Lecture note on
PROBLEMS AND PROSPECTS RELATED TO HYDROGEOLOGY OF WEST BENGAL

The dry variety or the boro paddy is the water intensive crop but the magic key for rural economic growth

By

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Water is considered as primary resource to support the life system of the earth, generation of wealth and significant factor in economic development. Achieving solutions to water related problems that humanity faces today, requires long-term potential actions far sustainable development instead of short term development for quick benefit – which may culminate to risk for future social and environmental consequences. The widely accepted definition of sustainable development is "development that meets the needs of the present without compromising the ability of future generations to meet their own needs". In this point of view secure supply of water has become the most important issue, categorically for the developing countries where population growth rate is very high poverty alleviation is a crux for the nation, trans-boundary water related problems invite conflicts, self-sufficiency in food is yet to reach, environment is highly degraded and generating awareness about effective and efficient utilization water is a difficult task.

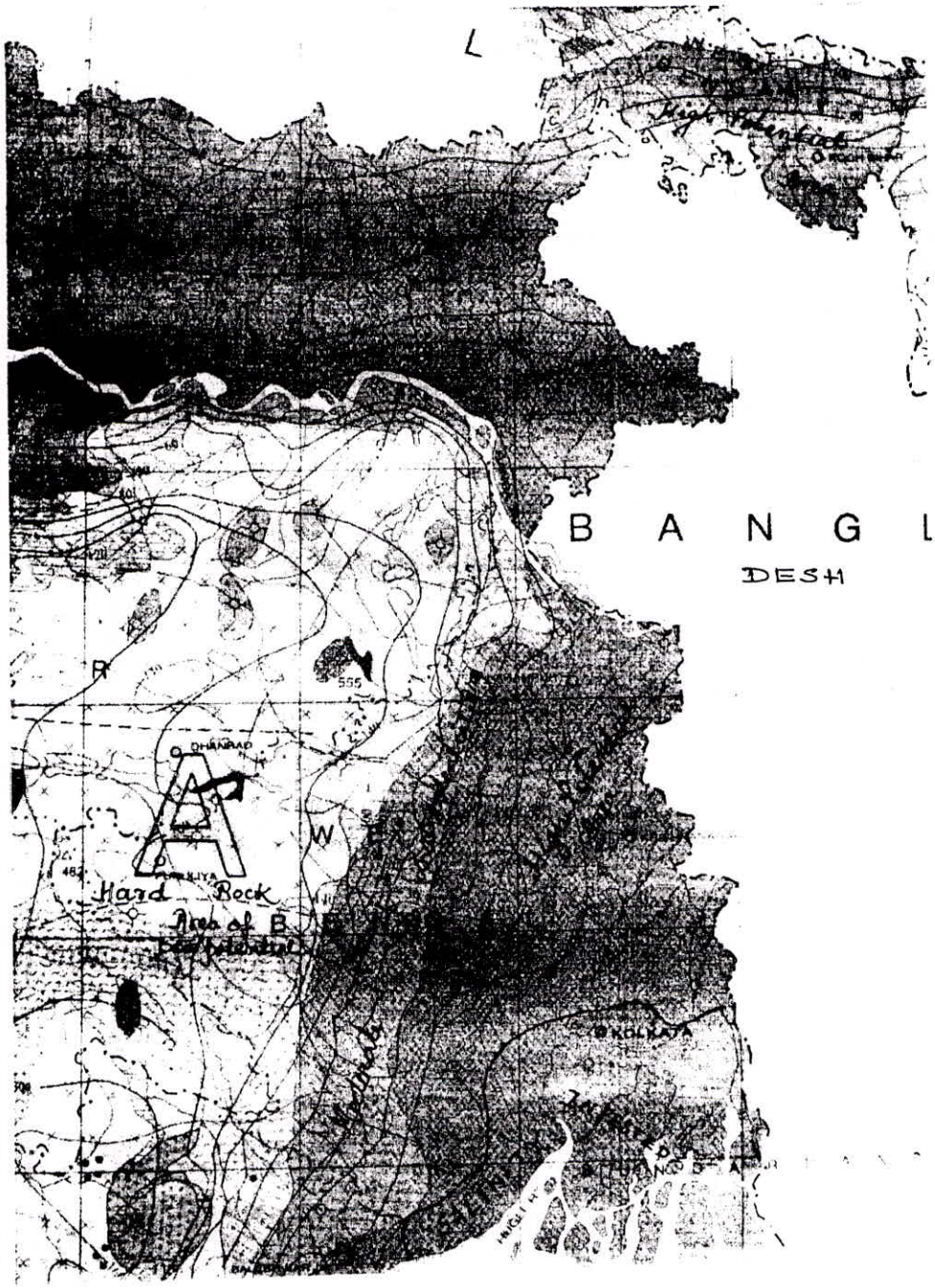
There are large number of factors which are significant in the determination of the future level of the water consumption. Such factors include population growth, economic performance in agriculture and industry, consumers attitude for protecting the resource and success in implementing the water governance.

It is needless to mention that Governance for Water Resources in the state of West Bengal is in the early stage and yet to reach all the stake-holders properly and effectively. However, it is the high time to review the potential of the ground water resource and identify the problems related with it. Certainly the responsibility lies with the nodal agency of the state to enlighten individual stake-holders, agencies engaged with the dev elopement of minor-irrigation and public distribution system for potable water. To discuss the prospect and potential of Ground Water Resources of West Bengal this lecture is divided mainly into two parts with a supplementary part.

Part - I. : Ground Water Resource potential of the state - a synopsis.

Part – II : Outline of the problems related with ground water for the state.

Annexed Supplementary part : Newly promulgated West Bengal Ground Water Resources (Management, Control and Regulation) Act, 2005 dated 31st August, 2005



GROUND WATER POTENTIAL MAP

MAP-1

GROUND WATER POTENTIAL OF WEST BENGAL

West Bengal is highly rich in ground water resources. The porous formations of the GMB basin developed during Cenozoic era by prolonged cyclic perennial riverine activities and coastal delta building processes had developed potential aquifers of clastic sediments. Since historic past to present day, agro-produces are the cardinal pillars of economic growth. As a matter of fact, 'Water' has a key role not only in the agro practices of this state but in our culture, social system, and even in our art, literatures and what not ? Intensive irrigation happens to be the common practice of our state. Be it in irrigation use or in domestic use, it is still beyond our perception, that serious permutation taking place in the regime of water may culminate to a catastrophe. That will be our culpable negligence to recognize the emanating problems related with increasing use of ground water.

