MODIFIED MINING PLAN ALONG WITH PMCP
FOR
NK BLOCK IV EE ILMENITEMINES(Category 'A')
(EXTRACTION OF ILMENITE, RUTILE,ZIRCON,LEUCOXENE,SILLIMANITE,MONAZITE)
OVER AN EXTENT OF 180.00.0 HECTARES
ALAPPAD, PANMANA AND AYANIVELIKKULANGARA VILLAGES
KARUNAGAPPALLI TALUK
KOLLAM DISTRICT,
OF
INDIAN RARE EARTHS LIMITED, CHAVARA, KERALA
(G.O.(Rt.) No.746/07/ID dated 08.06.2007)
(Under ruleRule8(9)of AMCR 2016and Rule 23 of MCDR2017**)**

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Introduction :

Indian Rare Earths Limited (Called IREL) is a public sector undertaking under Department of Atomic Energy, Government of India. It has beach sand mining and processing operations at Chavara, in Kerala, Manavalakurichi in TamilNadu and in Chhatrapur in Orissa. The deposit of heavy minerals in Neendakara – Kayamkulam Coast in South Kerala is commonly known as "Chavara Deposits". It occurs in a 22.5 km. long barrier beach with an average width of 200 m between the two tidal channels at Neendakara in the south and Kayamkulam in the north. The deposit is seen to extend beyond Kayamkulam estuary (or Pozhi as it is known locally) up to Thottapalli, but the area to the North of the Pozhi has not been mined so far. The area south of KayamkulamPozhi has been under intensive mining since 1932. During this period, it was the main center for export of llmenite. This has been the only deposit so far on the Indian coast, to have a heavy mineral content running as high as 60 to 70%. Also the Quilon grade or 'Q' grade llmenite has high TiO_2 content of 59 to 60% as against 55% in othermining areas.

The Indian Rare Earths Limited, which in 1965 became the successors to M/s.Travancore Mineral Concern and M/s.Hopkin & Williams Ltd., took over the assets of these companies and rationalized and reorganized the production of the economic mineral concentrates from these sand deposits. Their activities were earlier confined to the utilization of beach washings, the rich heavy mineral concentrates were deposited over the beach by the wave action between high and low watermarks. The Atomic Minerals Division (now called as Atomic Minerals Directorate for Exploration and Research), under the Department of Atomic Energy which carried out geological exploration of the area. The company has started inland dredge mining operation since 1990. The modified mining plan is for a lease hold area which is an eastern extension of the Block IV (IRE Block II) of Neendakara Kayamkulam coastal strip. This plot lies between Vattakayal in the south and Panikerkadavu Bridge on the north. This modified mining

plan is prepared as per Rule 8(9) of Atomic Minerals Concession Rules 2016 and Rule 23 of MCDR 2017 and is to be approved from Atomic Minerals Directorate, Hyderabad.

The lessee has already obtained mining plan approval for Ilmenite, Rutile, Zircon, Sillimanite, Leucoxene & Monazite) over an extent of 180.00.0 Hectares in Alappad, Panmana and Ayanivelikulangara Villages in KarunagappallyTaluk, Kollam District, Kerala State (having mining lease vide G.O.(Rt.) No.746/07/ID dated 08/06/2007 for a period of 20 years from 07.06.2011 to 06.06.2031) from Indian Bureau of Mine vide Ltr.No. 279/1031/2009/BNG/1079, dated 25.06.2009 for the period 2011-12 to 2015-16 and from AMD vide letter No.AMD/MPA/3M/IREL/180Ha/2008, dated- 19.11.2008. The G.O. copy & the copy of Mining Plan approval letter both from IBM and AMD, Hyderabad, is enclosed as Annexure No. 1A &10. The lease deed was executed on 07.06.2011. The copy of lease deed is enclosed as Annexure No.1.

The lessee has obtained MOEF clearance from Ministry of Environmental Forest New Delhi vide File No.11-36/2008-IA.III dated 01.03.2011and the copy is enclosed as annexure No.12.

The lessee proposed to enhance the production from 2,37,000 t per annum to 7,50,000 t per annum from inland. Hence the present modified Mining plan is prepared under Rule 8(9) of AMCR 2016 and Rule 23 of MCDR 2017 for the period from 2016-17 to 2020-21.

C SUNDAR

MINING ENGINEER

IREL, CHAVARA

KOLLAM- 691583,

KERALA STATE

M/s IREL Chavara has the following four mining leases:

(TABLE 1)

Sl. No.	Name of the lease	G.O. No & date	Village	Taluk& Dist.	Extent (Ha)	Validity of ML	Status
1	NK Block -II EE	GO.(MS) No.147/98/ID, dt 21.10.1998	Neendakara & Chavara	Karunagappally, Kollam Dist.	67.00	01.06.2019	Live
2	NK Block- II & IV	G.O.(Ms) 22/2005/ID dated 22.02.2005 & G.O.(MS) No.32/2006/ID dated 15.03.2006	Thekkaumbhagom, Chavara, Panmana and Karunagappally villages	Karunagappally, Kollam Dist.	102.77 (62.204 + 40.566)	28.02.2020	Live
3	Azheekal Ilmenite Mine	G.O.(Ms).No.59/07/ID dated 07.05.2007	Alappad	Karunagappally, Kollam Dist.	4.80	21.04.2039	Live
4	**NK Block - IV EE**	**G.O.(Rt) .No. 746/07/ID dated 08.06.2007**	**Alappad, Panmana&Ayanivelikkulangara**	**Karunagappally, Kollam Dist.**	**180.00**	**06.06.2031**	**Live**
Total					354.57		

IREL, Chavara has obtained Environmental Clearance as per MoEF notification dated 2006 for the mining leases at Sl. No. 3 & 4 above. EIA consultant (i.e. National Institute for Interdisciplinary Science & Technology (NIIST-CSIR), Thiruvanthapuram) accredited by MoEF has been engaged for conducting the EIA studies for obtaining Environmental Clearance for other areas.

The mining plan over an extent of 180.00 Ha.of IREL Chavara was approved by Atomic Minerals Division, Hyderabad, Department of Atomic Energy on 19.11.2008 and by IBM, letter no. 279/1031/2009/BNG/1079, dated 25.06.2009. However, in view of requirement under Rule 8(9) of AMCR2016 and Rule 23 of MCDR2017, the present document is prepared for the Modified Mining plan with PMCP for the proposed production from 2,37,000 t per annum to 7,50,000 t per annum **from Inland area only**. The present Modified Mining plan is prepared for the period from 2016-17 to 2020-21.

The details of IREL Mining Lease areas in other States are as follows:

TAMILNADU:

MANAVALAKURICHI UNIT (TABLE 2)

Existing Mining Lease					
Tamilnadu Government G.O.No& Date	Area in (Ha)	Lease Period	Mining Lease validity upto	Status	Name of the Villages

G.O.Ms.No. 1114dated 12.08.1981	141.22.69	20 Yrs	26.06.2004	Renewal of mining Lease applications submitted in time. Mining Lease areas are under deemed extension as per Rule 24A(6) of the MC Rules 1960.As per the Rule 6(11) of AMCR,2016, application for extension of mining lease period till the exhaust of entire reserves of the minerals was submitted in time.	Manavalakurichi Lekshmipuram Colachel
G.O.3(D)No.6 dated 28.1.2000	7.06.00	20 Yrs	30.08.2010		Manavalakurichi.-(Coastal sea beach poramboke land)
G.O.Ms.No.1085, dated 21.09.1977	29.78.12	20 Yrs	15.10.1999		Midalam and KeezhMidalam
Mining Lease Applied for					
G.O.(3D) No.74 dated 17.6.1998	14.84.00	Mining Lease deed execution pending due to want of Environmental Clearance			Manavalakurichi

ODISHA:

OSCOM UNIT(TABLE 3)

Sl No	Total Area (in Ha)	Location	Minerals	Working/ Non Working	Status	Details
1	2464.054 Ha	Ganjam Dist., ChatrapurTaha sil.	Ilmenite, Rutile, Zircon, Monazite, Sillimanite and Garnet	Working	Under active mining operations	Mining Lease got renewed for 20 years from (21.3.1999 to 20.3.2019)

The present Modified Mining plan for G.O. (Rt) .No. 746/07/ID dated 08.06.2007 over an extent of 180.00.0 Ha. is prepared under Rule 8(9) of AMCR 2016 and Rule 23 of MCDR2017 and as per the new guidelines.

The copy of Mining plan approval letter from IBM and AMD, Hyderabad is enclosed as Annexure No.10.

