BQA NCQF QUALIFICATION TEMPLATE

SECTION A:	QUALIFICATION DETAILS		
QUALIFICATION DEVELOPER (S)	Botswana International University of Science and Technology Faculty of Science		
TITLE	Bachelor of Science in Earth and Environmental Sciences	**NCQF LEVEL**	7
STRANDS (where applicable)	N/A.		
FIELD	Natural, Mathematical and Life Sciences	**CREDIT VALUE**	498
SUB FIELD	Earth Sciences		

New Qualification	✓	Legacy Qualification		Renewal Qualification	
				Registration Code	

SUB-FRAMEWORK	General Education		TVET		Higher Education	✓									
QUALIFICATION TYPE	Certificate	I		II		III		IV		V		Diploma		Bachelor	✓
	Bachelor Honours		Post Graduate Certificate		Post Graduate Diploma										
	Masters		Doctorate/ PhD												

RATIONALE AND PURPOSE OF THE QUALIFICATION

RATIONALE:

The Earth's environment and its natural resources are important for human well-being. It is inevitable that livelihoods as well as other ecosystems depend on the environment and its natural resources. However, if mankind continues to overexploit the earth's resources, there may be irreparable consequences that can negatively affect the survival of future generations. Botswana's economy is largely based on mineral resources (WAVES Technical Report, Botswana, 2016) while most rural livelihoods depend on rainfed agriculture. There has been a surge in demand for the use of natural and mineral resources with increased developmental needs. Thus, depletion of natural resources and impairment of the Earth's natural system processes are becoming a cause of global concern. Issues emanating from mineral and natural resource exploitation, disposal of industrial and municipal wastes and their negative impact on preservation of groundwater supplies as well as climate change have compounded effects on the availability and sustainable use of Earth's natural resources. To promote sustainability and development it is necessary to understand the synergistic relationships between the environment and its resources, earth system processes and human interactions. This will in turn provide sustainable solutions to environmental problems aimed at improving the quality of life of humans and the ecosystem at large. It is also important to understand the occurrence and nature of mineral resources to assist informed decisions on the modes of mineral extraction and environmental conservation. A critical understanding of the processes that sustain environmental systems, how these systems function and interact with each other and with human society requires human skills at the appropriate level.

Botswana therefore needs skilled personnel in Earth and Environmental Sciences that will drive sustainable development of the country's economy (WAVES Technical Report, Botswana, 2016) particularly with respect to natural resource exploitation and protection. The applicability of the field of Earth and Environmental Sciences towards development and advancing the economy and livelihoods in Botswana is clearly outlined in the priority skills listing by the Human Resource Development Council of Botswana, HRDC. The skills listed include Environmental Protection Professionals who advocate for green technologies as well as Physical and Earth Science Professionals. The specialization in Earth and Environmental Sciences is also relevant to some of the skills listed since most of the skills interact with the environment in one way or another.

The degree in Earth and Environmental Sciences is aimed at producing skilled human resources that will oversee the sustainable development of Botswana's economy. The program explores the earth's structure, the processes of plate tectonics, energy transformation, the formatting and cycling of water and nutrients and human-environmental interactions. It is emphasized on education and awareness about the natural environment and its resources, the impact of human activities on natural systems and environmental conservation. Reports show that there is a growing shortage of skilled manpower who can translate scientific knowledge into actions that can manage resources sustainably (MDG Africa Steering Group, 2008) for the future generations. Thus, this training in Earth and Environmental Sciences is increasingly becoming an important discipline in many universities worldwide. The BSc degree in Earth and Environmental Sciences is designed to prepare individuals for careers in various sectors such as environmental consulting, water resources, agriculture, mining industry, energy, commerce, health as well as in various organs of government.

PURPOSE: (itemise exit level outcomes)

The purpose of this qualification is to produce graduates with specialised knowledge, skills, and competences to:

1. Apply specialised chemical, physical, geological, and mathematical concepts in understanding the processes and synergistic interactions between the geosphere, hydrosphere, atmosphere, and biosphere and offer reasoned advice to clients.
2. Apply advanced practical skills of research and field work methods to acquire data and locate different natural resources within the Earth's surface together with geological resources in the earth's crust.
3. Implement sustainable environmental mitigation and management strategies for impacts caused by natural resource exploitation.
4. Identify the opportunities and challenges of entrepreneurship in the field of Earth and Environmental Sciences and offer reasoned advice.

MINIMUM ENTRY REQUIREMENTS (including access and inclusion)

a) Certificate IV NCQF Level 4 (General Education or TVET)

b) Applicants who do not meet the above criteria may be considered through Recognition of Prior Learning (RPL) and Credit Accumulation and Transfer (CAT) policies for access. This consideration will be done following guidelines of the education and trainings providers (ETP) which are aligned with BQA/ National policies.

