CHAPTER 4.1.9 GROUND WATER RESOURCES

TIRUVANNAMALAI DISTRICT

INDEX

GROUND WATER REPORT OF TIRUVANNAMALAI DISTRICT

INRODUCTION :

In Tamil Nadu, the surface water resources are fully utilized by various stake holders. The demand of water is increasing day by day. So, groundwater resources play a vital role for additional demand by farmers and Industries and domestic usage leads to rapid development of groundwater. About 63% of available groundwater resources are now being used. However, the development is not uniform all over the State, and in certain districts of Tamil Nadu, intensive groundwater development had led to declining water levels, increasing trend of Over Exploited and Critical Firkas, saline water intrusion, etc.

ADMINISTRATIVE SET UP

Thiruvannamalai District was established on 30.09.1989 by bifurcating the erstwhile North Arcot District with Thiruvannamalai as its head quarters. The Geographical extent is 6, 31,205 Hectares (6312.05 sq.km) accounting for 4.85% of the geographical area of Tamilnadu State.

The district has well laid out roads, connecting all major towns with in the State and has a railway line connecting the famous temple town of Thiruvannamalai with other districts. For administrative purpose, it has been further subdivided into six Taluks,52 Firkas and eighteen Blocks (Table 1 and Map 1) and comprises 0f 1071 villages.

Tiruvannamalai district is totally bifurcated into 52 Firkas.

1. HYDROGELOGY

(i) Major Geological formations:

Geology:

The origin, occurrence and movement of groundwater are controlled by geological setup of a terrain. Hence, a clear understanding of the sub surface geological conditions is of primary importance. Geologically, the area lying with in this district can be broadly classified into hard rock and sedimentary terrain.

a) Hard rocks

More than 95% of the area of this district is underlain by hard rock formations. These hard rock formations are predominantly occupied by gneissic rock. Charockites are prevalent in the western part, in and around Javadu hills, around central part of Tiruvannamalai block and as narrow limbs in parts of Cheyyar and Vandavasitaluks.

b) Sedimentary formations

Sedimentary formations include the transported materials by means of stream, river, wind etc., which are either loose or compact in nature. The common terminology used for such formations are alluvium which consists of sandstone, compact gravels, shales, etc., Alluvial or unconsolidated formation occur as thin and isolated patches along the river Cheyyar and also in southern portion of the river Palar. They generally consists of sand, gravel, gravelly soil, clay, etc., which are recent to sub recent (quarternary) in age.

b.1) Gondwana formations

These are semi-consolidated formations consisting of sandstone and shale.

Drilling of boreholes:

Thorough knowledge of the sub-surface geological framework is absolutely necessary to understand the hydrogeological condition existing with in it. To ascertain the sub-surface geological and aquifers parameters , boreholes are drilled in this district by State Ground and Surface Water Resources Data Centre, Tharamani, Chennai.

More than 140 bore holes were drilled, spreading over the entire district, to find out the behaviour and nature of the water bearing zones. It is inferred that in Arni, Polur and Cheyyartaluks considerable thickness of weathered and jointed formations to a maximum depth of 32 meters below ground surface are existing, depending upon topography and relief.

However, in the remaining parts, the thickness of weathering is restricted to a maimum depth of 25 meters below ground level, which indicates that there is diversity in nature of the formations even within a short distance. The depth to bed rock is varying from 18 m to 42 m. Fractured zone occursin between 5 and 38 m.

Aquifer parameters:

The thickness of aquifers (weathered and jointed portion) in this district is highly erratic and varies from 18 to 32 meters below ground level. The intergranular porosity is essentially depending upon the intensity and degree of weathering and fracture development in the bed rock. It is noted that thickness if weathering is more in gnessic formation and moderate in chrnockite formation. The range of aquifer parameters in hard rock region is given below.

Aquifer Characteristics

S.No.	Parameters	Range
1.	Well yield in LPM (Average pumping of 2 hrs in a day)	30 to 250
2.	Transmissivity (T) m^2/day	12 to 43
3.	Permeability (K) m/day	0.39 to 1.56

(iii) Drilling:

The drilling types are different according to the formation of the terrain. In general, DTH rigs are used in Hard rock formations for drilling a borewell at a depth ranges from 30m to 200m, according to the extension of joints, fractures, lineaments, etc in an area. In Sedimentary formations, rotary rigs with different rotors used according to the Tube well's diameter. The Bento novate clay is used in rotary rigs to avoid the collapse of the Tube well. The sedimentary tube wells are drilled up to a depth of 30m to 300m depending on the area, yield,etc. In alluvial formations, the hand rotary used for drilling tube wells ranges from 10m to 15m.In river beds, infiltration tube wells used for extraction of groundwater.

In Hard rock, the well designing is simple. The upper top soil and highly weathered zone is cased with PVC pipe and the remaining weathered, Fissured, Jointed portion is left as it is. In Tiruvannamalai District, the weathered zone ranges from 1.0m to 12.0m. In Granitic gneiss area, the highly weathered portion will be more up to 15m but in charnockite area, the weathered zone will extend up to 8.0m to 10.m

only. In Sedimentary area, the well construction depends on the occurrence of sand thickness in the referred area. The logger is also used in the construction to identify the area of good quality of water.

2. GROUNDWATER REGIME MONITORING:

(i) Notes on existing water level scenario:

The water level is being monitored by State Ground & Surface Water Resources Data Centre from 1971 onwards from a network of 1746 observation wells (shallow open wells) located all over the State. The water level readings are observed in the first week of every month by the field officers. In Tiruvannamalai District,224 observation wells and 61 piezometers,totally 285 wells are monitoring on Monthly basis. The Central Ground Water Board also monitors the water level from 900 numbers of wells spread all over the State. They observe water level four times in a year. (i.e January, May, August and November). The collected water level data are uploaded in GWDES software and database is maintained regularly for analysing the water level trend with rainfall. From the Monitoring network of wells, the selected representative wells are taken for Resource Estimation computations.

In Tiruvannamalai District, during the pre monsoon, the water level generally in declining trend ranges from G.L. to 15m. The depth of well below GroundLevel 12.0m are become dry during hot season like May, June, July. In the post monsoon, the water level generally in upward trend due to rainfall and it may reach the Ground Level also. The water level trend maps for pre and post monsoons are included as Annexure- I & II.

(ii) Long term trend of water level:

The long term fluctuations of water levels range from G.L. to 14.0m in many parts of the Tiruvannamalai District. The analysis reveals that the water level has gone down in the north, west and central parts of the Tiruvannamalai District. The inference taken from the annual fluctuation is due to lack of rainfall which in turn affects the groundwater levels in phreatic aquifer. The seasonal fluctuation study reveals that due to necessity for development of ground water for different sectored needs and due to failure of monsoons, the water level has gone down. The hydrograph of observation wells water level trend from 2005 to 2017 enclosed as Annexure – III and water level

trend from 2000 to 2017 of Piezometers enclosed as Annexure – IV for Tiruvannamalai District.

(iii) Existing network of Monitoring wells:

In Tiruvannamalai District, the existing network of monitoring wells is 285 wells, 224 wells are observation wells and 61 wells are piezometers. These wells are observed for every month water level.

Thiruvannamalai District Observation Wells - Location and Co-ordinates

Well No	District	Tahsil / Taluk	Block / Mandal	Village	Latitude	Longitude
23001	Thiruvannamalai	Thiruvannamalai	Thiruvannamalai	Thandarai	12°07'15"	79°09'27"
23002	Thiruvannamalai			Varagur	12°08'00"	79°02'00"
23003	Thiruvannamalai	Chengam	Thandarampattu	Olagalapadi	12°08'45"	78°55'00"
23006	Thiruvannamalai	Chengam	Kilpennathur	Sorapanandal	12°14'20"	78°52'20"
23007	Thiruvannamalai	Chengam	Chengam	Melchengam	12°16'20"	78°43'30"
23008	Thiruvannamalai	Thiruvannamalai	Thurinjapuram	Nayadimangalam	12°24'18"	79°06'06"
23008A	Thiruvannamalai	Thiruvannamalai	Thiruvannamalai	Muniappanthangal	12°24'10"	79°06'00"
23009	Thiruvannamalai	Thiruvannamalai	Thurinjapuram	Sirugalambadi	12°23'48"	79°02'42"
23010	Thiruvannamalai	Chengam	Pudupalayam	Pudupalayam	12°21'30"	78°52'30"
23011AA	Thiruvannamalai	Vandavasi	Thellar	Thellar	12°24'00"	79°33'00"
23012	Thiruvannamalai	Vandavasi	Thellar	Kodiyalam	12°23'00"	79°34'20"
23013	Thiruvannamalai	Vandavasi	Thellar	Desur	12°28'00"	79°28'00"
23014	Thiruvannamalai	Vandavasi	Vandavasi	Tennangur	12°34'00"	79°38'00"
23015	Thiruvannamalai	Vandavasi	Peranamallur	Vishamangalam	12°34'00"	79°30'00"
23016	Thiruvannamalai	Vandavasi	Peranamallur	Gangapuram	12°34'00"	79°18'00"
23017	Thiruvannamalai	Polur	Polur	Murugapadi	12°03'00"	79°10'00"

