DISTRICT SURVEY REPORT – GRAVEL & ROUGH STONE
RAMANATHAPURAM DISTRICT
TAMILNADU STATE

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

தமிழ்நாடு அரசு
புவியியல் மற்றும் சுரங்கத்துறை

GOVERNMENT OF TAMIL NADU
DEPARTMENT OF GEOLOGY AND MINING

15/19
Assistant Director (i/c)
Geology and Mining,
Ramanathapuram.

28.05.2019
DISTRICT COLLECTOR
RAMANATHAPURAM

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1. INTRODUCTION

In pursuance to the Gazette Notification, Ministry of Environment, Forest and Climate Change, the **Government of India Notification No. S.O.3611 (E) dated 25.07.2018** laidprocedure for preparation of District Survey Report of minor minerals other than sand mining or river bed mining. The main purpose of preparation of District Survey Report is to identify the mineral resources and developing the mining activities along with other relevant data of the District.

2.0 OVERVIEW OF MINING ACTIVITY

The district of Ramanathapuram is not very much rich in mineral resources. Among the known resources, only minor minerals are mostly found. Mineral of Economic importance found in Ramanathapuram district are mainly placer deposits like beach sand carrying garnet and Ilmentite, gypsum, salt, savadu, gravel/laterite, lignite and oil & natural gas. Mining activities based on these minerals are very less. However, numerous rough stone quarries are operational for production of construction material and earth fill (gravel) in Kilaramanadi, Naranapuram, Kilaramanadi, Kalimangundu ,Ervadi, Panaikulum and Sudiyur, areas in this district. In addition to above, 'brick clay' mining is also active in Kulanthapuri and Karuthanendal areas.

ONGC is carrying out pumping of crude oil & natural gas since last one decade in ThrippulaniRegunathapuram and Valandharavai areas. GSI has also explored presence of lignite in Vella and Bogalur and Kalari east sector.

The Office of the Assistant Director, Department of Geology and Mining (DGM) is functioning in Ramanathapuram district under the control of District Collector, Ramanathapuram. The DGM is looking after the work of granting leases for minor minerals

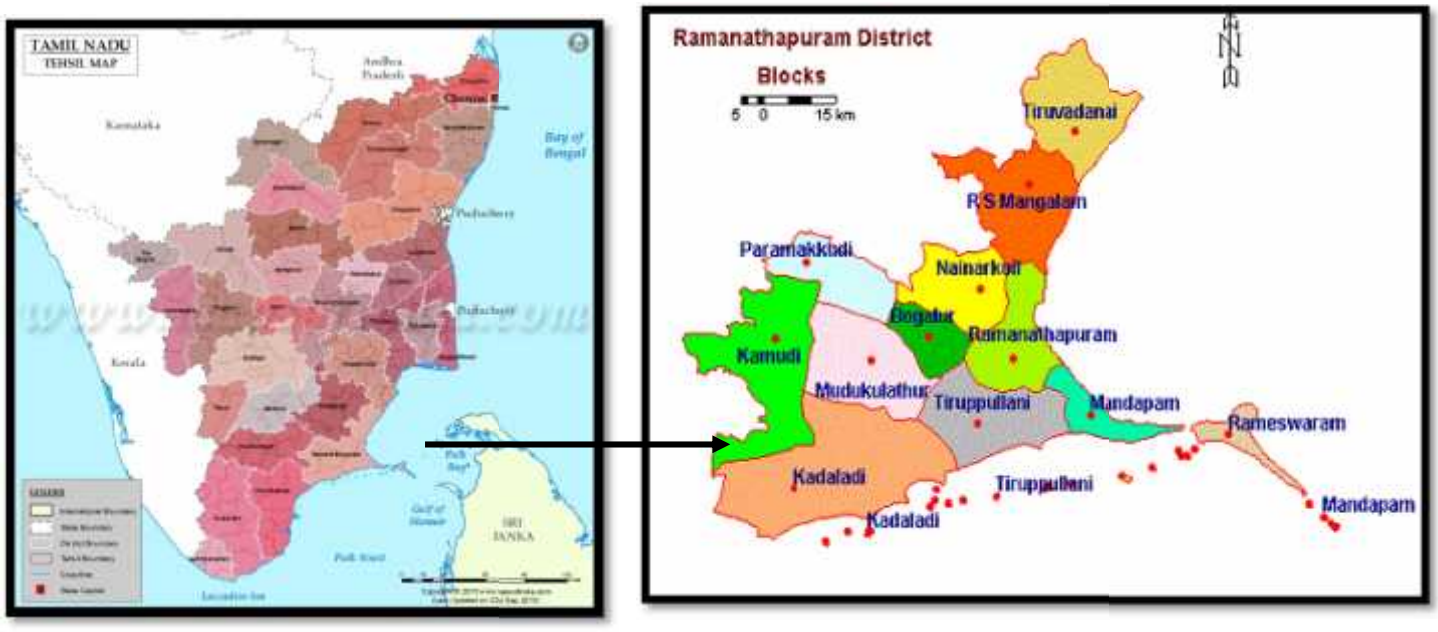
(savadu, gravel/laterite, brick clay, etc) dimensional stones and rough stones. DGM is also curbing illicit training in the district.

3.0 GENERAL PROFILE OF THE DISTRICT

In the early 15th Century the present territories of Ramanathapuram district comprising of taluks Tiruvadanai, Paramakudi, Kamuthi, Mudukulathur, Ramanathapuram and Rameswaram were included in Pandiyan Kingdom. For a short period, this area was under the Chola Kings when RajendraChola brought it under his territory in 1063 AD. In 1910, Ramanathapuram was formed by clubbing portions from Madurai and Tirunelveli district. During the British period this district was called "Ramnad". The name continued after independence. Later the district was renamed as Ramanathapuram to be in conformity with the Tamil name for this region.

3.1 LOCATION

Ramanthapuram District covers an area of 4123 sq.km and falls within the latitude from 09°05' to 09°50' and longitude from 78°10' to 79°27'. Ramanthapuram District is bounded on the north by Sivaganga District, on the northeast by Pudukkottai District, on the east by the Palk Strait, on the south by the Gulf of Mannar, on the west by Thoothukudi District, and on the northwest by Virudhunagar District.



3.3 ADMINISTRATIVE SET - UP

Ramanthapuram District covers an area of 4123 sq.km and falls within the latitude from 09°05' to 09°50' and longitude from 78°10' to 79°27'. It has seven taluks (Ramanathapuram, Tiruvadanai, Rameswaram, Paramakudi, Mudukulathur, Kamuthi and Kadaladi. with total population of 1,353,445 (as per 2011 census). But now one new Taluk named Kilakarai has been formed by clubbing portion of Ramanathapuram and Kadaladi Taluks in the year 2015 and its head quaters in Kilakarai. Total No. of Hamelet villages are 2362. The divisional details of the district is given below:

Name of the Division	Taluks comprised in the Division	Total No. of firkas	Total No.of Revenue Villages	Total No.ofHamelet villages
Ramanathapuram	Ramanathapuram	4	43	529
	Tiruvadanai	4	61	635
	Rameswaram	1	2	31
	Keelakarai	3	26	-
	R.S Mangalam	3	39	-
Paramakudi	Paramakudi	6	93	367
	Mudukulathur	6	46	207
	Kamuthi	5	49	352
	Kadaladi	6	45	241

3.4 AGRICULTURAL RESOURCES AND IRRIGATION

The above district profile reveals that the Ramanathapuram district is a dry and most backward area which has more sandy soil on which nothing grows. Among the cultivation of major important crops, the productions of pulses are more than other crops. The important food crops grown were paddy, millets like Cholam, Cumbu, Chillies, ragi and Varagu, groundnut and sugarcane It is known that the pulses occupied first place by production and covering 47.98 per cent of the districts total principal crops in production. It is inferred from the result that the farmers preferred dry crops (Pulses) for earning more money because of shortage of rain water.

