CHAPTER 4.1.9 GROUND WATER RESOURCES

THIRUNELVELI DISTRICT

INDEX

GROUND WATER REPORT OF THIRUNELVELI 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

The geographical extent of Tirunelveli District is 682308 hectares (6823sq.km) accounting for 5.25 percent of geographical area of Tamil Nadu State. The district has well laidout roads and railway lines connecting all major towns and outside the State. For administrative purpose, the district has been bifurcated into 9 Taluks, 19 Blocks and 17 Firkas. Tirunelveli is the major town with corporation status.

Thirunelveli district is totally bifurcated into 17 Firkas.

1. Hydrogelogy

(i) Major Geological formations:

Geology

The entire area of Tirunelveli district is covered by Archaean crystalline rocks comprising of various types of gneiss and charnockite. However very small part i.e., nearly 1% of the area is covered by sedimentary formation, which occurs in Radhapuramtaluk.

a) Hard rock area

Nearly 99% of the district is covered by hard rock formation. Charnockites, which occur in this district, are acidic to intermediate type. Generally black cotton soil and Kankar overlies the charnockite.

GarnetiferousBiotite Gneisses are white to grey in colour whereas GarnetiferousSillimanite Gneiss are pure white in colour. In this district, Quartzite occur as small hills and ridges. Hill types are seen in Sivanthipatti and kunnathoor village areas. Ridge type are seen near Alangulam and Pettai areas. It occurs as bands in Garnetiferous gneiss also. Such bands which occur near Palayamkottai and Reddiarpatti villages are considerable in size.

Crystalline limestone mainly occurs near Thirunelveli and Nanguneritaluk areas. High qualities of these limestones are seen near Seliyanallur and Ramayanpatti areas, and being quarried for India Cements at Thalaiyoothu. Bands of Calcareous Gneiss are seen around Kalakkadu and Nanguneri areas.

b) Sedimentary formations

Sedimentary formation which occur around Thisayanvilai area is Recent to tertiary age. Recent to sub-recent (Quarternary) formations mainly occurs as teri sand; soil and clay are seen around Thirunelveli area.

Tertiary formation (Mainly Panamparai sand stone) occurs as small patches near Kundamangalam.

Drilling of bore holes:

The occurrence and movement of groundwater is restricted to open system of fractures and joints in unweathered portion and also in the porous zones of weathered formation. For investigation purpose, The State Ground and Surface Water Resources Data Centre has drilled more than 330 bore holes spread over the entire district. Bore holes in sedimentary area are very much limited because of limited extent of the sedimentary area.

Generally in hard rock regions the occurrence of weathered thickness is discontinuous both in space and depth. Hence the recharge of groundwater is

influenced by the intensity of weathering. However gneissic rock with quartz-feldspathic nature, garnetiferous and micaceous gneiss of Tenkasi, Nanguneri and Sankarankoiltaluk areas are good potential zones, charnockite with micaceous nature are also good yielding aquifers (Kasidharmam, Thulkapatti area).

In general, weathering thickness is higher in gneissic rock than that of charnockite. It varies from 10m to 35m below ground level.

Aquifer parameters

To findout the aquifer thickness and parameters, more than 330 investigations bore wells have been drilled in the district. The aquifer parameters in alluvium, bazada and hard rock formations are given below.

Range of alluvial parameters

Formation	**Specific capacity lpm/m-d**	**T m^2-d**	**K m/d**	**Yield of wells lps**
Alluvium	12-461	8-854	0.1-44	2.2-34
Bazada	17-137	8-225	1-16	3.8-17
Hard rock	7.5-78	3-212	0.1-27	0.15-6

(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 Thirunelveli 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 Thirunelveli District,168 observation wells and 82 piezometers,totally 250 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 Thirunelveli 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 Thirunelveli District. The analysis reveals that the water level has gone down in the north, west and central parts of the Thirunelveli 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 Thirunelveli District.

(iii) Existing network of Monitoring wells:

In Thirunelveli District, the existing network of monitoring wells is 250 wells, 168 wells are observation wells and 82 wells are piezometers. These wells are observed for every month water level.

Tirunelveli : Observation Wells - Location and Co-ordinates

Well No	District	Tahsil / Taluk	Block / Mandal	Village	Latitude	Longitude
507001	Tirunelveli			Maranthai	08°48'48"	77°34'15"
507002	Tirunelveli			Karumpuliyuthu	08°50'19"	77°32'33"
507003	Tirunelveli			Alangulam	08°52'30"	77°29'10"
507006	Tirunelveli			Makilvannathapuram	-	-
507007	Tirunelveli	Ambasamudram		Vaniyankulam	08°38'19"	77°37'00"
507008	Tirunelveli	Ambasamudram		Thiruvithanpuli	08°37'54"	77°34'56"
507009	Tirunelveli	Ambasamudram		Puthankudiyiruppu	08°35'57"	77°33'50"

