University of Toronto

OFFICE OF THE VICE-PRESIDENT AND PROVOST

"Appendix A"

TO: Committee on Academic Policy and Programs

SPONSOR: Edith Hillan
CONTACT INFO: edith.hillan@utoronto.ca

DATE: September 15, 2004 for the meeting on September 22, 2004

AGENDA ITEM: 6

ITEM IDENTIFICATION:
School of Graduate Studies proposal of the Institute for Environmental Studies for a new one-year Master's Professional Program in Environmental Science (M.Env.Sc.) to be located in the Department of Physical Education and Environmental Sciences at UTSC, effective September 2005.

JURISDICTIONAL INFORMATION:
The Committee has authority to recommend to Academic Board for approval changes which establish a new degree program.

PREVIOUS ACTION TAKEN:
The School of Graduate Studies approved this proposal at its Council meeting on May 25, 2004.

HIGHLIGHTS:
The M.Env.Sc. Program includes a new graduate course and has the objective of producing skilled practitioners of environmental science well trained in field and laboratory techniques to meet the needs primarily of industry and government. The 12-month program will be attractive newly graduate B.Sc. students and also existing practitioners wishing to upgrade their skills. An initial program enrollment of between 10 to 20 students is expected. There has been extensive consultation and market research with external stakeholders in industry and government, Chairs and Directors of cognate Departments and Institutes, faculty across U of T and students during preparation of the proposal.

FINANCIAL AND/OR PLANNING IMPLICATIONS:
New resources are required at UTSC such as equipment, space and administrative and technical assistance; sources of funding for this commitment are identified in the proposal. The program will receive funding from sharing of tuition fees (75%) of domestic tuition revenue net of student aid) through the Enrolment Growth Fund.

RECOMMENDATION:
It is recommended that the Committee on Academic Policy and Programs recommend to the Academic Board for approval:

THAT the Institute for Environmental Studies offer a new one-year Master's Professional Program in Environmental Science (M.Env.Sc.) to be located in the Department of Physical Education and Environmental Sciences at UTSC, effective September 2005.

School of Graduate Studies

University of Toronto

OFFICE OF THE DEAN

May 28, 2004

Professor Vivek Goel
Interim Vice-President and Provost
Room 225, Simcoe Hall
27 King's College Circle
University of Toronto

Dear Professor Goel:

At its meeting of May 25, 2004, the Council of the School of Graduate Studies approved the following motion:

> **THAT** SGS Council approve the proposal of the Institute for Environmental Studies for a new one-year Master's Professional Program in Environmental Science (M.Env.Sc.) to be located in the Department of Physical and Environmental Sciences at UTSC, effective September, 2005.

The motion and supporting documentation are attached. Division III Executive Committee approved the proposal at its meeting of May 11, 2004.

On behalf of the Council of the School of Graduate Studies, I am presenting this item to Governing Council committees, for approval. Due to the September 2005 start date, approval under Summer Executive Authority is not required.

Yours sincerely,

Jane Alderdice
Secretary to SGS Council
and Coordinator of Policy, Program and Liaison

Encl. (1)
/smr

c.c. D. Coombs, S. Horton, L. Yee, A. Drummond (with attachments), C. Johnston, S. Zaky (with attachments), G. Ferris, R. White

H:Council/FollowUp/2003-2004/May 25/Environmental Science M.Env.Sc.

65 St. George Street Toronto Canada M5S 2Z9 Fax: (416) 946-7021

Motion

School of Graduate Studies Council
Tuesday, May 25, 2004

Item 6.

6. New Degree and Collaborative Program Proposals

6.1 Environmental Science

MOTION (/) THAT SGS Council approve the proposal of the Institute for Environmental Studies for a new one-year Master's Professional Program in Environmental Science (M.Env.Sc.) to be located in the Department of Physical and Environmental Sciences at UTSC, effective September, 2005.

See the proposal and executive summary attached.

NOTE:
Division III Executive Committee approved this proposal at its meeting of May 11, 2004.

With SGS Council's approval this item will go to Governing Council committees for approval, and to the Ontario Council on Graduate Studies for a standard appraisal.

Institute for Environmental Studies
Institut pour l'Etude de l'Environnement

University of Toronto
33 Willcocks Street, Suite 1016, Toronto, Ontario, Canada M5S 3E8
fax: 416-978-3884 internet: http://www.utoronto.ca/env/es.htm

15th April 2004

Professor Michael Marrus
Dean, School of Graduate Studies
University of Toronto

Dear Michael,

I am very pleased to see this proposal for a masters degree in Environmental Science completed and forwarded to SGS Council. It comes with the enthusiastic support of the Institute for Environmental Studies. It complements existing programs at the Institute and I believe that it will help us to develop some very valuable synergies in environmental research and teaching at the graduate level.

I have had several meetings with the proponents and I believe that we have established a common understanding of the potential for the development of the program and an agreement on its management structure.

I am happy to supply further information should it be needed.

Sincerely,

Rodney R. White
Director, IES

cc. Prof. Sue Horton, Interim Vice-Principal Academic and Dean, UTSC
Prof. Donald Cormack, Vice-Dean, SGS
Prof. Grant Ferris, Associate Dean, Division III, SGS

University of Toronto at Scarborough

Vice-Principal (Academic) and Dean
1265 Military Trail, Toronto
Ontario, Canada M1C 1A4

Tel: 416-287-7129
Fax: 416-287-7029
Website: http://www.utsc.utoronto.ca

April 14, 2004

Professor Michael Marrus
Dean, School of Graduate Studies
University of Toronto

Dear Michael,

I am writing to indicate UTSC's very strong support for the Masters in Environment Science proposal. This has been a campus priority for more than a decade. The undergraduate program in Environmental Science took its first students in 1993, and at that time this interdisciplinary grouping in this area was novel at the university. Since then, the undergraduate program has grown, this group of scientists has put in two CFI proposals, and environmental science has become a distinctive focus area at UTSC. The present draft of the program was approved by the Academic Committee at UTSC on March 9th, and by the College Council on March 16th.

This area will be a key focus area in the upcoming academic plan. We will request at least two growth positions in the area of Environmental Science, which will help to support this program. The user committee report on the renovation of the Soil Erosion Lab should be completed this month (to go to Planning and Budget in May). The renovated building will provide an excellent facility to house faculty and graduate students and research labs. We have identified funding for this renovation.

The draft Budget is attached. We are meeting with Professor Safwat Zaky later this month to discuss the budget. The Memorandum of Agreement concerning the program is being drafted as you know, and I will forward the final signed Agreement when it is available.

Thanks to you and to SGS for helping to develop this program. I understand that you will take the program proposal next to SGS Council for approval.

Sincerely,

Sue Horton
(Interim Vice-Principal Academic and Dean, UTSC)

University of Toronto

DEGREE OF MASTER OF ENVIRONMENTAL SCIENCE

M.Env.Sc.

