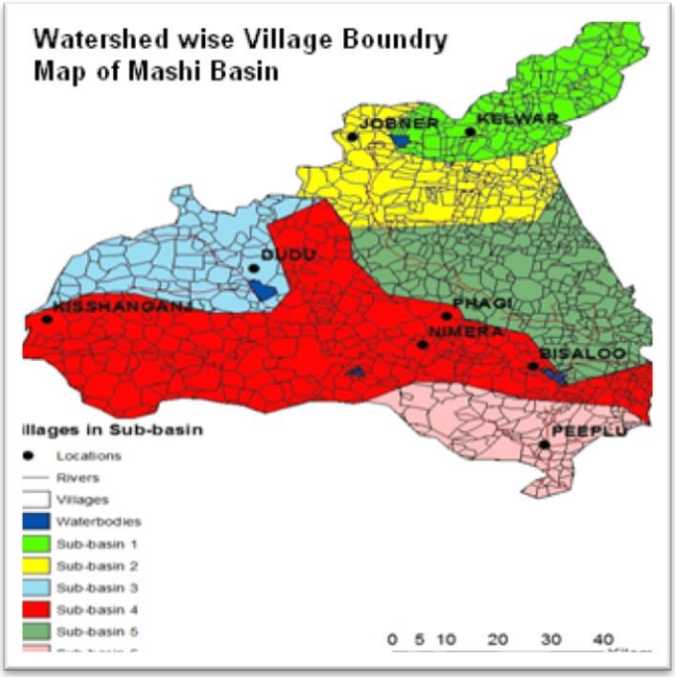
NARURAL RESOURCES MANAGEMENT IN MASHI RIVER BASIN

STAKEHOLDERS CAPACITY BUILDING TRAINING MODULE

Farmers and Domestic Water Users



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CENTRE FOR ENVIRONMENT AND DEVELOPMENT STUDIES

B-92, NITYANAND NAGAR, GANDHIPATH

QUEEN'S ROAD, JAIPUR 302 021

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STAKEHOLDERS CAPACITY BUILDING TRAINING MODULE
(FARMERS)

I. INTRODUCTION

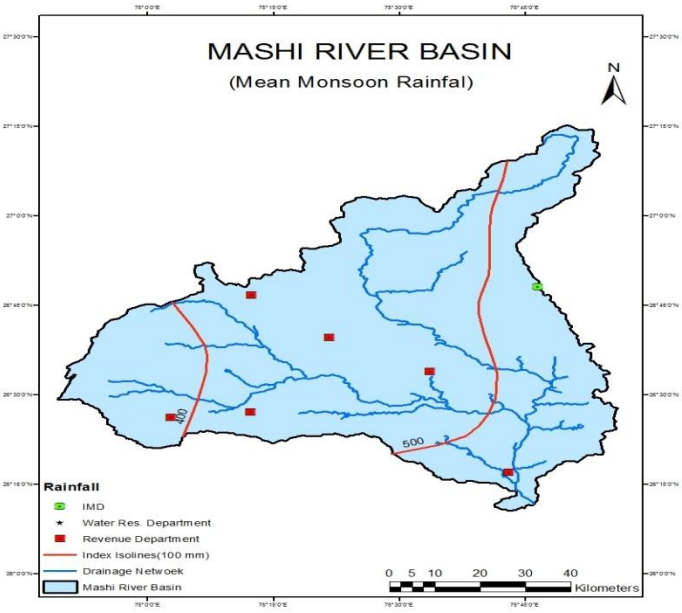
1.1 General Features of Mashi River Basin

Mashi River Basin is part of the larger River Basin called Banas River Basin, which is located in the middle of the Rajasthan. There are 11 sub basins in Banas River Basin namely;Banas (1,174,039 ha), Dain (306,138.4 ha), Gudia (92,038.56 ha), Kalisil (62,308.94 ha), Khari (639,052.9 ha), Kothari (229,852.1 ha), Mashi (647,615.8 ha), Morel (572,250.7 ha), Sodra (151,942.2 ha) and Berach (830,788.6 ha). The catchment area including all upstream Major/Medium projects is 5,872.0 $Km^2$where as the differential catchment area (area excluding upstream catchment areas of Major/Medium projects) is 3,641.4 Km^2 and falls in Tonk District.

