APPENDIX H

Discharge Hydraulix™

PROJECT : Carnation Wastewater Treatment Facility
King County DNRP - WWTF to Snoqualmie River

JOB # : 6620A.10 **REVISION:** 1

CHECKED : B. Einfeld **DATE :** 3/3/2005

BY : S. Leung **DATE :** 3/1/2005

	Equation Ref.	HGL	EGL

DOWNSTREAM CONTROL

WSE =	**64.10**		
Flow =	**1.40 mgd =**	**2.17 cfs**	

Base flood elevation at Bridge (NAVD 88) — HGL 64.10, EGL 64.10

(FEMA Map 53033C0420G, 12/6/01)

[PIPE FRICTION LOSSES (DARCY-WEISBACH / COLEBROOK)] **{ 4 }**

Flow	1.4	mgd =	2.2 cfs
Pipe Diameter, D	8	inch	*ductile iron pipe*
Pipe Length, L	310	ft	
Absolute Roughness, ε	0.00040	ft	
Pipe velocity, v	6.23	fps	
Kinematic Viscosity	1.000E-05	ft^2/sec	
Reynold's Number, R	415085		
Friction factor, f	0.0184		
Friction Energy Loss, h_L	5.15	ft	

MINOR PIPE LOSS HEADING

Flow, Q 1.4 mgd = 2.2 cfs

No.	Description	Flow (mgd)	Flow (cfs)	K	Dia Up (in)	Dia Down (in)	Vel Up (fps)	Vel Down (fps)	Vel Head (ft)	Minor Loss (ft)
3	90 º Bend - Regular Fl.	1.40	2.17	0.30	8	----	6.23	----	0.60	0.54
1	Check Valve - Swing	1.40	2.17	2.50	8	----	6.23	----	0.60	1.50
1	Gate Valve (Open)	1.40	2.17	0.19	8	----	6.23	----	0.60	0.11
1	Outlet Loss - Still Water	1.40	2.17	1.00	8	----	6.23	----	0.60	0.60
									Sum =	2.76

Total Energy Loss = 7.92 ft

Upstream Condition — HGL 72.02, EGL 72.02

[PIPE FRICTION LOSSES (DARCY-WEISBACH / COLEBROOK)] **{ 4 }**

Flow	1.4	mgd =	2.2 cfs
Pipe Diameter, D	12	inch	*HDPE SDR 27 pipe*
Pipe Length, L	4120	ft	
Absolute Roughness, ε	0.00040	ft	
Pipe velocity, v	2.90	fps	
Kinematic Viscosity	1.000E-05	ft^2/sec	
Reynold's Number, R	283093		
Friction factor, f	0.0178		
Friction Energy Loss, h_L	9.75	ft	

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	Equation Ref.	HGL	EGL

MINOR PIPE LOSS HEADING

Flow, Q 1.4 mgd = 2.2 cfs

No.	Description	Flow (mgd)	Flow (cfs)	K	Dia Up (in)	Dia Down (in)	Vel Up (fps)	Vel Down (fps)	Vel Head (ft)	Minor Loss (ft)
1	90 º Elbow - Regular Fl.	1.40	2.17	0.30	12	----	2.90	----	0.13	0.04
1	Reducer	1.40	2.17	0.25	12	8	2.90	6.23	0.60	0.15
									Sum =	0.19

Total Energy Loss = 9.94 ft

Upstream Condition 81.96 81.96

[PIPE FRICTION LOSSES (DARCY-WEISBACH / COLEBROOK)] **{ 4 }**

Flow 1.4 mgd = 2.2 cfs

Pipe Diameter, D 12 inch *HDPE SDR 27 pipe*
Pipe Length, L 4200 ft
Absolute Roughness, ε 0.00040 ft
Pipe velocity, v 2.90 fps
Kinematic Viscosity 1.000E-05 ft^2/sec
Reynold's Number, R 283093
Friction factor, f 0.0178

Friction Energy Loss, h_L 9.94 ft

MINOR PIPE LOSS HEADING

Flow, Q 1.4 mgd = 2.2 cfs

No.	Description	Flow (mgd)	Flow (cfs)	K	Dia Up (in)	Dia Down (in)	Vel Up (fps)	Vel Down (fps)	Vel Head (ft)	Minor Loss (ft)
1	Entrance Loss - Flush	1.40	2.17	0.50	----	12	----	2.90	0.13	0.07
2	Gate Valve (Open)	1.40	2.17	0.19	12	----	2.90	----	0.13	0.05
4	90 º Elbow - Regular Fl.	1.40	2.17	0.30	12	----	2.90	----	0.13	0.16
									Sum =	0.27

