APPENDIX H
STORM WATER MANAGEMENT REPORT

Ontario

Ministry of Transportation Southwestern Region

HIGHWAY 7 PLANNING STUDY

DRAINAGE AND STORM WATER MANAGEMENT

PRELIMINARY DESIGN REPORT

April 2004

TABLE OF CONTENTS

List Of Tables

List Of Exhibits

List Of Appendices

1.0 Introduction

This Drainage and Storm Water Management Report is a supporting document for the Amendment to the EA Report 1997 to address the affects of storm water runoff generated by the proposed Highway 7, Kitchener to Guelph and how these effects can be managed through implementation of the Best Management Practices. This report presents:

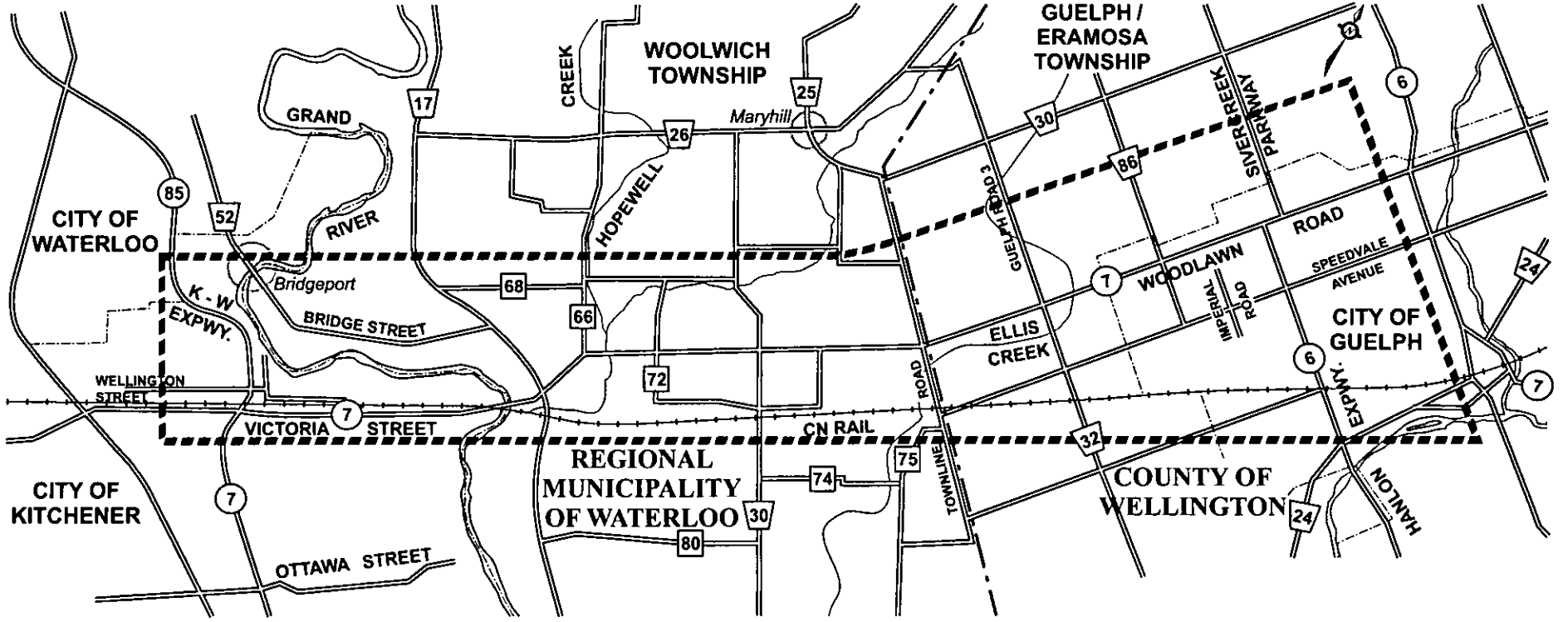
- Existing conditions in the area with respect to storm water runoff;
- Hydrologic modelling to generate flows at culvert crossings along the proposed highway alignment;
- Design of culverts along the proposed highway alignment; and
- Selection and preliminary design of feasible storm water management measures.

The report does not address in detail the requirements for the proposed bridges crossing the Grand River, Hopewell Creek and Ellis Creek. However, a preliminary hydraulic analysis was conducted for the Grand River bridge and the Hopewell Creek bridge. The results of this analysis are summarized in a technical memorandum included in Appendix A. The Ellis Creek structure will be sized during the detailed design phase; it will have a sufficient span to satisfy the required hydraulic criteria.

The report documents the sizing of all culverts based on hydraulic design criteria. However, there are a number of culverts that must be expanded to facilitate wildlife and fish passage. Consequently this report provides recommendation for expanding some culverts beyond the hydraulic requirements in order to facilitate wildlife and fish passage. The storm water management facilities have been designed to accommodate the 4-lane divided highway.

1.1 Study Area

The study area, shown on Exhibit 1 extends from the Kitchener-Waterloo Expressway in the Regional Municipality of Waterloo (RMW), easterly to the Hanlon Expressway (Highway 6) in the City of Guelph. Within the RMW the study area extends north of the community of Bridgeport and Woolwich Road 68 to approximately 0.7 km south of the CN Railway. Within the County of Wellington, the study area extends north to mid-way between County Road 30 and Woodlawn Road, with the south limit paralleling the CN Railway approximately 0.7 km south of the railway.



HIGHWAY 7 PLANNING STUDY KITCHENER TO GUELPH	STUDY AREA	EXHIBIT 1

1.2 Study Approach

The drainage and storm water management study involved the following tasks:

- Review of the background information including:

  a. Highway 7 Planning Study – Kitchener to Guelph,
  b. Ontario Base Mapping 1:10000,
  c. Agriculture Drain Maps for County of Wellington and Waterloo,
  d. Contract drawings for Wellington Street Interchange, Contract No. 68-62, W.P. NO. 619-64,
  e. Proposed Highway 7 plan and profile, and
  f. Soils of Wellington County, Report No. 35 and Soils of Waterloo County, Report No. 44.

- Delineation of drainage subcatchments for the proposed Highway 7 alignment;
- Generation of design flows using the hydrologic model SWMHYMO;
- Hydraulic assessment of proposed culverts using CulvertMaster;
- Identification of the need for storm water management practices; and
- Preliminary design of storm water management facilities.

There are no Master Drainage Plans for the study area.

1.3 Guidelines and Policy Framework

The Ministry of Transportation has prepared a number of directives and manuals that outline the approach and guidelines to be used in the development of drainage and storm water management strategies for highway projects. They include the following:

1. PHY Directive B-100 Design Flood Criteria (1980);
2. PHY Directive B-63 Drainage Act - MTO Policy and Procedures;
3. PHY Directive B-237 MTO Drainage Management Policy and Practice (1989); and
4. Drainage Management Manual (1997).

Although the development of this document has been guided primarily by the requirements of the Ministry of Transportation, the following regulatory agency policies and guidelines have also been considered:

1. The Ministry of the Environment *Stormwater Management Practices Planning and Design Manual* (1994);
2. The Ministry of Natural Resources' *Fish Habitat Protection Guidelines for Developing Areas* (March 1994);
3. The Ministry of Natural Resources' *Guidelines on Erosion and Sediment Control for Urban Construction Sites* (May 1987); and
4. The Ministry of Natural Resources' *Technical Guidelines on Erosion and Sediment Control* (February 1989).

Drainage and Storm Water Management Objectives

Based on the prevailing policy framework, general drainage and storm water management objectives have been identified to minimize the impacts of the future Highway 7 on the surrounding environment. The following objectives have guided the preparation of this preliminary Drainage and Storm Water Management Plan:

1. Provide an effective/efficient drainage system;
2. Minimize risk to public safety;
3. Maintain flow paths for upstream lands;
4. Provide mitigation for quality and quantity of runoff from paved areas;
5. Maintain or enhance the quality of storm runoff;
6. Maintain or reduce the existing potential for erosion in receiving ditches and watercourses;
7. Maintain or reduce the flood risk for lands adjacent to and downstream of the highway; and
8. Maintain outlet locations from the Highway right-of-way.

2.0 Existing Drainage Conditions

In general, the study area is dominated by agricultural land with the exception of a small rural development. The topography of the study area is relatively flat. The proposed Highway 7 alignment is generally oriented in the east-west direction; conversely, general flow patterns in the study are north to south. The proposed right-of-way extends through a surface water drainage system consisting of a network of streams, their tributaries, and wetland pockets. The largest of the watercourses in the study area is the Grand River, which meanders southward along the eastern boundary of the City of Kitchener. All other streams in the study area form part of the Grand River watershed. There are two significant stream crossings: Hopewell Creek, and Ellis Creek, and several minor streams, swale and ditch crossings. In the study area, Hopewell Creek is a third order stream, which flows directly to the Grand River. Ellis Creek is a tributary of the Speed River, which flows into the Grand River in Cambridge. There is also a series of small creeks, both perennial and intermittent.

3.0 Hydrologic Modelling

3.1 Model Selection

SWMHYMO was used to generate the design peak flows at proposed culvert crossings and at points of interest under existing and proposed highway conditions. The SWMHYMO modeling software was selected for the reasons listed below. The model:

- Was developed and tested in Ontario;
- Allows single event modeling of user defined design storms;
- Generates flow hydrographs at user specified locations;
- Considers varying soil and land use conditions; and
- Allows channel and reservoir routing.

Future developments in the identified study catchments outside of the highway right-of-way should ensure that the quality and quantity of the existing flows from these areas are preserved.

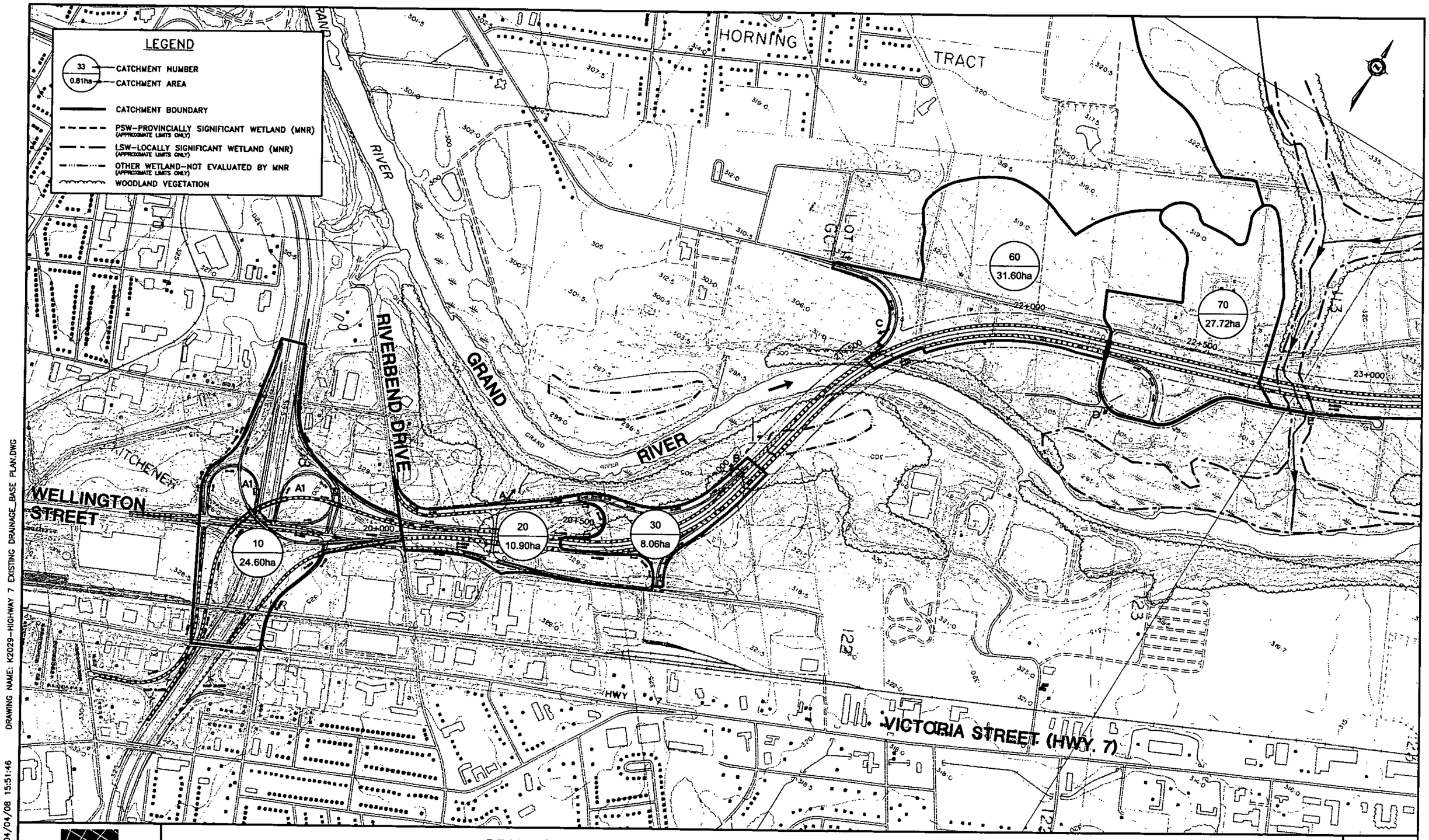
3.2 Model Development

The hydrologic response of lands contributing drainage to the points of interests and culverts has been evaluated using the 50 year and 100 year design storms. The Design Chart 1.01 (c) of the Ministry of Transportation *Drainage Management Manual* and the intensity-duration-frequency data for District 3-Stratford have been used to formulate rainfall parameters for each of the storms being considered. These parameters were used in the SWMHYMO models to generate 3 hour and 12 hour design storms using the Chicago distribution. Both distributions produced similar peak discharges and volumes. The 3 hour storm was adopted in this analysis. Based on our experience application of a 24 hour storm would not produce realistic results for the purpose of this study. The drainage response of subcatchments representing rural areas was evaluated using a NASH instantaneous unit hydrograph. A

Standard instantaneous unit hydrograph was used for subcatchments with greater than 20% impervious areas.

The drainage subcatchments delineated for the existing conditions are presented in Exhibits 2.1 to 2.5. For modeling the post-development conditions drainage areas were separated into subcatchments upstream of the highway and the subcatchments of the right-of-way. Exhibits 3.1 to 3.13 demonstrate drainage patterns under proposed highway conditions. For each subcatchment, modelling parameters have been selected based on existing soil distribution, land use and topography. The methods used to calculate the time to peak for the rural catchments included the SCS Upland Method, the SCS Curve Number Method, the Bransby Williams Method and the Airport Method. The average of the four methods was applied to determine the time to peak. Airport Method was excluded in cases where the drainage area exceeds 100 ha.

Tables 1 and 2 summarize the parameters used in the SWMHYMO modeling of existing and future conditions, respectively. Detailed hydrologic calculations are summarized in Appendix B.



MODIFIED: 04/04/08 15:51:46 DRAWING NAME: K2029–HIGHWAY 7 EXISTING DRAINAGE_BASE PLAN.DWG

MRC

DRAINAGE MOSAIC FOR EXISTING CONDITIONS HYDROLOGIC MODELLING

HIGHWAY 7 - KITCHENER TO GUELPH

SCALE 1:10,000

EXHIBIT 2.1

HOPEWELL CREEK
DRAINAGE AREA=71km²

110
430ha

120
64.0ha

135
17.80ha

140
8.80ha

141
12.7ha

BRIDGE STREET

WOOLWICH ROAD 66

WOOLWICH ROAD 72

HORNINGS

HOPEWELL CREEK

GRAND RIVER

REGIONAL ROAD 17

HOPEWELL CREEK

HIGHWAY 7

BRESLAU BYPASS (BY OTHERS)

23+000 23+500 24+000 24+500 25+000 25+500 26+000 26+500

LEGEND

- 33 / 0.81ha — CATCHMENT NUMBER / CATCHMENT AREA
- CATCHMENT BOUNDARY
- PSW–PROVINCIALLY SIGNIFICANT WETLAND (MNR) (APPROXIMATE LIMITS ONLY)
- LSW–LOCALLY SIGNIFICANT WETLAND (MNR) (APPROXIMATE LIMITS ONLY)
- OTHER WETLAND–NOT EVALUATED BY MNR (APPROXIMATE LIMITS ONLY)
- WOODLAND VEGETATION

MODIFIED: 04/04/08 15:51:46 DRAWING NAME: K2029-HIGHWAY 7 EXISTING DRAINAGE_BASE PLAN.DWG

MRC

DRAINAGE MOSAIC FOR EXISTING CONDITIONS HYDROLOGIC MODELLING

HIGHWAY 7 - KITCHENER TO GUELPH

SCALE 1:10,000

EXHIBIT 2.2

WOOLWICH ROAD 72

HOPEWELL CREEK

REGIONAL ROAD 30

HIGHWAY 7

HWY 7

LOT 83

GORE

160
36.0ha

150
30.1ha

155
19.25ha

170
19.08ha

27+000
27+500
28+000
28+500
29+000
29+500
30+000
30+500

J
K
L
U2

LEGEND

- 33 / 0.81ha — CATCHMENT NUMBER / CATCHMENT AREA
- CATCHMENT BOUNDARY
- PSW–PROVINCIALLY SIGNIFICANT WETLAND (MNR) (APPROXIMATE LIMITS ONLY)
- LSW–LOCALLY SIGNIFICANT WETLAND (MNR) (APPROXIMATE LIMITS ONLY)
- OTHER WETLAND–NOT EVALUATED BY MNR (APPROXIMATE LIMITS ONLY)
- WOODLAND VEGETATION

MODIFIED: 04/04/08 15:51:46 DRAWING NAME: K2029–HIGHWAY 7 EXISTING DRAINAGE_BASE PLAN.DWG

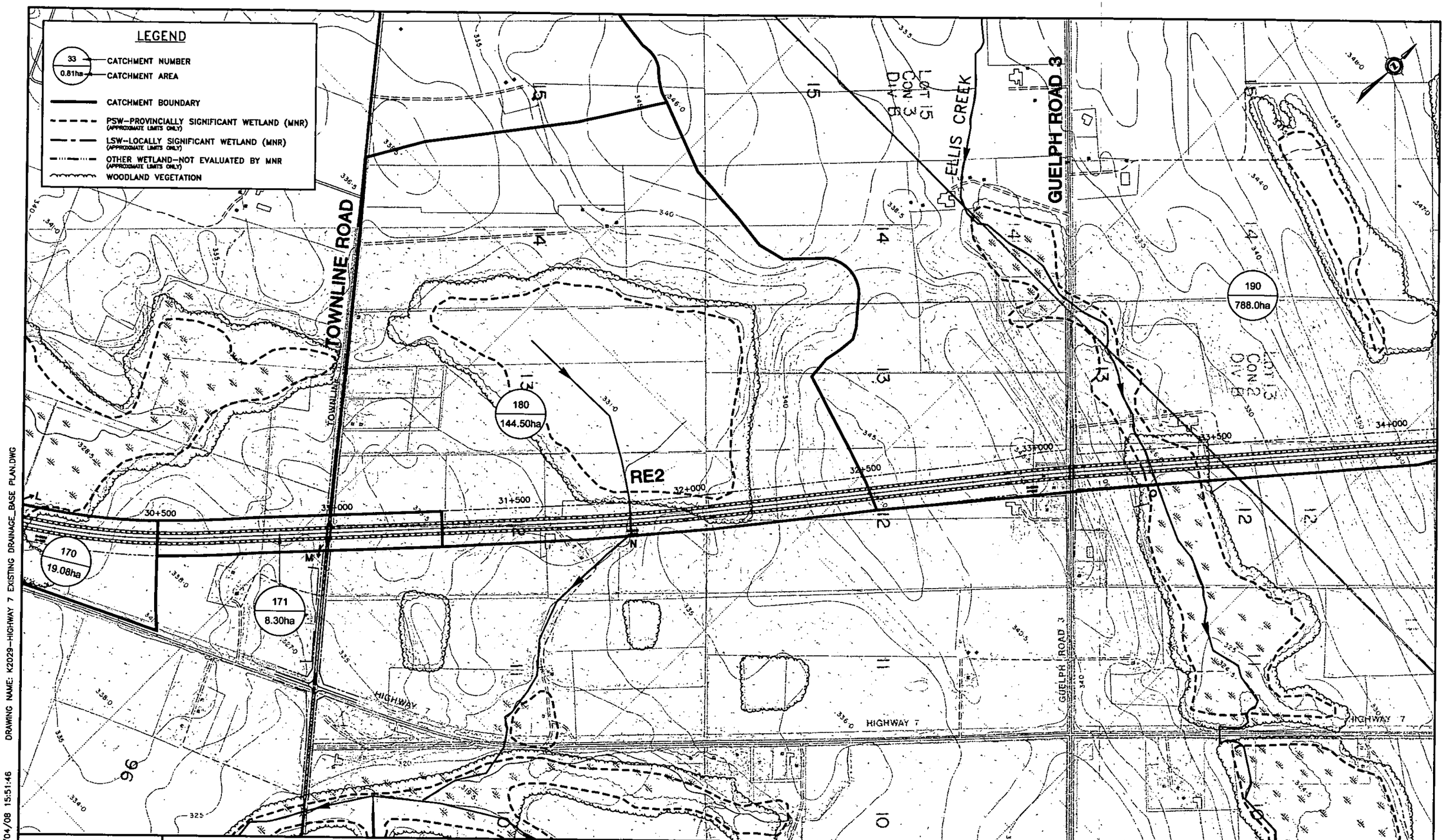
MRC

DRAINAGE MOSAIC FOR EXISTING CONDITIONS HYDROLOGIC MODELLING

HIGHWAY 7 - KITCHENER TO GUELPH

SCALE 1:10,000

EXHIBIT 2.3



MODIFIED: 04/04/08 15:51:46 DRAWING NAME: K2029–HIGHWAY 7 EXISTING DRAINAGE_BASE PLAN.DWG

MRC

DRAINAGE MOSAIC FOR EXISTING CONDITIONS HYDROLOGIC MODELLING

HIGHWAY 7 - KITCHENER TO GUELPH

SCALE 1:10,000

EXHIBIT 2.4

COUNTY ROAD 86

SILVERCREEK PARKWAY

WOODLAWN ROAD (HWY. 7)

HIGHWAY 6

190
788.0ha

220
8.00ha

250
205.0ha

160
110.5ha

RE2

LEGEND

- 33 / 0.81ha — CATCHMENT NUMBER / CATCHMENT AREA
- CATCHMENT BOUNDARY
- PSW–PROVINCIALLY SIGNIFICANT WETLAND (MNR) (APPROXIMATE LIMITS ONLY)
- LSW–LOCALLY SIGNIFICANT WETLAND (MNR) (APPROXIMATE LIMITS ONLY)
- OTHER WETLAND–NOT EVALUATED BY MNR (APPROXIMATE LIMITS ONLY)
- WOODLAND VEGETATION

MODIFIED: 04/04/08 15:51:46 DRAWING NAME: K2029-HIGHWAY 7 EXISTING DRAINAGE_BASE PLAN.DWG

MRC

DRAINAGE MOSAIC FOR EXISTING CONDITIONS HYDROLOGIC MODELLING

HIGHWAY 7 - KITCHENER TO GUELPH

SCALE 1:10,000

EXHIBIT 2.5

NOTE:
STORM WATER MANAGEMENT OPTION (POND VERSUS ENHANCED GRASSED SWALES) TO BE DETERMINED IN DETAILED DESIGN.

POSSIBLE LOCATIONS OF WET DETENTION POND No.1

WELLINGTON STREET

CITY OF KITCHENER

VICTORIA STREET (HWY 7)

C.N.R.

RIVERBEND DRIVE

RAMP CLOSED

RAMP CLOSED

10
24.60ha

20.1000

A1

A1

LEGEND

- 33 / 0.81ha — CATCHMENT NUMBER / CATCHMENT AREA
- AREA DRAINING TO BASIN
- SUBCATCHMENT BOUNDARY DOUBLE
- DITCH
- DRAINAGE DITCH
- 1m FLAT BOTTOM GRASSED SWALES
- ENHANCED GRASSED SWALES
- CULVERT
- PSW–PROVINCIALLY SIGNIFICANT WETLAND (MNR) (APPROXIMATE LIMITS ONLY)
- LSW–LOCALLY SIGNIFICANT WETLAND (MNR) (APPROXIMATE LIMITS ONLY)
- OTHER WETLAND–NOT EVALUATED BY MNR (APPROXIMATE LIMITS ONLY)
- WOODLAND VEGETATION

MRC

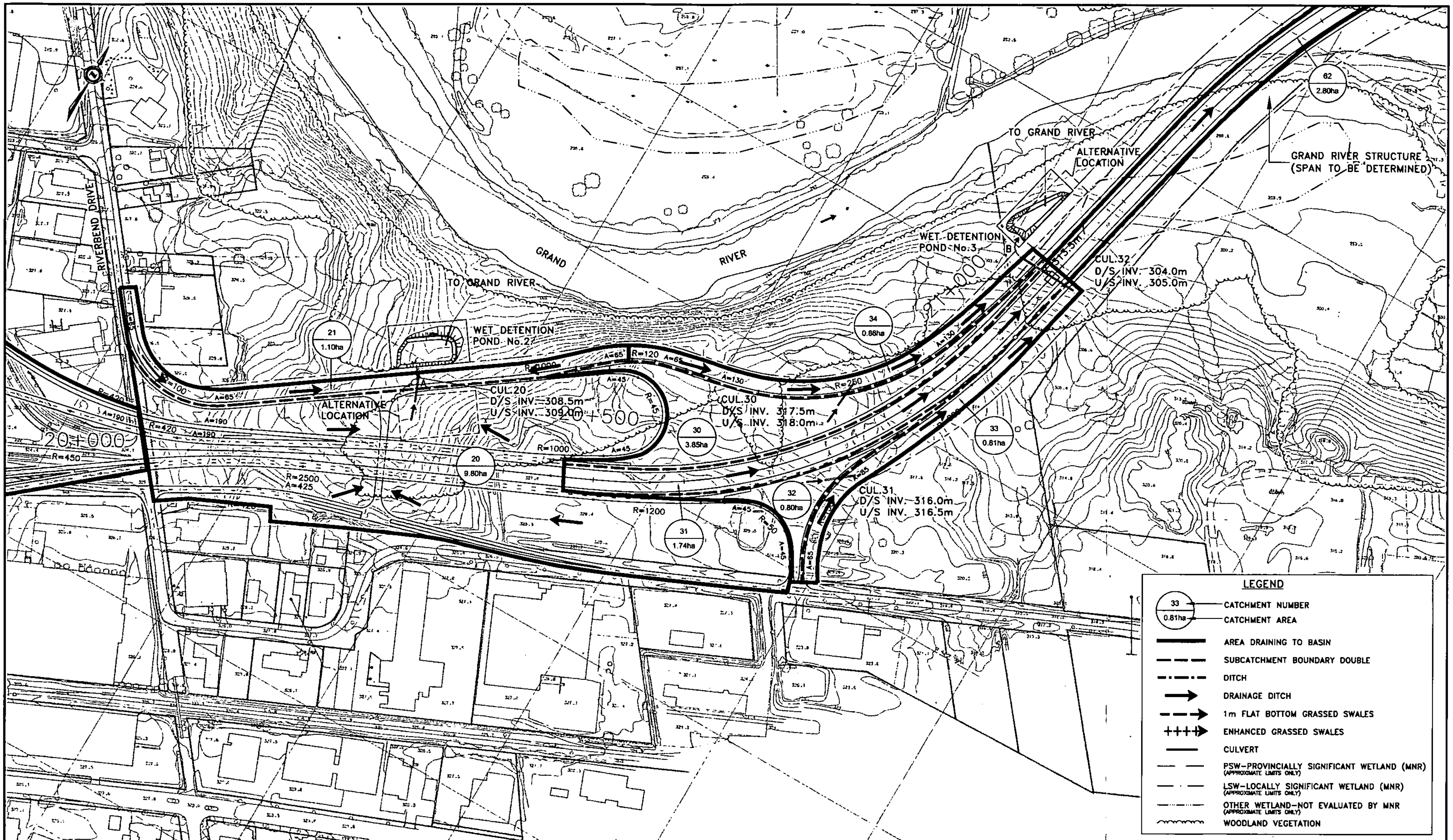
PROPOSED DRAINAGE AND STORM WATER MANAGEMENT PLAN

HIGHWAY 7 - KITCHENER TO GUELPH

SCALE 1:4,000

EXHIBIT 3.1

MODIFIED: 04/04/08 08:45:51 DRAWING NAME: K2029-HIGHWAY 7 PROPOSED DRAINAGE_BASE PLAN.DWG



MRC

PROPOSED DRAINAGE AND STORM WATER MANAGEMENT PLAN

HIGHWAY 7 - KITCHENER TO GUELPH

EXHIBIT 3.2

SCALE 1:4,000

DRAWING NAME: K2029-HIGHWAY 7 PROPOSED DRAINAGE_BASE PLAN.DWG

MODIFIED: 04/04/08 08:45:51

LEGEND

- 33 / 0.81ha — CATCHMENT NUMBER / CATCHMENT AREA
- AREA DRAINING TO BASIN
- SUBCATCHMENT BOUNDARY DOUBLE
- DITCH
- DRAINAGE DITCH
- 1m FLAT BOTTOM GRASSED SWALES
- ENHANCED GRASSED SWALES
- CULVERT
- PSW–PROVINCIALLY SIGNIFICANT WETLAND (MNR) (APPROXIMATE LIMITS ONLY)
- LSW–LOCALLY SIGNIFICANT WETLAND (MNR) (APPROXIMATE LIMITS ONLY)
- OTHER WETLAND–NOT EVALUATED BY MNR (APPROXIMATE LIMITS ONLY)
- WOODLAND VEGETATION

66 / 0.27ha
64 / 0.32ha
65 / 0.28ha
67 / 0.18ha
63 / 1.20ha
60 / 25.40ha
61 / 1.10ha
62 / 2.80ha
70 / 2.70ha
71 / 0.64ha
80 / 10.6ha
111 / 420ha
81 / 0.32ha
82 / 0.21ha
76 / 2.5ha
73 / 4.4ha
75 / 4.0ha
83 / 0.16ha
84 / 0.17ha

CUL.62
D/S INV. 305.0m
U/S INV. 305.5m

CUL.63
D/S INV. 305.3m
U/S INV. 305.4m

CUL.61
D/S INV. 305.7m
U/S INV. 305.8m

CUL.60
D/S INV. 305.9m
U/S INV. 306.0m

CUL.71
D/S INV. 311.3m
U/S INV. 311.5m

CUL.72
D/S INV. 311.0m
U/S INV. 311.2m

CUL.73
D/S INV. 308.0m
U/S INV. 308.2m

CUL.75
D/S INV. 306.8m
U/S INV. 307.0m

CUL.80 E
D/S INV. 304.5m
U/S INV. 305.0m

WET DETENTION POND No.4

WET DETENTION POND No.5

TO GRAND RIVER

GRAND RIVER

GRAND RIVER STRUCTURE (SPAN TO BE DETERMINED)

22+000

22+500

312.0m

314.0

317.0

319.0

ROSEDALE CREEK

MRC

PROPOSED DRAINAGE AND STORM WATER MANAGEMENT PLAN

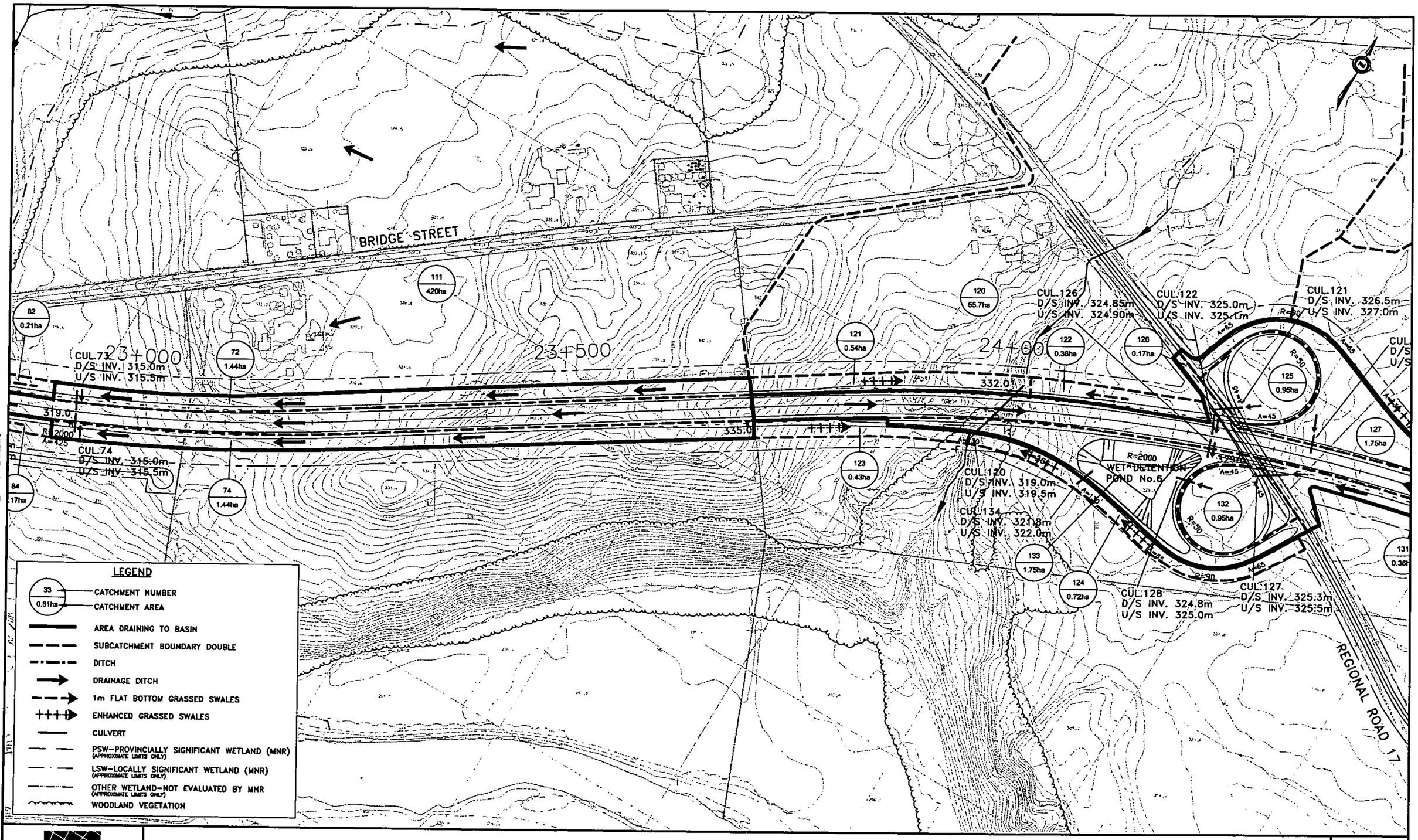
HIGHWAY 7 - KITCHENER TO GUELPH

SCALE 1:4,000

EXHIBIT 3.3

MODIFIED: 04/04/08 08:45:51

DRAWING NAME: K2029-HIGHWAY 7 PROPOSED DRAINAGE_BASE PLAN.DWG



MODIFIED: 04/04/08 08:45:51 DRAWING NAME: K2029-HIGHWAY 7 PROPOSED DRAINAGE_BASE PLAN.DWG

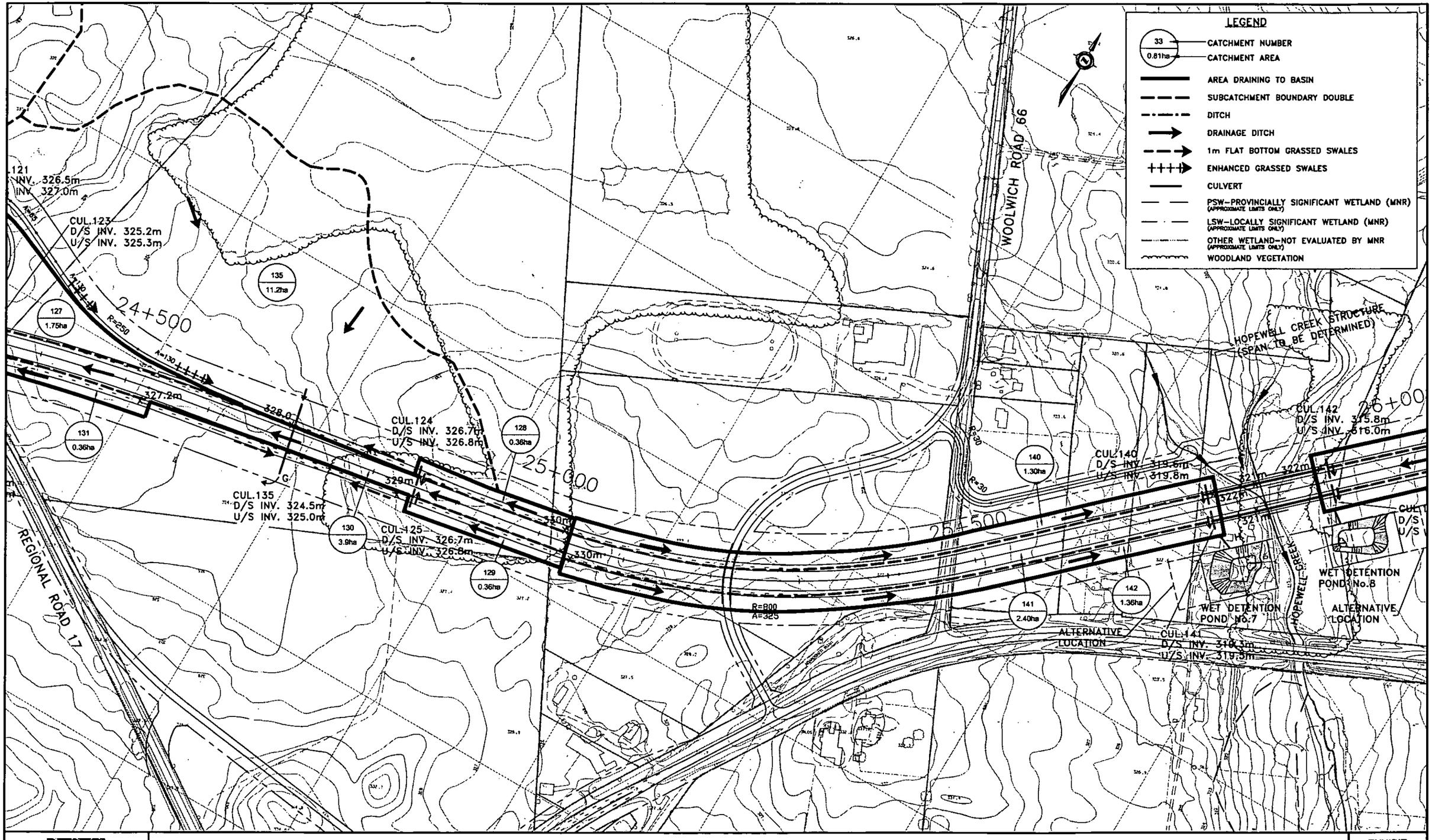
MRC

PROPOSED DRAINAGE AND STORM WATER MANAGEMENT PLAN

HIGHWAY 7 - KITCHENER TO GUELPH

SCALE 1:4,000

EXHIBIT 3.4



MODIFIED: 04/04/08 08:45:51 DRAWING NAME: K2029-HIGHWAY 7 PROPOSED DRAINAGE_BASE PLAN.DWG

MRC

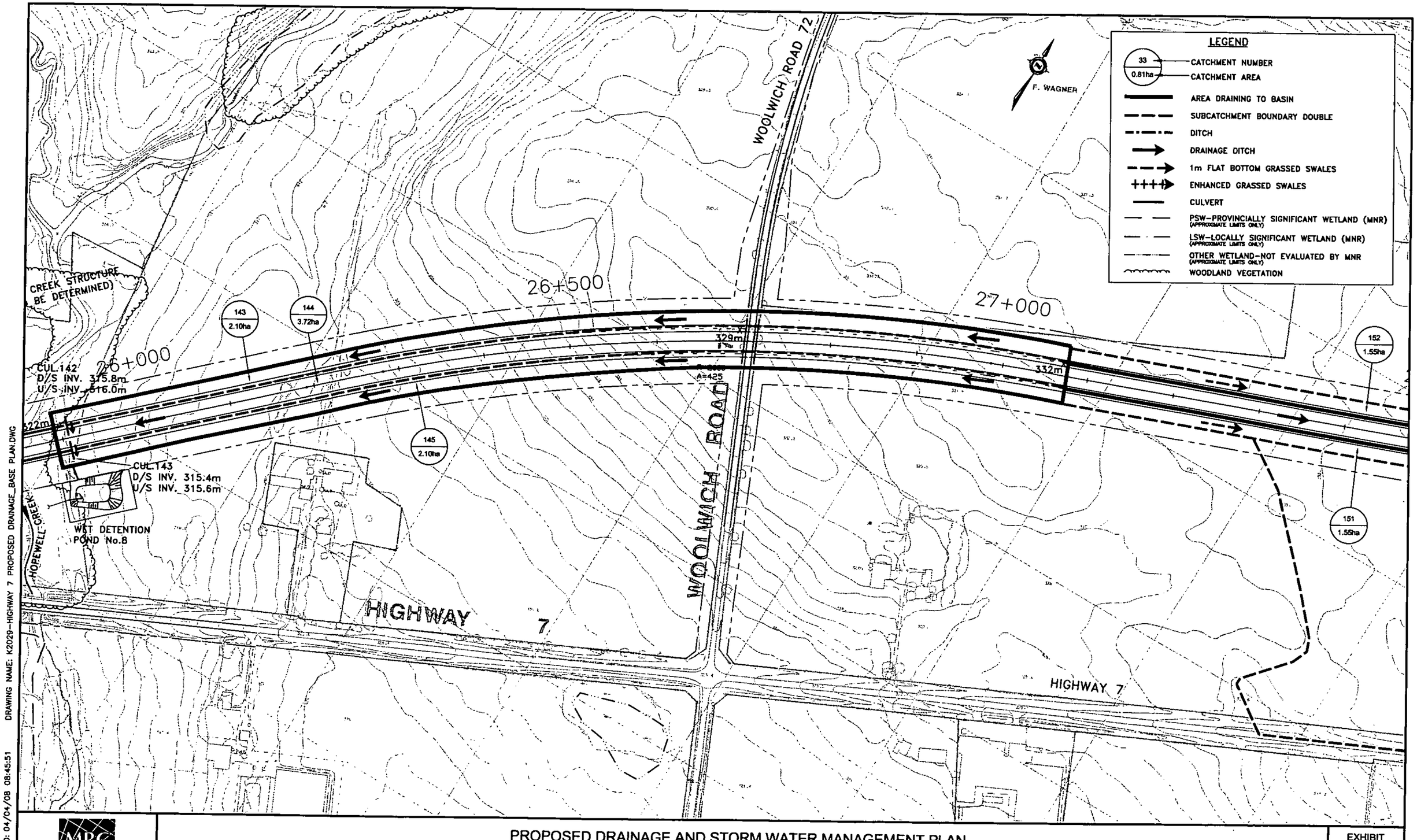
PROPOSED DRAINAGE AND STORM WATER MANAGEMENT PLAN

HIGHWAY 7 - KITCHENER TO GUELPH

SCALE 1:4,000

EXHIBIT

3.5



MODIFIED: 04/04/08 08:45:51 DRAWING NAME: K2029-HIGHWAY 7 PROPOSED DRAINAGE_BASE PLAN.DWG

MRC

PROPOSED DRAINAGE AND STORM WATER MANAGEMENT PLAN

HIGHWAY 7 - KITCHENER TO GUELPH

SCALE 1:4,000

EXHIBIT

3.6

LEGEND

- 33 / 0.81ha — CATCHMENT NUMBER / CATCHMENT AREA
- AREA DRAINING TO BASIN
- SUBCATCHMENT BOUNDARY DOUBLE
- DITCH
- DRAINAGE DITCH
- 1m FLAT BOTTOM GRASSED SWALES
- ENHANCED GRASSED SWALES
- CULVERT
- PSW–PROVINCIALLY SIGNIFICANT WETLAND (MNR) (APPROXIMATE LIMITS ONLY)
- LSW–LOCALLY SIGNIFICANT WETLAND (MNR) (APPROXIMATE LIMITS ONLY)
- OTHER WETLAND–NOT EVALUATED BY MNR (APPROXIMATE LIMITS ONLY)
- WOODLAND VEGETATION

REGIONAL ROAD 30

ST. JOHN'S KILMARNOCK SCHOOL

J. & B. JOHNSTON

P. & P. LEHMAN

L. & C. FAY

K. KRIVIC
G. GRIGAS

H. & L. HENHOEFFER

P. & A. MITCHELL

M. LAATSC

TILLICH DRAIN

152 / 1.55ha

27+500

329.5m

CUL.150
D/S INV. 322.8m
U/S INV. 323.0m

151 / 1.55ha

328m

WET DETENTION POND No.9

162 / 0.99ha

28+000

J2

CUL.158
D/S INV. 324.55m
U/S INV. 324.60m

CUL.157
D/S INV. 324.65m
U/S INV. 324.70m

A=65

R=410

CUL.156
D/S INV. 325.40m
U/S INV. 325.45m

160 / 25.82ha

A=65

R=100

CUL.153
D/S INV. 325.48m
U/S INV. 325.52m

R=55

A=45

159 / 1.23ha

28+500

161 / 2.15ha

158 / 2.27ha

RC1

A=130

R=2500

326.5m

CUL.150
D/S INV. 324.75m
U/S INV. 324.80m

157 / 1.40ha

150 / 20.51ha

CUL.154
D/S INV. 325.4m
U/S INV. 325.5m

156 / 1.40ha

329.0

K

CUL.160
D/S INV. 325.6m
U/S INV. 326.0m

HIGHWAY 7

MODIFIED: 04/04/08 08:45:51 DRAWING NAME: K2029-HIGHWAY 7 PROPOSED DRAINAGE_BASE PLAN.DWG

MRC

PROPOSED DRAINAGE AND STORM WATER MANAGEMENT PLAN

HIGHWAY 7 - KITCHENER TO GUELPH

SCALE 1:4,000

EXHIBIT 3.7

M. LAATSCH

R. LUCKHARDT

R. WOSTMANN

29+000

29+500

30+000

30+500

154
1.56ha

153
7.90ha

155
1.56ha

173
1.13ha

175
0.66ha

174
1.20ha

176
0.72ha

171
0.68ha

170
13.80ha

172
0.72ha

336.8

340.0

340.0

R=3000
A=425

CUL.170
D/S INV. 329.5m
U/S INV. 330.0m

HIGHWAY 7

L

LEGEND

- 33 / 0.81ha — CATCHMENT NUMBER / CATCHMENT AREA
- AREA DRAINING TO BASIN
- SUBCATCHMENT BOUNDARY DOUBLE
- DITCH
- DRAINAGE DITCH
- 1m FLAT BOTTOM GRASSED SWALES
- ENHANCED GRASSED SWALES
- CULVERT
- PSW–PROVINCIALLY SIGNIFICANT WETLAND (MNR) (APPROXIMATE LIMITS ONLY)
- LSW–LOCALLY SIGNIFICANT WETLAND (MNR) (APPROXIMATE LIMITS ONLY)
- OTHER WETLAND–NOT EVALUATED BY MNR (APPROXIMATE LIMITS ONLY)
- WOODLAND VEGETATION

MODIFIED: 04/04/08 08:45:51 DRAWING NAME: K2029–HIGHWAY 7 PROPOSED DRAINAGE_BASE PLAN.DWG

MRC

PROPOSED DRAINAGE AND STORM WATER MANAGEMENT PLAN

HIGHWAY 7 - KITCHENER TO GUELPH

SCALE 1:4,000

EXHIBIT

3.8

TOWNLINE ROAD

ELLIS CREEK TRIBUTARY

RE2

30+500

31+000

31+500

CUL.176
D/S INV. 330.6m
U/S INV. 330.8m

CUL.175
D/S INV. 331.0m
U/S INV. 331.4m

CUL.177
D/S INV. 330.4m
U/S INV. 330.6m

CUL.178
D/S INV. 331.0m
U/S INV. 331.4m

CUL.180
D/S INV. 329.0m
U/S INV. 329.5m

340.0

333m

332.8m

336.2m

340.5m

R=5000
AM635

176
0.72ha

177
0.85ha

178
1.43ha

179
0.85ha

181
0.57ha

182
0.96ha

183
0.57ha

184
0.97ha

188
0.97ha

WET DETENTION POND No.10

HIGHWAY 7

LEGEND

- 33 / 0.81ha — CATCHMENT NUMBER / CATCHMENT AREA
- AREA DRAINING TO BASIN
- SUBCATCHMENT BOUNDARY DOUBLE
- DITCH
- DRAINAGE DITCH
- 1m FLAT BOTTOM GRASSED SWALES
- ENHANCED GRASSED SWALES
- CULVERT
- PSW–PROVINCIALLY SIGNIFICANT WETLAND (MNR) (APPROXIMATE LIMITS ONLY)
- LSW–LOCALLY SIGNIFICANT WETLAND (MNR) (APPROXIMATE LIMITS ONLY)
- OTHER WETLAND–NOT EVALUATED BY MNR (APPROXIMATE LIMITS ONLY)
- WOODLAND VEGETATION

MRC

PROPOSED DRAINAGE AND STORM WATER MANAGEMENT PLAN

HIGHWAY 7 - KITCHENER TO GUELPH

SCALE 1:4,000

EXHIBIT 3.9

MODIFIED: 04/04/08 08:45:51 DRAWING NAME: K2029-HIGHWAY 7 PROPOSED DRAINAGE_BASE PLAN.DWG

LEGEND

- 33 / 0.81ha — CATCHMENT NUMBER / CATCHMENT AREA
- AREA DRAINING TO BASIN
- SUBCATCHMENT BOUNDARY DOUBLE
- DITCH
- DRAINAGE DITCH
- 1m FLAT BOTTOM GRASSED SWALES
- ENHANCED GRASSED SWALES
- CULVERT
- PSW–PROVINCIALLY SIGNIFICANT WETLAND (MNR) (APPROXIMATE LIMITS ONLY)
- LSW–LOCALLY SIGNIFICANT WETLAND (MNR) (APPROXIMATE LIMITS ONLY)
- OTHER WETLAND–NOT EVALUATED BY MNR (APPROXIMATE LIMITS ONLY)
- WOODLAND VEGETATION

GUELPH ROAD 3

ELLIS CR
(SPAN TO

ELLIS CREEK TRIBUTARY

186 — 3.23ha

185 — 0.96ha

187 — 0.96ha

191 — 6.30ha

192 — 1.62ha

194 — 1.62ha

183 — 3.33ha

32+000

32+500

33+000

341.5

340.5m

R=5000
A=625

CUL.180
D/S INV. 329.0m
U/S INV. 329.5m

CUL.191
D/S INV. 326.1m
U/S INV. 326.3m

328.8m

CUL.192
D/S INV. 325.8m
U/S INV. 326.0m

WET. DETENTION
POND No.11

ELLIS CREEK

MODIFIED: 04/04/08 08:45:51 DRAWING NAME: K2029–HIGHWAY 7 PROPOSED DRAINAGE_BASE PLAN.DWG

MRC

PROPOSED DRAINAGE AND STORM WATER MANAGEMENT PLAN

HIGHWAY 7 - KITCHENER TO GUELPH

SCALE 1:4,000

EXHIBIT

3.10

LEGEND

- 33 / 0.81ha — CATCHMENT NUMBER / CATCHMENT AREA
- AREA DRAINING TO BASIN
- SUBCATCHMENT BOUNDARY DOUBLE
- DITCH
- DRAINAGE DITCH
- 1m FLAT BOTTOM GRASSED SWALES
- ENHANCED GRASSED SWALES
- CULVERT
- PSW–PROVINCIALLY SIGNIFICANT WETLAND (MNR) (APPROXIMATE LIMITS ONLY)
- LSW–LOCALLY SIGNIFICANT WETLAND (MNR) (APPROXIMATE LIMITS ONLY)
- OTHER WETLAND–NOT EVALUATED BY MNR (APPROXIMATE LIMITS ONLY)
- WOODLAND VEGETATION

ELLIS CREEK STRUCTURE
(SPAN TO BE DETERMINED)

33+500

34+000

34+500

196 / 2.76ha

195 / 1.65ha

197 / 1.65ha

203 / 2.40ha

207 / 1.16ha

332m

344.8m

DITCH INLET

CUL.194
D/S INV. 325.5m
U/S INV. 326.0m

WET DETENTION
POND No.12

ELLIS CREEK

CUL.206
D/S INV. 339.0m
U/S INV. 339.3m

CUL.204
D/S INV
U/S INV

A=130
R=250

CUL.
D/S
U/S

WET D
POND

MODIFIED: 04/04/08 08:45:51 DRAWING NAME: K2029-HIGHWAY 7 PROPOSED DRAINAGE_BASE PLAN.DWG

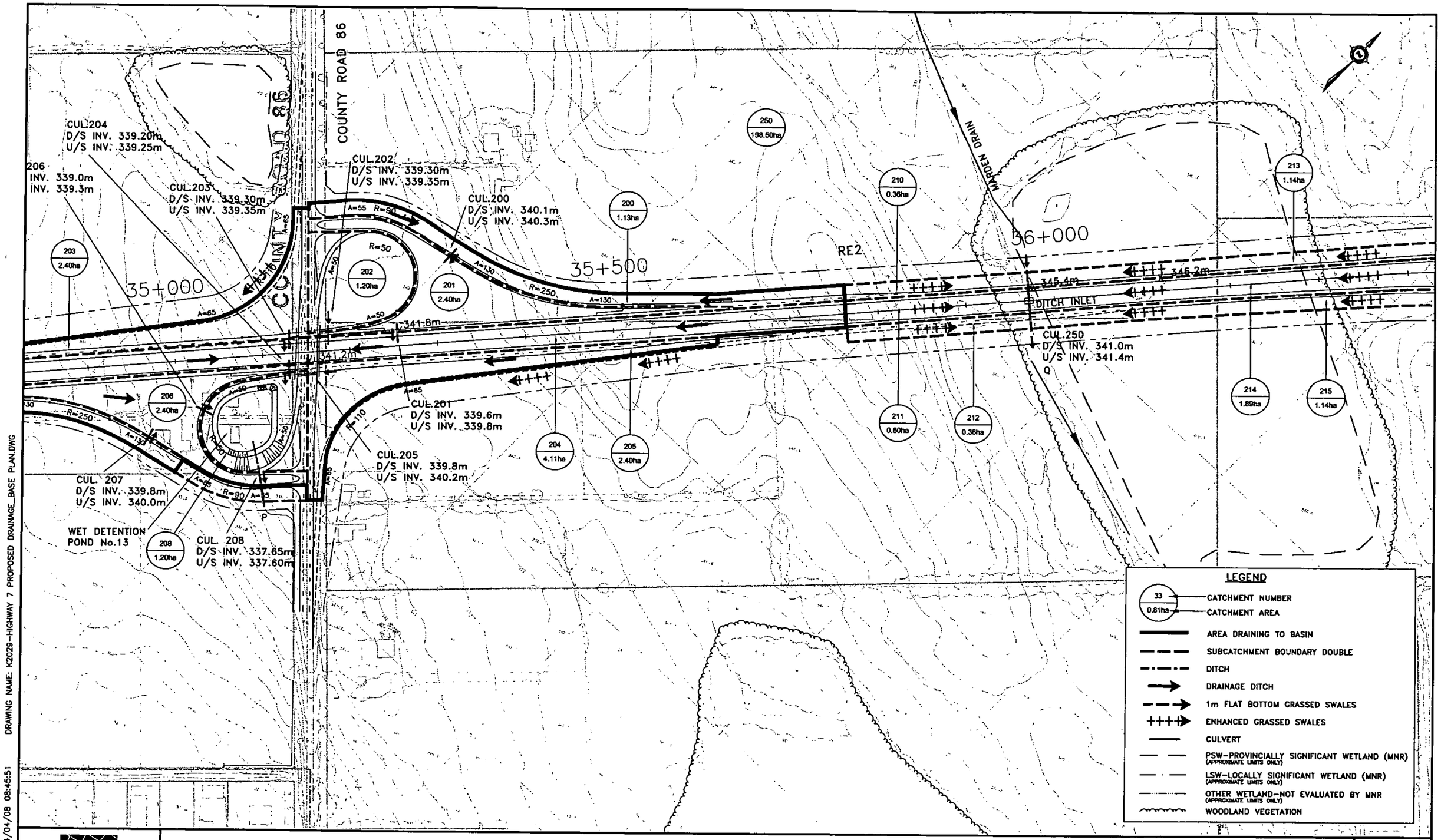
MRC

PROPOSED DRAINAGE AND STORM WATER MANAGEMENT PLAN

HIGHWAY 7 - KITCHENER TO GUELPH

SCALE 1:4,000

EXHIBIT 3.11



MODIFIED: 04/04/08 08:45:51 DRAWING NAME: K2029-HIGHWAY 7 PROPOSED DRAINAGE_BASE PLAN.DWG

MRC

PROPOSED DRAINAGE AND STORM WATER MANAGEMENT PLAN

HIGHWAY 7 - KITCHENER TO GUELPH

SCALE 1:4,000

EXHIBIT

3.12

SILVERCREEK PARKWAY

SILVERCREEK PARKWAY

CUL.304
D/S INV. 339.70m
U/S INV. 339.80m

WET-DETENTION
POND-No.14

CUL.303
D/S INV. 339.45m
U/S INV. 339.50m

CUL.302
D/S INV. 340.80m
U/S INV. 340.85m

CUL.301
D/S INV. 340.90m
U/S INV. 340.95m

303
2.10ha

302
1.30ha

301
3.86ha

260
8.60ha

300
2.17ha

37+500

38+000

37+000

36+500

HIGHWAY 6

HIGHWAY 7

R=575

A=250

R=500

A=65

A=180

R=500

A=110 R=250

R=400

A=160

R=85

A=50

365.4m

LEGEND

- 33 / 0.81ha — CATCHMENT NUMBER / CATCHMENT AREA
- AREA DRAINING TO BASIN
- SUBCATCHMENT BOUNDARY DOUBLE
- DITCH
- DRAINAGE DITCH
- 1m FLAT BOTTOM GRASSED SWALES
- ENHANCED GRASSED SWALES
- CULVERT
- PSW–PROVINCIALLY SIGNIFICANT WETLAND (MNR) (APPROXIMATE LIMITS ONLY)
- LSW–LOCALLY SIGNIFICANT WETLAND (MNR) (APPROXIMATE LIMITS ONLY)
- OTHER WETLAND–NOT EVALUATED BY MNR (APPROXIMATE LIMITS ONLY)
- WOODLAND VEGETATION

MODIFIED: 04/04/08 08:45:51 DRAWING NAME: K2029-HIGHWAY 7 PROPOSED DRAINAGE_BASE PLAN.DWG

MRC

PROPOSED DRAINAGE AND STORM WATER MANAGEMENT PLAN

HIGHWAY 7 - KITCHENER TO GUELPH

SCALE 1:4,000

EXHIBIT 3.13

Table 1
Summary of Hydrologic Modelling Parameters for Existing Conditions

Subcatchment I.D.	Instantaneous Unit Hydrograph Classification	Drainage Area (ha)	Imperviousness (%)						SCS Curve Number	Initial Abstraction (mm)		Manning's 'n'		Time to Peak (hours)	Number of Linear Reservoirs	Flow Length (m)		Slope (%)	
			Direct	+	Indirect	=	Total			Pervious	Impervious	Pervious	Impervious			Pervious	Impervious	Pervious	Impervious
Existing Conditions																			
10	Standard	24.60	25	+	0	=	25		65	13.68	2.00	0.35	0.015	n/a	n/a	40	405	2.00	1.00
20	Nash	10.90	0	+	0	=	0		62	15.57	n/a	n/a	n/a	0.40	3	n/a	n/a	n/a	n/a
30	Nash	8.06	0	+	0	=	0		62	15.57	n/a	n/a	n/a	0.38	3	n/a	n/a	n/a	n/a
60	Nash	31.60	2	+	0	=	2		70	10.89	n/a	n/a	n/a	0.99	3	n/a	n/a	n/a	n/a
70	Nash	27.72	0	+	0	=	0		67	12.51	n/a	n/a	n/a	0.69	3	n/a	n/a	n/a	n/a
110	Nash	430.00	0	+	0	=	0		72	9.88	n/a	n/a	n/a	6.03	3	n/a	n/a	n/a	n/a
120	Nash	64.00	0	+	0	=	0		71	10.37	n/a	n/a	n/a	1.10	3	n/a	n/a	n/a	n/a
135	Nash	17.80	0	+	0	=	0		71	10.37	n/a	n/a	n/a	0.44	3	n/a	n/a	n/a	n/a
140	Nash	8.80	0	+	0	=	0		72	9.88	n/a	n/a	n/a	0.73	3	n/a	n/a	n/a	n/a
141	Nash	12.70	0	+	0	=	0		68	11.95	n/a	n/a	n/a	0.54	3	n/a	n/a	n/a	n/a
150	Nash	30.10	0	+	2	=	2		67	12.51	n/a	n/a	n/a	0.80	3	n/a	n/a	n/a	n/a
155	Nash	19.25	0	+	0	=	0		67	12.51	n/a	n/a	n/a	1.09	3	n/a	n/a	n/a	n/a
160	Nash	36.00	0	+	1	=	1		73	9.39	n/a	n/a	n/a	0.51	3	n/a	n/a	n/a	n/a
170	Nash	19.08	0	+	0	=	0		71	10.37	n/a	n/a	n/a	0.49	3	n/a	n/a	n/a	n/a
171	Nash	8.30	0	+	0	=	0		70	10.89	n/a	n/a	n/a	0.47	3	n/a	n/a	n/a	n/a
180	Nash	144.50	0	+	1	=	1		76	8.02	n/a	n/a	n/a	1.12	3	n/a	n/a	n/a	n/a
190	Nash	788.00	0	+	0	=	0		76	8.02	n/a	n/a	n/a	2.29	3	n/a	n/a	n/a	n/a
220	Nash	8.00	0	+	0	=	0		74	8.92	n/a	n/a	n/a	0.44	3	n/a	n/a	n/a	n/a
250	Nash	205.00	0	+	0	=	0		76	8.02	n/a	n/a	n/a	3.17	3	n/a	n/a	n/a	n/a
260	Nash	110.50	8	+	1	=	9		77	7.59	n/a	n/a	n/a	2.07	3	n/a	n/a	n/a	n/a
	Total/Average =	2004.91	1	+	0	=	1		74	8.95	-	-	-	-	-	-	-	-	-

Table 2

Summary of Hydrologic Modeling Parameters for the Proposed Highway Conditions

Subcatchment I.D.	Instantaneous Unit Hydrograph Classification	Drainage Area (ha)	Imperviousness (%)				SCS Curve Number	Initial Abstraction (mm)		Manning's 'n'		Time to Peak (hours)	Number of Linear Reservoirs	Flow Length (m)		Slope (%)	
			Direct	+ Indirect	=	Total		Pervious	Impervious	Pervious	Impervious			Pervious	Impervious	Pervious	Impervious
Proposed Conditions																	
10	Standard	24.60	35	+ 0	=	35	65	13.68	2.00	0.35	0.015	n/a	n/a	40	405	2.00	1.00
20	Standard	9.80	27	+ 0	=	27	62	15.57	2.00	0.35	0.015	n/a	n/a	40	256	2.00	1.00
21	Standard	1.10	22	+ 0	=	22	62	15.57	2.00	0.35	0.015	n/a	n/a	40	86	2.00	1.00
30	Nash	3.85	10	+ 0	=	10	65	13.68	n/a	n/a	n/a	0.35	3	n/a	n/a	n/a	n/a
31	Standard	1.74	23	+ 0	=	23	62	15.57	2.00	0.35	0.015	n/a	n/a	40	108	2.00	1.00
32	Nash	0.80	0	+ 0	=	0	62	15.57	n/a	n/a	n/a	0.16	3	n/a	n/a	n/a	n/a
33	Standard	0.81	27	+ 0	=	27	62	15.57	2.00	0.35	0.015	n/a	n/a	40	73	2.00	1.00
34	Standard	0.86	28	+ 0	=	28	62	15.57	2.00	0.35	0.015	n/a	n/a	40	76	2.00	1.00
60	Nash	25.40	2	+ 0	=	2	70	10.89	n/a	n/a	n/a	0.91	3	n/a	n/a	n/a	n/a
61	Standard	1.10	37	+ 0	=	37	62	15.57	2.00	0.35	0.015	n/a	n/a	40	86	2.00	1.00
62	Standard	2.80	49	+ 0	=	49	63	14.92	2.00	0.35	0.015	n/a	n/a	40	137	2.00	1.00
63	Nash	1.20	0	+ 0	=	0	62	15.57	n/a	n/a	n/a	0.64	3	n/a	n/a	n/a	n/a
64	Standard	0.32	31	+ 0	=	31	62	15.57	2.00	0.35	0.015	n/a	n/a	40	46	2.00	1.00
65	Standard	0.28	27	+ 0	=	27	62	15.57	2.00	0.35	0.015	n/a	n/a	40	43	2.00	1.00
66	Nash	0.27	0	+ 0	=	0	62	15.57	n/a	n/a	n/a	0.22	3	n/a	n/a	n/a	n/a
67	Nash	0.18	0	+ 0	=	0	62	15.57	n/a	n/a	n/a	0.19	3	n/a	n/a	n/a	n/a
70	Nash	2.70	7	+ 0	=	7	68	11.95	n/a	n/a	n/a	0.19	3	n/a	n/a	n/a	n/a
71	Standard	0.64	22	+ 0	=	22	62	15.57	2.00	0.35	0.015	n/a	n/a	40	65	2.00	1.00
72	Standard	1.44	21	+ 0	=	21	62	15.57	2.00	0.35	0.015	n/a	n/a	40	98	2.00	1.00
73	Standard	4.40	25	+ 0	=	25	62	15.57	2.00	0.35	0.015	n/a	n/a	40	171	2.00	1.00
74	Standard	1.44	21	+ 0	=	21	62	15.57	2.00	0.35	0.015	n/a	n/a	40	98	2.00	1.00
75	Nash	4.00	8	+ 0	=	8	65	13.68	n/a	n/a	n/a	0.35	3	n/a	n/a	n/a	n/a
76	Nash	2.50	14	+ 0	=	14	67	12.51	n/a	n/a	n/a	0.20	3	n/a	n/a	n/a	n/a
80	Nash	10.60	9	+ 0	=	9	71	10.37	n/a	n/a	n/a	0.44	3	n/a	n/a	n/a	n/a
81	Standard	0.32	21	+ 0	=	21	62	15.57	2.00	0.35	0.015	n/a	n/a	40	46	2.00	1.00
82	Standard	0.21	21	+ 0	=	21	62	15.57	2.00	0.35	0.015	n/a	n/a	40	37	2.00	1.00
83	Standard	0.16	21	+ 0	=	21	62	15.57	2.00	0.35	0.015	n/a	n/a	40	33	2.00	1.00
84	Standard	0.17	21	+ 0	=	21	62	15.57	2.00	0.35	0.015	n/a	n/a	40	34	2.00	1.00
110	Nash	420.50	0	+ 0	=	0	72	9.88	n/a	n/a	n/a	5.93	3	n/a	n/a	n/a	n/a
120	Nash	55.70	0	+ 0	=	0	71	10.37	n/a	n/a	n/a	1.04	3	n/a	n/a	n/a	n/a
121	Standard	0.54	21	+ 0	=	21	65	13.68	2.00	0.35	0.015	n/a	n/a	40	60	2.00	1.00
122	Standard	0.38	21	+ 0	=	21	65	13.68	2.00	0.35	0.015	n/a	n/a	40	50	2.00	1.00
123	Standard	0.43	21	+ 0	=	21	65	13.68	2.00	0.35	0.015	n/a	n/a	40	54	2.00	1.00
124	Standard	0.72	21	+ 0	=	21	65	13.68	2.00	0.35	0.015	n/a	n/a	40	69	2.00	1.00
125	Standard	0.95	25	+ 0	=	25	65	13.68	2.00	0.35	0.015	n/a	n/a	40	80	2.00	1.00
126	Standard	0.17	34	+ 0	=	34	65	13.68	2.00	0.35	0.015	n/a	n/a	40	34	2.00	1.00
127	Nash	1.75	11	+ 0	=	11	69	11.41	n/a	n/a	n/a	0.25	3	n/a	n/a	n/a	n/a
128	Standard	0.36	21	+ 0	=	21	65	13.68	2.00	0.35	0.015	n/a	n/a	40	49	2.00	1.00
129	Standard	0.36	21	+ 0	=	21	65	13.68	2.00	0.35	0.015	n/a	n/a	40	49	2.00	1.00

Table 2

Summary of Hydrologic Modeling Parameters for the Proposed Highway Conditions

Subcatchment I.D.	Instantaneous Unit Hydrograph Classification	Drainage Area (ha)	Imperviousness (%)				SCS Curve Number	Initial Abstraction (mm)		Manning's 'n'		Time to Peak (hours)	Number of Linear Reservoirs	Flow Length (m)		Slope (%)	
			Direct	+ Indirect	=	Total		Pervious	Impervious	Pervious	Impervious			Pervious	Impervious	Pervious	Impervious
Proposed Conditions																	
130	Standard	3.90	29	+ 0	=	29	65	13.68	2.00	0.35	0.015	n/a	n/a	40	161	2.00	1.00
131	Standard	0.36	68	+ 0	=	68	65	13.68	2.00	0.35	0.015	n/a	n/a	40	49	2.00	1.00
132	Standard	0.95	25	+ 0	=	25	65	13.68	2.00	0.35	0.015	n/a	n/a	40	80	2.00	1.00
	Standard	1.75	20	+ 0	=	20	65	13.68	2.00	0.35	0.015	n/a	n/a	40	108	2.00	1.00
135	Nash	11.20	4	+ 0	=	4	73	9.39	n/a	n/a	n/a	0.33	3	n/a	n/a	n/a	n/a
140	Standard	1.30	34	+ 0	=	34	71	10.37	2.00	0.35	0.015	n/a	n/a	40	93	2.00	1.00
141	Standard	2.40	25	+ 0	=	25	71	10.37	2.00	0.35	0.015	n/a	n/a	40	126	2.00	1.00
142	Nash	1.30	9	+ 0	=	9	73	9.39	n/a	n/a	n/a	0.60	3	n/a	n/a	n/a	n/a
143	Nash	2.10	10	+ 0	=	10	68	11.95	n/a	n/a	n/a	0.87	3	n/a	n/a	n/a	n/a
144	Standard	3.72	25	+ 0	=	25	65	13.68	2.00	0.35	0.015	n/a	n/a	40	157	2.00	1.00
145	Standard	2.10	33	+ 0	=	33	65	13.68	2.00	0.35	0.015	n/a	n/a	40	118	2.00	1.00
150	Nash	31.76	0	+ 2	=	2	67	12.51	n/a	n/a	n/a	1.03	3	n/a	n/a	n/a	n/a
151	Standard	2.52	21	+ 0	=	21	65	13.68	2.00	0.35	0.015	n/a	n/a	40	130	2.00	1.00
152	Standard	1.55	21	+ 0	=	21	65	13.68	2.00	0.35	0.015	n/a	n/a	40	102	2.00	1.00
153	Standard	7.90	25	+ 0	=	25	68	11.95	2.00	0.35	0.015	n/a	n/a	40	229	2.00	1.00
154	Standard	1.56	21	+ 0	=	21	71	10.37	2.00	0.35	0.015	n/a	n/a	40	102	2.00	1.00
155	Standard	1.56	21	+ 0	=	21	71	10.37	2.00	0.35	0.015	n/a	n/a	40	102	2.00	1.00
156	Standard	1.40	62	+ 0	=	62	71	10.37	2.00	0.35	0.015	n/a	n/a	40	97	2.00	1.00
157	Standard	1.40	62	+ 0	=	62	71	10.37	2.00	0.35	0.015	n/a	n/a	40	97	2.00	1.00
158	Nash	2.27	15	+ 0	=	15	75	8.47	n/a	n/a	n/a	0.23	3	n/a	n/a	n/a	n/a
159	Standard	1.23	28	+ 0	=	28	71	10.37	2.00	0.35	0.015	n/a	n/a	40	91	2.00	1.00
160	Nash	25.82	0	+ 2	=	2	74	8.92	n/a	n/a	n/a	0.43	3	n/a	n/a	n/a	n/a
161	Standard	2.15	20	+ 0	=	20	65	13.68	2.00	0.35	0.015	n/a	n/a	40	120	2.00	1.00
162	Standard	0.99	27	+ 0	=	27	65	13.68	2.00	0.35	0.015	n/a	n/a	40	81	2.00	1.00
170	Nash	13.80	0	+ 0	=	0	71	10.37	n/a	n/a	n/a	0.36	3	n/a	n/a	n/a	n/a
171	Standard	0.68	21	+ 0	=	21	65	13.68	2.00	0.35	0.015	n/a	n/a	40	67	2.00	1.00
172	Standard	0.72	21	+ 0	=	21	65	13.68	2.00	0.35	0.015	n/a	n/a	40	69	2.00	1.00
173	Standard	1.13	25	+ 0	=	25	65	13.68	2.00	0.35	0.015	n/a	n/a	40	87	2.00	1.00
174	Standard	1.20	25	+ 0	=	25	65	13.68	2.00	0.35	0.015	n/a	n/a	40	89	2.00	1.00
175	Standard	0.68	21	+ 0	=	21	65	13.68	2.00	0.35	0.015	n/a	n/a	40	67	2.00	1.00
176	Standard	0.72	21	+ 0	=	21	65	13.68	2.00	0.35	0.015	n/a	n/a	40	69	2.00	1.00
177	Standard	0.85	21	+ 0	=	21	71	10.37	2.00	0.35	0.015	n/a	n/a	40	75	2.00	1.00
178	Standard	1.43	25	+ 0	=	25	71	10.37	2.00	0.35	0.015	n/a	n/a	40	98	2.00	1.00
179	Standard	0.85	21	+ 0	=	21	71	10.37	2.00	0.35	0.015	n/a	n/a	40	75	2.00	1.00
180	Nash	134.00	0	+ 1	=	1	76	8.02	n/a	n/a	n/a	1.06	3	n/a	n/a	n/a	n/a
181	Standard	0.57	21	+ 0	=	21	71	10.37	2.00	0.35	0.015	n/a	n/a	40	62	2.00	1.00
182	Standard	0.96	25	+ 0	=	25	71	10.37	2.00	0.35	0.015	n/a	n/a	40	80	2.00	1.00
183	Standard	0.57	21	+ 0	=	21	71	10.37	2.00	0.35	0.015	n/a	n/a	40	62	2.00	1.00
184	Standard	0.97	21	+ 0	=	21	71	10.37	2.00	0.35	0.015	n/a	n/a	40	80	2.00	1.00

Table 2

Summary of Hydrologic Modeling Parameters for the Proposed Highway Conditions

Subcatchment I.D.	Instantaneous Unit Hydrograph Classification	Drainage Area (ha)	Imperviousness (%)				SCS Curve Number	Initial Abstraction (mm)		Manning's 'n'		Time to Peak (hours)	Number of Linear Reservoirs	Flow Length (m)		Slope (%)	
			Direct	+ Indirect =	Total			Pervious	Impervious	Pervious	Impervious			Pervious	Impervious	Pervious	Impervious
Proposed Conditions																	
185	Standard	0.96	21	+ 0 =	21		71	10.37	2.00	0.35	0.015	n/a	n/a	40	80	2.00	1.00
186	Standard	3.23	25	+ 0 =	25		71	10.37	2.00	0.35	0.015	n/a	n/a	40	147	2.00	1.00
187	Standard	0.96	21	+ 0 =	21		71	10.37	2.00	0.35	0.015	n/a	n/a	40	80	2.00	1.00
188	Standard	0.97	21	+ 0 =	21		71	10.37	2.00	0.35	0.015	n/a	n/a	40	80	2.00	1.00
190	Nash	771.00	0	+ 0 =	0		76	8.02	n/a	n/a	n/a	2.23	3	n/a	n/a	n/a	n/a
191	Nash	6.30	0	+ 0 =	0		76	8.02	n/a	n/a	n/a	0.23	3	n/a	n/a	n/a	n/a
192	Standard	1.62	21	+ 0 =	21		71	10.37	2.00	0.35	0.015	n/a	n/a	40	104	2.00	1.00
193	Standard	3.33	25	+ 0 =	25		71	10.37	2.00	0.35	0.015	n/a	n/a	40	149	2.00	1.00
194	Standard	1.62	21	+ 0 =	21		71	10.37	2.00	0.35	0.015	n/a	n/a	40	104	2.00	1.00
195	Standard	1.65	21	+ 0 =	21		71	10.37	2.00	0.35	0.015	n/a	n/a	40	105	2.00	1.00
196	Standard	2.76	25	+ 0 =	25		71	10.37	2.00	0.35	0.015	n/a	n/a	40	136	2.00	1.00
197	Standard	1.65	21	+ 0 =	21		71	10.37	2.00	0.35	0.015	n/a	n/a	40	105	2.00	1.00
200	Standard	1.13	33	+ 0 =	33		71	10.37	2.00	0.35	0.015	n/a	n/a	40	87	2.00	1.00
201	Nash	2.40	10	+ 0 =	10		74	8.92	n/a	n/a	n/a	0.24	3	n/a	n/a	n/a	n/a
202	Standard	1.20	23	+ 0 =	23		71	10.37	2.00	0.35	0.015	n/a	n/a	40	89	2.00	1.00
203	Standard	2.40	21	+ 0 =	21		71	10.37	2.00	0.35	0.015	n/a	n/a	40	126	2.00	1.00
204	Standard	4.11	25	+ 0 =	25		71	10.37	2.00	0.35	0.015	n/a	n/a	40	166	2.00	1.00
205	Standard	2.40	21	+ 0 =	21		71	10.37	2.00	0.35	0.015	n/a	n/a	40	126	2.00	1.00
206	Nash	2.40	10	+ 0 =	10		74	8.92	n/a	n/a	n/a	0.24	3	n/a	n/a	n/a	n/a
207	Standard	1.10	32	+ 0 =	32		71	10.37	2.00	0.35	0.015	n/a	n/a	40	86	2.00	1.00
208	Standard	1.20	23	+ 0 =	23		71	10.37	2.00	0.35	0.015	n/a	n/a	40	89	2.00	1.00
210	Standard	0.36	21	+ 0 =	21		71	10.37	2.00	0.35	0.015	n/a	n/a	40	49	2.00	1.00
211	Standard	0.60	25	+ 0 =	25		71	10.37	2.00	0.35	0.015	n/a	n/a	40	63	2.00	1.00
212	Standard	0.36	21	+ 0 =	21		71	10.37	2.00	0.35	0.015	n/a	n/a	40	49	2.00	1.00
213	Standard	1.14	21	+ 0 =	21		71	10.37	2.00	0.35	0.015	n/a	n/a	40	87	2.00	1.00
214	Standard	1.89	25	+ 0 =	25		71	10.37	2.00	0.35	0.015	n/a	n/a	40	112	2.00	1.00
215	Standard	1.14	21	+ 0 =	21		71	10.37	2.00	0.35	0.015	n/a	n/a	40	87	2.00	1.00
250	Nash	198.50	0	+ 0 =	0		76	8.02	n/a	n/a	n/a	2.97	3	n/a	n/a	n/a	n/a
260	Standard	8.60	31	+ 8 =	39		75	8.47	2.00	0.29	0.015	n/a	n/a	40	239	2.00	1.00
300	Standard	2.17	34	+ 0 =	34		71	10.37	2.00	0.35	0.015	n/a	n/a	40	120	2.00	1.00
301	Standard	3.86	28	+ 0 =	28		71	10.37	2.00	0.35	0.015	n/a	n/a	40	160	2.00	1.00
302	Nash	1.30	0	+ 0 =	0		71	10.37	n/a	n/a	n/a	0.82	3	n/a	n/a	n/a	n/a
303	Nash	1.00	8	+ 0 =	8		73	9.39	n/a	n/a	n/a	0.18	3	n/a	n/a	n/a	n/a
304	Nash	93.55	4	+ 1 =	5		76	8.02	n/a	n/a	n/a	1.98	3	n/a	n/a	n/a	n/a

3.3 Results of Hydrologic Modelling

Table 3 compares the existing and post-development 100 year flows at points of interest. A review of the results indicates that at most locations the changes in land use and drainage patterns associated with the new highway have no significant impact on peak flows, with the exception of flows at Points of Interest A1, A, J2 and P. Storm water at these points of interest will be conveyed to storm water detention ponds for peak flow attenuation and water quality control, as illustrated on Exhibits 3.1, 3.2, 3.7, and 3.12, and in Table 3. Table 4 summarizes the 50 year and 100 year peak flows (3-hour Chicago distribution) generated under post-development conditions at all major culvert crossings. The Regional Storm peak flows are also included for culverts that have catchment area exceeding 125 ha, which include Culverts 80, 180 and 250.

