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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
PAKALA MANDAL, CHITTOOR DISTRICT,
ANDHRA PRADESH

SOUTHERN REGION
HYDERABAD
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PLAN ON
ARTIFICIAL RECHARGE TO GROUNDWATER AND
WATER CONSERVATION IN
PAKALA MANDAL, CHITTOOR DISTRICT,
ANDHRA PRADESH

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AT A GLANCE

Name of the Mandal	PAKALA
District	CHITTOOR
State	ANDHRA PRADESH
Total Area(sq. km)	182
Area suitable for Artificial Recharge (sq.km.)	182
Latitude and Longitude	13.399090 to 13.522910 and 78.975290 to 79.170240.
Average Annual Rainfall (mm)	1004
Geology	BGC
Average Depth To Water Level (Decadal) (Pre Monsoon)	17.4
Average Depth To Water Level (Decadal) (Post Monsoon)	9.6
Ground Water Resources (2011)	
Annual Replenishable Ground Water Resources (MCM/yr)	20.17
Net Annual Ground Water Availability(MCM)/yr	18.15
Net Annual Ground Water Draft(MCM)/yr	21.82
Projected Demand for Domestic and Industrial Use(MCM)/yr	4.28
Stage of Ground Water Development (%)	120
Surface runoff available (MCM)/yr	49.96
Total Storage Created in the Mandal by Various Agencies (MCM)/yr	0.96
Artificial Recharge/Conservation Measures	
Recharge Structures Proposed (No.s)	Percolation Tanks: 0, Check Dams: 116 Farm ponds: 580, Recharge Shafts: 68
Improving Water use Efficiency	Micro Irrigation System: 2900 ha
Tentative Total Cost in Lakhs (Rs.)	2657.44
Expected Recharge/Savings (MCM)/yr	11.959

1. INTRODUCTION

Pakala Mandal is one of over-exploited Mandal in Chittoor district, Andhra Pradesh State, which is economically backward and chronically drought affected. The Mandal has 15 inhabited villages and with 29 gram Panchayats.

2. LOCATION

The Mandal lies between north latitudes 13.399090 to 13.522910 and between east longitudes 78.975290 to 79.170240. The Mandal occupies the Middle part of the Anantapur district and is bounded on the north by Pulicherla Mandal, on the east by Chandragiri Mandal, on the South by Uduru Mandal and west by Sodam Mandal. (Fig.1) The geographical area of the Mandal is 182 sq.km.

3. PHYSIOGRAPHY AND DRAINAGE:

The area is drained by streams which are tributaries of Palar 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 1004 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 182 sq.km, the area covered by forest is 33.41 sq.km and the net area sown is 63.75 sq.km. Barren and uncultivable land is 11.56 sq.km. The land for non agricultural use accounts for 21.9 sq.km. (Fig.3)

6. HYDROGEOLOGY

The area is underlain by granites and 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 11.5 m. The weathered zone has been extensively tapped by dug and dug cum bore wells upto 20 m depth, which are mostly dry now. Ground water occurs in the fractured granites up to 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 the pre-monsoon and post-monsoon varies from 5 to 20 m. The average depth to water level (decadal) during pre and post monsoon is 17.4 and 9.6 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 Pakala, Mandal, Chittoor District is given in Table-1.

Table-1: Ground water resources of Pakala Mandal, Chittoor district.

Annual Replenishable Ground water resources (MCM)	20.17
Net Annual Ground Water Availability(MCM)/yr	18.15
Net Annual Ground Water Draft(MCM)/yr	21.82
Projected Demand for Domestic and Industrial use up to 2025. (MCM)	4.28
Stage of Ground water development (%).	120
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. 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

Pakala Mandal falls under high stage of ground water development i.e., 120 % 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)	182
Hilly Area (Sq.kms)	0
Area suitable for Artificial Recharge (sq.km.)	182
Runoff Yield in MCM/yr	49.96
Existing No. of Check Dams	77
Storage created MCM/yr	0.546
Existing No. of Percolation Tanks	58
Storage created MCM/yr	0.41
Total Existing Storage Created	0.96

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 49 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 705 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.

Thus, a total of **116 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 39 and 29 recharge shafts of 165 mm dia with 30 m depth in the existing check dams and percolation tanks respectively.

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 580 farm ponds in 29 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 2900 ha @ 100 ha per village.

13. TENTATIVE COST ESTIMATES (PAKALA 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)	116	3.248	5	580	2.436
2	Recharge shaft in Check dam (50% of the existing Check dams)	39	0.429	0.5	19.5	0.429
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)	29	0.319	1	29	0.319
5	Proposed Farm Pond (6 filling) 5*5*1.5 dimension @ 20 farm ponds per each village	580	0.08352	0.25	145	0.075168
6	Proposed Sprinkler/drip/HDPE pipes for 100 ha in each village	2900	17.4	0.6	1740	8.7
7	Proposed Piezometers up to 50 mbgl @ one PZ per Village	29	0	0.6	17.4	0
8 (i)	Total (No. of AR Structures)	793	4.08		790.9	3.259
8 (ii)	Total (ha)	2900			1740	8.7
	Total (8(i) + 8 (ii))				2530.9	11.959
9	Impact Assessment & O & M -5 % of Total cost of the Scheme				126.545	
	Grand Total				2657.445	

*(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 11.959 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 120% to 72% (48%)
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 have been taken from the EMUSTER, Department of Rural Development, Government of AP.

EXISTING ARTIFICIAL RECHARGE STRUCTURES
PAKALA MANDAL, CHITTOOR DISTRICT, AP.

