

Curriculum

for the Master Programme in

Water Management and Environmental Engineering

Programme Classification No. 066 447

Effective Date: October 1st, 2019



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<p style="text-align: center;">Curriculum of the Master Degree Programme “Water Management and Environmental Engineering” At the University of Natural Resources and Life Sciences, Vienna</p>
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As at October 1st, 2019

§ 1 QUALIFICATION PROFILE

The Master programme in Water Management and Environmental Engineering is a degree programme which serves to deepen and extend students' pre-vocational academic education, building on the basis provided by a Bachelor degree programme (§ 51 [2] item 5 of the Universities Act UG 2002, Federal Law Gazette BGBl I no. 81/2009). The programme fulfils the requirements of Directive 2005/36/EC on the recognition of professional qualifications, article 11, letter e.

The Master degree programme allows students to consolidate their knowledge of the areas and working practices within the applied sciences and their engineering-related applications. This study programme is aimed at enabling the use of the natural resource water by humans as well as ensuring its provision, diagnosing natural hazards and developing solutions for the protection and management of natural hazards.

The Master study programme is designed as a programme in English. This means that all courses are offered in English. Students' achievements such as exams, seminar papers and the Master's Thesis therefore have to be completed in English. Consequently, adequate competences of the English language are obligatory.

The Master study programme offers two specialisation options:

1. Water Management and Engineering
2. Mountain Risk Engineering

These specialisations are explicitly stated in the final degree document.

1a) Knowledge and Personal and Professional Skills

Water management aims at the sustainable use and safeguarding of the resource water. Thereby, it finds itself in an area of conflict of economic and ecologic objectives. The understanding of the water circle has to be the basis for all water management measures. It is imperative that the multifaceted functions of the natural potential water in its interplay with the soil is used and protected in the most perfect and purposeful way. Furthermore, it needs to be sustainable safeguarded for our livelihood. It gets harder and harder to provide the adequate quantity of water and, in particular, to also ensure sufficient water quality. Therefore, the focus on exceedingly complex ecological interrelationships and interdependencies gets more and more important.

For this professional training, a good basic scientific knowledge is required, in addition to a comprehensive understanding of the sustainable use of resources and a logical mind for responsible planning, design, construction and maintenance.

During the Master degree programme graduates of “Water Management and Environmental Engineering” acquire knowledge and skills in the areas of hydrology, water management planning, constructive hydraulic engineering and river management, cultural water and groundwater management, settlement water management, industrial water management and water protection, hydrobiology and water ecology, waste management.

In the field of Mountain Risk Engineering the identification of geo risks and the development of safety measures are essential. Thereby, special significance is given to the usages of integrative methods for risk management. Special expertise on alpine mass transportation, description and modeling of these processes and the technical constructions of safety measures are gained.

Graduates of the Master study programme Water Management and Environmental Engineering acquire the theoretical and practical knowledge in the fields of planning, administration and economy necessary for successful working. Within the framework of the university education communication, coordination and management skills are acquired. Activities such as mobility, improvement of language skills and internationality are promoted in the Master study programme and help students gain further competences for international occupational activities.

1b) Professional Qualifications

The versatility of this education opens the following fields of work for graduates:

- In commercial enterprises: as consulting engineers and in planning agencies, in industry and trade, in consulting offices, etc. ...
- In the services sector: in research and testing institutions, in planning agencies, engineering offices, etc. ...
- In administration and education: in the public sector (federal ministries, governments and district administration), as appraiser
- In development cooperation
- In international organisations including EU organisations

§ 2 ADMISSION REQUIREMENTS

Graduates of the Bachelor programme in Environmental Engineering offered by BOKU University of Natural Resources and Life Sciences are eligible for admission with no further requirements.

Graduates of other Bachelor degrees who wish to take the Master degree in Water Management and Environmental Engineering must be able to demonstrate a fundamental, equivalent knowledge of the central subjects taught as part of the Bachelor degree in Environmental Engineering. In detail, it deals with those designated courses stated in the areas of natural scientific basic principles, technical and subject-specific basic principles, social sciences, economics, law and the vocational compulsory subjects (culture-technical core area).

