SWIM-H2020 SM, Expert Facility

Activity No. EFS-JO-1-WP1

Training Report: Setting up and Calibrating WEAP Model for a Selected Sub-Catchment in Amman-Zarqa Basin (AZB)

December 2018

Version	Document Title	Author	Review and Clearance
1.0	WEAP Training and Capacity building for Expert Staff at Ministry of Water and Irrigation - Jordan	Saleh Al Qur'an	Suzan TAHA (Key Water Expert SWIM-H2020 SM)

THE SWIM AND H2020 SUPPORT MECHANISM PROJECT (2016-2019)

The SWIM-H2020 SM is a Regional Technical Support Program that includes the following Partner Countries (PCs): Algeria, Egypt, Israel, Jordan, Lebanon, Libya, Morocco, Palestine, [Syria] and Tunisia. However, in order to ensure the coherence and effectiveness of Union financing or to foster regional co-operation, eligibility of specific actions will be extended to the Western Balkan countries (Albania, Bosnia Herzegovina and Montenegro), Turkey and Mauritania. The Program is funded by the European Neighborhood Instrument (ENI) South/Environment. It ensures the continuation of EU's regional support to ENP South countries in the fields of water management, marine pollution prevention and adds value to other important EU-funded regional programs in related fields, in particular the SWITCH-Med program, and the Clima South program, as well as to projects under the EU bilateral programming, where environment and water are identified as priority sectors for the EU co-operation. It complements and provides operational partnerships and links with the projects labelled by the Union for the Mediterranean, project preparation facilities in particular MESHIP phase II and with the next phase of the ENPI-SEIS project on environmental information systems, whereas its work plan will be coherent with, and supportive of, the Barcelona Convention and its Mediterranean Action Plan.

The overall objective of the Program is to contribute to reduced marine pollution and a more sustainable use of scarce water resources. The Technical Assistance services are grouped in 6 work packages: WP1. Expert facility,WP2. Peer-to-peer experience sharing and dialogue, WP3. Training activities, WP4. Communication and visibility, WP5. Capitalizing the lessons learnt, good practices and success stories and WP6. Support activities.

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1 GENERAL INTRODUCTION

Within the scope of work of the EU funded SWIM-H2020 SM, the project is undertaking an activity titled: “Mainstreaming Drought Risk Management, with a focus on proactive measures” (Activity no. (EFS-JO-1). The activity aims to support Jordan in enhancing preparedness & response to drought-related natural disasters and boost the resilience in the water sector through a series of interrelated activities that include training of the MWI staff and relevant stakeholders on the application of the "Water Evaluation and Planning" (WEAP) system in drought risk management. In order to achieve that, two training events will be conducted:

- Training no. 1 (the subject of this training report): focusing on building the capacity of the MWI towards the efficient use of the WEAP water resources management model;
- Training no. 2: focusing on the application of the "Water Evaluation and Planning" (WEAP) system in drought risk management

This training report pertains to training no. 1 which took place at the Ministry of Water and Irrigation between 20 and 22 February, 2018

1.1 RATIONALE OF ACTIVITY

WEAP was selected as an appropriate tool to enable the water policy-directorate at Ministry of Water and Irrigation – Jordan (MWI) in order to enhance its strategic water resource planning. As part of task 5 of the above mentioned activity, SWIM-H2020 SM undertook a review and assessment of the current capacity of the WEAP model available at MWI for Amman Zarqa Basin (AZB), with a view to identify any gap in the existing conceptual model and the current simulation and data needed for adequate simulation; again focusing on the pilot area of Amman-Zarqa Basin and indicating the required model enhancements. To this effect, a demo model covering the said gaps was built aiming to improve the WEAP results to show the complete hydrological processes. The demo model has been built for AZB, and was populated with relevant data. The conceptual design of the model included hydrological analysis for AZB, and water balancing. The model is designed to integrate hydrological input data together with environmental and other restrictions that follow the sustainability context. Available data actually should allow more complex approaches on rainfall – runoff mechanisms in dry climates.

2 OBLECTIVES OF ACTIVITY

1. Introduce the relevant MWI staff to the findings of the assessment of the WEAP model deployed in MWI

2. Train the staff on setting up the WEAP model

3. Introduce the improvements made to the WEAP model (the enhanced demo model that has been developed by SWIM-H2020 SM Project for the pilot case of AZB) covering the gaps and improving WEAP results to show the complete hydrological processes using hydrological approach.

4. Train the staff on the demo model: to enter relevant input data (climatic data - rainfall, temp, and evaporation) needed for the calculation of runoff

5. Train them on simulating the water budget for the pilot case in AZB using hydrological analysis, also including the calculation of water balancing with special reference to the notion of “unmet demand” and water deficits from groundwater.

