DUNDALK INSTITUTE OF TECHNOLOGY

SCHOOL OF HEALTH AND SCIENCE
DEPARTMENT OF APPLIED SCIENCES

Bachelor of Science (Honours) in Environmental Bioscience

Bachelor of Science in Environmental Bioscience (Exit Award)

FINAL VERSION

June 2014

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1. Provider Profile

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1.1. Dundalk Institute of Technology:

Dundalk Institute of Technology is one of 13 Institutes of Technology in the Republic of Ireland and is the major third-level educational establishment for the North-East region of the 26 counties. It was founded as Dundalk Regional Technical College (RTC) in 1970, initially offering senior cycle second level courses. The college has grown substantially over the past 38 years. After its establishment it quickly moved into the provision of third level courses in 1972, initially at sub-degree level (National Certificate and National Diploma), then later at degree level (in the early 1980s) and then at postgraduate level with the awarding of the first Master's degree in 1992.

The College had, since its foundation, come under the management of County Louth Vocational Education Committee. This changed with the Regional Technical Colleges Act, 1992 which established the College for the first time as a self-governing, autonomous institution and which set out its functions (Act, Section 5.1). This resulted in the establishment, on a statutory basis, of Academic Council, Governing Body as well as the posts of Director, Registrar and Secretary/Financial Controller. Other existing senior posts were also formalised.

The Minister for Science and Education designated the College as an Institute of Technology in January 1998 and it was renamed as Dundalk Institute of Technology (DkIT). The act has been subsequently amended in 1994, 1999 and replaced by the Institutes of Technology Act 2006. The Qualifications (Education and Training) Act 1999, established the Higher Education and Training Awards Council (HETAC) as a successor to the National Council of Educational Awards (who had been the awarding body for the RTCs since 1972), and provided for Institutes to increase their autonomy by achieving delegated authority to make their own awards. This Institute, following an extensive self-study process, was, awarded this right, by HETAC, to make awards from levels 6 to level 9 (taught) of the National Qualifications Framework in 2004. This 10-level framework of qualifications, based on standards of knowledge, skill or competence was drawn up by the National Qualifications Authority of Ireland (NQAI), also established under the 1999 Act. The Institute also has authority to register students with HETAC for Level 9 and 10 research programmes in defined areas. The School of Health & Science has authority to register students in all three of its Research Centres.

DkIT currently offers programmes from level 6 to level 10 on the NFQ in a wide spectrum of disciplines across its four Schools. Because its hinterland is extremely complex in terms of its academic, research and labour needs, this diversity of programme provision is driven by its obligation to reconcile he requirements of the market that it serves.

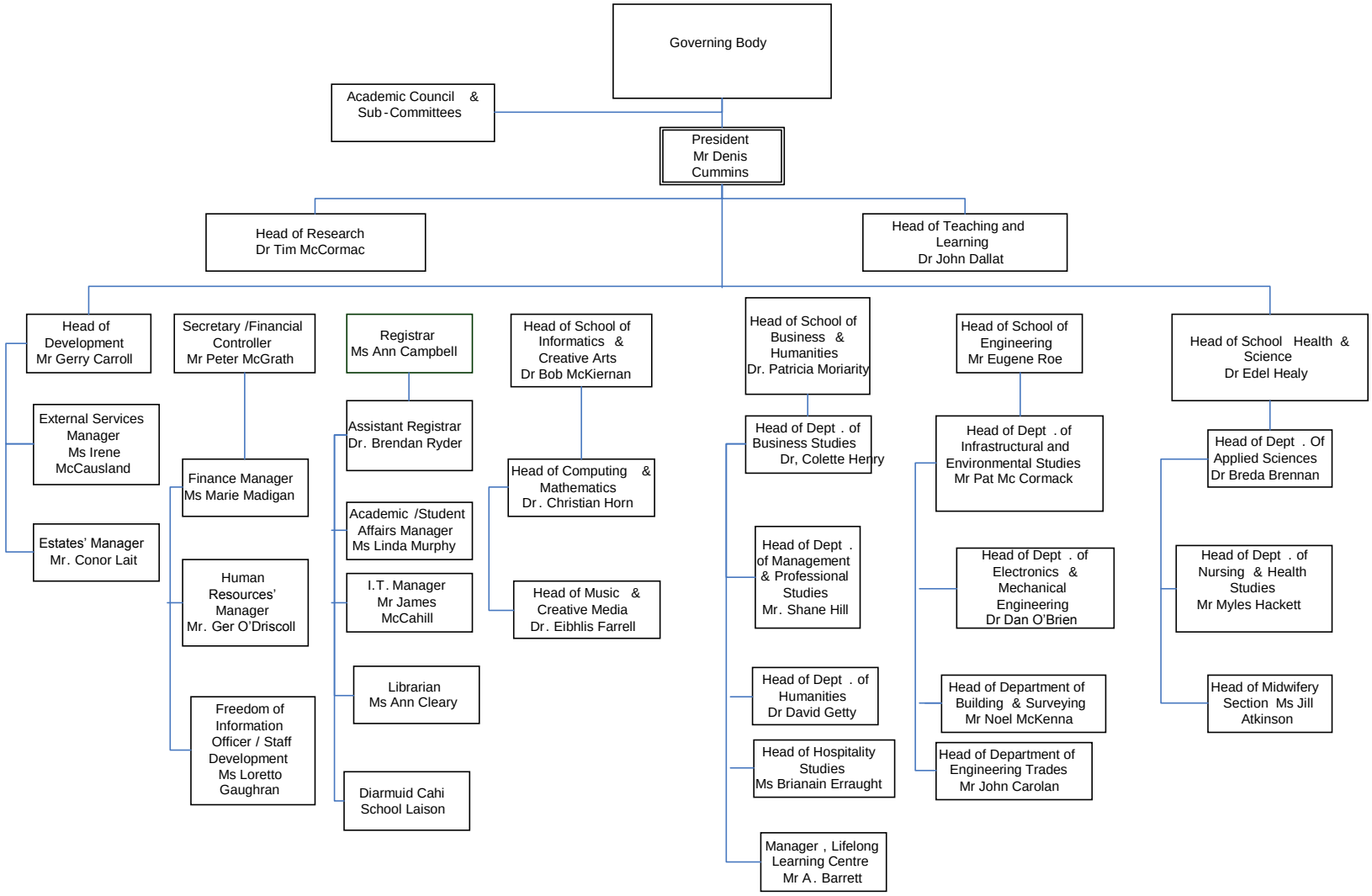
Within DkIT the wide discipline mix offered has contributed to the further development of academic programmes and an up-skilling of staff capability to their present high level. This has led to an extremely vibrant level of cross-disciplinary engagement which manifests itself in the strength of its graduates The ability to function across disciplines is an essential competency for modern graduates and is

recognised as such by regional employers. DkIT compares favourably with national trends in the sector in terms of overall enrolments of students and discipline mix. The Institute currently has over 5000 registered students.

1.2 Institute Governance and Structure

The following diagram shows the governance structure of the Institute. The School of Health & Science is one of 4 academic schools and is the second largest School in DkIT:

Figure 1.1: DkIT Governance Structure



1.3 DkIT Strategic Plan (2011 - 2016)

The DkIT Strategic Plan (2011 - 2016) https://www.dkit.ie/strategy was officially launched in March 2013 and contains the following vision, mission, values and structure.

1.3.1 DkIT Strategic Plan: Vision

'Dundalk Institute of Technology will provide university-level higher education to graduates who will excel in their specialised discipline and have the creativity, confidence, resilience and entrepreneurial flair to thrive in the 21st Century. Working sustainably and with a practical focus, we will help lead the regeneration of the North East region and more widely Ireland by acting locally and thinking globally'.

1.3.2 DkIT Strategic Plan: Mission

'DkIT is fully committed to its role in the economic, social and cultural development of the region. This plan has a particular focus on developing learners and graduates with the following qualities:

- Excellent in their discipline
- Able to apply disciplinary and trans-disciplinary knowledge, especially focusing on entrepreneurship and sustainability
- Able to contribute globally as well as locally
- Personal and employability qualities to include an ability to solve complex problems; critical thinking; systems thinking and capacity for on-going learning'

1.3.3 DkIT Strategic Plan: Values

'The following values will become ever more central to all that we do in the years ahead:

- Willingness to change and re-interpret our work in the light of changed needs, circumstances and contexts
- Resilience in responding to change and uncertainty
- Leadership throughout the organisation
- Effectiveness in our operations and processes
- Engagement within DkIT and with the wider community and society
- Respect for each other, for diversity, for our society and environment
- Inclusion of diverse needs and approaches'

1.3.4 DkIT Strategic Plan: Pillars

'In order to develop graduates with the qualities our mission requires, a series of goals and objectives under three different pillars are outlined in the Strategy. The intention of all of the goals and actions is to create an organization, an approach to regional and community

development and an approach to knowledge development which is aligned with the core vision, mission and values of DkIT

The pillars are:

1. **Knowledge Asset** meaning our work in scholarship (teaching, learning, research) and knowledge transfer
2. **Community and Development** meaning our role in the enhancement of the social, economic and cultural life of the community on a regional, national and international level.
3. **Organisation** meaning the processes and resources that underpin our work.

Each of these pillars represents a critical aspect of DkIT and, together, they contribute to the development of our graduates and the overall objectives of the Institute.'

1.3.5 DkIT Strategic Plan: Themes

The current global and national economic landscapes together with the overall impact of globalisation and societal expectations of quality of life have developed a paradigm where global sustainability, entrepreneurship and international collaboration are critical to future economic survival. Sustainability, in particular education for sustainability, where sustainability education, in its broadest sense, is education for social transformation with the goal of creating more sustainable societies [1]guarantees the delivery of graduates with a focused understanding of the inter-related social, economic and environmental behaviours, skills and values needed to ensure a 'Sustainable economy'. .

DkIT realises the importance of and our moral obligation as a third level educational institution to actively engage and contribute in these areas. As such, sustainability, entrepreneurship and engagement (local and international) are core themes running throughout all strategic activity.

- Sustainability– future-proofing so that today's solution doesn't become tomorrow's problem. Understanding the inter-related social, economic and environmental impacts of all we do and progressing under each measure rather than any one to the cost of others
- Entrepreneurship - a capacity to create new responses and innovations in the economic, social and cultural environment interfacing with external stakeholders and fostering the development of the region
- Local & International Engagement - ensuring that opportunities for knowledge exchange and co-creation are fostered in its aims to promote and deliver a partnership approach as a learner-centred institute for the benefit of its wider public, civic, economic and community constituents

[1] UNESCO (2012) Shaping the Education of Tomorrow. 2012 Report on the UN Decade of Education for Sustainable Development

1.4 School of Health and Science.

The School of Health & Science was formed in 2004. It consists of almost 1200 students and comprises the following academic Departments, Section and affiliated Research Centres:

- Department of Nursing, Midwifery and Health Studies
- Department of Applied Sciences
- Midwifery Section
- Smooth Muscle Research Centre
- Centre for Freshwater and Environmental Studies
- Netwell Centre

The management team of the School is as follows:

Name	Function
Dr Edel Healy	Head of School
Mr. Myles Hackett	Head of Dept. Nursing, Midwifery & Health Studies
Dr Breda Brennan	Head of Dept. Applied Sciences
Ms. Jill Atkinson	Head of Midwifery Section
Ms. Dolores McGill	School Administrator (Grade 6)

1.4.1 Department of Applied Sciences.

The Department of Applied Sciences at DkIT is committed to providing high quality, relevant science programmes at a range of levels. The Department provides full-time undergraduate programmes across a range of disciplines, including, Applied Bioscience, Pharmaceutical Science, Biopharmaceutical Science, Veterinary Nursing, Environmental Biology and Agriculture. The Department has almost 500 full time undergraduate students and 15 part-time students. It is staffed by twenty two full-time and part-time lecturers, four technical staff and 1.5 administrative staff. The physical facilities of the Department include 7 theatres/classrooms and 12 laboratories (including 3 research laboratories).

1.4.2 Centre for Freshwater & Environmental Studies (CFES) & Electrochemistry Research Group (ERG).

Research within the environmental and energy research cluster area is led by the Centre for Freshwater and Environmental Studies (CFES) and the Electrochemistry Research Group (ERG). This centre and group operate with distinct and separate management structures. In addition, there are internal interdisciplinary research

collaborations within this research theme between these centres and the Institute's Centre for Renewable Energy (CREDIT), profiled within our Energy Forfás Sheet submission, within the School of Engineering. To date, researchers within this research area have been awarded in excess of €5M from national and international funding sources including:

1. Enterprise Ireland – Research Voucher & Innovation Partnership Programmes
2. European Union – Framework 7 Benefit for SMEs Programme
3. Environmental Protection Agency – STRIVE programme
4. Higher Education Authority – Irish Aid programme
5. Council of Directors – TSR Strand 1 programme
6. EU COST COST (European Cooperation in Science and Technology) funding
7. Irish Research Council (IRSCET) postgraduate funding
8. EU Interreg IVA development programme

The Centre for Freshwater and Environmental Studies was established in 2005 in order to lead the National Source Protection Pilot Project (NSPPP), Ireland's first source protection project. This centre currently has twenty-one members; seven principal investigators, one technician, one project manager and fourteen post-graduate researchers, all located within the Department of Applied Science.

CFES identifies four thematic areas:

Each of the seven principal investigators has primary duty for their own postgraduate students in this area, with the research director having overall responsibility for achieving the strategic plan of CFS.

1. Freshwater / catchment management:

2. Organic resource management:

    a. Development of novel strategies for the processing of novel biomass and agricultural residues into biofuels and other value-added products;

    b. Development of further expertise in the areas of environmental biotechnology and biomass utilisation;

    c. Including areas of phytoremediation and bioremediation;

    d. Bioconversion and applied environmental research.

3. Wetlands and waste water management: This thematic area links both thematic areas of freshwater and organic resource management and is associated with wastewater companies and organisations.

