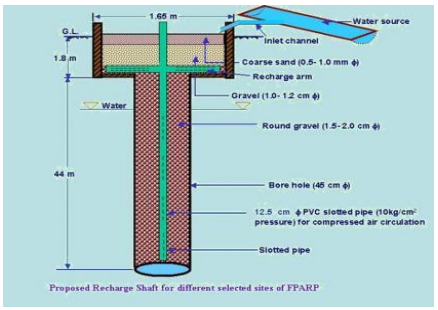
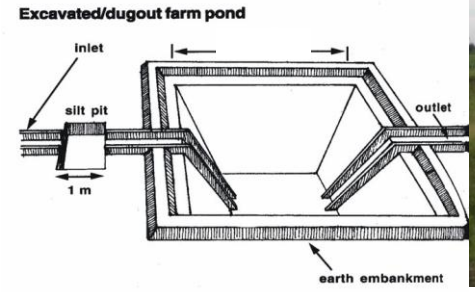
Plan on Artificial Recharge to Groundwater and Water Conservation in Nambiyur Firka, Gobichettipalayam Taluk, Erode District, Tamil Nadu





By

Central Ground Water Board
South Eastern Coastal Region
RajajiBhawan, Besant Nagar
Chennai

Content

AT GLANCE	
Name of Firka	Nambiyur
Taluk	Gobichettipalayam
District	Erode
State	Tamil Nadu
Total area in Sq.Km	138.906
Total Area Suitable for Recharge in Sq.Km	138.906
Lat. & Lon.	11°15'19" to 11°23'52" & 77°17'02" to 77°26'14".
Rainfall	569 mm
Monsoon	471 mm
Non- Mon soon	98 mm
Geology	Crystalline metamorphic gneiss complex comprising Hornblende gneiss and Granite
WATER LEVEL	
Pre – Monsoon (May -2015)	1.65 to 20.07 m bgl.
Post - Monsoon (Jan_2016)	1.00 to 14.90 m bgl.
GROUND WATER RESOURCES ESTIMATION	
Replenish able ground water resources	10.85 MCM
Net ground water available	9.77 MCM
Ground water draft for irrigation	26.40 MCM
Groundwater draft for domestic & industrial water supply	1.31 MCM
Total ground water draft	27.71 MCM
Stage of ground water development (%)	284
Uncommitted surface runoff available for the Firka	9.81 MCM
Total volume of weathered zone	16.67 MCM
Total volume available for recharge (considering 3 m depth from 3 m bgl	25.00 MCM
ARTIFICIAL RECHARGE /CONSERVATION MEASURES	
Structures Proposed (tentative) Masonry Check dam Nalla Bund Revival, repair of pond, tanks with recharge shaft Only shafts in larger tanks Farm Pond	 19 82 7 4 100 Unit
Improving Water Efficiency/ Saving (Micro irrigation system for 100 ha)	0.70 MCM
Expected recharge	1.95MCM
Excepted total groundwater recharge/ saving	2.65 MCM
Tentative total cost of the project	Rs.7.65 Cr
Expected raise in water level by recharging/saving.	1.25 m

Plan on Artificial Recharge to Groundwater and Water Conservation in Nambiyur Firka, Gobichettipalayam Taluk, Erode district, Tamil Nadu

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 Nambiyur firka is 138.90 sq.km and Nambiyur firka lies between North latitudes 11°15'19 "to 11°23'52" and east longitudes 77°17'02" to 77°26'14". Location map of Nambiyur firka is given in Figure 1.

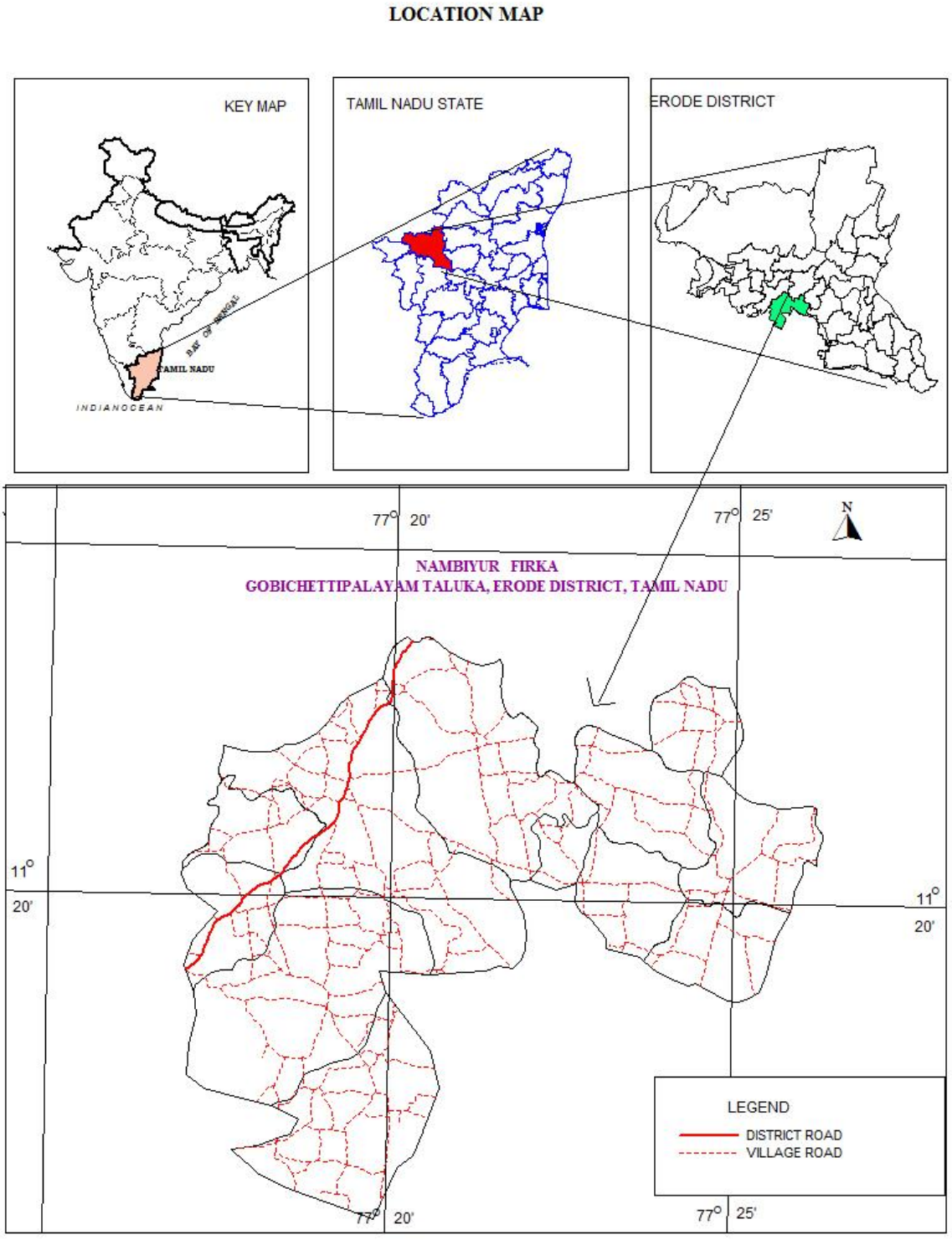


Figure 1. Location map of Nambiyur firka

3.2 Geomorphological Set up

Geomorphologically, the area consists of dissected/ undissected plediment plain landforms and small hillock. In plain landforms, Pediplain weathered shallow occupies major part of the firka. These landforms are influencing the ground water recharge. Inselberg complex are act as runoff zone. Dissected and Undissected landforms spread over the entire firka (*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 firka forms part of the uplands of the district. 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 Nambiyur firka

