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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
AGALI MANDAL, ANANTAPUR DISTRICT,
ANDHRA PRADESH

SOUTHERN REGION
HYDERABAD
AUGUST-2016

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

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
10	JUSTIFICATION OF 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	AGALI
District	ANATAPUR
State	ANDHRA PRADESH
Total Area (Sq.kms)	140
Area suitable for Artificial Recharge (Sq.kms)	110
Latitude and Longitude	13.739440 to 13.890610 and 76.974360 to 77.109420
Average Annual Rainfall (mm)	600
Geology	Granites, Gneisses
Average Depth To Water Level (Decadal) (Pre Monsoon) m bgl	73
Average Depth To Water Level (Decadal) (Post Monsoon) m bgl	71.5
Ground Water Resources (2011)	
Annual Replenishable Ground Water Resources (MCM)	13.51
Net Annual Ground Water Availability (MCM)/yr	12.16
Net Annual Ground Water Draft (MCM)/yr	21.27
Projected Demand for Domestic and Industrial Use (MCM)/yr	0.60
Stage of Ground Water Development (%)	175
Surface Run-off (MCM/yr)	9
Total Storage Created by Various Agencies (MCM)/yr	2.03
Artificial Recharge/Conservation Measures	
Recharge Structures Proposed (No.s)	Percolation Tanks: 0, Check Dams: 0 Farm ponds: 180, Recharge Shafts: 143
Improving Water use Efficiency	Micro Irrigation System: 900 ha
Tentative Total Cost in Lakhs (Rs.)	706.02
Expected Recharge/Savings (MCM)/yr	4.296

1. INTRODUCTION

Agali Mandal is one of the over-exploited mandals in Anantapur district, Andhra Pradesh, which is economically backward and chronically drought affected. The mandal has 7 inhabited villages and 2 un-inhabited villages with 9 gram panchayats.

2. LOCATION

Agali mandal lies between north latitudes 13.739440 to 13.890610 and between east longitudes 76.974360 to 77.109420. It is situated in the south-west part of Anantapur district and is bounded on the north by Gudibanda mandal, on the east by Rolla mandal, on the south and west by Karnataka State (Fig.1). The geographical area of the mandal is 140 Sq.km.

3. PHYSIOGRAPHY AND DRAINAGE

The area is drained by streams which are tributaries of Thungabhadra River. The streams are mostly ephemeral in nature. The drainage pattern is dendritic, rectangular to sub rectangular (Fig.2).

4. RAINFALL

The average annual rainfall is 600 mm. The rainfall during South-west monsoon i.e., June-September accounts for about 85% of the total rainfall.

5. LAND USE PATTERN

Out of the total geographical area of 140 sq km, the net area sown is 84.78 Sq.km. Barren and uncultivable land is 1.48 Sq.km. The land for non agricultural use accounts for 18.69 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 10 m. The weathered zone has been extensively tapped by dug and dug cum bore wells up to 20 m depth. Ground water occurs in fractured granites down to a depth of 200 m bgl. However, the potential fractures are encountered between 50-150 m bgl. The cumulative yield varies from 2-10 lps.

7. GROUND WATER LEVEL SCENARIO

The depth to water level during pre and post-monsoon varies from 5 to 10 m bgl. The average depth to water level (decadal) during pre and post monsoon is 73 and 71.5 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 is given in the Table-1

Table-1: Ground water resources –Agali Mandal, Anantapur District

Annual Replenishable Ground water resources (MCM)	13.51
Net Annual Ground water Availability. (MCM)	12.16
Net Annual Ground water draft. (MCM)	21.27
Projected Demand for Domestic and Industrial use up to 2025. (MCM)	0.60
Stage of Ground water development (%).	175
Whether notified or not with year of notification.	No

9. NEED FOR ARTIFICIAL RECHARGE AND CONSERVATION

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 30 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 ARTIFICIAL RECHARGE PROJECT

Agali Mandal falls under high stage of ground water development i.e., 175 % 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 RECHARGE

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)	140
Hilly Area (Sq.kms)	30
Area suitable for Artificial Recharge (sq.km.)	110
Runoff Yield in MCM/yr	9
Existing No. of Check Dams	244
Storage created MCM/yr	1.73
Existing No. of Percolation Tanks	42
Storage created MCM/yr	0.30
Total Existing Storage Created MCM/yr	2.03

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 6.97 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). 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 122 and 21 recharge shafts of 165 mm dia with 30 m depth in the existing check dams and percolation tanks respectively.

B). Farm Ponds

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 supply 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.

C). 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.

13. TENTATIVE COST ESTIMATES (AGALI 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)	0	0	5	0	0
2	Recharge shaft in Check dam (50% of the existing Check dams)	122	1.342	0.5	61	1.342
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)	21	0.231	1	21	0.231
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)	332	1.60		132.4	1.596
8 (ii)	Total (ha)	900			540	2.7
	Total (8(i) + 8 (ii))				672.4	4.296
9	Impact Assessment & O & M -5 % of Total cost of the Scheme				33.62	
	Grand Total				706.02	

*(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							
	1 st	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 4.296 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 175% to 129% (46%)
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
AGALI MANDAL, ANANTAPUR DISTRICT, AP.

