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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 AMARAPURAM MANDAL, ANANTAPUR DISTRICT, ANDHRA PRADESH

SOUTHERN REGION
HYDERABAD
AUGUST, 2016

PLAN ON
ARTIFICIAL RECHARGE TO GROUNDWATER AND WATER CONSERVATION IN AMARAPURAM MANDAL, ANANTAPUR DISTRICT, ANDHRA PRADESH

CONTENTS

AT A GLANCE

Name of the Mandal	AMARAPURAM
District	ANANTAPUR
State	ANDHRA PRADESH
Total Area (Sq.kms.)	243
Area suitable for Artificial Recharge (sq.kms)	243
Latitude and Longitude	13.991020 to 14.195450 and 76.888930 to 77.127190
Average Annual Rainfall (mm)	546
Geology	Granites, Gneisses
Average Depth To Water Level (Decadal) (Pre Monsoon)	12.5
Average Depth To Water Level (Decadal) (Post Monsoon)	5.1
Ground Water Resources (2011)	
Annual Replenishable Ground Water Resources (MCM)	29.66
Net Annual Ground Water Availability (MCM)/yr	26.69
Net Annual Ground Water Draft (MCM)/yr	29.78
Projected Demand for Domestic and Industrial Use (MCM)/yr	1.07
Stage of Ground Water Development (%)	112
Surface runoff available (MCM)/yr	15.89
Total Storage created in the Mandal by Various Agencies (MCM)/yr	1.04
Artificial Recharge/Conservation Measures	
Recharge Structures Proposed (No.s)	Percolation Tanks-0, Check Dams-20 Farm ponds-180, Recharge Shafts-72
Improving Water use Efficiency	Micro Irrigation System -900 ha
Tentative Total Cost in Lakhs (Rs.)	769.02
Expected Recharge/Savings (MCM)/yr	3.935

1. INTRODUCTION

Amarapuram 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 8 inhabited villages and one un inhabited village with 9 gram panchayats.

2. LOCATION

The mandal lies between North latitudes 13.991020 to 14.195450 and between East Longitudes of 76.888930 to 77.127190. The mandal occupies the South-west part of the Anantapur district and is bounded on the north by Kundurpi Mandal, on the east by Karnataka State, on the south by Gudibanda mandal and west by Karnataka State. (Fig.1). The geographical area of the mandal is 243 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 546 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 243 sq.km, the net area sown is 140.99 sq.km. Barren and uncultivable land is 16.13 sq.km. The land for non agricultural use accounts for 17.13 sq.km. (Fig.3)

6. HYDROGEOLOGY

The Mandal is underlain by granitic gneisses of Archaean age. 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 12 m. The weathered zone has been extensively tapped by dug and dug cum bore wells upto20 m depth. Ground water occurs in fractured granites down to a depth of 200 m. However, the potential fractures are encountered between 50-100 m bgl. The cumulative yield varies from 2-5 lps. The average depth to water level (decadal) during pre and post monsoon is 12.5 and 5.1 m bgl respectively (Fig.4).

7. GROUND WATER LEVEL SCENARIO

The depth to water level during pre and post-monsoon varies from 5 to 20 m bgl. 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 Amarapuram Mandal, Anantapur District is given in Table-1.

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

Annual Replenishable Ground water resources (MCM)	29.66
Net Annual Ground Availability draft. (MCM)	26.69
Net Annual Ground water draft. (MCM)	29.78
Projected Demand for Domestic and Industrial use up to 2025 (MCM)	1.07
Stage of Ground water development (%).	112
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 up to 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

Amarapuram Mandal falls under high stage of ground water development i.e., 112 % 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 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)	243
Hilly Area (Sq.kms)	0
Area suitable for Artificial Recharge (sq.km.)	243
Runoff Yield in MCM/yr	15.89
Existing No. of Check Dams	122
Storage created MCM/yr	0.86
Existing No. of Percolation Tanks	25
Storage created MCM/yr	0.18
Total Existing Storage Created MCM/yr	1.04

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 storm water available for ground water recharge purpose within the mandal has been assessed as 14.85 MCM/yr, which could be considered for further planning of artificial recharge in the mandal. 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 along with silt load and 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 546 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, **20 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 60 and 12 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 180 farm ponds in 9 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 900 ha @ 100 ha per village.

13. TENTATIVE COST ESTIMATES (AMARAPURAM 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)	20	0.56	5	100	0.42
2	Recharge shaft in Check dam (50% of the existing Check dams)	60	0.66	0.5	30	0.66
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)	12	0.132	1	12	0.132
5	Proposed Farm Pond (6 filling) 5*5*1.5 dimension @ 20 farm ponds per each village	180	0.02592	0.25	45	0.023328
6	Proposed Sprinkler/drip/HDPE pipes for 100 ha in each village	900		0.6	540	2.7
7	Proposed Piezometers up to 50 mbgl @ one PZ per Village	9	0	0.6	5.4	0
8 (i)	Total (No. of AR Structures)	281	1.38		192.4	1.235
8 (ii)	Total (ha)	900			540	2.7
	Total (8(i) + 8 (ii))				**732.4**	**3.935**
9	Impact Assessment & O & M -5 % of Total cost of the Scheme				**36.62**	
	Grand Total				**769.02**	

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

15. 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 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 3.93 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 112% to 96% (16%)
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 AP.