6. Hands on training for calibrating the demo model

3 EXPECTED RESULTS OF ACTIVITY

will:

1. The participants’ general understanding of how water resources assessment tools can be used to determine water demand and availability at the basin and sub-basin levels is improved.

2. The use of the WEAP tool for AZ Basin is understood.

3. The participants are able to calibrate and set up the model for other basins

4. The participants are able to make changes and build additional scenarios on the WEAP system.

4 PROFILE OF THE PARTICIPANTS

The training targeted representatives from MWI, WAJ, and JVA who are directly involved in drought management/ water resources management and planning, hydrological and water balance modelling from the Policies and Strategic planning Directorate, Water Resources Study Department, and GIS and Modelling).

5 EVALUATION OF THE EVENT

A. <u>Organizational, administrative and planning issues before and during the event</u>

A set of 7 criteria; A1-A7 (See table 1 below) was assessed by the participants, using a qualitative description ranging between “Excellent” to “ Poor”, See table 1.

Figure 1 summarises the results of the evaluation for the organisational and administrative issues. Figure 2 focuses on planning issues. **Noting that the total no. of replies obtained were 11.**

The overall rating of 3.45 out of four indicates that the event was well appreciated

Table 1: Criteria for the evaluation of the organization, administrative and planning issues

A.	ORGANISATIONAL, ADMINISTRATIVE AND PLANNING ISSUES BEFORE AND DURING THE EVENT
A1	Efficient logistics: accommodation, transportation, location of venue and interpretation
A2	Handling of Emerging needs and attentiveness to participants concerns
A3	Adequacy of the presentations (Presentations correspond and contribute to the planned objectives and are conducive to enhanced shared understanding and participation on addressed topics)
A4	Clarity, coverage and sufficiency of concepts, objectives, anticipated outputs
A5	The materials distributed were helpful
A6	Efficiency and effectiveness of the facilitation
A7	Overall rating of the event

