DISTRICT SURVEY REPORT FOR LIMEKANKAR

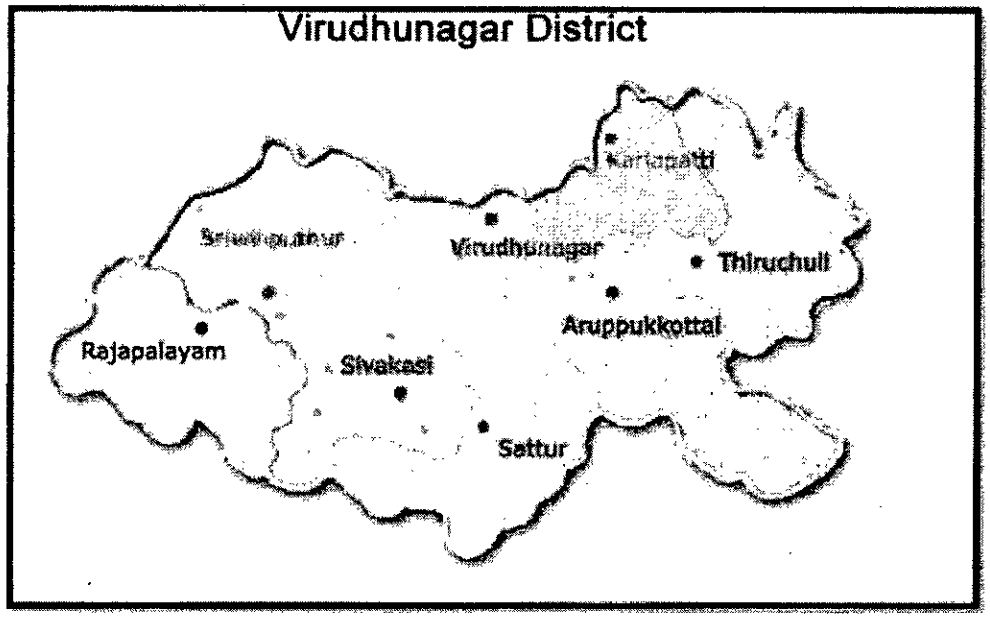
VIRUDHUNAGAR DISTRICT

TAMILNADU STATE

(Prepared as per Gazette Notification S.O.3611 (E) dated 25.07.2018 of Ministry of Environment, Forest and Climatic Change)

1.INTRODUCTION

Virudhunagar District came into existence by the bifurcation of Ramanathapuram District vide State Government Notification, G.O. Ms. 347 dated 8.3.1985. It is bounded on North by Madurai and Sivagangai District, South by Tirunelveli and Tuticorin District, East by Ramanathapuram District, West by Kerala State and NorthWest by Theni District. The district headquarters is Virudhunagar town. It covers an area of 4232 sq.km. Virudhunagar District consists of 3 Revenue divisions namely Sivakasi, Aruppukottai and Sattur, 9 Taluks, namely Aruppukkottai, kariapatti, Rajapalayam, Sattur, Sivakasi, Srivilliputur, Tiruchuli, Virudhunagar and Vembakottai, 39 Firkas and 600 Revenue Villages. It is located at on interactive map 11°00'N 77°28"'E /12°N 78°50"'E.



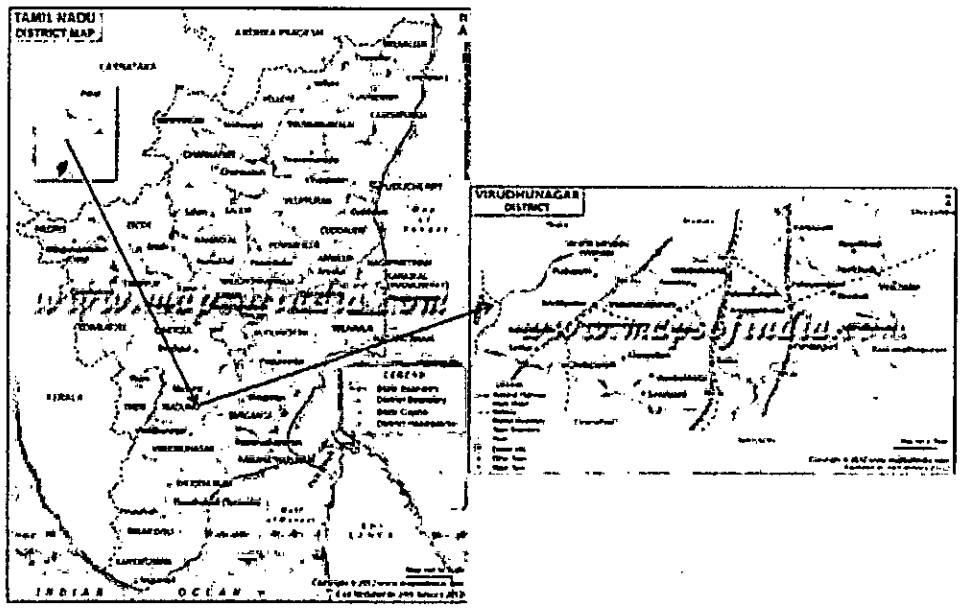
Virudhunagar is endowed with minor mineral resources like, granite (Leptynite), blue metal, gravel, brick soil, Limekankar, Clay (others) and sand deposit and the crystalline limestone is major mineral resource in the District. As a result of developmental activities and market demand for

carving out certain portions from Madurai and Tirunelveli Districts. The Government of Tamil Nadu decided to divide the large Districts into small Districts in order to ensure an effective and transparent administration. To fall in line with the above policy, the Government trifurcated the erstwhile Ramanthapuram, District into Kamarajar District, Ramanathapuram District and Pasumpon District. Kamarajar District was formed on 15th July, 1984 and was named after the freedom fighter and former Chief Minister of Tamil Nadu, Sri. K. Kamaraj. The District started functioning on 15th March 1985. Subsequently the name of the district changed from Kamarajar to Virudhunagar on 1st July, 1997. Now, the District is functioning with Virudhunagar as its headquarters.

3.2 Location

The Virudhunagar District is located between 11°00' and 12°00' North Latitudes and 77°28' and 78°50' East Longitudes. It has an area of about 4243 square kilometers. It is bounded by the Western Ghats in West, Madurai District in North, Sivagangai District in North East, Ramanathapuram District in South-East and Thoothukkudi District in South. The location map of the Virudhunagar District is shown in Plate No 1.

PLATE NO: 1. LOCATION MAP OF VIRUDHUNAGAR DISTRICT



3.3 Area and Population

According to the Director of Statistics, Chennai, the Virudhunagar District covers an area of 4243 square kilometers or 1638 square miles. Virudhunagar District occupies the fifteenth rank among the Districts of the State of Tamil Nadu with regard to its size. The population of the District is 15,65,037. Of this total population, 7, 84,912 (50.15 per cent) are males and the remaining 7, 80,125 (49.85 per cent) are females.

3.4 Administrative Set-up

Virudhunagar District has been divided into three Revenue Divisions for administrative convenience, one at Sivakasi comprising Sivakasi and Srivilliputhur, the second one at Sattur covering Sattur, Rajapalayam and Vembakottai Taluks and the third one at Aruppukottai covering Aruppukottai, Kariapatti, Virudhunagar and Thiruchuli Taluks. It has 11 community development blocks namely, Rajapalayam, Sivakasi, Virudhunagar, Sattur, Aruppukottai, Vembakottai, Srivilliputhur, Watrap, Thiruchuli, Narikudi and Kariapatti. Seven municipalities namely, Aruppukottai, Virudhunagar, Sattur, Sivakasi, Srivilliputhur , Rajapalayam and Thiruthangal, 600 revenue villages, 464 village panchayats, 11 panchayat Unions and 10 town panchayats. It falls part of two parliamentary constituencies and seven assembly constituencies.

3.5 Agricultural Resources and Irrigation

Agriculture is the predominant occupation of the District. Nearly 66.3% of the total population of the District is dependent on agriculture and its allied occupations. The District is a drought prone District. The most striking feature of the District is the absence of dependable irrigation sources like perennial rivers.