LANDFORMS	% of Area
DISSECTED/UNDISSECTED	58.24
PEDIMENT-INSELBERG COMPLEX	0.35
PIEDMONT ZONE	0.03
SHALLOW PEDIMENT	41.38

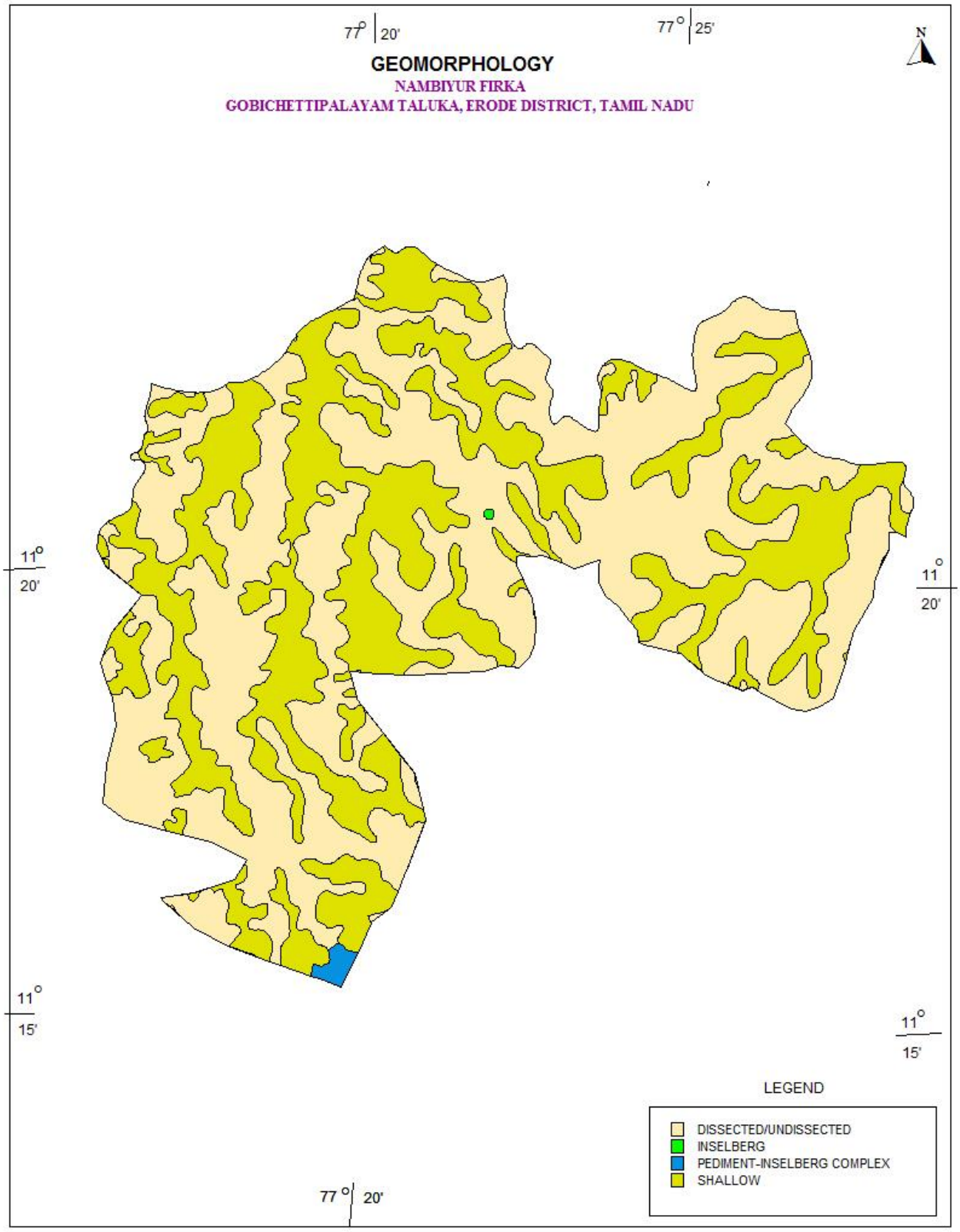


Figure 2. Geomorphology of Nambiyur Firka

3.3 Land use and soil

The land use pattern of the Nambiyur Firka is given in figure 3. Predominantly the most of the area is characterised by the wet crop, plantation and dry crop (i.,e agricultural field)and accounts for 84.50 % 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 soil is mainly of Ustorthents type, which covers more than 90% of the firka. The soil map is given in Figure 4.

