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In Conversation with People of Meghalaya

Water Mission

IBDLP

IBDLP MEGHALAYA

Contents

Foreword

Meghalaya, popularly known for its scenic beauty with its numerous meandering streamlets, cascading waterfalls and natural springs, is one of the most rain-drenched places in the world, but providing safe drinking water for all is still a major challenge. The state is yet to realize and fully develop the true potential of the abundant water resources for overall development of its people. Water Mission, under the IBDLP programme, was launched with a vision to provide safe and adequate access to water for all by the time the state celebrates 50 years of statehood in the year 2022.

The key elements of the Meghalaya water mission includes knowledge management, institutional development and capacity building , water use and efficiency, water quality management, ground water management, flood management, promoting multipurpose use of water, water and climate change adaptation, water governance and convergence. The mission also focuses on creating awareness for sustainable use of water and aims to bring in collective participation of people on the issue related to climate change adaptation and water conservation.

The Department of Water Resources of the Government of Meghalaya is implementing the Integrated Water Resources Management Programme (IWRMP) for creating a convergent mechanism for optimal utilization of water resources in the state. The IWRMP will cover the various activities under the water mission in the aegis of the IBDLP through the Meghalaya Water Resources Development Agency (MeWDA). IBDLP water mission is a process which promotes the coordinated development and management of water, land and related resources in order to maximize the resultant economic and social welfare in an equitable manner without compromising the sustainability of the eco-system. Under this Programme, activities for management and maximum utilization of the available water resources through the implementation of water harvesting structures, Jalkunds and Multipurpose Reservoirs are being taken up. The water mission covers all the 11 districts of the state, with a view of conserving its water resources with the aid of the people and the government machinery. It aims to ensure that water is used efficiently, shared equitably, managed substantially which ultimately contributes to the well being of its citizens.

This issue of 'In Conversation with the People of Meghalaya' is focused on Water Mission of IBDLP programme. Through this publication, it is our endeavour to bring into focus the activities of the Government of Meghalaya in managing the water resources of the state to ensure equitable distribution of this precious resource to all the stakeholders. This publication lays out the policies, the principles, the activities and the mechanisms of the Government of Meghalaya in dealing with the present and continuous issue of optimum utilization of water resources.

Editorial Team
MBDA

WATER RESOURCES IN MEGHALAYA

The state of Meghalaya is situated in the north east of India and occupies an area of 22429 sq. km. It is bounded on the north by Goalpara, Kamrup and Nowgong districts, on the east by Karbi Anglong and North Cachar Hills Districts, all of Assam, and on the South and West by Bangladesh. Shillong, the capital of Meghalaya, is located at an altitude of 1496 meters above sea level.

The state experiences typical monsoon climate, the summer temperature recorded as high as 29 ° C and the minimum winter temperature falling down to 1.40 ° C in Shillong. The border areas get higher temperature as much as 38 ° C and more. Meghalaya gets high rainfall during May to September/October only and erratic as well as less in the remaining period. Summer in the state is for a period of about five months from May to September when torrential rains are caused by the South – West monsoon. The average annual rainfall is 2800 mm and reaches to over 12000 mm in Sohra region.

Agriculture is the mainstay of the people of the State. About 76% of the population of the State, living in the rural areas, depends on agriculture for their livelihood. The diversity of soil type, variation of altitude and climatic condition provide ample scope for growing a variety of agricultural and horticultural crops. The main crops grown are paddy, maize, wheat, potato, vegetables and fruits such as oranges, pineapple, cashewnut, arecanut, etc.

Cultivation in the state is mainly carried out under rain fed conditions since the total area that is being covered under assured irrigation, through Minor Irrigation projects implemented by the Govt. departments and private parties, is only 54,000 ha out of the total approximate 2.2 lakh hectares of net sown area. Due to various factors such as rapid population growth, industrial growth, ever increasing demand of food and water, etc., the vital gifts to mankind i.e. land and water resources are being over-exploited and unscientifically utilized. Deforestation, traditional jhum cultivation and unscientific extraction of minerals etc. have drastically affected the hydrological parameters, viz. rainfall interception, infiltration, soil moisture, evaporation, ground water, water yield, soil loss, floods, etc. Catchment areas and river systems are being exploited leading to the reduction in the discharge or drying up of many rivers, streams and rivulets. Even though the state receives heavy rainfall during the monsoon season, the water, however, is wasted as surface runoff that drains to the neighbouring states and to Bangladesh. Therefore, the water scenario in the State during the off monsoon periods looks very grim. Cultivation during this period is generally limited to only some areas. The trend on cultivation will change for the better once water is provided during this period and will subsequently contribute to socio-economic upliftment of the farmers.

Water Resources Scenario in Meghalaya

Meghalaya is endowed generously by nature as far as the water resources are concerned. The replenish-able ground water is estimated to be 1.15 billion cubic meters (BCM). Though, the ground water in the state has not yet been over exploited to its highest extent, but water stress is building up in urban areas due to high rate of extraction of ground water for domestic purposes. The annual gross dynamic ground water recharge in Meghalaya has been estimated as 1.234 BCM. Annual allocation for domestic and individual requirement up to 2025 is estimated to be 0. 096 BCM as per census 2001which was 1.014 BCM. (Source: Central Ground Water Board, CGWB).

Out of 9326 habitations only 5041 are fully covered for drinking water supply at 40 litter per capita daily (LPCD) and remaining 4285 partially covered habitations yet to be covered with drinking water supply. Similarly, merely 25 per cent of the cropped areas in the state are covered under irrigation, while remaining 75 per cent are still under rain fed cultivation. Water supply to habitants for their livestock remains almost un-organized in the state.

Topography and recharge of water resources

The total area of Meghalaya is 22,429 km2. Meghalaya comprises a hilly upland plateau formed by the Khasi, Jaintia and Garo Hills with an elevation ranging from 150 to 1961 meters above sea level. Due to the undulating terrain only 12% of the geographical area of Meghalaya is suitable for agricultural cultivation (source: Twelfth Five Year Plan – 2007-2012).

The state of Meghalaya is blessed with bountiful water resources that need to be harnessed. Hydrologically, the State comprises of two basins, viz., the Left Bank of Brahmaputra Basin (11220.11 km2) and the Brahmaputra Tributaries Basin (11208.89 km2), three catchments viz., Kalang to Dhansiri Confluence (about 4499.61 km2), Bangladesh Border to Kalang Confluence (about 6720.50 km2) and South Flowing Drainage of Meghalaya (11208.89 km2), eight sub catchments with a size range of 2.08 to 2.46 lakh hectare and 35 watersheds with a size range of 0.03 to 0.22 lakh hectare.

Meghalaya is sharing water resources with Assam and Bangladesh, with Meghalaya being located upstream. The state has 3300 km of rivers and 390 ha of swamps. Rivers and streams in Meghalaya are generally fast flowing.

Main rivers and streams in Meghalaya:

Brahmaputra basin: Dilni, Ganol, Jinjiram, Ringgi, Ghagua, Didak, Damring, Krishnai, Dudhnoi, Ronggre, Umsiang, Umkhri, Umiam, Umiew, Myntang, and Umlarem

Meghna/Barak basin: Kangra, Simsang, Dareng, Darong, Rongik, Kynshi, Umngi, Myntdu, Umngot and Lubha

There is a very high density of drainage network system in Meghalaya, but most of the rivers and streams have water only during the rainy season and many streams dry up or their flow dwindles during the summer leading to water scarcity. Groundwater is the largest accessible and yet underdeveloped resource in the entire State. The regional water shortages and water crises can only be met with a rational and sustainable use of this untapped freshwater reservoir. The importance and contribution of ground water is felt in the recent years to cope with development and scarcity situations, particularly to meet the drinking water needs.

The annual gross dynamic ground water recharge of Meghalaya has been estimated as 1.234 billion m3 (BCM). Annual allocation for domestic & industrial water requirement up to year 2025 is estimated as 0.096 billion m3 as per census 2001. 1.014 billion m3 of ground water potential may be utilized for irrigation. The level of ground water development in the state is 0.15%. (Source: Central Ground Water Board, 2012).

Climate and rainfall

The only form of precipitation occurring in Meghalaya is rainfall. The State receives bountiful rainfall, especially in its southern river basins and boasts the highest annual rainfall in the world in the belt of Sohra-Mawsynram region. However, there is considerable variation in the rainfall; the average annual rainfall scenario in the State is presented below:

- **Southern Meghalaya = 2600mm**
- **Northern Meghalaya = 2500 to 3000mm**
- **South Eastern Meghalaya = 4000mm**
- **State average = 2818mm**

Furthermore, the temporal distribution of precipitation is uneven; most of the rainfall is received during the Southwest Monsoon. As a result, many parts of the state experiences acute water shortages during the dry season. Depending on altitude and season, temperatures range from 2 °C to 36°C.

Vegetation and land use

The natural vegetation of Meghalaya is primarily mountainous moist broadleaf forest, which is tropical, subtropical or temperate, depending on elevation. The forest cover is high, according to the State of Forest Report (2001, Forest Survey of India), the total forest cover is 9496 km2 corresponding to approx. 42% of the total geographical area, comprising a mix of dense forest, open forests and scrub forests. (State of Forests Report 2005, Forest Survey of India)

The main anthropogenic land use is agriculture. Agriculture in Meghalaya is in many places characterised by the widespread use of “jhum” or shifting cultivation and a large proportion of the area classified as forest is actually jhum fallow regrowth; in 1987-1997, an estimated 1800 km2 of the forest was part of the Jhum fallow cycle. Permanent bun cultivation, where slopes are terraced to reduce surface runoff and erosion, is also practiced, especially in East Khasi Hills. The total cropped area in Meghalaya is 2658 km2 corresponding 11.85% of the total geographical area.

Most of the villages are situated on the top of the hills, while water sources like streams and rivers flow at the bottom of the hills.

Water availability and quality

The annual availability of surface water in Meghalaya is roughly estimated at 63.204 billion cubic metres and the estimated replenishable ground water resources are 1.15 billion cubic metres (source: Department of Water Resources).

According to the Central Ground Water Board, 1.04 billion cubic metres of ground water are potentially available for utilisation. The state has 8400 ha of reservoirs and 3734 ha of ponds and tanks.

Reference:

1. *Central Ground Water Board (CGWB)*
2. *Department of Water Resource, Meghalaya*
3. *State of Forest Report 2005, Forest Survey of India*
4. *Draft Meghalaya State Water Policy on Department of Water Resource, Megalaya Website*

DIFFERENT WATER USES AND POTENTIALS

The major consumptive uses of water in Meghalaya are irrigation and household and industrial water supply, with irrigation being the main consumer. Annual domestic and industrial water requirements up to year 2025 are estimated as 0.096 billion cubic meters as per census 2001, and 1.014 billion cubic metres of ground water can be utilised for irrigation (source: Central Ground Water Board: Aquifer Systems of Meghalaya, 2012). According to the Central Ground Water Board, 18% of the available groundwater is currently being utilised and there is thus ample potential for further increasing the exploitation of ground water. However, ground water stress is building up in urban areas due to water extraction for domestic purposes. Therefore, to protect exploitation of ground water the following actions need to be taken:-

- There should be a periodical reassessment of the ground water potential on a scientific basis, taking into consideration the quality of water available and economic viability of its extraction.

- Exploitation of ground water resources should be so regulated as not to exceed the recharging possibilities, as also to ensure social equity. The detrimental environmental consequences of overexploitation of ground water need to be effectively prevented by the Central and State Governments. Ground water recharge projects should be developed and implemented for improving both the quality and availability of ground water resource.

- Integrated and coordinated development of surface water and ground water resources and their conjunctive use, should be envisaged right from the project planning stage and should form an integral part of the project implementation.

Water supply and sanitation

The majority of households have access to safe drinking water, but the proportion of households with tap water connections remains low, except in East Khasi Hills.

Under Rural Drinking Water Supply, as of April 2011, 5041 nos. of habitations have been fully covered (54 %) while 4285 nos. of habitations have been partially covered (45 %) both in terms of coverage and per capita availability, out of a total of 9326 nos. of habitations in the state. Provision of safe drinking water supply to the remaining Partially Covered Habitations, including other Newly Identified Partially Covered Habitations (slipped back from fully covered category due to various reasons including drying up of sources etc.) will be taken up as per the guidelines of Govt. of India during the 12th Plan period. As of April 2011, there existed 102 nos. of Iron Affected Habitations in the State. Steps would also be taken for covering the Iron affected habitations and any newly identified water quality problem for habitations during the 12th Plan period. The Main Thrust of the Department in the Rural Water Supply Sector during the 12th Plan period would be to cover all the remaining Partially Covered Habitations as well as Quality Affected Habitations with 40 LPCD of potable safe water.

Water related diseases are those which are caused by pathogens or chemicals where water acts as a conveyance or medium. For example, microbes and arsenic present in water cause cholera and arsenicosis respectively to human being. Water related diseases are divided into infectious diseases (biological – bacteria, virus, worms etc) and non-infectious diseases (chemicals – arsenic, fluorosis, nitrates etc). Water related diseases are essentially environmental health related issues, as these are linked with polluted water, sanitation and hygiene and these three are intertwined determinants.

Agriculture

Agriculture is the primary source of livelihoods in Meghalaya. About 76% of the population depends on agriculture. While the cultivated area at any given time only comprises around 10% of the land area, a significant proportion of the open forest is the fallow part of the jhum agricultural rotation cycle (source: Department of Agriculture's website). In spite of the abundant water availability, the state is deficit in food grains by 122,000 tonnes annually, and population growth will further increase this deficit, unless production is increased.

By volume, agriculture is by far the major water consumer in Meghalaya. The bulk of agriculture in the State is rain fed; only 18.5% of the cultivated area is irrigated. Thus, there is potential to increase agricultural productivity through both increasing the area under surface water irrigation and improving water management in rain fed farming systems.

Fisheries

The actual achievement of fish production during the 11th Plan period was 21,413 Metric tonnes and the number of fish seeds produced was 9.46 million. There is a huge demand-supply gap in the production of fish and the State mission mode approach to bridge the gap as soon as possible (source: Twelfth Five Year Plan – 2007-2012). The Government of Meghalaya has identified fisheries as a key sector and has decided to launch the Meghalaya State Aquaculture Mission (MSAM) co-terminus with the Twelfth Five Year Plan period (2012-13 to 2016-17). The MSAM has the following major objectives:

- Development of existing water bodies and creation of additional water area for large scale fish production, including reclamation/rehabilitation of marshy and swampy lands,
- Conservation of native, endangered and traditional species of Meghalaya and developing breeding farms of commercially potential species on a large scale,
- Creation of mass awareness, capacity building, exposure training and skill development of all the stakeholders and technical support for long term sustainability of fishery sector,
- Capturing emerging opportunities in the fisheries sector.