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

S.no	Gram Panchayat	Habitation	Structure Type	Longitude	Latitude	Scheme
1	Halukuru	Chinthinudiki	Check Dam	77.0217	14.0781	NREGS
2	Halukuru	Kachikunta	Check Dam	76.9843	14.0812	NREGS
3	Nidragatta	Nidragatta	Check Dam	76.9646	14.0518	NREGS
4	Nidragatta	Nidragatta	Check Dam	76.9678	14.0491	NREGS
5	Nidragatta	Nidragatta	Check Dam	76.9677	14.0469	NREGS
6	Nidragatta	Nidragatta	Check Dam	76.9526	14.0497	NREGS
7	Nidragatta	Nidragatta	Check Dam	76.9519	14.0509	NREGS
8	Nidragatta	Nidragatta	Check Dam	76.9542	14.0475	NREGS
9	Nidragatta	Nidragatta	Check Dam	76.9568	14.0446	NREGS
10	Nidragatta	Nidragattagollahatti	Check Dam	76.9470	14.0294	NREGS
11	Nidragatta	Yerraguntanahalli	Check Dam	76.9392	14.0408	NREGS
12	Nidragatta	Yerraguntanahalli	Check Dam	76.9392	14.0384	NREGS
13	Nidragatta	Yerraguntanahalli	Check Dam	76.9381	14.0378	NREGS
14	Nidragatta	Yerraguntanahalli	Check Dam	76.9350	14.0363	NREGS
15	Nidragatta	Yerraguntanahalli	Check Dam	76.9423	14.0489	NREGS
16	Thammedahalli	Devaganihalli	Check Dam	77.0027	14.1551	NREGS
17	Thammedahalli	Gowdanakunta	Check Dam	77.0098	14.1319	NREGS
18	Thammedahalli	Gowdanakunta	Check Dam	77.0119	14.1337	NREGS
19	Thammedahalli	Gowdanakunta	Check Dam	77.0125	14.1440	NREGS
20	Thammedahalli	Nagavanahalli	Check Dam	76.9963	14.1561	NREGS
21	Thammedahalli	Nagavanahalli	Check Dam	76.9926	14.1566	NREGS
22	Thammedahalli	Thammedahalli	Check Dam	76.9701	14.1697	NREGS
23	Valasa	Agraharam	Check Dam	76.8987	14.1398	NREGS
24	Valasa	Agraharam	Check Dam	76.8983	14.1561	NREGS
25	Valasa	Naduludam	Check Dam	76.9469	14.1821	NREGS
26	Valasa	Valasa	Check Dam	76.9309	14.1571	NREGS
27	Valasa	Valasa	Check Dam	76.9322	14.1608	NREGS
28	Valasa	Valasa	Check Dam	76.9357	14.1376	NREGS
29	Valasa	Valasa	Check Dam	76.9481	14.1500	NREGS
30	Valasa	Valasa	Check Dam	76.9087	14.1616	NREGS
31	Amarapuram	Amarapuram	Check Dam	76.9698	14.1314	NREGS
32	Amarapuram	Amarapuram	Check Dam	76.9655	14.1325	NREGS
33	Amarapuram	Amarapuram	Check Dam	76.9667	14.1334	NREGS
34	Amarapuram	Amarapuram	Check Dam	76.9658	14.1359	NREGS
35	Amarapuram	Amarapuram	Check Dam	76.9733	14.1304	NREGS
36	Amarapuram	Amarapuram	Check Dam	76.9628	14.1235	NREGS
37	Amarapuram	Amarapuram	Check Dam	76.9736	14.1219	NREGS
38	Amarapuram	Amarapuram	Check Dam	76.9750	14.1260	NREGS
39	Amarapuram	Amarapuram	Check Dam	76.9599	14.1295	NREGS
40	Amarapuram	Maddenakunta	Check Dam	76.9552	14.0938	NREGS

41	Amarapuram	Pullikunta	Check Dam	76.9381	14.1446	NREGS
42	Amarapuram	Pullikunta	Check Dam	76.9405	14.1322	NREGS
43	Amarapuram	Pullikunta	Check Dam	76.9530	14.1341	NREGS
44	Basavanahalli	Aronahalli	Check Dam	77.0799	14.0345	NREGS
45	Basavanahalli	Aronahalli	Check Dam	77.0834	14.0363	NREGS
46	Basavanahalli	Bullanahalli	Check Dam	77.0633	14.0191	NREGS
47	Basavanahalli	Kadaratahatti	Check Dam	77.0659	14.0159	NREGS
48	Basavanahalli	Upparlapalli	Check Dam	77.0614	14.0164	NREGS
49	Basavanahalli	Upparlapalli	Check Dam	77.0553	14.0108	NREGS
50	Basavanahalli	Upparlapalli	Check Dam	77.0548	14.0082	NREGS
51	Sivaram	Pelubanda	Check Dam	77.0013	14.0424	NREGS
52	Sivaram	Pelubanda	Check Dam	77.0044	14.0561	NREGS
53	Sivaram	Pelubanda	Check Dam	77.0037	14.0580	NREGS
54	Aldahalli	Aldahalli	Check Dam	77.0555	14.0482	NREGS
55	Aldahalli	Aldahalli	Check Dam	77.0528	14.0450	NREGS
56	Aldahalli	Aldahalli	Check Dam	77.0530	14.0432	NREGS
57	Aldahalli	Aldahalli	Check Dam	77.0507	14.0443	NREGS
58	Aldahalli	Aldahalli	Check Dam	77.0468	14.0427	NREGS
59	Aldahalli	Aldahalli	Check Dam	77.0528	14.0450	NREGS
60	Hemavathi	Gollamaranahalli	Check Dam	76.9694	14.0151	NREGS
61	Hemavathi	Gollamaranahalli	Check Dam	76.9762	14.0090	NREGS
62	Hemavathi	Gollamaranahalli	Check Dam	76.9798	14.0202	NREGS
63	Hemavathi	Gollamaranahalli	Check Dam	76.9774	14.0199	NREGS
64	Hemavathi	Gunehalli	Check Dam	77.0227	13.9967	NREGS
65	Hemavathi	Gunehalli	Check Dam	77.0178	14.0008	NREGS
66	Hemavathi	Gunehalli	Check Dam	77.0108	14.0059	NREGS
67	Hemavathi	Gunehalli	Check Dam	77.0073	14.0088	NREGS
68	Hemavathi	Gunehalli	Check Dam	77.0031	14.0107	NREGS
69	Hemavathi	Gunehalli	Check Dam	76.9840	14.0163	NREGS
70	Hemavathi	Hemavathi	Check Dam	76.9840	14.0119	NREGS
71	Hemavathi	Hosahatti	Check Dam	76.9658	14.0212	NREGS
72	Hemavathi	Kenkera	Check Dam	76.9740	14.0573	NREGS
73	Hemavathi	Kenkera	Check Dam	76.9811	14.0551	NREGS
74	Hemavathi	Kenkera	Check Dam	76.9816	14.0571	NREGS
75	Hemavathi	Kenkera	Check Dam	76.9789	14.0594	NREGS
76	Hemavathi	Kenkera	Check Dam	76.9822	14.0655	NREGS
77	Hemavathi	Kenkera	Check Dam	76.9823	14.0677	NREGS
78	Hemavathi	Kenkera	Check Dam	77.0031	14.0628	NREGS
79	Hemavathi	Kenkera	Check Dam	77.0037	14.0578	NREGS
80	Hemavathi	Kenkera	Check Dam	77.0022	14.0531	NREGS
81	Hemavathi	Tambalahatti	Check Dam	77.0062	13.9973	NREGS
82	Hemavathi	Tambalahatti	Check Dam	77.0074	13.9914	NREGS
83	Basavanahalli	Aronahalli	Check Dam	77.0799	14.0345	IWMP
84	Basavanahalli	Aronahalli	Check Dam	77.0834	14.0363	IWMP

