

# MODULE 6

## WATER MANAGEMENT

**The topics covered in this module are:**

- Water In a watershed
- Water security
- Integrated water resource management (IWRM)
- Participatory approach in water management

## OBJECTIVE (S) OF THE MODULE

The trainer informs the following module objectives to participants:

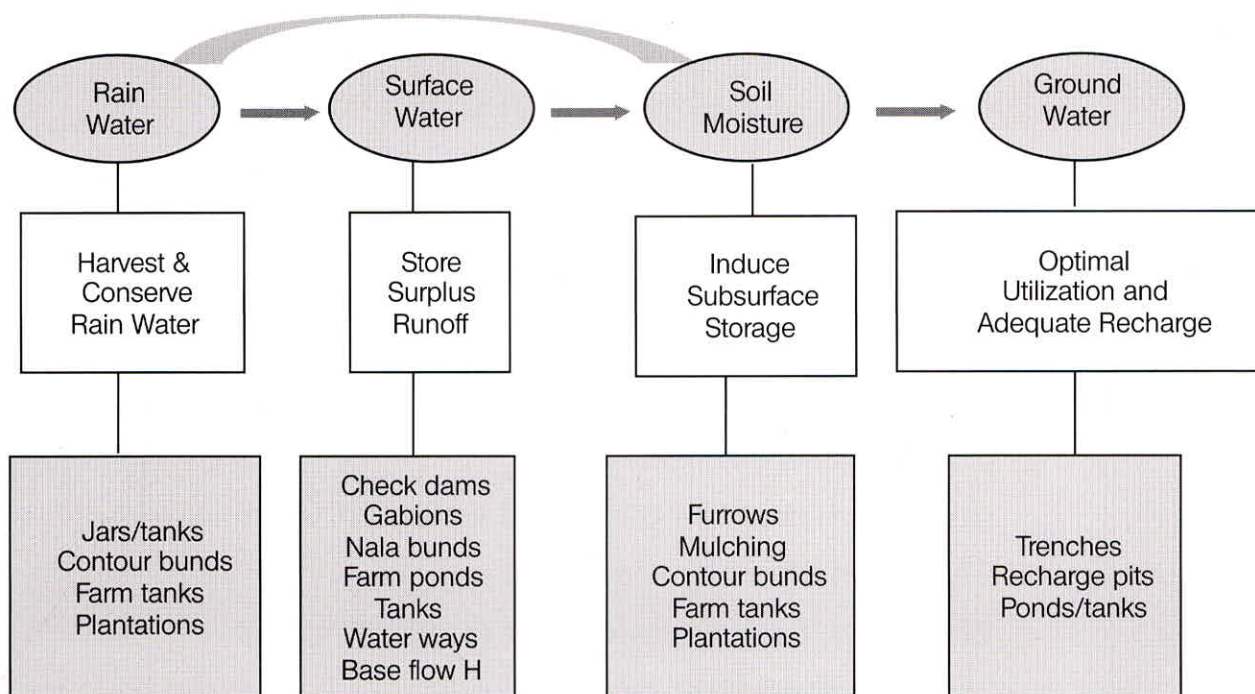
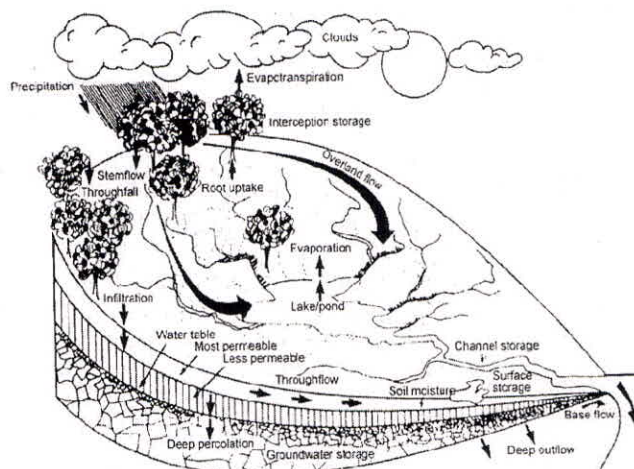
- Explain watershed and its management.
- Discuss the water security and its related aspects.
- Give knowledge on Integrated Water Resource Management and role of participatory approach in water management.