Assured irrigation is available through wells only for 57 per cent. The remaining area is irrigated by rain fed tanks. The reservoirs namely Periyar and Kovilar at Pilavakkal in Watrap irrigate about 3000 hectares through 40 tanks. There are also a number of irrigation schemes like Anaikuttam, Kullursandai, Vembakottai and Golwarpatti. More than half of the total geographical area of the District is being utilized for cultivation and net

cultivated area amounts to 2,70,800 hectares. About 7.4 percent of the cultivated area falls under double cropping; 5.82 per cent is covered by forests; 2.8 per cent is not suitable for cultivation. The permanent pasture and other fallow land constitute 15.67 per cent of the total area. Paddy, cumbu, sugarcane, groundnut, cotton, cholam, maize, ragi, varagu, plantain, samai, chillies, greengram, blackgram, horsegram, and gingelly are the important crops of the District. Paddy is the most predominant crop and it is cultivated in 27,892 hectares. Cotton is the next important crop grown in 38,859 hectares. Cotton is intensively cultivated in Rajapalayam, Srivilliputhur and Aruppukottai taluks. Teak and other trees are grown in some parts of the Western Ghats. The plains of Sattur taluk have black soil which is locally known as Karisal. This soil is suitable for cotton cultivation.

3.6 Trade and Commerce

Internal trade of the District is developing on a large scale. Fireworks, matches, polythene articles, litho-printed calendars, posters, diaries and the like are manufactured in Sivakasi. These products enter the markets situated in the different parts of the country. The products, which are produced in the District, have got insignificant local market. Market Committees are functioning in the District for the purchase and sale of cotton, groundnut, jaggery, chilli and other products.

A number of studies are held in the District at various places for helping the rural folk to purchase and sell their products such as food grain, vegetables, groceries, textiles, cattle.

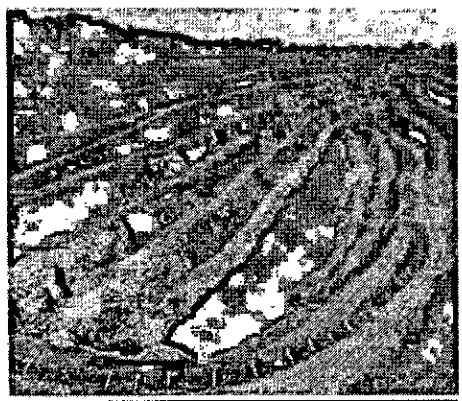
There are two warehouses in this District, one at Virudhuangar and the other at Rajapalayam. The commodities of the chief wholesale trading in the District are pulses, cotton, groundnut and coffee (Virudhunagar block), cotton and groundnut (Rajapalayam block) and chillies (Sattur block).

4. GEOLOGY OF THE DISTRICT

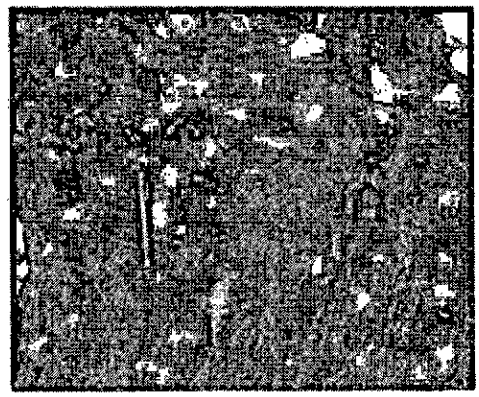
The most of the area in Virudhunagar District is covered by a vast tract of black soil with residual hills and knolls. Since the area is covered by thick pediments, the geology of the area is studied in available exposure and quarry section opened up for limestone, dimension stone and blue metals for various purposes. The area exposes Khondalite Group of rocks and migmatite gneisses of Precambrian (V.R.Sowmi Narayanan, etal.,). The Khondalite Group of rocks comprises Charnockite, crystalline limestone/calc gneiss, garnetiferous quartzofeldspathic gneiss (leptynite), all these litho units probably represent a sequence of metamorphosed sedimentary units of arenaceous, calcareous and argillaceous composition with various intermixtures of different proportions (V.R.Sowmi Narayanan, etal.,). Granite and quartz veins form the younger intrusive.

4.1 Charnockite:

Generally, the Charnockite is grey to greenish colored, coarse to medium grained, greasy nature with or without garnet. Because of the limited outcrops, the quarry sections are studied to infer the various interrelationships between the litho units. Charnockite is interbanded nature with crystalline carbonate rocks are observed in most of the limestone quarry in Pandalgudi, Lakshmipuram, Gopalapuram villages (Field photograph. 1), suggested a metasedimentary origin for the charnockite (V.R.Sowmi Narayanan, etal.,). Weathering of the Charnockite on the surface gives a deceptive look of gneiss and in the quarry sections at depth the fresh charnockite is exposed, which are well exemplified in almost all the Charnockite quarry sections. The specks of pyrites within the charnockite are seen in the Duraisamypuram village. Banded charnockite is observed in Gopalapuram rough stone quarry (Field photograph. 2).



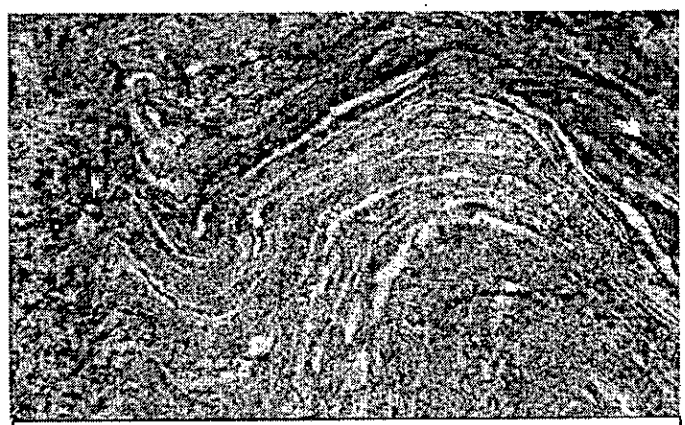
Field photgraph 1. Interbanded nature of Charnockite and crystalline limestone in Pandalgudi village.



Field photgraph 2. Banded Charnockite is noticed in Gopalapuram village rough stone quarry.

4.2 Migmatite:

The Charnockite shows migmatisation is noticed in hill locating East of Kalasalingam university, where the rock exposes segregation of mafic and felsic layers with ptygmatic folds showing conversion of Charnockite in to hornblende biotite gneiss, the occurrences of garnet parallel to the foliation is also observed (Field photograph. 3).



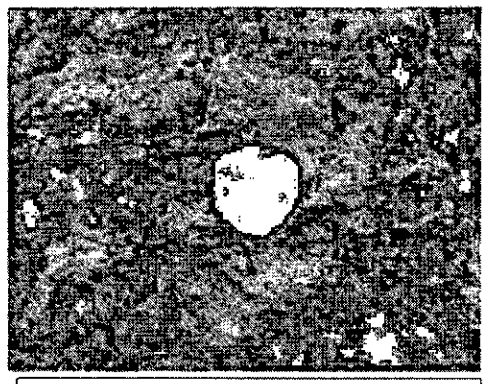
Field photograph 3. Segregation of mafic and felsic layers with ptygmatic folds.

4.3 Calc Gneiss:

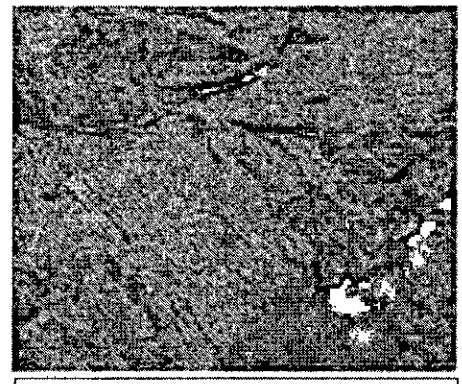
Calc gneiss are characterized by alternating layer of carbonate rich and diopside rich layers are noticed in outcrop in association with garnetiferous quartzofeldspathic gneiss, is medium to coarse grained and is made up of calcite, diopside, biotite and garnet. The exposers are seen in quarry section in Nadikudi, Erichanatham, Kanjanpatti, Sundakottai, Aladipatti, Kadambankulam villages. Kanker is forming as a weathering product of calc gnessic, containing CaO content more than 30% is mined by RAMCO cements in Maravarperungudi village and in many local quarries for various purposes.