PROPOSAL: **A New Professional Master's Graduate Degree in Environmental Science**

To commence in September 2005

PROPOSED BY: Institute for Environmental Studies

May 14, 2004

VOLUME I: THE PROGRAM

Executive Summary

The environmental sector in Canada is growing rapidly. Market research identifies a national shortage of well-qualified individuals with graduate training in scientific disciplines relating to contaminants and their fate in natural and degraded environments. A major challenge is to produce environmental scientists with advanced training at the Master's level, which is becoming the degree of choice among employers. Understanding and dealing with the transport and distribution of contaminants in surface and near surface environments demands knowledge of a broad spectrum of cognate environmental disciplines such as contaminant transport, biochemistry, geochemistry, hydrogeology, hydrology, aquatic ecology, atmospheric physics and chemistry, soil science, climatology, sedimentology, stratigraphy and geophysics. This knowledge base extends well beyond normal departmental boundaries but is readily available at the University of Toronto at Scarborough (UTSC). UTSC faculty are well placed to contribute to the national challenge of training well-qualified students for the environmental sector.

This proposal is for a new one-year Institute for Environmental Studies (IES) Master's Professional Program in Environmental Science (M.Env.Sc.) to be located in the Department of Physical and Environmental Sciences at UTSC. The M.Env.Sc. Program includes new graduate courses and has the objective of producing skilled practitioners of environmental science well trained in field and laboratory techniques to meet the needs primarily of industry and government. The 12 month M.Env.Sc program will be attractive to newly graduated B.Sc students and also existing practitioners wishing to upgrade their skills. Students admitted to the program will require a minimum mid-B standing from a 4-year University of Toronto baccalaureate degree, or equivalent, in science or relevant postgraduate experience as evidenced by a resume, a written statement outlining the candidate's objectives in applying to the program and letters of reference. Admission of students and administration of the program will be dealt with conjointly by IES and UTSC working through a Program Committee. The program consists of two options (an *all-course* option, and an *intern* option) both requiring completion of a total of 5 FCE's. Graduating students will gain valuable skills in the design and management of environmental projects, the completion of laboratory analyses and field investigations, and research reporting. Full time students will complete all instructional requirements in two terms (Fall and Winter) and then complete field and research-based courses during the early summer; the program can also be completed on a part time basis. The M.Env.Sc complements existing graduate programs in the environment, namely the collaborative Master's in Environmental Studies and the Collaborative Program in Environmental Engineering both administered through IES. It is anticipated that highly qualified candidates may move on to doctoral programs at the University of Toronto.

An initial program enrollment of between 10 and 20 students is expected. New resources are required at UTSC such as equipment, space, and administrative and technical assistance; sources of funding for this commitment are identified in this proposal. There has been extensive consultation and market research with external stakeholders in industry and government, Chairs and Directors of cognate Departments and Institutes, faculty across U of T and students during preparation of this proposal.

THE PROGRAM

Appendix I:	**Calendar entry**
Appendix II:	**Course offerings 2005-2011**
Appendix III:	**SGS new graduate course proposals**

1 INTRODUCTION

1.1 Brief listing of programs

This proposal is for the introduction of a new 12-month Master of Environmental Science (M.Env.Sc) Professional Program to be located at the University of Toronto at Scarborough (UTSC). This requires the completion of a four-year undergraduate B.Sc degree for admission. The Institute for Environmental Studies (IES) on the St. George campus is the relevant Graduate Unit and students will be admitted through a Joint Steering Committee chaired by the Director of IES or his designate, the Chair of the Department of Physical and Environmental Sciences (or his designate), the Director of the M.Env.Sc Program, a faculty member from UTSC, and a graduate student representative. The Institute has a high international reputation and introduction of an M.Env.Sc graduate degree at UTSC as a distinct and separate graduate program within IES accords well with the pan-University responsibilities of IES.

1.2 Objectives of the program

The University of Toronto at Scarborough (UTSC) is substantially expanding its undergraduate enrollment. Significant expansion in graduate enrollment is expected given the demand by newly graduated B.Sc students to continue their studies.

There is a pressing national shortage of well-qualified practitioners of environmental science in industry and government with postgraduate training at the Master's level. The overall objective of a proposed M.Env.Sc graduate program at UTSC is to provide a strong and coherent professional education to students from diverse undergraduate backgrounds in science. This will be achieved through course work, laboratory and technical training, fieldwork, major research papers and oral presentations. UTSC is committed to the development of highly trained professional practitioners of environmental science who can assume a leadership and management role in industry and government. UTSC is uniquely situated with respect to such a Masters program. Both teaching and research expertise in these areas, as well as established research facilities, are already present on campus. Graduates will build on their four-year baccalaureate degree in science by receiving training in the physical and life sciences; they will gather and analyze data, produce research reports, be consumers of research, identify professional issues and engage in evidence based analysis and decision making. The program will above all, be based on the integration of advanced scientific knowledge with practical problem solving.

The M.Env.Sc program is intended to serve two main audiences:

(i) "Newly graduated" students entering the program direct from a first degree in science and:

(ii) "Existing professionals" already with a science degree currently practicing professionally, who wish to increase their knowledge base and skills by pursuing an all course Master's degree.

Regardless of the academic preparation of students entering the Master's program, the emphasis will be on a common program of practical (field and laboratory based) courses. The program is also designed to provide solid research training for those students who may wish to pursue a career either in industry, government or academe, which may include further research to the Ph.D. level in other graduate divisions within the university or elsewhere.

M.Env.Sc courses and research training will be largely carried out at UTSC but other optional courses can be taken through IES on the St. George campus and related departments in Engineering or the Sciences. It is expected that instructional courses will be completed in two sessions (Fall and Winter) with those courses requiring a component of field or laboratory research to be finalized in the summer allowing full time students to complete in 12 months.

1.3 Methods used for the self-study

This proposal is for a new professional Master's program. The need for such a program has been made clear through extensive consultations with colleagues in industry and government. In addition, detailed market research has been undertaken to gauge demand and needs. The results of this research are reviewed below.

Educational Rationale

Contamination of natural environments is currently the focus of much research, public discussion and legislation. Contamination of water, soil and air has occurred because of the introduction of pollutants by human activity, especially in and around urban centers. Intensification of agricultural practices has also contributed to contamination. Many contaminants are toxic to humans and this has created significant national concern with respect to the integrity of domestic water supplies (e.g. Walkerton, Ontario; North Battleford, Saskatchewan; Sydney, Nova Scotia etc). These concerns have generated major conflicts between the sustainability of economic systems, especially urban-industrial development, and the conservation and overall health of aquatic and terrestrial environments. Unfortunately, the behavior of contaminants and their movements through water, soil and air is still poorly understood. Consequently, the making of public policy and legislation is constrained by lack of scientific information and an inadequate supply of adequately trained professionals. The environmental consulting sector is at present experiencing problems in recruiting sufficient numbers of well-trained environmental scientists. In particular, there is need for individuals with a thorough understanding of contaminant types and their fate in natural and degraded systems, such as contaminant transport through surface and subsurface terrestrial and aquatic environments, their concentration and degradation during transport, the interaction with biota including humans and the appropriate remediation techniques needed to restore degraded environments.

