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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
GANDLAPENTA MANDAL, ANANTAPUR DISTRICT,
ANDHRA PRADESH

SOUTHERN REGION
HYDERABAD
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PLAN ON
ARTIFICIAL RECHARGE TO GROUNDWATER AND
WATER CONSERVATION IN
GANDLAPENTA MANDAL, ANANTAPUR DISTRICT,
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CONTENTS

S.NO	TOPIC
1	INTRODUCTION
2	LOCATION
3	PHYSIOGRAPHY AND DRAINAGE
4	RAINFALL
5	LAND USE PATTERN
6	HYDROGEOLOGY
7	GROUND WATER LEVEL SCENARIO
8	DYNAMIC GROUND WATER RESOURCES
9	NEED FOR ARTIFICIAL RECHARGE AND CONSERVATION METHODS
10	JUSTIFICATION OF THE ARTIFICIAL RECHARGE PROJECT
11	AVAILABILITY OF SURPLUS, SURFACE WATER FOR ARTIFICIAL RECAHRGE OR CONSERVATION
12	FEASIBLE ARTIFICIAL RECHARGE STRUCTURES
13	TENTATIVE COST ESTIMATES
14	TIME SCHEDULE

AT A GLANCE

Name of the Mandal	GANDLAPENTA
District	ANANTAPUR
State	ANDHRA PRADESH
Total Area (Sq.kms)	247
Area suitable for Artificial Recharge (Sq.kms)	204
Latitude and Longitude	13.949420 to 14.268480 and 78.090990 to 78.321350
Average Annual Rainfall (mm)	596
Geology	Granites, Gneisses
Average Depth To Water Level (Decadal) (Pre Monsoon)	26.4
Average Depth To Water Level (Decadal) (Post Monsoon)	10.9
Ground Water Resources (2011)	
Annual Replenishable Ground Water Resources (MCM/yr)	14.18
Net Annual Ground Water Availability(MCM)/yr	12.76
Net Annual Ground Water Draft(MCM)/yr	13.34
Projected Demand for Domestic and Industrial Use(MCM)/yr	1.66
Stage of Ground Water Development (%)	105
Surface runoff available (MCM)/yr	16.70
Total Storage Created in the Mandal by Various Agencies (MCM)/yr	1.08
Artificial Recharge/Conservation Measures	
Recharge Structures Proposed (No.s)	Percolation Tanks: 0, Check Dams: 58 Farm ponds: 240, Recharge Shafts: 77
Improving Water use Efficiency	Micro Irrigation System: 1200 ha
Tentative Total Cost in Lakhs (Rs.)	1189.33
Expected Recharge/Savings (MCM)/yr	5.696

1. INTRODUCTION

Gandlapenta Mandal is one of the over-exploited mandal in Anantapur district, Andhra Pradesh State, which is economically backward and chronically drought affected. The mandal has 12 inhabited villages and one un-inhabited village with 12 gram panchayats.

2. LOCATION

The mandal lies between north latitudes 13.949420 to 14.268480 and between east longitudes 78.090990 to 78.321350. The mandal occupies the South-east part of the Anantapur district and is bounded on the north by Talupula mandal, on the east by Nambulipulikunta mandal, on the south by Tanakal mandal and west by Kadiri mandal. (Fig.1) The geographical area of the mandal is 247 sq.km.

3. PHYSIOGRAPHY AND DRAINAGE:

The area is drained by streams which are tributaries of Pennar River. 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 860 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 247 sq.km, the area covered by forest is 43.01 sq.km and the net area sown is 72.09 sq.km. Barren and uncultivable land is 35.72 sq.km. The land for non agricultural use accounts for 7.20 sq.km. (Fig.3)

6. HYDROGEOLOGY

The Mandal is underlain by granitic gneisses of Archaean age (Fig-4). The ground water in these formations occurs in the weathered and fractured zones under the water table and Semi- Confined conditions. The weathered zone thickness as per the GEC report is 8 m. The weathered zone has been extensively tapped by dug and dug cum bore wells upto 20 m depth. Ground water occurs in fractured granites down to a depth of 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 m bgl. The average depth to water level (decadal) during pre and post monsoon is 26.4 and 10.9 m bgl respectively. The depth to water levels maps for pre and post monsoon period (2014) are shown in (Fig. 5 & 6 respectively.). The 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 Gandlapenta Mandal, Anantapur district is given in Table-1.

Table-1: Ground water resources of Gandlapenta Mandal, Anantapur District.

Annual Replenishable Ground water resources (MCM)	14.18
Net Annual Ground water Availability. (MCM)	12.76
Net Annual Ground Water Draft(MCM)/yr	13.34
Projected Demand for Domestic and Industrial use up to 2025. (MCM)	1.66
Stage of Ground water development (%).	105
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 upto 20 m bgl. 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.

10. JUSTIFICATION OF THE ARTIFICIAL RECHARGE PROJECT

Gandlapenta Mandal falls under high stage of ground water development i.e., 105 % and with sufficient amount of uncommitted surface runoff. The area is completely dependent on ground water for domestic industrial and irrigation purposes. During the monsoon 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 RECHARGE 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)	247
Hilly Area (Sq.kms)	43
Area suitable for Artificial Recharge (sq.km.)	204
Runoff Yield in MCM/yr	16.70
Existing No. of Check Dams	85
Storage created MCM/yr	0.60
Existing No. of Percolation Tanks	68
Storage created MCM/yr	0.48
Total Existing Storage Created	1.08

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 run off available in the mandal has been assessed as 15.62 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 596 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 rates.

Thus, **58 Check dams** 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 43 and 34 recharge shafts of 165 mm dia with 30 m depth in the existing check dams and percolation tanks respectively.

C). Farm Pond

A farm pond is a large dug out in the earth, usually square or rectangular in shape, which harvests rainwater 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 240 farm ponds in 12 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 1200 ha @ 100 ha per village.