85	Basavanahalli	Bullanahalli	Check Dam	77.0633	14.0191	IWMP
86	Basavanahalli	Kadaratahatti	Check Dam	77.0659	14.0159	IWMP
87	Basavanahalli	Upparlapalli	Check Dam	77.0614	14.0164	IWMP
88	Basavanahalli	Upparlapalli	Check Dam	77.0553	14.0108	IWMP
89	Basavanahalli	Upparlapalli	Check Dam	77.0548	14.0082	IWMP
90	Sivaram	Pelubanda	Check Dam	77.0013	14.0424	IWMP
91	Sivaram	Pelubanda	Check Dam	77.0044	14.0561	IWMP
92	Sivaram	Pelubanda	Check Dam	77.0037	14.0580	IWMP
93	Hemavathi	Gunehalli	Check Dam	77.0227	13.9967	IWMP
94	Hemavathi	Gunehalli	Check Dam	77.0178	14.0008	IWMP
95	Hemavathi	Gunehalli	Check Dam	77.0108	14.0059	IWMP
96	Hemavathi	Gunehalli	Check Dam	77.0073	14.0088	IWMP
97	Hemavathi	Gunehalli	Check Dam	77.0031	14.0107	IWMP
98	Hemavathi	Gunehalli	Check Dam	76.9840	14.0163	IWMP
99	Hemavathi	Hemavathi	Check Dam	76.9840	14.0119	IWMP
100	Hemavathi	Kenkera	Check Dam	76.9740	14.0573	IWMP
101	Hemavathi	Kenkera	Check Dam	76.9811	14.0551	IWMP
102	Hemavathi	Kenkera	Check Dam	76.9816	14.0571	IWMP
103	Hemavathi	Kenkera	Check Dam	76.9789	14.0594	IWMP
104	Hemavathi	Kenkera	Check Dam	76.9822	14.0655	IWMP
105	Hemavathi	Kenkera	Check Dam	76.9823	14.0677	IWMP
106	Hemavathi	Kenkera	Check Dam	77.0031	14.0628	IWMP
107	Hemavathi	Kenkera	Check Dam	77.0037	14.0578	IWMP
108	Hemavathi	Kenkera	Check Dam	77.0022	14.0531	IWMP
109	Halukuru	Kachikunta	Check Wall	76.9772	14.0769	NREGS
110	Halukuru	Kachikunta	Check Wall	76.9832	14.0781	NREGS
111	Halukuru	Kachikunta	Check Wall	76.9762	14.0757	NREGS
112	Halukuru	Kachikunta	Check Wall	76.9774	14.0727	NREGS
113	Nidragatta	Yerraguntanahalli	Check Wall	76.9422	14.0414	NREGS
114	Valasa	Agraharam	Check Wall	76.9130	14.1345	NREGS
115	Valasa	Valasa	Check Wall	76.9381	14.1445	NREGS
116	Valasa	Valasa	Check Wall	76.9369	14.1657	NREGS
117	Valasa	Valasa	Check Wall	76.9360	14.1493	NREGS
118	Valasa	Valasa	Check Wall	76.9374	14.1682	NREGS
119	Valasa	Valasa	Check Wall	76.9382	14.1705	NREGS
120	Amarapuram	Amarapuram	Check Wall	76.9532	14.1199	NREGS
121	Basavanahalli	Aronahalli	Check Wall	77.0829	14.0359	NREGS
122	Basavanahalli	Aronahalli	Check Wall	77.0829	14.0359	IWMP
123	Thammedahalli	Nagavanahalli	MPT	77.0069	14.1802	NREGS
124	Thammedahalli	Nagavanahalli	MPT	76.9973	14.1585	NREGS
125	Amarapuram	Bangarupalem	MPT	77.0189	14.1290	NREGS
126	Hemavathi	Gunehalli	MPT	77.0203	13.9986	NREGS
127	Hemavathi	Gunehalli	MPT	77.0203	13.9986	IWMP
128	Halukuru	Halukuru	PT	77.0212	14.1180	NREGS

129	Thammedahalli	Devaganihalli	PT	77.0114	14.1571	NREGS
130	Valasa	Agraharam	PT	76.8924	14.1389	NREGS
131	Valasa	Valasa	PT	76.9250	14.1546	NREGS
132	Valasa	Valasa	PT	76.9341	14.1414	NREGS
133	Valasa	Valasa	PT	76.9320	14.1489	NREGS
134	Amarapuram	Bangarupalem	PT	77.0029	14.1271	NREGS
135	Amarapuram	Bangarupalem	PT	77.0125	14.1269	NREGS
136	Sivaram	P.Sivaram	PT	77.0224	14.0127	NREGS
137	Sivaram	P.Sivaram	PT	77.0173	14.0186	NREGS
138	Sivaram	Pelubanda	PT	77.0050	14.0390	NREGS
139	Sivaram	Rangapuram	PT	77.0199	14.0467	NREGS
140	Aldahalli	Aldahalli	PT	77.0504	14.0493	NREGS
141	Aldahalli	Aldahalli	PT	77.0476	14.0394	NREGS
142	Hemavathi	Kenkera	PT	76.9783	14.0551	NREGS
143	Sivaram	P.Sivaram	PT	77.0224	14.0127	IWMP
144	Sivaram	P.Sivaram	PT	77.0173	14.0186	IWMP
145	Sivaram	Pelubanda	PT	77.0050	14.0390	IWMP
146	Sivaram	Rangapuram	PT	77.0199	14.0467	IWMP
147	Hemavathi	Kenkera	PT	76.9783	14.0551	IWMP

PROPOSED ARTIFICIAL RECHARGE STRUCTURES
AMARAPURAM MANDAL ANANTAPUR DISTRICT AP.

