PURBA MEDINIPUR DISTRICT AT A GLANCE

Sl. No.	Items	Statistics
1.	**GENERAL INFORMATION**	
	i) Geographical Area (Sq. km.)	3966
	ii) Administrative Division (as on 2001)	
	• No. of Subdivision	4 nos.
	• No. of Blocks	25 nos.
	• No. of Municipalities	2 nos.
	• No. of inhabited villages	2957 nos.
	iii) Population (as on 2001 Census) (with density of population)	44,17,377 (1028 per sq.km.)
	iv) Normal Annual Rainfall (mm)	1640
2.	**GEOMORPHOLOGY**	
	Major Physiographic Units	Alluvial terrain with deltaic plain & coastal tract
	Major Drainages	River Kasai, Kalaghai, Rupnarayan and Hugli etc.
3.	**LAND USE (Sq.km.) (as on 2004-05)**	
	a) Forest Area	9.00
	b) Area under non-agricultural use	906.30
	c) Net Area Sown	2975
4.	**MAJOR SOIL TYPES**	Mainly alluvial soils with saline soil, saline alkali soil & degraded alkali soil in coastal tract.
5.	**AREA UNDER PRINCIPAL CROPS (Sq.km.) (As on 2004-05)**	Total Food Grains :5187.0 Total Oilseeds : 220.00 Total Fibre : 560.00 Total Miscellaneous Crops: 278.00
6.	**IRRIGATION BY DIFFERENT SOURCES (Areas & No. of Structures)**	
	Tube wells	425.59 sq. km. area irrigated through 15300 STW and 45.87 sq. km. area irrigated through 293 DTW
	Surface Flow	72.19 sq.km. area irrigated through 547 nos. of Surface flow .
	Surface Lift (RLI)	287.41 sq. km. area irrigated through 26347 nos. of RLI.
	Actual area irrigated by GW	471.46 sq.km
	Actual area irrigated by SW	359.60 sq.km
	Total Irrigated Area	831.06 sq.km.
7.	**NUMBERS OF GROUND WATER MONITORING WELLS OF CGWB (As on 31.03.07)** No. of Dug wells No. of Piezometers/ Tube wells	**37** 1 36
8.	**PREDOMINANT GEOLOGICAL FORMATIONS**	Recent alluvium underlain by older alluvium & Tertiary sediments.
9.	**HYDROGEOLOGY**	
	➢ Major Water bearing formation	Quaternary alluvium and Tertiary sediments
	➢ Pre-monsoon depth to water level during 2006	3.05 to 16.34 m bgl in in piezometers
	➢ Post-monsoon depth to water level during 2006	2.71 to 11.63 m bgl in in piezometers
	➢ Long term water level trend in 10 years (1997-2006) in m/yr	Falling trend of water level (0.06m/yr to 0.60m/yr has been observed in Potashpur I&II, Egra I & II, Bhagawanpur I & II, Moyna, Panskura I & II and all the coastal blocks ,
10.	**GROUND WATER EXPLORATION BY CGWB (As on 31.03.07)**	
	No. of wells drilled	79
	Depth Range (m)	Maximum depth drilled 350m bgl

	Discharge (lps)	1lps to 24 lps
	Storativity (S)	$1.3 X10^{-4}$ to $9 X10^{-4}$
	Transmissivity (m^2/day)	434 to 4000m^2/d
11.	**GROUND WATER QUALITY**	
	Presence of Chemical constituents more than permissible limit	Iron & Chloride
	Type of water	Na-Ca-Cl-HCO_3 to Na-Ca-Mg-HCO_3 type
12.	**DYNAMIC GROUNDWATER RESOURCES in mcm**	
	Annual Net replenishable GroundWater Resources available	7.434
	Gross Annual Ground water draft **a) For Irrigational use** **b) For domestic & industrial use**	2.882 2.6034 0.2847
	Projected Demand for domestic and Industrial uses upto 20-25	0.3965
	Stage of Ground Water Development	38.85
13.	**AWARENESS AND TRAINING ACTIVITY**	
	Number of Mass Awareness programme organised	2
	Number of Water Management Training programme organised	1
14.	**EFFORTS OF ARTIFICIAL RECHARGE AND RAIN WATER HARVESTING**	
	Projects Completed by CGWB (No. and amount spent)	Nil
	Projects under technical guidence of CGWB (nos)	Nil
15.	**GROUND WATER CONTROL AND REGULATION**	
	No. of over-exploited blocks	Nil
	No. of Critical Blocks	1
	No. of Blocks notified	1
16.	**MAJOR GROUND WATER PROBLEMS AND ISSUES**	1. Salinity problem in coastal tract 2. Iron conc. in ground water beyond permissible limit 3. Declining trend of water level

NAME OF THE DISTRICT: PURBA MEDINIPUR

1.0 INTRODUCTION

Location and Administrative details :

Purba Medinipur district lies between north latitudes 21° 36' 35" and 22° 57' 10" and east longitudes 86° 33'50" and 88°12' 40" and covers an area of 3966Sq. Km (2004-05). The district is bounded by Paschim Medinipur in the north and west, Bay of Bengal in the south, state of Orissa in the south west and Hugli river in the east (Plate-I). The district has got 4 sub- divisions eg. Tamluk sub-division, Haldia sub-division, Egra sub-division and Contai sub-division, 25 blocks, 17 panchayat samities, 223 gram panchayat, 2957 villages, 2 municipalities. The district headquater is at Tamluk

Ground water basin :

The district is located in the part of lower deltaic part of the Ganga basin .

Population :

Population with density of population: 44,17,377 & 1028 per sq.km. (as per 2001 census).Percentage of Male and female population are 51.35 and 48.65 respectively. Percentage of Rural and Urban population is , 91.71and 8.29 respectively. Scheduled Castes population is 638997 (14.46% of total) and Scheduled Tribes population is 26507 (0.60% of total)

Land use :

The land use pattern of the district is as follows (Table-1)

Table-1 Land use pattern for 2004-2005.