13. TENTATIVE COST ESTIMATES (GANDLAPENTA 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)	58	1.624	5	290	1.218
2	Recharge shaft in Check dam (50% of the existing Check dams)	43	0.473	0.5	21.5	0.473
3	Proposed Percolation Tanks (100*100*2.5)* 4 fillings)	0	0	15	0	0
4	Renovation Desilting, Repairs and installation of Recharge Shafts in existing PTS (50% of the existing PTS)	34	0.374	1	34	0.374
5	Proposed Farm Pond (6 filling) 5*5*1.5 dimension @ 20 farm ponds per each village	240	0.03456	0.25	60	0.031104
6	Proposed Sprinkler/drip/HDPE pipes for 100 ha in each village	1200	7.2	0.6	720	3.6
7	Proposed Piezometers up to 50 mbgl @ one PZ per Village	12	0	0.6	7.2	0
8 (i)	Total (No. of AR Structures)	387	2.51		412.7	2.096
8 (ii)	Total (ha)	1200			720	3.6
	Total (8(i) + 8 (ii))				1132.7	5.696
9	Impact Assessment & O & M -5 % of Total cost of the Scheme				56.635	
	Grand Total				1189.335	

*(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 5.696 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 105% to 72% (33%)
4. It will also help in controlling soil erosion.

Acknowledgements

The data received from the Director Ground Water Department Andhra Pradesh in respect of the basic inputs is duly acknowledged. The information on existing Artificial Recharge Structures has been taken from the EMUSTER, Department of Rural Development, Government of Andhra Pradesh.

EXISTING ARTIFICIAL RECHARGE STRUCTURES
GANDLAPENTA MANDAL, ANANTAPUR DISTRICT, AP.

S.no	Gram Panchayat	Habitation	Structure Type	Longitude	Latitude	Scheme
1	Jeenulakunta	Jeenulakunta	Check Dam	78.2932	14.1175	NREGS
2	Jeenulakunta	Jeenulakunta	Check Dam	78.2962	14.1155	NREGS
3	Jeenulakunta	Jeenulakunta	Check Dam	78.2918	14.1273	NREGS
4	Jeenulakunta	ValasavandlaPalli	Check Dam	78.2806	14.1280	NREGS
5	Thummalabylu	Peddathnada	Check Dam	78.2520	14.1536	NREGS
6	Thummalabylu	PothenePalli	Check Dam	78.2325	14.1522	NREGS
7	Thummalabylu	Thummalabylu	Check Dam	78.2432	14.1515	NREGS
8	Maddivarigondi	Harijana Wada	Check Dam	78.2127	14.1226	NREGS
9	Maddivarigondi	Harijana Wada	Check Dam	78.2159	14.1208	NREGS
10	Maddivarigondi	Maddivarigondi	Check Dam	78.2258	14.1110	NREGS
11	Maddivarigondi	Maddivarigondi	Check Dam	78.2254	14.1092	NREGS
12	Veparala	Tallakalva	Check Dam	78.3058	14.0901	NREGS
13	Veparala	Tallakalva	Check Dam	78.3081	14.0976	NREGS
14	Veparala	Tallakalva	Check Dam	78.3057	14.0962	NREGS
15	Veparala	Tallakalva	Check Dam	78.2942	14.0928	NREGS
16	Veparala	Tallakalva	Check Dam	78.2972	14.0960	NREGS
17	Veparala	Veparala	Check Dam	78.2947	14.0970	NREGS
18	Somayajulapalli	Baligutlapalli	Check Dam	78.2696	14.0576	NREGS
19	Somayajulapalli	KathivariPalli	Check Dam	78.2849	14.0882	NREGS
20	Somayajulapalli	KathivariPalli	Check Dam	78.2826	14.0873	NREGS
21	Somayajulapalli	KathivariPalli	Check Dam	78.2880	14.0892	NREGS
22	Somayajulapalli	KathivariPalli	Check Dam	78.2886	14.0896	NREGS
23	Somayajulapalli	KathivariPalli	Check Dam	78.2889	14.0873	NREGS
24	Somayajulapalli	KathivariPalli	Check Dam	78.2919	14.0897	NREGS
25	Somayajulapalli	SomayajulaPalli	Check Dam	78.2807	14.0871	NREGS
26	Somayajulapalli	SomayajulaPalli	Check Dam	78.2784	14.0793	NREGS
27	Somayajulapalli	YenumulavariPalli	Check Dam	78.2893	14.0734	NREGS
28	Somayajulapalli	YenumulavariPalli	Check Dam	78.2894	14.0726	NREGS
29	Somayajulapalli	YerrachenuPalli	Check Dam	78.2569	14.0475	NREGS
30	Somayajulapalli	YerrachenuPalli	Check Dam	78.2624	14.0477	NREGS
31	Somayajulapalli	YerrachenuPalli	Check Dam	78.2656	14.0460	NREGS
32	Somayajulapalli	YerrachenuPalli	Check Dam	78.2659	14.0476	NREGS
33	Thoopalli	KatakamvariPalli	Check Dam	78.2500	14.0920	NREGS
34	Thoopalli	KatakamvariPalli	Check Dam	78.2465	14.0906	NREGS
35	Thoopalli	Vankapalli	Check Dam	78.2536	14.0786	NREGS
36	Thoopalli	Vankapalli	Check Dam	78.2544	14.0777	NREGS
37	Gandlapenta	Gandlapenta	Check Dam	78.2638	14.1000	NREGS
38	Gandlapenta	Gandlapenta	Check Dam	78.2685	14.1006	NREGS
39	Gandlapenta	KotlaPalli	Check Dam	78.2694	14.1213	NREGS