SECTION B	**QUALIFICATION SPECIFICATION**
GRADUATE PROFILE (LEARNING OUTCOMES)	**ASSESSMENT CRITERIA**
1. Demonstrate specialized knowledge and understanding of the earth system processes and interactions between the different spheres of the earth.	1.1 Explain to stakeholders the interactions between the different spheres of earth system in relation to natural resource functions, use and sustainability. 1.2 Recommend sustainable use of natural resources. 1.3 Create awareness of environmental conservation. 1.4 Enforce a mentality of equitable distribution and use of resources.
2. Apply knowledge of the theories and processes that affect, diversity, evolution, structure, and composition of the earth when prospecting for natural resources	2.1 Explain to clientele the specialized knowledge of life, the theories of origin and evolution of life and the current body of knowledge on the interaction of humans and the natural environment.

	2.2 Explain to clients in mining and natural resource sectors the processes that influence earth surface processes and how they can be impacted by human activity. 2.3 Assist clientele to identify different types of rocks, their genesis, occurrence, distribution and uses.
3. Use advanced principles of stratigraphy and tectonics to characterize sedimentary basins and complex geological formations.	3.1 Apply the principles of lithostratigraphy to the description of rock units in the field and in the laboratory (drill cores). 3.2 Categorize rock deformation processes and their causative factors both in the field and in the laboratory. 3.3 Assess the architecture of sedimentary basins and their evolution through space and time. 3.4 Compile reports of geological surveys that can be used by clients.
4. Apply advanced and practical skills of field work methods to acquire detailed geological data and locate natural resources in the earth's crust.	4.1 Utilize advanced geophysical, geochemical, and other geological tools to collect field data. 4.2 Conduct supervised geological field work, (geochemical, geophysical, hydrogeological, structural, etc.,) using various pieces of equipment and methods.
5. Apply specialised knowledge of the sustainability and development concepts when solving complex environmental problems	5.1 Explain and provide reasoned advice to clientele, project developers, and communities the importance of sustainable development on social, economic, and environmental resources. 5.2 Perform a cost benefit analysis of economic and social development vis a vis environmental sustainability for proposed projects. 5.3 Plan sustainable use measures and implement sustainable strategies for natural resource use.

	5.4 Evaluate the effectiveness of recommended strategies.
6. Demonstrate understanding of advanced concepts in sustainability science and natural resource conservation including measures for enhancing perspectives of environmental and sustainable development.	6.1 Utilize the multidisciplinary approach in planning appropriate developmental strategies that will enhance efficient resource utilization and sustainability. 6.2 Develop environmental conservation and protection plans 6.3 Formulate sustainable strategies of resource reuse, recycling and minimised resource use 6.1 Execute comprehensive, strategic and sustainable resources and land-use development strategies for projects that promote economic development with wise use of environmental resources 6.2 Evaluate the performance and success of implemented strategies and improve them where necessary.
7. Use specialised knowledge in Earth and Environmental Sciences to conduct, evaluate and critically analyse research outputs in natural resources conservation and sustainable development in compliance with legislated and ethical research principles.	7.1 Identify and synthesize problems related to natural resources and sustainable development. 7.2 Implement sound research techniques in formulating hypotheses; objectives; methodologies for research and development programs in resource utilization, maintenance, and sustainable development. 7.3 Gather and interpret reliable data using appropriate scientific tools. Formulate up to date and practical recommendations based on research results. 7.1 Prepare and package comprehensive report. 7.2 Effectively Communicate the research findings to relevant audiences.

8. Apply specialised knowledge of the principles of environmental protection to perform environmental impact assessments for proposed projects.	8.1 Conduct scoping and base-line analysis of the current environment prior to any development projects. 8.2 Conduct interviews and consultations with stakeholder communities to inform them about anticipated impacts of proposed developments in their area. 8.3 Predict and quantify the environmental impacts. 8.4 Propose mitigation measures to alleviate current and future environmental problems. 8.5 Implement localized sustainable mitigation strategies. 8.6 Perform an audit compliance of the mitigation Measures.
9. Demonstrate competence to produce coherent information on environmental issues and communicate effectively, both orally and in writing	9.1 Identify and validate environmental issues. 9.2 Provide an analysis of the environmental issues based on verified and factual information. 9.3 Prepare report using appropriate structure, style and language for a specific purpose and audience.
10. Apply the code of ethics in professional practice, including how to project the potential impacts of technical decisions on the society, organizations and external	10.1 Practice the Environmental Professionals code of ethics in carrying out professional duties. 10.2 Inculcate in oneself a culture, philosophy and integrity that puts society and

constituencies involved, and identify ethical and legal implications;	environment at the fore when executing professional duties.
11. Create business opportunities related to services provision, consultancies, and products in environmental related economic activities	11.1 Create business models in the specialized field of Earth and Environmental Sciences. 11.2 Conduct feasibility studies on business opportunities in environmental related economic activities. 11.3 Develop business plans for environmental related economic activities. 11.4 Execute environmental related economic activities aimed at boosting the individual's and the country's economy base.

