ERJ PROGRAM REVIEW DRAFT

**1.0 INDUSTRY TRENDS AND EMPLOYMENT**

**1.1 Industry and Sector Trends**

The change in the federal environmental legislation in past years clearly creates a climate of resource development in Canada across all sectors (mines, gas/oil, aggregate), but there is also increased attention being paid to post-development remediation and reclamation. As such, there is significant demand for graduates that have some hands-on experience as well as a strong understanding of the discipline of ecological restoration. In addition, many of the new development projects are occurring on lands that are under current treaty negotiations with First Nations Communities or are happening in direct partnerships with First Nations. Thus there is also a need for practitioners to have a working knowledge of the important cultural practices and accommodations that need to be undertaken, which aligns quite nicely with our current curriculum and partnerships with the Indigenous Environmental Studies Program at our partner institution.

In addition to this new development, there continues to be a need at a more regional and local level to deal with legacy sites related to invasive species, eutrophication, resource extraction, intensive silvicultural, and industrial agriculture. These projects require individuals with a range of quantitative and qualitative skill sets at both the organismal, chemical, and ecosystem level.

**1.2 Labour Market and Employment Trends**

Graduates of the Ecological Restoration program receive both the Ecological Restoration Technician college diploma and the Ecological Restoration Honour B.Sc. degree. Research provided on industry and sector trends tracks two MCU job categories – Environmental Technologists and Technicians and Biologists.

During 2001-2011, the two employment areas show significantly greater job growth (Bio-Tech, 43%; Biologist, 53%) than both their respective sectors (2%;26%) and the general job market (14%). Raw numbers of total jobs at the time of the Ontario Job Futures research shows 3000 Bio-Tech existing positions and 6500 Biologist existing positions. For 2013-17 both have employment prospect ratings of “Average” (metric not specified).

Receiving a degree as well as a diploma positions graduates for employment in a sector where the average salary is $76,326 – a wage approximately $22,000 greater than the average wage in the technician/technologist sector.

In short, the industry sectors collectively provide solid job prospects for graduates. Ecological Restoration graduates enjoy better employment prospects than graduates of programs exiting with only either a diploma or a degree.

**2.0 KEY PERFORMANCE INDICATORS**

**2.1** **Student satisfaction**

KPI

Student satisfaction scores for the learning experience in ERJ and its teachers are consistently higher than system and college averages.

Focus group

The focus group provided some specific sources of satisfaction with the ERJ program learning experience at Fleming and Trent. Students particularly noted the connections between courses at Fleming (for instance, the critical-thinking/communications course ties into the environmental communication course and the indigenous courses). Students also praised the field courses at Fleming because they were good preparation for work at Trent. While first and second year students voiced concerns about the rigour and theoretical aspects of Chemistry courses at Fleming, third and fourth year students praise their relevance for the curriculum at Trent. The variety of writing was appreciated by upper-year students, who also note, however that a Trent they write far more. The prevalence of face-to-face teaching, including lectures, was considered a strength. Other than a few comments on the convenience of online courses for scheduling at Trent, students voiced no desire for more digital or web-based learning.

**2.2 Retention rates**

Within the program – nb. anomalous data

Students enter into the program based upon the Ontario College entrance requirements and, as such, there have been some progression expectations placed upon all enrolled students. In the first semester, students must pass all courses and achieve a grade of at least 65 in SCIE 118 and COMM131 to progress to semester 2. To progress to Trent for the final years o f the program, students must have passed all courses in years 1 and 2 and maintained an overall average of at least 70. We have found that the largest percentage of student losses occur between semester 1 and 2 whereby students don’t achieve the necessary minimum standards.

Looking more specifically, in the years 2010 to 2014, through semesters 1 to 4, ERJ’s retention rates within the program are comparable to the SENRS’ average retention rates and better than the college’s average retention rates. There are two notable exceptions to this – 2010 and 2012 in the early semesters. They skew the cross-year average retention rates for retention in the first two terms. In 2010 and 2012 the retention rates within the program from Semester 1 to Semester 2 were 55% and 66% respectively, versus the 73% average for the other three years (close to SENRS 77% average). In both those years, the initial enrolment was quite high (approximately 60 and 50 students respectively) and, in addition to students not meeting the academic expectations, a number of individuals transferred into other SENRS programs as they were interested in a shorter academic experience. These two anomalous years have created the impression of a significantly greater withdrawal rate for the program after the first term.

Within the college

The programs’s retention percentages for students within the college – that is, summing those in the program and those who transferred to another program – are consistent with other SENRS programs and better than the college average.

**2.3 Graduation rates**

 Graduates are counted upon completion of the two years at Trent. It should be noted that graduation rate shortfalls are not occurring at Trent, where the completion rate for those entering from Fleming is very high. In 2010 cohort, 20 students progressed to Trent and all 20 completed the program and in the 2011 cohort, 21 of 22 students completed the program. One trend that is apparent at the university is that students are taking extra time beyond the prescribed two years (many take on employment) as they are allowed the flexibility in creating their academic timetable. The average completion time of years 3 and 4 for the 2010 cohort was 2.23 years and for the 2011 cohort was 2.2 years.

