BQA NCQF Qualification Template

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SECTION A:	***QUALIFICATION DETAILS***				
QUALIFICATION DEVELOPER	University of Botswana				
TITLE	Master of Science in Environmental Science			***NCQF LEVEL***	*9*
FIELD	Natural, Mathematical, and Life Sciences	***SUB-FIELD***	Social Sciences/ Environment Management Sciences	***CREDIT VALUE***	*248*
New Qualification			*Review of Existing Qualification*		✓
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:

Leaders in various aspects of environmental science in the country, the Southern African sub-region, Africa, and throughout the world are still in demand as environmental issues are expanding in importance. Postgraduate qualifications (such as this one) to produce scientists with the ability to provide leadership in both academic and professional fields in environmental management are therefore essential. This view was also underscored by the stakeholder advisory team drawn from government ministries and parastatals during an Advisory Board meeting.

First, there is a need to strengthen the relevance of this qualification to Botswana's aspirations and commitments as expressed in the various policy and strategic documents, such as the Education and Training Sector Strategic Plan (ETSSP: 2015-2020) and Human Resource Development Council (HRDC, 2019), Vision 2036 and NDP11. Both the ETSSP and HRDC emphasize the alignment of educational curricula to the needs of the national and international markets. The Department of Environmental Science used its good links with Government Ministries and Departments, parastatals, NGOs, and the private sector to design the qualification aimed at producing the right caliber of cadre to assist the nation towards the attainment of its recently adopted **Vision** 2036, particularly about Pillars 1, 2 and 3:

- **Pillar 1: Sustainable Economic Development**. One of the aspirations here is for the country to have "developed an internationally competitive workforce that is productive, creative and has international exposure" (p.13).
- **Pillar 2: Human and Social Development.** One of the goals here is to have relevant education that "is outcome-based, with an emphasis on technical and vocational skills as well as academic competencies" (p.20).
- **Pillar 3: Sustainable Environment**. This is the environmental sustainability pillar where the objectives include water and energy security, sustainable utilization of natural resources, and land use.

These pillars demand the right kind of human capital coming out of enabling academic and professional qualifications, such as this one. Like its predecessor (Vision 2016), Vision 2036 is essentially about

promoting sustainable development, in general, and sustainable resource utilization and integrated resource management and development, in particular, and these issues are all primary concerns of the discipline of Environmental Science at UB. Thus, through this qualification, the Department will contribute to the production of appropriately qualified high-level human resources to champion the national drive towards sustainable development (Pillar 1) in general and environmental sustainability (Pillar 3). Already graduates of UB's Environmental Science occupy leadership positions in Government Departments dealing with environmental management (e.g., Department of Environmental Affairs, Department of Water Affairs, Department of Lands, Department of Mines, Department of Wildlife and National Parks, and the Department of Forestry and Range Resources). The Department of Environmental Affairs still needs to grow its capacity to implement and monitor National Conservation Strategy projects and the various multi-lateral environmental agreements (MEAs) under its charge, as well as enforce the Environmental Assessment Act (No. 10 of 2011) for all EIA/EMP projects. Graduates of this MSc qualification will have the advanced knowledge, skills, and competences to fill this need. Indeed, one of the institutional outcomes of the EA Act (2011) is the Botswana Environmental Assessment Practitioners Association (BEAPA). Membership of BEAPA requires the kind of environmental assessment expertise to be acquired through the qualification, especially the environmental policy and assessments specialization.

Our graduates are also to be found in several environmental NGOs and consultancy firms, some of which are owned or led by these graduates themselves. It is, therefore, reasonable to expect more consultancy firms to be formed by graduates of this qualification in the future, thereby creating more employment opportunities in the environmental management sector.