In 2003-04 Last Ground Water Resource estimation has been carried out for the state considering the actual irrigation draft computed from 3rd Minor Irrigation (MI) Census data and sectorial allocation for domestic plus industry (per capita 60 liters). The methodology is prescribed by Ground Water Estimation Committee of 1997 constituted by GOI. The estimation has worked out ground water availability, draft, stage of ground water development, future allocation for domestic and industrial use, and resource availability for future irrigation use. Estimations are done for 269 blocks of the state out of total 341 blocks.

Computed State level figures and district wise figures are given in table – I & II.

Table – I.

GROUND WATER POTENTIAL FOR THE STATE OF WEST BENGAL AS ON 2001

(Computed by application of GEC – 97 methodology)

Estimated figures of	Lakh ham.
1. Total annual GW recharge	+ 30.28
2. Unaccounted natural GW discharge	- 2.89
3. Net GW availability	+ 27.39
4. Gross annual GW draft as per 3rd MI Census	10.17
5. Gross annual GW draft for domestic and industrial use	1.14
6. Gross annual GW draft for all uses i.e. (4+5) =	11.31
7. Stage of GW development $SOD = \frac{\text{Gross GW draft for all uses}}{\text{Net GW availability}} \times 100\ \%$	41.30%
8. Annual allocation of GW for domestic and industrial use upto 25 years (As per GEC – 97)	1.60
9. New GW availability for irrigation i.e (3 – 8)	25.73
10. Net GW availability for future irrigation as on March 2001.	15.81

SALIENT FEATURES OF THE DYNAMIC GROUNDWATER RESOURCE POTENTIAL

Stage of Ground Water Development (SOD) of the state is 42% which is 16% less than national SOD : 58%

1. Stage of Development is lowest in Brahmaputra valley area Jalpaiguri : 4.76 %
   Darjeeling
   (Siliguri Mahakuma) : 4.99%
   Coochbehar : 16.75%

   (Little above hard rock terrain of Purulia : SOD is 14.47%).

2. SOD is highest in two districts of Bhagirathi Plain

   Nadia : 84.56 % ; Murshidabad : 83.57%

3. SOD in Damodar Valley area lies above 40% but below 45%, except the areas where coastal deltaic facies are developed (< 25%)

4. SOD for Kangsabati & Dwarkeswar basin area are above 20% but less than 35%.

5. SODs for Purulia hard rock terrain vary widely 5.45% to as high as 44.03%

6. In Burdwan district aquifers of Gondwna Group of rocks are having SOD : 8.77% to 20.60% comparably higher than Tertiary aquifers having SOD < 9%

7. SOD of hard rock terrain of Bankura district varies from as low as 3.09% to 30.60%.

8. SOD at the peripheral part of basaltic terrain is as high as 50%.

9. SOD for moribund area is > 75%.

10. Induced recharge from the river Bhagirathi play a key role to stabilize the depleting trend of ground water level in many blocks of Nadia and Murshidabad having SOD > 100 %.

11. In 28 blocks of Nadia and Murshidabad falling trend of decadal GWL (ground water level) is not observed in spite of the attainment of 100% SOD.

12. In some blocks of Burdwan, Birbhum, Hooghly, Purba & Paschim Medinipur and Murshidabad falling trends are observed for both and pre and post monsoon in spite of 40 – 70% development.

The above points are indicative of following inferences :

A. Tube well irrigation has not developed equally over the groundwater potential map of the state.

B. Tube well irrigation is intensified in and around the traditionally old areas availing that facilities and the possibilities of new areas are less explored.

C. Technical arguments often fail to explain the upsurge of high tube well density (number/ km^2 arable land) in some pockets of similar hydrogeological condition.

D. Falling trend of GWL does not depend only on SOD but hydrogeological conditions of the area also control the rise/fall of GWL.

E. A meaningful, efficient and effective groundwater resource management mechanism is essentially required for sustainable development of ground water wherein stake holders of all sectors will put their efforts to keep up the prospect towards ground water protection, by adopting groundwater recharge and rain water conservation.

