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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 KAMAREDDY MANDAL, NIZAMABAD DISTRICT, TELANGANA STATE

SOUTHERN REGION
HYDERABAD
AUGUST- 2016

PLAN ON
ARTIFICIAL RECHARGE TO GROUNDWATER AND WATER CONSERVATION IN KAMAREDDY MANDAL, NIZAMABAD DISTRICT, TELANGANA STATE

CONTENTS

AT A GLANCE

Name of the Mandal	KAMAREDDY
District	NIZAMABAD
State	TELANGANA
Total Area(sq. km)	130
Area suitable for Artificial Recharge (sq.km.)	125.50
Latitude and Longitude	18.238770 to 18.372430 and 78.286160 to 78.433580.
Average Annual Rainfall (mm)	997
Geology	BGC
Average Depth To Water Level (Decadal) (Pre Monsoon)	23.90
Average Depth To Water Level (Decadal) (Post Monsoon)	23.30
Ground Water Resources (2011)	
Annual Replenishable Ground Water Resources (MCM/yr)	17.36
Net Annual Ground Water Availability(MCM)/yr	15.62
Net Annual Ground Water Draft(MCM)/yr	25.30
Projected Demand for Domestic and Industrial Use(MCM)/yr	0.72
Stage of Ground Water Development (%)	162
Surface runoff available (MCM)/yr	34.46
Total Storage Created in the Mandal by Various Agencies (MCM)/yr	0.92
Artificial Recharge/Conservation Measures	
Recharge Structures Proposed (No.s)	Percolation Tanks: 24, Check Dams: 36 Farm ponds: 440, Recharge Shafts-65
Improving Water use Efficiency	Micro Irrigation System -2200 ha
Tentative Total Cost in Lakhs (Rs.)	2116.485 Lakhs
Expected Recharge/Savings (MCM)/yr	9.928

1. INTRODUCTION

Kamareddy Mandal is one of over-exploited Mandal in Nizamabad district, Telangana State, which is economically backward and chronically drought affected. The Mandal has 22 inhabited villages and with 17 gram panchayats.

2. LOCATION

The Mandal lies between north latitudes 18.238770 to 18.372430 and between east longitudes 78.286160 to 78.433580. The Mandal occupies the southeast part of the Nizamabad district and is bounded on the north by Sadasivanagar mandal, on the east by Machareddy mandal, on the south by Bhiknoor mandal and west by Tadwai Mandal. (Fig.1) The geographical area of the Mandal is 130 sq.km.

3. PHYSIOGRAPHY AND DRAINAGE:

The area is drained by streams, falling in Manneru sub-basin of Godavari basin. The streams are mostly ephemeral in nature. The drainage pattern is dendritic, rectangular to sub rectangular due to the influence of geological structures. (Fig.2)

4. RAINFALL

The average rainfall in the Mandal is 997 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 130 sq.km, the area covered by forest is 0.51 sq.km and the net area sown is 32.73 sq.km. Barren and uncultivable land is 2.55 sq.km. The land for non agricultural use accounts for 28.96 sq.km.(Fig.3).

6. HYDROGEOLOGY

The area is underlain by granitic gneisses of Archaean age (Fig.4). Ground water occurs in weathered and fractured zones under water table and semi- confined conditions. The weathered zone thickness as per the GEC report is 30 m. The weathered zone has been extensively tapped by dug and dug cum bore wells up to 30 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 pre and post-monsoon varies from 2 to 20 m bgl. The average depth to water level (decadal) during pre and post monsoon is 23.3 and 23.9 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 Kamareddy Mandal, Nizamabad District is given in Table-1.

Table-1 Ground water resources of KamareddyMandal,Nizamabad District.

Annual Replenishable Ground water resources (MCM)	17.36
Net Annual Ground Water Availability(MCM)/yr	15.62
Net Annual Ground Water Draft(MCM)/yr	25.30
Projected Demand for Domestic and Industrial use up to 2025. (MCM)	0.72
Stage of Ground water development (%).	162
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 upto30m. 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

Kamareddy Mandal falls under high stage of ground water development i.e., 162 % 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)	130.00
Hilly Area (Sq.kms)	4.50
Area suitable for Artificial Recharge (sq.km.)	125.50
Runoff Yield in MCM/yr.	34.46
Existing No. of Check Dams	130.00
Storage created MCM/yr.	0.92
Existing No. of Percolation Tanks	0.00
Storage created MCM/yr.	0.00
Total Existing Storage Created	0.92

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 33.54 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 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 997 mm, sufficient rain water can be harnessed. This will improve ground water regime as well as delaying the instant flow into the main river.

- The flow in these seasonal rivers can be sustained up to about 2 to 3 months after monsoon.

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

A total of 36 **Check dams and 24 Percolation tanks** are recommended.

B). Recharge Shaft

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 64 recharge shafts of 165 mm dia with 30 m depth in the existing check dams.

C). Farm Pond

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 440 farm ponds in 22 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 2200 ha @ 100 ha per village.

