SECTION A:	***QUALIFICATION DETAILS***																
QUALIFICATION DEVELOPER (S)	Botswana International University of Science and Technology																
TITLE	Bachelor of Engineering (Honors) Civil and Environmental Engineering													***NCQF LEVEL***	*8*		
FIELD	Manufacturing, Engineering and Technology		***SUB-FIELD***	Civil and Environmental Engineering										***CREDIT VALUE***	*642*		
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

PURPOSE:

The purpose of the qualification is to produce graduates who have specialized knowledge, skills, and competences to:

- Identify, formulate, analyse, and solve complex civil and environmental engineering problems creatively and innovatively. Provide civil engineering design, analysis, and problem-solving as well as soft skills in communication, teamwork, management, enterprise, and professional ethics.
- Apply specialized knowledge of mathematics, natural science, engineering fundamentals, and skills to solve civil engineering problems from first principles.
- Perform specialized creative, procedural, and non-procedural civil and environmental engineering design and synthesis of components, systems, and products or processes.

- Design and conduct specialized investigations to inform civil and environmental engineering designs and decision-making.

ENTRY REQUIREMENTS (including access and inclusion)

Minimum entry requirement:

- Certificate IV, NCQF level 4 (BGCSE) or equivalent.

- Access through Recognition of Prior Learning (RPL) and Credit Accumulation and Transfer (CAT) will be provided through ETP policies in line with National RPL and CAT Policies provided the applicant credits are from subfields or domains of learning similar in level to those in civil and environmental engineering.

SECTION B	***QUALIFICATION SPECIFICATION***
GRADUATE PROFILE (LEARNING OUTCOMES)	***ASSESSMENT CRITERIA***
LO 1: Demonstrate specialized knowledge to identify, formulate, analyze, and solve complex civil and environmental engineering problems creatively and innovatively.	1.1. Syntheses and evaluate possible solutions to a civil and environmental engineering problem. 1.2. Identify and apply the best possible method or solution to the problem.
LO 2: Apply specialized knowledge of mathematics, natural science, engineering fundamentals, and skills to solve civil engineering problems from first principles.	2.1. Solve structural defects, calculating loads applied in soils and in water retaining structures. 2.2. Survey and structural Engineering to analyze defects in roads and other structures. 2.3. Impact a range of mathematical principles and natural science concepts during Civil and Environmental Engineering problem investigations. .
LO 3: Perform specialized creative, procedural, and non-procedural civil and environmental engineering design and synthesis of components, systems, and products or processes	3.1. Carry out design, be creative by addition of other components that will improve the overall performance of the structure or system. 3.2. Formulate the design problem, the design brief, and be able to analyze the problem and produce alternative solutions.
LO 4: Design and conduct specialized investigations to inform civil and environmental engineering designs and decision-making.	4.1. Design investigative experiments in accordance with Civil and Environmental Engineering standardized design principles and processes. 4.2. Use appropriate equipment or software for the investigations and experiment in accordance with engineering principles to achieve accurate, precise, and reliable results. 4.3. Conduct tests, experiments, and measurements are conducted, and readings presented in international system Units (S.I) and format that allows analysis. 4.4. Analyze investigational data using the appropriate analysis method and the results or findings

	presented in a format consistent with engineering standard reports.
LO 5: Demonstrate specialized competency to use appropriate Engineering methods skills and tools including those based on Information technology.	5.1. Produce engineering drawings using appropriate software. 5.2. Use appropriate packages or software to model and solve complex civil and Environmental Engineering problems. 5.3. Determine the constraints of scaling up simulated results to the industry level. 5.4. Establish technologies, procedures, and challenges of big data handling and management.
LO 6: Apply specialized skills to communicate effectively, both orally and in writing with engineering audiences as well as with the community.	6.1. Produce engineering reports and drawings that meet professional standards. 6.2. Communicate orally and in writing the impact of any civil engineering work to the public in an appropriate manner.
LO 7: Demonstrate critical awareness of the impact of civil and environmental engineering project activity on the socio-economic, industrial, and physical environment.	7.1. Conduct an Environmental Impact Assessment of the activities related to any civil engineering project. 7.2. Mitigate the; social, economic, safety, health, and environmental impacts of civil engineering projects to ensure legal compliance. 7.3. Produce environmental management plans for civil engineering projects, where necessary.
LO 8: Determine specialized skills to work effectively as an individual, in teams, and in multidisciplinary environments.	8.1. Work effectively in a multidisciplinary team for the delivery of a civil and environmental engineering project. 8.2. Establish good team leadership and project management skills as a team leader through activities like job allocations and time management.

LO 9: Determine specialized skills to engage in independent learning through well-developed learning skills.	9.1. Show autonomy and creativity in planning and executing projects as determined or dictated by the operational environment. 9.2. Adapt culturally and otherwise to the operational environment
LO10: Apply ethical behaviour and conduct in both social and professional setup.	10.1. Show qualities of taking responsibility and exercising judgment in an ethical manner in their activities.
LO11: Demonstrate specialized knowledge and understanding of engineering management principles and economic decision-making.	11.1. Estimate the cost of a project. 11.2. Manage project cash flow in line with attainment of project milestones.