1.0 GENERAL

a)Name of applicant /lessee/Rule 45 registration no. IBM/ 6118/2011

Owner	:	Chairman and Managing Director.
Address	:	M/s.Indian Rare EarthsLtd.
Registered Office	:	No.1207, VeersavarkarMarg, Opp. Siddhi Vinayak Temple, Prabhadevi, Mumbai–400028.
Telephone No.	:	+9122 24382042,24211630
Fax	:	+9122 24220236
E-mail	:	**cs@irel.gov.in**
Address of authorized Signatory	:	Shri.S.Surya Kumar, CGM &Unit Head, Chavara Plant, Chavara, District: Kollam State: Kerala Pin code: 691 583 Phone: 0476- 2680701 to 2680705 Fax: 0476 – 2680141 Mobile No: 9447142739 Email id. : cgm-ch@irel.co.in, head-ch@irel.co.in

Copy of photo identity card of lessee with permanent address proof &certified true copy of the Board resolution is enclosed as annexure No. 4. List of Board of Directors is enclosed as annexure No. 7. Certificate of registration of the company and memorandum of the associationis enclosed as annexure No. 8.

b)Status of applicant/lessee: Government of India Undertaking under DAE.

c)Mineral(s) which is /are included in the prospecting license (For Fresh grant) :NA

d)Mineral(s) which is / are included in the lease deed :

Ilmenite, Rutile,Zircon,Monazite, Leucoxene & Sillimanite

e)Mineral(s) which the applicant /lessee intends to mine:

Ilmenite, Rutile, Zircon, Monazite, Leucoxene & Sillimanite

f)Name of Mining engineer/ person under rule(9) AMCR, 2016 or a person employed under sub-rule(1) of Rule55 of MCDR,2017–:

Name	:Shri.C.Sundar
Address	:M/s Indian Rare Earths Limited, Chavara,

Kollam- 691583. Kerala state
Phone: 0476 - 2680701– 05Fax:2680041
Email:c.sundar@irel.co.in
Mobile No: 09447094682

Experience : 19 years

2.0 LOCATION AND ACCESSIBILITY

a) Lease Details (Existing Mine)

Name of mine : **NK-IV EE ILMENITE MINE**

Lat/long of any boundary point ..

The mining lease area falls in the Survey of India Topo-sheet no. 58 C/8and bounded by following co-ordinates (by using GPS)

(TABLE 4)

Latitude	Longitude
$09^0$00' 55.97" – 09^0 02' 3.80" N	$76^0$31'17.19" & 76^0 30' 29.90" E

Date of grant of lease : 08.06.2007 Period/Expiry: 20 years from 07.06.2011 to 06.06.2031

Name of leaseholder : M/s Indian Rare Earths Limited,

Postal Address: M/s Indian Rare Earths Limited,Chavara

District: Kollam State: Kerala Pin code: 691 583.

Phone: 0476- 2680701 to 2680705 Fax: 0476 – 2680141 Mobile No: 9447142739

Email id. : cgm-ch@irel.gov.in

Details of lease area with location map (Mine) (TABLE 5)

Forest		Non-forest	
	Area (ha)		Area (ha)
Forest (specify)	NIL	(i) waste land, (ii) grazing land, (iii) Agriculture land, (iv)others(specify Dry Patta &Govt poramboke land (including canal and lake poramboke)	**180.00**

Few photographs showing Land use of the lease area, environmental status of the area is enclosed as annexure No. 3

Total lease area :180.00.0 Hectares

District : Kollam State : Kerala

Taluk : Karunagapally Village :Alappad, Panmana and Ayanivelikkulangara

Whether the area falls under Coastal Regulation Zone(CRZ)?: Yes

if yes, details thereof.

Form 1 for CRZ Clearance submitted to KCZMA with respect to the enhancing of the production. KCZMA recommendation has been forwarded to MoEF, New Delhi and is enclosed as Annexure No. 17.

Existence of public road/railway line, if any nearby and approximate distance .

Road & Railway line:

Road

The area is connected by an all weather-asphalted (Kollam - Cochin) road, NH 66 at a distance of 4 km from the mining lease area. Kerala State Road Transport Corporation bus services are available to and fro from the area throughout the day.

Railway Line

The nearest railhead is Karunagappally situated at a distance of 10 KM from the lease area.

Top sheet No. with latitude & longitude of all corner boundary point/pillar

The mining lease area falls in the Survey of India Topo-sheet no. 58C/8 and bounded by following co-ordinates (by using GPS).

(TABLE 6)

Latitude	Longitude
$09^0$00' 55.97" – 09^0 02' 3.80" N	$76^0$31'17.19" & 76^0 30' 29.90" E

c) Attach a general location map showing area and access routes. It is preferred that the area be marked on a Survey of India topographical map or a cadastral map or forest map as the case may be. However, if none of these are available, the area may be shown on an administrative map.

Plate No.1

3.0 DETAILS OF APPROVED MINING PLAN

3.1 Date and reference of earlier approved MP/SOM.(TABLE 7)

Sl.No.	Mining plan / Mining plan	Under MCR or MCDR	Approval letter No. Date
01.	Mining Plan approval from IBM	MCR1960	279/1031/2009/BNG/1079, dated,25.06.2009
02	Mining Plan approval from AMD	MCR 1960	AMD/MPA/3M/IREL/180Ha/2008, dated, 19.11.2008

3.2 Details of last modifications if any (for the previous approved period) of approved MP/SOM, indicating date of approval, reason for modification

NIL

3.3 Give review of earlier approved proposal (if any) in respect of exploration, excavation, reclamation etc.

3.3.1(a):Exploration:

Neendakara-Kayamkulam coastal belt including this mining lease area was investigated thoroughly (detailed exploration) by AMD, Hyderabad. Taking into consideration of the detailed investigations conducted by AMD in different phases from 1956-57 to 1995-96. Recently, the company approached the Atomic Minerals Directorate (AMD) for carrying out exploration as per UNFC guidelines, to which AMD confirmed and already commenced the work. The exploration report will be submitted as soon as it is made available.

3.3.1(b): Mine Development:

Mineralization starts from the surface and the deposit is devoid of top soil and over burden. The mineable reserve in Neendakara-Chavara Block has been under active mining. Presently, the operation of Dredge and Wet Upgradation Plant (DWUP) is in progress, however, the inland areas are also extracted by deploying excavator & tipper combination

Developmental work proposed for "A" Other Than Fully Mechanized (OTFM) mining in various inland areas using loader-tipper combination.

For inland deposits

- Laying of temporary approach roads utilizing trommel screen over waste for tipper movement.
- The deposit in pockets were dredgers cannot be reached, the areas are mined mechanically utilizing tipper and excavator combination and transporting the mined out

material to a Spiral Unit at the site for upgradation *and the upgraded sand is transported to* Heavies Upgradation Plant (HUP) / Mineral Separation Plant (MSP) at Chavara for upgradation of heavy minerals. Dewatering pumps are used for pumping the water from the excavation pit for further lowering the excavator used for the excavation purpose.

- The deposit is also extracted through dredging operation deploying a cutter & suction pump mounted over a floating pontoon. The dredged sand is upgraded in the in built wet upgradation plant (WUP) and dewatered immediately using hydro-cyclones located on the immediate dredge pond bank and the upgraded sand is transported to HUP for further up-gradation and separation. The tailings generated from the WUP are pumped back into the pond for backfilling.

- The tailing generated from HUP are utilized for back filling of inland mined out areas systematically and the original topography is restored followed by plantation.

3.3.1(c): Exploitation of Mineral:

The strategy of mineral exploitation has been framed on the following factors.

- Inland mining has been restricted to conserve and optimize the existing raw mineral sand reserves.

- The upgraded mineral sand collected from inland areas is transported to HUP for further up-gradation and the Magnetic and Non magnetic outputs from HUPis fed to Ilmenite Circuit and Rutile Circuit respectively for further separation of individual minerals.

- Recovery of heavy minerals at HUP is around 90%.