S.no	Gram Panchayat	Habitation	Structure Type	Longitude	Latitude	Scheme
1	Madhudi	M.Gollahatti	Check Dam	77.0266	13.8038	NREGS
2	Madhudi	M.Gollahatti	Check Dam	77.0267	13.8002	NREGS
3	Madhudi	M.Gollahatti	Check Dam	77.0288	13.8000	NREGS
4	Madhudi	Madhudi	Check Dam	77.0146	13.8278	NREGS
5	P.byadigera	Kenkera	Check Dam	77.0052	13.8111	NREGS
6	P.byadigera	Kenkera	Check Dam	77.0066	13.8107	NREGS
7	P.byadigera	Kenkera	Check Dam	77.0089	13.8109	NREGS
8	P.byadigera	Kenkera	Check Dam	77.0035	13.8107	NREGS
9	P.byadigera	Kenkera	Check Dam	76.9993	13.8129	NREGS
10	P.byadigera	P.Byadigera	Check Dam	76.9961	13.7938	NREGS
11	P.byadigera	P.Byadigera	Check Dam	76.9996	13.7920	NREGS
12	P.byadigera	P.Byadigera	Check Dam	76.9910	13.7990	NREGS
13	P.byadigera	V.Thonasanahalli	Check Dam	76.9971	13.8028	NREGS
14	P.byadigera	V.Thonasanahalli	Check Dam	76.9986	13.8027	NREGS
15	P.byadigera	V.Thonasanahalli	Check Dam	76.9903	13.8117	NREGS
16	P.byadigera	Vadaguntanahalli	Check Dam	77.0052	13.7933	NREGS
17	P.byadigera	Vadaguntanahalli	Check Dam	77.0051	13.7911	NREGS
18	P.byadigera	Vadaguntanahalli	Check Dam	77.0081	13.7915	NREGS
19	Hulikeradevarahalli	Gayatri Colony	Check Dam	77.0091	13.7632	NREGS
20	Hulikeradevarahalli	Gayatri Colony	Check Dam	76.9995	13.7552	NREGS
21	Hulikeradevarahalli	Gayatri Colony	Check Dam	77.0015	13.7524	NREGS
22	Hulikeradevarahalli	Gayatri Colony	Check Dam	77.0004	13.7500	NREGS
23	Hulikeradevarahalli	Gayatri Colony	Check Dam	77.0032	13.7485	NREGS
24	Hulikeradevarahalli	Gayatri Colony	Check Dam	77.0031	13.7473	NREGS
25	Hulikeradevarahalli	Gayatri Colony	Check Dam	77.0098	13.7654	NREGS
26	Hulikeradevarahalli	Gayatri Colony	Check Dam	77.0733	13.7502	NREGS
27	Hulikeradevarahalli	Gayatri Colony	Check Dam	77.0082	13.7445	NREGS
28	Hulikeradevarahalli	Gayatri Colony	Check Dam	77.0063	13.7452	NREGS
29	Hulikeradevarahalli	Gayatri Colony	Check Dam	77.0046	13.7461	NREGS
30	Hulikeradevarahalli	Gayatri Colony	Check Dam	77.0044	13.7567	NREGS
31	Hulikeradevarahalli	Gayatri Colony	Check Dam	77.0050	13.7579	NREGS
32	Hulikeradevarahalli	Gayatri Colony	Check Dam	77.0115	13.7460	NREGS
33	Hulikeradevarahalli	Hulikeradevarahalli	Check Dam	77.0136	13.7926	NREGS
34	Hulikeradevarahalli	Hulikeradevarahalli	Check Dam	77.0197	13.7917	NREGS
35	Hulikeradevarahalli	Hulikeradevarahalli	Check Dam	77.0152	13.7850	NREGS
36	Hulikeradevarahalli	Hulikeradevarahalli	Check Dam	77.0116	13.7836	NREGS
37	Hulikeradevarahalli	Hulikeradevarahalli	Check Dam	77.0179	13.7820	NREGS
38	Hulikeradevarahalli	SugaliThanda	Check Dam	77.0103	13.7630	NREGS
39	Hulikeradevarahalli	SugaliThanda	Check Dam	77.0138	13.7641	NREGS
40	Hulikeradevarahalli	SugaliThanda	Check Dam	77.0166	13.7662	NREGS
41	Hulikeradevarahalli	SugaliThanda	Check Dam	77.0197	13.7673	NREGS

42	Hulikeradevarahalli	SugaliThanda	Check Dam	77.0198	13.7666	NREGS
43	Ragelinganahalli	Bommarasanahalli	Check Dam	77.0802	13.7551	NREGS
44	Ragelinganahalli	Bommarasanahalli	Check Dam	77.0802	13.7557	NREGS
45	Ragelinganahalli	Bommarasanahalli	Check Dam	77.0838	13.7568	NREGS
46	Ragelinganahalli	Bommarasanahalli	Check Dam	77.0817	13.7552	NREGS
47	Ragelinganahalli	Bommarasanahalli	Check Dam	77.0816	13.7541	NREGS
48	Ragelinganahalli	Bommarasanahalli	Check Dam	77.0691	13.7504	NREGS
49	Ragelinganahalli	Bommarasanahalli	Check Dam	77.0677	13.7516	NREGS
50	Ragelinganahalli	Bommarasanahalli	Check Dam	77.0669	13.7484	NREGS
51	Ragelinganahalli	Bommarasanahalli	Check Dam	77.0824	13.7441	NREGS
52	Ragelinganahalli	Hanumanahalli	Check Dam	77.0916	13.7674	NREGS
53	Ragelinganahalli	Hanumanahalli	Check Dam	77.0767	13.7722	NREGS
54	Ragelinganahalli	Hanumanahalli	Check Dam	77.0874	13.7694	NREGS
55	Ragelinganahalli	Hanumanahalli	Check Dam	77.0867	13.7705	NREGS
56	Ravudi	Haluvidi	Check Dam	76.9964	13.8444	NREGS
57	Ravudi	Haluvidi	Check Dam	76.9796	13.8209	NREGS
58	Ravudi	Haluvidi	Check Dam	76.9846	13.8209	NREGS
59	Ravudi	Haluvidi	Check Dam	76.9947	13.8185	NREGS
60	Ravudi	Haluvidi	Check Dam	76.9911	13.8146	NREGS
61	Ravudi	Haluvidi	Check Dam	76.9984	13.8485	NREGS
62	Ravudi	Kadirehalli	Check Dam	77.0056	13.8348	NREGS
63	Ravudi	Kadirehalli	Check Dam	77.0115	13.8500	NREGS
64	Ravudi	Kadirehalli	Check Dam	77.0133	13.8460	NREGS
65	Ravudi	Kadirehalli	Check Dam	77.0057	13.8459	NREGS
66	Ravudi	Kadirehalli	Check Dam	77.0035	13.8467	NREGS
67	Ravudi	Kadirehalli	Check Dam	77.0064	13.8515	NREGS
68	Ravudi	Kambadahalli	Check Dam	76.9973	13.8370	NREGS
69	Ravudi	Kambadahalli	Check Dam	76.9969	13.8348	NREGS
70	Ravudi	Kambadahalli	Check Dam	76.9950	13.8357	NREGS
71	Ravudi	Karidasarahalli	Check Dam	77.0215	13.8404	NREGS
72	Ravudi	Karidasarahalli	Check Dam	77.0211	13.8462	NREGS
73	Ravudi	Karidasarahalli	Check Dam	77.0231	13.8444	NREGS
74	Ravudi	Karidasarahalli	Check Dam	77.0196	13.8435	NREGS
75	Ravudi	Karidasarahalli	Check Dam	77.0202	13.8494	NREGS
76	Ravudi	Karidasarahalli	Check Dam	77.0184	13.8511	NREGS
77	Narasambudi	Gyaragondanahalli	Check Dam	77.0526	13.8078	NREGS
78	Narasambudi	Kasapuram	Check Dam	77.0672	13.8081	NREGS
79	Narasambudi	Kasapuram	Check Dam	77.0652	13.8080	NREGS
80	Narasambudi	Kasapuram	Check Dam	77.0702	13.7963	NREGS
81	Narasambudi	Kurusakanahalli	Check Dam	77.0701	13.8084	NREGS
82	Narasambudi	Kurusakanahalli	Check Dam	77.0707	13.8102	NREGS
83	Narasambudi	Narasambudi	Check Dam	77.0441	13.7996	NREGS
84	Narasambudi	Narasambudi	Check Dam	77.0410	13.8012	NREGS
85	Narasambudi	Narasambudi	Check Dam	77.0388	13.8027	NREGS
86	Narasambudi	Narasambudi	Check Dam	77.0388	13.8009	NREGS

