

POLICY INITIATIVES FOR RAIN WATER HARVESTING IN UTTAR PRADESH : CHALLENGES & GAPS

(A Critical Overview)



R.S. Sinha

Ground Water Expert

State Water Resources Agency, U.P.

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WATER CRISIS: A MANAGEMENT CONCERN

The looming danger of increasing water crisis has become an area of National Concern.

❑ World Bank, in its report (*India's Water Economy: Bracing for a Turbulent Future*) warned of a serious crisis in country in the next 2 decades “due to inadequate water supplies and poor management of Ground Water Resource”.

❑ **Report states** “ Unless Water Management practices are changed and changed soon..... India will face a severe water crisis within the next two decades and will have neither the cash to build new infrastructure nor the adequate water required for its growing economy and rising population.”

□ Bank has also sounded and alert about further projections of climate change, likely to worsen India's water problems.

□ If such climate changes occur, more rain is expected to fall only in fewer days and monsoon may likely become erratic.

□ As such, rainfall deficits may cause droughts when continuous over-pumping of ground water takes place causing water tables to fall further and the consequent critical depletion of aquifers.

□ NASA has recently reported major Ground water crisis in North India. Report states that huge ground water resource from the aquifers has vanished in last few years.

GROUND WATER IN U.P.

....perhaps, the most neglected, poorly managed & unregulated resource.

- However, its contribution can not be overlooked. The significance of this resource can be evaluated-**
- 75% irrigation supplies.**
 - 80-90% of drinking water supplies.**
 - almost all the industrial needs.**

But, despite its growing significance, regulatory & management requirements for protecting this resource have never been given due recognition.

GROUND WATER RESOURCE

- U.P. SCENARIO / CRITICAL ISSUES

- Ground water has emerged as a 'Democratic resource' in the state because of relative ease to exploit it with greater flexibility.
- But, different line departments are **developing, utilizing & conserving** this resource in a fragmented manner, as there is **no Institutional Mechanism** in the state.
- Due to continuous heavy abstraction of dynamic ground water in various parts of the state, **aquifers have depleted to alarming levels** causing widespread decline of water levels.
- Almost **half of the state** is in grip of Ground Water Level decline.
- In prominent **Urban Centers**, Ground water levels **have depleted** to alarming levels **even to an irreversible stage**.
- **Lucknow city: Glaring Example of 'Hydrogeological Stress'** with **G.W. level decline of 50 cm to 1.5 Mt./yr**. Critical trends also observed in cities like Kanpur, Bareilly, Meerut, Varanasi, Ghaziabad.

-- U.P. SCENARIO --

- Bundelkhand & Vindhya are facing acute water scarcity, due to low ground water availability. **63 blocks** are prone to **drought**.
- Large areas in eastern U.P. are affected with the problem of Water logging /rising water levels.
- **Ground water contamination/pollution** is also widely reported from the state.

*-As a result, Ground water domain of various Rural & Urban sprawls is **under critical state**, both qualitatively & quantitatively.*

*- **Such Ground Water situations have now become quite challenging.***

KEY PROBLEMS-NEED ATTENTION

Four major ground water related problems have been identified in the State-

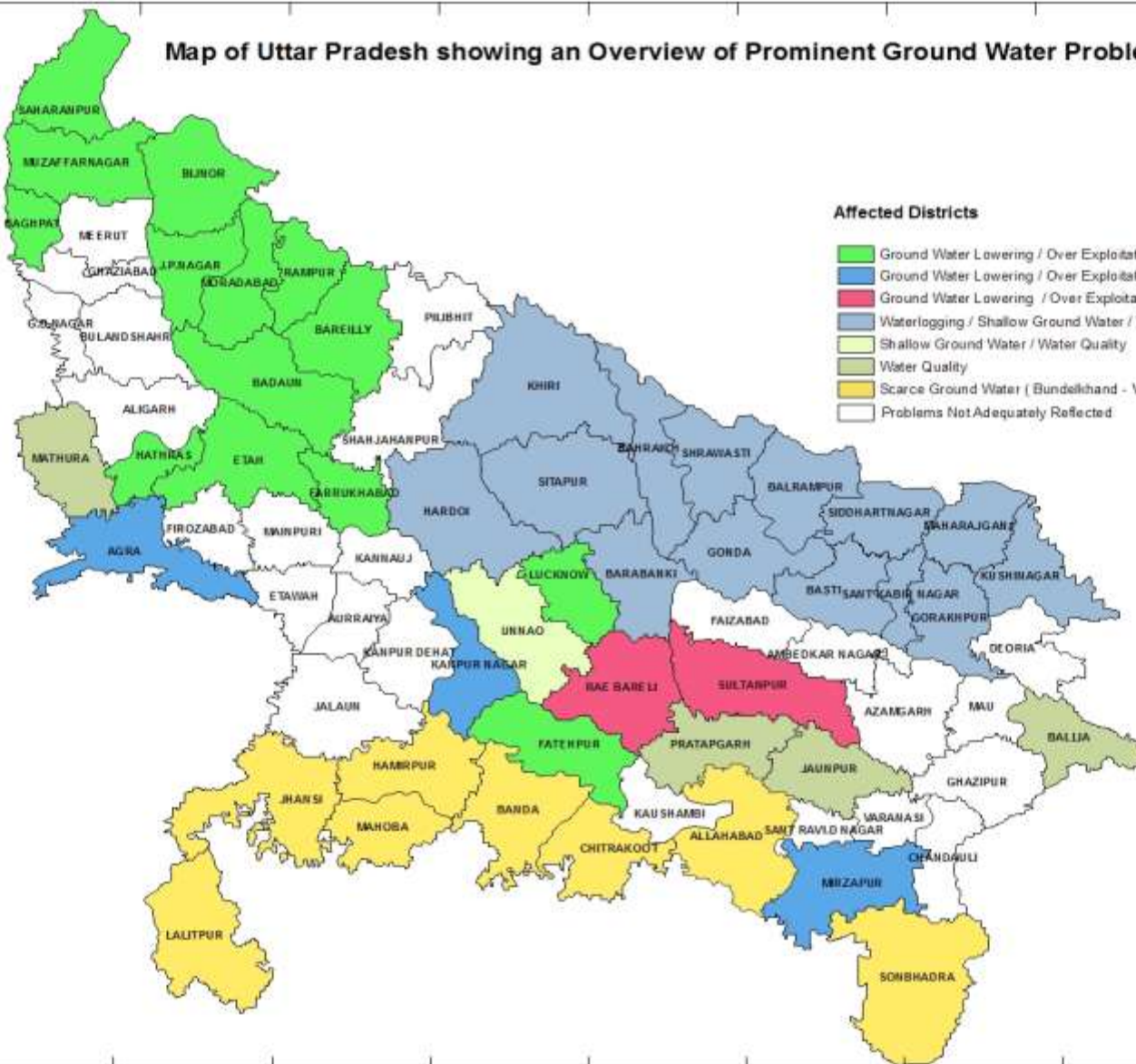
- ❑ **Over-exploitation/indiscriminate extraction of ground water in both the urban and rural areas, causing significant decline of groundwater levels.**
- ❑ **Waterlogging /shallow water levels affecting the agricultural productivity.**
- ❑ **Poor availability as well as relatively poor development of ground water in hard rock areas of Bundelkhand-Vindhya.**
- ❑ **Contamination/pollution hazards related to ground water resource.**