23019	Thiruvannamalai	Cheyyar	Anakkavur	Koolamandal	12°39'00"	79°40'00"
23020	Thiruvannamalai	Cheyyar	Cheyyar	Thandarai	12°39'00"	79°30'00"
23021	Thiruvannamalai	Arni	Arni	Hariharan Colony	12°41'00"	79°18'00"
23022	Thiruvannamalai	Arni	Arani west	Vannakulam	12°40'00"	79°10'00"
23024	Thiruvannamalai	Cheyyar	Arani west	Valavanur	12°48'00"	79°30'00"
23037	Thiruvannamalai	Chengam	Thandarampattu	Perungalathur	12°02'45"	78°55'00"
23038	Thiruvannamalai	Thiruvannamalai	Tiruvannamalai	Thatchampattu	12°07'30"	79°06'55"
23039	Thiruvannamalai	Chengam	Thandarampattu	Thanipadi	12°06'45"	78°50'00"
23040	Thiruvannamalai	Chengam	Chengam	Pachal	12°17'38"	78°57'26"
23041	Thiruvannamalai	Thiruvannamalai	Thurinjapuram	Mangalam	12°19'45"	79°11'05"
23054	Thiruvannamalai	Cheyyar	Anakkavur	Echur	12°33'18"	79°34'01"
23055	Thiruvannamalai	Cheyyar	Anakkavur	Sengadu	12°36'10"	79°30'21"
23056	Thiruvannamalai	Cheyyar	Cheyyar	Thirumani	12°36'20"	79°21'36"
23057	Thiruvannamalai	Cheyyar	Cheyyar	Palli	12°42'03"	79°35'46"
23058	Thiruvannamalai	Cheyyar	Vembakkam	Dusi	12°46'20"	79°40'43"
23059	Thiruvannamalai	Cheyyar	Vembakkam	Sumangali	12°45'00"	79°34'00"
23060	Thiruvannamalai	Cheyyar	Vembakkam	Moranam	12°45'20"	79°29'00"
23061	Thiruvannamalai	Vandavasi	Vandavasi	Marudhadu	12°30'21"	79°40'00"
23062	Thiruvannamalai	Vandavasi	Vandavasi	Salavedu	12°29'00"	79°43'56"
23063	Thiruvannamalai	Vandavasi	Vandavasi	Amudur	12°23'40"	79°40'21"
23064	Thiruvannamalai	Vandavasi	Peranamallur	Nedungunam	12°28'07"	79°23'13"
23065	Thiruvannamalai	Vandavasi	Peranamallur	Peranamallur	12°34'17"	79°25'59"
23066	Thiruvannamalai	Arni	Arni	Nesal	12°37'20"	79°03'20"

23067	Thiruvannamalai	Arni	Arani west	Thatchur	12°34'50"	79°16'23"
23068	Thiruvannamalai	Arni	Arani west	Kamakurpalayam	12°39'19"	79°15'38"
23069	Thiruvannamalai	Arni	Arni	Velleri	12°43'30"	79°18'42"
23070	Thiruvannamalai	Arni	Arni	Mullandram	12°46'40"	79°14'13"
23077	Thiruvannamalai	Arni	Arani west	Puthur	12°42'09"	79°13'58"
23094	Thiruvannamalai	Polur	Polur	Athuvampadi	12°35'45"	79°07'10"
23095	Thiruvannamalai	Polur	Polur	Santhavasal	12°38'30"	79°11'45"
23096	Thiruvannamalai	Polur	Polur	Padavedu	12°25'30"	79°11'45"
23098	Thiruvannamalai	Polur	Kalasapakkam	Kadaladi	12°24'15"	78°58'10"
23099	Thiruvannamalai	Polur	Kalasapakkam	Padagam	12°25'30"	79°11'45"
23100	Thiruvannamalai	Polur	Chetpet	Chetpet	12°27'45"	79°21'15"
23101	Thiruvannamalai	Polur	Chetpet	Authurai	12°28'10"	79°14'45"
23102	Thiruvannamalai	Polur	Chetpet	Vadamathimangalam	12°34'50"	79°11'45"
23103	Thiruvannamalai	Polur	Chetpet	Othalavadi	12°32'50"	79°15'00"
23104	Thiruvannamalai	Chengam	Chengam	Melchengam Farm 1	12°16'00"	79°42'30"
23105	Thiruvannamalai	Chengam	Chengam	Chengam Farm 2	12°16'20"	78°43'10"
23110	Thiruvannamalai	Thiruvannamalai	Kilpennathur	Aiyenkunam	12°16'05"	79°09'2 "
23111	Thiruvannamalai	Thiruvannamalai	Kilpennathur	Keekalur	12°18'34"	79°16'34"
23112	Thiruvannamalai	Thiruvannamalai	Kilpennathur	Polagunam	12°12'00"	79°09'20"
23113	Thiruvannamalai	Chengam	Pudupalayam	Periyakulam	12°19'30"	78°59'50"
23114	Thiruvannamalai	Chengam	Pudupalayam	Adivaram	12°23'20"	78°53'10"
23115	Thiruvannamalai	Chengam	Chengam	Alaputhur	12°20'25"	78°45'25"

23116	Thiruvannamalai	Chengam	Chengam	Kuppanatham	12°23'20"	78°46'00"
23117	Thiruvannamalai	Chengam	Chengam	Sennasamudram	12°18'20"	28°44'54"
23118	Thiruvannamalai	Chengam	Chengam	Melravandavadi	12°12'15"	78°42'20"
23119	Thiruvannamalai	Chengam	Chengam	Neepathurai	12°09'40"	78°39'00"
23120	Thiruvannamalai	Chengam	Thandarampattu	Malaiyanur Chakkadi	12°05'05"	78°46'25"
23121	Thiruvannamalai	Chengam	Pudupalayam	Melmudiyanur	12°17'40"	78°53'10"
23122	Thiruvannamalai	Chengam	Thandarampattu	Kootaru	12°04'54"	78°45'38"
23123	Thiruvannamalai	Chengam	Thandarampattu	Pudur Chakkadi	12°03'20"	78°50'25"
23124	Thiruvannamalai	Chengam	Thandarampattu	Pudur Chakkadi	12°06'12"	78°55'05"
23125	Thiruvannamalai	Polur	Chetpet	Karapudi	12°31'30"	79°08'55"
23126	Thiruvannamalai	Polur	Polur	Mampattu	12°30'35"	79°05'30"
23127	Thiruvannamalai	Polur	Polur	Ganesapuram	12°32'15"	79°04'15"
23130	Thiruvannamalai	Polur	Kalasapakkam	Siruvallur	12°27'45"	79°01'20"
23131	Thiruvannamalai	Chengam	Thandarampattu	Rayandapuram	12°05'25"	78°56'05"
23132	Thiruvannamalai	Polur	Kalasapakkam	Kalasapakkam	12°26'00"	79°06'32"
23133	Thiruvannamalai	Polur	Kalasapakkam	Pillur	12°25'55"	79°05'50"
23138	Thiruvannamalai	Thiruvannamalai	Tiruvannamalai	Malappambadi	12°14'30"	79°07'05"
23139	Thiruvannamalai	Thiruvannamalai	Thurinjapuram	Kunnumurunji	12°16'04"	79°05'40"
23140	Thiruvannamalai	Thiruvannamalai	Thurinjapuram	Kariandal	12°17'45"	79°03'25"
23141	Thiruvannamalai	Thiruvannamalai	Thurinjapuram	Pichanandal	12°18'55"	79°03'20"
23143	Thiruvannamalai	Thiruvannamalai	Thurinjapuram	Mallavadi	12°19'35"	79°04'30"
A 23008	Thiruvannamalai			Arni - Pwd Office	12°13'22"	79°03'28"

A 23009	Thiruvannamalai			Cheyyar Municipality	12°39'43"	79°32'36"
A 23010	Thiruvannamalai	Vandavasi	Thellar	Vandavasi	12°30'24"	79°36'14"
A 23011	Thiruvannamalai	Vandavasi	Thellar	Thellar	12°24'04"	79°33'05"
A 23011 A	Thiruvannamalai			Thellar	12°24'04"	79°33'05"
A 23019	Thiruvannamalai			Kannamangalam	12°45'08"	79°08'52"
A 23035	Thiruvannamalai			Arni Bdo Office	12°40'23"	79°16'58"
A 23036	Thiruvannamalai			Cheyyar G.b.h.school	12°39'45"	79°32'31"
A23008	Thiruvannamalai	Arni	Arni	Arni - Pwd Office	12°41'00"	79°17'00"
A23009	Thiruvannamalai	Cheyyar	Cheyyar	Cheyyar Municipality	12°39'57"	79°32'27"
A23010	Thiruvannamalai	Vandavasi	Thellar	Vandavasi	12°30'24"	79°36'14"
A23011	Thiruvannamalai	Vandavasi	Thellar	Thellar	12°24'04"	79°33'05"
A23012	Thiruvannamalai	Thiruvannamalai	Kilpennathur	Kilpennathur	12°14'40"	79°13'40"
A23013	Thiruvannamalai	Thiruvannamalai	Kilpennathur	Vettavalam	12°06'33"	79°14'37"
A23014	Thiruvannamalai	Thiruvannamalai	Thiruvannamala	Thiruvannamalai	12°13'31"	79°04'28"
A23015	Thiruvannamalai	Chengam	Thandarampattu	Thandarampattu	12°09'10"	78°56'50"
A23016	Thiruvannamalai	Chengam	Chengam	Chengam	12°18'56"	78°57'40"
A23018	Thiruvannamalai	Polur	Polur	Polur	12°30'44"	79°07'42"
A23019	Thiruvannamalai	Arni	Arni	Kannamangalam	12°43'00"	79°10'00"
A23035	Thiruvannamalai	Arni	Arni	Arni Bdo Office	12°40'00"	79°17'30"
A23036	Thiruvannamalai	Cheyyar	Cheyyar	Cheyyar G.b.h.school	12°39'45"	79°32'31"
hp21636	Thiruvannamalai	Chengam	Chengam	Paramandal	12°21'30"	78°46'00"

