number of end caps (EC) required depends on the number of rows required by the project. Once the number of chamber rows is determined, multiply the number of chamber rows by 2 to determine the number of end caps required. **EC = No. of Chamber Rows x 2**

NOTE: Additional end caps may be required for systems having inlet locations within the chamber bed.

4) Determine additional storage provided by end caps. End Caps will provide additional storage to the project. Multiply the number of end caps (EC) by the storage volume per end cap (ECS) to determine the additional storage (As) provided by the end caps. **As = EC x ECs**

5) Adjust number of chambers (C) to account for additional end cap storage (As). The original number of chambers (C) can now be reduced due to the additional storage in the end caps. Divide the additional storage (As) by the storage volume per chamber to determine the number of chambers that can be removed. **Number of chambers to remove = As/ volume per chamber**

NOTE: Additional storage exists in the stone perimeter as well as in the inlet and outlet manifold systems. Contact StormTech's Technical Services Department for assistance with determining the number of chambers and end caps required for your project.

6) Determine the required bed size (S). The size of the bed will depend on the number of chambers and end caps required:

MC-4500 area per chamber = 36.6 ft² (3.4 m²)
MC-4500 area per end cap = 23.2 ft² (2.2 m²)

S = (C x area per chamber) + (EC x area per end cap)

NOTE: It is necessary to add 12" (300 mm) of stone perimeter parallel to the chamber rows and 6" (150 mm) of stone perimeter from the base of all end caps. The additional area due to perimeter stone is not included in the area numbers above.

7) Determine the amount of stone (Vst) required. To calculate the total amount of clean, crushed, angular stone required, multiply the number of chambers (C) and the number of end caps (EC) by the selected weight of stone from **Table 15.**

NOTE: Clean, crushed, angular stone is also required around the perimeter of the system.

TABLE 15—Amount of Stone Per Chamber

ENGLISH tons (yd³)	Stone Foundation Depth			
	9"	12"	15"	18"
MC-4500	7.4 (5.2)	7.8 (5.5)	8.3 (5.9)	8.8 (6.2)
End Cap	9.6 (6.8)	10.0 (7.1)	10.4 (7.4)	10.9 (7.7)
METRIC kg (m³)	230 mm	300 mm	375 mm	450 mm
MC-4500	6681 (4.0)	7117 (4.2)	7552 (4.5)	7987 (4.7)
End Cap	8691 (5.2)	9075 (5.4)	9460 (5.6)	9845 (5.9)

NOTE: Assumes 12" (300 mm) of stone above, and 9" (230 mm) row spacing, and 12" (300 mm) of perimeter stone in front of end caps.

8) Determine the volume of excavation (Ex) required. Each additional foot of cover will add a volume of excavation of 1.4 yd³ (1.0 m³) per MC-4500 chamber and 1.4 yd³ (0.8 m³) per MC-4500 end cap.

TABLE 16—Volume of Excavation Per Chamber/End Cap yd³ (m³)

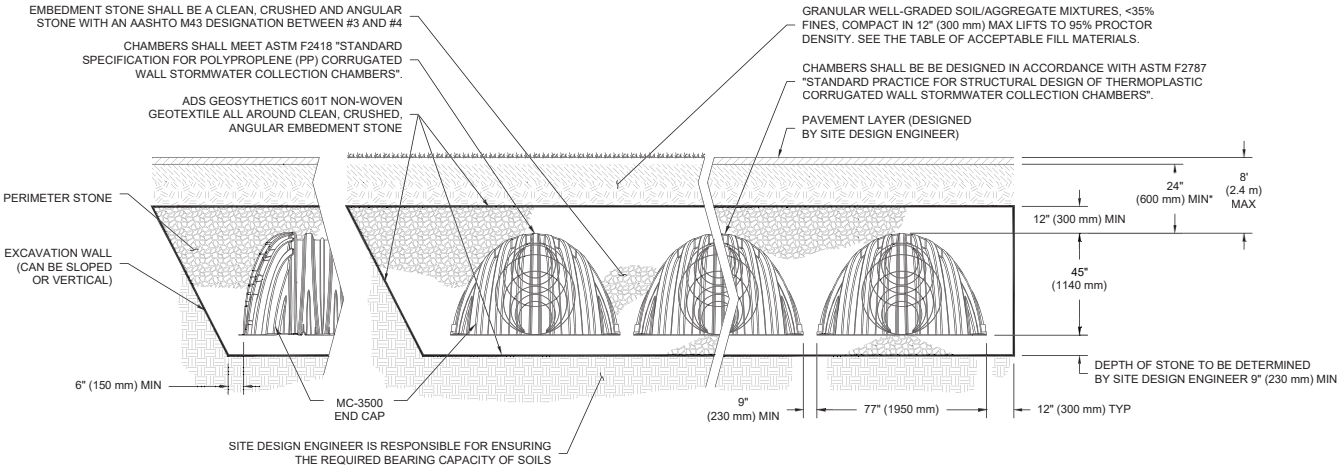
	Stone Foundation Depth			
	9" (230 mm)	12" (300 mm)	15"(375 mm)	18"(450 mm)
MC-4500	10.5 (8.0)	10.8 (8.3)	11.2 (8.5)	11.5 (8.8)
End Cap	9.3 (7.1)	9.6 (7.3)	9.9 (7.6)	10.2 (7.8)