Total geographical area	396600 (ha)
Area under forest	900 (ha)
Area under Non-Agri use	90630 (ha)
Barren & Unculturable land	16600 (ha)
Permanent Pasture & other grazing land	10 (ha)
Land under Misc. tree groves not included in net area sown	3300 (ha)
Culturable Waste Land	370 (ha)
Fallow land other than current fallow	120 (ha)
Current fallow	2110 (ha)
Net area Sown	297500(ha)

Studies of C.G.W.B :

CGWB has completed systematic Hydrogeological survey and continuing Groundwater Management Studies. Apart from this, Groundwater Exploration has been carried out to delineate the aquifer geometry and to know the aquifer characteristics Special attention has been given to identify the deeper aquifers and construction of tubewells adopting cement sealing techniques.

2.0 RAINFALL & CLIMATE

Rainfall :

Normal rainfall of the district is 1640mm of which monsoon rainfall for 4months from June to September contributes 71.5%. Normal monsoon rainfall is 1173mm and normal non-monsoon rainfall is 467mm.

Climate :

The district experiences a humid sub- tropical type of climate with minimum and maximum temperature varying from 9°C in the winter to 38°C in summer respectively. Highest temperature recorded in June1998 was 40°C and lowest temperature recorded in January2001 was 8°C.Relative humidity varies from 52-88% being maximum in the month of August.

Drianage :

The major rivers are Kasai ,Kaliaghai, Rupnarayan and Hugli(Bhagirathi/Ganga) . The Kasai river flowing from the north passes through Panskura town, the industrial township of Haldia etc. Kasai river, at its lower stretch, down from its confluence with Kaliaghai river, known as Haldi river which ultimately joins with the Hugli river near Haldia Anchorage Point. Rupnarayan river, which flows by the eastern border of the district of Hugli and Haora for its stretch of its course. Mighty Hugli river, to which the Rupnarayan disgorges near Geonkhali, passes by the extreme southeastern part of the district, on its journey to Bay of Bengal.

3.0 GEOMORPHOLOGY & SOIL TYPE

Geomorphology :

The district is characertised by gently slopping flat alluvial terrain, which gradually merges to deltaic plain to wards farther south. The elevation of land mass ranges from 10 m above mean sea level in the northern part to 3 to 4m above mean sea level in the coast, after that the land gradually dips into the Bay of Bengal.In the vicinity of coast falling in Ramnagar and Contai blocks a series of sand dunes stretching ENE-WSW direction are present, which are indicative of palaeo shoreline.

Soil :

Major part of the district is covered by alluvial soil except a narrow belt along the sea coast in the extreme south where saline soil, saline alkali soil, non saline alkali soil and degraded alkali soils developed.

4.0 AGRICULTURE AND IRRIGATION PRACTICES

Agriculture :

The fertility of the soil helps different types of crops to grow in Purba Medinipur district. The area under different crops, their production and yield rate for the year 2001-02 is given in the following. (Table-2)

Table-2 Area under different crops and produc tion

Sl No	Crops	Area under Principal Crops (In thousand hectares)	Production of Principal Crops (In thousand tonnes)	Yield rate of Principal Crops (Kg/Hectare)
1	2	3	4	5
1	Foodgrains	518.7	1280.2	2468
2	Rice	510.6	1269.6	2487
a	Aus	25.9	58.7	2270
b	Aman	333.9	754.2	2259
c	Boro	150.8	456.7	3027
3	Wheat	0.6	1.3	1929
4	Maize	<0.05	<0.05	1778
5	Pulses	7.5	9.3	1246
6	Oilseeds	22.0	30.0	1365
7	Rape & Mustard	4.2	3.4	809
8	Other Oilseeds	17.8	26.6	1494
9	Fibre	5.6	120.3	21.5
A	Jute	5.4	118.9	22.1
b	Other fibre	0.2	1.4	5.6
10	Miscellaneous crops	27.8	493.4	17748
11	Potato	22.1	488.0	22074
12	Chillies (dry)	4.4	3.6	828
13	Ginger	1.3	1.8	1415

Source: District Statistical Hand Book 2002, Bureau of Applied economics & Statistics, Govt. of West Bengal.

Irrigation practices :

Both surface as well as subsurface water is being used for irrigation in the district. The irrigation potential created and the actual area irrigated as evaluated under Third M. I. Census conducted by Govt of West Bengal in 2000-2001 is as follows (Table-3)

Table –3 Mode of irrigation from different sources

Block	Shallow tubewell			Deep tubewell			Surface flow			Surface lift		
	No	Irrigation potential (ha)	Actual area Irrigated (ha)	No	Irrigation potential (ha)	Actual area Irrigated (ha)	No	Irrigation potential (ha)	Actual area Irrigated (ha)	No	Irrigation potential (ha)	Actual area Irrigated (ha)
Total	15300	65263.51	42559.81	293	12239.38	4587.92	547	8134.05	7219.07	26347	41331.98	28741.87

Source: Minor Irrigation Third Census Report during 2000-2001, Govt of West Bengal.

As per the Third M. I. Census ground water development is being done through 15300 nos of shallow tube wells and 293 nos of deep tube wells. But there is a gap between Irrigation potential and actual area Irrigated. There is a shortfall of total 30355.16ha of land (22703.7ha of land in case of shallow tubewells and 7651.46 ha of land in case of deep tube wells). This clearly indicates that the total number of both shallow as well as deep tubewells are not being fully utilized. If all the tubewells are fully utilized then another 30355.16 hectares of land can be easily brought under irrigation.

For agricultural productions, water is being provided either by major irrigation systems or by minor irrigation systems and it comes to about 98.73% of the cultivated area. The major irrigation systems are generally being operated through network of canal system of Mayurakshi River and about 58.13% of the total irrigated lands has been irrigated by canals in 2004-05. The minor irrigation systems are being operated, partly utilizing ground water and partly by lifting water from small water bodies. Area irrigated during 2004-05 through ground water abstraction structures (125 MDTW, 17461 STW and 539 dug wells), surface lift irrigation system, tank and other sources are 50020 ha, 2150 ha, 25400 ha and 54950 ha respectively.

