DISTRICT SURVEY REPORT

FOR MINOR MINERAL INCLUDING SAND & STONE

SINDHUDURG DISTRICT, MAHARASHTRA

PREPARED BY

DISTRICT MINING OFFICER, SINDHUDURG

DATED – 02.05.2017

District Survey Report is prepared in accordance with Para 7 (iii) of S.O.141 (E) dated 15th January 2016 of Ministry of Environment, Forest and Climate Change

TABLE OF CONTENTS

1. Introduction 5
1.1. Location & Geographical Area 5
1.2. Administrative 5
1.3. Population 6
1.4. Connectivity 6
1.5. Railway 7
1.6. Road 7
1.7. General Description 9
1.8. Guidelines For Mining Of Minor Minerals 9
2. Overview Of Mining Activity 10
2.1. The List Of Mining Leases (Minor Minerals) In The District With Location, Area And Period Of Validity 12
3. Details Of Royalty Or Revenue Received In Last Three Years 14
3.1. Revenue Collected For Last 3 Years 14
3.2. Details Of Production Of Minerals 14
4. Process Of Deposition Of Sediments In The Rivers Of The District 15
5. General Profile Of Sindhudurg District 18
6. Land Utilization Pattern In The District 21
7. Physiography Of The Sindhudurg District 22
8. Rainfall: Month-Wise 24
9. Geology And Mineral Wealth 26
9.1. Arma Stratigraphic Succession Within The Sub Basin 27
9.2. Geological Structure 27
9.2.1. Archaeans 27
9.2.2. Kaladgis 28
9.2.3. Deccan Basalts 28
9.3. Soil Type 28
9.3.1. Laterite Soil 28
9.3.2. Salty Soil 28
9.3.3. Coastal Alluvium 28
9.4. Economic Minerals 29
10. Mineral Potential 29

11. Ground Water Resource 29

TABLES

Table 1: Geographical Data 5
Table 2 : Administrative Divisions 6
Table 3: Population Of District 6
Table 4 : Major Roads 7
Table 5 : List Of All Major Mineral Leases In Sindhudurg 11
Table 6: - List Of All Minor Mineral Leases In Sindhudurg 12
Table 7 : The Rates For Royalty For Different Minor Mineral 14
Table 8: Royalty Collected For Last 3 Years 14
Table 9 : Production Details For 3 Years 14
Table 10 :Drainage System With Description Of Main Rivers 15
Table 11 : Salient Features Of Important Rivers And Streams 15
Table 12 : Salient Features Of Important Rivers And Streams 16
Table 13 : Census Details 19
Table 14: Principal Crops 19
Table 15 : Name Of Cereals 19
Table 16 : Tehsil Wise Government & Private Organization 20
Table 17 : Water Supply Facility 20
Table 18 : District Cereals 21
Table 19 : Landuse Pattern 21
Table 20 : Physiography Of Sindhudurg District 23
Table 21 : Total Rainfall Of Sindhudurg District 25
Table 22: Ground Water Monitoring Stations 31
Table 23: Summary Of Ground Water Levels In Pre – Monsoon And Post Monsoon Season. 31
Table 24 : Taluka Wise Average Ground Water Levels In Sindhudurg District 34
Table 25 : Assessment Of Ground Water Resources In Sindhudurg District 35

FIGURES

Figure 1: Connectivity Map 8
Figure 2: Land Use Pattern 22
Figure 3: Physiographic Map Of Sindhudurg 24
Figure 4: Monthly Rainfall Variation Of Sindhudurg District 25

Figure 5: Hydrogeology Map.....30

Figure 6: Pre – Monsoon Ground Water Levels.....32

Figure 7: Post – Monsoon Ground Water Levels 33

1. INTRODUCTION

1.1. LOCATION & GEOGRAPHICAL AREA

Maharashtra State is divided into six revenue divisions namely Amravati, Aurangabad, Konkan, Nagpur, Nashik and Pune. District such as Thane, Raigad, Ratnagiri, Palghar and Sindhudurg, falls under Konkan Division.

District Sindhudurg is the southernmost district of the state. The district lies in the Survey of India degree sheets 47H, 48 E and 48 I. It is located along the west coast of India. It spreads between 15^{o} 37' and 16^{o} 40' north latitudes and between 73^{o} 19' and 74^{o} 13' east longitudes. Sindhudurg District was a part of Ratnagiri District, but in 1981 for administrative convenience, industrial & agricultural development Ratnagiri district was divided into Ratnagiri & Sindhudurg District. The district got its name from the famous sea fort which was built by Cht. Shivaji Maharaj near Malwan.The district is surrounded by Kolhapur district in the east, Ratnagiri district in the north, Arabian Sea towards the west and Karnataka and Goa States to the south. On the west, Arabian Sea gives the district a seaboard of about 121 kilometers. The district now comprises the tahsils kudal, Malvan,Deogad,kankavli,Sawantwadiand Vengurla carved out from Ratnagiri district and the new tahsils of Vaibhavwadi and Dodamarg created by transfer of the villages from district Kolhapur.

The district has an area of 5,207.0 sq.kms. This area accounts for 1.7 percent of the total area of the state. The population density of the district is 167 persons per sq.km. The headquarters of the district is at Oros Bk. which is also named as Sindhudurgnagari which lies in tahsil Kudal. The district is well connected to Mumbai and Kanyakumari by the Konkan Railway, which traverses through the district. It also has a good network of roads connecting it to other parts of the country.

Table 1: Geographical Data

Sr.No.	Geographical data	Unit	Statistics
1	***Latitude***	Degree	15.37 to 16.40 North
2	***Longitude***	Degree	73.19 to 74.18 East
3	***Geographical Area***	Sq Km	5207

1.2. ADMINISTRATIVE

District comprises of 8 Tehsils, 8 Panchayat Samitis, 3 Nagar Parishads, 4 Nagar Palikas and 433 Gram Panchayats for about 752 villages and 5 towns, 9 police stations & 23 police outposts. The details are tabulated below:

Table 2 : Administrative Divisions

Tehsils	Panchayat Samitis	Nagar Parishad	Nagar Palika
Dodamarg	Yes	--	--
Sawantwadi	Yes	Yes	Yes
Vengurla	Yes	Yes	Yes
Kudal	Yes	--	--
Malvan	Yes	Yes	Yes
Kankavli	Yes	--	Yes
Devgad	Yes	--	--
Vaibhavwadi	Yes	--	--

1.3. POPULATION

In 2011, Sindhudurg had population of 849,651 of which male and female were 417,332 and 432,319 respectively. In 2001 census, Sindhudurg had a population of 868,825 of which males were 417,890 and remaining 450,935 were females. Sindhudurg District population constituted 0.76 percent of total Maharashtra population. In 2001 census, this figure for Sindhudurg District was at 0.90 percent of Maharashtra population.

There was change of -2.21 percent in the population compared to population as per 2001. In the previous census of India 2001, Sindhudurg District recorded increase of 4.41 percent to its population compared to 1991.

Table 3: Population of district

Sr.No	Particulars	2015-2016
1	***Population***	**846855**
2	***Male***	**419527**
3	***female***	**427328**
4	***No of Villages***	**752**

1.4. CONNECTIVITY

The Sindhudurg district is well connected by number of highways. National Highway No. 17 passes through the district from Banda in the south to Kankavali in the north. This highway also connects district to neighboring state Goa and Karnataka. There are regular MSRTC and private luxury buses connecting to neighboring cities like Kolhapur (110 km away from Kanakavli City), Belgaum (90 km away from Sawantwadi City), Panaji – Goa (55 km away from Sawantwadi & Vengurla).

Towns and major villages have good connectivity with Mumbai as major migrated population of district is located in Mumbai area.

1.5. RAILWAY

District is also well connected by Konkan railway to Mumbai, Thane, Goa and other parts of the country like Mangalore, Karwar Ernakulam, Thiruvananthapuram, Coimbatore, Tirunelveli, Hapa, Veraval, New Delhi, Jodhpur, Porbundar by Konkan Railway. The main railway stations on this route are Kudal, Kankavli and Sawantwadi. The nearest airport is Dabolim Airport in Goa which is very close (100 km) for cities like Sawantwadi, Kudal and Vengurla. New airport at Chipi-Parule Taluka Vengurla is under construction and will be operational shortly.