Second, Graduates of this MSc qualification will be equipped to play a role in promoting the Southern African Development Community (SADC) Regional Indicative Strategic Development Plan (RISDP) that identifies Environment and Sustainable Development as one of the key interventions areas in fighting poverty and food insecurity. This will be expedited through the SADC protocols on the free movement of persons and goods that will permit the free circulation of human resources within the Region. This qualification will attract international students through the quality and relevance of its career-oriented domains or specializations. The qualification will also produce graduates who can articulate with ease

vertically into any cognate Master of Philosophy/Doctor of Philosophy qualification nationally and internationally. This is because the qualification is relevant and was also benchmarked against some of the strongest environmental science qualifications in the world.

Third, this qualification will contribute to the production of human resources to enable Botswana's meaningful participation in the implementation of the internationally agreed development agenda. Following the conclusion of the Millennium Development Goals (MDG) period in 2015, UN member states agreed to address the succeeding Sustainable Development Goals (SDGs) under "The 2030 Agenda for Sustainable Development". In Botswana, SDGs overlap with aspirations expressed in Vision 2036 and planned for in NDP11 (2017-24). Among the 17 SDGs, the following six are directly linked to **environmental sustainability**, the third pillar of Vision 2036:

- **Goal 2.** End hunger, achieve food security and improved nutrition, and **promote sustainable agriculture.**
- **Goal 6.** Ensure availability and **sustainable management of water and sanitation** for all.
- **Goal 11. Make** cities and **human settlements** inclusive, safe, resilient, and **sustainable.**
- **Goal 12.** Ensure **sustainable consumption** and production patterns.
- **Goal 13.** Take urgent action **to combat climate change and its impacts**; and
- **Goal 15.** Protect, restore, and **promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss.**

The specializations in this MSc qualification answer these international and national priorities and goals in terms of producing human resources with the required knowledge, technical skills, and competencies.

PURPOSE:

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

- Analyze the natural and human complexities and processes that contribute to environmental problems.
- Provide resource management solutions using appropriate natural and human environment methodological approaches or tools.
- Communicate effectively with technical and non-technical stakeholders/audiences about environmental issues at national and global levels via national debates, conferences, or reviewed publications.
- Carry out advanced scientific research on environmental issues and provide leadership in resource management at research institutes, industries, and consulting firms.

ENTRY REQUIREMENTS (including access and inclusion)

The entrance requirements to the MSc (Environmental Science) degree shall be:

NCQF Level 7 (BSc or BA Environmental Science) or any other cognate subjects such as Geography, Wildlife Management, Natural Resources Management, Forestry)

- Recognition of Prior Learning (RPL) shall be considered according to institutional RPL policies

SECTION B	*QUALIFICATION SPECIFICATION*
GRADUATE PROFILE (LEARNING OUTCOMES)	***ASSESSMENT CRITERIA***
COMMON LEARNING OUTCOMES 1. Communicate effectively and ethically knowledge and skills in the area of Geospatial science; Environmental policy and assessment; Sustainable development and climate change and Environmental resources management.	1.1 Evaluate and synthesize knowledge from literature. 1.2 Express and articulate your own opinion on human-physical environment issues. 1.3 Write a logical and well-balanced scientific report. 1.4 Demonstrate skills in project implementation and reporting. 1.5 Formulate and conduct self-directed projects on human-physical environment interactions. 1.6 Critically think, analyze, and present literary and oral skills by preparing the state-of-the-art essays
2. Demonstrate competence in the research process and scholarship (e.g., proposal development, data collection, data analysis, documentation, and communication/publication of results).	2.1 Identify a researchable problem 2.2 Review literature 2.3 Develop research objectives and questions 2.4 Collect data 2.5 Analyze data 2.6 Write the dissertation 2.7 Write journal manuscripts(s) for publication

