Plan on Artificial Recharge to Groundwater and Water Conservation in Vaniyambadi Firka, Vaniyambadi Taluk, Vellore District, Tamil Nadu

By

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Content

AT GLANCE	
Name of Firka	Vaniyambadi
Taluk	Vaniyambadi
District	Vellore
State	Tamil Nadu
Total area	72.39 Sq. Km
Total area suitable for Recharge	39.81 Sq.km
Lat. & Lon.	12°37’ 00“to 12° 48’ 00” &78° 33’ 00” to 78° 42’ 00”.
Rainfall	852 mm
Monsoon	724 mm
Non- Mon soon	128 mm
Geology	Crystalline metamorphic gneiss complex comprising Hornblende gneiss
WATER LEVEL	
Pre – Monsoon (May -2015)	2.7 to 9.7 m bgl.
Post - Monsoon (Jan_2016)	1.2 to 5.6 m bgl.
GROUND WATER RESOURCES ESTIMATION	
Replenish able ground water resources	6.439 MCM
Net ground water available	5.795 MCM
Ground water draft for irrigation	5.442 MCM
Groundwater draft for domestic & industrial water supply	5.807MCM
Total ground water draft	11.249 MCM
Stage of ground water development (%)	200 %
Uncommitted surface runoff available for the Firka	5.1855 MCM
Total volume of weathered zone	11.94435 MCM
Total volume available for recharge	3.25755 MCM
ARTIFICIAL RECHARGE /CONSERVATION MEASURES	
Structures Proposed (tentative) Masonry Check dam Nalla Bund Revival, repair of pond, tanks With Recharge Shaft	 15 50 14
Improving Water Efficiency/ Saving (Micro irrigation system for 50 ha)	0.35 MCM
Excepted recharge	1.76 MCM
Excepted total groundwater recharge/ saving	2.11 MCM
Tentative total cost of the project	Rs.7.64 crores
Expected raise in water level by recharging/saving.	3.48 m

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1. Introduction

India is the largest user of groundwater in the world. Food grain security of the country is largely dependent on water resources and groundwater resources play major role in irrigation sector. Imprints of Over-Exploitation on groundwater resources are being observed as steep deepening of water levels, drying of shallow groundwater abstraction structures, ingress of salinity in fresh aquifers etc. which signal towards taking necessity of emergent action for artificial recharge and rainwater harvesting by utilizing surplus runoff and maintaining groundwater resources at sustainable stage.

In Tamil Nadu dependency on groundwater has increased many folds during the recent years and the groundwater extraction for irrigation, domestic and industries have resulted in lowering of water levels, long-term water level declining trend and even drying up of wells. In order to regulate the groundwater development, Central Ground Water Board in association with State Ground Water Departments has computed Dynamic Groundwater Resources and categorized blocks as Over Exploited, Critical, Semi Critical and Safe.

Out of 1129 firkas (assessment units) in Tamil Nadu the groundwater situation in 374 firkas overexploited, 48 firkas critical, 235firkassemi-critical, 437 firkas safe and 35 firkas are saline. Various measures such as rainwater harvesting, artificial recharge and water use efficiency are successfully practiced by some NGOs, Central and State govts., which need replication at larger scale in close coordination with State govt. agencies and stakeholders so that capacity building of state implementing agencies and awareness of stakeholders towards artificial recharge and rainwater harvesting can be made.

2. Objectives of the scheme

Objectives of the proposed scheme are

- To upscale recharge activities, supplement additional groundwater resources by harvesting surplus runoff, sustainability of groundwater resources at shallow depths
- Recovery of over-exploited groundwater areas by implementing artificial recharge measures in groundwater stress areas.
- Conservation, development and sustainable management of natural resources including their use.

3. Study area details

3.1 Location

The total area of Vaniyambadi Firka is 72.39 sq.km and Vaniyambadi Firka lies between North latitudes 12°37’ 00“to 12° 48’ 00” and east longitudes 78° 33’ 00”to 78° 42’ 00”. Location map of Vaniyambadi Firka is given in Figure 1.

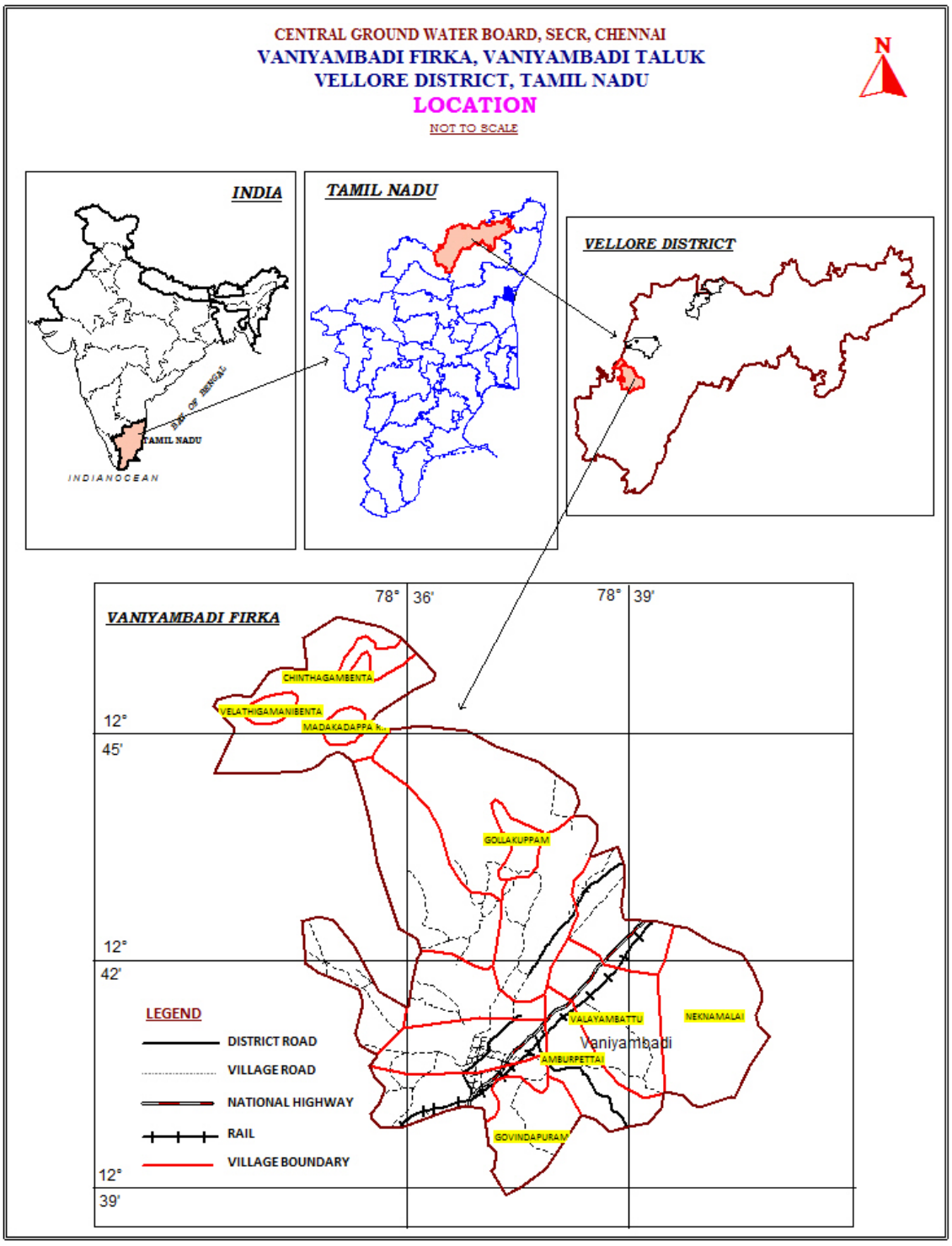


Figure 1. Location map of Vaniyambadi Firka

3.2 Geomorphological Set up

Geomorphologically, the area consists of Moderate buried pediment, deflection slope, deep buried pediment and highly dissected pediments predominate the firka. These landforms are influencing the ground water recharge. Dissected/undissected, Inselberg complex and residual hillsact as runoff zone. (*Source: IRS, Anna university, Chennai Tamil Nadu). Geomorphological map prepared using IRS- 1D data on 1: 50,000 scale and units are as per NNRMS standard*s. The various geomorphological units with its % of coverage area are given in table 1 and shown in figure 2.