MCR01001	Thiruvannamalai	Chengam	Pudupalyam	Mashar	12°21'49"	79°01'01"
MCR01002	Thiruvannamalai	Chengam	Pudupalayam	Nayampadi Mottur	12°22'58"	79°00'23"
MCR01003	Thiruvannamalai	Chengam	Pudupalayam	Nandhimangalam	12°21'37"	78°55'53"
MCR01004	Thiruvannamalai	Chengam	Pudupalayam	G.N.palayam	12°22'04"	78°52'52"
MCR01005	Thiruvannamalai	Chengam	Pudupalayam	Viranandhal	12°22'15"	78°52'56"
MCR01006	Thiruvannamalai	Chengam	Pudupalayam	Pudurchengam	12°20'38"	78°51'26"
MCR01007	Thiruvannamalai	Chengam	Pudupalayam	Munnurmangalam	12°20'01"	78°50'00"
MCR01008	Thiruvannamalai	Chengam	Pudupalayam	Melpulithiyur	12°17'10"	78°46'39"
MCR01009	Thiruvannamalai	Chengam	Chengam	Valaiyampattu	12°19'17"	78°45'30"
MCR01010	Thiruvannamalai	Chengam	Chengam	Anandavadi	12°15'23"	78°39'56"
MCR01011	Thiruvannamalai	Chengam	Chengam	Melravandavadi	12°12'01"	78°42'26"
MCR01012	Thiruvannamalai	Chengam	Chengam	Elangunni	12°08'20"	78°40'24"
MCR01013	Thiruvannamalai	Chengam	Chengam	Puliyampatti	12°08'43"	78°42'35"
MCR01014	Thiruvannamalai	Chengam	Chengam	Karungalipadipatti	12°10'20"	78°43'48"
MCR01015	Thiruvannamalai	Chengam	Chengam	Kariyamangalam	12°16'59"	78°49'53"
MCR01016	Thiruvannamalai	Chengam	Chengam	Kottakulam	12°17'00"	78°50'45"
MCR01017	Thiruvannamalai	Chengam	Chengam	Eraiyur	12°17'26"	78°54'05"
MCR01018	Thiruvannamalai	Chengam	Chengam	Vinnavanur	12°14'51"	78°55'25"
MCR01019	Thiruvannamalai	Chengam	Chengam	Chinnakolapadi	12°15'32"	78°59'12"
MCR01020	Thiruvannamalai	Thandarampattu	Thandarampattu	Seranthangal	12°12'42"	78°58'41"
MCR01021	Thiruvannamalai	Thandarampattu	Thandarampattu	Kilvanakkambadi	12°11'04"	78°57'48"
MCR01022	Thiruvannamalai	Thandarampattu	Thandarampattu	Veeranam	12°11'18"	78°54'25"

MCR01023	Thiruvannamalai	Thandarampattu	Thandarampattu	Sathanur	12°12'07"	78°53'38"
MCR01024	Thiruvannamalai	Thandarampattu	Thandarampattu	Thenmudiyanur	12°07'50"	78°57'00"
MCR01025	Thiruvannamalai	Thandarampattu	Thandarampattu	Thiruvadathanur	12°07'17"	78°53'30"
MCR01026	Thiruvannamalai	Thandarampattu	Thandarampattu	Kolamanjanur	12°07'37"	78°53'21"
MCR01027	Thiruvannamalai	Thandarampattu	Thandarampattu	Malamanjanur	12°07'15"	78°52'18"
MCR01028	Thiruvannamalai	Thandarampattu	Thandarampattu	Veppurchekkadi	12°09'08"	78°49'10"
MCR01029	Thiruvannamalai	Thandarampattu	Thandarampattu	Veppurchekkadi	12°09'16"	78°49'09"
MCR01030	Thiruvannamalai	Thandarampattu	Thandarampattu	Kuperapattinam	12°04'38"	78°45'09"
MCR01031	Thiruvannamalai	Thandarampattu	Thandarampattu	Mothakkal	12°05'00"	78°44'17"
MCR01032	Thiruvannamalai	Thandarampattu	Thandarampattu	Melpachar	12°06'04"	78°44'42"
MCR01033	Thiruvannamalai	Thandarampattu	Thandarmpattu	Chinniyampettai	12°05'25"	78°48'41"
MCR01034	Thiruvannamalai	Thandarampattu	Thandarampattu	Udayarkuppam	12°03'11"	78°48'25"
MCR01035	Thiruvannamalai	Thandarampattu	Thandarampattu	Puliyampatti	12°02'28"	78°48'24"
MCR01036	Thiruvannamalai	Thandarampattu	Thandarampattu	Ayothiyanagar	12°04'50"	78°52'55"
MCR01037	Thiruvannamalai	Thandarampattu	Thandarampattu	Saidapettai	12°05'16"	78°53'30"
MCR01038	Thiruvannamalai	Thandarampattu	Thandarampattu	Kungilinatham	12°05'27"	79°00'40"
MCR01039	Thiruvannamalai	Thiruvannamalai	Thiruvannamalai	Su.valavetti	12°04'15"	79°05'26"
MCR01040	Thiruvannamalai	Thiruvannamalai	Thiruvannamalai	Kattampoondi	12°06'48"	79°05'16"
MCR01041	Thiruvannamalai	Thiruvannamalai	Kilpennathur	Konalur	12°09'53"	79°09'28"
MCR01042	Thiruvannamalai	Thiruvannamalai	Thiruvannamalai	Nallavanpalayam	12°11'54"	79°02'56"
MCR01043	Thiruvannamalai	Thiruvannamalai	Thiruvannamalai	Annanadhal	12°04'32"	79°10'27"
MCR01044	Thiruvannamalai	Thiruvannamalai	Tiruvannamalai	Kilkaripur	12°08'23"	79°11'27"
MCR01045	Thiruvannamalai	Thiruvannamalai	Kilpennathur	Naraiyur	12°05'06"	79°12'25"

MCR01046	Thiruvannamalai	Thiruvannamalai	Kilpennathur	Chinnaolapadi	12°06'39"	79°12'38"
MCR01047	Thiruvannamalai	Thiruvannamalai	Kilpennathur	Somasipadi	12°06'48"	79°05'16"
MCR01048	Thiruvannamalai	Thiruvannamalai	Thurinjapuram	Nukkampadi	12°10'29"	79°07'51"
MCR01049	Thiruvannamalai	Thiruvannamalai	Thurinjapuram	Kariyandal	12°22'12"	79°05'29"
MCR01050	Thiruvannamalai	Thiruvannamalai	Thurinjapuram	Arpakkam	12°21'59"	79°11'07"
MCR01051	Thiruvannamalai	Thiruvannamalai	Kilpennathur	Ingunam	12°16'03"	79°09'32"
MCR01052	Thiruvannamalai	Thiruvannamalai	Kilpennathur	Kolathur	12°10'29"	79°12'06"
MCR01053	Thiruvannamalai	Thiruvannamalai	Kilpennathur	Rajanthangal	12°09'03"	79°11'18"
MCR01054	Thiruvannamalai	Thiruvannamalai	Thurinjapuram	Salayanur	12°25'31"	79°07'25"
MCR01055	Thiruvannamalai	Polur	Kalasapakkam	Thenpallipattu	12°24'29"	79°06'22"
MCR01056	Thiruvannamalai	Polur	Chetpet	Chetpat	12°27'53"	79°20'37"
MCR01057	Thiruvannamalai	Polur	Chetpet	Thachampadi	12°28'31"	79°16'02"
MCR01058	Thiruvannamalai	Polur	Chetpet	Peranampakkam	12°27'33"	79°12'54"
MCR01059	Thiruvannamalai	Polur	Chetpet	Pelasur	12°27'40"	79°09'07"
MCR01060	Thiruvannamalai	Polur	Chetpet	Mandakolathur	12°31'17"	79°11'40"
MCR01061	Thiruvannamalai	Polur	Chetpet	Modaiyur	12°30'13"	79°13'32"
MCR01062	Thiruvannamalai	Polur	Polur	Kasthambadi	12°36'52"	79°12'22"
MCR01063	Thiruvannamalai	Polur	Polur	Thirumalai	12°33'13"	79°12'46"
MCR01064	Thiruvannamalai	Polur	Polur	Ettivadi	12°34'12"	79°10'12"
MCR01065	Thiruvannamalai	Polur	Polur	Potrharai	12°33'56"	79°07'09"
MCR01066	Thiruvannamalai	Polur	Polur	Potharai	12°34'17"	79°07'25"
MCR01067	Thiruvannamalai	Polur	Polur	Vasur	12°29'05"	79°07'30"
MCR01068	Thiruvannamalai	Polur	Kalasapakkam	Thennagaram	12°23'54"	79°02'15"

MCR01069	Thiruvannamalai	Polur	Kalasapakkam	Kilpalur	12°23'38"	78°56'49"
MCR01070	Thiruvannamalai	Polur	Kalasapakkam	Vadakarainammiyandal	12°27'53"	78°57'05"
MCR01071	Thiruvannamalai	Polur	Kalasapakkam	Vadakarainammiyandal	12°27'50"	78°56'54"
MCR01072	Thiruvannamalai	Polur	Kalasapakkam	Sengaputheri	12°28'04"	79°01'50"
MCR01073	Thiruvannamalai	Polur	Kalasapakkam	Seenandal	12°28'29"	78°58'52"
MCR01074	Thiruvannamalai	Polur	Jawvathu hills	Puliyur	12°28'24"	78°49'54"
MCR01075	Thiruvannamalai	Polur	Jawvathu hills	Palakanur	12°29'35"	78°50'03"
MCR01076	Thiruvannamalai	Polur	Jawvathu hills	Kalyanamandhai	12°32'40"	78°51'32"
MCR01077	Thiruvannamalai	Polur	Jawvathu hills	Palamarathur	12°33'17"	78°51'44"
MCR01078	Thiruvannamalai	Polur	Polur	Pushpagiri	12°38'24"	79°08'59"
MCR01079	Thiruvannamalai	Polur	Jawvadhu hills	Thumpakaddu	12°33'16"	79°01'48"
MCR01080	Thiruvannamalai	Polur	Jawvathu hills	Thumpakaddu	12°33'29"	79°01'53"
MCR01081	Thiruvannamalai	Polur	Polur	Sandhavasal	12°38'41"	79°09'48"
MCR01082	Thiruvannamalai	Polur	Polur	Chinnaiyampalayam	12°41'26"	79°10'11"
MCR01083	Thiruvannamalai	Polur	Jawvathu hills	Puthur	12°39'32"	78°58'45"
MCR01084	Thiruvannamalai	Polur	Jawvathu hills	Mutnattur	12°39'35"	78°59'58"
MCR01085	Thiruvannamalai	Polur	Jawvathu hills	Kovilur	12°33'00"	78°55'49"
MCR01086	Thiruvannamalai	Polur	Jawvathu hills	Vedanthoppu	12°33'07"	78°55'49"
MCR01087	Thiruvannamalai	Polur	Jawvathu hills	Kuniyanthur	12°36'16"	78°53'53"
MCR01088	Thiruvannamalai	Polur	Jawvathu hills	Kanaganeri	12°36'42"	78°54'19"
MCR02001	Thiruvannamalai	Vandavasi	Vandavas	Ariyathur	12°32'23"	79°40'16"
MCR02002	Thiruvannamalai	Vandavasi	Vandavasi	Kilpakkam	12°31'15"	79°42'08"