S.no	Gram Panchayat	Habitation	Structure Type	Longitude	Latitude	Scheme
1	Nendragunta	Nendragunta	Check Dam	79.1658	13.4585	NREGS
2	Samkampalle	Sankampalle	Check Dam	79.1460	13.4356	NREGS
3	Samkampalle	Sankampalle	Check Dam	79.1454	13.4378	NREGS
4	Adenapalle	Pulivarthivaripalle	Check Dam	79.1618	13.4379	NREGS
5	Peddabynapalle	Chinnabynapalle	Check Dam	79.1369	13.4262	NREGS
6	Peddabynapalle	Peddabynapalle	Check Dam	79.1328	13.4214	NREGS
7	Ramanaiahgaripalle	Ramanaiahgaripalle	Check Dam	79.0701	13.5147	NREGS
8	Ramanaiahgaripalle	Ramanaiahgaripalle	Check Dam	79.0696	13.5129	NREGS
9	Kavalivaripalle	KavalavaripalleKoth	Check Dam	79.1737	13.4143	NREGS
10	Kavalivaripalle	KavalavaripalleKoth	Check Dam	79.1722	13.4153	NREGS
11	Kavalivaripalle	KavalavaripalleKoth	Check Dam	79.1792	13.4141	NREGS
12	Kavalivaripalle	Linganapalle H/W	Check Dam	79.1833	13.4090	NREGS
13	Achmmaagraharam	Achmmaagraharam	Check Dam	79.1694	13.4094	NREGS
14	Samireddipalle	Konappareddipalle	Check Dam	79.1245	13.4239	NREGS
15	Samireddipalle	Peddapakala	Check Dam	79.1222	13.4295	NREGS
16	Samireddipalle	Peddapakala	Check Dam	79.1243	13.4255	NREGS
17	Peddagorpadu	Bavirangannachervu	Check Dam	79.1432	13.4689	NREGS
18	Peddagorpadu	Gorpadu	Check Dam	79.1169	13.4697	NREGS
19	Peddagorpadu	Gorpadu	Check Dam	79.1164	13.4679	NREGS
20	Peddagorpadu	Singareddipalle	Check Dam	79.1216	13.4788	NREGS
21	Gadanki	Gadanki	Check Dam	79.1752	13.4562	NREGS
22	Gadanki	Gadanki	Check Dam	79.1698	13.4565	NREGS
23	Gadanki	Gunditivaripalle	Check Dam	79.1683	13.4720	NREGS
24	Gadanki	Rangaiahgaripalle	Check Dam	79.1765	13.4714	NREGS
25	Inamathipalaguttapalle	Lakshmipuram	Check Dam	79.0581	13.5474	NREGS
26	Inamathipalaguttapalle	Lakshmipuram	Check Dam	79.0520	13.5512	NREGS
27	Irramgaripalle	Adusupalle	Check Dam	79.1320	13.4441	NREGS
28	Irramgaripalle	Irramgaripalle	Check Dam	79.1336	13.4573	NREGS
29	Irramgaripalle	Irramgaripalle	Check Dam	79.1374	13.4550	NREGS
30	K.oddepalle	Polireddigaripalle	Check Dam	79.1662	13.4228	NREGS
31	K.oddepalle	Polireddigaripalle	Check Dam	79.1651	13.4284	NREGS
32	K.oddepalle	Polireddigaripalle	Check Dam	79.1664	13.4288	NREGS
33	Pakala	Kamathampalle	Check Dam	79.1092	13.4478	NREGS
34	Pakala	Kamathampalle	Check Dam	79.1107	13.4449	NREGS
35	Pantapalle	Desireddipalle	Check Dam	79.1481	13.4503	NREGS
36	Pantapalle	Desireddipalle	Check Dam	79.1453	13.4424	NREGS
37	Pantapalle	Pantapalle	Check Dam	79.1380	13.4437	NREGS
38	Pantapalle	Pantapalle	Check Dam	79.1361	13.4468	NREGS
39	Pantapalle	Yellampalli	Check Dam	79.1422	13.4427	NREGS
40	Pantapalle	Yellampalli	Check Dam	79.1394	13.4392	NREGS
41	Maddinayanipalle	Kondakindagokula	Check Dam	79.1387	13.5224	NREGS

42	Maddinayanipalle	Kondakindagokula	Check Dam	79.1409	13.5218	NREGS
43	Maddinayanipalle	Nagapuram	Check Dam	79.1064	13.5097	NREGS
44	Pepasanipalle	Gundlaguttapalle	Check Dam	79.0431	13.5070	NREGS
45	Chinnagorpadu	Billaihgaripalle	Check Dam	79.1135	13.4612	NREGS
46	Chinnagorpadu	Chinnagorpadu	Check Dam	79.1144	13.4636	NREGS
47	Chinnagorpadu	Kothaoddepalle	Check Dam	79.1045	13.4729	NREGS
48	Chinnagorpadu	Kothuru	Check Dam	79.1005	13.4817	NREGS
49	Padipatlabayalu	Kondakindapalle	Check Dam	79.0267	13.5188	NREGS
50	Padipatlabayalu	Kondakindapalle	Check Dam	79.0216	13.5172	NREGS
51	Peddaramapuram	Chigurapalle	Check Dam	79.1219	13.4859	NREGS
52	Peddaramapuram	Chigurapalle	Check Dam	79.1229	13.4879	NREGS
53	Peddaramapuram	Chinnavenkataramapu	Check Dam	79.1117	13.4907	NREGS
54	Peddaramapuram	Chinnavenkataramapu	Check Dam	79.1114	13.4918	NREGS
55	Peddaramapuram	Chinnavenkataramapu	Check Dam	79.1145	13.4913	NREGS
56	Peddaramapuram	Peddaramapuram	Check Dam	79.1330	13.4936	NREGS
57	Peddaramapuram	Rajulapalle	Check Dam	79.1201	13.4822	NREGS
58	Upparapalle	Polavarapuindlu	Check Dam	79.0933	13.4657	NREGS
59	Mogarala	Jangalapalle	Check Dam	79.0808	13.5009	NREGS
60	Mogarala	Jangalapalle	Check Dam	79.0803	13.5009	NREGS
61	Mogarala	Siddaiahgariendlu	Check Dam	79.0893	13.5038	NREGS
62	Damalcheruvu	Damalcheruvu -I	Check Dam	79.0564	13.4843	NREGS
63	Damalcheruvu	Damalcheruvu -I	Check Dam	79.0529	13.4731	NREGS
64	Damalcheruvu	Kondepalle	Check Dam	79.0584	13.4875	NREGS
65	Damalcheruvu	Kothapalle	Check Dam	79.0494	13.4825	NREGS
66	Damalcheruvu	Moravapalle H/W	Check Dam	79.0281	13.4782	NREGS
67	Damalcheruvu	Morvapalli	Check Dam	79.0226	13.4793	NREGS
68	Damalcheruvu	Morvapalli	Check Dam	79.0327	13.4796	NREGS
69	Pantapalle	Pantapalle	Check Wall	79.1371	13.4462	NREGS
70	Maddinayanipalle	Maddinayanipalle H.W	Check Wall	79.1307	13.5120	NREGS
71	Maddinayanipalle	Nagapuram	Check Wall	79.1069	13.5094	NREGS
72	Padipatlabayalu	Kondakindapalle	Check Wall	79.0283	13.5227	NREGS
73	Upparapalle	Abbayanayuduindlu	Check Wall	79.0922	13.4697	NREGS
74	Upparapalle	T.Oddipall	Check Wall	79.0853	13.4626	NREGS
75	Upparapalle	T.Oddipall	Check Wall	79.0860	13.4629	NREGS
76	Mogarala	Chellavaripalle	Check Wall	79.0851	13.5032	NREGS
77	Damalcheruvu	Kommepalli	Check Wall	79.0610	13.4923	NREGS
78	Adenapalle	Adenapalle	MPT	79.1613	13.4410	NREGS
79	Kavalivaripalle	KavalavaripalleKoth	MPT	79.1807	13.4183	NREGS
80	Kavalivaripalle	KavalavaripalleKoth	MPT	79.1886	13.4106	NREGS
81	Kavalivaripalle	Linganapalle H/W	MPT	79.1828	13.4073	NREGS
82	Achmmaagraharam	AchmmaagraharamHw	MPT	79.1685	13.4016	NREGS
83	Achmmaagraharam	Achmmaagraharam	MPT	79.1586	13.4050	NREGS
84	Samireddipalle	Samireddipalle H.W.	MPT	79.1373	13.4380	NREGS
85	Samireddipalle	Thotapalle	MPT	79.1332	13.4319	NREGS

