MASTER DRAINAGE PLAN

PART LOT 1,2,3,4,5,6,7 & 8

CONCESSION 3

TOWNSHIP OF THURLOW

CANNIFF MILL ESTATE SUB-WATERSHED

FINAL DRAFT

DECEMBER 15, 1997

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1.0 INTRODUCTION

1.1 BACKGROUND

The Township of Thurlow Cannifton Secondary Plan, Section 3.2.1 requires that prior to the development of a subdivision in any drainage basin in the plan area, a Master Drainage Plan shall be prepared for each drainage basin by the developer on behalf of the municipality.

The following report has been compiled to meet this requirement and satisfy all reviewing agencies that a complete and concise investigation of the site has been undertaken.

1.2 PURPOSE AND SCOPE

The purpose of this report is to provide the various reviewing agencies a comprehensive analysis of stormwater management within the Canniff Mill Subwatershed and to serve as a guide throughout the various phases of development.

The scope of this Master Drainage Plan as outlined in the terms of reference for a Master Drainage Plan in the Cannifton Secondary Plan is summarized as follows:

1. Conduct hydrologic and water quality modelling to determine the pre- and post-development conditions within the study area. The modelling will include both water quantity and water quality aspects.

2. Establish runoff water quality and quantities criteria for drainage of all watercourses and also determine hydraulic constraints necessary for erosion and flood control purposes.

3. Formulate stormwater management alternatives for providing the required level of control and/or treatment.

4. Present the preliminary design of the stormwater management facilities in sufficient detail to allow the document to be used as a guideline for the final detailed design. As well as outlining a phasing strategy for development of the complete drainage basin.

1.3 SITE DESCRIPTION

1.3.1 LOCATION

The Canniff Mill Subwatershed is located in part of lots 5,6,7 and 8, Concession 3 in the Township of Thurlow. The lands are bordered to the west by Farnham Road and by the Moira River to the east and south, and to the north by a natural high point as outlined on Plan ST1.

1.3.2 EXISTING AND PROPOSED LAND USE

The majority of the drainage basin is presently undeveloped. The exception is some residential single family dwellings and a steel fabrication shop, Doef's Ironworks Ltd., along Farnham Road -- the west boundary of the subwatershed area.

The subwatershed will be developed through three separate draft plans, of which only one is presently conditionally approved (MMA #12T-90001). The division of these lands is shown on Plan ST3.

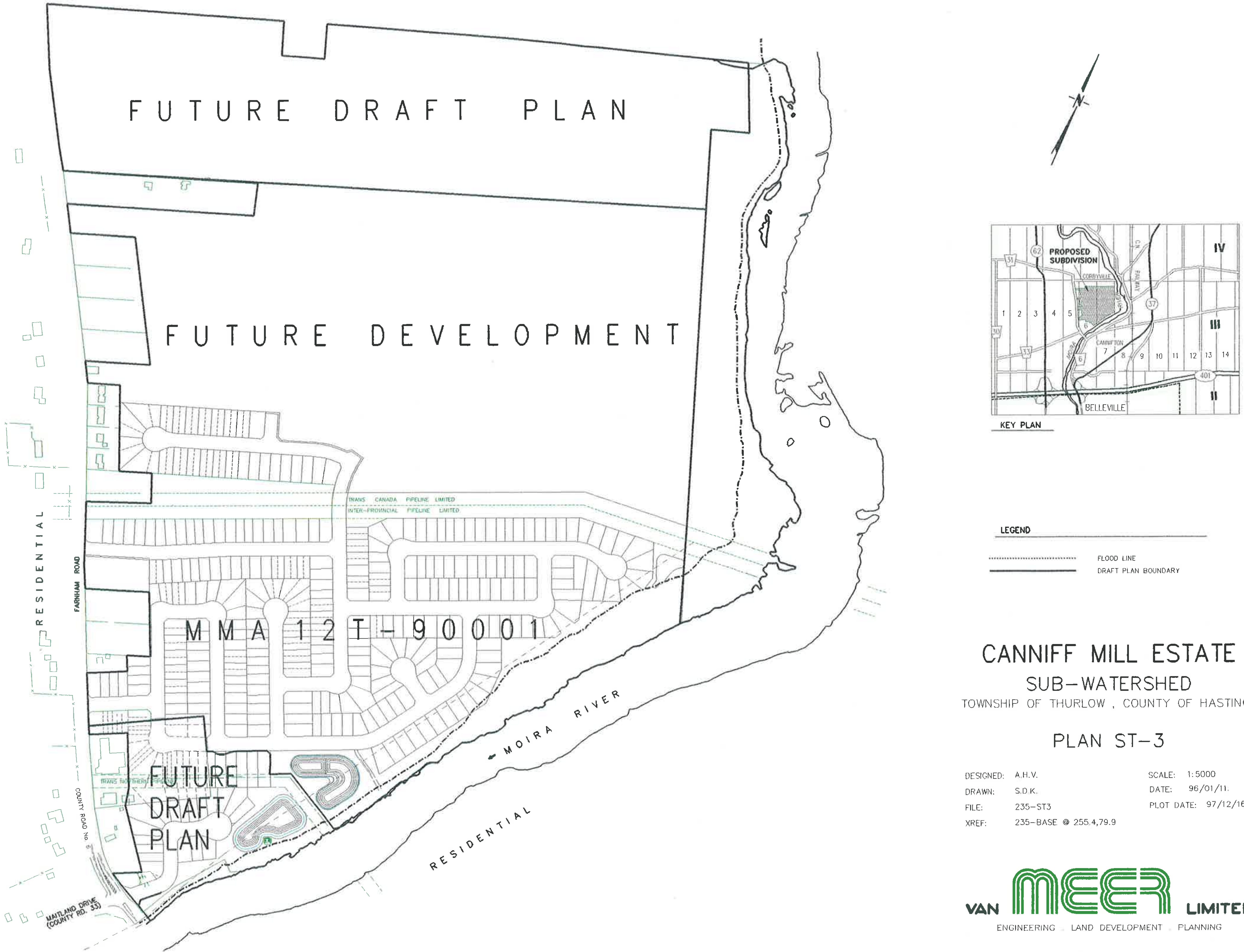
At present, the subwatershed is owned by two development groups. The Latchfords own the uppermost parcel indicated on plan ST3 while the remaining parcels are owned by Manhole #10 Development Group.

1.3.3 TOPOGRAPHY AND SOILS

The terrain in the subwatershed is mostly flat having a gentle slope towards the Moira River in a south-southeasterly direction. There is a natural drainage swale which collects the majority of the storm water from the subwatershed stretching from the north end of the property flowing southerly to outlet into the Moira River, as shown on Plan ST1.

The site lies within the Napanee Plain physiographic region having a typically surficial cover of dark brown, clayey-silt topsoil overlying glacial till. The glacial till in turn overlies highly fractured limestone bedrock.

A small 0.6 Ha parcel of land located in the northeastern portion of the drainage area is comprised of a low lying seasonal wetland. Field investigations of this 0.6 Ha parcel reveal the existence of numerous wet water plants. It is noted that this parcel is encompassed by the Moira River flood plain. Consequently, the conditionally approved draft plan includes this parcel within a block designated as parkland.



LEGEND

FLOOD LINE

DRAFT PLAN BOUNDARY

CANNIFF MILL ESTATE

SUB-WATERSHED

TOWNSHIP OF THURLOW, COUNTY OF HASTINGS

PLAN ST-3

DESIGNED:	A.H.V.	SCALE:	1:5000
DRAWN:	S.D.K.	DATE:	96/01/11.
FILE:	235-ST3	PLOT DATE:	97/12/16.
XREF:	235-BASE @ 255.4,79.9		

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1.3.4 RAINFALL DATA

Precipitation data and rainfall intensities were obtained from the Atmospheric Environment Service Rainfall Station in Belleville and are included in Appendix A. A single quantity storm event is represented using a 100 year 6-hour SCS Type II distribution.

The subwatershed was modelled using OTTHYMO 89. Storms of varying durations and intensities were simulated in the model to determine the storm giving the critical response. The following table shows the results of this analysis:

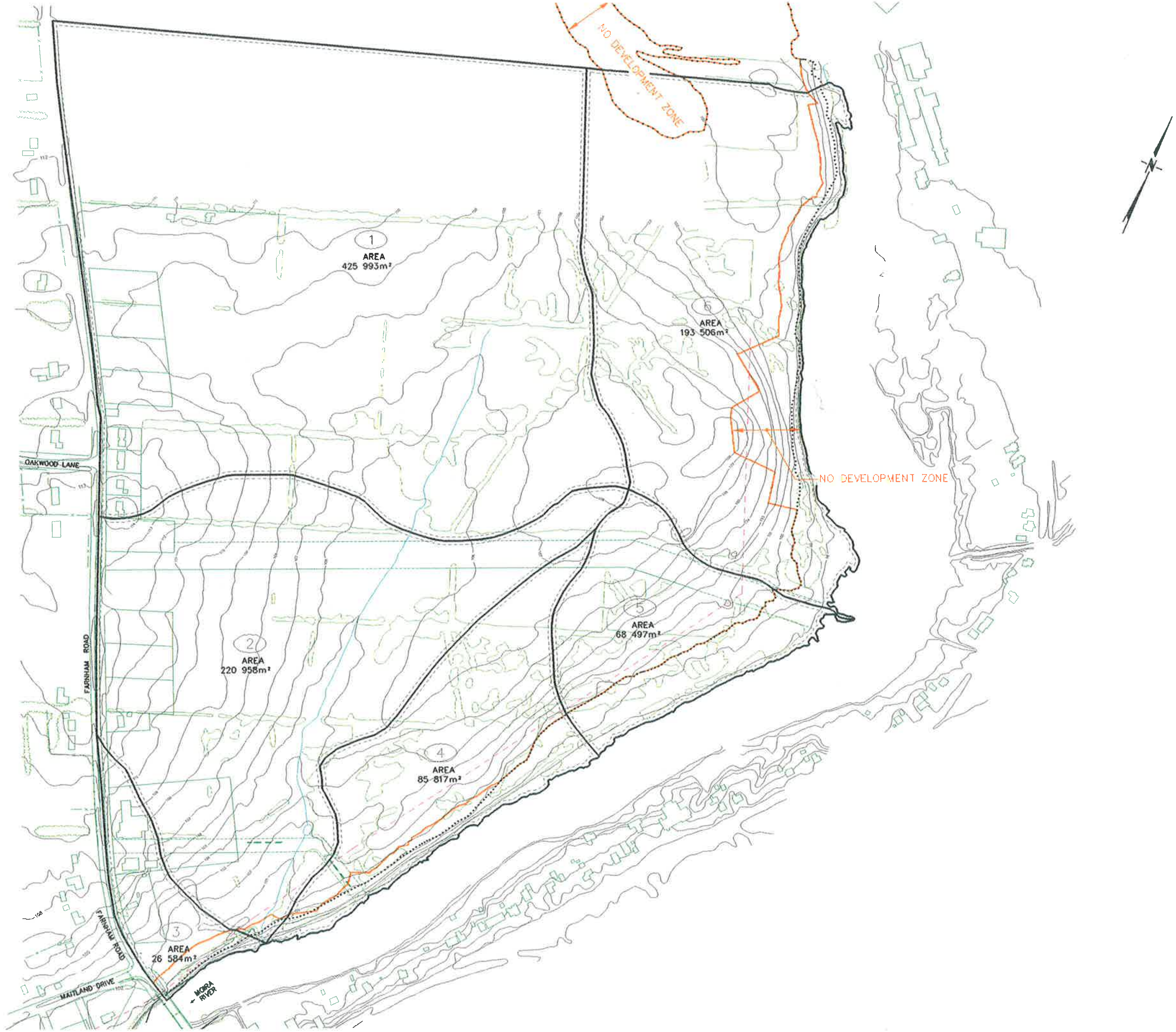
Table 1
DESIGN FLOW ANALYSIS

STORM	100 year (PRE)	100 YEAR (POST)
SCS 6hr	1.70	6.09
SCS 12hr	1.69	4.62
AES 12hr	1.04	1.72
CHICAGO 3hr	0.96	4.23
CHICAGO 6hr	1.17	4.86

As can be seen by examining the data, the 100 year six hour SCS distribution is the critical storm resulting in the largest post-development flow and showing the greatest difference between pre- and post-development flows. This is the same storm used by Gore and Storrie Limited for the Upper No Name Creek Management Study. The Canniff Mill sub-basin is in close proximity to the Upper No Name Creek sub-basin and similar in nature suggesting the same design storm for both sub-basins.

1.3.5 PRE-DEVELOPMENT DRAINAGE

The Canniff Mill Subwatershed is approximately 102 Ha and can be subdivided into six subcatchment areas as shown on Plan ST1. The subwatershed has been delineated more precisely than the area shown in the Cannifton Secondary Plan. This has been made possible by the availability of more detailed contours derived from field work for the proposed subdivision.



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CANNIFF MILL ESTATE
TOWNSHIP OF THURLOW
COUNTY OF HASTINGS

Date	Description	By
15/12/97	PER COMMENTS FROM M.R.C.A. DEC 15/97	M.W.
09/09/96	PER COMMENTS FROM M.R.C.A. AUG./96	M.W.

REVISIONS

SCALE:	1: 2500
DESIGNED:	A.H.V.
DRAWN:	J.B. / S.D.K.
DATE:	DEC./95
DISK:	ACAD-___

PRE-DEVELOPMENT STORM DRAINAGE AREA PLAN

SHEET - 235-ST1

Catchment areas 1 and 2 flow into a small drainage swale which conducts the flow south into the Moira River. The remaining four catchment areas flow directly into the Moira River.

The pre-development flows were estimated using the computer modelling program, OTTHYMO. A 6-hour SCS type II storm event was used in this analysis. The following table summarizes the input data for the model as well as the corresponding output:

Table 2
PRE-DEVELOPMENT CATCHMENT DATA

Catchment Number	Area (m^2)	Peak Flow (cms)	Curve Number (CN)*	Time to Peak (Tp)
1	42.6	0.92	70	3.58
2	22.1	0.59	70	3.42
3	2.7	0.14	70	3.00
4	8.6	0.37	70	3.08
5	6.9	0.31	70	3.08
6	19.6	0.66	70	3.25

* CN from Hoggan represents a type 'C' soil, 'Brush--brush-weed-grass with brush the major element, and ' fair' hydrologic condition.