40	Gandlapenta	NayanavariPalli	Check Dam	78.2650	14.1222	NREGS
41	Gandlapenta	NayanavariPalli	Check Dam	78.2630	14.1243	NREGS
42	Gandlapenta	NayanavariPalli	Check Dam	78.2614	14.1262	NREGS
43	Gandlapenta	YelugootivariPalli	Check Dam	78.2833	14.1083	NREGS
44	Chamalagondi	BandameedaPalli	Check Dam	78.3271	14.0456	NREGS
45	Chamalagondi	BandameedaPalli	Check Dam	78.3273	14.0404	NREGS
46	Chamalagondi	BandameedaPalli	Check Dam	78.3278	14.0407	NREGS
47	Chamalagondi	BayareddiPalli	Check Dam	78.3203	14.0616	NREGS
48	Chamalagondi	GajulavariPali	Check Dam	78.3319	14.0873	NREGS
49	Chamalagondi	GajulavariPali	Check Dam	78.3325	14.0877	NREGS
50	Chamalagondi	GajulavariPali	Check Dam	78.3279	14.0854	NREGS
51	Chamalagondi	SinganavariPalli	Check Dam	78.3270	14.0826	NREGS
52	Chamalagondi	SinganavariPalli	Check Dam	78.3286	14.0780	NREGS
53	Kurumamidi	Gollapalli	Check Dam	78.3240	14.1168	NREGS
54	Kurumamidi	Gollapalli	Check Dam	78.3238	14.1107	NREGS
55	Kurumamidi	Kurumamidi	Check Dam	78.3086	14.0792	NREGS
56	Kurumamidi	PathacheruvuM.Thand	Check Dam	78.3142	14.0995	NREGS
57	Katarupalli	KataruPalli	Check Dam	78.2481	14.1283	NREGS
58	Katarupalli	KataruPalli	Check Dam	78.2483	14.1271	NREGS
59	Katarupalli	KataruPalli	Check Dam	78.2559	14.1319	NREGS
60	Katarupalli	KataruPalli	Check Dam	78.2568	14.1329	NREGS
61	Katarupalli	KataruPalli	Check Dam	78.2405	14.1212	NREGS
62	Katarupalli	KataruPalli	Check Dam	78.2458	14.1322	NREGS
63	Katarupalli	KataruPalli	Check Dam	78.2704	14.1486	NREGS
64	Malameedapalli	Aramadakalavari Pall	Check Dam	78.2837	14.0376	NREGS
65	Malameedapalli	Aramadakalavari Pall	Check Dam	78.2781	14.0339	NREGS
66	Malameedapalli	Aramadakalavari Pall	Check Dam	78.2767	14.0315	NREGS
67	Malameedapalli	Banancherupalli	Check Dam	78.2614	14.0289	NREGS
68	Malameedapalli	Banancherupalli	Check Dam	78.2577	14.0238	NREGS
69	Malameedapalli	Banancherupalli	Check Dam	78.2463	14.0245	NREGS
70	Malameedapalli	Banancherupalli	Check Dam	78.2484	14.0256	NREGS
71	Malameedapalli	Banancherupalli	Check Dam	78.2485	14.0264	NREGS
72	Malameedapalli	Chamalachenubylu	Check Dam	78.2308	14.0429	NREGS
73	Malameedapalli	DevalacheruvuPalli	Check Dam	78.2744	14.0068	NREGS
74	Malameedapalli	Kotapalli(Koturu)	Check Dam	78.2650	14.0304	NREGS
75	Malameedapalli	KummaravandlaPalli	Check Dam	78.2916	14.0279	NREGS
76	Malameedapalli	KummaravandlaPalli	Check Dam	78.2920	14.0260	NREGS
77	Malameedapalli	KummaravandlaPalli	Check Dam	78.2885	14.0305	NREGS
78	Malameedapalli	KummaravandlaPalli	Check Dam	78.2874	14.0331	NREGS
79	Malameedapalli	KummaravandlaPalli	Check Dam	78.2848	14.0172	NREGS
80	Godduvelagala	ErrannagattuPalli	Check Dam	78.1905	14.1518	NREGS
81	Godduvelagala	PallavandlaPalli	Check Dam	78.2160	14.1543	NREGS
82	Chamalagondi	SinganavariPalli	Check Wall	78.3290	14.0745	NREGS

83	Godduvelagala	PallavandlaPalli	Check Wall	78.2188	14.1546	NREGS
84	Godduvelagala	VankaloPalli	Check Wall	78.2219	14.1702	NREGS
85	Godduvelagala	VankaloPalli	Check Wall	78.2269	14.1679	NREGS
86	Somayajulapalli	Baligutlapalli	MPT	78.2622	14.0632	NREGS
87	Somayajulapalli	KathivariPalli	MPT	78.2946	14.0837	NREGS
88	Gandlapenta	NayanavariPalli	MPT	78.2618	14.1252	NREGS
89	Chamalagondi	BayareddiPalli	MPT	78.3236	14.0617	NREGS
90	Chamalagondi	BayareddiPalli	MPT	78.3192	14.0627	NREGS
91	Chamalagondi	BayareddiPalli	MPT	78.3189	14.0612	NREGS
92	Chamalagondi	BayareddiPalli	MPT	78.3214	14.0598	NREGS
93	Katarupalli	KataruPalli	MPT	78.2406	14.1364	NREGS
94	Malameedapalli	Chamalachenubylu	MPT	78.2395	14.0499	NREGS
95	Malameedapalli	Kotapalli(Koturu)	MPT	78.2637	14.0299	NREGS
96	Jeenulakunta	Jeenulakunta	PT	78.2891	14.1194	NREGS
97	Jeenulakunta	ValasavandlaPalli	PT	78.2818	14.1267	NREGS
98	Jeenulakunta	ValasavandlaPalli	PT	78.2816	14.1368	NREGS
99	Jeenulakunta	ValasavandlaPalli	PT	78.2849	14.1322	NREGS
100	Thummalabylu	Peddathnada	PT	78.2499	14.1545	NREGS
101	Thummalabylu	Thummalabylu	PT	78.2404	14.1462	NREGS
102	Maddivarigondi	DasarivandlaPalli	PT	78.2232	14.0968	NREGS
103	Maddivarigondi	Kamathampalli	PT	78.2116	14.1177	NREGS
104	Maddivarigondi	Kamathampalli	PT	78.2148	14.1200	NREGS
105	Maddivarigondi	Kamathampalli	PT	78.2117	14.1188	NREGS
106	Maddivarigondi	Kota Palli	PT	78.2219	14.1023	NREGS
107	Maddivarigondi	Maddivarigondi	PT	78.2260	14.1056	NREGS
108	Maddivarigondi	Maddivarigondi	PT	78.2274	14.1140	NREGS
109	Veparala	Tallakalva	PT	78.2917	14.0928	NREGS
110	Veparala	Veparala	PT	78.2897	14.0978	NREGS
111	Somayajulapalli	Baligutlapalli	PT	78.2605	14.0541	NREGS
112	Somayajulapalli	KathivariPalli	PT	78.2915	14.0802	NREGS
113	Somayajulapalli	YenumulavariPalli	PT	78.2882	14.0753	NREGS
114	Somayajulapalli	YerrachenuPalli	PT	78.2674	14.0505	NREGS
115	Gandlapenta	KotlaPalli	PT	78.2762	14.1193	NREGS
116	Gandlapenta	PothavandlaPalli	PT	78.2777	14.1244	NREGS
117	Gandlapenta	YelugootivariPalli	PT	78.2788	14.1042	NREGS
118	Gandlapenta	YelugootivariPalli	PT	78.2709	14.1041	NREGS
119	Chamalagondi	BandameedaPalli	PT	78.3311	14.0592	NREGS
120	Chamalagondi	BayareddiPalli	PT	78.3267	14.0688	NREGS
121	Chamalagondi	Chamalagoudi	PT	78.3349	14.0612	NREGS
122	Katarupalli	JurukivariPalli	PT	78.2350	14.1055	NREGS
123	Katarupalli	KataruPalli	PT	78.2561	14.1303	NREGS
124	Katarupalli	KataruPalli	PT	78.2561	14.1311	NREGS
125	Malameedapalli	Aramadakalavari Pall	PT	78.2784	14.0227	NREGS

