WATERMINING

Hydrogeology Engineering MSc

2022/23 I. félév

TANTÁRGYI KOMMUNIKÁCIÓS DOSSZIÉ

Miskolci Egyetem
Műszaki Földtudományi Kar
Környezetgazdálkodási Intézet

Tartalomjegyzék

1. Tantárgyleírás, tárgyjegyző, óraszám, kreditérték

Course Title: Watermining **Instructor(s):** Rita Miklós, assistant research fellow; Dr. Márton Tóth, senior lecturer	**Code:** MFKHT740021 **Responsible department/institute:** Institute of Environmental Management
	Type of course: Compulsory
Position in curriculum (which semester): 3	**Pre-requisites (if any):** -
No. of contact hours per week (lecture + seminar): 2+0	**Type of Assessment (examination/ practical mark / other):** exam
Credits: 3	**Course:** full time

Course Description:
The students shall be acquainted with the design, drilling, construction and operation of groundwater wells. The curriculum discusses other type of water production installations. The students will be competent in designing a drilled groundwater well and preparing the documentation for the technical and legal permission of the well. Production techniques, operation and maintenance of groundwater wells close the curriculum.

The short curriculum of the subject:
Selection of drilling technique and its main aspects, influencing factors in drilling operations, Classification of groundwater wells, applied well designs, types and classification of well screens, design and requirements of well screens, materials of well screens, screen installation techniques, installation of groundwater well, measurements in operating wells, well maintenance and repair, Well design project.
Practical work: self-made solutions of simple case-study problems.

Compatencies to evolve:
Knowledge:
T1 – It includes knowledge of hydrogeology, water resource management, water quality protection, water treatment, production and waterworks operat
T2 – Extensive knowledge of hydrogeological assessment and monitoring techniques related to watershed approach and considers ecological water demands.
T4 – Have a working knowledge of computer-aided design and analysis
T7 – Have knowledge of a wide range of problem-solving techniques for research or academic work.
T8 – Have general and specialist management skills to manage complex design work.
Ability:
K1 – Ability to understand the laws and relationships related to the location, movement and quality of groundwater, to apply and put into practice the knowledge acquired, and to use problem-solving techniques.
K4 – Ability to effectively apply water production techniques and knowledge of modern well construction technologies.
K5 – Ability to apply design, knowledge and technologies related to water supply and water treatment at a high level.
K7 – Prepared to identify and solve geotechnical problems.
K8 – Able to solve mining and pit dewatering problems at a high level
K9 – Ability to model hydrodynamics and transport of groundwater flow systems
K10 – Prepared to effectively apply relevant national and European professional, environmental and conservation legislation
K12 – Ability to work in compliance with EU legislation, to cooperate with foreign partners to solve the tasks required by the EU Water Framework Directive
K14 – Ability to lead and participate in complex design work and project management in water management and water supply
Attitude:
A7 – Adhere to and comply with health and safety, environmental protection, quality assurance and

control requirements.
A9 – In addition to his technical and engineering background, he also has an interest in science.
Autonomy and responsibility:
F2 – Have a responsible attitude towards the environment.
F5 – Committed to sustainable natural resource management practices.

Assessment and grading:

Students will be assessed with using the following elements.

Attendance:	15 %
Short quizzes	10 %
Midterm exam	40 %
Final exam	35 %
Total	100%

Grading scale:

% value	Grade
90 -100%	5 (excellent)
80 – 89%	4 (good)
70 - 79%	3 (satisfactory)
60 - 69%	2 (pass)
0 - 59%	1 (failed)

Compulsory or recommended literature resources:

- Achmed N., Taylor S. W., Sheng Z.: Hydraulics of wells: design, construction, testing, and maintenance of water well systems, American Socity of Civil Engineers, 2014
- Aler L.: Handbook of suggested practices for the design and istallation of ground-water monitoring wells, National water well association, 1989.
- Bloetscher F., Munitz A., Largey J.:Siting, drilling and contruction of water supply wells, American Water Works Association, 2007.
- State coordinating committe on Ground water: State of Ohio Technical Guidance for Well Construction and Groundwater Protection, USA 2000
- F. G. Driscoll: Groundwater and Wells I. II. III., Johnson Division, St. Paul Mn, 1990, USA
- K. Neven (ed): Groundwater Hydrology of Springs: Chapter 2, Chapter 9: 9.1, 9.2, 9.3.
- Jacques W. Delleur (ed.): The handbook of groundwater engineering. CRC Press LLC. 1999, Indiana: Chapter 9: 9.5, 9.6.