The movements of air, water and sediment control the transport and distribution of contaminants in near-surface environments. To fully understand the fluxes of contaminants and their interaction with biota, requires training (and research) in a large

number of cognate areas such as: boundary layer climatology, surface hydrology, geology and hydrogeology, limnology, sediment transport and stratigraphy, geophysics, geomorphology, geochemistry, chemistry, terrestrial and aquatic ecology and microbial ecology. This knowledge base is readily accessible to graduate students at UTSC where the research and teaching of existing Environmental Science faculty encompass many of the scientific disciplines required to mount a comprehensive and innovative Master of Environmental Science program.

The M.Env.Sc. Program at UTSC will complement existing graduate programs in the environment at the University of Toronto, namely the collaborative Masters in Environmental Studies and the collaborative Masters of Environmental Engineering offered by IES. The new program at UTSC greatly extends the range of options available to graduate students wishing to complete graduate studies in environmental science at U of T.

Market research

Considerable market research was conducted during the formulation of this proposal. In the most recent survey of the Environmental Industry in Canada (CCHREI, 2000), the Canadian environmental sector employed ~ 221,000 persons in jobs that contributed to:

(a) Environmental protection;
(b) Conservation of natural resources;
(c) Environmental education;
(d) Communications;
(e) Research.

Approximately 50 % of these had university degrees and/or college diplomas and ~ 25 % of the practitioners were women. The latter has grown from 10 % to 20 % between 1993 and 1998. Some 9500 public and private sector organizations employed environmental practitioners in 1998, divided into:

(a) Private sector environmental companies ~ 44 %; the majority of these are classified as small with < 50 employees and more than 50% with 2-10 employees. The large number of small and medium size enterprises supports the view that these are fueling growth in the industry. Extensive industry contacts with the faculty at UTSC confirm that the environmental sector is rapidly growing in the form of small companies providing specific services to the industry. This growth is expected to continue as the market place becomes ever more specialized.
(b) Other private companies associated with the environmental industry (mining, petroleum, etc.) ~ 23 %; half of these were in the province of Ontario.
(c) Public sector: federal, provincial & municipal ~ 25%; ~ 3 % academe; ~ 5 % in non-governmental organizations (NGOs).

Environmental services of all sorts are a major component of the Canadian and Ontario economy and we see an increasing demand for individuals in this field. For example, of the 800 member firms of the Association of Consulting Engineers of Canada, over 50% are providing environmental services nationally (Directory of ACEC). The equivalent Ontario Association lists 280 member firms of which 150 are directly involved in the

environment. These firms employ both scientists and engineers. Approximately 100 of the national companies operate internationally and have secured in the region of ~ 10% of the total world's consulting services in recent years (Directory ACEC).

With respect to the existing national job market, in January 1999 there were ~ 4,200 positions available in Canada (CCHREI, 2000). This is anticipated to increase by ~ 7 % annually. The highest demand is for specialists in:

(a) Science in the environment;
(b) Environmental studies (more loosely defined as science/social science);
(c) Engineering & engineering technology.

Approximately 82 % of all organizations polled indicated that their environmental practitioners required more training and/or skills upgrading. Many felt that courses at educational institution were necessary for this to be achieved.

In 1997, the Canadian Environmental Certification Approvals Board (CECAB) was established to develop and administer a national certification program for environmental practitioners. Standards for being approved as a Canadian Certified Environmental Practitioner (CCEP) have now been established. The M.Env.Sc program at UTSC is timely and offers professional development opportunities for those wishing to meet CECAB standards.

The need to train additional well-qualified practitioners is also reflected in the creation in early 2000 of the Association of Professional Geoscientists of Ontario. There is now a legal requirement for professional registration of practicing geoscientists in Ontario and Canada. As of March 2003, all professional practitioners of environmental geosciences must possess certain minimum educational qualifications and be licensed by the Association. It is anticipated that there will be a growing demand from newly graduated and existing graduate geoscientists to upgrade their qualifications in environmental geosciences to meet APGO requirements.

Other relevant organizations include the Ontario Environmental Industry Association and the Canada Council for Human Resources in the Environmental Industry. Both organizations have recently identified a national lack of technical specialists with environmental skills, and the difficulty in recruiting experienced practitioners at the M. Sc level.

In the light of the above, a major educational challenge over the next few decades is to provide sufficient numbers of well-trained individuals with the scientific expertise necessary to deal with contaminant problems in terrestrial and aquatic environments. It is clear therefore, that important *provincial* and *national* human resource needs can be addressed by the proposed IES Master's of Environmental Science program housed at the University of Toronto at Scarborough.

1.4 Fields in the program

The academic scope of this program is in the single broad field of Environmental Science.

1.5 Review concerns expressed in previous appraisal and actions taken

Not applicable as this is a new proposal.

1.6 Special matters and innovative features

It is evident from the Canadian Environmental Directory that there are a large number of College and University programs dealing with the environment. However, most of these are classed as "Environmental Studies" and focus on the sociological or economic aspects of human-environment interactions. There are relatively few science-based graduate programs dealing with the environment. Even fewer focus explicitly on the areas proposed for the IES Master's program at UTSC emphasizing the migration of contaminants and their management. None provide training explicitly in the biophysical interactions that are critical to well-trained environmental scientists. The closest equivalent to the program proposed at UTSC would perhaps be the program in the Department of Earth Sciences at Waterloo University in the area of Environmental Hydrogeology. This focuses on water flows but is restricted to study of the physical system only; biota and their interactions are largely ignored.

Within the University of Toronto there is a newly established Environmental Chemistry stream at the M.Sc and Ph.D levels within the Department of Chemistry. However, once again, the focus is not on biota and the focus is within chemistry rather than interdisciplinary environmental science.

The intention of the IES M.Env.Sc. Program at UTSC is to provide a 12 month professional degree that will attract environmental scientists, and others, who wish to improve or update their skills for employment in consulting companies and government agencies. Many will be mature students with considerable work and business experience. This is a rather different audience than that catered to by the current doctoral stream programs at this university. However, it is anticipated that some students will wish to eventually pursue doctoral studies after completion of the M.Env.Sc and will move on to enter doctoral programs in Geography, Geology, Chemistry, Zoology, Botany, IES, Environmental Engineering, etc.

2 THE FACULTY

2.1 List of faculty by field

The following Table 2.1 lists the faculty members involved in the professional Master's graduate program within the Department of Physical and Environmental Sciences at UTSC along with their professional qualifications and research fields.

Table 2.1 Core faculty members at UTSC by field. Non-core adjuncts (Category 6) are also listed as they assist in teaching. Faculty CV's are presented in Volume II of this proposal. Two new appointments in Environmental Science will be made in 2004-5 and 2005-6 (see below).

