PRE-DEVELOPMENT DRAINAGE CALCULATIONS

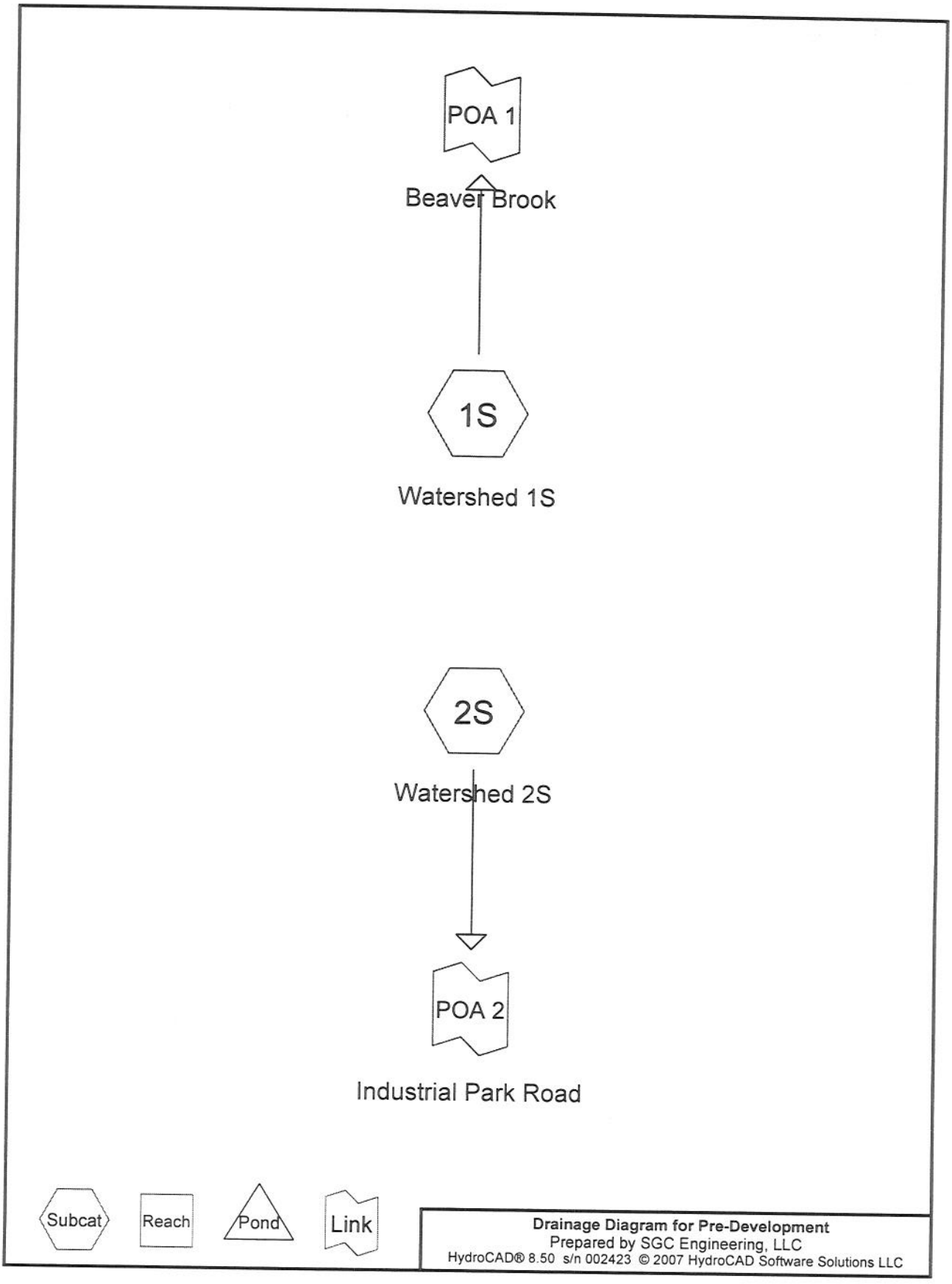

POA 1
Beaver Brook
1S
Watershed 1S
2S
Watershed 2S
POA 2
Industrial Park Road
Subcat
Reach
Pond
Link
Drainage Diagram for Pre-Development
Prepared by SGC Engineering, LLC
HydroCAD® 8.50 s/n 002423 © 2007 HydroCAD Software Solutions LLC

TABLE 1
Existing Watershed ID Information

Subcatchment ID	Area (sq-ft)	Surface Discription	HSG	CN	Tc Criteria Segment	Length	Slope	Flow Type
1S								
	309,415	Woods/Grass	A	45	A-B	100	0.080	Sheet
	58,280	Woods/Grass	B	65	B-C	300	0.120	Shallow
	76,575	Forested Wetlands/Flood Plain	C	70	C-D	45	0.180	Shallow
	8,365	Existing Gravel Access	-	98	D-E	150	0.130	Shallow
TOTAL	452,635	sq-ft						
	10.39	acres						
2S								
	61,360	Undeveloped Woodland	C	45	A-B	70	0.120	Sheet
	14,780	Existing Gravel Access	-	98	B-C	500	0.040	Channel
TOTAL	76,140	sq-ft						
	1.75	acres						

2-YEAR RUNOFF CALCULATIONS

Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S: Watershed 1S Runoff Area=452,635 sf 1.85% Impervious Runoff Depth>0.10"
Flow Length=595' Tc=17.7 min CN=53 Runoff=0.24 cfs 0.084 af

Subcatchment 2S: Watershed 2S Runoff Area=76,140 sf 19.41% Impervious Runoff Depth>0.13"
Flow Length=570' Tc=12.4 min CN=55 Runoff=0.10 cfs 0.020 af

Link POA 1: Beaver Brook Inflow=0.24 cfs 0.084 af
Primary=0.24 cfs 0.084 af

Link POA 2: Industrial Park Road Inflow=0.10 cfs 0.020 af
Primary=0.10 cfs 0.020 af

Total Runoff Area = 12.139 ac Runoff Volume = 0.104 af Average Runoff Depth = 0.10"
95.62% Pervious = 11.608 ac 4.38% Impervious = 0.531 ac

Summary for Subcatchment 1S: Watershed 1S

Runoff = 0.24 cfs @ 12.50 hrs, Volume= 0.084 af, Depth> 0.10"

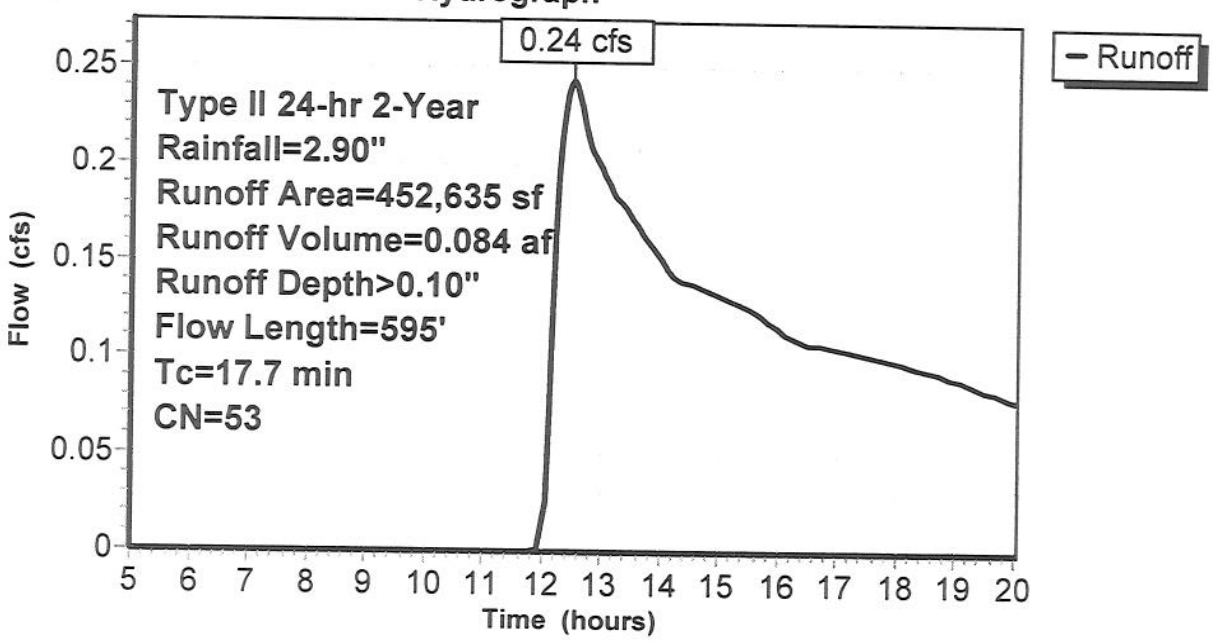
Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 2-Year Rainfall=2.90"

	Area (sf)	CN	Description
*	309,415	45	Woods/Grass HSG A
*	58,280	65	Woods/Grass HSG B
*	76,575	70	Forested Wetlands/Flood Plain
*	8,365	98	Existing Gravel Access
	452,635	53	Weighted Average
	444,270		Pervious Area
	8,365		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
13.0	100	0.0800	0.13		**Sheet Flow, Sheet Flow Segment A-B** Woods: Light underbrush n= 0.400 P2= 2.90"
2.9	300	0.1200	1.73		**Shallow Concentrated Flow, Shallow Flow, Segment B-C** Woodland Kv= 5.0 fps
0.4	45	0.1800	2.12		**Shallow Concentrated Flow, Shallow Flow, Segment C-D** Woodland Kv= 5.0 fps
1.4	150	0.1300	1.80		**Shallow Concentrated Flow, Shallow Flow, Segment D-E** Woodland Kv= 5.0 fps
17.7	595	Total			

Subcatchment 1S: Watershed 1S

Hydrograph



Summary for Subcatchment 2S: Watershed 2S

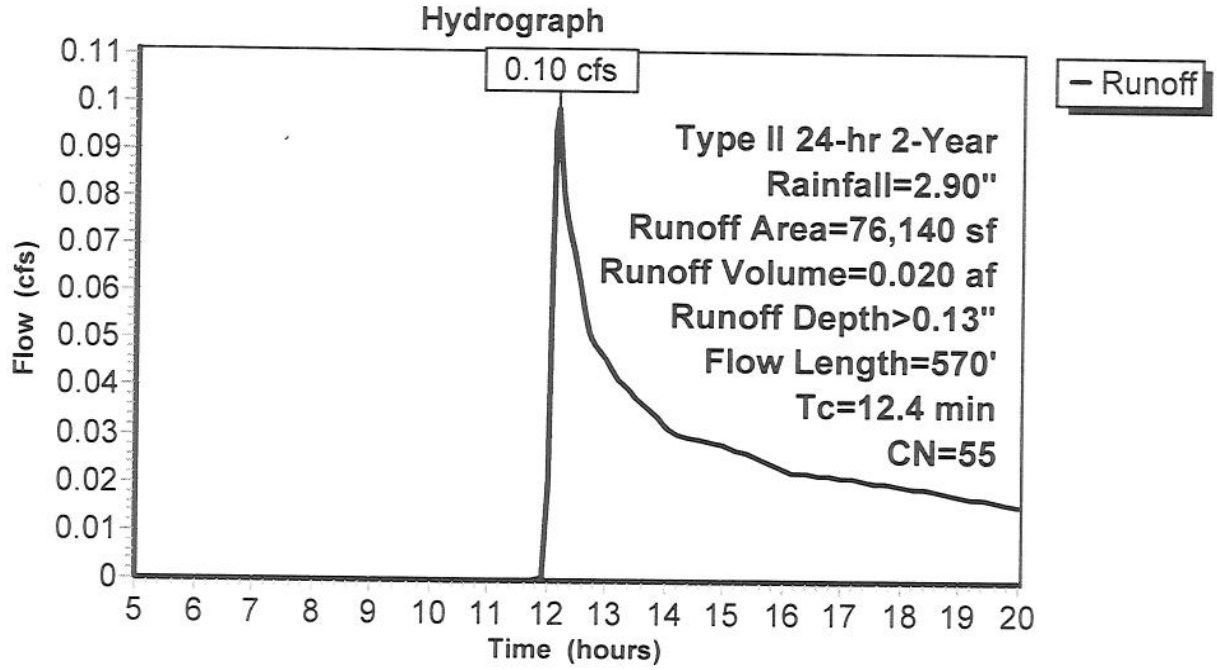
Runoff = 0.10 cfs @ 12.14 hrs, Volume= 0.020 af, Depth> 0.13"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 2-Year Rainfall=2.90"

	Area (sf)	CN	Description
*	61,360	45	Woods/Grass HSG A
*	14,780	98	Existing Gravel Access
	76,140	55	Weighted Average
	61,360		Pervious Area
	14,780		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.7	70	0.0800	0.12		**Sheet Flow, Sheet Flow Segment A-B** Woods: Light underbrush n= 0.400 P2= 2.90"
2.7	500	0.0400	3.03	0.76	**Trap/Vee/Rect Channel Flow, Roadside Ditch** Bot.W=0.00' D=0.25' Z= 4.0 '/' Top.W=2.00' n= 0.024
12.4	570	Total			

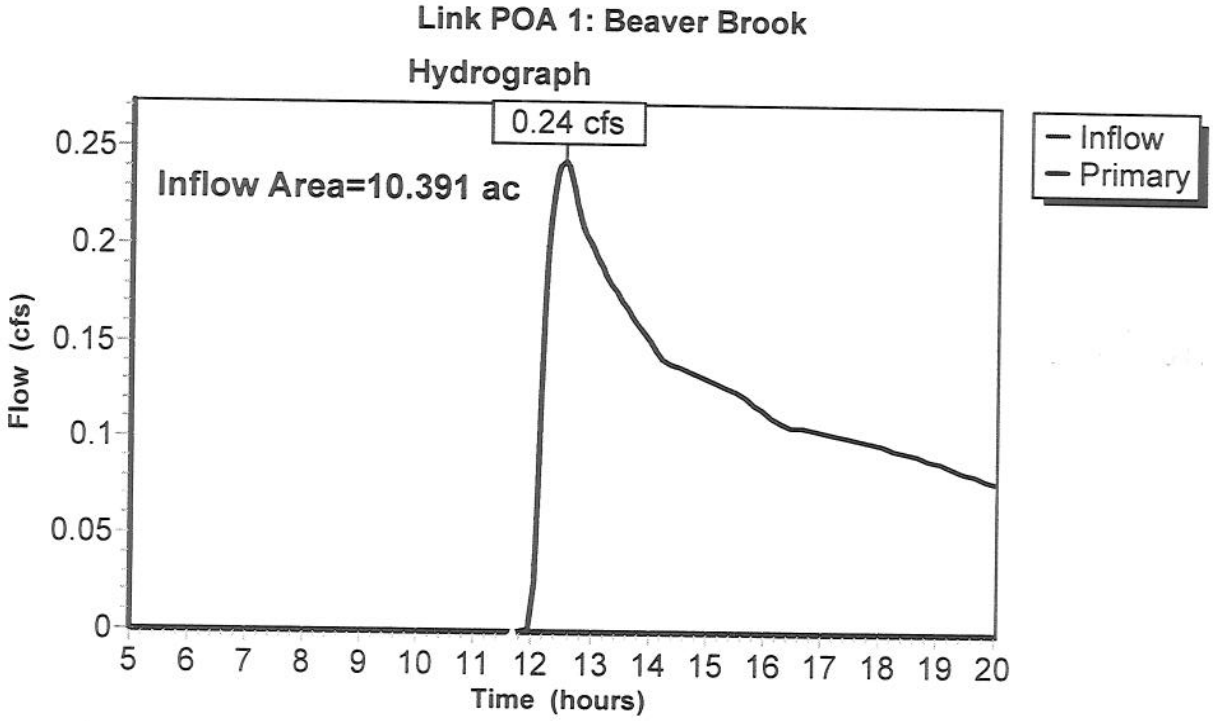
Subcatchment 2S: Watershed 2S



Summary for Link POA 1: Beaver Brook

Inflow Area = 10.391 ac, 1.85% Impervious, Inflow Depth > 0.10" for 2-Year event
Inflow = 0.24 cfs @ 12.50 hrs, Volume= 0.084 af
Primary = 0.24 cfs @ 12.50 hrs, Volume= 0.084 af, Atten= 0%, Lag= 0.0 min

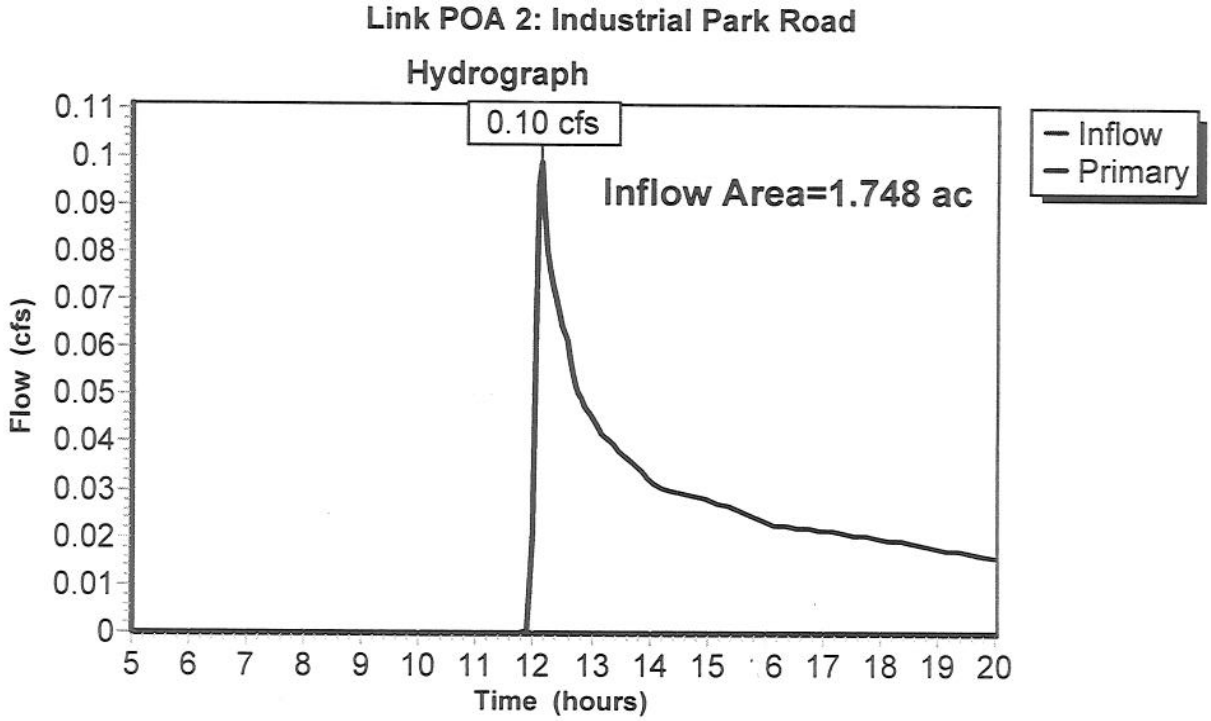
Primary outflow = Inflow, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs



Summary for Link POA 2: Industrial Park Road

Inflow Area = 1.748 ac, 19.41% Impervious, Inflow Depth > 0.13" for 2-Year event
Inflow = 0.10 cfs @ 12.14 hrs, Volume= 0.020 af
Primary = 0.10 cfs @ 12.14 hrs, Volume= 0.020 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs



10-YEAR RUNOFF CALCULATIONS

Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S: Watershed 1S Runoff Area=452,635 sf 1.85% Impervious Runoff Depth>0.48"
Flow Length=595' Tc=17.7 min CN=53 Runoff=4.42 cfs 0.412 af

Subcatchment 2S: Watershed 2S Runoff Area=76,140 sf 19.41% Impervious Runoff Depth>0.56"
Flow Length=570' Tc=12.4 min CN=55 Runoff=1.21 cfs 0.082 af

Link POA 1: Beaver Brook Inflow=4.42 cfs 0.412 af
Primary=4.42 cfs 0.412 af

Link POA 2: Industrial Park Road Inflow=1.21 cfs 0.082 af
Primary=1.21 cfs 0.082 af

Total Runoff Area = 12.139 ac Runoff Volume = 0.494 af Average Runoff Depth = 0.49"
95.62% Pervious = 11.608 ac 4.38% Impervious = 0.531 ac

Summary for Subcatchment 1S: Watershed 1S

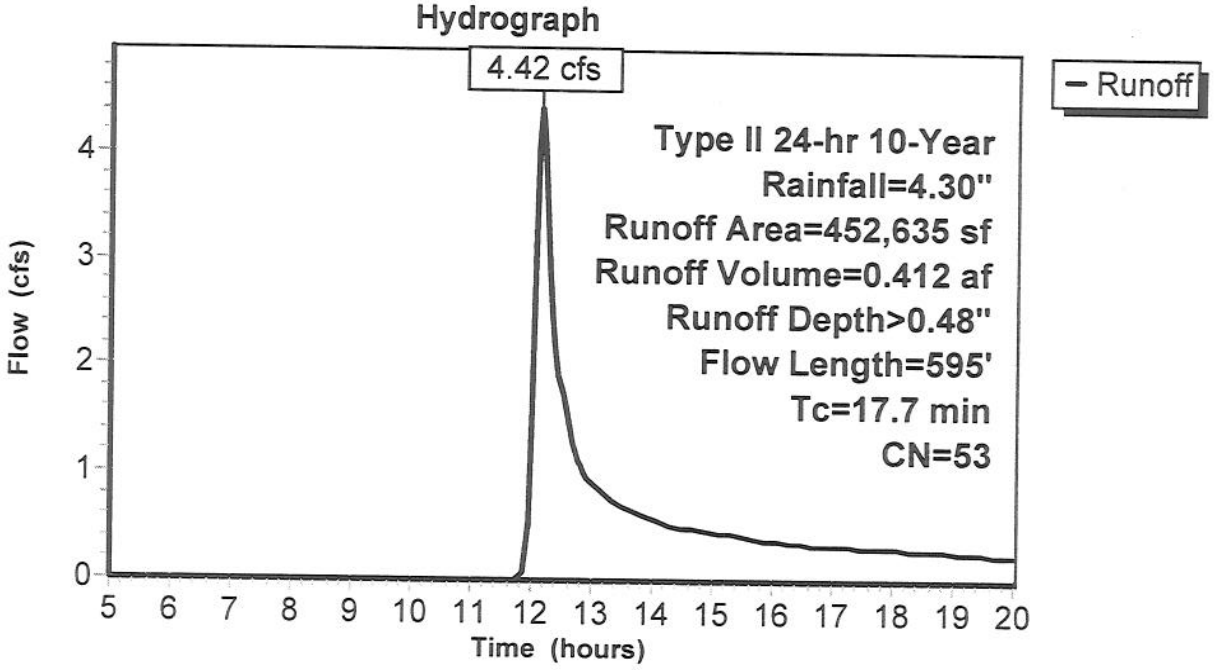
Runoff = 4.42 cfs @ 12.15 hrs, Volume= 0.412 af, Depth> 0.48"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 10-Year Rainfall=4.30"

	Area (sf)	CN	Description
*	309,415	45	Woods/Grass HSG A
*	58,280	65	Woods/Grass HSG B
*	76,575	70	Forested Wetlands/Flood Plain
*	8,365	98	Existing Gravel Access
	452,635	53	Weighted Average
	444,270		Pervious Area
	8,365		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
13.0	100	0.0800	0.13		**Sheet Flow, Sheet Flow Segment A-B** Woods: Light underbrush n= 0.400 P2= 2.90"
2.9	300	0.1200	1.73		**Shallow Concentrated Flow, Shallow Flow, Segment B-C** Woodland Kv= 5.0 fps
0.4	45	0.1800	2.12		**Shallow Concentrated Flow, Shallow Flow, Segment C-D** Woodland Kv= 5.0 fps
1.4	150	0.1300	1.80		**Shallow Concentrated Flow, Shallow Flow, Segment D-E** Woodland Kv= 5.0 fps
17.7	595	Total			

Subcatchment 1S: Watershed 1S



Summary for Subcatchment 2S: Watershed 2S

Runoff = 1.21 cfs @ 12.07 hrs, Volume= 0.082 af, Depth> 0.56"

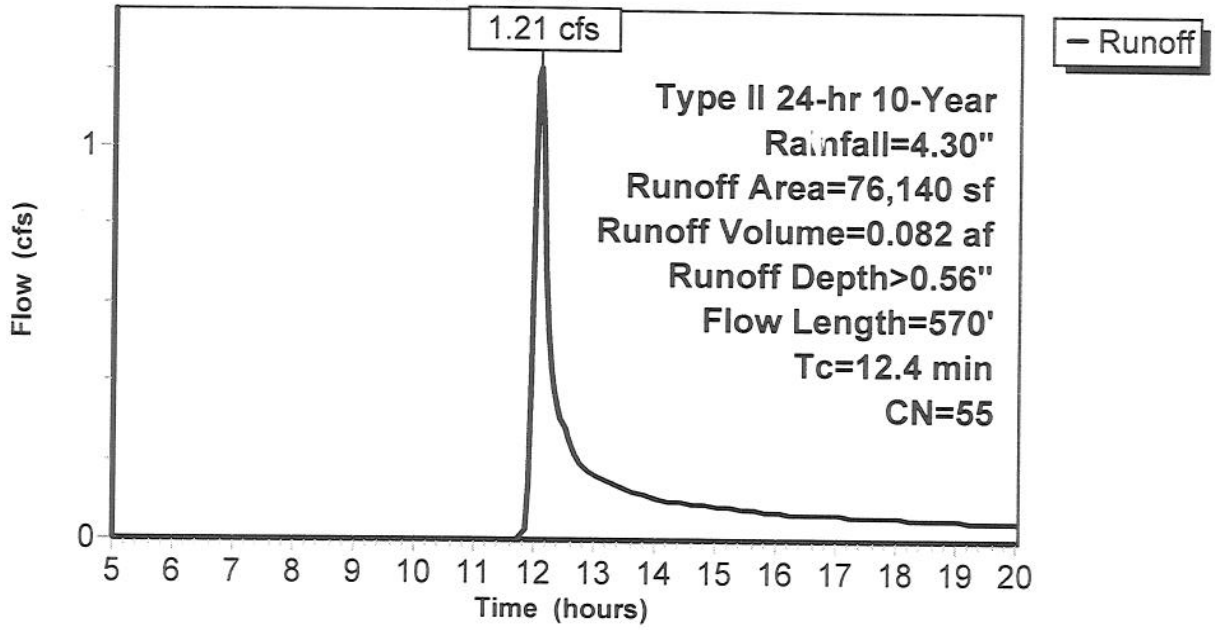
Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 10-Year Rainfall=4.30"

	Area (sf)	CN	Description
*	61,360	45	Woods/Grass HSG A
*	14,780	98	Existing Gravel Access
	76,140	55	Weighted Average
	61,360		Pervious Area
	14,780		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.7	70	0.0800	0.12		**Sheet Flow, Sheet Flow Segment A-B** Woods: Light underbrush n= 0.400 P2= 2.90"
2.7	500	0.0400	3.03	0.76	**Trap/Vee/Rect Channel Flow, Roadside Ditch** Bot.W=0.00' D=0.25' Z= 4.0 '/' Top.W=2.00' n= 0.024
12.4	570	Total			

Subcatchment 2S: Watershed 2S

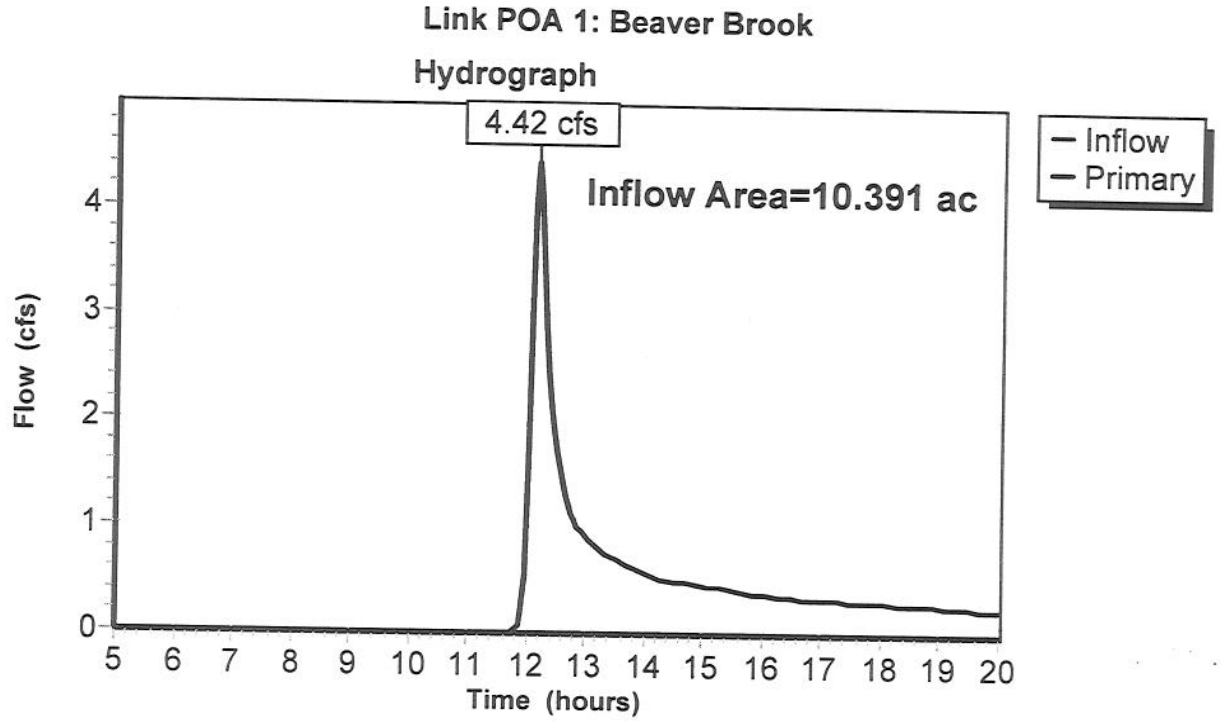
Hydrograph



Summary for Link POA 1: Beaver Brook

Inflow Area = 10.391 ac, 1.85% Impervious, Inflow Depth > 0.48" for 10-Year event
Inflow = 4.42 cfs @ 12.15 hrs, Volume= 0.412 af
Primary = 4.42 cfs @ 12.15 hrs, Volume= 0.412 af, Atten= 0%, Lag= 0.0 min

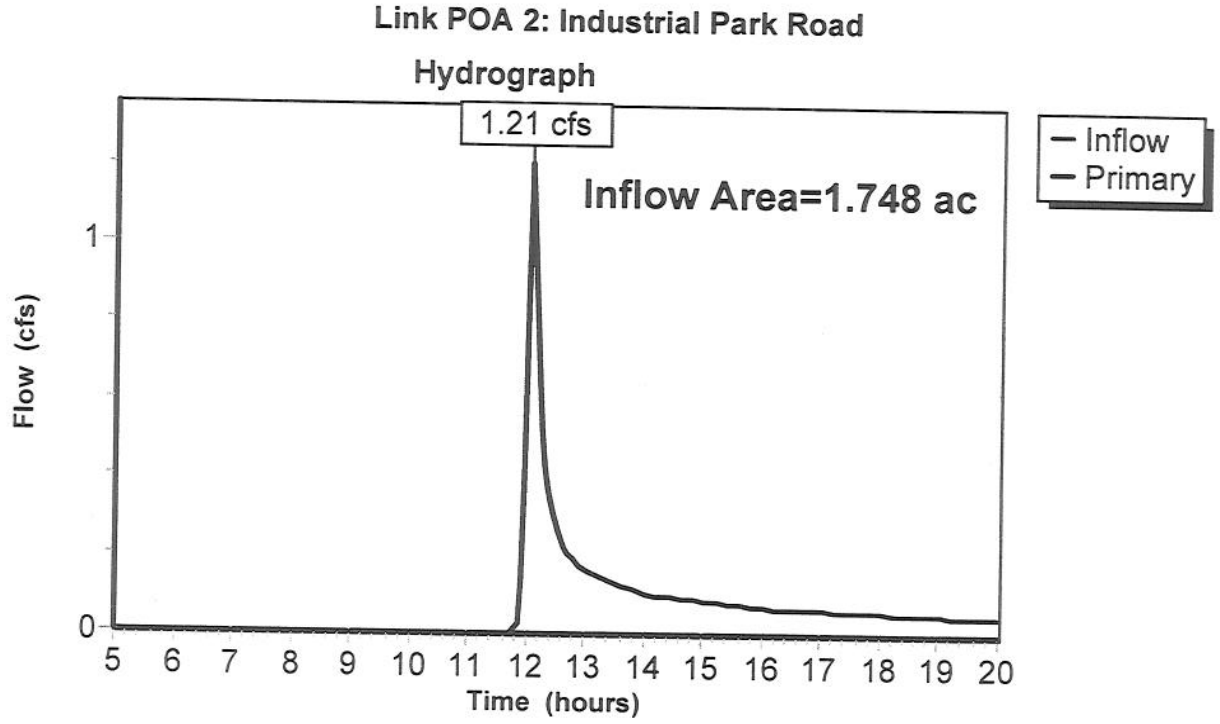
Primary outflow = Inflow, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs



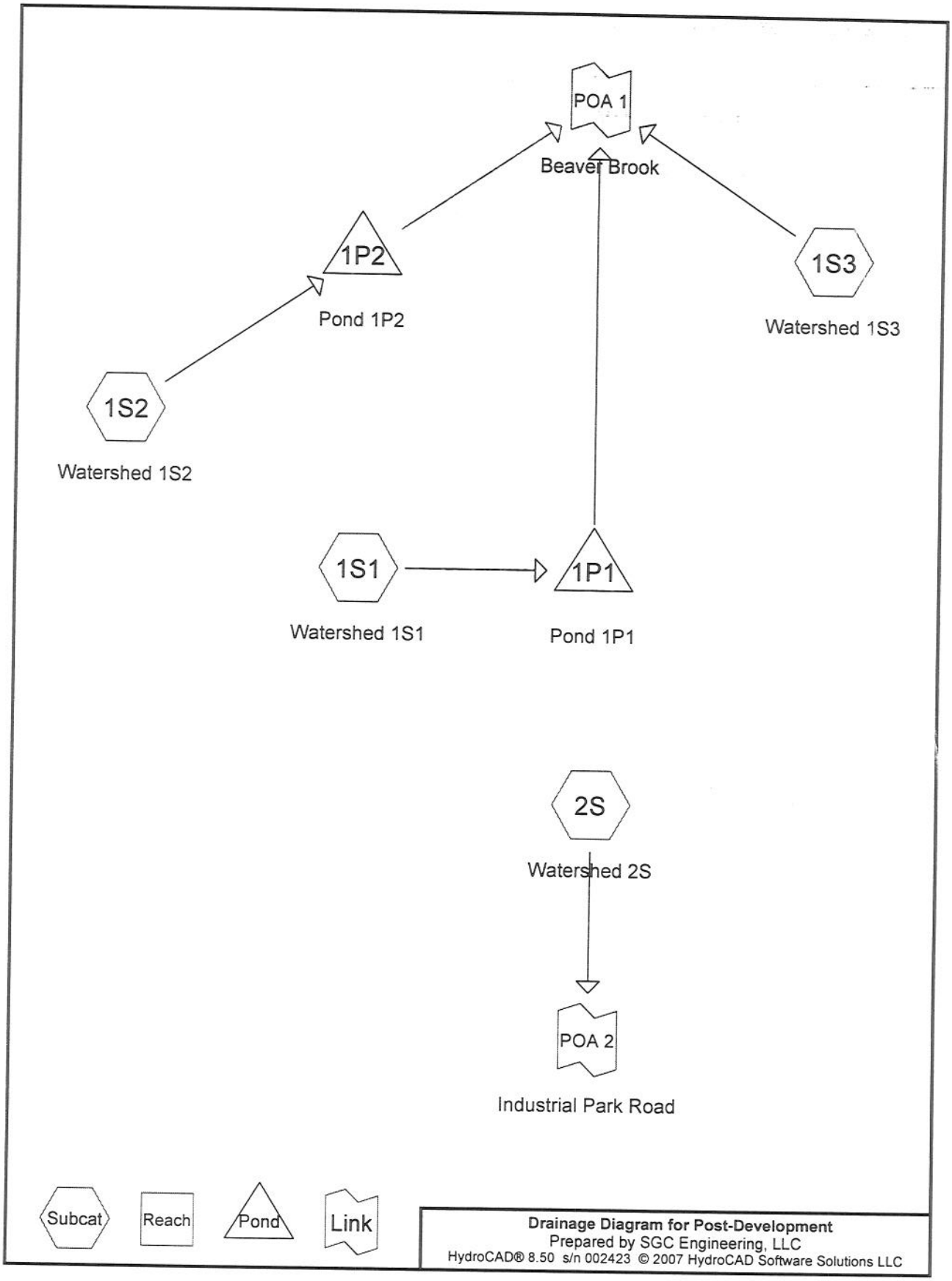
Summary for Link POA 2: Industrial Park Road

Inflow Area = 1.748 ac, 19.41% Impervious, Inflow Depth > 0.56" for 10-Year event
Inflow = 1.21 cfs @ 12.07 hrs, Volume= 0.082 af
Primary = 1.21 cfs @ 12.07 hrs, Volume= 0.082 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs



POST-DEVELOPMENT DRAINAGE CALCULATIONS



Drainage Diagram for Post-Development
Prepared by SGC Engineering, LLC
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TABLE 2
Proposed Watershed ID Information

Subcatchment ID	Area (sq-ft)	Surface Discription	HSG	CN	Tc Criteria Segment	Length	Slope	Flow Type
1S1								
	57,870	Woods/Landscaping	A	45	A-B	100	0.120	Sheet
	10,715	Proposed Impervious Area	-	98	B-C	75	0.080	Shallow
					C-D	250	0.040	Channel
					D-E	215	0.020	Channel
1S2								
	61,125	Woods/Landscaping	A	45	A-B	100	0.080	Sheet
	21,420	Proposed Impervious Area	-	98	B-C	85	0.070	Shallow
					C-D	115	0.010	Channel
1S3								
	163,250	Woods/Landscaping	A	45	A-B	100	0.100	Sheet
	58,280	Undeveloped Woodland	B	65	B-C	340	0.080	Shallow
	76,575	Forested Wetlands/Flood Plain	C	70	C-D	220	0.050	Shallow
	3,400	Proposed Impervious Area	-	98				Shallow
TOTAL	452,635	sq-ft						
	10.39	acres						
2S								
	66,140	Undeveloped Woodland	C	45	A-B	70	0.120	Sheet
	10,000	Proposed Impervious Area	-	98	B-C	525	0.040	Channel
TOTAL	76,140	sq-ft						
	1.75	acres						