## WATER IN WATERSHED

When rain falls on the Earth, that water flows across or under the ground and begins its way to a stream or river, and then on to a larger body of water such as an ocean. Thus, watershed is an area of land which drains to a common point.

The water in a watershed originates via precipitation that is collected on the surface and groundwater. However, it is important to note that not all precipitation falling in an area exits the watershed. Some of it is lost through evaporation and transpiration, some is used by people and some soaks into the soil and groundwater.

At the boundaries of watersheds there are drainage divides usually in the form of ridges or hills. Here the water flows into two separate watersheds and does not always end up in a common outlet.



'Four Waters' of Water Security

## A HEALTHY WATERSHED

When watersheds are healthy and functioning well, they provide food and fiber, clean water, and habitat for native plants and animals. Appropriate diversified vegetation cover is a key



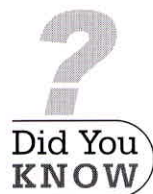
element to maintain healthy watersheds. They even affect air quality by absorbing pollutants and greenhouse gases. Well-functioning watersheds are more resilient to natural and human-induced disturbances than highly-impacted watersheds.

## CHARACTERISTICS OF A HEALTHY WATERSHED

- Water quality is high enough to support native aquatic species.
- The streams and their floodplains are able to accommodate flood flows without regular destructive flooding and erosion.
- Streams have sufficient complex habitat features including pools, gravel bars, and large pieces of wood to support fish and other aquatic wildlife even through short-term changes from drought, wildfire, landslides, or other events that alter habitat conditions in parts of the system.
- Native, keystone plant and animal species are able to sustain stable populations.
- Upland forests and grasslands are managed to promote rain infiltration, provide diverse habitat for native wildlife, reduce soil erosion, and deliver clean water into streams.
- Tidal areas are connected to their wetlands.

## MAKING A WATERSHED HEALTHY

- When you can, plant a variety of species and types of plants from grasses for erosion control and wildflowers for bees and butterflies, to shrubs and trees for birds and healthy streams.
- Reduce impervious surfaces and disconnect them from streams and storm drains. Use porous alternatives such as gravel or pervious pavement for driveways and paths. Collect roof runoff and slow its release through rain barrels and rain gardens.
- Keep water clean. Prevent soil erosion, use non-toxic household and garden products, keep oil and animal waste out of streams and storm drains.
- Repair erosion wherever possible with biotechnical techniques that incorporate native plants. These methods allow for natural watershed functions to continue.
- Protect and restore riparian areas.



*A watershed becomes unhealthy when water pollution threatens its wildlife and endangers the people who use it for drinking water, irrigation, and recreation.*

## WATER SECURITY

"Produced water" is an industry term to describe water that is extracted from the earth along with the oil and gas in that industry. The water produced may include water from the fossil fuel reservoir, water injected into the formation, including the high pressure water used to fracture the rock formation (fracking), and chemicals added during the production and well treatment process.

Water security can be defined as the ability to access sufficient quantities of clean water to maintain adequate standards of food and goods production, proper sanitation, and sustainable health care.

*But we live on a water rich planet - why are we concerned about water security?*

Water, in absolute terms, is not in short supply planet-wide. But, according to the United Nations water organization, UN-Water, the total usable freshwater supply for ecosystems and humans is only about 200,000 km<sup>3</sup> of water - less than one percent (<1%) of all freshwater resources.

And, water use has been growing at more than twice the rate of the population increase in the last century. Specifically, water withdrawals are predicted to increase by 50 percent by 2025 in developing countries, and 18 per cent in developed countries. By 2025, 800 million people will be living in countries or regions with absolute water scarcity, and two-thirds of the world population could be under stress conditions.

### COMBATING THE SITUATION

We can manage our water better: take better care of our water resources, clean up the water that mankind has polluted, and improve upon current water purification technologies - clean water access systems.

For example: in developing countries, 70 percent of industrial wastes are dumped untreated into waters where they pollute the usable water supply. Many pollutants in industrial wastes, and those in water produced by mining and oil & gas operations, have been proven to cause immediate illnesses and chronic illnesses, birth defects, and immediate or eventual death in human populations. These pollutants have also affected crops and livestock, frequently destroying both.

This practice of dumping industrial, mining and oil & gas wastes and "produced water" from those processes should be eliminated and the polluted water should be cleaned up.