1.3.6 NATURAL FEATURES

Pre-development drainage areas 1-3 consist primarily of pasture land with some agricultural land, with very little or no brush cover. Areas 4-6 have some pasture land but are primarily covered with light brush consisting mainly of white and red cedars. There are very few large trees found within the subwatershed. The main growths are found within a 100 metre band along the river, these trees should be disturbed as little as possible throughout development of the subwatershed.

The Cannifton Secondary Plan recommends the designation of pipeline rights-of-way as greenspace as well as the preservation of waterways within the region. Consequently, the Trans-Canada Pipeline stretching across the middle of the subwatershed and the Trans Northern Pipeline to the south should be preserved as greenspace.

Development should be restricted to beyond 30 m from the bank of the Moira River to protect the waterway. This meets the Secondary Plan's objective of directing development away from areas which are environmentally sensitive. Similarly, the parcel of land in area 6 having slopes of 10% or greater should not be developed being considered by the MRCA as environmentally sensitive.

Site investigations have shown some evidence of the presence of various wildlife species (deer, various birds), particularly in the northeast brush covered area adjacent to the Moira River and extending north of the subwatershed towards an adjacent forested area.

The subwatershed experiences intermittent flow within the drainage swale and is considered unsuitable for fish habitat.

2.0 STORMWATER MANAGEMENT ALTERNATIVES

2.1 DESIGN REQUIREMENTS AND CRITERIA

There are a large number of possible stormwater management alternatives which could be used to control quality and quantity in the Canniff Mill Subwatershed. Each alternative has its own advantages and disadvantages, this report will examine the various alternatives and decide which alternative is best suited for the Canniff Mill Subwatershed.

The following is a list of the main criteria which were examined in choosing the best stormwater management alternative:

1. Treatment of Post-development flows to appropriate levels for quality control as outlined in the Bay of Quinte Remedial Action Plan (RAP).

2. Effectiveness in controlling site erosion and sediment transport in stormwater flows both during and after construction.

3. Integration of the Stormwater alternative into the natural drainage patterns found at the site.

4. Initial construction cost for the developer and future maintenance costs for the Township of Thurlow.

2.2 EVALUATION OF SELECTED CONTROL STRATEGIES

The following table overviews seven stormwater management alternatives that may be appropriate for the Canniff Mill Subwatershed:

Table 3
STORMWATER MANAGEMENT ALTERNATIVES

STORMWATER ALTERNATIVE	KEY CHARACTERISTICS	COMMENTS
1. Lot Level Controls	- source control - provides treatment before stormwater reaches the conveyance system. - reduces peak runoff rates.	- easy to implement - low initial cost and no maintenance cost - recommended for use
2. Grassed Swales	- conveyance control - very effective for pollutant removal when designed properly	- can be used in conjunction with end-of-pipe controls -small initial cost and low maintenance cost - recommended for use
3. Wet Ponds	- most reliable end-of-pipe pollutant removal. - aesthetically pleasing - good control of peak flows - treats both solid and soluble pollutants	- fractured rock requires clay linings -regular maintenance to remove sediments is required. - recommended for use
4. Wetlands	- very effective for quality control, biological removal of pollutants - requires a large amount of area	- feasible except for the area restrictions which are present in this subwatershed
5. Dry Ponds	- removal of	- very efficient for

	contaminants is a function of drawdown time - resuspension of sediment can be a problem - Aesthetics are a problem with the proximity of bedrock	areas requiring quantity controls - feasible but not as effective for quality control as wet ponds
6. Infiltration Trenches/Basins	- effective in removing small particles - large number of basins would be required	- high groundwater table reduces effectiveness. - proximity of bedrock hinders construction - not recommended
7. Oil/Grit Separators	- primarily used for low flow situations - sediment removal rates are good	- effective for tight spaces with low flows - could be used in these situations

In summary, in order to achieve the most feasible approach for stormwater management for the Canniff Mill Subwatershed the following factors should be considered:

1. A combination of source, conveyance and end-of-pipe controls will prove most effective.

2. Source Control - Lot Level controls such as reduced lot grading and rear yard detention should be used whenever possible this promotes sheet flow and increases depression storage.

3. Conveyance Control - Rear yard grass swales should be allowed to grow above 75 mm and should channel slopes at 1% wherever possible to enhance filtration of suspended solids.

4. End-of-Pipe Control - Wet ponds are the preferred end-of-pipe treatment. They are cost-effective and are able to achieve a high removal rate of sediments and other pollutants. They also produce biological processes within the pond to remove soluble nutrients that contribute to nutrient enrichment.

3.0 STORMWATER CONTROL STRATEGY

Under direction of the Moira River Conservation Authority, the treatment facilities considered for the subwatershed are for quality treatment only. It was felt that detaining a major storm event would only exacerbate the subsequent expected high water levels in the river draining the watersheds to the north. Therefore the strategy for Canniff Mills should be to bypass the quantity flows through to the river and detain only the smaller events in the quality treatment facilities.

3.1 STORMWATER MANAGEMENT PLAN

The topography and restrictions due to the 1:100 year flood line must be taken into consideration during the decision making process of which of the stormwater management alternatives to implement. The Secondary Plan further requires areas abutting the Moira River closer than 30 metres from the high water mark to be reserved for public open space. Both pipeline companies have restrictions regarding any activity or construction near their pipelines and have setback requirements, further restricting the options. The pipelines also cross through the lowlands presenting more barriers to treatment facility designs.

Wet ponds, owing to their more compact nature, may be located within this restrictive environment with greater ease than would a wetland treatment facility. A dry pond is, however, not recommended for quality treatment since there is a danger of contaminant resuspension between events.

The preferred location for a treatment facility is along an existing drainage course and as close as permissible to the Moira River in a naturally low lying region. In this way, the intrusion on the environment and construction costs are minimized and major alterations to the existing drainage pattern can be avoided.

In keeping with these restrictions and preferences and attempting to minimize the number of facilities, the drainage areas have been grouped into three separate regions.

The first is comprised of drainage areas 1 to 4 and is to be serviced by a two-celled pond located near the existing swale outlet to the Moira (refer to ST2 and ST1). The configuration shown on ST3 makes use of the existing lowland, takes into consideration the Trans-Northern Pipeline and permits utilization of the natural swale outlet. Access to both pond cells may be

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COUNTY OF HASTINGS

Date	Description	By
15/12/96	PER COMMENTS FROM M.R.C.A. DEC.15/97	M.W.
09/09/96	PER COMMENTS FROM M.R.C.A. AUG./96	M.W.
07/30/96	FLOW ARROWS @ NORTH END & STORM PONDS	S.D.K.

REVISIONS

SCALE: 1: 2500
DESIGNED: A.H.V.
DRAWN: J.B. / S.D.K.
DATE: DEC./95
DISK: ACAD-605

POST-DEVELOPMENT STORM DRAINAGE AREA PLAN

SHEET - 235-ST2

gained by two adjacent proposed roads permitting monitoring and sediment removal.

The second region is comprised primarily of drainage area 5 with a small contribution from area 4. Again, this is in keeping with the natural slopes and makes use of the proposed grading of the conditionally approved draft plan. The preferred location for this pond is shown on ST2. Access to the pond may be gained from the adjacent proposed road.

The final region consists of area 6. Two possible locations are presented for a pond servicing this region, each fulfilling the mandates listed above. The southernmost location, however, would take advantage of a slightly lower elevation and is within property held by the owners sponsoring this report.

The 1:100 year event will be routed around the quality ponds by a bypass and will be conveyed directly to the river. The 1:5 year event will enter the pond system and exit through a spillway to the river. In this way some quality treatment will occur but flushing of the pond will be prevented.

It is noted that further information on preliminary sizing and area requirements for these three pond systems are provided in section 3.2.1 of this report.

3.2 STORMWATER CONSIDERATIONS

Design criteria required by the Township of Thurlow, Ministry of the Environment and Energy, Ministry of Natural Resources and the Moira River Conservation Authority requires the following to be addressed:

1. Limit flood damage and hazards under long term storm conditions.

2. Provide a reasonable amount of safety and convenience for pedestrian and traffic use by removal of lot and street surface runoff under short term storm conditions.

3. Minimize alterations of the local ground water system and maintain the base flows in the receiving watercourse.

4. Minimize pollution discharge to the receiving watercourse.

5. Minimize sediment pollution of watercourse from construction activity.

6. Address and institute stormwater management requirements that have been developed for the Bay of Quinte Stormwater Implementation Area as part of the Bay of Quinte Remedial Action Plan (RAP).

3.2.1 PRELIMINARY SIZING OF QUALITY PONDS

At the time of this report, the MRCA has indicated that quality ponds should be sized using the guidelines set forth by the Ministry of the Environment and Energy, Stormwater Management and Practices and Design Manual, 1994. Under these guidelines, sizing for Level 1 protection and 35 % imperviousness will be 140 m^3/Ha. Of this, 100 m^3/Ha will be permanent pool size and the remaining 40 m^3/Ha will be the active storage of the pond. This allows for a 24 hour detention during which roughly 80 % of the Total Solids are expected to settle out.

The following table shows the preliminary sizing results for the four ponds, further details are provided in Appendix C:

Table 4
PRELIMINARY POND SIZING

POND	DRAINAGE AREA (Ha)	VOLUME (m^3)	POND AREA (Ha)
1	74.42	10420	0.9
2	7.82	1100	0.1
3	19.35	2710	0.3

3.2.2 MAJOR / MINOR ROUTING

The Major/Minor principle of stormwater routing is recommended for this region to best achieve the above drainage objectives. The major storm event should be routed overland through swales, ditches, and roadways in a manner which reduces property damage and risk to human life. The minor system should be routed through storm sewers sized to convey storms up to and including the 5-year event.

In this way quality ponds will be bypassed during a major event to prevent the washing out of sediments from the ponds and thus decrease the contamination entering the Moira River. Smaller events will enter the ponds via the storm sewers and receive treatment by sediment removal, bacteriological processes and plant uptake.

3.2.3 OVERLAND ROUTE

The drainage path for the major event, according to the concept plans and draft plan for the subwatershed, closely follows the existing drainage flowpath. The 100-year event will be routed from area 1 across the Trans-Canada Pipeline by a road which will be located along the existing natural swale.

A computer model of the area was created using OTTHYMO to determine the maximum expected depth of flow down this corridor. For emergency vehicle access during a major event the depth of flow at the centre line of the road should be below 0.3 m. Assuming the storm sewer in the model at capacity (3.72 m^3/s), the maximum overland depth of flow was calculated to be 0.23 m at a velocity of 2.05 m/s.

To protect against erosion and loss of life the product of the depth of flow and the velocity should be kept below 0.65 m^2/s. The result of this proposed overland route is 0.47 m^2/s.

3.2.4 PHOSPHORUS

Little of the region is farmed and as a result little fertilizer is presently being applied. Phosphorus, a common nutrient found in agricultural fertilizers, has been found to contribute to eutrophication of the Bay of Quinte. The Remedial Action Plan for the Bay of Quinte calls for a reduction of phosphates.

Phosphates enter the receiving waters in both soluble and insoluble forms. Settling will remove some of the insoluble forms and plant uptake removes some of the soluble phosphates. Removal rates are highly dependant upon the site specific conditions and detention time.

It is felt that phosphorus will not be a significant pollutant in this subwatershed. However, the wet pond system will assist in keeping the phosphorus levels in check.

3.2.5 POND CONSTRUCTION

The wetponds will need to be constructed by blasting out the underlying fractured limestone bedrock. As a result, the ponds will need to be clay lined to prevent leaching.

Preliminary engineering has been completed on the southern most twin ponds. Side slopes have been set to 5:1 for the upper pond and 7:1 for the lower pond. This results in a maximum depth of 3.0 m in each pond and 1 to 2 m of permanent pool depth. The gentle 7:1 slope on the lower pond has been designed to permit possible winter use as a skating rink.

The two-cell pond has several advantages. It acts much like a tertiary treatment facility. The sediment forebay in the first cell removes most of the larger suspended solids, leaving the remaining area of the pond as the secondary settling region. The following cell will receive the treated flow from the first pond and act much like a polishing pond.

Another advantage is to confine the majority of the sediments to the first pond. This may reduce the maintenance required on the second pond saving on costs and reducing the detrimental impact of heavy machinery on the flora.

A third advantage of the two-cell pond is its adaptability to phasing. Since this subwatershed will be developed by at least three draft plans and several phases, the pond may be constructed in phases resulting in minimal intrusion on the established flora during upgrading.

3.3 PHASING

At the present time, it is envisioned that the development of the subwatershed will proceed as three draft plans (see drawing ST3). The first draft plan, MMA #12T-90001, consists of 299 single detached residential lots and 7 semi-detached residential lots. This draft plan was granted approval on April 8, 1993, and revised on April 27, 1996 and is subject to draft conditions dated September 4, 1996. This draft plan incorporates all undeveloped lands south of the Inter-provincial Pipeline and a 2.5 ha parcel North of this pipeline.

The first phase of development is expected, however, to be the region to the south indicated on plan ST3 as 'Future Development'. It will be developed under a separate draft plan and consist of about 18 lots. This development will require the construction of a portion of the two-cell pond system located adjacent to the Moira River at the Trans-Northern crossing known as Pond #1.

This first phase pond, servicing a development of about 5.4 Ha pond, will have a volume of about 750 m^3 and incorporate a temporary sediment forebay that will be moved when the pond is expanded to allow for more development.

The third draft plan will likely consist of approximately 290 residential lots.

3.4 EROSION AND SEDIMENT CONTROL

To ensure minimal impact on the surrounding environment during the construction of services for the proposed development, the following procedures should be followed:

1. Prior to removal of topsoil or earth, sedimentation control measures should be implemented. These include filter cloth siltation fencing on the downstream slopes of any work areas and straw bale check dams along any drainage path to create sedimentation basins.