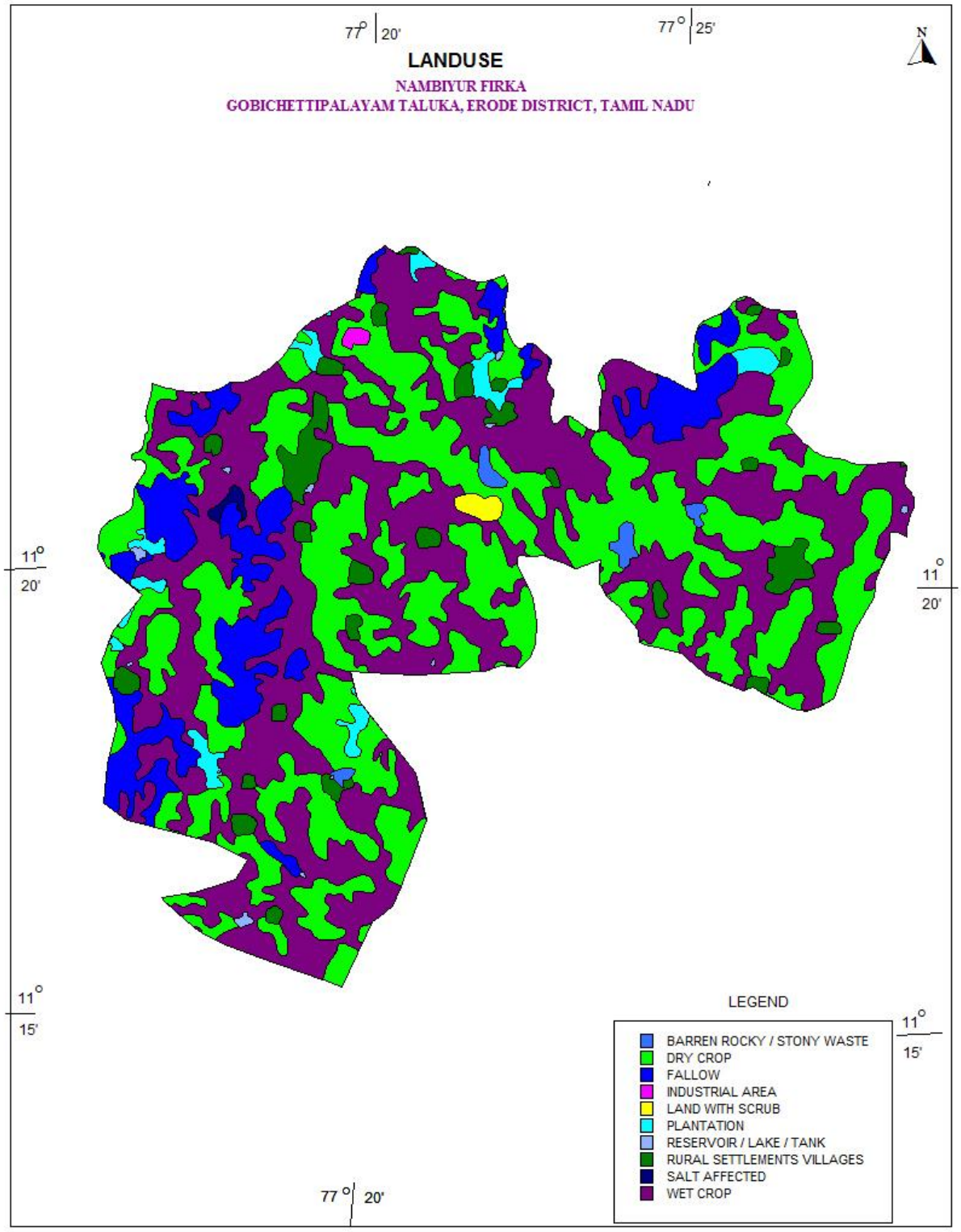


Figure 3. Landuse map of Nambiyur Firka

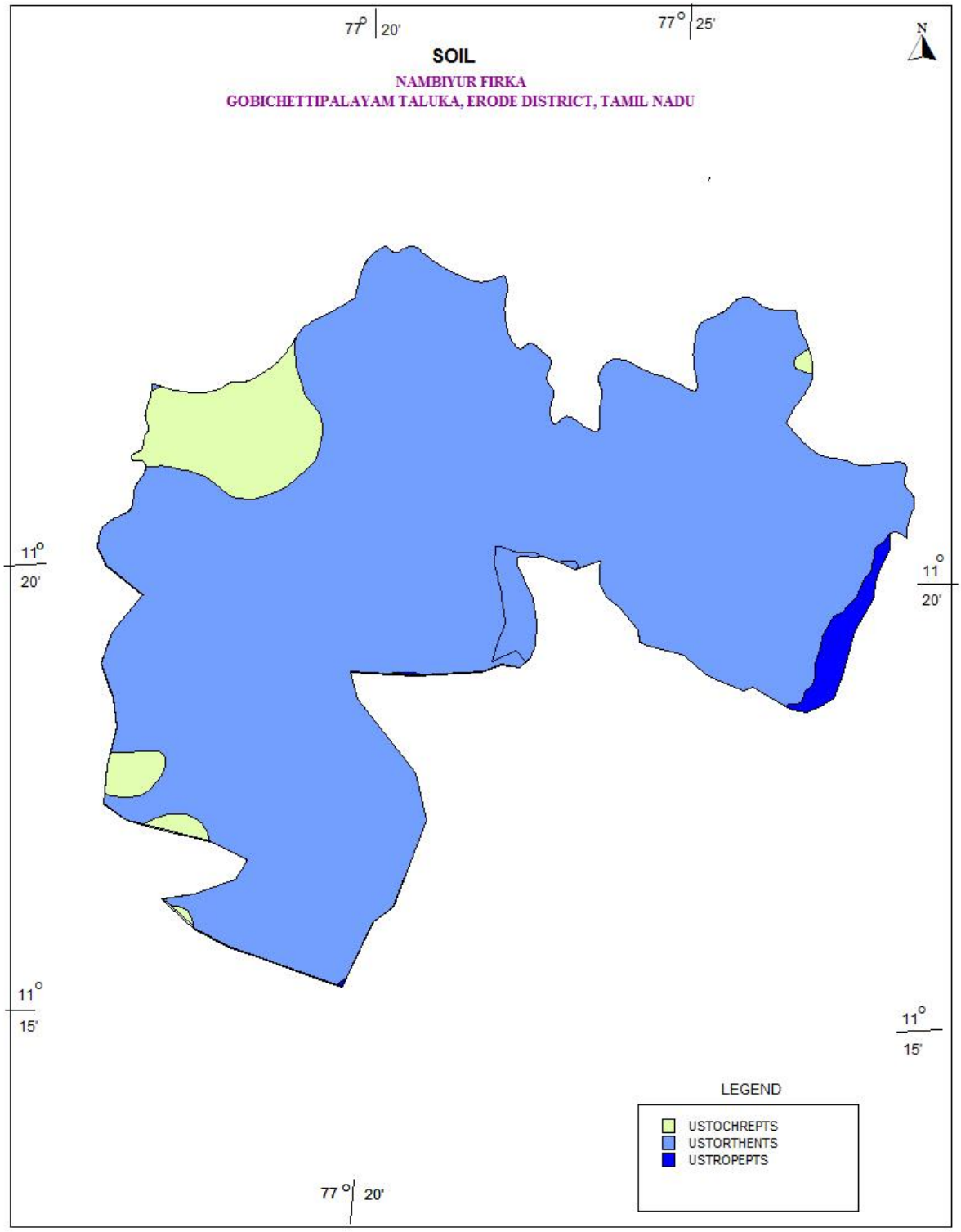


Figure- 4. Soil map of Nambiyur Firka

3.4 Drainage

The entire Firka area falls in the Cauvery river basin. Minor streams are flowing and only seasonal floods inundate 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 Nambiyur firka is given in Fig 5.