126	Malameedapalli	Banancherupalli	PT	78.2590	14.0421	NREGS
127	Malameedapalli	Banancherupalli	PT	78.2575	14.0323	NREGS
128	Malameedapalli	Banancherupalli	PT	78.2461	14.0323	NREGS
129	Malameedapalli	Banancherupalli	PT	78.2612	14.0260	NREGS
130	Malameedapalli	Chamalachenubylu	PT	78.2325	14.0418	NREGS
131	Malameedapalli	Chamalachenubylu	PT	78.2263	14.0451	NREGS
132	Malameedapalli	Chamalachenubylu	PT	78.2269	14.0470	NREGS
133	Malameedapalli	Chamalachenubylu	PT	78.2302	14.0502	NREGS
134	Malameedapalli	Chamalachenubylu	PT	78.2316	14.0473	NREGS
135	Malameedapalli	Chamalachenubylu	PT	78.2312	14.0464	NREGS
136	Malameedapalli	DevalacheruvuPalli	PT	78.2780	14.0051	NREGS
137	Malameedapalli	DevalacheruvuPalli	PT	78.2782	14.0051	NREGS
138	Malameedapalli	KaranamvariPaalli	PT	78.2880	14.0158	NREGS
139	Malameedapalli	KaranamvariPaalli	PT	78.2950	14.0239	NREGS
140	Malameedapalli	Kotapalli(Koturu)	PT	78.2711	14.0143	NREGS
141	Malameedapalli	Kotapalli(Koturu)	PT	78.2706	14.0246	NREGS
142	Malameedapalli	Kotapalli(Koturu)	PT	78.2684	14.0255	NREGS
143	Malameedapalli	Malameedapalli	PT	78.2745	14.0115	NREGS
144	Malameedapalli	Malameedapalli	PT	78.2717	14.0163	NREGS
145	Malameedapalli	Malameedapalli	PT	78.2698	14.0318	NREGS
146	Malameedapalli	PatravandlaPalli	PT	78.2438	14.0388	NREGS
147	Malameedapalli	PatravandlaPalli	PT	78.2410	14.0373	NREGS
148	Malameedapalli	PatravandlaPalli	PT	78.2451	14.0413	NREGS
149	Godduvelagala	NeerukuntlaPalli	PT	78.2150	14.1709	NREGS
150	Godduvelagala	PallavandlaPalli	PT	78.2153	14.1550	NREGS
151	Godduvelagala	PallavandlaPalli	PT	78.2010	14.1646	NREGS
152	Godduvelagala	PallavandlaPalli	PT	78.2197	14.1558	NREGS
153	Godduvelagala	VankaloPalli	PT	78.2277	14.1695	NREGS

PROPOSED ARTIFICIAL RECHARGE STRUCTURES GANDLAPENTA MANDAL,
ANATAPUR DISTRICT, AP.

S.No.	Mandal	Latitude	Longitude	Structure_Type
1	Gandlapenta	14.0968	78.2232	CheckDam
2	Gandlapenta	14.0786	78.2536	CheckDam
3	Gandlapenta	14.0777	78.2544	CheckDam
4	Gandlapenta	14.1709	78.2150	CheckDam
5	Gandlapenta	14.1550	78.2153	CheckDam
6	Gandlapenta	14.1646	78.2010	CheckDam
7	Gandlapenta	14.1558	78.2197	CheckDam
8	Gandlapenta	14.1702	78.2219	CheckDam
9	Gandlapenta	14.1695	78.2277	CheckDam
10	Gandlapenta	14.1679	78.2269	CheckDam
11	Gandlapenta	14.2232	78.1420	CheckDam
12	Gandlapenta	14.2287	78.1297	CheckDam
13	Gandlapenta	14.2295	78.1611	CheckDam
14	Gandlapenta	14.2484	78.1337	CheckDam
15	Gandlapenta	14.2427	78.1428	CheckDam
16	Gandlapenta	14.2427	78.1087	CheckDam
17	Gandlapenta	14.2629	78.1149	CheckDam
18	Gandlapenta	14.2145	78.1751	CheckDam
19	Gandlapenta	14.2195	78.1783	CheckDam
20	Gandlapenta	14.2170	78.1494	CheckDam
21	Gandlapenta	14.2113	78.2133	CheckDam
22	Gandlapenta	14.2284	78.1937	CheckDam
23	Gandlapenta	14.2026	78.2012	CheckDam
24	Gandlapenta	14.1856	78.1919	CheckDam
25	Gandlapenta	14.1761	78.1809	CheckDam
26	Gandlapenta	14.1911	78.2181	CheckDam
27	Gandlapenta	14.2031	78.2209	CheckDam
28	Gandlapenta	14.2113	78.2233	CheckDam
29	Gandlapenta	14.1993	78.1876	CheckDam
30	Gandlapenta	14.1881	78.2381	CheckDam
31	Gandlapenta	14.1813	78.2171	CheckDam
32	Gandlapenta	14.1709	78.2562	CheckDam
33	Gandlapenta	14.1709	78.2000	CheckDam
34	Gandlapenta	14.2055	78.1465	CheckDam
35	Gandlapenta	14.2013	78.1289	CheckDam
36	Gandlapenta	14.1923	78.1408	CheckDam
37	Gandlapenta	14.2397	78.1244	CheckDam
38	Gandlapenta	14.1702	78.2379	CheckDam
39	Gandlapenta	14.1636	78.2622	CheckDam
40	Gandlapenta	14.1288	78.2872	CheckDam
41	Gandlapenta	14.1405	78.2326	CheckDam

