GOVERNMENT OF KERALA

REPORT

OF THE HIGH POWER COMMITTEE TO ASSESS THE EXTENT OF DAMAGES CAUSED BY THE COCA COLA PLANT AT PLACHIMADA AND CLAIMING COMPENSATION

PART II

ANNEXURE AND REFERENCES

MARCH 2010

LIST OF ANNEXURE AND REFERENCES

ANNEXURE I

IA - Government order constituting the High Power Committee

IB - English version of the original Government Order issued in Malayalam

IC - Terms of reference

ANNEXURE II - KSGWD Report- September 2003

ANNEXURE III - CGWB Report-May 2005

ANNEXURE IV - KSGWD Report- 2006

ANNEXURE V - Report of the committee constituted by Hon'ble High Court of Kerala-2005

ANNEXURE VI - KSPCB Report- September 2003

ANNEXURE VII - SCMC Report-2004

ANNEXURE VIII - Palakkad DMO's letter to Perumatty PHC MO dt 8/4/2003 and PHC MO's letter to Perumatty Panchayat dt 13/5/2003

ANNEXURE IX - Report of Sargam Laboratory Services, Chennai.

ANNEXURE X - VT Padmanabhan etal, 2003 .Analysis of birth weight of children in Plachimada mimeographed report.

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ANNEXURE I

കേരള സർക്കാർ

സംഗ്രഹം

ജലവിഭവ വകുപ്പ് പ്ലാച്ചിമടയിലെ കൊക്കകോള കമ്പനിയുടെ പ്രവർത്തനം മൂലമുണ്ടായ നഷ്ടത്തിന്റെ തോതും സ്വഭാവവും പഠിച്ച് റിപ്പോർട്ട് സമർപ്പിക്കുന്നതിന് ഒരു ഉന്നതാധികാര സമിതിയെ നിയോഗിക്കാൻ തീരുമാനിച്ചുകൊണ്ട് ഉത്തരവ് പുറപ്പെടുവിക്കുന്നു.

ജലവിഭവ (ഭൂജല) വകുപ്പ്

സ.ഉ.(സാധാ)നം.425/2009 ജലവിവ തിരുവനന്തപുരം തീയതി 17.04.2009

പരാമർശം *1. ഭൂജല വകുപ്പ് ഡയറക്ടറുടെ 20.10.08ലെ റ്റി(1)/1809/04(13) നമ്പർ കത്ത്*
2. ഭൂജല വകുപ്പ് ഡയറക്ടറുടെ 6.12.08ലെ റ്റി(4)/ 5552/08 നമ്പർ കത്ത്

ഉത്തരവ്

പ്ലാച്ചിമടയിലെ കൊക്കകോള കമ്പനിയുടെ പ്രവർത്തനംമൂലം പരിസരവാസികൾക്കുണ്ടായ നഷ്ടത്തിന്റെ തോതും സ്വഭാവവും പഠിച്ച് റിപ്പോർട്ട് സമർപ്പിക്കുന്നതിന് കൃഷി, മലിനീകരണ നിയന്ത്രണ ബോർഡ്, ഭൂജലം, മൃഗസംരക്ഷണം, ആരോഗ്യം എന്നീ മേഖലകളിലെ വിദഗ്ദ്ധരടങ്ങുന്ന ഒരു ഉന്നതാധികാര സമിതിയെ നിയോഗിക്കാൻ തീരുമാനിച്ചുകൊണ്ട് ഉത്തരവാകുന്നു.

ഗവർണറുടെ ഉത്തരവിൻ പ്രകാരം,
കെ. ജയകുമാർ
അഡീഷണൽ ചീഫ് സെക്രട്ടറി

ഡയറക്ടർ, ഭൂജലവകുപ്പ്, തിരുവനന്തപുരം & സെക്രട്ടറി, കേരള ഭൂജല അതോറിറ്റി.
കൃഷി വകുപ്പ്
പരിസ്ഥിതി വകുപ്പ്
മൃഗസംരക്ഷണ വകുപ്പ്
ആരോഗ്യവകുപ്പ്
പൊതു ഭരണ / (എസ്.സി) വകുപ്പ്
ആ വകുപ്പിന്റെ ഇന്നം.നം.3229 തീയതി 8.4.09 പ്രകാരം)
കരുതൽ ഫയൽ / ഓഫീസ് പകർപ്പ്

ഉത്തരവിൻ പ്രകാരം

ഒപ്പ്
സെക്ഷൻ ഓഫീസർ

കേരള സർക്കാർ

സംഗ്രഹം

ജലവിഭവ വകുപ്പ് - പ്ലാച്ചിമടയിലെ കൊക്കകോള കമ്പനിയുടെ പ്രവർത്തനം മൂലമുണ്ടായ നഷ്ടത്തിന്റെ തോതും സ്വഭാവവും പഠിച്ച് റിപ്പോർട്ട് സമർപ്പിക്കുന്നതിനുള്ള ഉന്നതാധികാരസമിതിയിലെ അംഗങ്ങളെ നിശ്ചയിച്ചുകൊണ്ട് ഉത്തരവ് - പുറപ്പെടുവിക്കുന്നു.

ജലവിഭവ (ഭൂജല) വകുപ്പ്

സർക്കാർ ഉത്തരവ് (സാധാ)നം.542/2009 ജലവിവ തീയതി തിരുവനന്തപുരം 23-05-2009

പരാമർശം :- സർക്കാർ ഉത്തരവ് (സാധാ) നം. 425/09/ ജലവിവ. തീയതി 17.04.2009

ഉത്തരവ്

പ്ലാച്ചിമടയിലെ കൊക്കകോള കമ്പനിയുടെ പ്രവർത്തനംമൂലമുണ്ടായ നഷ്ടത്തിന്റെ തോതും സ്വഭാവവും പഠിച്ച് റിപ്പോർട്ട് സമർപ്പിക്കുന്നതിന് വിവിധ മേഖലകളിലെ വിദഗ്ദ്ധർ അടങ്ങുന്ന ഒരു ഉന്നതാധികാര സമിതിയെ നിയോഗിക്കാൻ പരാമർശത്തിലെ സർക്കാർ ഉത്തരവ് പ്രകാരം തീരുമാനിച്ചിരുന്നു. അതിന്റെയടിസ്ഥാനത്തിൽ ചുവടെപ്പറയുന്ന വിദഗ്ദ്ധർ അടങ്ങുന്ന ഒരു ഉന്നതാധികാരസമിതി രൂപീകരിച്ചുകൊണ്ട് ഉത്തരവാകുന്നു.

1. കാർഷികോൽപ്പാദന കമ്മീഷണർ	-	ചെയർമാൻ
2. ഡയറക്ടർ, കൃഷി വകുപ്പ്	-	മെംബർ
3. ഡയറക്ടർ, ആരോഗ്യവകുപ്പ്	-	മെംബർ
4. ഡയറക്ടർ, മൃഗസംരക്ഷണവകുപ്പ്	-	മെംബർ
5. റീജിയണൽ ഡയറക്ടർ, കേന്ദ്ര ഭൂജല ബോർഡ്	-	മെംബർ
6. ഡയറക്ടർ, കെറി	-	മെംബർ
7. ഡീൻ, വെറ്റിനറി സയൻസ്സ്, കേരള കാർഷിക സർവ്വകലാശാല	-	മെംബർ
8. ഡയറക്ടർ, (റിസർച്ച്), കേരള കാർഷിക സർവ്വകലാശാല	-	മെംബർ
9. ഡോ.ഉഷ ടൈറ്റസ് ഐ.എ.എസ് ചെയർപേഴ്സൺ, കേരള മലിനീകരണ നിയന്ത്രണ ബോർഡ്	-	മെംബർ
10. ഡോ.സി.ആർ.സോമൻ പൊതുജനാരോഗ്യ പ്രവർത്തകൻ	-	മെംബർ
11. ഡോ.ഫെയ്സി, പരിസ്ഥിതി വിദഗ്ദ്ധൻ	-	മെംബർ
12. ശ്രീ.ടി.കെ.രാമൻ, റിട്ട.ഡിസ്ട്രിക് & സെഷൻസ് ജഡ്ജ്, കോഴിക്കോട്	-	മെംബർ
13. ശ്രീമതി.ആർ.വസന്തകുമാരി എക്സി എഞ്ചിനിയർ, ക്വാളിറ്റി കൺട്രോൾ ഡിവിഷൻ, കേരള ജല അതോറിറ്റി, തിരുവനന്തപുരം	-	മെംബർ
14. ഡയറക്ടർ, ഭൂജലവകുപ്പ്, തിരുവനന്തപുരം	-	കൺവീനർ

കമ്മിറ്റിയുടെ പഠന റിപ്പോർട്ട് നാലു മാസത്തിനുള്ളിൽ സമർപ്പിക്കേണ്ടതാണ്.

ഗവർണറുടെ ഉത്തരവിൻ പ്രകാരം,

കെ. ജയകുമാർ
അഡീഷണൽ ചീഫ് സെക്രട്ടറി

എല്ലാ അംഗങ്ങൾക്കും

ഉത്തരവിൻ പ്രകാരം

ഒപ്പ്
സെക്ഷൻ ഓഫീസർ

GOVERNMENT OF KERALA

Abstract

Water resource department- Constitution of a High Power Committee to study the extent and nature of losses incurred due to the functioning of Coca Cola Company at Plachimada– Orders issued

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WATER RESOURCES (GROUND WATER) DEPARTMENT

G.O(Rt) NO.425/2009/WRD, Thiruvananthapuram, dated 17-4-2009

Ref: 1. Letter No.T(1)/1809/04 (13) dated 20-10-2008 of the Director, Groundwater Department.

2. Letter No.T(4)/5552/08 dated 6-12-08 of the Director, Groundwater Department.

ORDER

In order to study the extent and nature of losses caused to the people in the surrounding areas due to the functioning of the Coca Cola Company at Plachimada, orders are issued for constituting a high power committee comprising experts from various sectors viz, Agriculture, Pollution Control Board, Groundwater, Animal Husbandry and Health.

By Order of the Governor

K.Jayakumar
Additional Chief Secretary

Director, Groundwater Department, Thiruvananthapuram and
Secretary, Kerala Groundwater Authority.
Agriculture Department
Environment Department
Animal Husbandry Department
Health Department
General Administration (SC) Department (vide that department item No.3229 dated 8-4-09)
Stock file/Office copy

Issued/ By Order
Sd/-

Section Officer

GOVERNMENT OF KERALA

Abstract

Water resource department- Constitution of a High Power Committee to study the extent and nature of losses incurred due to the functioning of Coca Cola company at Plachimada- Members nominated – Orders issued

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WATER RESOURCES (GROUND WATER) DEPARTMENT

G.O(Rt) NO.542/2009/WRD, Thiruvananthapuram, DATED 23-5-2009

Ref: GO (Rt) No. 425/09 WRD dated 17-4-09

ORDER

Vide the reference read, Government have decided to constitute a high power committee to study the extent and nature of losses incurred at Plachimada due to the functioning of Coca Cola Company. Accordingly orders are issued for constituting a high power committee comprising experts, as below.

1. Agriculture Production Commissioner - Chairman
2. Director, Agriculture Department - Member
3. Director, Health Department - Member
4. Director, Animal Husbandry Department - Member
5. Regional Director, Central Groundwater Board - Member
6. Director, KERI - Member
7. Dean, Veterinary Science, Kerala Agriculture University - Member
8. Director, (Research), Kerala Agriculture Department - Member
9. Dr.Usha Titus IAS, Chairperson, Kerala State Pollution Control Board - Member
10. Dr.C.R.Soman, Public Health Activist -Member
11. Sri.S.Faizi, Environmental Expert - Member
12. Sri.T.K.Raman, Rtd, District & session judge,Kozhikode - Member
13. Smt.R.Vasanthakumari, Executive Engineer, Quality control Division, Kerala Water Authority - Member
14. Director, Groundwater Department, Thiruvananthapuram - Convenor

Study report of the committee should be submitted within four months.

By Order of the Governor
K.JAYAKUMAR
Additional Chief Secretary

All Members

Issued /By Order
Sd/-
Section Officer

The Terms of Reference of High Power committee

The terms and reference of the High Power Committee shall be:

I. To study the short term and long term damages.
    1. Agriculture
    2. Animal Husbandry
    3. Drinking Water
    4. Health
    5. Loss of livelihood
    6. Environmental damages and consequent changes in the soil, flora and fauna
    7. Depletion of Groundwater and deterioration of water quality and pollution of water resources.

II. To quantify, to the extent possible, the value of these damages

III. To scientifically analyze the ill effects of the work materials and by products, even after the factory ceased operation in 2004.

IV. To calculate the amount required for reversing the Ecological imbalance

V. To recommend the setting up of an appropriate institutional mechanism to receive individual claims and to make the company liable to pay the damages in a legally tenable manner.

Sd/-
Chairman

ANNEXURE II

GOVERNMENT OF KERALA

GROUNDWATER DEPARTMENT

REPORT ON THE

MONITORING OF WELLS IN AND AROUND

THE COCA COLA FACTORY

IN PLACHIMADA, KANNIMARI,

PALAKKAD DISTRICT

September 2003

Introduction

The State Ground Water Department is carrying out monitoring work in and around Coca Cola factory area in Plachimada in Palakkad district for monitoring the groundwater levels and quality. This report presents the findings regarding the groundwater level trends and the water quality in the area as observed during the period from March, 2002 to August, 2003. A sketch showing the observation well network and rainfall data from two rain gauge stations are also enclosed. There are 3 items to be monitored in the case of Coca Cola factory at Palghat. The Ground Water Department is not concerned with item (1) and (2).

(1) The waste from the factory
(2) The content of the product
(3) The water used for the production

Location

The factory is located in Plachimada near Kanjimari in Perumatty panchayat. It is on Vandithavalam – Meenakshipuram road, about 5.5 km west of Meenakshipuram, between the 29th and 30th km stones. Latitude – 10° 38' 38" and longitude – 76° 48' 18".

Physiography

The area has gently undulating topography. The factory is on the slope of a small hillock. The northern part of the factory area forms part of a broad valley extending further north. The area is

between 180 and 200 m above mean sea level. The Moolathara irrigation canal (lined) forms the northern boundary of the factory area.

Climate

Bar diagram for annual rainfall based on data from two nearby stations, viz. Meenkara and Chulliar dams, is presented. The data indicates considerable spatial variation in rainfall. In Meenkara, rainfall was more than 2000 mm during 1999 and 2000. In 2001 it was only 1205mm which is 40% less. During the year 2002 the rainfall was 757mm which is 36% less than the previous year. In Chulliar, during 1999 the rain fall was 687mm. In 2000 it was 673mm. In 2001 it was 1118mm. In 2002 it was 1312mm. Rainfall was slightly better in 2002. Overall, the data for the last several years indicates a declining trend in rainfall.

Hydrogeology

Biotite gneiss with pegmatite veins is the rock type in the area. Weathered rock occurs below a soil cover of about 1 to 3m. Hard rock is present at depths ranging from 4 to 12 metres. The weathered and jointed rock forms a phreatic aquifer. The occurrence of this aquifer at a shallow depth probably facilitates percolation of shallow groundwater to deeper fracture zones in the hard rock through joints and fractures. Thickness of weathering is less in the area immediately south of the factory. Depth to water table ranges from around 0.65 m

in the valley to more than 13.27m on the highest ground. The borewells in the area tap semi-confined to confined fracture aquifers.

Groundwater use in the factory

The factory has 6 borewells and 2 openwells from which 5 lakh litres per day of water is being pumped. There is an effluent treatment plant. This water is reported to be used for gardening purpose. Nearly 1.5 lakh litres per day is the actual reported consumption for the products.

Recharge conditions

The location of the factory falls in the better recharge terrain. Although the area has less rainfall than the coastal regions of the State, conditions for groundwater recharge are better here because of the gently undulating nature of terrain. The area receives irrigation water from Moolathara dam through the Kambalathara reservoir. The return flow increases recharge to groundwater. The Coca Cola company has constructed three large percolation ponds or lagoons for collecting rain water for increasing recharge in its premises. Each lagoon has a capacity of about 35 lakh litres of water. The recharge conditions are favourable due to the adaptation of Rainwater structures.

Observation of groundwater level

Totally 18 wells were monitored for water level. It consists of 16 open wells and 2 bore wells in and around the factory. In 6 wells there is rise in water level ranging from0.21 metres to 1.10 metres. In 9 wells there is fall in water level ranging from0.22 metres to 1.37 metres. One well was dry. The above result was taken by comparing the water level of March 2002 to March 2003 (period of one year).

Sl.No.	Location well No.	Water level in March 2003	Water level in March 2002	Rise/fall in water level
1	GW 1	6.22	7.32	1.10 Rise
2	GW 3	8.28	7.00	1.28 Fall
3	GW 5	Dry	7.65	Dry
4	GW 6	9.13	8.45	0.68 Fall
5	GW 7	4.89	5.40	0.51 Rise
6	GW 8	6.71	6.30	0.41 Fall
7	GW 9	4.77	4.4	0.37 Fall
8	GW 10	4.82	5.10	0.28 Rise
9	GW 11	3.81	3.50	0.31 Fall
10	GW 12B	11.34	-	Bore well
11	GW 13	4.54	4.05	0.49 Fall
12	GW 14	7.44	6.90	0.54 Fall
13	GW 15B	3.01	-	Bore well
14	GW 16	1.62	1.40	0.22 Fall
15	GW 17	12.87	11.5	1.37 Fall
16	GW 20	3.68	4.60	0.92 Rise
17	GW 21	0.79	1	0.21 Rise
18	GW 22	7.54	8.05	0.51 Rise

The decline is due to the combined effect of lower than normal rainfall and groundwater draft by wells. The rise could be due to the recharge from percolation ponds and the effluent water discharged from the factory.

Two more wells (No.3 and 17) were dry in July, 2003. In August, 2003 a general rise in water level was observed. This was due to the arrival of irrigation water in the nearby Kambalathara reservoir from the Moolathara dam and the subsequent flow of water in the canals. Some rain also contributed to the rise. Ins spite of this, well Nos. 3 and 5 in the southern part of the area continued to be dry. This is due to deficient rainfall and groundwater draft from wells, including the wells in the Coca Cola factory. The recharge from irrigation water, till August, 03, has not been sufficient to make up the entire deficit in the groundwater reservoir.

16 samples were analysed for water quality during September, 03. The wells details are as follows:

No.	Well No.	Type of well	Location
	GW 1	OW	Sri.Natarajan, N.R. Stores, Kannimary
	GW 2B	BW	Sri.Natarajan, N.R. Stores, Kannimary
	GW 4B	BW	Sri.Retnaswami, Thottichipathy
	GW 6	OW	Sri.Devarajan, Plachimada
5	GW 7	OW	Sri. Aruchami Kounder, Plachimada
6	GW 8	OW	Sri.Pazhani malai, Plachimada
7	GW 9	OW	Sri.Sudevan, Plachimada
8	GW 10	OW	Sri.Rengaswami Kounder, Kambalathara
9	GW 11	OW	Sri.P.V. Shahul Hameed, Plachimada
10	GW 13	OW	Panchayat open well, Adivasi Colony
11	GW 15B	BW	Panchayat bore well, Plachimada Colony
12	GW 16	OW	Sri.K.P. Balan, Plachimada
13	GW 17	OW	Sri.Gopalan.K. Kambalathara
14	GW 20	OW	Inside the Coca Cola Company
15	GW 21	OW	Government Puramboke
16	GW 22	OW	Meenakshi Amman, Kambalathara

In general the water quality do not show an alarming harmful result. In six wells (GW1, GW 2B, GW6, GW7, GW13 and GW20). Total Hardness is more than permissible limit. Permissible limit is 600 milligram per litre. In well No. GW1 presence of Calcium and Chloride are above permissible limit. Permissible limit of Calcium is 200 mg per litre and for Chloride it is 1000 mg per litre. There is no presence of heavy metals such as Lead and Cadmium (poisonous items). The results of Lead and Cadmium are

shown as bdl, which means below detectable limit of 0.01 milligram per litre. The presence of factory do not indicate any distribution of poisonous metals in groundwater such as Lead and Cadmium.

Conclusion

The area has less rainfall compared to other parts of the State. Irrigation requirements are greater here and consequently number of dugwells and borewells used for irrigation purpose is also more. Considering these factors, caution is needed in the use of groundwater. The decline in water level in several wells, as well as the drying up of three wells (due to the groundwater draft and less rainfall), indicate the need for controlling use of groundwater and implementing artificial recharge measures in the area. The Ground Water Department has studied only the groundwater level and quality in that area. The monitoring does not include the analysis of solid waste and content of the product. In ground water quality studies there is no presence of heavy metals such as Lead and Cadmium (poisonous items). The results of Lead and Cadmium are shown as bdl, which means below detectable limit of 0.01mg per litre. In water level, out of 16 open wells, 6 wells showed rise in water level ranging from 0.21metre to 1.10 metres. 9 wells showed decline ranging from 0.22 metre to 1.37 metres. This result is based on the observation of March 2002 to March 2003 (one year duration). During March 2003, one well was dry. During July 2003, two more wells were dry. Therefore it is recommended to control the intake of ground water by the firm.

Vasanthi

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CHIEF CHEMIST i/c

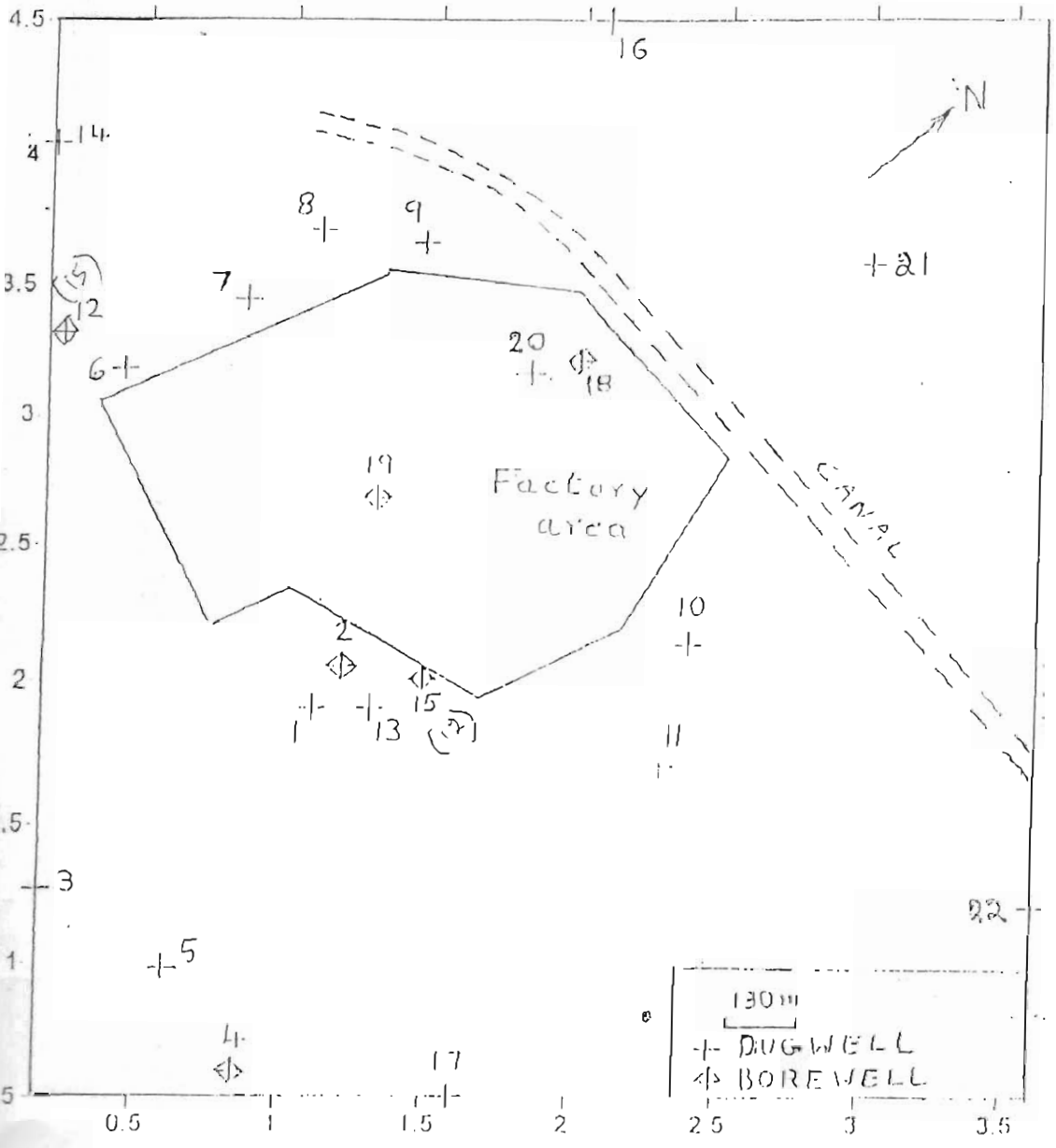
J. P. Kukilliaya

J. PRADEEP KUKILLAYA
SUPERINTENDING HYDROGEOLOGIST

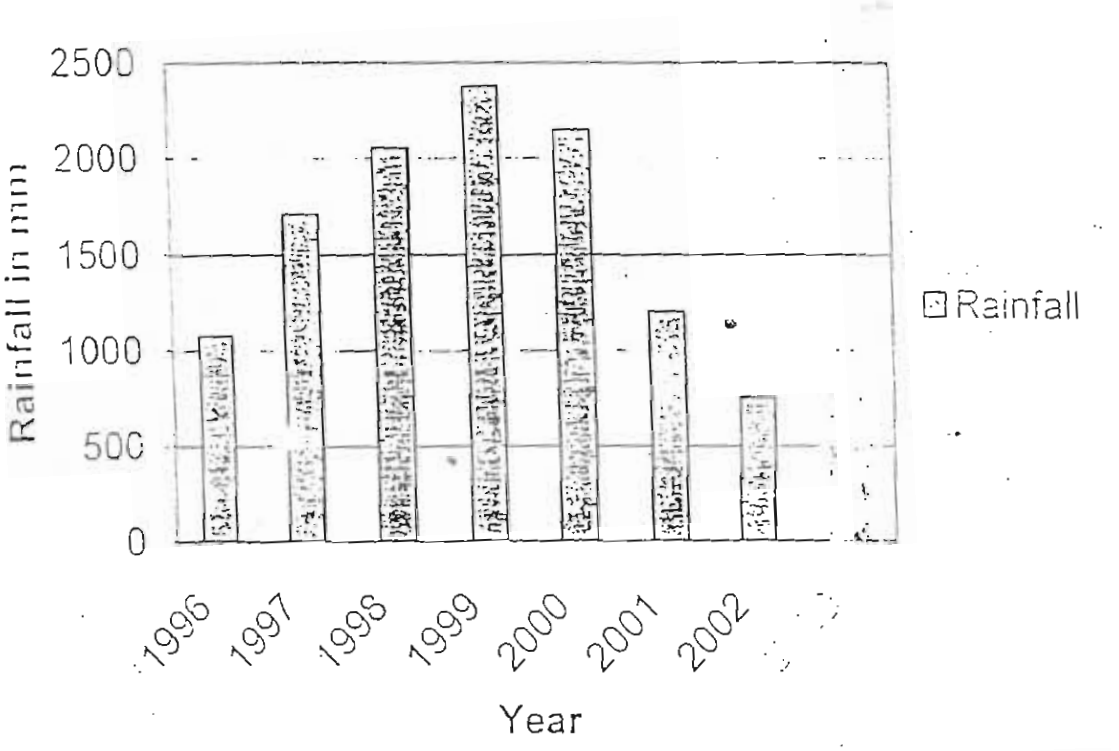
G Balaji
15.10.2003

DIRECTOR
GROUND WATER DEPARTMENT

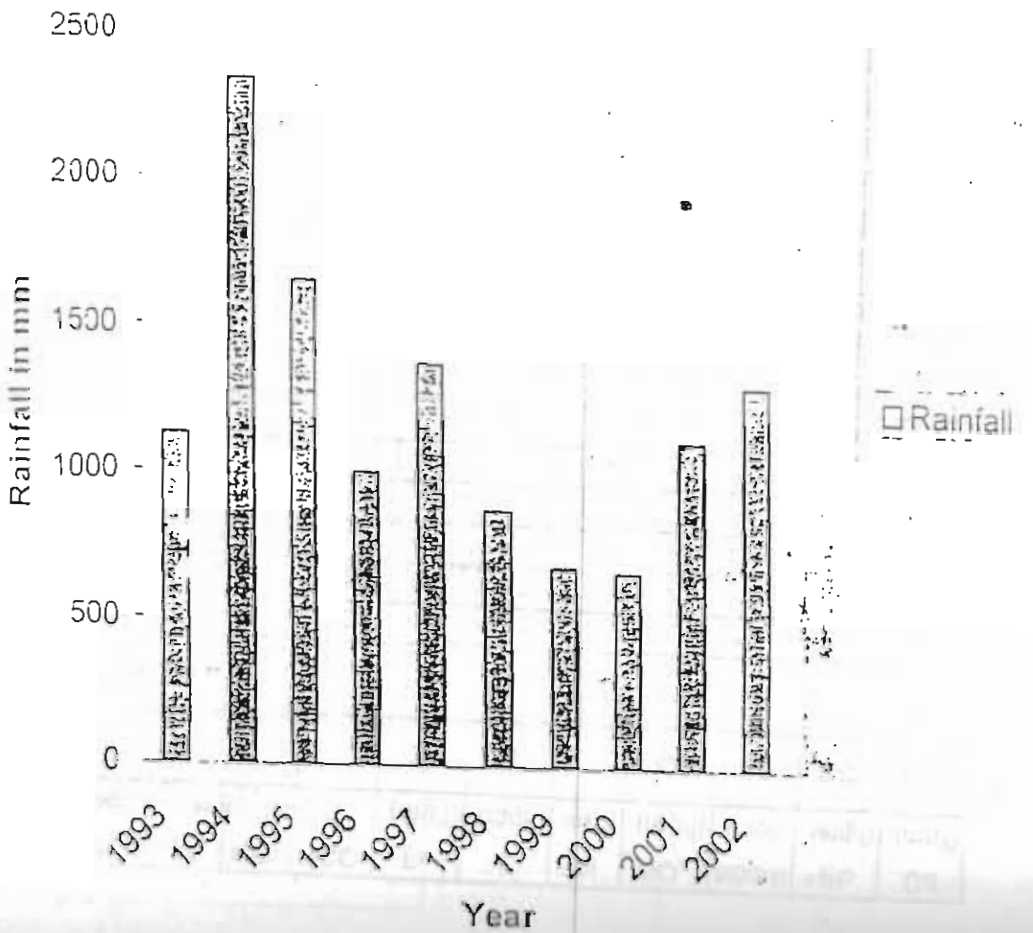
ROUGH SKETCH OF OBSERVATION WELL NETWORK IN AND AROUND COCA COLA FACTORY AREA IN PLACHIMADA, PALAKKAD DISTRICT



Year	Rainfall	
1996	1080	
1997	1715	
1998	2055	
1999	2379	
2000	2149	
2001	1205	
2002	757	
2003	764	upto 31-07-2003



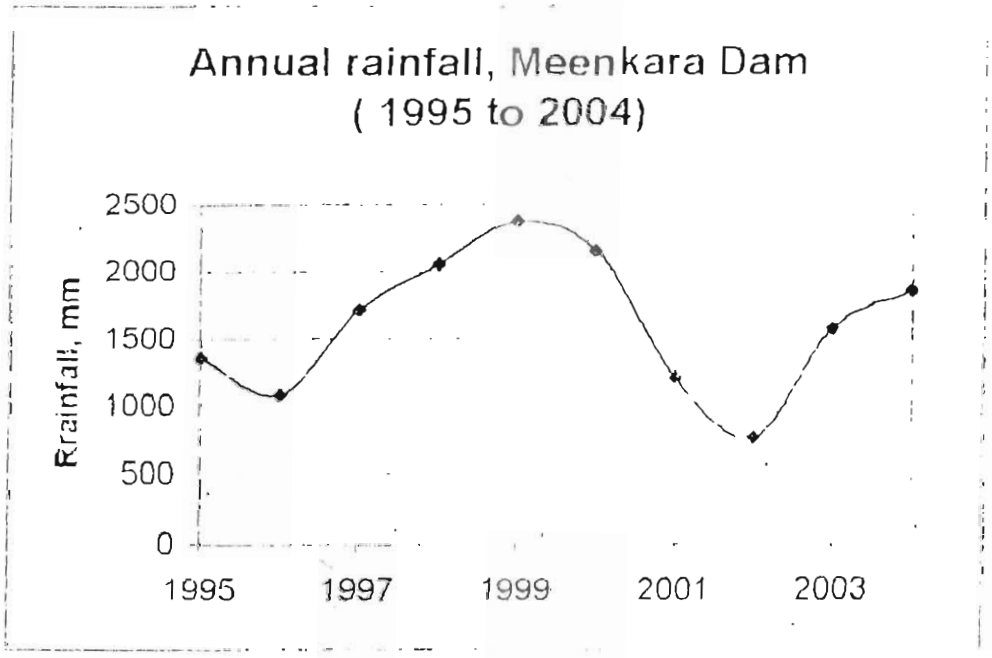
Year	Rainfall	
1993	1130	
1994	2340	
1995	1653	
1996	1003	
1997	1375	
1998	879	
1999	687	
2000	673	
2001	1118	
2002	1312	
2003	794	upto 31-07-2003



Sl No.	Lab No	Sample No.	pH	EC (micromhos/cm)	TH as mg CaCO3/l	Ca as mg CaCO3/l	Ca (mg/l)	Mg (mg/l)	Na (mg/l)	K (mg/l)	Cl (mg/l)	TA as mg CaCO3/l	CO_3	HCO_3	Fe (mg/l)	F (mg/l)	Si (mg/l)	SO_4 (mg/l)	NO3-N (mg/l)	Pb (mg/l)	Cd (mg/l)
	BIS limit	Desirable	6.5-8.5		300		75	30			250	200			0.3	1		200	10	0.05	0.01
		Permissible	6.5-8.5		600		200	100			1000	600			1	1.5		400	45	0.1	0.01
1	888/03	GW1	7.2	5240	1795	1123	449.2	164.0	450	5.0	1762	350	0	350	0.45	0.42	28	83	12.50	bdl	bdl
2	889	GW2B	7.8	3060	701	365	146	82.0	506	7.0	897	336	0	336	0.06	0.83	71	42	1.37	bdl	bdl
3	890	GW4B	8	710	297	182	72.8	28.0	43.3	3.1	52	258	0	258.0	0.15	1.18	75	69	13.30	bdl	bdl
4	891	GW5	8	2300	729	393	157.2	82.0	332	2.0	597	206	0	206	0.15	0.40	48	87	13.10	bdl	bdl
5	892	GW7	7.1	2840	912	490	196	103.0	328	3.4	792	374	0	374	0.16	0.58	62	54	3.37	bdl	bdl
6	893	GW8	7.3	745	259	134	53.6	30.0	42.8	5.4	79	198	0	198	0.34	0.50	67	19	2.15	bdl	bdl
7	894	GW9	7.2	1400	480	355	142	30.0	77	7.2	289	170	0	170.0	0.32	0.50	75	10	1.35	bdl	bdl
8	895	GW10	8.1	1360	480	336	134.4	35.0	139	2.8	369	256	0	256	0.15	0.42	64	37	2.03	bdl	bdl
9	896	GW11	7.4	720	307	153	61.2	37.0	28.4	3.1	96	272	0	272	0.30	0.43	70	21	0.87	bdl	bdl
10	897	GW13	7.2	1940	845	461	184.4	94.0	58.4	3.0	535	320	0	320	0.21	0.46	78	25	3.85	bdl	bdl
11	898	GW15B	8.4	2500	470	356	142.4	28.0	562	3.1	649	360	56	304	0.33	0.88	43	61	6.37	bdl	bdl
12	899	GW16	7.9	1000	240	96	38.4	35.0	84	46.0	82	424	0	424.0	0.11	1.06	64	79	1.05	bdl	bdl
13	900	GW17	7.4	460	211	110	44	25.0	19	5.3	29	212	0	212.0	1.33	0.23	64	34	2.95	bdl	bdl
14	901	GW20	7.7	2480	653	355	142	73.0	393	3.9	637	388	0	388.0	0.22	0.58	63	67	2.55	bdl	bdl
15	902	GW21	7.3	320	125	57	22.8	17.0	20.5	1.6	45	86	0	86	0.21	0.39	77	23	4.60	bdl	bdl
16	903	GW22	7.1	200	53	24	9.6	7.0	12.5	1.1	9	88	0	88	0.33	0.34	48	16	0.55	bdl	bdl

bdl - below detection limit
detection limit is 0.01 mg/l

Chief Chemist


Annual rainfall, Meenkara Dam
(1995 to 2004)
Rrainfall, mm
2500
2000
1500
1000
500
0
1995
1997
1999
2001
2003

Remarks on the report given by the Expert Committee on the matter of groundwater use by Coca Cola company in Plachimada, Palakkad District

1. **Groundwater estimation at block level (Table 1 in report)**

The expert committee has evaluated the groundwater potential in the area both at the block level and at the minor watershed level. For block level estimation, the committee has used the figures published by the Groundwater Estimation Committee for the year 1999. The balance groundwater potential available in Chittur block in 1999 (as per GEC figures) was 14.48 MCM. Now the GEC is revising the estimation for the entire State, taking into consideration the probable increase in number of wells since 1999.

2. **Groundwater estimation at watershed level and the recommendation of the committee (Table 2 in report)**

The committee has estimated the annual balance groundwater resource in the Plachimada watershed as 0.25 MCM as against Coca Cola factory's annual requirement of 0.1825 MCM . This is for a normal monsoon rainfall year (Table 2 and page no.16 in committee's report). In the recommendation given in Table 5 on page 23, the permissible withdrawal in case of deficient monsoon rainfall is given. If the balance annual groundwater resource is calculated for deficient rainfall years (using the same parameters and factors used by the committee), it is seen that a deficiency of 20 % in the monsoon rainfall results in deficit groundwater potential for the year even without considering groundwater withdrawal by the Coca Cola company. But the committee has recommended that the company can draw 3 lakh litres of water daily. Similar is the case for a monsoon rainfall deficit of 30% . Even with a rainfall deficit of only 10%, the balance resource becomes 0.07 MCM which is less than the company's annual requirement. The detailed statement illustrating the above points is given below in Table 1. The committee may be requested to explain this apparent anomaly.

Table -1

1	2	3	4	5	6	7	
Sl No	% deviation of monsoon rainfall	Annual GW recharge by rainfall, MCM (Reduction made in monsoon season recharge for monsoon rainfall deviation)	Annual GW recharge due to return flow from domestic and irrigation water use, MCM	Total annual GW recharge, MCM	Annual available GW resource, MCM (90% of Column 5)	Allocation for domestic and irrigation requirements , MCM	Balance annual GW resource available, MCM (6-7)
1	Normal	2.31 (annual rf =1217 +196)	1.77	4.08	3.67	3.42	0.25
2	-10	2.11 (annual rf = 1095 +196)	1.77	3.88	3.49	3.42	0.07
3	-20	1.92 (annual rf = 974 +196)	1.77	3.69	3.32	3.42	- 0.10
4	-30	1.72 (annual rf = 852 +196)	1.77	3.49	3.14	3.42	- 0.28

Annual water requirement of coca cola factory at 5 lakhs litres per day = 0.1825 MCM

3. Groundwater level trends in Chittur block

Chittur block is an area where fall in groundwater levels is generally observed. Heavy withdrawal for irrigation purpose is observed here. This should be an important consideration in deciding groundwater management issues in the area.

4. Need for regulations on groundwater use in the monsoon season.

The expert committee has stated that there is no need for any regulations to be imposed on groundwater withdrawal for industrial uses during the monsoon season

(ie, before December) in any year (page 22 of report). They have based this on the fact that monsoon season rainfall forms about 85 % of the annual rainfall. This is applicable only if the post monsoon recession in ground water levels does not start before December during years experiencing deficit monsoon season rainfall.

Hydrographs for the period May,2003 to April,2005 for six observation wells (open wells) of the groundwater department located in Palakkad district are presented here. In majority of cases the hydrographs indicate beginning of recession at various times ranging from September to November. Start of recession in December is rare. Failure of north – east monsoon in a particular year will lead to earlier beginning of recession. The eastern part of Palakkad district (where Plachimada is situated) is dependent more on the north – east monsoon. But the report does not consider this aspect. The effect of good rains in the SW monsoon period is often negated by a poor NE monsoon. Hence considering December as the cut off month may not be satisfactory.. The water level trends of observation wells in 2003 monitored by the groundwater department around Coca Cola factory (explained below) illustrate this further.

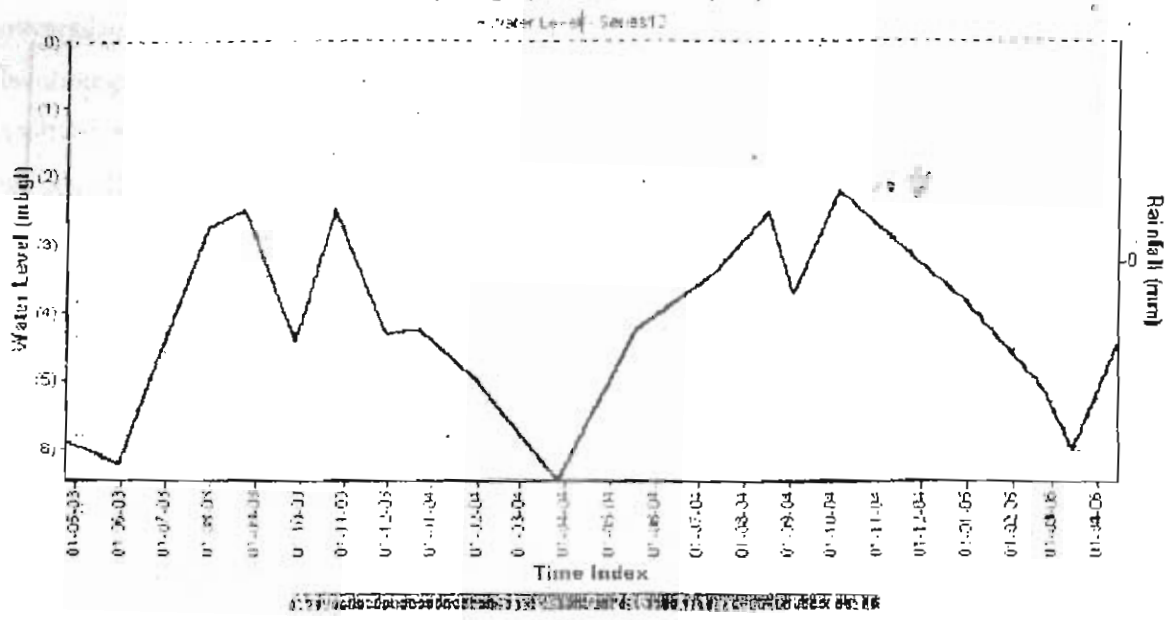
5. Groundwater level trends in observation wells monitored around the Coca Cola factory from 2002

The groundwater department was observing water level trends in 16 open wells and 2 bore wells in and around the factory from March,2002. In the report given by the department in September,2003, it was stated that water levels in March 2003 had fallen in nine wells as compared to the levels in March 2002. One well had gone dry. In six wells the level had risen. Subsequently in July,2003 two more wells dried up. The decline in level was explained as being due to the combined effect of lower than normal rainfall and groundwater draft from wells, including the wells in the factory. It was also observed that recharge from irrigation water, till August 2003, was not able to make up for the entire deficit in the groundwater reservoir.

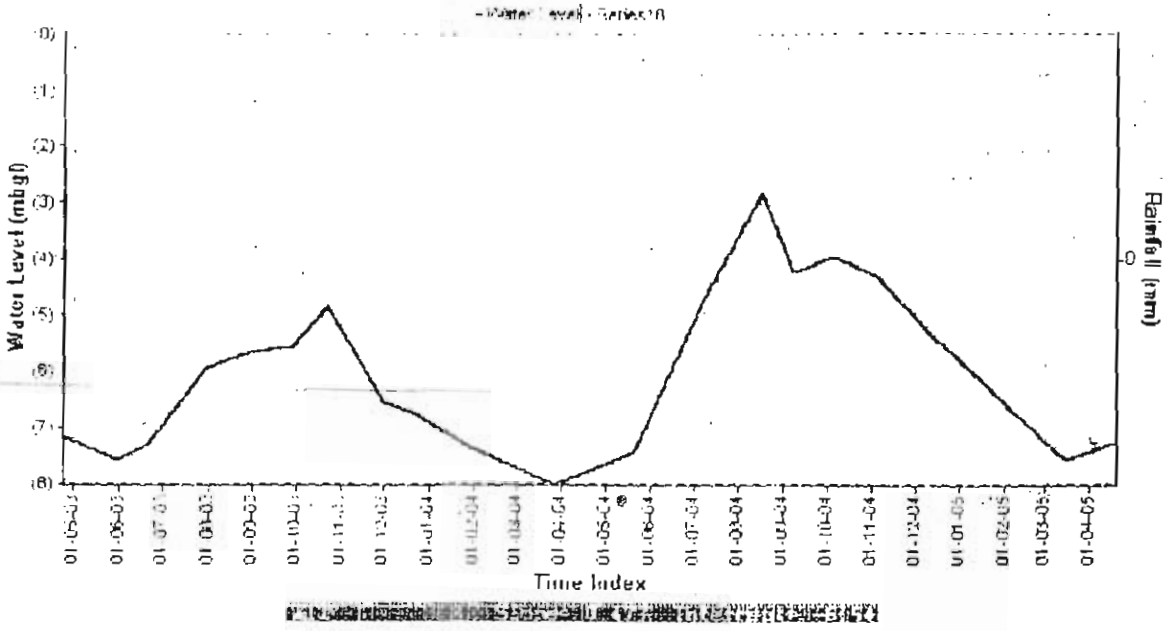
The expert committee is understood to have continued the monitoring of these wells during their study. In page no 9 of their report , the committee

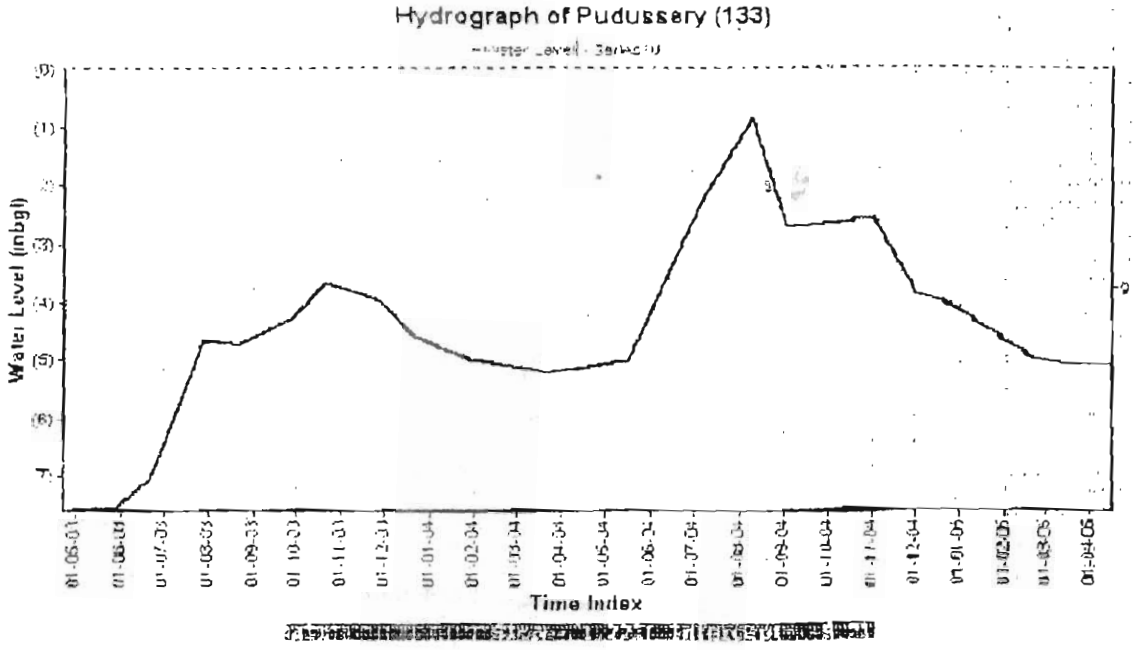
has pointed out that declining water level trend was noticed in the observation wells even after pumping of water was stopped in the factory in March 2004. The groundwater level decline in summer reflects the recession in water level taking place due to subsurface groundwater flow from recharge areas to discharge areas. This will happen during summer even if pumping is stopped in the wells in some areas. The effect of pumping from the wells in the factory and irrigation wells in the area and the effect of recharge due to arrival of irrigation water in the area (for example, the Kambalathara reservoir near the factory) and due to good pre-monsoon rainfall (for example, good rains in May, 2004) , etc are superimposed on the summer groundwater recession in an area. It is not possible to draw any inference from the fact that the water level continued to decline in the short period (couple of months) following stoppage of pumping in the factory. Subsequently the water levels rose due to good south- west monsoon rains in 2004. The long term effect of increased use of groundwater cannot be judged by the water level observations made in two or three years since several factors are at play.

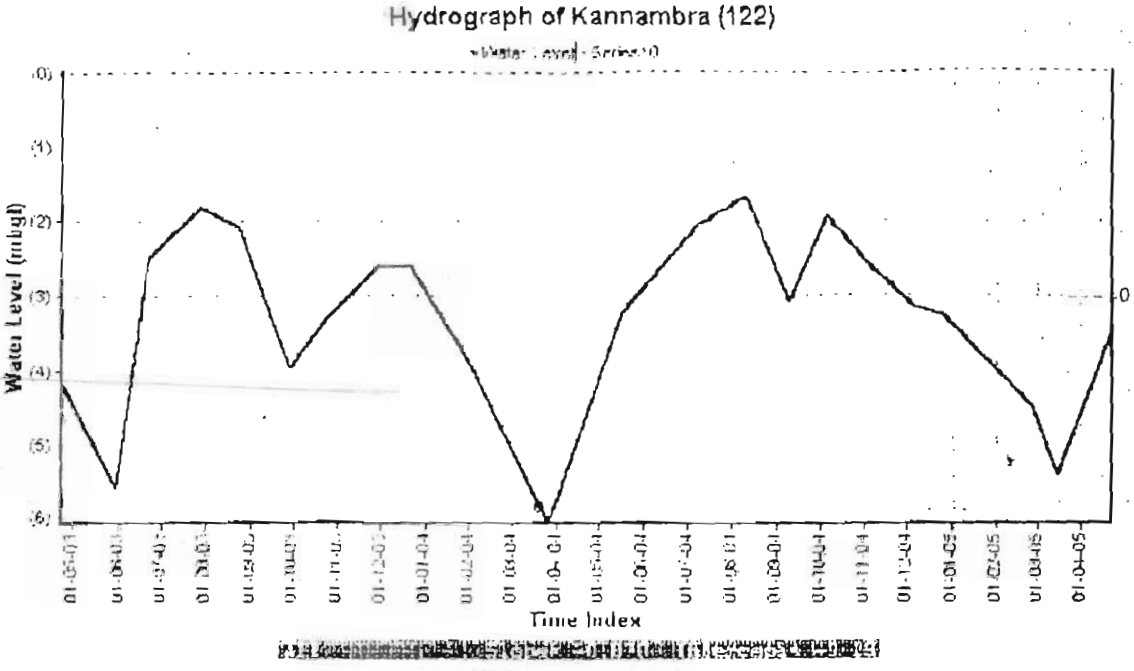
Hydrograph of Mankara (128)

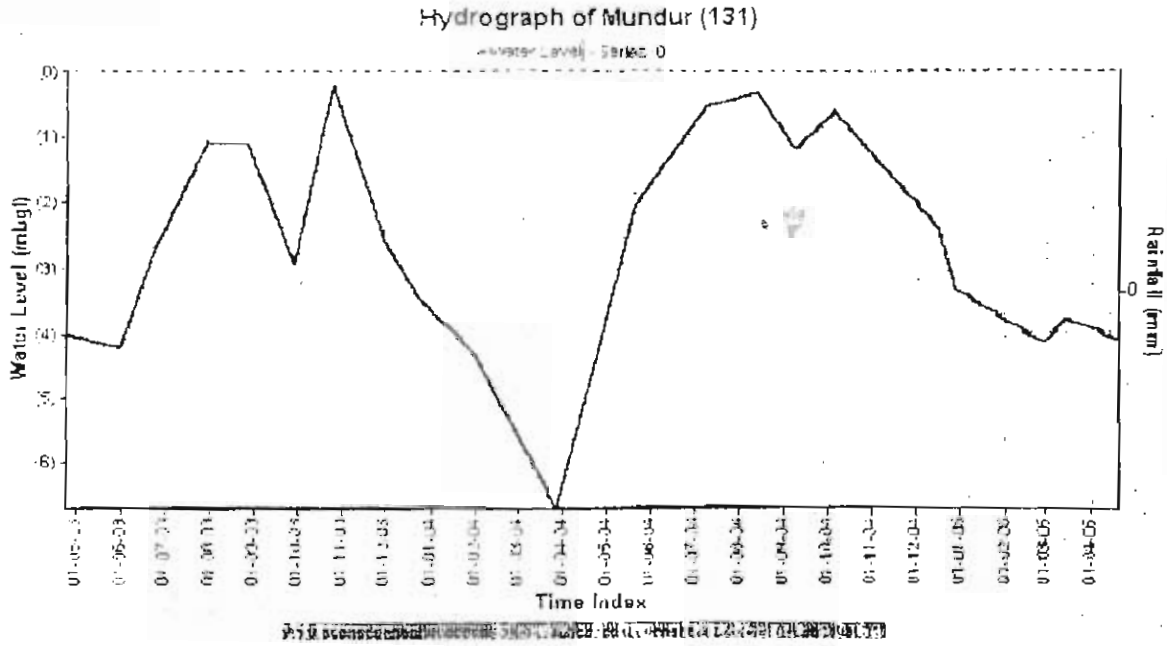


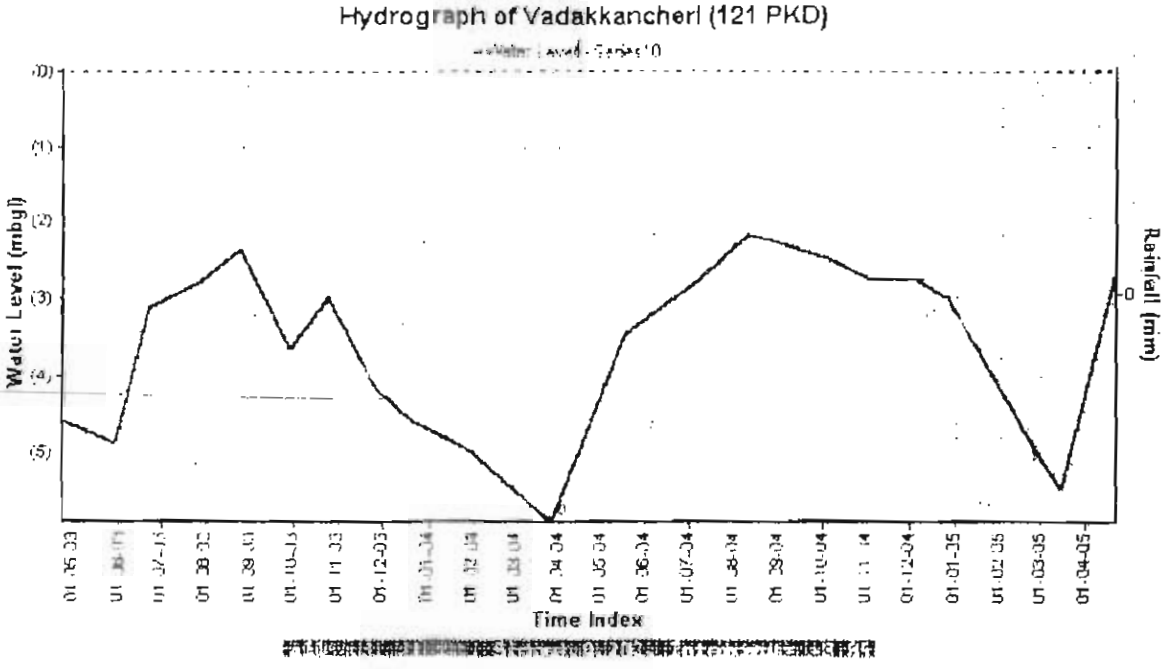
Hydrograph of Kongad (130)




Hydrograph of Pudussery (133)
Water Level (mbgl)
Time Index


Hydrograph of Kannambra (122)
Water Level (mbgl)
Time Index


Hydrograph of Mundur (131)
Water Level (mbgl)
Rainfall (mm)
Time Index


Hydrograph of Vadakkancheri (121 PKD)
Water Level (mbgl)
Rainfall (mm)
Time Index

ANNEXURE III

GOVERNMENT OF INDIA
MINISTRY OF WATER RESOURCES
CENTRAL GROUND WATER BOARD

ESTIMATION OF GROUND WATER DRAFT FOR DOMESTIC, AGRICULTURE AND INDUSTRIAL USE IN PLACHIMADA AREA, PALAKKAD DISTRICT, KERALA

KERALA REGION
TRIVANDRUM
MAY, 2005

ESTIMATION OF GROUND WATER DRAFT FOR DOMESTIC, AGRICULTURE AND INDUSTRIAL USE IN PLACHIMADA AREA, PALAKKAD DISTRICT, KERALA STATE

CONTENTS

Executive Summary

Introduction

Selection Of The Study Area

Methodology

Location, Extent and Accessibility

Demographic Profile

Soil and Land Use

Geomorphology

Drainage

Hydrology

Rainfall Pattern

Drinking Water Sources

Hydrogeology

Ground Water Draft Estimation

Conclusion

Figures

Appendices

EXECUTIVE SUMMARY

The study has been carried out in fulfillment of assurance given in reply to Rajya Sabha starred question No. 220 dated 20.7.2004 regarding utilization of ground water vide letter No.39/TC/Chn/CGWB/04-1140 dated 17th February 2005 of Chairman, Central Ground Water Board. The ground water study in the whole Perumatty Panchayath was carried out in a systematic manner to get actual ground water draft for various purposes-domestic, irrigation and industrial.

Palakkad is the land of palmyrahs and paddy fields. Along with Kuttanad, Palakkad is a major paddy growing area of Kerala state. The total area of the district is 4480 sq km. The district is divided into 13 community development blocks and 130 panchayaths. The study area, Plachimada, is located in the Perumatti Panchayaths of Chittoor block. The Chittur block is further divided into six Panchayaths. Out of the six, Perumatty Panchayath is situated eastern side of Palakkad district in Chittoor block bordering the State of Tamil Nadu with Ayyappankavu as headquarters. The Perumatty Panchayaths lies between latitudes N 10^0 37'53'' and $10^0$41' 29'' East longitudes $76^0$43' 28'' and $76^0$53' 05'' having an area of 60.91 sq.km comes under Chittoorpuzha sub-basin of Bharatapuzha river basin (58B/10and B/14).

The total population of the Perumatty Panchayath is 26923 out of which 13393 are males and 13530 are females.

The study area, Plachimada, comprises of ward numbers 4, 8 and 9 of Perumatty Panchayath. But the entire Panchayath with 15 wards forms a separate hydrogeological unit hence the entire Panchayath has been studied.

The area can be broadly classified under physiographic unit-highland. The landform units of the area are valley fill, pediment and denudational hill.

The main surface water sources of the area are Moolathara dam and Kambalathara Lake.

No rain gauge station exists in the study area. Data from the near by rain gauge stations in the at Meenkara Reservoir area and Chittor Puzha Project Office are used . The average annual rainfall of the Meenkara Reservoir area and Chittor Puzha Project Office are 1513 and 1413 mm respectively.

The area is underlain by crystalline rocks of Archaean age with Hornblende Biotite Gneiss and Biotite Gneiss as the major rock types.

The major hydrogeological unit is weathered crystalline. The thickness of weathering is very negligible and is ranges from 0.5 to 2 m. Along the valley portion potential alluvial patches are noticed. The ground water occurs under unconfined- semi confined condition in the weathered/

fractured crystalline. In general the depth to water level ranges from 2- 13 mbgl. In the eastern side of area deeper water levels are noticed where as in the western side it is relatively shallow. It is also noticed that in ward number 8 most of the dug wells are dry and the water levels in the bore wells are very deep. Mostly farmers are tapping the deeper aquifer down to a depth of 120 to 300 mbgl. Detailed study in the ward number 8 revealed that the phreatic zone is almost devoid of water and the groundwater is being extracted from the static resource. Proper artificial recharge mechanisms are also not implemented in the area.