13. TENTATIVE COST ESTIMATES (KAMAREDDY 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)	36	1.008	5	180	0.756
2	Recharge shaft in Check dam (50% of the existing Check dams)	65	0.715	0.5	32.5	0.715
3	Proposed Percolation Tanks (100*100*2.5)* 4 fillings)	24	2.4	15	360	1.8
4	Renovation Desilting, Repairs and installation of Recharge Shafts in existing PTS (50% of the existing PTS)	0	0	1	0	0
5	Proposed Farm Pond (6 filling) 5*5*1.5 dimension @ 20 farm ponds per each village	440	0.06336	0.25	110	0.057024
6	Proposed Sprinkler/drip/HDPE pipes for 100 ha in each village	2200		0.6	1320	6.6
7	Proposed Piezometers up to 50 mbgl @ one PZ per Village	22	0	0.6	13.2	0
8 (i)	Total (No. of AR Structures)	587	4.19		695.7	3.328
8 (ii)	Total (ha)	2200			1320	6.6
	Total (8(i) + 8 (ii))				**2015.7**	**9.928**
9	**Impact Assessment & O & M -5 % of Total cost of the Scheme**				**100.785**	
	Grand Total				**2116.485**	

*(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								

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 9.928 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 162% to 99% (63%)
4. It will also help in controlling soil erosion.

Acknowledgements

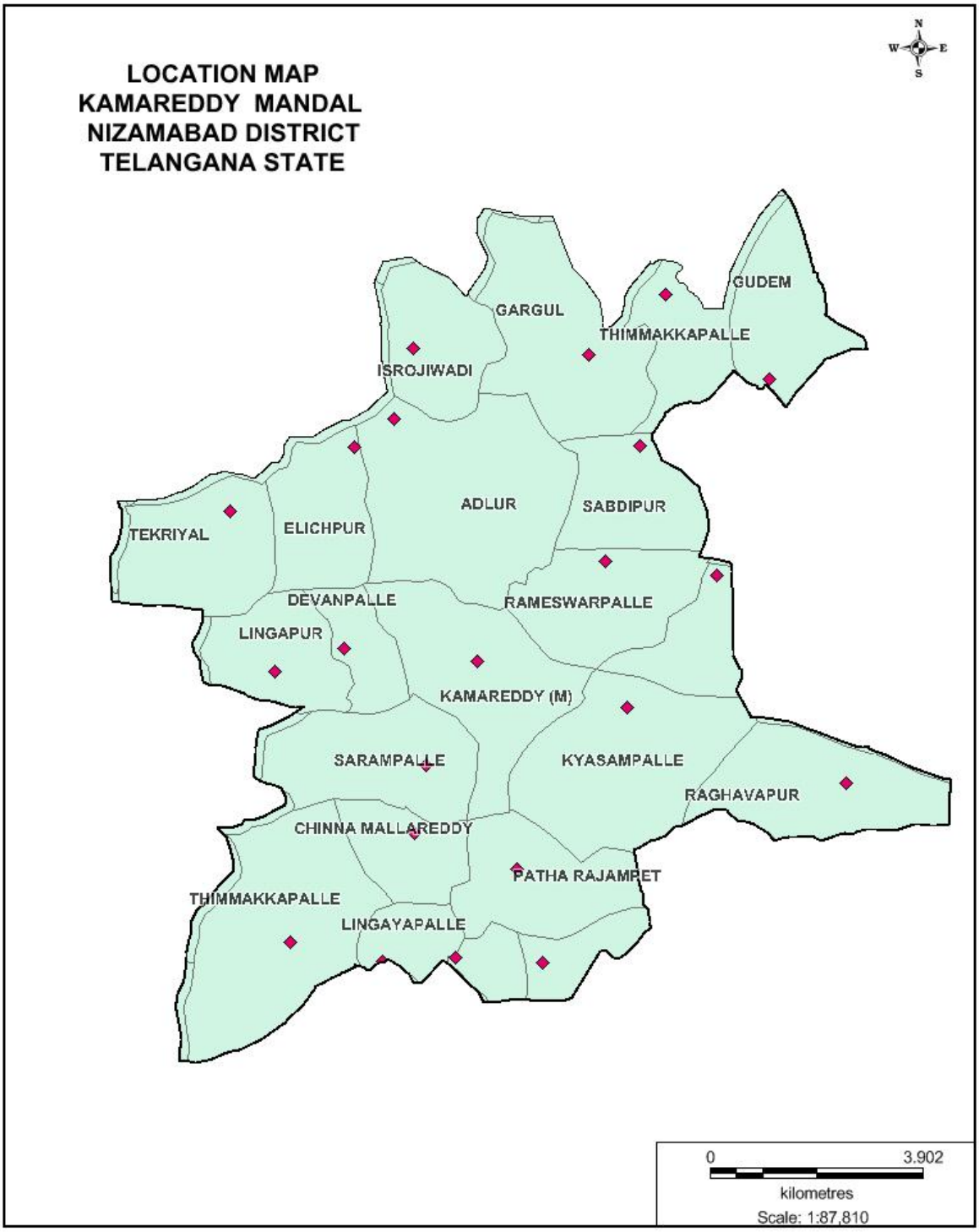
The inputs with regard to the Utilizable Yield, existing and proposed Artificial Recharge Structures have been provided by the Director, State Ground Water Department, Government of Telangana. The same is duly acknowledged.