Table 3 Comparisons of Flows under Existing and Proposed Highway Conditions for 100-Year 3 Hour Storm

Point of Interest	Existing Condition	Future Condition (Uncontrolled)	SWM Facility and its Downstream Discharge
A1	2.7	3.7	Wet Pond 1 to Grand River
A	0.4	1.3	Wet Pond 2 to Grand River
B	0.3	0.5	Wet Pond 3 to Grand River
C	1.0	1.0	Wet Pond 4 to Grand River
D	1.1	1.1	Wet Pond 5 to Grand River
E Rosendale Creek	3.0	3.0	Grassed Swales to Rosendale Creek
F	1.9	2.0	Enhanced Grassed Swales to Grand River Tributary
G	1.0	0.8	Wet Pond 6 to Grand River Tributary
H Hopewell Creek	0.4	0.6	Wet Pond 7 to Hopewell Creek
I Hopewell Creek	0.4	0.8	Wet Pond 8 to Hopewell Creek
J Tillich Drain	0.9	0.9	Grassed Swales to Tillich Drain to Hopewell Creek
J2	0.5	2.9	Wet Pond 9 to Wetland
K	2.1	1.7	Enhanced Grassed Swales To Culvert 160 Wetland
L	1.0	1.2	Enhanced Grassed Swales to Wetland
M	0.4	0.7	Wet Pond 10 to a Culvert under Existing Highway 7 to Ellis Creek Tributary
N Ellis Creek Tributary	5.2	5.2	Enhanced Grassed Swales to Ellis Creek Tributary
O Ellis Creek	16.0	16.1	Wet Ponds 11 and 12 to Ellis Creek
P	0.5	2.0	Wet Pond 13 to County Road 86 Ditch.
Q Marden Drain	3.1	3.2	Enhanced Grassed Swales to Marden Drain
R	2.6	2.7	Wet Pond 14 to Roadside Ditch

Table 4 Peak Flow Rates at Major Culvert Crossings

Culvert ID	Approximate Chainage	50 Year (m^3/s)	100 Year (m^3/s)	Regional Storm (m^3/s)
72	22+600 EBL	0.79	0.90	
80	22+800	2.54	2.96	16.47
120	24+000	1.48	1.73	
126	24+200 EBL	0.74	0.84	
135	24+700	0.70	0.81	
150	27+620	0.70	0.82	
157	28+220 WBL	2.04	2.33	
160	28+800	1.43	1.67	
170	30+100	0.92	1.08	
180	31+830	4.44	5.11	14.13
192	33+220 EBL	0.98	1.14	
204	35+130 EBL	1.05	1.18	
250	35+980	2.76	3.18	11.60
301	37+250 EBL	1.85	2.06	
302	37+250 WBL	2.36	2.63	
304	Beneath Ramps to Silvercreek Parkway	1.89	2.18	

4.0 Culvert Sizing

Exhibits 3.1 to 3.13 identify locations of proposed culverts within the study limits. Hydraulic models have been formulated to design and evaluate the hydraulic performance of the proposed major culverts under proposed Highway 7 alignment using the flows estimated in Section 3.0 and parameters representing physical culvert characteristics.

Presently drainage from the Wellington Street Interchange is conveyed in a storm sewer system connected to a trunk storm sewer that extends along the west edge of the southbound lanes. Under the post-development conditions the existing drainage pattern will be maintained without requirements for additional culverts. The capacity of the existing storm sewer system at Wellington/KWE interchange will be assessed in the detailed design phase to determine if

the system is capable to convey future flows. It the existing system does not have the capacity, other options for directing post-development flows will be investigated, which may include provision of peak flow control facilities at the interchange loops.

The following sections provide additional details of the hydraulic model formulation, and present the results of the hydraulic analyses.

4.1 Model Selection

The hydraulic modeling program CulvertMaster has been selected to determine the required culvert sizes for the reasons listed below. The model:

- Evaluates inlet and outlet controlled headwater depths based on internationally accepted Federal Highways Administration design nomographs;
- Implements a design algorithm that is consistent with procedures recommended by the Ministry of Transportation;
- Simulates the hydraulic performance of culverts based on user specified flows;
- Considers variable tailwater depths based on either outlet channel geometry or user specified depth-discharge rating curves;
- Incorporates an extensive database of standard culvert sizes, shapes and materials, and allows for the addition of custom culvert types; and
- Has an interactive interface that facilitates the evaluation of alternative culvert configurations.

4.2 Design and Evaluation Criteria

A design and evaluation criteria have been established to facilitate the design of the highway drainage conveyance system. The following criteria have been adopted based on the *Ministry of Transportation Directive B-100*:

- Freeway and urban arterial culvert crossings with less than a 6 metre span should be sized to convey the flow generated during a 50 year rainfall event; and
- Crossings with greater than a 6 metre span should be sized to convey the flow generated during a 100 year rainfall event.

In addition to the criteria specified by the *Ministry of Transportation Directive B-100*, several assumptions have been made regarding acceptable headwater levels at the proposed culverts. Exceedance of the maximum allowable headwater elevation during the specified rainfall event may be an indicator that a culvert is undersized. The headwater criteria used to design and evaluate the culverts within the study limits are summarized as follows:

1. The maximum water level upstream of a crossing during a 50 year rainfall event should:
   - Remain at least 1.0 metres below the minimum top-of-road elevation at or near the culvert (***Freeboard Criterion***); and

- Not result in a depth of water that is greater than 1.2 times the height of the culvert barrel (***Depth Criterion***).

2. A design check should be carried out to ensure that water levels upstream of the highway crossing remain below the minimum top-of-road elevation during a 100 year rainfall event (***Overtopping Criterion***).

3. For watercourses with catchments exceeding 125 ha, the Regional Storm should be conveyed through the culvert without overtopping the highway. Alternatively, a spill over the highway is acceptable, provided that there is no increase in flood elevations in upstream properties.

4.3 Model Development

Hydraulic models were developed to simulate the performance of the proposed major culverts under the proposed Highway 7 alignment during the 50 year and 100 year rainfall events, and to simulate the performance of Culverts 80, 180 and 250 (Stations 22+800, 31+830 and 35+980, respectively) during the Regional Storm. Culvert parameters including invert elevations, culvert lengths, and top of road elevations were determined based on the proposed highway characteristics and original ground profile. Appropriate culvert sizes were then determined based on the design criteria.

Where information was available, culvert tailwater elevations were estimated based on physical characteristics of the receiving drainage system. Where applicable, the headwater of the downstream culvert was used as the tailwater for the next upstream culvert. However, in all cases, the tailwater elevation was not set below a depth equal to half of the culvert height. Table 5 summarizes the results of a hydraulic assessment for the proposed culverts. All culverts were modeled as round concrete pipes. The actual culvert material may vary in the detailed design.

4.4 Culvert Performance

The results in Table 5 reveal the following:

- The Freeboard Criterion (Freeboard = 1.0 m) will be satisfied for all highway culverts during the 50 year storm.
- The Depth Criterion (H/D =1.2) will be satisfied for all culverts during the 50 year and 100 year storms.
- All culverts will convey the 100 year storm without overtopping the highway, and in fact the 100 year freeboard will be equal or exceed 1.0 m in all cases.
- Culverts 80 and 180 will convey the Regional Storm without overtopping the highway.
- During the Regional Storm the highway will be overtopped at Culvert 250. In order to convey the Regional Storm under the highway the required culvert size will be 1800 mm rise x 3000 mm span. For the 1500 mm culvert approximately 5.2 m^3/s would spilled over the highway during the Regional Storm.

Due to constraints imposed by road profile, larger size culverts were not provided at Sta. 28+220 and Sta. 37+250. Instead twin culverts were used to satisfy the Freeboard Criterion.

4.5 Wildlife and Fish Passage

The requirements for wildlife and fish passage are documented in the Amendment to the Highway 7 Environmental Assessment Report 1997. Where fish habitat is an issue, site-specific solutions will be developed in consultation with the appropriate agencies.

4.5.1 Wildlife

Culverts 120, 150, 170 and 250 will need to accommodate wildlife passage. The final size of these culverts will be determined as part of the detailed design. However, as a minimum 1800 mm x 3000 mm box culverts should be considered.

4.5.2 Fish Passage

Culverts 80, 120, 150, 180 and 250 will need to accommodate fish passage. The final size of these culverts will be determined as part of the detailed design, where each culvert will be considered on its own merit. As a minimum, each of these culverts should be an 1800x3000 mm box culvert with substrate incorporated into the design of each structure to promote aquatic habitat. Note that enlarging of Culvert 250 (Point Q) to an 1800 mm x3000 mm box culvert will accomplish conveyance of the Regional Storm without flooding the highway.

4.6 Equalization of Culverts

Equalization culverts may be required in the vicinity of Culvert 250 between Sta. 35+900 and Sta. 36+500. These culverts will assist in maintaining shallow groundwater elevations on either side of the highway.

Table 5 Summary of Proposed Culverts Characteristics and Hydraulic Assessment

Culvert Characteristics							Hydraulic Assessment														
Culvert #	Chainage	Size (mm)	Length (m)	Inverts (mAMSL)		Slope (%)	Flow (m^3/s)			Tailwater Elevation (mAMSL)	TOR (mAMSL)	Cover (m)	Spill Elevation (mAMSL)	Headwater Elevation (mAMSL)			Depth of Headwater / Height of Culvert			Freeboard from Spill Elevation (m)		
				U/S	D/S		50yr	100yr	Regional Storm					50yr	100yr	Regional Storm	50yr	100yr	Regional Storm	50yr	100yr	Regional Storm
72	22+600 EBL	1200	20	311.20	311.00	1.00	0.79	0.90		311.72	315.00	2.8	313.0	311.94	312.00		0.61	0.66		1.1	1.0	
80	22+800	1800	82	305.00	304.50	0.61	2.54	2.96	16.49	305.58	317.00	10.7	315.0	306.21	306.32	311.37	0.66	0.72	3.48	8.8	8.7	3.6
120	24+000	1200	90	319.50	319.00	0.56	1.48	1.73		319.72	332.00	11.8	329.0	320.56	320.67		0.87	0.96		8.4	8.3	
126	24+200 EBL	1200	20	324.90	324.85	0.25	0.74	0.84		325.57	329.50	3.4	329.0	325.67	325.70		0.63	0.66		3.3	3.3	
135	24+700	1200	65	325.00	324.50	0.77	0.70	0.81		325.22	328.00	2.3	327.0	325.70	325.75		0.57	0.62		1.3	1.3	
150	27+620	1200	75	323.00	322.80	0.27	0.70	0.82		323.52	329.00	5.0	328.0	323.70	323.75		0.57	0.62		4.3	4.3	
157	28+220 WBL	2 X 1200	20	324.70	324.65	0.25	2.04	2.33		325.37	327.00	1.2	326.6	325.56	325.62		0.71	0.75		1.0	1.0	
160	28+800	1200	100	326.00	325.60	0.40	1.43	1.67		326.32	329.00	2.2	328.2	327.04	327.14		0.85	0.93		1.2	1.1	
170	30+100	1200	60	330.00	329.50	0.83	0.92	1.08		330.22	334.20	3.5	336.0	330.81	330.89		0.66	0.73		5.2	5.1	
180	31+830	1800	80	329.50	329.00	0.63	4.44	5.11	14.13	330.08	340.50	9.7	336.0	331.17	331.32	334.50	0.92	1.00	2.73	4.8	4.7	1.5
192	33+220 EBL	1200	20	326.00	325.80	1.00	0.98	1.14		326.52	328.50	1.5	328.5	326.84	326.91		0.69	0.75		1.7	1.6	
204	35+130 EBL	1200	20	339.25	339.20	0.25	1.15	1.31		339.92	341.20	0.8	341.2	340.16	340.22		0.75	0.80		1.0	1.0	
250	35+980	1500	58	341.40	341.00	0.69	2.76	3.18	11.60	341.90	345.50	3.0	344.0	342.78	342.90	347.74	0.91	0.99	4.13	1.2	1.1	Overtopped
301	37+250 EBL	2 X 1200	20	340.95	340.90	0.25	1.85	2.06		341.83	343.00	0.9	343.0	341.92	341.94		0.79	0.81		1.1	1.1	
302	37+250 WBL	2 X 1200	20	340.85	340.80	0.25	2.36	2.63		341.52	343.00	1.0	343.0	341.77	341.93		0.76	0.80		1.2	1.1	
304	Beneath Ramps at Curtis	1800	45	339.80	339.70	0.22	1.89	2.18		340.78	342.50	1.0	342.5	340.92	340.97		0.61	0.64		1.6	1.5	

Notes:

1. All culverts were analyzed as round concrete pipes. Actual culvert material may vary
2. Culverts invert elevations, length and cover are estimated based on proposed Highway 7 road profile.

5.0 Selection of Feasible Storm Water Management Measures

The purpose of this section is to identify feasible storm water management practices that can be integrated to provide a preliminary Drainage and Storm Water Management Plan that comprehensively addresses all of the drainage and storm water management objectives defined for the proposed Highway 7.

5.1 Alternative Management Practices Considered

In 1994, the Ministry of the Environment and Energy released the *Stormwater Management Practices Planning and Design Manual* (2003 latest revision). The document classified management practices as lot level controls, conveyance controls or end-of-pipe facilities. Although a storm water management concept should integrate measures from all three categories, lot level controls are preferred, followed by conveyance controls and finally, end-of-pipe facilities. However, lot level controls are typically not feasible in a highway setting due to the linear nature of the drainage system.

The *Stormwater Management Practices Planning and Design Manual* was reviewed and storm water management practices that can be implemented in conjunction with the proposed Highway 7 alignment have been selected. A brief description of each practice is provided in Table 6. Detailed descriptions of each measure can be found in the *Stormwater Management Practices Planning and Design Manual.*

5.2 Management Practice Screening

The management practices listed in Table 6 were screened further to determine which measures are feasible for this project. The measures were assessed using the following evaluation criteria:

- Physical suitability of site;
- Sediment removal benefits;
- Water quality benefits;
- Erosion control benefits;
- Flood control benefits;
- Maintenance requirements; and
- Capital cost.

The best alternatives are those that provide the required level of treatment for a reasonable cost, are easy to maintain, and fit within available right-of-way lands.

Table 6 Feasible Storm Water Management Measures (Part 1 of 2)

Measure	Benefits	Comments
CONVEYANCE CONTROLS		
i) Goss Traps Located in Catchbasins	• water quality enhancement.	• Extra deep sumps required to prevent re-suspension of settled particles. • Provides pre-treatment of runoff from the road network. • Not typically accepted in highway drainage system design due to potential for clogging.
ii) Vegetated Swales/Enhanced Vegetated Swales	• water quality enhancement; • infiltration; • erosion control; and • flood control.	• Used to filter and detain storm water runoff as it is conveyed downstream. • Commonly implemented in highway drainage systems with proven effectiveness. • Enhancements such as permanent check dams constructed at intervals along the swale and a trapezoidal cross-section will enhance infiltration and settling of suspended pollutants. • Pre-treatment should be provided before drainage from road networks is infiltrated.
END-OF-PIPE FACILITIES		
i) Constructed Wetlands	• water quality enhancement; • erosion control; and • flood control.	• Most promising end-of-pipe facility for water quality enhancement. • Have been implemented in highway drainage systems with proven effectiveness. • Contributing drainage areas greater than 5 hectares required to sustain permanent pool. • Ponds require large blocks of land if flood control is provided.
ii) Wet Ponds	• water quality enhancement; • erosion control; and • flood control.	• Most reliable end-of-pipe facilities in terms of pollutant removal. • Have been implemented in highway drainage systems with proven effectiveness. • Downstream environmental impacts related to increases in water temperature. • Contributing drainage areas greater than 5 hectares required to sustain permanent pool.
iii) Dry Ponds	• water quality enhancement; • erosion control; and • flood control.	• Have been implemented in highway drainage systems with varying success. • Limited in effectiveness for removing storm water contaminants. • Should be limited to areas that have a contributing drainage area greater than 5 hectares. • Should not be considered in watersheds with sensitive aquatic habitat (i.e. receiving watercourse designated as Protection Level 1 or 2 watercourse).

Table 6
Feasible Storm Water Management Measures (Part 2 of 2)

Measure	Benefits	Comments
END-OF-PIPE FACILITIES CONT'D		
iv) Infiltration Trenches	• water quality enhancement; • infiltration; • erosion control; and • flood control.	• Consist of subsurface storage component that treats storm water from several lots. • Best utilized in compact residential development situations. • Not well suited in highway settings due to high potential for both clogging and urban contaminant migration in to the groundwater system.
v) Oil and Grit Separators	• water quality enhancement.	• Valuable for small impervious areas. • Typically implemented in industrial and commercial settings. • Not typically acceptable in highway drainage systems due to high potential for clogging.
vi) Vegetated Buffer and Filter Strips	• water quality enhancement; and • erosion control.	• Natural area between development and receiving waters. • Typically limited to small drainage areas (i.e. less than 2 hectares). • In the past, vegetated side slopes along highway embankments have proven somewhat effective as filter strips. • Integral part of overall environmental management for sustainable development.

Of the eight measures listed in Table 6, the dry pond, wet pond, and constructed wetland end-of-pipe alternatives would provide the highest level of treatment for runoff contributed from lands within the study limits. These measures are also the only available means for effectively controlling runoff rates from developing lands during major rainfall events. However, based on the results of hydrologic modelling there is no significant increase in the peak flow due to the construction of a new highway. Therefore, any pond constructed in conjunction with the proposed highway would mostly be required to provide water quality enhancement. Based on the above mentioned criteria, the Best Management Practices listed in Table 6 are short listed to Dry Ponds, Wet Ponds and Grassed Swales.

Solely on the basis of the screening criteria, dry ponds are suitable; however, recently Ministry of Natural Resources (MNR) has indicated a concern with regard to their quality treatment capabilities. In relation to this, MNR has stated a reluctance to accept dry ponds, and a preference for wet pond instead. As such, the dry pond management practice was not considered in further assessment. The overall site conditions are such that wet ponds and grassed swales meet all of the screening criteria and are therefore carried forward.

Wet ponds require varied amounts of property to implement. Wet ponds will be located within the proposed right-of-way wherever possible in order to minimize the amount of property acquisition. Conventional wet ponds have a permanent pool of water for treating incoming storm water runoff; extended detention zone for erosion control, and attenuation zone for flood control. In situations where wet ponds cannot be implemented due to constraints imposed by land requirement or where technically not feasible to separate highway drainage from external drainage, grassed swales will be provided.

Conventional and enhanced grassed swales are selected as the secondary measure for providing water quality enhancement of storm runoff for Highway 7. Conventional grassed swales are flat bottom earthen conveyance systems in which pollutants are removed from urban storm water by filtration through grass and infiltration through soil, whereas, enhanced grassed swales utilize check dams and wide depressions to increase runoff storage and promote greater settling of pollutants. Although a typical highway grassed V-ditch may be adequate at some locations, based on the results in the final design, it may be possible to provide enhanced swales with a minimum bottom width of 1 metre at all locations where wet ponds are not feasible.

6.0 Preliminary Storm Water Management Plan

6.1 Storm Water Management Criteria

The storm water management criteria have been established to provide treatment of runoff, and minimize both erosion and flood risk. A combination of wet ponds and grassed swales will be used to meet the storm water management criteria described below.

Wet Ponds

The proposed design criteria for wet ponds are summarized as follows:

- Water Quality: Provide MOE level one (Enhanced) protection of downstream watercourses for water quality control;
- Erosion Control: Provide erosion control (extended detention) by controlling the greater of 40 m^3/ha or the runoff volume produced by a 25 mm rainfall event;
- Flood Control: Provide flow control to match existing flows, with the exception where runoff outlets to Grand River. The Grand River Conservation Authority does not require peak flow control where runoff outlets to Grand River;
- Minimum permanent pool depth of 0.9 metres;
- Freeboard of 0.3 m;
- Side slopes of 4:1 (H:V) within the active portion of the pond and 3:1 (H:V) above the pond to match existing ground elevations.
- Minimum setback from the pond to the toe of the road 10 m.

Ideally, wet ponds would be designed to treat only runoff from the highway and would not involve redirecting watercourses and having on-line ponds. However, outside of interchanges, this is often difficult to achieve and would result in the placement of many small ponds that would not be cost effective. Thus, wet ponds will be located such that they would treat a large area of highway relative to any external areas and such that the diversion of watercourses would be minimized and would only involve minor watercourses.

Flat-Bottom Grassed Swales

Highway areas conducive to treatment with flat-bottom grassed swales were identified based on the MOE Stormwater Management Practices Planning and Design Manual (MOE Manual-1994) design criteria, summarized as follows:

- Bottom widths not less than 0.75 metres;
- Longitudinal slopes not greater than 1.0 %; and
- Peak flow velocity of the 25 mm (4 hr) rainfall event runoff not greater than 0.5 m/s.

In addition, the velocity generated by the 100-year design storm should not exceed 1.5 m/s, at which point rock protection should be provided to prevent erosion.

For the 25 mm (4 hour) storm the design peak flows were estimated based on upstream drainage area characteristics. These flows were used to estimate the velocities of flow that would occur in grassed swales at the proposed swale locations (highway ditches). Where flat-bottom grassed swales did not meet the MOE water quality control criteria, enhanced ditches were selected to provide additional protection. The proposed enhanced flat bottom grassed swales have bottom widths ranging from 1.0 m to 3.0 m, check dams and wide depressions to increase runoff storage and promote greater settling of pollutants.

6.2 Proposed Storm Water Management Strategy

The primary storm water management strategy consists of directing highway runoff to wet ponds. Thirteen extended detention storm water management wet ponds will be provided including three within the right-of-way and ten outside the right-of-way. An additional pond (Pond 1) may be provided in the Wellington Street interchange, which will be determined in the detailed design phase. Grassed swales are provided for small catchments (less than 5.0 ha) or where grading constraints render a wet pond infeasible.

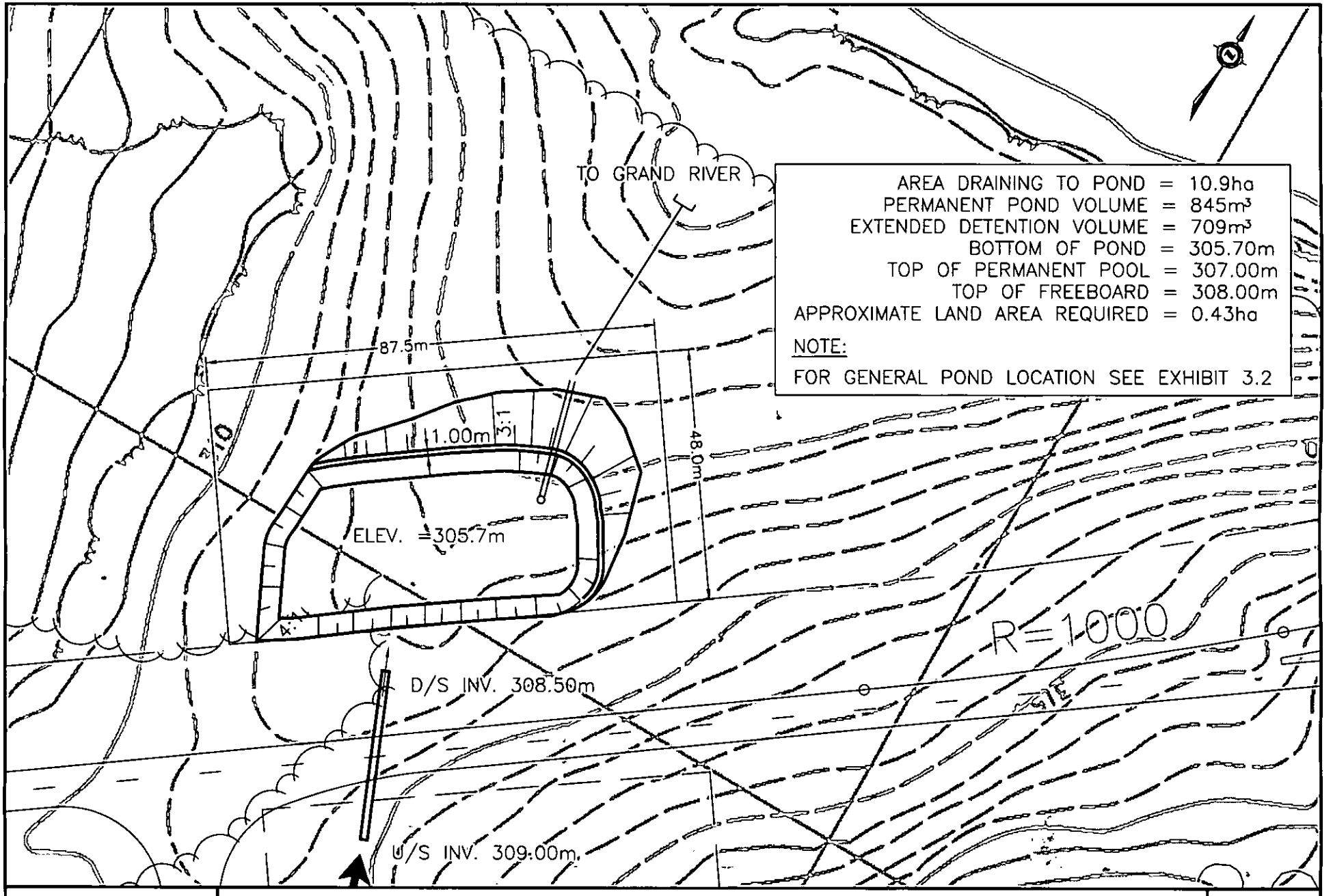
Existing Wellington Street Interchange:

Presently drainage from the Wellington Street Interchange (Subcatchment 10) is facilitated by a trunk sewer extending along the west edge of the southbound lanes. The interchange area drains north-easterly underneath Highway 86 to the Grand River. Opportunities for storm water management at the proposed interchange are limited because of physical constraints and the varied nature of ramp elevations at the interchange. One storm water management option includes grassed swales, which could be incorporated along sections of all the interchange ramps, thus providing a degree of treatment prior to draining to the storm sewer system. The second option includes provision of an extended detention storm water management wet pond in an interchange loop, shown as Pond 1 on Exhibit 3.1. The pond/swale locations will be determined in detailed design. As part of the detailed design the capacity of the trunk sewer should be assessed for an increase in flow resulting from the increased pavement areas within the interchange right-of-way. Options should be evaluated for directing storm water to the storm sewer system.

Proposed Highway:

The proposed storm water management strategy and post-development drainage patterns are demonstrated on Exhibits 3.1 to 3.13. The preliminary design parameters of the proposed Ponds 2 to 14 are presented on Exhibits 4.1 to 4.12, and are summarized in Table 7 (Pond 1 parameters, if the pond option is selected, will be provided in the detailed design phase). Table 8 summarizes the 100 year peak flows for the existing conditions, future uncontrolled conditions and future conditions with storm water detention for each of the proposed ponds.

A typical cross section of an extended detention storm water management wet pond is shown on Exhibit 5. The pond outlet control will consist of ditch inlets for minor flows and weir overflows for major flows. An access road will be provided to each pond, including access to pond inflow and outflow areas for maintenance purposes.



MODIFIED: 04/04/08 08:45:51 DRAWING NAME: K2029-HIGHWAY 7 PROPOSED DRAINAGE_BASE PLAN.DWG

MRC

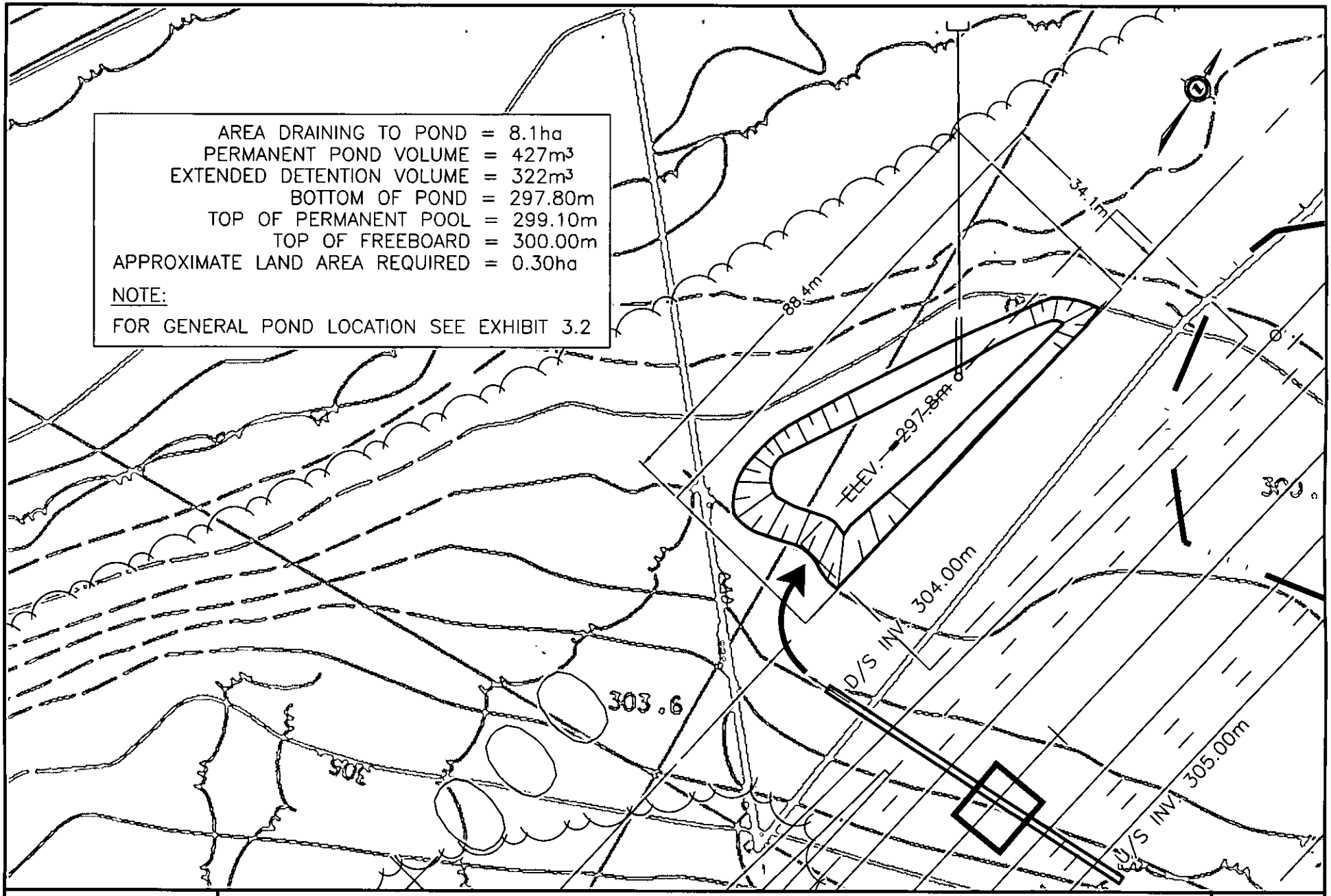
STORM WATER MANAGEMENT FACILITY - WET POND 2

HIGHWAY 7 - KITCHENER TO GUELPH

SCALE 1:1,000

EXHIBIT

4.1



MODIFIED: 04/04/08 08:45:51 DRAWING NAME: K2029-HIGHWAY 7 PROPOSED DRAINAGE_BASE PLAN.DWG

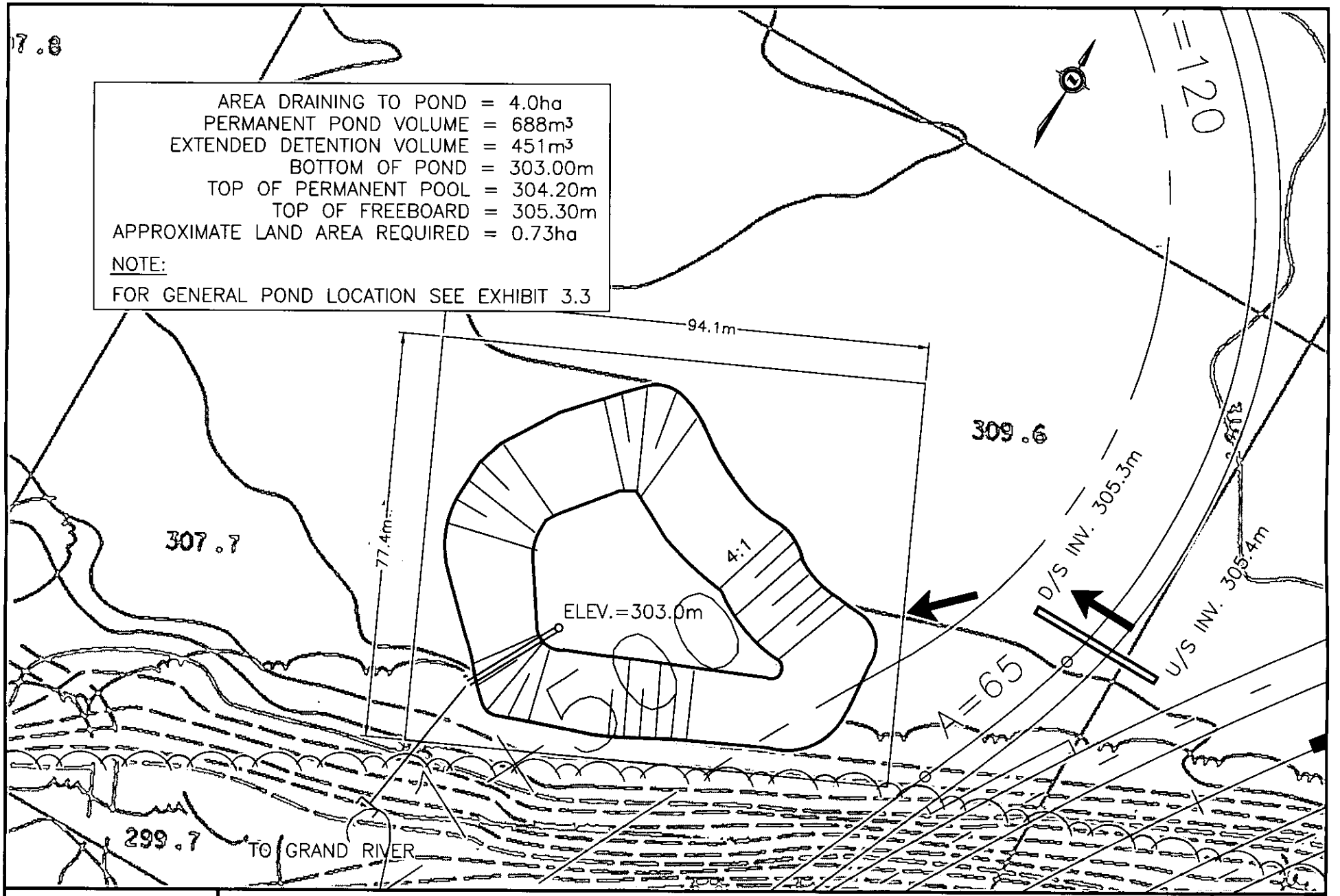
MRC

STORM WATER MANAGEMENT FACILITY - WET POND 3

HIGHWAY 7 - KITCHENER TO GUELPH

SCALE 1:1,000

EXHIBIT 4.2



MODIFIED: 04/04/08 08:45:51 DRAWING NAME: K2029-HIGHWAY 7 PROPOSED DRAINAGE_BASE PLAN.DWG

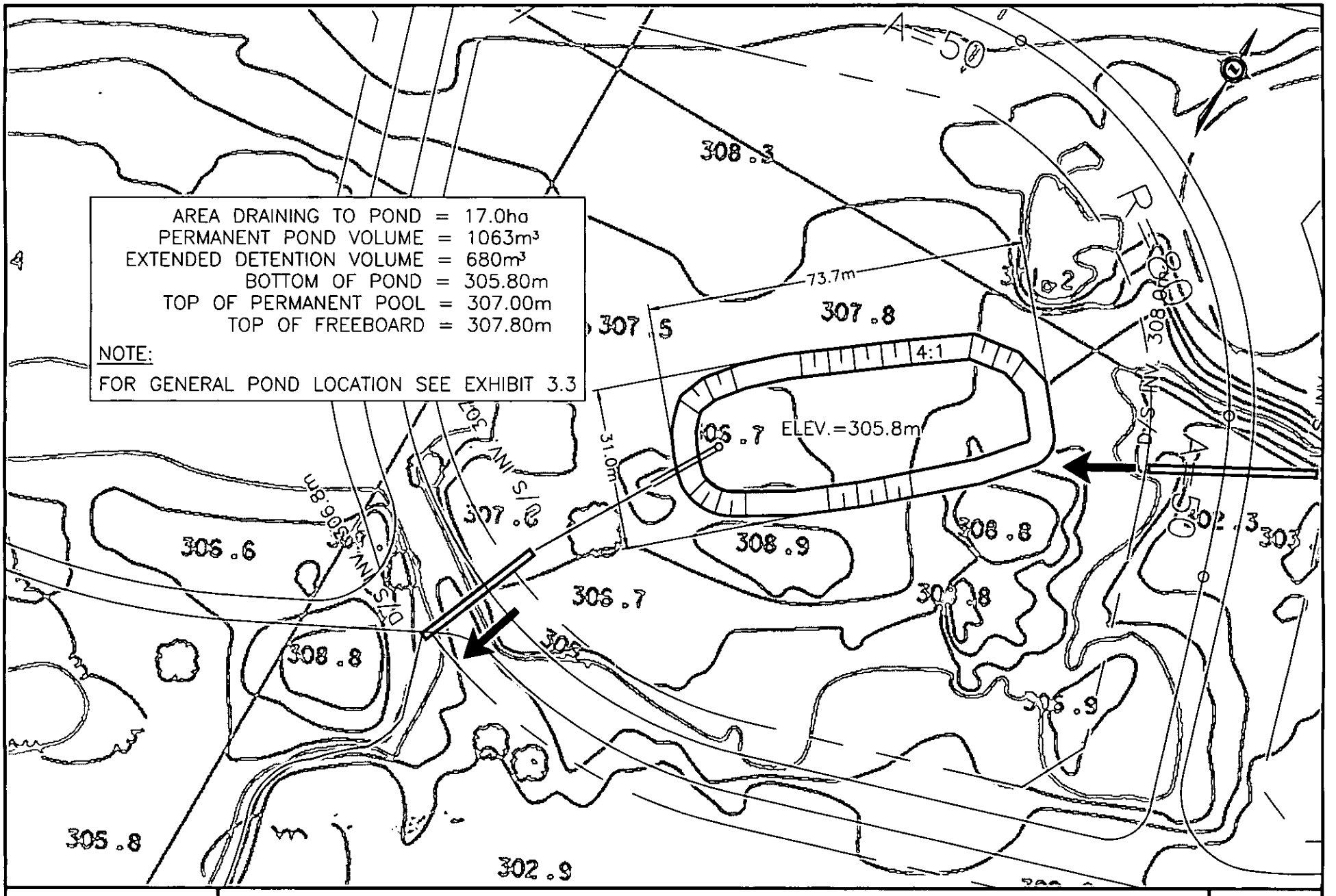
MRC

STORM WATER MANAGEMENT FACILITY - WET POND 4

HIGHWAY 7 - KITCHENER TO GUELPH

SCALE 1:1,000

EXHIBIT 4.3



MODIFIED: 04/04/08 08:45:51 DRAWING NAME: K2029-HIGHWAY 7 PROPOSED DRAINAGE_BASE PLAN.DWG

MRC

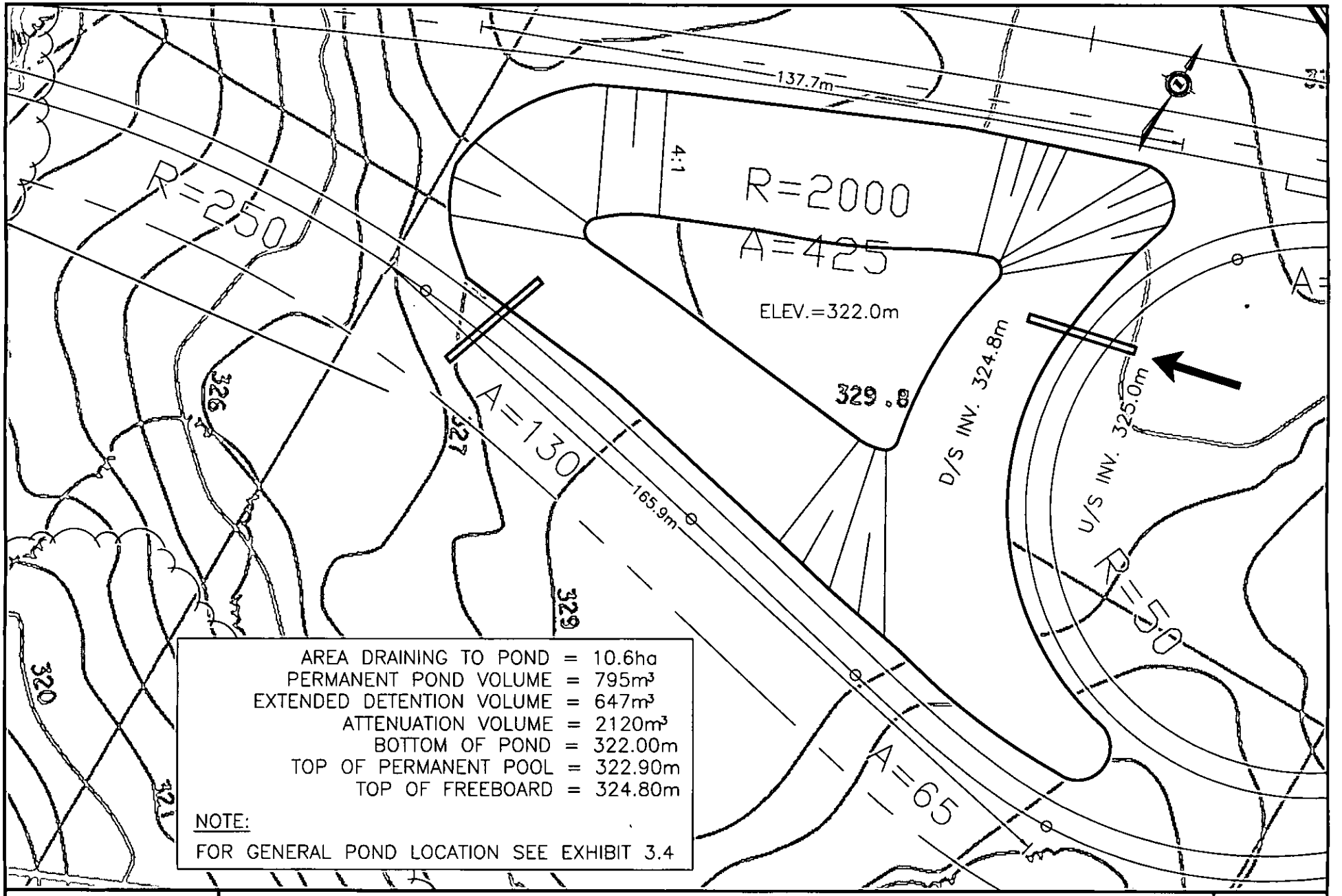
STORM WATER MANAGEMENT FACILITY - WET POND 5

HIGHWAY 7 - KITCHENER TO GUELPH

SCALE 1:1,000

EXHIBIT

4.4



AREA DRAINING TO POND = 10.6ha
PERMANENT POND VOLUME = 795m³
EXTENDED DETENTION VOLUME = 647m³
ATTENUATION VOLUME = 2120m³
BOTTOM OF POND = 322.00m
TOP OF PERMANENT POOL = 322.90m
TOP OF FREEBOARD = 324.80m

NOTE:
FOR GENERAL POND LOCATION SEE EXHIBIT 3.4

MRC

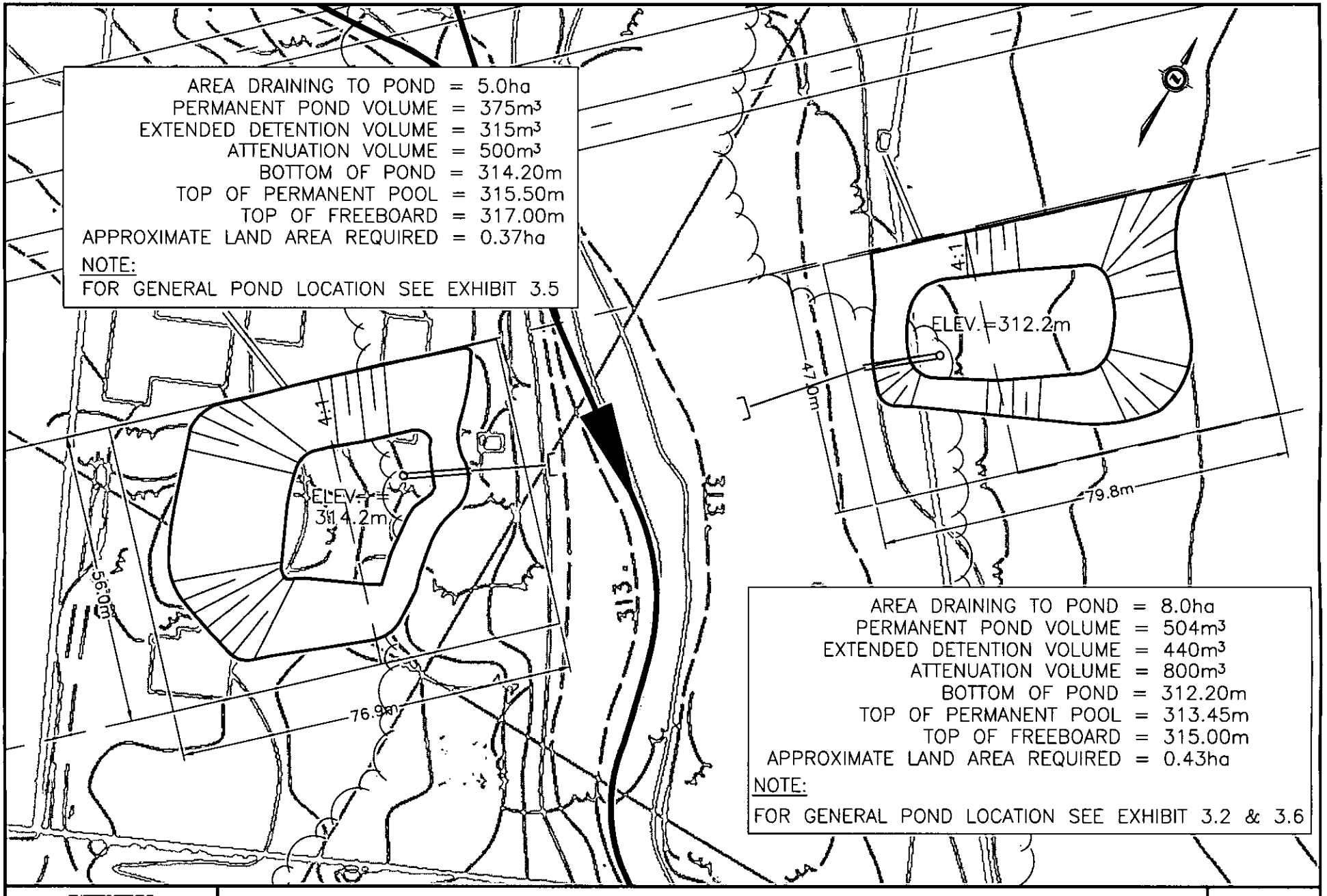
STORM WATER MANAGEMENT FACILITY - WET POND 6

HIGHWAY 7 - KITCHENER TO GUELPH

SCALE 1:1,000

EXHIBIT
4.5

MODIFIED: 04/04/08 08:45:51 DRAWING NAME: K2029-HIGHWAY 7 PROPOSED DRAINAGE_BASE PLAN.DWG



MODIFIED: 04/04/08 08:45:51 DRAWING NAME: K2029-HIGHWAY 7 PROPOSED DRAINAGE_BASE PLAN.DWG

MRC

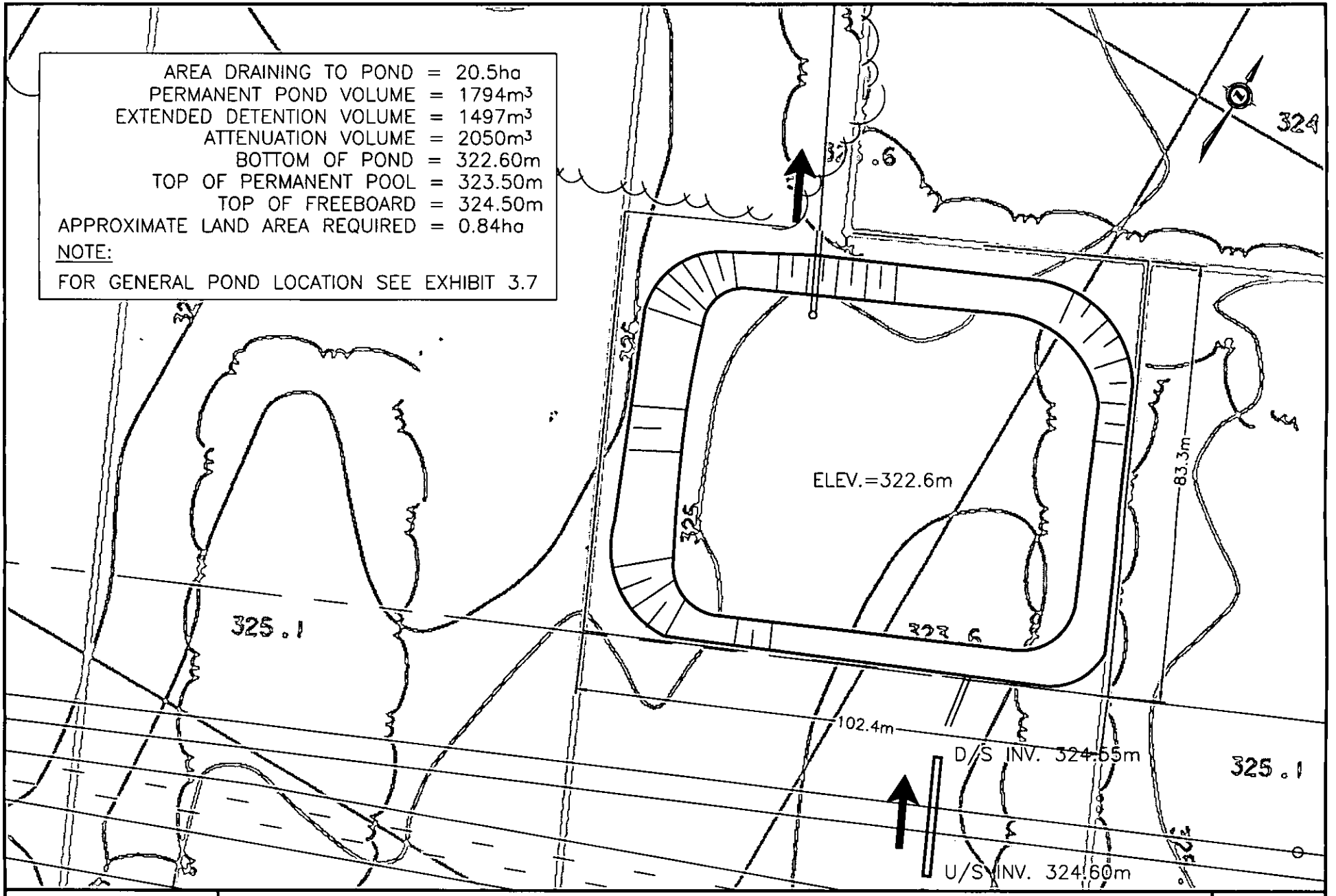
STORM WATER MANAGEMENT FACILITY - WET PONDS 7 AND 8

HIGHWAY 7 - KITCHENER TO GUELPH

SCALE 1:1,000

EXHIBIT

4.6



MODIFIED: 04/04/08 08:45:51 DRAWING NAME: K2029-HIGHWAY 7 PROPOSED DRAINAGE_BASE PLAN.DWG

MRC

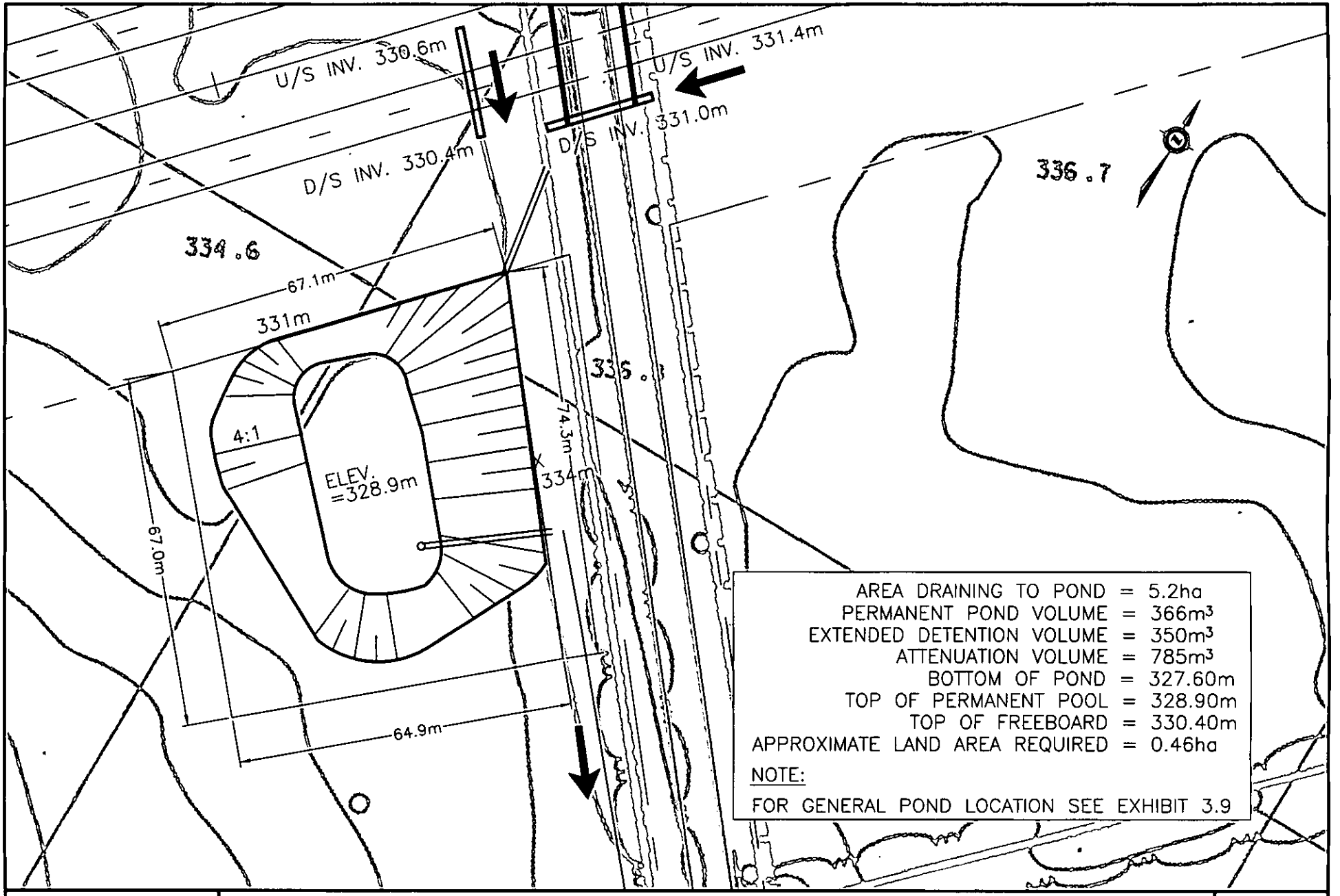
STORM WATER MANAGEMENT FACILITY - WET POND 9

HIGHWAY 7 - KITCHENER TO GUELPH

SCALE 1:1,000

EXHIBIT

4.7



MRC

STORM WATER MANAGEMENT FACILITY - WET POND 10

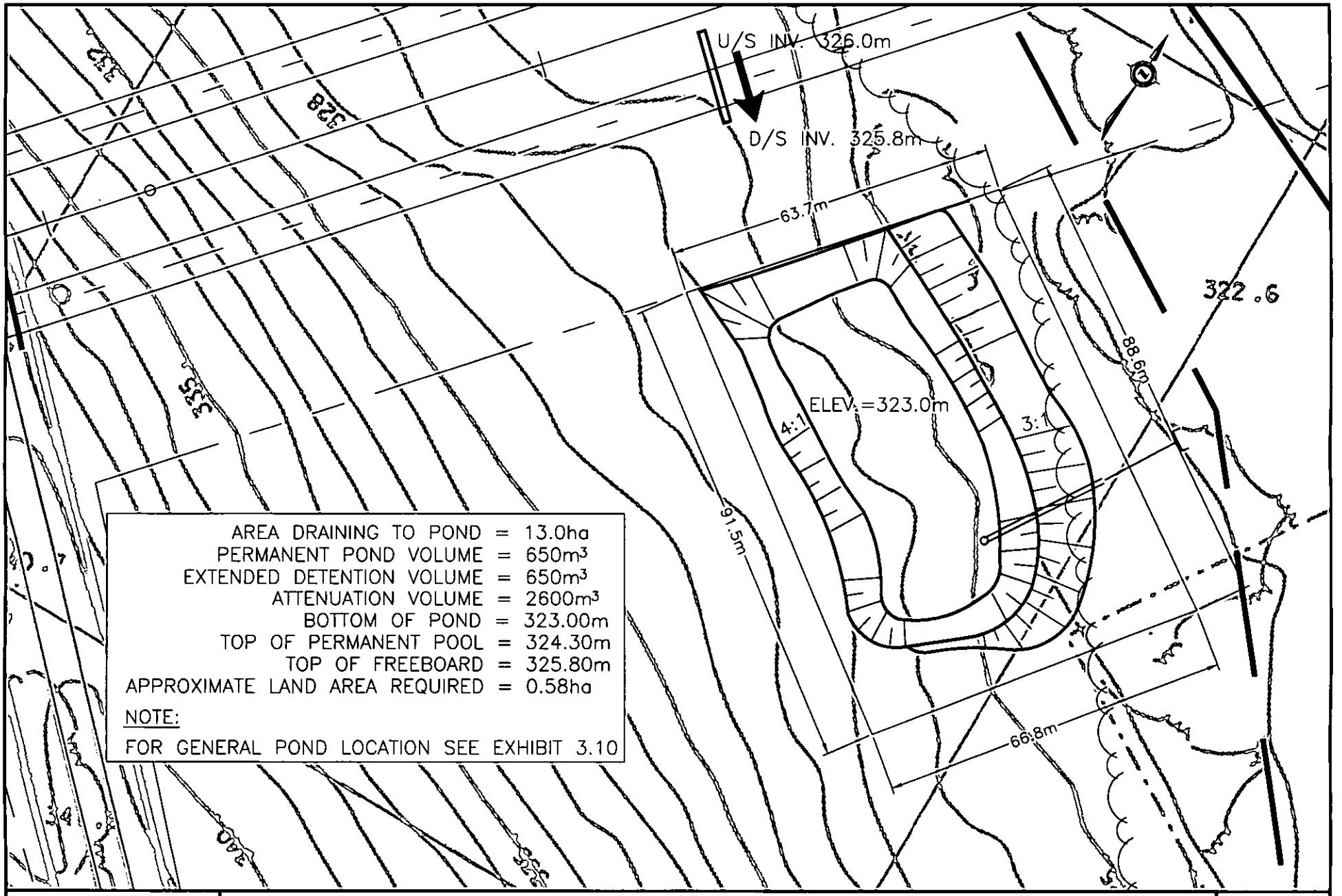
HIGHWAY 7 - KITCHENER TO GUELPH

SCALE 1:1,000

EXHIBIT

4.8

MODIFIED: 04/04/08 08:45:51 DRAWING NAME: K2029-HIGHWAY 7 PROPOSED DRAINAGE_BASE PLAN.DWG



AREA DRAINING TO POND	= 13.0ha
PERMANENT POND VOLUME	= 650m³
EXTENDED DETENTION VOLUME	= 650m³
ATTENUATION VOLUME	= 2600m³
BOTTOM OF POND	= 323.00m
TOP OF PERMANENT POOL	= 324.30m
TOP OF FREEBOARD	= 325.80m
APPROXIMATE LAND AREA REQUIRED	= 0.58ha

NOTE:

FOR GENERAL POND LOCATION SEE EXHIBIT 3.10

MODIFIED: 04/04/08 08:45:51 DRAWING NAME: K2029-HIGHWAY 7 PROPOSED DRAINAGE_BASE PLAN.DWG

MRC

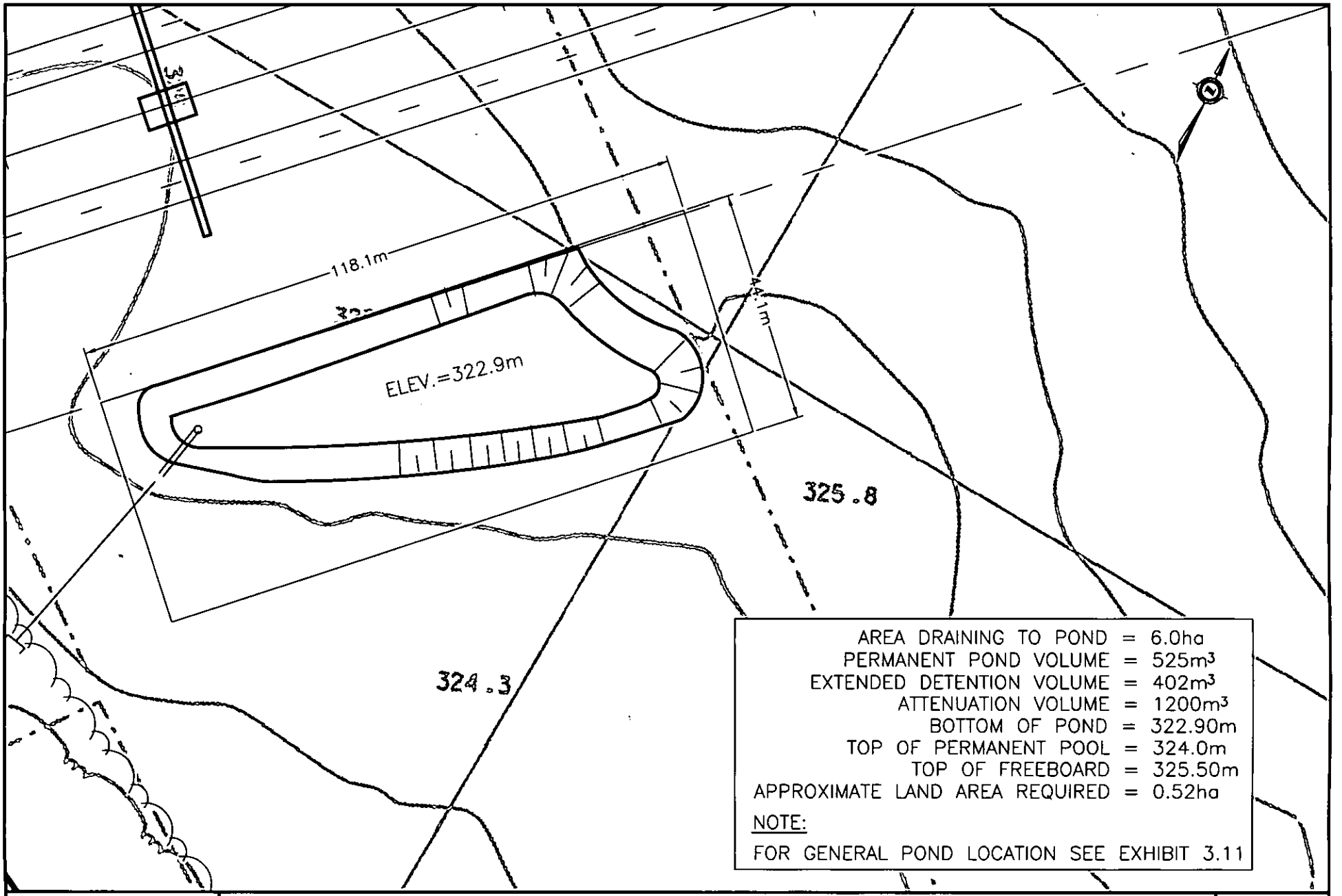
STORM WATER MANAGEMENT FACILITY - WET POND 11

HIGHWAY 7 - KITCHENER TO GUELPH

SCALE 1:1,000

EXHIBIT

4.9



MODIFIED: 04/04/08 08:45:51 DRAWING NAME: K2029-HIGHWAY 7 PROPOSED DRAINAGE_BASE PLAN.DWG

MRC

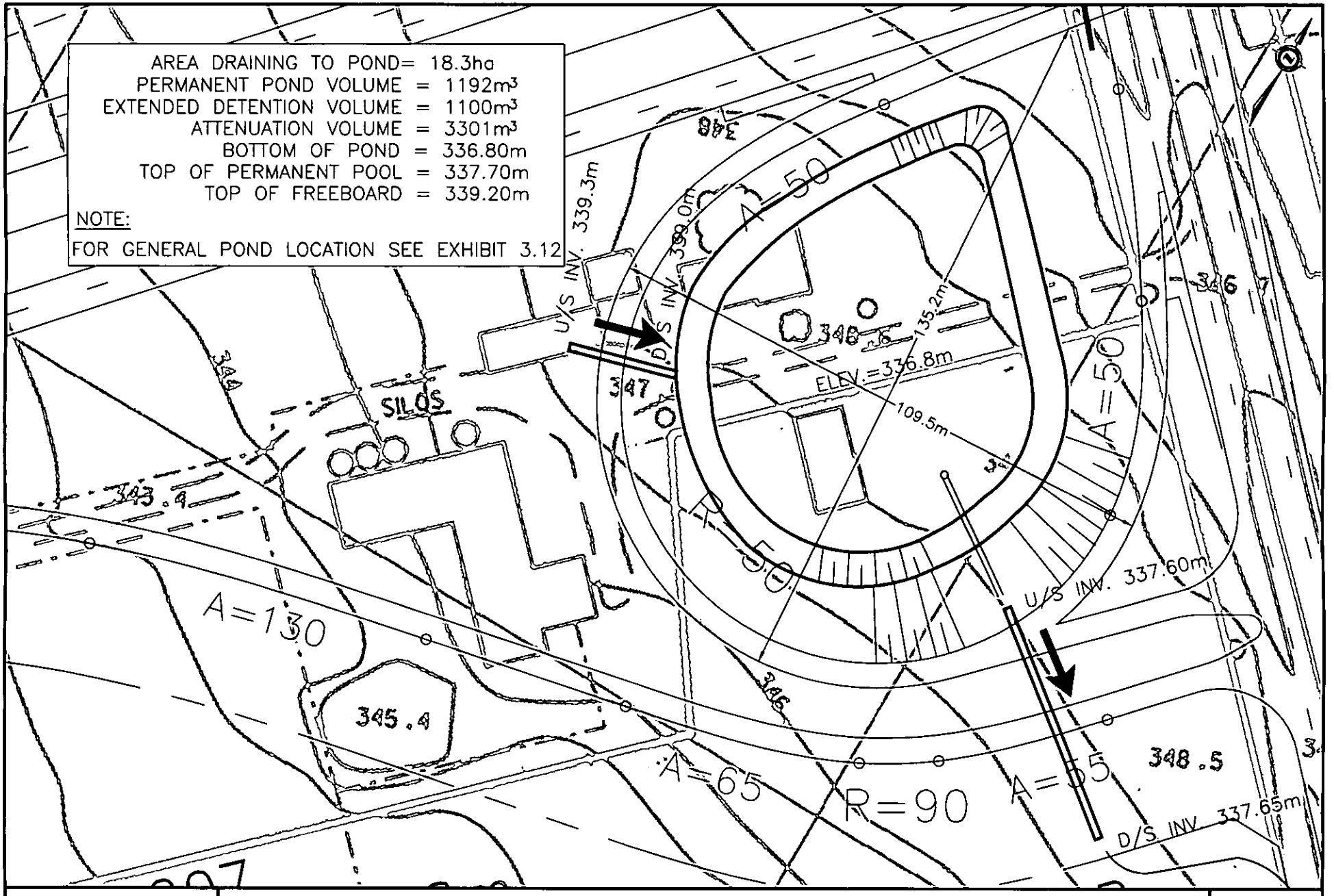
STORM WATER MANAGEMENT FACILITY - WET POND 12

HIGHWAY 7 - KITCHENER TO GUELPH

SCALE 1:1,000

EXHIBIT

4.10



MODIFIED: 04/04/08 08:45:51 DRAWING NAME: K2029-HIGHWAY 7 PROPOSED DRAINAGE_BASE PLAN.DWG

MRC

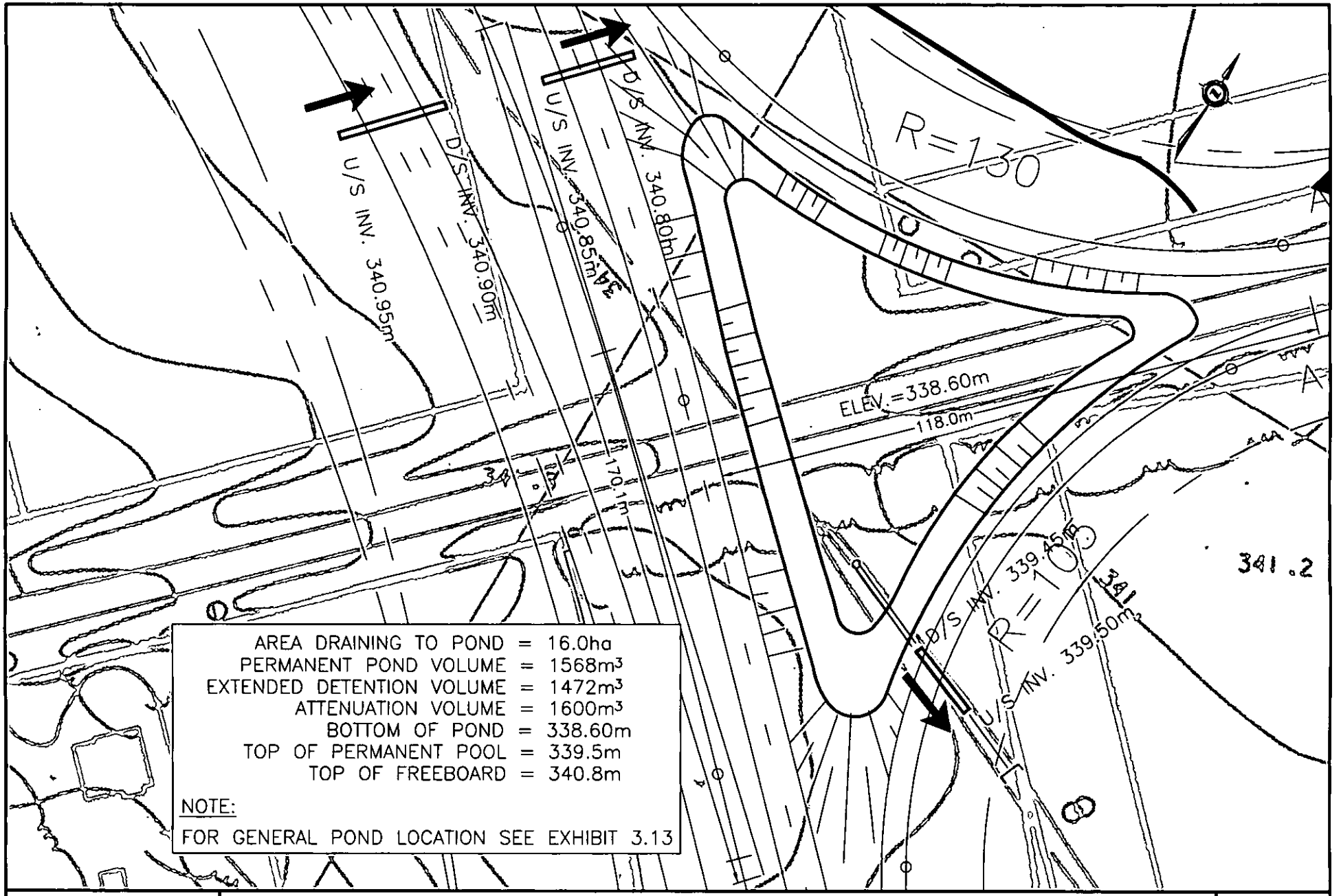
STORM WATER MANAGEMENT FACILITY - WET POND 13

HIGHWAY 7 - KITCHENER TO GUELPH

SCALE 1:1,000

EXHIBIT

4.11



MODIFIED: 04/04/08 08:45:51 DRAWING NAME: K2029-HIGHWAY 7 PROPOSED DRAINAGE_BASE PLAN.DWG

MRC

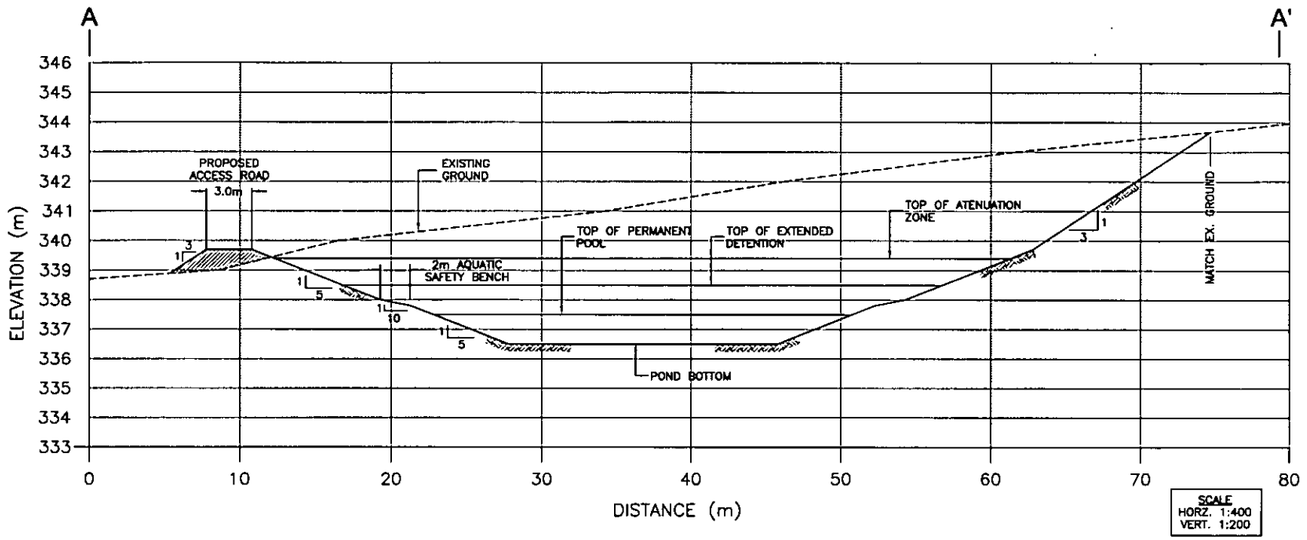
STORM WATER MANAGEMENT FACILITY - WET POND 14

HIGHWAY 7 - KITCHENER TO GUELPH

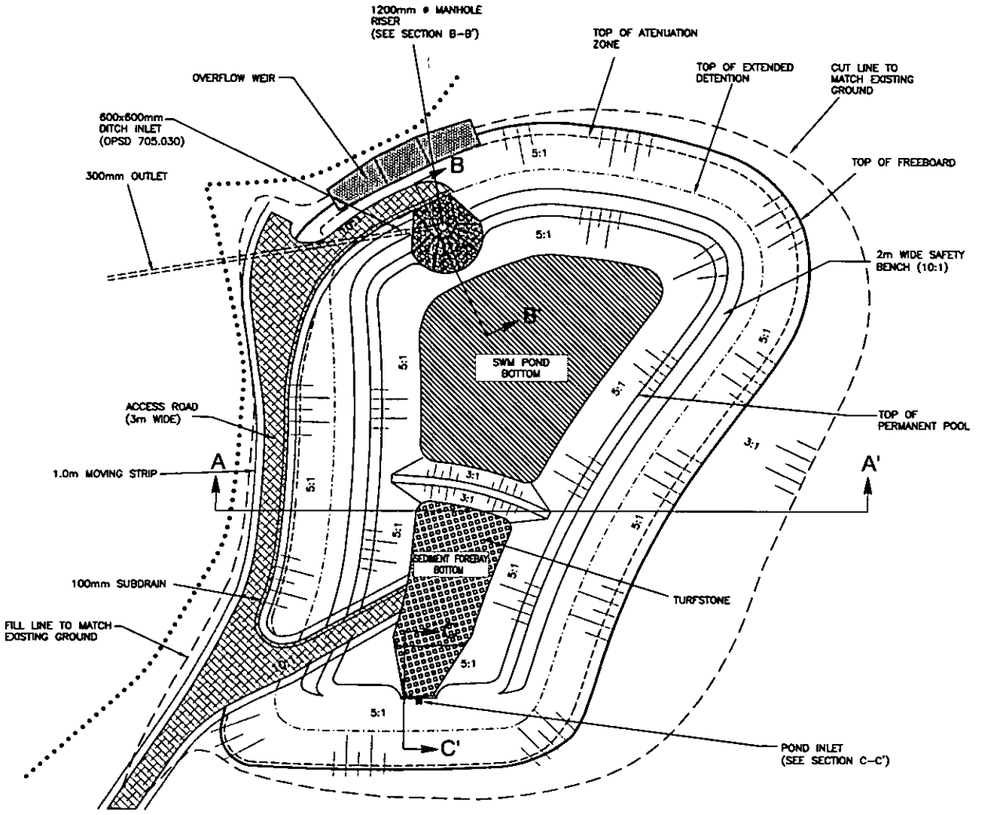
SCALE 1:1,000

EXHIBIT

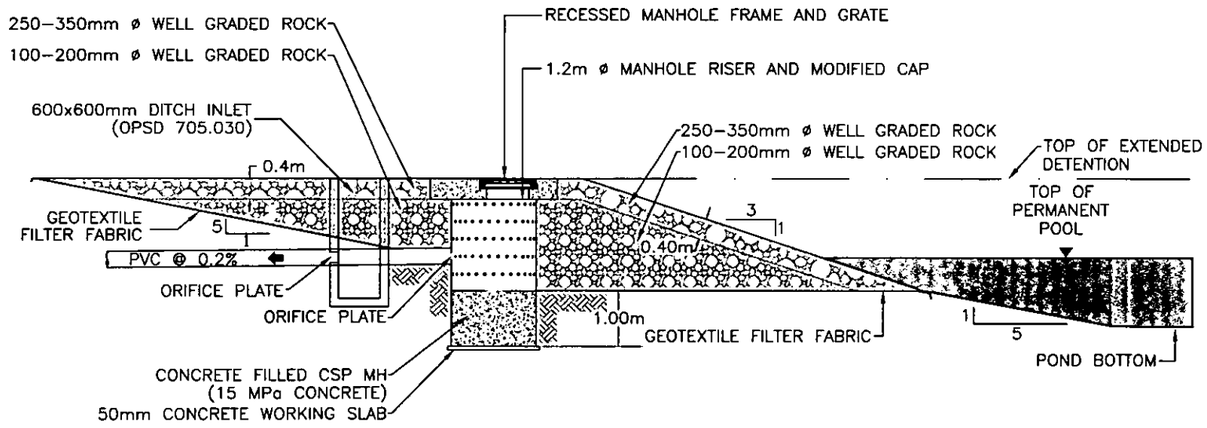
4.12



SECTION A–A' – STORM WATER MANAGEMENT POND SECTION

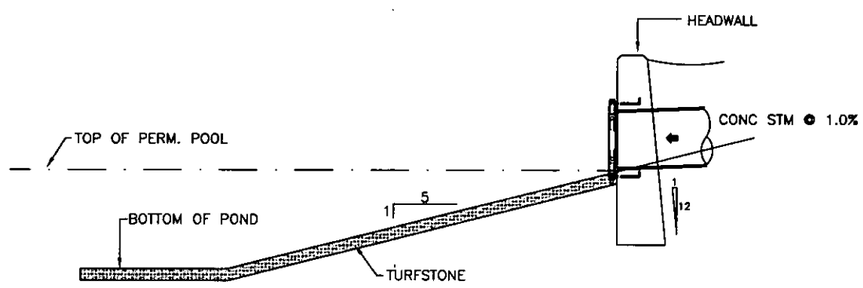


PLAN
N. T. S.



