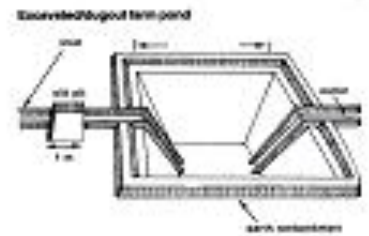
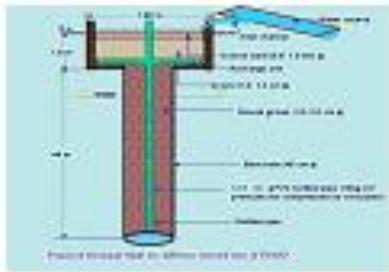




# Plan on Artificial Recharge to Groundwater and Water Conservation in Coimbatore (South) Firka, Coimbatore (South) Taluk, Coimbatore District, Tamil Nadu



By

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Chennai

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<b>AT GLANCE</b>	
Name of Firka	Coimbatore(South)
Taluk	Coimbatore (South)
District	Coimbatore
State	Tamil Nadu
Total area (Sq. Kms)	22.56755
Total Area suitable for recharge	18.49
Co-ordinates: (Latitude. & Longitude)	10°56'22"to 11°02'20" & 76°54'36"to 77°03'28".
Rainfall	692 mm
Monsoon	522 mm
Non- Mon soon	170 mm
Geology	Crystalline and metamorphic gneiss complex of Archaean age
<b>WATER LEVEL</b>	
Pre - Monsoon	1.7 to 19.7 m bgl.
Post - Monsoon	1.8 to 11.25 m bgl.
<b>GROUND WATER RESOURCES ESTIMATION</b>	
Replenish able ground water resources	3.37847 MCM
Net ground water available	3.04062 MCM
Ground water draft for irrigation	3.3310 MCM
Groundwater draft for domestic & industrial water supply	2.787 MCM
Total ground water draft	6.118 MCM
Stage of ground water development (%)	201.209 %
Uncommitted surface runoff available for the Firka	1.767662 MCM
Total volume of weathered zone	180.5404 MCM
Total aquifer volume available for recharge (considering 7 m depth from 3 m bgl)	157.97 MCM
<b>ARTIFICIAL RECHARGE /CONSERVATION MEASURES</b>	
Structures Proposed ( tentative)	
Masonry Check dam	5
Nalla Bund	10
Revival, repair of pond, tanks with recharge shaft .	11
Improving Water Efficiency /saving (Micro irrigation system for 100 ha)	0.7 MCM
Excepted ground water recharge	1.262 MCM
Excepted total ground water recharge/saving	1.962 MCM
Tentative total cost of the project	Rs.4.18 Cr
Expected raise in water level by recharging /saving	3.72 m

# **Plan on Artificial Recharge to Groundwater and Water Conservation in Coimbatore(South) Firka, Coimbatore(North) Taluk, Coimbatore 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 Coimbatore(South) firka is 22.56755sq.km and lies between North latitudes 10°56'22"to 11°02'20" and East longitudes 76°54'36"to 77°03'28".The location map of Coimbatore(South) firka is given in Figure 1.