MCR02003	Thiruvannamalai	Vandavasi	Vandavasi	Kavedu	12°30'16"	79°12'33"
MCR02004	Thiruvannamalai	Vandavasi	Vandavasi	Aarasur	12°30'56"	79°32'44"
MCR02005	Thiruvannamalai	Vandavasi	Vandavasi	Sedara Kuppam	12°28'44"	79°37'52"
MCR02006	Thiruvannamalai	Vandavasi	Vandavasi	Kadaisikulam	12°29'33"	79°39'07"
MCR02007	Thiruvannamalai	Vandavasi	Vandavasi	Elangadu	12°28'01"	79°33'57"
MCR02008	Thiruvannamalai	Vandavasi	Thellar	S.kattari	12°21'11"	79°35'52"
MCR02009	Thiruvannamalai	Vandavasi	Thellar	Missnallur	12°24'30"	79°34'24"
MCR02010	Thiruvannamalai	Vandavasi	Thellar	Kilnamandi	12°23'20"	79°30'37"
MCR02011	Thiruvannamalai	Vandavasi	Thellar	Nerkunam	12°21'49"	79°29'40"
MCR02012	Thiruvannamalai	Vandavasi	Thellar	Urgudi	12°31'07"	79°30'00"
MCR02013	Thiruvannamalai	Vandavasi	Thellar	Vellam	12°30'51"	79°29'14"
MCR02014	Thiruvannamalai	Vandavasi	Thellar	Kilvelliyur	12°29'50"	79°28'18"
MCR02015	Thiruvannamalai	Vandavasi	Thellaer	Malaiyur	12°29'38"	79°28'18"
MCR02016	Thiruvannamalai	Vandavasi	Thellar	Arunthodu	12°25'16"	79°27'07"
MCR02017	Thiruvannamalai	Vandavasi	Thellar	Aliyur	12°27'24"	79°25'46"
MCR02018	Thiruvannamalai	Vandavasi	Thellar	Arasampattu	12°27'49"	79°24'22"
MCR02019	Thiruvannamalai	Vandavasi	Pernamallur	Konnamangalam	12°30'56"	79°22'17"
MCR02020	Thiruvannamalai	Vandavasi	Pernamallur	Namathodu	12°32'03"	79°22'26"
MCR02021	Thiruvannamalai	Vandavasi	Pernamallur	Kolapallur	12°33'07"	79°20'51"
MCR02022	Thiruvannamalai	Vandavasi	Pernamallur	Vinnamangalam	12°35'04"	29°18'04"
MCR02023	Thiruvannamalai	Vandavasi	Pernamallur	Sudrakatteri	12°35'29"	79°21'31"
MCR02024	Thiruvannamalai	Arani	Arani	Kilnayakenpalayam	12°36'41"	79°16'31"
MCR02025	Thiruvannamalai	Arani	Arani	Ratinamangalam	12°41'38"	79°16'51"

MCR02026	Thiruvannamalai	Arani	Arani	Pakirithakka	12°41'34"	79°17'47"
MCR02027	Thiruvannamalai	Arani	Arani	Kunnathur	12°41'25"	79°39'46"
MCR02028	Thiruvannamalai	Arani	Arani	Seevur	12°41'08"	79°16'33"
MCR02029	Thiruvannamalai	Arani	Arani	Alagusenai	12°43'53"	79°09'16"
MCR02029.	Thiruvannamalai	Arani	Arani	Alagusenai	12°43'53"	79°09'16"
MCR02030	Thiruvannamalai	Cheyyar	Vembakkam	Vembakkam	12°47'04"	79°35'46"
MCR02031	Thiruvannamalai	Cheyyar	Vembakkam	Thirupangadu	12°47'31"	79°36'45"
MCR02032	Thiruvannamalai	Cheyyar	Vembakkam	Perungattur	12°44'57"	79°32'27"
MCR02033	Thiruvannamalai	Cheyyar	Vembakkam	Thiruppanamur	12°45'54"	79°35'12"
MCR02034	Thiruvannamalai	Cheyyar	Vembakkam	Bokkasamuthiram	12°48'10"	79°40'16"
MCR02035	Thiruvannamalai	Cheyyar	Vembakkam	Bokkasamuthiram	12°48'35"	79°31'26"
MCR02036	Thiruvannamalai	Cheyyar	Vembakkam	Mamandur	12°45'36"	79°40'38"
MCR02037	Thiruvannamalai	Cheyyar	Vembakkam	Sellaperumbullimedu	12°43'21"	79°38'58"
MCR02038	Thiruvannamalai	Cheyyar	Vembakkam	Asanamapettai	12°44'27"	79°31'19"
MCR02039	Thiruvannamalai	Cheyyar	Annakkavur	Thenilluppai	12°35'06"	79°36'03"
MCR02040	Thiruvannamalai	Cheyyar	Annakkavur	Veerambakkam	12°34'58"	79°37'25"
MCR02041	Thiruvannamalai	Cheyyar	Annakkavur	Annakkavur	12°38'08"	79°33'16"
MCR02042	Thiruvannamalai	Cheyyar	Annakkavur	Annakkavur	12°38'10"	79°32'45"
MCR02043	Thiruvannamalai	Cheyyar	Annakkavur	Vinayagapuram	12°37'11"	79°33'49"
MCR02044	Thiruvannamalai	Cheyyar	Annakkavur	Arasur	12°36'04"	79°33'42"
MCR02045	Thiruvannamalai	Cheyyar	Annakkavur	Cheyatriventran	12°39'17"	79°30'27"
MCR02046	Thiruvannamalai	Cheyyar	Annakkavur	Cheyatriventran	12°39'21"	79°30'39"

MCR02047	Thiruvannamalai	Cheyyar	Annakkavur	Irungal	12°30'37"	79°30'31"
MCR02048	Thiruvannamalai	Cheyyar	Annakkavur	Mangal	12°42'47"	79°40'05"
MCR02049	Thiruvannamalai	Cheyyar	Cheyyar	Perungalathur	12°41'16"	79°34'43"
MCR02050	Thiruvannamalai	Cheyyar	Cheyyar	Thulli	12°41'58"	79°31'53"
MCR02051	Thiruvannamalai	Cheyyar	Cheyyar	Pappanthangal	12°42'34"	79°31'20"
MCR02052	Thiruvannamalai	Cheyyar	Cheyyar	Kaduganur	12°38'22"	79°25'17"
MCR02053	Thiruvannamalai	Cheyyar	Cheyyar	Melmattai	12°36'41"	79°25'54"
MCR02054	Thiruvannamalai	Cheyyar	Cheyyar	Tholupedu	12°39'33"	79°27'16"

Thiruvannamalai District - Piezometers - Location and Co-ordinates

Well no	District	Tashil/Taluk	Block/Mandal	Village	Latitude	Longitude
HP 21404	Tiruvannamalai	Vembakkam	Vembakkam	Dusi Ayyangarkulam	12.759722	79.680556
hp A21562	Tiruvannamalai	Chengam	Pudupalayam	Vasudevampattu	12.320833	79.933333
HP21372	Tiruvannamalai	Tiruvannamalai	Tiruvannamalai	Kilnachipattu	12.239444	79.106389
HP21513	Tiruvannamalai	Tiruvannamalai	Thurinjapuram	Kunnumurinji	12.275000	79.097222
HP21514	Tiruvannamalai	Tiruvannamalai	Thurinjapuram	Kolakkaravadi	12.333333	79.050000
HP21515	Tiruvannamalai	Kilpennathur	Kilpennathur	Kilpennathur	12.241667	79.229167
HP21516	Tiruvannamalai	Kilpennathur	Kilpennathur	Thandarai	12.120833	79.150000
HP21517	Tiruvannamalai	Chengam	Chengam	Melchengam	12.269444	78.725000
HP21518	Tiruvannamalai	Chengam	Chengam	Sorpanandal	12.238889	78.875000
HP21519	Tiruvannamalai	Polur	Polur	Kidampalayam	12.475000	78.988889
HP21520	Tiruvannamalai	Kalasapakkam	Kalasapakkam	Veeralur	12.468056	78.940278
HP21521	Tiruvannamalai	Polur	Polur	Athuvambadi	12.597222	79.126389
HP21521A	Tiruvannamalai	Polur	Polur	Athuvambadi	12.597222	79.126389
HP21522	Tiruvannamalai	Polur	Polur	Venmani	12.508333	79.147222
HP21523	Tiruvannamalai	Arani	West arani	Kannamangalam	12.745833	79.155556
HP21524	Tiruvannamalai	Arani	West arani	Somanthangal	12.713889	79.212500
HP21524A	Tiruvannamalai	Arani	West arni	Somanthangal	12.713333	79.213056
HP21525	Tiruvannamalai	Cheyyar	Annakkavur	Koolamandal	12.683333	79.663889
HP21525A	Tiruvannamalai	Cheyyar	Annakkavur	Koolamandal	12.682778	79.665000
HP21559	Tiruvannamalai	Tiruvannamalai	Tiruvannamalai	Nachanandal	12.145833	79.047222
HP21560	Tiruvannamalai	Tiruvannamalai	Tiruvannamalai	Palayanur	12.069444	79.043056
HP21561	Tiruvannamalai	Thandrampattu	Thandrampattu	Thanipadi	12.108333	78.836111
HP21562	Tiruvannamalai	Chengam	Pudupalayam	Vasudevanpattu	12.320833	79.933333
HP21563	Tiruvannamalai	Kalasapakkam	Kalasapakkam	Melarani	12.455556	79.045833
HP21564	Tiruvannamalai	Kalasapakkam	Kalasapakkam	Padagam	12.425000	79.191667

