



**MOIRA RIVER
CONSERVATION AUTHORITY**

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Flood Plain Mapping Master Drainage Plan

Bell Creek



Environment Canada
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Ministry of Natural Resources
Ministère des Richesses naturelles

CANADA/ONTARIO FLOOD DAMAGE REDUCTION PROGRAM

EGA

ECOS GARATECH ASSOCIATES LTD.
Consulting Engineers



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Consulting Engineers

1625 Steeles Ave. E., Unit 19, Brampton, Ont. L6T 4T7 TEL. (416) 458-4110 FAX (416) 458-1479

File No.: 8551-15-010

November 6, 1989

Moira River Conservation Authority
P.O. Box 698
Belleville, Ontario
K8N 5B3

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Attention: Mr. D. King
General Manager

Reference: Flood Plain Mapping
Master Drainage Plan
Bell Creek

Dear Dave:

We are pleased to submit herewith our Report entitled Flood Plain Mapping - Master Drainage Plan - Bell Creek, detailing the hydrologic and hydraulic analyses carried out, as well as the preparation of a Master Drainage Plan, for Bell Creek within the City of Belleville and the Township of Thurlow.

We trust that the results, conclusions and recommendations contained in this Report and the Flood Risk Maps will assist the Authority in establishing a comprehensive Water Management Program and a Master Drainage Plan for the Bell Creek Watershed, and we would be pleased to assist and participate in the implementation and compilation of these programs.

Yours truly,

ECOS GARATECH ASSOCIATES LTD.

M.D. Garraway
Project Manager

P.S.H. Lim, P.Eng.
Project Engineer

MDG/pl

Encl.



MOIRA RIVER CONSERVATION AUTHORITY



Environment Environnement
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Ministry of Ministère des
Natural Richesses
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Ontario

CANADA/ONTARIO FLOOD DAMAGE REDUCTION PROGRAM

FLOOD PLAIN MAPPING
MASTER DRAINAGE PLAN

BELL CREEK

NOVEMBER 1989

PREPARED BY:

ECOS GARATECH ASSOCIATES LTD.
1625 Steeles Avenue East
Unit 19
Brampton, Ontario
L6T 4T7

PREFACE

Under the Terms of Reference established by the Moira River Conservation Authority, this report documents the findings and conclusions of the hydrologic and hydraulic analyses, and the Master Drainage Planning undertaken for Bell Creek within the City of Belleville and the Township of Thurlow.

ACKNOWLEDGEMENTS

Ecos Garatech are grateful to the following organizations for their support and co-operation throughout the course of the study:

Moira River Conservation Authority

Ontario Ministry of Natural Resources (Eastern Region)

City of Belleville

Township of Thurlow

Atmospheric Environment Service, Environment Canada

STUDY TEAM MEMBERS

M.D. Garraway, C.E.T.	-	Project Manager
P.S.H. Lim, P.Eng.	-	Project Engineer
E. Calwell, P.Eng.	-	Hydrotechnical Engineer

PROJECT TEAM MEMBERS

A. Rungis (Miss)	-	Chairperson
P. Sandhu, P.Eng.	-	Federal Member
L.H. Christl, P.Eng.	-	Provincial Member

SUMMARY

In the spring of 1988, the Moira River Conservation Authority retained Ecos Garatech Associates Ltd. to undertake flood and fill line delineation, as well as the preparation of a Master Drainage Plan, for Bell Creek within the City of Belleville and the Township of Thurlow, from the Bay of Quinte to the top of the watershed, north of Highway No. 401.

Flood and Fill Line Delineation

Hydraulic systems have been analyzed with the aid of the HEC-2 computer program supplemented by cross sections taken by field surveys. The resulting Regulatory (100 year) flood plain and corresponding fill line have been plotted on the Moira River Conservation Authority's Flood Risk Mapping, Sheet Nos. 1 to 8.

