



WATER

8.1 BACKGROUND

Water is an essential component in every aspect of life and must be valued and safeguarded. The NCR is a water scarce region, but can have sufficient water if this resource is conserved and managed properly. This is essential for the sustainable development of the region. The "National Commission on Water for the year 2051" has recommended that water should be considered as a National Asset and should not be treated as 'State subject'.

NCR is endowed with four perennial rivers namely the Yamuna, Hindon and Kali passing through it and the Ganga skirting its eastern boundary. Main sources of water supply in the region are surface and ground water (e.g. rivers, canals, tubewells, hand pumps and open wells). While the U.P. Sub-region has abundant ground water, the area west of river Yamuna comprising the districts of Gurgaon, Rohtak, Sonapat, Jhajjar and most part of Faridabad district in Haryana, Alwar in Rajasthan and large part of NCT-Delhi have insufficient ground water, which is often brackish in quality rendering it unpalatable for domestic consumption. Delhi draws its water needs mostly from the Yamuna and Western Yamuna canal and partly from Ranney wells and tubewells in Yamuna belt and Upper Ganga canal system. There is generally a wide demand-supply gap of water in NCR and the problem becomes acute in dry summer months.

Regional Plan-2001 proposed norms and standards of water supply in urban area, particularly for the DMA (now CNCR) and Priority towns to be comparable to that of Delhi, with a target of starting the rate of water supply at 225 lpcd and achieving a rate of 363 lpcd by 2001. This norm was also stipulated in Master Plan for Delhi-2001. Rate of water supply was proposed varying from 100 lpcd to 275 lpcd for the other NCR towns of sizes one to five lakhs respectively. Rate of water supply for rural areas was proposed as 70 lpcd (including 30 lpcd for cattle).

Review of Regional Plan-2001, done in the year 1999, observed that the norms and standards for water supply had not been achieved. Even in Delhi, the national Capital, water supply norms could not match the Delhi Master Plan-2001 norms of 363 lpcd and remained on an average at about 225 lpcd. Further, in the NCR the water resources were found to be totally inadequate to meet the demand of even the domestic sector with limited availability of piped water supply. During the summers, water scarcity worsened in the entire region including Delhi. The review also suggested reduction in norms and standards to make them realistic and achievable.

8.2 EXISTING SITUATION AND ISSUES

The study has indicated that barring Delhi, which has an average water availability of 225 lpcd, per capita rate of water supply in urban centres of Haryana Sub-region ranges from 45 lpcd in Ganaur to 145 lpcd in Panipat, 35 lpcd in Shahjahanpur to 98 lpcd in Alwar in Rajasthan Sub-region and 28 lpcd in Phalauda to

142 lpcd in Meerut in Uttar Pradesh Sub-region. Status of availability of drinking water supply in some of the towns of NCR in the year 2000 is given in Annexure 8/I. Per capita availability of water in most of the urban centres has dwindled over the last decade due to rapid urbanisation and lack of financial resources for augmentation.

The status in rural areas presented a dismal picture since not enough database was available to exactly determine the position of water supply in these areas. Moreover, many villages did not have local sources of water and almost equal numbers did not have adequate sources.

There were neither sufficient financial resources nor the water sources available to achieve ambitious norms and targets fixed in Regional Plan-2001.

8.2.1 Lack of Regional Planning Approach

Towns/Cities have so far been planned by their respective authorities for their individual needs. There has been total lack of regional approach for sustainable use of available water and its conveyance from areas of plenty to scarcity. The raw water augmentation should not be territory specific but it should be region-wise irrespective of State boundaries.

8.2.2 Dependence on Outside Sources

In order to meet the raw water requirement of NCR, the major sources have been through inter- state allocations of the Yamuna water, Ganga water and, in future, through storage dams to be developed in Himachal Pradesh and Uttaranchal. However, so far these water storage reservoirs/dams have been considered as source only for Delhi and not for other parts of the region. Further, there has been lack of emphasis on planning and development of ground water sources including recharge of ground water through rainwater harvesting and schemes to harness the sources/potential of water in NCR which are necessary for sustainable development.