NOTE: Assumes 9" (230 mm) separation between chamber rows, 12" (300 mm) of perimeter in front of end caps, and 24" (600 mm) of cover. The volume of excavation will vary as the depth of cover increases.

9) Determine the area of geotextile (F) required. The bottom, top and sides of the bed must be covered with a non-woven geotextile (filter fabric) that meets AASHTO M288 Class 2 requirements. The area of the sidewalls must be calculated and a 24" (600 mm) overlap must be included for all seams. Geotextiles typically come in 15 foot (4.57 m) wide rolls.

7.0 Structural Cross Sections and Specifications

FIGURE 16—MC-3500 Structural Cross Section Detail (Not to Scale)



*MINIMUM COVER TO BOTTOM OF FLEXIBLE PAVEMENT. FOR UNPAVED INSTALLATIONS WHERE RUTTING FROM VEHICLES MAY OCCUR, INCREASE COVER TO 30" (750 mm).

Special applications will be considered on a project by project basis. Please contact our application department should you have a unique application for our team to evaluate.

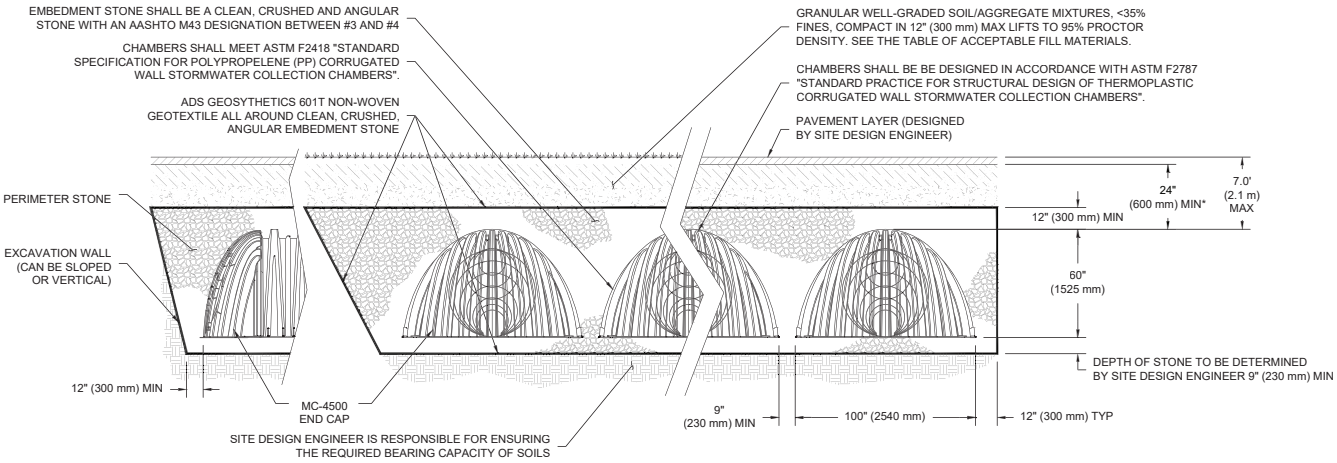
MC-3500 STORMWATER CHAMBER SPECIFICATIONS