507010	Tirunelveli	Ambasamudram		Sunpapermill Farm	08°39'00"	77°34'19"
507011	Tirunelveli	Ambasamudram		Veeravanallur	08°41'14"	77°31'20"
507012	Tirunelveli	Ambasamudram		Karambai	08°40'42"	77°29'60"
507013	Tirunelveli	Ambasamudram		Idaikal	08°45'14"	77°27'42"
507016	Tirunelveli	Nanguneri		Iraippuvari	08°26'45"	77°43'02"
507017	Tirunelveli	Nanguneri		Ervadi	08°25'40"	77°36'33"
507018	Tirunelveli	Nanguneri		Perumazhanji	-	-
507020	Tirunelveli	Palayamkottai		Barkitmanagar	09°00'46"	77°30'00"
507021	Tirunelveli	Palayamkottai		Marukalthalai	09°00'46"	77°30'00"
507022	Tirunelveli	Palayamkottai		Rediyarpatti	08°40'24"	77°44'38"
507023	Tirunelveli	Palayamkottai		Krishnapuram	09°05'53"	77°20'56"
507024	Tirunelveli	Palayamkottai		Avinaperi	08°44'40"	77°47'17"
507025	Tirunelveli	Radhapuram		Madappuram	08°22'16"	77°38'06"
507026	Tirunelveli	Radhapuram		Kottaikarungulam	08°20'25"	77°44'25"
507027	Tirunelveli	Radhapuram		Thiyagarajapuram	08°17'08"	77°39'43"
507028	Tirunelveli	Radhapuram		Nambipathu	08°20'47"	77°37'10"
507029	Tirunelveli	Sankarankoil	Kuruvikulam	Avaranthai	09°17'27"	77°36'55"
507030	Tirunelveli	Sankarankoil	Kuruvikulam	Alangulam	09°09'16"	77°39'48"
507031	Tirunelveli	Sankarankoil	Kuruvikulam	Sevalkulam	09°09'32"	77°37'20"
507032	Tirunelveli	Sankarankoil	Sankarankovil	Perumpathur	09°13'02"	77°32'05"
507033	Tirunelveli	Sankarankoil	Sankarankovil	Karivalamvanthanallur	09°16'44"	77°32'36"

507034	Tirunelveli	Sankarankoil	Melaneelithanallur	Panavadalichatiram	09°03'15"	77°36'32"
507035	Tirunelveli	Senkottai		Munru Vaikkal	08°58'80"	77°13'53"
507036	Tirunelveli	Senkottai		Kannupulimettu	08°56'50"	77°12'54"
507037	Tirunelveli	Senkottai		Karkudi	08°59'22"	77°13'20"
507038	Tirunelveli	Senkottai		Thirumalaikovil	09°01'46"	77°13'53"
507039	Tirunelveli	Senkottai		Vadagarikilpidagai	09°02'16"	77°16'09"
507040	Tirunelveli	Sivagiri		Subramaniyapuram	09°12'50"	77°23'59"
507041	Tirunelveli	Sivagiri		Rayagiri	09°18'06"	77°26'34"
507042	Tirunelveli	Sivagiri		Sangupuram	09°15'31"	77°28'09"
507043	Tirunelveli	Sivagiri		Nelkatumseval	09°13'54"	77°27'31"
507044	Tirunelveli	Sivagiri		Thenmalai	09°18'30"	77°30'00"
507045	Tirunelveli	Thenkasi		Mathalamparai	08°54'36"	77°19'15"
507047	Tirunelveli	Thenkasi		Asathnagar	08°57'02"	77°20'02"
507048	Tirunelveli	Thenkasi		Kudiyiruppu	08°56'30"	77°17'30"
507049	Tirunelveli	Thenkasi		Punnaiyapuram	09°09'18"	77°23'21"
507050	Tirunelveli	Tirunelveli		Mavadi	08°50'31"	77°39'20"
507051	Tirunelveli	Tirunelveli		Kanarpatti	08°53'27"	77°39'12"
507052	Tirunelveli	Tirunelveli		Vellankulam	08°35'55"	77°35'43"
507053	Tirunelveli	Tirunelveli		Kondanagaram	08°42'30"	77°37'05"
507054	Tirunelveli	Tirunelveli		Tirunelveli Vetnary Hospi	08°45'19"	77°42'26"
507055	Tirunelveli	Tirunelveli		Vagaikulam	08°55'01"	77°37'30"