3. Apply descriptive and inferential analytical statistics to solve human and physical environmental problems.	3.1 Process and present human-environment data in tabular, statistical, and graphic forms. 3.2 Draw conclusions on the interrelationships between human and physical environmental issues
4. Communicate analysis findings in geographic data.	4.1 Interpret geographic data in written, verbal, cartographic, and graphical format 4.2 Draw potential policy implications from quantitative analysis
5. Apply quantitative techniques to the analysis of the biophysical environment and human-biophysical environment-related issues.	5.1 Interpret environmental events after analysis of the data so that they can make informed decisions on environmental system trends. 5.2 Measure physical and human environment indicators to inform policy making.
<u>INTEGRATED ENVIRONMENTAL MANAGEMENT</u> 6. Demonstrate knowledge of how socio-cultural, political, and economic factors interactively enhance the long-term feedback on the environment.	6.1 Evaluate the effectiveness of how each discipline The approach can contribute to better decision making 6.2 Develop an analytical framework on the role of socio-cultural, political, and economic factors in the relationship between human and natural environment

7. Apply to understand of the interrelationships and interactions in nature and the implications for environmental management and sustainability.	7.1 Critique key theories, frameworks, and tools that underpin integrated environmental conservation and management. 7.2 Critically analyze policies from an interdisciplinary Perspective.
8. Resolve the human environment by drawing the linkages between the human and physical environment.	8.1 Assess the anthropological impacts on the environment. 8.2 Develop integrated human-environment frameworks for solve environment issues.
GEOSPATIAL SCIENCES 9. Apply GIS and Remote Sensing technologies and science to the study and analysis of the biophysical environment and human-biophysical environment-related issues.	9.1 Process, analyze and interpret remotely sensed images to produce outputs for integration with other spatial data for instance in a GIS environment. 9.2 Formulate and perform experimental tests to test hypotheses using GIS and Remote sensing data 9.3 Develop image processing, analysis, and interpretation methodologies that respond to social problems, with specific reference to supporting the modeling of environmental problems

10. Resolve human-environment problems using GIS/Remote Sensing and integrated environmental management tools.	10.1 Integrate spatial and non-spatial data to develop solutions to human-environment issues. 10.3 Use remote sensing modes of data collection, data types, limitations, and potential usefulness of this data for environmental applications including inventories, monitoring, and management of natural resources in the private or public sector and research purposes. 10.3 Carry out the image processing in available software to fully analyze and interpret remote sensing data and deliver reports of professional standards on the analysis performed to clients in the private or government sector.
<u>ENVIRONMENTAL POLICY & ASSESSMENTS</u> 11. Formulate and evaluate the impact of policies on natural resources and the environment.	11.1 Differentiate among environmental governance, assessment frameworks, and tools. 11.2 Critique key theories, frameworks, and tools that underpin environmental governance. 11.3 Critically evaluate public policies towards the environment and natural resources within the context of environmental economics.
12. Apply knowledge of environmental governance, assessment frameworks, and	12.1 Examine how environmental governance as a discipline and approach can be used to manage the environment.

tools to solve environmental management issues.	12.2 Integrate human-environment frameworks and policies in developing interventions for environmental management issues. 12.3 Use economic tools to improve resource governance.
13. Analyze the various ecosystem services of the environment using appropriate economic techniques.	13.1 Differentiate between categories of ecosystem services. 13.2 Assess the effectiveness of the different types of economic valuation techniques. 13.3 Apply economic tools to determine optimal resource utilization and environmental management.

14. Determine the value of the various services of the environment using appropriate economic models.	14.1 Apply specific valuation techniques to an existing environmental problem e.g., waste management 14.2 Evaluate public policies towards the environment and natural resources using economic evaluation techniques. 14.3 Predict and evaluate the significant environmental consequences of a proposed action. 14.3.1 Evaluate the costs and benefits of environmental audits.
<u>SUSTAINABLE DEVELOPMENT & CLIMATE CHANGE</u> 15. Demonstrate highly specialised knowledge in a chosen theme of sustainable development and climate change.	15.1 Develop a conceptual framework that links sustainable development to climate change. 15.2 Analyse time series data to generate climate trends 15.3 Evaluate different types and levels of responses to the opportunities and challenges of urban growth on the environment and determine the implications for sustainable development