PROPOSED ARTIFICIAL RECHARGE STRUCTURES KAMAREDDY MANDAL, NIZAMABAD DISTRICT, TELANGANA.

S.No.	Mandal	Lattitude	Longitude	Structure type
1	Kamareddy	18.3563	78.3616	Checkdam
2	Kamareddy	18.3638	78.3497	Checkdam
3	Kamareddy	18.3648	78.3601	Checkdam
4	Kamareddy	18.3692	78.3449	Checkdam
5	Kamareddy	18.365	78.3407	Checkdam
6	Kamareddy	18.3451	78.3864	Checkdam
7	Kamareddy	18.3639	78.4048	Checkdam
8	Kamareddy	18.3542	78.4104	Checkdam
9	Kamareddy	18.3315	78.3082	Checkdam
10	Kamareddy	18.3297	78.3098	Checkdam
11	Kamareddy	18.3269	78.3051	Checkdam
12	Kamareddy	18.3359	78.326	Checkdam
13	Kamareddy	18.3439	78.3206	Checkdam
14	Kamareddy	18.3313	78.3146	Checkdam
15	Kamareddy	18.3422	78.3604	Checkdam
16	Kamareddy	18.3269	78.3443	Checkdam
17	Kamareddy	18.3237	78.3542	Checkdam
18	Kamareddy	18.3207	78.3486	Checkdam
19	Kamareddy	18.3184	78.3618	Checkdam
20	Kamareddy	18.3057	78.3466	Checkdam
21	Kamareddy	18.2913	78.3445	Checkdam
22	Kamareddy	18.2941	78.3542	Checkdam
23	Kamareddy	18.3034	78.3595	Checkdam
24	Kamareddy	18.3034	78.3751	Checkdam
25	Kamareddy	18.2959	78.3958	Checkdam
26	Kamareddy	18.2944	78.407	Checkdam
27	Kamareddy	18.2946	78.4017	Checkdam
28	Kamareddy	18.2959	78.414	Checkdam
29	Kamareddy	18.2849	78.37	Checkdam
30	Kamareddy	18.2768	78.3729	Checkdam
31	Kamareddy	18.2634	78.3751	Checkdam
32	Kamareddy	18.2596	78.3536	Checkdam
33	Kamareddy	18.2688	78.3282	Checkdam
34	Kamareddy	18.2794	78.3189	Checkdam
35	Kamareddy	18.28	78.3232	Checkdam
36	Kamareddy	18.2593	78.3214	Checkdam
37	Kamareddy	18.3681	78.3412	Percolation Tank
38	Kamareddy	18.3641	78.3777	Percolation Tank
39	Kamareddy	18.3613	78.4062	Percolation Tank
40	Kamareddy	18.3597	78.4081	Percolation Tank

41	Kamareddy	18.326	78.307	Percolation Tank
42	Kamareddy	18.3234	78.3279	Percolation Tank
43	Kamareddy	18.3021	78.3164	Percolation Tank
44	Kamareddy	18.2935	78.3061	Percolation Tank
45	Kamareddy	18.2849	78.2979	Percolation Tank
46	Kamareddy	18.2819	78.3215	Percolation Tank
47	Kamareddy	18.2866	78.3081	Percolation Tank
48	Kamareddy	18.2866	78.326	Percolation Tank
49	Kamareddy	18.2644	78.3262	Percolation Tank
50	Kamareddy	18.263	78.3596	Percolation Tank
51	Kamareddy	18.2815	78.3649	Percolation Tank
52	Kamareddy	18.285	78.3581	Percolation Tank
53	Kamareddy	18.2932	78.4243	Percolation Tank
54	Kamareddy	18.2982	78.3884	Percolation Tank
55	Kamareddy	18.3022	78.402	Percolation Tank
56	Kamareddy	18.2885	78.3994	Percolation Tank
57	Kamareddy	18.2971	78.3671	Percolation Tank
58	Kamareddy	18.2975	78.348	Percolation Tank
59	Kamareddy	18.3226	78.3688	Percolation Tank
60	Kamareddy	18.3362	78.3455	Percolation Tank