The Mashi River Basin area falls in three districts namely Jaipur, Ajmer and Tonk Districts. The two main tributaries of Mashi River are, namely Bandi and Mashi, which originates from the hills of Samod and Ajmer district respectively. Mashi River originates from the Silora hills about 6 kilometers south of Kishangarh Town in Ajmer district and passing through Phulera tehsil in Jaipur district. It flows initially in an eastward direction and then towards south for about 96 km in partly hilly and partly plain areas along the borders of Jaipur and Tonk districts between the tehsil of Malpura and phagi until it turns south to join the Banas River at Galod village near Tonk. The catchment of the Mashi River is located between latitudes 26°11 and 26°16’ and longitudes 74°48’ and 75°54’. It has got one tributary called Bandi. Bandi River the tributary of Mashi River originates from hills located in the North-West of Jaipur and passes through Kalwar town near Jobner and meets Mashi near Madhorajpura. These tributaries are fed by large number of small rivulets originating from the plains of tehsil Sanganer, Dudu, Chaksu, Malpura, etc. All of them are non-perennial rivulets.

1.2 Rainfall

There is high rainfall variability in the Basin. Occurrence of drought of high and moderate intensity is a common phenomenon. Average rainy days in the study area are 32 with rains of 450 to 650 mm a year. Figure shows the mean monsoon rainfall in Mashi River Basin.



Mean Monsoon Rainfall in Mashi River Basin

1.3 Land Use

Land use / Land cover maps will be prepared using spectral analysis of the LISS IV satellite images and visual characteristics of the images. The land use map consists of various land use classes representing the towns, village, water bodies, forest, types of land cover etc. These categories are delineated using interpretation key elements. Remaining features like road, river and railway were captured through head-on digitization from the satellite image. All the layers are overlaid and verified with the field check to prepare the final land use / land cover map.

Sl.	Type	Type	Classes
1	Builtup	Urban	Residential, Mixed builtup, Public / Semi Public, Communication, Public utilities / facility, Commercial, Transportation, Reclaimed land, Vegetated Area, Recreational, Industrial, Industrial / Mine dump, Ash / Cooling pond
		Rural	Rural
		Mining	Mine / Quarry, Abandoned Mine Pit, Land fill area
2	Agriculture	Crop land	Kharif, Rabi, Zaid, Two cropped, More than two cropped
		Plantation	Plantation -Agricultural, Horticultural, Agro Horticultural
		Fallow	Current and Long Fallow
		Current Shifting cultivation	Current Shifting cultivation
3	Forest	Evergreen / Semi evergreen	Dense / Closed and Open category of Evergreen / Semi evergreen
		Deciduous	Dense / Closed and Open category of Deciduous and Tree Clad Area
		Forest Plantation	Forest Plantation
		Scrub Forest	Scrub Forest, Forest Blank, Current & Abandoned Shifting Cultivation
		Swamp / Mangroves	Dense / Closed & Open Mangrove
4	Grass/ Grazing	Grass/ Grazing	Grassland: Alpine / Sub-Alpine, Temperate / Sub Tropical Tropical / Desertic
5	Barren/ unculturable/ Wastelands	Salt Affected Land	Slight, Moderate & Strong Salt Affected Land
		Gullied / Ravinous Land	Gullied, Shallow ravine & Deep ravine area
		Scrub land	Dense / Closed and Open category of scrub land
		Sandy area	Desertic, Coastal, Riverine sandy area
		Barren rocky	Barren rocky
		Rann	Rann
6	Wetlands / Water Bodies	Inland Wetland	Inland Natural and Inland Manmade wetland
		Coastal Wetland	Coastal Natural and Coastal Manmade wetland
		River / Stream / canals	Perennial & Dry River/stream and line & unlined canal/drain
		Water bodies	Perennial, Dry, Kharif, Rabi &Zaid extent of lake/pond and reservoir and tanks

The information on land use generated from remote sensing data is reported in Table. It shows that the Mashi River sub basin is covering an area of 6476 Km^2 extending to three districts. The Cultivated area (including current and permanent fallow lands) accounts for 78.16 percent of total geographical area of the Basin. The forest area is around 3.66 percent and Barren/ un-culturable/ Wastelands 14.55 percent. Other categories are covering less than 5% area. The five categories of wastelands (Barren / Outcropped, Built-up, Crop Land, Dry River bed &Water bodies) shows trend of increase in area over last 8 years. The area under Built-up category has increased significantly. Major decline is reported in fallow land, land with scrub and land without scrub.

Table: Land use Pattern in Mashi Sub Basin Catchment.

