APPENDIX D

STAGE-DISCHARGE-STORAGE CURVE

CNR AT TRIBUTARY 2

STAGE-DISCHARGE-STORAGE CURVE

CNR AT TRIBUTARY 2

Stage (m)	Discharge (cfs)	Storage (ac-ft)
87.50	0.0	0.0
87.53	10.0	0.006
87.57	21.0	0.042
87.66	41.0	0.367
87.77	65.0	0.862
88.00	94.0	2.85
88.24	117.0	5.99
88.50	140.0	11.1
89.01	182.0	25.5
89.50	231.0	49.3

APPENDIX E

MONTHLY MEAN WATER LEVELS

LAKE ONTARIO

(Extract from MacLaren's Report)

TABLE 4.1

MONTHLY MEAN WATER LEVELS

LAKE ONTARIO - KINGSTON GAUGE 13988 [1]

Month	Mean Water Level (m) GSCD	
January	74.54	
February	74.56	
March	74.65	
April	74.85	
May	74.99	
June	75.03 *	
July	74.99	
August	74.89	
September	74.75	
October	74.63	
November	74.55	
December	74.53	
1:100 Year [2]	76.5	(flood elevation)
1:100 Year	76.7	(wave uprush level)

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* greatest monthly mean water level and starting backwater level for design precipitation storm runoff

1/ Canadian Hydrographic Service, 1983 "Monthly Mean Levels - Present and Past, with a Forecast of Probable Future Levels", Monthly Mean Water Level Bulletin - Great Lakes and Montreal Harbour

2/ Fisheries and Environment Canada and Ontario Ministry of Natural Resources, 1978. "Great Lakes Flood and Erosion Prone Areas" Mapping Sheet 62 - Bay of Quinte

APPENDIX F

BRIDGE DATA

BRIDGE DATA

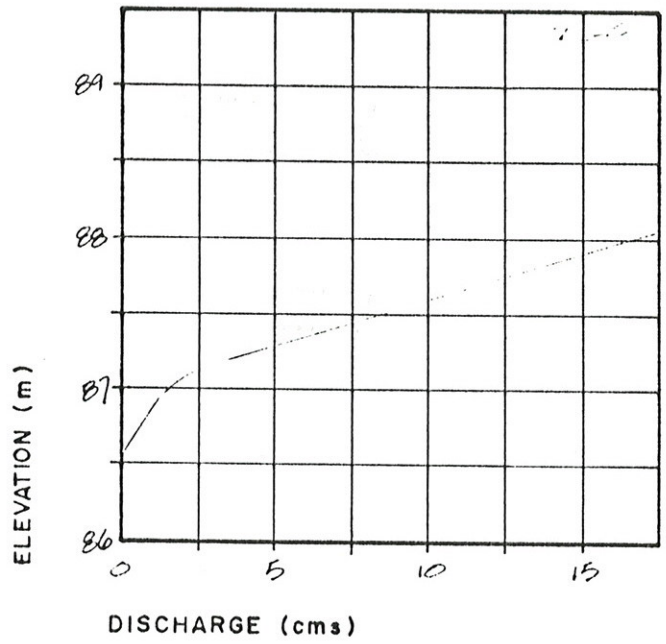
WATERCOURSE BELL CREEK
LOCATION CANADIAN NATIONAL RAILWAY
CROSS-SECTION No. 192

MAP SHEET No. 8
U.T.M. GRID REFERENCE 4895268 m N
313047 m E

A. SPECIFICATIONS

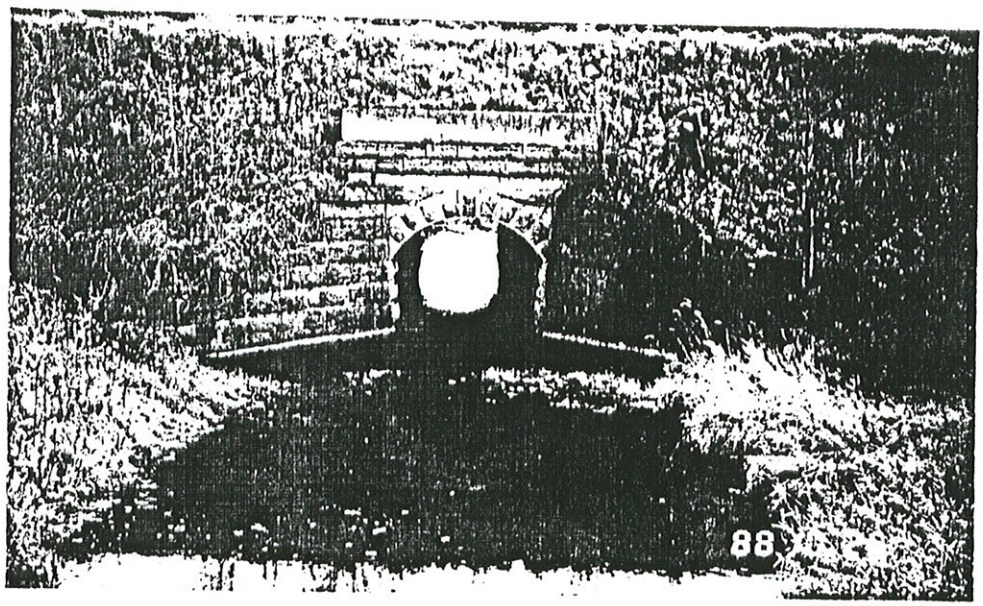
Span	3.0	m
Length of Structure	20.2	m
Top of Road Elevation	93.74	m
Top of Road Elevation (min.)	93.00	m
Low Chord (Soffit) Elevation Upstream	89.34	m
Low Chord (Soffit) Elevation Downstream	89.34	m
Upstream Invert Elevation	86.54	m
Downstream Invert Elevation	86.36	m
Effective Flow Area	7.82	m^2
Manning's 'n' Value	0.020	
Type of Structure	STONE ARCH CULVERT	