4. Sustainable water in developing countries: The management structure associated within this thematic area includes a project manager, a part-time administrator and multi-institutional and international steering and advisory committees.

The electrochemistry research group at Dundalk Institute of Technology, which was established in 2008, carries out internationally recognised research within the field of electrochemistry, combining aspects of fundamental physical chemistry, surface chemistry and synthetic inorganic / organic chemistry for the development of novel nanostructured materials. Examples of materials include

- Conducting and π-conjugated polymers (i.e. polypyrrole, polythiophenes)
- Inorganic metal oxide clusters (i.e. Polyoxometallates)
- Functionalised nanoparticles (i.e. Gold)

These materials are then surface immobilised through the application of electrochemical techniques and self-assembly methods onto a range of surface types, conducting (i.e. platinum, carbon, gold), semiconducting (i.e. Indium tin Oxide, Silicon) and non-conducting (i.e. glass). The group employs a range of techniques, such as, surface acoustic wave technology, electrochemistry, spectroscopy and surface techniques to investigate and characterise the behaviour of our systems.

The specific environmental based technological applications which the group are actively exploring include:

- Environmental Gas sensing for the volatile and toxic gases
- Sensor arrays for environmental water monitoring
- Nanostructured surfaces for Fuel Cell technology

In addition, the group are also involved in collaborative research programmes to explore:

- Nanostructured semiconductor surfaces for molecular electronics and memory devices
- Nanostructured electrochemical surfaces for point of care biosensor systems

1.4.5 Centre for Excellence in Teaching and Learning

Given the acknowledged and strong correlation between quality teaching and quality learning, DkIT places significant emphasis on the continuing professional development (CPD) of its staff. This emphasis is reflected in numerous Institute initiatives, including the setting up of its Centre for Excellence in Learning and Teaching (CELT) in 2008, a Master of Arts in Learning and Teaching (2009), which has

a current enrolment of 55 Institute staff, and, significantly too, the creation of a Student Learning and Development Centre (2009). In 2009, an e-Learning Development Unit was established to promote technology enhanced, flexible and blended approaches to student learning throughout the Institute. The MA Programme was validated in October 2009 and provides an accredited and modularised professional development pathway incorporating a flexible/blended learning philosophy. The Programme has modules which are specifically focused on the enhancement of student learning, as the following titles highlight:

- Student-centred Learning and Teaching: Models and Strategies (Mandatory);
- Enhancing Student Learning through E- pedagogy;
- Improving Learning and Teaching through Creativity and Scholarship.

CPD within the Institute is further consolidated through the provision of a range of other opportunities for staff to promote excellence in their teaching, including: professional development events (PDEs), exhibitions in which staff projects showcasing the diversity of approaches to learning and teaching are exhibited and guest speaker presentations. CELT seeks to promote excellence with particular emphasis on student-centred learning (SCL), technology-enhanced learning (TEL) and teaching quality, all of which are inter-linked. This aim is aligned with the 'Hunt Report' which recommends that: "All higher education institutions must ensure that all teaching staff are both qualified and competent in teaching and learning, and should support on-going development and improvement of their skills". CELT works actively with Schools across the Institute, piloting, implementing and evaluating teaching and learning approaches with a view to improving practice through application. The Centre has participated in nationally-funded learning and teaching projects such as the National Digital Learning Repository (NDLR) and SIF 2 Flexible Learning. It also collaborates with the wider higher education teaching and learning community such as NAIRTL, LIN and ILTA. A number of staff within the School of Health & Science have completed the MA in Teaching and Learning Programme.

2 Programme Details:

Award Type: Bachelor of Science (Honours)

Programme Title: Bachelor of Science (Honours) in Environmental Bioscience.

Proposed Level: Level 8

Proposed Duration: Four Years

Delivery Modes: Full Time

Location of Delivery: Department of Applied Sciences, DkIT

Proposed Intake: 20 students

Embedded Awards: Bachelor of Science in Environmental Bioscience (3 years)

Entry Requirements:

Entrants must have a pass or higher in at least six Leaving Cert subjects (including Maths and Irish or English) **including** a grade C3 or higher in two Higher Level subjects **and** at least 300 points. Entrants from Northern Ireland must have at least two academic A levels at grade C or higher and four other subjects at GCSE, AS or Applied A levels, to include Mathematics and English (or Irish). Equivalencies to the Leaving Cert and GCEs are also accepted.

International students must have a minimum level of English equivalent to IELTS 6.0.

Progression:

Learners who have completed 1, 2 or 3 years of a cognate programme at NQAI level 8 may be considered for advanced entry to the 2nd , 3rd or 4th year of this programme. Cognate programmes will include NQAI level 8 programmes (or equivalent) in Environmental Science, Biology or Applied Bioscience. Candidates will be assessed using the DkIT process for recognition of certified prior learning (RPCL) and may be required to attend for interview.

Learners who have completed 2 years of the B.Sc. in Applied Bioscience at DkIT and have achieved an average mark of at least 50% at one sitting in year 2 **may** be considered for entry to the 3rd year of this programme, subject to the availability of places.

Note:
This document also includes the Programme Schedule and Programme Learning Outcomes for **the BSc Environmental Science** which is the **Level 7 exit award** for this Programme. Module learning outcomes are also mapped to the Level 7 Programme Learning Outcomes. Details are Included in Appendix 1. Students may also apply to exit with a Higher Certificate in Science Exit Award at Level 6 upon completion of 2 years of the programme. This has been previously validated.

3 Programmes Offered by the Department:

3.4 Existing programmes:

Higher Certificate in Science in Agriculture (Level 6)
B.Sc. in Agriculture (Level 7, add-on)
B.Sc. in Veterinary Nursing (Level 7)
B.Sc. in Applied Biosciences (Level 7)
B.Sc. in Pharmaceutical Science (Level 7)
B.Sc. (Honours) in Environmental Biology (Level 8, add-on)
B.Sc. (Honours) in Biopharmaceutical Science (Level 8, add-on)
B.Sc. (Hons) in Sustainable Agriculture (Level 8, add-on)
Certificate/Diploma in Food Supply Chain Management (Supplemental Award)
Certificate/Diploma in Agri-Food Business Excellence (Supplemental Award)
Masters by Research (Level 9)
Ph.D. by Research (Level 10)

3.3. Programmes under development:

B.Sc. (Hons) in Agri-Food Science (Add-on)
M.Sc. in Agricultural Biotechnology

4 Programme Background

4.1. Rationale:

The Department of Applied Sciences has currently a diverse range of undergraduate programmes on offer at levels 6 to 8 and the number of applications for places on these programmes has been steadily increasing in recent years. However, it has been recognised both within the department and externally (in the recent 2013 Programmatic Review process) that the suite of programmes is incomplete without an *ab-initio* level 8 offering. The progression of the majority of the Level 7 intake students to one of the Level 8 add-on programmes has indicated student demand for

programmes at this level and indeed the ability of the students to succeed at this level.

In the recent Programmatic Review (June 2013) a significant re-structuring of the Level 7 Science Programmes took place. As no additional resources are currently available the academic team are proposing to reduce the intake on the level 7 science programmes to allow an intake into a new 4-year ab-initio programme, which will run alongside the existing level 7 offerings (in part). When additional resources become available the intake numbers into the Level 7 programmes can be restored. This will mean no current change to the net intake into Stage1 programmes but may increase overall student numbers in the Department as it would be hoped that a Level 8 programme will attract academically stronger students and thus improve the student completion rate.

The recent Programmatic Review Panel strongly recommended that the Department should develop a Level 8 *ab-initio* programme in the Environmental field to complement their strong research activity in this area in the Centre for Freshwater and Environmental Studies. At a strategic level within the proposed regional cluster (DkIT/DCU/NUIM/AIT) within which DkIT has been positioned no other HEI is currently offering a Level 8 programme specifically in the field proposed in this document. This would therefore represent an area of distinctiveness for DkIT.

This distinctiveness will be reinforced through links between the programme and the DkIT Centre for Freshwater and Environmental Studies (CFES). Research within the centre is focused on the investigation and evaluation of freshwater and environmental issues and the implementation of effective solutions. This research falls under four thematic areas: Lake and Catchment Management, Organic Resources Management, Wetlands and Wastewater and Sustainable Water in Developing Countries. CFES members have extensive national and international research links that place this research in a global context. There are currently seven academic and research staff attached to the CFES and the researchers have strong links to undergraduate teaching, particularly on the B.Sc. (Hons) in Environmental Biology and B.Sc. (Hons) in Sustainable Agriculture.

The proposed Level 8 ab-initio Programme entitled 'B.Sc. (Hons) in Environmental Bioscience' will combine the Level 7 Applied Biosciences programme and the BSc (Hons) add-on programme in Environmental Biology the latter of which will be phased out. The proposed programme will encompass all of the strong analytical training of the other science programmes with an emphasis on the development of skills in environmental monitoring, environmental biotechnology, resource management and sustainable solutions. The emphasis of this particular programme will be on the monitoring and treatment technologies which have a basis in Biology.

The aim of the proposed programme is to produce graduates with knowledge, skills and competencies in the key areas of ecology, environmental biotechnology,

environmental monitoring, and analysis and risk assessment. Graduates of this programme will be able to make a significant contribution to the resolution of environmental problems and the implementation of sustainable solutions.

The graduates would have skills in green bio technology, white bio technology, and environmental monitoring and regulation. White Biotechnology is an emerging area of biotechnology which utilises biological systems and biocatalysts to produce biofuels, biopolymers, biochemicals and agricultural products in a sustainable manner. White Biotechnology processes are performed in an environmentally benign way with low energy consumption and minimal waste generation and have the potential to produce high yields of specific commercial products. Topics such as production of commercial biocatalysts, production of bioethanol, biodiesel, thermochemical conversion of biomass into fuels and chemicals and the production of bioplastics will be covered in the programme.

4.2. Student demand for the programme:

In 2012, there was a significant increase in the number of students applying through the CAO for Science, Technology, Engineering and Maths (STEM) courses. The number of students expressing a first preference for Science courses (including Computing) at honours degree level (level 8) increased by 18.47% in 2012 and over the five-year period 2008-12, this figure has increased by a total of 63.5%. The HEA Chief Executive, Tom Boland, said,

"*The significant growth in interest in STEM courses at third level is very welcome. The higher education institutions have been making available more places in these fields of study and we've been actively encouraging students to express their preferences for such options. It is vital for Ireland's future economic and social development that we have a greater number of top class graduates in science and technology."*

In 2013, the number of first preference applicants for STEM programmes increased by a further 4%.

As the Department of Applied Sciences has currently no provision at ab-initio Level 8, it is envisaged that this programme will attract students who are currently travelling to Universities in Dublin to study science.

Appendix 5 lists and describes the current environmental courses available in other Irish HEIs. A number of environmental programmes are available nationally but none specifically in Environmental Biosciences. The emphasis of the proposed B.Sc. (Hons) in Environmental Biosciences will therefore address the need to provide a programme which specifically deals with monitoring and treatment technologies which have a basis in biology, thus producing graduates capable of resolving current and future environmental problems and implementing sustainable solutions.

Under the HEA's 'Higher Education Landscape' which aims to promote regional clustering, DkIT has been positioned in the 'Dublin/Leinster 2' cluster. Our cluster partners include DCU, NUIM and AIT. This proposed programme is not offered by any other partners in our Regional Cluster. The B.Sc. (Hons) in Biotechnology in Athlone IT focuses specifically on biotechnology and its applications. The Environmental Science programme in DCU has more of a health focus. Therefore the proposed programme is unique to DkIT in the region and complements the Programmes offered by our Regional Cluster Partners.

4.3. Secondary research in relation to demand:

The Irish Government's Strategy for Science, Technology and Innovation, 2006-2013 highlighted a number of priorities for the environmental sector in Ireland including air and water quality, climate change, aspects of biodiversity, waste management, energy production and the marine environment. In addition, it recognised the fact that Ireland's *'……..future strategic direction of environmental research will be to anticipate and respond to changing circumstances and to engage in research to generate new knowledge of the environment and environmental technologies. Meeting international environmental obligations will demand continued engagement in such areas as climate change, biodiversity loss, environment and health, the urban environment, air pollution, waste management and water quality…..*'

Following on from the SSTI, Science Foundation Ireland recently launched their 'Agenda 2020' strategy which aims to position Ireland as a global knowledge leader and a society with scientific and engineering research at its core, driving economic, social and cultural development. Agenda 2020 clearly recognises that education and training of the population in the sciences at 3rd and 4th level is crucial for economic and social development. In addition, Ireland's Strategy and Target for Participation in Horizon 2020 recognises that scientific research and innovation are of major importance given their potential role in contributing to economic recovery, competitiveness and growth across the EU. It is considered that potential for research infrastructures exists in a number of areas linked to opportunities for Ireland, including, atmospheric observations of GHGs and air pollutants, ecosystems and ecosystems change, peatland and restoration resource potentials, wastewater research, marine resources, smart bay concept, smart city concept, agriculture field testing sites (livestock and arable), nutrition and food consumption databases and humanities and the social sciences. In 2010 the Department of Agriculture published a major strategy 'Food Harvest 2020' setting out a range of objectives for the entire agricultural sector for the next decade. The goal of Harvest 2020 is that the Irish Agri-food industry would grow and prosper sustainably through the delivery of high quality, natural and naturally based products. To achieve this, Ireland needs to address a number of structural challenges to meet the competitive challenge of the international marketplace while also focusing on environmental standards. This strategy could potentially have massive negative long term impacts on Ireland's

environment and therefore central to its implementation will be an obligation to meet requirements under EU Directives such as the Water Framework and Birds and Habitats Directives thereby enhancing compliance with environmental laws. In addition, as the strategy acknowledges the fact that, if carried out, it could have huge negative consequences, it states that 'DAFF should lead a strategic environmental assessment on the impact of the recommendations of this report and a coherent plan should be put in place to offset increased GHG emissions prior to implementation'. Therefore, in the area of climate change, DAFF and its agencies have stated that they will both continue research investments and enhance efforts to improve uptake of existing mitigation technologies.