Ground water is mainly used for domestic and irrigation purposes in Perumatty Panchayath and in ward 9 it is used for industrial purpose by M/S Hindusthan Cocacola Beverages Pvt Limited and in ward 6 M/S Kerala Alcoholic. The ground water drafts for various uses are calculated for the Chittor block, Perumatty Panchayath and Plachimada area and are furnished below.

Sl no	Assessment unit	Area in sq km	Annual gross groundwater draft						
			Irrigation MCM	%	Domestic MCM	%	Industry MCM	%	Total MCM
1	Chittor block *	261.46	39.38	65.05	5.96	9.84	15.2	25.1	60.54
2	Perumatti Panchayath**	60.91	16.125	62.94	1.08	6.20	0.201	1.15	17.406
3	Plachimada** area (ward 4,8,9)	14.511	4.86	86.76	0.203	3.55	0.183	9.69	5.246

* GEC as on March 2004 ** based on the study

The annual irrigation draft for Perumatty Panchayath is 16.125 MCM, domestic draft is 1.08 and the industrial draft is 0.201 MCM. The total annual ground water draft of the Panchayath for irrigation, domestic and industrial uses during 2004- 2005 is 17.406 MCM. Since the Panchayath is an agrarian the groundwater requirement for irrigation purposes is more. The industrial draft in Ward 9 is taken from the factory records since the factory is not extracting groundwater for the last one year due to court ban.

ESTIMATION OF GROUND WATER DRAFT FOR DOMESTIC, AGRICULTURE AND INDUSTRIAL USE IN PLACHIMADA AREA, PALAKKAD DISTRICT, KERALASTATE.

Introduction

The study has been carried out in fulfillment of assurance given in reply to Rajya Sabha starred question No. 220 dated 20.7.2004 regarding utilization of ground water vide letter No.39/TC/Chn/CGWB/04-1140 dated 17th February 2005 of Chairman Central Ground Water Board. The ground water study in the whole Perumatty Panchayath was carried out in a systematic manner to get actual draft for various purposes-domestic, irrigation and industrial. The study has been carried out by a team of Scientists of CGWB, KR namely S/Sh V Kunhambu Scientist 'D', Dr V S Joji, Scientist 'B'and Shaji E Scientist 'B'.

Selection Of The Study Area

The study area, Plachimada, comprises the ward no 4,8 and 9 of Perumatty Panchayath, Chittoor block Palakkad district of Kerala State (location map). But the entire Panchayath with 15 wards forms a separate hydrogeological unit with the Chittoor river bordering the north and Vandithavalam- Minakshipuram state highway conformable to water shed boundary in the south boarder and the eastern boundary coincide with Tamil Nadu State boundary which is also parallel to the meandering course of Chittoor river. Hence the entire Plachimada Panchayath with a total geographical area of 60.91 sq. km has been studied in detail. The Panchayath is divided into 15 wards.

Methodology

The Perumatty Panchayath has been approached first and requested to provide the Panchayath map with ward boundaries and ward wise total households and ward wise populations Then the study team visited every house ward wise systematically with the assistance of ward member and representatives of farmers society locally called 'Padasekhara Samithi'. Thus houses with ground water abstraction structure and without the same were categorized and daily ground water draft for domestic purpose is calculated by local enquiry confirming by conducting sample yield test. Similarly the list of pumping wells for agricultural purpose is collected from the a representatives of farmers society locally called 'Padasekhara Samithi' and the study team

inventoried all the wells used for irrigation purpose. The daily ground water draft for irrigation, number of pumping days per year ,types of crops were collected from the local farmers in the field itself and confirmed by conducting sample yield test by measuring the discharge rate volumetrically. In this way the ground water draft for agriculture purpose is calculated.

The industrial draft is calculated by visiting the industrial units and taking the quantity of the figure given by the industrial unit followed by field measurement of discharge. In this way the ward wise annual ground water draft for domestic, agriculture and industrial use are calculated.

The present study utilized Survey Of India (SOI) top sheets 58 B/ 14 and B/10 surveyed in 1968-69 (1:50,000). The geological and soil type mapping carried out in the area to know the aquifer type and surface material. Various geomorphic units of the area and land use / land cover categorizes were identified during the field truth verification. The house-to-house survey in the area gathered information on various types of ground water abstraction structures practiced on the area and sources of drinking water. It is noticed that people of Perumatty Panchayath utilized large diameter dug wells for irrigation draft (locally known as 'Kokarinis'). The acreage of different crop types utilizing ground water of Kokarinis is obtained from farmers during the survey period. The discharge of individual Kokarinis determined by yield test utilizing volumetric method.

A total of 15 key wells were established and depth to water level and other well inventories recorded for various types of analysis. Water samples were collected from the key wells for routine analysis.

The secondary data collected include rainfall of the area from Chittoor Puzha project. Historical water level data of Meenakshipuram Hydrograph Station and the piezometer at Perumatty have been utilised in the study.

The various statistical analyses were carried out by using Microsoft Excel. The GIS software Map Info 6.5 has been utilized for map generation and precise measurement of area. In the Map Info different layers were digitized and is followed editing. The projection (WGS 84) done before the process of digitization. After editing polygonisation done. This is followed by annotation and analysis of various layers.

Location, Extent and Accessibility

Palakkad is the land of palmyrahs and paddy fields. Along with Kuttanad, Palakkad is a major paddy growing area of Kerala state. The total area of the district is 4480 sq km. The district is divided into 13 community development blocks. The Chittur block is further divided into six Panchayaths viz. Eruthenpathy, Kozhinjampara, Nallepally, Pattancherry, Perumatty and Vadakarapathy. The study area, Plachimada is located in the Perumatti Panchayath of Chittoor block. Perumatty Panchayath is situated eastern side of Palakkad district in Chittoor block bordering the State of Tamil Nadu with Ayyappankavu as headquarters. The Perumatty lies between latitudes N 10^0 37'53'' and $10^0$41' 29'' East longitudes $76^0$43' 28'' and $76^0$53' 05'' having an area of 60.91 sq.km comes under Chittoorpuzha sub-basin of Bharatapuzha river basin. The Panchayath is divided into 15 wards for administrative purpose and bound by Chittoorpuzha in the north, Pattancherry Panchayath in the South, Coimbatore district of Tamil Nadu in the east and Chittur-Thattamangalam in west. The Panchayath comes under Chittoor Block Panchayath and Chittoor Tehsil with three villages- Perumatty, Vandithavalam and Moolathara and falls in the survey of India toposheet 58B/14 and B/10. The area has a wide network of roads and can be approachable from Palakkad, Coimbatore and Pollachi (Figure 1). The study area is about 30 km from Palakkad and Palakkad-Pollachi road pass through the area. The areal extent of different wards of the Panchayath is compiled (Table 1) and the Ward map is depicted in Fig.2.

Table 1: Areal extent of different wards of Perumatty Panchayath

Sl. No	Ward	Perimeter, Km	Area, Sq. km
1	Ward 1	9.186	3.332
2	Ward 2	13.54	4.331
3	Ward 3	11.16	4.719
4	Ward 4	14.13	6.575
5	Ward 5	13.48	7.113
6	Ward 6	10.62	4.717
7	Ward 7	7.119	3.225
8	Ward 8	10.32	5.18
9	Ward 9	9.024	2.756
10	Ward 10	11.47	5.856
11	Ward 11	8.969	2.759
12	Ward 12	7.598	2.665
13	Ward 13	7.679	1.776
14	Ward 14	10.45	2.699
15	Ward 15	7.824	3.207
Total		152.569	60.91

Soils of the area

There are three major soil types in the area viz.

1. Alluvial soil
2. Black cotton soil and
3. Lateritic soil

The alluvial soils are restricted along the banks of tributaries of Chittoorpuzha. The alluvial soil in the area is mainly utilised for paddy cultivation. The black cotton soul exhibit mud crack and have high water retaining power. The cotton cultivation is mainly done in the cotton soil. Lateritic soil is derived from laterites with more ferruginous content on valleys than high grounds. The fertility of the soul is poor with low Nitrogen and phosphorous contents. The coconut cultivation of the area is mainly done in lateritic soil.

Land use and Land cover

There is no forest cover in the area. Coconut and paddy are the principal crops in the area.

The cropping pattern of the area are paddy / viruppu (2350 ha), paddy / mundakan (2050 ha), pulses viz. low pea (1 ha) black gram (3 ha), green gram (1 ha), sugarcane (100 ha), pepper (1 ha), chilies (10 ha), ginger (3 ha), turmeric (2 ha), areca nut (1 ha), tamarind (2 ha), nutmeg (1 ha), mango (50 ha), banana (25 ha), vanilla (2 ha), drumstick (2 ha), tapioca (20 ha), brinjal (5 ha), tomato (7 ha), Amaranthus (1 ha), lady's finer (5 ha), bitter guard (1 ha), snake guard (2 ha), ash guard (2 ha), ground nut (200 ha), sesamam (2 ha), coconut 500 ha, cotton (5 ha) and fodder grass (5 ha). Barren and uncultivable land (160.5817 hectares) land under miscellaneous tree crops (67 ha), fallow other than current follow (160 ha) cultivable waste (160 ha). The viruppu and mundakan, two crops of paddy are cultivated mainly by using canal water from Chittoorpuzha project (Moolathra Main Canal). The most predominant perennial crop-coconut, vegetables and the other crops are irrigated with the help of ground water draft from dug wells (Kokaranis) and bore wells. The ward VI and VII are mainly occupied by coconut palms.

One of the main problems faced by farmers of the region is that most of the crops are producing in Perumatty Panchayath and selling at Pollachi market of Tamil Nadu at meager rate. There is no proper marketing system to collect the agricultural products in the area.

Geomorphology

As the general elevation is more than 76 m.amsl, the area can be broadly classified under physiographic unit-highland. The elevation of the area ranges between 120 and 220 m.amsl and a contour map is prepared (Fig.4). The landform units of the area are valley fill, pediment and denudational hill. The valley fill is occupied in 11 polygons with an areal extent of 10.4998 sq.km. denudational hill in 6 polygons with an area of 7.1102 sq.km and the pediment occupying only one polygon with a perimeter length of 102.4 km and an area of 43.30 sq.km. The pediment predominates (71%) among different landform categories and the areal extent of different geomorphic units is compiled (Table 3). Geomorphological map of the Panchayath is given in figure 5.

Table 3: Area extent of landform units of Perumatty Panchayath

Sl .No	Landform unit	No. of Polygons	Area, sq.km	Area, %
1	Valley fill	11	10.4998	17.23822
2	Pediment	1	43.30	71.08849
3	Denudational hill	6	7.1102	11.67329

Drainage

The area comes under Chittoorpuzha sub-basin of Bhratapuzha river basins. The drainage pattern is dendritic with third order streams joining Chittoorpuzha. The drainage map is given in figure 3.

Geology

The area under investigation is underlain by crystalline rocks of Archaean age with a higher degree of metamorphism. Hornblende biotite gneiss is the rock type of the area. The hornblende biotite gneiss of the area got migmatised and is seen in number of exposures at Karadikunnu. Mica schists within the hornblende biotite gneiss are also common in the area. Thick lateritisation in

noticed at well cuttings and road cuttings. Valley fill materials on either bank of rivers mainly occupy low-lying areas. The stratigraphic succession is compiled (Table 4).

Table 4: Stratigraphic succession of the area

Age	Formation
Recent	Valley fill
Sub-Recent	Laterite
Archaean	Hornblende biotite gneiss and biotite gneisses

Hydrology

The main surface water sources of the area are tanks/ponds, Moolathara Reservoir and Kambalathara Lake. There are numerous tanks/ponds and drainage channels in the area details are furnished in Table 5 & 6.

Table 5: Details of drainages in Perumatty Panchayath

Sl.No	Name of drainage	Length, km	Breadth, m	Depth, m
1	Karimbarathodu	3.5	4	4
2	Aazham Thodu	1.5	6	4
3	Muthalam Thodu 1	5.75	7	3
4	Muthalam Thodu 2	1	4	2
5	Kaitharavu Chal	1.85	5	2.5
6	Thannikundu Chal	1.85	5	0.5
7	Analippara Chal	1.25	5	1.2
8	Thimmichetty Chal	2.57	4.5	1.5
9	Erattuchalla Chal	2.5	5	2.5
10	Vasuvam padam Chal 1	2.25	5	2.5
11	Vasuvam padam Chal 2	10	2	1
12	Kayyem kolamb Chal	1.5	3.1	1.5
13	Nanniyode Chal	15	3.4	1.2
14	Kariyakkarakolambu Chal	3.8	5.2	1.8
15	Kizhakke maruthampara Chal	1.5	4.3	1.2
16	Anjuvellakkadu Chal	1.52	4.6	1.7
17	Srambikkal	3.2	4.3	1.6
18	Veettukuzhi Chal	1.45	3	2
19	Karakkarakolambu Chal	2.3	5.6	2.3
20	Annakkode Chal	5.8	5.6	2.3
21	Kalyappeta-Mallanchalla Chal	3.25	3.8	1.3
22	Apsmarakovil-Vhinnayappan pillai Chal	2.62	6.1	2.4
23	Valayanpara Chal	0.75	4.1	1.7
24	Ezhuthani hcal	1.53	5.3	2.3
25	Odukurinji Chal	1.48	6.32	2.3
26	Vilayodi-Chemmanam Chal	2.5	4.2	1.6
27	Paanmkolambu Chal	1.61	4.36	1.45
28	Thazhathupadam Chal	1.51	3.63	1.24
29	Pothanaykkan chlla Chal	1.3	4.21	1.31
30	Uppukaran challa Chal	2.3	3.75	1.25
31	Maruimbara Chal	4.3	3.12	1.31
32	Dafedar challa Chal	2.31	4.25	1.65
33	Plachimada	3.1	5.23	2.47
34	Mulanthodu	1.54	4.75	1.64
35	Puthusseri Chal	2.81	6.21	2.31
36	Purayoram Chal	1.32	4.12	1.35
37	Ambadukolambu Chal	3.12	3.21	1.25
38	Panayadiyan challa Chal	1.32	4.21	1.6
39	Melpadam Chal	1.02	4.85	1.64
40	Varavarachalla Chal	1	3.85	2.1
41	Mallanchalla Chal	1	4	1.5
42	Kallanthodu Chal	2.5	4.5	1.6

Table 6: Details of Perennial Ponds in Perumatty Panchayath

S. No	Name of Pond	Ward	Village
1	Veetukuzhi Kulam	I	Vandithavalam
2	Panamkolambu Kulam	,,	,,
3	Puthusseri thamarakKulam	,,	,,
4	Koomankadu Kulam	II	,,
5	Parakkalam Kulam	,,	,,
6	Thazhathupadam Kulam	,,	,,
7	Vayalukulam Kulam	,,	,,
8	Perumadu Kulam	,,	,,
9	Perumadu thamarak Kulam	,,	,,
10	Mannakkodu Kulam	,,	,,
11	Mooppan Kulam	,,	,,
12	Alayar Kulam	III	,,
13	Kariyakkarakolambu Kulam	,,	,,
14	Pothanayikkan challa thamarakKulam	,,	,,
15	Namboori challa Kulam	,,	,,
16	Pond near Apasmarakovil	IV	Perumatty
17	Dafedar challa Kulam	,,	,,
18	Vembra Kulam	,,	,,
19	Chinnappan challa Kulam	,,	,,
20	Ezhuthani kualm	VII	Vandithavalam
21	Ambattukolambu Kulam	,,	,,
22	Kalyanapetta Kulam	VIII	Perumatty
23	Thimmichetti Kulam	,,	,,
24	Kali menon challa Kulam	,,	,,
25	Mullakkal challa Kulam	,,	,,
26	Odukurinji Kulam	X	,,
27	Nandiyodu Kulam	,,	,,
28	Kaypem kolambu Kulam	,,	,,
29	Erattu challa Kulam	,,	,,
30	Thattan challa Kulam	,,	,,
31	Ayyappankavu Kulam	,,	,,

The left bank canal of Moolathara irrigation Project provides water for irrigation in the eastern half of Perumatty Panchayath whereas the canals of Chittor Puzha Project meets irrigation requirements to some extent in the western part of the Panchayath.

Rainfall of the Area

It is noticed that there is no rain gauge station in the area. The rain gauge stations in the near by area are at Meenkara Reservoir area and Chittor Puzha Project office and are about 6 km each

from the study area. The mean values of annual rainfall of the Meenkara Reservoir area and Chittor Puzha Project Office are 1513 and 1413 mm respectively.

Drinking Water Sources

There are a total of 1254 public taps supplying drinking water to different wards during summer and the figure comes to 1057 during rainy season. The number of tanker lorries employed for supplying water during rainy and summer season are 404 and 471 respectively.

The main water resources of the area are open dug wells, bore wells, tanks / ponds. There are 2804 public wells in the Panchayath. The well statistics and water infrastructure in the different wards of the Panchayath are compiled (Table 7, 8, 9 & 10).

Table 7: Source of drinking water in Summer Season

	Ward															Grand Total
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	
Own Well	143	130	162	106	8	50	44	49	55	128	108	177	93	85	135	1473
Borewell	31	30	40	28	36	58	42	47	5	14	88	18	24	28	19	508
Public tap	52	82	38	8	160	136	126	26	109	46	45	92	168	121	45	1254
Public well	189	56	189	31	8	12	5	40	123	173	64	31	51	39	68	1079
Neighbors well	40	259	27	99	6	6	39	47	32	9	5	112	28	165	184	1058
Tanker Lorry	2		0	95	95	24		137	94				2	14	8	471
Others	2		44	0		17	46	20					18	4	29	130
Total	459	557	500	367	313	303	302	366	418	370	419	430	384	456	488	6132

Table 8: Source of drinking water in rainy season

	Ward															Grand Total
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	
Own Well	238	265	202	174	54	57	62	76	140	216	110	157	187	244	160	2342
Borewell	26	29	31	20	36	56	19	30	30	9	88	39	8	12	37	470
Public tap	31	49	39	16	147	130	127	14	36	35	45	121	116	102	49	1057
Public well	122	58	127	47	8	12	3	10	114	104	63	18		21	86	793
Neighbours well	41	153	25	102	4	13	37	28	5	6	4	95		59	149	721
Tanker Lorry		0		8	64	28		194	93					13	4	404
Others	1	3	76			7	54	14			109		73	109	14	341
Total	459	557	500	367	313	303	302	366	418	370	419	430	384	456	488	6132

Table 9: Distance for getting water during summer season

	Ward															Grand Total
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	
up to 100mt	393	429	327	176	160	190	177	199	82	303	186	335	345	377	148	3827
101mt-200mt	47	70	23	19	119	29	55	124	85	41	77	44	34	27	40	834
201mt-500mt	14	38	15	49	34	3	17	25	83	9	10	36	5	42	51	431
501mt-1km	4	14	4	30			8	12	85	6	19	15		10	4	211
1km to 2km	1	6		6			3	6	42	11	18				12	105
2km- above				87					41							128
No response			131				42				109				233	515
Total Families	459	557	500	367	313	303	302	366	418	370	419	430	384	456	488	6132

Table 10: Distance for getting water during rainy season

	Ward														Grand Total	
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	
up to 100mt	424	494	314	159	182	204	91	202	84	345	210	341	364	393	183	3990
101mt-200mt	19	48	37	22	109	20	34	92	104	18	75	56	20	17	43	714
201mt-500mt	11	6	44	27	22	4	18	64	83	7	13	33		23	23	378
501mt-1km	5	5	6	9			9	2	85		8			15	4	148
1km to 2km		4		2			3	6	36		4			8	27	90
2km- above									26							26
No response			99	148			147				109				208	711
Total Families	459	557	500	367	313	303	302	366	418	370	419	430	384	456	488	6132

Hydrogeology

The area is underlain by crystalline rocks of Archaean age with Hornblende Biotite Gneiss and Biotite Gneiss as the major rock types.

The major hydrogeological unit is weathered crystalline. The thickness of weathering is very negligible and is ranges from 0.5 to 2 m. Along the valley portion potential alluvial patches are noticed. The ground water occurs under unconfined- semi confined condition in the weathered/ fractured crystalline. In general the depth to water level ranges from 2- 13 mbgl. In the eastern side of area deeper water levels are noticed where as in the western side it is relatively shallow. It is also noticed that in ward no 8 most of the dug wells are dry and the water levels in the bore wells are very deep. Mostly farmers are tapping the deeper aquifer down to a depth of 120 to 300 mbgl. Detailed study in the ward number 8 revealed that the phreatic zone is almost dry and the groundwater is being extracted from the static resource. Proper artificial recharge mechanisms are also not implemented in the area.

Hydrogeological map has been prepared and presented in fig.7. Various layers used in the preparation of hydrogeological maps are boundary, drainage, geology, depth to water level and Key wells.

Water Level Elevation Contour

The water level elevation contour map of Perumatty Panchayath has been prepared using approximate water table contour values and furnished in fig.8.

Table 14: Reduced Water level of Key wells of Perumatty Panchayath.

Well ID	Longitude	Latitude	DWL, mbgl	Reduced Water Level, mamsl
K1	76.8092	10.6703	5.13	154.87
k2	76.8046	10.6659	6.25	153.75
K3	76.8133	10.6480	8.2	171.8
K4	76.8099	10.6472	3.75	176.25
K5	76.8068	10.6536	4.9	175.1
K6	76.7563	10.6775	2.98	117.02
K7	76.7494	10.6872	8	112
K8	76.7740	10.6484	5	135
K9	76.7814	10.6848	6.5	133.5
K10	76.7540	10.6504	6.6	133.4
K11	76.7253	10.6719	3.9	116.1
K12	76.7896	10.6500	6.2	153.8
K13	76.8335	10.6361	13	187
K14	76.8237	10.6586	3.8	176.2
K15	76.8730	10.6608	2	198
*K16	76.8612	10.6326	8.21	191.79

* K16 – National Hydrograph Station at Meenakshipuram

The following conclusions are made based on the perusal of the map.

1. Lowest water table contours occur towards western part of Perumatty Panchayath and the values of water level elevation ranges between 111.94 and 125 mamsl in the western part.

2. Higher water table contours occurs towards east and north-eastern portions and national hydrograph station at Meenkshipuram; and the values of water level elevation ranges between 175 and 198 mamsl.

3. Values of water table contours ranges between 125 and 150 mamsl in the middle part of the Perumatty Panchayat.

4. Flow lines are drawn perpendicular to contours and the flow direction is mainly towards northwest.

Long Term Trend of Water Level

In order to know the long-term trend of depth to water level, depth to water level data of national hydrograph at Meenakshipuram with geocoordinates of 76° 51' 40.4316" and 10° 37' 57.385 has been taken and the data is compiled (Table 11) and the hydrograph is depicted in Fig. 9. The study reveals that there is a declining trend in the area.

Table 11: Depth to water level (mbgl) data of Meenakshipuram National Hydrograph Station

Year	January	April	August	November
1994			3.75	3.5
1995	5.60	7.85	6.10	6.64
1996	8.15	10.05	6.06	5.56
1997	6.02	7.32	4.35	3.37
1998	4.58	5.09	4.63	4.15
1999	3.97	6.39	5.01	5.15
2000	6.70	6.10	6.97	6.05
2001	6.09	8.39	6.00	6.58
2002	5.88	8.40	6.78	6.84
2003	7.57	7.57	6.67	4.58
2004	5.74	8.33	4.50	-

Sub-Surface Lithology

In order to study the sub surface lithology, the exploratory well details of the Perumatty Piezometer has been taken. The Perumatty piezometer with geocoordinates of 76° 45' 52.4016" and 10° 38' 54.337 having a depth of 60 mbgl and the litholog is compiled (Table 12) and the water quality parameters analyzed on 01/08/1998 reveals that the water is suitable for domestic, irrigation and industrial purposes and the water quality parameters are compiled (Table 13). The litholog of the Perumatty Piezometer is depicted in Fig.10.

Table 12: Litholog of Perumatty Piezometer

Sl. No	Depth, mbgl	Lithological Description			
		Lithology	Colour*	Texture	Shape
1	2.5	Topsoil	Brownish yellow	Fine	Rounded
2	6	Weathered gneiss	Grayish black	Medium	Sub angular
3	24	Massive gneiss	Grayish black	Fine	Sub angular
4	57	Fractured gneiss	Grayish black	Medium	Angular
5	60	Massive gneiss	Grayish black	Fine	Sub angular

Table 13: Water Quality Parameters of Water Sample of Perumatty Piezometer

Sl. No	Parameters	Results
1	pH	9.01
2	EC, ms/cm	511
3	Total Hardness	216
4	CO3 (mg/l)	12.00
5	HCO3 (mg/l	229.00
6	Cl (mg/l)	26.00
7	SO4 (mg/l)	8.00
8	NO3 (mg/l)	0.40
9	Ca (mg/l)	54.00
10	Mg (mg/l)	19.00
11	Na (mg/l)	19.00
12	K (mg/l)	4.40
13	F (mg/l)	0.80

Groundwater Draft Estimation

Ground water is mainly used for domestic and irrigation purposes in Perumatty Panchayath and in ward 9 it is used for industrial purpose by M/S Hindusthan Cocacola Beverages Pvt Limited and in ward 6 (M/S Kerala Alcoholic).

Ground Water Draft for Irrigation

Paddy and coconut are the main irrigated crops. Ground water is the principal source of irrigation supplemented by canal water. Large dug wells and bore wells are the major types of abstraction structures. Detailed study revealed that the eastern part of the area withdrawal of ground water is more than the eastern part of the area. There are 838 irrigation wells in Perumatty Panchayath. Wards 5 and 7 contain maximum number of irrigation wells. Details of irrigation wells with name of farmer, type of abstraction structure, daily ground water draft and annual ground water draft etc of all the 15 Wards of Perumatty Panchayat are compiled in Appendix 1. The total annual ground water draft for irrigation worked out is 16.12553 MCM, which is 92.64% of the total draft.

Ground Water Draft for Domestic Purpose

Ground water meets the domestic requirement of 27000 people living in 6132 houses of the Panchayat. There are 1473 private dug wells and 508 bore wells, which cater to the domestic needs. Water is imported from adjoining Wards through tanker lorries during summer especially in Ward 8, 9 and 6. The details of the drinking water source are depicted in Table No. 7, 8, 9 and 10. Ground water draft for domestic purpose of all the Ward of Perumatty Panchayath is presented in Appendix II. A perusal of this shows that the total ground water draft for domestic purpose is 1.079 MCM, which is 6.2% of the annual gross ground water draft.

Ground Water Draft for Industrial Purpose

There are two industrial units withdrawing ground water as raw material. One is M/S Hindustan Cocacola Beverages Pvt Limited in ward 9. As per factory record 500 cubic meter ground water is withdrawn daily through 5 bore wells and 2 dug wells. Thus the total annual ground water draft is 0.183 MCM. Another ground water using industry is M/S Kerala Alcoholic in Ward 6. The total ground water draft per day though 2 bore wells is 50 cubic meter and the annual ground water

draft is 0.118 MCM. Thus the gross ground water draft for industrial draft in the Perumatty Panchayat is 0.201 MCM, which is 1.15 % of the gross draft for all purposes. Ward wise total draft for all uses is compiled (Table 15).

Table 15: Ward wise total ground water draft (MCM) for all uses in Perumatty Panchayath

Ward No	Area, Sq. km	Irrigation draft	Domestic daft	Industrial draft	Draft for all uses
1	3.332	0.34776	0.084		0.432
2	4.331	0.41616	0.103		0.519
3	4.719	0.98496	0.08		1.065
4	6.575	1.55196	0.069		1.621
5	7.113	3.14244	0.062		3.204
6	4.717	1.33812	0.063	0.018	1.419
7	3.225	2.64024	0.062		2.702
8	5.18	1.67400	0.067		1.741
9	2.756	1.63872	0.067	0.183	1.889
10	5.856	0.41801	0.066		0.484
11	2.759	0.25920	0.068		0.327
12	2.665	0.38880	0.055		0.444
13	1.776	0.56700	0.072		0.639
14	2.699	0.31752	0.071		0.389
15	3.207	0.44064	0.091		0.532
Total	60.91	16.12553	1.08	0.201	17.407
% to Total Draft		92.64069 %	6.204588 %	1.154739 %	100%

Ground Water Draft in Plachimada Area

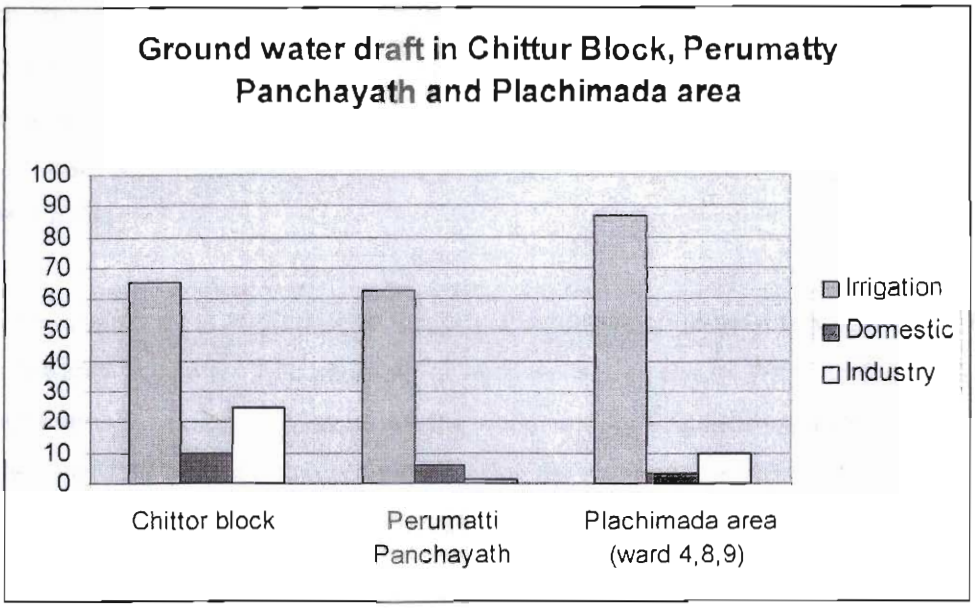
Even though ground water draft has been estimated for the entire Panchayat, the actual Plachimada area comprises only Wards 8,9 and 4 with a total area of 14.511 sq.km. M/S Hindustan Cocacola Beverages Pvt Limited in ward 9, where three wards meet together. There are 71 irrigation wells in Ward No 4, 47 in Ward No 8 and 95 in Ward No 9. Hence the total ground water draft for irrigation in Plachimada area is 4.86 MCM (92.64%). The total ground water draft for domestic use 0.203 MCM (3.87%) and for the only industry is 0.183 MCM (3.49%). In Ward 9 where the M/S Hindustan Cocacola Beverages Pvt Ltd is situated, the gross ground water draft for all uses is 1.889 MCM (Appndix 1). The percent ground water draft for domestic, irrigation and industrial purposes in Ward 9 are 3.55 %, 86.76% and 9.69% respectively.

The ground water drafts for various uses are calculated for the Chittor block, Perumatty Panchayath and Plachimada area and are furnished below (Table 16).

Table 16: The drafts for various uses in Chittor block, Perumatty Panchayath and Plachimada area

Sl no	Assessment unit	Area in sq km	Annual gross groundwater draft						
			Irrigation MCM	%	Domestic MCM	%	Industry MCM	%	Total MCM
1	Chittor block *	261.46	39.38	65.05	5.96	9.84	15.2	25.1	60.54
2	Perumatti Panchayath**	60.91	16.125	62.94	1.08	6.20	0.201	1.15	17.406
3	Plachimada** area (ward 4,8,9)	14.511	4.86	86.76	0.203	3.55	0.183	9.69	5.246

* GEC as on March 2004 ** based on the study



Conclusions

Entire Perumatty Panchayath has been taken for the study. It consists of 15 wards. Ward wise details of total draft for all uses were calculated. The irrigation draft for the Panchayath is 16.125 MCM, domestic draft is 1.08 and the industrial draft is 0.201 MCM. The total draft of the Panchayath is 17.406MCM. Since the Panchayath is an agrarian the groundwater requirement for irrigation purposes is more. The coco cola factory is located in Ward no 9. In this ward irrigation draft is also on the higher side. Though this area is a rain shadow region the demand for groundwater and its exploitation is more. To sustain the actual irrigated crops 16.125 MCM of groundwater is highly essential in the event of failure of monsoon or stoppage of canal flow. The principle source of recharge is rainfall, canal water and return flow from irrigation. Majority of the area is practicing drip irrigation.

Even though the ground water draft has been estimated for the entire panchayath, the actual Plachimada area comprises only ward no.8,9&4 with a total area of 14.511sqkm. M/S Hindustan Cococola Factory is situated in ward no.9 where three wards meet together. There are 77 irrigation wells in ward no.4, 47 in ward no.8 and 95 in ward no.9 and the total ground water draft for the irrigation is 4.86 MCM(92.64%), Domestic draft is 0.203MCM(3.87%) and industrial draft is 0.183MCM(3.49%).

In the eastern side of Coco cola factory, Plachimada in Ward no 8 and 9 the hydraulic gradient is towards northwest. Maximum no of bore wells are seen in Ward no 8 and the phreatic groundwater source is negligible. Most of the dug wells used for irrigation went dry. Now the farmers are using these dry dug wells as storage tank of storing the water pumped from bore wells. This is not only giving added expenditure on pumping but also a significant quantity of water is lost as recharge. Hence the farmers have been advised to construct separate storage tanks.

There is no deeper peizometer exists in the Plachimada area to monitor the peizometric head of the deeper aquifer. But local enquiry with the farmers revealed that during 2002-03 they have lowered the submersible pumps since the water levels in the bore wells have gone down and majority of the bore wells are being pumped using submersible pumps from 120 – 200 meters. Hence the entire groundwater draft in Ward no 8 (i.e. 1.674 MCM) can be treated as exploitation from the static resource. This ward is located on the eastern side of the Coco Cola factory. Over dependence on the static resource in the area may lead to future groundwater crisis. Hence adequate artificial recharge to groundwater measures is to be adopted in the Panchayath.

Fig 1: Road Network in Perumatty Panchayat

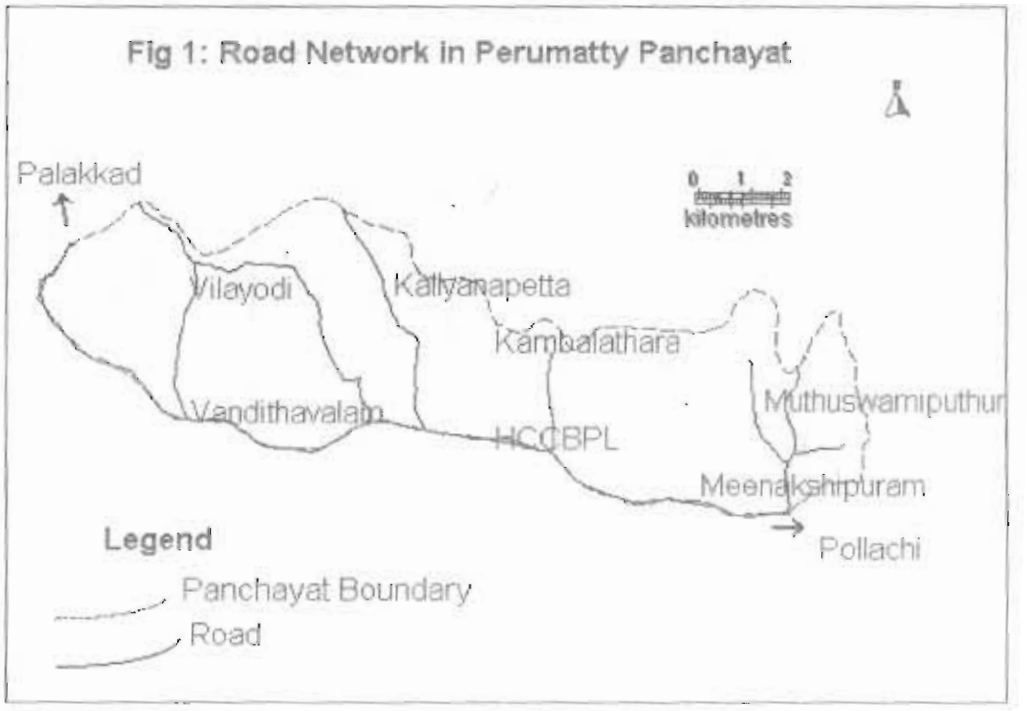
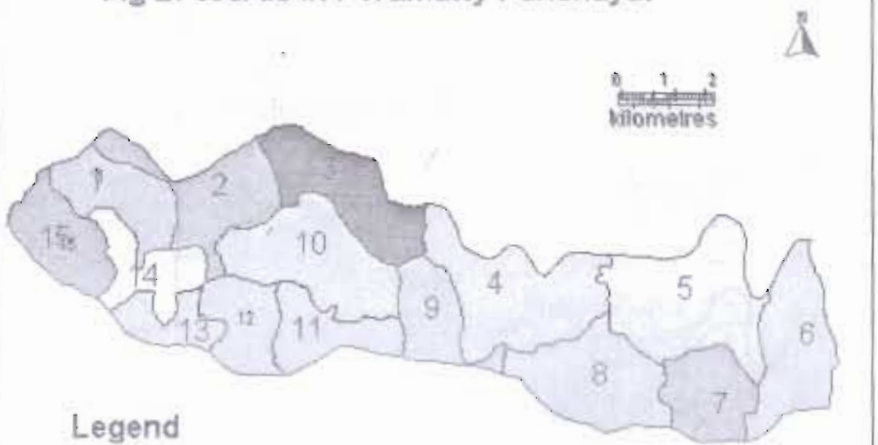


Fig 2: Wards in Perumatty Panchayat



Legend

1,2 ....15 Wards

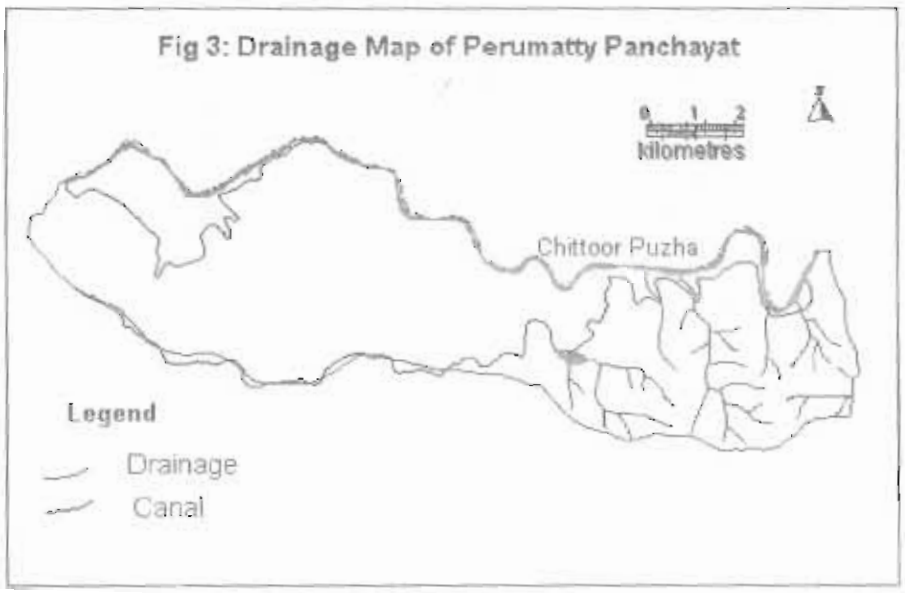


Fig 3: Drainage Map of Perumatty Panchayat
0 1 2
kilometres
Chittoor Puzha
Legend
Drainage
Canal

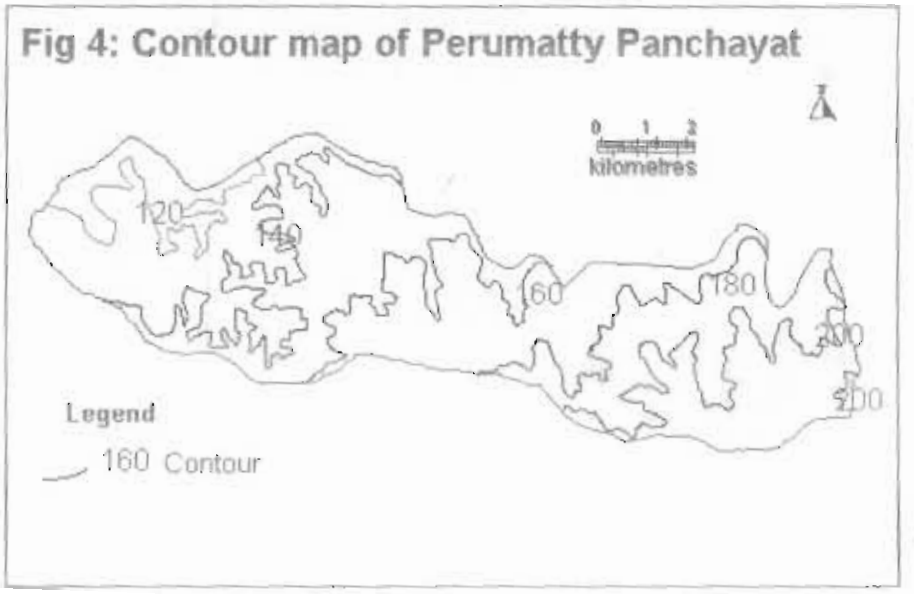


Fig 4: Contour map of Perumatty Panchayat
0 1 2
kilometres
120
140
160
180
200
200
Legend
160 Contour

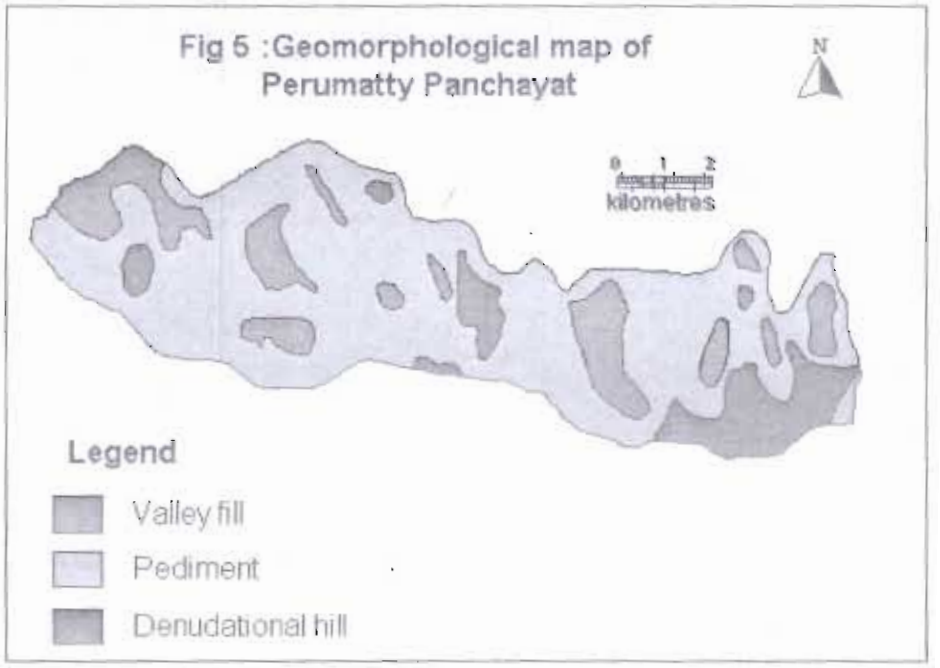


Fig 5 :Geomorphological map of
Perumatty Panchayat
N
0 1 2
kilometres
Legend
Valley fill
Pediment
Denudational hill

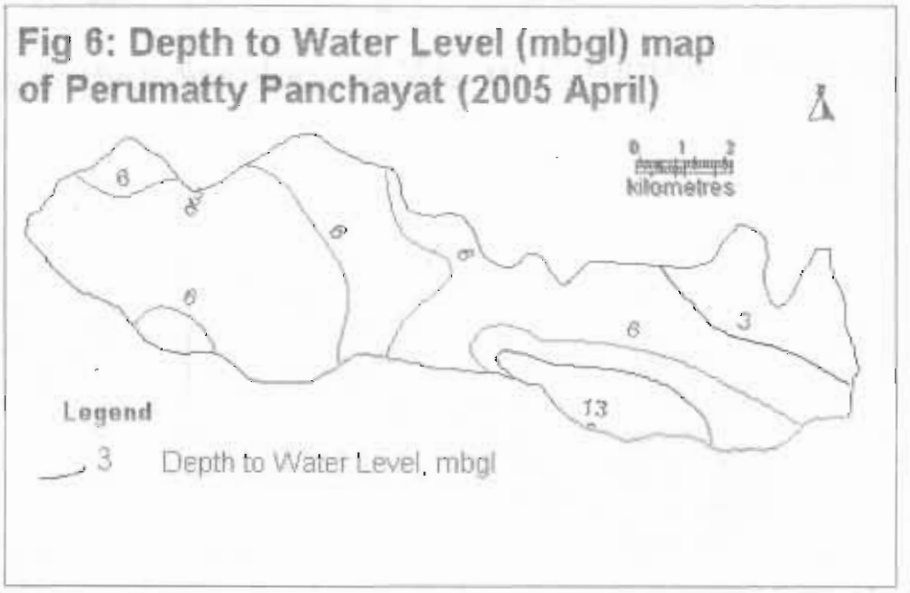


Fig 6: Depth to Water Level (mbgl) map of Perumatty Panchayat (2005 April)
0 1 2
kilometres
6
6
6
6
3
13
Legend
3 Depth to Water Level, mbgl

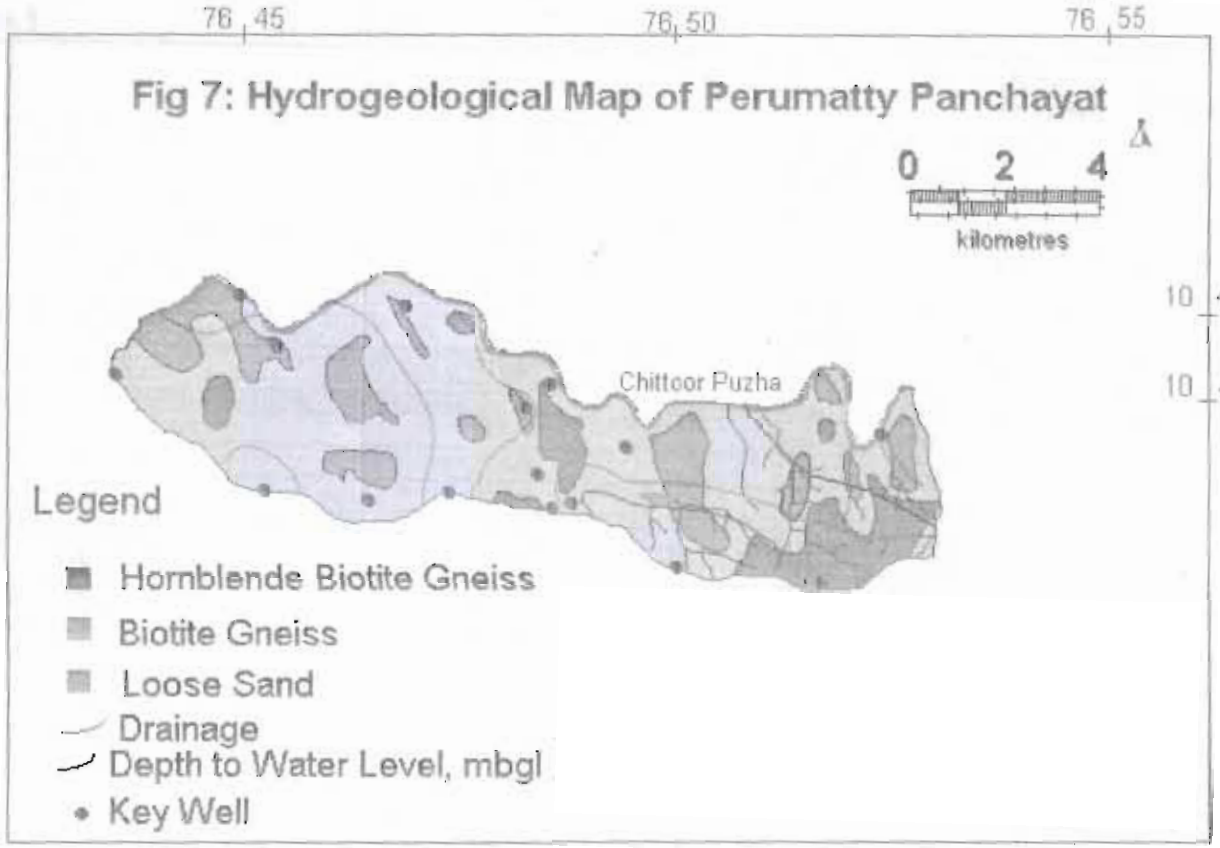


Fig 7: Hydrogeological Map of Perumatty Panchayat

Detailed irrigation wells(Wardwise) in Perumatty panchayath, Palakkad district

Ward No.1

Sl.No.	Name of farmer	Type of well	No. of well	Crops cultivated	Area irrigated, acre	Ground water draftm^3/day	No. of days/year	Annual draft m^3
1	Mayappan	DW	1	coconut,paddy	6	108	180	19440
2	Vydyanatha Iyer	DW	2	coconut,paddy	6	108	180	19440
3	Sasidharan, Village officer	BW	1	coconut	3	54	180	9720
4	Praveen Kumar	BW	1	coconut	2	54	180	9720
5	Sasidharan(Gulf)	DW	1	coconut,paddy	2	54	180	9720
6	Sasidharan(Gulf)	BW	1	coconut	4	108	180	19440
7	Gangadharan	BW	1	coconut	3	54	180	9720
8	Panamkulambu Brothers,Sreenivasan	DW	3	coconut,paddy	30	324	180	58320
9	Parakalam-Kannu	DW	1	coconut,paddy	15	188	180	33840
10	Ramkrishnan	DW	1	coconut,paddy	6	108	180	19440
11	Angalan	DW	1	coconut,paddy	10	124	180	22320
12	K.Madhavan, Kottapadam	DW	2	coconut,paddy	25	324	180	58320
13	Guruvayoorappan	DW	1	coconut,paddy	4	108	180	19440
14	Haridas	DW	1	coconut,paddy	5	108	180	19440
15	Ibrahim	DW	1	coconut,paddy	5	108	180	19440
							Total	347760
							=	0.34776MCM

Detailed irrigation wells(Wardwise) in Perumatty panchayath, Palakkad district

Ward No.2

Sl.No.	Name of farmer	Type of well	No. of well	Crops cultivated	Area irrigated, acre	Ground water draftm^3/day	No. of days/year	Annual draft m^3
1	Santhosh	DW	1	coconut,paddy	8	144	180	25920
2	Ramankutty	DW	1	coconut,paddy	6	108	180	19440
3	Karunakaran	DW	1	coconut,paddy	12	188	180	33840
4	Chandran	DW	1	coconut,paddy	8	144	180	25920
5	Karuna Medical College	DW	2	college garden	5	288	180	51840
6	Rajendran	DW	2	coconut,paddy	10	144	180	25920
7	Sekaharan	DW	3	coconut,paddy	4	108	180	19440
8	Gafoor	DW	1	coconut,paddy	10	144	180	25920
9	Asokan	DW	1	paddy	2	72	180	12960
10	Bhaskaran	DW	1	paddy	3	72	180	12960
11	Kurchan	DW	1	coconut,paddy	5	108	180	19440
12	Ramachadnran	DW	1	coconut,paddy	3	72	180	12960
13	Shanmugham	DW	1	coconut,paddy	3	72	180	12960
14	Prashob	DW	1	coconut,paddy	3	72	180	12960
15	Gopalankutty	DW	1	coconut,paddy	8	144	180	25920
16	Krishnankutty	DW	2	paddy	10	144	180	25920
17	Krishnankutty	BW	5	coconut	20	288	180	51840
							Total	416160
							=	0.41616MCM

Detailed irrigation wells(Wardwise) in Perumatty panchayath, Palakkad district

Ward No.3

Sl.No.	Name of farmer	Type of well	No. of well	Crops cultivated	Area irrigated, acre	Ground water draftm^3/day	No. of days/year	Annual draft m^3
1	Kutty Appu	DW	1	coconut,paddy	5	108	180	19440
2	Gopi	DW	1	coconut,paddy	5	108	180	19440
3	Sankaran	DW	1	coconut,paddy	8	144	180	25920
4	Ponnuchami	DW	1	coconut,paddy	9	144	180	25920
5	Jayan	DW	1	coconut,paddy	15	180	180	32400
6	Chenthamara	DW	1	coconut,paddy	10	144	180	25920
7	Prabhakaran	DW	1	coconut,paddy	15	180	180	32400
8	Prabhakaran	BW	3	coconut,paddy	10	144	180	25920
9	Satheesan	DW	1	coconut,paddy	10	144	180	25920
10	Muthaliyar Murukadas	DW	1	coconut,paddy	9	144	180	25920
11	Raj Muthaliyar	DW	1	coconut,paddy	15	180	180	32400
12	Raj Muthaliyar	BW	1	coconut,paddy	10	144	180	25920
13	Ponnu Muthaliyar	DW	1	coconut,paddy	10	144	180	25920
14	Mohanan	DW	2	coconut,paddy	10	144	180	25920
15	Mohanan	BW	1	coconut,paddy	8	108	180	19440
16	Haneefa	DW	1	coconut,paddy	5	108	180	19440
17	Aru	DW	1	coconut,paddy	5	108	180	19440
18	Sankaran	DW	1	coconut,paddy	4	72	180	12960
19	Sankaran	DW	1	coconut,paddy	4	72	180	12960
20	Nachu	DW	1	coconut,paddy	2	54	180	9720
21	Krishnamoorthi	DW	1	coconut,paddy	3	54	180	9720
22	Mohammed Shareef	DW	1	coconut,paddy	5	108	180	19440
23	Prakash	DW	1	coconut,paddy	3	72	180	12960
24	Ramesh	DW	1	coconut,paddy	6	108	180	19440
25	Kesavan	DW	1	coconut,paddy	5	108	180	19440
26	Johnson	DW	1	coconut,paddy	4	72	180	12960
27	Vijayan	DW	1	coconut,paddy	5	108	180	19440
28	Shahul Hameed	DW	1	coconut,paddy	10	144	180	25920
29	Shahul Hameed	BW	1	coconut,paddy	8	144	180	25920
30	Ismail	BW	1	coconut,paddy	7	108	180	19440
31	Ismail	DW	1	coconut,paddy	8	144	180	25920

Sl.No.	Name of farmer	Type of well	No. of well	Crops cultivated	Area irrigated, acre	Ground water draftm^3/day	No. of days/year	Annual draft m^3
32	Gopinath	DW	1	coconut,paddy	6	108	180	19440
33	Elite	DW	1	coconut,paddy	6	108	180	19440
34	Raveendran	DW	1	coconut,paddy	5	108	180	19440
35	Jaleel	BW	1	coconut,paddy	7	108	180	19440
36	Nandakumar	DW	1	coconut,paddy	7	108	180	19440
37	Marudajalam	BW	2	coconut,paddy	30	288	180	51840
38	Marudajalam	DW	1	coconut,paddy	5	108	180	19440
39	Krishnan R	DW	1	coconut,paddy	10	144	180	25920
40	Siva Narayanan	DW	1	coconut,paddy	7	108	180	19440
41	Thankavelu Goundar	DW	1	coconut,paddy	10	144	180	25920
42	Soma Goundar	DW	1	coconut,paddy	5	108	180	19440
43	Rajappan	BW	1	coconut,paddy	10	144	180	25920
44	Rajappan	DW	1	coconut,paddy	10	144	180	25920
							Total	984960
							=	0.98496MCM

Detailed irrigation wells(Wardwise) in Perumatty panchayath, Palakkad district

Ward No.4

Sl.No.	Name of farmer	Type of well	No. of well	Crops cultivated	Area irrigated, acre	Ground water draftm^3/day	No. of days/year	Annual draft m^3
1	N.V.Sudarsan	DW	1	coconut	6	108	180	19440
2	N.V.Shankaran	DW	1	coconut	10	144	180	25920
3	Suguna Vijayan	DW	1	coconut	8	144	180	25920
4	Sahadevan	DW	1	coconut	5	108	180	19440
5	Shanmukha Bros	DW	1	coconut	3	72	180	12960
6	Damayanth	DW	1	coconut	2	54	180	9720
7	Chamunni	DW	1	coconut	3	72	180	12960
8	Shanmukham	DW	1	coconut	3	72	180	12960
9	Manjar	DW	1	coconut	8	108	180	19440
10	Raja Kunnar Alias Suryanproob	DW	1	coconut	3	72	180	12960
11	Rajan & Sons	DW	2	coconut	15	288	180	51840
12	Ramachandran s/o Pasha	DW	1	coconut/mixed	10	144	180	25920
13	Nataraja Centre	DW	1	coconut/mixed	5	108	180	19440
14	Nagarath Nanu	DW	1	coconut	5	108	180	19440
15	Bhagavatheruvu	DW	1	coconut	7	108	180	19440
16	Ambikapathy	DW	1	coconut	7	108	180	19440
17	Shanmukha	DW	3	coconut,paddy	12	180	180	32400
18	Radhkrishann	DW	1	coconut	3	72	180	12960
19	Chandran & Sons	DW	3	coconut,paddy	20	324	180	58320
20	Radhakrishnan	DW	1	coconut,paddy	7	108	180	19440
21	Chinnappan	DW	1	coconut,paddy	10	144	180	25920
22	Vasu	DW	1	coconut,paddy	6	108	180	19440
23	Marimuthu Goundar	DW	1	coconut	2	54	180	9720
24	Gopalakrishnan	DW	1	coconut	1.5	54	180	9720
25	Thajinisa	DW	2	coconut	3	72	180	12960
26	Bharataraj	DW	1	coconut	6	108	180	19440
27	Ramakrishnan	DW	1	coconut	6	108	180	19440
28	Vallianna	DW	1	coconut	10	144	180	25920
29	Ibrahim	DW	1	coconut	2	54	180	9720
30	Vellakutti	DW	1	coconut	12	144	180	25920

Sl.No.	Name of farmer	Type of well	No. of well	Crops cultivated	Area irrigated, acre	Ground water draftm^3/day	No. of days/year	Annual draft m^3
32	Gopinath	DW	1	coconut,paddy	6	108	180	19440
33	Elite	DW	1	coconut,paddy	6	108	180	19440
34	Raveendran	DW	1	coconut,paddy	5	108	180	19440
35	Jaleel	BW	1	coconut,paddy	7	108	180	19440
36	Nandakumar	DW	1	coconut,paddy	7	108	180	19440
37	Marudajalam	BW	2	coconut,paddy	30	288	180	51840
38	Marudajalam	DW	1	coconut,paddy	5	108	180	19440
39	Krishnan R	DW	1	coconut,paddy	10	144	180	25920
40	Siva Narayanan	DW	1	coconut,paddy	7	108	180	19440
41	Thankavelu Goundar	DW	1	coconut,paddy	10	144	180	25920
42	Soma Goundar	DW	1	coconut,paddy	5	108	180	19440
43	Rajappan	BW	1	coconut,paddy	10	144	180	25920
44	Rajappan	DW	1	coconut,paddy	10	144	180	25920
							Total	984960
							=	0.98496MCM

Detailed irrigation wells(Wardwise) in Perumatty panchayath, Palakkad district

Ward No.3

Sl.No.	Name of farmer	Type of well	No. of well	Crops cultivated	Area irrigated, acre	Ground water draftm^3/day	No. of days/year	Annual draft m^3
1	Kutty Appu	DW	1	coconut,paddy	5	108	180	19440
2	Gopi	DW	1	coconut,paddy	5	108	180	19440
3	Sankaran	DW	1	coconut,paddy	8	144	180	25920
4	Ponnuchami	DW	1	coconut,paddy	9	144	180	25920
5	Jayan	DW	1	coconut,paddy	15	180	180	32400
6	Chenthamara	DW	1	coconut,paddy	10	144	180	25920
7	Prabhakaran	DW	1	coconut,paddy	15	180	180	32400
8	Prabhakaran	BW	3	coconut,paddy	10	144	180	25920
9	Satheesan	DW	1	coconut,paddy	10	144	180	25920
10	Muthaliyar Murukadas	DW	1	coconut,paddy	9	144	180	25920
11	Raj Muthaliyar	DW	1	coconut,paddy	15	180	180	32400
12	Raj Muthaliyar	BW	1	coconut,paddy	10	144	180	25920
13	Ponnu Muthaliyar	DW	1	coconut,paddy	10	144	180	25920
14	Mohanan	DW	2	coconut,paddy	10	144	180	25920
15	Mohanan	BW	1	coconut,paddy	8	108	180	19440
16	Haneefa	DW	1	coconut,paddy	5	108	180	19440
17	Aru	DW	1	coconut,paddy	5	108	180	19440
18	Sankaran	DW	1	coconut,paddy	4	72	180	12960
19	Sankaran	DW	1	coconut,paddy	4	72	180	12960
20	Nachu	DW	1	coconut,paddy	2	54	180	9720
21	Krishnamoorthi	DW	1	coconut,paddy	3	54	180	9720
22	Mohammed Shareef	DW	1	coconut,paddy	5	108	180	19440
23	Prakash	DW	1	coconut,paddy	3	72	180	12960
24	Ramesh	DW	1	coconut,paddy	6	108	180	19440
25	Kesavan	DW	1	coconut,paddy	5	108	180	19440
26	Johnson	DW	1	coconut,paddy	4	72	180	12960
27	Vijayan	DW	1	coconut,paddy	5	108	180	19440
28	Shahul Hameed	DW	1	coconut,paddy	10	144	180	25920
29	Shahul Hameed	BW	1	coconut,paddy	8	144	180	25920
30	Ismail	BW	1	coconut,paddy	7	108	180	19440
31	Ismail	DW	1	coconut,paddy	8	144	180	25920