1. Chambers shall be StormTech MC-3500 or approved equal.
2. Chambers shall be made from virgin, impact-modified polypropylene copolymers.
3. Chamber rows shall provide continuous, unobstructed internal space with no internal panels that would impede flow.
4. The structural design of the chambers, the structural backfill and the installation requirements shall ensure that the load factors specified in the AASHTO LRFD Bridge Design Specifications, Section 12.12 are met for: 1) long-duration dead loads and 2) short-duration live loads, based on the AASHTO Design Truck with consideration for impact and multiple vehicle presences.
5. Chambers shall meet the requirements of ASTM F 2418, "Standard Specification for Polypropylene (PP) Corrugated Wall Stormwater Collection Chambers."
6. Chambers shall conform to the requirements of ASTM F 2787, "Standard Practice for Structural Design of Thermoplastic Corrugated Wall Stormwater Collection Chambers."
7. Only chambers that are approved by the engineer will be allowed. The contractor shall submit (3 sets) of the following to the engineer for approval before delivering chambers to the project site:
   - A structural evaluation by a registered structural engineer that demonstrates that the load factors specified in the AASHTO LRFD Bridge Design Specifications, Section 12.12 are met. The 50-year creep modulus data specified in ASTM F 2418 must be used as part of the AASHTO structural evaluation to verify long-term performance.
   - Structural cross section detail on which the structural cross section is based.
8. The installation of chambers shall be in accordance with the manufacturer's latest Construction Guide.

Detail drawings available in Cad Rev. 2000 format at www.stormtech.com

7.0 Structural Cross Sections and Specifications

FIGURE 16—MC-4500 Structural Cross Section Detail (Not to Scale)



*MINIMUM COVER TO BOTTOM OF FLEXIBLE PAVEMENT. FOR UNPAVED INSTALLATIONS WHERE RUTTING FROM VEHICLES MAY OCCUR, INCREASE COVER TO 30" (750 mm).

Special applications will be considered on a project by project basis. Please contact our application department should you have a unique application for our team to evaluate.

MC-4500 STORMWATER CHAMBER SPECIFICATIONS

1. Chambers shall be StormTech MC-4500 or approved equal.
2. Chambers shall be made from virgin, impact-modified polypropylene copolymers.
3. Chamber rows shall provide continuous, unobstructed internal space with no internal panels that would impede flow.
4. The structural design of the chambers, the structural backfill and the installation requirements shall ensure that the load factors specified in the AASHTO LRFD Bridge Design Specifications, Section 12.12 are met for: 1) long-duration dead loads and 2) short-duration live loads, based on the AASHTO Design Truck with consideration for impact and multiple vehicle presences.
5. Chambers shall meet the requirements of ASTM F 2418, "Standard Specification for Polypropylene (PP) Corrugated Wall Stormwater Collection Chambers."
6. Chambers shall conform to the requirements of ASTM F 2787, "Standard Practice for Structural Design of Thermoplastic Corrugated Wall Stormwater Collection Chambers."
7. Only chambers that are approved by the engineer will be allowed. The contractor shall submit (3 sets) of the following to the engineer for approval before delivering chambers to the project site:
   - A structural evaluation by a registered structural engineer that demonstrates that the load factors specified in the AASHTO LRFD Bridge Design Specifications, Section 12.12 are met. The 50-year creep modulus data specified in ASTM F 2418 must be used as part of the AASHTO structural evaluation to verify long-term performance.
   - Structural cross section detail on which the structural cross section is based.
8. The installation of chambers shall be in accordance with the manufacturer's latest Construction Guide.

Detail drawings available in Cad Rev. 2000 format at www.stormtech.com

8.0 General Notes

1. StormTech ("StormTech") requires installing contractors to use and understand the latest **StormTech MC-3500 and MC-4500 Construction Guide** prior to beginning system installation.