TABLE 2.1

Faculty Name & Rank	M/F	Ret. Date	Home Unit	Supervisory Privileges
Category 3				
Eyles, N., BSc, MSc, PhD, DSc - Professor	M	N/A	Geology	Full
Greenwood, B., BSc, PhD – Professor	M	2008	Geology	Full
Fulthorpe, R.R., BSc, MSc, PhD – Associate Professor	F	N/A	Chemical Engineering	Full
Gough, W.A., BSc, MSc, PhD – Associate Professor	M	N/A	Geography	Full
Howard, K., BSc, MSc, PhD – Professor	M	N/A	Geology	Full
Price, A., BSc, MSc, PhD – Associate Professor	M	N/A	Geography	Full
Simpson, M.J., BSc, PhD – Assistant Professor	F	N/A	Geography	Full
Wania, F., BA, PhD – Assistant Professor	M	N/A	Chemistry	Full
Williams, D.D., BSc, MSc, PhD – Professor	M	N/A	Zoology	Full
TBA1 – Assistant Professor			Geology	Full
TBA2 – Assistant Professor			Geography	Full
[1]Tenured or tenure-track core faculty members				
Category 6				
Non-core faculty with adjunct status who participate in teaching				
Gerber, R., BSc, MSc, PhD – Adjunct Assistant Professor	M	NA	Geology	Master's
Mohajer, A., BSc, MSc, PhD – Adjunct Associate Professor	M	N/A	Geology	Master's
Timmer, V., BSc, MSc, PhD	M	N/A	Geography	-

The Environmental Science faculty group at UTSC is in a strong position to offer an M.Env.Sc graduate program. The group already offers (uniquely at U of T) an undergraduate program in Environmental Science where traditional discipline boundaries have merged within a single Department of Physical and Environmental Sciences. We already support undergraduate and graduate teaching and research in such diverse areas as contaminant transport, geochemistry, biochemistry, hydrogeology, hydrology, aquatic ecology, atmospheric physics and chemistry, climatology, sedimentology, soil science, stratigraphy and geophysics. These are essential building blocks of advanced graduate training in environmental science.

2.2 External operating research funding

UTSC faculty are well supported by external funding. External funding since 1997 is listed in Table 2.2. Funding from non-granting council sources (e.g., CFI, OIT) has grown steadily and currently exceeds $1 million, whereas grants from science councils (principally NSERC) has remained steady by and large (on average $500,000 pa). UTSC faculty are closely linked to other research centers both locally (e.g. Watershed Ecosystem Program at Trent; Price and Wania) and nationally (e.g., CRESTech at Waterloo, Howard; the Environmental Engineering Program at Western; Greenwood, etc.). In addition, UTSC faculty are working closely with such government agencies such as the Ontario Ministry of Natural Resources and area municipalities (Eyles) and the Federal Ministry of the Environment (Gough). All UTSC faculty have strong, well-funded research programs and an excellent cadre of research Master's and Doctoral graduate students. All have strong links with environmental consulting companies. This is a very important consideration in our ability to attract graduate students to the professional program.

TABLE 2.2
Operating Research Funding by Source and Year

Year (Grant) Apr 1 – Mar 31	Granting Councils	Other Peer Adjudicated	Contracts	Other
1997 – 1998	444,000	20,000	--	
1998 – 1999	973,000	113,000	--	
1999 – 2000	179,000	273,000	--	
2000 – 2001	443,000	269,000	--	
2001 – 2002	716,000	800,000	--	
2002 – 2003	447,000	792,000	--	
2003 – 2004	559,000	1,100,000	--	

2.3 Graduate supervision

Table 2.3 lists graduate student supervision for the past 7 years. The UTSC group has an enviable record of graduate training already in place; the group also has strong collaborative links with environmental scientists at the St. George Campus such as in Chemistry (through Donaldson, Simpson & Wania), Chemical Engineering (through

Fulthorpe, Wania), Forestry (through Bryan & Price), Geography (through Bryan, Gough, Greenwood, Price & Simpson), Geology (through Eyles & Howard), the Institute for Environmental Studies (through Howard) and Zoology (through Williams). With undergraduate growth at UTSC there also will be new hires in areas that will support the program. In addition, several faculty members at St. George might gravitate to, and be actively involved with the new program.

TABLE 2.3
Career and Current Numbers of Thesis Supervisions by Faculty Member

	Career			Current		
Member	Master's	PhD	PDF	Master's	PhD	PDF
Category 3						
Eyles, N.	10	3	2	1	2	-
Fulthorpe, R.	3	1	6	2	2	2
Gough, W.	11	-	-	2	2	-
Greenwood, B.	17	3	2	1	1	-
Howard, K.	14	2	-	3	1	-
Price, A.	6	3	-	-	-	-
Simpson, M.	-	-	-	3	-	2
Wania, F.	1	-	-	2	4	-
Williams, D.D.	20	8	2-	-	2	-

2.4 Current teaching assignments

The normal UTSC undergraduate teaching load is 1.5 full courses for full time faculty outside of graduate instruction.

TABLE 2.4
Teaching Assignments 2000-2004

Faculty & Rank	Undergraduate	Graduate	Area of Expertise
Category 3			
Eyles, N.	EESA06, EESB15, EESC16, EESC24, EESC31, EESD07	GlG2608	Geology
Fulthorpe, R.	EESB09, EESC30, EESD15	BOT1200	Botany
Gough, W.	EESB03, EESC24, EESD06	GGR1311	Geography
Greenwood, B.	EESB02, EESC18, EESC19	GGR1206	Geography
Howard, K.	EESC07, EESC16/D07, EESD02	JGN260	Geology
Price, A.	EESA01, EESA06, EESB04, EESD11	GGR1308	Geography
Simpson, M.	-	-	Geography/Chemistry
Wania, F.	-	CHM1401	Chemistry
Williams, D.D.	EESC04	ZOO1002	Zoology
Category 6			
Doughty, M.	EESC03		Geology
Mohajer, A.	EESA05		Geology

Teaching Assignments
2001

Faculty & Rank	Undergraduate	Graduate	Area of Expertise
Category 3			
Eyles, N.	EESA06, EESB15, EESC16, EESC31, EESD07	GLG2608	Geology
Fulthorpe, R.	EESB09, EESC30, EESD15	BOT1700	Geography
Gough, W.	EESB03, EESC24, EESD06	GGR1205	Geography
Greenwood, B.	EESB02, EESC18, EESC19		Geography
Howard, K.	EESC07, EESC16/D07, EESD02	JGN260	Geology
Price, A.	EESA01, EESA06, EESB04	GGR1308	Geography
Simpson, M.	-	-	Geography/Chemistry
Wania, F.		CHM1550	Chemistry
Willliams, D.D.	EESC04	ZOO1002	Zoology
Category 6			
Doughty, M.	EESC03	-	Geology
Mohajer, A.	EESA05	-	Geology
Timmer, V.	EESC13	-	Forestry

Teaching Assignments
2002

Faculty & Rank	Undergraduate	Graduate	Area of Expertise
Category 3			
Eyles, N.	EESA06, EESB15, EESC16, EESC31, EESD07	GLG2608	Geology
Fulthorpe, R.	EESB09, EESC30, EESD15	BOT1700	Geography
Gough, W.	EESB03, EESC24, EESD06	GGR1205	Geography
Greenwood, B.	EESB02, EESC18, EESC19	GGR1206	Geography
Howard, K.	EESC07, EESC16/D07, EESD02	JGN260	Geology
Price, A.	EESA01, EESA06, EESB04	GGR1308	Geography
Simpson, M.	EESB05	GGR1149	Geography/Chemistry
Wania, F.		CHM1401	Chemistry
Williams, D.D.	EESC04	ZOO1002	Zoology
Category 6			
Doughty, M.	EESC03	-	Geography
Mohajer, A.	EESA05	-	Geology
Timmer, V.	EESC13	-	Forestry