In the report of the Forfas High-Level Group on Green Enterprise (2009) 'Developing the Green Economy in Ireland', it was identified that Ireland already has significant strengths in the environmental goods and services sector. There is already a significant existing base of companies in this sector in addition to other sectors which are also developing products, services and processes which capture emerging green-related opportunities. The group believed that the green economy offers significant potential to generate economic activity and employment.

The Forfas 2010 publication 'Future Skills Needs of Enterprise within the Green Economy in Ireland' listed waste management (including waste water treatment) and renewables technology (including biological methods) as areas where there would be skills requirements into the future. At that time, the Green Economy sector employed 18,750 people and its market size was estimated at €3.05 billion. It was anticipated that employment in the sector could rise to 29,000 by 2015. Taking into account 'expansion' and 'replacement' demand, around 14,500 employment opportunities would arise over the next five years. Much of this demand would be for higher-skilled staff. The global market for environmental goods and services (EGS) is estimated at approx €1,100 billion. The sector is also attracting considerable investment and is now the third largest sector for venture capital, after ICT and Life Sciences.

Green technology was still identified as one of the main areas where job creation announcements in the media were made during 2012 in the Expert Group on Future Skills Needs 'Vacancy Overview 2012' report, while life sciences was an area where the demand for professionals was particularly strong.

According to the recent Policy Statement 'Delivering our Green Potential' (2012), the government is planning to establish a Consultative Committee on the Green Economy, which will be chaired by the Minister for Jobs, Enterprise and Innovation, to identify emerging opportunities for Ireland in the Green Economy. The policy states: 'To ensure that Irish companies maximise the strengths that Ireland possesses in the Green Economy, it is vitally important that training and education programmes are aligned to the opportunities we have set out in this Policy Statement. Green Economy jobs often rely on specialist knowledge and expertise, especially in the

fields of engineering, science, technology and mathematics.' The EGFSN estimated that up to 10,000 extra jobs could be created in six key sub-sectors of the Green Economy alone by 2015 if substantive progress was made in addressing key policy challenges impacting on the development of these sectors.

5 Programme Development Methodology

5.1. Consultation with students, employers and experts:

The following persons and organisations were consulted during the development of this programme:

5.1.1. Consultation with students:

A recent survey of 62 second level students visiting Open Day (October 2013) suggested that there should be an interest in this programme from school leavers. The commitment to this particular programme was not clear (29% were interested in the programme and 42% 'might' be interested). However, 52% of participants in this survey stated that they were interested in entering DkIT on a *level 8* science programme. The students surveyed were those who approached the science stand for information so it is reasonable to assume that they were already considering doing a level 7 programme. In addition to this cohort, it would be reasonable to add the local candidates who passed our doors to seek information about level 8 science programmes elsewhere in the region.

5.1.2. Consultation with Employers:

A survey of potential employers of Environmental Bioscience graduates was undertaken between February and March 2014. The survey was carried out to ascertain the opportunities for employment of graduates from the programme and to seek advice about the relevance of the programme content. A total of 83 organisations were approached, 31 of whom responded to the on-line survey. The respondents comprised:

- Environmental Consultancy (42% of respondents)
- State Agency/Local Authority (26% of respondents)
- Manufacturing (6% of respondents)
- Other Consultancy/Analytical Services (3% of respondents)
- Education (3% of respondents)
- Waste Management (3% of respondents)
- Health and Safety (3% of respondents)

The respondents' organisations varied in size from 1 employee to 8000 employees worldwide. The majority of respondents (20 in total) indicated their intention to increase their employment of science graduates over the next 5-10 years, particularly those at B.Sc. (Honours) level and above[2]. The combined number of science graduates which they plan to employ in the next 5-10 years is 299 and more specifically the combined number of environmental science graduates is 104.

They identified the following topics as the most relevant for the programme:

- Biological Tools for Environmental Monitoring
- Environmental Modelling
- Geographic Information Systems (GIS)
- Environmental Risk Assessment
- Environmental Field Studies
- Aquatic Science
- Soil and Water Management
- Applied Ecology
- Healthy and Safety
- Analytical Instrumentation and Techniques

The topics which they identified as least relevant were:

- Fundamental and Applied Microbiology
- Zoology
- Botany

Some general observations from the responses received include:

- Business and legal training would be advantageous to both graduates and potential employers.
- As GIS has become a large component of all ecological studies, it would be useful if it were to comprise a significant proportion of this programme, and in particular the application of ArcGIS software.
- Project and budget management are skills that would be highly sought after given the greater expectation now for specific target identification, tracking and ultimately the meeting of those targets.
- Practical field work experience is very relevant to the sector.
- Communication skills are of particular importance to the sector, with the ability to communicate to a wider public audience being highlighted by a number of respondents.

Potential roles envisaged by employers for graduates of this programme include:

- GIS
- Field Sampling and Analysis

[2] It should be noted that In the case of State Agencies and Local Authorities, they could not commit to an intention to employment at this time due to the public service moratorium currently in place.

- Laboratory Analysts
- Public Liaison Officer
- Citizen Science Education
- Environmental Officer
- Environmental Scientist
- Environmental Inspector

Overall, there was a high level of support for the proposed programme with 94% of respondents stating that they felt that this programme is relevant to the sector. The full survey results are included in Appendix 2.

5.1.3. Consultation with Career Guidance Counsellors:

A survey of the local Career Guidance Counsellors Association (Louth, Meath, Cavan, Dublin and Monaghan) in March 2014 concluded that there is a strong level of interest amongst second level students for studying science at third level. Of those who responded, at least 70% indicated that their students would consider studying science at DkIT. In addition, they believed that there would be a demand amongst second level students in the region for a direct entry B.Sc. (Honours) in Environmental Bioscience. Some general advantages of the proposed programme cited by respondents included:

- The programme's strong biology basis.
- DkIT's good contacts and connections with industry.
- The programmes good level of general sciences.
- DkIT's location - less expensive than Dublin.
- The fact that there are few similar degrees within commuting distance of Dundalk.
- The potential exposure of students to new technologies within this programme.

6 Link with DkIT Strategy and Strategic Themes

The DkIT Strategic Plan (2011-2016) has identified three strategic themes which must be embedded in all programmes:

6.1. Sustainability:

Sustainability is the capacity to endure and is a wide-ranging term that can be applied to almost every facet of life on Earth, from local to a global scale and over various time periods. Traditionally, sustainability was interpreted as:
'*Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs*'. (Brundtland Report, 1987).

It is recognised that this requires the reconciliation of environment and social performance, as well as, financial or economic success, often referred to as the three pillars of sustainability. UNESCO (2012) suggest that education for sustainability is more than teaching knowledge and principles, professing this to be education for social transformation with the end goal being more sustainable societies.

6.2. Local and International Engagement:

The importance of engagement for the Higher Education sector has become more formally recognised in the last five years. The Department of Education and Skills (2011) in the Report of the National Strategy for Higher Education to 2030 (Hunt Report) outlines the importance of fostering engagement with enterprise, community and other education providers. Subsequently, 'Towards a Future Higher Education Landscape' recognises as one of its three key objectives, the need for our Higher Education system 'to improve impact on society and economy'. That report further outlines criteria related to engagement that are of relevance to Institutions as they develop their identity within the broader structure of Higher Education generally

'*Internationalisation is the process of integrating the international, intercultural or global dimension in the purpose, functions and delivery of post-secondary education*'. (Knight, 2004).

The Department of Education and Skills (2011) also suggests that internationalisation, in the higher education sector, encompasses a range of practices and activities designed to enable students to achieve an international perspective of their subject and its application in practice. An internationalised curriculum helps students to appreciate the multiple realities of a global society (Banks, 2002). To this end, a culturally inclusive transformation approach to the internationalisation of a curriculum enables students to move between world views (Bond, 2003) and encourages the use of critical pedagogy, with a view to addressing unequal social structures through the process of education. An internationalised curriculum includes internationalised content, pedagogical strategies (student-

centred teaching and learning), culturally sensitive assessment strategies and both international student recruitment and cross-border partnerships that facilitate the development of graduates as global citizens (Schuerholz-Lehr and Van Gyn, 2006). As global citizens, internationalisation supports the development of a student's intercultural experiences and international understanding that will enable them to meet the professional and personal challenges they will encounter throughout their lives.

6.3. Entrepreneurship:

'Entrepreneurship refers to an individual's ability to turn ideas into action. It includes creativity, innovation and risk taking, as well as the ability to plan and manage projects in order to achieve objectives. This supports everyone in day-to-day life at home and in society, makes employees more aware of the context of their work and better able to seize opportunities and provides a foundation for entrepreneurs establishing a social or commercial activity.(European Commission, 2008). The same report goes on to say that: "Entrepreneurial programmes and modules [which offer] students the tools to think creatively, be an effective problem-solver, analyse a business idea objectively, and communicate, network, lead, and evaluate any given project." (European Commission, 2008, pp. 10-11).

According to Bridge *et al*. (2010) entrepreneurship education has three main objectives. Specifically, they are for the student to:

- Learn to understand entrepreneurship as a concept.
- Learn to become entrepreneurial by developing skills and competencies.
- Learn to become an entrepreneur.

Entrepreneurship is about a way of thinking and behaving identifying opportunities realisation of value building and learning from relationships gathering resources being positive and taking risks. The extent to which a graduate can be expected to become more enterprising as a result of their entrepreneurship education will inevitably vary from person to person. It depends on the extent to which they demonstrate some, or all of, the following:

„... personal skills, attributes, behavioural and motivational capacities which can be used in any context (social, work, leisure etc). Prominent among these are: intuitive decision-making, capacity to make things happen autonomously, networking, initiative taking, opportunity identification, creative problem-solving, strategic thinking, self-efficacy , ability to cope with ambiguity) and having empathy with entrepreneurial ways of doing, thinking, feeling, communicating, organising and learning". (NCEE definition of Entrepreneurship)

References:

Bond S. (2003) Engaging educators: Bringing the world into the classroom: Guidelines for practice. Ottawa, ON: Canadian Bureau for International Education.

Bridge S., Hegarty, C. & Porter, S. (2010) 'Rediscovering enterprise: developing appropriate university entrepreneurship education'. Education and Training, 52 (8/9): 722-734

Brundtland G. (1987) Our Common Future: Report of the World Commission on Environment and Development. OSLO: United Nations

Department of Education and Skills (2011) The National Strategy for Higher Education to 2030. Available at: http://www.hea.ie/files/files/DES_Higher_Ed_Summary.pdf/ [accessed 26th January 2013]

European Commission (2008) Entrepreneurship in Higher Education, especially within Non-Business Studies. Europe: European Commission. Available online at http://ec.europa.eu/enterprise/policies/sme/files/support_measures/training_education/entr_highed_en.pdf [accessed 16th April 2013]

Knight J. (2004) 'Internationalisation remodelled: Definitions, rationales and approaches'. Journal for Studies in International Education, 8 (1): 5-31

Schuerholz-Lehr S. & Van Gyn G. (2006) Internationalizing pedagogy or applying pedagogy to internationalism - the journey of a professional development workshop. Paper presented at Internationalizing Canada's Universities: Practices, Challenges, and Opportunities symposium. Available online at http://www.yorku.ca/yorkint/global/archive/conference/canada/papers/Sabine-Schuerholz-Lehr.pdf/ [accessed 15th February 2013]

UNESCO. (2012) Education for Sustainable Development. Available at:http://www.unesco.org/new/en/education/themes/leading-the international-agenda/education-for-sustainable-development/ [accessed 15th February 2013]

6.4. Links with Strategic Themes:

In the Table below examples of how each of the Strategic Themes is embedded throughout this Programme are outlined. Engagement has not been specifically addressed at a modular level in this table as this is an activity that is core to all of the activities within the Department of Applied Sciences and will in this way impact on students of this proposed programme. This includes but is not limited to:

- Provision of undergraduate lecture material, case study and project work derived from industry/community
- Students have the opportunity to carry out research projects and summer internships in the Centre for Freshwater and Environmental Studies. Research in this centre involves engagement with both local and international stakeholders.
- Department participation in Science outreach programmes e.g. National Biodiversity day, Scifest.
- Programme content is informed by dynamic external inputs e.g. guest peakers from industry.

International engagement in the context of internationalisation of the curriculum is addressed at a modular level below.

STAGE 1:

Module Name	Strategic Theme
Physics through PBL 1	Entreprenurship: Entrepreneurship is about a way of thinking and behaving identifying opportunities realisation of value building and learning from relationships gathering. Peer learning activities and group work are promoted in the PBL sessions to encourage teamwork professional relationships.
Fundamental Chemistry	Entrepreneurship: Peer learning activities are promoted in the lab practical sessions encouraging teamwork and building professional relationships.
Mathematics 1	N/A
Physics through PBL 2	Entrepreneurship: Peer learning activities and group work are promoted in the PBL sessions to encourage teamwork professional relationships.
Mathematics 2	N/A
Chemistry	Entrepreneurship: Peer learning activities are promoted in the lab practical sessions encouraging teamwork and building professional relationships Sustainability:. Students are encouraged to use the minimum amount of chemicals and be mindful of the effects of chemicals and improper waste disposal on the environment.
Biology	Sustainability: Awareness of the diversity of plant and animal life should help foster an interest in sustaining this diversity. The topic "external factors affecting the growth of plants" will include issues that might impact on this global resource.
Health and Safety & Academic Skills	Sustainability: Students address global environmental issues related to chemical hazards and biohazards, their risk assessment and management, and disposal. Students will also review associated Irish and European Health and Safety legislation, regulations and codes of practice. Internationalisation: Students will have the opportunity to learn about global scientific trends.