2. All disturbed areas should be topsoiled and grassed with native species as soon as possible.

3. Prior to the removal of any siltation fencing or straw bale checkdams, all sediments should be removed and the disturbed areas reinstated with native species which are actively growing.

4. Lot grading should be designed to maintain the natural sheet drainage across the property. The sheet flow will be maintained around structures such as residential dwellings by proper grading of the building apron. This will reduce the potential for erosion which would occur should rivulets be permitted to form.

5. Crushed stone, check dams or equivalent are proposed at all ditch inlets and critical swale locations. The check dams will restrict erosion and encourage sedimentation. The check dams will be removed when the swales have been revegetated and firmly established.

3.5 PRELIMINARY COSTS

Provided in the following table are the initial construction costs and the future maintenance costs for the three stormwater ponds which are proposed for the Canniff Mill subwatershed:

TABLE 5
PRELIMINARY COST ESTIMATES

POND	CONSTRUCTION COST	ANNUAL MAINTENANCE COST
1	$ 250000	$ 3500
2	$ 60000	$ 1500
3	$ 90000	$ 1500

3.6 REGULATORY APPROVALS

Before implementation of this stormwater management strategy a number of approvals from various regulatory agencies will be required:

1. Ontario Water Resources Act approval will be required for the stormwater management ponds and Certificates of Approval will be issued by the Ontario Ministry of Environment & Energy based upon approval of final facility designs.

2. Pipeline crossing permits will be required at any location where drainage swales or storm sewer pipes cross any of the three pipelines. These permits are available directly from the appropriate Pipeline Company.

3. Conservation Authorities Act approval will be required for the storm water ponds. This approval will be provided by the Moira River Conservation Authority.

3.7 SUPPLEMENTARY

Lands within the 30 metre protected region and the 1:100 year flood line shall be preserved in accordance with Sections 6 and 7 of the Cannifton Secondary Plan.

These Sections of the Secondary Plan require:

- lands within 30 metres of the high water mark of the river or lands within the flood plain, whichever is greater, be used for public open space purposes. The intent is to provide a continuous open space system along the river's edge.

- parks and open space areas be landscaped to the satisfaction of the Township.

- all vegetation adjacent to the Moira River, its tributaries and all other water courses within the flood plain or a 30 m setback be preserved and maintained wherever possible.

Environmental Protection Policies which govern lands within the 30 metre zone and floodplain are as follows:

- the uses permitted in Environmental Protection areas shall be limited to conservation, wildlife areas, public or private parks and resource management uses and wherever possible should be retained in a natural state.

- all vegetation in the Environmental Protection area should be preserved and maintained wherever possible to assist in maintaining water quality, providing cover/protection and food for fish and wildlife species and protecting the stream banks from erosion.

- setbacks may be imposed in consultation with the Moira River Conservation Authority on buildings or structures to be erected on land adjacent to Environmental Protection areas to the nature and extent of the feature to be preserved.

- development of existing uses within the Environmental Protection area shall be guided by Section 3.2.2 of the Official Plan.

Moira River Conservation Authority Policies governing the aforementioned lands are as follows:

- where new development is proposed, excluding accessary or outbuildings it must be located above the 1:100 year flood plain.

- setbacks from the 1:100 year flood plain will be decided on a site by site basis accounting for lot grading and vegetation cover/erosion control and width of the flood plain.

- where 1:100 year floodplain is at or near the top of bank:
    - a general 30 m development setback form top of bank will be applied.
    - a minimum 15 m no development vegetative buffer from top of bank will be applied
    - if a vegetated buffer does not exist, as part of permit approval revegetation and erosion/sediment control must be established based on recognized engineering/ecological principles.
    - no stormwater management facilities will be allowed within the 15 m buffer.
    - vegetation and construction mitigation will be established on a site by site basis.

Provincial Policies regarding the aforementioned lands are as follows:

- development will generally directed to areas outside of hazardous lands adjacent to river and stream systems which are impacted by flooding and/or erosion hazards.

- development and site alteration will not be permitted within a floodway.

- development and site alterations may be permitted in hazardous lands provided that all of the following can be achieved:
    - the hazards can be safely addressed, and the development and site alteration is carried out in accordance with established standards and procedures.
    - new hazards are not created and existing hazards are not aggravated.
    - no adverse environmental impacts will result.
    - vehicles and people have a way of safely entering and exiting the area during times of flooding, erosion and other emergencies.
    - the development does not include institutional uses or essential emergency services or the disposal, manufacture, treatment or storage of hazardous substances.

Important definitions follow:

Site alteration: means activities, such as fill, grading and excavation, that would change the landform and natural vegetative characteristics of a site.

Development: means the creation of a new lot, a change in land use, or the construction of buildings and structures, requiring approval under the Planning Act; but does not include activities that create or maintain infrastructure authorized under an environmental assessment process; or works subject to the Drainage Act.

Floodway: means the portion of the flood plain where development (other than uses which by their nature must be located within the floodway, flood and/or erosion control works, or where appropriate, minor additions or passive, nonstructural uses which do not affect flood flows) and site alteration which would cause a danger to public health and safety or property damage.

4.0 RECOMMENDATIONS

The Canniff Mills subwatershed comprises lands that are considered environmentally sensitive. Consequently, the following recommendations are made in accordance with the Cannifton Secondary Plan and the Moira River Conservation Authority Policies to protect these areas. These recommendations are:

1) An Environmental Protection Zone be maintained adjacent to the Moira River. This Zone will be measured by the greater of 30 metres from the high water mark or the 1:100 year flood plain. This Zone will be maintained in a natural vegetative state wherever possible.

2) No development or site alteration be permitted within the 1:100 year flood plain or 15 metres from top of bank, except as required for stormwater outlets to the Moira River, where these outlets have been approved by the Moira River Conservation Authority. Site alteration may be permitted within the 30 metre setback from the high water mark in areas outside of the 1:100 year flood plain and no closer than 15 metres from top of bank.

3) Regions with slopes 10 % or greater be considered environmentally sensitive and development prohibited on these slopes.

4) The pipeline easements, river frontage and other parklands be incorporated into a continuous system of greenspace.

5) Permanent wet pond treatment facilities be located along existing drainage routes.

6) Every effort be made by the developer to preserve mature trees in the approximately 100 m band along the river.

7) Sedimentation and erosion controls be in place downstream of any construction.

8) A major/minor stormwater management strategy be adopted with the major system as the overland route.

9) An Open Space system be established and conform to Part 2, Section 6 of the Cannifton Secondary Plan.

10) Fencing be installed along rear yards on lots abutting the 30 metre setback or 1:100 year flood plain.

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APPENDIX A

RAINFALL DATA

100 YEAR - 6 HOUR SCS RAINFALL DATA

TIME (hrs.)	INTENSITY (mm/hr)
0.25	4
0.5	2
0.75	3
1.0	3
1.25	4.4
1.5	4
1.75	5
2.0	4.8
2.25	7.6
2.5	14.4
2.75	14.4
3.0	116
3.25	30
3.5	13
3.75	8.4
4.0	8
4.25	6
4.5	6.4
4.75	4
5.0	3.6
5.25	4
5.5	3
5.75	3
6.0	3

ATMOSPHERIC ENVIRONMENT SERVICE
SERVICE DE L"ENVIRONNEMENT ATMOSPHERIQUE

RAINFALL INTENSITY-DURATION FREQUENCY VALUES
INTENSITE, DUREE ET FREQUENCE DES PLUIES

PREPARED BY / PREPARE PAR
THE HYDROMETEOROLOGY AND MARINE DIVISION
LA DIVISION DE L"HYDROMETEOROLOGIE ET DU CLIMAT MARITIME

****

TABLE 1 BELLEVILLE ONT (COMPOSITE) 6150689

LATITUDE 4409 LONGITUDE 7724 ELEVATION/ALTITUDE 76 M

****

YEAR ANNEE	5 MIN	10 MIN	15 MIN	30 MIN	1 H	2 H	6 H	12 H	24 H
1960	6.3	9.1	12.4	23.4	25.4	35.1	53.8	55.1	55.9
1961	6.1	7.9	8.9	12.2	18.0	18.8	23.9	34.0	36.3
1963	12.4	19.0	23.1	28.4	30.7	31.0	31.0	31.7	44.4
1964	4.3	5.6	7.4	12.2	12.4	20.6	45.2	45.7	45.7
1966	6.3	8.9	10.4	11.9	13.2	16.0	32.8	37.8	38.1
1967	7.4	9.9	10.4	10.4	11.9	13.2	26.4	42.4	58.7
1968	7.9	11.9	13.7	18.5	21.8	27.2	43.9	57.1	57.1
1969	5.8	9.7	13.0	17.5	24.4	31.0	37.8	43.2	62.2
1971	7.4	11.4	13.0	23.9	25.1	25.4	25.7	25.7	32.5
1972	9.4	10.7	11.7	12.4	14.7	20.6	28.2	33.5	50.5
1973	7.4	10.7	11.9	18.0	21.3	21.8	37.3	45.5	48.0
1974	10.9	15.2	17.8	25.4	25.4	25.4	34.3	42.7	42.7
1980	13.2	16.9	19.0	20.5	20.5	34.6	46.9	47.6	59.6
1981	-99.9	-99.9	13.3	25.5	29.4	34.6	46.2	49.2	57.4
1982	4.6	8.5	10.1	14.2	18.3	24.7	39.8	45.0	45.0
1983	6.5	8.9	10.5	18.4	22.2	30.7	39.6	39.6	50.3
1984	5.1	8.1	10.1	11.3	19.7	23.7	33.4	51.4	55.1
1985	10.5	16.2	20.0	27.0	27.4	42.3	42.3	44.5	44.5
1986	9.1	14.4	16.4	23.2	25.2	35.0	59.2	68.8	78.9

NOTE:-99.9 INDICATES MSG DATA
DONNEES MANQUANTES

	5 MIN	10 MIN	15 MIN	30 MIN	1 H	2 H	6 H	12 H	24 H
# YRS. ANNEES	18	18	19	19	19	19	19	19	19
MEAN MOYENNE	7.8	11.3	13.3	18.6	21.4	26.9	38.3	44.2	50.7
STD. DEV. ECART-TYPE	2.6	3.6	4.1	6.0	5.6	7.6	9.6	9.9	10.8
SKEW DISSYMETRIE	0.71	0.73	0.96	0.10	-0.27	0.09	0.43	0.49	0.67
KURTOSIS KURTOSIS	3.12	3.17	3.70	2.02	2.65	2.91	3.21	4.41	4.59

ATMOSPHERIC ENVIRONMENT SERVICE
SERVICE DE L"ENVIRONNEMENT ATMOSPHERIQUE

RAINFALL INTENSITY-DURATION FREQUENCY VALUES
INTENSITE, DUREE ET FREQUENCE DES PLUIES

****

TABLE 2 BELLEVILLE ONT (COMPOSITE) 6150689

LATITUDE 4409 LONGITUDE 7724 ELEVATION/ALTITUDE 76 M

****

RETURN PERIOD RAINFALL AMOUNTS (MM)
PERIODE DE RETOUR QUANTITIES DE PLUIE (MM)

DURATION DUREE	2 YR/ANS	5 YR/ANS	10 YR/ANS	25 YR/ANS	50 YR/ANS	100 YR/ANS	# YEARS ANNEES
5 MIN	7.4	9.7	11.2	13.1	14.5	16.0	18
10 MIN	10.7	13.9	16.0	18.7	20.7	22.7	18
15 MIN	12.6	16.3	18.7	21.8	24.0	26.3	19
30 MIN	17.7	22.9	26.4	30.9	34.1	37.4	19
1 H	20.5	25.4	28.7	32.9	35.9	39.0	19
2 H	25.7	32.4	36.8	42.4	46.6	50.7	19
6 H	36.7	45.2	50.8	57.9	63.1	68.3	19
12 H	42.6	51.4	57.2	64.5	69.9	75.3	19
24 H	48.9	58.5	64.8	72.8	78.7	84.6	19

RETURN PERIOD RAINFALL RATES EXPRESSED AS MM/HR
INTENSITE DE LA PLUIE PAR PERIODE DE RETOUR, EXPRIMEE EN MM/H
WITH 95% CONFIDENCE LIMITS / AVEC DES LIMITES DE CONFIANCE DE 95%

DURATION DUREE	2 YR/ANS	5 YR/ANS	10 YR/ANS	25 YR/ANS	50 YR/ANS	100 YR/ANS
5 MIN	88.6	116.2	134.4	157.5	174.6	191.6
	+/- 13.2	+/- 22.3	+/- 30.1	+/- 40.6	+/- 48.5	+/- 56.5
10 MIN	64.1	83.3	96.1	112.1	124.1	135.9
	+/- 9.2	+/- 15.5	+/- 21.0	+/- 28.3	+/- 33.9	+/- 39.4
15 MIN	50.6	65.2	74.9	87.1	96.2	105.2
	+/- 6.8	+/- 11.5	+/- 15.5	+/- 21.0	+/- 25.1	+/- 29.2
30 MIN	35.3	45.9	52.9	61.7	68.3	74.8
	+/- 4.9	+/- 8.3	+/- 11.2	+/- 15.1	+/- 18.1	+/- 21.1
1 H	20.5	25.4	28.7	32.9	35.9	39.0
	+/- 2.3	+/- 3.9	+/- 5.3	+/- 7.1	+/- 8.5	+/- 9.9
2 H	12.8	16.2	18.4	21.2	23.3	25.4
	+/- 1.6	+/- 2.6	+/- 3.6	+/- 4.8	+/- 5.7	+/- 6.7
6 H	6.1	7.5	8.5	9.6	10.5	11.4
	+/- 0.7	+/- 1.1	+/- 1.5	+/- 2.0	+/- 2.4	+/- 2.8
12 H	3.6	4.3	4.8	5.4	5.8	6.3
	+/- 0.3	+/- 0.6	+/- 0.8	+/- 1.0	+/- 1.3	+/- 1.5
24 H	2.0	2.4	2.7	3.0	3.3	3.5
	+/- 0.2	+/- 0.3	+/- 0.4	+/- 0.6	+/- 0.7	+/- 0.8