Teaching Assignments
2003

Faculty & Rank	Undergraduate	Graduate	Area of Expertise
Category 3			
Eyles, N.	EESA06, EESB15, EESC16, EESC31, EESD07	GLG2608	Geology
Fulthorpe, R.	EESB09, EESC30, EESD15	JCC1313	Geography
Gough, W.	EESB03, EESC24, EESD06	GGR1314	Geography
Greenwood, B.	EESB02, EESC18, EESC19	JGN260	Geography
Howard, K.			Geology
Price, A.	EESA01, EESA06, EESD11	GGR1308	Geography
Simpson, M.	EESB05, EESC15	GGR1149	Geography/Chemistry
Wania, F.		CHM1550	Chemistry
Willliams, D.D.	EESC04	ZOO1002	Zoology
Category 6			
Doughty, M.	EESC03	-	Geology
Gerber, R.	EESA07	-	Geology
Mohajer, A.	EESA05	-	Geology
Timmer, V.	EESC13	-	Forestry

Graduate teaching loads within the proposed M.Env. Sc program and new appointments

The core faculty requirements for the new M.Env.Sc program exist at present at the University of Toronto at Scarborough and the graduate courses for this program are new (Appendix III). Each existing faculty member will be committed to teach approximately 0.5 F.C.E. within the M.Env.Sc program (note that one faculty member would also serve as Program Director requiring a 0.5 FCE release). Five stipends have been budgeted by UTSC to maintain undergraduate courses.

The growth of the faculty complement is important and new faculty resources will be necessary to maintain an acceptable teaching load for the faculty involved. The minimum requirements with respect to *new* faculty positions are two positions currently being searched

TBA1 Appointment in Chemistry in Toxicology

TBA2 Appointment in Physics either in Geophysics or Planetary Physics

And two *new* positions:

TBA3 Environmental Sciences appointment in Limnology area/Geology:
Effective July 2005

TBA4 Environmental Sciences appointment in Surface Processes/Geographic Information Systems/Geography:
Effective July 2006

2.5 Commitment of faculty member from the graduate programs

All graduate faculty at UTSC involved in the M.Env.Sc Program will be cross appointed between their home departments and IES. This has been agreed between individual Departmental Chairs, the Director of IES and faculty.

3 PHYSICAL AND FINANCIAL RESOURCES

3.1 Library resources

The University of Toronto at Scarborough library has extensive holdings in environmental sciences and cognate disciplines; these already support current research graduate activity. When combined with library facilities and holdings at St. George and on the Mississauga campus provide a sufficient resource for the proposed Professional M.Env.Sc. Program. The UTSC Library will be used as the centralized location for the program.

3.2 Laboratory facilities

Besides the availability of research laboratories at UTSC, state-of-the-art field monitoring and data acquisition equipment is also available for research training in contaminant transport by air, water (surface runoff, soil and groundwater) and in sediments. Additional resources are required to maintain and enhance the pool of equipment required for graduate student use. The anticipated additional equipment purchases and maintenance costs necessary to ensure the viability of the M.Env.Sc Program will be significant and sources of funding for this have been identified by UTSC.

The following list faculty and laboratories at UTSC.

Climate/Ocean Modeling Laboratory	W. Gough
Hydrogeology & Geochemistry Laboratory	K. Howard
Sedimentology & Geophysics Laboratory	N. Eyles
Hydrodynamics and Sedimentation Laboratory	B. Greenwood
NMR/Soil Chemistry Laboratory	M. Simpson
Microbial Ecology & Bio-remediation Laboratory	R. Fulthorpe
Geographic Information Systems Laboratory	M. Doughty
Aquatic Ecology & Bio-monitoring Laboratory	D. Williams
Environmental Chemistry Laboratory	F. Wania

In addition to laboratories at UTSC, a 26-foot research vessel operated by N. Eyles is available for contaminant, limnology, geophysical, biological and sedimentology studies in the Great lakes, as well as a number of smaller boats.

3.3 Computer facilities

All students will have access to UTSC computing facilities. All faculty have microcomputers in their laboratories and students will be able to utilize the web, library resources and U of T's computing services. Ethernet links will be provided in each student's study space.

3.4 Space

Additional faculty, staff and students will need both laboratory and office additional to that currently present at UTSC and this is being addressed through renovation and expansion of existing labs (e.g., the former Soil Erosion Laboratory) and the availability of space formerly occupied by the administration at UTSC. This space will be available by the September 2005.

3.5 Financial support of graduate students

There is no significant funding for this Master's program at this time. Although limited, there are sources of funding available for students.

3.6 Technical and secretarial support

The demand for technical support will be well beyond the capacity of our present technician in Environmental Science. At least 2 positions are necessary (1 in Chemistry and 1 in Environmental Science) to support the new program. These will be available by the startup of the new program in September 2005.

Extra administrative personnel have been assigned to manage the increased administrative load: These are:

a) Director for the Program with 0.5 FCE course release.

b) Secretary to be responsible for the day-to-day administrative operation of the program.

4 PROGRAM REGULATIONS AND COURSES

4.1 The intellectual development and the educational experience of the student

Environmental science is an eclectic discipline built on a number of sub-disciplines such as geology, geography, biology, chemistry and geophysics among others. Nonetheless, Environmental Science is much more than simply a collection of parts and requires faculty to share a collective vision as to the nature of real world problems, how they should be approached for study, and the skills needed to do so both from a research and practical route. Faculty members at UTSC already have considerable experience in teaching in an undergraduate environmental science program and conducting high quality interdisciplinary research involving graduate supervision. This is a firm foundation for the IES Professional Master's program in Environmental Science at UTSC and means that incoming graduate students will be exposed to a learning environment that promotes not only academic training but also a good understanding of real world environmental problems. Teamwork will be fostered by all students having to complete a seminar course (EES 1000) and by hands-on field and laboratory work in small groups designed to foster collaborative learning.

4.2 Program regulations

Admission requirements and procedures
Candidates will be admitted to the M.Env.Sc under the general regulations of the School of Graduate Studies. Students will be expected to satisfy all other requirements for entry into the graduate school at this university within a competitive selection process. Students entering the program will have a 4-year University of Toronto specialist bachelor's degree, or equivalent, either in Environmental Science or a closely related science or

engineering discipline with a minimum mid-B grade average in the last two years of the undergraduate program. Candidates will submit a short written statement explaining their objectives in wishing to enter the program and how their background is appropriate. Appropriate postgraduate work experience such as in industry will be considered as part of the admission application. Those candidates lacking essential background preparation in one or more areas of study, if admitted, may be required to complete additional undergraduate courses in addition to the regular program requirements on a case-by-case basis.

The Program Committee will make admission decisions in accordance with SGS regulations. This committee will be chaired by the Director of the Institute for Environmental Studies (IES), or his designate, the Chair of the Department of Physical and Environmental Sciences (or his designate), the Director of the M.Env.Sc. Program, a UTSC faculty member and a secretarial assistant.

Program design and structure
The program is designed to allow significant flexibility to students of different backgrounds (see above) by offering *two* options. In respect of the professional nature of the program, both options draw upon a common pool of courses, laboratories and research facilities.