87	Narasambudi	Ramanahalli	Check Dam	77.0848	13.8139	NREGS
88	Narasambudi	Ramanahalli	Check Dam	77.0722	13.7954	NREGS
89	Narasambudi	Ramanahalli	Check Dam	77.0741	13.7954	NREGS
90	Narasambudi	Ramanahalli	Check Dam	77.0797	13.8043	NREGS
91	Narasambudi	Ramanahalli	Check Dam	77.0858	13.8077	NREGS
92	Narasambudi	Ramanahalli	Check Dam	77.0912	13.8064	NREGS
93	Narasambudi	Ramanahalli	Check Dam	77.0902	13.7990	NREGS
94	Narasambudi	Ramanahalli	Check Dam	77.0891	13.7951	NREGS
95	Narasambudi	Ramanahalli	Check Dam	77.0831	13.8059	NREGS
96	Narasambudi	Ramanahalli	Check Dam	77.0879	13.8083	NREGS
97	Narasambudi	Ramanahalli	Check Dam	77.0864	13.8094	NREGS
98	Narasambudi	Ramanahalli	Check Dam	77.0892	13.8119	NREGS
99	Narasambudi	Ramanahalli	Check Dam	77.0915	13.8106	NREGS
100	Narasambudi	Ramanahalli	Check Dam	77.0750	13.7949	NREGS
101	Narasambudi	Ramanahalli	Check Dam	77.0761	13.7978	NREGS
102	Agali	Agali	Check Dam	77.0582	13.7944	NREGS
103	Agali	Irigenahalli	Check Dam	77.0312	13.7820	NREGS
104	Agali	Irigenahalli	Check Dam	77.0271	13.7849	NREGS
105	Agali	Irigenahalli	Check Dam	77.0259	13.7812	NREGS
106	Agali	Irigenahalli	Check Dam	77.0273	13.7807	NREGS
107	Agali	Irigenahalli	Check Dam	77.0294	13.7977	NREGS
108	Agali	Nandarajanahalli	Check Dam	77.0257	13.7797	NREGS
109	Agali	Nandarajanahalli	Check Dam	77.0313	13.7797	NREGS
110	Agali	Ramapuram	Check Dam	77.0554	13.7752	NREGS
111	Kodihalli	Dasegowdnahalli	Check Dam	77.0977	13.7921	NREGS
112	Kodihalli	Jangamarahalli	Check Dam	77.1011	13.8092	NREGS
113	Kodihalli	Jangamarahalli	Check Dam	77.1088	13.8026	NREGS
114	Kodihalli	Jangamarahalli	Check Dam	77.1080	13.8040	NREGS
115	Kodihalli	Jangamarahalli	Check Dam	77.0921	13.8053	NREGS
116	Kodihalli	Kodihalli	Check Dam	77.0853	13.7755	NREGS
117	Kodihalli	Kodihalli	Check Dam	77.0882	13.7725	NREGS
118	Kodihalli	Kodihalli	Check Dam	77.0889	13.7737	NREGS
119	Kodihalli	Kodihalli	Check Dam	77.0866	13.7704	NREGS
120	Kodihalli	Kodihalli	Check Dam	77.0854	13.7727	NREGS
121	Kodihalli	Kodihalli	Check Dam	77.0832	13.7736	NREGS
122	Kodihalli	Poolapalli	Check Dam	77.0969	13.7785	NREGS
123	Kodihalli	Poolapalli	Check Dam	77.1048	13.7732	NREGS
124	Kodihalli	Poolapalli	Check Dam	77.1036	13.7726	NREGS
125	Kodihalli	Poolapalli	Check Dam	77.0968	13.7724	NREGS
126	Kodihalli	Poolapalli	Check Dam	77.1024	13.7726	NREGS
127	Kodihalli	Poolapalli	Check Dam	77.0994	13.7686	NREGS
128	Kodihalli	Poolapalli	Check Dam	77.0970	13.7667	NREGS
129	Kodihalli	Poolapalli	Check Dam	77.0930	13.7693	NREGS
130	Inagalore	Dakkalapalli	Check Dam	77.0627	13.8290	NREGS
131	Inagalore	Dakkalapalli	Check Dam	77.0606	13.8295	NREGS

132	Inagalore	Dakkalapalli	Check Dam	77.0597	13.8309	NREGS
133	Inagalore	Dakkalapalli	Check Dam	77.0583	13.8325	NREGS
134	Inagalore	Dakkalapalli	Check Dam	77.0735	13.8295	NREGS
135	Inagalore	Dakkalapalli	Check Dam	77.0670	13.8306	NREGS
136	Inagalore	Dakkalapalli	Check Dam	77.0646	13.8252	NREGS
137	Inagalore	Dakkalapalli	Check Dam	77.0694	13.8265	NREGS
138	Inagalore	Dakkalapalli	Check Dam	77.0671	13.8266	NREGS
139	Inagalore	Dakkalapalli	Check Dam	77.0661	13.8270	NREGS
140	Inagalore	Dakkalapalli	Check Dam	77.0646	13.8280	NREGS
141	Inagalore	Dakkalapalli	Check Dam	77.0614	13.8196	NREGS
142	Inagalore	Dakkalapalli	Check Dam	77.0768	13.8177	NREGS
143	Inagalore	Hallikera	Check Dam	77.0668	13.8585	NREGS
144	Inagalore	Hallikera	Check Dam	77.0678	13.8567	NREGS
145	Inagalore	Hallikera	Check Dam	77.0719	13.8527	NREGS
146	Inagalore	Hallikera	Check Dam	77.0687	13.8535	NREGS
147	Inagalore	Mathenahalli	Check Dam	77.0574	13.8439	NREGS
148	Inagalore	Mathenahalli	Check Dam	77.0589	13.8505	NREGS
149	Inagalore	Thonasanahalli	Check Dam	77.0320	13.8314	NREGS
150	Inagalore	Thonasanahalli	Check Dam	77.0363	13.8306	NREGS
151	Inagalore	Thonasanahalli	Check Dam	77.0376	13.8342	NREGS
152	Inagalore	Thonasanahalli	Check Dam	77.0367	13.8474	NREGS
153	Inagalore	Thonasanahalli	Check Dam	77.0337	13.8430	NREGS
154	Madhudi	M.Gollahatti	Check Dam	77.0266	13.8038	IWMP
155	Madhudi	M.Gollahatti	Check Dam	77.0267	13.8002	IWMP
156	Madhudi	M.Gollahatti	Check Dam	77.0288	13.8000	IWMP
157	Madhudi	Madhudi	Check Dam	77.0146	13.8278	IWMP
158	P.byadigera	Kenkera	Check Dam	77.0052	13.8111	IWMP
159	P.byadigera	Kenkera	Check Dam	77.0066	13.8107	IWMP
160	P.byadigera	Kenkera	Check Dam	77.0089	13.8109	IWMP
161	P.byadigera	Kenkera	Check Dam	77.0035	13.8107	IWMP
162	P.byadigera	Kenkera	Check Dam	76.9993	13.8129	IWMP
163	P.byadigera	P.Byadigera	Check Dam	76.9961	13.7938	IWMP
164	P.byadigera	P.Byadigera	Check Dam	76.9996	13.7920	IWMP
165	P.byadigera	P.Byadigera	Check Dam	76.9910	13.7990	IWMP
166	P.byadigera	V.Thonasanahalli	Check Dam	76.9971	13.8028	IWMP
167	P.byadigera	V.Thonasanahalli	Check Dam	76.9986	13.8027	IWMP
168	P.byadigera	V.Thonasanahalli	Check Dam	76.9903	13.8117	IWMP
169	P.byadigera	Vadaguntanahalli	Check Dam	77.0052	13.7933	IWMP
170	P.byadigera	Vadaguntanahalli	Check Dam	77.0051	13.7911	IWMP
171	P.byadigera	Vadaguntanahalli	Check Dam	77.0081	13.7915	IWMP
172	Ragelinganahalli	Bommarasanahalli	Check Dam	77.0802	13.7551	IWMP
173	Ragelinganahalli	Bommarasanahalli	Check Dam	77.0802	13.7557	IWMP
174	Ragelinganahalli	Bommarasanahalli	Check Dam	77.0838	13.7568	IWMP
175	Ragelinganahalli	Bommarasanahalli	Check Dam	77.0817	13.7552	IWMP
176	Ragelinganahalli	Bommarasanahalli	Check Dam	77.0816	13.7541	IWMP