STAGE 2:

Module Name	Strategic Theme
Analytical Instrumentation & Techniques 1	Sustainability: The application of atomic spectroscopy for sustainable environmental monitoring of trace metals and pollutants will be covered. Entrepreneurship: Students will be encouraged to develop new ideas for the use of biosensors for environmental or disease monitoring. In addition students will be given a problem in forensic, environmental or pharmaceutical science to solve as part of a Group project. Internationalisation: Focusing on the International Conference on Harmonisation Harmonised Tripartite Guidelines on assay validation, students will be asked to validate data obtained from international case studies.
Fundamental Microbiology	N/A
Intro to Organic Chemistry	N/A
Molecular Bioscience	Internationalisation: Students are regularly provided with internationally published, science breakthrough articles to supplement the lecture series. Sustainability & Entrepreneurship: Formative Classroom assessment techniques assist in developing students self-learning, self-awareness and reflection skills. New laboratory assessment system (incremental marking system) in combination with the use of self-assessment checklists and feedback sheets will assist in developing self-awareness and self-learning/reflection skills in the students. Peer learning activities are promoted in the lab practical sessions encouraging teamwork and building professional relationships. For example, the students always work in groups and for one session, they must generate a lab report as a team.
Microbial Pathogenesis and Control	Internationalisation: Students conduct research and collect data from international organisations/journals to map the pathway of infection of a pathogen Sustainability: Students will discuss the importance of the maintaining the human microbiome in the face of decreasing antibiotic development
Statistics and Data Analysis	N/A
Applied Ecology	Sustainability: students are provided with an insight into sustainable solutions to a range of environmental problems.

STAGE 3:

Module Name	Strategic Theme
Environmental Communication & Critique	Internationalisation: The literature components of this module give students an insight into global research literature.
Plant Science	Sustainability: Student will gain knowledge on the Irish flora which contributes to sustainable management of Ireland's natural resources.
Applied Microbiology	Internationalisation: International legislation will be covered with respect to microbiological quality and safety of water, food and pharmaceutical products. In the Project: Students conduct research and collect data from international organisations/regulatory bodies/journals to microbiologically characterise a food sample and will apply ISO and other regulatory body laboratory standard methods to isolate and characterise pathogens from this food. Sustainability: Students will debate the use of microorganisms for various applications e.g. GMO's and food production, habitat conservation and biodegradation, probiotics and intestinal health, the importance of microorganisms in climatic processes and production of new energy sources. etc.
Aquatic Sciences	Sustainability: students undertake a series of field and laboratory based exercises to provide them with an understanding of sustainable solutions to water quality issues. Internationalisation: students are provided with and discuss internationally published material on current issues in aquatic ecosystem science
Biotechnology	Internationalisation: Students are regularly provided with internationally published, science breakthrough articles to supplement the lecture series. International regulations will be covered with respect to pharmceuticals (e.g. FDA, EMA, IMB) and environmental policies in relation to water and wastewater quality, solid waste management and air treatment technology. Sustainability & Entrepreneurship: Formative Classroom assessment techniques assist in developing students self-learning, self-awareness and reflection skills. Peer learning activities are promoted in the lab practical sessions encouraging teamwork and building professional relationships. Sustainability: Social implications of the allocation of scarce resources (e.g. limited water) will be discussed. Environmental sustainability with respect to resource management will be covered in detail.
Quality Management	N/A
Environmental Chemistry	Internationalisation & Sustainability: Students are asked to compile international news articles in a scrap book specific to topical media items in the area of environmental chemistry.
Habitat and Wildlife Ecology	Sustainability: The need to sustainably manage and conserve our natural resources including preserving ecosystem integrity and biodiversity and the

Module Name	Strategic Theme
	social and economic implications of the continued degradation of these resources will be discussed.

STAGE 4:

Module Name	Strategic Theme
Soil and Water Management	Internationalisation: The literature component gives students an insight into global research literature and provides information on regulation and legislation at European and global scales. Entrepreneurship: This module provides information on the management of water resources as both potable water sources and of ecological status, skills that provide potential for entrepreneurship in water provision, fishery, and tourism sectors Sustainability: The module provides student with insight into the importance of sustainable management of soil and water resources and into the issues related to degradation of these resources at a national level.
Research Design and Ethics	Entrepreneurship: This module promotes the student's potential to turn ideas into action in an entrepreneurial context and to gather the required resources to produce a successful outcome. Sustainability: Students are asked to write a novel (theoretical) research proposal and defend this to a 'mock' ethics committee, providing insight into ensuring an environmentally and socially sustainable research programme.
Data Handling & GIS	Internationalisation: The GIS component provides the student with the ability to assess spatial data from diverse geographical locations. The data handling component of this course will introduce students to a range of data handling software programs and statistical packages which are used internationally, including the 'R' Statistical Program which is freely available. The R language is widely used for data mining and analysis and increased in popularity in recent years making it a leading data management and analyses tool throughout the world. Entrepreneurship: The module provides skills in data management and GIS that are valued across all economic sectors. Sustainability: GIS is increasingly used in the sustainable management of land and aquatic resources both nationally and internationally.
Ecotoxicology	Internationalisation:. This module will allow students to critically asses a range of environmental pollutants and their impacts on global ecosystem function. internationally published material will be used to provide insight and encourage discussion into current issues relating to ecotoxicology. Entrepreneurship: The module provides skills and insight into the management and disposal of environmental pollution which will have relevance across a range of industrial and service provision sectors. Practical sessions will develops the students decision making and problem solving skills. Sustainability: Insight is provided in into the principals approaches used to evaluate the risk to the environment of a range of pollutants. Understanding of these risks and impacts will allow for the development of more sustainable

Module Name	Strategic Theme
	approaches to resource management from both an environmental and industry point of view.
Environmental Risk Assessment	Internationalisation:. This module provide information on regulation and legislation at European and global scales. The student also gains an insight into environmental risk on a global scale though case studies on major environmental incidents, for example the Bhopal disaster in India in 1984, and the long-term health impacts of mercury poisoning in Mininmata, Japan. Entrepreneurship: In this module students gain insight to legislative requirements relating to environmental management and risk assessment through undertaking a series of hypothetical case studies that reflect real-life situations. Sustainability Students will undertake a range of exercises to provide them with an understanding of environmental sustainable solutions to planning and development issues.
Environmental Biotechnology	Internationalisation: This module provides information on regulation and legislation at European and global scales. Entrepreneurship: Laboratory sessions will be used to encourage decision-making, problem solving and strategic thinking. Sustainability: Implications of scarce resources (e.g. crops / farmed animals) will be discussed from a biotechnology perspective. Environmental sustainability will also be covered.
Environmental Monitoring & Modelling	Internationalisation: This module provides information on monitoring, regulation and legislation at European and global scales. Entrepreneurship: the skills gained in this module have relevance across a range of economic sectors including the water industry, agricultural and land use management and environmental Research and Development sectors. Sustainability: A knowledge of state-of-art monitoring and modelling skills will contribute to sustainable management of environmental resources.
Environmental Biosciences Project	Internationalisation: The literature component gives students an insight into global research literature Entrepreneurship: This module module also fosters confidence in the student's ability to turn their project design into a reality, and therefore learn to take risks based on their own assessment of the abilities.

7 Graduate Profile and Career Opportunities

Graduates from this programme will have advanced skills and knowledge in environmental assessment and control, particularly in techniques and technologies which have an ecological or biotechnological basis. Graduates will find careers in environmental monitoring and assessment (both lab and field based), licensing and regulation roles, consultancy services and environmental management within industry. They will also find employment in other sectors which require good analytical and scientific skills.

Graduates from the BSc (Hons) in Environmental Biology have found jobs in a variery of sectors and this is indicative of the opportunites which will be available to graduates of the proposed programme. Five have completed taught Masters degrees in an environmental area, one has completed a Masters by research in UCD in water quality, one is currently undertaking a research Master's degree in DkIT, and one is currently undertaking a PhD in UCD. One graduate is currently working as a planning ecologist in the NI Civil Service, having previously worked for the NI Loughs Agency, one is a freshwater taxonomist with a large consultancy company in the UK (APEM) while one is an Environmental Manager in one of Western Australia's largest gold mines (Millennium Minerals Ltd). Nine students are working in laboratory based positions, including a quality assurance analyst in Pfizer and quality assurance / technical laboratory positions in Guinness (Dublin), Norbrook (Newry), Helsinn Birex (Dublin), Lancaster Laboratories (Swords) and Warner Chilcott Pharma (Dundalk). Although not all graduates are currently working in the Environmental sector *per-se,* their excellent analytical skills have allowed them to find employment in other sectors. As opportunities within the public and semi-state sectors start to re-emerge, graduates will also find employment in local authorities, the EPA and Teagasc. See Appendix 6 for a selection of graduate testimonials.

Graduates of this Programme will be able to progress to level 9 taught postgraduate and Level 9 and 10 research programmes . The Department is currently developing a MSc Agricultural Biotechnology which graduates of this programme would be eligible to apply for. In addition they may avail of Level 9 and 10 research opportunities within the Centre for Freshwater and Environmental Studies.

8 Aim of the Programme

The aim of the proposed programme is to produce graduates with knowledge, skills and competencies in the key areas of ecology, environmental biotechnology, environmental monitoring, analysis and risk assessment. Graduates of this programme will be able to make a significant contribution to the resolution of environmental problems and the implementation of sustainable solutions.

9 Learning Outcomes

The learning outcomes for this programme are consistent with those specified with the National Framework of Qualifications for a level 8 qualification in Science. See AAppendix 3 for details of programme learning outcomes and how these link with module learning outcomes. Module Descriptors are also included.

The programme learning outcomes are linked to graduate attributes in the table below:

NQAI Programme Learning Outcomes / Science / Level 8	**B.Sc. (Hons) in Environmental Bioscience graduates will be able to:**
Knowledge – Breadth: Detailed knowledge and understanding of the essential facts, major concepts, principles and theories associated with a sub-field of Science.	Demonstrate a detailed knowledge and understanding of the essential facts, major concepts, priniciples and theories associated with Environmental Bioscience.
Knowledge – Kind: a. Detailed knowledge of the terminology, nomenclature and/or classification systems appropriate to the subject area b. Detailed knowledge of the theories, paradigms, defining concepts and underlying principles of the subject area c. Detailed knowledge of advanced methods for acquiring, interpreting and analysing subject-specific information with a critical understanding of the appropriate contexts for their use through the study of texts and original papers d. Detailed knowledge of the identification, definition and resolution of complex problems e. Detailed knowledge of the relevant legal and regulatory frameworks f. Detailed knowledge of current issues of concern to society and an understanding of the philosophical and ethical issues involved g. Detailed knowledge of some aspects of the defining elements of the subject area as a result of in-depth individual study or research h. Detailed knowledge of the current knowledge and development of the subject area (including current limits of theoretical and applied knowledge).	Demonstrate knowledge and understanding of the essential facts, major concepts, principles and theories of chemistry, physics, animal and plant biology, taxonomy, ecology, cell biology, microbiology, biochemistry and molecular biology. Demonstrate a detailed knowledge and understanding of the taxonomy and biology of a range of animals and plants, the interaction of these organisms with their environment and the role they have in ecosystem and community structure. Demonstrate a detailed knowledge and understand of the chemistry of the environment, including air, water and soil and how this relates with the physical environment. Demonstrate a detailed knowledge of the principles, operating criteria and design options for a range of water, air and waste treatment technologies, including the production of sustainable energy from biomass, and select suitable technologies for specific applications. Demonstrate a detailed knowledge of the national and international policies and legislation in relation to environmental protection and conservation. Describe and critically interpret the knowledge base in a defined topic within environmental bioscience and apply it to a new area of study.

Skill – Range: a. Ability to solve complex technical problems b. Ability to employ advanced data analysing, synthesising and summarising skills in a scientific work setting c. Ability to source, interpret and apply appropriate and referenced literature and other information sources d. Ability to work independently within defined time and resource boundaries e. Ability to effectively and safely operate a range of complex laboratory and other relevant equipment f. Ability to apply advanced numerical and statistical analysis skills g. Ability to maintain detailed records of activities and to communicate scientific information in a variety of forms to specialist and non-specialist audiences h. Ability to design a relevant programme of investigation	Collect samples of air, water, soil, sediment and biota and analyse these in the laboratory using a range of bench-top and instrumental techniques, in accordance with standard operating procedures, while applying Good Laboratory Practice. Carry out a range of advanced laboratory analytical techniques, including chromatographic, spectroscopic and immobilised reaction techniques and assess the validity of analytical procedures and assays. Classify a range of animals, plants and microorganisms and carry out environmental assessments of habitats (both terrestrial and aquatic). Demonstrate competence in the use of a light microscope and the preparation of animal, plant and bacterial smaples for microscopic analysis. Carry out selected procedures in handling, maintaining, enumerating and identifying microorganisms. Carry out a range of laboratory techniques in biochemistry and molecular biology. Carry out laboratory-based toxicity tests. Design experiments and collect, record, analyse, present and interpret data generated from field studies, lab studies and environmental modelling. Select and utilise appropriate IT software to organise, store, manipulate and analyse and present scientific data. Carry out a range of statistical analyses and use a computer based statistics package. Use Geographical Information Systems to manage and process environmental data. Maintain detailed records of activities and communicate scientific information in oral and written formats, including the production of high-quality reports of field and laboratory activities. Design,, document and audit a quality management system and environmental management system.