5.0 GROUNDWATER SCENARIO

5.1 Geology :

The district is underlain by unconsolidated alluvium sediments of Quaternary age, which is overlain by linear, continuous beach ridges (sand dunes) along the present day coastline around Digha-Ramnagar- Contai deposited by the wave action of the sea. The thickness of the alluvial sediments increases towards east and southeast following the basin configuration. The Quaternary formation comprises newer alluvium of recent age and older alluvium of Pleistocene age. The older alluvium is restricted to the fringe area of the platform terrain towards west and northwest and is overlain by newer alluvium towards east , south and south east. The older alluvium comprises predominantly of yellow to reddish brown clays with kankar and ferruginous gravel and sand, fine to medium. The newer alluvium consists predominantly of clay with occasional intercalation of silt and fine sand and is light grey in colour. It is restricted to the coastal tract and marginal alluvium plains. The Quaternary sediments are underlain by semi-consolidated Tertiary sediments of Mio-Pliocene age. The Tertiary sediments comprise of alternations of graded sand-silt-clay sequence suggesting cyclic sedimentation. In contrast to Quaternaries, the Tertiaries are grey in colour with deeper lithofacies being steel grey.

The subsurface correlation diagram prepared from the existing borehole data (Plate-II) indicates that there is lateral facies variation often resulting in the coalescing of granular zones and / or their gradation into silty/ clayey beds towards east, south and southeast. The top of the Tertiary sediment is generally represented by ' grey clay'. This grey clay bed is persistent throughout the area and is considered as 'marker bed' which separates the upper litho system (Quaternary sediments) and lower litho system (Tertiary sediments). The quartzo-feldspathic unconsolidated Quaternary sediments vary considerably in thickness from 120m in the west to over 150m in the east and from 150m in the northwest to over 180m in the southeast. It is predominantly arenacious in the north and northwest to mostly argillaceous in the south and southeast. The thickness of the newer alluvium varies between 10 and 60m in the northwest – southeast direction. The thickness of older alluvium varies between 50m in the northwest to over 90m in the southeast direction. The newer alluvium is devoid of any significance granular zones.

The semi-consolidated Tertiary sediments are most extensive and underlie the entire alluvial as well as coastal plains. The thickness of the Tertiary formation increases towards the coastal area being more than 300m.The depth of occurrence of different stratigraphic units as established by ground water exploration under Kasai-Subarnarekha Project (UNDP) is as follows (Table-4).

Table-4 **The depth of occurrence of different stratigraphic units**

Location	Depth of borehole (m bgl)	Quaternary sediments		Tertiary sediments	Remarks
		Newer alluvium	Older alluvium		
Negua	420.97	GL – 18.00	18.00- 57.00	57.00 - >420.90	Basement rock not encountered.
Sarasankha	413.62	GL – 23.00	23.00 – 66.00	66.00 - >413.62	-Do-
Bhagawanpur	250.00	GL – 10.00	10.00 – 67.00	67.00 - >250.00	-Do-
Kapasaria	400.00	GL – 54.00	54.00 – 118.00	118.00 - >400.00	-Do-
Narghat	249.55	GL – 18.00	18.00 – 70.00	70.00 - >249.55	-Do-
Contai	400.55	GL – 70.00	70.00 – 172.00	172.00 - >400.55	-Do-
Shankarpur	251.00	GL – 68.00	68.00 – 110.00	110.00 - >251.00	-Do-
Junput	251.00	GL – 65.00	65.00 – 107.00	107.00 - >251.20	-Do-
Haldia	304.64	GL – 90.00	90.00 – 150.00	150.00 - >304.64	-Do-
Khejuria	401.37	GL –109.00	109.00- 211.00	211.00 - >401.37	-Do-

5.2 Hydrogeology :

The Quaternary sediments is underlain by Tertiary sediments as mentioned earlier (Table-7). A 30-50m thick blanket of clay at the top is underlain by sand-clay sequence down to explored depth of 400m bgl. Ground water in the district occurs under semi-confined to confined condition in both the litho systems. In general the area is underlain by a single aquifer in each litho system, which splits up into multiple aquifers with the intervening clay/sandy clay layers. In Quaternary sediments this single aquifer has been spilted up into two regionally extensive aquifers whereas in Tertiary sediments four such regionally extensive aquifers has come out from the single aquifer (Plate-II)

Depth To Ground Water Level :

Depth to piezometric surface in these aquifers varies from 2.71 to 16.34 m bgl in pre monsoon period and from 3.05 to 11.63 mbgl in post monsoon period. Flow of ground water is from NW to SE with a gradient varying from 0.44m/km to 0.10m/km .

Aquifer Parameters :

Aquifers in both the litho- systems are being recharged in the western platform area. The laterite cover in the platform area in the Northwest plays a vital role in recharging the lower litho- system by direct vertical infiltration and also the older alluvium in the upper litho system by lateral flow of ground water.

The yield of tube well in Panskura –Tamluk blocks is generally about 200m^3 /hr with a drawdown of 4-6m whereas in Sutahata – Mahishadal block the yield of tube wells tapping 30-40m aquifer within 120-300m depth vary between 100-200m^3 /hr for a drawdown of 5-18m and at Haldia the yield of tube well tapping 23m of granular zone within the depth of 187 – 228m is only 91 m^3 /hr. The tranmissivity (T) of the aquifers varies from 434 – 4000m^2 /day with storativity (S) varying from1.3- 9 X10 $^{-4}$.

Long Term Water Level Trend :

The ground water levels monitored for the period from May,"76 to May,"04 has been analysis and the trend of ground water level determined. The trend of ground water level indicates a falling trend in the blocks of Postaspur, Egra-I&II, Sutahata- I&II, Bhagwanpur-I&II, Contai- III, Moyna , Panskura, Tamluk-I,Ramnagar and Mahishadal. The decling trend varies from 0.06m/yr in Mahishadal to 0.607m/yr in Potashpur.