The major source of irrigation in the district was tank fed by rains. Details with regard to net area irrigated by sources of tanks, tubewells and other wells revealed the erratic pattern in area irrigated. The net area irrigated by the three different sources was very high and dependence on well had been relied upon in the event of tank water shortage.

3.5 TRADE AND COMMERCE

This district is industrially backward and the three taIuks, Paramakkudi, Kadaladi and Kamuthy had been declared by the State Government as backward areas. The main industries in which they were engaged were wood based industries, tinkering, fabricating of metal products, printing and binding, manufacture of agricultural implements and cement tiles, automobiles servicing and repair and safety matches. In addition to the small scale units, there were a number of villages and 320 cottage industries prominent among them were pottery, blacksmith, carpentry, basket making, rope making and synthetic gem-cutting.

There are about 184 fishing villages situated along the coastline in Ramanathapuram district. This district had the natural advantage of having its fishing ground in Palk Bay and the Gulf of Manner. The coastal area is not influenced by dynamic changes of the sea like tsunami waves, monsoon winds and currents. Therefore, it is offered wide scope for spawning activities of fishes. These favourable natural conditions facilitated the conduct of marine fishery operations throughout the year. But the inland fisheries are also ineffectively carried on in this district. In Ramanathapuram district 7 fish processing factories are functioning in Tondi and Mandapam. Prawn, Squids, Cuttle fish, Crabs and fish are processed by fishing and exported to foreign countries. Many small entrepreneurs are involved in fish drying and dried fish is used in poultry and cattle feed manufacturing.

4. GEOLOGY OF THE DISTRICT

Most of the area is covered by the unconsolidated sediments of Quaternary age except in the northwestern part, where isolated patches of ArchaenCrystallines and Tertiary sandstone are exposed. The Archaeans are mainly represented by the Charnockite Group of rocks comprising garnetiferrous granulite and the Khondalite Group of rocks made up of quartzite of geneses. The Tertiary sandstone (Cuddalore Formation) comprise pinkish, yellowish, reddish (variegated colours) medium to coarse grained sandstone and clay stone. It is overlain by thin alluvium and exposed towards north of Vaigai River.

Detached exposures of laterite and lateritic soil are seen in the northwestern part of the district. A major part of the district is covered with the fluvial, fuvio-marine, Aeolian and marine sediments of Quaternary age. The fluvial deposits which are made up of sand, silt and clay in varying degree of admixture occur along the active channels of Vaigai, Gundar, Manimuthar and Pambar rivers. They have been categorized into levee, flood basin, channel bar/ point bar and paleo-channel deposits. The paleo channel deposits comprise brown coloured, fine to medium sands with well preserved cross-beddings.

The fluvio-marine deposits are exposed in the Vaigai delta as deltaic plain, paleo-tidal and dune flat deposits. The deltaic plain and dune flats comprise medium, Grey brown sands. The paleo tidal flat deposits include black silty clay, black clay and mud. In Rameswaram Island, the fluvio-marine deposits include indurated sand and dune sands.

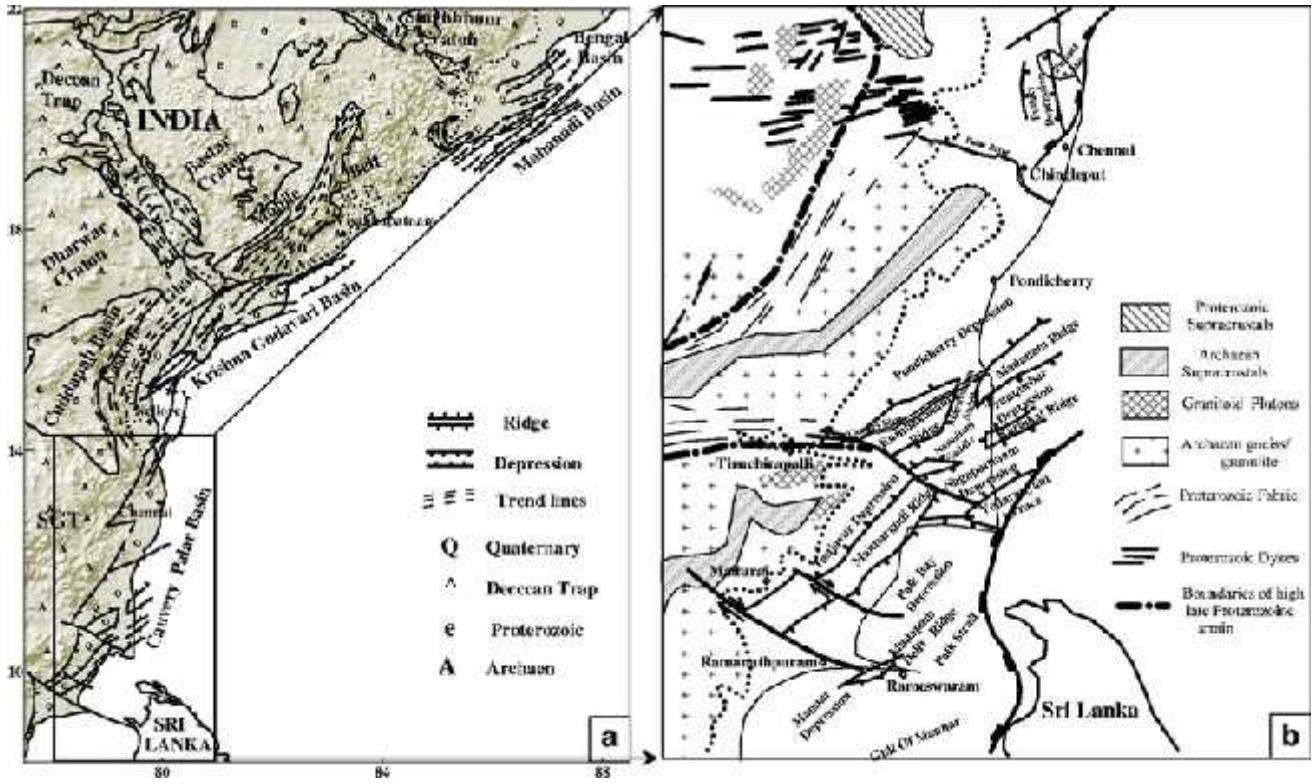
The Aeolian deposits comprise red sands which are in nature of ancient dunes and occur over a 3.2 Km wide and 8 Km long stretch and lie parallel to the sea coast. These are separated by marshy deposits of black clays. The sands are underlain by calcareous hardpan. In Rameswaram Island also brown sand deposits occur around Sambaimadam on either side of NH 49 west of the town.