TABLE-II

GROUND WATER RESOURCES OF THE STATE OF WEST BENGAL AT A GLANCE,
ASSESSMENT YEAR 2000 - 2001

Sl.No.	District	Total Annual Ground Water Recharge in ham	Unaccounted Annual natural ground water discharge in ham	Net Ground Water availability in ham	No. of different types of G. W. structures(in use and not in use temporarily)			Current Annual Gross GW Draft for irrigation in ham	Current ground water draft for domestic and industrial uses (ham)	Gross ground water draft for all uses (ham)	Stage of Ground Water Developme nt as %	Annual Allocation of GW for Domestic & Industrial Water Supply upto next 25 yrs. in ham	Net Annual GW Availability for Irrigation Use in ham	Net Annual GW Availability for "Future Irrigation Use" in ham
					DW	STW	DTW							
1	2	3	4	5	6a	6b	6c	7	8	9	10	11	12	13
1	Malda	140338.19	13210.36	127127.83	1	36766	329	62058.40	6844.29	68902.69	54.20	11137.00	115990.83	54391.73
2	Nadia	217234.01	21723.38	195510.63	2	94110	748	156873.80	8456.22	165330.02	84.56	12641.00	182869.63	30896.24
3	North 24Parganas (Part)	157640.24	15764.02	141876.22	0	60330	324	91266.00	9282.90	100548.90	70.87	14603.00	127273.22	36007.22
4	Murshidabad	252264.32	24695.35	227568.97	1	82948	588	178244.40	11929.20	190173.60	83.57	19093.00	208475.97	49075.59
5	Coochbehar	231666.41	23166.65	208499.76	6480	41148	61	29854.20	5073.29	34927.49	16.75	6891.00	201608.76	171754.56
6	Jalpaiguri (Part)	263620.62	26362.05	237258.57	3136	7157	127	6335.60	4965.65	11301.25	4.76	7661.00	229597.57	223261.97
7	Uttar Dinajpur	168191.36	14505.30	153686.06	0	41120	159	65019.00	4771.46	69790.46	45.41	8244.00	145442.06	80423.06
8	Dakshin Dinajpur	95202.83	8082.88	87119.95	125	22617	139	36894.50	2891.18	39785.68	45.67	4508.00	82611.95	45717.45
9	Hooghly	161744.75	16174.47	145570.28	21	20291	509	51279.40	8248.41	59527.81	40.89	11539.00	134031.28	83732.39
10	Burdwan	333868.21	30573.13	303295.08	63	50696	605	114122.20	**16723.31	130845.51	43.14	**20784.57	282510.51	168388.31
11	Howrah (Part)	37033.77	3703.37	33330.40	0	1104	143	4769.40	2427.62	7197.02	21.59	3328.00	30002.40	25233.00
12	Darjeeling (Part)	52174.97	5217.50	46957.47	253	1439	38	1266.90	1077.20	2344.10	4.99	1719.00	45238.47	43971.57
13	Purba Midnapore (Part)	82600.93	8260.09	74340.84	0	12902	246	24579.20	3884.79	28463.99	38.29	5443.00	68897.84	44318.64
14	Paschim Midnapore	381808.22	37361.60	344446.62	8906	62261	479	110844.00	10241.76	121085.76	35.15	14306.00	330140.62	219296.62
15	Bankura	209152.98	19226.80	189926.18	4521	27580	140	47906.30	6502.68	54408.98	28.65	8766.00	181160.18	133253.88
16	Birbhum	166714.64	14102.71	152611.93	448	17382	118	30423.60	6062.36	36485.96	23.91	8808.00	143803.93	113380.33
17	Purulia	76744.77	6597.85	70146.92	12796	2	0	5121.60	5027.82	10149.42	14.47	6810.00	63336.92	58215.32
	West Bengal	*3028001.22*	*288727.51*	*2739273.71*	*36753*	*579853*	*4753*	*1016858.50*	*114410.11*	*1131268.61*	*41.30*	*166281.57*	*2572992.14*	*1581317.88*

Note : (a) (**) - figures include draft due to mining activities considered 30% of net ground water availability in the seven blocks of coal field area
(b) Col.5 = Col.3- Col.4; (c) Col.9 = Col.7+ Col.8; (d) Col. 10 = Col.9/Col.5*100 %; (e) Col. 12 = Col.5 - Col. 11; f) Col. 13 = Col. 12 - Col. 7;
This relation (f) will not hold good for the districts of Malda, Nadia, Murshidabad and Hooghly, because negative balances in column 7 of Table III in respect of a number of blocks under these districts have been considered as zero.

[U. K. Ghosh]

NET GROUND WATER AVAILABILITY, EXISTING GROSS GROUND WATER DRAFT, STAGE OF GROUND WATER DEVELOPMENT AND CATEGORISATION OF BLOCKS IN WEST BENGAL AS ON 31ST MARCH, 2004

TABLE: 3

Sl. No.	District	Recharge from rainfall during monsoon season in ham	Recharge from other sources during monsoon season in ham	Recharge from rainfall during non-monsoon season in ham	Recharge from other sources during non-monsoon season in ham	Total Annual Ground Water Recharge in ham	Natural Discharge during non-monsoon season in ham	Net Annual Ground Water Availability in ham	**Existing Gross Ground Water Draft for irrigation in ham
1	BANKURA	104088	28873	29170	47022	209153	19227	189926	52097
2	BURDWAN	178041	34645	49654	71528	333868	30573	303295	123679
3	BIRBHUM	71505	26062	19271	49876	166715	14103	152612	34887
4	DARJEELING	39332	565	10813	1465	52175	5218	46957	1700
5	DAKSHIN DINAJPORE	55956	5321	18962	14964	95203	8083	87120	39045
6	HOWRAH	19382	2883	5576	9193	37034	3703	33330	5096
7	HOOGHLY	86202	18763	24882	39754	169601	16960	152640	53047
8	JALPAIGURI	198706	1518	59567	3830	263621	26362	237259	6635
9	COOCHBEHAR	157742	3686	61238	9000	231666	23167	208500	31081
10	MALDA	86128	6587	25363	22260	140338	13210	127128	67237
11	PURBA MEDINIPUR	54616	2453	15258	10273	82601	8260	74341	26034
12	PASCHIM MEDINIPUR	231555	23133	69527	57592	381808	37362	344447	116340
13	MURSHIDABAD	138378	21043	41382	51461	252264	25226	227038	191893
14	NADIA	111789	16817	42127	46501	217234	21723	195511	166677
15	NORTH 24 PARAGANAS	95287	8980	26958	26416	157640	15764	141876	94066
16	PURULIA	47629	10640	12742	5734	76745	6598	70147	6000
17	UTTAR DINAJPORE	110836	6669	31624	19062	168191	14505	153686	68657
	WB STATE	1787173	218639	544113	485932	3035857	290044	2745814	1084172

Note ** Projected Gross Ground Water Draft

NET GROUND WATER AVAILABILITY, EXISTING GROSS GROUND WATER DRAFT, STAGE OF GROUND WATER DEVELOPMENT AND CATEGORISATION OF BLOCKS IN WEST BENGAL AS ON 31ST MARCH, 2004

Sl. No.	District	Existing Gross Ground Water Draft for domestic and industrial water supply in ham	Existing Gross Ground Water Draft for All uses in ham	Stage of Ground Water Development in percentage	Allocation for domestic, and industrial requirement supply upto next 25 years	Additional GW draft for Mining activities (30%)	Net Ground Water Availability for future irrigation development
1	BANKURA	4740	56837	29.93	6376	0	131453
2	BURDWAN	8221	131900	43.49	12187	5622	167429
3	BIRBHUM	4472	39359	25.79	6073	0	111651
4	DARJEELING	807	2507	5.34	1719	0	43539
5	DAKSHIN DINAJPORE	2186	41231	47.33	3519	0	44555
6	HOWRAH	1774	6870	20.61	2421	0	25813
7	HOOGHLY	6047	59093	38.71	8419	0	92895
8	JALPAIGURI	3700	10335	4.36	5957	0	224667
9	COOCHBEHAR	3702	34783	16.68	5006	0	172412
10	MALDA	5142	72379	56.93	8278	0	51613
11	PURBA MEDINIPUR	2847	28882	38.85	3965	0	44342
12	PASCHIM MEDINIPUR	7507	123846	35.96	10453	0	217654
13	MURSHIDABAD	8944	200837	88.46	18303	0	16842
14	NADIA	6266	172943	88.46	9320	0	19513
15	NORTH 24 PARAGANAS	6939	101005	71.19	10859	0	36951
16	PURULIA	3666	9666	13.78	4940	0	59207
17	UTTAR DINAJPORE	3608	72265	47.02	5808	0	79221
	WB STATE	80567	1164736	42.42	121885	5622	1539757