8.2.3 Unaccounted for Water (UFW)

There are significantly high losses at different stages of water supply system ranging from 30% to 50% in conveyance and distribution system apart from treatment plants including pilferages. These need to be capped to 15%.

8.2.4 Dependence on Plan Funds

State Governments and their local bodies operating and maintaining the water supply schemes are totally dependent on plan funds. There is a wide gap between revenue and expenditure of the local bodies. Characteristics like ineffective billing, poor collection of revenue and operation and maintenance inefficiencies etc. attribute to bad financial health of the local bodies. There is need to introduce efficiency of services i.e., efficiency in cost recovery and demand management through telescopic pricing in order to improve the revenue generation.

8.2.5 Regional Plan-2001: Norms and Standards

The drinking water supply norms proposed in Regional Plan-2001 and Master Plan for Delhi-2001 could not be met because neither adequate financial resources were allocated to meet their requirement nor physical efforts to tie up the water resources management had been undertaken.

8.2.6 Depletion of Ground Water

Ground water is depleting at a very fast pace in the region and the quality of ground water is also deteriorating due to over exploitation and contamination. Historical water bodies/ponds are being neglected or encroached upon.

8.2.7 Areas Lacking Adequate Focus

Besides, there are certain areas which need focus in order to maintain the minimum standards of water supply and quality.

- Phased augmentation/replacement of distribution network in the congested areas.
- Public awareness and media coverage for minimizing wastage.
- Correct population forecasting for adequate planning for drinking water supply.
- Involvement of NGOs and private sector in operation and maintenance.
- Decline of ground water due to over-drawal and increase in the runoff due to urbanization.
- Contamination of ground water and surface water.

8.3 POLICIES AND PROPOSALS

In order to improve the overall situation in the National Capital Region for the perspective 2021, for the harmonized and balanced development of the region following strategies and policies are proposed:

8.3.1 Blueprint for Water Resources in the Region

Blueprint for water resources in the region including augmentation of drinking water should be prepared for NCR identifying all the potential surface water sources, ground water aquifers and inter-basin transfer of water. This should include water mapping, desilting, augmentation of existing lakes/depressions for storage of rain/flood water, rain water harvesting, reuse and recycling of waste water, measures for conservation of water, inter-basin transfer of water and include integrated land and water management for the region.

8.3.2 Integrated Regional Schemes for Augmentation of Drinking Water Supply (surface and ground) considering NCR as a Single Entity

While the demand for irrigation is to be met through various MOUs signed/to be signed/entered into by various riparian states, the demand for drinking water supply and industrial use is to be given priority in respective policies of the constituent States, facilitating for inter-basin transfer of water through regional schemes. Sub-region wise water demand is given in Table 8.1. Total tentative projected drinking water supply demand for the region in the year 2021 is 11,984 mld (11.984 MCM/day or 4,374 MCM/annum), which includes 5,822 mld demand for Delhi also. An equivalent demand has to be considered for industrial use. Therefore, integrated Regional Plan to augment water should be done for about 23,968 mld of water.

Long term solution will include construction of upstream reservoirs to store excess water during monsoon for use in the lean period and inter-basin transfer of water such as the Sarda-Yamuna link canal which envisages transfer of surplus waters of Sarda river for meeting various requirements in U.P., NCT-Delhi and further transfer for use in water short areas of Haryana and Rajasthan. Four multi-purpose projects namely Tehri, Kishau, Renuka and Lakhwar-Vyasi have been planned in the upstream Himalayan foothills. Presently, plans are on the anvil to draw water from these reservoirs for Delhi only. The system should be planned to provide water to the entire National Capital Region, through regional schemes of

water supply for all the urban and rural areas considering NCR as a single entity. Since Tehri Dam is likely to be commissioned soon, the water should be allocated from this dam for drinking water supply and industrial use of the entire NCR. All the future planning for multi-purpose dams should be done considering further demands of NCR.