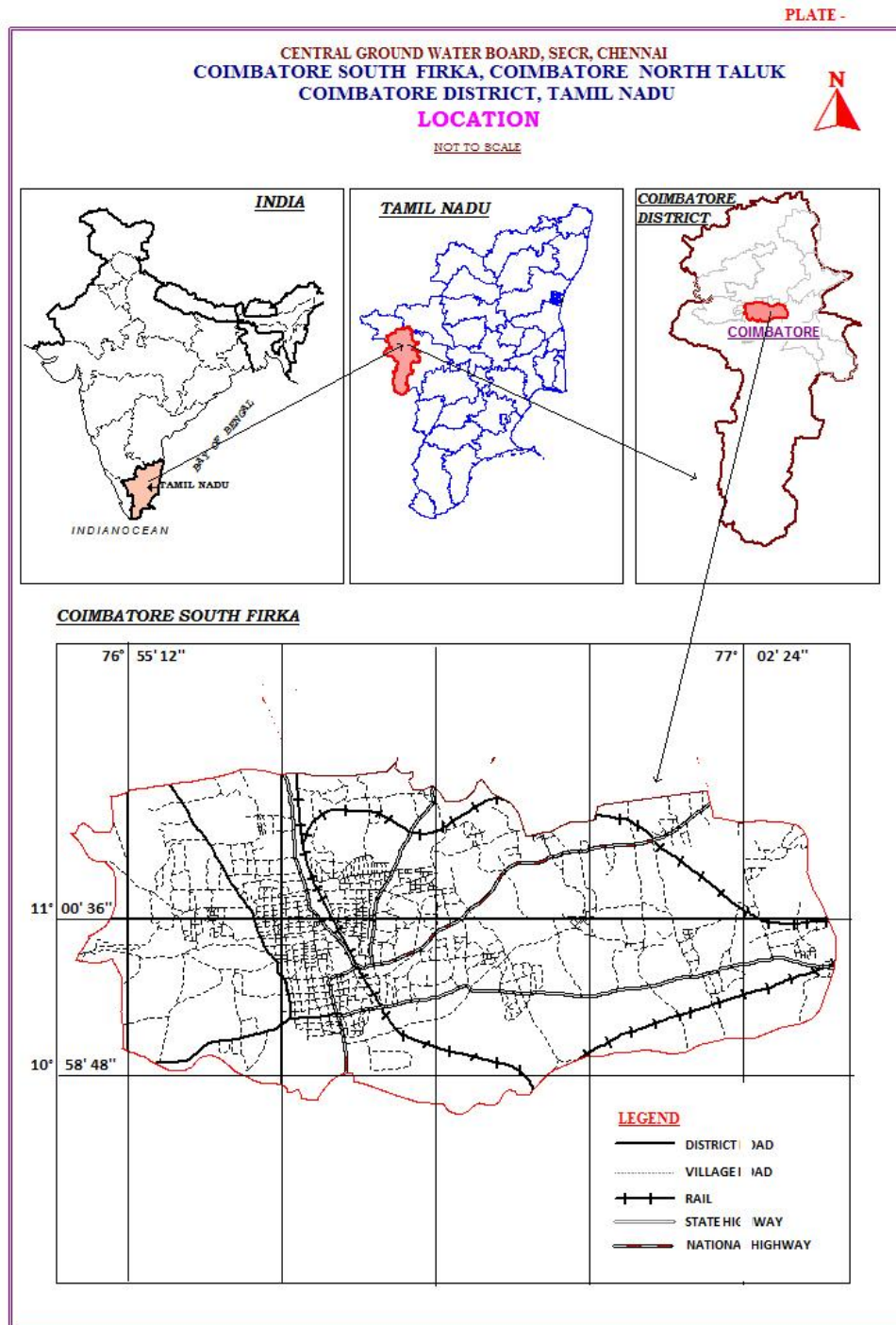


Figure 1. Location map of Coimbatore (South) firka

### 3.2 Geomorphological Set up

Geomorphologically, the area consists of plain landforms. In plain landforms, PEDI plain, weathered moderate and shallow pediment is occupied major part of the firka. These landforms are influencing the ground water recharge. *(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 standards..*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 Coimbatore(South) firka

LANDFORMS	% of Area
PEDIPLAIN ( WEATHERED) MODERATE	13
STRUCTURAL HILLS	--
DENUATIONAL HILLS / RESIDUAL HILLS	--
DISSECTED/UNDISSECTED	10
PEDIPLAIN (WEATHERED) DEEP	10
PEDIMENT-INSELBERG COMPLEX	--
PEDIPLAIN ( WEATHERED) SHALLOW	67

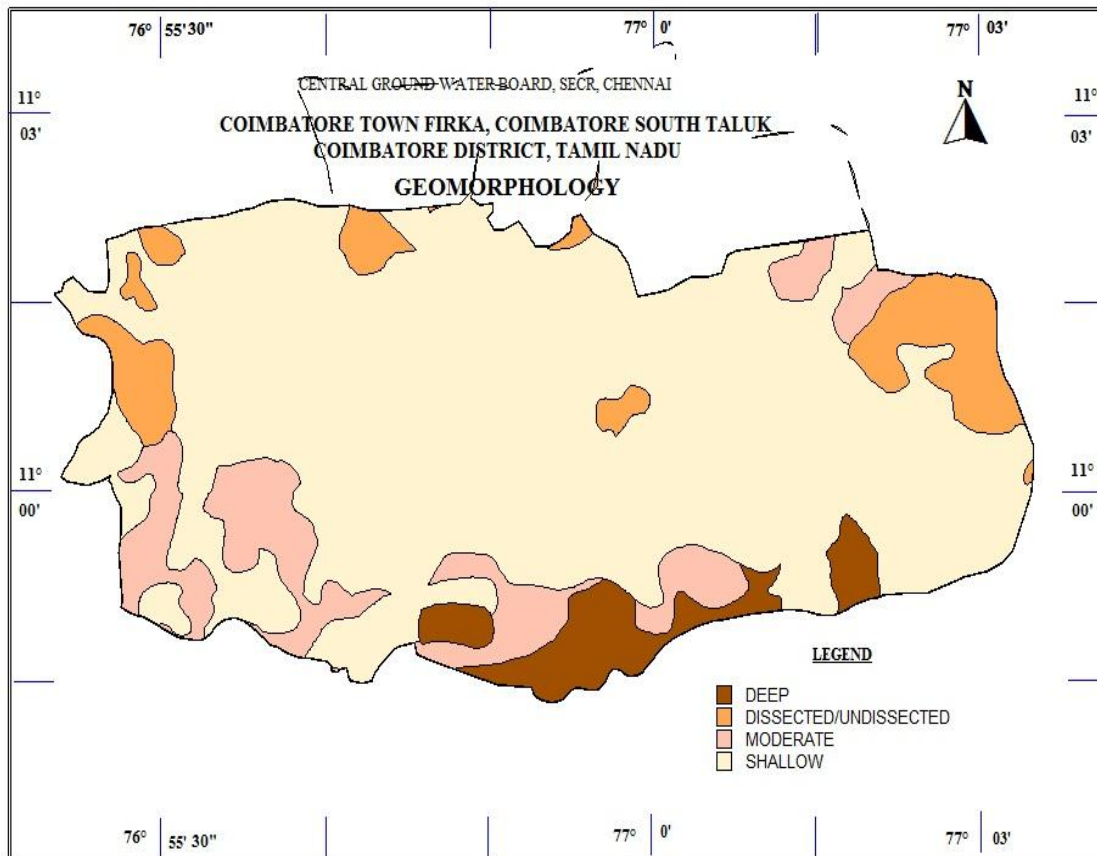


Figure 2. Geomorphology of Coimbatore(South) Firka

### 3.3 Land use and soil

The land use pattern of the Coimbatore(South) 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 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 entire Firkas is occupied by rock outcrops scatter with loamy soil. Soil map of the Coimbatore(South) Firka is given as figure 3a.