507056	Tirunelveli	Veerakeralampudur		Surandai	08°59'17"	77°25'33"
507057	Tirunelveli	Veerakeralampudur		Arunachalapuram	08°59'17"	77°25'32"
507060	Tirunelveli	Veerakeralampudur		Veerakeralampudur	09°00'46"	77°30'00"
93001	Tirunelveli	Sivagiri	Vasudevanallur	Sivagiri	09°20'38"	77°25'46"
93001A	Tirunelveli	Sivagiri	Vasudevanallur	Sivagiri	09°20'30"	77°25'40"
93001B	Tirunelveli	Sivagiri	Vasudevanallur	Sivagiri	09°20'30"	77°25'40"
93002	Tirunelveli	Sankarankovil	Sankarankovil	Velayuthapuram	09°20'57"	77°33'31"
93002A	Tirunelveli	Sankarankovil	Sankarankovil	Velayuthapuram	09°19'05"	77°33'10"
93004	Tirunelveli	Sivagiri	Vasudevanallur	Mullikulam	09°10'28"	77°27'12"
93004A	Tirunelveli	Sivagiri	Vasudevanallur	Mullikulam	09°11'00"	77°27'00"
93005	Tirunelveli	Sankarankovil	Kuruvikulam	Malayankulam	09°09'28"	77°36'33"
93005A	Tirunelveli	Sankarankovil	Kuruvikulam	Malayankulam	09°08'46"	77°36'10"
93010	Tirunelveli	Thenkasi	Thenkasi	Panpozhi	09°01'00"	77°18'00"
93010A	Tirunelveli	Thenkasi	Thenkasi	Panpozhi	09°01'00"	77°18'00"
93010B	Tirunelveli	Thenkasi	Thenkasi	Panpozhi	09°01'00"	77°18'00"
93011	Tirunelveli	Thenkasi	Kadayanallur	Kulayaneri	09°00'20"	77°26'00"
93012	Tirunelveli	Sankarankovil	Melaneelithanallur	Vannikonenthal	08°59'43"	77°37'30"
93017	Tirunelveli	Thenkasi	Thenkasi	Athiyuthu	08°52'49"	77°27'22"
93017A	Tirunelveli	Veerakeralampudur	Keelapavoor	Athiyuthu	08°52'49"	77°27'22"
93018 AY	Tirunelveli	Tirunelveli	Manur	Ettankulam	08°52'00"	77°36'00"
93019 AY	Tirunelveli	Tirunelveli	Manur	Gangaikondan	08°52'00"	77°48'00"

93019A	Tirunelveli	Tirunelveli	Manur	Gangaikondan	08°51'25"	77°46'50"
93022	Tirunelveli	Ambasamudram	Ambasamudram	Mannarkoil	08°43'29"	77°26'00"
93022A	Tirunelveli	Ambasamudram	Ambasamudram	Mannarkoil	08°43'38"	77°25'53"
93023 AY	Tirunelveli	Tirunelveli	Manur	Melakallur	08°42'00"	77°36'00"
93023A AY	Tirunelveli	Tirunelveli	Manur	Melakallur	08°42'45"	77°36'18"
93024	Tirunelveli	Palayamkottai	Palayamkottai	Palayamkottai	08°43'00"	77°33'00"
93024A	Tirunelveli	Palayamkottai	Palayamkottai	Palayamkottai	08°43'15"	77°44'00"
93024A1	Tirunelveli	Palayamkottai	Palayamkottai	Palayamkottai	08°46'00"	77°40'30"
93027	Tirunelveli	Nanguneri	Kalakkadu	Padmaneri	08°32'28"	77°34'18"
93027A	Tirunelveli	Nanguneri	Kalakkadu	Padmaneri	08°31'20"	77°34'25"
93028	Tirunelveli	Nanguneri	Nanguneri	Unnankulam	08°32'30"	77°43'00"
93031	Tirunelveli	Nanguneri	Kalakkadu	Alangulam	08°27'23"	77°37'07"
93032	Tirunelveli	Nanguneri	Nanguneri	Parappadi	08°25'33"	77°43'52"
93032A	Tirunelveli	Nanguneri	Nanguneri	Parappadi	08°25'42"	77°43'40"
93033	Tirunelveli	Nanguneri	Nanguneri	Ittamozhi	08°23'35"	77°51'08"
93033A	Tirunelveli	Nanguneri	Nanguneri	Ittamozhipudur	08°22'55"	77°50'20"
93039	Tirunelveli	Radhapuram	Radhapuram	Kavalkinar	08°16'00"	77°34'09"
93039A	Tirunelveli	Radhapuram	Radhapuram	Kavalkinar	08°16'00"	77°34'16"
93040A	Tirunelveli	Radhapuram	Radhapuram	Radhapuram	08°15'46"	77°40'46"
93041	Tirunelveli	Radhapuram	Radhapuram	Uvari	08°16'12"	77°53'33"
93060	Tirunelveli	Radhapuram	Valliyoor	Panagudi	08°19'00"	77°34'47"
93060A	Tirunelveli	Radhapuram	Valliyoor	Panagudi	08°19'20"	77°34'38"
93061	Tirunelveli	Radhapuram	Valliyoor	Valliyoor	08°22'45"	77°36'32"