Table 8.1: Sub-region Wise Drinking Water Demand

Sub-region	Drinking Water Requirement (mld)	
	2001	2021
1	2	3
Haryana	1,046	2,412
Rajasthan	266	664
Uttar Pradesh	1,433	3,086
NCT-Delhi	3,584	5,822
Total	6,329	11,984
	6.329 MCM/day	11.984 MCM/day
	2310.07 MCM/annum	4374.27 MCM/annum

8.3.3 Norms and Standards

Following minimum norms and standards should be adopted for drinking water supply in the region:

- Urban Settlements

Towns/Cities	Recommended Water Supply (lpcd)
NCT-Delhi	225
Population one lakh and above	200
Population below one lakh	135

Note: This includes demand for commercial areas and floating population.

- Rural Settlements: A minimum of 70 lpcd including a supply of 30 lpcd for cattle is proposed. If independent connections are proposed to be given, a minimum rate of 100 lpcd of water supply has been advised. Spot sources may supply a minimum of 40 lpcd, which can supplement the piped supply. In rural areas, where water is provided through public standposts, 40 lpcd should be considered. In urban villages rate of water supply should be similar to the town with which it is surrounded.
- Unaccounted for water should be limited to 15%.
- The bulk requirement of institutional establishment should be assessed separately with proper justification.
- Fire fighting requirement should be added to this as per norms in the CPHEEO water supply Manual.

8.3.4 Protection of Land for Ground Water Recharging

Study done by Central Ground Water Board (CGWB) has revealed that an additional exploitation to the extent of 1,816 mld (1.82 MCM/day), 454 mld (0.45 MCM/day) and 908 mld (0.91 MCM/day) of water could be made available by harvesting the ground water potential of aquifer system of river Yamuna, upper Ganga canal system and Ganga flood plains respectively falling within NCR. In the Sub-regional Plans and Master/Development Plans, all the flood plains and other ground water recharging areas such as ponds, lakes, other water bodies etc. should be identified and protected from the invasion by other land uses and encroachments. Some of the areas to be protected for ground water recharging have already been identified in the Plan on the basis of the study done by Indian Institute of Remote Sensing, Dehradun "Geology, Geomorphology and Ground Water prospects for NCR". At least, 2-5% area should be earmarked under water bodies (natural as well as constructive) in the distribution of land uses. Areas with very good ground water prospects, riverbeds, ponds, ox-bow lakes, paleo-channels, etc., which need to be protected, have been marked in the Map 8.1 National Capital Region: Ground Water Recharge Areas).

The analysis of the water rechargeable areas in NCR shows that only 2.29% area of the total NCR has potential rechargeable areas (refer Table 8.2).

Table 8.2: Potential Water Rechargeable Areas (in sq kms)

Sub-region	Flood Plain and River Bed	Ox-bow Lake	Paleo-Channel	Valley Fill	Lake, tank and Pond	Total
1	2	3	4	5	6	7
NCT-Delhi	25	Nil	2.5	Nil	5.5	33
Haryana	68.88	4.25	5.13	21.7	62.65	162.61
Rajasthan	17.75	Nil	Nil	127.75	9.14	154.64
Uttar Pradesh	227.35	Nil	84.74	Nil	32.26	344.35
Total	338.98	4.25	92.37	149.45	109.55	694.6

Note: The area figures are approximate

8.3.5 Recharge of Aquifer

Since construction of dams as proposed above, would take long time to complete, it becomes necessary to think of other means to augment the water resources. Therefore, it would be necessary to adopt recharge of the aquifer by various means as detailed below:

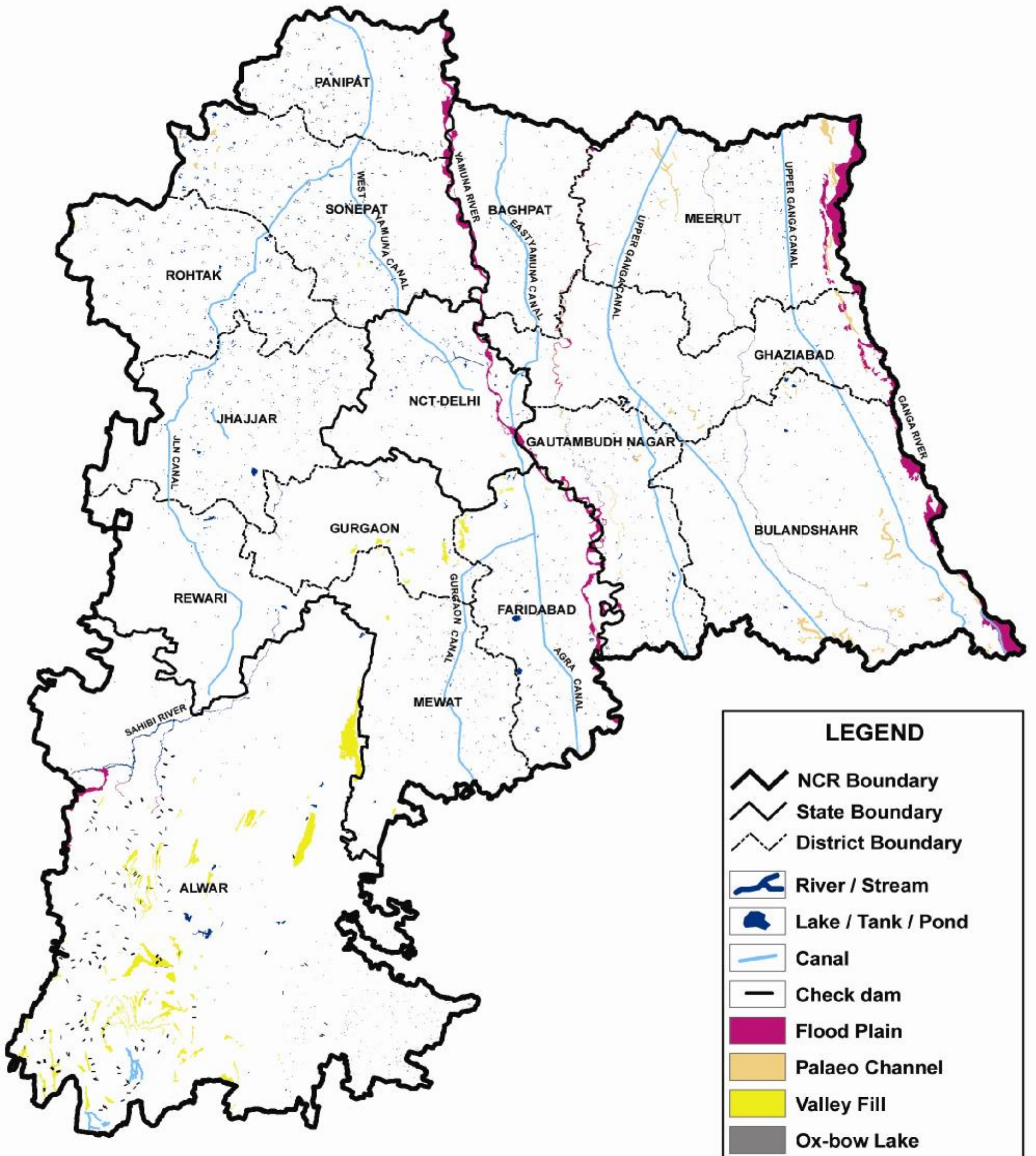
- Artificial recharge through rainwater harvesting in ponds, Yamuna flood plains, construction of small check dams at favorable locations in part of the ridge for recharge etc.
- Utilizing surplus canal water during monsoon period for recharging the depleted aquifers.
- Roof- top rain water harvesting should be made mandatory in building bye-laws especially in the over exploited and dark Blocks i.e., the areas with unsustainable ground water resources as identified by CGWB.
- Indian Institute of Remote Sensing, Dehradun submitted a report on "Geology, Geomorphology and Ground Water prospects for NCR" in April 2002. It has given suggestions on the recharge of the aquifer of NCR region as under:
 - § Rainwater harvesting etc.
 - § Flushing out of aquifers of the most polluted region
 - § Recharging of affected aquifers with good quality water
 - § Providing drainage in the area of stagnation of ground water
 - § Closing or relocation of polluting industries
 - § Consultation with expert from ground water and soil department for other approaches.

Thus, the preparation of blueprint after a detailed study becomes much more important and should be taken up on priority and these issues can be taken up in this study.