4.4 Garnetiferous Quartzofeldspathic Gneiss:

White coarse to medium grained garnetiferous quartzofeldspathic gneiss occurs as bands along the foliation in the charnockite, also as enclaves engulfed by charnockite. It consists of quartz, feldspar and garnet with subordinate biotite. The garnets at places are rounded simulating snowball garnets, as observed in Motamalai hill (Field photograph. 4). Quartz and feldspar show stretching and alignment, imparting a crude gneissosity and garnets are unevenly distributed (Field photograph. 5). The rock is exposed in association with calc gneiss and Charnockite as observed in quarries in Pandalgudi, Duraisamipuram, Thiruthangal villages.



Field photograph 4. Snowball garnets, as observed in Motamalai hill.

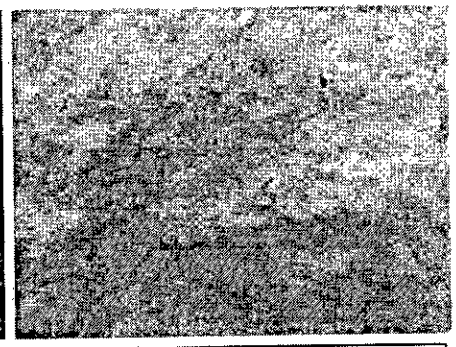


Field photograph 5. Quartz and feldspar show stretching and alignment, imparting a crude gneissosity in Chinnakollapatti village.

4.5 Crystalline carbonate rock:

The rock is white, pale grey and pink in color, medium to coarse grained and consists essentially of calcite with mafic minerals (diopside) unevenly distributed within it. The crystalline limestone is associated with calc gneissic in Pandalgudi, K.Pudhur villages and it associated with Charnockite in Gopalapuram, Cholapuram villages (Field photograph. 6). At places the limestone show compositional variation to dolomitisation due to presence of mineral sapphire (Field photograph. 7) as observed in Tamilnadu Cements Corporation mining in.Alangulam village. The presence of quartz vein within the limestone degrades the quality of cement grade purposes. In Cholapuram area, the remobilation of carbonate rock is noticed within the Charnockite.

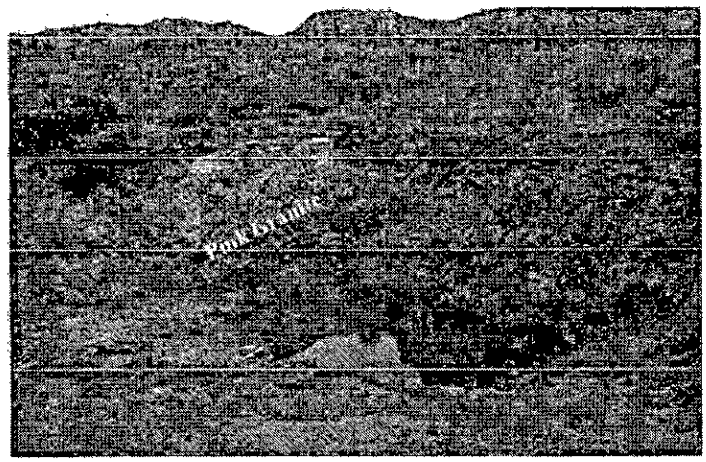
Field photograph 6. Association of crystalline limestone with Charnockite in Gopalapuram. limestone quarry.



Field photograph 7. Presence of mineral sapphire (Blue color) in dolomite is observed in Gopalapuram crystalline limestone quarry.

4.6 Pink Granite:

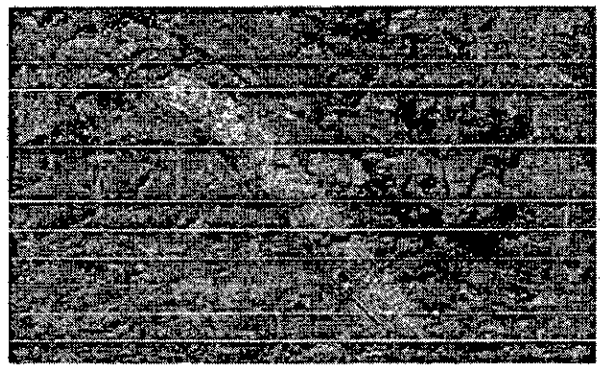
The pink granite occurs as veins intruding into the above all litho units. It is coarse grained, consists of quartz, pink feldspar, with biotite in lesser proportion. It is associated with Charnockite is observed in Kothankulam and Aladipatti villages (Field photograph. 8).



Field photograph 8. Intrusion of pink granite within the Charnockite is observed in Kothankulam rough stone quarry.

4.7 Quartz Vein:

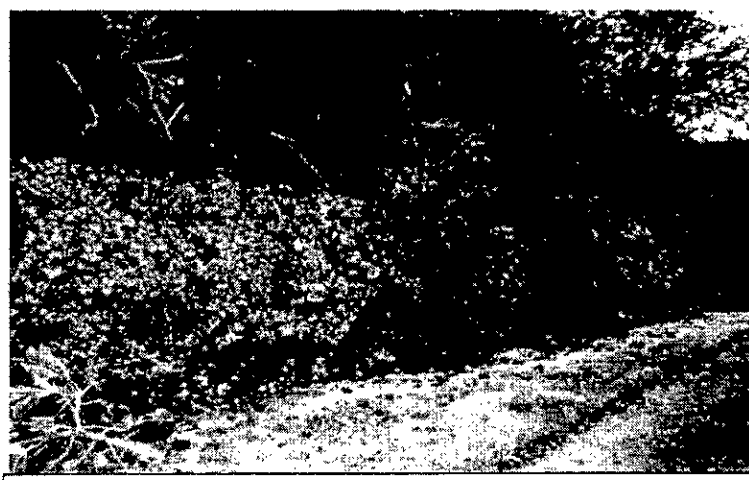
Quartz veins are cutting across into the litho units like charnockite, crystalline limestone, calc gneissic are observed in the field and the presence of garnet in the quartz vein are noticed in the village Kothankulam is associated with Charnockite (Field photograph. 9). The quartz vein in limestone makes unsuitable for cement grade purposes.



Field photograph 9. Presence of quartz vein in Charnockite in rough stone quarry in Nathigudi.

4.8 Limekankar

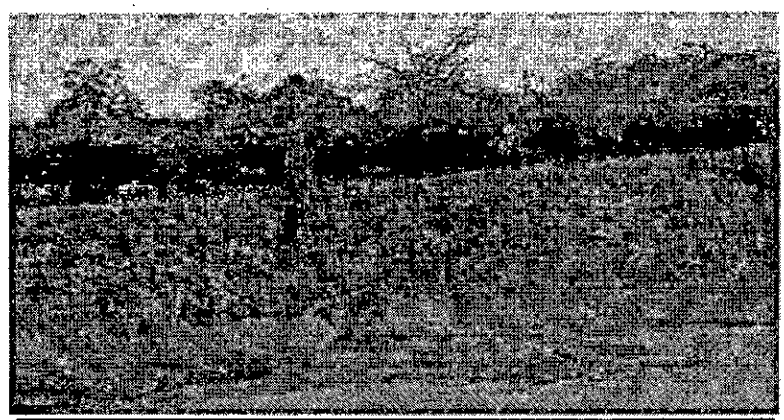
The Limekankar is found to be occurring in a vast stretch of area on the South of Aruppukottai Taluk, Virudhunagar District to Vilathikulam Taluk in Thoothukudi District. The deposits are all superficial, limited to depth of 1 to 2 meters. The Limekankar in this region is generally overlained by Clay. Limekankar is widely used for manufacturing burned lime and also being used for Cement Manufacturing. Limekankar deposit around Maravarperungudi village is currently being mined by Tvl. The Ramco Cements Limited, which is having around 38% CaO content. The estimated limekankar reserves of about 8 lacs tons for the average lime kankar thickness of 1.5 m. Potential deposits of Limekankar is also occurring in Kallurani, Muthuramalingapuram, Narttampatti, Sudhamadam, Vadakkunatham, Sallukuvarpatti, Velayuthapuram and T.Koppuchittampatti Villages of Aruppukottai Taluk. The average thickness of Limekankar deposit in these regions is 1.0 meters and the estimated Resources for ROM Kankar (Kankar plus intercalated clay) for each Square Kilometer is about 2 million Tonnes.



Field photograph 10. Limekankar overlained by Clay in Maravarperungudi Village of Aruppukottai Taluk.

4.9 Soil:

The area is mostly covered by black soil for 0 – 6m thickness, at places reddish in color where laterite formation are prominent as observed in gravel quarry in Kariapatti village. Moreover the black and red soil formations in the District are being quarried for manufacture of bricks and few good quality of black soil is using in cement industries (Field photograph. 11).