2. StormTech offers installation consultations to installing contractors. Contact our Technical Service Department or local StormTech representative at least 30 days prior to system installation to arrange a pre-installation consultation. Our representatives can then answer questions or address comments on the StormTech chamber system and inform the installing contractor of the minimum installation requirements before beginning the system's construction. Call 860-529-8188 to speak to a Technical Service Representative or visit www.stormtech.com to receive a copy of our Construction Guide.

3. StormTech requirements for systems with pavement design (asphalt, concrete pavers, etc.): Minimum cover is 24" (600 mm) not including pavement; MC-3500 maximum cover is 8.0' (1.98 m) and MC-4500 maximum cover is 7.0' (2.43 m) both including pavement. For designs with cover depths deeper than these maximums, please contact Stormtech. For installations that do not include pavement, where rutting from vehicles may occur, minimum required cover is increased to 30" (762 mm).

4. The contractor must report any discrepancies with the bearing capacity of the subgrade materials to the design engineer.

5. AASHTO M288 Class 2 non-woven geotextile (ADS601 or equal) (filter fabric) must be used as indicated in the project plans.

6. Stone placement between chamber rows and around perimeter must follow instructions as indicated in the most current version of StormTech MC-3500 / MC-4500 Construction Guide.

7. Backfilling over the chambers must follow requirements as indicated in the most current version of StormTech MC-3500 / MC-4500 Construction Guide.

8. The contractor must refer to StormTech MC-3500 / MC-4500 Construction Guide for a Table of Acceptable Vehicle Loads at various depths of cover. This information is also available at the StormTech website: www.stormtech.com. The contractor is responsible for preventing vehicles that exceed StormTech requirements from traveling across or parking over the stormwater system. Temporary fencing, warning tape and appropriately located signs are commonly used to prevent unauthorized vehicles from entering sensitive construction areas.

9. The contractor must apply erosion and sediment control measures to protect the stormwater system during all phases of site construction per local codes and design engineer's specifications.

10. STORMTECH PRODUCT WARRANTY IS LIMITED. Contact StormTech for warranty information.

9.1 ISOLATOR ROW INSPECTION

Regular inspection and maintenance are essential to assure a properly functioning stormwater system. Inspection is easily accomplished through the manhole or optional inspection ports of an Isolator Row. Please follow local and OSHA rules for a confined space entry.

Inspection ports can allow inspection to be accomplished completely from the surface without the need for a confined space entry. Inspection ports provide visual access to the system with the use of a flashlight. A stadia rod may be inserted to determine the depth of sediment. If upon visual inspection it is found that sediment has accumulated to an average depth exceeding 3" (76 mm), cleanout is required.

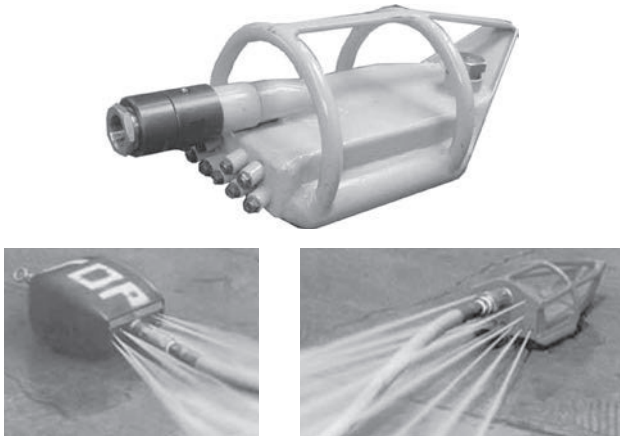
A StormTech Isolator Row should initially be inspected immediately after completion of the site's construction. While every effort should be made to prevent sediment from entering the system during construction, it is during this time that excess amounts of sediments are most likely to enter any stormwater system. Inspection and maintenance, if necessary, should be performed prior to passing responsibility over to the site's owner. Once in normal service, a StormTech Isolator Row should be inspected bi-annually until an understanding of the sites characteristics is developed. The site's maintenance manager can then revise the inspection schedule based on experience or local requirements.