Table 1. Various geomorphological units with its % of coverage area in Vaniyambadi Firka

Geomorphological Units	Area (Sq.Km)	%
DENUDATIONAL HILLS / RESIDUAL HILLS	0.925508106	1.10
RIVER	1.892213425	2.25
DISSECTED/UNDISSECTED	2.136072431	2.54
PEDIMENT-INSELBERG COMPLEX	5.291730789	6.29
UNDISSECTED / LESS DISSECTED	5.956635316	7.08
MODERATELY DISSECTED	5.982498107	7.11
SHALLOW	6.267428956	7.45
HIGHLY DISSECTED	7.276070076	8.65
DEEPBurried Pediment	10.98630617	13.07
DEFLECTION SLOPE	11.43519727	13.60
MODERATEBurried Pediment	25.90752644	30.82
Grand Total	**84.05718709**	100

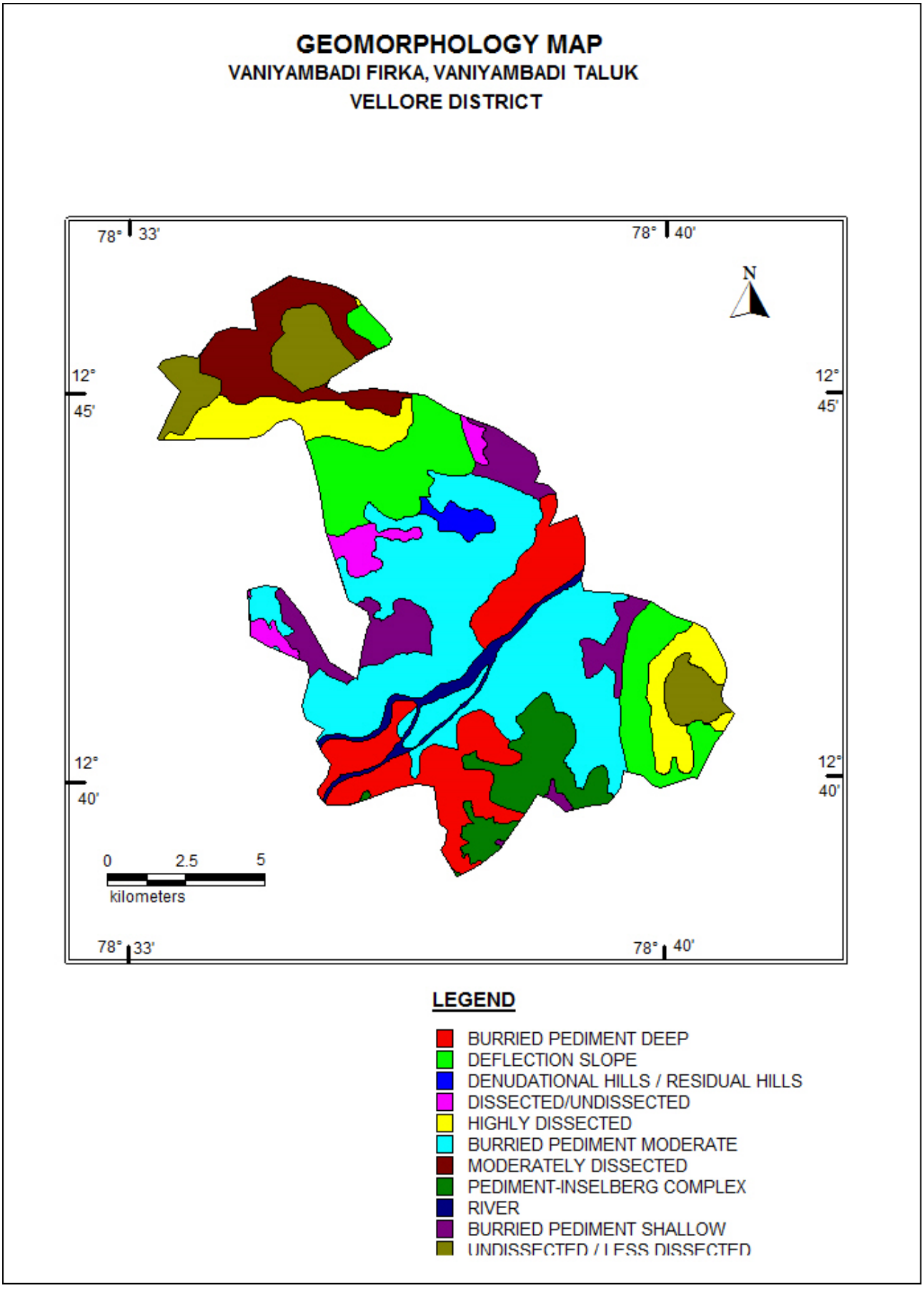


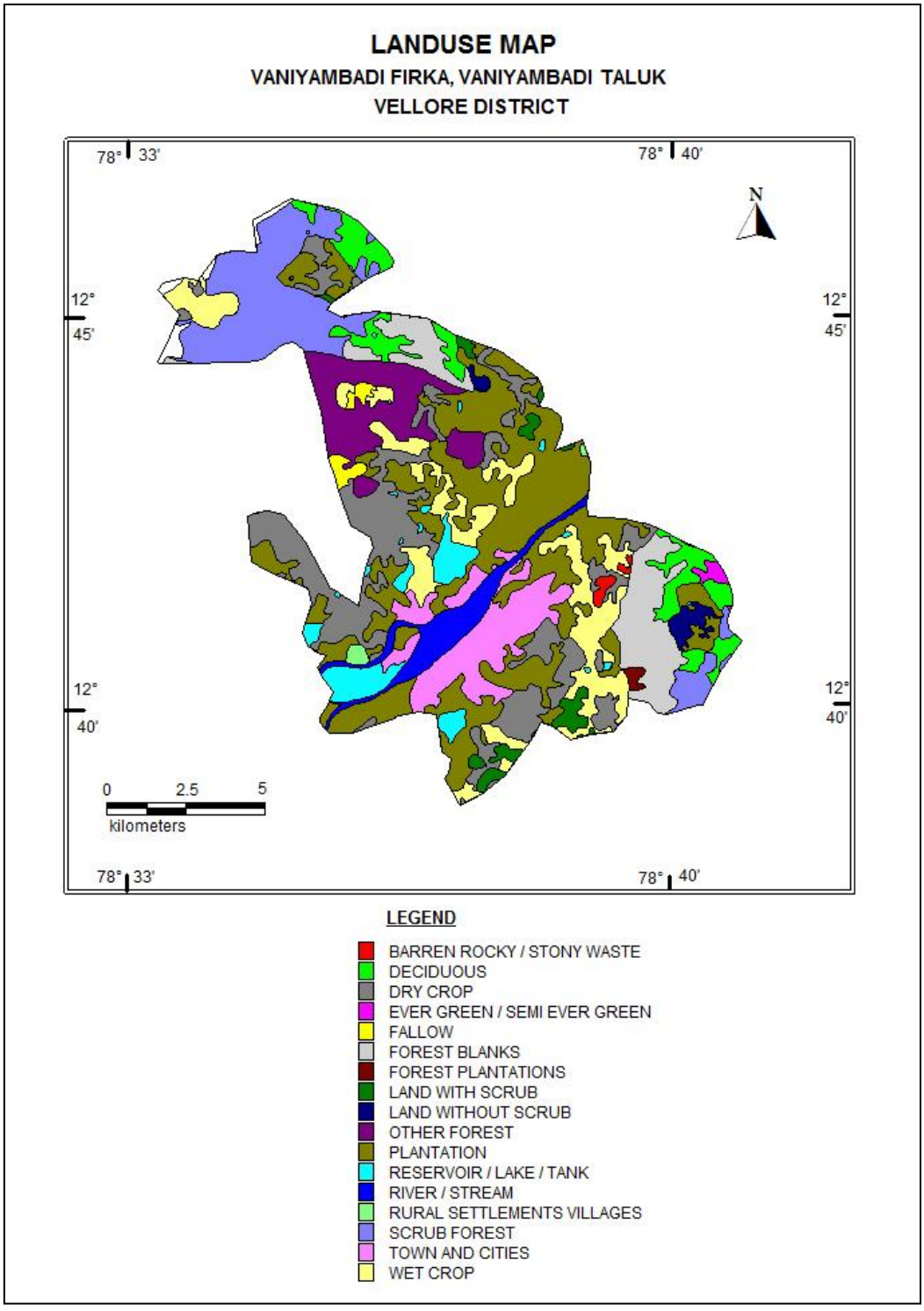
Figure 2. Geomorphology of Vaniyambadi Firka