SECTION C		***QUALIFICATION STRUCTURE***				
COMPONENT	***TITLE***	***Credits Per Relevant NCQF Level***				***Total Credits***
		Level [5]	***Level [6]***	***Level [7]***	***Level [8]***	
FUNDAMENTAL COMPONENT *Subjects/ Courses/ Modules/Units*	Pre-calculus	12				12
	Chemistry 1	12				12
	Physics 1	12				12
	Introduction to Computing	12				12
	Introduction to Technical Communication and Academic Literacy.	6				6
	Chemistry 2	12				12
	Physics 2	12				12
	Introduction to calculus	12				12
	Introduction to statistics	12				12
	Technical and Professional Communication	*6*				6

	Professional Communication: Practical Application		*6*			6
	Introduction to Entrepreneurship	6				6
	Research methods for Engineering and Technology		*12*			12
CORE COMPONENT *Subjects/Courses/ Modules/Units*	Engineering Graphics	*12*				12
	Introduction to Engineering	6				6
	Workshop practice	12				12
	Engineering Mathematics I	12				12
	Procedural Programming	12				12
	Applied Mechanics I - Statics	*12*				12
	Fundamentals of Electrical Engineering -I		*12*			12
	Materials Science		*12*			12
	Engineering Mathematics II	*12*				12
	Strength of Materials		*12*			12

	Fluid Mechanics for Civil Engineers	*12*				12
	Engineering Mathematics III		*12*			12
	Construction Materials		*12*			12
	Unit Operations I		*12*			12
	Structural Analysis I		*12*			12
	Geotechnics I		*12*			12
	Hydraulics I		*12*			12
	Earth and its materials		*12*			12
	Environmental Assessment and management		*12*			12
	Hydraulics II		*12*			12
	Traffic Engineering		*12*			12
	Structural Analysis II		*12*			12
	Geotechnics II		*12*			12
	Land Surveying		*12*			12
	Structural Engineering, I			*12*		12

	Structural Engineering II			*12*		12
	Water and Wastewater Treatment Process			*12*		12
	Highway Engineering and Pavement Design			*12*		12
	Hydrology and water resources engineering			*12*		12
	Industrial Training			*36*		36
	Civil Engineering Design Project				*36*	36
	Professional Practices & Ethics				*12*	12
	Design of Water & Wastewater Structures and Distribution Systems				*12*	12
	Civil Engineering Investigational Project				*36*	36
	Construction Management				*12*	12
	Waste Management and Air Pollution Control				*12*	12

ELECTIVE/ OPTIONAL COMPONENT *Subjects/Courses/ Modules/Units*	Economics, Business & Entrepreneurship			*12*		12
	Advanced Chinese Proficient Users 1		*6*			6
	Advanced Chinese for Proficient Users II		*6*			6
	Introduction to Small Business Accounting and Financial Management		*6*			6
	Management and Entrepreneurship Concepts and Principles		*6*			6
	Starting and Sustaining a Business		*6*			6
	Sociology, Technology, and Society			*12*		12
	Risk Management in Science Technology and Engineering.			*12*		12
	Innovation, Intellectual property rights and Commercialization			*12*		12

SUMMARY OF CREDIT DISTRIBUTION FOR EACH COMPONENT PER NCQF LEVEL	
TOTAL CREDITS PER NCQF LEVEL	
NCQF Level	***Credit Value***
5	***204***
6	***210***
7	***114***
8	***120***
TOTAL CREDITS	***642***

Rules of Combination:

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

The proposed qualification requires that a candidate obtain a **minimum of 642 credits:** with

- **618 credits** from core modules.
- **6 credits** from a pool of elective modules at NCQF level 6.
- **12 credits** from a pool of elective modules at NCQF level 7.
- The modules are allocated in the knowledge areas of mathematical sciences, natural sciences, engineering sciences, design and synthesis, complementary studies and work integrated learning.
- **120 credits** should be at NQF level 8.

ASSESSMENT ARRANGEMENTS

All assessments which are leading to the award of the qualification should be based on learning outcomes

and associated assessment criteria.

The recommended weights of the formative assessment shall be at least 50% and shall not exceed 60% of the final marks for that module whilst the recommended weights of the summative assessment will vary from 50% to 40% of the final marks for that module. Some modules are wholly assessed by summative assessment.

A student must demonstrate competence in all the eleven exit level outcomes to graduate.

MODERATION ARRANGEMENTS

Internal Moderation Arrangements:

The assessments will be moderated internally by subject experts within the organization and externally by subject experts outside the institution. Internal moderations will be done prior to external moderation.

External Moderation Requirements:

External moderation is a final check, by external subject experts, that the assessment is at the right standard for the type and level of the qualification. External moderation exercise may lead to a decision to change marks. Each sub-field will have a Substantive External Examiner

Assessment and moderation will be carried out by BQA registered assessors and moderators in line with

BQA/ national policies.

RECOGNITION OF PRIOR LEARNING

Recognition of Prior Learning (RPL) will be considered in the award of the qualification in accordance with applicable the University Recognition of Prior Learning Policy which is aligned to the BQA's Policies.