Detailed irrigation wells(Wardwise) in Perumatty panchayath, Palakkad district

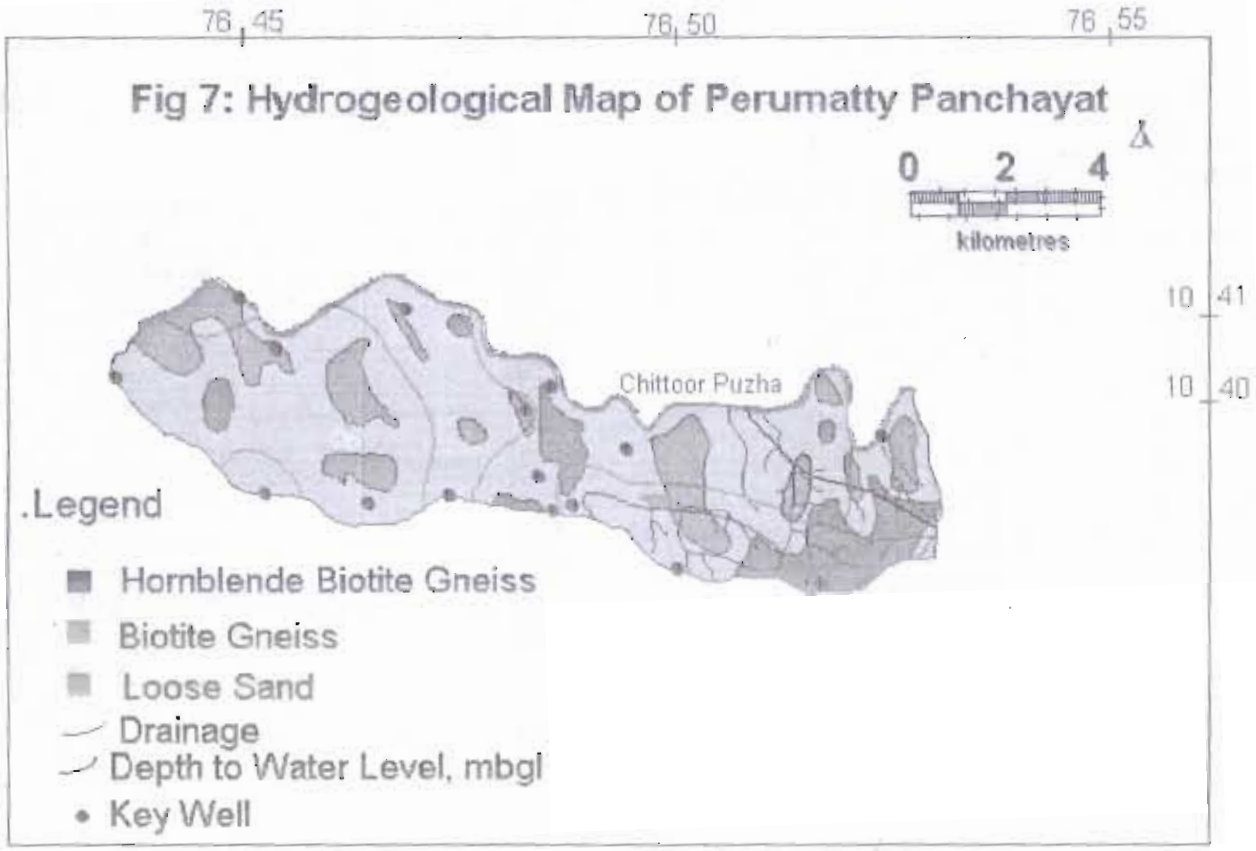
Ward No.2

Sl.No.	Name of farmer	Type of well	No. of well	Crops cultivated	Area irrigated, acre	Ground water draftm^3/day	No. of days/year	Annual draft m^3
1	Santhosh	DW	1	coconut,paddy	8	144	180	25920
2	Ramankutty	DW	1	coconut,paddy	6	108	180	19440
3	Karunakaran	DW	1	coconut,paddy	12	188	180	33840
4	Chandran	DW	1	coconut,paddy	8	144	180	25920
5	Karuna Medical College	DW	2	college garden	5	288	180	51840
6	Rajendran	DW	2	coconut,paddy	10	144	180	25920
7	Sekaharan	DW	3	coconut,paddy	4	108	180	19440
8	Gafoor	DW	1	coconut,paddy	10	144	180	25920
9	Asokan	DW	1	paddy	2	72	180	12960
10	Bhaskaran	DW	1	paddy	3	72	180	12960
11	Kurchan	DW	1	coconut,paddy	5	108	180	19440
12	Ramachadnran	DW	1	coconut,paddy	3	72	180	12960
13	Shanmugham	DW	1	coconut,paddy	3	72	180	12960
14	Prashob	DW	1	coconut,paddy	3	72	180	12960
15	Gopalankutty	DW	1	coconut,paddy	8	144	180	25920
16	Krishnankutty	DW	2	paddy	10	144	180	25920
17	Krishnankutty	BW	5	coconut	20	288	180	51840
							Total	416160
							=	0.41616MCM

Detailed irrigation wells(Wardwise) in Perumatty panchayath, Palakkad district

Ward No.1

Sl.No.	Name of farmer	Type of well	No. of well	Crops cultivated	Area irrigated, acre	Ground water draftm^3/day	No. of days/year	Annual draft m^3
1	Mayappan	DW	1	coconut,paddy	6	108	180	19440
2	Vydyanatha Iyer	DW	2	coconut,paddy	6	108	180	19440
3	Sasidharan, Village officer	BW	1	coconut	3	54	180	9720
4	Praveen Kumar	BW	1	coconut	2	54	180	9720
5	Sasidharan(Gulf)	DW	1	coconut,paddy	2	54	180	9720
6	Sasidharan(Gulf)	BW	1	coconut	4	108	180	19440
7	Gangadharan	BW	1	coconut	3	54	180	9720
8	Panamkulambu Brothers,Sreenivasan	DW	3	coconut,paddy	30	324	180	58320
9	Parakalam-Kannu	DW	1	coconut,paddy	15	188	180	33840
10	Ramkrishnan	DW	1	coconut,paddy	6	108	180	19440
11	Angalan	DW	1	coconut,paddy	10	124	180	22320
12	K.Madhavan, Kottapadam	DW	2	coconut,paddy	25	324	180	58320
13	Guruvayoorappan	DW	1	coconut,paddy	4	108	180	19440
14	Haridas	DW	1	coconut,paddy	5	108	180	19440
15	Ibrahim	DW	1	coconut,paddy	5	108	180	19440
							Total	347760
							=	0.34776MCM


76 45
76 50
76 55
Fig 7: Hydrogeological Map of Perumatty Panchayat
N
0 2 4
kilometres
10 41
10 40
Chittoor Puzha
.Legend
Hornblende Biotite Gneiss
Biotite Gneiss
Loose Sand
Drainage
Depth to Water Level, mbgl
Key Well

Detailed irrigation wells(Wardwise) in Perumatty panchayath, Palakkad district

Ward No.1

Sl.No.	Name of farmer	Type of well	No. of well	Crops cultivated	Area irrigated, acre	Ground water draftm^3/day	No. of days/year	Annual draft m^3
1	Mayappan	DW	1	coconut,paddy	6	108	180	19440
2	Vydyanatha Iyer	DW	2	coconut,paddy	6	108	180	19440
3	Sasidharan, Village officer	BW	1	coconut	3	54	180	9720
4	Praveen Kumar	BW	1	coconut	2	54	180	9720
5	Sasidharan(Gulf)	DW	1	coconut,paddy	2	54	180	9720
6	Sasidharan(Gulf)	BW	1	coconut	4	108	180	19440
7	Gangadharan	BW	1	coconut	3	54	180	9720
8	Panamkulambu Brothers,Sreenivasan	DW	3	coconut,paddy	30	324	180	58320
9	Parakalam-Kannu	DW	1	coconut,paddy	15	188	180	33840
10	Ramkrishnan	DW	1	coconut,paddy	6	108	180	19440
11	Angalan	DW	1	coconut,paddy	10	124	180	22320
12	K.Madhavan, Kottapadam	DW	2	coconut,paddy	25	324	180	58320
13	Guruvayoorappan	DW	1	coconut,paddy	4	108	180	19440
14	Haridas	DW	1	coconut,paddy	5	108	180	19440
15	Ibrahim	DW	1	coconut,paddy	5	108	180	19440
							Total	347760
							=	0.34776MCM

Detailed irrigation wells(Wardwise) in Perumatty panchayath, Palakkad district

Ward No.2

Sl.No.	Name of farmer	Type of well	No. of well	Crops cultivated	Area irrigated, acre	Ground water draftm^3/day	No. of days/year	Annual draft m^3
1	Santhosh	DW	1	coconut,paddy	8	144	180	25920
2	Ramankutty	DW	1	coconut,paddy	6	108	180	19440
3	Karunakaran	DW	1	coconut,paddy	12	188	180	33840
4	Chandran	DW	1	coconut,paddy	8	144	180	25920
5	Karuna Medical College	DW	2	college garden	5	288	180	51840
6	Rajendran	DW	2	coconut,paddy	10	144	180	25920
7	Sekaharan	DW	3	coconut,paddy	4	108	180	19440
8	Gafoor	DW	1	coconut,paddy	10	144	180	25920
9	Asokan	DW	1	paddy	2	72	180	12960
10	Bhaskaran	DW	1	paddy	3	72	180	12960
11	Kurchan	DW	1	coconut,paddy	5	108	180	19440
12	Ramachadnran	DW	1	coconut,paddy	3	72	180	12960
13	Shanmugham	DW	1	coconut,paddy	3	72	180	12960
14	Prashob	DW	1	coconut,paddy	3	72	180	12960
15	Gopalankutty	DW	1	coconut,paddy	8	144	180	25920
16	Krishnankutty	DW	2	paddy	10	144	180	25920
17	Krishnankutty	BW	5	coconut	20	288	180	51840
							Total	416160
							=	0.41616MCM

Detailed irrigation wells(Wardwise) in Perumatty panchayath, Palakkad district

Ward No.1

Sl.No.	Name of farmer	Type of well	No. of well	Crops cultivated	Area irrigated, acre	Ground water draftm^3/day	No. of days/year	Annual draft m^3
1	Mayappan	DW	1	coconut,paddy	6	108	180	19440
2	Vydyanatha Iyer	DW	2	coconut,paddy	6	108	180	19440
3	Sasidharan, Village officer	BW	1	coconut	3	54	180	9720
4	Praveen Kumar	BW	1	coconut	2	54	180	9720
5	Sasidharan(Gulf)	DW	1	coconut,paddy	2	54	180	9720
6	Sasidharan(Gulf)	BW	1	coconut	4	108	180	19440
7	Gangadharan	BW	1	coconut	3	54	180	9720
8	Panamkulambu Brothers,Sreenivasan	DW	3	coconut,paddy	30	324	180	58320
9	Parakalam-Kannu	DW	1	coconut,paddy	15	188	180	33840
10	Ramkrishnan	DW	1	coconut,paddy	6	108	180	19440
11	Angalan	DW	1	coconut,paddy	10	124	180	22320
12	K.Madhavan, Kottapadam	DW	2	coconut,paddy	25	324	180	58320
13	Guruvayoorappan	DW	1	coconut,paddy	4	108	180	19440
14	Haridas	DW	1	coconut,paddy	5	108	180	19440
15	Ibrahim	DW	1	coconut,paddy	5	108	180	19440
							Total	347760
							=	0.34776MCM

Detailed irrigation wells(Wardwise) in Perumatty panchayath, Palakkad district

Ward No.2

Sl.No.	Name of farmer	Type of well	No. of well	Crops cultivated	Area irrigated, acre	Ground water draftm^3/day	No. of days/year	Annual draft m^3
1	Santhosh	DW	1	coconut,paddy	8	144	180	25920
2	Ramankutty	DW	1	coconut,paddy	6	108	180	19440
3	Karunakaran	DW	1	coconut,paddy	12	188	180	33840
4	Chandran	DW	1	coconut,paddy	8	144	180	25920
5	Karuna Medical College	DW	2	college garden	5	288	180	51840
6	Rajendran	DW	2	coconut,paddy	10	144	180	25920
7	Sekaharan	DW	3	coconut,paddy	4	108	180	19440
8	Gafoor	DW	1	coconut,paddy	10	144	180	25920
9	Asokan	DW	1	paddy	2	72	180	12960
10	Bhaskaran	DW	1	paddy	3	72	180	12960
11	Kurchan	DW	1	coconut,paddy	5	108	180	19440
12	Ramachadnran	DW	1	coconut,paddy	3	72	180	12960
13	Shanmugham	DW	1	coconut,paddy	3	72	180	12960
14	Prashob	DW	1	coconut,paddy	3	72	180	12960
15	Gopalankutty	DW	1	coconut,paddy	8	144	180	25920
16	Krishnankutty	DW	2	paddy	10	144	180	25920
17	Krishnankutty	BW	5	coconut	20	288	180	51840
							Total	416160
							=	0.41616MCM

Detailed irrigation wells(Wardwise) in Perumatty panchayath, Palakkad district

Ward No.3

Sl.No.	Name of farmer	Type of well	No. of well	Crops cultivated	Area irrigated, acre	Ground water draftm^3/day	No. of days/year	Annual draft m^3
1	Kutty Appu	DW	1	coconut,paddy	5	108	180	19440
2	Gopi	DW	1	coconut,paddy	5	108	180	19440
3	Sankaran	DW	1	coconut,paddy	8	144	180	25920
4	Ponnuchami	DW	1	coconut,paddy	9	144	180	25920
5	Jayan	DW	1	coconut,paddy	15	180	180	32400
6	Chenthamara	DW	1	coconut,paddy	10	144	180	25920
7	Prabhakaran	DW	1	coconut,paddy	15	180	180	32400
8	Prabhakaran	BW	3	coconut,paddy	10	144	180	25920
9	Satheesan	DW	1	coconut,paddy	10	144	180	25920
10	Muthaliyar Murukadas	DW	1	coconut,paddy	9	144	180	25920
11	Raj Muthaliyar	DW	1	coconut,paddy	15	180	180	32400
12	Raj Muthaliyar	BW	1	coconut,paddy	10	144	180	25920
13	Ponnu Muthaliyar	DW	1	coconut,paddy	10	144	180	25920
14	Mohanan	DW	2	coconut,paddy	10	144	180	25920
15	Mohanan	BW	1	coconut,paddy	8	108	180	19440
16	Haneefa	DW	1	coconut,paddy	5	108	180	19440
17	Aru	DW	1	coconut,paddy	5	108	180	19440
18	Sankaran	DW	1	coconut,paddy	4	72	180	12960
19	Sankaran	DW	1	coconut,paddy	4	72	180	12960
20	Nachu	DW	1	coconut,paddy	2	54	180	9720
21	Krishnamoorthi	DW	1	coconut,paddy	3	54	180	9720
22	Mohammed Shareef	DW	1	coconut,paddy	5	108	180	19440
23	Prakash	DW	1	coconut,paddy	3	72	180	12960
24	Ramesh	DW	1	coconut,paddy	6	108	180	19440
25	Kesavan	DW	1	coconut,paddy	5	108	180	19440
26	Johnson	DW	1	coconut,paddy	4	72	180	12960
27	Vijayan	DW	1	coconut,paddy	5	108	180	19440
28	Shahul Hameed	DW	1	coconut,paddy	10	144	180	25920
29	Shahul Hameed	BW	1	coconut,paddy	8	144	180	25920
30	Ismail	BW	1	coconut,paddy	7	108	180	19440
31	Ismail	DW	1	coconut,paddy	8	144	180	25920

Sl.No.	Name of farmer	Type of well	No. of well	Crops cultivated	Area irrigated, acre	Ground water draftm^3/day	No. of days/year	Annual draft m^3
32	Gopinath	DW	1	coconut,paddy	6	108	180	19440
33	Elite	DW	1	coconut,paddy	6	108	180	19440
34	Raveendran	DW	1	coconut,paddy	5	108	180	19440
35	Jaleel	BW	1	coconut,paddy	7	108	180	19440
36	Nandakumar	DW	1	coconut,paddy	7	108	180	19440
37	Marudajalam	BW	2	coconut,paddy	30	288	180	51840
38	Marudajalam	DW	1	coconut,paddy	5	108	180	19440
39	Krishnan R	DW	1	coconut,paddy	10	144	180	25920
40	Siva Narayanan	DW	1	coconut,paddy	7	108	180	19440
41	Thankavelu Goundar	DW	1	coconut,paddy	10	144	180	25920
42	Soma Goundar	DW	1	coconut,paddy	5	108	180	19440
43	Rajappan	BW	1	coconut,paddy	10	144	180	25920
44	Rajappan	DW	1	coconut,paddy	10	144	180	25920
							Total	984960
							=	0.98496MCM

Detailed irrigation wells (Wardwise) in Perumatty panchayath, Palakkad district

Ward No.4

Sl.No.	Name of farmer	Type of well	No. of well	Crops cultivated	Area irrigated, acre	Ground water draftm^3/day	No. of days/year	Annual draft m^3
1	N.V.Sudarsan	DW	1	coconut	6	108	180	19440
2	N.V.Shankaran	DW	1	coconut	10	144	180	25920
3	Suguna Vijayan	DW	1	coconut	8	144	180	25920
4	Sahadevan	DW	1	coconut	5	108	180	19440
5	Shanmukha Bros	DW	1	coconut	3	72	180	12960
6	Damayanth	DW	1	coconut	2	54	180	9720
7	Chamunni	DW	1	coconut	3	72	180	12960
8	Shanmukham	DW	1	coconut	3	72	180	12960
9	Manjar	DW	1	coconut	8	108	180	19440
10	Raja Kunnar Alias Suryanproob	DW	1	coconut	3	72	180	12960
11	Rajan & Sons	DW	2	coconut	15	288	180	51840
12	Ramachandran s/o Pasha	DW	1	coconut/mixed	10	144	180	25920
13	Nataraja Centre	DW	1	coconut/mixed	5	108	180	19440
14	Nagarath Nanu	DW	1	coconut	5	108	180	19440
15	Bhagavatheruvu	DW	1	coconut	7	108	180	19440
16	Ambikapathy	DW	1	coconut	7	108	180	19440
17	Shanmukha	DW	3	coconut,paddy	12	180	180	32400
18	Radhkrishann	DW	1	coconut	3	72	180	12960
19	Chandran & Sons	DW	3	coconut,paddy	20	324	180	58320
20	Radhakrishnan	DW	1	coconut,paddy	7	108	180	19440
21	Chinnappan	DW	1	coconut,paddy	10	144	180	25920
22	Vasu	DW	1	coconut,paddy	6	108	180	19440
23	Marimuthu Goundar	DW	1	coconut	2	54	180	9720
24	Gopalakrishnan	DW	1	coconut	1.5	54	180	9720
25	Thajinisa	DW	2	coconut	3	72	180	12960
26	Bharataraj	DW	1	coconut	6	108	180	19440
27	Ramakrishnan	DW	1	coconut	6	108	180	19440
28	Vallianna	DW	1	coconut	10	144	180	25920
29	Ibrahim	DW	1	coconut	2	54	180	9720
30	Vellakutti	DW	1	coconut	12	144	180	25920

Sl.No.	Name of farmer	Type of well	No. of well	Crops cultivated	Area irrigated, acre	Ground water draftm^3/day	No. of days/year	Annual draft m^3
31	Sundaran	DW	1	coconut	5	108	180	19440
32	Suguna	DW	1	coconut	6	108	180	19440
33	Krishannkutti	DW	1	coconut	8	144	180	25920
34	Ravi	BW	1	coconut	6	108	180	19440
35	Ramakrishnan	DW	2	coconut	6	180	180	32400
36	Kanakadan	DW	1	coconut	6	108	180	19440
37	Pankajakshan	DW	2	coconut	6	180	180	32400
38	Sudhakaran	DW	2	coconut	6	180	180	32400
39	Puskaran	DW	2	coconut	5	180	180	32400
40	Sadanantha	DW	1	coconut	5	108	180	19440
41	Sundaram	DW	1	coconut	5	108	180	19440
42	Suresh	DW	2	coconut	8	180	180	32400
43	Sampathkumar Jayam	DW	3	coconut	12	180	180	32400
44	Sasidharan	DW	2	coconut	8	180	180	32400
45	Janardhanan	DW	1	coconut	6	108	180	19440
46	Thankavel	DW	2	coconut	5	180	180	32400
47	Late Bhaskaran	DW	1	coconut	9	144	180	25920
48	Unni(Secretary)	DW	1	coconut	5	108	180	19440
49	Raveh Goundar	DW	1	coconut	6	108	180	19440
50	Late Cherakutty	DW	1	coconut	4	72	180	12960
51	Velappan	DW	1	coconut	12	144	180	25920
52	Jwellan Ocus Ayyappa	DW	1	coconut	10	144	180	25920
53	Chandnimani	DW	1	coconut	5	108	180	19440
54	Narayanakutty	DW	1	coconut	5	108	180	19440
55	Rajagopalan	DW	1	coconut	5	108	180	19440
56	Sundarsamy	DW	1	coconut	5	108	180	19440
57	Meghanath	DW	1	coconut	10	144	180	25920
58	Prithvi Raj	DW	1	coconut	5	108	180	19440
59	Lakshman	DW	1	coconut	5	108	180	19440
60	Radhakrishnan	DW	1	coconut	6	108	180	19440
61	Doraisamy	DW	1	coconut	5	108	180	19440
62	Ramasamy	DW	1	coconut	2	54	180	9720
63	Arun Lal	DW	1	coconut,paddy	9	108	180	19440
64	Sreekumar	DW	1	coconut	4	72	180	12960

Sl.No.	Name of farmer	Type of well	No. of well	Crops cultivated	Area irrigated, acre	Ground water draftm^3/day	No. of days/year	Annual draft m^3
65	Sreekumar	DW	1	coconut	4	72	180	12960
66	Mohandas	DW	1	coconut	6	108	180	19440
67	Sasi	DW	1	coconut	6	108	180	19440
68	Karvarnan	DW	1	coconut,paddy	10	144	180	25920
69	Velayudhankutty	DW	1	coconut,paddy	5	108	180	19440
70	Sundardas	DW	1	coconut,paddy	5	108	180	19440
71	Joseph Sooraj	DW	1	coconut,paddy	15	180	180	32400
							Total	1551960
							=	1.55196MCM

Detailed irrigation wells(Wardwise) in Perumatty panchayath, Palakkad district

Ward No.5

Sl.No.	Name of farmer	Type of well	No. of well	Crops cultivated	Area irrigated, acre	Ground water draftm^3/day	No. of days/year	Annual draft m^3
1	Ramasamy Goundar	DW	2	coconut	10	288	180	51840
2	Karuppuswamy Goundar	DW	2	coconut	10	288	180	51840
3	Thrissul	DW	2	coconut	15	360	180	64800
4	Thrissul	BW	2	coconut	15	360	180	64800
5	Swivaraj Goundar	DW	2	coconut	15	360	180	64800
6	Velayudhan	DW	1	coconut	3	108	180	19440
7	Murukandy	DW	1	coconut	2.8	82	180	14760
8	Palanyswamy goudnar	DW	1	coconut	10	144	180	25920
9	Aruswamy Goundar	DW	2	coconut	7	216	180	38880
10	Selvamuthu	DW	2	coconut	10	288	180	51840
11	Selvamuthu	BW	2	coconut	10	288	180	51840
12	Nachimuthu	DW	1	coconut	4	108	180	19440
13	Aruchami Goundar	DW	1	coconut	4	108	180	19440
14	Prof.X	DW	3	coconut	15	540	180	97200
15	Ganesh	DW	1	coconut	5	108	180	19440
16	Ganesh	BW	1	coconut	5	108	180	19440
17	Sachidanandan	DW	2	coconut	8	216	180	38880
18	Prof.	DW	1	coconut	10	144	180	25920
19	Suseelan	DW	1	coconut	6	108	180	19440
20	Pushparaj	DW	1	coconut	6	108	180	19440
21	Ganesh Goundar	DW	3	coconut	15	324	180	58320
22	Nachimuthu	DW	1	coconut	5	108	180	19440
23	Appu Goundar	DW	1	coconut	10	144	180	25920
24	Appu Goundar	BW	1	coconut	6	108	180	19440
25	Thappattakanam Puthoor	DW	1	coconut	7	108	180	19440
26	Kannappan Goundar	DW	1	coconut	5	108	180	19440
27	Sooloor	DW	1	coconut	10	144	180	25920
28	Chinna Goundar	DW	3	coconut	40	360	180	64800
29	Chinna Goundar	BW	2	coconut	10	216	180	38880
					20	258	180	46440

Sl.No.	Name of farmer	Type of well	No. of well	Crops cultivated	Area irrigated, acre	Ground water draftm^3/day	No. of days/year	Annual draft m^3
65	Sreekumar	BW	1	coconut	4	72	180	12960
66	Mohandas	DW	1	coconut	6	108	180	19440
67	Sasi	DW	1	coconut	6	108	180	19440
68	Karvarnan	DW	1	coconut,paddy	10	144	180	25920
69	Velayudhankutty	DW	1	coconut,paddy	5	108	180	19440
70	Sundardas	DW	1	coconut,paddy	5	108	180	19440
71	Joseph Sooraj	DW	1	coconut,paddy	15	180	180	32400
							Total	1551960
							=	1.55196MCM

Detailed irrigation wells(Wardwise) in Perumatty panchayath, Palakkad district

Ward No.5

Sl.No.	Name of farmer	Type of well	No. of well	Crops cultivated	Area irrigated, acre	Ground water draftm^3/day	No. of days/year	Annual draft m^3
1	Ramasamy Goundar	DW	2	coconut	10	288	180	51840
2	Karuppuswamy Goundar	DW	2	coconut	10	288	180	51840
3	Thrissul	DW	2	coconut	15	360	180	64800
4	Thrissul	BW	2	coconut	15	360	180	64800
5	Swlvaraj Goundar	DW	2	coconut	15	360	180	64800
6	Velayudhan	DW	1	coconut	3	108	180	19440
7	Murukandy	DW	1	coconut	2.8	82	180	14760
8	Palanyswamy goudnar	DW	1	coconut	10	144	180	25920
9	Aruswamy Goundar	DW	2	coconut	7	216	180	38880
10	Selvamuthu	DW	2	coconut	10	288	180	51840
11	Selvamuthu	BW	2	coconut	10	288	180	51840
12	Nachimuthu	DW	1	coconut	4	108	180	19440
13	Aruchami Goundar	DW	1	coconut	4	108	180	19440
14	Prof.X	DW	3	coconut	15	540	180	97200
15	Ganesh	DW	1	coconut	5	108	180	19440
16	Ganesh	BW	1	coconut	5	108	180	19440
17	Sachidanandan	DW	2	coconut	8	216	180	38880
18	Prof.	DW	1	coconut	10	144	180	25920
19	Suseelan	DW	1	coconut	6	108	180	19440
20	Pushparaj	DW	1	coconut	6	108	180	19440
21	Ganesh Goundar	DW	3	coconut	15	324	180	58320
22	Nachimuthu	DW	1	coconut	5	108	180	19440
23	Appu Goundar	DW	1	coconut	10	144	180	25920
24	Appu Goundar	BW	1	coconut	6	108	180	19440
25	Thappattakanam Puthoor	DW	1	coconut	7	108	180	19440
26	Kannappan Goundar	DW	1	coconut	5	108	180	19440
27	Sooloor	DW	1	coconut	10	144	180	25920
28	Chinna Goundar	DW	3	coconut	40	360	180	64800
29	Chinna Goundar	BW	2	coconut	10	216	180	38880
30	Mannadiar	DW	2	coconut	20	258	180	46440

66	Mohandas	DW	1	coconut	6	108	180	19440
67	Sasi	DW	1	coconut	6	108	180	19440
68	Karvarnan	DW	1	coconut,paddy	10	144	180	25920
69	Velayudhankutty	DW	1	coconut,paddy	5	108	180	19440
70	Sundardas	DW	1	coconut,paddy	5	108	180	19440
71	Joseph Sooraj	DW	1	coconut,paddy	15	180	180	32400
							Total	1551960
							=	1.55196MCM

Detailed irrigation wells(Wardwise) in Perumatty panchayath, Palakkad district

Ward No.5

Sl.No.	Name of farmer	Type of well	No. of well	Crops cultivated	Area irrigated, acre	Ground water draftm^3/day	No. of days/year	Annual draft m^3
1	Ramasamy Goundar	DW	2	coconut	10	288	180	51840
2	Karuppuswamy Goundar	DW	2	coconut	10	288	180	51840
3	Thrissul	DW	2	coconut	15	360	180	64800
4	Thrissul	BW	2	coconut	15	360	180	64800
5	Swlvaraj Goundar	DW	2	coconut	15	360	180	64800
6	Velayudhan	DW	1	coconut	3	108	180	19440
7	Murukandy	DW	1	coconut	2.8	82	180	14760
8	Palanyswamy goudnar	DW	1	coconut	10	144	180	25920
9	Aruswamy Goundar	DW	2	coconut	7	216	180	38880
10	Selvamuthu	DW	2	coconut	10	288	180	51840
11	Selvamuthu	BW	2	coconut	10	288	180	51840
12	Nachimuthu	DW	1	coconut	4	108	180	19440
13	Aruchami Goundar	DW	1	coconut	4	108	180	19440
14	Prof.X	DW	3	coconut	15	540	180	97200
15	Ganesh	DW	1	coconut	5	108	180	19440
16	Ganesh	BW	1	coconut	5	108	180	19440
17	Sachidanandan	DW	2	coconut	8	216	180	38880
18	Prof.	DW	1	coconut	10	144	180	25920
19	Suseelan	DW	1	coconut	6	108	180	19440
20	Pushparaj	DW	1	coconut	6	108	180	19440
21	Ganesh Goundar	DW	3	coconut	15	324	180	58320
22	Nachimuthu	DW	1	coconut	5	108	180	19440
23	Appu Goundar	DW	1	coconut	10	144	180	25920
24	Appu Goundar	BW	1	coconut	6	108	180	19440
25	Thappattakanam Puthoor	DW	1	coconut	7	108	180	19440
26	Kannappan Goundar	DW	1	coconut	5	108	180	19440
27	Sooloor	DW	1	coconut	10	144	180	25920
28	Chinna Goundar	DW	3	coconut	40	360	180	64800
29	Chinna Goundar	BW	2	coconut	10	216	180	38880
30	Mannadiar	DW	2	coconut	20	258	180	46440

Sl.No.	Name of farmer	Type of well	No. of well	Crops cultivated	Area irrigated, acre	Ground water draftm^3/day	No. of days/year	Annual draft m^3
65	Sreekumar	BW	1	coconut	4	72	180	12960
66	Mohandas	DW	1	coconut	6	108	180	19440
67	Sasi	DW	1	coconut	6	108	180	19440
68	Karvarnan	DW	1	coconut,paddy	10	144	180	25920
69	Velayudhankutty	DW	1	coconut,paddy	5	108	180	19440
70	Sundardas	DW	1	coconut,paddy	5	108	180	19440
71	Joseph Sooraj	DW	1	coconut,paddy	15	180	180	32400
							Total	1551960
							=	1.55196MCM

Ward 4

Detailed irrigation wells(Wardwise) in Perumatty panchayath, Palakkad district

Ward No.5

Sl.No.	Name of farmer	Type of well	No. of well	Crops cultivated	Area irrigated, acre	Ground water draftm^3/day	No. of days/year	Annual draft m^3
1	Ramasamy Goundar	DW	2	coconut	10	288	180	51840
2	Karuppuswamy Goundar	DW	2	coconut	10	288	180	51840
3	Thrissul	DW	2	coconut	15	360	180	64800
4	Thrissul	BW	2	coconut	15	360	180	64800
5	Swlvaraj Goundar	DW	2	coconut	15	360	180	64800
6	Velayudhan	DW	1	coconut	3	108	180	19440
7	Murukandy	DW	1	coconut	2.8	82	180	14760
8	Palanyswamy goudnar	DW	1	coconut	10	144	180	25920
9	Aruswamy Goundar	DW	2	coconut	7	216	180	38880
10	Selvamuthu	DW	2	coconut	10	288	180	51840
11	Selvamuthu	BW	2	coconut	10	288	180	51840
12	Nachimuthu	DW	1	coconut	4	108	180	19440
13	Aruchami Goundar	DW	1	coconut	4	108	180	19440
14	Prof.X	DW	3	coconut	15	540	180	97200
15	Ganesh	DW	1	coconut	5	108	180	19440
16	Ganesh	BW	1	coconut	5	108	180	19440
17	Sachidanandan	DW	2	coconut	8	216	180	38880
18	Prof.	DW	1	coconut	10	144	180	25920
19	Suseelan	DW	1	coconut	6	108	180	19440
20	Pushparaj	DW	1	coconut	6	108	180	19440
21	Ganesh Goundar	DW	3	coconut	15	324	180	58320
22	Nachimuthu	DW	1	coconut	5	108	180	19440
23	Appu Goundar	DW	1	coconut	10	144	180	25920
24	Appu Goundar	BW	1	coconut	6	108	180	19440
25	Thappattakanam Puthoor	DW	1	coconut	7	108	180	19440
26	Kannappan Goundar	DW	1	coconut	5	108	180	19440
27	Sooloor	DW	1	coconut	10	144	180	25920
28	Chinna Goundar	DW	3	coconut	40	360	180	64800
29	Chinna Goundar	BW	2	coconut	10	216	180	38880
30	Mannadiar	DW	2	coconut	20	258	180	46440

Sl.No.	Name of farmer	Type of well	No. of well	Crops cultivated	Area irrigated, acre	Ground water draftm^3/day	No. of days/year	Annual draft m^3
31	P.Sundaraj	DW	1	sugarcane	2	54	180	9720
32	S.Rahuswamy	DW	1	sugarcane	2	54	180	9720
33	Kanakaraj	DW	1	coconut,tapioca	8	108	180	19440
34	Sivalingam	DW	1	coconut	4	54	180	9720
35	Tulasiammal	DW	1	coconut	4	54	180	9720
36	Rajendran	DW	1	coconut	8	108	180	19440
37	Arumugham	DW	1	coconut,tapioca	4	54	180	9720
38	Nagarajan	DW	2	coconut,miscella	3	54	180	9720
39	Parameswaram	DW	3	coconut,paddy	2	54	180	9720
40	Pattiyappan	DW	4	coconut,paddy	2	54	180	9720
41	Ramaswamy	DW	1	coconut,paddy	5	108	180	19440
42	Chellakumaraswamy	DW	1	coconut,sugarca	10	144	180	25920
43	Apuswamy	DW	1	sugarcane	6	144	180	25920
44	Karuppuswamy Goundar	DW	1	coconut	4	108	180	19440
45	Narendran	DW	1	coconut	4	108	180	19440
46	Raghunathan	DW	1	coconut	6	108	180	19440
47	Kanakaraj	DW	1	coconut	8	108	180	19440
48	Kannarchettiyar	DW	1	coconut	4	108	180	19440
49	Varadaraj	DW	1	coconut,sugarca	8	144	180	25920
50	Nachimuth Goundar	DW	1	coconut	8	108	180	19440
51	Mail swamy	DW	1	coconut	6	108	180	19440
52	Kanakaraj	DW	1	coconut	4	108	180	19440
53	Kittuswamy	DW	1	coconut	5	108	180	19440
54	Nalaraj	DW	1	coconut	4	108	180	19440
55	Mailswamy Goundar	DW	1	coconut	6	108	180	19440
56	Jyothi	DW	2	coconut	10	216	180	38880
57	Gopal Swamy	DW	1	coconut	6	108	180	19440
58	Chinna Swamy	DW	1	coconut	4	72	180	12960
59	Kamaresan	DW	1	coconut	6	72	180	12960
60	Senthil	DW	1	coconut	6	72	180	12960
61	Ramaswamy	DW	1	coconut	7	108	180	19440
62	Vel Swamy	DW	1	coconut	7	108	180	19440
63	Dandapany	DW	1	coconut	6	72	180	12960
64	Nittyanandan	DW	1	coconut	8	108	180	19440

Sl.No.	Name of farmer	Type of well	No. of well	Crops cultivated	Area irrigated, acre	Ground water draftm^3/day	No. of days/year	Annual draft m^3
65	Krishnaswamy	DW	2	coconut	6	144	180	25920
66	Ramaraj	DW	2	coconut	15	324	180	58320
67	Ramaraj	BW	1	coconut	10	144	180	25920
68	Manikiam	DW	1	coconut	8	108	180	19440
69	Pazhaniswamy	DW	1	coconut	10	144	180	25920
70	Pazhaniswamy	BW	1	coconut	10	144	180	25920
71	Aaruchamy	DW	3	coconut	10	324	180	58320
72	Chellamuthu	DW	1	coconut	15	180	180	32400
73	Chellamuthu	BW	1	coconut	10	144	180	25920
74	Nachimuthu	DW	1	coconut	4	72	180	12960
75	Ramal	DW	1	coconut,tapioca	3	72	180	12960
76	Chinnppan	DW	1	coconut	5	72	180	12960
77	Rasoo	DW	1	coconut	6	108	180	19440
78	Thankaveloo	DW	1	coconut	8	108	180	19440
79	Kittuswamy	DW	2	coconut	15	288	180	51840
80	Selvaraj	DW	1	coconut	15	144	180	25920
81	Karthikeyan	DW	2	coconut	8	216	180	38880
82	Veluswamy	DW	2	coconut	10	216	180	38880
83	Aaru chamy	DW	1	coconut	5	108	180	19440
84	Nataraj Goundar	DW	3	coconut	15	324	180	58320
85	Ramaswamy Goundar	DW	1	coconut	10	144	180	25920
86	Rangaswamy Goundar	DW	1	coconut	4	72	180	12960
87	Muthuswamy Goundar	DW	1	coconut	4	72	180	12960
88	Ramaswamy	DW	1	coconut	3	72	180	12960
89	Gopal Swamy	DW	1	coconut	6	108	180	19440
90	Raju	DW	1	coconut	8	108	180	19440
91	Manikandan	DW	1	coconut	10	144	180	25920
92	Chellamuthu	DW	2	coconut	8	216	180	38880
93	Kumar	DW	1	coconut	8	108	180	19440
94	Govindaraj	DW	1	coconut	4	72	180	12960
95	Thankaraj	DW	2	coconut	8	216	180	38880
96	Kittuswamy	DW	2	coconut	20	288	180	51840
97	Ratnaswamy	DW	2	coconut	15	288	180	51840
98	Mayilswamy	DW	1	coconut	4	72	180	12960

Sl.No.	Name of farmer	Type of well	No. of well	Crops cultivated	Area irrigated, acre	Ground water draftm^3/day	No. of days/year	Annual draft m^3
99	Murukesh	DW	2	coconut	8	216	180	38880
100	Ponnuchamy	DW	1	coconut	8	108	180	19440
101	Bhagavathy	DW	1	coconut	6	72	180	12960
102	Annadurai	DW	1	coconut	6	72	180	12960
103	Krishnaswamy	DW	1	coconut	6	72	180	12960
104	Marappan	DW	1	coconut	6	72	180	12960
105	Nachimuthu Goundar	DW	2	coconut	8	216	180	38880
106	Karuppu swamy	DW	2	coconut	12	144	180	25920
107	Dorad	DW	1	coconut	6	72	180	12960
108	Nataraj Goundar	DW	1	coconut	8	72	180	12960
109	Katirvelu	DW	2	coconut	6	144	180	25920
110	Appachi	DW	1	coconut	4	72	180	12960
111	Panniappan	DW	1	coconut,tapioca	4	72	180	12960
112	Chinnappa	DW	1	tapioca	2	54	180	9720
113	Shanmugharaj	DW	1	coconut	4	72	180	12960
114	Sivaswamy	DW	1	coconut	3	54	180	9720
115	Tirumalaswamy	DW	1	coconut	10	144	180	25920
116	Kanthaswamy Goundar	DW	1	coconut	6	108	180	19440
117	Murukesh Goundar	DW	1	coconut	2	54	180	9720
118	Veluswamy Goundar	DW	1	coconut	2	54	180	9720
119	Kumar	DW	1	coconut	4	54	180	9720
120	Rajendran	DW	1	coconut	3	54	180	9720
121	Subaiah	DW	1	coconut,tapioca	4	54	180	9720
122	Appu Goundar	DW	1	coconut	8	108	180	19440
123	Kandaswamy Goundar	DW	2	coconut	15	288	180	51840
124	Veluswamy	DW	1	coconut	6	72	180	12960
					Total	17458		3142440
							=	3.14244 MCM

Detailed irrigation wells(Wardwise) in Perumatty panchayath, Palakkad district

Ward No.6

Sl.No.	Name of farmer	Type of well	No. of well	Crops cultiva	Area irrigated, acre	Ground water draftm^3/day	No. of days/year	Annual draft m^3
1	Gopalasam	BW		paddy,cocor	10	144	180	25920
2	Periyasami Goudnar	BW	1	coconut	8	108	180	19440
3		DW	1	coconut	6	72	180	12960
4	Kittusami Goudnar	BW	1	coconut	8	108	180	19440
5		DW	1	coconut	8	108	180	19440
6	Rajamanikka Goundar	DW	2	coconut	20	288	180	51840
7	Y Goundar	DW	2	coconut	20	288	180	51840
8	Subbayakar	DW	2	coconut	40	288	180	51840
9	Pechimuthu	DW	1	coconut	6	72	180	12960
10	Ramasami Goudnar	DW	1	coconut	5	72	180	12960
11	Nataraja Rice Mill	DW	1	coconut	10	144	180	25920
12	Govindasami Chettiar	DW	1	coconut	10	144	180	25920
13	Thirumalasami Goundar	DW	1	coconut	15	180	180	32400
14	Kalyana Goundar	DW	1	coconut	14	180	180	32400
15	Mailswamy Goundar	DW	1	coconut	8	108	180	19440
16	Varadaraj Goudnar	DW	1	coconut	10	144	180	25920
17	Kittusamy Goundar	DW	1	coconut	8	108	180	19440
18	Dharma Goundar	DW	1	coconut	4	72	180	12960
19	Thankavel Goundar	DW	1	coconut	15	216	180	38880
20	Muthappa Goundar	DW	1	coconut	4	54	180	9720
21	Mayilsami Goudnar	DW	1	coconut	10	144	180	25920
22	Arusami Goundar	DW	1	coconut	10	144	180	25920
23	Tirunahsan Goundar	DW	1	coconut	15	180	180	32400
24	Thankanel Goundar	DW	1	coconut	15	180	180	32400
25	Shivas	DW	1	coconut	5	72	180	12960
26	Ratha Conichi	DW	1	coconut	6	72	180	12960
27	Ramesh Goche	DW	1	coconut	20	180	180	32400
28	Vadivel Chettiar	DW	1	coconut	10	144	180	25920
29	Thirumoorthy Chettiar	DW	1	coconut	10	144	180	25920
30	Ellakkattu San Centre	DW	1	coconut	12	144	180	25920

Sl.No.	Name of farmer	Type of well	No. of well	Crops cultiva	Area irrigated, acre	Ground water draftm^3/day	No. of days/year	Annual draft m^3
31	Elatte Vandiyappa Goundar	DW	1	coconut	16	144	180	25920
32	Kittuchami Goundar	DW	1	coconut	20	180	180	32400
33	Raghu Pathi Goudnar	DW	1	coconut	40	180	180	32400
34	Raj Goundar	DW	1	coconut	10	144	180	25920
35	Gopala Goundar	DW	1	coconut	8	108	180	19440
36	Kandayya Goundar	DW	1	coconut	20	180	180	32400
37	Ramaswamy Goundar	DW	1	coconut	5	72	180	12960
38	Muthusami	BW	1	coconut	5	72	180	12960
39	Raman Pande	DW	1	coconut	8	108	180	19440
40	Nadukkatt raj	DW	1	coconut	20	180	180	32400
41	Arumukh Goundar	DW	1	coconut	15	180	180	32400
42	Dharma Goundar	DW	1	coconut	20	180	180	32400
43	Kandayya Goundar	DW	1	coconut	20	180	180	32400
44	Kittappa Goundar	DW	1	coconut	20	180	180	32400
45	Senthil Goundar	DW	1	coconut	10	108	180	19440
46	Arumukha Goundar	DW	1	coconut	20	180	180	32400
47	Rakiyappa Goundar	DW	1	coconut	4	72	180	12960
48	Vanchiyappa Goudnar	DW	1	coconut	10	108	180	19440
49	Ratnaswami goudnar	DW	1	coconut	15	144	180	25920
50	Sivasami Goundar	DW	1	coconut	15	144	180	25920
51	Jagadeesh Goundar	DW	1	coconut	40	180	180	32400
52	Kalathil Chinnappa Goundar	DW	1	coconut	8	108	180	19440
								1338120
							=	1.33812MCM

Detailed irrigation wells(Wardwise) in Perumatty panchayath, Palakkad district

Ward No.7

Sl.No.	Name of farmer	Type of well	No. of well	Crops cultivated	Area irrigated, acre	Ground water draftm^3/day	No. of days /year	Annual draft m^3
1	Arisamy Goundar	DW	1	coconut	10	108	180	19440
2	Marimuthu Goundar	DW	1	coconut	2.5	54	180	9720
3	Dharmi Goundar	DW	1	coconut	5	72	180	12960
4	Raj Goundar	DW	1	coconut	4	72	180	12960
5	Ramasami Goundar	DW	1	coconut	5	72	180	12960
6	Gopal Goundar	DW	1	coconut	4	72	180	12960
7	Palamuthu Goundar	DW	1	coconut	8	108	180	19440
8	Appukutty Goundar	DW	1	coconut	8	108	180	19440
9	Giri Goundar	DW	1	coconut	40	180	180	32400
10	Rajamanka Goundar	DW	1	coconut	40	180	180	32400
11	Vel Goundar	DW	1	coconut	15	144	180	25920
12	Muthuleenti Goundar	DW	1	coconut	15	144	180	25920
13	Kaliyappa Goundar	DW	1	coconut	15	144	180	25920
14	Nachimuthu Goundar	DW	1	coconut	10	108	180	19440
15	Rameswaran Goundar	DW	1	coconut	4	72	180	12960
16	Ratnasami Goundar	DW	1	coconut	5	72	180	12960
17	Muthaammal	DW	1	coconut	5	72	180	12960
18	Ramakrishnan	DW	1	coconut	4	72	180	12960
19	Sivasami Goundar	DW	1	coconut	9	108	180	19440
20	Rameswaran	DW	1	coconut, tapioca	6	108	180	19440
21	Oversear	DW	1	coconut	8	108	180	19440
22	Achuthan Nair	DW	1	coconut	6	108	180	19440
23	Dhanush	DW	1	coconut	7	108	180	19440
24	Rameswaran	DW	1	coconut	8	108	180	19440
25	Puthiya Al	DW	1	coconut	4	72	180	12960
26	Mimkosh Goundar	DW	1	coconut	3	72	180	12960
27	A.Adichami	BW	2	coconut	13	288	180	51840
28	A.Adichami	DW	2	coconut	5	108	180	19440
29	Thirumalesan	DW	2	coconut	7.5	108	180	19440
30	Thirumalesan	BW	1	coconut	8	144	180	25920

Sl.No.	Name of farmer	Type of well	No. of well	Crops cultivated	Area irrigated, acre	Ground water draftm^3/day	No. of days /year	Annual draft m^3
31	Bhagavathi	DW	1	coconut	2	54	180	9720
32	Mahesh	DW	2	coconut	10	144	180	25920
33	Mahesh	BW	1	coconut	5	108	180	19440
34	Muthu kumar	DW	2	coconut	10	288	180	51840
35	Kumarvel	DW	2	coconut	10	288	180	51840
36	XYZ	DW	3	coconut	30	324	180	58320
37	Chellamuthu Goundar	DW	4	coconut	20	324	180	58320
38	Chellamuthu Goundar	BW	2	coconut	10	216	180	38880
39	Babu	DW	2	coconut	20	216	180	38880
40	Ramalingam	DW	1	coconut	10	144	180	25920
41	Kumara	DW	1	coconut	10	144	180	25920
42	Saniya Goundar	DW	3	coconut	20	288	180	51840
43	Saniya Goundar	BW	3	coconut	20	288	180	51840
44	Senthil kumar	DW	1	coconut	6	108	180	19440
45	Senthil kumar	BW	1	coconut	8	108	180	19440
46	Karuppusami	DW	1	coconut, mango	10	108	180	19440
47	Subramanian	DW	1	coconut	3.5	54	180	9720
48	Giri Goundar	DW	1	Mango	20	144	180	25920
49	Sella Muthu	DW	2	coconut	8	144	180	25920
50	Nachi Muthu	DW	1	coconut	6	108	180	19440
51	Chinnathambi	DW	3	coconut	20	288	180	51840
52	Mahalingam	DW	2	coconut	12	144	180	25920
53	Vittar Ramasamy Goundar	DW	1	coconut	6.5	108	180	19440
54	Vittar Ramasamy Goundar	BW	1	coconut	7	108	180	19440
55	Aruchami	DW	1	coconut	6	108	180	19440
56	Istikulathu Palaniswami	DW	1	coconut	8	108	180	19440
57	Selvaraj Goundar	DW	2	coconut	20	288	180	51840
58	Sabharpata	DW	1	coconut	15	144	180	25920
59	Rame Sauhats	DW	1	coconut	3	54	180	9720
60	Radhakrishanan	DW	2	coconut	20	288	180	51840
61	M.K.Aru	DW	1	coconut, mango	5	108	180	19440
62	Appad	DW	1	coconut	5	108	180	19440
63	Chinna Ara	DW	1	coconut	6	108	180	19440
64	Ra	DW	1	coconut	4	108	180	19440

Sl.No.	Name of farmer	Type of well	No. of well	Crops cultivated	Area irrigated, acre	Ground water draftm^3/day	No. of days /year	Annual draft m^3
65	Kuppu	DW	1	coconut	6	108	180	19440
66	Ramesh	DW	1	coconut	10	144	180	25920
67	Ramesh	DW	1	coconut	4	108	180	19440
68	Dhanraj	DW	1	coconut	6	108	180	19440
69	Nachimuthu	DW	1	coconut	10	144	180	25920
70	Saraswathi	DW	1	coconut	2	54	180	9720
71	Padinjaru	DW	1	coconut	7	108	180	19440
72	Palanichami	DW	1	coconut	4	72	180	12960
73	Kantasami Goundar	DW	1	coconut	4	72	180	12960
74	Kantasami Goundar	BW	1	coconut	4	72	180	12960
75	Ramasami Goundar	DW	1	coconut	4	72	180	12960
76	Kantavel Goundar	DW	1	coconut	4	72	180	12960
77	PR Chamu	DW	1	coconut	6	108	180	19440
78	PR Chamu	BW	1	coconut	8	108	180	19440
79	Vannamana	DW	1	coconut	6	108	180	19440
80	Muthusami Goundar	DW	1	coconut	16	188	180	33840
81	Kuttichavar Goundar	DW	2	coconut	3	54	180	9720
82	Chellamuthu Goundar	DW	1	coconut	5	72	180	12960
83	Jothilingam	DW	1	coconut	6	108	180	19440
84	Palaniyammal	DW	1	coconut	5	72	180	12960
85	Subramaniam	DW	1	coconut	4	72	180	12960
86	Balakrishanna	DW	1	coconut	6	108	180	19440
87	Veluchami	DW	1	coconut	6	108	180	19440
88	Subramaniam	DW	1	coconut	4	72	180	12960
89	Ramasami	DW	1	coconut	3	54	180	9720
90	Ramasami	BW	1	coconut	5	72	180	12960
91	Palanichami	DW	1	coconut	5	72	180	12960
92	Krishanchami	DW	1	coconut	5	72	180	12960
93	K.Natarajan	DW	1	coconut	5	72	180	12960
94	Trimulasam Goudnar	DW	1	coconut	5	72	180	12960
95	Mayilsami Goundar	DW	2	coconut	6	72	180	12960
96	Sivasami Goundar	DW	1	coconut	4	72	180	12960
97	Ramasami	DW	1	coconut	4	72	180	12960
98	Selvaraj	DW	1	coconut	3	72	180	12960

Sl.No.	Name of farmer	Type of well	No. of well	Crops cultivated	Area irrigated, acre	Ground water draftm^3/day	No. of days /year	Annual draft m^3
99	Mayilsami Tailor	DW	1	coconut	6	72	180	12960
100	Maragatham	DW	1	coconut	3	54	180	9720
101	Ajeef Gounder	DW	1	coconut	4	72	180	12960
102	Palanichami	DW	1	coconut	6	108	180	19440
103	Ponnusami Goundar	DW	1	coconut	15	188	180	33840
104	Ponnusami Goundar	BW	1	coconut	10	144	180	25920
105	Ponnusami Gounder	DW	1	coconut	7	108	180	19440
106	Radhkrishnan Goundar	DW	2	coconut	30	324	180	58320
107	Radhkrishnan Goundar	BW	1	coconut	5	108	180	19440
108	Subbayyam	DW	1	coconut	8	108	180	19440
109	Subbayyam	BW	1	coconut	5	72	180	12960
110	Masraya Reddy	DW	1	coconut	3	54	180	9720
111	Ramasami Gounder	DW	1	coconut	2	54	180	9720
112	Palanichami	DW	1	coconut	4	54	180	9720
113	Thankavel	DW	1	coconut	3	54	180	9720
114	XYZ evels	DW	1	coconut	3	54	180	9720
115	Murthy Jayaprkash	DW	1	coconut	6	108	180	19440
116	Doraiswami	DW	1	coconut	4	54	180	9720
117	Periyaswami Goundar	DW	1	coconut	12	144	180	25920
118	Mayilchami Goundar	DW	1	coconut	6	108	180	19440
119	Rudramoorthy	DW	1	coconut	4	72	180	12960
120	Dantapani	DW	1	coconut	4	72	180	12960
121	Dhanus raj Natar	DW	1	coconut	4	72	180	12960
122	Kalyana Sundaram	DW	1	coconut	12	144	180	25920
123	Nachimuthu gounder	DW	1	coconut	7	108	180	19440
124	K.C.Jnandhanan	DW	1	coconut	5	72	180	12960
125	Palanichami Goundar	DW	1	coconut	6	108	180	19440
							Total	2640240
							=	2.64024MCM

Ward 7

Detailed irrigation wells(Wardwise) in Perumatty panchayath, Palakkad district

Ward No.8

Sl.No.	Name of farmer	Type of well	No. of well	Crops cultivated	Area irrigated, acre	Ground water draftm^3/day	No. of days/year	Annual draft m^3
1	Arunachalam	Bore well	1	coconut	10	144	180	43200
2	Subramanian	Bore well	1	coconut	5	108	180	32400
3	Lingamuthu	Bore well	1	coconut	6	108	180	32400
4	Nallamuthu	Bore well	1	coconut	4	108	180	32400
5	Nallaswamy	Bore well	1	coconut	4	108	180	32400
6	Easwaraswamy Goundar	Bore well	1	coconut	5	108	180	32400
7	Sivanandan	Bore well	1	coconut	8	108	180	32400
8	Alakaswamy Goundar	Bore well	1	coconut	8	108	180	32400
9	Arumukhan	Bore well	1	coconut	5	108	180	32400
10	Veluchamy	Bore well	2	coconut,paddy	10	144	180	43200
11	I.R Goundar	Bore well	1	coconut	6	108	180	32400
12	Kannimuthu Goundar	Bore well	2	coconut	10	144	180	43200
13	Ratnaswamy	Bore well	1	coconut	8	108	180	32400
14	Krishnaswamy	Bore well	2	coconut	12	144	180	43200
15	Samoohavel	Bore well	1	coconut	5	108	180	32400
16	Palaniswamy	Bore well	2	coconut,paddy	12	144	180	43200
17	Appadurai	Bore well	1	coconut,paddy	10	144	180	43200
18	Ponnammal	Bore well	1	coconut	5	108	180	32400
19	Late Maruthachalam	Bore well	1	coconut	5	108	180	32400
20	Rajalakshmi	Bore well	1	coconut	5	108	180	32400
21	Vijayakumar	Bore well	1	coconut	5	108	180	32400
22	Asokkumar	Bore well	1	coconut	5	108	180	32400
23	Kamaludeen	Bore well	1	coconut	7	108	180	32400
24	Vijaya kumar	Bore well	2	coconut,paddy	10	144	180	43200
25	Guruvayoorappan	Bore well	1	coconut	8	108	180	32400
26	Bevatha	Bore well	1	coconut	7	108	180	32400
27	Kandatha	Bore well	1	coconut	5	108	180	32400
28	Varadarajan	Bore well	1	coconut	6	108	180	32400
29	Subbaiha Goundar	Bore well	5	coconut	15	144	180	43200
30	Mani	Bore well	1	coconut	7	108	180	32400

Sl.No.	Name of farmer	Type of well	No. of well	Crops cultivated	Area irrigated, acre	Ground water draftm^3/day	No. of days/year	Annual draft m^3
31	Senniappan	Bore well	1	coconut	5	108	180	32400
32	Govindaswamy	Dug well	1	coconut	4	108	180	32400
33	Azhakappan	Bore well	1	coconut	4	108	180	32400
34	Saroja	Bore well	1	coconut	5	108	180	32400
35	Arunachalam	Bore well	2	coconut,paddy	15	144	180	43200
36	Pazhaniammal	Bore well	1	coconut	5	108	180	32400
37	Nataraj	Bore well	1	coconut	5	108	180	32400
38	Mylathal	Bore well	1	coconut	3	108	180	32400
39	Rangaswami Goundar	Bore well	1	paddy	5	108	180	32400
40	Vellingirinathan	Bore well	1	coconut	5	108	180	32400
41	Shahul Hameed	Bore well	1	coconut	4	108	180	32400
42	Arunachalam	Bore well	2	coconut	8	108	180	32400
43	Kayamkulam	Bore well	2	coconut	15	144	180	43200
44	Rajappan	Bore well	2	coconut	15	144	180	43200
45	Kambalathara	Dug well	1	coconut,paddy	15	144	180	43200
46	Parvathy	Bore well	1	coconut	10	144	180	43200
47	Guruvayoorappan	Bore well	1	coconut	10	144	180	43200
								1674000
							=	1.674MCM

Detailed irrigation wells(Wardwise) in Perumatty panchayath, Palakkad district

Ward 9

Sl.No.	Name of farmer	Type of well	No. of well	Crops cultivated	Area irrigated, acre	Ground water draftm^3/day	No. of days/year	Annual draft m^3
1	Abdul Saleem	Bore well	1	coconut	2	54	180	9720
2	Achuthankutty	Dug well	1	coconut	8	144	180	25920
3	Appu	Dug well	1	garden	1	36	180	6480
4	Appu	Dug well	1	coconut	12	144	180	25920
5	Arukutty	Bore well	1	coconut	5	108	180	19440
6	Arukutty	Dug well	1	coconut	4	108	180	19440
7	Arumukhan	Dug well	1	coconut	4	108	180	19440
8	Balakrishnan	Dug well	1	coconut	4.5	108	180	19440
9	Balan	Dug well	1	coconut	5	108	180	19440
10	Balasubramaniam	Dug well	1	coconut	4	108	180	19440
11	Chamu	Dug well	1	coconut	6	108	180	19440
12	Chandradas	Dug well	1	coconut	3	72	180	12960
13	Chandran	Dug well	1	coconut	5	108	180	19440
14	Chandran	Dug well	1	coconut	4	108	180	19440
15	Chanimala	Dug well	1	coconut	4	108	180	19440
16	Chinna Goundar	Dug well	1	coconut	2	54	180	9720
17	Chipra	Dug well	1	coconut	4	108	180	19440
18	Devaki	Dug well	1	coconut	2	54	180	9720
19	Dharmaraj	Dug well	1	coconut	6	108	180	19440
20	Govindan	Dug well	1	coconut	5	108	180	19440
21	Govindan	Dug well	1	coconut	5	108	180	19440
22	X Goundar	Dugwell	1	coconut	7	144	180	25920
23	Janaki	Dug well	1	coconut	8	144	180	25920
24	Joseph	Dug well	1	coconut	6	108	180	19440
25	Khan H.S	Dug well	1	coconut	2	32	180	5760
26	Kalyani	Dug well	1	coconut	4	108	180	19440