177	Ragelinganahalli	Bommarasanahalli	Check Dam	77.0691	13.7504	IWMP
178	Ragelinganahalli	Bommarasanahalli	Check Dam	77.0677	13.7516	IWMP
179	Ragelinganahalli	Bommarasanahalli	Check Dam	77.0669	13.7484	IWMP
180	Ragelinganahalli	Bommarasanahalli	Check Dam	77.0824	13.7441	IWMP
181	Ragelinganahalli	Hanumanahalli	Check Dam	77.0916	13.7674	IWMP
182	Ragelinganahalli	Hanumanahalli	Check Dam	77.0767	13.7722	IWMP
183	Ragelinganahalli	Hanumanahalli	Check Dam	77.0874	13.7694	IWMP
184	Ragelinganahalli	Hanumanahalli	Check Dam	77.0867	13.7705	IWMP
185	Narasambudi	Gyaragondanahalli	Check Dam	77.0526	13.8078	IWMP
186	Narasambudi	Kasapuram	Check Dam	77.0672	13.8081	IWMP
187	Narasambudi	Kasapuram	Check Dam	77.0652	13.8080	IWMP
188	Narasambudi	Kasapuram	Check Dam	77.0702	13.7963	IWMP
189	Narasambudi	Kurusakanahalli	Check Dam	77.0701	13.8084	IWMP
190	Narasambudi	Kurusakanahalli	Check Dam	77.0707	13.8102	IWMP
191	Narasambudi	Ramanahalli	Check Dam	77.0848	13.8139	IWMP
192	Narasambudi	Ramanahalli	Check Dam	77.0722	13.7954	IWMP
193	Narasambudi	Ramanahalli	Check Dam	77.0741	13.7954	IWMP
194	Narasambudi	Ramanahalli	Check Dam	77.0797	13.8043	IWMP
195	Narasambudi	Ramanahalli	Check Dam	77.0858	13.8077	IWMP
196	Narasambudi	Ramanahalli	Check Dam	77.0912	13.8064	IWMP
197	Narasambudi	Ramanahalli	Check Dam	77.0902	13.7990	IWMP
198	Narasambudi	Ramanahalli	Check Dam	77.0891	13.7951	IWMP
199	Narasambudi	Ramanahalli	Check Dam	77.0831	13.8059	IWMP
200	Narasambudi	Ramanahalli	Check Dam	77.0879	13.8083	IWMP
201	Narasambudi	Ramanahalli	Check Dam	77.0864	13.8094	IWMP
202	Narasambudi	Ramanahalli	Check Dam	77.0892	13.8119	IWMP
203	Narasambudi	Ramanahalli	Check Dam	77.0915	13.8106	IWMP
204	Narasambudi	Ramanahalli	Check Dam	77.0750	13.7949	IWMP
205	Narasambudi	Ramanahalli	Check Dam	77.0761	13.7978	IWMP
206	Agali	Agali	Check Dam	77.0582	13.7944	IWMP
207	Agali	Irigenahalli	Check Dam	77.0312	13.7820	IWMP
208	Agali	Irigenahalli	Check Dam	77.0259	13.7812	IWMP
209	Agali	Irigenahalli	Check Dam	77.0273	13.7807	IWMP
210	Agali	Irigenahalli	Check Dam	77.0271	13.7849	IWMP
211	Agali	Irigenahalli	Check Dam	77.0294	13.7977	IWMP
212	Agali	Nandarajanahalli	Check Dam	77.0257	13.7797	IWMP
213	Agali	Nandarajanahalli	Check Dam	77.0313	13.7797	IWMP
214	Agali	Ramapuram	Check Dam	77.0554	13.7752	IWMP
215	Kodihalli	Dasegowdnahalli	Check Dam	77.0977	13.7921	IWMP
216	Kodihalli	Jangamarahalli	Check Dam	77.1011	13.8092	IWMP
217	Kodihalli	Jangamarahalli	Check Dam	77.1088	13.8026	IWMP
218	Kodihalli	Jangamarahalli	Check Dam	77.1080	13.8040	IWMP
219	Kodihalli	Jangamarahalli	Check Dam	77.0921	13.8053	IWMP
220	Kodihalli	Kodihalli	Check Dam	77.0866	13.7704	IWMP
221	Kodihalli	Kodihalli	Check Dam	77.0854	13.7727	IWMP