Skill – Selectivity: a. Ability to think independently and make effective decisions b. Ability to recognise and respect the views of others c. Ability to contribute fully to the day-to-day operations of a scientific industry or other scientific work setting d. Ability to make decisions in relation to a complex or highly regulated environment e. Ability to formulate and test hypotheses f. Appreciation of limits of knowledge in a scientific area and ability to respond appropriately	Design a programme of investigation and present this in the form of a coherent plan. Apply knowledge and skills in the research of a specific aspect of environmental bioscience. Recognise biological and chemical hazards, associated risks and mitigation measures in accordance with Health and Safety legislation.
Competence – Context: a. Ability to use advanced scientific skills to critically interpret existing knowledge and apply in new situations b. Ability to make and report appropriate decisions and take responsibility for such decisions c. Ability to behave ethically in a range of work settings d. Ability to present and engage in debate relating to general scientific issues	Utilise Risk Assessment, Environmental Impact Assessment and Strategic Environmental Assessment as tools for environmental planning. Combine theoretical knowledge and practical skills to define and resolve problems in analytical science. Rrelate environmental contamination to sources and pathways. Analyse the theory and practice of molecular biology and microbiology approaches to environmental and ecological problems. Demonstrate knowledge and understanding of conservation management techniques, including integrated ecosystem management.
Competence – Role: a. Ability to plan for effective project implementation and manage the organisation of tasks, people and resources b. Ability to participate constructively in a complex team environment within a scientific field c. Ability to reflect on own practices, accept responsibility for the work of self and others and develop and train staff to meet changing technical needs	Contribute to problem solving in a team situation. Recognise the personal and professional skills required for study or work environments.
Competence – Learning to Learn: a. Ability to identify knowledge gaps and source and undertake self-learning to fill the gaps b. Awareness of the need for enhanced technical competencies and continuing professional development c. Ability to evince a commitment to continuing education and lifelong learning	Learn through self-directed learning and self assess own learning. Source and critically review scientific literature with due consideration to appropriate referencing and academic integrity.

Competence – Insight: a. Capacity for social responsibility and ability to contribute to the development of the role of scientist in society b. Capacity to draw complex information together and present in an understandable format c. Capacity to acknowledge the current issues of concern to society and an understanding of the philosophical and ethical issues involved d. Questioning attitude to the assumptions, both overt and covert, underlying modern science	Be aware of, informed about and articulate views on the impacts of humans on the local and global environments. Present scientific information in various oral and written formats to a range of audiences.

10 Resources

10.1 Staff:

Due to the current recruitment restrictions driven by the HEA Employment Control Framework no additional staff can be recruited for this programme at present. The resourcing of this programme for the first intake will be accommodated by a reduction in the intake on the level 7 programmes, the B.Sc. in Applied Bioscience and B.Sc. in Pharmaceutical Science (from a total of 80 students to 60 students). The total intake to Stage 1 science programmes will not change (80 students). The level of commonality between the proposed programme and the existing level 7 and 8 programmes will be optimised. Existing environmental electives on the Applied Bioscience programme will be removed and converted to level 8 modules to be exclusively available on the level 8 programme. The existing add-on B.Sc. (Hons) in Environmental Biology will be phased out and these modules will be reviewed and revised for inclusion in the final year of the proposed programme.

The intake onto the programme will be reviewed each year in the context of the provision of additional staff resources. When additional staff resources become available the Department will then be able to return the intake to all programmes to capacity level.

10.2 Physical Resources:

As this is a replacement programme, no additional physical resources will be required. Details of the laboratory equipment available in the Department of Applied Science are included in Appendix 4.

10.3 Library:

The Library provides the following services

- borrowing
- inter-library loans
- information literacy training
- access to group and individual study spaces
- access to 120 Electronic Desktops
- wireless access areas for laptops
- access to staff knowledge and support
- publications
- events such as lectures and readings.

The Library building offers its readers choice as to how to study. Readers can read printed books or journals or digital publications. They can choose to study individually or in small groups. There are three Seminar Rooms in the Library, which can be used by all members of DkIT as group workspaces. There is also a Roof Garden which is accessible to all

11 Quality Assurance and Programme Management

11.1 Academic Council

The Academic Council was established by Section 10 of the 1992 Act. Its role is to assist the Governing Body in the planning, co-ordination, development and overseeing of the educational work of the Institute as well as protecting, maintaining and developing the academic standards of the courses and activities of the Institute. Each Academic Council is established for a three-year term and is composed of both ex-officio and elected members. The current Academic Council has 52 members, 22 ex-officio and 30 elected.

The Council's membership, structure and procedures are determined by its Constitution, which is approved by Governing Body and which was last substantially revised in December 2011. The Council has a number of permanent sub-committees to help with the efficient carrying out of its work. In addition, working groups are established, as required by Council, to deal with more short-term issues. The decisions of any committees are subject to confirmation by Academic Council. The membership of committees is drawn from the members of Council as well as other co-opted members.

11.2 Programme Boards

Each programme is governed by a programme board, consisting of the Head of Department, academic staff and representative students from each stage of the programme. The tasks of the programme boards include:

- Review of programme content and revision of material as appropriate;

- Implementation and review of learning outcomes;
- Programme delivery;
- Maintenance of academic standards;
- Analysis of assessment and examination results;
- Discussion of external examiners' reports;
- Reporting annually to Academic Council.

Programme boards meet at the beginning of the academic year and at least once per semester thereafter. Special meetings of the programme board are held in January and May and constitute the Examination Board. Academic staff and external examiners, but not students, attend these meetings, which consider and recommend the examination results for approval by Academic Council.

The preparation of the annual report to the Academic Council represents an opportunity to carefully analyse the overall performance of the programme. Examination results of the previous session are reviewed. The review considers:

- Distribution of grades
- Distribution of marks within modules
- Modules that are most significant in affecting students' progress.
- Overall pass rate
- Pass rate of individual modules

11.3 External Examiners

The Institute, in accordance with a procedure adopted by the Academic Council appoints external examiners to act as independent and impartial advisors, providing informed comment on the standards set and student achievement in relation to those standards. The main purposes of external examining are:

- To verify that learning outcomes assigned to a programme or module have been met.
- To assist DkIT in the comparison of academic standards across higher education awards and award elements.
- To ensure that DkIT's assessment processes are fair and are fairly operated and in line with DkIT regulations.

External examiners are drawn from academia or from business, industry and professional practice and are of senior standing in their fields. The Annual Reports of the External Examiners are sent to the Registrar's Office. They are forwarded to the relevant Department office and circulated to all academic staff. External examiners reports are discussed at programme board meetings and incorporated into annual programme reports. Most external examiners also write to the Head of Department prior to the examinations to provide feedback on exam papers and marking

schemes. This feedback is copied to the lecturer(s) associated with the relevant examination(s).

11.4 Student appeals, reviews and rechecks.

Staff and students engage informally in consultation about programme-related matters during the course of the academic year. However, specially structured arrangements are in place to provide students with an opportunity to consult with staff following the end of semester, or end of year examinations. These formal consultations provide the students with an opportunity to discuss their subject results with their lecturers and to seek clarification regarding their detailed marks. Following these consultation sessions, students may lodge an appeal to have their subject marks or grades rechecked and/or reviewed independently.

12 Programme Development Team

Staff member:	Position and responsibilities:	Professional and Research Interests:
Dr Edel Healy	Head of School of Health & Science	Renal Cell Biology; Chemical Risk Assessment; Regulatory Toxicology; Pharmacology; REACH.
Dr Breda Brennan	Head of Department of Applied Sciences, DkIT.	Biogeochemistry of marine sediments; Biological methods of pollution control;
Dr Suzanne Linnane	Senior Lecturer (Permanent, full-time)	Sustainable water management in the developing world; Source water protection; Community engagement and citizen science; Palaeolimnology.
Dr Eleanor Jennings	Lecturer (Permanent, full-time). Director of Centre for Freshwater and Environmental Studies.	Research interests include nutrient cycling in soils and aquatic systems; carbon processing in humic lakes; high frequency monitoring in lakes and rivers; modelling of catchment and in-lake processes, including climate change impacts.
Dr Siobhán Jordan	Lecturer (Permanent, full-time)	Alternative organic waste management systems; bioremediation of mine sites and wastewater; soil conditioning; nutrient management planning.

Dr Valerie McCarthy	Lecturer (Permanent, full-time)	Freshwater and wetland ecology, hydroecology, biological stoichiometry, nutrient cycling, alternative wastewater management, fate and transport of contaminants, monitoring technologies
Dr Siobhán McCarthy	Lecturer (Permanent, full-time)	Freshwater ecology; Water quality assessment; Pollution control.
Dr Arjan van Rossum	Lecturer (Permanent, full-time)	Parasite Biochemistry; Bioinformatics & Molecular Biotechnology.
Dr Caroline Gilleran	Lecturer (Permanent, full-time)	Liquid biofuels; bioethanol fermentation technology; biotechnological application of eukaryotic glycoproteins.
Dr Ronan Bree Dr Bríd Moloney Mr. Seamus Bellew Ms. Ann-Marie McHugh Dr Niamh Dreeling Mr. Richard Crowley Dr Chiara Hanlon Mr. Tony Lennon Dr Orla Sherlock Ms. Noelle Cunning Dr Annamarie Rogers Dr Sinead Loughran Mr. Paddy Carroll Mr. Gabriel Matthews Dr Bridget Kelly Mr. Simon O'Neill	Lecturers	Various

13 Student Experience

13.1 Learning and Teaching Strategy

An induction for first year students will allow students to be introduced to the Institute and the Department of Applied Sciences. This will also provide (basic) information on Health and Safety, Study & Life Skills, Problem Based Learning, e-beam training, Moodle & e-mail.

Learning and teaching methods will include lectures, tutorials, group discussions, (laboratory and field based) practicals, computational analysis and both individual and group project work. Active participation, peer-learning, group discussions and exploration of topics in the classroom will be encouraged (e.g. through Problem Based Learning). A number of Industrial visits will be organised during the Programme. Students will be expected to spend time on directed reading, assignments and independent study of the programme content. The final year Project will require analysis and collation of published scientific (research) information.

The Department uses Moodle and Mahara as VLE platforms in programme delivery. Computer-based assignments/assessments will be used to improve computer-literacy and as an example of current (industrial) practices. The above listed learning and teaching methods are designed to provide students with an in-depth preparation for a career in science a consultancy, analytical and/or a research setting. The student weekly workload is summarised in Appendix 7 of the document.

13.2 Assessment Strategy

Students will be assessed using a variety of assessment tools, both formative and summative, for example:

- Final semester or year-long written examinations
- Practical laboratory and field skills demonstrations
- Practical laboratory and field reports
- Individual and group projects
- Problem-based learning reports
- Oral presentations
- Poster presentations
- Literature reviews/critiques
- Computer software assignments
- In-class tests
- Final year project thesis

In accordance with DkIT Assessment Guidelines, a range of assessment methods will be used at each stage, to address individual student needs and diversity. Assessment will be learner-centred and students will have opportunities for feedback and for self-assessment. Assessment will be aligned to module and programme learning outcomes and benchmarked against graduate skills, to ensure validity. Assessments will also be reliable and authentic.

Assessments will be scheduled to avoid duplication, overload and overlapping and these schedules will be agreed by the programme board at the beginning of each semester.

Assessment of first year students will be in accordance with Institute guidelines to promote achievement and retention.

13.2.1. Examples of learner-centered assessments:

- The 'Research Design, Statistics and Ethics' group project is a student-centred module: Students will be divided into groups and asked to design their own theoretical research proposal (with practical potential). The proposal should have an ethical basis. Students will be guided on the direction of the proposal, but will be encouraged to perform this as a group. The assessment will incorporate both group and individual marks.
- The laboratory and field based 'Environmental Biosciences Project' is a student-centred module. Students will be required to design and perform their own research project (with guidance from their supervisor). This will be reflected in the assessments, e.g. a presentation in Semester 1 to outline the academic rationale for the proposed research project, making reference to relevant literature. This module will foster independence, confidence and a sense of personal responsibility for the practical research performed.
- Where possible, assessments have been chosen to reflect 'real practice'. This includes assessment of laboratory and fieldwork reports, computer-based assessments and oral presentations.
- Formative assessment in *Analytical Instrumentation and Techniques 1* will include classroom assessment techniques such as online quizzes and multiple-choice questions to monitor and help improve student learning while the learning is taking place and will be an integral part of lectures and practical sessions.
- Use of online interactive quizzes which provides immediate (formative) feedback will promote student centred learning and improve computer skills.
- Completion of virtual labs via the VLE promotes student learning of both practical and theoretical elements of the programme.
- Active learning exercises are promoted throughout the programme. Modules will engage with group- and peer-learning through the use of formative assessment strategies.

- Classroom Assessment Techniques are used throughout delivery of modules (e.g. background knowledge probe, the one minute paper, small group interaction and discussion, question & answer sessions, team presentations to class colleagues, pop-quizzes and open ended questioning).
- The team-based *Molecular Bioscience* ePortfolio project centres on collaborative teamwork between group members and engages the students with a technology based environment.
- Classroom response systems ('clickers') will be used in lectures to engage students with participation in formative assessments.
- An incremental marking scheme will be used in the *Molecular Bioscience* laboratory sessions (for the first few sessions) so that students can adapt to writing professional reports to their supervisor's standards. Detailed feedback will be provided to each student to encourage improvement.
- In *Molecular Bioscience*, an interactive lab manual containing exercises and details of skill set tests will be used to promote learning and understanding in the laboratory.
- As part of the *Molecular Bioscience* module, students are provided with a virtual learning environment with details of breakthroughs in the field. Students are required to read these breakthroughs and write a summary report on one that stood out for them. This allows the students to engage with recent developments while also improving their communication and referencing skills.
- The use of e-books has been encouraged in the updated reading lists, with details of texts available through the DkIT Library online collection.
- *Molecular Bioscience* contains two CA exams (MCQ/Short answer). These will allow the students to assess their work during the module and self-assess the level of study required going forward.
- Self-assessment checklists are being used in the *Molecular Bioscience* module lab sessions. This ensures that students are reflecting on their work prior to submitting it.
- Moodle is used regularly for circulating notes, group discussions, & online quizzes.
- Tutorials will be used to re-inforce study material and to discuss (topical) information, relevant to the subject.
- The Environmental Communication and Critique module is a student-centred module. Students are encouraged to have open discussion and debate about environmental topics. Each student will choose a media article and facilitate an in-class discussion on the topic. Students will be peer assessed for their skills as facilitators. They will also conduct a literature review on an area of their choice. This module will allow students to develop confidence in discussing scientific information and communicating information through technical and non-technical writing.

