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GOVERNMENT OF INDIA
MINISTRY OF WATER RESOURCES,
RIVER DEVELOPMENT & GANGA REJUVENATION
CENTRAL GROUND WATER BOARD

PLAN ON
ARTIFICIAL RECHARGE TO GROUNDWATER AND
WATER CONSERVATION IN
KODAKANDLA MANDAL, WARANGAL DISTRICT,
TELANGANA STATE

SOUTHERN REGION
HYDERABAD
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PLAN ON
ARTIFICIAL RECHARGE TO GROUNDWATER AND
WATER CONSERVATION IN
KODAKANDLA MANDAL, WARANGAL DISTRICT,
TELANGANA STATE

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AT A GLANCE

Name of the Mandal	KODAKANDLA
District	WARANGAL
State	TELANGANA
Total Area(sq. km)	189.36
Area suitable for Artificial Recharge (sq.km.)	189.36
Latitude and Longitude	17.494050 to 17.657850 and 79.402830 to 79.634440.
Average Annual Rainfall (mm)	776
Geology	BGC
Average Depth To Water Level (Decadal) (Pre Monsoon)	18.5
Average Depth To Water Level (Decadal) (Post Monsoon)	12.9
Ground Water Resources (2011)	
Annual Replenishable Ground Water Resources (MCM/yr)	30.37
Net Annual Ground Water Availability(MCM)/yr	27.33
Net Annual Ground Water Draft(MCM)/yr	28.13
Projected Demand for Domestic and Industrial Use(MCM)/yr	1.69
Stage of Ground Water Development (%)	103
Surface runoff available (MCM)/yr	28.88
Total Storage Created in the Mandal by Various Agencies (MCM)/yr	1.46
Artificial Recharge/Conservation Measures	
Recharge Structures Proposed (No.s)	Percolation Tanks: 10, Check Dams: 11 Farm ponds: 320, Recharge Shafts: 103
Improving Water use Efficiency	Micro Irrigation System: 1600 ha
Tentative Total Cost in Lakhs (Rs.)	1371.405
Expected Recharge/Savings (MCM)/yr	6.955

1. INTRODUCTION

Kodakandla Mandal is one of over-exploited Mandal in Warangal district, Telangana State, which is economically backward and chronically drought affected. The Mandal has 16 inhabited villages and with 17 gram panchayats.

2. LOCATION

The Mandal lies between north latitudes 17.494050 to 17.657850 and between east longitudes 79.402830 to 79.634440. The Mandal occupies the southern part of the Warangal district and is bounded on the north by Palakurthy mandal, on the east by Thorrur mandal, on the south by Nalgondadistrict and west by Devaruppula Mandal. (Fig.1) The geographical area of the Mandal is 189.36 sq.km.

3. PHYSIOGRAPHY AND DRAINAGE:

The area is drained by low order streams which are tributaries of Lower Krishna basin. The streams are mostly ephemeral in nature. The drainage pattern is dendritic, rectangular to sub rectangular due to the influence of geological structures. (Fig.2)

4. RAINFALL

The average rainfall in the Mandal is 776 mm. The rainfall during the South-west monsoon season i.e., June-September accounts for about 85% of the total rainfall.

5. LAND USE PATTERN

Out of the total geographical area of 189.36 sq.km, the net area sown is 86.98 sq.km. Barren and uncultivable land is 3.34 sq.km. The land for non agricultural use accounts for 9.75 sq.km. (Fig.3)

6. HYDROGEOLOGY

The area is underlain by granitic gneisses of Archaean age (Fig.4). Ground water occurs in weathered and fractured zones under water table and semi- confined conditions. The weathered zone thickness as per the GEC report is 30 m. The weathered zone has been extensively tapped by dug and dug cum bore wells upto 30 m depth, which are mostly dry now. Ground water occurs in the fractured granites upto 200 m bgl. However, the potential fractures are encountered between 50-100 m bgl. The cumulative yield varies from 2-5 lps.

7. GROUND WATER LEVEL SCENARIO

The depth to water level during pre and post-monsoon varies from 5 to 20 mbgl. The average depth to water level (decadal) during pre and post monsoon is 18.5 and 12.9 m bgl respectively. The depth to water levels maps for pre and post monsoon period (2014) are shown in (Fig. 5 & 6 respectively). Decadal mean water level trend during post monsoon is depicted in the Fig.7.

8. DYNAMIC GROUND WATER RESOURCES

The Ground water availability, Utilization and stage of Development in Kodakandla Mandal, Warangal District is given in Table-1.

Table-1 : Ground water resources of KodakandlaMandal, Warangal District.