**2.4 Graduate satisfaction**

KPI data

A common point of raised at the Program Advisory Committee table is that the members feel that the KPI survey questions do not adequately reflect the dual credential nature of this program. Assessment of the data on graduate satisfaction with the program and with the vocational outcomes is also hampered (i) by small sample sizes (ranging from 3 to 12 respondents over 2013 through 2015); (ii) by the KPI’s tendency to measure the satisfaction of graduates with respect to jobs and employment when a high percentage of ERJ students have actually gone on to graduate school and other professional degree programs (i.e. B.Ed) from Trent. Apt questions, in that case, would require assessing how well the program had prepared them for Masters level or post-graduate academic work.

Taking into account both limited sample size and less than optimal questions, ERJ’s graduates score as follows across 2013 through 2015: 82 for satisfaction with the program (versus 76 for the system and 83 for the college); 75 for satisfaction with generic and vocational outcomes (versus 76.3 for the system and 86.3 for the college).

**2.5 Enrolment trends and demand**

IPP data implications for ERJ

The Ecological Restoration B.Sc. meets the growing need for specialists in the field. Its curriculum is informed by the academic and applied journals, conferences and educational initiatives of the international Society for Ecological Restoration. It is consistent with the guidance of ECO Canada. The degree is served well by an Advisory Committee of academic, industry and government service experts in the field.

 It is reasonable to assume that demand for ERJ will be better than average, even if it does not achieve the high percentile rank of its sibling credential, Environmental Technician. In terms of raw data, ERJ has varied little from its average of 128 applications between 2013 and 2015 and its average conversion rate of 33.8%.

The degree/diploma credential that the Ecological Restoration Program students are receiving is seen as quite valuable by potential employers, including positions in the private sector and government agencies. Anecdotally, our students are finding employment across thus usual environmental sectors as our graduates are now working with NGO’s (Nature Conservancy Canada, Land Trust Organizations, Ontario Federation of Anglers and Hunters, Ontario Nature), provincial agencies (OMNRFF, OMOECC) and environmental consultants and private companies in the resource development sector.

Employers and graduate supervisors routinely comment about the strength of the students in the field setting. They are very familiar with the different methodological approaches to sampling and characterizing terrestrial and aquatic communities as well as being prepared for the rigors of field work. Employers also routinely emphasize the need for graduates to be able to work effectively in a group setting, to be effective communicators, and to be effective problem solvers. These skills are addressed directly in a number of the courses, but are also woven into the fabric of the entire curriculum.

**3.0 PROGRAM CURRICULUM**

**3.1 Program learning outcomes and/or sector standards**

The diploma/degree’s continues to align with the original program outcomes which were established for the original launch in 2008-2009. Those outcomes are stated below:

|  |  |
| --- | --- |
| **Diploma level outcomes** | **Honours degree level outcomes** |
| 1. Use knowledge of the rationale for, history, and benefits of, ecological restoration in order to better understand the scope and limitations of contemporary practice | 1. Analyse the theoretical foundations of ecological restoration, the scope of the discipline, the relationship between theory and application and issues in contemporary practice (ethics, the concepts of ecological integrity, ecosystem health and sustainability) |
| 2. Apply principles of foundation science and engineering to the practice of ecological restoration | 2. Effectively integrate knowledge from a range of disciplines (ecology, aquatic biology, hydrology, engineering, planning, communications, social science) in developing one’s professional practice in ecological restoration |
| 3. Read and assess a given landscape; its features, key ecological structures, functions, relationships and context (biological, social, physical) | 3. Develop on site environmental sampling, testing, research and monitoring programs to inform understanding of a site’s key ecological features and ecosystem health |
| 4. Establish baseline data using simple tests (soil, water, taxonomical). Collect samples and data accurately, under lab and field conditions, using recognised protocols and methods of reporting | 4. Analyse the social, cultural, economic, legal and political context for a given project, including the positions of key stakeholders and their respective needs, wants, and desires. |
| 5. Assist with the assessment and analysis of a project site using historical and contemporary references, aerial and ground level photos and GIS applications | 5. Analyse and interpret relevant site data and use that information to develop the rationale and strategies for the restoration project. |
| 6. Assess causes of site degradation, damage, or destruction in the immediate and remote landscape and including biological, social and physical factors | 6. Promote the concept of land stewardship and develop strategies to build and sustain a given project |
| 7. Use knowledge of government policy, and regulation, the roles and functions of government agencies, and NGOs in order to inform the project context | 7. Develop plans and programs that comply with environmental/planning and other regulatory requirements and standards |
| 8. Source and manage supplies; cost project components accurately, make economic use of resources | 8. Apply principles of environmental restoration economics in planning and resourcing project scope, monitoring, and maintenance |
| 9. Conduct project work using the recognized protocols, codes of ethics and standards of the field and in accordance with permits and authorizations | 9. Think critically and creatively in problem solving and selecting appropriate restoration strategies and methods |
| 10. Use a range of restoration technologies, models, tools competently and safely, under field conditions | 10. Plan and manage projects including securing authorizations, engagement of stakeholders, training in and assessment of field techniques, and timelines. |
| 11. Conduct onsite reclamation and restoration activities including landscaping, tree planting and habitat development/restoration | 11. Design a restoration project with clear, achievable and measureable goals and intended outcomes; accounting for ongoing causes of degradation, anticipating future changes, and sustainability and use |
| 12. Conduct onsite aquatic restoration activities including wetland construction, stream rehabilitation, and design of ecologically engineered water and wastewater treatment systems | 12. Manage projects for long term sustainability; monitoring and adapting where changes are necessary |
| 13. Implement monitoring protocols including data analysis | 13. Evaluate a given project including scope, protocols, interventions, and natural products and services and in relation to funding, organizational supports and stakeholder needs. |
| 14. Participate in applied research projects assuming progressive levels of responsibility for design, implementation and reporting | 14. Design and implement an applied research project through all stages of development (Selection/design of scientific methodology and techniques; data collection, analysis, and interpretation; publication/dissemination of results) |