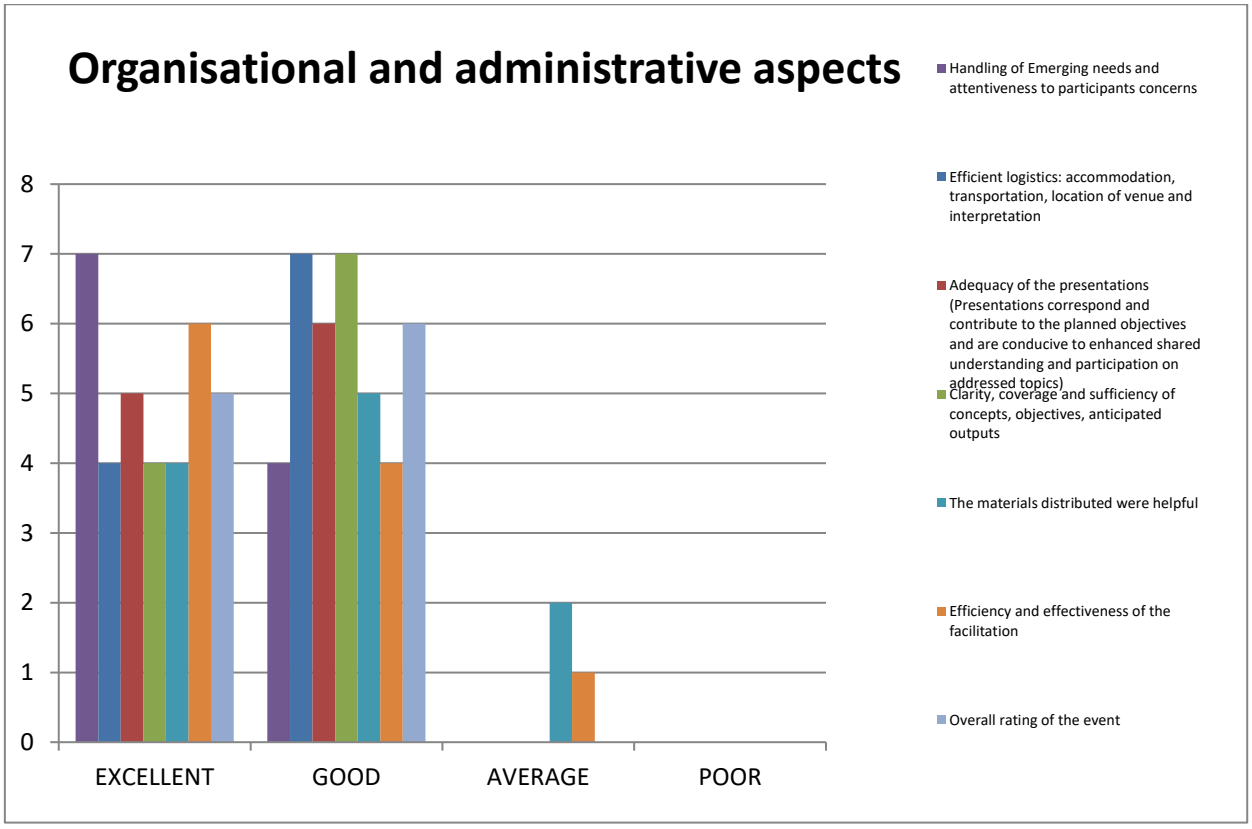

FIGURE 1. ORGANIZATIONAL AND ADMINISTRATIVE ASPECTS

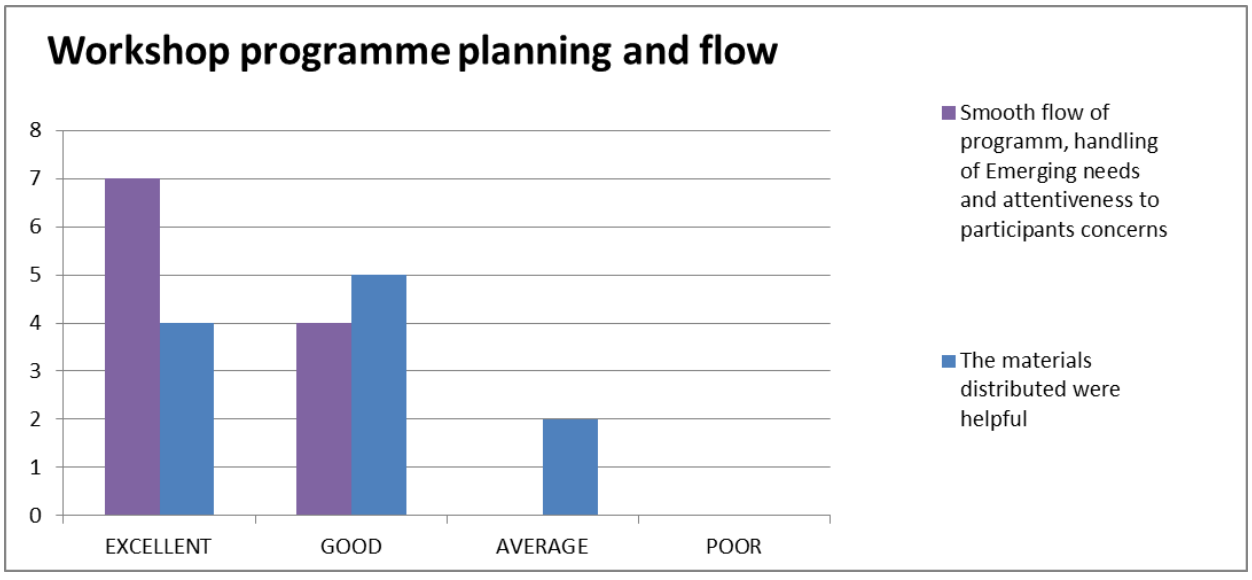

FIGURE 2. WORSHOP PROGRAM PLANNING AND FLOW

B. Feedback on Technical Aspects :

The figures 3-6 below present the feedback received from the participants on the technical aspects of the event; see table 2 for the criteria used for evaluation of the technical aspects of the training

Table 2: Criteria for the evaluation of the technical aspects of the training

B. FEEDBACK ON TECHNICAL ASPECTS	
B1	**Coverage of the event** **In your opinion did the event cover (tick one of the following):**
	All the topics necessary for a good comprehension of the subject nothing more
	Some topics covered are not necessary
	Some additional topics should be included
	No reply
	Total Replies
B2	**Level of difficulty**
	Difficult
	Adequate
	Elementary
	No reply
	Total Replies
B3	**Length of the training** **In your view the workshop duration (tick one of the following):**
	Longer than needed
	Sufficient
	Shorter than required
	No reply
	Total Replies