3.3 Land use and soil

The land use pattern of the Vaniyambadi Firka is given in figure 3. Predominantly the most of the area is characterised by the plantation, dry crop and wet crop in that order (i.,e agricultural field)and accounts for 42 % of the total area of the firka(Source: IRS, Anna university, Chennai Tamil Nadu). This area is highly suitable for water conservation and recharge. The entire Firkas is also occupied by plantations, fallow land, tanks deciduous forest and urban settlements. Table 2 shows the distribution of various land forms and their area spread with percentage. Red and forest soil predominates and clay soils also occupy a sizeable area in this firka.

Table 2 Showing the various land use pattern in Vaniyambadi Firka.

Land Use	Area (Sq.Km)	%
FOREST PLANTATIONS	0.19	0.222336
RURAL SETTLEMENTS VILLAGES	0.24	0.292676
EVER GREEN / SEMI EVER GREEN	0.27	0.322811
BARREN ROCKY / STONY WASTE	0.29	0.350457
FALLOW	0.61	0.729313
LAND WITHOUT SCRUB	0.81	0.969996
LAND WITH SCRUB	1.42	1.701868
RIVER / STREAM	2.83	3.390554
RESERVOIR / LAKE / TANK	2.94	3.52527
DECIDUOUS	4.41	5.280861
OTHER FOREST	5.46	6.54783
TOWN AND CITIES	5.87	7.037328
FOREST BLANKS	5.93	7.10519
WET CROP	8.43	10.10783
SCRUB FOREST	9.31	11.15858
DRY CROP	12.30	14.73444
PLANTATION	22.13	26.52266
Grand Total	**83.45**	**100**



Fiigure3.Landuse map of Vaniyambadi Firka

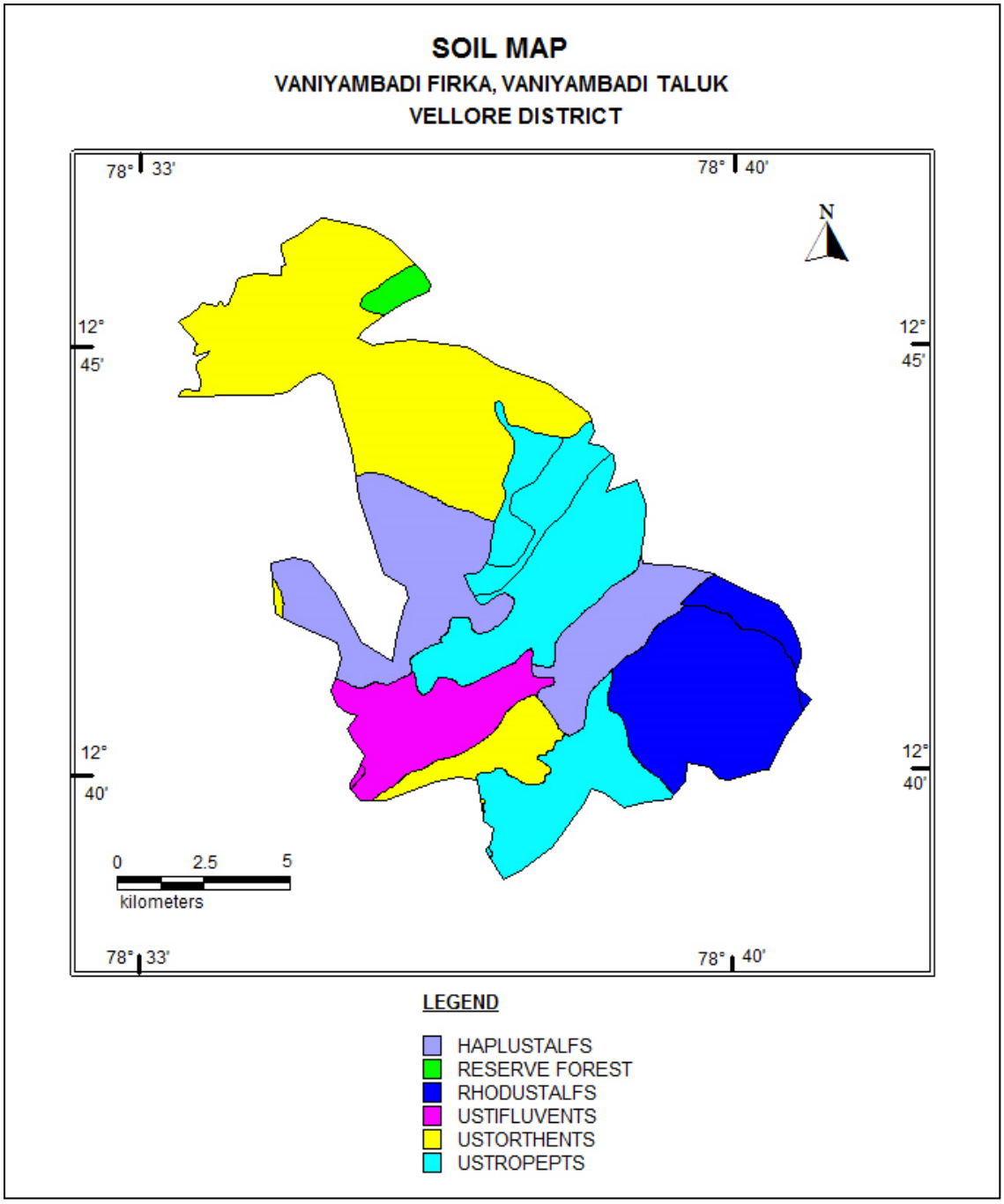


Figure – 3a Showing Soil distribution in Vaniyambadi Firka

3.4 Drainage

The entire Firka area is within the Pallarriver basin and number of small streams originate from the hills located in the Vaniyambadi Firka.Only seasonal floods inundate lower parts of the basins. Basin sub soil water is used to irrigate the lands. Tanks and surface water bodies are spread over the entire firka. The drainage pattern is the dendritic and sub- dendritic. The drainage map of Vaniyambadi Firka is given in Fig 4.