93062	Tirunelveli	Nanguneri	Nanguneri	Nanguneri	08°29'27"	77°39'32"
93063	Tirunelveli	Nanguneri	Nanguneri	Vadakku Vijayanarayanam	08°25'37"	77°47'27"
93063A	Tirunelveli	Nanguneri	Nanguneri	Sivanthiyapuram	08°23'12"	77°46'47"
93064	Tirunelveli	Nanguneri	Nanguneri	Moolaikaraipatti	08°32'45"	77°46'12"
93065	Tirunelveli	Radhapuram	Radhapuram	Samugarengapuram	08°20'17"	77°41'37"
93066	Tirunelveli	Radhapuram	Valliyoor	Karunkulam	08°10'32"	77°34'32"
93066A	Tirunelveli	Nanguneri	Valliyoor	Karunkulam	08°10'32"	77°34'32"
93067	Tirunelveli	Radhapuram	Radhapuram	Vijayapathi	08°11'30"	77°44'53"
93068	Tirunelveli	Radhapuram	Radhapuram	Kasturi rangapuram	08°18'29"	77°45'50"
93069	Tirunelveli	Radhapuram	Radhapuram	Mannarpuram vilakku	08°21'57"	77°48'28"
93069A	Tirunelveli	Nanguneri	Nanguneri	Mannarpuram	08°21'57"	77°48'28"
93070	Tirunelveli	Nanguneri	Nanguneri	Moonradaippu	08°35'07"	77°47'25"
93070A	Tirunelveli	Nanguneri	Nanguneri	Moondradaippu	08°35'07"	77°47'25"
93071	Tirunelveli	Nanguneri	Nanguneri	Munanjipatti	08°31'30"	77°47'25"
93072	Tirunelveli	Thenkasi	Kadayanallur	Kadayanallur	09°04'45"	77°20'45"
93072A	Tirunelveli	Thenkasi	Kadayanallur	Krishnapuram	09°05'40"	77°21'00"
93073	Tirunelveli	Thenkasi	Kadayanallur	Valasai	09°04'35"	77°24'00"
93074	Tirunelveli	Thenkasi	Alangulam	Kallathikulam	09°04'25"	77°33'05"
93075	Tirunelveli	Thenkasi	Kadayanallur	Nainaragaram	09°01'35"	77°19'35"
93075A	Tirunelveli	Thenkasi	Kadayanallur	Nainaragaram	09°01'32"	77°19'35"
93075B	Tirunelveli	Thenkasi	Kadayanallur	Nainaragaram	09°01'32"	77°19'35"

93076	Tirunelveli	Thenkasi	Kadayanallur	T.Sundarapuram	09°01'40"	77°23'20"
93076A	Tirunelveli	Thenkasi	Kadayanallur	Velayuthapuram	09°02'20"	77°23'30"
93077	Tirunelveli	Thenkasi	Alankulam	Navaneethakrishnapuram	09°00'25"	77°30'50"
93078	Tirunelveli	Thenkasi	Thenkasi	Kasimajorpuram	08°56'28"	77°16'25"
93078A	Tirunelveli	Thenkasi	Thenkasi	Kasimajorpuram	08°56'28"	77°16'18"
93079	Tirunelveli	Thenkasi	Thenkasi	Mela meignanapuram	08°55'57"	77°20'42"
93080	Tirunelveli	Thenkasi	Thenkasi	Melapavoor	08°56'41"	77°23'12"
93081	Tirunelveli	Thenkasi	Keelapavoor	Veerakeralampudur	08°56'08"	77°27'00"
93081A	Tirunelveli	Veerakeralampudur	Keelapavoor	V.k.pudur	08°56'08"	77°27'00"
93082	Tirunelveli	Thenkasi	Alangulam	Kil Veeranam	08°56'07"	77°30'00"
93082A	Tirunelveli	Thenkasi	Alangulam	Veeranam	08°56'09"	77°29'50"
93082A1	Tirunelveli	Veerakeralampudur	Alangulam	Veeranam	08°56'14"	77°29'49"
93082B	Tirunelveli	Thenkasi	Alangulam	Veeranam	08°56'09"	77°29'50"
93083	Tirunelveli	Tirunelveli	Manur	Chettikurichi	08°55'45"	77°37'30"
93084	Tirunelveli	Thenkasi	Thenkasi	Thiraviyanagar	08°52'48"	77°20'36"
93085	Tirunelveli	Thenkasi	Alangulam	Sivalarkulam	08°52'15"	77°31'35"
93086	Tirunelveli	Tirunelveli	Manur	Thengalampudur	08°49'00"	77°43'00"
93087	Tirunelveli	Ambasamudram	Kadayam	Keela Kadayam	08°49'15"	77°22'15"
93088	Tirunelveli	Ambasamudram	Kadayam	A.Perumal nadanoor	08°47'52"	77°25'30"