Map of Uttar Pradesh showing an Overview of Prominent Ground Water Problems



Affected Districts

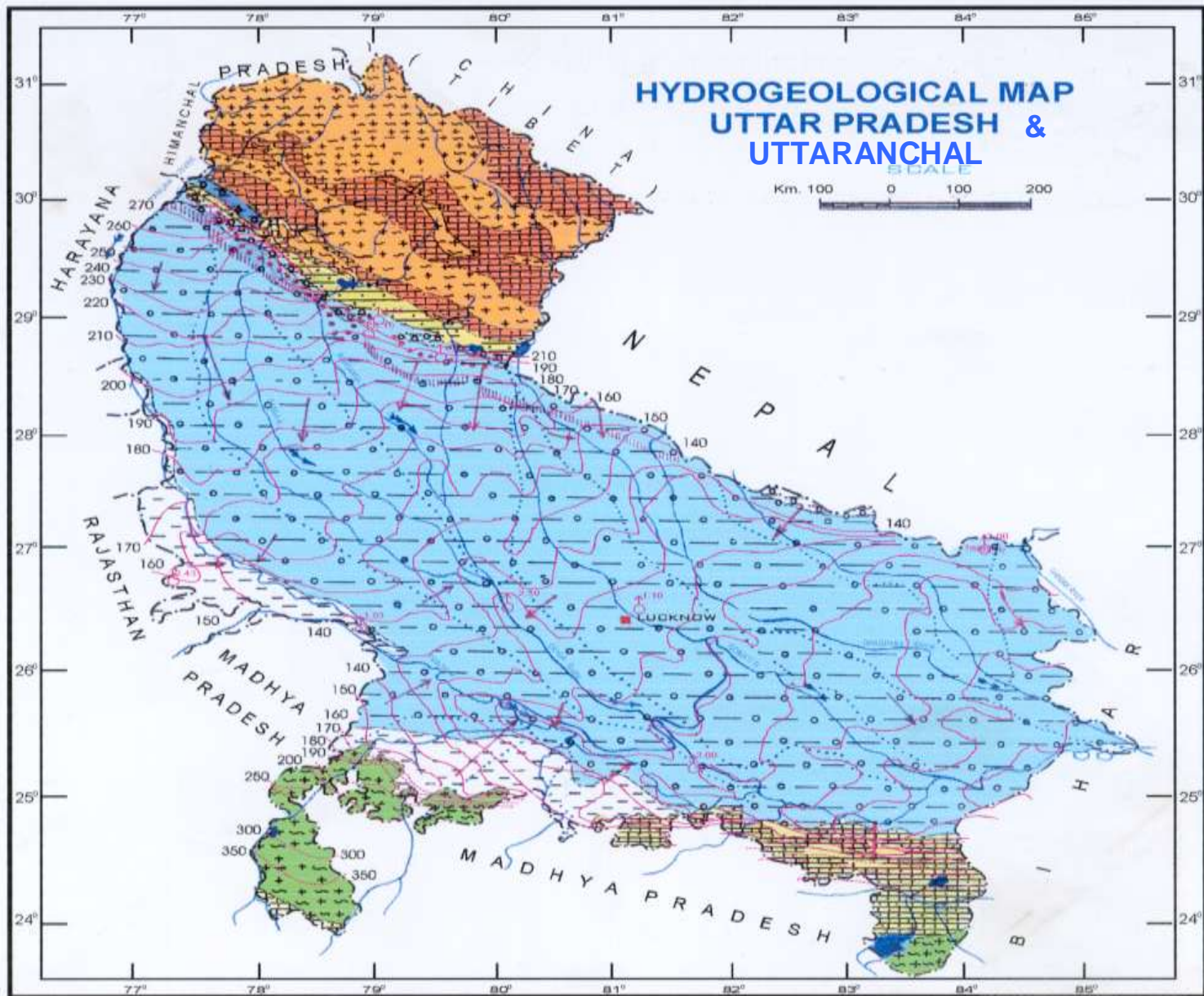
- Ground Water Lowering / Over Exploitation
- Ground Water Lowering / Over Exploitation / Water Quality
- Ground Water Lowering / Over Exploitation / Waterlogging / Water Quality
- Waterlogging / Shallow Ground Water / Water Quality
- Shallow Ground Water / Water Quality
- Water Quality
- Scarce Ground Water (Bundelkhand - Vindhyan Rocky Terrain)
- Problems Not Adequately Reflected



Prepared By
State Water Resources Agency
Govt of Uttar Pradesh

Hydro-Geological Setup of U.P.

Hydrogeological Unit	Area (sq.km.)	Geological Formations
Bhabar	Small area falling in Bijnor & Saharanpur District	Assorted sediments constituting boulder, cobbles, pebbles and sand
Terai	11500	Alluvium Predominantly fine sediments with intercalation of clay of silt with sands
Central Ganga Plain	187736	Alluvium
Marginal Alluvial Plain	7688	Alluvium
Southern Peninsular Area	21750	Pre-Cambrian crystalline and Vindhyan sediments



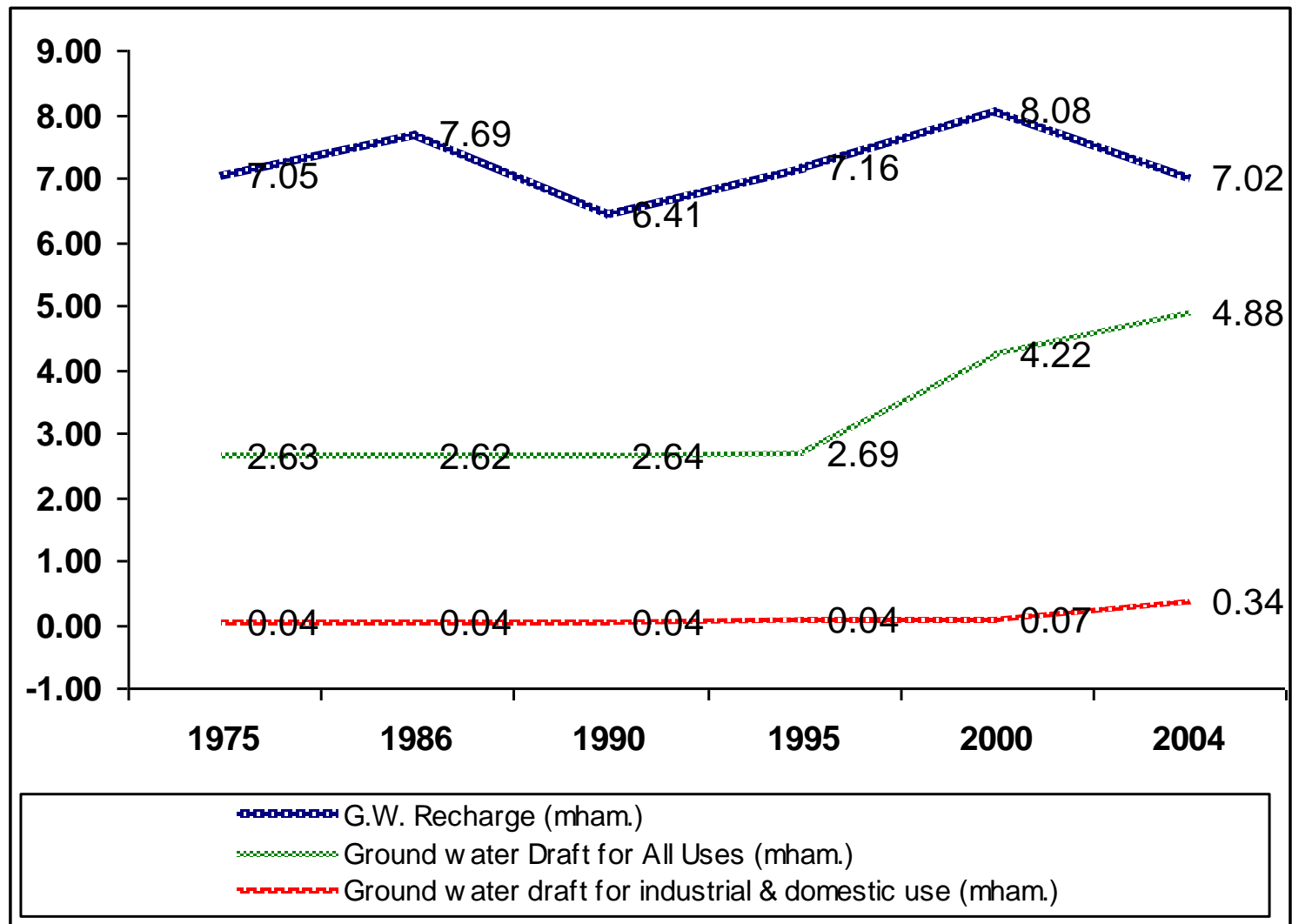
Total Ground Water Potential in U.P.

- **Rainfall & Recharge from various sources replenishes Ground Water every year, but its large scale exploitation/development is increasing day by day.**

Regionwise status of Ground Water resource in U.P.