2. TANTÁRGYTEMATIKA

Watermining.
Tantárgytematika (ÜTEMTERV)
Aktuális tanév őszi félév
Hydrogeology Engineering MSc, 3. félév, törzsanyagos tárgy

Week of semester	Date	Planned topic	Activity/Assignment
1.	Sept 5, 2022	**Release of Task 1** *Terminology – Well design, basics*	
2.	Sept 12, 2022	**Release of Task 2** *Terminology - Great depth well design*	
3.	Sept 19, 2022	Consultation of Task 2 Deadline of Task 1	
4.	Sept 26, 2022	Consultation of Task 2 *Terminology – Surface water utilization*	
5.	Oct 3, 2022	Consultation of Task 2 *Terminology – Springs*	
6.	Oct 10, 2022	Consultation of Task 2 *Terminology – Waterwells*	
7.	Oct 17, 2022	*Terminology - Introducing a mine dewatering system*	
8.	Oct 24, 2022	Deadline of Task 2 **Release of Task 3**	
9.	Oct 31, 2022	Holiday	
10.	Nov 7, 2022	Consultation of Task 3	
11.	Nov 14, 2022	Test Consultation of Task 3	
12.	Nov 21, 2022	Retake of test I. Consultation of Task 3	
13.	Nov 28, 2022	Deadline of Task 3	
14.	Dec 5, 2022	Retake of test II.	

3) MINTA ZÁRTHELYI

Watermining c. tárgy zárthelyi dolgozat

1. Give the general water balance equation and give the exact name of the members, too. (3 points)
2. What is valley dammed reservoir? (3 points)
3. What are the advantages of the bank-side reservoir? (2 points)
4. Give the definition of the spring. Draw an artificial gravity spring captation and name the parts of it. (6 points)
5. What can be the driving forces in case of an artesian spring? What types of artesian springs do you know? Name&illustrate them. (6 points)
6. How can you classify drilled wells according to the depth (with values), direction and pressure conditions? (8 points)
7. Describe the features of an infiltration gallery. (3 points)
8. Describe the features of a radial collector well with drawing. (3 points)
9. Describe the right scouring drilling with illustration. (3 points)
10. What are the roles of the slurry? (6 points)
11. What is the role of the standpipe? (2 points)
12. What type of filter is usually used in water wells? What material can it be made by? (3 points)
13. What type of gravel packs do you know in case of a water well? (2 points)

Ponthatárok:

jeles	50-46
jó	45-41
közepes	40-36
elégséges	35-31

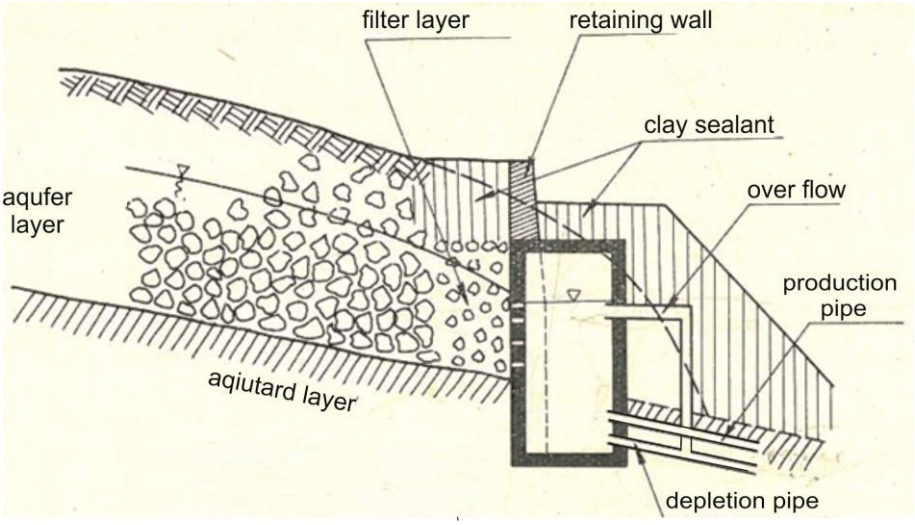
Watermining c. tárgy zárthelyi dolgozat (megoldás)

1. **Give the general water balance equation and give the exact name of the members, too. (3 points)**
   General water balance equation
   P = R + E +ΔS
   P-precipitation; **R**-runoff/streamflow; **E**-evapotranspiration; **ΔS**-change in storage

2. **What is valley dammed reservoir? (3 points)**
   - Created in valleys between mountains
   - Dam: artificial wall in the reservoir, there are typically located at the narrowest part of a valley
   - The valley sides act as natural walls, with the dam located at the narrowest practical point to provide strength and the lowest cost of construction