Energy/hydropower

The hydropower potential of Meghalaya is large. In 2011, the installed capacity was 272.70 MW (source: Twelfth Five Year Plan – 2007-2012), so there is still much potential to further expand hydropower production. The State Government plans to increase the production capacity to 1400-1530 MW. 4425 villages (77%) were electrified by the beginning of 2012 (source: Twelfth Five Year Plan – 2007-2012).

Mining

While water is used in mining operations, the main related water concerns in the State are widespread pollution of streams and rivers through mining operations which results in environmental damage, e.g. to biodiversity, and health hazards for people living near the mining and downstream areas.

Industry

The level of industrial production in Meghalaya is currently low, but as it expands, the need for water will increase, and so will the volume of wastewater discharged. Waste water should be managed to prevent contamination and for reuse and recycling.

Tourism and recreation

The number of tourists visiting Meghalaya is increasing, and the State Government plans to further develop this sector. While the sector needs domestic water, its primary role in the water sector is non-consumptive water use. The major tourist attraction in Meghalaya is the natural beauty, such as waterfalls, rivers and lush vegetation, which is closely linked to the abundant water resources.

Transport

Inland water transport in Meghalaya is limited, due to the terrain. It mainly takes place in the low lying areas of the State near the border with Assam and Bangladesh.

Reference:

1. *Central Ground Water Board (CGWB) : Aquifer Systems of Meghalaya, 2012*
2. *Draft Meghalaya State Water Policy on Department of Water Resource, Meghalaya Website*
3. *Website: Department of Agriculture, Meghalaya*
4. *Twelfth Five Year Plan 2007-2012, Planning Department, Meghalaya*
5. *Department of Water Resources , Meghalaya*

WATER SECTOR IN MEGHALAYA: CONCERNS AND CHALLENGES

Further development of the water sector in Meghalaya comes with a number of challenges in the context of poverty, population growth, environmental degradation and climate change. These concerns need to be addressed on the basis of sound and well-aligned policies and effective strategies.

Pressure on the bio-physical environment

Water pollution

Although the industrial development of the state is still low, pollution of surface from discharges of domestic waste due to the absence of proper sewerage systems, and unregulated, unscientific and often illegal mining activities (especially for coal and limestone) are degrading and polluting streams and water bodies, and creating difficulties for meeting the increasing drinking water and irrigation water demands.

Land degradation

Due to the high rainfall and hilly terrain, Meghalaya is prone to erosion. Deforestation and inadequate land management practices such as cultivation on steep slopes in upper catchments and recurrent fire, has led to degradation of river catchments, erosion, flash floods, silting of water bodies, soil degradation, and the emergence of wastelands. Moreoever, quarrying of stone and sans from rivers and river banks are causing siltation of water courses. Population pressure has in many areas resulted in shortened fallow periods in jhum cultivation, which has resulted in reduced soil fertility and accelerated soil erosion. Furthermore, irrigated agricultural lands are in some places degraded by water logging.

Biodiversity

With the increasing demand for water, there is an increased risk of over-extraction, which could deprive ecosystems of their ecological water needs. Water pollution and disruptions to hydrological cycles caused by dams, siltation and changes in water levels in the dry and wet seasons are other threats to aquatic and wetland biodiversity.

Floods and Seasonal water shortages

Floods, which were mostly unheard of in the past, have now begun to affect a significant population in certain areas of Meghalaya and causing damage to crops, houses, road and bridges. Initially, 0.02 million ha were flood prone area in the state, on an average. But this area has now increased to around 0.6 million ha per year (source: the World Bank). The increased occurrence of floods is

related to the deforestation of upper catchments, which reduces the water retention capacity and increases surface runoff during the monsoon. Similarly, reduced vegetation cover in urban areas is causing rapid water runoff during storms.

With the highly uneven spatial and temporal distribution of water in the State, some areas experience water shortages during the dry season. The occurrence of such dry spells has increased, one driver being deforestation. Climate change and the associated temperature changes, erratic rainfalls, and increased magnitude and frequency of extreme weather events will further increase the occurrence of floods and dry spells.

Climate change

The state of Meghalaya is highly prone to the effects of climate change because of its geo-ecological fragility, humid monsoon climate, and socio-economic problems. Since 2005-6, there has been an observed trend of declining annual rainfalls in Meghalaya; this is attributed by experts to a combination of climate change and deforestation. However, climate models predict 2-3.5 C temperature increase and a 250-500 mm increase in precipitation. Furthermore, the rainfall variability and occurrence of extreme events has increased and is expected to further increase, with monsoon rains already having increased drastically since 2001 and shifted towards the "post-monsoon" period, this has over the last twenty years led to an increased frequency and magnitude of floods. At the same time, the occurrence of dry spells has increased in Meghalaya. Thus, in the future climate change will further increase the frequency and magnitude of floods and droughts.

The increased uncertainty, variability and unpredictability is affecting the hydrological system and thereby both reducing the availability of water as well as increasing the destructive forces of water. The following water related negative impacts of climate change in Meghalaya can be noted: in increased destruction of grain crops by heavy rainfalls and hail storms, increased soil erosion and loss of soil fertility as a result of increased intensity rainfalls, displacement of people by floods, shortages of drinking water during winter months, destruction of forests have been destroyed due to extreme climatic events. Hence the hydrological changes threaten the livelihoods and food security of the vast majority of Meghalaya's population, who are engaged in the agricultural sector and depend on natural resources.

Socio-economic pressure

Increasing and competing demands for water

The demand for water will increase significantly as a result of both high population growth and significant economic growth. Given the needs for water for multiple purposes, the competition for water is likely to increase in the future.

Growth processes and the expansion of economic activities inevitably lead to increasing demands for water for diverse purposes: domestic water supply, agricultural, industrial, hydropower, transport, recreation etc.

The drinking water needs of people and livestock have gone up. Water demands for production of food

grains have also increased substantially. Furthermore, the water demand (e.g. for domestic water consumption, irrigation water, water for livestock) in rural areas is also expected to increase sharply as the development programmes improve economic conditions of the rural areas.

Demand for water for hydro and thermal power generation and for other industrial uses is also increasing substantially.

As a result, water, which is already a scare resource, will become scarcer in future. This underscores the need for the utmost efficiency in water utilization and a public awareness of the importance of its conservation. Complex issues of equity and social justice in regard to water distribution also need to be addressed, to ensure that the water rights and needs of the poor and vulnerable are respected.

Unplanned urban growth

Population growth and economic opportunities have also led to significant and unplanned urban growth, especially in Shillong, which is creating significant pressure on water resources and posing challenges for ensuring adequate water service provision. The current water infrastructure is not sufficient to serve all urban dwellers, unregulated wells and water pumping is affecting the groundwater table, and untreated sewage and domestic effluents pollute water bodies, water sources, and aquifers.

Governance constraints

The legal and policy framework

The legal and policy framework is not yet fully in place to accommodate an integrated and participatory approach to water management or to address the challenges associated with climate change. Several of the national and state acts governing the sector are old and not geared towards a contemporary, integrated and participatory approach to water resources. Other acts and policies are being written or rewritten, and are still only available in draft form. Furthermore, the state water policy shall take into account Constitutional amendment with importance for the policy, e.g. the proposed 6th Schedule Amendment. Meghalaya is governed by the 6th Schedule Amendment, which means that most land in the State is either private land or communal land, this can make it a challenge to regulate over extraction of water or activities that damage water sources, while respecting customary rights.

Institutional landscape and coordination

The water sector in Meghalaya is characterised by a complex institutional landscape with several government institutions at the national, state and local levels each being responsible for different areas of water management. Furthermore, the private sector, civil society and communities have roles, rights and obligations in the sector. The complexity and somewhat overlapping mandates in the current institutional setup, e.g. in relation to irrigation, are creating challenges for ensuring a coordinated and integrated approach to the sector. Other areas are inadequately covered, such as ground water management with no department specifically tasked with ground water management, and the absence of a centralised Regulatory Board for water.

Institutional capacity

The institutional capacity is uneven; in some area such as surface water management there is capacity within several institutions, whereas none of the state institutions have technical staff or equipment to handle ground water. Different problems and constraints have adversely affected some of the water sector projects in the State of Meghalaya. There have been substantial time and cost overruns on certain projects. Furthermore, maintenance of existing schemes is insufficient. Moreover, traditional institutions are increasingly facing challenges in controlling the use of common pool natural resources and ensuring they are management sustainably; due to a number of factors, including privatisation of land and water sources located within in private land, urbanisation and increased demand for economic development.

Data availability

Limited availability of quality data on water resources, hydrology and climate, especially at the local level, are posing challenges to making informed and economically, environmentally and socially appropriate decisions and plans for resources utilisation, investments and management arrangements in the water sector.

Reference:

1. *Fifth Draft Meghalaya State Water Policy on Department of Water Resource, Meghalaya*
2. *Department of Water Resources , Meghalaya*
3. *The World Bank*

MEGHALAYA WATER POLICY

Water is a natural resource, fundamental to life, livelihood, food security, and sustainable development. In addition, there are challenges of frequent floods and seasonal water shortages in many parts of Meghalaya. With a growing population and rising needs of a fast developing state as well as the given indications of the impact of climate change, availability of utilizable water will be under further strains in future with the possibility of deepening water conflicts among different user groups. Low public consciousness about the overall scarcity and economic value of water results in its wastage and inefficient use. In addition, there are iniquitous distribution and lack of a unified perspective in planning, management and use of water resources.

Realising the significance and scarcity attached to the fresh water and the fact that it is an essential requirement for sustaining all forms of life, it has to be planned, developed, conserved and managed with utmost prudence and care.

The importance of water is critical in relation to several aspects of life:

- Safe drinking water is a human right and a fundamental requirement for people to live a healthy life
- Clean water is essential for hygiene and disease control
- Water is needed for the production of food
- Water is fundamental in the sustenance of ecosystems, biodiversity and environmental services
- Water is a requirement for economic activity; it serves multiple purposes in relation to agriculture, fisheries, industrial production, energy supply, and tourism

Sustainable and equitable planning, development and management of water resources is critical for the economic development of Meghalaya and for securing health and livelihoods of her citizens, while protecting the state's natural assets. Considering the multiple and competing needs for, and uses of, water and the multiple and complex processes putting increased pressure on water resources, water resources must be managed in an integrated and holistic manner, where the various social, economic and environmental needs are balanced and met in a sustainable manner.

The Meghalaya State Government has the responsibility to govern and lead this, while taking national priorities, policies, and legislation into account.

The Meghalaya State Water Policy provides the framework for sustainable management of Meghalaya's water resources. The State Water Policy builds on India's National Water Policy (2012). Previously, the policies and legislation governing the water sector in Meghalaya and in India was sectoral and did not sufficiently apply an integrated and holistic approach to water management and planning, and as a result, they did not provide an adequate framework to ensure sustainable water resource management. Hence, the Meghalaya State Water Policy implies a significant shift of paradigm and move towards an integrated and more sustainable management of the State's water resources. Applying an integrated water resources management (IWRM) approach, the State Water Policy targets all

stakeholders in the water sector. This includes state government agencies and staff at all levels, district government, district councils, water user associations, private sector, civil society, research institutions, and international development partners. It frames the roles and responsibilities of these stakeholders. Furthermore, the State Water Policy recognises cross-sectoral issues related to water use and links to other relevant state and national sector policies.

Meghalaya Vision 2030

Vision 2030 (released in 2011) is the overarching development vision for Meghalaya. It aims at ensuring inclusive economic and political empowerment, which it acknowledges requires inclusive and participatory governance. Furthermore, it calls for the provision in the urban and rural areas of water supply to ensure the wellbeing of people, and water harvesting and water retention along with major irrigation based on river and stream water, is seen as precondition for agricultural development in Meghalaya. It emphasises that devolution of irrigation, water supply and sanitation service delivery to local communities helps reduce the cost of delivery, and as local residents are most familiar with local conditions they can use their knowledge to best decide where to situate the service.

Five Year Plans

Meghalaya's Five Year Plans outline development priorities and objectives for the higher level and for all sectors, including specific programmes and five-year budgets within the overall framework of Meghalaya Vision 2030.

The Twelfth Five Year Plan, 2012-2017 has three overarching priorities:

1) To harness the state's natural resources for sustainable livelihoods,
2) To expand and strengthen the infrastructural base, and
3) To build capacity among the people.

Water is mentioned in several sectors, in particular in relation to water resources management, agricultural production, water and sanitation, and environmental protection.

Priority 1:
Focuses on agricultural/primary production, acknowledging that water resources management is a key focus area, such as promoting effective groundwater use, rainwater harvesting and small multipurpose reservoirs, e.g. in order to address the vulnerability of rain fed agriculture to weather conditions and climate change.

Priority 2:
Concern is raised that while there has been a push towards increasing the area under irrigation investments comprise only 2.7% of the total spending under previous Five Year Plans.

The 12th Five Year Plan also emphasises to further utilize the State's hydropower potential through large, small and medium scale schemes. The Five Year Plan also outlines objectives to further increase the coverage of urban and rural water supply and sanitation.

The overall strategy for water is to embrace an integrated water resources management approach, which seeks to:

- Encourage planning and management of natural water systems through a dynamic process
- Balance competing uses of water through efficient allocation that addresses social values, cost effectiveness, and environmental benefits and costs
- Require the participation of all units of government and stakeholders in decision-making through a process of coordination and conflict resolution
- Promote water conservation, reuse, source protection, and supply development to enhance water quality and quantity
- Foster public health, safety, and community goodwill

State Action Plan on Climate Change

The State Action Plan on Climate Change has the objective of stabilising greenhouse gas emissions and enhancing ecosystem resilience. With a projected enhanced water scarcity due to climate change, the Plan aims at improving water efficiency by 20%.

The key priorities of the Plan in relation to the water sector are:

- Formulation of an equitable Meghalaya State Water Policy;
- Expansion of the hydrometric network and river monitoring to improve data availability;
- Development of flood and drought forecasting models;
- Restoration and creation of water structures;
- Preparation and implementation of a water management plan (Integrated Water Resource Management)
- Water conservation
- Minimise waste and ensure equitable distribution, and
- Establishment of the Meghalaya River Basin Authority.