The two options are:
Course work option - this consists of a focused selection of courses, some of which will be team taught to expose students to a wide array of faculty and research methodologies as possible. Each student will be required to take a total of 5.0 FCE's consisting of 3.5 FCE's (7 half-courses) and completion of a substantial research paper (1.5 FCE; EES1001Y). As part of their course requirements, all students will take EES 1000H a seminar course designed to foster group cohesion and maximize contact between faculty and students.

The course work option will consist of lectures, seminars and laboratory modules as well as individual field and laboratory projects. The former will focus on theory, while the latter will emphasize the application of technology to practical issues in environmental science. Each student will be assigned a Supervisor who in consultation with the Program Director will choose appropriate courses for completion over two terms of instructions (Fall, Winter). Those courses requiring completion of fieldwork or research will be completed in the summer allowing completion of the Master's in 12 months.

Intern Option - this consists of courses combined with an internship in industry, government or university. UTSC has very considerable experience in Co-Op undergraduate placements in Environmental Science and other disciplines. We will draw on this experience in finding and assigning appropriate placements for graduate students enrolled in the M.Env.Sc program.

Each student will be required to complete a total of 5.0 FCE's and spend 4 months (either concurrently or sequentially) as a work placement internship in an area specifically related to their field of specialization; the work placement will be appropriate to future

career choices. The work placement will be worth 2.0 FCE's consisting of 0.5 FCE for successful completion of the internship as judged on the basis of a letter addressed to the Program Director from the student's work supervisor, and 1.5 FCE's for the satisfactory completion of a substantial written research paper that presents the results of a project executed while on placement. We anticipate that this program will appeal to those already in, or wishing to move quickly into a professional position with industry or government.

A wide range of graduate courses will be offered in any one academic year (Appendix II). Enhanced flexibility is also provided by Directed Readings courses designed to address the specific needs of any one student.

4.3 Part time studies

The program is expected to attract students already in employment with consulting companies or government agencies and who may wish to upgrade their skills while remaining in full time employment. Part time study for such students is a highly desirable feature of the M.Env.Sc program. Courses will be taught in evenings where possible (such as the mandatory seminar course EES 1000H; see below) and summer offerings will be made available that will allow completion of the program on a part time basis. In addition, many employers are increasingly flexible in regard to study leave time for skills training. Part time students will pay School of Graduate Studies part time fees and would normally finish the program over a time period longer than 2 years; in those cases where students are able to complete the program within 2 years payment of the balance of full time fees would be required as in normal SGS practice. As with full time studies, considerable flexibility is provided by Directed Readings courses designed to address the specific needs of any one student.

4.4 Total graduate courses listed and descriptions

A listing of graduate courses available at UTSC is identified below. The faculty required to mount these courses is also listed; in order to maximize efficiency in faculty resources it is proposed that several courses will be team taught with a single Team Leader (in bold).

EES 1000H Advanced Seminar in Environmental Science (Faculty)
This new course is designed to introduce students to the major issues in research in contaminant fluxes through terrestrial and aquatic systems. It will also expose students to the diverse fields of research expertise within the UTSC Group. Students will be expected to contribute one seminar paper in their own field of interest. The class will meet every 2-weeks throughout the fall and winter and will act as a focus group for the program. The course is restricted to those students enrolled in the M.Env.Sc. Program.

EES 1001Y Research Paper in Environmental Science (Faculty)
This new course involves the design, implementation and presentation, of a research project involving literature review, laboratory or fieldwork. Existing faculty allow a broad range of research topics. The permission of a faculty member who agrees to supervise the project is required. The Program Director and the supervising faculty member must approve a detailed project proposal outlining the objectives and scope of the project. The research will be written up in a research journal format and will be evaluated by a small committee. The course is restricted to those students enrolled in the M.Env.Sc. Program.

EES 1002H Analytical Chemistry for Geoscientists (Simpson)
This new course will familiarize students with a working knowledge of analytical chemistry and modern instrumentation and the common laboratory methods used in the analysis of contaminants and ions in environmental media. Students will be introduced to a number of instruments and techniques and the methods used to analyze soils, air and water.

EES 1003H Air and Water Quality Sampling and Monitoring (Price)
This new course will focus on the measurement of atmospheric contaminant fluxes, including dry and wet atmospheric deposition rates and gas fluxes (e.g. NO_X, CO_2) to and from the surface. It will also consider the sampling of chemical storages and fluxes in the aqueous phase in soil, snow and snowmelt, stream flow and groundwater. Problems of sampling including spatial and temporal variability and process (pathway) uncertainty will be examined.

EES 1004H Methods for the Detection of Pathogens (Fulthorpe)
This is a new course focused on biological contaminants in the environment such as *E. coli, Giardia, Cryptosporidium* in public water supplies. Population pressure combined with a changing climate is increasing the range of *Vibrio chlorae* world wide, and the expansion of viruses such as West Nile. The ability to control these serious problems depends on our ability to detect these pathogens and to track their movements. This course will introduce students to the biology of the life history of these organisms, and will educate them in the state of the methods of high sensitivity detection.

EES 1005H Soil Contamination Chemistry (Simpson)
This new course will present fundamental chemical concepts and reactions that occur in soils with emphasis on contaminant behavior. The basics of soil chemistry will be introduced and the processes that relate to: quantities, attenuation, sequestration, and movement of ions, heavy metals, and organic molecules in terrestrial environments will

be addressed in detail. Students will become familiar with geochemical computer models and these models will be used to predict the behavior of ions in soil. Soil chemical characteristics, which can be used to predict the fate of contaminants in terrestrial environments, will also be presented.

EES 1006H Geology and Geophysics of the Shallow Subsurface (Eyles)
This new course provides an overview of the principal geophysical techniques; emphasis will be placed on their use in understanding site conditions in glaciated terrains such as in Canada. Contaminants move through subsurface and surface environments along pathways controlled by geologic conditions and by surface processes. Identifying these complex pathways is fundamental to environmental assessments of contaminated sites and their remediation and in turn, is reliant on a good understanding of the local sedimentology and stratigraphy. In places, this can be gained by direct sampling or drilling but in most cases requires the application of geophysical techniques such as radar, on-land and marine seismic and down-hole logging.

EES 1007H Remediation Methods (Fulthorpe)
This new course will examine the principal methods currently in use for remediating contaminated soils and waters. Emphasis will be placed on reviewing the advantages and limitations and site-specific applicability of remediation techniques and technologies.

EES 1008H Environmental Science Field Camp (Eyles)
This new ten-day course will provide students with important experience of designing, conducting and reporting investigations in the field.

EES 1009H Advanced Techniques in Geographic Information Systems (Doughty)
This new course covers an advanced set of techniques and applications of GIS, including a substantial practical component. Technical issues (including data format and conversion, geo-referencing, spatial indexing and terrain analysis), application/spatial modeling (including watershed analysis, land use classification, soil erosion modeling, etc...) as well as visualization and incorporation of spatial data and analysis into decision support systems will be examined. Underlying programming techniques will be reviewed and extended on a student-project basis. Students should have a basic understanding of the Unix operating system.