Sl.No.	Name of farmer	Type of well	No. of well	Crops cultivated	Area irrigated, acre	Ground water draftm^3/day	No. of days/year	Annual draft m^3
27	Kamalakshi	Dug well	1	coconut	5	108	180	19440
28	Kamalam	Dug well	1	coconut	5	108	180	19440
29	Kannan	Dug well	1	coconut	2	36	180	6480
30	Karuppaswamy	Dug well	1	coconut	2	36	180	6480
31	Katha	Dug well	1	coconut	2	36	180	6480
32	Kesavan	Dug well	1	coconut	5	108	180	19440
33	Khadharkutti	Dug well	1	coconut	1	36	180	6480
34	Krishnanutty	Dug well	1	coconut	5	108	180	19440
35	Krishnaswamy	Dug well	1	coconut,paddy	10	144	180	25920
36	KunjuMuhammad	Dug well	1	coconut	1	36	180	6480
37	Kuppuswami	Dug well	1	coconut	3	72	180	12960
38	Kozhikode Goudnar	Dug well	1	coconut	6	108	180	19440
39	Kuttan Mannadiyar	Dug well	1	coconut	5	108	180	19440
40	Kuttan Mannadiyar	Dug well	1	coconut	5	108	180	19440
41	Leela	Dug well	1	coconut	5	108	180	19440
42	Muthukrishnan	Dug well	1	coconut	6	108	180	19440
43	Madhavan	Bore well	1	coconut	8	144	180	25920
44	Muhammad Haneefa	Dug well	1	coconut	5	108	180	19440
45	Military man	Borewell	1	coconut	6	108	180	19440
46	Military man	Dugwell	1	coconut	6	72	180	12960
47	Marimuth	Dugwell	1	coconut	3	54	180	9720
48	Muralikrishnan	Dug well	1	coconut	4	72	180	12960
49	P.K.Saseendran	Dug well	1	coconut	5	108	180	19440
50	Palaniswamy	Bore well	1	coconut	5	108	180	19440
51	Ponnan	Dug well	1	coconut	5	108	180	19440
52	Ponnan	Dug well	1	coconut	4	72	180	12960
53	Ponnukuttan	Dugwell	1	coconut	5	108	180	19440
54	Ponnuchami	Dug well	1	coconut	2	54	180	9720
55	Periyappan	Dug well	1	coconut	2	54	180	9720
56	Prabhakaran	Dug well	1	paddy	3	72	180	12960
57	Prabhakaran	Dug well	1	coconut	3	72	180	12960
58	Prabhakaran	Dug well	1	coconut	3	72	180	12960
59	Prema	Dug well	1	coconut	4	108	180	19440

Sl.No.	Name of farmer	Type of well	No. of well	Crops cultivated	Area irrigated, acre	Ground water draftm^3/day	No. of days/year	Annual draft m^3
60	R.Chami	Dug well	1	coconut	5	108	180	19440
61	Ramakrishnan	Dug well	1	coconut	9	180	180	32400
62	Radhakrishnan	Dug well	1	coconut	5	108	180	19440
63	Rajakumar malla	Dug well	1	coconut	5	108	180	19440
64	Rajamanikkam	Bore well	1	coconut	4	108	180	19440
65	Rajan	Dug well	1	coconut	4	108	180	19440
66	Ramachandran	Bore well	1	coconut	6	108	180	19440
67	Raveendranathan	Dug well	1	coconut	3	72	180	12960
68	Sahadevan	Dug well	1	paddy	6	108	180	19440
69	Sambhavathi	Dug well	1	coconut	4	72	180	12960
70	Santhakumari	Dug well	1	coconut	6	108	180	19440
71	Sreedharan	Dugwell	1	coconut	4	108	180	19440
72	Sasikumar	Dug well	1	coconut	5	108	180	19440
73	Shanmughan	Dug well	1	coconut	5	108	180	19440
74	Sukumar Ezhava	Dug well	1	paddy	5	108	180	19440
75	Sukumaran	Dug well	1	coconut	3	72	180	12960
76	Sukumaran	Dug well	1	coconut	2	54	180	9720
77	Sulaiman	Dug well	1	coconut	4	108	180	19440
78	Sundaran	Dug well	1	coconut	6	108	180	19440
79	Sundaran	Bore well	1	coconut	5	108	180	19440
80	Sundar master	Dug well	1	coconut	6	108	180	19440
81	Thankavel Ponnukuttan	Dug well	1	paddy	2	54	180	9720
82	Thankavelu Goundar	Dug well	1	coconut	4	72	180	12960
83	Thanku	Dug well	1	paddy	5	108	180	19440
84	Taluk officer	Dug well	1	coconut	9	144	180	25920
85	Unnikrishnan	Dug well	1	coconut	3	72	180	12960
86	Vasu	Dug well	1	coconut	8	144	180	25920
87	Vasu	Bore well	1	coconut	5	108	180	19440
88	Velappan	Dug well	1	coconut	5	108	180	19440
89	Velayudhan	Dug well	1	coconut	5	108	180	19440
90	Velayudhan	Dug well	1	coconut	5	108	180	19440
91	Velayudhan	Bore well	1	coconut	4	72	180	12960
92	Velu	Dug well	1	coconut	4	72	180	12960

Sl.No.	Name of farmer	Type of well	No. of well	Crops cultivated	Area irrigated, acre	Ground water draftm^3/day	No. of days/year	Annual draft m^3
93	Veluchamy	Dug well	1	coconut	5	108	180	19440
94	Vijayakumar	Dug well	1	coconut	5	108	180	19440
95	Viswanathan	Dug well	1	coconut	3	72	180	12960
							Total	1638720
							=	1.63872MCM

Detailed irrigation wells(Wardwise) in Perumatty panchayath, Palakkad district

Ward No.10

Sl.No.	Name of farmer	Type of well	No. of well	Crops cultivated	Area irrigated, acre	Ground water draftm3/day	No. of days /year	Annual draft m3/day
1	Mohanan mash	DW	2	coconut,paddy	16	216	175	37800
2	Ramadas	DW	2	coconut,paddy	10	144	200	28800
3	Natarajan	DW	1	coconut,paddy	5	72	175	12600
4	Subhash	DW	1	coconut,paddy	6	72	175	12600
5	Peethambaran	DW	1	coconut,paddy	4	54	175	9450
6	Sankarankutty	DW	1	coconut,paddy	2	54	175	9450
7	Chettan chettan	DW	1	coconut,paddy	4	54	196	10584
8	Kesu(late)	DW	1	coconut,paddy	5	72	175	12600
9	Devu	DW	1	coconut,paddy	10	144	175	25200
10	Devu	BW	1	coconut,paddy	10	144	175	25200
11	Mani(late)	DW	1	coconut,paddy	1	18	125	2250
12	Kuttu	DW	2	coconut,paddy	15	144	125	18000
13	Kuttu	BW	1	coconut,paddy	4	72	125	9000
14	Sanmugham	DW	1	coconut,paddy	4	72	125	9000
15	Lakshmi	DW	1	coconut,paddy	5	72	125	9000
16	Dinesh	DW	1	coconut,paddy	4	72	140	10080
17	Sudarshan mash	DW	1	coconut,paddy	5	72	140	10080
18	Velunni	DW	1	coconut,paddy	5	72	140	10080
19	Baby	DW	1	coconut,paddy	5	72	140	10080
20	Velunni(Kunnikadu)	DW	1	coconut,paddy	5	72	140	10080
21	Velunni(Kunnikadu)	DW	1	coconut,paddy	2	54	140	7560
22	Parthan	DW	1	coconut,paddy	3	54	140	7560
23	Parthan	BW	1	coconut,paddy	6	72	140	10080
24	Ramesh	DW	1	coconut,paddy	4	72	140	10080
25	Babu(Narayanan)	DW	1	coconut,paddy	5	72	140	10080
26	Mani	DW	1	coconut,paddy	6	72	140	10080
27	Mani	BW	1	coconut,paddy	8	108	140	15120
28	Preman	DW	1	coconut,paddy	10	144	140	20160

Sl.No.	Name of farmer	Type of well	No. of well	Crops cultivated	Area irrigated, acre	Ground water draftm3/day	No. of days /year	Annual draft m3/day
29	Chamiar	DW	1	coconut,paddy	5	108	140	15120
30	Mani	DW	1	coconut,paddy	3	72	140	10080
31	Prasannan	DW	1	coconut,paddy	5	72	140	10080
32	Sathyamoorthi	DW	1	coconut,paddy	5	72	140	10080
							Total	418014
							=	0.418014MCM

Detailed irrigation wells(Wardwise) in Perumatty panchayath, Palakkad district

Ward No.11

Sl.No.	Name of farmer	Type of well	No. of well	Crops cultivated	Area irrigated, acre	Ground water draftm^3/day	No. of days/year	Annual draft m^3
1	Thankaraja Goundar	Bore well	1	coconut	5	108	180	19440
2	Thankaraja Goundar	Dug well	1	coconut	4	72	180	12960
3	Neighbour widow	Dug well	1	coconut	4	72	180	12960
4	R Chami Goundar	Dug well	1	coconut	8	108	180	19440
5	R Chami Goundar	Bore well	1	paddy	3	72	180	12960
6	Pankajakshy	Dug well	1	coconut	3	72	180	12960
7	Prabhakaran	Dug well	1	paddy	3	72	180	12960
8	Mr.X Pallimukku	Dug well	1	coconut	5	108	180	19440
9	Raj Goundar	Dug well	1	coconut	5	108	180	19440
10	New 1(Pallimukku)	Dug well	1	coconut	4	108	180	19440
11	New 2(Pallimukku)	Dug well	1	coconut	4	108	180	19440
12	New Prabhakaran	Dug well	1	coconut	8	108	180	19440
13	Murukesh	Dug well	1	coconut	6	108	180	19440
14	Kasi	Dug well	1	coconut	6	108	180	19440
15	Jaleel	Dug well	1	coconut	5	108	180	19440
							Total	259200
							=	0.2592MCM

Detailed irrigation wells(Wardwise) in Perumatty panchayath, Palakkad district

Ward No.12

Sl.No.	Name of farmer	Type of well	No. of well	Crops cultivated	Area irrigated, acre	Ground water draftm^3/day	No. of days/year	Annual draft m^3
1	Chanddrakaladharan	DW	1	coconut	7	108	180	19440
2	Kamalakshy Amma	DW	1	paddy	10	144	180	25920
3	Vasu Thattan	DW	1	coconut	6	108	180	19440
4	Kochappan	DW	1	paddy	5	108	180	19440
5	Chandran Thattan	DW	1	paddy	2	72	180	12960
6	Anandakrishnan	DW	1	paddy	2	72	180	12960
7	Rajan	DW	1	paddy	2	72	180	12960
8	Muthu	DW	1	paddy	2	72	180	12960
9	Sahadevan	DW	1	paddy	8	108	180	19440
10	Chenthamara	DW	2	paddy	15	324	180	58320
11	Thajudeen	BW	1	paddy	15	180	180	32400
12	Eratiapa Vasu	DW	1	paddy	3	72	180	12960
13	Ramachandran Otiakurinji	BW	1	paddy	4	108	180	19440
14	Ramakrishnan	DW	1	paddy	15	180	180	32400
15	Sahnmukham Odukka	DW	1	paddy	4	108	180	19440
16	Ravivelsan	DW	1	paddy	5	108	180	19440
17	Sathyaraj	DW	1	coconut	6	108	180	19440
18	Ramankutty	DW	1	coconut	6	108	180	19440
							Total	388800
							=	0.3888MCM

Detailed irrigation wells(Wardwise) in Perumatty panchayath, Palakkad district

Ward No.13

Sl.No.	Name of farmer	Type of well	No. of well	Crops cultivated	Area irrigated, acre	Ground water draftm^3/day	No. of days/year	Annual draft m^3
1	Ravi	DW	1	coconut,paddy	10	180	180	32400
2	Ravi	BW	1	coconut,paddy	5	108	180	19440
3	Radhakrishnan	DW	1	coconut,paddy	10	180	180	32400
4	Kirshnankutty	DW	1	coconut,paddy	10	180	180	32400
5	Kirshnankutty	BW	1	coconut,paddy	5	108	180	19440
6	Padmanabhan	DW	1	coconut,paddy	5	108	180	19440
7	Ramakrishnan	DW	1	coconut,paddy	5	108	180	19440
8	Mani	DW	1	coconut,paddy	6	108	180	19440
9	Appukuttan	DW	1	coconut,paddy	5	108	180	19440
10	Ramakrishnan	DW	1	coconut,paddy	6	108	180	19440
11	Bhaskaran	DW	1	coconut,paddy	7	108	180	19440
12	Sunilkrishnan	DW	1	coconut,paddy	5	108	180	19440
13	Sreekrishnan	DW	1	coconut,paddy	5	108	180	19440
14	Sreekrishnan	BW	1	coconut,paddy	5	108	180	19440
15	Kaladharan	DW	1	coconut,paddy	5	108	180	19440
16	Muthukutti mash(late)	DW	1	coconut,paddy	5	108	180	19440
17	Ammu(Sulochana)	DW	1	coconut,paddy	4	108	180	19440
18	Ramachandran	DW	1	coconut,paddy	5	108	180	19440
19	SethuMadhavan	DW	1	coconut,paddy	10	180	180	32400
20	SethuMadhavan	BW	1	coconut,paddy	5	108	180	19440
21	Ismail	DW	1	coconut,paddy	5	108	180	19440
22	Abdul Hakim	DW	1	coconut,paddy	5	108	180	19440
23	Sathu Mash	DW	1	coconut,paddy	2	54	180	9720
24	Sathu Mash	BW	1	coconut,paddy	5	108	180	19440
25	Ammini	DW	1	coconut,paddy	5	108	180	19440
26	Babu	DW	1	coconut,paddy	5	108	180	19440
27	Babu	DW	1	coconut,paddy	5	108	180	19440
							Total	567000
							=	0.567MCM

Detailed irrigation wells(Wardwise) in Perumatty panchayath, Palakkad district

Ward No.14

Sl.No.	Name of farmer	Type of well	No. of well	Crops cultivated	Area irrigated, acre	Ground water draftm^3/day	No. of days/year	Annual draft m^3
1	K.B.Koya	DW	1	Coconut,paddy	3	72	180	12960
2	Ismail	BW	1	Coconut,paddy,banana	5	108	180	19440
3	Ismail	DW	1	Coconut,paddy	5	108	180	19440
4	Mahaboob Beevi	DW	1	Coconut,paddy	5	108	180	19440
5	Narayanan	DW	1	Coconut,paddy	3	72	180	12960
6	Subramanian	DW	1	Coconut,paddy	3	72	180	12960
7	Kuttamani(Radhakrishnan)	BW	1	Coconut,paddy	5	108	180	19440
8	Kuttamani(Radhakrishnan)	DW	1	Coconut,paddy	5	108	180	19440
9	Pazhanimala	DW	1	Coconut,paddy	5	108	180	19440
10	Balan	DW	1	Coconut,paddy	5	108	180	19440
11	Sureshkumar	DW	1	Coconut,paddy	5	108	180	19440
12	Gopi	DW	1	Coconut,paddy	2.5	72	180	12960
13	Moideen Sheik	BW	1	Coconut,paddy	5	108	180	19440
14	Moideen Sheik	DW	1	Coconut,paddy	6	108	180	19440
15	Kirshnankutty	DW	1	Coconut,paddy	10	180	180	32400
16	Narayanankutty	DW	1	Coconut,paddy	5	108	180	19440
17	Sreenviasan Panakulamb	DW	1	Coconut,paddy	6	108	180	19440
							Total	317520
							=	0.31752MCM

Detailed irrigation wells(Wardwise) in Perumatty panchayath, Palakkad district

Ward No.15

Sl.No.	Name of farmer	Type of well	No. of well	Crops cultivated	Area irrigated, acre	Ground water draftm^3/day	No. of days/year	Annual draft m^3/day
1	20 DW-Athancheri	DW	2	coconut	4	144	180	25920
2	20 DW-Athancheri	BW	1	paddy	4	108	180	19440
3	Chemunni Odachire	DW	1	coconut,paddy	4	108	180	19440
4	Kunjan	DW	1	coconut,paddy	7	144	180	25920
5	Mohanan	DW	1	coconut,paddy	5	108	180	19440
6	Kunjan s/o K.L.Odachira	DW	1	coconut,paddy	4	108	180	19440
7	Viswambaran	DW	1	coconut,paddy	5	108	180	19440
8	Sukumaran	DW	1	coconut,paddy	6	108	180	19440
9	Abdul Kareem	DW	1	coconut,paddy	8	144	180	25920
10	Abdul Kareem	BW	1	coconut,paddy	5	108	180	19440
11	Aleema	DW	1	coconut,paddy	6	108	180	19440
12	Sukumaran	DW	1	coconut,paddy	5	108	180	19440
13	Kamarudeen	DW	2	coconut,paddy	3	72	180	12960
14	Shahulhameed	DW	1	coconut,paddy	5	108	180	19440
15	Jose	DW	2	coconut,paddy	7.5	108	180	19440
16	Atancheri Toddy shop Manager	DW		coconut,paddy	3	72	180	12960
17	Kuttikrishnan	DW	1	coconut,paddy	5	108	180	19440
18	Gopalakrishnan	DW	1	coconut,paddy	4	108	180	19440
19	Raman	DW	1	coconut,paddy	9	144	180	25920
20	Krishnankutti mash	BW	1	coconut,paddy	5	108	180	19440
21	Husain	DW	1	coconut,paddy	5	108	180	19440
22	Narayana Nair	DW	1	coconut,paddy	5	108	180	19440
							Total	440640
							=	0.44064MCM

Appendix II Ward wise details of Domestic draft, Perumatti panchayath (100 lpcd)					
Ward no	No of house holds	Total population (2001)	Domestic Draft in MCM	Live stock draft MCM	Total draft in MCM
1	461	2287	0.083	0.00014	0.084
2	586	2809	0.103	0.00018	0 103
3	478	2196	0.080	0.00014	0.080
4	425	1898	0.069	0.00013	0.069
5	456	1686	0.062	0.00014	0.062
6	450	1730	0.063	0.00014	0.063
7	422	1683	0.061	0.00013	0.062
8	442	1821	0.066	0.00013	0.067
9	435	1825	0.067	0.00013	0.067
10	381	1797	0.066	0.00011	0.066
11	419	1851	0.068	0.00013	0.068
12	327	1509	0.055	0.00010	0.055
13	404	1974	0.072	0.00012	0.072
14	409	1936	0.071	0.00012	0.071
15	514	2498	0.091	0.00015	0.091
	Total	29500	1.077	0.00198	1.079

Appendix - III Ward wise details of Industrial draft, Perumatti panchayath

Ward no	No of abstraction structures	Daily daft in m3	Annual Industrial draft MCM	Name of industry
1	no industry			
2	no industry			
3	no industry			
4	no industry			
5	no industry			
6	BW -2	50	0.018	Kerala alchoholics , Meenakshipuram
7	no industry			
8	BW- 5 & DW -	500	0.183	Hindustahan coco cola , Plachimada
9	no industry			
10	no industry			
11	no industry			
12	no industry			
13	no industry			
14	no industry			
15	no industry			
	Total	550	0.201	

ANNEXURE IV

GOVERNMENT OF KERALA

GROUND WATER DEPARTMENT

Report on the monitoring of water levels and water quality in wells in and around the Hindusthan Coca Cola Factory at Plachimada, Palakkad district

May 2006

Introduction

The State Groundwater Department carried out monitoring of water levels and quality in wells around the Coca Cola factory in Plachimada, Palakkad district from March, 2002 to March 2006. The objective was to study the changes in the water levels and quality in wells in the area due to withdrawal of groundwater and discharge of effluent by the factory. Detailed studies for knowing long term changes were begun in October,2002 and continued upto December, 2003. A report was given in September, 03 on the work done. Later, the periodicity of the observations was reduced, since an expert committee headed by CWRDM was constituted by the Hon. High Court to go into the question of groundwater availability in the area. The department continued to monitor the situation, though at larger intervals of time. Figure 1 shows the approximate factory area and the locations of the wells monitored.

Location:

The factory is located at Plachimada near Kannimari in Perumatty Panchayat. It is on Vandithavalam – Meenakshipuram road, about 5.5 km west of Meenakshipuram, between the 29th and 30th km stones. The area falls in Survey of India toposheet no. 58 B/14. The geographical coordinates are shown in figure 1.

Study area:

The factory occupies about 13 ha of land on the slope of a minor hillock. Wells in an area of about one sq.km around the factory were monitored. Initially all 22 wells (16 dugwells and 6 borewells) in the area were selected for the study. Later two borewells (nos. 18 and 19), located inside the factory, were left out due to difficulty in obtaining samples directly from the wells. Another borewell outside the factory (no. 4) was also dropped for similar reasons. Further, correct water levels could not be obtained from these energized borewells. Well inventory data is presented in table 1.

Physiography:

The area has undulating topography. The northern part of the factory area forms a broad valley extending further north. Elevation above mean sea level is between 180 and 200 metres. The Moolathara irrigation canal (lined) forms the northern boundary of the factory. The Kambalathara reservoir, which is part of the Moolathara irrigation system and hence receives water through the canals, is located about 600 metres east of the study area.

Rainfall:

The nearest raingauge station is located at Meenkara Dam, about 4 km south west of the study area. Monthly rainfall data for this station for the period 1995 to 2005 is presented in table 2.The average annual rainfall during the period was 1666 mm. South west monsoon contributes about 65% of annual rainfall and the north east monsoon about 25%.

Hydrogeology :

Biotite gneiss with pegmatite veins forms the rock type in the area. Weathered rock occurs below a soil cover of about 1 to 3 metres thickness. The weathered zone thickness varies from 4 to 12 metes and includes partially weathered and jointed hard rock. It forms a phreatic aquifer. The occurrence of the jointed rock at shallow depth could facilitate percolation of shallow groundwater to deeper fracture zones in the bedrock. Thickness of weathering is comparatively less in the area immediately south of the factory. Depth to water table ranges from around 0.65 m in the valley to more than 13.27 m on the highest ground. The borewells in the area probably tap semi-confined aquifers.

Groundwater use in the area

The Coca Cola factory has 6 borewells and 2 openwells. Daily extraction of groundwater was reported to be 5 lakh litres. It was also reported that treated effluent water from the factory was used for gardening within the premises. There are two borewells with handpumps (no. 12 and 15) in the habitations located outside the factory. The rest of the wells in the study area are privately owned. Six (nos. 3,4,7,10,11 and 14) of these are irrigation wells used for watering coconut plants and seasonal crops. The rest are domestic wells.

Recharge conditions

The area receives less rainfall compared to the State annual average of 3000 mm. The undulating topography, presence of broad valleys with paddy fields, the jointed and fractured nature of the rocks and the availability of surface water irrigation promote recharge to groundwater and offset the disadvantage of lower rainfall. The large percolation ponds constructed by the factory within its premises have also contributed to greater recharge. Thus the hydrogeological conditions in the area are favourable for groundwater recharge.

Water level trends

Groundwater level trend in the study area is a reflection of the influence of several factors. Variation in monsoon rainfall is a major factor. The effect of the increasing rainfall trend from 2002 to 2005 is evident in the water level trends in most of the monitored wells(figs. 2 to 19). Releasing of water from the Moolathara Dam in to the irrigation canals and storage position in the

adjacent Kambalathara reservoir is another significant feature. A general rise in water table was noted in the area in August,2003 when irrigation water arrived in the reservoir.

Changes in pumping pattern of irrigation wells in the area also contribute to water level changes. The quantity of groundwater pumped may vary depending on the rainfall and the type of seasonal crop cultivated. The groundwater draft due to the Coca Cola factory is a major influence which has emerged in recent years. Part of this water is returned to the subsurface in the form of an effluent. The percolation ponds in the factory is another new factor. Water level data of the monitored wells is given in table3.

Comparison of depth to water table observed in the monitored wells in the month of March in 2002 and 2003 showed decline of water level in majority of cases and rise in water level in a few cases (report dated September,2003). The decline was attributed to the combined effect of lower than normal rainfall and groundwater draft, especially by the wells in the factory. The rise in level in a few wells was probably the localized effect of recharge from percolation ponds and the effluent discharged in the factory. This rise would also depend on the pumping pattern of irrigation wells in the area. Three dug wells (nos. 3,5 and 17) became dry. Comparison of water levels in March,06 with those of March,03 shows rise in most of the wells. Slight fall was observed in only two cases (nos. 1 and 14). The good rainfall in 2005 and the absence of draft in the factory have both contributed to the improvement in water level.

Comparison of depth to water table in dug wells in May,2003 and May, 2004 shows fall in most wells. One well was dry. Rise is seen only in three cases (nos.6, 7 and 20).Well 20 is near the percolation ponds inside the factory, and wells 6 and 7 are located near the area where effluent is discharged. The factory was working till the summer of 2004. The higher rainfall in 2003 (1566 mm as compared to 757 mm in 2002) does not seem to have improved the position of groundwater resources in the summer of 2004. However, there was a significant rise in water level in May,05 due to another good monsoon in 2004 and the closure of the factory.

Groundwater Estimation

Plachimada falls within Chittur block in Palakkad district. The Groundwater Estimation Committee has classified this block as an over-exploited area with reference to groundwater availability and use. The Government of Kerala has declared the block as a notified area as per Kerala Ground Water (Control and Regulation) Act, 2002. The estimation of groundwater resources is done based on certain broad principles, and is useful for obtaining a general understanding of the status of groundwater resources in a large area. Application of this method in a small area like the present study area may not yield an accurate picture of the situation.

WATER QUALITY

Water quality monitoring was conducted from March 2002 to March 2006 in 19 wells (16 numbers of open wells and 3 bore wells) in and around the Coca-Cola factory in Plachimada. Treated effluent is let out by the factory in its garden located in the South-West part of the factory.

The purpose of the study was to analyse the chemical quality of the treated effluent and a number of wells around the factory and to see whether the effluent is causing changes in the chemical quality of ground water in the area. Though the study was started with 5 bore wells, analysis could be continued only for 3 bore wells due to difficulty in obtaining samples from the other 2 wells. Thus the results from 16 open wells and 3 bore wells are presented in figures (figs: Q1 to Q19).

The factory had begun production before the water quality monitoring was started. The factory stopped functioning in the summer 2004, but the monitoring was continued. Till now water samples have been tested 9 times.

Results and discussion

Detailed analysis of all major ions and also Fluoride, Iron, Nitrate was done. Variation in the values of Electrical Conductivity, Total Hardness and Chloride with time in the monitored wells is shown in figures Q1 to Q19. This is done to evaluate the effect of the high "Electrical Conductivity – Chloride" treated effluent on the ground water in the surrounding area.

Treated effluent

The treated effluent was tested twice, in July, 2002 and April, 2003 and the results are given in table I. Effluent samples were provided by the factory. The analysis was done only to determine the major ions in the effluent. It is possible that the concentrations may vary at different times, which cannot be monitored by the department.

Table I

Lab ref. No.			566/02	06/03
Sample			Treated effluent from factory during July, 2002	Treated effluent from factory during April, 2003
Parameter	Desirable Limit (BIS)	Permissible limit	Analysed value	Analysed value
pH	6.5 – 8.5	6.5 – 8.5	7.98	7.3
Electrical conductivity (µmhos/cm)	–	–	2880	2040
Total Dissolved solids (ppm)	500	2000	1577	1694
Turbidity (NTU)	5	10	0.3	-
Total hardness	300	600	341	625
Calcium (ppm)	75	200	22.8	22.4
Magnesium (ppm)	30	100	73	139
Sodium (ppm)	–	–	540	105
Potassium (ppm)	–	–	5.1	3.7
Total alkalinity (ppm)	200	600	322	278
Carbonate (ppm)	–	–	0	0
Bicarbonate (ppm)	–	–	196	170
Sulphate (ppm)	200	400	9	37
Chloride (ppm)	250	1000	852	610
Fluoride (ppm)	1	1.5	-	1.738
Iron (ppm)	0.3	1	0.55	0
Nitrate-N (ppm)	10	–	-	-
Silica (ppm)	–	–	42.2	61
Zinc (ppm)	5	15	0.19	0.067
Lead (ppm)	0.05	0.05	-	0.024
Cadmium (ppm)	0.01	0.01	-	bdl

bdl – below detection limit

The characteristic chemical feature of the effluent is a comparatively high Electrical Conductivity and high Chloride in comparison to bicarbonate. Generally, ground water in the phreatic zone contains considerably more bicarbonate than Chloride.

Background Quality

The general background quality of ground water in this area is indicated by the initial values of electrical conductivity, total hardness and chloride observed in dug wells 3,5, 8, 9, 10, 11, 14, 16, 17 & 20 and in bore well number 4. In these wells the initial electrical conductivity value (summer of 2002) ranges from 390 µmhos/cm to 650 µmhos/cm.

Similarly, the total hardness and chloride values ranged from 11 mg/l to 239 mg/l and 43 mg/l to 133 mg/l respectively in these wells in the summer of 2002. The dug wells 21 & 22 are located near an irrigation canal and the Kambalathara reservoir respectively, and appear to be influenced by surface water inflow. In dug wells 1,6,7 and 13 and in bore wells 2 and 12 high values are observed even in 2002. This is possible, since the factory was in production before this time. These are the wells located nearest to the factory.

Effect of effluent on ground water quality

The monitored wells can be classified into 3 types based on the effect of the effluent on the "Electrical Conductivity – Chloride" values of the groundwater samples.

Type I:

Wells which show an increase in dissolved solids concentration from 2002 and reach a maximum in 2004, followed by a decrease afterwards. The dug wells 1, 7, 9, 10, 13 & 17 belong to this type. Most of these wells are within a distance of approximately 70 meters from the factory. Only two wells (16 and 17) are about 350 meters away. Bore wells 2 and 4 also show similar result. In these wells, the maximum electrical conductivity value observed ranges from 917 µmhos/cm to 5700 µmhos/cm. Similar trend is seen in chloride concentrations. Maximum chloride concentration in these wells is between 93 mg/l and 1552 mg/l.

The result indicate that the seepage from the effluent was reaching these wells when factory was in production up to 2004, followed by a general improvement in quality after the factory was closed. However the values have not yet reached the background concentration.

Type II:

These wells show a delayed increase in electrical conductivity and chloride compared to the Type I wells. The maximum values are observed in 2005 or 2006. ie one or two years after the closure of the factory. Dug wells 3 and 5 and 8 belong to this category . These wells

are away from the factory area (about 300 meters), indicating that the delayed effect may be due to the greater distance from the factory. Well 16 is also away from the factory, but it shows earlier response probably due to the fact that it is down slope from the factory.

The wells 6,8,11,14,16 and 20 (well number 20 is located inside factory compound) show slightly different behaviour compared to type I and II. They show increase in 2004 similar to type I. This is followed by a decrease in value and again an increase in 2005 or 2006.

Drinking water standards

Bureau of Indian Standards (BIS) has prescribed desirable and permissible standards for drinking water. The table below shows the number of wells in the study area (year-wise) which had concentration above desirable or permissible limits.

Year	Total Hardness		Chloride	
	Permissible	Desirable	Permissible	Desirable
7/2003	8	13	1	9
7/2004	7	13	2	10
5/2005	10	11	Nil	9
3/2006	3	13	Nil	6

The permissible limit: Total Hardness - 600 mg/l Chloride - 1000 mg/l
Desirable limit: Total Hardness -300 mg/l Chloride - 250 mg/l
Lead and Cadmium concentrations were analysed 2 times in 2003 and were below detectable limit of 0.01 mg/l. Zinc concentration was determined twice in 2003 and, all the values were found to be below desirable limit of 5 mg/l. Arsenic analysis was done once in 2003, and was below detectable limit.

Conclusions

Any new, large scale groundwater withdrawal in an area will cause a lowering of the water table in that area. If rainfall is normal, then the water table may recover during monsoon and stabilize at a new lower level in summer. However, if recharge is not sufficient (due to below normal rainfall), then the water table may show a continuously declining trend over several years. Even if the water table recovers during a particularly good monsoon, deep water levels and drying up of wells may cause hardship in summer. In such a situation, it is important to fix priorities for groundwater use.

Groundwater level trend in the present study area is controlled by several factors like rainfall, reservoir storage, groundwater use, crop pattern, effluent discharge and recharge structures. In a hard rock terrain like the present one,

groundwater flow paths may be quite heterogeneous, resulting in different degrees of subsurface interconnection between adjacent areas. In such a situation, overall water level trends are more indicative than the water level fluctuations in individual wells. The data from the monitored wells in the present area suggest some amount of water level decline in 2003 and 2004 due to pumping in the factory. Later study does not throw any light on this aspect since the factory closed in 2004. Further, the increasing trend in rainfall from 2003 to 2005 caused improvement in groundwater storage.

Comparison of the background ground water quality in the area with water quality in wells in and around the factory was done in this study. Data for several years is required to establish water quality trends (as can be observed from the results presented here).

The results indicate that the discharge of effluent water, having concentration of Dissolved solids greater than the concentration present in ground water in the area, has resulted in an increase in dissolved solids in the water in the nearby wells. In some of the wells high concentration was noted at the beginning of the study (2002), since the factory was already functioning. In other cases, sharp increase in Electrical Conductivity was observed from 2002 to 2004, when peak concentration was reached. After the closure of the factory in 2004, the concentration started declining, but has not reached background values yet.

Generally it is observed that wells located nearer to the factory showed the effect of effluent earlier than wells located further away. In some of the wells located away from the factory, peak values occured in 2005 or 2006, indicating the spreading of effluent in the area.

It has to be noted that the effects of variation in monsoon rainfall during different years is also superimposed on the influence of seepage of treated effluent into the ground water. The subsurface movement of the effluent also depends on the interconnections between ground water flow paths in the subsurface. Hence the degree of influence of the effluent on the ground water quality does not always vary linearly with distance between wells and the point where the effluent is discharged.

Jasaulle
CHIEF CHEMIST

HYDROGEOLOGIST

J. P. Kukillaya
Director

TABLE 1 – WELL INVENTORY

Sl. No.	Well No.	Type of well	Owner	Total Depth In Mts.	Depth to weathered rock In Mts.	Type of pump
1	1	O/W	Natarajan, N.R. Stores, Plachimada, Kannimary	8.16	4.70	Nil
2	2	B/W	Natarajan, N.R. Stores, Plachimada, Kannimary	105		5HP Compressor
3	3	O/W	K.Appuswamy, Thottichipathy	8.80	8 (Hard rock)	5HP Compressor
4	4	B/W	Retnaswami, Rajiv Nagar Thottichipathy	105		5HP Compressor
5	5	O/W	Lakshmana Kounder, Thottichipathy	9.58	Hard rock 7.7 mts	
6	6	O/W	Devarajan, Plachimada	10.3	Hard rock 9 Weathered roack 1.15	
7	7	O/W	Aruchami Kounder, Plachimada	8.65	4.60	5 HP Centrifugal
8	8	O/W	Pazhanimalai, Plachimada	8.60	3	Nil
9	9	O/W	Sudevan, Plachimada	6.30	3	Nil
10	10	O/W	Rengasami Kounder, Kambalathara	7.10	1	5HP Centrifugal
11	11	O/W	P.V.Shahul Hameed, Plachimada	7.30	1	5HP Centrifugal
12	12	B/W	Panchayath B/W in Adivasi Colony			
13	13	O/W	Panchayath O/W in Adivasi Colony	6.60		
14	14	O/W	A.C.Ravindranath, Azhichira Kannimary	10.0	3	5HP Centrifugal
15	15	B/W	Panchayath well in Plachimada colony			Hand pump
16	16	O/W	K.P. Balan, Plachimada	1.85	1.20	
17	17	O/W	Gopalan K., Kambalathara	13.5	3 (Highly weathered)	
18	18	B/W	Inside the Coca-cola Company Bore No. 3/6	72.0		5 HP Submersible
19	19	B/W	Inside the Coca-cola Company Bore No. 5/6	103		5 HP Submersible
20	20	O/W	Inside the Coca-cola Company	8.80		5 HP
21	21	O/W	Govt puramboke near canal			
22	22	O/W	Meenakshi Amman w/o Mayilswami Kaundar, Kambalathara	9.80	7.05	

Year	January	February	March	April	May	June	July	August	September	October	November	December	Total
1995	0	5	13	51	204	141	279	316	105	81	159	0	1354
1996	0	0	0	62	11	172	318	122	126	194	51	24	1080
1997	0	0	0	0	0	133	459	391	75	374	261	22	1715
1998	0	0	0	33	80	434	518	185	94	138	384	189	2055
1999	0	7	2	50	170	224	873	250	39	723	41	0	2379
2000	0	175	2	30	0	469	422	796	75	0	114	66	2149
2001	0	0	0	30	81	396	262	142	10	103	182	0	1206
2002	0	0	0	0	83	162	163	218	0	103	14	14	757
2003	0	92	113	70	0	208	281	328	28	341.5	77	28	1566.5
2004	12	0	38	55	260	470	350	440	48	76	102	0	1851
2005	0	5	6	32	161	369	802	282	159	110	171	116	2213

Table 2 . Monthly rainfall data for Meenkara Dam raingauge station

TABLE 1 – WELL INVENTORY

Sl. No.	Well No.	Type of well	Owner	Total Depth In Mts.	Depth to weathered rock In Mts.	Type of pump
1	1	O/W	Natarajan, N.R. Stores, Plachimada, Kannimary	8.16	4.70	Nil
2	2	B/W	Natarajan, N.R. Stores, Plachimada, Kannimary	105		5HP Compressor
3	3	O/W	K.Appuswamy, Thottichipathy	8.80	8 (Hard rock)	5HP Compressor
4	4	B/W	Retnaswami, Rajiv Nagar Thottichipathy	105		5HP Compressor
5	5	O/W	Lakshmana Kounder, Thottichipathy	9.58	Hard rock 7.7 mts	
6	6	O/W	Devarajan, Plachimada	10.3	Hard rock 9 Weathered roack 1.15	
7	7	O/W	Aruchami Kounder, Plachimada	8.65	4.60	5 HP Centrifugal
8	8	O/W	Pazhanimalai, Plachimada	8.60	3	Nil
9	9	O/W	Sudevan, Plachimada	6.30	3	Nil
10	10	O/W	Rengasami Kounder, Kambalathara	7.10	1	5HP Centrifugal
11	11	O/W	P.V.Shahul Hameed, Plachimada	7.30	1	5HP Centrifugal
12	12	B/W	Panchayath B/W in Adivasi Colony			
13	13	O/W	Panchayath O/W in Adivasi Colony	6.60		
14	14	O/W	A.C.Ravindranath, Azhichira Kannimary	10.0	3	5HP Centrifugal
15	15	B/W	Panchayath well in Plachimada colony			Hand pump
16	16	O/W	K.P. Balan, Plachimada	1.85	1.20	
17	17	O/W	Gopalan K., Kambalathara	13.5	3 (Highly weathered)	
18	18	B/W	Inside the Coca-cola Company Bore No. 3/6	72.0		5 HP Submersible
19	19	B/W	Inside the Coca-cola Company Bore No. 5/6	103		5 HP Submersible
20	20	O/W	Inside the Coca-cola Company	8.80		5 HP
21	21	O/W	Govt puramboke near canal			
22	22	O/W	Meenakshi Amman w/o Mayilswami Kaundar, Kambalathara	9.80	7.05	

Year	January	February	March	April	May	June	July	August	September	October	November	December	Total
1995	0	5	13	51	204	141	279	316	105	81	159	0	1354
1996	0	0	0	62	11	172	318	122	126	194	51	24	1080
1997	0	0	0	0	0	133	459	391	75	374	261	22	1715
1998	0	0	0	33	80	434	518	185	94	138	384	189	2055
1999	0	7	2	50	170	224	873	250	39	723	41	0	2379
2000	0	175	2	30	0	469	422	796	75	0	114	66	2149
2001	0	0	0	30	81	396	262	142	10	103	182	0	1206
2002	0	0	0	0	83	162	163	218	0	103	14	14	757
2003	0	92	113	70	0	208	281	328	28	341.5	77	28	1566.5
2004	12	0	38	55	260	470	350	440	48	76	102	0	1851
2005	0	5	6	32	161	369	802	282	159	110	171	116	2213

Table 2 . Monthly rainfall data for Meenkara Dam raingauge station

Well no.	March,02	Oct,02	Nov.02	Dec.02	Jan.03	Feb.03	Mar.03	May,03	July,03	Aug.03	Oct.03	Dec.03	May,04	June,04	July,04	Nov.04	April,05	May,05	Sep.05	March,06
1	7.32	6.35	6.45	6.28	7.43	7.25	6.22	6.93	6.6	4.93	5.56	6.55	7.49	6.46	3.62	5.5	7.38	8.14	3.27	6.63
3	7	7.35	8.38	7.52	8.27	8.05	8.28	8.23	dry	dry	8.2	7.875	8.28	dry	5.5	6.69	6.98	7.59	3.2	5.96
5	7.65	8.83	8.1	9.36	dry	dry	dry	dry	dry	dry	9.58	6.98	dry	dry	4.04	3.57	dry	9.25	1.98	5.72
6	8.45	4.63	5.49	7.56	8.81	9.35	9.13	10.65	9.85	5.75	5.5	7.19	10.26	8.45	3.94	6.96	10.17	10.92	3.99	7.89
7	5.4	3.77	4.13	3.86	4.76	7.73	4.89	8.77	7.7	5.69	2.76	2.09	6.79	6.32	2.93	4.2	5.7	8.5	3.3	4.85
8	6.3	4.68	5.53	6.11	6.2	6.51	6.71	8.7	6.46	6.46	5.14	4.55	8.99	7.9	4.38	5.07	7.25	7.94	6.35	6.72
9	4.4	3.35	3.57	3	3.16	3.8	4.77	5.89	5.06	4.75	3.4	3.05	6.7	5.78	2.95	3.5	5.38	5.86	3.29	3.54
10	5.1	2.76	5	4.41	5.33	5.47	4.82	5.6	5.1	5.57	2.06	3.42	5.66	3.06	0.85	1.63	2.95	3.91	0.94	4.41
11	3.5	4.2	6	4.03	5.2	4.26	3.81	5.37	5.02	4.35	1.34	2.17	6.39	4.67	0.49	3.3	4.55	4.52		3.8
13	4.05	3.86	4.05	3.86	4.38	5.64	4.54	5.22	5.67	3.76	3.96	4.21	5.49	5.63	1.95	2.48	4.94	5.05	1.01	3.52
14	6.9	8.16	8.4	8.3	8.47	8.15	7.44	9.64	8.74		7.68	7.26	9.72	9.3	6.63	6.97	8.06	9.18	8.66	7.68
16	1.4	1.43	1.44	1.43	1.4	1.46	1.62	2.13	1.52	1.4	1.37	1.47	2.14	1.57	1.4	1.4	1.54	2.01	1.39	1.37
17	11.5	11.85	11.8	12	12.66	12.87	12.87	13.27	dry	13.42	11.51	10.8	dry	13.35	8.39	8.56	11.6	12.03	6.23	10.07
20	4.6	2.34	1.37	2.72	2.55	3.72	3.68	6.8	5.16	2.26	1.44	1.29	3.01	1.67	0.81	0.98	1.215	1.27	1.17	1.28
21	1	0.65	0.68	0.74	0.72	1.31	0.79	1.44	0.8	0.69	0.5	0.63	1.44	0.96	0.6	0.69	0.7	0.75	0.8	0.71
22	8.05	4.14	6.72	5.28	8.28	8.24	7.54	8.26	6.95	5.61	2.2	2.21	8.37	7.84	1.71	2.24	4.33	6.51		
Borewells																				
12					3.31	3.57	3.01	4.33	3.92	2.18	3.68	2.17	3.98	3.47	1.13	1.49	3.51	3.8	0.85	7.37
15			8.52	9.97	11.27	11.93	11.34	11.51	11.01		9.16	10.12	12.98	11.22	7.56	9.67	11.94	12.04	7.41	11.94

Table 3. Water Level readings at Plachimada area in Palakkad district

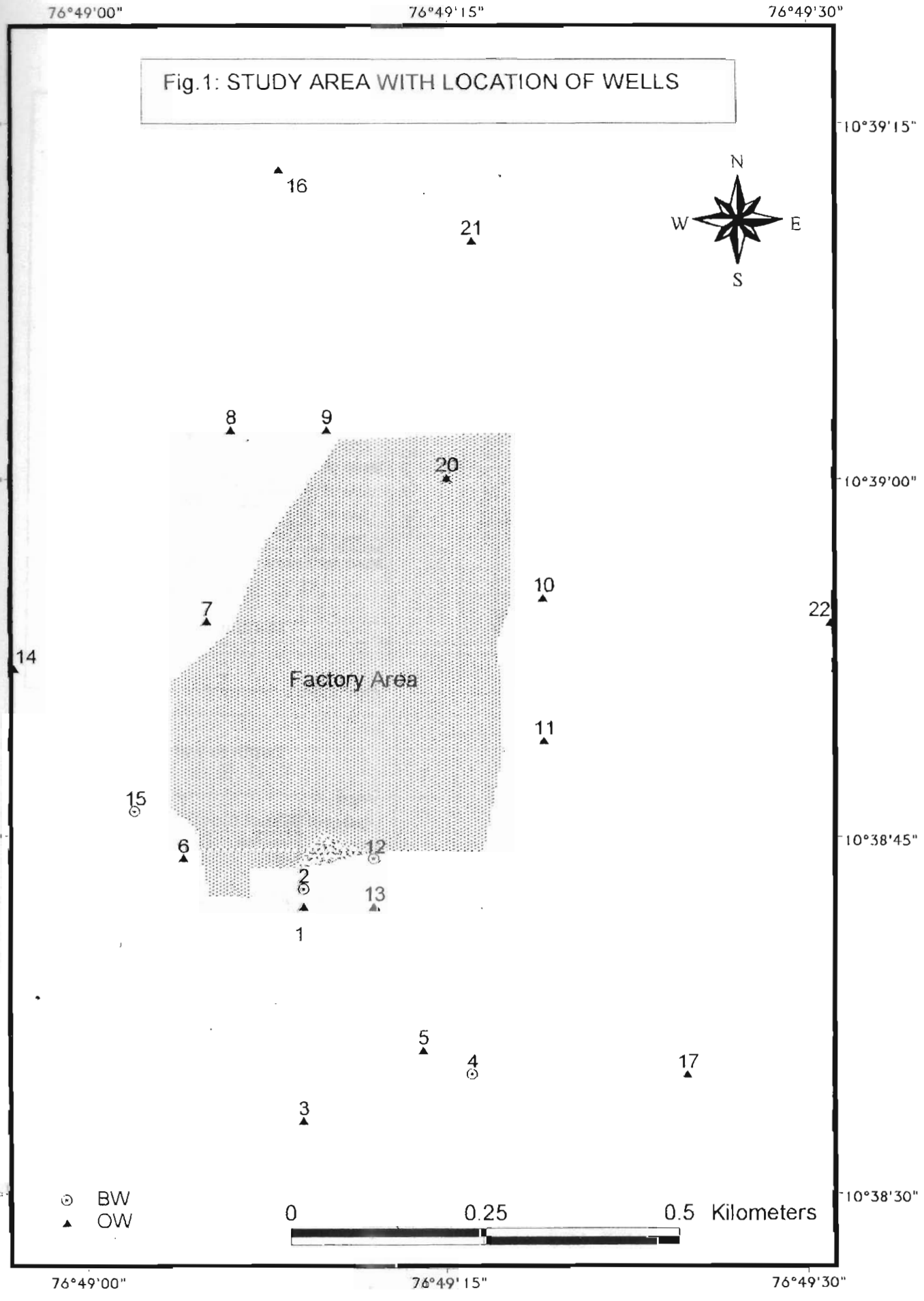


Fig.1: STUDY AREA WITH LOCATION OF WELLS

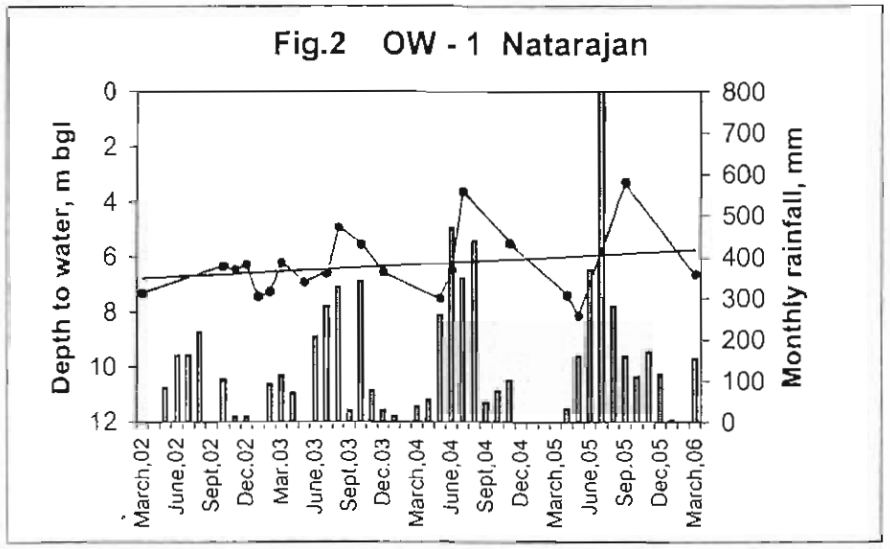


Fig.2 OW - 1 Natarajan
Depth to water, m bgl
Monthly rainfall, mm
0
2
4
6
8
10
12
800
700
600
500
400
300
200
100
0
March,02
June,02
Sept,02
Dec.02
Mar.03
June,03
Sept,03
Dec.03
March,04
June,04
Sept,04
Dec,04
March,05
June,05
Sep.05
Dec,05
March,06

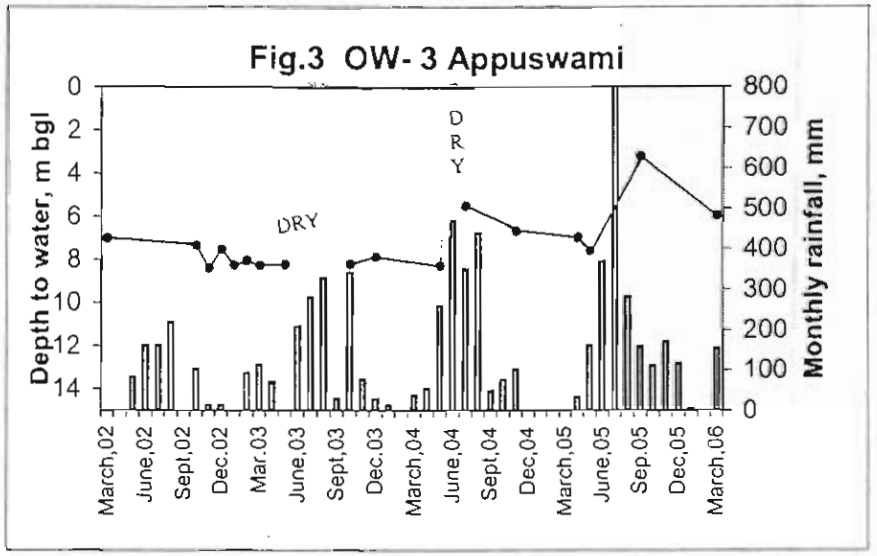


Fig.3 OW- 3 Appuswami
Depth to water, m bgl
Monthly rainfall, mm
DRY
DRY
0
2
4
6
8
10
12
14
800
700
600
500
400
300
200
100
0
March,02
June,02
Sept,02
Dec.02
Mar.03
June,03
Sept,03
Dec.03
March,04
June,04
Sept,04
Dec,04
March,05
June,05
Sep.05
Dec,05
March,06

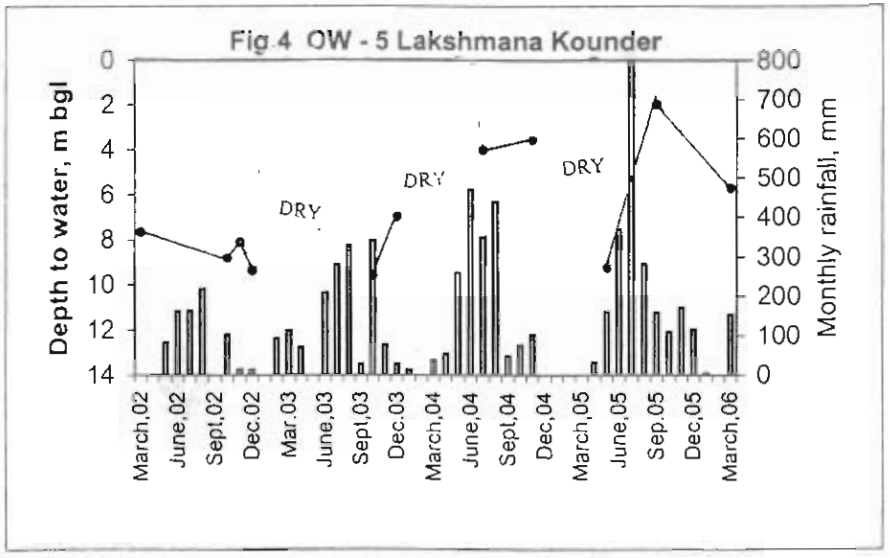


Fig.4 OW - 5 Lakshmana Kounder
Depth to water, m bgl
Monthly rainfall, mm
DRY
DRY
DRY
0
2
4
6
8
10
12
14
800
700
600
500
400
300
200
100
0
March,02
June,02
Sept,02
Dec.02
Mar.03
June,03
Sept,03
Dec.03
March,04
June,04
Sept,04
Dec,04
March,05
June,05
Sep.05
Dec,05
March,06

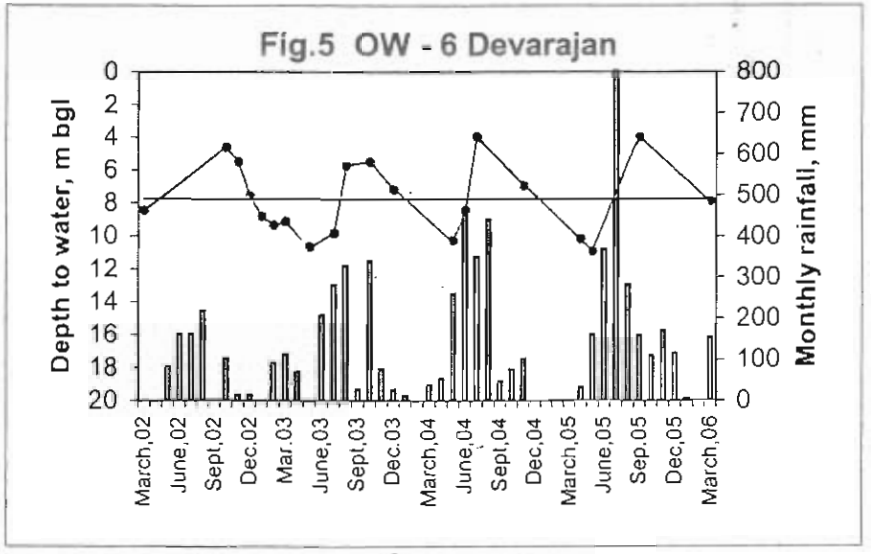


Fig.5 OW - 6 Devarajan
Depth to water, m bgl
Monthly rainfall, mm
0
2
4
6
8
10
12
14
16
18
20
800
700
600
500
400
300
200
100
0
March,02
June,02
Sept,02
Dec.02
Mar.03
June,03
Sept,03
Dec.03
March,04
June,04
Sept,04
Dec,04
March,05
June,05
Sep.05
Dec,05
March,06

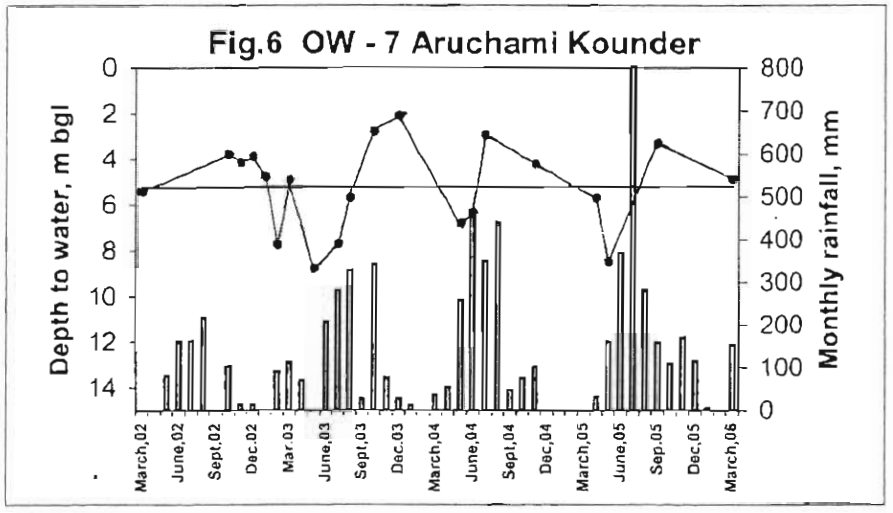


Fig.6 OW - 7 Aruchami Kounder
Depth to water, m bgl
Monthly rainfall, mm
0
2
4
6
8
10
12
14
800
700
600
500
400
300
200
100
0
March,02
June,02
Sept,02
Dec,02
Mar,03
June,03
Sept,03
Dec,03
March,04
June,04
Sept,04
Dec,04
March,05
June,05
Sep,05
Dec,05
March,06

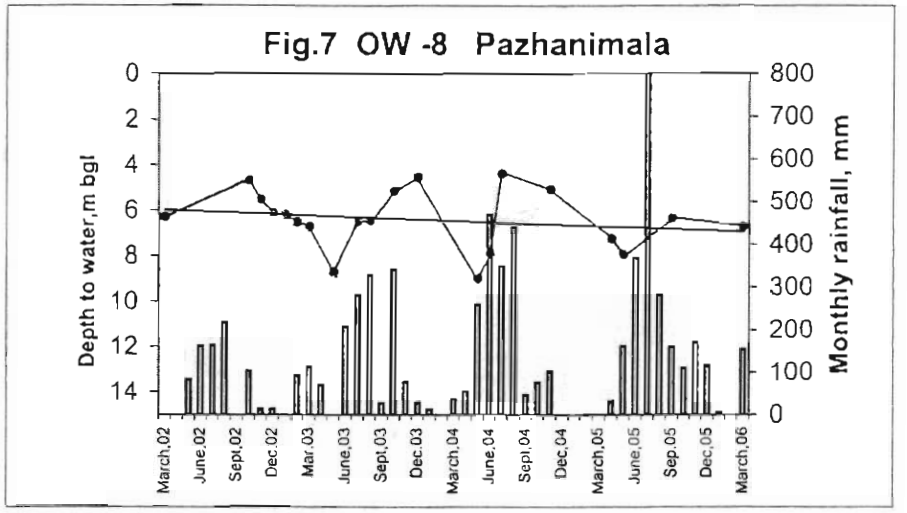


Fig.7 OW -8 Pazhanimala
Depth to water,m bgl
Monthly rainfall, mm
0
2
4
6
8
10
12
14
800
700
600
500
400
300
200
100
0
March,02
June,02
Sept,02
Dec,02
Mar,03
June,03
Sept,03
Dec,03
March,04
June,04
Sept,04
Dec,04
March,05
June,05
Sep,05
Dec,05
March,06

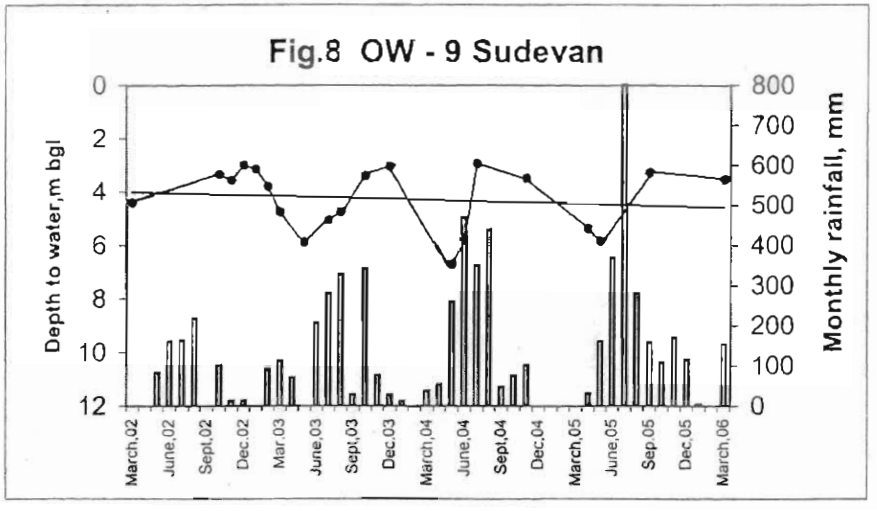


Fig.8 OW - 9 Sudevan
Depth to water,m bgl
Monthly rainfall, mm
0
2
4
6
8
10
12
800
700
600
500
400
300
200
100
0
March,02
June,02
Sept,02
Dec,02
Mar,03
June,03
Sept,03
Dec,03
March,04
June,04
Sept,04
Dec,04
March,05
June,05
Sep,05
Dec,05
March,06