Depth and Breadth of Knowledge

Students learn to analyse the theoretical foundations of ecological restoration, the scope of the discipline, the relationship between theory and application and issues in contemporary practice (ethics, the concepts of ecological integrity and resiliency, ecosystem health and sustainability).

Students are taught how to effectively integrate knowledge from a range of disciplines (ecology, aquatic biology, hydrology, engineering, planning, communications, social science) in developing their professional practice in ecological restoration.

Knowledge of Methodologies

Students learn how to develop on-site environmental sampling, testing, research and monitoring programs to inform understanding of a site’s key ecological features and ecosystem health.

They are taught how to analyse and interpret relevant site data and use that information to develop the rationale and strategies for the restoration project.

Included in the methodological education is the analysis of social, cultural, economic, legal and political context for a given project, including the positions of key stakeholders and their respective needs, wants, and desires.

Application of Knowledge

The curriculum covers the design of a restoration project with clear, achievable and measurable goals and intended outcomes; accounting for ongoing causes of degradation, anticipating future changes, and sustainability and use.

Students learn how to develop plans and programs that comply with environmental / planning and other regulatory requirements and standards.

Included in the education is understanding of the principles of environmental restoration economics in planning and resourcing project scope, monitoring and maintenance.

Training includes the design and implementation of an applied research project through all stages of development (selection / design of scientific methodology and techniques; data collection, analysis and interpretation; publication / dissemination of results).

Communication Skills

Students learn how to promote the concept of land stewardship and develop strategies to build and sustain it in a given project.

Advanced training is provided on how to communicate effectively and persuasively in oral and written forms to diverse audiences using a range of techniques (reporting, presentation, liaison, dispute resolution, public education and advocacy).

Awareness of Limits of Knowledge

Students learn to think critically and creatively in problem solving and selecting appropriate restoration strategies and methods.

Training is provided on the evaluation of projects including scope, protocols, interventions, and natural products and services and in relation to funding, organizational supports and stakeholder needs.

Autonomy and Professional Capacity

Graduates of the degree will know how to plan and manage projects including securing authorisations, engagement of stakeholders, training in and assessment of field techniques, and timelines.

Training on the management of projects will include foci on long term sustainability; monitoring and adapting where changes are necessary.

Students learn how to work both independently and co-operatively in multidisciplinary teams and with stakeholders in order to achieve adaptively the desired results.

**3.2 Program of study**

As stated earlier, to account for the fact that we have students entering a degree granting program based upon Ontario College entrance requirements, we have created the following progression requirements: To progress to Semester 2 of the joint program, students must achieve a 65% grade in the Semester 1 courses SCIE 118 and COMM 131. In order to progress to Year 3 of the program, students must pass (50%) all courses and achieve a 70% overall program average in Years 1 and 2.

The 1st and 2nd years of the program address basic and intermediate-level competencies. This covers the principles of environmental and restoration interdisciplinary science, math (statistics), Indigenous perspectives, chemistry, ecological theory and science, GIS, environmental literature, university-level writing, vegetational analysis, and both landscape and site-scale aquatic and terrestrial field skills. The 3rd and 4th years of the program emphasize intermediate and advanced-level competencies. In addition to the extension of some of the 1st and 2nd year competencies, the curriculum covers ethics, environmental politics, restoration project planning and management, site and landscape scale restoration thinking, experiential field research design, oral and written communication, and the opportunity to study relevant electives in specialty subjects and applications.

Approximately 75% of the courses in the Ecological Restoration Diploma/B.Sc. are required, plus some of the electives must be selected from the advanced options in the ERS Program. Given this prescribed nature of the joint diploma-degree, links with other degrees would be difficult. However, a few students have inquired about adding a “specialization” or “minor” to their degrees in the areas of Sustainable Agriculture, Indigenous Environmental Studies or Northern Studies. Any actual attempts have not been tracked.