86	K.oddepalle	Peddammagaripalle	MPT	79.1633	13.4246	NREGS
87	K.oddepalle	Peddammagaripalle	MPT	79.1549	13.4243	NREGS
88	K.oddepalle	Polireddigaripalle	MPT	79.1678	13.4223	NREGS
89	Upparapalle	Nallaguttaindu	MPT	79.0950	13.4554	NREGS
90	Upparapalle	Nannuruvaripalle	MPT	79.1019	13.4541	NREGS
91	Upparapalle	Pachipalaindu	MPT	79.0936	13.4465	NREGS
92	Upparapalle	VemanaIndlu	MPT	79.0805	13.4466	NREGS
93	Upparapalle	VemanaIndlu	MPT	79.0827	13.4507	NREGS
94	Nendragunta	Nendragunta	PT	79.1573	13.4530	NREGS
95	Adenapalle	Pulivarthivaripalle	PT	79.1670	13.4376	NREGS
96	Peddabynapalle	Dasallapalle	PT	79.1261	13.4256	NREGS
97	Vallivedu	Vallivedu	PT	79.0660	13.5272	NREGS
98	Ramanaiahgaripalle	Ramanaiahgaripalle	PT	79.0752	13.5108	NREGS
99	Ramanaiahgaripalle	Ramanaiahgaripalle	PT	79.0788	13.5224	NREGS
100	Ramanaiahgaripalle	Valluruvaripalle	PT	79.0677	13.5201	NREGS
101	Achmmaagraharam	Kambalamitta	PT	79.1528	13.4185	NREGS
102	Samireddipalle	Samireddipalle	PT	79.1226	13.4384	NREGS
103	Samireddipalle	Thotapalle	PT	79.1323	13.4314	NREGS
104	Samireddipalle	Thotapalle	PT	79.1333	13.4313	NREGS
105	Gadanki	Gadanki	PT	79.1825	13.4576	NREGS
106	Gadanki	Gadanki	PT	79.1815	13.4571	NREGS
107	Gadanki	Gadanki	PT	79.1781	13.4560	NREGS
108	Gadanki	Gunditivaripalle	PT	79.1699	13.4750	NREGS
109	Gadanki	Nadimpalle	PT	79.1730	13.4688	NREGS
110	Gadanki	Nadimpalle	PT	79.1702	13.4665	NREGS
111	Inamathipalaguttapalle	Inamathipalaguttapal	PT	79.0640	13.5409	NREGS
112	Inamathipalaguttapalle	Inamathipalaguttapal	PT	79.0672	13.5470	NREGS
113	Pantapalle	Desireddipalle	PT	79.1480	13.4506	NREGS
114	Pantapalle	Yellampalli	PT	79.1414	13.4424	NREGS
115	Maddinayanipalle	Kondakindagokula	PT	79.1356	13.5220	NREGS
116	Maddinayanipalle	Kondakindagokula	PT	79.1351	13.5216	NREGS
117	Maddinayanipalle	Maddinayanipalle	PT	79.1431	13.5121	NREGS
118	Maddinayanipalle	Maddinayanipalle H.W	PT	79.1329	13.5118	NREGS
119	Pepasanipalle	Kummarapalli	PT	79.0482	13.5093	NREGS
120	Padipatlabayalu	Perumalaguidpalli	PT	79.0393	13.5202	NREGS
121	Padipatlabayalu	Perumalaguidpalli	PT	79.0375	13.5274	NREGS
122	Padipatlabayalu	Pullavandlapalle	PT	79.0201	13.5183	NREGS
123	Upparapalle	Abbayanayuduindu	PT	79.0879	13.4693	NREGS
124	Upparapalle	Agraharam D.W	PT	79.1060	13.4561	NREGS
125	Upparapalle	Nallaguttaindu	PT	79.0973	13.4605	NREGS
126	Upparapalle	Pachipalaindu	PT	79.0943	13.4466	NREGS
127	Damalcheruvu	Bandarlapalle	PT	79.0815	13.4588	NREGS
128	Damalcheruvu	Kakarlavaripalle	PT	79.0198	13.4783	NREGS
129	Damalcheruvu	Kakarlavaripalli	PT	79.0111	13.4840	NREGS

130	Damalcheruvu	Kommepalli	PT	79.0649	13.4924	NREGS
131	Damalcheruvu	Manginayanipalle	PT	79.0656	13.4756	NREGS
132	Damalcheruvu	Morvapalli	PT	79.0314	13.4773	NREGS
133	Damalcheruvu	Pachipalapalle	PT	79.0700	13.4626	NREGS
134	Damalcheruvu	Pachipalapalle	PT	79.0680	13.4630	NREGS
135	Damalcheruvu	Pathipativaripalle	PT	79.0426	13.4751	NREGS

PROPOSED ARTIFICIAL RECHARGE STRUCTURES
PAKALA MANDAL, CHITTOOR DISTRICT, AP.