42	Gandlapenta	14.1392	78.2076	CheckDam
43	Gandlapenta	14.0338	78.2066	CheckDam
44	Gandlapenta	14.0420	78.1923	CheckDam
45	Gandlapenta	14.0560	78.1847	CheckDam
46	Gandlapenta	14.0766	78.1725	CheckDam
47	Gandlapenta	14.0503	78.2152	CheckDam
48	Gandlapenta	14.0911	78.2179	CheckDam
49	Gandlapenta	14.0727	78.2588	CheckDam
50	Gandlapenta	14.0191	78.2488	CheckDam
51	Gandlapenta	13.9792	78.2489	CheckDam
52	Gandlapenta	13.9956	78.2340	CheckDam
53	Gandlapenta	13.9774	78.2801	CheckDam
54	Gandlapenta	13.9627	78.2708	CheckDam
55	Gandlapenta	14.0275	78.2104	CheckDam
56	Gandlapenta	14.1014	78.2515	CheckDam
57	Gandlapenta	14.1180	78.1988	CheckDam
58	Gandlapenta	14.1307	78.1937	CheckDam

Fig.1

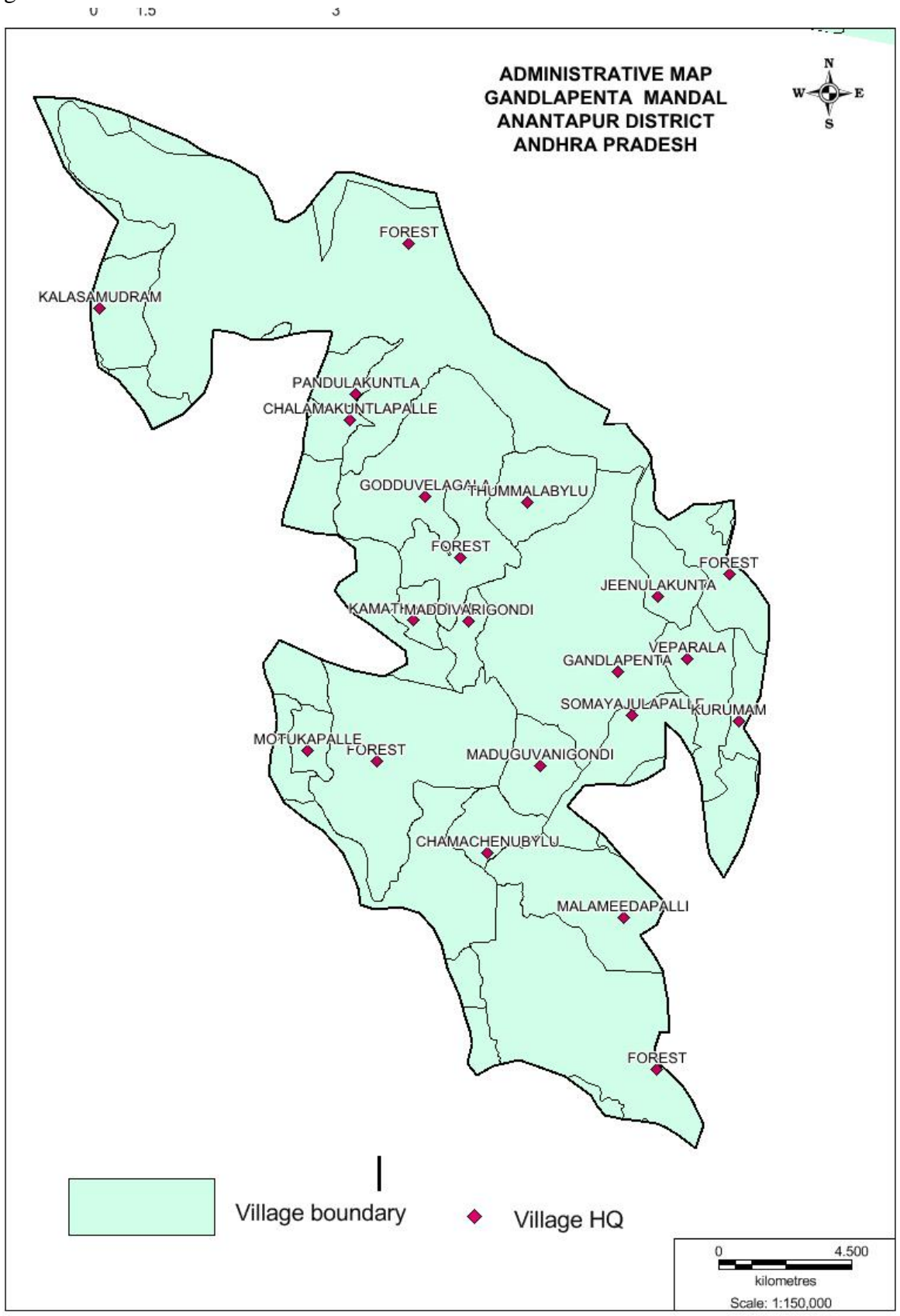


Fig.2