**Years 1 and 2 (at Fleming College)**

SEMESTER 1

Ecosystem Skills ECOS0013

Geospatial Techniques GEOM0036

Applied Mathematics in Natural Resource Sciences MATH0063

Applied Chemistry in Ecological Restoration SCIE0135

Critical Thinking and Communication COMM0131

**Environmental Science I SCIE0118**

SEMESTER 2

**Environmental Science II SCIE0119**

**Introduction to Ecology ECOS0027**

GIS Principles GEOM0021

**Readings in Environment and Restoration COMM0137**

**Introductory Chemistry I SCIE0120**

Trees and Shrubs Of Ontario FSTY0050

SEMESTER 3

**Introductory Chemistry II SCIE0121**

Principles of Hydrogeology GEOL0021

**Math I MATH0086**

**Restoration Ecology Field Camp APST0083**

**Introduction to Plant Community Systematics FSTY0075**

**Introduction to Indigenous Environmental Studies: History and Culture ECOS0031**

SEMESTER 4

Ecosystem Monitoring and Assessment ECOS0007

**Methods in Environmental Science SCIE0136**

**Math II MATH0087**

**Introduction to Indigenous Environmental Studies: Culture and the Environment ECOS0030**

Remote Sensing GEOM0041

Geomatics in Surveying SURV0018

* Courses in **bold**  are recognized by partner institution as being university-equivalent
* Courses that are underlined : students must receive at least a 65 to progress to next semester

Current course descriptions:

**Applied Mathematics in Natural Resource Sciences**

*Course Number:* MATH063

This course will enable students to apply specific mathematical concepts and acquire foundation skills important in the Natural Resource and Environmental Sciences. It is designed to complement and reinforce learning within other first semester courses and program areas.

*Units:* 45.00
*Hours:* 45.00

**Critical Thinking and Communication**

*Course Number:* COMM131

Communication is an exciting and rewarding part of any career. Successful professional communication requires an understanding of both individual and organizational audiences and the ability to create effective messages for them. Communications for Ecological Restoration will introduce students to the critical-thinking, problem-solving and professional communication and writing skills that are required in order to be successful advocates for ecological restoration, technical writers, and academic researchers and authors. Course content will develop skill in writing lab and field reports, academic essays and managing positive and negative messages.

In this course students will learn to "see communication, understand it, and manage it." They will learn to recognise and analyse the rich examples of written and nonverbal communication found in personal and work experiences and in current ecological restoration issues as they appear in both popular and academic media. Students make an important contribution to this course in the study and experience of professional communication.

*Units:* 60.00
*Hours:* 60.00

**Ecosystem Skills**

*Course Number:* ECOS013

This course will focus on three areas of study: identification, field and lab skills. Students will identify and classify the living and non-living components of the specific ecosystems described in the Ecology and Environment (ENVR 20) course. Field skills to be developed include the ability to navigate through the natural environment and use a variety of ecosystem inventory techniques. Special emphasis will be placed on safe work habits in lab and field.

*Units:* 60.00
*Hours:* 60.00

**Applied Chemistry in Ecological Restoration**

*Course Number:* SCIE135

This course is designed to be an introduction to some of the basic principles of chemistry which the students will expand upon in Chemistry 1 and 2. The course will also familiarize the learner with topics such as matter and energy, atomic structure, properties and nomenclature of compounds, chemical bonding, chemical reactions, solutions, acids and bases. Students that feel they have the necessary background and training can write a challenge exam to be exempted from this course.

*Units:* 45.00

 *Hours:* 45.00

***Environmental Science I***

*Course Number:* SCIE118

Environmental Science is a university level foundation course introducing the scientific principles required for an understanding of environmental problems and solutions in our highly technological society. Emphasis will be placed upon developing scientific literacy for students in key areas of concern such as energy use and sustainability, environmental policies, globalisation, human population dynamics and waste management.

*Units:* 45.00
*Hours:* 45.00

**Geospatial Techniques**

*Course Number:* GEOM036

This course is designed around the four pillars of Geomatics: Remote Sensing, Cartography, Surveying and GIS. Students will develop entry-level skills in data capture, surveying, (computer) drafting, principles of remote sensing, air photo interpretation, and in usage of representative Geomatics-related software.

*Units:* 45.00
*Hours:* 45.00

**Semester 2**

***Environmental Science II***

*Course Number:* SCIE119

**Prerequisite:** Environmental Science 1 (SCIE 118)

Environmental Science is a university level foundation course introducing the scientific principles required for an understanding of environmental problems and solutions in our highly technological society. Emphasis will be placed upon continuing to developing scientific literacy for students in key areas of concern while at the same begin to introduce many of the approaches that are being applied with respect to remediation and restoration of ecosystems.