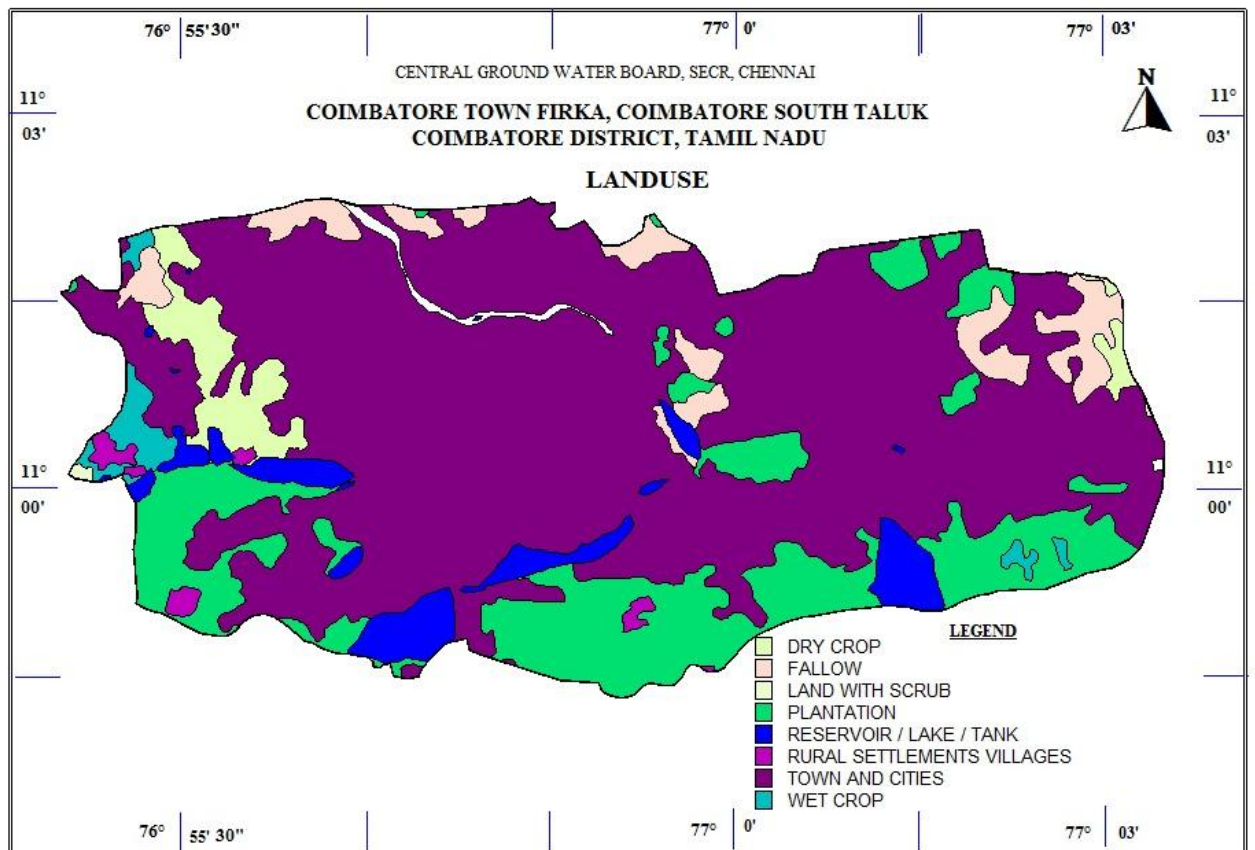
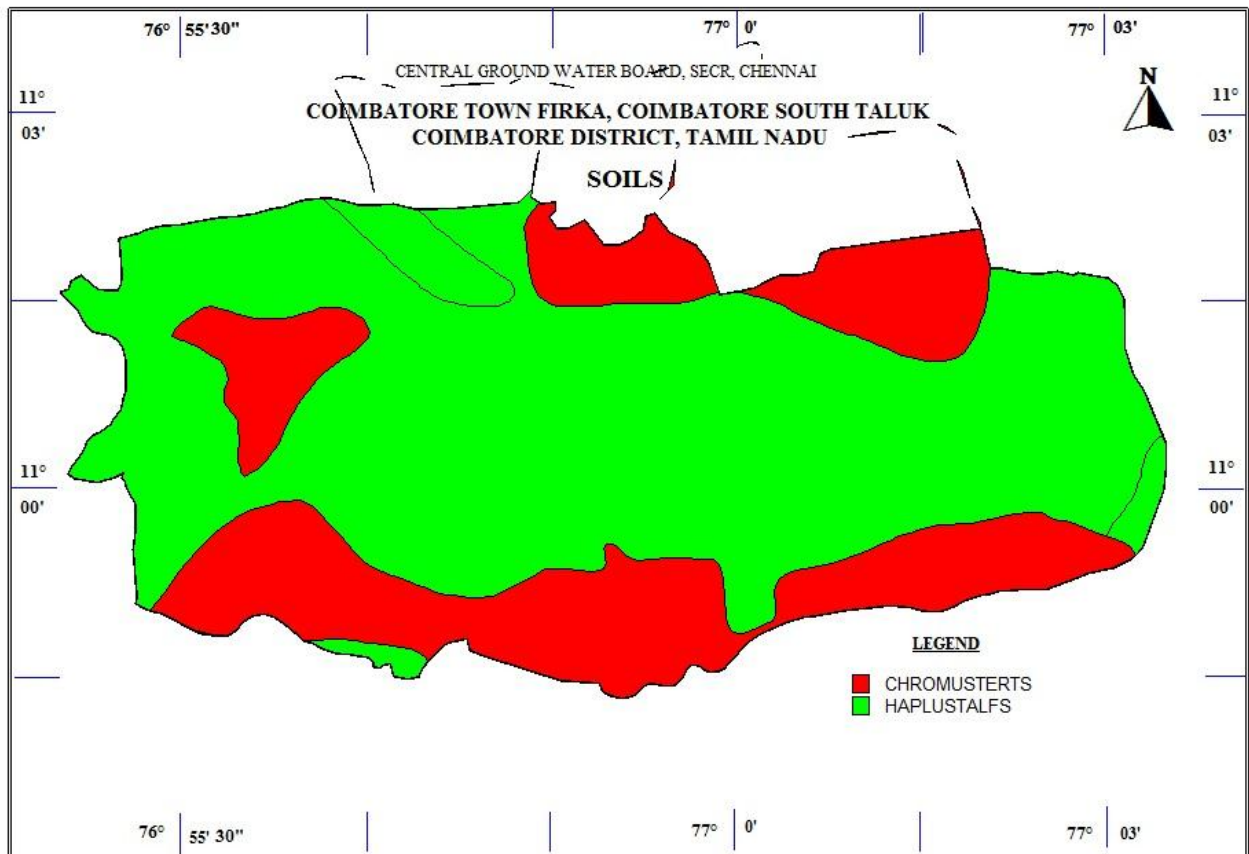