PROBLEMS OF GROUND WATER DEVELOPMENT

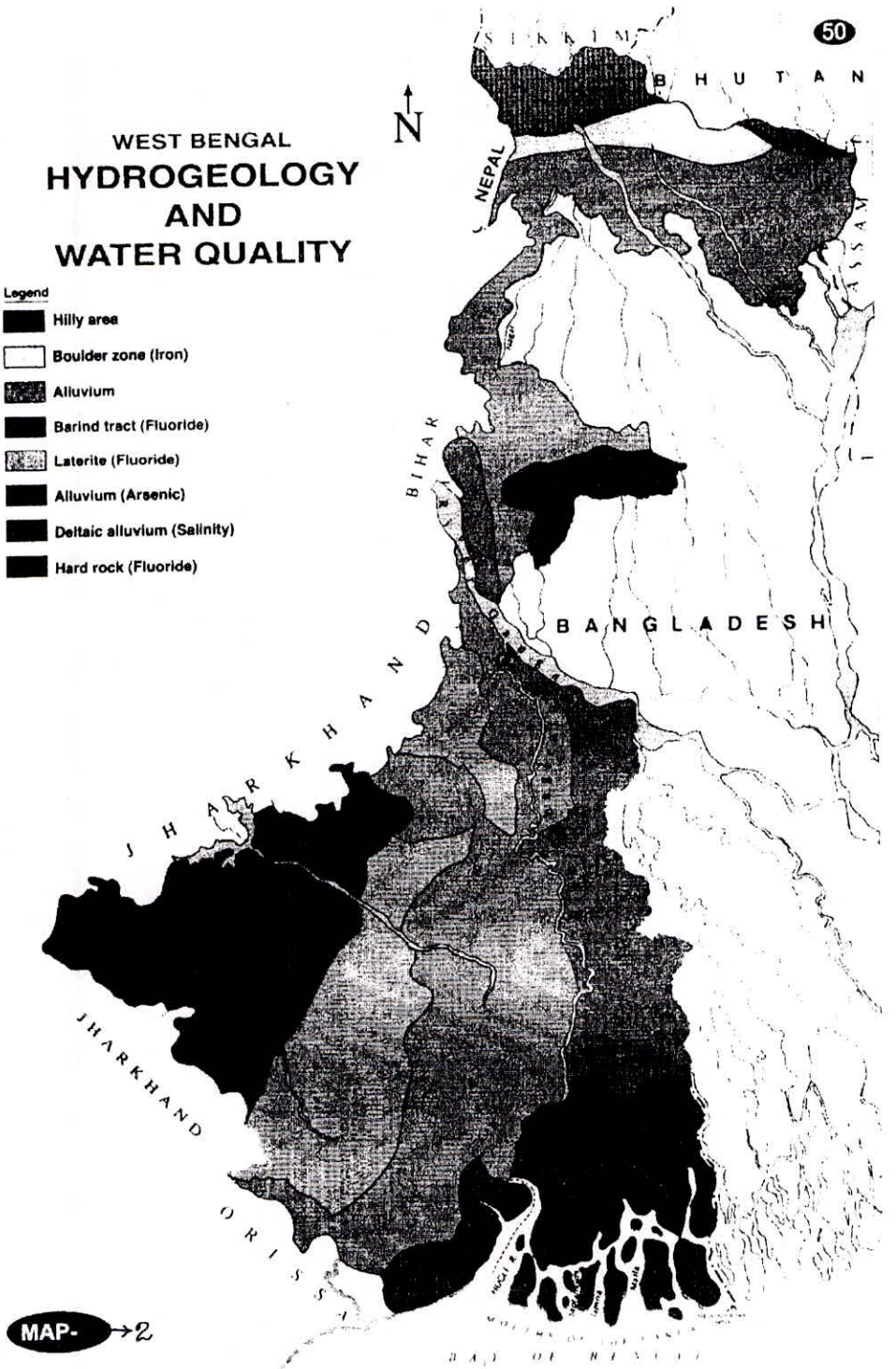
West Bengal is rich in ground water resources. The bounty of water resources has encouraged every sector of water users to depend on ground water resources for economic growth –be it for Green Revolution for Grow more food, Industrial expansion or Urban Infrastructural expansion. The scenario got a jolt when one after another problem had emerged to put hindrance on those growth scenarios. During 1980s some cases of the people suffering from arsenical dermatosis were focused from Nadia, Murshidabad, Bardhaman, North and South 24 Parganas. The problem became so grave that in 1999 UNICEF decided to enter into strategic alliance with the government of West Bengal through a joint action plan (JPOA) to address the arsenic poisoning problem in the state. When the arsenic toxicity problem in ground water was in its climax, rejection level fluoride were reported from sub-terrain an water of Birbhum district, within a short period Fluoride toxicity were reported from Bankura, Purulia, South 24 Parganas and more perplexing from Malda, Uttar & Dakhsin Dinajpur.

These are the quality related problem which is added with the coastal salinity hazards in ground water prevailing over one complete district and partly over three adjoining other districts due to proximity to the Bay of Bengal coast and presence of deltaic formation at the fore deep of the Bengal basin.

However, those quality hazards problems were ground realities to recognize, but in early eighties another problem rapidly entered into the domain of ground water resources, which is indiscriminate abstraction of ground water to cause depleting trend of ground water level. Though adverse effects were experienced by the stake holders but in general community remained indifferent in attitude to recognize the issue. Thus the quality hazard problems are coupled with the crucial problem of sustainability of the renewable resource.

So, if we go through the history of ground water development in the state, following problems can be identified.