Annual Replenishable Ground water resources (MCM)	30.37
Net Annual Ground Water Availability(MCM)/yr	27.33
Net Annual Ground Water Draft(MCM)/yr	28.13
Projected Demand for Domestic and Industrial use up to 2025. (MCM)	1.69
Stage of Ground water development (%).	103
Whether notified or not with year of notification.	No

9. NEED FOR ARTIFICIAL RECHARGE AND CONSERVATION METHODS

The ground water withdrawal is more than the recharge with a stage of development above hundred percent. The long term water level trend mostly shows a declining trend and the water levels are very deep ranging upto20m. The sustainability of bore wells has become questionable as many bore wells are either drying up or have recorded reduced yields. There is no surface water irrigation facility in the area. All these factors indicate that there is an urgent need for artificial recharge and water conservation in the Mandal.

10. JUSTIFICATION OF THE ARTIFICIAL RECHARGE PROJECT

Kodakandla Mandal falls under high stage of ground water development i.e., 103 % and with sufficient amount of uncommitted surface runoff. The area is completely dependent on ground water for domestic, industrial and irrigation purposes. During the monsoons runoff quickly flows out of the area without natural recharge to ground water. It is necessary to apply artificial recharge techniques to allow more and more recharge through check dams, PTs, MPTs, farm ponds, recharge shafts to cope up with the withdrawal pattern and also to improve ground water situation through various interventions including on farm activities and micro irrigation systems (Sprinkler-Drip-HDPE).

11. AVAILABILITY OF SURPLUS, SURFACE WATER FOR ARTIFICIAL RECAHRGE OR CONSERVATION

The runoff was calculated by taking into account of normal rainfall of the mandal and corresponding runoff yield from Strangers table. The existing storage created by various artificial recharge structures constructed by the State Government, if any, was deducted for calculating the runoff yield to recommend new AR structures.

Total Geographical area (Sq.kms)	189.36
Hilly Area (Sq.kms)	0
Area suitable for Artificial Recharge (sq.km.)	189.36
Runoff Yield in MCM	28.88
Existing No. of Check Dams	206
Storage created	1.46
Existing No. of Percolation Tanks	0
Storage created	0
Total Existing Storage Created	1.46

12. FEASIBLE ARTIFICIAL RECHARGE STRUCTURES

Since the mandal is categorized as over exploited, there is an immediate need for improving ground water scenario and to ensure sustainability of ground water sources. It is also suggested to create additional storage capacity of surface water bodies which would result in supplementing irrigation thereby reducing the ground water draft. The runoff available in the mandal has been assessed as 27.42 MCM/yr, which could be considered for further planning of artificial recharge. However, the number of artificial recharge structures feasible has been recommended in areas, by considering the utilizable yield, number of existing structures, land use, drainage pattern and also where the post monsoon water levels (decadal mean) are more than 5 m bgl, and or decadal trends are either falling or showing insignificant raising trend.

A) Check dams and Percolation Tanks

The area is covered by seasonal nalas – drains, which carry discharge during monsoon period debauched into the water bodies within a short duration. It is proposed to identify such nalas for construction of check dams/Percolation tank with recharge shafts, so as to harness ground water and to increase soil moisture content.

- The site selected for check dam/Percolation Tank should have sufficient thickness of permeable soils or weathered material to facilitate recharge of stored water within a short span of time. The water stored in these structures is mostly confined to the stream course and height is normally less than 2m.
- These are designed based on stream width and excess water is allowed to flow over the crest wall. In order to avoid scouring from excess runoff water cushions are provided on the downstream side. To harness maximum runoff in the stream, a series of such check dams can be constructed to have recharge on a regional scale.
- Considering the annual monsoon rainfall of 776 mm, sufficient rain water can be harnessed. This will improve ground water regime as well as delaying the instant flow into the main river.
- The flow in these seasonal rivers can be sustained up to about 2 to 3 months after monsoon.

- Recharge trenches can also be constructed along upstream side of the check dam/Percolation Tank in the impoundment area for enhancing the ground water recharge rate.

A total of **11 Check dams and 10 Percolation tanks** are recommended.

B). Recharge Shafts

The existing check dams and percolation tanks lose their storage capacity as well as recharge capacity due to siltation. Hence, Recharge shafts are recommended in the existing Check dams and Percolation tanks to enhance the ground water recharge. During the heavy downpours, there will be sufficient accumulation of runoff, which can also effectively be utilized for recharge by constructing recharge shafts. Hence, it is proposed to construct 103 recharge shafts of 165 mm dia with 30 m depth in the existing check dams.

C). Farm Ponds

A farm pond is a large dug out in the earth, usually square or rectangular in shape, which harvests rain water and stores it for future use. It has an inlet to regulate inflow and an outlet to discharge excess water. The pond is surrounded by a small bund, which prevents erosion on the banks of the pond. The size and depth depend on the amount of land available; the type of soil water from the farm pond is conveyed to the fields manually, by pumping, or by both methods.

Advantages of Farm Ponds

- They provide water to start growing crops, without waiting for rain to fall.
- They provide irrigation water during dry spells between rainfalls. This increases the yield, the number of crops in one year, and the diversity of crops that can be grown.
- Bunds can be used to raise vegetables and fruit trees, thus supplying the farm household with an additional source of income and of nutritious food.
- Farmers are able to apply adequate farm inputs and perform farming operations at the appropriate time, thus increasing their productivity and their confidence in farming.
- They check soil erosion and minimize siltation of waterways and reservoirs.
- They supplies water for domestic purposes and livestock.
- They promote fish rearing.
- They recharge the ground water.
- They improve drainage.
- The excavated earth has a very high value and can be used to enrich soil in the fields, levelling land, and constructing farm roads.