### WHERE DOES INDIA STANDS?

- Water along with food and energy forms a critical part of the 'new security agenda' and redefines the understanding of security as a basis for policy-response and long-term planning.
- The Union Ministry of Water Resources has estimated the country's water requirements to be around 1093 BCM for the year 2025 and 1447 BCM for the year 2050.
- With projected population growth of 1.4 billion by 2050, the total available water resources would barely match the total water requirement of the country. In

1951, the annual per capita availability of water was 5177 m<sup>3</sup>, which reduced to 1342 m<sup>3</sup> by 2000. The facts indicate that India is expected to become 'water stressed' by 2025 and 'water scarce' by 2050.

- The National Commission for Integrated water Resource Development (NCIWRD) has estimated that against a total annual availability of 1953 BCM (inclusive of 432 BCM of ground water and 1521 BCM of surface water) only 1123 BCM (433 BCM ground water and 690 BCM surface water) can be put to use, i.e., only 55.6 per cent. The high-level of pollution further restricts the utilizable water thus posing a serious threat to its availability and use.

## INTEGRATED WATER RESOURCE MANAGEMENT (IWRM)

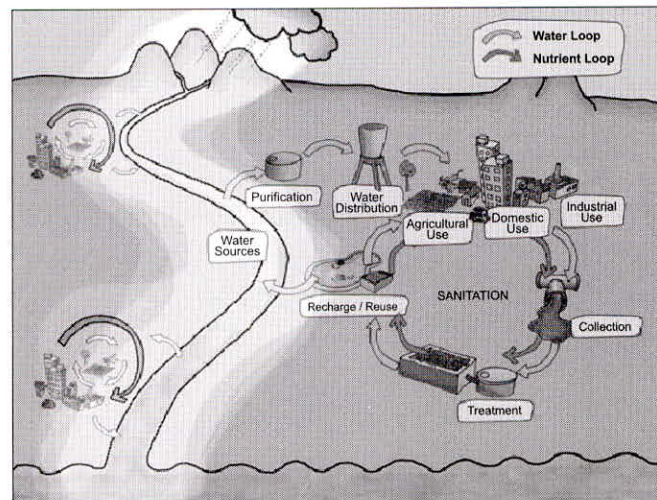
### Water is a Key

Food security exists when all people at all times have both physical and economic access to sufficient, safe and nutritious food that meets their dietary needs for an active and healthy life.

People who have better access to water tend to have lower levels of undernourishment. The lack of water can be a major cause of famine and undernourishment, in particular in areas where people depend on local agriculture for food and income.

Integrated water resources management is a systematic process for the sustainable development, allocation and monitoring of water resource use in the context of social, economic and environmental objectives.

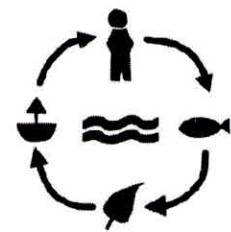
It contrasts with the sectoral approach that applies in many countries. When responsibility for drinking water rests with one agency, for irrigation water with another and for the environment with yet another, lack of cross-sectoral linkages leads to uncoordinated water resource development and management, resulting in conflict, waste and unsustainable systems.



### WHY IWRM?

Water is vital for human survival, health and dignity and a fundamental resource for human development. The world's freshwater resources are under increasing pressure yet many still lack access to adequate water supply for basic needs. Growth in population, increased economic activity and improved standards of living lead to increased competition for, and conflicts over, the limited freshwater resource. Here are a few reasons why many people argue that the world faces an impending water crisis:

- Water resources are increasingly under pressure from population growth, economic activity and intensifying competition for the water among users;
- Water withdrawals have increased more than twice as fast as population growth and currently one third of the world's population live in countries that



Erratic rainfall and seasonal differences in water availability can cause temporary food shortages. Floods and droughts can cause some of the most intensive food emergencies.

experience medium to high water stress;

- Pollution is further enhancing water scarcity by reducing water usability downstream;
- Shortcomings in the management of water, a focus on developing new sources rather than managing existing ones better, and top-down sector approaches to water management result in uncoordinated development and management of the resource.
- More and more development means greater impacts on the environment.
- Current concerns about climate variability and climate change demand improved management of water resources to cope with more intense floods and droughts.