13.2.2. *Assessment Instruments used in the Programme*

Formative assessment is acknowledged as being part of the learning process, and so is used to monitor and thus help improve student learning while that learning is taking place. Examples include practical write ups, MCQs, etc.
Summative assessment, on the other hand, measures learning at fixed points in time against agreed standards or criteria, and includes, for example, mid-semester and/or end-of-term project reports or examinations.

Module	Semester / Stage	Formative (Formal) Assessment	Summative Assessment
Stage 1:			
Physics Through PBL 1	Semester 1 Stage 1	Formative Asssessment CA based on the PBL reports. The mark for each student being derived form a combination of tutor, peer and self-assessment (100%)	
Fundamental Chemistry	Semester 1 Stage 1	In fundamental chemistry practicals, the students will be regularly assessed on fundamental laboratory skills and neat report writing of practicals (40%). Tutorials: Students will use a weekly tutorial class to solve a range of chemistry problems based on topics being covered in lecture. Continuous Assessment: A one-hour, short question written exam will be used to assess student understanding of the module content to date and identify areas that require improvement (10%)	End of semester Exam (50%)

Module	Semester / Stage	Formative (Formal) Assessment	Summative Assessment
Mathematics 1	Semester 1 Stage 1	Attendance and participation at tutorials, completion of a set of tutorial sheets based on the course content and two one-hour mid-semester examinations (40%).	End of semester Exam (60%)
Biology	Semester 1 & 2 Stage 1	A series of one hour class tests (4 in total) will be used to assess the student's understanding of the material covered to date and identify areas that require improvement (20%) Practical skills and the student's record of their work will be assessed regularly by practical examinations, correction of practical reports, short questions or multiple choice questions as appropriate. Average of all practical exams and reports (30%)	End of year Exam (50%)

Module	Semester / Stage	Formative (Formal) Assessment	Summative Assessment
Health & Safety & Academic Skills	Semester 1 & 2 Stage 1	Health & Safety: Multiple Choice Questions (5%) Fortnightly in class MCQ assessments of students understanding of Health and Safety content and identify areas that require improvement.	Poster on a scientific application of the 20th century (20%) Health & Safety: Risk Inspection (20%) A 1 hour risk assessment of a chemical or biological laboratory and report. This assessment allows students identify all hazard types in the laboratory, calculate the associated risk factor and suggest control measures (Safety, Health & Welfare at Work Act 2005). Presentation on an Irish scientist (10%) Written report on an Irish scientist (10%) Attendance & participation (10%) Health & Safety: End of Semester Class Test (10%). A 1 hour in class test to examine Health & Safety content. Examination in Advanced Excel 15%
Physics Through PBL 2	Semester 2 Stage	Continuous assessment will be based on the problem reports / presentations. The product mark will be assigned based report and then each student mark will be assigned by peer assessment (50%).	End of semester Exam (50%)
Mathematics 2	Semester 2 Stage 1	Attendance and participation at tutorials, completion of a set of tutorial sheets based on the course content and two one-hour mid-semester examinations (40%).	End of semester Exam (60%)

Module	Semester / Stage	Formative (Formal) Assessment	Summative Assessment
Chemistry	Semester 2 Stage 1	In chemistry practicals, the students will be regularly assessed on chemistry laboratory skills and detailed report writing Average of all practical exams and reports (40%). Tutorials: Students will use a weekly tutorial class to solve a range of chemistry problems based on topics being covered in lecture. Continuous Assessment: A one-hour, short question written exam will be used to assess student understanding of the module content to date and identify areas that require improvement (10%)	End of semester Exam (50%)
Stage 2:			
Analytical Instrumentation & Techniques 1	Semester 1 Stage 2	Practicals; students will be required to write a formal laboratory report for each experiment. Self-assessment and peer-assisted learning through small group work, formative assessment through classroom assessment techniques (no marks allocated) and E-learning assessment will be embedded in laboratory sessions. Average of Laboratory reports, laboratory performance and e-assessments (30%). Group Project: Formative assessment and feedback is provided during the development of the project question (no marks are allocated).	Group Project; students are divided into groups (4-6) and using the problem-based learning technique, will solve a problem by combining technical skills and theoretical knowledge and produce a written report (10%) Continuous Assessment; students produce an in class written evaluation of the validity of data from International case studies (10%) End of Semester Exam (50%)

Module	Semester / Stage	Formative (Formal) Assessment	Summative Assessment
Fundamental Microbiology	Semester 1 Stage 2	Online-Exam: Students will complete an interactive on-line quiz (10%) Class Test: Students will select and apply appropriate equations to complete mathematical calculations for the enumeration of microorganisms (15%) Practical: Laboratory data sheets demonstrating student ability to accurately record and interpret scientific data will be graded regularly. Practical skills and competencies will be assessed via performance evaluation in class. Average of Laboratory reports, skills and competencies (25%)	End of year exam (50%)
Intro to Organic Chemistry	Semester 1 Stage 2	Practicals: Students will be required to submit a formal laboratory report for each experiment. Students will receive generic oral feedback and specific individual written feedback on the laboratory reports. Average mark from all laboratory reports (40%) A continuous assessment (e.g. MCQ exam) will be used to assess student understanding of the module content to date and identify areas that require improvement (10%). Tutorials: Students will use a weekly tutorial class to solve a range of organic chemistry problems (naming, drawing , bonding etc.). These tutorials are designed to facilitate group work and peer learning. Individual feedback is provided to the student on work completed during the tutorials (answers to problems provided on moodle after the tutorial)	End of semester Exam (50%)

Module	Semester / Stage	Formative (Formal) Assessment	Summative Assessment
Molecular Bioscience	Semester 1 & 2 Stage 2	Laboratory reports and skills set tests will be graded regularly to focus on the content and presentation of a high quality laboratory report and laboratory practical skills. Average of all Laboratory Reports / skill set tests (25%) Throughout the semester, students will be provided with formative assessments in both lectures and laboratory environments (e.g. problem based learning, quizzes, protocol review exercises, interactive lab manuals, worksheet completion etc.). These are designed to facilitate group work and peer learning in problem solving situations. No marks are allocated for these. formative assessments.	Scientific breakthrough news article (5%) MCQ exam (10%) Short answer exam (10%) Mahara ePortfolio (10%) End of year exam (40%)
Microbial Pathogenesis and Control	Semester 2 Stage 2	Online-Exam: Students will complete an interactive on-line quiz (15%) Students will conduct research and subsequently apply this information to trace and map the pathway of infection for a pathogen of their choice (10%) Laboratory reports focusing on discussion of data to enhance understanding and critical thinking skills will be graded regularly. Practical skills and competencies will be assessed via performance evaluation in class. Average of Laboratory reports, skills and competencies (25%)	End of year exam (50%)

Module	Semester / Stage	Formative (Formal) Assessment	Summative Assessment
Statistics and Data Analysis	Semester 2 Stage 2	Half way through the module students perform an assessment covering material from the first two sections of the course. Students have the opportunity to engage with the lecturer on a one-to-one basis or in small groups to gain feedback on this assessment. This highlights gaps in the students' knowledge and allows them to focus on areas requiring more attention (15%).	Students perform a final assessment at the end of module covering most of the course. This assessment offers good preparation for the end of module exam (15%) End of semester Exam (70%)
Applied Ecology	Semester 2 Stage 2	Laboratory and field reports will be graded regularly to focus on the content and presentation of a high quality reports and practical skills (50%)	End of year exam (50%)
Stage 3:			
Environmental Communication and Critique	Semester 1 Stage 3	In a series of lectures, students learn about the profile of the environment in politics and the role of NGOs in influencing policy. Through class discussions/debates and written reports, students gain a knowledge on current global and Irish environmental issues. Students also learn how to critically evaluate scientific papers and practise writing abstracts for papers.	Literature review of an environmental issue (15%) Evaluate a journal article x2 (10%) Sustainable development report (5%) Group presentation on sustainable development (5%) Discussion on articles brought in by each student about current environmental issue (5%) Report on a NGO (10%) Presentation on environmental issue in Ireland (15%) Abstract writing (5%) Final exam (30%)

Module	Semester / Stage	Formative (Formal) Assessment	Summative Assessment
Plant Science	Semester 1 Stage 3	Lectures on plant identification and plant science to provide students with required background information. Weekly practical plant identification sessions, including two half day field based projects with continuous feedback to students.	Weekly practical and plant recording notebook (30%) Project report on selected plant family (10%) Final exam (60%)
Applied Microbiology	Semester 1 Stage 3	Project: Each student will conduct research and produce a report describing the microbiology of a food of their choice. Students will plan and complete a laboratory analysis of their product (20%) Practical: Laboratory reports will be graded regularly to focus on the content and presentation of a complete high quality laboratory report. Average of Laboratory reports, skills and competencies (30%)	End of year exam (50%)
Aquatic Sciences	Semester 1 Stage 3	Practical skills will be evaluated regularly to focus on the content and presentation of a high quality reports and practical skills. Average of all Laboratory Reports (25%) Project (survey of a lake or marine habitat): students will receive formative feedback on their project work following a presentation to the class.	Project report (15%) Project presentation (10%) End of year exam (50%)

Module	Semester / Stage	Formative (Formal) Assessment	Summative Assessment
Biotechnology	Semester 1 &2 Stage 3	Laboratory reports and skills set tests will be graded regularly to focus on the content and presentation of a high quality laboratory report and laboratory practical skills. Average of all Laboratory Reports / skill set tests (30%) A one-hour, short question written exam will be used to assess student understanding of the module content to date and identify areas that require improvement (10%)	Each student will be asked to evaluate a case study on some aspect of biotechnology. The study will be presented using one of a number of different possible methods - e.g. type-written report, poster, video, interactive CD or oral presentation. (10%) End of year Exam (50%)
Quality Management	Semester 2 Stage 3	A Class Test (e.g. MCQ exam) will be used to assess student understanding of the module content to date and identify areas that require improvement (10%).	Suitable Project (20%) End of semester Exam (70%)
Environmental Chemistry	Semester 2 Stage 3	Laboratory reports on a range of interactive laboratory experiments that will incorporate assessment of cognitive, affective and psychomotor domain skills. Average of all Laboratory Reports (30%).	Project: Compilation of news articles in a scrap book specific to topical media items in the area of environmental chemistry (10%) End of semester Exam (60%)

Module	Semester / Stage	Formative (Formal) Assessment	Summative Assessment
Habitat and Wildlife Ecology	Semester 2 Stage 3	Laboratory and field reports will be assessed on a regular basis in which field and laboratory skills, data analyses and reporting will be evaluated. Average of all Laboratory Reports/Skill set tests (30%) An essay on a topic related to habitat and wildlife ecology and conservation. Project: Students will be divided into groups and asked to research and present on a topical issue related to wildlife management and habitat conservation (10%)	Practical assessment (30%) Essay (10%) Suitable Project (10%) End of year Exam (50%)
Stage 4:			
Research Design Statistics and Ethics	Semester 1 Stage 4	Students are divided over groups (3-4 students) and asked to write a Research Proposal to be presented orally to a 'mock' ethics committee. Formative feedback is provided (on up to 5 drafts of the proposal and a '2 week trial period' of the Group Journal). No marks are allocated for these formative assessments. Students perform a formative assessment covering (basic) statistical methods. Students have the opportunity to engage with the lecturer on a one-to-one basis or in small groups if additional help is required to complete this task (10%).	Research proposal: written group project (22.5%) Oral group presentation (22.5%) Group journal and information file (11.25%) Individual interview (18.75%) Group Project Total (75%) Students analyse statistical data from industrial experiments using Minitab and report on their findings. Students have the opportunity to get advice and (formative) feedback from the lecturer while doing this assessment (15%).

Module	Semester / Stage	Formative (Formal) Assessment	Summative Assessment
Soil and Water Management	Semester 1 Stage 4	Students undertake laboratory and field work on a weekly basis; reports are assessed by providing feedback only (no marks allocated) until the mid-semester point: 15%). Students are allocated one of a related set of peer-reviewed journal publications which are assessed (as a set) by discussion groups, with on-going feedback from lecturer.	Final assessment of lab notebooks and final lab-based report (15%) Oral presentation of review of allocated research paper (3%) Written review of group of research papers (7%). Final exam 60%
Data Handling & GIS	Semester 1 Stage 4	Students will be required to complete a set of mapping exercises to a professional standard using GIS software on a weekly basis. A Class Test will be used to assess student skills in the use of GIS software. Studies will carry out a variety of weekly practical exercises using suitable data handling and statistical software and receive feedback in these sessions on their skills development. Presentation on the methodology employed to collect, organise, manipulate and appropriately analyse and visually represent a dataset.	Weekly Maps Assessments (30%) Class Test (20%) Weekly Data Handling Exercises (30%) Presentation (20%)

Module	Semester / Stage	Formative (Formal) Assessment	Summative Assessment
Environmental Biosciences Project	Semesters 1 and 2 Stage 4	Presentation, outlining the academic rationale and aims and objectives of the proposed research project, making reference to the relevant literature (15%) Written report: a proposed plan of the research work, including methods to be used and a risk assessment of the research project (15%).	Research project thesis, structured as a peer reviewed publication (50%). Oral presentation of the research project, 10-15 minutes duration, followed by questions (10%) Supervisor's report, based on the student's performance during the course of the project (10%).
Environmental Biotechnology	Semester 2 Stage 4	Laboratory reports are graded regularly to focus on the content and presentation of a high quality laboratory report. Alternating workshops and tutorials promote critical thinking and familiarise students with current global and national environmental and sustainability issues. Workshops will facilitate student-led debates and discussions.	Average of all laboratory reports (30%) Presentation (5%) Debate (5%) Final exam (60%)