NOTE: A SUFFICIENT LENGTH OF A SMALL DIAMETER PIPE MAY BE USED INSTEAD OF AN ORIFICE PLATE.

SECTION B–B' – OUTLET STRUCTURE DETAIL
N. T. S.



SECTION C–C' – POND INLET
N. T. S.

MODIFIED: 04/04/12 08:31:08 DRAWING NAME: K2029-SWMBASIN.DWG

MRC

TYPICAL EXTENDED DETENTION STORM WATER MANAGEMENT WET POND

HIGHWAY 7 - KITCHENER TO GUELPH

EXHIBIT 5

Table 7
Storm Water Management Facility - Preliminary Characteristics

Storm Water Management Pond #			2	3	4	5	6	7	8	9	10	11	12	13	14
Total Tributary Area (ha)			10.9	8.1	5.5	17.0	10.6	5.0	8	20.5	5.2	13	6	18.3	16
Impervious (%)			26	16	45	20	25	25	25	30	23	15	30	21	34
Type			Wet Pond	Wet Pond	Wet Pond	Wet Pond	Wet Pond	Wet Pond	Wet Pond	Wet Pond	Wet Pond	Wet Pond	Wet Pond	Wet Pond	Wet Pond
Permanent Pool Requirement (m^3/ha) [1]			78	53	125	63	75	75	63	88	70	50	88	65	98
Extended Detention Requirement (m^3/ha) [2]	Water Quality Control (m^3/ha)		40	40	40	40	40	40	40	40	40	40	40	40	40
	Erosion Control [3] (m^3/ha)		65	31	82	36	61	63	55	73	67	50	67	60	92
Depth (m)		Permanent Pool	1.35	1.30	1.20	1.20	0.90	1.32	1.25	0.9	1.3	0.9	1.1	0.9	0.9
		Extended Detention	0.65	0.60	0.80	0.50	0.50	0.41	0.55	0.31	0.46	0.41	0.45	0.34	0.52
		Attenuation	0.00	0.00	0.00	0.00	1.10	0.77	0.70	0.39	0.74	1.19	0.95	0.86	0.48
		Freeboard	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30
		Total	2.30	2.20	2.30	2.00	2.80	2.80	2.80	1.90	2.80	2.80	2.80	2.40	2.20
Storage Volume (m^3)	Permanent Pool	Required	845	427	688	1063	795	375	504	1794	366	650	525	1192	1568
	Extended Detention	Required	709	322	451	680	647	315	440	1497	350	650	402	1100	1472
	Peak Flow Attenuation	Provided	0	0	0	0	2120	500	800	2050	785	2600	1200	3301	1600
	Total		1554	749	1139	1743	3562	1190	1744	5341	1501	3900	2127	5593	4640
Surface Area of Pond (ha)			0.16	0.11	0.15	0.18	0.26	0.15	0.15	0.59	0.15	0.3	0.18	0.42	0.39
Storm Water Management Block Area (ha) [4]			0.43	0.3	0.73	n/a	n/a	0.37	0.43	0.84	0.46	0.58	0.52	n/a	n/a

Notes:

[1] Level one protection based on Table 4.1 of the MOEE Storm Water Management Practices Planning and Design Manual (MOEE Manual-1994).

[2] Greater of water quality control and erosion control volume See Appendix E for calculations details

[3] Based on 25 mm Runoff Volume. See Appendix E for calculations details
Proposed flow control depth above extended detention is 0.5 metres for all ponds
Pond side slope are 4:1 (H:1). Slopes to match existing ground are 3:1 (H:1)

[4] Area represents the total area required for basin including landscaping and pond access plus required area to match existing ground

Note: Characteristics for the potential Pond 1 at the Wellington Street Interchange, if selected, will be provided during detailed design.

Table 8 Comparison of 100 year Peak Flows (m^3/s)

Pond No.	Points of Interest	Existing Condition	Future Condition (Uncontrolled)	Pond Inflow	Pond Outflow	Future Condition (Controlled)
2	A	0.4	1.3	1.3	1.3	1.3
3	B	0.3	0.5	0.5	0.4	0.4
4	C	1	1	0.8	0.4	1.0
5	D	1.1	1.1	1.1	1.0	1.0
6	F	1.9	2	1.3	0.2	1.9
7	H Hopewell Creek	0.4	0.6	0.6	0.2	0.2
8	I Hopewell Creek	0.4	0.8	0.8	0.3	0.3
9	J2	0.5	2.9	0.9	1.3	1.3
10	M	0.4	0.7	0.7	0.5	0.5
11	O Ellis Creek	16	16.1	1.3	0.2	16.3
12				0.8	0.1	
13	P	0.5	2	2.0	0.5	0.5
14	R	2.6	2.7	2.7	1.4	2.4

The following is a brief description of the proposed Ponds 2 to 14:

- Pond 2 is located north of Riverbend Drive on a rolling landscape. Its drainage area includes Highway 7 alignment from Sta. 20+000 to 20+460 and an area extending from south of Shirley Avenue to north of Riverbend Drive. The pond outlets in a northerly direction to Grand River.

- Pond 3 is located southwest of the Grand River structure and outlets to Grand River. Its drainage area includes the Shirley Avenue East Ramp, East Riverbend Drive Ramp and the section of the highway including the highway median from Sta. 20+460 to 21+020. Runoff in the south ditch and the median will be intercepted and directed northerly across the highway in Culvert 32.

- Pond 4 is located northwest of the Grand River structure and outlets to Grand River. The tributary area includes the Grand River Structure and extends to Sta. 22+220 at the proposed Highway 7. The highway runoff will be intercepted by roadside ditches and directed to Pond 4. Runoff from the Grand River structure will discharge northerly into a ditch for a short section before outletting to the pond.

- Pond 5 is located within the Bridge Street West Ramp and outlets to Grand River through an existing natural drain. The pond drainage area includes the section of proposed Highway 7 from Sta. 22+220 to a high point in the profile at Sta. 23+700 and the area south of the Highway 7 within the Bridge Street Ramp and the proposed side road. The natural drainage within the right-of-way from Subcatchments 70 and 80 will be directed by double ditching to a stream crossing at Sta. 22+800, which outlets southerly to the Grand River. The contributing north side road ditches are linked through culverts directing flow towards the highway median. An option of replacing Culverts 71, 72 and 73 with ditch inlets should be considered as part of detailed design.

- Pond 6 is located within the southwest quadrant of the Regional Road 17 Interchange. The pond drainage area includes the northeast and southwest quadrants of the interchange, the highway median from Sta. 23+700 to Sta. 25+000 and the runoff from the outside ditches from Sta. 25+820 to Sta. 25+000. Within the right-of-way the runoff will generally flow from the east and the west to a sag in the alignment at Sta. 24+250. Drainage from ramps on either side of the right-of-way will be linked with culverts to convey runoff to the pond. Pond 6 will outlet to a tributary of Grand River downstream of Culvert 120.

- Pond 7 is located on west side of Hopewell Creek south of Highway 7. The tributary area draining to the east extends from a high point on profile at Sta. 25+000 to the Hopewell Creek structure. Runoff from the north side ditch will be conveyed southerly through a culvert. An option of replacing culvert with a ditch inlet should be considered as part of detailed design.

- Pond 8 is located on the east side of Hopewell Creek south of Highway 7. The pond drainage area extends from the Hopewell Creek structure to a high point on profile at

Sta. 27+080. Runoff from the north side ditch will be conveyed southerly through a culvert. An option of replacing the culvert with a ditch inlet should be considered as part of detailed design.

- Pond 9 is located northwest of the Regional Road 30 Interchange. This pond will not provide enough flow control to match the existing flow rates. The pond attenuation depth is restricted to 0.39 m due to constraints imposed by the proposed highway alignment and elevation at the pond outlet. This pond will treat runoff from the interchange and the section of highway median between two high points at Sta. 27+080 and Sta. 29+720. Highway runoff from roadside ditches between Sta. 28+820 and Sta. 29+720 will be directed towards the median through ditch inlets. Natural drainage to the north from an area southwest of the interchange will be directed by double ditching along the south side of the alignment to a stream crossing at Sta. 27+620. The stream flows northerly towards Hopewell Creek. Grassed swales outletting to the stream will be provided on both sides of the highway between Sta. 27+000 and the Regional Road 30.

- Pond 10 is located southwest of the proposed Townline Road overpass and outlets to an existing culvert crossing under the existing Highway 7. The pond drainage area includes the highway from Sta. 30+500 to 31+300. The highway runoff would be intercepted by roadside ditches and directed towards the basin via culverts.

- Pond 11 is located west of the Ellis Creek structure on the south side of proposed Highway 7 alignment. The area draining to the pond includes a rural subcatchment of approximately 6.3 ha and a section of highway extending from a high point on profile at Sta. 32+400 to the Ellis Creek structure.

- Pond 12 is located east of the Ellis Creek structure on the south side of the proposed Highway 7 alignment. This pond will treat runoff from a section of a highway between Ellis Creek structure and a high point on profile at Sta. 34+400.

- Pond 13 is located within the southwest quadrant of the County Road 86 Interchange. The drainage area of the pond includes the interchange and a section of highway from Sta. 34+400 to Sta. 35+780. This pond will outlet to a roadside ditch located approximately 350 m south of the interchange. Within the right-of-way the runoff will generally flow from the east and the west to a sag in the alignment at Sta. 35+650. Drainage from the ramps on either side of the right-of-way will be linked with culverts to convey runoff to the pond.

- Pond 14 is located within the Silvercreek Parkway Interchange. The area draining to the pond includes an urban subcatchment west of the interchange and a section of the proposed highway alignment extending from Sta. 36+600 to the existing Highway 7/Woodlawn Road. The pond will discharge to the existing drainage ditch. Within the right-of-way, runoff will generally flow from the north and the south to a sag in the alignment at Sta. 37+300. The natural drainage in the area is to the south. An excavated drainage ditch flowing parallel to the Silvercreek Parkway will be intercepted by a double ditch and conveyed across the ramps through Culvert 304.

Flat bottom grassed swales will treat the highway runoff generated in catchments less than 5.0 ha where a wet pond is not feasible, or where the runoff cannot be directed towards the basin. Peak flows for the 25 mm design storm were used to estimate the flow velocity that would occur in the proposed grassed swales. Enhanced flat bottom grassed swales will be used to provide additional protection in areas where the highway runoff is not conducive to treatment with grassed swales (i.e. where ditch slopes are too steep and standard flat bottom grassed swales do not meet the MOE design). Table E-1 in Appendix E provides a summary of calculations for the proposed grassed swales. The locations and types of the proposed grassed swales are illustrated on Exhibits 3.2 to 3.13, and summarized in Table 9. The identified swales will have 1.0 m bottom width and maximum 3:1 side slopes.

Table 9 Grassed Swales Locations and Types

Location	Types	
	One metre Flat Bottom Grassed Swales	Enhanced Grassed Swales
22+600 - 22+900 WBL [1]	Y	
22+700 - 22+900 EBL [2]	Y	
23+700 - 24+000 WBL		Y
24+000 - 24+200 WBL	Y	
23+700 - 23+950 EBL		Y
W-N/S, E-N/S Ramps (RR 17 Interchange)		Y
24+700 - 24+800 WBL	Y	
24+500 - 24+800 EBL	Y	
27+080 - 27+920 WBL	Y	
27+080 - 28+450 EBL	Y	
E-N/S, N/S-E, W-N/S Ramps (RR 30 Interchange)		Y
29+720 - 30+100 WBL		Y
30+100 - 30+500 WBL	Y	
29+720 - 30+100 EBL		Y
30+100 - 30+500 EBL	Y	
29+720 - 30+100 Median		Y
30+100 - 30+500 Median	Y	
31+300 - 32+380 WBL		Y
31+300 - 32+380 EBL		Y
31+300 - 32+380 Median		Y
S-W, N-E Ramps (County Rd. 86 Interchange)		Y
35+780 - 36+600 WBL		Y
35+780 - 36+600 EBL		Y
35+780 - 36+600 Median		Y

Notes:

1. WBL = West Bound Lane
2. EBL = East Bound Lane
3. "Y" indicates the type of the proposed grassed swale .

6.3 Effectiveness of the Recommended Plan

The total length of the proposed Highway 7 is 17.5 km. Approximately 84 percent of the runoff generated by the highway will be directed to one of the proposed extended detention storm water management wet ponds designed to meet MOE level one (Enhanced) protection requirements and reduce the downstream erosion and flood potential. The remaining 16 percent of runoff will be conveyed and treated by flat-bottomed grassed swales, also designed to meet the MOE treatment objectives.

All of the proposed wet ponds will meet the water quality and erosion objectives, and all, but Pond 9 will meet the peak flows objectives. The 100 year peak flow from Pond 9 will be 1.3 m^3/s compared to an existing peak flow rate of 0.5 m^3/s. The increase in pond outflow was considered acceptable given that its discharge will be attenuated by the wetland (Hopewell Creek Riparian Woodland/Wetland) prior to the runoff being conveyed to the Tillich Drain north of the highway.

For Ponds 11 and 12, the times to peak of the highway runoff hydrographs for the controlled condition (with SWM ponds) are delayed due to pond routing. As a result of routing, discharge hydrographs for the two ponds have times to peak close to the time of peak of the Ellis Creek hydrograph upstream of the ponds (peak flow 16.0 m^3/s). By adding the routed highway and creek hydrographs, the overall creek discharge downstream of the ponds is 16.3 m^3/s or 0.3 m^3/s higher than the 100 year creek flow upstream of the ponds.

Although the peak flow for the uncontrolled highway runoff is higher than the peak flow for the controlled condition, the peak for uncontrolled condition occurs significantly earlier than the peak flow of the Ellis Creek hydrograph upstream of the ponds. By adding the uncontrolled highway runoff and creek hydrographs the overall increase in the 100 year creek flow downstream of the ponds is only 0.1 m^3/s.

With reference to the storm water management objectives specified in Section 1.4 the proposed, Preliminary Drainage and Storm Water Management Plan:

1. Provides an effective/efficient drainage system;
2. Minimizes risk to public safety;
3. Maintains flow paths for upstream lands;
4. Maximizes the area of paved surfaces draining to storm water management measures;
5. Protects or enhances the quality of storm runoff;
6. Minimizes potential for erosion in the receiving ditches and watercourses;
7. Minimizes flood risk for lands adjacent to and downstream of the highway; and
8. Maintains outlet locations from the highway right-of-way.

7.0 Summary of Findings and Recommendations

1. Bridge structures are proposed for the crossings of the Grand River, Hopewell Creek, and Ellis Creek. A preliminary hydraulic analysis was carried out in this study for the Grand River and the Hopewell Creek bridges and its results are summarized in

Appendix A. The results of the preliminary analysis reveal that the proposed 460 m span Grand River bridge will satisfy all performance criteria. The proposed 12 m span Hopewell Creek bridge will satisfy most of the performance criteria and will be subject to approval by the Grand River Conservation Authority. A detailed hydraulic analysis for the above three structures should be conducted during detailed design.

2. A total of 11 transverse culverts are proposed under the proposed Highway 7 alignment. This total excludes local culverts required to convey highway runoff along or under the highway.

3. The minimum culvert size has been set to a 1.2 meters diameter.

4. All culverts will convey the 50 years peak flow with a headwater depth-to-culvert diameter ratio (H/D) of not more than 1.2.

5. All culverts will convey the 100 year flow with a minimum freeboard of 1.0 meter. This exceeds the requirements of Directive B-100 that stipulates that a culvert must convey the 50 year peak flow with a minimum freeboard of 1.0 meter.

6. Where the catchment area exceeds 125 ha, culverts have been sized as follows:
    a. Culverts 80 and 180 will convey the Regional Storm peak flow without overtopping the highway.
    b. The proposed highway at Culvert 250 will be overtopped during the Regional Storm, although no overtopping will occur if the culvert size is increased from 1500 mm diameter to 1800 mm rise x 3000 mm span. For the 1500 mm culvert approximately 5.2 m^3/s would spilled over the highway during the Regional Storm.

7. Culverts 120, 150, 170 and 250 will be designed to include wildlife passage and as such, should be box culverts with a minimum of 1800 mm rise x 3000 mm span. The final size will be determined as part of the detailed design of the highway.

8. Culverts 80, 120, 150, 180 and 250 will be designed to include fish passage, and as such should be box culverts with a minimum size of 1800x3000 mm. The final size will be determined as part of the detailed design of the highway.

9. The proposed extended detention storm water management wet ponds will treat 84 percent of the runoff generated by the proposed highway. The remaining 16 percent of the runoff will be treated by grassed swales, designed in accordance with MOE requirements.

10. The storm water management criteria for the proposed ponds are as follows:
    a. Water quality treatment as required to meet MOE level one (Enhanced) objectives.
    b. Erosion control through the provision of extended detention design to capture all runoff generated by a 25 mm design storm.

c. Peak flow control not required for ponds or watercourses discharging to the Grand River.
d. Peak flows for all events up to the 100 year design storm to be controlled to existing condition flows.

11. With the exception of Pond 9, all storm water management ponds will meet the design criteria.

12. The 100 year peak flow from Pond 9 will be 1.3 m^3/s compared to an existing peak flow of 0.5 m^3/s. The increase is considered acceptable given that the discharge will be attenuated by the receiving wetland (Hopewell Creek Riparian Woodland/Wetland) prior to the runoff being conveyed to the Tillich Drain north of the highway.

APPENDIX A

Grand River and Hopewell Creek Preliminary Bridge Hydraulic Analysis

HYDRAULICS TECHNICAL MEMORANDUM

To: Mr. Martin Scott
McCormick Rankin Corporation

File: 2029/3

From: Jeff Schroeder

Date: April 8, 2004

RE: New Highway 7 crossing of the Grand River

1.0 INTRODUCTION

1.1 Study Purpose

The proposed Highway 7 alignment between Kitchener and Guelph crosses the Grand River between Victoria Street and Bridgeport. See Exhibit A1.

This Hydraulics Technical Memo outlines the required performance standards for the proposed bridge, documents the design flows, and details the development of the hydraulic model used to evaluate the hydraulic performance of the proposed bridge structure.

1.2 Proposed Structure

The dimensions of the proposed structure should be large enough to minimize the upstream impact of flood elevations and meet generally accepted design practices. It is proposed to build a 460 metre multi-span structure with 9 piers across the Grand River.

1.3 Study Scope

This Hydraulics Technical Memo includes the following:

- Identification of design flows during 2-year, 5-year, 10-year, 20-year, 50-year, 100-year and Regulatory (Regional) rainfall events;
- Development of a hydraulic model for calculating existing and future water surface elevations;
- A presentation of design requirements for the proposed structure based on generally accepted hydraulic performance standards;
- A review of the impacts of the new structure on flood elevations.

2.0 PERFORMANCE STANDARDS

The following performance standards have been used to ensure the proposed structure satisfies standard design practices:

- The design storm used to calculate flood elevations;
- The freeboard between the design flood elevation and the top of road;
- The freeboard between the design flood elevation and the bridge soffit;
- The design storm which must be conveyed without flooding the roadway;
- The allowable increase in the flood elevation upstream of the structure.

Each of these is discussed in the following sections.

2.1 Design Storms

In accordance with standard design practices, a structure beneath a highway/freeway and a span greater than 6.0m should be designed to convey the 100-year design flow. Therefore the structure should be able to convey the flow generated during a 100-year storm with the required freeboard (Section 2.2). In addition where flooding is of concern there should be minimal increase in the Regional Flood elevation.

2.2 Top of Road Freeboard

Section 1.10.8.2 of the *Canadian Highway Bridge Design Code* recommends a freeboard of 1.0m *"... from the edge of through traffic lanes to the design high-water level"* for the design storm (100-year storm).

2.3 Soffit Freeboard

Section 1.10.7.1 of the *Canadian Highway Bridge Design Code* recommends a soffit clearance of 1.0m.

2.4 Upstream Flooding

Based on the best available mapping there are several buildings located upstream of the proposed structure that are potentially within the Regional Floodplain. In accordance with good design practice there should be a minimal increase in flood elevations for a full range of design storms.

Ministry of Transportation Directive B-100 also provides for increasing the design storm to the Regulatory event where any structure *" ...would increase the flooding of buildings or developable land during a regional flood."* Given that there are several buildings upstream of the proposed structure the increase in the Regional Flood elevation should be kept to less than 0.1 metres upstream of the new structure.

3.0 DESIGN FLOWS

3.1 Design Storms

Peak flows for the 2-year, 5-year, 10-year, 20-year, 50-year, 100-year and Regional Storms were included in the HEC-2 file H2GSC.DAT provided by the Grand River Conservation Authority (GRCA). Table 1 summarizes the peak flows.

Table 1
Summary of Peak Flows (m^3/s)

2yr	5yr	10yr	20yr	50yr	100yr	Regional Storm
696.6	1050.6	1200.6	1489.5	1679.2	1840.6	1996.3

4.0 HYDRAULIC MODELLING

4.1 Model Setup

The HEC-2 model provided by the GRCA has been used as a base for the Bridge Structure hydraulic analysis. The New Highway 7 crossing of the Grand River portion was extracted from the original HEC-2 model and converted into HEC-RAS. The original HEC-2 model used imperial units and was converted to metric within HEC-RAS for this analysis. Existing and future conditions models were then created to calculate flood elevations.

4.2 Modelling Results

Table 2 summarizes the existing and future flood elevations.

Table 2 - Flood Elevation Comparison

Description	Section Number	100 Year Storm			Regional Storm		
		Existing	Proposed 460m Span	Increase	Existing	Proposed 460m Span	Increase
2378m d/s	110	300.71	300.71	0.00	301.09	301.09	0.00
1598m d/s	111	301.04	301.04	0.00	301.39	301.39	0.00
745m d/s	112	301.66	301.66	0.00	301.99	301.99	0.00
New Hwy 7 d/s face	112.5	301.94	301.94	0.00	302.26	302.26	0.00
New Hwy 7 u/s face	112.6	301.96	301.96	0.00	302.28	302.28	0.00
335m u/s	113	302.04	302.04	0.00	302.35	302.36	0.01
1523m u/s	114	302.58	302.58	0.00	302.84	302.84	0.00
1827m u/s	115	302.66	302.66	0.00	302.90	302.90	0.00
2147m u/s	116	302.75	302.76	0.01	302.97	302.98	0.01

The following are observations from the HEC-RAS calculations:

- The results indicate that all design storm elevations will have minimal increase upstream of the structure.

- The upstream 100-year flood elevation is 5.04 metres below the top of road elevation of 307.00 metres and 4.34 metres below the upstream soffit elevation of 306.3 metres.

- During the Regional Storm the future flood elevation will not increase upstream of the New Highway 7 Structure. Therefore the new structure will not increase the flood risk to buildings upstream of the structure.

5.0 SUMMARY OF FINDINGS

Key findings are as follows.

i) The 100-year design storm of 1840.6 m^3/s was used to check if the proposed structure on the Grand River meets standard design practices.

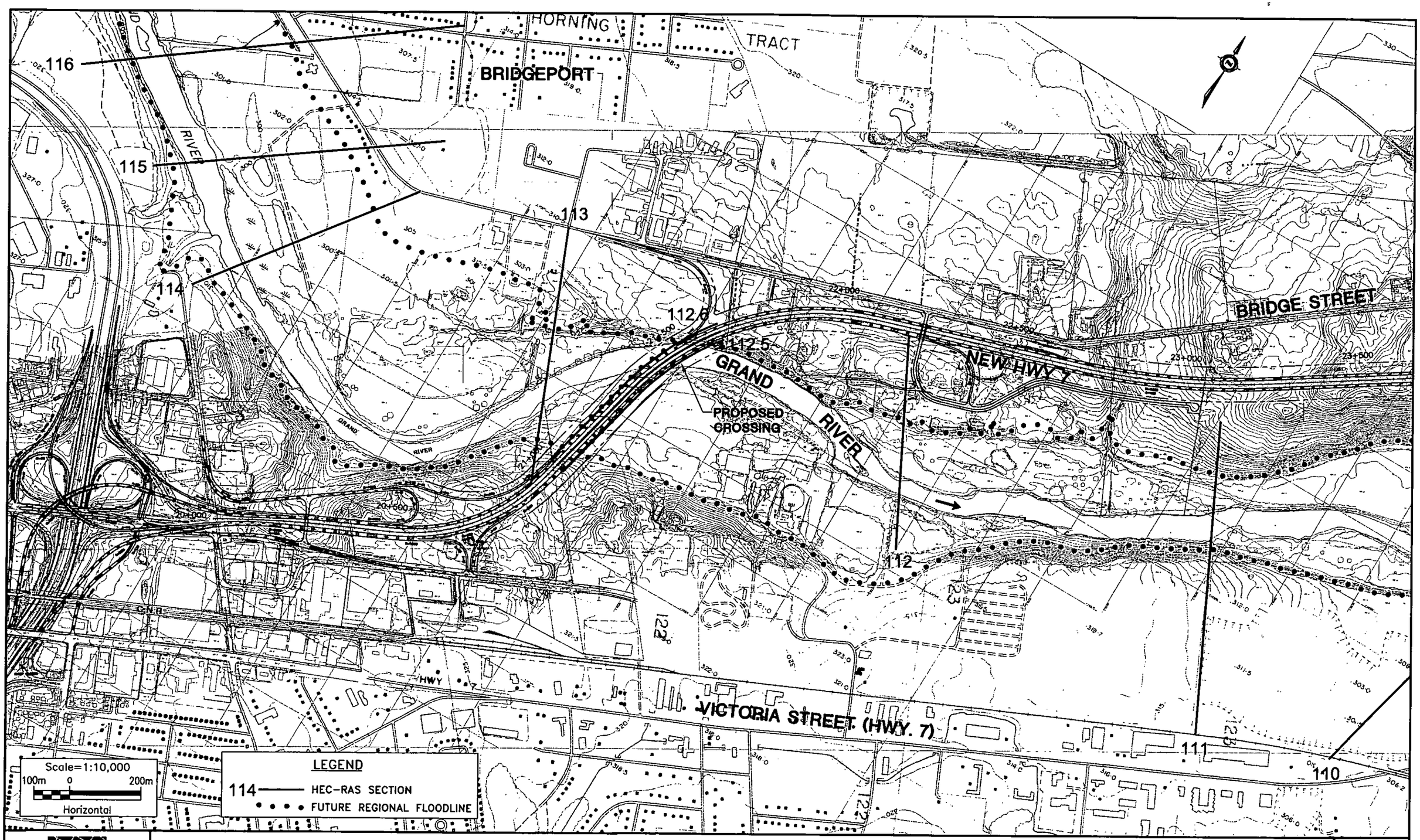
ii) The upstream 100-year flood elevation is 5.04 metres below the top of road elevation of 307.00 metres and 4.34 metres below the upstream soffit elevation of 306.3 metres. This meets the performance standards outlined in Sections 2.2 and 2.3.

iii) There will be no increase in flooding upstream of the proposed Highway 7 structure for all storms. The structure will have a capacity of the Regional Storm, therefore the structure will not be overtopped during any storm.

iv) The proposed 460 metre span will satisfy all performance standards outlined in Section 2.0.

All of which is respectfully submitted,
McCormick Rankin Corporation

Jeff Schroeder, C.E.T.



MODIFIED: 04/04/09 10:58:49 DRAWING NAME: K2029-HIGHWAY 7 HYDRAULIC SECTION LOCATIONS.DWG

MRC

GRAND RIVER HEC-RAS SECTION LOCATIONS

HIGHWAY 7 - KITCHENER TO GUELPH

EXHIBIT

A1

HYDRAULICS TECHNICAL MEMORANDUM

To: Mr. Martin Scott **File:** 2029/3
McCormick Rankin Corporation
From: Jeff Schroeder **Date:** April 8, 2004
RE: New Highway 7 crossing of the Hopewell Creek

1.0 INTRODUCTION

1.1 Study Purpose

The proposed Highway 7 alignment between Kitchener and Guelph crosses Hopewell Creek between Woolwich Road 66 and Woolwich Road 72. See Exhibit A2.

This Hydraulics Technical Memo outlines the required performance standards for the proposed bridge, documents the design flows, and details the development of the hydraulic model used to evaluate the hydraulic performance of the proposed bridge structure.

1.2 Proposed Structure

The dimensions of the proposed structure should be large enough to minimize the upstream impact of flood elevations and meet generally accepted design practices. It is proposed to build a 12 metre span structure across Hopewell Creek.

1.3 Study Scope

This Hydraulics Technical Memo includes the following:

- Identification of design flows during 2-year, 5-year, 10-year, 20-year, 50-year, 100-year and Regulatory (Regional) rainfall events;
- Development of a hydraulic model for calculating existing and future water surface elevations;
- A presentation of design requirements for the proposed structure based on generally accepted hydraulic performance standards;
- A review of the impacts of the new structure on flood elevations.

2.0 PERFORMANCE STANDARDS

The following performance standards have been used to ensure the proposed structure satisfies standard design practices:

- The design storm used to calculate flood elevations;
- The freeboard between the design flood elevation and the top of road;
- The freeboard between the design flood elevation and the bridge soffit;
- The design storm which must be conveyed without flooding the roadway;
- The allowable increase in the flood elevation upstream of the structure.

Each of these is discussed in the following sections.

2.1 Design Storms

In accordance with standard design practices, a structure beneath a highway/freeway and a span greater than 6.0m should be designed to convey the 100-year design flow. Therefore the structure should be able to convey the flow generated during a 100-year storm with the required freeboard (Section 2.2). In addition where flooding is of concern there should be minimal increase in the Regional Flood elevation.

2.2 Top of Road Freeboard

Section 1.10.8.2 of the *Canadian Highway Bridge Design Code* recommends a freeboard of 1.0m *"... from the edge of through traffic lanes to the design high-water level"* for the design storm (100-year storm).

2.3 Soffit Freeboard

Section 1.10.7.1 of the *Canadian Highway Bridge Design Code* recommends a soffit clearance of 1.0m.

2.4 Upstream Flooding

Based on the best available mapping there are no buildings located immediately upstream of the proposed structure that are potentially within the Regional Floodplain. In accordance with good design practice there should be a minimal increase in flood elevations for a full range of design storms.

Ministry of Transportation Directive B-100 also provides for increasing the design storm to the Regulatory event where any structure *" ...would increase the flooding of buildings or developable land during a Regional Flood."* There are no buildings upstream of the proposed structure however the increase in the Regional Flood elevation should be kept to less than 0.3 metres upstream of the new structure and flooding kept within the creek valley.

3.0 DESIGN FLOWS

3.1 Design Storms

Peak flows for the 2-year, 5-year, 10-year, 20-year, 50-year, 100-year and Regional Storms were included in the HEC-2 file H2GSC.DAT provided by the Grand River Conservation Authority (GRCA). Table 1 summarizes the peak flows.

Table 1
Summary of Peak Flows (m^3/s)

2yr	5yr	10yr	20yr	50yr	100yr	Regional Storm
18.0	21.0	21.0	31.0	33.0	38.0	158.0

4.0 HYDRAULIC MODELLING

4.1 Model Setup

An original HEC-2 model provided by the GRCA was used as a base for the HEC-RAS analysis of the Breslau By-Pass crossing of Hopewell Creek completed by McCormick Rankin Corporation (MRC) in March 2003. This HEC-RAS model was then used as a base for the hydraulic analysis of the New Highway 7 crossing of Hopewell Creek. Existing and future conditions models were then created to calculate flood elevations.

Sections 110 to 130 were added to the model in order to include the New Highway 7 crossing. For this analysis two opening spans were analyzed, 12 metre (Option 1) and a 22 metre (Option 2) span.

4.2 Modelling Results

Table 2 summarizes the existing and future flood elevations for the 100 Year Storm.

Table 2 – 100-Year Storm Flood Elevation Comparison (m)

Description	Section Number	Existing	Opt 1 12m Span	Increase	Opt 2 22m Span	Increase
127m d/s	103	314.11	314.11	0.00	314.11	0.00
66m d/s	110	314.18	314.18	0.00	314.18	0.00
New Hwy 7 d/s face	115	314.28	314.28	0.00	314.28	0.00
New Hwy 7 u/s face	117	314.34	314.42	0.08	314.37	0.03
149m u/s	120	314.72	314.87	0.15	314.78	0.06
247m u/s	130	315.09	315.12	0.03	315.10	0.01

Table 3 summarizes the existing and future flood elevations for the Regional Storm.

Table 3 - Regional Storm Flood Elevation Comparison (m)						
Description	Section Number	Existing	Option 1 12m Span	Increase	Option 2 22m Span	Increase
127m d/s	103	316.38	316.38	0.00	316.38	0.00
66m d/s	110	316.40	316.40	0.00	316.40	0.00
New Hwy 7 d/s face	115	316.45	316.47	0.02	316.47	0.02
New Hwy 7 u/s face	117	316.49	316.59	0.10	316.49	0.00
149m u/s	120	316.58	317.23	0.65	316.88	0.30
247m u/s	130	316.67	317.27	0.60	316.94	0.27

The following are observations from the HEC-RAS calculations:

Option 1 (12m span):

- The upstream 100-year flood elevation is 5.98 metres below the top of road elevation of 320.40 metres and 3.98 metres below the upstream soffit elevation of 318.40 metres.

- During the 100-year storm the future flood elevation will increase by a maximum of 0.15 metres upstream of the New Highway 7 Structure.

- During the Regional Storm the future flood elevation will increase by a maximum of 0.65 metres upstream of the New Highway 7 Structure.

Option 2 (22m span):

- The upstream 100-year flood elevation is 6.03 metres below the top of road elevation of 320.40 metres and 4.03 metres below the upstream soffit elevation of 318.40 metres.

- During the 100-year storm the future flood elevation will increase by a maximum of 0.06 metres upstream of the New Highway 7 Structure.

- During the Regional Storm the future flood elevation will increase by a maximum of 0.30 metres upstream of the New Highway 7 Structure.

5.0 SUMMARY OF FINDINGS

Key findings are as follows.

i) The 100-year design storm of 38.0 m^3/s was used to check if the proposed structure on Hopewell Creek meets standard design practices.

ii) The top of road freeboard of 1.0 metres outlined in Section 2.2 can be met by both options.

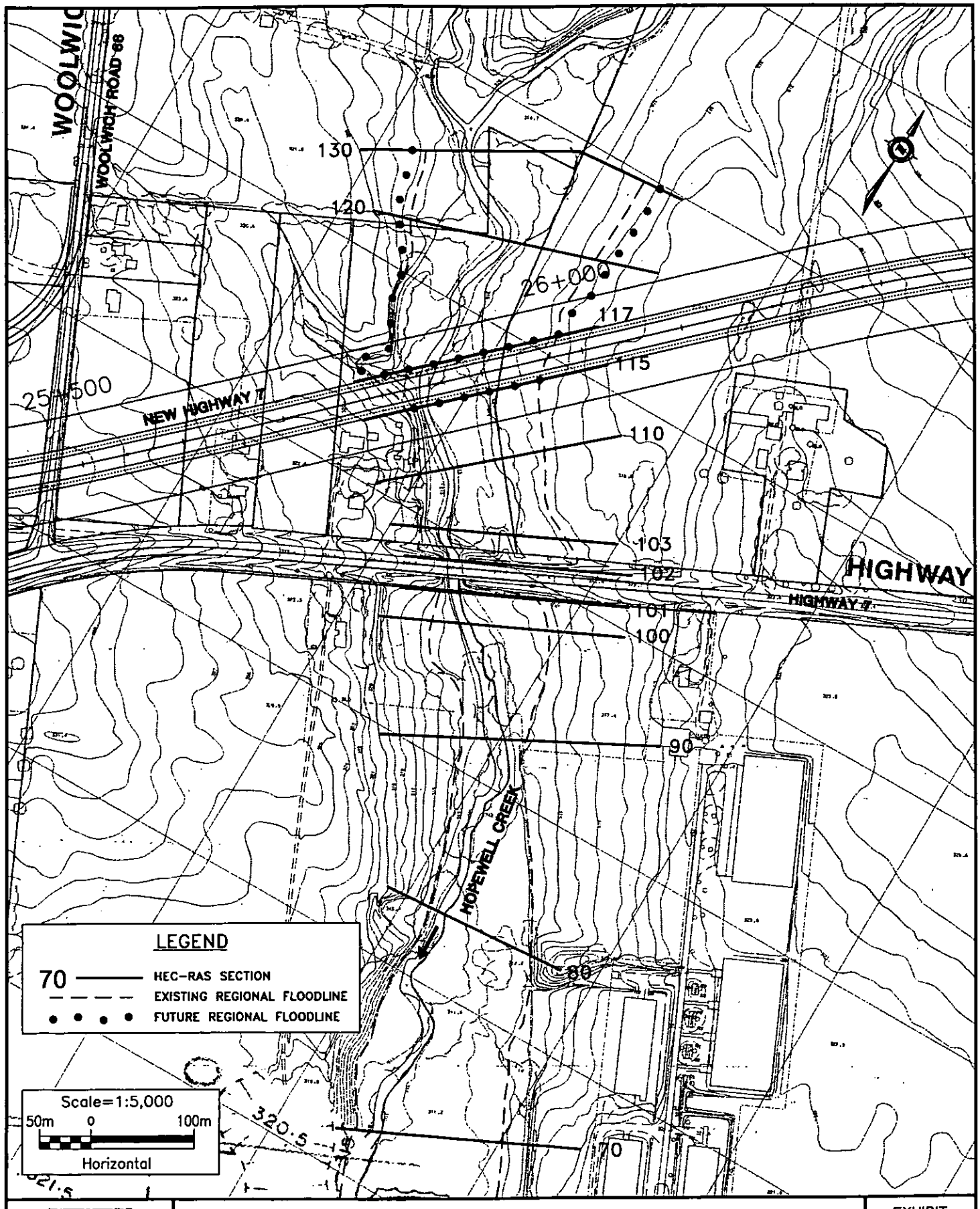
iii) The soffit freeboard of 1.0 metres outlined in Section 2.3 can be met by both options.

iv) There will be an increase in flooding upstream of the proposed Highway 7 structure for both the 100-year and Regional Storms. Option 2 (22m span) can meet the performance standard outlined in Section 2.4 but Option 1 (12m span) cannot make that standard.

v) The proposed 12 metre span will need to be approved by the GRCA and weighed against increased costs of building a larger structure.

All of which is respectfully submitted,
McCormick Rankin Corporation

Jeff Schroeder, C.E.T.



MRC

HOPEWELL CREEK HEC-RAS SECTION LOCATIONS

HIGHWAY 7 - KITCHENER TO GUELPH

EXHIBIT

A2

MODIFIED: 04/04/09 11:42:02 DRAWING NAME: K2029-HIGHWAY 7 HYDRAULIC SECTION LOCATIONS.DWG

APPENDIX B

Hydrologic Calculations

Subcatchment I.D.	Instantaneous Unit Hydrograph Classification	Drainage Area (ha)	Runoff Coefficient (<10 Year)	Curve Number	Initial Abstraction (mm) Pervious	Initial Abstraction (mm) Impervious	Imperviousness (%) Direct	+	Indirect	=	Total
Existing Conditions											
10	Standard	24.60	0.42	65	13.7	2.00	25	+	0	=	25
20	Nash	10.90	0.19	62	15.6	n/a	0	+	0	=	0
30	Nash	8.06	0.19	62	15.6	n/a	0	+	0	=	0
60	Nash	31.60	0.31	70	10.9	n/a	2	+	0	=	2
70	Nash	27.72	0.28	67	12.5	n/a	0	+	0	=	0
110	Nash	430.00	0.35	72	9.9	n/a	0	+	0	=	0
120	Nash	64.00	0.34	71	10.4	n/a	0	+	0	=	0
135	Nash	17.80	0.34	71	10.4	n/a	0	+	0	=	0
140	Nash	8.80	0.35	72	9.9	n/a	0	+	0	=	0
141	Nash	12.70	0.29	68	12.0	n/a	0	+	0	=	0
150	Nash	30.10	0.26	67	12.5	n/a	0	+	2	=	2
155	Nash	19.25	0.27	67	12.5	n/a	0	+	0	=	0
160	Nash	36.00	0.37	73	9.4	n/a	0	+	1	=	1
170	Nash	19.08	0.34	71	10.4	n/a	0	+	0	=	0
171	Nash	8.30	0.32	70	10.9	n/a	0	+	0	=	0
180	Nash	144.50	0.39	76	8.0	n/a	0	+	1	=	1
190	Nash	788.00	0.39	76	8.0	n/a	0	+	0	=	0
220	Nash	8.00	0.38	74	8.9	n/a	0	+	0	=	0
250	Nash	205.00	0.39	76	8.0	n/a	0	+	0	=	0
260	Nash	110.50	0.42	77	7.6	n/a	8	+	1	=	9
Total/Average =		2004.91	0.37	74	8.9	-	1	+	0	=	1

Subcatchment I.D.	Flow Length (m) Pervious	Flow Length (m) Impervious	Slope (%) Pervious	Slope (%) Impervious	Manning's 'n' Pervious	Manning's 'n' Impervious	N
10	40	405	2.00	1.00	0.35	0.015	n/a
20	n/a	n/a	n/a	n/a	n/a	n/a	3
30	n/a	n/a	n/a	n/a	n/a	n/a	3
60	n/a	n/a	n/a	n/a	n/a	n/a	3
70	n/a	n/a	n/a	n/a	n/a	n/a	3
110	n/a	n/a	n/a	n/a	n/a	n/a	3
120	n/a	n/a	n/a	n/a	n/a	n/a	3
135	n/a	n/a	n/a	n/a	n/a	n/a	3
140	n/a	n/a	n/a	n/a	n/a	n/a	3
141	n/a	n/a	n/a	n/a	n/a	n/a	3
150	n/a	n/a	n/a	n/a	n/a	n/a	3
155	n/a	n/a	n/a	n/a	n/a	n/a	3
160	n/a	n/a	n/a	n/a	n/a	n/a	3
170	n/a	n/a	n/a	n/a	n/a	n/a	3
171	n/a	n/a	n/a	n/a	n/a	n/a	3
180	n/a	n/a	n/a	n/a	n/a	n/a	3
190	n/a	n/a	n/a	n/a	n/a	n/a	3
220	n/a	n/a	n/a	n/a	n/a	n/a	3
250	n/a	n/a	n/a	n/a	n/a	n/a	3
260	n/a	n/a	n/a	n/a	n/a	n/a	3
Total/Average =	-	-	-	-	-	-	-

Subcatchment I.D.	Basin Length (m) Overland 1	Overland 2	Overland Subtotal	Channel 1	Channel 2	Channel Subtotal	Total
10	-	-	-	-	-	-	-
20	470	-	470	70	-	70	540
30	550	-	550	-	-	-	550
60	950	-	950	-	-	-	950
70	350	-	350	450	-	450	800
110	800	-	800	4,200	-	4,200	5,000
120	620	-	620	680	-	680	1,300
135	450	-	450	-	-	-	450
140	850	-	850	-	-	-	850
141	600	-	600	-	-	-	600
150	330	-	330	400	-	400	730
155	250	-	250	400	-	400	650
160	700	-	700	-	-	-	700
170	560	-	560	-	-	-	560
171	500	-	500	-	-	-	500
180	800	-	800	600	-	600	1,400
190	550	-	550	2,400	-	2,400	2,950
220	500	-	500	-	-	-	500
250	550	-	550	1,300	-	1,300	1,850
260	900	-	900	900	-	900	1,800
Total/Average =	-	-	-	-	-	-	-

Subcatchment I.D.	Basin Fall (m) Overland 1	Overland 2	Overland Subtotal	Channel 1	Channel 2	Channel Subtotal	Total
10	-	-	-	-	-	-	-
20	18.4	-	18.4	2.0	-	2.0	20.4
30	25.0	-	25.0	-	-	-	25.0
60	9.0	-	9.0	-	-	-	9.0
70	5.5	-	5.5	9.0	-	9.0	14.5
110	3.5	-	3.5	20.0	-	20.0	23.5
120	7.0	-	7.0	8.5	-	8.5	15.5
135	7.0	-	7.0	-	-	-	7.0
140	12.0	-	12.0	-	-	-	12.0
141	11.0	-	11.0	-	-	-	11.0
150	5.0	-	5.0	2.0	-	2.0	7.0
155	2.5	-	2.5	0.5	-	0.5	3.0
160	15.5	-	15.5	-	-	-	15.5
170	10.0	-	10.0	-	-	-	10.0
171	8.5	-	8.5	-	-	-	8.5
180	16.0	-	16.0	2.0	-	2.0	18.0
190	10.0	-	10.0	14.0	-	14.0	24.0
220	8.5	-	8.5	-	-	-	8.5
250	1.6	-	1.6	2.4	-	2.4	4.0
260	3.5	-	3.5	2.0	-	2.0	5.5
Total/Average =	-	-	-	-	-	-	-

Subcatchment I.D.	Basin Slope (%) Overland 1	Overland 2	Overland Effective	Channel 1	Channel 2	Channel Effective	Effective
10	-	-	-	-	-	-	-
20	3.9	-	3.9	2.9	-	2.9	3.7
30	4.5	-	4.5	-	-	-	4.5
60	0.9	-	0.9	-	-	-	0.9
70	1.6	-	1.6	2.0	-	2.0	1.8
110	0.4	-	0.4	0.5	-	0.5	0.5
120	1.1	-	1.1	1.3	-	1.3	1.2
135	1.6	-	1.6	-	-	-	1.6
140	1.4	-	1.4	-	-	-	1.4
141	1.8	-	1.8	-	-	-	1.8
150	1.5	-	1.5	0.5	-	0.5	0.8
155	1.0	-	1.0	0.1	-	0.1	0.2
160	2.2	-	2.2	-	-	-	2.2
170	1.8	-	1.8	-	-	-	1.8
171	1.7	-	1.7	-	-	-	1.7
180	2.0	-	2.0	0.3	-	0.3	0.8
190	1.8	-	1.8	0.6	-	0.6	0.7
220	1.7	-	1.7	-	-	-	1.7
250	0.3	-	0.3	0.2	-	0.2	0.2
260	0.4	-	0.4	0.2	-	0.2	0.3
Total/Average =	-	-	-	-	-	-	-

Subcatchment I.D.	Land Use Along Flow Path Overland 1	Overland 2	Channel 1	Channel 2	Velocity (m/s) Overland 1	Overland 2	Channel 1	Channel 2
10	-	-	-	-	-	-	-	-
20	3.0	-	3.5		0.43	-	0.41	-
30	3.0	-	-	-	0.46	-	-	-
60	3.0	-	-	-	0.21	-	-	-
70	3.0	-	3.5	-	0.27	-	0.35	-
110	3.0	-	3.5	-	0.14	-	0.17	-
120	3.0	-	3.5	-	0.23	-	0.27	-
135	3.0	-	-	-	0.27	-	-	-
140	3.0	-	-	-	0.26	-	-	-
141	3.0	-	-	-	0.29	-	-	-
150	3.0	-	3.5	-	0.26	-	0.17	-
155	3.0	-	3.5	-	0.22	-	0.09	-
160	3.0	-	-	-	0.32	-	-	-
170	3.0	-	-	-	0.29	-	-	-
171	3.0	-	-	-	0.28	-	-	-
180	3.0	-	3.5	-	0.30	-	0.14	-
190	3.0	-	3.5	-	0.29	-	0.19	-
220	3.0	-	-	-	0.28	-	-	-
250	3.0	-	3.5	-	0.12	-	0.11	-
260	3.0	-	3.5	-	0.13	-	0.12	-
Total/Average =	-	-	-	-	-	-	-	-

Subcatchment I.D.	Upland T_c (minutes) Overland 1	Overland 2	Overland Subtotal	Channel 1	Channel 2	Channel Subtotal	Total	Time to Peak (hours) SCS Upland	Airport	Bransby Williams	SCS CN	Average
10	-	-	-	-	-	-	-	-	-	-	-	n/a
20	18	-	18	3	-	3	21	0.24	0.49	n/a	0.47	0.40
30	20	-	20	-	-	-	20	0.22	0.47	n/a	0.44	0.38
60	76	-	76	-	-	-	76	0.84	0.90	n/a	1.22	0.99
70	22	-	22	22	-	22	43	0.48	0.69	n/a	0.89	0.69
110	94	-	94	415	-	415	508	5.65	n/a	n/a	6.41	6.03
120	45	-	45	41	-	41	87	0.96	0.94	n/a	1.40	1.10
135	28	-	28	-	-	-	28	0.31	0.51	n/a	0.51	0.44
140	55	-	55	-	-	-	55	0.62	0.71	n/a	0.86	0.73
141	34	-	34	-	-	-	34	0.38	0.59	n/a	0.64	0.54
150	21	-	21	39	-	39	59	0.66	0.89	n/a	0.85	0.80
155	19	-	19	77	-	77	96	1.07	1.26	n/a	0.95	1.09
160	36	-	36	-	-	-	36	0.41	0.54	n/a	0.57	0.51
170	32	-	32	-	-	-	32	0.36	0.54	n/a	0.57	0.49
171	30	-	30	-	-	-	30	0.33	0.53	n/a	0.54	0.47
180	44	-	44	71	-	71	115	1.27	n/a	n/a	0.97	1.12
190	32	-	32	214	-	214	246	2.73	n/a	n/a	1.84	2.29
220	30	-	30	-	-	-	30	0.33	0.49	n/a	0.49	0.44
250	79	-	79	206	-	206	285	3.17	n/a	n/a	3.17	3.17
260	112	-	112	130	-	130	242	2.69	n/a	0.92	2.60	2.07
Total/Average =	-	-	-	-	-	-	-	-	-	-	-	-

Highway-7, Kitchener to Guelph (2029)

Curve Numbers Calculations As of 28/04/02

COMMENTS

The study area is dominated by agricultural land with the exception of small rural development. The topography of the study area is relatively flat. According to Soils of Wellington County, Report No. 35 and Soils of Waterloo County, Report No. 44 soils west of the Townline Road are sandy loam and gravely loam (Freeport - Woolwich, Burford - Fox and Guelph), whereas, soils east of the Townline Road are predominantly loam (Guelph Loam and London Loam).

Units –> 1 (1=Percent of Total S/C Area / 2=Area in Hectares)

Area	S/C	Hydrologic Soil Distribution (%)							Comments
(ha)	I.D.	A	AB	B	BC	C	CD	D	
Existing Conditions									
24.60	10			100					
10.90	20		100						
8.06	30		100						
31.60	60		50	50					
27.72	70		100						
430.00	110			80	20				
64.00	120			100					
17.80	135			100					
8.80	140			50	50				
12.70	141		40	60					
30.10	150		40	60					
19.25	155		40	60					
36.00	160			30	70				
19.08	170			100					
8.30	171			100					
144.50	180				100				
788.00	190				100				
8.00	220				100				
205.00	250				100				
110.50	260				100				
2,004.91	*TOTAL*		*4*	*27*	*68*				

Highway-7, Kitchener to Guelph (2029)
Curve Numbers Calculations As of 28/04/02

Units --> 1 (1=Percent of Total S/C Area / 2=Area in Hectares)

Area (ha)	S/C #	Land Use Distribution (%)										
		Woodlot	Row Crop	Pasture	Rural Res.	Builtup (L.D.)	Builtup (M.D.)	Comm.	School	Open Space	Imperv.	Total Pervious
Existing Conditions												
24.60	10			75							25	75
10.90	20			100								100
8.06	30			100								100
31.60	60		60	38							2	98
27.72	70		70	30								100
430.00	110		70	30								100
64.00	120		70	30								100
17.80	135		70	30								100
8.80	140		50	50								100
12.70	141		50	50								100
30.10	150		20	70	10							98
19.25	155		30	70								99
36.00	160		64	30	6							100
19.08	170		70	30								100
8.30	171		50	50								100
144.50	180		66	30	4							99
788.00	190		70	30								100
8.00	220		50	50								100
205.00	250		70	30								100
110.50	260		50	36			14					91
2,004.91	*TOTAL*		*65*	*33*	*1*		*1*				*0*	*99*

Highway-7, Kitchener to Guelph (2029)
Curve Numbers Calculations As of 28/04/02

Area (ha)	S/C #	Summary of Imperviousness by Land Use (% of Total Area)										Imperviousness (% of Total Area)		
		Woodlot	Row Crop	Pasture	Rural Res.	Builtup (L.D.)	Builtup (M.D.)	Comm.	School	Open Space	Imperv.	Total (TIMP)	Indirect	Direct (XIMP)
% Impervious		-	-	-	20	50	65	80	15		100			
Existing Conditions														
24.60	10										25	25		25
10.90	20													
8.06	30													
31.60	60										2	2		2
27.72	70													
430.00	110													
64.00	120													
17.80	135													
8.80	140													
12.70	141													
30.10	150				2							2	2	
19.25	155													
36.00	160				1							1	1	
19.08	170													
8.30	171													
144.50	180				1							1	1	
788.00	190													
8.00	220													
205.00	250													
110.50	260						9					9	1	8
2,004.91	*TOTAL*				*0*		*1*				*0*	*1*	*0*	*1*

Highway-7, Kitchener to Guelph (2029)

Curve Numbers Calculations As of 28/04/02

TABLE OF CNs								
Land Use	Hydrologic Soil Type							Mann.
	A	AB	B	BC	C	CD	D	'n'
Woodlot	50	55	61	67	74	77	80	0.400
Row Crop/Grain	66	70	74	78	82	84	86	0.130
Pasture	58	62	65	71	76	79	81	0.350
Rural Residential	60	66	71	77	83	86	89	0.250
Builtup (L.D.)	60	66	71	77	83	86	89	0.250
Builtup (M.D.)	60	66	71	77	83	86	89	0.250
Commercial	60	66	71	77	83	86	89	0.250
School	60	66	71	77	83	86	89	0.250
Open Space	60	66	71	77	83	86	89	0.250
Impervious	98	98	98	98	98	98	98	0.013

Subcatchment I.D.	Hydrologic Soil Distribution (%)							
(Drainage Area)	A	AB	B	BC	C	CD	D	Total
Existing Conditions								
10 (24.60 ha)			100					100
20 (10.90 ha)		100						100
30 (8.06 ha)		100						100
60 (31.60 ha)		50	50					100
70 (27.72 ha)		100						100
110 (430.00 ha)			80	20				100
120 (64.00 ha)			100					100
135 (17.80 ha)			100					100
140 (8.80 ha)			50	50				100
141 (12.70 ha)		40	60					100
150 (30.10 ha)		40	60					100
155 (19.25 ha)		40	60					100
160 (36.00 ha)			30	70				100
170 (19.08 ha)			100					100
171 (8.30 ha)			100					100
180 (144.50 ha)				100				100
190 (788.00 ha)				100				100
220 (8.00 ha)				100				100
250 (205.00 ha)				100				100
260 (110.50 ha)				100				100
TOTAL = 2,004.91ha		*4*	*27*	*68*				*100*

Highway-7, Kitchener to Guelph (2029)
Curve Numbers Calculations As of 28/04/02

Subcatchment I.D. (Drainage Area)	Pervious Land Use Distribution										
	Woodlot	Row Crop	Pasture	Rural Res.	Builtup (L.D.)	Builtup (M.D.)	Comm.	School	Open Space	Imperv.	Total
Existing Conditions											
10 (24.60 ha)			100								100
20 (10.90 ha)			100								100
30 (8.06 ha)			100								100
60 (31.60 ha)		61	39								100
70 (27.72 ha)		70	30								100
110 (430.00 ha)		70	30								100
120 (64.00 ha)		70	30								100
135 (17.80 ha)		70	30								100
140 (8.80 ha)		50	50								100
141 (12.70 ha)		50	50								100
150 (30.10 ha)		20	71	8							100
155 (19.25 ha)		30	71								101
160 (36.00 ha)		64	30	5							99
170 (19.08 ha)		70	30								100
171 (8.30 ha)		50	50								100
180 (144.50 ha)		67	30	3							100
190 (788.00 ha)		70	30								100
220 (8.00 ha)		50	50								100
250 (205.00 ha)		70	30								100
260 (110.50 ha)		55	40			5					100
TOTAL = 2,004.91ha		66	33	0		0					100

Highway-7, Kitchener to Guelph (2029)
Curve Numbers Calculations As of 28/04/02

Subcatchment	Curve Number											f	Initial Abstraction (mm)		Manning's 'n'	
	Woodlot	Row Crop	Pasture	Rural Res.	Builtup (L.D.)	Builtup (M.D.)	Comm.	School	Open Space	Composite Pervious	Composite Weighted		Pervious	Weighted	Pervious	Weighted
Existing Conditions																
10 (24.60 ha)			65							65	73	0.10	13.68	9.39	0.35	0.35
20 (10.90 ha)			62							62	62	0.10	15.57	15.57	0.35	0.35
30 (8.06 ha)			62							62	62	0.10	15.57	15.57	0.35	0.35
60 (31.60 ha)		44	25							69	70	0.10	11.41	10.89	0.22	0.22
70 (27.72 ha)		49	18							67	67	0.10	12.51	12.51	0.20	0.20
110 (430.00 ha)		52	20							72	72	0.10	9.88	9.88	0.20	0.20
120 (64.00 ha)		52	20							71	71	0.10	10.37	10.37	0.20	0.20
135 (17.80 ha)		52	20							71	71	0.10	10.37	10.37	0.20	0.20
140 (8.80 ha)		38	34							72	72	0.10	9.88	9.88	0.24	0.24
141 (12.70 ha)		36	32							68	68	0.10	11.95	11.95	0.24	0.24
150 (30.10 ha)		15	45	6						66	67	0.10	13.08	12.51	0.30	0.29
155 (19.25 ha)		22	45							67	67	0.10	12.51	12.51	0.29	0.29
160 (36.00 ha)		49	21	4						73	73	0.10	9.39	9.39	0.20	0.20
170 (19.08 ha)		52	20							71	71	0.10	10.37	10.37	0.20	0.20
171 (8.30 ha)		37	33							70	70	0.10	10.89	10.89	0.24	0.24
180 (144.50 ha)		52	21	2						76	76	0.10	8.02	8.02	0.20	0.20
190 (788.00 ha)		55	21							76	76	0.10	8.02	8.02	0.20	0.20
220 (8.00 ha)		39	35							74	74	0.10	8.92	8.92	0.24	0.24
250 (205.00 ha)		55	21							76	76	0.10	8.02	8.02	0.20	0.20
260 (110.50 ha)		43	28			4				75	77	0.10	8.47	7.59	0.22	0.22
												0.10				
										74	74	=Total=	9.01	8.89	0.20	0.20

Highway-7, Kitchener to Guelph (2029)
Ultimate Runoff Coefficients As of 29/11/2001

COMMENTS

The study area is dominated by agricultural land with the exception of small rural development. The topography of the study area is relatively flat. According to Soils of Wellington County, Report No. 35 and Soils of Waterloo County, Report No. 44 soils west of the Townline Road are sandy loam and gravely loam (Freeport - Woolwich, Burford - Fox and Guelph), whereas, soils east of the Townline Road are predominantly loam (Guelph Loam and London Loam).

TABLE OF RUNOFF COEFFICIENTS (5 Year)

Land Use	Hydrologic Soil Type						
	A	AB	B	BC	C	CD	D
Woodlot	0.08	0.14	0.19	0.25	0.28	0.32	0.35
Row Crop/Grain	0.22	0.26	0.31	0.35	0.42	0.48	0.55
Pasture	0.10	0.16	0.22	0.28	0.32	0.36	0.40
Rural Residential	0.10	0.12	0.14	0.16	0.18	0.20	0.22
Builtup (L.D.)	0.10	0.12	0.14	0.16	0.18	0.20	0.22
Builtup (M.D.)	0.10	0.12	0.14	0.16	0.18	0.20	0.22
Commercial	0.10	0.12	0.14	0.16	0.18	0.20	0.22
School	0.10	0.12	0.14	0.16	0.18	0.20	0.22
Open Space	0.10	0.12	0.14	0.16	0.18	0.20	0.22
Impervious	0.90	0.90	0.90	0.90	0.90	0.90	0.90

Subcatchment	Runoff Coefficients for Pervious Land Use									Pervious Runoff Coefficient			Weighted Runoff Coefficient ($f_{perv}xC_{perv} + f_{imp}xC_{imp}$)		
	Woodlot	Row Crop	Pasture	Rural Res.	Builtup (L.D.)	Builtup (M.D.)	Comm.	School	Open Space	< 10 Yr	50 Yr	100 Yr	< 10 Yr	50 Yr	100 Yr
Existing Conditions															
10 (24.60 ha)			0.22							0.22	0.26	0.28	0.39	0.42	0.43
20 (10.90 ha)			0.16							0.16	0.19	0.20	0.16	0.19	0.20
30 (8.06 ha)			0.16							0.16	0.19	0.20	0.16	0.19	0.20
60 (31.60 ha)		0.17	0.07							0.25	0.30	0.31	0.26	0.31	0.32
70 (27.72 ha)		0.18	0.05							0.23	0.28	0.29	0.23	0.28	0.29
110 (430.00 ha)		0.22	0.07							0.29	0.35	0.36	0.29	0.35	0.36
120 (64.00 ha)		0.21	0.07							0.28	0.34	0.35	0.28	0.34	0.35
135 (17.80 ha)		0.21	0.07							0.28	0.34	0.35	0.28	0.34	0.35
140 (8.80 ha)		0.16	0.13							0.29	0.35	0.36	0.29	0.35	0.36
141 (12.70 ha)		0.14	0.10							0.24	0.29	0.30	0.24	0.29	0.30
150 (30.10 ha)		0.06	0.14	0.01						0.21	0.25	0.26	0.22	0.26	0.28
155 (19.25 ha)		0.09	0.14							0.23	0.27	0.28	0.23	0.27	0.28
160 (36.00 ha)		0.22	0.08	0.01						0.30	0.36	0.38	0.31	0.37	0.38
170 (19.08 ha)		0.21	0.07							0.28	0.34	0.35	0.28	0.34	0.35
171 (8.30 ha)		0.15	0.11							0.26	0.32	0.33	0.26	0.32	0.33
180 (144.50 ha)		0.23	0.08	0.01						0.32	0.39	0.40	0.33	0.39	0.41
190 (788.00 ha)		0.25	0.08							0.33	0.39	0.41	0.33	0.39	0.41
220 (8.00 ha)		0.18	0.14							0.32	0.38	0.39	0.32	0.38	0.39
250 (205.00 ha)		0.25	0.08							0.33	0.39	0.41	0.33	0.39	0.41
260 (110.50 ha)		0.19	0.11			0.01				0.31	0.37	0.39	0.37	0.42	0.44
									Total=	**0.31**	**0.37**	**0.38**	**0.31**	**0.37**	**0.39**

Subcatchment I.D.	Instantaneous Unit Hydrograph Classification	Drainage Area (ha)	Runoff Coefficient (<10 Year)	Curve Number	Initial Abstraction (mm) Pervious	Initial Abstraction (mm) Impervious	Imperviousness (%) Direct +	Indirect =	Total	Flow Length (m) Pervious	Flow Length (m) Impervious	Slope (%) Pervious	Slope (%) Impervious	Manning's 'n' Pervious	Manning's 'n' Impervious	N
Proposed Conditions																
10	Standard	24.60	0.49	65	13.7	2.00	35	0	35	40	405	2.00	1.00	0.35	0.015	n/a
20	Standard	9.80	0.38	62	15.6	2.00	27	0	27	40	256	2.00	1.00	0.35	0.015	n/a
21	Standard	1.10	0.35	62	15.6	2.00	22	0	22	40	86	2.00	1.00	0.35	0.015	n/a
30	Nash	3.85	0.26	65	13.7	n/a	10	0	10	n/a	n/a	n/a	n/a	n/a	n/a	3
31	Standard	1.74	0.35	62	15.6	2.00	23	0	23	40	108	2.00	1.00	0.35	0.015	n/a
32	Nash	0.80	0.19	62	15.6	n/a	0	0	0	n/a	n/a	n/a	n/a	n/a	n/a	3
33	Standard	0.81	0.38	62	15.6	2.00	27	0	27	40	73	2.00	1.00	0.35	0.015	n/a
34	Standard	0.86	0.39	62	15.6	2.00	28	0	28	40	76	2.00	1.00	0.35	0.015	n/a
60	Nash	25.40	0.31	70	10.9	n/a	2	0	2	n/a	n/a	n/a	n/a	n/a	n/a	3
61	Standard	1.10	0.46	62	15.6	2.00	37	0	37	40	86	2.00	1.00	0.35	0.015	n/a
62	Standard	2.80	0.55	63	14.9	2.00	49	0	49	40	137	2.00	1.00	0.35	0.015	n/a
63	Nash	1.20	0.19	62	15.6	n/a	0	0	0	n/a	n/a	n/a	n/a	n/a	n/a	3
64	Standard	0.32	0.41	62	15.6	2.00	31	0	31	40	46	2.00	1.00	0.35	0.015	n/a
65	Standard	0.28	0.38	62	15.6	2.00	27	0	27	40	43	2.00	1.00	0.35	0.015	n/a
66	Nash	0.27	0.19	62	15.6	n/a	0	0	0	n/a	n/a	n/a	n/a	n/a	n/a	3
67	Nash	0.18	0.19	62	15.6	n/a	0	0	0	n/a	n/a	n/a	n/a	n/a	n/a	3
70	Nash	2.70	0.30	68	12.0	n/a	7	0	7	n/a	n/a	n/a	n/a	n/a	n/a	3
71	Standard	0.64	0.35	62	15.6	2.00	22	0	22	40	65	2.00	1.00	0.35	0.015	n/a
72	Standard	1.44	0.34	62	15.6	2.00	21	0	21	40	98	2.00	1.00	0.35	0.015	n/a
73	Standard	4.40	0.37	62	15.6	2.00	25	0	25	40	171	2.00	1.00	0.35	0.015	n/a
74	Standard	1.44	0.34	62	15.6	2.00	21	0	21	40	98	2.00	1.00	0.35	0.015	n/a
75	Nash	4.00	0.25	65	13.7	n/a	8	0	8	n/a	n/a	n/a	n/a	n/a	n/a	3
76	Nash	2.50	0.29	67	12.5	n/a	14	0	14	n/a	n/a	n/a	n/a	n/a	n/a	3
80	Nash	10.60	0.35	71	10.4	n/a	9	0	9	n/a	n/a	n/a	n/a	n/a	n/a	3
81	Standard	0.32	0.34	62	15.6	2.00	21	0	21	40	46	2.00	1.00	0.35	0.015	n/a
82	Standard	0.21	0.34	62	15.6	2.00	21	0	21	40	37	2.00	1.00	0.35	0.015	n/a
83	Standard	0.16	0.34	62	15.6	2.00	21	0	21	40	33	2.00	1.00	0.35	0.015	n/a
84	Standard	0.17	0.34	62	15.6	2.00	21	0	21	40	34	2.00	1.00	0.35	0.015	n/a
110	Nash	420.50	0.35	72	9.9	n/a	0	0	0	n/a	n/a	n/a	n/a	n/a	n/a	3
120	Nash	55.70	0.34	71	10.4	n/a	0	0	0	n/a	n/a	n/a	n/a	n/a	n/a	3
121	Standard	0.54	0.40	65	13.7	2.00	21	0	21	40	60	2.00	1.00	0.35	0.015	n/a
122	Standard	0.38	0.40	65	13.7	2.00	21	0	21	40	50	2.00	1.00	0.35	0.015	n/a
123	Standard	0.43	0.40	65	13.7	2.00	21	0	21	40	54	2.00	1.00	0.35	0.015	n/a
124	Standard	0.72	0.40	65	13.7	2.00	21	0	21	40	69	2.00	1.00	0.35	0.015	n/a
125	Standard	0.95	0.42	65	13.7	2.00	25	0	25	40	80	2.00	1.00	0.35	0.015	n/a
126	Standard	0.17	0.48	65	13.7	2.00	34	0	34	40	34	2.00	1.00	0.35	0.015	n/a
127	Nash	1.75	0.34	69	11.4	n/a	11	0	11	n/a	n/a	n/a	n/a	n/a	n/a	3
128	Standard	0.36	0.40	65	13.7	2.00	21	0	21	40	49	2.00	1.00	0.35	0.015	n/a
129	Standard	0.36	0.40	65	13.7	2.00	21	0	21	40	49	2.00	1.00	0.35	0.015	n/a
130	Standard	3.90	0.45	65	13.7	2.00	29	0	29	40	161	2.00	1.00	0.35	0.015	n/a
131	Standard	0.36	0.70	65	13.7	2.00	68	0	68	40	49	2.00	1.00	0.35	0.015	n/a
132	Standard	0.95	0.42	65	13.7	2.00	25	0	25	40	80	2.00	1.00	0.35	0.015	n/a
133	Standard	1.75	0.39	65	13.7	2.00	20	0	20	40	108	2.00	1.00	0.35	0.015	n/a
135	Nash	11.20	0.36	73	9.4	n/a	4	0	4	n/a	n/a	n/a	n/a	n/a	n/a	3
140	Standard	1.30	0.53	71	10.4	2.00	34	0	34	40	93	2.00	1.00	0.35	0.015	n/a
141	Standard	2.40	0.48	71	10.4	2.00	25	0	25	40	126	2.00	1.00	0.35	0.015	n/a
142	Nash	1.30	0.39	73	9.4	n/a	9	0	9	n/a	n/a	n/a	n/a	n/a	n/a	3
143	Nash	2.10	0.33	68	12.0	n/a	10	0	10	n/a	n/a	n/a	n/a	n/a	n/a	3
144	Standard	3.72	0.42	65	13.7	2.00	25	0	25	40	157	2.00	1.00	0.35	0.015	n/a
145	Standard	2.10	0.48	65	13.7	2.00	33	0	33	40	118	2.00	1.00	0.35	0.015	n/a
150	Nash	31.76	0.26	67	12.5	n/a	0	2	2	n/a	n/a	n/a	n/a	n/a	n/a	3
151	Standard	2.52	0.40	65	13.7	2.00	21	0	21	40	130	2.00	1.00	0.35	0.015	n/a
152	Standard	1.55	0.40	65	13.7	2.00	21	0	21	40	102	2.00	1.00	0.35	0.015	n/a
153	Standard	7.90	0.45	68	12.0	2.00	25	0	25	40	229	2.00	1.00	0.35	0.015	n/a
154	Standard	1.56	0.45	71	10.4	2.00	21	0	21	40	102	2.00	1.00	0.35	0.015	n/a
155	Standard	1.56	0.45	71	10.4	2.00	21	0	21	40	102	2.00	1.00	0.35	0.015	n/a
156	Standard	1.40	0.69	71	10.4	2.00	62	0	62	40	97	2.00	1.00	0.35	0.015	n/a
157	Standard	1.40	0.69	71	10.4	2.00	62	0	62	40	97	2.00	1.00	0.35	0.015	n/a
158	Nash	2.27	0.42	75	8.5	n/a	15	0	15	n/a	n/a	n/a	n/a	n/a	n/a	3
159	Standard	1.23	0.50	71	10.4	2.00	28	0	28	40	91	2.00	1.00	0.35	0.015	n/a
160	Nash	25.82	0.37	74	8.9	n/a	0	2	2	n/a	n/a	n/a	n/a	n/a	n/a	3
161	Standard	2.15	0.39	65	13.7	2.00	20	0	20	40	120	2.00	1.00	0.35	0.015	n/a
162	Standard	0.99	0.44	65	13.7	2.00	27	0	27	40	81	2.00	1.00	0.35	0.015	n/a
170	Nash	13.80	0.34	71	10.4	n/a	0	0	0	n/a	n/a	n/a	n/a	n/a	n/a	3
171	Standard	0.68	0.40	65	13.7	2.00	21	0	21	40	67	2.00	1.00	0.35	0.015	n/a
172	Standard	0.72	0.40	65	13.7	2.00	21	0	21	40	69	2.00	1.00	0.35	0.015	n/a
173	Standard	1.13	0.42	65	13.7	2.00	25	0	25	40	87	2.00	1.00	0.35	0.015	n/a
174	Standard	1.20	0.42	65	13.7	2.00	25	0	25	40	89	2.00	1.00	0.35	0.015	n/a
175	Standard	0.68	0.40	65	13.7	2.00	21	0	21	40	67	2.00	1.00	0.35	0.015	n/a
176	Standard	0.72	0.40	65	13.7	2.00	21	0	21	40	69	2.00	1.00	0.35	0.015	n/a
177	Standard	0.85	0.45	71	10.4	2.00	21	0	21	40	75	2.00	1.00	0.35	0.015	n/a
178	Standard	1.43	0.48	71	10.4	2.00	25	0	25	40	98	2.00	1.00	0.35	0.015	n/a
179	Standard	0.85	0.45	71	10.4	2.00	21	0	21	40	75	2.00	1.00	0.35	0.015	n/a
180	Nash	134.00	0.39	76	8.0	n/a	0	1	1	n/a	n/a	n/a	n/a	n/a	n/a	3
181	Standard	0.57	0.45	71	10.4	2.00	21	0	21	40	62	2.00	1.00	0.35	0.015	n/a
182	Standard	0.96	0.48	71	10.4	2.00	25	0	25	40	80	2.00	1.00	0.35	0.015	n/a
183	Standard	0.57	0.45	71	10.4	2.00	21	0	21	40	62	2.00	1.00	0.35	0.015	n/a
184	Standard	0.97	0.45	71	10.4	2.00	21	0	21	40	80	2.00	1.00	0.35	0.015	n/a
185	Standard	0.96	0.45	71	10.4	2.00	21	0	21	40	80	2.00	1.00	0.35	0.015	n/a
186	Standard	3.23	0.48	71	10.4	2.00	25	0	25	40	147	2.00	1.00	0.35	0.015	n/a
187	Standard	0.96	0.45	71	10.4	2.00	21	0	21	40	80	2.00	1.00	0.35	0.015	n/a
188	Standard	0.97	0.45	71	10.4	2.00	21	0	21	40	80	2.00	1.00	0.35	0.015	n/a
190	Nash	771.00	0.39	76	8.0	n/a	0	0	0	n/a	n/a	n/a	n/a	n/a	n/a	3
191	Nash	6.30	0.39	76	8.0	n/a	0	0	0	n/a	n/a	n/a	n/a	n/a	n/a	3
192	Standard	1.62	0.45	71	10.4	2.00	21	0	21	40	104	2.00	1.00	0.35	0.015	n/a
193	Standard	3.33	0.48	71	10.4	2.00	25	0	25	40	149	2.00	1.00	0.35	0.015	n/a
194	Standard	1.62	0.45	71	10.4	2.00	21	0	21	40	104	2.00	1.00	0.35	0.015	n/a
195	Standard	1.65	0.45	71	10.4	2.00	21	0	21	40	105	2.00	1.00	0.35	0.015	n/a
196	Standard	2.76	0.48	71	10.4	2.00	25	0	25	40	136	2.00	1.00	0.35	0.015	n/a
197	Standard	1.65	0.45	71	10.4	2.00	21	0	21	40	105	2.00	1.00	0.35	0.015	n/a
200	Standard	1.13	0.52	71	10.4	2.00	33	0	33	40	87	2.00	1.00	0.35	0.015	n/a
201	Nash	2.40	0.39	74	8.9	n/a	10	0	10	n/a	n/a	n/a	n/a	n/a	n/a	3
202	Standard	1.20	0.47	71	10.4	2.00	23	0	23	40	89	2.00	1.00	0.35	0.015	n/a
203	Standard	2.40	0.45	71	10.4	2.00	21	0	21	40	126	2.00	1.00	0.35	0.015	n/a
204	Standard	4.11	0.48	71	10.4	2.00	25	0	25	40	166	2.00	1.00	0.35	0.015	n/a
205	Standard	2.40	0.45	71	10.4	2.00	21	0	21	40	126	2.00	1.00	0.35	0.015	n/a
206	Nash	2.40	0.39	74	8.9	n/a	10	0	10	n/a	n/a	n/a	n/a	n/a	n/a	3
207	Standard	1.10	0.52	71	10.4	2.00	32	0	32	40	86	2.00	1.00	0.35	0.015	n/a
208	Standard	1.20	0.47	71	10.4	2.00	23	0	23	40	89	2.00	1.00	0.35	0.015	n/a
210	Standard	0.36	0.45	71	10.4	2.00	21	0	21	40	49	2.00	1.00	0.35	0.015	n/a
211	Standard	0.60	0.48	71	10.4	2.00	25	0	25	40	63	2.00	1.00	0.35	0.015	n/a
212	Standard	0.36	0.45	71	10.4	2.00	21	0	21	40	49	2.00	1.00	0.35	0.015	n/a
213	Standard	1.14	0.45	71	10.4	2.00	21	0	21	40	87	2.00	1.00	0.35	0.015	n/a
214	Standard	1.89	0.48	71	10.4	2.00	25	0	25	40	112	2.00	1.00	0.35	0.015	n/a
215	Standard	1.14	0.45	71	10.4	2.00	21	0	21	40	87	2.00	1.00	0.35	0.015	n/a
250	Nash	198.50	0.39	76	8.0	n/a	0	0	0	n/a	n/a	n/a	n/a	n/a	n/a	3
260	Standard	8.60	0.50	75	8.5	2.00	31	8	39	40	239	2.00	1.00	0.29	0.015	n/a
300	Standard	2.17	0.53	71	10.4	2.00	34	0	34	40	120	2.00	1.00	0.35	0.015	n/a
301	Standard	3.86	0.50	71	10.4	2.00	28	0	28	40	180	2.00	1.00	0.35	0.015	n/a
302	Nash	1.30	0.34	71	10.4	n/a	0	0	0	n/a	n/a	n/a	n/a	n/a	n/a	3
303	Nash	1.00	0.38	73	9.4	n/a	8	0	8	n/a	n/a	n/a	n/a	n/a	n/a	3
304	Nash	93.55	0.40	76	8.0	n/a	4	1	5	n/a	n/a	n/a	n/a	n/a	n/a	3