For graduates of Bachelor programmes completed at other universities, mastery of the following learning outcomes is required for admission:

- (1) Basic knowledge in natural sciences: Mathematics, statistics, physics, chemistry, geology, soil science and botany, hydrobiology
- (2) Basic knowledge in technical sciences: Geometry, mechanics, statics and strength of materials, surveying, structural design, geotechnics, geoinformation
- (3) Basic knowledge in environmental engineering: hydraulics, hydrology, river basin management, hydraulic engineering, settlement water management, hydrology,

waste management, transport, rural water management, spatial planning and construction economics

Students are directly entitled to admission to the study programme if they can provide proof of 20 ECTS credits each in all three areas.

Furthermore, competences in English at a level of B2 (according to the Common European Framework of Reference for Languages by the Council of Europe) are a precondition.

§ 3 PROGRAMME STRUCTURE

3a) Duration, Total ECTS Credits and Structure

The programme consists of courses and other requirements worth a total of 120 ECTS credits. This is equivalent to a duration of four semesters (a total of 3,000 60-minute credit hours). The programme is divided into

Compulsory courses:	32 ECTS credits, including
Master's seminar:	2 ECTS credits
Elective courses:	46 ECTS credits (thereof 30 ECTS obligatory courses)
Free electives:	12 ECTS credits (thereof 3 ECTS practical training optional)
Master's Thesis:	30 ECTS credits

Detailed Structure of the Study Programme:

Compulsory Basic Subjects

Basic Subjects	12 ECTS credits
Complementary Subjects	12 ECTS credits
Engineering Project	6 ECTS credits
Master's seminar	2 ECTS credits

Specialisations

1. *Water Management and Environmental Engineering (WME):*

5 sectoral subjects to the extent of 30 ECTS credits have to be completed (each of the sectoral subjects is worth 6 ECTS credits).

Sectoral subjects 30 ECTS credits

For the specialisation in Water Management and Environmental Engineering at least 3 sectoral subjects have to be chosen from "*Sanitary Engineering*", "*Rural Water Management*", "*Hydrology and Water Management*" and "*Hydraulic Engineering and River Basin Management*".

or

2. Mountain Risk Engineering (MRE):

5 sectoral subjects to the extent of 30 ECTS credits have to be completed (each sectoral subject is worth 6 ECTS credits).

Sectoral subjects

30 ECTS credits

For the specialisation in Mountain Risk Engineering the sectoral subjects "*Mountain Hazard Processes*", "*Mitigation Measures for Mountain Hazards*" and "*Risk Management*" are compulsory.

Elective Specialisation Subjects

16 ECTS credits

have to be chosen out of the 5 sectoral subjects!

Elective Subjects

12 ECTS credits

(incl. Practical Training)

3 ECTS credits)

Master's Thesis

30 ECTS credits

Total

120 ECTS credits

3b) Three-Pillar Principle

The three-pillar principle is one of the central identifying characteristics of both the Bachelor and Master programmes offered at the University of Natural Resources and Life Sciences, Vienna. In the Master programmes, the sum of the compulsory and elective courses must be made up of at least

15% technology and engineering

15% natural sciences

15% economic and social sciences, law

The Master's Thesis, compulsory internship and free electives are excluded from the three-pillar rule.

3c) Limited Number of Participants in Courses

For courses with a limited number of participants the head of the Master course is authorised to first admit students enrolled in the Master programme (that means that students enrolled in a Bachelor study programme can only be admitted to the courses if further spaces are left on the course!) The admission of students enrolled in the Master study programme is conducted according to the following order of required courses by the students: compulsory course, elective course, free elective course.

§ 4 COMPULSORY COURSES

Used Abbreviations:

ECTS = European Credit Transfer System points

WS = Winter Semester

SS = Summer Semester

Notes:

¹⁾ In English

²⁾ In English and German

³⁾ In German

⁴⁾ Courses not offered in the academic year 2019/20

The following compulsory courses to the extent of 32 ECTS credits are required to complete the Master programme:

Course Number	Course Title	Semester	Course Type	ECTS Credits
	Basics			
815340	Lecture series in soil, water and atmosphere ¹	WS	VO	3.0
851311	Environmental statistics ¹	SS	VU	3.0
731370	Operations research and system analysis ¹	SS	VU	3.0
816333	International law and cooperation development ¹	WS	VO	3.0
	Complementary Subjects			
857321	Remote sensing and GIS in natural resource management ¹	WS	VO	3.0
873320	Geotechnics ¹	SS	VO	3.0
872330	Hydrogeology ¹	WS	VU	3.0
875330	Planning and design / conceptual design ²	WS	VO	3.0
	Engineering Project			
810301 870305	Structural exercises ¹ *)	WS or SS	UE	6.0
	Master's Seminar			
	Master's thesis seminar ¹		SE	2.0

*) For the specialisation in Water Management and Environmental Engineering the **Engineering project has to be chosen from the 4 sectoral subjects** “Sanitary Engineering”, “Rural Water Management”, “Hydrology and Water Management” and “Hydraulic Engineering and River Basin Management”.

For the specialisation in Mountain Risk Engineering the **Engineering project has to be chosen from the 3 sectoral subjects** “Mountain Hazard Processes”, “Mitigation Measures for Mountain Hazards” and “Risk Management”.

§ 5 ELECTIVE COURSES

Elective courses worth a total of 46 ECTS credits are required to complete the Master programme. These are structured in 11 specialist division units. Once a unit is chosen the completion of 6 ECTS points each is compulsory. 5 sectoral subjects have to be chosen!

For the specialisation in Water Management and Environmental Engineering at least 3 sectoral subjects have to be chosen from “*Sanitary Engineering*”, “*Rural Water Management*”, “*Hydrology and Water Management*” and “*Hydraulic Engineering and River Basin Management*”.

For the specialisation in Mountain Risk Engineering the sectoral subjects “*Mountain Hazard Processes*”, “*Mitigation Measures for Mountain Hazards*” and “*Risk Management*” are compulsory. Additionally 16 ECTS credits from the elective courses have to be completed.

Detailed Structure of the Sectoral Subjects:

1. Sanitary Engineering

Course Number	Compulsory Courses	Semester	Course Type	ECTS Credits
	Course Title			
811362	On site solutions for water supply and sanitation ¹	WS	VO	3.0
811358	Planning and design in water supply and wastewater treatment ¹	SS	UE	3.0

Course Number	Elective Courses	Semester	Course Type	ECTS Credits
	Course Title			
811354	Case studies in sanitary engineering ¹	WS	SE	3.0
811360	Modelling in sanitary engineering (sewer, treatment plant and receiver) ¹	WS	VU	4.5
811363	Industrial water management ¹	SS	VO	3.0
811332	Water resources management in developing co-operation ¹	SS	VU	3.0
811357	Biology, chemistry and microbiology for civil engineering ¹	SS	VU	3.0

2. Rural Water Management

Course Number	Compulsory Courses	Semester	Course Type	ECTS Credits
	Course Title			
815342	Rural water management (advanced) ¹	SS	VO	3.0
815321	Soil conservation and soil protection ¹	WS	VU	3.0

Course Number	Elective Courses	Semester	Course Type	ECTS Credits
	Course Title			
815320	Soil water management ¹	WS	VO	3.0
815322	Soil erosion models and their application ¹	WS	VU	4.5

815329	Selected methods of soil analysis ²	SS	PR	4.0
815311	Simulation in vadose zone environment ¹	WS	VU	3.0
815319	Irrigation design ¹	WS	VU	3.0

3. Hydrology and Water Management

Course Number	Compulsory Courses	Semester	Course Type	ECTS Credits
	Course Title			
816334	Hydrological processes and modelling ¹	WS	VU	3.0
816338	Water resources planning and management ¹	WS	VO	3.0

Course Number	Elective Courses	Semester	Course Type	ECTS Credits
	Course Title			
819336	Integrated flood risk management ¹	WS	VO	3.0
816347	Application of GIS in hydrology and water management ¹	SS	VO	3.0
816343	Environmental risk analysis and management ¹	SS	VO	3.0
816342	Possible impacts of climate change on water resources ¹	SS	VO	3.0
816325	Flood forecasting and flood protection ¹	SS	SE	3.0
816305	Seminar in surface hydrology ³	SS	SE	3.0
816303	Seminar in groundwater management ¹	WS	SE	3.0
816351	Hydrometric and river engineering field exercises ³	SS	PR	4.5