Figure 3. Landuse map of Coimbatore(South) Firka



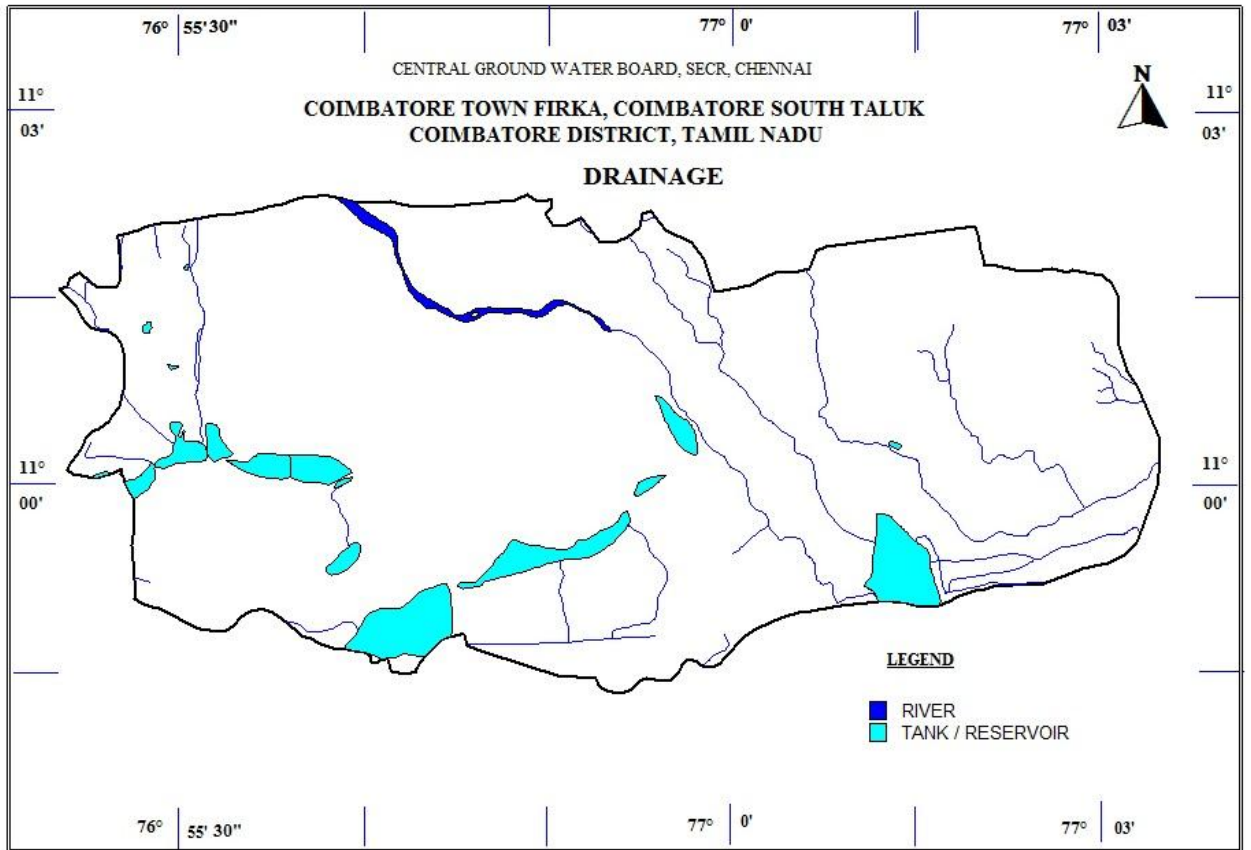


**Figure 3A. Soil map of Coimbatore(South) Firka**

### 3.4 Drainage

The entire Firka area is within the Bhavani river Basin. A number of small streams originate from the hills located in the adjacent firka are 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 and also parallel. The drainage map of Coimbatore (South) firka is given in Fig 4.





**Figure 4.Drainage map of Coimbatore(South) Firka**

### 3.5 Rainfall

Coimbatore(South) area 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. Coimbatore(South) 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 692 mm .