As per the Land use classification, majority of the area is covered by the agricultural field. Hence, it is proposed to construct 320 farm ponds in 16 villages of the Mandal @ 20 farm ponds in each village.

D). Micro Irrigation System (Sprinkler /drip/HDPE pipes)

Micro irrigation is defined as the frequent application of small quantities of water directly above and below the soil surface; usually as discrete drops, continuous drops or tiny streams through emitters placed along a water delivery line.

In flood/furrow irrigation method more than 50% of applied water is wasted through seepage to deeper level, localized inundation causes loss through evaporation and it leaches out the nutrients from the plant. While through drip & sprinkler irrigation wastages of irrigational water could be minimized. The studies on different crops, has revealed that irrigation water is saved drastically. The conveyance losses (mainly seepage & evaporation) can be saved up to 25 to 40% through utilization of HDPE pipes. Initially the scheme is proposed to be implemented in worst affected areas showing deepest water levels and significant declining trends. It is proposed to take up micro irrigation system in 1600 ha @ 100 ha per village.

13. TENTATIVE COST ESTIMATES (KODAKANDLA MANDAL)

S.No.	Feasible Artificial Recharge & Water Conservation structures/	No. of Structures/ Quantity	Total Volume (MCM)	Tentative unit cost (in Rs lakh)	Total tentative cost (in Rs Lakh)	Expected Annual GW recharge/savings (MCM)
1	Proposed Masonry Check dams Crest Length -10-15 m, Height-1-2 m) (0.007 MCM*4 fillings)	11	0.308	5	55	0.231
2	Recharge shaft in Check dam (50% of the existing Check dams)	103	1.133	0.5	51.5	1.133
3	Proposed Percolation Tanks (100*100*2.5)* 4 fillings)	10	1	15	150	0.75
4	Renovation Desilting, Repairs and installation of Recharge Shafts in existing PTS (50% of the existing PTS)	0	0	1	0	0
5	Proposed Farm Pond (6 filling) 5*5*1.5 dimension @ 20 farm ponds per each village	320	0.04608	0.25	80	0.041472
6	Proposed Sprinkler/drip/HDPE pipes for 100 ha in each village	1600		0.6	960	4.8
7	Proposed Piezometers up to 50 mbgl @ one PZ per Village	16	0	0.6	9.6	0
8 (i)	Total (No. of AR Structures)	460	2.49		346.1	2.155
8 (ii)	Total (ha)	1600			960	4.8
	Total (8(i) + 8 (ii))				1306.1	6.955
9	Impact Assessment & O & M -5 % of Total cost of the Scheme				65.305	
	Grand Total				1371.405	

*(Expected annual GW Recharge/Savings MCM - CDS& PTS: 75%, Farm ponds - 90%, Sprinklers-50%, Recharge shafts in existing CDS and PTS-100%)

Note: The type, number and cost of structure may vary according to site, after the ground truth verification.

14. TIME SCHEDULE

Steps	Quarters							
	1st	2 nd	3 rd	4 th	5 th	6 th	7 th	8 th
Identification of line department/implementing agency and preparation of DPR								
Approval of Scheme and releases of sanction of funds								
Implementation of ARS								

Phase = one quarter or 3 months or equivalent to financial quarter

A). Operation and Maintenance

In all projects impact assessment has to be carried out to ensure that project is economically viable, socially equitable and environmentally sustainable by inter-related socio-economic, cultural and human-health impacts, both beneficial and adverse. Accordingly it is proposed to have impact assessment as well as operation & Maintenance at the rate of 5% of the total cost of the project for 5 years from the completion of artificial recharge project.

B). Expected Benefits

The benefits of the project are:

1. The implementation of the project would result in additional recharge/Ground water savings to the tune of 6.95 MCM.
2. Ground water recharge will help in arresting the rapid decline in ground water resources and will also ensure improvement in quality of ground water by dilution.
3. Proposed structures and measures will also enhance the ground water potential and would ensure sustainability of ground water resources. It is estimated that the stage of ground water development may likely to be reduced from the present 103% to 82% (21%)
4. It will also help in controlling soil erosion.