Name of region	Net Annual Ground Water Recharge (m. ham)	Annual Draft for all users (m. ham)	Net Ground Water availability for future use (m. ham)	Stage of Ground Water Development (%)
Eastern	2.54	1.68	0.86	66
Western	2.58	2.05	0.53	79
Central	1.45	0.96	0.49	66
Bundelkhand	0.44	0.19	0.25	43
Total	7.01	4.88	2.13	69

Changing Pattern of Ground Water Development



Source: Ground Water Deptt, U.P.
(State Water Resources Agency, U.P.)

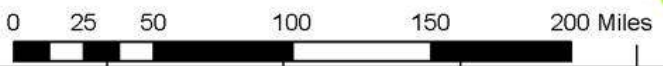
Stage of Groundwater Development in U.P., 2004



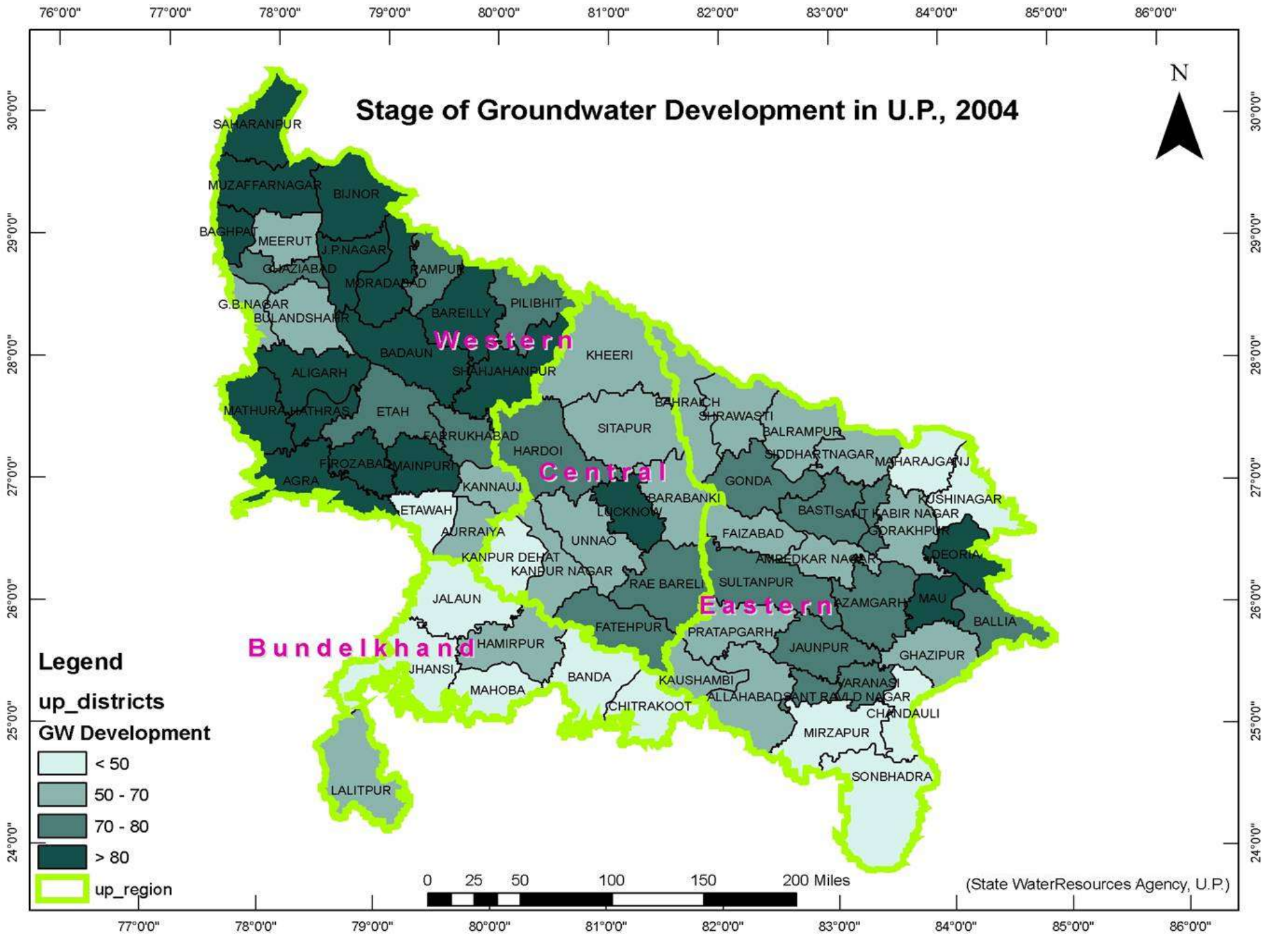
Legend
up_districts
GW Development

- < 50
- 50 - 70
- 70 - 80
- > 80

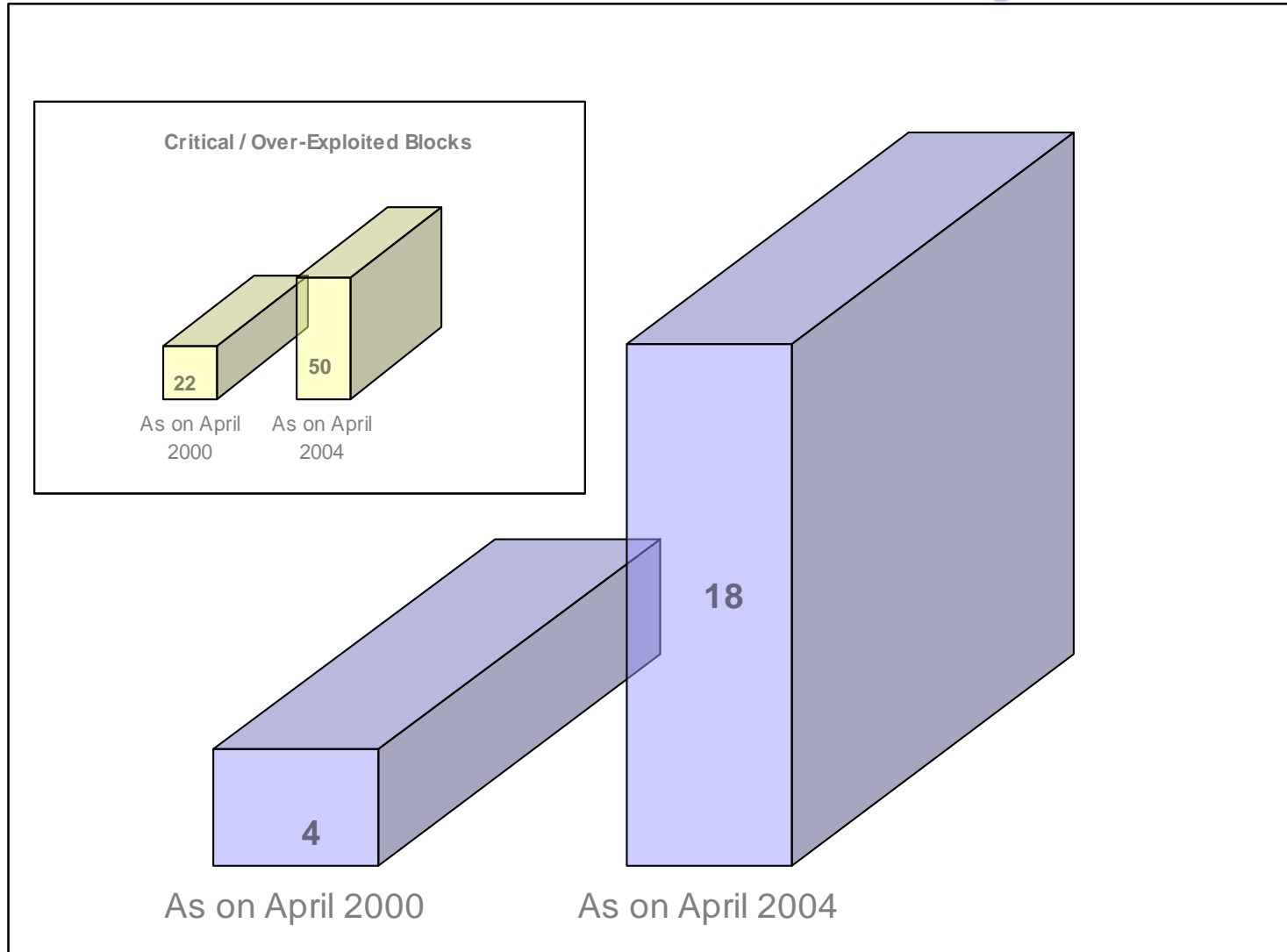
up_region



(State WaterResources Agency, U.P.)