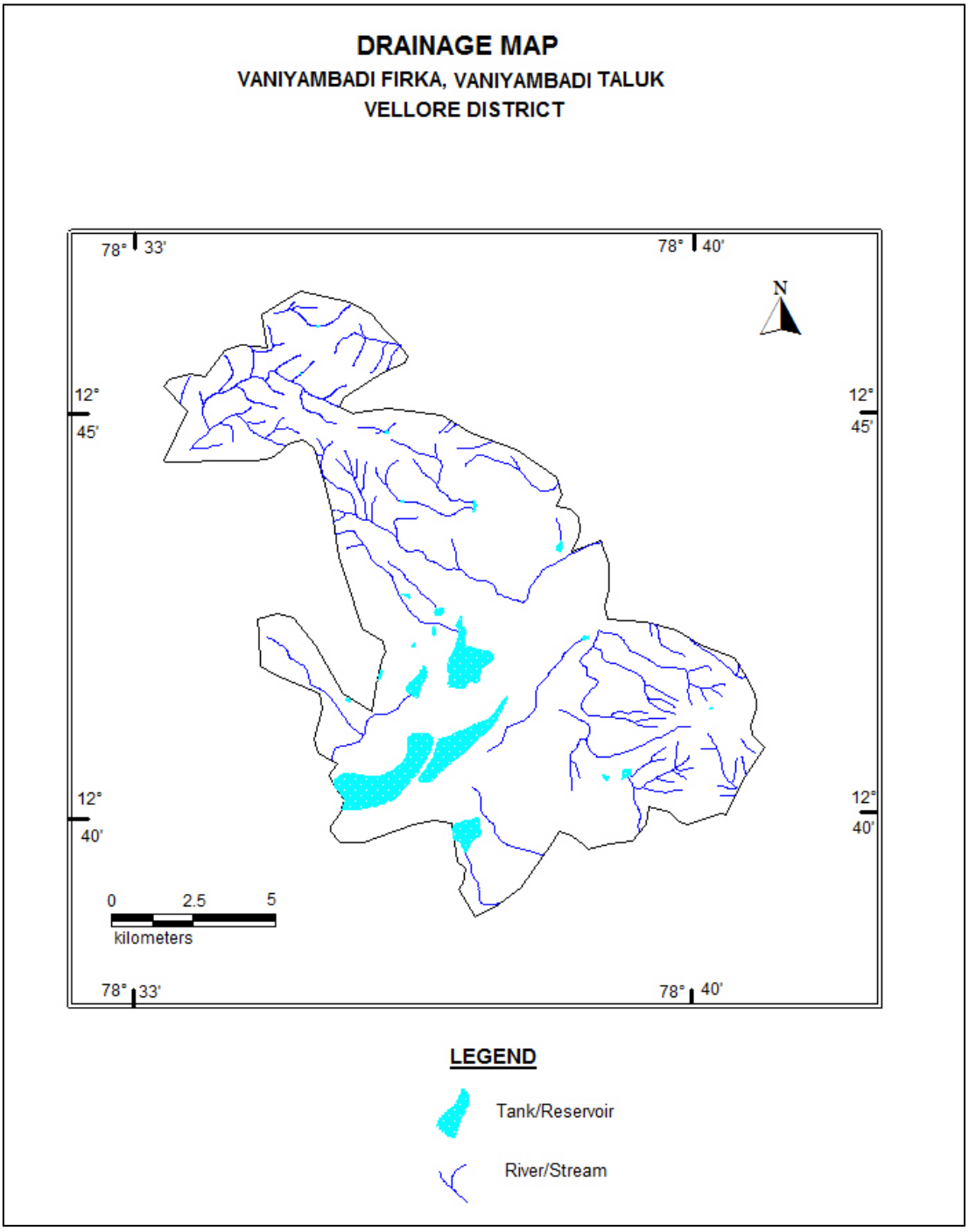


Figure - 4.Drainage map of Vaniyambadi Firka

3.5 Rainfall

Vaniyambadiarea falls under tropical climate with temperature in the summer months of March to May. The average temperature varies from 26 to 41° C. The humidity is also high in the order of 80%. The wind speed is high during the months of July and August. The wind speed ranges from 7.4 to 12.6 km/hr, which increases from 100 to 120 km/hr during cyclone period.Vaniyambadi Firkasreceives rainfall from southwest monsoon (June – September), northeast monsoon (October – December) and non-monsoon periods (January – May). The area receives the major rainfall from northeast monsoon. Rainfall is generally heavy during low-pressure depressions and cyclones during the northeast monsoon period. The normal annual rainfall is 852 mm.

Taluk	Name of Firkas	Area in sq.km	Monsoon rainfall (Jun to Dec) In m	Non monsoon rainfall (Jan – May) In m	Total Rainfall In m
Vaniyambadi	Vaniyambadi	72.39	0.724	0.128	0.852

3.6 Hydrogeology

The entire firka is underlain by the crystalline metamorphic gneiss complex consisting Honrblede –Biotite gneiss, Epidote-Hornblede gneiss and granite. Ground water is occurring in pheratic conditions in weathered and fractured gneiss rock formation.The weathering is highly erratic and the depth of abstraction structures is controlled by the intensity of weathering and fracturing.Large diameter dug well is more common ground water abstraction structures in the area. The diameter of the dug well is in the range of 7 to 10 m and depth of dug wells range from 15 to 18 m bgl. The dug wells yield up to 1 lps in summer months and few wells remains dry. The yield is adequate for irrigation for one or two crops in monsoon period.

The depth of wells varies from 6.64 to 17 m bgl. The present water levels in tn the firka is in the range of 2.7 to 9.7 m bgl during pre- monsoon (May 2015) and from 1.2to 5.6m bgl during post monsoon (January 2016). The hydrogeological map of Vaniyambadi Firka is given in Figure 5. Decadal mean water level ofpre-monsoon and post monsoon are given in fig 6a & b.