9.2 ISOLATOR ROW MAINTENANCE

JetVac maintenance is recommended if sediment has been collected to an average depth of 3" (76 mm) inside the Isolator Row. More frequent maintenance may be required to maintain minimum flow rates through the Isolator Row. The JetVac process utilizes a high pressure water nozzle to propel itself down the Isolator Row while scouring and suspending sediments. As the nozzle is retrieved, a wave of suspended sediments is flushed back into the manhole for vacuuming. Most sewer and pipe maintenance companies have vacuum/ JetVac combination vehicles. Fixed nozzles designed for culverts or large diameter pipe cleaning are preferable. Rear facing jets with an effective spread of at least 45" (1143 mm) are best. The JetVac process shall only be performed on StormTech Rows that have AASHTO class 1 woven geotextile over their foundation stone (ADS 315WTM or equal).

Looking down the Isolator Row

A typical JetVac truck (This is not a StormTech product.)



Examples of culvert cleaning nozzles appropriate for Isolator Row maintenance. (These are not StormTech products).

ADS "Terms and Conditions of Sale" are available on the ADS website, www.ads-pipe.com
Advanced Drainage Systems, the ADS logo and the Green Stripe are registered trademarks of Advanced Drainage Systems, Inc.
StormTech® and the Isolator® Row are registered trademarks of StormTech, Inc.
Green Building Council Member Logo is a registered trademark of the U.S. Green Building Council.
© 2018 Advanced Drainage Systems, Inc. S250211 01/18

A Family of Products and Services for the Stormwater Industry:

- MC-3500 and MC-4500 Chambers and End Caps
- SC-310 and SC-740 Chambers and End Caps
- DC-780 Chambers and End Caps
- Fabricated End Caps
- Fabricated Manifold Fittings
- Patented Isolator Row for Maintenance and Water Quality
- Chamber Separation Spacers
- In-House System Layout Assistance
- On-Site Educational Seminars
- Worldwide Technical Sales Group
- Centralized Product Applications Department
- Research and Development Team
- Technical Literature, O&M Manuals and Detailed CAD drawings all downloadable via our Website

StormTech provides state-of-the-art products and services that meet or exceed industry performance standards and expectations. We offer designers, regulators, owners and contractors the highest quality products and services for stormwater management that "Saves Valuable Land and Protects Water Resources."

ADS StormTech DESIGN TOOL

Advanced Drainage Systems, Inc.
4640 Trueman Blvd. Hilliard, OH 43026

1-800-821-6710

www.ads-pipe.com

*THE MOST **ADVANCED** NAME IN WATER MANAGEMENT SOLUTIONS™*

ADS

9.1 ISOLATOR ROW INSPECTION

Regular inspection and maintenance are essential to assure a properly functioning stormwater system. Inspection is easily accomplished through the manhole or optional inspection ports of an Isolator Row. Please follow local and OSHA rules for a confined space entry.

Inspection ports can allow inspection to be accomplished completely from the surface without the need for a confined space entry. Inspection ports provide visual access to the system with the use of a flashlight. A stadia rod may be inserted to determine the depth of sediment. If upon visual inspection it is found that sediment has accumulated to an average depth exceeding 3" (76 mm), cleanout is required.

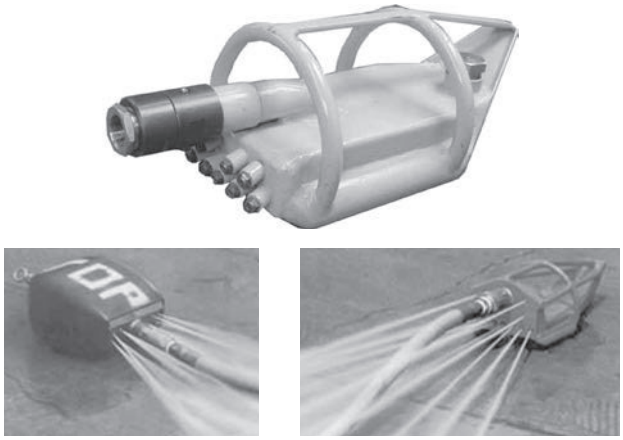
A StormTech Isolator Row should initially be inspected immediately after completion of the site's construction. While every effort should be made to prevent sediment from entering the system during construction, it is during this time that excess amounts of sediments are most likely to enter any stormwater system. Inspection and maintenance, if necessary, should be performed prior to passing responsibility over to the site's owner. Once in normal service, a StormTech Isolator Row should be inspected bi-annually until an understanding of the sites characteristics is developed. The site's maintenance manager can then revise the inspection schedule based on experience or local requirements.