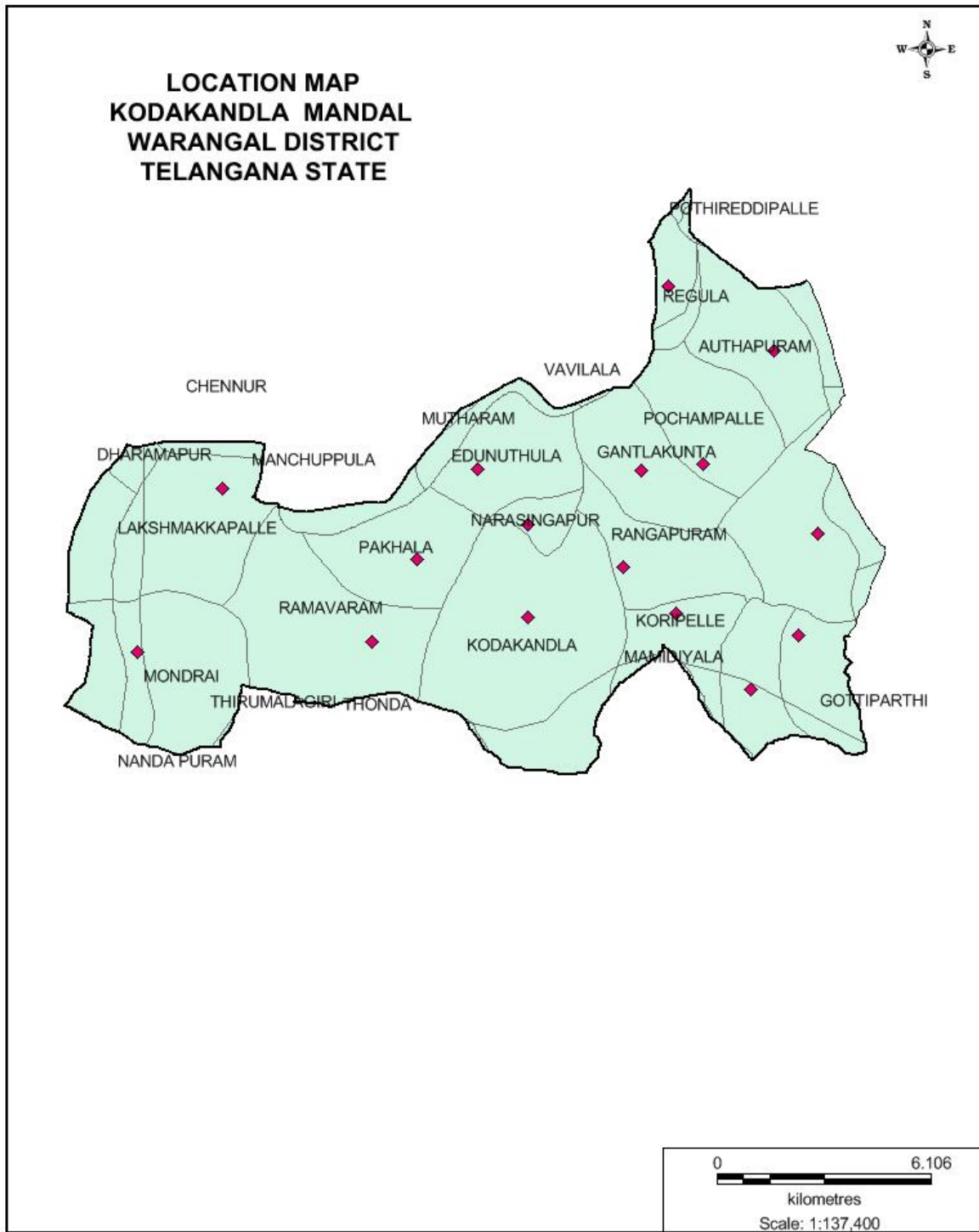
Acknowledgements

The inputs with regard to the Utilizable Yield, existing and proposed Artificial Recharge Structures have been provided by the Director, State Ground Water Department, Government of Telangana. The same is duly acknowledged.

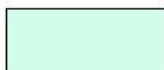
**PROPOSED ARTIFICIAL RECHARGE STRUCTURES KODAKANDLA MANDAL,
WARANGAL DISTRICT, TELANGANA.**

S.No.	Mandal	Lattitude	Longitude	Structure type
1	Kodakandla	17.5335	79.4130	Checkdam
2	Kodakandla	17.5547	79.4564	Checkdam
3	Kodakandla	17.5253	79.4442	Checkdam
4	Kodakandla	17.5618	79.4964	Checkdam
5	Kodakandla	17.5477	79.5028	Checkdam
6	Kodakandla	17.5361	79.5175	Checkdam
7	Kodakandla	17.5141	79.5175	Checkdam
8	Kodakandla	17.5447	79.5451	Checkdam
9	Kodakandla	17.5211	79.5734	Checkdam
10	Kodakandla	17.5846	79.5594	Checkdam
11	Kodakandla	17.6129	79.6096	Checkdam
12	Kodakandla	17.5696	79.4526	Percolation Tank
13	Kodakandla	17.5331	79.4338	Percolation Tank
14	Kodakandla	17.5539	79.5110	Percolation Tank
15	Kodakandla	17.5469	79.5365	Percolation Tank
16	Kodakandla	17.5557	79.5420	Percolation Tank
17	Kodakandla	17.5479	79.5594	Percolation Tank
18	Kodakandla	17.5573	79.5941	Percolation Tank
19	Kodakandla	17.5541	79.6056	Percolation Tank
20	Kodakandla	17.5806	79.5564	Percolation Tank
21	Kodakandla	17.5942	79.5083	Percolation Tank

