



REPORT ON NEEDED RESOURCES FOR HARMONIZATION OF WB LABORATORY

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University of Nis



**Strengthening of master curricula in water resources management
for the Western Balkans HEIs and stakeholders**

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List of abbreviations

BOKU	University of Natural Resources and Life Sciences, Vienna
EACEA	Education, Audiovisual and Culture Executive Agency
HEI	Higher Education Institution
SWARM	Strengthening of master curricula in water resources management for the Western Balkans HEIs and stakeholders
UNI	University of Nis, Serbia
UNMO	Dzemal Bijedic University of Mostar
UNS	University of Novi Sad
UNSA	University of Sarajevo
UoM	University of Montenegro
UPKM	University of Pristina in Kosovska Mitrovica
TCASU	Technical College of Applied Sciences Urosevac with temporary seat in Leposavic
WB	Western Balkan
WP	Work package
WPL	Work package leader
WRM	Water Resources Management

1 Introduction

Report on needed resources for harmonization of Western Balkan (WB) laboratory is part of work package (WP) 1 “Analysis of water resources management in the Western Balkan region” and activity A1.4 “Identification of needed laboratory resources in WB HEIs and alignment with formed EU HEIs WRM laboratory equipment list” of the Erasmus+ Capacity Building in the Field of Higher Education project „Strengthening of master curricula in water resources management for the Western Balkans HEIs and stakeholders” (SWARM).

A major financial part of the SWARM project was the purchase of the necessary laboratory and teaching equipment and software. Table 1 summarises the proposed budget per WB partner HEI.

Table 1. Proposed budget in the SWARM application

No	HEI	Type	Budget (EUR)
1	University of Nis (UNI)	Teaching and laboratory equipment	49,000.00
2	University of Novi Sad (UNS)	Laboratory equipment	35,000.00
3	University of Sarajevo (UNSA)	Laboratory equipment	34,000.00
		Software	
4	Dzemal Bijedic University of Mostar (UNMO)	Laboratory equipment	34,000.00
		Software	
5	University of Pristina in Kosovska Mitrovica (UPKM)	Teaching and laboratory equipment	34,000.00
6	Technical College of Applied Sciences Urosevac with temporary seat in Leposavic (TCASU)	Teaching and laboratory equipment	34,000.00
		Software	
7	University of Montenegro (UoM)	Laboratory equipment	34,000.00
		Software	
TOTAL			254,000.00

The reason behind the purchase of equipment was to use it intensively for project related activities such as:

- Implementation of developed master curricula (WP4.1),
- Implementation of trainings for professionals in water sector (WP4.2).

The equipment and software will be used after the project realization as a part of activities in teaching and learning process at the benefiting WB HEIs.

In order to evaluate the purchase and installation of the equipment, the following activities will be conducted:

- receipt of property register with the respective equipment items and books from each WB HEI,
- pictures of equipment items and literature were taken,
- protocol was signed with a confirmation signature on the receipt/installment of the full equipment that had been purchased and the integration of it into the property register,
- Erasmus+ stickers were put on the IT equipment, which is obligatory according to the EACEA Guidelines.

According to the Guidelines for the Use of the Grant, the beneficiary i.e. WB HEIs shall retain with project accounts:

- All invoices for all equipment declared costs;
- Proofs of payment (bank statement);
- Proofs of tendering procedure for purchases above EUR 25,000;
- Proof that VAT is not deductible (if VAT exemption is not obtained and VAT costs are charged to the project budget);
- Registration in the inventory registry.

Four public procurements of equipment are planned (Serbia for UNI and UNS at UNI, Kosovo* for UPKM and TCASU at TCASU, Bosnia and Herzegovina for UNMO and UNSA at UNSA, Montenegro for UoM). When the most affordable bid was selected, each HEI will sign a separate contract with the supplier and pay for its share of the equipment in order to receive a separate invoice and introduced the equipment in the inventory books of its HEI. All equipment purchased on the project must be exempted from taxes and custom duties, so each WB HEI should ask for exemption of taxes and custom duties at competent institutions. The moment when the HEI get its equipment, it must introduce it in the inventory registry as its own property and appoint a person in charge of its maintenance.

The procurement of equipment will be public and transparent (as the Call for bids and Tender documentation related to public procurement). Documentation related to public procurement will be available at the SWARM platform such as invoices, proof of payment, proof of tendering procedure for purchases above EUR 25,000, proof that VAT is not deductible, inventory numbers, and photos.