8.3.6 Relocation of Water Consuming Industries

Intensive urban development/induced developments/water consuming industries, should not to be recommended/proposed in over exploited/dark blocks of ground water potential as per Central Ground Water Board, Ministry of Water Resources in Sub-regional and Master/Development Plans. Status of availability of ground water including dark and over-exploited areas in the region is shown in Map 8.2 National Capital Region: Status of Ground Water Availability.

NATIONAL CAPITAL REGION GROUND WATER RECHARGABLE AREAS



LEGEND

- NCR Boundary
- State Boundary
- District Boundary
- River / Stream
- Lake / Tank / Pond
- Canal
- Check dam
- Flood Plain
- Palaeo Channel
- Valley Fill
- Ox-bow Lake

0 5 10 20 30 40 50 Kms

NATIONAL CAPITAL REGION PLANNING BOARD

MAP 8.1

Source: NRSA Study

8.3.7 Recycling of Waste Water for Non-Drinking Use

All new development areas should have two distribution lines, one for drinking water and other for non-drinking water/recycled treated waste water to reuse the treated waste water. All the waste requirements for non-drinking purpose in big hotels, industrial units, air-conditioning of large buildings/institutions, large installations, irrigation of parks/green areas and other non-potable demands should be met through treated recycled waste water as per norms. At least 50% of the treated waste water should be recycled for these purposes and emphasis should be laid towards waste minimization, which will also help in improving the environment on the whole. Government may also provide liberal tax rebates for institutions/industries adopting recycled waste water to compensate for the cost involved in treating waste water for recycling. Fresh water should not be used for irrigation purpose if treated waste water is available. If required, enabling provisions in the respective acts of the local bodies may be made by the respective State Governments.

8.3.8 Creation of Mass Awareness

It is imperative to create mass awareness among public through mass media with regard to saving water, waste minimization and utilization of sprinkler/drip irrigation techniques to save water for human consumption.

8.3.9 Commercial Approach for Tariff

With the increased requirement of improved quality as well as adequate quantity of water, the Government alone will not have financial capacity to continue with subsidies for improving the water supply systems in times to come. Metering coupled with improved recovery of revenue may help reduce the revenue-expenditure gap. The tariff should be fixed to meet at least the operation and maintenance cost of the water supply system, if not the capital cost of the system. The structure of the water tariff should be demand based and increase telescopically depending upon the monthly consumption and should be reviewed periodically as a built-in mechanism to make the service self-sustaining and a deterrent to wastage. Tariff for the recycled treated waste water should be fixed accordingly to encourage its non-potable uses such as gardening, horticulture and other uses referred above. Commercial approach should be adopted by the local bodies for revenue generation. 'Public-Private Partnership' needs to be introduced for operation and maintenance of the water supply schemes.

8.3.10 Institutional Capacity Building

Water demand management and institutional capacity building measures, e.g. zoning, setting up a contingent valuation fund, transparent operation-maintenance, regulatory guidelines etc. for efficient operation of the system contribute towards improvement in the finances.