In relation to agricultural water, its main focus is on:

- Enhancing the resilience of rain fed agriculture,
- Small-scale irrigation, and rehabilitation of existing water dams,
- Construction of rainwater harvesting facilities,
- Upper catchment protection,
- Drought tolerant crops, and
- Scientific crop management.

In the design of urban water supply and sanitation the need to incorporate climate change measures is emphasised to manage storm flows and prevent contamination; furthermore increasing urban water use efficiency and water conservation are priorities. In relation to mining operations, protection and management of nearby water bodies is a priority. Regarding energy productions, the priorities are to undertake climate change related hydrological studies, to map the hydropower potential, and to construct hydropower plants.

State water legislation

The existing State legislations, as indicated below, primarily cover the prevention and control of water pollution, collection of water cess from industries and local authorities, and catchment protection.

- The Meghalaya Water (Prevention and Control) Rules, 1996
- The Water Pollution (Procedure for Transaction) of Business Rules, 1975
- The Water (Prevention and Control of Pollution) Cess Act, 1977
- The Water (Prevention & Control of Pollution) Cess Rules, 1978
- Meghalaya Protection of Catchment Areas Act, 1990

Other State policies

Other State policies and laws of relevance to water management and use include:

- The Meghalaya Mineral Policy Draft (2008)– specifies that mining operations must adhere to the legislation on water pollution prevention and control, address environmental concerns, and not compromise the health and water access of communities.

- The Tourism Policy of Meghalaya (2011) –highlights the importance of water for the tourism sector in Meghalaya, in relation to attractive landscape features (rivers, waterfalls and vegetation) and the potential for water sports. It also encourages hotel operators to reduce water consumption and harvest rainwater.

Interstate policy framework for shared water resource management

The Brahmaputra Master Plan is the overall plan for the Indian part of the Brahmaputra and Barak Basins in relation to the development and utilisation of water resources of for irrigation, hydropower, navigation and other purposes. It is divided into three parts:

- Master Plan Part-I: Main stem of Brahmaputra
- Master Plan Part-II: Barak river and its eight important tributaries
  Master Plan Part-III: Important tributaries of the Brahmaputra, Barak, eight rivers of Tripura, and Majuli Island. Under Part- III, individual master plans are made for each tributary

Guiding principles

This Meghalaya Water Policy is based on the following principles:

Social principles:

- ***Right to basic water principle:*** Access to safe and adequate water to meet basic human needs is a fundamental right of all people without discrimination. The supply of drinking water must be given the highest priority, over any other use.

- ***Inclusive and gender-sensitive participation principle:*** All stakeholders must be given the opportunity to participate in water management, involving users, planners and policy-makers at all levels. Special attention must be given to ensure a) that women and vulnerable groups are sufficiently empowered to participate actively, and b) that all citizens have sufficient and readily access to information for informed participation and decision-making.

- ***Solidarity principle:*** All citizens are obliged to contribute to the solution of common water related problems. To ensure social cohesion, the recurrent costs of public water service will be distributed so to ensure access to water for poor and vulnerable people and the most disadvantaged areas. When water uses are in conflict, the greatest common good to society will be given priority.

- ***Fairness principle:*** All people must be treated equally in access to drinking water. Water resources must be allocated and managed equitably.

Environmental principles:

- ***Sustainability principle:*** Fresh water is a finite and vulnerable resource, essential to sustain life, development and the environment. As such, its availability and quality must be ensured over time, and social and economic development must be balanced with the protection of natural ecosystems. Minimum ecological water needs must be given higher priority than other uses, except drinking water.

- ***Precautionary principle:*** Measures must be taken to prevent the risk of serious and irreversible damage of any activities that potentially may negatively affect the integrity of water resources and water sources.

- ***Responsibility principle:*** Water conservation is every citizen's responsibility. Water users and public authorities have the shared responsibility of maintaining the integrity of water resources. No citizen or entity will engage in actions, which deteriorates the quality of water or results in wastage of water. Nor will any citizen divert water from water bodies, channels of supply systems. Such acts will be punishable under law as provided in the Meghalaya Water Act. Furthermore, the "polluter pays" concept is adopted to curb uncontrolled discharge of pollutants, where the polluter will be financially responsible for the costs associated with reversing, or compensating for, the damage caused.

- ***Conservation consciousness principle:*** Water conservation consciousness shall be promoted through education, regulation, incentives and disincentives.

Good governance principles:

- ***Common good principle:*** Water is a community resource. All waters of the state including surface waters in the rivers (streams), lakes, underground aquifers, and reservoirs are common property and no individual or socio-political institution including state agencies can have absolute ownership of these water sources and bodies, in the sense that due consideration of the needs of others and maintaining the integrity of the water resources has to be given.

- ***Value of water principle:*** Water has an economic and social value in all its competing uses and is recognized as an economic good. Water is not considered a free resource. Meeting social water needs is a priority. The price of water shall approach its economic value, to achieve full cost recovery over time and ensure services are financially viable. Government and local institutions can levy taxes, royalties or charges for water use as prescribed in the regulations framed under the Meghalaya Water Act.

- ***Peaceful conflict resolution principle:*** Water related conflicts will be resolved peacefully through appropriate mechanisms.

- ***Subsidiarity principle:*** The responsibility for decision-making is allocated to the lowest appropriate level.

- ***Building on local capacity principle:*** Traditional institutions and local knowledge has over generations been developed and adapted to the local context. This capacity shall be utilised to its

full potential, so partnerships shall be made with traditional institutions, especially in relation to actions at the local level.

- ***Convergence principle:*** Actions by different ministries and agencies need to be carried out in a coordinated, harmonised and collaborative manner to maximise the benefits achieved, and to avoid duplication as well as unintended negative impacts of actions on each other.

- ***Basin management principle:*** The basic unit for water resource management is the river basin or sub-basin, using an integrated water resource management approach, where different uses of water resources and their effect of each other will be taken into account and balanced against the water availability. Water resource planning will be coordinated with land use planning.

- ***Interstate and international cooperation principle:*** Cooperation is needed to ensure that both upstream and downstream users in basins shared with Assam and Bangladesh benefit adequately from the water resources. Interstate cooperation with Assam, inter-basin water transfers to states outside Meghalaya and international cooperation with Bangladesh will take place in accordance with the provisions of the Government of India.

Strategic orientation

The overall goal of the Meghalaya State Water Policy is to "achieve sustainable development, management and use of Meghalaya's water resources to improve health and livelihoods, reduce vulnerability while assuring good governance for present and future generations". This will be achieved by addressing relevant issues under water resources management, rural water supply and sanitation, urban water supply, wastewater and sanitation, and agriculture and irrigation. Furthermore, other uses, such as fisheries, hydropower, mining and industry, and tourism and recreation are addressed. Moreover, environmental sustainability and conservation, gender, social inclusion and equity are crosscutting issues, which shall be duly considered in relation to all aspects of water management and use.

Policy Objectives

The overall objective of the Meghalaya Water Policy is to "ensure that water is used efficiently, shared equitably, managed sustainably, governed transparently and contributing to improving the health and livelihoods of all citizens, while maintaining the environment for future generations".

To attain this, the Water Policy aims at ensuring that appropriate systems and measure are in place to balance the following specific objectives:

- Meeting the basic water and sanitation needs so all inhabitants of the State can live healthy lives,
- Effectively harnessing water resources for economic development and for ensuring the livelihoods and incomes of all inhabitants of the State,
- Ensuring that water resources are protected, maintained, improved and utilised sustainably, so that future generations can enjoy them,
- Ensuring that ecosystem integrity and land productivity is maintained and minimum ecological water requirements are met,
- Enhancing the resilience to disasters and the impacts of climate change,
- Ensuring good governance, transparency, inclusion, equity and participation in the water resource planning and management,
- Providing the regulatory framework for effective regulation of the water sector.

Reference:
1. *Fifth Draft Meghalaya State Water Policy on Department of Water Resource, Meghalaya*
2. *Department of Water Resources , Meghalaya*
3. *Draft Meghalaya State Water Policy on Department of Water Resource, Meghalaya Website*

WATER MISSION UNDER IBDLP

Meghalaya is endowed generously by nature as far as the water resources are concerned. The State ranks amongst the wettest regions in the world with an annual average rainfall of 1200 cm in some areas. The overall annual average rainfall of Meghalaya as a whole is 280 cm with some pockets receiving about 250 cm in the Garo hills to as high as 400 cm in the Khasi and Jaintia Hills region. One-third of India's run-off flows from the North-East through and the Brahmaputra and the Barak rivers. The rivers, streams and lakes distributes themselves throughout the state; these may have comparatively smaller stretch but are quite important due to their uses of water as most of them are exploited for drinking water and many other purposes. The state is having ground water potential of 1226.44 million cubic meters (MCM) out of which only 1041.99 MCM is utilized for irrigation. Presently, there exists about 3300 km length of rivers, 8400 ha of reservoirs, 3734 ha of tanks and ponds, and 390 ha of swamps in Meghalaya. However, water resources in the state are currently threatened with contamination, siltation and pollution primarily being contributed from mining.

The five year average rainfall recorded in and around Shillong city from the year 1986 to 2010 showed that there has been a decrease in the amount of rainfall from 2606.60 mm in the year 1986-90 to 2371.80 mm in 2001-05. The decreasing trend from the year 1986 onwards led to the decreased in water availability which is mainly due to the dwindling of forests because of deforestation. The effects of deforestation lead to less humidity whereby there is less absorption in the root zone reducing the availability of water to the plants. This results in less evaporation/transpiration through the leaves which reduces the amount of water vapour in the atmosphere, resulting less rainfall in succeeding years. The decline trend of availability of rain water signifies a possible danger awaiting the state, which may reduce the water availability per capita in the years to come.

Since last few decades or so, the state started facing serious problems of pollution of surface as well as ground water due to indiscriminate discharge of untreated municipal effluents as none of the cities and towns have adequate wastewater or sewerage collection and treatment systems. Dumping of garbage in the rivers is also another source of pollution. Unorganized mining activities mainly coal on a large scale in almost all the parts of the state are another major sources of water pollution and contamination. In monsoons, the rivers and streams experience heavy siltation. This has accentuated due to deforestation, sand quarrying activities and land degradation. Siltation has also resulted in the disappearance of several perennial streams and natural springs. Due to contamination of surface sources there occurs problem in drinking water. The Ecology of the rivers and streams have also been severely affected whereby a number of local aquatic species have become either extinct or are in the endangered phase. Many rivers in Jaintia Hills have become dead rivers.

Meghalaya's economy is closely linked to its natural resources, such as agriculture, water and forestry which are in turn dependent on the climatic factors. Global warming is already affecting the climatic pattern of the state and the hydrological cycle is witnessing a drastic change. The state has been receiving less than normal rains for some years now and it is expected the trend will continue into the future. This change in rainfall pattern due to climate change is also adversely affecting the ground water levels as the underground aquifer are not be replenished adequately. To manage the precious water resources of the state, Meghalaya Integrated Basin Development and Livelihoods Promotion Programme, under its Water Mission has focused its attention on introducing scientifically planned activities to address the changing realities.

The Meghalaya Water Mission is one of the core missions under the IBDLP. The Mission aims at promoting Integrated Water Resources Management (IWRM) in the State with a vision to ensure availability of adequate water resources for drinking purposes as well as for different economic activities particularly the ones promoted under the aegis of Integrated Basin Development & Livelihood Promotion Programme.

The Water Mission under the IBDLP became necessary to address challenges which were unique to the State. Meghalaya grapples with the irony of scarcity amidst plenty. Although the State receives the highest rainfall in the world, it is one of the driest places in the region during winters wherein people face extreme shortage of water for drinking and irrigation. Agriculture in Meghalaya is mainly dependent on monsoon in the kharif and cultivation in rabi is carried out with soil moisture retention. With state experiencing heavy rainfall annually is adequate for few months but water retention capacity is less (megplanning.gov.in). It is envisaged that after the implementation of the Water Mission under IBDLP, it would be possible to grow two or even three crops in a year in regions where only one-two crops are being grown. Also, the additional water harvested and stored shall also be used for other livelihood generation activities such as fishery, live stocks etc.

Vision

"To promote Integrated Water Resources Management in the State of Meghalaya and to conserve and use water judiciously with the ultimate goal of building of water related livelihood and enterprise opportunities in the state."

Mission

"To manage Meghalaya's water resources for the common benefit to assure its sustained use by the people of the state."

Objectives

- Promote water conservation and preservation mechanism, and judicious uses of water resources, available through surface, ground and rain sources,
- Ensure adequate capacity building and training to different stakeholders, and department personnel,
- Prepare comprehensive mapping of water resources at village/ community level and estimate the demand for and supply of quality water for various uses-drinking, irrigation, livestock, fishery and other purposes,
- Integrate water resources in to village development planning for inclusive economic growth and prosperity of rural households,
- Identify eco-sensitive zones (vulnerable zones) and promote water use efficiency in water sectors,
- Develop and improve water bodies including rejuvenation of springs for enhancement of water storage so as to preserve water for adaptation and mitigation of climate change effect.
- Develop small multiple reservoirs and micro-hydro power units and strengthen existing State Water Resources Council and District Water Council, and integrate their activities for betterment of water resources in the state, and
- Enhance investment through public-private partnerships and community mobilisation in conservation and management of water resources.

Plan of Action

Natural Resource Management- Water, Soil and vegetation:

- Promote social regulations and mass mobilization campaign towards conservation & preservation of water resource, protective measures of soil erosion & forests depletion, and environmental consequences, etc.

Judicious uses of Water resource:

- Building up network for assessment and monitoring of water resource, both for surface and ground sources, and extends suitable measures to ensure equitable access to responsibility for judicious use of water resources for various purposes.

- Develop intensive programme for rain water harvest, conservation, ground water recharge/ recycling and promote optimal conjunctive use of surface and ground water for various uses.

Maintenance of Wet-land, Rivers/ Lakes and other water bodies:

- Conserve wet-lands/ rivers/ lakes and rejuvenate & restore different water bodies, and promote need-base, ecological and economic development.

- Encourage and improve traditional way of rain water harvesting and storage, and control and abate pollution of water bodies from municipal and industrial wastes generated from habitats by intercepting and diverting such wastes away from water bodies.

Water Resources Development-Application of Science & Technologies:

- Promote science and technologies in developing strategic integrated water resources development plans and their implementation for maintaining the quality of water bodies to protect and enhance their capabilities to support the various designated uses.