222	Kodihalli	Kodihalli	Check Dam	77.0832	13.7736	IWMP
223	Kodihalli	Kodihalli	Check Dam	77.0853	13.7755	IWMP
224	Kodihalli	Kodihalli	Check Dam	77.0882	13.7725	IWMP
225	Kodihalli	Kodihalli	Check Dam	77.0889	13.7737	IWMP
226	Kodihalli	Poolapalli	Check Dam	77.0969	13.7785	IWMP
227	Kodihalli	Poolapalli	Check Dam	77.1048	13.7732	IWMP
228	Kodihalli	Poolapalli	Check Dam	77.1036	13.7726	IWMP
229	Kodihalli	Poolapalli	Check Dam	77.0968	13.7724	IWMP
230	Kodihalli	Poolapalli	Check Dam	77.1024	13.7726	IWMP
231	Kodihalli	Poolapalli	Check Dam	77.0994	13.7686	IWMP
232	Kodihalli	Poolapalli	Check Dam	77.0970	13.7667	IWMP
233	Kodihalli	Poolapalli	Check Dam	77.0930	13.7693	IWMP
234	P.byadigera	Kenkera	Check Wall	77.0028	13.8131	NREGS
235	Hulikeradevarahalli	Gayatri Colony	Check Wall	77.0043	13.7516	NREGS
236	Hulikeradevarahalli	Vadrahatti	Check Wall	77.0037	13.7694	NREGS
237	Ravudi	Haluvidi	Check Wall	76.9939	13.8448	NREGS
238	Ravudi	Haluvidi	Check Wall	76.9964	13.8457	NREGS
239	Ravudi	Kadirehalli	Check Wall	77.0146	13.8281	NREGS
240	Ravudi	Karidasarahalli	Check Wall	77.0233	13.8383	NREGS
241	Inagalore	Mathenahalli	Check Wall	77.0565	13.8412	NREGS
242	Inagalore	Mathenahalli	Check Wall	77.0511	13.8402	NREGS
243	Inagalore	Mathenahalli	Check Wall	77.0600	13.8491	NREGS
244	P.byadigera	Kenkera	Check Wall	77.0028	13.8131	IWMP
245	Hulikeradevarahalli	Devarahalli	MPT	77.0200	13.7761	NREGS
246	Hulikeradevarahalli	Gayatri Colony	MPT	77.0116	13.7526	NREGS
247	Hulikeradevarahalli	Gayatri Colony	MPT	77.0040	13.7633	NREGS
248	Hulikeradevarahalli	Gayatri Colony	MPT	77.0005	13.7632	NREGS
249	Hulikeradevarahalli	Gayatri Colony	MPT	77.0019	13.7611	NREGS
250	Hulikeradevarahalli	Gayatri Colony	MPT	77.0082	13.7540	NREGS
251	Ravudi	Kadirehalli	MPT	77.0059	13.8375	NREGS
252	Ravudi	Kadirehalli	MPT	77.0088	13.8443	NREGS
253	Kodihalli	Dasegowdnahalli	MPT	77.0974	13.7884	NREGS
254	Inagalore	Hallikera	MPT	77.0682	13.8579	NREGS
255	Kodihalli	Dasegowdnahalli	MPT	77.0974	13.7884	IWMP
256	Hulikeradevarahalli	SugaliThanda	PT	77.0149	13.7617	NREGS
257	Hulikeradevarahalli	SugaliThanda	PT	77.0163	13.7615	NREGS
258	Ravudi	Haluvidi	PT	76.9889	13.8336	NREGS
259	Ravudi	Haluvidi	PT	76.9844	13.8304	NREGS
260	Ravudi	Haluvidi	PT	76.9818	13.8251	NREGS
261	Ravudi	Haluvidi	PT	76.9981	13.8466	NREGS
262	Ravudi	Kadirehalli	PT	77.0110	13.8544	NREGS
263	Ravudi	Kadirehalli	PT	77.0095	13.8562	NREGS
264	Narasambudi	Ramanahalli	PT	77.0879	13.7946	NREGS
265	Kodihalli	Jangamarahalli	PT	77.0902	13.7991	NREGS
266	Kodihalli	Poolapalli	PT	77.0918	13.7752	NREGS

267	Kodihalli	Poolapalli	PT	77.1031	13.7790	NREGS
268	Kodihalli	Poolapalli	PT	77.1050	13.7739	NREGS
269	Kodihalli	Poolapalli	PT	77.0911	13.7695	NREGS
270	Kodihalli	Poolapalli	PT	77.1019	13.7713	NREGS
271	Kodihalli	Poolapalli	PT	77.1026	13.7688	NREGS
272	Inagalore	Dakkalapalli	PT	77.0651	13.8335	NREGS
273	Inagalore	Dakkalapalli	PT	77.0771	13.8190	NREGS
274	Inagalore	Hallikera	PT	77.0693	13.8573	NREGS
275	Inagalore	Hallikera	PT	77.0573	13.8571	NREGS
276	Inagalore	Mathenahalli	PT	77.0620	13.8485	NREGS
277	Inagalore	Mathenahalli	PT	77.0620	13.8485	NREGS
278	Inagalore	Mathenahalli	PT	77.0637	13.8490	NREGS
279	Narasambudi	Ramanahalli	PT	77.0879	13.7946	IWMP
280	Kodihalli	Jangamarahalli	PT	77.0902	13.7991	IWMP
281	Kodihalli	Poolapalli	PT	77.0918	13.7752	IWMP
282	Kodihalli	Poolapalli	PT	77.1031	13.7790	IWMP
283	Kodihalli	Poolapalli	PT	77.1050	13.7739	IWMP
284	Kodihalli	Poolapalli	PT	77.0911	13.7695	IWMP
285	Kodihalli	Poolapalli	PT	77.1019	13.7713	IWMP
286	Kodihalli	Poolapalli	PT	77.1026	13.7688	IWMP