93089	Tirunelveli	Ambasamudram	Pappakudi	O.Thulukarpatti	08°46'37"	77°31'07"
93089A	Tirunelveli	Ambasamudram	Pappakudi	O.Thulukarpatti	08°48'30"	77°29'00"
93090	Tirunelveli	Tirunelveli	Manur	Seethaparappanallur	08°47'00"	77°36'00"
93091	Tirunelveli	Tirunelveli	Manur	Sethurayanpudur	08°46'35"	77°40'30"
93091A	Tirunelveli	Tirunelveli	Manur	Sethurayanpudur	08°46'00"	77°40'30"
93092	Tirunelveli	Tirunelveli	Manur	Sankarnagar	08°48'40"	77°43'50"
93093	Tirunelveli	Tirunelveli	Manur	Kuppakurichi	08°47'53"	77°48'10"
93094	Tirunelveli	Ambasamudram	Ambasamudram	Pothigaiadi	08°42'47"	77°21'53"
93095	Tirunelveli	Ambasamudram	Pappakudi	Pappakudi	08°44'45"	77°30'00"
93095A	Tirunelveli	Ambasamudram	Pappakudi	Pappakudi	08°44'50"	77°30'37"
93096	Tirunelveli	Tirunelveli	Manur	Pettai	08°43'42"	77°40'05"
93097	Tirunelveli	Palayamkottai	Palayamkottai	Ariakulam	08°46'22"	77°48'15"
93098	Tirunelveli	Ambasamudram	Ambasamudram	Melasingampatti	08°39'02"	77°26'03"
93099A	Tirunelveli	Ambasamudram	Chermadevi	Veeravanallur	08°41'00"	77°30'52"
93100	Tirunelveli	Ambasamudram	Chermadevi	Pathamadai	08°40'00"	77°35'07"
93101	Tirunelveli	Palayamkottai	Palayamkottai	Thidiyoor	08°37'07"	77°38'37"
93101A	Tirunelveli	Palayamkottai	Palayamkottai	Thidiyoor	08°37'20"	77°39'50"
93102	Tirunelveli	Palayamkottai	Palayamkottai	Gongathanparai	08°38'25"	77°42'20"
93103	Tirunelveli	Palayamkottai	Palayamkottai	Sivanthipatti	08°38'30"	77°46'47"
93121	Tirunelveli	Sankarankovil	Melaneelithanallur	Kurukkalpatti	09°06'28"	77°35'04"
93122	Tirunelveli	Sankarankovil	Melaneelithanallur	Naduvakkurichi	09°05'57"	77°29'31"
93123	Tirunelveli	Sankarankovil	Sankarankovil	Sankarankovil	09°10'37"	77°32'06"

93124	Tirunelveli	Sivagiri	Vasudevanallur	Vasudevanallur	09°14'00"	77°25'00"
93125	Tirunelveli	Sankarankovil	Kuruvikulam	Thiruvengadam	09°15'33"	77°40'58"
93132	Tirunelveli	Senkottai	Senkottai	Bagavathipuram	09°01'15"	77°11'55"
93134	Tirunelveli	Sankarankovil	Sankarankovil	Panaiyur	09°15'00"	77°30'00"
93134A	Tirunelveli	Sankarankoil	Sankarankoil	Panaiyur	09°15'00"	77°30'00"
93135	Tirunelveli	Sankarankovil	Kuruvikulam	Ilaiyarasanendal	09°12'55"	77°40'30"
93136	Tirunelveli	Sankarankovil	Kuruvikulam	Sayamalai	09°05'00"	77°40'00"

Tirunelveli District- Piezometers - Location and Co-ordinates

Well no	District	Tashil/Taluk	Block/Mandal	Village	Latitude	Longitude
AWLR 92028	Tirunelveli	Palayamkottai		Melapalayam	8.696389	77.715833
AWLR 92105	Tirunelveli	Sivagiri		Thirumalapuram	9.287778	77.411389
AWLR 92243	Tirunelveli	Thenkasi		Nainaragaram	9.025556	77.159722
27001D	Tirunelveli	Thenkasi	Keezhapavoor	Athiyuthu	8.754167	77.868889
27002D	Tirunelveli	Sankarankovil	Kuruvikulam	Elayarasanendal	8.879444	77.454722
27003D	Tirunelveli	Tirunelveli	Manur	Ettankulam	9.214722	77.788056
27004D	Tirunelveli	Thenkasi	Alangulam	Kallathikulam	8.864444	77.617500
27005D	Tirunelveli	Sankarankovil	Melaneelithanallur	Kurukkalpatti	9.073889	77.548056
27006D	Tirunelveli	Sankarankovil	Kuruvikulam	Malayankulam	9.106389	77.584167
27007D	Tirunelveli	Ambasamudram	Ambasamudram	Zaminsingampatti	9.145000	77.600000
27008D	Tirunelveli	Nanguneri	Nanguneri	Moolakaraipatti	8.650833	77.434167
27009D	Tirunelveli	Sivagiri	Vasudevanallur	Mullikulam	8.546111	77.768333
27010D	Tirunelveli	Palayamkottai	Palayamkottai	Palayamkottai	9.183611	77.448056
27011D	Tirunelveli	Radhapuram	Valliyoor	Panagudi	8.700556	77.717778
27012D	Tirunelveli	Rhadapuram	Rhadapuram	Rhadapuram	8.317222	77.579167
27013D	Tirunelveli	Tirunelveli	Manur	Seethaparpanallur	8.261944	77.685000
27014D	Tirunelveli	Sivagiri	Vasadevanallur	Sivagiri	8.787778	77.600000
27015D	Tirunelveli	Sankarankovil	Melaneelithanallur	Vannikonendal	9.345000	77.428056
27016D	Tirunelveli	Sankarankovil	Sankarankovil	Velayuthapuram	8.995278	77.625000
27017D	Tirunelveli	Rhadapuram	Rhadapuram	Vijayapathi	9.351944	77.555833
27018D	Tirunelveli	Sankarankovil	Sankarankovil	Manalur	8.191389	77.747500
27019D	Tirunelveli	Nanguneri	Nanguneri	Alwaneri	9.225833	77.550833
27020D	Tirunelveli	Tirunelveli	Manur	Gangaikondan part-1	8.608611	77.756944
27021D	Tirunelveli	Sivagiri	Vasudevanallur	Andarkulam	8.846389	77.774167