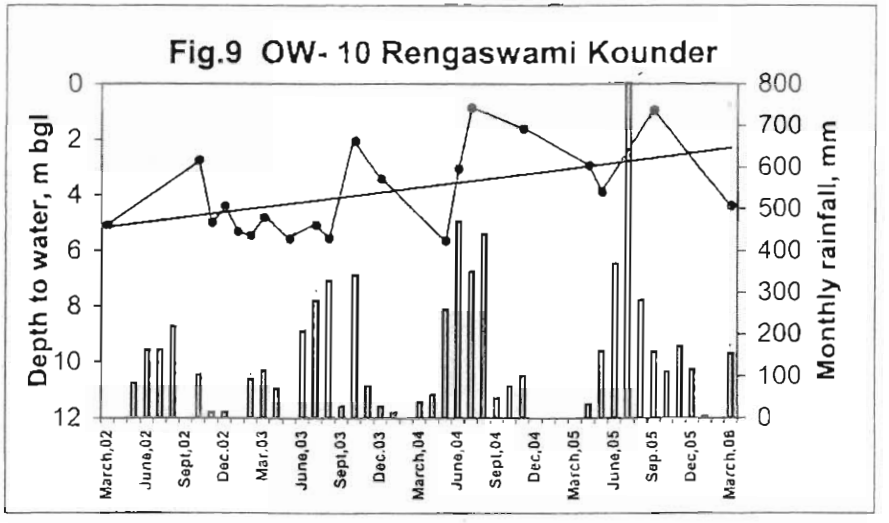


Fig.9 OW- 10 Rengaswami Kounder
Depth to water, m bgl
Monthly rainfall, mm
0
2
4
6
8
10
12
800
700
600
500
400
300
200
100
0
March,02
June,02
Sept,02
Dec,02
Mar,03
June,03
Sept,03
Dec,03
March,04
June,04
Sept,04
Dec,04
March,05
June,05
Sep,05
Dec,05
March,06

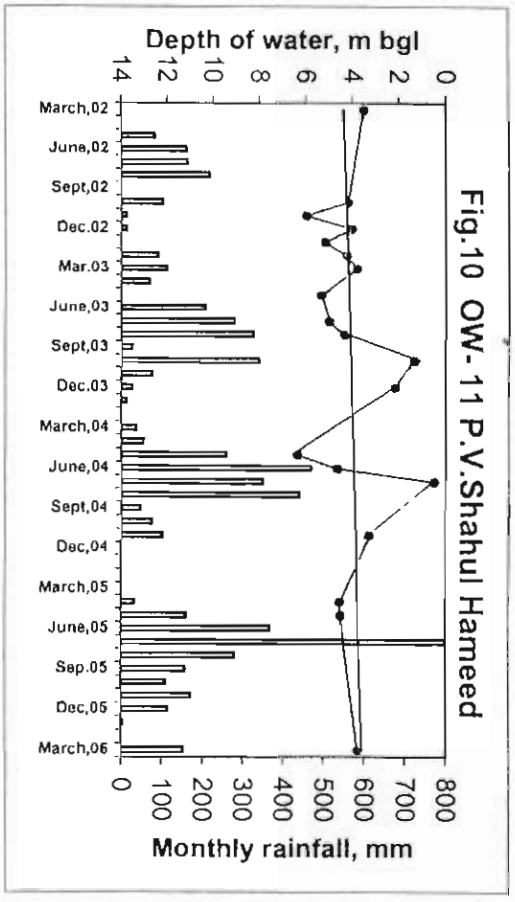


Fig.10 OW- 11 P.V.Shahul Hameed

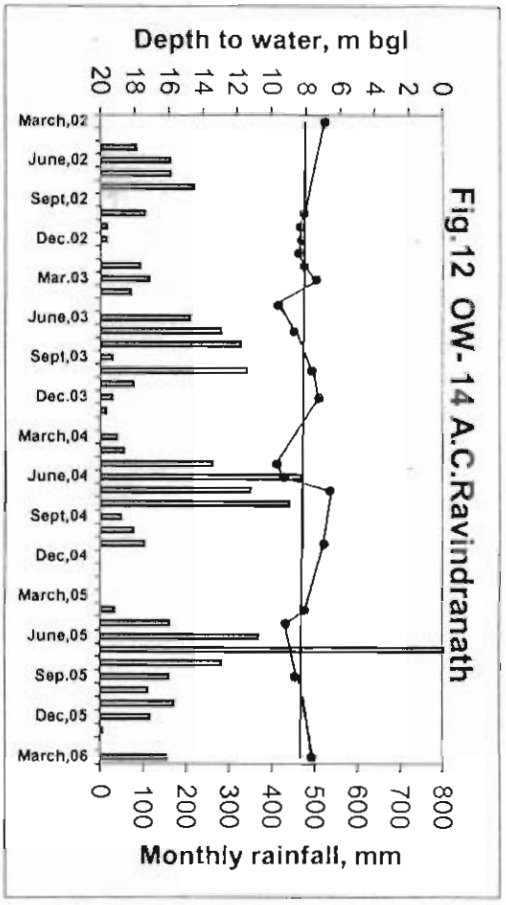


Fig.12 OW- 14 A.C.Ravindranath

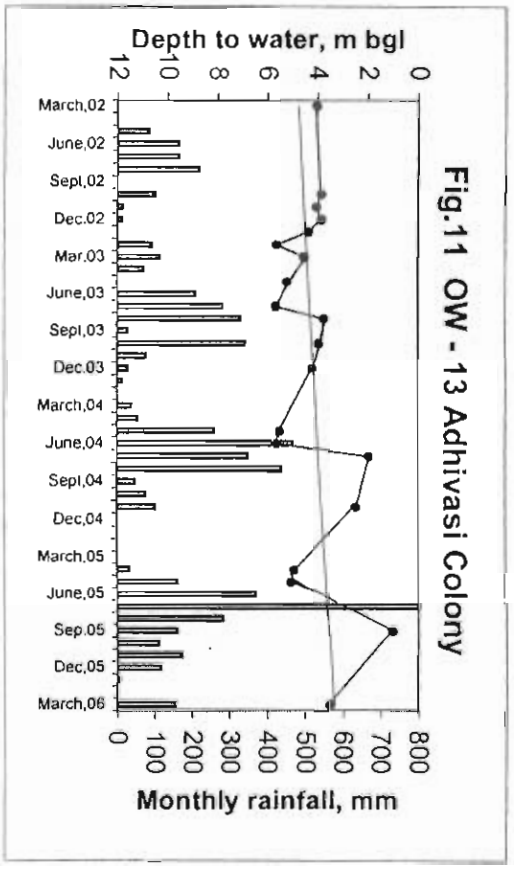


Fig.11 OW - 13 Adhivasi Colony

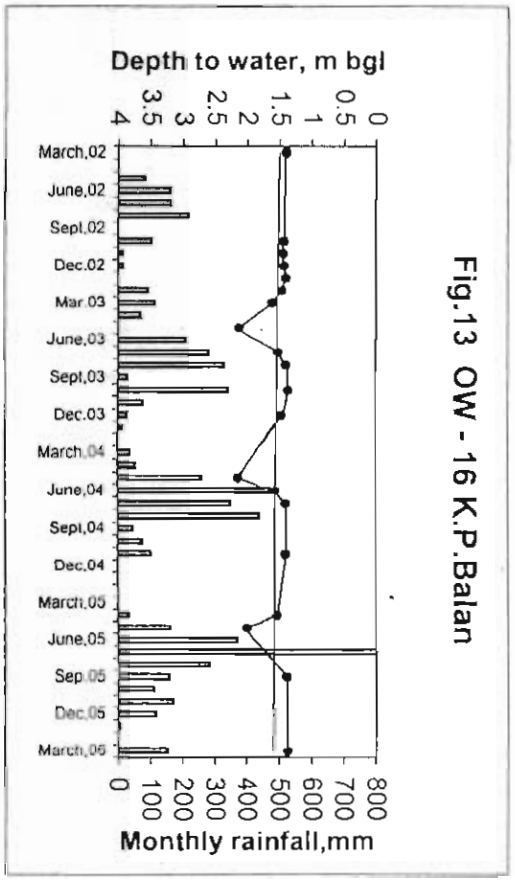


Fig.13 OW - 16 K.P.Balan

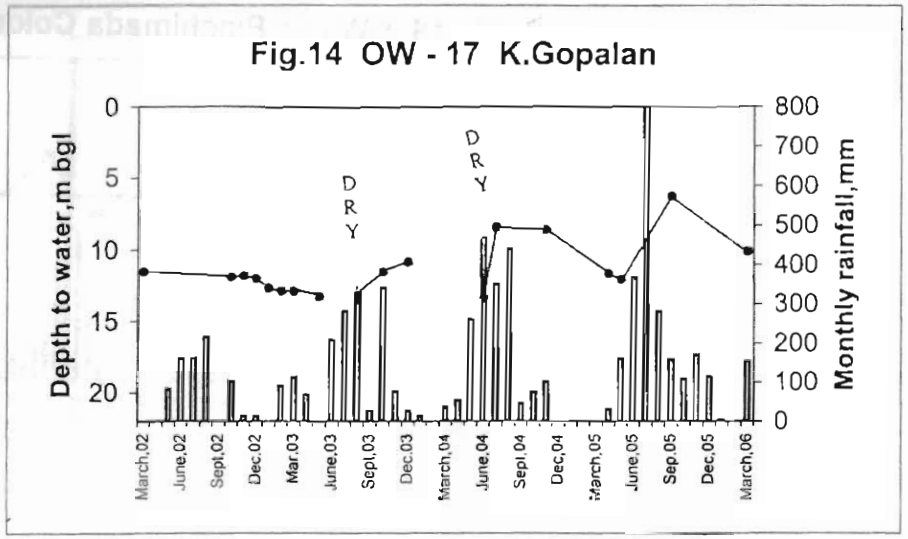


Fig.14 OW - 17 K.Gopalan
Depth to water,m bgl
Monthly rainfall,mm
DRY
DRY
0
5
10
15
20
800
700
600
500
400
300
200
100
0
March,02
June,02
Sept,02
Dec,02
Mar,03
June,03
Sept,03
Dec,03
March,04
June,04
Sept,04
Dec,04
March,05
June,05
Sep,05
Dec,05
March,06

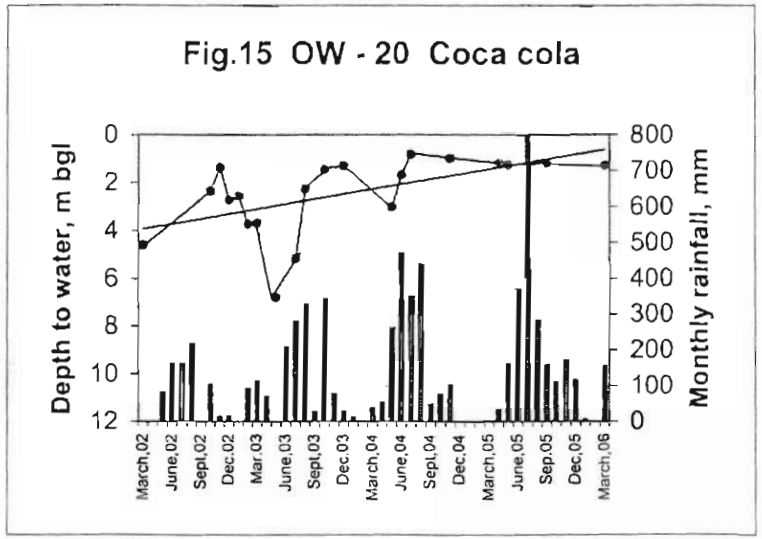


Fig.15 OW - 20 Coca cola
Depth to water, m bgl
Monthly rainfall, mm
0
2
4
6
8
10
12
800
700
600
500
400
300
200
100
0
March,02
June,02
Sept,02
Dec,02
Mar,03
June,03
Sept,03
Dec,03
March,04
June,04
Sept,04
Dec,04
March,05
June,05
Sep,05
Dec,05
March,06

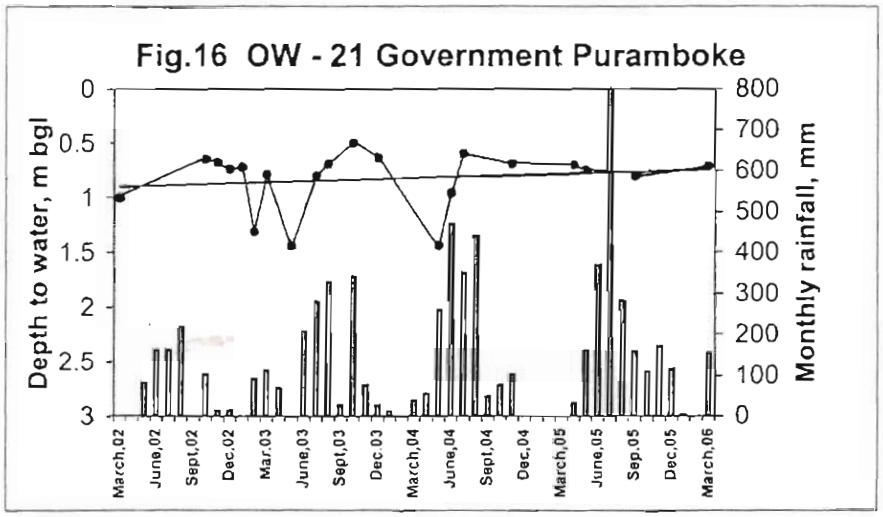


Fig.16 OW - 21 Government Puramboke
Depth to water, m bgl
Monthly rainfall, mm
0
0.5
1
1.5
2
2.5
3
800
700
600
500
400
300
200
100
0
March,02
June,02
Sept,02
Dec,02
Mar,03
June,03
Sept,03
Dec,03
March,04
June,04
Sept,04
Dec,04
March,05
June,05
Sep,05
Dec,05
March,06

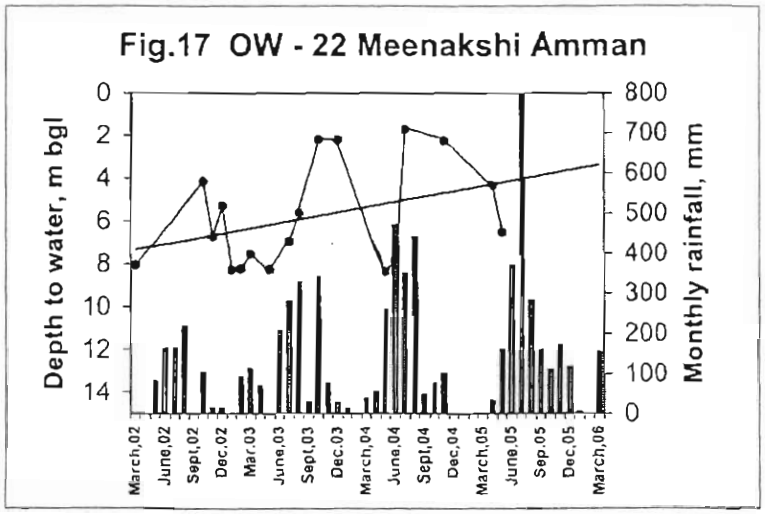


Fig.17 OW - 22 Meenakshi Amman
Depth to water, m bgl
Monthly rainfall, mm
0
2
4
6
8
10
12
14
800
700
600
500
400
300
200
100
0
March,02
June,02
Sept,02
Dec,02
Mar,03
June,03
Sept,03
Dec,03
March,04
June,04
Sept,04
Dec,04
March,05
June,05
Sep,05
Dec,05
March,06

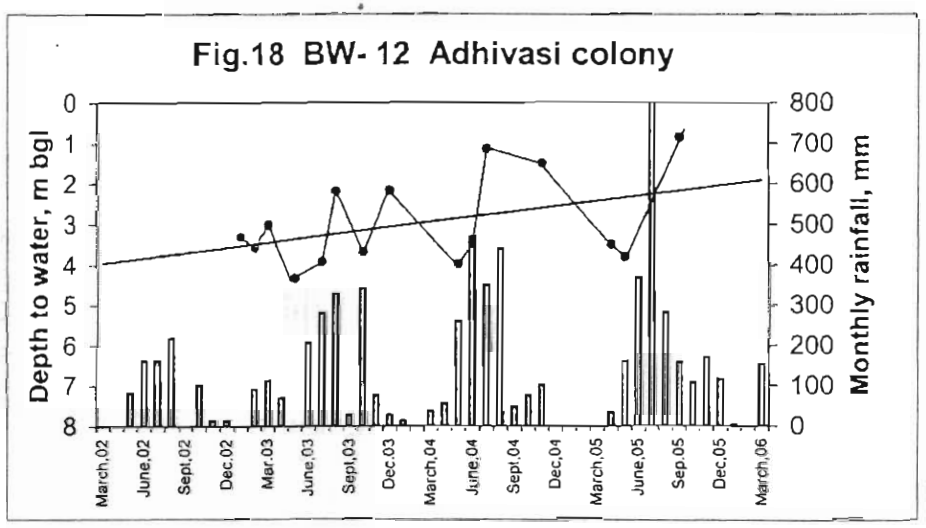


Fig.18 BW- 12 Adhivasi colony
Depth to water, m bgl
Monthly rainfall, mm
0
1
2
3
4
5
6
7
8
800
700
600
500
400
300
200
100
0
March,02
June,02
Sept,02
Dec.02
Mar.03
June,03
Sept,03
Dec.03
March,04
June,04
Sept.04
Dec,04
March,05
June,05
Sep.05
Dec.05
March,06

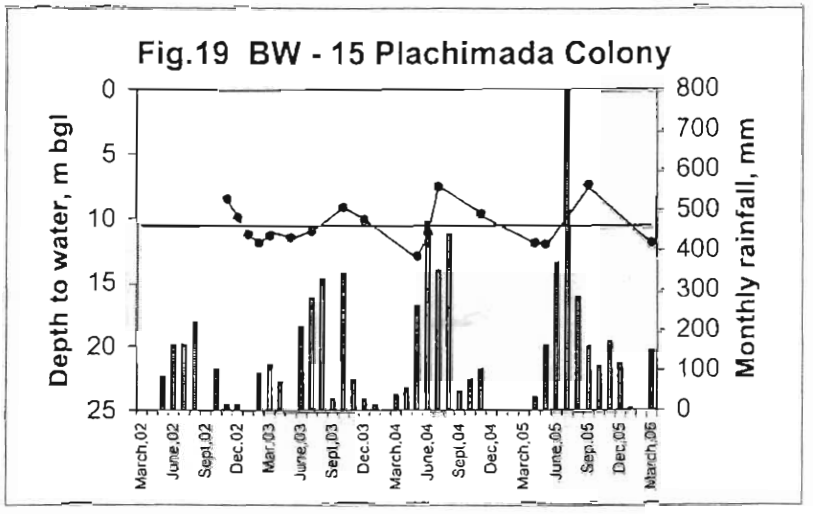
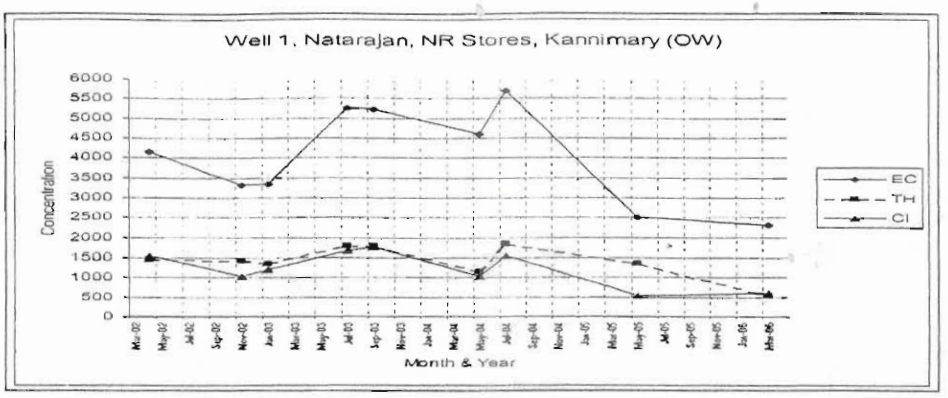
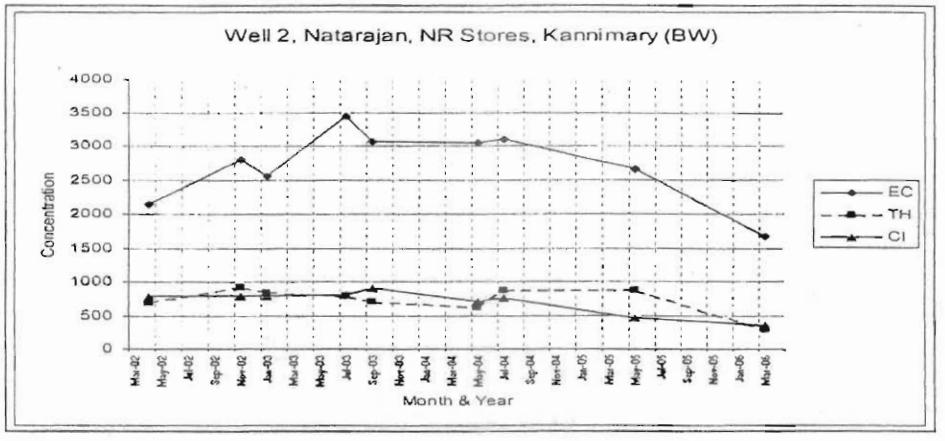


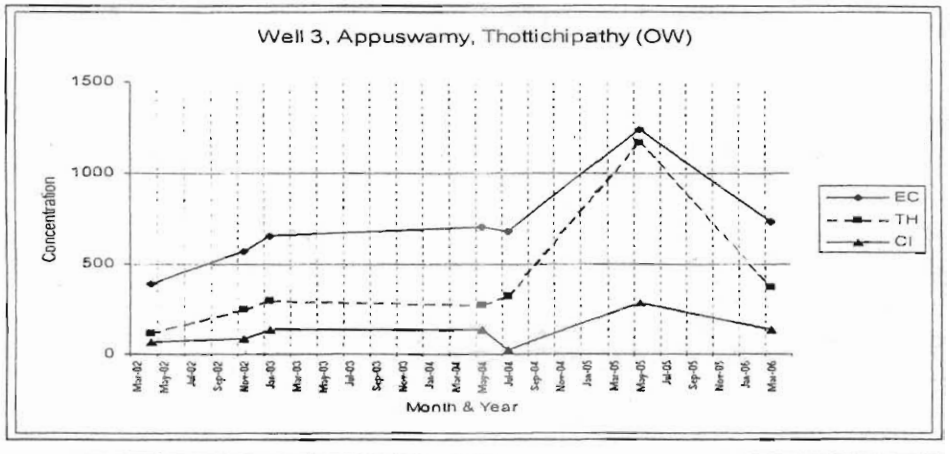
Fig.19 BW - 15 Plachimada Colony
Depth to water, m bgl
Monthly rainfall, mm
0
5
10
15
20
25
800
700
600
500
400
300
200
100
0
March,02
June,02
Sept,02
Dec.02
Mar.03
June,03
Sept,03
Dec.03
March,04
June,04
Sept,04
Dec,04
March,05
June,05
Sep.05
Dec.05
March,06


Well 1, Natarajan, NR Stores, Kannimary (OW)
Concentration
Month & Year
EC
TH
Cl

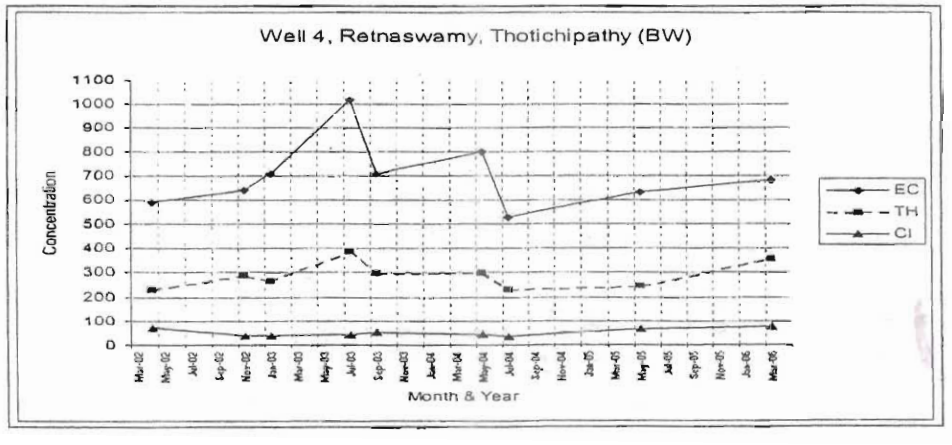
Q:1


Well 2, Natarajan, NR Stores, Kannimary (BW)
Concentration
Month & Year
EC
TH
Cl

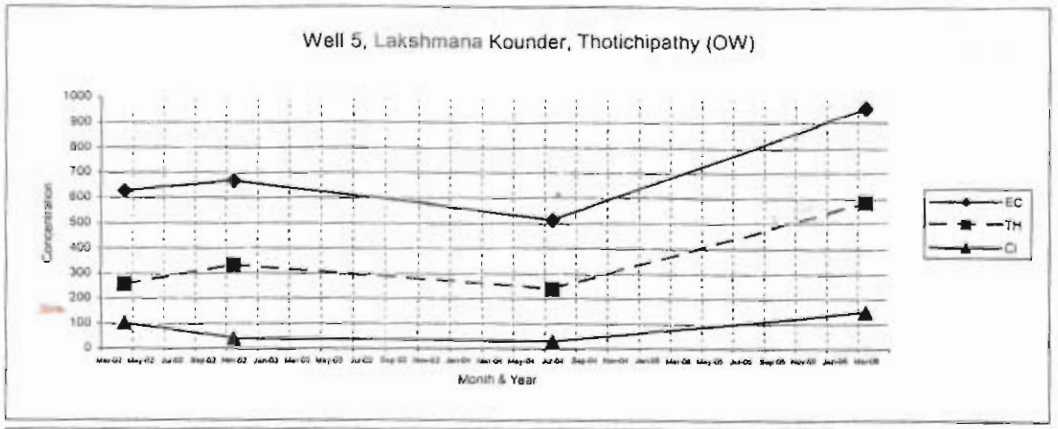
Q:2


Well 3, Appuswamy, Thottichipathy (OW)
Concentration
Month & Year
EC
TH
Cl

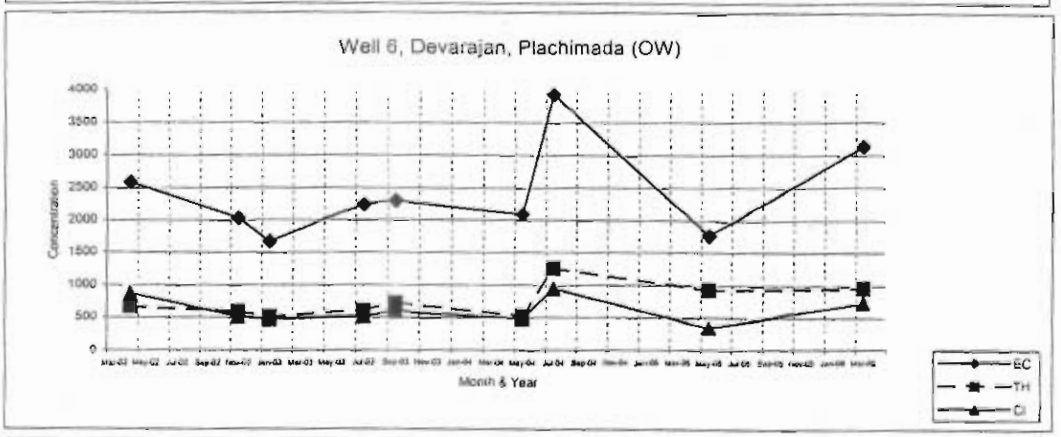
Q:3


Well 4, Retnaswamy, Thotichipathy (BW)
Concentration
Month & Year
EC
TH
Cl

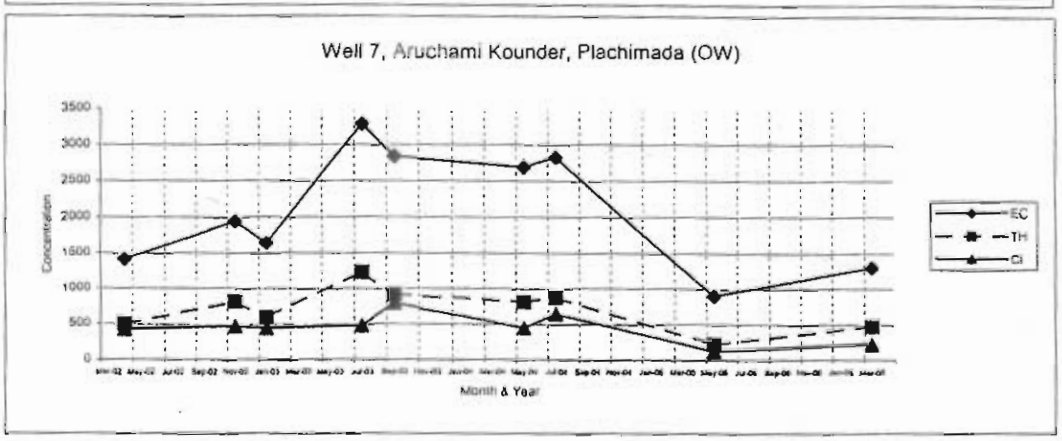
Q:4


Well 5, Lakshmana Kounder, Thotichipathy (OW)
Concentration
Month & Year
EC
TH
Cl

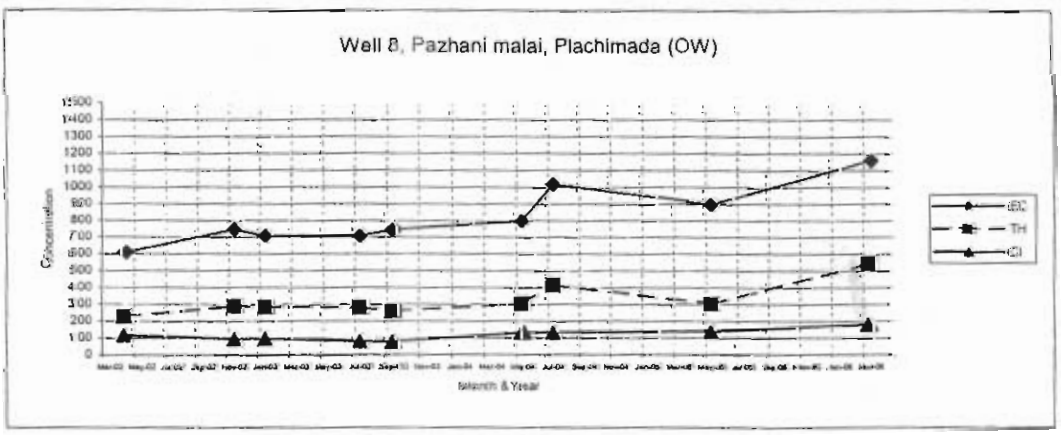
Q:5


Well 6, Devarajan, Plachimada (OW)
Concentration
Month & Year
EC
TH
Cl

Q:6


Well 7, Aruchami Kounder, Plachimada (OW)
Concentration
Month & Year
EC
TH
Cl

Q:7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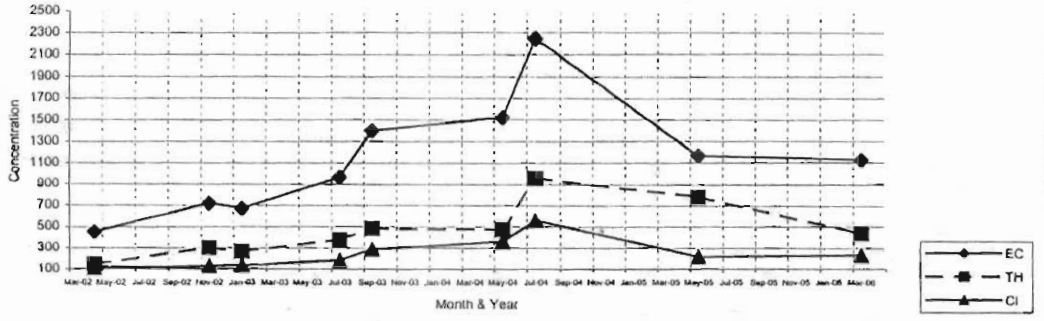

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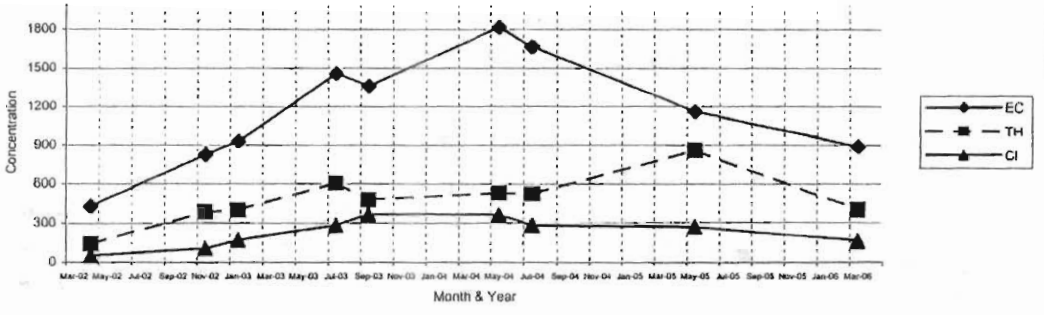

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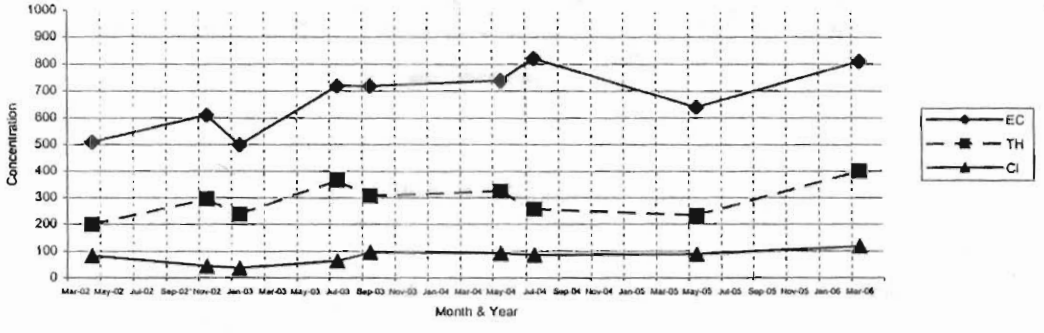

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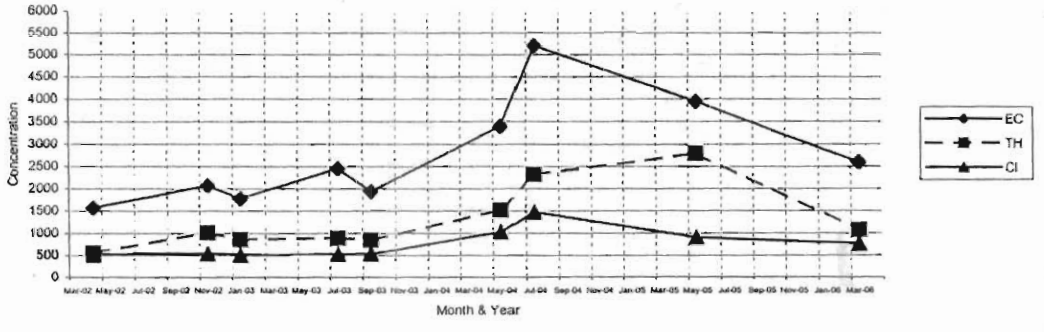

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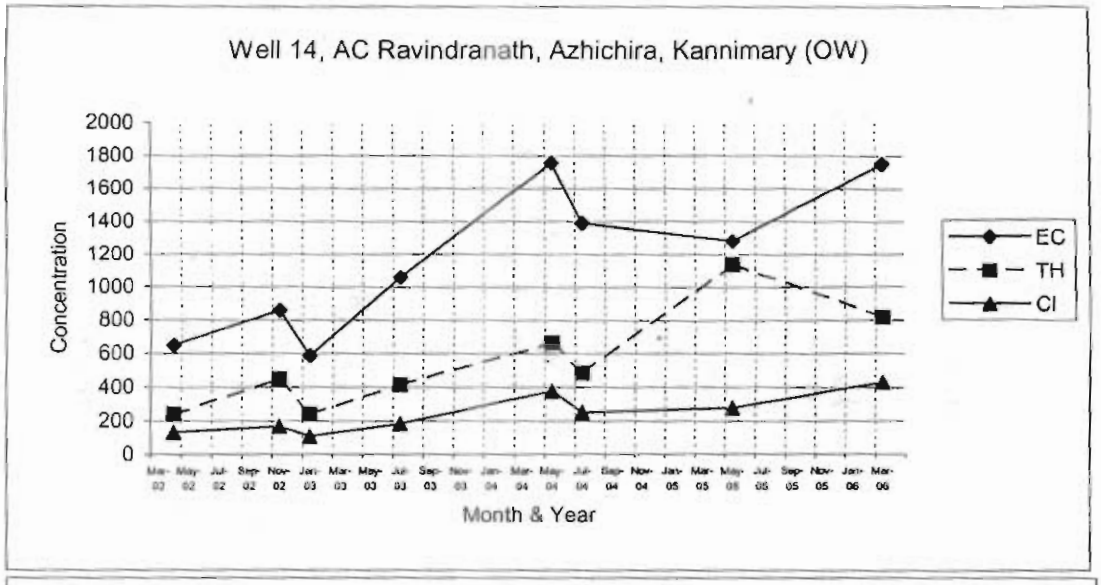
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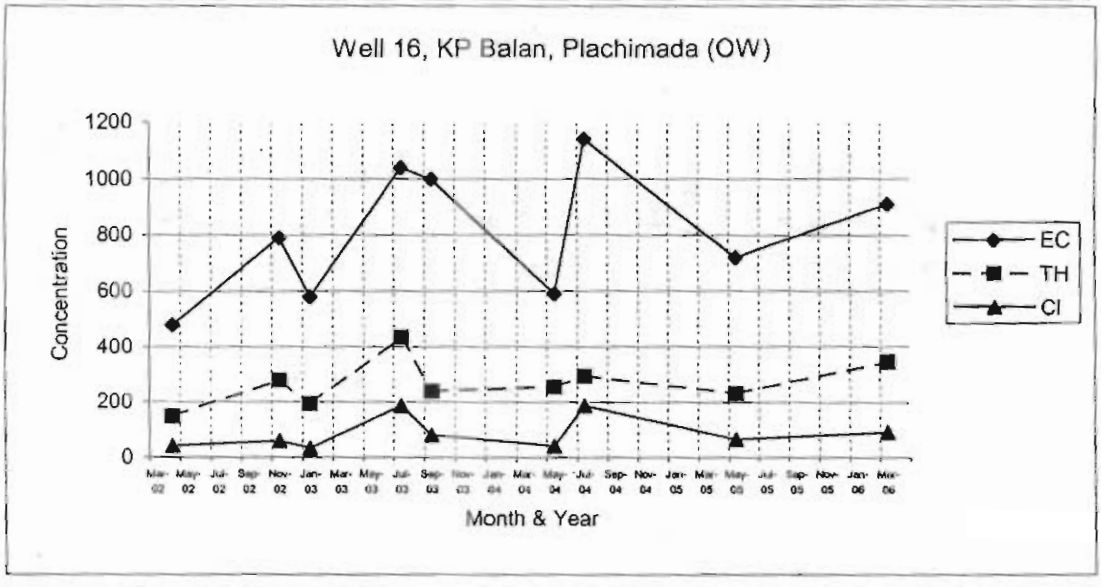
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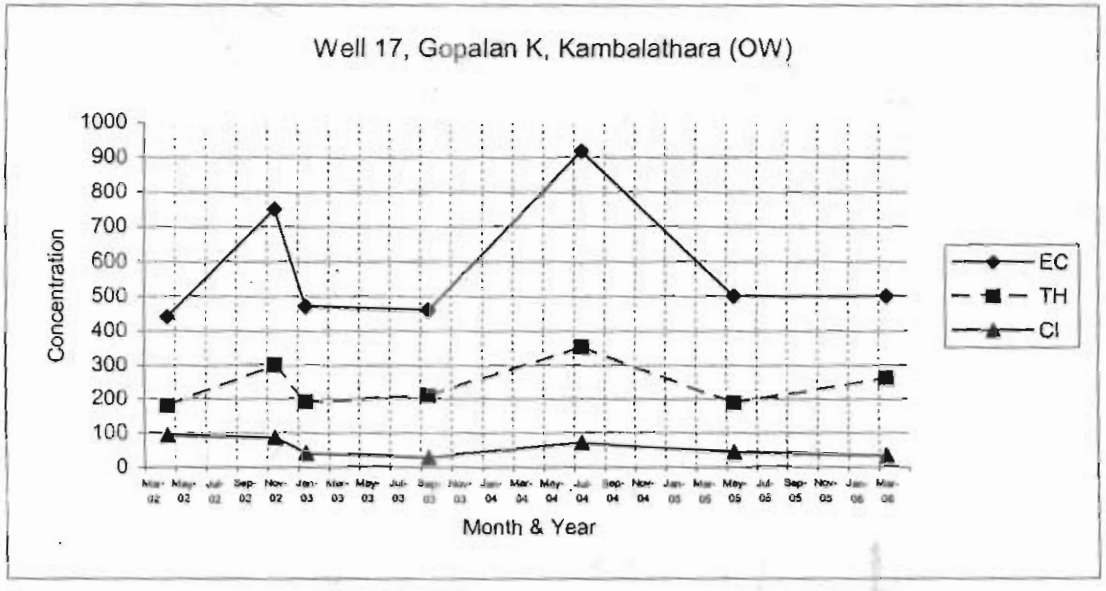
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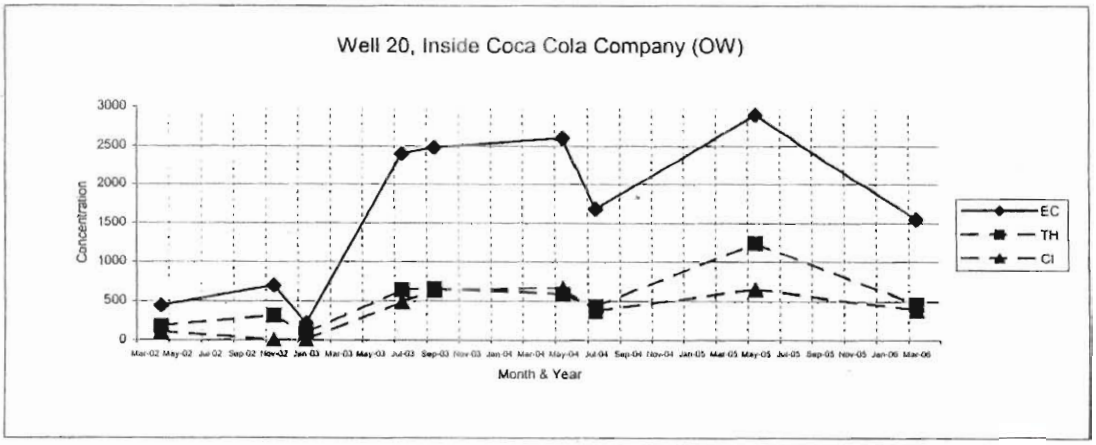

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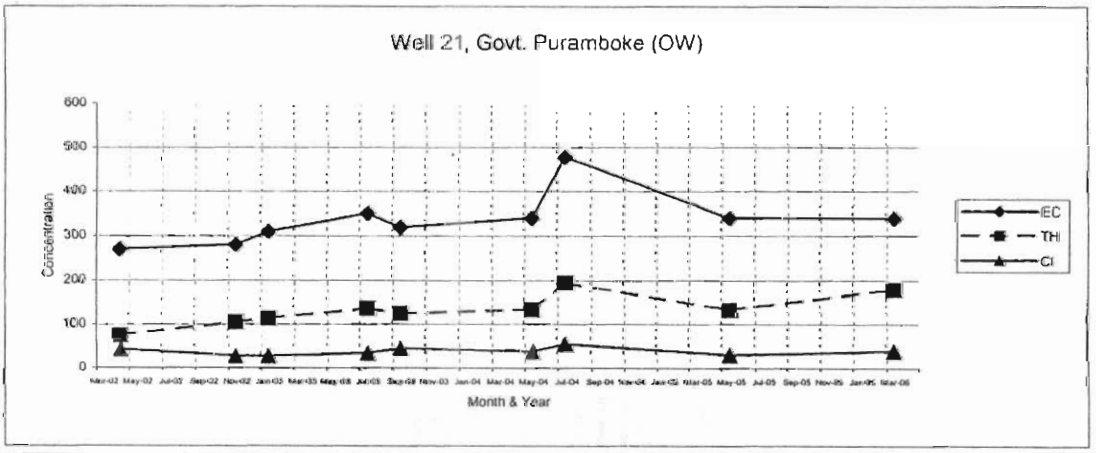

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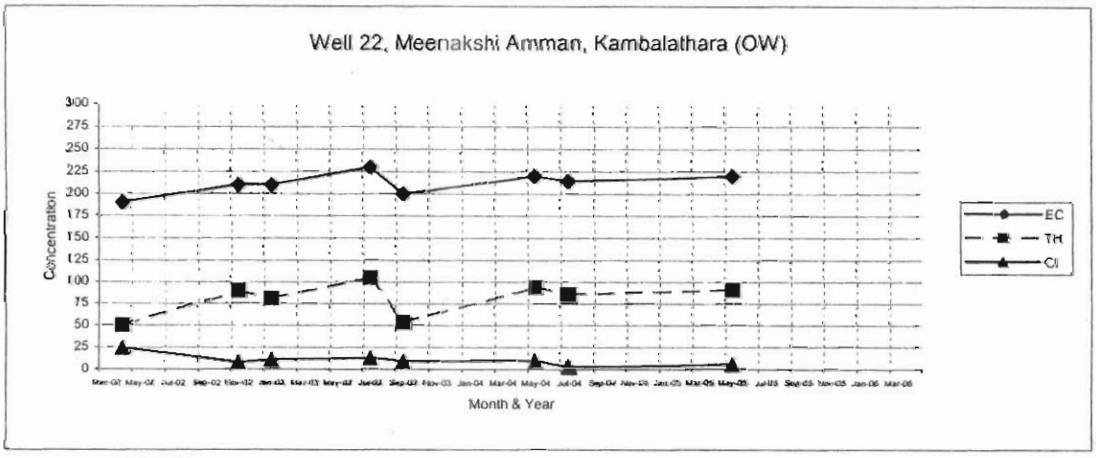

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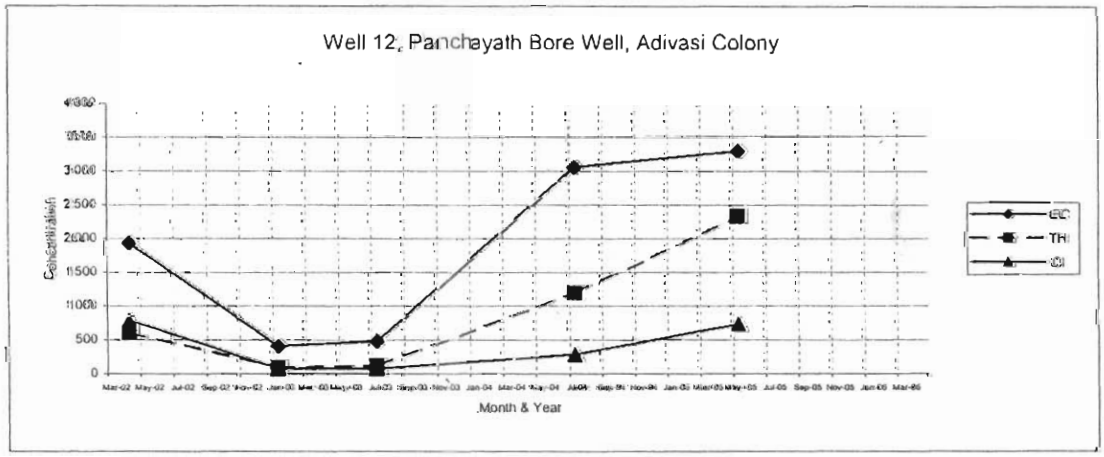

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ANNEXURE V

INVESTIGATIONS ON THE EXTRACTION OF GROUNDWATER BY M/s HINDUSTAN COCA-COLA BEVERAGES PRIVATE LIMITED AT PLACHIMADA

Final Report

Filed before

THE HONOURABLE HIGH COURT OF KERALA

Prepared by

The Investigation Team

Constituted vide Order WA/2125/2003, dated 19.12.2003

by the Honourable High Court of Kerala

11 February 2005

CONTENTS

		Page No
	Executive Summery	1
1.0	Background	4
2.0	Objectives	7
	2.1 Short Term Objectives	8
	2.2 Long Term Objectives	8
3.0	Institutions Involved	8
4.0	Summery of Investigations Carried Out	9
5.0	Results	11
	5.1 Groundwater Assessment- Block Level	11
	5.2 Groundwater Assessment – Watershed Basis	14
	5.3 Groundwater Extraction Structures in the Study Area	16
	5.4 Rainfall Condition	20
	5.5 Artificial Recharge Measures by Coca- Cola	21
6.0	Recommendations	21
	References	24

List of Figures

Figure-1	Location of Coca-Cola Factory in Palakkad District	5
Figure-2	Location Map of the Water Extraction and Conservation Structures Within the Premises of Coca-Cola Factory	6
Figure-3	Location Map of Plachimada Watershed	15

List of Tables

Table-1	Evaluation of the Scope for Groundwater Withdrawal by Hindustan Coca-Cola Beverages Pvt Ltd, Palakkad with Chittur Block as the Assessment unit.	12-13
Table-2	Evaluation of the Scope for Groundwater Withdrawal by Hindustan Coca-Cola Beverages Pvt Ltd, with Plachimada Watershed as the Assessment unit.	17-18
Table-3	Monsoon, Non-Monsoon and Annual Rainfall as Recorded in Chitturpuzha Raingauge Station in Palakkad District	19
Table-4	Details of the Existing Wells in 1 sq. km Around the Coca-cola Factory	20
Table-5	Regulations on Groundwater Withdrawal	23

List of Appendix

Appendix-IA to IF	Minutes of the Meeting of the Investigation Team	25-35
Appendix-IIA	Hydrogeological Information of the Observation Wells	36-38
Appendix-IIB	Groundwater Level Fluctuation Data from the Observation Wells around Coca-Cola Factory near Plachimada in Perumatty Grama Panchayat, Palakkad District.	39-41
Appendix-IIC	Weekly Groundwater Level Data as Recorded from the Observation Wells Located in the Vicinity of Hindustan Coca-Cola Beverages Pvt Ltd, Palakkad	42-45
Appendix-III	Water Consumed by Hindustan Coca-Cola Beverages Pvt Ltd, Palakkad	46-52

EXECUTIVE SUMMARY

1. The Honorable High Court of Kerala has directed the Centre for Water Resources Development and Management (CWRDM), vide Order No. WA/2125/03 dated 19th December 2003, to conduct a scientific investigation into the allegation that the works of M/s Hindustan Coca-Cola Beverages Private Limited at Moolathara village in Chittur taluk has resulted in shortage and scarcity of drinking water in neighbouring areas. The Honorable High Court in the order had also directed the Executive Director, CWRDM, to prepare and file a project proposal with the above objectives before the court. The present study is in response to the above direction from the Honorable High Court. The study has envisaged a scientific investigation on the groundwater potential of the area and the shortage and scarcity of drinking water in the nearby areas due to the current level of groundwater extraction by the Coca-Cola factory. The duration of the project is for a period of one year, commencing from 2nd week of January, 2004. This Final Report has been prepared based on the analysis of all available information pertaining to the study area and also additional data generated during the twelve months period from the start of the investigation. A submission was filed on 3.01.2005 for extension of one-month period till 12th February 2005, for submitting the Recommendations.

2. Groundwater forms the main source of water in the study area and recharge to groundwater is predominantly from rainfall. The two rain gauge stations located near to the study area are Meenkara (located at about 6 km towards south and maintained by Water Resources Department) and Chitturpuzha Project office (located at about 6 Km towards north and maintained by CWRDM). The annual average rainfall, considering the rainfall data during the last ten years at these two stations, is 1413 mm at Chitturpuzha Project office and 1513mm at Meenkara. The lower value of 1413mm at Chitturpuzha Project office has been taken to estimate the groundwater potential in the study area. The rainfall data recorded at this rain gauge station shows that the monsoon season (June to Nov) rainfall in both 2002-03 and 2003-04 has been much less than the mean value. The deviation of the monsoon rainfall from the mean as a percentage of the mean is lower than even – 30 per cent. This deficiency in the rainfall and that too in two successive years can be considered to be the most significant factor that has contributed to the scarcity of water experienced in the study area. The unregulated withdrawal of groundwater from the wells within the Coca Cola factory complex and also outside even during such a water deficit period had aggravated the water scarcity situation further.

3. The scientific investigation on the groundwater potential of the area has been evaluated with Chittur Block (261.24 sq. kms) as the assessment unit on a macro scale and the Plachimada watershed (14.89 sq. kms) as the assessment unit on a

micro scale. The Plachimada watershed forms part of the Chittur Block and the Coca-Cola factory is situated within the Plachimada watershed.

The annual available groundwater resource in Chittur Block has been assessed by the Central Ground Water Board as 66.7 Million Cubic Metres (MCM) on the basis of groundwater estimation methodology-1997 guidelines approved by the Ministry of Water Resources, Government of India. This estimate of available groundwater applies for mean rainfall conditions in the whole of Chittur Block. Domestic water supply forms the most important use of water in any area. Irrigation water supply is also crucially important in Chittur Block since agriculture forms the main economic activity there. The committed annual groundwater draft that should be reserved to meet the water requirements of both domestic and irrigation sectors in Chittur Block till 2025 AD has been very safely estimated as 62.5 MCM, as part of this study. This leaves an annual balance of about 4.2 MCM of groundwater resources for meeting other uses of water of which the requirement by Coca Cola factory forms only a part. The annual groundwater required by Coca Cola factory can be estimated as 0.1825 MCM (at the average rate of 5 lakh litres per day), which forms a little less than 5 per cent of 4.2 MCM available for industrial purposes and 0.27 per cent of the annual available groundwater resource of Chittur Block. Hence, it can be very safely concluded that under normal rainfall conditions the planned groundwater withdrawal of 5 lakh litres per day by Coca Cola factory will not adversely affect the availability of groundwater in the Chittur Block. However, groundwater withdrawal by Coca-Cola factory has to be strictly controlled in those years in which the rainfall is much less than the mean value.

The annual available groundwater resource of Plachimada watershed is estimated as 3.67 MCM, on the basis of groundwater estimation methodology-1997 guidelines approved by the Ministry of Water Resources, Government of India. The committed groundwater resources to be reserved to meet domestic water supply till 2025 AD can be safely estimated as 0.81 MCM and that for irrigation water supply can be very conservatively estimated as 2.61 MCM. Thus the total annual allocation to be reserved is 3.42 MCM. This leaves a balance of 0.25 MCM of groundwater resource, which can be used to meet other uses such as that of Coca-Cola factory. The annual groundwater requirement of Coca-Cola factory is 0.1825 MCM, which is about 73 % of the above balance of 0.25 MCM. The water required by Coca-Cola factory is also only 4.97 % of the annual available groundwater resource of 3.67 MCM in the Plachimada watershed.

Estimates of annual available groundwater resource and the groundwater withdrawal to be reserved for meeting committed domestic and irrigation water supply up to 2025 AD that have been arrived at both on Chittur Block level (macro scale) and Plachimada watershed level (micro scale) show that the Coca-Cola factory can be safely permitted to withdraw 5 lakh litres per day without adversely affecting both domestic and irrigation water requirements. At the same time the conclusion is valid only under normal rainfall condition. Groundwater

withdrawal by Coca-Cola factory has to be strictly controlled in those years in which the rainfall is much less than the mean value.

7. A realistic scheme of such a control regulation can be as follows. The rain gauge at Chitturpuzha project office maintained by CWRDM can be considered as the reference rain gauge. A hydrologic year in Kerala can be very conveniently considered to comprise of 12 calendar months between June of one calendar year and May of the next one. The monsoon season rainfall between June and November can be taken as the basis to decide the restrictions to be imposed on the groundwater withdrawal by Coca Cola factory during the non-monsoon season between December and May. Let the deviation of the monsoon season rainfall in a given year from the mean monsoon rainfall as a percentage of the mean monsoon rainfall be 'X'. The restrictions to be imposed can apply for a practical set of ranges of 'X' values. For each such range, the period of restrictions can be uniformly between 1st of December and 15 days from the onset of subsequent south-west monsoon. If 'X' is between 0 and –10 per cent, the groundwater withdrawal can be limited to 4.0 lakh litres per day. If 'X' is between-10 and -20 per cent, the groundwater withdrawal can be limited to3.0 lakh litres per day. If 'X' is between –20 and –30 per cent, the groundwater withdrawal can be limited to2.0 lakh litres per day. If 'X' is less than –30 per cent, groundwater withdrawal can be fully stopped.

8. The recommendations will protect the interests of domestic and irrigation water supply sectors adequately. They will also ensure that the developmental opportunities, which industrial establishments can create in an area that is otherwise predominantly agrarian, are fully utilized. Further, all the recommendations are very practical from the point of view of convenience of implementation.

INVESTIGATIONS ON THE EXTRACTION OF GROUNDWATER BY M/s HINDUSTAN COCA-COLA BEVERAGES PRIVATE LIMITED AT PLACHIMADA

1.0 BACKGROUND

M/s Hindustan Coca-Cola Beverages Private Limited is situated at Plachimada in Moolathara village of Perummatti Grama Panchayat in Chittur taluk of Palakkad District. The Coca-Cola Factory is located at 10^0 35' 30" North latitude and 76^0 46' 15" East longitude. Location map of the factory is shown in Figure 1. M/s Hindustan Coca-Cola Factory, established in March 2000 is producing aerated carbonated non-alcoholic beverages. Their campus at Plachimada has an areal extent of about 35 acres (14 hectares) within which groundwater is extracted through 6 bore wells and 2 dug wells. The location map of the water extraction and conservation structures within the premises of Coca-Cola Factory is shown in Figure 2.

The study area receives an average annual rainfall of about 1413 mm (Chitturpuzha Project office raingauge, 1993-04 to 2003-04). The altitude of this area varies from 160 to 220 metres above mean sea level. This area shows generally an undulating topography and is drained by the Chitturpuzha, a major tributary of Bharathapuzha. The major lithological units occurring in the Perumatty Grama Panchayat area are Migmatites, Khondalites, Charnockites, Gneiss, and Aplites / Pegmatites. All these formations are embedded in a migmatite matrix. The main branch of the Moolathara Canal from Kambalathara Dam runs close to the northern boundary of the Coca-Cola campus. Agriculture is the main occupation of the people of the area.

Final Report prepared by the Investigation Team constituted vide Order WA/2125/2003 dated 19.12.2003 of the Honourable High Court of Kerala.

