Greenwich, CT | **Existing Pipes - Morningside Drive - 10-Year Storm** | MDP - 9/4/09

Pipe I.D.	Downstream Pipe I.D.	Design Notes	Pipe Length (ft)	Approx. Slope (ft/ft) (min= 0.005)	10-Yr Storm Peak Rate of Runoff (cfs)	Pipe Diam (in) Existing	*n* (exist 0.015 new 0.013)	Manning's Pipe Velocity (fps)	Manning's Pipe Capacity (cfs)	Sufficient Capacity (Manning's)	Orifice's Pipe Velocity (fps)	Orifice's Pipe Capacity (cfs)	Sufficient Capacity (Orifice)	Watershed Areas contributing to the flow in the pipe	DS Cover	US Cover	DS Invert	US Invert	DS Ground Elev	US Ground Elev
		Notation	L	S		D	*n*	V_m	Q_m		V_o	Q_o					ID	IU		
		Equation Used		(1)				(2)**	(3)**		(4)*	(5)*								
CVT_96	DR_15303		40	0.0005	29.4	24	0.015	1.4	4.4	no				1	2.40	1.46	10.20	10.22	14.60	13.68
DR_15303	DR_15304		104	0.0010	31.3	24	0.015	1.9	6.1	no				1->3	2.37	2.50	10.00	10.10	14.37	14.60
DR_15304	DR_1730		185	0.0003	31.4	24	0.015	1.0	3.2	no				1->4	2.05	2.37	9.95	10.00	14.00	14.37
DR_1730	DR_1731		235	0.0004	31.4	24	0.015	1.3	4.0	no				1->4	1.40	2.05	9.85	9.95	13.25	14.00
DR_1731	DR_1737		228	0.0027	31.4	24	0.015	3.3	10.2	no				1->4	1.77	1.40	9.23	9.85	13.00	13.25
DR_15105	DR_1737		226	0.0065	2.1	12	0.015	3.2	2.5	yes				5	2.67	3.33	9.33	10.79	13.00	15.12
DR_17232	DR_1737		192	0.0059	3.0	12	0.015	3.0	2.4	no				6	2.67	3.90	9.33	10.47	13.00	15.37
DR_1737	POND		336	0.0001	33.4	24	0.015	0.6	1.9	no	6.6	20.7	no	1->7	0.00	1.77	9.20	9.23	11.20	13.00
DR_1744	no_name (outfall)	Eliptical (36"x60")	129	0.0111	53.4	36	0.015	9.9	116.6	yes				1->9	3.14	4.10	7.66	9.09	13.80	16.19
no_name	CHANNEL	**OUTFALL - heavily silted**	155	0.0098	58.5	48	0.015	3.3	8.1	no	12.6	30.9	no	1->10	0.00	1.34	6.14	7.66	10.14	13.80
no_name		**OUTFALL - modeled as cleaned**	155	0.0098	58.5	48	0.015	9.8	123.3	yes				1->10	0.00	2.14	6.14	7.66	10.14	13.80

User Input =	
HMS Results =	
Calculated =	
Velocity > 10 fps; OR <3 fps =	

Equations Used:

(1) $S = (IU-ID)/L$

(2) $V_m = (1.486/n)*((D/48)^{(2/3)})*(S^{0.5})$

(3) $Q_m = Vm*A$

(4) $V_o = Q_o/A$

(5) $Q_o = c_d*A*((2*g*h)^{0.5})$

*When V_m > 10 fps then Q_o will be checked for capacity under orifice equation.

**When Vm < 10 fps then only Q_m and V_m should be used.

Hydraulic Gradeline Calculations

Morningside Drive - Greenwich, CT

Existing - 10-Year Storm

Water Surface Elevation	10-Yr Storm Peak Rate of Runoff (cfs)	Surface Elev. @ Inlet	Surface Elev. @ Outlet	Pipe Segment	Pipe Length (ft)	Pipe Diam (in)	Area (sf)	HGL Slope	Freeboard (ft)
34.99	29.4	13.68	14.60	CVT_96	40	24	3.14	0.0224	-21.3
34.09	31.3	14.60	14.37	DR_15303	104	24	3.14	0.0253	-19.5
31.46	31.4	14.37	14.00	DR_15304	185	24	3.14	0.0255	-17.1
26.75	31.4	14.00	13.25	DR_1730	235	24	3.14	0.0255	-12.7
20.76	31.4	13.25	13.00	DR_1731	228	24	3.14	0.0255	-7.5
15.97	2.1	15.12	13.00	DR_15105	226	12	0.79	0.0045	-0.8
16.73	3.0	15.37	13.00	DR_17232	192	12	0.79	0.0092	-1.4
14.95	33.4	13.00	11.20	DR_1737	336	24	3.14	0.0128	-2.0
10.65	*Starting Water Surface Elevation - From Pond (Developed in HEC-HMS)								

10.78	53.4	16.19	13.80	DR_1744	129	36	11.78	0.00231	5.4
10.48	58.5	13.80	10.14	no_name	155	48	12.57	0.0022	3.3
10.14	*Starting Water Surface Elevation - Assume D/S crown of outfall								

HGL SLOPE = $((Q*n)/(1.486*A*R_h^{2/3}))^2$