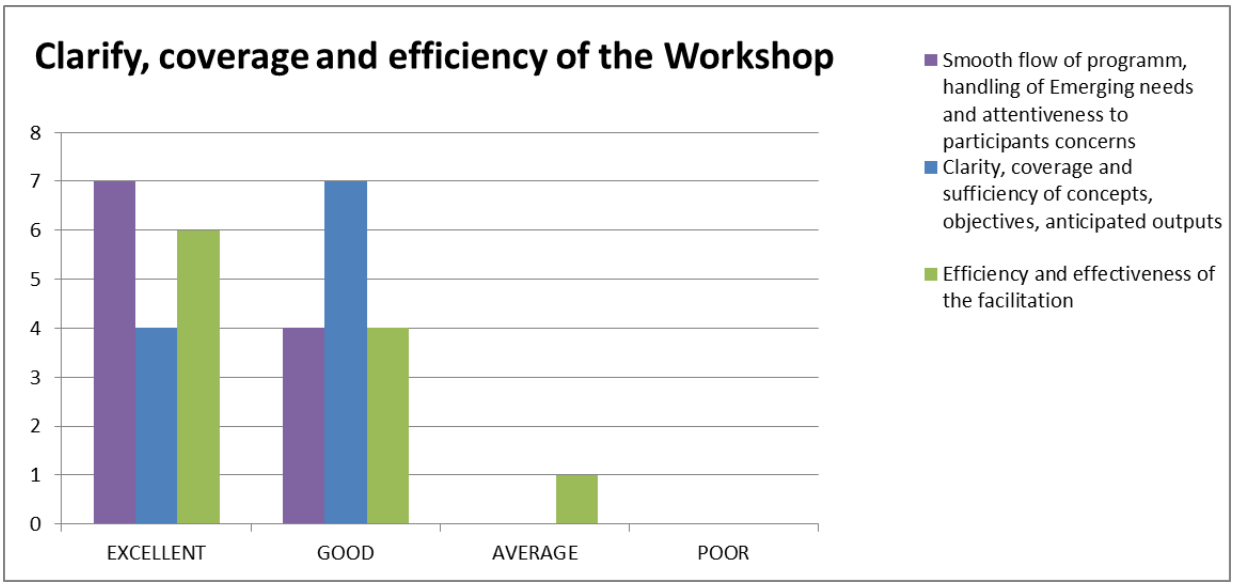

FIGURE 3. CLARITY, COVERAGE AND EFFICIENCY OF WORKSHOP

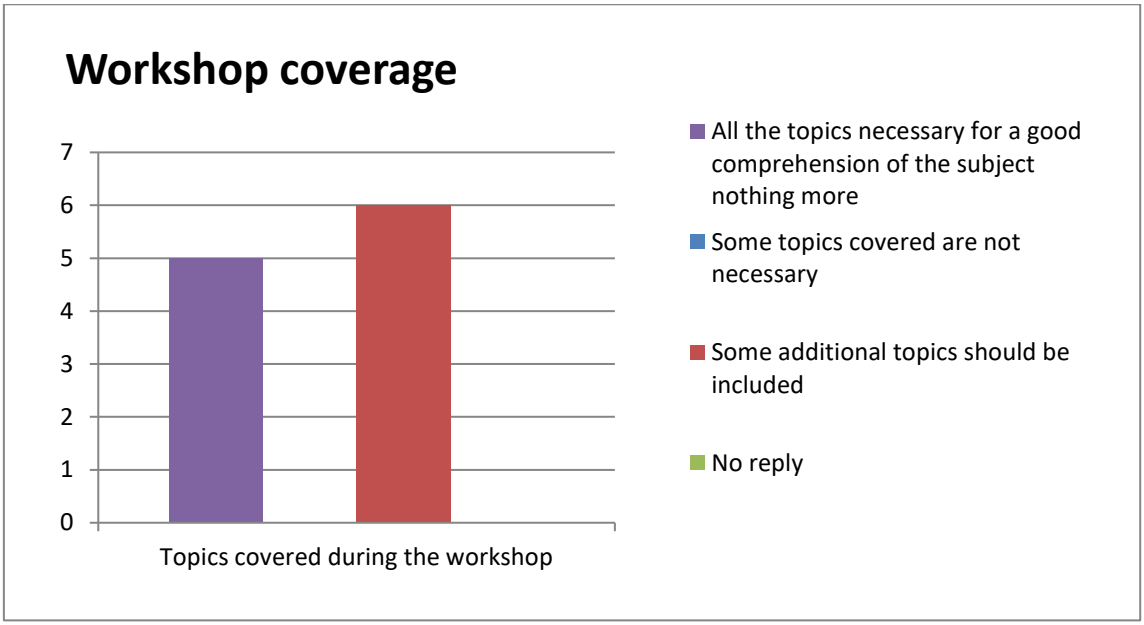

FIGURE 4. WORKSHOP COVERAGE

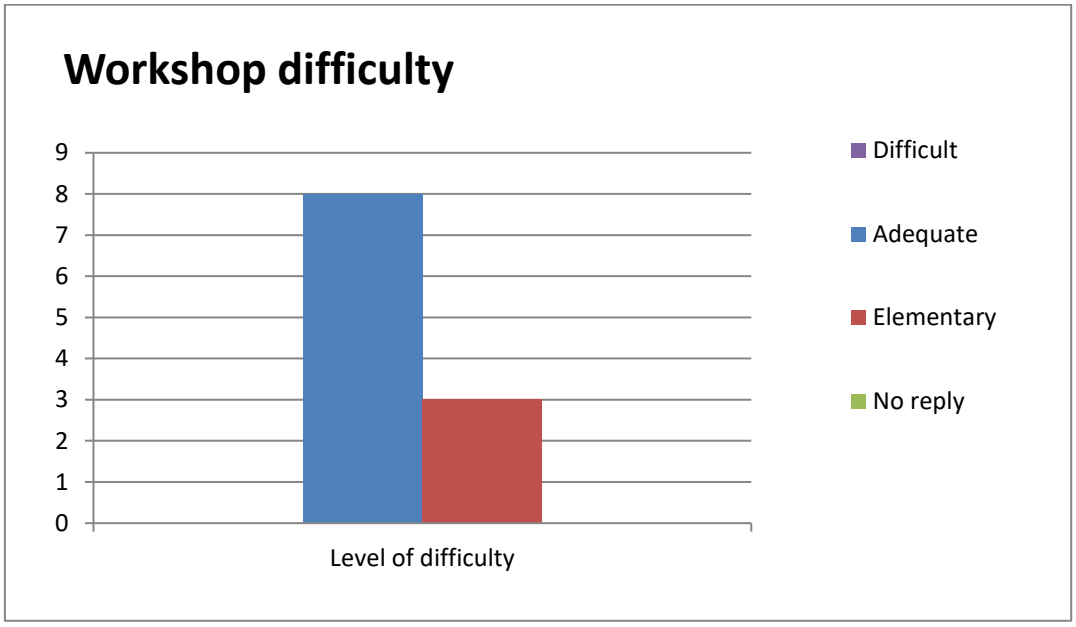

FIGURE 5. WORKSHOP DIFFICULTY

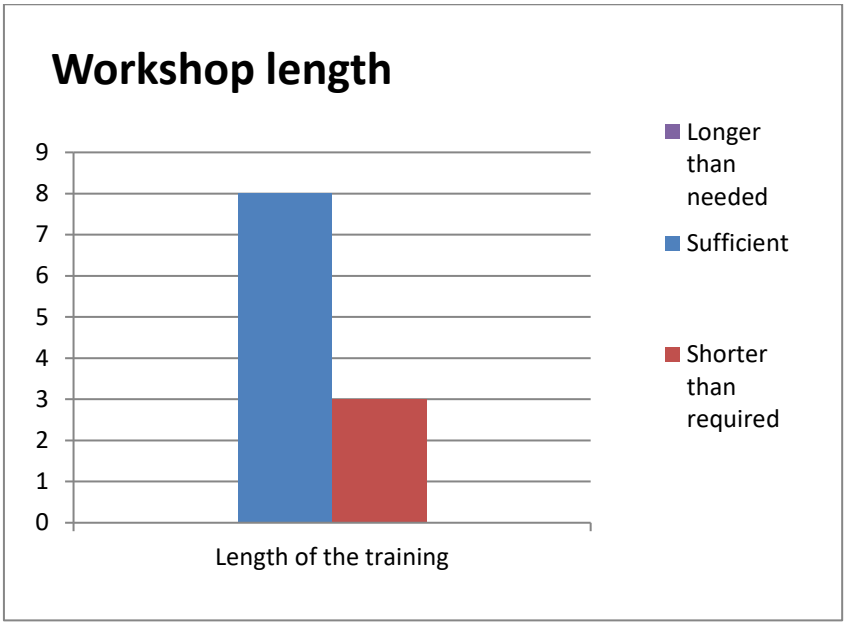

FIGURE 6. WORKSHOP LENGTH

C. Proposals for improvements

The participants were requested to respond to questions on the relevance of the training, and linkage with his/her future work and proposals for improvements. The following lists the answers obtained on that section

B4	**What is the most valuable thing you learned during the workshop (knowledge or skills)?**	
	Most answers have revealed that partcipants are first time they deal with WEAP as tool for water allocation and demand model. They are mostly understanding the main concept of the program and they are fimiliar with its components.	
	Total Replies	**11**
B5	**How do you think that the current event will assist you in your future work on the subject?**	
	It depends if the model is used regularly or not. However the model is so helpful because it calculates the water budget so that Ministry of water and irrigation can rely on such models for calculating the annual water balance.	
	Total Replies	**11**
B6	**Please indicate whether (and how) you could transfer part of the experience gained from the event to your colleagues in your country?**	
	The participants will work in groups and will exchange the data and information to reach the good use of WEAP. And through transfer of knowledge shared in the examples given and presentations	
	Total Replies	**7**
B7	**What did you like most about this event?**	
	The event is good; The attitude of the instructor and ability to clarify the ideas.	
	Total Replies	**11**
B8	**What needs to be improved?**	

	More time for such valuable course. More future scenarios for climate change should be introduced. Also more hands-on exercises are very important especially through real case studies.	
	Total Replies	**11**

Remarks by the trainer

A set of nine criteria; B1-B9 (See table 3 below) are used hereby by the trainer to provide an overall assessment of the event..