## PRINCIPLES

This module revolves around the Dublin Principles - the four guiding principles that the international water community adopted in 1992:

1. Fresh water is a finite and vulnerable resource, essential to sustain life, development and the environment.
  2. Water development and management should be based on a participatory approach, involving users, planners and policy-makers at all levels.
  3. Women play a central part in the provision, management and safeguarding of water.
  4. Water has an economic value in all its competing uses and should be recognized as an economic good.
- The Dublin Statement on Water and Sustainable Development, also known as the Dublin Principles, was a meeting of experts on water related problems that took place on the 31st of January 1992 at the International Conference on Water and the Environment (ICWE), Dublin, Ireland, organised on 26-31 January 1992.
  - The Dublin Statement on Water and Sustainable Development recognises the increasing scarcity of water as a result of the different conflicting uses and overuses of water.

## BENEFITS

### Environmental

- Ecosystems can benefit from applying an integrated approach to water management by giving environmental needs a voice in the water allocation debate. At present these needs are often not represented at the negotiating table.
- IWRM can assist the sector by raising awareness among other users of the needs of ecosystems and the benefits these generate for them. Often these are undervalued and not incorporated into planning and decision-making.

- The ecosystem approach provides a new framework for IWRM that focuses more attention on a system approach to water management: - protecting upper catchments (e.g. reforestation, good land husbandry, soil erosion control), pollution control (e.g. point source reduction, non-point source incentives, groundwater protection) and environmental flows. It provides an alternative to a sub-sector competition perspective that can join stakeholders in developing a shared view and joint action.

## Agricultural

- As the single largest user of water and the major non-point source polluter of surface and groundwater resources, agriculture has a poor image. Taken alongside the low value added in agricultural production, this frequently means that, especially under conditions of water scarcity, water is diverted from agriculture to other water uses. However, indiscriminate reduction in water allocation for agriculture may have far-reaching economic and social consequences. With IWRM, planners are encouraged to look beyond the sector economics and take account of the implications of water management decisions on employment, the environment and social equity.
- By bringing all sectors and all stakeholders into the decision-making process, IWRM is able to reflect the combined 'value' of water to society as a whole in difficult decisions on water allocations. This may mean that the contribution of food production to health, poverty reduction and gender equity, for example, could over-ride strict economic comparisons of rates of return on each cubic metre of water. Equally, IWRM can bring into the equation the reuse potential of agricultural return flows for other sectors and the scope for agricultural reuse of municipal and industrial wastewaters.
- IWRM calls for integrated planning so that water, land and other resources are utilised in a sustainable manner. For the agricultural sector IWRM seeks to increase water productivity (i.e. more crop per drop) within the constraints imposed by the economic, social and ecological context of a particular region or country.

