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Water and Rajasthan

1.1 Precarious Situation of Rajasthan

1.11 The entire world has become increasingly aware of shortage of fresh water, imminent in some countries and regions. These include India, with 16 per cent of the humanity but less than 3 per cent of global fresh water resources. The poor water availability is exacerbated by its uneven spread over regions and time of the year. Rajasthan is very much at a disadvantage even in the Indian context. This large but possibly the driest state suffers from a disproportionately poor availability of water when compared to its potential large users, people, animals and agriculture:

Table 1.1: Rajasthan Water Resources and Potential Users[1]

State Parameter	Share of Nation, %
Area	10.40
Population	5.40
Livestock	18.70
Cultivable area	13.88
Surface water	1.16
Ground water	1.70

1.12 The situation has worsened over time due to a rapid increase in use-related parameters. The population growth rate of the state is among the highest in the country. Demand for water from hitherto insubstantial uses, such as industry, tourism and recreation, as well as sanitation and environmental purposes, has been growing apace. The supply, however, has remained unchanged. The primary source is the scanty and uncertain precipitation, confined to just two months of the year. Nearly a third of the state is arid and another 30 per cent semi-arid, which implies that nearly two-thirds of the state suffers from recurrent water scarcity.

[1] All figures in the entire Report are from the official records of the Government of Rajasthan, unless otherwise stated.

1.13 Iniquitous access to water, caused partly by natural features and partly by injudicious policies, has led to frequent water-related disputes. Irrigation potential is used to near-saturation. Heavy and rather indiscriminate reliance on ground-water extraction, possibly to compensate for the paucity of surface water, has led to declining ground water availability and falling water tables in large areas. This is compounded by inefficient use of surface water and inability to control water pollution, causing progressive deterioration of water quality.

1.2 About the Committee and Its Activities

1.21 Concerned with this situation, the Government of Rajasthan formed a committee of experts to deliberate and recommend the integrated development of water resources in the state under the Chairmanship of Professor V S Vyas in June 2004 vide office order no SWRD/F-41 (see Annex 1). The Committee's initial non-official membership comprised:

Professor V S Vyas, Chairman
Shri P S Rajvanshi, Expert, Public Health and Engineering
Shri Gajraj Singh, Expert, Irrigation
Shri N M Sadguru, Director, Water Development Foundation
Chairman, Gramin Research and Development Council, Rajasthan
Shri Rajendra Singh, Taraun Bharat Sangh
Dr Ashok Agarwal, Bhoruka Charitable Trust
Shri Jagdish Chandra Joshi, Vanvasi Welfare Council
Shri Bunker Roy, SWRC

and the following officials:

Principal Secretary, Water Resources
Principal Secretary, Rural Development and Panchayati Raj
Principal Secretary, Agriculture
Secretary, Public Health Engineering
Dr B M Sikka, Expert, Central Ground Water Development Board, Chandigarh
Secretary, Irrigation and Command Area Development, Member-Secretary

Subsequently, the following additional members were inducted:

Shri Prithvi Raj Singh, Managing Trustee, Jal Bhagirathi Foundation
Dr Katar Singh, Former Director, Institute of Rural Management, Anand, and
Shri S R Gupta, Executive Director, Lupin Human Welfare and Research Foundation
Sh P.S. Kawadia was appointed as the member-secretary of the committee.

The following officials were special invitees to the Committee:

Shri A D Joseph, Regional Director, CGWB, Jaipur
Chief Engineer, Irrigation
Chief Engineer, ID&R, Irrigation
Director (T) cum OSD, Irrigation Department
Technical Member, PHED
Chief Engineer (HQ) PHED
Chief Engineer, Ground-water Department

1.22 The Committee was given the following terms of reference:

1. Suggest changes in the State's water policy keeping in view the State's water resources and its requirements;
2. Recommend measures for integrated development of water resources of the State;
3. Analyse the emerging ground water scenario and suggest remedial measures for sustainable development of ground water, including steps required to prevent its over-exploitation and suggest actions to augment water resources;
4. Propose measures for improving water use efficiency in the State.