B. STAGE DISCHARGE CURVE



C. PHOTOGRAPHIC PRESENTATION

DATE:



UPSTREAM FACE

BRIDGE DATA

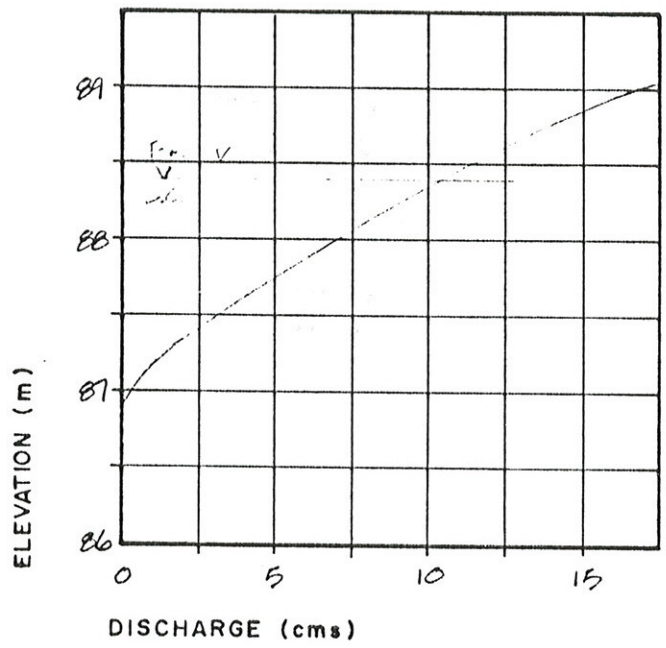
WATERCOURSE BELL CREEK
LOCATION COUNTY ROAD No. 18
CROSS-SECTION No. 231

MAP SHEET No. 8
U.T.M. GRID REFERENCE 4895304 m N
313036 m E

A. SPECIFICATIONS

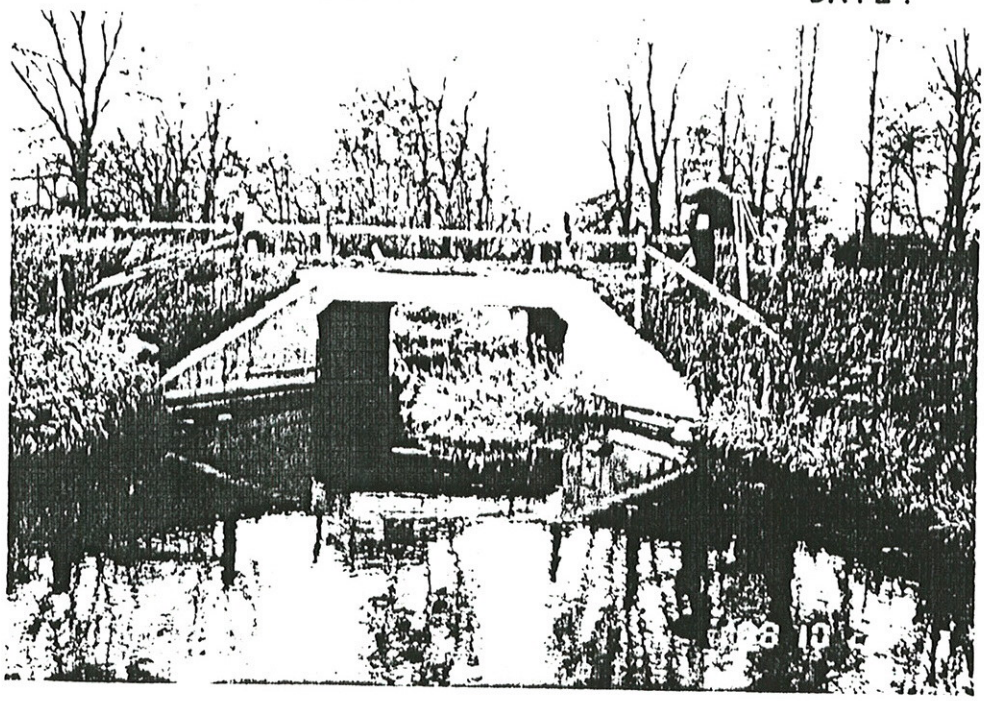
Span	3.65	m
Length of Structure	13.10	m
Top of Road Elevation	89.10	m
Top of Road Elevation (min.)	88.40	m
Low Chord (Soffit) Elevation Upstream	88.38	m
Low Chord (Soffit) Elevation Downstream	88.38	m
Upstream Invert Elevation	86.83	m
Downstream Invert Elevation	86.81	m
Effective Flow Area	5.60	m^2
Manning's 'n' Value	0.013	
Type of Structure	CONCRETE CULVERT	