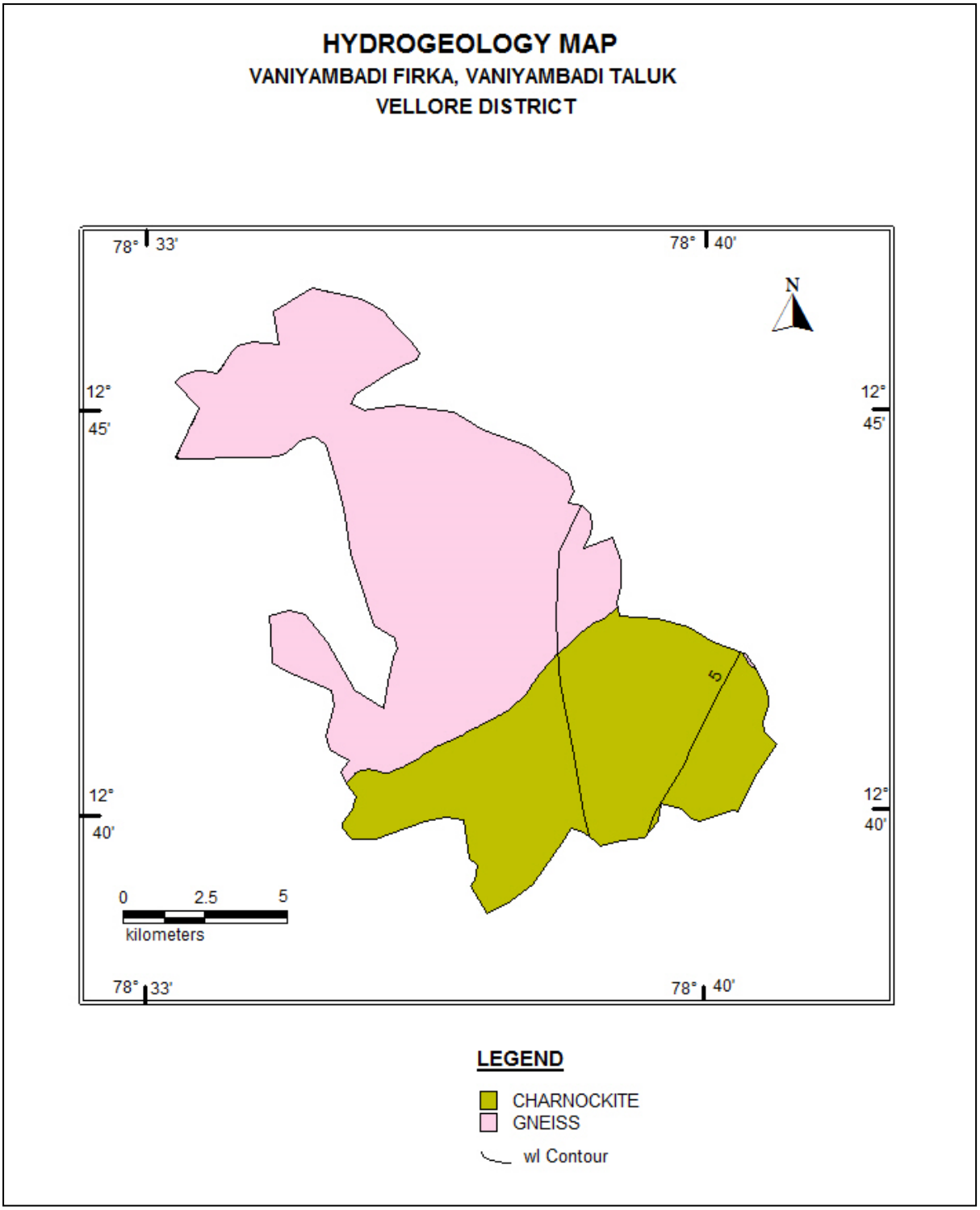


Figure 5: Hydrogeological Map of Vaniyambadi Firka

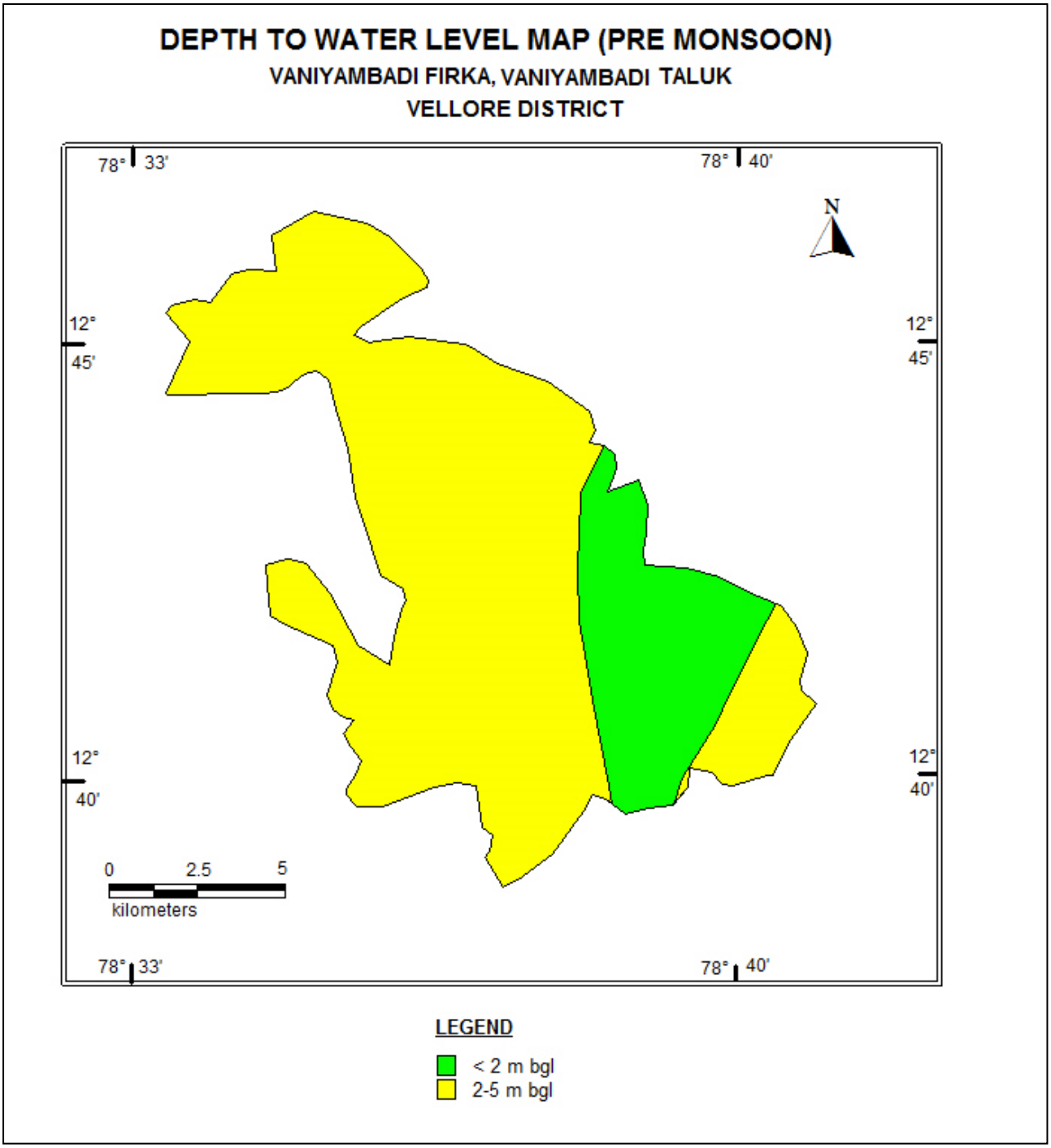


Figure 6a. Pre –monsoon Decadal water level in Vaniyambadi Firka

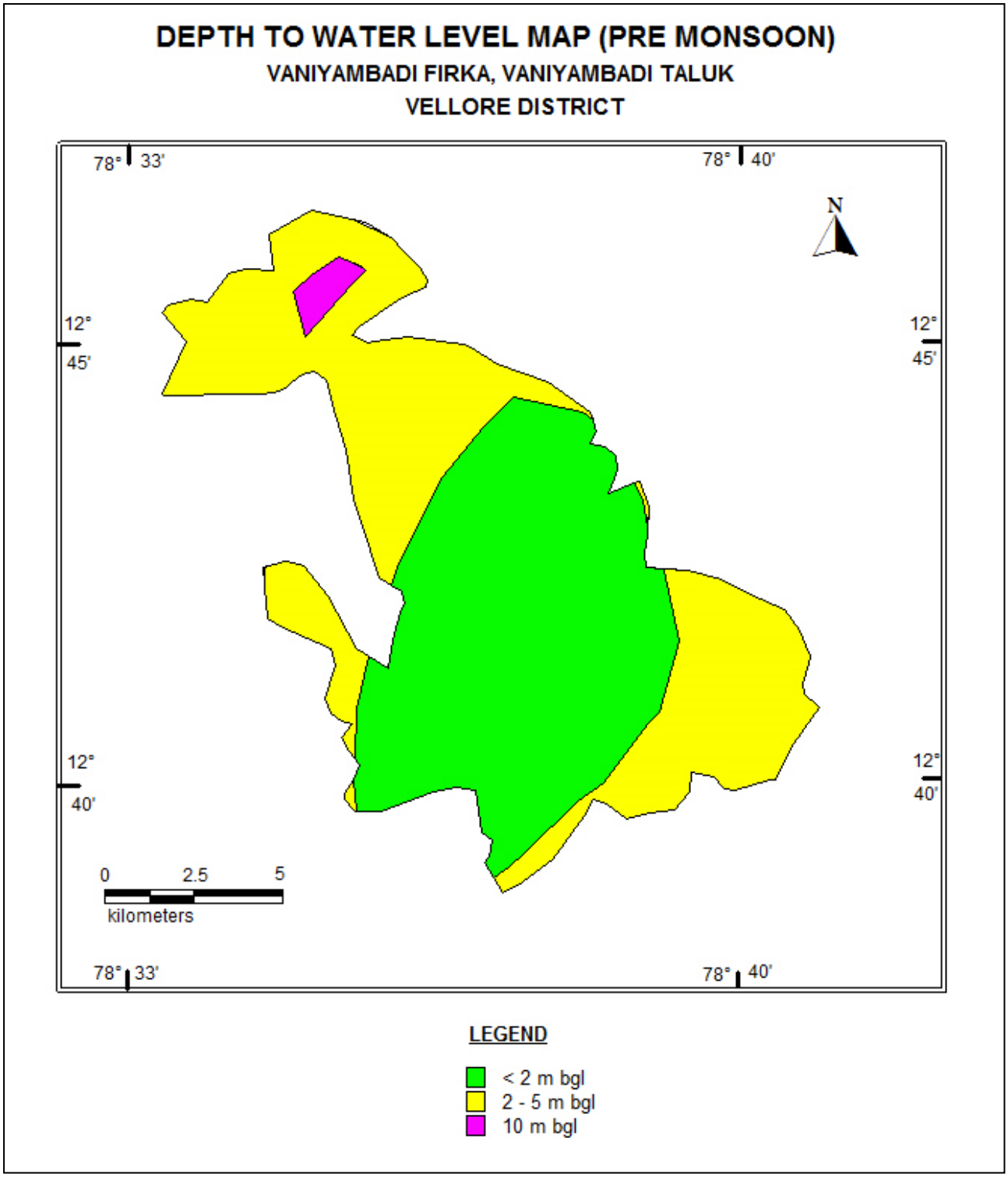


Figure 6 b. Post-monsoon Decadal water level in Vaniyambadi Firka

3.7 Dynamic Ground water Resources

The ground water resources have been computed jointly by Central Ground Water Board and State Ground Water Resources Data Centre (PWD, WRO, Govt. of Tamil Nadu) as on 31st March 2011. The computation has been done using GEC1997 methodology. The salient features of the computations are furnished in table 2.

Table 2. Dynamic Ground water resources estimation of Vaniyambadi Firka

Firka	GW WORTHY AREA	REPLENISHABLE GROUND WATER RESOURCES	NET GROUND WATER AVAILABLE	GROUND WATER DRAFT FOR IRRIGATION	GROUNDWATER DRAFT FOR DOMESTIC & INDUSTRIAL WATER SUPPLY	TOTAL GROUND WATER DRAFT	STAGE OF GROUND WATER DEVELOPMENT (%)	CATEGORY
	(Sq.Km)	(In MCM)					%	
Vaniyambadi	72.39	6.439	5.795	5.442	5.807	11.249	200	OVER EXPLOITED

4. Spatial Data Integration

The potential area for groundwater recharge is highly influenced by Geology, Geomorphology, Land use /land cover, Drainage, Surface Water Body, Weathered Thickness and first fractured Depth in the area. In order to ascertain the suitable area for groundwater recharge in firka, spatial data integration of have been attempted using index overlay model in GIS environ. In this model,above seven layers have been integrated byassigning weightage for the theme having scale of 1-100 and sub-classes of the theme between 1 to 10 scales.The resultant map has been reclassified into four classes(High-low integrated values) indicating the suitable area for artificial recharge and given in fig-7 and described below.