2-YEAR RUNOFF CALCULATIONS

Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S1: Watershed 1S1 Runoff Area=68,585 sf 15.62% Impervious Runoff Depth>0.10"
Flow Length=640' Tc=14.3 min CN=53 Runoff=0.04 cfs 0.013 af

Subcatchment 1S2: Watershed 1S2 Runoff Area=82,545 sf 25.95% Impervious Runoff Depth>0.22"
Flow Length=300' Tc=15.1 min CN=59 Runoff=0.31 cfs 0.035 af

Subcatchment 1S3: Watershed 1S3 Runoff Area=301,505 sf 1.13% Impervious Runoff Depth>0.15"
Flow Length=660' Tc=19.1 min CN=56 Runoff=0.45 cfs 0.089 af

Subcatchment 2S: Watershed 2S Runoff Area=76,140 sf 13.13% Impervious Runoff Depth>0.08"
Flow Length=595' Tc=12.0 min CN=52 Runoff=0.03 cfs 0.012 af

Pond 1P1: Pond 1P1 Peak Elev=178.03' Storage=556 cf Inflow=0.04 cfs 0.013 af
Outflow=0.00 cfs 0.000 af

Pond 1P2: Pond 1P2 Peak Elev=170.49' Storage=204 cf Inflow=0.31 cfs 0.035 af
Primary=0.14 cfs 0.034 af Secondary=0.00 cfs 0.000 af Outflow=0.14 cfs 0.034 af

Link POA 1: Beaver Brook Inflow=0.58 cfs 0.123 af
Primary=0.58 cfs 0.123 af

Link POA 2: Industrial Park Road Inflow=0.03 cfs 0.012 af
Primary=0.03 cfs 0.012 af

Total Runoff Area = 12.139 ac Runoff Volume = 0.149 af Average Runoff Depth = 0.15"
91.39% Pervious = 11.094 ac 8.61% Impervious = 1.045 ac

Summary for Subcatchment 1S1: Watershed 1S1

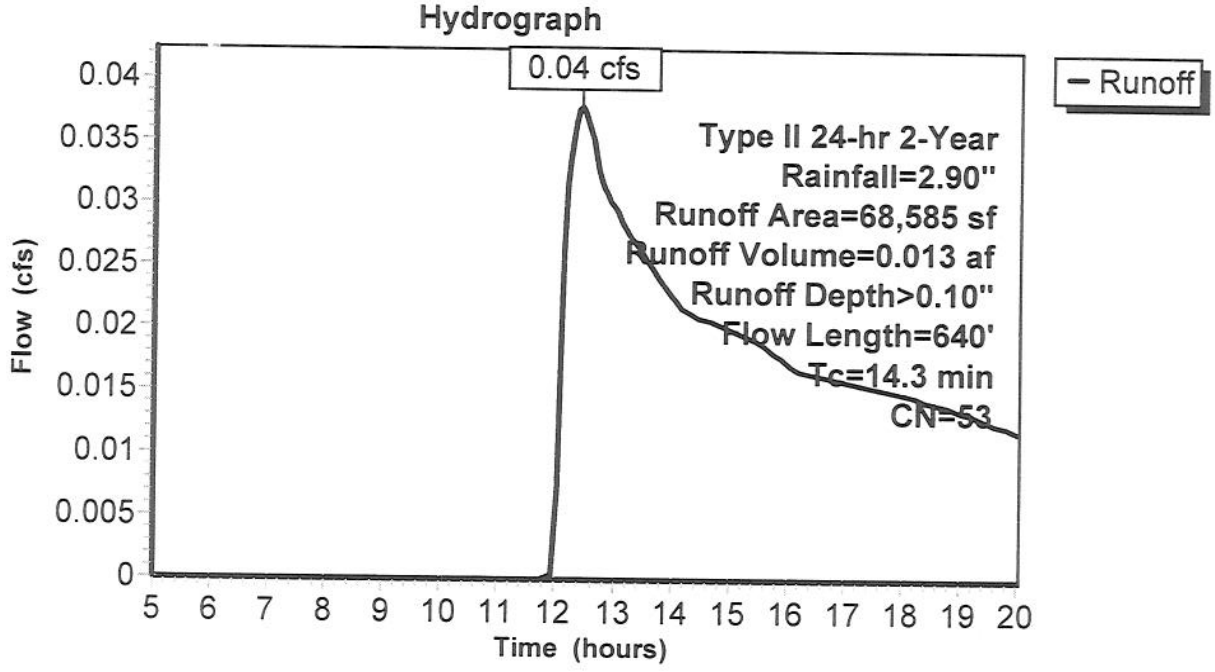
Runoff = 0.04 cfs @ 12.45 hrs, Volume= 0.013 af, Depth> 0.10"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 2-Year Rainfall=2.90"

	Area (sf)	CN	Description
*	57,870	45	Wood/Landscaping, HSG A
*	10,715	98	Proposed Impervious Area
	68,585	53	Weighted Average
	57,870		Pervious Area
	10,715		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
11.0	100	0.1200	0.15		**Sheet Flow, Sheet Flow Segment A-B** Woods: Light underbrush n= 0.400 P2= 2.90"
0.9	75	0.0800	1.41		**Shallow Concentrated Flow, Shallow Flow, Segment B-C** Woodland Kv= 5.0 fps
1.1	250	0.0400	3.77	2.36	**Trap/Vee/Rect Channel Flow, Roadside Ditch, C-D** Bot.W=2.00' D=0.25' Z= 2.0 '/' Top.W=3.00' n= 0.027
1.3	215	0.0200	2.67	1.67	**Trap/Vee/Rect Channel Flow, Roadside Ditch, D-E** Bot.W=2.00' D=0.25' Z= 2.0 '/' Top.W=3.00' n= 0.027
14.3	640	Total			

Subcatchment 1S1: Watershed 1S1



Summary for Subcatchment 1S2: Watershed 1S2

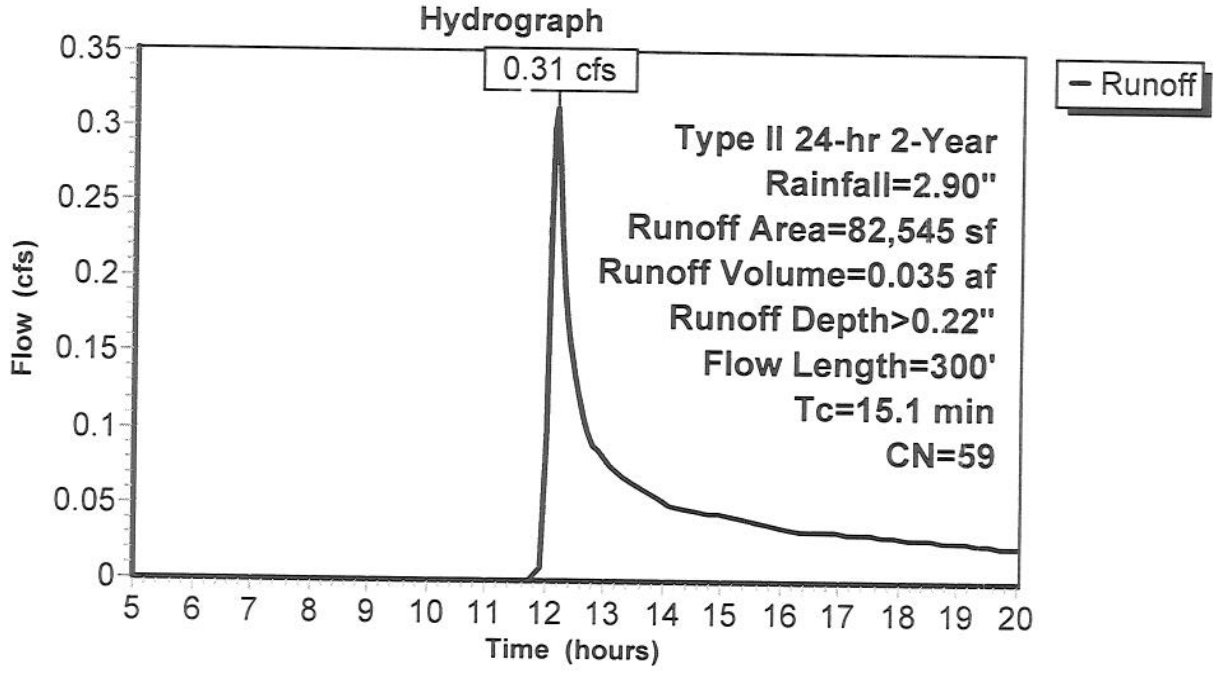
Runoff = 0.31 cfs @ 12.14 hrs, Volume= 0.035 af, Depth> 0.22"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 2-Year Rainfall=2.90"

	Area (sf)	CN	Description
*	61,125	45	Woods/Landscaping, HSG A
*	21,420	98	Proposed Impervious Area
	82,545	59	Weighted Average
	61,125		Pervious Area
	21,420		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
13.0	100	0.0800	0.13		**Sheet Flow, Sheet Flow Segment A-B** Woods: Light underbrush n= 0.400 P2= 2.90"
1.1	85	0.0700	1.32		**Shallow Concentrated Flow, Shallow Flow, Segment B-C** Woodland Kv= 5.0 fps
1.0	115	0.0100	1.89	1.18	**Trap/Vee/Rect Channel Flow, Grassed Swale** Bot.W=2.00' D=0.25' Z= 2.0 '/' Top.W=3.00' n= 0.027
15.1	300	Total			

Subcatchment 1S2: Watershed 1S2



Summary for Subcatchment 1S3: Watershed 1S3

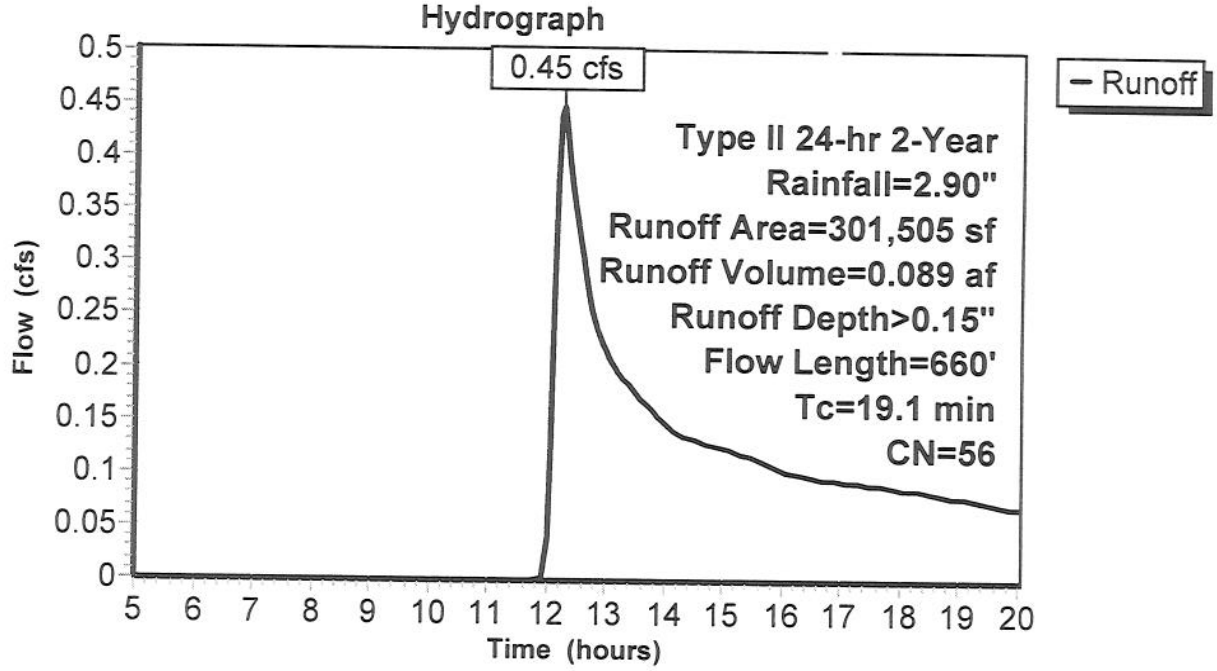
Runoff = 0.45 cfs @ 12.24 hrs, Volume= 0.089 af, Depth> 0.15"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 2-Year Rainfall=2.90"

	Area (sf)	CN	Description
*	163,250	45	Woods/Grass HSG A
*	58,280	65	Woods/Grass HSG B
*	76,575	70	Forested Wetlands/Flood Plain
*	3,400	98	Proposed Impervious Area
	301,505	56	Weighted Average
	298,105		Pervious Area
	3,400		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
11.8	100	0.1000	0.14		**Sheet Flow, Sheet Flow Segment A-B** Woods: Light underbrush n= 0.400 P2= 2.90"
4.0	340	0.0800	1.41		**Shallow Concentrated Flow, Shallow Flow, Segment B-C** Woodland Kv= 5.0 fps
3.3	220	0.0500	1.12		**Shallow Concentrated Flow, Shallow Flow, Segment C-D** Woodland Kv= 5.0 fps
19.1	660	Total			

Subcatchment 1S3: Watershed 1S3



Summary for Subcatchment 2S: Watershed 2S

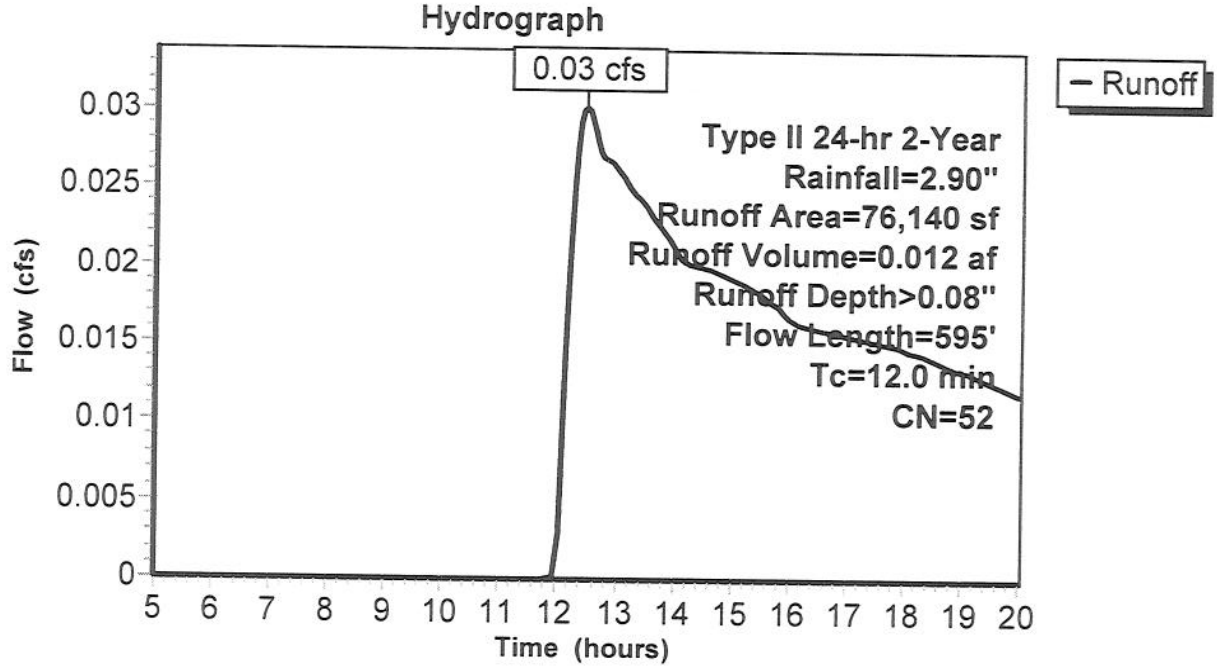
Runoff = 0.03 cfs @ 12.49 hrs, Volume= 0.012 af, Depth> 0.08"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 2-Year Rainfall=2.90"

	Area (sf)	CN	Description
*	66,140	45	Woods/Landscaping, HSG A
*	10,000	98	Existing Gravel Access
	76,140	52	Weighted Average
	66,140		Pervious Area
	10,000		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.7	70	0.0800	0.12		**Sheet Flow, Sheet Flow Segment A-B** Woods: Light underbrush n= 0.400 P2= 2.90"
2.3	525	0.0400	3.77	2.36	**Trap/Vee/Rect Channel Flow, Roadside Ditch** Bot.W=2.00' D=0.25' Z= 2.0 '/' Top.W=3.00' n= 0.027
12.0	595	Total			

Subcatchment 2S: Watershed 2S



Summary for Pond 1P1: Pond 1P1

Inflow Area = 1.574 ac, 15.62% Impervious, Inflow Depth > 0.10" for 2-Year event
Inflow = 0.04 cfs @ 12.45 hrs, Volume= 0.013 af
Outflow = 0.00 cfs @ 5.00 hrs, Volume= 0.000 af, Atten= 100%, Lag= 0.0 min
Primary = 0.00 cfs @ 5.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 178.03' @ 20.00 hrs Surf.Area= 405 sf Storage= 556 cf

Plug-Flow detention time= (not calculated: initial storage excedes outflow)
Center-of-Mass det. time= (not calculated: no outflow)

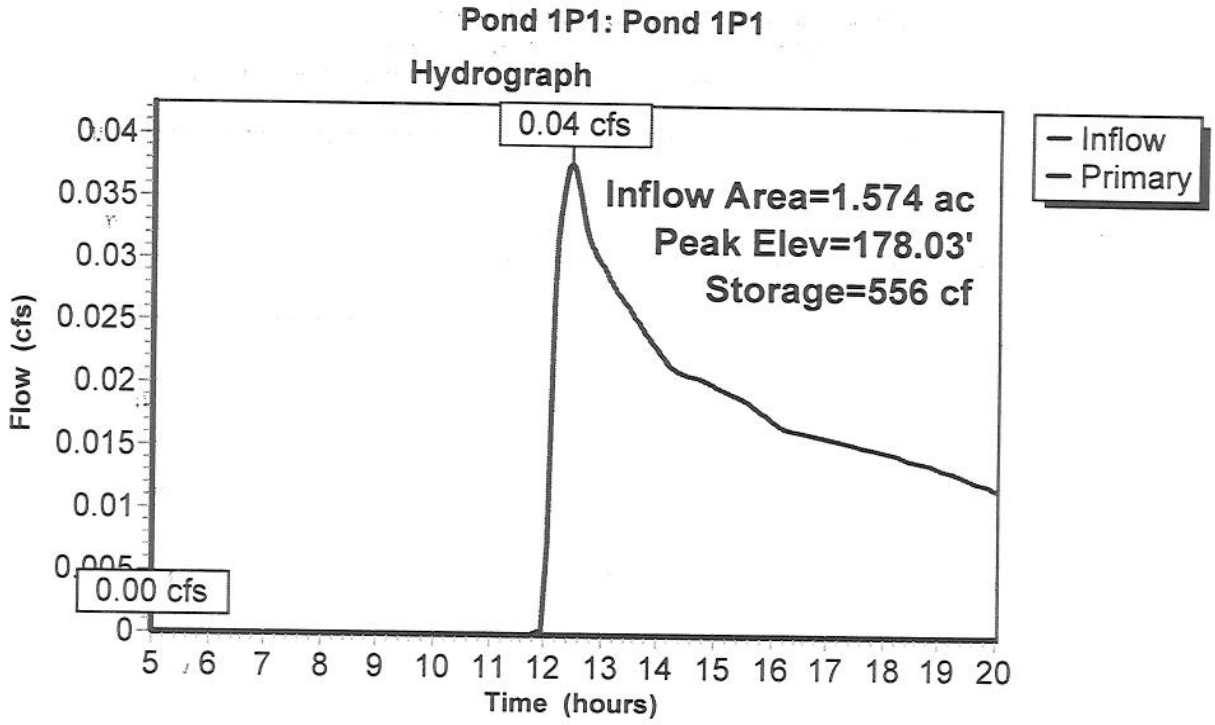
Volume	Invert	Avail.Storage	Storage Description
#1	176.00'	1,740 cf	**Custom Stage Data (Prismatic)**Listed below