Fig.1

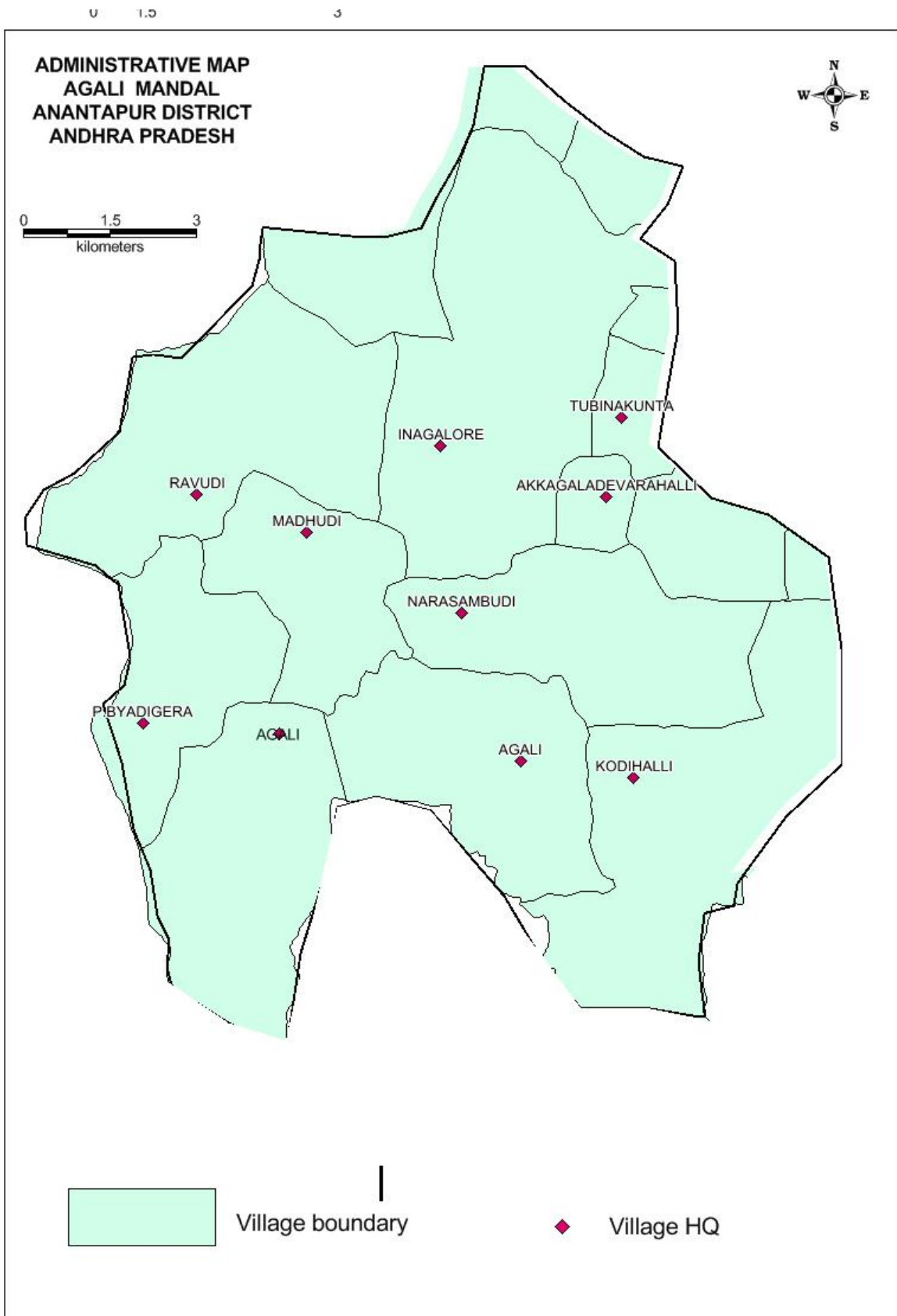


Fig.2

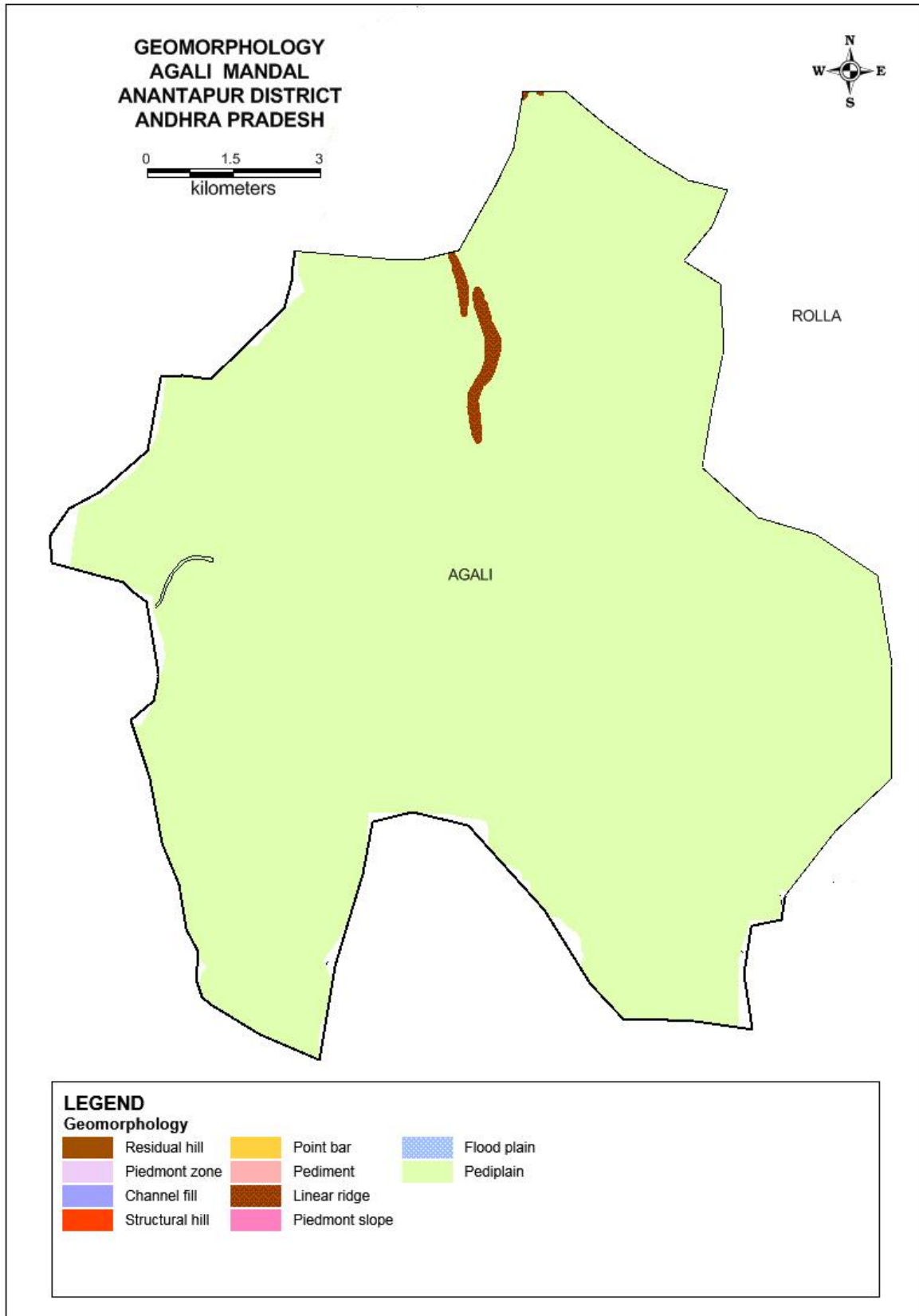