S.No.	Mandal	Lattitude	Longitude	Structure_Type
1	Amarapuram	14.1537	76.9582	CheckDam
2	Amarapuram	14.1121	76.9604	CheckDam
3	Amarapuram	14.1010	76.9757	CheckDam
4	Amarapuram	14.1715	76.9863	CheckDam
5	Amarapuram	14.1414	76.9604	CheckDam
6	Amarapuram	14.0969	76.9990	CheckDam
7	Amarapuram	14.0717	77.0003	CheckDam
8	Amarapuram	14.0721	77.0211	CheckDam
9	Amarapuram	14.0936	76.9774	CheckDam
10	Amarapuram	14.0985	76.9633	CheckDam
11	Amarapuram	14.1756	77.0160	CheckDam
12	Amarapuram	14.1138	77.0084	CheckDam
13	Amarapuram	14.0523	77.0220	CheckDam
14	Amarapuram	14.0247	77.0071	CheckDam
15	Amarapuram	14.0165	77.0798	CheckDam
16	Amarapuram	14.0321	77.1150	CheckDam
17	Amarapuram	14.0466	77.0679	CheckDam
18	Amarapuram	14.0396	77.1006	CheckDam
19	Amarapuram	14.0111	77.0309	CheckDam
20	Amarapuram	14.1611	76.9684	CheckDam

Fig.1

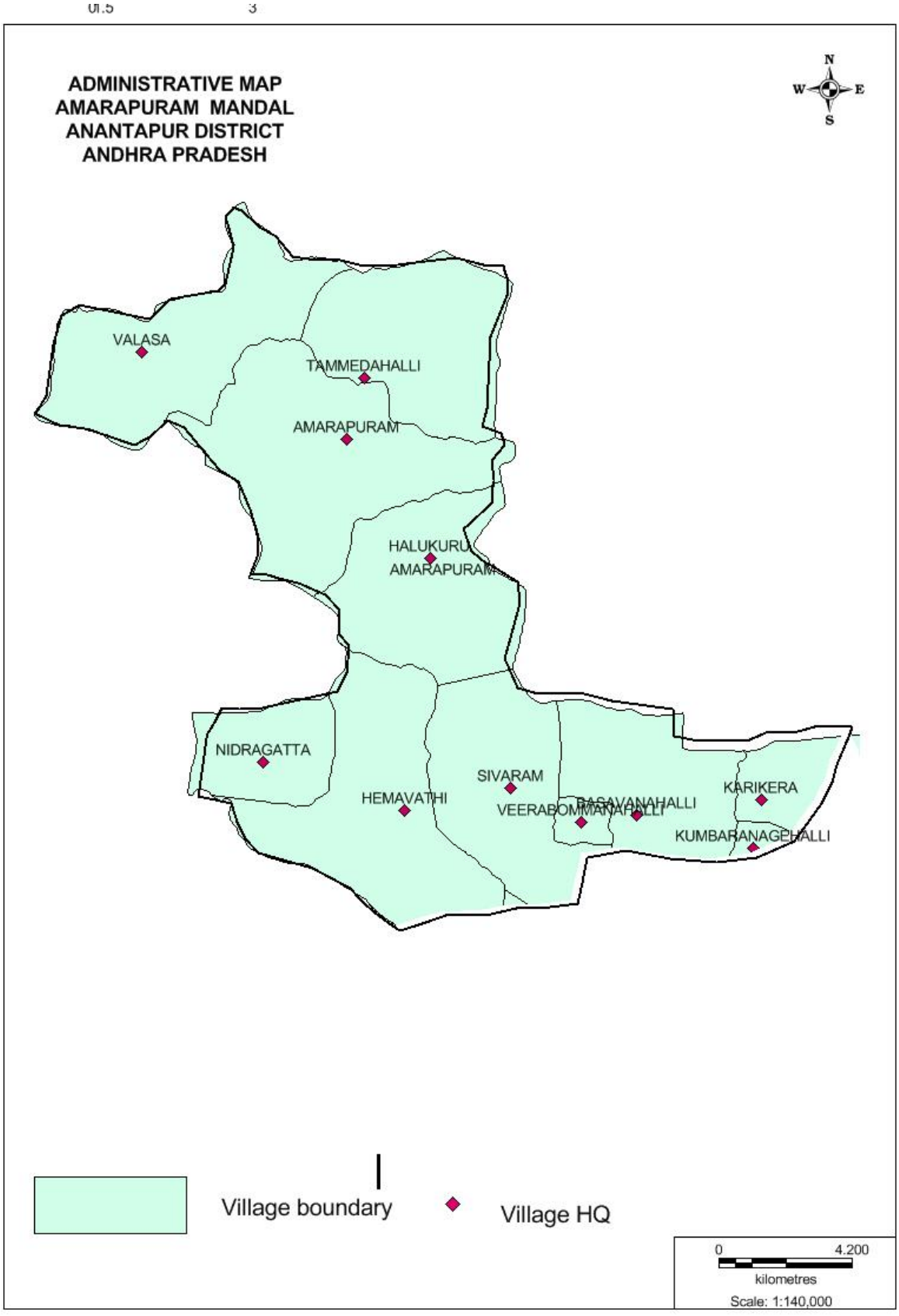

0.5
3
ADMINISTRATIVE MAP
AMARAPURAM MANDAL
ANANTAPUR DISTRICT
ANDHRA PRADESH
N
W
E
S
VALASA
TAMMEDAHALLI
AMARAPURAM
HALUKURU
AMARAPURAM
NIDRAGATTA
SIVARAM
HEMAVATHI
VEERABOMMANAPALLI
BASAVANAHALLI
KARIKERA
KUMBARANAGEHALLI
Village boundary
Village HQ
0
4.200
kilometres
Scale: 1:140,000

