



Chap II: Basic Concepts of Water Resources Management

Water resources management does not concern only the quantity of water but its quality and its availability. It ensure equitable access for drinking water, agriculture water, it handles also the risks of floods and drought. It extend to prevent future shortages, protecting this precious resource for future generations.

Definition: The management of water resources is defined as; the whole set of technical, institutional, managerial, legal and operational actions required **to plan, develop, and operate** water resources. It can be considered as a process including all activities of planning, design, construction and operation of water resources systems. (H.H.G Savenije, 1996)

2.1 Objectives of Water Resources Management: The main goal of the water resources management is sustainable water use.

The achievement of an effective and sustainable water resources management, can be made by a proper monitoring, evaluating and controlling works as are summarized in below:

- a) Water quantity
- b) Water quality



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- c) Hydro-meteorological and hydro-geological network
- d) Drought management (Reservoir operation/ Water diversion)
- e) Watershed management (Drainage water regulation/Forest protection/Land conservation)
- f) Water facilities maintenance

As a result to well understand the WRM (Water Resource Management) concepts we should follow the water cycle and its users.

2.1 The hydrological Cycle (Water Cycle): The continuous movement of water (evaporation, condensation, precipitation, infiltration, runoff) is understanding this cycle will helps managers to know how much water is available, when, where and how to use this WR (Water Resource).

2.2 Water Balance:

The basic of water balance is the fundamental following equation:

$$\text{Inflow} = \text{Outflow} + \text{Change in Storage}$$

Managers quantify all sources (rain, rivers, groundwater recharge) and all uses (evaporation, human consumption, flow to sea). Any imbalance in this equation signals scarcity of water or flooding risk.



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2.3 Catchment and ground water management: These are part of the hydrological cycle that need a careful management to meet the water sustainability for all users. In details catchment management is the integrated planning and management of land, water, and related natural resources within a watershed to sustainably secure water quality, quantity, and ecosystem health. It strengthens ecosystem resilience against climate change. In the other side groundwater management involves sustainably developing, monitoring, and protecting underground aquifers to ensure long-term availability for drinking, agriculture, and ecosystems. It include controlling extraction rates to prevent depletion, managing recharge to replenish stocks, and regulating quality to prevent contamination. Groundwater secure reliable, high-quality water for over 50% of the global population, so it has a great importance in countries where surface water are limited.

2.4. Integrated Water Resources Management (IWRM): It promotes coordinated management of land, water, and related resources to maximize economic and social welfare without compromising ecosystem sustainability. Three pillars:

- Economic efficiency (water as a valuable good)
- Social equity (fair access for all users)
- Environmental sustainability (maintaining aquatic ecosystems)



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2.5 Demand vs. Supply Management

This concept is the key to set distribution strategy and improving water allocation based on the demand and supply.

Supply management (traditional): Building dams, wells, water transfer to increase water availability in other location.

Demand management (modern): Reducing waste water, pricing water reasonably, using efficient irrigation/technologies, leak detection, consumer behavior change and of course prioritization of consumers .

2.6 Water rights & allocation

water right is typically a legal privilege to use water, rather than ownership of the resource itself. It covers aspects such as the quantity, source, priority date, and type of use. while water allocation defines the process of distributing available water resources among users by using administrative permits, licenses, or market-based trading systems. In simply explanation water rights are usually granted with the requirement that the water is put to "beneficial use," and its allocation define who can take water, how much, from where, and for what purpose, ensuring equitable and efficient usage.



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2.7 Adaptation to climate change

Climate change directly impacts the hydrological cycle, leading to more frequent extremes like severe droughts and intense flooding over the world. The new basic concept is defined by shifting baselines. Past hydrological data no longer fully predict future. So it is a must to include a climate resilience in order to minimize risks related flood and drought difficult to forecast due to climate change. It should be done by implementing a dynamic process that uses continuous feedback and monitoring to adjust decisions as new climate data becomes available, moving away from rigid "quick-fix" solutions toward long-term resilience. As example of short-term relief measures like water rationing, emergency tankers during the hot season in the other hands long-term changes, including redesigning urban water systems with "green" infrastructure. The Integrated water resources management (IWRM) is expected to work well as an adaptation tool and strategy to climate change.



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Adhering to these previous objectives we need to start planning the water resources by matching the water availability and water demand already explained Demand Vs Supply concept.

2.8 Water Resources Planning: water resources planning (WRP) is the development of and allocation of scarce resource to meet the diverse needs from sectoral to intersectoral, taking into account the full set of national objectives and constraints and the interests of stakeholders (all parties that can benefit from the water resource). This is achieved by ensuring adequate, inexpensive, and sustainable supplies and qualities of water for both humans and natural ecosystems.

Water Resource Planning (WRP) is related directly to certain hydrologic facts. One of these facts is that surface water and ground water quantity **vary over space and time**. The volume to be withdrawn from them is also limited and can be subject **to pollutants** that alter the water quality. WRP is not limited to these it extent to Hydrologic basin

Planning is only effective if all interested parties during the implementation stage are involved in the process of decision making and must be committed. In no respect to this fundamental rules the project or program is likely to fail. We will see this in detail the IWRM chapter.