27022D	Tirunelveli	Ambasamudram	Ambasamudram	Ayanthiruvaleeswaram	9.161389	77.456389
27023D	Tirunelveli	Senkottai	Senkottai	Bhagavathipuram	8.739167	77.440000
27024D	Tirunelveli	Thenkasi	Kadayanallur	Chockampatti	9.016667	77.193889
27025D	Tirunelveli	Ambasamudram	Chermadevi	Gopalasamudram	9.127500	77.362222
27026D	Tirunelveli	Nanguneri	Nanguneri	Ittamozhi	8.674444	77.636389
27027D	Tirunelveli	Sankarankovil	Kuruvikulam	Karisathan	8.394167	77.848056
27028D	Tirunelveli	Radhapuram	Radhapuram	Kausturirangapuram	9.293611	77.574167
27029D	Tirunelveli	Tirunelveli	Manur	Nadupillaiyarkulam	8.308056	77.761944
27030D	Tirunelveli	Sankarankovil	Melaneelithanallur	Naduvakuruchi	8.895556	77.675833
27031D	Tirunelveli	Nanguneri	Kalakkadu	Padmaneri	9.100000	77.487500
27032D	Tirunelveli	Tirunelveli	Manur	Pettai	8.542778	77.569444
27033D	Tirunelveli	Palayamkottai	Palayamkottai	Ponnakudi	8.721389	77.662500
27034D	Tirunelveli	Senkottai	Senkottai	Sambavarvadakarai	8.617222	77.703056
27035D	Tirunelveli	Sankarankovil	Kuruvikulam	Sembakulam	8.999444	77.389444
27036D	Tirunelveli	Senkottai	Senkottai	Senkottai	9.090278	77.683333
27037D	Tirunelveli	Ambasamudram	Pappakudi	Seevalasamudram	8.975556	77.254167
27038D	Tirunelveli	Palayamkottai	Palayamkottai	Sivanthipatti	8.803889	77.510833
27039D	Tirunelveli	Radhapuram	Valliyoor	Soundaralingapuram	8.638889	77.783333
27040D	Tirunelveli	Tirunelveli	Manur	Thathanuthu	8.234722	77.580278
27041D	Tirunelveli	Nanguneri	Kalakadu	Tirukkurungudi	8.802222	77.741944
27042D	Tirunelveli	Radhapuram	Valliyoor	Tulukkarpatti	8.435000	77.567778
27043D	Tirunelveli	Thenkasi	Alangulam	Veeranam	8.426111	77.668889
27044D	Tirunelveli	Thenkasi	Kilapavur	Vellakkal	8.937778	77.433611
27045D	Tirunelveli	Ambasamudram	Kadayam	Venkatampatti	8.937778	77.433611
27046D	Tirunelveli	Ambasamudram	Chermadevi	Venkatarangapuram	8.868056	77.371389
27047D	Tirunelveli	Radhapuram	Valliyoor	Vadakku Valliyoor	8.582222	77.608333
27048D	Tirunelveli	Radhapuram	Valliyoor	Parivirisooriyan	8.396389	77.605556
27049D	Tirunelveli	Sankarankoil	Melaneelithanallur	Moovirunthali	8.350833	77.565278
27050D	Tirunelveli	Sankarankovil	Melaneelithnallur	Chinnakovilankulam	8.944722	77.683056
27051D	Tirunelveli	Tirunelveli	Manur	Kattarankulam	9.108056	77.552778
27052MWS	Tirunelveli	Thenkasi	Keelapavoor	Pavurchathiram	8.908056	77.681667
27053MWS	Tirunelveli	Thenkasi	Thenkasi	Ilanji	8.914444	77.387778
27054MWS	Tirunelveli	Thenkasi	Kadayanallur	Kambaneripudukudi	8.961389	77.277222
27055MWS	Tirunelveli	Sankarankovil	Melaneelithanallur	Serndamangalam	9.069167	77.379444
27063MWS	Tirunelveli	Palayamkottai	Palayamkottai	Ramayanpatti	9.059722	77.436667
27064MWS	Tirunelveli	Nanguneri	Nanguneri	Panankulam	8.777500	77.676389
27065MWS	Tirunelveli	Palayamkottai	Palayamkottai	Nochikulam	8.557222	77.673611
27066MWS	Tirunelveli	Nanguneri	Nanguneri	Munanjipatti	8.693056	77.812500
27067MWS	Tirunelveli	Radhapuram	Valliyoor	Veppilankulam	8.520556	77.797778
27068MWS	Tirunelveli	Nanguneri	Nanguneri	Nanguneri	8.291389	77.620000
27069MWS	Tirunelveli	Nanguneri	Kalakkadu	Pudukulam	8.495556	77.646389
27070MWS	Tirunelveli	Ambasamudram	Chermadevi	Chermadevi	8.571389	77.652778
27083	Tirunelveli	Palayamkottai		Vagaikulam	8.690278	77.561944
27057MWS	Tirunelveli	Sankarankovil	Kuruvikulam	Karisalkulam	9.069444	77.598611
27058MWS	Tirunelveli	Sankarankovil	Kuruvikulam	Maipparai	9.225556	77.626944