1. Geogenic problems of quality hazards in ground water- namely Fluoride & Arsenic toxicity.
2. Anthropogenic problems of quality hazards – namely nitrate pollution.
3. Quality hazard problem due to geographical and geomorphological character of the state- proximity to the cost, causing salinity hazards in deltaic aquifers.
4. High level of iron (>0.5 mg/l) with iron friendly bacteria has remained perpetual problem causing health hazards and incrustation in tube well assembly as well as distribution pipe lines.
5. Effect of irrigation use of arsenical water on agriculture produces has become a cause of concern to many experts.
6. Rapidly ascending trend of ground water dependence for irrigation and domestic need, manifested by declining trend of ground water level in many blocks of the Southern district of state.
7. Equity in access to ground water is yet to be addressed with rational guidelines.
8. Resource development is often given priority over the resource planning. Boom and bust progression of ground water development is typical in most of agriculturally advanced districts of the state.
9. Demand – side management has become a difficult task due to lack of community awareness about the devastating effects of groundwater overuse, public litigations, local conflicts and above all weak governance.
10. Supply side management is least understood in the context of sustainable ground water development.
11. Ground level detail information about industrial and urban use of water is not available.
12. Response and participation towards implementation of Ground Water Resource Act (Management, Control and Regulation) Act 2005 is not that satisfactory as it should be.

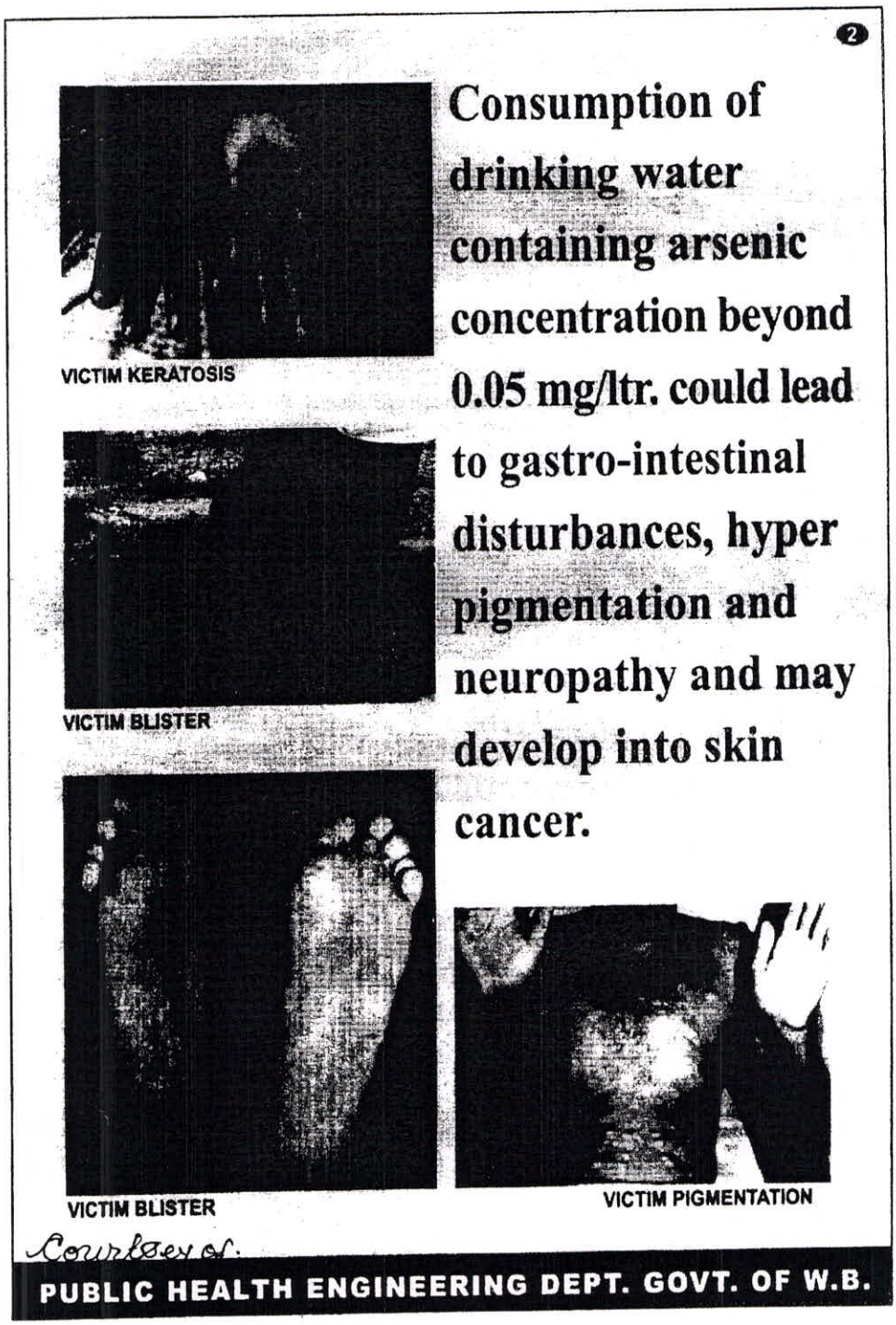

WEST BENGAL
HYDROGEOLOGY
AND
WATER QUALITY
Legend
Hilly area
Boulder zone (Iron)
Alluvium
Barind tract (Fluoride)
Laterite (Fluoride)
Alluvium (Arsenic)
Deltaic alluvium (Salinity)
Hard rock (Fluoride)
N
50
BHUTAN
NEPAL
BIHAR
BANGLADESH
JHARKHAND
ORISSA
MAP-2

ARSENIC CONTAMINATION IN GROUND WATER

Arsenic poisoning in ground water is the major health hazard problem of this state, which was reported in early 1980s. Considering the seriousness of the problem the State Government proposed a project at an estimated cost of Rs. 10.82 lakhs under Arsenic Sub-Mission of National Drinking Water Mission in 1998 and Steering Committee was constituted up to December 1998 number of arsenic affected moujas were 1312 wherein more than 45 lakhs population exposed to toxic menace of arsenic ground water. The extent and effect of chronic endemic regional hydroarsenicism in West Bengal and contiguous Bangladesh become a challenge to plan the mitigation programme. At present the numbers of arsenic affect blocks are 81 distributed over 8 districts in a linear belt from North 24 Parganas in South to Malda at north, mainly the Halocene sediments of GMB basin. Most of experts propose that the arsenic is mobilized due to the reduction of the iron- oxy-hydroxides in a reducing environment.