2 Requested resources for public procurement

Before preparing the list of equipment and software WB partners have analysed the market and also used WP1.4 document titled “EU HEIs WM laboratory equipment lists”. Also, the list of needed resources for harmonization of WB laboratories was prepared in communication with EU partners and work package leader (WPL) from BOKU and will be used to improve current teaching methods and especially laboratory exercises in the field of water resources management (WRM). In order to have better exchange of students and staff during and after the project realization between WB HEIs, different types of laboratory equipment was selected.

2.1 University of Nis

Tables 2 and 3 summarised needed equipment.

Table 2. Teaching equipment

No	Model	Quantity	Type of the equipment
1	Desktop computer (Windows 10, processor 3 GHz, graphic card with 3 GB Dedicated Memory, 16 GB, DDR4 SDRAM, 1 TB HDD)	1	IT equipment - desktop computer
2	Digital photo camera (DSLR, 24.2 Mpix, 3.2", CMOS)	1	Audio, Video and Communication equipment
3	3D Structured Light Scanner Pro S3 with Dual Camera Bundle	1	IT equipment
4	FLIR Duo R Thermal Camera (Dimensions 41 × 59 × 29.6 mm, Spectral Band 7.5 – 13.5 μm, Thermal Frame Rate 7.5 Hz (NTSC); 8.3 Hz (PAL), Thermal Imager Uncooled VOx Microbolometer, Thermal Measurement Accuracy +/-5°C)	1	Audio, Video and Communication equipment
5	UPS BPU Memo RT 3000VA - 2700W	1	IT equipment - UPS
6	All-new Kindle Paperwhite Essentials Bundle	1	IT equipment

Table 3. Laboratory equipment

No	Model	Specification	Quantity
1	Advanced hydrological investigations	* investigation of precipitation-discharge relationships, storage capacity of soils, seepage flows, groundwater flows and sediment transport * closed water circuit	1

		<ul style="list-style-type: none"> * inclinable stainless steel experiment tank contains 19 measuring connections to detect groundwater levels, transparent splash guard and screens for separating the chambers * 2 wells with open seam tubes in the experiment tank * adjustable precipitation device * precipitation time can be adjusted via timer * water supplies and drains can be selected individually * transparent measuring tank (flow) and force sensor (determining the amount of sediment) * 3 models for pillars: round, square, oval * instruments: tube manometers (groundwater), flow meter (2x at the supply) and measuring weir in the measuring tank (1x at the drain) * software for data acquisition via USB under Windows 7, 8.1, 10 	
2	Losses in a pipe system	<ul style="list-style-type: none"> * investigation of pressure losses in piping elements and shut-off devices * different measuring objects for determining flow rate according to the differential pressure method * six pipe sections capable of being individually shut off, with different piping elements: sudden contraction, sudden enlargement, Y-pieces, T-pieces, corners and bends * one pipe section to hold interchangeable shut-off/measuring objects * measuring objects made of transparent material: Venturi nozzle, orifice plate flow meter and measuring nozzle * shut-off devices: angle seat valve, gate valve * annular chambers allow measurement of pressure without interaction * 2 twin tube manometers for measuring the pressure difference * water supply via laboratory supply or other modules 	1
3	Base module for experiments in fluid mechanics	<ul style="list-style-type: none"> * base module for supplying experimental units in fluid mechanics * closed water circuit with storage tank, submersible pump and measuring tank 	1

		<ul style="list-style-type: none"> * measuring tank divided in two for volumetric flow rate measurements * measuring beaker with scale for very small volumetric flow rates * measurement of volumetric flow rates by using a stopwatch * work surface with integrated flume for experiments with weirs * work surface with inside edge for safe placement of the accessory and for collecting the dripping water * storage tank, measuring tank and work surface made of GRP 	
4	Methods of flow measurement	<ul style="list-style-type: none"> * different methods of flow rate measurement * measuring instruments: orifice plate flow meter/measuring nozzle, Venturi nozzle and rotometer * 6 tube manometers to determine the pressure distribution in Venturi nozzle, orifice plate flow meter and measuring nozzle * measurement of the total pressure with Pitot tube * water supply via laboratory supply or other modules 	1

2.2 University of Novi Sad

Tables 4 and 5 summarised needed equipment.