SECTION C	QUALIFICATION STRUCTURE		
	TITLE	**Credits Per Relevant NCQF Level**	**Total Credits**

COMPONENT		Level [5]	Level [6]	Level [7]	
FUNDAMENTAL COMPONENT Subjects/ Courses/ Modules/Units	Principles of Biology I	**12**			**12**
	General Chemistry I	**12**			**12**
	Introduction to Computing	**12**			**12**
	Pre-Calculus	**24**			**24**
	Introductory Physics I	**12**			**12**
	Introduction to Technical Communication and Academic Literacy	**6**			**6**
	Principles of Biology II		**12**		**12**
	General Chemistry II		**12**		**12**
	Introduction to Statistics	**12**			**12**
	Technical Writing & Academic Literacy (Writing Process)		**6**		**6**
	Introduction to Calculus		**12**		**12**

	Calculus for Applied Sciences		**24**		**24**
CORE COMPONENT Subjects/Courses/ Modules/Units	Introductory Analytical Chemistry	**12**			**12**
	Earth and its Materials		**12**		**12**
	Introduction to Structural Geology and Field Methods		**12**		**12**
	Physics for Earth and Environmental Sciences	**12**			**12**
	Introduction to Human Environments	**12**			**12**
	Chemical Bonding and Periodicity of Elements	**12**			**12**
	Research methods in Earth and Environmental Sciences		**12**		**12**
	Introduction to the Biophysical Environment	**12**			**12**

	Mineralogy and Mineral Microscopy		**12**		**12**
	Professional Communication	**6**			**6**
	Starting and Sustaining a Business	**6**			**6**
	Fundamentals of Soil Science	**12**			**12**
	Atmospheric Physics and Chemistry		**12**		**12**
	Geographic Information Systems and Databases		**12**		**12**
	Statistics for Environmental and Earth and Environmental Science	**12**			**12**
	Principles of Hydrogeology		**12**		**12**
	Principles of Geochemistry		**12**		**12**
	Introduction to Entrepreneurship	**12**			**12**

	Environmental Impact Assessment		**12**		**12**
	Natural Resource Economics		**12**		**12**
	Stratigraphy and Paleontology		**12**		**12**
	Field Mapping and Reporting/Internship		**12**		**12**
	Geology of Botswana and Southern Africa		**12**		**12**
	Climate and Climate Change		**12**		**12**
	Principles of Hydrology		**12**		**12**
	Pollution and Remediation		**12**		**12**
	Environmental Law and Policy		**12**		**12**
	Internship		**36**		**36**
STRANDS/ SPECIALIZATION	Subjects/ Courses/ Modules/Units	**Credits Per Relevant NCQF Level**			**Total Credits**
		Level [ ]	**Level [ ]**	**Level [ ]**	

1.	**N/A**				
2.	**N/A**				
Electives	**N/A**				

SUMMARY OF CREDIT DISTRIBUTION FOR EACH COMPONENT PER NCQF LEVEL	
TOTAL CREDITS PER NCQF LEVEL	
NCQF Level	**Credit Value**
5	**96**
6	**162**
7	**240**
TOTAL CREDITS	**498**
Rules of Combination: **(Please Indicate combinations for the different constituent components of the qualification)**	
To graduate a learner should do all modules under core and fundamentals and to gain 498 credits**.**	

ASSESSMENT ARRANGEMENTS

Formative assessment or continuous assessment (CA) contributing towards the award of credits shall be based on course outcomes. This can include tests, assignments, laboratory, fieldwork and projects as well as simulated and real work settings. The overall weighted contribution of formative assessment to the final grade shall be 40%.

Summative assessment

Candidates may undergo assessment including written, practical and simulated projects. The final examination for each course contributes a weighted mark of 60% of the final mark for that course. In addition, there will be internal and external moderation for the qualification. Assessors and moderators must be BQA registered and accredited. Both internal and external moderation will be done in-line with the moderation policy of the Institution.

Assessors must be registered and accredited by BQA. The details of assessments processes shall apply as per the individual ETP policies in line with the BQA or national policies

MODERATION ARRANGEMENTS

This qualification must be moderated internally and externally for quality assurance purpose. Moderators must be registered and accredited by BQA. The details of moderation and assessments processes shall apply as per the individual ETP policies in line with the BQA or national policies.