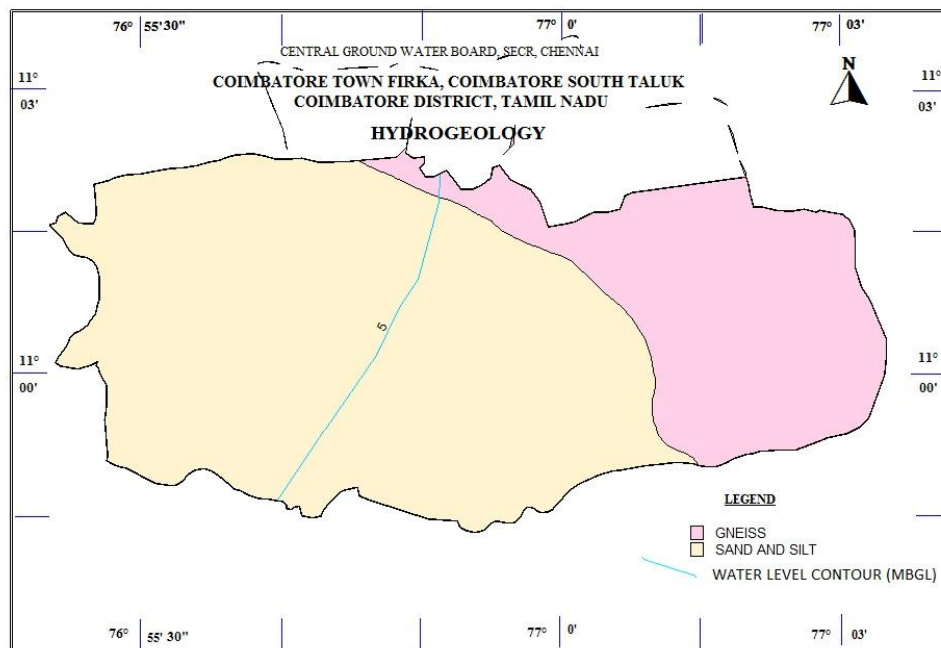
Taluk	Name of Firkas	Area in sq.km	Monsoon rainfall (Jun to Dec) In m	Non monsoon rainfall (Jan – May) In m	Total Rainfall In m
Coimbatore (South)	Coimbatore(South)	22.56755	0.522	0.170	0.692

### 3.6 Hydrogeology

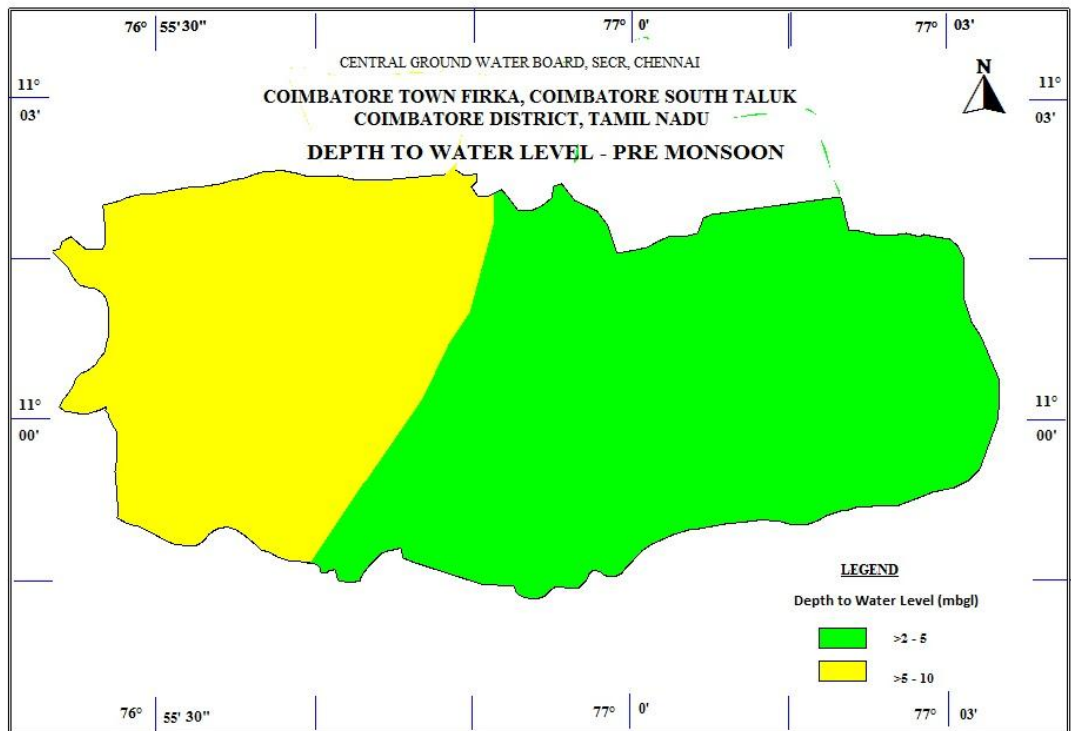
The entire firka is underlain by the Archaean crystalline and metamorphic gneiss complex. Groundwater is occurring in phreatic conditions in weathered and fractured gneiss rock formation. The weathering is erratic and the depth of abstraction structures is controlled by the intensity of weathering and 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 5 to 10 m and depth of dug wells range from 15 to 40 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 hydrogeological map of Coimbatore(South) firka is given in Figure 5. Decadal mean water level of pre-monsoon and post monsoon are given in fig 6 a & b respectively. The decadal maps reveal that, mean water level during pre-monsoon in majority area is < 6 m bgl likewise during post monsoon majority part is under < 5m below ground level.