5.3 Groundwater Resources:

The resource for the blocks (9 nos) falling in the northern part of the district excluding coastal blocks are evaluated jointly by CGWB, ER, Kolkata and SWID, Govt of West Bengal, Kolkata following the GEC 1997 methodology. Net ground water resources available, gross ground water draft etc for the above blocks are given in the following table-5

Table-5 Dynamic Ground water resource in Blocks under Unconfined condition

Sl No	Block	Area In hectare	Net Ground Water availability (ham)	Gross Ground Water draft for all uses (ham)	Stage of ground water development (%)	Category
1	Bhagawanpur-I	17995	7852.84	3183	40.53	Safe
2	Bhagawanpur-II	17786	7086.09	1718	24.25	Safe
3	Egra-I	21480	9832.24	5709	58.06	Safe
4	Egra-II	21888	8990.86	2730	30.36	Safe
5	Moyna	14700	6407.25	1401	21.86	Semi-Critical
6	Panskura-I	24468	10017.35	2824	28.19	Safe
7	Panskura-II	15277	7244.33	1334	18.41	Safe
8	Potashpur-I	17169	7998.96	4286	53.58	Safe
9	Potashpur-II	18811	8910.93	5697	63.93	Safe
	Total	169574	74340.84	28882	38.85	

Since ground water in the coastal area occurs under semi-confined to confined condition in both the litho systems and receives recharge from a distant area, the exact amount of recharge is difficult to determine. However, an attempt were made by earlier workers to evaluate the quantum of sub-surface outflow of ground water through the deeper confined aquifers in the coastal blocks which are as follows (Table-6)

Table-6 Sub-surface outflow of ground water in coastal blocks

Block	Average Transmissivity (T) (m^2 /day)	Average Hydraulic gradient. (I)	Maximum length of flow path (L) (Km)	Annual ground water flow Q=TIL in MCM
Tamluk (I & II)	2000	1: 3294	20.27	4.492
Mahishadal (I & II)	2000	1: 5068	16.22	2.336
Sutahata (I & II)	2000	1:4300	17.74	3.012
Nadigram (I, II & III)	2000	1: 5447	17.74	2.377
Khejuri (I &II)	2000	1: 6000	14.19	1.726
Contai (I, II & III)	2000	1: 5068	26.35	3.795
Ramnagar (I & II)	2000	1:6586	21.79	2.415
Total	-	-	-	20.15

A total of 20.15MCM of ground water is flowing away from the deeper confined aquifers in the 16nos of blocks situated in the coastal belt.

5.4 Ground Water Quality :

The chemical quality of ground water as determined from the analysis of water samples collected during various hydrogeological studies including the studies conducted under Kasai- Subarnarekha (UNDP) Project as well as monitoring of National hydrograph Net Work Stations. The range of different chemical constituents present in ground water in different geological formations is as follows
(Table-4).

Table-4 Range of concentration of chemical constituents (in mg/l) in pre and post monsoon periods in Upper and Lower Litho systems

Chemical constituents	Alluvial area				Coastal area			
	Upper litho units		Lower litho units		Upper litho units		Lower litho units	
1	2	3	4	5	6	7	8	9
	Pre-monsoon	Post monsoon	Pre-monsoon	Post monsoon	Pre-monsoon	Post monsoon	Pre-monsoon	Post monsoon
PH	6.92-9.02	7.6-9.88	7.53-8.7	7.6-9.46	7.35-8.47	8.17-8.31	7.44-8.45	7.15-8.29
EC in Micro mohos/cm at 25° C	46-1418	104-804	160-663	191-561	211-830	202-805	272-1990	284-1463
Total Hardness	10-175	25-215	7.5-270	15-180	15-230	30-215	85-375	90-290
NO_3	1.1-21	0.3-21	0.04-18	0.5-14	1.1-21.2	2.5-17.2	0.27-6.7	0.71-2.0
F	0.02-0.45	0.11-0.51	0.02-0.55	0.19-0.61	0.03-0.62	0.04-0.24	0.05-0.28	0.12-0.20
Cl	7.1-92	3-94	7-110	11-121	18-160	32-106	7.1-532	25-479
SO_4	0.09-16	<1-7	0.40-52	5-40	1.5-30	6-20	<1-152	<1-28
CO_3	9-15	6-18	6-24	6-30	6-96	3-12	24-30	6
HCO_3	43-311	24-354	18-500	61-195	24-228	55-226	73-465	134-354
Ca	2-60	5-54	Nd-54	Nd-40	8.4-64	4-60	8-64	16-72
Mg	0.6-19	4.86-19	<1-19	2-18	1.2-25	4.6-25.5	7.3-58	9.7-27
Na	2.4-82	9.8-400	11-74	10-83	30-138	31.5-100	25-375	18.25-350
K	0.9-16.5	1.6-16.5	2.1-10	2-9	1.2-54	0.08-12.5	2.5-16	2.8-9.5
Fe	0.01-0.54	0.051-0.278	0.004-0.888	0.015-0.27	0.003-0.453	0.002—0.21	0.005-0.212	0.04-0.24
SiO_2	0.2-19	1-4.5	0.2-39	2-26	0.5-37	1-20	1-36	2.4-24
Br	0.25-27	0.1-2.9	0.07-1.15	0.07-1.0	0.26-46	0.18-36	0.27-6.7	0.71-2
I	0.02-0.06	0.01-0.05	0.01-0.18	0.01-0.64	0.01-2.3	0.01-0.66	0.01-0.06	-
B	0.01-0.44	0.01-0.2	0.01-0.37	0.01-0.21	0.03-0.81	-	0.06-0.25	-

The analytical data indicates that ground water in upper litho system indicates Ca- Mg- HCO_3 types in alluvial plain and mixed type in coastal plain but ground water in the lower litho system in both the areas shows variation in the quality. Ground water in both the litho systems are neutral to mildly alkaline in alluvial area and mildly alkaline to distinctly alkaline in coastal area. All the chemical constituents are in general within permissible limit for human consumption except the occurrence of iron, which exceeds the permissible limit in some places. As for irrigational purposes ground water in the district is in general suitable except in the southeastern parts from Tamluk to Chranjibpur where sodium hazards are anticipated, which requires a little treatment.