1.6. ROAD

District Headquarters Oros is well connected by State highway roads. Devgad, Sawantwadi, Kudal, Kankavali, Malwan & Vengurla are the important Cities in this district having road connectivity to major towns and remote villages. District Headquarter Oros is about 492 KM by road to Mumbai (Capital of Maharashtra). The connectivity map is given in **Figure 1.**

Table 4 : Major Roads

Major Roads		
1	***NH-17 now NH-66***	**Mumbai-Goa**
2	***SH-18***	**Mumbai-Goa**
3	***Railway Length***	**99.5**

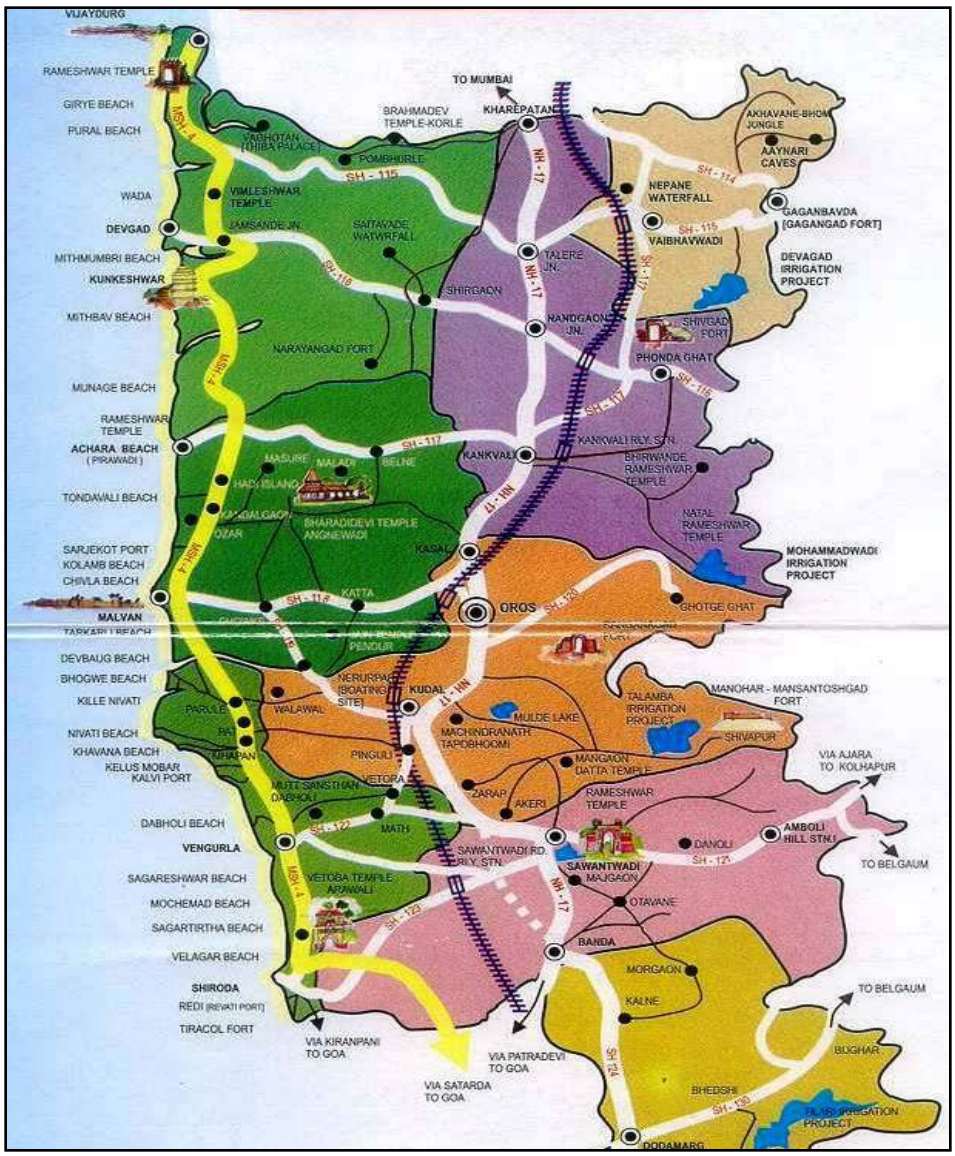

Figure 1: Connectivity map

1.7. GENERAL DESCRIPTION

Minerals are classified into two groups as Major minerals and Minor minerals. Minor mineral have been defined under section 3 (e) of Mines and Minerals (Regulation and development) Act, 1957. They include building stones, gravel, ordinary sand, limestone lime burning, boulders, kankar, murum, brick earth ordinary clay used for, bentonite, road metal, slate, marble, stones used for making household utensils etc. Therefore, all other minerals not defined as minor minerals in the said Act are treated as major minerals. They include coal, manganese ore, iron ore, bauxite, limestone, kyanite, sillimanite, barites, chromite, silica sand, fluorite, quartz, sand used for stowing purposes in coal mines and many other minerals used for industrial purposes.

1.8. GUIDELINES FOR MINING OF MINOR MINERALS

The mining operations for minor minerals were carried out in unscientific manner in Maharashtra since there were no guidelines for extraction of minor mineral.

Identifying this fact In exercise of powers conferred by Section 15 of Mines & Minerals (Development & Regulation) Act, 1957 (67 of 1957) and of all other powers enabling it in that behalf, the Revenue & Forest Department, Government of Maharashtra framed the Maharashtra Minor Mineral Extraction (Development and Regulation) Rules, 2013.The present Mining Plan is submitted under rule 22 of MCR 1960.

Since prior environmental clearance has now become mandatory for mining of minor minerals irrespective of the area of mining lease after the matter of Deepak Kumar etc. Vs. State of Haryana and Others as per Hon'ble Supreme Court dated the 27th February, 2012 in I.A. No.12-13 of 2011 in Special Leave Petition (C) No.19628-19629 of 2009, Ministry of Environment, Forest & Climate Change (MoEF & CC) had issued Office Memorandum No. L-llOll/47/2011-IA.II (M) dated 18th May 2012; henceforth as per this O.M. all mining projects of minor minerals would require prior environmental clearance irrespective of the lease area.

Mining projects with Lease area less than 5 ha are categorized as category 'B2' and projects with lease area 5 Ha and above and less than 50 ha are categorized as category 'B' whereas projects with lease area of 50 ha and above are categorized as category 'A'.

Policy on Environmental Clearance for mining leases in cluster for minor minerals in the matter of sand mining was directed by the Hon'ble National Green Tribunal (NGT); vide its order dated the 13th January, 2015.

The Central Government had constituted the District Level Environment Impact Assessment Authority (DEIAA), for grant of Environmental Clearance for Category ''B2'' Projects for mining of minor minerals, for all the districts in the country as per the latest amendment S.O. 141 (E) & S.O.190(E) dated 15th January 2016 & 20th January 2016 in

exercise of the powers conferred by sub-section (3) of Section 3 of the Environment (Protection) Act, 1986 (29 of 1986) and in pursuance of the notification of the Government of India in the erstwhile Ministry of Environment and Forest number S.O. 1533 (E), dated the 14th September.

Direction for preparation of District Survey Report for Sand Mining or River Bed Mining & Mining of other Minor Minerals was made in the Notification dated 15th January 2016 by MoEF & CC along with detailed procedure & format for preparation of District Survey Report.

To make certain identification of areas of aggradations or depositions where mining can be allowed and identifying areas of erosion rate of replenishment and allowing time for replenishment after mining in that area is the foremost objective of the preparation of District Survey Report.

2. OVERVIEW OF MINING ACTIVITY

Maharashtra is the sole producer of corundum and is the second largest producer of manganese ore after Orissa. The principal mineral-bearing belts in Maharashtra are Vidarbha area in the East and Konkan area in the West. Important mineral occurrences are bauxite in Kolhapur, Raigad, Ratnagiri, Satara, Sindhudurg and Thane districts; china clay in Amravati, Bhandara, Chandrapur, Nagpur, Sindhudurg and Thane districts; chromite in Bhandara, Chandrapur, Nagpur and Sindhudurg districts; coal in Nagpur, Chandrapur and Yavatmal districts; dolomite in Chandrapur, Nagpur and Yavatmal districts; fireclay in Amravati, Chandrapur, Nagpur and Ratnagiri districts; fluorite and Shale in Chandrapur district; iron ore (hematite) in Chandrapur, Gadchiroli and Sindhudurg districts; iron ore (magnetite) in Gondia district; kyanite in Bhandara and Nagpur districts; laterite in Kolhapur district; limestone in Ahmednagar, Chandrapur, Dhule, Gadchiroli, Nagpur, Nanded, Sangli and Yavatmal districts; manganese ore in Bhandara, Nagpur and Ratnagiri districts; corundum, pyrophyllite and sillimanite in Bhandara district; quartz and silica sand in Bhandara, Gadchiroli, Gondia, Kolhapur, Nagpur, Ratnagiri and Sindhudurg districts and quartzite in Gondia and Nagpur districts. Other minerals that occur in the State are barytes in Chandrapur and Gadchiroli districts; copper in Bhandara, Chandrapur, Gadchiroli and Nagpur districts; felspar in Sindhudurg district; gold in Bhandara and Nagpur districts; granite in Bhandra, Chandrapur, Dhule, Gadchiroli, Nagpur, Nanded, Nasik, Sindhudurg and Thane districts; graphite in Sindhudurg district; lead-zinc in Nagpur district; marble in Bhandara and Nagpur districts; ochre and tungsten in Chandrapur and Nagpur districts; silver and vanadium in Bhandara district; steatite in Bhandara, Ratnagiri and Sindhudurg districts; and titanium minerals in Gondia and Ratnagiri districts.

In case of Sindhudurg district Out of the total area of Sindhudurg District only a small portion is under mining. However in the district variety of minerals are present, the important minerals found in Sindhudurg are iron ore, silica sand, bauxite, feldspar, fire clay, china clay, mica and Quartz silica. Out of these iron ores in talukas of Sawantwadi, Vengurla and Dodamarg & silica sand in Kankavli and Vaibhavwadi are currently operational. Other minor minerals like black stone, lateritic stone, granite and river / creek sand are also found in the district. The stone mineral are used for construction purposes for residential as well as commercial purpose.