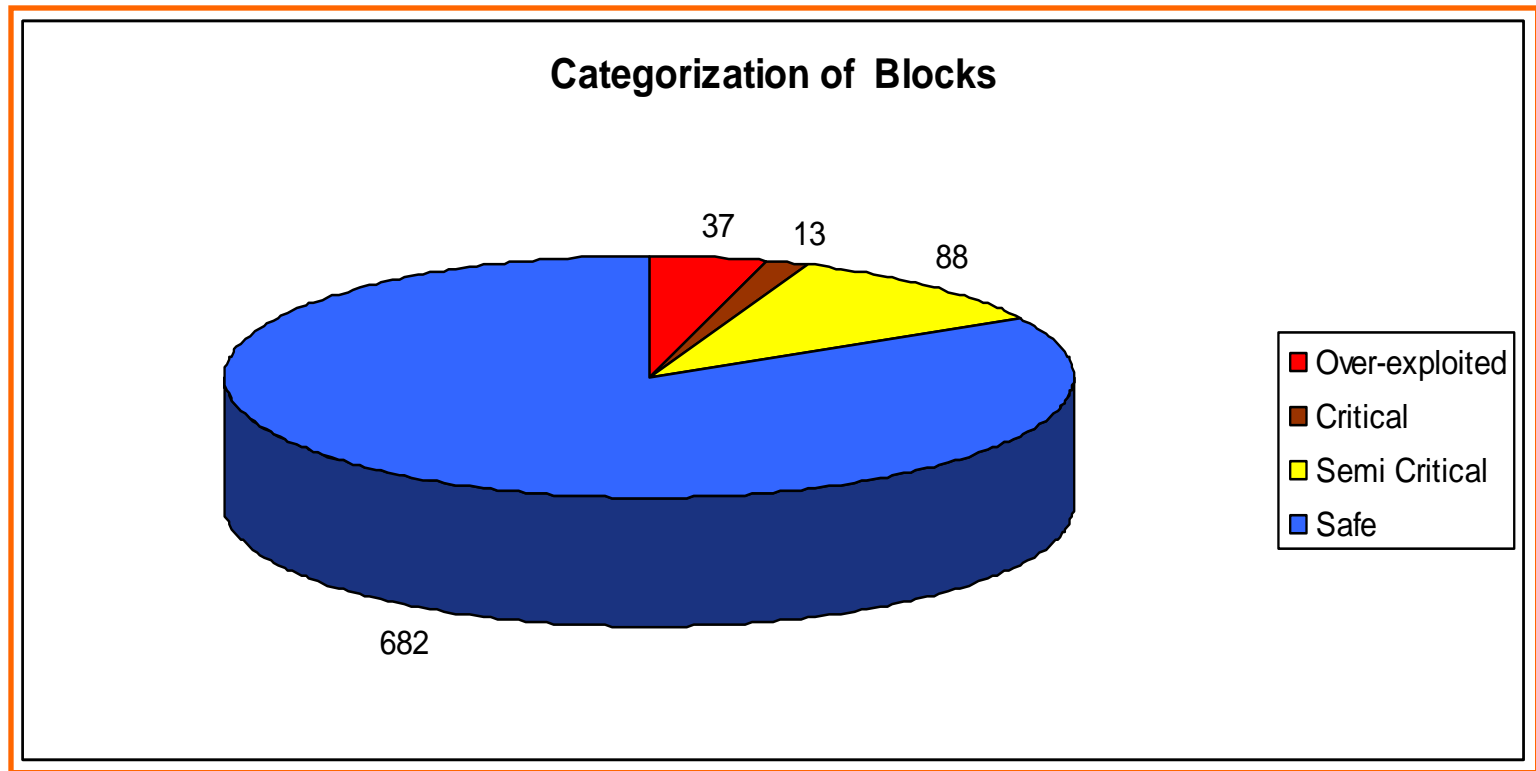
Districts with Groundwater Development > 80%



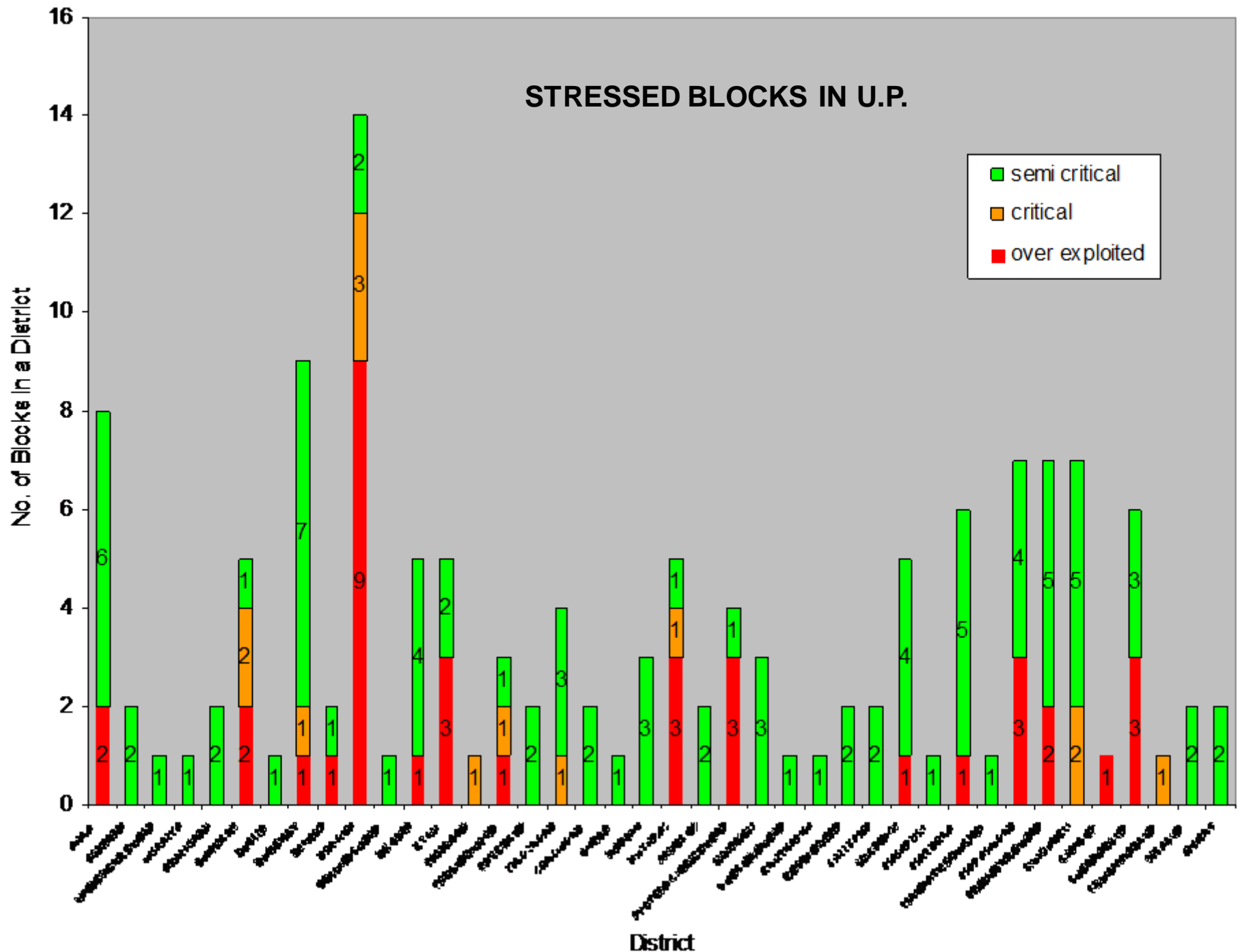
Source: Ground Water Department, U.P.
(State Water Resources Agency, U.P.)

Categorization of Blocks

Categorization of 820 blocks of the State with respect to ground water development.