16. Apply environmental science knowledge to environmental sustainability issues in the industry as advisors or managers (e.g., in the mining, agriculture, manufacturing, technological and hospitality sectors).	16.1 Undertake environmental sustainability assessment using relevant tools and methodologies. 16.2 Assess biophysical and socio-economic sectorial issues and determine how these could be integrated to mitigate the adverse impact of urbanisation on the environment. 16.3 Develop tools and methods for integrating climate change resilience into sustainable development.
17. Design appropriate adaptation and mitigation strategies against the impacts of climate variability and change using knowledge of climate dynamics and socio-ecological systems.	17.1 Distinguish between adaptation and mitigation actions. 17.2 Develop vulnerability maps and indices for adaption and mitigation strategies. 17.3 Develop different climate change scenarios through climate simulation to inform adaptation/mitigation decision-making or policy.
18. Apply knowledge of political-ecological frameworks and models to understand human settlements and populations as well as their relationship with operational environments within rural and urban contexts.	18.1 Analyse how climate change response is shaped by psychological, environmental, and socio-political factors. 18.2 Assess how the climate system dynamics impact the prospects for sustainable livelihoods or development in rural and urban areas. 18.3 Develop models and frameworks for analyzing urbanization as a developmental and environmental issue.

19. Apply knowledge of natural resources availability, sensitivity, and management issues (e.g., of water) in the southern African region and semi-arid environments.	19.1 Engage in critical discussions on several important topics related to natural resources management issues. 19.2 Use deterministic/conceptual and stochastic models to make hydrological predictions and forecasts. 19.3 Interpret hydrological information presented in different ways.
20. Design strategies to manage water resources sustainably.	20.1 Develop integrated tools for sustainable water resource management. 20.2 Initiate an appropriate modeling framework to address key water resources challenges. 20.3 Compute floods/droughts quantiles for hydrological applications.
21. Apply scientific and indigenous knowledge of the land, soils, and range of resources to their sustainable use and integrated environmental management.	21.1 Evaluate the range of potential fields of knowledge on sustainable use and management of environmental resources. 21.2 Integrate scientific and indigenous knowledge frameworks for resource management. 21.3 Quantify the effects of biophysical and chemical processes in soils.

22. Measure environmental pollution and design pollution control strategies.	22.1 Identify and evaluate methodologies to predict toxicity for common environmental pollutants. 22.2 Develop a pollution control index for environmental management. 22.3 Identify various anthropogenic pollution stresses and disturbances on ecosystems. 22.4 Apply management practices to restore /remediate altered ecosystems.

SECTION C	QUALIFICATION STRUCTURE				
COMPONENT	TITLE	Credits Per Relevant NCQF Level			Total Credits
		Level [9]	Level [ ]	Level [ ]	
FUNDAMENTAL COMPONENT Subjects/ Courses/ Modules/Units	NA				
CORE COMPONENT Subjects/Courses/ Modules/Units	Quantitative Techniques in Environmental Science	16			16
	Integrated Environmental Management	16			16
	Research Methodology	16			16
	Research Proposal	30			30
	Dissertation	90			90
ELECTIVE/ OPTIONAL COMPONENT	1. GEOSPATIAL SCIENCE				
	Directed Readings	16			16
	GIS Analytical Methods	16			16

Subjects/Courses/ Modules/Units	*Remote Sensing for Environmental Scientists*	***16***			***16***
	GIS Modeling & Data Management	***16***			***16***
	Advanced Image Processing & Interpretation	***16***			***16***
	Remote Sensing & Spatial Modeling	***16***			***16***
	Digital Cartographic Visualization	***16***			***16***
	OPTIONAL COURSES CREDITS				***80***
	2. ENVIRONMENTAL POLICY & ASSESSMENTS				
	Economic Aspects of Resource utilization and Management	***16***			***16***
	Natural Resource Use Policies	***16***			***16***
	Selected Topics in Environmental Economics	***16***			***16***