4.1. PHYSIOGRAPHY OF THE DISTRICT

Physiographically, the entire district is a plain terrain. Major part of the district is a gently sloping plain except for remnant hills in the western area. Recent Quaternary studies have brought out various erosional and depositional landforms of fluvial and marine regimes. The fluvial landforms comprise flood plains of Vaigai, Varshalei, Pambar, Kottakkarai and Gundar rivers. The marine landforms comprise sand mounds (Teri's) and barrier dunes along the present

coast. The erosional processes are manifested in the form of pediments and pedipalin around Kamuthi.

The Cauvery–Palar basin is one of the major petroliferous basins located at the south eastern coast of the peninsular India covering the coast between Ramanathapuram near the Palk Strait. The basin is characterized by the presence of NE–SWtrending horst-graben subsurface basement struc-tural features having a sediment cover of nearly1–6 km.



Geomorphological and tectonic map showing Cauvery–Palar basin covering the coast between Ramanathapuram near the Palk Strait.

The marine formation comprises coastal plain deposits of sand and clay in varied proportion. Marine calcareous hardpan occurs as low terraces and platforms, with admixture of quartz, limonite and garnet concentration.

4.2. PROCESSES OF DEPOSITION OF SEDIMENTS IN THE RIVERS OF THE DISTRICT

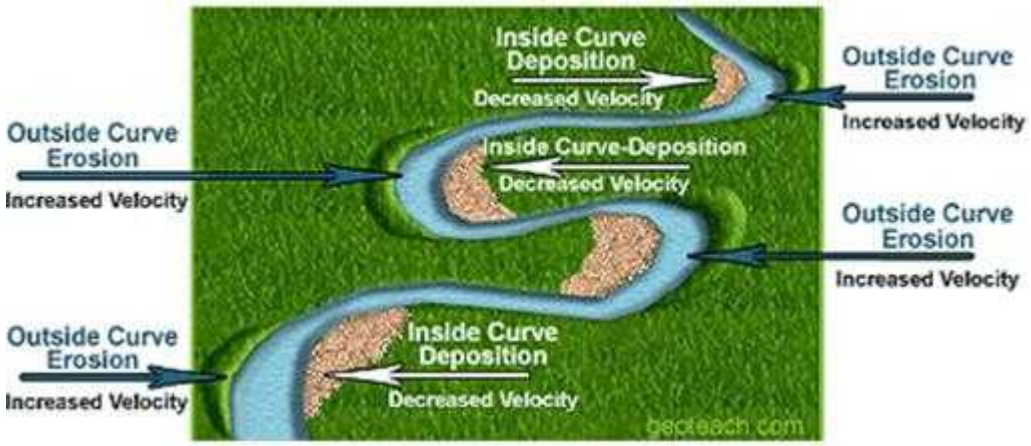
River sediment refers to the conglomerate of mineral matters such as clay, silt and sand which are derived from erosion and weathering of rocks present in the river bed. Breaking down of rocks by a geological agent, here it is river (water flow), is called erosion. Erosion of rocks

occurs in many ways. Weathering is described as disintegration and decomposition of rocks due to change in physical and chemical conditions of the rock. Sediments are derived by these natural processes. Sediments are subsequently transported by water and/or by the force of gravity acting on the sediments.

Sediments become the river's load and the river transport this loads through its course. Transportation of the sediments depends on the energy of the river and how big the load is. Boulders are transported by traction by which boulders are rolled along the bed of the river, eroding the bed and the particles in the process, because the river doesn't have enough energy to move these large particles in any other way. Slightly smaller particles, such as pebbles and gravel, are transported by saltation. This is where the load bounces along the bed of the river because the river has enough energy to lift the particles off the bed but the particles are too heavy to travel by suspension. Fine particles like clay and silt are transported in suspension; they are suspended in the water. Most of a river's load is transported by suspension. Solution is a special method of transportation. This is where particles are dissolved into the water so only rocks that are soluble, such as limestone or chalk, can be transported in solution.

Deposition occurs when forces responsible for sediment transportation are no longer sufficient to overcome the forces of gravity and friction which are creating a resistance to motion. To transport load, a river needs to have energy at the same time when a river loses energy, it is forced to deposit its load. One of the following ways, a river could lose its energy:

1. Reduction in the discharge: Reduction in discharge may be due to lack of precipitation and evaporation and abstraction by human activity.
2. Change in the river gradient: If the gradient of the river's course flattens out, the river will deposit its load because it will be travelling a lot slower. When a river meets the sea a river will deposit its load because the gradient is generally reduced at sea level and the sea will absorb a lot of energy.



Much of the material will be carried in suspension and loads in suspension erode the river banks by abrasion. When rivers flow over flatter land, they form large bends called meanders. As a river goes around a bend, most of the water is pushed towards the outside causing increased erosion. The river is now eroding sideways into its banks rather than downwards into its bed, a process called lateral erosion. On the inside of the bend, in contrast, there is much less water. The river will therefore be shallow and slow flowing. It cannot carry as much material and so sand and gravels will be deposited. This is called a point bar or slip off slope. Due to erosion on the outside of a bend and deposition on the inside, the shape of a meander will change over a period of time. Eventually deposition will block off the old meander to leave an oxbow lake. The oxbow lake will slowly dry up, only refilling after heavy rain or during a flood.

5. DRAINAGE OF IRRIGATION PATTERN

Vaigai, Gundar, Manimuthar and Pambar rivers are the major rivers draining the district. The general trend of the rivers is in NW-SE direction. The fluvio-marine deposits are exposed in the Vaigai delta as deltaic plain, paleo-tidal and dune flat deposits. Deposition of river sand in the rivers flowing in Ramanathapuram district is very less due to its seasonal in nature. The rivers of the district were only jungle streams that remained dry for the greatest portion of the year.

However, mention may be made of Vaigai River which starts in Theni district in Tamil Nadu and ends with the Ramanathapuram big tank to the west of the Ramanathapuram town. There are seasonal smaller rivers like Malataru, Gundaru, and Sarugani river.