Field photograph 11. 2 to 3m thick black soil over calc gnessic rock in Seeniyapuram village.

4.10 Clay (Others)

A fine to silty clayey nature black soil (commonly known as black cotton soil) occurrence is identified in various parts of the District. The Clay layer is of 0 – 5m thickness and generally underlined by Limekankar or basement gneissic formation. This Clay deposit in the form of black cotton soil has a vide spread occurrence in the District. The clay is rich in Alumina and occurring in Kallurani, Muthuramalingapuram, Narttampatti, Sudhamadam, Vadakkunatham & T.Koppuchittampatti Villages of Aruppukottai Taluk.

5. DRAINAGE OF IRRIGATION PATTERN

5.1 Drainage

The major part of Virudhunagar District falls in Vaippar – Gundar river basin. Vaippar, Arjuna River, and the important rivers. The drainage pattern, in general, is dendritic. All the rivers are seasonal and carry substantial flows during monsoon period. Vaippar, which is one of the important rivers of the District, flow and drain in the vembakkam and Sattur blocks. The Arjuna River, flowing in the central part of the District, has its origin from the Sattur Watrap Hills and is formed by Kovillar, periyar and Chittar rivers. The Gundar River originates at an altitude of 500m. A msl near Kottaimalai of Sattur reserve forest in Varushanadu hills in Madurai District.

5.2 Irrigation practices:

The nine- fold land use classification (2005-06) for the District is given below.

S.No	Classification	Area (Ha)
1	Forests	26466
2	Barren & Uncultivable lands	4525
3	Land put to non-agricultural uses	70286
4	Cultivable waste	9663
5	Permanent pastures & other grazing lands	804
6	Groves not included in the area sown	6568
7	Current Fallows	3063
8	Other fallow lands	160066
9	Net Area sown	142882
	Total	**424323**

The chief irrigation sources in the area are the tanks, wells and tube/bore wells. Reservoirs and Tank irrigation is highest in Srivalliputtur, Thiruchuli and Kariyapatti blocks followed by Aruppukottai, Rajapalayam, Sivakasi,

Sattur, and Virudhunagar blocks.

The block – wise and source – wise net area irrigated (2005-06) (in Ha) is given below

S.No	Block	Canals	Tanks	Tube/ Bore wells	Ordinary wells	Other Sources	Total Net Area Irrigated
1	Srivilliputtur	0	1056	4211	439	0	5706
2	Watrap	0	1259	1983	4017	0	7259
3	Rajapalayam	32	2581	2794	1848	15	7270
4	Virudhunagar	98	289	6517	4679	0	11583
5	Sathur	0	650	1417	881	0	2498
6	Aruppukottai	7	481	764	3192	0	4444
7	Thiruchuli	20	1307	769	4678	0	6774
8	Narikudi	253	275	2881	1006	0	4415
9	Kariyapatti	313	1822	484	407	813	3839
10	Sivakasi	28	4756	7797	721	358	13660
11	Vembakottai	0	315	1716	524	93	2666
	Total	**751**	**14791**	**31333**	**22410**	**1279**	**70564**

6. LAND UTILISATION PATTERN IN THE DISTRICT: FOREST, AGRICULTURAL, HORTICULTURAL, MINING ETC.;

The land areas of Virudhunagar District are classified in to forest (Evergreen, Deciduos, Scrub, Swamp etc.,), agricultural land (crop, plantation and fallow), wet land (River, lake, Dam etc.,), buildup land (urban, rural and mining) and barren land. The forest lands are confined to the North-Western part of the District and the major part of the land is used for agricultural purpose. Vaippar, Gundar and Arjuna rivers are contributing to wet land classification. The land use statistics with reference to Virudhunagar District are furnished below.

Sl.No	Land Classification	Area in Ha	Percentage
1.	Forest	26466	6.24
2.	Uncultivable waste	4525	1.07
3.	Land put to Non- Agricultural use	70286	16.56
4.	Cultivable waste	9663	2.28
5.	Permanent pastures / grazing lands	864	0.19
6.	Land under miscellaneous tree crops	6568	1.55
7.	Current fallow	3063	0.72
8.	Other fallow	160066	37.72
9.	Net area zone	142882	33.67
10.	Area sown more than once	5961	1.40
11.	Gross cropped area	148843	35.08
12.	Geographical areas	424323	100.00

The land use and land cover map of Virudhunagar District, source from http://Bhuvan.nrsc.gov.in/gis/thematic/index.php is shown in (Plate No: 2).

7. SURFACE WATER AND GROUND WATER SCENARIO OF THE DISTRICT

7.1 Ground Water Scenario

Hydrogeology

The District is underlain by both porous and fissured formation Unconsolidated & Semi – consolidated formation and Weathered, Fissured and fractured crystalline rocks constitute the important aquifer systems in the District.

The porous formations in the District include sandstones and clays of Recent to sub- recent and Tertiary age (Quaternary). The alluvial formations comprising mainly sands, clays and gravels are confined to major drainage course in the District. The maximum thickness of alluvium is 35.0 m. whereas

the average thickness is about 25.0 m. ground water occurs under phreatic to dug wells and filter points. Alluvium, which forms a good aquifer system along the vaippar and Gundar river bed, which is one of the major source of water supply to the villages.

The water – bearing properties of crystalline formations, which lack primary porosity, depend on the extent of development of secondary intergranular porosity. The occurrence and movement of ground water in these rocks are generally confined to such spaces. These aquifers are highly heterogeneous in nature due to variation in lithology, texture and structure features even within short distances. Ground water generally occurs under phreatic conditions in the weathered mantle and under semi- confined conditions in the fissured and fractured zones at deeper levels.

The thickness of weathered zone in the District is in range of 4 to 15 m. the depth of dug wells ranged from 10 to 15 m bgl. The yield of large diameter wells in the District, tapping the weathered mantle of crystalline rocks from 40 to 110 lpm and are able to sustain pumping for 2 to 6 hours per day. The specific capacity of large diameter wells tested in crystalline rocks range from 6.26 to 183.8 lpm / m. of drawdown. The yield characteristics of wells vary considerably depending on the topographic set- up, lithology and nature of weathering.

The yield of bore wells drilled down to a depth of 40 to 70 m. by various state agencies mainly for domestic purposes ranged from 10 to 250 lpm. The yield of successful bore wells ranged up to 6 lps for the drawdown varying between 5.76 and 17.56 m drilled down to a depth of 200 m bgl during the ground water exploration programme of central Ground Water Board.
The depth to water level in the District varied between 0.67 and 12.12 m bgl during pre- monsoon (May 2006) and varied between 0.49 and 8.78 m bgl during post monsoon (Jan 2007). The seasonal fluctuation shows a rise in water level which ranges from 0.35 to 2.8 m. the piezometric head varied between 3.49 and 16.23 m bgl during pre monsoon (May 2006) and 1.29 and 8.06 m bgl during post monsoon (Jan 2007).

Long Term Fluctuation (1998 – 2007):

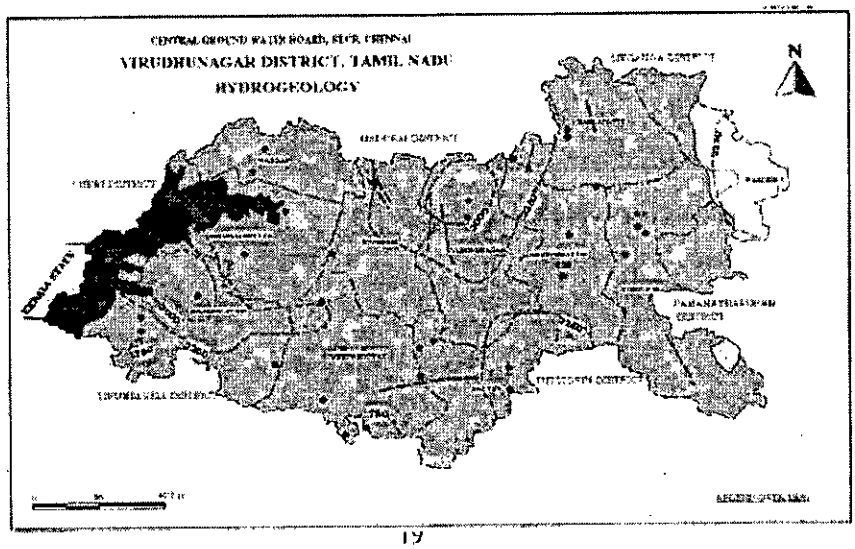
The long term water level fluctuation for the 1998 -2007 is indicates rise in water level in the range of 0.0009 – 0.3944 m/year. The fall in water level ranging between 0.0635 and 0.2693 m/year.