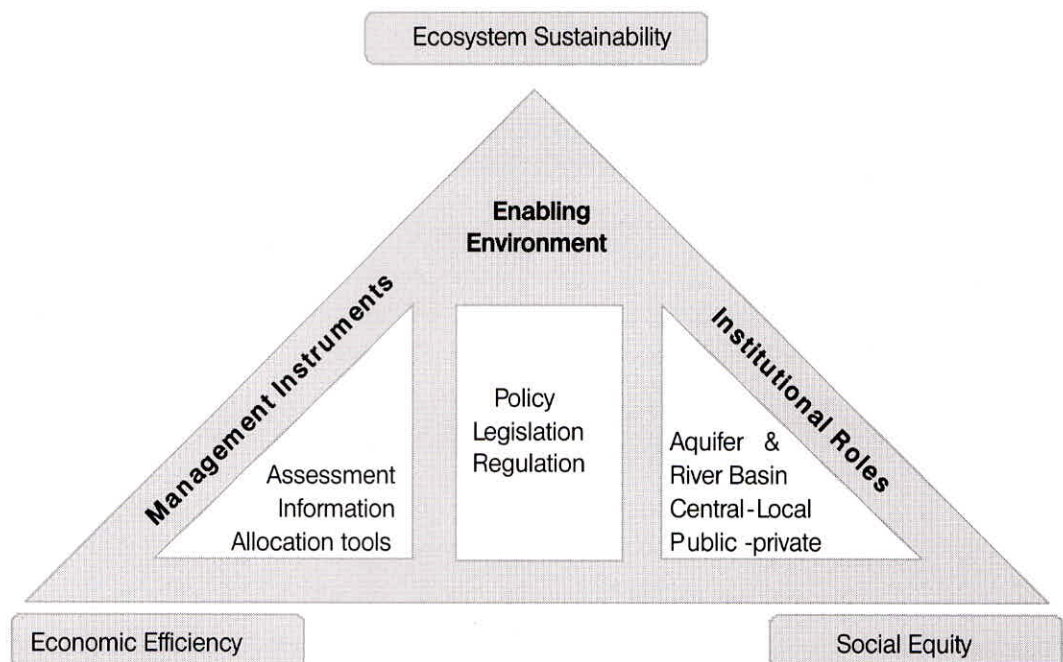
## Supply & Sanitation

- Above all, properly applied IWRM would lead to the water security of the world's poor and unserved being assured. The implementation of IWRM based policies should mean increased security of domestic water supplies, as well as reduced costs of treatment as pollution is tackled more effectively.
- Recognizing the rights of people, and particularly women and the poor, to a fair share of water resources for both domestic and household-based productive uses, leads inevitably to the need to ensure proper representation of these groups on the bodies that make water resource allocation decisions.
- The focus on integrated management and efficient use should be a stimulus to the sector to push for recycling, reuse and waste reduction. High pollution charges backed by rigid enforcement have led to impressive improvements in industrial water-use efficiencies in the industrialised countries, with benefits for

domestic water supplies and the environment.

- Past sanitation systems often focused on removing the waste problem from the areas of human occupation, thus keeping the human territories clean and healthy, but merely replacing the waste problem, with often detrimental environmental effects elsewhere. Introduction of IWRM will improve the opportunity for introduction of sustainable sanitation solutions that aim to minimise waste-generating inputs, and reduction of waste outputs, and to solve sanitation problems as close as possible to where they occur.
- At a practical local level, improved integration of water resource management could lead to greatly reduced costs of providing domestic water services, if for instance more irrigation schemes were designed with a domestic water component explicitly involved from the start.

## STAGES



## ACHIEVING IWRM AT LOCAL LEVEL

### STEP 1 - Mobilize Support

- Strengthen existing development plans.
- Compile integrated support.
- Define targeting procedures.
- Establish horizontal, integrated service delivery structures.
- Ensure vertical national support.



**Step 2 - Select Community**

- Develop selection criteria within time and funding frames.
- Communicate widely and test for compliance.
- Select.

**Step 3 - Understand the community and build capacity**

- Build trusting relationships and communicate the project concept.
- Do contextual profiling.
- Train the community and select community mobilizers.

**Step 4 - Create a vision and select activities to fulfil it**

- Do participatory situational diagnosis and problem analysis.
- Create a vision of new ways to manage water.
- Rank opportunities and needs.
- Select activities for implementation.

**Step 5 - Compile detailed action plans**

- Create and train community structures.
- Specify actions, roles and budgets.
- Sign off.

**Step 6 - Implement the action plans**

- Construct communal infrastructure and develop the capacity to operate and maintain it.
- Create management structures and develop their capacity.
- Implement the accompanying interventions and develop the capacity to maintain them.
- Ensure sustainability when exiting.
- Operate and maintain infrastructure and continue capacity development

**Continuous 'Step 7': Do participatory monitoring and evaluation, and livelihood impact assessment for follow-up**

- Monitor planning, implementation and use.
- Monitor the impacts on livelihoods.
- Identify follow-up plans for community-based water resource management.

## PARTICIPATORY APPROACH IN WATER MANAGEMENT

In the past, watershed management was synonymous with increase in crop productivity. Today, it is synonymous with poverty alleviation and sustainable development of watersheds for the welfare of the population or land users. Watershed management is seen in its entire complexity, where interrelated factors and their interactions are considered with the objective of poverty alleviation and food security of the populations. The past models of development, e.g., government or outside agency driven development programs (often top down) have not proved to be successful and have resulted in a waste of available resources (budgets).

With the new focus on poverty alleviation and food security through appropriate natural resources management, both people and natural resources become the focus of watershed management. Participation of local community in watershed development and management is essential to sustain the watersheds.