27059MWS	Tirunelveli	Sivagiri	Vasudevanallur	Kottaiyur	9.239167	77.725278
27060MWS	Tirunelveli	Nanguneri	Alangulam	Sivalarkulam	9.266111	77.409444
27061MWS	Tirunelveli	Veerakeralampudur	Alangulam	Uthumalai	8.868333	77.524167
27062MWS	Tirunelveli	Sankarankovil	Sankarankoil	Panaiyur	8.980833	77.525000
27071MWS	Tirunelveli	Ambasamudram	Ambasamudram	Ambasamudram	9.261111	77.493889
27072MWS	Tirunelveli	Ambasamudram	Kadayam	Kilakadayam	8.702500	77.457222
27078	Tirunelveli	Tirunelveli	Manur	Thachanallur	8.824444	77.373611
27079	Tirunelveli	Tirunelveli	Manur	Thulukkarpatti	8.745278	77.694444
27080	Tirunelveli	Sankarankoil	Melaneelithanallur	Devarkulam	8.806667	77.640000
27081	Tirunelveli	Palayamkottai	Palayamkottai	Seevalaperi	8.959444	77.635000
EX27074	Tirunelveli	Tirunelveli	Manur	Palamadai	9.174167	77.400000
EX27075	Tirunelveli	Ambasamudram	Kadayam	Thuppakudi	8.780556	77.766944
EX27052	Tirunelveli	Sivagiri	Vasudevanallur	Puliyangudi	8.775278	77.445278

(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 Thirunelveli 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

$$\text{Stage of Ground water Development (\%)} = \frac{\text{Existing Gross Ground water Draft for all uses}}{\text{Net annual Ground Water Availability}} \times 100$$

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)

THIRUNELVELI 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	CHENNAI	1,496.90	0.00	2,768.26	2,768.26	185	20

Firka Wise Summary

(in ha.m)

THIRUNELVELI 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	ALANKULAM	1,516.64	1,080.15	47.33	1,127.48	74	SEMI CRITICAL
2	ALWARKURICHI	2,260.34	536.00	15.26	551.26	24	SAFE
3	AMBASAMUDRAM	2,858.40	103.25	6.77	110.02	4	SAFE
4	AYIKUDI	1,742.05	1,649.60	49.08	1,698.68	98	CRITICAL

5	CHERANMAHADEVI	3,318.39	507.50	30.39	537.89	16	SAFE
6	ELATHUR	1,127.31	392.00	44.11	436.11	39	SAFE
7	ERUVADI	2,813.32	985.25	46.66	1,031.91	37	SAFE
THIRUNELVELI 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	GANGAIKONDAN	1,038.93	466.40	26.40	492.80	47	SAFE
9	GUDALUR	1,346.72	1,245.25	40.38	1,285.63	95	CRITICAL
10	KADAYAM	2,053.61	794.25	96.86	891.11	43	SAFE
11	KADAYANALLUR	3,376.95	2,499.80	33.29	2,533.09	75	SEMI CRITICAL
12	KALAKADU	2,307.81	586.40	12.88	599.28	26	SAFE
13	Kallurani	1,994.00	2,247.00	125.28	2,372.28	119	OVER EXPLOITED
14	KARISAL KULAM	1,277.63	1,890.00	52.79	1,942.79	152	OVER EXPLOITED
15	KARIVAKLAMVANDANALLUR	1,403.52	1,761.20	66.71	1,827.91	130	OVER EXPLOITED
16	KARUVANTHA	663.72	1,115.40	42.71	1,158.11	174	OVER EXPLOITED
17	KEEZHAPAVOOR	1,323.45	1,320.00	22.75	1,342.75	101	OVER EXPLOITED
18	KURUKKALPATTI	916.92	1,293.00	46.21	1,339.21	146	OVER EXPLOITED
19	LEVINJIPURAM	1,046.06	822.60	59.26	881.86	84	SEMI CRITICAL
20	MADHAVAKURICHI	1,071.91	491.60	32.34	523.94	49	SAFE
21	MANUR	1,114.93	753.00	38.48	791.48	71	SEMI CRITICAL
22	MELAPATTAM	1,158.98	135.80	46.36	182.16	16	SAFE
23	MELASEVAL	2,158.57	519.40	15.26	534.66	25	SAFE
24	MOOLAKARAIPATTI	1,676.96	933.80	34.25	968.05	58	SAFE
25	MUKKUDAL	1,233.11	101.60	96.86	198.46	16	SAFE
26	MUNEER PALLAM	1,425.80	464.40	23.31	487.71	34	SAFE
27	NANGUNERI	1,668.81	616.70	81.30	698.00	42	SAFE