Aquifer parameters:

Formation	Transmissivity (m^2/ day)	Storativity	Specific Yield (%)
Weathered Crystallines	-	-	<2
Fractured	1-548	3.41 X 10^{-5} to	-
Crystallines		7.0 X 10^{-3}	

Ground water resources:

The ground water resources have been computed jointly by central Ground Water Board and State Ground & surface water Resources and Data center (PWD, WRO, and Government of Tamil Nadu) as on 31st March 2004. The salient features of the computations are furnished below. The computation of ground water resources available in the District has been done using GEC 1997 methodology.



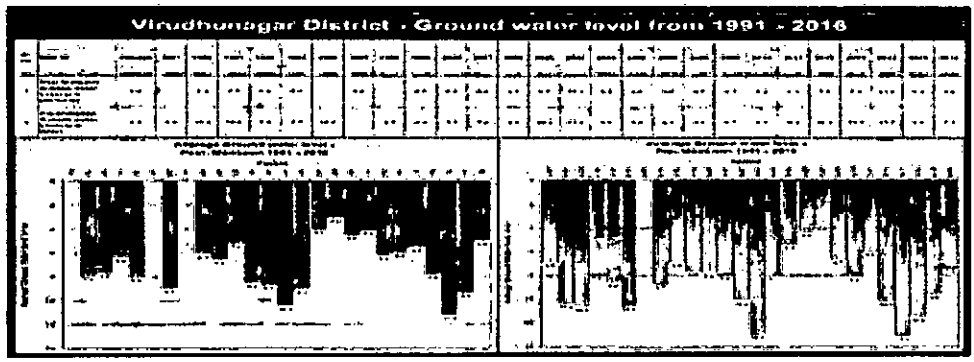
Block	Net Groundwater Availability (M.Cu.m)	Existing Gross Draft for Irrigation (M.Cu.m)	Existing Gross Draft for Domestic and industrial water supply (M.Cu.m)	Existing Gross Draft for all uses (M.Cu.m)	Allocation for Domestic and Industrial Requirement supply upto next 25 years (2029) (M.Cu.m)	Net groundwatre Availability for future Irrlation Development (M.Cu.m)	Stage of Groundwater Development (%)	Category of Block
Srivilliputtur	45.30	36.89	20.40	38.93	23.3	62.8	86	Semi Critical
Watrap	52.27	49.03	25.80	51.6	26.8	0.5	99	Critical
Rajapalayam	67.37	65.48	20.2	67.5	21.1	-	100	Over
Virudhunagar	36.17	14.20	30.4	17.24	31.7	18.80	48	Safe
Sathur	26.13	87.60	19.30	10.69	20.1	15.36	41	Safe
Aruppukottai	26.33	86.30	18.00	10.43	18.8	15.82	40	Safe
Thiruchuli	47.35	19.87	18.00	21.66	18.7	25.61	46	Safe
Narikudi	59.86	25.94	16.8	27.62	17.5	32.16	46	Safe
Kariyapatti	50.36	25.93	19.1	27.84	20.0	22.43	55	Safe
Sivakasi	31.82	18.85	46.30	23.48	48.3	8.1	74	Semi Critical
Vembakottai	26.82	13.14	23.7	15.51	24.7	11.22	58	Safe
Total	**469.78**	**443.23**	**258.00**	**312.5**	**271.00**	**212.67**	**66.52**	

Ground water quality:

The chemical characteristics of ground water in the phreatic zone in Virudhunagar District has been studied using the analytical data of ground water samples collected from Ground water monitoring wells of Central Ground Water Board. The study of quality of ground water in deeper aquifers in the District has been attempted using the data collected from exploratory bore/tube wells constructed in the District. Ground water in phreatic aquifers in Virudhunagar District, in general, is colorless, odourless and slightly alkaline in nature. The specific electrical conductance of ground water in phreatic zone (in Micro Seimens at 250 C) during May 2006 was in the range of 409 to 4350 in the District. It is between 750µS/Cm at 250 C in the major part of the District. Conductance below 750 µS/Cm at 25o C have been observed in ground water in parts of Sathur and Watrap blocks, whereas conductance exceeding 2250 µS/Cm at 25o C have been observed in part of Rajapalayam and Virudhunagar blocks.

It is observed that the ground water is suitable for drinking and domestic uses in respect of all the constituents except Total Hardness and Nitrate. Total hardness as CaCO3 is observed to be in excess of permissible limits of treating water standard of BU in about 49 percent of samples analyzed whereas Nitrate is found in excess of 45 mg/l in about 30 percent samples

analyzed. The incidence of high Total Hardness is attributed to the composition of litho units constituting the aquifers in the District. Whereas the Nitrate pollution is most likely due to the use of pesticides based on specific electrical conductance and Sodium Absorption Ratio (SAR), it is observed that ground water in the phreatic zone may cause high to very high salinity hazard and medium to high alkali hazard when used for the District while using ground water for irrigation.



Status of ground water development:

The estimation of ground water resources of the District shows that one block is over exploited and one block is under "critical" category. The shallow alluvial aquifers along Vaippar and Gundar rivers serves as an important source of drinking water and irrigation development of Virudhunagar District. Dug wells are the most common ground water abstraction structures used for irrigation in the District. The yield of dug wells range from <50 to 200 m3 /day in weathered crystalline rocks , 20 to 100 m3/day in Tertiary formation and up to 400 m3 /day in Recent alluvial formations along major drainage courses. The dug wells in hard rock terrain tapping the entire weathered residuum are capable of yielding 6 -7 lps, requiring the installation of 5 HP centrifugal pumps for extraction of ground water.

Groundwater management strategy:

In view of the presence of black top soil in the major parts of the District, the recharge potentials are very low and it has also resulted in quality problem. Hence, it is necessary to exercise causion while planning further development

of available groundwater resources in the District. The yields of dug wells in crystalline and Tertiary formations can be improved at favorable locations by construction of extension bores and radial arms respectively to a length of 20-30 m. In recent years, farmers for irrigation purposes have also drilled a large number of bore wells. The development of ground water for irrigation in the District is mainly through dug wells tapping the weathered residuum or recent alluvial deposits. Bore wells have also become popular as the source for irrigation in the District in recent years. Dug wells with extension bores wherever necessary is ideal for hard rock areas whereas large diameter dug wells with radials is suitable for alluvial areas.

Water conservation and artificial recharge:

CGWB had prepared a master plan to augment groundwater potential by saturating the shallow aquifer taking into consideration the available unsaturated space during post monsoon and available uncommitted surplus run off. Subsequently, computations have been made for Drought Prone Area Program (DPAP) for over exploited and critical blocks in the Districts warranting immediate attention. Institute of Remote Sensing, Anna University had prepared block wise maps demarcating potential zones for artificial recharge for the State of Tamil Nadu. Subsequently, State Government agencies have constructed artificial recharge structures with their own fund or with fund from Central Government, dovetailing various government programs. Ministry of Water Resources, Government of India has initiated Dug Well Recharge Scheme in the State. The scheme is being implemented by the Nodal Department (SG&SWRDC, PWD, WRO, and Government of Tamil Nadu) with the technical guidance of CGWB. The subsidy of Rs. 4000/- for small and marginal farmers and Rs. 2000/- for the other farmers is credited to the beneficiaries' bank account through NABARD. The scheme after implementation will prove to be beneficial to the irrigation sector. The available uncommitted surplus run off has to be recomputed, taking into consideration the quantum of recharge effected through existing irrigation dug wells also. The existing structures and uncommitted surplus flow should be considered for further planning of artificial recharge program.

On the basis of experimental studies, it has been found that de-silting of existing tanks followed by percolation pond with recharge wells, recharge shafts are economical.

There is considerable scope for implementation of roof – top rainwater harvesting in the District. Recharge pits / Shafts / trenches of suitable design are ideal structures for rainwater harvesting in such areas. Central Ground Water Board is also providing free technical guidance for implementation of rooftop rainwater harvesting schemes.