Table 3: Assessment by the trainer

B1	**Efficient and effective performance and interaction by participants:** this training added new skills in WEAP modelling for the Ministry staff. Being of interdisciplinary nature, the participants from different departments in the ministry were highly interactive between each other at both levels of analysis and data integration. For other more familiar participants several discussions were raised and inquiries about further development and enhancement needs for the old models used in the ministry..
B2	**Efficient and effective cooperation and team spirit;** During this training the participants were divided into working groups, each being responsible of one aspect of the training, The training showed significant cooperative efforts.
B3	**Level of achievement of planned objectives:** All the information and examples presented were received with impressive enthusiasm. The level of achievement was as planned
B4	**Did the event contribute to helping participants practice skills or gain knowledge related to course concepts:** Yes.
B5	**What worked well during the event;** Examples of different model outputs and discussions on the results was very useful and added new knowledge on the WEAP model capability and why it is selected as a drought management tool.
B6	**What didn't work well and why:**
B7	**What components/concepts did participants seem to understand well:**. The FAO Rainfall-Runoff models used by the WEAP model and the integration of climatic data like Rainfall and Evapotranspiration and water balance at the basin level.
B8	**Were there any components/concepts that participants appeared to not understand**: the concept of how drought indicators like measuring unmet demands can be modelled by WEAP tool? It was difficult to understand how WEAP is managing these concepts.
B9	**What aspects of the event could be improved and what to be kept:** This training must be a kind of on-job training, not just focusing on the introduction of the technical materials in a short duration. The participants were interested to acquire new knowledge but they did not have the time to prepare real case studies. Further involvement of the participants through different tasks during the training could be more useful.

6 ANALYSIS OF THE RESULTS OF THE TRAINING COURSE

The training succeeded to mobilise a good number of trainees that are implicated in water resources management and planning at the MWI, as indicated in Table 4 below.

Table 4: Workshop participation/ demographics

		Comments
Total No. of participants actually attending one or more training days	12	
Total No. of participants Planned to attend	20	The original plan (before the Terms of Reference (TORs) were changed) was to open the training for other relevant organisations such as the Ministry of Agriculture and NCARE and NGOs. This has changed in the revised TORs to target only MWI designated staff, being responsible for planning and water resources management in Jordan
Planned/Actual	60%	
Number of organisations/agencies/authorities that were represented	1	The training was intended for the MWI staff
Gender balance (% of women participants)	58.3%	
NGO representation: No. of participants from NGOs	-	The training was intended for the MWI staff

After the training workshop, an assessment questionnaire was distributed to test the level of knowledge of the participants in the various subjects of the training. Ten participants of the 12 filled the assessment questionnaire. The results of the quiz are summarised in table 6

Table 5: Evaluation of the results of the quiz:

Question	participants that answered correctly (A total of 10 participants completed the quiz)	
	No.	%
Q1	10	100
Q2	10	100
Q3	10	100

Q4. A	5	50
Q4. B	5	50
Q5	4	40
Q6	7	70
Q7	9	90
Q8. A	5	50
Q8. B	5	50
Q9	9	90

As indicated above, the quiz was filled in by most of the participants. Overall, the scores indicated that the trainees have understood the whole aspects of the course, and they have shown the ability to deal with modeling the water system using the WEAP tool. Since it was a highly specialized technical issue, no pre-training evaluation was made. This course is to be followed by another advanced training especially that the trainees have received well the training and are by now well-prepared with the knowledge and skills needed for additional courses. The quiz that was lunched at the end of the training reflected the theoretical and practical examples. The participants scored higher on the practical part, which helped the trainees get focused and be encouraged to build examples and some case-studies. This final result will also help on how to structure and design the second training session.

7 CONCLUSIONS & OVERALL ASSESSMENT

This training was the first step towards the development of WEAP-based drought modeling. The staff has been trained on calculating the demands and its inter-seasonal fluctuations and the deficit in supply, water requirements and calculation of losses. The training also guided them to set growth rates for demands and introduced them to the catchment system in the WEAP through FAO Rainfall-Runoff calculations within the catchment. They were also introduced to how to deal with climatic parameters like Precipitation, Evapotranspiration. In this training, a model of country wide WEAP was introduced to them. A demo version of Amman-Zarqa Basin was also demonstrated. Participants showed ability to deal with the different parameters and variables that define the conceptual design and structure of the WEAP for a river basin. They are able now to develop small scale WEAP model using the full capability of Supply-Demand Allocation and to use water supply and demand scenarios for future (Examples on the supply side:Increase/decrease the water allocation and the per capita use, No NRW reduction, No water use efficiency. On the demand side; Population increase and growth rate.). The next training that will be conducted by next September 2018 will include more WEAP simulations and how to investigate over-abstraction in groundwater resources, unmet water demands and manipulating 15 years of hydrological data. They will be able to investigate the change over these years in the drought indicators and linking WEAP to measure drought vulnerability in Amman-Zarqa Basin.