28	NARANAMMALPURAM	862.05	263.20	32.92	296.12	34	SAFE
29	NETTUR	1,035.69	1,027.95	44.96	1,072.91	104	OVER EXPLOITED
30	PALAYAMKOTTAI	811.75	172.80	8.91	181.71	22	SAFE
31	PANAGUDI	1,559.16	1,002.00	7.46	1,009.46	65	SAFE
32	PANPOLI	1,443.01	493.55	20.38	513.93	36	SAFE
33	PAPPAKUDI	1,553.47	265.20	11.15	276.35	18	SAFE
34	PAZHANKOTTAI	1,057.20	1,963.80	49.99	2,013.79	190	OVER EXPLOITED
35	PAZHAVOOR	1,247.94	1,450.00	71.27	1,521.27	122	OVER EXPLOITED
36	POOLAM	1,194.19	393.80	31.49	425.29	36	SAFE
37	PUDUPATTI	765.66	206.00	39.21	245.21	32	SAFE
38	PULIYANKUDI	2,055.50	2,009.20	12.33	2,021.53	98	CRITICAL
39	RADHAPURAM	1,452.10	1,306.20	42.09	1,348.29	93	CRITICAL
40	SAMUGARENGAPURAM	1,779.51	985.80	30.22	1,016.02	57	SAFE
41	SANKARANKOIL	1,069.82	1,258.40	30.25	1,288.65	120	OVER EXPLOITED
42	SCHENCOTTAI	1,743.58	128.40	14.12	142.52	8	SAFE
43	SERNTHAMANGALAM	1,032.97	1,268.40	19.04	1,287.44	125	OVER EXPLOITED
44	SINGAMPATTI	1,873.06	73.25	7.08	80.33	4	SAFE
45	SIVAKIRI	2,982.53	1,776.40	17.94	1,794.34	60	SAFE
46	SIVANTHIPATTI	985.07	655.40	41.87	697.27	71	SEMI CRITICAL
47	SURANDAI	870.86	1,177.00	6.12	1,183.12	136	OVER EXPLOITED
48	TENKASI	2,043.53	825.60	19.34	844.94	41	SAFE
49	THALAIYUTHU	1,111.52	936.60	19.70	956.30	86	SEMI CRITICAL
50	THIRUVENGADEM	624.52	543.60	48.21	591.81	95	CRITICAL
51	TIRUNELVELI	2,117.25	963.90	31.72	995.62	47	SAFE
52	TISAYANVILAI	1,283.25	923.55	9.04	932.59	73	SEMI CRITICAL
53	UTHUMALAI	973.57	1,275.85	15.32	1,291.17	133	OVER EXPLOITED
54	VALLIYOOR	1,607.88	884.80	18.17	902.97	56	SAFE
55	VANNIKONENTHAL	1,123.42	1,386.00	10.98	1,396.98	124	OVER EXPLOITED
56	VASUDEVANALLUR	1,960.74	1,417.60	6.23	1,423.83	73	SEMI CRITICAL
57	VEERAKERALAMPUDUR	1,214.88	1,053.15	4.62	1,057.77	87	SEMI CRITICAL

58	VEERASIGAMANI	967.62	1,740.55	11.44	1,751.99	181	OVER EXPLOITED
59	VENKADAMPATTI	850.44	768.56	37.25	805.82	95	CRITICAL
60	VIJAYANARAYANAPURAM	1,691.22	1,072.40	7.17	1,079.57	64	SAFE
TOTAL		**90,839.84**	**56,980.26**	**2,011.28**	**58,991.54**	**65**	

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 Thirunelveli 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 19 blocks in Thirunelveli District, 6 blocks are categorized as Over Exploited and Critical blocks and remaining 13 blocks are categorized as Semi Critical and Safe blocks.

  The next Ground Water Resources Assessment of the State was done as on March 2011 and taking Firka as an assessment unit. In Thirunelveli District, totally 60 Firkas, 18 Firkas are categorized as Over Exploited and remaining 42 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 31.57%, but, the total percentage of over exploited and critical Firkas as on March 2011 Assessment is 30%, in the Thirunelveli 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 60 Firkas, the total percentage of over exploited and critical Firkas is 30%, but, In 2013 assessment, out of 60 Firkas, it has been come down marginally to 35%, in the Thirunelveli 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 60 Firkas in the District, 15 Firkas are categorized as “Over Exploited Firkas”, 6 Firkas are categorized as “Critical Firkas”, 9 Firkas are categorized as “Semi Critical Firkas”, 30 Firkas are categorized as “Safe Firkas”.

Based on the Estimation of Ground Water Resources of Tamil Nadu State as on March 2011, Out of 60 Firkas in the District, 15 Firkas are categorized as “Over Exploited Firkas”, 3 Firkas are categorized as “Critical Firkas”, 9 Firkas are categorized as “Semi Critical Firkas”, 33 Firkas are categorized as “Safe Firkas”.

When compared to last assessment as on March 2011, the “Over Exploited Firkas” maintains the same as 15 Firkas, the “Critical Firkas” increased from 3 to 6 Firkas, the “Semi Critical Firkas” maintains the same as 9 Firkas, the “Safe Firkas” increased from 33 to 30 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	15	15
2	Critical	3	6
3	Semi Critical	9	9
4	Safe	33	30
5	Saline	Nil	Nil
TOTAL		60	60

(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.