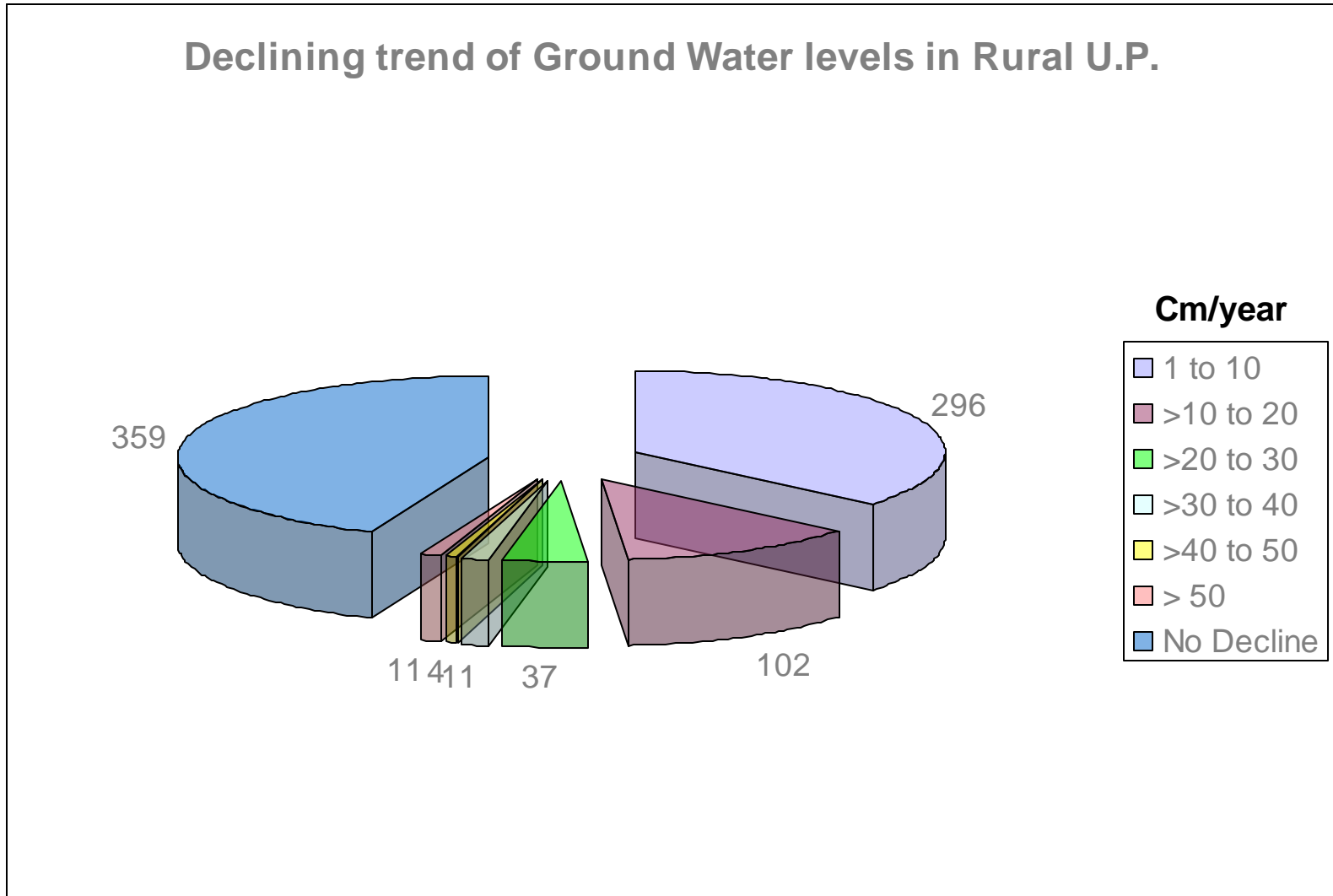


STRESSED BLOCKS IN U.P.

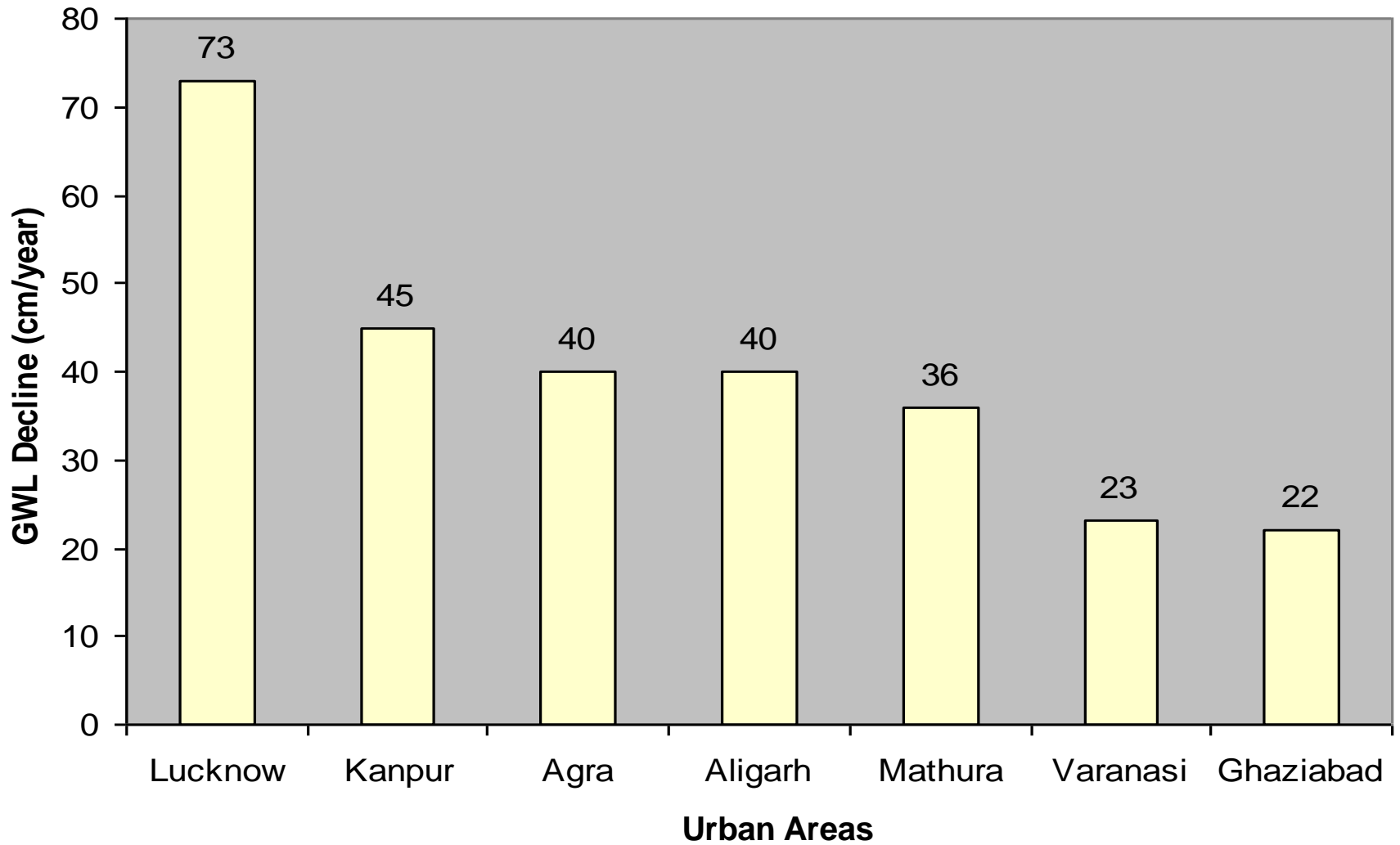


Declining trend of Ground Water levels in Rural U.P.

(Between Pre Monsoon 1996 & 2006)



Yearly GW Decline in Urban Areas



HOW TO SAVE & PROTECT DEPLETING GROUND WATER RESOURCE

Two effective ways:

❑ REGULATORY MECHANISM

❑ ADOPTING GROUND WATER CONSERVATION/RECHARGE METHODS

-At present there are no regulatory provisions to control indiscriminate use and exploitation of ground water.

The only option is Rain Water Harvesting & Ground Water Recharge.

RWH – AN “AREA SPECIFIC ISSUE”

Rain Water Harvesting structure is an area / site specific system.