All lands falling within the flood and fill line delineations are considered to be susceptible to flooding, and subject to erosion and potential slope failure. Therefore, it has been recommended that the City, and Thurlow Township, in co-operation with the Authority, prepare Official Plan Policies and Zoning By-Laws covering the regulation of Bell Creek in accordance with Provincial water management objectives. The Master Drainage Plan, Part B of this report, will assist the involved agencies to meet this goal.

Bell Creek Master Drainage Plan

In the mid 1900's municipal engineers, in an attempt to improve the level of convenience on roadways, replaced roadside ditches with curb and gutter, paved sidewalks, catchbasins, and storm sewers. If water conveyance on these roadways was undesirable the answer was to install yet another catchbasin. This increase in the number of catchbasins allowed too much water to enter the storm sewer during intense events and the result was sewer surcharging and backups which caused basement flooding. Failure to provide safe and adequate overland flow paths also led to surface ponding on some properties. As a result the further downstream in the urban watershed, the more severe the problem.

The answer to this problem is to prepare Storm Water Master Drainage Plans for a watershed prior to development. This not only provides education for the municipalities, developers, designers, and general public about the severity and necessity for storm water management, but good management planning is more economical than attempting to "fix" an existing problem.

While on-site problems were severe, the problems downstream were inevitably worse. The "efficiency" of the storm sewer system created increases in both the volume and peak magnitude of storm water runoff. In the major system watercourses and lakes, these effects were manifested as increased flood damage, increased erosion damage, and increased pollution. To illustrate the magnitude of some of these effects, consider the following examples.

- (a) In the 1950's, one municipality developed a 100 hectare parcel using the conventional drainage system. It is currently faced with having to spend \$4.2 million on remedial erosion and bank stability works.
- (b) In the last 25 years, Ontario has spent over \$200 million on remedial works through the MNR, the conservation authorities and their member municipalities. And yet a great deal has been left undone.

Storm Water Management is an attempt to resolve both the on-site and downstream problems by:

- (a) establishing a preventative program that will be less expensive to society than a remedial one;
- (b) establishing the same level of protection against flood damage to properties caused by water below or above the ground as we have had on our other watercourses for many years (Conservation Authorities' Act); and
- (c) establishing control of the quality of urban runoff to the degree dictated by downstream conditions.

It is necessary to integrate into one coherent set of policies the concerns that used to be handled separately by various agencies such as the municipality, MNR, MOE, MTO, and the conservation authorities. It requires a higher level of co-operation between departments in a municipality during planning, implementation, operation, and maintenance. It also requires that engineers, planners, biologists, economists, and sociologists work together to produce more viable and exciting urban developments.

That it can be done has already been proven. That it can be done economically has also been proven in Brampton, Burlington, Guelph, Markham, Mississauga, Oakville, and Ottawa-Carleton, to name only a few. The total costs comprise both on-site and off-site (external) works.

A large percentage of the time there is no need to provide off-site works downstream of developments incorporating on-site storm water management practices. This is a marked contrast to experience with conventional drainage systems where large off-site pipes, channels, and outfalls were the norm. Taking both on-site and off-site works together, the total initial capital costs of developments using storm water management are less than those using the conventional approach.

Urbanization of a rural watershed such as Bell Creek can lead to incidence of increased flooding downstream. If left uncontrolled this increased runoff will not only provide nuisance flooding but will also ultimately limit the potential for development within the watershed. The purpose of Part B of this document is to serve as a guideline and set criteria for storm water management within the watershed. Setting guidelines will ultimately enable each property within the watershed to achieve its full potential.

The adopted criteria has set the control of post-development flows to that of the pre-development condition for the 5, 10, 25, 50, and 100 year storm events.

For the area north of the Canadian National Railway (CNR), the future industrial land must provide runoff control on-site. To the south of the CNR the residential areas will be permitted runoff control either on-site or on-line.

To co-ordinate the development of a viable urban area, each developer must submit a Storm Water Management Plan Report for review by the local Municipalities, the City of Belleville and the Township of Thurlow, and the Moira River Conservation Authority. This report shall contain, in addition to the major and minor system and runoff control designs, a plan addressing erosion and bank stability remedial measures and water quality maintenance.

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2. HEC-2 Model Input Data and Output Files