Total Energy Loss = 10.21 ft

Upstream Condition 92.17 92.17

WWTF site elevation 72.6 ft (NAVD 88)
WSE w/ 30' standpipe 97.6 ft
(25' water)

Gravity flow **OK**

PROJECT : Carnation Wastewater Treatment Facility
King County DNRP - WWTF to Stillwater

JOB # : 6620A.10 **REVISION:** 1

CHECKED : B. Einfeld **DATE :** 3/3/2005

BY : S. Leung **DATE :** 3/1/2005

	Equation Ref.	HGL	EGL

DOWNSTREAM CONTROL

WSE =	**59.60**		
Flow =	**1.40 mgd =**	**2.17 cfs**	

Base flood elevation at SWA (NAVD 88) — HGL 59.60, EGL 59.60

(FEMA Map 53033C0420G, 12/6/01)

[PIPE FRICTION LOSSES (DARCY-WEISBACH / COLEBROOK)] — **{ 4 }**

Flow	1.4	mgd =	2.2 cfs
Pipe Diameter, D	12	inch	
Pipe Length, L	12770	ft	
Absolute Roughness, ε	0.00040	ft	
Pipe velocity, v	2.89	fps	
Kinematic Viscosity	1.000E-05	ft^2/sec	
Reynold's Number, R	282106		
Friction factor, f	0.0178		
Friction Energy Loss, h_L	30.02	ft	

HDPE SDR 27 pipe

MINOR PIPE LOSS HEADING

Flow, Q: 1.4 mgd = 2.2 cfs

No.	Description	Flow (mgd)	Flow (cfs)	K	Dia Up (in)	Dia Down (in)	Vel Up (fps)	Vel Down (fps)	Vel Head (ft)	Minor Loss (ft)
4	90 º Elbow - Regular Fl.	1.40	2.17	0.30	12	----	2.89	----	0.13	0.16
4	45 º Bend - Regular Fl.	1.40	2.17	0.23	12	----	2.89	----	0.13	0.12
1	Check Valve - Swing	1.40	2.17	2.50	12	----	2.89	----	0.13	0.32
1	Gate Valve (Open)	1.40	2.17	0.19	12	----	2.89	----	0.13	0.02
1	Outlet Loss - Still Water	1.40	2.17	1.00	12	----	2.89	----	0.13	0.13
									Sum =	0.75

Total Energy Loss = 30.77 ft

Upstream Condition — HGL 90.37, EGL 90.37

[PIPE FRICTION LOSSES (DARCY-WEISBACH / COLEBROOK)] — **{ 4 }**

Flow	1.4	mgd =	2.2 cfs
Pipe Diameter, D	12	inch	
Pipe Length, L	4200	ft	
Absolute Roughness, ε	0.00040	ft	
Pipe velocity, v	2.89	fps	
Kinematic Viscosity	1.000E-05	ft^2/sec	
Reynold's Number, R	282106		
Friction factor, f	0.0178		
Friction Energy Loss, h_L	9.87	ft	

HDPE SDR 27 pipe

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											Equation Ref.	HGL	EGL

MINOR PIPE LOSS HEADING

Flow, Q 1.4 mgd = 2.2 cfs

No.	Description	Flow (mgd)	Flow (cfs)	K	Dia Up (in)	Dia Down (in)	Vel Up (fps)	Vel Down (fps)	Vel Head (ft)	Minor Loss (ft)
1	Entrance Loss - Flush	1.40	2.17	0.50	----	12	----	2.89	0.13	0.06
2	Gate Valve (Open)	1.40	2.17	0.19	12	----	2.89	----	0.13	0.05
4	90 º Elbow - Regular Fl.	1.40	2.17	0.30	12	----	2.89	----	0.13	0.16
									Sum =	0.27

Total Energy Loss = 10.14 ft

Upstream Condition				100.51	100.51

WWTF site elevation 72.6 ft (NAVD 88)
WSE w/ 38' standpipe 106.6 ft
(34' water)

Gravity flow **OK**