Module	Semester / Stage	Formative (Formal) Assessment	Summative Assessment
Environmental Risk Assessment	Semester 2 Stage 4	Students undertake a series of practical exercises in field based environmental assessment (habitat, flora, bird and stream surveys) which is then compiled into a final Environmental Report on the DkIT campus. This provides background data for the following Environmental Impact Assessment (EIA) Scoping Report. Feedback is provided on on-going results. In addition they give a presentation on an allocated Environmental Impact Statement (EIS) report to provide an understanding of the required content and format (5%). Students will also undertake several hypothetical risk assessment exercises, for example a Strategic Environmental Assessment of the Louth County Development Plan, and an EIA screening review of a hypothetical development.	Environmental report on DkIT campus (10%) Short series of laboratory practicals (15%) EIA scoping report for an assigned hypothetical development on the grounds of DkIT (20%) Final exam (50%)
Environmental Monitoring & Modelling	Semester 2 Stage 4	Students carry out a series of practicals and class exercises in monitoring and modelling techniques, and receive feedback in these sessions on their skills development. Each student will carry out a desk study on an assigned tool or metric, which they present orally and as a report.	Practical assessment (30%) Presentation (10%) Report (10%) Final exam (50%)
Ecotoxicology	Stage 4	Laboratory experiments will be assessed on a regular basis. Each student will be asked to evaluate a case study on some aspect of ecotoxicology. The study will be presented either orally or in written format.	Practical assessments (30%) Appropriate presentation of case-study findings (10%) Final exam (60%)

13.2.3 Assessment and Graduate Skills

- Laboratory reports will be regularly assessed to foster the production of high quality laboratory reports (both in presentation and content). This is an important graduate skill, required in both an industrial and a research environment.
- Additional written assignments and reports will be used to encourage scientific writing and analytical skills.
- Laboratory practical skills tests will be assessed to promote practical capabilities in a laboratory setting (including laboratory health and safety).
- Group assignments will be used to encourage team-working and peer-learning skills. Peer-assessment assists in ensuring group exercises are performed with more focus and participation.
- Computer-based assignments will be used to promote the computational analysis of data.
- Compilation of news articles in a scrap book specific to topical media items in the area of environmental chemistry.
- The objectives of this assessment strategy are to provide students with key skills for ecological and environmental assessment, as outlined for example by the Chartered Institute of Ecological and Environmental Management (CIEEM), together with skills required in the environmental monitoring and regulation sectors. Laboratory and field reports and notebooks, and the write-up of results in a report format, will be regularly assessed to foster the production of high quality presentation and accurate content. This is an important graduate skill, required in professional, business, industrial and research environments.
- Additional written assignments and reports will be used to encourage scientific writing and analytical skills.
- The laboratory/field based 'Environmental Biosciences Project' will foster independence, confidence and a sense of personal responsibility for the practical research performed. This module will also provide the student with a clear insight into the key elements of environmental research.
- Computer-based assignments, including the GIS-based assignments, will be used to promote the computational analysis of data. These will provide the student with the skills necessary for analysing larger, more complex temporal and spatial data-sets for analysis, which are becoming increasing common in the environmental and ecological management sector.
- A group based project is carried out in Applied Ecology. Students collaborate in the laboratory and during fieldwork. This develops their teamwork, analytical, cognitive and organisational skills.

13.2.4. First Year Assessment

First Year assessment will contain two Final Exams at the end of the first semester (*Mathematics 1* & *Fundamental Chemistry 1*) and four Final Exams at the end of the second semester (*Mathematics 2*, *Physics through PBL 2, Fundamental Chemistry 2* and *Biology* - a year-long module). Continuous Assessment (CA) will form the basis of assessment for the other modules (*Physics through PBL 1* and *Academic Skills* – a year-long module). This mixture of Exams and CA should allow students to gradually become accustomed to third level education, without an 'exam-overload'. The increased number of CA assessments should also encourage peer-learning among students, as they will have opportunities to collaborate on and/or compare CA assignments.

13.2.5. Assessment Balance

A list of all assessments for each semester of the programme will be compiled and discussed at the Programme Board meeting. Assessment dates will be spread (where possible) to ensure that assessment dates are balanced. A copy of the assessment schedule will be provided to all students at the start of each semester.

13.2.6. Control of validity, reliability and authenticity of assessment

- Clear marking schemes will be used in order to ensure validity, reliability and authenticity of assessment marking.
- For the Analytical Instrumentation and Techniques 1 group project: A group mark will be given for the written project. A portion of this mark will be distributed by the students themselves through 'peer-marking'. This will allow for variation of the mark for individual group-members, to reflect their individual input into the project.
- Written assignments (including the Project Literature Review) will be monitored for plagiarism through the 'Turnitin' plagiarism detection software. Some assignments may be excluded from this e.g. laboratory practical reports.
- Students will be informed of the DkIT Academic Integrity Policy and the 'dos and don'ts of plagiarism' through the Student Information Handbook. The Academic Integrity Policy is available on the institute web-site and the policy will be used to encourage honesty, trust, fairness, respect and responsibility. In the Project module, tutorials are delivered (in collaboration with the DkIT library) where the rules and regulations of plagiarism and referencing are outlined in further detail.
- Mid-term exams will be assessed to identify gaps in student knowledge and allow students to focus more on particular areas that require further study before sitting the end of term Exam.
- Double marking will be used for all written assignments of the Environmental Project (year-long, 20 credit module). The project presentations (in both first and second semester) will be assessed by all research project supervisors (as far as reasonably possible).

- For the 'Research Design, Statistics and Ethics' group project, a group mark will be given for the written research proposal. The group mark for the presentation and journal will be individually adjusted, according to each group-member's input into these components. The Interview will be graded on an individual basis. This combination of group and individual marking should ensure a more reliable distribution of marks amongst individual group-members.

13.2.7. Special Regulations

- A minimum grade of 40% is required to pass each module.
- For modules with practical or final exam components, a minimum mark of 30% must be obtained in each of these two components.[1]
- Any failed final examination will need to be repeated.
- If a student fails one module of 5 credits, they will be allowed to proceed to the next year under the Approved to Progress rule. This module will need to be passed before continuing to the following stage.
- A failed practical element would normally require repeating the practical component. In exceptional circumstances an alternative (suitable) replacement examination may be completed instead.

14 Award

In order to achieve the required standard for the award of B.Sc. (Honours) in Environmental Bioscience, a student must successfully complete all modules on the programme and obtain 240 credits. The award mark will be determined as the credit-weighted average of all module marks. The award will be made at one of the following levels:

First Class Honour:	$\geq$ 70%
Second Class Honour, Grade 1:	60-69%
Second Class Honour, Grade 2:	50-59%
Pass:	40-49%

[1] All Bachelor of Science and Bachelor of Science (Honours) programme schedules in the Department of Applied Sciences contain the following special regulation: *'For modules with Prac or Final components, a minimum mark of 30% in each component must be obtained.'* This was approved by DkIT Academic Council in 2010. It does not apply to other module components such as projects, work placement reports, class tests and other written assignments.

What the regulation means for students is that for the Practical and Final Examination components of modules, they must achieve a minimum mark of 30% in each component to pass the module, in addition to attaining a minimum overall mark of 40% for the module as a whole. The rationale for this regulation is to ensure that students demonstrate a minimum achievement of both theory and practical learning outcomes for each module.

Appendix 1:

Programme Schedule and Learning Outcomes for Exit Award, B.Sc. in Environmental Bioscience.

Appendix 2: Employer Survey Results

Appendix 2:

Results of Employer Survey

1. Company / organisation name (optional)	
Answer Options	**Response Count**
	17
answered question	**17**
skipped question	**14**

2. Nature of organisation		
Answer Options	**Response Percent**	**Response Count**
State Body	12.5%	3
Local Authority	20.8%	5
Education	4.2%	1
Environmental Consultancy	54.2%	13
Other Consultancy or Analytical Services	4.2%	1
Manufacturing - Food or Beverages	0.0%	0
Manufacturing - Pharmaceuticals or Medical Devices	8.3%	2
Manufacturing - Environmental Products	0.0%	0
Waste Management	4.2%	1
Health and Safety	4.2%	1

Other (please specify)	8
answered question	24
skipped question	7

3. How many people do you currently employ in your organisation and how many of these have a science qualification?

Answer Options	Response Percent	Response Count
Total employees	100.0%	30
Employees with a Science qualification	90.0%	27
Employees with an Environmental Science qualification	93.3%	28
answered question		30
skipped question		1

4. How many of these are qualified at NQAI Level 8 (i.e. Honours degree level) or higher?

Answer Options	Response Count
	28
answered question	28
skipped question	3

5. How many additional graduates do you intend to employ during the next 5-10 years?

Answer Options	Response Percent	Response Count
Total graduates	93.3%	28
Science graduates	76.7%	23
Environmental Science	86.7%	26

graduates	
answered question	30
skipped question	1

6. Rate the following knowledge or skill sets according to their relevance to current or future science graduates working in your organisation?

Answer Options	Very relevant	Relevant	Not relevant	Rating Average	Response Count
Analytical Skills	17	12	1	1.47	30
IT Skills	16	13	1	1.50	30
Maths / Statistics	7	18	4	1.90	29
Scientific Knowledge	22	7	0	1.24	29
Research Skills	14	12	2	1.57	28
Quality Management	18	10	1	1.41	29
Ability to be innovative	17	12	1	1.47	30
Oral communication skills	20	10	0	1.33	30
Written communication skills	26	4	0	1.13	30
Teamwork	21	9	0	1.30	30
Health and Safety	17	11	1	1.45	29
Other (please specify)					7
				answered question	30
				skipped question	1

7. The following subject areas are proposed as part of this proposed B.Sc. programme. Please rank the relevance of each module to your company / organisation.

Answer Options	Very relevant	Relevant	Not relevant	Rating Average	Response Count
Analytical Instrumentation and Techniques	7	17	7	2.00	31
Health and Safety	16	12	3	1.58	31

Environmental modelling	7	15	9	2.06	31	
Environmental Risk Assessment (including SEA, EIA and EMS)	13	13	5	1.74	31	
Fundamental and Applied Microbiology	3	14	14	2.35	31	
Zoology	8	10	13	2.16	31	
Botany	8	11	12	2.13	31	
Applied Ecology	13	13	5	1.74	31	
Wildlife and Habitat Ecology	12	11	8	1.87	31	
Environmental Field Studies	8	18	5	1.90	31	
Aquatic Science	12	12	7	1.84	31	
Biotechnology	5	10	16	2.35	31	
Land Contamination and Reclamation	12	9	10	1.94	31	
Environmental Biotechnology	4	15	12	2.26	31	
Environmental Chemistry and Biogeochemistry	12	11	8	1.87	31	
Geographical Information Systems	16	8	7	1.71	31	
Soil and Water Management	15	11	5	1.68	31	
Integrated Waste Management	12	8	11	1.97	31	
Biological Tools for Environmental Monitoring	9	16	6	1.90	31	
Ecotoxicology	5	16	10	2.16	31	
Research Dissertation	9	17	5	1.87	31	
Other (please specify)					6	
				answered question		31
				skipped question		0

8. Please choose the analytical skills you would consider desirable in a graduate of this proposed B.Sc. programme

Answer Options	Response Percent	Response Count
Atomic Absorption Spectroscopy (AAS)	35.3%	6
Fourier Transform Infrared Spectroscopy (FTIR)	23.5%	4
High Performance Liquid Chromatography (HPLC)	52.9%	9
Ion Chromatography (IC)	41.2%	7

Gas Chromatography (GC)	58.8%	10
Wet Chemistry techniques	82.4%	14
Microscopy	58.8%	10
Other (please specify)		13
	answered question	17
	skipped question	14

9. Would you employ graduates from the B.Sc. (Hons) Environmental Bioscience Programme?

Answer Options	Response Percent	Response Count
Yes	71.0%	22
No	29.0%	9
	answered question	31
	skipped question	0

10. If so, what role would you envisage for them?

Answer Options	Response Count
	21
answered question	21
skipped question	10

11. Do you think a programme such as this is:

Answer Options	Very relevant	Relevant	Not relevant	Rating Average	Response Count

	6	23	2	1.87	31	
				answered question		**31**
				skipped question		**0**

12. Please provide any other comments which you have on the proposed programme	
Answer Options	**Response Count**
	15
answered question	**15**
skipped question	**16**

Appendix 3: Programme Schedule, Programme Learning Outcomes and Module Descriptors for B.Sc. (Hons) in Environmental Bioscience

Appendix 4: Laboratory Equipment, Department of Applied Sciences.

Appendix 5 – Existing Programmes in other Institutions

Institute	Course title	Level	CAO indicative	Content
TCD	B.A (Mod) Nat Sc Environmental Science	4 years (ab initio)	505	First two years common, then modules including Environmental management & governance, Water technology, Global environmental change, Environmental chemistry, Bioindicators and pollution, Groundwater quality, Conservation and biodiversity, and GIS plus other electives.
UCD	BSc (Hons) in Environmental Biology	4 years (ab initio)	500-615	Focuses on the biological aspects of environmental science. Marine, terrestrial and freshwater ecosystems, plant, animal and microbial ecology, evolutionary biology, conservation biology, global change biology, pollution biology, soil science and wildlife ecology. There is a strong emphasis on vocational skills and links with industry; core modules include mock environmental impact assessment, field-based sampling in Ireland and Spain, and guest lectures from environmental managers and consultants.
DCU	BSc (Hons) Environmental Science and Health	4 years (ab initio)	435	Environmental science, ranging from atmospheric physics and environmental geophysics, to environmental biotechnology and epidemiology. In Year Three, you will have the opportunity to work on a paid industrial (INTRA) placement.

Institute	Course title	Level	CAO indicative	Content
UCC	BSc (Hons) in Environmental Science	4 years (ab initio)	420	Common first year course. At the end of year 1, students who choose the dedicated Environmental Science degree continue specialised environmental aspects of each science discipline. In years 3 and 4, students will study selected interdisciplinary environmental topics and can choose to specialise in aspects of the earth, biological or chemical environmental sciences, or to remain broadly interdisciplinary. Most of year 4 of the degree course, including the individual research project, is concentrated within your chosen area of interest.
NUIG	BSc (Hons) in Environmental Science	4 years (ab initio)	375 - 485	Year 3: Validation and Industrial Chemistry, Environmental Management and Legislation, Environmental Microbiology, Statistics and Computer Studies Plus two of the following: Environmental Geosciences, Introduction to GIS, Plant Ecology and Palaeoecology, Principles of, Animal Ecology; Year 4 Environmental Management, Environmental Microbiology and Waste Management, Project and two modules from the following: Advanced GIS, Ecology and Conservation Issues, History of Plants, Atmosphere & Climate Change, Environmental Zoology, Physics of the Environment, Applied Geoscience
UL	BSc (Hons) in Environmental Science	4 years (ab initio)	355	Main areas of study include Environmental Science - the application of the fundamental sciences to environmental issues, Environmental Management, Clean Technology, Waste Management, Health & Safety.