8 ANNEXES

8.1 AGENDA

TABLE 6. AGENDA OF TRAINING. DAY 1

Time	Session	
9:00	Registration	
9:30	Opening Session Welcome Speech from MWI coordinator Opening Remarks Ex-Post Assessment and evaluation form	
10:00	Introduction to water resources management modelling • Principles • Hydrologic (surface and groundwater) modelling (empirical, conceptual, physically based & lumped, semi distributed, fully distributed) • Water resources simulation and software models Introduction to WEAP • Potential of Water Evaluation and Planning tools: WEAP Model • WEAP Environment and structure • WEAP Conceptual Design	
11:30	***Break***	
12:00	WEAP Capabilities and Limitations • Capabilities of WEAP - Data Models built in WEAP - Simulation of water management Systems - Data and Model Requirements • Limitations	
12:30	***Break***	

13:30	Calculating Water Budget by WEAP • Simplified Rainfall-Runoff Model • Penman-Monteith Approach • Setting up (data and methods) • Understanding time-steps, Current Account year, calculation procedures and reporting formats	
15:00	**Wrap up of Day 1**	

TABLE 7. AGENDA OF TRAINING. DAY 2, 3

DAY 2: Application and Calibration of WEAP		
9:30	Recap from Day 1	All participants
10:00	• Application of WEAP on local water management : a case study from AZ Basin • Understanding water system dynamics in AZ Basin and the mass-balance elements	
11:00	***Break***	
11:30	Building an aggregated model on WEAP at Zarqa River sub-catchment • Creating a new WEAP project • Adding supply and demand to the WEAP project (eg. irrigation and catchment areas-Rainfall Runoff Model) • Simulation of more detailed model in AZ catchment	
12:30	***Break***	
13:30	Model Calibration and Understanding the Inputs Running the Amman-Zarqa WEAP model • Running the model • Viewing and understanding outputs • Understanding unmet demand and deficits from groundwater	
15:00		
Day 3: Scenario Building of WEAP		
9:30	Recap from Day 2	All participants

10:00	WEAP application and scenario building • Application of WEAP through case studies Discussion on potential of scenario building in WEAP Demonstration of the AZ WEAP model • Walking through the general WEAP model • Expanding the model and adding more nodes, data	
11:15	***Break***	
11:45	Continued…	
12:30	***Break***	
13:30	Continued… Changing the model and understanding outputs • Viewing and understanding the outputs • Discussion	
15:00		

8.2 LIST OF PARTICIPANTS

COUNTRY	TYPE OF INSTITUTION (please use the options provided*)	TITLE (Mr/Ms)	FIRST NAME	LAST NAME	ORGANISATION/ INSTITUTION	Mobile	EMAIL
Jordan	GOVERNMENT AGENCIES	Ms	Razan	Alroud	GIS and Modeling	0799569634	razan_alroud@mwi.gov.jo
Jordan	GOVERNMENT AGENCIES	Ms	Ala'a	Atieh	Water Resources Study Department	0795597927	cards19alaa@yahoo.com
Jordan	GOVERNMENT AGENCIES	Mr	Mohammad	Almasri	Water Resources Study Department	0799496985	mohammad_al-masri@mwi.gov.jo
Jordan	GOVERNMENT AGENCIES	Mr.	Noureddin	Hamad	Water Resources Study Department	0796525558	noureddin.hamad@yahoo.com
Jordan	GOVERNMENT AGENCIES	Ms	Najah	Seelawi	Water Resources Study Department	0781530024	najah_seelawi@mwi.gov.jo
Jordan	GOVERNMENT AGENCIES	Ms	Maysa	Subah	GIS and Modeling	0777102525	maysaali@yahoo.com
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Jordan	GOVERNMENT AGENCIES	Mr	Hisham	Almaharmeh	Policies and Strategic planning Directorate	0772102158	heshammaharmeh@yahoo.com
Jordan	GOVERNMENT AGENCIES	Ms	Mona	Dahabiyeh	Modeling Department	0795553449	mona-dahabiyeh@mwi.gov.jo
Jordan	GOVERNMENT AGENCIES	Ms	Helda	Al-Shakatreh	Policies and Strategic planning Directorate	0772562120	hilda_al-shakatreh@mwi.gov.jo

8.3 QUIZ

TRAINING ASSESSMENT QUESTIONNAIRE

14.12.2016

Workshop Title	**SWIM-Horizon 2020 Support Mechanism "Drought Risk Management (DRM) Mainstreaming" regional training**
Date	4 -6 March 2018
Venue Location	Amman, Jordan
Participant Name	
Participant Title/ Position	
Participant Country	Jordan

INSTRUCTIONS/ INSTRUCTIONS:

Please respond to the questions below. Your feedback is sincerely appreciated. Thank you.