Year-wise production:(TABLE 8)

Year	PROPOSED Inland (Non-replenishable)		ACHIEVED Inland (Non-replenishable)	
	Raw sand (in lakh tons)	Heavy Mineral %	Raw sand (in lakh tons)	THM %
2011-12	2.37	10 to 18.85 %	Nil	N.A
2012-13	2.37		Nil	N.A
2013-14	2.37		Nil	N.A
2014-15	2.37		Nil	N.A
2015-16	2.37		Nil	N.A

Details of Year-wise Mineral Production Achieved

From this G.O.(Rt.)No.746 (180 Ha), no production was carried for the last plan period (2011-12 to 2015-16) due to the following reasons,

**Local issues like Land acquisition, settlements, compensating package, and demanding employment for the land owners*.

The raw sand received from all the mining lease areas are fed to HUP for primary up-gradation. In the HUP, the raw sand is upgraded and separated as magnetic and non-magnetic. These out puts are further fed to the Mineral Separation Plant for separation of individual minerals. The mineral production since 1999-00 in the MSP is as follows:

(TABLE 9)

Year	Ilmenite (t)	Rutile (t)	Zircon (t)	Monazite * (t)	Leucoxene (t)	Sillimanite (t)
1999-00	1,26,183	8,943	13,620	0	745.45	9,595
2000-01	1,37,513	8,302	14,878	0	452.25	8,645
2001-02	1,39,401	7,212	13,075	0	477.55	6,759
2002-03	1,04,374	5,736	11,781	0	207.90	4,405
2003-04	1,08,466	4,504	8,638	0	0.20	5,022
2004-05	83,244	4,031	7,713	0	0.00	7,159
2005-06	1,06,419	4,701	8,287	0	118.70	10,742
2006-07	80,468	2,394	4,033	0	209.90	5,718
2007-08	1,13,916	5,233	12,396	0	170.45	14,571
2008-09	86,909	3,859	7,773	0	198.00	10,423
2009-10	92,299	3,273	8,119	0	137.55	7,935
2010-11	74,320	3,556	7,500	0	110.45	8,243
2011-12	43,096	2,771	5,231	0	534.90	7,667
2012-13	23,309	1224	1992	0	104.75	4,936
2013-14	32,233	1138	2132	0	161.85	3,840
2014-15	28,008	992	1738	156	197.45	6,943
2015-16	22706	1010	1714	129	298.05	5397

*Monazite is produced as a concentrate containing around 30% of monazite. Monazite rich fraction is stored in earthen pits as per guidelines of AERB within the plant premises. Around 38000 t of Monazite rich tailing is stored in earthen pits till 31.03.2016. From 2014-15 onwards, monazite concentrate is upgraded to 95 % HM.

3.3.1(d):Method of mining:

The Mine is categorized as “A” i.e. Other than Fully Mechanized (OTFM) in inland mining (non-replenishable deposit).The mining will commence only after obtaining surface rights or consent from the land owner

The mining operations in 180 Ha ML area is carried out by either of the following methods:

(i)Dredging & Wet Up gradation of the inland deposits either by DWUP-II or by Dredge-III and feeding to a Land based Wet Upgradation Plant.

(ii) Surface mining of areas by excavator & tipper combination which are unapproachable by DWUP.

(i)The Dredge & Wet Up-gradation Plant (DWUP) is operated for mining the mineral deposit to the full depth of mineral body and up-gradation of HM% in a floating plant. The throughput capacity of the DWUP is 125 t per hour. The raw sand containing 17% HM is upgraded to output containing about 85% HM.

The DWUP comprises of a dredge which is the main excavating equipment with a bucket wheel cutter mounted on a ladder lift. The Bucket Wheel ladder is lowered and lifted by hydraulically operated winches. The bucket wheel and the gravel pumps are also driven hydraulically. The ladder lift is designed for a dredging depth of 8 metres. Anchoring ropes are provided for swinging the dredge and bucket wheel. Spud carriage ways are provided for movement of the DWUP and also for anchoring the plant when there is no operation. The sideway movement of the dredge is achieved by hydraulically operated slew winches. Two rear anchors are provided for additional safety during rough weather conditions.

The dredge slurry is pumped to a surge bin through a rotating trommel screen. The screen is of 3 mm aperture and made of polyurethane. The trommel removes the pebbles, roots and trash materials. The screened sand slurry is collected in surge bin from where it is pumped to a set of desliming hydrocyclones. The deslimed sand slurry is re pulped and pumped to the gravity spirals.

The gravity separation are done in 4 stages viz. Rougher, Cleaner, Scavenger, and Scavenger- cleaner spirals. This upgrades the HM grade up to 85%. The tailings consisting mostly of quartz are pumped to the dredged out area for back filling. The heavy mineral output is pumped to the land based hydro cyclone to stockpile which are transported by loader & tipper combination to HUP.

Quantity of Excavation:

Proposed excavation	: 7, 50,000 tonne per annum
Dredge operating Hours	: 6000 hours per annum
Hourly dredging quantity	:125 tonne per hour
Annual dredging quantity	: 6000 x 125 = 7, 50,000 tonne
No. of working days in a year	: 300 days (for 12 months)
No. of Shifts per Day	: 3 shifts.

(ii) Surface Mining by deploying Excavators & Tippers:

In some areas, mining operation cannot be carried out by dredging because of restricted/ small extent of land. For operation of dredge, continuous availability of land having an extent of 4 to 5 Ha is required. Since the area is thickly populated and land acquisition is a big challenge, wherever sufficient land is not available, surface mining by deploying excavators is done up to a depth of 8 meter and the excavated material is directly transported to Spiral Unit at the site for upgradation and then upgraded sand is transported to HUP for further up gradation. A dewatering pump is deployed for keeping the excavation pit dry.

Proposed excavation	-	7, 50,000tonne per annum
No. of working days in a year	-	300 days (for 12 months)
No. of Shifts Per Day	-	1 shift.
No. of excavators	-	3 nos.
Upgraded sand for transportation	-	3,75,000 tonne per annum
No. of tippers	-	25 nos.(10 tonne capacity)
No. of trips for each tipper	-	4-5 trips
Daily excavation & transportation	-	25 x 10 x 5 = 1250 tonne

There is no much change in the method of mining proposed in the approved mining plan and actual mining operations.

3.3.1(e): Disposal of waste:

The waste comprises of the tailings sand generated after separation of heavy minerals like Ilmenite, Rutile, Zircon, Monazite, Sillimanite etc. The tailings sand is mostly silica sand containing quartz. No other waste material is generated during the mining operations as well as separation of individual minerals. There is no overburden (OB) or top soil available over the deposit. The mineralization occurs right from the surface up to a depth of *8* meters. Hence, there is no requirement of identifying locations for storing the waste materials (OB / spoil). The entire 180.00.0 Ha mining lease area consists of mineral sand. The mined out area will be back filled by waste sand which is about 83 % by volume of the excavated quantity in a scientific manner followed by plantations. Village built-up area, roads, plant areas etc. will not be disturbed. Inland areas near sea shore are back filled to height of original topography. Under no circumstances, tailing will be

dumped in agriculture lands, canals etc.

The entire upgraded/ raw mineral sand mined from the inland mining areas is transported to the HUP through tippers. The tailing/waste generated at the HUP (mostly consisting of quartz in its native state) is used for back filling of inland mined out areas to bring the land profile to the near original topography. The mined out inland areas near to sea are back filled followed by plantation activities.

The raw mineral sand contribution from 180.00.0 Ha ML area will be 7,50,000 tonne. Tailing production annually from 180.00.0 Ha ML area will be around 6.0 to 6.6 lakh ton from 7.5 lakh tonne of ROM and this tailing will be used for back filling.

Mining activity in the inland deposits are carried out with simultaneous back filling of mined out areas and hence it is an eco-friendly mining operation.

3.3.1(f): Environment Management:

The impact of mining activities on the coastal and inland environment is very insignificant. Periodical environmental data monitoring is being done regularly through Kerala State Pollution Control Board. Health Physics Unit (BARC) also monitoring radiation and the reports are documented.

The environmental data is generated for ambient air and noise. Ground & Surface water level and Quality, Soil quality during the previous plan period are also showing the conformity with the least environmental impact due to mining.

During the approved mining plan period, afforestation proposals were made and the status of afforestation proposals and the corresponding achievements are done simultaneously after refilling the mined out inland areas. Environment Management Plan is enclosed as plate No. 6.

Details of Existing Afforestation:

Major part of the mined out area of the other lease areas are back filled with tailing sand from the HUP & MSP and used for plantation (casuarinas, coconut, mango, teak, jackfruit etc,) mixed with general afforestation. To facilitate plant growth and improve survival rate of the saplings, small pits are dug on the sand and filled with soil, coconut husk and kitchen waste from the kitchen. Usually this activity is done before the onset of the monsoon. Native and fast growing, deep rooted plant species like casuarinas and coconuts which are adaptable to the local climatic condition are preferred for plantation in the back

filled areas. The management consults the District Forest Officer and concerned officers of Kollam District regularly for proper guidance if required.