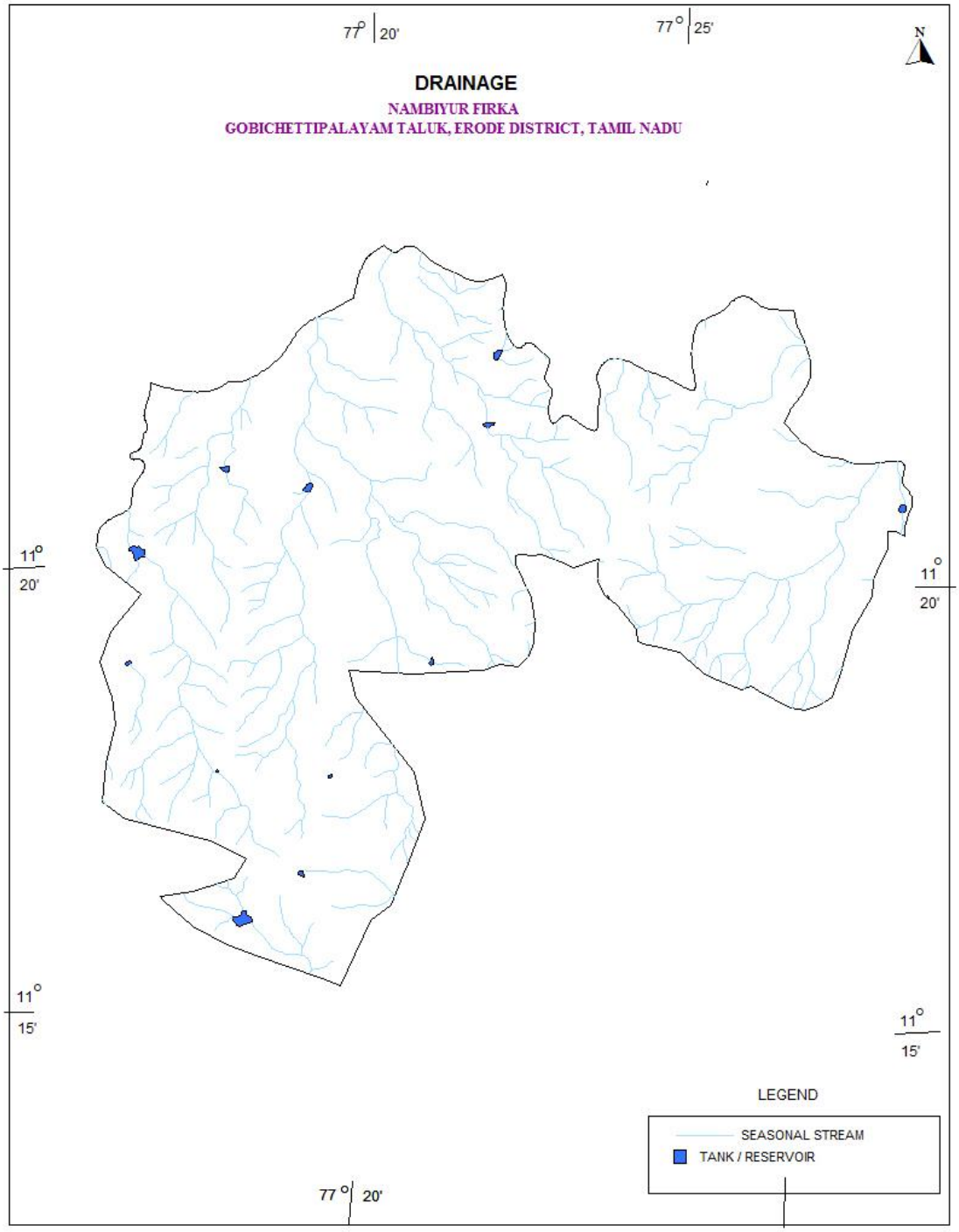


Figure 5. Drainage map of Nambiyur Firka

3.5 Rainfall

Nambiyur area falls under tropical climate with temperature in the summer months of March to May. The average temperature varies from 19 to 35° C. The humidity is also high in the order of 70%. 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. Nambiyur Firkas receives 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 703 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
Gobichettipalayam	Nambiyur	138.906	0.471	0.098	0.569

3.6 Hydrogeology

The entire firka is underlain by the crystalline metamorphic gneiss complex consisting Hornblede –Biotite gneiss, Epidote-Hornblede gneiss and Granite rocks. Ground water is occurring in phreatic 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 3 to 10 m and depth of dug wells range from 6 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 in the firka is in the range of 1.7 to 20.07 m bgl during pre- monsoon (May 2015) and from 1.00 to 14.90 m bgl during post monsoon (January 2016). The hydrogeological map of Nambiyur firka is given in Figure 6.Decadal mean water level of pre-monsoon and post monsoon are given in fig 7a & b. The decadal maps reveal that, mean water level during pre-monsoon in majority area is < 10 m bgl likewise during post monsoon majority part is under < 5 m ground water level.