There was a complete moratorium on mining as per the O.M dated 16th August 2010 and its subsequent amendments wherein the moratorium was extended upto 31st October 2013.As per the O.M dated 25th July 2014, the moratorium was lifted from the non-eco sensitive villages identified by the High Level Working Group except Directions issued on 13th November 2013 under Section 5 of the Environment (Protection) Act, 1986 and for the villages covered under PIL No. 179 of 2012 pending in the High Court of Bombay. A initial Draft Notification no – S.O. 733 (E) dated 10th March 2014 was published which was superseded by Draft Notification no - S.O. 2435 (E) dated 04th September 2015 which have identified 192 villages as eco-sensitive zone.

Table 5 : List of all major mineral leases in Sindhudurg

Sr.No	Name of Minerals	Total	Operational	Closed
1	Iron Ore	16	09	07
2	Shilphata Sand	25	04	21
3	Bauxite	01	00	01
4	Feldspar	02	00	02
5	Fire Clay	01	00	01
6	China Clay	01	00	01
7	Mica	01	00	01
8	Quartz Silica	01	00	01
Total		**48**	**13**	**35**

2.1. THE LIST OF MINING LEASES (MINOR MINERALS) IN THE DISTRICT WITH LOCATION, AREA AND PERIOD OF VALIDITY

Table 6: - List of all minor mineral leases in Sindhudurg

Sr No	Name of Mining Owner & Address	Name of Place/Taluka	Type of stone	Mining Area Details			Lease Granted on	Lease upto
				Govt/ Private	Survey/ Gut No	Area (Ha)		
1	irhS. oarpatarP ijavihS valaP , Humarmala, Taluka Kudal	Asrondi/ Malvan	Laterite	Private	rS. oN. 115/5,6,7	2.24	26/10/15	24/10/20
2	irhS. dasarP agruD elupluT nanajaG; Adavali, Taluka Malvan	ilavadA/ navlaM	Laterite	Private	rS. oN. 641	2.33	26/10/15	25/10/20
3	irhS. maratiS tnakardnahC rakdaH; radnihC-idavedaS, navlaM akulaT	nahtoaG/ navlaM	Laterite	Private	rS. oN. 813	4.98.66	27/10/15	26/10/20
4	irhS. ijanhsirK irahraN sargniL; Janavali , Taluka Kankavli	pioP/ navlaM	Laterite	Private	rS. oN. 9/1	4.00	26/10/15	24/10/20
5	irhS. tnakardnahC sakiV rakdaH; razabradnihC, navlaM akulaT	ipoduK/ Malvan	Black Stone	Private	rS. oN. 55/40	3.33	26/10/15	25/10/20
6	irhS.tnakardnahC sakiV; Chindarbaza,Taluka Malvan	idawdagaB/ navlaM	Laterite	Private	rS. oN. 385	5.00	26/10/15	25/10/20
7	irhS. marhsiV radnuS tagahB; iddaH, akulaT navlaM	nahtnoaG/ navlaM	Laterite	Private	rS. oN. A850/B/C	2.24	26/10/15	25/10/20
8	irhS. mataS vedahaMyajA; Adavali, Taluka Malvan	idaweylaP/ nawlaM	Laterite	Private	rS. oN. 870	5.00	26/10/15	25/10/20
9	nadranaJtadaveD irhS edavrihS tnamaS, akulaT navlaM	edavrihS/ navlaM	Black Stone	Private	rS. oN. 61/2,62/2/2	4.48	01/01/16	31/12/20
10	M/s. etinarG mirpuS, irehdnA(P.) iabmuM	Keravade Karyad Narur / Kudal	etinarG	Private	rS. oN. 144/B5	4.35	28/09/ 99 or 13/10/14	30/09/18
11	M/s. saesrevO zajE, akulaT– gruduhdniS sorO	Keravade Karyad Narur / Kudal	etinarG	Private	rS. oN. 137/1 A- 1B	2.39	17/06/10	16/06/25
12	irhS. gnarudnaPhtannagaJ iraniS, aoG ijnaP	Degave/ Sawantwadi	Black Stone	Private	rS. oN. 77/1B,78/2	4.50	10/10/16	09/10/21
13	irhS. dniliM iniwhsA rakednaD; Purad, Taluka Devgad	rapdnoM/ dagveD	Laterite	Private	rS. oN. 19/1B21, /1B	3.12.66	25/10/16	24/10/21
14	irhS. kayaniV rakerahcAardnaclahB; Talebazar, Taluka Devgad	ireraV/ dagveD	Laterite	Private	oN tuG. 1384	2.82	25/10/16	24/10/21

Sr No	Name of Mining Owner & Address	Name of Place/Taluka	Type of stone	Mining Area Details			Lease Granted on	Lease upto
				Govt/ Private	Survey/ Gut No	Area (Ha)		
15	irhS. ardnarhsiraH nariK raklubmeT, Kinjawade, Taluka Devgad	Kinjawade / Devgad	Laterite	Private	yevruS oN. 258/1	2.80	25/10/16	24/10/21
16	irhS. ukahD udnohD erakoK; ireraV, akulaT Devgad	ireraV/ Devgad	Laterite	Private	oN tuG. 1656	3.00	25/10/16	24/10/21
17	irhS. ehteJ unhsiV nitiN; Aare, Taluka Devgad.	Kinjawade / Devgad	Laterite	Private	oN tuG. 260	1.00	25/10/16	24/10/21
18	Shri. Milind Bharat Khanvilkar;Ghotan,Taluka Devgad	noagdaM/ dagveD	Laterite	Private	rS. oN 149 (213)	2.10	25/10/16	24/10/21
19	irhS. mataS lattiV dniliM; Torsole, Taluka Devgad	Torsole /Devgad	Laterite	Private	oN rS. 99/1	2.00.80	25/10/16	24/10/21
20	irhS. vedahaM namxaL ivdaS; rapdnoM, akulaT dagveD	Mondpar/ Devgad	Laterite	Private	oN rS. 19 (239)	3.00	25/10/16	24/10/21
21	irhS. nayaraN peednaS rakeldniHKinjawade, Taluka Devgad	Kinjawade / Devgad	Laterite	Private	oN rS. 254 1/	1.00	25/10/16	24/10/21
22	Shri. Dayanand Shankar Gavas; Pikule Dodamarg	Pikule /Dodamarg	Black Stone	Private	Gut No. 1958	1.00	05/01/17	04/01/22
23	M/s. Nanu Industries; Mouje Parme, Taluka Dodamarg	Parme/ Dodamarg	Black Stone	Private	oN rS. 26 or 33/1	4.90	24/05/16	23/05/21
24	Shri. Sanjay Satyavan Rane; Digas, Taluka Kudal.	Hedul /Malvan	Laterite	Private	oN rS . 164/5B	1.00	02/03/17	01/03/22
25	Shri. Santosh Pandurang Samant; Hedul, Taluka Malvan	Hedul /Malvan	Black Stone	Private	oN rS. 141/2,3, 26	1.06	14/02/17	13/02/22
26	Shri. Anthon Crispino Skiver; Shivolim Siolim , Taluka Bardez ,Goa	Kshetrafal/ Sindhudurg	Black Stone	Private	oN rS. 32/2/3B	1.93.5	31/03/17	30/03/22
27	Shri. Pramod Pandurang Gavade;Bicholim Goa.	Talekhol /Dodamarg	Black Stone	Private	oN rS. 143/2	1.2	17/02/17	16/02/22
28	Shri. Jagdish Shripadhrao Rane; Talekhol Taluka Dodamarg	Talekhol /Dodamarg	Black Stone	Private	oN rS. 338/1B	0.80	11/01/17	10/01/22
29	Shri. Bijendra Ganpat Gavde; Chowke , Taluka Malvan	Amberi /Malvan	Laterite	Private	oN rS. 63/2	2.00	17/04/17	16/04/22
30	Shri. Rajan Waman Angne; Bhairavwadi, Taluka Sawantwadi	Bhairavwadi /Sawantwadi	Black Stone	Private	oN rS. 99/ 1A	1.68.53	14/04/17	16/04/22

Other than the above mentioned leases there are other stone quarries which are operative on temporary permits.

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

The royalty rates vary on the type of mineral exploited. The rates for royalty for different minor mineral are tabulated below.

Table 7 : The rates for royalty for different minor mineral

Sr. No	Type of Mineral	Royalty rate per Brass (Rs)
1	***Laterite***	75/-
2	***Black stone***	300/-
3	***Sand***	478/-

Royalty rates on 19.03.2016

3.1. Revenue collected for last 3 years

The Revenue & Forest Department, Government of Maharashtra, had set the revenue collection targets for entire Maharashtra State and accordingly it was distributed to every district for every financial year wise. Accordingly every district try to achieve the targets given by Revenue Department. The details of the target set by Revenue Department and against which revenue collected is tabulated below.

Table 8: Royalty collected for last 3 years

Sr. No	Financial Year	Target set for the Financial Year	Revenue collected in Lac	Percent revenue collected
1	2014-15	1300	1919.26	147.64%
2	2015-16	2500	2612.06	104.48
3	2016-17	2700	2846.62	105.43

3.2. Details of production of Minerals

The details of mineral produced in the District from last three years is tabulated below.