The most striking and interesting area from quality point of view is that fresh ground water in coastal area occurs within a depth span of 120-300m bgl. The upper aquifers within 120mbgl contain saline water and the chloride concentration ranges from 2000- 6000 mg/l. In Contai sub basin (around Contai town) covering approximately 150 sq.km besides, the near surface aquifer 5 to 12m thick, there are three to four distinct aquifers within a depth of 250mbgl in the sub-basin and all theses horizons contain saline water (Plate-II). Here the brackish/fresh water interface does not show any deteriotion in quality with time, which is suggestive of poor flushing.

in Digha-Ramnagar area the sand dunes in the coastal area formed by sea contain fresh ground water. The dune sand alternating with thin clay and gravelly clay bed down to a depth of 6-8mbgl forms near surface aquifer. The top thick clay bed of the coastal aquifers as discussed above underlies this near surface aquifer. The near surface aquifer emerges under the sea on the continental shelf, thus sea water having easy access into this aquifer. The general gradient of the near surface aquifer is towards sea, but it was found that minor movements of the saline-fresh water contact were due to to and fro movement of the sea and further controlled by the ocean tides.

5.5 Status of Groundwater Development (Blockwise):

Status of ground water occurrences and aquifer potentialy is presented in Table 5.

Block	Tentative AquiferZones in m bgl	Aquifer Potentiality & Chemical Quality
1. Tamluk	44-48, 62-64, 86-90, 137-149,161-173, 216-228	Upper aquifer within 120mbgl is brackish/ saline.Potential fresh aquifer is below 120 m bgl. Aquifer is under Confined condition. HDTW tapping granular zone of 30-40m within depth of 300mbgl yield 100-200 m^3/hr. T values range 400-2000 m^2/day S values range1.4X10^{-4} to 9.0X10^{-4} Ground water is Na-Ca-Cl-HCO_3 Type
2.Sahid Matangini	44-48, 62-64, 86-90, 137-149,161-173, 216-228	
3. Mahishadal	56-62, 137-143, 150-156, 183-189, 213-222, 240-252, 257-263,330-346 T 357 m^2/day, S 4.9X10^{-5}	
4..Nandakumar		
5. Sutahata	55-64, 102-108, 116-121, 130-136,155-160, 164-170, 177-183, 203-225. T 789 m^2/day	
6. Haldia	55-64, 102-108, 116-121, 130-136,155-160, 164-170, 177-183, 203-225.	
7. Nandigram I	50-60, 226-228, 236-254, 265-280,	
8.Nadigram II		
9. Nandigram III	50-60, 226-228, 236-254, 265-280,	
10. Khejuri I	50-60, 226-228, 236-254, 265-280, T 2444 m^2/day S 6.8X10^{-2}	
11. Khejuri II	54-56, 226-228, 236-254, 265-280,	
12. Contai I	4-12, 30-50, 60-80,130-136, 140-146,190-197, 210-216,Contai Municipal area is on dune sand where fresh ground water only found in dune sand witin depth of 15m and below this ground water is brackish down to depth of 250mbgl	Upper aquifer within 120mbgl is brackish/ saline.Potential fresh aquifer is below 120 m bgl.Aquifer is under Confined condition. HDTW tapping granular zone of 30-40m within depth of 300mbgl yield 100-150 m^3/hr.T values range 300-1800m^2/day S values range 1.4X10^{-4} to 9.0X10^{-4}
13. Contai II		
14. Contai III		
15. Ramnagar I	6-8, 40-55, 60-80,130-136, 140-146,190-197, 210-216,	Ground water is fresh in Dune sand down to depth of 12mbgl Upper aquifer within 120mbgl is brackish/ saline.Potential fresh aquifer is below 120 m bgl.Aquifer is under Confined condition. Ground water is Na-Ca-Mg-HCO_3-Cl Type
16. Ramnagar II		
17. Bhagawanpur I	20-50, 68-71, 89-92, 140-146, 167-170, 218-221.	Upper aquifer is unconfined to semiconfined condition. 20-100mbgl tapped by LDTW having yield 15-30 m^3/hr, HDTW tapping cumulative thickness of 30m within depth of 180m having yield of 60-150m^3/hr
18. Bhagwanpur II	68-71, 89-92, 140-146, 167-170, 218-221.	
19. Egra I	38-52,110-120, 125-147, 150-170, 177-188,	
20. Egra II		
21. Moyna	68-71, 89-92, 140-146, 167-170, 218-221.	
22. Panskura I	44-48, 62-64, 86-90,137-149,161-173, 216-228	
23. Panskura II		
24. Potashpur I	38-52,110-120, 125-147, 150-170, 177-188,	
25. Potashpur II		