B. STAGE DISCHARGE CURVE



C. PHOTOGRAPHIC PRESENTATION

DATE :



DOWNSTREAM FACE

BRIDGE DATA

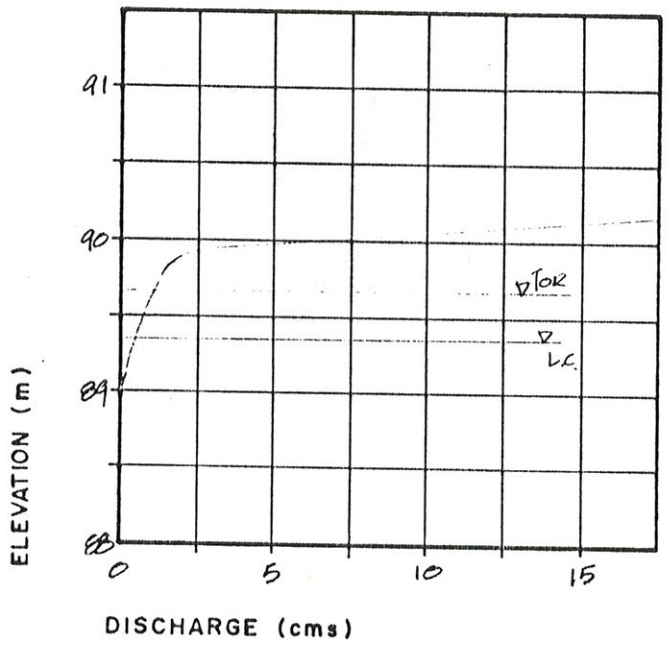
WATERCOURSE BELL CREEK
LOCATION FARM CROSSING
CROSS-SECTION No. 864

MAP SHEET No. 8
U.T.M. GRID REFERENCE 4895845 m N
313101 m E

A. SPECIFICATIONS

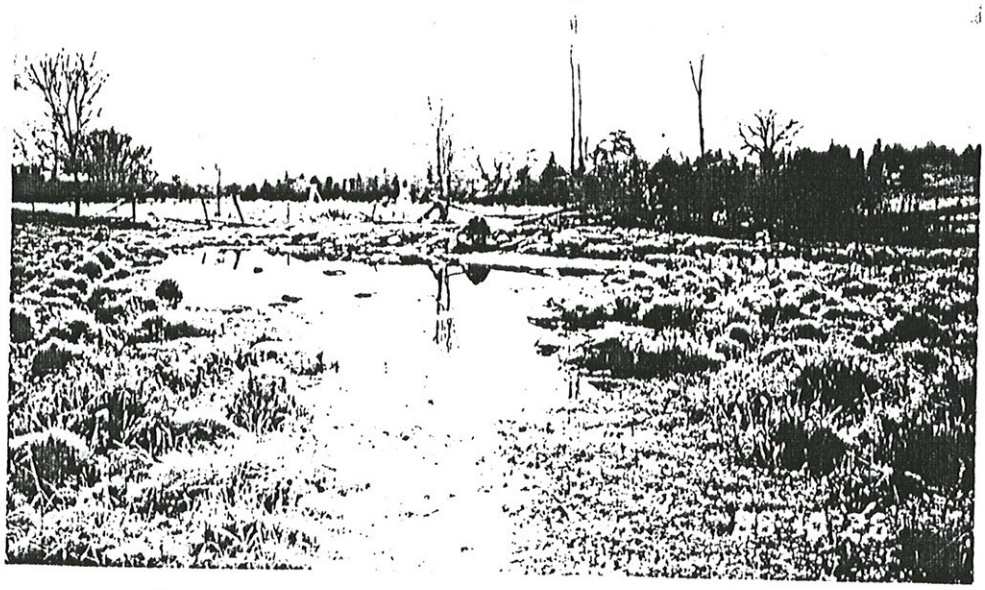
Span	1.44	m
Length of Structure	3.90	m
Top of Road Elevation	89.67	m
Top of Road Elevation (min.)	89.67	m
Low Chord (Soffit) Elevation Upstream	89.36	m
Low Chord (Soffit) Elevation Downstream	89.41	m
Upstream Invert Elevation	88.88	m
Downstream Invert Elevation	88.93	m
Effective Flow Area	0.54	m^2
Manning's 'n' Value	0.024	
Type of Structure	TRIPLE 0.48m CSP	