*Units:* 45.00
*Hours:* 45.00

***Trees and Shrubs of Ontario***

*Course Number:* FSTY 50

This course deals with the identification of approximately 100 species of trees and shrubs of importance to those managing the forests resources of Ontario. Throughout the semester identification features for common trees and shrubs in both summer and winter condition are introduced and applied. A number of field trips are utilized to assist students with their identification skills. In the weekly lecture series topics such as tree growth, reproduction, photosynthesis, respiration, forest ecology and uses of trees will be introduced. At the completion of the course students will have a sound working knowledge of dendrology. The skills introduced in this semester may then be used in following semesters when working with Forest Ecosystem Classification, Restoration Ecology, Conservation Planning and other habitat management situations.

*Units:* 45.00

*Hours:* 45.00

***GIS Principles***

*Course Number:* GEOM021

**Prerequisite:** Geospatial Techniques (GEOM036)

As one of the pillars of Geomatics, GIS is the science of deriving, determining, and communicating spatial relationships between and within geographic features. This course will provide the student with the fundamental principles supporting the two main spatial data models, vector and raster, and will introduce concepts of spatial relationships and preliminary spatial analysis.

*Units:* 45.00
*Hours:* 45.00

***Introduction to Ecology***

*Course Number:* ECOS027

Introduction to Ecology offers an examination of the interactions between organisms and their environment at the individual, population and community level. The course will cover basic concepts, theories and methods used in ecology and the application of these to ecological and environmental problems.

*Units:* 45.00
*Hours:* 45.00

***Introductory Chemistry I***

*Course Number:* SCIE120

This course introduces the fundamental theories, measurements, calculations and laboratory methods required to apply chemistry principles to applications in organic and inorganic chemistry. The course also provides an introduction to biochemistry. The integrated course concept and its relevance to environmental science is illustrated below.

*Units:* 60.00
*Hours:* 60.00

***Readings in Environment and Restoration***

*Course Number:* COMM137

Readings in Environment and Restoration will introduce students to literature that illuminates and serves as the foundation of the disciplines of restoration ecology and environmental studies. It will provide students with an opportunity to study and contextualize the major themes of these disciplines as they are expressed through poetry, narrative and discursive prose.

It will begin with a brief overview of the European religious views of nature represented in literature from the Middle Ages to Renaissance and contrast these with the scientific world-view of the 18th Century. We will then consider the significant re-definition of the environment and human nature in the 19th Century through the works of Ralph Waldo Emerson, Henry David Thoreau and Jack London. Finally, we will examine the emergence of the modern ecological restoration movement in seminal texts by Aldo Leopold, Rachel Carson, Edward Abbey, and native novelist Leslie Marmon Silko. As well, we will examine various selected readings, including poets Robert Frost, Wallace Stevens, William Carlos Williams, Robinson Jeffers, and Gary Snyder.

*Units:* 45.00
*Hours:* 45.00

**Semester 3**

***Geomatics in Surveying***

*Course Number:* SURV018

This course places the emphasis on the fundamental principles of Geomatics as they apply to Surveying. Electronic instruments will be used with emphasis on data loggers to obtain field positions with features and attribute data. These field locations and attributes will be used to create GIS related survey plans. Coordinate Geometry will be used in the computation of boundaries areas and volumes. The GIS features will be implemented using practical field projects and the projects will be related to land information systems.

*Units:* 45.00
*Hours:* 45.00

***Indigenous Environmental Studies I: History and Culture***

*Course Number:* ECOS031

In this course students will be given the opportunity to explore Indigenous worldviews, environmental philosophies, values and ways-of-life through exposure to the perspectives of traditional Indigenous Teachings, lectures, and guest speakers. This course will cover such topics as approaches to studying the environment, the impact of colonization and colonialism on Indigenous Peoples and their environment. Students will also investigate Indigenous and non-Indigenous perspectives on Indigenous Environmental Knowledge and its use and application in environmental management with special attention being paid to interactions between Indigenous knowledge and western science. This course is designed to encourage students to use Indigenous Knowledge and western science, as well as knowledge from the social sciences, to develop sustainable resolutions to specific environmental issues currently facing Indigenous communities.

*Units:* 45.00
*Hours:* 45.00

***Introduction to Plant Community Systematics***

*Course Number:* FSTY075

**Prerequisite:** Intro to Ecology (ECOS 27)

Introduction to Plant Community Systematics introduces students to concepts in systematic classification with an emphasis on local flora. The course is fundamental to the understanding of relationships, both evolutionary and ecological, among plant and animal communities; their roles in the ecosystem, and the underlying reasons for their geographical distributions. The importance of plant taxonomy in ecological restoration will be explored in terms of rebuilding viable communities based on the historical data, current conditions and the appropriate plant associations that can be reconstructed.

*Units:* 45.00
*Hours:* 45.00

***Introductory Chemistry II***

*Course Number:* SCIE121

**Prerequisite:** Intro to Chemistry 1 (SCIE 120)

This course introduces the fundamental theories, measurements, calculations and laboratory methods required to apply chemistry principles to applications in organic and inorganic chemistry. The course also provides an introduction to biochemistry. The integrated course concept and its relevance to environmental science is illustrated below.