GROUND WATER DEVELOPMENT STATUS IN PURBA MEDINIPUR DISTRICT, WEST BENGAL

Block	Existing GW Structures and their IP potential in ha					Irrigation Potential from SW in ha					Total IP created from GW + SW in ha	Percentage of GW irrigation w.r.t total Irrigation	Percentage of SW irrigation w.r.t total Irrigation	GW Development Status	Remarks
	STW	IP created in ha	DTW	IP created in ha	Total IP Created from GW in ha	Surface Flow	IP created in ha	Surface Lift	IP created in ha	Total IP created from SW in ha					
1. Tamluk	13	71.68	19	776.00	847.68	195	2386.30	2093	3064.90	5451.20	6298.88	13.46	86.54	-	GW in confined aquifer
2.Sahid Matangini	0	0.00	14	594.00	594.00	60	1095.30	1794	4195.90	5291.20	5885.20	10.09	89.91	-	GW in confined aquifer
3. Mahishadal	59	486.20	5	140.00	626.20	103	2357.56	5622	4366.98	6724.54	7350.74	8.52	91.48	-	GW in confined aquifer
4..Nandakumar	13	71.50	3	100.00	171.50	29	517.80	3003	5672.87	6190.67	6362.17	2.70	97.30	-	GW in confined aquifer
5. Sutahata	0	0.00	0	0.00	0.00	0	0.00	679	2544.84	2544.84	2544.84	0.00	100.00	-	GW in confined aquifer
6. Haldia	0	0.00	1	68.00	68.00	75	416.49	1300	1854.80	2271.29	2339.29	2.91	97.09	-	GW in confined aquifer
7. Nandigram I	2	26.98	0	0.00	26.98	0	0.00	1417	388.80	388.80	415.78	6.49	93.51	-	GW in confined aquifer
8.Nadigram II	22	154.28	0	0.00	154.28	0	0.00	255	109.87	109.87	264.15	58.41	41.59	-	GW in confined aquifer
9. Nandigram III	236	1259.82	0	0.00	1259.82	39	17.26	164	729.86	747.12	2006.94	62.77	37.23	-	GW in confined aquifer
10. Khejuri I	38	162.04	0	0.00	162.04	0	0.00	545	102.98	102.98	265.02	61.14	38.86	-	GW in confined aquifer
11. Khejuri II	161	1312.52	0	0.00	1312.52	0	0.00	727	200.69	200.69	1513.21	86.74	13.26	-	GW in confined aquifer
12. Contai I	464	1566.92	3	60.00	1626.92	1	0.20	715	596.41	596.61	2223.53	73.17	26.83	-	GW in confined aquifer
13. Contai II	115	348.20	0	0.00	348.20	0	0.00	3084	8516.45	8516.45	8864.65	3.93	96.07	-	GW in confined aquifer
14. Contai III	187	973.71	1	20.00	993.71	0	0.00	1849	1005.71	1005.71	1999.42	49.70	50.30	-	GW in confined aquifer
15. Ramnagar I	507	2737.36	1	20.00	2757.36	0	0.00	21	67.88	67.88	2825.24	97.60	2.40	-	GW in confined aquifer
16. Ramnagar II	508	2717.15	0	0.00	2717.15	0	0.00	1270	600.00	600.00	3317.15	81.91	18.09	-	GW in confined aquifer
17. Bhagawanpur I	707	3373.85	100	2260.00	5633.85	0	0.00	691	296.79	296.79	5930.64	95.00	5.00	40.53%	GW in unconfined aquifer
18. Bhagwanpur II	780	6542.33	8	466.00	7008.33	0	0.00	111	41.94	41.94	7050.27	99.41	0.59	24.25%	GW in unconfined aquifer
19. Egra I	2987	9190.02	21	1720.48	10910.50	0	0.00	364	75.72	75.72	10986.22	99.31	0.69	58.06%	GW in unconfined aquifer
20. Egra II	1321	6417.23	14	985.64	7402.87	2	10.00	2	45.00	55.00	7457.87	99.26	0.74	30.36%	GW in unconfined aquifer
21. Moyna	518	1792.25	12	360.00	2152.25	3	12.01	191	1051.17	1063.18	3215.43	66.94	33.06	21.86%	GW in unconfined aquifer
22. Panskura I	1142	6226.51	26	1350.16	7576.67	9	132.67	106	1535.96	1668.63	9245.30	81.95	18.05	28.19%	GW in unconfined aquifer
23. Panskura II	205	2279.70	34	1238.82	3518.52	30	1187.86	297	3564.04	4751.90	8270.42	42.54	57.46	18.41%	GW in unconfined aquifer
24. Potashpur I	2245	8359.21	16	1124.28	9483.49	0	0.00	41	692.57	692.57	10176.06	93.19	6.81	53.58%	GW in unconfined aquifer
25. Potashpur II	3070	9190.71	15	956.00	10146.71	1	0.60	6	9.85	10.45	10157.16	99.90	0.10	63.93%	GW in unconfined aquifer
TOTAL	15300	65260.17	293	12239.38	77499.55	547	8134.05	26347	41331.98	49466.03	126965.58	61.04	38.96		

6.0 GROUND WATER MANAGEMENT STRATEGY

6.1 Groundwater Development :

Since ground water in the district occurs under semi-confined to confined condition, ground water in the district is being developed by shallow and deep tube wells. A total of 15300 nos of low duty shallow tube wells and 293 nos of medium to heavy duty deep tube wells are present in the district. In Digha-Ramnagar area the sand dunes in the coastal area formed by sea contain fresh ground water. These sand dunes alternating with thin clay and gravelly clay bed down to a depth of 6-8mbgl form near surface aquifer and this near surface aquifer is being developed by hand pump fitted shallow tubewells for domestic water supply.

In area other than coast out of 9 nos of blocks, 6nos of blocks fall under safe category where net ground water resource available is 52994.66 ham and the stage of ground water development varies from20% to 61%. These blocks barring Bhagawanpur-I&II and Moyna still hold scope for further ground water development through low to medium duty shallow tube wells, cavity wells and medium to heavy duty deep tube wells down to a depth of 200m bgl.Pre monsoon falling trend (> 5cm/yr) and post monsoon falling trend ((within –5cm/yr to +5cm/yr) has been noticed in the all the 6nos of blocks mentioned above, which indicates that careful and judicious approach is very much required to exploit the available net ground water resource.

The falling trend of ground water level generally indicates that development has started exceeding the available ground water resource. The distance between two heavy duty tubewells vary from 600-750m depending upon the local hydrogeological condition and the distance between two low duty tubewells may be kept as 200m depending upon the area of irrigation. The close cluster of low duty tubewells, sometimes heavy duty tubewells within or in close proximity of the cluster, where the safe distance criteria is ignored, also results in overexploitation of ground water. The exact reason for falling trend is necessary to be determined first and depending upon the result further ground water development may be taken.

a) In coastal blocks Tamluk- I, Mahishadal –I, Sutahata –I&II and Contai –III show declining trend (>5cm/yr) in both pre monsoon and post monsoon period but Ramnagar shows only pre monsoon falling trend (>5cm/yr). This indicates that ground water draft in Tamluk-I, Mahishadal –I, Sutahata –I&II and Contai –III blocks has exceeded the subsurface outflow of ground water through the deeper aquifers. Hence further ground water development needs careful consideration and with restriction.

b) Ground water development in the rest of the coastal blocks needs to be done very cautiously and logically considering the quantum of subsurface outflow through the deeper aquifers. Over exploitation of ground water from the deeper fresh water aquifer will create inequilibrium condition with the overlying and underlying saline aquifers, which may invite saline water into the fresh water aquifer.

c) Ground water development in the coastal area needs specially designed tube wells. The design of the tube wells will be as follows.