S.No.	Mandal	Lattitude	Longitude	Structure_Type
1	Pakala	13.5391	78.9978	Check Dam
2	Pakala	13.5304	79.0006	Check Dam
3	Pakala	13.5376	78.9885	Check Dam
4	Pakala	13.5422	78.9957	Check Dam
5	Pakala	13.5296	78.9828	Check Dam
6	Pakala	13.5338	78.9802	Check Dam
7	Pakala	13.5304	78.9952	Check Dam
8	Pakala	13.5244	79.0032	Check Dam
9	Pakala	13.5197	79.0054	Check Dam
10	Pakala	13.5126	78.9980	Check Dam
11	Pakala	13.5071	78.9971	Check Dam
12	Pakala	13.5045	78.9932	Check Dam
13	Pakala	13.5010	78.9862	Check Dam
14	Pakala	13.5158	79.0101	Check Dam
15	Pakala	13.5239	79.0123	Check Dam
16	Pakala	13.5222	79.0258	Check Dam
17	Pakala	13.5279	79.0293	Check Dam
18	Pakala	13.5312	79.0194	Check Dam
19	Pakala	13.5351	79.0163	Check Dam
20	Pakala	13.5334	79.0253	Check Dam
21	Pakala	13.5442	79.0313	Check Dam
22	Pakala	13.5524	79.0286	Check Dam
23	Pakala	13.5558	79.0263	Check Dam
24	Pakala	13.5385	79.0148	Check Dam
25	Pakala	13.5336	78.9764	Check Dam
26	Pakala	13.5328	78.9723	Check Dam
27	Pakala	13.5400	78.9631	Check Dam
28	Pakala	13.5391	78.9728	Check Dam
29	Pakala	13.5353	78.9994	Check Dam
30	Pakala	13.5086	79.0127	Check Dam
31	Pakala	13.5097	79.0011	Check Dam
32	Pakala	13.5003	78.9959	Check Dam
33	Pakala	13.5000	78.9847	Check Dam
34	Pakala	13.4956	79.0115	Check Dam
35	Pakala	13.4948	79.0161	Check Dam
36	Pakala	13.4884	79.0186	Check Dam
37	Pakala	13.4973	79.0398	Check Dam
38	Pakala	13.4950	79.0434	Check Dam
39	Pakala	13.5128	79.0426	Check Dam
40	Pakala	13.5076	79.0379	Check Dam

41	Pakala	13.5316	79.0381	Check Dam
42	Pakala	13.5376	79.0503	Check Dam
43	Pakala	13.5375	79.0427	Check Dam
44	Pakala	13.5328	79.0405	Check Dam
45	Pakala	13.5230	79.0224	Check Dam
46	Pakala	13.5034	79.0678	Check Dam
47	Pakala	13.5133	79.0723	Check Dam
48	Pakala	13.5091	79.0697	Check Dam
49	Pakala	13.5225	79.0733	Check Dam
50	Pakala	13.5489	79.0377	Check Dam
51	Pakala	13.5433	79.0211	Check Dam
52	Pakala	13.5141	78.9942	Check Dam
53	Pakala	13.5279	79.0021	Check Dam
54	Pakala	13.4827	79.0541	Check Dam
55	Pakala	13.4777	79.1039	Check Dam
56	Pakala	13.4847	79.0875	Check Dam
57	Pakala	13.4924	79.1345	Check Dam
58	Pakala	13.5005	79.1371	Check Dam
59	Pakala	13.5064	79.1158	Check Dam
60	Pakala	13.4840	79.1144	Check Dam
61	Pakala	13.4491	79.0726	Check Dam
62	Pakala	13.4956	79.0331	Check Dam
63	Pakala	13.5111	79.0310	Check Dam
64	Pakala	13.4983	79.0168	Check Dam
65	Pakala	13.5106	79.0630	Check Dam
66	Pakala	13.5150	79.0659	Check Dam
67	Pakala	13.5168	79.0602	Check Dam
68	Pakala	13.5237	79.0545	Check Dam
69	Pakala	13.5250	79.0604	Check Dam
70	Pakala	13.5195	79.0431	Check Dam
71	Pakala	13.5250	79.0419	Check Dam
72	Pakala	13.5326	79.0362	Check Dam
73	Pakala	13.5391	79.0414	Check Dam
74	Pakala	13.5462	79.0277	Check Dam
75	Pakala	13.5202	79.0306	Check Dam
76	Pakala	13.5171	79.0382	Check Dam
77	Pakala	13.5314	78.9926	Check Dam
78	Pakala	13.4661	79.1642	Check Dam
79	Pakala	13.4607	79.1642	Check Dam
80	Pakala	13.4555	79.1557	Check Dam
81	Pakala	13.4431	79.1599	Check Dam
82	Pakala	13.4607	79.1677	Check Dam
83	Pakala	13.4681	79.1628	Check Dam
84	Pakala	13.4684	79.1761	Check Dam

85	Pakala	13.4536	79.1791	Check Dam
86	Pakala	13.4562	79.1096	Check Dam
87	Pakala	13.4588	79.1018	Check Dam
88	Pakala	13.4372	79.1025	Check Dam
89	Pakala	13.4086	79.1704	Check Dam
90	Pakala	13.4221	79.1533	Check Dam
91	Pakala	13.4226	79.1568	Check Dam
92	Pakala	13.4085	79.1756	Check Dam
93	Pakala	13.4345	79.1621	Check Dam
94	Pakala	13.4625	79.1626	Check Dam
95	Pakala	13.4642	79.1594	Check Dam
96	Pakala	13.4234	79.1189	Check Dam
97	Pakala	13.4627	79.0804	Check Dam
98	Pakala	13.4901	79.1281	Check Dam
99	Pakala	13.4940	79.1424	Check Dam
100	Pakala	13.4960	79.1500	Check Dam
101	Pakala	13.5025	79.1519	Check Dam
102	Pakala	13.5133	79.1243	Check Dam
103	Pakala	13.5062	79.1264	Check Dam
104	Pakala	13.5054	79.1319	Check Dam
105	Pakala	13.5066	79.1333	Check Dam
106	Pakala	13.5183	79.1250	Check Dam
107	Pakala	13.5163	79.1189	Check Dam
108	Pakala	13.5108	79.1103	Check Dam
109	Pakala	13.5064	79.0977	Check Dam
110	Pakala	13.5040	79.0937	Check Dam
111	Pakala	13.5030	79.0459	Check Dam
112	Pakala	13.5398	79.0329	Check Dam
113	Pakala	13.5062	79.1023	Check Dam
114	Pakala	13.4916	79.1074	Check Dam
115	Pakala	13.4842	79.1105	Check Dam
116	Pakala	13.4558	79.1505	Check Dam