- ‘Hydrogeology’ is the most vital component of RWH, providing base line informations for planning, designing and implementation of RWH & Ground Water recharge programme in an area.**
- Locations feasibility.**
- Rainfall data.**
- Water level decline & depth to ground water.**
- Magnitude of ground water extraction.**
- Status of ground water resource.**
- Lithological configuration.**
- Qualitative & quantitative aspects.**

GUIDELINES FOR RWH & GWR

- Areas of continuous Ground Water level Decline
 - ☐ - Where post-monsoon ground water level is **more than 8 mt.** deep b.g.l.and annual decline of water level is **above 20 cm.** in pre-monsoon. (This condition pertains to Alluvial region).
 - ☐ - In Hard rock region of Bundelkhand- Vindhya's,the depth to water level limit will be 5mt.bgl.
- Over-exploited / Critical Blocks
- Over- exploited Urban Areas

UNSUITABLE AREAS

- **Water logged areas/shallow water level.**
- **Flood plain areas.**
- **Canal command areas.**
- **Where drainage is under construction.**

POLICY INITIATIVES IN RAIN WATER HARVESTING

Govt. of UP has initiated Rain Water Harvesting and Ground Water Recharge Programme in the State in a big way and various initiatives have been taken.

- Executive Committee** under the Chairmanship of Chief Secretary constituted to review RWH schemes in the State.
- Ground Water Deptt.** declared as **“Nodal Agency”** to monitor RWH & GW Management.
- TCC** under chairmanship of DM for RWH Projects.

----POLICY INITIATIVES

- **10th June declared as Ground Water Day.**
- **RWH introduced as subject for 6th to 8th class.**
- **Adarsh Jalashaya Yojna to construct/ renovate at least one pond in every Gram Sabha in the State has been initiated from 2006-07.**
- **An “Expert Committee” constituted under the Chairmanship of APC to control falling of ground water level & promoting recharge**

----POLICY INITIATIVES / PROVISIONS OF RWH & GWR

□ DECISIONS TAKEN –

- Conserving existing ponds / reservoirs in new housing schemes.**
- Provision of 5% land for water body.**
- DEPTHS OF PONDS – 3 mts (Identify natural catchment & feasibility assessment).**
- In parks, only 5% area be covered with concrete / pavements.**

----POLICY INITIATIVES / PROVISIONS OF RWH & GWR

- Foot paths / tracks be provided with permeable / perforated blocks.
- **Recharge shaft** not to be constructed in ponds where risk of industrial/other pollution may occur.
- Direct recharging of rain water to aquifers from open/paved/unpaved areas is not allowed.

ROOF TOP RAIN WATER HARVESTING (POLICY DECISIONS)

□ In lay-out plans of (newly/ proposed) Group Housing schemes (Govt./Pvt.), separate network of pipes for **combined RWH / recharging system** be provided.

□ Vide G.O. Dated 01-07-08, Housing department, GOUP, has modified the initial provisions of RWH, wherein recharging system made compulsory for plots of **300 sq.m. & above.**

□ **GOVT./SEMI GOVT. BUILDINGS :**

Installations of RWH/GWR structures are made compulsory for all Govt./semi Govt. buildings in the state.

POLICY DECISIONS FOR INDUSTRIES

- ❑ For Ground Water Level/Quality monitoring, **PIEZOMETERS** made compulsory for **industries**.
- ❑ Rain Water Harvesting: All industries, including **existing and new**, which are drawing ground water shall mandatorily undertake artificial recharge measures.

PROGRESS OF RWH

● URBAN AREA

142 new/existing ponds have been renovated by Housing Dept; claiming Ground water recharging as 1636017 m³

● Roof Top Rain Water Harvesting Schemes installed on 2014 private buildings.

● In 698 Govt. buildings, Roof Top Recharging System installed.

• RURAL AREA

Department	Check Dam	Renovation of Ponds
Minor Irrigation	1937	1150
Land Development & WR	4928	1476
Irrigation department	199	-
Jal Nigam	42	-
Agriculture Deptt.	9921	831
Rural Development		1653
Adarsh Jalashay Yojna		51346
Total	17027	56456

RICHEST REPOSITORY- BOON BECAME BANE?

- As part of the Ganga Basin, the state of Uttar Pradesh is always considered as having richest repository of ground water resources and also comprising the largest aquifer systems in the world.
- **With this background in mind**, the user departments and water related organizations in the state are indiscriminately extracting & utilizing ground water under various development schemes, without thinking that this may have adverse impacts on sustainability of the resource.
- As there is no effective management policy/ intervention, ground water withdrawals in the state are going on unchecked in both rural and urban centers.
 - **39 lakhs private M.I. Tubewells (40%) are located in U.P..**
 - **In urban centers, 4218 million liters and in rural sectors 7430 million liters of ground water is being extracted daily for drinking use.**
- So, Minor Irrigation Department & U.P. Jal Nigam are the biggest exploiter of ground water in the state.

GROUND WATER MANAGEMENT - SOME CHALLENGES

An action without efficient and suitable mechanism is a failure, so the case is with the management scenario of Ground Water in U.P.

- So far, the importance of the effective and integrated ground water management in the state is **neither suitably recognized nor given any serious thought.**
- This is an Irony that the biggest ground water exploiter i.e. M.I. & Jal Nigam have also become the Main Conservator for rain water harvesting & ground water recharge.
- Despite various policy statements and useful initiatives at state level signifying the need of judicious development of ground water and its efficient use alongwith rain water harvesting, suitable ***management plans and interventions are almost missing*** in the state.
- ***The fact is that in rural areas,*** ground water resource is ***improperly managed,*** whereas ***in urban areas*** it is almost ***neglected.***

Some Critical Questions related to R.W.H.

Though various Initiatives & actions have started in the state, there are some key issues related to various challenges and critical gaps in the implementation process of R.W.H. which must be resolved.

- Should the RWH & GWR programme be executed in whole state or should it be focused only in problematic/over exploited/critical areas.
- Technically are we ready and capable enough for implementing RWH & GWR schemes, without identifying the priority/problem areas, the area specific requirement & the critical gaps based on geo- scientific inputs?
- How the implementation of the guidelines & hydrogeological parameters in R.W.H. could be ensured?

----Critical Questions

- What mechanism should be evolved to ensure the enforcement/execution of mandatory provisions & the rules made for RWH & Ground Water recharging in urban areas?
- For the sustainability of ground water in Alluvial aquifers of U.P., which aquifers & of what depth shall be recharged and which agency shall ensure the monitoring & protection of aquifers?
- How the execution of R.W.H. activities, being carried out in isolation by the line departments, should be integrated/co-ordinated under one umbrella and how the funds available for R.W.H. should be dovetailed to problem areas?

Challenges & Gaps in Implementation

- Area specific concept & the guidelines are not being followed.
- RWH schemes are being undertaken everywhere even in non- problematic areas without considering the local conditions, whereas problematic areas are not being given priority for RWH.
- Various provisions of Government orders on RWH are not being properly implemented.
- Hydrogeological parameters are being neglected and the pre-project hydrogeological surveys in mega schemes are not conducted.
- Selection of feasible sites & appropriate technologies are not being done scientifically as per hydrogeological norms. Therefore, desired benefits are not being realized.

--- Challenges & Gaps

- Construction of recharge shafts in ponds has not been stopped, despite risk of contamination.**
- In spite of the ban, in some schemes rain water from paved / unpaved area is being recharged directly to the aquifers. This is a serious concern because of pollution risk.**
- There is no mechanism to monitor the status of rain water harvesting systems in private buildings of urban areas.**
- There are gaps in the implementation methodology. For existing colonies/built-up houses located in urban areas, there is no provision for installing roof top rain water harvesting system.**
- Maintenance of recharge structure, especially roof top system is being totally ignored. Such negligence may lead to chocking of structure with pollution risk.**

--- Challenges & Gaps

- There is also no mechanism by which the real benefit & impact of recharge schemes could be assessed.
- Effective programs & campaign for sensitization/ awareness are missing for rain water harvesting & ground water recharge.
- Line departments are implementing recharge schemes in isolation and therefore integrated micro plans for RWH & GWR in rural and urban areas are yet to be prepared.

Overall, the monitoring & implementation mechanism in the state is fragmented and therefore, desired results could not be obtained so far.

Rainfall Management : Erratic Rainfall

Rainfall management is an important component for R.W.H., so its area specific pattern is to be analysed while preparing Recharge plans.