- Ensure convergence among various programmes of water resource development-efficient management of surface and ground water, sewage and water drainage system.

Human Resources Development:

- Promote capacity building and skill development of various stakeholders and create mass awareness towards water resources conservation & management as campaign to proved equitable accessibility to water resource for its various end uses.

- Establish and strengthen MIS for water sector and promote applied research on water resource management.

Mission Intervention

The following are the key interventions that are envisaged through State Water Mission:

1. Awareness and Sensitisation Programme for efficient water use
2. Development of Multipurpose Reservoirs
3. Knowledge Sharing
4. Convergence of various schemes for effective infrastructure creation and management
5. Support linking to social, economic and ecological development
6. Legislation and policy framing
7. Water quality control
8. Monitoring, evaluation (including social auditing) and learning

The State Water Mission envisages a cluster approach for intensive development and management of state water resource as per its potential and aims to promote convergence and participatory development in the water sector.

Mission Components

The Water Mission is sub-divided in to the following ten "sub-missions"

Knowledge sub mission

The primary aim of the Knowledge sub-mission is to enhance data collection by use of state-of-art-technologies to ensure availability of reliable and regularly updated data on the state of water resources, water management, and socio-economic challenges and constraints vis-à-vis water in Meghalaya for informed and evidence-based decision making.

Institutional Development and capacity Building sub mission

The objectives of the "Water Mission" can be achieved only through proper co-ordination, effective monitoring and in-depth evaluation at regular interval. Therefore, an appropriate institutional set-up is needed. The State Government will be the policy planning and coordinating agency for the project. Village / Community level Institutions will be the Implementing Agencies.

Water Governance sub mission

To make the Water Mission effective, an enabling environment is needed. And, therefore, the foremost requirement is to have a set of principles to guide decisions and achieve rational outcomes to fulfill the Mission. The Meghalaya State Water Policy shall provide the framework for sustainable management of the state's water resources. The objective of the policy is to ensure that water is used efficiently, shared equitably, managed sustainably, governed transparently and is contributing to improving the health and livelihood of all citizens. Another requirement of the enabling environment is to provide legal authority i.e. Water Act (legislation framework) to undertake and carry out activities in accordance with the policy guidelines and pursuant to the mission.

Water Use & Water Use Efficiency sub mission

By identifying water use/ demand promotion of micro-enterprises and generation of variety of livelihood opportunities by leveraging the intrinsic natural resource potential in a given area will be covered under this Sub-Mission. The key intention is to increase the availability and reliability of water supply so that people of the state can choose other sustainable livelihood activities and thereby improve their lives and also contribute effectively to the growth of the GDP of the state and the nation.

Water Quality Management sub mission

The quality & the availability of the fresh water resources is the most pressing of the many environmental challenges. Geometric increase in population coupled with rapid urbanization, industrialization and agricultural development has resulted in high impact on quality and quantity of water in our country. Special emphasis shall be given to implement long term sustainable solutions that ensure the delicate balance between livelihood opportunities, environment and social development is well maintained.

Ground Water Management sub mission

Groundwater is the largest accessible and yet underdeveloped resource in the entire State. The regional water shortages and water crises can only be met with a rational and sustainable use of this untapped freshwater reservoir. The importance and contribution of ground water is felt in the recent years to cope up with development and scarcity situations, particularly to meet the drinking water needs.

Flood Management sub mission

In Meghalaya, flood affected areas are mostly on the low altitude areas, bordering Assam and the international border (India-Bangladesh). Flash floods have become a regular feature in these areas, due to massive deforestation, unchecked jhum cultivation. The flood water carries huge amount of hill sand, stone, logs and trees, which are deposited in agricultural fields due to inundation of banks in the foot hills, thus causing immense damage to crops. This sub-mission intends to address the issue of floods in the state and its mitigation measures.

Promoting multipurpose use of water sub mission

Multi-purpose reservoirs are a widely used form of infrastructure for the provision of water. They supply water for domestic use, livestock watering, small scale irrigation, and other beneficial uses. In order to achieve the goal of storing water for multiple purposes without giving rise to conflicting social and environmental issues, the State Government has initiated the development of multipurpose reservoirs (MR) through a community led participatory approach.

Water & Climate Change sub mission

The state of Meghalaya is highly prone to the effects of climate change because of its geo-ecological fragility, humid monsoon climate, and socio-economic problems. Climate change impacts are potentially very severe for the environmental security and sustainability and thus for rural livelihoods. Studies involving climate change modeling have been initiated in Umiam Basin and appropriate adaptation measures to mitigate the effect of climate change are being formulated. Such efforts shall be replicated in other water basins throughout the state.

Convergence sub mission

For effective and successful implementation of the Water Mission, it is imperative to dovetail and coordinate the activities of different sectors that have water dependence so as to have a holistic approach. In this context, IBLDP has several schemes that underline convergence among various sectors for proper utilization of water resources.

Reference:
1. *Draft Meghalaya State Water Mission 2014*
2. *Department of Water Resources , Meghalaya*
3. *url: https://mbdaonline.com/PDFs/Water_Mission.pdf on MBDA Website*

GROUND WATER DEVELOPMENT, MANAGEMENT AND ITS IMPORTANCE IN MEGHALAYA

by
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Development of ground water in the State is practically negligible as surface water schemes may include those which involve flow due to gravity, whereas, groundwater schemes require pumping up of water from tube wells. In the district all the minor irrigation schemes are executed by the surface water only. Small dams across the streams in the upper slopes are constructed by the State Water Resources Department and water in the upper reaches of the streams are tapped for water supply as the natural head can be used for distribution, avoiding pumping costs.

Moreover, as the area is characterized by undulatory terrain, the scope for development of ground water lies in low lying areas and valley fills which hold good prospects for ground water development. However, groundwater in the form of hill springs or along the foothills are the only dependable sources of water in most places as well as means of irrigation in some places. Ground water development in a small scale is being done through dug wells and bore wells in the intermontane valley in a few places.

There is an ample scope for future development of ground water. As per ground water resources estimation, the stage of ground water development is less than 1% which leaves a great scope for ground water development. The terrain being formed of very coarse and loose sedimentary rocks, the ground water potential is likely to be considerable and can be developed in the valley areas. The peneplain surfaces, buried pediments and the valley fills are the most favorable locations for the development of ground water. The fractured rocks and lineaments too hold prospect for the development of ground water. Moreover, the narrow and linear valleys hold ample scope of development of ground water. Structures like ring wells, shallow as well as deep tube wells are the feasible ground water structures. As ground water is poorly developed/ exploited, dugwells are the preferred structures as of now in low-lying areas and valleys. The shallow water level condition gives scope to maintain sufficient water column in the dug wells. The fractured, fissured rocks and the intersection of faults / lineaments hold good prospects for ground water. The weathered mantle holds good prospect for dugwell within the depth range of 4m to 10m depending on topographical setting and having a diameter of 2 m to 4 m depending upon their requirement, large diameter dugwells can sustain moderately higher yield. The well has to be properly curbed to avoid collapse of weathered zone. Tube well can be drilled in such formation down to a depth of about 100-150 m tapping about 2 to 4 fractured zones.

There really exists a need for large scale tapping of groundwater for development of the area and ground water exploration needs to be carried out. As the area is characterized by undulatory terrain, the scope for development of ground water lies in low lying depression, and valley fills which hold good prospects for ground water development. As the valley areas have very good ground water potential, the possibility of utilising the ground water resources for irrigation should be thought of immediately so that the jhummed areas could be brought under permanent cultivation, adopting techniques like terracing, contour bunding etc., to retard soil erosion. The topographically elevated areas are highly suitable for plantations like rubber, pepper, coffee, cashew, etc. There is a continuous expansion of terraces in the villages. Mono cropping like paddy is cultivated only once in a year with the land remaining barren for the rest of the year. The farmers have experienced better paddy yield in terrace as compared to jhum. Terrace production can also be further enhanced by linking with irrigation development, introduction of short-gestation high yield varieties to enable two-season cultivation, cultivation of off-season vegetables in terraces, etc.

Ground Water Management

The groundwater management involves the optimum utilization of sub-surface water based on geological, hydrological, economic, ecological and legal consideration for the welfare and benefit of the society, remembering that ground water, though replenishable by rainfall recharge, is finite and vulnerable resource. The management of the ground water resources has to be taken up after understanding the varied hydrogeological characteristics. In addition, the development of ground water requires thorough understanding of the heterogeneity of the formation. Therefore, there is a need for scientific approach for proper management of the ground water resource for the sustainability of the resource for the present and future generation. A database of all sources of water and their temporal status should be maintained.

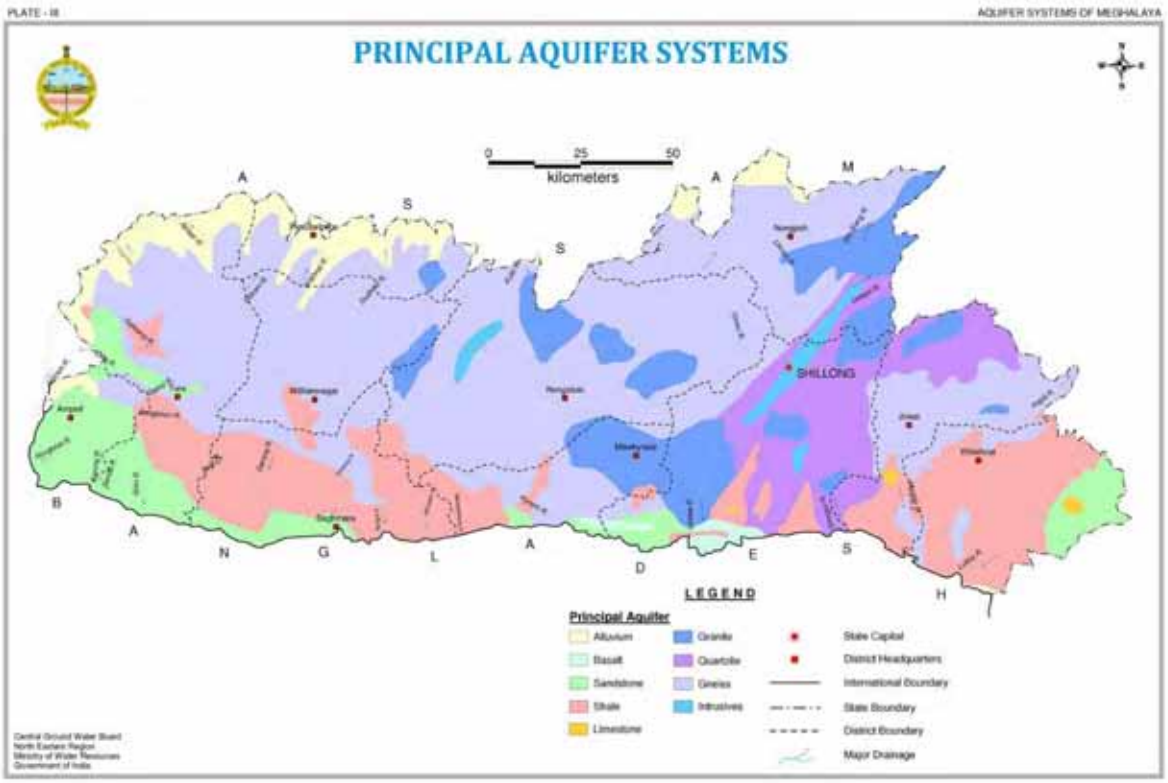
There is also an inherent need to educate the general public as a whole for management of this precious resource. Ground water should be used judiciously and landuse, industrial waste, sewage systems should be managed to avoid pollution of ground water as well as surface water. Over-exploitation of ground water should be restricted to avoid falling ground water tables and artificial recharge of groundwater should be made mandatory wherever falling trend of water table/ piezometric heads is observed.

Deforestation, especially in upper catchments and around springs should be proscribed. Water use efficiency and recycling should be promoted.

As the incidence of rainfall is very high in Meghalaya, rainwater harvesting is another viable option to augment the water supply. Many development scheme of government for water harvesting and utilisation of ground water resources should be implemented. Agricultural water and especially irrigation water must be used prudently to maximise the yields per volume of water and avoid wastage. To minimise surface runoff and erosion, agrochemicals and fertilisers must be applied carefully to avoid pollution of ground water and water bodies.

The Government should evolve and position a ground water cell in Meghalaya as a state of art, progressive and people friendly organization specifically assigned to govern the issues of ground water management. It must be task to providing

comprehensive, cost effective technical services for Ground Water related problems. It should develop and document indigenous technologies based on traditional wisdom and local knowledge, thereby, taking innovative measures based on scientific and technical know-how. The Ground Water cell should also promote participatory management of Ground Water Resources at village level and work as partners with communities for implementation of development programmes to provide reliable services in sustainable Ground Water Management.