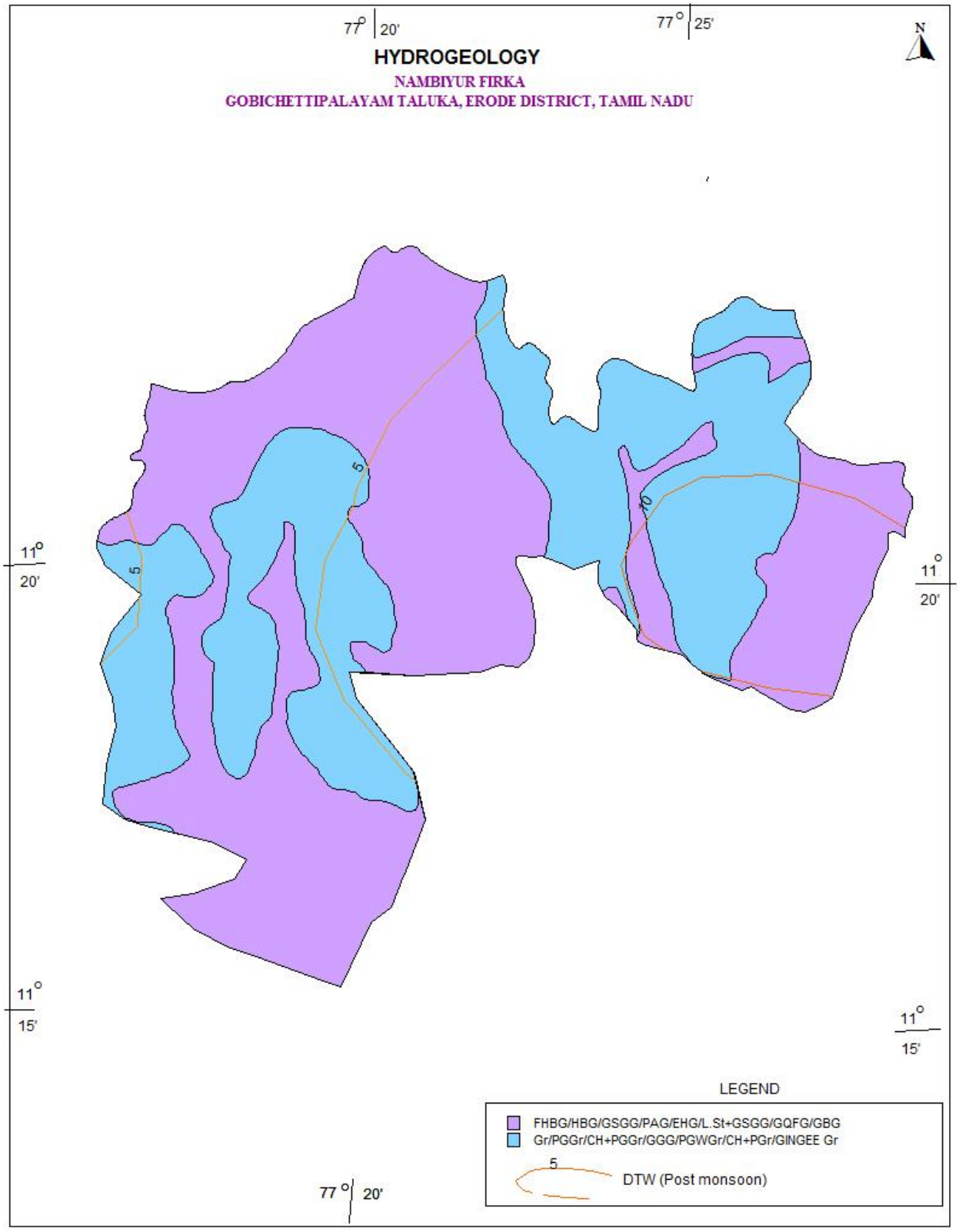


Figure 6- Hydrogeological Map of Nambiyur Firka

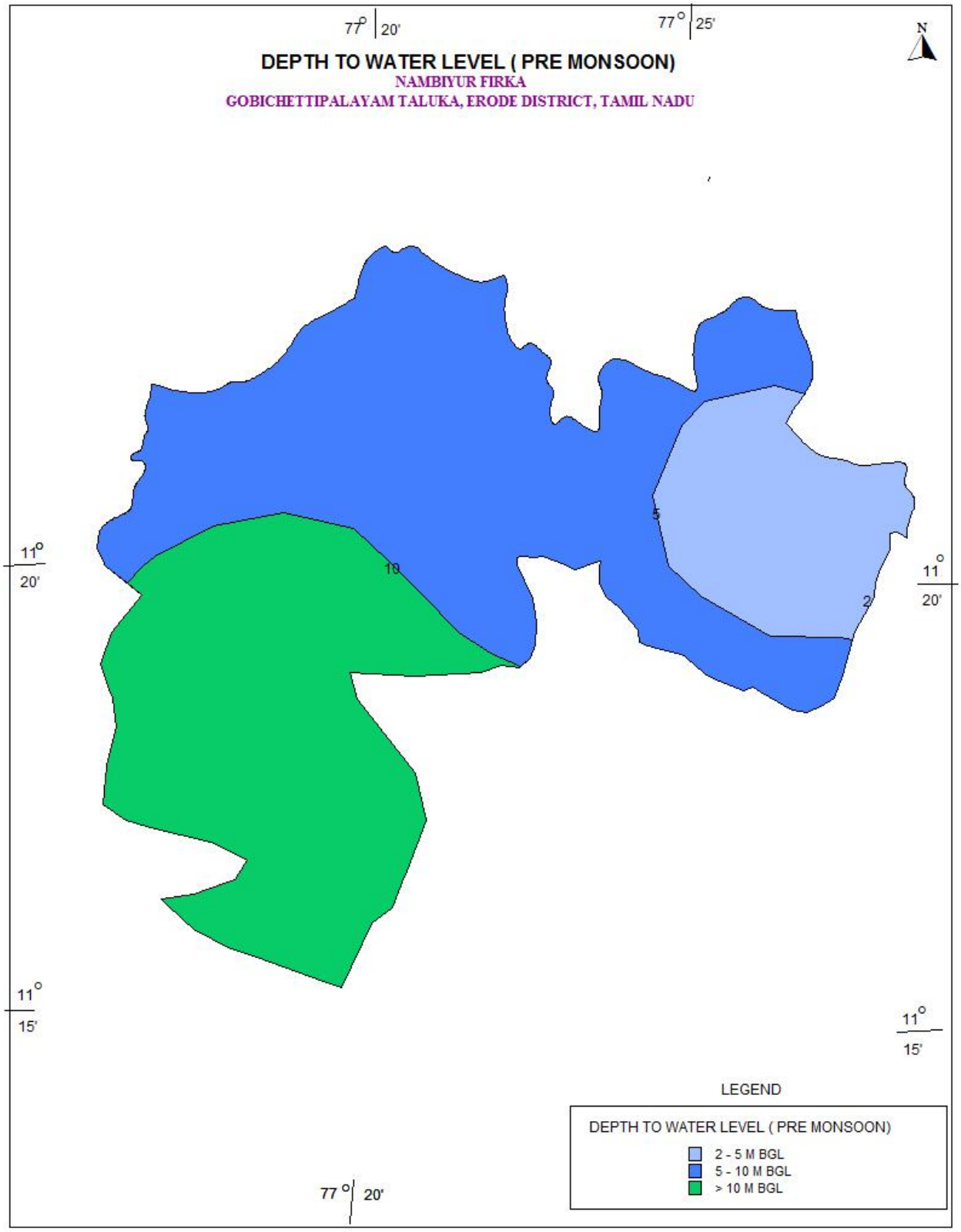


Figure 7a.Pre –monsoon (Decadal) water level in Nambiyur firka

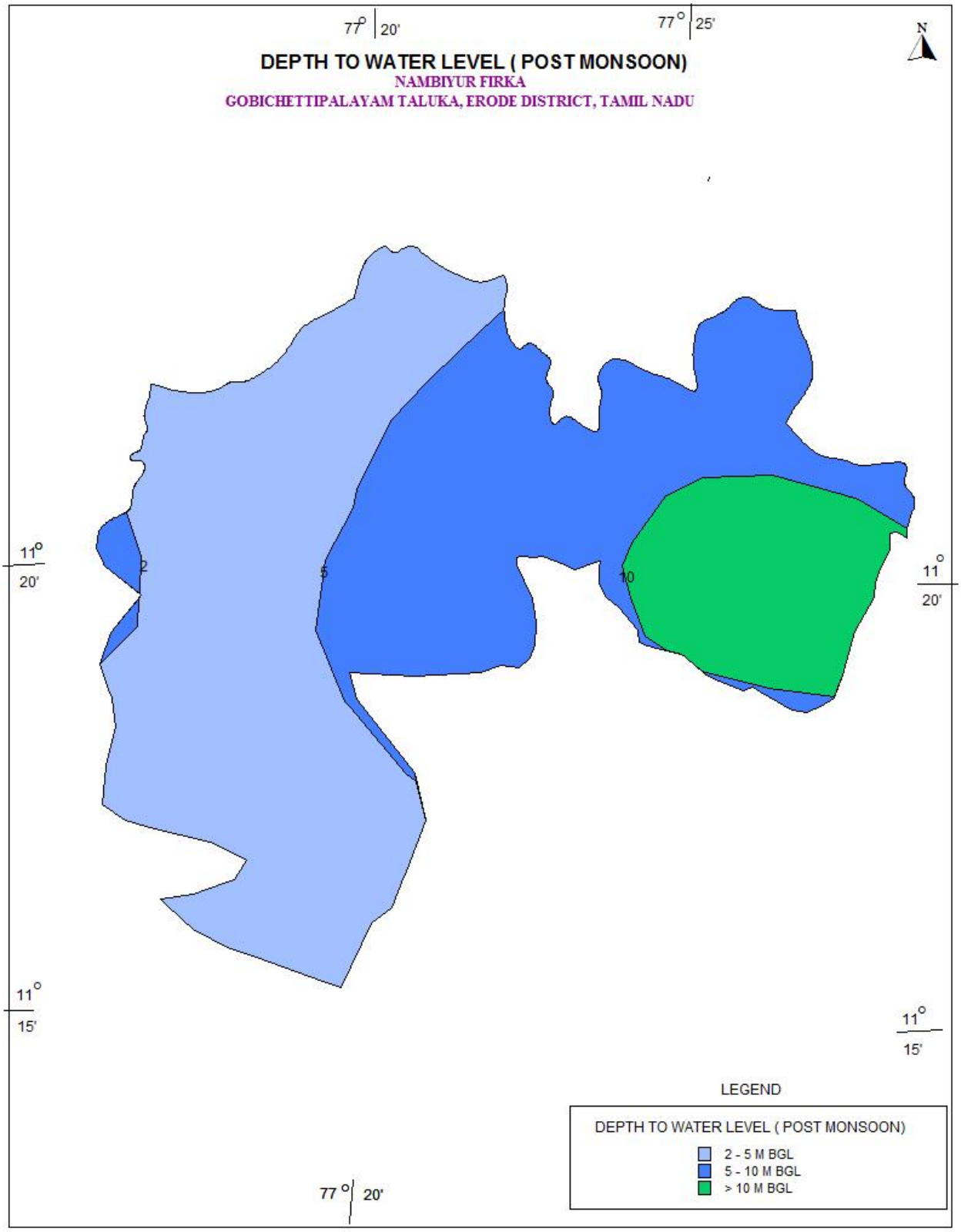


Figure 7b. Post-monsoon (Decadal) water level in Nambiyur firka

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 Nambiyur 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)					%	
Nambiyur	138.906	10.85	9.77	26.40	1.31	27.70	284	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 by assigning 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	1	Suitable for all major recharge structures like Percolation pond and stop dam, check dam etc.,
High	23	Suitable for all major recharge structures like stop dam, check dam etc.,
Moderate	67	Suitable for all major recharge structures like earthen check dam, Boulder check dam and Nala bund etc.,
Poor	10	Hilly/Forest /Catchment area