Subcatchment I.D.	Basin Length (m) Overland 1	Overland 2	Overland Subtotal	Channel 1	Channel 2	Channel Subtotal	Total	Basin Fall (m) Overland 1	Overland 2	Overland Subtotal	Channel 1	Channel 2	Channel Subtotal	Total	Basin Slope (%) Overland 1	Overland 2	Overland Effective	Channel 1	Channel 2	Channel Effective	Effective	Land Use Along Flow Path Overland 1	Overland 2	Channel 1	Channel 2	Velocity (m/s) Overland 1	Overland 2	Channel 1	Channel 2	Upland T_t (minutes) Overland 1	Overland 2	Overland Subtotal	Channel 1	Channel 2	Channel Subtotal	Total	Time to Peak (hours) SCS Upland	Airport	Bransby Williams	SCS CN	Average
10	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	n/a
20	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	n/a
21	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	n/a
30	50	-	50	250	-	250	300	1.0	-	1.0	2.0	-	2.0	3.0	2.0	-	2.0	0.8	-	2.0	2.0	3.0	-	3.5	-	0.30	-	0.22	-	3	-	3	19	-	19	22	0.24	0.42	n/a	0.38	0.35
31	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3.0	-	3.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	n/a
32	50	-	50	50	-	50	100	1.0	-	1.0	1.0	-	1.0	2.0	2.0	-	2.0	2.0	-	2.0	2.0	3.0	-	3.5	-	0.30	-	0.35	-	3	-	3	2	-	2	5	0.06	0.26	n/a	0.17	0.16
33	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3.0	-	3.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	n/a
34	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	n/a
60	850	-	850	-	-	-	850	8.0	-	8.0	-	-	-	8.0	0.9	-	0.9	-	-	-	0.9	3.0	-	3.5	-	0.21	-	-	-	68	-	68	-	-	-	68	0.75	0.85	n/a	1.12	0.91
61	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	n/a
62	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	n/a
63	5	-	5	550	-	550	555	2.0	-	2.0	2.0	-	2.0	4.0	40.0	-	40.0	0.4	-	0.4	0.4	3.0	-	3.5	-	1.36	-	0.15	-	0	-	0	62	-	62	62	0.69	1.08	n/a	0.15	0.64
64	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3.0	-	3.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	n/a
65	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3.0	-	3.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	n/a
66	5	-	5	120	-	120	125	2.0	-	2.0	0.5	-	0.5	2.5	40.0	-	40.0	0.4	-	0.4	0.4	3.0	-	3.5	-	1.36	-	0.16	-	0	-	0	13	-	13	13	0.14	0.48	n/a	0.05	0.22
67	5	-	5	100	-	100	105	2.0	-	2.0	0.5	-	0.5	2.5	40.0	-	40.0	0.5	-	0.5	0.5	3.0	-	3.5	-	1.36	-	0.17	-	0	-	0	10	-	10	10	0.11	0.41	n/a	0.04	0.19
70	85	-	85	90	-	90	175	2.5	-	2.5	1.5	-	1.5	4.0	2.9	-	2.9	1.7	-	1.7	2.2	3.0	-	3.5	-	0.37	-	0.32	-	4	-	4	5	-	5	9	0.10	0.30	n/a	0.19	0.19
71	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	n/a
72	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	n/a
73	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	n/a
74	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	n/a
75	8	-	8	300	-	300	308	1.0	-	1.0	2.0	-	2.0	3.0	12.5	-	12.5	0.7	-	0.7	0.7	3.0	-	3.5	-	0.76	-	0.20	-	0	-	0	25	-	25	25	0.28	0.61	n/a	0.16	0.35
76	5	-	5	150	-	150	155	2.0	-	2.0	1.0	-	1.0	3.0	40.0	-	40.0	0.7	-	0.7	0.7	3.0	-	3.5	-	1.36	-	0.20	-	0	-	0	13	-	13	13	0.14	0.41	n/a	0.05	0.20
80	350	-	350	100	-	100	450	5.5	-	5.5	1.5	-	1.5	7.0	1.6	-	1.6	1.5	-	1.5	1.6	3.0	-	3.5	-	0.27	-	0.30	-	22	-	22	6	-	6	27	0.30	0.50	n/a	0.51	0.44
81	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	n/a
82	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	n/a
83	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	n/a
84	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	n/a
110	800	-	800	4,100	-	4,100	4,900	3.5	-	3.5	19.5	-	19.5	23.0	0.4	-	0.4	0.5	-	0.5	0.5	3.0	-	3.5	-	0.14	-	0.17	-	94	-	94	405	-	405	499	5.54	n/a	n/a	6.31	5.93
120	620	-	620	600	-	600	1,220	7.0	-	7.0	8.0	-	8.0	15.0	1.1	-	1.1	1.3	-	1.3	1.2	3.0	-	3.5	-	0.23	-	0.28	-	45	-	45	35	-	35	81	0.90	0.90	n/a	1.33	1.04
121	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	n/a
122	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	n/a
123	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	n/a
124	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	n/a
125	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	n/a
126	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	n/a
127	5	-	5	200	-	200	205	2.0	-	2.0	1.0	-	1.0	3.0	40.0	-	40.0	0.5	-	0.5	0.5	3.0	-	3.5	-	1.36	-	0.17	-	0	-	0	19	-	19	19	0.21	0.49	n/a	0.06	0.25
128	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3.0	-	3.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	n/a
129	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	n/a
130	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	n/a
131	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	n/a
132	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	n/a
133	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	n/a
135	355	-	355	-	-	-	355	7	-	7.0	-	-	-	7.0	2.0	-	2.0	-	-	-	2.0	3.0	-	3.5	-	0.30	-	-	-	20	-	20	-	-	-	20	0.22	0.40	n/a	0.35	0.33
140	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	n/a
141	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	n/a
142	5	-	5	750	-	750	755	2	-	2.0	4	-	4.0	6.0	40.0	-	40.0	0.5	-	0.5	0.5	3.0	-	3.5	-	1.36	-	0.18	-	0	-	0	70	-	70	70	0.78	0.87	n/a	0.14	0.60
143	5	-	5	1,150	-	1,150	1,155	2	-	2.0	6	-	6.0	8.0	40.0	-	40.0	0.5	-	0.5	0.5	3.0	-	3.5	-	1.36	-	0.18	-	0	-	0	108	-	108	109	1.21	1.17	n/a	0.23	0.87
144	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	n/a
145	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	n/a
150	280	-	280	600	-	600	880	3	-	3.0	3	-	3.0	6.0	1.1	-	1.1	0.5	-	0.5	0.6	3.0	-	3.5	-	0.22	-	0.17	-	21	-	21	58	-	58	79	0.88	1.05	n/a	1.17	1.03
151	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	n/a
152	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	n/a
153	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	n/a
154	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	n/a
155	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	n/a
156	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	n/a
157	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	n/a
158	5	-	5	250	-	250	255	2	-	2.0	2	-	1.5	3.5	40.0	-	40.0	0.6	-	0.6	0.6	3.0	-	3.5	-	1.36	-	0.19	-	0	-	0	22	-	22	22	0.25	0.46	0.17	0.06	0.23
159	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	n/a
160	600	-	600	-	-	-	600	15	-	14.8	-	-	-	14.8	2.5	-	2.5	-	-	-	2.5	3.0	-	3.5	-	0.34	-	-	-	30	-	30	-	-	-	30	0.33	0.48	n/a	0.47	0.43
161	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	n/a
162	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	n/a
170	420	-	420	-	-	-	420	9	-	9.1	-	-	-	9.1	2.2	-	2.2	-	-	-	2.2	3.0	-	3.5	-	0.32	-	-	-	22	-	22	-	-	-	22	0.25	0.44	n/a	0.41	0.36
171	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	n/a
172	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	n/a
173	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	n/a
174	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	n/a
175	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	n/a
176	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	n/a
177	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	n/a
178	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	n/a
179	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	n/a
180	800	-	800	510	-	510	1,310	16.0	-	16.0	1.5	-	1.5	17.5	2.0	-	2.0	0.3	-	0.3	0.8	3.0	-	3.5	-	0.30	-	0.13	-	44	-	44	64	-	64	108	1.20	n/a	n/a	0.92	1.06
181	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	n/a
182	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	n/a
183	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	n/a
184	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	n/a
185	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	n/a
186	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	n/a
187	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	n/a
188	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	n/a
190	550	-	550	2,300	-	2,300	2,850	10	-	10.0	13	-	13.0	23.0	1.8	-	1.8	0.6	-	0.6	0.7	3.0	-	3.5	-	0.29	-	0.18	-	32	-	32	208	-	208	240	2.67	n/a	n/a	1.79	2.23
191	150	-	150	110	-	110	260	4	-	3.5	2	-	2.0	5.5	2.3	-	2.3	1.8	-	1.8	2.1	3.0	-	3.5	-	0.33	-	0.33	-	8	-	8	6	-	6	13	0.15	0.32	n/a	0.23	0.23
192	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	n/a
193	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	n/a
194	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	n/a
195	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	n/a
196	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	n/a
197	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	n/a
200	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	n/a
201	5	-	5	200	-	200	205	2	-	2.0	1	-	1.0	3.0	40.0	-	40.0	0.5	-	0.5	0.5	3.0	-	3.5	-	1.36	-	0.17	-	0	-	0	19	-	19	19	0.21	0.45	n/a	0.05	0.24
202	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	n/a
203	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	n/a
204	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	n/a
205	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	n/a
206	5	-	5	200	-	200	205	2	-	2.0	1	-	1.0	3.0	40.0	-	40.0	0.5	-	0.5	0.5	3.0	-	3.5	-	1.36	-	0.17	-	0	-	0	19	-	19	19	0.21	0.45	n/a	0.05	0.24
207	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	n/a
208	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	n/a
210	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	n/a
211	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	n/a
212	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	n/a
213	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	n/a
214	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	n/a
215	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	n/a
250	550	-	550	1,200	-	1,200	1,750	2	-	1.6	2	-	2.4	4.0	0.3	-	0.3	0.2	-	0.2	0.2	3.0	-	3.5	-	0.12	-	0.11	-	79	-	79	183	-	183	262	2.91	n/a	n/a	3.03	2.97
260	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	n/a
300	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	n/a
301	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	n/a
302	5	-	5	760	-	760	765	2	-	2.0	2	-	2.0	4.0	40.0	-	40.0	0.3	-	0.3	0.3	3.0	-	3.5	-	1.36	-	0.13	-	0	-	0	101	-	101	101	1.12	1.18	n/a	0.15	0.82
303	5	-	5	150	-	150	155	2	-	2.0	1	-	1.0	3.0	40.0	-	40.0	0.7	-	0.7	0.7	3.0	-	3.5	-	1.36	-	0.20	-	0	-	0	13	-	13	13	0.14	0.37	n/a	0.04	0.18
304	900	-	900	900	-	900	1,800	4	-	3.5	2	-	2.0	5.5	0.4	-	0.4	0.2	-	0.2	0.3	3.0	-	3.5	-	0.13	-	0.12	-	112	-	112	130	-	130	242	2.69	1.61	0.94	2.68	1.98

Highway-7, Kitchener to Guelph (2029)

Curve Numbers Calculations As of 20/05/02

COMMENTS

The study area is dominated by agricultural land with the exception of small rural development. The topography of the study area is relatively flat. According to Soils of Wellington County, Report No. 35 and Soils of Waterloo County, Report No. 44 soils west of the Townline Road are sandy loam and gravely loam (Freeport - Woolwich, Burford - Fox and Guelph), whereas, soils east of the Townline Road are predominantly loam (Guelph Loam and London Loam).

Units --> 1 (1=Percent of Total S/C Area / 2=Area in Hectares)

Area (ha)	S/C I.D.	Hydrologic Soil Distribution (%)							Comments
		A	AB	B	BC	C	CD	D	
Proposed Conditions									
24.60	10			100					
9.80	20		100						
1.10	21		100						
3.85	30		100						
1.74	31		100						
0.80	32		100						
0.81	33		100						
0.86	34		100						
25.40	60		50	50					
1.10	61		100						
2.80	62		50	50					
1.20	63		100						
0.32	64		100						
0.28	65		100						
0.27	66		100						
0.18	67		100						
2.70	70		100						
0.64	71		100						
1.44	72		100						
4.40	73		100						
1.44	74		100						
4.00	75		100						
2.50	76		100						
10.60	80		50	50					
0.32	81		100						
0.21	82		100						
0.16	83		100						
0.17	84		100						
420.50	110			80	20				
55.70	120			100					
0.54	121			100					
0.38	122			100					
0.43	123			100					
0.72	124			100					
0.95	125			100					
0.17	126			100					
1.75	127			100					
0.36	128			100					
0.36	129			100					
3.90	130			100					
0.36	131			100					
0.95	132			100					
1.75	133			100					
11.21	135			100					
1.30	140				100				
2.40	141				100				
1.30	142				100				
2.10	143			100					
3.72	144			100					
2.10	145			100					
31.76	150		40	60					
2.52	151			100					
1.55	152			100					
7.90	153			50	50				
1.56	154				100				
1.56	155				100				
1.40	156				100				
1.40	157				100				
2.27	158				100				
1.23	159				100				
25.82	160			30	70				
2.15	161			100					
0.99	162			100					
13.80	170			100					
0.68	171			100					
0.72	172			100					
1.13	173			100					
1.20	174			100					
0.68	175			100					
0.72	176			100					
0.85	177				100				
1.43	178				100				
0.85	179				100				
134.00	180				100				
0.57	181				100				
0.96	182				100				
0.57	183				100				
0.97	184				100				
0.96	185				100				
3.23	186				100				
0.96	187				100				
0.97	188				100				
771.00	190				100				
6.30	191				100				
1.62	192				100				
3.33	193				100				
1.62	194				100				
1.65	195				100				
2.76	196				100				
1.65	197				100				
1.13	200				100				
2.40	201				100				
1.20	202				100				
2.40	203				100				
4.11	204				100				
2.40	205				100				
2.40	206				100				
1.10	207				100				
1.20	208				100				
0.36	210				100				
0.60	211				100				
0.36	212				100				
1.14	213				100				
1.89	214				100				
1.14	215				100				
198.50	250				100				
8.60	260				100				
2.17	300				100				
3.86	301				100				
1.30	302				100				
1.00	303				100				
93.55	304				100				
1,986.73	*TOTAL*		*4*	*25*	*70*				

Highway-7, Kitchener to Guelph (2029)

Curve Numbers Calculations As of 20/05/02

Units --> 1 (1=Percent of Total S/C Area / 2=Area in Hectares)

Area (ha)	S/C #	Land Use Distribution (%)										
		Woodlot	Row Crop	Pasture	Rural Res.	Builtup (L.D.)	Builtup (M.D.)	Comm.	School	Open Space	Imperv.	Total Pervious
Proposed Conditions												
24.60	10			65							35	65
9.80	20			73							27	73
1.10	21			78							22	78
3.85	30			90							10	90
1.74	31			77							23	77
0.80	32			100								100
0.81	33			73							27	73
0.86	34			72							28	72
25.40	60		60	38							2	98
1.10	61			63							37	63
2.80	62			51							49	51
1.20	63			100								100
0.32	64			69							31	69
0.28	65			73							27	73
0.27	66			100								100
0.18	67			100								100
2.70	70		50	43							7	93
0.64	71			78							22	78
1.44	72			79							21	79
4.40	73			75							25	75
1.44	74			79							21	79
4.00	75			92							8	92
2.50	78			86							14	86
10.60	80		50	41							9	91
0.32	81			79							21	79
0.21	82			79							21	79
0.16	83			79							21	79
0.17	84			79							21	79
420.50	110		70	30								100
55.70	120		70	30								100
0.54	121			79							21	79
0.38	122			79							21	79
0.43	123			79							21	79
0.72	124			79							21	79
0.95	125			75							25	75
0.17	126			66							34	66
1.75	127			89							11	89
0.36	128			79							21	79
0.36	129			79							21	79
3.90	130			71							29	71
0.36	131			32							68	32
0.95	132			75							25	75
1.75	133			80							20	80
11.20	135		70	27							4	97
1.30	140			66							34	66
2.40	141			75							25	75
1.30	142			91							9	91
2.10	143			90							10	90
3.72	144			75							25	75
2.10	145			67							33	67
31.76	150		20	70	10							98
2.52	151			79							21	79
1.55	152			79							21	79
7.90	153			75							25	75
1.56	154			79							21	79
1.58	155			79							21	79
1.40	156			38							62	38
1.40	157			38							62	38
2.27	158			85							15	85
1.23	159			72							28	72
25.82	160		62	30	8							98
2.15	161			80							20	80
0.99	162			73							27	73
13.80	170		70	30								100
0.68	171			79							21	79
0.72	172			79							21	79
1.13	173			75							25	75
1.20	174			75							25	75
0.68	175			79							21	79
0.72	176			79							21	79
0.85	177			79							21	79
1.43	178			75							25	75
0.85	179			79							21	79
134.00	180		66	30	4							99
0.57	181			79							21	79
0.96	182			75							25	75
0.57	183			79							21	79
0.97	184			79							21	79
0.96	185			79							21	79
3.23	186			75							25	75
0.96	187			79							21	79
0.97	188			79							21	79
771.00	190		70	30								100
6.30	191		70	30								100
1.62	192			79							21	79
3.33	193			75							25	75
1.62	194			79							21	79
1.65	195			79							21	79
2.76	196			75							25	75
1.65	197			79							21	79
1.13	200			67							33	67
2.40	201			90							10	90
1.20	202			77							23	77
2.40	203			79							21	79
4.11	204			75							25	75
2.40	205			79							21	79
2.40	206			90							10	90
1.10	207			68							32	68
1.20	208			77							23	77
0.36	210			79							21	79
0.60	211			75							25	75
0.36	212			79							21	79
1.14	213			79							21	79
1.89	214			75							25	75
1.14	215			79							21	79
198.50	250		70	30								100
8.60	260			23		77						62
2.17	300			66							34	66
3.86	301			72							28	72
1.30	302			100								100
1.00	303			93							8	93
93.55	304		50	42			8					95
1,986.72	*TOTAL*		*61*	*35*	*1*	*0*	*0*				*2*	*96*

Highway-7, Kitchener to Guelph (2029)

Curve Numbers Calculations As of 20/05/02

112500 32.656

Area (ha)	S/C #	Summary of Imperviousness by Land Use (% of Total Area) Woodlot	Row Crop	Pasture	Rural Res.	Builtup (L.D.)	Builtup (M.D.)	Comm.	School	Open Space	Imperv.	Imperviousness (% of Total Area) Total (TIMP)	Indirect	Direct (XIMP)
% Impervious		-	-	-	20	50	65	80	15		100			
Proposed Conditions														
24.60	10										35	35		35
9.80	20										27	27		27
1.10	21										22	22		22
3.85	30										10	10		10
1.74	31										23	23		23
0.80	32													
0.81	33										27	27		27
0.86	34										28	28		28
25.40	60										2	2		2
1.10	61										37	37		37
2.80	62										49	49		49
1.20	63													
0.32	64										31	31		31
0.28	65										27	27		27
0.27	66													
0.18	67													
2.70	70										7	7		7
0.64	71										22	22		22
1.44	72										21	21		21
4.40	73										25	25		25
1.44	74										21	21		21
4.00	75										8	8		8
2.50	76										14	14		14
10.60	80										9	9		9
0.32	81										21	21		21
0.21	82										21	21		21
0.16	83										21	21		21
0.17	84										21	21		21
420.50	110													
55.70	120													
0.54	121										21	21		21
0.38	122										21	21		21
0.43	123										21	21		21
0.72	124										21	21		21
0.95	125										25	25		25
0.17	126										34	34		34
1.75	127										11	11		11
0.36	128										21	21		21
0.36	129										21	21		21
3.90	130										29	29		29
0.36	131										68	68		68
0.95	132										25	25		25
1.75	133										20	20		20
11.20	135										4	4		4
1.30	140										34	34		34
2.40	141										25	25		25
1.30	142										9	9		9
2.10	143										10	10		10
3.72	144										25	25		25
2.10	145										33	33		33
31.76	150				2							2	2	
2.52	151										21	21		21
1.55	152										21	21		21
7.90	153										25	25		25
1.56	154										21	21		21
1.56	155										21	21		21
1.40	156										62	62		62
1.40	157										62	62		62
2.27	158										15	15		15
1.23	159										28	28		28
25.82	160				2							2	2	
2.15	161										20	20		20
0.99	162										27	27		27
13.80	170													
0.68	171										21	21		21
0.72	172										21	21		21
1.13	173										25	25		25
1.20	174										25	25		25
0.68	175										21	21		21
0.72	176										21	21		21
0.85	177										21	21		21
1.43	178										25	25		25
0.85	179										21	21		21
134.00	180				1							1	1	
0.57	181										21	21		21
0.96	182										25	25		25
0.57	183										21	21		21
0.97	184										21	21		21
0.96	185										21	21		21
3.23	186										25	25		25
0.96	187										21	21		21
0.97	188										21	21		21
771.00	190													
6.30	191													
1.62	192										21	21		21
3.33	193										25	25		25
1.62	194										21	21		21
1.65	195										21	21		21
2.76	196										25	25		25
1.65	197										21	21		21
1.13	200										33	33		33
2.40	201										10	10		10
1.20	202										23	23		23
2.40	203										21	21		21
4.11	204										25	25		25
2.40	205										21	21		21
2.40	206										10	10		10
1.10	207										32	32		32
1.20	208										23	23		23
0.36	210										21	21		21
0.60	211										25	25		25
0.36	212										21	21		21
1.14	213										21	21		21
1.89	214										25	25		25
1.14	215										21	21		21
198.50	250													
8.60	260					39						39	8	31
2.17	300										34	34		34
3.86	301										28	28		28
1.30	302													
1.00	303										8	8		8
93.55	304						5					5	1	4
1,986.72	*TOTAL*				*0*	*0*	*0*				*2*	*2*	*0*	*2*

Highway-7, Kitchener to Guelph (2029)

Curve Numbers Calculations As of 20/05/02

TABLE OF CNs								
Land Use	Hydrologic Soil Type							Mann.
	A	AB	B	BC	C	CD	D	'n'
Woodlot	50	55	61	67	74	77	80	0.400
Row Crop/Grain	66	70	74	78	82	84	86	0.130
Pasture	58	62	65	71	76	79	81	0.350
Rural Residential	60	66	71	77	83	86	89	0.250
Builtup (L.D.)	60	66	71	77	83	86	89	0.250
Builtup (M.D.)	60	66	71	77	83	86	89	0.250
Commercial	60	66	71	77	83	86	89	0.250
School	60	66	71	77	83	86	89	0.250
Open Space	60	66	71	77	83	86	89	0.250
Impervious	98	98	98	98	98	98	98	0.013

Subcatchment I.D. (Drainage Area)	Hydrologic Soil Distribution (%)							
	A	AB	B	BC	C	CD	D	Total
Proposed Conditions								
10 (24.60 ha)			100					100
20 (9.80 ha)		100						100
21 (1.10 ha)		100						100
30 (3.85 ha)		100						100
31 (1.74 ha)		100						100
32 (.80 ha)		100						100
33 (.81 ha)		100						100
34 (.86 ha)		100						100
60 (25.40 ha)		50	50					100
61 (1.10 ha)		100						100
62 (2.60 ha)		50	50					100
63 (1.20 ha)		100						100
64 (.32 ha)		100						100
65 (.28 ha)		100						100
66 (.27 ha)		100						100
67 (.18 ha)		100						100
70 (2.70 ha)		100						100
71 (.84 ha)		100						100
72 (1.44 ha)		100						100
73 (4.40 ha)		100						100
74 (1.44 ha)		100						100
75 (4.00 ha)		100						100
76 (2.50 ha)		100						100
80 (10.60 ha)		50	50					100
81 (.32 ha)		100						100
82 (.21 ha)		100						100
83 (.18 ha)		100						100
84 (.17 ha)		100						100
110 (420.50 ha)			80	20				100
120 (55.70 ha)			100					100
121 (.54 ha)			100					100
122 (.38 ha)			100					100
123 (.43 ha)			100					100
124 (.72 ha)			100					100
125 (.95 ha)			100					100
126 (.17 ha)			100					100
127 (1.75 ha)			100					100
128 (.36 ha)			100					100
129 (.36 ha)			100					100
130 (3.90 ha)			100					100
131 (.36 ha)			100					100
132 (.95 ha)			100					100
133 (1.75 ha)			100					100
135 (11.21 ha)			100					100
140 (1.30 ha)				100				100
141 (2.40 ha)				100				100
142 (1.30 ha)				100				100
143 (2.10 ha)			100					100
144 (3.72 ha)			100					100
145 (2.10 ha)			100					100
150 (31.76 ha)	40		60					100
151 (2.52 ha)			100					100
152 (1.55 ha)			100					100
153 (7.90 ha)			50	50				100
154 (1.56 ha)				100				100
155 (1.56 ha)				100				100
156 (1.40 ha)				100				100
157 (1.40 ha)				100				100
158 (2.27 ha)				100				100
159 (1.23 ha)				100				100
160 (25.82 ha)			30	70				100
161 (2.15 ha)			100					100
162 (.99 ha)			100					100
170 (13.80 ha)			100					100
171 (.68 ha)			100					100
172 (.72 ha)			100					100
173 (1.13 ha)			100					100
174 (1.20 ha)			100					100
175 (.68 ha)			100					100
176 (.72 ha)			100					100
177 (.85 ha)				100				100
178 (1.43 ha)				100				100
179 (.85 ha)				100				100
180 (134.00 ha)				100				100
181 (.57 ha)				100				100
182 (.96 ha)				100				100
183 (.57 ha)				100				100
184 (.97 ha)				100				100
185 (.96 ha)				100				100
186 (3.23 ha)				100				100
187 (.96 ha)				100				100
188 (.97 ha)				100				100
190 (771.00 ha)				100				100
191 (6.30 ha)				100				100
192 (1.62 ha)				100				100
193 (3.33 ha)				100				100
194 (1.62 ha)				100				100
195 (1.65 ha)				100				100
196 (2.76 ha)				100				100
197 (1.65 ha)				100				100
200 (1.13 ha)				100				100
201 (2.40 ha)				100				100
202 (1.20 ha)				100				100
203 (2.40 ha)				100				100
204 (4.11 ha)				100				100
205 (2.40 ha)				100				100
206 (2.40 ha)				100				100
207 (1.10 ha)				100				100
208 (1.20 ha)				100				100
210 (.36 ha)				100				100
211 (.60 ha)				100				100
212 (.38 ha)				100				100
213 (1.14 ha)				100				100
214 (1.89 ha)				100				100
215 (1.14 ha)				100				100
250 (198.50 ha)				100				100
260 (8.60 ha)				100				100
300 (2.17 ha)				100				100
301 (3.88 ha)				100				100
302 (1.30 ha)				100				100
303 (1.00 ha)				100				100
304 (93.55 ha)				100				100
TOTAL = 1,986.73ha		*4*	*25*	*70*				*99*

Highway-7, Kitchener to Guelph (2029)
Curve Numbers Calculations As of 20/05/02

Subcatchment I.D. (Drainage Area)	Pervious Land Use Distribution										Total
	Woodlot	Row Crop	Pasture	Rural Res.	Builtup (L.D.)	Builtup (M.D.)	Comm.	School	Open Space	Imperv.	
Proposed Conditions											
10 (24.60 ha)			100								100
20 (9.80 ha)			100								100
21 (1.10 ha)			100							0	100
30 (3.85 ha)			100								100
31 (1.74 ha)			100								100
32 (.80 ha)			100								100
33 (.81 ha)			100								100
34 (.86 ha)			100								100
60 (25.40 ha)		61	39								100
61 (1.10 ha)			100								100
62 (2.80 ha)			100								100
63 (1.20 ha)			100								100
64 (.32 ha)			100								100
65 (.28 ha)			100								100
66 (.27 ha)			100								100
67 (.18 ha)			100								100
70 (2.70 ha)		54	46								100
71 (.84 ha)			100								100
72 (1.44 ha)			100								100
73 (4.40 ha)			100								100
74 (1.44 ha)			100								100
75 (4.00 ha)			100								100
76 (2.50 ha)			100								100
80 (10.60 ha)		55	45								100
81 (.32 ha)			100								100
82 (.21 ha)			100								100
83 (.16 ha)			100								100
84 (.17 ha)			100								100
110 (420.50 ha)		70	30								100
120 (55.70 ha)		70	30								100
121 (.54 ha)			100								100
122 (.38 ha)			100								100
123 (.43 ha)			100								100
124 (.72 ha)			100								100
125 (.95 ha)			100								100
126 (.17 ha)			100								100
127 (1.75 ha)			100								100
128 (.36 ha)			100								100
129 (.36 ha)			100								100
130 (3.90 ha)			100							0	100
131 (.36 ha)			100								100
132 (.95 ha)			100								100
133 (1.75 ha)			100								100
135 (11.21 ha)		73	27								100
140 (1.30 ha)			100								100
141 (2.40 ha)			100								100
142 (1.30 ha)			100								100
143 (2.10 ha)			100								100
144 (3.72 ha)			100								100
145 (2.10 ha)			100								100
150 (31.76 ha)		20	71	8							100
151 (2.52 ha)			100								100
152 (1.55 ha)			100								100
153 (7.90 ha)			100								100
154 (1.56 ha)			100								100
155 (1.56 ha)			100								100
156 (1.40 ha)			100								100
157 (1.40 ha)			100								100
158 (2.27 ha)			100								100
159 (1.23 ha)			100								100
160 (25.82 ha)		63	30	7							100
161 (2.15 ha)			100								100
162 (.99 ha)			100							0	100
170 (13.60 ha)		70	30								100
171 (.68 ha)			100								100
172 (.72 ha)			100								100
173 (1.13 ha)			100								100
174 (1.20 ha)			100								100
175 (.68 ha)			100								100
176 (.72 ha)			100								100
177 (.85 ha)			100								100
178 (1.43 ha)			100								100
179 (.85 ha)			100								100
180 (134.00 ha)		67	30	3							100
181 (.57 ha)			100								100
182 (.96 ha)			100								100
183 (.57 ha)			100								100
184 (.97 ha)			100								100
185 (.96 ha)			100								100
186 (3.23 ha)			100								100
187 (.96 ha)			100								100
188 (.97 ha)			100								100
190 (771.00 ha)		70	30								100
191 (6.30 ha)		70	30								100
192 (1.62 ha)			100								100
193 (3.33 ha)			100								100
194 (1.62 ha)			100								100
195 (1.65 ha)			100								100
196 (2.76 ha)			100								100
197 (1.65 ha)			100								100
200 (1.13 ha)			100								100
201 (2.40 ha)			100								100
202 (1.20 ha)			100								100
203 (2.40 ha)			100								100
204 (4.11 ha)			100								100
205 (2.40 ha)			100								100
206 (2.40 ha)			100								100
207 (1.10 ha)			100							0	100
208 (1.20 ha)			100								100
210 (.36 ha)			100								100
211 (.60 ha)			100								100
212 (.36 ha)			100								100
213 (1.14 ha)			100								100
214 (1.89 ha)			100								100
215 (1.14 ha)			100								100
250 (198.50 ha)		70	30								100
260 (8.60 ha)			37		63						100
300 (2.17 ha)			100								100
301 (3.86 ha)			100								100
302 (1.30 ha)			100								100
303 (1.00 ha)			100								100
304 (93.55 ha)		53	44			3					100
TOTAL = 1,986.73ha		63	36	0	0	0					100

Highway-7, Kitchener to Guelph (2029)

Curve Numbers Calculations As of 20/05/02

Subcatchment	Curve Number											f	Initial Abstraction (mm)		Manning's 'n'	
	Woodlot	Row Crop	Pasture	Rural Res.	Builtup (L.D.)	Builtup (M.D.)	Comm.	School	Open Space	Composite Pervious	Composite Weighted		Pervious	Weighted	Pervious	Weighted
Proposed Conditions																
10 (24.60 ha)			65							65	77	0.10	13.68	7.59	0.35	0.35
20 (9.80 ha)			62							62	72	0.10	15.57	9.88	0.35	0.35
21 (1.10 ha)			62							62	70	0.10	15.57	10.89	0.35	0.35
30 (3.85 ha)			62							62	65	0.10	15.57	13.68	0.35	0.35
31 (1.74 ha)			62							62	70	0.10	15.57	10.89	0.35	0.35
32 (.80 ha)			62							62	62	0.10	15.57	15.57	0.35	0.35
33 (.81 ha)			62							62	72	0.10	15.57	9.88	0.35	0.35
34 (.86 ha)			62							62	72	0.10	15.57	9.88	0.35	0.35
60 (25.40 ha)		44	25							69	70	0.10	11.41	10.89	0.22	0.22
61 (1.10 ha)			62							62	75	0.10	15.57	8.47	0.35	0.35
62 (2.80 ha)			63							63	80	0.10	14.92	6.35	0.35	0.35
63 (1.20 ha)			62							62	62	0.10	15.57	15.57	0.35	0.35
64 (.32 ha)			62							62	73	0.10	15.57	9.39	0.35	0.35
65 (.28 ha)			62							62	72	0.10	15.57	9.88	0.35	0.35
66 (.27 ha)			62							62	62	0.10	15.57	15.57	0.35	0.35
67 (.18 ha)			62							62	62	0.10	15.57	15.57	0.35	0.35
70 (2.70 ha)		38	28							66	68	0.10	13.08	11.95	0.23	0.23
71 (.64 ha)			62							62	70	0.10	15.57	10.89	0.35	0.35
72 (1.44 ha)			62							62	70	0.10	15.57	10.89	0.35	0.35
73 (4.40 ha)			62							62	71	0.10	15.57	10.37	0.35	0.35
74 (1.44 ha)			62							62	70	0.10	15.57	10.89	0.35	0.35
75 (4.00 ha)			62							62	65	0.10	15.57	13.68	0.35	0.35
76 (2.50 ha)			62							62	67	0.10	15.57	12.51	0.35	0.35
80 (10.60 ha)		40	28							68	71	0.10	11.95	10.37	0.23	0.23
81 (.32 ha)			62							62	70	0.10	15.57	10.89	0.35	0.35
82 (.21 ha)			62							62	70	0.10	15.57	10.89	0.35	0.35
83 (.16 ha)			62							62	70	0.10	15.57	10.89	0.35	0.35
84 (.17 ha)			62							62	70	0.10	15.57	10.89	0.35	0.35
110 (420.50 ha)		52	20							72	72	0.10	9.88	9.88	0.20	0.20
120 (55.70 ha)		52	20							71	71	0.10	10.37	10.37	0.20	0.20
121 (.54 ha)			65							65	72	0.10	13.68	9.88	0.35	0.35
122 (.38 ha)			65							65	72	0.10	13.68	9.88	0.35	0.35
123 (.43 ha)			65							65	72	0.10	13.68	9.88	0.35	0.35
124 (.72 ha)			65							65	72	0.10	13.68	9.88	0.35	0.35
125 (.95 ha)			65							65	73	0.10	13.68	9.39	0.35	0.35
126 (.17 ha)			65							65	76	0.10	13.68	8.02	0.35	0.35
127 (1.75 ha)			65							65	69	0.10	13.68	11.41	0.35	0.35
128 (.36 ha)			65							65	72	0.10	13.68	9.88	0.35	0.35
129 (.36 ha)			65							65	72	0.10	13.68	9.88	0.35	0.35
130 (3.90 ha)			65							65	75	0.10	13.68	8.47	0.35	0.35
131 (.36 ha)			65							65	87	0.10	13.68	3.80	0.35	0.35
132 (.95 ha)			65							65	73	0.10	13.68	9.39	0.35	0.35
133 (1.75 ha)			65							65	72	0.10	13.68	9.88	0.35	0.35
135 (11.21 ha)		54	18							72	73	0.10	9.88	9.39	0.19	0.19
140 (1.30 ha)			71							71	80	0.10	10.37	6.35	0.35	0.35
141 (2.40 ha)			71							71	78	0.10	10.37	7.16	0.35	0.35
142 (1.30 ha)			71							71	73	0.10	10.37	9.39	0.35	0.35
143 (2.10 ha)			65							65	68	0.10	13.68	11.95	0.35	0.35
144 (3.72 ha)			65							65	73	0.10	13.68	9.39	0.35	0.35
145 (2.10 ha)			65							65	78	0.10	13.68	8.02	0.35	0.35
150 (31.76 ha)		15	45	6						66	67	0.10	13.08	12.51	0.30	0.29
151 (2.52 ha)			65							65	72	0.10	13.68	9.88	0.35	0.35
152 (1.55 ha)			65							65	72	0.10	13.68	9.88	0.35	0.35
153 (7.90 ha)			68							68	76	0.10	11.95	8.02	0.35	0.35
154 (1.56 ha)			71							71	77	0.10	10.37	7.59	0.35	0.35
155 (1.56 ha)			71							71	77	0.10	10.37	7.59	0.35	0.35
156 (1.40 ha)			71							71	88	0.10	10.37	3.46	0.35	0.35
157 (1.40 ha)			71							71	88	0.10	10.37	3.46	0.35	0.35
158 (2.27 ha)			71							71	75	0.10	10.37	8.47	0.35	0.35
159 (1.23 ha)			71							71	79	0.10	10.37	6.75	0.35	0.35
160 (25.82 ha)		48	21	5						74	74	0.10	8.92	8.92	0.20	0.20
161 (2.15 ha)			65							65	72	0.10	13.68	9.88	0.35	0.35
162 (.99 ha)			65							65	74	0.10	13.68	8.92	0.35	0.35
170 (13.80 ha)		52	20							71	71	0.10	10.37	10.37	0.20	0.20
171 (.68 ha)			65							65	72	0.10	13.68	9.88	0.35	0.35
172 (.72 ha)			65							65	72	0.10	13.68	9.88	0.35	0.35
173 (1.13 ha)			65							65	73	0.10	13.68	9.39	0.35	0.35
174 (1.20 ha)			65							65	73	0.10	13.68	9.39	0.35	0.35
175 (.68 ha)			65							65	72	0.10	13.68	9.88	0.35	0.35
176 (.72 ha)			65							65	72	0.10	13.68	9.88	0.35	0.35
177 (.85 ha)			71							71	77	0.10	10.37	7.59	0.35	0.35
178 (1.43 ha)			71							71	78	0.10	10.37	7.16	0.35	0.35
179 (.85 ha)			71							71	77	0.10	10.37	7.59	0.35	0.35
180 (134.00 ha)		52	21	2						76	76	0.10	8.02	8.02	0.20	0.20
181 (.57 ha)			71							71	77	0.10	10.37	7.59	0.35	0.35
182 (.96 ha)			71							71	78	0.10	10.37	7.16	0.35	0.35
183 (.57 ha)			71							71	77	0.10	10.37	7.59	0.35	0.35
184 (.97 ha)			71							71	77	0.10	10.37	7.59	0.35	0.35
185 (.96 ha)			71							71	77	0.10	10.37	7.59	0.35	0.35
186 (3.23 ha)			71							71	78	0.10	10.37	7.16	0.35	0.35
187 (.96 ha)			71							71	77	0.10	10.37	7.59	0.35	0.35
188 (.97 ha)			71							71	77	0.10	10.37	7.59	0.35	0.35
190 (771.00 ha)		55	21							76	76	0.10	8.02	8.02	0.20	0.20
191 (6.30 ha)		55	21							76	76	0.10	8.02	8.02	0.20	0.20
192 (1.62 ha)			71							71	77	0.10	10.37	7.59	0.35	0.35
193 (3.33 ha)			71							71	78	0.10	10.37	7.16	0.35	0.35
194 (1.62 ha)			71							71	77	0.10	10.37	7.59	0.35	0.35
195 (1.65 ha)			71							71	77	0.10	10.37	7.59	0.35	0.35
196 (2.76 ha)			71							71	78	0.10	10.37	7.16	0.35	0.35
197 (1.65 ha)			71							71	77	0.10	10.37	7.59	0.35	0.35
200 (1.13 ha)			71							71	80	0.10	10.37	6.35	0.35	0.35
201 (2.40 ha)			71							71	74	0.10	10.37	8.92	0.35	0.35
202 (1.20 ha)			71							71	77	0.10	10.37	7.59	0.35	0.35
203 (2.40 ha)			71							71	77	0.10	10.37	7.59	0.35	0.35
204 (4.11 ha)			71							71	78	0.10	10.37	7.16	0.35	0.35
205 (2.40 ha)			71							71	77	0.10	10.37	7.59	0.35	0.35
206 (2.40 ha)			71							71	74	0.10	10.37	8.92	0.35	0.35
207 (1.10 ha)			71							71	80	0.10	10.37	6.35	0.35	0.35
208 (1.20 ha)			71							71	77	0.10	10.37	7.59	0.35	0.35
210 (.36 ha)			71							71	77	0.10	10.37	7.59	0.35	0.35
211 (.60 ha)			71							71	78	0.10	10.37	7.16	0.35	0.35
212 (.36 ha)			71							71	77	0.10	10.37	7.59	0.35	0.35
213 (1.14 ha)			71							71	77	0.10	10.37	7.59	0.35	0.35
214 (1.89 ha)			71							71	78	0.10	10.37	7.16	0.35	0.35
215 (1.14 ha)			71							71	77	0.10	10.37	7.59	0.35	0.35
250 (198.50 ha)		55	21							76	76	0.10	8.02	8.02	0.20	0.20
260 (8.60 ha)			26		48					75	84	0.10	8.47	4.84	0.29	0.27
300 (2.17 ha)			71							71	80	0.10	10.37	6.35	0.35	0.35
301 (3.88 ha)			71							71	79	0.10	10.37	6.75	0.35	0.35
302 (1.30 ha)			71							71	71	0.10	10.37	10.37	0.35	0.35
303 (1.00 ha)			71							71	73	0.10	10.37	9.39	0.35	0.35
304 (93.55 ha)		41	31			2				75	76	0.10	8.47	8.02	0.23	0.23
										73	74	=Total=	8.94	8.59	0.21	0.21

Highway-7, Kitchener to Guelph (2029)
Ultimate Runoff Coefficients As of 29/11/2001

COMMENTS

The study area is dominated by agricultural land with the exception of small rural development. The topography of the study area is relatively flat. According to Soils of Wellington County, Report No. 35 and Soils of Waterloo County, Report No. 44 soils west of the Townline Road are sandy loam and gravely loam (Freeport - Woolwich, Burford Fox and Guelph), whereas, soils east of the Townline Road are predominantly loam (Guelph Loam and London Loam).

TABLE OF RUNOFF COEFFICIENTS (5 Year)

Land Use	Hydrologic Soil Type						
	A	AB	B	BC	C	CD	D
Woodlot	0.08	0.14	0.19	0.25	0.28	0.32	0.35
Row Crop/Grain	0.22	0.26	0.31	0.35	0.42	0.48	0.55
Pasture	0.10	0.16	0.22	0.28	0.32	0.36	0.40
Rural Residential	0.10	0.12	0.14	0.16	0.18	0.20	0.22
Builtup (L.D.)	0.10	0.12	0.14	0.16	0.18	0.20	0.22
Builtup (M.D.)	0.10	0.12	0.14	0.16	0.18	0.20	0.22
Commercial	0.10	0.12	0.14	0.16	0.18	0.20	0.22
School	0.10	0.12	0.14	0.16	0.18	0.20	0.22
Open Space	0.10	0.12	0.14	0.16	0.18	0.20	0.22
Impervious	0.90	0.90	0.90	0.90	0.90	0.90	0.90

Subcatchment	Runoff Coefficients for Pervious Land Use									Pervious Runoff Coefficient			Weighted Runoff Coefficient ($f_{perv}xC_{perv} + f_{imp}xC_{imp}$)		
	Woodlot	Row Crop	Pasture	Rural Res.	Builtup (L.D.)	Builtup (M.D.)	Comm.	School	Open Space	< 10 Yr	50 Yr	100 Yr	< 10 Yr	50 Yr	100 Yr
Proposed Conditions															
10 (24.60 ha)			0.22							0.22	0.26	0.28	0.46	0.49	0.49
20 (9.80 ha)			0.16							0.16	0.19	0.20	0.36	0.38	0.39
21 (1.10 ha)			0.16							0.16	0.19	0.20	0.32	0.35	0.35
30 (3.85 ha)			0.16							0.16	0.19	0.20	0.23	0.26	0.27
31 (1.74 ha)			0.16							0.16	0.19	0.20	0.33	0.35	0.36
32 (.80 ha)			0.16							0.16	0.19	0.20	0.16	0.19	0.20
33 (.81 ha)			0.16							0.16	0.19	0.20	0.36	0.38	0.39
34 (.86 ha)			0.16							0.16	0.19	0.20	0.37	0.39	0.40
60 (25.40 ha)		0.17	0.07							0.25	0.30	0.31	0.26	0.31	0.32
61 (1.10 ha)			0.16							0.16	0.19	0.20	0.44	0.46	0.46
62 (2.80 ha)			0.19							0.19	0.23	0.24	0.53	0.55	0.56
63 (1.20 ha)			0.16							0.16	0.19	0.20	0.16	0.19	0.20
64 (.32 ha)			0.16							0.16	0.19	0.20	0.39	0.41	0.42
65 (.28 ha)			0.16							0.16	0.19	0.20	0.36	0.38	0.39
66 (.27 ha)			0.16							0.16	0.19	0.20	0.16	0.19	0.20
67 (.18 ha)			0.16							0.16	0.19	0.20	0.16	0.19	0.20
70 (2.70 ha)		0.14	0.07							0.22	0.26	0.27	0.26	0.30	0.31
71 (.64 ha)			0.16							0.16	0.19	0.20	0.32	0.35	0.35
72 (1.44 ha)			0.16							0.16	0.19	0.20	0.31	0.34	0.35
73 (4.40 ha)			0.16							0.16	0.19	0.20	0.35	0.37	0.38
74 (1.44 ha)			0.16							0.16	0.19	0.20	0.31	0.34	0.35
75 (4.00 ha)			0.16							0.16	0.19	0.20	0.22	0.25	0.25
76 (2.50 ha)			0.16							0.16	0.19	0.20	0.27	0.29	0.30
80 (10.60 ha)		0.16	0.09							0.24	0.29	0.30	0.30	0.35	0.36
81 (.32 ha)			0.16							0.16	0.19	0.20	0.32	0.34	0.35
82 (.21 ha)			0.16							0.16	0.19	0.20	0.32	0.34	0.35
83 (.16 ha)			0.16							0.16	0.19	0.20	0.32	0.34	0.35
84 (.17 ha)			0.16							0.16	0.19	0.20	0.32	0.34	0.35
110 (420.50 ha)		0.22	0.07							0.29	0.35	0.36	0.29	0.35	0.36
120 (55.70 ha)		0.21	0.07							0.28	0.34	0.35	0.28	0.34	0.35
121 (.54 ha)			0.22							0.22	0.26	0.28	0.36	0.40	0.41
122 (.38 ha)			0.22							0.22	0.26	0.28	0.36	0.40	0.41
123 (.43 ha)			0.22							0.22	0.26	0.28	0.36	0.40	0.41
124 (.72 ha)			0.22							0.22	0.26	0.28	0.36	0.40	0.41
125 (.95 ha)			0.22							0.22	0.26	0.28	0.39	0.42	0.43
126 (.17 ha)			0.22							0.22	0.26	0.28	0.45	0.48	0.49
127 (1.75 ha)			0.22							0.22	0.26	0.28	0.30	0.34	0.35
128 (.36 ha)			0.22							0.22	0.26	0.28	0.36	0.40	0.41
129 (.36 ha)			0.22							0.22	0.26	0.28	0.36	0.40	0.41
130 (3.90 ha)			0.22							0.22	0.26	0.28	0.42	0.45	0.46
131 (.36 ha)			0.22							0.22	0.26	0.28	0.68	0.70	0.70
132 (.95 ha)			0.22							0.22	0.26	0.28	0.39	0.42	0.43
0 (1.75 ha)			0.22							0.22	0.26	0.28	0.36	0.39	0.40
135 (11.21 ha)		0.22	0.06							0.28	0.34	0.35	0.30	0.36	0.37
140 (1.30 ha)			0.28							0.28	0.34	0.35	0.49	0.53	0.54
141 (2.40 ha)			0.28							0.28	0.34	0.35	0.44	0.48	0.49
142 (1.30 ha)			0.28							0.28	0.34	0.35	0.34	0.39	0.40
143 (2.10 ha)			0.22							0.22	0.26	0.28	0.29	0.33	0.34
144 (3.72 ha)			0.22							0.22	0.26	0.28	0.39	0.42	0.43
145 (2.10 ha)			0.22							0.22	0.26	0.28	0.45	0.48	0.48
150 (31.76 ha)		0.06	0.14	0.01						0.21	0.25	0.26	0.22	0.26	0.28
151 (2.52 ha)			0.22							0.22	0.26	0.28	0.36	0.40	0.41
152 (1.55 ha)			0.22							0.22	0.26	0.28	0.36	0.40	0.41
153 (7.90 ha)			0.25							0.25	0.30	0.31	0.41	0.45	0.46
154 (1.56 ha)			0.28							0.28	0.34	0.35	0.41	0.45	0.47
155 (1.56 ha)			0.28							0.28	0.34	0.35	0.41	0.45	0.47
156 (1.40 ha)			0.28							0.28	0.34	0.35	0.67	0.69	0.69
157 (1.40 ha)			0.28							0.28	0.34	0.35	0.67	0.69	0.69
158 (2.27 ha)			0.28							0.28	0.34	0.35	0.38	0.42	0.43
159 (1.23 ha)			0.28							0.28	0.34	0.35	0.46	0.50	0.51
160 (25.82 ha)		0.21	0.08	0.01						0.30	0.36	0.38	0.31	0.37	0.39
161 (2.15 ha)			0.22							0.22	0.26	0.28	0.36	0.39	0.40
162 (.99 ha)			0.22							0.22	0.26	0.28	0.41	0.44	0.45
170 (13.80 ha)		0.21	0.07							0.28	0.34	0.35	0.28	0.34	0.35
171 (.68 ha)			0.22							0.22	0.26	0.28	0.36	0.40	0.41
172 (.72 ha)			0.22							0.22	0.26	0.28	0.36	0.40	0.41
173 (1.13 ha)			0.22							0.22	0.26	0.28	0.39	0.42	0.43
174 (1.20 ha)			0.22							0.22	0.26	0.28	0.39	0.42	0.43
175 (.68 ha)			0.22							0.22	0.26	0.28	0.36	0.40	0.41
176 (.72 ha)			0.22							0.22	0.26	0.28	0.36	0.40	0.41
177 (.85 ha)			0.28							0.28	0.34	0.35	0.41	0.45	0.47
178 (1.43 ha)			0.28							0.28	0.34	0.35	0.44	0.48	0.49
179 (.85 ha)			0.28							0.28	0.34	0.35	0.41	0.45	0.47
180 (134.00 ha)		0.23	0.08	0.01						0.32	0.39	0.40	0.33	0.39	0.41
181 (.57 ha)			0.28							0.28	0.34	0.35	0.41	0.45	0.47
182 (.96 ha)			0.28							0.28	0.34	0.35	0.44	0.48	0.49
183 (.57 ha)			0.28							0.28	0.34	0.35	0.41	0.45	0.47
184 (.97 ha)			0.28							0.28	0.34	0.35	0.41	0.45	0.47
185 (.96 ha)			0.28							0.28	0.34	0.35	0.41	0.45	0.47
186 (3.23 ha)			0.28							0.28	0.34	0.35	0.44	0.48	0.49
187 (.96 ha)			0.28							0.28	0.34	0.35	0.41	0.45	0.47
188 (.97 ha)			0.28							0.28	0.34	0.35	0.41	0.45	0.47
190 (771.00 ha)		0.25	0.08							0.33	0.39	0.41	0.33	0.39	0.41
191 (6.30 ha)		0.25	0.08							0.33	0.39	0.41	0.33	0.39	0.41
192 (1.62 ha)			0.28							0.28	0.34	0.35	0.41	0.45	0.47
193 (3.33 ha)			0.28							0.28	0.34	0.35	0.44	0.48	0.49
194 (1.62 ha)			0.28							0.28	0.34	0.35	0.41	0.45	0.47
195 (1.65 ha)			0.28							0.28	0.34	0.35	0.41	0.45	0.47
196 (2.76 ha)			0.28							0.28	0.34	0.35	0.44	0.48	0.49
197 (1.65 ha)			0.28							0.28	0.34	0.35	0.41	0.45	0.47
200 (1.13 ha)			0.28							0.28	0.34	0.35	0.48	0.52	0.53
201 (2.40 ha)			0.28							0.28	0.34	0.35	0.34	0.39	0.41
202 (1.20 ha)			0.28							0.28	0.34	0.35	0.42	0.47	0.48
203 (2.40 ha)			0.28							0.28	0.34	0.35	0.41	0.45	0.47
204 (4.11 ha)			0.28							0.28	0.34	0.35	0.44	0.48	0.49
205 (2.40 ha)			0.28							0.28	0.34	0.35	0.41	0.45	0.47
206 (2.40 ha)			0.28							0.28	0.34	0.35	0.34	0.39	0.41
207 (1.10 ha)			0.28							0.28	0.34	0.35	0.48	0.52	0.53
208 (1.20 ha)			0.28							0.28	0.34	0.35	0.42	0.47	0.48
210 (.36 ha)			0.28							0.28	0.34	0.35	0.41	0.45	0.47
211 (.60 ha)			0.28							0.28	0.34	0.35	0.44	0.48	0.49
212 (.36 ha)			0.28							0.28	0.34	0.35	0.41	0.45	0.47
213 (1.14 ha)			0.28							0.28	0.34	0.35	0.41	0.45	0.47
214 (1.89 ha)			0.28							0.28	0.34	0.35	0.44	0.48	0.49
215 (1.14 ha)			0.28							0.28	0.34	0.35	0.41	0.45	0.47
250 (198.50 ha)		0.25	0.08							0.33	0.39	0.41	0.33	0.39	0.41
260 (8.60 ha)			0.10		0.10					0.20	0.25	0.26	0.47	0.50	0.50
300 (2.17 ha)			0.28							0.28	0.34	0.35	0.49	0.53	0.54
301 (3.86 ha)			0.28							0.28	0.34	0.35	0.46	0.50	0.51
302 (1.30 ha)			0.28							0.28	0.34	0.35	0.28	0.34	0.35
303 (1.00 ha)			0.28							0.28	0.34	0.35	0.33	0.38	0.39
304 (93.55 ha)		0.18	0.12			0.00				0.31	0.38	0.39	0.34	0.40	0.42
									Total=	0.30	0.37	0.38	0.32	0.38	0.40

APPENDIX C

Hydrologic Modelling Input Files and Output Summary

```
2
*****************************************************************************
*                   ---------------------------------                       *
*                   McCormick Rankin Corporation                            *
*                   April 18, 2002                                          *
*                   Arif Shahzad                                            *
*                   Highway 7, (Kitchener - Guelph)                         *
*                   ---------------------------------                       *
*                                                                           *
*                   ------------------------------------------------------- *
*                   Flows under Existing Cobdition at Points of Interest    *
*                   ------------------------------------------------------- *
*****************************************************************************
*
*
*
*
START               TIME= 0   METOUT= 0  NSTORM=1  NRUN=001
                    4h25mm.stm
*
READ STORM          "STORM.001"
*
*
*                     Catchment 10: Hwy-86/Hwy-7 Interchange
*
*
*
CALIB STANDHYD      ID=1 NHYD=10      DT=5min AREA=24.6
                    XIMP=0.25 TIMP=0.25  DWF=0.0 LOSS=2 CN=65 IA=13.68
                    Pervious Area:
                    SLOPE=2% LENGTH=40  MNP=0.35 SCP=0.0
                    Impervious Area: DEPSTOR=2.0
                    SLOPE=1% LENGTH=405 MNP=0.015 SCP=0.0
                    END=-1
*
*                     Catchment 20: Flow to Point of Interest A
*
CALIB NASHYD        ID=1 NHYD=20      DT=5MIN  AREA=10.9
                    DWF=0.  CN=62 IA=15.57  N=3  TP=.4 HRS    END=-1
*
*                     Catchment 30: Flow to Point of Interest B
*
CALIB NASHYD        ID=1 NHYD=30      DT=5MIN  AREA=8.06
                    DWF=0.  CN=62 IA=15.57  N=3  TP=.38 HRS    END=-1
*
*                     Catchment 60: Flow to Point of Interest C
*
CALIB NASHYD        ID=1 NHYD=60      DT=5MIN  AREA=31.6
                    DWF=0.  CN=70 IA=10.89  N=3  TP=.99 HRS    END=-1
*
*                     Catchment 70: Flow to Point of Interest D
*
CALIB NASHYD        ID=1 NHYD=70      DT=5MIN  AREA=27.72
                    DWF=0.  CN=70 IA=12.51  N=3  TP=.69 HRS    END=-1
*
*                     Catchment 110: Flow to Point of Interest E
*
CALIB NASHYD        ID=1 NHYD=110     DT=5MIN  AREA=430.0
                    DWF=0.  CN=72 IA=9.88  N=3  TP=6.03 HRS    END=-1
*
*                     Catchment 120: Flow to Point of Interest F
*
CALIB NASHYD        ID=1 NHYD=120     DT=5MIN  AREA=64.0
                    DWF=0.  CN=71 IA=10.37  N=3  TP=1.1 HRS    END=-1
*
*                     Catchment 135: Flow to Point of Interest G
*
CALIB NASHYD        ID=1 NHYD=135     DT=5MIN  AREA=17.8
                    DWF=0.  CN=71 IA=10.37  N=3  TP=.44 HRS    END=-1
*
*                     Catchment 140: Flow to Point of Interest H
```

```
*
CALIB NASHYD        ID=1 NHYD=140     DT=5MIN  AREA=8.8
                    DWF=0.  CN=72 IA=9.88  N=3  TP=.73 HRS    END=-1
*
*                     Catchment 141: Flow to Point of Interest I
*
CALIB NASHYD        ID=1 NHYD=141     DT=5MIN  AREA=8.5
                    DWF=0.  CN=68 IA=11.95  N=3  TP=.54 HRS    END=-1
*
*                     Catchment 150: Flow to Point of Interest J
*
CALIB NASHYD        ID=1 NHYD=150     DT=5MIN  AREA=28.5
                    DWF=0.  CN=67 IA=12.51  N=3  TP=.8 HRS    END=-1
*
*                     Catchment 155: Flow to Point of Interest J2
*
CALIB NASHYD        ID=1 NHYD=155     DT=5MIN  AREA=19.25
                    DWF=0.  CN=67 IA=12.51  N=3  TP=1.09 HRS    END=-1
*
*                     Catchment 160: Flow to Point of Interest K
*
CALIB NASHYD        ID=1 NHYD=160     DT=5MIN  AREA=36.0
                    DWF=0.  CN=74 IA=8.92  N=3  TP=.50 HRS    END=-1
*
*                     Catchment 170: Flow to Point of Interest L
*
CALIB NASHYD        ID=1 NHYD=170     DT=5MIN  AREA=19.08
                    DWF=0.  CN=71 IA=10.37  N=3  TP=.49 HRS    END=-1
*
*                     Catchment 171: Flow to Point of Interest M
*
CALIB NASHYD        ID=1 NHYD=171     DT=5MIN  AREA=8.3
                    DWF=0.  CN=70 IA=10.89  N=3  TP=.47 HRS    END=-1
*
*                     Catchment 180: Flow to Point of Interest N
*
CALIB NASHYD        ID=1 NHYD=180     DT=5MIN  AREA=144.5
                    DWF=0.  CN=76 IA=8.02  N=3  TP=1.12 HRS    END=-1
*
*                     Catchment 190: Flow to Point of Interest O
*
CALIB NASHYD        ID=1 NHYD=190     DT=5MIN  AREA=788.0
                    DWF=0.  CN=76 IA=8.02  N=3  TP=2.29 HRS    END=-1
*
*                     Catchment 220: Flow to Point of Interest P
*
CALIB NASHYD        ID=1 NHYD=220     DT=5MIN  AREA=8.0
                    DWF=0.  CN=74 IA=8.92  N=3  TP=.44 HRS    END=-1
*
*                     Catchment 250: Flow to Point of Interest Q
*
CALIB NASHYD        ID=1 NHYD=250     DT=5MIN  AREA=205
                    DWF=0.  CN=76 IA=8.02  N=3  TP=3.17 HRS    END=-1
*
*                     Catchment 260: Flow to Point of Interest R

CALIB NASHYD        ID=1 NHYD=260     DT=5MIN  AREA=110.5
                    DWF=0.  CN=77 IA=7.59  N=3  TP=2.07 HRS    END=-1
*
************************************************************
*
START               TIME= 0   METOUT= 0  NSTORM=1  NRUN=002
                    3hc50.stm
*
*
START               TIME= 0   METOUT= 0  NSTORM=1  NRUN=003
                    3hc100.stm
*
FINISH
```

```
 SSSSS  W   W  M   M  H   H  Y   Y  M   M   OOO        999    999  =========
 S      W W W  MM MM  H   H   Y Y   MM MM  O   O      9   9  9   9
 SSSSS  W W W  M M M  HHHHH    Y    M M M  O   O  ##  9   9  9   9 Ver. 4.02
     S  W W    M   M  H   H    Y    M   M  O   O       9999   9999 July 1999
 SSSSS   W W   M   M  H   H    Y    M   M   OOO           9      9  =========
                                                      9   9  9   9 # 4313781
      StormWater Management HYdrologic Model           999    999  =========

 ********************************************************************************
 ************************** SWMHYMO-99 Ver/4.02 *********************************
 *******  A single event and continuous hydrologic simulation model  ********
 *******     based on the principles of HYMO and its successors      ********
 *******                  OTTHYMO-83 and OTTHYMO-89.                  ********
 ********************************************************************************
 ******* Distributed by:  J.F. Sabourin and Associates Inc.          ********
 *******                   Ottawa,  Ontario: (613) 727-5199          ********
 *******                   Gatineau, Quebec: (819) 243-6858          ********
 *******                   E-Mail: swmhymo@jfsa.Com                  ********
 ********************************************************************************

 +++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
 +++++++ Licensed user: McCormick Rankin Corporation                      +++++++
 +++++++                Kitchener            SERIAL#:4313781             +++++++
 +++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++

 ********************************************************************************
 *******          ++++++ PROGRAM ARRAY DIMENSIONS ++++++              ********
 *******          Maximum value for ID numbers  :     10              ********
 *******          Max. number of rainfall points:  15000              ********
 *******          Max. number of flow points    :  15000              ********
 ********************************************************************************

 *** DESCRIPTION SUMMARY TABLE HEADERS (units depend on METOUT in START) ***
 ***------------------------------------------------------------------------***
 ***    ID:  Hydrograph IDentification numbers, (1-10).                     ***
 ***  NHYD:  Hydrograph reference numbers, (6 digits or characters).        ***
 ***  AREA:  Drainage area associated with hydrograph, (ac.) or (ha.).      ***
 *** QPEAK:  Peak flow of simulated hydrograph, (ft^3/s) or (m^3/s).        ***
 *** TpeakDate_hh:mm is the date and time of the peak flow.                 ***
 ***  R.V.:  Runoff Volume of simulated hydrograph, (in) or (mm).           ***
 ***  R.C.:  Runoff Coefficient of simulated hydrograph, (ratio).           ***
 ***     *:  see WARNING or NOTE message printed at end of run.             ***
 ***    **:  see  ERROR  message printed at end of run.                     ***
 ********************************************************************************
 ********************************************************************************

::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::

 ********************************************************************************

 *********************   S U M M A R Y   O U T P U T   **********************
 ********************************************************************************
 *       DATE: 2004-04-08      TIME: 18:02:19      RUN COUNTER: 000011         *
 ********************************************************************************
 * Input   filename: K:\Projects\2000-2-1\2029\HYDROL~1\16-04-02\REVISE~1.D*
 * Output  filename: K:\Projects\2000-2-1\2029\HYDROL~1\16-04-02\REVISE~1.o*
 * Summary filename: K:\Projects\2000-2-1\2029\HYDROL~1\16-04-02\REVISE~1.s*
 * User comments:                                                          *
 * 1:_____________________________________________________________________*
 * 2:_____________________________________________________________________*
 * 3:_____________________________________________________________________*
 ********************************************************************************


RUN:COMMAND#
001:0001----------------------------------------------------------------------
    START
     [TZERO =    .00 hrs on        0]
     [METOUT=   2     (1=imperial, 2=metric output)]
```

```
     [NSTORM=    1 ]
     [NRUN  =    1 ]
001:0002-------------------------------------------------------------------------
     READ STORM
      Filename = STORM.001
      Comment  = 25mm, 4-hr Chicago Storm
      [SDT=10.00:SDUR=    4.00:PTOT=  24.99]
001:0003---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     CALIB STANDHYD      01:000010     24.60      .718 No_date     1:35     6.40 .256
      [XIMP=.25:TIMP=.25]
      [LOSS= 2 :CN= 65.0]
      [Pervious      area: IAper=13.68:SLPP=2.00:LGP=  40.:MNP=.350:SCP=    .0]
      [Impervious    area: IAimp= 2.00:SLPI=1.00:LGI= 405.:MNI=.015:SCI=    .0]
001:0004---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     CALIB NASHYD        01:000020     10.90      .009 No_date     2:25      .54 .022
      [CN= 62.0: N= 3.00]
      [Tp=  .40:DT= 5.00]
001:0005---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     CALIB NASHYD        01:000030      8.06      .006 No_date     2:20      .54 .022
      [CN= 62.0: N= 3.00]
      [Tp=  .38:DT= 5.00]
001:0006---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     CALIB NASHYD        01:000060     31.60      .053 No_date     3:00     1.62 .065
      [CN= 70.0: N= 3.00]
      [Tp=  .99:DT= 5.00]
001:0007---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     CALIB NASHYD        01:000070     27.72      .045 No_date     2:40     1.28 .051
      [CN= 70.0: N= 3.00]
      [Tp=  .69:DT= 5.00]
001:0008---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     CALIB NASHYD        01:000110    430.00      .213 No_date     8:10     2.01 .080
      [CN= 72.0: N= 3.00]
      [Tp= 6.03:DT= 5.00]
001:0009---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     CALIB NASHYD        01:000120     64.00      .113 No_date     3:05     1.81 .072
      [CN= 71.0: N= 3.00]
      [Tp= 1.10:DT= 5.00]
001:0010---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     CALIB NASHYD        01:000135     17.80      .055 No_date     2:10     1.81 .072
      [CN= 71.0: N= 3.00]
      [Tp=  .44:DT= 5.00]
001:0011---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     CALIB NASHYD        01:000140      8.80      .023 No_date     2:35     2.01 .080
      [CN= 72.0: N= 3.00]
      [Tp=  .73:DT= 5.00]
001:0012---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     CALIB NASHYD        01:000141      8.50      .016 No_date     2:25     1.28 .051
      [CN= 68.0: N= 3.00]
      [Tp=  .54:DT= 5.00]
001:0013---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     CALIB NASHYD        01:000150     28.50      .037 No_date     2:50     1.13 .045
      [CN= 67.0: N= 3.00]
      [Tp=  .80:DT= 5.00]
001:0014---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     CALIB NASHYD        01:000155     19.25      .021 No_date     3:15     1.13 .045
      [CN= 67.0: N= 3.00]
      [Tp= 1.09:DT= 5.00]
001:0015---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     CALIB NASHYD        01:000160     36.00      .147 No_date     2:10     2.45 .098
      [CN= 74.0: N= 3.00]
      [Tp=  .50:DT= 5.00]
001:0016---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     CALIB NASHYD        01:000170     19.08      .056 No_date     2:15     1.81 .072
      [CN= 71.0: N= 3.00]
      [Tp=  .49:DT= 5.00]
001:0017---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     CALIB NASHYD        01:000171      8.30      .022 No_date     2:15     1.62 .065
      [CN= 70.0: N= 3.00]
      [Tp=  .47:DT= 5.00]
001:0018---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     CALIB NASHYD        01:000180    144.50      .427 No_date     3:00     2.96 .119
```

```
     [CN= 76.0: N= 3.00]
     [Tp= 1.12:DT= 5.00]
001:0019--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD       01:000190   788.00    1.387 No_date    4:30    2.96 .119
     [CN= 76.0: N= 3.00]
     [Tp= 2.29:DT= 5.00]
001:0020--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD       01:000220     8.00     .035 No_date    2:05    2.45 .098
     [CN= 74.0: N= 3.00]
     [Tp=  .44:DT= 5.00]
001:0021--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD       01:000250   205.00     .274 No_date    5:20    2.96 .119
     [CN= 76.0: N= 3.00]
     [Tp= 3.17:DT= 5.00]
001:0022--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD       01:000260   110.50     .231 No_date    4:15    3.25 .130
     [CN= 77.0: N= 3.00]
     [Tp= 2.07:DT= 5.00]
 ** END OF RUN :   1

********************************************************************************



RUN:COMMAND#
002:0001--------------------------------------------------------------------------
    START
     [TZERO =    .00 hrs on        0]
     [METOUT=   2    (1=imperial, 2=metric output)]
     [NSTORM=   1 ]
     [NRUN  =   2 ]
002:0002--------------------------------------------------------------------------
    READ STORM
     Filename = STORM.001
     Comment  = 3 HR Chicago 50-yr storm, Stratford Parameters
     [SDT=10.00:SDUR=   3.00:PTOT=  71.87]
002:0003--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB STANDHYD     01:000010    24.60    2.447 No_date    1:10   30.49 .424
     [XIMP=.25:TIMP=.25]
     [LOSS= 2 :CN= 65.0]
     [Pervious     area: IAper=13.68:SLPP=2.00:LGP=  40.:MNP=.350:SCP=   .0]
     [Impervious   area: IAimp= 2.00:SLPI=1.00:LGI= 405.:MNI=.015:SCI=   .0]
002:0004--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD       01:000020    10.90     .342 No_date    1:40   14.95 .208
     [CN= 62.0: N= 3.00]
     [Tp=  .40:DT= 5.00]
002:0005--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD       01:000030     8.06     .261 No_date    1:40   14.95 .208
     [CN= 62.0: N= 3.00]
     [Tp=  .38:DT= 5.00]
002:0006--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD       01:000060    31.60     .825 No_date    2:25   21.90 .305
     [CN= 70.0: N= 3.00]
     [Tp=  .99:DT= 5.00]
002:0007--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD       01:000070    27.72     .887 No_date    2:05   20.95 .291
     [CN= 70.0: N= 3.00]
     [Tp=  .69:DT= 5.00]
002:0008--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD       01:000110   430.00    2.555 No_date    7:30   23.90 .333
     [CN= 72.0: N= 3.00]
     [Tp= 6.03:DT= 5.00]
002:0009--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD       01:000120    64.00    1.623 No_date    2:35   22.89 .318
     [CN= 71.0: N= 3.00]
     [Tp= 1.10:DT= 5.00]
002:0010--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD       01:000135    17.80     .842 No_date    1:45   22.89 .318
     [CN= 71.0: N= 3.00]
```

```
     [Tp=  .44:DT= 5.00]
002:0011--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD       01:000140     8.80      .313 No_date    2:05   23.90 .333
     [CN= 72.0: N= 3.00]
     [Tp=  .73:DT= 5.00]
002:0012--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD       01:000141     8.50      .305 No_date    1:50   20.01 .278
     [CN= 68.0: N= 3.00]
     [Tp=  .54:DT= 5.00]
002:0013--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD       01:000150    28.50      .749 No_date    2:15   19.10 .266
     [CN= 67.0: N= 3.00]
     [Tp=  .80:DT= 5.00]
002:0014--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD       01:000155    19.25      .408 No_date    2:35   19.10 .266
     [CN= 67.0: N= 3.00]
     [Tp= 1.09:DT= 5.00]
002:0015--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD       01:000160    36.00     1.811 No_date    1:45   26.04 .362
     [CN= 74.0: N= 3.00]
     [Tp=  .50:DT= 5.00]
002:0016--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD       01:000170    19.08      .845 No_date    1:45   22.89 .318
     [CN= 71.0: N= 3.00]
     [Tp=  .49:DT= 5.00]
002:0017--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD       01:000171     8.30      .360 No_date    1:45   21.90 .305
     [CN= 70.0: N= 3.00]
     [Tp=  .47:DT= 5.00]
002:0018--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD       01:000180   144.50     4.502 No_date    2:35   28.30 .394
     [CN= 76.0: N= 3.00]
     [Tp= 1.12:DT= 5.00]
002:0019--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD       01:000190   788.00    13.891 No_date    3:50   28.30 .394
     [CN= 76.0: N= 3.00]
     [Tp= 2.29:DT= 5.00]
002:0020--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD       01:000220     8.00      .437 No_date    1:40   26.04 .362
     [CN= 74.0: N= 3.00]
     [Tp=  .44:DT= 5.00]
002:0021--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD       01:000250   205.00     2.683 No_date    4:40   28.30 .394
     [CN= 76.0: N= 3.00]
     [Tp= 3.17:DT= 5.00]
002:0022--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD       01:000260   110.50     2.217 No_date    3:35   29.48 .410
     [CN= 77.0: N= 3.00]
     [Tp= 2.07:DT= 5.00]
 ** END OF RUN :   2
```