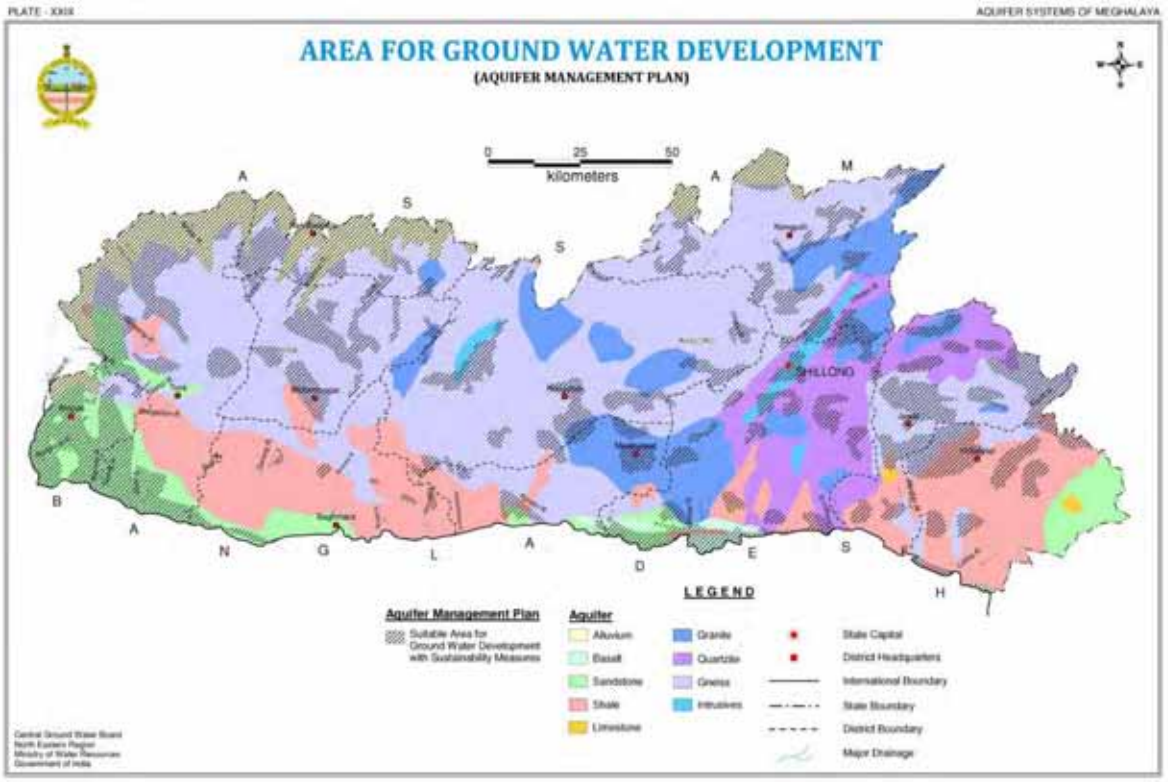


Image Source: AQUIFER SYSTEMS OF MEGHALAYA- September 2012
Govt. of India, Ministry of Water Resources, Central Ground Water Board, North Eastern Region, Guwahati

Expected Role of Meghalaya Ground Water Cell

1.... Hydrogeological surveys, Exploration, development and augmentation of groundwater resources in the State through various schemes. This mainly includes, drilling of bore wells/tube wells under Rural Water Supply Programme, rendering technical guidance under minor irrigation programme by locating suitable dug well sites, strengthening of groundwater sources by water conservation measures, artificial recharge projects for induced groundwater, specific studies related to the periodic status of groundwater availability,

2.... Monitoring the water level and discharge of Ground Water through various abstraction structures.

3.... Monitoring the quality of Ground Water for drinking, irrigation, domestic and industrial use.

4.... Census of Ground Water structures (dugwells, tubewells and springs)

5.... Maintenance of Ground Water database.

6.... Development of minor irrigation schemes based on groundwater.

7.... Protecting the existing groundwater resources through technical assistance under Groundwater Act etc.

8.... Carrying out Ground Water Resource Estimation, in consultation with Central Ground Water Board based on norms established by Ground Water estimation committee report of Govt. Of India

9.... GIS , Scanning & digitization facilities with modern equipments

10.. Remote sensing data analysis facilities for ground water investigation

11.. Carry out micro level geohydrological investigations for each district and block considering village as a Unit

12.. Carry out district and blockswise geophysical investigation in hard rock formations to locate feasible sites for ground water explorations

13.. Carry out detailed geophysical & geohydrological and suggest remedial measures for problematic areas.

14.. Provide drinking water by development of Ground Water.

15.. Carry out rain water harvesting and Ground Water recharge work wherever needed.

16.. Ensuring that irrigation facilities are created for all areas of the State

17.. Irrigation facilities through Conjunctive use of surface & ground water

18.. Authorising and certifying drilling agencies for state of art tube well construction work

19.. Carry out the deposit works allotted from the Govt. of Meghalaya

20.. Watershed development programme in co- operation with other State Department.

21.. Capacity building at village level for upkeep/ maintenance of Ground Water structures.

22.. To work as consultant for Ground Water related services for State Government, defence, industry etc and also for farmers and individuals.

23.. Providing technical service in locating the well sites under different Government schemes viz. bank finance assisted scheme, minor irrigation schemes, Failed well Subsidy schemes, Rural Electrification scheme, Mini Electrification scheme, Jeevan Dhara and Javahar Dug Well scheme.

Reference:

1. Central Ground Water Board, State Unit Office, Shillong, Meghalaya

RAIN WATER HARVESTING

By
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Assistant Engineer, Water Resources

Rainwater harvesting is the accumulation and deposition of rainwater for reuse before it reaches the aquifer. Uses include water for garden, water for livestock, water for irrigation, and indoor heating for houses etc. Rainwater harvesting provides an independent water supply during regional water restrictions and in developed countries is often used to supplement the main supply. It provides water when there is a drought, can help mitigate flooding of low-lying areas, and reduces demand on wells which may enable ground water levels to be sustained. It also helps in the availability of potable water as rainwater is substantially free of salinity and other salts.

Water has been harvested in India since antiquity, with our ancestors perfecting the art of water management. The farming communities in Baluchistan (in present day Pakistan, Afghanistan and Iran), and Kutch (in present-day India) used rainwater harvesting for irrigation. The Cholas Dynasty in the South were famous for having taking up many water harvesting projects, many of which are still functioning till today. Many water harvesting structures and water conveyance systems specific to the eco-regions and culture has been developed.

- These systems harvest the rain drop directly. From rooftops, they collected water and stored it in tanks built in their courtyards. From open community lands, they collected the rain and stored it in artificial wells.
- They harvested monsoon runoff by capturing water from swollen streams during the monsoon season and stored it various forms of water bodies.
- They harvested water from flooded rivers

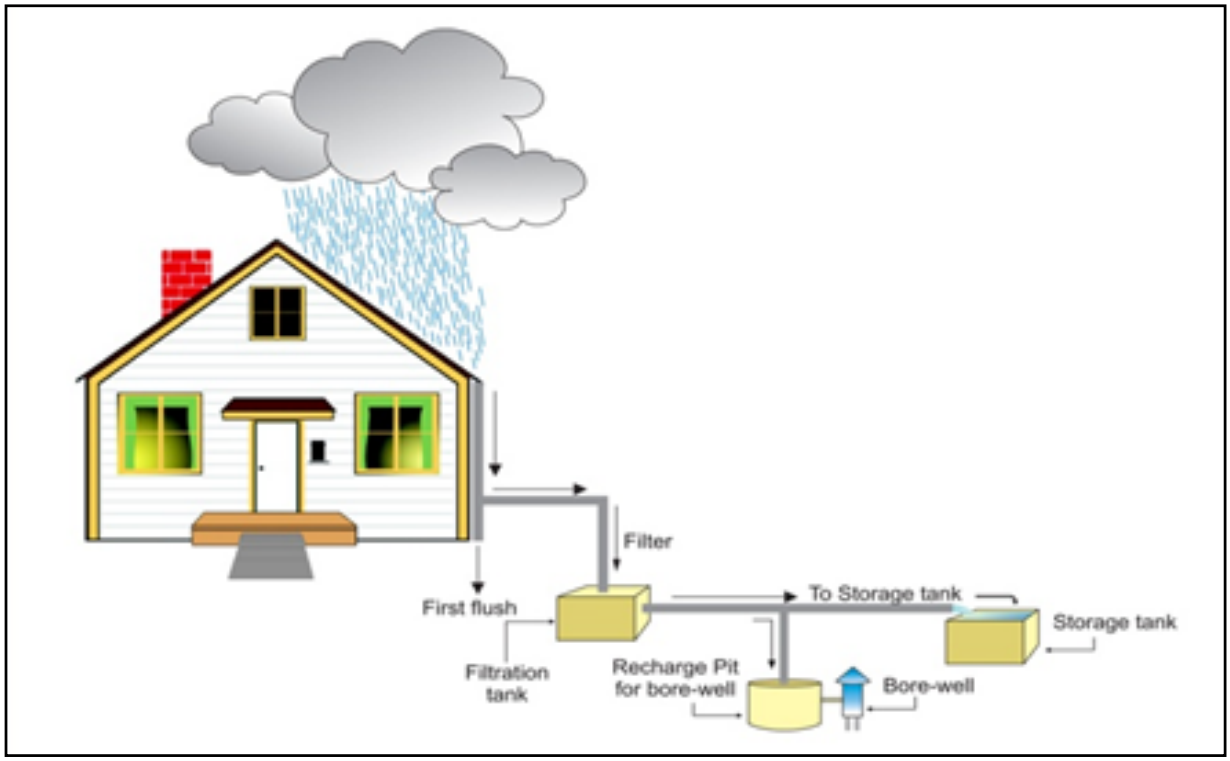


Fig: Typical Roof Top Rain Water Harvesting

Rain Water Harvesting is mostly practiced in rural area to supplement the crop water requirements in the agricultural fields. Whereas in urban areas, Roof Top Rain Water Harvesting is being promoted to cater to the domestic water requirement needs. Roof top water harvesting is also used to recharge the aquifers where ground water is an important source of water.

Some Traditional Forms of Water Harvesting in India

Sl. No	Region	Water Harvesting Structure / System
1	Trans Himalayan Region	Zing
2	Western Himalaya	Kul, Naula, Kuhl, Khatri
3	Eastern Himalayas	Apatani
4	North-eastern Hill ranges	Zabo, Cheo-ozihi, Bamboo Drip Irrigation
5	Brahmaputra Valley	Dongs, Dungs/jampois
6	Indo-gangetic Plains	Ahars-pynes, Bengals Inundation channels, Dighis, Baolis
7	Thar Desert	Kunds/kundis/ Kuis/beris, Baoris/bers, Jhalaras, Nadi, Tobas, Tankas, Khadins, Vay/Vavdi/Baoli/Bavadi, Virdass, Paar
8	Central Highlands	Talab/Bandhis, Saza Kuva, Johads, Nada/bandh, Pat, Rapat, Chandela tank, Bundela tank
9	Eastern Highlands	Katas/Mundas/Bandhas
10	Deccan Plateau	Cheruvu, Kohli tanks, Bhandaras, Phad, Kere
11	Western Ghats	Cheruvu, Kohli tanks, Bhandaras, Phad, Kere
12	Western Coastal plains	Virdas
13	Eastern Ghats	Korambu
14	Eastern Coastal Plains	Eri, Ooranis

Meghalaya being the main beneficiary of the southwest Monsoons, receives very high rainfall, higher than most parts of the country. The monsoon clouds fly unhindered over the plains of Bangladesh after they cross over to land. After about 400 km of traveling over land they are confronted by fortress wall like Khasi hills, which abruptly erupt out of the plains to reach a height of about 4500 feet above MSL within a short distance of 2 to 5 km. The orography of the hills with many deep valleys, acting like funnels to channel the low flying moisture laden clouds (500-1000 feet) helps clouds from a wide area to converge. Meghalaya falls directly on the middle of the path of this stream of southwest monsoon. The monsoon winds push the rain clouds through these gorges and up the steep slopes. The rapid ascendance of the clouds into the upper atmosphere hastens the cooling and helps water vapour to condense into water. The rainfall varies in the state, from more than 12000mm in the southern slopes and close to 2000mm in the northern slopes. However, the rainfall is only for 6-8 months in a year, leaving the dry months with lots of water scarcity problems. And due to the distinct topographical and geomorphological conditions of the state, there is high surface run off to the neighboring plains very quickly. In total rain water discharge from 11, 667 sq km of catchment area in the state drains into the Brahmaputra basin and the rest 10,650 sq km into the Barak Basin (Source: Central Water Commission).

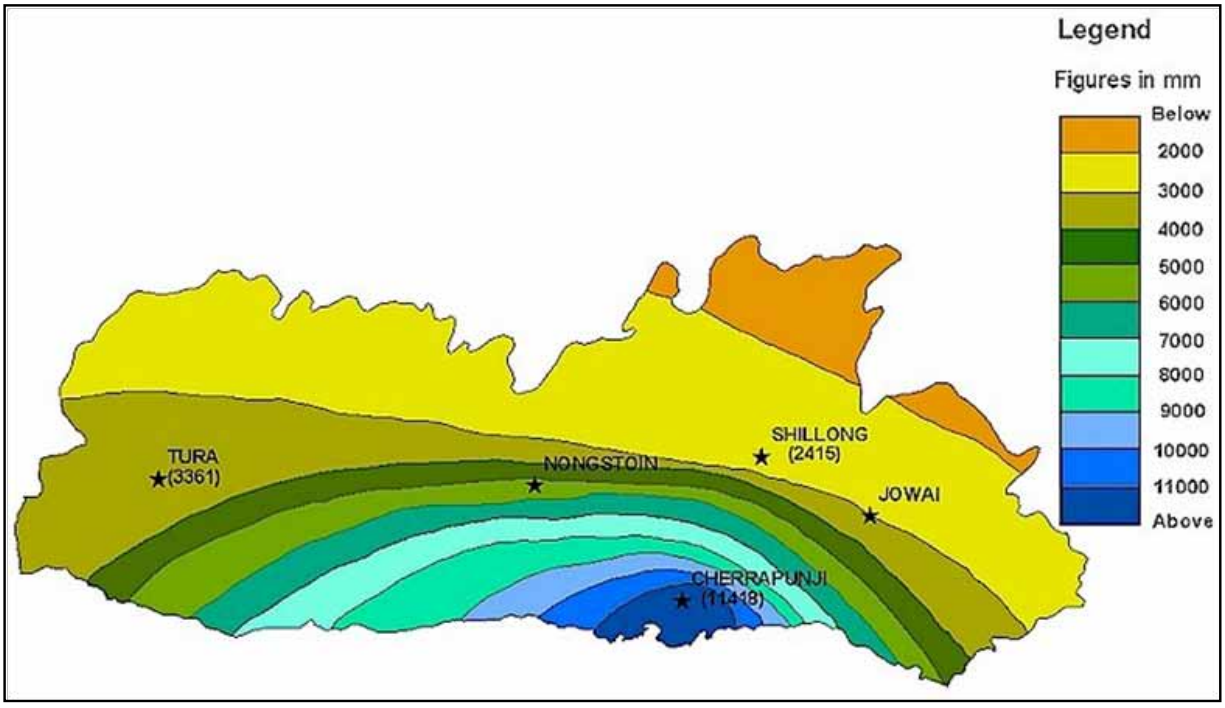


Fig: Annual Rainfall Distribution in Meghalaya

The availability of surface water sources in Meghalaya has been roughly estimated at 63.00 BCM and for ground water at 1.23 BCM. Although there is no tangible accounting of water domains in the State, however, countrywide, it has been assessed that 89% of water is used for agriculture and livestock, 6% for industry and 5% for domestic use (source: Water sector in India, Emerging investment opportunities report by Ernst & Young September 2011). Further, it is anticipated that the State requires about 15 BCM of stored water annually for meeting the water requirements for drinking water, irrigation and other livelihood generating activities such as fisheries etc.