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
176.00	140	0	0
178.00	400	540	540
180.00	800	1,200	1,740

Device	Routing	Invert	Outlet Devices
#1	Primary	179.00'	**10'-Wide Stone Spillway**

Head (feet) 0.00 0.05 0.10 0.15 0.20 0.25 0.30 0.35 0.40 0.45 0.50
Disch. (cfs) 0.000 0.190 0.620 1.260 3.930 7.720 12.630 18.630 25.720 33.890 43.140

Primary OutFlow Max=0.00 cfs @ 5.00 hrs HW=176.00' (Free Discharge)
↑—**1=10'-Wide Stone Spillway** (Controls 0.00 cfs)


Pond 1P1: Pond 1P1
Hydrograph
0.04 cfs
0.00 cfs
Inflow Area=1.574 ac
Peak Elev=178.03'
Storage=556 cf
Inflow
Primary
Flow (cfs)
0.04
0.035
0.03
0.025
0.02
0.015
0.01
0
5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
Time (hours)

Summary for Pond 1P2: Pond 1P2

Inflow Area = 1.895 ac, 25.95% Impervious, Inflow Depth > 0.22" for 2-Year event
Inflow = 0.31 cfs @ 12.14 hrs, Volume= 0.035 af
Outflow = 0.14 cfs @ 12.46 hrs, Volume= 0.034 af, Atten= 54%, Lag= 19.3 min
Primary = 0.14 cfs @ 12.46 hrs, Volume= 0.034 af
Secondary = 0.00 cfs @ 5.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 170.49' @ 12.46 hrs Surf.Area= 305 sf Storage= 204 cf

Plug-Flow detention time= 24.0 min calculated for 0.034 af (97% of inflow)
Center-of-Mass det. time= 14.6 min (888.7 - 874.1)

Volume	Invert	Avail.Storage	Storage Description
#1	170.00'	2,600 cf	**Custom Stage Data (Prismatic)**Listed below

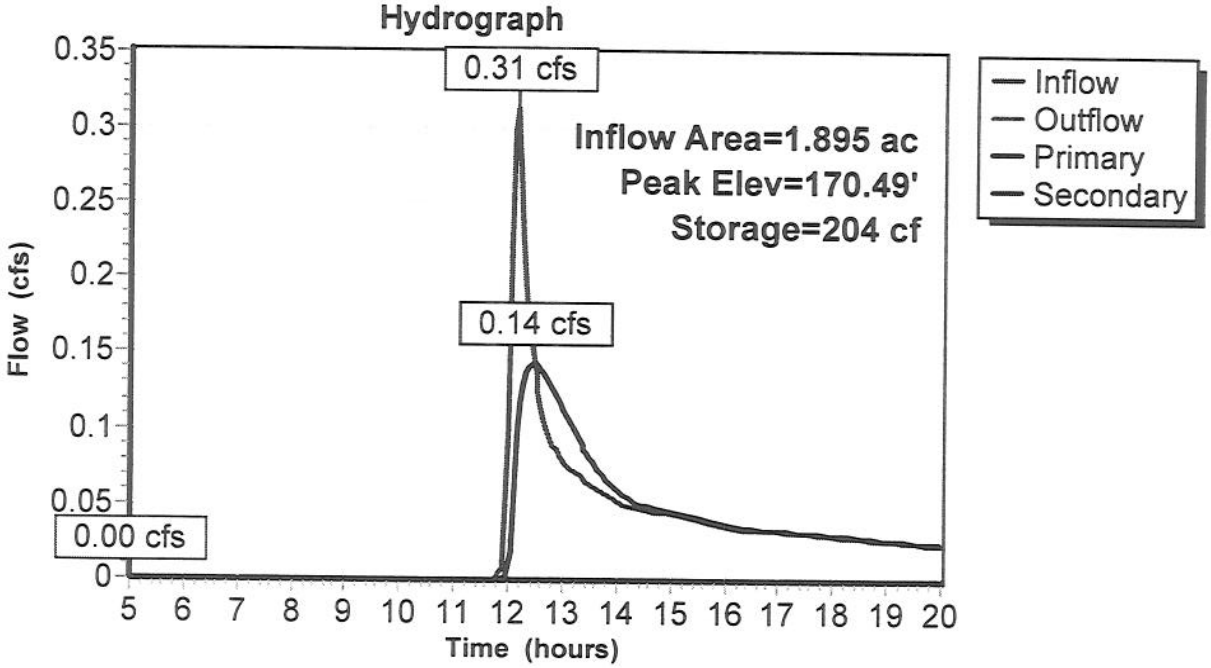
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
170.00	200	0	0
172.00	625	825	825
174.00	1,150	1,775	2,600

Device	Routing	Invert	Outlet Devices
#1	Primary	170.00'	**3.0" Vert. Orifice/Grate** C= 0.600
#2	Secondary	173.00'	**10'-Wide Stone Spillway** Head (feet) 0.00 0.05 0.10 0.15 0.20 0.25 0.30 0.35 0.40 0.45 0.50 Disch. (cfs) 0.000 0.190 0.620 1.260 3.930 7.720 12.630 18.630 25.720 3[illegible].890 43.140

Primary OutFlow Max=0.14 cfs @ 12.46 hrs HW=170.49' (Free Discharge)
↑—**1=Orifice/Grate** (Orifice Controls 0.14 cfs @ 2.92 fps)

Secondary OutFlow Max=0.00 cfs @ 5.00 hrs HW=170.00' (Free Discharge)
↑—**2=10'-Wide Stone Spillway** (Controls 0.00 cfs)

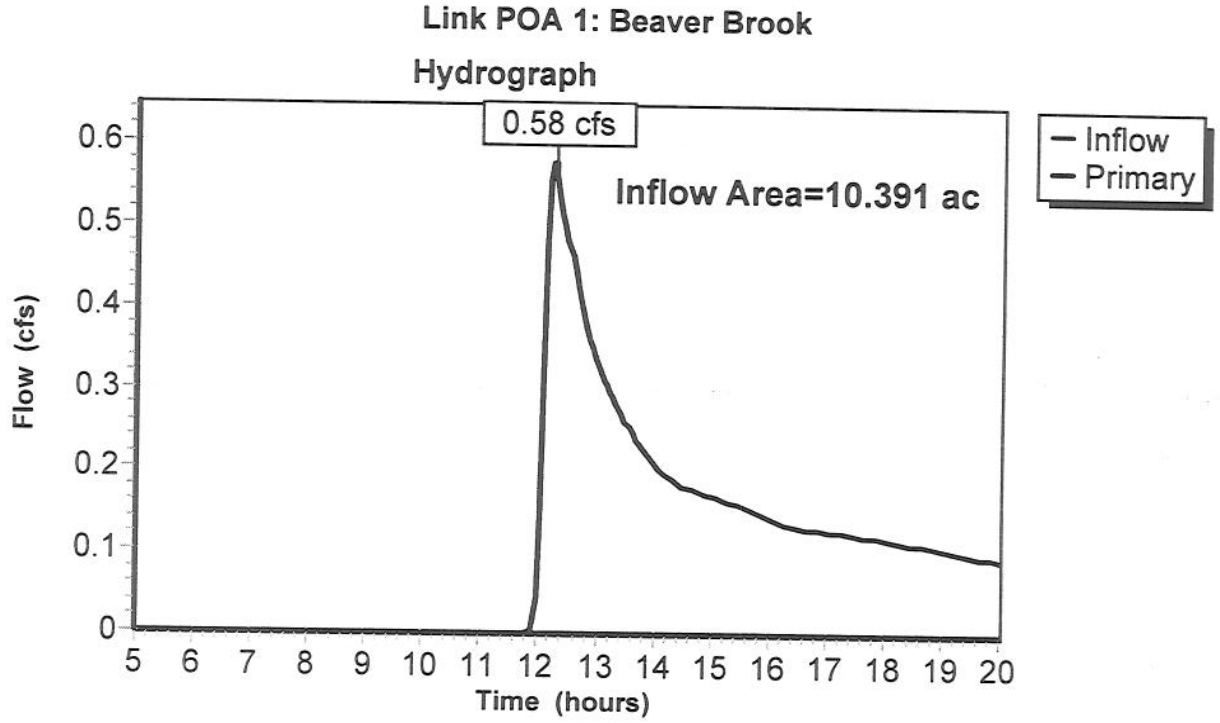
Pond 1P2: Pond 1P2



Summary for Link POA 1: Beaver Brook

Inflow Area = 10.391 ac, 7.85% Impervious, Inflow Depth > 0.14" for 2-Year event
Inflow = 0.58 cfs @ 12.25 hrs, Volume= 0.123 af
Primary = 0.58 cfs @ 12.25 hrs, Volume= 0.123 af, Atten= 0%, Lag= 0.0 min

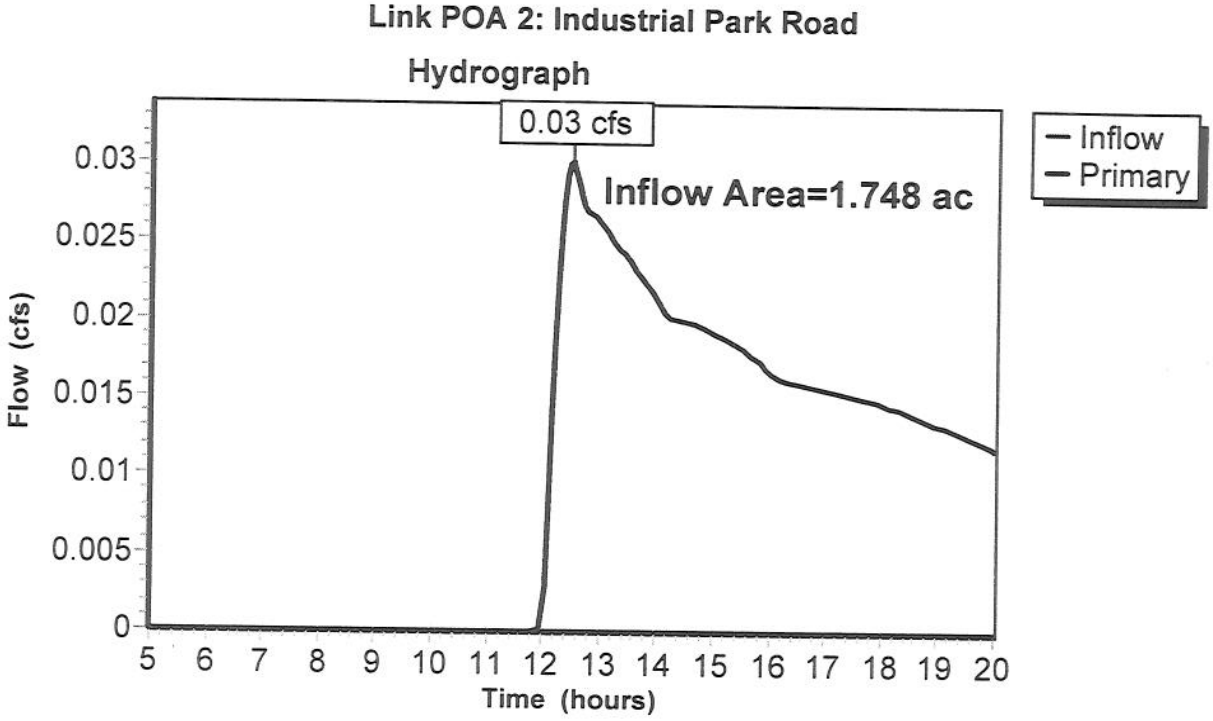
Primary outflow = Inflow, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs



Summary for Link POA 2: Industrial Park Road

Inflow Area = 1.748 ac, 13.13% Impervious, Inflow Depth > 0.08" for 2-Year event
Inflow = 0.03 cfs @ 12.49 hrs, Volume= 0.012 af
Primary = 0.03 cfs @ 12.49 hrs, Volume= 0.012 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs



10-YEAR RUNOFF CALCULATIONS

Time span=5.00-20.00 hrs, dt=0.05 hrs, 301 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 1S1: Watershed 1S1 Runoff Area=68,585 sf 15.62% Impervious Runoff Depth>0.48"
Flow Length=640' Tc=14.3 min CN=53 Runoff=0.77 cfs 0.063 af

Subcatchment 1S2: Watershed 1S2 Runoff Area=82,545 sf 25.95% Impervious Runoff Depth>0.75"
Flow Length=300' Tc=15.1 min CN=59 Runoff=1.75 cfs 0.119 af

Subcatchment 1S3: Watershed 1S3 Runoff Area=301,505 sf 1.13% Impervious Runoff Depth>0.61"
Flow Length=660' Tc=19.1 min CN=56 Runoff=4.08 cfs 0.350 af

Subcatchment 2S: Watershed 2S Runoff Area=76,140 sf 13.13% Impervious Runoff Depth>0.44"
Flow Length=595' Tc=12.0 min CN=52 Runoff=0.81 cfs 0.064 af

Pond 1P1: Pond 1P1 Peak Elev=179.03' Storage=1,161 cf Inflow=0.77 cfs 0.063 af
Outflow=0.13 cfs 0.036 af

Pond 1P2: Pond 1P2 Peak Elev=172.79' Storage=1,524 cf Inflow=1.75 cfs 0.119 af
Primary=0.39 cfs 0.117 af Secondary=0.00 cfs 0.000 af Outflow=0.39 cfs 0.117 af

Link POA 1: Beaver Brook Inflow=4.43 cfs 0.503 af
Primary=4.43 cfs 0.503 af

Link POA 2: Industrial Park Road Inflow=0.81 cfs 0.064 af
Primary=0.81 cfs 0.064 af

Total Runoff Area = 12.139 ac Runoff Volume = 0.595 af Average Runoff Depth = 0.59"
91.39% Pervious = 11.094 ac 8.61% Impervious = 1.045 ac

Summary for Subcatchment 1S1: Watershed 1S1

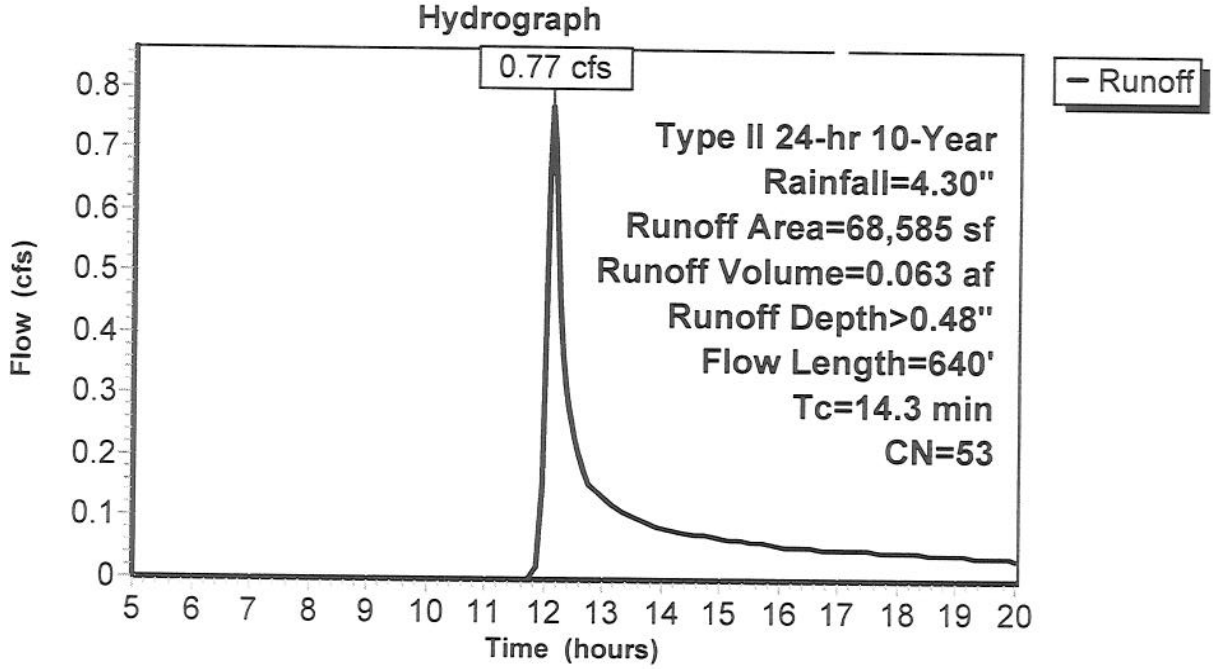
Runoff = 0.77 cfs @ 12.11 hrs, Volume= 0.063 af, Depth> 0.48"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 10-Year Rainfall=4.30"

	Area (sf)	CN	Description
*	57,870	45	Wood/Landscaping, HSG A
*	10,715	98	Proposed Impervious Area
	68,585	53	Weighted Average
	57,870		Pervious Area
	10,715		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
11.0	100	0.1200	0.15		**Sheet Flow, Sheet Flow Segment A-B** Woods: Light underbrush n= 0.400 P2= 2.90"
0.9	75	0.0800	1.41		**Shallow Concentrated Flow, Shallow Flow, Segment B-C** Woodland Kv= 5.0 fps
1.1	250	0.0400	3.77	2.36	**Trap/Vee/Rect Channel Flow, Roadside Ditch, C-D** Bot.W=2.00' D=0.25' Z= 2.0 '/' Top.W=3.00' n= 0.027
1.3	215	0.0200	2.67	1.67	**Trap/Vee/Rect Channel Flow, Roadside Ditch, D-E** Bot.W=2.00' D=0.25' Z= 2.0 '/' Top.W=3.00' n= 0.027
14.3	640	Total			