TubeWell design:

In the area other than coastal part both shallow tube wells and deep tube wells are feasible but in coastal area only deep tube wells are suitable. Where there is no such quality problem in ground water simple tube well design will serve the purpose, but in the coastal area having a specific salinity problem in ground water a special type of well design is required. In coastal area the fresh ground water bearing aquifers are overlain by saline aquifers from the surface. A thick clay layer separates these two saline and fresh water aquifers. In order to protect the fresh water aquifer from saline water in the overlying aquifer these two aquifers need to be separated. In the tube design the fresh and saline zones are to be separated by **Cement Sealing** .The aim of this technique is to place properly mixed cement slurry against the impervious layer, between the casing and the wall of the borehole, either by gravity or by pump. Practically, it is filling the openings principally to retain the impervious character so that there is no seepage from the top to the lower aquifer. After lowering of the well assembly in the reamed bore hole the annular space between the well assembly and the borehole is to be shrouded with pea gravel upto the middle part of the clay bed occurring on the top of the fresh water bearing aquifer. **On the top of this shrouded gravel the cement sealing is to be done against the clay bed.** The thickness of the cement sealing will be generally 3m. The cement slurry consists of ordinary / quick settling cement and water. A little clay is added in cement water mix to improve the sealing properties. 40 kg of cement should be mixed with 18-27 litres of water with a specific gravity of 1.8.About 2to 6 percent of bentonite is added to this slurry to improve its workability. About 30cm of fine sand layer should be placed on the top of the shrouded gravel before grouting operation is carried out. Settling time of 72 hrs for ordinary cement and 30hrs for quick settling cement may be provided and no work is to be done till the cement is fully set.

6.2 Water Conservation & Artificial Recharge :

No structure has been constructed by CGWB so far in this district.

7.0 GROUND WATER RELATED ISSUES AND PROBLEMS

The major problems related to ground water is discussed as below:

1. The ground water resource as evaluated by CGWB and SWID indicates that among the non-coastal blocks Bhagawanpur-I&II and Moyna are falling in the critical category (table-10), where further ground water development is not possible.
2. Among the coastal blocks Sutahata- I&II, Contai- III, Tamluk-I Ramnagar and Mahishadal show falling trend in both pre and post monsoon periods (table-12), where further ground water development is to be done very cautiously.
3. Another problem in ground water development in East Mednipur district is the occurrence of saline water in the near surface shallow aquifer in the coastal zone. The existence of a thick clay bed at the top of the sedimentary sequence and the saline water in the near surface aquifers has restricted the development of ground water in the shallow aquifers in the coastal area. Ground water development in the coastal belt can only be done through deep tube wells. The fresh ground water occurs within the depth of 120 to 300m bgl sandwiched between two saline aquifers. In the area other than coast there is no salinity problem where ground water development can be done by both shallow and deep tube wells. In the coastal belt withdrawal of fresh ground water in excess of recharge may have adverse effect on the ground water regime. Such a case has happened in Haldia Industrial area, the details of which are discussed below.
4. Coastal tracks of East Medinipur district is very much prone to beach erosion which actually disturbs the fresh water aquifers of the sand dunes.

8.0 AWARENESS & TRAINING ACTIVITY

8.1 Mass Awareness Program (MAP) :

A total two no. of mass awareness programme was conducted in this district the details are given below :

Sl..No	Place/ Block	Participants	Theme
1.	Digha /Ramnagar	225	Ground Water Management in Coastal areas and Scope for Rain Water Harvesting
2.	Contai/ Contai (M)	250	Ground Water Management in Coastal areas and Scope for Rain Water Harvesting

8.2 Ground Water Management Training Programme (WMTP) :

One Ground Water Management Training Programme was conducted in this district the detail is given below

Sl..No	Place/ Block	Participants	Theme
1.	Contai/ Contai (M)	17	Ground Water Development and Management with special reference to Rain Water Harvesting

8.3 Exhibition/ Mela/ Fair etc :

Nil

8.4 Presentation and lectures delivered: Delivered lectures by CGWB officers :

Nil

9.0 AREA NOTIFIED BY CGWB/ SGWA

One area (Haldia Industrial Complex area) has been notified . The Haldia Industrial Complex area falls in the coastal plains of Sutahata I and II blocks (presently in Haldia block) of East Medinipur district, West Bengal. The area is bounded by two rivers namely Hugli and Haldi. The rivers of the area are influence by tidal effects due to close vicinity of coastal tracts. As a result river water in Haldia industrial area is brackish to saline in nature. During last three decades, there has been tremendous growth of Industrial development in Haldia Industrial Complex area and ground water use in this area has increased many folds.

Aquifers in this part of the coastal tract are saline to brackish down to the depth of 120 mbgl with a blanket of 6 to 50m thick clay from the surface. Below the saline to brackish water bearing aquifers, fresh water bearing aquifers occur in the depth range of 120 m and 300mbgl.These two aquifers are separated by 12 to 24m thick clay layer. The aquifers below are again brackish in nature.

Ground water occurs under confined condition. Pre-monsoon piezometric level of the fresh ground water in the area lies within 7-15m bgl. Annual withdrawal of fresh ground water in the area is 24.63MCM and the annual ground water flow through the confined aquifer is 5.348MCM leaving an annual deficit of 18.282MCM. As a result of this heavy withdrawal of fresh ground water, a ground water trough has been formed in the area close to the river Hugli. Long term analysis of piezometric level data show a distinct falling trend of piezometric level in both pre and post monsoon period

Study indicate that there is a distinct lowering of piezometric level of the fresh ground water to the tune of 5-7m during last three decades due to heavy withdrawal of ground water from large no of heavy duty tube wells constructed by several organizations like IOC, HFCL, PHED, Hindustan Liver, CPT and others.