Fig.1



LEGEND

Village boundary

Village HQ

Fig.2

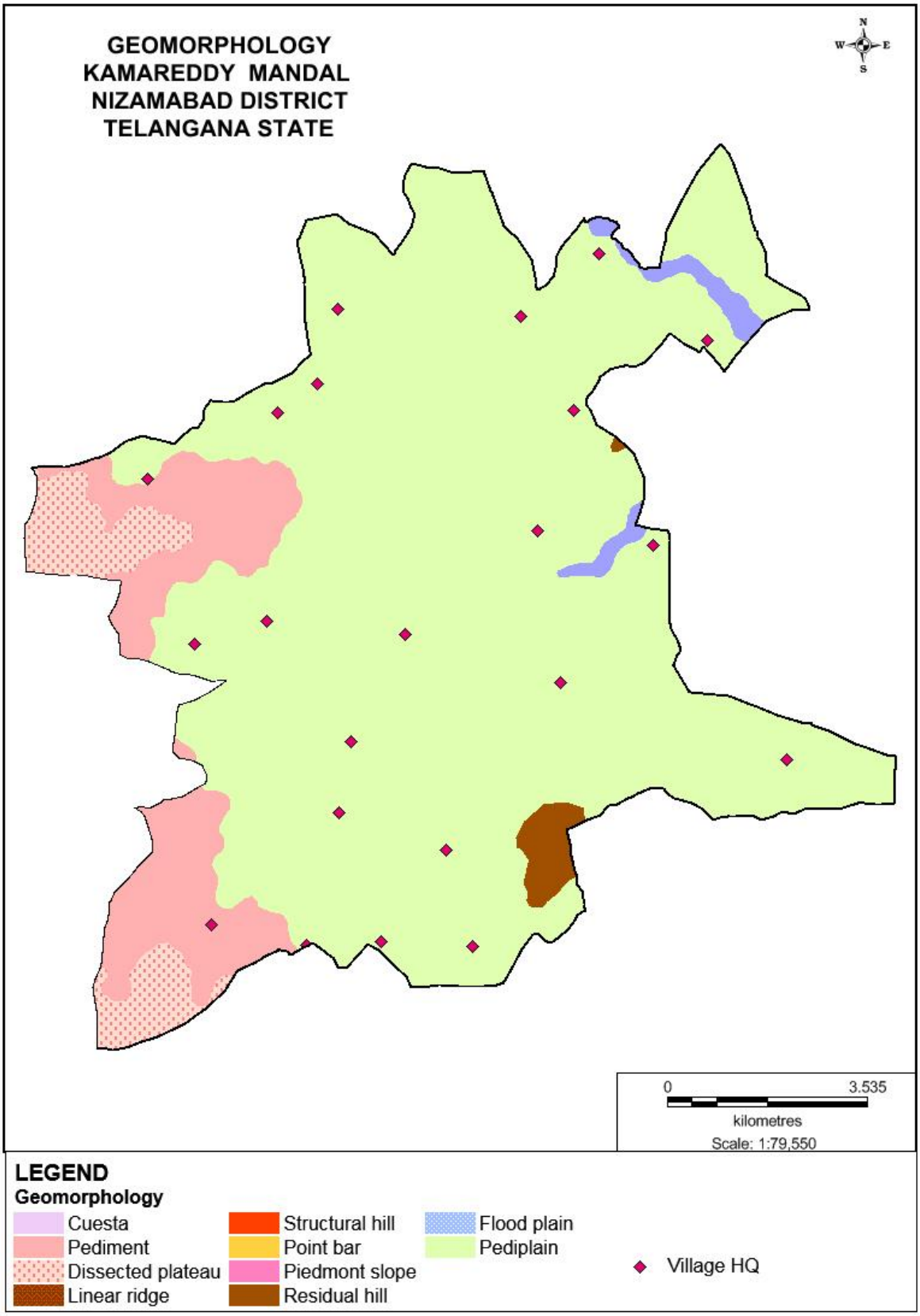

GEOMORPHOLOGY
KAMAREDDY MANDAL
NIZAMABAD DISTRICT
TELANGANA STATE
N
W
E
S
0
3.535
kilometres
Scale: 1:79,550
LEGEND
Geomorphology
Cuesta
Pediment
Dissected plateau
Linear ridge
Structural hill
Point bar
Piedmont slope
Residual hill
Flood plain
Pediplain
Village HQ