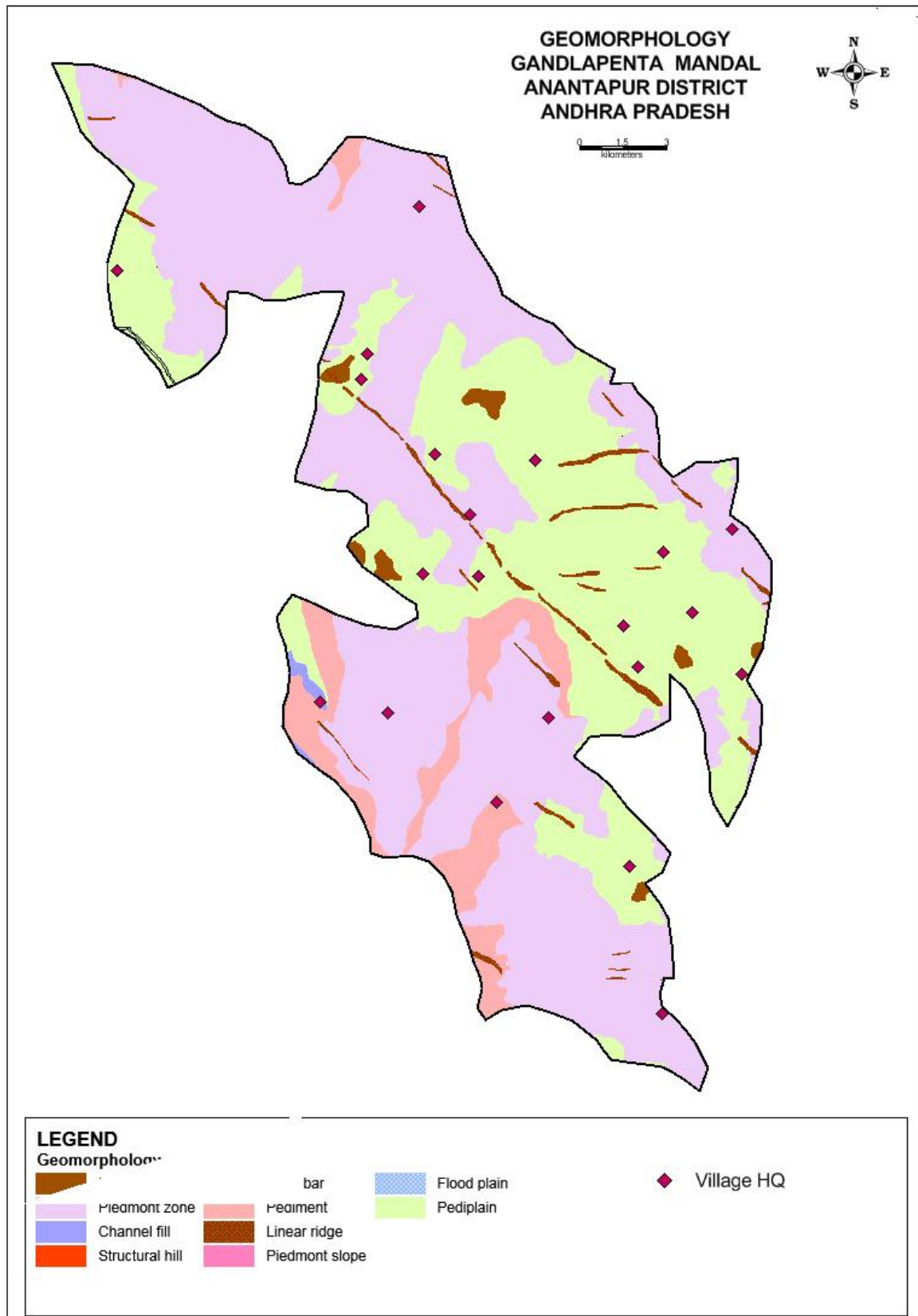


Fig.3

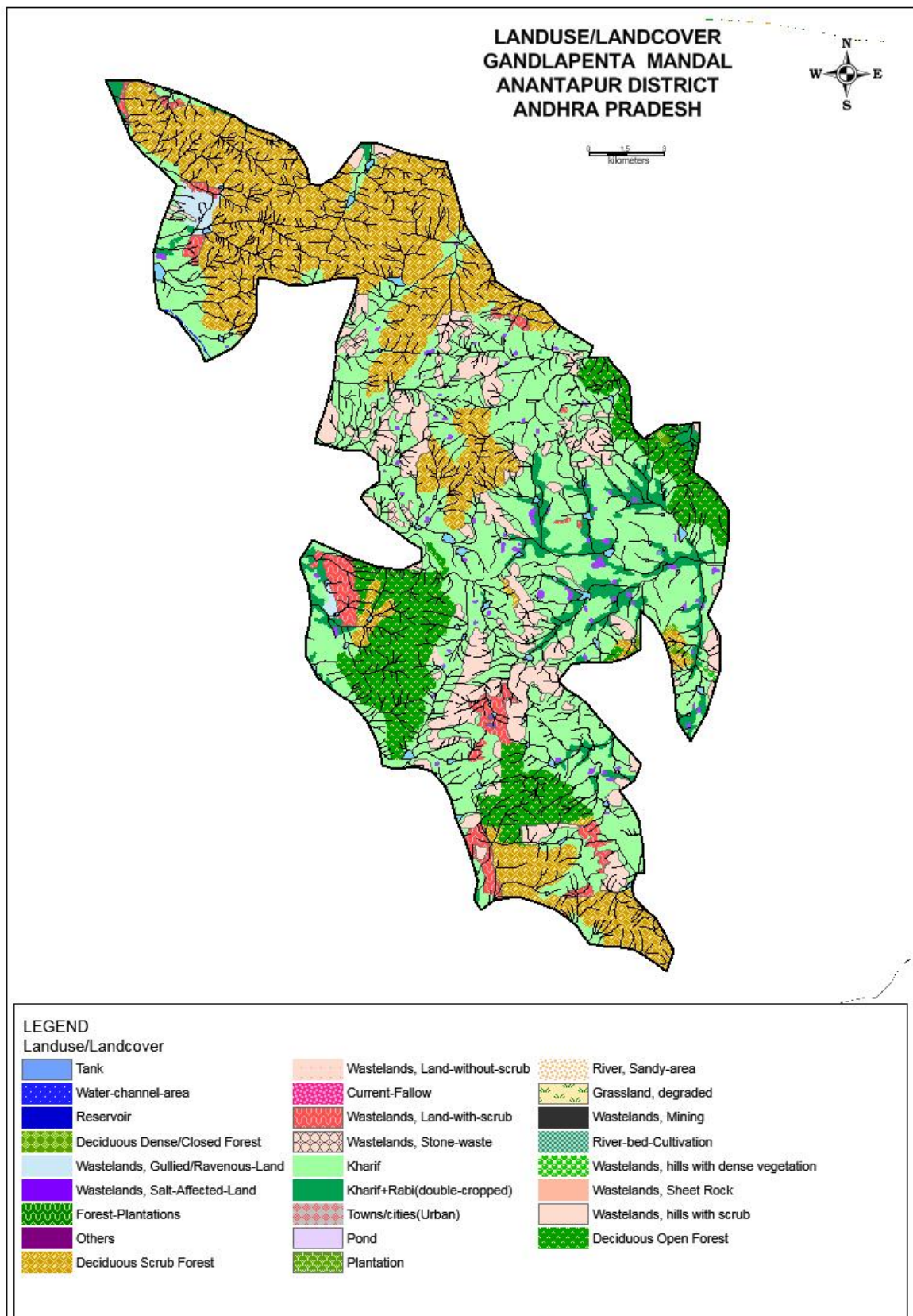


Fig.4

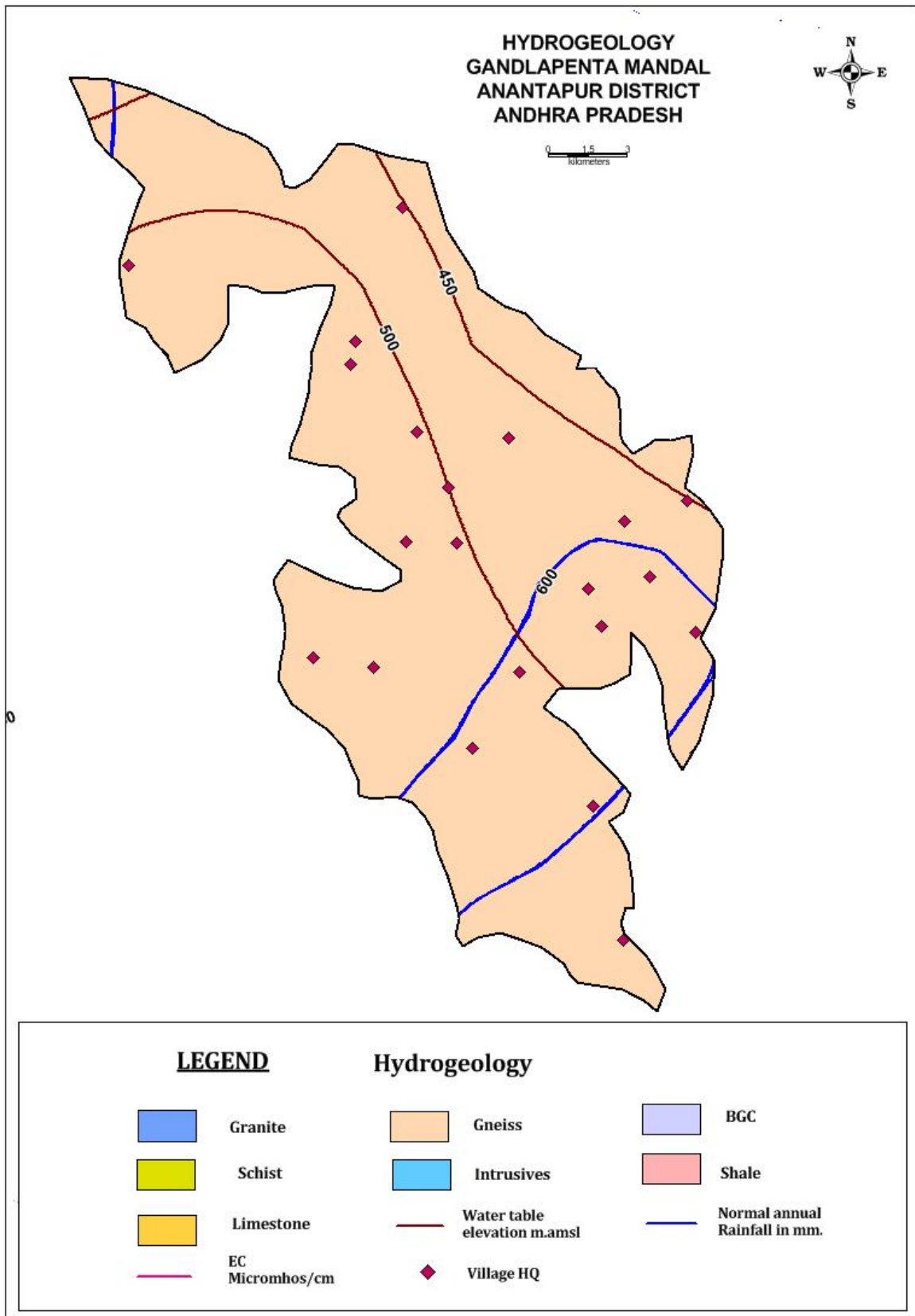


Fig.5

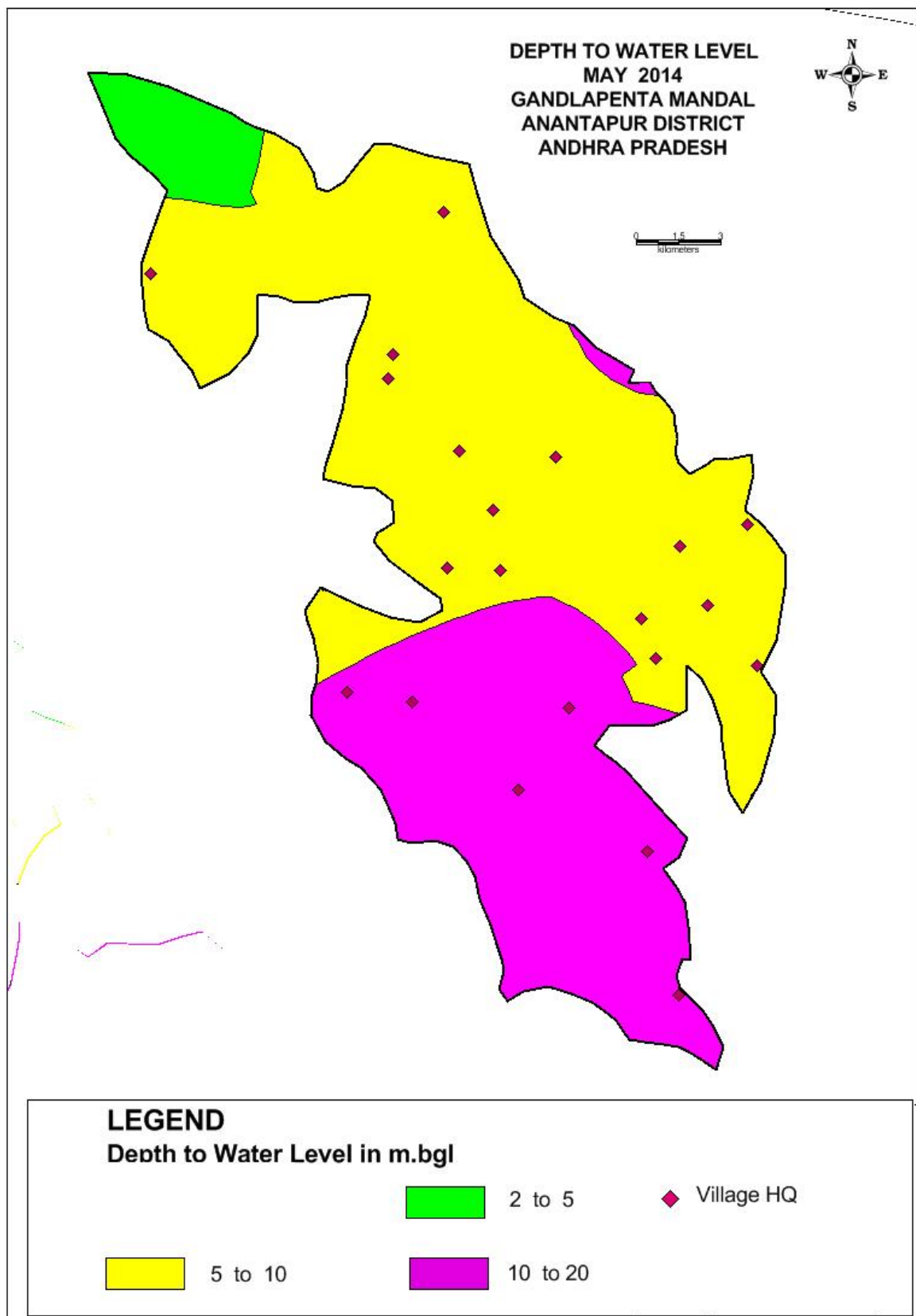


Fig.6

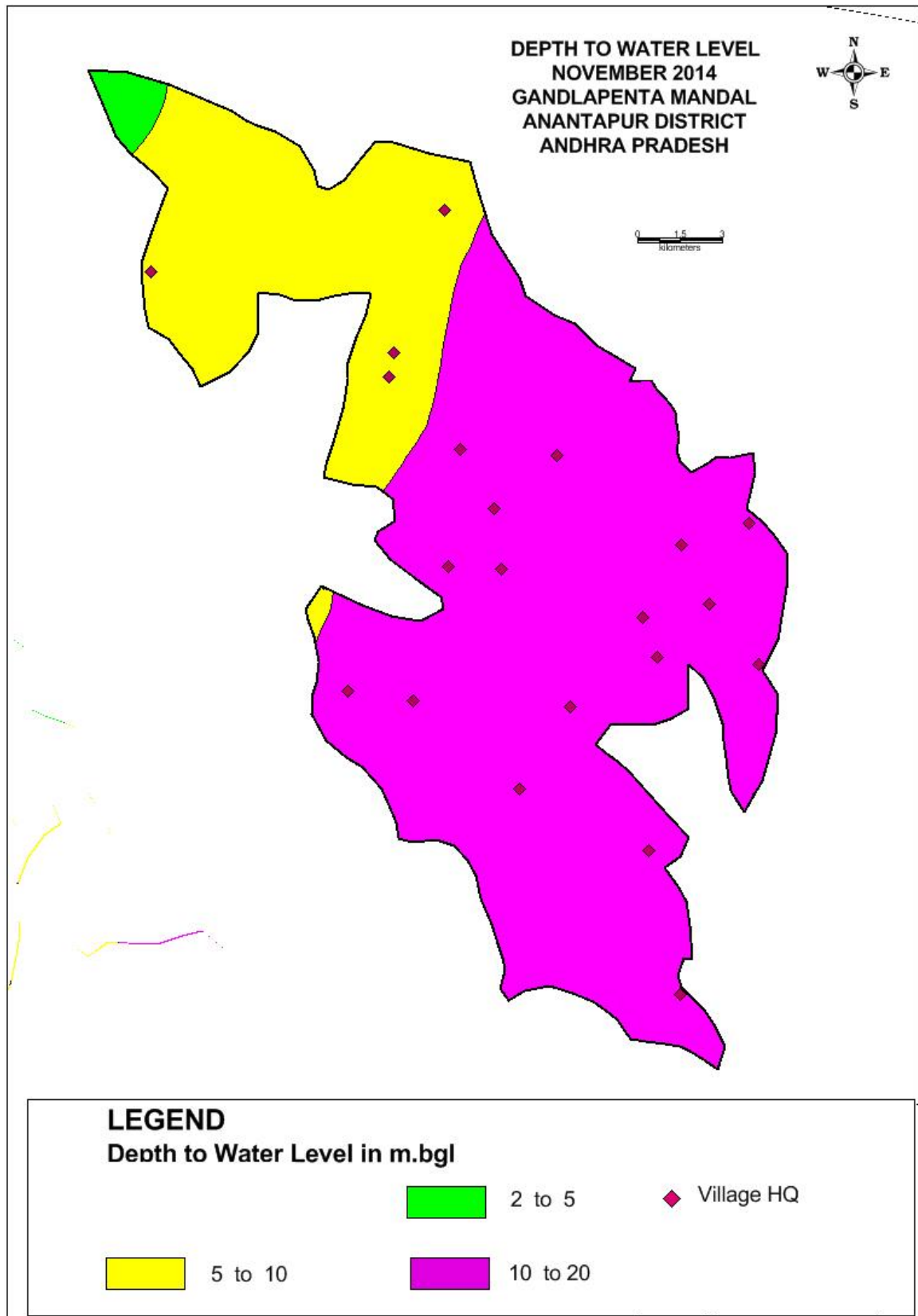


Fig.7