Important information about high level arsenic concentration in ground water is

- Arsenic concentration above 0.05 mg/l is said to be contaminated.
- Intermediate aquifers 20m -80m bgl in GMB basin are mainly affected by high level of arsenic.
- Arsenic is undoubtedly geogenic in origin.
- Arsenic ground water in quaternary sediments (mainly Halocene) building up multiple aquifers system, wherein the top aquifer is free from arsenic (<30 m bgl), semi-confined/ middle aquifers (30 m bgl-80m bgl) is contaminated and the deeper aquifer in general free from arsenic. In eastern part of Bhagirathi effective clay barrier rests over deeper aquifer.
- Arsenic in ground water is not controlled by the concentration of the arsenic sediments.
- In space or lateral extension of the aquifer arsenic concentration may vary from our place to another.
- In eastern part of Bhagirathi high arsenic ground water is confined to old river meander belt (moribund area) towards Bangladesh.
- Beside meander belts arsenical ground water repositories are also found in back swamp and flood plains of Bhagirathi plain.
- Government departments along with external supports, private organizations, universities and research institutes have aimed at addressing arsenic contamination. The Government of West Bengal has constituted a Arsenic Task Force with the representatives from those offices and institutes.
- Source and mobilization of arsenic in groundwater are debatable issues.
- Arsenic Removal Plants are installed for Rural Water Supply and large scale public distribution schemes.
- Different types of domestic filters are used to remove arsenic.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Consumption of drinking water containing arsenic concentration beyond 0.05 mg/ltr. could lead to gastro-intestinal disturbances, hyper pigmentation and neuropathy and may develop into skin cancer.
VICTIM KERATOSIS
VICTIM BLISTER
VICTIM BLISTER
VICTIM PIGMENTATION
Courtesy of:
PUBLIC HEALTH ENGINEERING DEPT. GOVT. OF W.B.

Fluoride Contamination in Groundwater

In late nineties fluoride contamination in ground water was reported from Nalhati Block of Birbhum district. Today the number of fluoride affected block is 49 endangering the health of 1.85 million people. Fluoride contamination in ground water is reported from 7 districts of West Bengal (pl. see annexed list). Among those worst effected (a) Rearch upland of Purulia, Bankura and Purulia (b) Barind area of South Dinajpur and Malda, categorically, Tapan, Gangarampore and Bamangola blocks of that area. Intensive research works are taken up by the Fluoride Task Force constituted by CGWB.

The research works are mainly focused on the source rock &/ mineral of fluoride contamination and mechanism of fluoride mobilization in fissured formation and porous formations.

Hopefully, the research works which are carried out by G.S.I., S.W.I.D., C.G.W.B., Presidency College, Jadavpur University will come up with the results to explain the cause and possible future extent of the problem.

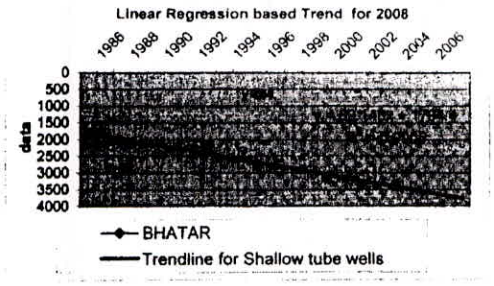
Public Health Engineering Dte is on the task of framing mitigation plans.

Fluoride victim of Ekteswar village of Bankura district

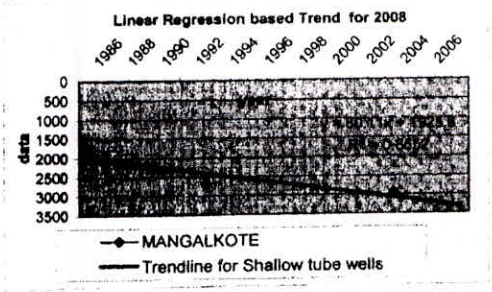
PRESENT SCENARIO OF FLUORIDE TOXICITY IN WEST BENGAL

District	No. of Blocks affected	Population (as per 2001census) at risk
Purulia	17	71813
Bankura	11	41906
Birbhum	7	10221
Uttar Dinajpur	1	1063
Dakshin Dinajpur	5	86490
Malda	2	13739
24 Parganas, South	1	1221
Total	44	161823