ATMOSPHERIC ENVIRONMENT SERVICE
SERVICE DE L"ENVIRONNEMENT ATMOSPHERIQUE

RAINFALL INTENSITY-DURATION FREQUENCY VALUES
INTENSITE, DUREE ET FREQUENCE DES PLUIES

****

TABLE 3 BELLEVILLE ONT (COMPOSITE) 6150689

LATITUDE 4409 LONGITUDE 7724 ELEVATION/ALTITUDE 76 M

****

INTERPOLATION EQUATION / EQUATION D"INTERPOLATION: R = A * T ** B
R = RAINFALL RATE / INTENSITE DE LA PLUIE (MM /HR)
T = TIME IN HOURS / TEMPS EN HEURES

STATISTICS STATISTIQUES	2 YR ANS	5 YR ANS	10 YR ANS	25 YR ANS	50 YR ANS	100 YR ANS
MEAN OF R MOYENNE DE R	31.5	40.7	46.8	54.5	60.2	65.8
STD. DEV. R ECART-TYPE	30.5	40.0	46.4	54.4	60.3	66.2
STD. ERROR ERREUR STANDARD	5.9	8.0	9.5	11.3	12.7	14.0
COEFF. (A) COEFFICIENT (A)	19.4	24.5	27.9	32.1	35.3	38.4
EXPONENT (B) EXPOSANT (B)	-0.674	-0.691	-0.698	-0.706	-0.710	-0.714
MEAN % ERROR % D'ERREUR	6.9	7.2	7.3	7.4	7.5	7.6

APPENDIX B

OTTHYMO Data - Pre

```
2
*
START                  EXCESS RUNOFF BEGINS AT 0.0 HRS
*
*                      PROPOSED CANIFF MILL ESTATE SUBDIVISION
*                      TOWNSHIP OF THURLOW
*                      100-YR RAINFALL EVENT
*                      6-HR SCS DISTRIBUTION
*                      REVISED MARCH 1997
*
*                      PRE-DEVELOPMENT
*
READ STORM             A:6SCS.100
*
CALIB NASHYD           ID=1 HYD=101 DT=5 MIN AREA=42.6 HA
                       DWF=0.0 CN=70 IA=21.8 N=3 TP=.5143
                       END=-1
*
CALIB NASHYD           ID=2 HYD=102 DT=5 MIN AREA=22.1 HA
                       DWF=0.0 CN=70 IA=21.8 N=3 TP=.3729
                       END=-1
*
CALIB NASHYD           ID=3 HYD=103 DT=5 MIN AREA=2.7 HA
                       DWF=0.0 CN=70 IA=21.8 N=3 TP=.1106
                       END=-1
*
CALIB NASHYD           ID=4 HYD=104 DT=5 MIN AREA=8.6 HA
                       DWF=0.0 CN=70 IA=21.8 N=3 TP=.1565
                       END=-1
*
CALIB NASHYD           ID=5 HYD=105 DT=5 MIN AREA=6.9 HA
                       DWF=0.0 CN=70 IA=21.8 N=3 TP=.1435
                       END=-1
*
CALIB NASHYD           ID=6 HYD=106 DT=5 MIN AREA=19.4 HA
                       DWF=0.0 CN=70 IA=21.8 N=3 TP=.2466
                       END=-1
*
ADD HYD                ID=8 NHYD=1111 ID=1 + ID=2
ADD HYD                ID=7 NHYD=1111 ID=8 + ID=4
*
ADD HYD                ID=9 NHYD=1112 ID=7 + ID=3
*
PRINT HYD              ID=7 NPCYC=1
PRINT HYD              ID=3 NPCYC=1
PRINT HYD              ID=6 NPCYC=1
*
SAVE HYD               ID=7 NPCYC=1 ICASE=-1
                       100PRE.HYD
                       SEPT 1996
*
SAVE HYD               ID=3 NPCYC=1 ICASE=-1
                       100PRE3.HYD
                       SEPT 1996
*
SAVE HYD               ID=6 NPCYC=1 ICASE=-1
                       100PRE5.HYD
                       SEPT 1996
*
FINISH
```

```
==========================================================================

  OOO    TTTTT   TTTTT  H   H  Y   Y  M   M   OOO    I N T E R H Y M O
 O   O     T       T    H   H   Y Y   MM MM  O   O   * * * 1989a * * *
 O   O     T       T    HHHHH    Y    M M M  O   O
 O   O     T       T    H   H    Y    M   M  O   O
  OOO      T       T    H   H    Y    M   M   OOO
```


***** S U M M A R Y   O U T P U T *****

Input filename: 100PRE.DAT
Output filename: 100PRE.OUT
Summary filename: 100PRE.SUM

DATE: 10-27-1997 TIME: 20:03:34

USER: ____________________

COMMENTS: ____________________

****
** SIMULATION NUMBER: 1 **
****

W/E COMMAND	HYD	ID	DT min	AREA ha	Qpeak cms	Tpeak hrs	R.V. mm	R.C.	Qbase cms
START @ .00 hrs									
READ STORM [Ptot= 68.75 in] fname :A:6SCS.100 remark:*SCS Type 2 Hyetograph, 100-yr 6-hour distribution			15.0						
CALIB NASHYD [CN=70.0] [N= 3.0:Tp= .51]	0101	1	5.0	42.60	.92	3.58	14.02	.20	.000
CALIB NASHYD [CN=70.0] [N= 3.0:Tp= .37]	0102	2	5.0	22.10	.59	3.42	14.01	.20	.000
CALIB NASHYD [CN=70.0] [N= 3.0:Tp= .11]	0103	3	5.0	2.70	.14	3.00	13.76	.20	.000
CALIB NASHYD [CN=70.0] [N= 3.0:Tp= .16]	0104	4	5.0	8.60	.37	3.08	13.95	.20	.000
CALIB NASHYD [CN=70.0] [N= 3.0:Tp= .14]	0105	5	5.0	6.90	.31	3.08	13.92	.20	.000
CALIB NASHYD [CN=70.0] [N= 3.0:Tp= .25]	0106	6	5.0	19.40	.66	3.25	14.01	.20	.000
ADD [0101 + 0102]	1111	8	5.0	64.70	1.48	3.50	14.02	n/a	.000
ADD [1111 + 0104]	1111	7	5.0	73.30	1.65	3.50	14.01	n/a	.000
ADD [1111 + 0103]	1112	9	5.0	76.00	1.70	3.50	14.00	n/a	.000
PRINT HYD	1111	7	5.0	73.30	1.65	3.50	14.01	n/a	.000
PRINT HYD	0103	3	5.0	2.70	.14	3.00	13.76	n/a	.000
PRINT HYD	0106	6	5.0	19.40	.66	3.25	14.01	n/a	.000

```
     SAVE HYD              1111  7  5.0    73.30    1.65  3.50  14.01  n/a    .000
     fname :100PRE.HYD
     remark:SEPT 1996
     ------------------
     SAVE HYD              0103  3  5.0     2.70     .14  3.00  13.76  n/a    .000
     fname :100PRE3.HYD
     remark:SEPT 1996
     ------------------
     SAVE HYD              0106  6  5.0    19.40     .66  3.25  14.01  n/a    .000
     fname :100PRE5.HYD
     remark:SEPT 1996
     ------------------
 FINISH
=================================================================================
```