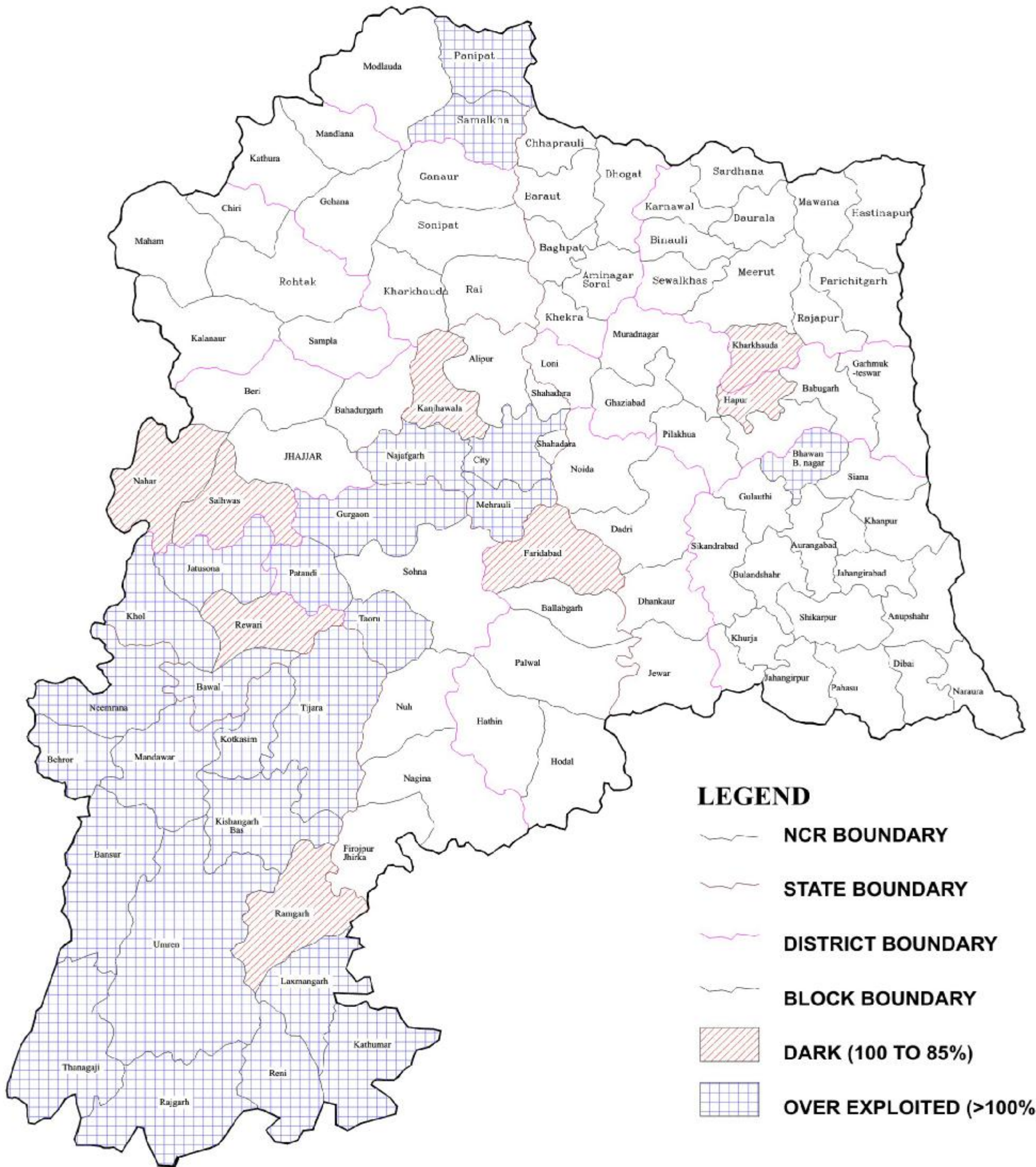
8.3.11 Quality of Drinking Water

The quality of water should conform to the BIS standards and CPHEEO Manual for water supply and its treatment.

8.3.12 Allocation of land for Water Treatment Plants and Water Distribution System

Planning of the city must incorporate advance land allocations at appropriate places for different components of water treatment and distribution systems. 0.1 hectare per mld of land area should be reserved for Water Treatment Plant at suitable locations in the town. This area, however, does not include storage of raw water where water supply is based on rotational canal system, additional land will have to be provided for underground/overhead/surface storage reservoir and for boosting stations.

NATIONAL CAPITAL REGION STATUS OF GROUND WATER AVAILABILITY



LEGEND

- NCR BOUNDARY**
- STATE BOUNDARY**
- DISTRICT BOUNDARY**
- BLOCK BOUNDARY**
- DARK (100 TO 85%)**
- OVER EXPLOITED (>100%)**

Source: CGWB



**NATIONAL CAPITAL REGION PLANNING BOARD
MAP 8.2**

8.3.13 Funding of Water Supply Schemes through Five-Year Plans

Present state of affairs of utility and service infrastructure in the region, barring Delhi, is dismal due to non-availability of funds for these sectors. Therefore, some mechanism should be developed under the five-year plans so that funds are made available to the State Governments for the development of infrastructure in their respective Sub-region for balanced and harmonious development. Provision for Special Component Plan for NCR should be made by the Planning Commission for the National Capital Region.