Fig.3

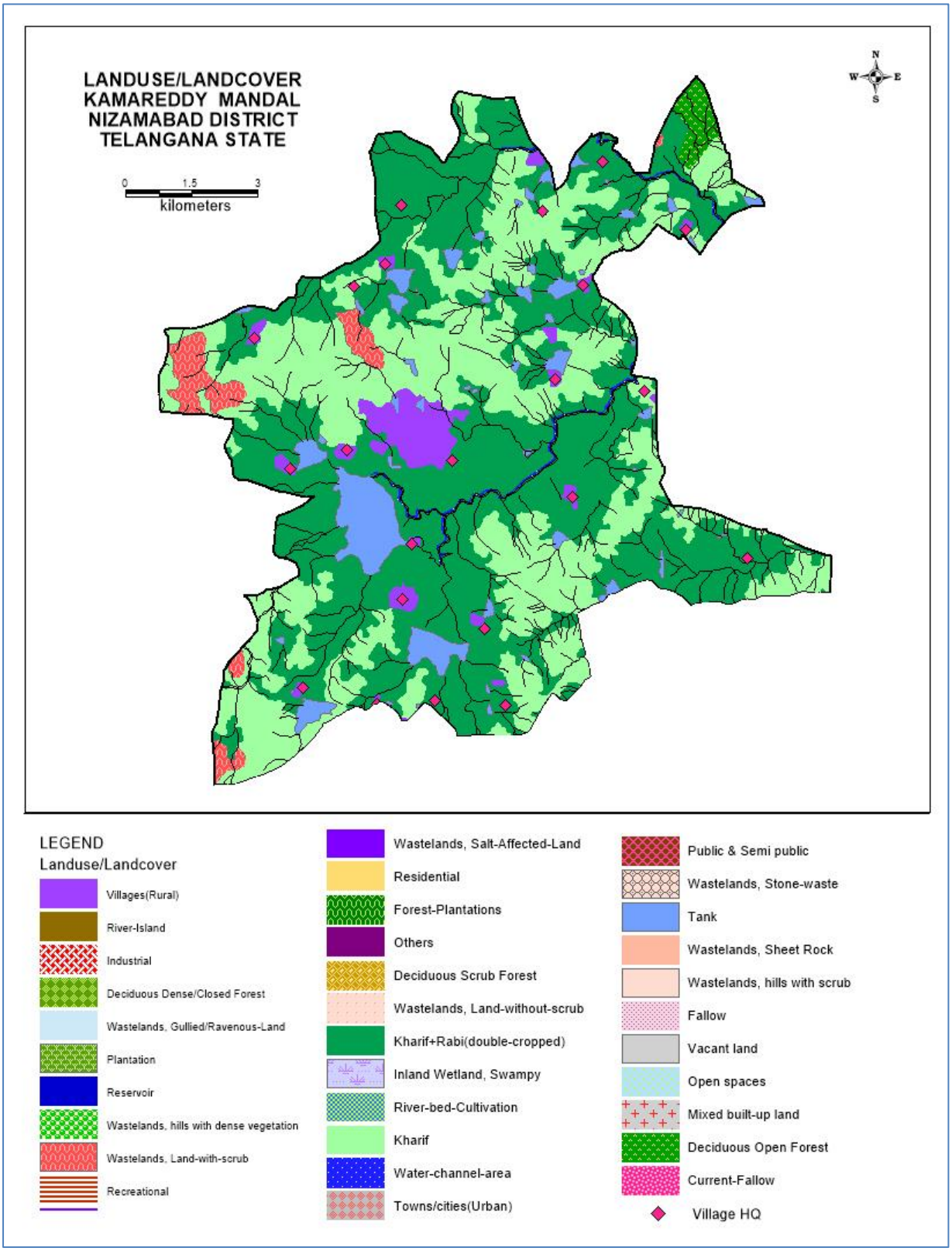

LANDUSE/LANDCOVER
KAMAREDDY MANDAL
NIZAMABAD DISTRICT
TELANGANA STATE
0
1.5
3
kilometers
N
W
E
S
LEGEND
Landuse/Landcover
Villages(Rural)
River-Island
Industrial
Deciduous Dense/Closed Forest
Wastelands, Gullied/Ravenous-Land
Plantation
Reservoir
Wastelands, hills with dense vegetation
Wastelands, Land-with-scrub
Recreational
Wastelands, Salt-Affected-Land
Residential
Forest-Plantations
Others
Deciduous Scrub Forest
Wastelands, Land-without-scrub
Kharif+Rabi(double-cropped)
Inland Wetland, Swampy
River-bed-Cultivation
Kharif
Water-channel-area
Towns/cities(Urban)
Public & Semi public
Wastelands, Stone-waste
Tank
Wastelands, Sheet Rock
Wastelands, hills with scrub
Fallow
Vacant land
Open spaces
Mixed built-up land
Deciduous Open Forest
Current-Fallow
Village HQ