Existing Green belt /Plantation development Programme within the Mine Lease

As the mining operations are yet to commence Green belt is not developed.

Review of Environmental proposals and the status of compilation at the end of the Mining plan period .(TABLE 10)

Sl. No.	Item	Proposals as per amp and approved mining plan	Position at the end of mining plan period
1	2	3	4
1.	Top soil storage	Top soil – Nil	Top soil – Nil
2.	Land reclamation and rehabilitation	During dredge operation, the dredged out waste as slurry is used for backfilling the mining area	Mining operations are yet to commence
3.	Waste dump management	The waste generated during dredge mining will be used for refilling the mined out area. Due to backfilling no dump will be formed in the mining area.	Mining operations are yet to commence
4.	Afforestation programme with precautions for survival and protection of plantation	Casurina and Coconut plantation proposals are made in the excavated and refilled area.	Mining operations are yet to commence
5.	Quality of air.	Periodical environmental monitoring of air quality to be conducted.	Mining operations are yet to commence
6.	Quality of water. Surface & ground water	Periodical environmental monitoring of Water quality to be conducted.	Mining operations are yet to commence
7.	Noise level	Periodical environmental monitoring of noise level to be conducted.	Mining operations are yet to commence
8.	Treatment of mine water including surface and ground water.	There was no proposal to treat ground or surface water in the AMP and AMS. No additional water is required for mining operations, the dredge is working in a pond of water, and the water is reused	Mining operations are yet to commence
9.	Re-circulation of treated water.	No proposal in the AMP or AMS for re-circulation of treated water as there was no need to treat water in the mine.	Mining operations are yet to commence

3.4 Status of compliance of violations pointed out by IBM.

NIL

3.5 Indicate and give details of any suspension /closure/ prohibitory order issued by any Government agency under any rule or Court of law.

NIL

3.6 In case the MP/SOM is submitted under rules 9 and 10 of the MCDR'88 or under rule 22(6) of the MCR'1960 for approval of modification, specify reason and

justification for modification under these rules.

The lessee proposed to enhance the production from 2.37 LTPA to 7.5 LTPA from inland. Hence the present Modified Mining plan is prepared under Rule 8(9) of AMCR 2016 and Rule 23 of MCDR 2017, for the period from 2016-17 to 2020-21.

PART – A

1.0 GEOLOGY AND EXPLORATION:

a) Briefly describe the topography, drainage pattern, vegetation, climate, rainfall data of the mining lease area.

Topography

The mining lease area situated at the Alappad, Panmana and Ayanivelikkulangara villages in the District of Kollam and the taluk of Karunagapally containing an area of 180.00.0 hectares. The entire mining lease area is of patta &Govt poromboke land Including canal and lake puramboke. The mining lease area falls in the Survey of India Topo-sheet no. 58 C/8and is covered between North Latitude: N $09^0$00' 55.97'' to N $09^0$02' 03.80''08^0 56' 03" and East Longitude E$076^0$31' 17.19'' to E $076^0$30' 29.90''

The leasehold extends from the eastern boundary of mining lease for Block No.IV. The area under the lease can be divided into the following geographical types.

1. Beach area to the east of Block No.IV : This area is part of the beach deposit. The land is flat and the elevation is generally within 2 meters of M.S.L. The area was mostly patta lands owned by private persons. M/s.IRE has purchased part of the land. All the land required for commencement of mining operation is in IRE possession. IRE is in the process of buying the balance extent of land.
2. Canal and Lake Area: About 25% of the area is canal or lake. Canal and lake areas are classified as Govt land. The lake here is called VattaKayal. The Canal is part of the waterway between Trivandrum and Cherthalai called T.S.canal. The canal area is generally shallow with depth of 1.7 meters. The Govt has a scheme to deepen the canal and lake to make it navigable. The bottom of the lake and canal are also beach sand deposit, but with low Heavy mineral content.

3. Area to the east of T.S.Canal: This area is mainly private land used for agriculture and homestead. The area will be required only towards the latter half of the lease period of 20 years. IRE will be buying this land as and when required.

Drainage pattern and Vegetation:

180.00 hectares land covered under the inland Mining is done by dredging in a pond of water. The pond is generated and maintained by the dredge. The pond will have a depth of 7.5 M from MSL. Hence there is no need for mine drainage

The mining lease area has no agricultural, grazing, forest land in the close vicinity. There is no forestland in and around the mining lease area. The land includes private land and Government land (including canal and Lake Poramboke)

Climate & Rainfall:

Climate of the region is characterized by high humidity nearly all the year round, aggressive summer and a good seasonal rainfall. The summer season (March-May) is very hot (to some extent moderated by the sea) followed by South-west monsoon which lasts from the first week of June to the end of September. October and November constitute the post monsoon or in this place “retreating monsoon period”. Winter is not very well defined and is of short duration. Maximum annual temperature is around 38^0C while the minimum 20^0C. Annual rainfall recorded at Fort Cochin IMD Observatory is 3099 mm.

b) Brief descriptions of Regional Geology with reference to location of lease area.

The mining lease is to the east of Neendakara – Kayamkulam (NK) belt of beach sand deposit. (Survey of India Topo sheet No.58 C/8). The coastal strip from Neendakara – Kayamkulam Pozhi (Lake inlet) was divided into 8 blocks for sanctioning mining lease. NK Block II,IV,VI,and VIII were leased to IRE Ltd. This lease hold is to the east of Block IV. and extends beyond the lake and T.S. canal. The deposits is a part of Neendakara – Kayamkulam beach deposit. The wave and tidal action has concentrated the Heavy minerals into this deposit. The raw sand mined from the beach is used as feed to the Mineral Separation Plant for the separation of minerals like Ilmenite, Sillimanite, Zircon, Rutile, Leucoxene and Monazite. Geology of this deposit is discussed in subsequent paragraphs.
There is no forest area in the lease area.

Regional Geology:

The prominent geological feature of the region is the beach sand deposits of Neendakara to Arattupuzha coast. The coastal plain of Neendakara to Arattupuzha extends inland for some miles. It is an (raised) – marine plain and is marked by retreat dunes, which extend inland for some distance. The present coast is marked by a raised barrier dune behind which there is a canal which links a series of lagoons between the tidal channels at Neendakara on the Ashtamudi estuary and at the Kayamkulam lagoon.

Block II, Where IRE's plant is located, has been divided into two major parts: the beach Zone consisting of the beach –front and the mid-zone and the easterly extension.

The economically valuable minerals occur dominantly in the beach Zone Valuable minerals extend to the west for a mile or so under the waters of the Arabian Sea (Rao 1968b) and on land to the east, across the coastal plains. The lease boundaries are well defined but the reserve of heavy minerals continues eastwood beyond the lease boundary also.

The beach is subject to intermittent marine erosion and to replacement of heavy minerals from abundant off-shore, submarine deposits (Rao, 1968b).

It is thought probably that economically valuable minerals could occur intermittently for some miles to the east across the plain. The mineralized layer is of the order of 7m (22ft) deep but the grades are generally much lower than those of the beach zone.

The beach zone is rich and grades near 30% total heavy minerals are found near the surface. The average grade of the beach front zone is 30% and that of the remainder of the zone (the mid zone) is 20% heavy mineral.

The eastern extension is lower in grade with the majority of the higher grade samples around 15%. There are extensive areas of material with grades between5 and 15% total heavy mineral and the average is 10.8% heavy mineral.

Although the beach ridge forms a single recognizable body, the structure of the mineralization through the eastern extension is not clear. This is due partly to a lack of information but also to there being no correspondence between topography and mineralization in that the higher grades are not located on or near dunes.

The deposit along the sea coast is formed by the tidal waves of the sea. The origin of the sand deposits is attributed to the weathering action on the Archean crystalline rocks in the hinterland including the Western Ghats. The minerals were carried along the rivers to the sea and sorted by tidal action.

There is no over burden in the area. There is no wall rock etc. and the deposits have quartz, shells etc. as gangue mineral.

Stratigraphic Sequence

Paulose and Narayanaswami (1969) have suggested a general Stratigraphic Succession of these sedimentary rocks.