Which is the main **Schematic Tool** on WEAP intended to estimate water volume from precipitation?

☐ Demand Site (Agricultural and Domestic)

☐ Groundwater

☒ Catchment

☐ Diversion

☐ River

1. What are main parameters used by **Catchment** for a hydrological balance? (4 out of 5 answer is correct)

☒ Precipitation

☒ Evapotranspiration

☒ GW Recharge

☒ Runoff

☐ Return Flows to WWTP

2. One of the following criteria are correct for water **Return flow**? (1 out of 3 is correct answer)

☒ Return flow = Inflow * (1-Consumption)

☐ Return flow = Inflow * (1+Consumption)

☐ Return flow = (1-Consumption)

3. What are main results in WEAP that can show the deficit in water supply?

☒ Unmet Demand

☒ Coverage

☐ River Stream Flow

☐ Supply Delivered

4. What is Difference between **Streamflow Gauge** and **Flow Requirement** in WEAP:

Streamflow Gauge (Absolute): The absolute difference between streamflow gauge data (observed streamflow) and the simulated streamflow at the node immediately above the gauge (simulated minus observed).While Flow Requirement is The minimum flow is achieved either by restricting upstream withdrawals from the river or by releasing water from upstream reservoirs----------

5. Do you know How to add **Demand Site** for Domestic **on WEAP**? Please list the main **steps of the methodology**

1. Add demand site from WEAP legend to the Schematic and define its name
2. Go to the Database, and browse the demand site you already added in the scheme of WEAP and then define the unit of Annual Activity Level into **"People"**
3. Define number population for the demand site in the current account scenario
4. Go to the Annual Water Rate Use and Define the **"per capita share"** for the population.
5. Put the monthly variation and percentage of consumption in the database.

6. In order to develop a **transmission link** for a given demand site you need to: (2 out of 4 answers are correct)

☐ Connect Demand site directly with WWTP by a return flow

☐ Construct a transmission link between demand sites and WWTP

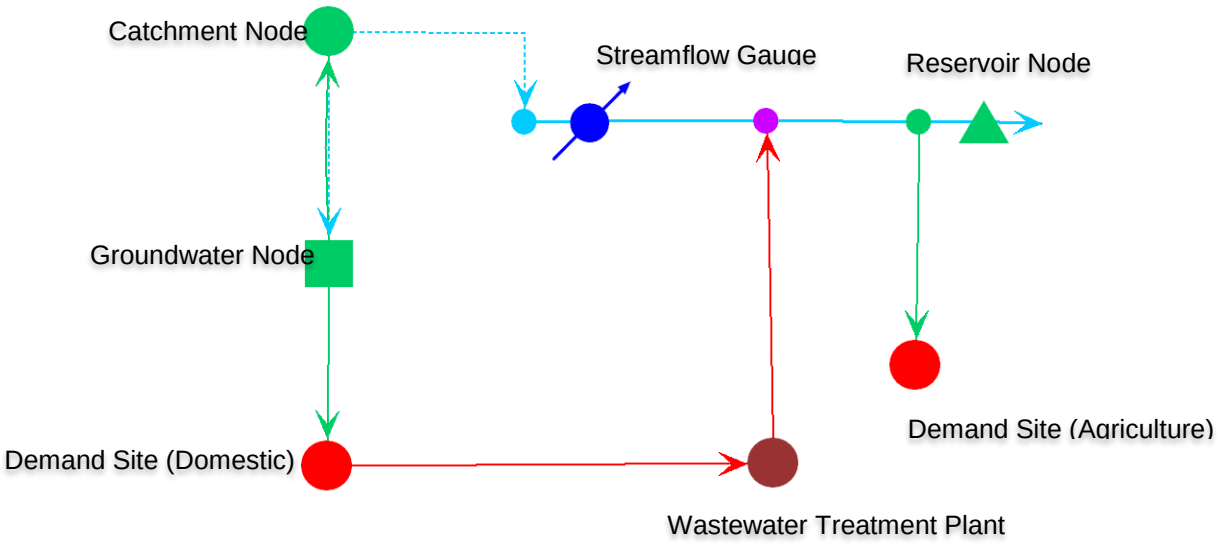
☒ Construct a transmission link between GW Supply and Demand

☒ Construct a transmission link between River and Demand Site

7. The parameters listed below contribute to increase **Demand Requirements.** Is this correct?

▪ Population density and growth	☒ YES	☐ NO
▪ Losses within demand site	☒ YES	☐ NO
▪ Low precipitation and droughts	☐ YES	☒ NO
▪ Water reuse within demand site	☒ YES	☐ NO

8. Please fill in the name/function of the following symbols used in WEAP Schematic?



THANK YOU!

The civil society component of SWIM-H2020 SM is facilitated by the UfM labelled BlueGreen project and network