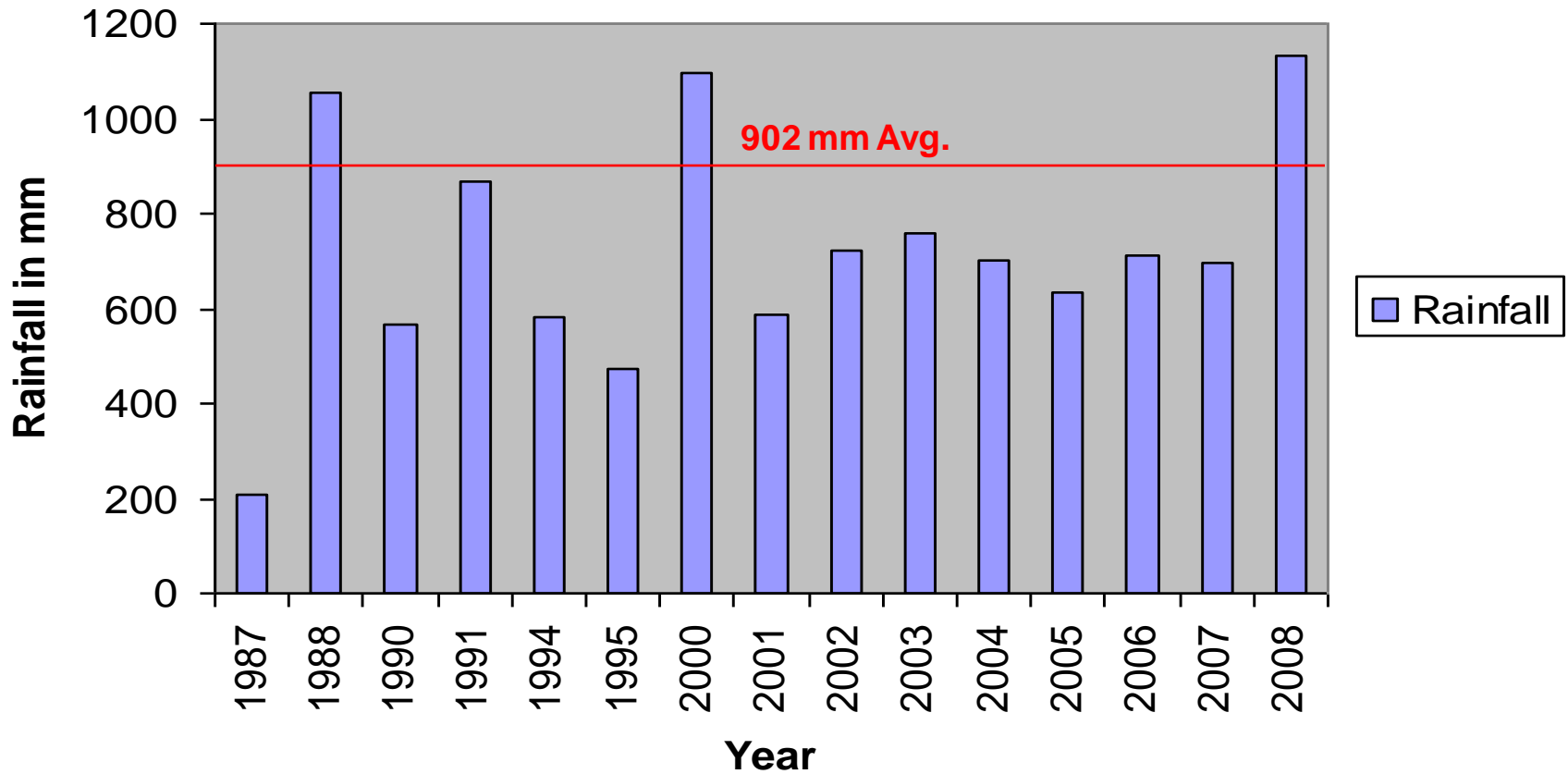
- Since eighties, the state is not receiving normal rains except few instances.
- This year also, most of the districts have faced drought like conditions.
- This is also one of the reason for water scarcity & ground water depletion in various regions.

RAINFALL PATTERN : LUCKNOW CITY

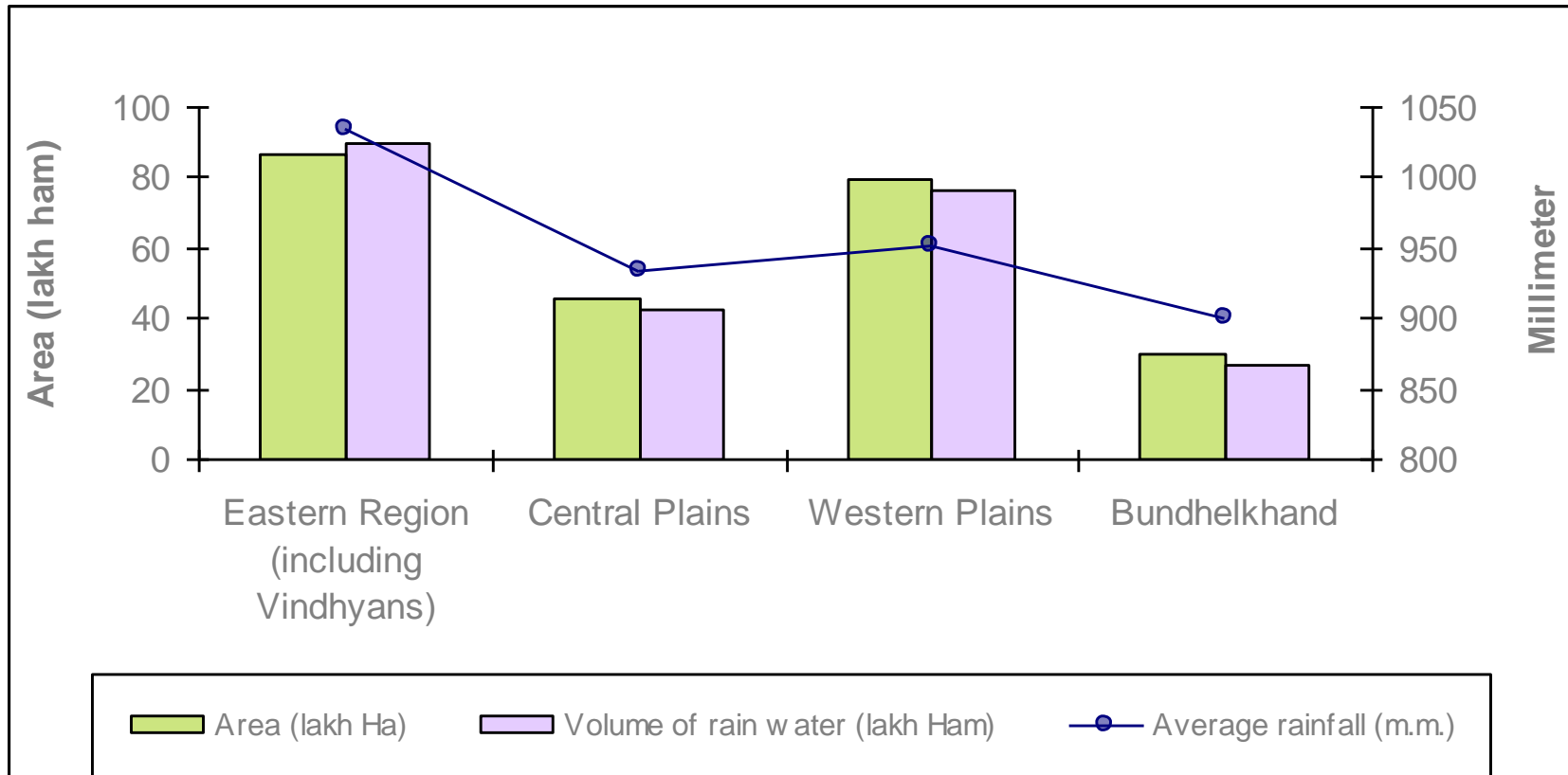
AVERAGE MONSOON RAINFALL : 902 mm.

ANNUAL NORMAL RAINFALL : 1144mm.