B. STAGE DISCHARGE CURVE



C. PHOTOGRAPHIC PRESENTATION

DATE :



UPSTREAM FACE

BRIDGE DATA

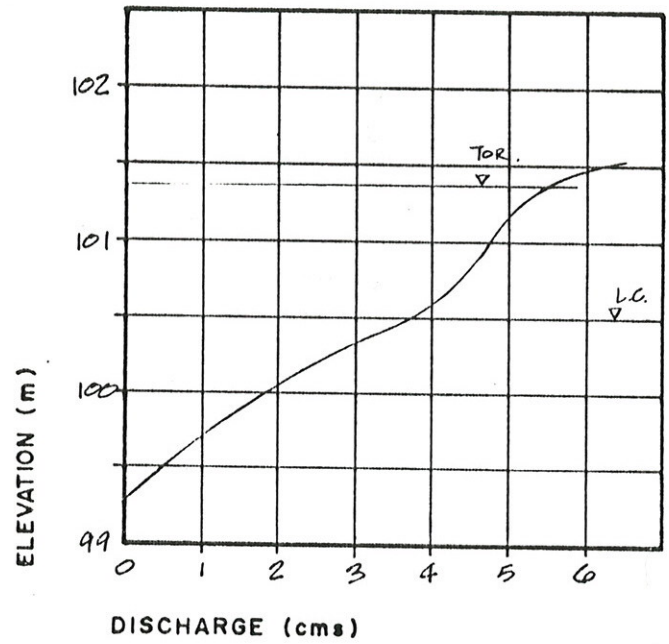
WATERCOURSE BELL CREEK
LOCATION HIGHWAY No. 401
CROSS-SECTION No. 3503

MAP SHEET No. 1
U.T.M. GRID REFERENCE 4897255 m N
311703 m E

A. SPECIFICATIONS

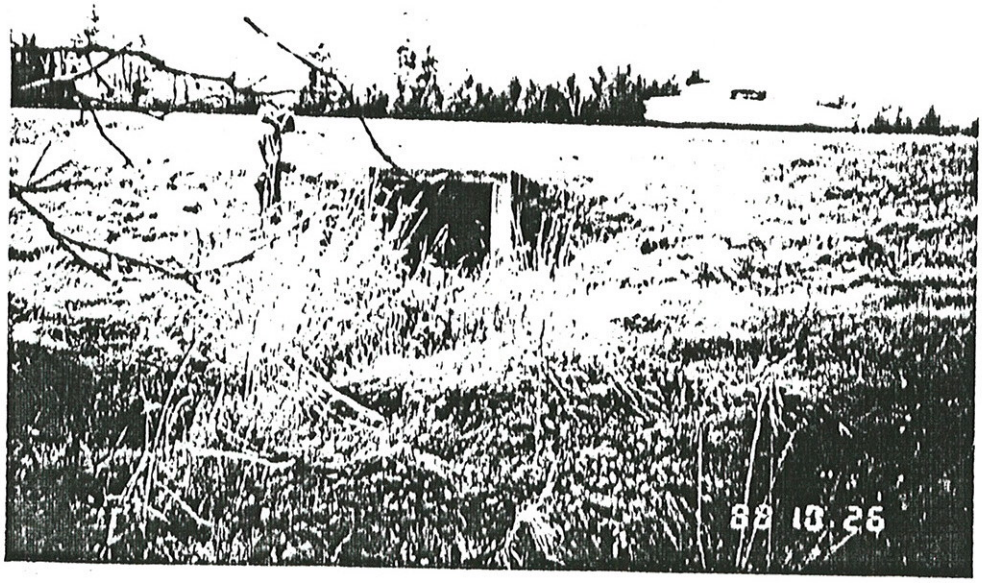
Span	1.75	m
Length of Structure	52.00	m
Top of Road Elevation	101.86	m
Top of Road Elevation (min.)	101.36	m
Low Chord (Soffit) Elevation Upstream	100.50	m
Low Chord (Soffit) Elevation Downstream	100.32	m
Upstream Invert Elevation	99.25	m
Downstream Invert Elevation	99.07	m
Effective Flow Area	1.56	m^2
Manning's 'n' Value	0.013	
Type of Structure	SQUARE CONC. BOX CULVERT	

B. STAGE DISCHARGE CURVE



C. PHOTOGRAPHIC PRESENTATION

DATE:



DOWNSTREAM FACE

BRIDGE DATA

WATERCOURSE BELL CREEK (TRIB.) MAP SHEET No. 6

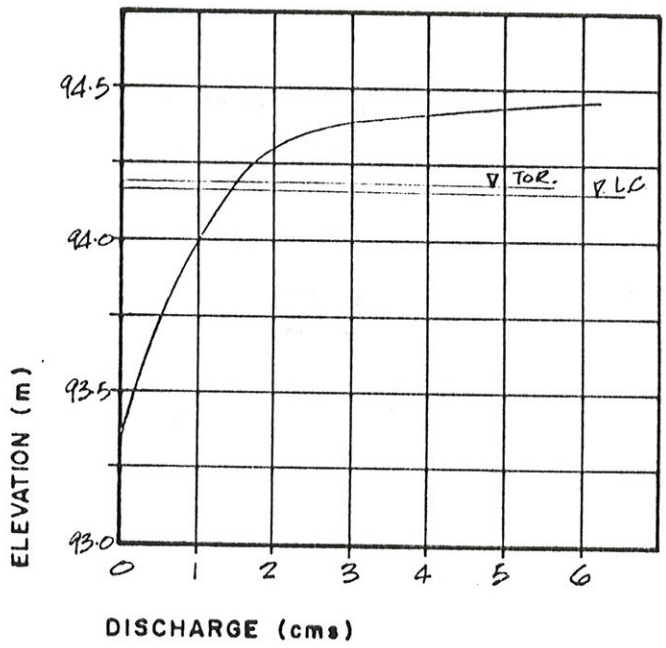
LOCATION FARM CROSSING U.T.M. GRID REFERENCE 4896433m N

CROSS-SECTION No. 102 313314m E

A. SPECIFICATIONS

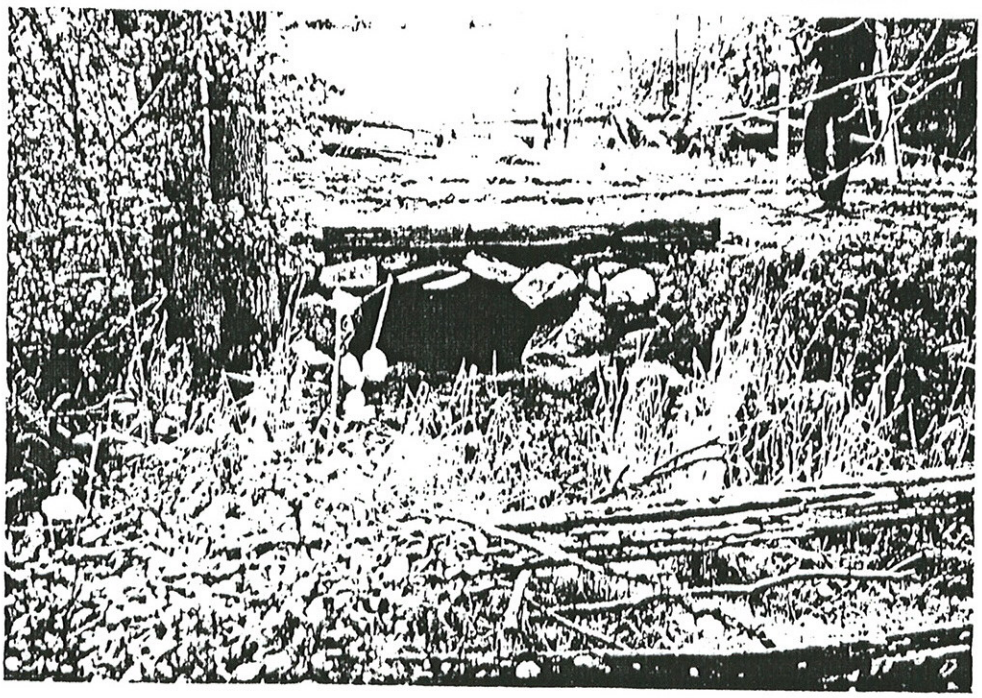
Span	1·48	m
Length of Structure	4·95	m
Top of Road Elevation	94·20	m
Top of Road Elevation (min.)	94·19	m
Low Chord (Soffit) Elevation Upstream	94·17	m
Low Chord (Soffit) Elevation Downstream	94·01	m
Upstream Invert Elevation	93·32	m
Downstream Invert Elevation	93·16	m
Effective Flow Area	1·13	m^2
Manning's 'n' Value	0.024	
Type of Structure	1·48 x 0·85m PIPE ARCH	

B. STAGE DISCHARGE CURVE



C. PHOTOGRAPHIC PRESENTATION

DATE:



UPSTREAM FACE

BRIDGE DATA

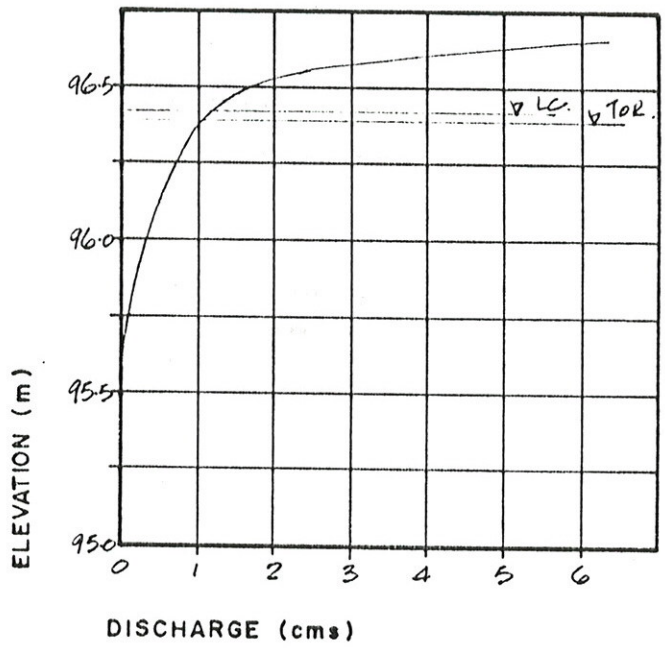
WATERCOURSE BELL CREEK (TRIB.)
LOCATION MITCHELL ROAD
CROSS-SECTION No. 656

MAP SHEET No. 6
U.T.M. GRID REFERENCE 4896775m N
313603m E

A. SPECIFICATIONS

Span	1.65	m
Length of Structure	9.40	m
Top of Road Elevation	96.62	m
Top of Road Elevation (min.)	96.39	m
Low Chord (Soffit) Elevation Upstream	96.42	m
Low Chord (Soffit) Elevation Downstream	96.47	m
Upstream Invert Elevation	95.52	m
Downstream Invert Elevation	95.57	m
Effective Flow Area	1.08	m^2
Manning's 'n' Value	0.024	
Type of Structure	DOUBLE CSP (0.9m AND 0.75m)	

B. STAGE DISCHARGE CURVE



C. PHOTOGRAPHIC PRESENTATION

DATE:

DOWNSTREAM FACE

BRIDGE DATA

WATERCOURSE BELL CREEK (TRIB.) MAP SHEET No. 6

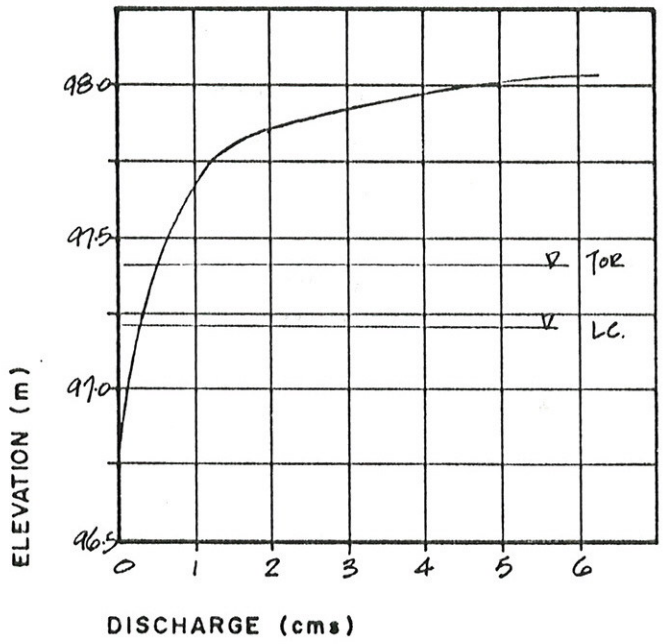
LOCATION FARM CROSSING U.T.M. GRID REFERENCE 4896993 m N

CROSS-SECTION No. 938 313744 m E

A. SPECIFICATIONS

Span	0.60	m
Length of Structure	3.20	m
Top of Road Elevation	97.41	m
Top of Road Elevation (min.)	97.41	m
Low Chord (Soffit) Elevation Upstream	97.21	m
Low Chord (Soffit) Elevation Downstream	97.26	m
Upstream Invert Elevation	96.61	m
Downstream Invert Elevation	96.66	m
Effective Flow Area	0.28	m^2
Manning's 'n' Value	0.024	
Type of Structure	0.60m CSP	