HP21565	Tiruvannamalai	Tiruvannamalai	Thurinjapuram	Mangalam	12.327778	79.177778
HP21566	Tiruvannamalai	Tiruvannamalai	Thurinjapuram	Poyyandal (Budamangalam)	12.383333	79.195833
HP21567	Tiruvannamalai	Thandarampattu	Thandrampattu	Perungolathur	12.041667	78.919444
HP21568	Tiruvannamalai	Kilpennathur	Kilpennathur	Keekkalur	12.305556	79.269444
HP21569	Tiruvannamalai	Chetpet	Chetpet	Devikapuram	12.498611	79.247222
HP21569A	Tiruvannamalai	Chetpet	Chetpet	Devikapuram	12.487500	79.236389
HP21570	Tiruvannamalai	Chetpet	Chetpet	Narasingapuram	12.519444	79.258333
HP21571	Tiruvannamalai	Vandavasi	Pernamallur	Ragunathasamudram	12.508333	79.416667
HP21572	Tiruvannamalai	Vandavasi	Thellar	Melpathy	12.516667	79.511111
HP21573	Tiruvannamalai	Vandavasi	Vandavasi	Kilvillivalam	12.441667	79.625000
HP21574	Tiruvannamalai	Vandavasi	Vandavasi	Murukkeri	12.558333	79.708333
HP21575	Tiruvannamalai	Vandavasi	Thellar	Thellar	12.400000	79.554167
HP21576	Tiruvannamalai	Vandavasi	Thellar	Osur	12.437500	79.669444
HP21577A	Tiruvannamalai	Vembakkam	Cheyyar	Dusi	12.756111	79.686111
HP21578	Tiruvannamalai	Vembakkam	Vembakkam	Natteri	12.819444	79.501389
HP21579	Tiruvannamalai	Vembakkam	Vembakkam	Moranam	12.758333	79.487500
HP21580	Tiruvannamalai	Chetpet	Chetpet	Anadhimangalam	12.506944	79.361111
HP21581	Tiruvannamalai	Kalasapakkam	Kalasapakkam	Kalasapakkam	12.440833	79.112778
HP21581A	Tiruvannamalai	Cheyyar	Cheyyar	Korukkai	12.636389	79.450000
HP21582	Tiruvannamalai	Cheyyar	Cheyyar	Tirumpoondi	12.575000	79.559722
HP21583	Tiruvannamalai	Polur	Polur	Padavedu	12.647222	79.127778
HP21584	Tiruvannamalai	Arani	Arani	Vadugasathu	12.633333	79.277778
HP21587	Tiruvannamalai	Kalasapakkam	Kalasapakkam	Adamangalampusur	12.475556	78.990556
HP21634	Tiruvannamalai	Kilpennathur	Kilpennathur	lyyngunam	12.268889	79.155556
HP21635	Tiruvannamalai	Kilpennathur	Kilpennathur	Mekkalur	12.322222	79.231111
hp21637	Tiruvannamalai	Chengam	Chengam	Chennasamuthuram	12.308056	78.748611
Inv 21404	Tiruvannamalai	Vembakkam	Vembakkam	Dusi Ayyangarkulam	12.759722	79.680556
INV01001	Tiruvannamalai	Chengam	Pudupalayam	Kallaraipadi	12.361389	79.022778
INV01002	Tiruvannamalai	Chengam	Chengam	Kuilem	12.340000	78.801111
INV01003	Tiruvannamalai	Tiruvannamalai	Thiruvannamalai	Thiruvannamalai	12.520833	79.059722
INV01004	Tiruvannamalai	Kilpennathur	Kilpennathur	Kazhikulam	12.274167	79.182500
INV01005	Tiruvannamalai	Tiruvannamalai	Tiruvannamalai	Medical Collage	12.273889	79.695556
MWS21606	Tiruvannamalai	Chengam	Chengam	Chengam	12.305000	78.792222
MWS21607	Tiruvannamalai	Chengam	Chengam	Arattavadi	12.233333	78.796389
MWS21608	Tiruvannamalai	Chengam	Pudupalayam	Melmudiyanur	12.296944	78.885556
MWS21609	Tiruvannamalai	Chengam	Pudupalayam	Karapattu	12.378889	78.935278
MWS21610	Tiruvannamalai	Thandarampattu	Thandrampattu	Pudur Chekkadi	12.042222	78.828889
MWS21611	Tiruvannamalai	Chengam	Chengam	Perumbakkam	12.218056	78.994444
MWS21612	Tiruvannamalai	Polur	Polur	Munivanthangal	12.610278	79.165278
MWS21613	Tiruvannamalai	Polur	Polur	Tindivanam	12.529444	79.087222
MWS21614	Tiruvannamalai	Chetpet	Chetpet	Peranampakkam	12.456944	79.208611
MWS21615	Tiruvannamalai	Chetpet	Chetpet	Thachampadi	12.482222	79.273611
MWS21616	Tiruvannamalai	Tiruvannamalai	Thurinjapuram	Devanampattu	12.385278	79.055556
MWS21617	Tiruvannamalai	Tiruvannamalai	Thurinjapuram	Mathalampadi	12.309722	79.118611

MWS21618	Tiruvannamalai	Tiruvannamalai	Tiruvannamalai	Vengikkal	12.268333	79.072778
MWS21619	Tiruvannamalai	Tiruvannamalai	Tiruvannamalai	Thalayampallam	12.100000	79.065000
MWS21620	Tiruvannamalai	Tiruvannamalai	Tiruvannamalai	Alaganandal	12.161111	79.094444
MWS21621	Tiruvannamalai	Tiruvannamalai	Tiruvannamalai	Samukudayampattu	12.311944	79.136111
MWS21622	Tiruvannamalai	Kilpennathur	Kilpennathur	Sanipoondi	12.155556	79.197222
MWS21623	Tiruvannamalai	Kilpennathur	Kilpennathur	Anukkumalai	12.119444	79.233333
MWS21624	Tiruvannamalai	Arani	Arani	Arani Town	12.672222	79.283333
MWS21625	Tiruvannamalai	Arani	Arani	Pulavanpadi	12.613889	79.247222
MWS21626	Tiruvannamalai	Vembakkam	Vembakkam	Randam	12.783333	79.483333
MWS21627	Tiruvannamalai	Cheyyar	Cheyyar	Tirumani	12.607778	79.351389
MWS21628	Tiruvannamalai	Chetpet	Chetpet	Gengapuram	12.563056	79.322222
MWS21629	Tiruvannamalai	Vandavasi	Vandavasi	Sennavaram	12.501944	79.622222
MWS21630	Tiruvannamalai	Vandavasi	Vandavasi	Salavedu	12.481389	79.736667

(iv) Data Constraints:

The following are constraints in collecting the water level data in the field and validating the data are:

1) The water level data are collected on the monthly basis in the referred observation wells and piezometers. The collected data is not sufficient quantity for analyzing purpose due to drying of wells, Wells abounded by various reasons, lack of selecting the alternate wells, lack of open wells available for monitoring purpose due to increased usage of bore wells in the villages, Panchayats, etc. In many villages, the water supply schemes implemented by overhead tank supply or mini energised pumps and the existing open wells are not used generally by the villagers and moreover, they filled with garbage.
2) The number of bore wells should be increased for monitoring purpose.
3) The site selection of new bore wells should be based on the Geological methods.
4) Strengthening the network of monitoring wells by closing the gaps in the network.
5) Maintenance cost should be allotted to maintain the bore wells on the periodical basis to maintain the quality as well as yield.
6) Installation of Automatic water level recorders in the sensitive and more water level fluctuation in the bore wells will helpful to monitor the extensive depletion of groundwater areas.
7) Upgrading the measuring instruments will helpful to take accurate reading of water levels in the field.
8) Upgrading the soft ware will helpful to minimize the errors and increasing the accuracy of data.

9) Erecting the Telemetric water level recorders in the over exploited Firkas will helpful to monitor the over extraction of groundwater.

10) Lack of manpower and transporting vehicles are also major problems for data collection in the field in proper time.

3. DYNAMIC GROUND WATER RESOURCES:

The State Ground and Surface Water Resources Data Centre has estimated the ground water resources of Tamil Nadu periodically in co-ordination with the Central Ground Water Board, Government of India , Ministry of Water Resources, Chennai, based on the Methodology evolved by the Ground Water Resources Estimation Committee, 1997 (GEC 97).

Groundwater potential assessment is a dynamic one and not static. While assessing an area, the following factors can be considered such as Geology, Total Irrigated Area, Total Number of Wells used for Irrigation, Water Level Data for the past five years, Average Rainfall, Total Recharge, Irrigation methods adopted in the area, Cropping pattern details, Seepage factor, Specific yield, Geological conditions prevailing in that area, Recharge through Artificial recharge structures, etc.

Groundwater potential assessment proposal should be presented for approval in the Central and State Level Working Group Committees and then, presented for final approval in the Central Level Committee as well as State Level Committees.

The Ground Water Potential Assessments as on January 1992 and January 1997 were done in the State, taking the Panchayat Union Block as an Assessment Unit and the entire State **was categorized as Dark, Grey and White areas**. The Blocks with more than 85% to 100% ground water development (extraction) were categorized as “Dark Blocks” and the blocks with ground water development between 65% to 85% were categorized as “Grey Blocks” and blocks with less than 65% ground water development were categorized as “White Blocks”.

Subsequently, the **Ground Water Potential Assessment was done as on March 2003 and as on March 2009.** In these assessments, the Panchayat Union Blocks in Tamil Nadu were **categorized as Over-Exploited, Critical, Semi-**

Critical, Safe and Saline instead of Dark, Grey and White blocks. The Blocks with more than 100% extraction were categorized as “Over Exploited Blocks”, the blocks with 90% to 100% extraction as “Critical Blocks”, the blocks with 65% to 90% extraction as “Semi Critical Blocks”, the blocks with less than 65% extraction as “Safe Blocks” and the bad quality blocks were categorized as “Saline Blocks”. No schemes should be formulated in over exploited and critical blocks - “Notified Blocks – A category – (Stage of Groundwater extraction is 90% and above)”.

The re-estimation of groundwater resources in the State as on March 2011 and as on March 2013 can be assessed in Micro Level basis. In these assessments, the assessing unit is Firka (Unit of Taluk) and **categorized as Over-Exploited, Critical, Semi-Critical, Safe, and Saline Firkas.** As on March 2013 assessment, in the Tiruvannamalai District

Based on the Estimation of Ground Water Resources of Tamil Nadu State as on March 2013, Out of 1139 Firkas in the State, 358 Firkas are categorized as “Over Exploited Firkas”, 105 Firkas are categorized as “Critical Firkas”, 212 Firkas are categorized as “Semi Critical Firkas”, 429 Firkas are categorized as “Safe Firkas” and 35 Firkas are categorized as “Saline Firkas”.