Agriculture forms the backbone of the economy in the state. Also the state's population has a decadal growth of 27.95 percent with the population standing at 29,66,889 as per 2011 population census. 80% of this population depends entirely on agriculture for their livelihood. Taking both factors into consideration, the per capita water availability will decrease with time, since agriculture consumes a lot of water. Also with improved lifestyles especially in urban and semi-urban centers, the per capita water demand will only increase. This will create a situation where there will be a lot of demand but little supply, creating water scarcity in many pockets in the state in the near future. Scarcity will then only lead to conflicts which may be difficult to solve and in most cases impending in the long run.

With all the factors, including the uncertainty of rainfall, the water availability situation is the state is grim. The government is serious in promoting rainwater harvesting. Increasing water availability throughout the year in the State by providing storage facilities through rainwater harvesting have been given importance and various projects have already been taken up by the State government. As a start, the Government has initiated programmes like Jalkunds, Multi-purpose Reservoirs (MRs) and Roof Top Water Rain Water harvesting as tools to implement Rainwater Harvesting in the state.

Sl. No	Programme	Started	Amount sanctioned (till 31.03.2014)
1	Jalkunds	2011-12	Rs. 28.00 crores
2	Multi-purpose Reservoirs	2012-13	Rs. 29.15 crores
3	Roof Top Rain Water Harvesting	2013-14	Rs. 4.00 crores
	Total		Rs. 61.15 crores

Jalkunds Programme

Jalkunds are small water harvesting structures that supplement the crop water requirement during the dry season where numerous types of crops may be grown and also helps expand the irrigation coverage especially in areas which are on the fringes of existing command areas which have already been covered by irrigation facilities. The Jalkunds programme is restricted to a total command area of 10ha. It has become a boon especially to many small &marginal farmers in the interior most parts of the state, who would otherwise not be eligible for most of the irrigation schemes

Multipurpose- Reservoirs(MRs)

Multipurpose Reservoirs (MRs) are water resources structures that will cater to the different water needs of the community by providing water solutions for various needs such as Drinking & Domestic Water, Irrigation, Fisheries, Livestock, Micro hydel, etc, wherever feasible. In addition, components like capacity building, institution building, Management Information System (MIS), monitoring & evaluation, entrepreneurial promotion, etc have also been included to ensure that programme is successful.

Roof Top Rain Water Harvesting

Realizing the importance of having adequate and clean water supply in Health Centers across the state, the government is proposing to construct rain water harvesting structures in Primary Health Centers and Community Health Centers located all over the state. The water will be stored in 50,000-1,00,000 liters tanks which will supplement the daily domestic water requirements. It is anticipated that this programme will cover schools and colleges, institutions, offices, etc in due course of time.

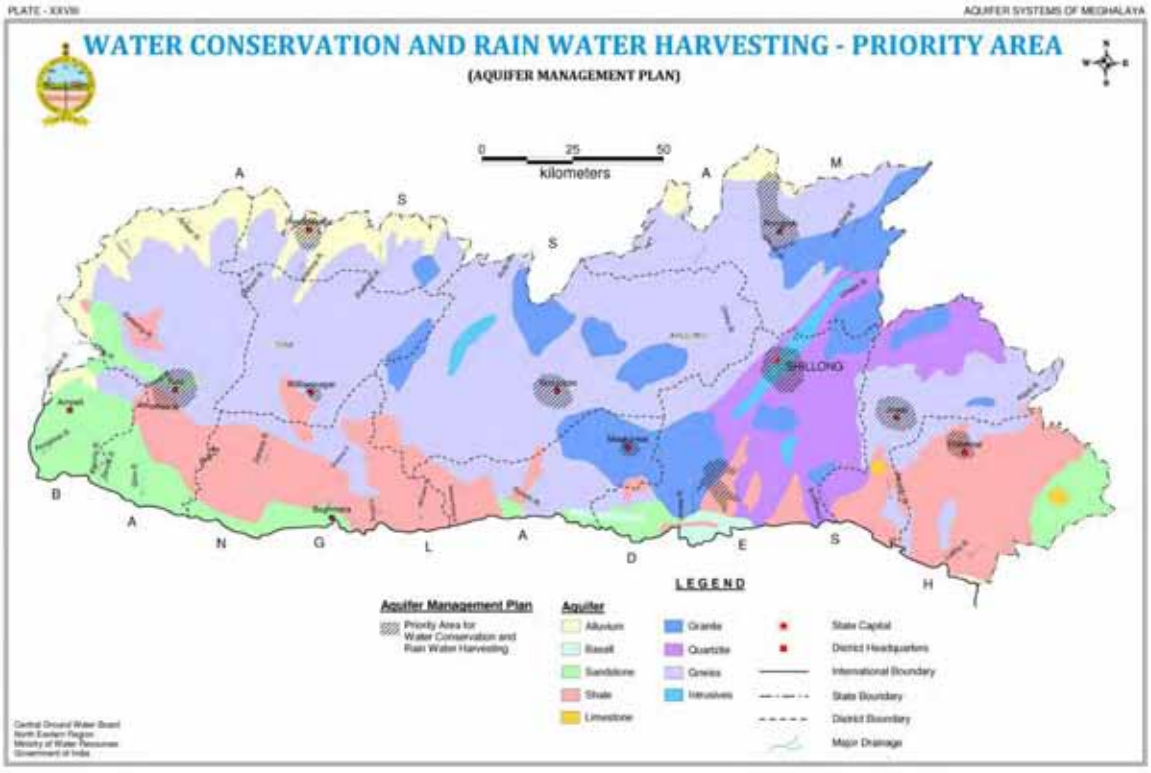


Image Source: AQUIFER SYSTEMS OF MEGHALAYA- September 2012
Govt. of India, Ministry of Water Resources, Central Ground Water Board, North Eastern Region, Guwahati

Reference:

1. *Central Water Commission*
2. *Water Sector in India, Emerging Investment Opportunities Report by Ernst & Young, September 2011*
3. *Central Ground Water Board: Aquifer Systems of Meghalaya, September 2012*
4. *Wikipedia*

ROLE OF MEGHALAYA WATER RESOURCE DEPARTMENT

The Department of Water Resources was created during 2009 by the up-gradation of the erstwhile Directorate of Irrigation of the Agriculture Department. The main function of the Department is to support the holistic development of water resources in the State in a mission mode.

The aims and objectives of the Department are to materialize the identified thrust areas which will inter alia pave the way for creation of additional irrigation potential, promotion of water use efficiency, better water quality management, Flood Control and Flood Management Works, Repair Renovation & Restoration of Water Bodies, rejuvenation of springs, more robust water regulatory mechanism, convergence of initiative of different stakeholders on demand and supply side, Awareness, Education & Knowledge of Water Resources, Integrated Development & Management of water resources, etc.

The Department of Water Resources is also shouldered with the responsibility to ensure better utilization of the existing irrigated areas by implementing different programmes such as Command Area and Water Management Programme, Improvement, Modernization and renovation of Irrigation projects. Improvement of water use efficiency in the irrigation projects is another focused area and activities for improving the water conveyance and distribution systems are being taken up which eventually result in more area coverage under irrigation.

The Department has also an important role to play in promoting Participatory Irrigation Management (PIM) and, for this, it is initiating the formation of the Water Users' Associations (WUAs) in project areas and these are being registered under the Registration of Society's Act.

Thrust Areas of Department of Water Resource

- Launch Meghalaya Water Mission in line with the National Water Mission launched by the Union Government under National Action Plan for Climate Change and promote Meghalaya Water Resources Development Agency to take up activities relating thereto. The agency will also promote convergence and participatory development in the water sector.
- Promote Meghalaya Water Foundation, a civil society organization to mobilize participation of water user communities and traditional self – governance institutions around the water sector issues.
- Restructuring of Irrigation Directorate to enable it function as an effective supporting agency for newly created Water Resources
- Preparation of basin plans required for promoting optimum use of water resources.
- Strengthening of the water Quality Monitoring system.
- Strengthening of knowledge management in relation to water resources, application of IT enabled services, GIS resources therein and campaign for effective awareness and capacity

- Building of different Stake holders in the Water sector.
- Establishing Meghalaya Water Resources Regulatory Authority/ Commission.
- Promote water harvesting with the help of renovation of water bodies and creation of Jalkunds.
- Rejuvenation of springs in order to further promote drinking water and micro irrigation security.
- Preparation of Irrigation Master Plan for the state
- Work on legislations for Participatory Irrigation Management and Ground Water Regulation.
- Convergence guidelines aimed at ensuring Integrated Water Resources Development.
- Need to protect and conserve the Catchment areas and to enforce the related laws for the purpose.
- Detail studies on Water Resources Management for Climate Change adaptation in Meghalaya.

The newly constituted and notified District Water Resources Council under the purview of the Meghalaya Water Development Agency (MeWDA), in its mandate to draw up plans and assist the water resources and other line departments in implementation, development of schemes relating to water resources, is being entrusted to identify, map, prepare DPRs, and implement the same. The District Water Resources Council has the Deputy Commissioner of the district as the Chairman and the Executive Engineer (Water Resources) as the Member Secretary. Other members of DWRC will constitute of District Heads from Public Health Engineering, PWD-Roads, Forest, Agriculture, Horticulture, Soil & Water Conservation, Community & Rural Development, Power and Tourism. The WUAs/development partners will execute the work under technical supervision of the DWRC. The Meghalaya Water Resources Development Agency (MeWDA), will look into the overall policy and monitoring of the program. The Chief Secretary shall be the Chairman of the Governing Council whereas the Chief Engineer (Water Resources) shall be the Member Secretary. Other members include Principal Secretaries/ Commisssioner & Secretaries of concerned departments. The Executive Council of the MeWDA shall consist of the Commissioner & Secretary (Water Resources) as the Chairman and the Chief Engineer (Water Resources) as the Member Secretary. Other members consist of Heads of Departments of concerned departments.

The activities of the Water Mission are briefly summarized below:

Expansion of Irrigation

With respect to Irrigation development, there has been an additional potential creation of 28501 ha in the last three years i.e. 2010-11 to 2012-13 through the minor irrigation projects implemented in the State. The overall irrigation coverage till the year 2012-13 is 65513 ha during the last 3 years. The irrigation coverage as of now has gone up to 28% of the identified potential of 2.18 lakh hectare as against 17% coverage 3 years back.

Integrated Water Resources Management (IWRM)

Under this programme the following activities have been taken up and their status of implementation is as given below:

Multipurpose Reservoirs (MRs)

During March 2013, an amount of Rs. 29.15 crore was sanctioned under Special Plan Assistance for development of Multipurpose Reservoirs (MRs).

Multipurpose Reservoirs (MRs) are water bodies that will cater to the different water needs of the community. It may be mentioned that the Multipurpose Reservoirs (MRs) will have the following components:-

- Structural components having a combination of components for different uses such as Drinking & Domestic Water, Irrigation, Fisheries, Livestock, Micro hydel (< 100kw; where ever feasible) etc.
- Non-structural components like capacity building, institution building, Management Information System (MIS), monitoring & evaluation, entrepreneurial promotion, etc.
- Ancillary Components like water filtration, soil fertility testing, water testing kits, improvement of traditional sources, improvement of catchment areas, conveyance systems through canals and pipes, etc.

The District Water Resources Councils (DWRCs) have been instructed to identify feasible sites for which this programme can be taken up shortly.

So far 6 Multipurpose Reservoirs have been identified and inspected by the team of experts. Work for DPR preparation is currently being taken up for these 6 proposed sites. 5 more potential sites have been identified with the help of NECTAR.

Also, 77 existing Irrigation dams of the Water Resources Department and 15 existing dams of the Soil & Water Conservation Department have been identified and are being considered to be converted in to Multipurpose Reservoirs by either increasing the dam height or by constructing additional headworks, upstream or downstream of the existing dam to facilitate multipurpose uses. Investigation is currently in progress.

Jalkunds/ Water Harvesting structures

An amount of Rs. 28.00 crore has been sanctioned for the construction of Jalkunds/ Water Harvesting structures. 597 structures at an amount of Rs.17.86 crore are likely to be created with the help of this investment to help create irrigation potential of 1942.46 hectare benefitting 1983 development partners during the next one year.

The schemes are being implemented through the District Water Resources Councils (DWRCs). Work is under progress.

Participatory Irrigation Management (PIM)

As part of the implementation of the Participatory Irrigation Management (PIM), Water Users Associations (WUAs) are being formed and registered under the Registration of Societies Act. The total number of WUAs as on March 2013 is 254.

Capacity Building and Awareness Programmes

The following programmes have been organized:

- Workshop on Jalkunds at the district level to apprise the farmers about the implementation of Jalkunds.
- Awareness Programmes held at Khliehriat and Tura on "Save Water, Save Earth" in collaboration with Central Soil & Material Research Station (CSMRS), New Delhi
- Water Retreat at Polo Orchid , Sohra in collaboration with Meghalaya Water Foundation (MWF)
- Training Programme at Shillong on Micro-Irrigation Techniques in collaboration with NERIWALM.
- Stakeholders Workshop at Shillong on Draft Water Mission Document.
- Awareness Ad on Water Conservation in the Independence Issue of Eastern Panaroma Magazine as part of Awareness programme.
- Water Retreat at Shillong in collaboration with Meghalaya Water Foundation (MWF)
- Workshop for existing Water Users Association (WUAs) on "Usuage of Irrigation Dams for Fish Culture" under the Water Plus Programme at the Meghalaya State Fisheries Research & Training Institute, Mawpun.
- Shillong Water Summit held at NEHU campus, Shillong in collaboration with Meghalaya Water Foundation (MWF)

Other activities under the Integrated Water Resources Management (IWRM)

- *Monitoring & Evaluation of Accelerated Irrigation Benefit Programme (AIBP)*
  Third party monitoring of projects under the Accelerated Irrigation Benefit Programme (AIBP) implemented by the Water Resources Department and Soil & Water Conservation Department has been taken up.

- *Draft Water Policy*
  The Meghalaya Water Policy has been drafted and copies of the draft have been circulated to different stakeholders for their comments and suggestions for improvement. Finalization of the draft will be made after taking into consideration the inputs and suggestions received. The draft water policy has also been reviewed by the State Water Resources Council (SWRC) of which the Chief Minister is the Chairman.

- *Draft Meghalaya Ground Water Bill*
  The Meghalaya Water Resources Development Agency (MeWDA) has just completed drafting the Meghalaya Ground Water Bill, 2013. The Bill has been circulated to stakeholders concerned and suggestions and inputs from them are awaited.