B. STAGE DISCHARGE CURVE



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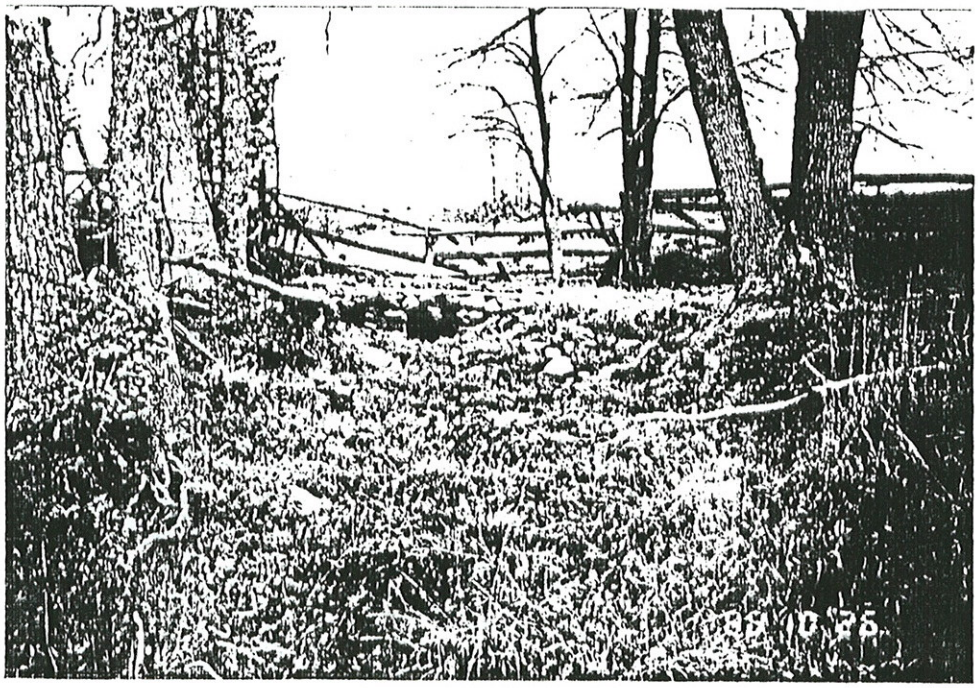
DATE :