Subcatchment 1S1: Watershed 1S1



Summary for Subcatchment 1S2: Watershed 1S2

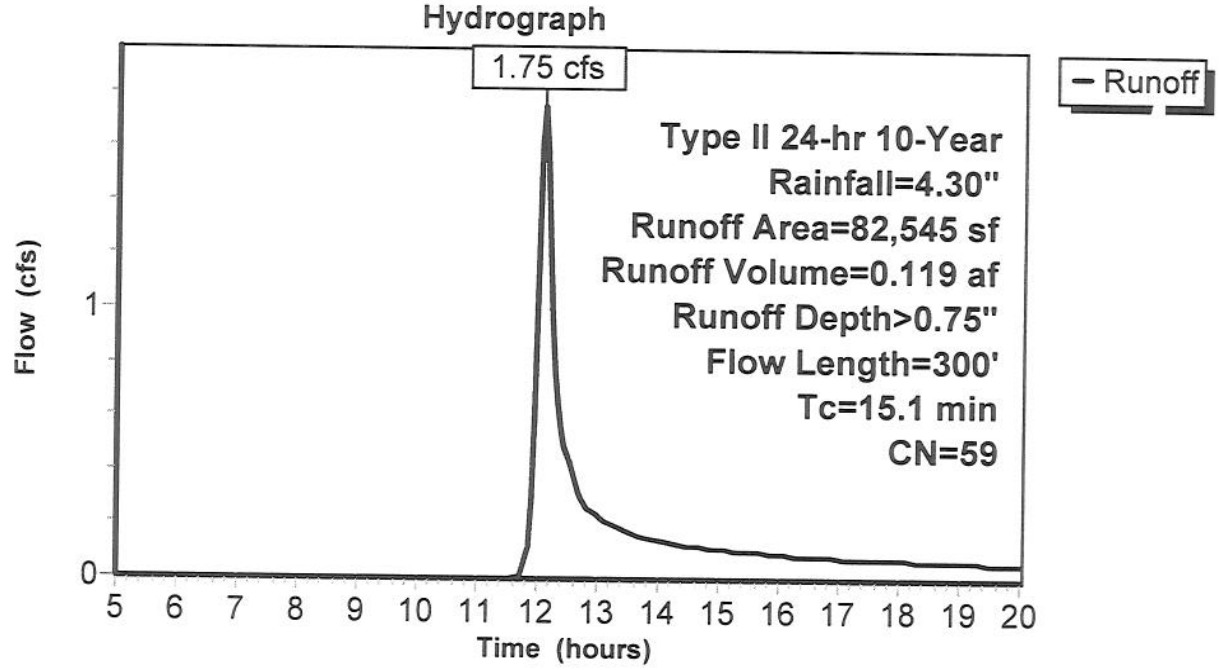
Runoff = 1.75 cfs @ 12.10 hrs, Volume= 0.119 af, Depth> 0.75"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 10-Year Rainfall=4.30"

	Area (sf)	CN	Description
*	61,125	45	Woods/Landscaping, HSG A
*	21,420	98	Proposed Impervious Area
	82,545	59	Weighted Average
	61,125		Pervious Area
	21,420		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
13.0	100	0.0800	0.13		**Sheet Flow, Sheet Flow Segment A-B** Woods: Light underbrush n= 0.400 P2= 2.90"
1.1	85	0.0700	1.32		**Shallow Concentrated Flow, Shallow Flow, Segment B-C** Woodland Kv= 5.0 fps
1.0	115	0.0100	1.89	1.18	**Trap/Vee/Rect Channel Flow, Grassed Swale** Bot.W=2.00' D=0.25' Z= 2.0 '/' Top.W=3.00' n= 0.027
15.1	300	Total			

Subcatchment 1S2: Watershed 1S2



Summary for Subcatchment 1S3: Watershed 1S3

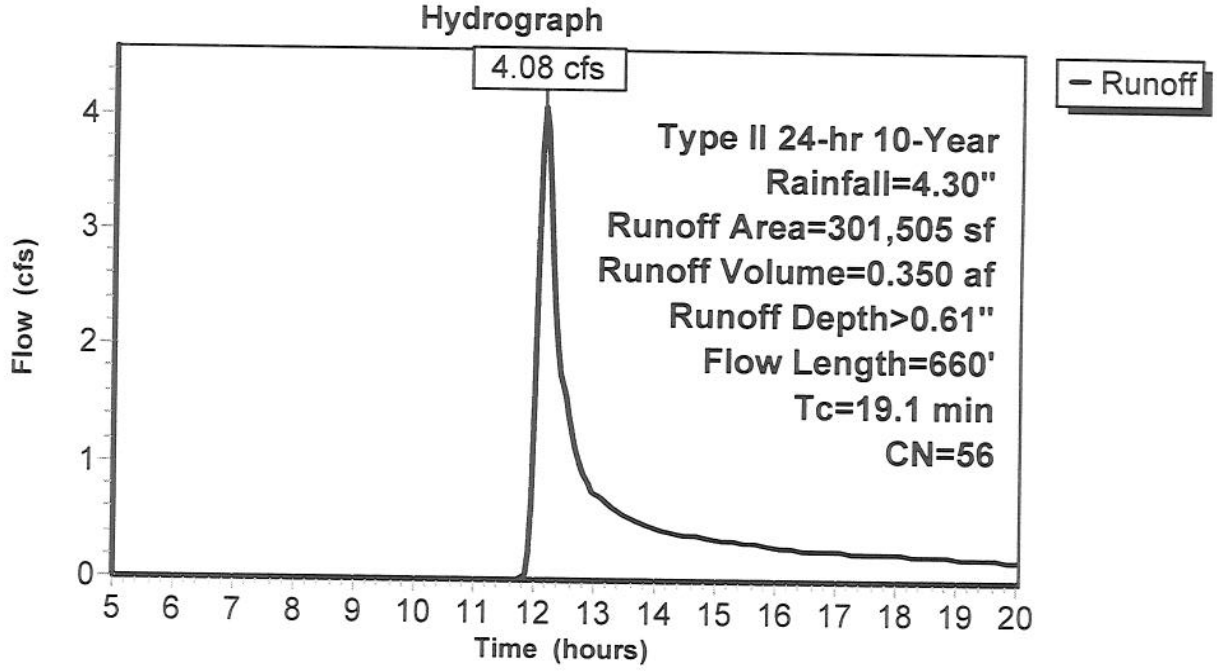
Runoff = 4.08 cfs @ 12.16 hrs, Volume= 0.350 af, Depth> 0.61"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 10-Year Rainfall=4.30"

	Area (sf)	CN	Description
*	163,250	45	Woods/Grass HSG A
*	58,280	65	Woods/Grass HSG B
*	76,575	70	Forested Wetlands/Flood Plain
*	3,400	98	Proposed Impervious Area
	301,505	56	Weighted Average
	298,105		Pervious Area
	3,400		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
11.8	100	0.1000	0.14		**Sheet Flow, Sheet Flow Segment A-B** Woods: Light underbrush n= 0.400 P2= 2.90"
4.0	340	0.0800	1.41		**Shallow Concentrated Flow, Shallow Flow, Segment B-C** Woodland Kv= 5.0 fps
3.3	220	0.0500	1.12		**Shallow Concentrated Flow, Shallow Flow, Segment C-D** Woodland Kv= 5.0 fps
19.1	660	Total			

Subcatchment 1S3: Watershed 1S3



Summary for Subcatchment 2S: Watershed 2S

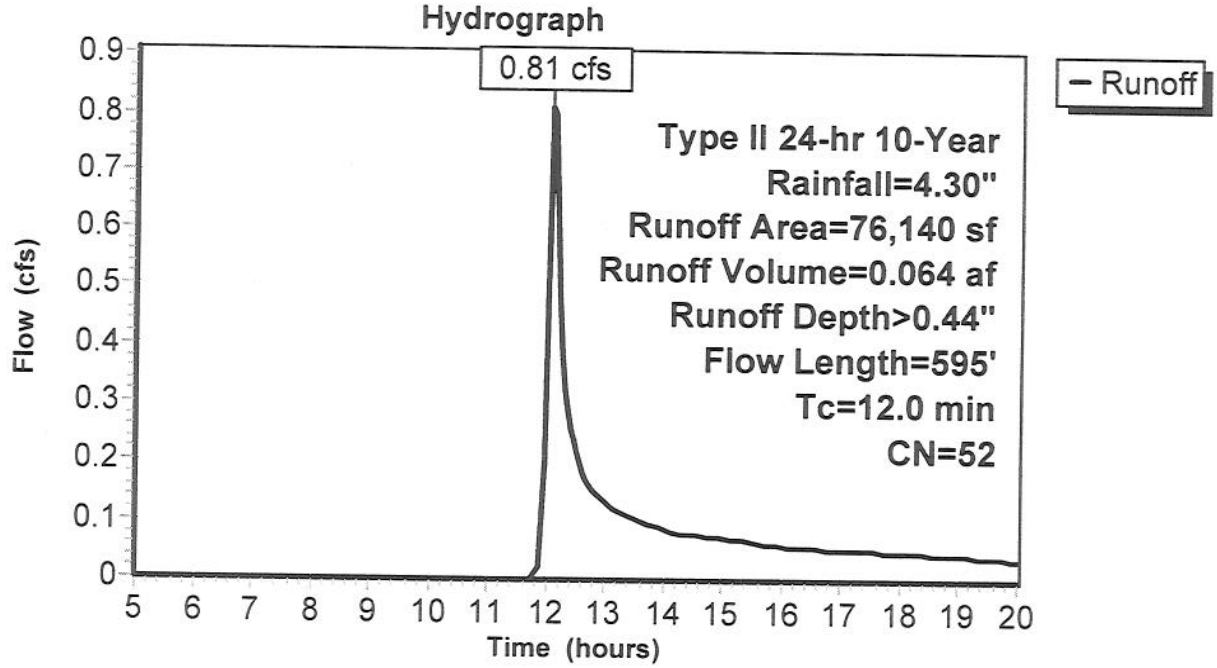
Runoff = 0.81 cfs @ 12.08 hrs, Volume= 0.064 af, Depth> 0.44"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Type II 24-hr 10-Year Rainfall=4.30"

	Area (sf)	CN	Description
*	66,140	45	Woods/Landscaping, HSG A
*	10,000	98	Existing Gravel Access
	76,140	52	Weighted Average
	66,140		Pervious Area
	10,000		Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
9.7	70	0.0800	0.12		**Sheet Flow, Sheet Flow Segment A-B** Woods: Light underbrush n= 0.400 P2= 2.90"
2.3	525	0.0400	3.77	2.36	**Trap/Vee/Rect Channel Flow, Roadside Ditch** Bot.W=2.00' D=0.25' Z= 2.0 '/' Top.W=3.00' n= 0.027
12.0	595	Total			

Subcatchment 2S: Watershed 2S



Summary for Pond 1P1: Pond 1P1

Inflow Area = 1.574 ac, 15.62% Impervious, Inflow Depth > 0.48" for 10-Year event
Inflow = 0.77 cfs @ 12.11 hrs, Volume= 0.063 af
Outflow = 0.13 cfs @ 13.02 hrs, Volume= 0.036 af, Atten= 83%, Lag= 54.6 min
Primary = 0.13 cfs @ 13.02 hrs, Volume= 0.036 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 179.03' @ 13.02 hrs Surf.Area= 607 sf Storage= 1,161 cf

Plug-Flow detention time= 188.0 min calculated for 0.036 af (58% of inflow)
Center-of-Mass det. time= 87.3 min (943.0 - 855.8)

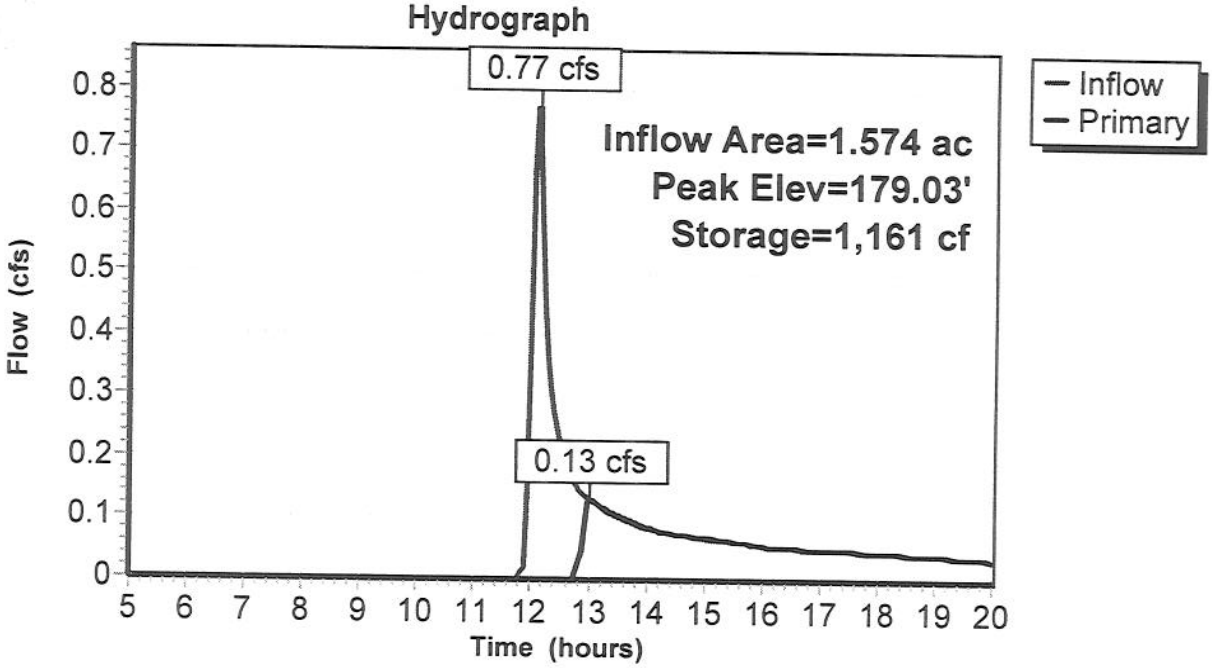
Volume	Invert	Avail.Storage	Storage Description
#1	176.00'	1,740 cf	**Custom Stage Data (Prismatic)**Listed below

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
176.00	140	0	0
178.00	400	540	540
180.00	800	1,200	1,740

Device	Routing	Invert	Outlet Devices
#1	Primary	179.00'	**10'-Wide Stone Spillway** Head (feet) 0.00 0.05 0.10 0.15 0.20 0.25 0.30 0.35 0.40 0.45 0.50 Disch. (cfs) 0.000 0.190 0.620 1.260 3.930 7.720 12.630 18.630 25.720 33.890 43.140

Primary OutFlow Max=0.13 cfs @ 13.02 hrs HW=179.03' (Free Discharge)
↑—**1=10'-Wide Stone Spillway** (Custom Controls 0.13 cfs)

Pond 1P1: Pond 1P1



Summary for Pond 1P2: Pond 1P2

Inflow Area = 1.895 ac, 25.95% Impervious, Inflow Depth > 0.75" for 10-Year event
Inflow = 1.75 cfs @ 12.10 hrs, Volume= 0.119 af
Outflow = 0.39 cfs @ 12.56 hrs, Volume= 0.117 af, Atten= 78%, Lag= 27.8 min
Primary = 0.39 cfs @ 12.56 hrs, Volume= 0.117 af
Secondary = 0.00 cfs @ 5.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 172.79' @ 12.56 hrs Surf.Area= 832 sf Storage= 1,524 cf

Plug-Flow detention time= 41.1 min calculated for 0.117 af (98% of inflow)
Center-of-Mass det. time= 35.8 min (872.0 - 836.2)

Volume	Invert	Avail.Storage	Storage Description
#1	170.00'	2,600 cf	**Custom Stage Data (Prismatic)**Listed below

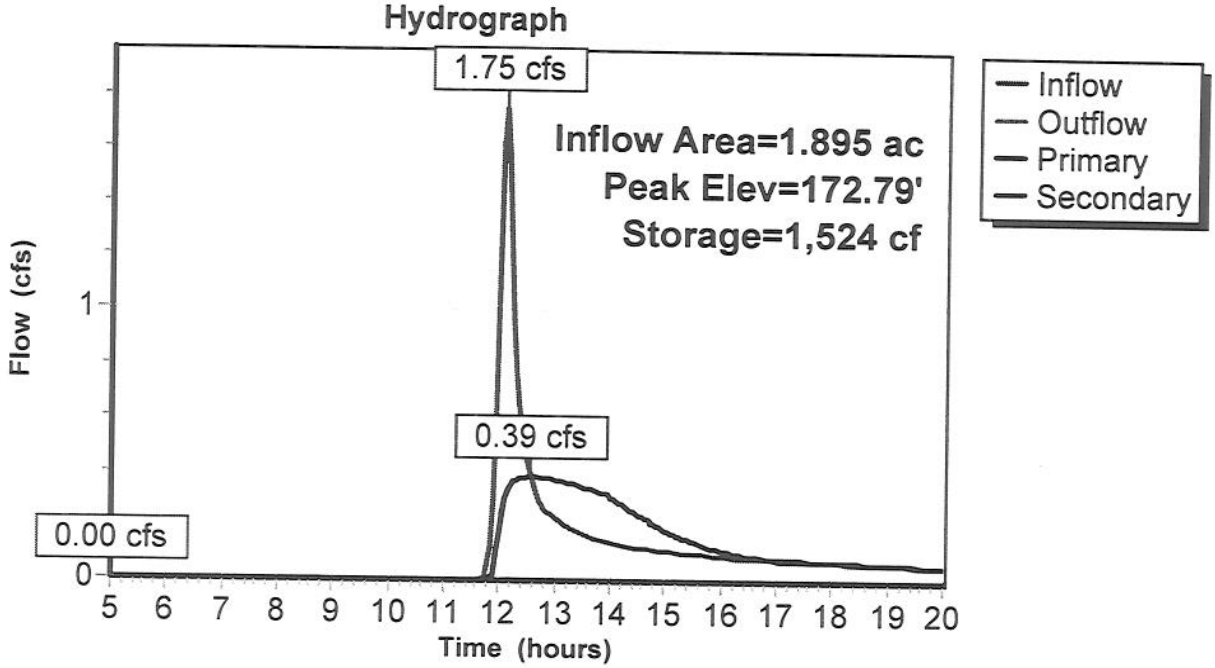
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
170.00	200	0	0
172.00	625	825	825
174.00	1,150	1,775	2,600

Device	Routing	Invert	Outlet Devices
#1	Primary	170.00'	**3.0" Vert. Orifice/Grate** C= 0.600
#2	Secondary	173.00'	**10'-Wide Stone Spillway** Head (feet) 0.00 0.05 0.10 0.15 0.20 0.25 0.30 0.35 0.40 0.45 0.50 Disch. (cfs) 0.000 0.190 0.620 1.260 3.930 7.720 12.630 18.630 25.720 33.890 43.140

Primary OutFlow Max=0.39 cfs @ 12.56 hrs HW=172.79' (Free Discharge)
└**1=Orifice/Grate** (Orifice Controls 0.39 cfs @ 7.86 fps)

Secondary OutFlow Max=0.00 cfs @ 5.00 hrs HW=170.00' (Free Discharge)
└**2=10'-Wide Stone Spillway** (Controls 0.00 cfs)