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

Soil is one of the natural resources which has the most direct impact on agricultural development. Types of soil, rainfall and irrigation projects have influenced the development of land use in the district. While the entire area of this district consists of Red loam, Laterite soil Black soil and Sandy soil. This area is dry and backward and known as East Ramanathapuram, comprising the taluks Thiruvadanai, Ramanathapuram, Kadaladi and Rameswaram. This region is called coastal region of Ramanathapuram district. It has all the depressing features such as poor soil, frequent droughts, absence of irrigation systems, precarious farming etc. This area is much more backward and underdeveloped than any other districts. Mainly in coastal area, the terrain is completely a sandy tract with very little scope for agriculture. So, all the people of

coastal region of Ramanathapuram are engaging themselves intensively in the fishing occupation. The major source of irrigation in the district was tank fed by rains. Details with regard to net area irrigated by sources of tanks, tube wells and other wells revealed the erratic pattern in area irrigated. The cattle wealth of this district is important to improve its agricultural resources. The important subsidiary activities carried on by the cultivators and agricultural labourers are dairying, sheep rearing and poultry. The following table shows land utilization pattern in the district:

Nine Fold Classification

Sl.No	Land Classification	AREA Current	LastYear	Diff.	Perc.
a	Forest	4488.000	4488.000	0.000	0.00
b	Uncultivable Waste	4524.395	4524.395	0.000	0.00
c	Non Agri Uses				
	-Building	5106.312	5100.382	5.930	0.12
	-Roads	5941.606	5941.606	0.000	0.00
	-Railway Lines	630.000	630.000	0.000	0.00
	-Rivers	7184.000	7184.000	0.000	0.00
	-Canals	7593.270	7593.270	0.000	0.00
	-Check Dams	38900.010	38900.010	0.000	0.00
	-Swamp Area	2341.000	2341.000	0.000	0.00
	-Social Forest	4557.300	4557.300	0.000	0.00
	-Others	14791.755	14797.685	-5.930	-0.04
	-Total	87045.253	87045.253	0.000	0.00
d	Cultivable Waste Land	3490.860	3532.670	-41.810	-1.18
e	Permanent Pasture & Grass Land	154.000	154.000	0.000	0.00
f	Misc. Tree Crops & Groves	30922.489	30940.949	-18.460	-0.06
g	Current Fallow	61622.097	38289.801	23332.296	60.94
h	Other Fallow	49239.296	41163.702	8075.594	19.62
i	Net Cultivated Area	167470.645	198818.265	-31347.620	-15.77
	Total	408957.035	408957.035	0.000	0.00

7. SURFACE WATER AND GROUND WATER SCENARIO OF THE DISTRICT

7.1 HYDROGEOLOGY

The district is underlain by both porous and fissured formations. . The important aquifer systems in the district are constituted by i) unconsolidated & semiconsolidated formations and ii) weathered and fractured crystalline rocks.

The porous formations can be grouped into three aquifer groups, viz., Cretaceous sediments, Tertiary Sediments and Quaternary Sediments. The cretaceous aquifer is semi confined to confined in nature and consists of two zones. The top unit comprises fossiliferous sandstone red in colour and compact in nature, while the bottom is pinkish or grayish sandstone intercalated with shales. The aquifers are characterized by freshwater and occurs at the depth range of 116-407 and 205-777 m bgl and has thickness in the range of 68 to 535 m. The aquifer

is made up of compact sandstone and the potential is limited. The wells may yield a discharge of 5-10 lps and can sustain a pumping of 10-15 hours a day. However, because of the presence of potential shallow tertiary aquifer, this aquifer has not been extensively developed. Cuddalore

Sandstone of Tertiary sediments consists Sandstone, Clay &Conglomerate. They are encountered at the depth of 15-75 m bgl with the thickness ranging from 20 to 70 m. The groundwater occurs under unconfined condition with thickness varying from 15-20m and under confined condition in deeper depths. The unconfined aquifer can be tapped by dug well/ dug cum bore well and can yield about 10-15 lps and can sustain a pumping of 10-15 hours a day. The deeper tube wells can yield about 15-20 lps and can sustain a pumping of 10-15 hours a day.

Quaternary sediments comprises fluvial and coastal sands and laterites. The alluvium with alternate layer of sand and clay with a thickness of 15-25 m and are characterized by floating freshwater lenses limited to a depth 6-7 m bgl and can sustain a pumping of 2 – 3 hours and can yield about 2-5 lps.

The water-bearing properties of crystalline formations which lack primary porosity depend on the extent of development of secondary intergranularporosity . 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 structural features even within short distances. Ground water generally occurs under phreatic conditions in the weathered mantle and under semiconfined conditions in the fissured and fractured zones at deeper levels. The thickness of weathered zone in the district is in the range of 4 to 15 m. The depth of the wells ranged from 10.00 to 15.00 m bgl.

The yield of large diameter wells in the district, tapping the weathered mantle of crystalline rocks ranges 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 ranges from 20.25 to 95 lpm / m. of drawdown. The yield characteristics of wells vary considerably depending on the topographic set-up, litho logy and nature of weathering. The transmissivity of weathered formations computed from pumping test data using empirical methods range < 1 m /day.

7.2. LONG TERM FLUCTUATION (1998-2007)

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

7.3. GROUND WATER QUALITY

The chemical characteristics of ground water in the phreatic zone in Ramanathapuram district has been studied using the analytical data of ground water samples collected from Network Hydrograph Stations 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 inRamanathapuram district, in general, is colourless,odourless and slightly alkaline in nature. The specific electrical conductance ofground water in phreatic zone (in MicroSeimens at 25^{o} C) during May 2006 was in therange of 409 to 4350 in the district. It is between 750 and 2250µS/cm at 25C in themajor part of the district.

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 in more than 90 percent of samples analysed. Total Hardness as CaCo3 is observed to be in excess of permissible limits in about 49 percent of samples analysed whereas Nitrate is found in excess of 45 mg/l in about 30 percent samples. The incidence of high total hardness is attributed to the composition of lithounits constituting the aquifers in the district, whereas the Nitrate pollution is most likely due to the use of pesticides and fertilizers for agriculture.

With regard to irrigation suitability based on specific electrical conductance and Sodium Adsorption 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 irrigation. Proper soil management strategies are to be adopted in the major part of the district while using ground water for irrigation.

7.4. GROUNDWATER DEVELOPMENT

In view of the comparatively high level of ground water development in the major part of the district and the quality problems due to lithogenic and anthropogenic factors, it is necessary to exercise caution while planning further development of available ground water resources in the district.

The yields of dug wells in crystalline and Tertiary formations are improved at favorable locations by construction of extension bores which are 20 to 40m. deep. In recent years, a large number of bore wells have also been drilled by farmers for irrigation purposes.

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.

Large diameter collector wells are ideal structures for ground water extraction in the river alluvial tracts, where the granular zones are generally restricted to 35 m bgl. The coastal sands in the eastern part of the district also form good aquifer material. The tube wells may be constructed down to a maximum depth of 40 m bgl in the district. The width and position of the screen in the wells may be decided based on the depth to piezometric surface and discharge required.

7.5. WATER CONSERVATION AND ARTIFICIAL RECHARGE

The topography of Virudhunagar district, in general, is suited for construction of various artificial recharge structures such as percolation ponds, check dams and subsurface dykes.

However, detailed studies are necessary to formulate a comprehensive scheme for artificial recharge of phreatic ground water in the district in view of the variations in the geomorphic set-up and the complex hydrological and hydrogeological conditions.

The artificial recharge to ground water is recommended giving priority to blocks where the development of ground water resources is comparatively high, Site specific design has to be adopted depending on the on the aquifer geometry and availability of surplus non committed runoff.

There is considerable scope for implementation of rain water harvesting in the district, especially in the area underlain by Recent alluvial formations. Such schemes, which are simple in design and are comparatively cheap, could serve to arrest the decline in ground water levels

and improve ground water quality, if taken up in sufficient numbers. Recharge pits / Shafts / trenches of suitable design are ideal structures for rain water harvesting in such areas. Free technical guidance for implementation of roof-top rain water harvesting schemes is also being provided by Central Ground Water Board, and manual is also published to give more scientific design tips.