Fig.2

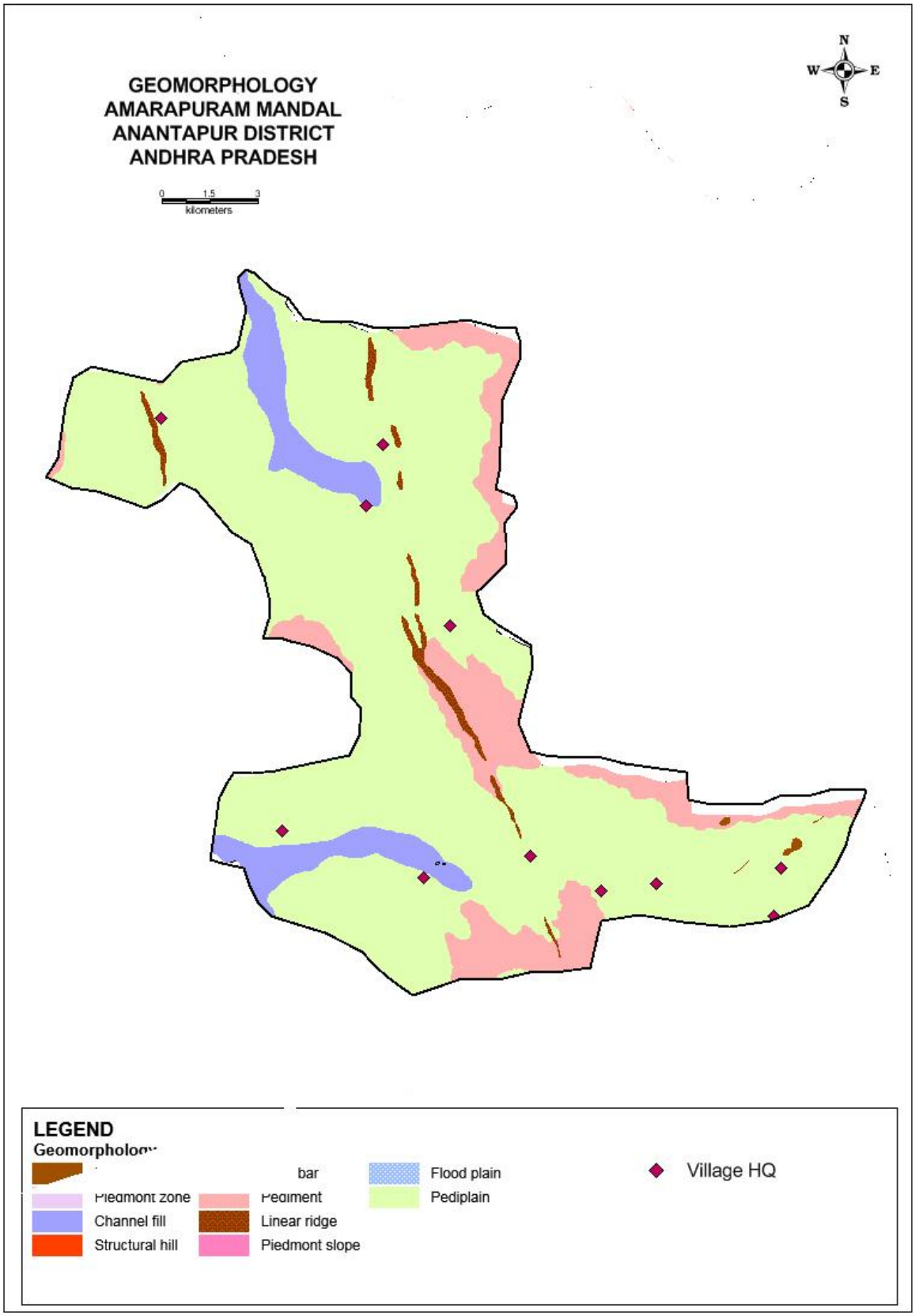

GEOMORPHOLOGY
AMARAPURAM MANDAL
ANANTAPUR DISTRICT
ANDHRA PRADESH
0 1.5 3
kilometers
N
W
E
S
LEGEND
Geomorpholo
bar
Flood plain
Village HQ
Piedmont zone
Pediment
Pediplain
Channel fill
Linear ridge
Structural hill
Piedmont slope