Table 4. Teaching equipment

No	Model	Quantity	Type of the equipment
1	Headphones for monitoring multimedia teaching content (Model: Sennheiser GSP 300 series)	6	Audio, Video and Communication equipment
2	Ethernet switches. (Model: Cisco WS-C2960X-48TD-L + Direct Connect Cable SFP-H10GB-CU5M)	1	Network equipment
3	Telecommunication cabinet for the installation of equipment for the needs of the expansion of IT infrastructure	1	Audio, Video and Communication equipment
4	Laptop computer, 13"-14", Intel Processor i5 or i7	1	IT equipment – laptop computer

Proposed computer equipment is necessary for the needs of the expansion of IT infrastructure necessary for the acquisition, processing and presentation of data relevant for the project.

Table 5. Teaching equipment

No	Model	Quantity
1	Bioreactors of 2L from plexiglass for EBPR reactor operation	2
2	Bioreactor of 0.5L for batch tests	1
3	Refrigerated/heating circulator for temperature control of the reactor	1
4	Two headed feeding reactor pump for reactor operation	1
5	Pump of lower flow for carbon feeding	1
6	Pump for SRT control of the reactor	1
7	Air pump for aerobic conditions in the reactor	3
8	Mini peristaltic pumps for pH reactor control	4
9	Air, Argon and supernatant removal on/off valves	6
10	Timers for automatic control of the reactor	10
11	Lyophilizator for preserving biomass samples (freeze dryer)	1
12	Jar Testing Equipment	1
13	Overhead stirring motor with stirring shafts	2
14	Online carbon measurement	1
15	Online turbidity/suspended solids measurement	1
16	Online dissolved oxygen measurement	1
17	pH probe with controller and cables	2
18	Probes for dissolved oxygen and temperature, with monitor and cables	2
19	Glass flasks for reactors solutions	2

2.3 University of Sarajevo

Tables 6 and 7 summarised needed equipment.

Table 6. Laboratory equipment for fluid mechanics, testing principles in hydrodynamics, testing flow in pipes

No	Model	Specification	Quantity
1	Base module for experiments in fluid mechanics	* base module for supplying experimental units in fluid mechanics * closed water circuit with storage tank, submersible pump and measuring tank	1

		<ul style="list-style-type: none"> * measuring tank divided in two for volumetric flow rate measurements * measuring beaker with scale for very small volumetric flow rates * measurement of volumetric flow rates by using a stopwatch * work surface with integrated flume for experiments with weirs * work surface with inside edge for safe placement of the accessory and for collecting the dripping water * storage tank, measuring tank and work surface made of GRP 	
2	Bernoulli's principle	<ul style="list-style-type: none"> * familiarisation with Bernoulli's principle * Venturi nozzle with transparent front panel and measuring points for measuring the static pressures * axially movable Pitot tube for determining the total pressure at various points within the Venturi nozzle * 6 tube manometers for displaying the static pressures, * single tube manometer for displaying the total pressure, * flow rate determined by HM 150 base module, * water supply using HM 150 base module or via laboratory supply 	1
3	Methods of flow measurement	<ul style="list-style-type: none"> * different methods of flow rate measurement * measuring instruments: orifice plate flow meter/measuring nozzle, Venturi nozzle and rotameter * 6 tube manometers to determine the pressure distribution in Venturi nozzle, orifice plate flow meter and measuring nozzle * measurement of the total pressure with Pitot tube * flow rate determined by HM 150 base module * water supply via HM 150 or via laboratory supply 	1
4	Open channel and closed channel flow	<ul style="list-style-type: none"> * investigation of flow processes in the open and closed channel * experimental flume with upper limit, made of transparent material * height-adjustable sill in the bottom of the experimental flume * water level adjustable via plate weir at the water 	1

		outlet * simple conversion from open to closed channel * control structures for experiments in the open channel: broad-crested weir, narrow-crested weir, ogee-crested weir with ski jump spillway, sill, gate * fully flowed through experimental section and change in cross-section over sill for experiments in the closed channel * closed water circuit with supply tank and pump * transparent measuring tubes for measuring static pressure and total pressure	
5	Groundwater flow	* investigation of groundwater flows * stainless steel tank as experimental section to be filled with coarse sand * water supply via 2 open-seam tubes * water drain via 2 wells with open-seam tubes in the experimental section * water feeds and discharges can be adjusted separately via valves * 19 measuring connections with filters to detect the groundwater levels, arranged orthogonal to the tank bottom * 2 different models for excavation pits * 1 model for structure with waterproof bottom, * groundwater levels displayed on the 19 tube manometers	1

Table 7. Software in the field of water resources management

No	Type	Quantity
1	Watershed Modeling System, Premium license of WMS for academic use, 2 permanent licenses and as many student passwords as we need.	1
2	Aquifer Win32, Unsaturated Zone Flow & Contaminant Transport- UnSat Suite, academic version	1

2.4 Dzemal Bijedic University of Mostar

Tables 8 and 9 summarised needed equipment.