Recent to Sub –content	Soils and alluvium, Beach sand deposits, Lime shell deposits of back waters, Old and red teri sands of sub-recent Marine and lacustrine formations, peat beds with semi-carbonised woods, Calcareous clays with shell etc., Laterite.
---------- Unconformity----------	
Warkalai Beds	Current bedded friable variegated sandstone
(Mio –Pliocene)	interbedded with plastic clay and variegated clays, Carbonaceous clays with lignite seams and alum clays, Gravel and pebble beds, Base marked by gibbstic sedimentary clays
Quilon Beds (Middle Miocene)	Fossiliferous shell limestones alternating with thick beds of sandy clays, calcareous clays and sandstone, Base unknown.
	---------- Unconformity----------
Archaen	Crystalline rocks represented by high grade metamorphites like charnockiteskhondalites, leptynites and other granulites intruded by dolerites and pegmatites.

Heavy minerals of economic value are found along the western and eastern coast of Indian Peninsula. The source rock for many of these heavy mineral deposits is charnockites and peninsular gneisses intruded by leptynites and Khondalites to some extent. These deposits are formed by weathering and transportation processes. Enrichment of heavy minerals along the western coast is due to cyclic subsidence of coast, wind and wave action.

Lithological sequence observed from the exploratory drill holes.

↑
Top sand
Teri Sand
Clayey Sand
Sandy clay
Clay
Coarse sand and gravel/laterite
Bottom weathered leptynite
Clay
Coarse sand and gravel/laterite
Weathered leptynite

c) Detailed description of geology of the lease area such as shape and size of the mineral/ore deposit, disposition various litho-units indicating structural features if any etc. (Applicable for Mining Plan for grant & renewal and not for Mining plan/Modifications in the approved mining plan/mining plan).

Not applicable

d) Name of prospecting /exploration agency :

(i) Atomic Minerals Directorate (AMD),
Department of Atomic Energy, Government of India.

(ii) Address : Atomic Minerals Directorate (AMD), Department of Atomic Energy, Government of India, AMD Complex, Begumpet, Hyderabad-500 016.

(iii) E mail :amdhyd@ap.nic.in, headbsoi.amd@gov.in.

e. Previous Work:

EXPLORATION ALREADY CARRIED OUT IN THE AREA.

The area was prospected by AMD in October 1981 to April 1982 under "Heavy Mineral Investigation of Eastern Extension of IRE Block (II), Chavara (Eastern and Western sides of TS Canal".

A series of boreholes were drilled in the area. These are along lines spaced at a distance of 30 meters and the lines were numbered 118 to 196. In each line, boreholes were located at a spacing of about 30 meters and named as A, B, C etc., Some of the boreholes were in the old lease hold of Block IV and the rest in new lease area. In each bore hole, samples were taken every 1.5 meters and the HM content was checked. The boreholes were restricted to the area to the west of TS canal. There were 274 boreholes in the land purchased by IRE and adjoining areas. Based on the Heavy Mineral data of the boreholes, the weighted average of heavy mineral content of the boreholes in the area in possession of IRE was worked out. The gridlines from 118 to 196 relate to this area, weighted average of the data from the core analysis for this area is seen to be 17.62%.The exploration carried out only in the Alappad and Panmana villages of this lease.

Method of Estimation of Reserves:

The 180 Ha leasehold forms part of the 225 Ha.area for which detailed exploration is done and report is being prepared as per UNFC standards by AMD. The Whole area was systematically prospected by the Atomic Minerals Directorate (AMD) ,Department of Atomic Energy and the boreholes are located along the ore body all along the coastal area and to the full width of ore body within mining lease area. The total area ,depth of the ore and reserves are being prepared as per UNFC standards which will be incorporated in next 5 years Mining Plan accordingly. As

the plan is submitted for the period from 2016-17 to 2020-21, and the area proposed for production is in the western side of TS canal , the reserves are calculated with the available data. As the report is awaited for the study carried out as per the UNFC classification which covers the entire lease area of 180 Ha , the reserve estimation will be modified in the Mining plan period of 2021-22 to 2025-26.

However the details of heavy mineral reserves investigation done in 1981-82 by AMD for 97.2 Ha.of IRE Mining block II Eastern extension (NK Block IVEE) as per extended executive summary which will include area for next five years are as follows :

Dimension of the deposit : length 21.6 Km ,Width : 300 m average

Bore hole sample grid: 30 m X 30 m ,Number of boreholes: 644

Quantity of ore Reserve:6.02 million tons (Raw sand), Grade: Avg.: 17.624% HM%.

Total Heavy Mineral Reserve:1.06 Million Tons, Average bulk density: 1.72 ton/ m^3

Ilmenite:732252 T(12.152 HM%), Rutile: 46222 T (0.767 HM%), Leucoxene: 20005 T (0.332 HM%), Zircon : 72400 T(1.202 HM%), Monazite :13136 T(0.22 HM%), Sillimanite: 131445 T (2.181 HM%)

Geological Reserves and Grades.

The reserves were calculated and depending on the borehole data, the grade of the ore in the respective areas was marked. As the ore body, the mineral sand, is graded by the percentage of the heavy mineral content in the raw sand, the expected grades and mineral contents are worked out in Annexure-6.(AMD report) The grade of the ore body was found to be higher at the top and was seen to decrease with depth. The whole area was explored systematically and the geological reserves and grades were found out.

Depletion of reserve: (TABLE 11)

Year	Raw sand production G.O. (Rt.) No 746/07/ID dt 08.06.2007 – in inland areas (in lakh tons)	Remarks
2011-12	Nil	The proposed production was not done due to the agitation of the previous land owners and asking for more compensation for the lands and employment.
2012-13	Nil	
2013-14	Nil	
2014-15	Nil	
2015-16	Nil	
Total	**Nil**	

Reserves available as on April – 2016 :(TABLE 12)

Inland Deposit			
Sl.No	Name of the Block	Raw mineral sand (In Million Tons)	UNFC code

1	Neendakara IV EE (As on 01.04.2011)as per AMD report	6.02	Proved (111)
	Depletion for the period (2011-12 to 2015-16)	0	
	Total Proven Mineable inland reserve (as on 01.04.2016)	**6.02**	**"111"**

Number of boreholes indicating type (Core/RC/DTH), diameter, spacing, inclination, Collar level, depth etc

Details of samples analysis indicating type of sample (surface/sub-surface from pits/trenches/borehole etc) Complete chemical analysis for entire strata for all radicals may be undertaken for selected samples from a NABL accredited Laboratory or Government laboratory or equivalent.

Refer Annexure No.6(Executive summary of Eastern extension of IRE mining block II , Chavara)

iv)Expenditure incurred in various prospecting operations.

Rs. 75.00 Lakhs

f) The surface plan of the lease area may be prepared on a scale of 1: 1000 or 1: 2000 with contour interval of maximum of 10 m depending upon the topography and size of the area duly marked by grid lines showing all features indicated under Rule 32(1)(a) of MCDR 2017.

Plate No.4

g) For preparation of geological plan, surface plan prepared on a scale of 1: 1000 or 1: 2000 scale specified under para 1.0 (f) of Part A of the format may be taken as the base plan. The details of exploration already carried out along with supporting data for existence of mineral, locations proposed exploration, various lithounits along with structural features, mineralized/ore zone with grade variation if any may be marked on the geological plan along with other features indicated under Rule 32 (1)(b) of MCDR 2017.

Geological Plan Plate No.3

h) Geological sections may be prepared on natural scale of geological plan at suitable interval across the lease area from boundary to boundary.

Geological Cross Section : Plate No.3A

i) Broadly indicate the future programme of exploration with due justification(duly marking on Geological plan year wise location in different colours) taking into consideration the future tentative excavation programme planned in next five years as in

table below: -

The exploration work already carried out in and adjacent area by Atomic Minerals Directorate (AMD), Department of Atomic Energy, Government of India. and report " **HEAVY MINERAL RESERVES IN BEACH PLACER SEDIMENTS OF IREL- IIEE (NK BLOCK IVEE), IREL PROJECT)- N-K SECTOR , KOLLAM DISTT., KERALA** is being prepared by AMD. Hence no future exploration is required.

j**) Reserves and Resources as per UNFC with respect to the threshold value notified by IBM may be furnished in a tabular form as given below: (Area explored under different level of exploration may be marked on the geological plan and UNFC code for area considered for different categories of reserve/resources estimation may also be marked on geological cross sections).**

Submit a feasibility/pre-feasibility study report along with financial analysis for economic viability of the deposit as specified under the UNFC field guidelines may be incorporated.

Feasibility report Annexure No. 13

k) Furnish detailed calculation of reserves/resources section wise (When the mine is fully mechanized and deposit is of complex nature with variation of size , shape of mineralized zones, grade due to intrusion within ore zone etc, an attempt may be made to estimate reserves/resources by slice plan method). In case of deposits where underground mining is proposed, reserve/resources may be estimated by level plan method, as applicable, as per the proposed mining parameters.