****

```
RUN:COMMAND#
003:0001--------------------------------------------------------------------------
    START
     [TZERO =    .00 hrs on        0]
     [METOUT=   2    (1=imperial, 2=metric output)]
     [NSTORM=   1 ]
     [NRUN  =   3 ]
003:0002--------------------------------------------------------------------------
    READ STORM
     Filename = STORM.001
     Comment  = 3 HR Chicago 100-yr storm, Stratford Parameters
     [SDT=10.00:SDUR=   3.00:PTOT=  78.03]
003:0003--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB STANDHYD     01:000010    24.60     2.734 No_date    1:10   34.45 .441
```

```
     [XIMP=.25:TIMP=.25]
     [LOSS= 2 :CN= 65.0]
     [Pervious     area: IAper=13.68:SLPP=2.00:LGP=  40.:MNP=.350:SCP=   .0]
     [Impervious   area: IAimp= 2.00:SLPI=1.00:LGI= 405.:MNI=.015:SCI=   .0]
003:0004--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD       01:000020    10.90     .413 No_date    1:40   17.89 .229
     [CN= 62.0: N= 3.00]
     [Tp=  .40:DT= 5.00]
003:0005--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD       01:000030     8.06     .315 No_date    1:40   17.89 .229
     [CN= 62.0: N= 3.00]
     [Tp=  .38:DT= 5.00]
003:0006--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD       01:000060    31.60     .967 No_date    2:25   25.61 .328
     [CN= 70.0: N= 3.00]
     [Tp=  .99:DT= 5.00]
003:0007--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD       01:000070    27.72    1.045 No_date    2:05   24.62 .316
     [CN= 70.0: N= 3.00]
     [Tp=  .69:DT= 5.00]
003:0008--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD       01:000110   430.00    2.974 No_date    7:30   27.82 .357
     [CN= 72.0: N= 3.00]
     [Tp= 6.03:DT= 5.00]
003:0009--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD       01:000120    64.00    1.894 No_date    2:35   26.71 .342
     [CN= 71.0: N= 3.00]
     [Tp= 1.10:DT= 5.00]
003:0010--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD       01:000135    17.80     .989 No_date    1:40   26.71 .342
     [CN= 71.0: N= 3.00]
     [Tp=  .44:DT= 5.00]
003:0011--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD       01:000140     8.80     .365 No_date    2:05   27.82 .357
     [CN= 72.0: N= 3.00]
     [Tp=  .73:DT= 5.00]
003:0012--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD       01:000141     8.50     .361 No_date    1:50   23.53 .301
     [CN= 68.0: N= 3.00]
     [Tp=  .54:DT= 5.00]
003:0013--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD       01:000150    28.50     .885 No_date    2:10   22.52 .289
     [CN= 67.0: N= 3.00]
     [Tp=  .80:DT= 5.00]
003:0014--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD       01:000155    19.25     .481 No_date    2:35   22.52 .289
     [CN= 67.0: N= 3.00]
     [Tp= 1.09:DT= 5.00]
003:0015--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD       01:000160    36.00    2.107 No_date    1:45   30.16 .387
     [CN= 74.0: N= 3.00]
     [Tp=  .50:DT= 5.00]
003:0016--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD       01:000170    19.08     .991 No_date    1:45   26.71 .342
     [CN= 71.0: N= 3.00]
     [Tp=  .49:DT= 5.00]
003:0017--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD       01:000171     8.30     .423 No_date    1:45   25.61 .328
     [CN= 70.0: N= 3.00]
     [Tp=  .47:DT= 5.00]
003:0018--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD       01:000180   144.50    5.191 No_date    2:35   32.63 .418
     [CN= 76.0: N= 3.00]
     [Tp= 1.12:DT= 5.00]
003:0019--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD       01:000190   788.00   16.012 No_date    3:50   32.63 .418
     [CN= 76.0: N= 3.00]
     [Tp= 2.29:DT= 5.00]
003:0020--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD       01:000220     8.00     .509 No_date    1:40   30.16 .387
     [CN= 74.0: N= 3.00]
```

```
     [Tp=  .44:DT= 5.00]
003:0021---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD       01:000250   205.00    3.093 No_date    4:40   32.63 .418
     [CN= 76.0: N= 3.00]
     [Tp= 3.17:DT= 5.00]
003:0022---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD       01:000260   110.50    2.549 No_date    3:35   33.91 .435
     [CN= 77.0: N= 3.00]
     [Tp= 2.07:DT= 5.00]
003:0002--------------------------------------------------------------------------
     FINISH
--------------------------------------------------------------------------------
********************************************************************************
     WARNINGS / ERRORS / NOTES
     -------------------------
   Simulation ended on 2004-04-08     at 18:02:20
================================================================================
```

```
2
*****************************************************************************
*                    ---------------------------------                      *
*                    McCormick Rankin Corporation                           *
*                    April 16, 2002                                         *
*                    Arif Shahzad                                           *
*                    Highway 7, (Kitchener - Guelph)                        *
*                    ---------------------------------                      *
*                                                                           *
*                    ----------------------------------------------------   *
*                    Flow under proposed condition with SWM Basins          *
*                    ----------------------------------------------------   *
*****************************************************************************
*
*
*
*
START                TIME= 0   METOUT= 0  NSTORM=1  NRUN=001
                     3hc100.stm
*
READ STORM           "STORM.001"
*
*
*                        Catchment 10: Hwy-86/Hwy-7 Interchange
*
*
*
CALIB STANDHYD       ID=1 NHYD=10         DT=5min AREA=24.6
                     XIMP=0.35 TIMP=0.35  DWF=0.0 LOSS=2 CN=65 IA=13.68
                     Pervious Area:
                     SLOPE=2% LENGTH=40  MNP=0.35 SCP=0.0
                     Impervious Area: DEPSTOR=2.0
                     SLOPE=1% LENGTH=405 MNP=0.015 SCP=0.0
                     END=-1
*                        Catchment 20:
*                        Flow at Culvert 20
*
CALIB STANDHYD       ID=1 NHYD=20         DT=5min AREA=9.8
                     XIMP=0.27 TIMP=0.27  DWF=0.0 LOSS=2 CN=62 IA=15.57
                     Pervious Area:
                     SLOPE=2% LENGTH=40  MNP=0.35 SCP=0.0
                     Impervious Area: DEPSTOR=2.0
                     SLOPE=1% LENGTH=256 MNP=0.015 SCP=0.0
                     END=-1
*                        Catchment 21:
*
*
CALIB STANDHYD       ID=2 NHYD=21         DT=5min AREA=1.1
                     XIMP=0.22 TIMP=0.22  DWF=0.0 LOSS=2 CN=62 IA=15.57
                     Pervious Area:
                     SLOPE=2% LENGTH=40  MNP=0.35 SCP=0.0
                     Impervious Area: DEPSTOR=2.0
                     SLOPE=1% LENGTH=86 MNP=0.015 SCP=0.0
                     END=-1
*                        Flow to Basin 1 (Point of Interest A)
*
ADD HYD              IDsum=3, NHYD=200 IDs to add=1,2
*
*                        Basin 1
*
ROUTE RESERVOIR      IDout=4,   NHYD=1,  IDin=3,
                     RDT=1(min),
                           TABLE of ( OUTFLOW-STORAGE ) values
                                    (cms) - (ha-m)
                                  0.0000   0.000
                                  0.0129   0.016
                                  0.0182   0.033
                                  0.0223   0.051
                                  0.0258   0.071
                                  0.0515   0.072
                                  0.1459   0.074
                                  0.2681   0.075
                                  0.4130   0.076
                                  6.2877   0.097
                                  19.2318  0.120
                                       END= -1
*
*
*                       Catchment 30:
*
*                       Flow at Culvert 30
*
```

```
CALIB NASHYD          ID=1 NHYD=30          DT=5MIN  AREA=3.85
                      DWF=0.  CN=65 IA=13.68  N=3  TP=.35 HRS     END=-1
*
*                         Catchment 31:
*
*
CALIB STANDHYD        ID=2 NHYD=31          DT=5min AREA=1.74
                      XIMP=0.23 TIMP=0.23  DWF=0.0 LOSS=2 CN=62 IA=15.57
                      Pervious Area:
                      SLOPE=2% LENGTH=40  MNP=0.35 SCP=0.0
                      Impervious Area: DEPSTOR=2.0
                      SLOPE=1% LENGTH=108 MNP=0.015 SCP=0.0
                      END=-1
*
*                         Catchment 32:
*                         Flow at Culvert 31
*
CALIB NASHYD          ID=3 NHYD=32          DT=5MIN  AREA=.80
                      DWF=0.  CN=62 IA=15.57  N=3  TP=.16 HRS     END=-1
*
*                         Catchment 33:
*
CALIB STANDHYD        ID=4 NHYD=33          DT=5min AREA=.81
                      XIMP=0.27 TIMP=0.27  DWF=0.0 LOSS=2 CN=62 IA=15.57
                      Pervious Area:
                      SLOPE=2% LENGTH=40  MNP=0.35 SCP=0.0
                      Impervious Area: DEPSTOR=2.0
                      SLOPE=1% LENGTH=73 MNP=0.015 SCP=0.0
                      END=-1
*
*
*                         Flow at Culvert 32
*
ADD HYD               IDsum=5, NHYD=300 IDs to add=2,3,4
*
*                         Catchment 34:
*
CALIB STANDHYD        ID=7 NHYD=34          DT=5min AREA=.86
                      XIMP=0.28 TIMP=0.28  DWF=0.0 LOSS=2 CN=62 IA=15.57
                      Pervious Area:
                      SLOPE=2% LENGTH=40  MNP=0.35 SCP=0.0
                      Impervious Area: DEPSTOR=2.0
                      SLOPE=1% LENGTH=76 MNP=0.015 SCP=0.0
                      END=-1
*
*                         Flow to Basin 2 (Point of Interest B)
*
ADD HYD               IDsum=8, NHYD=302 IDs to add=1,5,7
*
*                         Basin 2
*
ROUTE RESERVOIR       IDout=9,   NHYD=2,  IDin=8,
                      RDT=5(min),
                            TABLE of ( OUTFLOW-STORAGE ) values
                                        (cms) - (ha-m)
                                      0.0000      0.000
                                      0.0095      0.007
                                      0.0135      0.015
                                      0.0165      0.023
                                      0.0190      0.032
                                      0.0491      0.035
                                      0.1413      0.039
                                      0.2640      0.042
                                      0.4130      0.045
                                      3.2966      0.059
                                      9.4944      0.073
                                           END=-1
*
*
*
*                         Catchment 60:
*
*
CALIB NASHYD          ID=1 NHYD=60          DT=5MIN  AREA=25.4
                      DWF=0.  CN=70 IA=10.89  N=3  TP=.91 HRS     END=-1
*
*                         Catchment 61:
*                         Flow at Culvert 60
*
CALIB STANDHYD        ID=2 NHYD=61          DT=5min AREA=1.2
                      XIMP=0.34 TIMP=0.34  DWF=0.0 LOSS=2 CN=62 IA=15.57
                      Pervious Area:
                      SLOPE=2% LENGTH=40  MNP=0.35 SCP=0.0
                      Impervious Area: DEPSTOR=2.0
                      SLOPE=1% LENGTH=89 MNP=0.015 SCP=0.0
```

```
                    END=-1
*
*                       Catchment 62:
*
*
CALIB STANDHYD      ID=3 NHYD=62         DT=5min AREA=2.8
                    XIMP=0.49 TIMP=0.49  DWF=0.0 LOSS=2 CN=63 IA=14.92
                    Pervious Area:
                    SLOPE=2% LENGTH=40   MNP=0.35 SCP=0.0
                    Impervious Area: DEPSTOR=2.0
                    SLOPE=1% LENGTH=137 MNP=0.015 SCP=0.0
                    END=-1
*
*                       Flow at Culvert 61
*
ADD HYD             IDsum=4, NHYD=600 IDs to add=2, 3,
*
*                       Catchment 63:
*
*
CALIB NASHYD        ID=2 NHYD=63         DT=5MIN  AREA=1.2
                    DWF=0.  CN=62 IA=15.57  N=3  TP=.64 HRS    END=-1
*
*                       Catchment 67:
*
*
CALIB NASHYD        ID=5 NHYD=67         DT=5MIN  AREA=.18
                    DWF=0.  CN=62 IA=15.57  N=3  TP=.19 HRS    END=-1
*
*                       Catchment 65:
*
*
CALIB STANDHYD      ID=6 NHYD=65         DT=5min AREA=.28
                    XIMP=0.27 TIMP=0.27  DWF=0.0 LOSS=2 CN=62 IA=15.57
                    Pervious Area:
                    SLOPE=2% LENGTH=40   MNP=0.35 SCP=0.0
                    Impervious Area: DEPSTOR=2.0
                    SLOPE=1% LENGTH=43 MNP=0.015 SCP=0.0
                    END=-1
*
*                       Flow at Culvert 63, conveying flow to Basin 3
*
ADD HYD             IDsum=7, NHYD=601 IDs to add=2, 4, 5
*
ADD HYD             IDsum=8, NHYD=601 IDs to add=7, 6
*
*                       Bain 3
*
ROUTE RESERVOIR     IDout=9,   NHYD=3,  IDin=8,
                    RDT=5(min),
                        TABLE of ( OUTFLOW-STORAGE ) values
                                  (cms) - (ha-m)
                                0.0000      0.000
                                0.0170      0.018
                                0.0241      0.038
                                0.0295      0.061
                                0.0340      0.086
                                1.0981      0.106
                                3.5815      0.128
                                    END=-1
*
*                       Catchment 64:
*
*
CALIB STANDHYD      ID=2 NHYD=64         DT=5min AREA=.32
                    XIMP=0.31 TIMP=0.31  DWF=0.0 LOSS=2 CN=62 IA=15.57
                    Pervious Area:
                    SLOPE=2% LENGTH=40   MNP=0.35 SCP=0.0
                    Impervious Area: DEPSTOR=2.0
                    SLOPE=1% LENGTH=46 MNP=0.015 SCP=0.0
                    END=-1
*
*                       Catchment 66:
*
*
CALIB NASHYD        ID=3 NHYD=66         DT=5MIN  AREA=.27
                    DWF=0.  CN=62 IA=15.57  N=3  TP=.22 HRS    END=-1
*
*                       Flow at Culvert 62
*
*
ADD HYD             IDsum=4, NHYD=602 IDs to add=1, 3
*
*                       (Point of Interest C)
```

```
*
ADD HYD              IDsum=9, NHYD=602 IDs to add=4, 9
*
*                        Catchment 70:
*
*
CALIB NASHYD         ID=1 NHYD=70         DT=5MIN  AREA=2.7
                     DWF=0.   CN=68 IA=11.95  N=3  TP=.19 HRS     END=-1
*
*                        Catchment 71:
*                        Flow at Culvert 71
*
CALIB STANDHYD       ID=2 NHYD=71         DT=5min AREA=.64
                     XIMP=0.22 TIMP=0.22  DWF=0.0 LOSS=2 CN=62 IA=15.57
                     Pervious Area:
                     SLOPE=2% LENGTH=40  MNP=0.35 SCP=0.0
                     Impervious Area: DEPSTOR=2.0
                     SLOPE=1% LENGTH=65 MNP=0.015 SCP=0.0
                     END=-1
*
*                        Catchment 72:
*                        Flow at Culvert 73
*
CALIB STANDHYD       ID=3 NHYD=72         DT=5min AREA=1.44
                     XIMP=0.21 TIMP=0.21  DWF=0.0 LOSS=2 CN=62 IA=15.57
                     Pervious Area:
                     SLOPE=2% LENGTH=40  MNP=0.35 SCP=0.0
                     Impervious Area: DEPSTOR=2.0
                     SLOPE=1% LENGTH=98 MNP=0.015 SCP=0.0
                     END=-1
*
*                        Catchment 73:
*
*
CALIB STANDHYD       ID=4 NHYD=73         DT=5min AREA=4.40
                     XIMP=0.25 TIMP=0.25  DWF=0.0 LOSS=2 CN=62 IA=15.57
                     Pervious Area:
                     SLOPE=2% LENGTH=40  MNP=0.35 SCP=0.0
                     Impervious Area: DEPSTOR=2.0
                     SLOPE=1% LENGTH=171 MNP=0.015 SCP=0.0
                     END=-1
*
*                        Catchment 74:
*                        Flow at Culvert 74
*
CALIB STANDHYD       ID=5 NHYD=74         DT=5min AREA=1.44
                     XIMP=0.21 TIMP=0.21  DWF=0.0 LOSS=2 CN=62 IA=15.57
                     Pervious Area:
                     SLOPE=2% LENGTH=40  MNP=0.35 SCP=0.0
                     Impervious Area: DEPSTOR=2.0
                     SLOPE=1% LENGTH=98 MNP=0.015 SCP=0.0
                     END=-1
*
*                        Flow at Culvert 72
*
*
ADD HYD              IDsum=6, NHYD=700 IDs to add=2,3,4,5
*
*                        Catchment 75:
*
*
CALIB NASHYD         ID=7 NHYD=75         DT=5MIN  AREA=6.5
                     DWF=0.   CN=65 IA=13.68  N=3  TP=.35 HRS     END=-1
*
*                        Flow at Culvert 73
*
*
ADD HYD              IDsum=8, NHYD=701 IDs to add=6,7
*
*                        Catchment 76:
*
*
CALIB NASHYD         ID=9 NHYD=75         DT=5MIN  AREA=2.5
                     DWF=0.   CN=67 IA=12.51  N=3  TP=.20 HRS     END=-1
*
*                        Flow to Basin  4
*
*
ADD HYD              IDsum=10, NHYD=702 IDs to add=8, 9
*
*                        Bain 4 (Point of Interest D)
*
ROUTE RESERVOIR      IDout=3,   NHYD=4,  IDin=10,
                     RDT=1(min),
                           TABLE of ( OUTFLOW-STORAGE ) values
```

```
                                        (cms) - (ha-m)
                                      0.0000      0.000
                                      0.0106      0.016
                                      0.0149      0.032
                                      0.0183      0.050
                                      0.0211      0.068
                                      0.0382      0.068
                                      0.1082      0.069
                                      0.1987      0.069
                                      0.3060      0.070
                                      19.1739     0.094
                                      57.1248     0.119
                                          END=-1
*
*
*
*                       Catchment 80:
*
*
CALIB NASHYD          ID=2 NHYD=80         DT=5MIN  AREA=10.6
                      DWF=0.  CN=71 IA=10.37  N=3  TP=.44 HRS     END=-1
*
*                       Catchment 81:
*
*
CALIB STANDHYD        ID=3 NHYD=81         DT=5min AREA=.32
                      XIMP=0.21 TIMP=0.21  DWF=0.0 LOSS=2 CN=62 IA=15.57
                      Pervious Area:
                      SLOPE=2% LENGTH=40  MNP=0.35 SCP=0.0
                      Impervious Area: DEPSTOR=2.0
                      SLOPE=1% LENGTH=46 MNP=0.015 SCP=0.0
                      END=-1
*
*                       Catchment 82:
*
CALIB STANDHYD        ID=4 NHYD=82         DT=5min AREA=.21
                      XIMP=0.21 TIMP=0.21  DWF=0.0 LOSS=2 CN=62 IA=15.57
                      Pervious Area:
                      SLOPE=2% LENGTH=40  MNP=0.35 SCP=0.0
                      Impervious Area: DEPSTOR=2.0
                      SLOPE=1% LENGTH=37 MNP=0.015 SCP=0.0
                      END=-1
*
*                       Catchment 83:
*
*
CALIB STANDHYD        ID=5 NHYD=83         DT=5min AREA=.16
                      XIMP=0.21 TIMP=0.21  DWF=0.0 LOSS=2 CN=62 IA=15.57
                      Pervious Area:
                      SLOPE=2% LENGTH=40  MNP=0.35 SCP=0.0
                      Impervious Area: DEPSTOR=2.0
                      SLOPE=1% LENGTH=33 MNP=0.015 SCP=0.0
                      END=-1
*
*                       Catchment 84:
*
CALIB STANDHYD        ID=6 NHYD=84         DT=5min AREA=.17
                      XIMP=0.21 TIMP=0.21  DWF=0.0 LOSS=2 CN=62 IA=15.57
                      Pervious Area:
                      SLOPE=2% LENGTH=40  MNP=0.35 SCP=0.0
                      Impervious Area: DEPSTOR=2.0
                      SLOPE=1% LENGTH=34 MNP=0.015 SCP=0.0
                      END=-1
*
*                       Catchment 110:
*
*
CALIB NASHYD          ID=7 NHYD=110        DT=5MIN  AREA=420.5
                      DWF=0.  CN=72 IA=9.88  N=3  TP=5.93 HRS     END=-1
*
*                       Flow at Culvert 80
*
*
ADD HYD               IDsum=8, NHYD=800 IDs to add=1,2,3,4,7
*
*                       (Point of Interest E)
*
ADD HYD               IDsum=9, NHYD=801 IDs to add=5,6,8
*
*
*                       Catchment 120:
*
*
CALIB NASHYD          ID=1 NHYD=120        DT=5MIN  AREA=55.7
                      DWF=0.  CN=71 IA=10.37  N=3  TP=1.04 HRS     END=-1
```

```
*
*
*                       Catchment 121:
*
CALIB STANDHYD          ID=2 NHYD=121        DT=5min AREA=.54
                        XIMP=0.21 TIMP=0.21  DWF=0.0 LOSS=2 CN=65 IA=13.68
                        Pervious Area:
                        SLOPE=2% LENGTH=40  MNP=0.35 SCP=0.0
                        Impervious Area: DEPSTOR=2.0
                        SLOPE=1% LENGTH=60 MNP=0.015 SCP=0.0
                        END=-1
*
*                       Catchment 122:
*
CALIB STANDHYD          ID=3 NHYD=122        DT=5min AREA=.38
                        XIMP=0.21 TIMP=0.21  DWF=0.0 LOSS=2 CN=65 IA=13.68
                        Pervious Area:
                        SLOPE=2% LENGTH=40  MNP=0.35 SCP=0.0
                        Impervious Area: DEPSTOR=2.0
                        SLOPE=1% LENGTH=50 MNP=0.015 SCP=0.0
                        END=-1
*
*                       Flow at Culvert 120
*
*
ADD HYD                 IDsum=4, NHYD=1200 IDs to add=1,2,3
*
*
*                       Catchment 123:
*
CALIB STANDHYD          ID=5 NHYD=123        DT=5min AREA=.43
                        XIMP=0.21 TIMP=0.21  DWF=0.0 LOSS=2 CN=65 IA=13.68
                        Pervious Area:
                        SLOPE=2% LENGTH=40  MNP=0.35 SCP=0.0
                        Impervious Area: DEPSTOR=2.0
                        SLOPE=1% LENGTH=54 MNP=0.015 SCP=0.0
                        END=-1
*
*                       Catchment 124:
*
CALIB STANDHYD          ID=6 NHYD=124        DT=5min AREA=.72
                        XIMP=0.21 TIMP=0.21  DWF=0.0 LOSS=2 CN=65 IA=13.68
                        Pervious Area:
                        SLOPE=2% LENGTH=40  MNP=0.35 SCP=0.0
                        Impervious Area: DEPSTOR=2.0
                        SLOPE=1% LENGTH=69 MNP=0.015 SCP=0.0
                        END=-1
*
*                       Flow d/s of Culvert 120
*
ADD HYD                 IDsum=10, NHYD=1201 IDs to add=4,5,6
*
*                       Catchment 125:
*                       Flow at Culvert 121
*
CALIB STANDHYD          ID=1 NHYD=125        DT=5min AREA=.95
                        XIMP=0.25 TIMP=0.25  DWF=0.0 LOSS=2 CN=65 IA=13.68
                        Pervious Area:
                        SLOPE=2% LENGTH=40  MNP=0.35 SCP=0.0
                        Impervious Area: DEPSTOR=2.0
                        SLOPE=1% LENGTH=80 MNP=0.015 SCP=0.0
                        END=-1
*
*                       Catchment 126:
*
CALIB STANDHYD          ID=2 NHYD=126        DT=5min AREA=.17
                        XIMP=0.34 TIMP=0.34  DWF=0.0 LOSS=2 CN=65 IA=13.68
                        Pervious Area:
                        SLOPE=2% LENGTH=40  MNP=0.35 SCP=0.0
                        Impervious Area: DEPSTOR=2.0
                        SLOPE=1% LENGTH=34 MNP=0.015 SCP=0.0
                        END=-1
*
*                       Flow at Culvert 122
*
*
ADD HYD                 IDsum=3, NHYD=1201 IDs to add=1,2
*
*                       Catchment 127:
*                       Flow at Culvert 123
*
*
CALIB NASHYD            ID=4 NHYD=127        DT=5MIN  AREA=1.75
                        DWF=0.   CN=69 IA=11.41  N=3  TP=.25 HRS     END=-1
*
```

```
*                       Catchment 128:
*                       Flow at Culvert 124
*
CALIB STANDHYD      ID=5 NHYD=128        DT=5min AREA=.36
                    XIMP=0.21 TIMP=0.21  DWF=0.0 LOSS=2 CN=65 IA=13.68
                    Pervious Area:
                    SLOPE=2% LENGTH=40  MNP=0.35 SCP=0.0
                    Impervious Area: DEPSTOR=2.0
                    SLOPE=1% LENGTH=49 MNP=0.015 SCP=0.0
                    END=-1
*
*                       Catchment 129:
*                       Flow at Culvert 125
*
CALIB STANDHYD      ID=6 NHYD=129        DT=5min AREA=.36
                    XIMP=0.21 TIMP=0.21  DWF=0.0 LOSS=2 CN=65 IA=13.68
                    Pervious Area:
                    SLOPE=2% LENGTH=40  MNP=0.35 SCP=0.0
                    Impervious Area: DEPSTOR=2.0
                    SLOPE=1% LENGTH=49 MNP=0.015 SCP=0.0
                    END=-1
*
*                       Catchment 130:
*
CALIB STANDHYD      ID=7 NHYD=130        DT=5min AREA=3.9
                    XIMP=0.29 TIMP=0.29  DWF=0.0 LOSS=2 CN=65 IA=13.68
                    Pervious Area:
                    SLOPE=2% LENGTH=40  MNP=0.35 SCP=0.0
                    Impervious Area: DEPSTOR=2.0
                    SLOPE=1% LENGTH=161 MNP=0.015 SCP=0.0
                    END=-1
*
*                       Flow at Culvert 126
*
*
ADD HYD             IDsum=8, NHYD=1202 IDs to add=3,4,5,6,7
*
*                       Catchment 131:
*                       Flow at Culvert 127
*
CALIB STANDHYD      ID=1 NHYD=131        DT=5min AREA=.36
                    XIMP=0.68 TIMP=0.68  DWF=0.0 LOSS=2 CN=65 IA=13.68
                    Pervious Area:
                    SLOPE=2% LENGTH=40  MNP=0.35 SCP=0.0
                    Impervious Area: DEPSTOR=2.0
                    SLOPE=1% LENGTH=49 MNP=0.015 SCP=0.0
                    END=-1
*
*                       Catchment 132:
*                       Flow at Culvert 128
*
CALIB STANDHYD      ID=2 NHYD=132        DT=5min AREA=.95
                    XIMP=0.25 TIMP=0.25  DWF=0.0 LOSS=2 CN=65 IA=13.68
                    Pervious Area:
                    SLOPE=2% LENGTH=40  MNP=0.35 SCP=0.0
                    Impervious Area: DEPSTOR=2.0
                    SLOPE=1% LENGTH=80 MNP=0.015 SCP=0.0
                    END=-1
*
*                       Catchment 133:
*
*
CALIB STANDHYD      ID=3 NHYD=133        DT=5min AREA=1.75
                    XIMP=0.20 TIMP=0.20  DWF=0.0 LOSS=2 CN=65 IA=13.68
                    Pervious Area:
                    SLOPE=2% LENGTH=40  MNP=0.35 SCP=0.0
                    Impervious Area: DEPSTOR=2.0
                    SLOPE=1% LENGTH=108 MNP=0.015 SCP=0.0
                    END=-1
*
*                       Flow to Basin 5
*
ADD HYD             IDsum=4, NHYD=1203 IDs to add=8,1,2,3
*
*                       Basin 5
*
ROUTE RESERVOIR     IDout=5,   NHYD=5,  IDin=4,
                    RDT=5(min),
                          TABLE of ( OUTFLOW-STORAGE ) values
                                    (cms) - (ha-m)
                                  0.0000      0.000
                                  0.0096      0.015
                                  0.0136      0.030
                                  0.0166      0.047
                                  0.0192      0.065
```

```
                                    0.0697      0.109
                                    0.1240      0.159
                                    0.1609      0.215
                                    0.1908      0.277
                                    2.2908      0.313
                                    6.4303      0.350
                                         END=-1
*
*
*                       (Point of Interest F) Add flows from reservoir and ID 10)
*
ADD HYD             IDsum=6, NHYD=1204 IDs to add=5,10
*
*                       Catchment 135:
*                       Flow at Culvert 135 (point of Interest G)
*
*
CALIB NASHYD        ID=1 NHYD=135       DT=5MIN  AREA=11.2
                    DWF=0.  CN=73 IA=9.39  N=3  TP=.33 HRS    END=-1
*
*                       Catchment 140:
*                       Flow at Culvert 140
*
*
CALIB STANDHYD      ID=1 NHYD=140       DT=5min AREA=1.30
                    XIMP=0.34 TIMP=0.34  DWF=0.0 LOSS=2 CN=71 IA=10.37
                    Pervious Area:
                    SLOPE=2% LENGTH=40  MNP=0.35 SCP=0.0
                    Impervious Area: DEPSTOR=2.0
                    SLOPE=1% LENGTH=93 MNP=0.015 SCP=0.0
                    END=-1
*
*                       Catchment 141:
*
*
CALIB STANDHYD      ID=2 NHYD=141       DT=5min AREA=2.4
                    XIMP=0.25 TIMP=0.25  DWF=0.0 LOSS=2 CN=71 IA=10.37
                    Pervious Area:
                    SLOPE=2% LENGTH=40  MNP=0.35 SCP=0.0
                    Impervious Area: DEPSTOR=2.0
                    SLOPE=1% LENGTH=126 MNP=0.015 SCP=0.0
                    END=-1
*
*                       Flow at Culvert 141
*
ADD HYD             IDsum=3, NHYD=1400 IDs to add=1,2
*
*                       Catchment 142:
*
*
CALIB NASHYD        ID=4 NHYD=142       DT=5MIN  AREA=1.3
                    DWF=0.  CN=73 IA=9.39  N=3  TP=.6 HRS     END=-1
*
*                       Flow to Basin 6
*
ADD HYD             IDsum=5, NHYD=1401 IDs to add=3,4
*
*                       Basin 6 (Point of Interest H)
*
ROUTE RESERVOIR     IDout=6,   NHYD=6,  IDin=5,
                    RDT=5(min),
                          TABLE of ( OUTFLOW-STORAGE ) values
                                (cms) - (ha-m)
                                    0.0000      0.000
                                    0.0081      0.007
                                    0.0114      0.015
                                    0.0140      0.023
                                    0.0162      0.032
                                    0.0237      0.049
                                    0.0554      0.069
                                    0.0747      0.091
                                    0.0900      0.115
                                    2.1860      0.136
                                    6.3214      0.157
                                         END=-1
*
*
*                       Catchment 143:
*                       Flow at Culvert 142
*
CALIB NASHYD        ID=1 NHYD=143       DT=5MIN  AREA=2.1
                    DWF=0.  CN=68 IA=11.95  N=3  TP=.87 HRS    END=-1
*
*                       Catchment 144:
*
```

```
*
CALIB STANDHYD       ID=2 NHYD=144        DT=5min AREA=3.72
                     XIMP=0.25 TIMP=0.25  DWF=0.0 LOSS=2 CN=65 IA=13.68
                     Pervious Area:
                     SLOPE=2% LENGTH=40   MNP=0.35 SCP=0.0
                     Impervious Area: DEPSTOR=2.0
                     SLOPE=1% LENGTH=157 MNP=0.015 SCP=0.0
                     END=-1
*
*                        Flow at Culvert 143
*
*
ADD HYD              IDsum=3, NHYD=1402 IDs to add=1,2
*
*                        Catchment 145:
*
*
CALIB STANDHYD       ID=4 NHYD=145        DT=5min AREA=2.10
                     XIMP=0.33 TIMP=0.33  DWF=0.0 LOSS=2 CN=65 IA=13.68
                     Pervious Area:
                     SLOPE=2% LENGTH=40   MNP=0.35 SCP=0.0
                     Impervious Area: DEPSTOR=2.0
                     SLOPE=1% LENGTH=118 MNP=0.015 SCP=0.0
                     END=-1
*
*                        Flow to Basin 7
*
*
ADD HYD              IDsum=5, NHYD=1402 IDs to add=3,4
*
*
*                        Basin 7 (Point of Interest I)
*
ROUTE RESERVOIR      IDout=6,   NHYD=7,  IDin=5,
                     RDT=5(min),
                           TABLE of ( OUTFLOW-STORAGE ) values
                                    (cms) - (ha-m)
                                  0.0000      0.000
                                  0.0112      0.010
                                  0.0158      0.020
                                  0.0193      0.032
                                  0.0223      0.044
                                  0.0309      0.061
                                  0.0869      0.080
                                  0.1189      0.101
                                  0.1440      0.124
                                  2.2481      0.145
                                  6.3907      0.167
                                        END=-1
*
*
*
*                        Catchment 150:
*
*
CALIB NASHYD         ID=1 NHYD=150        DT=5MIN  AREA=31.76
                     DWF=0.  CN=67 IA=12.51  N=3  TP=1.03 HRS    END=-1
*
*                        Catchment 151:
*
*
CALIB STANDHYD       ID=2 NHYD=151        DT=5min AREA=2.52
                     XIMP=0.21 TIMP=0.21  DWF=0.0 LOSS=2 CN=65 IA=13.68
                     Pervious Area:
                     SLOPE=2% LENGTH=40   MNP=0.35 SCP=0.0
                     Impervious Area: DEPSTOR=2.0
                     SLOPE=1% LENGTH=130 MNP=0.015 SCP=0.0
                     END=-1
*
*                        Flow at Culvert 150
*
ADD HYD              IDsum=3, NHYD=1500 IDs to add=1,2
*
*                        Catchment 152:
*
*
CALIB STANDHYD       ID=4 NHYD=152        DT=5min AREA=1.55
                     XIMP=0.21 TIMP=0.21  DWF=0.0 LOSS=2 CN=65 IA=13.68
                     Pervious Area:
                     SLOPE=2% LENGTH=40   MNP=0.35 SCP=0.0
                     Impervious Area: DEPSTOR=2.0
                     SLOPE=1% LENGTH=102 MNP=0.015 SCP=0.0
                     END=-1
*
*                        Flow d/s of Culvert 150 (Point of Interest J)
```

```
*
ADD HYD              IDsum=10, NHYD=1501 IDs to add=3,4
*
*                        Catchment 153:
*
*
CALIB STANDHYD       ID=1 NHYD=153        DT=5min AREA=7.9
                     XIMP=0.25 TIMP=0.25  DWF=0.0 LOSS=2 CN=68 IA=11.95
                     Pervious Area:
                     SLOPE=2% LENGTH=40  MNP=0.35 SCP=0.0
                     Impervious Area: DEPSTOR=2.0
                     SLOPE=1% LENGTH=229 MNP=0.015 SCP=0.0
                     END=-1
*
*                        Catchment 154:
*                        Flow at Ditch Inlet
*
*
CALIB STANDHYD       ID=2 NHYD=154        DT=5min AREA=1.56
                     XIMP=0.21 TIMP=0.21  DWF=0.0 LOSS=2 CN=71 IA=10.37
                     Pervious Area:
                     SLOPE=2% LENGTH=40  MNP=0.35 SCP=0.0
                     Impervious Area: DEPSTOR=2.0
                     SLOPE=1% LENGTH=102 MNP=0.015 SCP=0.0
                     END=-1
*
*
*                        Catchment 155:
*                        Flow at Ditch Inlet
*
*
CALIB STANDHYD       ID=3 NHYD=155        DT=5min AREA=1.56
                     XIMP=0.21 TIMP=0.21  DWF=0.0 LOSS=2 CN=71 IA=10.37
                     Pervious Area:
                     SLOPE=2% LENGTH=40  MNP=0.35 SCP=0.0
                     Impervious Area: DEPSTOR=2.0
                     SLOPE=1% LENGTH=102 MNP=0.015 SCP=0.0
                     END=-1
*
*                        Catchment 156:
*                        Flow at Culvert 154
*
*
CALIB STANDHYD       ID=4 NHYD=156        DT=5min AREA=1.4
                     XIMP=0.62 TIMP=0.62  DWF=0.0 LOSS=2 CN=71 IA=10.37
                     Pervious Area:
                     SLOPE=2% LENGTH=40  MNP=0.35 SCP=0.0
                     Impervious Area: DEPSTOR=2.0
                     SLOPE=1% LENGTH=97 MNP=0.015 SCP=0.0
                     END=-1
*
*                        Catchment 157:
*                        Flow at Culvert 155
*
*
CALIB STANDHYD       ID=5 NHYD=157        DT=5min AREA=1.4
                     XIMP=0.62 TIMP=0.62  DWF=0.0 LOSS=2 CN=71 IA=10.37
                     Pervious Area:
                     SLOPE=2% LENGTH=40  MNP=0.35 SCP=0.0
                     Impervious Area: DEPSTOR=2.0
                     SLOPE=1% LENGTH=97 MNP=0.015 SCP=0.0
                     END=-1
*
*                        Catchment 158:
*                        Flow at Culvert 153
*
*
CALIB NASHYD         ID=6 NHYD=158        DT=5MIN  AREA=2.27
                     DWF=0.   CN=75 IA=8.47  N=3  TP=.23 HRS     END=-1
*
*                        Flow at Culvert 157
*
*
*
ADD HYD              IDsum=7, NHYD=1501 IDs to add=1,2,3,4,5,6
*
*
*                        Catchment 159:
*                        Flow at Culvert 156
*
*
```

```
CALIB STANDHYD        ID=1 NHYD=159        DT=5min AREA=1.23
                      XIMP=0.28 TIMP=0.28  DWF=0.0 LOSS=2 CN=71 IA=10.37
                      Pervious Area:
                      SLOPE=2% LENGTH=40   MNP=0.35 SCP=0.0
                      Impervious Area: DEPSTOR=2.0
                      SLOPE=1% LENGTH=91 MNP=0.015 SCP=0.0
                      END=-1
*
*
*                         Catchment 161:
*
CALIB STANDHYD        ID=2 NHYD=158        DT=5min AREA=2.15
                      XIMP=0.20 TIMP=0.20  DWF=0.0 LOSS=2 CN=65 IA=13.68
                      Pervious Area:
                      SLOPE=2% LENGTH=40   MNP=0.35 SCP=0.0
                      Impervious Area: DEPSTOR=2.0
                      SLOPE=1% LENGTH=120 MNP=0.015 SCP=0.0
                      END=-1
*
*                         Flow at Culvert 158
*
*
ADD HYD               IDsum=3, NHYD=1501 IDs to add=1,2,7
*
*                         Catchment 162:
*
CALIB STANDHYD        ID=4 NHYD=162        DT=5min AREA=.99
                      XIMP=0.27 TIMP=0.27  DWF=0.0 LOSS=2 CN=65 IA=13.68
                      Pervious Area:
                      SLOPE=2% LENGTH=40   MNP=0.35 SCP=0.0
                      Impervious Area: DEPSTOR=2.0
                      SLOPE=1% LENGTH=81 MNP=0.015 SCP=0.0
                      END=-1
*
*                         Flow to Basin 8
*
*
ADD HYD               IDsum=5, NHYD=1502 IDs to add=3,4
*
*                        (Point of Interest J2)
*                           Basin 8
*
ROUTE RESERVOIR       IDout=6,   NHYD=7,  IDin=5,
                      RDT=5(min),
                            TABLE of ( OUTFLOW-STORAGE ) values
                                      (cms) - (ha-m)
                                    0.0000      0.000
                                    0.0064      0.036
                                    0.0091      0.073
                                    0.0111      0.111
                                    0.0128      0.150
                                    0.0294      0.199
                                    0.1063      0.250
                                    0.2376      0.302
                                    0.3690      0.355
                                    2.5561      0.439
                                    6.7653      0.525
                                          END=-1
*
*
*
*
*ADD HYD               IDsum=7, NHYD=1503 IDs to add=6,10
*
*
*                         Catchment 160:
*                         Flow at Culvert 160 (Point of Interest K)
*
*
CALIB NASHYD          ID=1 NHYD=160        DT=5MIN  AREA=25.82
                      DWF=0.  CN=74 IA=8.92  N=3  TP=.43 HRS    END=-1
*
*                         Catchment 170:
*
*
CALIB NASHYD          ID=1 NHYD=170        DT=5MIN  AREA=13.8
                      DWF=0.  CN=71 IA=10.37  N=3  TP=.36 HRS    END=-1
*
*                         Catchment 171:
*
CALIB STANDHYD        ID=2 NHYD=171        DT=5min AREA=.68
                      XIMP=0.21 TIMP=0.21  DWF=0.0 LOSS=2 CN=65 IA=13.68
                      Pervious Area:
                      SLOPE=2% LENGTH=40   MNP=0.35 SCP=0.0
                      Impervious Area: DEPSTOR=2.0
```

```
                    SLOPE=1% LENGTH=67 MNP=0.015 SCP=0.0
                    END=-1
*
*                       Catchment 172:
*
CALIB STANDHYD      ID=3 NHYD=172       DT=5min AREA=.72
                    XIMP=0.21 TIMP=0.21  DWF=0.0 LOSS=2 CN=65 IA=13.68
                    Pervious Area:
                    SLOPE=2% LENGTH=40  MNP=0.35 SCP=0.0
                    Impervious Area: DEPSTOR=2.0
                    SLOPE=1% LENGTH=69 MNP=0.015 SCP=0.0
                    END=-1
*
*
*                       Catchment 173:
*
CALIB STANDHYD      ID=4 NHYD=173       DT=5min AREA=1.13
                    XIMP=0.25 TIMP=0.25  DWF=0.0 LOSS=2 CN=65 IA=13.68
                    Pervious Area:
                    SLOPE=2% LENGTH=40  MNP=0.35 SCP=0.0
                    Impervious Area: DEPSTOR=2.0
                    SLOPE=1% LENGTH=87 MNP=0.015 SCP=0.0
                    END=-1
*
*                       Catchment 174:
*
CALIB STANDHYD      ID=5 NHYD=174       DT=5min AREA=1.2
                    XIMP=0.25 TIMP=0.25  DWF=0.0 LOSS=2 CN=65 IA=13.68
                    Pervious Area:
                    SLOPE=2% LENGTH=40  MNP=0.35 SCP=0.0
                    Impervious Area: DEPSTOR=2.0
                    SLOPE=1% LENGTH=89 MNP=0.015 SCP=0.0
                    END=-1
*
*                       Flow at Culvert 170
*
*
ADD HYD             IDsum=6, NHYD=1700 IDs to add=1,2,3,4,5
*
*
*                       Catchment 175:
*
CALIB STANDHYD      ID=7 NHYD=175       DT=5min AREA=.68
                    XIMP=0.21 TIMP=0.21  DWF=0.0 LOSS=2 CN=65 IA=13.68
                    Pervious Area:
                    SLOPE=2% LENGTH=40  MNP=0.35 SCP=0.0
                    Impervious Area: DEPSTOR=2.0
                    SLOPE=1% LENGTH=67 MNP=0.015 SCP=0.0
                    END=-1
*
*                       Catchment 176:
*
CALIB STANDHYD      ID=8 NHYD=176       DT=5min AREA=.72
                    XIMP=0.21 TIMP=0.21  DWF=0.0 LOSS=2 CN=65 IA=13.68
                    Pervious Area:
                    SLOPE=2% LENGTH=40  MNP=0.35 SCP=0.0
                    Impervious Area: DEPSTOR=2.0
                    SLOPE=1% LENGTH=69 MNP=0.015 SCP=0.0
                    END=-1
*
*                       (Point of Interest L)
*
ADD HYD             IDsum=9, NHYD=1503 IDs to add=6,7,8
*
*
*                       Catchment 177:
*
CALIB STANDHYD      ID=1 NHYD=177       DT=5min AREA=.85
                    XIMP=0.21 TIMP=0.21  DWF=0.0 LOSS=2 CN=71 IA=10.37
                    Pervious Area:
                    SLOPE=2% LENGTH=40  MNP=0.35 SCP=0.0
                    Impervious Area: DEPSTOR=2.0
                    SLOPE=1% LENGTH=75 MNP=0.015 SCP=0.0
                    END=-1
*
*                       Catchment 181:
*                       Flow at culvert 175
*
CALIB STANDHYD      ID=2 NHYD=181       DT=5min AREA=.57
                    XIMP=0.21 TIMP=0.21  DWF=0.0 LOSS=2 CN=71 IA=10.37
                    Pervious Area:
                    SLOPE=2% LENGTH=40  MNP=0.35 SCP=0.0
                    Impervious Area: DEPSTOR=2.0
                    SLOPE=1% LENGTH=62 MNP=0.015 SCP=0.0
                    END=-1
```

```
*
*                       Flow at Culvert 176
*
ADD HYD             IDsum=3, NHYD=1800 IDs to add=1,2
*
*                       Catchment 178:
*
CALIB STANDHYD      ID=4 NHYD=178       DT=5min AREA=1.43
                    XIMP=0.25 TIMP=0.25  DWF=0.0 LOSS=2 CN=71 IA=10.37
                    Pervious Area:
                    SLOPE=2% LENGTH=40  MNP=0.35 SCP=0.0
                    Impervious Area: DEPSTOR=2.0
                    SLOPE=1% LENGTH=98 MNP=0.015 SCP=0.0
                    END=-1
*
*                       Catchment 182:
*
CALIB STANDHYD      ID=5 NHYD=182       DT=5min AREA=.96
                    XIMP=0.25 TIMP=0.25  DWF=0.0 LOSS=2 CN=71 IA=10.37
                    Pervious Area:
                    SLOPE=2% LENGTH=40  MNP=0.35 SCP=0.0
                    Impervious Area: DEPSTOR=2.0
                    SLOPE=1% LENGTH=80 MNP=0.015 SCP=0.0
                    END=-1
*
*                       Flow at Culvert 177
*
ADD HYD             IDsum=6, NHYD=1801 IDs to add=3,4,5
*
*                       Catchment 179:
*
*
CALIB STANDHYD      ID=7 NHYD=179       DT=5min AREA=.85
                    XIMP=0.21 TIMP=0.21  DWF=0.0 LOSS=2 CN=71 IA=10.37
                    Pervious Area:
                    SLOPE=2% LENGTH=40  MNP=0.35 SCP=0.0
                    Impervious Area: DEPSTOR=2.0
                    SLOPE=1% LENGTH=75 MNP=0.015 SCP=0.0
                    END=-1
*
*                       Catchment 183:
*                       Flow at culvert 178
*
CALIB STANDHYD      ID=8 NHYD=183       DT=5min AREA=.57
                    XIMP=0.21 TIMP=0.21  DWF=0.0 LOSS=2 CN=71 IA=10.37
                    Pervious Area:
                    SLOPE=2% LENGTH=40  MNP=0.35 SCP=0.0
                    Impervious Area: DEPSTOR=2.0
                    SLOPE=1% LENGTH=62 MNP=0.015 SCP=0.0
                    END=-1
*
*                       Total Outflow to Basin 10 (Basin if required)
*                       (Point of Interest M)
*
*
ADD HYD             IDsum=9, NHYD=1801 IDs to add=6,7,8
*
*                       Basin 10
*
ROUTE RESERVOIR     IDout=10,   NHYD=10,  IDin=9
                    RDT=5(min),
                          TABLE of ( OUTFLOW-STORAGE ) values
                                    (cms) - (ha-m)
                                  0.0000      0.000
                                  0.0077      0.008
                                  0.0109      0.017
                                  0.0133      0.026
                                  0.0154      0.035
                                  0.0172      0.047
                                  0.0466      0.060
                                  0.0743      0.073
                                  0.0941      0.087
                                  2.2014      0.108
                                  6.3456      0.129
                                        END=-1
*
*
*                      Catchment 180:
*
*
*
CALIB NASHYD        ID=1 NHYD=180       DT=5MIN  AREA=134
                    DWF=0.  CN=76 IA=8.02  N=3  TP=1.06 HRS     END=-1
*
*
```

```
*                       Catchment 184:
*                       Flow at culvert 181
*
CALIB STANDHYD      ID=2 NHYD=184       DT=5min AREA=.97
                    XIMP=0.21 TIMP=0.21  DWF=0.0 LOSS=2 CN=71 IA=10.37
                    Pervious Area:
                    SLOPE=2% LENGTH=40  MNP=0.35 SCP=0.0
                    Impervious Area: DEPSTOR=2.0
                    SLOPE=1% LENGTH=80 MNP=0.015 SCP=0.0
                    END=-1
*
*
*                       Catchment 185:
*                       Flow at culvert 182
*
CALIB STANDHYD      ID=3 NHYD=185       DT=5min AREA=.96
                    XIMP=0.21 TIMP=0.21  DWF=0.0 LOSS=2 CN=71 IA=10.37
                    Pervious Area:
                    SLOPE=2% LENGTH=40  MNP=0.35 SCP=0.0
                    Impervious Area: DEPSTOR=2.0
                    SLOPE=1% LENGTH=80 MNP=0.015 SCP=0.0
                    END=-1
*
*
*                       Catchment 186:
*
CALIB STANDHYD      ID=4 NHYD=186       DT=5min AREA=3.23
                    XIMP=0.25 TIMP=0.25  DWF=0.0 LOSS=2 CN=71 IA=10.37
                    Pervious Area:
                    SLOPE=2% LENGTH=40  MNP=0.35 SCP=0.0
                    Impervious Area: DEPSTOR=2.0
                    SLOPE=1% LENGTH=147 MNP=0.015 SCP=0.0
                    END=-1
*
*                       Flow at Culvert 180
*
*
ADD HYD             IDsum=5, NHYD=1802 IDs to add=1,2,3,4
*
*                       Catchment 187:
*
*
CALIB STANDHYD      ID=6 NHYD=187       DT=5min AREA=.96
                    XIMP=0.21 TIMP=0.21  DWF=0.0 LOSS=2 CN=71 IA=10.37
                    Pervious Area:
                    SLOPE=2% LENGTH=40  MNP=0.35 SCP=0.0
                    Impervious Area: DEPSTOR=2.0
                    SLOPE=1% LENGTH=80 MNP=0.015 SCP=0.0
                    END=-1
*
*
*                       Catchment 188:
*
*
CALIB STANDHYD      ID=7 NHYD=188       DT=5min AREA=.97
                    XIMP=0.21 TIMP=0.21  DWF=0.0 LOSS=2 CN=71 IA=10.37
                    Pervious Area:
                    SLOPE=2% LENGTH=40  MNP=0.35 SCP=0.0
                    Impervious Area: DEPSTOR=2.0
                    SLOPE=1% LENGTH=80 MNP=0.015 SCP=0.0
                    END=-1
*
*
*
*                        (Point of Interest N)
*
*
ADD HYD             IDsum=10, NHYD=1804 IDs to add=5,6,7
*
*
*                       Catchment 190:
*
*
CALIB NASHYD        ID=10 NHYD=190      DT=5MIN  AREA=771
                    DWF=0.  CN=76 IA=8.02  N=3  TP=2.23 HRS     END=-1
*
*
*                       Catchment 191:
*
*
CALIB NASHYD        ID=1 NHYD=191       DT=5MIN  AREA=6.3
                    DWF=0.  CN=76 IA=8.02  N=3  TP=.23 HRS     END=-1
*
*
*                       Catchment 192:
```

```
*
CALIB STANDHYD          ID=2 NHYD=192        DT=5min AREA=1.62
                        XIMP=0.21 TIMP=0.21  DWF=0.0 LOSS=2 CN=71 IA=10.37
                        Pervious Area:
                        SLOPE=2% LENGTH=40   MNP=0.35 SCP=0.0
                        Impervious Area: DEPSTOR=2.0
                        SLOPE=1% LENGTH=104 MNP=0.015 SCP=0.0
                        END=-1
*
*                           Flow at Culvert 191
*
*
ADD HYD                 IDsum=3, NHYD=1900 IDs to add=1,2
*
*                           Catchment 193:
*
CALIB STANDHYD          ID=4 NHYD=192        DT=5min AREA=3.33
                        XIMP=0.25 TIMP=0.25  DWF=0.0 LOSS=2 CN=71 IA=10.37
                        Pervious Area:
                        SLOPE=2% LENGTH=40   MNP=0.35 SCP=0.0
                        Impervious Area: DEPSTOR=2.0
                        SLOPE=1% LENGTH=149 MNP=0.015 SCP=0.0
                        END=-1
*
*                           Flow at Culvert 192
*
*
ADD HYD                 IDsum=5, NHYD=1901 IDs to add=3,4
*
*                           Catchment 194:
*
CALIB STANDHYD          ID=6 NHYD=194        DT=5min AREA=1.62
                        XIMP=0.21 TIMP=0.21  DWF=0.0 LOSS=2 CN=71 IA=10.37
                        Pervious Area:
                        SLOPE=2% LENGTH=40   MNP=0.35 SCP=0.0
                        Impervious Area: DEPSTOR=2.0
                        SLOPE=1% LENGTH=104 MNP=0.015 SCP=0.0
                        END=-1
*
*                           Flow to Basin 12
*
*
ADD HYD                 IDsum=7, NHYD=1902 IDs to add=5,6
*
*                           Basin 12
*
ROUTE RESERVOIR         IDout=8,   NHYD=12,  IDin=7
                        RDT=5(min),
                              TABLE of ( OUTFLOW-STORAGE ) values
                                        (cms) - (ha-m)
                                      0.0000      0.000
                                      0.0092      0.015
                                      0.0130      0.030
                                      0.0159      0.047
                                      0.0183      0.065
                                      0.0471      0.117
                                      0.1527      0.178
                                      0.1976      0.247
                                      0.2340      0.325
                                      2.3365      0.369
                                      6.4783      0.416
                                           END=-1
*
*                           Catchment 195:
*                           Flow at Culvert 193
*
CALIB STANDHYD          ID=1 NHYD=195        DT=5min AREA=1.65
                        XIMP=0.21 TIMP=0.21  DWF=0.0 LOSS=2 CN=71 IA=10.37
                        Pervious Area:
                        SLOPE=2% LENGTH=40   MNP=0.35 SCP=0.0
                        Impervious Area: DEPSTOR=2.0
                        SLOPE=1% LENGTH=105 MNP=0.015 SCP=0.0
                        END=-1
*
*
*                           Catchment 196:
*
CALIB STANDHYD          ID=2 NHYD=196        DT=5min AREA=2.76
                        XIMP=0.25 TIMP=0.25  DWF=0.0 LOSS=2 CN=71 IA=10.37
                        Pervious Area:
                        SLOPE=2% LENGTH=40   MNP=0.35 SCP=0.0
                        Impervious Area: DEPSTOR=2.0
                        SLOPE=1% LENGTH=136 MNP=0.015 SCP=0.0
                        END=-1
*
```

```
*                       Flow at Culvert 194
*
*
ADD HYD             IDsum=3, NHYD=1903 IDs to add=1,2
*
*                       Catchment 197:
*
CALIB STANDHYD      ID=4 NHYD=197       DT=5min AREA=1.65
                    XIMP=0.21 TIMP=0.21  DWF=0.0 LOSS=2 CN=71 IA=10.37
                    Pervious Area:
                    SLOPE=2% LENGTH=40  MNP=0.35 SCP=0.0
                    Impervious Area: DEPSTOR=2.0
                    SLOPE=1% LENGTH=105 MNP=0.015 SCP=0.0
                    END=-1
*
*                       Flow to Basin 13
*
*
ADD HYD             IDsum=5, NHYD=1904 IDs to add=3,4
*
*                       Basin 13
*
ROUTE RESERVOIR     IDout=6,   NHYD=10,  IDin=5
                    RDT=5(min),
                          TABLE of ( OUTFLOW-STORAGE ) values
                                (cms) - (ha-m)
                               0.0000      0.000
                               0.0095      0.009
                               0.0134      0.019
                               0.0164      0.029
                               0.0190      0.040
                               0.0358      0.065
                               0.0689      0.093
                               0.0906      0.125
                               0.1080      0.160
                               2.2034      0.184
                               6.3384      0.210
                                     END=-1
*
*
*                       Point of Interest 0 (Add ID 10, flow from basin 12 & 13)
*
*
ADD HYD             IDsum=9, NHYD=1905 IDs to add=6, 8, 10
*
*                       Catchment 200:
*                       Flow at Culvert 200
*
CALIB STANDHYD      ID=1 NHYD=200       DT=5min AREA=1.13
                    XIMP=0.33 TIMP=0.33  DWF=0.0 LOSS=2 CN=71 IA=10.37
                    Pervious Area:
                    SLOPE=2% LENGTH=40  MNP=0.35 SCP=0.0
                    Impervious Area: DEPSTOR=2.0
                    SLOPE=1% LENGTH=87 MNP=0.015 SCP=0.0
                    END=-1
*
*                       Catchment 201:
*
*
CALIB NASHYD        ID=2 NHYD=201       DT=5MIN  AREA=2.4
                    DWF=0.   CN=74 IA=8.92  N=3  TP=.24 HRS    END=-1
*
*                       Flow at Culvert 201
*
*
ADD HYD             IDsum=3, NHYD=2000 IDs to add=1,2
*
*                       Catchment 202:
*                       Flow at Culvert 202
*
CALIB STANDHYD      ID=4 NHYD=202       DT=5min AREA=1.2
                    XIMP=0.23 TIMP=0.23  DWF=0.0 LOSS=2 CN=71 IA=10.37
                    Pervious Area:
                    SLOPE=2% LENGTH=40  MNP=0.35 SCP=0.0
                    Impervious Area: DEPSTOR=2.0
                    SLOPE=1% LENGTH=89 MNP=0.015 SCP=0.0
                    END=-1
*
*                       Catchment 203:
*                       Flow at Culvert 203
*
CALIB STANDHYD      ID=5 NHYD=203       DT=5min AREA=2.4
                    XIMP=0.21 TIMP=0.21  DWF=0.0 LOSS=2 CN=71 IA=10.37
                    Pervious Area:
                    SLOPE=2% LENGTH=40  MNP=0.35 SCP=0.0
```

```
                    Impervious Area: DEPSTOR=2.0
                    SLOPE=1% LENGTH=126 MNP=0.015 SCP=0.0
                    END=-1
*
*                       Catchment 204:
*
*
CALIB STANDHYD      ID=6 NHYD=204       DT=5min AREA=4.11
                    XIMP=0.25 TIMP=0.25  DWF=0.0 LOSS=2 CN=71 IA=10.37
                    Pervious Area:
                    SLOPE=2% LENGTH=40  MNP=0.35 SCP=0.0
                    Impervious Area: DEPSTOR=2.0
                    SLOPE=1% LENGTH=166 MNP=0.015 SCP=0.0
                    END=-1
*
*                       Flow at Culvert 204
*
*
ADD HYD             IDsum=7, NHYD=2001 IDs to add=3,4,5,6
*
*                       Catchment 205:
*                       Flow at Culvert 205
*
CALIB STANDHYD      ID=8 NHYD=205       DT=5min AREA=2.4
                    XIMP=0.21 TIMP=0.21  DWF=0.0 LOSS=2 CN=71 IA=10.37
                    Pervious Area:
                    SLOPE=2% LENGTH=40  MNP=0.35 SCP=0.0
                    Impervious Area: DEPSTOR=2.0
                    SLOPE=1% LENGTH=126 MNP=0.015 SCP=0.0
                    END=-1
*
*                       Catchment 207:
*                       Flow at Culvert 207
*
CALIB STANDHYD      ID=1 NHYD=207       DT=5min AREA=1.1
                    XIMP=0.32 TIMP=0.32  DWF=0.0 LOSS=2 CN=71 IA=10.37
                    Pervious Area:
                    SLOPE=2% LENGTH=40  MNP=0.35 SCP=0.0
                    Impervious Area: DEPSTOR=2.0
                    SLOPE=1% LENGTH=86 MNP=0.015 SCP=0.0
                    END=-1
*
*                       Catchment 206:
*
*
CALIB NASHYD        ID=2 NHYD=206       DT=5MIN  AREA=2.4
                    DWF=0.  CN=74 IA=8.92  N=3  TP=.24 HRS     END=-1
*
*                       Flow at Culvert 206
*
*
ADD HYD             IDsum=3, NHYD=2002 IDs to add=1,2
*
*                       Catchment 208:
*
*
CALIB STANDHYD      ID=4 NHYD=208       DT=5min AREA=1.2
                    XIMP=0.23 TIMP=0.23  DWF=0.0 LOSS=2 CN=71 IA=10.37
                    Pervious Area:
                    SLOPE=2% LENGTH=40  MNP=0.35 SCP=0.0
                    Impervious Area: DEPSTOR=2.0
                    SLOPE=1% LENGTH=89 MNP=0.015 SCP=0.0
                    END=-1
*
*                       Flow to Basin 14 (Point of Interest P)
*
*
ADD HYD             IDsum=5, NHYD=2002 IDs to add=3,4,7,8
*
*
*                       Basin 14
*
ROUTE RESERVOIR     IDout=6,   NHYD=10,  IDin=5
                    RDT=5(min),
                          TABLE of ( OUTFLOW-STORAGE ) values
                                     (cms) - (ha-m)
                                   0.0000     0.000
                                   0.0067     0.026
                                   0.0095     0.054
                                   0.0116     0.081
                                   0.0134     0.110
                                   0.0948     0.185
                                   0.2073     0.265
                                   0.2756     0.350
                                   0.3301     0.440
```

```
                                    2.4491      0.506
                                    6.6057      0.575
                                        END=-1
*
*                       Catchment 250:
*
*
CALIB NASHYD          ID=1 NHYD=250         DT=5MIN  AREA=198.5
                      DWF=0.   CN=76 IA=8.02  N=3  TP=2.97 HRS     END=-1
*
*                       Catchment 210:
*
*
CALIB STANDHYD        ID=2 NHYD=210         DT=5min AREA=.36
                      XIMP=0.21 TIMP=0.21  DWF=0.0 LOSS=2 CN=71 IA=10.37
                      Pervious Area:
                      SLOPE=2% LENGTH=40  MNP=0.35 SCP=0.0
                      Impervious Area: DEPSTOR=2.0
                      SLOPE=1% LENGTH=49 MNP=0.015 SCP=0.0
                      END=-1
*
*                       Catchment 211:
*
*
CALIB STANDHYD        ID=3 NHYD=211         DT=5min AREA=.6
                      XIMP=0.25 TIMP=0.25  DWF=0.0 LOSS=2 CN=71 IA=10.37
                      Pervious Area:
                      SLOPE=2% LENGTH=40  MNP=0.35 SCP=0.0
                      Impervious Area: DEPSTOR=2.0
                      SLOPE=1% LENGTH=63 MNP=0.015 SCP=0.0
                      END=-1
*
*                       Catchment 213:
*
*
CALIB STANDHYD        ID=4 NHYD=213         DT=5min AREA=1.14
                      XIMP=0.21 TIMP=0.21  DWF=0.0 LOSS=2 CN=71 IA=10.37
                      Pervious Area:
                      SLOPE=2% LENGTH=40  MNP=0.35 SCP=0.0
                      Impervious Area: DEPSTOR=2.0
                      SLOPE=1% LENGTH=87 MNP=0.015 SCP=0.0
                      END=-1
*
*                       Catchment 214:
*
*
CALIB STANDHYD        ID=5 NHYD=214         DT=5min AREA=1.89
                      XIMP=0.25 TIMP=0.25  DWF=0.0 LOSS=2 CN=71 IA=10.37
                      Pervious Area:
                      SLOPE=2% LENGTH=40  MNP=0.35 SCP=0.0
                      Impervious Area: DEPSTOR=2.0
                      SLOPE=1% LENGTH=112 MNP=0.015 SCP=0.0
                      END=-1
*
*                       Flow at Culvert 250
*
*
ADD HYD               IDsum=6, NHYD=2500 IDs to add=1,2,3,4,5
*
*                       Catchment 212:
*
*
CALIB STANDHYD        ID=7 NHYD=212         DT=5min AREA=0.36
                      XIMP=0.21 TIMP=0.21  DWF=0.0 LOSS=2 CN=71 IA=10.37
                      Pervious Area:
                      SLOPE=2% LENGTH=40  MNP=0.35 SCP=0.0
                      Impervious Area: DEPSTOR=2.0
                      SLOPE=1% LENGTH=49 MNP=0.015 SCP=0.0
                      END=-1
*
*                       Catchment 215:
*
*
CALIB STANDHYD        ID=8 NHYD=215         DT=5min AREA=1.14
                      XIMP=0.21 TIMP=0.21  DWF=0.0 LOSS=2 CN=71 IA=10.37
                      Pervious Area:
                      SLOPE=2% LENGTH=40  MNP=0.35 SCP=0.0
                      Impervious Area: DEPSTOR=2.0
                      SLOPE=1% LENGTH=87 MNP=0.015 SCP=0.0
                      END=-1
*
*                       (Point of Interest Q) d/s of Culvert 250
*
*
ADD HYD               IDsum=9, NHYD=2501 IDs to add=6,7,8
```

```
*
*
*                         Catchment 260:
*
*
CALIB STANDHYD          ID=1 NHYD=260        DT=5min AREA=8.6
                        XIMP=0.39 TIMP=0.39  DWF=0.0 LOSS=2 CN=75 IA=8.47
                        Pervious Area:
                        SLOPE=2% LENGTH=40  MNP=0.35 SCP=0.0
                        Impervious Area: DEPSTOR=2.0
                        SLOPE=1% LENGTH=239 MNP=0.015 SCP=0.0
                        END=-1
*
*
*                         Catchment 300:
*
*
CALIB STANDHYD          ID=2 NHYD=300        DT=5min AREA=2.17
                        XIMP=0.34 TIMP=0.34  DWF=0.0 LOSS=2 CN=71 IA=10.37
                        Pervious Area:
                        SLOPE=2% LENGTH=40  MNP=0.35 SCP=0.0
                        Impervious Area: DEPSTOR=2.0
                        SLOPE=1% LENGTH=120 MNP=0.015 SCP=0.0
                        END=-1
*
*                         Flow at Culvert 301
*
*
ADD HYD                 IDsum=3, NHYD=2600 IDs to add=1,2
*
*                         Catchment 302:
*
*
CALIB STANDHYD          ID=4 NHYD=301        DT=5min AREA=3.86
                        XIMP=0.28 TIMP=0.28  DWF=0.0 LOSS=2 CN=71 IA=10.37
                        Pervious Area:
                        SLOPE=2% LENGTH=40  MNP=0.35 SCP=0.0
                        Impervious Area: DEPSTOR=2.0
                        SLOPE=1% LENGTH=160 MNP=0.015 SCP=0.0
                        END=-1
*
*                         Flow at Culvert 302
*
ADD HYD                 IDsum=5, NHYD=2601 IDs to add=3,4
*
*                         Catchment 302:
*       (This catchment has no runoff contribution from
*        pavement therefore no treatment required)
*
*
CALIB NASHYD            ID=6 NHYD=302        DT=5MIN  AREA=1.3
                        DWF=0.  CN=71 IA=10.37  N=3  TP=.82 HRS     END=-1
*
*
*                         Catchment 303:
*
*
CALIB NASHYD            ID=7 NHYD=303        DT=5MIN  AREA=1.0
                        DWF=0.  CN=73 IA=9.39  N=3  TP=.18 HRS     END=-1
*
*
*                         Flow to Basin 15
*
*
ADD HYD                 IDsum=8, NHYD=2601 IDs to add=5,7
*
*
*                         Basin 15
*
ROUTE RESERVOIR         IDout=9,   NHYD=15,  IDin=8
                        RDT=5(min),
                              TABLE of ( OUTFLOW-STORAGE ) values
                                        (cms) - (ha-m)
                                      0.0000      0.000
                                      0.0108      0.034
                                      0.0153      0.071
                                      0.0187      0.108
                                      0.0216      0.147
                                      0.0332      0.185
                                      0.1331      0.224
                                      0.2299      0.265
                                      0.2880      0.307
                                      2.4327      0.362
                                      6.6092      0.419
                                           END=-1
```

```
*
*                        Catchment 304: External Subcatchment
*
*
CALIB NASHYD          ID=7 NHYD=304         DT=5MIN  AREA=93.55
                      DWF=0.   CN=76 IA=8.02   N=3   TP=1.98 HRS     END=-1
*
*                        Flow at Culvert 304
*
ADD HYD               IDsum=8, NHYD=2602 IDs to add=6,7
*
*                        (Point of Interest R) (Flow from reservoir)
*
*
ADD HYD               IDsum=10, NHYD=2602 IDs to add=8,9
*
*
*************************************************************
*
START                 TIME= 0    METOUT= 0  NSTORM=1  NRUN=002
                      3hc50.stm
*
*
*START                 TIME= 0    METOUT= 0  NSTORM=1  NRUN=003
*                      4h25mm.stm
*
FINISH
```

```
 SSSSS  W    W  M   M  H   H  Y   Y  M   M   000        999    999  *********
 S      W W W  MM MM  H   H   Y Y   MM MM  0   0      9   9  9   9
 SSSSS  W W W  M M M  HHHHH    Y    M M M  0   0  **  9   9  9   9  Ver. 4.02
     S  W W W  M   M  H   H    Y    M   M  0   0       9999   9999  July 1999
 SSSSS   W W   M   M  H   H    Y    M   M   000            9      9  *********
                                                      9   9  9   9  # 4313781
      StormWater Management HYdrologic Model           999    999  *********

 ********************************************************************************
 ************************** SWMHYMO-99 Ver/4.02 *********************************
 *******  A single event and continuous hydrologic simulation model  ********
 *******     based on the principles of HYMO and its successors      ********
 *******                 OTTHYMO-83 and OTTHYMO-89.                  ********
 ********************************************************************************
 ******* Distributed by:  J.F. Sabourin and Associates Inc.          ********
 *******                  Ottawa, Ontario: (613) 727-5199           ********
 *******                  Gatineau, Quebec: (819) 243-6858          ********
 *******                  E-Mail: swmhymo@jfsa.com                  ********
 ********************************************************************************

 +++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
 +++++++ Licensed user: McCormick rankin Corporation                      +++++++
 +++++++                Kitchener          SERIAL#:4313781               +++++++
 +++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++

 ********************************************************************************
 *******          ++++++ PROGRAM ARRAY DIMENSIONS ++++++                ********
 *******          Maximum value for ID numbers  :     10                ********
 *******          Max. number of rainfall points:  15000                ********
 *******          Max. number of flow points    :  15000                ********
 ********************************************************************************

 *** DESCRIPTION SUMMARY TABLE HEADERS (units depend on METOUT in START) ***
 ***------------------------------------------------------------------------***
 ***     ID:  Hydrograph IDentification numbers, (1-10).                    ***
 ***   NHYD:  Hydrograph reference numbers, (6 digits or characters).       ***
 ***   AREA:  Drainage area associated with hydrograph, (ac.) or (ha.).     ***
 *** QPEAK:  Peak flow of simulated hydrograph, (ft^3/s) or (m^3/s).       ***
 *** TpeakDate_hh:mm is the date and time of the peak flow.                ***
 ***   R.V.:  Runoff Volume of simulated hydrograph, (in) or (mm).          ***
 ***   R.C.:  Runoff Coefficient of simulated hydrograph, (ratio).          ***
 ***      *:  see WARNING or NOTE message printed at end of run.            ***
 ***     **:  see  ERROR  message printed at end of run.                    ***
 ********************************************************************************
 ********************************************************************************

::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::::

 ********************************************************************************

 *********************   S U M M A R Y   O U T P U T   **********************
 ********************************************************************************
 *       DATE: 2002-06-04      TIME: 15:31:50      RUN COUNTER: 000191          *
 ********************************************************************************
 * Input   filename: k:\PROJECTS\2000-2-1\2029\HYDROL-1\16-04-02\PRSWM.DAT *
 * Output  filename: k:\PROJECTS\2000-2-1\2029\HYDROL-1\16-04-02\PRSWM.out *
 * Summary filename: k:\PROJECTS\2000-2-1\2029\HYDROL-1\16-04-02\PRSWM.sum *
 * User comments:                                                          *
 * 1:_____________________________________________________________________*
 * 2:_____________________________________________________________________*
 * 3:_____________________________________________________________________*
 ********************************************************************************


RUN:COMMAND*
001:0001----------------------------------------------------------------------
    START
     CTZERO =     .00 hrs on         0]
     CMETOUT=    2     (1=imperial, 2=metric output)]
     CNSTORM=    1 ]
     CNRUN  =    1 ]
001:0002----------------------------------------------------------------------
    READ STORM
     Filename = STORM.001
     Comment  = 3 HR Chicago 100-yr storm, Stratford Parameters
     CSDT=10.00:SDUR=    3.00:PTOT=  78.03]
001:0003---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB STANDHYD      01:000010     24.60     3.707 No_date     1:10   39.99 .513
     CXIMP=.35:TIMP=.35]
     CLOSS= 2 :CN= 65.0]
     CPervious     area: IAper=13.68:SLPP=2.00:LGP=  40.:MNP=.350:SCP=    .0]
     CImpervious   area: IAimp= 2.00:SLPI=1.00:LGI= 405.:MNI=.015:SCI=    .0]
001:0004---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
```

```
  *  CALIB STANDHYD      01:000020      9.80     1.207 No_date     1:10    33.58 .430
     [XIMP=.27:TIMP=.27]
     [LOSS= 2 :CN= 62.0]
     [Pervious      area: IAper=15.57:SLPP=2.00:LGP=  40.:MNP=.350:SCP=    .0]
     [Impervious    area: IAimp= 2.00:SLPI=1.00:LGI= 256.:MNI=.015:SCI=    .0]
001:0005---------------ID:NHYD--------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
  *  CALIB STANDHYD      02:000021      1.10      .123 No_date     1:10    30.68 .393
     [XIMP=.22:TIMP=.22]
     [LOSS= 2 :CN= 62.0]
     [Pervious      area: IAper=15.57:SLPP=2.00:LGP=  40.:MNP=.350:SCP=    .0]
     [Impervious    area: IAimp= 2.00:SLPI=1.00:LGI=  86.:MNI=.015:SCI=    .0]
001:0006---------------ID:NHYD--------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ADD HYD             01:000020      9.80     1.207 No_date     1:10    33.58  n/a
                       + 02:000021      1.10      .123 No_date     1:10    30.68  n/a
     [DT= 5.00]  SUM=    03:000200     10.90     1.330 No_date     1:10    33.29  n/a
001:0007---------------ID:NHYD--------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ROUTE RESERVOIR -> 03:000200     10.90     1.330 No_date     1:10    33.29  n/a
     [RDT= 1.00] out<- 04:000001     10.90     1.296 No_date     1:10    33.29  n/a
     {MxStoUsed=.7926E-01}
001:0008---------------ID:NHYD--------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     CALIB NASHYD        01:000030      3.85      .185 No_date     1:35    20.59 .264
     [CN= 65.0: N= 3.00]
     [Tp=  .35:DT= 5.00]
001:0009---------------ID:NHYD--------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
  *  CALIB STANDHYD      02:000031      1.74      .201 No_date     1:10    31.26 .401
     [XIMP=.23:TIMP=.23]
     [LOSS= 2 :CN= 62.0]
     [Pervious      area: IAper=15.57:SLPP=2.00:LGP=  40.:MNP=.350:SCP=    .0]
     [Impervious    area: IAimp= 2.00:SLPI=1.00:LGI= 108.:MNI=.015:SCI=    .0]
001:0010---------------ID:NHYD--------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
  *  CALIB NASHYD        03:000032       .80      .049 No_date     1:20    17.88 .229
     [CN= 62.0: N= 3.00]
     [Tp=  .16:DT= 5.00]
001:0011---------------ID:NHYD--------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
  *  CALIB STANDHYD      04:000033       .81      .109 No_date     1:10    33.58 .430
     [XIMP=.27:TIMP=.27]
     [LOSS= 2 :CN= 62.0]
     [Pervious      area: IAper=15.57:SLPP=2.00:LGP=  40.:MNP=.350:SCP=    .0]
     [Impervious    area: IAimp= 2.00:SLPI=1.00:LGI=  73.:MNI=.015:SCI=    .0]
001:0012---------------ID:NHYD--------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ADD HYD             02:000031      1.74      .201 No_date     1:10    31.26  n/a
                       + 03:000032       .80      .049 No_date     1:20    17.88  n/a
                       + 04:000033       .81      .109 No_date     1:10    33.58  n/a
     [DT= 5.00]  SUM=    05:000300      3.35      .340 No_date     1:10    28.63  n/a
001:0013---------------ID:NHYD--------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
  *  CALIB STANDHYD      07:000034       .86      .119 No_date     1:10    34.17 .438
     [XIMP=.28:TIMP=.28]
     [LOSS= 2 :CN= 62.0]
     [Pervious      area: IAper=15.57:SLPP=2.00:LGP=  40.:MNP=.350:SCP=    .0]
     [Impervious    area: IAimp= 2.00:SLPI=1.00:LGI=  76.:MNI=.015:SCI=    .0]
001:0014---------------ID:NHYD--------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ADD HYD             01:000030      3.85      .185 No_date     1:35    20.59  n/a
                       + 05:000300      3.35      .340 No_date     1:10    28.63  n/a
                       + 07:000034       .86      .119 No_date     1:10    34.17  n/a
     [DT= 5.00]  SUM=    08:000302      8.06      .501 No_date     1:10    25.38  n/a
001:0015---------------ID:NHYD--------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ROUTE RESERVOIR -> 08:000302      8.06      .501 No_date     1:10    25.38  n/a
     [RDT= 5.00] out<- 09:000002      8.06      .423 No_date     1:25    25.38  n/a
     {MxStoUsed=.4527E-01}
001:0016---------------ID:NHYD--------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     CALIB NASHYD        01:000060     25.40      .825 No_date     2:20    25.61 .328
     [CN= 70.0: N= 3.00]
     [Tp=  .91:DT= 5.00]
001:0017---------------ID:NHYD--------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
  *  CALIB STANDHYD      02:000061      1.20      .197 No_date     1:10    37.65 .483
     [XIMP=.34:TIMP=.34]
     [LOSS= 2 :CN= 62.0]
     [Pervious      area: IAper=15.57:SLPP=2.00:LGP=  40.:MNP=.350:SCP=    .0]
     [Impervious    area: IAimp= 2.00:SLPI=1.00:LGI=  89.:MNI=.015:SCI=    .0]
001:0018---------------ID:NHYD--------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
  *  CALIB STANDHYD      03:000062      2.80      .639 No_date     1:10    46.82 .600
     [XIMP=.49:TIMP=.49]
     [LOSS= 2 :CN= 63.0]
     [Pervious      area: IAper=14.92:SLPP=2.00:LGP=  40.:MNP=.350:SCP=    .0]
     [Impervious    area: IAimp= 2.00:SLPI=1.00:LGI= 137.:MNI=.015:SCI=    .0]
001:0019---------------ID:NHYD--------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ADD HYD             02:000061      1.20      .197 No_date     1:10    37.65  n/a
                       + 03:000062      2.80      .639 No_date     1:10    46.82  n/a
     [DT= 5.00]  SUM=    04:000600      4.00      .836 No_date     1:10    44.07  n/a
001:0020---------------ID:NHYD--------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     CALIB NASHYD        02:000063      1.20      .034 No_date     2:00    17.88 .229
     [CN= 62.0: N= 3.00]
     [Tp=  .64:DT= 5.00]
001:0021---------------ID:NHYD--------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     CALIB NASHYD        05:000067       .18      .010 No_date     1:25    17.88 .229
```

```
     [CN= 62.0: N= 3.00]
     [Tp=  .19:DT= 5.00]
001:0022---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
 *   CALIB STANDHYD      06:000065      .28      .038 No_date     1:10   33.58 .430
     [XIMP=.27:TIMP=.27]
     [LOSS= 2 :CN= 62.0]
     [Pervious      area: IAper=15.57:SLPP=2.00:LGP=  40.:MNP=.350:SCP=    .0]
     [Impervious    area: IAimp= 2.00:SLPI=1.00:LGI=  43.:MNI=.015:SCI=    .0]
001:0023---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ADD HYD             02:000063     1.20      .034 No_date     2:00   17.88  n/a
                       + 04:000600     4.00      .836 No_date     1:10   44.07  n/a
                       + 05:000067      .18      .010 No_date     1:25   17.88  n/a
     [DT= 5.00]  SUM=  07:000601     5.38      .843 No_date     1:10   37.36  n/a
001:0024---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ADD HYD             07:000601     5.38      .843 No_date     1:10   37.36  n/a
                       + 06:000065      .28      .038 No_date     1:10   33.58  n/a
     [DT= 5.00]  SUM=  08:000601     5.66      .881 No_date     1:10   37.17  n/a
001:0025---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ROUTE RESERVOIR -> 08:000601     5.66      .881 No_date     1:10   37.17  n/a
     [RDT= 5.00] out<- 09:000003     5.66      .395 No_date     1:25   37.17  n/a
     (MxStoUsed=.9369E-01)
001:0026---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
 *   CALIB STANDHYD      02:000064      .32      .049 No_date     1:10   35.91 .460
     [XIMP=.31:TIMP=.31]
     [LOSS= 2 :CN= 62.0]
     [Pervious      area: IAper=15.57:SLPP=2.00:LGP=  40.:MNP=.350:SCP=    .0]
     [Impervious    area: IAimp= 2.00:SLPI=1.00:LGI=  46.:MNI=.015:SCI=    .0]
001:0027---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     CALIB NASHYD        03:000066      .27      .014 No_date     1:25   17.88 .229
     [CN= 62.0: N= 3.00]
     [Tp=  .22:DT= 5.00]
001:0028---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ADD HYD             01:000060    25.40      .825 No_date     2:20   25.61  n/a
                       + 03:000066      .27      .014 No_date     1:25   17.88  n/a
     [DT= 5.00]  SUM=  04:000602    25.67      .829 No_date     2:20   25.53  n/a
001:0029---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ADD HYD             04:000602    25.67      .829 No_date     2:20   25.53  n/a
                       + 09:000602     5.66      .395 No_date     1:25   37.17  n/a
     [DT= 5.00]  SUM=  09:000602    31.33      .961 No_date     2:15   27.63  n/a
001:0030---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     CALIB NASHYD        01:000070     2.70      .209 No_date     1:20   23.53 .301
     [CN= 68.0: N= 3.00]
     [Tp=  .19:DT= 5.00]
001:0031---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
 *   CALIB STANDHYD      02:000071      .64      .072 No_date     1:10   30.68 .393
     [XIMP=.22:TIMP=.22]
     [LOSS= 2 :CN= 62.0]
     [Pervious      area: IAper=15.57:SLPP=2.00:LGP=  40.:MNP=.350:SCP=    .0]
     [Impervious    area: IAimp= 2.00:SLPI=1.00:LGI=  65.:MNI=.015:SCI=    .0]
001:0032---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
 *   CALIB STANDHYD      03:000072     1.44      .154 No_date     1:10   30.10 .386
     [XIMP=.21:TIMP=.21]
     [LOSS= 2 :CN= 62.0]
     [Pervious      area: IAper=15.57:SLPP=2.00:LGP=  40.:MNP=.350:SCP=    .0]
     [Impervious    area: IAimp= 2.00:SLPI=1.00:LGI=  98.:MNI=.015:SCI=    .0]
001:0033---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
 *   CALIB STANDHYD      04:000073     4.40      .520 No_date     1:10   32.42 .415
     [XIMP=.25:TIMP=.25]
     [LOSS= 2 :CN= 62.0]
     [Pervious      area: IAper=15.57:SLPP=2.00:LGP=  40.:MNP=.350:SCP=    .0]
     [Impervious    area: IAimp= 2.00:SLPI=1.00:LGI= 171.:MNI=.015:SCI=    .0]
001:0034---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
 *   CALIB STANDHYD      05:000074     1.44      .154 No_date     1:10   30.10 .386
     [XIMP=.21:TIMP=.21]
     [LOSS= 2 :CN= 62.0]
     [Pervious      area: IAper=15.57:SLPP=2.00:LGP=  40.:MNP=.350:SCP=    .0]
     [Impervious    area: IAimp= 2.00:SLPI=1.00:LGI=  98.:MNI=.015:SCI=    .0]
001:0035---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ADD HYD             02:000071      .64      .072 No_date     1:10   30.68  n/a
                       + 03:000072     1.44      .154 No_date     1:10   30.10  n/a
                       + 04:000073     4.40      .520 No_date     1:10   32.42  n/a
                       + 05:000074     1.44      .154 No_date     1:10   30.10  n/a
     [DT= 5.00]  SUM=  06:000700     7.92      .901 No_date     1:10   31.44  n/a
001:0036---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     CALIB NASHYD        07:000075     6.50      .312 No_date     1:35   20.59 .264
     [CN= 65.0: N= 3.00]
     [Tp=  .35:DT= 5.00]
001:0037---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ADD HYD             06:000700     7.92      .901 No_date     1:10   31.44  n/a
                       + 07:000075     6.50      .312 No_date     1:35   20.59  n/a
     [DT= 5.00]  SUM=  08:000701    14.42      .971 No_date     1:10   26.55  n/a
001:0038---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     CALIB NASHYD        09:000075     2.50      .179 No_date     1:25   22.52 .289
     [CN= 67.0: N= 3.00]
     [Tp=  .20:DT= 5.00]
```

```
001:0039---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD              08:000701    14.42     .971 No_date     1:10   26.55  n/a
                       + 09:000075     2.50     .179 No_date     1:25   22.52  n/a
     EDT= 5.00]  SUM=  10:000702    16.92    1.067 No_date     1:10   25.95  n/a
001:0040---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ROUTE RESERVOIR -> 10:000702    16.92    1.067 No_date     1:10   25.95  n/a
     ERDT= 1.00] out<- 03:000004    16.92    1.006 No_date     1:12   25.95  n/a
    {MxStoUsed=.7097E-01}
001:0041---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD         02:000080    10.60     .589 No_date     1:40   26.71 .342
     ECN= 71.0: N= 3.00]
     ETp=  .44:DT= 5.00]
001:0042---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
  * CALIB STANDHYD       03:000081     .32     .035 No_date     1:10   30.10 .386
     EXIMP=.21:TIMP=.21]
     ELOSS= 2 :CN= 62.0]
     EPervious      area: IAper=15.57:SLPP=2.00:LGP=  40.:MNP=.350:SCP=   .0]
     EImpervious    area: IAimp= 2.00:SLPI=1.00:LGI=  46.:MNI=.015:SCI=   .0]
001:0043---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
  * CALIB STANDHYD       04:000082     .21     .023 No_date     1:10   30.10 .386
     EXIMP=.21:TIMP=.21]
     ELOSS= 2 :CN= 62.0]
     EPervious      area: IAper=15.57:SLPP=2.00:LGP=  40.:MNP=.350:SCP=   .0]
     EImpervious    area: IAimp= 2.00:SLPI=1.00:LGI=  37.:MNI=.015:SCI=   .0]
001:0044---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
  * CALIB STANDHYD       05:000083     .16     .017 No_date     1:10   30.10 .386
     EXIMP=.21:TIMP=.21]
     ELOSS= 2 :CN= 62.0]
     EPervious      area: IAper=15.57:SLPP=2.00:LGP=  40.:MNP=.350:SCP=   .0]
     EImpervious    area: IAimp= 2.00:SLPI=1.00:LGI=  33.:MNI=.015:SCI=   .0]
001:0045---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
  * CALIB STANDHYD       06:000084     .17     .018 No_date     1:10   30.10 .386
     EXIMP=.21:TIMP=.21]
     ELOSS= 2 :CN= 62.0]
     EPervious      area: IAper=15.57:SLPP=2.00:LGP=  40.:MNP=.350:SCP=   .0]
     EImpervious    area: IAimp= 2.00:SLPI=1.00:LGI=  34.:MNI=.015:SCI=   .0]
001:0046---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD         07:000110   420.50    2.957 No_date     7:25   27.82 .357
     ECN= 72.0: N= 3.00]
     ETp= 5.93:DT= 5.00]
001:0047---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD              01:000070     2.70     .209 No_date     1:20   23.53  n/a
                       + 02:000080    10.60     .589 No_date     1:40   26.71  n/a
                       + 03:000081      .32     .035 No_date     1:10   30.10  n/a
                       + 04:000082      .21     .023 No_date     1:10   30.10  n/a
                       + 07:000110   420.50    2.957 No_date     7:25   27.82  n/a
     EDT= 5.00]  SUM=  08:000800   434.33    2.957 No_date     7:25   27.77  n/a
001:0048---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD              05:000083      .16     .017 No_date     1:10   30.10  n/a
                       + 06:000084      .17     .018 No_date     1:10   30.10  n/a
                       + 08:000800   434.33    2.957 No_date     7:25   27.77  n/a
     EDT= 5.00]  SUM=  09:000801   434.66    2.957 No_date     7:25   27.77  n/a
001:0049---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD         01:000120    55.70    1.718 No_date     2:30   26.71 .342
     ECN= 71.0: N= 3.00]
     ETp= 1.04:DT= 5.00]
001:0050---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
  * CALIB STANDHYD       02:000121      .54     .061 No_date     1:10   32.23 .413
     EXIMP=.21:TIMP=.21]
     ELOSS= 2 :CN= 65.0]
     EPervious      area: IAper=13.68:SLPP=2.00:LGP=  40.:MNP=.350:SCP=   .0]
     EImpervious    area: IAimp= 2.00:SLPI=1.00:LGI=  60.:MNI=.015:SCI=   .0]
001:0051---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
  * CALIB STANDHYD       03:000122      .38     .043 No_date     1:10   32.23 .413
     EXIMP=.21:TIMP=.21]
     ELOSS= 2 :CN= 65.0]
     EPervious      area: IAper=13.68:SLPP=2.00:LGP=  40.:MNP=.350:SCP=   .0]
     EImpervious    area: IAimp= 2.00:SLPI=1.00:LGI=  50.:MNI=.015:SCI=   .0]
001:0052---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD              01:000120    55.70    1.718 No_date     2:30   26.71  n/a
                       + 02:000121      .54     .061 No_date     1:10   32.23  n/a
                       + 03:000122      .38     .043 No_date     1:10   32.23  n/a
     EDT= 5.00]  SUM=  04:001200    56.62    1.733 No_date     2:30   26.80  n/a
001:0053---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
  * CALIB STANDHYD       05:000123      .43     .048 No_date     1:10   32.23 .413
     EXIMP=.21:TIMP=.21]
     ELOSS= 2 :CN= 65.0]
     EPervious      area: IAper=13.68:SLPP=2.00:LGP=  40.:MNP=.350:SCP=   .0]
     EImpervious    area: IAimp= 2.00:SLPI=1.00:LGI=  54.:MNI=.015:SCI=   .0]
001:0054---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
  * CALIB STANDHYD       06:000124      .72     .081 No_date     1:10   32.23 .413
     EXIMP=.21:TIMP=.21]
     ELOSS= 2 :CN= 65.0]
     EPervious      area: IAper=13.68:SLPP=2.00:LGP=  40.:MNP=.350:SCP=   .0]
     EImpervious    area: IAimp= 2.00:SLPI=1.00:LGI=  69.:MNI=.015:SCI=   .0]
```

```
001:0055--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD             04:001200    56.62    1.733 No_date    2:30   26.80  n/a
                      + 05:000123      .43     .048 No_date    1:10   32.23  n/a
                      + 06:000124      .72     .081 No_date    1:10   32.23  n/a
     EDT= 5.00]  SUM=  10:001201    57.77    1.751 No_date    2:30   26.91  n/a
001:0056--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
 *  CALIB STANDHYD      01:000125      .95     .123 No_date    1:10   34.45 .441
     EXIMP=.25:TIMP=.25]
     ELOSS= 2 :CN= 65.0]
     EPervious      area: IAper=13.68:SLPP=2.00:LGP=  40.:MNP=.350:SCP=   .0]
     EImpervious    area: IAimp= 2.00:SLPI=1.00:LGI=  80.:MNI=.015:SCI=   .0]
001:0057--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
 *  CALIB STANDHYD      02:000126      .17     .029 No_date    1:10   39.44 .505
     EXIMP=.34:TIMP=.34]
     ELOSS= 2 :CN= 65.0]
     EPervious      area: IAper=13.68:SLPP=2.00:LGP=  40.:MNP=.350:SCP=   .0]
     EImpervious    area: IAimp= 2.00:SLPI=1.00:LGI=  34.:MNI=.015:SCI=   .0]
001:0058--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD             01:000125      .95     .123 No_date    1:10   34.45  n/a
                      + 02:000126      .17     .029 No_date    1:10   39.44  n/a
     EDT= 5.00]  SUM=  03:001201     1.12     .151 No_date    1:10   35.21  n/a
001:0059--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD        04:000127     1.75     .124 No_date    1:25   24.56 .315
     ECN= 69.0: N= 3.00]
     ETp=  .25:DT= 5.00]
001:0060--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
 *  CALIB STANDHYD      05:000128      .36     .040 No_date    1:10   32.23 .413
     EXIMP=.21:TIMP=.21]
     ELOSS= 2 :CN= 65.0]
     EPervious      area: IAper=13.68:SLPP=2.00:LGP=  40.:MNP=.350:SCP=   .0]
     EImpervious    area: IAimp= 2.00:SLPI=1.00:LGI=  49.:MNI=.015:SCI=   .0]
001:0061--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
 *  CALIB STANDHYD      06:000129      .36     .040 No_date    1:10   32.23 .413
     EXIMP=.21:TIMP=.21]
     ELOSS= 2 :CN= 65.0]
     EPervious      area: IAper=13.68:SLPP=2.00:LGP=  40.:MNP=.350:SCP=   .0]
     EImpervious    area: IAimp= 2.00:SLPI=1.00:LGI=  49.:MNI=.015:SCI=   .0]
001:0062--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
 *  CALIB STANDHYD      07:000130     3.90     .558 No_date    1:10   36.67 .470
     EXIMP=.29:TIMP=.29]
     ELOSS= 2 :CN= 65.0]
     EPervious      area: IAper=13.68:SLPP=2.00:LGP=  40.:MNP=.350:SCP=   .0]
     EImpervious    area: IAimp= 2.00:SLPI=1.00:LGI= 161.:MNI=.015:SCI=   .0]
001:0063--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD             03:001201     1.12     .151 No_date    1:10   35.21  n/a
                      + 04:000127     1.75     .124 No_date    1:25   24.56  n/a
                      + 05:000128      .36     .040 No_date    1:10   32.23  n/a
                      + 06:000129      .36     .040 No_date    1:10   32.23  n/a
                      + 07:000130     3.90     .558 No_date    1:10   36.67  n/a
     EDT= 5.00]  SUM=  08:001202     7.49     .842 No_date    1:10   33.19  n/a
001:0064--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
 *  CALIB STANDHYD      01:000131      .36     .114 No_date    1:10   58.29 .747
     EXIMP=.68:TIMP=.68]
     ELOSS= 2 :CN= 65.0]
     EPervious      area: IAper=13.68:SLPP=2.00:LGP=  40.:MNP=.350:SCP=   .0]
     EImpervious    area: IAimp= 2.00:SLPI=1.00:LGI=  49.:MNI=.015:SCI=   .0]
001:0065--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
 *  CALIB STANDHYD      02:000132      .95     .123 No_date    1:10   34.45 .441
     EXIMP=.25:TIMP=.25]
     ELOSS= 2 :CN= 65.0]
     EPervious      area: IAper=13.68:SLPP=2.00:LGP=  40.:MNP=.350:SCP=   .0]
     EImpervious    area: IAimp= 2.00:SLPI=1.00:LGI=  80.:MNI=.015:SCI=   .0]
001:0066--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
 *  CALIB STANDHYD      03:000133     1.75     .186 No_date    1:10   31.68 .406
     EXIMP=.20:TIMP=.20]
     ELOSS= 2 :CN= 65.0]
     EPervious      area: IAper=13.68:SLPP=2.00:LGP=  40.:MNP=.350:SCP=   .0]
     EImpervious    area: IAimp= 2.00:SLPI=1.00:LGI= 108.:MNI=.015:SCI=   .0]
001:0067--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD             08:001202     7.49     .842 No_date    1:10   33.19  n/a
                      + 01:000131      .36     .114 No_date    1:10   58.29  n/a
                      + 02:000132      .95     .123 No_date    1:10   34.45  n/a
                      + 03:000133     1.75     .186 No_date    1:10   31.68  n/a
     EDT= 5.00]  SUM=  04:001203    10.55    1.265 No_date    1:10   33.91  n/a
001:0068--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ROUTE RESERVOIR -> 04:001203    10.55    1.265 No_date    1:10   33.91  n/a
     ERDT= 5.00] out<- 05:000005    10.55     .176 No_date    2:30   33.91  n/a
    {MxStoUsed=.2463E+00}
001:0069--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD             05:000005    10.55     .176 No_date    2:30   33.91  n/a
                      + 10:001201    57.77    1.751 No_date    2:30   26.91  n/a
     EDT= 5.00]  SUM=  06:001204    68.32    1.927 No_date    2:30   27.99  n/a
001:0070--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD        01:000135    11.20     .812 No_date    1:35   28.98 .371
     ECN= 73.0: N= 3.00]
```

```
     [Tp=  .33:DT= 5.00]
001:0071---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
  *  CALIB STANDHYD      01:000140      1.30      .230 No_date     1:10    43.48 .557
     [XIMP=.34:TIMP=.34]
     [LOSS= 2 :CN= 71.0]
     [Pervious      area: IAper=10.37:SLPP=2.00:LGP=  40.:MNP=.350:SCP=    .0]
     [Impervious    area: IAimp= 2.00:SLPI=1.00:LGI=  93.:MNI=.015:SCI=    .0]
001:0072---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
  *  CALIB STANDHYD      02:000141      2.40      .330 No_date     1:10    39.04 .500
     [XIMP=.25:TIMP=.25]
     [LOSS= 2 :CN= 71.0]
     [Pervious      area: IAper=10.37:SLPP=2.00:LGP=  40.:MNP=.350:SCP=    .0]
     [Impervious    area: IAimp= 2.00:SLPI=1.00:LGI= 126.:MNI=.015:SCI=    .0]
001:0073---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ADD HYD             01:000140      1.30      .230 No_date     1:10    43.48  n/a
                       + 02:000141      2.40      .330 No_date     1:10    39.04  n/a
     [DT= 5.00]  SUM=    03:001400      3.70      .560 No_date     1:10    40.60  n/a
001:0074---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     CALIB NASHYD        04:000142      1.30      .064 No_date     1:55    28.98 .371
     [CN= 73.0: N= 3.00]
     [Tp=  .60:DT= 5.00]
001:0075---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ADD HYD             03:001400      3.70      .560 No_date     1:10    40.60  n/a
                       + 04:000142      1.30      .064 No_date     1:55    28.98  n/a
     [DT= 5.00]  SUM=    05:001401      5.00      .568 No_date     1:10    37.58  n/a
001:0076---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ROUTE RESERVOIR -> 05:001401      5.00      .568 No_date     1:10    37.58  n/a
     [RDT= 5.00] out<- 06:000006      5.00      .177 No_date     2:10    37.58  n/a
     {MxStoUsed=.1161E+00}
001:0077---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     CALIB NASHYD        01:000143      2.10      .064 No_date     2:15    23.53 .301
     [CN= 68.0: N= 3.00]
     [Tp=  .87:DT= 5.00]
001:0078---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
  *  CALIB STANDHYD      02:000144      3.72      .469 No_date     1:10    34.45 .441
     [XIMP=.25:TIMP=.25]
     [LOSS= 2 :CN= 65.0]
     [Pervious      area: IAper=13.68:SLPP=2.00:LGP=  40.:MNP=.350:SCP=    .0]
     [Impervious    area: IAimp= 2.00:SLPI=1.00:LGI= 157.:MNI=.015:SCI=    .0]
001:0079---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ADD HYD             01:000143      2.10      .064 No_date     2:15    23.53  n/a
                       + 02:000144      3.72      .469 No_date     1:10    34.45  n/a
     [DT= 5.00]  SUM=    03:001402      5.82      .473 No_date     1:10    30.51  n/a
001:0080---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
  *  CALIB STANDHYD      04:000145      2.10      .341 No_date     1:10    38.89 .498
     [XIMP=.33:TIMP=.33]
     [LOSS= 2 :CN= 65.0]
     [Pervious      area: IAper=13.68:SLPP=2.00:LGP=  40.:MNP=.350:SCP=    .0]
     [Impervious    area: IAimp= 2.00:SLPI=1.00:LGI= 118.:MNI=.015:SCI=    .0]
001:0081---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ADD HYD             03:001402      5.82      .473 No_date     1:10    30.51  n/a
                       + 04:000145      2.10      .341 No_date     1:10    38.89  n/a
     [DT= 5.00]  SUM=    05:001402      7.92      .813 No_date     1:10    32.73  n/a
001:0082---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ROUTE RESERVOIR -> 05:001402      7.92      .813 No_date     1:10    32.73  n/a
     [RDT= 5.00] out<- 06:000007      7.92      .295 No_date     1:50    32.73  n/a
     {MxStoUsed=.1258E+00}
001:0083---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     CALIB NASHYD        01:000150     31.76      .826 No_date     2:30    22.52 .289
     [CN= 67.0: N= 3.00]
     [Tp= 1.03:DT= 5.00]
001:0084---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
  *  CALIB STANDHYD      02:000151      2.52      .278 No_date     1:10    32.23 .413
     [XIMP=.21:TIMP=.21]
     [LOSS= 2 :CN= 65.0]
     [Pervious      area: IAper=13.68:SLPP=2.00:LGP=  40.:MNP=.350:SCP=    .0]
     [Impervious    area: IAimp= 2.00:SLPI=1.00:LGI= 130.:MNI=.015:SCI=    .0]
001:0085---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ADD HYD             01:000150     31.76      .826 No_date     2:30    22.52  n/a
                       + 02:000151      2.52      .278 No_date     1:10    32.23  n/a
     [DT= 5.00]  SUM=    03:001500     34.28      .868 No_date     2:30    23.23  n/a
001:0086---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
  *  CALIB STANDHYD      04:000152      1.55      .172 No_date     1:10    32.23 .413
     [XIMP=.21:TIMP=.21]
     [LOSS= 2 :CN= 65.0]
     [Pervious      area: IAper=13.68:SLPP=2.00:LGP=  40.:MNP=.350:SCP=    .0]
     [Impervious    area: IAimp= 2.00:SLPI=1.00:LGI= 102.:MNI=.015:SCI=    .0]
001:0087---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ADD HYD             03:001500     34.28      .868 No_date     2:30    23.23  n/a
                       + 04:000152      1.55      .172 No_date     1:10    32.23  n/a
     [DT= 5.00]  SUM=    10:001501     35.83      .895 No_date     2:25    23.62  n/a
001:0088---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
  *  CALIB STANDHYD      01:000153      7.90     1.006 No_date     1:10    36.65 .470
     [XIMP=.25:TIMP=.25]
     [LOSS= 2 :CN= 68.0]
```

```
      [Pervious      area: IAper=11.95:SLPP=2.00:LGP=  40.:MNP=.350:SCP=    .0]
      [Impervious    area: IAimp= 2.00:SLPI=1.00:LGI= 229.:MNI=.015:SCI=    .0]
 001:0089---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
  *   CALIB STANDHYD      02:000154      1.56      .190 No_date     1:10    37.07 .475
      [XIMP=.21:TIMP=.21]
      [LOSS= 2 :CN= 71.0]
      [Pervious      area: IAper=10.37:SLPP=2.00:LGP=  40.:MNP=.350:SCP=    .0]
      [Impervious    area: IAimp= 2.00:SLPI=1.00:LGI= 102.:MNI=.015:SCI=    .0]
 001:0090---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
  *   CALIB STANDHYD      03:000155      1.56      .190 No_date     1:10    37.07 .475
      [XIMP=.21:TIMP=.21]
      [LOSS= 2 :CN= 71.0]
      [Pervious      area: IAper=10.37:SLPP=2.00:LGP=  40.:MNP=.350:SCP=    .0]
      [Impervious    area: IAimp= 2.00:SLPI=1.00:LGI= 102.:MNI=.015:SCI=    .0]
 001:0091---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
  *   CALIB STANDHYD      04:000156      1.40      .411 No_date     1:10    57.29 .734
      [XIMP=.62:TIMP=.62]
      [LOSS= 2 :CN= 71.0]
      [Pervious      area: IAper=10.37:SLPP=2.00:LGP=  40.:MNP=.350:SCP=    .0]
      [Impervious    area: IAimp= 2.00:SLPI=1.00:LGI=  97.:MNI=.015:SCI=    .0]
 001:0092---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
  *   CALIB STANDHYD      05:000157      1.40      .411 No_date     1:10    57.29 .734
      [XIMP=.62:TIMP=.62]
      [LOSS= 2 :CN= 71.0]
      [Pervious      area: IAper=10.37:SLPP=2.00:LGP=  40.:MNP=.350:SCP=    .0]
      [Impervious    area: IAimp= 2.00:SLPI=1.00:LGI=  97.:MNI=.015:SCI=    .0]
 001:0093---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     CALIB NASHYD        06:000158      2.27      .222 No_date     1:25    31.37 .402
      [CN= 75.0: N= 3.00]
      [Tp=  .23:DT= 5.00]
 001:0094---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ADD HYD             01:000153      7.90     1.006 No_date     1:10    36.65  n/a
                       + 02:000154      1.56      .190 No_date     1:10    37.07  n/a
                       + 03:000155      1.56      .190 No_date     1:10    37.07  n/a
                       + 04:000156      1.40      .411 No_date     1:10    57.29  n/a
                       + 05:000157      1.40      .411 No_date     1:10    57.29  n/a
                       + 06:000158      2.27      .222 No_date     1:25    31.37  n/a
      [DT= 5.00]  SUM=   07:001501     16.09     2.325 No_date     1:10    39.58  n/a
 001:0095---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
  *   CALIB STANDHYD      01:000159      1.23      .187 No_date     1:10    40.52 .519
      [XIMP=.28:TIMP=.28]
      [LOSS= 2 :CN= 71.0]
      [Pervious      area: IAper=10.37:SLPP=2.00:LGP=  40.:MNP=.350:SCP=    .0]
      [Impervious    area: IAimp= 2.00:SLPI=1.00:LGI=  91.:MNI=.015:SCI=    .0]
 001:0096---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
  *   CALIB STANDHYD      02:000158      2.15      .228 No_date     1:10    31.68 .406
      [XIMP=.20:TIMP=.20]
      [LOSS= 2 :CN= 65.0]
      [Pervious      area: IAper=13.68:SLPP=2.00:LGP=  40.:MNP=.350:SCP=    .0]
      [Impervious    area: IAimp= 2.00:SLPI=1.00:LGI= 120.:MNI=.015:SCI=    .0]
 001:0097---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ADD HYD             01:000159      1.23      .187 No_date     1:10    40.52  n/a
                       + 02:000158      2.15      .228 No_date     1:10    31.68  n/a
                       + 07:001501     16.09     2.325 No_date     1:10    39.58  n/a
      [DT= 5.00]  SUM=   03:001501     19.47     2.740 No_date     1:10    38.77  n/a
 001:0098---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
  *   CALIB STANDHYD      04:000162       .99      .136 No_date     1:10    35.56 .456
      [XIMP=.27:TIMP=.27]
      [LOSS= 2 :CN= 65.0]
      [Pervious      area: IAper=13.68:SLPP=2.00:LGP=  40.:MNP=.350:SCP=    .0]
      [Impervious    area: IAimp= 2.00:SLPI=1.00:LGI=  81.:MNI=.015:SCI=    .0]
 001:0099---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ADD HYD             03:001501     19.47     2.740 No_date     1:10    38.77  n/a
                       + 04:000162       .99      .136 No_date     1:10    35.56  n/a
      [DT= 5.00]  SUM=   05:001502     20.46     2.876 No_date     1:10    38.61  n/a
 001:0100---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ROUTE RESERVOIR -> 05:001502     20.46     2.876 No_date     1:10    38.61  n/a
      [RDT= 5.00] out<- 06:000007     20.46     1.319 No_date     1:35    38.61  n/a
     {MxStoUsed=.3919E+00}
 001:0101---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     CALIB NASHYD        01:000160     25.82     1.670 No_date     1:40    30.16 .387
      [CN= 74.0: N= 3.00]
      [Tp=  .43:DT= 5.00]
 001:0102---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     CALIB NASHYD        01:000170     13.80      .872 No_date     1:35    26.71 .342
      [CN= 71.0: N= 3.00]
      [Tp=  .36:DT= 5.00]
 001:0103---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
  *   CALIB STANDHYD      02:000171       .68      .076 No_date     1:10    32.23 .413
      [XIMP=.21:TIMP=.21]
      [LOSS= 2 :CN= 65.0]
      [Pervious      area: IAper=13.68:SLPP=2.00:LGP=  40.:MNP=.350:SCP=    .0]
      [Impervious    area: IAimp= 2.00:SLPI=1.00:LGI=  67.:MNI=.015:SCI=    .0]
 001:0104---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
  *   CALIB STANDHYD      03:000172       .72      .081 No_date     1:10    32.23 .413
```

```
     [XIMP=.21:TIMP=.21]
     [LOSS= 2 :CN= 65.0]
     [Pervious      area: IAper=13.68:SLPP=2.00:LGP=  40.:MNP=.350:SCP=   .0]
     [Impervious    area: IAimp= 2.00:SLPI=1.00:LGI=  69.:MNI=.015:SCI=   .0]
001:0105---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
  *  CALIB STANDHYD      04:000173      1.13      .146 No_date     1:10   34.45 .441
     [XIMP=.25:TIMP=.25]
     [LOSS= 2 :CN= 65.0]
     [Pervious      area: IAper=13.68:SLPP=2.00:LGP=  40.:MNP=.350:SCP=   .0]
     [Impervious    area: IAimp= 2.00:SLPI=1.00:LGI=  87.:MNI=.015:SCI=   .0]
001:0106---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
  *  CALIB STANDHYD      05:000174      1.20      .155 No_date     1:10   34.45 .441
     [XIMP=.25:TIMP=.25]
     [LOSS= 2 :CN= 65.0]
     [Pervious      area: IAper=13.68:SLPP=2.00:LGP=  40.:MNP=.350:SCP=   .0]
     [Impervious    area: IAimp= 2.00:SLPI=1.00:LGI=  89.:MNI=.015:SCI=   .0]
001:0107---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ADD HYD             01:000170     13.80      .872 No_date     1:35   26.71  n/a
                       + 02:000171       .68      .076 No_date     1:10   32.23  n/a
                       + 03:000172       .72      .081 No_date     1:10   32.23  n/a
                       + 04:000173      1.13      .146 No_date     1:10   34.45  n/a
                       + 05:000174      1.20      .155 No_date     1:10   34.45  n/a
     [DT= 5.00]  SUM=  06:001700     17.53     1.083 No_date     1:30   28.18  n/a
001:0108---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
  *  CALIB STANDHYD      07:000175       .68      .076 No_date     1:10   32.23 .413
     [XIMP=.21:TIMP=.21]
     [LOSS= 2 :CN= 65.0]
     [Pervious      area: IAper=13.68:SLPP=2.00:LGP=  40.:MNP=.350:SCP=   .0]
     [Impervious    area: IAimp= 2.00:SLPI=1.00:LGI=  67.:MNI=.015:SCI=   .0]
001:0109---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
  *  CALIB STANDHYD      08:000176       .72      .081 No_date     1:10   32.23 .413
     [XIMP=.21:TIMP=.21]
     [LOSS= 2 :CN= 65.0]
     [Pervious      area: IAper=13.68:SLPP=2.00:LGP=  40.:MNP=.350:SCP=   .0]
     [Impervious    area: IAimp= 2.00:SLPI=1.00:LGI=  69.:MNI=.015:SCI=   .0]
001:0110---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ADD HYD             06:001700     17.53     1.083 No_date     1:30   28.18  n/a
                       + 07:000175       .68      .076 No_date     1:10   32.23  n/a
                       + 08:000176       .72      .081 No_date     1:10   32.23  n/a
     [DT= 5.00]  SUM=  09:001503     18.93     1.172 No_date     1:30   28.48  n/a
001:0111---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
  *  CALIB STANDHYD      01:000177       .85      .104 No_date     1:10   37.07 .475
     [XIMP=.21:TIMP=.21]
     [LOSS= 2 :CN= 71.0]
     [Pervious      area: IAper=10.37:SLPP=2.00:LGP=  40.:MNP=.350:SCP=   .0]
     [Impervious    area: IAimp= 2.00:SLPI=1.00:LGI=  75.:MNI=.015:SCI=   .0]
001:0112---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