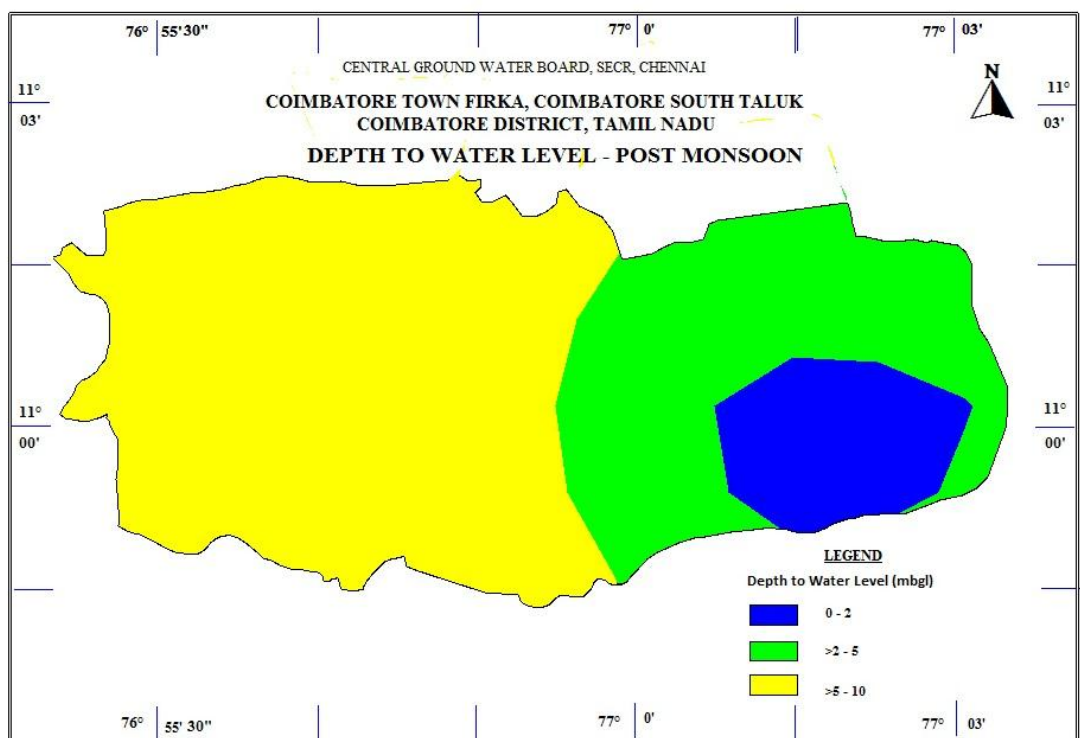
The present water level in the firka is in the range of 1.8 to 11.24 m bgl. ( May 2016)



**Figure 5 Hydrogeological Map of Coimbatore(South) Firka**



**Figure 6a. Pre -monsoon water level in Coimbatore (South) firka (Decadal mean)**



**Figure 6 b. Post-monsoon water level in Coimbatore(South) firka (Decadal mean)**

### 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 Coimbatore(South) firka**

Firka	GW WORTHY AREA	REPLENISH ABLE 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)					%	
Coimbatore (South)	22.56755	3.37847	3.04062	3.331	2.787	6.118	201.209	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	7	Suitable for all major recharge structures like Percolation pond and Nala bund , check dam etc.,
High	14	Suitable for all major recharge structures like Nala bund , check dam etc.,
Moderate	61	Suitable for all major recharge structures like earthen check dam, Boulder check dam and Nala bund etc.,
Poor	18	Hilly/Forest /Catchment area