4. Hydraulic Engineering and River Basin Management

Course Number	Compulsory Courses	Semester	Course Type	ECTS Credits
	Course Title			
819301	Hydraulic engineering and river basin management ¹	WS	VO	3.0
819339	Sediment regime and river morphology ¹	SS	VO	3.0

Course Number	Elective Courses	Semester	Course Type	ECTS Credits
	Course Title			
819340	Ecologically oriented methods and monitoring in river engineering ¹	SS	VU	3.0
819332	Computer based river modelling ¹	WS	VU	3.0
816351	Hydrometric and river engineering field exercises ³	SS	PR	4.5
819318	Monitoring in river engineering ³	SS	VO	3.0

5. Aquatic Ecology and Wetland Management

Course Number	Compulsory Courses	Semester	Course Type	ECTS Credits
	Course Title			
812347	Human impacts in riverine landscapes ¹	WS	VO	2.0
812384	Aquatic biomonitoring and -assessment ¹	WS	VO	2.0
812349	Ecological river landscape management ¹	WS	VO	2.0

Course Number	Elective Courses	Semester	Course Type	ECTS Credits
	Course Title			
812358	Benthic invertebrate status assessment ¹	SS	VU	3.0
812357	Benthic invertebrate sampling and monitoring ¹	SS	VU	3.0
812344	Ecology of fishes ¹	WS	VO	3.0
812350	Applications in river landscape management ¹	WS or SS	VX	2.0
812380	Multi-scale modelling and system dynamics in aquatic ecosystems ¹	SS	VU	2.0
831301	Ecology of aquatic plants ¹	SS	VU	2.0

6. Water Management in Developing Countries

Course Number	Compulsory Courses	Semester	Course Type	ECTS Credits
	Course Title			
731333	Globalisation and rural development ¹	SS	VO	3.0
811332	Water resources management in developing co-operation ¹	SS	VU	3.0

Course Number	Elective Courses	Semester	Course Type	ECTS Credits
	Course Title			
811334	Risk assessment in the aquatic environment ¹	WS	VU	3.0
811362	On site solutions for water supply and sanitation ¹	WS	VO	3.0
811308	Appropriate technologies for water supply & sanitation in developing countries ¹	SS	VO	3.0
815308	Selected topics of hydraulics and rural water management ^{1,4}	SS	VO	3.0
911343	In-situ treatment of polluted soils and sediments: phytoremediation, in-situ fixation and attenuation techniques ¹	SS	UE	3.0
874300	Soil-bioengineering techniques (slopes and gullies) ¹	SS	VS	3.0
169317	Participatory methods in development research and practice ¹	SS	SE	3.0

7. Waste Management

Course Number	Compulsory Courses	Semester	Course Type	ECTS Credits
	Course Title			
813300	Global waste management I ¹	WS	VO	3.0
813301	Global waste management II ¹	SS	VO	3.0

Course Number	Elective Courses	Semester	Course Type	ECTS Credits
	Course Title			
813307	Waste management seminar ¹	WS	SE	4.5
813303	Planning and assessment of waste management systems ¹	SS	VU	3.0
813304	Life cycle management ¹	SS	VO	2.0

8. Economy and Law

Course Number	Compulsory Courses	Semester	Course Type	ECTS Credits
	Course Title			
731348	Managerial economics ¹	WS	VU	3.0
731328	Valuation methods for natural resources ¹	SS	VO	3.0

Course Number	Elective Courses	Semester	Course Type	ECTS Credits
	Course Title			
731325	Principles of commodity markets and trade policy ¹	SS	VO	3.0
731335	Game theory in environmental and natural resource management ¹	WS	VO	3.0
731324	Resource and environmental economics ¹	SS	VO	3.0
732326	Institutions and policies of the EU (Introduction to the law and politics of the European union) ^{1, 4}	SS	VO	3.0
731347	Rural development ¹	SS	VO	3.0
169306	Negotiating change: Simulating an international conference for sustainable development ¹	WS	VS	3.0

9. Mountain Hazard Processes

Course Number	Compulsory Courses	Semester	Course Type	ECTS Credits
	Course Title			
871324	Mountain hazard processes ¹	WS	VX	6.0