EES 1010H Sediment and Contaminant Transport in Aquatic Systems (Greenwood)
This new course examines contaminant transport in water bodies such as rivers and the Great Lakes using numerical modeling and other techniques. Physical methods for determining mass circulation in response to wind and water temperatures at different times of the year will be examined; case studies will be reviewed.

EES 1011H Freshwater Ecology and Biomonitoring (Williams)
Freshwater environments support diverse communities of plants and animals that are controlled by both biotic and abiotic factors. Organisms respond to changes in the habitat through detectable shifts in population abundances and the loss/gain of species. Monitoring such biological changes in freshwater communities is an established protocol

for assessing the condition of rivers, lakes and ponds subject to human influence. This new course will have a large practical component in which students will have the opportunity to learn the skills necessary to evaluate the condition of aquatic environments variously affected by urbanization.

EES 1012H Boundary Layer Climates and Contaminant Fate (Gough)
This course examines the dynamics and radiation physics of the atmospheric planetary boundary layers. Topics include the formation of a planetary boundary layer, vertical stability, temperature inversions, diurnal and seasonal variations and impacts of local and regional scale circulation. With this foundation the dispersion of airborne pollutants will be studied. The course will conclude with modeling of airborne pollutants and case studies.

EES 1013H Groundwater Hydrochemistry and Contaminant Transport (Howard)
This new course focuses on groundwater contamination and the various methods used to investigate, assess and evaluate the movement and behavior of contaminants in the subsurface. Emphasis will be on urban groundwater issues with case study examples taken from North America, Europe, central Asia and Africa.

EES 1014H and 1015H Directed Readings in Environmental Science I and II (Faculty)
Students may follow a structured independent readings course in any sub-discipline of Environmental Science. A faculty member will supervise the student and a short description of the objectives and scope of the course must be approved by both the faculty member and Program Director.

EES 1016H Intern Placement (Faculty)
This course involves completion of a 4 month long internship at a location approved by the Program Director and a supervising faculty member. Students will be responsible for securing their own placements although the Director will be aggressive in securing commitments from industry and government. In those cases where the student is taking a leave of absence from an appropriate job, it is expected that he or she will normally return to this job as their placement. The student will be adjudged to have completed the intern portion of this course worth 0.5 FCE, upon receipt of a letter from the student's supervisor at their place of work to the Program Director stating that the placement has been satisfactorily completed. The student will also submit a research paper on a project completed while on placement. This will be evaluated by a small committee and is worth 1.5 FCE's.

EES 1017H Climate Change Impact Assessment (Gough)
The study and consideration of climate change is of increasing significance to society. This course will review the evidence for climate change over the past 150 years using both direct measurements and proxy data. Projection of future climate change will also be considered by modeling. Students will complete a major case study and research paper.

EES 1018H Contaminant Fate in Terrestrial Environments (Simpson)
Students will learn the fundamental chemical concepts that underlie and control the movement of contaminants and will be required to present a detailed written research report and oral presentation on examples from contaminated sites.

4.5 Collateral and supporting departments

The following list identifies existing University of Toronto graduate courses that can be taken as part of the M.Env.Sc. Program at UTSC subject to approval on a case-by-case basis from appropriate departments. This agreement in general has already been made during consultation with individual Chairs. An asterisk and name indicates a course taught by UTSC faculty.

Chemistry:	
CHM 1415H	Atmospheric Chemistry
CHM 1425H	Modeling the Fate of Organic Chemicals in the Environment * (F.Wania)
CHM 1550H	Topics in Environmental Chemistry
Chemical Engineering:	
CHE2504S	Industrial Pollution Prevention
JCC1313F	Environmental Microbiology
JNC2503F	Environmental Pathways
Engineering:	
CIV 549H	Groundwater Flow and Contamination
CIV 1319H	Chemistry and Analyses of Water and Waste
CIV 1335H	Advanced Hydrogeology
Geography:	
GGR 1203H	Coastal Hydrodynamics and Sedimentation * (B. Greenwood)
GGR 1204H	Soil Erosion Research
GGR 1206H	Sedimentary Processes
GGR 1308H	Process Hydrology * (T. Price)
GGR 1311H	Atmosphere-Ocean Modeling* (B. Gough)
GGR 1314H	Topics in Physical Oceanography* (B. Gough)
Geology:	
GLG 2608H	Advanced Glacial Sedimentology * (N. Eyles)
GLG 2701H	Advanced Microbial Geochemistry
GLG 2703H	Environmental Isotope Geochemistry
GLG 2705H	Groundwater Flow and Contaminant Transport

Institute for Environmental Studies:

IES 1014H	Aquatic Chemistry
JBE 1434H	Applied Ecology
JGN 2607H	Advanced Techniques in Hydrogeology* (K. Howard)
JNP 1017H	The Molecular and Biochemical Basis of Toxicology
JPG 1312H	Contaminants in the Environment

Zoology:

ZOO 1002Y	Advanced River Ecology * (D.D. Williams)
ZOO 1013H	Limnology

In addition, existing Institute for Environmental Studies graduate courses are:

Academic Code	Section Code	Course	Instructor
IES1001 H	F	Environmental Decision Making	Stefanovic, Ingrid
IES1410H	F	Analytical Environmental Chemistry	Mabury, Scott
IES1701H	F	Environmental Law	Muldoon, Paul
IES1705H	F	Corporate Perspectives on the Environment	Powell, David
IES1706H	F	Natural Hazards & Natural Disasters	Etkin, Dave
IES1707H	F	Environmental Finance: Risk Management & Business Opportunities	Whittaker, Martin
IES4444H	F/S	Internship	Workman, Donna
IES2000H	F/S	Independent Study	Workman, Donna
IES2002H	F/S	Environmental Governance in the City of Toronto	Chiotti, Quentin
IES2503Y (*)	F/S	Atmospheric Toxic Substances: Science & Policy	McKay, Don
CHL5416H	F	Environmental Epidemiology	Smith, Lesbia
JEI1901H	F	Technology, Society &	Vanderburg, Bill
IES1002H	S	Environmental Management Case Studies	Timmerman, Peter
IES1703H	S	Water Resource Management	Grima Lino
IES1704H	S	Environmental Risk Analysis & Management	Grima, Lino
IES2501H	S	Pollution Prevention & Control	Salbach, Steve
IES1433H	S	Regional Ecology: Evaluation of Natural Capital	Hansell, Roger
MSC4000H/IE S4001Y	S	Graduate Seminars in Environment & Health	Smith, Lesbia

IES4444H	F/S	Internship	Workman, Donna
IES2000H	F/S	Independent Study	Workman, Donna
IES2002H	F/S	Environmental Governance: A Practical Project	Robinson, Pamela Savan, Beth
IES2503 (*)	F/S	Atmospheric Toxic Substances: Science & Policy	McKay, Don
HIS1111H	S	Environmental History	MacDowell, Laurel
JNC2503H	S	Environmental Pathways	Jia, Charles
RLG2019H	S	Advanced Topics:	Scharper, Stephen
JGE1420H	F	Urban Waste Management: An International Perspective	Maclaren, Virginia
JPV1201H	F	Bureaucracy & the Environment	Stren, Richard

(*) Pending approval

It is emphasized that the new graduate courses being proposed at UTSC will be open to St. George and Mississauga students thereby expanding the range of studies available across the entire U of T campus. In this way, the broader development of environmental sciences at U of T will be fostered and cross-disciplinary faculty and student co-operation greatly enhanced.