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

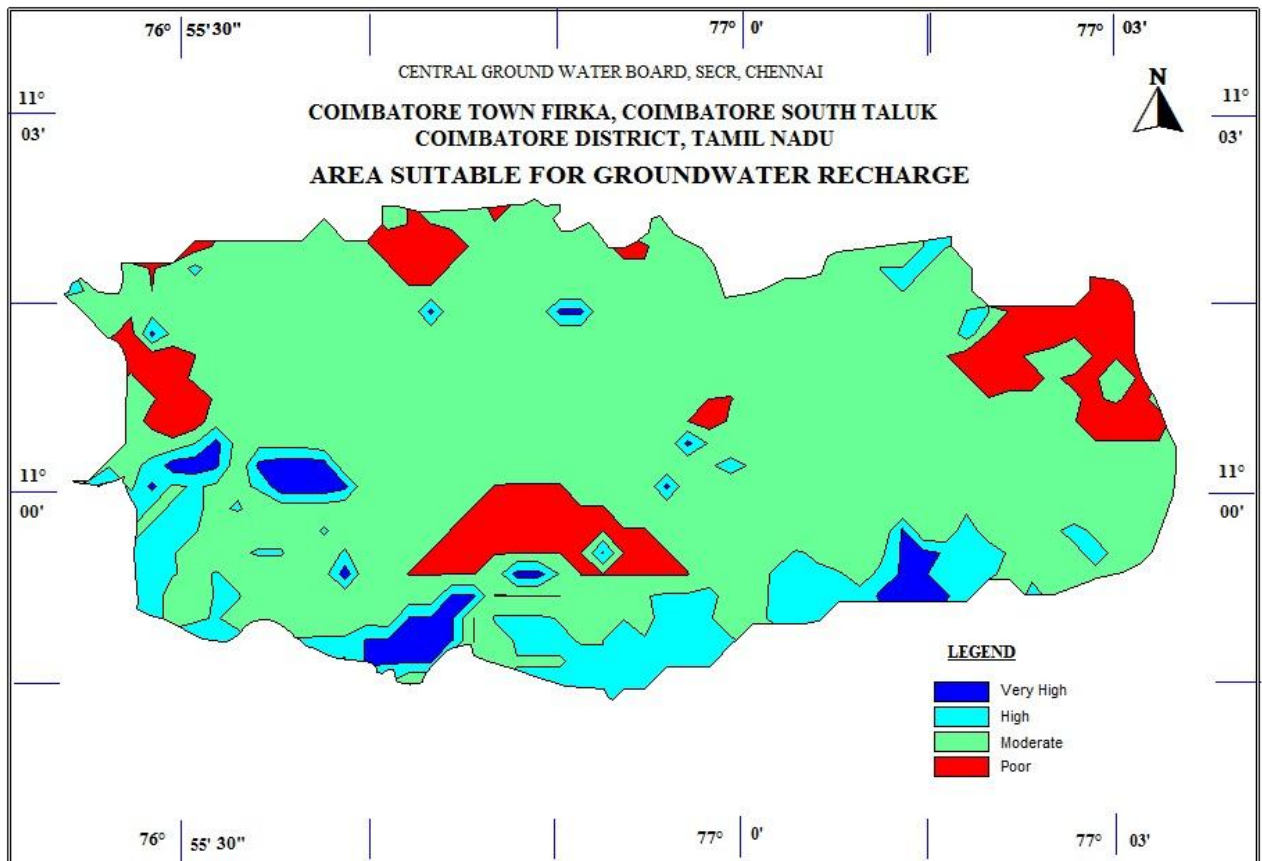


Figure 7 showing the recharge worthy area Coimbatore (South) firka

## 5. Planning for groundwater recharge /conservation

### 5.1 Justification of the artificial recharge & conservation measures

- ❖ The Coimbatore (South) Firkas is with high stage of groundwater development i.e, 201.209 % and with sufficient amount of uncommitted surface runoff/flow of 1.767662 MCM.
- ❖ The total weathered zone available beneath the ground in the firka is 180.54 MCM. Out of these total volume available for recharge (considering 7 m depth from 3 m) is 109.281 MCM.
- ❖ The Coimbatore (South) Firka consists of few surface water bodies /lakes (cover almost 3% of the total area of the firka) 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 Coimbatore (South) areas reveals that 45 % of areas are suitable for recharge.
- ❖ In Coimbatore (South) firka more than 40 % 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.
- ❖ In this firka, 40% of the area is having town and city area and hence RTRWH (Roof Top Rain Water Harvesting) may be emphasized.

## 5.2 Availability of surplus surface water for artificial recharge or conservation

The uncommitted surface flow for Coimbatore(South) 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 Coimbatore (South) Firka is 1.77 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 /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

Coimbatore (South) firka area is covered by the seasonal nallahs/drains which carry heavy discharge during monsoon period this is debauched into the water bodies within a short duration. 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 30 % of the firkas areas are suitable for these structures. It is proposed to construct 5 Check dam and 10 Nala bunds. The tentative location of these 15 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 5 Check dam in Coimbatore (South) firka

S. NO.	LATITUDE	LONGITUDE	TYPE OF ARS
1	11.0136	77.0295	Check Dam
2	10.9968	77.0448	Check Dam
3	10.9915	77.0414	Check Dam
4	10.9949	77.1157	Check Dam
5	11.0287	76.9269	Check Dam

Tentative location of proposed 10 Nalla bund in Coimbatore(South) firka

SL.NO	LATITUDE (DD)	LONGITUDE(DD)	TYPE OF ARS
1	11.0249	76.9914	Nala Bund
2	11.0258	76.9971	Nala Bund
3	11.0068	77.0089	Nala Bund
4	10.9947	77.0148	Nala Bund
5	11.0227	77.0132	Nala Bund

6	11.0329	77.0249	Nala Bund
7	10.9939	77.0385	Nala Bund
8	11.0067	77.0328	Nala Bund
9	11.026	77.0443	Nala Bund
10	11.0241	76.9282	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 11 existing ponds/tanks have been identified for the renovation with recharge shaft. The latitude and longitude of 11 ponds are given below and marked on Plate 1.

#### Tentative location of proposed de-siltation of pond/tanks with recharge shaft in Coimbatore(South) firka.

SI.NO	LATITUDE	LONGITUDE	STRUCTURE	ACTION
1	10.9902	77.0230	TANK / RESERVOIR	Desilting and recharge shaft
2	10.990	76.9702	TANK / RESERVOIR	Desilting and recharge shaft
3	11.0031	76.9400	TANK / RESERVOIR	Desilting and recharge shaft
4	11.0060	79.9940	TANK / RESERVOIR	Desilting and recharge shaft
5	10.9895	76.9455	TANK / RESERVOIR	Desilting and recharge shaft
6	11.0048	76.9269	TANK / RESERVOIR	Desilting and recharge shaft
7	11.0014	76.9886	TANK / RESERVOIR	Desilting and recharge shaft
8	10.9818	76.9567	TANK / RESERVOIR	Desilting and recharge shaft
9	11.0057	76.9300	TANK / RESERVOIR	Desilting and recharge shaft
10	11.0055	76.9262	TANK / RESERVOIR	Desilting and recharge shaft
11	11.0060	76.9202	TANK / RESERVOIR	Desilting 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

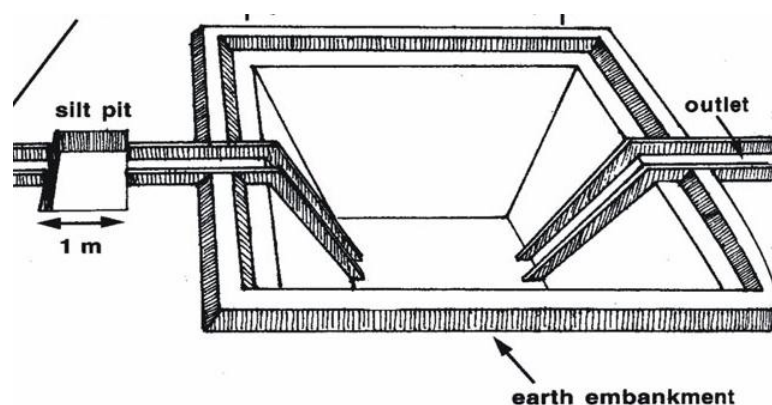


discharge excess water. The pond is surrounded by a small bund, which prevents erosion on the banks of the pond. The size and depth depend on the amount of land available, the type of soil, the farmer's water requirements, the cost of excavation, and the possible uses of the excavated earth. Water from 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 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 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. The cost estimation for this component has been taken from SOR of Agricultural Engineering Department (AED), Govt. of Tamil Nadu.