Fig.3

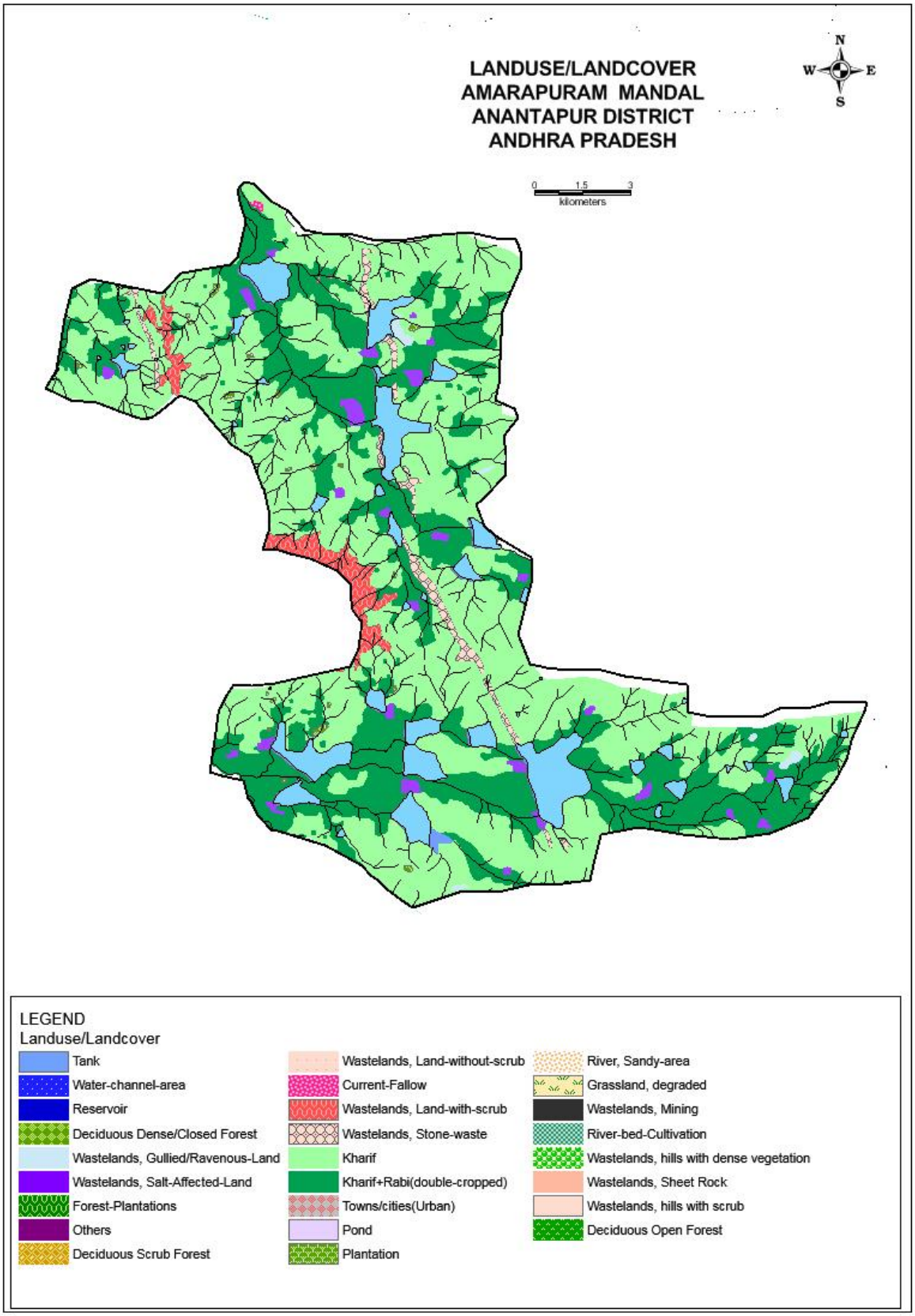

LANDUSE/LANDCOVER
AMARAPURAM MANDAL
ANANTAPUR DISTRICT
ANDHRA PRADESH
N
W
E
S
0 1.5 3
kilometers
LEGEND
Landuse/Landcover
Tank
Water-channel-area
Reservoir
Deciduous Dense/Closed Forest
Wastelands, Gullied/Ravenous-Land
Wastelands, Salt-Affected-Land
Forest-Plantations
Others
Deciduous Scrub Forest
Wastelands, Land-without-scrub
Current-Fallow
Wastelands, Land-with-scrub
Wastelands, Stone-waste
Kharif
Kharif+Rabi(double-cropped)
Towns/cities(Urban)
Pond
Plantation
River, Sandy-area
Grassland, degraded
Wastelands, Mining
River-bed-Cultivation
Wastelands, hills with dense vegetation
Wastelands, Sheet Rock
Wastelands, hills with scrub
Deciduous Open Forest

Fig.4

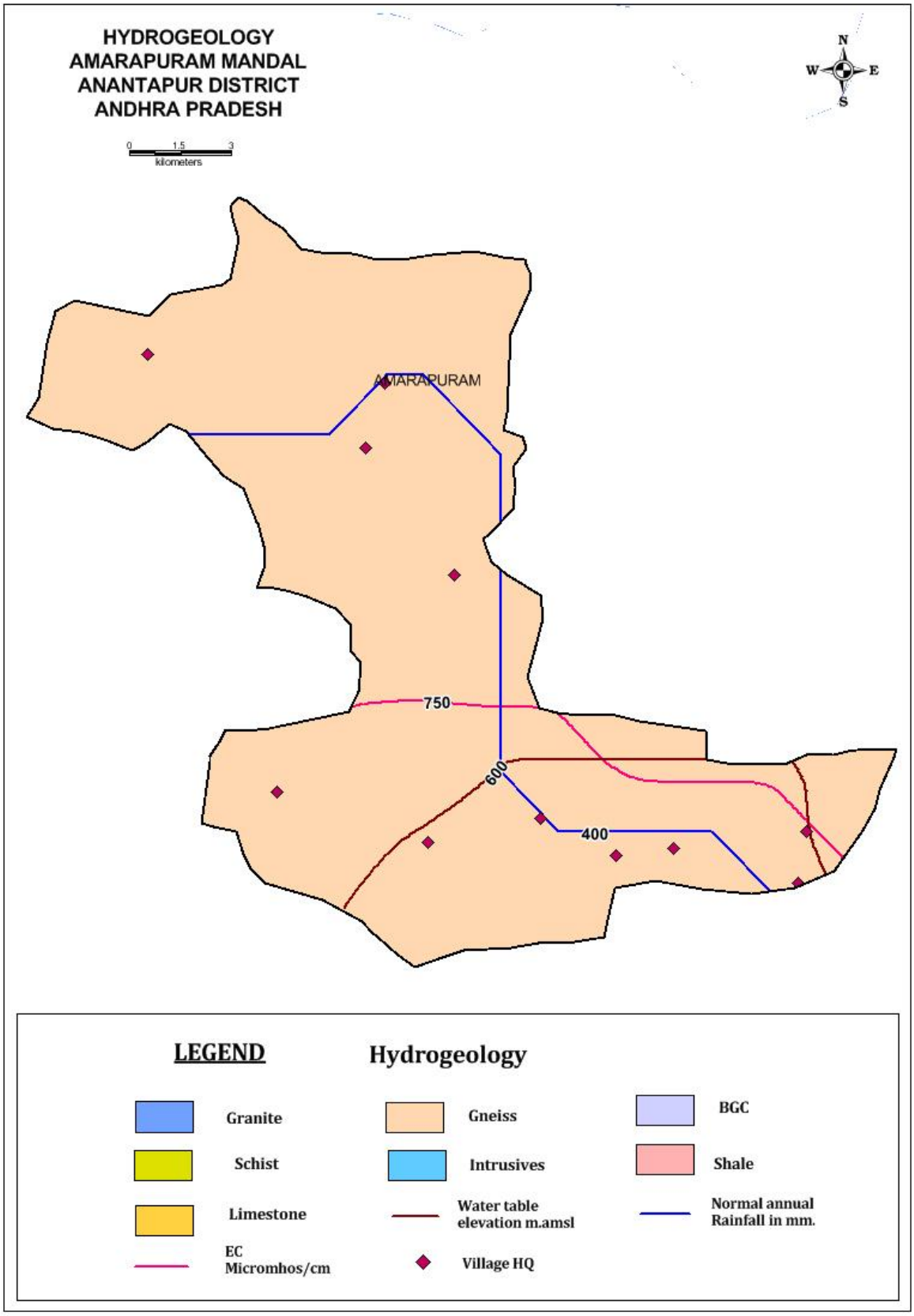

HYDROGEOLOGY
AMARAPURAM MANDAL
ANANTAPUR DISTRICT
ANDHRA PRADESH
0 1.5 3
kilometers
N
W
E
S
AMARAPURAM
750
600
400
LEGEND
Hydrogeology
Granite
Gneiss
BGC
Schist
Intrusives
Shale
Limestone
Water table elevation m.amsl
Normal annual Rainfall in mm.
EC Micromhos/cm
Village HQ