9.2 ISOLATOR ROW MAINTENANCE

JetVac maintenance is recommended if sediment has been collected to an average depth of 3" (76 mm) inside the Isolator Row. More frequent maintenance may be required to maintain minimum flow rates through the Isolator Row. The JetVac process utilizes a high pressure water nozzle to propel itself down the Isolator Row while scouring and suspending sediments. As the nozzle is retrieved, a wave of suspended sediments is flushed back into the manhole for vacuuming. Most sewer and pipe maintenance companies have vacuum/ JetVac combination vehicles. Fixed nozzles designed for culverts or large diameter pipe cleaning are preferable. Rear facing jets with an effective spread of at least 45" (1143 mm) are best. The JetVac process shall only be performed on StormTech Rows that have AASHTO class 1 woven geotextile over their foundation stone (ADS 315WTM or equal).

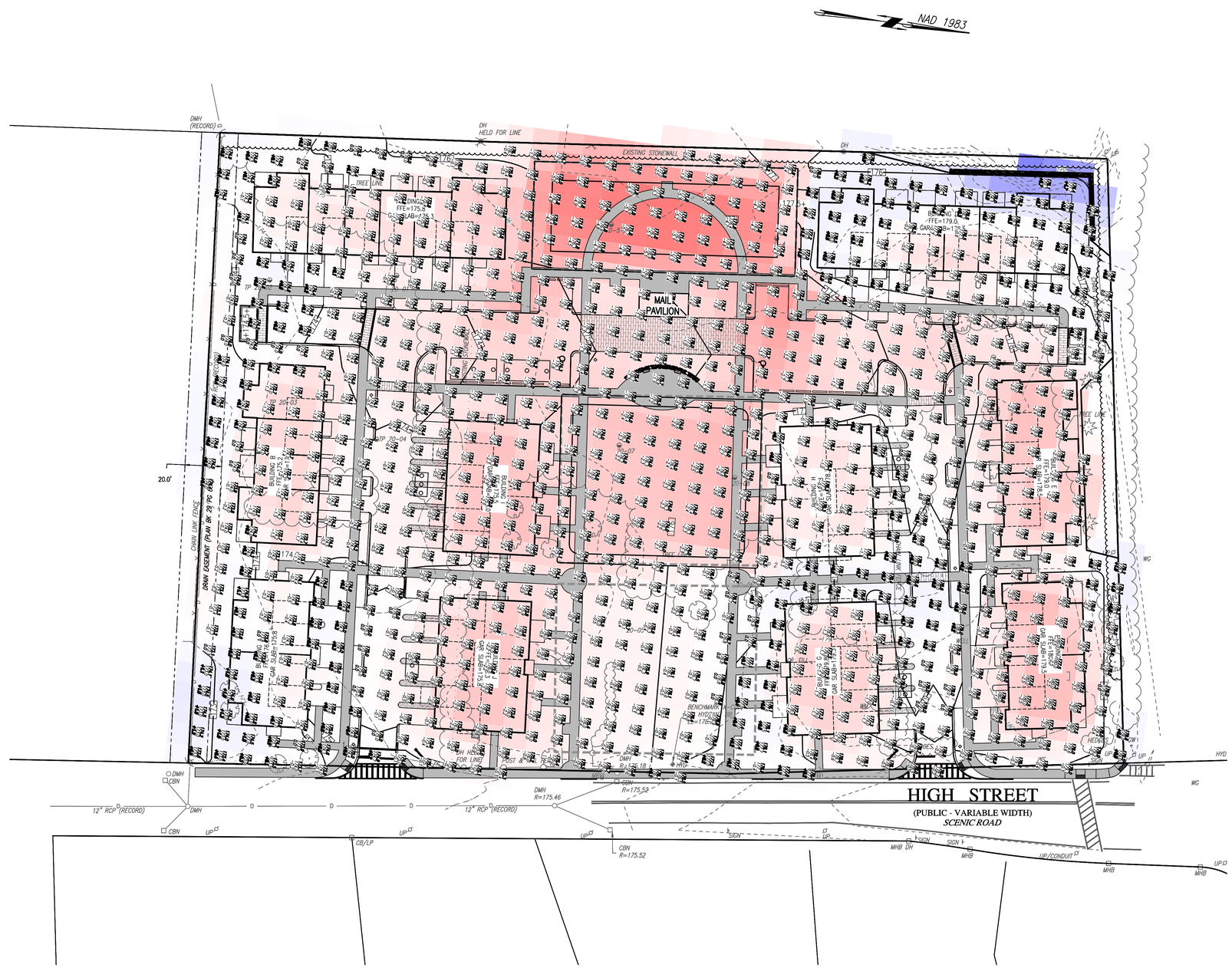
Looking down the Isolator Row

A typical JetVac truck (This is not a StormTech product.)



Examples of culvert cleaning nozzles appropriate for Isolator Row maintenance. (These are not StormTech products).

Site Plan – Attached



COPYRIGHT © BY MERRILL CORPORATION
NO PART OF THIS DOCUMENT MAY BE REPRODUCED, STORED IN A RETRIEVAL SYSTEM, OR TRANSMITTED IN ANY FORM OR BY ANY MEANS, ELECTRONIC, MECHANICAL, PHOTOCOPYING, RECORDING OR OTHERWISE, WITHOUT THE EXPRESS WRITTEN CONSENT OF MERRILL CORPORATION WITH THE EXCEPTION OF ANY REGULATORY AUTHORITY WHICH MAY REPRODUCE IT IN CONJUNCTION WITH THE PERFORMANCE OF OFFICIAL BUSINESS UNDER ITS JURISDICTION. ANY MODIFICATIONS MADE TO THIS DOCUMENT WITHOUT THE EXPRESS WRITTEN CONSENT OF MERRILL CORPORATION SHALL RENDER IT UNUSABLE.