APPENDIX C

OTTHYMO Data - Post

```
*
START                EXCESS RUNOFF BEGINS AT 0.0 HRS
*
*                    CANNIFF MILL ESTATE SUBDIVISION
*                    TOWNSHIP OF THURLOW
*                    100-YR RUNOFF POST-DEVELOPMENT
*                    6-HOUR SCS DISTRIBUTION
*                    REVISED OCTOBER 1997
*
*
READ STORM           A:6SCS.100
*
CALIB NASHYD         ID=1 NHD=59 DT=5 MIN AREA=.385 HA DWF=0.0 CN=83 IA=10.4 N=3
                     TP=.1675 END=-1
*
CALIB STANDHYD       ID=1 NYHD=201 DT=5 MIN AREA=0.385 HA XIMP=.40 TIMP=.40
                     DWF=0.00 LOSS=2 CN=83 IA=10.8
                     SLPP=2.0 LGP=15 MNP=.25 SCP=0 DPSI=1.5 SLPI=2.5
                     LGI=90 MNI=.013 SCI=0 RAIN=-1
*
CALIB STANDHYD       ID=1 NYHD=202 DT=5 MIN AREA=0.385 HA XIMP=.40 TIMP=.40
                     DWF=0.00 LOSS=1 FO=76.3 FC=3.0 DCAY=4.14 F=0 DPSP=5.0
                     SLPP=2.0 LGP=15 MNP=.25 SCP=0 DPSI=1.5 SLPI=2.5
                     LGI=90 MNI=.013 SCI=0 RAIN=-1
ROUTE CHANNEL        IDOUT=2 NHYD=202 IDIN=1 DT=5 MIN
                     CHLGTH=80 CHSLOPE=2.5 FPSLOPE=2.5
                     VSN=1.1 NSEG=3
                     THE SEGMENT DATA FOLLOWS
                      N       DIST(M)
                      0.025     5.65
                     -0.013    14.35
                      0.025    20.00
                     THE CROSS SECTION DATA FOLLOWS
                     DIST(M)   ELEV(M)
                      0.00       1.27
                      5.65       1.15
                      5.80       1.00
                     10.00       1.11
                     14.20       1.00
                     14.35       1.15
                     20.00       1.27
*
*
CALIB STANDHYD       ID=3 NYHD=202 DT=5 MIN AREA=0.385 HA XIMP=.40 TIMP=.40
                     DWF=0.00 LOSS=1 FO=76.3 FC=3.0 DCAY=4.14 F=0 DPSP=5.0
                     SLPP=2.0 LGP=15 MNP=.25 SCP=0 DPSI=1.5 SLPI=2.5
                     LGI=70 MNI=.013 SCI=0 RAIN=-1
*
ADD HYD              ID=1 NHYD=1000 IDONE=2 IDTWO=3
*
ROUTE CHANNEL        IDOUT=2 NHYD=203 IDIN=1 DT=0.167
                     CHLGTH=80 CHSLOPE=2.5 FPSLOPE=2.5
                     VSN=1.2 NSEG=3
                     THE SEGMENT DATA FOLLOWS
                      N       DIST(M)
                      0.025     5.65
                     -0.013    14.35
                      0.025    20.00
                     THE CROSS SECTION DATA FOLLOWS
                     DIST(M)   ELEV(M)
                      0.00       1.27
                      5.65       1.15
                      5.80       1.00
                     10.00       1.11
                     14.20       1.00
                     14.35       1.15
                     20.00       1.27
*
*
CALIB STANDHYD       ID=3 NYHD=203 DT=5 MIN AREA=0.353 HA XIMP=.40 TIMP=.40
                     DWF=0.00 LOSS=1 FO=76.3 FC=3.0 DCAY=4.14 F=0 DPSP=5.0
                     SLPP=2.0 LGP=15 MNP=.25 SCP=0 DPSI=1.5 SLPI=2.5
                     LGI=80 MNI=.013 SCI=0 RAIN=-1
*
ADD HYD              ID=1 NHYD=1001 IDONE=2 IDTWO=3
*
ROUTE CHANNEL        IDOUT=2 NHYD=204 IDIN=1 DT=5 MIN
```

```
                        CHLGTH=90 CHSLOPE=2.5 FPSLOPE=2.5
                        VSN=1.3 NSEG=3
                        THE SEGMENT DATA FOLLOWS
                         N       DIST(M)
                         0.025     5.65
                        -0.013    14.35
                         0.025    20.00
                        THE CROSS SECTION DATA FOLLOWS
                        DIST(M)    ELEV(M)
                         0.00       1.27
                         5.65       1.15
                         5.80       1.00
                        10.00       1.11
                        14.20       1.00
                        14.35       1.15
                        20.00       1.27
*
*
CALIB STANDHYD          ID=3 NYHD=204 DT=5 MIN AREA=0.391 HA XIMP=.40 TIMP=.40
                        DWF=0.00 LOSS=1 FO=76.3 FC=3.0 DCAY=4.14 F=0 DPSP=5.0
                        SLPP=2.0 LGP=15 MNP=.25 SCP=0 DPSI=1.5 SLPI=2.5
                        LGI=90 MNI=.013 SCI=0 RAIN=-1
*
ADD HYD                 ID=5 NHYD=1002 IDONE=2 IDTWO=3
*
*READ HYD                ID=4 HYD=1
*                        OVERLAND.TXT
*
CALIB NASHYD            ID=4 HYD=1 DT=5 MIN AREA=42.6 HA
                        DWF=0.0 CN=83 IA= 10.4 N=3 TP=.2468
                        END=-1
ADD HYD                 ID=1 NHYD=1002 IDONE=4 IDTWO=5
*
*READ STORM              A:6SCS.100
*
CALIB STANDHYD          ID=2 NYHD=101 DT=5 MIN AREA=0.255 HA XIMP=.40 TIMP=.40
                        DWF=0.00 LOSS=1 FO=76.3 FC=3.0 DCAY=4.14 F=0 DPSP=5.0
                        SLPP=2.0 LGP=18 MNP=.25 SCP=0 DPSI=1.5 SLPI=0.4
                        LGI=90 MNI=.013 SCI=0 RAIN=-1
*
CALIB STANDHYD          ID=3 NYHD=701 DT=5 MIN AREA=0.737 HA XIMP=.30 TIMP=.30
                        DWF=0.00 LOSS=1 FO=76.3 FC=3.0 DCAY=4.14 F=0 DPSP=5.0
                        SLPP=2.5 LGP=330 MNP=.25 SCP=0 DPSI=1.5 SLPI=2.0
                        LGI=10 MNI=.013 SCI=0 RAIN=-1
*
CALIB NASHYD            ID=4 HYD=903 DT=5 MIN AREA=3.9 HA
                        DWF=0.0 CN=70 IA= 21.8 N=3 TP=.1643
                        END=-1
*
ADD HYD                 ID=5 NHYD=1003 IDONE=1 IDTWO=2
ADD HYD                 ID=6 NHYD=1004 IDONE=5 IDTWO=3
ADD HYD                 ID=7 NHYD=1005 IDONE=6 IDTWO=4
*
*
CALIB STANDHYD          ID=1 NYHD=702 DT=5 MIN AREA=0.219 HA XIMP=.30 TIMP=.30
                        DWF=0.00 LOSS=1 FO=76.3 FC=3.0 DCAY=4.14 F=0 DPSP=5.0
                        SLPP=2.5 LGP=70 MNP=.25 SCP=0 DPSI=1.5 SLPI=2.0
                        LGI=10 MNI=.013 SCI=0 RAIN=-1
*
ROUTE CHANNEL           IDOUT=2 NHYD=703 IDIN=1 DT=5 MIN
                        CHLGTH=30 CHSLOPE=2 FPSLOPE=2
                        VSN=1.4 NSEG=3
                        THE SEGMENT DATA FOLLOWS
                          N          DIST(M)
                         0.025         1.00
                        -0.045        3.00
                         0.025         4.00
                        THE CROSS SECTION DATA FOLLOWS
                        DIST(M)     ELEV(M)
                         0.00       1.27
                         1.00       1.25
                         2.00       1.00
                         3.00       1.25
                         4.00       1.27
*
*
CALIB STANDHYD          ID=3 NYHD=703 DT=5 MIN AREA=0.352 HA XIMP=.30 TIMP=.30
                        DWF=0.00 LOSS=1 FO=76.3 FC=3.0 DCAY=4.14 F=0 DPSP=5.0
```

```
                        SLPP=2.0 LGP=10 MNP=.25 SCP=0 DPSI=1.5 SLPI=2.0
                        LGI=90 MNI=.013 SCI=0 RAIN=-1
*
ADD HYD                 ID=1 NHYD=1006 IDONE=2 IDTWO=3
*
ROUTE CHANNEL           IDOUT=2 NHYD=704 IDIN=1 DT=5 MIN
                        CHLGTH=130 CHSLOPE=2 FPSLOPE=2
                        VSN=1.5 NSEG=3
                        THE SEGMENT DATA FOLLOWS
                          N          DIST(M)
                         0.025         1.00
                        -0.045         3.00
                         0.025         4.00
                        THE CROSS SECTION DATA FOLLOWS
                        DIST(M)    ELEV(M)
                         0.00       1.27
                         1.00       1.25
                         2.00       1.00
                         3.00       1.25
                         4.00       1.27
*
*
CALIB STANDHYD          ID=3 NYHD=704 DT=5 MIN AREA=0.359 HA XIMP=.30 TIMP=.30
                        DWF=0.00 LOSS=1 FO=76.3 FC=3.0 DCAY=4.14 F=0 DPSP=5.0
                        SLPP=2.5 LGP=160 MNP=.25 SCP=0 DPSI=1.5 SLPI=2.0
                        LGI=10 MNI=.013 SCI=0 RAIN=-1
*
ADD HYD                 ID=1 NHYD=1007 IDONE=2 IDTWO=3
ADD HYD                 ID=3 NHYD=1008 IDONE=1 IDTWO=7
*
ROUTE CHANNEL           IDOUT=2 NHYD=102 IDIN=3 DT=5 MIN
                        CHLGTH=80 CHSLOPE=0.4 FPSLOPE=0.4
                        VSN=1.6 NSEG=3
                        THE SEGMENT DATA FOLLOWS
                         N       DIST(M)
                         0.025     5.65
                        -0.013    14.35
                         0.025    20.00
                        THE CROSS SECTION DATA FOLLOWS
                        DIST(M)   ELEV(M)
                         0.00      1.27
                         5.65      1.15
                         5.80      1.00
                        10.00      1.11
                        14.20      1.00
                        14.35      1.15
                        20.00      1.27
*
*
CALIB STANDHYD          ID=3 NYHD=102 DT=5 MIN AREA=0.303 HA XIMP=.40 TIMP=.40
                        DWF=0.00 LOSS=1 FO=76.3 FC=3.0 DCAY=4.14 F=0 DPSP=5.0
                        SLPP=0.4 LGP=18 MNP=.25 SCP=0 DPSI=1.5 SLPI=2.0
                        LGI=80 MNI=.013 SCI=0 RAIN=-1
*
ADD HYD                 ID=9 NHYD=1009 IDONE=2 IDTWO=3
*
CALIB NASHYD            ID=1 HYD=904 DT=5 MIN AREA=1.8 HA
                        DWF=0.0 CN=70 IA=21.8 N=3 TP=.1823
                        END=-1
*
*
CALIB STANDHYD          ID=2 NYHD=721 DT=5 MIN AREA=0.445 HA XIMP=.30 TIMP=.30
                        DWF=0.00 LOSS=1 FO=76.3 FC=3.0 DCAY=4.14 F=0 DPSP=5.0
                        SLPP=0.5 LGP=220 MNP=.25 SCP=0 DPSI=1.5 SLPI=2.0
                        LGI=10 MNI=.013 SCI=0 RAIN=-1
*
ADD HYD                 ID=3 NHYD=1010 IDONE=1 IDTWO=2
*
ROUTE CHANNEL           IDOUT=2 NHYD=720 IDIN=3 DT=5 MIN
                        CHLGTH=130 CHSLOPE=0.5 FPSLOPE=0.5
                        VSN=1.7 NSEG=3
                        THE SEGMENT DATA FOLLOWS
                          N          DIST(M)
                         0.025         1.00
                        -0.045         3.00
                         0.025         4.00
                        THE CROSS SECTION DATA FOLLOWS
                        DIST(M)     ELEV(M)
```

```
                     0.00        1.27
                     1.00        1.25
                     2.00        1.00
                     3.00        1.25
                     4.00        1.27
*
*
CALIB STANDHYD      ID=3 NYHD=720 DT=5 MIN AREA=0.358 HA XIMP=.30 TIMP=.30
                    DWF=0.00 LOSS=1 FO=76.3 FC=3.0 DCAY=4.14 F=0 DPSP=5.0
                    SLPP=0.5 LGP=100 MNP=.25 SCP=0 DPSI=1.5 SLPI=2.0
                    LGI=10 MNI=.013 SCI=0 RAIN=-1
*
ADD HYD             ID=8 NHYD=1011 IDONE=2 IDTWO=3
*
*
CALIB STANDHYD      ID=1 NYHD=401 DT=5 MIN AREA=0.341 HA XIMP=.40 TIMP=.40
                    DWF=0.00 LOSS=1 FO=76.3 FC=3.0 DCAY=4.14 F=0 DPSP=5.0
                    SLPP=2.0 LGP=18 MNP=.25 SCP=0 DPSI=1.5 SLPI=0.5
                    LGI=70 MNI=.013 SCI=0 RAIN=-1
*
ROUTE CHANNEL       IDOUT=2 NHYD=402 IDIN=1 DT=5 MIN
                    CHLGTH=60 CHSLOPE=0.5 FPSLOPE=0.5
                    VSN=1.9 NSEG=3
                    THE SEGMENT DATA FOLLOWS
                     N        DIST(M)
                     0.025     5.65
                    -0.013    14.35
                     0.025    20.00
                    THE CROSS SECTION DATA FOLLOWS
                    DIST(M)    ELEV(M)
                     0.00       1.27
                     5.65       1.15
                     5.80       1.00
                    10.00       1.11
                    14.20       1.00
                    14.35       1.15
                    20.00       1.27
*
*
CALIB STANDHYD      ID=1 NYHD=402 DT=5 MIN AREA=0.302 HA XIMP=.40 TIMP=.40
                    DWF=0.00 LOSS=1 FO=76.3 FC=3.0 DCAY=4.14 F=0 DPSP=5.0
                    SLPP=2.0 LGP=18 MNP=.25 SCP=0 DPSI=1.5 SLPI=0.5
                    LGI=70 MNI=.013 SCI=0 RAIN=-1
*
ADD HYD             ID=3 NHYD=1013 IDONE=2 IDTWO=1
*
*
CALIB STANDHYD      ID=1 NYHD=723 DT=5 MIN AREA=0.348 HA XIMP=.30 TIMP=.30
                    DWF=0.00 LOSS=1 FO=76.3 FC=3.0 DCAY=4.14 F=0 DPSP=5.0
                    SLPP=1.0 LGP=80 MNP=.25 SCP=0 DPSI=1.5 SLPI=2.0
                    LGI=10 MNI=.013 SCI=0 RAIN=-1
*
ROUTE CHANNEL       IDOUT=2 NHYD=725 IDIN=1 DT=5 MIN
                    CHLGTH=40 CHSLOPE=2.0 FPSLOPE=2.0
                    VSN=2.0 NSEG=3
                    THE SEGMENT DATA FOLLOWS
                      N         DIST(M)
                     0.025         1.00
                    -0.045        3.00
                     0.025         4.00
                    THE CROSS SECTION DATA FOLLOWS
                    DIST(M)     ELEV(M)
                     0.00       1.27
                     1.00       1.25
                     2.00       1.00
                     3.00       1.25
                     4.00       1.27
*
*
CALIB STANDHYD      ID=7 NYHD=725 DT=5 MIN AREA=0.402 HA XIMP=.40 TIMP=.40
                    DWF=0.00 LOSS=1 FO=76.3 FC=3.0 DCAY=4.14 F=0 DPSP=5.0
                    SLPP=2.0 LGP=18 MNP=.25 SCP=0 DPSI=1.5 SLPI=2.0
                    LGI=90 MNI=.013 SCI=0 RAIN=-1
*
ADD HYD             ID=1 NHYD=1014 IDONE=7 IDTWO=2
ADD HYD             ID=2 NHYD=1015 IDONE=1 IDTWO=3
ADD HYD             ID=3 NHYD=1016 IDONE=2 IDTWO=8
*
```

```
ROUTE CHANNEL          IDOUT=2 NHYD=403 IDIN=3 DT=5 MIN
                       CHLGTH=65 CHSLOPE=2.0 FPSLOPE=2.0
                       VSN=2.1 NSEG=3
                       THE SEGMENT DATA FOLLOWS
                        N       DIST(M)
                        0.025    5.65
                       -0.013   14.35
                        0.025   20.00
                       THE CROSS SECTION DATA FOLLOWS
                       DIST(M)   ELEV(M)
                        0.00       1.27
                        5.65       1.15
                        5.80       1.00
                       10.00       1.11
                       14.20       1.00
                       14.35       1.15
                       20.00       1.27
*
*
CALIB STANDHYD         ID=3 NYHD=403 DT=5 MIN AREA=0.289 HA XIMP=.40 TIMP=.40
                       DWF=0.00 LOSS=1 FO=76.3 FC=3.0 DCAY=4.14 F=0 DPSP=5.0
                       SLPP=2.0 LGP=18 MNP=.25 SCP=0 DPSI=1.5 SLPI=2.0
                       LGI=70 MNI=.013 SCI=0 RAIN=-1
*
ADD HYD                ID=1 NHYD=1017 IDONE=2 IDTWO=3
ADD HYD                ID=2 NHYD=1018 IDONE=1 IDTWO=9
*
ROUTE CHANNEL          IDOUT=3 NHYD=103 IDIN=2 DT=5 MIN
                       CHLGTH=90 CHSLOPE=0.4 FPSLOPE=0.4
                       VSN=2.2 NSEG=3
                       THE SEGMENT DATA FOLLOWS
                        N       DIST(M)
                        0.025    5.65
                       -0.013   14.35
                        0.025   20.00
                       THE CROSS SECTION DATA FOLLOWS
                       DIST(M)   ELEV(M)
                        0.00       1.27
                        5.65       1.15
                        5.80       1.00
                       10.00       1.11
                       14.20       1.00
                       14.35       1.15
                       20.00       1.27
*
*
CALIB STANDHYD         ID=1 NYHD=103 DT=5 MIN AREA=0.373 HA XIMP=.40 TIMP=.40
                       DWF=0.00 LOSS=1 FO=76.3 FC=3.0 DCAY=4.14 F=0 DPSP=5.0
                       SLPP=2.0 LGP=18 MNP=.25 SCP=0 DPSI=1.5 SLPI=0.4
                       LGI=90 MNI=.013 SCI=0 RAIN=-1
*
ADD HYD                ID=2 NHYD=1019 IDONE=1 IDTWO=3
*
ROUTE CHANNEL          IDOUT=3 NHYD=104 IDIN=2 DT=5 MIN
                       CHLGTH=80 CHSLOPE=0.4 FPSLOPE=0.4
                       VSN=2.3 NSEG=3
                       THE SEGMENT DATA FOLLOWS
                        N       DIST(M)
                        0.025    5.65
                       -0.013   14.35
                        0.025   20.00
                       THE CROSS SECTION DATA FOLLOWS
                       DIST(M)   ELEV(M)
                        0.00       1.27
                        5.65       1.15
                        5.80       1.00
                       10.00       1.11
                       14.20       1.00
                       14.35       1.15
                       20.00       1.27
*
*
CALIB STANDHYD         ID=2 NYHD=104 DT=5 MIN AREA=0.408 HA XIMP=.40 TIMP=.40
                       DWF=0.00 LOSS=1 FO=76.3 FC=3.0 DCAY=4.14 F=0 DPSP=5.0
                       SLPP=2.0 LGP=18 MNP=.25 SCP=0 DPSI=1.5 SLPI=0.4
                       LGI=80 MNI=.013 SCI=0 RAIN=-1
*
ADD HYD                ID=1 NHYD=1020 IDONE=2 IDTWO=3
```

```
*
*
CALIB STANDHYD        ID=3 NYHD=705 DT=5 MIN AREA=0.572 HA XIMP=.30 TIMP=.30