UPSTREAM FACE

APPENDIX G

DETAILED LIST OF PRE-DEVELOPMENT FLOWS

APPENDIX 6

BELL CREEK STORM WATER MANAGEMENT PRE-DEVELOPMENT

LOCATION	100 year PEAK FLOW (cfs)	Qp (cms)	50 year PEAK FLOW (cfs)	Qp (cms)	25 year PEAK FLOW (cfs)	Qp (cms)	10 year PEAK FLOW (cfs)	Qp (cms)	5 year PEAK FLOW (cfs)	Qp (cms)
BASIN 301	124.99	3.54	106.55	3.02	88.88	2.52	66.21	1.87	49.93	1.41
BASIN 302	143.06	4.05	123.90	3.51	105.30	2.98	80.92	2.29	62.89	1.78
FLOW PT #101	246.00	6.97	226.40	6.41	191.00	5.41	144.00	4.08	111.00	3.14
REACH #1	247.50	7.01	211.50	5.99	177.60	5.03	133.70	3.79	102.30	2.90
BASIN 305	47.32	1.34	40.30	1.14	33.59	0.95	25.02	0.71	18.83	0.53
PARTIAL FLOW @ PT #102	293.20	8.30	251.00	7.11	210.00	5.95	158.00	4.47	120.00	3.40
BASIN 303	114.59	3.24	97.16	2.75	80.52	2.28	59.28	1.68	44.19	1.25
FLOW PT #102	403.30	11.42	344.00	9.74	287.00	8.13	214.00	6.06	162.00	4.59
REACH #2	393.90	11.15	335.30	9.49	280.30	7.94	209.30	5.93	158.60	4.49
BASIN 306	58.16	1.65	50.11	1.42	42.34	1.20	32.21	0.91	24.87	0.70
FLOW @ RR TRACK	442.00	12.52	377.00	10.68	315.00	8.92	236.00	6.68	179.00	5.07
RESERVOIR 501	422.60	11.97	364.00	10.31	309.50	8.76	232.30	6.58	176.40	5.00
REACH #3	421.00	11.92	362.80	10.27	308.30	8.73	231.20	6.55	175.60	4.97
BASIN 320	11.96	0.34	10.26	0.29	8.62	0.24	6.54	0.19	5.07	0.14
FLOW D/S OF RR @ 320	425.00	12.03	366.00	10.36	311.50	8.82	233.60	6.61	178.00	5.04
BASIN 307	39.91	1.13	33.71	0.95	27.80	0.79	20.25	0.57	14.79	0.42
REACH #4	38.30	1.08	32.10	0.91	26.10	0.74	18.70	0.53	13.40	0.38
BASIN 308	42.76	1.21	35.17	1.00	28.07	0.79	19.36	0.55	13.37	0.38
ADD HYD (134)	79.60	2.25	66.30	1.88	53.50	1.51	37.40	1.06	26.40	0.75
BASIN310	71.99	2.04	62.17	1.76	53.06	1.50	41.36	1.17	32.54	0.92
BASIN 308+310	116.00	3.28	98.00	2.78	80.00	2.27	58.00	1.64	43.00	1.22
RESERVOIR 502	100.70	2.85	89.30	2.53	74.80	2.12	57.10	1.62	41.80	1.18
REACH #5	99.50	2.82	87.40	2.47	73.30	2.08	54.90	1.55	40.00	1.13
BASIN 319	5.08	0.14	4.21	0.12	3.38	0.10	2.34	0.07	1.61	0.05
ADD HYD (132)	102.90	2.91	90.60	2.57	75.80	2.15	57.00	1.61	41.40	1.17
FLOW PT #103	506.80	14.35	435.00	12.32	364.00	10.31	270.00	7.65	204.00	5.78
REACH #6	496.90	14.07	428.50	12.13	355.80	10.08	261.30	7.40	197.20	5.58
BASIN 312	33.61	0.95	29.17	0.83	24.86	0.70	19.24	0.54	15.08	0.43
ADD HYD (134)	518.80	14.69	448.70	12.71	372.50	10.55	273.90	7.76	206.70	5.85
BASIN 304	180.78	5.12	156.56	4.43	133.06	3.77	102.24	2.90	79.46	2.25
RESERVOIR #503	170.50	4.83	150.80	4.27	132.50	3.75	102.00	2.89	79.40	2.25
BASIN 309	99.22	2.81	88.98	2.52	74.91	2.12	59.06	1.67	47.20	1.34
ADD HYD (135)	252.00	7.14	224.60	6.36	196.60	5.57	152.20	4.31	118.60	3.36
PARTIAL @ PT #104	755.20	21.38	660.00	18.69	545.00	15.43	403.00	11.41	307.00	8.69
BASIN 313	65.71	1.86	56.50	1.60	60.82	1.72	36.43	1.03	28.11	0.80
BASIN 314	88.90	2.52	78.34	2.22	68.00	1.93	54.09	1.53	43.47	1.23
FLOW PT #105	137.60	3.90	119.00	3.37	115.00	3.26	78.00	2.21	61.00	1.73
REACH #8	91.00	2.58	78.10	2.21	77.20	2.19	50.50	1.43	39.10	1.11
BASIN 315	16.31	0.46	14.11	0.40	11.99	0.34	9.21	0.26	7.18	0.20
ADD HYD (116)	106.90	3.03	92.10	2.61	89.10	2.52	59.60	1.69	46.10	1.31
BASIN 311	27.74	0.79	24.17	0.68	20.69	0.59	16.11	0.46	10.92	0.31
FLOW PT #106	134.60	3.81	116.00	3.28	110.00	3.11	76.00	2.15	57.10	1.62
REACH #9	134.30	3.80	116.50	3.30	109.90	3.11	75.50	2.14	56.80	1.61
BASIN 316	57.48	1.63	49.01	1.39	40.95	1.16	31.05	0.88	23.74	0.67
ADD HYD (116)	170.60	4.83	147.50	4.18	135.90	3.85	95.40	2.70	72.30	2.05
FLOW PT #104	846.00	23.96	744.00	21.07	622.00	17.61	458.00	12.97	349.00	9.88
REACH #10	841.80	23.84	737.30	20.88	616.90	17.47	455.10	12.89	347.50	9.84
BASIN 317	53.32	1.51	46.65	1.32	40.28	1.14	31.84	0.90	25.41	0.72
FLOW PT #107	864.00	24.47	757.00	21.44	634.00	17.95	468.00	13.25	358.00	10.14
RESERVOIR #504	833.50	23.60	725.50	20.54	617.50	17.49	466.60	13.21	357.70	10.13
REACH #11	832.90	23.59	725.60	20.55	617.10	17.47	466.40	13.21	357.70	10.13
BASIN 318	14.08	0.40	11.69	0.33	9.55	0.27	6.83	0.19	4.88	0.14
FLOW PT #108	837.00	23.70	729.00	20.64	621.00	17.58	469.00	13.28	360.00	10.19

When a Storm Water Management Plan is submitted for a proposed development the proponent should submit an outline of his proposed erosion-sediment control plan. Methods of control are such things as sediment traps or temporary retention ponds, seeding of topsoil stock piles, isolated stripping of development lands, and vegetation screens.

8.4.1 Erosion and Bank Stability

Urbanization, if uncontrolled will accelerate the natural evolution of a valley. As a result, if erosion or bank instability is already evident, the proponent should participate in stabilizing the situation by appropriate remedial measures or by controlling the quantity and rate of runoff. Attention should also be paid to erosion caused by overbank flow. Erosive velocities should either be avoided or remedial works constructed to handle them.

Channelization

Where channelization is required, the works should be designed to the extent possible, to maintain natural vegetation in the floodway and to replicate the good features of the natural channel.

Small weirs should be used to keep velocities low. Side slopes should not be steeper than 3:1 (horizontal:vertical) and parabolic and V-shaped channels are preferred over trapezoidal channels.

Storm Sewer Outlets

The channel must be protected at local points of entry of the storm sewer system to the major system. Protection can be provided through the design of a channel lining or an energy dissipator.

Overland Flow Outfalls

In designing overland flow outfalls from streets to other components of the major system aesthetics, erosion control, and water quality are of dominant concern. Protection must be provided to protect the major system from erosion or bank instability.