1.23 The Committee formed four study groups:

I *Irrigation Sub Group*
Shri G S Chaudhary, Convenor
Shri S N Thanvi, Secretary, Irrigation
Shri Mahesh Kumar, Expert, Irrigation
Shri Harnath Jagawat
Principal Secretary, Agriculture
Commissioner, Agriculture
Chief Engineer, ID&R

II *Ground Water Sub Group*
Shri A D Joseph, Convenor
Shri J P Joshi
Dr B S Tanwar

III *Drinking Water Sub Group*
Shri Bunker Roy, Convenor
Secretary, PHED
Technical Member, RWSSMB

IV *Water Conservation and Augmentation Sub Group*
Shri Rajendra Singh, Convenor
Chief Engineer, Irrigation
Chief Conservator of Forest

1.24 The Committee held nine meetings between 5 July 2004 and 23 May 2005. The sub-groups met as and when required.

1.25 The Committee produced two interim reports:

a. Participatory Management of Water Resources in Association with NGOs;
b. Approach to Resolving Drinking Water Problem in Rajasthan.

1.26 This document is the Final Report of the Committee, as approved by its member in its tenth meeting held on 30 June 2005.

1.3 About This Report

1.31 This Report addresses five critical areas of the water sector in Rajasthan:

- Growing imbalance between demand and supply of water;
- Uncertainty in availability of water;
- Deteriorating quality of water;
- Inequity in access to water; and
- Inefficient use of water resources.

This section provides a broad overview of these issues. They are discussed in greater detail in subsequent sections. The Committee's approach to resolve, or at least to minimise the impact of these handicaps is spelt out thereafter.

1.32 The second section discusses the mission and goals of reforms in the water sector in the state and suggests strategic areas of action. The third section looks at the prospects and strategies for augmenting water supply. Measures to encourage rain-water harvesting, recharging ground water resources, saving water with more efficient applications, conjunctive use of surface water and ground water, and scope for recycling used or impure water are all emphasised. The next two sections focus on demand management in the two most important uses of water, for drinking and irrigation since the scope for augmenting supplies is limited. Efficiency and equity are equally stressed while discussing strategies for these areas. The next section highlights the need for administrative and legal reforms and suggests broad approaches to reforms in these critical areas. The following section emphasises the need for involvement of people's organisations in the task of development and

management of water resources in the state, and suggests some *modus operandii* for their inclusion in these tasks. The final section sums up the observations and suggestions and outlines the broad contours of a Water Policy for the state. An Epilogue at the end suggests the follow-up steps for implementing the recommendations of the Report.

1.4 Growing Imbalance between Demand and Supply of Water

1.41 Accepted international standards deem countries and regions with per capita annual water supply of 1,000-2,000 cubic meters (cum) as water-stressed. If the supply is under 1,000 cum per person per year, a situation of water scarcity is said to exist. Inadequate water becomes a serious constraint to human well being and economic growth in the event of such scarcity. Availability of water in Rajasthan has already fallen to 809 cum per person per year. This suggests that if remedial measures are not taken immediately, the situation will become seriously stressful.

1.42 The overall paucity of water is compounded in view of the relative importance of the sources from which water is obtained in the state:

Table 1.2 Rajasthan's Water Resources (billion cum), 2000

Source	**Availability**	**Utilisation**
Surface water		
Internal	16.05	11.29
Inter-state	17.89	12.66
Total	33.94	23.95 (71%)
Ground water	11.15	11.83 (104%)
Grand Total	**44.09**	**35.78 (81%)**

1.43 Two facts stand out from this table: first, the state has a large dependence on 'imported' surface water, i e water received from different states under inter-state agreements and second, the rather large share of ground water in the total water supply. Inter-state water supplies which should be normally considered assured, are now becoming increasingly uncertain due to political factors prevailing in some of the neighboring states.