Fig.1

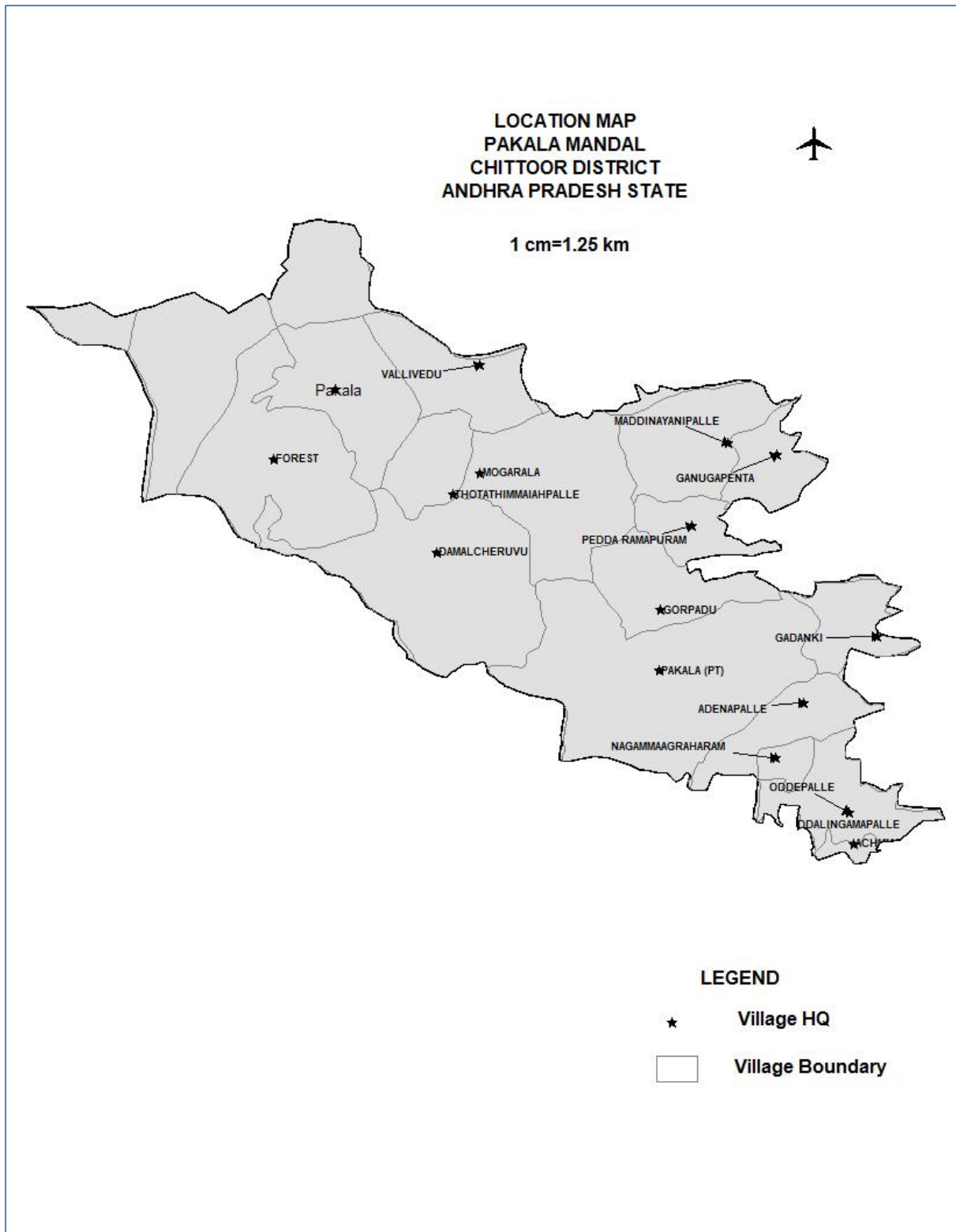


Fig.2

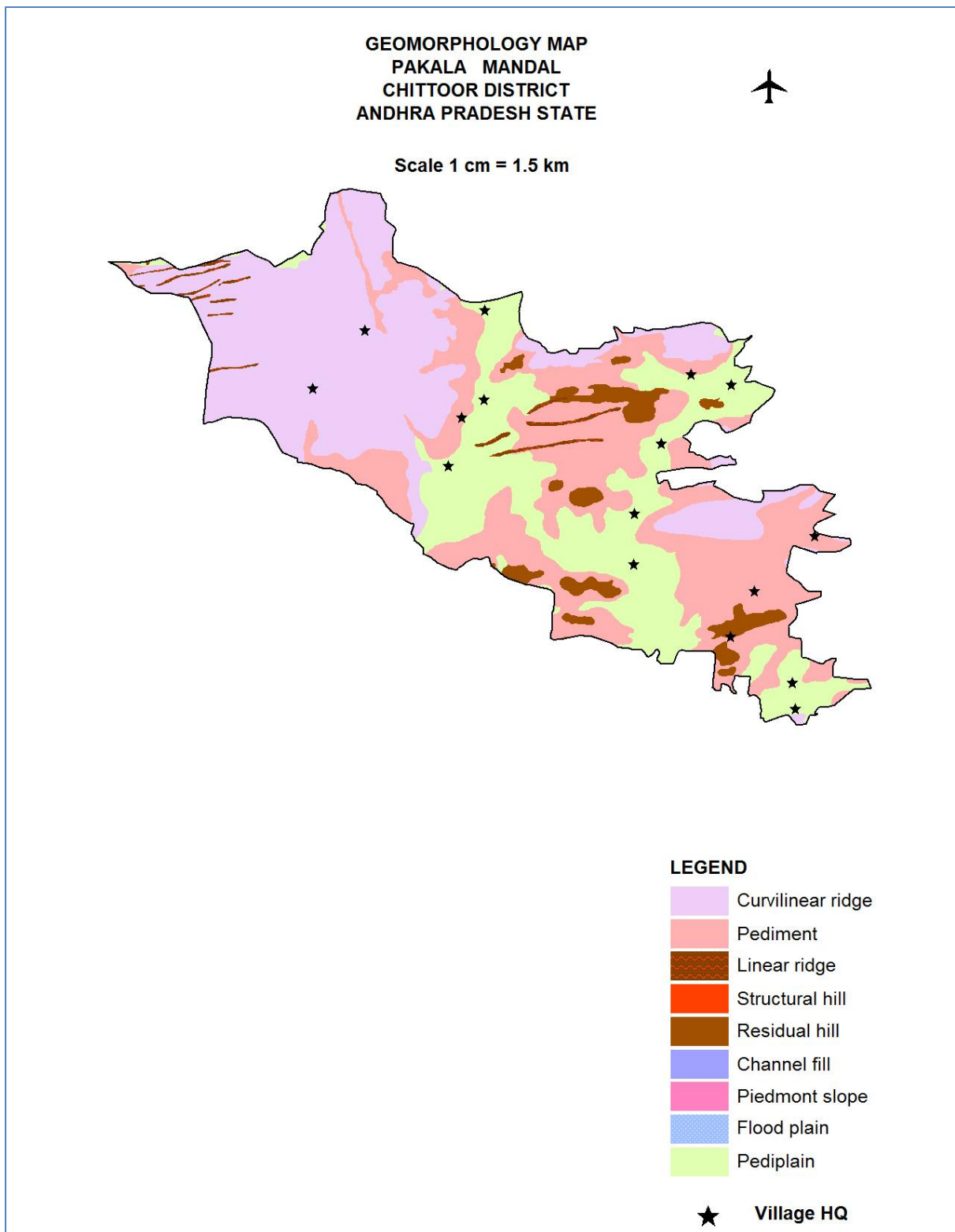


Fig.3

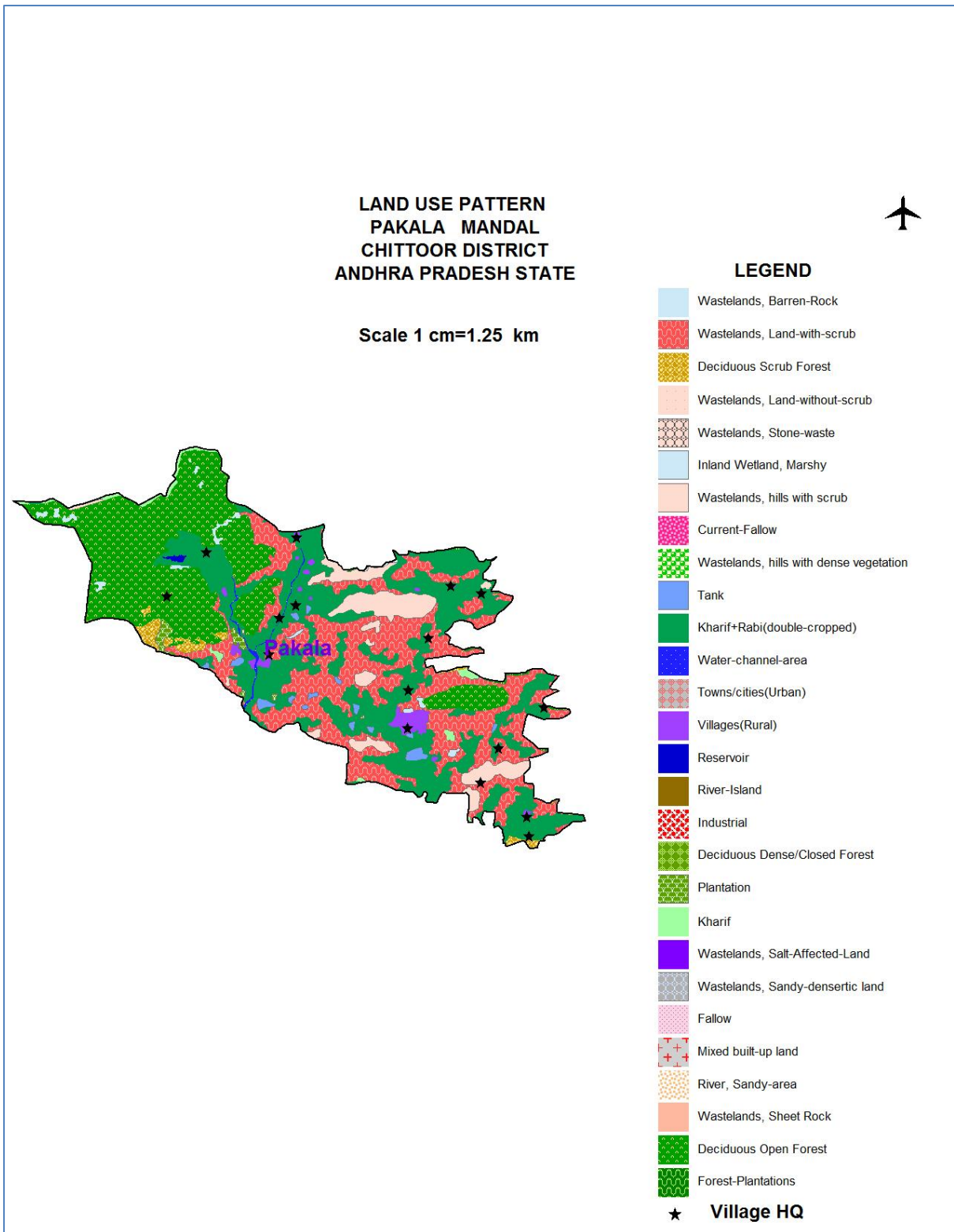


Fig.4

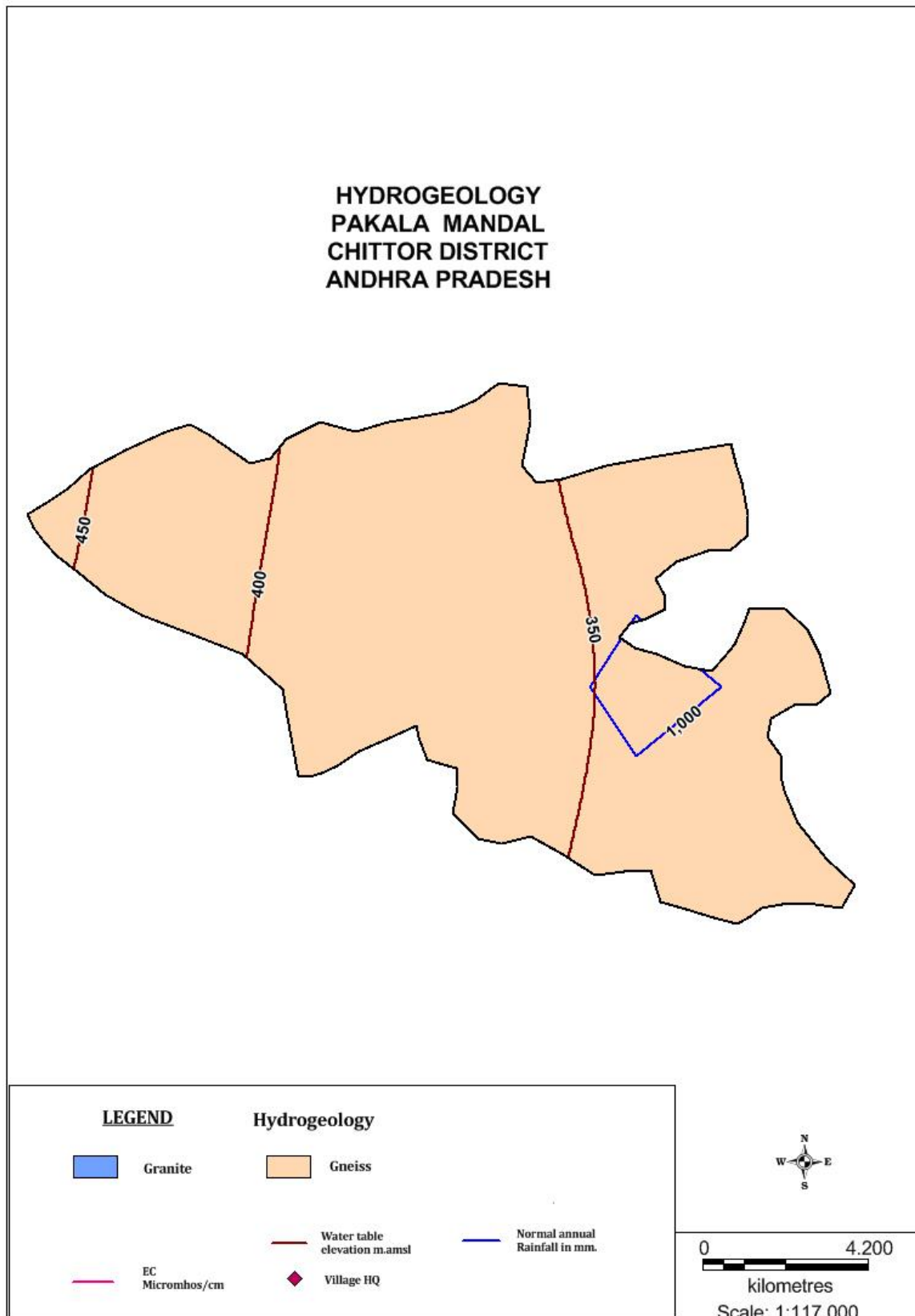