*Units:* 60.00
*Hours:* 60.00

***Math I***

*Course Number:* MATH086

This course is designed to introduce students to the fundamentals of descriptive and inferential statistics with an emphasis on inference. The major topics include methods of analysing sets of data, probability, probability distributions, estimation, confidence intervals, hypothesis testing, simple linear regression and correlation. Course concepts are applied to the natural sciences.

*Units:* 45.00
*Hours:* 45.00

**Principles of Hydrogeology**

*Course Number:* GEOL021

This course introduces the fundamental theories and applications of groundwater studies. Lecture topics will include basic principles of groundwater, aquifer investigation, wells, groundwater management, and groundwater geotechniques. Lab efforts will be directed to hydraulic conductivity determinations, flow nets, pump tests, piezometric tests, and uses of test data.

*Units:* 60.00
*Hours:* 60.00

***Restoration Ecology Field Camp***

*Course Number:* APST083

**Prerequisite:** Environmental Science 2 (SCIE 119), Intro to Ecology (ECOS 27)

This 2-week field course provides students with exposure to the principles and practices in ecosystem restoration. Ongoing or completed projects addressing both terrestrial and aquatic ecosystems will be visited thus exposing students to current techniques in the field. Students will get the opportunity to further develop their skills in taxonomical classification, ecosystem monitoring, and ecosystem assessment.

*Units:* 40.00
*Hours:* 40.00

 **Semester 4**

**Ecosystem Monitoring and Assessment**

*Course Number:* ECOS007

This course provides students with technical skills and knowledge related to monitoring and assessing ecosystem health and change in terrestrial and aquatic ecosystems. An emphasis will be placed on scientific methodology, report-writing skills, and experimental design principles. Students will also become familiar with the federal and provincial Environmental Assessment acts.

*Units:* 45.00
*Hours:* 45.00

***Methods in Environmental Science***

*Course Number*: SCIE136

The primary objective of this course is to provide the student with the theoretical and practical knowledge of the different methods that practitioners use in the field and the different techniques used to assess impacts on the environment and understand basic ecosystem processes.

*Units:* 45.00
*Hours:* 45.00

***Indigenous Environmental Studies II: Culture and Environment***

*Course Number:* ECOS030

**Prerequisite:** Indigenous Environmental Studies 1: History and Culture (ECOS031)

This course will be an extension of Indigenous Environmental Studies I and will continue to explore the relationship between Indigenous communities and their environment and the connections between western science and Indigenous and local knowledge systems.

*Units:* 45.00
*Hours:* 45.00

***Remote Sensing***

*Course Number:* GEOM 41

Geographic Information Systems are using many new remote sensing computer programs to build and analyse map features. This course introduces the basic physical concepts and the major imaging systems employed in remote sensing. Spatial and spectral resolution of the image is processed and interpreted to create map features and design and to build the database.

*Units:* 45.00

*Hours:* 45.00***Math II***

*Course Number:* MATH087

**Prerequisite:** Math 1 (Math086)

A continuation of Math I, this course is designed to introduce students to the fundamentals of descriptive and inferential statistics with an emphasis on inference. The major topics include methods of analysing sets of data, probability, probability distributions, estimation, confidence intervals, hypothesis testing, simple linear regression and correlation.

This is the equivalency of a full credit course and outcomes are realised over two semesters

*Units:* 45.00
*Hours:* 45.00

**Geomatics in Surveying**

*Course Number:* SURV018

This course places the emphasis on the fundamental principles of Geomatics as they apply to Surveying. Electronic instruments will be used with emphasis on data loggers to obtain field positions with features and attribute data. These field locations and attributes will be used to create GIS related survey plans. Coordinate Geometry will be used in the computation of boundaries areas and volumes. The GIS features will be implemented using practical field projects and the projects will be related to land information systems.

*Units:* 45.00
*Hours:* 45.00

YEARS 3 AND 4 (AT TRENT UNIVERSITY)

These courses may be taken in either years 3 or 4, provided the course prerequisites have been met.

REQUIRED COURSES:

* Environmental Science and Politics ERST-POST 2100H
* Canadian Renewable Resource Economics and Project Planning ERST-CAST 3780H
* Canadian Renewable Resource Economics and Project Planning ERSC/ERST 3310Y

 -- OR -- Environmental and Ecological Risk Assessment ERST-PHIL 3300Y

* Environment and communication: Oral and Visual Presentation -- OR -- Environment and Communication: Writing and Reporting ERSC 3501H / ERSC 3502H
* Restoration Ecology ERSC 4520H
* Remediation and Reclamation of Sites ERSC 4530H
* Approved field course

In addition to the above, students will need to enrol obtain an additional 6 credits, as follows:

* 2.5 additional ERSC/ERST credits, including 1.0 at the 4000 level
* 3.5 elective credits of choice, including 2.0 @ the 3000 or 4000 level

 *Note: 3.5 of the above credits must be SCIENCE credits*

**4.0 STRATEGIC POSITIONING**

**4.1 College and School Alignment**

The mission of both institutions focus on providing students with a distinctive education that is enhanced by experiential and interdisciplinary learning, involves partnerships with other institutions, and integrates curriculum in Indigenous Studies. This dual credential program in Ecological Restoration is unique to Canadian undergraduate degrees in the environmental sciences. It is indeed interdisciplinary and partnered, requiring courses that are cross-listed across multiple programs in the School of Enviornmental and Resoruce Sciences at the Frost Campus of Fleming College and with 6 academic departments at Trent University. Experiential and Indigenous-themed courses are required and are also offered as electives.