8. CLIMATE AND RAINFALL OF THE DISTRICT

Ramanathapuram district is a dry and backward area. Here, the hottest months of a year are May and June. The rainy season begins from the month of August. The average annual rainfall of this district from South-West monsoon is 136.1 mm and North-East monsoon is 507.4 mm, the district also gets considerable rainfall during North-East monsoon.. Month wise rainfall data of the district is given below:

YEAR	JAN		FEB		MAR		APR		MAY		JUN	
	R/F	%DEP	R/F	%DEP	R/F	%DEP	R/F	%DEP	R/F	%DEP	R/F	%DEP
2014	-	-	-	-	-	-	-	-	-	-	-	-
2015	-	-	-	-	-	-	-	-	-	-	-	-
2016	-	-	-	-	-	-	-	-	-	-	-	-

YEAR	JUL		AUG		SEPT		OCT-DEC	
	R/F	%DEP	R/F	%DEP	R/F	%DEP	R/F	%DEP
2014	-	-	-	-	-	-	630.64	
2015	-	-	-	-	-	-	627.31	
2016	-	-	-	-	-	-	173.29	

9. DETAILS OF THE MINING LEASES IN THE DISTRICT AS PER THE FOLLOWING FORMAT

Sl. No	Name of the Mineral	Name of the Lessee	Address & Contact No. of Lessee	Mining Lease Grant order No. & Date	Area of Mining Lease (Ha.)	Period of Mining Lease (Initial)		Period of Mining lease (1st /2nd ….renewal)		Date of Commencement of Mining Operations	Status (Working / Non-Working /Temp. Working for dispatch etc.,)	Capitive / Non-Capitive	Obtained Environmental clearance (Yes/No), If yes letter No. with date of grant of EC.	Location of the Mining Lease (Latitude& Longitude)	Method of Mining (Opencast/Underground)
						From	To	From	To						
1.	Rough Stone & Gravel	**S.lakhsmanan**	**Mustakurutchi, Kamuthi.**	1168/GM2/2017 19.012.2017	**6.22.5**	**26.12.2017**	**25.12.2022**			**26.12.2017**	Working	Non captive	Yes	Latitude :09°23'26"N to 09°23'87"N Longitude :79°17'54"E to 79°18'03"E	Opencast

10. **DETAILS OF ROYALTY OR REVENUE RECEIVED DURING THE LAST THREE YEARS**

Month and Year	Gravel	Month and Year	Gravel	Month and Year	Gravel
04/2016	67500	**04/2017**	48750	**04/2018**	12000
05/2016	142500	**05/2017**	37500	**05/2018**	6000
06/2016	354375	**06/2017**	132825	**06/2018**	24000
07/2016	202500	**07/2018**	105450	**07/2018**	24000
08/2016	241875	**08/2017**	137250	**08/2018**	30000
09/2016	185625	**09/2017.**	111150	**09/2018**	24000
10/2016	78750	**10/2017**	120900	**10/2018**	6000
11/2016	33750	**11/2017.**	100050	**11/2018**	0
12/2016	0	**12/2017**	128475	**12/2018**	0
01/2017	0	**01/2018**	77750	**01/2019**	120000
02/2017	0	**02/2018**	43500	**02/2019**	30000
03/2017	177502	**03/2018**	51000	**03/2019**	165000
Total	1484377	**Total**	1094600	**Total**	441000

11. DETAILS OF PRODUCTION OF MINOR MINERAL IN LAST THREE YEARS:

Seigniorage Fee (Minor Minerals) (2016-2017)				
Month and Year	**Rough Stone**	**Production**	**Gravel**	**Production**
04/2016	0	0	67500	2250
05/2016	0	0	142500	4825
06/2016	0	0	354375	118125

07/2016	0	0	202500	6750
08/2016	0	0	241875	80625
09/2016	0	0	185625	61875
10/2016	0	0	78750	2625
11/2016	0	0	33750	1125
12/2016	0	0	0	0
01/2017	0	0	0	0
02/2017	0	0	0	0
03/2017	0	0	177502	5917
Total	**0**	**0**	1484377	49479

Seigniorage Fee (Minor Minerals) (2017-2018)

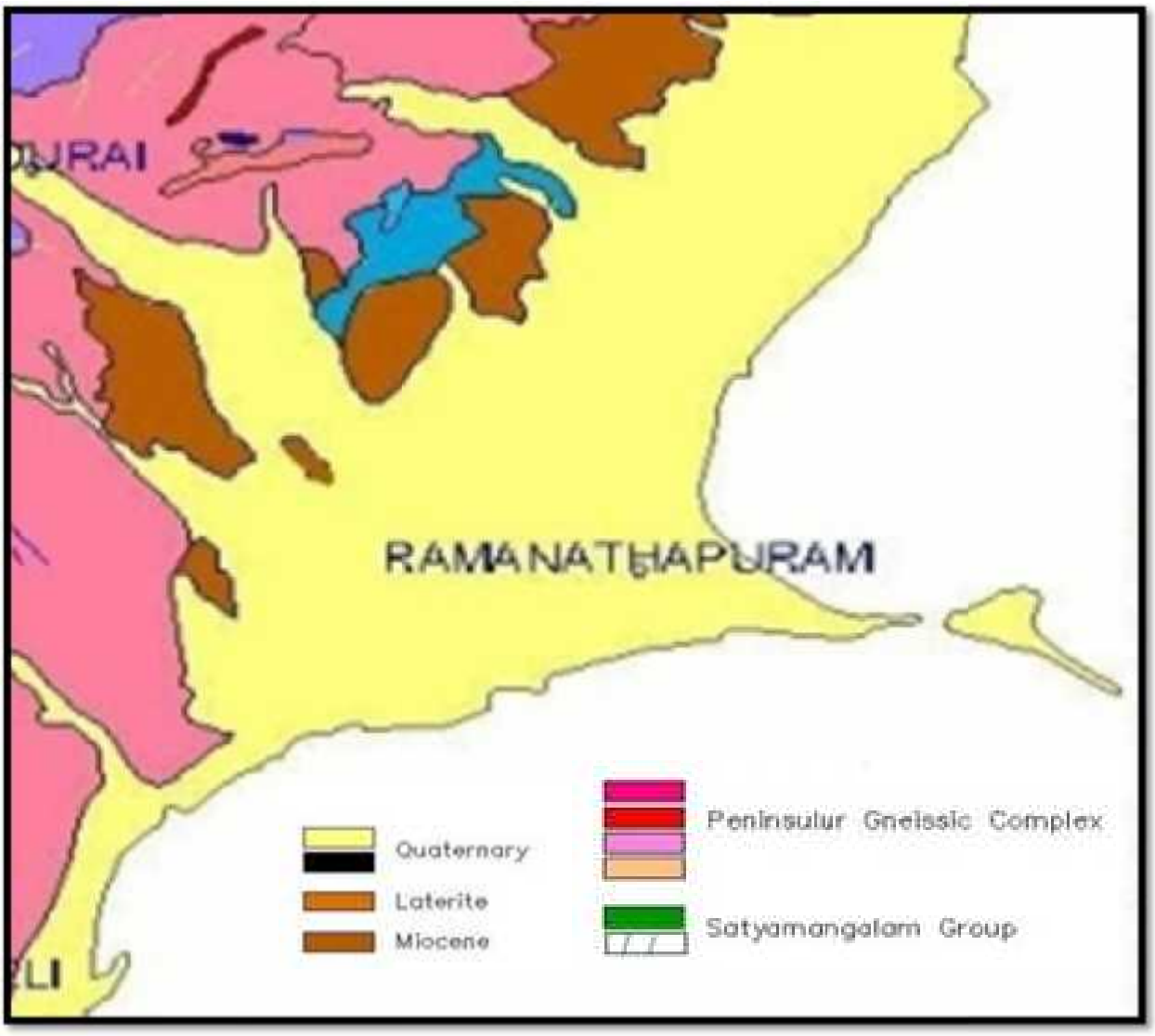
Month and Year	Rough Stone	Production	Gravel	Production
04/2017	0	0	48750	1625
05/2017	0	0	37500	1250
06/2017	0	0	132825	4427.5
07/2017	0	0	105450	3515
08/2017	0	0	137250	4575
09/2017	0	0	111150	3705
10/2017	0	0	120900	4030
11/2017	0	0	100050	3335
12/2017	0	0	128475	4282.5
01/2018	0	0	77750	2591.667
02/2018	0	0	43500	1450