Institute	Course title	Level	CAO indicative	Content
SGIT	BSc (Hons) Environmental Science	4 years (ab initio) and as I year add-on	300	Year 3 topics water and wastewater treatment, waste management, habitat and species management, environmental agricultural systems, environmental assessment, chemical toxicology, environmental microbiology and molecular biology. Year 4 topics covered include environmental planning, ecological and energy management systems, environmental legislation, science research methods and advanced geographical mapping (GIS) and project. Year 3 work placement
SGIT	BSc (Hons) Environmental Management	by distance learning (2 years)		Modules include: Environmental policy and legislation, Water quality In Irish river basin districts, Natural heritage management, Planning and environmental impact assessment, Energy use and sustainability, Air quality, Environmental management systems and auditing, Occupational Safety and Health
GMIT	BSc (Hons) Applied Freshwater and Marine Biology	4 years (ab initio) and as I year add-on	370	All modules on the Level 7 ordinary degree programme plus the following: Biology & Ecology of, Aquatic Species, Data Analysis, Modelling & GIS, Biodiversity & Conservation, Residential Field Trip (typically held abroad), Resource Management, Environmental Legislation, Aquatic Animal Behaviour, Project Data Management, Project
ITT	BSc (Hons) in Wildlife Biology	4 years (ab initio)	300	Environmental protection, wildlife biodiversity, habitat studies, GIS, Land use concepts, project etc.
LIT	BSc (Hons) Environmental & Analytical Science	1 year add on		Modules: Chemical/ Environmental & Instrumental Analysis, Special Topics – Environmental, Environmental Project, Chromatographic Methods and Validation, Spectroscopic and Complementary Methods, Quality Management & Statistics

Institute	Course title	Level	CAO indicative	Content
LIT	BSc (Hons) Environmental and Natural Resource Management	4 years (ab initio)	275	Year 1 Environmental Science, Rural Land Use & the Environment, Introduction to Environmental Management, Personal Effectiveness, Introduction to Sustainable Development, Applied Environmental Science, Environmental Maths & Computing. Year 2 Earth Science & Ecology, Environment & Sustainable Development, Conservation & Biodiversity Management, Waste & Energy Management, Group Work – Theory & Practice, Field Study Skills & GIS; Year 3
Cork IT	BSc (Hons) Environmental Science & Sustainable Technology	4 years (ab initio)	300	Water Quality Analysis & Treatment, Research Techniques, Water Resource Management, Planning & the Environment, Train the Trainer, Geographic Information Systems, Work Placement, Professional Development. Year 4 Dissertation, Economy, Society & Sustainable Development, Climate & the Atmosphere, Organisational Behaviour & Management for the Environmental Sector, Environmental Monitoring & Modelling, Carbon & Sustainable Energy.
Athlone IT	BSc (Hons) in Biotechnology	4 years (ab initio)	275	Year 1 and 2 general/common modules; Year 3: Forensic Science, Environmental Biotechnology, Ethics, Applied Biotechnology, Genetic Engineering, Experimental Design & Quality Control, Molecular Biology, Advanced Cell Biology, Advanced Techniques in Molecular Biology and Occupational Regulatory Affairs; Year 4 Bioprocess Technology, Bioinformatics, Analytical Biotechnology, Validation, Innovation & Entrepreneurship, Good Manufacturing Practice, Regulatory Affairs & Legislation, Research Methods and Research Project.

Institute	Course title	Level	CAO indicative	Content
Queens Belfast	BSc (Hons) in Environmental Biology	3 years (ab initio)		Year 1: Biological Diversity, Environmental Biology, Genetics and Molecular Biology, Introductory Skills for Biosciences, Micro-organisms, And usually Biochemistry. Year 2: Marine ecology, Comparative Animal Physiology, Environmental and Applied Microbiology, Invertebrate Biology, Molecular Ecology and Evolutionary Genetics. Year 3: Two-module research project; The four taught modules are: Behavioural Ecology and Sociobiology Marine Processes or Marine Zoology And two other modules
University Ulster, Coleraine	BSc (Hons) in Environmental Science	3 or 4 years (ab initio); optional I year work experience		In Year 1 ecology and biogeography; environment and society; the environmental skills toolbox; how the earth works; and marine systems. Year 2: rivers and lakes; soils and vegetation; coastal and marine processes; and research methods. Additional modules from atmospheric and oceanic systems; an introduction to remote sensing and geographical information systems; environmental planning; development, environment and society; and landforms and landscapes. Year 3 can be 1 year work experience

Appendix 6 – Graduate Testimonials

Anne Lennon Environmental Biology 2009-2010

I graduated from the Environmental Biology course in 2010. During my degree I also held two bursaries in the Centre for Freshwater Studies at DkIT which gave me my first taste of working in the environmental sector which I loved. During the Applied Bioscience course, I really enjoyed environmental modules, so when the time came to choose for my 4th year option, I picked the course that suited me best and in which I was most interested. This was the best decision and is the advice I would give to anyone trying to make these choices. After leaving college, I got a job in customer support and general office work which helped me to develop good communication skills, highly valued in the world of science.

I then worked in the National Virus Reference Laboratory, UCD, as a Laboratory Assistant, where my duties included sorting and archiving samples, labelling and preparing samples for testing and running confirmatory HIV, Hep A,B,C,D and E, Toxo, CMV and EBV tests. I did a postgraduate Diploma in Rural Conservation and Environmental Management in UCD on a part time basis, and I plan to finish my Masters in 2014. After the NVRL, I worked in the Water Services Department, Laois County Council, as a Quality Analyst implementing new quality and standardisation procedures, and I am currently a Quality Analyst for Pfizer in Mycoplasma and Virology.

The truth is you can map out your career all you want, but when you get into the real world not everything goes to plan, so study the subjects that you are most interested in and doing well in. One of our modules was Environmental Review and Critique which teaches you how to question and evaluate scientific papers and data, along with how to argue a scientific point. In all the roles I have held, the lessons I learned in this module have served me well. Although I am currently working for a pharmaceutical company, I would still choose Environmental Biology because the course suited me and played to my strengths. I can talk with knowledge and passion about what I studied and this has impressed at interviews, while the skills and knowledge that this course gave to me has afforded me a good career in roles that I enjoy.

Chris Goti B. Sc. (Hons) Environmental Biology 2008-2009
Environmental Advisor on a Western Australian gold mine

In my role as Environmental Advisor on a Western Australian gold mine I work a fly in, fly out roster where I spend 12 days on the mine site in regional Western Australia and fly back to Perth for 9 days off. While I am on site, I am the only management level member of the environmental department and because of this. the role offers a lot of responsibility.

The work of all environmental departments on mine sites is structured around our environmental licence conditions. This licence is issued by the Department of Environment and Regulations and my site has 50 conditions that we must adhere to. The most important condition for almost all mine sites is water monitoring. A gold mine uses huge volumes of water to process the dirt/ore that we mine from the pit and this water is pumped up from the groundwater in the area surrounding our mine. Along with the environmental technicians, I undertake monitoring programs to ensure that our processing ponds are not contaminating the groundwater source with heavy metals and cyanide and that we are not taking more water than we are allocated.

An Environmental Advisor's role is extremely varied and the management of tasks is usually at your own discretion. A typical day can involve:

- undertaking inspections of work areas,
- leading investigations into environmental incidents on site,
- attending mine production meetings,
- undertaking fauna surveys and controlling feral animal numbers,
- Updating the environmental management system with standard operating procedures.

Typically, the progression to an environmental advisor position involves first working as an environmental technician, preferably involving water monitoring, and any mine site experience that can be secured will provide a great advantage. The average starting salary for environmental advisors on Western Australian mine sites is $100,000 per year, rising substantially with experience.

Pamela Maher Environmental Biology 2008-2009

The broad range of topics covered in the Environmental Biology course in DkIT was a great way for me to explore the different subject areas within the Environmental Biology sector. It was through this course that I found my career calling which led me to further my studies in the form of a research MSc in UCD in Aquatic Ecology. Since then, I have worked as a Research Assistant within UCD and am currently employed as a Laboratory Scientist with APEM in Manchester, UK, as a freshwater taxonomist.

Appendix 7: Student Weekly Workload

Stage 1/Semester 1

Mod Code	Module Title	Level	Credits	Contact Hours (Lecture)	Contact Hours (Practical)	Contact Hours (Tutorial)	Directed Reading	Independent Study	Total Contact Hours	Total Learner Workload
CHEM S7Z04	Fundamental Chemistry	6	7.5	3	3	1	2	3	7	12
MATH S7Z01	Mathematics 1	6	5	3		1		4	4	8
PHYS S7203	Physics Through PBL 1	7	5		4			5	4	9
BIOL S8Z01	Biology	7	7.5	3	3	1		4	7	11
HLSTS8Z01	Health and Safety and Academic Skills	7	5	4				4	4	8
	Total Weekly Hours								**26**	48

Stage 1/Semester 2

Mod Code	Module Title	Level	Credits	Contact Hours (Lecture)	Contact Hours (Practical)	Contact Hours (Tutorial)	Directed Reading	Independent Study	Total Contact Hours	Total Learner Workload
CHEM S7Z05	Chemistry	7	7.5	3	3	1	3	2.5	7	12.5
MATH S7Z02	Mathematics 2	6	5	3		1		5	4	9
PHYS S7204	Physics Through PBL 2	7	5		4			5	4	9
BIOL S8Z01	Biology	7	7.5	3	3	1		4	7	11
HLSTS8Z01	Health and Safety and Academic Skills	7	5	4				4	4	8
	Total Weekly Hours								**26**	49.5

Stage 2/Semester 1

Mod Code	Module Title	Level	Credits	Contact Hours (Lecture)	Contact Hours (Practical)	Contact Hours (Tutorial)	Directed Reading	Independent Study	Total Contact Hours	Total Learner Workload
BIOL S7009	Fundamental Microbiology	7	7.5	3	3		2	3	6	11
CHEM S7003	Intro to Organic Chemistry	7	7.5	2	3	1	3	3	6	12
INST S7Z01	Analytical Instrumentation & Techniques 1	7	7.5	3	3		3	4	6	13
SCIA S7Z01	Molecular Bioscience	7	7.5	3	3		2	5	6	13
	Total Weekly Hours								**24**	49

Stage 2/Semester 2

Mod Code	Module Title	Level	Credits	Contact Hours (Lecture)	Contact Hours (Practical)	Contact Hours (Tutorial)	Directed Reading	Independent Study	Total Contact Hours	Total Learner Workload
SCIA S7003	Microbial Pathogenesis and Control	7	7.5	3	3		2	3	6	11
ENVR S7008	Applied Ecology	7	7.5	3	3		2	4	6	12
DATA S7Z01	Statistics and Data Analyses	7	7.5	4	1			8	5	13
SCIA S7Z01	Molecular Bioscience	7	7.5	3	3		2	5	6	13
	Total Weekly Hours								**23**	49

Stage 3/Semester 1

Mod Code	Module Title	Level	Credits	Contact Hours (Lecture)	Contact Hours (Practical)	Contact Hours (Tutorial)	Directed Reading	Independent Study	Total Contact Hours	Total Learner Workload
MCBL S7001	Applied Microbiology	7	7.5	3	3		2	4	6	12
	Environmental Communication and Critique	8	5	1		2		4	3	7
	Plant Science	8	5	2	3			2	5	7
	Aquatic Science	8	7.5	3	3		2	3	6	11
BITC S7011	Biotechnology	7	5	3	3		1	3	6	10
	Total Weekly Hours								**26**	47

Stage 3/Semester 2

Mod Code	Module Title	Level	Credits	Contact Hours (Lecture)	Contact Hours (Practical)	Contact Hours (Tutorial)	Directed Reading	Independent Study	Total Contact Hours	Total Learner Workload
QUAL S7009	Quality Management	7	5	4		1	2	2	5	9
	Habitat and Wildlife Ecology	7	7.5	3	3		3	4	6	13
	Environmental Chemistry	8	7.5	3	3			4	6	10
BITC S7011	Biotechnology	7	10	3	3		1	3	6	10
	Total Weekly Hours								**23**	42

Stage 4/Semester 1

Mod Code	Module Title	Level	Credits	Contact Hours (Lecture)	Contact Hours (Practical)	Contact Hours (Tutorial)	Directed Reading	Independent Study	Total Contact Hours	Total Learner Workload
SCIA S8002	Soil and Water Management	8	7.5	3	3			5	6	11
RESA S8002	Research Design, Stats & Ethics	8	5	1	2	2	1	3	5	9
	Data Handling and GIS	8	5			4		5	4	9
	Ecotoxicology	8	5	3	2			4	5	9
	Environmental Bioscience Project	8	7.5		2 (ave)	1	7		3	10
	Total Weekly Hours								**23**	48

Stage 4/Semester 2

Mod Code	Module Title	Level	Credits	Contact Hours (Lecture)	Contact Hours (Practical)	Contact Hours (Tutorial)	Directed Reading	Independent Study	Total Contact Hours	Total Learner Workload
ENVR S8009	Environmental Risk Assessment	8	5	2	3			4	5	9
ENVR S8010	Environmental Biotechnology	8	7.5	2	3	1	2	3	6	11
	Environmental Monitoring and Modelling	8	5	2	2			3	4	7
	Environmental Bioscience Project	8	12.5		8	1	7		9	16
	Total Weekly Hours								**24**	43