                      DWF=0.00 LOSS=1 FO=76.3 FC=3.0 DCAY=4.14 F=0 DPSP=5.0
                      SLPP=0.4 LGP=120 MNP=.25 SCP=0 DPSI=1.5 SLPI=2.0
                      LGI=10 MNI=.013 SCI=0 RAIN=-1
*
ADD HYD               ID=2 NHYD=1021 IDONE=1 IDTWO=3
*
*
CALIB STANDHYD        ID=4 NYHD=706 DT=5 MIN AREA=0.880 HA XIMP=.40 TIMP=.40
                      DWF=0.00 LOSS=1 FO=76.3 FC=3.0 DCAY=4.14 F=0 DPSP=5.0
                      SLPP=1.5 LGP=35 MNP=.25 SCP=0 DPSI=1.5 SLPI=2.0
                      LGI=130 MNI=.013 SCI=0 RAIN=-1
*
ADD HYD               ID=9 NHYD=1022 IDONE=2 IDTWO=4
*
ROUTE CHANNEL         IDOUT=2 NHYD=304 IDIN=9 DT=5 MIN
                      CHLGTH=80 CHSLOPE=0.4 FPSLOPE=0.4
                      VSN=2.3 NSEG=3
                      THE SEGMENT DATA FOLLOWS
                       N       DIST(M)
                       0.025    5.65
                      -0.013   14.35
                       0.025   20.00
                      THE CROSS SECTION DATA FOLLOWS
                      DIST(M)   ELEV(M)
                       0.00      1.27
                       5.65      1.15
                       5.80      1.00
                      10.00      1.11
                      14.20      1.00
                      14.35      1.15
                      20.00      1.27
*
CALIB STANDHYD        ID=1 NYHD=105 DT=5 MIN AREA=0.463 HA XIMP=.40 TIMP=.40
                      DWF=0.00 LOSS=1 FO=76.3 FC=3.0 DCAY=4.14 F=0 DPSP=5.0
                      SLPP=2.0 LGP=40 MNP=.25 SCP=0 DPSI=1.5 SLPI=1.5
                      LGI=75 MNI=.013 SCI=0 RAIN=-1
*
ADD HYD               ID=9 NHYD=1003 IDONE=1 IDTWO=2
*
SAVE HYD              ID=9 NPCYC=2000 ICASE=1
                      MAINST.HYD
                      CENTRE AREA
*
CALIB STANDHYD        ID=1 NYHD=719 DT=5 MIN AREA=0.600 HA XIMP=.30 TIMP=.30
                      DWF=0.00 LOSS=1 FO=76.3 FC=3.0 DCAY=4.14 F=0 DPSP=5.0
                      SLPP=2.0 LGP=150 MNP=.25 SCP=0 DPSI=1.5 SLPI=2.0
                      LGI=10 MNI=.013 SCI=0 RAIN=-1
*
CALIB STANDHYD        ID=2 NYHD=726 DT=5 MIN AREA=0.363 HA XIMP=.40 TIMP=.40
                      DWF=0.00 LOSS=1 FO=76.3 FC=3.0 DCAY=4.14 F=0 DPSP=5.0
                      SLPP=2.0 LGP=18 MNP=.25 SCP=0 DPSI=1.5 SLPI=2.0
                      LGI=90 MNI=.013 SCI=0 RAIN=-1
*
ADD HYD               ID=3 NHYD=1023 IDONE=1 IDTWO=2
*
ROUTE CHANNEL         IDOUT=2 NHYD=501 IDIN=3 DT=5 MIN
                      CHLGTH=70 CHSLOPE=0.5 FPSLOPE=0.5
                      VSN=2.4 NSEG=3
                      THE SEGMENT DATA FOLLOWS
                       N       DIST(M)
                       0.025    5.65
                      -0.013   14.35
                       0.025   20.00
                      THE CROSS SECTION DATA FOLLOWS
                      DIST(M)   ELEV(M)
                       0.00      1.27
                       5.65      1.15
                       5.80      1.00
                      10.00      1.11
                      14.20      1.00
                      14.35      1.15
                      20.00      1.27
*
*
CALIB STANDHYD        ID=1 NYHD=501 DT=5 MIN AREA=0.292 HA XIMP=.40 TIMP=.40
```

```
                    DWF=0.00 LOSS=1 FO=76.3 FC=3.0 DCAY=4.14 F=0 DPSP=5.0
                    SLPP=2.0 LGP=18 MNP=.25 SCP=0 DPSI=1.5 SLPI=0.5
                    LGI=70 MNI=.013 SCI=0 RAIN=-1
*
ADD HYD             ID=3 NHYD=1024 IDONE=1 IDTWO=2
*
*
CALIB STANDHYD      ID=1 NYHD=718 DT=5 MIN AREA=0.375 HA XIMP=.40 TIMP=.40
                    DWF=0.00 LOSS=1 FO=76.3 FC=3.0 DCAY=4.14 F=0 DPSP=5.0
                    SLPP=2.0 LGP=15 MNP=.25 SCP=0 DPSI=1.5 SLPI=4.0
                    LGI=65 MNI=.013 SCI=0 RAIN=-1
*
ADD HYD             ID=2 NHYD=1025 IDONE=1 IDTWO=3
*
ROUTE CHANNEL       IDOUT=3 NHYD=502 IDIN=2 DT=5 MIN
                    CHLGTH=140 CHSLOPE=0.5 FPSLOPE=0.5
                    VSN=2.5 NSEG=3
                    THE SEGMENT DATA FOLLOWS
                     N       DIST(M)
                     0.025     5.65
                    -0.013    14.35
                     0.025    20.00
                    THE CROSS SECTION DATA FOLLOWS
                    DIST(M)    ELEV(M)
                     0.00       1.27
                     5.65       1.15
                     5.80       1.00
                    10.00       1.11
                    14.20       1.00
                    14.35       1.15
                    20.00       1.27
*
CALIB STANDHYD      ID=4 NYHD=717 DT=5 MIN AREA=0.925 HA XIMP=.30 TIMP=.30
                    DWF=0.00 LOSS=1 FO=76.3 FC=3.0 DCAY=4.14 F=0 DPSP=5.0
                    SLPP=1.0 LGP=200 MNP=.25 SCP=0 DPSI=1.5 SLPI=2.0
                    LGI=10 MNI=.013 SCI=0 RAIN=-1
*
ADD HYD             ID=10 NHYD=1028 IDONE=3 IDTWO=4
*
CALIB STANDHYD      ID=1 NYHD=710 DT=5 MIN AREA=0.483 HA XIMP=.35 TIMP=.35
                    DWF=0.00 LOSS=1 FO=76.3 FC=3.0 DCAY=4.14 F=0 DPSP=5.0
                    SLPP=2.0 LGP=40 MNP=.25 SCP=0 DPSI=1.5 SLPI=2.0
                    LGI=60 MNI=.013 SCI=0 RAIN=-1
*
ROUTE CHANNEL       IDOUT=3 NHYD=711 IDIN=1 DT=5 MIN
                    CHLGTH=120 CHSLOPE=2.0 FPSLOPE=2.0
                    VSN=2.8 NSEG=3
                    THE SEGMENT DATA FOLLOWS
                     N       DIST(M)
                     0.025     5.65
                    -0.013    14.35
                     0.025    20.00
                    THE CROSS SECTION DATA FOLLOWS
                    DIST(M)    ELEV(M)
                     0.00       1.27
                     5.65       1.15
                     5.80       1.00
                    10.00       1.11
                    14.20       1.00
                    14.35       1.15
                    20.00       1.27
*
*
CALIB STANDHYD      ID=2 NYHD=711 DT=5 MIN AREA=0.544 HA XIMP=.40 TIMP=.40
                    DWF=0.00 LOSS=1 FO=76.3 FC=3.0 DCAY=4.14 F=0 DPSP=5.0
                    SLPP=2.0 LGP=40 MNP=.25 SCP=0 DPSI=1.5 SLPI=2.0
                    LGI=50 MNI=.013 SCI=0 RAIN=-1
*
ADD HYD             ID=1 NHYD=1030 IDONE=2 IDTWO=3
*
*
CALIB STANDHYD      ID=2 NYHD=301 DT=5 MIN AREA=0.553 HA XIMP=.40 TIMP=.40
                    DWF=0.00 LOSS=1 FO=76.3 FC=3.0 DCAY=4.14 F=0 DPSP=5.0
                    SLPP=2.0 LGP=40 MNP=.25 SCP=0 DPSI=1.5 SLPI=3.5
                    LGI=90 MNI=.013 SCI=0 RAIN=-1
*
CALIB NASHYD        ID=4 HYD=902 DT=5 MIN AREA=1.01 HA
                    DWF=0.0 CN=70 IA=21.8 N=3 TP=.1137
```

```
                      END=-1
*
ADD HYD               ID=5 NHYD=1031 IDONE=1 IDTWO=2
ADD HYD               ID=6 NHYD=1033 IDONE=5 IDTWO=4
*
ROUTE CHANNEL         IDOUT=7 NHYD=303 IDIN=6 DT=5 MIN
                      CHLGTH=60 CHSLOPE=2.0 FPSLOPE=2.0
                      VSN=2.8 NSEG=3
                      THE SEGMENT DATA FOLLOWS
                       N       DIST(M)
                       0.025    5.65
                      -0.013   14.35
                       0.025   20.00
                      THE CROSS SECTION DATA FOLLOWS
                      DIST(M)   ELEV(M)
                       0.00      1.27
                       5.65      1.15
                       5.80      1.00
                      10.00      1.11
                      14.20      1.00
                      14.35      1.15
                      20.00      1.27
*
*
CALIB STANDHYD        ID=3 NYHD=712 DT=5 MIN AREA=0.318 HA XIMP=.30 TIMP=.30
                      DWF=0.00 LOSS=1 FO=76.3 FC=3.0 DCAY=4.14 F=0 DPSP=5.0
                      SLPP=2.0 LGP=150 MNP=.25 SCP=0 DPSI=1.5 SLPI=2.0
                      LGI=10 MNI=.013 SCI=0 RAIN=-1
*
CALIB STANDHYD        ID=4 NYHD=303 DT=5 MIN AREA=0.321 HA XIMP=.40 TIMP=.40
                      DWF=0.00 LOSS=1 FO=76.3 FC=3.0 DCAY=4.14 F=0 DPSP=5.0
                      SLPP=2.0 LGP=15 MNP=.25 SCP=0 DPSI=1.5 SLPI=2.0
                      LGI=70 MNI=.013 SCI=0 RAIN=-1
*
ADD HYD               ID=1 NHYD=1000 IDONE=7 IDTWO=3
ADD HYD               ID=6 NHYD=1001 IDONE=1 IDTWO=4
*
CALIB STANDHYD        ID=1 NYHD=714 DT=5 MIN AREA=0.421 HA XIMP=.40 TIMP=.40
                      DWF=0.00 LOSS=1 FO=76.3 FC=3.0 DCAY=4.14 F=0 DPSP=5.0
                      SLPP=2.0 LGP=40 MNP=.25 SCP=0 DPSI=1.5 SLPI=2.5
                      LGI=50 MNI=.013 SCI=0 RAIN=-1
*
CALIB STANDHYD        ID=2 NYHD=709 DT=5 MIN AREA=0.309 HA XIMP=.40 TIMP=.40
                      DWF=0.00 LOSS=1 FO=76.3 FC=3.0 DCAY=4.14 F=0 DPSP=5.0
                      SLPP=2.0 LGP=15 MNP=.25 SCP=0 DPSI=1.5 SLPI=2.0
                      LGI=90 MNI=.013 SCI=0 RAIN=-1
*
ROUTE CHANNEL         IDOUT=3 NHYD=709 IDIN=2 DT=5 MIN
                      CHLGTH=60 CHSLOPE=2.0 FPSLOPE=2.0
                      VSN=2.7 NSEG=3
                      THE SEGMENT DATA FOLLOWS
                       N       DIST(M)
                       0.025    5.65
                      -0.013   14.35
                       0.025   20.00
                      THE CROSS SECTION DATA FOLLOWS
                      DIST(M)   ELEV(M)
                       0.00      1.27
                       5.65      1.15
                       5.80      1.00
                      10.00      1.11
                      14.20      1.00
                      14.35      1.15
                      20.00      1.27
ADD HYD               ID=4 NHYD=1000 IDONE=3 IDTWO=1
*
ROUTE CHANNEL         IDOUT=2 NHYD=713 IDIN=4 DT=5 MIN
                      CHLGTH=50 CHSLOPE=2.0 FPSLOPE=2.0
                      VSN=2.9 NSEG=3
                      THE SEGMENT DATA FOLLOWS
                       N       DIST(M)
                       0.025    5.65
                      -0.013   14.35
                       0.025   20.00
                      THE CROSS SECTION DATA FOLLOWS
                      DIST(M)   ELEV(M)
                       0.00      1.27
                       5.65      1.15
```

```
                         5.80       1.00
                        10.00       1.11
                        14.20       1.00
                        14.35       1.15
                        20.00       1.27
*
*
CALIB STANDHYD          ID=3 NYHD=713 DT=5 MIN AREA=0.327 HA XIMP=.35 TIMP=.35
                        DWF=0.00 LOSS=1 FO=76.3 FC=3.0 DCAY=4.14 F=0 DPSP=5.0
                        SLPP=2.0 LGP=40 MNP=.25 SCP=0 DPSI=1.5 SLPI=2.0
                        LGI=50 MNI=.013 SCI=0 RAIN=-1
*
ADD HYD                 ID=1 NHYD=1034 IDONE=3 IDTWO=2
*
ROUTE CHANNEL           IDOUT=3 NHYD=302 IDIN=1 DT=5 MIN
                        CHLGTH=50 CHSLOPE=2.0 FPSLOPE=2.0
                        VSN=3.0 NSEG=3
                        THE SEGMENT DATA FOLLOWS
                         N        DIST(M)
                         0.025     5.65
                        -0.013    14.35
                         0.025    20.00
                        THE CROSS SECTION DATA FOLLOWS
                        DIST(M)    ELEV(M)
                         0.00       1.27
                         5.65       1.15
                         5.80       1.00
                        10.00       1.11
                        14.20       1.00
                        14.35       1.15
                        20.00       1.27
*
*
CALIB STANDHYD          ID=1 NYHD=302 DT=5 MIN AREA=0.227 HA XIMP=.35 TIMP=.35
                        DWF=0.00 LOSS=1 FO=76.3 FC=3.0 DCAY=4.14 F=0 DPSP=5.0
                        SLPP=2.0 LGP=40 MNP=.25 SCP=0 DPSI=1.5 SLPI=2.0
                        LGI=50 MNI=.013 SCI=0 RAIN=-1
*
ADD HYD                 ID=2 NHYD=1036 IDONE=3 IDTWO=1
ADD HYD                 ID=8 NHYD=1037 IDONE=2 IDTWO=6
*
ROUTE CHANNEL           IDOUT=1 NHYD=303 IDIN=8 DT=5 MIN
                        CHLGTH=80 CHSLOPE=1.0 FPSLOPE=1.0
                        VSN=3.0 NSEG=3
                        THE SEGMENT DATA FOLLOWS
                         N        DIST(M)
                         0.025     5.65
                        -0.013    14.35
                         0.025    20.00
                        THE CROSS SECTION DATA FOLLOWS
                        DIST(M)    ELEV(M)
                         0.00       1.27
                         5.65       1.15
                         5.80       1.00
                        10.00       1.11
                        14.20       1.00
                        14.35       1.15
                        20.00       1.27
*
CALIB STANDHYD          ID=2 NYHD=304 DT=5 MIN AREA=0.310 HA XIMP=.40 TIMP=.40
                        DWF=0.00 LOSS=1 FO=76.3 FC=3.0 DCAY=4.14 F=0 DPSP=5.0
                        SLPP=2.0 LGP=15 MNP=.25 SCP=0 DPSI=1.5 SLPI=2.0
                        LGI=80 MNI=.013 SCI=0 RAIN=-1
*
ADD HYD                 ID=3 NHYD=1038 IDONE=1 IDTWO=2
*
CALIB STANDHYD          ID=2 NYHD=707 DT=5 MIN AREA=0.265 HA XIMP=.30 TIMP=.30
                        DWF=0.00 LOSS=1 FO=76.3 FC=3.0 DCAY=4.14 F=0 DPSP=5.0
                        SLPP=1.5 LGP=90 MNP=.25 SCP=0 DPSI=1.5 SLPI=2.0
                        LGI=10 MNI=.013 SCI=0 RAIN=-1
*
ROUTE CHANNEL           IDOUT=1 NHYD=715 IDIN=2 DT=5 MIN
                        CHLGTH=130 CHSLOPE=2.0 FPSLOPE=2.0
                        VSN=3.2 NSEG=3
                        THE SEGMENT DATA FOLLOWS
                          N          DIST(M)
                         0.025          1.00
                        -0.045         3.00
```

```
                       0.025        4.00
                      THE CROSS SECTION DATA FOLLOWS
                      DIST(M)     ELEV(M)
                       0.00        1.27
                       1.00        1.25
                       2.00        1.00
                       3.00        1.25
                       4.00        1.27
*
*
CALIB STANDHYD        ID=2 NYHD=715 DT=5 MIN AREA=0.288 HA XIMP=.30 TIMP=.30
                      DWF=0.00 LOSS=1 FO=76.3 FC=3.0 DCAY=4.14 F=0 DPSP=5.0
                      SLPP=2.0 LGP=130 MNP=.25 SCP=0 DPSI=1.5 SLPI=2.0
                      LGI=10 MNI=.013 SCI=0 RAIN=-1
*
ADD HYD               ID=4 NHYD=1038 IDONE=3 IDTWO=2
ADD HYD               ID=2 NHYD=1039 IDONE=4 IDTWO=1
ADD HYD               ID=3 NHYD=1040 IDONE=2 IDTWO=9
ADD HYD               ID=1 NHYD=1041 IDONE=3 IDTWO=10
*
CALIB NASHYD          ID=5 HYD=907 DT=5 MIN AREA=3.87 HA
                      DWF=0.0 CN=70 IA=21.8 N=3 TP=.1330
                      END=-1
*
ADD HYD               ID=2 NHYD=1041 IDONE=5 IDTWO=1
*
PRINT HYD             ID=2 NPCYC=1
SAVE HYD              ID=2 NPCYC=1 ICASE=-1
                      100PST.HYD
*
SAVE HYD              ID=3 NPCYC=2 ICASE=-1
                      MAXDEPTH.HYD
                      100YR POST DEPTH
*
ROUTE CHANNEL         IDOUT=4 NHYD=303 IDIN=3 DT=5 MIN
                      CHLGTH=100 CHSLOPE=1.0 FPSLOPE=1.0
                      VSN=3.0 NSEG=3
                      THE SEGMENT DATA FOLLOWS
                       N        DIST(M)
                       0.025     5.65
                      -0.013    14.35
                       0.025    20.00
                      THE CROSS SECTION DATA FOLLOWS
                      DIST(M)    ELEV(M)
                       0.00       1.27
                       5.65       1.15
                       5.80       1.00
                      10.00       1.11
                      14.20       1.00
                      14.35       1.15
                      20.00       1.27
ROUTE CHANNEL         IDOUT=5 NHYD=303 IDIN=2 DT=5 MIN
                      CHLGTH=100 CHSLOPE=1.0 FPSLOPE=1.0
                      VSN=3.0 NSEG=3
                      THE SEGMENT DATA FOLLOWS
                       N        DIST(M)
                       0.025     5.65
                      -0.013    14.35
                       0.025    20.00
                      THE CROSS SECTION DATA FOLLOWS
                      DIST(M)    ELEV(M)
                       0.00       1.27
                       5.65       1.15
                       5.80       1.00
                      10.00       1.11
                      14.20       1.00
                      14.35       1.15
                      20.00       1.27
FINISH
```

```
================================================================================

  OOO    TTTTT   TTTTT   H    H   Y    Y   M    M   OOO      I N T E R H Y M O
 O   O     T       T     H    H    Y Y     MM MM   O   O     * * * 1989a * * *
 O   O     T       T     HHHHH      Y      M M M   O   O
 O   O     T       T     H    H     Y      M    M  O   O
  OOO      T       T     H    H     Y      M    M   OOO
```