Table 9 : Production details for 3 years

Sr. No.	Year (Financial year)	Production in Brass		
		Soil	Laterite	Black Stone
1	2014-15	40975	211900	148150
2	2015-16	15950	274100	96825
3	2016-17	25000	310000	130000

4. PROCESS OF DEPOSITION OF SEDIMENTS IN THE RIVERS OF THE DISTRICT

Sediment is naturally occurring material that is broken down by process of weathering & erosion, and is consequently transported by the action of wind, water, tides& force of gravity acting on the particles. The strongest agent for transportationof the sediments is water and degree of sediment transported is depending on strength and velocity of flow. There is a range of different particle size in flow; material of different sizes moves through all areas of the flow for given stream conditions.

Sand is an essential minor mineral used extensively across the country as a useful construction constituent. The rivers are the most important source for sand. It acts as source of transportation and deposition of sand and Bajri etc. The various aspectsleadingto the formation and deposition of sand aregeological activity,climate, rainfall, and water velocity acting on country rock.

The drainage system of the major rivers in the district is mostly of sub-parallel type and the tributaries drainage pattern tends to be sub-rectangular type.

The river systems are young with a small drainage area and westerly seasonal regime.Five major rivers forms part of the westerly flowing river system originating from Sahayadri hill ranges and emerging in Arabian Sea.

Table 10 :Drainage System with Description of Main Rivers

S.No.	Name of the River	Area Drained (sq km.)	% Area drained in the District
1	***Waghotan river***	983.89	18.89
2	***Karli River***	825.61	15.85
3	***Devgad River***	712.22	13.68
4	***Gad River***	897.12	17.25
5	***Terekhol***	708.48	13.61
6	***Tillari***	703.31	13.50

Table 11 : Salient Features of Important Rivers and Streams

S.No.	Name of river	Total length in the district (km)	Place of origin	Altitude of origin
1	***Waghotan River***	72	Ranewadi Village, Taluka – Panhala, District - Kolhapur	693 meters
2	***Karli River***	92	Shivapur village, Kudal - Taluka, District - Sindhudurg	823 meters

3	***Devgad River***	75	Sivagad Pass, Ghonsari Village, Taluka - Kankavli	550 meters
4	***Gad River***	92	Yevteshwar Village, Taluka – Kankavli, District - Sindhudurg	650 meters
5	***Terekhol***	69	Gotvewadi, Taluka – Kankavli , District – Sindhudurg	638 meters
6	***Tillari***	86 (Maharashtra – 57 kms and Goa – 29 kms)	Tillari Nagar, Taluka – Dodamarg, Maharashtra.	509 meters

Table 12 : Salient Features of Important Rivers and Streams

Portion of the River/Creek			**Length of River Area**		**Avg. Width (Approx)**	**Total quantity of Material**
S.No	**Tehsil**	**River Village**	**River/Creek Name**	**In Sq m (Approx)**	**In Mts. (Approx)**	**(Brass)**
1	*Malvan*	*Chunavare*	Gad River	88	15	400
2	*Malvan*	*Hiwale*	Gad River	40	15	370
3	*Malvan*	*Rathivade*	Gad River	66	15	345
4	Malvan	Korjai to Kalwan (D-1)	Karli Creek	500	50	10000
5	Malvan	Korjai to Kalwan (D-2)	Karli Creek	500	50	4424
6	Malvan	Korjai to Kalwan (D-3)	Karli Creek	530	50	13110
7	Malvan	Korjai to Kalwan (D-5)	Karli Creek	530	50	27624
8	Malvan	Kalwan to Amberi (E-1)	Karli Creek	500	50	14134
9	Malvan	Kalwan to Amberi (E-2)	Karli Creek	500	50	13604
10	Malvan	Kalwan to Amberi (E-4)	Karli Creek	650	50	15318
11	Malvan	Kalwan to Amberi (E-6)	Karli Creek	500	50	13251
12	Malvan	Kalwan to Amberi (E-7)	Karli Creek	255	50	1352

Portion of the River/Creek			Length of River Area		Avg. Width (Approx)	Total quantity of Material
S.No	Tehsil	River Village	River/Creek Name	In Sq m (Approx)	In Mts. (Approx)	(Brass)
13	Malvan	Amberi to Valawal (F-5)	Karli Creek	500	50	6184
14	Malvan	Amberi to Valawal (F-6)	Karli Creek	500	50	5300
15	Malvan	Amberi to Valawal (F-7)	Karli Creek	500	50	5300
16	Malvan	Amberi to Valawal (F-8)	Karli Creek	270	50	5300
17	Malvan	Kalse Walaval to Nerur Par (G-	Karli Creek	300	50	7632
18	Malvan	Nerur Par to Pendur (H-4)	Karli Creek	130	50	1332
19	Malvan	Nerur Par to Pendur (H-7)	Karli Creek	400	50	5000
20	Malvan	Pendur to Varad (I-1)	Karli Creek	220	50	3887
21	Malvan	Pendur to Varad (I-1)	Karli Creek	220	50	3887
22	Malvan	Pendur to Varad (I-5)	Karli Creek	500	50	5000
23	Malvan	Pendur to Varad (I-5)	Karli Creek	500	50	5000
24	Malvan	Pendur to Varad (I-6)	Karli Creek	240	50	2120
25	Malvan	Varad to Sanavade (J-2)	Karli Creek	500	50	2120
26	Malvan	Varad to Sanavade (J-4)	Karli Creek	500	50	9187
27	Malvan	Varad to Sanavade (J-5)	Karli Creek	500	50	13958
28	Malvan	Varad to Sanavade (J-6)	Karli Creek	580	50	5000

Portion of the River/Creek			Length of River Area		Avg. Width (Approx)	Total quantity of Material
S.No	Tehsil	River Village	River/Creek Name	In Sq m (Approx)	In Mts. (Approx)	(Brass)
29	Malvan	Tarkarli to Korjai (C-4)	Karli Creek	570	50	4000
30	Malvan	Tarkarli to Korjai (C-5)	Karli Creek	500	50	7000
31	Malvan	Tarkarli to Korjai (C-6)	Karli Creek	500	50	12500
32	Malvan	Tarkarli to Korjai (C-7)	Karli Creek	500	50	8000
33	Malvan	Shelti to Haddi (B-3)	Kalawal Creek	500	50	6000
34	Malvan	Shelti to Haddi (B-4)	Kalawal Creek	500	50	5000
35	Malvan	Shelti to Haddi (B-6)	Kalawal Creek	625	50	6000

****All sand mining are done by Hathpati (Manual means) for clearance and maintenance of navigational channel.***

5. GENERAL PROFILE OF SINDHUDURG DISTRICT

District Sindhudurg is the southernmost district of the state. The district lies in the Survey of India degree sheets 47H, 48 E and 48 I. It is located along the west coast of India. It spreads between 15° 37' and 16 ° 40' north latitudes and between 73 ° 19' and 74 ° 13' east longitudes. Sindhudurg District was a part of Ratnagiri District, but in 1981 for administrative convenience, industrial & agricultural development Ratnagiri district was divided into Ratnagiri & Sindhudurg District. The district got its name from the famous sea fort which was built by Cht. Shivaji Maharaj near Malwan. The district is surrounded by Kolhapur district in the east, Ratnagiri district in the north, Arabian Sea towards the west and Karnataka and Goa States to the south. On the west, Arabian Sea gives the district a seaboard of about 121 kilometers. The district now comprises the tahsils kudal, Malvan, Deogad, kankavli, Sawantwadi and Vengurla carved out from Ratnagiri district and the new tahsils of Vaibhavwadi and Dodamarg created by transfer of the villages from district Kolhapur.

The district has an area of 5,207.0 sq. kms. This area accounts for 1.7 percent of the total area of the state. The population density of the district is 167 persons per sq.km. The headquarters of the district is at Oros Bk. which is also named as Sindhudurgnagari which lies in tahsil Kudal. The district is well connected to Mumbai and Kanyakumari by the Konkan Railway, which traverses through the district. It also has a good network of roads connecting it to other parts of the country.

District comprises of 8 Tehsils, 8 Panchayat Samitis, 3 Nagar Parishads, 4 Nagar Palikas and 433 Gram Panchayats for about 752 villages and 5 towns, 9 police stations & 23 police outposts.