ZONE	% OF AREA COVERAGE	SIGNIFICANCE*
Very high	4	Suitable for all major recharge structures like Percolation pond and stop dam, check dam etc.,
High	15	Suitable for all major recharge structures like stop dam, check dam etc.,
Moderate	36	Suitable for all major recharge structures like earthen check dam, Boulder check dam and Nala bund etc.,
Poor	45	Hilly/Forest /Catchment area

*However, the filed verification is required to confirm above potential area for groundwater recharge.

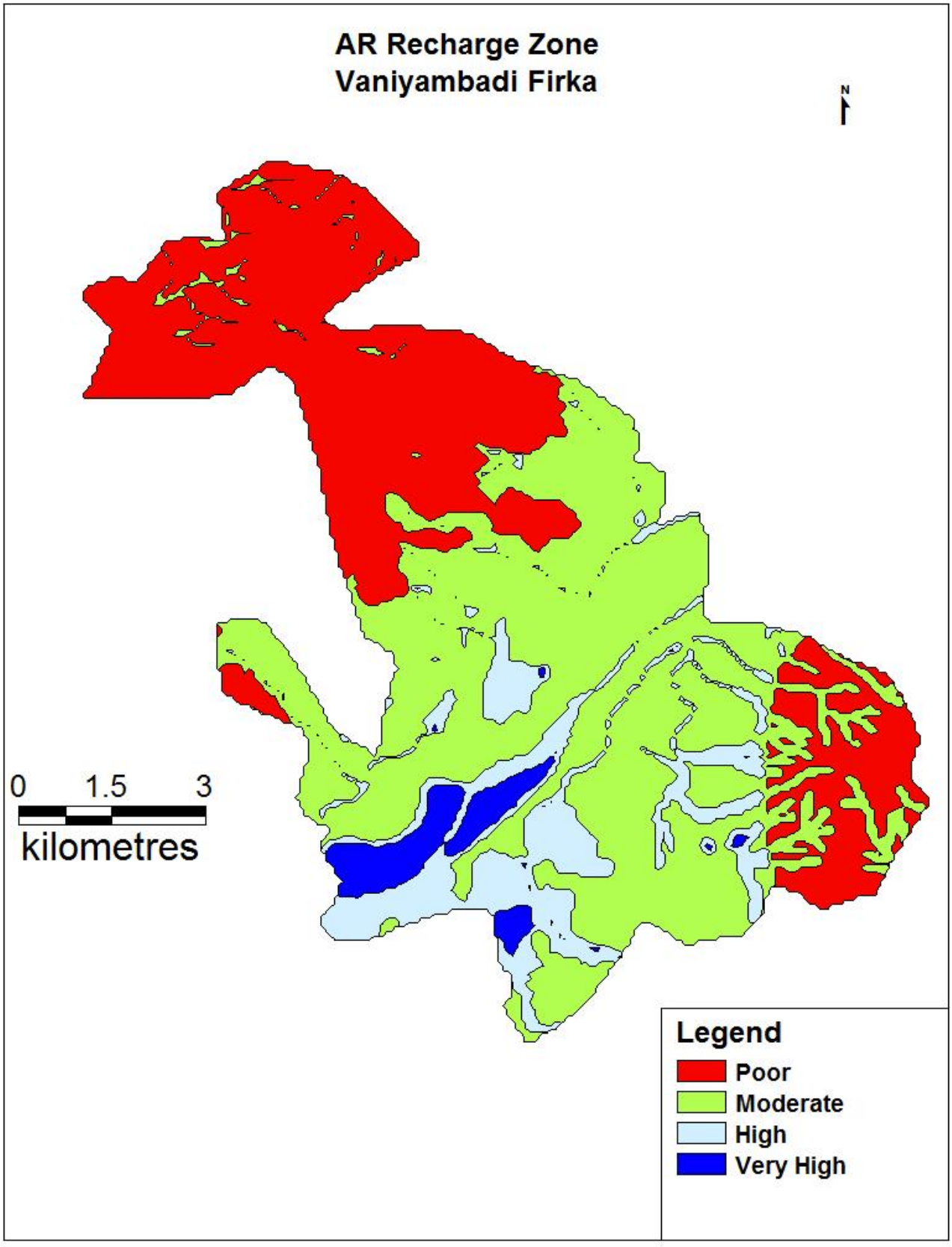


Figure 7showing the recharge worthy area Vaniyambadi Firka

5. Planning for groundwater recharge /conservation

5.1 Justification of the artificial recharge & conservation measures

- The Vaniyambadi Firkas is with high stage of groundwater development i.e, **200** % and with sufficient amount of uncommitted surface runoff/flow of **7.8615** MCM.
- The total weathered zone available beneath the ground in the firka is **11.944** MCM. Out of these total volume available for recharge considering **6 m**water level is **3.257** MCM.
- TheVaniyambadi Firka consists of **14** surface water bodies /lakeswhich are well connected by the drainage. Revival and Recharge of these ponds will enhance the sustainability of the ground water abstraction structures.
- However, most of the ground water developments for agricultural purposes are met through dug-cum bore well and bore wells only. Hence, there is sufficient scope of recharge.
- Model generated in the Vaniyambadiareas reveals that more than **55** % of areas are suitable for recharge.
- In Vaniyambadi Firka more than **51** % area is characterised by the agricultural activities, there is sufficient scope for the water conservation measures for enhance the crop production and better ground water development.