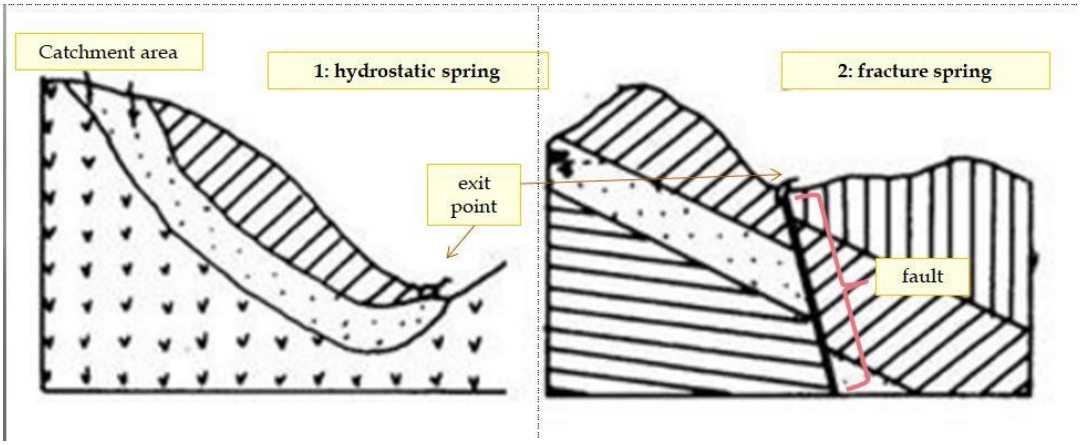
3. **What are the advantages of the bank-side reservoir? (2 points)**
   - The use of bank-side reservoirs also allows water abstraction to be stopped for some time, when the river is unacceptably polluted or when flow conditions are very low due to drought.
   - The water stored in such reservoirs may stay there for several months, during which time normal biological processes may substantially reduce many contaminants and almost eliminate any turbidity.

4. **Give the definition of the spring. Draw an artificial gravity spring captation and name the parts of it. (6 points)**
   - A place where water naturally flows out from subsurface, has a surface entering point



5. **What can be the driving forces in case of an artesian spring? What types of artesian springs do you know? Name&illustrate them. (6 points)**
   - pressure in confined aquifers forcing the water to the surface. The pressure inside the confined aquifer is higher than outside the aquifer so the water moves up.

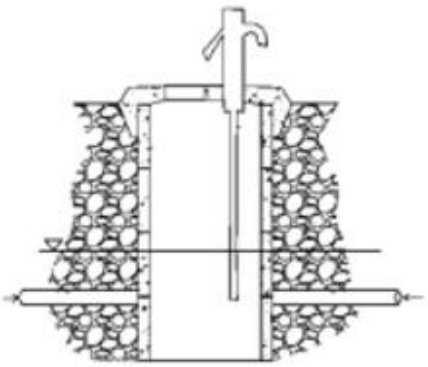
- Another driving force is the gas content of the water Any cracks and hole in the surface are suitable to the water to escape



6. **How can you classify drilled wells according to the depth (with values), direction and pressure conditions? (8 points)**
    - Depth:
        - Shallow (total depth < 200 m)
        - Medium (200 m < total depth < 500 m)
        - Large (total depth > 500 m)
    - Direction
        - Vertical
        - Horizontal
        - Inclined
    - Pressure conditions
        - Positive
        - negative

7. **Describe the features of an infiltration gallery. (3 points)**
    - A shallow horizontal well usually constructed in the bed of a river or along a river bank in an alluvial aquifer to collect infiltrated surface water
    - Advantage of the system is: infiltrated water is free from suspended impurities (like microorganisms)
    - On or near the surface infiltration galleries are '*trenches*' or '*tunnels*' (in horizontal way they are more longer then in vertical way)
    - An infiltration gallery may also be the best way to product water from a thin aquifer or lens of fresh water overlying saline water.
    - We can use it not only in porous layer, but in karst terrains

8. **Describe the features of a radial collector well with drawing. (3 points)**
    - A large diameter vertical well with horizontal boreholes extending radially outwards into the aquifer (also known as a Ranney well)



9. **Describe the right scouring drilling with illustration. (3 points)**
   Right scouring drilling: the bentonite slurry goes down through the drill rod/pipe to the actual bottom of the borehole and the slurry brings the cuttings up to the surface between the rod and the borehole (in the annular space).

10. **What are the roles of the slurry? (6 points)**
    - Brings the cuttings up to the surface
    - Protects the borehole wall from collapsing
    - Protects from inflow
    - Cooling of the drill head
    - Lubrican
    - Flotation of the cuttings if the scouring intermits (if the cuttings are not in move (if we take a brake in the drilling), bentonite slurry has a feature called *thixotropy* – for physical impacts it is liquid, without outer impacts it is solid.

11. **What is the role of the standpipe? (2 points)**
    - The standpipe is responsible for the verticality of the drilling and the well
    - closing out surface waters and close-to-surface waters

12. **What type of filter is usually used in water wells? What material can it be made by? (3 points)**
    Johnson-filter; PVC or steel
13. **What type of gravel packs do you know in case of a water well? (2 points)**
    - Poured gravel (from the surface with assisstant pipe)
    - Well screen with built up gravel layer (based on the rules of a filter – diameter of gravel is increasing to the direction of the filter)

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