Land Use/ Land Cover Class	2006 to 2010		2010 to 2014		2006 to 2014	
	Area	%	Area	%	Area	%
Forest Land	129.92	2.01	139.89	2.16	129.05	1.99
Forest Open Veg.	106.86	1.65	96.89	1.5	117.9	1.82
Land with Scrub	400.28	6.18	308.74	4.77	296.83	4.58
Land without Scrub	344.65	5.32	317.4	4.9	242.51	3.74
Barren / Outcropped	197.33	3.05	220.65	3.41	247.72	3.83
Built-up	142.77	2.2	220.69	3.41	261.24	4.03
Dry River bed	38.72	0.6	44.02	0.68	43.92	0.68
Crop Land	2823.4	43.6	2870.13	44.32	2968.74	45.84
Fallow	2238.23	34.56	2191.5	33.84	2092.88	32.32
Water body	53.85	0.83	66.08	1.02	75.21	1.16
Total area	**6476**	**100**	**6475.99**	**100**	**6476**	**100**

Since the major water demand comes from agriculture sector the above discussed changes in the land use pattern will affect the total demand and through new challenges for water resource management in the basin. The area categories Not Available for Cultivation and Other uncultivated Lands are the areas acting catchment area for surface water structures and groundwater recharge, therefore, these changes have to be analysed carefully.

1.3 Cropping Pattern

The Mashi Basin has two different set of areas, i.e. the catchment areas of Bandi and Mashi rivers and they are differently endowed with quantity and quality of water (both surface and groundwater) and therefore difference in cropping pattern. Jowar (fodder crop), Bajra and Pulses (particularly short duration green Gram) are the main prominent kharif crops. In the Bandi River catchment area where groundwater availability is higher and tubewell irrigation is practiced even the rainfed crop like Bajra is also irrigated, mostly as life saving irrigation. Irrigated Groundnut is also grown in the Bandi river sub-basin mainly because of the sandy soils and availability of groundwater. Jowar as fodder crop is more popular in the Mashi Basin as it is profitable because the fodder rates are high. Overall 77.8% of the crops are rainfed and only 22.3% crops are irrigated in the Kharif season.

Except Gram crop all other crops in the Rabi season are grown under irrigated condition. Wheat and mustered are the main Rabi crops. Barley the low water demanding crop almost went out of

the area a decade ago because area was comfortable in availability of ground water and farmers were growing wheat. But overexploitation of groundwater lead to emergence of drak zone and people are now looking for less water demanding crops namely, Mustard, Gram and Barley. In Rabi season 94% area is under irrigation and only 6% is under rainfed crops (Gram and Mustard/Taramira)

1.4 Land and Water Management Issues in the Basin

- The soils of the region suffer variously in the different soil regions from excessive drainage, low water retentive capacity, moderate erosion by wind, and low fertility mostly in the upper northern part of the basin. Salinity, alkalinity, poor drainage accompanied moderate to severe erosion are the problem of the soils.

- Five hydrogeological formations viz; ***Younger Alluvium, Older Alluvium, Phyllite& Schist, Quartzite and BGC (Banded Gneissic Complex)*** are the main water bearing formation (aquifer) in the Basin.

- **Land Use**: The Cultivated area (including current and permanent fallow lands) accounts for 78.2 percent of total geographical area of the Basin. The forest area is around 3.6 percent and Barren/ un-culturable/ Wastelands 14.5 percent. Other categories are covering less than 5% area.

- **Cropping Pattern**: Farmers taking high water demanding irrigated crops in Rabi and Kharif season. Lack behind in new irrigation technology and crop cultural practices. Lack of diversification of crops and livelihood.

- **Surface Water**: The number of Water Harvesting Structures (WHS) constructed in with differential catchment is 3,087 with total water holding capacity is 112.23 Mm^3. Actual mean annual water yield to the Mashi sub basin is computed to be 203.95 Mm^3 (with all interventions).

- Rainfall occurs mainly during the monsoon season in Mashi Project catchment therefore, major portion of stream flow occurs only during these months. The annual dependable water yield at 50% is 59.6 Mm^3, while water yield at 75% dependability is 6.4 Mm^3 (13.3% of gross storage capacity).

- Major and Medium Projects: There are 3 upstream projects in Mashi sub basin catchment. The live storage capacity of these three existing upstream project in the Mashi Sub Basin catchment is 81.36 Mm^3.