***** S U M M A R Y   O U T P U T *****

Input filename: 100PST.DAT
Output filename: 100PST.OUT
Summary filename: 100PST.SUM

DATE: 10-14-1997 TIME: 08:12:57

USER: ______________________________

COMMENTS: ______________________________

```
******************************
** SIMULATION NUMBER:   1 **
******************************
```

W/E	COMMAND	HYD	ID	DT min	AREA ha	Qpeak cms	Tpeak hrs	R.V. mm	R.C.	Qbase cms
	START @ .00 hrs									
	READ STORM [Ptot= 68.75 in] fname :A:6SCS.100 remark:*SCS Type 2 Hyetograph, 100-yr 6-hour distribution			15.0						
	CALIB NASHYD [CN=83.0] [N= 3.0:Tp= .17]	0059	1	5.0	.39	.04	3.08	30.41	.44	.000
*	CALIB STANDHYD [I%=40.0:S%= 2.00]	0201	1	5.0	.39	.08	3.00	44.93	.65	.000
*	CALIB STANDHYD [I%=40.0:S%= 2.00]	0202	1	5.0	.39	.10	3.00	47.72	.69	.000
	CHANNEL[1 : 0202]	0202	2	5.0	.39	.10	3.00	47.71	n/a	.000
*	CALIB STANDHYD [I%=40.0:S%= 2.00]	0202	3	5.0	.39	.10	3.00	47.72	.69	.000
	ADD [0202 + 0202]	1000	1	5.0	.77	.20	3.00	47.71	n/a	.000
	CHANNEL[1 : 1000]	0203	2	5.0	.77	.19	3.00	47.71	n/a	.000
*	CALIB STANDHYD [I%=40.0:S%= 2.00]	0203	3	5.0	.35	.09	3.00	47.72	.69	.000
	ADD [0203 + 0203]	1001	1	5.0	1.12	.29	3.00	47.71	n/a	.000
	CHANNEL[1 : 1001]	0204	2	5.0	1.12	.28	3.00	47.71	n/a	.000
*	CALIB STANDHYD [I%=40.0:S%= 2.00]	0204	3	5.0	.39	.10	3.00	47.72	.69	.000
	ADD [0204 + 0204]	1002	5	5.0	1.51	.39	3.00	47.71	n/a	.000
	CALIB NASHYD [CN=83.0] [N= 3.0:Tp= .25]	0001	4	5.0	42.60	3.80	3.17	30.63	.45	.000
	ADD [0001 + 1002]	1002	1	5.0	44.11	3.99	3.17	31.21	n/a	.000

*	CALIB STANDHYD [I%=40.0:S%= 2.00]	0101	2	5.0	.26	.06	3.08	47.08	.68	.000
*	CALIB STANDHYD [I%=30.0:S%= 2.50]	0701	3	5.0	.74	.08	3.00	44.27	.64	.000
	CALIB NASHYD [CN=70.0] [N= 3.0:Tp= .16]	0903	4	5.0	3.90	.16	3.08	13.95	.20	.000
	ADD [1002 + 0101]	1003	5	5.0	44.37	4.04	3.17	31.30	n/a	.000
	ADD [1003 + 0701]	1004	6	5.0	45.11	4.08	3.17	31.52	n/a	.000
	ADD [1004 + 0903]	1005	7	5.0	49.01	4.24	3.17	30.12	n/a	.000
*	CALIB STANDHYD [I%=30.0:S%= 2.50]	0702	1	5.0	.22	.04	3.00	43.75	.64	.000
	CHANNEL[1 : 0702]	0703	2	5.0	.22	.04	3.00	43.75	n/a	.000
*	CALIB STANDHYD [I%=30.0:S%= 2.00]	0703	3	5.0	.35	.09	3.00	44.04	.64	.000
	ADD [0703 + 0703]	1006	1	5.0	.57	.12	3.00	43.93	n/a	.000
	CHANNEL[1 : 1006]	0704	2	5.0	.57	.11	3.08	43.85	n/a	.000
*	CALIB STANDHYD [I%=30.0:S%= 2.50]	0704	3	5.0	.36	.05	3.00	44.47	.65	.000
	ADD [0704 + 0704]	1007	1	5.0	.93	.16	3.00	44.09	n/a	.000
	ADD [1007 + 1005]	1008	3	5.0	49.94	4.36	3.17	30.38	n/a	.000
*	CHANNEL[3 : 1008]	0102	2	5.0	49.94	4.38	3.17	30.38	n/a	.000
*	CALIB STANDHYD [I%=40.0:S%= .40]	0102	3	5.0	.30	.07	3.00	47.72	.69	.000
	ADD [0102 + 0102]	1009	9	5.0	50.24	4.42	3.17	30.48	n/a	.000
	CALIB NASHYD [CN=70.0] [N= 3.0:Tp= .18]	0904	1	5.0	1.80	.07	3.17	13.95	.20	.000
*	CALIB STANDHYD [I%=30.0:S%= .50]	0721	2	5.0	.45	.05	3.00	43.95	.64	.000
	ADD [0904 + 0721]	1010	3	5.0	2.24	.09	3.00	19.90	n/a	.000
	CHANNEL[3 : 1010]	0720	2	5.0	2.24	.09	3.25	19.83	n/a	.000
*	CALIB STANDHYD [I%=30.0:S%= .50]	0720	3	5.0	.36	.04	3.00	44.41	.65	.000
	ADD [0720 + 0720]	1011	8	5.0	2.60	.12	3.25	23.21	n/a	.000
*	CALIB STANDHYD [I%=40.0:S%= 2.00]	0401	1	5.0	.34	.09	3.08	47.71	.69	.000
	CHANNEL[1 : 0401]	0402	2	5.0	.34	.08	3.08	47.68	n/a	.000
*	CALIB STANDHYD [I%=40.0:S%= 2.00]	0402	1	5.0	.30	.08	3.08	47.71	.69	.000
	ADD [0402 + 0402]	1013	3	5.0	.64	.16	3.08	47.70	n/a	.000
*	CALIB STANDHYD [I%=30.0:S%= 1.00]	0723	1	5.0	.35	.06	3.00	44.33	.64	.000
	CHANNEL[1 : 0723]	0725	2	5.0	.35	.05	3.00	44.32	n/a	.000
*	CALIB STANDHYD [I%=40.0:S%= 2.00]	0725	7	5.0	.40	.10	3.00	47.72	.69	.000
	ADD [0725 + 0725]	1014	1	5.0	.75	.15	3.00	46.14	n/a	.000

	ADD [1014 + 1013]	1015	2	5.0	1.39	.28	3.00	46.86	n/a	.000
	ADD [1015 + 1011]	1016	3	5.0	4.00	.38	3.00	31.45	n/a	.000
	CHANNEL[3 : 1016]	0403	2	5.0	4.00	.39	3.08	31.45	n/a	.000
*	CALIB STANDHYD [I%=40.0:S%= 2.00]	0403	3	5.0	.29	.07	3.00	47.21	.69	.000
	ADD [0403 + 0403]	1017	1	5.0	4.28	.44	3.00	32.51	n/a	.000
	ADD [1017 + 1009]	1018	2	5.0	54.52	4.78	3.17	30.64	n/a	.000
*	CHANNEL[2 : 1018]	0103	3	5.0	54.52	4.76	3.17	30.64	n/a	.000
*	CALIB STANDHYD [I%=40.0:S%= 2.00]	0103	1	5.0	.37	.09	3.08	47.70	.69	.000
	ADD [0103 + 0103]	1019	2	5.0	54.90	4.82	3.17	30.76	n/a	.000
*	CHANNEL[2 : 1019]	0104	3	5.0	54.90	4.85	3.17	30.76	n/a	.000
*	CALIB STANDHYD [I%=40.0:S%= 2.00]	0104	2	5.0	.41	.10	3.08	47.70	.69	.000
	ADD [0104 + 0104]	1020	1	5.0	55.30	4.92	3.17	30.88	n/a	.000
*	CALIB STANDHYD [I%=30.0:S%= .40]	0705	3	5.0	.57	.06	3.00	44.27	.64	.000
	ADD [1020 + 0705]	1021	2	5.0	55.88	4.95	3.17	31.02	n/a	.000
*	CALIB STANDHYD [I%=40.0:S%= 1.50]	0706	4	5.0	.88	.18	3.08	47.71	.69	.000
	ADD [1021 + 0706]	1022	9	5.0	56.76	5.08	3.17	31.28	n/a	.000
*	CHANNEL[9 : 1022]	0304	2	5.0	56.76	5.01	3.17	31.28	n/a	.000
*	CALIB STANDHYD [I%=40.0:S%= 2.00]	0105	1	5.0	.46	.11	3.00	47.71	.69	.000
	ADD [0105 + 0304]	1003	9	5.0	57.22	5.06	3.17	31.41	n/a	.000
	SAVE HYD fname :HYD1003.001 remark:MAINST.HYD	1003	9	5.0	57.22	5.06	3.17	31.41	n/a	.000
*	CALIB STANDHYD [I%=30.0:S%= 2.00]	0719	1	5.0	.60	.08	3.00	44.47	.65	.000
*	CALIB STANDHYD [I%=40.0:S%= 2.00]	0726	2	5.0	.36	.09	3.00	47.72	.69	.000
	ADD [0719 + 0726]	1023	3	5.0	.96	.17	3.00	45.69	n/a	.000
	CHANNEL[3 : 1023]	0501	2	5.0	.96	.16	3.00	45.68	n/a	.000
*	CALIB STANDHYD [I%=40.0:S%= 2.00]	0501	1	5.0	.29	.07	3.08	47.30	.69	.000
	ADD [0501 + 0501]	1024	3	5.0	1.25	.22	3.00	46.08	n/a	.000
*	CALIB STANDHYD [I%=40.0:S%= 2.00]	0718	1	5.0	.38	.10	3.00	47.72	.69	.000
	ADD [0718 + 1024]	1025	2	5.0	1.63	.32	3.00	46.46	n/a	.000
	CHANNEL[2 : 1025]	0502	3	5.0	1.63	.30	3.08	46.43	n/a	.000
*	CALIB STANDHYD [I%=30.0:S%= 1.00]	0717	4	5.0	.93	.10	3.00	44.32	.64	.000
	ADD [0502 + 0717]	1028	10	5.0	2.56	.39	3.00	45.66	n/a	.000
*	CALIB STANDHYD [I%=35.0:S%= 2.00]	0710	1	5.0	.48	.11	3.00	46.11	.67	.000