- *State Water Act*
  The Meghalaya Water Resources Development Agency (MeWDA) has called for an EOI for "Drafting of a Comprehensive Meghalaya Water Act" and the work has been allotted. Work on the same is currently being taken up.

Institution Development

To promote the Integrated Water Resources Management and to bring about coordination between the different water sector departments and other stakeholders Meghalaya State Water Resource Council has been set up under the chairmanship of Chief Minister. The Meghalaya Water Resource Development Agency (MeWDA) has also been promoted to function as an agency for bringing convergence in the activity of various water related departments and agencies. Further, District Water Resources Councils have been constituted in all the districts in the state to facilitate coordinated formulation and implementation of programmes under the water mission.

Intervention by MeWDA - Jalkunds :-

In order to preserve the water resource that is available abundantly during the monsoon and for utilization them during the lean periods, MeWDA has proposed to introduce small micro- rain water harvesting structures in the form of Jalkunds. Planning Commission under the aegis of the Special Plan Assistance (SPA) has initially sanctioned Rs. 15.00 crore (Rupees Fifteen crore) for implementation of Jalkunds. As per recommendations made by the Planning Commission, it was decided that from the current Rs.15.00 crore available under SPA, initial focus will be given to type-I jalkund structures whereas only 5-10 type-II structures will be implemented on a model basis until further recommendation. Subsequently, if and when funding is available, to achieve the goal of providing access to irrigation water to every farmer in the state by the end of the 12th five year plan period, the same guideline will be applicable.

In view of various Agro-climatic zones in the state, different types of Jalkunds are being implemented based on the need assessment of the farmer in consultation with the District Water Resources Council. These jalkunds are being placed strategically, based on the topography of the area and is not detrimental on the activities of the village in any way.

Types of Rain water Harvesting/Jalkunds

There are two types of harvesting rain water/Jalkunds:

Type-1 Impounding Rain Water Harvesting

This type of rain water harvesting is suitable in location where there are negative spaces and the topography allows for the surface runoff/ natural drainage to be blocked by an impounding structure. The water impounded from these structures can then be conveyed by gravity to the required locations through canals or pipe.

Type-2 Lined Dugout Pond

These structures are suitable mostly on hill tops, where the collection of rainwater is in-situ. These structures can vastly help in converting jhum cultivation areas. The target area for these structures is more localized as the storage of water is completely dependent on the rain water that falls directly from the sky. The coverage will also depend on the size of the pond and the crops planted.

The structures mentioned above will help in managing surplus run-off and make water available for most months if not throughout the year. Livelihood options and activities will also improve as water is crux to different economic activities.

Jalkunds Sanctioned in the State (upto 31st March 2014)

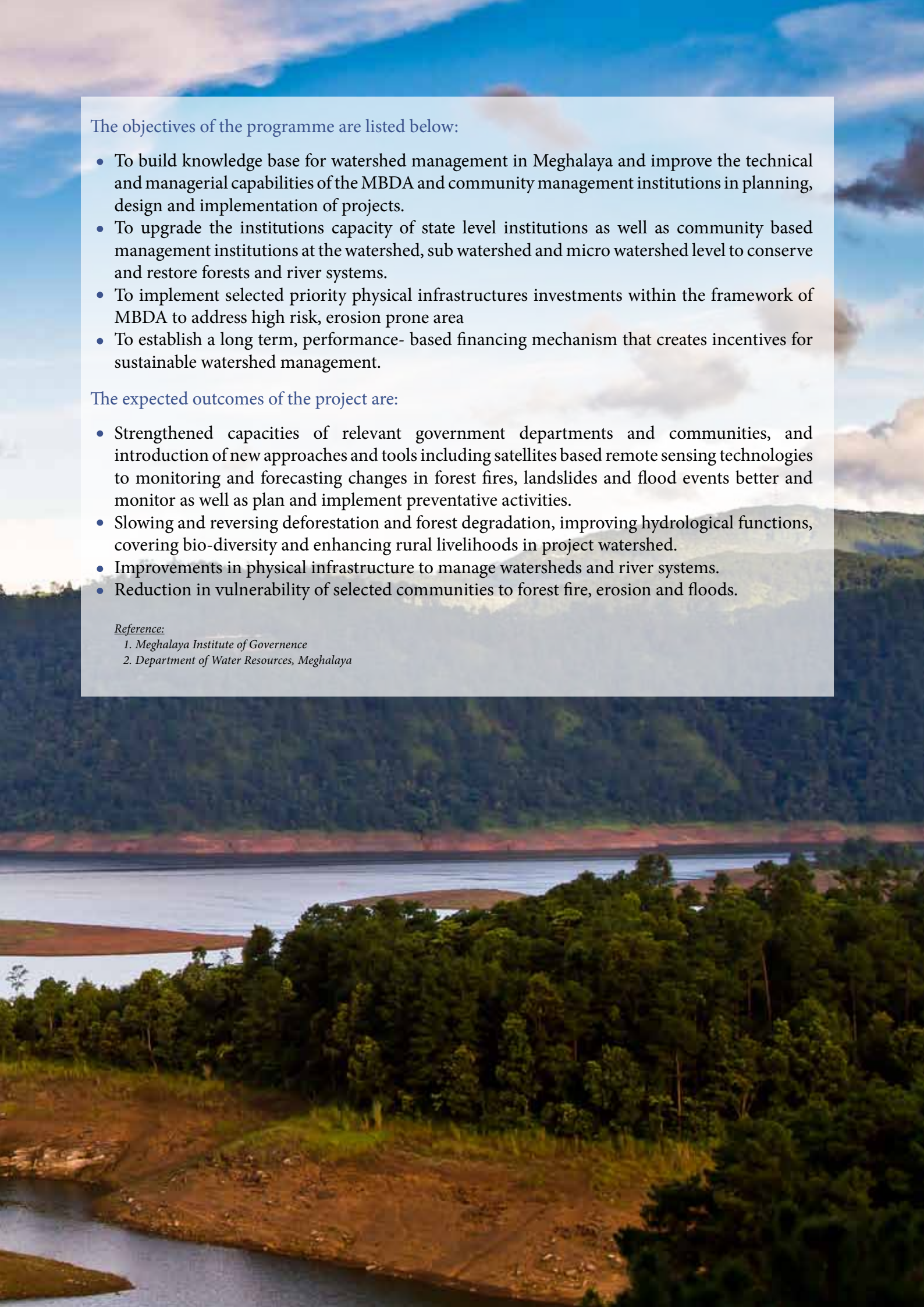
Sl. No	District	No. of Jalkunds	Area (in Ha)	Amount (in lakhs)
1	West Khasi Hills District	23	163.6100	161.84287
2	South West Khasi Hills	12	73.7000	71.38745
3	Ri Bhoi	80	159.0000	163.92300
4	East Khasi Hills	83	193.2585	177.17529
5	South Garo Hills	37	253.7000	245.22000
6	East Jaintia Hills	59	66.9000	61.03039
7	West Jaintia Hills	149	288.6000	168.48573
8	East Garo Hills	50	211.5000	220.36035
9	North Garo Hills	42	187.0000	186.66000
10	West Garo Hills	48	254.2000	239.88720
11	South West Garo Hills	14	91.0000	90.70000
	Total	597	1942.4685	1786.67228

Reference:
1. Department of Water Resources, Meghalaya

UPPER UMIAM RIVER BASIN RESTORATION INITIATIVE

The Upper Umiam River Basin Project is an initiative of the Umiam River Federation to restore and protect the Umiam river watershed and ensure the delivery of environmental services which are important to ensure a sustainable rural livelihood. The target area for the implementation of the project is the watershed of Umiam River which covers an area of approximately 27,000 ha with 10,000 ha being open forests. MBDA under its IBDLP programme is the primary implementing agency and would be working in close partnership with the 10 indigenous khasi governments which represent 62 villages having a population of 4500 households. In addition, the project would be supported by experts from the North East Space Application centre, Science and Research institutes which are specialized in remote sensing, forest carbon modelling, hydrological modelling and NGO's for community mobilization.

The project seeks to develop a community watershed training and research centre with an aim to restore the Umiam reservoir watershed with community participation. The programme is expected to start by January 2015 and to be successfully implemented by December 2020 with East and West Khasi Hills and RiBhoi District being the operational area.



The objectives of the programme are listed below:

- To build knowledge base for watershed management in Meghalaya and improve the technical and managerial capabilities of the MBDA and community management institutions in planning, design and implementation of projects.
- To upgrade the institutions capacity of state level institutions as well as community based management institutions at the watershed, sub watershed and micro watershed level to conserve and restore forests and river systems.
- To implement selected priority physical infrastructures investments within the framework of MBDA to address high risk, erosion prone area
- To establish a long term, performance- based financing mechanism that creates incentives for sustainable watershed management.

The expected outcomes of the project are:

- Strengthened capacities of relevant government departments and communities, and introduction of new approaches and tools including satellites based remote sensing technologies to monitoring and forecasting changes in forest fires, landslides and flood events better and monitor as well as plan and implement preventative activities.
- Slowing and reversing deforestation and forest degradation, improving hydrological functions, covering bio-diversity and enhancing rural livelihoods in project watershed.
- Improvements in physical infrastructure to manage watersheds and river systems.
- Reduction in vulnerability of selected communities to forest fire, erosion and floods.

Reference:

1. *Meghalaya Institute of Governence*
2. *Department of Water Resources, Meghalaya*

BAMBOO IRRIGATION

Dating back 200 years, tribes in Meghalaya have used bamboo drip irrigation as a means of bringing water to seasonal crops. This traditional technology uses locally available material while harnessing the forces of gravity. Holed bamboo shoots are placed downhill, diverting the natural flow of streams and springs across terraced cropland. The advantages of using bamboo are such that it prevents leakage, increases crop yield with less water, and makes use of natural, local, and inexpensive material.

The Jaintia, Khasi, and Garo hills of Meghalaya are largely made up of steep slopes and generally rocky terrain where the soil has low water retention capacity and where the use of groundwater channels is impossible. During the dry seasons, rain fed crops such as paddy, betel leaf, and black peppers can be irrigated by bamboo drip irrigation.

Within the state, the small village of Nongbareh in AmlaremBlock, Jaintia Hills relies on terrace agriculture for betel leaf cultivation as there are no restrictions for individuals tapping into water flows from perennial streams, natural springs or collection ponds. This enables farmers, nearly 97% of the population to cultivate betel leaf and black peppers in seasonal rotations. Meanwhile, drinking needs are met by perennial springs during the dry months from October to March. Only during the winter is irrigation required and the bamboo system is used for crops that need relatively less water.

The system is found in the 'war' areas of Meghalaya but is more prevalent in the 'war' of Jaintia hills than in the 'war' of Khasi hills. This system is also widely prevalent in the Muktapur region bordering Bangladesh. The land used for cultivation is owned by the clan, and is allocated for cultivation by the clan elders on payment of a one-time rent. The clan elders have the prerogative to decide who should get what and how much land. Once the rent has been paid and the land taken on lease for cultivation, the lessee operates as long as the plants last. In case of betel leaf cultivation the lease can last for a very long time since the plants are not lopped off after one harvest. But once the plants die, for whatever reason, the land reverts back to the clan and can only be leased out again after paying new rent.

The water for betel leaf plantation is diverted from streams by temporary diversions into a very intricate bamboo canal system. Betel leaf is planted in March before the monsoon. It is only during winter that irrigation water is required, and the bamboo pipe system is used. Hence, these bamboo systems are made ready before the onset of the winter, and during the monsoon no water is diverted into them.

The few materials needed are a small dao (a type of local axe), bamboo strands of various sizes, forked branches, smaller bamboo shoots used for the channel diversions, and two daily labourers. It is said that two workers can construct a system covering one hectare of land in 15 days. About four or five stages of irrigation from the water source to the last point of application to the plantation is required. Along the way, 18-20 litres of water/ minute will eventually disseminate at a rate of 20-80 drops per minute. With this arrangement each plant will be given water for 24 hours in one week.

Materials used during installation last around three years while maintenance is limited to cleaning and reinforcement after seasonal monsoons. Cost is also limited to labour which can be carried out by farmers themselves. Adapting to drier growing seasons farmers are advised to match irrigation decisions with crop selection.

In addition to the bamboo irrigation, trout rearing (Mahasir) is also done on the river flowing through the village. This trout rearing is maintained by the village community. No angling is allowed in the riverine but only those people who are sick, ill and having health diseases of any kind are permitted provided they get permission from the village elder. It is believed that any person/ persons consuming the fish gets cured in spite of having any form of diseases.

The Jaintia, Khasi and Garo tribes have long entrusted the use of bamboo drip irrigation as a means to fulfilling domestic, agricultural and customary needs. Its function remains unspoiled so as the rains continue to fall and the bamboo continues to grow.

Attempts have been made to introduce modern pipe systems but farmers prefer to use their indigenous form of irrigation. Local farmers do not trust the new materials or the people who supply them.

Reference:

1. *Meghalaya Institute of Governence*
2. *Department of Water Resources, Meghalaya*

CLEANING WAH UMKHRAH & UMSHYRPI – A PEOPLE'S INITIATIVE

Due to the amenities of typical urban life, such as flush toilets and washing machines, people living in Greater Shillong area tend to lead more water intensive lives. The urban population has doubled over the past 30 years. Population growth is going to accelerate the water crisis, especially as more and more people move into the city and its adjoining areas and become part of the middle class. A growing city requires a robust urban amenities management system. The acute shortage of solid waste collection and disposal facilities has led to a scenario of waste management in Shillong which requires immediate attention of all the stakeholders.

Umiam Lake, located 16 kms from Shillong has been a bright jewel. The lake draws its name from the River Umiam, which was dammed in 1965 to create North East India's first hydel power project. Umiam Lake though downstream of the city of Shillong, is deeply connected to it, as it is fed by two rivers, Wah Umkhrah and Wah Umshyrpi. These two rivers cut across the bustling cityscape and join Umiam downstream. For years, Shillong has derived its identity from these rivers. Localities like Laitumkhrah, Pynthorumkhrah, Umpling and Wahingdoh owe their names to the Wah Umkhrah River. It is a general belief that Wah Umkhrah is also divine as it is one of the khyndai umtong (nine streams) of mythic origin. These streams emanate from Shillong Peak, which is worshipped as the chief deity of the Khasis. Khasi poet, Late Bah Victor G Bareh, besides glorifying, also emphasised on the phenomenal role of the river in his poem Ka Wahumkhrah: 'La um jakhlia la tngit pyrthei, Ha pha ki wan b'an theh kyntei, Pha rong ia ki sha trai duriaw.' (Though turbid waters of the world empty into you, you carry all this to the bottom of the seas).As these two rivers cleave the city, they carry with them voluminous water that reaches Umiam Lake. This in turn leads to production of electricity for the State of Meghalaya and especially the city of Shillong.