8. RAINFALL OF THE DISTRICT AND CLIMATIC CONDITION

The District receives the rain under the influence of both SouthWest & North East monsoons. The NorthEast monsoon chiefly contributes to the rainfall in the District. Most of the precipitation occurs in the form of cyclonic storms caused due to the depression in Bay of Bengal. The SouthWest monsoon rainfall is highly erratic and summer rains are negligible. Rainfall data from seven stations over the period 1901 -2000 were utilized for analysis and a perusal of the data shows that the normal annual rainfall over the District varies from about 724 to 913. It is minimum around Sathur in the SouthEastern part of the District. It gradually increases towards West, North and NorthWest and attains a maximum around watrap.

The District enjoys a subtropical climate. The period from April to June is generally hot and dry. The weather is pleasant during the period from November to January. Usually mornings are more humid than afternoons. The relative humidity is on an average between 65 and 85% in the mornings. Humidity in the afternoon is generally between 40 and 70 The annual mean, minimum and maximum temperatures are 23.78 and 33.950 C respectively. The daytime heat is oppressive and the temperature is as 40.20 C. the lowest temperature recorded is of the order of 19.30 C.

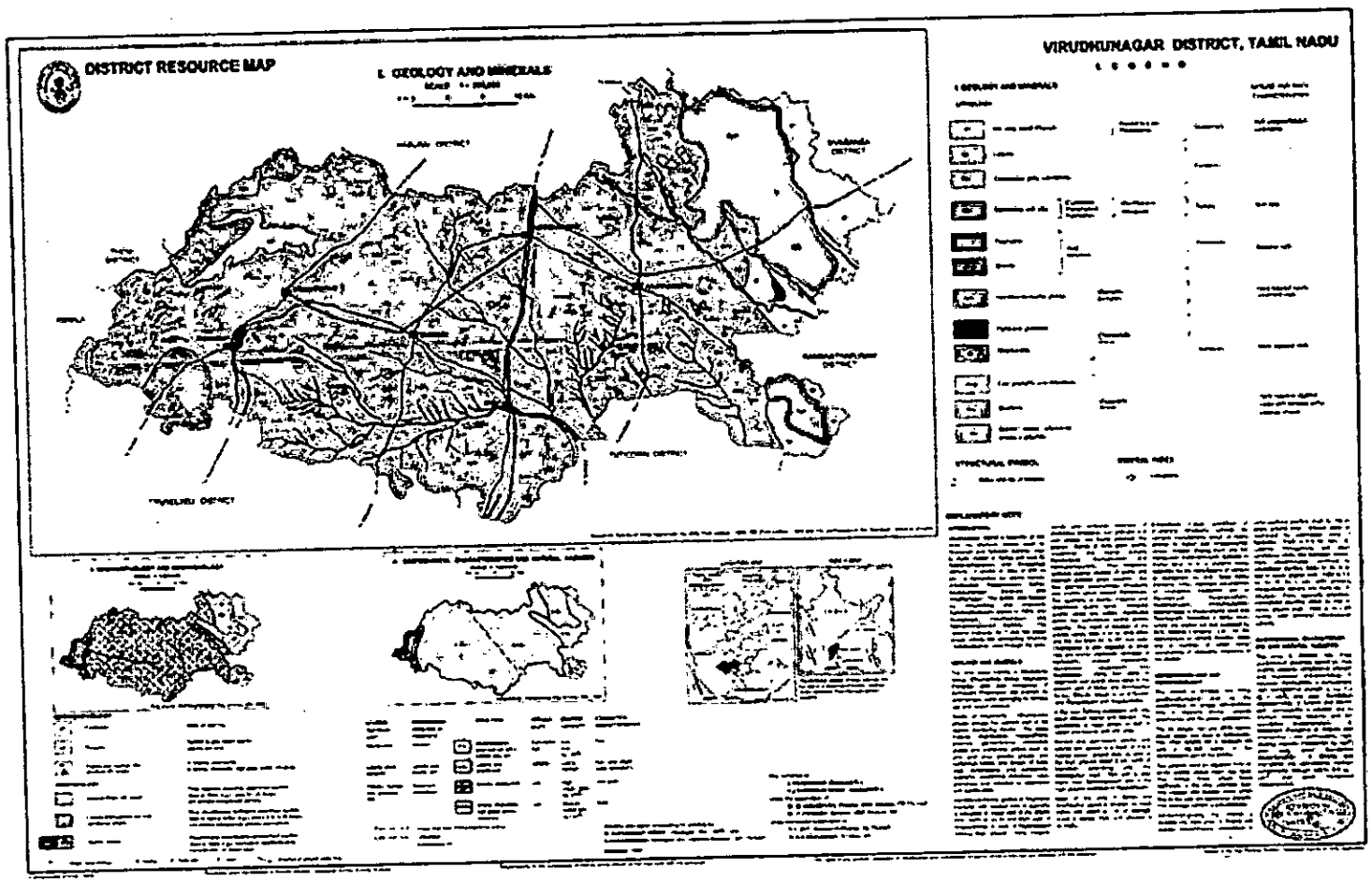
10. DETAILS OF ROYALTY OR REVENUE RECEIVED IN LAST THREE YEARS

Year	Royalty (in Lakhs Rs)	DMF (in Lakhs Rs)	NMET (in Lakhs Rs)
2015-16	388.16	77.76	1.83
2016-17	570.06	171.02	4.55
2017-18	658.74	197.62	5.34

11. DETAILS OF PRODUCTION OF LIMEKANKAR IN LAST THREE YEARS

Year	Lime kankar Production (Lakhs Ts)
2015-16	4.85
2016-17	7.12
2017-18	8.24

12. MINERAL MAP OF THE DISTRICT



13.LIST OF LETTER OF INTENT (LOI) HOLDERS FOR LIMEKANKAR IN THE DISTRICT ALONG WITH ITS VALIDITY AS PER THE FOLLOWING FORMAT

Sl. No.	Name of the Mineral	Name of the Lessee	Address & Contact No. of Letter of Intent Holder	Letter of Intent Grant Order No. & date	Area of mining lease to be allotted	Validity of LoI	Use (Captive/ Non-Captive)	Location of the Mining lease (Latitude & Longitude)
1	2	3	4	5	6	7	8	9
1	Limekankar & Clay (others)	The Ramco Cements Limited	5th Floor, Auras Corporate Centre, Chennai – 600004 Ph: 044-28478666	Lr.No.14547/MMC.2/2016-1 dated 21.04.2017	498.870 Ha	-	Captive	N9°19'42" to N9°21'38" E78°10'03" to E78°12'39"
2	Limekankar & Clay (others)	The Ramco Cements Limited	5th Floor, Auras Corporate Centre, Chennai – 600004 Ph: 044-28478666	Ltr No. 14546/MMC.2/2016-1, dt. 21.04.2017	23.290 Ha	-	Captive	N9°23'43" to N9°24'00" E78°09'37"to E78°10'05"
3	Limekankar & Clay (others)	The India Cements Limited	827, Dhun Building, Anna Salai, Chennai – 600 002. Ph: 0462 2300221	Lr. No. 16025/MMC.2/2016-1 dated 23.05.2017	479.195 Ha	-	Captive	N9°25'32.9" to N9°27'10.7" E78°07'55.5" to E78°09'28.7"
4	Limekankar & Clay (others)	The Ramco Cements Limited	5th Floor, Auras Corporate Centre, Chennai – 600004 Ph: 044-28478666	Ltr No. 2171/MMC.2/2018-1 dt. 02.04.2018	158.865 Ha	-	Captive	N9o23'24" to N9o24'05" E78o09'07" to E78o10'42"
5	Limekankar & Clay (Black Cotton Soil)	The Ramco Cements Limited	5th Floor, Auras Corporate Centre, Chennai – 600004 Ph: 044-28478666	Lr.No.2169/MMC.2/2018-1 dated 02.04.2018	123.265 Ha	-	Captive	N9°19'04" to N9°20'07" E78°12'32" to E78°13'38"
6	Limekankar & Clay (Black Cotton Soil)	The Ramco Cements Limited	5th Floor, Auras Corporate Centre, Chennai – 600004 Ph: 044-28478666	Lr.No.1769/MMC.2/2018 dated 12.03.2018	294.185 Ha	-	Captive	N9°26'08" to N9°24'33" E78°06'42" to E78°08'03"

14. TOTAL LIMEKANKAR RESERVE AVAILABLE IN THE DISTRICT

Sl. No.	Name of Lessee/ LoI Holder	Villages	Taluk	Limekankar Geological Reserves (Million Ts)
1	The Ramco Cements Limited	Suddhamadam	Aruppukottai	13.72
2	The Ramco Cements Limited	Marvarperungudi	Aruppukottai	0.64
3	The India Cements Limited	Kallurani, Muthuramalingapuram & Narttampatti Villages	Aruppukottai	9.58
4	The Ramco Cements Limited	Marvarperungudi & T.Koppuchittampatti	Aruppukottai	4.37
5	The Ramco Cements Limited	Vadakkunatham	Aruppukottai	3.39
6	The Ramco Cements Limited	T.Koppuchittampatti	Aruppukottai	8.09
7	The Ramco Cements Limited	Suddhamadam & Salukkuvarpatti	Aruppukottai	1.11

15. QUALITY /GRADE OF MINERAL AVAILABLE IN THE DISTRICT

The general chemical composition of the Limekankar available in the District is given below

CaO – 35 % to 40%
SiO2 – 16 % to 22 %
MgO – 01 % to 04 %
Al2O3 – 03 % to 05 %
Fe2O3 - 01 % to 03 %

16. USE OF MINERAL

The Limekankar available in the District is mainly used as a raw material for manufacturing of Cement.