The situation is very much alarming as there is every possibility of deterioration of quality of ground water by mixing of saline water from the overlying aquifers and intrusion of saline water from sea and hence needs special attention. Quality of ground water of the aquifers in the depth range of 120-300mbgl is in general good and is potable. However, in some parts iron is present in little excess of permissible limit and needs treatment before use.

Keeping in view of the ever increasing demand of both domestic as well as industrial water in Haldia Industrial Complex area and the gradual depletion of the piezometric level Central Ground Water authority has notified the Haldia Industrial complex area and imposed embargo on further exploitation of fresh water from the aquifer occurring within the depth range of 120 to 300m bgl.

10.0 RECOMMENDATIONS

In Purba Medinipur district planning for future ground water development may be done keeping in view of the following points.

a) In Purba Medinipur district there is 15% growth rate in Population compared to 17.84% growth rate of the entire state of West Bengal.
b) Ground water in the area occurs under semi confined to confined condition, where only tubewells and cavity wells are feasible.
c) In general quality of ground water is good and fit for domestic as well as irrigational uses.
d) In the coastal area the near surface aquifers are saline. Fresh ground water bearing zone occurs within the depth span of 120-300m bgl. In Contai sub basin (around Contai town) there are three to four distinct aquifers within a depth of 250mbgl in the sub-basin and all theses horizons contain saline water.
e) In Digha-Ramnagar area the sand dunes formed by sea contain fresh ground water. These sand dunes alternating with thin clay and gravelly clay bed down to a depth of 6-8mbgl form near surface aquifer and this near surface aquifer is being developed by hand pump fitted shallow tubewells for domestic water supply.
f) Ground water resource as estimated jointly by CGWB and SWID in 9 nos of blocks other than coastal blocks indicates that a total of 74340.84 ham of net ground water resource is available for utilization. Gross draft of ground water is 28463.99ham and the stage of ground water development is 38.29%.

g) Considering the falling trend of ground water level in both pre-monsoon and post- monsoon period as more than 5cm/yr Bhagawanpur-I&II and Moyna has been categorized as Critical.
h) A total of 20.15MCM of ground water is flowing away from the deeper confined aquifers in the 16nos of blocks situated in the coastal belt.
i) Falling trend (>5cm/yr) of ground water level in both pre and post monsoon period has been noticed in the coastal blocks of
i) In Haldia Industrial area there is a distinct lowering of piezometric level of the fresh ground water to the tune of 5-7m during last three decades due to heavy withdrawal of ground water from large no of heavy duty tube wells constructed by several organizations like IOC, HFCL, PHED, Hindustan Liver, CPT and others.

Considering the above mentioned points, strategy for future ground water development may be done as follows.

1) In area other than coast out of 9 nos of blocks, 6nos of blocks fall under safe category where net ground water resource available is 52994.66 ham and the stage of ground water development varies from20% to 61%. These blocks barring Bhagawanpur-I&II and Moyna still hold scope for further ground water development through low to medium duty shallow tube wells, cavity wells and medium to heavy duty deep tube wells down to a depth of 200m bgl.
2) Pre monsoon falling trend (> 5cm/yr) and post monsoon falling trend ((within –5cm/yr to +5cm/yr) has been noticed in the all the 6nos of blocks mentioned above, which indicates that careful and judicious approach is very much required to exploit the available net ground water resource.
   The falling trend of ground water level generally indicates that development has started exceeding the available ground water resource. The distance between two heavy duty tubewells vary from 600-750m depending upon the local hydrogeological condition and the distance between two low duty tubewells may be kept as 200m depending upon the area of irrigation. The close cluster of low duty tubewells, sometimes heavy duty tubewells within or in close proximity of the cluster, where the safe distance criteria is ignored, also results in overexploitation of ground water. The exact reason for falling trend is necessary to be determined first and depending upon the result further ground water development may be taken.
3) In coastal blocks Tamluk- I, Mahishadal –I, Sutahata –I&II and Contai –III show declining trend (>5cm/yr) in both pre monsoon and post monsoon period but Ramnagar shows only pre monsoon falling trend (>5cm/yr). This indicates that ground water draft in Tamluk-I, Mahishadal –I, Sutahata –I&II and Contai –III blocks has exceeded the subsurface outflow of ground water through the deeper aquifers. Hence further ground water exploitation needs to be restricted.
4) Ground water development in the rest of the coastal blocks needs to be done very cautiously and logically considering the quantum of subsurface outflow through the deeper aquifers. Over exploitation of ground water from the deeper fresh water aquifer will create inequilibrium condition with the overlying and underlying saline aquifers, which may invite saline water into the fresh water aquifer.
5) Ground water development in the coastal area needs specially designed tube wells.

In order to save the fresh ground water resource in Purba Medinipur district from further dewatering and from contamination with saline water in future the following mitigation measures may be adopted.

1) Keeping in mind the net available resource and declining trend of ground water level, Planned and controlled ground water development is essential for future use.
2) Wastage of this valuable resource needs to be controlled.
3) Development of upper saline aquifers in coastal area as saline/brackish water occurs in the near surface aquifers which may be utilized after blending with fresh water. This blended water may be utilized for prawn cultivation and for irrigation to salt resistant crops.
4) The cropping pattern needs to be changed. Salt resistant crops may be introduced in the coastal belt using saline water from upper near surface aquifers for irrigation.
5) Mode of irrigation needs to be modified and Sprinklers and drip irrigation methods may be adopted.
6) Rain Water Harvesting by way of conservation and/or artificial recharge is the best option to mitigate the crisis of fresh ground water in this area. Conservation of rainwater will save same quantum of ground water from withdrawal, which in other words recharging same amount of water to the aquifer indirectly.
   The deep confined aquifer which is showing declining trend of ground water level in both pre and post monsoon period needs to be recharged artificially to arrest its water level from further decline.