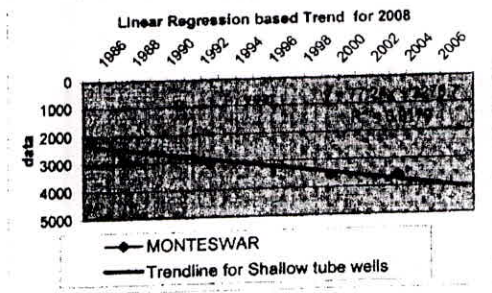
y = 89.148 x 23 + 1704.4 = 3754.804



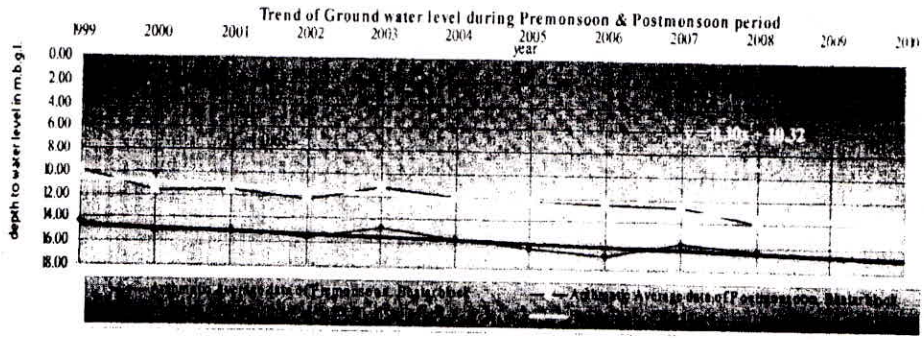
y = 60.11 x 23 + 1925.6 = 3308.13

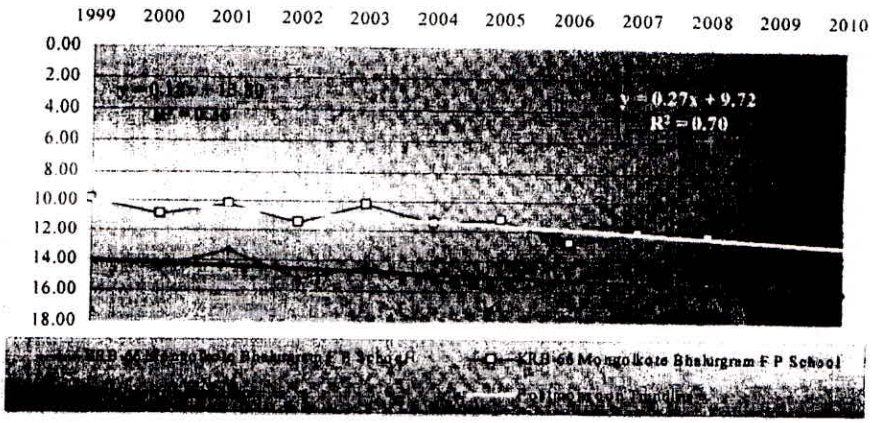


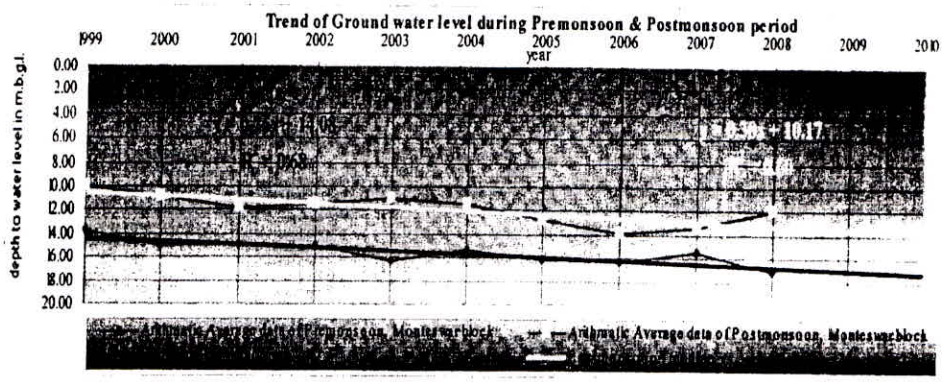
y = 77.24 x 23 + 2278.7 = 4055.22



TREND OF GROWTH OF TUBE WELL IRRIGATION IN BURDWAN DISTRICT







Declining Trend of GWL

ANTHROPOGENIC PROBLEM

Nitrate pollution in ground water has been studied as academic interest by Bidhan Chandra Krishi Viswavidyalaya at Nadia and Hugli districts. Research indicates that nitrate enrichment in groundwater may increase above permissible limit due to long-term intensive agriculture. NO_3-N contamination in ground water is also reported from Durgapur industrial area of Bardhaman district.

COSTAL SALINITY HAZARD

It is a perpetual problem for 59 southern blocks of the district in distributed over North & South 24 Parganas, Howrah, and Purba Medinipore.

The important findings of investigation are

1) Deep ground water near the coast is generally fresh.
2) Salinity in some places is due to either contribution from Salt lakes or through leaching of salts from the soils (Joynagar).
3) Salinity of ground water in some pockets could be a local effect due to intrusion of Hooghly tidal waters.
4) In some places deeper water become saline due to leakage from shallow aquifer.

To conclude the discussion, the following issues are to be noted for rational planning of ground water development.

a) To tap the resource without exhausting the resource.
b) To be sincerely vigilant to the problems of salinity, arsenic, fluoride and depletion of resource.
c) Implement and restore an effective and efficient ground water governance.
d) To develop the mind set and water management skills which will push the state for shifting from resource development to resource planning.
e) To put priority on resource augmentation by ground water recharge planning and subsequent implementation.
f) Implementation of West Bengal Ground Water Resources (Management, Control and Regulation) Act, 2005 should be accepted as a public agenda. Ground Water abuse should be considered as a social offence and violation to public laws.
g) There should be rational and scientific value appreciation mechanism for ground water – used as commodity and used as life support.

Annexure

Supplementary part
On
West Bengal Ground Water Resources (Management, Control and Regulation) Act, 2005 dated 31st August, 2005

WEST BENGAL GROUND WATER RESOURCE (MCR) ACT, – A STEP FOR ECONOMIC USE OF WATER

T.K.Ray

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Introduction

It is not only a social obligation but a constitutionally defined responsibility of a state to protect the natural resource for sustainable development of the various sectors of essential needs and economic growth. Ground water is the life line of our farmers.To ensures the supply of safe drinking water is the commitment of a welfare state. Allocation of ground water to meet the industrial demand is unavoidable. Judicious allocation for all the essential sectors is possible by introducing a sound managerial system, - guided by law.

The present ground water resource scenario of the state is as given below:

* Total recharge from annual rainfall (average: 140cm) = 30.28 Lakh hectare meter(ham)
* Net ground water availability for all uses = 27.39 Lakh ham
*Gross annual ground water draft for irrigation from 36753 Dug well, 579853 STW, & 4753 DTW = 10.17 Lakh ham
*Computed draft for domestic & industrial use (by GEC-97 norms) = 1.14 Lakh ham
* Total draft for all uses considering 3rd, M.I. Census of 2001& percapita use for industry & drinking. = 11.31Lakh ham
*Annual allocation of GW for drinking & Industry = 1.66 Lakh ham
* Net GW available for future irrigation. = 25.73 Lakh ham
* Net GW availability for future irrigation as on March , 2001 after 3rd, MI census = 15.81 Lakh ham

Overall stage of the ground water development (SOD) as a ratio of gross draft and net availability expressed in percent is **41.30%.**

The above figures are quite encouraging to embark on any schemes for harnessing ground water to cater the water demands for any sector of development. For the last three decades, the slogan "*grow more food*" was largely dependent on ground water fed minor irrigations, either under public schemes or private installations. But this picture of the advancement of minor irrigation is not same for the all districts of the state of West Bengal. Eventually when the average S.O.D. of the south Bengal districts is around 50%, the average S.O.D. for the districts of Brahmaputra Valley and Mahananda plains is as low as 10% . Out of *37 Semi – Critical* Blocks of the State except 2 all are in South Bengal and only *Critical* Block is at Murshidabad. The stupendous growth of tube well irrigation in south Bengal districts are the manifestation of a) heavy investment by the government for micro- irrigation b) improved seeds, fertilizers & pesticides c) Commercialization of agro-produce – mainly summer crop *Boro paddy* & resurgence of rural economy d) development of power sector. e) Widening of agro – market net work.