When compared to last assessment as on March 2011, the “Over Exploited Firkas” comes down from 374 to 358 Firkas, the “Critical Firkas” increased from 48 to 105 Firkas, the “Semi Critical Firkas” comes down marginally from 235 to 212 Firkas, the “Safe Firkas” comes down marginally from 437 to 429 Firkas and the “Saline Firkas” remains same as 35 Firkas. The alteration of Firkas are due to the construction of Artificial Recharge structures such as Check Dams, Recharge Wells, Recharge shafts, percolation ponds; etc was constructed in the “Over Exploited Firkas” by various departments.

Methodology adopted for Estimation of Ground Water Potential :

The present methodology used for resources assessment is known as Ground Water Resource Estimation Methodology - 1997 (GEC'97) .In GEC'97, two approaches are recommended - **water level fluctuation method and norms of rainfall infiltration method**. The water level fluctuation method is based on the concept of storage change due to differences between various input and output components. Input refers to recharge from rainfall and other sources and subsurface

inflow into the unit of assessment. Output refers to ground water draft, ground water evapotranspiration, base flow to streams and subsurface outflow from the unit. Since the data on subsurface inflow / outflow are not readily available, it is advantageous to adopt the unit for ground water assessment as basin / sub basin / watershed, as the inflow / outflow across these boundaries may be taken as negligible.

In each assessment unit, hilly areas having slope more than 20% are deleted from the total area to get the area suitable for recharge. Further, areas where the quality of ground water is beyond the usable limits should be identified and handled separately. The remaining area after deleting the hilly area and separating the area with poor ground water quality is to be delineated into command and non-command areas. Ground water assessment in command and non-command areas are done separately for monsoon and non-monsoon seasons.

The rainfall recharge during monsoon season computed by Water Level Fluctuation (WLF) method is compared with recharge figures from Rainfall Infiltration Factor (RIF) method. In case the difference between the two sets of data are more than 20% then RIF figure is considered, otherwise monsoon recharge from WLF is adopted. While adopting the rainfall recharge figures, weight age is to be given to WLF method over adhoc norms method of RIF. Hence, wherever the difference between RIF & WLF is more than 20%, data have to be scrutinized and corrected accordingly.

During non-Monsoon season, rainfall recharge is computed by using Rainfall infiltration Factor (RIF) method. Recharge from other sources is then added to get total non-Monsoon recharge. In case of areas receiving less than 10% of the annual rainfall during non-monsoon season, the rainfall recharge is ignored.

The total annual ground water recharge of the area is the sum-total of monsoon and non-monsoon recharge. An allowance is kept for natural discharge in the non-monsoon season by deducting 5 to 10 % of total annual ground water recharge.

The balance ground water available accounts for existing ground water withdrawal for various uses and potential for future development. This quantity is termed as Net Ground Water Availability.

Net Ground Water Availability = Annual Ground Water Recharge - Natural discharge during non-monsoon season.

GEC'97 methodology has recommended norms for various parameters being used in ground water recharge estimation. These norms vary depending upon

water bearing formations and agroclimatic conditions. While norms for specific yield and recharge from rainfall values are to be adopted within the guidelines of GEC'97, in case of other parameters like seepage from canals, return flow from irrigation, recharge from tanks & ponds, water conservation structures, results of specific case studies may replace the adhoc norms.

The Gross yearly ground water draft is to be calculated for Irrigation, Domestic and Industrial uses. The gross ground water draft would include the ground water extraction from all existing ground water structures during monsoon as well as during non-monsoon period. While the number of ground water structures should preferably be based on latest well census, the average unit draft from different types of structures should be based on specific studies or adhoc norms given in GEC'97 report.

The stage of Ground water Development is defined by

Stage of Ground water Development (%) = Existing Gross Ground water Draft for all uses / Net annual Ground Water Availability X 100

The units of assessment are categorized for ground water development based on two criteria – a) stage of ground water development and b) long-term trend of pre and post monsoon water levels. Four categories are - Safe areas which have ground water potential for development; Semi-critical areas where cautious ground water development
is recommended; Critical areas; Over -exploited areas where there should be intensive monitoring and evaluation and future ground water development be linked with water conservation measures.

The criteria for categorization of assessment units are as follows:

S. No.	Stage of Groundwater Development	Significant Long term Decline		Categorization
		Pre-monsoon	**Post -monsoon**	
1.	<=70%	No	No	SAFE
		Yes / No	No / Yes	To be re-assessed
		Yes	Yes	To be re-assessed
2.	>70% and <=90%	No	No	To be re-assessed
		Yes / No	No / Yes	SEMI – CRITICAL
		Yes	Yes	SEMI – CRITICAL
3.	>90 and <=100%	No	No	To be re-assessed
		Yes / No	No / Yes	CRITICAL
		Yes	Yes	CRITICAL
4.	>100%	No	No	To be re-assessed
		Yes / No	No / Yes	OVER- EXPLOITED
		Yes	Yes	OVER- EXPLOITED

Note:' *To be re-assessed' means that data is to be checked and reviewed. If the ground water resources assessment and the trend of long term water levels contradict each other. This anomalous situations requires a review of the ground water resource computations, as well as the reliability of water level data.*

The long term ground water level data should preferably be for a period of 10 years. The significant water level decline may be taken in consideration between 10 to 20 cm/ year depending upon the local hydro geological conditions.

Dynamic Ground Water Resources Estimation of TamilNadu As on March 2013

District Summary

(in ha.m)

TIRUVANNAMALAI DISTRICT							
Sl.No (District))	**District**	**Net Annual Ground Water Availability**	**Existing Gross Ground Water Draft for Irrigation**	**Existing Gross Ground Water Draft for domestic and industrial water supply**	**Existing Gross Ground Water Draft for All uses (4+5)**	**Stage of Ground Water Development {(6/3)*100} %**	**No of Over Exploited Firkas**
1	**2**	**3**	**4**	**5**	**6**	**7**	**8**
1	THIRUVANNAMALAI	111,687.47	99,684.23	3,278.01	102,962.24	92	13

Firka Wise Summary

(in ha.m)

TIRUVANNAMALAI DISTRICT							
Sl.No	**Assessment Unit (Firka)**	**Net Annual Ground Water Availability**	**Existing Gross Ground Water Draft for Irrigation**	**Existing Gross Ground Water Draft for domestic and industrial water supply**	**Existing Gross Ground Water Draft for All uses (4+5)**	**Stage of Ground Water Development {(6/3)*100} %**	**Category of the Firka**
1	EGMORE - NUNGAMBAKKAM--I	80.11	-	214.52	214.52	268	OVER EXPLOITED
2	ANAKAVOOR	3,104.64	2,497.65	72.93	2,570.58	83	SEMI CRITICAL
3	ARNI	1,002.86	432.15	164.65	596.80	60	SAFE

4	CHENGAM	2,565.03	2,648.85	90.51	2,739.36	107	OVER EXPLOITED
5	CHENNAVARAM	1,834.53	1,713.08	34.62	1,747.70	95	CRITICAL
6	CHEYYAR	1,522.95	1,526.85	120.80	1,647.65	108	OVER EXPLOITED
7	DESUR	2,428.85	2,233.25	46.37	2,279.62	94	CRITICAL

TIRUVANNAMALAI DISTRICT

Sl.No	Assessment Unit (Firka)	Net Annual Ground Water Availability	Existing Gross Ground Water Draft for Irrigation	Existing Gross Ground Water Draft for domestic and industrial water supply	Existing Gross Ground Water Draft for All uses (4+5)	Stage of Ground Water Development {(6/3)*100} %	Category of the Firka
8	DUSI	1,914.32	1,567.13	57.58	1,624.71	85	SEMI CRITICAL
9	ERAIYUR	3,089.99	2,944.13	66.99	3,011.12	97	CRITICAL
10	KADALADI	1,839.80	1,499.13	54.31	1,553.43	84	SEMI CRITICAL
11	KALASAPAKKAM	2,228.92	1,895.55	67.10	1,962.65	88	SEMI CRITICAL
12	KANNAMANGALAM	1,672.72	1,389.15	63.93	1,453.08	87	SEMI CRITICAL
13	KELUR	2,001.93	1,778.85	115.32	1,894.17	95	CRITICAL
14	KETTAVARAMPALAYAM	3,199.44	2,864.25	98.56	2,962.81	93	CRITICAL
15	KILKODUNGALUR	2,362.56	2,216.20	46.66	2,262.86	96	CRITICAL
16	KILPENNATHUR	2,305.20	2,566.50	66.32	2,632.82	114	OVER EXPLOITED
17	KOLAPPALUR	1,886.36	1,815.86	49.21	1,865.08	99	CRITICAL
18	MALAIYUR	1,848.09	1,834.80	43.15	1,877.95	102	OVER EXPLOITED
19	MANDAKOLATHUR	2,046.89	1,688.55	53.63	1,742.18	85	SEMI CRITICAL
20	MANGALAM	2,884.35	2,349.75	75.79	2,425.54	84	SEMI CRITICAL
21	MELPALLIPATTU	2,068.01	2,684.85	87.93	2,772.78	134	OVER EXPLOITED
22	MODAYUR	2,616.39	1,835.55	51.14	1,886.69	72	SEMI CRITICAL
23	MULLIPATTU	1,475.04	1,191.40	34.74	1,226.14	83	SEMI CRITICAL
24	NATERI	1,530.42	1,090.75	38.67	1,129.42	74	SEMI CRITICAL
25	NAYADUMANGALAM	2,363.04	2,213.40	50.87	2,264.27	96	CRITICAL