Table 8. Laboratory equipment for fluid mechanics, testing principles in hydrodynamics, testing flow in pipes

No	Model	Specification	Quantity
1	Base module for experiments in fluid mechanics	<ul style="list-style-type: none"> * base module for supplying experimental units in fluid mechanics * closed water circuit with storage tank, submersible pump and measuring tank * measuring tank divided in two for volumetric flow rate measurements * measuring beaker with scale for very small volumetric flow rates * measurement of volumetric flow rates by using a stopwatch * work surface with integrated flume for experiments with weirs * work surface with inside edge for safe placement of the accessory and for collecting the dripping water * storage tank, measuring tank and work surface made of GRP 	1
2	Bernoulli's principle	<ul style="list-style-type: none"> * familiarisation with Bernoulli's principle * Venturi nozzle with transparent front panel and measuring points for measuring the static pressures * axially movable Pitot tube for determining the total pressure at various points within the Venturi nozzle * 6 tube manometers for displaying the static pressures, * single tube manometer for displaying the total pressure, * flow rate determined by HM 150 base module, * water supply using HM 150 base module or via laboratory supply 	1
3	Methods of flow measurement	<ul style="list-style-type: none"> * different methods of flow rate measurement * measuring instruments: orifice plate flow meter/measuring nozzle, Venturi nozzle and rotameter * 6 tube manometers to determine the pressure distribution in Venturi nozzle, orifice plate flow meter and measuring nozzle 	1

		<ul style="list-style-type: none"> * measurement of the total pressure with Pitot tube * flow rate determined by HM 150 base module * water supply via HM 150 or via laboratory supply 	
4	Open channel and closed channel flow	<ul style="list-style-type: none"> * investigation of flow processes in the open and closed channel * experimental flume with upper limit, made of transparent material * height-adjustable sill in the bottom of the experimental flume * water level adjustable via plate weir at the water outlet * simple conversion from open to closed channel * control structures for experiments in the open channel: broad-crested weir, narrow-crested weir, ogee-crested weir with ski jump spillway, sill, gate * fully flowed through experimental section and change in cross-section over sill for experiments in the closed channel * closed water circuit with supply tank and pump * transparent measuring tubes for measuring static pressure and total pressure 	1
5	Groundwater flow	<ul style="list-style-type: none"> * investigation of groundwater flows * stainless steel tank as experimental section to be filled with coarse sand * water supply via 2 open-seam tubes * water drain via 2 wells with open-seam tubes in the experimental section * water feeds and discharges can be adjusted separately via valves * 19 measuring connections with filters to detect the groundwater levels, arranged orthogonal to the tank bottom * 2 different models for excavation pits * 1 model for structure with waterproof bottom, * groundwater levels displayed on the 19 tube manometers 	1

Table 9. Software in the field of water resources management

No	Type	Quantity
1	Watershed Modeling System, Premium license of WMS for academic use, 2 permanent licenses and as many student passwords as we need.	1
2	Aquifer Win32, Unsaturated Zone Flow & Contaminant Transport- UnSat Suite, academic version	1

2.5 University of Pristina in Kosovska Mitrovica

Tables 10 and 11 summarised needed equipment.

Table 10. Laboratory equipment for fluid mechanics, testing principles in hydrodynamics, testing flow in pipes, groundwater flow

No	Model	Specification	Quantity
1	Base module for experiments in fluid mechanics	<ul style="list-style-type: none"> * base module for supplying experimental units in fluid mechanics * closed water circuit with storage tank, submersible pump and measuring tank * measuring tank divided in two for volumetric flow rate measurements * measuring beaker with scale for very small volumetric flow rates * measurement of volumetric flow rates by using a stopwatch * work surface with integrated flume for experiments with weirs * work surface with inside edge for safe placement of the accessory and for collecting the dripping water * storage tank, measuring tank and work surface made of GRP 	1
2	Bernoulli's principle	<ul style="list-style-type: none"> * familiarisation with Bernoulli's principle * Venturi nozzle with transparent front panel and measuring points for measuring the static pressures * axially movable Pitot tube for determining the total pressure at various points within the Venturi nozzle * 6 tube manometers for displaying the static pressures * single tube manometer for displaying the total pressure * flow rate determined by HM 150 base module * water supply using HM 150 base module or via 	1