  *  CALIB STANDHYD      02:000181       .57      .070 No_date     1:10   37.07 .475
     [XIMP=.21:TIMP=.21]
     [LOSS= 2 :CN= 71.0]
     [Pervious      area: IAper=10.37:SLPP=2.00:LGP=  40.:MNP=.350:SCP=   .0]
     [Impervious    area: IAimp= 2.00:SLPI=1.00:LGI=  62.:MNI=.015:SCI=   .0]
001:0113---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ADD HYD             01:000177       .85      .104 No_date     1:10   37.07  n/a
                       + 02:000181       .57      .070 No_date     1:10   37.07  n/a
     [DT= 5.00]  SUM=  03:001800     1.42      .175 No_date     1:10   37.07  n/a
001:0114---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
  *  CALIB STANDHYD      04:000178      1.43      .198 No_date     1:10   39.04 .500
     [XIMP=.25:TIMP=.25]
     [LOSS= 2 :CN= 71.0]
     [Pervious      area: IAper=10.37:SLPP=2.00:LGP=  40.:MNP=.350:SCP=   .0]
     [Impervious    area: IAimp= 2.00:SLPI=1.00:LGI=  98.:MNI=.015:SCI=   .0]
001:0115---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
  *  CALIB STANDHYD      05:000182       .96      .134 No_date     1:10   39.04 .500
     [XIMP=.25:TIMP=.25]
     [LOSS= 2 :CN= 71.0]
     [Pervious      area: IAper=10.37:SLPP=2.00:LGP=  40.:MNP=.350:SCP=   .0]
     [Impervious    area: IAimp= 2.00:SLPI=1.00:LGI=  80.:MNI=.015:SCI=   .0]
001:0116---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ADD HYD             03:001800      1.42      .175 No_date     1:10   37.07  n/a
                       + 04:000178      1.43      .198 No_date     1:10   39.04  n/a
                       + 05:000182       .96      .134 No_date     1:10   39.04  n/a
     [DT= 5.00]  SUM=  06:001801      3.81      .507 No_date     1:10   38.30  n/a
001:0117---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
  *  CALIB STANDHYD      07:000179       .85      .104 No_date     1:10   37.07 .475
     [XIMP=.21:TIMP=.21]
     [LOSS= 2 :CN= 71.0]
     [Pervious      area: IAper=10.37:SLPP=2.00:LGP=  40.:MNP=.350:SCP=   .0]
     [Impervious    area: IAimp= 2.00:SLPI=1.00:LGI=  75.:MNI=.015:SCI=   .0]
001:0118---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
  *  CALIB STANDHYD      08:000183       .57      .070 No_date     1:10   37.07 .475
     [XIMP=.21:TIMP=.21]
     [LOSS= 2 :CN= 71.0]
     [Pervious      area: IAper=10.37:SLPP=2.00:LGP=  40.:MNP=.350:SCP=   .0]
     [Impervious    area: IAimp= 2.00:SLPI=1.00:LGI=  62.:MNI=.015:SCI=   .0]
```

```
001:0119---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD              06:001801     3.81     .507 No_date     1:10   38.30  n/a
                       + 07:000179      .85     .104 No_date     1:10   37.07  n/a
                       + 08:000183      .57     .070 No_date     1:10   37.07  n/a
     [DT= 5.00] SUM=   09:001801     5.23     .682 No_date     1:10   37.97  n/a
001:0120---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ROUTE RESERVOIR -> 09:001801     5.23     .682 No_date     1:10   37.97  n/a
     [RDT= 5.00] out<- 10:000010     5.23     .492 No_date     1:30   37.97  n/a
    (MxStoUsed=.9214E-01)
001:0121---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD         01:000180   134.00    5.016 No_date     2:30   32.63 .418
     [CN= 76.0: N= 3.00]
     [Tp= 1.06:DT= 5.00]
001:0122---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
  *  CALIB STANDHYD       02:000184      .97     .119 No_date     1:10   37.07 .475
     [XIMP=.21:TIMP=.21]
     [LOSS= 2 :CN= 71.0]
     [Pervious      area: IAper=10.37:SLPP=2.00:LGP=  40.:MNP=.350:SCP=    .0]
     [Impervious    area: IAimp= 2.00:SLPI=1.00:LGI=  80.:MNI=.015:SCI=    .0]
001:0123---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
  *  CALIB STANDHYD       03:000185      .96     .118 No_date     1:10   37.07 .475
     [XIMP=.21:TIMP=.21]
     [LOSS= 2 :CN= 71.0]
     [Pervious      area: IAper=10.37:SLPP=2.00:LGP=  40.:MNP=.350:SCP=    .0]
     [Impervious    area: IAimp= 2.00:SLPI=1.00:LGI=  80.:MNI=.015:SCI=    .0]
001:0124---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
  *  CALIB STANDHYD       04:000186     3.23     .441 No_date     1:10   39.04 .500
     [XIMP=.25:TIMP=.25]
     [LOSS= 2 :CN= 71.0]
     [Pervious      area: IAper=10.37:SLPP=2.00:LGP=  40.:MNP=.350:SCP=    .0]
     [Impervious    area: IAimp= 2.00:SLPI=1.00:LGI= 147.:MNI=.015:SCI=    .0]
001:0125---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD              01:000180   134.00    5.016 No_date     2:30   32.63  n/a
                       + 02:000184      .97     .119 No_date     1:10   37.07  n/a
                       + 03:000185      .96     .118 No_date     1:10   37.07  n/a
                       + 04:000186     3.23     .441 No_date     1:10   39.04  n/a
     [DT= 5.00] SUM=   05:001802   139.16    5.112 No_date     2:30   32.84  n/a
001:0126---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
  *  CALIB STANDHYD       06:000187      .96     .118 No_date     1:10   37.07 .475
     [XIMP=.21:TIMP=.21]
     [LOSS= 2 :CN= 71.0]
     [Pervious      area: IAper=10.37:SLPP=2.00:LGP=  40.:MNP=.350:SCP=    .0]
     [Impervious    area: IAimp= 2.00:SLPI=1.00:LGI=  80.:MNI=.015:SCI=    .0]
001:0127---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
  *  CALIB STANDHYD       07:000188      .97     .119 No_date     1:10   37.07 .475
     [XIMP=.21:TIMP=.21]
     [LOSS= 2 :CN= 71.0]
     [Pervious      area: IAper=10.37:SLPP=2.00:LGP=  40.:MNP=.350:SCP=    .0]
     [Impervious    area: IAimp= 2.00:SLPI=1.00:LGI=  80.:MNI=.015:SCI=    .0]
001:0128---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD              05:001802   139.16    5.112 No_date     2:30   32.84  n/a
                       + 06:000187      .96     .118 No_date     1:10   37.07  n/a
                       + 07:000188      .97     .119 No_date     1:10   37.07  n/a
     [DT= 5.00] SUM=   10:001804   141.09    5.149 No_date     2:25   32.90  n/a
001:0129---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD         10:000190   771.00   16.038 No_date     3:45   32.63 .418
     [CN= 76.0: N= 3.00]
     [Tp= 2.23:DT= 5.00]
001:0130---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD         01:000191     6.30     .645 No_date     1:25   32.63 .418
     [CN= 76.0: N= 3.00]
     [Tp=  .23:DT= 5.00]
001:0131---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
  *  CALIB STANDHYD       02:000192     1.62     .197 No_date     1:10   37.07 .475
     [XIMP=.21:TIMP=.21]
     [LOSS= 2 :CN= 71.0]
     [Pervious      area: IAper=10.37:SLPP=2.00:LGP=  40.:MNP=.350:SCP=    .0]
     [Impervious    area: IAimp= 2.00:SLPI=1.00:LGI= 104.:MNI=.015:SCI=    .0]
001:0132---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD              01:000191     6.30     .645 No_date     1:25   32.63  n/a
                       + 02:000192     1.62     .197 No_date     1:10   37.07  n/a
     [DT= 5.00] SUM=   03:001900     7.92     .791 No_date     1:20   33.54  n/a
001:0133---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
  *  CALIB STANDHYD       04:000192     3.33     .455 No_date     1:10   39.04 .500
     [XIMP=.25:TIMP=.25]
     [LOSS= 2 :CN= 71.0]
     [Pervious      area: IAper=10.37:SLPP=2.00:LGP=  40.:MNP=.350:SCP=    .0]
     [Impervious    area: IAimp= 2.00:SLPI=1.00:LGI= 149.:MNI=.015:SCI=    .0]
001:0134---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD              03:001900     7.92     .791 No_date     1:20   33.54  n/a
                       + 04:000192     3.33     .455 No_date     1:10   39.04  n/a
     [DT= 5.00] SUM=   05:001901    11.25    1.140 No_date     1:20   35.17  n/a
001:0135---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
  *  CALIB STANDHYD       06:000194     1.62     .197 No_date     1:10   37.07 .475
     [XIMP=.21:TIMP=.21]
```

```
     [LOSS= 2 :CN= 71.0]
     [Pervious      area: IAper=10.37:SLPP=2.00:LGP=  40.:MNP=.350:SCP=   .0]
     [Impervious    area: IAimp= 2.00:SLPI=1.00:LGI= 104.:MNI=.015:SCI=   .0]
001:0136---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD             05:001901     11.25     1.140 No_date     1:20   35.17  n/a
                      + 06:000194      1.62      .197 No_date     1:10   37.07  n/a
     [DT= 5.00]  SUM=  07:001902     12.87     1.303 No_date     1:20   35.40  n/a
001:0137---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ROUTE RESERVOIR -> 07:001902     12.87     1.303 No_date     1:20   35.40  n/a
     [RDT= 5.00] out<- 08:000012     12.87      .229 No_date     2:35   35.40  n/a
    {MxStoUsed=.3143E+00}
001:0138---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
  * CALIB STANDHYD      01:000195      1.65      .201 No_date     1:10   37.07 .475
     [XIMP=.21:TIMP=.21]
     [LOSS= 2 :CN= 71.0]
     [Pervious      area: IAper=10.37:SLPP=2.00:LGP=  40.:MNP=.350:SCP=   .0]
     [Impervious    area: IAimp= 2.00:SLPI=1.00:LGI= 105.:MNI=.015:SCI=   .0]
001:0139---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
  * CALIB STANDHYD      02:000196      2.76      .379 No_date     1:10   39.04 .500
     [XIMP=.25:TIMP=.25]
     [LOSS= 2 :CN= 71.0]
     [Pervious      area: IAper=10.37:SLPP=2.00:LGP=  40.:MNP=.350:SCP=   .0]
     [Impervious    area: IAimp= 2.00:SLPI=1.00:LGI= 136.:MNI=.015:SCI=   .0]
001:0140---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD             01:000195      1.65      .201 No_date     1:10   37.07  n/a
                      + 02:000196      2.76      .379 No_date     1:10   39.04  n/a
     [DT= 5.00]  SUM=  03:001903      4.41      .579 No_date     1:10   38.30  n/a
001:0141---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
  * CALIB STANDHYD      04:000197      1.65      .201 No_date     1:10   37.07 .475
     [XIMP=.21:TIMP=.21]
     [LOSS= 2 :CN= 71.0]
     [Pervious      area: IAper=10.37:SLPP=2.00:LGP=  40.:MNP=.350:SCP=   .0]
     [Impervious    area: IAimp= 2.00:SLPI=1.00:LGI= 105.:MNI=.015:SCI=   .0]
001:0142---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD             03:001903      4.41      .579 No_date     1:10   38.30  n/a
                      + 04:000197      1.65      .201 No_date     1:10   37.07  n/a
     [DT= 5.00]  SUM=  05:001904      6.06      .780 No_date     1:10   37.97  n/a
001:0143---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ROUTE RESERVOIR -> 05:001904      6.06      .780 No_date     1:10   37.97  n/a
     [RDT= 5.00] out<- 06:000010      6.06      .129 No_date     2:25   37.96  n/a
    {MxStoUsed=.1604E+00}
001:0144---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD             06:000010      6.06      .129 No_date     2:25   37.96  n/a
                      + 08:000012     12.87      .229 No_date     2:35   35.40  n/a
                      + 10:000190    771.00    16.038 No_date     3:45   32.63  n/a
     [DT= 5.00]  SUM=  09:001905    789.93    16.340 No_date     3:45   32.72  n/a
001:0145---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
  * CALIB STANDHYD      01:000200      1.13      .195 No_date     1:10   42.99 .551
     [XIMP=.33:TIMP=.33]
     [LOSS= 2 :CN= 71.0]
     [Pervious      area: IAper=10.37:SLPP=2.00:LGP=  40.:MNP=.350:SCP=   .0]
     [Impervious    area: IAimp= 2.00:SLPI=1.00:LGI=  87.:MNI=.015:SCI=   .0]
001:0146---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD        02:000201      2.40      .220 No_date     1:25   30.16 .387
     [CN= 74.0: N= 3.00]
     [Tp=  .24:DT= 5.00]
001:0147---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD             01:000200      1.13      .195 No_date     1:10   42.99  n/a
                      + 02:000201      2.40      .220 No_date     1:25   30.16  n/a
     [DT= 5.00]  SUM=  03:002000      3.53      .337 No_date     1:20   34.27  n/a
001:0148---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
  * CALIB STANDHYD      04:000202      1.20      .157 No_date     1:10   38.05 .488
     [XIMP=.23:TIMP=.23]
     [LOSS= 2 :CN= 71.0]
     [Pervious      area: IAper=10.37:SLPP=2.00:LGP=  40.:MNP=.350:SCP=   .0]
     [Impervious    area: IAimp= 2.00:SLPI=1.00:LGI=  89.:MNI=.015:SCI=   .0]
001:0149---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
  * CALIB STANDHYD      05:000203      2.40      .290 No_date     1:10   37.07 .475
     [XIMP=.21:TIMP=.21]
     [LOSS= 2 :CN= 71.0]
     [Pervious      area: IAper=10.37:SLPP=2.00:LGP=  40.:MNP=.350:SCP=   .0]
     [Impervious    area: IAimp= 2.00:SLPI=1.00:LGI= 126.:MNI=.015:SCI=   .0]
001:0150---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
  * CALIB STANDHYD      06:000204      4.11      .558 No_date     1:10   39.04 .500
     [XIMP=.25:TIMP=.25]
     [LOSS= 2 :CN= 71.0]
     [Pervious      area: IAper=10.37:SLPP=2.00:LGP=  40.:MNP=.350:SCP=   .0]
     [Impervious    area: IAimp= 2.00:SLPI=1.00:LGI= 166.:MNI=.015:SCI=   .0]
001:0151---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD             03:002000      3.53      .337 No_date     1:20   34.27  n/a
                      + 04:000202      1.20      .157 No_date     1:10   38.05  n/a
                      + 05:000203      2.40      .290 No_date     1:10   37.07  n/a
                      + 06:000204      4.11      .558 No_date     1:10   39.04  n/a
     [DT= 5.00]  SUM=  07:002001     11.24     1.307 No_date     1:10   37.01  n/a
001:0152---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
```

```
  *  CALIB STANDHYD      08:000205      2.40      .290 No_date     1:10    37.07 .475
     [XIMP=.21:TIMP=.21]
     [LOSS= 2 :CN= 71.0]
     [Pervious      area: IAper=10.37:SLPP=2.00:LGP=  40.:MNP=.350:SCP=    .0]
     [Impervious    area: IAimp= 2.00:SLPI=1.00:LGI= 126.:MNI=.015:SCI=    .0]
001:0153--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
  *  CALIB STANDHYD      01:000207      1.10      .186 No_date     1:10    42.49 .545
     [XIMP=.32:TIMP=.32]
     [LOSS= 2 :CN= 71.0]
     [Pervious      area: IAper=10.37:SLPP=2.00:LGP=  40.:MNP=.350:SCP=    .0]
     [Impervious    area: IAimp= 2.00:SLPI=1.00:LGI=  86.:MNI=.015:SCI=    .0]
001:0154--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     CALIB NASHYD        02:000206      2.40      .220 No_date     1:25    30.16 .387
     [CN= 74.0: N= 3.00]
     [Tp=  .24:DT= 5.00]
001:0155--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ADD HYD             01:000207      1.10      .186 No_date     1:10    42.49  n/a
                       + 02:000206      2.40      .220 No_date     1:25    30.16  n/a
     [DT= 5.00]  SUM=  03:002002      3.50      .333 No_date     1:20    34.04  n/a
001:0156--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
  *  CALIB STANDHYD      04:000208      1.20      .157 No_date     1:10    38.05 .488
     [XIMP=.23:TIMP=.23]
     [LOSS= 2 :CN= 71.0]
     [Pervious      area: IAper=10.37:SLPP=2.00:LGP=  40.:MNP=.350:SCP=    .0]
     [Impervious    area: IAimp= 2.00:SLPI=1.00:LGI=  89.:MNI=.015:SCI=    .0]
001:0157--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ADD HYD             03:002002      3.50      .333 No_date     1:20    34.04  n/a
                       + 04:000208      1.20      .157 No_date     1:10    38.05  n/a
                       + 07:002001     11.24     1.307 No_date     1:10    37.01  n/a
                       + 08:000205      2.40      .290 No_date     1:10    37.07  n/a
     [DT= 5.00]  SUM=  05:002002     18.34     2.046 No_date     1:10    36.52  n/a
001:0158--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ROUTE RESERVOIR -> 05:002002     18.34     2.046 No_date     1:10    36.52  n/a
     [RDT= 5.00] out<- 06:000010     18.34      .524 No_date     2:10    36.52  n/a
     {MxStoUsed=.4464E+00}
001:0159--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     CALIB NASHYD        01:000250    198.50     3.183 No_date     4:30    32.63 .418
     [CN= 76.0: N= 3.00]
     [Tp= 2.97:DT= 5.00]
001:0160--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
  *  CALIB STANDHYD      02:000210       .36      .045 No_date     1:10    37.07 .475
     [XIMP=.21:TIMP=.21]
     [LOSS= 2 :CN= 71.0]
     [Pervious      area: IAper=10.37:SLPP=2.00:LGP=  40.:MNP=.350:SCP=    .0]
     [Impervious    area: IAimp= 2.00:SLPI=1.00:LGI=  49.:MNI=.015:SCI=    .0]
001:0161--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
  *  CALIB STANDHYD      03:000211       .60      .084 No_date     1:10    39.04 .500
     [XIMP=.25:TIMP=.25]
     [LOSS= 2 :CN= 71.0]
     [Pervious      area: IAper=10.37:SLPP=2.00:LGP=  40.:MNP=.350:SCP=    .0]
     [Impervious    area: IAimp= 2.00:SLPI=1.00:LGI=  63.:MNI=.015:SCI=    .0]
001:0162--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
  *  CALIB STANDHYD      04:000213      1.14      .140 No_date     1:10    37.07 .475
     [XIMP=.21:TIMP=.21]
     [LOSS= 2 :CN= 71.0]
     [Pervious      area: IAper=10.37:SLPP=2.00:LGP=  40.:MNP=.350:SCP=    .0]
     [Impervious    area: IAimp= 2.00:SLPI=1.00:LGI=  87.:MNI=.015:SCI=    .0]
001:0163--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
  *  CALIB STANDHYD      05:000214      1.89      .261 No_date     1:10    39.04 .500
     [XIMP=.25:TIMP=.25]
     [LOSS= 2 :CN= 71.0]
     [Pervious      area: IAper=10.37:SLPP=2.00:LGP=  40.:MNP=.350:SCP=    .0]
     [Impervious    area: IAimp= 2.00:SLPI=1.00:LGI= 112.:MNI=.015:SCI=    .0]
001:0164--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ADD HYD             01:000250    198.50     3.183 No_date     4:30    32.63  n/a
                       + 02:000210       .36      .045 No_date     1:10    37.07  n/a
                       + 03:000211       .60      .084 No_date     1:10    39.04  n/a
                       + 04:000213      1.14      .140 No_date     1:10    37.07  n/a
                       + 05:000214      1.89      .261 No_date     1:10    39.04  n/a
     [DT= 5.00]  SUM=  06:002500    202.49     3.183 No_date     4:30    32.74  n/a
001:0165--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
  *  CALIB STANDHYD      07:000212       .36      .045 No_date     1:10    37.07 .475
     [XIMP=.21:TIMP=.21]
     [LOSS= 2 :CN= 71.0]
     [Pervious      area: IAper=10.37:SLPP=2.00:LGP=  40.:MNP=.350:SCP=    .0]
     [Impervious    area: IAimp= 2.00:SLPI=1.00:LGI=  49.:MNI=.015:SCI=    .0]
001:0166--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
  *  CALIB STANDHYD      08:000215      1.14      .140 No_date     1:10    37.07 .475
     [XIMP=.21:TIMP=.21]
     [LOSS= 2 :CN= 71.0]
     [Pervious      area: IAper=10.37:SLPP=2.00:LGP=  40.:MNP=.350:SCP=    .0]
     [Impervious    area: IAimp= 2.00:SLPI=1.00:LGI=  87.:MNI=.015:SCI=    .0]
001:0167--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ADD HYD             06:002500    202.49     3.183 No_date     4:30    32.74  n/a
                       + 07:000212       .36      .045 No_date     1:10    37.07  n/a
```

```
                    +  08:000215      1.14      .140 No_date     1:10    37.07  n/a
     EDT= 5.00]  SUM=  09:002501    203.99     3.183 No_date     4:30    32.77  n/a
001:0168--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
 *   CALIB STANDHYD     01:000260      8.60     1.679 No_date     1:10    48.79 .625
     EXIMP=.39:TIMP=.39]
     ELOSS= 2 :CN= 75.0]
     EPervious      area: IAper= 8.47:SLPP=2.00:LGP=  40.:MNP=.350:SCP=    .0]
     EImpervious    area: IAimp= 2.00:SLPI=1.00:LGI= 239.:MNI=.015:SCI=    .0]
001:0169--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
 *   CALIB STANDHYD     02:000300      2.17      .381 No_date     1:10    43.48 .557
     EXIMP=.34:TIMP=.34]
     ELOSS= 2 :CN= 71.0]
     EPervious      area: IAper=10.37:SLPP=2.00:LGP=  40.:MNP=.350:SCP=    .0]
     EImpervious    area: IAimp= 2.00:SLPI=1.00:LGI= 120.:MNI=.015:SCI=    .0]
001:0170--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ADD HYD            01:000260      8.60     1.679 No_date     1:10    48.79  n/a
                    +   02:000300      2.17      .381 No_date     1:10    43.48  n/a
     EDT= 5.00]  SUM=   03:002600     10.77     2.059 No_date     1:10    47.72  n/a
001:0171--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
 *   CALIB STANDHYD     04:000301      3.86      .573 No_date     1:10    40.52 .519
     EXIMP=.28:TIMP=.28]
     ELOSS= 2 :CN= 71.0]
     EPervious      area: IAper=10.37:SLPP=2.00:LGP=  40.:MNP=.350:SCP=    .0]
     EImpervious    area: IAimp= 2.00:SLPI=1.00:LGI= 160.:MNI=.015:SCI=    .0]
001:0172--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ADD HYD            03:002600     10.77     2.059 No_date     1:10    47.72  n/a
                    +   04:000301      3.86      .573 No_date     1:10    40.52  n/a
     EDT= 5.00]  SUM=   05:002601     14.63     2.632 No_date     1:10    45.82  n/a
001:0173--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     CALIB NASHYD       06:000302      1.30      .047 No_date     2:10    26.71 .342
     ECN= 71.0: N= 3.00]
     ETp=  .82:DT= 5.00]
001:0174--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     CALIB NASHYD       07:000303      1.00      .102 No_date     1:20    28.98 .371
     ECN= 73.0: N= 3.00]
     ETp=  .18:DT= 5.00]
001:0175--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ADD HYD            05:002601     14.63     2.632 No_date     1:10    45.82  n/a
                    +   07:000303      1.00      .102 No_date     1:20    28.98  n/a
     EDT= 5.00]  SUM=   08:002601     15.63     2.699 No_date     1:10    44.74  n/a
001:0176--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ROUTE RESERVOIR -> 08:002601     15.63     2.699 No_date     1:10    44.74  n/a
     ERDT= 5.00] out<-  09:000015     15.63     1.363 No_date     1:30    44.74  n/a
     {MxStoUsed=.3347E+00}
001:0177--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     CALIB NASHYD       07:000304     93.55     2.156 No_date     3:30    32.63 .418
     ECN= 76.0: N= 3.00]
     ETp= 1.98:DT= 5.00]
001:0178--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ADD HYD            06:000302      1.30      .047 No_date     2:10    26.71  n/a
                    +   07:000304     93.55     2.156 No_date     3:30    32.63  n/a
     EDT= 5.00]  SUM=   08:002602     94.85     2.179 No_date     3:30    32.55  n/a
001:0179--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ADD HYD            08:002602     94.85     2.179 No_date     3:30    32.55  n/a
                    +   09:000015     15.63     1.363 No_date     1:30    44.74  n/a
     EDT= 5.00]  SUM=   10:002602    110.48     2.420 No_date     3:25    34.27  n/a
 ** END OF RUN :   1

*******************************************************************************



RUN:COMMAND#
002:0001--------------------------------------------------------------------------
     START
      ETZERO =     .00 hrs on          0]
      EMETOUT=    2     (1=imperial, 2=metric output)]
      ENSTORM=    1 ]
      ENRUN  =    2 ]
002:0002--------------------------------------------------------------------------
     READ STORM
      Filename = STORM.001
      Comment  = 3 HR Chicago 50-yr storm, Stratford Parameters
      ESDT=10.00:SDUR=    3.00:PTOT=  71.87]
002:0003--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     CALIB STANDHYD     01:000010     24.60     3.336 No_date     1:10    35.74 .497
      EXIMP=.35:TIMP=.35]
      ELOSS= 2 :CN= 65.0]
      EPervious      area: IAper=13.68:SLPP=2.00:LGP=  40.:MNP=.350:SCP=    .0]
      EImpervious    area: IAimp= 2.00:SLPI=1.00:LGI= 405.:MNI=.015:SCI=    .0]
002:0004--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
 *   CALIB STANDHYD     01:000020      9.80     1.087 No_date     1:10    29.78 .414
      EXIMP=.27:TIMP=.27]
```

```
     [LOSS= 2 :CN= 62.0]
     [Pervious      area: IAper=15.57:SLPP=2.00:LGP=  40.:MNP=.350:SCP=   .0]
     [Impervious    area: IAimp= 2.00:SLPI=1.00:LGI= 256.:MNI=.015:SCI=   .0]
002:0005---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
 *   CALIB STANDHYD      02:000021      1.10      .107 No_date     1:10    27.04 .376
     [XIMP=.22:TIMP=.22]
     [LOSS= 2 :CN= 62.0]
     [Pervious      area: IAper=15.57:SLPP=2.00:LGP=  40.:MNP=.350:SCP=   .0]
     [Impervious    area: IAimp= 2.00:SLPI=1.00:LGI=  86.:MNI=.015:SCI=   .0]
002:0006---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ADD HYD             01:000020      9.80     1.087 No_date     1:10    29.78  n/a
                       + 02:000021      1.10      .107 No_date     1:10    27.04  n/a
     [DT= 5.00]  SUM=  03:000200     10.90     1.194 No_date     1:10    29.50  n/a
002:0007---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ROUTE RESERVOIR -> 03:000200     10.90     1.194 No_date     1:10    29.50  n/a
      [RDT= 1.00] out<- 04:000001     10.90     1.147 No_date     1:11    29.50  n/a
     {MxStoUsed=.7873E-01}
002:0008---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     CALIB NASHYD        01:000030      3.85      .154 No_date     1:35    17.37 .242
      [CN= 65.0: N= 3.00]
      [Tp=  .35:DT= 5.00]
002:0009---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
 *   CALIB STANDHYD      02:000031      1.74      .175 No_date     1:10    27.58 .384
     [XIMP=.23:TIMP=.23]
     [LOSS= 2 :CN= 62.0]
     [Pervious      area: IAper=15.57:SLPP=2.00:LGP=  40.:MNP=.350:SCP=   .0]
     [Impervious    area: IAimp= 2.00:SLPI=1.00:LGI= 108.:MNI=.015:SCI=   .0]
002:0010---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
 *   CALIB NASHYD        03:000032       .80      .040 No_date     1:20    14.95 .208
      [CN= 62.0: N= 3.00]
      [Tp=  .16:DT= 5.00]
002:0011---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
 *   CALIB STANDHYD      04:000033       .81      .095 No_date     1:10    29.78 .414
     [XIMP=.27:TIMP=.27]
     [LOSS= 2 :CN= 62.0]
     [Pervious      area: IAper=15.57:SLPP=2.00:LGP=  40.:MNP=.350:SCP=   .0]
     [Impervious    area: IAimp= 2.00:SLPI=1.00:LGI=  73.:MNI=.015:SCI=   .0]
002:0012---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ADD HYD             02:000031      1.74      .175 No_date     1:10    27.58  n/a
                       + 03:000032       .80      .040 No_date     1:20    14.95  n/a
                       + 04:000033       .81      .095 No_date     1:10    29.78  n/a
     [DT= 5.00]  SUM=  05:000300      3.35      .294 No_date     1:10    25.10  n/a
002:0013---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
 *   CALIB STANDHYD      07:000034       .86      .105 No_date     1:10    30.33 .422
     [XIMP=.28:TIMP=.28]
     [LOSS= 2 :CN= 62.0]
     [Pervious      area: IAper=15.57:SLPP=2.00:LGP=  40.:MNP=.350:SCP=   .0]
     [Impervious    area: IAimp= 2.00:SLPI=1.00:LGI=  76.:MNI=.015:SCI=   .0]
002:0014---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ADD HYD             01:000030      3.85      .154 No_date     1:35    17.37  n/a
                       + 05:000300      3.35      .294 No_date     1:10    25.10  n/a
                       + 07:000034       .86      .105 No_date     1:10    30.33  n/a
     [DT= 5.00]  SUM=  08:000302      8.06      .432 No_date     1:10    21.97  n/a
002:0015---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ROUTE RESERVOIR -> 08:000302      8.06      .432 No_date     1:10    21.97  n/a
      [RDT= 5.00] out<- 09:000002      8.06      .339 No_date     1:30    21.96  n/a
     {MxStoUsed=.4362E-01}
002:0016---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     CALIB NASHYD        01:000060     25.40      .705 No_date     2:20    21.90 .305
      [CN= 70.0: N= 3.00]
      [Tp=  .91:DT= 5.00]
002:0017---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
 *   CALIB STANDHYD      02:000061      1.20      .175 No_date     1:10    33.63 .468
     [XIMP=.34:TIMP=.34]
     [LOSS= 2 :CN= 62.0]
     [Pervious      area: IAper=15.57:SLPP=2.00:LGP=  40.:MNP=.350:SCP=   .0]
     [Impervious    area: IAimp= 2.00:SLPI=1.00:LGI=  89.:MNI=.015:SCI=   .0]
002:0018---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
 *   CALIB STANDHYD      03:000062      2.80      .573 No_date     1:10    42.26 .588
     [XIMP=.49:TIMP=.49]
     [LOSS= 2 :CN= 63.0]
     [Pervious      area: IAper=14.92:SLPP=2.00:LGP=  40.:MNP=.350:SCP=   .0]
     [Impervious    area: IAimp= 2.00:SLPI=1.00:LGI= 137.:MNI=.015:SCI=   .0]
002:0019---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ADD HYD             02:000061      1.20      .175 No_date     1:10    33.63  n/a
                       + 03:000062      2.80      .573 No_date     1:10    42.26  n/a
     [DT= 5.00]  SUM=  04:000600      4.00      .748 No_date     1:10    39.67  n/a
002:0020---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     CALIB NASHYD        02:000063      1.20      .028 No_date     2:00    14.95 .208
      [CN= 62.0: N= 3.00]
      [Tp=  .64:DT= 5.00]
002:0021---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     CALIB NASHYD        05:000067       .18      .008 No_date     1:25    14.95 .208
      [CN= 62.0: N= 3.00]
      [Tp=  .19:DT= 5.00]
```

```
002:0022---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
 *  CALIB STANDHYD      06:000065      .28      .034 No_date     1:10   29.78 .414
     [XIMP=.27:TIMP=.27]
     [LOSS= 2 :CN= 62.0]
     [Pervious      area: IAper=15.57:SLPP=2.00:LGP=  40.:MNP=.350:SCP=    .0]
     [Impervious    area: IAimp= 2.00:SLPI=1.00:LGI=  43.:MNI=.015:SCI=    .0]
002:0023---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ADD HYD             02:000063     1.20      .028 No_date     2:00   14.95  n/a
                       + 04:000600     4.00      .748 No_date     1:10   39.67  n/a
                       + 05:000067      .18      .008 No_date     1:25   14.95  n/a
     [DT= 5.00]  SUM=  07:000601     5.38      .754 No_date     1:10   33.33  n/a
002:0024---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ADD HYD             07:000601     5.38      .754 No_date     1:10   33.33  n/a
                       + 06:000065      .28      .034 No_date     1:10   29.78  n/a
     [DT= 5.00]  SUM=  08:000601     5.66      .788 No_date     1:10   33.16  n/a
002:0025---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ROUTE RESERVOIR -> 08:000601     5.66      .788 No_date     1:10   33.16  n/a
     [RDT= 5.00] out<- 09:000003     5.66      .300 No_date     1:25   33.16  n/a
    {MxStoUsed=.9117E-01}
002:0026---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
 *  CALIB STANDHYD      02:000064      .32      .044 No_date     1:10   31.98 .445
     [XIMP=.31:TIMP=.31]
     [LOSS= 2 :CN= 62.0]
     [Pervious      area: IAper=15.57:SLPP=2.00:LGP=  40.:MNP=.350:SCP=    .0]
     [Impervious    area: IAimp= 2.00:SLPI=1.00:LGI=  46.:MNI=.015:SCI=    .0]
002:0027---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     CALIB NASHYD        03:000066      .27      .012 No_date     1:25   14.95 .208
     [CN= 62.0: N= 3.00]
     [Tp=  .22:DT= 5.00]
002:0028---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ADD HYD             01:000060    25.40      .705 No_date     2:20   21.90  n/a
                       + 03:000066      .27      .012 No_date     1:25   14.95  n/a
     [DT= 5.00]  SUM=  04:000602    25.67      .708 No_date     2:20   21.82  n/a
002:0029---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ADD HYD             04:000602    25.67      .708 No_date     2:20   21.82  n/a
                       + 09:000602     5.66      .300 No_date     1:25   33.16  n/a
     [DT= 5.00]  SUM=  09:000602    31.33      .826 No_date     2:15   23.87  n/a
002:0030---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     CALIB NASHYD        01:000070     2.70      .175 No_date     1:20   20.01 .278
     [CN= 68.0: N= 3.00]
     [Tp=  .19:DT= 5.00]
002:0031---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
 *  CALIB STANDHYD      02:000071      .64      .062 No_date     1:10   27.04 .376
     [XIMP=.22:TIMP=.22]
     [LOSS= 2 :CN= 62.0]
     [Pervious      area: IAper=15.57:SLPP=2.00:LGP=  40.:MNP=.350:SCP=    .0]
     [Impervious    area: IAimp= 2.00:SLPI=1.00:LGI=  65.:MNI=.015:SCI=    .0]
002:0032---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
 *  CALIB STANDHYD      03:000072     1.44      .134 No_date     1:10   26.49 .369
     [XIMP=.21:TIMP=.21]
     [LOSS= 2 :CN= 62.0]
     [Pervious      area: IAper=15.57:SLPP=2.00:LGP=  40.:MNP=.350:SCP=    .0]
     [Impervious    area: IAimp= 2.00:SLPI=1.00:LGI=  98.:MNI=.015:SCI=    .0]
002:0033---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
 *  CALIB STANDHYD      04:000073     4.40      .469 No_date     1:10   28.68 .399
     [XIMP=.25:TIMP=.25]
     [LOSS= 2 :CN= 62.0]
     [Pervious      area: IAper=15.57:SLPP=2.00:LGP=  40.:MNP=.350:SCP=    .0]
     [Impervious    area: IAimp= 2.00:SLPI=1.00:LGI= 171.:MNI=.015:SCI=    .0]
002:0034---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
 *  CALIB STANDHYD      05:000074     1.44      .134 No_date     1:10   26.49 .369
     [XIMP=.21:TIMP=.21]
     [LOSS= 2 :CN= 62.0]
     [Pervious      area: IAper=15.57:SLPP=2.00:LGP=  40.:MNP=.350:SCP=    .0]
     [Impervious    area: IAimp= 2.00:SLPI=1.00:LGI=  98.:MNI=.015:SCI=    .0]
002:0035---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ADD HYD             02:000071      .64      .062 No_date     1:10   27.04  n/a
                       + 03:000072     1.44      .134 No_date     1:10   26.49  n/a
                       + 04:000073     4.40      .469 No_date     1:10   28.68  n/a
                       + 05:000074     1.44      .134 No_date     1:10   26.49  n/a
     [DT= 5.00]  SUM=  06:000700     7.92      .799 No_date     1:10   27.75  n/a
002:0036---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     CALIB NASHYD        07:000075     6.50      .261 No_date     1:35   17.37 .242
     [CN= 65.0: N= 3.00]
     [Tp=  .35:DT= 5.00]
002:0037---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ADD HYD             06:000700     7.92      .799 No_date     1:10   27.75  n/a
                       + 07:000075     6.50      .261 No_date     1:35   17.37  n/a
     [DT= 5.00]  SUM=  08:000701    14.42      .854 No_date     1:10   23.07  n/a
002:0038---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     CALIB NASHYD        09:000075     2.50      .150 No_date     1:25   19.10 .266
     [CN= 67.0: N= 3.00]
     [Tp=  .20:DT= 5.00]
002:0039---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ADD HYD             08:000701    14.42      .854 No_date     1:10   23.07  n/a
```

```
                    +  09:000075      2.50      .150 No_date     1:25    19.10  n/a
     [DT= 5.00]  SUM=  10:000702     16.92      .930 No_date     1:10    22.48  n/a
002:0040---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ROUTE RESERVOIR -> 10:000702     16.92      .930 No_date     1:10    22.48  n/a
 *   [RDT= 1.00] out<- 03:000004     16.92     1.021 No_date     1:13    22.48  n/a
    (MxStoUsed=.7158E-01)
002:0041---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD        02:000080     10.60      .501 No_date     1:45    22.89 .318
     [CN= 71.0: N= 3.00]
     [Tp=  .44:DT= 5.00]
002:0042---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
 *  CALIB STANDHYD      03:000081      .32      .031 No_date     1:10    26.49 .369
     [XIMP=.21:TIMP=.21]
     [LOSS= 2 :CN= 62.0]
     [Pervious      area: IAper=15.57:SLPP=2.00:LGP=  40.:MNP=.350:SCP=   .0]
     [Impervious    area: IAimp= 2.00:SLPI=1.00:LGI=  46.:MNI=.015:SCI=   .0]
002:0043---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
 *  CALIB STANDHYD      04:000082      .21      .020 No_date     1:10    26.49 .369
     [XIMP=.21:TIMP=.21]
     [LOSS= 2 :CN= 62.0]
     [Pervious      area: IAper=15.57:SLPP=2.00:LGP=  40.:MNP=.350:SCP=   .0]
     [Impervious    area: IAimp= 2.00:SLPI=1.00:LGI=  37.:MNI=.015:SCI=   .0]
002:0044---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
 *  CALIB STANDHYD      05:000083      .16      .016 No_date     1:10    26.49 .369
     [XIMP=.21:TIMP=.21]
     [LOSS= 2 :CN= 62.0]
     [Pervious      area: IAper=15.57:SLPP=2.00:LGP=  40.:MNP=.350:SCP=   .0]
     [Impervious    area: IAimp= 2.00:SLPI=1.00:LGI=  33.:MNI=.015:SCI=   .0]
002:0045---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
 *  CALIB STANDHYD      06:000084      .17      .016 No_date     1:10    26.49 .369
     [XIMP=.21:TIMP=.21]
     [LOSS= 2 :CN= 62.0]
     [Pervious      area: IAper=15.57:SLPP=2.00:LGP=  40.:MNP=.350:SCP=   .0]
     [Impervious    area: IAimp= 2.00:SLPI=1.00:LGI=  34.:MNI=.015:SCI=   .0]
002:0046---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD        07:000110    420.50     2.540 No_date     7:25    23.90 .333
     [CN= 72.0: N= 3.00]
     [Tp= 5.93:DT= 5.00]
002:0047---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD             01:000070      2.70      .175 No_date     1:20    20.01  n/a
                    +   02:000080     10.60      .501 No_date     1:45    22.89  n/a
                    +   03:000081      .32      .031 No_date     1:10    26.49  n/a
                    +   04:000082      .21      .020 No_date     1:10    26.49  n/a
                    +   07:000110    420.50     2.540 No_date     7:25    23.90  n/a
     [DT= 5.00]  SUM=   08:000800    434.33     2.540 No_date     7:25    23.86  n/a
002:0048---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD             05:000083      .16      .016 No_date     1:10    26.49  n/a
                    +   06:000084      .17      .016 No_date     1:10    26.49  n/a
                    +   08:000800    434.33     2.540 No_date     7:25    23.86  n/a
     [DT= 5.00]  SUM=   09:000801    434.66     2.540 No_date     7:25    23.86  n/a
002:0049---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD        01:000120     55.70     1.471 No_date     2:30    22.89 .318
     [CN= 71.0: N= 3.00]
     [Tp= 1.04:DT= 5.00]
002:0050---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
 *  CALIB STANDHYD      02:000121      .54      .054 No_date     1:10    28.39 .395
     [XIMP=.21:TIMP=.21]
     [LOSS= 2 :CN= 65.0]
     [Pervious      area: IAper=13.68:SLPP=2.00:LGP=  40.:MNP=.350:SCP=   .0]
     [Impervious    area: IAimp= 2.00:SLPI=1.00:LGI=  60.:MNI=.015:SCI=   .0]
002:0051---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
 *  CALIB STANDHYD      03:000122      .38      .038 No_date     1:10    28.39 .395
     [XIMP=.21:TIMP=.21]
     [LOSS= 2 :CN= 65.0]
     [Pervious      area: IAper=13.68:SLPP=2.00:LGP=  40.:MNP=.350:SCP=   .0]
     [Impervious    area: IAimp= 2.00:SLPI=1.00:LGI=  50.:MNI=.015:SCI=   .0]
002:0052---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD             01:000120     55.70     1.471 No_date     2:30    22.89  n/a
                    +   02:000121      .54      .054 No_date     1:10    28.39  n/a
                    +   03:000122      .38      .038 No_date     1:10    28.39  n/a
     [DT= 5.00]  SUM=   04:001200     56.62     1.484 No_date     2:30    22.98  n/a
002:0053---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
 *  CALIB STANDHYD      05:000123      .43      .043 No_date     1:10    28.39 .395
     [XIMP=.21:TIMP=.21]
     [LOSS= 2 :CN= 65.0]
     [Pervious      area: IAper=13.68:SLPP=2.00:LGP=  40.:MNP=.350:SCP=   .0]
     [Impervious    area: IAimp= 2.00:SLPI=1.00:LGI=  54.:MNI=.015:SCI=   .0]
002:0054---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
 *  CALIB STANDHYD      06:000124      .72      .072 No_date     1:10    28.39 .395
     [XIMP=.21:TIMP=.21]
     [LOSS= 2 :CN= 65.0]
     [Pervious      area: IAper=13.68:SLPP=2.00:LGP=  40.:MNP=.350:SCP=   .0]
     [Impervious    area: IAimp= 2.00:SLPI=1.00:LGI=  69.:MNI=.015:SCI=   .0]
002:0055---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD             04:001200     56.62     1.484 No_date     2:30    22.98  n/a
```

```
                    +  05:000123      .43      .043 No_date    1:10    28.39  n/a
                    +  06:000124      .72      .072 No_date    1:10    28.39  n/a
     [DT= 5.00]  SUM=  10:001201    57.77    1.501 No_date    2:30    23.09  n/a
002:0056--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
  *  CALIB STANDHYD     01:000125      .95      .110 No_date    1:10    30.49 .424
     [XIMP=.25:TIMP=.25]
     [LOSS= 2 :CN= 65.0]
     [Pervious      area: IAper=13.68:SLPP=2.00:LGP=  40.:MNP=.350:SCP=    .0]
     [Impervious    area: IAimp= 2.00:SLPI=1.00:LGI=  80.:MNI=.015:SCI=    .0]
002:0057--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
  *  CALIB STANDHYD     02:000126      .17      .026 No_date    1:10    35.22 .490
     [XIMP=.34:TIMP=.34]
     [LOSS= 2 :CN= 65.0]
     [Pervious      area: IAper=13.68:SLPP=2.00:LGP=  40.:MNP=.350:SCP=    .0]
     [Impervious    area: IAimp= 2.00:SLPI=1.00:LGI=  34.:MNI=.015:SCI=    .0]
002:0058--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ADD HYD            01:000125      .95      .110 No_date    1:10    30.49  n/a
                    +  02:000126      .17      .026 No_date    1:10    35.22  n/a
     [DT= 5.00]  SUM=  03:001201     1.12      .136 No_date    1:10    31.21  n/a
002:0059--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     CALIB NASHYD       04:000127     1.75      .104 No_date    1:25    20.94 .291
     [CN= 69.0: N= 3.00]
     [Tp=  .25:DT= 5.00]
002:0060--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
  *  CALIB STANDHYD     05:000128      .36      .036 No_date    1:10    28.39 .395
     [XIMP=.21:TIMP=.21]
     [LOSS= 2 :CN= 65.0]
     [Pervious      area: IAper=13.68:SLPP=2.00:LGP=  40.:MNP=.350:SCP=    .0]
     [Impervious    area: IAimp= 2.00:SLPI=1.00:LGI=  49.:MNI=.015:SCI=    .0]
002:0061--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
  *  CALIB STANDHYD     06:000129      .36      .036 No_date    1:10    28.39 .395
     [XIMP=.21:TIMP=.21]
     [LOSS= 2 :CN= 65.0]
     [Pervious      area: IAper=13.68:SLPP=2.00:LGP=  40.:MNP=.350:SCP=    .0]
     [Impervious    area: IAimp= 2.00:SLPI=1.00:LGI=  49.:MNI=.015:SCI=    .0]
002:0062--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
  *  CALIB STANDHYD     07:000130     3.90      .487 No_date    1:10    32.59 .454
     [XIMP=.29:TIMP=.29]
     [LOSS= 2 :CN= 65.0]
     [Pervious      area: IAper=13.68:SLPP=2.00:LGP=  40.:MNP=.350:SCP=    .0]
     [Impervious    area: IAimp= 2.00:SLPI=1.00:LGI= 161.:MNI=.015:SCI=    .0]
002:0063--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ADD HYD            03:001201     1.12      .136 No_date    1:10    31.21  n/a
                    +  04:000127     1.75      .104 No_date    1:25    20.94  n/a
                    +  05:000128      .36      .036 No_date    1:10    28.39  n/a
                    +  06:000129      .36      .036 No_date    1:10    28.39  n/a
                    +  07:000130     3.90      .487 No_date    1:10    32.59  n/a
     [DT= 5.00]  SUM=  08:001202     7.49      .736 No_date    1:10    29.26  n/a
002:0064--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
  *  CALIB STANDHYD     01:000131      .36      .104 No_date    1:10    53.07 .738
     [XIMP=.68:TIMP=.68]
     [LOSS= 2 :CN= 65.0]
     [Pervious      area: IAper=13.68:SLPP=2.00:LGP=  40.:MNP=.350:SCP=    .0]
     [Impervious    area: IAimp= 2.00:SLPI=1.00:LGI=  49.:MNI=.015:SCI=    .0]
002:0065--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
  *  CALIB STANDHYD     02:000132      .95      .110 No_date    1:10    30.49 .424
     [XIMP=.25:TIMP=.25]
     [LOSS= 2 :CN= 65.0]
     [Pervious      area: IAper=13.68:SLPP=2.00:LGP=  40.:MNP=.350:SCP=    .0]
     [Impervious    area: IAimp= 2.00:SLPI=1.00:LGI=  80.:MNI=.015:SCI=    .0]
002:0066--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
  *  CALIB STANDHYD     03:000133     1.75      .166 No_date    1:10    27.87 .388
     [XIMP=.20:TIMP=.20]
     [LOSS= 2 :CN= 65.0]
     [Pervious      area: IAper=13.68:SLPP=2.00:LGP=  40.:MNP=.350:SCP=    .0]
     [Impervious    area: IAimp= 2.00:SLPI=1.00:LGI= 108.:MNI=.015:SCI=    .0]
002:0067--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ADD HYD            08:001202     7.49      .736 No_date    1:10    29.26  n/a
                    +  01:000131      .36      .104 No_date    1:10    53.07  n/a
                    +  02:000132      .95      .110 No_date    1:10    30.49  n/a
                    +  03:000133     1.75      .166 No_date    1:10    27.87  n/a
     [DT= 5.00]  SUM=  04:001203    10.55    1.115 No_date    1:10    29.95  n/a
002:0068--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ROUTE RESERVOIR -> 04:001203    10.55    1.115 No_date    1:10    29.95  n/a
     [RDT= 5.00] out<- 05:000005    10.55      .161 No_date    2:30    29.95  n/a
     {MxStoUsed=.2156E+00}
002:0069--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ADD HYD            05:000005    10.55      .161 No_date    2:30    29.95  n/a
                    +  10:001201    57.77    1.501 No_date    2:30    23.09  n/a
     [DT= 5.00]  SUM=  06:001204    68.32    1.662 No_date    2:30    24.15  n/a
002:0070--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     CALIB NASHYD       01:000135    11.20      .696 No_date    1:35    24.96 .347
     [CN= 73.0: N= 3.00]
     [Tp=  .33:DT= 5.00]
002:0071--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
```

```
  *  CALIB STANDHYD      01:000140      1.30      .206 No_date     1:10    38.86 .541
     [XIMP=.34:TIMP=.34]
     [LOSS= 2 :CN= 71.0]
     [Pervious      area: IAper=10.37:SLPP=2.00:LGP=  40.:MNP=.350:SCP=    .0]
     [Impervious    area: IAimp= 2.00:SLPI=1.00:LGI=  93.:MNI=.015:SCI=    .0]
002:0072---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
  *  CALIB STANDHYD      02:000141      2.40      .294 No_date     1:10    34.64 .482
     [XIMP=.25:TIMP=.25]
     [LOSS= 2 :CN= 71.0]
     [Pervious      area: IAper=10.37:SLPP=2.00:LGP=  40.:MNP=.350:SCP=    .0]
     [Impervious    area: IAimp= 2.00:SLPI=1.00:LGI= 126.:MNI=.015:SCI=    .0]
002:0073---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ADD HYD             01:000140      1.30      .206 No_date     1:10    38.86  n/a
                       + 02:000141      2.40      .294 No_date     1:10    34.64  n/a
     [DT= 5.00]  SUM=    03:001400      3.70      .500 No_date     1:10    36.12  n/a
002:0074---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     CALIB NASHYD        04:000142      1.30      .055 No_date     1:55    24.96 .347
     [CN= 73.0: N= 3.00]
     [Tp=  .60:DT= 5.00]
002:0075---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ADD HYD             03:001400      3.70      .500 No_date     1:10    36.12  n/a
                       + 04:000142      1.30      .055 No_date     1:55    24.96  n/a
     [DT= 5.00]  SUM=    05:001401      5.00      .506 No_date     1:10    33.22  n/a
002:0076---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ROUTE RESERVOIR -> 05:001401      5.00      .506 No_date     1:10    33.22  n/a
     [RDT= 5.00] out<- 06:000006      5.00      .086 No_date     2:40    33.22  n/a
     {MxStoUsed=.1083E+00}
002:0077---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     CALIB NASHYD        01:000143      2.10      .055 No_date     2:20    20.01 .278
     [CN= 68.0: N= 3.00]
     [Tp=  .87:DT= 5.00]
002:0078---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
  *  CALIB STANDHYD      02:000144      3.72      .406 No_date     1:10    30.49 .424
     [XIMP=.25:TIMP=.25]
     [LOSS= 2 :CN= 65.0]
     [Pervious      area: IAper=13.68:SLPP=2.00:LGP=  40.:MNP=.350:SCP=    .0]
     [Impervious    area: IAimp= 2.00:SLPI=1.00:LGI= 157.:MNI=.015:SCI=    .0]
002:0079---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ADD HYD             01:000143      2.10      .055 No_date     2:20    20.01  n/a
                       + 02:000144      3.72      .406 No_date     1:10    30.49  n/a
     [DT= 5.00]  SUM=    03:001402      5.82      .408 No_date     1:10    26.71  n/a
002:0080---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
  *  CALIB STANDHYD      04:000145      2.10      .307 No_date     1:10    34.69 .483
     [XIMP=.33:TIMP=.33]
     [LOSS= 2 :CN= 65.0]
     [Pervious      area: IAper=13.68:SLPP=2.00:LGP=  40.:MNP=.350:SCP=    .0]
     [Impervious    area: IAimp= 2.00:SLPI=1.00:LGI= 118.:MNI=.015:SCI=    .0]
002:0081---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ADD HYD             03:001402      5.82      .408 No_date     1:10    26.71  n/a
                       + 04:000145      2.10      .307 No_date     1:10    34.69  n/a
     [DT= 5.00]  SUM=    05:001402      7.92      .715 No_date     1:10    28.83  n/a
002:0082---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ROUTE RESERVOIR -> 05:001402      7.92      .715 No_date     1:10    28.83  n/a
     [RDT= 5.00] out<- 06:000007      7.92      .167 No_date     2:20    28.83  n/a
     {MxStoUsed=.1243E+00}
002:0083---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     CALIB NASHYD        01:000150     31.76      .700 No_date     2:30    19.10 .266
     [CN= 67.0: N= 3.00]
     [Tp= 1.03:DT= 5.00]
002:0084---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
  *  CALIB STANDHYD      02:000151      2.52      .237 No_date     1:10    28.39 .395
     [XIMP=.21:TIMP=.21]
     [LOSS= 2 :CN= 65.0]
     [Pervious      area: IAper=13.68:SLPP=2.00:LGP=  40.:MNP=.350:SCP=    .0]
     [Impervious    area: IAimp= 2.00:SLPI=1.00:LGI= 130.:MNI=.015:SCI=    .0]
002:0085---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ADD HYD             01:000150     31.76      .700 No_date     2:30    19.10  n/a
                       + 02:000151      2.52      .237 No_date     1:10    28.39  n/a
     [DT= 5.00]  SUM=    03:001500     34.28      .739 No_date     2:30    19.79  n/a
002:0086---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
  *  CALIB STANDHYD      04:000152      1.55      .153 No_date     1:10    28.39 .395
     [XIMP=.21:TIMP=.21]
     [LOSS= 2 :CN= 65.0]
     [Pervious      area: IAper=13.68:SLPP=2.00:LGP=  40.:MNP=.350:SCP=    .0]
     [Impervious    area: IAimp= 2.00:SLPI=1.00:LGI= 102.:MNI=.015:SCI=    .0]
002:0087---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ADD HYD             03:001500     34.28      .739 No_date     2:30    19.79  n/a
                       + 04:000152      1.55      .153 No_date     1:10    28.39  n/a
     [DT= 5.00]  SUM=    10:001501     35.83      .763 No_date     2:25    20.16  n/a
002:0088---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
  *  CALIB STANDHYD      01:000153      7.90      .858 No_date     1:10    32.47 .452
     [XIMP=.25:TIMP=.25]
     [LOSS= 2 :CN= 68.0]
     [Pervious      area: IAper=11.95:SLPP=2.00:LGP=  40.:MNP=.350:SCP=    .0]
     [Impervious    area: IAimp= 2.00:SLPI=1.00:LGI= 229.:MNI=.015:SCI=    .0]
```

```
002:0089---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
  *  CALIB STANDHYD      02:000154      1.56      .168 No_date     1:10   32.76 .456
     [XIMP=.21:TIMP=.21]
     [LOSS= 2 :CN= 71.0]
     [Pervious      area: IAper=10.37:SLPP=2.00:LGP=  40.:MNP=.350:SCP=    .0]
     [Impervious    area: IAimp= 2.00:SLPI=1.00:LGI= 102.:MNI=.015:SCI=    .0]
002:0090---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
  *  CALIB STANDHYD      03:000155      1.56      .168 No_date     1:10   32.76 .456
     [XIMP=.21:TIMP=.21]
     [LOSS= 2 :CN= 71.0]
     [Pervious      area: IAper=10.37:SLPP=2.00:LGP=  40.:MNP=.350:SCP=    .0]
     [Impervious    area: IAimp= 2.00:SLPI=1.00:LGI= 102.:MNI=.015:SCI=    .0]
002:0091---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
  *  CALIB STANDHYD      04:000156      1.40      .374 No_date     1:10   52.02 .724
     [XIMP=.62:TIMP=.62]
     [LOSS= 2 :CN= 71.0]
     [Pervious      area: IAper=10.37:SLPP=2.00:LGP=  40.:MNP=.350:SCP=    .0]
     [Impervious    area: IAimp= 2.00:SLPI=1.00:LGI=  97.:MNI=.015:SCI=    .0]
002:0092---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
  *  CALIB STANDHYD      05:000157      1.40      .374 No_date     1:10   52.02 .724
     [XIMP=.62:TIMP=.62]
     [LOSS= 2 :CN= 71.0]
     [Pervious      area: IAper=10.37:SLPP=2.00:LGP=  40.:MNP=.350:SCP=    .0]
     [Impervious    area: IAimp= 2.00:SLPI=1.00:LGI=  97.:MNI=.015:SCI=    .0]
002:0093---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     CALIB NASHYD        06:000158      2.27      .191 No_date     1:25   27.15 .378
     [CN= 75.0: N= 3.00]
     [Tp=  .23:DT= 5.00]
002:0094---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ADD HYD             01:000153      7.90      .858 No_date     1:10   32.47  n/a
                       + 02:000154      1.56      .168 No_date     1:10   32.76  n/a
                       + 03:000155      1.56      .168 No_date     1:10   32.76  n/a
                       + 04:000156      1.40      .374 No_date     1:10   52.02  n/a
                       + 05:000157      1.40      .374 No_date     1:10   52.02  n/a
                       + 06:000158      2.27      .191 No_date     1:25   27.15  n/a
     [DT= 5.00]  SUM=  07:001501     16.09     2.038 No_date     1:10   35.18  n/a
002:0095---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
  *  CALIB STANDHYD      01:000159      1.23      .166 No_date     1:10   36.04 .502
     [XIMP=.28:TIMP=.28]
     [LOSS= 2 :CN= 71.0]
     [Pervious      area: IAper=10.37:SLPP=2.00:LGP=  40.:MNP=.350:SCP=    .0]
     [Impervious    area: IAimp= 2.00:SLPI=1.00:LGI=  91.:MNI=.015:SCI=    .0]
002:0096---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
  *  CALIB STANDHYD      02:000158      2.15      .203 No_date     1:10   27.87 .388
     [XIMP=.20:TIMP=.20]
     [LOSS= 2 :CN= 65.0]
     [Pervious      area: IAper=13.68:SLPP=2.00:LGP=  40.:MNP=.350:SCP=    .0]
     [Impervious    area: IAimp= 2.00:SLPI=1.00:LGI= 120.:MNI=.015:SCI=    .0]
002:0097---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ADD HYD             01:000159      1.23      .166 No_date     1:10   36.04  n/a
                       + 02:000158      2.15      .203 No_date     1:10   27.87  n/a
                       + 07:001501     16.09     2.038 No_date     1:10   35.18  n/a
     [DT= 5.00]  SUM=  03:001501     19.47     2.407 No_date     1:10   34.43  n/a
002:0098---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
  *  CALIB STANDHYD      04:000162       .99      .122 No_date     1:10   31.54 .439
     [XIMP=.27:TIMP=.27]
     [LOSS= 2 :CN= 65.0]
     [Pervious      area: IAper=13.68:SLPP=2.00:LGP=  40.:MNP=.350:SCP=    .0]
     [Impervious    area: IAimp= 2.00:SLPI=1.00:LGI=  81.:MNI=.015:SCI=    .0]
002:0099---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ADD HYD             03:001501     19.47     2.407 No_date     1:10   34.43  n/a
                       + 04:000162       .99      .122 No_date     1:10   31.54  n/a
     [DT= 5.00]  SUM=  05:001502     20.46     2.529 No_date     1:10   34.29  n/a
002:0100---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ROUTE RESERVOIR -> 05:001502     20.46     2.529 No_date     1:10   34.29  n/a
     [RDT= 5.00] out<- 06:000007     20.46     1.000 No_date     1:40   34.29  n/a
     {MxStoUsed=.3798E+00}
002:0101---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     CALIB NASHYD        01:000160     25.82     1.434 No_date     1:40   26.04 .362
     [CN= 74.0: N= 3.00]
     [Tp=  .43:DT= 5.00]
002:0102---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     CALIB NASHYD        01:000170     13.80      .742 No_date     1:35   22.89 .318
     [CN= 71.0: N= 3.00]
     [Tp=  .36:DT= 5.00]
002:0103---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
  *  CALIB STANDHYD      02:000171       .68      .068 No_date     1:10   28.39 .395
     [XIMP=.21:TIMP=.21]
     [LOSS= 2 :CN= 65.0]
     [Pervious      area: IAper=13.68:SLPP=2.00:LGP=  40.:MNP=.350:SCP=    .0]
     [Impervious    area: IAimp= 2.00:SLPI=1.00:LGI=  67.:MNI=.015:SCI=    .0]
002:0104---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
  *  CALIB STANDHYD      03:000172       .72      .072 No_date     1:10   28.39 .395
     [XIMP=.21:TIMP=.21]
     [LOSS= 2 :CN= 65.0]
```

```
     [Pervious      area: IAper=13.68:SLPP=2.00:LGP=  40.:MNP=.350:SCP=   .0]
     [Impervious    area: IAimp= 2.00:SLPI=1.00:LGI=  69.:MNI=.015:SCI=   .0]
002:0105--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
  *  CALIB STANDHYD      04:000173      1.13      .130 No_date     1:10   30.49 .424
     [XIMP=.25:TIMP=.25]
     [LOSS= 2 :CN= 65.0]
     [Pervious      area: IAper=13.68:SLPP=2.00:LGP=  40.:MNP=.350:SCP=   .0]
     [Impervious    area: IAimp= 2.00:SLPI=1.00:LGI=  87.:MNI=.015:SCI=   .0]
002:0106--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
  *  CALIB STANDHYD      05:000174      1.20      .138 No_date     1:10   30.49 .424
     [XIMP=.25:TIMP=.25]
     [LOSS= 2 :CN= 65.0]
     [Pervious      area: IAper=13.68:SLPP=2.00:LGP=  40.:MNP=.350:SCP=   .0]
     [Impervious    area: IAimp= 2.00:SLPI=1.00:LGI=  89.:MNI=.015:SCI=   .0]
002:0107--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ADD HYD            01:000170     13.80      .742 No_date     1:35   22.89  n/a
                      + 02:000171       .68      .068 No_date     1:10   28.39  n/a
                      + 03:000172       .72      .072 No_date     1:10   28.39  n/a
                      + 04:000173      1.13      .130 No_date     1:10   30.49  n/a
                      + 05:000174      1.20      .138 No_date     1:10   30.49  n/a
     [DT= 5.0]  SUM=  06:001700     17.53      .920 No_date     1:30   24.34  n/a
002:0108--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
  *  CALIB STANDHYD      07:000175       .68      .068 No_date     1:10   28.39 .395
     [XIMP=.21:TIMP=.21]
     [LOSS= 2 :CN= 65.0]
     [Pervious      area: IAper=13.68:SLPP=2.00:LGP=  40.:MNP=.350:SCP=   .0]
     [Impervious    area: IAimp= 2.00:SLPI=1.00:LGI=  67.:MNI=.015:SCI=   .0]
002:0109--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
  *  CALIB STANDHYD      08:000176       .72      .072 No_date     1:10   28.39 .395
     [XIMP=.21:TIMP=.21]
     [LOSS= 2 :CN= 65.0]
     [Pervious      area: IAper=13.68:SLPP=2.00:LGP=  40.:MNP=.350:SCP=   .0]
     [Impervious    area: IAimp= 2.00:SLPI=1.00:LGI=  69.:MNI=.015:SCI=   .0]
002:0110--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ADD HYD            06:001700     17.53      .920 No_date     1:30   24.34  n/a
                      + 07:000175       .68      .068 No_date     1:10   28.39  n/a
                      + 08:000176       .72      .072 No_date     1:10   28.39  n/a
     [DT= 5.0]  SUM=  09:001503     18.93      .995 No_date     1:30   24.64  n/a
002:0111--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
  *  CALIB STANDHYD      01:000177       .85      .092 No_date     1:10   32.76 .456
     [XIMP=.21:TIMP=.21]
     [LOSS= 2 :CN= 71.0]
     [Pervious      area: IAper=10.37:SLPP=2.00:LGP=  40.:MNP=.350:SCP=   .0]
     [Impervious    area: IAimp= 2.00:SLPI=1.00:LGI=  75.:MNI=.015:SCI=   .0]
002:0112--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
  *  CALIB STANDHYD      02:000181       .57      .062 No_date     1:10   32.76 .456
     [XIMP=.21:TIMP=.21]
     [LOSS= 2 :CN= 71.0]
     [Pervious      area: IAper=10.37:SLPP=2.00:LGP=  40.:MNP=.350:SCP=   .0]
     [Impervious    area: IAimp= 2.00:SLPI=1.00:LGI=  62.:MNI=.015:SCI=   .0]
002:0113--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ADD HYD            01:000177       .85      .092 No_date     1:10   32.76  n/a
                      + 02:000181       .57      .062 No_date     1:10   32.76  n/a
     [DT= 5.0]  SUM=  03:001800      1.42      .155 No_date     1:10   32.76  n/a
002:0114--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
  *  CALIB STANDHYD      04:000178      1.43      .177 No_date     1:10   34.64 .482
     [XIMP=.25:TIMP=.25]
     [LOSS= 2 :CN= 71.0]
     [Pervious      area: IAper=10.37:SLPP=2.00:LGP=  40.:MNP=.350:SCP=   .0]
     [Impervious    area: IAimp= 2.00:SLPI=1.00:LGI=  98.:MNI=.015:SCI=   .0]
002:0115--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
  *  CALIB STANDHYD      05:000182       .96      .119 No_date     1:10   34.64 .482
     [XIMP=.25:TIMP=.25]
     [LOSS= 2 :CN= 71.0]
     [Pervious      area: IAper=10.37:SLPP=2.00:LGP=  40.:MNP=.350:SCP=   .0]
     [Impervious    area: IAimp= 2.00:SLPI=1.00:LGI=  80.:MNI=.015:SCI=   .0]
002:0116--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ADD HYD            03:001800      1.42      .155 No_date     1:10   32.76  n/a
                      + 04:000178      1.43      .177 No_date     1:10   34.64  n/a
                      + 05:000182       .96      .119 No_date     1:10   34.64  n/a
     [DT= 5.0]  SUM=  06:001801      3.81      .450 No_date     1:10   33.93  n/a
002:0117--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
  *  CALIB STANDHYD      07:000179       .85      .092 No_date     1:10   32.76 .456
     [XIMP=.21:TIMP=.21]
     [LOSS= 2 :CN= 71.0]
     [Pervious      area: IAper=10.37:SLPP=2.00:LGP=  40.:MNP=.350:SCP=   .0]
     [Impervious    area: IAimp= 2.00:SLPI=1.00:LGI=  75.:MNI=.015:SCI=   .0]
002:0118--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
  *  CALIB STANDHYD      08:000183       .57      .062 No_date     1:10   32.76 .456
     [XIMP=.21:TIMP=.21]
     [LOSS= 2 :CN= 71.0]
     [Pervious      area: IAper=10.37:SLPP=2.00:LGP=  40.:MNP=.350:SCP=   .0]
     [Impervious    area: IAimp= 2.00:SLPI=1.00:LGI=  62.:MNI=.015:SCI=   .0]
002:0119--------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ADD HYD            06:001801      3.81      .450 No_date     1:10   33.93  n/a
```

```
                      +  07:000179       .85      .092 No_date     1:10    32.76  n/a
                      +  08:000183       .57      .062 No_date     1:10    32.76  n/a
     [DT= 5.00]  SUM=  09:001801      5.23      .605 No_date     1:10    33.61  n/a
002:0120---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ROUTE RESERVOIR -> 09:001801      5.23      .605 No_date     1:10    33.61  n/a
      [RDT= 5.00] out<- 10:000010      5.23      .321 No_date     1:35    33.61  n/a
     (MxStoUsed=.8962E-01)
002:0121---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     CALIB NASHYD      01:000180    134.00     4.349 No_date     2:30    28.30 .394
      [CN= 76.0: N= 3.00]
      [Tp= 1.06:DT= 5.00]
002:0122---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
  *  CALIB STANDHYD    02:000184       .97      .105 No_date     1:10    32.76 .456
      [XIMP=.21:TIMP=.21]
      [LOSS= 2 :CN= 71.0]
      [Pervious      area: IAper=10.37:SLPP=2.00:LGP=  40.:MNP=.350:SCP=    .0]
      [Impervious    area: IAimp= 2.00:SLPI=1.00:LGI=  80.:MNI=.015:SCI=    .0]
002:0123---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
  *  CALIB STANDHYD    03:000185       .96      .104 No_date     1:10    32.76 .456
      [XIMP=.21:TIMP=.21]
      [LOSS= 2 :CN= 71.0]
      [Pervious      area: IAper=10.37:SLPP=2.00:LGP=  40.:MNP=.350:SCP=    .0]
      [Impervious    area: IAimp= 2.00:SLPI=1.00:LGI=  80.:MNI=.015:SCI=    .0]
002:0124---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
  *  CALIB STANDHYD    04:000186      3.23      .392 No_date     1:10    34.64 .482
      [XIMP=.25:TIMP=.25]
      [LOSS= 2 :CN= 71.0]
      [Pervious      area: IAper=10.37:SLPP=2.00:LGP=  40.:MNP=.350:SCP=    .0]
      [Impervious    area: IAimp= 2.00:SLPI=1.00:LGI= 147.:MNI=.015:SCI=    .0]
002:0125---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ADD HYD           01:000180    134.00     4.349 No_date     2:30    28.30  n/a
                      +  02:000184       .97      .105 No_date     1:10    32.76  n/a
                      +  03:000185       .96      .104 No_date     1:10    32.76  n/a
                      +  04:000186      3.23      .392 No_date     1:10    34.64  n/a
     [DT= 5.00]  SUM=  05:001802    139.16     4.435 No_date     2:30    28.51  n/a
002:0126---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
  *  CALIB STANDHYD    06:000187       .96      .104 No_date     1:10    32.76 .456
      [XIMP=.21:TIMP=.21]
      [LOSS= 2 :CN= 71.0]
      [Pervious      area: IAper=10.37:SLPP=2.00:LGP=  40.:MNP=.350:SCP=    .0]
      [Impervious    area: IAimp= 2.00:SLPI=1.00:LGI=  80.:MNI=.015:SCI=    .0]
002:0127---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
  *  CALIB STANDHYD    07:000188       .97      .105 No_date     1:10    32.76 .456
      [XIMP=.21:TIMP=.21]
      [LOSS= 2 :CN= 71.0]
      [Pervious      area: IAper=10.37:SLPP=2.00:LGP=  40.:MNP=.350:SCP=    .0]
      [Impervious    area: IAimp= 2.00:SLPI=1.00:LGI=  80.:MNI=.015:SCI=    .0]
002:0128---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ADD HYD           05:001802    139.16     4.435 No_date     2:30    28.51  n/a
                      +  06:000187       .96      .104 No_date     1:10    32.76  n/a
                      +  07:000188       .97      .105 No_date     1:10    32.76  n/a
     [DT= 5.00]  SUM=  10:001804    141.09     4.467 No_date     2:30    28.57  n/a
002:0129---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     CALIB NASHYD      10:000190    771.00    13.912 No_date     3:45    28.30 .394
      [CN= 76.0: N= 3.00]
      [Tp= 2.23:DT= 5.00]
002:0130---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     CALIB NASHYD      01:000191      6.30      .556 No_date     1:25    28.30 .394
      [CN= 76.0: N= 3.00]
      [Tp=  .23:DT= 5.00]
002:0131---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
  *  CALIB STANDHYD    02:000192      1.62      .175 No_date     1:10    32.76 .456
      [XIMP=.21:TIMP=.21]
      [LOSS= 2 :CN= 71.0]
      [Pervious      area: IAper=10.37:SLPP=2.00:LGP=  40.:MNP=.350:SCP=    .0]
      [Impervious    area: IAimp= 2.00:SLPI=1.00:LGI= 104.:MNI=.015:SCI=    .0]
002:0132---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ADD HYD           01:000191      6.30      .556 No_date     1:25    28.30  n/a
                      +  02:000192      1.62      .175 No_date     1:10    32.76  n/a
     [DT= 5.00]  SUM=  03:001900      7.92      .677 No_date     1:20    29.21  n/a
002:0133---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
  *  CALIB STANDHYD    04:000192      3.33      .404 No_date     1:10    34.64 .482
      [XIMP=.25:TIMP=.25]
      [LOSS= 2 :CN= 71.0]
      [Pervious      area: IAper=10.37:SLPP=2.00:LGP=  40.:MNP=.350:SCP=    .0]
      [Impervious    area: IAimp= 2.00:SLPI=1.00:LGI= 149.:MNI=.015:SCI=    .0]
002:0134---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ADD HYD           03:001900      7.92      .677 No_date     1:20    29.21  n/a
                      +  04:000192      3.33      .404 No_date     1:10    34.64  n/a
     [DT= 5.00]  SUM=  05:001901     11.25      .979 No_date     1:20    30.82  n/a
002:0135---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
  *  CALIB STANDHYD    06:000194      1.62      .175 No_date     1:10    32.76 .456
      [XIMP=.21:TIMP=.21]
      [LOSS= 2 :CN= 71.0]
      [Pervious      area: IAper=10.37:SLPP=2.00:LGP=  40.:MNP=.350:SCP=    .0]
```

```
     [Impervious    area: IAimp= 2.00:SLPI=1.00:LGI= 104.:MNI=.015:SCI=    .03]
002:0136---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD              05:001901     11.25      .979 No_date     1:20   30.82  n/a
                       + 06:000194      1.62      .175 No_date     1:10   32.76  n/a
     [DT= 5.00]  SUM=  07:001902     12.87     1.118 No_date     1:20   31.06  n/a
002:0137---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ROUTE RESERVOIR -> 07:001902     12.87     1.118 No_date     1:20   31.06  n/a
     [RDT= 5.00] out<- 08:000012     12.87      .210 No_date     2:30   31.06  n/a
    {MxStoUsed=.2728E+00}
002:0138---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
  * CALIB STANDHYD     01:000195      1.65      .178 No_date     1:10   32.76 .456
     [XIMP=.21:TIMP=.21]
     [LOSS= 2 :CN= 71.0]
     [Pervious      area: IAper=10.37:SLPP=2.00:LGP=  40.:MNP=.350:SCP=    .03]
     [Impervious    area: IAimp= 2.00:SLPI=1.00:LGI= 105.:MNI=.015:SCI=    .03]
002:0139---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
  * CALIB STANDHYD     02:000196      2.76      .336 No_date     1:10   34.64 .482
     [XIMP=.25:TIMP=.25]
     [LOSS= 2 :CN= 71.0]
     [Pervious      area: IAper=10.37:SLPP=2.00:LGP=  40.:MNP=.350:SCP=    .03]
     [Impervious    area: IAimp= 2.00:SLPI=1.00:LGI= 136.:MNI=.015:SCI=    .03]
002:0140---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD              01:000195      1.65      .178 No_date     1:10   32.76  n/a
                       + 02:000196      2.76      .336 No_date     1:10   34.64  n/a
     [DT= 5.00]  SUM=  03:001903      4.41      .514 No_date     1:10   33.93  n/a
002:0141---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
  * CALIB STANDHYD     04:000197      1.65      .178 No_date     1:10   32.76 .456
     [XIMP=.21:TIMP=.21]
     [LOSS= 2 :CN= 71.0]
     [Pervious      area: IAper=10.37:SLPP=2.00:LGP=  40.:MNP=.350:SCP=    .03]
     [Impervious    area: IAimp= 2.00:SLPI=1.00:LGI= 105.:MNI=.015:SCI=    .03]
002:0142---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD              03:001903      4.41      .514 No_date     1:10   33.93  n/a
                       + 04:000197      1.65      .178 No_date     1:10   32.76  n/a
     [DT= 5.00]  SUM=  05:001904      6.06      .692 No_date     1:10   33.61  n/a
002:0143---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ROUTE RESERVOIR -> 05:001904      6.06      .692 No_date     1:10   33.61  n/a
     [RDT= 5.00] out<- 06:000010      6.06      .099 No_date     2:30   33.61  n/a
    {MxStoUsed=.1414E+00}
002:0144---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD              06:000010      6.06      .099 No_date     2:30   33.61  n/a
                       + 08:000012     12.87      .210 No_date     2:30   31.06  n/a
                       + 10:000190    771.00    13.912 No_date     3:45   28.30  n/a
     [DT= 5.00]  SUM=  09:001905    789.93    14.183 No_date     3:45   28.39  n/a
002:0145---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
  * CALIB STANDHYD     01:000200      1.13      .175 No_date     1:10   38.39 .534
     [XIMP=.33:TIMP=.33]
     [LOSS= 2 :CN= 71.0]
     [Pervious      area: IAper=10.37:SLPP=2.00:LGP=  40.:MNP=.350:SCP=    .03]
     [Impervious    area: IAimp= 2.00:SLPI=1.00:LGI=  87.:MNI=.015:SCI=    .03]
002:0146---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    CALIB NASHYD         02:000201      2.40      .189 No_date     1:25   26.04 .362
     [CN= 74.0: N= 3.00]
     [Tp=  .24:DT= 5.00]
002:0147---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD              01:000200      1.13      .175 No_date     1:10   38.39  n/a
                       + 02:000201      2.40      .189 No_date     1:25   26.04  n/a
     [DT= 5.00]  SUM=  03:002000      3.53      .289 No_date     1:20   29.99  n/a
002:0148---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
  * CALIB STANDHYD     04:000202      1.20      .139 No_date     1:10   33.70 .469
     [XIMP=.23:TIMP=.23]
     [LOSS= 2 :CN= 71.0]
     [Pervious      area: IAper=10.37:SLPP=2.00:LGP=  40.:MNP=.350:SCP=    .03]
     [Impervious    area: IAimp= 2.00:SLPI=1.00:LGI=  89.:MNI=.015:SCI=    .03]
002:0149---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
  * CALIB STANDHYD     05:000203      2.40      .257 No_date     1:10   32.76 .456
     [XIMP=.21:TIMP=.21]
     [LOSS= 2 :CN= 71.0]
     [Pervious      area: IAper=10.37:SLPP=2.00:LGP=  40.:MNP=.350:SCP=    .03]
     [Impervious    area: IAimp= 2.00:SLPI=1.00:LGI= 126.:MNI=.015:SCI=    .03]
002:0150---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
  * CALIB STANDHYD     06:000204      4.11      .496 No_date     1:10   34.64 .482
     [XIMP=.25:TIMP=.25]
     [LOSS= 2 :CN= 71.0]
     [Pervious      area: IAper=10.37:SLPP=2.00:LGP=  40.:MNP=.350:SCP=    .03]
     [Impervious    area: IAimp= 2.00:SLPI=1.00:LGI= 166.:MNI=.015:SCI=    .03]
002:0151---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
    ADD HYD              03:002000      3.53      .289 No_date     1:20   29.99  n/a
                       + 04:000202      1.20      .139 No_date     1:10   33.70  n/a
                       + 05:000203      2.40      .257 No_date     1:10   32.76  n/a
                       + 06:000204      4.11      .496 No_date     1:10   34.64  n/a
     [DT= 5.00]  SUM=  07:002001     11.24     1.155 No_date     1:10   32.68  n/a
002:0152---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
  * CALIB STANDHYD     08:000205      2.40      .257 No_date     1:10   32.76 .456
     [XIMP=.21:TIMP=.21]
```

```
     [LOSS= 2 :CN= 71.0]
     [Pervious      area: IAper=10.37:SLPP=2.00:LGP=  40.:MNP=.350:SCP=   .0]
     [Impervious    area: IAimp= 2.00:SLPI=1.00:LGI= 126.:MNI=.015:SCI=   .0]
002:0153---------------ID:NHYD-------AREA----@PEAK-TpeakDate_hh:mm-----R.V.-R.C.-
  *  CALIB STANDHYD      01:000207      1.10      .166 No_date     1:10   37.92 .528
     [XIMP=.32:TIMP=.32]
     [LOSS= 2 :CN= 71.0]
     [Pervious      area: IAper=10.37:SLPP=2.00:LGP=  40.:MNP=.350:SCP=   .0]
     [Impervious    area: IAimp= 2.00:SLPI=1.00:LGI=  86.:MNI=.015:SCI=   .0]
002:0154---------------ID:NHYD-------AREA----@PEAK-TpeakDate_hh:mm-----R.V.-R.C.-
     CALIB NASHYD        02:000206      2.40      .189 No_date     1:25   26.04 .362
     [CN= 74.0: N= 3.00]
     [Tp=  .24:DT= 5.00]
002:0155---------------ID:NHYD-------AREA----@PEAK-TpeakDate_hh:mm-----R.V.-R.C.-
     ADD HYD             01:000207      1.10      .166 No_date     1:10   37.92  n/a
                       + 02:000206      2.40      .189 No_date     1:25   26.04  n/a
     [DT= 5.00]  SUM=    03:002002      3.50      .285 No_date     1:20   29.77  n/a
002:0156---------------ID:NHYD-------AREA----@PEAK-TpeakDate_hh:mm-----R.V.-R.C.-
  *  CALIB STANDHYD      04:000208      1.20      .139 No_date     1:10   33.70 .469
     [XIMP=.23:TIMP=.23]
     [LOSS= 2 :CN= 71.0]
     [Pervious      area: IAper=10.37:SLPP=2.00:LGP=  40.:MNP=.350:SCP=   .0]
     [Impervious    area: IAimp= 2.00:SLPI=1.00:LGI=  89.:MNI=.015:SCI=   .0]
002:0157---------------ID:NHYD-------AREA----@PEAK-TpeakDate_hh:mm-----R.V.-R.C.-
     ADD HYD             03:002002      3.50      .285 No_date     1:20   29.77  n/a
                       + 04:000208      1.20      .139 No_date     1:10   33.70  n/a
                       + 07:002001     11.24     1.155 No_date     1:10   32.68  n/a
                       + 08:000205      2.40      .257 No_date     1:10   32.76  n/a
     [DT= 5.00]  SUM=    05:002002     18.34     1.805 No_date     1:10   32.20  n/a
002:0158---------------ID:NHYD-------AREA----@PEAK-TpeakDate_hh:mm-----R.V.-R.C.-
     ROUTE RESERVOIR -> 05:002002     18.34     1.805 No_date     1:10   32.20  n/a
     [RDT= 5.00] out<-  06:000010     18.34      .310 No_date     2:30   32.20  n/a
     {MxStoUsed=.4071E+00}
002:0159---------------ID:NHYD-------AREA----@PEAK-TpeakDate_hh:mm-----R.V.-R.C.-
     CALIB NASHYD        01:000250    198.50     2.761 No_date     4:30   28.30 .394
     [CN= 76.0: N= 3.00]
     [Tp= 2.97:DT= 5.00]
002:0160---------------ID:NHYD-------AREA----@PEAK-TpeakDate_hh:mm-----R.V.-R.C.-
  *  CALIB STANDHYD      02:000210       .36      .039 No_date     1:10   32.76 .456
     [XIMP=.21:TIMP=.21]
     [LOSS= 2 :CN= 71.0]
     [Pervious      area: IAper=10.37:SLPP=2.00:LGP=  40.:MNP=.350:SCP=   .0]
     [Impervious    area: IAimp= 2.00:SLPI=1.00:LGI=  49.:MNI=.015:SCI=   .0]
002:0161---------------ID:NHYD-------AREA----@PEAK-TpeakDate_hh:mm-----R.V.-R.C.-
  *  CALIB STANDHYD      03:000211       .60      .075 No_date     1:10   34.64 .482
     [XIMP=.25:TIMP=.25]
     [LOSS= 2 :CN= 71.0]
     [Pervious      area: IAper=10.37:SLPP=2.00:LGP=  40.:MNP=.350:SCP=   .0]
     [Impervious    area: IAimp= 2.00:SLPI=1.00:LGI=  63.:MNI=.015:SCI=   .0]
002:0162---------------ID:NHYD-------AREA----@PEAK-TpeakDate_hh:mm-----R.V.-R.C.-
  *  CALIB STANDHYD      04:000213      1.14      .123 No_date     1:10   32.76 .456
     [XIMP=.21:TIMP=.21]
     [LOSS= 2 :CN= 71.0]
     [Pervious      area: IAper=10.37:SLPP=2.00:LGP=  40.:MNP=.350:SCP=   .0]
     [Impervious    area: IAimp= 2.00:SLPI=1.00:LGI=  87.:MNI=.015:SCI=   .0]
002:0163---------------ID:NHYD-------AREA----@PEAK-TpeakDate_hh:mm-----R.V.-R.C.-
  *  CALIB STANDHYD      05:000214      1.89      .232 No_date     1:10   34.64 .482
     [XIMP=.25:TIMP=.25]
     [LOSS= 2 :CN= 71.0]
     [Pervious      area: IAper=10.37:SLPP=2.00:LGP=  40.:MNP=.350:SCP=   .0]
     [Impervious    area: IAimp= 2.00:SLPI=1.00:LGI= 112.:MNI=.015:SCI=   .0]
002:0164---------------ID:NHYD-------AREA----@PEAK-TpeakDate_hh:mm-----R.V.-R.C.-
     ADD HYD             01:000250    198.50     2.761 No_date     4:30   28.30  n/a
                       + 02:000210       .36      .039 No_date     1:10   32.76  n/a
                       + 03:000211       .60      .075 No_date     1:10   34.64  n/a
                       + 04:000213      1.14      .123 No_date     1:10   32.76  n/a
                       + 05:000214      1.89      .232 No_date     1:10   34.64  n/a
     [DT= 5.00]  SUM=    06:002500    202.49     2.761 No_date     4:30   28.41  n/a
002:0165---------------ID:NHYD-------AREA----@PEAK-TpeakDate_hh:mm-----R.V.-R.C.-
  *  CALIB STANDHYD      07:000212       .36      .039 No_date     1:10   32.76 .456
     [XIMP=.21:TIMP=.21]
     [LOSS= 2 :CN= 71.0]
     [Pervious      area: IAper=10.37:SLPP=2.00:LGP=  40.:MNP=.350:SCP=   .0]
     [Impervious    area: IAimp= 2.00:SLPI=1.00:LGI=  49.:MNI=.015:SCI=   .0]
002:0166---------------ID:NHYD-------AREA----@PEAK-TpeakDate_hh:mm-----R.V.-R.C.-
  *  CALIB STANDHYD      08:000215      1.14      .123 No_date     1:10   32.76 .456
     [XIMP=.21:TIMP=.21]
     [LOSS= 2 :CN= 71.0]
     [Pervious      area: IAper=10.37:SLPP=2.00:LGP=  40.:MNP=.350:SCP=   .0]
     [Impervious    area: IAimp= 2.00:SLPI=1.00:LGI=  87.:MNI=.015:SCI=   .0]
002:0167---------------ID:NHYD-------AREA----@PEAK-TpeakDate_hh:mm-----R.V.-R.C.-
     ADD HYD             06:002500    202.49     2.761 No_date     4:30   28.41  n/a
                       + 07:000212       .36      .039 No_date     1:10   32.76  n/a
                       + 08:000215      1.14      .123 No_date     1:10   32.76  n/a
     [DT= 5.00]  SUM=    09:002501    203.99     2.761 No_date     4:30   28.44  n/a
```

```
 002:0168---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
  *  CALIB STANDHYD      01:000260      8.60     1.504 No_date     1:10    43.81 .610
      EXIMP=.39:TIMP=.39]
      ELOSS= 2 :CN= 75.0]
      EPervious      area: IAper= 8.47:SLPP=2.00:LGP=  40.:MNP=.350:SCP=    .0]
      EImpervious    area: IAimp= 2.00:SLPI=1.00:LGI= 239.:MNI=.015:SCI=    .0]
 002:0169---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
  *  CALIB STANDHYD      02:000300      2.17      .341 No_date     1:10    38.86 .541
      EXIMP=.34:TIMP=.34]
      ELOSS= 2 :CN= 71.0]
      EPervious      area: IAper=10.37:SLPP=2.00:LGP=  40.:MNP=.350:SCP=    .0]
      EImpervious    area: IAimp= 2.00:SLPI=1.00:LGI= 120.:MNI=.015:SCI=    .0]
 002:0170---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ADD HYD             01:000260      8.60     1.504 No_date     1:10    43.81  n/a
                       + 02:000300      2.17      .341 No_date     1:10    38.86  n/a
      EDT= 5.00]  SUM=   03:002600     10.77     1.845 No_date     1:10    42.81  n/a
 002:0171---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
  *  CALIB STANDHYD      04:000301      3.86      .510 No_date     1:10    36.04 .502
      EXIMP=.28:TIMP=.28]
      ELOSS= 2 :CN= 71.0]
      EPervious      area: IAper=10.37:SLPP=2.00:LGP=  40.:MNP=.350:SCP=    .0]
      EImpervious    area: IAimp= 2.00:SLPI=1.00:LGI= 160.:MNI=.015:SCI=    .0]
 002:0172---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ADD HYD             03:002600     10.77     1.845 No_date     1:10    42.81  n/a
                       + 04:000301      3.86      .510 No_date     1:10    36.04  n/a
      EDT= 5.00]  SUM=   05:002601     14.63     2.355 No_date     1:10    41.03  n/a
 002:0173---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     CALIB NASHYD        06:000302      1.30      .041 No_date     2:15    22.89 .318
      ECN= 71.0: N= 3.00]
      ETp=  .82:DT= 5.00]
 002:0174---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     CALIB NASHYD        07:000303      1.00      .087 No_date     1:20    24.96 .347
      ECN= 73.0: N= 3.00]
      ETp=  .18:DT= 5.00]
 002:0175---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ADD HYD             05:002601     14.63     2.355 No_date     1:10    41.03  n/a
                       + 07:000303      1.00      .087 No_date     1:20    24.96  n/a
      EDT= 5.00]  SUM=   08:002601     15.63     2.410 No_date     1:10    40.00  n/a
 002:0176---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ROUTE RESERVOIR -> 08:002601     15.63     2.410 No_date     1:10    40.00  n/a
      ERDT= 5.00] out<- 09:000015     15.63     1.066 No_date     1:35    40.00  n/a
     {MxStoUsed=.3283E+00}
 002:0177---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     CALIB NASHYD        07:000304     93.55     1.871 No_date     3:30    28.30 .394
      ECN= 76.0: N= 3.00]
      ETp= 1.98:DT= 5.00]
 002:0178---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ADD HYD             06:000302      1.30      .041 No_date     2:15    22.89  n/a
                       + 07:000304     93.55     1.871 No_date     3:30    28.30  n/a
      EDT= 5.00]  SUM=   08:002602     94.85     1.890 No_date     3:30    28.23  n/a
 002:0179---------------ID:NHYD-------AREA----QPEAK-TpeakDate_hh:mm----R.V.-R.C.-
     ADD HYD             08:002602     94.85     1.890 No_date     3:30    28.23  n/a
                       + 09:000015     15.63     1.066 No_date     1:35    40.00  n/a
      EDT= 5.00]  SUM=   10:002602    110.48     2.125 No_date     3:25    29.89  n/a
 002:0002---------------------------------------------------------------------------
     FINISH
-------------------------------------------------------------------------------
*******************************************************************************
     WARNINGS / ERRORS / NOTES
     -------------------------
 001:0004 CALIB STANDHYD
     *** WARNING: Storage Coefficient is smaller than DT!
                  Use a smaller DT or a larger area.
 001:0005 CALIB STANDHYD
     *** WARNING: Storage Coefficient is smaller than DT!
                  Use a smaller DT or a larger area.
 001:0009 CALIB STANDHYD
     *** WARNING: Storage Coefficient is smaller than DT!
                  Use a smaller DT or a larger area.
 001:0010 CALIB NASHYD
     *** WARNING: Time step is too large for value of TP.
                  R.V. may be ok.  Peak flow could be off.
 001:0011 CALIB STANDHYD
     *** WARNING: Storage Coefficient is smaller than DT!
                  Use a smaller DT or a larger area.
 001:0013 CALIB STANDHYD
     *** WARNING: Storage Coefficient is smaller than DT!
                  Use a smaller DT or a larger area.
 001:0017 CALIB STANDHYD
     *** WARNING: Storage Coefficient is smaller than DT!
                  Use a smaller DT or a larger area.
 001:0018 CALIB STANDHYD
     *** WARNING: Storage Coefficient is smaller than DT!
                  Use a smaller DT or a larger area.
 001:0022 CALIB STANDHYD
```

```
     *** WARNING: Storage Coefficient is smaller than DT!
                  Use a smaller DT or a larger area.
 001:0026 CALIB STANDHYD
     *** WARNING: Storage Coefficient is smaller than DT!
                  Use a smaller DT or a larger area.
 001:0031 CALIB STANDHYD
     *** WARNING: Storage Coefficient is smaller than DT!
                  Use a smaller DT or a larger area.
 001:0032 CALIB STANDHYD
     *** WARNING: Storage Coefficient is smaller than DT!
                  Use a smaller DT or a larger area.
 001:0033 CALIB STANDHYD
     *** WARNING: Storage Coefficient is smaller than DT!
                  Use a smaller DT or a larger area.
 001:0034 CALIB STANDHYD
     *** WARNING: Storage Coefficient is smaller than DT!
                  Use a smaller DT or a larger area.
 001:0042 CALIB STANDHYD
     *** WARNING: Storage Coefficient is smaller than DT!
                  Use a smaller DT or a larger area.
 001:0043 CALIB STANDHYD
     *** WARNING: Storage Coefficient is smaller than DT!
                  Use a smaller DT or a larger area.
 001:0044 CALIB STANDHYD
     *** WARNING: Storage Coefficient is smaller than DT!
                  Use a smaller DT or a larger area.
 001:0045 CALIB STANDHYD
     *** WARNING: Storage Coefficient is smaller than DT!
                  Use a smaller DT or a larger area.
 001:0050 CALIB STANDHYD
     *** WARNING: Storage Coefficient is smaller than DT!
                  Use a smaller DT or a larger area.
 001:0051 CALIB STANDHYD
     *** WARNING: Storage Coefficient is smaller than DT!
                  Use a smaller DT or a larger area.
 001:0053 CALIB STANDHYD
     *** WARNING: Storage Coefficient is smaller than DT!
                  Use a smaller DT or a larger area.
 001:0054 CALIB STANDHYD
     *** WARNING: Storage Coefficient is smaller than DT!
                  Use a smaller DT or a larger area.
 001:0056 CALIB STANDHYD
     *** WARNING: Storage Coefficient is smaller than DT!
                  Use a smaller DT or a larger area.
 001:0057 CALIB STANDHYD
     *** WARNING: Storage Coefficient is smaller than DT!
                  Use a smaller DT or a larger area.
 001:0060 CALIB STANDHYD
     *** WARNING: Storage Coefficient is smaller than DT!
                  Use a smaller DT or a larger area.
 001:0061 CALIB STANDHYD
     *** WARNING: Storage Coefficient is smaller than DT!
                  Use a smaller DT or a larger area.
 001:0062 CALIB STANDHYD
     *** WARNING: Storage Coefficient is smaller than DT!
                  Use a smaller DT or a larger area.
 001:0064 CALIB STANDHYD
     *** WARNING: Storage Coefficient is smaller than DT!
                  Use a smaller DT or a larger area.
 001:0065 CALIB STANDHYD
     *** WARNING: Storage Coefficient is smaller than DT!
                  Use a smaller DT or a larger area.
 001:0066 CALIB STANDHYD
     *** WARNING: Storage Coefficient is smaller than DT!
                  Use a smaller DT or a larger area.
 001:0071 CALIB STANDHYD
     *** WARNING: Storage Coefficient is smaller than DT!
                  Use a smaller DT or a larger area.
 001:0072 CALIB STANDHYD
     *** WARNING: Storage Coefficient is smaller than DT!
                  Use a smaller DT or a larger area.
 001:0078 CALIB STANDHYD
     *** WARNING: Storage Coefficient is smaller than DT!
                  Use a smaller DT or a larger area.
 001:0080 CALIB STANDHYD
     *** WARNING: Storage Coefficient is smaller than DT!
                  Use a smaller DT or a larger area.
 001:0084 CALIB STANDHYD
     *** WARNING: Storage Coefficient is smaller than DT!
                  Use a smaller DT or a larger area.
 001:0086 CALIB STANDHYD
     *** WARNING: Storage Coefficient is smaller than DT!
                  Use a smaller DT or a larger area.
 001:0088 CALIB STANDHYD
     *** WARNING: Storage Coefficient is smaller than DT!
```

```
                    Use a smaller DT or a larger area.
001:0089 CALIB STANDHYD
     *** WARNING: Storage Coefficient is smaller than DT!
                    Use a smaller DT or a larger area.
001:0090 CALIB STANDHYD
     *** WARNING: Storage Coefficient is smaller than DT!
                    Use a smaller DT or a larger area.
001:0091 CALIB STANDHYD
     *** WARNING: Storage Coefficient is smaller than DT!
                    Use a smaller DT or a larger area.
001:0092 CALIB STANDHYD
     *** WARNING: Storage Coefficient is smaller than DT!
                    Use a smaller DT or a larger area.
001:0095 CALIB STANDHYD
     *** WARNING: Storage Coefficient is smaller than DT!
                    Use a smaller DT or a larger area.
001:0096 CALIB STANDHYD
     *** WARNING: Storage Coefficient is smaller than DT!
                    Use a smaller DT or a larger area.
001:0098 CALIB STANDHYD
     *** WARNING: Storage Coefficient is smaller than DT!
                    Use a smaller DT or a larger area.
001:0103 CALIB STANDHYD
     *** WARNING: Storage Coefficient is smaller than DT!
                    Use a smaller DT or a larger area.
001:0104 CALIB STANDHYD
     *** WARNING: Storage Coefficient is smaller than DT!
                    Use a smaller DT or a larger area.
001:0105 CALIB STANDHYD
     *** WARNING: Storage Coefficient is smaller than DT!
                    Use a smaller DT or a larger area.
001:0106 CALIB STANDHYD
     *** WARNING: Storage Coefficient is smaller than DT!
                    Use a smaller DT or a larger area.
001:0108 CALIB STANDHYD
     *** WARNING: Storage Coefficient is smaller than DT!
                    Use a smaller DT or a larger area.
001:0109 CALIB STANDHYD
     *** WARNING: Storage Coefficient is smaller than DT!
                    Use a smaller DT or a larger area.
001:0111 CALIB STANDHYD
     *** WARNING: Storage Coefficient is smaller than DT!
                    Use a smaller DT or a larger area.
001:0112 CALIB STANDHYD
     *** WARNING: Storage Coefficient is smaller than DT!
                    Use a smaller DT or a larger area.
001:0114 CALIB STANDHYD
     *** WARNING: Storage Coefficient is smaller than DT!
                    Use a smaller DT or a larger area.
001:0115 CALIB STANDHYD
     *** WARNING: Storage Coefficient is smaller than DT!
                    Use a smaller DT or a larger area.
001:0117 CALIB STANDHYD
     *** WARNING: Storage Coefficient is smaller than DT!
                    Use a smaller DT or a larger area.
001:0118 CALIB STANDHYD
     *** WARNING: Storage Coefficient is smaller than DT!
                    Use a smaller DT or a larger area.
001:0122 CALIB STANDHYD
     *** WARNING: Storage Coefficient is smaller than DT!
                    Use a smaller DT or a larger area.
001:0123 CALIB STANDHYD
     *** WARNING: Storage Coefficient is smaller than DT!
                    Use a smaller DT or a larger area.
001:0124 CALIB STANDHYD
     *** WARNING: Storage Coefficient is smaller than DT!
                    Use a smaller DT or a larger area.
001:0126 CALIB STANDHYD
     *** WARNING: Storage Coefficient is smaller than DT!
                    Use a smaller DT or a larger area.
001:0127 CALIB STANDHYD
     *** WARNING: Storage Coefficient is smaller than DT!
                    Use a smaller DT or a larger area.
001:0131 CALIB STANDHYD
     *** WARNING: Storage Coefficient is smaller than DT!
                    Use a smaller DT or a larger area.
001:0133 CALIB STANDHYD
     *** WARNING: Storage Coefficient is smaller than DT!
                    Use a smaller DT or a larger area.
001:0135 CALIB STANDHYD
     *** WARNING: Storage Coefficient is smaller than DT!
                    Use a smaller DT or a larger area.
001:0138 CALIB STANDHYD
     *** WARNING: Storage Coefficient is smaller than DT!
                    Use a smaller DT or a larger area.
```

```
001:0139 CALIB STANDHYD
     *** WARNING: Storage Coefficient is smaller than DT!
                  Use a smaller DT or a larger area.
001:0141 CALIB STANDHYD
     *** WARNING: Storage Coefficient is smaller than DT!
                  Use a smaller DT or a larger area.
001:0145 CALIB STANDHYD
     *** WARNING: Storage Coefficient is smaller than DT!
                  Use a smaller DT or a larger area.
001:0148 CALIB STANDHYD
     *** WARNING: Storage Coefficient is smaller than DT!
                  Use a smaller DT or a larger area.
001:0149 CALIB STANDHYD
     *** WARNING: Storage Coefficient is smaller than DT!
                  Use a smaller DT or a larger area.
001:0150 CALIB STANDHYD
     *** WARNING: Storage Coefficient is smaller than DT!
                  Use a smaller DT or a larger area.
001:0152 CALIB STANDHYD
     *** WARNING: Storage Coefficient is smaller than DT!
                  Use a smaller DT or a larger area.
001:0153 CALIB STANDHYD
     *** WARNING: Storage Coefficient is smaller than DT!
                  Use a smaller DT or a larger area.
001:0156 CALIB STANDHYD
     *** WARNING: Storage Coefficient is smaller than DT!
                  Use a smaller DT or a larger area.
001:0160 CALIB STANDHYD
     *** WARNING: Storage Coefficient is smaller than DT!
                  Use a smaller DT or a larger area.
001:0161 CALIB STANDHYD
     *** WARNING: Storage Coefficient is smaller than DT!
                  Use a smaller DT or a larger area.
001:0162 CALIB STANDHYD
     *** WARNING: Storage Coefficient is smaller than DT!
                  Use a smaller DT or a larger area.
001:0163 CALIB STANDHYD
     *** WARNING: Storage Coefficient is smaller than DT!
                  Use a smaller DT or a larger area.
001:0165 CALIB STANDHYD
     *** WARNING: Storage Coefficient is smaller than DT!
                  Use a smaller DT or a larger area.
001:0166 CALIB STANDHYD
     *** WARNING: Storage Coefficient is smaller than DT!
                  Use a smaller DT or a larger area.
001:0168 CALIB STANDHYD
     *** WARNING: Storage Coefficient is smaller than DT!
                  Use a smaller DT or a larger area.
001:0169 CALIB STANDHYD
     *** WARNING: Storage Coefficient is smaller than DT!
                  Use a smaller DT or a larger area.
001:0171 CALIB STANDHYD
     *** WARNING: Storage Coefficient is smaller than DT!
                  Use a smaller DT or a larger area.
002:0004 CALIB STANDHYD
     *** WARNING: Storage Coefficient is smaller than DT!
                  Use a smaller DT or a larger area.
002:0005 CALIB STANDHYD
     *** WARNING: Storage Coefficient is smaller than DT!
                  Use a smaller DT or a larger area.
002:0009 CALIB STANDHYD
     *** WARNING: Storage Coefficient is smaller than DT!
                  Use a smaller DT or a larger area.
002:0010 CALIB NASHYD
     *** WARNING: Time step is too large for value of TP.
                  R.V. may be ok.  Peak flow could be off.
002:0011 CALIB STANDHYD
     *** WARNING: Storage Coefficient is smaller than DT!
                  Use a smaller DT or a larger area.
002:0013 CALIB STANDHYD
     *** WARNING: Storage Coefficient is smaller than DT!
                  Use a smaller DT or a larger area.
002:0017 CALIB STANDHYD
     *** WARNING: Storage Coefficient is smaller than DT!
                  Use a smaller DT or a larger area.
002:0018 CALIB STANDHYD
     *** WARNING: Storage Coefficient is smaller than DT!
                  Use a smaller DT or a larger area.
002:0022 CALIB STANDHYD
     *** WARNING: Storage Coefficient is smaller than DT!
                  Use a smaller DT or a larger area.
002:0026 CALIB STANDHYD
     *** WARNING: Storage Coefficient is smaller than DT!
                  Use a smaller DT or a larger area.
002:0031 CALIB STANDHYD
```

```
      *** WARNING: Storage Coefficient is smaller than DT!
                   Use a smaller DT or a larger area.
 002:0032 CALIB STANDHYD
      *** WARNING: Storage Coefficient is smaller than DT!
                   Use a smaller DT or a larger area.
 002:0033 CALIB STANDHYD
      *** WARNING: Storage Coefficient is smaller than DT!
                   Use a smaller DT or a larger area.
 002:0034 CALIB STANDHYD
      *** WARNING: Storage Coefficient is smaller than DT!
                   Use a smaller DT or a larger area.
 002:0040 ROUTE RESERVOIR
      *** WARNING: Inflow peak was not reduced!
                   Check OUTFLOW/STORAGE table or reduce DT.
 002:0042 CALIB STANDHYD
      *** WARNING: Storage Coefficient is smaller than DT!
                   Use a smaller DT or a larger area.
 002:0043 CALIB STANDHYD
      *** WARNING: Storage Coefficient is smaller than DT!
                   Use a smaller DT or a larger area.
 002:0044 CALIB STANDHYD
      *** WARNING: Storage Coefficient is smaller than DT!
                   Use a smaller DT or a larger area.
 002:0045 CALIB STANDHYD
      *** WARNING: Storage Coefficient is smaller than DT!
                   Use a smaller DT or a larger area.
 002:0050 CALIB STANDHYD
      *** WARNING: Storage Coefficient is smaller than DT!
                   Use a smaller DT or a larger area.
 002:0051 CALIB STANDHYD
      *** WARNING: Storage Coefficient is smaller than DT!
                   Use a smaller DT or a larger area.
 002:0053 CALIB STANDHYD
      *** WARNING: Storage Coefficient is smaller than DT!
                   Use a smaller DT or a larger area.
 002:0054 CALIB STANDHYD
      *** WARNING: Storage Coefficient is smaller than DT!
                   Use a smaller DT or a larger area.
 002:0056 CALIB STANDHYD
      *** WARNING: Storage Coefficient is smaller than DT!
                   Use a smaller DT or a larger area.
 002:0057 CALIB STANDHYD
      *** WARNING: Storage Coefficient is smaller than DT!
                   Use a smaller DT or a larger area.
 002:0060 CALIB STANDHYD
      *** WARNING: Storage Coefficient is smaller than DT!
                   Use a smaller DT or a larger area.
 002:0061 CALIB STANDHYD
      *** WARNING: Storage Coefficient is smaller than DT!
                   Use a smaller DT or a larger area.
 002:0062 CALIB STANDHYD
      *** WARNING: Storage Coefficient is smaller than DT!
                   Use a smaller DT or a larger area.
 002:0064 CALIB STANDHYD
      *** WARNING: Storage Coefficient is smaller than DT!
                   Use a smaller DT or a larger area.
 002:0065 CALIB STANDHYD
      *** WARNING: Storage Coefficient is smaller than DT!
                   Use a smaller DT or a larger area.
 002:0066 CALIB STANDHYD
      *** WARNING: Storage Coefficient is smaller than DT!
                   Use a smaller DT or a larger area.
 002:0071 CALIB STANDHYD
      *** WARNING: Storage Coefficient is smaller than DT!
                   Use a smaller DT or a larger area.
 002:0072 CALIB STANDHYD
      *** WARNING: Storage Coefficient is smaller than DT!
                   Use a smaller DT or a larger area.
 002:0078 CALIB STANDHYD
      *** WARNING: Storage Coefficient is smaller than DT!
                   Use a smaller DT or a larger area.
 002:0080 CALIB STANDHYD
      *** WARNING: Storage Coefficient is smaller than DT!
                   Use a smaller DT or a larger area.
 002:0084 CALIB STANDHYD
      *** WARNING: Storage Coefficient is smaller than DT!
                   Use a smaller DT or a larger area.
 002:0086 CALIB STANDHYD
      *** WARNING: Storage Coefficient is smaller than DT!
                   Use a smaller DT or a larger area.
 002:0088 CALIB STANDHYD
      *** WARNING: Storage Coefficient is smaller than DT!
                   Use a smaller DT or a larger area.
 002:0089 CALIB STANDHYD
      *** WARNING: Storage Coefficient is smaller than DT!
```

```
                    Use a smaller DT or a larger area.
002:0090 CALIB STANDHYD
     *** WARNING: Storage Coefficient is smaller than DT!
                    Use a smaller DT or a larger area.
002:0091 CALIB STANDHYD
     *** WARNING: Storage Coefficient is smaller than DT!
                    Use a smaller DT or a larger area.
002:0092 CALIB STANDHYD
     *** WARNING: Storage Coefficient is smaller than DT!
                    Use a smaller DT or a larger area.
002:0095 CALIB STANDHYD
     *** WARNING: Storage Coefficient is smaller than DT!
                    Use a smaller DT or a larger area.
002:0096 CALIB STANDHYD
     *** WARNING: Storage Coefficient is smaller than DT!
                    Use a smaller DT or a larger area.
002:0098 CALIB STANDHYD
     *** WARNING: Storage Coefficient is smaller than DT!
                    Use a smaller DT or a larger area.
002:0103 CALIB STANDHYD
     *** WARNING: Storage Coefficient is smaller than DT!
                    Use a smaller DT or a larger area.
002:0104 CALIB STANDHYD
     *** WARNING: Storage Coefficient is smaller than DT!
                    Use a smaller DT or a larger area.
002:0105 CALIB STANDHYD
     *** WARNING: Storage Coefficient is smaller than DT!
                    Use a smaller DT or a larger area.
002:0106 CALIB STANDHYD
     *** WARNING: Storage Coefficient is smaller than DT!
                    Use a smaller DT or a larger area.
002:0108 CALIB STANDHYD
     *** WARNING: Storage Coefficient is smaller than DT!
                    Use a smaller DT or a larger area.
002:0109 CALIB STANDHYD
     *** WARNING: Storage Coefficient is smaller than DT!
                    Use a smaller DT or a larger area.
002:0111 CALIB STANDHYD
     *** WARNING: Storage Coefficient is smaller than DT!
                    Use a smaller DT or a larger area.
002:0112 CALIB STANDHYD
     *** WARNING: Storage Coefficient is smaller than DT!
                    Use a smaller DT or a larger area.
002:0114 CALIB STANDHYD
     *** WARNING: Storage Coefficient is smaller than DT!
                    Use a smaller DT or a larger area.
002:0115 CALIB STANDHYD
     *** WARNING: Storage Coefficient is smaller than DT!
                    Use a smaller DT or a larger area.
002:0117 CALIB STANDHYD
     *** WARNING: Storage Coefficient is smaller than DT!
                    Use a smaller DT or a larger area.
002:0118 CALIB STANDHYD
     *** WARNING: Storage Coefficient is smaller than DT!
                    Use a smaller DT or a larger area.
002:0122 CALIB STANDHYD
     *** WARNING: Storage Coefficient is smaller than DT!
                    Use a smaller DT or a larger area.
002:0123 CALIB STANDHYD
     *** WARNING: Storage Coefficient is smaller than DT!
                    Use a smaller DT or a larger area.
002:0124 CALIB STANDHYD
     *** WARNING: Storage Coefficient is smaller than DT!
                    Use a smaller DT or a larger area.
002:0126 CALIB STANDHYD
     *** WARNING: Storage Coefficient is smaller than DT!
                    Use a smaller DT or a larger area.
002:0127 CALIB STANDHYD
     *** WARNING: Storage Coefficient is smaller than DT!
                    Use a smaller DT or a larger area.
002:0131 CALIB STANDHYD
     *** WARNING: Storage Coefficient is smaller than DT!
                    Use a smaller DT or a larger area.
002:0133 CALIB STANDHYD
     *** WARNING: Storage Coefficient is smaller than DT!
                    Use a smaller DT or a larger area.
002:0135 CALIB STANDHYD
     *** WARNING: Storage Coefficient is smaller than DT!
                    Use a smaller DT or a larger area.
002:0138 CALIB STANDHYD
     *** WARNING: Storage Coefficient is smaller than DT!
                    Use a smaller DT or a larger area.
002:0139 CALIB STANDHYD
     *** WARNING: Storage Coefficient is smaller than DT!
                    Use a smaller DT or a larger area.
```

```
 002:0141 CALIB STANDHYD
      *** WARNING: Storage Coefficient is smaller than DT!
                   Use a smaller DT or a larger area.
 002:0145 CALIB STANDHYD
      *** WARNING: Storage Coefficient is smaller than DT!
                   Use a smaller DT or a larger area.
 002:0148 CALIB STANDHYD
      *** WARNING: Storage Coefficient is smaller than DT!
                   Use a smaller DT or a larger area.
 002:0149 CALIB STANDHYD
      *** WARNING: Storage Coefficient is smaller than DT!
                   Use a smaller DT or a larger area.
 002:0150 CALIB STANDHYD
      *** WARNING: Storage Coefficient is smaller than DT!
                   Use a smaller DT or a larger area.
 002:0152 CALIB STANDHYD
      *** WARNING: Storage Coefficient is smaller than DT!
                   Use a smaller DT or a larger area.
 002:0153 CALIB STANDHYD
      *** WARNING: Storage Coefficient is smaller than DT!
                   Use a smaller DT or a larger area.
 002:0156 CALIB STANDHYD
      *** WARNING: Storage Coefficient is smaller than DT!
                   Use a smaller DT or a larger area.
 002:0160 CALIB STANDHYD
      *** WARNING: Storage Coefficient is smaller than DT!
                   Use a smaller DT or a larger area.
 002:0161 CALIB STANDHYD
      *** WARNING: Storage Coefficient is smaller than DT!
                   Use a smaller DT or a larger area.
 002:0162 CALIB STANDHYD
      *** WARNING: Storage Coefficient is smaller than DT!
                   Use a smaller DT or a larger area.
 002:0163 CALIB STANDHYD
      *** WARNING: Storage Coefficient is smaller than DT!
                   Use a smaller DT or a larger area.
 002:0165 CALIB STANDHYD
      *** WARNING: Storage Coefficient is smaller than DT!
                   Use a smaller DT or a larger area.
 002:0166 CALIB STANDHYD
      *** WARNING: Storage Coefficient is smaller than DT!
                   Use a smaller DT or a larger area.
 002:0168 CALIB STANDHYD
      *** WARNING: Storage Coefficient is smaller than DT!
                   Use a smaller DT or a larger area.
 002:0169 CALIB STANDHYD
      *** WARNING: Storage Coefficient is smaller than DT!
                   Use a smaller DT or a larger area.
 002:0171 CALIB STANDHYD
      *** WARNING: Storage Coefficient is smaller than DT!
                   Use a smaller DT or a larger area.
   Simulation ended on 2002-06-04      at 15:32:26
*************************************************************************
```