General profile of all the Tehsil of Sindhudurg district is given in the below following:

Table 13 : Census Details

Year 2015-2016								
Tehsils	***Dodamarg***	***Sawantwadi***	***Vengurla***	***Kudal***	***Malvan***	***Kankavali***	***Devgad***	***Vaibhavwadi***
Area(Sq.m)	498	856	291	826	666	773	875	416
Population	48904	147466	85801	152939	111807	135184	120909	43845
Male	24242	72944	42235	79489	55010	661066	58938	20563
Female	24662	74522	43566	73450	56797	69078	61971	23282
No of Villages	59	86	84	125	136	105	98	59

Table 14: Principal Crops

Principal Crops								
Tehsils	***Dodamarg***	***Sawantwadi***	***Vengurla***	***Kudal***	***Malvan***	***Kankavali***	***Devgad***	***Vaibhavwadi***
Kharif Crops	35053.6	24263.54	1416538	23842	21547	57036	21890	31400.34
Robi Crops	-	1041.29	2030	552.23	0	166	350	918.51
Non Agricultural land	249.6	872.8899	12995.1	174.54	417053	333	134.28	2109.16
Waste Land	1435.83	5166.376	149113	119	65.38	0	682.33	119.9739
Saline soil	9501.55	28049.08	611320	12749	152966	10059	32951	5016.933
Forest land	4184.66	8120.883	71744.2	11775	305	9047	0	2111.512
Playground	253	5.045	2400	2.8	0	10000	0	0
Encroached area	8.86	1.268	46000	0	0	180	0	0

Table 15 : Name of Cereals

Name of Cereals								
Tehsils	***Dodamarg***	***Sawantwadi***	***Vengurla***	***Kudal***	***Malvan***	***Kankavali***	***Devgad***	***Vaibhavwadi***
Rice	25.5	8283.417	3819.88	17163.1	12672.1	13792	5493.09	484912
Kharif Jowar	0	0	0	0	0	0	0	0
Rabi	0	0	0	0	0	0	0	0

Jowar								
Wheat	0	0	0	0	0	0	0	0
Moong	0	72.65	119.2	0	258.75	128	66.53	513500
Sugar cane	0	106	0	0	0	2.6	2.6	490000

Table 16 : Tehsil wise Government & Private Organization

Government & Private Organization								
Tehsils	***Dodamarg***	***Sawantwadi***	***Vengurla***	***Kudal***	***Malvan***	***Kankavali***	***Devgad***	***Vaibhavwadi***
Nagarpalika	1	1	1	1	1	1	1	1
Panchayat samiti	1	1	1	1	1	1	1	1
Police Station	3	2	3	3	2	5	2	1
Post Office	2	33	17	6	1	5	13	5
Primary School	98	152	140	246	217	236	222	110
Secondary School	1	27	0	0	3	11	0	0
College	3	6	2	1	1	3	4	1
University	0	0	0	0	0	0	0	0
Dispensaries	7	16	6	12	12	13	22	9
For Humans	4	11	6	7	7	7	7	3
For Domestic Animals	3	5	0	5	5	6	15	6

Table 17 : Water Supply Facility

Water Supply Facility								
Tehsils	***Dodamarg***	***Sawantwadi***	***Vengurla***	***Kudal***	***Malvan***	***Kankavali***	***Devgad***	***Vaibhavwadi***
Canal	0	13	0	323.4	1	-	0	2
Dam	0	156	389	0	0	-	143	0
Well	0	1605	439	0	205	2311	240	26
Hand Pump	0	0	0	0	0	0	0	0
Generator	0	293	0	0	168	5	0	25
Electric Pump	0	420	0	0	170	225	2628	122
Pump	0	63	0	0	0	0	0	0

Table 18 : District Cereals

District : Cereals		
1	Rice	**546161.13**
2	Kharif Jowar	**0**
3	Rabi Jowar	**0**
4	Wheat	**0**
5	Moong	**514145.13**
6	Sugar cane	**490178.6**
7	Cotton	**0**
8	Others	**134213.1961**

6. LAND UTILIZATION PATTERN IN THE DISTRICT

The concept of the general land use is related to the use of to which land is put in a certain reason at a given period of time. The term land use is virtually self- explanatory. Land use study carries a great importance because it can provide a picture about intensively used, under used and unused land of the area. The actual and specific use to which the land surface is put in terms of inherent primary land use, namely, Land under forest, pasture, cultivation etc. The general land use of any region is an impact of various factors. Land use is a result of combinations of both natural genesis and human influences which have been brought to bear unit in the past and of those which are still active in the present. Spatial variations in land use are related to physical environment, socio-economic factors are also responsible for shaping the land use in the region. The changing man-environment relationship also plays a key role in defining the land use of particular region. The basic objective of the land use pattern is to use the available land which is limited. The pattern of land use is complex and dynamic. The land use pattern is different in different regions. The present pattern of land use is result of long continued operation of the whole range of environmental factors but modified by socio-economic and historical elements.

The classification and general Land use pattern is tabulated below:

Table 19 : Landuse Pattern

Land Use Pattern (Sq.m)		2015-2016
1	***Agricultural Land***	**1636629.05**
	Kharif	**1631571.02**
	Rabi	**5058.03**
2	***Government Land***	**156702.33**
3	***Fallow Land***	**683151.79**
4	***Saline Soil***	**2239254.57**
5	***Forest***	**107286.14**
6	***Playground Area***	**12660.85**
7	***Encroached area***	**46190.13**
8	***Land Under Irrigation***	**588265.98**

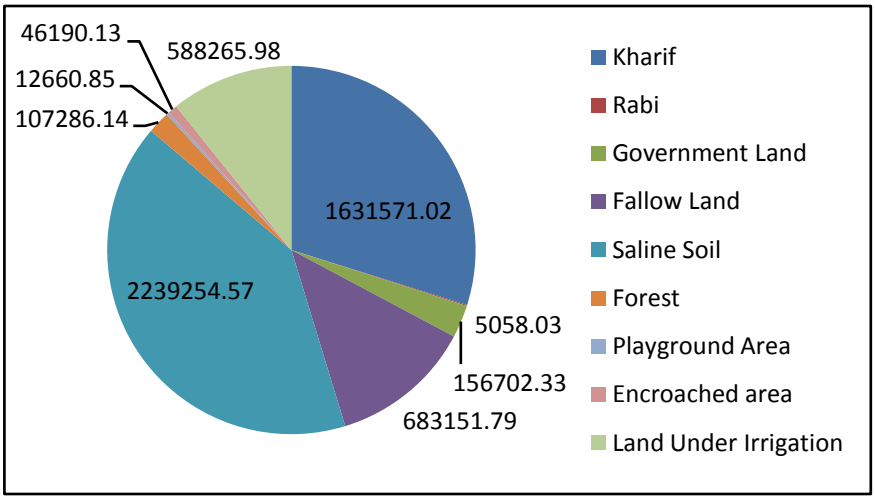

Figure 2: Land Use Pattern

7. PHYSIOGRAPHY OF THE SINDHUDURG DISTRICT

Physiography is one of the dominant parameters of physical environment and its impact on patterns and density of agriculture is immense (Chouhan T. S., 1987). Agriculture in mountains, plateaus and plains is different from scarps, pediments valleys, flanks, flood plains ridges, alluvial flanks, drumlins, monodnocks, levees and dunes.

The relief features are essentially the product of geological past, the nature of geological composition mantle (Deshpande C. D., 1971). A number of small bands of crushed conglomerate ale noticed especially between Niwati village and Malvan town (Sahsrabuddhe Y. S.). Relief of the land influences land use, particularly through the elevation, ruggedness and slope. Relief also influences farming by modifying climate and by affecting the ease of cultivation (Sing, 1974). The relief varies remarkably from place to place and the broad and relief changes are seen in the west-east direction with local variations. These variations in land are due to the geographical evolution (Deshpande C. D., 1971).

Konkan zone of Maharashtra state especially the important physiographic unit. Sindhudurg district is broadly divided into three small sub-divisions based on the elevation and local topography.

(i) The Sahyadri hills cover the eastern portion of the district in three parts. The first part occupies Vaibhavvadi tahsil, the second spreads over the parts of Kankavli, kudal and Sawantwadi tahsils and the third occupies part of Dodamarg tahsil. The hills have an elevation of over 200 metres at the bottom while at the upper reaches they attain a height of about 700 metres. This region has very steep slopes and is fairly covered by forests. This is the source region for most of the rivers in the district.

(ii) Sindhudurg Plateau extends in a north-south direction through the central portion of the district and covers parts of all tahsils of the district except Vaibhavvadi tahsil. It has transverse chains of small hills, which are projecting from the Sahyadri hills; develop higher elevation in middle portions. The hill runs parallel to each other and forms small valleys in the intervening land. In general the plateau attains height varying between 100 and 200 meters but there are a number of spot heights that rise to more than 200 meters, 455 metres in Sawantwadi tahsil being the highest. The plateau is drained mainly by parallel

westward flowing streams. Forest cover is limited in this region. The soils on the slopes of the hills are partly eroded, yellowish red and poor in fertility having shallow depth and coarse texture. These soils are known as Rice soils and Varkas soils. Rice and ragi (nagli) are the principal crops in this region. Cashewnut grows in plenty in this area and the world famous "Alphanso" or "Hapus" mangoes are also grown mainly in Devgad, Malwan and Vengurla. Ratamba is other important fruit which is grown widely and after cutting into pieces is dried and is known as "Kokam".

(iii) Sindhudurg Coast is situated along the extreme western fringe of the district and comprises of parts of Devgad, Malwan, Vengurla and Sawantwadi tahsils. It is a long narrow strip of land running the entire length of the district and generally lies below 100 metres. In this region unlike the coast around Mumbai and to the north, which is low lying, this coast is cliffy. However in the upper part of the strip rice, coconut and arecanut gardening is practiced.