Basis of reserve estimation and parameters:

There is no over-burden in these deposits and the entire sand available up to the drilling depth is taken as proved reserves.

The weight percent of each individual mineral is calculated from the total number of grains counted for each mineral, its specific gravity and the weight of the respective sieve fractions. Initially, pure fractions of all the individual heavy minerals are separated and their specific gravities are determined with a gravity bottle. Only these values are used for calculations in lieu of empirical values. The weight of the individual minerals in the respective sieve fractions are summed up to determine the total weight percentage of that mineral in the original sample. The total tonnage of raw sand in each block was calculated from its volume and the tonnage factor/bulk density of the corresponding composite/block samples. The individual mineral tonnages in total rawsand in each block are calculated from

their respective weight percentages, the weighted average for each mineral in a given block.

The deposit of NK BLOCK IV EE ILMENITE MINE is Placer and Residual deposits The deposit is technically feasible and economically viable for mining. The total proved reserves come under UNFC- 111. Presently as per the AMD report the mineable reserve in ML area is as follows.

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Based on the experience of IRE in dredge Mining in the Block II of its lease hold in Chavara and on the data obtain by core drilling programme of AMD in 1981 – 1982 mentioned above., reserves are calculated on the following basis.

1. All the area is of mineral sand
2. All the area can be mined to a depth of 7.5 M below MSL.
3. There is no report of laterite or other hard rocks up to elevation of 7.5M below MSL.
4. The volume of reserve is 3491180 m^3. (Raw sand 6025777 t / 1.726 t/ m^3bulk density).
5. Average bulk density is seen to be 1.726 Tons/M^3.

(TABLE 13)

(1)	Type	Units	Land	Water spread	Total
(2)	Area	Ha	132.0219	47.9781	180
(3)	Area in SQ meters.	SQ meters	1,320,219	479,781	
(4)	Average Ground elevation	Meters	1	-2	
(5)	Average Depth of Mineral	Meters	7.5	7.5	
(6)	Minable Thickness of Deposit	Meters	8.5*********	5.5*********	
(7)	Volume of Mineral Sand	Cubic Meter	2,711,833	637681	3349514
(8)	Reserve Tonnage	Tons	4,878,588	1,147,189	6,025,777
			Rounded to		6,025,000
(9)	HM content	%	17.62	17.62	
(10)	Heavy Minerals	Tons	859802	202181	1061983

The total reserves are as 6.025 Million Tons

l) Mineral Reserves/Resources:

Mineral Resources: (Mineral resources may be estimated purely based on level of exploration, with reference to the threshold value of minerals declared by IBM)

Level of Exploration	Resources in million tons	Grade
G1 - Detailed exploration	6.02	17.62 %

G2 - General Exploration

G3 - Preliminary Exploration 2.91 7.00 %

G4- Reconnaissance

(TABLE 14)

Classification	Block	UNFC Code	Quantity (Million Ton)	Grade (%)	Forest/Non Forest/ Unspecified
(A) Mineral Reserve	**NK-IV (EE)**				
Proved Mineral reserve	**NK-IV (EE)**	**111**	**6.025**	**17.62%**	**Non- Forest**

Resources and Reserves within the lease may be arrived after applying results feasibility/pre-feasibility study and economic evaluation of deposit based on various factors such as:

a) Mining method, Recovery factor, mining losses, processing loss etc.

b) Cut off grade, Ultimate pit depth proposed.

c) Mineral/ ore blocked due to benches, barriers, pillars, road, railway, river, nala, reservoir, electric line and other statutory barriers etc, under forest, sanctuaries etc. where necessary permissions are not available.

Refer FEASBILITY REPORT-Annexure-13

The deposit of NK BLOCK IV EE ILMENITE MINE is Placer deposits

(TABLE 15)

Classification	Block	UNFC Code	Quantity (Million tons)	Grade (%)	Forest/Non Forest/ Unspecified
(A) Mineral Reserve	**NK-IV (EE)**				
Proved Mineral reserve	**NK-IV (EE)**	**111**	**6.025 (raw sand)**	**17.62%**	**Non- Forest**

Ilmenite : 732252 T (12.152 HM%)

Rutile: 46222 T (0.767 HM%)

Leucoxene: 20005 T (0.332 HM%)

Zircon : 72400 T (1.202 HM%)

Monazite : 13136 T (0.22 HM%)

Sillimanite: 131445 T (2.181 HM%)

GEOLOGICAL AXIS:

Refer Feasibility Report : Annexure - 13

FEASIBILITY AXIS:-

Refer Feasibility Report : Annexure - 13

ECONOMIC AXES:

Refer Feasibility Report : Annexure –13

(TABLE 16)

.	UNFC Code	Quantity in million tons	Grade(HM)
A. Total Mineral Reserve	111	6.025	17.62%
Proved Mineral Reserve	121 and 122		
Probable mineral Reserve			
B. Total Remaining Resources			
Feasibility mineral Resource	211		
Prefeasibility mineral resource Measured mineral resource	221 and 222, 331		
Indicated mineral resource	332		
Inferred mineral resource	333	2.911	7.00 %
Reconnaissance mineral resource	334		
Total Reserves + Resources		8.936	14.16 %

The inferred resource as per the UNFC code 333 is for the portion of the lease area which lies to the eastern portion of the TS canal. The same will be converted into the Total Mineral reserve as per UNFC code 111 in the subsequent plan period of 2021-22 to 2025-26.

2.0 MINING

A. OPEN CAST MINING:

a) Briefly describe the existing as well as proposed method for excavation with all design parameters indicating on plans /sections.

The mine is categorized as “A” (Other Than Fully Mechanised) and the deposit is non-replenishable type (inland deposit). The mining will commence only after obtaining surface rights or consent from the land owner.

The mining operations in 180.00 Ha ML area is carried out by either of the following methods:

(i) Dredging & Wet Up gradation of the inland deposits either by DWUP-I or by Dredge-III and feeding to a Land based Wet-Up gradation Plant.

(ii) Surface mining of areas by excavator &tipper combination.

(i)The Dredge & Wet Up gradation Plant (DWUP) is operated for mining the mineral deposit to the full depth of mineral body and up-gradation of HM% in a floating plant. The throughput capacity of the DWUP is 125 t per hour. The raw sand containing 18% HM is upgraded to output containing about 85% HM.

The DWUP comprises of a dredge which is the main excavating equipment with a bucket wheel cutter mounted on a ladder lift. The Bucket Wheel ladder is lowered and lifted by hydraulically operated winches. The bucket wheel and the gravel pumps are also driven hydraulically. The ladder lift is designed for a dredging depth of 6 - 8 metres. Anchoring ropes are provided for swinging the dredge and bucket wheel. Spud carriage ways are provided for movement of the DWUP and also for anchoring the plant when there is no operation. The sideway movement of the dredge is achieved by hydraulically operated slew winches. Two rear anchors are provided for additional safety during rough weather conditions.

The dredge slurry is pumped to a surge bin through a rotating trommel screen. The screen is of 3 mm aperture and made of polyeurathene. The trommel removes the pebbles, roots and trash materials. The screened sand slurry is collected in surge bin from where it is pumped to a set of desliminghydrocyclones. The deslimed sand slurry is repulped and pumped to the gravity spirals.

The gravity separation are done in 4 stages viz. Rougher, Cleaner, Scavenger, and Scavenger- cleaner spirals. This upgrades the HM grade up to 85%. The tailing consisting mostly of quartz are pumped to the dredged out area for back filling. The heavy mineral output

is pumped to the land based hydrocyclone to stockpile which are transported by loader & tipper combination to HUP.

Quantity of Excavation:

Proposed excavation	:7,50,000tonne per annum
Dredge operating hours	: 6000 hours per annum
Hourly dredging quantity	: 125 tonne per hour
Annual dredging quantity	: 6000 x 125 = 7,50,000tonne
No. of working days in a year	: 300 days (for 12 months)
No. of Shifts Per Day	: 3 shifts.

(ii) Surface Mining by deploying Excavators & Tippers:

In some areas, mining operation cannot be carried out by dredging because of restricted/ small extent of land. For operation of dredge, continuous availability of land having an extent of 4 to 5 Ha is required. Since the area is thickly populated and land acquisition is a big challenge, wherever sufficient land is not available, surface mining by deploying excavators will bedone up to a depth of 8metre and the excavated material is directly transported to Spiral Unit at the site for upgradation and then upgraded sand is transported to HUP for further up gradation. A dewatering pump is deployed for keeping the excavation pit dry.