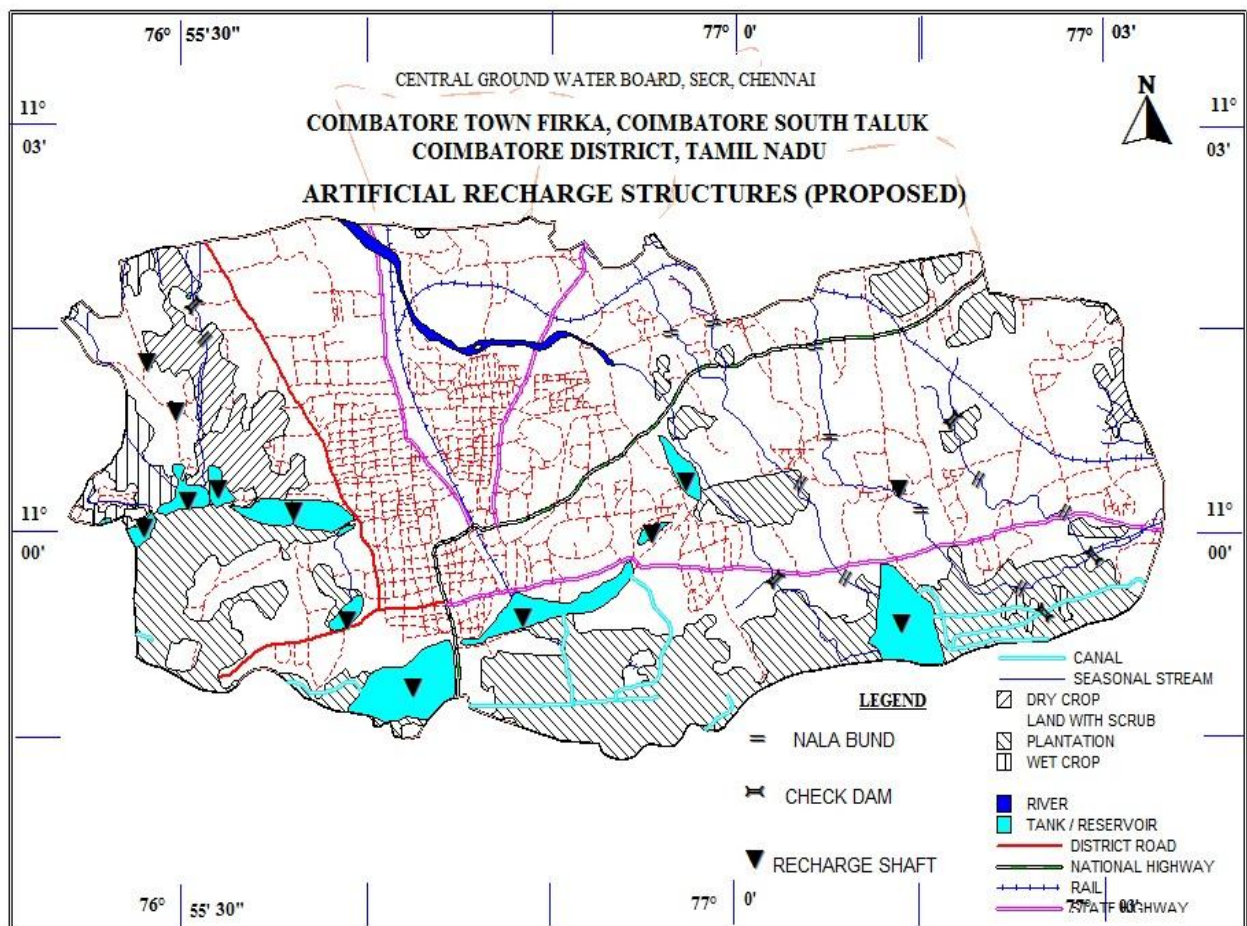


Plate 1. Location map showing the proposed AR Structures in Coimbatore (South) firka

## 6. Tentative Cost Estimation

A tentative number of feasible structures, its cost and expected annual ground water recharge /water saving is given in the table 7. The unit rates are as followed by the PWD, Govt. of Tamil Nadu (Sources : Schedule of rates , Govt. of Tamil Nadu 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)
<b>Recharge Structures/ Activities</b>						
Masonry Check dams ( 5 Fillings )	Crest- 10 -15 m; Height- 1 to 1.5 m	5	85000	9	45	68000
Nala bunds/ Gabion ( 4 Fillings)	Width: 5 to 15 m	10	30000	2.0	20	24000
Revival, repair of water bodies (3 fillings)	(~100mx100mx2.5m)	11	825000	12.0	132	660000
Recharge shaft (within pond /tank)	Recharge shaft of 1.5 m dia. with 2 m depth with filter media in lower 1 m Bore dia 10" Casing 6" Depth 30 m	11		2	22	
<b>Water Conservation Activities</b>						
Farm Pond (in ha) (5 filling)	( 30 m x 30m x 1.5 m)	100 unit	600000	1	100	510000
Sprinkler/ drip/ HDPE pipes	For 1 ha with 5 m interval HDPE pipe	100 ha	1000000	0.6 /ha	60	700000
<b>Sub total</b>					<b>379</b>	<b>1962000</b>
<b>Impact assessment and O &amp; M</b>						
Piezometers Up to 50 m bgl – 1 nos. @ 0.6 lakh					<b>0.6</b>	
Total cost of the project					<b>379.6</b>	
<b>O &amp; M - 5 % of total cost of the scheme</b>					<b>18.98</b>	
<b>Impact assessment -5 % of total cost of the scheme</b>					<b>18.98</b>	
<b>TOTAL</b>					<b>417.56</b>	

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 ground water recharge as well as effective utilisation of the artificial recharge structures.

## 7. Implementation 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 Coimbatore district 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	1 <sup>st</sup> Quarter	2 <sup>th</sup> Quarter	3 <sup>rd</sup> Quarter	4 <sup>th</sup> Quarter	5 <sup>th</sup> Quarter	6 <sup>th</sup> Quarter	7 <sup>th</sup> Quarter	8 <sup>th</sup> Quarter
❖ Identification of line department /implementing agency and preparation of DPR								
❖ Approval of scheme and release of sanction of funds								
❖ Implementation of ARS								

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

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जीविका, समृद्धि एवं खुशहाली के लिए जल संवयन करें

CONSERVE WATER FOR SUSTENANCE, PROSPERITY AND HAPPINESS

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