03/2018	0	0	51000	1700
Total	0	0	1094600	36486.67

Seigniorage Fee (Minor Minerals) (2018-2019)

Month and Year	Rough Stone	Production	Gravel	Production
04/2018	0	0	12000	400
05/2018	0	0	6000	200
06/2018	0	0	24000	800
07/2018	0	0	24000	800
08/2018	0	0	30000	1000
09/2018	185850	3150	24000	800
10/2018	743400	12600	6000	200
11/2018	1062000	18000	0	0
12/2018	902700	15300	0	0
01/2019	637200	10800	120000	4000
02/2019	849600	14400	30000	1000
03/2019	610650	10350	165000	5500
TOTAL	4991400	84600	441000	14700

12. MINERAL MAP OF THE DISTRICT:



13. LIST OF LETTER OF INTENT (LOI) HOLDERS IN 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 (Ha)	Validity of LOI	Use (Captive/ Non-capitive)	Location of the Mining lease (Latitude & Longitude)
1.	ANNEXURE I							

14. TOTAL RESERVE AVAILABLE IN THE DISTRICT

The Gravel and Rough stone available in Kamudhi taluk only. Gravel available for 2 metres above the Sandstone. The sandstone extends up to 30 metres below the ground. Total geological reserve in the proposed area is given in annexure II.

14.1.GRAVEL

Gravel is a loose aggregation of rock fragments. Gravel is classified by particle size range and includes size classes from granule- to boulder-sized fragments. In the Udden-Wentworth scale gravel is categorized into granular gravel (2 to 4 mm or 0.079 to 0.157 in) and pebble gravel (4 to 64 mm or 0.2 to 2.5 in). ISO 14688 grades gravels as fine, medium, and coarse with ranges 2 mm to 6.3 mm to 20 mm to 63 mm. One cubic metre of gravel typically weighs about 1,800 kg (or a cubic yard weighs about 3,000 pounds).

Types of gravel include:

- **Bank gravel**: naturally deposited gravel intermixed with sand or clay found in and next to rivers and streams. Also known as "bank run" or "river run".
- **Bench gravel**: a bed of gravel located on the side of a valley above the present stream bottom, indicating the former location of the stream bed when it was at a higher level.
- **Creek rock or river rock**: this is generally rounded, semi-polished stones, potentially of

a wide range of types, that are dredged or scooped from stream beds. It is also often used as concrete aggregate and less often as a paving surface.

- **Crushed stone**: rock crushed and graded by screens and then mixed to a blend of stones and fines. It is widely used as a surfacing for roads and driveways, sometimes with tar applied over it. Crushed stone may be made from granite, limestone, dolomite, and other rocks. Also known as "crusher run", DGA (dense grade aggregate) QP (quarry process), and shoulder stone.[8]
- **Fine gravel**: gravel consisting of particles with a diameter of 2 to 8 mm.
- **Stone dust**: fine, crushed, gravel from the final stage of screen separation, such that the gravel is not separated out from fine dust particles.
- **Lag gravel**: a surface accumulation of coarse gravel produced by the removal of finer particles.
- **Pay gravel**: also known as "pay dirt"; a nickname for gravel with a high concentration of gold and other precious metals. The metals are recovered through gold panning.
- **Pea gravel**: also known as "pea shingle" is gravel that consists of small, rounded stones used in concrete surfaces. Also used for walkways, driveways and as a substrate in home aquariums.
- **Piedmont gravel**: a coarse gravel carried down from high places by mountain streams and deposited on relatively flat ground, where the water runs more slowly.
- **Plateau gravel**: a layer of gravel on a plateau or other region above the height at which stream-terrace gravel is usually found.

Gravel deposits have been found in Kilaramanadi (N 09°23’36.90”; E 78°18’00.77”), Naranapuram (N 09°25’41.11”; E 78°22’43.41”) and Sudiyur (N 09°36’34.82”; E78°29’43.00”) areas. It is used as an earth filling or road material. Maximum depth permission for gravel excavation is 1 m. Large gravel deposits are a common geological feature, being formed as a result of the weathering and erosion of rocks. The action of rivers and waves tends to pile up gravel in large accumulations. This can sometimes result in gravel becoming compacted and lithifiedinto the sedimentary rock called conglomerate. Where natural gravel deposits are insufficient for human purposes, gravel is often produced by quarrying and crushing hard-wearing rocks, such as sandstone, limestone, or basalt. Quarries where gravel is extracted are

known as gravel pits.

Gravel at Kilaramanadi, Kamuthi Taluk, N 09°23’36.90”; E 78°18’00.77”.

Roughstone at Kilaramanadi, Kamuthi Taluk, N 09°23’36.90”; E 78°18’00.77”.

At Kilaramanadi (N 09°23’36.90”; E 78°18’00.77”), rough stone deposit is also present 1 m below the surface (below laterite horizon). This is used for the production of m-sand or synthetic sand.

15. QUALITY /GRADE OF MINERAL AVAILABILITY IN THE DISTRICT

Good gravel generally have larger top-sized stone and a very small percentage of clay or fine material. This is necessary for the strength and good drainability needed in base gravels. This material will not form a crust to keep the material bound together on a gravel road.