Table 20 : Physiography of Sindhudurg District

S.N	Sub Region	Local Name	Area in Hectare	% to the total Geographical area of the district
1	Coastal	Khalati	1,11,978	22.23
2	Plateau	Valati	1,83,623	36.43
3	Hilly	Sahyadri	2,08,349	41.34
Total			**5,03,950**	**100.00**

The Phyiographic map of Sindhudurg is given below as **Figure 3.**

Figure 3: Physiographic map of Sindhudurg

8. RAINFALL: MONTH-WISE

In India, the year has been divided into four seasons.

a. Winter Season : December to February
b. Summer Season : March to May
c. Monsoon Season : June to September
d. Post Monsoon Season : October to November

Owing to the geographical conditions within the district, the rainfall is unevenly distributed. The Western part of the district adjacent to the West coast is hilly area having forest cover, due to which the rainfall intensity is more in this area as compared to the eastern parts. Most of this rain is brought by the southwest monsoon winds during the summer and about 87% of rainfalls during the monsoon months. The monsoon arrives in the first week of June, with the maximum

intensity of rainfall during the month of June and August. Rain fall data discussed in the table below is the mean rainfall (mm) received in Sindhudurg District during the year 2012.

Table 21 : Total Rainfall of Sindhudurg District

SR.No	MONTH	TOTAL RAINFALL (mm)
1	January	0.0
2	February	0.0
3	March	0.2
4	April	0.2
5	May	0.0
6	June	1040.3
7	July	579.9
8	August	712.6
9	September	176.3
10	October	89.0
11	November	7.1
12	December	0.0
	Total Rainfall	**2605.6**

***** Source: IMD Mumbai Data 2012***

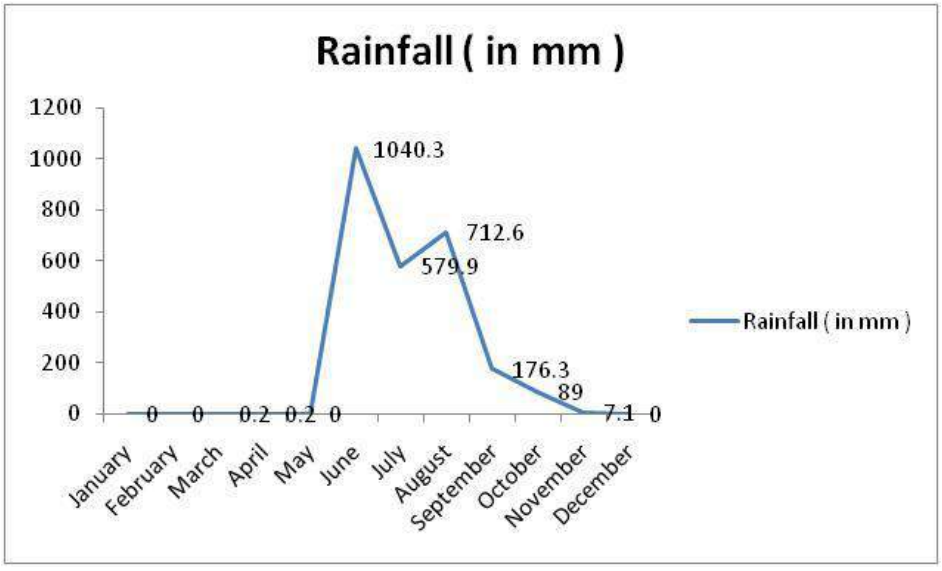

Figure 4: Monthly Rainfall Variation of Sindhudurg District

9. GEOLOGY AND MINERAL WEALTH

Geologically, the district exposes rocks ranging in age from Archaeans to Quaternary period. The Archaeans are represented by Granite gneiss and is seen in southern part of the district near Vengurla & Sawantwadi. The Paleo to meso-proterozoic rocks represented by Dharwar Supergroup overlie the Archeans and occupy major part of the area comprises psammatic meta sediments consisting of Meta-gabbro, quartz chlorite amphibolite schist and ferruginous phyllite. The Kaladgis are noticed as comparatively smaller exposures. They strike NW-SE with dips of 15 to 30 towards west.

Three phases of folding seen in the area and a major synform with its axis trending in NNW-SSE is noticed in the southern portion of the district. The Deccan basalt flow which occupies the northern part of the district is divisiable in to two formations viz. the Purandargarh formation and the overlying Mahabaleshwar Formation. Purandargarh formation mostly consists of aphyric to few feldspar phyric flows. Basic dykes of Doleritic composition are noticed at few places. Lateritic spreads are noticed in the northern part of the district as isolated patches. It varies in thickness from 25 to 75 mts. Quaternary sediments are represented by beach sands and sandy loams.

The Geological formations in the area investigated are Archaeans, Kaladgis, Deccan Trap, Tertiary and Secondary laterite and recent formations. The archaean rocks represented by Dharwarian Meta Sediments and granite gneisses with mafic and ultramafic intrusive occupy major part of the area. Kaladgis rest unconfirmably over the archaeans comprises of conglomerates, grits, ortho-quartzites shales and stand in relief as narrow ridges. Deccan traps occupy small area in the northern and eastern part of the area forming isolated patches separated by river valleys. Sedimentary beds comprising carbonaceous, pyritic and ferruginous shales are noticed below lateritis in well sentions and dissected valley sections along the coast near Malvan & Kaluswadi, Laterites both primary and secondary occupy extensive areas in low lying platens and coastal track in the West as well as East. Beach sand along narrow coastal strip and along the banks of rivers is recent formations in the area.

9.1. ARMA STRATIGRAPHIC SUCCESSION WITHIN THE SUB BASIN

LITHOLOGY	STRATIGRAPHIC STATUS AGE
Soil, Laterites, Kankar, etc.	- Recent to Sub-recent
Laterites	- Pleistocene
Deccan Traps	- Cretaceous to Eocene
----------Unconformity ----------	
Kaladgis -- (Conglomerates, cherty limestone, Cherty limestones, quartzites and Shale's associated with limestones)	***Upper Pre-Cambrian***
----------Unconformity ----------	
Achaeans – (Pegmatite's and quartz veins, Basic dykes, Granulite's and Granite gneisses, Hornblende schist's, Mafic and Ultra-mafic rocks, Amphibolite's, Banded ferruginous quartzites)	***Lower Pre- Cambrians***

(Source: District Resource Map)

9.2. GEOLOGICAL STRUCTURE

9.2.1. Archaeans

The regional trend of foliation observed in the schistose formations is generally NNW-SSE to NW-SE conforming to the Dharwarians However the trends is found veering to ENE-WSW exihibiting acute folding. The rocks have steep dips of 60^0 to 80^0 mostly to the west. The following four sets of joints are common in these rocks.

i) $N75^0E$-$S75^0W$ dipping 75^0 South
ii) $N50^0W$-$S50^0E$ dipping 60^0 East
iii) $N60^0E$-$S60^0W$ vertical and
iv) E-W Vertical

9.2.2. Kaladgis

The regional strike of the Kaladgi formation veer from NNE-SSW to NW-SE dipping at low to moderate angles of 5^0 to 20^0 towards west; The shales are almost horizontally bedded at places. The strike $N80^0W$-$S80^0E$ with gentle dip towards south; the kaladgi formations display joints in diverse directions. The following set of joints is more common.

- N-S vertical
- $N40^0W$-$S40^0E$ vertical
- $N10^0E$-$S10^0W$dipping 60^0 East
- $N10^0W$-$S10^0E$ dipping 70^0 East

9.2.3. Deccan Basalts

The Deccan lava flows are horizontally disposed and are traversed by vertical and horizontal joints. Two sets of vertical joints striking NW-SE and NE-SW and horizontal joints are common.

9.3. SOIL TYPE

The soils of the district are generally classified into three parts i.e. Laterite soil Salty soil, and Coastal alluviums.

9.3.1. Laterite soil

The predominant soils in the district are laterite soils and extensive spreades of laterites are noticed throughout the district. They vary in colour from red to brownish red, owing to the preponderance of hydrated iron oxides. They are fairly well supplied with nitrogen and organic matter and their texture is loamy. They are porous and not retentive of moisture. These soils are found in several grades, the main being rice soil and varkas soil. Both of there soils are available on the slopes of the hills. There are yellowish red in colour and poor in fertility. Paddy, the principal crop of the district grows in these soils and more than 50 per cent of the area is under this crop. The balance land is traditionally cultivated for Ragi, Vari, Nagli, etc., but this practice is being abandoned and there is a definite shift towards horticultural crops in the recent years. The cultivation of groundnut has also picked up in the recent years. The district is famous for its mango crop specially the world renowned Alphonso. There has been rapid increase in the area under Cashew-nuts and mangoes with more and more Varkas soil being brought under plantations. Entire land-scape is also dotted with Coconut, Kokum, Arecaanut and Jackfruit trees which thrive well in these soils and climate. Pulses and spices like pepper are also cultivated especially in the coastal areas.

9.3.2. Salty soil

Due to the inundation of the sea, a part of the coastal soils has become salty. They are locally known as ‘Khar’ or ‘Khajan’. In Devgad, Malwan and Vengural tahsils, the entire western strips are salty while in other tahsils only salt patches are noticed.

9.3.3. Coastal Alluvium

The coastal strips have deep sandy loams and in these soils coconut and arecanut gardens thrive well.