### COMMUNITY INTERVENTIONS

There are many activities which are not effective, when attempted at an individual field or farm level, but call for simultaneous community action. For some areas/activities community interventions are essential. These activities are:

- Management of social forestry and pasture lands.
- Management of surface and groundwater resources.
- Maintenance of major structures.
- Management of gully control structures.
- Maintenance of drainage ways.
- Resolution of conflicts.
- Management of community funds.
- Management of other common property resources

### KEY ELEMENT

Some critical elements, which need to be integrated into watershed management programs have often been overlooked in the past. The following critical elements are the key elements in participatory processes for integrated watershed management:

- Participatory, multidisciplinary, and multi-sectoral approach.
- Envisioning of both farmers and professionals for integrated watershed management.
- Farmers' empowerment and ownership of watershed management processes and programs.
- Assured and quick benefit generation by watershed management programs.
- Land use titling/tenure for farmer ownership of watershed management

programs.

- Mainstreaming gender concerns specially those of women and other disadvantaged groups.

## PRINCIPLES

### Mutual respect

All people must be accepted as they are with their strengths and weaknesses.

### Active involvement

Active involvement of the people is a pre-requisite for participation. Participation patterns must continue from planning through evaluation.

### Agree to disagree

Participation requires an implicit and explicit understanding to agree and disagree and to accept the common interest above personal interest.

### Building consensus

Collective responsibility for decisions made.

### Commitment to action

Collective commitment to action on the basis of agreed upon decisions and plans.

## AN EXAMPLE OF 'PARTICIPATORY WATERSHED DEVELOPMENT' TO FOLLOW:

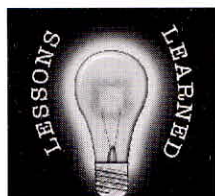
The regeneration of the Arvari and other small rivers with johads (check-dams), in Alwar district in Rajasthan has brought about a change to the lives of the people. Johads are small earthen check dams that capture and conserve rainwater improving percolation and groundwater discharge.

In the 80s, 700 villages in Alwar district were reeling from drought. Only 6 per cent of the area was under forest cover; the topsoil had eroded, only 3 per cent land was cultivable and there was widespread degradation. 80 per cent of the men had migrated to nearby cities.

Realizing the importance of johads the Bhaonta village decided to dig out the ancient johad, Once the johad had water in it, it recharged the groundwater and made the Arvari river, which originates from there, come back to life. Similar activities were conducted downstream and the river started flowing through the year by 1995. This initiative has been inspired by the Tarun Bharat Sangh (TBS) which set up its ashram at Bheekampura and started promoting johads through their paani yatras. Till date, they have built thousands of water-harvesting structures in the region. After the initiative, more than 6,500 square kilometers of land was re-claimed in 65 villages, wells had water, milk production increased 10

times and those who had migrated came back to build johads. What makes the TBS initiative different is involvement of the local people. No decision was taken to build anything unless there was consensus among the villagers. The villagers have elected a "water parliament" to ensure that the rivers, and the wells they regenerate, do not dry up again. During sessions of the water parliament In-depth study and discussions are held highlighting the villages' individual problems and finding ways to tackle them. There are strict rules regarding the use of the river water. The choice of crops is also monitored by the members of the Parliament. Since the water resources are limited, sugar rice (paddy) are forbidden. The model has been replicated in other areas of the district. The result is that three villages now have water throughout the year.

## LESSONS LEARNED



- The land that the water flows across on its way is called a watershed. The water in a watershed originates via precipitation that is collected on the surface and groundwater.
- When watersheds are healthy and functioning well, they provide food and fiber, clean water, and habitat for native plants and animals. Healthy watersheds work hard.
- Water security is the ability to access sufficient quantities of clean water to maintain adequate standards of food and goods production, proper sanitation, and sustainable health care.
- The estimated water requirement of the country is expected to be around 1093 BCM for the year 2025 and 1447 BCM for the year 2050.
- Integrated water resources management is a systematic process for the sustainable development, allocation and monitoring of water resource use in the context of social, economic and environmental objectives.
- Water resources are increasingly under pressure from population growth, economic activity and intensifying competition for the water among users.
- IWRM should be based on the Dublin Principle, to comply 3 principles - social equity, economic efficiency and environment sustainability of water resources.
- Participation of local community in watershed development and management is essential to sustain the watersheds.

# NOTES



The trainer can note down important notes below and discuss them towards the end of the training programme.

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