26	NEDUNGUNAM	1,527.00	1,393.00	39.02	1,432.02	94	CRITICAL
27	OSUR	1,844.01	1,845.21	40.75	1,885.96	102	OVER EXPLOITED
28	PACHAL	2,098.70	2,062.20	79.45	2,141.65	102	OVER EXPLOITED
29	PERANAMALLUR	1,585.57	1,515.71	43.95	1,559.67	98	CRITICAL
30	PERUNGATTUR	2,085.18	1,370.50	76.20	1,446.70	69	SAFE
31	POLUR	2,138.28	1,754.70	71.44	1,826.14	85	SEMI CRITICAL
32	PUDUPALAYAM	3,469.68	3,457.05	95.44	3,552.49	102	OVER EXPLOITED
33	SANTHAVASAL	3,254.83	3,102.45	111.59	3,214.04	99	CRITICAL
34	SATHYAVIJAYANAGARAM	1,665.08	828.60	38.00	866.60	52	SAFE
35	SOMASPADI	1,947.62	1,964.55	53.71	2,018.26	104	OVER EXPLOITED
36	T.V.MALAI (SOUTH)	1,864.62	1,553.40	55.78	1,609.18	86	SEMI CRITICAL
37	T.V.MALAI (NORTH)	1,948.14	1,536.90	97.06	1,633.96	84	SEMI CRITICAL
38	THACHAMBADI	1,621.49	1,457.35	42.35	1,499.70	92	CRITICAL
39	THANDARAMPAT	2,641.90	2,801.58	74.47	2,876.05	109	OVER EXPLOITED
40	THANIPADI	2,647.12	2,473.63	91.12	2,564.75	97	CRITICAL
41	THATCHAMPATTU	2,032.75	1,869.75	59.68	1,929.43	95	CRITICAL
42	THELLAR	2,901.10	2,329.75	57.21	2,386.96	82	SEMI CRITICAL
43	THETHURAI	3,044.66	2,101.95	53.61	2,155.56	71	SEMI CRITICAL
44	THURINJAPURAM	2,017.85	2,321.20	55.35	2,376.55	118	OVER EXPLOITED
45	VADATHANDALAM	2,124.62	1,971.90	50.23	2,022.13	95	CRITICAL
46	VAKKADAI	1,797.91	1,536.00	54.48	1,590.48	88	SEMI CRITICAL
47	VANAPURAM	3,103.04	2,821.80	93.34	2,915.14	94	CRITICAL
48	VANDAVASI	1,726.81	1,732.95	65.38	1,798.33	104	OVER EXPLOITED
49	VEMBAKKAM	2,043.19	1,357.80	48.17	1,405.97	69	SAFE
50	VERAIYUR	1,675.88	2,003.25	2.13	2,005.38	120	OVER EXPLOITED
51	VETTAVLAM	1,992.56	1,734.15	2.00	1,736.15	87	SEMI CRITICAL
52	VINNAMANGALAM	1,330.49	1,086.50	1.61	1,088.11	82	SEMI CRITICAL
TOTAL		**111,687.47**	**99,684.23**	**3,278.01**	**102,962.24**	**92**	

4. Groundwater quality issues:

The rainfall is the main source for the availability of water both in surface and sub surface. The quantum of rainfall varies every year depending upon the monsoon. However, the extraction of surface and sub surface water is increasing year by year. It leads to environmental impact on the water sources like depletion of water level, deterioration of water quality. It makes the demand for the quantification of available water and also its quality for various purposes like agriculture, industries, drinking and domestic purposes.

For the present assessment, the value of Total Dissolved Solids (TDS) have been considered for demarcation of good / bad quality areas. For this purpose, the TDS value of less than or equal to 2000 mg/l have been considered as good quality and the value more than 2000 mg/l have been considered as bad quality areas.

The presence of fluoride in natural Ground Water is having its merits and demerits depending upon the concentration. Presence of fluoride <1.0 mg/l in drinking water reduces dental diseases whereas higher level > 1.50 mg/l will affect the health and causes dental fluoridise. Nitrate is noted significantly in Ground Water due to use of chemical fertilizer for agriculture and other local pollution rocks and soils are also contributing nitrate to Ground Water. Arsenic is another poisonous heavy metal in Ground Water. The allowable limits for drinking purposes are 0.05 mg/l.

In Tiruvannamalai District, the quality of Ground Water generally ranges from moderate to good quality both in the shallow dug well and bore wells except in & around the Kazhuveli tank, where the water quality is poor due to seawater intrusion in the lagoons during high tide seasons, the production of salt and Aquaculture farming.

5. Groundwater issues and challenges:

The groundwater quantity and quality are to be highlighted and may be analyzed in terms of :

(i)Problems posed by nature:

In terms of Quantitative aspects, nowadays, rainfall may more within the short period of duration. Due to this aspect, recharge is less and runoff will be more. The availability of groundwater is less due to over extraction than recharge. The Percentage of OE/Critical Firkas increased due to this reason. Increasing the artificial

recharge structures in the proper areas may avoid the depletion of groundwater especially in OE/Critical Firkas.

(ii) Problems caused by anthropogenic activities:

The problems caused due to intensive groundwater extraction, intensive surface water irrigation, intensive mining activities, growing urban complexes and industrial establishments will lead to drastic depletion in groundwater resources only. Proper alternative recharge structures must be established.

(iii) Problems caused by socio-economic condition:

The land holdings of farmers may be different from another. One farmer having more than 5 Acres has less expense than a farmer having one acre. The free electric supply to all farmers have chance to extract more groundwater. To avoid this, proper guidance will be given to the farmers for the usage of groundwater.

(iv) Administrative issues:

To control, regulate and manage the Ground Water Resources in the State, there is no groundwater act, now in force. But, the **Chennai Metropolitan Area Ground Water (Regulation) Act, 1987** is in force and it extends to Chennai City and notified 302 revenue villages in Kanchipuram and Thiruvallur Districts, only.

The rest of Tamilnadu, **G.O.(Ms).No.142, Public Works (R2) Department, dated: 23.07.2014** and **G.O.(Ms).No.113, Public Works (R2) Dept , Dt:09.06.2016** are regulate and manage the groundwater resources. The Government of Tamil Nadu had enacted the **Tamil Nadu Ground Water (Development and Management) Act, 2003**. However, this **Act was repealed on 14.09.2013**, in order to enact a comprehensive law to develop and manage the groundwater in the changed scenario in the State.

The pricing policy for groundwater users is also an important strategy in controlling the illegal extraction of groundwater by taking from lorries,etc. The unused dug wells and bore wells can be used as artificial recharge structures will be good concept in recharging the ground water.

6. Groundwater Management and Regulations:

(i) <u>Statute/Law/Policy/Regulations if any</u>:

The Central Ground Water Authority has been constituted to regulate, control, development and management of ground water resources for whole country

based on overall situation prevailing in India. But, the ground water conditions are varying from State to State. **Ground Water is a State subject and the State Government has every right to protect and regulate their own precious ground water resources according to the prevailing conditions in the State.**

The Tamil Nadu Government had enacted **"The Tamil Nadu Ground Water (Development and Management) Act, 2003"** which was subsequently **repealed in 2013**, so as to bring out an effective management Act considering the present scenario. **As an interim measure, for regulating the exploitation of ground water, the Government have issued G.O. (Ms) No.142,PWD dated 23.07.2014 for regulations for management of ground water for safe guarding the scarce groundwater resources in Tamil Nadu State.** In the absence of an Act, the Government executes this Government order to control, regulate and manage the Ground Water Resources while taking into consideration of the future of the State and its people.

The State Ground and Surface Water Resources Data Centre has estimated the Ground Water resources of Tamil Nadu State periodically in co-ordination with the Central Ground Water Board, Government of India, SECR, Chennai, based on the Methodology evolved by Ground Water Resources Estimation Committee, 1997 (GEC 97).

Accordingly, **the Ground Water Potential Assessment done as on January 1992 and as on January 1997 on the basis of Panchayat Union Blocks as assessment units** in Tamil Nadu and **categorized as Dark, Grey and White areas.** The Blocks with more than 85% to 100% ground water development were categorized as "Dark Blocks" and the blocks with ground water development between 65% to 85% were categorized as "Grey Blocks" and less than 65% ground water development were categorized as "White Blocks" and the Government approved the categorisation and released as Government order and G.O.No:326, PW (R2) Dept, dated: 23.11.1993. It was in effect up to the next assessment done as on March 2003.

Subsequently, **the Ground Water Potential Assessment done as on March 2003**, **categorized the blocks as Over Exploited, Critical, Semi Critical, Safe, Saline instead of Dark, Grey and White blocks**. The Blocks with more

than 100% were categorized as “Over Exploited Blocks”, the blocks in between 90% to 100% as “Critical Blocks”, the blocks in between 65% to 90% as “Semi Critical Blocks” and less than 65% as “Safe Blocks” and the bad quality blocks were categorized as “Saline Blocks” and the same was approved by the Government and released as G.O.No:51, PW (R2) Dept, dated: 11.02.2004. It was in effect up to the next assessment done as on March 2009.

The Next **Ground Water Potential Assessment done as on March 2009**, and the same was approved by the Government and **released as G.O.No:52,PW(R2) Dept, dated: 02.03.2012.**

As per G.O.No.52,PW(R2) Dept, dated: 02.03.2012 and G.O. (Ms) No.142,PW(R2)Dept dated 23.07.2014, the State Government have authorized and empowered the Chief Engineer, State Ground and Surface Water Resources Data Centre, Chennai for issuing permission or license or No Objection Certificate/renewal for drawal and transportation of Ground Water based on the hydro geological conditions to the New Industries, Packaged Drinking Water Companies, Infrastructures and Mining projects, etc except the areas to which the Chennai Metropolitan Area Ground Water (Regulation) Act,1987 extends.

Subsequently, the next **Ground Water Resources Assessment of the State was completed as on March 2011** and taking **Firka as an assessment unit** in the State of Tamil Nadu. Based on the above assessment, **the Government had approved and issued G.O.(Ms).No.113, Public Works (R2) Dept , Dt:09.06.2016** for categorisation of the Firkas in the State as Over Exploited, Critical, Semi-Critical and Safe Firkas. All the Over Exploited and Critical Firkas are notified as **“A” Category** (where the stage of ground water extraction is 90% and Above) and all the Semi Critical and Safe Firkas are notified as **“B” Category** (where the stage of ground water extraction is below 89%). In this Government Order, the Government had directed that **no Schemes should be formulated in the “A” Category Firkas and in “B” Category Firkas, all the Schemes should be formulated through State Ground and Surface Water Resources Data Centre by issuing No Objection Certificate for Ground Water Clearance.**

The term “Schemes” excludes Energisation of Agricultural pump sets by the Tamil Nadu Electricity Board. The present order may also exclude the Ground Water drawal for a). Domestic purpose by individual household, b). Domestic Infrastructure project (Housing), c).Government’s Drinking Water Supply Schemes and d). non water based industries, (i.e.- the industries which do not require and use water, either as raw material or for other processing). However, the domestic use of water by this non water based industries will be permitted by the Chief Engineer / State Ground and Surface Water Resources Data Centre based on hydro geological conditions. (i.e. NOC from Chief Engineer, State Ground and Surface Water Resources Data Centre, Water Resources Department, Chennai). The list of non water based industries will be issued by the Industries Department of Government of Tamil Nadu separately.