9.4. ECONOMIC MINERALS

Of all the districts in the Konkan region, district Sindhudurg seems to be favourably placed with regard to the availability of some of the important workable minerals deposit. The southern part of the coastline, Kudal and Kankavli tahsils have important deposits of minerals. Iron ores are found at Redi (Vengurla tahsil), Banda, Tirawade and Aros (Sawantwadi tahsil).

In the district abundant iron ores are found in Redi. The proportion of ore carrying between 58-60 percent of iron is found in the area. Approximately 48 lakh tons of iron can be extracted from Redi. Bauxite and limonite are found at a few places along the coast near Vijaydurg and Devgad of tahsil Deogad and at Amboli of tahsil Sawantwadi.

The reserves of lavish chromite are found in Kankavli tahsil. Kankavli tahsil is also blessed with deposits of silica sand and annually thousands of tons of silica sand is being dispatched to places like Mumbai, Pune, Kolhapur, Belgaum, Ichalkaranji etc.

Manganese is found in the district at Phondye, Sasoli, Netarde and Dingne. Feldspar, a minor mineral found in this district, can be used in the manufacture of potteries.

Other minor minerals found in the district are mica, mineral pigments such as clay, asbestos, building, stones, glass sand, copper, salt, limestone etc. Radioactive minerals like Uranium oxide are also found in some parts of the district.

10. MINERAL POTENTIAL

Out of eight talukas, only two talukas are outside the extent of the ESA boundary as per the draft Notification S.O.2435 (E) dated 04.09.2015. A major portion of the other six talukas is under the draft ESA under the Western Ghats. There were numerous stone quarries, laterite & basalt mainly in the talukas of Devgad, Vengurla and Sawantwadi which were operational in these areas which were closed down after the imposition of moratorium and these areas were identified as ESA's.Efforts are being made to exclude these villages from the ESA area from the grass root level.

There are no sand mining leases given in the district for excavation of sand. Presently permission is given for excavation of sand to clear the navigational channel as per the policy of State Government. The sand excavation is done manually by means of "Hathpati" by coastal communities. The main purpose of sand excavation is to clear navigational channels for smooth movement of fishing and coast guard movements.

11. GROUND WATER RESOURCE

Ground Water Resource Estimation figures as a whole for Sindhudurg district indicates that Net Ground Water Availability is 26196.06 ha-m and Existing Ground Water Draft for all uses is 7262.86 ha-m.

After making provision for Domestic and Industrial Supply for next 25 Years as 3651.19 ha-m, Ground Water Availability for future Irrigation is 17107.6 ha-m.

Over all Stage of Ground Water development of the district is 27.73% indicating there is ample scope for ground water development in the district.

All Talukas of Sindhudurg district are categorized under "Safe Category" where there is scope for future development of ground water resources in Sindhudurg district.

Taluka wise ground water resources figures of Sindhudurg district are given below in

Table 22 reveling that stage of ground water development in the district is varying from 14.94% at Sawantwadi Taluka to 35.055 at Kudal Taluka. The hydrogeology map is given as **Figure 5.**

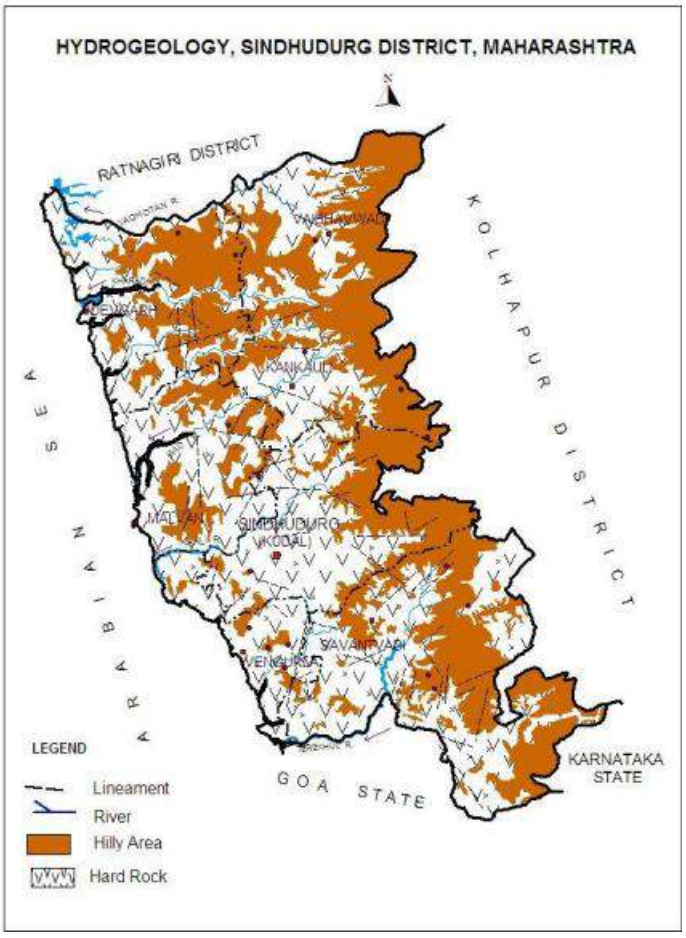

Figure 5: Hydrogeology map

Table 22: Ground Water Monitoring Stations

Sr.No	Tehsil	No of monitoring stations		
		Observation Wells	Piezometers	Water Quality Monitoring Stations
1	***Devgad***	7	1	11
2	***Vaibhavwadi***	2	2	09
3	***Kankavali***	6	1	13
4	***Malwan***	5	2	13
5	***Kudal***	4	1	14
6	***Sawantwadi***	7	2	10
7	***Dodamarg***	7	1	08
8	***Vengurla***	4	1	12

Table 23: Summary of ground water levels in pre – monsoon and post monsoon season.

Sr.No	Year	Average Pre-monsoon Static water level (m)	Average Pre-monsoon Static water level (m)	Category
1	2003	7.33	4.21	Safe
2	2004	7.14	4.61	Safe
3	2005	7.49	4.19	Safe
4	2006	7.39	3.29	Safe
5	2007	7.37	4.02	Safe
6	2008	7.16	4.51	Safe
7	2009	6.90	4.28	Safe
8	2010	6.98	3.02	Safe
9	2011	7.70	3.13	Safe
10	2012	7.11	3.10	Safe
11	2013	7.32	-	Safe

The figures showing pre – monsoon and post – monsoon ground water levels are given as Figure 6 & Figure 7.