16. USE OF MINERAL

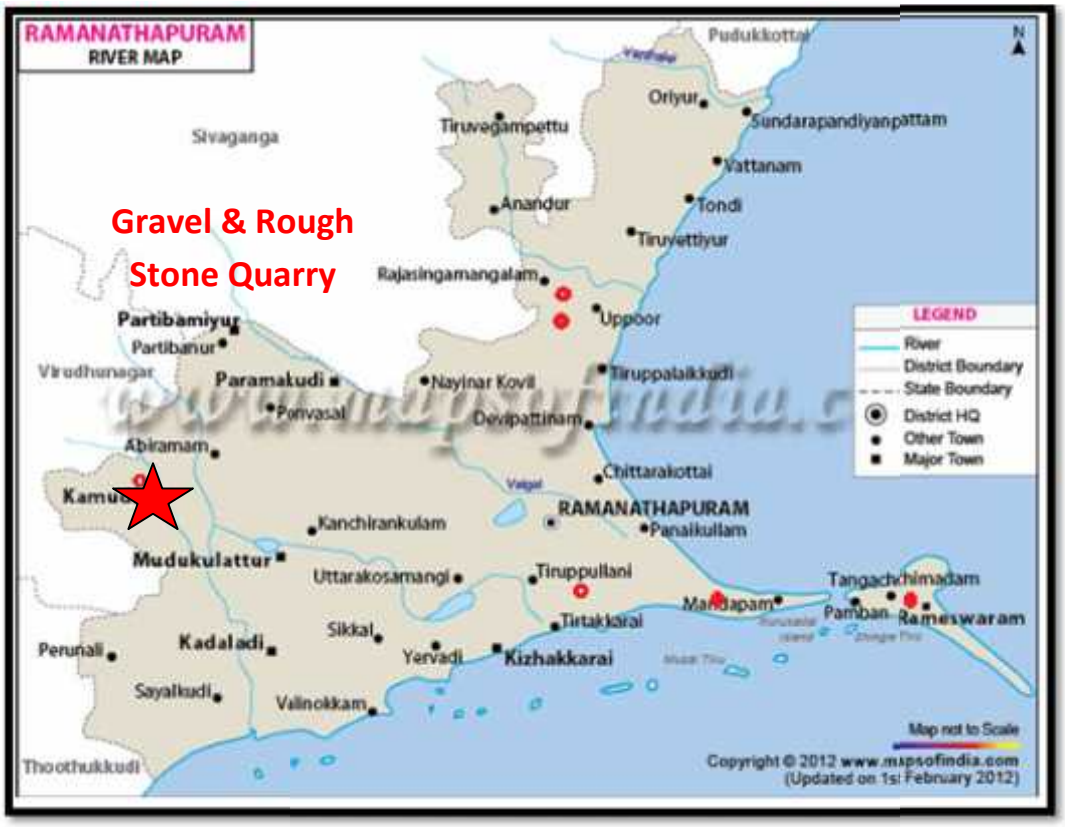
Gravel is an important commercial product, with a number of applications. Many roadways are surfaced with gravel, especially in rural areas where there is little traffic. Globally, far more roads are surfaced with gravel than with concrete or asphalt; Both sand and small gravel are also important for the manufacture of concrete. Gravel has high content of sand-sized particles which make it very drainable. This is a desirable characteristic in fill material since water can quickly flow through it and drain away from under building foundations and parking lots.

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

There is drastic variation in production of Gravel and Rough stone for the last three years due to the fluctuations of demand in the road and other construction work project.

18. MINING LEASES MARKED ON THE MAP OF THE DISTRICT

At present, there is only one lease operating in theKamudhi taluk of the district. The total quarries which are in operation are marked in the district map.



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

Nil

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

Sakkaraikottai Bird Sanctuary located in Ramanathapuram taluk and Ramanathapuram district of southern Tamil Nadu. This sanctuary is situated 2kms distance from Ramnad main town. It is a resident of several species of migratory, resident birds and plants.Sakkaraikottai Bird Sanctuary lies between latitude $09^0$21'8" N and longitude $78^0$78'50"E and extends over an area 230.49.5 Ha. This area is an important and unique habitat known for varied avian fauna which provide an ecologically sustainable habitat for more than 42 bird species. The total area of Eco Sensitive Zone for Sakkaraikottai Bird Sanctuary is 19.0387 sq.km.

Sakkaraikottai Bird Sanctuary Eco Sensitive Zone

Therthangal Bird Sanctuary located in Paramakudi taluk and Ramanathapuram district of southern Tamil Nadu. This sanctuary is situated12kms distance from Ramnad main town. It is a resident of several species of migratory, resident birds and plants.Therthangal Bird Sanctuary lies between latitude $09^0$27’499” N and longitude $78^0$45’536”E and extends over an area 29.29.5 Ha. This area is an important and unique habitat known for varied avian fauna which provide an ecologically sustainable habitat for more than 42 bird species. The total area of Eco Sensitive Zone for Therthangal Bird Sanctuary is 4.5718 sq.km.

Therthangal Bird Sanctuary Eco Sensitive Zone

Chitirangudi Bird Sanctuary located in Mudukulathur taluk and Ramanathapuram district of southern Tamil Nadu. It is a resident of several species of migratory, resident birds and plants.Chitirangudi Bird Sanctuary lies between latitude $09^0$19’ N and longitude $78^0$28’E and extends over an area 47.63 Ha. This area is an important and unique habitat known for varied

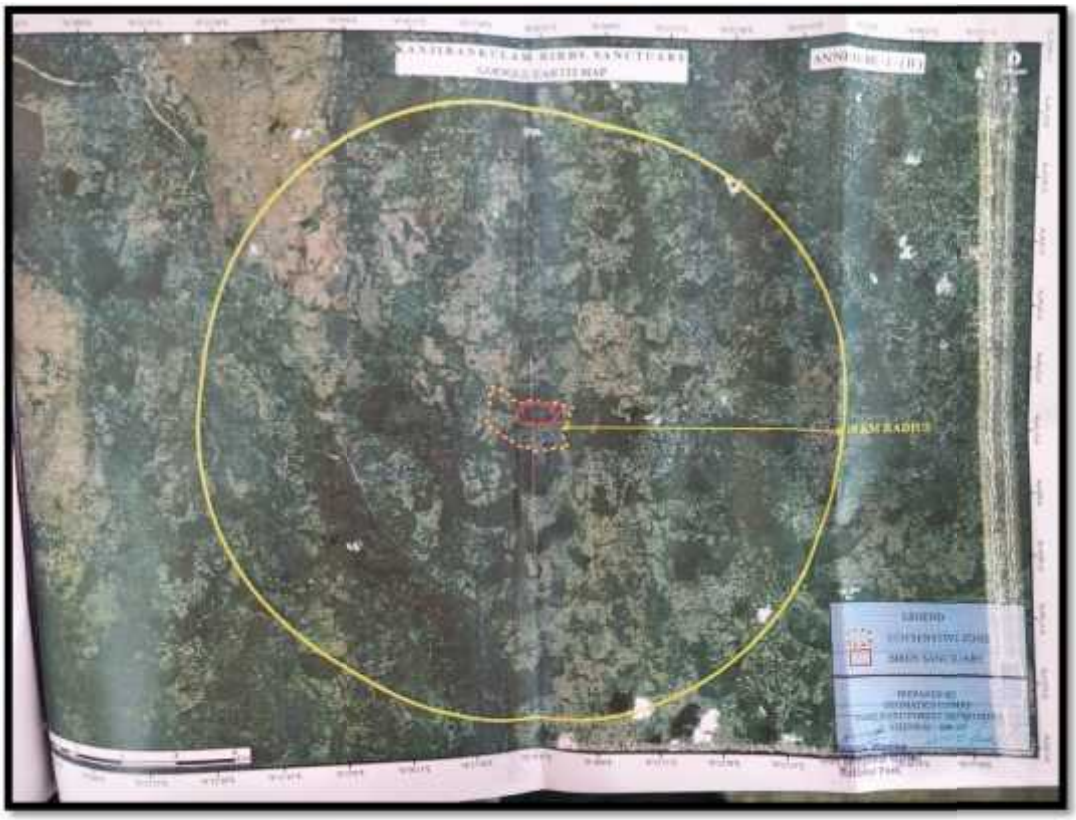
avian faunawhich provide an ecologically sustainable habitat for more than 30 bird species. The total area of Eco Sensitive Zone for Chitirangudi Bird Sanctuary is 4.7972 sq.km.