Fig.3

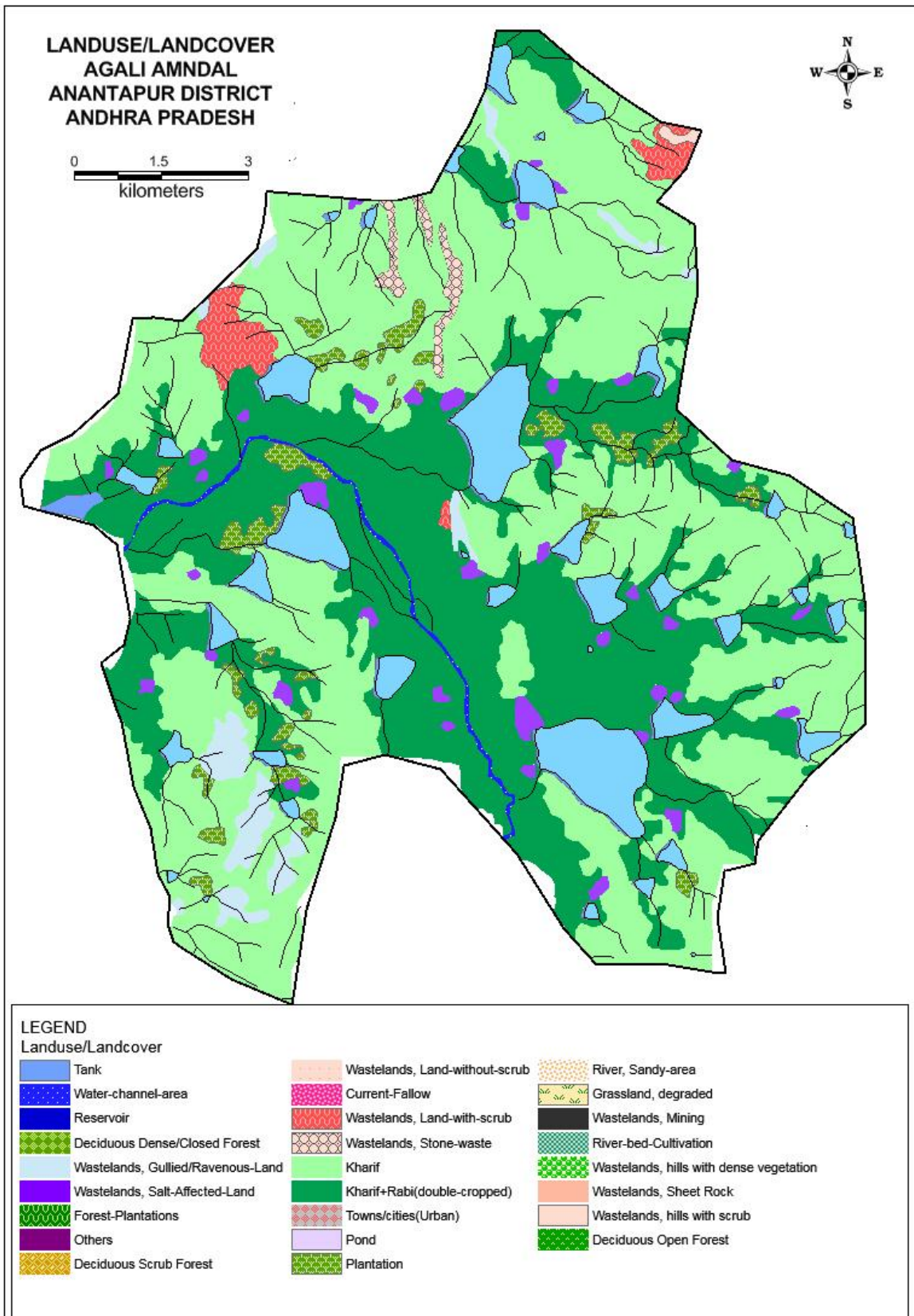


Fig.4

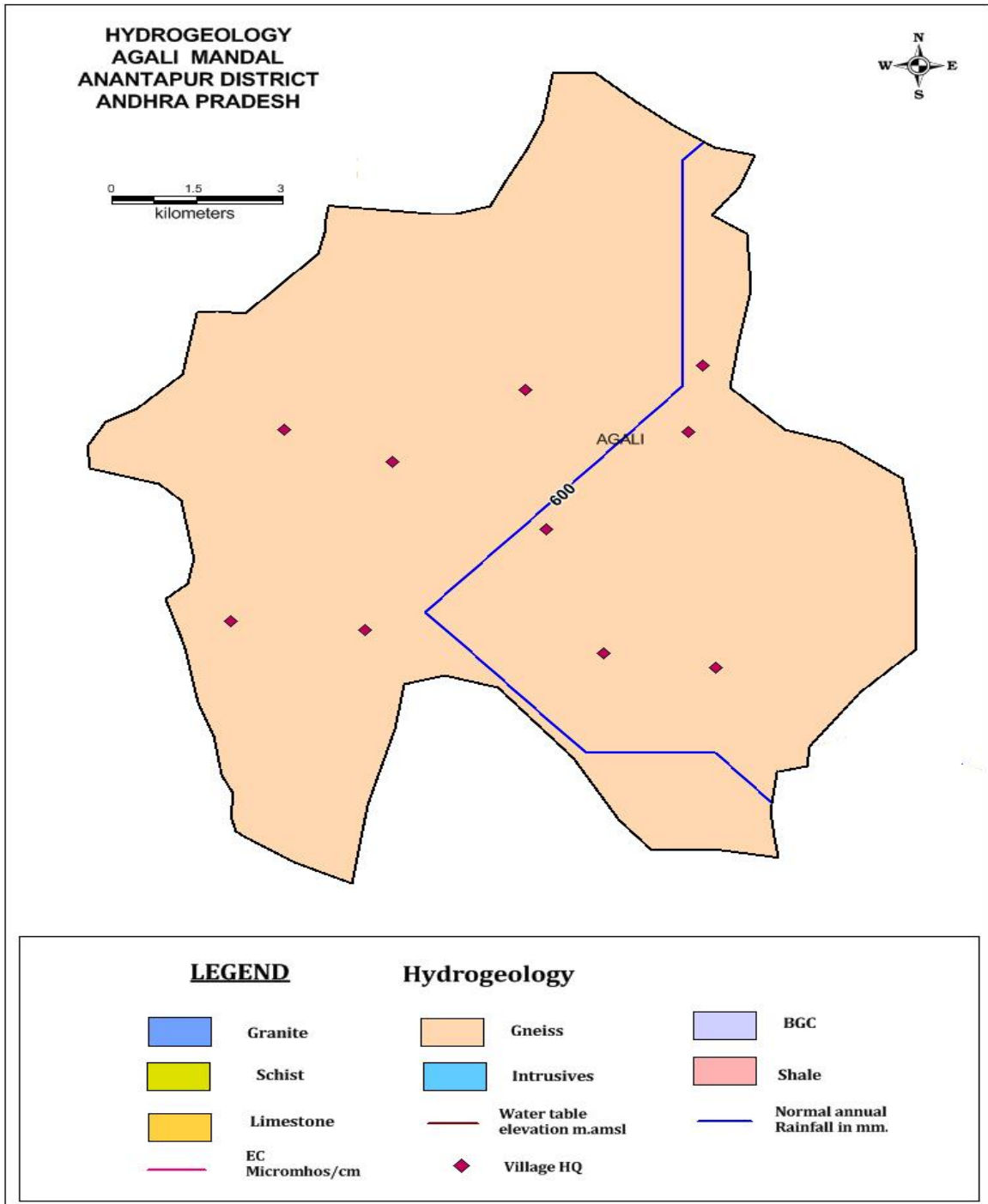


Fig.5