	Environmental Assessments and Audits	***16***			***16***
	Environmental Legislation & Compliance	***16***			***16***
	Selected Topics in Environmental Economics	***16***			***16***
	OPTIONAL COURSES CREDITS				***80***
	3. SUSTAINABLE DEVELOPMENT & CLIMATE CHANGE				
	Directed Readings	***16***			***16***
	Sustainable Tourism Development	***16***			***16***
	Agriculture and the Environment	***16***			***16***
	Advanced Climatology	***16***			***16***
	Sustainable Cities and the Environment	***16***			***16***
	Sustainable Wildlife Management	***16***			***16***

	Environmental Hazards & Disaster Management	***16***			***16***
	Climate Change Vulnerability, Impacts, and Resilience	***16***			***16***
	Rural Development & Natural Resource Conservation	***16***			***16***
	Population, Environment & Development	***16***			***16***
	OPTIONAL COURSES CREDITS (SUSTAINABLE DEVELOPMENT & CLIMATE CHANGE) REQUIRED				***80***
	4. ENVIRONMENTAL RESOURCES MANAGEMENT				
	Directed Readings	***16***			***16***
	Advanced Hydrology	***16***			***16***
	Range Resources Management	***16***			***16***
	Applied Environmental Toxicology	***16***			***16***
	Integrated Environmental Resources Management	***16***			***16***

	Water Resources Management	***16***			***16***
	Geomorphology and Environmental Management	***16***			***16***
	Environmental Applications of Soil Science	***16***			***16***
	Land Use Planning & Management	***16***			***16***
	Pollution Control and Resource Recovery	***16***			***16***
	OPTIONAL COURSES CREDITS REQUIRED (ENVIRONMENTAL RESOURCES MANAGEMENT)				***80***

SUMMARY OF CREDIT DISTRIBUTION FOR EACH COMPONENT PER NCQF LEVEL	
TOTAL CREDITS PER NCQF LEVEL	
NCQF Level	***Credit Value***
NCQF Level 9	***248***
TOTAL CREDITS	***248***

Rules of Combination:

(Please Indicate combinations for the different constituent components of the qualification)

1. A student chooses an area of specialization. All students do the core courses within a specialization to attain 48 credits
2. A student then picks 3 modules from the area of specialization and 2 modules from any of the other three specializations. OR all 5 modules can come from an area of specialization to the tune of 80 credits
3. All students accumulate 120 credits from research
4. For a student to graduate, a student should gain 248 credits

ASSESSMENT ARRANGEMENTS
Formative & Summative assessment Part I Coursework assessment: a) MSc-level courses shall be assessed through continuous assessment alone or through a combination of continuous assessment and a final examination at the end of the semester in which they are taken.

b) Continuous assessment shall be based on a combination of essay assignments, seminar presentations, tests, practical/laboratory exercises, etc., the balance of these varying as determined and approved for each course by the Departmental Board (these will appear in the MSc Curriculum Handbook).

c) The final examination of each examined course shall normally take the form of a written paper of three hours duration. The ratio between continuous assessment and examination shall be 1:1. The pass mark for each graded MSc course shall be 55%.

Part II – a) Proposal assessment:

The MSc Research Proposal shall be assessed on a pass/fail basis by the Departmental Board when it is presented at a departmental public seminar. The Board will determine if the proposal presents a) a viable research topic, b) a theoretically and conceptually well-contextualized research problem, c) specific and measurable objectives (with corresponding questions and/or hypotheses) aligned to the research topic and problem, and d) appropriate and sound research design and methods for data generation and analysis. The Departmental Board may require minor or major amendments to the proposal. In case of major amendments, a learner may be required to present the revised proposal to the Board again. Minor amendments shall be done to the satisfaction of the learner's supervisory committee. Only a passed research proposal shall be the basis for dissertation research.

Part II – b) MSc Dissertation assessment:

The MSc Dissertation shall be internally and externally assessed.

Progression:

To proceed to the MSc Research proposal, the learner must have attained a mark of at least 55%.