5.2 Availability of surplus surface water for artificial recharge or conservation

The uncommitted surface flow for Vaniyambadi Firka is estimated as per the norms followed by State Ground & Surface Water Resources data centre, PWD, Taramani, Chennai (Aug 2015). The available of surplus surface water for Vaniyambadi**is 7.8615 MCM**.

5.3 Proposed interventions including tentative location of artificial recharge /conservation measures

On basis of above description the following three type of approach have been made to propose artificial recharge or conservation structures.

a. Artificial recharge
b. Water conservation measure
c. Water Efficiency

5.3.1 Artificial recharge

The details of artificial recharge structure proposed along with justification are given below.

5.3.1.1 Check dam/Nala bund

Vaniyambadi Firka area is covered by the seasonal nallahs/drains which carry heavy discharge during monsoon period. As per the integrated model prediction around 55 % of the firkas areas are suitable for these structures. It is proposed to construct **15** Check dam, however **20** sites are identified, sites suitable on ground could be taken up for execution. **39** Nala bunds. The tentative

location of these **59 ARs**are given below and shown in Plate 1. The size and location of these structures are tentative and details field survey is essential to ascertain the exact size and location.

Tentative location of proposed 20 Check dam in Vaniyambadi Firka

S. NO.	LONGITUDE	LATITUDE	TYPE OF ARS
1	12.716763	78.623954	Check Dam
2	12.716598	78.633753	Check Dam
3	12.707862	78.613478	Check Dam
4	12.682808	78.594555	Check Dam
5	12.700665	78.658309	Check Dam
6	12.693797	78.657408	Check Dam
7	12.698687	78.654254	Check Dam
8	12.688522	78.654141	Check Dam
9	12.689292	78.646031	Check Dam
10	12.682149	78.645918	Check Dam
11	12.682698	78.642652	Check Dam
12	12.688412	78.599961	Check Dam
13	12.679209	78.656562	Check Dam
14	12.677780	78.661969	Check Dam
15	12.675637	78.657689	Check Dam
16	12.697561	78.636738	Check Dam
17	12.667176	78.625249	Check Dam
18	12.680528	78.673120	Check Dam
19	12.695693	78.667376	Check Dam
20	12.655088	78.622602	Check Dam

Tentative location of proposed 39Nalla bund in Vaniyambadi Firka

SL.NO	LONGITUDE(DD)	LATITUDE (DD)	TYPE OF ARS
1	12.685184	78.597792	Nala Bund
2	12.695912	78.671994	Nala Bund
3	12.694593	78.671712	Nala Bund
4	12.699154	78.668136	Nala Bund
5	12.698659	78.676387	Nala Bund
6	12.697780	78.676359	Nala Bund
7	12.694154	78.669178	Nala Bund
8	12.694291	78.666080	Nala Bund
9	12.703439	78.661406	Nala Bund
10	12.692753	78.660674	Nala Bund
11	12.690775	78.660167	Nala Bund
12	12.688714	78.657210	Nala Bund
13	12.694126	78.660814	Nala Bund
14	12.695500	78.682864	Nala Bund
15	12.687203	78.657379	Nala Bund
16	12.684593	78.658843	Nala Bund
17	12.681214	78.658815	Nala Bund
18	12.680198	78.659378	Nala Bund
19	12.679731	78.665095	Nala Bund
20	12.680582	78.663602	Nala Bund
21	12.678522	78.665602	Nala Bund
22	12.677478	78.664419	Nala Bund
23	12.676297	78.661180	Nala Bund
24	12.673934	78.659801	Nala Bund
25	12.683879	78.671628	Nala Bund
26	12.682780	78.670924	Nala Bund
27	12.678220	78.676133	Nala Bund

28	12.679236	78.642848	Nala Bund
29	12.678797	78.641666	Nala Bund
30	12.690033	78.653099	Nala Bund
31	12.700005	78.583741	Nala Bund
32	12.715939	78.608522	Nala Bund
33	12.721158	78.617421	Nala Bund
34	12.722807	78.607790	Nala Bund
35	12.730224	78.616125	Nala Bund
36	12.733356	78.617083	Nala Bund
37	12.728136	78.638766	Nala Bund
38	12.740334	78.629248	Nala Bund
39	12.741268	78.629586	Nala Bund

5.3.1.2. Revival, repair of water bodies

The existing ponds and tanks in loose their storage capacity as well as the natural ground water recharge through these water bodies has also become negligible due to siltation and encroachment by farmers for agriculture purposes. There are several such villages where ponds/ tanks are in dilapidated condition. These existing village tanks which are normally silted and damaged can be modified to serve as recharge structure in case these are suitably located to serve as percolation tanks. Through desilting, coupled with providing proper waste weir, the village tanks can be converted into recharge structure. Several such tanks are available in the area which can be modified for enhancing ground water recharge. Studies, however, are needed to ascertain whether the village tanks are suitably located to serve as recharge structures. The locations of about **14** existing ponds/tanks having an average area of **200** sq.m have been identified with latitude and longitude given below and marked on Plate 1. The above **14** tanks/ponds could be taken up for the renovation with recharge shaft .

Tentative location of proposed de-siltation of pond/tanks with recharge shaft in Vaniyambadi Firka.

Sl.NO	LONGITUDE	LATITUDE	STRUCTURE	ACTION
1	12.705222	78.644365	TANK / RESERVOIR	DESILTTAION AND RECHARGE SHAFT
2	12.731755	78.621016	TANK / RESERVOIR	DESILTTAION AND RECHARGE SHAFT
3	12.731755	78.621016	TANK / RESERVOIR	DESILTTAION AND RECHARGE SHAFT
4	12.731755	78.621016	TANK / RESERVOIR	DESILTTAION AND RECHARGE SHAFT
5	12.676449	78.649157	TANK / RESERVOIR	DESILTTAION AND RECHARGE SHAFT
6	12.690953	78.671234	TANK / RESERVOIR	DESILTTAION AND RECHARGE SHAFT
7	12.703260	78.608606	TANK / RESERVOIR	DESILTTAION AND RECHARGE SHAFT

8	12.706556	78.612887	TANK / RESERVOIR	DESILTTAION AND RECHARGE SHAFT
9	12.713588	78.607255	TANK / RESERVOIR	DESILTTAION AND RECHARGE SHAFT
10	12.732927	78.605678	TANK / RESERVOIR	DESILTTAION AND RECHARGE SHAFT
11	12.746771	78.602299	TANK / RESERVOIR	DESILTTAION AND RECHARGE SHAFT
12	12.758858	78.584276	TANK / RESERVOIR	DESILTTAION AND RECHARGE SHAFT
13	12.768747	78.587881	TANK / RESERVOIR	DESILTTAION AND RECHARGE SHAFT
14	12.692272	78.595315	TANK / RESERVOIR	DESILTTAION AND RECHARGE SHAFT

5.3.2 Water conservation measure

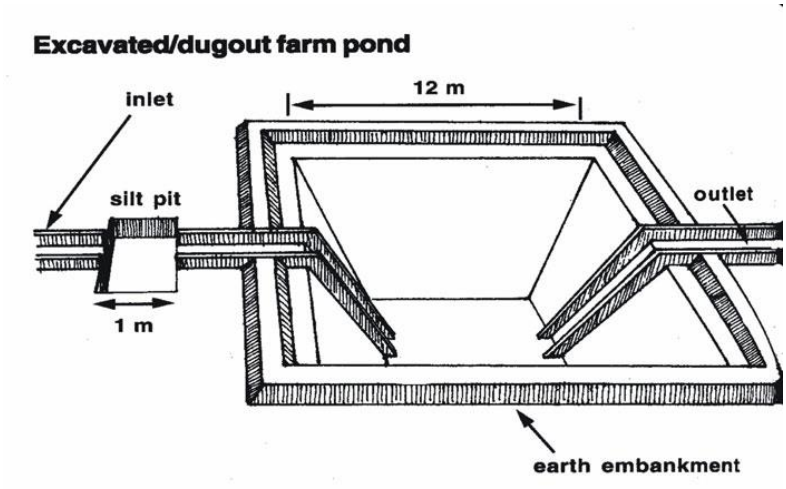
5.3.2.1 Farm Pond

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, the farmer's water requirements, the cost of excavation, and the possible uses of the excavated earth. 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 Landuse classification of the firka, majority of the area is covered by the agricultural field. Hence it is proposed to construct **50** farm ponds as per the specification of AED, Govt. of Tamil Nadu (30 x 30 x 1.5 m).