17. DEMAND AND SUPPLY OF LIMEKANKAR IN THE LAST THREE YEARS

Year	2015-16	2016-17	2017-18
Demand (Lakh Ts)	7.9	8.8	10.3
Supply (Lakh Ts)	4.85	7.12	8.24

18. MINING LEASES (LIMEKANKAR) MARKED ON THE MAP OF THE DISTRICT

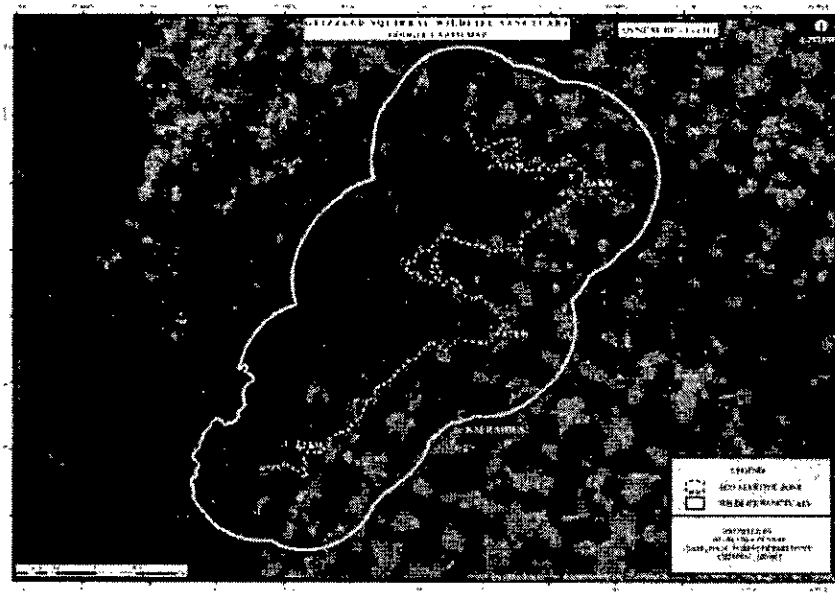
19. DETAILS OF THE AREA OF WHERE THERE IS A CLUSTER OF MINING LEASES VIZ. NUMBER OF MINING LEASES, LOCATION (LATITUDE AND LONGITUDE)

Sl.No	Name of the Mineral	Letter of Intent Grant Order No. & Date	Area of mining lease to be allotted (Ha)	Village	Taluk	District	Limekankar Geological Reserves (Mil.Tons)	Use (Captive/ non-captive)	Location of mining lease (Latitude & Longitude)
1	2	3	4	5	6	7	8	9	10
1	Lime kankar	Ltr No. 14546/MMC.2/ 2016-1, dt. 21.04.2017 & Ltr No. 2171/MMC.2/2 018-1 dt. 02.04.2018	23.29.0	Maravarperungudi	Aruppukottai	Virudhunagar	0.64	Captive	Lat; 9°23'43" N to 9°24'00" N Long: 78°09'37" E to 78°10'05" E
			158.865	Maravarperungudi & T.Koppuchithampatti	Aruppukottai	Virudhunagar	4.37		Lat; 9°23'24" N to 9°24'05" N Long: 78°09'07" E to 78°10'42" E
2	Lime kankar	Ltr No. 14547/MMC.2/ 2016-1, dt. 21.04.2017	498.87.0	Suddhamadam	Aruppukottai	Virudhunagar	13.72	Captive	Lat; 9°19'42" N to 9°21'38" N Long: 78°10'03" E to 78°12'39" E
		Ltr No. 2169/MMC.2/2 018-1 dated 02.04.2018	123.26.5	Vadakkunatham	Aruppukottai	Virudhunagar	3.39		Lat; 9°19'04" N to 9°20'07" N Long: 78°12'32" E to 78°13'38" E

20. DETAILS OF ECO-SENSITIVE AREA, IF ANY, IN THE DISTRICT

The Srivilliputhur Grizzled Squirrel Wildlife Sanctuary is the only wildlife sanctuary in Virudhunagar District which lies in the Western Ghats falling in the revenue Districts of Virudhunagar and Madurai between 09° 23' 37.77" to 09° 47' 48.74" N latitude and between 77° 20' 24.68" to 77° 47' 17.50" E longitude in the State of Tamil Nadu. The area was declared as a sanctuary in G.O. Ms. 399 Environment and Forests (FR.V) dated. 26-12-1988 with a total area of 476.65 Sq.km, consisting Reserved Forests in Rajapalayam and Srivilliputhur Taluk of Viruhudnagar District and Saptur R.F in Peraiyur Taluk of Madurai District with the sanctuary headquarters at Srivilliputhur. The plan showing the Eco Sensitive Zone declared a per the Ministry of Environment, Forest & Climatic Change draft notification vide S.O. 3363(E) dated 09.07.2018 is given below.

GOOGLE MAP OF ECO-SENSITIVE ZONE OF SRIVILLIPUTHUR GRIZZLED SQUIRREL WILDLIFE SANCTUARY



21. IMPACT ON THE ENVIRONMENT (AIR, WATER, NOISE, SOIL, FLORA & FAUNA, LAND USE, AGRICULTURE, FOREST ETC.) DUE TO MINING ACTIVITY

Mining and allied operations may affect the existing environmental setup in the area unless proper mitigation measures are not taken. Hence it is essential to assess the impacts of mining on various environmental parameters so that abatement measures could be planned in advance for systematic, sustainable and eco-friendly mining in the area.

21.1 Air Environment

The mining and allied operations may cause deterioration of air quality due to pollution if prompt care is not taken. The principal sources of air pollution in general due to mining and allied activities will be the dust generation in the mine due to:

- Excavation of Limekankar, overburden.
- Movement of HEMM such as Excavators, tippers etc.
- Loading and unloading operation
- Overburden & Limekankar transportation

Besides the above mentioned fugitive dust emissions, atmospheric pollution can occur as a result of emission of SO2, NOx, CO etc., from diesel driven mining equipment, compressors, generator sets, etc. Larger suspended particles are generally filtered in the nose and throat and do not cause problems.

Particulate matter smaller than 10 microns, referred to as PM10, can settle in the bronchi and lungs and cause health problems like Bronchitis, Emphysema, Bronchial Asthma, Irritation of mucus membranes of eyes, etc. Particles smaller than 2.5 micrometers (PM2.5), tend to penetrate into the lungs and very small particles (<100 nanometers) may pass through the lungs to affect other organs.

21.2 Water Environment

The major sources of water pollution normally associated due to mining and allied operations are:

- Generation of industrial effluent water from workshop, service building.
- Disturbance to drainage course or water bodies in the project area, if any.
- Washouts from waste dumps / embankment, if any.
- Domestic effluent
- Mine discharge water pumped out from opencast mines, if any and effect on ground water table.

Direct impact on human beings due to poor water quality consequent to mining operation can lead to various water borne diseases like diarrhea, jaundice, dysentery, typhoid, etc. Besides, the polluted water may not be useful for animal or human consumption, vegetation and may affect aquatic life, if effluents are not properly treated to remove the harmful pollutants.