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

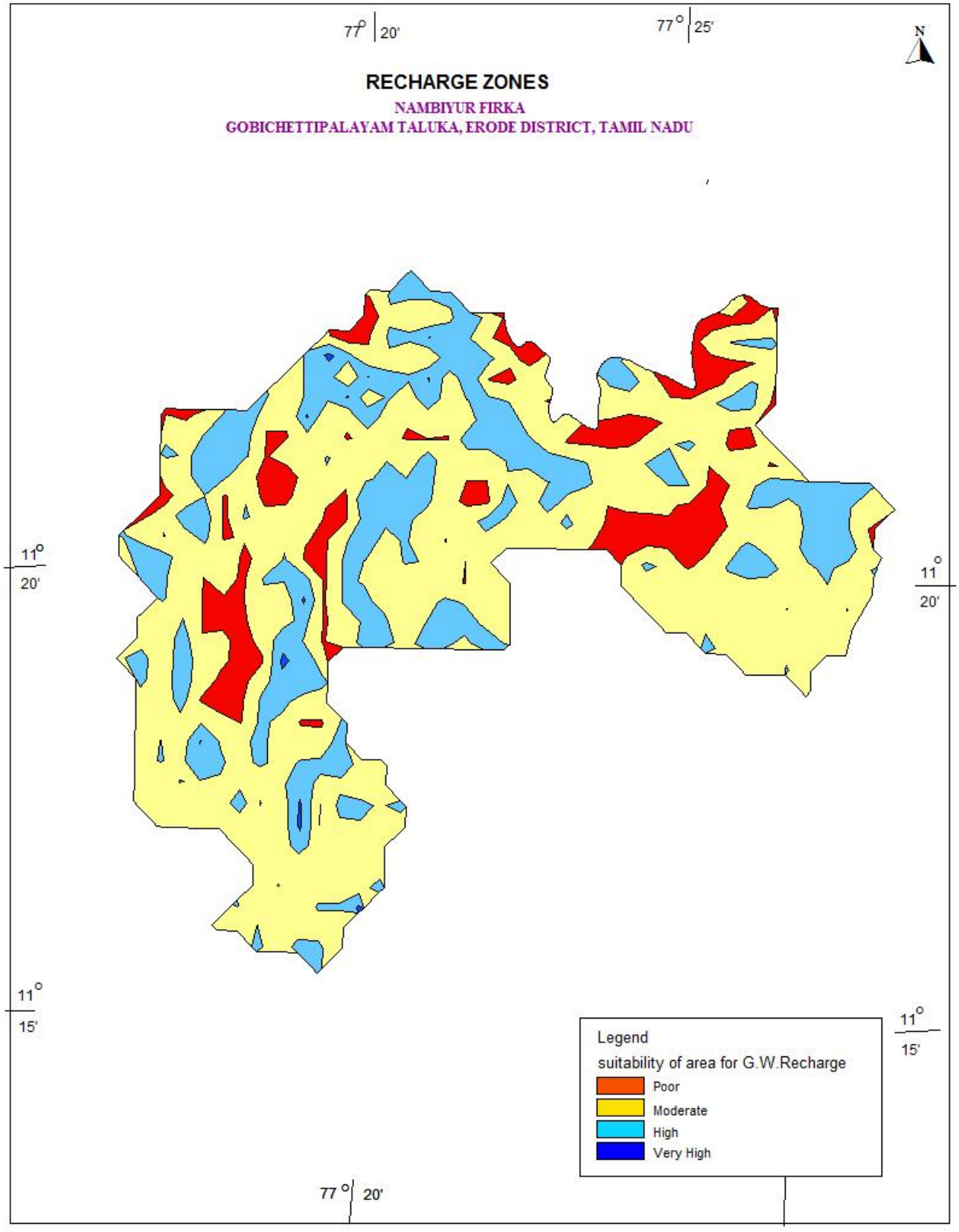


Figure - 7: Showing the recharge worthy area Nambiyur firka

5. Planning for groundwater recharge /conservation

5.1 Justification of the artificial recharge & conservation measures

- The Nambiyur Firkas is with high stage of groundwater development i.e, 284 % and with sufficient amount of uncommitted surface runoff/flow of 9.81 MCM.
- The total weathered zone available beneath the ground in the firka is 16.67 MCM. Out of these total volume available for recharge considering 12 m depth from 3 m) is 25.00 MCM.
- The Nambiyur Firka consists of few water bodies /lakes which 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 Nambiyur areas reveals that more than 90 % of areas are suitable for recharge.
- In Nambiyur firka more than 85 % 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 Nambiyur 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 Nambiyur Firka is 9.81 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

Nambiyur firka area is covered by the seasonal nallahs/drains which carry heavy discharge during monsoon. It is proposed that such seasonal nala rivers will be identified and the rain water will be

harnessed through construction of series of check dams, nala bund and gabion structures so as to harness this water thereby increasing the resident period of the water in these channels and to increase the soil moisture content. As per the integrated model prediction around 24 % of the firkas areas are suitable for these structures. It is proposed to construct 19 Check dam and 82 Nala bunds. The tentative location of these 101 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 19 Check dam in Nambiyur firka

Sl.No.	STRUCTURES	LONGITUDE	LATITUDE	VT_NAME
1	CHECK DAM	77.3532	11.3705	Koshanam
2	CHECK DAM	77.3658	11.3563	Koshanam
3	CHECK DAM	77.3389	11.3821	Koshanam
4	CHECK DAM	77.4058	11.3668	Talguni
5	CHECK DAM	77.3975	11.3587	Sinnaipalayam
6	CHECK DAM	77.4075	11.3342	Santhipalayam
7	CHECK DAM	77.4247	11.3421	Santhipalayam
8	CHECK DAM	77.3009	11.3456	Palavapalayam
9	CHECK DAM	77.3967	11.3287	Avalampalayam
10	CHECK DAM	77.2990	11.3182	Mettanam
11	CHECK DAM	77.4192	11.3225	Nichampalayam
12	CHECK DAM	77.3221	11.3231	Emmampoondi
13	CHECK DAM	77.3203	11.3099	Emmampoondi
14	CHECK DAM	77.3026	11.3004	Emmampoondi
15	CHECK DAM	77.3434	11.3393	Nambiyur
16	CHECK DAM	77.3240	11.3784	Nambiyur
17	CHECK DAM	77.3333	11.3523	Nambiyur
18	CHECK DAM	77.3184	11.3381	Nambiyur
19	CHECK DAM	77.3075	11.3607	Nambiyur