Fig.1



LEGEND



Village boundary



Village HQ

Fig.2

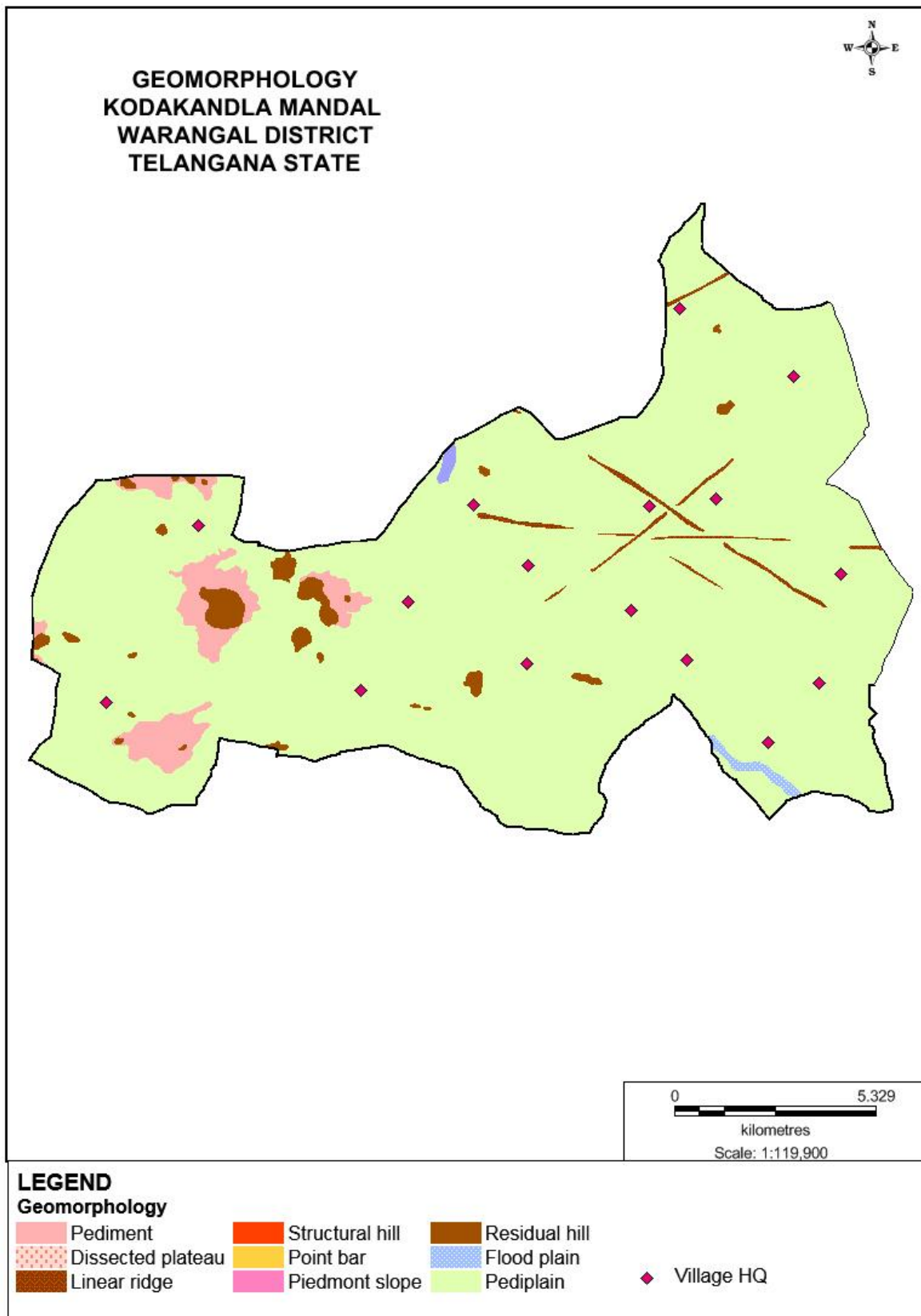


Fig.3

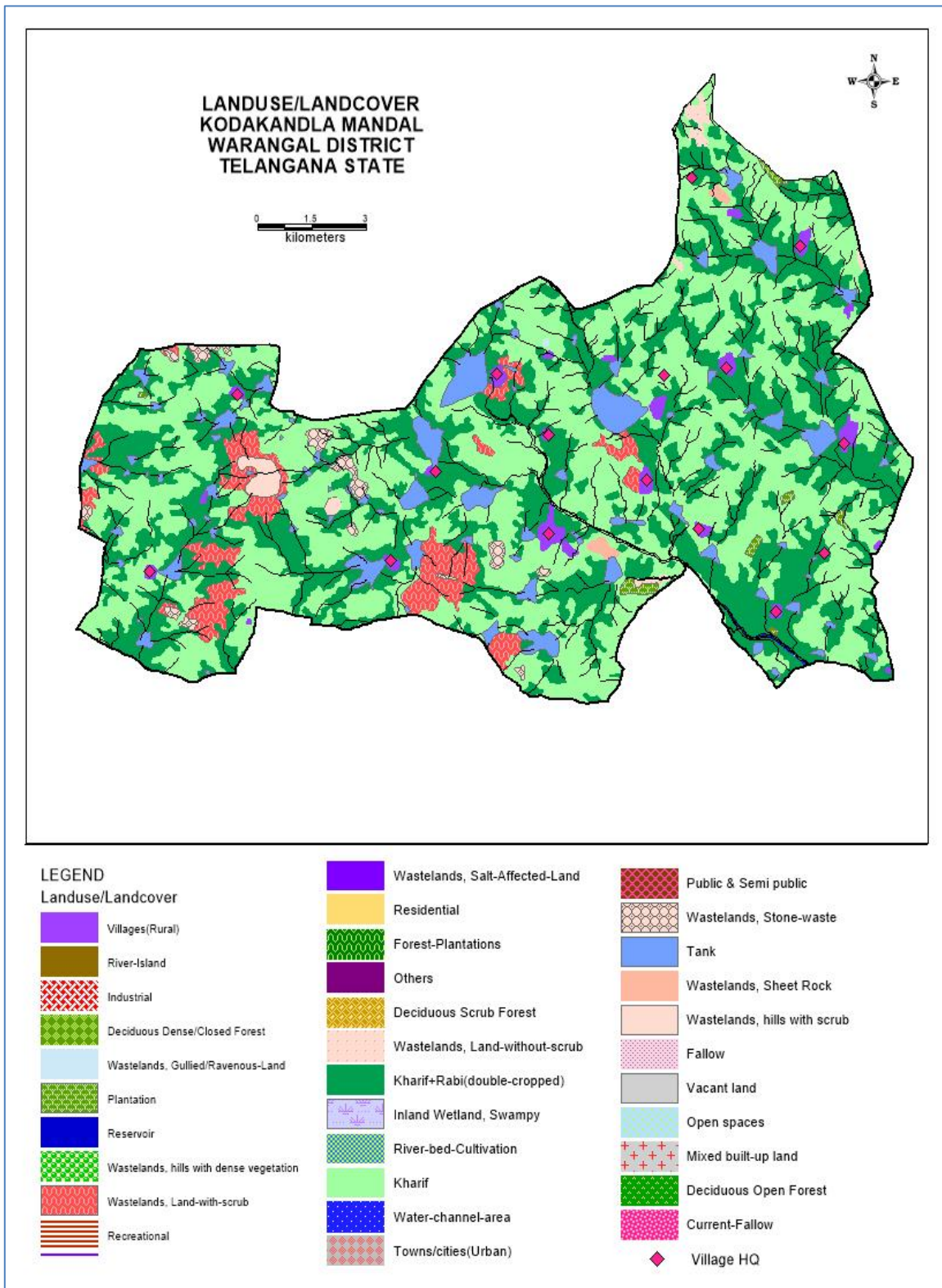