Thus the squandering efforts of harnessing ground water by faulty irrigation practice led to retreat of ground water level in many blocks of the Gangetic alluvial plain, Damoder Valley area, Cosai & Maurakshi sub- basins. In late nineties high lifting capacity submersible pumps became popular to the farmers for its magical capacity to lift water from any pushed down level. Access to ground water became a issue of dispute and conflict in many districts of South Bengal. The issues are dragged to the honorable High Court at Calcutta. Thousands of cases were heard. Valuable verdicts were given to ensure the proper use of the ground water. Social activists, ground water experts, environmentalists, politicians, administrators

all have resolved to a single opinion that *"enactment is essential to protect the valuable ground water resource"*.

Thus it was appropriately felt by the government that intervention of law and administration is imperative to ensure equitable& rational distribution of ground water to all stake holders and the law has to be scientifically evaluated & technologically affordable.

On 31st, August 2005 Government of West Bengal promulgated the *"Ground Water Resource (management, control and regulation) Act 2005,"* which came into force from **1st August,2006**.

Rules of the GWR Act

According to the rules of the act, 1) to sink a tube well for abstraction of ground water by machine- pump; user has to obtain a "***Permit***" from the Authority. Any tube well sunk after 15th September, 2005 or to be sunk will be categorized as new well. 2) Tube wells in operation prior to 15thSeptember, 2005 are categorized as old tube well and subject to "***Registration***". Recusant attitude to observe the act may cause to penalty.
Three authorities and Appellate authority are constituted to deal with and administer the act towards implementation.

Constituted Authority	Jurisdiction	Head of the Authority	Members
State Level Authority(SLA)	State of W.B. area; for above 50 m^3/ hr or 100m^3/hr(KMC) capacity.	Chairman; Director,SWID	18 + Invitees; Memb.Sec.Supdt. Geologist;SWID
District Level Authority(DLA)	District including municipalities; Proposal up to 50^3/hr capacity	Chairman, District Magistrate	20, Memb.Sec. Supdt Geologist, SWID
Corporation Level Authority(CLA)	Kolkata Municipal Corporation area; up to 100m^3/hr capacity	Chairman, Commissioner, KMC	9 + Invitee, Memb.Sec, Supdt. Geologist, SWID
Appellate Authority	For the above three	Joint Secretary to Govt of W.B. of WRI&D Deptt. authorised by the Secretary,WRI&DD	

Registration proposals may be disposed of by the DLA and CLA unless there is any special circumstance to be an agenda of SLA.

Non-refundable fee structure has been introduced for obtaining **permit** of the authority.

Fee Structure:

Capacity of well	Application fee in Rs	One time certificate fee in Rs
Upto 30 m^3/hr	500.00	1000.00
30 – 50m^3/hr	1000.00	2000.00
50 – 100m^3/ hr	1500.00	3000.00
Above 100 m^3/hr	2500.00	5000.00

- Application forms for Permit (Form No- 1) are issued from the office of the Member Secretaries.
- Application forms for Registration (Form No – 6) are issued from local B.D.O. offices at districts and KMC office at Kolkata.
- Fee for appeal ranges from Rs500/- to Rs.2500/- compared to application fee.

GWR(MCR) Act and Economic Use of Water

Section 6 of the act attributes to the holistic objectives for judicious conservation and economic use of the groundwater. The act vests the responsibility and task of managing every aspect of ground water to deal with the applications of Permit and Registrations for sanction or rejection. 1) Authority organizes mass awareness programs to propound the necessity of conserving ground water by economic use to irrigation, domestic and Industrial needs. Managerial role of the act are explained to the stake holders.2) Authority proposes for peoples participations for efficient use of ground water. 3) Authority frames need based local policies to restrict rampant abstraction of ground water. 4) Authority frames effective guidelines to ensure minimum extraction in and around "*groundwater stressed areas*".5) Authority takes up surveillance program on falling water level & quality deterioration, through nodal offices of SWID.

While scrutinizing the applications the following information are examined and evaluated after classifying the applications for a) irrigation b) urban & infrastructural development & 3) Industrial needs.

Irrigation purpose The demand is evaluated in the context of holding size, crop type and standard crop water requirement, irrigation practice and transmission loss nature and storage capacity of the dynamic aquifer, yield capacity of the aquifer, spacing between mutually operating wells and transmissivity of the producing aquifer, regional specific yield , SOD & category of the assessment unit, and quality of water.

Urban Development Applications are scrutinized on per capita drinking need as per standard schedule for city/urban/ semi- urban/ rural areas, domestic need & management to recycle gray waste water, scope for Roof Top Rain Water Harvesting, pool harvesting, and scope to recharge the producing aquifer besides the scope to minimize the use of ground water by use of surface water supply. In bigger metropolis, like Kolkata where KMC surface water supply is available, the use of ground water is largely pruned. Above all, pricing of water supply, for effective alertness of the user, is being introduced for metropolis.

Industrial Use Applications are examined on the basis of type of industry and standard requirement for per metric ton of production, requirement at different phases like establishment, commissioning, operational phases, recycling of effluent , scope for recharge and replenishment of aquifer, impact to peripheral areas and scope of availing surface water.

The brief discussion gives an idea about the measures for economic use of ground water, which are implied with the activities towards implementing the GWR (MCR) Act- 2005. But the authority is certainly at the threshold of the challenge to introduce a popular managerial system because the galloping population growth has no limit to indicate about the future water demand Major stake holders traditionally cherish the idea that "ground water is a democratic resource" and no authority can deny their right over that resource. However, the program of implementing the act is envisaged with a peoples' friendly approach. Awareness campaigns are conducted in different districts. Response of the mass is encouraging. The farmers of the south Bengal have the worst experience of declining water levels and consequences of water conflict. So, it is expected that they will respond to the discipline and managerial aspects of the ground water act, for sustainable development and better future.