Tentative location of proposed 82 Nalla bund in Nambiyur firka

Sl.No.	STRUCTURES	LONGITUDE	LATITUDE	VT_NAME
1	NALA BUND	77.3657	11.3434	Koshanam
2	NALA BUND	77.3615	11.3544	Koshanam
3	NALA BUND	77.3537	11.3587	Koshanam
4	NALA BUND	77.3626	11.3699	Koshanam
5	NALA BUND	77.3528	11.3787	Koshanam
6	NALA BUND	77.3495	11.3839	Koshanam
7	NALA BUND	77.3416	11.3524	Koshanam
8	NALA BUND	77.3453	11.3649	Koshanam
9	NALA BUND	77.3395	11.3782	Koshanam
10	NALA BUND	77.4013	11.3675	Talguni
11	NALA BUND	77.3941	11.3521	Sinnaipalayam
12	NALA BUND	77.3882	11.3522	Sinnaipalayam
13	NALA BUND	77.3927	11.3576	Sinnaipalayam
14	NALA BUND	77.3955	11.3619	Sinnaipalayam
15	NALA BUND	77.3844	11.3572	Sinnaipalayam
16	NALA BUND	77.3864	11.3677	Sinnaipalayam

17	NALA BUND	77.3805	11.3684	Sinnaipalayam
18	NALA BUND	77.4152	11.3491	Santhipalayam
19	NALA BUND	77.2975	11.3424	Palavapalayam
20	NALA BUND	77.2960	11.3495	Palavapalayam
21	NALA BUND	77.3727	11.3433	Kadasellipalayam
22	NALA BUND	77.3685	11.3519	Kadasellipalayam
23	NALA BUND	77.3798	11.3468	Kadasellipalayam
24	NALA BUND	77.3709	11.3530	Kadasellipalayam
25	NALA BUND	77.3895	11.3260	Avalampalayam
26	NALA BUND	77.4005	11.3256	Avalampalayam
27	NALA BUND	77.3880	11.3349	Avalampalayam
28	NALA BUND	77.3890	11.3404	Avalampalayam
29	NALA BUND	77.3957	11.3403	Avalampalayam
30	NALA BUND	77.3994	11.3409	Avalampalayam
31	NALA BUND	77.3018	11.3248	Mettanam
32	NALA BUND	77.4038	11.3194	Nichampalayam
33	NALA BUND	77.4174	11.3186	Nichampalayam
34	NALA BUND	77.4078	11.3187	Nichampalayam
35	NALA BUND	77.4148	11.3290	Nichampalayam
36	NALA BUND	77.3438	11.3188	Emmampoondi
37	NALA BUND	77.3355	11.3197	Emmampoondi
38	NALA BUND	77.3399	11.3169	Emmampoondi
39	NALA BUND	77.3281	11.3043	Emmampoondi
40	NALA BUND	77.3216	11.2944	Emmampoondi
41	NALA BUND	77.3174	11.3057	Emmampoondi
42	NALA BUND	77.3031	11.3157	Emmampoondi
43	NALA BUND	77.3145	11.3169	Emmampoondi
44	NALA BUND	77.3165	11.3241	Emmampoondi
45	NALA BUND	77.3065	11.3302	Emmampoondi
46	NALA BUND	77.3148	11.3306	Emmampoondi
47	NALA BUND	77.2966	11.3066	Emmampoondi
48	NALA BUND	77.3159	11.2996	Emmampoondi
49	NALA BUND	77.3076	11.2879	Emmampoondi
50	NALA BUND	77.3089	11.2931	Emmampoondi
51	NALA BUND	77.3139	11.3088	Emmampoondi
52	NALA BUND	77.3003	11.2932	Emmampoondi
53	NALA BUND	77.2921	11.2912	Emmampoondi
54	NALA BUND	77.2915	11.3091	Emmampoondi
55	NALA BUND	77.3048	11.3110	Emmampoondi
56	NALA BUND	77.3333	11.2707	Olalakovil
57	NALA BUND	77.3316	11.3004	Olalakovil
58	NALA BUND	77.3359	11.3008	Olalakovil
59	NALA BUND	77.3340	11.2894	Olalakovil
60	NALA BUND	77.3388	11.2898	Olalakovil
61	NALA BUND	77.3419	11.2814	Olalakovil
62	NALA BUND	77.3326	11.2778	Olalakovil
63	NALA BUND	77.3184	11.2694	Olalakovil

64	NALA BUND	77.3240	11.2655	Olalakovil
65	NALA BUND	77.3158	11.2646	Olalakovil
66	NALA BUND	77.3141	11.2827	Olalakovil
67	NALA BUND	77.3527	11.3297	Nambiyur
68	NALA BUND	77.3558	11.3311	Nambiyur
69	NALA BUND	77.3527	11.3297	Nambiyur
70	NALA BUND	77.3528	11.3369	Nambiyur
71	NALA BUND	77.3568	11.3209	Nambiyur
72	NALA BUND	77.3608	11.3386	Nambiyur
73	NALA BUND	77.3540	11.3427	Nambiyur
74	NALA BUND	77.3225	11.3431	Nambiyur
75	NALA BUND	77.3484	11.3278	Nambiyur
76	NALA BUND	77.3432	11.3351	Nambiyur
77	NALA BUND	77.3428	11.3454	Nambiyur
78	NALA BUND	77.3256	11.3503	Nambiyur
79	NALA BUND	77.3331	11.3649	Nambiyur
80	NALA BUND	77.3340	11.3699	Nambiyur
81	NALA BUND	77.3262	11.3748	Nambiyur
82	NALA BUND	77.2953	11.3592	Nambiyur

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 7 existing ponds/tanks have been identified with latitude and longitude given below and marked on Plate 1. There are two more tanks having very small area. The above 9 tanks/ponds could be taken up for the renovation with recharge shaft on priority. Like wise only recharge shafts are recommended for the bigger tanks. There are 4 such tanks in which totally 4 shafts are recommended.

Tentative location of proposed de-siltation of pond/tanks with recharge shaft in Nambiyur firka.