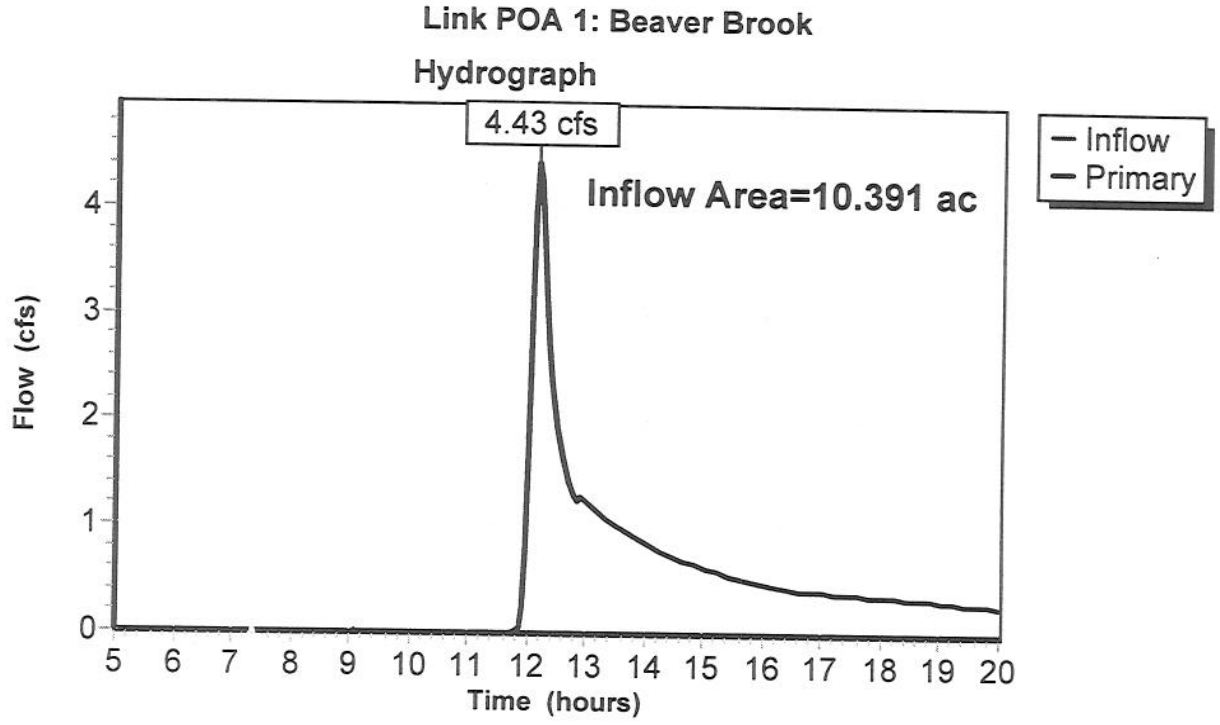
Pond 1P2: Pond 1P2



Summary for Link POA 1: Beaver Brook

Inflow Area = 10.391 ac, 7.85% Impervious, Inflow Depth > 0.58" for 10-Year event
Inflow = 4.43 cfs @ 12.16 hrs, Volume= 0.503 af
Primary = 4.43 cfs @ 12.16 hrs, Volume= 0.503 af, Atten= 0%, Lag= 0.0 min

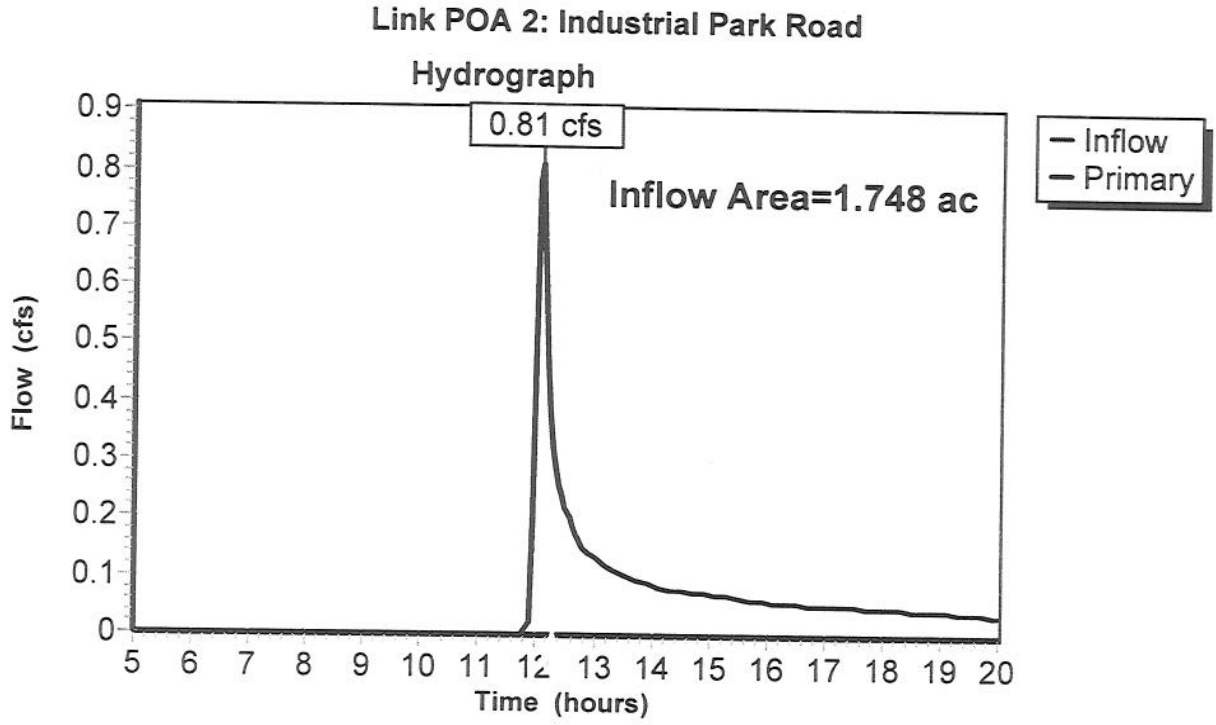
Primary outflow = Inflow, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs



Summary for Link POA 2: Industrial Park Road

Inflow Area = 1.748 ac, 13.13% Impervious, Inflow Depth > 0.44" for 10-Year event
Inflow = 0.81 cfs @ 12.08 hrs, Volume= 0.064 af
Primary = 0.81 cfs @ 12.08 hrs, Volume= 0.064 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs



SIZING CALCULATIONS

Stormwater Impoundment Stone Overflow Discharge Calculation

Inputs

D_{50}	0.50 feet
Width at Base	10.00 feet
Sideslopes	3.00 to 1
Channel Slope, S	0.33 ft/ft

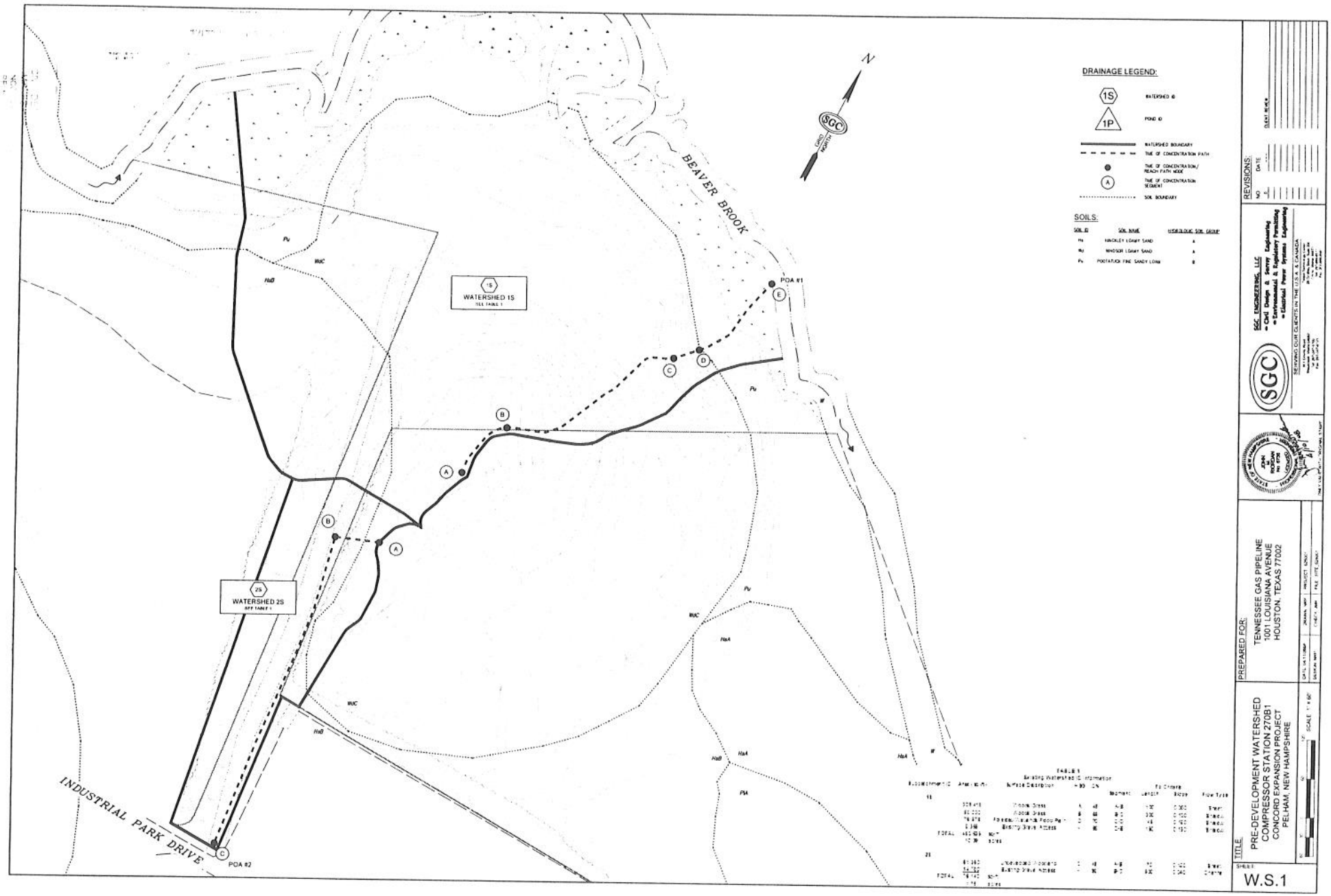
$$n = \frac{Y^{1/8}}{21.6*\mathrm{Log}_{10}(Y/D_{50}) + 14}$$

from: "Maine E&S Control BMP's", Section E-6-1

$$Q = \frac{1.486AR^{2/3}S^{1/3}}{n}$$

Depth of Flow, Y, ft	P, ft	A, ft^2	R = A/P, ft	n	Flow Rate,Q, cfs	Velocity, fps
0.05	10.32	0.51	0.05	0.300	0.19	0.38
0.10	10.63	1.03	0.10	0.300	0.62	0.60
0.15	10.95	1.57	0.14	0.292	1.26	0.80
0.20	11.26	2.12	0.19	0.151	3.93	1.85
0.25	11.58	2.69	0.23	0.112	7.72	2.87
0.30	11.90	3.27	0.27	0.093	12.63	3.86
0.35	12.21	3.87	0.32	0.082	18.63	4.82
0.40	12.53	4.48	0.36	0.075	25.72	5.74
0.45	12.85	5.11	0.40	0.070	33.89	6.64
0.50	13.16	5.75	0.44	0.066	43.14	7.50
0.55	13.48	6.41	0.48	0.062	53.47	8.35
0.60	13.79	7.08	0.51	0.060	64.88	9.16
0.65	14.11	7.77	0.55	0.058	77.37	9.96
0.70	14.43	8.47	0.59	0.056	90.94	10.74
0.75	14.74	9.19	0.62	0.054	105.60	11.49
0.80	15.06	9.92	0.66	0.053	121.36	12.23
0.85	15.38	10.67	0.69	0.052	138.21	12.96
0.90	15.69	11.43	0.73	0.051	156.18	13.66
0.95	16.01	12.21	0.76	0.050	175.26	14.36
1.00	16.32	13.00	0.80	0.049	195.47	15.04

WATERSHED PLANS



REVISIONS:
NO.
DATE

SGC ENGINEERING, LLC
• Civil Design & Survey Engineering
• Environmental & Regulatory Permitting
• Electrical Power Systems Engineering
SERVING OUR CLIENTS IN THE U.S.A. & CANADA

PREPARED FOR:
TENNESSEE GAS PIPELINE
1001 LOUISIANA AVENUE
HOUSTON, TEXAS 77002

TITLE:
PRE-DEVELOPMENT WATERSHED
COMPRESSOR STATION 27081
CONCORD EXPANSION PROJECT
PELHAM, NEW HAMPSHIRE

SCALE: 1" = 80'

SHEET:
W.S.1

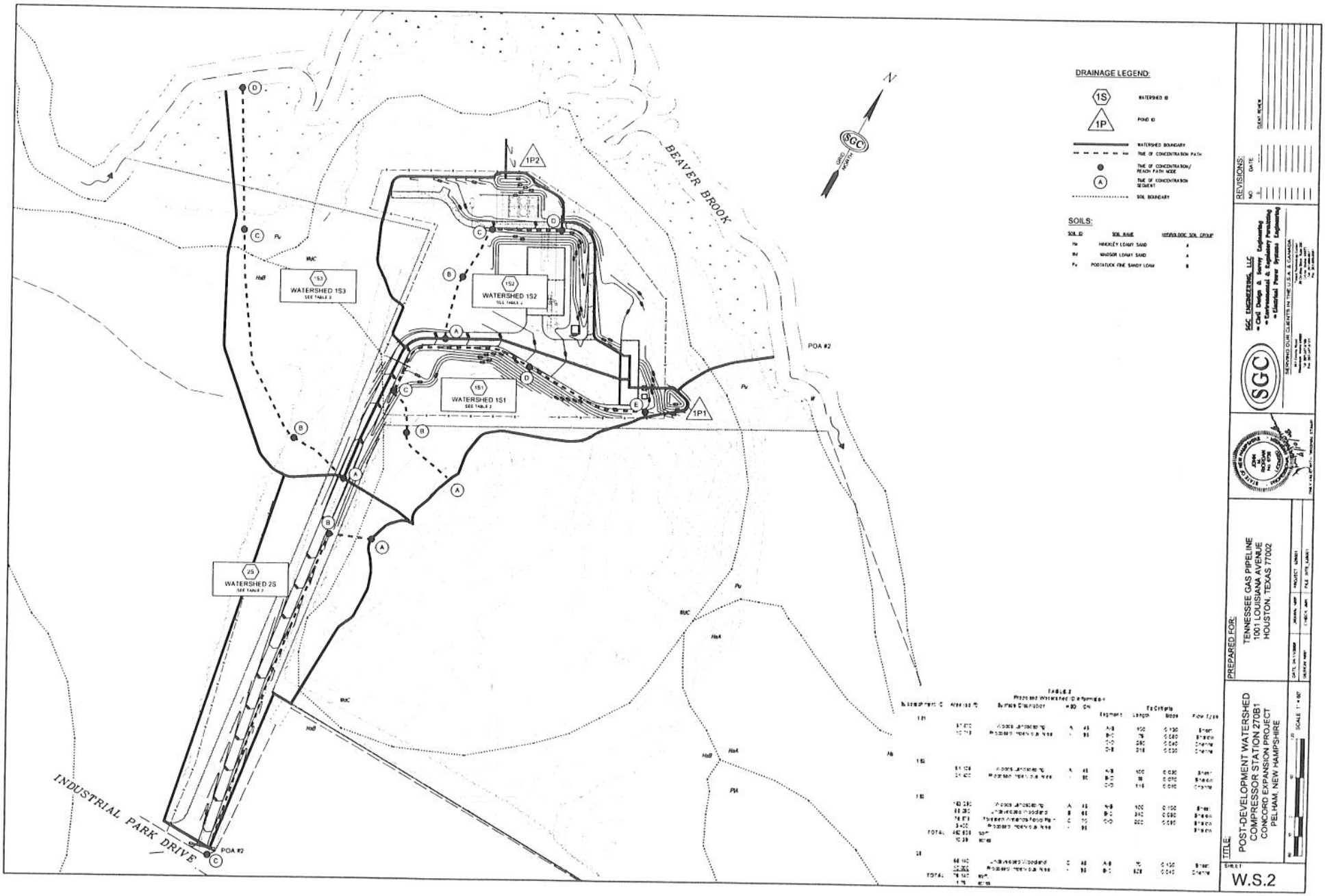


TABLE 2
Proposed Watershed ID Information

Subdevelopment ID	Area (sq ft)	Surface Description	HSD	CN	Segment	Tc Criteria Length	Tc Criteria Slope	Flow Type
1S1	[illegible]	Woods Landscaping	A	45	A-B	100	0.130	Sheet
	[illegible]	Proposed Impervious Area	-	98	B-C	75	0.080	Shallow
					C-D	280	0.040	Channel
					D-E	318	0.030	Channel
1S2	[illegible]	Woods Landscaping	A	45	A-B	100	0.030	Sheet
	[illegible]	Proposed Impervious Area	-	98	B-C	75	0.070	Shallow
					C-D	115	0.010	Channel
1S3	[illegible]	Woods Landscaping	A	45	A-B	100	0.130	Sheet
	[illegible]	Undeveloped Woodland	B	65	B-C	340	0.080	Shallow
	[illegible]	Forested Wetlands Flood Plain	C	70	C-D	200	0.080	Shallow
	[illegible]	Proposed Impervious Area	-	98				Shallow
TOTAL	[illegible]	sq ft						
	[illegible]	acres						
2S	[illegible]	Undeveloped Woodland	C	45	A-B	70	0.130	Sheet
	[illegible]	Proposed Impervious Area	-	98	B-C	520	0.040	Channel
TOTAL	[illegible]	sq ft						
	[illegible]	acres						

REVISIONS:

NO.	DATE	CLIENT REVIEW
0	---	

SGC ENGINEERING, LLC
• Civil Design & Survey Engineering
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• Electrical Power Systems Engineering

SERVING OUR CLIENTS IN THE U.S.A. & CANADA

STATE OF NEW HAMPSHIRE
JOHN M. ROGAN
No. 9738
LICENSED
PROFESSIONAL ENGINEER

PREPARED FOR:
TENNESSEE GAS PIPELINE
1001 LOUISIANA AVENUE
HOUSTON, TEXAS 77002

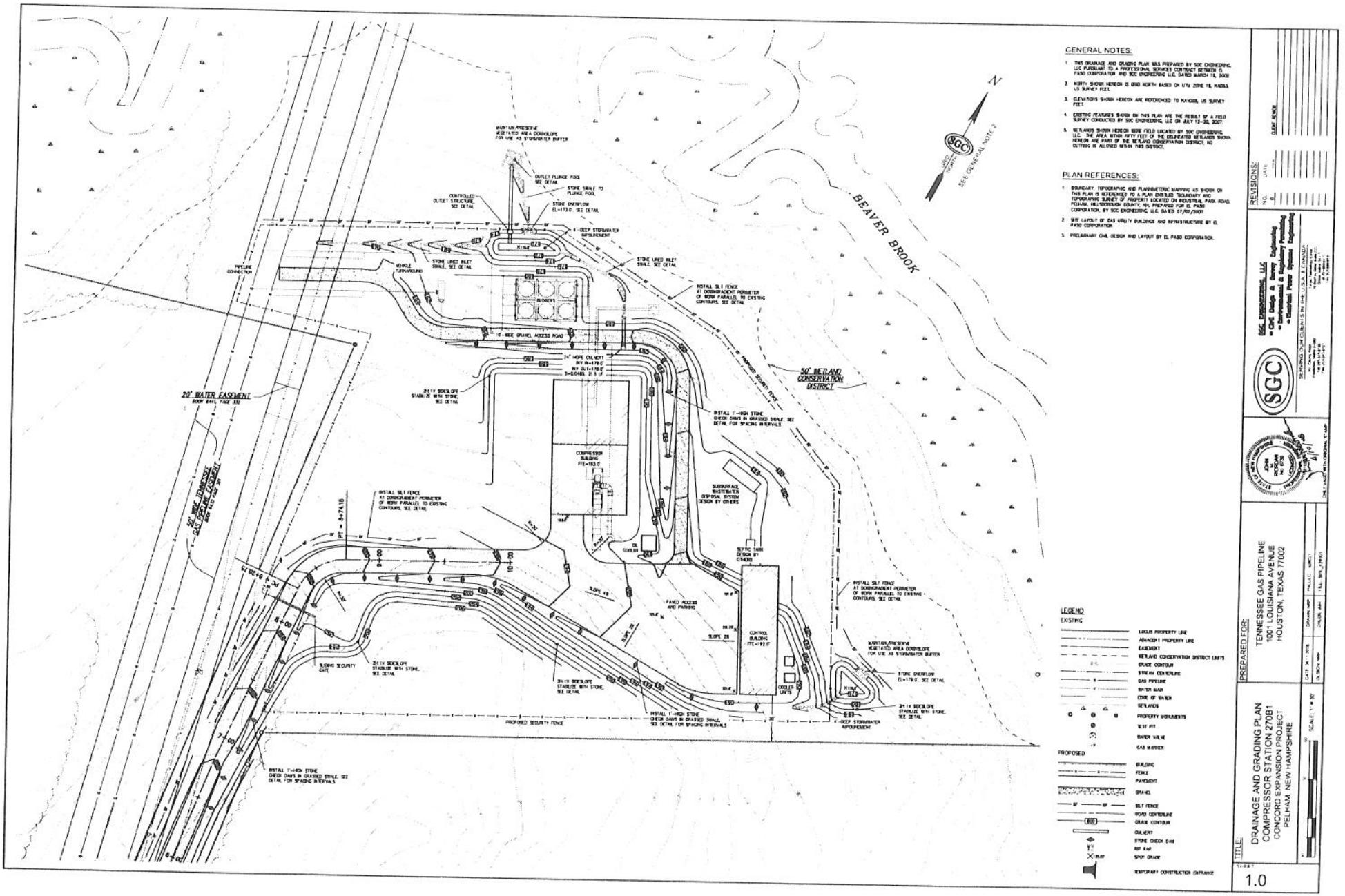
TITLE:
POST-DEVELOPMENT WATERSHED
COMPRESSOR STATION 270B1
CONCORD EXPANSION PROJECT
PELHAM, NEW HAMPSHIRE