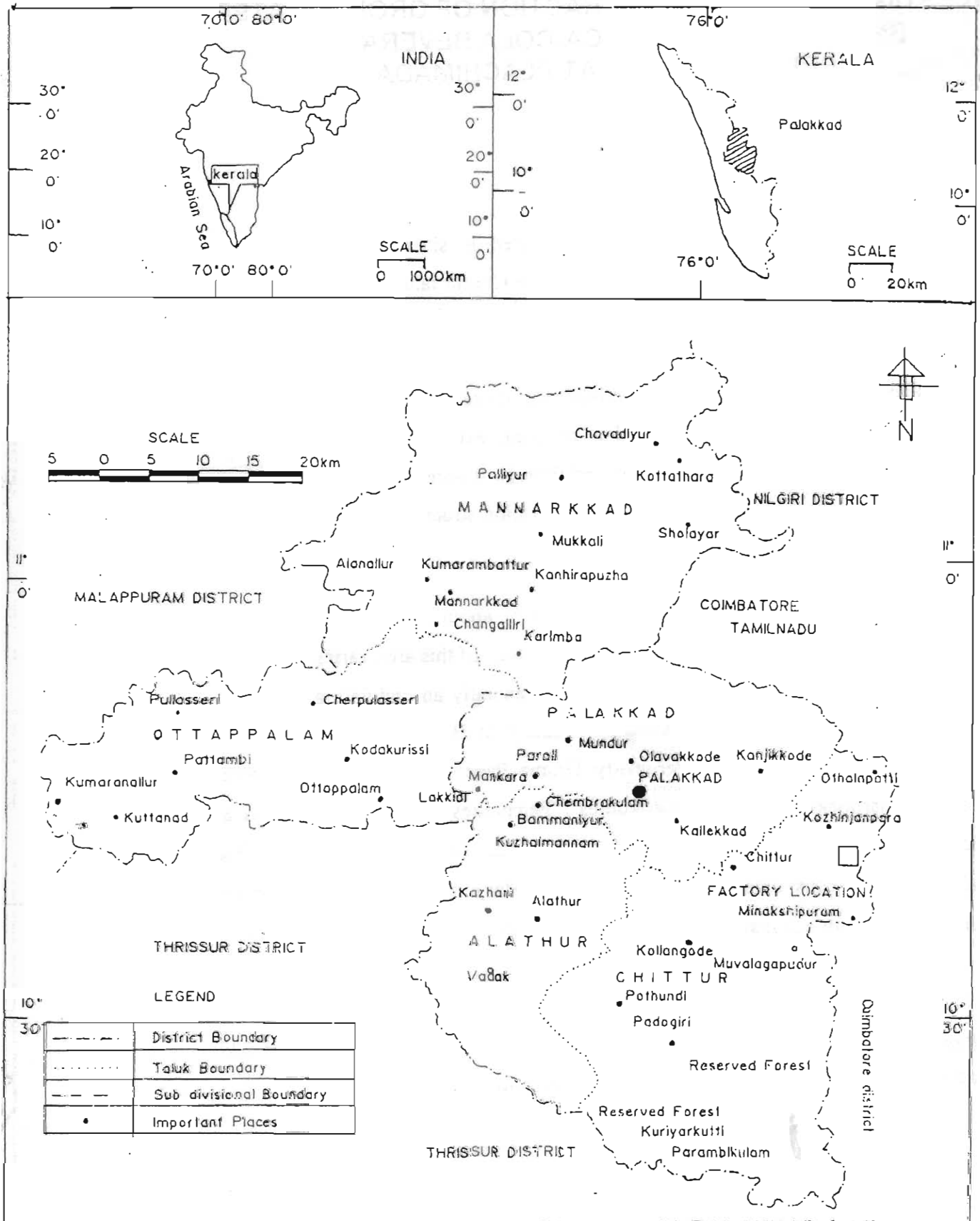

FIG 1 LOCATION OF COCACOLA FACTORY IN PALAKKAD DISTRICT

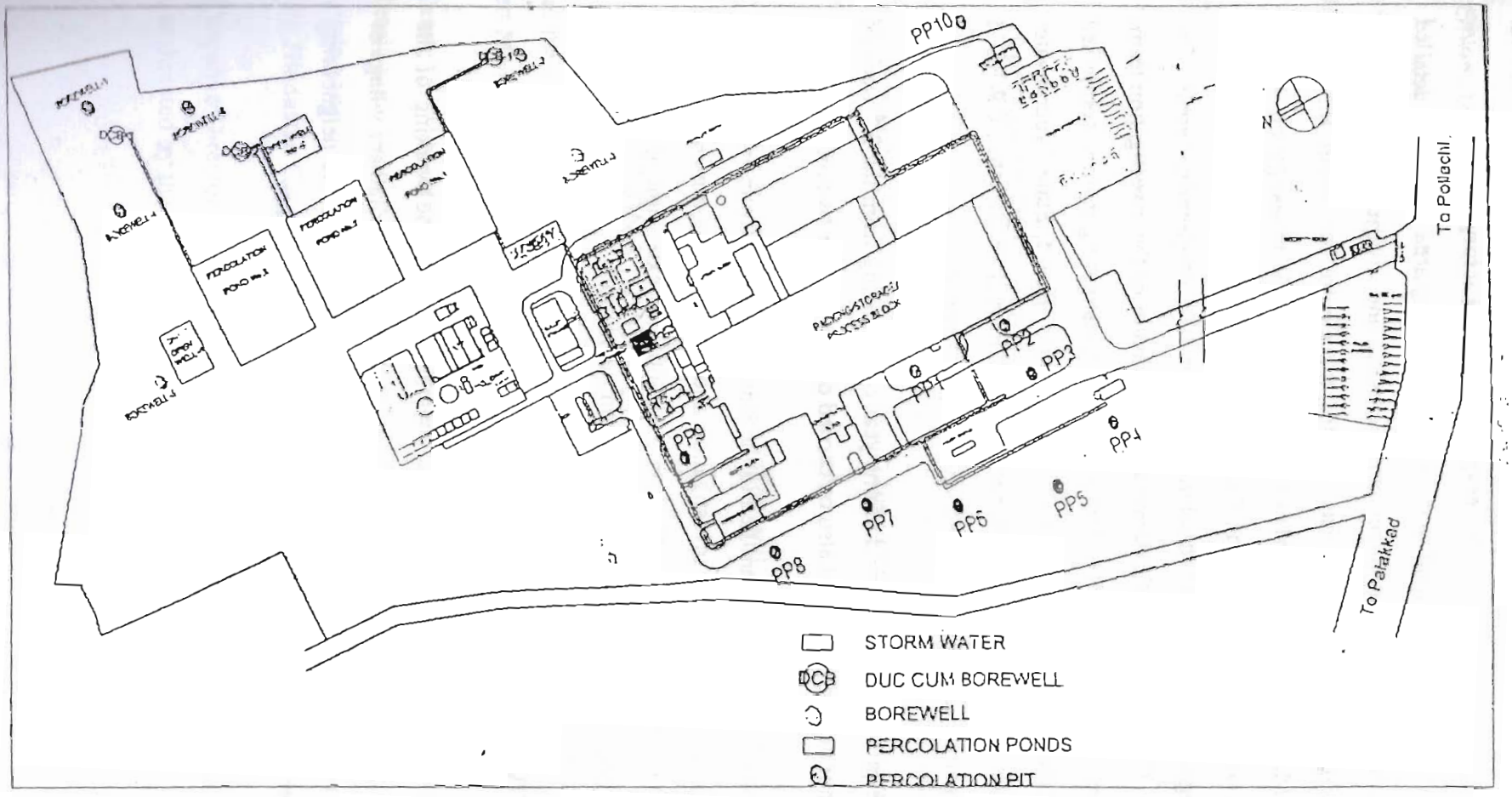

Fig 2. LOCATION MAP OF THE WATER EXTRACTION AND CONSERVATION STRUCTURES WITHIN THE PERMISES OF COCA-COLA COMPANY

As per the information given by the Factory, about 5.0 lakh liters of groundwater is pumped out daily from all the wells put together. There are grievances from several quarters that the extraction of groundwater every day by the Factory has created water shortage and scarcity problem of groundwater in the surrounding area. So far, no detailed scientific study has been carried out to understand the extent and severity of this problem. The Honourable High Court of Kerala has directed the Centre for Water Resources Development and Management (CWRDM) to conduct a scientific investigation into the allegation that the works of M/s Hindustan Coca-Cola factory at Moolathara village has resulted in shortage and scarcity of drinking water in the neighboring areas. The Executive Director, CWRDM, is the Convener and Coordinator of the investigation team. As per the directions of the Honourable High Court, the investigating team is comprised of one Expert Member each from the State Pollution Control Board, State Groundwater Department, and M/s Hindustan Coca-Cola Factory. The Executive Director, CWRDM from within that organization, has nominated seven Expert Members.

The duration of the project is for a period of one year commencing from the 2nd week of January 2004. A monitoring phase will also be carried out for another two more years.

An interim report has been already submitted to the Honorable High Court in May 2004. The complete results of the one-year investigation and the final recommendations are given in this report. A submission was filed on 3.01.2005 for extension of one-month period till 12th February 2005, for submitting the Recommendations.

2.0 OBJECTIVES

Conducting an investigation in the light of the apprehension that the working of the factory of M/s Hindustan Coca-Cola Beverages Private Limited in Moolathara village of Chittur Taluk has resulted in shortage / scarcity of drinking water in the neighboring areas due to the over- exploitation of groundwater for the use of the factory.

2.1 Short-term Objectives

All available data on rainfall, water table fluctuations, groundwater extraction, discharge in streams and canals, Block level estimation of groundwater potential, etc. will be analyzed and an inference will be made whether the current level of extraction by the Coca-Cola Factory can result in affecting the availability of water in the nearby areas. Based on this inference, a recommendation on what can be a sustainable level of groundwater extraction, which can be permitted to the Coca-Cola factory, will be made as an interim measure.

2.2 Long-term Objectives

All relevant hydrologic and hydrogeologic data will be collected and analyzed to re-confirm the interim recommendation or modify the same suitably. This forms the detailed investigation phase of the project.

A monitoring phase of at least two years duration will also be carried out as part of the project activities.

3.0 INSTITUTIONS INVOLVED

As per the directions of the Honourable High Court, the investigating team comprises of Expert Members nominated from the following institutions:

(1) Centre for Water Resources Development and Management (CWRDM), Kozhikode.
(2) Kerala State Groundwater Department.
(3) Kerala State Pollution Control Board.
(4) M/s. Hindustan Coca-Cola Beverages Private Limited, Plachimada.

The Executive Director, CWRDM, is the Convener and Co-ordinator of the investigating team, as directed by the Honourable High Court.

4.0 SUMMARY OF INVESTIGATIONS CARRIED OUT

The members of the investigating team met 6 times during January 2004 - January 2005 and discussed in detail the various aspects related to the investigations. Minutes of these meetings are enclosed as Appendix I (A to F). Based on the decisions taken in these meetings, different hydrological aspects have been studied.

1. All the available reports on the groundwater condition in the Palakkad District in general and the Chittur Block in particular, prepared by Central Ground Water Board (CGWB), State Ground Water Department (SGWD) and M/s. Coco-Cola, were collected and analyzed.
2. All the available data on the groundwater level fluctuation, rainfall, canal flow, etc., were collected from CGWB, SGWD, CWRDM, Water Resources Department and Indian Meteorological Department (IMD).
3. The State Ground Water Department has monitored monthly groundwater level fluctuations in 21 wells existing in and around the Coca-Cola factory since March 2002 (Appendix-IIA & IIB). Weekly groundwater level fluctuation was monitored in these 21 existing open wells and borewells, in and around the Coca-Cola factory, under this project during January 2004 - January 2005. Groundwater level was monitored mainly to understand the effect of groundwater pumping by the factory on the surrounding wells. Details of weekly monitoring of depth to groundwater level in some of the existing open wells and borewells in and around the Coca-Cola factory is given in Appendix-IIC. Some of these wells are fitted with pumps; if the water levels are measured in such wells just after the pumping is stopped, then the values will be incorrect and lead to wrong conclusions. Hence, only those wells, which are not fitted with pumps and borewells fitted with hand pumps, have been considered for the analysis of the groundwater level trend. It is noticed that the depth to water level falls from January to April end. The pumping of groundwater was stopped in the factory during mid-March 2004 but the trend of water level falling in the observation wells and the factory area can be seen continued till the onset of monsoon in the month of June. No

particular trend in groundwater level due to pumping from Coca-Cola could be established from these short-term observations.

4. The factory has 6 bore wells and 2 large diameter open wells. All these wells are fitted with water meters. As part of this study, weekly monitoring of water meter readings of these wells were carried out by the staff of CWRDM, in the presence of representatives from Perumatty Grama Panchayat and Coca-Cola Factory. According to this, the daily total groundwater withdrawal, from all the 6 borewells and 2 open wells vary from 2.75 to 5.04 lakh litres per day during January and March, 2004 (Appendix-III). On an average 60% of groundwater is withdrawn from 2 open wells and the balance 40% from 6 borewells. The Kerala State Government banned the Factory from withdrawing groundwater from the 2nd week of March 2004, till the 2nd week of June, 2004, due to severe drought condition. The ban still continues as on 10th January 2005 and there is no pumping taking place from any of the wells within the Coca-Cola factory premises.
5. Calibration of the water meter reading was done by checking the actual quantity of water pumped with respect to the reading shown by the water meter. The meter is found to be working satisfactorily.
6. A hundred per cent well census was carried out within an area of 1 sq. km around the Coca-Cola factory, to know the details of existing wells such as numbers of open wells and bore wells, purposes of usage, pumping details, etc.
7. The annual available groundwater resource and availability for various purposes was evaluated with Chittur Block (261.24 sq. km) as the assessment unit on a macro scale and the Plachimada watershed (14.89 sq. km) as the assessment unit on a micro scale. The Plachimada watershed forms part of the Chittur Block and the Coca-Cola factory is situated within the Plachimada watershed.
8. The artificial recharge measures taken up by the Coca-Cola factory has been considered in the evaluation of the scope of groundwater withdrawal from the Coca-Cola factory.

.0 RESULTS

.1 Groundwater Assessment - Block Level

he Central Ground Water Board (CGWB, 2003) has estimated the Block level roundwater potential for all the 151 Blocks in Kerala State, as per the groundwater stimation methodology-1997 guidelines approved by the Ministry of Water Resources, overnment of India. The Perumatty Grama Panchayat within which the Coca-Cola actory is located, falls within the Chittur Block in Palakkad District. The results of roundwater potential in the Chittur Block as given in the 2003 report of the CGWB are resented in Table –1. It can be seen that the total annual available groundwater esources in the Chittur Block is 66.7 MCM. Estimates of the annual groundwater draft, hat is to be reserved upto 2025 AD for combined domestic and industrial water supply nd the balance, that is left for meeting irrigation water supply have also been presented n Table –1. These estimates have been arrived at assuming that the domestic and ndustrial water supplies are given a higher priority. However, agriculture is the redominant activity in the study area. It may be, therefore more appropriate to first eserve a certain amount of groundwater resources to meet domestic and agricultural vater supply. The balance can be then allocated to industrial uses like that of Coca-Cola actory. The latest National and State level water policies also give prominence to neeting domestic and irrigation water supply.

Data on area and population that are required to estimate the groundwater resource that is o be reserved for domestic and irrigation water supply are given in Table –1. Very onservative and reasonably valid assumptions have also been made to compute the ommitted groundwater resources to be reserved to meet domestic and irrigation water upply till 2025 AD. These results show that a balance of 4.2 MCM of groundwater esource is available for use in Chittur Block after fully meeting all committed domestic nd irrigation water supply needs. This balance of 4.2 MCM can be allocated to other ses like that of Coca-Cola factory.

Table 1

Evaluation of the Scope for Groundwater Withdrawal by Hindustan Coca Cola Beverages Pvt.Ltd.,Palakkad with Chittur Block as the Assessment unit

A) Groundwater Resources of Chittur Block in Palakkad District as given in the 2003 Report of the Central Groundwater Board

* Total annual groundwater recharge in Million Cubic Metres(MCM)	:	74.1
* Annual available groundwater resources		
* in MCM	:	66.7
* as a % of annual groundwater recharge	:	90
* Current (2001AD) annual gross groundwater draft in MCM		
* Combined domestic and industrial water supply	:	21.1
* Irrigation water supply	:	28.8
* TOTAL	:	49.9
* Current (2001AD)stage of groundwater development as a %	:	74.8
* Annual gross groundwater draft that is reserved upto 2025 AD for combined domestic and industrial water supply	:	23.4
* Balance annual gross groundwater draft that is available to meet irrigation water supply (stage of groundwater development is 100%)	:	43.3
* Additional gross groundwater draft that can be developed over and above what is already currently (2001AD) extracted		
* Combined domestic and industrial water supply	:	2.3
* Irrigation water supply	:	14.5
* TOTAL	:	16.8

B) Data on Area and Population of Chittur Block

* Geographic area in Sq.Km	:	261.24
* Cultivable area		
* in Hectares	:	18287
* as a % of geographic area	:	70
* Irrigated area		
* in Hectares	:	9144
* as a % of cultivable area	:	50
* Year for which population data is available		
* Latest census year	:	2001
* Census year just prior to the latest	:	1991
* Future year till which a reservation of groundwater resources can be made to meet domestic and irrigation water supply	:	2025
* Population in numbers		
* as per 1991 census	:	149821
* as per 2001 census	:	158510
* Population growth in percent per year		
* Between 1991 and 2001as per available population data	:	0.5654
* Between 2001 and 2025 as assumed in this report	:	0.60
* Estimated population in numbers in year 2025 AD	:	172951

C) Commited Groundwater Resources to be Reserved to Meet Domestic and Irrigation Water Supply Till 2025 AD and the Balance Available to Meet other Uses

- Domestic water supply to be ensured in litres per capita per day (lpcd) : 160
- Share of groundwater resources as a % of total water required to meet domestic water supply : 100
- Efficiency of the system that harnesses and supplies groundwater to meet domestic water supply as a % : 60
- Annual irrigation water requirement in metres per unit area : 0.60
- Share of groundwater resources as a % of total water required to meet irrigation water supply : 50
- Efficiency of the system that harnesses and supplies groundwater to meet irrigation water supply : 60
- Groundwater resources to be reserved to meet the annual water requirement upto 2025 AD
  - Domestic water supply : 16.8
  - Irrigation water supply : 45.7
  - TOTAL : 62.5
- Balance annual groundwater resources available for uses other than domesticand irrigation water supply in MCM : 4.2

D) Annual Gross Groundwater Draft Required by Hindustan Coca Cola Beverages Private Limited,Palakkad

- Average daily requirement in lakhs of liters per day : 5.0
- Annual gross groundwater draft required
  - in MCM : 0.1825
  - as a percentage of the balance groundwater resources available after accounting for the commited groundwater resources reserved to meet domestic and irrigation water supply till 2025 AD : 4.35

E) Annual Gross Groundwater Draft that can be Permitted to be Extracted by Hindustan Coca Cola Bevarages Pvt,Ltd,Palakkad

- During the period between 15 days from the south-west monsoon and the end of November,the permitted withdrawal can be always 5.0 lakh litres per day.
- During the period between beginning of December and 15 days from the onset of the south-west monsoon,the permitted withdrawal can be as given in Table 5.
- Consider the rainguage at Chitturpuzha project office.Let the monsoom rainfall (June to November) in a given year be ' x ' and let the mean monsoon rainfall be ' $\bar{x}$ '. Let the deviation from the mean (x - $\bar{x}$) expressed as a percentage of the mean ($\bar{x}$) be " X ".

Sl.No.	Range of "X"	Permitted Groundwater withdrawl in Lakhs of Litres per day
1	"X"grater than or equal to zero%	5.0
2	"X"less than zero% and greater than or equal to -10%	4.0
3	"X" less than-10% and greater than or equal to -20%	3.0
4	"X" less than-20% and greater than or equal to -30%	2.0
5	"X" less than -30%	0.0

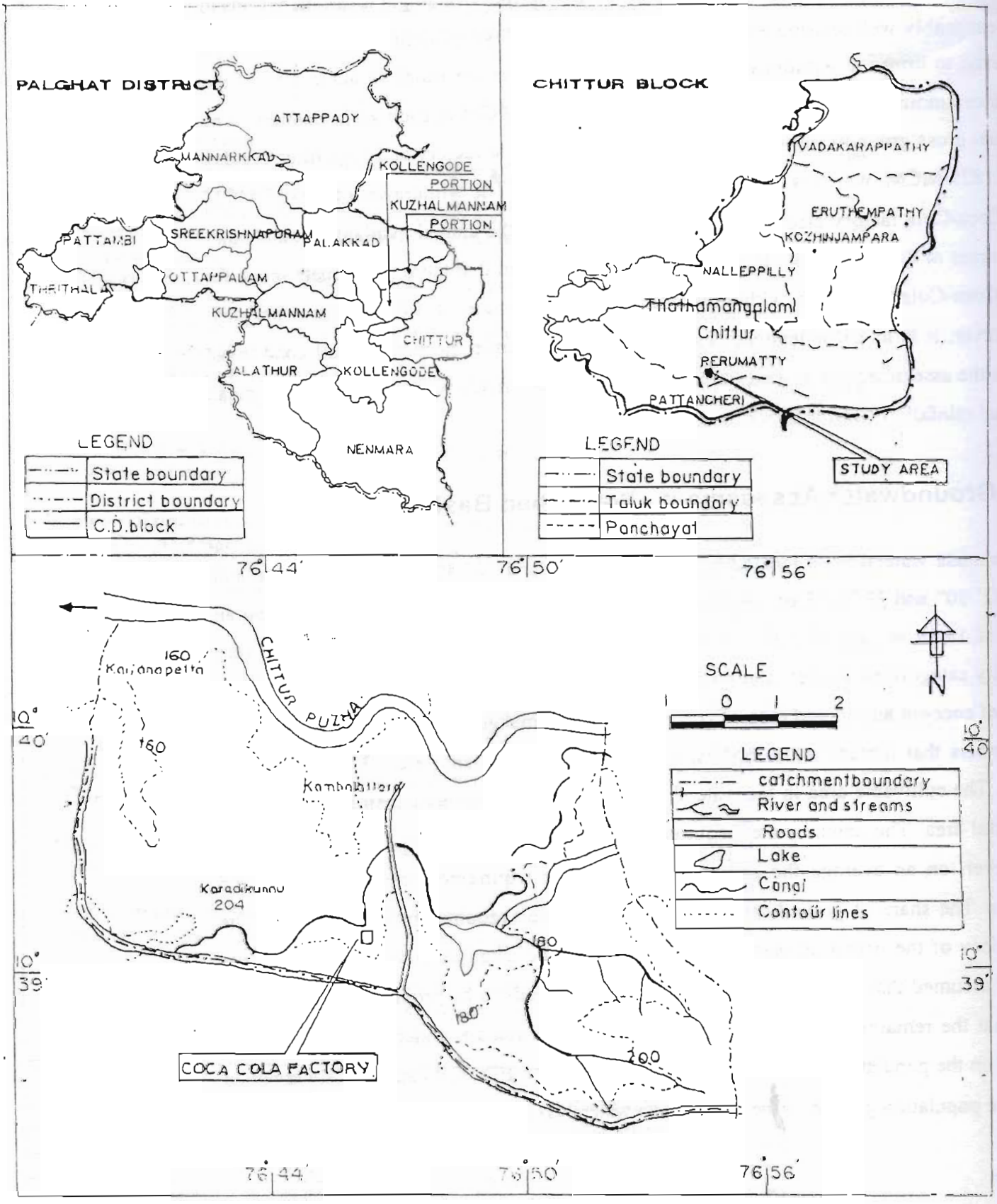

FIG. 3 LOCATION MAP OF PLACHIMADA WATERSHED

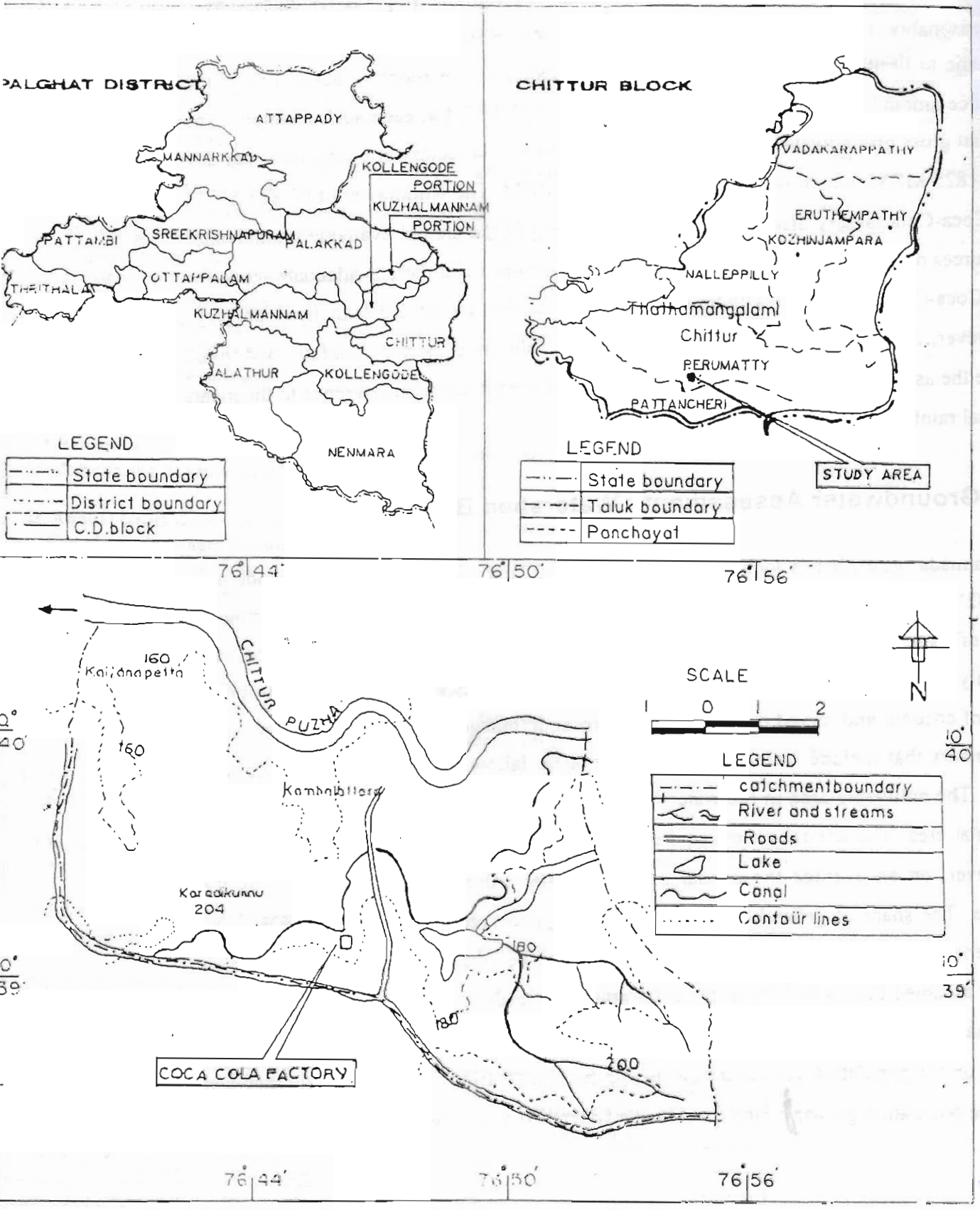

FIG. 3 LOCATION MAP OF PLACHIMADA WATERSHED

can be about 0.6 per cent per year. The domestic water requirement can be safely taken as 160 lpcd with a distribution efficiency of 75%. Drinking water supply demand can be assumed to be fully met with groundwater.

The results of groundwater potential in the Plachimada watershed are presented in Table –2. It can be seen that the estimated annual available groundwater resources of the Plachimada watershed (considering groundwater recharge due to rainfall and return flow from both domestic and irrigation water supply) is 3.67 MCM. The committed groundwater resources to be reserved to meet domestic water supply till 2025 AD can be safely estimated as 0.81 MCM and that for irrigation water supply can be very conservatively estimated as 2.61 MCM. Thus the total annual allocation to be reserved is 3.42 MCM. This leaves a balance of 0.25 MCM of groundwater resource, which can be used to meet other uses such as that of Coca-Cola factory. The annual groundwater requirement of Coca-Cola factory is 0.1825 MCM, which is about 73 % of the balance groundwater resource available after meeting all committed water demand for domestic and irrigation requirements. The water required by Coca-Cola factory is also 4.97 % of the annual available groundwater resource in the Plachimada watershed. It can be also safely assumed that the Coca-Cola factory already established will be the only major industrial user in the Plachimada watershed. Based on the above considerations it can be safely concluded that the Coca-Cola factory can be permitted to draw the required 5.0 lakh litres per day. However, it is to be understood that this is true only under normal rainfall conditions, since the assessment of groundwater resources had been made with reference to the mean annual rainfall as mentioned in Table-3.

5.3 Groundwater Extraction Structures in the Study Area

There are a number of individuals who own wells for domestic and / or irrigation purposes. The hundred per cent well inventory carried out as part of this study has revealed the details of the existing wells (Table 4) in 1 sq. km area around the Coca-Cola factory.

Table 2

Evaluation of the Scope for Groundwater Withdrawal by Hindustan Coco-cola Beverages Private Limited with Plachimada Watershed as the Assessment Unit

Input Data

• Geographical area of the Plachimada watershed in Sq. Km.	14.89
• Cultivable area in the Plachimada watershed	
• in Sq. Km.	10.42
• as a % of the geographical area	70.0
• Maximum expected irrigated area in the Plachimada watershed	
• in Sq. Km.	5.21
• as a % of the cultivable area	50.0
• Population in Chittur Block as per 2001 Census in numbers	158,510
• Geographical area of Chittur Block in Sq. Km.	261.24
• Population density in Chittur Block in 2001 in persons per Sq. Km.	607
• Estimated population in Plachimada watershed in year 2001 in numbers	9,038
• Assumed population growth in Plachimada watershed between 2001 and 2025 in per cent per year	0.6
• Estimated population in Plachimada watershed in year 2025 in numbers	10,433
• Mean annual rainfall in Millimetres (mm) in Plachimada watershed (taken as the mean annual rainfall in Chitturpuzha Project Office)	1,413
• Rainfall recharge as a % of the rainfall (rainfall infiltration factor)	11.0
• Return flow from domestic water supply as a % of the quantity supplied	25.0
• Return flow from irrigation water supply as a % of the quantity supplied	30.0
• Annual available groundwater resource as a % of the annual groundwater recharge	90.0
• Norms to be ensured for	
• Domestic water supply in litres per capita per day (lpcd)	160.0
• Irrigation water supply in metres per unit area irrigated	0.6
• Efficiency of the system that supplies groundwater as a percentage	
• Domestic water supply	75.0
• Irrigation water supply	60.0
• Share of groundwater as a % of total water supplied	
• Domestic water supply	100.0
• Irrigation water supply	50.0
• Annual water requirement of Coco-cola factory at 5.0 lakh litres per day in Million Cubic Metres (MCM)	0.1825

- Results

• Annual groundwater recharge by rainfall in MCM	2.31
• Annual groundwater recharge by sources other than rainfall in MCM	
◦ Return flow from domestic water supply	0.20
◦ Return flow from irrigation water supply	1.57
• Total annual groundwater recharge in MCM	4.08
• Annual available groundwater resource in MCM	3.67
• Annual allocation of groundwater resource to be reseved to meet the projected water demand till 2025 AD in MCM	
◦ Domestic water supply	0.81
◦ Irrigation water supply	2.61
◦ Total of both domestic and irrigation water supply	3.42
• Balance annual groundwater resource available in Plachimada watershed after meeting all committed groundwater withdrawals for domestic and irrigation water needs upto 2025 AD in MCM	0.25
• Annual groundwater withdrawal required by Coca-cola factory as a % of the	
◦ Annual available groundwater resource in Plachimada watershed	4.97
◦ Balance annual groundwater resource available in Plachimada watershed after meeting all committed groundwater withdrawals for domestic and irrigation water needs upto 2025 AD in MCM	73.00

Table 3

Monsoon, Non monsoon and Annual Rainfall as recorded in Chitturpuzha Rainguage Station In Palakkad District

Location of Rainguage

Latitude : 10°41'15"N
Longitude : 76°44'00"E

Sl.No	Year	Rainfall During					
		Monsoon Season (Jun-Nov)		Non-Monsoon Season (Dec-May)		Annual Period (Jun-May)	
		Rainfall in Millimeters (mm)	Deviation from the Mean as a % of the Mean, 'X'	Rainfall in Millimeters (mm)	Deviation from the Mean as a % of the Mean, 'X'	Rainfall in Millimeters (mm)	Deviation from the Mean as a % of the Mean, 'X'
1	1994-95	1932	58.8	203	3.6	2135	51.1
2	1995-96	1264	3.9	185	-5.6	1449	2.5
3	1996-97	1198	-1.6	232	18.4	1430	1.2
4	1997-98	1400	15.0	93	-52.6	1493	5.7
5	1998-99	1422	16.8	337	71.9	1759	24.5
6	1999-00	1207	-0.8	137	-30.1	1344	-4.9
7	2000-01	1048	-13.9	137	-30.1	1185	-16.1
8	2001-02	1087	-10.7	194	-1.0	1281	-9.3
9	2002-03	812	-33.3	219	11.7	1031	-27.0
10	2003-04	798	-34.4	223	13.8	1021	-27.7
Mean Rainfall in mm		1217		196		1413	

Number of years when			
a) X >=0%	4	5	5
b) 0%> X >= -10%	2	2	2
c) -10%> X >=-20%	2	0	1
d) -20%> X >=-30%	0	0	2
e) X< -30%	2	3	0
Total Years	10	10	10

Table 4: Details of the Existing Wells in 1 sq. km around the Coca-Cola factory.

Type of Usage	Dugwells Without Pumps	Dugwells With Pumps	Borewells With Hand Pumps	Borewells With Energized Pumps
Domestic	17	3	2	--
Domestic-cum-Irrigation	--	11	--	--
Irrigation	--	9	--	1
Industry	--	2	--	6
Total	17	25	2	7

The present annual groundwater withdrawal for domestic and irrigation through the existing groundwater extraction structures in the Plachimada watershed area is estimated as 1.67 MCM, whereas the reserved groundwater allocation for domestic and irrigation till year 2025 AD is 3.42 MCM. This means that about 49 % of the reserved allocation is only being currently utilized.

5.4 Rainfall Condition

As such there is no rain gauge station located within the watershed area. The two rain gauge stations located near to the study area are Meenkara (located at about 6 km towards south and maintained by Water Resources Department) and Chitturpuzha Project office (located at about 6 km towards north and maintained by CWRDM). The annual average rainfall, considering the rainfall data during the last ten years at these two stations, is 1413 mm at Chitturpuzha Project office and 1513mm at Meenkara. The lower value of 1413 mm at Chitturpuzha Project office has been used for computing the rainfall recharge in the Plachimada watershed

The rainfall data recorded at the Chitturpuzha Project office rain gauge station [illegible] monsoon season (June to Nov) rainfall in both 2002-03 and 2003-04 has been much less than the mean value with the deviation from the mean as a percentage of the mean being lower than even – 30 percent. This deficiency in the rainfall and that too in two successive years can be considered to be the most significant factor that has contributed to the acute scarcity of water experienced in the study area. The unregulated withdrawal of groundwater from the wells within the Coca Cola factory complex and also outside even during such a water deficit period is found to have aggravated the water scarcity situation further in the study area.

5.5 Artificial Recharge Measures by Coca-Cola

The Coca-Cola factory has adopted artificial recharge measures within their factory premises such as percolation ponds, recharge pits / wells, roof-top rainwater harvesting, etc. All these measures tap water during rainy period and the resultant recharge water goes as subsurface runoff to the downstream areas towards north of factory, which are all at lower elevations. There will be also limitation for the aquifers to receive the recharged water, as it will be mostly saturated during rainy season. Thus, the recharged water will not be actually available to the factory for its use in the non-rainy period.

6.0 RECOMMENDATIONS

1. Estimates of annual available groundwater resource and the groundwater withdrawal to be reserved for meeting committed domestic and irrigation water supply up to 2025 AD that have been arrived at both on Chittur Block level (macro scale) and Plachimada watershed level (micro scale) show that the Coca-Cola factory can be safely permitted to withdraw 5 lakh litres per day without adversely affecting both domestic and irrigation water requirements. However, this conclusion is valid only under normal rainfall condition. Groundwater withdrawal by Coca-Cola factory has to be strictly controlled in those years in which the rainfall is less than the mean value.

2. Consider the rain gauge at Chitturpuzha Project office maintained by CWRDM. Information on monsoon, non-monsoon and annual rainfall as recorded at this rain gauge station for a 10 year period between 1994 -95 and 2003 - 04 is presented in Table 3. The monsoon season rainfall accounts for nearly 85% of the annual rainfall. The balance 15% of rainfall during the non-monsoon season also falls mostly during April and May, as pre-monsoon showers. It is therefore, reasonable to consider only the monsoon season rainfall for regulating the groundwater withdrawals.

3. The results given in Table 3 show that the rainfall each year varies significantly from the mean. For example, the number of years when the monsoon season rainfall (June-November) is less than the mean value is 6. A typical regulation measure that can be tentatively adopted is given in Table 5. These regulations should be implemented during the period between 1st December and 15 days after the onset of south-west monsoon in Palakkad district, which typically occurs by the first week of June.

4. Regulations to be implemented on groundwater draft for industrial purpose by Hindustan Coca Cola Beverages Pvt. Ltd., Palakkad

a) Demand for domestic and industrial supply, which are uniformly the same through out the year, form only 25 % of the total water demand, to be met by groundwater. Irrigation water demand, which forms the remaining 75 % of the total water demand, is required mainly during the non-monsoon period. Monsoon season rainfall also forms about 85 % of the annual value. There is therefore no need for any regulations to be imposed on groundwater withdrawal for industrial uses during the monsoon season in any year.

b) The period during which restrictions on groundwater withdrawal are to be imposed can be conveniently considered to comprise of the period between 1st December and 15 days after the onset of the subsequent south-west monsoon. The rain gauge at Chitturpuzha project office maintained by CWRDM can be considered as the reference rain gauge for evaluating the deviations of the monsoon rainfall. Let the deviation of the monsoon season rainfall in a given year from the mean monsoon rainfall as a percentage

of the mean monsoon rainfall be 'X'. This parameter 'X' can be the basis for implementing the regulations on groundwater withdrawal by Coca-Cola factory. The restrictions to be imposed can apply for a practical set of ranges of 'X' values. For each such range, the period of restrictions can be uniformly between 1st of December and 15 days from the onset of south-west monsoon. If 'X' is between 0 and –10 per cent, the groundwater withdrawal can be limited to 4.0 lakh litres per day. If 'X' is between -10 and -20 per cent, the groundwater withdrawal can be limited to 3.0 lakh litres per day. If 'X' is between –20 and -30 per cent, the groundwater withdrawal can be limited to 2.0 lakh litres per day. If 'X' is less than - 30 per cent, groundwater withdrawal can be fully stopped.

c) The permitted groundwater withdrawal in lakh litres per day during the period between 1st of December and 15 days from the onset of south-west monsoon can be as per the scheme given in Table 5.

Table – 5: Regulations on Groundwater Withdrawal

Sl. No	Range of "X"	Permitted Groundwater Withdrawal in Lakhs of Litres per day
1	"X" less than zero % and greater than or equal to -10 %	4.0
2	"X" less than -10% and greater than or equal to -20%	3.0
3	"X" less than -20% and greater than or equal to -30%	2.0
4	"X" less than -30%	0.0

5. The artificial recharge measures adopted by the factory should continue in order to safeguard the groundwater potential in the neighboring areas.

6. The recommendations will protect the interests of domestic and irrigation water supply sectors adequately well. They will also ensure that the developmental opportunities, which industrial establishments can create in an area that is otherwise predominantly agrarian, are fully utilized. Further, all the recommendations are very practical from the point of view of convenience of implementation.

REFERENCES

1. "Analysis report of the samples collected on 4/8/03 from M/s Hindustan Coca-Cola Beverages (P) Ltd, Palakkad", prepared by Kerala State Pollution Control Board, August 2003.
2. "Report on the groundwater extraction in the Coca-Cola Factory, Plachimada, Palakkad District and water level trends in the area", prepared by State Groundwater Department, January 2003.
3. "Report on the monitoring of wells in and around the Coca-Cola factory in Plachimada, Kannimari, Palakkad district", prepared by State Groundwater Department, September 2003.
4. "Report on the groundwater conditions in and around Coca-Cola Beverages Private Limited Factory, Plachimada village, Palakkad district, Kerala", prepared by Central Groundwater Board.
5. "Water management at the Coca-Cola plant at Moolathara village, Palakkad district, Kerala State, India", prepared by R N Athavale, Emeritus Scientist, NGRI, Hyderabad, October 2002.
6. "Report on the integrated groundwater surveys conducted in the Coca-Cola factory site at Moolathara village, Chittoor Taluk, Palakkad district, Kerala State", prepared by DG integrated Groundwater Services, Vijayawada.
7. "Rainwater harvesting at Hindustan Coca-Cola Beverages (p) Ltd, Palakkad", prepared by KRG Rainwater Harvesting Foundation, Chennai.
8. " Water quality report", prepared by State Groundwater Department, Thiruvananthapuram, November 2002
9. "Groundwater Resources and Development Potential ofv Palghat District, Kerala", CGWB, March,1997.
10. "Groundwater Resources of Kerala (Based on GEC 1997 Methodology)", CGWB, 2003.
11. "Report on the Geology of the Study Area" by V C Jacob (Unpublished).

APPENDIX IA

Minutes of the First Meeting of the Investigation Team Constituted as per the Directions of the Honourable High Court

(Order No:WA/2125/2003 dated 19-12-03)

Venue : KSEB-IB, Palakkad Date: 01 01 04 Time:1000 hrs – 1700 hrs

Members Present:

1. Shri G Gopalakrishna Pillai, Hydrogeologist, Ground Water Department, Trivandrum
2. Shri R V Satheesan Thampuran, Senior Environmental Engineer, Kerala State Pollution Control Board, Calicut
3. Shri V C Jacob, (Retd Director, CGWB, Trivandrum) Representative of Hindustan Coca-Cola Beverages Private Limited
4. Dr S P Rajagopalan, Head, CAD,CWRDM
5. Dr M Nazimuddin, Head i/c, GWD, CWRDM
6. Dr N B Narasimha Prasad, Coordinator, MOS, CWRDM
7. Shri V P Dinesan, Scientist, SWD, CWRDM
8. Shri P K Abdulla, Officer i/c, CWRDM Sub Centre, Palakkad
9. Dr U K Warrier, Scientist, ED's Secretariat, CWRDM
10. Smt P Manjula, Technical Officer, IHD, CWRDM
11. Dr E J James, Convenor of the Investigation Team (Executive Director, CWRDM)

1. The Coordinator/Convenor welcomed the Expert Members and a self introduction was made by the Expert Members.

2. Expert Members 1-3 in the above list are from the State Groundwater Department, the State Pollution Control Board and Hindustan Coca-Cola Beverages Private Limited respectively and 4-10 are nominated by the Executive Director from within CWRDM.

3. Order No.WA/2125/2003 dated 19 December 2003 of the Hon'ble High Court was read out and the Investigation Team noted the work assigned, namely, "Conducting an investigation into the allegation that the working of the factory of the Hindustan Coco-Cola Beverages Private Limited at Moolathara Village of Chittur Taluk has resulted in shortage and scarcity of drinking water in the neighbouring areas due to the over-exploitation of groundwater for the use of the factory". It was informed by the Coordinator that a time-bound project has

to be prepared and submitted to the Hon'ble High Court on or before 6 January 2004.

4. The Expert Members of the Committee discussed in detail the course of action to be taken with regard to the assignment. It was decided to prepare a project proposal and submit it to the Hon'ble High Court on or before 6 January 2004. The project proposal should contain objectives, general methodology, programme of work and estimate of cost. The duration of the project is for a one-year period. An Interim Report based on all available information pertaining to the study area will be prepared and submitted at the end of 3 months from the start of the project. A monitoring phase will also be carried out for another two more years.

5. The Coordinator requested the Expert Members from the State Groundwater Department and the State Pollution Control Board to make available all relevant data and reports before 10 January 2004.

6. The Investigation Team was also requested to obtain all relevant data/reports from Central Groundwater Board, Thiruvananthapuram and any other relevant department/agency. The Expert Member from M/s Hindustan Coca-Cola Beverages Limited will make available all relevant data/reports with them before 10 January 2004.

7. The Concept Paper on the proposed project prepared by CWRDM was presented and copies circulated among the Expert Members. All the Members came to a consensus that a detailed project proposal based on the Concept Paper will be prepared by CWRDM and 10 copies filed before the Registrar of the Hon'ble High Court on or before 6 January 2004. A copy of the Concept Paper is given in Annexure 1.

8. The Expert Members of the Investigation Team visited the site and inspected the groundwater extraction structures, and the effluent treatment plant of M/s Hindustan Coca-Cola Beverages Limited.

9. The General Manager of the Company was requested to provide all available relevant data, which would be useful for the investigation.

10. After the field visit, a final round of discussion was held at KSEB-IB, Palakkad.

Dr E J James
Coordinator/Convener

APPENDIX IB

Minutes of the Second Meeting of the Investigation Team constituted as per the Directions of the Honourable High Court.
(Order No: WA/2125/2003, dated 19-12-03)

Venue: CWRDM Date: 23-02-04 Time: 1500-1615hrs

Expert Members present:

1. Shri. G. Gopalakrishna Pillai, Hydrogeologist, Ground water Department, Trivandrum
2. Shri. R. V. Satheesan Thampuran, Senior Environmental Engineer, Kerala State Pollution Control Board, Calicut.
3. Shri. V. C. Jacob, (Retd. Director, CGWB, Trivandrum) Representative of Hindustan Coca Cola Beverages Private limited.
4. Dr. S. P. Rajagopalan, Head, CAD, CWRDM.
5. Dr. M. Nazimuddin, Head, GWD, CWRDM.
6. Dr. N. B. Narasimha Prasad, Coordinator, MOS, CWRDM.
7. Shri. V. P. Dinesan, Scientist, SWD, CWRDM.
8. Shri. P. K. Abdulla, Officer i/c, CWRDM Sub Centre, Palakkad.
9. Dr. U. K. Warrier, Scientist, ED's Secretariat, CWRDM.
10. Smt. P. Manjula, Technical Officer, HID, CWRDM.
11. Dr. E. J. James, Convener of the investigation team (Executive Director, CWRDM).

1 All the Expert Members of the Investigating Team were present. Dr. E. J. James, Coordinator/Convener of the Investigating Team welcomed the Expert Members. He also briefed various developments which have taken place since the last meeting on 01-01-04.

2. On behalf of the Investigating Team, Dr. S. P. Rajagopalan briefly presented the progress of the work till date.

3. Dr. N. B. Narasimha Prasad read out the orders issued by the Honourable High Court on 7-01-2004 and 3-02-2004, regarding the acceptance of the project proposal submitted by the Investigating Team and locking of the water meters within the factory complex respectively.

4 Shri. P. K. Abdulla informed the Expert Members that the representatives from the Perumatty Grama Panchayat were absent during the water meter observations on 16-02-04 and 23-02-04, inspite of his informing them.

5. Shri. G Gopalakrishna Pillai communicated that the State Ground Water Department would continue to monitor the monthly ground water level fluctuations from the observation wells. He also expressed satisfaction in the progress of work so far achieved.

6 Shri. V C Jacob agreed with the methodology and progress of work in general, and was of the opinion that the general geological set up around the area may be considered. Shri. V C Jacob has agreed to prepare a writeup on the detailed geological set up around the study area based on the existing information and hand over the same to the Convener by 15-03-2004. Dr. M. Nazimuddin, Shri. Gopalakrishna Pillai, Dr C U Warrier and Smt. P Manjula will further go through this report and carry out further analysis.

7. The Convener/Coordinator was authorized by the Expert Members to take immediate and appropriate decisions, as per the exigencies demanded by the investigations and progress of work.

8 The meeting came to an end at 1630 hrs.

Dr P J James 04/02/06
Coordinator/Convener

APPENDIX IC

Minutes of the Third Meeting of the Investigation Team constituted as per the Directions of the Honourable High Court
(Order No: WA/2125/2003, dated 19-12-03)

Venue : CWRDM Date: 19-03-04 Time: 1030-1300hrs

Expert Members present:

1. Shri. G.Gopalakrishna Pillai, Hydrogeologist, Ground Water Department, Trivandrum
2. Shri.V.C.Jacob, (Retd. Director, CGWB, Trivandrum) Representative of Hindustan Coca Cola Beverages, Private Limited.
3. Dr. S.P.Rajagopalan,Head, CAD, CWRDM
4. Dr.M.Nazimuddin,Head, GWD, CWRDM
5. Dr.N.B.Narasimha Prasad, Coordinator, MOS, CWRDM
6. Shri.P.K.Abdulla, Officer i/c, CWRDM SubCentre, Palakkad.
7. Dr.C.U.K.Warrier, Scientist, ED's Secretariat, CWRDM
8. Smt.P.Manjula, Technical Officer, IHD, CWRDM
9. Dr. E.J.James, Convener of the investigation team (Executive Director, CWRDM)

1 Dr. E.J.James, Coordinator/ Convener of the Investigation Team welcomed the Expert Members. Shri. R.V. Satheesan Thampuran, Senior Environmental Engineer, Kerala, State Pollution Control Board, Calicut, and Shri.V.P.Dinesan, Scientist, SWD, CWRDM, did not attend the meeting due to other important engagements, with the prior permission of the Chair.

2. Shri.P.K. Abdulla informed the Expert Members that the water meters are locked only by CWRDM and the representatives from the Perumatty Grama Panchayat have not put their locks to the water meters, inspite of his orally informing them. He also communicated that Investigation Team would continue to monitor water meter reading within the factory complex.

3. The Investigation Team decided to conduct a hundred per cent well census within 1sq.km area around the Hindustan Coca Cola Company to understand the status of groundwater withdrawal in the surrounding areas. This work is planned to be completed by the first week of April 2004.

4. Shri. V.C.Jacob informed that he made a field visit along with the CWRDM Experts in observing the ground water levels in the observation wells around the factory premises on 8-03-04. He also informed that he has given a brief report on the Geology of the area to the Convener, as per the decision of the earlier meeting. It was decided that Shri.Gopalakrishna Pillai, Dr.M.Nazimuddin and Dr.N.B.Narasimha Prasad will discuss

further with Shri.V.C.Jacob and give a brief report to Dr. S.P.Rajagopalan for inclusion in the interim report.

5. It was noted by the Expert Team that the Coca-Cola company is at present not withdrawing groundwater. It was decided to continue monitoring of groundwater levels in and around the Company area with the changed scenario.

6. An account on the work completed so far and the work to be carried out before submitting the interim report was discussed. As some more works are to be completed, the members of the Investigating Team present came to a conclusion that the Coordinator take necessary steps to get an extension of time by the Honourable High Court for submitting the Interim Report.

7. The Coordinator requested Dr.S.P.Rajagopalan to coordinate the works with Team leader Dr.N.B.Narasimha Prasad and to assign works to members of the Investigation Team so that the draft report will be ready by 25-04-2004.

8. Dr.S.P.Rajagopalan will ensure participation of the State Ground Water Department and the representative of the Coca Cola Company in coming out with the draft Interim Report. The Coordinator will also join the discussions as and when necessary.

9. The Investigation Team entrusted the Coordinator to bring the notice of the Honorable High Court, the decision of the Investigation Team to get an extension of time up to 15-05-2004 for submitting the Interim Report.

10. The meeting came to an end at 1300 hrs.

Dr. E.J.James
Coordinator / Convener

APPENDIX 1D

Minutes of the Fourth Meeting of the Investigation Team constituted as per the Directions of the Honourable High Court.
(Order No: WA/2125/2003, dated 19-12-03)

Venue: CWRDM Date: 17-04-04 Time: 1030-1300hrs

Expert Members present:

1. Shri. G.Gopalakrishna Pillai, Hydrogeologist, Ground Water Department, Trivandrum
2. Shri.V.C.Jacob, (Retd. Director, CGWB, Trivandrum) Representative of Hindustan Coca Cola Beverages, Private Limited.
3. Shri. R.V. Satheesan Thampuran, Sr.Environmental Engineer, KSPCB, Calicut.
4. Dr. S.P.Rajagopalan,Head, CAD, CWRDM
5. Dr.M.Nazimuddin,Head, GWD, CWRDM
6. Dr.N.B.Narasimha Prasad, Coordinator, MOS, CWRDM
7. Shri.V.P.Dinesan, Scientist, SWD, CWRDM
8. Shri.P.K.Abdulla, Officer i/c, CWRDM SubCentre, Palakkad.
9. Dr.C.U.K.Warrier, Scientist, ED's Secretariat, CWRDM
10. Smt.P.Manjula, Technical Officer, IHD, CWRDM
11. Dr. E.J.James, Convener of the investigation team (Executive Director, CWRDM)

1. Dr. E.J.James, Coordinator/ Convener of the Investigation Team welcomed the Expert

2. Dr. S.P. Rajagopalan briefed the Expert Team Members that the following components of work are attended to, as part of the project :

    a. Monitored the pumping by Coca-Cola factory, by taking weekly water meter readings. Water meter monitoring is continuing even after the company has stopped pumping of groundwater.
    b. Calibrated the water meter reading.
    c. Weekly monitoring of depth to ground water level in about 22 observation wells in and around the factory is continuing.
    d. Well use statistics survey was carried out in about 4 sq. km area around the Coca-Cola factory.
    e. Collected and compiled 10 years rainfall data of Chitturpuzha area monitored by CWRDM.
    f. Secondary data from already published reports of State Ground Water Department, Central Ground Water Board and M/S Coca-Cola, have been collected and analyzed.

3. Expert Team Members agreed to consider the rainfall data of Chittupuzha area for the present study purpose.

4. The Expert Team examined the report of the State Ground Water Department and felt that a logical conclusion can not be arrived at from the limited data reported and it can be modified with additional data.

5. Shri.V.C.Jacob agreed that he will refine his earlier report on the geology of the study area and submit the same before 1st May 2004.The members of the expert team within CWRDM will analyze the same and modify, if necessary.

6. The Expert Team felt that the items given in the initial project proposal regarding the methodology may form part of the Interim Report. The members also discussed the points raised by Sri. V.C. Jacob in his letter to the Convener and the Committee unanimously agreed that there is no technical relevance to these points as far as solving the present problem.

7. Shri. Gopalakrishna Pillai will provide all the water level fluctuation data so far recorded under National Hydrology Project for the Chittur Block, including the depth details of the piezometers, before 24th April 2004.

8. The Committee felt that the well census survey and data collection done are adequate for the present study.

9. The Expert Team Members within CWRDM will start working on the Interim Report and Shri. V.C .Jacob, Shri. Satheesan Thampuran and Shri. Gopalakrishna Pillai will interact with the CWRDM members time to time and give their suggestions.

10. Next Meeting of the Committee is fixed for 7 May 2004 and the draft Interim Report will be discussed. If there is any change in date, the same will be communicated.

The Meeting came to an end at 1300 hrs.

Dr. E J James 04/04/19
Coordinator/Convener

APPENDIX IE

Minutes of the Fifth Meeting of the Investigation Team constituted as per the Directions of the Honourable High Court.
(Order No: WA/2125/2003 dated 19-12-03)

Venue: CWRDM Date: 7-05-04 Time: 1030-1415hrs

Expert Members present:

1. Shri. G. Gopalakrishna Pillai, Hydrogeologist, Ground Water Department, Trivandrum
2. Shri. V.C. Jacob, (Retd. Director, CGWB, Trivandrum) Representative of Hindustan Coca Cola Beverages, Private Limited.
3. Shri. R.V. Satheesan Thampuran, Sr. Environmental Engineer, KSPCB, Calicut.
4. Dr. S.P.Rajagopalan, Head, CAD, CWRDM
5. Dr.M.Nazimuddin, Head, GWD, CWRDM
6. Dr.N.B.Narasimha Prasad, Coordinator, MOS, CWRDM
7. Shri.V.P.Dinesan, Scientist, SWD, CWRDM
8. Shri.P.K.Abdulla, Officer i/c, CWRDM SubCentre, Palakkad.
9. Dr.C.U.K.Warrier, Scientist, ED's Secretariat, CWRDM
10. Smt.P.Manjula, Technical Officer, IHD, CWRDM
11. Dr. E.J.James, Convener of the investigation team (Executive Director, CWRDM)

1. The convenor welcomed the investigating team and requested Dr. S. P. Rajagopalan to make a presentation on the findings of the study.
2. Dr. S. P. Rajagopalan explained in detail the methodology adopted to estimate the groundwater potential, draft and the stage of development, considering the Chittur Block as a study unit, based on the 2003 report of CGWB.
3. The investigation team came to the consensus that based on the available data and the estimations made, the Coca-Cola factory can extract 5.0 lakh litres of groundwater per day whenever the rainfall is equal to or more than the long-term normal rainfall.
4. It was also decided that there should be restriction on the groundwater withdrawal during the years, when the rainfall is less than the normal rainfall. The restrictions suggested are as follows:

Rainfall Deviation from the mean	Groundwater Extraction in the plant
> 0%	No restriction on pumping. The company can extract 5.0 Lakh litres per day.
0 to – 10%	Restriction to 4.0 lakh litres per day from February till the onset of monsoon.
-10 to – 20%	Restriction to 3.0 lakh litres per day from February till the onset of monsoon
-20 to – 30%	Restriction to 2.0 lakh litres per day from February till the onset of monsoon
> - 30%	No groundwater withdrawal from first week of February till the onset of monsoon.

These recommendations are tentative and will be refined on the basis of further studies when the final report is submitted at the end of one year.

The investigating team will prepare an Interim Report incorporating the above recommendations. The convener is authorized to finalise the Interim Report on the basis of the discussions held in this meeting and submit the report to the Honorouble High Court on 14-05-04.

The meeting came to an end at 14.15 hrs.

Sd/-
Convener of the Investigation Team

14/05/04

APPENDIX IF

MINUTES OF THE SIXTH MEETING OF THE INVESTIGATION TEAM CONSTITUTED AS PER THE DIRECTIONS OF THE HONOURABLE HIGH COURT. (ORDER NO: WA/2125/2003, DATED 19-12-03)

VENUE : CWRDM DATE: 20-01-05 TIME: 1100-1330HRS

EXPERT MEMBERS PRESENT:

1. Shri. G.Gopalakrishna Pillai, Hydrogeologist, Ground Water Department, Trivandrum
2. Shri.V.C.Jacob (Retd. Director, Cgwb, Trivandrum), Representative of Hindustan Coca Cola Beverages, Private Limited.
3. Dr. S.P.Rajagopalan,Head, CAD, CWRDM
4. Dr.M.Nazimuddin,Head, GWD, CWRDM
5. Dr.N.B.Narasimha Prasad, Coordinator, MOS, CWRDM
6. Shri.P.K.Abdulla, Officer I/C, CWRDM Subcentre, Palakkad.
7. Dr.C.U.K.Warrier, Scientist, IHD, CWRDM
8. Mr. V P Dinesan, Scientist, SWD, CWRDM
9. Dr. E.J.James, Convener Of The Investigation Team (Executive Director, CWRDM)

1. Mr. Satheesan Thampuran, Kerala State Pollution Control Board, had communicated his inability to attend the meeting because of other pressing official commitments.

2. The Investigating Team Members from CWRDM presented details of what can form the Final Report of the Project. This presentation included the watershed approach to arrive at water availability status for various purposes. All members of the Investigation Team expressed their total agreement. The Final Report will be prepared by 31st January 2005. The external members namely, Mr. V C Jacob, Mr. Gopalakrishna Pilai and Mr. Satheesan Thampuran will interact closely with the members of CWRDM and will be present in CWRDM from at least 3 days prior to 31st January 2005. The committee decided that the water level monitoring may be done once in a month in future.

3. The Investigating Team experienced certain difficulties in monitoring the water level in the wells within the project area. In fact the last two sets of readings could not be taken. The Coordinator will take up this matter with the Amicus Curie for bringing it to the attention of the Honourable High Court.

The meeting came to an end at 1330 Hrs.