		laboratory supply	
3	Methods of flow measurement	<ul style="list-style-type: none"> * different methods of flow rate measurement * measuring instruments: orifice plate flow meter/measuring nozzle, Venturi nozzle and rotameter * 6 tube manometers to determine the pressure distribution in Venturi nozzle, orifice plate flow meter and measuring nozzle * measurement of the total pressure with Pitot tube * flow rate determined by HM 150 base module * water supply via HM 150 or via laboratory supply 	1
4	Groundwater flow	<ul style="list-style-type: none"> * investigation of groundwater flows * stainless steel tank as experimental section to be filled with coarse sand * water supply via 2 open-seam tubes * water drain via 2 wells with open-seam tubes in the experimental section * water feeds and discharges can be adjusted separately via valves * 19 measuring connections with filters to detect the groundwater levels, arranged orthogonal to the tank bottom * 2 different models for excavation pits * 1 model for structure with waterproof bottom * groundwater levels displayed on the 19 tube manometers 	1

Table 11. Teaching equipment

No	Model	Quantity	Type of the equipment
1	Desktop computer * INTEL Core i7-6700K 4.0GHz, Intel® 1151 with integrated graphic processor Intel® HD Graphics 530 * Mother board ASUS MB - SOCKET 1151 - B150M-C D3 * Graphic card GIGABYTE nVidia GeForce GTX750Ti 4GB DDR5 128bit -GV-N75TWF2OC-4GI * Memory 2 xKINGSTON 8GB DDR3 HyperX FURY Red 1866MHz CL10 -	16	IT equipment - desktop computer

	HX318C10FR/8 * Hard disc WD 1TB 3.5" SATA III 64MB 7200rpm Black -WD1003FZEX * Optical device ASUS 24 x DVD-RW DRW-24D5MT * DEEPCOOL Mini Tower Smarter, 201 x 365 x 420 mm * LC-Power 600W LC600H-12 V2.31 12CM FAN * S-BOX optical mouse - M-17B * Keyboard MS INDUSTRIAL USB (Black) - KB-01 * LG LED 21.5" 22MP58VQ-P IPS Full HD * WiFi card TP-LINK 150 Mbps Wireless N PCI Express Adapter TL-WN781ND)		
2	Laptop computer * Processor Intel Core i7, Quad Core, 6700HQ * Memory 8 GB * HDD 1 TB * Graphic card VGA NVIDIA GeForce GTX1060, 3GB * Display 15.6", 1920 x 1080, Anti-Glare * USB 3.0 3 * USB 3.1-Type C 1 * HDMI 1 * WiFi, LAN 10/100/1000 Mbps	2	IT equipment – laptop computer
3	Color Laserjet all-in-one printer * Laserjet Pro * A4 * print/scan/copy/fax * print 600x600 * 28/28ppm black/color * scan 1200dpi * ADF/Duplex * USB/LAN	2	IT equipment - printer
4	Scanner Duplex ADF, 200dpi * Image Enhancement Technology: Visioneer Acuity * Duplex (two side scanning)	2	IT equipment – scanner

	<ul style="list-style-type: none"> * Interface: USB 2.0 (3.0 compatible) * Optical Resolution: 600 dpi * ADF Capacity: 50 sheets * Visioneer OneTouch Technology (PC) * Duty Cycle: 3000 pages/day * ADF Maximum Paper Size: 8.5" x 38" in * ADF Minimum Paper Size: 2" x 2" in * Dimensions: 11.20" x 6.5" x 6.7" (WxDxH) * Output Bit Depth: 24-bit color, 8-bit grayscale * Light Source: LED * Drivers: PC: TWAIN, WIA, ISIS Mac: TWAIN, ICA * Supported Operating Systems (OneTouch 4): Windows 10, 8, 7, Vista, XP (SP2) * Imaging sensor: Contact Image Sensor (CIS) * Paper Thickness/Weight: 7 to 110 lbs. * Speed @ 300 dpi, b&w, grayscale, or color: 25 ppm / 46 ipm * Speed @ 200 dpi, b&w, grayscale, or color: 38 ppm / 66 ipm 		
5	<p>External Hard Disk Drive</p> <ul style="list-style-type: none"> * 2.5" * 4 TB Memory 	3	IT equipment – external HDD

2.6 Technical College of Applied Sciences Urosevac with temporary seat in Leposavic

Tables 12, 13 and 14 summarised needed equipment.