Fig.5

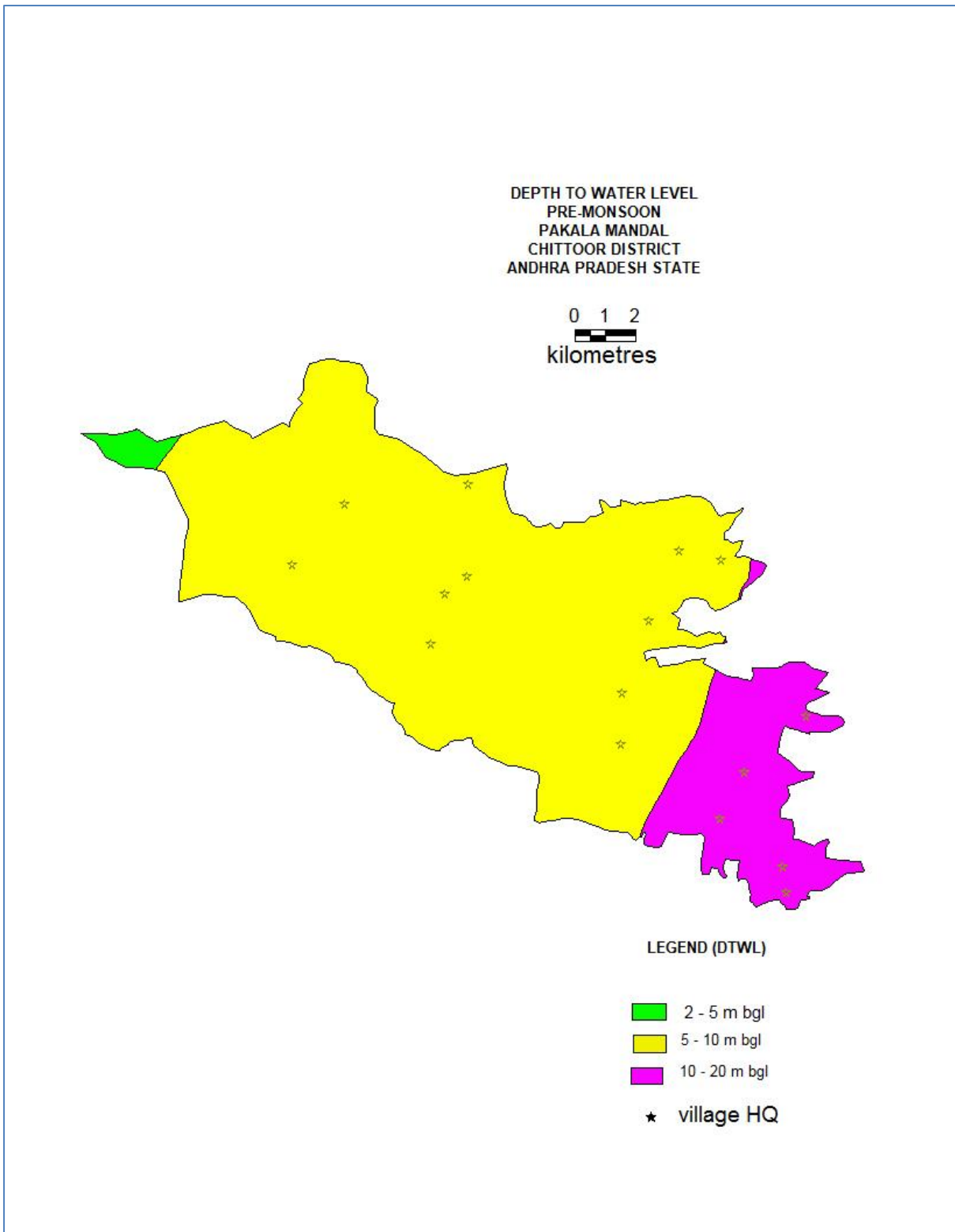


Fig.6

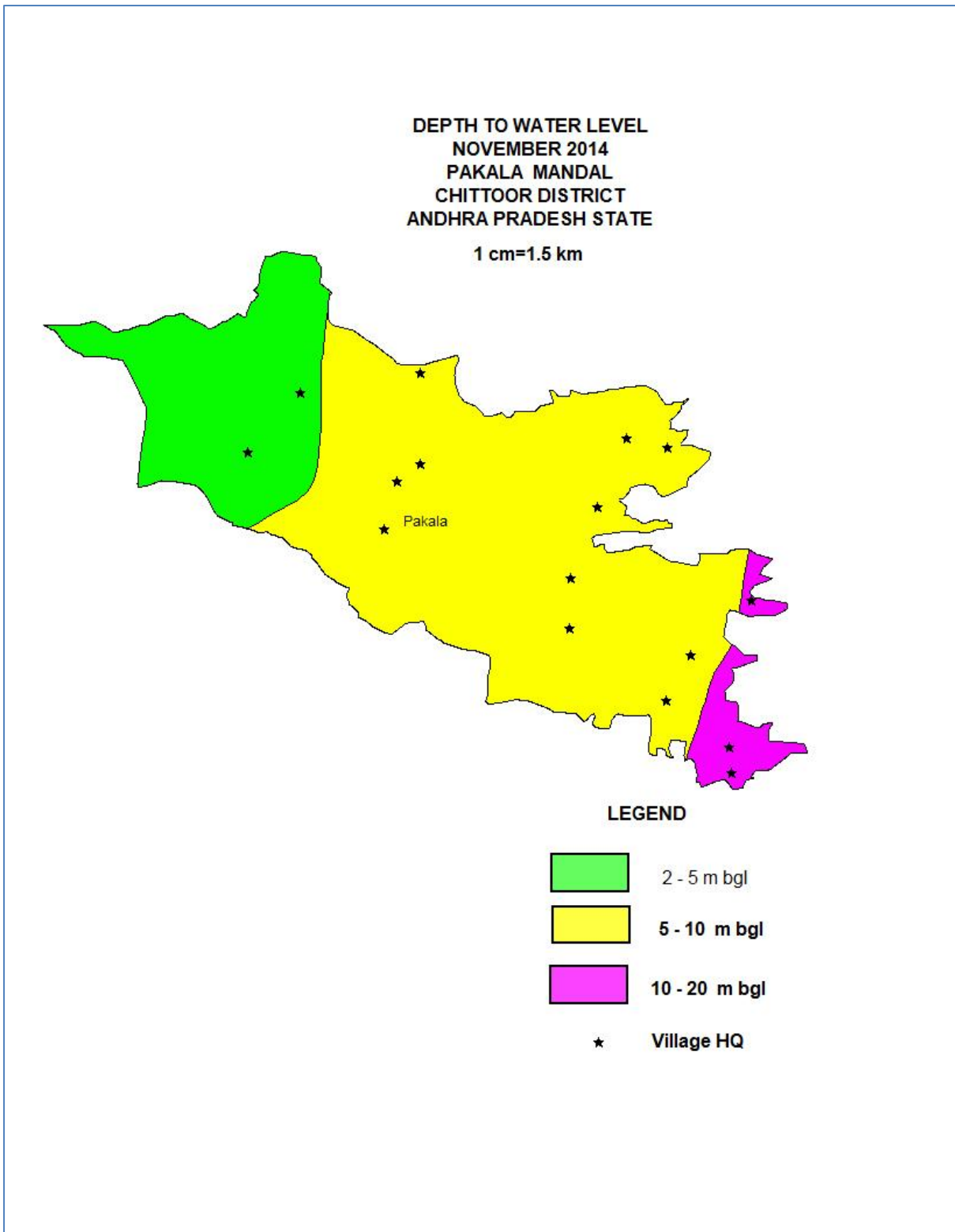
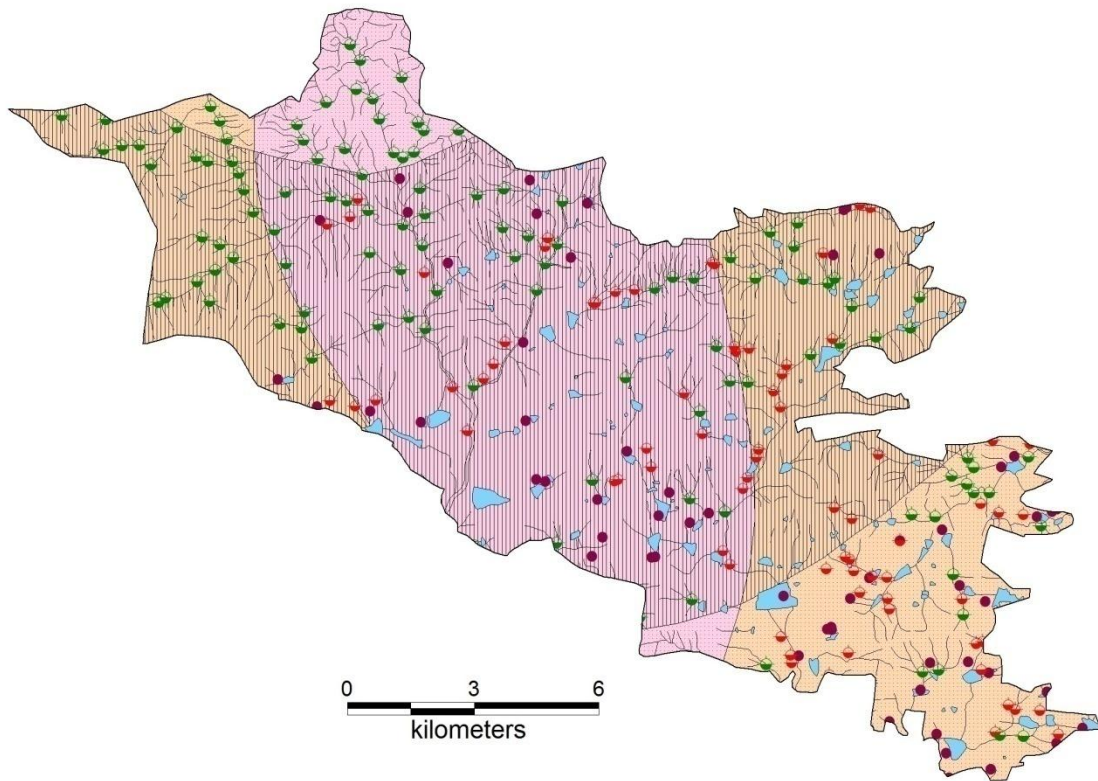


Fig.7

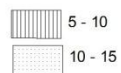
Post Monsoon Water Level and Trend (Decadal Mean) along with Existing and Proposed Artificial Recharge Structures in Pakala mandal, Chittoor District, Andhra Pradesh



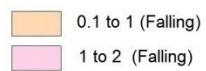
0 3 6
kilometers

LEGEND

Post Monsoon Water Level (m)
(Decadal Mean)



Post Monsoon
Water Level Trend (m/yr)



- ◆ Village HQ
- ◇ Existing CD
- Drainage
- Existing PT
- Tanks
- ◇ Proposed CD