Fig.5

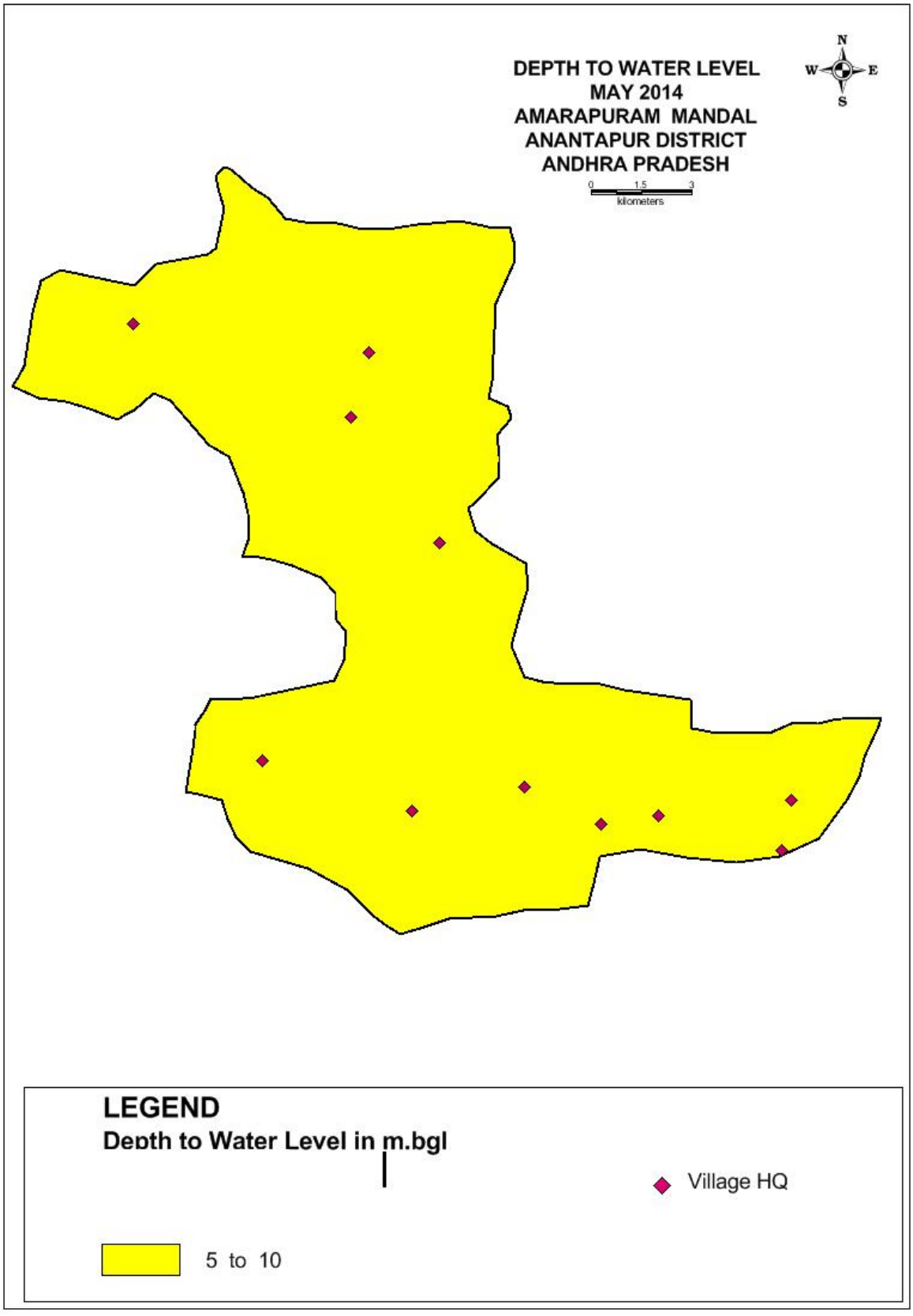

DEPTH TO WATER LEVEL
MAY 2014
AMARAPURAM MANDAL
ANANTAPUR DISTRICT
ANDHRA PRADESH
0 1.5 3
kilometers
N
W
E
S
LEGEND
Depth to Water Level in m.bgl
Village HQ
5 to 10