Dr. E J James
Coordinator/ Convener

8 OW	Sri.Pazhanimalai, Plachimada	10°38'57" 76°49'10"	8.75	6.012	3.0 H.P	No effect	141.60	Domestic & Irrigation	Circular Canal influence felt
9 OW	Sri.Sudevan, Plachimada	10°38'56" 76°49'13"	6.65	3.48	No pump	Quality problem	24.00	Domestic	Circular irregular South of the canal Canal influence Just back of the factory
10 OW	Sri.Rengaswami Kounder, Kambalathara	10°38'49" 76°49'23"	6.10	4.80	5 H.P	Extreme Quantity problem	39.30	Irrigation Square	Near Eastern boundary of the company Reading taken immediately after stopping the pump
11 OW	Sri.Shahul Hameed, Plachimada	10°38'43" 76°49'22"	5.66	5.07	5 H.P	Extreme Quantity Problem	99.20	Irrigation Square Irregular	
12 BW	Panchayat Bore well Adhivasi Colony	10°38'40" 76°49'05"		10.754	Hand pump		6.00		
13 OW	Panchayat Bore well Adhivasi Colony	10°38'36" 76°49'15"	7.55	3.98	No pump		70.85		
14 OW	Sri.A.C.Ravindranath, Azhichira Kannimary	10°38'45" 76°49'00"	8.76	7.695	5 H.P	Quantity &Quality problem	252.55	Irrigation& Domestic Perennial	Fully weathered formation Irregular(Square well)
15 BW	Panchayat Bore well Plachimada Colony	10°38'38" 76°49'15"		3.375	H.P		92.40		Near south east corner of the company
16 OW	Sri.K.P Balan, Plachimada	10°39'07" 76°49'12"	2.66	1.37	Pulley	Quality problem	348.50	Domestic Circular	Within the paddy field. North of the canal

17 OW	Sri.Gopalan.K, Kambalathara	10°38'30" 76°49'29"	13.06	11.53	1 H.P	Quantity problem	571.50	Domestic & Irrigation	
18 BW	Inside the Coco-Cola Company-No: 3/6	ONLY WATER QUALITY Monitoring							
19 BW	Inside the Coco-Cola Company-No: 5/6	ONLY WATER QUALITY Monitoring							
20 OW	Inside the Coco-Cola Company (OW-1)	10°38'53" 76°49'18"	8.90	1.813					Well with in the company
21 OW	Government Puramboke	10°39'03" 76°49'19"	1.42	0.765	No pump		285.45	Domestic Circular	Near to a branch canal
22 OW	Meenakshi Amman, Kambalathara	10°38'48" 76°49'35"	8.45	3.070	5 H.P		447.10	Irrigation & Domestic Square	Near to reservoir (Kambalathara)
23 BW	BW-6, Within the Coco-Cola Company	10°38'50" 76°49'20"		5.565					BW No.6 With in the company
24 OW	Inside the Coco-Cola Company (OW-2)	10°38'48" 76°49'19"	11.0	2.95					

GROUNDWATER LEVEL FLUCTUATION DATA FROM THE OBSERVATION WELLS AROUND COCA-COLA FACTORY NEAR PLACHIMADA IN PERUMATTY GRAMA PANCHAYAT, PALAKKAD DISTRICT

Date	Depth to water level below ground level in metres																				
	Well No: 1*	3	4	5*	6	7	8	9*	10	11	12*	13*	14	15*	16*	17	20	21*	22	2	24
27.03.02	7.32	7.00	-	7.65	8.45	5.40	6.30	4.40	6.15	3.50	Nil	4.05	6.90	Nil	1.40	11.50	4.60	1.00	9.80		-
29.10.02	5.67	7.35	5.55	8.63	3.81	3.77	4.68	3.35	2.76	4.20	Nil	3.07	8.16	7.46	1.43	11.85	2.34	0.65	4.14		-
21.11.02	6.45	8.38	-	8.10	5.49	4.13	5.53	3.57	5.00	6.00	8.52	4.05	8.40	No	1.44	11.80	1.37	0.68	6.72		-
21.12.02	6.42	7.52	-	9.36	7.56	3.86	6.11	3.00	4.41	4.03	9.97	3.86	8.30	No	1.43	12.00	2.72	0.74	5.28	-	-
23.01.03	7.43	8.27	12.28	Nil	8.81	4.76	6.20	3.16	5.33	5.20	11.27	4.38	8.47	3.31	1.40	12.66	2.55	0.72	8.28		-
25.02.03	7.25	8.05	32.16	-	9.35	7.73	6.51	3.80	5.47	4.26	11.93	5.64	8.15	3.57	1.46	12.87	3.72	1.31	8.24		-
30.03.03	6.22	8.28	14.98	-	9.13	4.89	6.71	4.77	4.82	3.81	11.34	4.54	7.44	3.01	1.62	12.87	3.68	0.79	7.54		-
13.05.03	6.93	8.23	40.70	-	10.65	8.77	8.70	5.89	5.60	5.37	11.51	5.22	9.64	4.33	2.13	13.27	6.80	1.44	8.26		-
11.07.03	6.59	-	12.24	-	9.85	7.70	6.46	5.06	5.10	5.02	11.01	5.67	8.74	3.92	1.52	Nil	5.16	0.80	6.95		-
30.08.03	4.93	-	7.64	-	5.75	5.69	6.46	4.75	5.57	4.35	No	3.76	No	2.18	1.40	13.42	2.26	0.69	5.61		-
18.10.03	5.56	8.20	6.47	9.58	5.50	2.76	5.14	3.40	2.06	1.34	9.16	3.96	7.68	3.68	1.37	11.51	1.44	0.50	2.20		-
03.12.03	6.55	7.87	7.66	6.98	7.19	2.09	4.55	3.05	3.42	2.17	2.17	4.21	7.26	10.12	1.47	10.80	1.29	0.63	2.21		-
18.12.03	6.76	5.70	12.21	7.39	7.98	6.33	5.88	3.66	4.20	2.87	2.39	4.24	7.75	10.59	1.39	10.94	1.38	0.70	3.20		-
19.01.04	6.61	7.58	21.14	9.15	7.60	6.89	6.01	3.48	4.80	5.07	10.75	3.98	7.69	3.37	1.37	11.53	1.81	0.76	3.07	5.56	2.95
26.01.04	7.37	8.00	20.58	9.48	8.70	7.60	6.53	3.66	5.10	3.08	11.50	4.83	7.95	3.11	1.38	11.50	1.99	0.81	5.05	5.72	3.09
02.02.04	7.30	7.57	16.06	Dry	8.90	6.52	6.54	3.80	5.70	3.15	11.52	4.88	8.00	3.18	1.39	11.66	2.44	0.76	4.30	6.44	3.07
09.02.04	7.37	8.00	16.28	Dry	8.91	7.38	6.67	3.60	5.05	3.20	11.53	4.92	8.00	3.08	1.36	12.02	2.41	0.80	2.57	10.08	3.28
16.02.04	7.47	-	-	-	8.90	-	-	3.99	-	-	11.64	5.10	-	3.82	1.40	11.89	-	0.90	-	-	-
23.02.04	7.52	-	-	-	9.16	-	-	4.42	-	-	11.86	5.18	-	5.23	1.42	12.04	-	0.87	-	-	-
01.03.04	7.60	-	-	-	9.13	-	-	4.76	-	-	11.97	5.26	-	4.64	1.51	12.18	-	0.87	-	-	-
04.03.04	7.58	-	-	-	9.35	-	-	4.83	-	-	12.00	5.35	-	4.05	1.66	12.33	-	0.96	-	-	-
08.03.04	7.64	8.20	29.60	Dry	9.35	5.45	7.18	5.00	5.52	5.35	12.08	5.49	8.60	3.58	1.74	12.40	4.75	0.96	7.47	17.73	4.63
11.03.04	7.56	8.40	NR	Dry	9.60	8.39	7.27	5.10	5.27	5.20	12.12	5.75	-P	4.92	1.85	12.42	3.45	1.05	8.20	7.15	3.79
15.03.04	7.65	8.52	NR	Dry	9.92	7.06	7.35	5.26	4.76	4.56	12.20	5.63	9.00	3.68	1.94	12.52	3.01	1.02	7.59	6.30	3.63

Note: Well no. 2, 18 & 19 are only for water quality monitoring purpose.

* Wells not fitted with pumps

Date	Depth to water level below ground level in metres																				
	Well No: 1*	3	4	5*	6	7	8	9*	10	11	12*	13*	14	15*	16*	17	20	21*	22	23	24
22.0304	7.47	8.70	NR	Dry	10.27	6.20	7.63	5.65	6.00	5.50	12.37	5.84	9.00	3.73	2.08	12.76	2.77	1.13	8.35	5.94	3.64
29.03.04	8.37	8.54	41.65	Dry	10.42	8.50	7.75	5.70	6.05	4.91	12.54	5.91	9.00	3.86	2.12	12.94	2.76	1.30	8.50	6.80	3.70
05.04.04	8.25	8.55	NR	Dry	10.52	8.45	8.22	NR	5.70	5.33	12.72	6.03	9.40	3.95	2.16	12.93	2.78	1.28	8.25	6.45	3.66
12.04.04	8.29	8.60	NR	Dry	10.75	6.90	8.57	NR	5.40	5.30	12.83	6.00	9.30	4.10	2.28	13.20	2.88	1.37	8.45	7.72	3.81
19.04.04	8.26	8.70	NR	Dry	10.99	7.54	9.05	6.36	5.85	5.05	12.89	6.25	10.00	4.19	2.32	13.20	2.88	1.47	8.35	7.72	3.96
26.04.04	8.35	8.63	44.63	Dry	11.04	7.27	Dry	6.58	5.65	5.42	13.05	6.23	9.82	4.54	2.29	13.22	3.10	1.62	8.52	10.36	3.88
03.05.04	8.17	8.74	41.47	Dry	11.07	7.70	Dry	6.79	6.00	5.55	13.06	6.31	9.80	4.24	2.16	Dry	3.13	1.46	8.40	12.96	3.53
10.05.04	NR	8.90	19.10	Dry	10.99	8.48	9.00	6.30	5.31	5.68	12.76	6.03	9.70	3.73	1.55	13.25	2.46	1.10	8.51	4.49	2.98
17.05.04	7.62	8.80	39.20	Dry	10.71	7.20	8.57	5.90	4.03	5.00	12.51	5.98	9.55	4.81	1.50	Dry	2.23	0.89	8.42	4.16	3.02
24.0504	7.45	8.90	15.96	Dry	10.15	6.65	8.12	5.65	3.60	4.95	12.25	5.87	9.35	4.18	1.47	Dry	1.85	1.03	8.29	3.22	2.86
31.05.04	7.20	NR	10.86	Dry	9.46	6.09	7.92	5.60	3.28	5.02	11.87	5.70	9.20	3.49	NR	Dry	1.69	0.99	8.40	2.82	2.71
07.06.04	7.42	Dry	14.72	Dry	9.28	5.63	7.91	5.58	2.97	4.28	11.79	5.63	9.00	3.54	1.50	Dry	1.60	0.90	8.21	2.65	2.73
14.06.04	5.60	Dry	9.28	Dry	7.83	4.60	6.91	4.62	2.51	3.94	10.14	5.15	8.60	2.33	1.25	13.45	1.10	0.65	8.00	2.10	2.11
21.06.04	3.44	8.41	4.83	8.85	4.79	2.81	4.85	3.51	1.37	3.03	8.64	3.90	7.00	2.89	1.39	1020	0.91	0.64	6.22	1.08	1.60
28.06.04	4.39	7.74	4.99	7.40	5.43	1.74	5.56	4.03	1.47	2.56	8.96	3.57	7.00	2.05	1.44	9.98	0.89	0.64	7.38	1.08	1.77
05.07.04	3.85	7.14	2.63	6.29	4.75	1.93	4.72	3.39	1.97	0.78	7.60	2.95	6.60	1.23	1.19	9.19	0.79	0.60	4.44	0.39	1.23
12.07.04	3.85	6.20	2.48	4.39	4.48	3.93	4.28	NR	NR	0.90	7.90	2.85	NR	0.59	NR	8.22	0.82	NR	NR	0.49	1.56
19.07.04	4.31	5.66	2.41	3.90	4.93	2.48	4.22	2.84	0.92	0.76	8.27	2.78	8.10	1.56	1.41	8.20	0.81	0.58	1.74	0.54	0.51
26.07.04	4.63	5.41	2.35	3.73	5.15	2.42	4.66	3.10	0.78	0.70	8.48	2.75	6.80	1.60	1.40	8.22	0.78	0.56	2.43	0.43	1.34
02.08.04	4.23	5.00	2.10	3.36	4.65	2.95	4.28	2.70	1.88	0.70	7.85	2.56	6.90	15.50	1.39	8.30	0.70	NR	1.73	0.34	1.32
09.08.04	2.46	3.13	0.64	1.17	2.70	1.88	3.73	2.22	2.50	1.07	5.95	1.36	5.20	0.91	1.30	5.44	0.61	0.61	1.71	0.00	1.19
16.08.04	2.80	3.00	0.66	1.36	3.11	1.98	3.95	2.72	2.08	1.28	6.31	1.30	5.80	0.97	1.39	5.39	0.65	0.59	1.72	0.25	1.23
23.08.04	2.98	2.98	0.75	1.42	3.38	2.00	5.53	2.97	2.53	1.14	6.40	1.46	5.80	1.23	1.40	5.70	0.66	0.61	2.22	0.38	1.30
30.08.04	3.47	3.25	1.05	1.74	4.07	2.55	5.10	3.33	1.33	0.16	6.88	1.70	7.65	1.22	1.40	6.14	0.75	0.62	1.72	0.67	1.44
06.09.04	4.02	3.55	1.45	2.05	4.71	3.57	6.05	3.00	2.53	0.87	7.37	1.90	7.15	1.38	1.40	6.56	0.77	0.68	2.32	0.74	1.53
13.09.04	4.46	3.76	1.67	2.29	5.25	3.96	5.16	2.57	2.27	1.64	7.89	2.12	7.50	3.68	1.42	6.62	0.78	0.66	4.22	0.83	1.69
20.09.04	4.76	4.00	1.86	2.53	5.74	3.57	5.76	2.99	2.03	3.57	8.33	2.38	7.40	1.52	1.48	7.27	0.82	NR	2.67	0.91	1.86
07.09.04	5.07	5.48	2.08	2.74	6.11	3.45	5.13	2.89	3.55	1.55	8.71	2.52	8.00	1.87	1.46	NR	0.84	0.65	1.72	1.09	1.96

Note: Well no. 2, 18 & 19 are only for water quality monitoring purpose.

* Wells not fitted with pumps

Date	Depth to water level below ground level in metres																			
	Well No: 1*	3	4	5*	6	7	8	9*	10	11	12*	13*	14	15*	16*	17	20	21*	22	23	24
04.10.04	5.30	4.80	1.80	2.87	6.49	2.76	4.71	2.86	2.02	0.89	9.00	2.61	7.20	1.63	1.45	NR	0.83	NR	1.79	0.80	1.94
11.10.04	5.52	8.00	1.85	3.00	6.77	4.90	5.88	3.43	3.08	2.67	9.28	2.78	8.60	1.72	1.47	7.77	0.80	NR	2.56	1.20	1.96
18.10.04	5.68	5.74	1.90	3.13	6.96	3.26	5.55	NR	3.35	2.82	9.49	2.90	7.10	1.74	1.48	7.99	0.80	NR	1.85	1.29	3.0-
25.10.04	5.83	5.83	2.11	3.27	7.15	3.26	5.53	3.11	3.46	2.60	9.70	3.02	7.00	1.80	1.41	8.19	0.85	NR	1.73	1.28	3.13
01.11.04	6.00	5.52	2.15	3.45	7.35	3.35	4.32	3.00	2.00	2.68	NR	3.10	7.10	NR	1.37	8.10	0.86	NR	1.90	1.35	2.13
09.11.04	6.00	5.75	2.23	3.48	7.52	3.45	4.85	3.44	1.69	3.36	10.00	3.17	7.40	1.85	1.43	8.44	0.93	NR	2.30	1.25	2.05
16.11.04	6.12	6.97	2.46	3.58	7.78	3.72	5.03	3.50	1.63	3.32	10.18	3.25	7.00	2.12	1.43	8.57	0.92	NR	2.27	1.34	2.08
22.11.04	6.25	6.38	2.85	3.72	7.91	5.58	5.62	3.20	3.83	2.45	10.29	3.33	7.70	1.99	1.43	8.68	0.93	0.66	1.79	1.36	2.20
29.11.04	6.38	7.03	3.22	3.94	8.07	5.31	6.00	2.95	3.98	2.15	10.44	3.50	7.50	2.12	1.46	8.91	0.93	0.72	1.72	1.70	2.43
06.12.04	6.54	8.08	3.85	4.18	8.27	4.05	5.43	3.06	3.20	2.72	10.61	3.65	8.00	2.19	1.44	8.98	0.96	0.68	4.10	1.62	2.47
13.12.04	6.75	7.58	4.42	4.46	8.32	6.98	5.99	3.28	3.62	4.45	10.74	3.78	7.50	2.27	1.43	9.19	0.88	0.68	2.57	1.81	2.54
20.12.04	6.82	7.35	4.14	4.80	8.46	5.65	5.46	3.32	4.30	4.76	10.94	3.84	8.24	2.38	1.43	9.38	0.99	0.66	1.73	1.93	2.63
27.12.04	6.95	6.86	4.21	5.18	8.20	6.28	5.43	3.15	4.15	4.10	11.19	4.03	8.50	3.10	1.41	9.70	1.00	0.65	4.43	2.16	2.72
03.01.05	7.08	7.85	4.48	5.46	8.78	5.44	5.25	3.00	3.60	4.21	11.37	4.10	7.40	2.66	1.42	10.06	1.00	0.75	5.22	2.20	2.78
10.01.05	-	-	-	-	8.93	6.78	6.20	3.30	-	-	11.50	4.25	-	2.79	1.45	10.32	1.13	0.85	5.64	2.37	2.83

Note: Well no. 2, 18 & 19 are only for water quality monitoring purpose.

* Wells not fitted with pumps

Appendix II C

Weekly Groundwater Level Data as Recorded from Observation Wells Located in the Vicinity of Hindustan Coca Cola Beverages Private Limited, Palakkad.

Sl No.	Date of Observation	Number of Days since start	Depth to Water Level Below Measuring Point in Metres								
			OPEN WELLS							BORE WELLS	
			(Not Fitted with Pumps)				(Fitted with pumps but Only for Domestic Use)		(Fitted with pumps that is not used now)	(Fitted only with Hand pumps)	
			9	13	16	21	6	17	1	12	15
1	19/01/04	0	3.48	3.98	1.37	0.76	7.67	11.53	6.62	10.75	3.37
2	26/01/04	7	3.66	4.83	1.38	0.81	8.70	11.50	7.37	11.50	3.11
3	02/02/04	14	3.80	4.88	1.39	0.76	8.90	11.66	7.30	11.52	3.18
4	09/02/04	21	3.60	4.92	1.36	0.80	8.91	12.02	7.37	11.53	3.08
5	16/02/04	28	3.99	5.10	1.40	0.90	8.90	11.89	7.47	11.64	3.82
6	23/02/04	35	4.42	5.18	1.42	0.87	9.16	12.04	7.52	11.86	5.23
7	01/03/04	42	4.76	5.26	1.51	0.87	9.31	12.18	7.60	11.97	4.64
8	04/03/04	45	4.83	5.35	1.66	0.96	9.35	12.33	7.58	12.00	4.05
9	08/03/04	49	5.00	5.49	1.74	0.96	9.35	12.40	7.64	12.08	3.58
10	11/03/04	52	5.10	5.75	1.85	1.05	9.60	12.42	7.56	12.12	4.92
11	15/03/04	56	5.26	5.63	1.94	1.02	9.92	12.52	7.65	12.20	3.68
12	22/03/04	63	5.65	5.84	2.08	1.13	10.27	12.76	7.47	12.37	3.73
13	29/03/04	69	5.70	5.91	2.12	1.30	10.42	12.94	8.37	12.54	3.86
14	05/04/04	76	NR	6.03	2.16	1.28	10.52	12.93	8.25	12.72	3.95
15	12/04/04	83	NR	6.00	2.28	1.37	10.75	13.20	8.29	12.83	4.10
16	19/04/04	90	6.36	6.25	2.32	1.47	10.99	13.20	8.26	12.89	4.19

Sl No	Date of Observation	Number of Days since	Depth to Water Level Below Measuring Point in Metres								
			OPEN WELLS							BORE WELLS	
			(Not Fitted with Pumps)				(Fitted with pumps but Only for Domestic Use)		(Fitted with pumps that is not used now)	(Fitted only with Hand pumps)	
			9	13	16	21	6	17	1	12	15
17	24/04/04	97	6.58	6.23	2.29	1.62	11.04	13.22	8.35	13.05	4.54
18	03/05/04	104	6.79	6.35	2.16	1.46	11.07	13.30	8.17	13.06	4.22
19	10/05/04	111	6.30	6.03	1.55	1.10	10.99	13.25	NR	12.76	3.73
20	17/05/04	118	5.90	5.98	1.50	0.89	10.71	DRY	7.62	12.51	4.81
21	24/05/04	125	5.65	5.87	1.47	1.03	1015	DRY	7.45	12.25	4.18
22	31/05/04	132	5.60	5.70	NR	0.99	9.46	DRY	7.20	11.87	3.49
23	07/06/04	139	5.58	5.63	1.50	0.90	9.28	DRY	7.42	11.79	3.54
24	14/06/04	146	4.62	5.15	1.25	0.65	7.83	13.45	5.60	10.14	2.33
25	21/06/04	153	3.51	3.90	1.39	0.64	4.79	10.20	3.44	8.64	2.89
26	28/06/04	160	4.03	3.57	1.44	0.64	5.43	9.98	4.39	8.96	2.05
27	05/07/04	167	3.39	2.95	1.19	0.60	4.75	9.19	3.85	7.60	1.23
28	12/07/04	174	-	2.85	-	-	4.48	8.22	3.85	7.90	0.59
29	19/07/04	181	2.84	2.78	1.41	0.58	4.93	8.20	4.31	8.27	1.56
30	26/07/04	188	3.10	2.75	1.40	0.56	5.15	8.22	4.63	8.48	1.60
31	02/08/04	195	2.70	2.56	1.39	-	4.65	8.30	4.23	7.85	15.50
32	09/08/04	202	2.22	1.36	1.30	0.61	2.70	5.44	2.46	5.95	0.91
33	16/08/04	209	2.72	1.30	1.39	0.59	3.11	5.39	2.80	6.31	0.97

Sl No	Date of Observation	Number of Days since start	Depth to Water Level Below Measuring Point in Metres								
			OPEN WELLS							BORE WELLS	
			(Not Fitted with Pumps)				(Fitted with pumps but Only for Domestic Use)		(Fitted with pumps that is not used now)	(Fitted only with Hand pumps)	
			9	13	16	21	6	17	1	12	15
34	23/08/04	216	2.97	1.46	1.40	0.61	3.38	5.70	2.98	6.40	1.23
35	30/08/04	223	3.33	1.70	1.40	0.62	4.07	6.14	3.47	6.88	1.22
36	06/09/04	230	3.00	1.90	1.40	0.68	4.71	6.56	4.02	7.37	1.38
37	13/09/04	237	2.57	2.12	1.42	0.66	5.25	6.62	4.46	7.89	3.68
38	20/09/04	244	2.99	2.38	1.48	-	5.74	7.27	4.76	8.33	1.52
39	27/09/04	251	2.89	2.52	1.46	0.65	6.11	-	5.07	8.71	1.87
40	04/10/04	258	2.86	2.61	1.45	-	6.49	-	5.03	9.00	1.63
41	11/10/04	265	3.43	2.78	1.47	-	6.77	7.77	5.52	9.28	1.72
42	18/10/04	272	-	2.90	1.48	-	6.96	7.99	5.68	9.49	1.74
43	25/10/04	279	3.11	3.02	1.41	-	7.15	8.19	5.83	9.70	1.80
44	01/11/04	286	3.0	3.10	1.37	-	7.35	8.10	6.00	-	-
45	09/11/04	294	3.44	3.17	1.43	-	7.52	8.44	6.00	10.00	1.85
46	16/11/04	300	3.50	3.25	1.43	-	7.78	8.57	6.12	10.18	2.12
47	22/11/04	307	3.20	3.33	1.43	0.66	7.91	8.68	6.25	10.29	1.99
48	29/11/04	314	2.95	3.50	1.46	0.72	8.07	8.91	6.38	10.44	2.12
49	06/12/04	321	3.06	3.65	1.44	0.68	8.27	8.98	6.54	10.61	2.19
50	13/12/04	328	3.28	3.78	1.43	0.68	8.32	9.19	6.75	10.74	2.27

Sl No	Date of Observation	Number of Days since start	Depth to Water Level Below Measuring Point in Metres								
			OPEN WELLS							BORE WELLS	
			(Not Fitted with Pumps)				(Fitted with pumps but Only for Domestic Use)		(Fitted with pumps that is not used now)	(Fitted only with Hand pumps)	
			9	13	16	21	6	17	1	12	15
51	20/12/04	335	3.32	3.84	1.43	0.66	8.46	9.38	6.82	10.94	2.38
52	27/12/04	342	3.15	4.03	1.41	0.65	8.20	9.70	6.95	11.19	3.10
53	03/01/05	349	3.00	4.10	1.42	0.75	8.78	10.06	7.08	11.37	2.66
54	10/01/05	356	3.30	4.25	1.45	0.85	8.93	10.32	-	11.50	2.74

Appendix III

Water Consumed by Hindustan Coca Cola Beverages Private Limited, Palakkad

Sl No	Weekly interval	Ground water pumped during each weekly interval from the wells within the factory premise														Water brought from external sources in kilo litres	Grand total of water consumed		Raw water Meter reading
		Open wells				Bore wells								Total from all wells					
		In kilo litres		Total from all open wells		In kilo litres						Total from all Bore wells							
		OW-1	OW-2	In kilo litres	As a% of total from all wells	BW-1	BW-2	BW-3	BW-4	BW-5	BW-6	In kilo litres	As a% of total from all wells	In kilo litres per week	In lakh litres per day		In kilo litres per week	In lakh litres per day	
1	12-01-04 to 19-01-04	779.62	432.00	1211.62	62.98	283.32	112.48	152.95	16.73	0.00	146.79	712.27	37.02	1923.89	2.748	677.49	2601.38	3.716	257[illegible]99
2	19-0104 to 26-01-04	820.12	568.20	1388.32	64.88	293.21	151.71	78.17	74.99	0.00	153.40	751.48	35.12	2139.80	3.057	163.60	2303.40	3.291	2257.60
3	26-01-04 to 02-02-04	753.61	869.44	1623.05	56.06	455.25	181.67	269.11	0.06	170.07	196.23	1272.39	43.94	2895.44	4.133	0.00	2895.44	4.136	2902.68
4	02-02-04 to 09-02-04	1146.41	746.40	1892.81	62.29	387.94	198.83	203.42	36.06	161.65	157.89	1145.79	37.71	3038.60	4.341	0.00	3038.60	4.341	305[illegible]48
5	09-02-04 to 16-02-04	1224.74	969.26	2194.00	64.33	516.24	234.35	277.62	0.00	0.00	188.37	1216.58	35.67	3410.58	4.872	0.00	3410.58	4.872	3461.35
6	16-02-04 to 23-02-04	994.75	1040.70	2035.45	57.72	541.24	215.53	317.53	10.53	107.52	298.82	1491.17	42.28	3526.62	5.038	0.00	3562.62	5.038	3553.59
7	23-02-04 to 01-03-04	762.79	618.57	1381.36	59.17	256.71	138.03	249.84	7.31	164.51	136.91	953.31	40.83	2334.67	3.335	867.54	3202.21	4.575	3151.60
8	01-03-04 to 08-03-04	926.04	729.37	1655.41	53.53	264.93	134.59	182.10	12.20	289.70	66.92	950.44	36.47	2605.85	3.723	1254.30	3860.15	5.515	3858.91

Sl.No	Weekly Interval	Ground water pumped during each weekly interval from the wells within the factory premise												Water brought from external sources in kilo litres	Grand total of water consumed		Raw water Meter reading
		Open wells				Bore wells											
		In kilo litres		Total from all open wells		In kilo litres						Total from all Bore wells		Total from all wells					
		OW-1	OW-2	In kilo litres	As a% of total from all wells	BW-1	BW-2	BW-3	BW-4	BW-5	BW-6	In kilo litres	As a% of total from all wells	In kilo litres per week	In lakh litres per day		In kilo litres per week	In lakh litres per day	
9	08-03-04 to 15-03-04	124.96	96.13	221.09	80.43	18.04	10.38	2.90	0.00	3.52	2.87	37.71	14.57	258.80	0.370	0.00	258.80	0.370	250.73
10	15-03-04 to 22-03-04	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-	0.00	0.000	10.18	10.18	0.015	10.51
11	22-03-04 to 29-03-04	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-	0.00	0.000	0.00	0.00	0.00	0.00
12	29-03-04 to 05-04-04	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-	0.00	0.000	36.19	36.19	0.052	37.02
13	05-04-04 to 12-04-04	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-	0.00	0.000	10.67	10.67	0.015	11.30
14	12-04-04 to 19-04-04	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-	0.00	0.000	19.92	19.92	0.028	20.15
15	19-04-04 to 26-04-04	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-	0.00	0.000	49.25	49.25	0.070	48.38
16	26-04-04 to 03-05-04	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-	0.00	0.000	36.90	36.90	0.053	38.59

Sl No	Weekly Interval	Ground water pumped during each weekly interval from the wells within the factory premise												Water brought from external sources in kilo litres	Grand total of water consumed		Raw water Meter reading
		Open wells				Bore wells								Total from all wells			
		In kilo litres		Total from all open wells		In kilo litres						Total from all Bore wells					
		OW-1	OW-2	In kilo litres	As a% of total from all wells	BW-1	BW-2	BW-3	BW-4	BW-5	BW-6	In kilo litres	As a% of total from all wells	In kilo litres per week	In lakh litres per day				
17	03-05-04 to 10-05-04	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-	0.00	0.000	63.27	63.27	0.090	64.07
18	10-05-04 to 17-05-04	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-	0.00	0.00	51.13	51.13	0.073	51.97
19	17-05-04 to 24-05-04	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	0.00	0.00	0.0	-	0.00	0.00	112.88	112.88	0.161	112.40
20	24-05-04 to 31-05-04	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-	0.00	0.00	103.84	103.84	0.148	99.21
21	31-05-04 to 07-06-04	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-	0.00	0.00	95.71	95.71	0.137	90.72
22	07-06-04 to 14-06-04	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-	0.00	0.00	83.49	83.49	0.119	78.98
23	14-06-04 to 21-06-04	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-	0.00	0.00	84.78	84.78	0.121	78.18
24	21-06-04 to 28-06-04	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-	0.00	0.00	117.59	117.59	0.168	107.01

Sl.No.	Weekly Interval	Ground water pumped during each weekly interval from the wells within the factory premise												Water brought from external sources in kilo litres	Grand total of water consumed		Rnw water Meter reading
		Open wells				Bore wells						Total from all wells					
		In kilo litres		Total from all open wells		In kilo litres						Total from all Bore wells		In kilo litres per week	In lakh litres per day				
		OW-1	OW-2	In kilo litres	As a% of total from all wells	BW-1	BW-2	BW-3	BW-4	BW-5	BW-6	In kilo litres	As a% of total from all wells						
25	28-06-04 to 05-07-04	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-	0.00	0.00	101.20	101.20	0.144	91.18
26	05-07-04 to 12-07-04	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-	0.00	0.00	68.57	68.57	0.098	60.06
27	12-07-04 to 19-07-04	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-	0.00	0.00	74.97	74.97	0.107	61.7
28	19-07-04 to 26-07-04	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-	0.00	0.00	76.34	76.34	0.109	70.69
29	26-07-04 to 02-08-04	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	0.00	0.0.0	0.00	-	0.00	0.00	77.05	77.05	0.110	72.28
30	02-08-04 to 09-08-04	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-	0.00	0.00	21.48	21.48	0.031	20.12
31	09-08-04 to 16-08-04	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-	0.00	0.00	10.72	10.72	0.015	8.50
32	16-08-04 to 23-08-04	0.00	0.00	0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	0.00	0.00

Sl.No	Weekly Interval	Ground water pumped during each weekly interval from the wells within the factory premise												Total from all wells		Water brought from external sources in kilo litres	Grand total of water consumed		Raw water Meter reading
		Open wells				Bore wells													
		In kilo litres		Total from all open wells		In kilo litres						Total from all Bore wells							
		OW-1	OW-2	In kilo litres	As a% of total from all wells	BW-1	BW-2	BW-3	BW-4	BW-5	BW-6	In kilo litres	As a% of total from all wells	In kilo litres per week	In lakh litres per day		In kilo litres per week	In lakh litres per day	
33	23-08-04 to 30-08-04	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	0.00	0.00
34	30-08-04 to 06-09-04	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-	0.00	0.00	93.37	93.37	0.133	89.75
35	06-09-04 to 13-09-04	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-	0.00	0.00	143.53	143.53	0.205	135.95
36	13-09-04 to 20-09-04	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-	0.00	0.00	81.33	81.33	0.116	75.32
37	20-09-04 to 27-09-04	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-	0.00	0.00	91.55	91.55	0.131	80.33
38	27-09-04 to 04-10-04	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-	0.00	0.00	85.71	85.71	0.122	75.31
39	04-10-04 to 11-10-04	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-	0.00	0.00	81.38	81.38	0.116	68.44
40	11-10-04 to 18-10-04	0.00	0.00	0.00	-	0.00	0.00	0.00	0.0	0.00	0.00	0.00	-	0.00	0.00	126.35	126.35	0.181	107.11

Sl No	Weekly Interval	Ground water pumped during each weekly interval from the wells within the factory premise												Total from all wells		Water brought from external sources in kilo litres	Grand total of water consumed		Raw water Meter reading
		Open wells				Bore wells													
		In kilo litres		Total from all open wells		In kilo litres						Total from all Bore wells							
		OW-1	OW-2	In kilo litres	As a% of total from all wells	BW-1	BW-2	BW-3	BW-4	BW-5	BW-6	In kilo litres	As a% of total from all wells	In kilo litres per week	In lakh litres per day		In kilo litres per week	In lakh litres per day	
41	18-10-04 to 25-10-04	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-	0.00	0.00	104.63	104.63		86
42	25-10-04 to 01-11-04	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-	0.00	0.00	113.97	113.97		97
43	0.11.04 to 09.11.04	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-	0.00	0.00	76.55	76.55	0.109	64.5
44	09.11.04 to 16.11.04	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-	0.00	0.00	55.05	55.05	0.079	45.43
45	16.11.04 to 22.11.04	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-	0.00	0.00	70.04	70.04	0.100	57.97
46	22.11.04 to 29.11.04	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-	0.00	0.00	29.51	29.51	0.042	24.73
47	29.11.04 to 06.12.04	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-	0.00	0.00	54.69	54.69	0.078	44.91
48	06.12.04 to 13.12.04	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-	0.00	0.00	55.51	55.51	0.079	45.71

Sl No	Weekly Interval	Ground water pumped during each weekly interval from the wells within the factory premise												Total from all wells		Water brought from external sources in kilo litres	Grand total of water consumed		Raw water Meter reading
		Open wells				Bore wells													
		In kilo litres		Total from all open wells		In kilo litres						Total from all Bore wells							
		OW-1	OW-2	In kilo litres	As a% of total from all wells	BW-1	BW-2	BW-3	BW-4	BW-5	BW-6	In kilo litres	As a% of total from all wells	In kilo litres per week	In lakh litres per day		In kilo litres per week	In lakh litres per day	
49	13.12.04 to 20.12.04	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-	0.00	0.00	78.75	78.75	0.113	65.78
50	20.12.04 to 27.12.04	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-	0.00	0.00	118.31	118.31	0.169	95.62
51	27.12.04 to 03.01.05	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-	0.00	0.00	85.67	85.67	0.122	73.15
52	03.01.05 to 10.01.05	0.00	0.00	0.00	-	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-	0.00	0.00	92.35	92.35	0.132	88.80

KERALA STATE
POLLUTION CONTROL BOARD

CONSENT

under
Section 25/26 of Water (Prevention & Control of Pollution) Act

Consentee: M/s Hindustan Coca-cola Beverages (P)L
Moolathara
Kanjikkari P.O
Palakkad - 678 534

Consent No.: W/09/ 137 / 2000

File No PCB/PLKD/CE/32/99

Consentee Industry Institution Hindustan Coco-cola Beverages (p) Ltd

Moolathara

Kanjikkode P.O

Palakkad - 678 534

Village : Moolathara

Taluk : Chittur

District : Palakkad

Survey No. : 969, 970/1, 2, 3, 4, 971, 972/3, 973/2,

~~Ward~~ : 981/2, 3, 991, 992/1, 2, 993/1, 2, 3, 942/2,

Panchayat/~~Municipality~~/~~Municipal Corporation~~ : 996/1, 2, 3, 1495/1, 1496

Perumatti

Category of Industry/ Institution : large/~~medium~~/~~small~~ ✓

Consent fee : Rs. 10000/-

Name, Designation & Address of

1. Occupier : 1. Mr. Sanjeev Gupta Occupier,
2. V. Kishan, Project Controller
Hindustan Coco-cola Beverages Pvt Ltd
Enkay Towers
Udyog Vihar - V
Gurgaon, Haryana - 122016

2. Authorised Agent :

Consent under Section 25/26 of the Water (Prevention & Control of Pollution) Act 1974 and amendments there to and incorporating requirements under other sections of the Act is hereby granted to the consentee

o discharge trade effluent/~~sewage~~ into ..... land ..... for .....
..... irrigation .....
subject to the following conditions.

This consent is valid upto: 31 · 12 · 2001

Conditions:

1. This consent is granted subject to the power of the Board to review and make variation in or revoke the conditions as the Board deems fit as per section 27 of the Act.

2. For renewal of the consent in case of continuance of discharge, application in the prescribed form shall be submitted to the Board between 3 and 4 months in advance of the date of expiry of the consent along with this consent book.

3. No change, deviation or alteration that may affect the quality or location of discharge of effluent is to be made without prior written permission of the Board. Any change in particulars furnished in the application and/or in the identity of the occupier/authorised agent is to be intimated to the Board forthwith.

4. The effluent characteristics should be within the following tolerance limits:

Sl. No.	Characteristic	Unit	Tolerance limit
1.	PH		6.5 to 8.5
2.	Suspended solids	mg/l.l mase	100
3.	Oil and Grease	"	10
4.	BOD (3 days at 27°C)	"	30

Effluent should not contain any other pollutant.

5. Samples of effluent should be collected at least once in. . . ..two.....months.....from the outlet (✗) and analysis, as per standard methods, conducted in laboratories approved by the Board. Daily measurement of quantity of flow of effluent through the outlet (✗) should be made by suitable measuring equipment. Records of effluent analysis and flow measurements should be maintained and made available to the inspecting officers of the Board whenever called for. Effluent monitoring report consisting of effluent analysis and flow measurement data is to be submitted in the specified format to the Head Office and the ~~Regional /~~ District Office of the Board before the 10th of every ... month. Any such other information as may be called for as per the statutes is to be furnished promptly.

alternate

6. The daily quantity of effluent discharge in litre should not exceed the following:

Outlet 1: 800000 (Eight lakh)

Outlet 2:

Outlet 3:

Outlet 4:

7. ~~The effluent is to be discharged through proper dispersion arrangement~~. Proper arrangements for utilization of effluent for irrigation or other forms of disposal onto land are to be provided.

8. Suitable species of trees should be planted and maintained within and along the periphery of the factory premises, forming a green belt to improve the environment.

RENEWAL OF CONSENT

The consent is renewed upto ......31/12/2004..............

....subject to the conditions in

pages........2 - 7........with the changes noted hereunder.

Changes Condition No. 10. The production rate is specified as 561 kl/d of soft drink.

K. V. INDU...

MEMBER SECRETARY

Date 2/4/2002
Seal

Signature
name and designation of
issuing officer

…B/PLKD/HW-5/2001 14-10-2004

ENQUIRY REPORT ON THE APPLICATION FOR AUTHORISATION

UNDER HWM&H RULES

1.Name & address of Industry : M/S. Hindustan Coca-Cola Beverages Pvt. Ltd; Kanjikode P.O; Palakkad - 678 534.

2.Location

i.Village : Moolathara

ii.Local body : Perumatti Grama Panchayath

iii.Taluk : Chittur

iv.District : Palakkad

3.Occupier/Authorised agent : Sri. Janardhan, Plant Manager

4.Operator/Facility owner : —do—

5.Nature of application : Fresh ✓ Renewal

6.Date of application/receipt : 27-9-04

7.Date of commissioning : March, 2000

8.Details of fee remitted : —

9.Date of inspection : 11-10-2004

10.Name of inspecting officer : Smt. C.V. Jayasree, E.E
Sri. T.A. Thankappan, AEE

11.

Sl. No	Waste category No.	Type of waste	Quantity t/y	Mode of disposal* Practised	Mode of disposal* Proposed
1.	Schedule-1 - 34.4	ETP Sludge	50 t/y	Currently stored in HDPE bags which are kept on pallets and covered with tarpaulin sheets. Stored in barrels in a room	Proposed to dispose in secured land fill facility after obtaining authorisation from the Board. Proposed to dispose as per the direction of KSPCB.
2.	Schedule-1 34.3	WTP Sludge	80 t/y		
3	Schedule-1- 35.3	Spent Carbon	4.2 t/y		
4	Schedule-1 5.2	Wastes/residues containing oil	0.5 t/y		

*Recycle, Incineration, Land Disposal (in impervious environment)
Land Dumping (without impervious environment), Transfer/sale/supply, Others (specify).

ANNEXURE-5

Item No. 13:

Hindustan Coca Cola is given permission to choose alternative water purification technology in place of the RO system recommended by the SCMC. However, an appropriate system has to be installed within six months. KSPCB should be informed when the system is being commissioned.

Item No. 14:

The SCMC is serious concerned with the lackadaisical manner in which this matter (of secured landfill) is still being handled by the Government. We are therefore issuing the following directions to the State Government for setting up the TSDF within six months:

1) The state government shall appoint a nodal agency for development of Common TSDF. This may be either the KSIDC or any other appropriate body. The TOR of the nodal agency can be worked out in consultation with the SPCB.

2) Subsidy of Rs.2 crore is available from the MoEF for CHWTSDF subject to matching contribution by the state. The state government shall take up the matter with the central government in this regard after making its own commitment of matching contribution.

3) Identification of land for TSDF shall be made within two weeks and notification to this effect shall be issued within one month. The state government shall make a case before MoEF for seeking exemption of public hearing in view of the urgency of the matter and due to the fact that the proposed TSDF will be located in the already notified industrial area and on a place which is in any case presently used as a dumping site for solid waste.

4) The industries shall make capital contribution of 50% of the cost of the TSDF. State government nodal agency shall be free to engage services of a professional operator for construction, operation and maintenance of TSDF on BOO basis. In this case, the capital contribution of 35% shall be made by the operator and 15% shall be made by the industries. This is along the lines of CETP scheme of MoEF.

5) After notification, the land shall be handed over to the operator within a period of two months starting from today. A suitable agreement (bi-partite or tri-partite) shall be made by the nodal agency. The state government shall provide the land at a nominal rate (say, Rs.1 per sq. mt for a lease period of 50 years) for the project.

6) The operator shall construct, operate and maintain the TSDF strictly in compliance of the Supreme Court order and guidelines issued by MoEF and CPCB.

7) The first cell of the secured landfill of the TSDF shall be ready for operation by March 2005 and the operator shall be prepared to receive the wastes with effect from

No.PCB/H&R/PLKD/257/02 Date: 07.09.2004.

DIRECTION

WHEREAS the factory of the Hindustan Coca Cola Beverages Pvt. Ltd., in Moolathara Village, Kannimara in Palakkad District comes under the purview of the Water (Prevention and Control of Pollution) Act 1974 as amended (hereinafter referred as Water Act) and the Hazardous Wastes (Management and Handling) Rules 1989 as amended up to 2003 (hereinafter referred to as HW Rules);

WHEREAS the Supreme Court of India directed the State Pollution Control Boards vide order dated 14-10-2003 in the Writ Petition No. 657 of 1995 to close down forthwith all the units that are operating without any authorisation or in violation of the conditions of authorisation issued under HW Rules;

WHEREAS the Supreme Court of India vide order dated 14-10-2003 in Writ Petition No. 657 of 1995 constituted a Monitoring Committee under the Chairmanship of Dr. C. Thyagarajan, Senior Secretary, COSTED, Chennai to oversee that the directions of the Hon'ble Court are implemented timely;

AND WHEREAS Supreme Court Monitoring Committee after investigation of the plant on 12-08-2004 directed to install Reverse Osmosis systems to ensure that use of public water for effluent treatment is returned to its original condition for re-use and directed the State Pollution Control Board to issue appropriate directions to the industries in this regard;

NOW THEREFORE, in compliance with the Supreme Court order dated 14-10-2003 in Writ Petition No. 357/95 and in compliance with the directions given by the Supreme Court Monitoring Committee and in exercise of the powers under section 33A of the Water Act, you, the Hindustan Coca Cola Beverages Pvt. Ltd., Moolathara Village, Kanjimari, Palakkad, are hereby directed to take immediate action to install R O Systems to ensure further treatment of the effluent to return it to its original condition for re-use within six months. The proposal with time schedule for implementation in this regard should be submitted to the Board and Central Pollution Control Board, Bangalore within 10 days of the receipt of this direction.

Dated this the 7th day of September 2004.

For and on behalf of the
KERALA STATE POLLUTION CONTROL BOARD

CHAIRMAN

To,

The Plant Manager,
Hindustan Coca Cola Beverages Pvt. Ltd.,
Moolathara Village, Kanjimari. P.O.,
Palakkad – 678 534.

Copy to :-

1. The Environmental Engineer, DO, Palakkad.
2. The Zonal Officer,
   Central Pollution Control Board,
   Bangalore.
3. The Secretary,
   Perumatti Grama Panchayat,
   Perumatti, Palakkad – 678 534.
4. Stock file.

Kind Attn: M S Sheeba, EE ANNEXURE -5 1/14

Hindustan Coca-Cola Beverages Private Limited

Moolathara Village, Kannimari P.O., Chittur Taluk, Palakkad Dist, Pin - 678534
☎ (04923) 232675, 232764, 231831, 232832, 232834 ■ Fax (04923) 232833

Ref: HCCBPL/PCB-18 September 22, 2004

To,
The Chairman,
Kerala State Pollution Control Board,
Pattom P.O.,
Thiruvananthapuram – 695 004

Ref: **Letter from KSPCB PCB/H&R/PLKD/257/02 dated 7.9.2004**

Subject: **Your direction for installation of RO system for further treatment of treated effluent**

Dear Sir,

We are in receipt of directions issued under cover of your above communication regarding the installation of Reverse Osmosis systems for further treatment of treated effluent for returning public water to its original condition for re-use. In this regard, we would like to make the following submissions for your kind perusal and consideration:

1. We are complying with all the requirements of the Water Consent (W/09/137/2000) for treated effluent under the Water (Prevention and Control of Pollution) Act, 1974. The Environmental Engineer from the District Office, Palakkad visits our plant regularly to check our compliance levels and has never reported any non-compliance with respect to Water Consent and any other issues pertaining to operations of Effluent Treatment Plant.

2. The treated water from ETP is used for maintenance of vegetation, gardens and lawn within the premises. **Palakkad District Agri-Horticultural Society has awarded the first prize for best maintenance of insitutional garden to our plant in the Flower, Fruit and Vegetable Show – 2002.** We have also demonstrated that the treated ETP water can sustain aquatic life by maintaining a fish pond.

3. It may also be not out of place to state that, the Directorate of Ground Water, Thiruvananthapuram vide its letter No. T1/767/2002/DGW dated 30/11/2002 has submitted a report to the Board on "Quality monitoring – Coca – Cola Palaghat – reg". The Ground Water Department has assessed about 20 wells which include 5 bore wells as well as 15 open wells around the plant for the quality of water. In page 2 of the report, the Director has categorically stated that "-- It is also reported that all the samples are showing pH well within the limits. As such we cannot observe that the pollution problem if any in the area is due to M/s Coca – Cola factory discharge ---." Enclosed please find copy of this letter for your perusal.

4. Further, the Central Ground Water Board, which is an authority under the Water (Prevention of Pollution and Control) Act, has submitted a detailed report in the month of September 2003 on "Ground Water conditions in and around Coca-Cola Beverages Pvt. Ltd., Company, Plachimada Village, Palakkad district, Kerala". Study was conducted from June 2002 to September 2003 which covered both pre monsoon and post monsoon periods. They have

Hindustan Coca-Cola Beverages Private Limited
Moolathara Village, Kannimari P.O., Chittur Taluk, Palakkad Dist, Pin - 678534
☎ (04923) 232675, 232764, 232831, 232832, 232834 Fax (04923) 232833

taken 45 wells for study purposes. In conclusion portion of the report, they have observed as follows:

a. No cases of complete drying up and abnormal changes in water level were observed in and around the factory.

b. The quality of water samples collected from the dug wells located in and around the factory during Feb' 2003 has been analyzed. It is indicating that the TDS in 78.3% of wells are within the permissible limit of drinking water standard (BIS). No cases of abnormally high TDS has been found in the area and the water is suitable for all purposes.

c. The heavy metal analysis (Cu, As, Hg, Mn etc.,) of the five samples taken from 4 dug wells and bore well shown concentrations below the permissible limit.

d. The EC of treated effluent of the plant has decreased from 2660 in June 2002 to 1352 in February 2003, which shows an improvement in the quality of the treated effluent and is within the permissible limit. The TDS and pH of treated effluent is also within the permissible limits.

e. The rainwater harvesting by constructing percolation tanks, percolation pits, dug cum well, collection of roof water is implemented by the Company.

Enclosed please find copy of the above report for your perusal.

A quick perusal of each of the above reports (mentioned against Point No. 3 & 4) will clearly show that the quantity and quality of water in and around the plant is in no way affected or deteriorated. It may also be important to note that, water quality is in conformity with the standards laid down by the BIS for drinking water. All the above reports have been placed for consideration of the Hon'ble High Court of Kerala in the pending dispute proceedings afore stated and in all such proceedings, the KPCB is a necessary party with complete access to the said reports and submissions.

5. The Company has implemented large-scale rainwater harvesting system in and around the plant. Both surface and roof water harvesting initiatives have been taken in a big way. The Company has been able to re-charge 50% of the water drawn by the plant. By the use of the said system, during the monsoon, the water is used in the process of manufacture and also helps in allowing the water to percolate into the sub-soil thereby contributing to the maintenance of the water table in and around the plant. As a matter of fact, the Company has become a single window live information center for rain water harvesting application in the State of Kerala.

In the above situation, we believe that the RO system for further treatment of treated effluent is not required and unnecessary as we comply with all the applicable legal requirements.

Hindustan Coca-Cola Beverages Private Limited
Moolathara Village, Kannimari P.O., Chittur Taluk, Palakkad Dist, Pin - 678534
☎ (04923) 232675, 232764, 232831, 232832, 232834 ✉ Fax (04923) 232833

We would like to seek clarification from the Board that our company is not the only industry, which is being singled out or discriminated against in as much as the direction issued by the Board for installation and implementing RO systems and that the Board must have surely issued such instruction without any inequitable discrimination.

We also desire to know as to under which provision of Water Act or in compliance of which provision of the Act, the directions under Section 33 A have been issued as the provisions of the Water Act does not prescribe any direction to be given by Board or any Authority for accepting one technology or the other. We therefore would like to place on record and seek clarifications as to the specific provisions of the Act under which the said directions are being issued so as to take necessary steps in compliance thereof.

In any case, it is a matter of record that the operations of the plant have been shut down by the orders of the Local Panchayat and the Hon'ble High Court of Kerala is considering the issues in dispute with the Panchayat. Till the time the plant remains shut and closed from undertaking any operations / manufacturing activity, the directions issued are meaningless and non-est like the other directions issued by the Board for distribution of water, etc.

Moreover, it is respectfully submitted that until and unless the disputes with the Panchayat are not resolved to the satisfaction of all the parties and the plant does not commence its operations and the directions issued by the Board in the communication under reply and any other communication will have to be kept in abeyance till such time the operations are fully started. It will be inequitable and improper to ask the Company to undertake any further investments when the investments of almost Rupees 60 crores made by it for setting up the plant have been jeopardized by certain actions, which are neither legal nor appropriate in accordance with the legal provisions.

We therefore seek the necessary clarifications, as detailed and described hereunder, as also in our earlier communications so that the Company could take all the steps to comply with the directions which are lawfully issued and which facilitate the operations of the Company in accordance with the law.

Thanking you,

Yours sincerely,
for **Hindustan Coca-Cola Beverages Pvt. Ltd.**

N. Janardhan

N.Janardhan
Plant Manager

cc: The Member Secretary, KSPCB, Thiruvananthapuram
The Environmental Engineer, District Office, KSPCB, Palakkad
Mr. D.C. Sharma, Zonal Officer, CPCB, Bangalore
The Chairman and Members, Supreme Court Monitoring Committee

ANNEXURE - G

Kerala State Pollution Control Board
Central Laboratory
Kochi-20.

Analysis Report of the Samples related to Coca Cola company at Palakkadu

Sl .#	Parameters	PCB-5	PCB-10	PCB-1	PCB-2	PCB-4	PCB-6	PCB-7	PCB-41	PCB-15
1.	Colour (APC)		--	Nil	Nil	Nil	Nil	Nil	--	--
2.	Turbidity (NTU)		--	Nil	Nil	Nil	0.10	0.15	--	--
3.	TDS		--	1424	2252	122	1662	1900	--	--
4.	pH		--	7.1	6.9	7.5	7.2	7.1	--	--
5.	T. Hardness	--	--	650	1030	146	710	800	--	--
6.	Chlorides	--	--	400	620	20	460	680	--	--
7.	Sulphates		--	55.0	49.0	14.3	68.5	65.0	--	--
8.	Nitrates-as-N		--	1.25	0.12	1.13	1.38	0.75	--	--
9.	Flourides		--	0.60	1.0	0.45	0.80	0.84	--	--
10.	Mineral Oil		--	BDL	BDL	BDL	BDL	BDL	--	--
11.	Free-Chlorine		--	BDL	BDL	BDL	BDL	BDL	--	--
12.	Phenolic-Compounds		--	BDL	BDL	BDL	BDL	BDL	--	--
13.	Calcium		--	180	340	44.8	184	228	--	--
14	Iron	0.06	4514.0	0.06	0.07	BDL	BDL	0.10	0.25	3163.0
15	Zinc	0.16	471.0	BDL	BDL	BDL	0.31	0.54	BDL	272.2
16	Copper	0.092	196.3	BDL	BDL	BDL	BDL	BDL	BDL	35.1

ANNEXURE - 6

Kerala State Pollution Control Board
Central Laboratory
Kochi-20.

Analysis Report of the Samples related to Coca Cola company at Palakkadu

Sl .#	Parameters	PCB-5	PCB-10	PCB-1	PCB-2	PCB-4	PCB-6	PCB-7	PCB-11	PCB 15
1.	Colour (APC)		--	Nil	Nil	Nil	Nil	Nil	--	--
2.	Turbidity (NTU)		--	Nil	Nil	Nil	0.10	0.15	--	--
3.	TDS	--	--	1424	2252	122	1662	1900	--	--
4.	pH		--	7.1	6.9	7.5	7.2	7.1	--	--
5.	T. Hardness	--	--	650	1030	146	710	800	--	--
6.	Chlorides	--	--	400	620	20	460	680	--	--
7.	Sulphates	--	--	55.0	49.0	14.3	68.5	65.0	--	--
8.	Nitrates-as-N		--	1.25	0.12	1.13	1.38	0.75	--	--
9.	Flourides	--	--	0.60	1.0	0.45	0.80	0.84	--	--
10.	Mineral Oil		--	BDL	BDL	BDL	BDL	BDL	--	--
11.	Free-Chlorine	--	--	BDL	BDL	BDL	BDL	BDL	--	--
12.	Phenolic-Compounds	--	--	BDL	BDL	BDL	BDL	BDL	--	--
13.	Calcium	--	--	180	340	44.8	184	228	--	--
14	Iron	0.06	4514.0	0.06	0.07	BDL	BDL	0.10	0.25	3163.
15	Zinc	0.16	471.0	BDL	BDL	BDL	0.31	0.54	BDL	272.2
16	Copper	0.092	196.3	BDL	BDL	BDL	BDL	BDL	BDL	35.1

measures as state above.

Table 1 : ANALYSIS REPORT OF HINDUSTAN COCA COLA BEVERAGES PVT. LTD., PALGHAT, KERALA

Sl No.	Sample Identification	Metal Concentration				
		Pb	Cd	Cr	Ni	Zn
	Water Sample					
1	Raw Water (mg/l)	0.020	NT	NT	0.160	0.190
2	Treated Water (mg/l)	0.012	0.002	NT	0.006	0.268
	Liquid Effluent					
1	Influent to ETP (mg/l)	0.248	0.004	0.008	0.096	0.074
2	Effluent from ETP (mg/l)	0.034	0.002	NT	0.122	0.746
	Sludge					
1	Sludge from ETP (mg/l)	3471	338.8	759.6	69.6	3810
2	Spent carbon & Hy-flow (mg/l)	2.9	5.2	42.0	196.7	199
3	Lime Sludge from ETP (mg/l)	NT	0.0	17.1	138.2	58.1
4	Recovered sludge from fields (kept in industrial premises) (mg/kg)	696.8	73.8	457.8	92.4	935

Table : 2 **Analysis results of M/S Bengal Beverages Pvt. Limited, Dankuni, West Bengal**

S. No	Source	Heavy metals concentrations	
		Cd	Pb
1.	Raw water (mg/l)	NT	NT
2.	Treated water (mg/l)	NT	NT
3.	Effluent of ETP (mg/l)	0.02	0.11
4.	ETP sludges (mg/kg)	56	1043

Table: 3 **Analysis results of M/s Diamond Beverages, Taratola West Bengal**

S. No	Source	Heavy metals concentrations	
		Cd	Pb
1.	Raw water (mg/l)	NT	NT
2.	Treated water (mg/l)	NT	NT
3.	Effluent of ETP (mg/l)	0.02	0.38
4.	ETP sludges (mg/kg)	69	805

Table: 3 Analysis of M/s PEPSICO, Sonarpur, West Bengal

S. No	Source	Heavy metals concentrations	
		Cd	Pb
1.	Raw water (mg/l)	NT	NT
2.	Treated water (mg/l)	NT	NT
3.	Effluent of ETP (mg/l)	NT	NT
4.	ETP sludges (mg/kg)	32	695

ANNEXURE-8

Schedule II
[*See* rule 3(l)]

List of Waste Constituents with Concentration Limits*

Class A
Concentration limit: □ 50 mg/kg

A1	Antimony and antimony compounds
A2	Arsenic and arsenic compounds
A3	Beryllium and beryllium compounds
A4	Cadmium and cadmium compounds
A5	Chromium (VI) compounds
A6	Mercury and mercury compounds
A7	Selenium and selenium compounds
A8	Tellurium and tellurium compounds
A9	Thallium and thallium compounds
A10	Inorganic cyanide compounds
A11	Metal carbonyls
A12	Napthalene
A13	Anthracene
A14	Phenanthrene
A15	Chrysene, benzo (a) anthracene, fluoranthene, benzo (a) pyrene, benzo (K) fluoranthene. indeno (1, 2, 3-cd) pyrene and benzo (ghi) perylene
A16	halogenated compounds of aromatic rings, e.g. polychlorinated biphenyls. polychloroterphenyls and their derivatives
A17	Halogenated aromatic compounds
A18	Benzene
A19	Organo-chlorine pesticides
A20	Organo-tin Compounds

Class B
Concentration limit: □ 5, 000 mg/kg

B1	Chromium (III) compounds
B2	Cobalt compounds
B3	Copper compounds
B4	Lead and lead compounds
B5	Molybdenum compounds
B6	Nickel compounds
B7	Inorganic Tin compounds
B8	Vanadium compounds
B9	Tungsten compounds
B10	Silver compounds
B11	Halogenated aliphatic compounds
B12	Organo phosphorus compounds

KIND ATTN: Smt. M.S SHEEBA, EE

ANNEXURE - 9

KERALA STATE POLLUTION CONTROL BOARD
PALAKKAD.
Date. 12.8.03
DISTRICT OFFICE

Email: kspcb@asianetindia.com
Telephone: 2318153, 2318154 & 2318155
Annex: 2304642, 2304643
FAX: 2318152

KERALA STATE POLLUTION CONTROL BOARD

PATTOM P.O., THIRUVANANTHAPURAM - 695 004

www.keralapcb.org

In reply please refer to: PCB/HO/HWM/CC-PLT/2003 Date : 7-8-2003

From

The Member Secretary

To

M/s Hindustan Cocoa Cola Beverages (P) ltd
Moolathara village
Chittoor,
Palakkad-6778534

Sub:- **Hazardous waste discharge from the factory- Reg.**

Ref:- This office letter No.PCB/H/EC/PLKD/15/2002 dated 5-8-2003

Sirs,

In continuation to the letter cited it is informed that the sludge sample taken from your factory premises has revealed a cadmium concentration of 201.8mg/kg on analysis by the Board. This quantity of cadmium in the waste is above the limit prescribed under schedule 2 class A of the Hazardous Waste (Management & Handling) Rules, which specifies a maximum concentration limit of 50mg/kg. The waste is hence to be treated as Hazardous Waste. You are requested to take immediate action to stop the supply of this waste to external agencies and also internal use as manure. Whatever waste that has been transported outside should immediately be recovered and stored in secured site within the factory premises itself. Please note that non-compliance with Board's direction can invite severe legal action against the company. A report on the compliance is also to be reported immediately.

Yours faithfully,

MEMBER SECRETARY

Copy to:- EE, Palakkad D.O

(15) Annexure-10

Hindustan Coca-Cola Beverages Private Limited

Moolathara Village, Kannimari P.O., Chittur Taluk, Palakkad Dist, Pin – 678 534
☎ (04923) 232764, 232831, 232833, 232834 ■ Fax (04923) 232833

Ref: HCCBPL/PCB-08

Date: 22nd April, 2004

The Member Secretary,
Kerala State Pollution Control Board,
Pattom PO,
Thiruvananthapuram 695 004.

Sub: Containment Storage Area for Solid Waste Management – Reg
Ref: Your letter no. PCB/H&R/PLKD/257/02 dated 23-2-2004

Dear Sir,

In this regard, we would like to respectfully submit that we had approached you earlier for authorisation of solid waste handling assuming that we need to take approval in principle initially before appointing consultant. Now, we approached Mr. R. Swaminathan, Ex Assistant Director, NEERI, Nagpur & Environmental Management Consultant based at Chennai. He has prepared a detailed technical report on Containment Storage area for solid waste considering all relevant recommendations and guidelines of Ministry of Environment & Forests, Govt. of India.