**4.2 Competitor Programs**

There are no comparable programs in Canada that deliver the dual credential in Ecological Restoration at the undergraduate level.

**4.3 Learning Pathways**

Given the fact that there the program is administered jointly between the two institutions already, there are limitations to creating additional institutional pathways. Some program students have explored the extent to which years 1 and 2 at Fleming would be evaluated at other post-secondary institutions (Acadia University, University of Victoria, University of British Columbia, University of Alberta), but were not granted a sufficient enough equivalencies that would make such a move a viable alternative.

A large percentage of our graduates have continued with their studies at the M.Sc and Ph.D level (Trent University, University of Toronto, University of Victoria, University of Saskatchewan, University of Alberta, Guelph University) and have stated that our program provided an excellent foundation in field and research skills to enable them to make this next step.

For those students in our program that do not meet the progression expectations after year 2, the pathway provided to them is to Semester 5 of the Ecosystem Management Program where they then receive a Technologist Diploma. It should be noted as well, that those students that do not meet the expectations for progression after semester 1, will often transfer into other SENRS programs, thus being retained by the college.

**4.4 New Program or Redesign Ideas**

The program curriculum has remained relatively unchanged since the inaugural cohort enrolled in Sept. 2008. The exception to this occurred for our second cohort where we adopted Trees and Shrubs to better prepare the students for the Plant Community Systematics course in year 2. To overcome some of the chemistry-based anxiety that was loudly expressed by our first cohort, we also created a first semester “warm-up” course called Chemistry for Ecological Restoration.

 As the students have moved through the program, we have routinely run focus groups to gain feedback on their experiences. We have engaged with faculty across both institutions to get their feedback as to the overall quality of the students and how prepared they are for the different courses. Finally, we have regular meetings of our Curriculum Committee that has representation from both institutions to keep all informed as to the feedback being received.

We are now at the point where we feel some minor changes in the curriculum are necessary during years 1 and 2. There are concerns expressed by students that there is too much redundancy in the curriculum being offered which takes away from their ability to fully engage in that curriculum that is new. They specifically identified the carry-over between ECOS 31 and ECOS 30, the redundancy in the curriculum of ECOS 7 - but praised the independent research project, and they questioned the relevancy of SURV18 as a full course, rather suggesting that they could pick it up on their own time if necessary. They also raised concerns with respect to their overall course load – a full course load at Trent is equivalent to five courses per semester, but while at Fleming they are routinely taking six courses per semester. They felt that six courses did not give them enough time to adequately complete assignments or fully distill the information being presented in a given course. Program faculty made the same comment. Finally, it was felt that there was an important component in Ecological Land Classification (largely identified by our graduates) missing from our curriculum which could be addressed with some novel and applied delivery approaches.

Thus we are proposing to modify the curriculum in Years 1 and 2 to be the following:

**Semester 1** would be unchanged to continue to give students access to Semester 2 curriculum for all other SENRS programs.

**Semester 2** would be reduced to five courses: SCIE 119 – Environmental Science 2, ECOS 27 Introduction to Ecology, GEOM 21 – GIS Principles, SCIE 120 – Introductory Chemistry 1, and FSTY 50 – Trees and Shrubs.

**Semester 3** would remain unchanged, but we would restructure ECOS31 so that it provides a significant cultural foundation for ECOS30 in Semester 4.

**Semester 4** is where the most change is proposed. We are proposing to drop ECOS 7 – Ecosystem Monitoring and Assessment, GEOM 41 – Remote Sensing, and SURV 18 – Geomatics in Surveying, and replacing them with a new course in Ecological Land Classification and COMM 137 – Readings in Environment and Restoration, which was previously offered in Semester 2. The new ELC course would likely adopt some of the curriculum from the Remote Sensing course, while aligning with the current course being delivered by OMNRF. The extent to which our students could gain professional accreditation is presently being discussed. To offset the loss of the important independent learning project that occurs in ECOS 7, we are proposing to expand the semester hours for SCIE 136 to 60 hours (from 45 hours) so we can continue to offer that independent learning experience.