Course Number	Elective Courses	Semester	Course Type	ECTS Credits
	Course Title			
871303	Rock fall ¹	WS	VS	1.5
871328	Snow and avalanches ¹	WS	VX	3.0
871358	Dynamics of geophysical flows ¹	WS	VS	3.0
912314	Mountain forest climatology and headwater hydrology ¹	WS	VU	4.5

10. Mitigation Measures for Mountain Hazards

Course Number	Compulsory Courses	Semester	Course Type	ECTS Credits
	Course Title			
871327	Mountain risk engineering ¹	SS	VX	6.0

Course Number	Elective Courses	Semester	Course Type	ECTS Credits
	Course Title			
916326	Management and forest protection in high altitude afforestations and protective forests ¹	SS	VX	3.0
874300	Soil-bioengineering techniques (slopes and gullies) ¹	SS	VS	3.0
819340	Ecologically oriented methods and monitoring in river engineering ¹	SS	VU	3.0
913327	Fire management in mountain forest ecosystems - prophylaxis and control ¹	SS	VS	2.0

11. Risk Management

Course Number	Compulsory Courses	Semester	Course Type	ECTS Credits
	Course Title			
871360	Risk management and vulnerability assessment ¹	WS	VS	3.0
871331	Cost/benefit analysis ^{1,4}	SS	VO	3.0

Course Number	Elective Courses	Semester	Course Type	ECTS Credits
	Course Title			
857320	Remote sensing and GIS in natural resource management ¹	WS	UE	3.0
819336	Integrated flood risk management ¹	WS	VO	3.0
811334	Risk assessment in the aquatic environment ¹	WS	VU	3.0
871332	Disaster management ¹	WS	VO	2.0
816343	Environmental risk analysis and management ¹	SS	VO	3.0

§ 6 FREE ELECTIVES

Free electives worth a total of 12 ECTS credits are required to complete the Master programme. Free electives may be selected from all courses offered by all recognized universities in Austria and abroad. Free electives are intended to impart knowledge and skills in the

student's own academic subject as well as in fields of general interest. It is recommended to choose elective courses from the sectoral subjects.

§ 7 COMPULSORY INTERNSHIP

In the course of the Master study programme Water Management and Environmental Engineering no compulsory internship has to be completed. The internship is intended to help students improve the skills acquired in their degree programme. It is also intended to encourage students to learn to apply what they have learned in practice, and recognize relationships between theory and practice.

The internship shall be at least 3 weeks in duration and will be awarded 3 ECTS credits in the form of an internship seminar (free elective). This requires the submission of a brief report on the practical experience as well as the employer's written confirmation of the completed training.

§ 8 MASTER'S THESIS

A Master's Thesis is a paper on a scientific topic, to be written as part of a Master degree programme (for exceptions please see the By Laws of the University of Natural Resources and Life Sciences, Vienna, part III- Teaching, § 30[9]). The thesis is worth a total of 30 ECTS credits. With their Master's Thesis, students demonstrate their ability to independently address a scientific topic, both thematically and methodologically (§ 51 [8] UG 2002 BGBl. I no. 81/2009).

The topic of a Master's Thesis shall be chosen in such a way that it is reasonable to expect a student to be able to complete it within six months. Multiple students may jointly address a topic, provided that the performance of individual students can be assessed (§ 81 [2] UG 2002 BGBl. I no. 81/2009).

The Master's Thesis shall be written in English. The thesis defence must be held in English.

§ 9 COMPLETION OF THE MASTER PROGRAMME

The Master programme in Water Management and Environmental Engineering has been completed when the student has passed all required courses and received a positive grade on the Master's Thesis and defence examination.

§ 10 ACADEMIC DEGREE

Graduates of the Master programme in Water Management and Environmental Engineering are awarded the academic title *Diplomingenieur* (m) or *Diplomingenieurin* (f), abbreviated as Dipl.-Ing./ Dipl.Ing.ⁱⁿ or DI/DIⁱⁿ. The academic title Dipl.-Ing./Dipl.Ing.ⁱⁿ or DI/DIⁱⁿ, if used, shall precede the bearer's name (§ 88 [2] UG 2002 BGBl. I no. 81/2009).