Elders recall that Umkhrah and Umshyrpi were sparkling clean water bodies. People swam, fished and even drank the water. Today, Shillong's river systems are a sad story, reeking of filth and neglect. Shillong has turned its back towards its natural ecosystems. Rivers Umkhrah and Umshyrpi are little but open drains in summer, where the water is black with sewage and kitchen waste. The major contributors to the waste in Wah Umkhrah are dry latrines on both sides of the river, direct discharge from hotels, restaurants, automobile workshops, hospitals, slaughter houses, markets, etc. and direct discharge of untreated sewage, municipal wastewater, dumping of solid waste, etc.

During monsoons, it is deep brown, carrying huge amounts of sediments as land use continues to change upstream. An estimated total of 20–25 metric tons of solid waste find its way to the rivers and streams of Shillong every day. The pollution of Shillong's rivers is symbolic of the human world that surrounds it. If Shillong has to revive its rivers, it would have to look inwards. It would require rebuilding social relationships and reviving environmental responsibility. And it's about time that this happened.

As water scarcity becomes a bigger and bigger problem, the poorest in the community will most likely be hit the hardest. Thus far, food and shelter has been one of the highest priorities to a community grown accustomed to cheap electricity, which allows extremely fast pumping of groundwater, which is something they are unwilling to give up for the sake of water conservation. If people want to maintain its level of water security, they will have to switch to a less water intensive lifestyle.

Water Pollution

Shillong city's two main river systems are Wah Umkhrah and the Wah Umshyrpi. Their catchment is endowed with abundant water resource in the forms of springs, streams, rivers and water bodies distributed throughout the area. Their water has being used for irrigation and washing purpose for ages but due to the absence of a proper sewage disposal and treatment system in the city, both the rivers have become the direct sewage disposal system. With the increasing human population and growing urbanization and industrialization most of these water sources are being gradually polluted. Rapid expansion of Shillong along with high rainfall and hilly topography has further compounded the problem. Fine particles of coal, sand, mud and household waste particles deposited in the water bodies destroy the habitat and reduce availability of oxygen for aquatic creatures. The consumption of polluted water for domestic use causes various kinds of diseases and poses threat to human health. Therefore, monitoring the quality of water and taking necessary measures to improve the same assumes a great significance as the same has not been done in a holistic manner.

Factsheet Crisis of Wah Umkhrah and Umshyrpi:-

- The rivers of Wah Umkhrah and Wah Umshyrpi impact the health of the city of Shillong. The rivers are the breeding ground for mosquitoes.
- Sewage and garbage disposal clogs the river system leading to floods which brings the filth at the doorsteps of the habitants in vicinity. This leads to a public health crisis.
- The sewage from the rivers has led to unprecedented silting of Umiam Lake which has reduced the power generation potential of the Hydel power project. This has contributed to frequent power cuts all across Meghalaya in last few years.
- Shillong which was famed as Paradise of the East has lost its glory by neglecting its eco-systems. This has a significant impact on the Tourist potential as well as clean water availability in the long run.
- Approximately 2,025 million litres of sewage enters into rivers Umkhrah and Umshyrpi every year.
- 42% of sewage generated in the Wah Umkhrah River catchment is discharged as either raw or partially treated sewage directly into the river system.
- In the dry season, sewage inflow makes up approximately 10% of average monthly river flow in the Umshyrpi River and 20% in Umkhrah River
- The rivers Wah Umkhrah and Wah Umshyrpi are detrimental to the vitality of the city of Shillong. The stink coming from the rivers has reduced the real estate value around their banks.
- Flooding brings up all the filth from the rivers and deposits it right at the doorstep of those living next to the rivers. This has significant public health impact.
- Studies peg average loss caused due to flooding and landslips to the order of Rs. 2,500 per household and a loss of 3 to 4 working days
- An estimated 40,000 cubic metres of silt enters Umiam Lake every year
- Umiam Lake produces most of the electricity for Meghalaya even now. As it silts up, it's potential to generate electricity decreases. Shillong has been witnessing severe power cuts in summer for the last 5 years

Our crisis is predominantly a manmade problem. Extremely poor management, unclear laws, government lethargy and public apathy have caused this crisis and rendered what river water available practically useless due to the huge quantity of pollution.

The Approach:

Problems like these have been solved over the years in the developed world and it can be done again, although it will take time, commitment and resources. The good news is that there are technologies and proven strategies for dealing with much of this pollution. Experience shows that bringing together Government agencies, Technical expertise, Funding resources and Local champions can make a real and measurable difference. One solution is to make people and institutions talk to each other. Everybody manages their bit of the catchment in their own way. There is a need to stitch together diverse interventions and make them work towards a common objective. The other is to generate a civic response to this crisis.

- Water Resources Survey Assessment
- Environmental Impact Assessments and Documentation of Good Practices
- DPR preparation
- Sustained Awareness, Capacity Building, Training
- Sustained Publicity and Media Campaign
- Execution of Works
- Post Project Monitoring, Evaluation and Impact Assessment

The Campaign

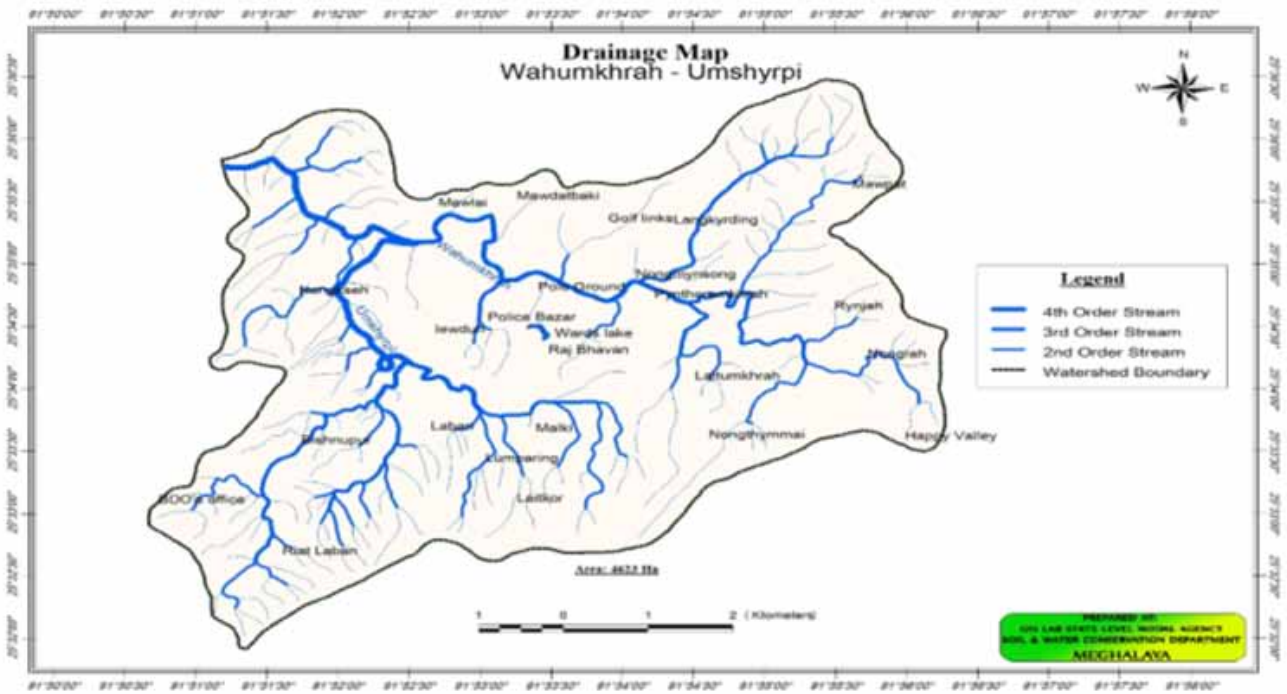
In 2012, the state government, district councils, city-based NGOs, educational institutions and individuals came together for the first time and started an awareness campaign and launched effective action programmes to protect and preserve the rivers from the pollution that they have been subjected to so far. Cleaning the river systems was based on a sustained plan of action that has more to do with a change of mindset and habits than anything else and the cleaning process had to start from home itself. In view of this, a Task Force was formed.

The task force comprising over 20 local NGOs of the state including the Khasi Hills Autonomous District Council and the Mylliem Syiemship was formed to win the minds and hearts of people in this huge task of reclaiming the city's rivers which have been allowed to degrade in the last forty years due to human activities. Then they came up with short, medium and long term goals involving several stakeholders and a clear action plan by each of the stakeholders with the Government partnering in this monumental project.

A long term people's movement to clean up the rivers of the city is being spearheaded by the Shillong Civil Society. It is being represented by all the major NGO's of the city which are working together with the State Government under the tutelage of the District Administration. The NGO's who are a part of the Task force include People's Learning Centre, I-Care, Lympung Ki Seng Kynthei, Meghalaya Women's Alliance, Meghalaya Water Foundation, Synjuk Ki Rangbah Shnong, MTDF, Soldier's Board, MSPCB, NEHU, FKJGP, KSU, SSSS, Pla Iew Club, Bethany Society, Central Puja Committee, Youth for Change, MLCU, Sikkim Manipal, NEEDS, NSS, Meghalaya Institute of Governance.

The nature of work undertaken by the Task Force so far includes the following:

- 10th Feb 2012 – Mass mobilization at Soso Tham Auditorium with a turnover of about 800 people.
- 2nd March 2012 – Save the Wah Umkhrah People's meet held in Arts & Culture Hall, State Central Library.
- 21st - 24th March 2012 – Visit and workshops, awareness campaigns of Mr. Srinivasan, Project Director, Indian Green Service, Vellore.
- 22nd March 2012 - Panel Discussion in local cable networks on the topic "Ka Wah Umkhrah Ka Iam Pangnud – Hato Ngim Don Jingkitkhlieh?"
- A short film on Wah Umkhrah was made in house and the same has been screened at various
- platforms.
  22nd March 2012 – World Water Day at Diengpasoh and Yojana Bhavan.
- 12 - 21st April 2012 - Campaign through Red FM
- 12 - 21stApril 2012 - Poster Campaign
- 21st April 2012 – Marathon and Public Rally from Fire Brigade to Polo Ground, Phawar,
- Poem Recital Competition.
  11th June 2012 – Visit of Dr. Kale (Scientist, Bharat Atomic Research Centre, Mumbai).
- Mass mobilization and awareness meetings were held with various Dorbars and other Stake
- Holders by members of the Task Force.
  Constitution of Sub Committee, Identification of Pilot Projects for Solid and Liquid Resource Management and preparation of DPR.



Reference:
1. *Meghalaya Institute of Governence*
2. *Department of Water Resources, Meghalaya*

ROMBAGRE FISH SANTUARY

Meghalaya is blessed with a very rich and diverse inland aquatic ecosystem having a variety of aquatic resources such as rivers, streams and lakes. But over the years, due to natural and man-made causes, aquatic bio-diversity in open waters has been declining sharply. Killing of fishes by explosives and poisoning is commonly practiced in the State, especially in the natural rivers and streams where there is no protection. It is very essential to undertake necessary attempts to conserve and enhance aquatic bio-diversity. One of the strategies adopted for protecting and conserving fish species from extinction is through establishment of Fish Sanctuaries. A sanctuary was established at Rombagre in Garo Hills.

Rombagre is situated at the distance of 35kms from Tura on the side of Williamnagar – Tura PWD Road. Illegal mass killing of fishes in the stream by explosives and poisoning has been a common practice by people in Rombagre. Besides, the place has also been a common picnic spot for people who hamper the stream by throwing waste into the stream and its surroundings. In order to preserve the fishes this sanctuary had been constructed. This sanctuary has been preserved and protected by the local villagers where schools of fish are found swimming in the clear waters turning the place into a tourist spot as many travelers are often found enjoying the fish in the protected water pool. Besides, there are lovely picnic spots in and around Rombagre which attract many people from far and near for seasonal picnics every year. It is also being run by an NGO, the Rombagre Resource Management (NARM).

People who are found to illegally fish from the sanctuary are made to pay a heavy sum of money. But, villagers are allowed to fish from the flowing river for their livelihood. Beside giving these fishermen an opportunity to earn their livelihood, it has also improved the livelihoods of local road side hawkers as visitors who are fascinated by the fish being conserved pass through their stalls and hence improve their incomes.

Reference:

1. *Meghalaya Institute of Governence*
2. *Department of Water Resources, Meghalaya*
3. *Fisheries Department, Government of Meghalaya*

COMMUNITY LED INTERVENSIONS: THE JAINTIA FISHING ASSOSIATION

Angling is a part-time leisure deeply associated with the people of the District. Having observed with deep pain the wanton destruction of fish fauna in the District, a group of responsible people under the leadership of Shri J.K. Passah (founding President) decided to form an organisation under which a message of "SAVE FISH CAMPAIGN" could be spread. Thus the Jaintia Fishing Association was formed in 1993 with its Headquarter at Jowai. The primary aims and objectives of the Association are:

1. To prevent selfish exploitation of riverine fishes by using dynamite, poison, generators etc.
2. To release fish seeds into rivers and streams.
3. To conduct awareness programmes on conservation of aquatic life.
4. To preserve the river as a clean and perennial source of drinking water.

Since its inception, the association has been working tirelessly in the river Myntdu which has been selected as a pilot project. No doubt, it is through the effort of the Jaintia Fishing Association that fishes at river Myntdu still thrive. The Association has been working in close collaboration with different Government agencies and District Administration in order to achieve its objective. This success at river Myntdu was spread to different parts of the District and as of today, the Association has 12 (twelve) units in different parts of Jaintia Hills which volunteer to work on the above objectives. Very recently the Jaintia Fishing Association has unanimously decided to change its name to Jaintia Fishing and Environment Protection group and is registered with the Government.

Reference:
1. Meghalaya Institute of Governence
2. Department of Water Resources, Meghalaya
3. Fisheries Department, Government of Meghalaya

Notes

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