**5.0 EXTERNAL RELATIONS**

**5.1 Community Partnerships**

Faculty at both institutions are have active research programs related to mine site restoration, air pollution monitoring and effects, invasive species management, climate change impacts, lake management, and conservation biology. They are routinely attending applied and professional meetings at the regional, national, and international level and incorporating their own experiences and that of their research colleagues into their course curriculum. This approach is vital for ensuring that our students are receiving living curriculum and can be provided with practical case studies of which faculty are intimately familiar. Through these faculty networks our students have been involved with research projects ranging from the impacts of the tar sands in northern Alberta to Socio-cultural restoration in South Africa. They have been involved with partnerships with local lake associations (Big Cedar Lake Stewards Assocation, Kawartha Lakes Stewards Association, Haliburton Coalition of Lake Associations), Conservation Authorities (Kawartha Conservation, Toronto Region Conservation, Otonabee Region Conservation, Rideau Valley Conservation Authority), First Nation Communities (Curve Lake, Alderville, Hiawatha, Six Nations), provincial and federal government agencies (Ministry of the Environment, Ministry of Natural Resources and Forestry, Environment Canada), and a number of private sector companies. The CVs of our individual faculty also highlight the many roles they are playing as individuals on committee’s, citizen advisory groups, etc.

**5.2 Program Advisory Committee**

The Ecological Restoration B.Sc. Advisory Committee meets annually to review the achievements, progress and concerns about the program. The Committee is comprised of professional practitioners of ecological restoration in government, and non-governmental organizations, as well as students in the degree program and faculty from both parent institutions. The Committee meetings involve the review of statistical documentation, recommendation of alteration of the curriculum and discussions related to student consultation. Presently, the committee has underrepresentation from the non-academic sector and efforts are being made to increase representation from the private and NGO sectors. A number of our recent alumni are currently being approached to gage their interest in participating.

Current membership of the Advisory Committee and their affiliations are given below.

* Brian Basterfield
* Andrea Hicks, Cambium Environmental
* Dale Leadbetter
* Dr. Mark Browning, Ontario Ministry of Natural Resources and Forestry
* Meredith Carter, Ottonabee Region Conservation Authority
* Rob Messervey, Kawartha Conservation Authority
* Kyle Borrowman, Ontario Federation of Anglers and Hunters
* Dr. Dan Longboat, Indigenous Environmental Studies Program, Trent University
* Dr. Shaun Watmough, Director, School of the Environment, Trent University
* Dr. Tom Hutchinson, Professor Emertius, Trent University
* Dr. Tom Whillans, Ecological Restoration Program Coordinator, Trent University

Internal members include Dr. Linda Skilton, Mary Ann Fader, Dr. Eric Sager, and Dr. Peter Lapp

**5.2 Alumni**

Given the fact that we are a relatively young program with only 5 graduating classes to date and the fact that many of our graduates have continued their studies, the number of engaged alumni is quite low. That said, when the few that are available are called upon their enthusiasm to participate has been notable. Colin Cassin, currently employed by the Ontario Invasive Plant Council following his masters studies at the University of Toronto, has been a very visual supporter, appearing in our most recent marketing and promotion video and regularly providing guest lectures. Val Deziel, working with Nature Conservancy Canada (NCC), also appears in our promotional video and works with our undergraduate student society of Ecological Restoration, in addition to regularly leading lectures around NCC’s tall grass prairie restoration efforts.

**6.0 PROGRAM RESOURCES**

**6.1 Program Revenue and Expenses**

**6.2 Staff and Faculty Resources**

Regarding years 1 and 2, an excellent team of instructors has been assembled from multiple programs and disciplines to deliver our curriculum and continue to receive excellent feedback from students. The Coordinator of the Fleming Program is Dr. Eric Sager, who is also an Adjunct Professor at Trent University, involving supervision of graduate students and participation in various Trent academic projects. Since many of the same courses are being offered at the university, some of those same individuals to offer their course at Fleming (i.e. James Wilkes (Indigenous Environmental Studies who is also teaching in the Indigenous Environmental Studies Program at Trent), Dr. Mark Dzurko (a SENRS faculty teaching chemistry), Dr. David Woodfine (Summer Field Camp), Dr. Peter Lapp (SENRS faculty who teaches the 1st year Critical Reading and Writing and Readings in Environment and Restoration and also delivers the Environmental Communication: Writing and Reporting at Trent), Dr. Gord Balch (Senior Scientist in the CAWT and co-instructor of our Methods in Environmental Science course), and Dr. Lisa Kraemer (who teaches our Introduction to Math courses and the Ecology course and has a long history of teaching in the Environmental and Resource Studies Program at Trent). As well, the program has taken advantage of the excellent curriculum already being delivered by Brian Gerry, Karen Whillans-Browning, and Barb Elliot in their home programs, as well as some of the curriculum of the common 1st and 2nd Semester courses at SENRS. The program has also been supported well with the efforts of technical staff – specifically Mark Newell who has 40% of his time allocated as the program tech. We also get some support from Environmental Technology Program tech Scott Miles.

The program is housed within the new School of the Environment at Trent and is coordinated by Dr. Tom Whillans.

CVs of key faculty are attached.