Fig.4

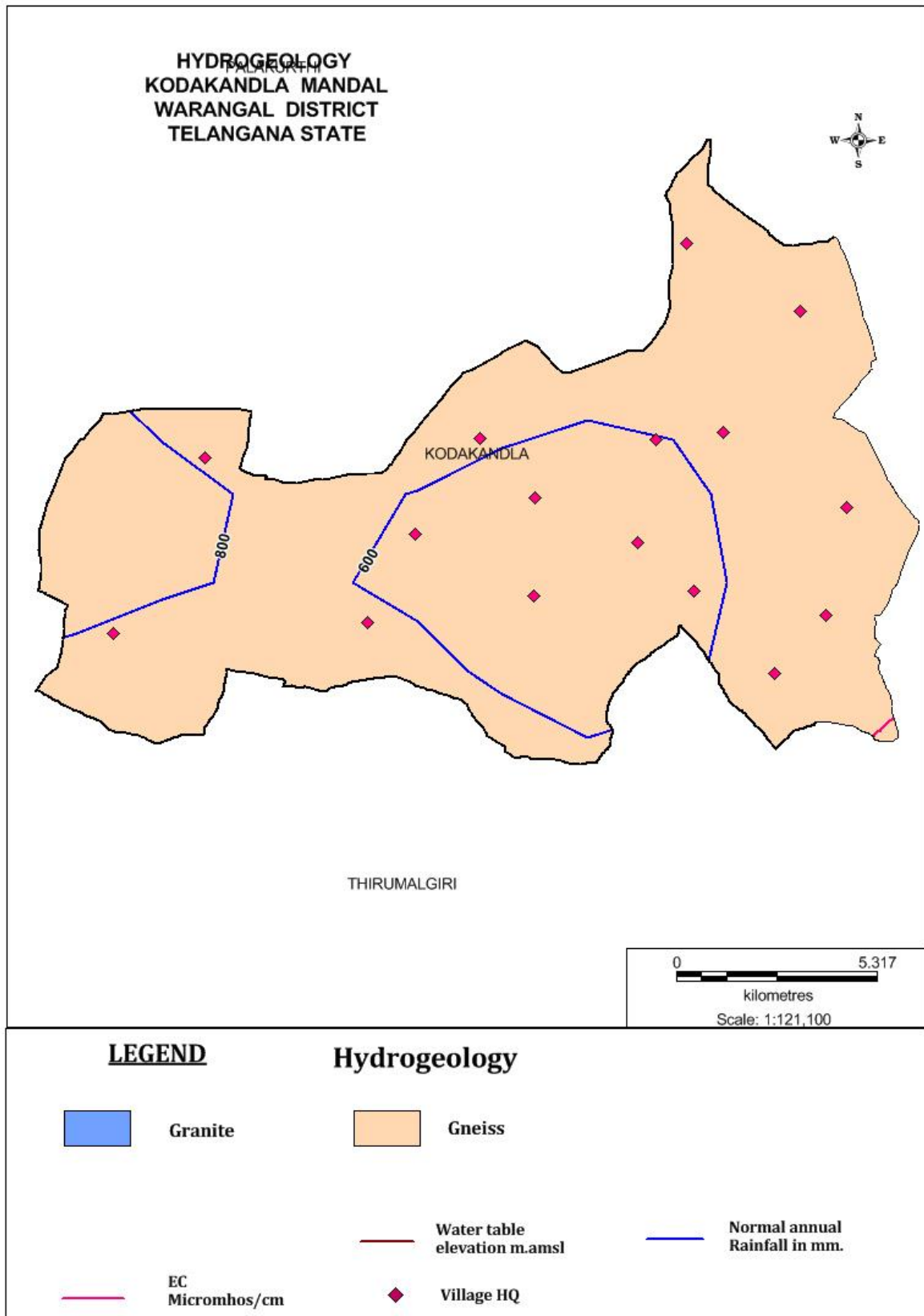


Fig.5

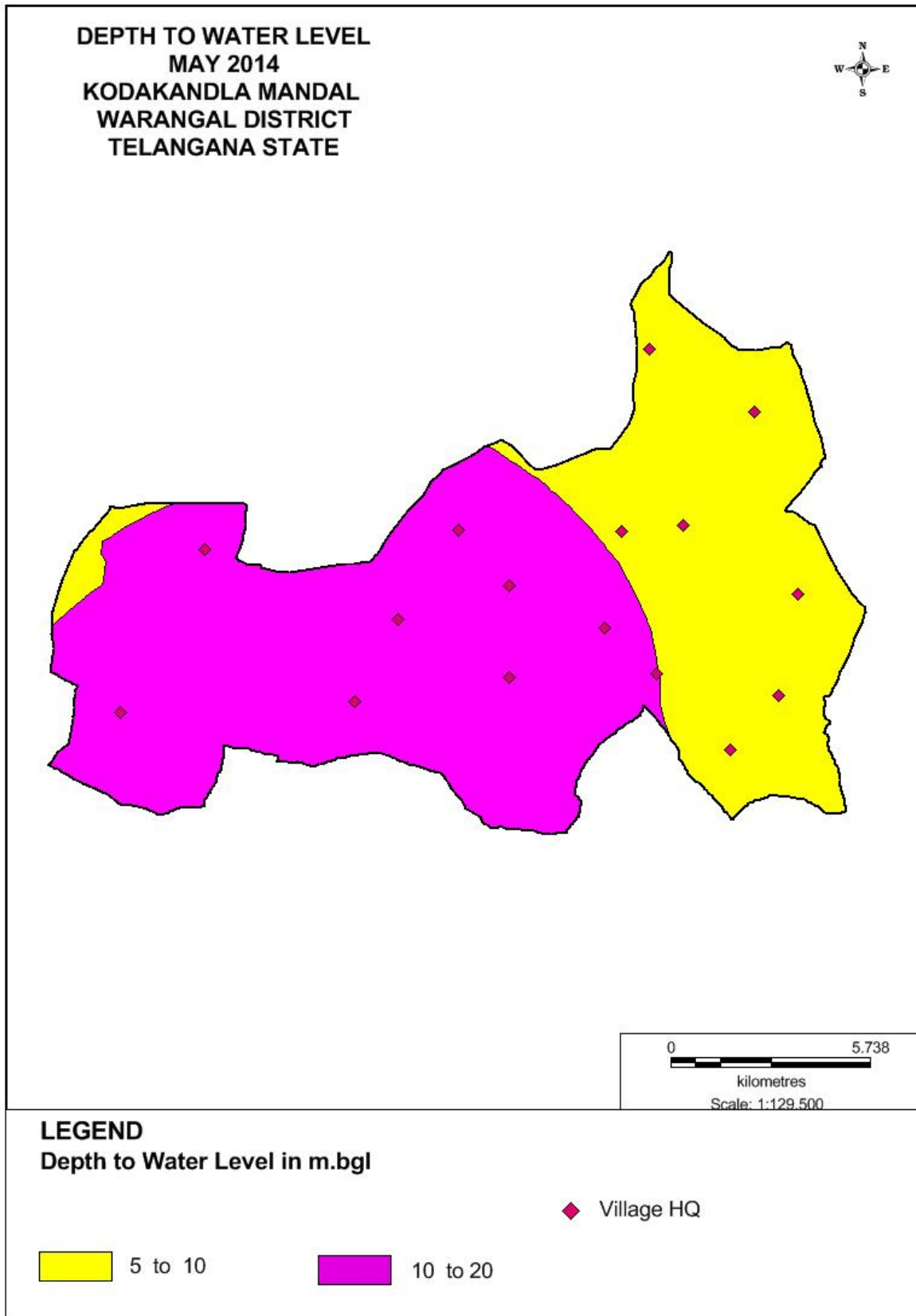