Fig.4

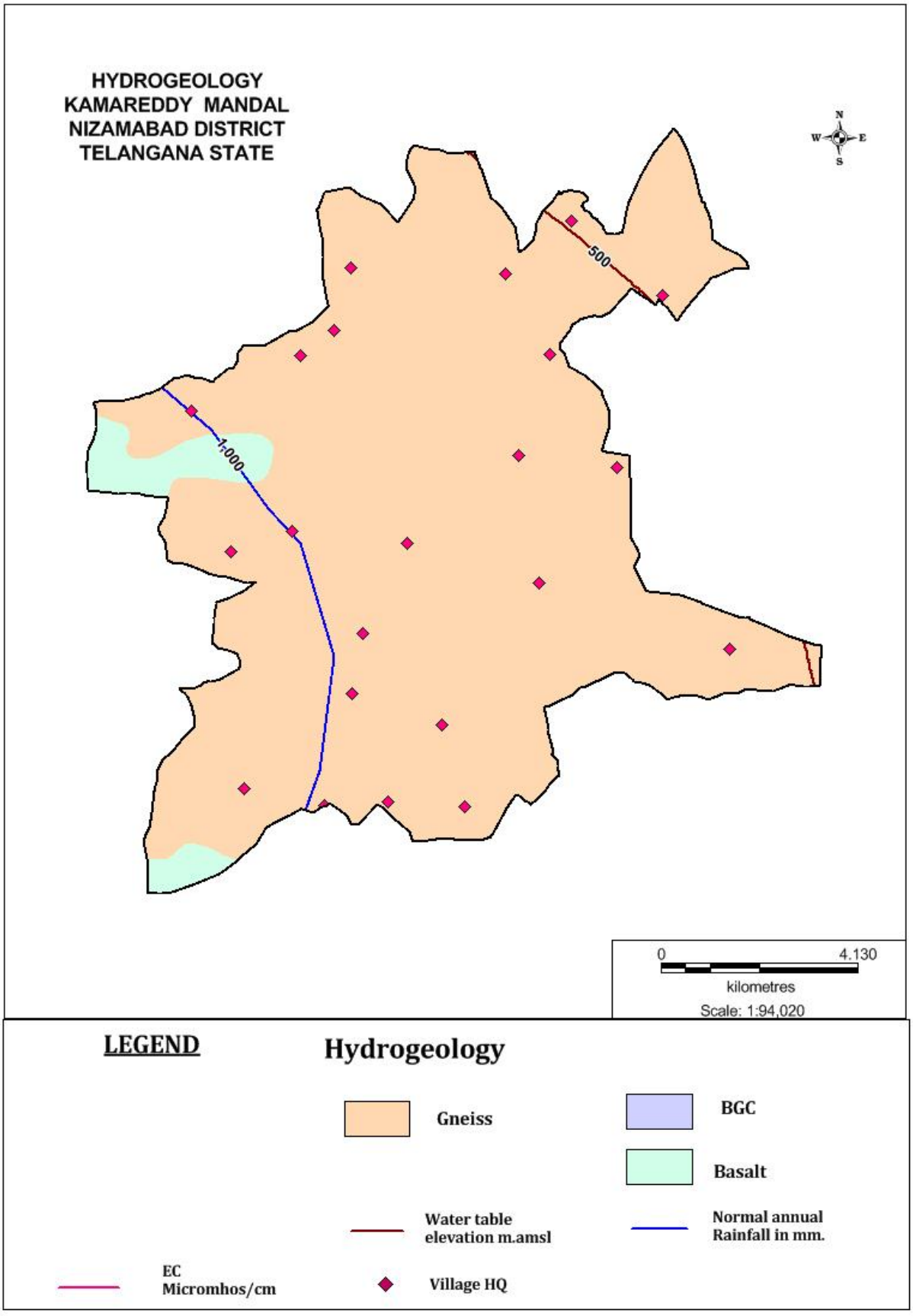

HYDROGEOLOGY
KAMAREDDY MANDAL
NIZAMABAD DISTRICT
TELANGANA STATE
N
W
E
S
500
1000
0
4.130
kilometres
Scale: 1:94,020
LEGEND
Hydrogeology
Gneiss
BGC
Basalt
Water table elevation m.amsl
Normal annual Rainfall in mm.
EC Micromhos/cm
Village HQ