CREDIT ACCUMULATION AND TRANSFER

Credit transfer will be awarded in accordance with the University Credit Accumulation and Transfer Policy which is aligned to BQA/National policies on the same.

PROGRESSION PATHWAYS (LEARNING AND EMPLOYMENT)

Exit level outcomes ensure that graduates in this qualification have progression pathways that are horizontal, vertical and employment.

Horizontal Pathway

- Postgraduate diploma in business administration
- Postgraduate diploma in financial management
- Postgraduate diploma in human resource management
- Postgraduate diploma in construction management
- Postgraduate diploma in project management

Vertical Pathway

- Master of Business Administration
- Master of Project Management
- Master of Civil Engineering
- Master of Environmental Engineering
- Master of Geotechnical Engineering
- Master of Structural Engineering
- Master of Highway and Pavement Engineering
- Master of Construction Engineering
- Master of Construction Management
- Master of Engineering Management
- Master of Facilities Management
- Masters in Bridge Engineering
- Maters in Railway Engineering

Employment

- Civil Engineers
- Road Engineers
- Bridge Engineers
- Water Engineers
- Environmental Engineers
- Structural Engineers

- Geotechnical Engineers
- Construction Engineers
- Managers
- Railway Engineers

QUALIFICATION AWARD AND CERTIFICATION

The qualification requires that a candidate pass all the core modules (630 credits) and obtain a minimum of 18 credits from elective modules for an overall 648 credits. At least 120 credits should be at NQF level 8.

Certification

Candidates meeting prescribed requirements will be awarded Bachelor's Honors Degree in Civil and Environmental Engineering (BEng Hons).

REGIONAL AND INTERNATIONAL COMPARABILITY

The proposed qualification meets the minimum requirements of the Engineering Council of South Africa (ECSA) which in turn is accredited by the Washington Accord. It is therefore comparable to most qualifications in South Africa, Australia, Canada, Chinese Taipei, Hong Kong China, India, Ireland, Japan, Republic Korea, Malaysia, Russia, New Zealand, Singapore, Sri Lanka, Turkey, United Kingdom, and The United States of America. The table below shows the comparability of this qualification with other local and regional qualifications. The proposed qualification offers the largest component of water and environmental engineering courses to meet its target of addressing challenges of diminishing water resources and assuring a water-secure nation and addresses issues concerned with environmental degradation. In addition, all sections of civil engineering at the proposed qualification offer credits that are comparable with those from similar universities. This allows students from proposed qualifications to choose to work as specialized environmental engineers or as general civil engineers.

Section in Civil Eng	Sample of some Leading Universities of Africa and Europe					
	University of Witwatersrand (South Africa)	University of Cape Town (UCT) (South Africa)	University of Kwazulu Natal (South Africa)	University of Aberdeen (the U.K.)	Leeds University (the U.K.)	proposed qualification

Environmental Engineering	87	90	72	60	65	**108**
Structural Eng	81	48	64	105	90	48
Geotechnical Eng	36	32	16	30	20	24
Transportation Eng	15	34	24	30	30	24
Construction materials	36	16	8	15	50	12
Projects	54	72	48	45	-	72
Other modules	306	292	328	240	205	360
Total	**615**	**584**	**560**	**525**	**460**	**648**

It can be observed from the Table above, which lists a sample of five leading Universities from Africa and Europe, the Qualifications offered by all of them are comparable to the proposed qualification.

But on a critical assessment, many of them have fewer environmental engineering components compared to the proposed qualification while Core courses such as structural design, strength of materials, structural analysis mechanics, hydrology, water engineering, and hydraulics are covered in all the qualifications. Most qualifications do not have components that relate to issues on solid waste management, air pollution, and environmental impact assessment which are now offered in the proposed qualification which will make students meet all aspects of environmental management for sustainable development.

Again, while UCT qualification offers a course on Introduction to Environmental Assessment & Management besides the Design project and Research projects which are offered in the final year bear a comparable to the structure proposed in our proposed qualification.

Though at UCT flexibility is provided for a student during the first year of study to change their qualification to a 5 year one like the one proposed by us, the student has to complete a minimum of 584 credits for graduation (close to our proposed structure).

On the contrary, Aberdeen University qualification while is loaded with a variety of courses from civil engineering or otherwise (with courses on structural engineering dominating the scene), covers only a few Environmental engineering components amounting to only 60 credits.

Similarly, Leeds university qualification has fewer environmental engineering courses compared to the proposed qualification.

Overall, a student has to complete a total of 648 credits to earn the proposed qualification. To maintain the quality of the program, a candidate has not only to earn the credit requirement prescribed for each level but also has to attain a specific level of the outcome at the exit (ELO) through the required competency and skills envisaged in the program.

Because of the above, graduates from proposed qualifications can therefore easily get employed to embark on environmental issues without any reservations from the industry. In addition to these, since qualifications from South African universities are all accredited by ECSA meaning that they are under Washington accord and those from Scotland, England, and Wales by their respective accreditation bodies; widens the chances of successful graduates with international employability

REVIEW PERIOD

Every (5) years.