REVISIONS

1	4/30/21	REVIEW & COORDINATION

DRAWN BY: JG

DESIGNED BY: DK

CHECKED BY: DK

Merrill
Engineers and Land Surveyors
427 COLUMBA ROAD, HANOVER, MA 02339 / T: (781) 826-9200
26 UNION STREET, PLYMOUTH MA 02360 / T: (508) 746-6060
WWW.MERRILLINC.COM

SITE PLAN

#15, 19, 27 & 35 HIGH STREET
NORWELL, MASSACHUSETTS 02061

OWNER/APPLICANT
NORTHLAND RESIDENTIAL CORPORATION
80 BEHARRELL STREET, SUITE E
CONCORD, MASSACHUSETTS 01742

JANUARY 29, 2021

SCALE: 1"=30'

JOB NO. 20-127

LATEST REVISION:
APRIL 30, 2021

CUT AND FILL
EXHIBIT PLAN

SHEET 1 of 1

High Street, Norwell MA

Volume Report Tue Apr 27 11:42:12 2021
Comparing Grid: C:\Users\jgreen\AppData\Roaming\Carlson Software\Carlson2021\R22.0_X64\USER\grid1.grd
and Grid: C:\Users\jgreen\AppData\Roaming\Carlson Software\Carlson2021\R22.0_X64\USER\grid2.grd
Grid corner locations: 824074.36,2887534.91 to 824637.26,2888230.70
Grid resolution X: 50, Y: 50 Grid cell size X: 11.26, Y: 13.92
Area in Cut : 132,609.0 S.F., 3.04 Acres
Area in Fill: 33,648.5 S.F., 0.77 Acres
Total inclusion area: 166,257.5 S.F., 3.82 Acres
Cut to Fill ratio: 9.51
Average Cut Depth: 1.29 Average Fill Depth: 0.54
Max Cut Depth: 5.25 Max Fill Depth: 5.96
Cut (C.Y.) / Area (acres): 1664.20
Fill (C.Y.) / Area (acres): 175.05
Cut volume: 171,500.0 C.F., 6,351.85 C.Y.
Fill volume: 18,039.8 C.F., 668.14 C.Y.