Chitirangudii Bird Sanctuary Eco Sensitive Zone

Mela - KeelaSelvanoor Bird Sanctuary Eco Sensitive Zone

Mela – KeelaSelvanoor Bird Sanctuary located in near Sayalkudi, Kadaladi taluk and Ramanathapuram district of southern Tamil Nadu. This sanctuary is situated12kms distance from Ramnad main town. It is a resident of several species of migratory, resident birds and plants.Therthangal Bird Sanctuary lies between latitude $09^0$13’47” N to $09^0$12’27” N and longitude $78^0$32’29”E to $78^0$34’28”E. The sanctuary lies in S.F. No. 166 of 78 MelaSelvanoor with 321.48.5 Ha and S.F. No 128 of 79 KeelaSelvanoor with 271.59.5 Ha. This area is an important and unique habitat known for varied avian fauna which provide an ecologically sustainable habitat for more than 45 bird species. The total area of Eco Sensitive Zone for Mela – KeelaSelvanoor Bird Sanctuary is 11.5108 sq.km.

Kanjirankulam Bird Sanctuary located in Mudukulathur taluk and Ramanathapuram district of southern Tamil Nadu.It is a resident of several species of migratory, resident birds and plants.Therthangal Bird Sanctuary lies between latitude $09^0$21’ N and longitude $78^0$30’E and extends over an area 104.21 Ha. This area is an important and unique habitat known for varied avian fauna which provide an ecologically sustainable habitat for more than 43 bird species. The total area of Eco Sensitive Zone for Kanjirankulam Bird Sanctuary is 3.90 sq.km.



Kanjirankulam Bird Sanctuary Eco Sensitive Zone

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

Environmental impact on Rough stone, gravel and earth quarrying can be broadly classified in to two categories:

1. Environmentaldegradation
2. Environmental pollution

ENVIRONMENTAL DEGRADATION: Degradation of topography, fauna and flora invariablytakesplaceongranitequarrying.Whiledevelopinginfrastructure,vegetationcover is destroyed, topography degraded and fauna and flora affected. If it is rubber plantation in Kerala, it is mango grooves in Tamil Nadu that is destroyed. Degradating the topography leads to destruction of vegetative cover, dry air circulation, non precipitation, choking of natural drainage and finally toextremedrought.Thisiswhathappeningatpresentinexcessivelyquarriedareasforwhich the reason attributed is failure ofmonsoon.

ENVIRONMENTAL POLLUTION: Air, water and noise pollution, ground vibration from blasting and generation of solid waste are some of the impacts of rough stone quarrying on environment which have extreme destructive consequences. Silicosis is the prevalent disease thataffectsmajorityofthequarryworkersandtheadjoiningvillages.Inadditiontothenatural water sources getting contaminated with particulates, deepening of quarry depth intercepts groundwatertable.Naturaltopographicgradientisupsetwithconcomitantchangeindrainage pattern. Deepened out quarries have become overnight perched aquifers draining away water from all the surrounding highlands. Noise pollution, over and above those from quarrying equipmentgetsaccentuatedfromincreaseduseofjetburners(flamescutters).Solid waste is non-biodegradable and slow mechanical disintegration of which leads to environment of silica, sodium, potassium and calcium in soils. Soils become unproductive. Inadequate space for dumping solid wastes near quarries leads to dumping of them on either side of the road. Solid waste and rough stone dumps on road sides impart not only aesthetic displeasure but also ugly sights and potential danger for traffichazards.

22. REMEDIAL MEASURE 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
- 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.
- Safety 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 pumping 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 may lead to less noise generation.
- 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 ear muff's 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.

22.5. REMEDIAL MEASURES TO REDUCE IMPACT ON BIOLOGICAL ENVIRONMENT

- 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 the 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 REGULATIONS, PROPOSED RECLAMATION PLAN)

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-siteemergency plans to meet the disastrous situations if any.

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

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 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 properly updated and displayed.

3) CONSULTATIVE COMMITTEE

A standing consultative committee will 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 shall 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 should be provided for quick communication with hospitals where the complicated cases are to be referred. Regular checking of these facilities shall be undertaken by the doctor and the in charge of the first aid room.

6) STORES AND EQUIPMENT

A detailed list of equipment available, its type & 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 OCCUPATIONAL HEALTH ISSUE 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	-
2	2016	NIL	-
3	2015	NIL	-
4	2014	NIL	-
5	2013	NIL	-

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.

Simultaneous backfilling method will be followed in most of the mining areas. During the operations, the plantation will be proposed and will be carried out on the safety barrier areas and also on the mined out and backfilling areas.

27. ANY OTHER INFORMATION

Nil

Annexure I

13. LIST OF LETTER OF INTENT (LOI) HOLDERS IN 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 (Ha)	Validity of LOI	Use (Captive/ Non-capitive)	Location of the Mining lease (Latitude & Longitude)
1.	Rough Stone & Gravel	S.Lakshamanan	Mushtakurichi, Kamudhi	1168/GM2/2017 10.08.2017	6.22.0	Nil	Non-capitive	Latitude :09°23'26"N to 09°23'87"N Longitude :79°17'54"E to 79°18'03"E
2	Gravel	Thiru.G.Ramamoorthy, S/o.Govindan,	Chithirangudi Village, Mudukulathur Taluk, Ramanathapuram District	Roc No.G&M.2/757/2017 17.11.2017	1.15.0	Nil	Non Captive	090 23’ 19.09’’ N 780 18’27.05’’ E.
3	Gravel	Thiru.M.Vadivel, S/o.Muniyandi	, KidathirukkaiMudukulathurRamanathapuram	Roc No.G&M.2/31/2017 06.06.2018	2.14.5	Nil	Non Captive	09°24'00"N to 09°24'10"N 78°17'35"E to 78°18'00"E

ANNEXURE II

14.0 Total Gravel and Rough Stone Reserve available in the district

Sl.No.	Mineral	Name of the Lessee/LOI Holder	Taluk and Village	Geological Reserves (Million Tonnes)
1.	Rough Stone & Gravel	S.Lakshamanan, Mushtakurichi, Kamudhi	Keelaramanadhi, Kamudhi	Rough Stone Gravel
2.	Gravel	Thiru.R.Thirumoorthy, S/o.Ramudevar, 9/16, Perumalkovil street, Veerasolan Village, Thiruchuli Taluk, Virudhunagar District,	Paramakudi, Keelaparuthiyur	39250 cbm
3.	Gravel	Thiru.M.Vadivel, S/o.Muniyandi, Kidathirukkai(p), Mudukulathur(Tk), Ramanathapuram	Kamuthi, Keelaramanathi	66000 cbm