APPENDIX D

Hydraulic Modelling

Culvert Design Report
Culvert 72 (22+600 EBL)

Peak Discharge Method: User-Specified			
Design Discharge	0.7900 m³/s	Check Discharge	0.9000 m³/s
Grades Model: Inverts			
Invert Upstream	311.20 m	Invert Downstream	311.00 m
Length	20.00 m	Slope	0.010000 m/m
Drop	0.20 m		
Headwater Model: Maximum Allowable HW			
Headwater Elevation	313.00 m		
Tailwater Conditions: Constant Tailwater			
Tailwater Elevation	311.72 m		

	Name	Desc	Discharge	HW Elev	Velocity
x	Trial-1	1-1200 mm(MTO) Circular	0.7900 m³/s	311.94 m	1.10 m/s
	Trial-2	1-1200 mm(MTO) Circular	0.9000 m³/s	312.00 m	1.25 m/s

McCormick Rankin Corporation
37 Brookside Road Waterbury, CT 06708 USA (203) 755-1666

Culvert Design Report
Culvert 72 (22+600 EBL)

Design:Trial-1

Solve For: Headwater Elevation

Culvert Summary			
Allowable HW Elevation	313.00 m	Storm Event	Design
Computed Headwater Elevation	311.94 m	Discharge	0.7900 m³/s
Headwater Depth/ Height	0.61	Tailwater Elevation	311.72 m
Inlet Control HW Elev	311.86 m	Control Type	Outlet Control
Outlet Control HW Elev	311.94 m		

Grades			
Upstream Invert	311.20 m	Downstream Invert	311.00 m
Length	20.00 m	Constructed Slope	0.010000 m/m

Hydraulic Profile			
Profile	CompositeS1S2	Depth, Downstream	0.72 m
Slope Type	Steep	Normal Depth	0.36 m
Flow Regime	N/A	Critical Depth	0.48 m
Velocity Downstream	1.10 m/s	Critical Slope	0.003611 m/m

Section			
Section Shape	Circular	Mannings Coefficient	0.013
Section Material	Concrete	Span	1.22 m
Section Size	1200 mm(MTO)	Rise	1.22 m
Number Sections	1		

Outlet Control Properties			
Outlet Control HW Elev	311.94 m	Upstream Velocity Head	0.18 m
Ke	0.50	Entrance Loss	0.09 m

Inlet Control Properties			
Inlet Control HW Elev	311.86 m	Flow Control	N/A
Inlet Type	Square edge w/headwall	Area Full	1.2 m²
K	0.00980	HDS 5 Chart	1
M	2.00000	HDS 5 Scale	1
C	0.03980	Equation Form	1
Y	0.67000		

Culvert Design Report
Culvert 72 (22+600 EBL)

Design:Trial-2

Solve For: Headwater Elevation

Culvert Summary			
Allowable HW Elevation	313.00 m	Storm Event	Check
Computed Headwater Elevation	312.00 m	Discharge	0.9000 m³/s
Headwater Depth/ Height	0.66	Tailwater Elevation	311.72 m
Inlet Control HW Elev	311.92 m	Control Type	Outlet Control
Outlet Control HW Elev	312.00 m		

Grades			
Upstream Invert	311.20 m	Downstream Invert	311.00 m
Length	20.00 m	Constructed Slope	0.010000 m/m

Hydraulic Profile			
Profile	CompositeS1S2	Depth, Downstream	0.72 m
Slope Type	Steep	Normal Depth	0.39 m
Flow Regime	N/A	Critical Depth	0.51 m
Velocity Downstream	1.25 m/s	Critical Slope	0.003657 m/m

Section			
Section Shape	Circular	Mannings Coefficient	0.013
Section Material	Concrete	Span	1.22 m
Section Size	1200 mm(MTO)	Rise	1.22 m
Number Sections	1		

Outlet Control Properties			
Outlet Control HW Elev	312.00 m	Upstream Velocity Head	0.19 m
Ke	0.50	Entrance Loss	0.10 m

Inlet Control Properties			
Inlet Control HW Elev	311.92 m	Flow Control	N/A
Inlet Type	Square edge w/headwall	Area Full	1.2 m²
K	0.00980	HDS 5 Chart	1
M	2.00000	HDS 5 Scale	1
C	0.03980	Equation Form	1
Y	0.67000		

Culvert Design Report
Culvert 80 (22+800)

Peak Discharge Method: User-Specified			
Design Discharge	2.5400 m³/s	Check Discharge	2.9600 m³/s
Grades Model: Inverts			
Invert Upstream	305.00 m	Invert Downstream	304.50 m
Length	82.00 m	Slope	0.006098 m/m
Drop	0.50 m		
Headwater Model: Maximum Allowable HW			
Headwater Elevation	315.00 m		
Tailwater Conditions: Constant Tailwater			
Tailwater Elevation	305.58 m		

	Name	Desc	Discharge	HW Elev	Velocity
x	Trial-1	1-1800 mm(MTO) Circular	2.5400 m³/s	306.21 m	1.57 m/s
	Trial-2	1-1800 mm(MTO) Circular	2.9600 m³/s	306.32 m	1.83 m/s

McCormick Rankin Corporation
37 Brookside Road Waterbury, CT 06708 USA (203) 755-1666

Culvert Design Report
Culvert 80 (22+800)

Design:Trial-1

Solve For: Headwater Elevation

Culvert Summary					
Allowable HW Elevation	315.00	m	Storm Event	Design	
Computed Headwater Elevation	306.21	m	Discharge	2.5400	m³/s
Headwater Depth/ Height	0.66		Tailwater Elevation	305.58	m
Inlet Control HW Elev	306.09	m	Control Type	Outlet Control	
Outlet Control HW Elev	306.21	m			

Grades					
Upstream Invert	305.00	m	Downstream Invert	304.50	m
Length	82.00	m	Constructed Slope	0.006098	m/m

Hydraulic Profile					
Profile	CompositeS1S2		Depth, Downstream	1.08	m
Slope Type	Steep		Normal Depth	0.65	m
Flow Regime	N/A		Critical Depth	0.77	m
Velocity Downstream	1.57	m/s	Critical Slope	0.003204	m/m

Section					
Section Shape	Circular		Mannings Coefficient	0.013	
Section Material	Concrete		Span	1.83	m
Section Size	1800 mm(MTO)		Rise	1.83	m
Number Sections	1				

Outlet Control Properties					
Outlet Control HW Elev	306.21	m	Upstream Velocity Head	0.29	m
Ke	0.50		Entrance Loss	0.15	m

Inlet Control Properties					
Inlet Control HW Elev	306.09	m	Flow Control	N/A	
Inlet Type	Square edge w/headwall		Area Full	2.6	m²
K	0.00980		HDS 5 Chart	1	
M	2.00000		HDS 5 Scale	1	
C	0.03980		Equation Form	1	
Y	0.67000				

Culvert Design Report
Culvert 80 (22+800)

Design:Trial-2

Solve For: Headwater Elevation

Culvert Summary					
Allowable HW Elevation	315.00	m	Storm Event	Check	
Computed Headwater Elevation	306.32	m	Discharge	2.9600	m³/s
Headwater Depth/ Height	0.72		Tailwater Elevation	305.58	m
Inlet Control HW Elev	306.20	m	Control Type	Outlet Control	
Outlet Control HW Elev	306.32	m			

Grades					
Upstream Invert	305.00	m	Downstream Invert	304.50	m
Length	82.00	m	Constructed Slope	0.006098	m/m

Hydraulic Profile					
Profile	CompositeS1S2		Depth, Downstream	1.08	m
Slope Type	Steep		Normal Depth	0.71	m
Flow Regime	N/A		Critical Depth	0.84	m
Velocity Downstream	1.83	m/s	Critical Slope	0.003274	m/m

Section					
Section Shape	Circular		Mannings Coefficient	0.013	
Section Material	Concrete		Span	1.83	m
Section Size	1800 mm(MTO)		Rise	1.83	m
Number Sections	1				

Outlet Control Properties					
Outlet Control HW Elev	306.32	m	Upstream Velocity Head	0.32	m
Ke	0.50		Entrance Loss	0.16	m

Inlet Control Properties					
Inlet Control HW Elev	306.20	m	Flow Control	N/A	
Inlet Type	Square edge w/headwall		Area Full	2.6	m²
K	0.00980		HDS 5 Chart	1	
M	2.00000		HDS 5 Scale	1	
C	0.03980		Equation Form	1	
Y	0.67000				

Culvert Design Report
Culvert 80 (22+800) Regional Storm

Peak Discharge Method: User-Specified			
Design Discharge	16.4900 m³/s	Check Discharge	0.0000 m³/s
Grades Model: Inverts			
Invert Upstream	305.00 m	Invert Downstream	304.50 m
Length	82.00 m	Slope	0.006098 m/m
Drop	0.50 m		
Headwater Model: Maximum Allowable HW			
Headwater Elevation	315.00 m		
Tailwater Conditions: Constant Tailwater			
Tailwater Elevation	305.58 m		