Sl.No.	STRUCTURES	LONGITUDE	LATITUDE	VT_NAME
1	DESILTTAION AND RECHARGE SHAFT	77.3569	11.3625	Koshanam
2	DESILTTAION AND RECHARGE SHAFT	77.3587	11.3759	Koshanam*
3	DESILTTAION AND RECHARGE SHAFT	77.4363	11.3479	Santhipalayam
4	DESILTTAION AND RECHARGE SHAFT	77.3069	11.3528	Palavapalayam
5	DESILTTAION AND RECHARGE SHAFT	77.2901	11.3365	Mettanam*
6	DESILTTAION AND RECHARGE SHAFT	77.2889	11.3164	Mettanam
7	DESILTTAION AND RECHARGE SHAFT	77.3277	11.2951	Olalakovil
8	DESILTTAION AND RECHARGE SHAFT	77.3228	11.2768	Olalakovil
9	DESILTTAION AND RECHARGE SHAFT	77.3120	11.2685	Olalakovil*

10	DESILTTAION AND RECHARGE SHAFT	77.3470	11.3175	Nambiyur
11	DESILTTAION AND RECHARGE SHAFT	77.3227	11.3500	Nambiyur*

***. Larger tanks where only shafts are proposed**

5.3.2 Water conservation measure

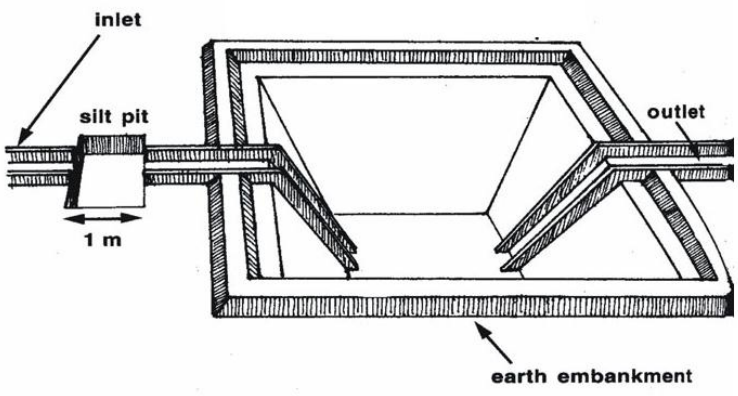
5.3.2.1 Farm Pond

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 100 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 100 ha. The cost estimation for this component has been taken from SOR of Agricultural Engineering Department (AED), Govt. of Tamil Nadu. Tentative locations of proposed micro irrigation are shown in Plate 1.

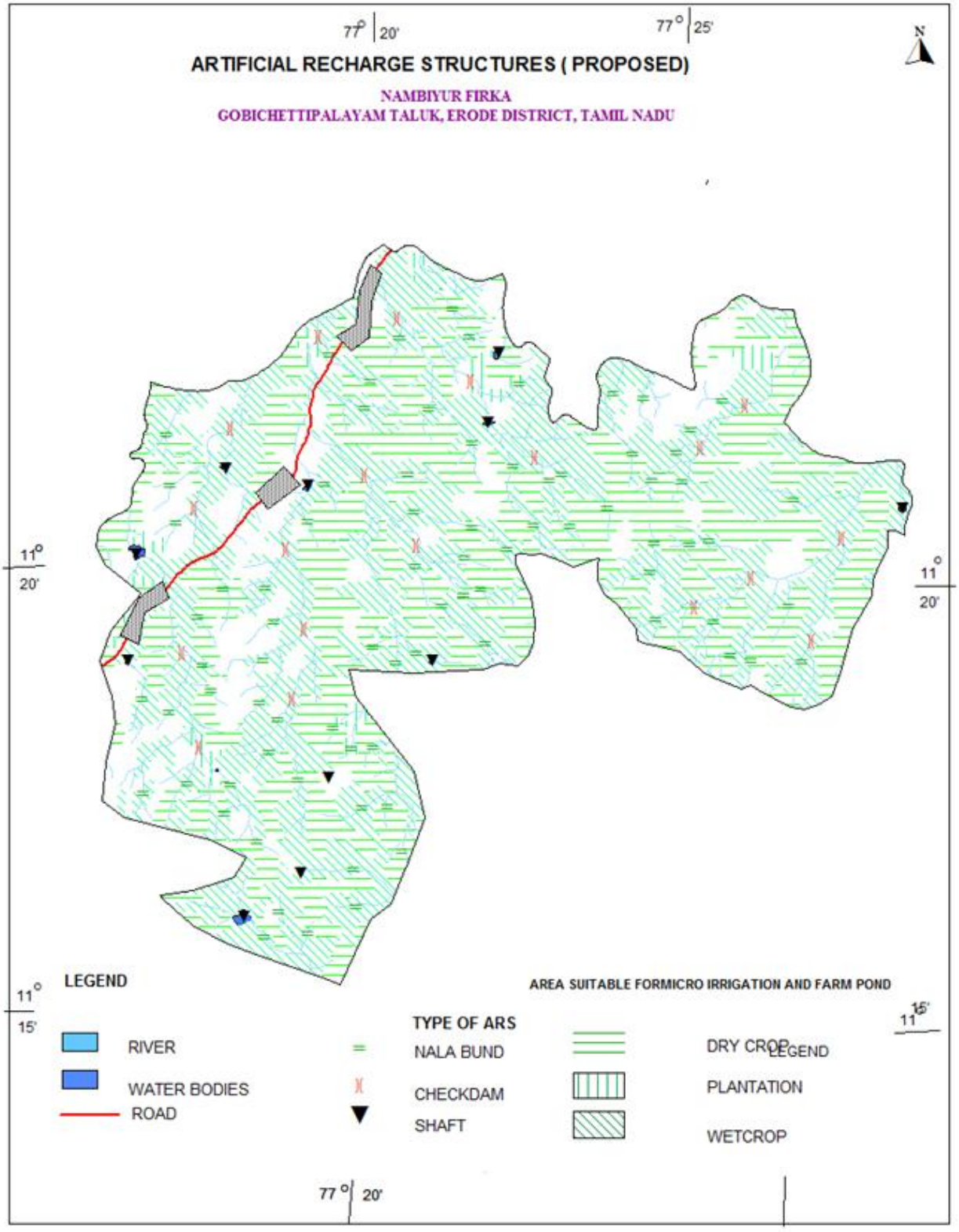


Plate 1. Location map showing the proposed AR Structures in Nambiyur firka

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	19	3400 (80%)	9.0	171	258400
Nala bund/Gab ion (4 fillings)	Width: 5 to 15 m)	82	3000	2.0	164	196800
Revival, repair of water bodies (3 fillings)	(~150 m x150 m x1.5m)	7	33750 (80%)	25.0	175	891000
Recharge shaft within larger tanks	Shaft = 1.5 m dia x 2m depth with filter media in lower 1 m . Bore dia =10", Casing = 6" Depth = 30 m)	11		2.0	22	
Farm Pond (in ha)(5 filling)	(30 m x 30m x 1.5 m)	100 unit	1200(85%)	1	100	600000
				Sub total	**632**	**1946200**
Water Conservation Measure						
Sprinkler/ drip/ HDPE pipes	For 1 ha with 5 m interval HDPE pipe	100 ha		0.6 /ha	60	700000
				Total	**692**	**2646200**
Impact assessment and O & M						
Piezometers Up to 50 m bgl – 5 nos. @ 0.6 lakh (Impact assessment to be carried out by the implementing agencies)					**3**	
				Total cost of the Project	**695**	
O & M - 5 % of total cost of the scheme					**34.75**	
Impact assessment to be carried out by the implementing agencies @ 5% of Total cost					**34.75**	
				TOTAL	**764.50**	

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 made between National Rural Employment Guarantee Act (NREGA) (Ministry of Rural Development) & Programmes of Water Resources (MoWR , RD & GR). The district Erode is one among the list of districts identified for Convergence between NREGS and schemes of MoWR. The details of permissible works under convergence are envisaged in the Joint Convergence Guideline.

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 impact assessment at rate of 5 % of the total cost of the project for 5 years from the completion of artificial recharge structures.