Please find the detailed engineering plan along with construction details in our report for your kind approval.

We shall be grateful if you could kindly accord approval of constructing for Containment storage area within our factory premises.

We will be glad to clarify incase of any further queries.

Thanking You.

Yours Sincerely

R. Durai Murugan
Quality Assurance Manager.

Cc: The Environmental Engineer, District Office, KSPCB, Palakkad

Encl: Two copies of detailed report on Containment Storage area

ANNEXURE - II

e-mail: kspcb@asianetindia.com Grams : CLEANWATER Fax: 2318152
: 0471- 2318153, 2318154, 2318155, 2312910

KERALA STATE POLLUTION CONTROL BOARD
Pattom P.O., Thiruvananthapuram - 695 004

In reply please refer to: PCB/H&R/PLKD/257/02 Date :19-5-2004

From

The Member Secretary

To

The Hindustan Coca-Cola Beverages
Private Limited,
Kannimari P.O.,
Palakkad -678534.

Sub:- Secured landfill.

Ref:- 1. This office letter of even no. dated 17-9-2003.
2. This office order of even no. dated 23-2-2004.
3. Your letter no. HCCBPL/PCB-08 dated 22-4-2004.

Sir,

You have in your proposal under ref.3,(page 7) stated that ETP sludge generated in your factory is not a hazardous waste. Please note that the said waste is found to be hazardous as per the Board's analysis, and this has already been communicated to you on many occasions.

Further your proposal under ref.3 to construct storage area for storing hazardous waste and selling out the same as manure is not acceptable. You are requested to use the storage area as a temporary measure for storing the present waste till pucca sanitary landfill as per the CPCB guidelines, is provided. Please note that there shall be no delay as your part in constructing a pucca sanitary land fill.

Yours faithfully,

MEMBER SECRETARY

Copy to:- The EE, DO, PLKD.

ANNEXURE - 12

Kerala State Pollution Control Board

Dist. Office, Opp : Dist. Industries Centre, Near Civil Station, Palakkad - 678001.

In reply please refer to: PCB/PLKD/HW-5/2001 20-8-2004

From

The Environmental Engineer

To

M/s. Hindustan Coca Cola Beverages (P) Ltd.,
Kannimari. PO.,
Palakkad – 678 534.

Sub:- Hazardous Waste (Management and Handling) Rules – Regarding

Ref:- 1. Visit of Supreme Court Monitoring Committee on Hazardous Waste
2. Refusal order No. PCB/H&R/PLKD/257/02 dated 23-2-2004 from the Member Secretary

Sir,

During the visit of Supreme Court Monitoring Committee to your unit on 12-8-2004, sludge waste supplied by you as manure to outside agencies could be seen at the property of a nearby farmer. In this connection, you are hereby directed to implement the following measures:

1. Remove the sludge (Effluent Treatment Plant sludge, lime sludge, spent carbon etc.) from the premises of the farmers and fill the place with equal quantity of good soil.
2. Provide drinking water facilities to all local people those who are affected with ground water pollution.

You are requested to apply afresh for authorisation for disposing Effluent Treatment Plant sludge, lime sludge spent carbon, wastes/residues containing oil etc. As per the monitoring committees decision TCLP test on HDPE liner should be done in the presence of a third party. So you are also requested to inform the date of laying of HDPE liner in the secured land fill in advance so that a representative from Central Pollution Control Board, Bangalore as a third party can come and attend for the pressure testing.

Yours faithfully,

ENVIRONMENTAL ENGINEER

ANNEXURE 13

Table-6. Analysis report of well water samples collected from outside the factory compound

Sl.No.	Description	Code	Concentration in mg/l											
			Cd	Pb	Cr	Cu	Fe	Mn	Ni	Zn	P	As	pH	T. Hardness
1	Eastern side Pazhavanal's house	CEW_1	BDL	BDL	BDL	0.05	0.08	0.04	0.10	0.14	BDL	BDL	7.1	1510
2	Eastern side Subramanian's house	CEW_2	BDL	BDL	BDL	BDL	BDL	BDL	0.08	0.16	BDL	BDL	7.2	1380
3	Eastern side Panchayat well	CEW_3	0.02	BDL	BDL	0.04	BDL	0.05	BDL	0.08	BDL	BDL	7.1	1110
4	Eastern side bore well	CEW_4	BDL	BDL	BDL	BDL	BDL	BDL	0.04	0.15	BDL	BDL	7.2	1110
5	Western side Plachimada colony	CWW_1	BDL	BDL	BDL	BDL	BDL	BDL	BDL	0.03	BDL	BDL	7.8	820
6	Western side Arusami's house	CWW_2	BDL	BDL	BDL	0.03	BDL	0.04	BDL	BDL	BDL	BDL	6.9	1260
7	Manikyam Chettiar's house	WW_1	0.01	BDL	BDL	0.06	BDL	BDL	BDL	BDL	0.50	BDL	7.2	600

ITEM 2(c)

ANNEXURE - 14

KERALA STATE POLLUTION CONTROL BOARD

Analysis Report - WATER/EFFLUENTS/ SOLID WASTE		No 17439	Date 20.10.05
Source	Hindustan Coca Cola Palakkad	Sample received from	EE, D.O, Palakkad
Date of sample Collection	-		
Ref. No.	PCB/PLKD/W-217 dt 3.10.05	Period of analysis	5-10-05 to 19-10-05
Date of Receipt	4.10.05		
Scientist-in-charge of analysis		C.K. SHAJI, AES	

Sl. No.	Determinand	Unit	Value				
			Sample No.				
			PCB 1	PCB 2	PCB 3	PCB 4	PCB 5
1	pH		7.14	7.42	7.04	7.44	7.28
2	B.O.D	mg/l	0.4	0.3	0.3	0.5	0.7
3	Colour	Hazen	BDL	BDL	BDL	BDL	BDL
4	T.D.S	mg/l	610	4000	3010	1720	2790
5	Total Hardness	"	370	1900	1620	880	1580
6	Calcium Hardness	"	220	1180	1160	640	1240
7	Mg Hardness	"	110	720	460	240	340
8	Chlorides	"	218	1500	1300	550	1030
9	Sulphate	"	36	36	39	38	41
10	Nitrate as N	"	0.34	10.46	9.9	9.45	5.57
11	Copper	"	BDL	BDL	BDL	BDL	BDL
12	Iron	"	BDL	BDL	BDL	BDL	BDL
13	Cadmium	"	BDL	0.002	0.007	0.004	0.008
14	Lead	"	BDL	0.30	0.58	0.24	0.38
15	Zinc	"	BDL	0.02	0.03	0.03	BDL
Details of samples							
Remarks: Contd → 1743							

V. Ramachandran
Environmental Scientist

KERALA STATE POLLUTION CONTROL BOARD

Analysis Report - WATER/EFFLUENTS/ SOLID WASTE		No. 17440	Date
Source		Sample received from	
Date of sample Collection			
Ref. No	Contd from 17439	Period of analysis	
Date of Receipt			
Scientist-in-charge of analysis			

Sl. No.	Determinand	Unit	Value				
			Sample No.				
			PCB1	PCB2	PCB3	PCB4	PCB5
1	Hexavalent Chromium	mg/l	BDL	BDL	BDL	BDL	BDL
2	Nickel	"	BDL	BDL	0.008	0.CA	0.11
3	Manganese	"	BDL	BDL	BDL	BDL	BDL
4							
5							
6							
7							
8							
9							
10							
11							
12							
13							
14							
15							
Details of samples							
Remarks :							

V. Ramachandran
Environmental Scientist

ANNEXURE - 15

Telephone Nos.
CES : 0484 - 220 7781
EPABX : 0484 - 220 7783 - 86
Fax : 0484 - 220 7783
E-mail : kspcbcl@asianetindia.com

KERALA STATE PC LLUTION CONTROL BOARD

CENTRAL LABORATORY, GANDHI NAGAR, KOCHI - 682 020.

കേരള സംസ്ഥാന മലിനീകരണ നിയന്ത്രണ ബോർഡ്
സെൻട്രൽ ലാബോറട്ടറി, കൊച്ചി - 20
www.keralapcb.org

ANA YSIS REPORT

Analysis Report No	100737	**Date**	23.08.2007
Ref. No.	PCB/PLKD/W-217/2001 d 21.8.07	**Date of Collection**	21.08.2007
Received From	District Office, Palakk d	**Date of Receipt**	22.08.2007
No of Sample	7	**Period of Analysis**	22.08.07 to 23.08.07
Source	Well water near Hindustan Coca Cola Pvt Ltd	**Scientist in Charge**	C K Shaji, AES

Sl.No	Parameter	Unit	PCB 11	PCB 12	PCB 13	PCB 14	PCB 15	PCB 16	PCB 17
1	Cadmium	mg/l	BDL	BDL	BDL	BDL	BDL	BDL	BDL
2	Chromium Total	mg/l	BDL	BDL	BDL	BDL	BDL	BDL	BDL
3	Chromium(Hexavalent)	mg/l	BDL	BDL	BDL	BDL	BDL	BDL	BDL
4	Copper	mg/l	BDL	BDL	BDL	BDL	BDL	BDL	BDL
5	Iron	mg/l	BDL	0.06	BDL	BDL	0.1	BDL	BDL
6	Lead	mg/l	BDL	BDL	BDL	BDL	BDL	BDL	BDL
7	Mercury	mg/l	BDL	BDL	BDL	BDL	BDL	BDL	BDL
8	Manganese	mg/l	BDL	BDL	BDL	0.08	0.05	BDL	BDL
9	Nickel	mg/l	0.05	0.04	0.05	0.02	BDL	BDL	BDL
10	Zinc	mg/l	0.06	0.04	0.05	0.08	0.04	0.02	0.04

Remarks

ANNEXURE - 10

KERALA STATE POLLUTION CONTROL BOARD

Analysis Report - WATER/EFFLUENTS/ SOLID WASTE		No. 31360	Date 9.12.2009
Source	Well water samples nearby Coca Cola Beverages (P) Ltd.	Sample received from	AE
Date of sample Collection	19.11.09		
Ref. No.		Period of analysis	19.11.09 &
Date of Receipt	19.11.09.		30.11.09.
Scientist-in-charge of analysis			

Sl. No.	Determinand	Unit	Value				
			Sample No.				
			PCB6	PCB7			
1	pH	–	7.2	7.4			
2	TDS	mg/l	500	700			
3	conductivity	µs/cm	800	1000			
4	colour.	Hazen	5	5.			
5	Dissolved oxygen	mg/l	5.2	7.3			
6	Hardness as CaCO3	"	90.0	110.0			
7	Calcium Hardness as Ca	"	79.0	[illegible]			
8	Magnesium hardness as Mg	"	10.0	15.0			
9	Sulphide	"	21.0	18.0			
10	Chloride	"	32	26			
11	Alkalinity	"	32	44			
12	Total Coliform	CFU/100 ml	60	Nil			
13	Fecal coliform.	CFU/100 ml	Nil	Nil			
14							
15							

Details of samples PCB6 – Well water of Sri. Manikyam chettiyar
PCB7 – Well water of Sri Arumugam Gouder.

Remarks :

Sd/-
For Assistant Engineer
District Office
Kerala State Pollution Control Board
Palakkad.

Analysis report of well water samples

Sl. No.	Sample No.	Location	Cu (mg/l)	Cd (mg/l)	Zinc (mg/l)	Lead (mg/l)	Nickel (mg/l)	Iron (mg/l)	Cr (mg/l)	Chloride (mg/l)	Fluoride (mg/l)
1	PCBK1	Panchayath Open well, Karadikunnu, Near house of Smt. Fathima	0.028	BDL	BDL	0.142	BDL	0.04	0.023	290	0.99
2	PCBK2	Panchayath Open well, Karadikunnu, Near house of Smt. Shaliha	0.017	BDL	BDL	0.058	BDL	BDL	BDL	650	0.95
3	PCBK3	Mr. Raveendranath's Open well	BDL	BDL	BDL	0.051	BDL	0.04	BDL	76	0.79
4	PCBK4	Mr. Devaraj's Open well	BDL	BDL	BDL	0.075	0.013	BDL	BDL	300	1.09
5	PCBK5	Mr. Pazhanimala's Open well	BDL	BDL	BDL	0.028	0.016	0.07	BDL	160	0.85
6	PCBK6	Mr. Sudhevan's Open well	BDL	BDL	BDL	BDL	0.019	0.22	BDL	118	0.79
7	PCBK7	Mr. Bala's Open well	0.015	BDL	BDL	BDL	0.032	BDL	0.011	60	1.3
8	PCBK8	Madhavanagar Colony Open well	BDL	BDL	BDL	BDL	BDL	0.05	0.015	20	0.54
9	PCBK9	Mr. Natarajan's Bore well	BDL	BDL	BDL	0.233	BDL	BDL	0.028	90	1.2
10	PCBK10	Panchayath Open well, Vijaya Nagar Colony	0.013	BDL	BDL	0.209	BDL	BDL	0.026	460	0.97
11	PCBK11	Panchayath Open well, Rajiv Nagar Colony, Near House of Mr. Ganesh	0.047	BDL	BDL	0.12	BDL	BDL	0.025	60	0.79
12	PCBK12	Mr. Shahual Hameed's Open well	0.126	BDL	BDL	0.12	BDL	BDL	0.014	90	0.83
13	PCBK13	Mr.Rangaswamy's Open well	0.187	BDL	BDL	0.115	BDL	BDL	0.02	70	0.73

14	PCBK14	Mr. Gopalan's Open well	0.203	BDL	BDL	0.159	BDL	BDL	0.013	24	1.2
15	PCBK15	Mr. Dharmaraj's Open well	0.189	BDL	BDL	0.154	BDL	BDL	0.015	48	1.01
16	PCBK16	Mr. Lakmana Gouder's Open well	0.172	BDL	BDL	0.17	BDL	BDL	0.015	54	0.76
17	PCBK17	Panchayath Open well, Kochikkad, Near House of Mr. Appuchamy	0.158	BDL	BDL	0.168	BDL	0.096	BDL	13	0.51
18	PCB1	Panchayath Open well, Karadikunna, Near house of Smt. Fathima	0.140	BDL	BDL	0.208	0.023	0.39	0.011	276	1.06
19	PCB2	Mr. Shahul Hameed's Open well	0.126	BDL	BDL	0.265	0.01	BDL	0.023	72	0.84
20	PCB3	Smt. Pazhanathal's Open well	0.119	BDL	BDL	0.215	0.024	0.015	0.03	500	0.97
21	PCB4	Mr. Subramaniyam's Open well	0.118	BDL	BDL	0.042	0.01	0.08	0.017	188	1.06
22	PCB5	Smt. Mayilamma's Open well	0.117	BDL	BDL	0.035	0.024	BDL	0.016	260	0.91
23	PCB6	Mr. Manikyam Chettiyar's Open well	0.112	BDL	BDL	0.028	BDL	BDL	0.013	60	0.74
24	PCB7	Mr. Aruchamy Gouder's Open well	0.105	BDL	BDL	0.083	BDL	0.39	0.019	42	0.79

2015 11:24 KSPCB,PALAKKAD 0491 2505542

line, and ethyl acetate. Flash point 210° F (99° C). Combustible.
Grades: 95% min.
Containers: Steel drums; carboys; tank cars.
Hazard: May be injurious to eyes.
Use: Manufacture of syntbetic rubber and plastics, also in the synthesis of pharmaceuticals, and in insecticides and fungicides; nonionic detergent.
See also thiol.

lauryl methacrylate $CH_2:C(CH_3)COO(CH_2)_{11}CH_3$. The commercial material is a mixture, containing also lower and higher fatty derivatives. Boiling range 272–344° C; density 0.868 g/ml; flash point 270° F (132° C) (COC). Combustible. Probably low toxicity.
Containers: Drums.
Uses: Polymerizable monomer for plastics, molding powders, solvent coatings, adhesives, oil additives; emulsions for textile, leather, and paper finishing.
See also acrylic resin.

lauryl pyridinium chloride $C_5H_5NClC_{12}H_{25}$.
Properties: Mottled tan semisolid. Soluble in water and organic solvents. Flashpoint 347° F (175° C); combustible.
Grade: Technical, contains higher and lower fatty acid derivatives.
Uses: Cationic detergent; dispersing and wetting agent; ingredient of fungicides and bactericides.

lauryl pyridinium 5-chloro-2-benzothiazyl sulfide. See "Vancide 26EC."

lautal. A hard aluminum alloy containing 4–5% copper, 1.5–2% silicon and fractional percentages of other metals such as iron, manganese, or magnesium.

"Lauxein."[58] Trademark for casein and soybean adhesives, dry powders good for low-temperature applications and glue bonding where water-resistance is desired.
Containers: Multiwall bags and fiber drums.
Uses: Bonding and cold-setting glues used in the manufacture of plywood furniture.

"Lauxite."[58] Trademark for a series of urea, phenolic, melamine and resorcinol resins. Available as dry powders or liquids. Used for bonding, cold-setting and impregnating adhesives and glues for furniture, plywood and aircraft; hot and cold pressing; radio frequency equipment; molding of diversified components from granulated wood.

lavandin oil. See lavender oil.

lavender oil. An essential oil used in perfumery. 35% ester content as linalyl acetate required. Terpeneless grade has about twice the concentration of the natural oil.

"Lavenol."[188] Trademark for a series of synthetic lavender oil substitutes of various types.

Lavoisier, Antoine Laurent (1743-1794). French chemist generally regarded as the "father" of chemistry. His "Traité Elementaire de Chimie" (1789) listed 30 elements, clarified the nomenclature of acids, bases and salts, and described the composition of numerous organic substances. He erroneously believed that oxygen is the characteristic element of acids. However, his fundamental work on combustion, as a result of which he identified and named nitrogen (azote), and on the separation of hydrogen from water by a unique reduction experiment carried out in a heated gun barrel, earned him a leading position among early chemists. (See also Mendeleéf).

lawrencium Lr A synthetic radioactive element with atomic number 103, discovered in 1961. Atomic weight 257. Only one other isotope is known (256). the 257 isotope has a half-life of 8 seconds. It has been made by bombarding californium with boron ions. It exhibits alpha radiation. See actinide series.

lay-up. In the reinforced plastics industry, a term used to refer to placement of the reinforcing material in the mold.

LC_{50} (lethal concentration, 50%). That quantity of a substance administered by inhalation that is necessary to kill 50% of test animals exposed to it within a specified time. This test applies not only to gases and vapors but to fume, dusts and other particulates suspended in air.

LCL. Abbreviation for "less than carload lot"; used by shippers, traffic managers, railroads, etc.

LD_{50} (lethal dose, 50%). That quantity of a substance administered either orally or by skin contact necessary to kill 50% of exposed animals in laboratory tests within a specified time. A substance having an LD_{50} of less than 50 mg per kg of body weight is rated highly toxic by toxicologists.

leaching. See solvent extraction.

lead Pb (from Latin plumbum). Metallic element of atomic number 82, Group IVA of the periodic table. Atomic weight 207.2; valences 2, 4; 4 stable isotopes. The isotopes are the end products of the three series of natural radioactive elements uranium (206), thorium (208), and actinium (207).
Properties: Heavy, ductile, soft gray solid. Sp. gr. 11.35; m.p. 327.4° C; b.p. 1755° C; soluble in dilute nitric acid; insoluble in water but dissolves slowly in water containing a weak acid; resists corrosion; relatively impenetrable to radiation. Poor electrical conductor; good sound and vibration absorber. Non-combustible.
Occurrence: U.S., Mexico, Canada, S. America, Australia, Africa, Europe.
Derivation: Roasting and reduction of galena (lead sulfide), anglesite (lead sulfate), and cerussite (lead carbonate). Also from scrap.
Purification method: Desilvering (Parkes process); electrolytic refining (Betts process); pyrometallur-

(3) Para-hydroxyphenylglycine (q.v.). A photographic developer.

glycocholic acid (cholylglycine) $C_{26}H_{43}NO_6$. The sodium salt occurs in bile, where it is formed by the combination of glycine with cholic acid (q.v.). It aids in the digestion and absorption of fats.
Properties: Crystallizes from water with 1.5 moles H_2O. Becomes anhydrous at 100°C. Anhydrous form decomposes at 165°C. Practically insoluble in water. The sodium salt is soluble in water and alcohol. Nontoxic.
Derivation: Precipitation from bile.
Uses: Biochemical research; food emulsifying agent (up to 0.1%).

glycocoll. See glycine (1).

glycocoll-para-phenetidine hydrochloride. See phenocoll hydrochloride.

glycogen (animal starch; liver starch) $(C_6H_{10}O_5)_n$. A glycose polysaccharide; the storage carbohydrate of the animal organism, found especially in the liver and rested muscle.
Properties: White powder; forms a dextrorotatory colloidal solution; insoluble in alcohol; soluble in water; sweet taste; nontoxic.
Derivation: Isolated from liver by treatment with 30% sodium hydroxide solution.
Use: Biochemical research.

glycogenic acid. See gluconic acid.

glycol. See ethylene glycol; it is also a general term for dihydric alcohols, which are physically and chemically similar to glycerol (q.v.).

glycol bromohydrin. See ethylene bromohydrin.

glycol carbonate. See ethylene carbonate.

glycol chlorohydrin. See ethylene chlorohydrin.

glycol diacetate. See ethylene glycol diacetate.

glycol dibutyrate. See ethylene glycol dibutyrate.

glycol diformate. See ethylene glycol diformate.

glycol dimercaptoacetate (ethylene glycol bisthioglycolate) $HSCH_2COOCH_2CH_2OOCCH_2SH$.
Properties: Liquid; sp. gr. 1.313; b.p. 137–139°C (2 mm); refractive index 1.519 (25/D); insoluble in water; soluble in alcohol, acetone, and benzene. Combustible.
Uses: Crosslinking agent for rubbers; accelerator in curing epoxy resins.

glycol dimercaptopropionate [ethylene glycol bis(mercaptopropionate)] $(HSCH_2CH_2COOCH_2)_2$.
Properties: Liquid; sp. gr. 1.219 (25°C); b.p. 175–195°C; refractive index 1.5150 (25/D); insoluble in water and hexane; soluble in alcohol, acetone and benzene. Combustible.
Uses: Crosslinking agent for polymers, especially epoxy resins; chemical intermediate.

glycol dimethyl ether. See ethylene glycol dimethyl ether.

glycol dipropionate. See ethylene glycol dipropionate.

glycolic acid. See hydroxyacetic acid.

glycol monoacetate. See ethylene glycol monoacetate.

glycolonitrile (glyconitrile; formaldehyde cyanohydrin) $HOCH_2CN$.
Properties: Mobile, colorless, odorless oil. Supplied commercially as a 70% aqueous solution stabilized with phosphoric acid. B.p. 183°C (slight decomposition); m.p., does not solidify when cooled to −72°C. Sp. gr. 1.1039 (19°C); refractive index (n 25/D) 1.4090; electrolytic dissociation constant $K = 0.843 \times 10^{-5}$ (25°C).
Derivation: Formaldehyde and hydrocyanic acid.
Containers: (70% solution) Drums; tank cars.
Hazard: Toxic by ingestion, inhalation, and skin absorption.
Uses: Solvent and organic intermediate.

glycol propionate. See ethylene glycol dipropionate.

glycol stearate. See ethylene glycol monostearate.

glycothiourea. See 2-thiohydantoin.

glycolylurea. See hydantoin.

glycolysis. Enzymatic (anaerobic) decomposition of sugars, starches and other carbohydrates, with release of energy, a type of reaction occurring in yeast fermentation and in certain metabolic processes. Lactic acid is one of the products formed.

"Glycomuls."[73] Trademark for a series of sorbitol fatty acid esters, ranging from liquids to relatively high-melting wax-like solids and with varying surface-active characteristics. Used in foods, cosmetics, pharmaceuticals, chemical specialties.

glyconic acid. See gluconic acid.

glyconitrile. See glycolonitrile.

glycoside. One of a group of organic compounds, of abundant occurrence in plants, which can be resolved by hydrolysis into sugars and other organic substances, known as aglycones. Specifically glycosides are acetals which are derived from a combination of various hydroxy compounds with various sugars. They are designated individually as glucosides, mannosides, galactosides, etc. Glycosides were formerly called glucosides, but the latter term now refers to any glycoside having glucose as its sugar constituent.

glycyl alcohol. See glycerol.

glycyrrhizin. A glycoside of the triterpene group, the active principle of licorice root, from which it is extracted. It has an intensely sweet taste and is used

ANNEXURE – 18

10/2/05

e-mail: kspcb@asianetindia.com
Telephone: 304642, 304643
312910, 2318153, 54, 55
FAX: 2318152

KERALA STATE POLLUTION CONTROL BOARD

Pattom P.O., Thiruvanai thapuram-695 004.
www.keralapcb.org

No.PCB/HO/HW/PLKD/542/04 Date: 8-2-2005

From

The Member Secretary.

To

M/s. Hindustan Coca Cola Ltd.,
Moolathara village,
Kannimari P.O.
Chittur,
Palakkad.

Sub: Supply of piped drinking water.

Ref: Your letter dated 22-1-2005

Sirs,

You have been putting forth arguments stating that you have not polluted the surroundings of your factory. This is against the fact.

The Board had earlier detected high concentration of cadmium in your solid waste. As the concentration exceeded the limit of 50mg/kg, you were directed to treat this waste as hazardous, and to provide secured landfill facility as per the CPCB guidelines. Prior to detection of cadmium, you have been supplying the solid waste as manure to farmers. This solid waste has hence been extensively used in farmlands in your neighborhood.

During the study conducted by the Board, 0.02mg/l of cadmium was detected in the common panchayat well on the eastern side of the factory and 0.01 mg/l was detected in the well of Sri Manikyam Chettiyar, who had used the solid waste as manure. This proves beyond doubt that water in the

surrounding area has been polluted owing to operation of your industrial unit.

You are once again directed to comply with the direction of the Supreme Court Monitoring Committee and to supply piped drinking water to the affected community. The list of persons affected has already been prepared by the Local Area Environment Committee .

Yours faithfully,

MEMBER SECRETARY

Copy to: The EE, DO, PLKD

ANNEXURE -19

MINUTES OF THE MEETING OF LOCAL AREA ENVIRONMENT PROTECTION COMMITTEE (CONSTITUTED AS PER PROCEEDINGS NO. PCB/HO/HWM/SCMC/498/04 DATED 14.09.2004 OF THE MEMBER SECRETARY, KERALA STATE POLLUTION CONTROL BOARD, THIRUVANANTHAPURAM) HELD ON 14.10.2004 IN THE CHAMBER OF THE ENVIRONMENTAL ENGINEER, KERALA STATE POLLUTION CONTROL BOARD, DISTRICT OFFICE, PALAKKAD.

The meeting commenced at 10.00 AM with Smt. C.V. Jayasree, Environmental Engineer, presiding. List of members who attended the meeting is attached. Sri. P.A. Pouran, Advocate explained to the members about the random checking of affected wells conducted on 9.10.2004 by the committee members. He said that about 40 affected families were inspected and 3 public wells (two Panchayath wells and one private well) apart from other private wells were observed as contaminated during the inspection. The total number of applications received from affected persons were shown to the members as given below:

1. Perumatty Grama Panchayath
   - Ward No. IV - 55 Nos.
   - Ward No. V - 25 Nos.
   - Ward No. VI - 2 Nos.
   - Ward No. VII - 2 Nos.
   - Ward No. VIII - 199 Nos.
   - Ward No. IX - 142 Nos.
   - Ward No. XI - 17 Nos.
2. Pattanchery Grama Panchayath
   - Ward No. I - 5 Nos.
   - Ward No. VIII - 46 Nos.
   - Ward No. IX - 94 Nos.
3. Muthalamada Grama Panchayath
   - Ward No. IV - 8 Nos.

It was decided, after detailed discussion that immediate water supply has to be provided to all the applicants in Ward No. 8 and 9 of Perumatty Grama Panchayath, as these are the wards situated on southern and northern part of the company and who had experienced more scarcity of drinking water due to the company. The company representatives Sri. N. Janardhan (Plant Manager) and Sri. S.K.K. Warrier (HR Manager) contended to the above decision saying that the company cannot provide water supply as the committee is proceeding on the assumption (without any scientific basis) that the company's operations/letting out treated water within plant has caused contamination of ground water in and around the villages of the plant. The company representatives asked that "How many wells were contaminated before 2000 and after 2000". Sri. P.A. Pouran replied that on 9th October, 2004, the members of the committee physically verified the affected wells. Though the company members were

vited for random checking, they did not accompany. The members after physical verification, found that 341 affected houses have to be provided water supply at war footing. The objection raised by the company members at present cannot hold good. They have no locus standi. to raise such objection at this moment. The company member, Sri. Janardhan replied that the above statement of the member, Sri. P.A. Pouran has no locus standi. and it is violation of the rules of business to be followed by the committee and no historical data has been considered for arriving such a decision. The representatives submitted all scientific data proving that the company has not polluted the water. They also said, that even for domestic purpose, the company is not permitted to draw water from their own well. For reaching to conclusion, samples from each wells has to be analysed. Sri. P.A. Pouran asked the Chairperson to give a project report of the company. It was also noted that the local member Sri. Vilayodi Venugopal is absent for the last two meetings. The following decision were taken in the meeting.

1. The list of 341 applicant may be finalised and forwarded for immediate water supply to Ward No. 8 and 9 of Perumatty Grama Panchayath.
2. It was recommended to conduct Environmental Audit Study including experts from various departments and to be conducted by an outside agency.

The meeting came to a close at 11.15 AM.

List of participants

1. Sri. P.A. Pouran, Manjeri
2. Sri. N. Janardhan, Hindustan Coca Cola Beverages Pvt. Ltd., Palakkad
3. Sri. S.K.K. Warrier, Hindustan Coca Cola Beverages Pvt. Ltd., Palakkad
4. Smt. C.V. Jayasree, Environmental Engineer, Kerala State Pollution Control Board, Palakkad
5. Sri. T.A. Thankappan, Assistant Environmental Engineer, Kerala State Pollution Control Board, Palakkad

ANNEXURE -

10/2/05

e-mail: kspcb@asianetindia.com
Telephone: 304642, 304643
312910, 2318153, 54, 55
FAX: 2318152

KERALA STATE POLLUTION CONTROL BOARD

Pattom P.O., Thiruvananthapuram-695 004.
www.keralapcb.org

No.PCB/HO/HW/PLKD/542/04 Date: 8-2-2005

From

The Member Secretary.

To

M/s. Hindustan Coca Cola Ltd.,
Moolathara village,
Kannimari P.O.
Chittur,
Palakkad.

Sub: Supply of piped drinking water.

Ref: Your letter dated 22-1-2005

Sirs,

You have been putting forth arguments stating that you have not polluted the surroundings of your factory. This is against the fact.

The Board had earlier detected high concentration of cadmium in your solid waste. As the concentration exceeded the limit of 50mg/kg, you were directed to treat this waste as hazardous, and to provide secured landfill facility as per the CPCB guidelines. Prior to detection of cadmium, you have been supplying the solid waste as manure to farmers. This solid waste has hence been extensively used in farmlands in your neighborhood.

During the study conducted by the Board, 0.02mg/l of cadmium was detected in the common panchayat well on the eastern side of the factory and 0.01 mg/l was detected in the well of Sri Manikyam Chettiyar, who had used the solid waste as manure. This proves beyond doubt that water in the

surrounding area has been polluted owing to operation of your industrial unit.

You are once again directed to comply with the direction of the Supreme Court Monitoring Committee and to supply piped drinking water to the affected community. The list of persons affected has already been prepared by the Local Area Environment Committee .

Yours faithfully,

MEMBER SECRETARY

Copy to: The EE, DO, PLKD

KIND ATTN: SHEEBA M S, EE

ANNEXURE - 21

Phone: 0491 - 2505542
Fax : 0491 - 2505542

KERALA STATE POLLUTION CONTROL BOARD

കേരള സംസ്ഥാന മലിനീകരണ നിയന്ത്രണ ബോർഡ്
ജില്ലാ ഓഫീസ്, പാലക്കാട്
DISTRICT OFFICE, PALAKKAD
NEAR DISTRICT PANCHAYATH OFFICE, PALAKKAD - 678 001
www.keralapcb.org

In reply please refer to : PCB/PLKD/W-217/2007 Date : 13-1-2010

From

The Senior Environmental Engineer

To

M/s. Hindustan Coca Cola Beverages (P) Ltd.,
Moolathara Village,
Kannimari (PO),
Chittur,
Palakkad – 678584.

Sub:- Disposal of sludge.

Sirs,

You are hereby directed to report the quantity of sludge stored in your secured land fill facility and in the factory premises. You are also directed to transfer the entire sludge stored in the secured land fill facility and in the factory premises to common TSDF at Ambalamedu, Ernakulam (Ph: 0484-2120196/7, 0484-4014345), as it is not safe to store the same for long duration.

Yours faithfully,

SENIOR ENVIRONMENTAL ENGINEER

Copy to:

The Chairman,
KSPCB, Thiruvananthapuram.

ANNEXURE VII

PUCL, August 2004

Official copy for SCMC Office

SUPREME COURT MONITORING COMMITTEE ON HAZARDOUS WASTES (SCMC)

Report of the visit of the SCMC to Kerala with recommendations (14.8.2004)

The SCMC visited Kerala to monitor implementation of the Supreme Court's order dated 14.10.2003. The Committee was also due to visit the Coke and Pepsi plants in Palakkad district on the recommendation of the "Joint Parliamentary Committee on Pesticide Residues in and Safety Standards for Soft Drinks, Fruit Juice and Other Beverages." (See page 94, para 2.187 of the JPC report).

The Committee visited several units generating hazardous wastes, from Thiruvananthapuram to Kochi , and thereafter also visited the Coke and Pepsi plants during its visit to Palakkad district, from 10-13 August 2004. It visited the Cochin Port Trust and Customs on August 13, 2004 to resolve outstanding issues. The Committee received a large number of written representations and photographs from community-oriented groups including the Periyar Malineekarana Virudha Samiti, Periyar Samrakshana Samiti, the Merchem Malineekarana Virudha Samiti, THANAL and PUCL. It also received representations from union leaders and some employees pleading against closure of industries on grounds of employment. It had meetings with company officials of industrial units it visited, district officials, officials of water regulatory bodies including the Kerala Pollution Control Board and panchayat officials.

General observations

The Committee found to its shock that the authorities in Kerala had allowed widespread disregard of the court's order dated 14.10.2003. It found several industrial units operating without authorization as required by the Hazardous Waste Rules, 1989 and in defiance of the order dated 14.10.2003. It found that since the state had no Treatment, Storage and Disposal Facility (TSDF) for hazardous wastes, these wastes was being discharged into the environment by most of the industries concerned. In addition, it found the provisions of the Air and Water Acts were also being openly flouted.

The Committee found that in many areas, industrial units had contaminated ground water supplies of the communities surrounding the plants and that nothing had been done to remedy this situation. Some water supplies were being delivered in tankers to the affected communities, but these were woefully inadequate and unjust.

The Committee was particularly alarmed and distressed at the state of the Periyar river, which is the lifeline of Kerala. The Committee found that the river itself had been converted into a vast, illegal TSDF for receiving a large quantity of hazardous wastes. Several industries – many owned by government -- that should have long been closed because they are still relying on obsolete technology and obsolete products, were in operation, not only impacting negatively on the environment but losing public money as well in crores. It appeared to the Committee that the state of Kerala was more than a decade behind the process improvements in other states: it looked as if the state had pushed itself into a time-warp from which it was unable to extricate itself.

The Committee noted that the Kerala Pollution Control Board (KPCB) had been informed during the latter's appearance before the Committee in Delhi on 7/8 April 2004 that all steps should be taken to ensure that no units were functioning without authorisation beyond May 31, 2004 . The Board was informed that if units were found without authorisation beyond that date, contempt proceedings would be recommended against the Board. The Board was also directed at the same time to ensure that all units had the requisite board displaying necessary information on-line about the unit's hazardous chemicals and wastes outside the factory gates. The Board had also been told that a site for the state's TSDF must be found and notified by 31 May 2004 .

The Committee records that thereafter a formal letter dated 31 May, 2004 , signed by its Chairman, was sent to the Chief Secretary, Kerala, for compliance on these points.

Despite these efforts of the SCMC to ensure compliance, it found to its dismay that the KPCB had continued to disregard the order of the Supreme Court dated 14.10.2003.

The Committee is therefore issuing the following directions to reverse this terrible situation in the State and to ensure compliance of the Supreme Court's orders:

• The State Government of Kerala will forthwith institute an inquiry as to why the Kerala Pollution Control Board has wilfully and callously disregarded the directions of the Supreme Court Order dt. 14.10.2003 and identify the officials responsible for it.

• The Secretary, Government of Kerala in the Department of Health (which supervises the KPCB) and the Chairman, KPCB, are both cited for contempt proceedings for their willful disregard and non-compliance of the order of the Supreme Court dated 14.10.2003.

• Given the current deplorable scenario of hazardous waste management in the State, the Government of Kerala is hereby advised to revamp the KPCB as necessary to inject dynamism, courage and foresight in its functioning and to make it a really performing Board.

• The KPCB is directed to close forthwith all units that have no authorisation to operate under the Hazardous Waste Rules, 1989. These units will not be allowed to reopen until they have the proper facilities to dispose of their hazardous wastes as required under the Rules. This order must be complied with within eight days and compliance report submitted to the SCMC in Delhi at the expiry of the period.

• Relying upon the Supreme Court order dated 7 May 2004 that requires water to be supplied to communities affected by industrial wastes, the Committee directs the State of Kerala and the industrial units of Hindustan Coca Cola, Binani Zinc, Kerala Mines and Minerals and Kerala Newsprint to ensure that water supply through pipeline is delivered to the residences of all the affected communities in the vicinities of these units. The present arrangement delivering water in tankers or in a few public locations through public taps is unacceptable. The KPCB is directed to set up four committees under KPCB Regional Officers in these places to create a register of persons affected and to ensure that the above companies install a piped water supply to the residences of all the persons so affected. Action plan for compliance of this direction shall be submitted within two weeks. Action shall be completed within six months.

• In relation to restoring the life of the Periyar river, the Committee directs the KPCB to set up a Local Area Environment Committee (LAEC) in terms of paras 52 and 55 of the order dated 14.10.2003. The LAEC will comprise the

Regional Officer, KPCB, as convenor, two representatives from the industry associations or industrial units located in Edayar and Eloor and two representatives of local environment groups. The LAEC will be constituted forthwith. Costs of its working will be met by the KPCB. Non-official members will be entitled to an honorarium or stipend for their work on the committee. All industrial units will be notified of the formation of the LAEC. The LAEC will have the following terms of work, to assist the SCMC:

- It will commence an environment audit of all the 247 industries located in the area and that are affecting the ecology and environment and the local health of populations along the Periyar river and in Udyogamandal industrial estate. This environment audit will be completed in six months.

- The LAEC will visit each of the industrial units and ensure that the units are complying with environment laws including the provisions of the Hazardous Waste Rules. It will ensure that there are no illegal discharges of hazardous wastes into the Periyar river either in the form of solid waste or liquid effluent containing hazardous wastes.

- It will ensure that a proper material balance is maintained of the various chemicals and wastes used and generated in the premises of each unit.

- It will also ensure that all industrial units covered by the order dated 14.10.2003 will have display boards in Malayalam and English at the main gate accessible to all members of the public in the vicinity.

- Copies of all the consents granted to the various units under the Water and Air Acts and the authorisations granted under the Hazardous Waste Rules, 1989, (if any), will be handed over to the LAEC. Any other environment information related to environment protection of the Periyar river will be handed over if requested by the LAEC as if it were being requested by the SCMC. Any non-compliance in this regard should be drawn to the Member Secretary, SCMC, for immediate redressal.

- Should the SCMC find that these actions do not turn the situation around and reverse the pollution of the Periyar river within the stipulated period of six months, it will have no hesitation in directing the closure of the entire Udyogamandal industrial estate and ordering a special audit of the area. Units will be allowed to re-open one by one

thereafter only if they are able to convince the KPCB that all measures have been installed to ensure discharge as per EPA standards and HW Rules.

• The SCMC has agonized over the hazardous state of the Periyar river and has decided to levy a heavy collective fine of Rs.2.5 crores on the entire industrial estate of Eloor and Edayar on the polluter pays principle. The KPCB will ensure that this amount is collected as per the directions of the SCMC. This fine will be utilized to monitor the health of the river, to create conditions for the re-entry of life in the river and to restore its ecology. The Committee feels there is no other way given the circumstances to raise an appropriate alarm and to jolt the industrial units into doing something drastic about the present state of affairs.

Directions in connection with individual units visited by the Committee:

• **Hindustan Insecticides Ltd (HIL)** : The Committee visited the plant and also queried the officials about the fire that had engulfed the Endosulfan plant on July 6, 2004 . It also inspected the hazardous waste facility (on-site). The Committee is firmly convinced that Hindustan Insecticides Ltd should go for closure and that the area in which the company has been conducting its operations should be allowed to recover from the various toxic materials and chemicals used by the company and discharged by it into the environment over the decades. The company should be allowed to reopen only if it can shift to clean technology and a new product mix. The Committee has noted that the sale and distribution of Endosulfan in the State of Kerala is, in any event, banned pursuant to orders of the Kerala High Court. The industry is also violating the conditions of authorisation and shall be closed as per order of the Supreme Court dated 14.10.2003.

• **Hindustan Coca Cola, Plachimada** : The Committee was disturbed that the company had, without prior approval of the authorities concerned with agriculture, disposed of its sludge (containing heavy metals) to farmers in the neighborhood as fertilizer. The company was unable to convince the Committee of the source of the toxic heavy metals found in the sludges. The Committee visited areas around the factory affected by the unauthorized disposal of sludge and also listened to complaints about contamination of ground water supply. The Committee members themselves consumed the ground water and found its taste odd. The Committee was provided reports from various

government authorities that the water was unfit for drinking. This was not the situation prevailing prior to the company being established in the area. As the communities settled around the plant were from the tribal and unprivileged communities whose life had been disturbed by the company's activities, the SCMC had no hesitation in coming to the conclusion that the company will take quick measures to ensure water supplies to all the persons in the vicinity of the plant. The RO of the KPCB to look into this and report compliance. The Committee also directed the KPCB to ensure that all sludges dumped by the factory outside its walls would be retrieved and placed within the new landfill being constructed by the Company.

• **Pepsi plant** : The SCMC visited the plant and inspected the secured landfill for the sludge generated by the company's activities. As the unit is located within an industrial estate, there were no complaints from adjoining communities relating to the activities of the company.

• **Pepsi and Coke plants** : The SCMC, in its investigation of both plants, discovered that the plants were withdrawing ground water without paying any charges for the collection and sale of these common resources. This anomaly needs to be looked into by the authorities and is outside the purview of this Committee's work. However, in order to reduce withdrawal of ground water, both units are directed to install RO systems to ensure that use of public water for effluent treatment is returned to its original condition for re-use. This recommendation will be implemented within six months. KPCB shall issue appropriate directions to the industries within one week. KPCB and CPCB (Bangalore office) shall report compliance to SCMC.

• **Fertilisers and Chemicals Travancore Ltd (FACT), Udyogamandal** : The Committee was told that the company was losing around Rs.200 crores every year. The Committee did not appreciate the manner in which the company had discharged its gypsum wastes in the open environment. It recommended that the Government of Kerala direct the company to hand over five acres of the land degraded by such gypsum disposal for the construction of a TSDF which could be used to handle the wastes generated from the entire Udyogamandal area. If the company is unwilling, the land should be acquired through process of law under Water Act. The operator of the facility could be asked to also secure the gypsum wastes as part of his contract since he would be entitled to Central government subsidy for the construction of the TSDF . The

Committee feels that hazardous wastes ought not to leave the Udyogamandal area and the facility should be located in the same area. (Action KPCB)

- **Cochin Minerals and Rutile Ltd, Edayar** : The hazardous waste storage is not as per the HW Rules. The quantities at site do not match the authorization granted. The unit has already faced closure earlier for discharging hazardous wastes through a concealed illegal pipeline into the Periyar river. The unit will not reopen until and unless its pollution of the Periyar river due to this industry is brought to a complete halt. (Action KPCB / CPCB)

- **Binani Zinc Limited, Binanipuram, Edayar** : The SCMC visited the area contaminated by the jarosite ponds of the company. The pollution of ground water was observed everywhere outside the ponds. (Later, the same evenings, photographs about the pollution were submitted to the Committee).

The KPCB opined that the pollution may be due to the old ponds that were sealed but which may still be leaking. The neighbourhood residents complained to the Committee that fresh water supply from the company in view of the pollution was woefully inadequate and the tanker system grossly

wastes and other wastes were thrown all over a large wetland area adjacent to the river and the ETP sludge and other dumped materials were allowed to overflow into the nearby settlement where it had contaminated around 40 wells and also the river. The company is directed to supply proper water supply to the affected community with piped water to the residences and not public taps as is presently arranged. The company will radically improve its containment of the slurry ponds and lime wastes. A local area environment protection committee may be set up here as well. (Action KPCB)

• **Kerala Minerals and Metals Ltd, Chavara, Kollam:** The ETP acidic iron sludge of the public sector unit has begun to seep through the containment and contaminated the wells of the local residents, making them all unpotable. All the residents have been warned that the water should not be used for drinking, bathing or even for toilets. Water is now being supplied by the company but is woefully inadequate. The company is to take the same measures as directed for the other units inspected by the SCMC. Containment of the breached sludge pond is an urgent necessity as the entire groundwater may become permanently damaged and unfit for use. As of now, the sludge pond violates the provisions of the HW Rules. Authorisation must be withdrawn till the problem is resolved. (Action KPCB)

• T he SCMC also visited the Cochin Port Trust, in view of a complaint made by Southern Refineries that the waste oils from the Port were disappearing in the hands of unauthorized processors. However, the Deputy Chairman of the Port (Shri A. Janardhana Rao) and Captain Alapath both assured the Committee that if this were true, it ought to have been brought directly to their notice since the authorized dealer is Southern Refineries only and no other unit. They assured the SCMC that they would look immediately into the matter and ensure corrective measures. (Action KPCB)

• The Customs was visited in connection with their communication to the SCMC dated 4.7.2004 relating to disposal of consignments imported as furnace oil but found on testing to be waste oil – illegal import as per the HW Rules. The SCMC informed the officers concerned that samples may be drawn in association with KPCB and sent to NIO to indicate presence, if any, of PCBs. If the presence of PCBs was positive, the entire consignment shall go for incineration. If not, they would stand confiscated and auctioned to registered recyclers. Addresses of the importers are to be handed over to the KPCB for further

action so that the parties can be persuaded to re-export the consignments if possible or face severe consequences. (Action KPCB / Customs)

The SCMC was told a fresh consignment of waste oil had been received and that the shipping company was already looking for ways to re-export since it was paying heavy fines on a daily basis for receiving the cargo.

• CPCB (Bangalore office) shall co-ordinate the work of implementation of the orders of the Court / SCMC and file reports to the Member Secretary of SCMC on quarterly basis on the above matters.

Dr G Thyagarajan, Chairman
Dr D.B. Boralkar, Member
Dr Claude Alvares, Member

ANNEXURE VIII

എക്സിബിറ്റ് പി 8

പ്രാഥമിക ആരോഗ്യ കേന്ദ്രം
പെരുമാട്ടി,
തീയതി : 13.5.2003.

പ്രേക്ഷിതൻ

മെഡിക്കൽ ഓഫീസർ,
പ്രാഥമിക ആരോഗ്യകേന്ദ്രം
പെരുമാട്ടി

സ്വീകർത്താവ്

പ്രസിഡന്റ്
ഗ്രാമപഞ്ചായത്ത്,
പെരുമാട്ടി.

സർ,

വിഷയം :- കിണറുകളിലെ ജലം രാസ പരിശോധനയ്ക്കയച്ചതിന്റെ ഫലവും വിവരവും സമർപ്പിക്കൽ.

സൂചന :- ജില്ലാ മെഡിക്കൽ ഓഫീസർ അവർകളുടെ സി2 - 10532/2000 8.4.2003 -ലെ കത്ത്

....

കൊക്കോകോള കമ്പനിയുടെ പരിസരത്തു നിന്നും 3 കിണറുകളിലെ ജലം രാസ പരിശോധനക്ക് അയച്ചതിന്റെ ഫലം ലഭിച്ചതിൻ പ്രകാരവും ജില്ലാ മെഡിക്കൽ ഓഫീസർ അവർകളുടെ അഭിപ്രായവും രേഖപ്പെടുത്തിയിരിക്കുന്നതു പ്രസ്തുത ജലം കുടിക്കുവാൻ ഉപയോഗിക്കരുതെന്ന്. ആയതിന് നാട്ടുകാരെ ബോധവൽക്കരിക്കുവാനും ആവശ്യപ്പെട്ടിരിക്കുന്നു.

റീജണൽ അനലിറ്റിക്കൽ ലാബിൽ നിന്നും അയച്ചു തന്നിട്ടുള്ള ലഭിച്ചതിന്റെ കോപ്പിയും ജില്ലാ മെഡിക്കൽ ഓഫീസർ അവർകളുടെ നിർദ്ദേശത്തിന്റെ കോപ്പിയും ഇതോടൊപ്പം താങ്കളുടെ അറിവിലേക്കും തുടർ നടപടികൾക്കുമായി സമർപ്പിച്ചുകൊള്ളുന്നു.

വിശ്വസ്തതയോടെ,

(ഒപ്പ്)

ഉള്ളടക്കം:

1) ജലം പരിശോധിച്ചതിന്റെ ഫലം 3 എണ്ണം (കോപ്പി)

2) ജില്ലാ മെഡിക്കൽ ഓഫീസർ അവർകളുടെ 8.4.2003 ലെ കത്ത് (കോപ്പി)

This is the true copy of document marked as Exhibit-P8 referred to the above W.P. (C).

Advocate

Medical Officer,
PHC, Perumatty

Analytical Laboratory
KOZHIKODE-6.

WATER ANALYST'S SECTION
REPORT ON ANALYSIS OF WATER
(Chemical)

No. 130/02-03

Source of sample	Well water of 8/19 of Subramanian S/o. late Muniyappan
Date of Collection	
Date of Receipt	15.1.03
PHYSICAL	
Appearance	clear
Colour, Taste, Odour	colourless, odourless
pH	7.4
Electrical Conductance	2.0 m. MHOS
Alkalinity (Parts per million)	396.0
Chloride	910.0
Iron	excess
Nitrates	nil
Sulphates	20.0
Oxygen dissolved	
Oxygen absorbed	1.4
Ammonia free & saline	0.2
Ammonia Albuminoid	0.2
Total dissolved solids	1517.0
Hardness	1060.0
... metals, if any	trace

True Copy
Attested

Remarks: [illegible]

...1.03
GAL, 16. SMT 2/01/5/91 500x100

58

[illegible]

Medical Officer,
PHC, Parumetty

[illegible] Laboratory
KODE-0.

WATER ANALYST'S SECTION

REPORT ON ANALYSIS OF WATER

(Chemical)

No. IA 130/02-03

Source of sample	well water of 8/22 Pozhanathil [illegible]
Date of Collection	
Date of Receipt	15.1.03
PHYSICAL	
Appearance	clear
Colour, Taste, Odour	colourless, odourless
pH.	7.6
Electrical Conductivity	2.4 m. MHOS
CHEMICAL	
Alkalinity (Parts per million)	352.0
Chlorides	770.0
Nitrites	present
Nitrates	nil
Sulphates	40.0
Oxygen disolved	
Oxygen absorbed	0.5
Ammonia free & saline	0.1
Ammonia—Albuminoid	0.1
Total Solids dissolved solids	1310.0
Loss on ignition	
Hardness—Total	1136.0
„ Temporary	
„ Permanent	
[illegible]	trace
[illegible] metals, if any	

True Copy
(Attested)

Remarks: [illegible]

21.1.03

GAL-16 SMT 24/1/591-500,000

Medical Officer,
PHC, Perumatty

...rl Laboratory

...HUR(DIST.-O.

WATER ANALYST'S SECTION

REPORT ON ANALYSIS OF WATER

(Chemical)

Source of sample: Well water of O/16 of Muthuswami S/o. (L)Ayappan

Date of Collection:

Date of Receipt: 15.1.03

PHYSICAL. Appearance	clear
Colour, Taste, Odour	colourless, odourless
pH.	7.6
Electrical Conductivity	2.5 m. MHOS
CHEMICAL Alkalinity (Parts per million)	364.0
Chlorides "	060.0
Nitrites "	trace
Nitrates "	nil
Sulphates "	60.0
Oxygen dissolved "	
Oxygen absorbed "	0.6
Ammonia, free & saline "	0.1
Ammonia—Albuminoid "	0.1
Total Solids dissolved solids	1434.0
Loss on ignition	
Hardness—Total "	11 ?0.0 [illegible]=0
" Temporary	
" Permanent	
Iron	
Other metals, if any	

Remarks: വെള്ളത്തിന്റെ കാഠിന്യം, ക്ലോറൈഡുകൾ എന്നിവ വളരെ കൂടുതലാണ്. കുടിക്കാനുള്ള ആവശ്യങ്ങൾക്ക് ഇതുപയോഗിക്കരുത്.

Date: 21.1.03

(A.L. No. 8847 2/12/500 5000/100)

This is the true copy of the document marked as Exhibit P 9 referred to in the above W.P (C)

Advocate

ANNEXURE IX

LABORATORY SERVICES DIVISION
Accredited by NABL in the fields of [illegible]

Fax: (044) 2491651
E-mail: sargam_metals@vsnl.com

No 004490

TEST REPORT

Issued To: MR. NITHYANAND JEYARAMAN
C/O. T. MOHAN & S. DEVIKA
NO.6 IIIrd AVENUE NEAR BAJAJI BHAVAN
BESANT NAGAR CHENNAI 600 090

Report Date: 04.03.2002

25.02.2002

Sample Description: WATER SAMPLES
A. PANCHAYAT WELL WATER SAMPLE
B. FARMER WELL WATER SAMPLE

Sample Drawn By / Date: PARTY
Party's Reference: LETTER DATED 25.02.2002

Analysis Commenced on: 25.02.2002

Completed on: 28.02.2002

PARAMETERS	#1	#2	PROCEDURE
A-PHYSICAL QUALITY			
			SM APHA 20th EDITION 1998
Electrical Conductivity (Micromhos/cm at 25 °C)	2092	681	-do-
pH value @ 25 °C	6.96	6.93	-do-
B-CHEMICAL QUALITY (in mg/l)			
Total Dissolved Solids	1293	396	-do-
Total hardness as $CaCO_3$	886	313	-do-
Magnesium hardness as $CaCO_3$	271	110	-do-
Alkalinity as $CaCO_3$			
Phenolphthalein	NIL	NIL	-do-
Total	300	291	-do-
Chlorides (as Cl^-)	500	38	-do-
Sulphates as SO_4^{--}	25	25	-do-

END

Verified by: [signature]

Remarks:

for SARGAM METALS (P) LIMITED
Laboratory Services Division
[signature]
Divisional / Quality Manager
Authorised Signatory

LALITHA RAMAN

NOTE: The test results relate only to the items tested.
This test report shall not be reproduced [illegible]

ANNEXURE X

Received on 6/4/04

BIRTH WEIGHT OF CHILDREN IN PLACHIMEDA

VT Padmanabhan, Omji John, Mustafa

The Adivasi villages living in Plachimada in Palghat district of Kerala State have been struggling against the water depletion and contamination caused by the bottling plant of Hindustan Coca Cola Ltd. The plant draws its water from underground wells, sunk within the factory compound. Independent teams of scientists and some government agencies have confirmed the present of cadmium and lead in the solid waste generated by the factory. "A joint sampling was conducted by the officers of the Board along with the officers of the Central Pollution Control Board at the Coca Cola factory on 12.09.2003. Sludge analysis revealed cadmium content upto 338.8 g/kg. The Central Pollution Control Board has therefore advised the State Board to direct the Company to dispose of the effluent treatment sludge as per the Hazardous Wastes Rules."

The well water in these colonies is not potable, reportedly due to concentration of heavy metals, resulting from over-exploitation of ground water by the Cola factory. The inhabitants say that the factory also clandestinely releases some unknown gases during night. The residents have been complaining about various health problems, which they attribute to the water and air pollution.

After the Cola plant started production, the water levels in the open wells in the area were affected. When protests rose, the Cola company is said to have let into the earth 5 to 3 lakh litres of waste water per day through shallow tube-wells. This mixed with surface water, led to the rise of water levels in the wells. However, these water proved to be contaminated. The operation of the Coca Cola Plant in Plachimada has led to various environmental problems: pollution of water, ground water depletion, reduced crop yields and skin disorders and other physical ailments among the inhabitant

The Central Pollution Control Board recommended more detailed study of raw water from individual wells in and around the factories and samples of raw materials like sugar, lime, soda ash, ferrous sulphate and activated carbon and the intake water need also be analysed.

Though the villagers in the worst affected colonies do not drink the water from their contaminated wells anymore, they were exposed to the contamination before it became acute. The health effects of exposures to small dose of toxic substance will have its visible and early impact on fetus and children. In this study, we set out to compare the birthweight of babies born before after the cola plant.

Under the integrated child development scheme (ICDS), the Anganwadis function as a day care center for pre-school children. Children stay in this play school cum feeding center, from 10 AM to 4 PM. Each child has a growth chart designed by the World Health Organization. The chart has the following details on each child: birth weight, weight at admission at around age 3, and weight at monthly intervals. The birth weight is copied from the

hospital discharge slip. (In these villages, almost all pregnancies are terminated in hospitals.)

The Vijayanagar (Plachimada) colony Anganwadi register has details of 118 children (63 boys and 55 girls) born between 1996 and 2003 in Vijayanagar and Plachimeda colonies. Median birth weight of all children in the sample is 2.5 kgs. According to WHO, infants weighing less than 2.5 kgs are considered as low birth weight (LBW). Birth weight of 73% of the children was below 3 kgs. The median weight is considerably lower than the national average. There is no difference between girls and boys.

In order to see if there is any temporal change in the birth weight attributable to the operation of the factory, the children were placed in two groups – those born during 1996-2000 (73 children) and those born during 2001-2003 (45 children). The median birth weight of these two groups was 2700 grams and 2500 grams respectively. This difference is statistically significant at 0.05 level.

As the table below shows, 15% of the children born before the operation of the factory were LBW. This more than doubled during 2001-2003.

Birth-weight of Children near Cola Factory during 1996-2003

Wight in Kilograms

	Numbers			Percentage		
Period	Under 2.5 kg	> 2.5 kg	Total	Under 2.5	>2.5	Total
1996-2000	11	62	73	15.1	84.9	100.0
2001-2003	14	31	45	31.1	68.9	100.0

The sharp increase in the proportion of underweight children and a 10% drop in the median birth weight is a serious problem, which has to be examined in detail.

Other Studies Elsewhere

Fetal toxicity of cadmium (Cd) is well documented in rodents. There are some data available regarding the human fetus also. Recent studies from

Italy, France and Sweden show that maternal cadmium challenge is a risk factor in LBW babies.

Scientists from University of Messina, Italy measured maternal and cord blood cadmium levels in 45 healthy non-smoking pregnant women exposed to a low cadmium challenge to evaluate the relationship between these cadmium levels and the birth weight of the infants. They report a highly significant direct correlation between maternal and cord blood cadmium concentrations. Since cadmium concentration appeared of the same order of magnitudine both in cord and maternal serum, one could speculate that cadmium is transferred easily from the mother to the fetus through the placenta. Finally, we found that birth weight is inversely correlated with maternal and cord blood cadmium concentrations; thus birth weight might be negatively influenced by cadmium levels as a result of the toxic effects of the metal on the placenta. Although preliminary, our data show that (also not-predictable) prenatal exposure to even low cadmium levels might be a risk factor for developmental impairment in infants. (J Perinat Med. 2002;30(5):395-9.)

Experts from Institute of Community Medicine, University of Tromso, Norway studied the delivering women and their newborns in the Kola Peninsula of Russia and the neighboring arctic area of Norway to explore relationships between maternal cadmium and lead status and birth weight as a pregnancy outcome. They concluded that maternal blood-lead level as an environmental factor is an apparent predictor of low birth weight and body mass index (BMIC). (Acta Obstet Gynecol Scand. 1999 Nov;78(10):852-60.)

Doctors from Epidemiological Research Unit, Villejuif, France investigated the effect of low levels of **cadmium** on the human placenta and the consequences on birthweight of 102 mothers and their newborns in an obstetrical care unit. Placental and hair samples were collected at delivery to determine Cd concentrations. The main finding of this study was the relationship between a decrease in birthweight and an increase of newborn hair Cd. Other placental parameters were not significantly related to placental Cd concentration. Toxicology. 1993 Apr 30;79(2):109-18.

Padmanabhan VT
PO. Pathayakkunnu
Tellicherry, Kerala