MODERATION ARRANGEMENTS

1. Internal moderation requirements:

Internal moderation will be carried out in two ways: i) The **moderation of the examination questions** at which point all staff meet to consider the examination questions as prepared by course lecturers. The purpose of this phase is to ensure that questions are clear for the students and have no ambiguities. In addition, the phase ensures that questions demand a state of knowledge that is consistent with the Masters's level (NCQF level 9). Finally, this phase ensures that the examination questions asked broadly cover the course and do not confine themselves to only a section of the course. ii) I**nternal moderation that consists of the exchange of marked examination scripts** among the lecturing staff that co-teach a course. This also ascertains quality by ensuring that there is consistency and validity in the assessment.

iii) Moderation of the Research Proposal has been carried out by the Departmental Board where the student presents the research proposal at a seminar after the guidance and satisfaction/approval of the supervision committee.

2. Internal and external moderation requirements:

The Dissertation is internally and externally moderated by accredited and registered examiners.

RECOGNITION OF PRIOR LEARNING (if applicable)

Credit Accumulation and Transfer (CAT) and Recognition of Prior Learning (RPL) will apply in gaining credits towards the qualification

PROGRESSION PATHWAYS (LEARNING AND EMPLOYMENT)

a) Progression pathways:

Learners in this MSc qualification could progress or articulate horizontally to cognate

- Master of Science in Geospatial Science
- Master of Environmental Science Policy and Assessments

- Master of Science in Sustainable Development and Climate Change
- Master of Science in Environmental Resources Management
- Master of Science Arts in Geography
- Master of Science in Wildlife Management
- Master of Science in Natural Resources Management
- Master of Science in Forestry
- Master of Philosophy in Environmental Science

Vertically, graduates of the qualification could enroll into

- Doctor of Philosophy in Environmental Science
- Doctor of Philosophy in Geography
- Doctor of Philosophy in Wildlife Management
- Doctor of Philosophy in Natural Resources Management
- Doctor of Philosophy in Forestry

b) Employment pathways:

As indicated under section A (rationale and purpose), this qualification is well aligned to national aspirations in the area of sustainable development and environmental sustainability as is reflected in Vision 2036 and NDP 11. From ETSSP and HRDC perspectives, the qualifying learner (graduate) could competently serve in one or more of the following expert positions:

- Remote sensing/GIS specialist
- Geospatial analyst/scientist
- Environmental assessment practitioner
- Environmental consultant
- Environmental policy analyst

- Environmental quality analyst
- Environmental planner
- Environmental economist
- Integrated environmental manager
- Pollution control manager/expert
- Pollution analyst
- Sustainable human settlement planner
- Hydrologist researcher

QUALIFICATION AWARD AND CERTIFICATION

Minimum standards of achievement for the award of the qualification

- The MSc in Environmental Science shall be awarded to a learner after accumulating 248

Certification

The Institution shall issue a certificate bearing the Qualification title as registered on the NCQF.

REGIONAL AND INTERNATIONAL COMPARABILITY

11. REGIONAL & INTERNATIONAL COMPARABILITY

Our online benchmarking exercise revealed that several leading Environmental Science departments in the region and the world are emphasizing specialist qualifications. Examples are to be found at the University of East Anglia (with 2 specializations) where Environmental Science was ranked number one in the UK in 2014 in terms of research impact; and the University of California at Santa Barbara in the USA (with 7 specializations). Within the University of Botswana, the Department of Civil Engineering has also adopted the specialization model for its MSc qualification.

Regionally, the University of Witwatersrand in South Africa offers MSc in Environmental Sciences and MSc (GIS & Remote Sensing); by coursework and research report as at UB. The University of Johannesburg offers MSc (Environmental Management) by course and dissertation (cf. appended comparability matrix – Table 3 below). Within Botswana, BIUST also offers MSc Environmental Sciences over two years as at UB, although it does not emphasize specialist streams within the MSc qualification.
REVIEW PERIOD
Qualification reviews for the department will be done every 5 years.