Fig.6

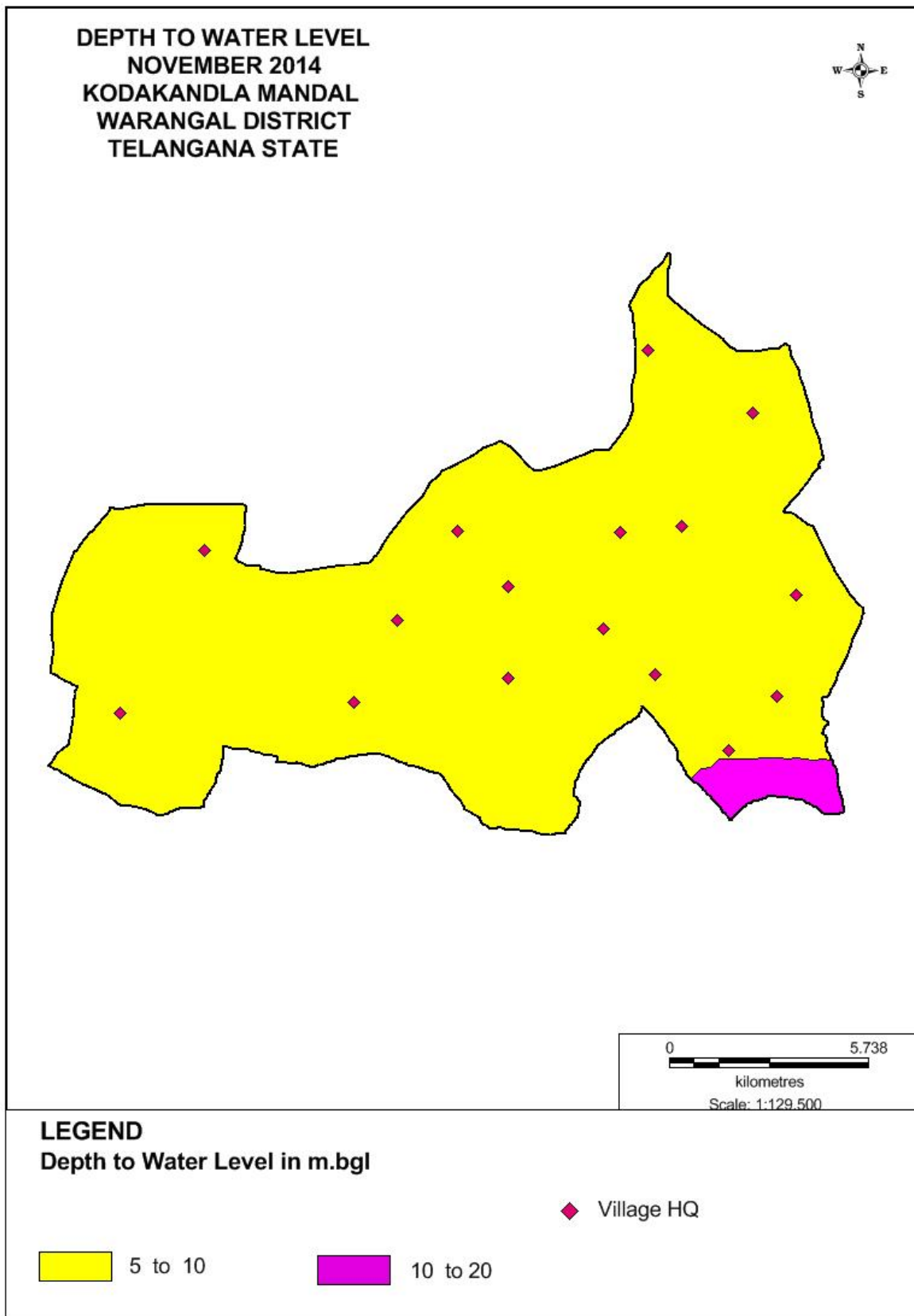


Fig.7