1.44 The situation in regard to ground water resources is even more precarious. The steady decline in the number of blocks with safe levels of exploitation of ground-water and the corresponding increase in critical and over-exploited categories in the Table below clearly shows an over-dependence on ground water:

Table 1.3 Ground Water Status of Blocks

No of Blocks in Category	1984	1988	2001	2004 (Tentative)
Over-Exploited (>100%)	12 (5%)	41 (17%)	86 (36%)	140 (59%)
Critical (90 to 100%)	11 (5%)	26 (11%)	80 (34%)	50 (21%)
Semi Critical (70 to 90%)	10 (4%)	34 (14%)	21 (9%)	14 (6%)
Safe (<70%)	203 (86%)	135 (57%)	49 (21%)	32 (14%)

Total number of Blocks: 236

1.45 As against the limited, and in some respect declining, supply, the demand for water is increasing day by day. The following table brings out the supply-demand imbalance:

Table 1.4 Projected Imbalances between Demand and Supply of Water (BCM)

Purpose/Year	2005			2015			2045		
	SW	**GW**	**Total**	**SW**	**GW**	**Total**	**SW**	**GW**	**Total**
Demand									
Domestic	0.5	2.1	2.6	1.0	2.2	3.2	2.5	2.2	4.7
Livestock	0.1	0.8	0.9	0.3	0.8	1.1	0.5	0.8	1.3
Irrigation	20.0	15.9	35.9	26.0	14.0	40.0	36.0	13.1	49.1
Others	0.3	0.4	0.7	0.4	0.4	0.8	1.0	1.0	2.0
Total	**20.9**	**19.2**	**40.1**	**27.7**	**17.4**	**45.1**	**40**	**17.1**	**57.1**
Availability									
Intrastate	5.8	7.5		8.0	7.5		16.9	7.5	
Interstate	12.2			13.0			15.0		
			25.5			28.5			39.4
Recycled Water									
Domestic	0.8			1.1			1.1		
Irrigation		6.0			6.5			7.2	
			6.8			7.6			8.3
Total	**18.8**	**13.6**	**32.4**	**22.1**	**14.0**	**36.1**	**33**	**14.7**	**47.7**
Shortage			**7.7**			**9.0**			**9.4**

SW= Surface water; GW= Ground water

1.46 Demand for domestic water use will increase continuously with the growth in population and greater attention to hygienic and sanitary requirements. A special feature in Rajasthan is its large livestock population, which will also increase over a period of time. It has had, and will continue to have, substantial claims on available water supply, between a quarter and a third of the demand for human consumption.

1.47 Presently, irrigation accounts for the lion's share of demand for water. In the foreseeable future, however, demand for water for other uses (industry, tourism and recreation and environmental purposes), which is currently in insubstantial at about 3 per cent of the total water use, is also likely to increase along with that for human and livestock consumption. Even today requirement of water for industry in relatively more industrialised districts such as Jaipur, Alwar, Kota and Jodhpur is significant and will continue to be so in time to come.

1.48 Thus, the limited availability of water in the face of its increasing requirement will result in a severe and worsening supply-demand imbalance.

1.5 Large Annual Fluctuations in Availability

1.51 Rainfall in large parts of Rajasthan is not only inadequate but also varies sharply from year to year. Consequently, droughts are now almost a normal occurrence. Hardly three or four years of the state's 52-year existence have been totally drought-free. Most of the rest of the years witnessed large number of districts affected by a paucity of rains. Fluctuations in rainfall influence both surface water and ground water availability. As seen in Table 1.2 above, even in the normal years extraction of ground-water at 104 per cent exceeds recharge. This situation is aggravated in drought years. Unfortunately, current efforts to increase ground-water recharge or to promote conjunctive use of surface and ground water are grossly inadequate.

1.52 Political factors of late have also affected water availability from another major source, namely inter-state supplies. Practically all states of a monsoon-dependent country such as India face periodic scarcities of water. Upper riparian states typically try to meet first their own needs before releasing water to a downstream state like Rajasthan, legal agreements and covenants to the contrary notwithstanding. This adds to the year-to-year variations in the availability of water.

1.6 Water Quality

1.61 Water quality is fast deteriorating due to a variety of reasons discussed in subsequent sections. This is a potential contributor to environmental as well as health hazards.