Proposed production	- 7,50, 000 tonne per annum
No. of working days in a year	- 300 days (for 12 months)
No. of Shifts Per Day	- general shift
No. of excavators	- 2 nos.
Upgraded sand for transportation	- 3,75,000tonne per annum
No. of tippers	- 25 nos.(10 tonne capacity)
No. of trips for each tipper	- 4-5 trips
Daily excavation & transportation	- 25 x 10 x 5 = 1250 tonne
i) Depth of Mining	Up to 8 m depth from Surface is to beexcavated by deploying excavators or by dredging operation.

ii) Type of Mining	"A" Other Than Fully Mechanized
iii) Type of Loading	Mechanized
iv) Area of mining	Inland areas
v) Maximum Lead distance from MSP	15- 18kms

There is no much change in the method of mining proposed in the approved mining plan and actual mining operations. Presently the DWUP operations are temporarily suspended due to non-availability of contiguous lands.

b)Indicate year-wise tentative Excavation in Cubic Meters indicating development, ROM, pit wise as in table below.

Following table shows year wise development and estimated production figures for this Mining plan period Average bulk density: 1.7 ton/m^3

I. Insitu Tentative Excavation **(TABLE 17(a))**

Year	Pit no.	Total tentative Excavation (Ton)	Top Soil (Ton)	OB/SB/IB (Ton)	ROM (Ton)		Mineral reject	ROM/ Waste Ratio
					Ore	Mineral reject		
1	2	3	4	5	6	7	8	9
2016-17	NK-IV(EE)	2,37,150	Nil	Nil	2,37,150	Nil	NIL	1:0
2017-18	NK-IV(EE)	2,37,150	Nil	Nil	2,37,150	Nil	NIL	1:0
2018-19	NK-IV(EE)	7,50,000	Nil	Nil	7,50,000	Nil	Nil	1:0
2019-20	NK-IV(EE)	7,50,000	Nil	Nil	7,50,000	Nil	Nil	1:0
2020-21	NK-IV(EE)	7,50,000	Nil	Nil	7,50,000	Nil	Nil	1:0
Total		27,24,300			27,24,300			

Break up of Individual Minerals in tonnes during the plan period

Table 17 (b)

Year	Ilmenite	Rutile	Zircon	Sillimanite	Monazite	Luecoxene
Grade	12.152%	0.767%	1.202%	2.181%	0.22%	0.332%
2016-17	28818	1819	2850	5054	510	769
2017-18	28818	1819	2850	5054	510	769
2018-19	91140	5752	9015	16357	1650	2490

2019-20	91140	5752	9015	16357	1650	2490
2020-21	91140	5752	9015	16357	1650	2490
Total	331056	20894	32745	59179	5970	9008

II. Dump re handling (for the purpose of recovery of mineral): Estimated available material (Cum) Table 17 (c)

No Proposal for Re handling of dump material.Dump identification/no	Year wise Handling(Cum)	Estimated recovery of salable material(Cum)	Reject (Cum)
NIL	NIL	NIL	NIL

c) Enclose Individual year wise development plans and sections showing pit layouts, dumps, stacks of mineral reject, if any, etcin case of 'A' category mines.

Refer Plate Nos. 5 & Plate No. 5 A

d) Describe briefly giving salient features of the proposed method of working indicating Category of mine.

The Mine is categorized as “A” i.e. Other Than Fully Mechanized (OTFM) in inland mining (non-replenishable deposit). The mining will commence only afterobtaining surface rights or consent from the land owners .

The mining operations in 180.00.0 Ha ML area is carried out by either of the following methods:

(i) Dredging & Wet Up gradation of the inland deposits either by DWUP-I or by Dredge- III and feeding to a Land based Wet-Up gradation Plant.

(ii) Surface mining of areas by excavator & tipper combination which are unapproachable by DWUP

(i)The Dredge & Wet Up gradation Plant (DWUP) is operated for mining the mineral deposit to the full depth of mineral body and up-gradation of HM% in a floating plant. The throughput capacity of the DWUP is 125 t per hour. The raw sand containing 12% HM is upgraded to output containing about 85% HM.

The DWUP comprises of a dredge which is the main excavating equipment with a bucket wheel cutter mounted on a ladder lift. The Bucket Wheel ladder is lowered and lifted by hydraulically operated winches. The bucket wheel and the gravel pumps are also driven hydraulically. The ladder lift is designed for a dredging depth of 6-8 metres. Anchoring ropes are provided for swinging the dredge and bucket wheel. Spud carriage ways are provided for movement of the DWUP and also for anchoring the plant when there is no operation. The sideway movement of the dredge is achieved by hydraulically operated slew winches. Two rear anchors are provided for additional safety during rough weather conditions.

The dredge slurry is pumped to a surge bin through a rotating trammel screen. The screen is of 3 mm aperture and made of polyurethane. The trommel removes the pebbles, roots and trash materials. The screened sand slurry is collected in surge bin from where it is pumped to a set of desliming hydrocyclones. The deslimed sand slurry is repulped and pumped to the gravity spirals.

The gravity separation are done in 4 stages viz. Rougher, Cleaner, Scavenger, and Scavenger- cleaner spirals. This upgrades the HM grade up to 85%. The tailing consisting mostly of quartz are pumped to the dredged out area for back filling. The heavy mineral output is pumped to the land based hydrocyclone to stockpile which are transported by loader & tipper combination to HUP.

(ii) Surface Mining by deploying Excavators & Tippers:

In some areas, mining operation cannot be carried out by dredging because of restricted/ small extent of land. For operation of dredge, continuous availability of land having an extent of 4 to 5 Ha is required. Since the area is thickly populated and land acquisition is a big challenge, wherever sufficient land is not available, surface mining by deploying excavators is done up to a depth of 8-9 meter (depending on availability of minerals) and the excavated material is upgraded in spiral at site and then upgraded sand istransported to HUP for further up gradation. A dewatering pump is deployed for keeping the excavation pit dry.

No drilling and blasting is involved since the mineral deposit is of beach sand placer.

e) Describe briefly the layout of mine workings, pit road layout, the layout of faces and sites for disposal of overburden/waste along with ground preparation prior to disposal of waste, reject etc. A reference to the plans and sections may be given. UPL or ultimate size of the pit is to be shown for identification of the suitable dumping site.

The mineral deposit starts from the surface in the entire Mining Lease area. There shall not be any generation of waste material in the mining area as there is no top soil & overburden. The entire raw sand will be transported to the plant through tippers. Hence, there will not be any waste which requires disposal or dumping separately. However, the tailing generated at DWUP / HUP will be transported for back filling the mined out areas.

The solid waste from the mining area is the gangue minerals mainly quartz and the unrecoverable minerals. The rejects are similar to the original deposits and they provide ideal back filling material in the mined out area. Hence solid waste disposal does not have any impact on the environment.

The only liquid effluent from the operations is water. A good amount of water is recovered for re-use and the balance water is pumped back to the mining area along with quartz and slimes.

Hence no treatment is contemplated. This waste is not likely to create any contamination of the ground water since no chemical will be used in the process as this is only a mining, up gradation and separation facility.

There will be no generation of overburden during the next five years. The waste material generated as tailing will be used to refill the back side of the pond as the pond moves in the direction of mining.

LAND CHOSEN FOR DISPOSAL OF WASTE

The ROM from 180Ha ML area is about 7,50,000 MT raw mineral sand per year. The tailing generated out of this quantity is about 6,00,000 to 6,60,000 MT per year.

Mining Lease area is covered under inland deposit and the complete area is utilized for transportation. There shall not be any generation of waste material in the mining area as there is no overburden in the area. The entire raw sand will be transported to the plant through tippers. Hence, there will not be any waste which requires disposal or dumping separately.
The tailing will be used to refill the back side of the pond, an area which is already mined out.

MANNER OF DISPOSAL

Mining Lease area is covered under inland and the complete area is utilized for mining and transportation. There shall not be any generation of waste material in the mining area as there is no overburden in the area. The entire raw sand will be transported to the plant through tippers. Hence, there will not be any waste which requires disposal or dumping separately. /waste from the beneficiation plant.

Mining and simultaneous back filling in mined out areas will be carried out. During scheme period entire mined out inland areas will be back filled with tailing. At the conceptual stage, near shore areas will be dumped at an elevated height of 8-10 mts by tailing generated from beach washing raw sand to protect the adjacent villages from the natural disasters like tsunami.