- Minor Projects: There are 97 Minor projects in the catchment area of Mashi Sub Basin with total live storage capacity of 90.64 Mm^3. There are large numbers of

minor projects constructed in the catchment of Mashi Dam capacity of which exceeds its design yield which may have substantial impact on inflow to project.

- **Groundwater:** Groundwater availability for long-term exploitation, clear of any current state of overdraft is the basic element. Since it is a derivative of rainfall, the dependability level of such rechargeable 'dynamic' groundwater availability relies on the statistic occurrence of precipitation. The total net annually assessed groundwater resource in the Mashi Basin is 2586.29 Mm^3 and groundwater draft 3497.64 Mm^3. The stage of groundwater development in the basin is 135.24 % and the basin is categorized as overexploited basin.

- Groundwater Quality: The groundwater quality in the Mashi Sub Basin has been reported with reference to selected parameters, namely, concentration of Chloride, Fluoride, Nitrate and EC value.

- The average chlorides concentration was relatively stable and ranges from a minimum of 175 mg/l to a maximum of 474 mg/l during the period of 1984 - 2010.

- Fluoride concentrations are above the upper permissible limit for drinking water in most of the basin's area. The 100% non-potable water area belongs to quartzite aquifer unit in Mashi sub basin.

- The average nitrates concentration ranges from a minimum of ~25 mg/l to a maximum of ~267mg/l during the aforementioned time period 1984 – 2010. The concentration rose from a value of ~41mg/l during 1984 to a value of ~100mg/l during 2010, a total rise of ~144% within 27 years. The average nitrate concentration is between the desirable and maximum allowed concentrations for drinking water (45 mg/l and 100mg/l, respectively); nevertheless, the last average value (2010) is very close to the maximum allowed limit. Most of the area in the basin is affected by nitrates ion concentrations above permissible concentrations.

- Encroachments in the riverbed and rivulets

- Sand mining

- Industrial pollution

There are numerous problems of water resources i.e. of availability, distribution, equity in access, quality, competition in usage, water pollution, encroachment on water bodies and catchment areas, ownership and right issues, etc. It is for this reason that this basin was selected to attempt a new model of water resource management. Also the State Government has enacted a River Basin Act without much understanding the implication

of it in terms of governance of water. The proposed River Basin Parliament may help in understanding and addressing the future water governance and management needs of the State.

In this Module we will deal with issues pertaining to agriculture only.

II. CONTENTS OF STAKEHOLDERS TRAINING - FARMERS

Water use in agriculture is between 85 to 90 percent of total water use in Rajasthan therefore, water saving in agriculture will make significant difference in management of water resources in Mashi Basin. The Hydrogeological Module will be common for all the stakeholders but for farmers there is need to know about water balance in the basin and location specific variability in availability of surface and groundwater. Since rainfall is the ultimate source of water knowledge about rainfall variability and impact of climate change on availability of water and planning agricultural activities s very critical. This module will address all aspects concerning farmers livelihood in the Basin.

The training will cover the following topics:

1. Introduction to basics of geology
   a. The earth system
   b. Introduction to maps

2. Water Balance and water demand for agriculture
   (i) Surface water
   (ii) Groundwater
   a. Introduction to surface and groundwater resources
   b. Surface and groundwater use

3. Climate variability and Climate Change
   a. Rainfall – pattern, variability, and forecasting
   b. Concept
   c. Impact on water and agriculture

4. Soils and Soil Health
   a. Importance & Needs of soil testing in present day Agriculture
   b. Soil Health Card

5. Farming System
   a. Farming System Approach
   b. Crop diversification
   c. Horticultural crops
   d. Livestock and Dairy enterprise

6. Crop Production and Agriculture Technology
   a. Cropping pattern and Cropping Intensity
   b. Agricultural Inputs
   c. Agricultural Technologies
   d. Agricultural output and post harvest technology

7. Agricultural Credit and Agricultural Marketing
   a. Agriculture Credit- policy, institutions/source, availability
   b. Agriculture Marketing- Primary and Secondary markets, marketing intelligence

8. Livestock
   a. Composition and growth of livestock
   b. Livestock and livelihood
   c. Dairy
   d. Livestock and livestock product marketing

9. Organic Farming
   a. Organic Farming-Concepts, scope
   b. Organic Farming-Need, benefits and basic principles
   c. Major Production Technologies for shifting to Organic farming

The training will include interactive class-room sessions and Field visit to KVKs, Agriculture University, regional agricultural research station to identify and discussed issues and solutions with scientists.

Training material will be provided to each participant.