1.62 Intensive surface water irrigation many a times causes water-logging and increased salinity, which are major environmental threats. The incidence of water logging and salinity depends upon factors such as quantity of water used, intensity of irrigation, soil drainage characteristics, depth of water table, etc. Among major projects, water logging has been observed on about 12,000 ha in Indira Gandhi Nahar Project (IGNP), 40,000 ha in Chambal Canals and some areas in the Mahi Project. Similar problems have also been observed in some of the medium and minor irrigation projects. These problems can be tackled to an extent, as has been attempted in IGNP area, with extension of area under irrigation command and reduction in quantity of water used, large-scale plantation and, conjunctive use of surface and ground water.

1.63 The soils are heavy in the Chambal Command area and intensity and quantity of water used for irrigation are such that artificial drainage is necessary to reclaim the lost arable land. About 15,000 ha have already been treated by providing sub-surface drainage system. Another 25,000 ha need to be provided with drainage. Overall, efforts made so far to reclaim water-logged and salinity-affected areas are not commensurate with the size of the problem.

1.64 Deterioration of the ground water quality is far more serious. Rajasthan is particularly handicapped in this regard, largely because of the over-dependence on ground water. Table 1.5 compares the magnitude of the problem in Rajasthan to the rest of India:

Table 1.5 Comparison of Ground-water Quality, Rajasthan and Rest of India

Particulars	India	Rajasthan			
		Villages	Habitations	Total	% of country
Multiple quality problems	25,092	9,572	9,067	18,639	74
Only fluoride	31,306	4,477	4,515	8,992	29
Only salinity	23,495	3,235	2,193	5,428	23
Only nitrate	13,958	4,211	3,671	7,882	56.5
Only iron	1,18,088	79	52	131	0.1
Only arsenic	5,029	0	0	0	0.0
TOTAL	**2,16,968**	**21,574**	**19,498**	**41,072**	

1.65 Rajasthan already accounts large poor water quality areas. Increasing pollution by industrial units, big and small, unregulated mining and even over-extraction of water from deep wells also add to the water quality problem in a number of districts.

1.66 The ground-water monitoring unit in the Comprehensive Area Development (CAD) Department is responsible for monitoring fluctuations in water tables, extent of water-logged area and quality of water. These data over time could be used not only to understand the causes of such problems, but also for evolving remedial measures.

1.7 Iniquitous Access to Water

1.71 With vast variations in rainfall and ground-water availability, some difference in access to water is inevitable. For example, while the state average annual rainfall is 531 mm, it is 318 mm in the western parts. Rapid urbanisation and industrialisation make such existing differences even more glaring. For one thing, they result in higher cost of water supply and conveyance from relatively surplus to deficit areas.

1.72 The existing arrangements have led to serious inequalities in access to water amongst its various users (drinking, irrigation and industry); between head-end and tail reaches of distribution systems; between urban and rural areas; and between the urban poor and rich. Such inequalities are making the struggle for survival harder for some sections, even as they encourage wasteful use of water by some others.

1.73 A major source of inequity is imbedded in the excessive reliance on ground-water. Farmers irrigating their fields from wells incur an irrigation expenditure which is more than six times that of the farmers in the command areas of surface irrigation schemes, although the former use lesser volumes of water for growing the same crops.

1.74 Such inequities often result in eruption of conflicts as also unrest and agitations.

1.8 Water Use Efficiency

1.81 Inefficient use of water aggravates its limited availability. The two major uses of water drinking purposes and irrigation, both show avoidable losses. About 10-11 per cent of the water is used for drinking. Losses in public distribution system for drinking water are of the order of 30-40 per cent. About 83 per cent of the water is used for irrigation. Of this, 65 per cent is surface water; losses in surface water

irrigation are much higher as compared to those in ground water irrigation. Thus, about two-thirds of the water used for irrigation is affected by inefficiency.