§ 11 EXAMINATION REGULATIONS

(1) The Master programme in *Water Management and Environmental Engineering* has been completed successfully when the following requirements have been met:

- positive completion of compulsory courses worth a total of 32 ECTS credits (§ 4)
- positive completion of elective courses worth a total of 46 ECTS credits (§ 5)
- positive completion of free electives worth a total of 12 ECTS credits (§ 6)
- a positive grade on the Master's Thesis and the defence examination
-

(2) Student evaluation takes the form of course and module examinations. Course examinations can be either written or oral, as determined by the course instructor, taking the ECTS credit value of the course into account. Any prerequisites for admission to examinations shall be listed in § 4 under the respective course/module.

(3) The choice of examination method shall be based on the type of course: Lectures shall conclude with a written or oral examination, if continuous assessment of student performance is not applied. Seminars and project-based courses can be evaluated based on independently written papers, length and contents of which are determined by the course instructor. For all other course types, the examination type is at the instructor's discretion.

(4) The topic of the Master's Thesis shall be selected from one of the subjects of the Master programme. The student must inform the dean in writing prior to the commencement of the work on the Master's Thesis. Thereby, the student has to state the Master's Thesis topic as well as the name of the supervisor of the Master's Thesis.

(5) The completed Master's Thesis which has been assessed positively by the supervisor shall be publically presented by the student and defended in the form of an academic discussion (defence examination) after successful completion of all courses. The committee shall consist of a committee chair and two additional university lecturers with a *venia docendi* or equivalent qualification. The student's total performance (thesis and defence examination) will be assigned a comprehensive grade. Both thesis and defence examination must receive a passing grade for the student to complete the programme. The written evaluations stating the grounds for the thesis grade and the defence examination grade are included in calculating the comprehensive grade and are documented separately.

The comprehensive grade is calculated as follows:

- Master's Thesis: 70%
- Defence examination (incl. presentation): 30%

(6) A comprehensive evaluation of the student's performance on the entire programme shall be assigned. A comprehensive evaluation of "passed" means that each individual component of the programme was completed successfully. If individual components of the programme have not been successfully completed, the comprehensive evaluation is "failed". A comprehensive evaluation of "passed with honours" is granted if the student has received no grade worse than a 2 (good) on all individual components, and if at least 50% of the individual components were graded with 1 (excellent).

§ 12 TRANSITIONAL PROVISIONS

For students in the new Master's curriculum, examinations for courses listed in § 4 and § 5, which have been taken under the provisions of another Master programme, shall be recognized towards the programme under this curriculum.

§ 13 EFFECTIVE DATE

This curriculum shall take effect on October 1st, 2019.

ANNEX A TYPES OF COURSES

The following types of courses are available:

Lecture (VO)

Lectures are courses in which certain areas of a subject and the methods used in this area are imparted through didactic presentation.

Lab Course (UE)

Lab courses are courses in which students are instructed in specific practical skills, based on theoretical knowledge.

Practical Course (PR)

Practical courses are classes in which students deal with specific topics independently, based on previously acquired theoretical and practical knowledge.

Compulsory Internship Seminar (PP)

The compulsory internship seminar is a class in which students deal independently with topics related to their internship placements, based on previously acquired theoretical and practical knowledge.

Seminar (SE)

Seminars are courses in which students are required to work independently on the respective subject, deepen their knowledge of the topic and discuss relevant issues.

Field Trips (EX)

Field trips are courses in which students have the opportunity to experience relevant fields of study in real-life practical application, to deepen their knowledge of the respective subject. Field trips can be taken to destinations both in Austria and abroad.

Master's Thesis Seminar (MA)

Master's Thesis seminars are seminars intended to provide students with academic support during the thesis writing process.

Mixed-Type Courses

Mixed-type courses combine the characteristics of the courses named above (with the exception of project-type courses). Integration of different course-type elements improved the didactic value of these courses.

Project Course (PJ)

Project courses are characterized by problem-based learning. Under instruction, students work (preferably in small groups) on case studies, applying appropriate scientific methods.

Lecture /Seminar (VS)

Lecture/Lab (VU)

Lecture/Field Trip (VX)

Seminar/Field Trip (SX)

Lab/Seminar (US)

Lab/Field Trip (UX)

Lecture/Seminar/Excursion (VY)