RAINFALL PATTERN : LUCKNOW CITY

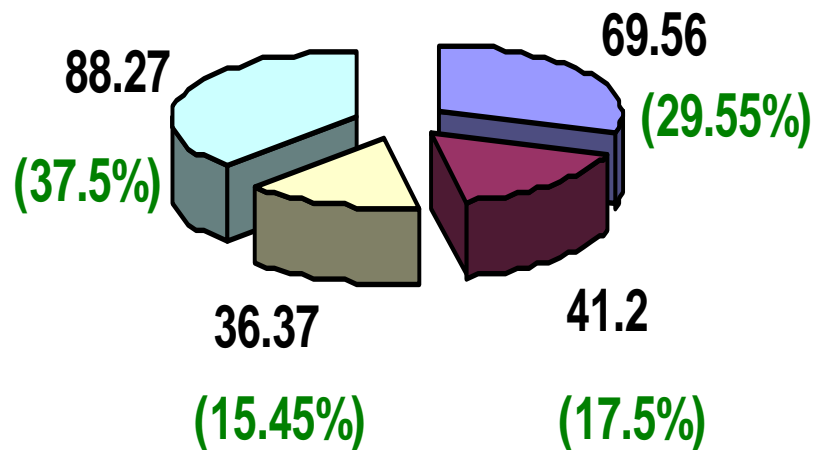


Regionwise Rainfall in U.P.



Rain Water Availability and Run-off Pattern of U.P.

Total Availability of Rain Water : 235.4 lakh ham



(in Lakh ha-m)

- Rain water absorbed in soil
- Evaporation losses
- Recharge to Ground Water
- Run off through Drains & Rivers

GROUND WATER SCARCITY IN BUNDELKHAND

- **Hard Rock Terrain**
- **Complex Hydrogeology/ Fractured Aquifers**
- **Low Ground Water storage due to quick & high run-off**
- **Watershed concept being not adopted**

Replenishing Aquifers – it takes time

- It takes long time to replenish depleted aquifers.
- Studies show that ground water levels respond slowly to climate changes.
- Aquifers can take months or even years to get replenished once pumped for various uses.
- Unsaturated soil layer acts as a buffer between the atmosphere & the aquifer. So, where it rains, it takes time to percolate to the aquifers. And less rains may not replenish aquifers.
- Studies revealed that it can take months or years for aquifers to recover, depending upon how deep is the aquifer is and how much it has depleted?

INTEGRATED MASTER PLAN FOR RWH/GWR

141 problematic blocks of U.P. including 50 over-exploited/critical blocks & 63 blocks of hard rock area have been identified for rain water harvesting and ground water recharge.

•Master plan costing approx. Rs. 2000.00 crore prepared for 141 problematic blocks.

□This ambitious master plan is yet to take off. *Different line departments are expected to take up recharge activities in integrated manner.*

□Now, another R.W.H. plan for 138 stressed blocks has been initiated.

But, no line department is taking-up RWH activities as per propos at & guidelines of the master plan.

Key Solutions

There are some solutions, which need to be addressed with effective interventions-

- **Separate Institutional mechanism with regulatory framework and adequate & skilled infrastructure is required to be developed so as to promote, guide, implement, co-ordinate & monitor rain water harvesting and recharging activities.**
- **There should be a 'State Plan' for rain water harvesting & ground water recharge with prioritization of separate Micro Plans for problematic areas of urban, rural & industrial segments. These plans & the identified problematic areas should be made public in order to sensitize & create awareness.**
- **Problematic areas should be prioritized in a way that such areas could be fully saturated first with site specific rain water harvesting activities in order to achieve cumulative impact on depleting ground water.**
- **Understanding Aquifer Geometry is an important pre-requisite for Rain Water Harvesting/Recharging & other management requirements.**

--- Key Solutions

- Area specific guidelines, technical specifications & appropriate practices should be strictly followed during the design & implementation stage.
- There should be separate strategies/plans for Alluvial & Bundelkhand areas. However, for Bundelkhand-Vindhyans, only micro watershed approach for rain water harvesting should be adopted.
- To assess the impact of rain water harvesting especially in alluvial aquifers, research (R&D) should be taken-up side by side.
- Along with rain water harvesting, Conjunctive Management of surface & ground water resources in both urban & rural areas should be taken up on priority.
- In problematic areas, indiscriminate/excessive exploitation of ground water should be discouraged & the roastering system should be enforced.
Therefore for problems areas, comprehensive management plans are needed to be proposed, so as to cover all ground water aspects, instead of taking up various management options in isolation.

Other Solutions

There are also other effective solutions for stressed areas-

- ❑ Changes in Cropping pattern.**
- ❑ Promotion of low water crops.**
- ❑ Adopt **Sprinkler & Drip irrigation** practices for efficient water use.**

Regulatory Mechanism for Ground Water

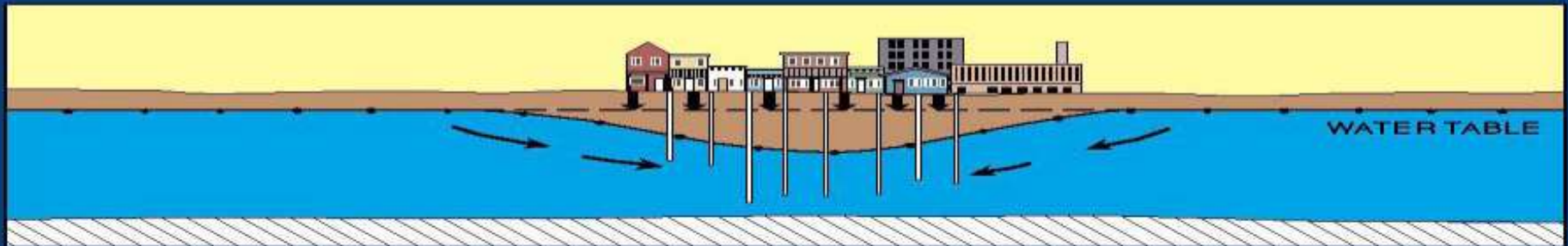
A draft Act to regulate and protect Ground Water in urban & rural segments of the state has been prepared and submitted to State Govt. for consideration/ approval.

Main objectives are

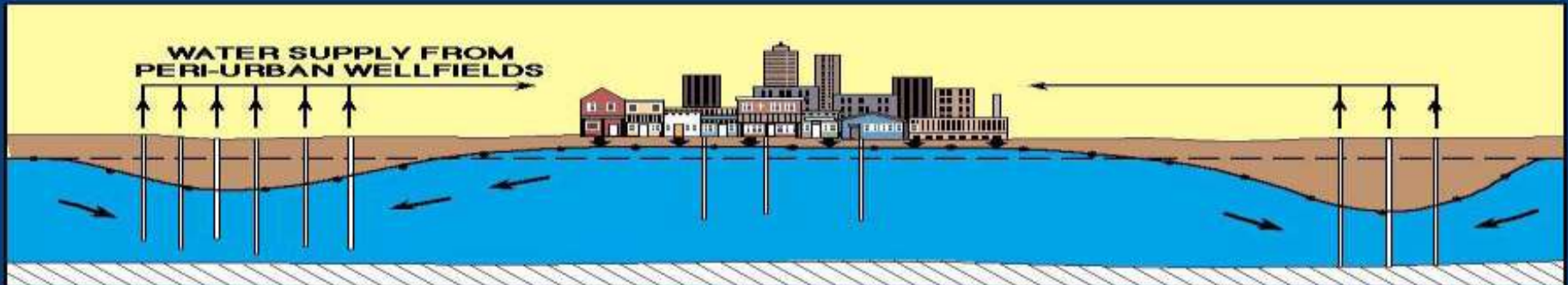
- To check the declining trend of Ground Water levels**
- to regulate uncontrolled development & extraction of Ground Water**
- to protect, conserve it through Rain water Harvesting.**

Various elaborate provisions for both rural & urban areas as well as for industrial and commercial users have been envisaged in the proposed draft act.

MANAGEMENT OPTION FOR URBAN AREA



(a) initial town



(b) town becomes city



(c) city expands

Key Recommendation

For the success of Government initiatives-

- RWH programme in the state should be initiated as a public movement.**
- There should be a change in the attitude, mind set & the approach of the line departments i.e. we have to shift our policies from unregulated exploitation to effective conservation of ground water resource.**

THANK YOU