Table 12. Laboratory equipment

No	Model	Quantity
1	UVI/IS spectrophotometer LAMBDA XLS	1
2	Channel Master H-ADCP	1

Table 13. Teaching equipment

No	Model	Quantity	Type of the equipment
1	Digital photo camera Nikon D5300 + Lens 18-105mm VR	1	Audio, Video and Communication equipment
2	LIGRA Luxiboard 6Touch 88 in Interactive board + NEC UM301W Ultra Short Throw projektor	1	Audio, Video and Communication equipment – interactive board and projektor
3	LAPTOP Intel® Core™ i5 7200U 3.1GHz, 15.6", 1TB HDD, 8GB	15	IT equipment – laptop computer
4	LAPTOP 10-12" HD Intel Pentium Quad Core N4200 4GB 128GB SSD Intel HD 505	2	IT equipment – laptop computer
5	PICO PROJECTOR WITH WI-FI	1	Audio, Video and Communication equipment - projektor
6	Projektor, 1920 x 1200 (WUXGA) 3600 ANSI, Wifi, USB	2	Audio, Video and Communication equipment - projektor
7	MFP Laser, A4	2	IT equipment – printer
8	Desktop Intel® Core™ i5 Processor, 8GB DDR4 2400 MHz, 1TB HDD, HD 630 + monitor LED 21.5" + keyboard and mouse	2	IT equipment – desktop computer

Table 14. Software

No	Type	Quantity
1	ICDD DATABASE PDF-2 2019	1

2.7 University of Montenegro

Tables 15 and 16 summarised needed equipment.

Table 15. Laboratory equipment for fluid mechanics, testing principles in hydrodynamics, testing flow in pipes

No	Model	Specification	Quantity
1	Base module for experiments in fluid mechanics	<ul style="list-style-type: none"> * base module for supplying experimental units in fluid mechanics * closed water circuit with storage tank, submersible pump and measuring tank * measuring tank divided in two for volumetric flow rate measurements * measuring beaker with scale for very small 	1

		volumetric flow rates * measurement of volumetric flow rates by using a stopwatch * work surface with integrated flume for experiments with weirs * work surface with inside edge for safe placement of the accessory and for collecting the dripping water * storage tank, measuring tank and work surface made of GRP	
2	Bernoulli's principle	* familiarisation with Bernoulli's principle * Venturi nozzle with transparent front panel and measuring points for measuring the static pressures * axially movable Pitot tube for determining the total pressure at various points within the Venturi nozzle * 6 tube manometers for displaying the static pressures, * single tube manometer for displaying the total pressure, * flow rate determined by HM 150 base module, * water supply using HM 150 base module or via laboratory supply	1
3	Methods of flow measurement	* different methods of flow rate measurement * measuring instruments: orifice plate flow meter/measuring nozzle, Venturi nozzle and rotameter * 6 tube manometers to determine the pressure distribution in Venturi nozzle, orifice plate flow meter and measuring nozzle * measurement of the total pressure with Pitot tube * flow rate determined by HM 150 base module * water supply via HM 150 or via laboratory supply	1
4	Open channel and closed channel flow	* investigation of flow processes in the open and closed channel * experimental flume with upper limit, made of transparent material * height-adjustable sill in the bottom of the experimental flume * water level adjustable via plate weir at the water outlet * simple conversion from open to closed channel	1

		<ul style="list-style-type: none"> * control structures for experiments in the open channel: broad-crested weir, narrow-crested weir, ogee-crested weir with ski jump spillway, sill, gate * fully flowed through experimental section and change in cross-section over sill for experiments in the closed channel * closed water circuit with supply tank and pump * transparent measuring tubes for measuring static pressure and total pressure 	
5	Groundwater flow	<ul style="list-style-type: none"> * investigation of groundwater flows * stainless steel tank as experimental section to be filled with coarse sand * water supply via 2 open-seam tubes * water drain via 2 wells with open-seam tubes in the experimental section * water feeds and discharges can be adjusted separately via valves * 19 measuring connections with filters to detect the groundwater levels, arranged orthogonal to the tank bottom * 2 different models for excavation pits * 1 model for structure with waterproof bottom, * groundwater levels displayed on the 19 tube manometers 	1

Table 16. Software in the field of water resources management

No	Type	Quantity
1	URBANO CANALIS + HYDRA, Designing, calculating and analyzing gravity, pressure and vacuum piping systems for sewage and water supply	1