5 OUTCOMES

5.1 Projected graduate enrolment

The program is intended to start in the fall of 2005 and we anticipate an initial demand of between 10 and 20 students. This number will allow us to educate students in relatively small classes ensuring an excellent learning environment and fostering a close relationship between faculty and students. The program is targeted at well-qualified and highly motivated individuals s and we do not anticipate attrition.

5.2 Employment

This is not applicable.

5.3 Publications

This is not applicable.

APPENDIX I: CALENDAR ENTRY

ENVIRONMENTAL SCIENCES
Degree of Master of Environmental Science

Core Faculty

R.R. White BA, M.Sc, Ph.D. Director
N. Eyles, B.Sc. (Leicester), M.Sc. (Memorial NFLD), Ph.D. (East Anglia), D.Sc. (Leicester) P.Geo.
B. Greenwood, B.Sc., Ph.D. (Bristol), Ph.D. *Hons. Causa* (Uppsala)
R.R. Fulthorpe, B.Sc., M.Sc., Ph.D.
W.A. Gough, B.Sc., M.Sc., Ph.D.
K. Howard, B.Sc., M.Sc., Ph.D.
A. Price, B.Sc., M.Sc., Ph.D.
M.J. Simpson, B.Sc., Ph.D.
F. Wania, B.A., Ph.D.
D.D. Williams, B.Sc. (Univ Coll, Wales), Dip. Ed. (Liverpool), M.Sc., Ph.D. (Waterloo), D.Sc. (Wales), *Professor*

A 12-month professional coursework Master of Environmental Science degree program is offered at the Scarborough Campus of the University of Toronto. The focus of the program relates to contaminants and their transport and fate in natural and degraded environments. It is committed to the development of well-trained practitioners in environmental science to meet the needs primarily of industry and government. The program is designed for both newly graduated students and existing professionals in industry and government agencies. The training received is also designed to allow and encourage students to pursue further advanced degrees within this university or elsewhere.

Students will be expected to satisfy all other requirements for entry into the graduate school at this university within a competitive selection process. This process will be administered by the Program Committee. Students entering the M.Env.Sc program will be expected to have a 4-year University of Toronto specialist bachelor's degree, or equivalent, either in Environmental Science or a closely related science or engineering discipline with a minimum mid-B grade average in the last two years of the undergraduate program. Candidates will submit a written statement explaining their objectives in wishing to enter the program and how their background is appropriate. Appropriate postgraduate work experience such as in industry will be considered as part of the admission application. Those candidates lacking essential background preparation in one or more areas of study, if admitted, may be required to complete additional undergraduate courses in addition to the regular program requirements on a case-by-case basis.

The M.Env.Sc. Program has two streams consisting of either an *all-course option*, or an *intern option* both requiring completion of 5 FCE's. Completion of EES 1000H and EES1001Y will be mandatory for students enrolled in either option; those pursuing the intern option will be required to take EES 1016H. It is anticipated that students will complete all instructional courses in two terms and will complete field and research-focused courses during the summer. Part time study is also possible. Supplementary courses offered within the Institute for Environmental Studies and other departments in the Sciences and Engineering can be used as electives with the permission of the departments and Program Director.

List of Courses

EES 1000H	Advanced Seminar in Environmental Science (**Faculty**)*+
EES 10001Y	Research Paper in Environmental Science (**Faculty**)*+
EES 1002H	Analytical Chemistry for Geoscientists (**Simpson**)+
EES 1003H	Air and Water Quality Sampling and Monitoring (**Price**)+
EES 1004H	Methods for the Detection of Pathogens (**Fulthorpe**)+
EES 1005H	Soil Contamination Chemistry (**Simpson**)+
EES 1006H	Geology and Geophysics of the Shallow Subsurface (**Eyles**)+
EES 1007H	Remediation Methods (**Fulthorpe**)+
EES 1008H	Environmental Science Field Camp (**Eyles**)+
EES 1009H	Advanced Techniques in Geographic Information Systems (**Doughty**)+
EES 1010H	Sediment and Contaminant Transport in Aquatic Systems (**Greenwood**)+
EES 1011H	Freshwater Ecology and Biomonitoring (**Williams**)+
EES 1012H	Boundary Layer Climates and Contaminant Fate (**Gough**)+
EES 1013H	Groundwater Hydrochemistry and Contaminant Transport (**Howard**)+
EES 1014H	Directed Readings in Environmental Science I (**Faculty**)+
EES 1015H	Directed Readings in Environmental Science II (**Faculty**)+
EES 1016H	Intern Placement (**Faculty**)+
EES 1017H	Climate Change Impact Assessment (**Gough**)+
EES 1018H	Contaminant Fate in Terrestrial Environments (**Simpson**)+

* denotes a course restricted to those students enrolled in the M. Env. Sc program.
+ denotes a new course: SGS course proposals are included at the end of this document.

MEMORANDUM OF AGREEMENT

For the

Master of Environmental Science Program

The Master of Environmental Science is a graduate degree program, academically administered through the Institute for Environmental Studies (IES) by the School of Graduate Studies.

The physical resources to deliver the program will be the responsibility of the Dean of the University of Toronto at Scarborough (UTSC), who will receive a budget for this purpose from the Provost.

The Director of the Program will be appointed by the Director of the Institute for Environmental Science, subject to the normal consultation process used to appoint directors of centres, institutes and programs at the University of Toronto. Consultation with the Dean and the Principal at UTSC will occur in this process.

A Program Committee will be composed of the Director of IES, the Director of the Program, and one other faculty member from the Department of Physical and Environmental Sciences at UTSC. For some issues a staff member and a graduate student representative may be invited to participate. The committee will meet at minimum once a year, preferably at least once per session. The committee will be responsible for admissions, academic program and course content, student financial aid and recommendations to the Chair of the Department of Physical and Environmental Sciences on assignment of teaching duties. Unresolved issues will be decided by (i) the Associate Dean, Division III, of the School of Graduate Studies in the case of academic issues; and (ii) the Dean at UTSC in the case of issues relating to fiscal matters.

Teaching requirements for the Program will be in addition to the normal graduate teaching loads that are presently supplied to existing graduate departments. The Department of Physical and Environmental Sciences has committed the required teaching resources to this program (to be not less than 3.5 FTE annually).

We the undersigned support the proposal for the Masters of Environmental Science Program, and approve the Memorandum of Agreement

Professor Charles Dyer – Chair DPES, UTSC — Date: May 3, 2004.

Professor Vivek Goel – Interim Provost — Date: Apr 29/04

Professor Sue Horton – Interim Dean, UTSC — Date: Apr 29 '04

Professor Michael Marrus – Dean, SGS — Date: April 29/04

Professor Kwong-loi Shun – Principal, UTSC — Date: Apr. 29/04

Professor Rodney White – Director, IES — Date: May 3rd, 2004.