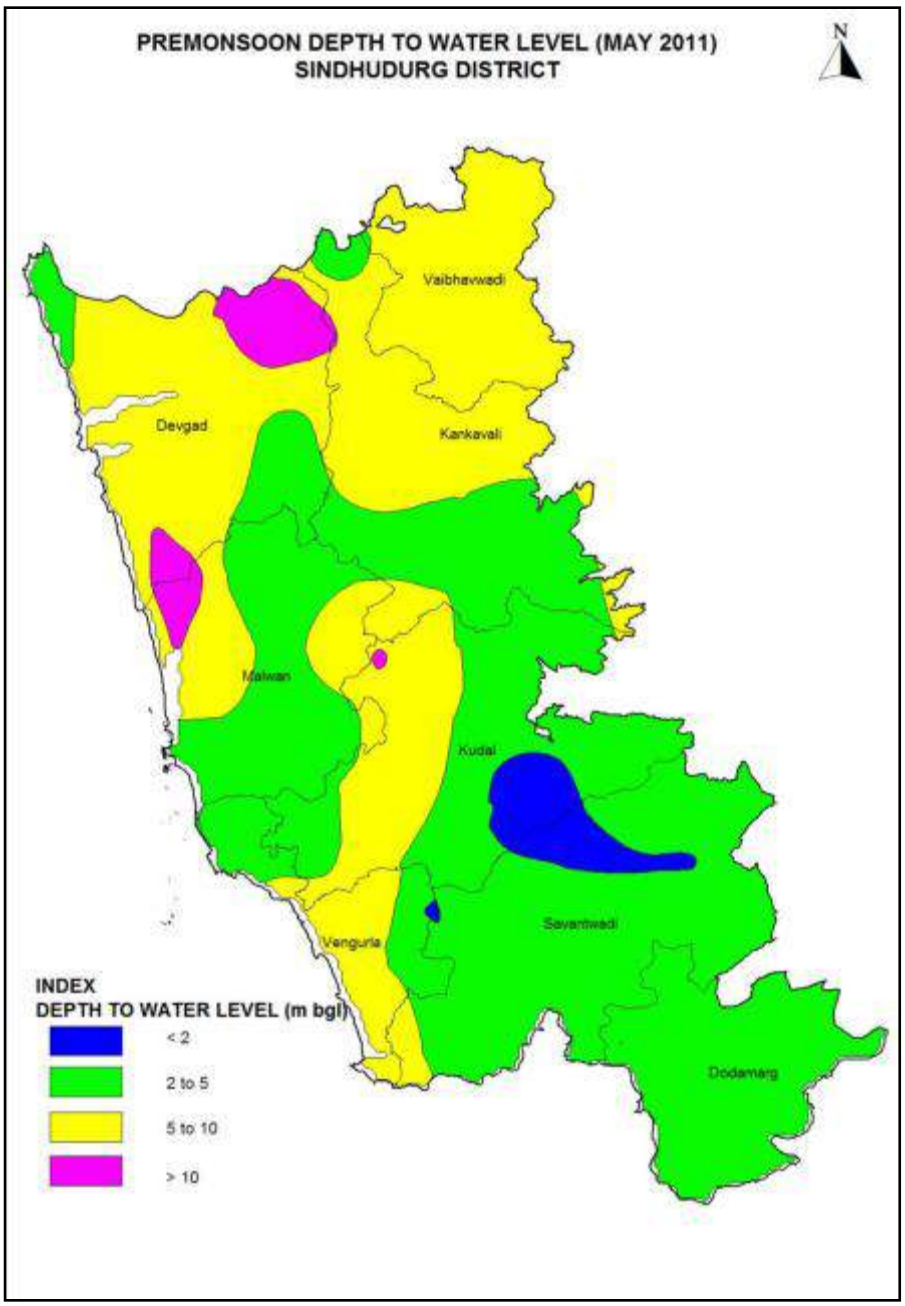

Figure 6: Pre – monsoon ground water levels

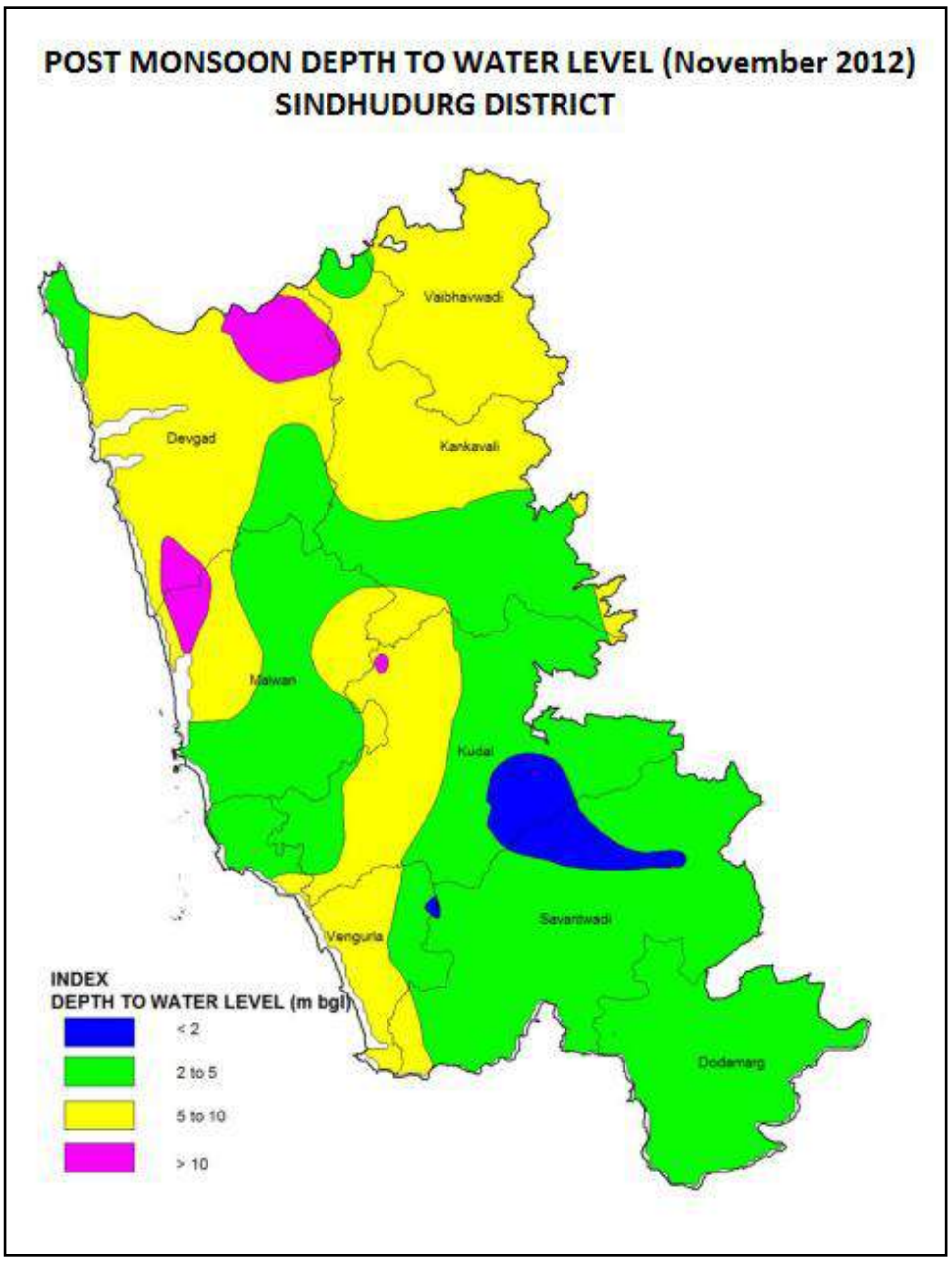

Figure 7: Post – monsoon ground water levels

Table 24 : Taluka wise average ground water levels in Sindhudurg District

Sr. No.	Administrative unit	Command/ Non Command/ Poor GW Quality	Rainfall (mm)	Average Pre Monsoon Water level (mbgl)	Average Pre Monsoon Water level (mbgl)	Average Fluctuation (m)
1	***Devgad***	Non Command	2784.98	7.35	4.28	3.07
2	***Dodamarg***	Non Command	3642.99	9.26	6.30	2.96
3	***Kankavli***	Command	2909.17	8.68	5.56	3.12
4	***Kankavli***	Non Command	2928.63	7.32	4.03	3.30
5	***Kudal***	Command	2909.17	7.34	2.47	4.86
6	***Kudal***	Non Command	2980.72	7.34	4.19	3.15
7	***Malvan***	Command	2909.17	7.34	2.47	4.86
8	***Malvan***	Non Command	2914.11	7.14	3.98	3.16
9	***Sawantwadi***	Command	3744.20	5.22	1.94	3.28
10	***Sawantwadi***	Non Command	3537.21	7.71	4.40	3.31
11	***Vaibhavwadi***	Non Command	2916.53	6.86	3.72	3.14
12	***Vengurla***	Non Command	3224.37	7.86	4.95	2.91

Reference: Report on the dynamic ground water resources of Maharashtra (2011-2012)

Table 25 : Assessment of ground water resources in Sindhudurg District

Sr. No	Administrative unit	Command / Non-Command / Total	Recharge from rainfall during monsoon season	Recharge from other sources during monsoon season	Recharge from rainfall during non - monsoon season	Recharge from other sources during non monsoon season	Total Annual Ground water Recharge (4+5+6+7)	Provision of Natural Discharge	Net Annual Ground water Availability
1	Devgad	Command	--	--	--	--	--	--	--
2	Devgad	Non Command	3662.84	28.10	134.19	300.21	4125.35	206.27	3919.09
3	Devgad	Total	3662.84	28.10	134.19	300.21	4125.35	206.27	3919.09
4	Dodamarg	Command	--	--	--	--	---	--	--
5	Dodamarg	Non Command	692.06	10.00	45.69	55.58	803.33	40.17	763.17
6	Dodamarg	Total	692.06	10.00	45.69	55.58	803.33	40.17	763.17
7	Kankavli	Command	32.86	19.16	0.0	25.60	77.63	3.88	73.75
8	Kankavli	Non Command	4584.34	17.54	63.33	308.02	5243.23	262.16	4981.07
9	Kankavli	Total	4887.20	36.70	63.33	333.62	5320.86	266.04	5054.81
10	Kudal	Command	142.17	28.17	0.00	181.11	351.46	17.57	333.88
11	Kudal	Non Command	4773.73	8.42	0.00	473.51	5255.66	262.78	4992.88
12	Kudal	Total	4915.90	36.59	0.00	654.63	5607.12	280.36	5326.76
13	Malvan	Command	10.36	2.05	0.00	13.19	25.60	1.28	24.32
14	Malvan	Non Command	3951.90	7.62	0.00	288.89	4248.41	212.42	4035.99
15	Malvan	Total	3962.26	9.67	0.00	302.08	4274.01	213.70	4060.31
16	Sawantwadi	Command	31.45	17.69	0.00	90.16	139.30	6.97	132.34
17	Sawantwadi	Non Command	3137.55	8.04	4.40	209.52	3359.51	167.98	3191.54
18	Sawantwadi	Total	3169.00	25.73	4.40	299.68	3498.82	174.94	3323.88
19	Vaibhavwadi	Command	--	--	--	--	--	--	--
20	Vaibhavwadi	Non Command	1579.74	6.62	100.15	156.18	1842.68	92.13	1750.55
21	Vaibhavwadi	Total	1579.74	6.62	100.15	156.18	1842.68	92.13	1750.55
22	Vengurla	Command	--	--	--	--	--	--	--
23	Vengurla	Non Command	1955.89	7.180	0.00	183.91	2146.98	107.35	2039.63
24	Vengurla	Total	1955.89	7.180	0.00	183.91	2146.98	107.35	2039.63

Reference: Report on the dynamic ground water resources of Maharashtra (2011-2012)