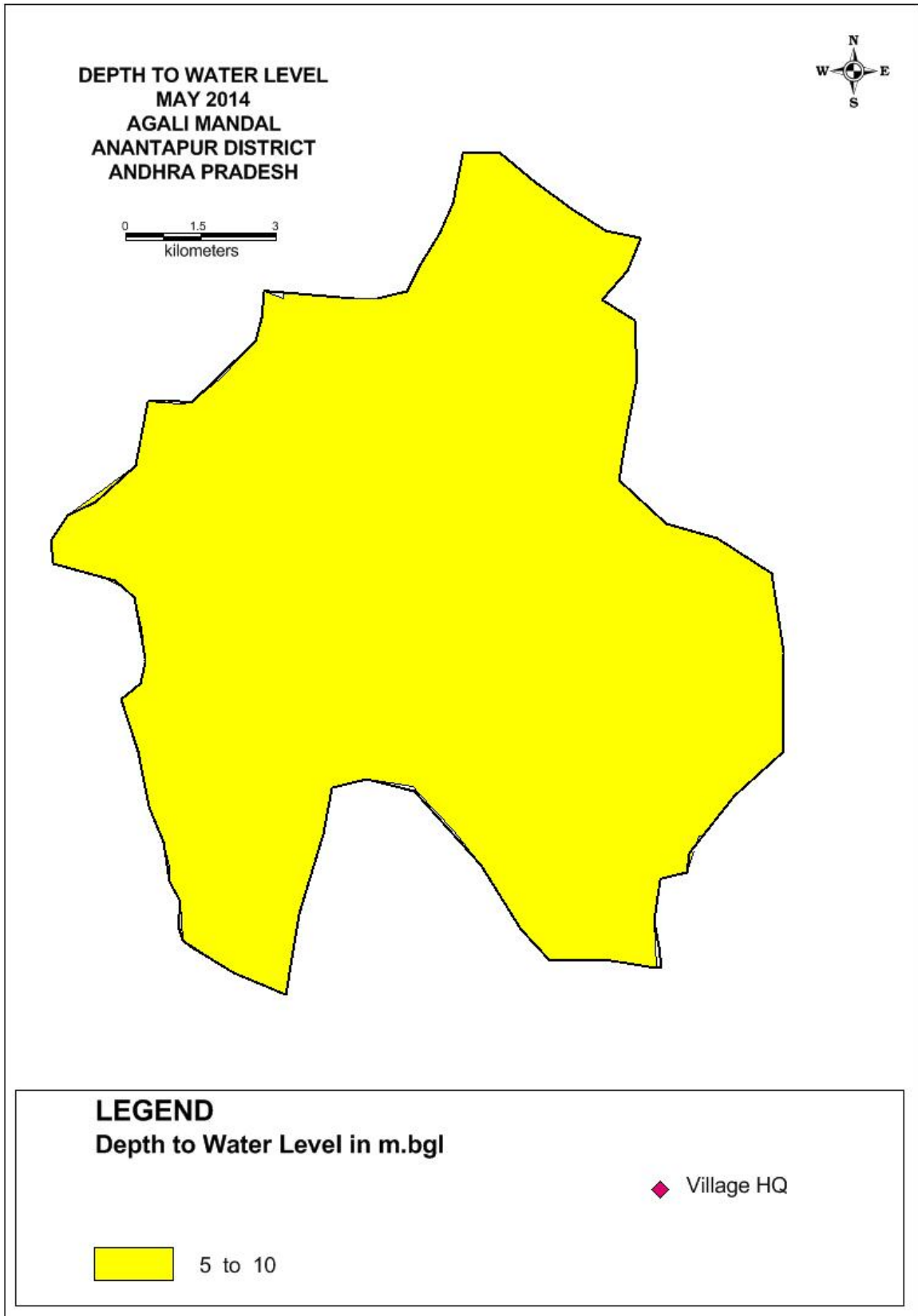


Fig.6

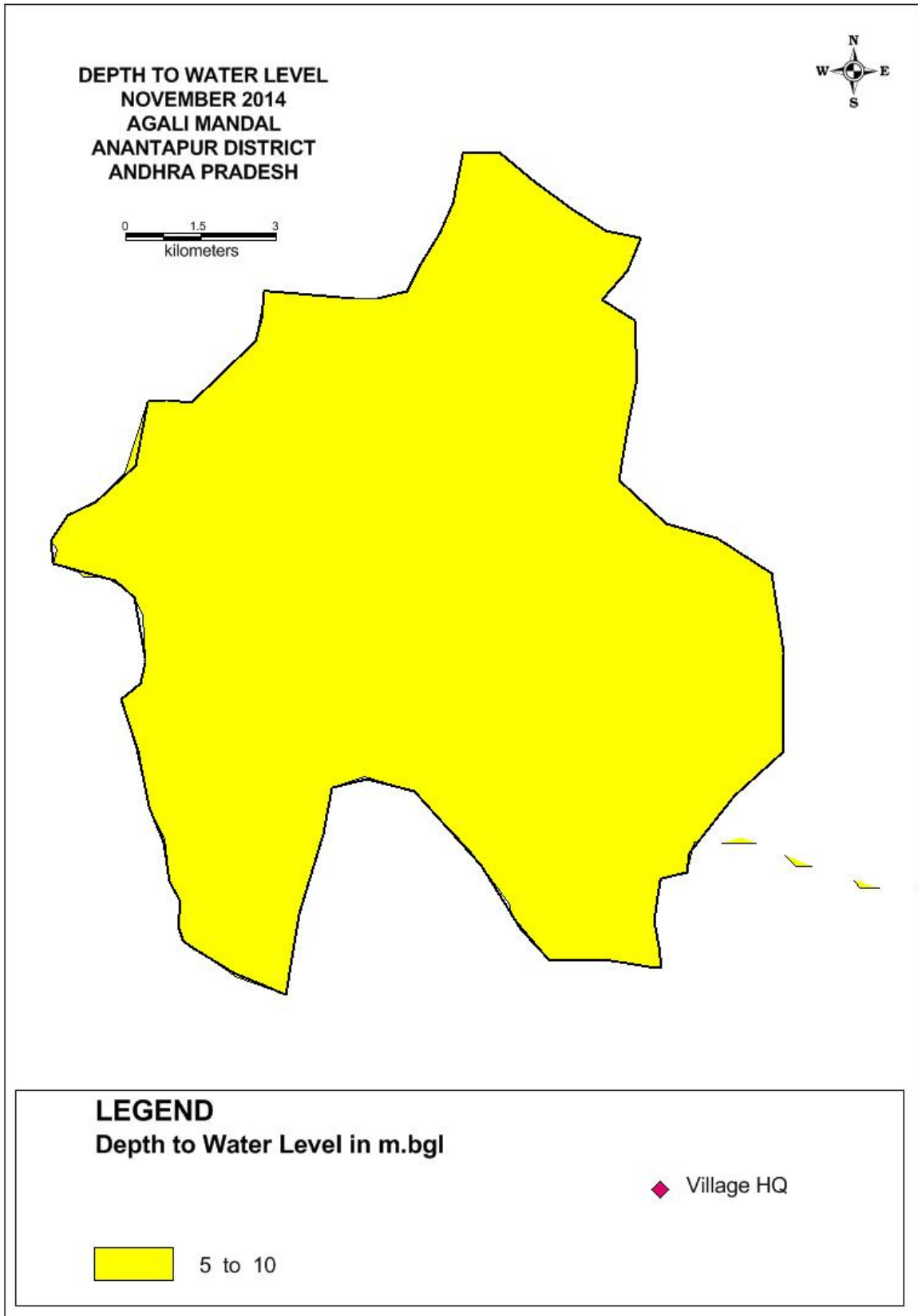


Fig.7