SCALE 1" = 60'

SHEET
W.S.2

SECTION VII

PROJECT PLANS



GENERAL NOTES:

1. THIS DRAINAGE AND GRADING PLAN WAS PREPARED BY SGC ENGINEERING, LLC PURSUANT TO A PROFESSIONAL SERVICES CONTRACT BETWEEN EL PASO CORPORATION AND SGC ENGINEERING LLC, DATED MARCH 19, 2008
2. NORTH SHOWN HEREON IS GRID NORTH BASED ON UTM ZONE 19, NAD83, US SURVEY FEET.
3. ELEVATIONS SHOWN HEREON ARE REFERENCED TO NAVD88, US SURVEY FEET.
4. EXISTING FEATURES SHOWN ON THIS PLAN ARE THE RESULT OF A FIELD SURVEY CONDUCTED BY SGC ENGINEERING, LLC ON JULY 13-20, 2007.
5. WETLANDS SHOWN HEREON WERE FIELD LOCATED BY SGC ENGINEERING, LLC. THE AREA WITHIN FIFTY FEET OF THE DELINEATED WETLANDS SHOWN HEREON ARE PART OF THE WETLAND CONSERVATION DISTRICT. NO CUTTING IS ALLOWED WITHIN THIS DISTRICT.

PLAN REFERENCES:

1. BOUNDARY, TOPOGRAPHIC AND PLANIMETERIC MAPPING AS SHOWN ON THIS PLAN IS REFERENCED TO A PLAN ENTITLED "BOUNDARY AND TOPOGRAPHIC SURVEY OF PROPERTY LOCATED ON INDUSTRIAL PARK ROAD, PELHAM, HILLSBOROUGH COUNTY, NH, PREPARED FOR EL PASO CORPORATION, BY SGC ENGINEERING, LLC, DATED 07/07/2007
2. SITE LAYOUT OF GAS UTILITY BUILDINGS AND INFRASTRUCTURE BY EL PASO CORPORATION
3. PRELIMINARY CIVIL DESIGN AND LAYOUT BY EL PASO CORPORATION.

LEGEND

EXISTING

- LOCUS PROPERTY LINE
- ADJACENT PROPERTY LINE
- EASEMENT
- WETLAND CONSERVATION DISTRICT LIMITS
- GRADE CONTOUR
- STREAM CENTERLINE
- GAS PIPELINE
- WATER MAIN
- EDGE OF WATER
- WETLANDS
- PROPERTY MONUMENTS
- TEST PIT
- WATER VALVE
- GAS MARKER

PROPOSED

- BUILDING
- FENCE
- PAVEMENT
- GRAVEL
- SILT FENCE
- ROAD CENTERLINE
- GRADE CONTOUR
- CULVERT
- STONE CHECK DAM
- RIP RAP
- SPOT GRADE
- TEMPORARY CONSTRUCTION ENTRANCE

REVISIONS:

NO.	DATE	DESCRIPTION
1		
2		

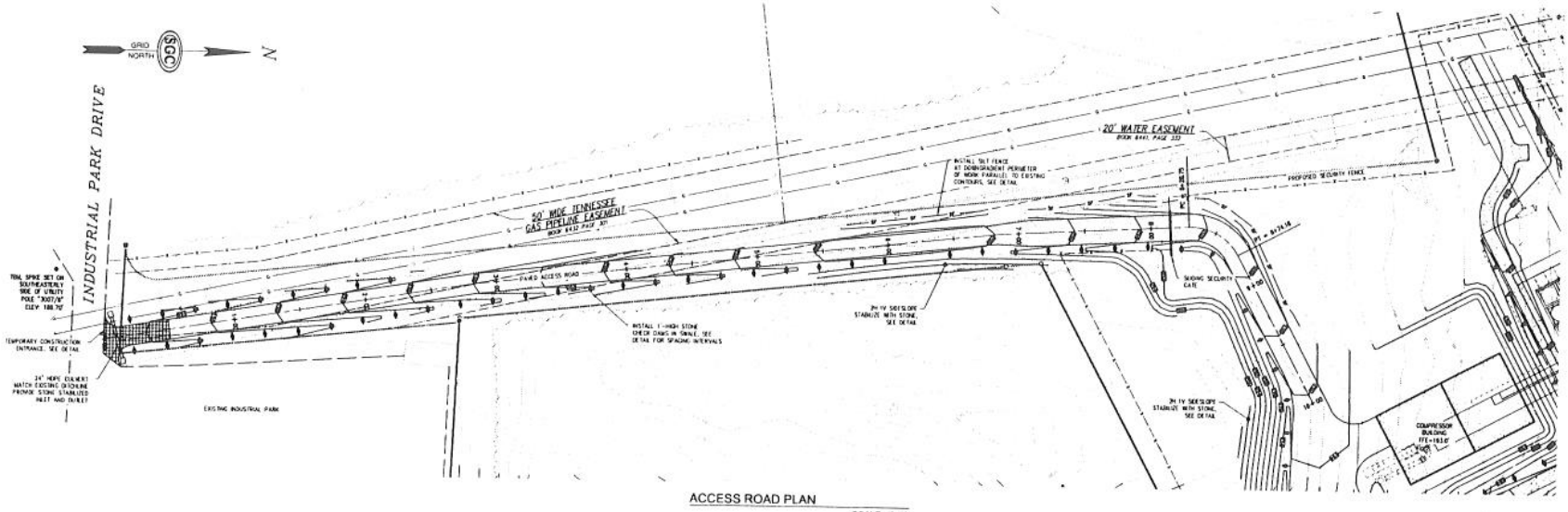
SGC ENGINEERING, LLC
• Civil Design & Survey Engineering
• Electrical & Regulatory Permitting
• Natural Power Systems Engineering
SERVING OUR CLIENTS BY THE U.S.A. & CANADA

PREPARED FOR:
TENNESSEE GAS PIPELINE
100 LOUISIANA AVENUE
HOUSTON, TEXAS 77002

TITLE:
DRAINAGE AND GRADING PLAN
COMPRESSOR STATION 270B1
CONCORD EXPANSION PROJECT
PELHAM, NEW HAMPSHIRE

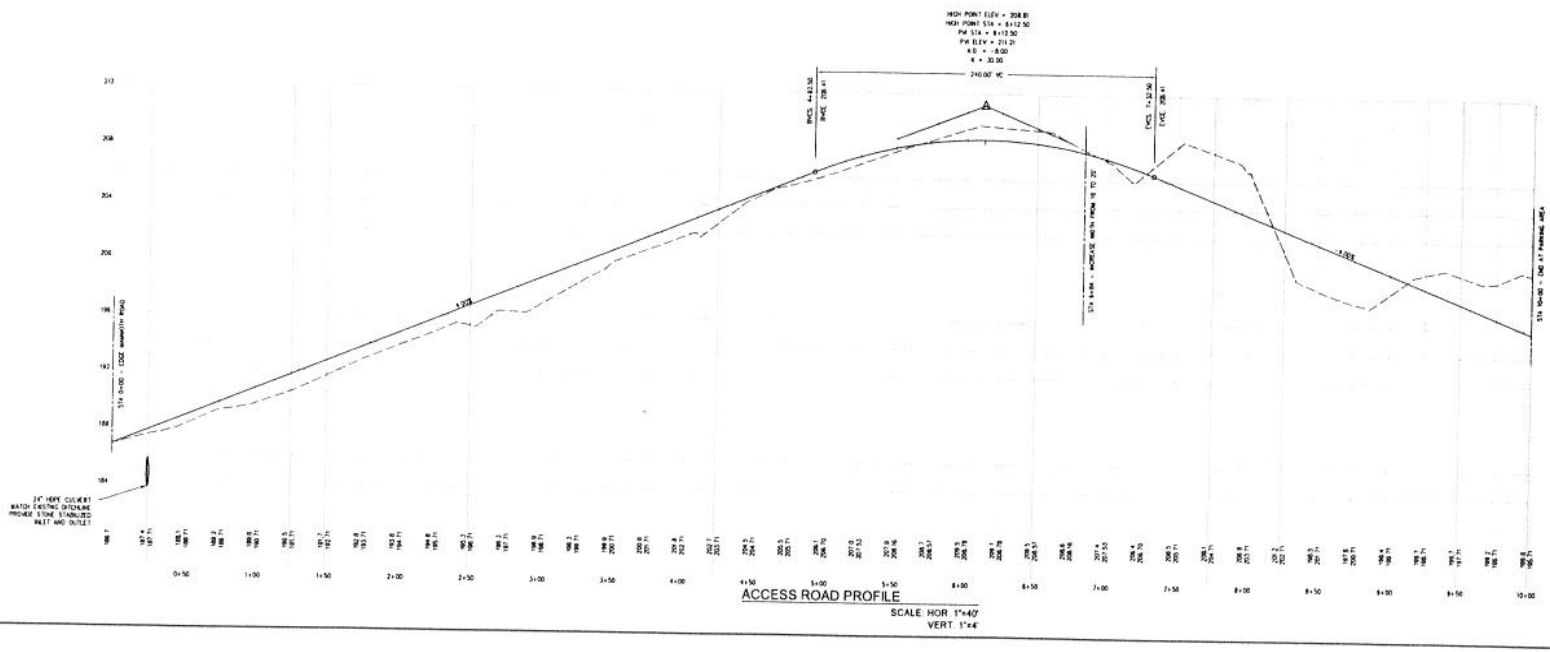
DATE: 24 JUL 2008
DRAWN BY: PROJECT MGR.
CHK'D BY: ALL SHEETS
SCALE: 1" = 30'

SHEET 1.0



ACCESS ROAD PLAN

SCALE: 1"=40'



ACCESS ROAD PROFILE

SCALE: HOR. 1"=40'
VERT. 1"=4'

REVISIONS:

NO	DATE	DESCRIPTION
1	---	---

SGC ENGINEERING, LLC
• Civil Design & Survey Engineering
• Environmental & Regulatory Permitting
• Electrical Power Systems Engineering

SERVING OUR CLIENTS IN THE U.S.A. & CANADA

PREPARED FOR:
TENNESSEE GAS PIPELINE
1001 LOUISIANA AVENUE
HOUSTON, TEXAS 77002

TITLE:
ENTRANCE ROAD PLAN AND PROFILE
COMPRESSOR STATION 270B1
CONCORD EXPANSION PROJECT
PELHAM, NEW HAMPSHIRE

SCALE: 1" = 40'

SHEET
2.0

GENERAL SITE GRADING NOTES:

1. ALL NEW DRIVE AND PARKING AREA SURFACES SHALL PITCH 1/4 INCH PER FOOT MINIMUM UNLESS OTHERWISE NOTED.
2. ALL AREAS THAT ARE EXCAVATED, FILLED, OR OTHERWISE DISTURBED BY THE CONTRACTOR SHALL BE LOAMED, GRADED, LIMED, FERTILIZED, SEEDED AND MULCHED, UNLESS OTHERWISE NOTED. THE TOP 4 INCHES OF SOIL SHALL BE TOPSOIL.
3. ALL ELEVATIONS REFER TO NAVD 88. THE CONTRACTOR WILL BE PROVIDED WITH A TEMPORARY BENCHMARK PRIOR TO CONSTRUCTION.
4. CONTRACTOR SHALL CONTROL DUST ON THE CONSTRUCTION SITE TO A REASONABLE LIMIT, TO THE SATISFACTION OF THE TOWN AND ENGINEER.
5. CONTRACTOR SHALL NOT TRACK OR SPILL EARTH, DEBRIS, OR OTHER CONSTRUCTION MATERIAL ON PUBLIC OR PRIVATE STREETS. THE CONTRACTOR SHALL BE RESPONSIBLE FOR THE IMMEDIATE ASSOCIATED CLEAN UP.
6. ALL MANHOLES, VALVE PITS, VALVE BOXES AND OTHER BURIED FACILITIES WITH SURFACE ACCESS SHALL BE ADJUSTED TO MATCH FINAL GRADES, UNLESS OTHERWISE INDICATED.
7. CONTRACTOR SHALL REMOVE AND DISPOSE OF ALL DEBRIS AND EXCESS EXCAVATED MATERIAL FROM WITHIN THE CONSTRUCTION LIMIT OF WORK, TO A SUITABLE OFF-SITE LOCATION PROVIDED BY THE CONTRACTOR, IN COMPLIANCE WITH STATE AND LOCAL REGULATIONS.
8. CONTRACTOR SHALL REMOVE AND REPLACE, OR REPAIR ALL PAVEMENT AND OTHER ITEMS DAMAGED BY HIS CONSTRUCTION ACTIVITIES TO AT LEAST THEIR ORIGINAL CONDITION, TO THE SATISFACTION OF THE TOWN AND ENGINEER.
9. WHERE EXISTING PAVEMENT IS REMOVED AND REPLACED, MATCH EXISTING GRADES TO THE EXTENT POSSIBLE. COORDINATE FINE GRADING WITH THE ENGINEER.

NEW HAMPSHIRE DES EROSION CONTROL NOTES:

1. THE SMALLEST PRACTICAL AREA SHALL BE DISTURBED DURING CONSTRUCTION, BUT IN NO CASE SHALL EXCEED 5 ACRES AT ANY ONE TIME BEFORE DISTURBED AREAS ARE STABILIZED.
2. ALL ROADS SHALL BE STABILIZED WITHIN 72 HOURS AFTER ACHIEVING FINAL GRADES.
3. ALL CUT AND FILL SLOPES SHALL BE SEEDED AND MULCHED OR STONED WITHIN 72 HOURS AFTER THEIR CONSTRUCTION.
4. ALL EROSION CONTROLS SHALL BE INSPECTED WEEKLY AND AFTER EVERY 0.5" OR GREATER RAINFALL WITHIN A 24-HOUR PERIOD.
5. AN AREA SHALL BE CONSIDERED STABLE IF ONE OF THE FOLLOWING HAS OCCURED:
   a. BASE COURSE GRAVELS HAVE BEEN INSTALLED IN AREAS TO BE PAVED.
   b. A MINIMUM OF 85% VEGETATED GROWTH HAS BEEN ESTABLISHED.
   c. A MINIMUM OF 3" OF NON-EROSIVE MATERIAL SUCH AS STONE OR RIPRAP HAS BEEN INSTALLED, OR
   d. EROSION CONTROL BLANKETS HAVE BEEN PROPERLY INSTALLED.

GENERAL EROSION CONTROL NOTES:

1. ALL EROSION AND SEDIMENT CONTROL MEASURES AS SHOWN ARE A MINIMUM. THE CONTRACTOR SHALL BE RESPONSIBLE FOR CONDUCTING EROSION AND SEDIMENT CONTROL PRACTICES IN ACCORDANCE WITH LOCAL REGULATIONS AND GOVERNING AUTHORITIES.
2. THE CONTRACTOR SHALL BE RESPONSIBLE FOR CONDUCTING STORM WATER MANAGEMENT PRACTICES IN ACCORDANCE WITH LOCAL REGULATIONS AND GOVERNING AUTHORITIES.
3. EROSION CONTROL MEASURES SHALL BE INSTALLED PRIOR TO THE START OF CONSTRUCTION AND SHALL BE MAINTAINED UNTIL FINAL SURFACING AND LANDSCAPING ARE ESTABLISHED.
4. THE CONTRACTOR SHALL PROVIDE PROPER EROSION CONTROL AND DRAINAGE MEASURES IN ALL AREAS OF WORK, AND CONFINE SOIL SEDIMENT TO WITHIN THE LIMITS OF EXCAVATION AND GRADING. PRIOR TO BEGINNING EXCAVATION WORK, SILT/HAYBALE FENCE SHALL BE INSTALLED AT THE DOWNGRADIENT PERIMETER OF THE ACTUAL LIMITS OF GRUBBING AND/OR GRADING, AND AS SHOWN ON THE DRAWINGS. EROSION CONTROL MEASURES SHOWN ON THE DRAWINGS ARE A MINIMUM. CONTRACTOR SHALL TAKE ALL OTHER NECESSARY MEASURES TO CONTROL EROSION. EROSION CONTROL FENCE SHALL ALSO BE INSTALLED AT THE DOWNGRADIENT PERIMETER OF THE TOPSOIL STOCKPILES. ALL DISTURBED EARTH SURFACES SHALL BE STABILIZED IN THE SHORTEST PRACTICAL TIME AND TEMPORARY EROSION CONTROL DEVICES SHALL BE EMPLOYED UNTIL SUCH TIME AS ADEQUATE SOIL STABILIZATION HAS BEEN ACHIEVED. TEMPORARY STORAGE OF EXCAVATED MATERIAL SHALL BE STABILIZED IN A MANNER THAT WILL MINIMIZE EROSION. ALL INSTALLED EROSION CONTROL FACILITIES SHALL BE REMOVED AT THE END OF THE PROJECT.
5. CATCH BASIN AND STORM DRAIN PROTECTION MEASURES SHALL BE INSTALLED PRIOR TO CONSTRUCTION TO PROTECT EXISTING SYSTEMS FROM RECEIVING RUNOFF FROM UNSTABILIZED SURFACES.
6. SEEDING SHALL BE INSTALLED ON EXPOSED AREAS OF THE SITE WHERE GRADING ACTIVITIES WILL CEASE FOR A PERIOD OF MORE THAN 21 DAYS. SEEDING SHALL BE INSTALLED BY THE 14TH DAY AFTER THE LAST DISTURBANCE. TEMPORARY SEEDING SHALL BE INSTALLED ON SUCH AREAS AS GRADED SLOPES, STOCKPILE AREAS, ETC.