	Name	Desc	Discharge	HW Elev	Velocity
x	Trial-1	1-1800 mm(MTO) Circular	16.4900 m³/s	311.37 m	6.34 m/s

Culvert Design Report
Culvert 80 (22+800) Regional Storm

Design:Trial-1

Solve For: Headwater Elevation

Culvert Summary					
Allowable HW Elevation	315.00	m	Storm Event	Design	
Computed Headwater Elevation	311.37	m	Discharge	16.4900	m³/s
Headwater Depth/ Height	3.48		Tailwater Elevation	305.58	m
Inlet Control HW Elev	311.37	m	Control Type	Inlet Control	
Outlet Control HW Elev	310.87	m			

Grades					
Upstream Invert	305.00	m	Downstream Invert	304.50	m
Length	82.00	m	Constructed Slope	0.006098	m/m

Hydraulic Profile					
Profile	CompositeM2Pressure		Depth, Downstream	1.77	m
Slope Type	Mild		Normal Depth	N/A	m
Flow Regime	Subcritical		Critical Depth	1.77	m
Velocity Downstream	6.34	m/s	Critical Slope	0.016622	m/m

Section					
Section Shape	Circular		Mannings Coefficient	0.013	
Section Material	Concrete		Span	1.83	m
Section Size	1800 mm(MTO)		Rise	1.83	m
Number Sections	1				

Outlet Control Properties					
Outlet Control HW Elev	310.87	m	Upstream Velocity Head	2.01	m
Ke	0.50		Entrance Loss	1.00	m

Inlet Control Properties					
Inlet Control HW Elev	311.37	m	Flow Control	Submerged	
Inlet Type	Square edge w/headwall		Area Full	2.6	m²
K	0.00980		HDS 5 Chart	1	
M	2.00000		HDS 5 Scale	1	
C	0.03980		Equation Form	1	
Y	0.67000				

McCormick Rankin Corporation
37 Brookside Road Waterbury, CT 06708 USA (203) 755-1666

Culvert Design Report
Culvert 120 (24+000)

Peak Discharge Method: User-Specified			
Design Discharge	1.4800 m³/s	Check Discharge	1.7300 m³/s
Grades Model: Inverts			
Invert Upstream	319.50 m	Invert Downstream	319.00 m
Length	90.00 m	Slope	0.005556 m/m
Drop	0.50 m		
Headwater Model: Maximum Allowable HW			
Headwater Elevation	329.00 m		
Tailwater Conditions: Constant Tailwater			
Tailwater Elevation	319.72 m		

	Name	Desc	Discharge	HW Elev	Velocity
x	Trial-1	1-1200 mm(MTO) Circular	1.4800 m³/s	320.56 m	2.06 m/s
	Trial-2	1-1200 mm(MTO) Circular	1.7300 m³/s	320.67 m	2.41 m/s

Culvert Design Report
Culvert 120 (24+000)

Design:Trial-1

Solve For: Headwater Elevation

Culvert Summary					
Allowable HW Elevation	329.00	m	Storm Event	Design	
Computed Headwater Elevation	320.56	m	Discharge	1.4800	m³/s
Headwater Depth/ Height	0.87		Tailwater Elevation	319.72	m
Inlet Control HW Elev	320.48	m	Control Type	Outlet Control	
Outlet Control HW Elev	320.56	m			

Grades					
Upstream Invert	319.50	m	Downstream Invert	319.00	m
Length	90.00	m	Constructed Slope	0.005556	m/m

Hydraulic Profile					
Profile	CompositeS1S2		Depth, Downstream	0.72	m
Slope Type	Steep		Normal Depth	0.60	m
Flow Regime	N/A		Critical Depth	0.66	m
Velocity Downstream	2.06	m/s	Critical Slope	0.004026	m/m

Section					
Section Shape	Circular		Mannings Coefficient	0.013	
Section Material	Concrete		Span	1.22	m
Section Size	1200 mm(MTO)		Rise	1.22	m
Number Sections	1				

Outlet Control Properties					
Outlet Control HW Elev	320.56	m	Upstream Velocity Head	0.27	m
Ke	0.50		Entrance Loss	0.13	m

Inlet Control Properties					
Inlet Control HW Elev	320.48	m	Flow Control	N/A	
Inlet Type	Square edge w/headwall		Area Full	1.2	m²
K	0.00980		HDS 5 Chart	1	
M	2.00000		HDS 5 Scale	1	
C	0.03980		Equation Form	1	
Y	0.67000				

Culvert Design Report
Culvert 120 (24+000)

Design:Trial-2

Solve For: Headwater Elevation

Culvert Summary			
Allowable HW Elevation	329.00 m	Storm Event	Check
Computed Headwater Elevation	320.67 m	Discharge	1.7300 m³/s
Headwater Depth/ Height	0.96	Tailwater Elevation	319.72 m
Inlet Control HW Elev	320.58 m	Control Type	Outlet Control
Outlet Control HW Elev	320.67 m		

Grades			
Upstream Invert	319.50 m	Downstream Invert	319.00 m
Length	90.00 m	Constructed Slope	0.005556 m/m

Hydraulic Profile			
Profile	CompositeS1S2	Depth, Downstream	0.72 m
Slope Type	Steep	Normal Depth	0.66 m
Flow Regime	N/A	Critical Depth	0.72 m
Velocity Downstream	2.41 m/s	Critical Slope	0.004243 m/m

Section			
Section Shape	Circular	Mannings Coefficient	0.013
Section Material	Concrete	Span	1.22 m
Section Size	1200 mm(MTO)	Rise	1.22 m
Number Sections	1		

Outlet Control Properties			
Outlet Control HW Elev	320.67 m	Upstream Velocity Head	0.30 m
Ke	0.50	Entrance Loss	0.15 m

Inlet Control Properties			
Inlet Control HW Elev	320.58 m	Flow Control	N/A
Inlet Type	Square edge w/headwall	Area Full	1.2 m²
K	0.00980	HDS 5 Chart	1
M	2.00000	HDS 5 Scale	1
C	0.03980	Equation Form	1
Y	0.67000		

Culvert Design Report
Culvert 126 (24+200 EBL)

Peak Discharge Method: User-Specified			
Design Discharge	0.7400 m³/s	Check Discharge	0.8400 m³/s
Grades Model: Inverts			
Invert Upstream	324.90 m	Invert Downstream	324.85 m
Length	20.00 m	Slope	0.002500 m/m
Drop	0.05 m		
Headwater Model: Maximum Allowable HW			
Headwater Elevation	329.00 m		
Tailwater Conditions: Constant Tailwater			
Tailwater Elevation	325.57 m		

	Name	Desc	Discharge	HW Elev	Velocity
x	Trial-1	1-1200 mm(MTO) Circular	0.7400 m³/s	325.67 m	1.03 m/s
	Trial-2	1-1200 mm(MTO) Circular	0.8400 m³/s	325.70 m	1.17 m/s

Culvert Design Report
Culvert 126 (24+200 EBL)

Design:Trial-1

Solve For: Headwater Elevation

Culvert Summary			
Allowable HW Elevation	329.00 m	Storm Event	Design
Computed Headwater Elevation	325.67 m	Discharge	0.7400 m³/s
Headwater Depth/ Height	0.63	Tailwater Elevation	325.57 m
Inlet Control HW Elev	325.57 m	Control Type	Outlet Control
Outlet Control HW Elev	325.67 m		

Grades			
Upstream Invert	324.90 m	Downstream Invert	324.85 m
Length	20.00 m	Constructed Slope	0.002500 m/m

Hydraulic Profile			
Profile	M1	Depth, Downstream	0.72 m
Slope Type	Mild	Normal Depth	0.51 m
Flow Regime	Subcritical	Critical Depth	0.46 m
Velocity Downstream	1.03 m/s	Critical Slope	0.003591 m/m

Section			
Section Shape	Circular	Mannings Coefficient	0.013
Section Material	Concrete	Span	1.22 m
Section Size	1200 mm(MTO)	Rise	1.22 m
Number Sections	1		

Outlet Control Properties			
Outlet Control HW Elev	325.67 m	Upstream Velocity Head	0.06 m
Ke	0.50	Entrance Loss	0.03 m

Inlet Control Properties			
Inlet Control HW Elev	325.57 m	Flow Control	N/A
Inlet Type	Square edge w/headwall	Area Full	1.2 m²
K	0.00980	HDS 5 Chart	1
M	2.00000	HDS 5 Scale	1
C	0.03980	Equation Form	1
Y	0.67000		

Culvert Design Report
Culvert 126 (24+200 EBL)

Design:Trial-2

Solve For: Headwater Elevation

Culvert Summary			
Allowable HW Elevation	329.00 m	Storm Event	Check
Computed Headwater Elevation	325.70 m	Discharge	0.8400 m³/s
Headwater Depth/ Height	0.66	Tailwater Elevation	325.57 m
Inlet Control HW Elev	325.59 m	Control Type	Outlet Control
Outlet Control HW Elev	325.70 m		

Grades			
Upstream Invert	324.90 m	Downstream Invert	324.85 m
Length	20.00 m	Constructed Slope	0.002500 m/m

Hydraulic Profile			
Profile	M1	Depth, Downstream	0.72 m
Slope Type	Mild	Normal Depth	0.55 m
Flow Regime	Subcritical	Critical Depth	0.49 m
Velocity Downstream	1.17 m/s	Critical Slope	0.003629 m/m

Section			
Section Shape	Circular	Mannings Coefficient	0.013
Section Material	Concrete	Span	1.22 m
Section Size	1200 mm(MTO)	Rise	1.22 m
Number Sections	1		

Outlet Control Properties			
Outlet Control HW Elev	325.70 m	Upstream Velocity Head	0.08 m
Ke	0.50	Entrance Loss	0.04 m

Inlet Control Properties			
Inlet Control HW Elev	325.59 m	Flow Control	N/A
Inlet Type	Square edge w/headwall	Area Full	1.2 m²
K	0.00980	HDS 5 Chart	1
M	2.00000	HDS 5 Scale	1
C	0.03980	Equation Form	1
Y	0.67000		

McCormick Rankin Corporation
37 Brookside Road Waterbury, CT 06708 USA (203) 755-1666

Culvert Design Report
Culvert 135 (24+700)

Peak Discharge Method: User-Specified			
Design Discharge	0.7000 m³/s	Check Discharge	0.8100 m³/s
Grades Model: Inverts			
Invert Upstream	325.00 m	Invert Downstream	324.50 m
Length	65.00 m	Slope	0.007692 m/m
Drop	0.50 m		
Headwater Model: Maximum Allowable HW			
Headwater Elevation	327.00 m		
Tailwater Conditions: Constant Tailwater			
Tailwater Elevation	325.22 m		

	Name	Desc	Discharge	HW Elev	Velocity
x	Trial-1	1-1200 mm(MTO) Circular	0.7000 m³/s	325.70 m	0.98 m/s
	Trial-2	1-1200 mm(MTO) Circular	0.8100 m³/s	325.75 m	1.13 m/s

McCormick Rankin Corporation
37 Brookside Road Waterbury, CT 06708 USA (203) 755-1666

Culvert Design Report
Culvert 135 (24+700)

Design:Trial-1

Solve For: Headwater Elevation

Culvert Summary					
Allowable HW Elevation	327.00	m	Storm Event	Design	
Computed Headwater Elevation	325.70	m	Discharge	0.7000	m³/s
Headwater Depth/ Height	0.57		Tailwater Elevation	325.22	m
Inlet Control HW Elev	325.62	m	Control Type	Outlet Control	
Outlet Control HW Elev	325.70	m			

Grades					
Upstream Invert	325.00	m	Downstream Invert	324.50	m
Length	65.00	m	Constructed Slope	0.007692	m/m

Hydraulic Profile					
Profile	CompositeS1S2		Depth, Downstream	0.72	m
Slope Type	Steep		Normal Depth	0.37	m
Flow Regime	N/A		Critical Depth	0.45	m
Velocity Downstream	0.98	m/s	Critical Slope	0.003577	m/m

Section					
Section Shape	Circular		Mannings Coefficient	0.013	
Section Material	Concrete		Span	1.22	m
Section Size	1200 mm(MTO)		Rise	1.22	m
Number Sections	1				

Outlet Control Properties					
Outlet Control HW Elev	325.70	m	Upstream Velocity Head	0.17	m
Ke	0.50		Entrance Loss	0.08	m

Inlet Control Properties					
Inlet Control HW Elev	325.62	m	Flow Control	N/A	
Inlet Type	Square edge w/headwall		Area Full	1.2	m²
K	0.00980		HDS 5 Chart	1	
M	2.00000		HDS 5 Scale	1	
C	0.03980		Equation Form	1	
Y	0.67000				

Culvert Design Report
Culvert 135 (24+700)

Design:Trial-2

Solve For: Headwater Elevation

Culvert Summary					
Allowable HW Elevation	327.00	m	Storm Event	Check	
Computed Headwater Elevation	325.75	m	Discharge	0.8100	m³/s
Headwater Depth/ Height	0.62		Tailwater Elevation	325.22	m
Inlet Control HW Elev	325.67	m	Control Type	Outlet Control	
Outlet Control HW Elev	325.75	m			

Grades					
Upstream Invert	325.00	m	Downstream Invert	324.50	m
Length	65.00	m	Constructed Slope	0.007692	m/m

Hydraulic Profile					
Profile	CompositeS1S2		Depth, Downstream	0.72	m
Slope Type	Steep		Normal Depth	0.39	m
Flow Regime	N/A		Critical Depth	0.48	m
Velocity Downstream	1.13	m/s	Critical Slope	0.003616	m/m

Section					
Section Shape	Circular		Mannings Coefficient	0.013	
Section Material	Concrete		Span	1.22	m
Section Size	1200 mm(MTO)		Rise	1.22	m
Number Sections	1				

Outlet Control Properties					
Outlet Control HW Elev	325.75	m	Upstream Velocity Head	0.18	m
Ke	0.50		Entrance Loss	0.09	m

Inlet Control Properties					
Inlet Control HW Elev	325.67	m	Flow Control	N/A	
Inlet Type	Square edge w/headwall		Area Full	1.2	m²
K	0.00980		HDS 5 Chart	1	
M	2.00000		HDS 5 Scale	1	
C	0.03980		Equation Form	1	
Y	0.67000				

McCormick Rankin Corporation
37 Brookside Road Waterbury, CT 06708 USA (203) 755-1666

Culvert Design Report
Culvert 150 (27+620)

Peak Discharge Method: User-Specified			
Design Discharge	0.7000 m³/s	Check Discharge	0.8200 m³/s
Grades Model: Inverts			
Invert Upstream	323.00 m	Invert Downstream	322.80 m
Length	75.00 m	Slope	0.002667 m/m
Drop	0.20 m		
Headwater Model: Maximum Allowable HW			
Headwater Elevation	328.00 m		
Tailwater Conditions: Constant Tailwater			
Tailwater Elevation	323.52 m		

	Name	Desc	Discharge	HW Elev	Velocity
x	Trial-1	1-1200 mm(MTO) Circular	0.7000 m³/s	323.70 m	0.98 m/s
	Trial-2	1-1200 mm(MTO) Circular	0.8200 m³/s	323.75 m	1.14 m/s

Culvert Design Report
Culvert 150 (27+620)

Design:Trial-1

Solve For: Headwater Elevation

Culvert Summary					
Allowable HW Elevation	328.00	m	Storm Event	Design	
Computed Headwater Elevation	323.70	m	Discharge	0.7000	m³/s
Headwater Depth/ Height	0.57		Tailwater Elevation	323.52	m
Inlet Control HW Elev	323.62	m	Control Type	Outlet Control	
Outlet Control HW Elev	323.70	m			

Grades					
Upstream Invert	323.00	m	Downstream Invert	322.80	m
Length	75.00	m	Constructed Slope	0.002667	m/m

Hydraulic Profile					
Profile	M1		Depth, Downstream	0.72	m
Slope Type	Mild		Normal Depth	0.48	m
Flow Regime	Subcritical		Critical Depth	0.45	m
Velocity Downstream	0.98	m/s	Critical Slope	0.003577	m/m

Section					
Section Shape	Circular		Mannings Coefficient	0.013	
Section Material	Concrete		Span	1.22	m
Section Size	1200 mm(MTO)		Rise	1.22	m
Number Sections	1				

Outlet Control Properties					
Outlet Control HW Elev	323.70	m	Upstream Velocity Head	0.09	m
Ke	0.50		Entrance Loss	0.05	m

Inlet Control Properties					
Inlet Control HW Elev	323.62	m	Flow Control	N/A	
Inlet Type	Square edge w/headwall		Area Full	1.2	m²
K	0.00980		HDS 5 Chart	1	
M	2.00000		HDS 5 Scale	1	
C	0.03980		Equation Form	1	
Y	0.67000				

Culvert Design Report
Culvert 150 (27+620)

Design:Trial-2

Solve For: Headwater Elevation

Culvert Summary					
Allowable HW Elevation	328.00	m	Storm Event	Check	
Computed Headwater Elevation	323.75	m	Discharge	0.8200	m³/s
Headwater Depth/ Height	0.62		Tailwater Elevation	323.52	m
Inlet Control HW Elev	323.68	m	Control Type	Outlet Control	
Outlet Control HW Elev	323.75	m			

Grades					
Upstream Invert	323.00	m	Downstream Invert	322.80	m
Length	75.00	m	Constructed Slope	0.002667	m/m

Hydraulic Profile					
Profile	M1		Depth, Downstream	0.72	m
Slope Type	Mild		Normal Depth	0.53	m
Flow Regime	Subcritical		Critical Depth	0.49	m
Velocity Downstream	1.14	m/s	Critical Slope	0.003620	m/m

Section					
Section Shape	Circular		Mannings Coefficient	0.013	
Section Material	Concrete		Span	1.22	m
Section Size	1200 mm(MTO)		Rise	1.22	m
Number Sections	1				

Outlet Control Properties					
Outlet Control HW Elev	323.75	m	Upstream Velocity Head	0.12	m
Ke	0.50		Entrance Loss	0.06	m

Inlet Control Properties					
Inlet Control HW Elev	323.68	m	Flow Control	N/A	
Inlet Type	Square edge w/headwall		Area Full	1.2	m²
K	0.00980		HDS 5 Chart	1	
M	2.00000		HDS 5 Scale	1	
C	0.03980		Equation Form	1	
Y	0.67000				

Culvert Design Report
Culvert 157 (28+220 WBL)

Peak Discharge Method: User-Specified			
Design Discharge	2.0400 m³/s	Check Discharge	2.3300 m³/s
Grades Model: Inverts			
Invert Upstream	324.70 m	Invert Downstream	324.65 m
Length	20.00 m	Slope	0.002500 m/m
Drop	0.05 m		
Headwater Model: Maximum Allowable HW			
Headwater Elevation	326.60 m		
Tailwater Conditions: Constant Tailwater			
Tailwater Elevation	325.37 m		

	Name	Desc	Discharge	HW Elev	Velocity
x	Trial-1	2-1200 mm(MTO) Circular	2.0400 m³/s	325.56 m	1.42 m/s
	Trial-2	2-1200 mm(MTO) Circular	2.3300 m³/s	325.62 m	1.62 m/s

37 Brookside Road Waterbury, CT 06708 USA (203) 755-1666

Culvert Design Report
Culvert 157 (28+220 WBL)

Design:Trial-1

Solve For: Headwater Elevation

Culvert Summary			
Allowable HW Elevation	326.60 m	Storm Event	Design
Computed Headwater Elevation	325.56 m	Discharge	2.0400 m³/s
Headwater Depth/ Height	0.71	Tailwater Elevation	325.37 m
Inlet Control HW Elev	325.48 m	Control Type	Outlet Control
Outlet Control HW Elev	325.56 m		

Grades			
Upstream Invert	324.70 m	Downstream Invert	324.65 m
Length	20.00 m	Constructed Slope	0.002500 m/m

Hydraulic Profile			
Profile	M1	Depth, Downstream	0.72 m
Slope Type	Mild	Normal Depth	0.61 m
Flow Regime	Subcritical	Critical Depth	0.54 m
Velocity Downstream	1.42 m/s	Critical Slope	0.003718 m/m

Section			
Section Shape	Circular	Mannings Coefficient	0.013
Section Material	Concrete	Span	1.22 m
Section Size	1200 mm(MTO)	Rise	1.22 m
Number Sections	2		

Outlet Control Properties			
Outlet Control HW Elev	325.56 m	Upstream Velocity Head	0.11 m
Ke	0.50	Entrance Loss	0.06 m

Inlet Control Properties			
Inlet Control HW Elev	325.48 m	Flow Control	N/A
Inlet Type	Square edge w/headwall	Area Full	2.3 m²
K	0.00980	HDS 5 Chart	1
M	2.00000	HDS 5 Scale	1
C	0.03980	Equation Form	1
Y	0.67000		

Culvert Design Report
Culvert 157 (28+220 WBL)

Design:Trial-2

Solve For: Headwater Elevation

Culvert Summary					
Allowable HW Elevation	326.60	m	Storm Event	Check	
Computed Headwater Elevation	325.62	m	Discharge	2.3300	m³/s
Headwater Depth/ Height	0.75		Tailwater Elevation	325.37	m
Inlet Control HW Elev	325.54	m	Control Type	Outlet Control	
Outlet Control HW Elev	325.62	m			

Grades					
Upstream Invert	324.70	m	Downstream Invert	324.65	m
Length	20.00	m	Constructed Slope	0.002500	m/m

Hydraulic Profile					
Profile	M1		Depth, Downstream	0.72	m
Slope Type	Mild		Normal Depth	0.66	m
Flow Regime	Subcritical		Critical Depth	0.58	m
Velocity Downstream	1.62	m/s	Critical Slope	0.003803	m/m

Section					
Section Shape	Circular		Mannings Coefficient	0.013	
Section Material	Concrete		Span	1.22	m
Section Size	1200 mm(MTO)		Rise	1.22	m
Number Sections	2				

Outlet Control Properties					
Outlet Control HW Elev	325.62	m	Upstream Velocity Head	0.14	m
Ke	0.50		Entrance Loss	0.07	m

Inlet Control Properties					
Inlet Control HW Elev	325.54	m	Flow Control	N/A	
Inlet Type	Square edge w/headwall		Area Full	2.3	m²
K	0.00980		HDS 5 Chart	1	
M	2.00000		HDS 5 Scale	1	
C	0.03980		Equation Form	1	
Y	0.67000				

Culvert Design Report
Culvert 160 (28+800)

Peak Discharge Method: User-Specified			
Design Discharge	1.4300 m³/s	Check Discharge	1.6700 m³/s
Grades Model: Inverts			
Invert Upstream	326.00 m	Invert Downstream	325.60 m
Length	100.00 m	Slope	0.004000 m/m
Drop	0.40 m		
Headwater Model: Maximum Allowable HW			
Headwater Elevation	328.20 m		
Tailwater Conditions: Constant Tailwater			
Tailwater Elevation	326.32 m		

	Name	Desc	Discharge	HW Elev	Velocity
x	Trial-1	1-1200 mm(MTO) Circular	1.4300 m³/s	327.04 m	1.99 m/s
	Trial-2	1-1200 mm(MTO) Circular	1.6700 m³/s	327.14 m	2.33 m/s

Culvert Design Report
Culvert 160 (28+800)

Design:Trial-1

Solve For: Headwater Elevation

Culvert Summary			
Allowable HW Elevation	328.20 m	Storm Event	Design
Computed Headwater Elevation	327.04 m	Discharge	1.4300 m³/s
Headwater Depth/ Height	0.85	Tailwater Elevation	326.32 m
Inlet Control HW Elev	326.96 m	Control Type	Outlet Control
Outlet Control HW Elev	327.04 m		

Grades			
Upstream Invert	326.00 m	Downstream Invert	325.60 m
Length	100.00 m	Constructed Slope	0.004000 m/m

Hydraulic Profile			
Profile	CompositeS1S2	Depth, Downstream	0.72 m
Slope Type	Steep	Normal Depth	0.65 m
Flow Regime	N/A	Critical Depth	0.65 m
Velocity Downstream	1.99 m/s	Critical Slope	0.003988 m/m

Section			
Section Shape	Circular	Mannings Coefficient	0.013
Section Material	Concrete	Span	1.22 m
Section Size	1200 mm(MTO)	Rise	1.22 m
Number Sections	1		

Outlet Control Properties			
Outlet Control HW Elev	327.04 m	Upstream Velocity Head	0.26 m
Ke	0.50	Entrance Loss	0.13 m

Inlet Control Properties			
Inlet Control HW Elev	326.96 m	Flow Control	N/A
Inlet Type	Square edge w/headwall	Area Full	1.2 m²
K	0.00980	HDS 5 Chart	1
M	2.00000	HDS 5 Scale	1
C	0.03980	Equation Form	1
Y	0.67000		

Culvert Design Report
Culvert 160 (28+800)

Design:Trial-2

Solve For: Headwater Elevation

Culvert Summary			
Allowable HW Elevation	328.20 m	Storm Event	Check
Computed Headwater Elevation	327.14 m	Discharge	1.6700 m³/s
Headwater Depth/ Height	0.93	Tailwater Elevation	326.32 m
Inlet Control HW Elev	327.06 m	Control Type	Outlet Control
Outlet Control HW Elev	327.14 m		

Grades			
Upstream Invert	326.00 m	Downstream Invert	325.60 m
Length	100.00 m	Constructed Slope	0.004000 m/m

Hydraulic Profile			
Profile	M1	Depth, Downstream	0.72 m
Slope Type	Mild	Normal Depth	0.72 m
Flow Regime	Subcritical	Critical Depth	0.71 m
Velocity Downstream	2.33 m/s	Critical Slope	0.004187 m/m

Section			
Section Shape	Circular	Mannings Coefficient	0.013
Section Material	Concrete	Span	1.22 m
Section Size	1200 mm(MTO)	Rise	1.22 m
Number Sections	1		

Outlet Control Properties			
Outlet Control HW Elev	327.14 m	Upstream Velocity Head	0.28 m
Ke	0.50	Entrance Loss	0.14 m

Inlet Control Properties			
Inlet Control HW Elev	327.06 m	Flow Control	N/A
Inlet Type	Square edge w/headwall	Area Full	1.2 m²
K	0.00980	HDS 5 Chart	1
M	2.00000	HDS 5 Scale	1
C	0.03980	Equation Form	1
Y	0.67000		

Culvert Design Report
Culvert 170 (30+100)

Peak Discharge Method: User-Specified			
Design Discharge	0.9200 m³/s	Check Discharge	1.0800 m³/s

Grades Model: Inverts			
Invert Upstream	330.00 m	Invert Downstream	329.50 m
Length	60.00 m	Slope	0.008333 m/m
Drop	0.50 m		

Headwater Model: Maximum Allowable HW	
Headwater Elevation	333.00 m

Tailwater Conditions: Constant Tailwater	
Tailwater Elevation	330.22 m

	Name	Desc	Discharge	HW Elev	Velocity
x	Trial-1	1-1200 mm(MTO) Circular	0.9200 m³/s	330.81 m	1.28 m/s
	Trial-2	1-1200 mm(MTO) Circular	1.0800 m³/s	330.89 m	1.51 m/s

McCormick Rankin Corporation
37 Brookside Road Waterbury, CT 06708 USA (203) 755-1666

Culvert Design Report
Culvert 170 (30+100)

Design:Trial-1

Solve For: Headwater Elevation

Culvert Summary					
Allowable HW Elevation	333.00	m	Storm Event	Design	
Computed Headwater Elevation	330.81	m	Discharge	0.9200	m³/s
Headwater Depth/ Height	0.66		Tailwater Elevation	330.22	m
Inlet Control HW Elev	330.73	m	Control Type	Outlet Control	
Outlet Control HW Elev	330.81	m			

Grades					
Upstream Invert	330.00	m	Downstream Invert	329.50	m
Length	60.00	m	Constructed Slope	0.008333	m/m

Hydraulic Profile					
Profile	CompositeS1S2		Depth, Downstream	0.72	m
Slope Type	Steep		Normal Depth	0.41	m
Flow Regime	N/A		Critical Depth	0.52	m
Velocity Downstream	1.28	m/s	Critical Slope	0.003666	m/m

Section					
Section Shape	Circular		Mannings Coefficient	0.013	
Section Material	Concrete		Span	1.22	m
Section Size	1200 mm(MTO)		Rise	1.22	m
Number Sections	1				

Outlet Control Properties					
Outlet Control HW Elev	330.81	m	Upstream Velocity Head	0.20	m
Ke	0.50		Entrance Loss	0.10	m

Inlet Control Properties					
Inlet Control HW Elev	330.73	m	Flow Control	N/A	
Inlet Type	Square edge w/headwall		Area Full	1.2	m²
K	0.00980		HDS 5 Chart	1	
M	2.00000		HDS 5 Scale	1	
C	0.03980		Equation Form	1	
Y	0.67000				

McCormick Rankin Corporation 37 Brookside Road Waterbury, CT 06708 USA (203) 755-1666

Culvert Design Report
Culvert 170 (30+100)

Design:Trial-2

Solve For: Headwater Elevation

Culvert Summary			
Allowable HW Elevation	333.00 m	Storm Event	Check
Computed Headwater Elevation	330.89 m	Discharge	1.0800 m³/s
Headwater Depth/ Height	0.73	Tailwater Elevation	330.22 m
Inlet Control HW Elev	330.80 m	Control Type	Outlet Control
Outlet Control HW Elev	330.89 m		

Grades			
Upstream Invert	330.00 m	Downstream Invert	329.50 m
Length	60.00 m	Constructed Slope	0.008333 m/m

Hydraulic Profile			
Profile	CompositeS1S2	Depth, Downstream	0.72 m
Slope Type	Steep	Normal Depth	0.45 m
Flow Regime	N/A	Critical Depth	0.56 m
Velocity Downstream	1.51 m/s	Critical Slope	0.003752 m/m

Section			
Section Shape	Circular	Mannings Coefficient	0.013
Section Material	Concrete	Span	1.22 m
Section Size	1200 mm(MTO)	Rise	1.22 m
Number Sections	1		

Outlet Control Properties			
Outlet Control HW Elev	330.89 m	Upstream Velocity Head	0.22 m
Ke	0.50	Entrance Loss	0.11 m

Inlet Control Properties			
Inlet Control HW Elev	330.80 m	Flow Control	N/A
Inlet Type	Square edge w/headwall	Area Full	1.2 m²
K	0.00980	HDS 5 Chart	1
M	2.00000	HDS 5 Scale	1
C	0.03980	Equation Form	1
Y	0.67000		

McCormick Rankin Corporation 37 Brookside Road Waterbury, CT 06708 USA (203) 755-1666

Culvert Design Report
Culvert 180 (31+830)

Peak Discharge Method: User-Specified			
Design Discharge	4.4400 m³/s	Check Discharge	5.1100 m³/s
Grades Model: Inverts			
Invert Upstream	329.50 m	Invert Downstream	329.00 m
Length	80.00 m	Slope	0.006250 m/m
Drop	0.50 m		
Headwater Model: Maximum Allowable HW			
Headwater Elevation	336.00 m		
Tailwater Conditions: Constant Tailwater			
Tailwater Elevation	330.08 m		

	Name	Desc	Discharge	HW Elev	Velocity
x	Trial-1	1-1800 mm(MTO) Circular	4.4400 m³/s	331.17 m	2.75 m/s
	Trial-2	1-1800 mm(MTO) Circular	5.1100 m³/s	331.32 m	3.66 m/s

McCormick Rankin Corporation
37 Brookside Road Waterbury, CT 06708 USA (203) 755-1666

Culvert Design Report
Culvert 180 (31+830)

Design:Trial-1

Solve For: Headwater Elevation

Culvert Summary					
Allowable HW Elevation	336.00	m	Storm Event	Design	
Computed Headwater Elevation	331.17	m	Discharge	4.4400	m³/s
Headwater Depth/ Height	0.92		Tailwater Elevation	330.08	m
Inlet Control HW Elev	331.05	m	Control Type	Outlet Control	
Outlet Control HW Elev	331.17	m			

Grades					
Upstream Invert	329.50	m	Downstream Invert	329.00	m
Length	80.00	m	Constructed Slope	0.006250	m/m

Hydraulic Profile					
Profile	CompositeS1S2		Depth, Downstream	1.08	m
Slope Type	Steep		Normal Depth	0.88	m
Flow Regime	N/A		Critical Depth	1.04	m
Velocity Downstream	2.75	m/s	Critical Slope	0.003612	m/m

Section					
Section Shape	Circular		Mannings Coefficient	0.013	
Section Material	Concrete		Span	1.83	m
Section Size	1800 mm(MTO)		Rise	1.83	m
Number Sections	1				

Outlet Control Properties					
Outlet Control HW Elev	331.17	m	Upstream Velocity Head	0.42	m
Ke	0.50		Entrance Loss	0.21	m

Inlet Control Properties					
Inlet Control HW Elev	331.05	m	Flow Control	N/A	
Inlet Type	Square edge w/headwall		Area Full	2.6	m²
K	0.00980		HDS 5 Chart	1	
M	2.00000		HDS 5 Scale	1	
C	0.03980		Equation Form	1	
Y	0.67000				

Culvert Design Report
Culvert 180 (31+830)

Design:Trial-2

Solve For: Headwater Elevation

Culvert Summary			
Allowable HW Elevation	336.00 m	Storm Event	Check
Computed Headwater Elevation	331.32 m	Discharge	5.1100 m³/s
Headwater Depth/ Height	1.00	Tailwater Elevation	330.08 m
Inlet Control HW Elev	331.20 m	Control Type	Outlet Control
Outlet Control HW Elev	331.32 m		

Grades			
Upstream Invert	329.50 m	Downstream Invert	329.00 m
Length	80.00 m	Constructed Slope	0.006250 m/m

Hydraulic Profile			
Profile	S2	Depth, Downstream	0.96 m
Slope Type	Steep	Normal Depth	0.96 m
Flow Regime	Supercritical	Critical Depth	1.12 m
Velocity Downstream	3.66 m/s	Critical Slope	0.003811 m/m

Section			
Section Shape	Circular	Mannings Coefficient	0.013
Section Material	Concrete	Span	1.83 m
Section Size	1800 mm(MTO)	Rise	1.83 m
Number Sections	1		

Outlet Control Properties			
Outlet Control HW Elev	331.32 m	Upstream Velocity Head	0.47 m
Ke	0.50	Entrance Loss	0.24 m

Inlet Control Properties			
Inlet Control HW Elev	331.20 m	Flow Control	N/A
Inlet Type	Square edge w/headwall	Area Full	2.6 m²
K	0.00980	HDS 5 Chart	1
M	2.00000	HDS 5 Scale	1
C	0.03980	Equation Form	1
Y	0.67000		

Culvert Design Report
Culvert 180 (31+830) Regional Storm

Peak Discharge Method: User-Specified			
Design Discharge	14.1300 m³/s	Check Discharge	0.0000 m³/s
Grades Model: Inverts			
Invert Upstream	329.50 m	Invert Downstream	329.00 m
Length	80.00 m	Slope	0.006250 m/m
Drop	0.50 m		
Headwater Model: Maximum Allowable HW			
Headwater Elevation	336.00 m		
Tailwater Conditions: Constant Tailwater			
Tailwater Elevation	330.08 m		

	Name	Desc	Discharge	HW Elev	Velocity
x	Trial-1	1-1800 mm(MTO) Circular	14.1300 m³/s	334.50 m	5.50 m/s

Culvert Design Report
Culvert 180 (31+830) Regional Storm

Design:Trial-1

Solve For: Headwater Elevation

Culvert Summary					
Allowable HW Elevation	336.00	m	Storm Event	Design	
Computed Headwater Elevation	334.50	m	Discharge	14.1300	m³/s
Headwater Depth/ Height	2.73		Tailwater Elevation	330.08	m
Inlet Control HW Elev	334.50	m	Control Type	Inlet Control	
Outlet Control HW Elev	334.11	m			

Gfades					
Upstream Invert	329.50	m	Downstream Invert	329.00	m
Length	80.00	m	Constructed Slope	0.006250	m/m

Hydraulic Profile					
Profile	CompositeM2Pressure		Depth, Downstream	1.73	m
Slope Type	Mild		Normal Depth	N/A	m
Flow Regime	Subcritical		Critical Depth	1.73	m
Velocity Downstream	5.50	m/s	Critical Slope	0.012007	m/m

Section					
Section Shape	Circular		Mannings Coefficient	0.013	
Section Material	Concrete		Span	1.83	m
Section Size	1800 mm(MTO)		Rise	1.83	m
Number Sections	1				

Outlet Control Properties					
Outlet Control HW Elev	334.11	m	Upstream Velocity Head	1.48	m
Ke	0.50		Entrance Loss	0.74	m

Inlet Control Properties					
Inlet Control HW Elev	334.50	m	Flow Control	N/A	
Inlet Type	Square edge w/headwall		Area Full	2.6	m²
K	0.00980		HDS 5 Chart	1	
M	2.00000		HDS 5 Scale	1	
C	0.03980		Equation Form	1	
Y	0.67000				

McCormick Rankin Corporation
37 Brookside Road Waterbury, CT 06708 USA (203) 755-1666

Culvert Design Report
Culvert 192 (33+220 EBL)

Peak Discharge Method: User-Specified			
Design Discharge	0.9800 m³/s	Check Discharge	1.1400 m³/s
Grades Model: Inverts			
Invert Upstream	326.00 m	Invert Downstream	325.80 m
Length	20.00 m	Slope	0.010000 m/m
Drop	0.20 m		
Headwater Model: Maximum Allowable HW			
Headwater Elevation	328.50 m		
Tailwater Conditions: Constant Tailwater			
Tailwater Elevation	326.52 m		

	Name	Desc	Discharge	HW Elev	Velocity
x	Trial-1	1-1200 mm(MTO) Circular	0.9800 m³/s	326.84 m	1.37 m/s
	Trial-2	1-1200 mm(MTO) Circular	1.1400 m³/s	326.91 m	1.59 m/s

McCormick Rankin Corporation
37 Brookside Road Waterbury, CT 06708 USA (203) 755-1666

Culvert Design Report
Culvert 192 (33+220 EBL)

Design:Trial-1

Solve For: Headwater Elevation

Culvert Summary					
Allowable HW Elevation	328.50	m	Storm Event	Design	
Computed Headwater Elevation	326.84	m	Discharge	0.9800	m³/s
Headwater Depth/ Height	0.69		Tailwater Elevation	326.52	m
Inlet Control HW Elev	326.75	m	Control Type	Outlet Control	
Outlet Control HW Elev	326.84	m			

Grades					
Upstream Invert	326.00	m	Downstream Invert	325.80	m
Length	20.00	m	Constructed Slope	0.010000	m/m

Hydraulic Profile					
Profile	CompositeS1S2		Depth, Downstream	0.72	m
Slope Type	Steep		Normal Depth	0.41	m
Flow Regime	N/A		Critical Depth	0.53	m
Velocity Downstream	1.37	m/s	Critical Slope	0.003696	m/m

Section					
Section Shape	Circular		Mannings Coefficient	0.013	
Section Material	Concrete		Span	1.22	m
Section Size	1200 mm(MTO)		Rise	1.22	m
Number Sections	1				

Outlet Control Properties					
Outlet Control HW Elev	326.84	m	Upstream Velocity Head	0.20	m
Ke	0.50		Entrance Loss	0.10	m

Inlet Control Properties					
Inlet Control HW Elev	326.75	m	Flow Control	N/A	
Inlet Type	Square edge w/headwall		Area Full	1.2	m²
K	0.00980		HDS 5 Chart	1	
M	2.00000		HDS 5 Scale	1	
C	0.03980		Equation Form	1	
Y	0.67000				

Culvert Design Report
Culvert 192 (33+220 EBL)

Design:Trial-2

Solve For: Headwater Elevation

Culvert Summary					
Allowable HW Elevation	328.50	m	Storm Event	Check	
Computed Headwater Elevation	326.91	m	Discharge	1.1400	m³/s
Headwater Depth/ Height	0.75		Tailwater Elevation	326.52	m
Inlet Control HW Elev	326.83	m	Control Type	Outlet Control	
Outlet Control HW Elev	326.91	m			

Grades					
Upstream Invert	326.00	m	Downstream Invert	325.80	m
Length	20.00	m	Constructed Slope	0.010000	m/m

Hydraulic Profile					
Profile	CompositeS1S2		Depth, Downstream	0.72	m
Slope Type	Steep		Normal Depth	0.44	m
Flow Regime	N/A		Critical Depth	0.58	m
Velocity Downstream	1.59	m/s	Critical Slope	0.003786	m/m

Section					
Section Shape	Circular		Mannings Coefficient	0.013	
Section Material	Concrete		Span	1.22	m
Section Size	1200 mm(MTO)		Rise	1.22	m
Number Sections	1				

Outlet Control Properties					
Outlet Control HW Elev	326.91	m	Upstream Velocity Head	0.22	m
Ke	0.50		Entrance Loss	0.11	m

Inlet Control Properties					
Inlet Control HW Elev	326.83	m	Flow Control	N/A	
Inlet Type	Square edge w/headwall		Area Full	1.2	m²
K	0.00980		HDS 5 Chart	1	
M	2.00000		HDS 5 Scale	1	
C	0.03980		Equation Form	1	
Y	0.67000				

Culvert Design Report
Culvert 204 (35+130 EBL)

Peak Discharge Method: User-Specified			
Design Discharge	1.1500 m³/s	Check Discharge	1.3100 m³/s
Grades Model: Inverts			
Invert Upstream	339.25 m	Invert Downstream	339.20 m
Length	20.00 m	Slope	0.002500 m/m
Drop	0.05 m		
Headwater Model: Maximum Allowable HW			
Headwater Elevation	341.00 m		
Tailwater Conditions: Constant Tailwater			
Tailwater Elevation	339.92 m		

	Name	Desc	Discharge	HW Elev	Velocity
x	Trial-1	1-1200 mm(MTO) Circular	1.1500 m³/s	340.16 m	1.60 m/s
	Trial-2	1-1200 mm(MTO) Circular	1.3100 m³/s	340.22 m	1.83 m/s

McCormick Rankin Corporation
37 Brookside Road Waterbury, CT 06708 USA (203) 755-1666

Culvert Design Report
Culvert 204 (35+130 EBL)

Design:Trial-1

Solve For: Headwater Elevation

Culvert Summary			
Allowable HW Elevation	341.00 m	Storm Event	Design
Computed Headwater Elevation	340.16 m	Discharge	1.1500 m³/s
Headwater Depth/ Height	0.75	Tailwater Elevation	339.92 m
Inlet Control HW Elev	340.08 m	Control Type	Outlet Control
Outlet Control HW Elev	340.16 m		

Grades			
Upstream Invert	339.25 m	Downstream Invert	339.20 m
Length	20.00 m	Constructed Slope	0.002500 m/m

Hydraulic Profile			
Profile	M1	Depth, Downstream	0.72 m
Slope Type	Mild	Normal Depth	0.66 m
Flow Regime	Subcritical	Critical Depth	0.58 m
Velocity Downstream	1.60 m/s	Critical Slope	0.003793 m/m

Section			
Section Shape	Circular	Mannings Coefficient	0.013
Section Material	Concrete	Span	1.22 m
Section Size	1200 mm(MTO)	Rise	1.22 m
Number Sections	1		

Outlet Control Properties			
Outlet Control HW Elev	340.16 m	Upstream Velocity Head	0.14 m
Ke	0.50	Entrance Loss	0.07 m

Inlet Control Properties			
Inlet Control HW Elev	340.08 m	Flow Control	N/A
Inlet Type	Square edge w/headwall	Area Full	1.2 m²
K	0.00980	HDS 5 Chart	1
M	2.00000	HDS 5 Scale	1
C	0.03980	Equation Form	1
Y	0.67000		

Culvert Design Report
Culvert 204 (35+130 EBL)

Design:Trial-2

Solve For: Headwater Elevation

Culvert Summary			
Allowable HW Elevation	341.00 m	Storm Event	Check
Computed Headwater Elevation	340.22 m	Discharge	1.3100 m³/s
Headwater Depth/ Height	0.80	Tailwater Elevation	339.92 m
Inlet Control HW Elev	340.15 m	Control Type	Outlet Control
Outlet Control HW Elev	340.22 m		

Grades			
Upstream Invert	339.25 m	Downstream Invert	339.20 m
Length	20.00 m	Constructed Slope	0.002500 m/m

Hydraulic Profile			
Profile	M1	Depth, Downstream	0.72 m
Slope Type	Mild	Normal Depth	0.71 m
Flow Regime	Subcritical	Critical Depth	0.62 m
Velocity Downstream	1.83 m/s	Critical Slope	0.003900 m/m

Section			
Section Shape	Circular	Mannings Coefficient	0.013
Section Material	Concrete	Span	1.22 m
Section Size	1200 mm(MTO)	Rise	1.22 m
Number Sections	1		

Outlet Control Properties			
Outlet Control HW Elev	340.22 m	Upstream Velocity Head	0.17 m
Ke	0.50	Entrance Loss	0.09 m

Inlet Control Properties			
Inlet Control HW Elev	340.15 m	Flow Control	N/A
Inlet Type	Square edge w/headwall	Area Full	1.2 m²
K	0.00980	HDS 5 Chart	1
M	2.00000	HDS 5 Scale	1
C	0.03980	Equation Form	1
Y	0.67000		

Culvert Design Report
Culvert 250 (35+980)

Peak Discharge Method: User-Specified			
Design Discharge	2.7600 m³/s	Check Discharge	3.1800 m³/s
Grades Model: Inverts			
Invert Upstream	341.40 m	Invert Downstream	341.00 m
Length	58.00 m	Slope	0.006897 m/m
Drop	0.40 m		
Headwater Model: Maximum Allowable HW			
Headwater Elevation	344.00 m		
Tailwater Conditions: Constant Tailwater			
Tailwater Elevation	341.90 m		

	Name	Desc	Discharge	HW Elev	Velocity
x	Trial-1	1-1500 mm(MTO) Circular	2.7600 m³/s	342.78 m	2.46 m/s
	Trial-2	1-1500 mm(MTO) Circular	3.1800 m³/s	342.90 m	3.35 m/s

Culvert Design Report
Culvert 250 (35+980)

Design:Trial-1

Solve For: Headwater Elevation

Culvert Summary					
Allowable HW Elevation	344.00	m	Storm Event	Design	
Computed Headwater Elevation	342.78	m	Discharge	2.7600	m³/s
Headwater Depth/ Height	0.91		Tailwater Elevation	341.90	m
Inlet Control HW Elev	342.67	m	Control Type	Outlet Control	
Outlet Control HW Elev	342.78	m			

Grades					
Upstream Invert	341.40	m	Downstream Invert	341.00	m
Length	58.00	m	Constructed Slope	0.006897	m/m

Hydraulic Profile					
Profile	CompositeS1S2		Depth, Downstream	0.90	m
Slope Type	Steep		Normal Depth	0.72	m
Flow Regime	N/A		Critical Depth	0.86	m
Velocity Downstream	2.46	m/s	Critical Slope	0.003814	m/m

Section					
Section Shape	Circular		Mannings Coefficient	0.013	
Section Material	Concrete		Span	1.52	m
Section Size	1500 mm(MTO)		Rise	1.52	m
Number Sections	1				

Outlet Control Properties					
Outlet Control HW Elev	342.78	m	Upstream Velocity Head	0.35	m
Ke	0.50		Entrance Loss	0.17	m

Inlet Control Properties					
Inlet Control HW Elev	342.67	m	Flow Control	N/A	
Inlet Type	Square edge w/headwall		Area Full	1.8	m²
K	0.00980		HDS 5 Chart	1	
M	2.00000		HDS 5 Scale	1	
C	0.03980		Equation Form	1	
Y	0.67000				

Culvert Design Report
Culvert 250 (35+980)

Design:Trial-2

Solve For: Headwater Elevation

Culvert Summary			
Allowable HW Elevation	344.00 m	Storm Event	Check
Computed Headwater Elevation	342.90 m	Discharge	3.1800 m³/s
Headwater Depth/ Height	0.99	Tailwater Elevation	341.90 m
Inlet Control HW Elev	342.80 m	Control Type	Outlet Control
Outlet Control HW Elev	342.90 m		

Grades			
Upstream Invert	341.40 m	Downstream Invert	341.00 m
Length	58.00 m	Constructed Slope	0.006897 m/m

Hydraulic Profile			
Profile	S2	Depth, Downstream	0.79 m
Slope Type	Steep	Normal Depth	0.78 m
Flow Regime	Supercritical	Critical Depth	0.92 m
Velocity Downstream	3.35 m/s	Critical Slope	0.004019 m/m

Section			
Section Shape	Circular	Mannings Coefficient	0.013
Section Material	Concrete	Span	1.52 m
Section Size	1500 mm(MTO)	Rise	1.52 m
Number Sections	1		

Outlet Control Properties			
Outlet Control HW Elev	342.90 m	Upstream Velocity Head	0.39 m
Ke	0.50	Entrance Loss	0.19 m

Inlet Control Properties			
Inlet Control HW Elev	342.80 m	Flow Control	N/A
Inlet Type	Square edge w/headwall	Area Full	1.8 m²
K	0.00980	HDS 5 Chart	1
M	2.00000	HDS 5 Scale	1
C	0.03980	Equation Form	1
Y	0.67000		

Culvert Design Report
Culvert 250 (35+980) Regional Storm

Peak Discharge Method: User-Specified			
Design Discharge	11.6000 m³/s	Check Discharge	0.0000 m³/s
Grades Model: Inverts			
Invert Upstream	341.40 m	Invert Downstream	341.00 m
Length	58.00 m	Slope	0.006897 m/m
Drop	0.40 m		
Headwater Model: Maximum Allowable HW			
Headwater Elevation	344.00 m		
Tailwater Conditions: Constant Tailwater			
Tailwater Elevation	341.90 m		

	Name	Desc	Discharge	HW Elev	Velocity
x	Trial-1	1-3000 x 1800 mm(MTO) Box	11.6000 m³/s	343.53 m	4.18 m/s

Culvert Design Report
Culvert 250 (35+980) Regional Storm

Design:Trial-1

Solve For: Headwater Elevation

Culvert Summary					
Allowable HW Elevation	344.00	m	Storm Event	Design	
Computed Headwater Elevation	343.53	m	Discharge	11.6000	m³/s
Headwater Depth/ Height	1.18		Tailwater Elevation	341.90	m
Inlet Control HW Elev	343.36	m	Control Type	Outlet Control	
Outlet Control HW Elev	343.53	m			

Grades					
Upstream Invert	341.40	m	Downstream Invert	341.00	m
Length	58.00	m	Constructed Slope	0.006897	m/m

Hydraulic Profile					
Profile	S2		Depth, Downstream	0.93	m
Slope Type	Steep		Normal Depth	0.89	m
Flow Regime	Supercritical		Critical Depth	1.15	m
Velocity Downstream	4.18	m/s	Critical Slope	0.003380	m/m

Section					
Section Shape	Box		Mannings Coefficient	0.013	
Section Material	Concrete		Span	3.00	m
Section Size	3000 x 1800 mm(MTO)		Rise	1.80	m
Number Sections	1				

Outlet Control Properties					
Outlet Control HW Elev	343.53	m	Upstream Velocity Head	0.58	m
Ke	0.70		Entrance Loss	0.40	m

Inlet Control Properties					
Inlet Control HW Elev	343.36	m	Flow Control	N/A	
Inlet Type	Square edge projecting		Area Full	5.4	m²
K	0.06100		HDS 5 Chart	8	
M	0.75000		HDS 5 Scale	2	
C	0.04000		Equation Form	1	
Y	0.80000				

McCormick Rankin Corporation
37 Brookside Road Waterbury, CT 06708 USA (203) 755-1666

Culvert Design Report
Culvert 301 (37+250 EBL)

Peak Discharge Method: User-Specified			
Design Discharge	1.8500 m³/s	Check Discharge	2.0600 m³/s
Grades Model: Inverts			
Invert Upstream	340.95 m	Invert Downstream	340.90 m
Length	20.00 m	Slope	0.002500 m/m
Drop	0.05 m		
Headwater Model: Maximum Allowable HW			
Headwater Elevation	343.00 m		
Tailwater Conditions: Constant Tailwater			
Tailwater Elevation	341.83 m		

	Name	Desc	Discharge	HW Elev	Velocity
x	Trial-1	2-1200 mm(MTO) Circular	1.8500 m³/s	341.92 m	0.97 m/s
	Trial-2	2-1200 mm(MTO) Circular	2.0600 m³/s	341.94 m	1.08 m/s

McCormick Rankin Corporation
37 Brookside Road Waterbury, CT 06708 USA (203) 755-1666

Culvert Design Report
Culvert 301 (37+250 EBL)

Design:Trial-1

Solve For: Headwater Elevation

Culvert Summary					
Allowable HW Elevation	343.00	m	Storm Event	Design	
Computed Headwater Elevation	341.92	m	Discharge	1.8500	m³/s
Headwater Depth/ Height	0.79		Tailwater Elevation	341.83	m
Inlet Control HW Elev	341.83	m	Control Type	Outlet Control	
Outlet Control HW Elev	341.92	m			

Grades					
Upstream Invert	340.95	m	Downstream Invert	340.90	m
Length	20.00	m	Constructed Slope	0.002500	m/m

Hydraulic Profile					
Profile	M1		Depth, Downstream	0.93	m
Slope Type	Mild		Normal Depth	0.58	m
Flow Regime	Subcritical		Critical Depth	0.52	m
Velocity Downstream	0.97	m/s	Critical Slope	0.003669	m/m

Section					
Section Shape	Circular		Mannings Coefficient	0.013	
Section Material	Concrete		Span	1.22	m
Section Size	1200 mm(MTO)		Rise	1.22	m
Number Sections	2				

Outlet Control Properties					
Outlet Control HW Elev	341.92	m	Upstream Velocity Head	0.05	m
Ke	0.50		Entrance Loss	0.03	m

Inlet Control Properties					
Inlet Control HW Elev	341.83	m	Flow Control	N/A	
Inlet Type	Square edge w/headwall		Area Full	2.3	m²
K	0.00980		HDS 5 Chart	1	
M	2.00000		HDS 5 Scale	1	
C	0.03980		Equation Form	1	
Y	0.67000				

Culvert Design Report
Culvert 301 (37+250 EBL)

Design:Trial-2

Solve For: Headwater Elevation

Culvert Summary					
Allowable HW Elevation	343.00	m	Storm Event	Check	
Computed Headwater Elevation	341.94	m	Discharge	2.0600	m³/s
Headwater Depth/ Height	0.81		Tailwater Elevation	341.83	m
Inlet Control HW Elev	341.83	m	Control Type	Outlet Control	
Outlet Control HW Elev	341.94	m			

Grades					
Upstream Invert	340.95	m	Downstream Invert	340.90	m
Length	20.00	m	Constructed Slope	0.002500	m/m

Hydraulic Profile					
Profile	M1		Depth, Downstream	0.93	m
Slope Type	Mild		Normal Depth	0.61	m
Flow Regime	Subcritical		Critical Depth	0.55	m
Velocity Downstream	1.08	m/s	Critical Slope	0.003723	m/m

Section					
Section Shape	Circular		Mannings Coefficient	0.013	
Section Material	Concrete		Span	1.22	m
Section Size	1200 mm(MTO)		Rise	1.22	m
Number Sections	2				

Outlet Control Properties					
Outlet Control HW Elev	341.94	m	Upstream Velocity Head	0.06	m
Ke	0.50		Entrance Loss	0.03	m

Inlet Control Properties					
Inlet Control HW Elev	341.83	m	Flow Control	N/A	
Inlet Type	Square edge w/headwall		Area Full	2.3	m²
K	0.00980		HDS 5 Chart	1	
M	2.00000		HDS 5 Scale	1	
C	0.03980		Equation Form	1	
Y	0.67000				

Culvert Design Report
Culvert 302 (37+250 WBL)

Peak Discharge Method: User-Specified			
Design Discharge	2.3600 m³/s	Check Discharge	2.6300 m³/s

Grades Model: Inverts			
Invert Upstream	340.85 m	Invert Downstream	340.80 m
Length	20.00 m	Slope	0.002500 m/m
Drop	0.05 m		

Headwater Model: Maximum Allowable HW	
Headwater Elevation	343.00 m

Tailwater Conditions: Constant Tailwater	
Tailwater Elevation	341.52 m

	Name	Desc	Discharge	HW Elev	Velocity
x	Trial-1	2-1200 mm(MTO) Circular	2.3600 m³/s	341.77 m	1.64 m/s
	Trial-2	2-1200 mm(MTO) Circular	2.6300 m³/s	341.83 m	1.83 m/s

Culvert Design Report
Culvert 302 (37+250 WBL)

Design:Trial-1

Solve For: Headwater Elevation

Culvert Summary			
Allowable HW Elevation	343.00 m	Storm Event	Design
Computed Headwater Elevation	341.77 m	Discharge	2.3600 m³/s
Headwater Depth/ Height	0.76	Tailwater Elevation	341.52 m
Inlet Control HW Elev	341.70 m	Control Type	Outlet Control
Outlet Control HW Elev	341.77 m		

Grades			
Upstream Invert	340.85 m	Downstream Invert	340.80 m
Length	20.00 m	Constructed Slope	0.002500 m/m

Hydraulic Profile			
Profile	M1	Depth, Downstream	0.72 m
Slope Type	Mild	Normal Depth	0.67 m
Flow Regime	Subcritical	Critical Depth	0.59 m
Velocity Downstream	1.64 m/s	Critical Slope	0.003812 m/m

Section			
Section Shape	Circular	Mannings Coefficient	0.013
Section Material	Concrete	Span	1.22 m
Section Size	1200 mm(MTO)	Rise	1.22 m
Number Sections	2		

Outlet Control Properties			
Outlet Control HW Elev	341.77 m	Upstream Velocity Head	0.15 m
Ke	0.50	Entrance Loss	0.07 m

Inlet Control Properties			
Inlet Control HW Elev	341.70 m	Flow Control	N/A
Inlet Type	Square edge w/headwall	Area Full	2.3 m²
K	0.00980	HDS 5 Chart	1
M	2.00000	HDS 5 Scale	1
C	0.03980	Equation Form	1
Y	0.67000		

Culvert Design Report
Culvert 302 (37+250 WBL)

Design:Trial-2

Solve For: Headwater Elevation

Culvert Summary			
Allowable HW Elevation	343.00 m	Storm Event	Check
Computed Headwater Elevation	341.83 m	Discharge	2.6300 m³/s
Headwater Depth/ Height	0.80	Tailwater Elevation	341.52 m
Inlet Control HW Elev	341.76 m	Control Type	Outlet Control
Outlet Control HW Elev	341.83 m		

Grades			
Upstream Invert	340.85 m	Downstream Invert	340.80 m
Length	20.00 m	Constructed Slope	0.002500 m/m

Hydraulic Profile			
Profile	M1	Depth, Downstream	0.72 m
Slope Type	Mild	Normal Depth	0.71 m
Flow Regime	Subcritical	Critical Depth	0.62 m
Velocity Downstream	1.83 m/s	Critical Slope	0.003903 m/m

Section			
Section Shape	Circular	Mannings Coefficient	0.013
Section Material	Concrete	Span	1.22 m
Section Size	1200 mm(MTO)	Rise	1.22 m
Number Sections	2		

Outlet Control Properties			
Outlet Control HW Elev	341.83 m	Upstream Velocity Head	0.17 m
Ke	0.50	Entrance Loss	0.09 m

Inlet Control Properties			
Inlet Control HW Elev	341.76 m	Flow Control	N/A
Inlet Type	Square edge w/headwall	Area Full	2.3 m²
K	0.00980	HDS 5 Chart	1
M	2.00000	HDS 5 Scale	1
C	0.03980	Equation Form	1
Y	0.67000		

Culvert Design Report
Culvert 304 (At Curtis)

Peak Discharge Method: User-Specified			
Design Discharge	1.8900 m³/s	Check Discharge	2.1800 m³/s
Grades Model: Inverts			
Invert Upstream	339.80 m	Invert Downstream	339.70 m
Length	45.00 m	Slope	0.002222 m/m
Drop	0.10 m		
Headwater Model: Maximum Allowable HW			
Headwater Elevation	342.50 m		
Tailwater Conditions: Constant Tailwater			
Tailwater Elevation	340.78 m		

	Name	Desc	Discharge	HW Elev	Velocity
x	Trial-1	1-1800 mm(MTO) Circular	1.8900 m³/s	340.92 m	1.17 m/s
	Trial-2	1-1800 mm(MTO) Circular	2.1800 m³/s	340.97 m	1.35 m/s

Culvert Design Report
Culvert 304 (At Curtis)

Design:Trial-1

Solve For: Headwater Elevation

Culvert Summary					
Allowable HW Elevation	342.50	m	Storm Event	Design	
Computed Headwater Elevation	340.92	m	Discharge	1.8900	m³/s
Headwater Depth/ Height	0.61		Tailwater Elevation	340.78	m
Inlet Control HW Elev	340.78	m	Control Type	Outlet Control	
Outlet Control HW Elev	340.92	m			

Grades					
Upstream Invert	339.80	m	Downstream Invert	339.70	m
Length	45.00	m	Constructed Slope	0.002222	m/m

Hydraulic Profile					
Profile	M1		Depth, Downstream	1.08	m
Slope Type	Mild		Normal Depth	0.73	m
Flow Regime	Subcritical		Critical Depth	0.66	m
Velocity Downstream	1.17	m/s	Critical Slope	0.003123	m/m

Section					
Section Shape	Circular		Mannings Coefficient	0.013	
Section Material	Concrete		Span	1.83	m
Section Size	1800 mm(MTO)		Rise	1.83	m
Number Sections	1				

Outlet Control Properties					
Outlet Control HW Elev	340.92	m	Upstream Velocity Head	0.09	m
Ke	0.50		Entrance Loss	0.04	m

Inlet Control Properties					
Inlet Control HW Elev	340.78	m	Flow Control	N/A	
Inlet Type	Square edge w/headwall		Area Full	2.6	m²
K	0.00980		HDS 5 Chart	1	
M	2.00000		HDS 5 Scale	1	
C	0.03980		Equation Form	1	
Y	0.67000				

Culvert Design Report
Culvert 304 (At Curtis)

Design:Trial-2

Solve For: Headwater Elevation

Culvert Summary			
Allowable HW Elevation	342.50 m	Storm Event	Check
Computed Headwater Elevation	340.97 m	Discharge	2.1800 m³/s
Headwater Depth/ Height	0.64	Tailwater Elevation	340.78 m
Inlet Control HW Elev	340.80 m	Control Type	Outlet Control
Outlet Control HW Elev	340.97 m		

Grades			
Upstream Invert	339.80 m	Downstream Invert	339.70 m
Length	45.00 m	Constructed Slope	0.002222 m/m

Hydraulic Profile			
Profile	M1	Depth, Downstream	1.08 m
Slope Type	Mild	Normal Depth	0.79 m
Flow Regime	Subcritical	Critical Depth	0.72 m
Velocity Downstream	1.35 m/s	Critical Slope	0.003154 m/m

Section			
Section Shape	Circular	Mannings Coefficient	0.013
Section Material	Concrete	Span	1.83 m
Section Size	1800 mm(MTO)	Rise	1.83 m
Number Sections	1		

Outlet Control Properties			
Outlet Control HW Elev	340.97 m	Upstream Velocity Head	0.11 m
Ke	0.50	Entrance Loss	0.06 m

Inlet Control Properties			
Inlet Control HW Elev	340.80 m	Flow Control	N/A
Inlet Type	Square edge w/headwall	Area Full	2.6 m²
K	0.00980	HDS 5 Chart	1
M	2.00000	HDS 5 Scale	1
C	0.03980	Equation Form	1
Y	0.67000		

APPENDIX E

Grassed Swales Evaluation Table

Table E-1 Grassed Swales Assessment

	Pavement	Shoulder + Rounding	Ditch + Others	
C 2-yr	0.9	0.5	0.25	
C 10-yr	0.95	0.6	0.3	
C 100-yr	0.95	0.75	0.4	Total
Outside DitchWidth (m)	3.75	4	27.25	35
Median Ditch Width (m)	7.5	6	16.5	30

Manning's n =	0.035

	Option 1				Option 2	
	Outside Ditch		Median Ditch		Outside Ditch	
	Left	Right	Left	Right	Left	Right
Side Slopes	3	3	4	4	3	3
Base Width	0		1		1	

Rainfall Parameters	Stratford Parameters		
Design Storm	A	B	C
2 - yr	722.952	7.503	0.862
10-yr	1289.329	9.016	0.817
100- yr	2159.346	11.382	0.841

Outside Ditch Option 1

Reach Length	Slope =	0.3 %		Slope =	0.5 %		Slope =	1 %		Slope =	1.5 %		Slope =	2 %	
	Q m3/s	Depth (m)	Velocity (m/s)	Q m3/s	Depth (m)	Velocity (m/s)	Q m3/s	Depth (m)	Velocity (m/s)	Q m3/s	Depth (m)	Velocity (m/s)	Q m3/s	Depth (m)	Velocity (m/s)
Ditch assesment for 25mm Storm															
100	0.098	0.282	0.409	0.098	0.257	0.496	0.098	0.226	0.644	0.098	0.209	0.749	0.098	0.198	0.834
200	0.153	0.334	0.458	0.159	0.308	0.560	0.166	0.275	0.734	0.170	0.257	0.859	0.172	0.244	0.960
300	0.194	0.364	0.485	0.206	0.339	0.597	0.221	0.306	0.788	0.229	0.287	0.926	0.234	0.274	1.037
400	0.225	0.386	0.504	0.244	0.361	0.622	0.267	0.328	0.826	0.279	0.309	0.973	0.287	0.296	1.092
500	0.252	0.402	0.518	0.275	0.378	0.642	0.306	0.345	0.855	0.323	0.327	1.009	0.335	0.314	1.134
600	0.274	0.415	0.530	0.303	0.392	0.657	0.341	0.359	0.878	0.362	0.341	1.038	0.377	0.328	1.168
800	0.336	0.448	0.557	0.373	0.424	0.693	0.425	0.390	0.928	0.454	0.371	1.099	0.475	0.358	1.238
1000	0.364	0.462	0.568	0.410	0.439	0.709	0.474	0.407	0.954	0.511	0.388	1.132	0.538	0.375	1.277
1200	0.387	0.473	0.577	0.440	0.451	0.722	0.515	0.420	0.974	0.560	0.402	1.158	0.593	0.389	1.308
Ditch assesment for 10 - yr Flow															
100	0.193	0.364	0.485	0.193	0.331	0.587	0.193	0.291	0.762	0.193	0.269	0.887	0.193	0.255	0.988
200	0.323	0.441	0.552	0.332	0.405	0.673	0.343	0.360	0.880	0.348	0.336	1.028	0.352	0.320	1.148
300	0.425	0.489	0.591	0.445	0.453	0.724	0.470	0.406	0.952	0.482	0.380	1.115	0.491	0.362	1.248
400	0.509	0.524	0.618	0.541	0.487	0.760	0.581	0.439	1.004	0.602	0.413	1.179	0.615	0.394	1.321
500	0.582	0.551	0.639	0.625	0.514	0.788	0.680	0.466	1.044	0.709	0.439	1.228	0.729	0.420	1.378
600	0.646	0.573	0.656	0.700	0.536	0.811	0.769	0.488	1.076	0.807	0.461	1.269	0.833	0.442	1.424
800	0.804	0.622	0.693	0.877	0.584	0.858	0.973	0.533	1.142	1.026	0.504	1.347	1.063	0.484	1.514
1000	0.894	0.647	0.712	0.986	0.610	0.883	1.110	0.560	1.180	1.180	0.531	1.395	1.229	0.511	1.570
1200	0.970	0.667	0.726	1.080	0.631	0.904	1.230	0.582	1.211	1.317	0.553	1.434	1.378	0.533	1.615
Ditch assesment for 100 - yr Flow															
100	0.285	0.422	0.535	0.285	0.383	0.648	0.285	0.336	0.840	0.285	0.312	0.978	0.285	0.296	1.090
200	0.493	0.517	0.613	0.504	0.474	0.747	0.518	0.421	0.975	0.525	0.392	1.139	0.529	0.373	1.272
300	0.662	0.578	0.660	0.689	0.533	0.808	0.721	0.476	1.059	0.737	0.445	1.240	0.748	0.424	1.387
400	0.806	0.622	0.693	0.850	0.577	0.851	0.902	0.518	1.120	0.929	0.486	1.314	0.947	0.463	1.471
500	0.932	0.657	0.719	0.992	0.611	0.885	1.066	0.552	1.168	1.106	0.518	1.372	1.132	0.495	1.538
600	1.044	0.686	0.740	1.121	0.640	0.912	1.217	0.580	1.208	1.269	0.546	1.421	1.303	0.522	1.593
800	1.309	0.746	0.783	1.414	0.698	0.967	1.550	0.634	1.283	1.623	0.598	1.511	1.673	0.574	1.698
1000	1.471	0.780	0.806	1.608	0.733	0.998	1.787	0.669	1.329	1.887	0.633	1.569	1.955	0.608	1.763
1200	1.611	0.807	0.825	1.777	0.761	1.024	1.998	0.698	1.367	2.124	0.662	1.616	2.210	0.637	1.818

Median ditch

Reach Length	Slope =	0.3 %		Slope =	0.5 %		Slope =	1 %		Slope =	1.5 %		Slope =	2 %	
	Q m3/s	Depth (m)	Velocity (m/s)	Q m3/s	Depth (m)	Velocity (m/s)	Q m3/s	Depth (m)	Velocity (m/s)	Q m3/s	Depth (m)	Velocity (m/s)	Q m3/s	Depth (m)	Velocity (m/s)
Ditch assesment for 25mm Storm															
100	0.171	0.215	0.430	0.171	0.189	0.517	0.171	0.158	0.663	0.171	0.142	0.767	0.171	0.132	0.850
200	0.271	0.269	0.486	0.281	0.241	0.592	0.292	0.207	0.770	0.298	0.189	0.897	0.302	0.177	0.999
300	0.345	0.302	0.519	0.366	0.274	0.635	0.391	0.239	0.833	0.404	0.220	0.974	0.412	0.207	1.088
400	0.405	0.325	0.541	0.435	0.298	0.665	0.474	0.263	0.877	0.494	0.243	1.029	0.508	0.230	1.152
500	0.454	0.343	0.557	0.494	0.317	0.688	0.546	0.282	0.911	0.574	0.262	1.072	0.594	0.248	1.202
600	0.496	0.358	0.570	0.545	0.332	0.706	0.609	0.297	0.938	0.646	0.277	1.106	0.671	0.263	1.241
800	0.609	0.393	0.602	0.674	0.366	0.746	0.762	0.330	0.995	0.812	0.309	1.175	0.847	0.294	1.321
1000	0.663	0.409	0.615	0.743	0.383	0.765	0.854	0.348	1.025	0.918	0.328	1.214	0.963	0.313	1.367
1200	0.709	0.422	0.626	0.801	0.397	0.780	0.932	0.362	1.049	1.010	0.342	1.244	1.065	0.328	1.403
Ditch assesment for 10 - yr Flow															
100	0.333	0.297	0.514	0.333	0.262	0.620	0.333	0.221	0.798	0.333	0.200	0.925	0.333	0.186	1.027
200	0.562	0.379	0.589	0.577	0.341	0.717	0.595	0.293	0.932	0.604	0.268	1.086	0.609	0.251	1.210
300	0.745	0.431	0.634	0.779	0.392	0.775	0.819	0.341	1.014	0.840	0.314	1.185	0.853	0.296	1.324
400	0.898	0.469	0.665	0.951	0.429	0.816	1.016	0.377	1.073	1.050	0.349	1.257	1.073	0.329	1.406
500	1.031	0.499	0.689	1.103	0.459	0.848	1.193	0.406	1.119	1.242	0.377	1.313	1.274	0.357	1.471
600	1.148	0.524	0.708	1.238	0.483	0.873	1.354	0.430	1.156	1.417	0.401	1.359	1.460	0.380	1.524
800	1.432	0.577	0.749	1.555	0.535	0.926	1.717	0.479	1.229	1.806	0.447	1.447	1.866	0.425	1.624
1000	1.599	0.606	0.771	1.756	0.564	0.955	1.966	0.509	1.272	2.085	0.477	1.502	2.166	0.455	1.688
1200	1.742	0.629	0.788	1.930	0.588	0.978	2.186	0.534	1.307	2.333	0.502	1.546	2.435	0.480	1.739
Ditch assesment for 100 - yr Flow															
100	0.474	0.350	0.564	0.474	0.311	0.680	0.474	0.263	0.878	0.474	0.238	1.018	0.474	0.222	1.131
200	0.825	0.452	0.651	0.843	0.406	0.791	0.865	0.350	1.029	0.875	0.320	1.198	0.882	0.300	1.335
300	1.114	0.517	0.703	1.157	0.469	0.858	1.208	0.408	1.122	1.233	0.376	1.311	1.250	0.354	1.463
400	1.362	0.565	0.740	1.432	0.516	0.906	1.515	0.453	1.190	1.559	0.418	1.393	1.587	0.395	1.557
500	1.581	0.603	0.769	1.677	0.553	0.944	1.796	0.489	1.243	1.859	0.453	1.456	1.900	0.429	1.632
600	1.775	0.634	0.792	1.899	0.584	0.974	2.054	0.519	1.287	2.137	0.483	1.511	2.192	0.458	1.693
800	2.230	0.700	0.839	2.402	0.647	1.034	2.621	0.578	1.369	2.739	0.539	1.610	2.818	0.512	1.806
1000	2.517	0.737	0.865	2.742	0.685	1.070	3.033	0.616	1.421	3.195	0.577	1.675	3.304	0.550	1.881
1200	2.765	0.767	0.886	3.038	0.716	1.098	3.401	0.647	1.463	3.605	0.608	1.727	3.744	0.581	1.942

Outside Ditch Option 2

Reach Length	Slope =	0.3 %		Slope =	0.5 %		Slope =	1 %		Slope =	1.5 %		Slope =	2 %	
	Q m3/s	Depth (m)	Velocity (m/s)	Q m3/s	Depth (m)	Velocity (m/s)	Q m3/s	Depth (m)	Velocity (m/s)	Q m3/s	Depth (m)	Velocity (m/s)	Q m3/s	Depth (m)	Velocity (m/s)
Ditch assesment for 25mm Storm															
100	0.098	0.169	0.386	0.098	0.147	0.462	0.098	0.121	0.589	0.098	0.109	0.678	0.098	0.100	0.749
200	0.151	0.212	0.438	0.157	0.189	0.531	0.164	0.161	0.687	0.167	0.146	0.798	0.170	0.136	0.887
300	0.190	0.238	0.466	0.202	0.215	0.570	0.216	0.186	0.745	0.224	0.171	0.870	0.229	0.160	0.969
400	0.221	0.257	0.486	0.238	0.235	0.598	0.261	0.205	0.786	0.273	0.189	0.920	0.281	0.178	1.028
500	0.247	0.271	0.501	0.269	0.250	0.618	0.299	0.220	0.816	0.315	0.204	0.959	0.326	0.193	1.074
600	0.268	0.283	0.512	0.296	0.262	0.634	0.332	0.233	0.842	0.353	0.216	0.990	0.367	0.205	1.110
800	0.328	0.313	0.541	0.364	0.290	0.671	0.414	0.260	0.894	0.442	0.243	1.054	0.462	0.231	1.184
1000	0.356	0.325	0.553	0.400	0.304	0.688	0.461	0.275	0.921	0.497	0.258	1.089	0.523	0.246	1.225
1200	0.378	0.335	0.562	0.429	0.315	0.701	0.501	0.286	0.941	0.544	0.270	1.116	0.575	0.258	1.258
Ditch assesment for 10 - yr Flow															
100	0.193	0.240	0.469	0.193	0.210	0.563	0.193	0.175	0.721	0.193	0.157	0.832	0.193	0.146	0.921
200	0.321	0.309	0.538	0.330	0.276	0.653	0.341	0.236	0.847	0.346	0.214	0.984	0.349	0.200	1.094
300	0.421	0.353	0.579	0.441	0.319	0.706	0.466	0.276	0.923	0.478	0.253	1.077	0.486	0.237	1.201
400	0.505	0.386	0.607	0.536	0.351	0.744	0.575	0.306	0.977	0.595	0.282	1.144	0.609	0.265	1.278
500	0.577	0.411	0.629	0.619	0.376	0.773	0.672	0.331	1.019	0.701	0.306	1.195	0.720	0.289	1.338
600	0.640	0.432	0.646	0.692	0.397	0.796	0.760	0.351	1.053	0.798	0.326	1.238	0.823	0.308	1.387
800	0.796	0.478	0.684	0.867	0.442	0.845	0.961	0.393	1.121	1.013	0.366	1.319	1.049	0.347	1.480
1000	0.885	0.502	0.703	0.975	0.467	0.871	1.096	0.419	1.160	1.165	0.391	1.369	1.213	0.372	1.538
1200	0.961	0.521	0.718	1.068	0.487	0.892	1.214	0.439	1.192	1.299	0.412	1.409	1.359	0.393	1.585
Ditch assesment for 100 - yr Flow															
100	0.285	0.292	0.522	0.285	0.257	0.627	0.285	0.215	0.806	0.285	0.194	0.932	0.285	0.180	1.033
200	0.491	0.381	0.603	0.503	0.340	0.731	0.516	0.290	0.949	0.523	0.264	1.104	0.527	0.247	1.228
300	0.659	0.437	0.651	0.685	0.395	0.794	0.717	0.341	1.037	0.733	0.313	1.210	0.743	0.293	1.349
400	0.802	0.480	0.685	0.845	0.436	0.839	0.896	0.380	1.100	0.923	0.350	1.287	0.941	0.329	1.438
500	0.927	0.513	0.712	0.986	0.469	0.874	1.059	0.412	1.150	1.098	0.380	1.348	1.123	0.359	1.507
600	1.038	0.540	0.733	1.113	0.496	0.902	1.208	0.438	1.190	1.259	0.406	1.397	1.293	0.384	1.564
800	1.301	0.599	0.777	1.405	0.552	0.958	1.538	0.491	1.267	1.610	0.456	1.490	1.659	0.432	1.670
1000	1.462	0.631	0.800	1.597	0.585	0.990	1.774	0.524	1.315	1.872	0.489	1.550	1.939	0.465	1.740
1200	1.601	0.657	0.819	1.764	0.612	1.015	1.983	0.552	1.354	2.106	0.517	1.598	2.191	0.492	1.796