Appropriate rain water harvesting and Artificial recharge schemes should be carried out in the categories viz , Over exploited , Critical , Semi Critical and Safe blocks of Tamil Nadu. While carrying out the above schemes, priority should be given to marginal quality and bad quality areas so as to avoid further deterioration.

All the schemes and proposals based on Ground Water will have to adhere to the Government orders and conditions. The Chief Engineer, State Ground and Surface Water Resources Data Centre had received the Government approval on Groundwater Assessment as on March 2011.

Regarding granting permission/ License for transportation of ground water for water suppliers/ private water tankers for selling the water on commercial basis, the State Ground and Surface Water Resources Data Centre, Public Works Department is not issuing any No Objection Certificate.

The Chief Engineer, SG&SWRDC have empowered to issue the NOC for drawal of Ground Water is up to 1 Million Gallons per day. Beyond this, the firms should get an approval in Water Utilisation Committee for drawal of both Surface and Ground Water resources in Tamil Nadu.

(ii) <u>Suggestions for improvement of groundwater governance</u>.

Groundwater is recognized as a common pool resource. The use of groundwater by anybody should in no way cause adverse impacts on realization of other person’s fundamental right to safe water for life. Access to

groundwater without any discrimination, equitable distribution, and sustainable use considering the needs of future generations are considered. Right to water for life is the first priority and then to agriculture, and eco system needs. The precautionary principle and the polluter pay principle only to conserve and recharge groundwater.

The responsibility of the State for ensuring every person's right to safe water even when water service is delegated to a private agency. Groundwater is not amenable to ownership by the State, communities or persons and the State is the public trustee of groundwater. It also deals elaborately on groundwater protection and groundwater security plans.

The Groundwater Act should incorporate legal pronouncement on groundwater such as the public, trust doctrine and recognition of the right to groundwater. It addresses the deficiencies in the present legal frame work in dealing with over exploitation and includes the improvements to the control mechanism to ensure the qualitative and quantitative sustainability of groundwater resources. It proposes to strengthen the regulating powers of Panchayat and Municipal bodies related to Ground water in line with articles 243G and 243W of the constitution.

The Pricing of Ground Water for irrigation, Industrial and domestic purposes and collecting fees by water users association should be left to the State decision.

(iii) <u>Institutions governing/managing/monitoring the resources and Institutional structure, gaps if any</u> :

While framing the Groundwater Act, the recommendation for the constitution of (1) Gram Panchayat Groundwater Sub-Committee, (2) Block Panchayat Groundwater Management, (3) Ward Groundwater Committee, (4) Municipal Water Management Committee, (5) District Ground Water Council and (6) State Ground Water Advisory Council to control and manage Ground water should be considered.

- The constitution of aforesaid committees is completely based on administrative boundaries such as village, block, ward, municipality, district etc. But, with respect to water resources control and management issues and conflicts, the boundary should be based on river basins to have efficient monitoring and management of

water resources. The Government of India, in all issues related to water resources considered only the basin boundary concept. Hence, the institutional frame work has to be revised so as to have the jurisdiction of the committees with respect to basin / watershed concept. Further, Government of India, MoWR, RD &GR advocates time and again integrated water resources management. The above institutional frame work separately for groundwater is not in line with that.

- Further, it has also provided for many committees, viz., Gram Panchayat Groundwater Sub-Committee, Village Water and Sanitation Committee, Ward Committee, Municipal Committee, Block level Committee, District level Committee and State level Committee. For managing surface water resource water users association already exists. Too many committees at village / ward level would jeopardize the very purpose of managing the Groundwater resources efficiently and may invite lot of conflicts.

(iv) <u>Areas of people/private participation if any</u>:

The participation of people or private parties in the groundwater management is not suggestible, acceptable one and more chances of making litigations in the society and has unnecessary law and order problems may arise.

7. Tools and Methods

(i) Water Level and quality measurements through wells, piezometers, DWLR with telemetry, ground water elevation.

In general, water levels in the observation wells and piezometers can be taken manually by measuring tape. This is the simple, cost effective, good accuracy and less maintenance method. Water Levels are observed above the Measuring point.

Monitoring water level in DWLR with telemetry is costly, high maintenance, good accuracy, get the data immediately on desktop, easy to analysis purpose.

The water quality generally is analysed in the Chemical Lab only by collecting water samples in Pre Monsoon and post Monsoon period in the field. Sometimes, instant kits are used for analyzing the TDS and Ph level in the water.

(ii) Metering water supply to confirm contribution from groundwater.

Metering the water supply is essential one to monitor the overall usage of groundwater by different sectors. Flow meter must be fixed in every extraction structure and it has to be monitored periodically by Government officials.

8. Performance Indicators:

(i) Bench Marks/ Norms/ Standards and deviation from the norms/bench marks/ standards currently.

The Ground Water resources of State periodically estimated in co-ordination with the Central Ground Water Board, Government of India, SECR, Chennai, based on the Norms evolved by Ground Water Resources Estimation Committee, 1997 (GEC 97).

The ground water potential assessment can be assessed based on the bench marks such as Average Rainfall, Total recharged Area, Monthly Water Level Data, Total no of wells in the area, Irrigation methods adopted, Cropping pattern details, Geological conditions prevailing in that area, Specific yield, Seepage factor, Constructed Artificial recharge structures, etc and various calculations methods, etc, have to be considered.

Status of various Performance Indicators

(ii) Percentage of over exploited ,critical, Semi critical , Safe and Saline/Poor quality Firkas/area units

- Trend of over exploited and critical Firkas to total Firkas as per pervious assessment. (2009 Assessment Vs 2011 Assessment)

  The Ground Water Potential Assessment as on March 2009, Out of 18 blocks in Tiruvannamalai District, 12 blocks are categorized as Over Exploited and Critical blocks and remaining 6 blocks are categorized as Semi Critical.

  The next Ground Water Resources Assessment of the State was done as on March 2011 and taking Firka as an assessment unit. In Tiruvannamalai District, totally 52 Firkas, 16 Firkas are categorized as Over Exploited and remaining 36 Firkas are categorized as Semi Critical and Safe blocks.

  Instead of taking Block as an assessment, Firka can be taken as assessment unit is to concentrate the assessment in micro level. For Eg, a block

contains more than three to four Firkas. In this block, two Firkas may have good groundwater potential than other two Firkas but it may to categorize as Over Exploited. To avoid this, assessment done on the basis of Firkas for the benefit of farmers to the implementation of schemes related to Irrigation.

The percentage of over exploited and critical Firkas has been increased by changing the concept from Block to Firka assessment. The total percentage of over exploited and critical Blocks for 2009 Assessment is 66.66%, but, the total percentage of over exploited and critical Firkas as on March 2011 Assessment is 30.76%, in the Tiruvannamalai District.

- Trend of over exploited and critical Firkas to total Firkas as per latest assessment

The percentage of over exploited and critical Firkas has been decreased in 2013 latest assessment when compared to 2011 assessment. In 2011 assessment, out of 52 Firkas, the total percentage of over exploited and critical Firkas is 30.76%, but, In 2013 assessment, out of 52 Firkas, it has been come down marginally to 55.76%, in the Tiruvannamalai District.

- Existing state of groundwater resources as compared to previous assessment (2013 Vs 2011 assessment).

Based on the Estimation of Ground Water Resources of Tamil Nadu State as on March 2013, Out of 52 Firkas in the District, 13 Firkas are categorized as “Over Exploited Firkas”, 16 Firkas are categorized as “Critical Firkas”, 19 Firkas are categorized as “Semi Critical Firkas”, 4 Firkas are categorized as “Safe Firkas”.

Based on the Estimation of Ground Water Resources of Tamil Nadu State as on March 2011, Out of 52 Firkas in the State, 8 Firkas are categorized as “Over Exploited Firkas”, 8 Firkas are categorized as “Critical Firkas”, 24 Firkas are categorized as “Semi Critical Firkas”, 12 Firkas are categorized as “Safe Firkas”.

When compared to last assessment as on March 2011, the “Over Exploited Firkas increased from 8 to 13 Firkas, the “Critical Firkas” increased from 8 to 16 Firkas, the “Semi Critical Firkas” decreased from 24 to 19 Firkas, the “Safe Firkas” decreased from 12 to 4 Firkas and the “Saline Firkas” remains Nil Firkas. The alteration of Firkas are due to the construction of Artificial Recharge structures such as Check Dams, Recharge Wells, Recharge shafts,

percolation ponds; etc was constructed in the “Over Exploited Firkas” by various departments.

S.No	Categorisation	No of Firkas	
		2011	2013
1	Over Exploited	8	13
2	Critical	8	16
3	Semi Critical	24	19
4	Safe	12	4
5	Saline	Nil	Nil
TOTAL		52	52

(iii) Water Level(Well hydrographs and water level trends – pre and post monsoon such as declining trend/rising trend,etc).

(iv) Comparison of area irrigated from groundwater resources (Current assessment 2013 to previous assessment 2011).

S.No	Description	2011 Assessment	2013 Assessment
1	Area Irrigated from ground water resources(In hm)	6538.07	6505.06

(v) No. of groundwater abstraction structures (existing no. over the year and trends).

S.No	Description	2011 Assessment	2013 Assessment
1	No of groundwater abstraction structures for Irrigation	1,71,071 Wells	1,70,983 Wells

(vi) Trend in water quality (no of habitations affected with groundwater contamination like As, F, Salinity etc. Change in contamination level over the years.

(vii) Source augmentation (Groundwater)

- Area covered with infrastructure for recharging groundwater:

  The proper artificial recharge structures has to be constructed based on local geological conditions in the areas of existing infrastructure for recharging groundwater according to their extraction needs.

- GW recharge plan to combat adversaries:

  Groundwater recharge plans has to be strictly followed by with of implementing the groundwater laws to combat adversaries.

9. Reforms undertaken/being undertaken/proposed if any.

10. Road Map of activities/tasks proposed for better governance with timelines and agencies responsible for each task/activity.