Fig.6

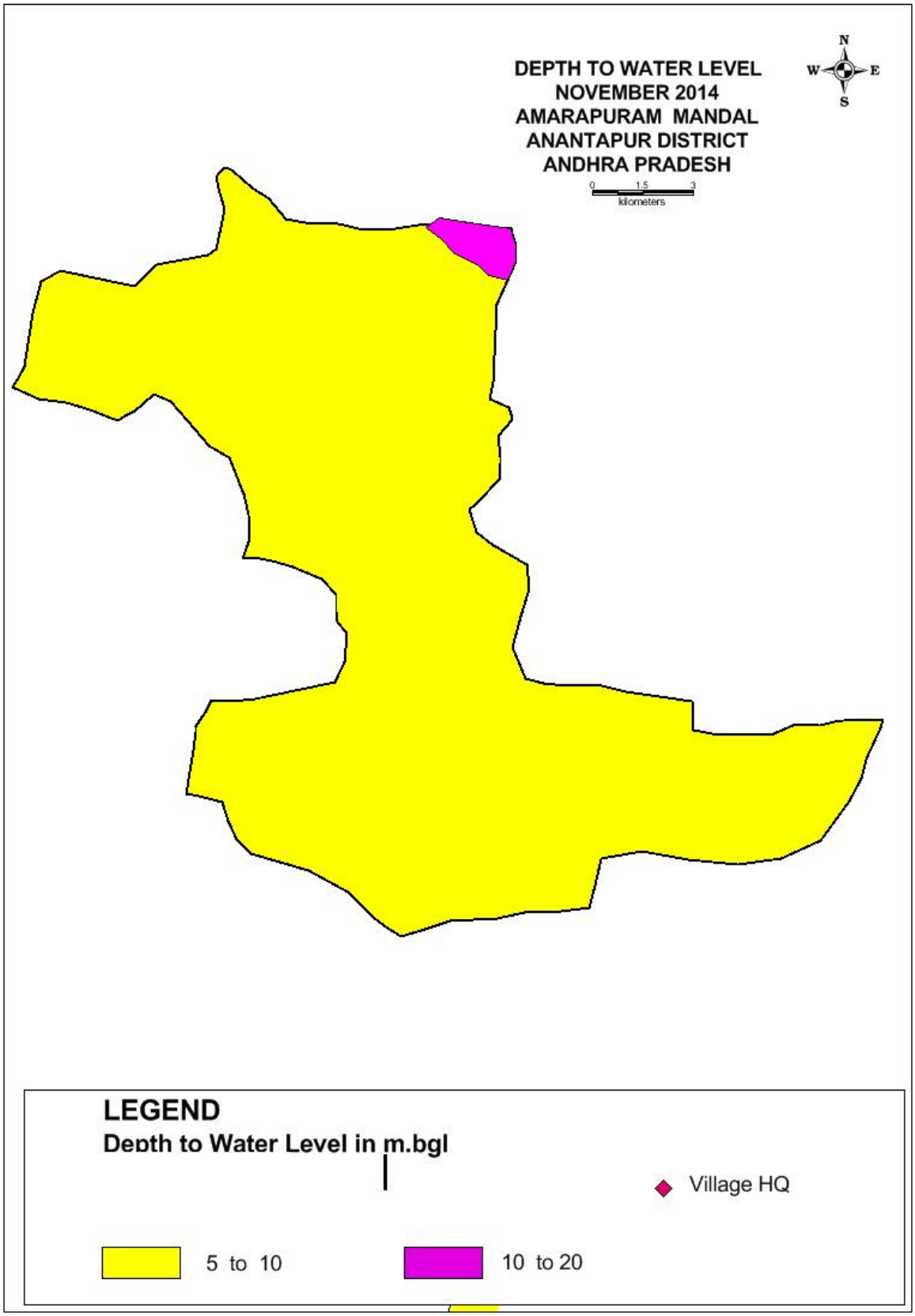
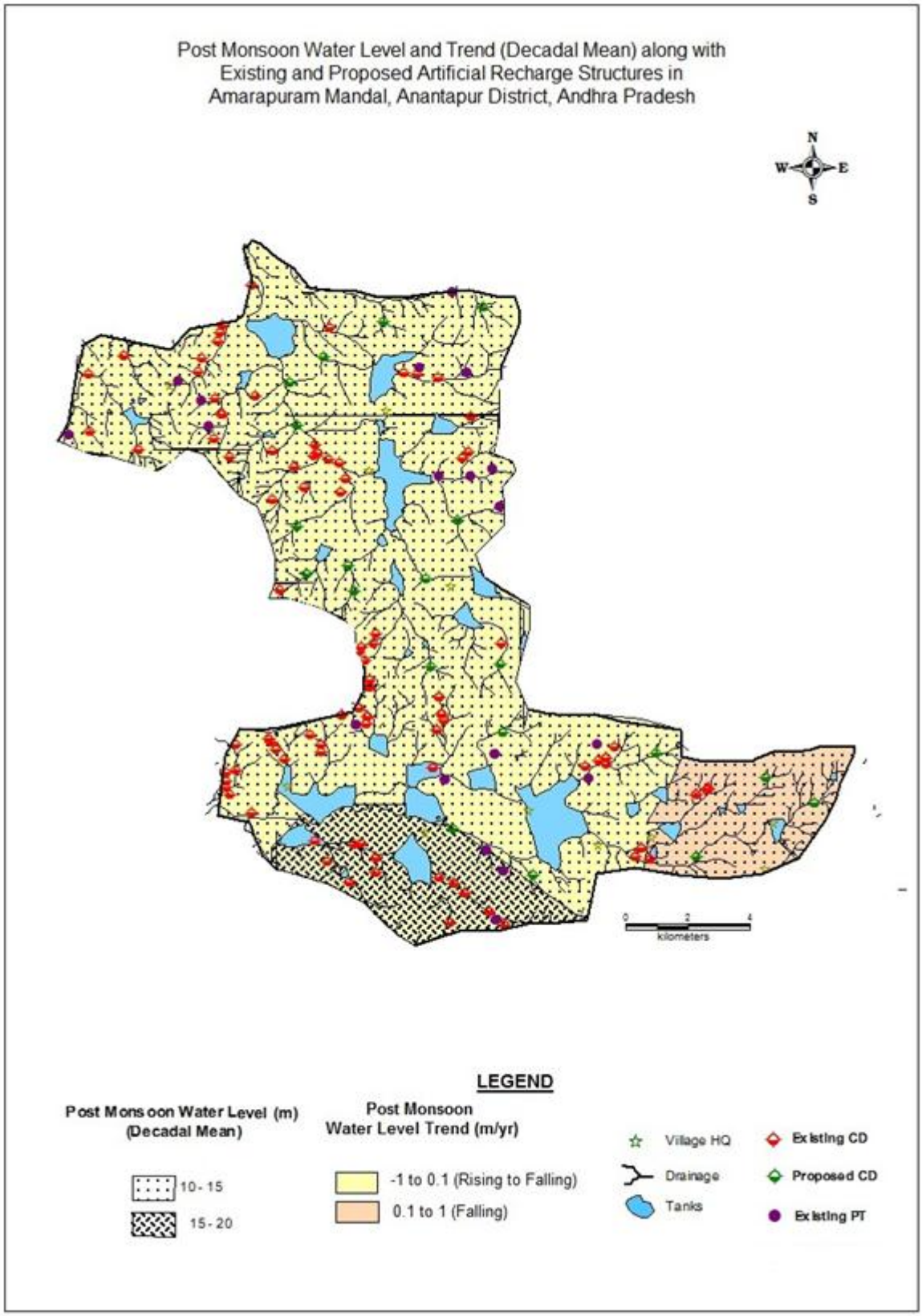

DEPTH TO WATER LEVEL
NOVEMBER 2014
AMARAPURAM MANDAL
ANANTAPUR DISTRICT
ANDHRA PRADESH
0 1.5 3
kilometers
N
W
E
S
LEGEND
Depth to Water Level in m.bgl
Village HQ
5 to 10
10 to 20

Fig.7


Post Monsoon Water Level and Trend (Decadal Mean) along with
Existing and Proposed Artificial Recharge Structures in
Amarapuram Mandal, Anantapur District, Andhra Pradesh
N
W
E
S
0
2
4
kilometers
LEGEND
Post Monsoon Water Level (m)
(Decadal Mean)
10 - 15
15 - 20
Post Monsoon
Water Level Trend (m/yr)
-1 to 0.1 (Rising to Falling)
0.1 to 1 (Falling)
Village HQ
Drainage
Tanks
Existing CD
Proposed CD
Existing PT