	CHANNEL[1 : 0710]	0711	3	5.0	.48	.10	3.00	46.08	n/a	.000
*	CALIB STANDHYD [I%=40.0:S%= 2.00]	0711	2	5.0	.54	.13	3.00	47.72	.69	.000
	ADD [0711 + 0711]	1030	1	5.0	1.03	.23	3.00	46.95	n/a	.000
*	CALIB STANDHYD [I%=40.0:S%= 2.00]	0301	2	5.0	.55	.13	3.00	47.72	.69	.000
	CALIB NASHYD [CN=70.0] [N= 3.0:Tp= .11]	0902	4	5.0	1.01	.05	3.00	13.77	.20	.000
	ADD [1030 + 0301]	1031	5	5.0	1.58	.36	3.00	47.22	n/a	.000
	ADD [1031 + 0902]	1033	6	5.0	2.59	.41	3.00	34.17	n/a	.000
	CHANNEL[6 : 1033]	0303	7	5.0	2.59	.39	3.00	34.17	n/a	.000
*	CALIB STANDHYD [I%=30.0:S%= 2.00]	0712	3	5.0	.32	.04	3.00	44.29	.64	.000
*	CALIB STANDHYD [I%=40.0:S%= 2.00]	0303	4	5.0	.32	.08	3.00	47.72	.69	.000
	ADD [0303 + 0712]	1000	1	5.0	2.91	.43	3.00	35.28	n/a	.000
	ADD [1000 + 0303]	1001	6	5.0	3.23	.52	3.00	36.52	n/a	.000
*	CALIB STANDHYD [I%=40.0:S%= 2.00]	0714	1	5.0	.42	.10	3.00	47.72	.69	.000
*	CALIB STANDHYD [I%=40.0:S%= 2.00]	0709	2	5.0	.31	.08	3.00	47.72	.69	.000
	CHANNEL[2 : 0709]	0709	3	5.0	.31	.08	3.00	47.71	n/a	.000
	ADD [0709 + 0714]	1000	4	5.0	.73	.18	3.00	47.72	n/a	.000
	CHANNEL[4 : 1000]	0713	2	5.0	.73	.17	3.00	47.72	n/a	.000
*	CALIB STANDHYD [I%=35.0:S%= 2.00]	0713	3	5.0	.33	.07	3.00	45.84	.67	.000
	ADD [0713 + 0713]	1034	1	5.0	1.06	.24	3.00	47.14	n/a	.000
	CHANNEL[1 : 1034]	0302	3	5.0	1.06	.24	3.00	47.14	n/a	.000
*	CALIB STANDHYD [I%=35.0:S%= 2.00]	0302	1	5.0	.23	.05	3.00	45.31	.66	.000
	ADD [0302 + 0302]	1036	2	5.0	1.28	.29	3.00	46.81	n/a	.000
	ADD [1036 + 1001]	1037	8	5.0	4.51	.81	3.00	39.45	n/a	.000
	CHANNEL[8 : 1037]	0303	1	5.0	4.51	.82	3.00	39.44	n/a	.000
*	CALIB STANDHYD [I%=40.0:S%= 2.00]	0304	2	5.0	.31	.08	3.00	47.72	.69	.000
	ADD [0303 + 0304]	1038	3	5.0	4.82	.90	3.00	39.97	n/a	.000
*	CALIB STANDHYD [I%=30.0:S%= 1.50]	0707	2	5.0	.27	.04	3.00	43.96	.64	.000
	CHANNEL[2 : 0707]	0715	1	5.0	.27	.04	3.08	43.77	n/a	.000
*	CALIB STANDHYD [I%=30.0:S%= 2.00]	0715	2	5.0	.29	.04	3.00	44.11	.64	.000
	ADD [1038 + 0715]	1038	4	5.0	5.11	.94	3.00	40.21	n/a	.000
	ADD [1038 + 0715]	1039	2	5.0	5.38	.98	3.00	40.38	n/a	.000
	ADD [1039 + 1003]	1040	3	5.0	62.60	5.64	3.17	32.18	n/a	.000

ADD [1040 + 1028]	1041	1	5.0	65.15	5.93	3.17	32.71	n/a	.000
CALIB NASHYD [CN=70.0] [N= 3.0:Tp= .13]	0907	5	5.0	3.87	.18	3.08	13.89	.20	.000
ADD [0907 + 1041]	1041	2	5.0	69.02	6.09	3.17	31.65	n/a	.000
PRINT HYD	1041	2	5.0	69.02	6.09	3.17	31.65	n/a	.000
SAVE HYD fname :100PST.HYD remark:	1041	2	5.0	69.02	6.09	3.17	31.65	n/a	.000
SAVE HYD fname :MAXDEPTH.HYD remark:100YR POST DEPTH	1040	3	5.0	62.60	5.64	3.17	32.18	n/a	.000
* CHANNEL[3 : 1040]	0303	4	5.0	62.60	5.62	3.25	32.18	n/a	.000
* CHANNEL[2 : 1041]	0303	5	5.0	69.02	6.04	3.17	31.65	n/a	.000

FINISH

==

APPENDIX D

Input Parameters

D1 EVALUATION OF INPUT PARAMETERS FOR THE COMPUTER MODEL

The CALIB STANDHYD subroutine was used to evaluate the runoff potential of the post-development condition. This subroutine allows for modelling of the subcatchment using one of three loss estimating methods. These are the Horton Infiltration relation, SCS modified Curve Number with the initial abstraction estimated from the SCS assumption (Ia = 0.2 x S), and the Proportional Loss Coefficient again using the SCS assumption.

The Horton Infiltration relation was used in this analysis. Values were chosen to represent a type D soil for the worst case scenario. These values are:

Fo	76.3
Fc	3.0
K	4.14
F	0

Depression Storage over Pervious area = 5.0 mm
Depression Storage over Impervious area = 1.5 mm

The values listed above, including the SCS assumption, were cross checked with Watt, 1989 and verified in a conversation with the author.

This model represents a more conservative estimate of runoff than does a more probable scenario of type C soil. The assumption of type D soil relates to approximately a 25 % increase in runoff over the type C soil. An example of the output from the computer model is included in this appendix.

Storm sewers were sized using the Rational Method and a runoff coefficient of 0.45. The Rational method is well known to over estimate the amount of runoff expected from a development usually resulting in over-sizing of storm sewers.

D1.1 POND SIZING

The ponds were sized using the guidelines given in the Stormwater Management Practices Planning and Design Manual. The computer model was not used in the pond sizing and therefore a change in the input parameters would have no influence on the size of the ponds. See section 3.2.1 for a more complete discussion of the sizing criteria.

```
--------------------
| CALIB              |
| NASHYD    (0059)   |   Area      (ha)=     .39   Curve Number    (CN)= 83.0
|ID= 1 DT= 5.0 min   |   Ia        (mm)=   10.40   # of Linear Res.(N)= 3.00
--------------------   U.H. Tp(hrs)=        .17

        NOTE:  RAINFALL WAS TRANSFORMED TO   5.0 MIN. TIME STEP.

     Unit Hyd Qpeak   (cms)=     .09

     PEAK FLOW        (cms)=     .04 (i)
     TIME TO PEAK     (hrs)=    3.08
     RUNOFF VOLUME     (mm)=   30.41
     TOTAL RAINFALL    (mm)=   68.75
     RUNOFF COEFFICIENT   =      .44

     (i) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
*
--------------------
| CALIB              |
| STANDHYD  (0201)   |   Area      (ha)=     .39
|ID= 1 DT= 5.0 min   |   Total Imp(%)=   40.00   Dir. Conn.(%)=   40.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area      (ha)=       .15          .23
     Dep. Storage      (mm)=      1.50        10.80
     Average Slope      (%)=      2.50         2.00
     Length             (m)=     90.00        15.00
     Mannings n            =      .013         .250

     Max.eff.Inten.(mm/hr)=     116.00        62.49
                over (min)      10.00        10.00
     Storage Coeff.   (min)=      1.72 (ii)    6.06 (ii)
     Unit Hyd. Tpeak  (min)=      5.00        10.00
     Unit Hyd. peak   (cms)=       .32          .15
                                                          *TOTALS*
     PEAK FLOW        (cms)=       .05          .03           .08 (iii)
     TIME TO PEAK     (hrs)=      3.00         3.08          3.00
     RUNOFF VOLUME     (mm)=     67.00        30.34         44.93
     TOTAL RAINFALL    (mm)=     68.75        68.75         68.75
     RUNOFF COEFFICIENT   =        .97          .44           .65

***** WARNING: STORAGE COEFF. IS SMALLER THAN TIME STEP!

       (i) CN PROCEDURE SELECTED FOR RAINFALL LOSSES:
            CN*  =   83.0     Ia = Dep. Storage  (Above)
      (ii) COMPUTATIONAL TIME STEP SHOULD BE SMALL OR EQUAL
           THAN THE STORAGE COEFFICIENT.
     (iii) PEAK FLOW DOES NOT INCLUDE BASEFLOW IF ANY.

--------------------------------------------------------------------------------
*
--------------------
| CALIB              |
| STANDHYD  (0202)   |   Area      (ha)=     .39
|ID= 1 DT= 5.0 min   |   Total Imp(%)=   40.00   Dir. Conn.(%)=   40.00
--------------------
                              IMPERVIOUS    PERVIOUS (i)
     Surface Area      (ha)=       .15          .23
     Dep. Storage      (mm)=      1.50         5.00
     Average Slope      (%)=      2.50         2.00
     Length             (m)=     90.00        15.00
     Mannings n            =      .013         .250

     Max.eff.Inten.(mm/hr)=     116.00       107.75
                over (min)      10.00        10.00
     Storage Coeff.   (min)=      1.72 (ii)    6.06 (ii)
     Unit Hyd. Tpeak  (min)=      5.00        10.00
     Unit Hyd. peak   (cms)=       .32          .15
                                                          *TOTALS*
     PEAK FLOW        (cms)=       .05          .05           .10 (iii)
     TIME TO PEAK     (hrs)=      3.00         3.00          3.00
     RUNOFF VOLUME     (mm)=     67.00        34.87         47.72
     TOTAL RAINFALL    (mm)=     68.75        68.75         68.75
     RUNOFF COEFFICIENT   =        .97          .51           .69
```

2 FLOW NEGLECTING STORMSEWER	2 FLOW -- STORMSEWER	2 OVERLAND FLOW
0.0833	0.08333	0.08333
42.6	42.6	42.6
0	0	0
0	0	0
0	0	0
0	0	0
0	0	0
0	0	0
0	0	0
0	0	0
0	0	0
0	0	0
0	0	0
0	0	0
0	0	0
0	0	0
0	0	0
0	0	0
0	0	0
0	0	0
0	0	0
0	0	0
0	0	0
0	0	0
0	0	0
0	0	0
0	0	0
0	0	0
0	0	0
0	0	0
0	0	0
0.005	0.005	0
0.019	0.019	0
0.046	0.046	0
0.084	0.084	0
0.13	0.13	0
0.492	0.492	0
1.359	0.9	0.459
2.622	2.615	0.007
3.523	2.615	0.908
3.801	2.615	1.186
3.7	2.615	1.085
3.342	2.615	0.727
2.857	2.615	0.242
2.383	2.383	0
1.959	1.959	0
1.601	1.601	0
1.322	1.322	0
1.115	1.115	0
0.969	0.969	0
0.87	0.87	0
0.791	0.791	0
0.723	0.723	0
0.666	0.666	0
0.625	0.625	0
0.599	0.599	0
0.585	0.585	0
0.56	0.56	0
0.523	0.523	0
0.482	0.482	0
0.444	0.444	0
0.41	0.41	0
0.383	0.383	0
0.366	0.366	0

0.359	0.359	0
0.356	0.356	0
0.35	0.35	0
0.336	0.336	0
0.321	0.321	0
0.308	0.308	0
0.297	0.297	0
0.289	0.289	0
0.284	0.284	0
0.28	0.28	0
0.257	0.257	0
0.211	0.211	0
0.16	0.16	0
0.114	0.114	0
0.078	0.078	0
0.051	0.051	0
0.033	0.033	0
0.02	0.02	0
0.013	0.013	0
0.008	0.008	0
0.005	0.005	0
0.003	0.003	0
0.002	0.002	0
−1	−1	−1