21.3 Noise & Vibration

The impact prediction and control measure for noise environment due to mining and allied activities are described below:

Noise is one of the inevitable causes of pollution in mining operations, largely due to the extensive mechanization adopted. Since the Limekankar in the District is in friable form, no drilling and blasting is required for the excavation. Hence the major source of noise will be from the equipment's, such as, Excavation, loading & unloading & movement of vehicles, etc. will produce noise of considerable magnitude in mining operations. Prolonged exposure to a high noise level is harmful to the human auditory system and can create mental fatigue, rebellious attitude, annoyance and carelessness, which may lead to neglect of work and also result in accidents.

The Limekankar in this region is in friable form and can be excavated directly by using hydraulic excavator and there will not be any drilling and blasting involved in the mining operation. Hence, vibration due to blasting is not envisaged.

21.4 Impact on Land Environment

Due to mining and its allied activities there will some changes to the pre mining land status due to the following activities:

- Excavation of Ore and Waste / Overburden.
- Temporary side casting / Backfilling of Waste / Overburden.
- Construction of infrastructure facilities such as, office, road. Site services, etc.

21.5 Impact on Biological Environment

The major possible impact on biological environment due to mining are given below

- Clearance of vegetation due to mining and allied activities
- Retardation of tree growth, tip burning, etc., due to deposition of dust and the Particulate matter generated from the mining operation.
- Presence of Schedule-I fauna in the mining area
- Proposed impact on surface water quality that also provides water to wildlife
- Risk of fall/slip or cause death to wild animals due to project activities
- The project releases effluents into water bodies that also supplies water to wildlife
- Diversion of Agricultural lands for mining
- Diversion of Forest Lands for mining

22. REMEDIAL MEASURES TO MITIGATE THE IMPACT OF MINING ON THE ENVIRONMENT

The following remedial measures to be taken during mining

22.1 Remedial Measures to mitigate Air Pollution

- Water sprinkling on mineral transport road from the mines to the main road
- Black topping of the main transportation roads to the possible extent

- Avoiding crowding of trucks by properly spacing them to avoid the concentration of dust emission at any time
- Covering the trucks by tarpaulin sheets during ore transportation
- Proper maintenance of HEMM to minimize gaseous emission
- Imparting sufficient training to operators on safety and environmental parameters
- Proper maintenance of haul road and other roads
- Development of green belt/ plantation around mine, along the roads, backfilled area, in various undisturbed areas within the mine lease areas etc.

22.2 Remedial Measures to mitigate Water Pollution

- Industrial effluent treatment systems wherever necessary to be introduced and maintained properly.
- Saftey barriers to be provided for all water bodies and no mining activities should be carried out in the safety barrier area
- Mitigative measures like construction of garland drains formation of earth bunds to be followed in the waste dumping areas to avoid wash off.
- Domestic effluents to be treated in scientific manner.
- Required statutory clearances to be obtained and all precautionary measures to be adopted wherever punping of ground water is involved.

22.3 Remedial Measures to reduce Noise & Vibration

- Planting rows of native trees around mine, along the roads, other noise generating centres to act as acoustic barriers.
- Sound proof operator's cabin for equipment like Excavators, tippers etc.
- Proper and regular maintenance of equipment may lead to less noise generation.
- Air silencers of suitable type that can modulate the noise of the engines of machinery to be utilized and will be maintained effectively.
- Providing in-built mechanism for reducing sound emissions.
- Providing earmuffs to workers exposed to higher noise level and to those persons operating or working close to any machine.
- Conducting regular health check-up of workers including Audiometric test for the workers engaged in noise prone area.

22.4 Remedial Measures to reduce Impact on Land Environment

Scientific reclamation measures to be adopted to reduce the impact of land environment due to mining. Limekankar being shallow deposit backfilling of mined out voids may be practiced to avoid land degradation.

22.5 Remedial Measures to reduce Impact on Biological Environment

- The Limekankar bearing areas in the District is mostly of dry areas, afforestation to be carried out in the mining areas.
- Necessary mitigative measures like dust suppression, proper maintenance of equipments, black topping of roads etc., to be carried out to prevent dust generation & any further impact on the vegetation
- Conservation plan for schedule-I species if any to be prepared in consultation with Forest Department and the proposals given in the conservation plan to be strictly implemented.
- Effluents generated in the mining areas to be treated properly.

23. RECLAMATION OF MINED OUT AREA (BEST PRACTICE ALREADY IMPLEMENTED IN THE DISTRICT, REQUIREMENT AS PER RULES AND REGULATION, PROPOSED RECLAMATION PLAN)

Limekankar deposit in the District is of shallow depth. The reclamation of mined out lands by simultaneous backfilling and development of plantation in the backfilled areas will be the best practice of reclamation.

24. RISK ASSESSMENT & DISASTER MANAGEMENT PLAN

Risk Assessment and Disaster Management Plan in connection with mining and allied operations should be spelt out in detail to cover possible dangers /risks/explosions/accidents, etc. likely to arise from the project operations, including onsite and off-site emergency plans to meet the disastrous situations if any.

The mine management should be able to deal with the situation efficiently to reduce confusion keeping in view of the likely sources of danger in the project.

1) Outline of Disaster Management Plan :-

The purpose of disaster management plan is to restore the normalcy for early resumption of mining operation due to an unexpected, sudden occurrence resulting to an abnormality in the course of mining activity leading to a serious danger to workers or any machinery or the environment.

2) System of Communication:-

An internal communication system should be provided. Telephone nos and addresses of adjoining mines, rescue station, police station, fire service station, local hospital, electricity supply agency and standing consultative committee members should be propely updated and displayed.

3) Consultative Committee:-

A standing consultative committee should be formed under the Head of Mines. The members consists of Mines Manager / Safety Officer / Medical Officer / Public Relation Officer/ Foreman/ and Environmental Engineer.

4) Facilities & Accommodation:-

Accommodation and facilities for medical centre, rescue room and for various working groups should be provided. Regular checking of these facilities shall be undertaken.

5) First Aid & Medical Facilities:-

The mine management should be having first aid / medical centre for use in emergency situation. All casualties should be registered and should be given first aid. The centre should have facilities for first aid & minor treatment, resuscitation, ambulance and transport. Proper telephone / wireless set should be provided for quick communication with hospitals where the complicated cases are to be referred. Regular checking of these facilities shall be under taken by the doctor and the in-charge of the first aid room.

6) Stores and Equipment :-

A detailed list of equipment available, its type and capacity and items reserved for emergency should be maintained.

7) Transport Services:-
A well-defined transport control system should be provided to deal with the situation.

8) Functions of Public Relations Group:-
Liaison with representatives of the mine workers is required to ameliorate the situation of panic, tension, sentiments, grievances and misgivings created by any disaster. Management is required to ameliorate the injured, survivors and family members of affected persons by providing material, finance, moral support and establishing contact with relatives of victims. The consultative committee formed, especially the nominated public relation officer shall look into these aspects.

9) Security:-
Manning of security posts is very essential during the disaster management.

10) Catering & Refreshment: -
Arrangement will be made for the victims, rescue teams and others.

25. DETAILS OF THE OCCUPATIONAL HEALTH ISSUES IN THE DISTRICT. (LAST FIVE-YEAR DATA OF NUMBER OF PATIENTS OF SILICOSIS & TUBERCULOSIS IS ALSO NEEDS TO BE SUBMITTED)

The details of number of patients treated for Silicosis and Tuberculosis for the last five years in the District is given below

Sl. No.	Year	Number of patients treated for Silicosis	Number of patients treated for Tuberculosis
1	2017	Nil	410
2	2016	Nil	423
3	2015	Nil	403
4	2014	Nil	316
5	2013	Nil	237

26.PLANTATION AND GREEN BELT DEVELOPMENT IN RESPECT OF LEASES ALREADY GRANTED IN THE DISTRICT

It is necessary to develop Green Belt in and around the polluted site with suitable species to reduce the air pollution effectively. Implementation of afforestation program is of paramount importance. In addition to augmenting existing vegetation, it also checks soil erosion, make the ecosystem more complex and functionally more stable and make the climate more conductive.

Limekankar deposits being shallow in depth, mining and simultaneous backfilling method is being followed in most of the mining areas. The plantation is proposed and is being carried out in the safety barrier areas and also in the minedout and backfilled areas. Plantation is propsoed in minimum 33% of the total lease area. There are around 1,56,000 trees has been planted in the existing mining areas in the District.

27.ANY OTHER INFORMATION

Nil

5/5

Deputy Director (i/c),
Geology and Mining,
Virudhunagar.

Chairperson / District Collector,
District Environment Impact Assessment Authority,
Virudhunagar.