Fig.5

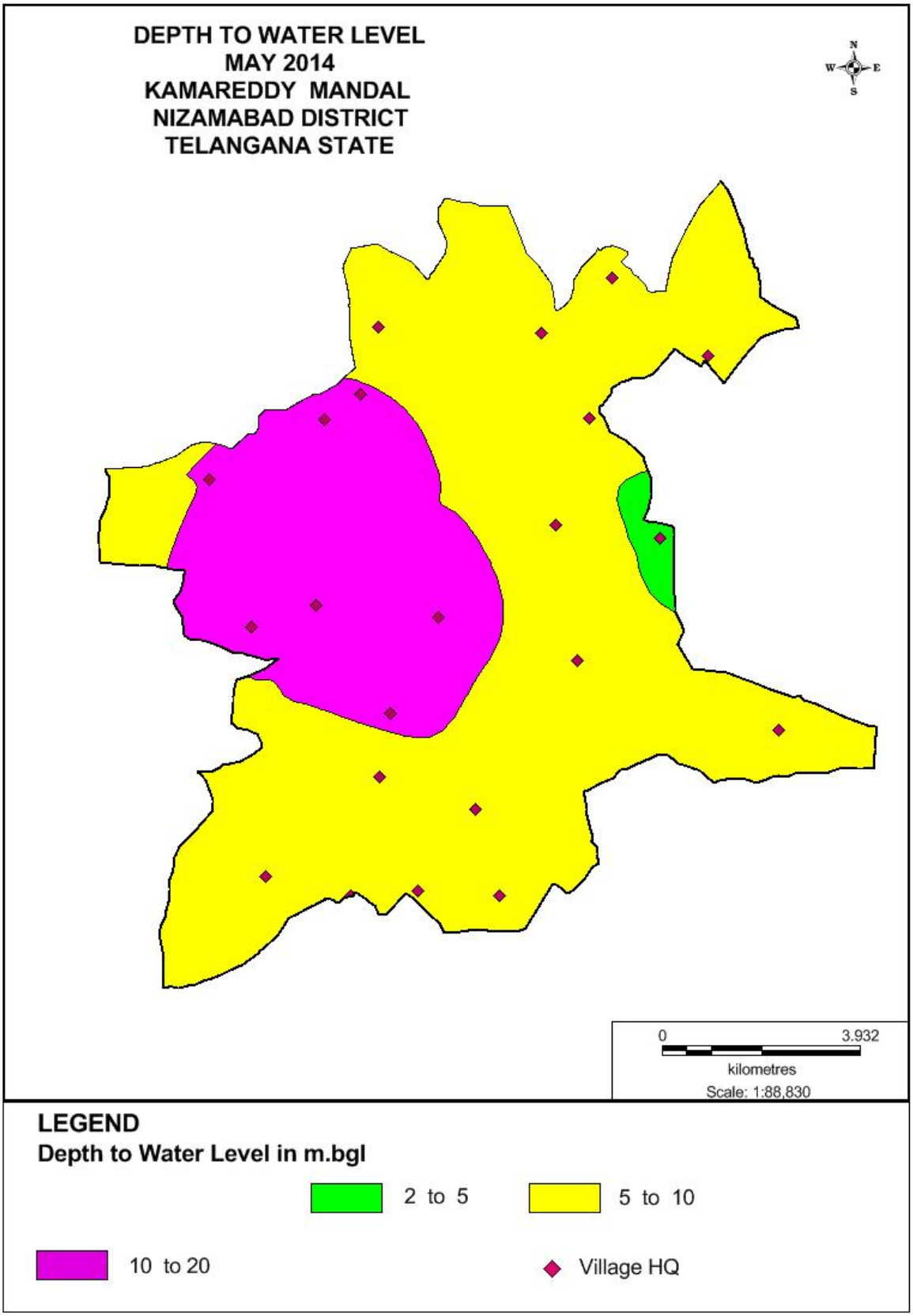

DEPTH TO WATER LEVEL
MAY 2014
KAMAREDDY MANDAL
NIZAMABAD DISTRICT
TELANGANA STATE
N
W
E
S
0
3.932
kilometres
Scale: 1:88,830
LEGEND
Depth to Water Level in m.bgl
2 to 5
5 to 10
10 to 20
Village HQ