5.3.2.2. 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 wastage 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 50 ha. The cost estimation for this component has been taken from SOR of Agricultural Engineering Department (AED), Govt. of Tamil Nadu.Tentativelocations of proposed micro irrigation are shown in Plate 1.

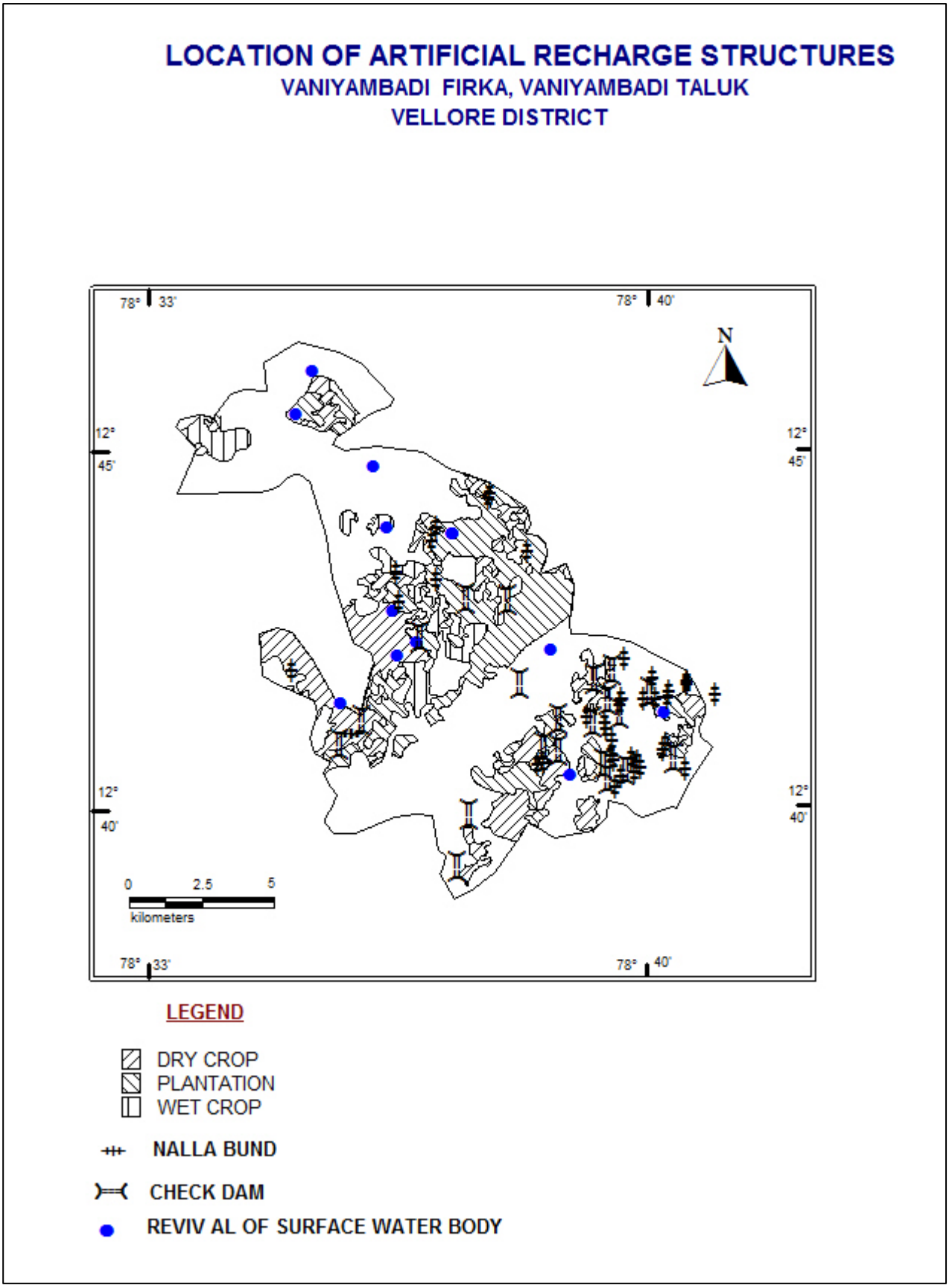


Plate 1. Location map showing the proposed AR Structures in Vaniyambadi Firka

6. Tentative Cost Estimation

The tentative number of feasible structures, its cost and expected annual groundwater recharge/water saving is given in the table 7. The unit rates are as followed by the PWD, Govt. of Tamilnadu (Sources: Scheduled rates, Govt. of Tamilnadu 2015).

Table 7. Showing the Cost Estimation of proposed Artificial Recharge Structures

Feasible Artificial Recharge & Water Conservation structures/ activities	Tentative Design	quantity (in nos. or area in sq. m)	Total volume (cu.m)	Tentative unit cost (in Rs lakh)	Total tentative cost (in Rs lakh)	Expected Annual GW recharge/Saving (cu.m)
Recharge Structures/ Activities						
Masonry Check dams (5 Fillings)	Crest- 10 -15 m; Height- 1.0 m to 1 .5 m	15	3400 (80%)	9.0	135	204000
Nala bunds/ Gabion (4 Fillings)	Width: 5 to 15 m	50	750 (80%)	2.0	100	120000
Revival, repair of water bodies (3 fillings)	(~250 m x250 m x2.5m)	14	33750 (80%)	25.0	350	1134000
Recharge shaft within the pond /tanks	Shaft = 1.5 m dia x 2m depth with filter media in lower 1 m . Bore dia =10", Casing = 6" Depth = 30 m)	14		2.0	28	
Farm Pond (in ha)(5 filling)	(30 m x 30m x 1.5 m)	50 unit	1200(85%)	1	50	300000
			Sub Total		**663**	**1758000**
Water Conservation Activities						
Sprinkler/ drip/ HDPE pipes	For 1 ha with 5 m interval HDPE pipe	50 ha		0.6 /ha	30	350000
			Total		**693**	**2108000**
Impact assessment and O & M						
Piezometers Up to 50 mbgl – 2 nos. @ 0.6 lakh (Impact assessment to be carried out by the implementing agencies)					**1.2**	
Total cost of the Project					**694.20**	
Add 5% for O & M on total cost of the scheme					**34.71**	
Impact assessment to be carried out by the implementing agencies @ 5% of Total cost					**34.71**	
				TOTAL	**763.62**	

- Note: The type, number and cost of structure may vary according to site, after the ground truth verification.
- CD, PC- the storage of Check-dams and percolation ponds is also proposed for irrigating the surrounding areas for enhancing the groundwater recharge as well as effective utilization of the artificial recharge structures.

7. Implication modalities

The implementation of the scheme will be done by the line department of the state selected by the respective State authority. Further, it is to add that more than 50 % MGNREGA works related to water conservation/sustainable management,accordingly a convergence guideline has been madebetween National Rural Employment Guarantee Act (NREGA) (Ministry of Rural Development) & Programmes of Water Resources (MoWR , RD & GR). .

a.) Time schedule

Steps	1st Quarter	2th Quarter	3rd Quarter	4th Quarter	5th Quarter	6th Quarter	7th Quarter	8th Quarter
❖ Identification of line department /implementing agency and preparation of DPR								
❖ Approval of scheme and release of sanction of funds								
❖ Implementation of ARS								

Phase = one quarter or 3 months or equivalent to financial quarter

b.) Operation and maintenance

In all projects Impact assessment has to be carried out to ensure that projects 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 a have an impact assessment at rate of 5 % of the total cost of the project for 5 years from the completion of artificial recharge structures.