1.82 Efficient water use depends on a number of measures:

- minimising loss in conveyance from source to the point of delivery or outlet;
- minimising loss from the point of delivery to the point of actual use - in the case of irrigation from outlet to the field, through field channels;
- minimising losses in water application in the field and in storing in the soil to the root zone;
- minimising operational losses from source to the point of delivery i e, losses through leakages in structures, breaches in canals, bursting of pipes, supply in excess of demand/need, or delivery when not needed; etc.

1.83 Tahal Consulting Engineers reported efficiencies of existing irrigation projects to range between 8 per cent (Gambhiri Irrigation Project-Medium) and about 40 per cent (Jawai Project-Major), the average being 18% per cent. The efficiency of ground-water use was reported to be about 52 per cent. Some losses in the transit from source to actual use are inevitable; however, the extent of losses being incurred strongly suggests a large scope for more efficient use.

1.84 Similarly, the use of water in crop production does not seem to be efficient. This is reflected in the actual yield of irrigated crops being lower than their potential:

Table 1.5 Comparison of Actual and Potential Yields of Differentc Crops (q/ha)

Crop	**Yield**		**Actual as % of Potential**
	Actual	**Potential**	
Wheat	15-34	40-50	53
Mustard	6-12	15-20	51
Gram	5-14	15-20	55
Barley	13-16	40-50	32

Admittedly, other factors also contribute to the yield, but the wide gap between actual and potential yields is indicative of serious mis-allocation of water.

1.9 Redeeming Factors

1.91 While emphasising major handicaps and constraints, we cannot lose sight of the fact that several favourable features could help overcome some of the handicaps. The most important among these is the growing consensus among the political and civil society leaders and opinion makers in different fields on the seriousness of the problem. This would be a *necessary* condition, although not *sufficient* to resolve the problem. The second positive feature is that examples of successfully resolving some of these issues exist not just in other states, but also in our state. These experiences have to be scaled up and made known more pervasively. We also have by now a better understanding of the efficacy of the economic and administrative measures to tackle these problems. This knowledge could be used to treat the current, rather difficult, situation. Subsequent sections take note of the favourable and positive features, while elaborating on various handicaps and constraints. Suggestions which may not be easy, but are implementable are also indicated.

Annex 1

Government of Rajasthan
Irrigation Department

No. SWRPD/F-41 Jaipur, dated : 29-6-2004

Office Order

To ensure integrated development of water resources of the State, a Committee under the Chairmanship of Professor V S Vyas is constituted as under:

1.	Professor V S Vyas	Chairman
2.	Shri P S Rajvanshi, Expert, Public Health & Engineering.	Member
3.	Shri Gajraj Singh, Expert, Irrigation	Member
4.	Shri N M Sadguru, Director, Water Development Foundation	Member
5.	Chairman, Gramin Research & Development Council, Rajasthan	Member
6.	Shri Rajendra Singh, Taraun Bharat Sangh	Member
7.	Dr Ashok Agarwal, Bhoruca Charitable Trust	Member
8.	Shri Jagdish Chandra Joshi, Vanvasi Welfare Council Kotda, Udaipur	Member
9.	Shri Bunker Roy, SWRC, Tilonia	Member

Government Officers:

1.	Principal Secretary, Water Resources	Member
2.	Principal Secretary, Rural Development & Panchayati Raj	Member
3.	Principal Secretary, Agriculture	Member
4.	Secretary, P H E Deptt,	Member
5.	Dr B M Sikka, Expert, Central Ground Water Development Board, Chandigarh	Member
6.	Secretary, Irrigation & Command Area Development	Member-Secretary

The terms of reference would be as follows:

1. Suggest changes in the State's water policy keeping in view the State's water resources and its requirements;
2. Recommend measures for integrated development of water resources of the State;
3. Analyse the emerging ground water scenario and suggest remedial measures for sustainable development of ground water, including steps required to prevent its over-exploitation and suggest actions to augment water resources;
4. Propose measures for improving was use efficiency in the State.

The committee would submit its report within six months from the date of issue of this order. The Irrigation Department will be the Administrative Department of this Committee.

(Rakesh Srivastava)
Secretary to Government