Fig.6

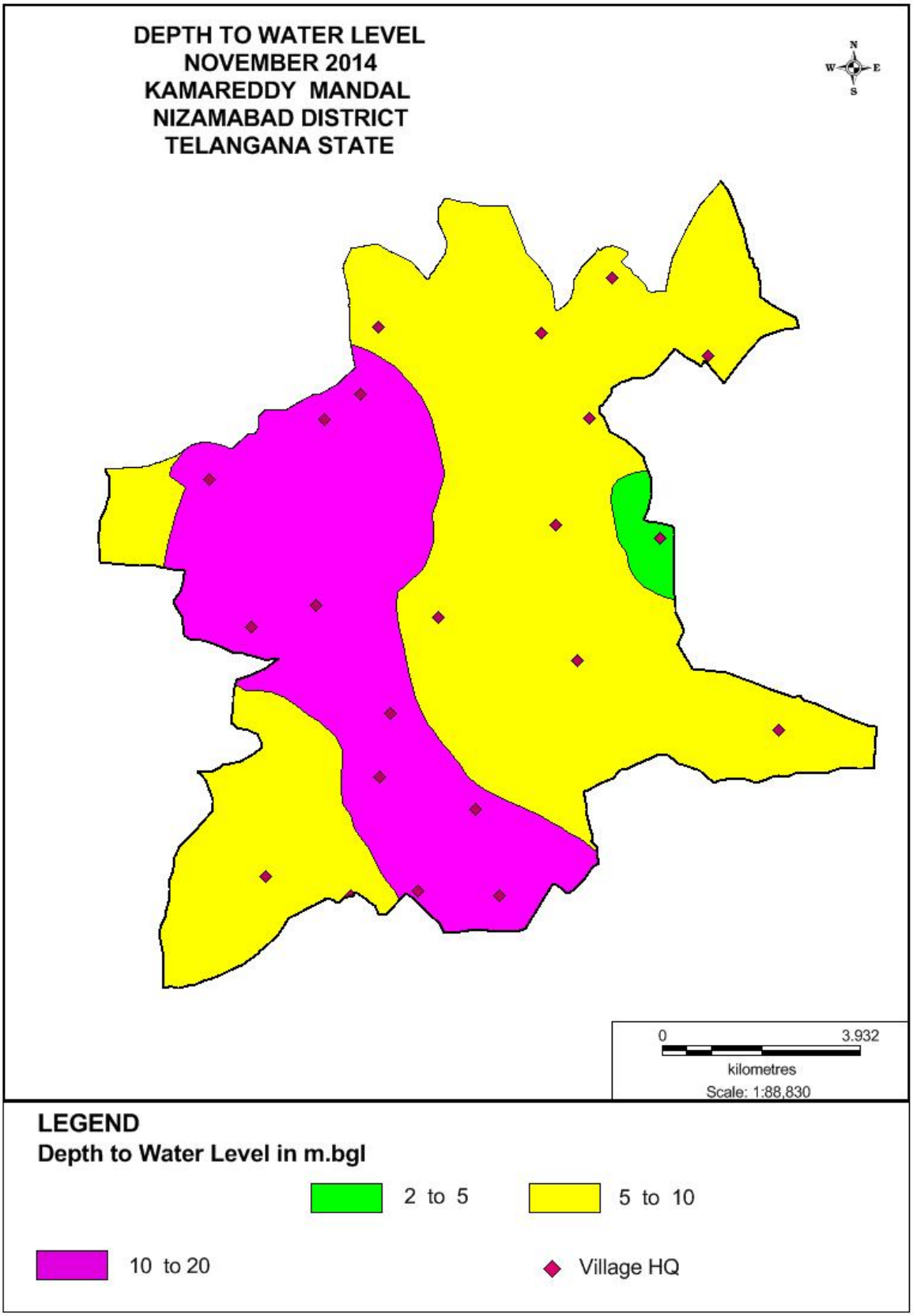
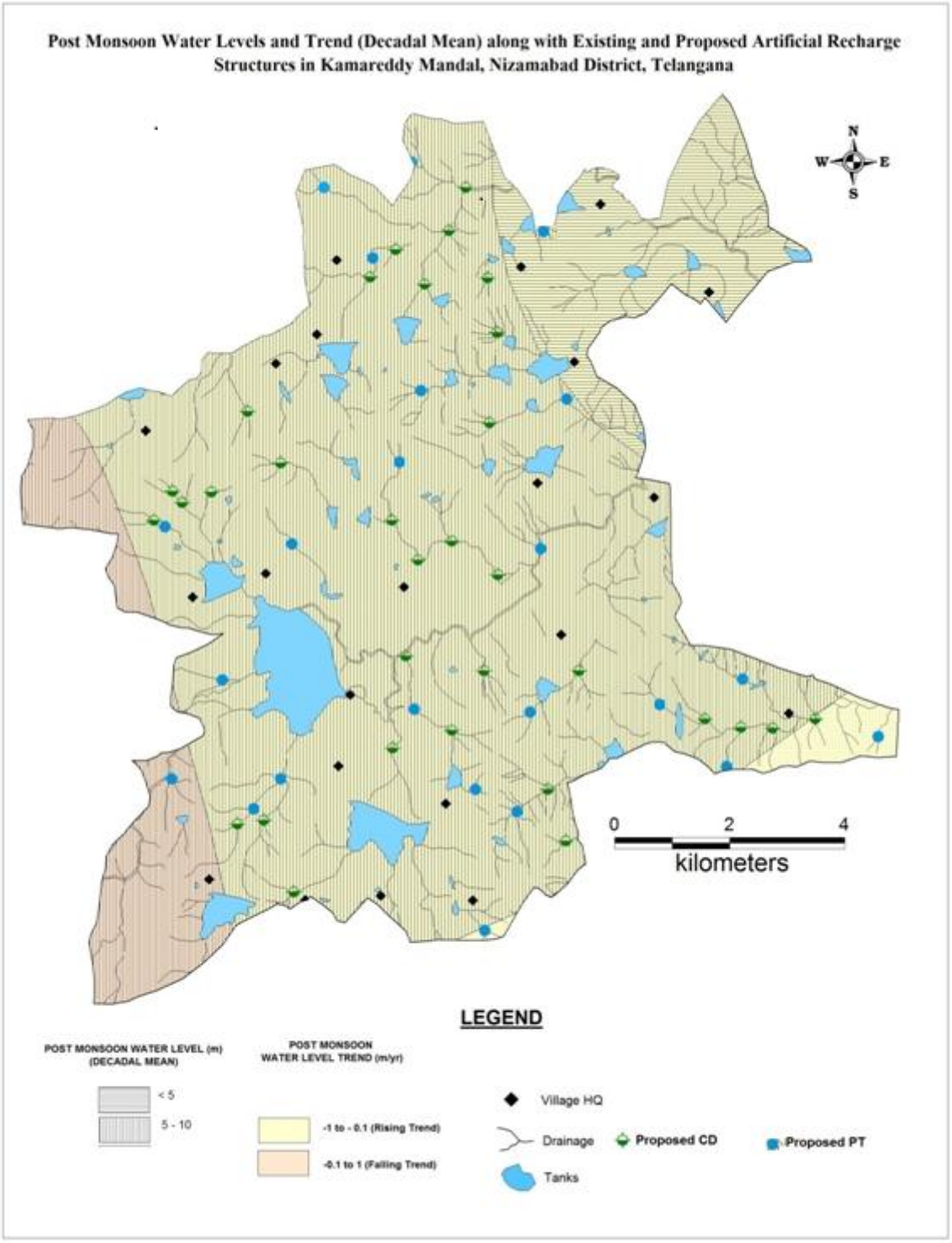

DEPTH TO WATER LEVEL
NOVEMBER 2014
KAMAREDDY MANDAL
NIZAMABAD DISTRICT
TELANGANA STATE
N
W
E
S
0
3.932
kilometres
Scale: 1:88,830
LEGEND
Depth to Water Level in m.bgl
2 to 5
5 to 10
10 to 20
Village HQ

Fig.7


Post Monsoon Water Levels and Trend (Decadal Mean) along with Existing and Proposed Artificial Recharge Structures in Kamareddy Mandal, Nizamabad District, Telangana
N
W
E
S
0
2
4
kilometers
LEGEND
POST MONSOON WATER LEVEL (m) (DECADAL MEAN)
< 5
5 - 10
POST MONSOON WATER LEVEL TREND (m/yr)
-1 to - 0.1 (Rising Trend)
-0.1 to 1 (Falling Trend)
Village HQ
Drainage
Proposed CD
Proposed PT
Tanks