EROSION CONTROL SEED MIX SHALL MEET THE FOLLOWING CRITERIA:

SEED	% WEIGHT	% GERMINATION
WINTER RYE	80 MINIMUM	85 MIN
RED FESCUE (CREEPING)	4 MIN	80 MIN
PERENNIAL RYE GRASS	3 MIN	90 MIN
RED CLOVER	3 MIN	90 MIN
OTHER CROP GRASS	0.5 MAX	
NOXIOUS WEED SEED	0.5 MAX	
INERT MATTER	1.0 MAX	

7. THE CONTRACTOR SHALL INSPECT THE EROSION AND SEDIMENTATION CONTROL DEVICES AFTER EACH RAINSTORM AND DURING MAJOR STORM EVENTS. REPAIRS SHALL BE MADE AS NECESSARY. ACCUMULATED SEDIMENT TRAPPED BY EROSION AND SEDIMENTATION CONTROL DEVICES SHALL BE REMOVED AS NECESSARY.
8. DURING CONSTRUCTION, TEMPORARY OUTLETS OF THE DRAINAGE SYSTEMS SHALL BE PROTECTED BY SEDIMENT BASINS.
9. TEMPORARY EROSION AND SEDIMENTATION CONTROL DEVICES SHALL BE REMOVED AND THOSE AND ADJACENT AREAS RESTORED UPON COMPLETION OF THE WORK OR WHEN SO ORDERED BY THE ENGINEER.
10. THE METHOD OF STRIPPING VEGETATION SHALL BE SUCH AS TO MINIMIZE EROSION. FILLS SHALL BE PLACED AND COMPACTED IN SUCH A MANNER THAT SOIL SLIDING AND EROSION IS MINIMIZED. GRADING SHALL BE DONE IN SUCH A MANNER AS NOT TO DIVERT WATER ON TO ADJOINING PROPERTY.
11. TEMPORARY MULCHING IS TO BE APPLIED TO ALL DISTURBED AREAS LEFT INACTIVE AND UNSTABILIZED FOR A PERIOD GREATER THAN 7 DAYS.
12. RIPRAP INLET/OUTLET PROTECTION SHALL BE INSTALLED WITHIN 48 HOURS OF CULVERT INSTALLATION.
13. EROSION CONTROL BLANKET SHALL BE USED FOR ALL DITCH INVERTS AS CHANNEL/DITCH STABILIZATION. EITHER MULCHING OR EROSION CONTROL BLANKET MAY BE USED ON SIDE SLOPES.
14. PERMANENT STONE CHECK DAMS ARE TO BE INSTALLED WITHIN ALL PROPOSED AND DISTURBED DRAINAGE SWALES AT INTERVALS SPECIFIED BY STONE CHECK DAM DETAIL.

WINTER EROSION CONTROL AND STABILIZATION NOTES:

1. THE CONTRACTOR SHALL BE RESPONSIBLE FOR COMPLETING ALL WINTER EROSION AND SEDIMENT CONTROL IN ACCORDANCE WITH LOCAL REGULATIONS AND GOVERNING AUTHORITIES.
2. WINTER EXCAVATION AND EARTHWORK SHALL BE COMPLETED SUCH THAT NO MORE THAN 1 ACRE OF THE SITE IS WITHOUT STABILIZATION AT ONE TIME.
3. DISTURBED AREAS ARE TO BE LIMITED TO AREAS WHERE WORK IS TO BE COMPLETED WITHIN 15 DAYS AND CAN BE MULCHED IN ONE DAY PRIOR TO A SNOW EVENT.
4. THE SITE STABILIZATION SCHEDULE BEFORE WINTER SHALL BE AS FOLLOWS:

SEPTEMBER 15 — ALL DISTURBED AREAS MUST BE SEEDED AND MULCHED. ALL SLOPES MUST BE STABILIZED, SEEDED AND MULCHED. ALL GRASS LINED DITCHES AND CHANNELS MUST BE STABILIZED WITH MULCH OR AN EROSION CONTROL BLANKET.

OCTOBER 1 — ALL DISTURBED AREAS TO BE PROTECTED WITH AN ANNUAL GRASS MUST BE SEEDED AT A SEEDING RATE OF 3 POUNDS PER 1000 SQ.FT AND MULCHED.

NOVEMBER 15 — ALL STONE-LINED DITCHES AND CHANNELS MUST BE CONSTRUCTED. SLOPES THAT ARE COVERED WITH RIPRAP MUST BE CONSTRUCTED BY THAT DATE.

DECEMBER 1 — ALL DISTURBED AREAS WHERE THE GROWTH OF VEGETATION FAILS TO BE AT LEAST THREE INCHES TALL OR AT LEAST 75% OF THE DISTURBED SOIL IS COVERED BY VEGETATION, MUST BE PROTECTED FOR OVER-WINTER.

STONE LINED SWALE DETAIL
NOT TO SCALE

NOTES:

1. STONE SIZE - USE 2-3 INCH STONE, OR RECLAIMED OR RECYCLED CONCRETE EQUIVALENT.
2. LENGTH - NOT LESS THAN 50 FEET.
3. THICKNESS - NOT LESS THAN EIGHT (8) INCHES.
4. WIDTH - SIXTEEN (16) FOOT MINIMUM, BUT NOT LESS THAN THE FULL WIDTH AT POINTS WHERE INGRESS OR EGRESS OCCURS.
5. GEOTEXTILE MIRAFI 600X MUST BE PLACED OVER THE ENTIRE BED PRIOR TO PLACING OF STONE.
6. MIN 15"Ø CULVERT SHALL BE INSTALLED FOR DRAINAGE BENEATH CONSTRUCTION ENTRANCES IF CULVERT IS IMPRACTICAL, A MOUNTABLE BERM WITH 5:1 SLOPES WILL BE PERMITTED.
7. MAINTENANCE - THE ENTRANCE SHALL BE MAINTAINED IN A CONDITION WHICH WILL PREVENT TRACKING OR FLOWING OF SEDIMENT ONTO PUBLIC RIGHTS-OF-WAY. ALL SEDIMENT SPILLED, DROPPED, WASHED OR TRACKED ONTO PUBLIC RIGHTS-OF-WAY MUST BE REMOVED IMMEDIATELY.
8. WHEN WASHING IS REQUIRED, IT SHALL BE DONE ON AN AREA STABILIZED WITH STONE AND WHICH DRAINS INTO AN APPROVED SEDIMENT TRAPPING DEVICE.
9. PERIODIC INSPECTION AND MAINTENANCE SHALL BE PROVIDED ACCORDING TO PERMIT REQUIREMENTS.

STABILIZED CONSTRUCTION ENTRANCE DETAIL
NOT TO SCALE

NOTES:

1. STONE WILL BE PLACED ON A FILTER FABRIC FOUNDATION TO THE LINES, GRADES AND LOCATIONS SHOWN IN THE PLAN.
2. SET SPACING OF CHECK DAMS TO ASSURE THAT THE ELEVATIONS OF THE CREST OF THE DOWNSTREAM DAM IS AT THE SAME ELEVATION OF THE TOE OF THE DOWNSTREAM DAM.
3. EXTEND THE STONE A MINIMUM OF 1.5 FEET BEYOND THE DITCH BANKS TO PREVENT CUTTING AROUND THE DAM.
4. PROTECT THE CHANNEL DOWNSTREAM OF THE LOWEST CHECK DAM FROM SCOUR AND EROSION WITH STONE OR LINER AS APPROPRIATE.
5. ENSURE THAT CHANNEL APPURTENANCES SUCH AS CULVERT ENTRANCES BELOW CHECK DAMS ARE NOT SUBJECT TO DAMAGE OR BLOCKAGE FROM DISPLACED STONE.

STONE CHECK DAM DETAIL
NOT TO SCALE

NOTES:

1. ALL TREES, BRUSH, STUMPS, OBSTRUCTIONS, AND OTHER OBJECTIONABLE MATERIAL SHALL BE REMOVED AND DISPOSED OF SO AS NOT TO INTERFERE WITH THE PROPER FUNCTIONING OF THE WATERWAY.
2. THE WATERWAY SHALL BE EXCAVATED OR SHAPED TO LINE, GRADE, AND CROSS SECTION AS REQUIRED TO MEET THE CRITERIA SPECIFIED HEREIN, AND BE FREE OF BANK PROJECTIONS OR OTHER IRREGULARITIES WHICH WILL IMPEDE NORMAL FLOW.
3. FILLS SHALL BE COMPACTED AS NEEDED TO PREVENT UNEQUAL SETTLEMENT THAT WOULD CAUSE DAMAGE IN THE COMPLETE WATERWAY.
4. ALL EARTH REMOVED AND NOT NEEDED IN CONSTRUCTION SHALL BE SPREAD OR DISPOSED OF SO THAT IT WILL NOT INTERFERE WITH THE FUNCTIONING OF THE WATERWAY.
5. GRASSED WATERWAY SHALL BE FINISHED AND STABILIZED AS FOLLOWS:
   A. A MINIMUM OF 4" SCREENED LOAM SHALL BE PROVIDED AS TOPSOIL.
   B. DURING THE WINTER MONTHS, THE PERIMETER SWALE IS TO BE LINED WITH EITHER MULCH OR EROSION CONTROL BLANKET AS GROUND CONDITIONS DICTATE.
   C. THE PERIMETER SWALE IS TO BE MULCHED AND SEEDED TO ENCOURAGE A GOOD CATCH OF GRASS AT THE COMPLETION OF CONSTRUCTION WHEN WATER CONDITIONS HAVE SUBSIDED. SEED MIX SHALL MATCH ONE OF THE FOLLOWING:

BIRDSFOOT TREFOIL OR LADINO CLOVER	27%
TALL FESCUE OR SMOOTH BROMEGRASS	67%
REDTOP	6%
OR	
KENTUCKY BLUEGRASS	45%
CREEPING RED FESCUE	36%
PERENNIAL RYEGRASS	19%

GRASSED SWALE DETAIL
NOT TO SCALE

RIPRAP SLOPE STABILIZATION DETAIL
NOT TO SCALE

NOTES:

1. WOVEN WIRE FENCE TO BE FASTENED SECURELY TO FENCE POSTS WITH WIRE TIES. WIRE FENCE REINFORCEMENT REQUIRED WITHIN 100 FT UPSLOPE OF RECEIVING WATERS.
2. FILTER CLOTH TO BE FASTENED SECURELY TO WOVEN WIRE FENCE WITH TIES SPACED EVERY 24" AT TOP AND MID SECTION. FENCE SHALL BE WOVEN WIRE, 6" MAXIMUM MESH OPENING.
3. WHEN TWO SECTIONS OF FILTER CLOTH ADJOIN EACH OTHER THEY SHALL BE OVERLAPPED BY SIX INCHES AND FOLDED. FILTER CLOTH SHALL BE EITHER FILTER X, MIRAFI 100X, STABILINKA T140N, OR APPROVED EQUIVALENT.
4. PREFABRICATED UNITS SHALL BE GEOFAB, ENVIROFENCE, OR APPROVED EQUIVALENT.
5. MAINTENANCE SHALL BE PERFORMED AS NEEDED AND MATERIAL REMOVED WHEN SEDIMENT REACHES HALF OF FABRIC HEIGHT.

SILT FENCE DETAIL
NOT TO SCALE

NOTES:

1. BURY THE TOP END OF THE MESH MATERIAL IN A 12" TRENCH AND BACKFILL AND TAMP TRENCHING SECURE END WITH STAPLES AT 6" SPACING, 4" DOWN FROM EXPOSED END.
2. FLOW DIRECTION JOINTS TO HAVE UPPER END OF LOWER STRIP BURIED WITH UPPER LAYERS OVERLAPPED 4" AND STAPLED. OVERLAP B OVER A.
3. LATERAL JOINTS TO HAVE 4" OVERLAP OF STRIPS. STAPLE 18" ON CENTER.
4. STAPLE OUTSIDE LATERAL EDGE 2' ON CENTER.
5. WIRE STAPLES TO BE MIN. OF # 11 WIRE 6" LONG AND 1-1/2" WIDE.
6. USE NORTH AMERICAN GREEN DS 150 OR APPROVED EQUAL.

EROSION CONTROL BLANKET DETAIL (DITCH)
NOT TO SCALE

NOTES:

1) SLOPE SURFACE SHALL BE FREE OF ROCKS, CLODS, STICKS, AND GRASS. BLANKETS SHALL HAVE GOOD SOIL CONTACT.
2) APPLY PERMANENT SEEDING BEFORE PLACING BLANKETS.
3) LAY BLANKETS LOOSELY AND STAKE OR STAPLE TO MAINTAIN DIRECT CONTACT WITH THE SOIL. DO NOT STRETCH.
4. INSTALL BLANKETS VERTICALLY DOWNSLOPE.

EROSION CONTROL BLANKET DETAIL (SLOPES)
NOT TO SCALE

REVISIONS:

NO	DATE	
0		CLIENT REVIEW

SGC ENGINEERING, LLC
• Civil Design & Survey Engineering
• Environmental & Regulatory Permitting
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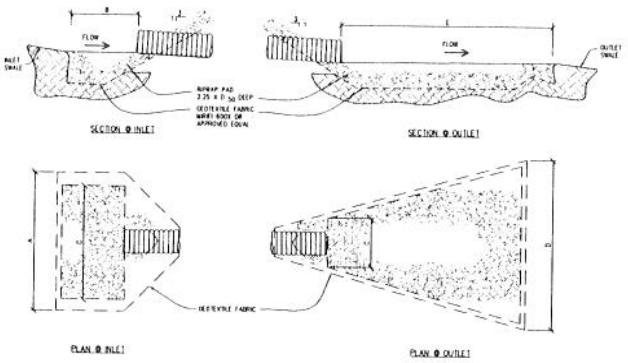
CIVIL DETAILS AND NOTES
COMPRESSOR STATION 270B1
CONCORD EXPANSION PROJECT
PELHAM, NEW HAMPSHIRE

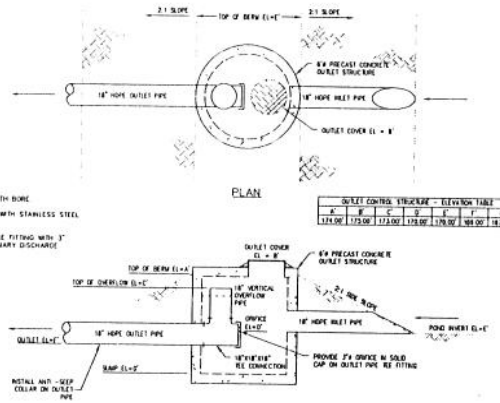
SHEET
3.1

RIPRAP PAD MUST BE INSTALLED WITHIN 48 HOURS OF INSTALLING NEW PIPE OR CULVERT.

PIPE	A	B	C	D	E	D 50
15"~	3.75 FT	2.5 FT	3.75 FT	10 FT	8 FT	6 IN
18"~	4.5 FT	3 FT	4.5 FT	11.5 FT	10 FT	6 IN
24"~	6 FT	4 FT	6 FT	14 FT	14 FT	6 IN
30"~	7.5 FT	5.5 FT	7.5 FT	18.5 FT	17 FT	8 IN



CULVERT INLET/OUTLET STONE APRON DETAIL
NOT TO SCALE

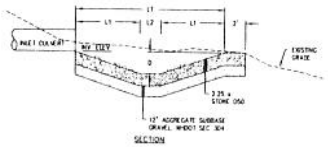


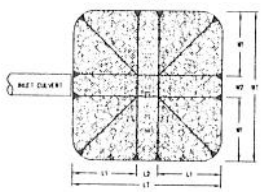
NOTES:
1. DRAIN PIPE SHALL BE 18" HDPE WITH SMOOTH BORE
2. FASTEN VERTICAL OVERFLOW PIPE TO WALL WITH STAINLESS STEEL STRAP
3. PROVIDE THREADED CAP ON OUTLET PIPE TEE FITTING WITH 3" DIAMETER DRILLED ORIFICE FOR USE AS PRIMARY DISCHARGE CONTROL

OUTLET CONTROL STRUCTURE - ELEVATION TABLE

A	B	C	D	E	F	G
174.00'	173.00'	173.00'	173.00'	176.00'	184.00'	187.00'

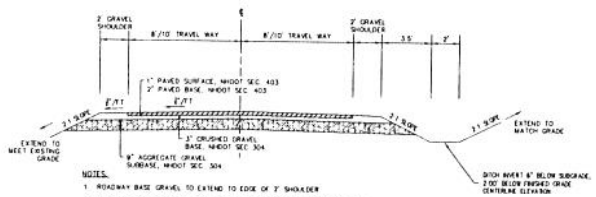
STORMWATER IMPOUNDMENT OUTLET CONTROL STRUCTURE
NOT TO SCALE





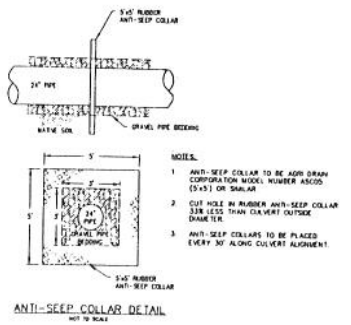
SCHEDULE									
CULVERT DIA	L1	L2	L3	W1	W2	W3	D	STONE D50	2.25 x D50
24"	6'	3'	14'	6'	3'	14'	3'	8"	18"

CULVERT PLUNGE POOL DETAIL
NOT TO SCALE



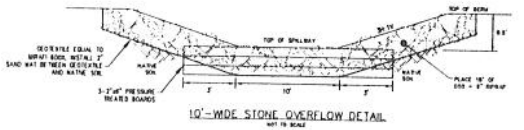
NOTES:
1. ROADWAY BASE GRAVEL TO EXTEND TO EDGE OF 3' SHOULDER
2. ROADWAY SUBBASE GRAVEL TO EXTEND TO THE EDGE OF THE DITCH SLOPE
3. ALL ROADWAY MATERIALS TO BE COMPACTED TO 95%
4. IN AREAS OF FILL, ROAD AREA SHALL BE GRUBBED 6" MIN. BELOW EXISTING GRADE AND TO A DEPTH SUFFICIENT TO REMOVE ALL ORGANICS. BRING TO SUBGRADE WITH COMMON BORROW
5. CUT AND FILL SIDE SLOPES CAN BE INCREASED FROM THE VALUES AS SHOWN PROVIDED THAT STONE SLOPE STABILIZATION TECHNIQUES OR RETAINING WALLS ARE USED

ROADWAY CROSS SECTION DETAIL
NOT TO SCALE



NOTES:
1. ANTI-SEEP COLLAR TO BE ADS® DRAIN CORPORATION MODEL NUMBER ASC05 (5'x5') OR SIMILAR
2. CUT HOLE IN RUBBER ANTI-SEEP COLLAR 33% LESS THAN CULVERT OUTSIDE DIAMETER
3. ANTI-SEEP COLLARS TO BE PLACED EVERY 30' ALONG CULVERT ALIGNMENT

ANTI-SEEP COLLAR DETAIL
NOT TO SCALE



10'-WIDE STONE OVERFLOW DETAIL
NOT TO SCALE

REVISIONS:
NO. DATE

SHEET INDEX

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