Centrally Sponsored Schemes for Infrastructure Development in NCR should be formulated which should include augmentation of drinking water supply schemes as one of the components. The scheme should be structured as follows:

State share	25%
Central Government Grant	25%
NCRPB Interest Bearing Loan	50%

The State Government's share should be provided in the Plan as a part of the Sub-component Plan for NCR Sub-region of the respective States, while the Central Government grant could be a part of the NCR Planning Board's central budgetary provision. The loan component can be met by the NCR Planning Board through its Internal Extra Budgetary Resources (IEBR).

Augmentation and upgradation of water supply in older areas should be financed through this funding. External Development Charges (EDC) collected by the development authorities from a town should be invested within the same town in proportion to the population of existing town proposed to be developed. In all new areas being developed, the capital cost of water supply systems should be self-financing and be met out of EDC.

8.4 PLAN OF ACTION AND PHASING OF IMPLEMENTATION OF STRATEGIES/ POLICIES/PROPOSALS

In order to implement the policies of water in the region, it is imperative to have a plan of action along with phasing so that the implementation of policies and proposals in the Regional Plan can be dovetailed with the five-year plans. In view of this, it is necessary that each recommendation should be phased plan wise where certain activities are to be completed within first five-year of the implementation of the Region Plan, whereas some activities will span over to all the four five-year plans.

Some of the activities which need to be implemented in the first five years of implementation of the Regional Plan include preparation of the Blue Print for water resources, an integrated regional scheme for augmentation of drinking water supply, protection of identified water bodies, to reserve 2-5% of land for ground water recharging, water consuming industry not to be set up in proposed over exploited/dark blocks of ground water potential, industries/hotels/large institutions to be compelled to use at least 50% of their waste water in their institutions itself and no fresh water should be allowed to be used for agriculture/horticulture purpose in the inhabited areas to promote use of treated waste water. Amendment in act/statue, if required, be carried out for the reuse and recycle of waste water.

Improvement in the existing water supply system in the region, as recommended above have been proposed to be carried out in a phased manner in the five-year plans. Phased programme and plan of action have been worked out to give effect to the proposal and implementation thereof, which is given in Annexure 8/II.

8.5 INVESTMENT PLAN

Total water requirement in the region would be 11,984 mld by the year 2021. Accordingly, there will be need to produce additional water and to strengthen/expand the water supply distribution system in the region. Total investment required for the production/augmentation of water would be about Rs.5,992.15 crores by the year 2021 and for strengthening/expansion of distribution system/network, it would be about Rs.7,190.57 crores. This cost does not include the cost of conveying water from long distances through canals/pipes. Sub-region wise fund requirement for the region has been given in the following table:

Table 8.3: Sub-region wise Investment Requirement for Drinking Water Demand (Rs. in Crores)

Sub-region	Distribution Network (@ Rs. 0.60 crores per mld)	Production of Water (@Rs. 0.50 crores per mld)	Total
1	2	3	4
Haryana	1,447.21	1,206.01	2,653.22
Rajasthan	398.24	331.87	730.11
Uttar Pradesh	1,851.99	1,543.33	3,395.32
NCT-Delhi	3,493.13	2,910.94	6,404.06
Total	7,190.57	5,992.15	13,182.72

This estimation has been done on the basis of assumption that facilities of 50% of water generation, 60% of population coverage and 50% area is covered with surface water, is presently available in the region. Plan wise fund requirement for the region is as follows:

Table 8.4: Plan wise Fund Requirement for Drinking Water

Plan Period	Percentage (%)	Amount (Rs. in Crores)
1	2	3
2002-2007	20.0	2,637
2007-2012	30.0	3,955
2012-2017	30.0	3,955
2017-2021	20.0	2,637

Above table clearly mentions the break-up of the fund required for various phases on the basis of consecutive five-year plans. Fund requirement varies from Rs.2,637 crores in the 10th Plan period (2002-2007) to Rs.3,995 crores in the 12th Plan period (2012-2017).

Phasing of investment has been proposed on the basis of plan of action for implementation, which is given in Annexure 8/II.