RECOGNITION OF PRIOR LEARNING

Candidates may submit evidence of prior learning and current competence and/or undergo appropriate forms of RPL assessment for the award of credits towards the qualification in accordance with applicable RPL policies and relevant national-level policy and legislative framework. Implementation of RPL shall also be consistent with requirements, if any, prescribed for the field or sub-field of study by relevant national, regional or international professional bodies.

CREDIT ACCUMULATION AND TRANSFER

Credit Accumulation and Transfer for gaining credits towards graduation shall apply as per ETP policy which is aligned with BQA/ National policy.

PROGRESSION PATHWAYS (LEARNING AND EMPLOYMENT)

Horizontal Articulation

- Bachelor of Science in Geology
- Bachelor of Science in Environmental Science
- Bachelor of Science in Atmospheric Sciences
- Bachelor of Science in Natural Resources Management and Conservation
- Bachelor of Science in Soil Science

Vertical articulation

Bachelor of Science Honours: NCQF level 8

- Bachelor of Science Honours in Geology
- Bachelor of Science Honours in Environmental Science
- Bachelor of Science Honours in Atmospheric Sciences
- Bachelor of Science Honours in Natural Resources Management and Conservation
- Bachelor of Science Honours in Soil Science

Post-Graduate diploma and certificate: NCQF level 8

- Post-Graduate Diploma in Environmental Planning and Sustainable Development
- Post-Graduate Diploma in Land use planning
- Post-Graduate Diploma in Ecohydrology
- Post-Graduate Diploma in Integrated Water-Resources Management
- Post-Graduate Diploma in Climate change and Mitigation
- Post-Graduate Diploma in GIS and Remote Sensing of the Environment
- Post-Graduate Diploma in Integrated Waste Management
- Post-Graduate Diploma in Environmental safety and HealthPost-Graduate Certificate

- Post-Graduate Certificate in GIS and remote sensing application
- Post-Graduate Certificate in Environmental Impact Assessment
- Post-Graduate Certificate in Environmental Audit and Compliance

Employment pathway

- Environmental Consultants
- Resource Valuation and Development Experts
- EIA practitioners
- Water Resource Planners
- Geo-Environmental Scientists and Researchers
- Specialist Environmental Advisor
- Academics in Earth and Environmental Sciences

QUALIFICATION AWARD AND CERTIFICATION

Qualification Award. To obtain the Bachelor of Science in Earth and Environmental Sciences the student must obtain a minimum of 498 credits and satisfy all the rules of combination as indicated above.

Certification - Candidates meeting prescribed requirements will be awarded a certificate.

SUMMARY OF REGIONAL AND INTERNATIONAL COMPARABILITY

The proposed **BSc in Earth and Environmental Sciences** follows a similar rationale to that of the institutions that have been used for comparison. The rationale of the proposed qualification is similar to those of the universities used for comparison. All universities place emphasis on Environmental Sciences and Earth Sciences as major components. However, the following differences are noted:

1. For the universities compared, the degree of Earth and Environmental Sciences is completed in 3 years at Wright State University and Jacobs University and 5 years at the University of Central Asia while it takes 4 years at the University of Washington, Bothell and 4 years for the proposed qualification.

2. Under the degree of Earth and Environmental Sciences, Right State University has 2 separate concentrations i.e. Environmental Sciences and Earth Sciences. Each of the concentrations has a total of 120 credits while the proposed qualification consists of 498 credits.
3. In addition to the other areas of focus, Jacobs University offers Oceanography which is not included in the proposed qualification. The total number of credits required to complete the qualification at Jacobs University is 180 compared to the total of 498 credits for the proposed qualification.
4. The University of Washington, Bothell offers instead a BSc. Qualification in Earth System Science and a minimum of 163 credit points is required to complete the qualification.
5. All qualifications have research, field and intern components.

The proposed qualification has been benchmarked against BSc in Earth and Environmental Sciences offered from the USA, Germany, and Kazakhstan. All qualifications prepare graduates for employment in various areas of the Earth and Environmental Sciences within academia and industry. Employment areas focus on exploration of natural resources including their use, management, and protection. Graduates can be employed as Environmental Specialists, Consultants, Practitioners and Academics.

In terms of learning pathways, graduates of the proposed qualification can progress to an honours degree in Earth and Environmental Sciences, the same applies to Wright State University and the University of Washington, Bothell. Graduates from Jacobs University can progress to a Master of Science in Earth and Environmental Sciences while graduates from University of Central Asia are competitive for entry into international graduate study qualifications in Earth and Environmental Sciences.

REVIEW PERIOD

Review period is 5 years.

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CODE (ID)			
REGISTRATION STATUS	**BQA DECISION NO.**	**REGISTRATION START DATE**	**REGISTRATION END DATE**
LAST DATE FOR ENROLMENT		**LAST DATE FOR ACHIEVEMENT**	