ULTIMATE PIT LIMIT

In the placer deposits no confined bench formation is possible. Hence, Conceptual Mining Plan and Sections have not been drawn to indicate the ultimate pit limit. The safety barrier of 7.5mt distance is given in the plate.

f) Conceptual Mine planning upto the end of lease period taking into consideration the present available reserves and resources describing the excavation, recovery of ROM, Disposal of waste, back filling of voids, reclamation and rehabilitation showing on a plan with few relevant sections.

The ROM from 180 Ha ML area is about 7,50,000 MT raw mineral sand per year. The tailing generated out of this quantity is about 6,00,000 to 6,60,,000 MT per year.

In the placer deposits no confined bench formation is possible. Hence, Conceptual Mining Plan and Sections have not been drawn to indicate the ultimate pit limit.The safety barrier of 7.5mt distance is given in the plate.

The mined out areas are refilled simultaneously after mining operations with tailings from DWUP / HUP.

Reclamation

Mining and simultaneous back filling in mined out areas in inland deposit will be carried out with the tailings generated from DWUP / HUP. During scheme period entire mined out inland areas will be back filled with tailing. At the conceptual stage, near shore areas will be dumped at an elevated height of 8-10 mts by tailing generated from beach washing raw sand to protect the adjacent villages from the natural disasters like tsunami.

The adjacent Mined out areas are simultaneously refilled and systematically afforested to maintain the original condition of the area. After mining and rehabilitation works, the same area is utilized for agriculture activities or handed over to the State Govt.

Mineable reserve and anticipated life of the mines:

As the plan is submitted for the period from 2016-17 to 2020-21, and the area proposed for production is in the western side of TS canal, the reserves of 6.025 Lakh tonne are calculated with the available data. As the report is awaited for the study carried out as per the UNFC classification which covers the entire lease area of 180 Ha , the reserve estimation will be modified in the Mining plan period of 2021-22 to 2025-26 . The anticipated life of mine will be indicated in the next mining plan period.

B. UNDERGROUND MINING

Not Applicable

ix) Extent of mechanization

Describe briefly with calculation for adequacy and type of machinery and equipment proposed to be used in different activities of drilling, material handling in development and stope, hauling, hoisting to surface, surface transportation and any other operation.

The following are the important parameters in opencast Inland mining operations.

i. Depth of Mining 8.0m
ii. Type of Mining/Collection Semi Mechanised

iii. Type of loading — Mechanised with loader/Excavator & Tipper combination.
iv. Area of collection — In inland mining areas.
v. Maximum Lead distance of Mine — 15K.M to plant.

Miscellaneous Operations

The following are the miscellaneous operations at different sites.

a)Dumping/unloading in the stacking area of Heavies Upgradation Plant Stock Yard & Stock Yard.

The following mining machineries have been deployed for mining operation:

Loading Equipment:(TABLE 18)

Equipment	Capacity	Size/HP	Nos
Front End Loader (Departmental)	1.53 cu.m	112 BHP	2
Backhoe excavator (Contractor)	0.9 cu.m.	-	3
Front end loader (Contractor)	1.53 cu.m	-	3

Hauling/Transport equipment:(TABLE 19)

Area	Equipment	Capacity	Size/HP	No.
"A" other than Mechanised Mining	Tippers (contract)	10 Tons	-	25

Average 20 tippers with upgraded raw sand will be conveyed from mining area to Mineral separation plant of average 800 t per day, assuming capacity of tippers as 10T and 4-5 trips per tipper per day. And around 5 tippers will be engaged for transporting raw sand from surface mining by " Excavator and tippers" to spiral plant at site.,assuming capacity of tippers as 10T and 15 trips per tipper per day

Inland Area: (TABLE 20)

Area	Equipment	Capacity	Size/HP	No.
Other than Fully Mechanised Mining	DWUP	125 tph	400 HP	1

DRILLING AND BLASTING:

Not applicable, as the deposit is sandy in nature and there is no need to adhere to blasting for mineral excavation process.

3. MINE DRAINAGE

a) Minimum and maximum depth of water table based on observations from nearby wells and water bodies .

180.00 hectares land covered under the beach Mining is done by dredging in a pond of water. The pond is generated and maintained by the dredge. The pond will have a depth of 7.5 M from MSL. Hence there is no need for mine drainage. Water table is generally at a depth less than 1 meter in the area .

b) Indicate maximum and minimum depth of Workings.

180hectares land covered under the beach Mining is done by dredging in a pond of water. The pond is generated and maintained by the dredge. The pond will have a depth of 7.5 M from MSL.

c) Quantity and quality of water likely to be encountered, the pumping arrangements and places where the mine water is finally proposed to be discharged.

180Hect.of land covered under the beachsand and no pumping arrangement is required.

d) Describe regional and local drainage pattern. Also indicate annual rain fall, catchments area, and likely quantity of rain water to flow through the lease area, arrangement for arresting solid wash off etc.

180Hectares of land covered under the coastal beach. Hence the drainage system is in order.

Annual rainfall recorded at Fort Cochin IMD Observatory is 3099 mm.

4.0 STACKING OFMINERAL REJECT /SUB GRADE MATERIAL AND DISPOSAL OF WASTE

a) Indicate briefly the nature and quantity of top soil, overburden / waste and Mineral Reject to be disposed off.

Mineral starts from surface hence there is no topsoil and overburden. Handling & stock filling of topsoil & waste does not arise. However, the tailings generated from the BWP are utilized for backfilling in the inland mined out areas of adjacent ML to restore original topography. Near shore areas will be backfilled at an elevated height of 8 to 10 mtrs. to protect against natural calamities.

The solid waste from the mining area is the gangue minerals mainly quartz and the unrecoverable minerals. The rejects are similar to the original deposits and they provide ideal back filling material in the mined out area.

Rejects from the DWUP mounted on the dredge will be used for refilling the mined out area of the pond. Hence refilling will go side by side with mining operation. The pond with the dredge in it will traverse the entire area of the lease area, recovering Heavy mineral present in the sand. The refilled area will be free of HM, especially Monazite, which is radio active. TS canal & lake areas inside the plot will also be mined. Deepening of the canal is necessary for movement of larger boats. The surplus rejects from the canal/lake area will be used to refill the land area, to make up for the material volume lost as concentrate

b) The proposed dumping ground within the lease area be proved for presence or absence of mineral and be outside the UPL unless simultaneous back filling is proposed or purely temporary dumping for a short period is proposed in mineralized area with technical constraints & justification.

The mineral deposit is devoid of overburden and hence there is no spoil. No separate dumping site is required for accumulating the wastes. The dredged out areas of nearby ML area is back filled with tailing in order to maintain the original contour. The back filled areas are maintained to a height of original contour and efforts are taken to restore the original contour topography. The slope of the tailing dumps are maintained scientifically taking into the angle of repose into consideration. The back filled areas are simultaneously afforested.

The solid waste from the mining area is the gangue minerals mainly quartz and the unrecoverable minerals. The rejects are similar to the original deposits and they provide ideal back filling material in the mined out area. Hence solid waste disposal does not have any impact on the environment.

There shall not be any generation of waste material in the mining area as there is no

overburden in the area. The entire raw sand will be transported to the plant through tippers. Hence, there will not be any waste which requires disposal or dumping separately.

The only liquid effluent from the operations is water. A good amount of water is recovered for re-use and the balance water is pumped back to the mining area along with quartz and slimes. Hence no treatment is contemplated. This waste is not likely to create any contamination of the ground water since no chemical will be used in the process as this is only a mining, up gradation and separation facility.

c) Attach a note indicating the manner of disposal of waste, configuration and sequence of year wise build up of dumps along with the proposals for protective measures.

The waste comprises of the tailings sand generated after separation of heavy minerals like ilmenite, rutile, zircon, monazite, sillimanite etc. The tailings sand is mostly silica sand containing quartz. No other waste material is generated during the mining operations as well as separation of individual minerals. There is no overburden or top soil available over the deposit. The mineralization occurs right from the surface up to a depth of 8 meters. Hence, there is no requirement of identifying locations for storing the waste materials (OB / spoil). The entire 180.00.0 Ha mining lease area consists of mineral sand. The mined out area will be back filled by tailings which is about 80 to 88 % by volume of the excavated quantity in a scientific manner followed by plantations. Village built-up area, roads, plant areas etc. will not be disturbedUnder no circumstances, tailing will be dumped in agriculture lands, canals etc.

The entire raw mineral sand mined from the inland mining areas is transported to the HUP through tippers. The tailing/waste generated at the HUP (mostly consisting of quartz in its native state) is used for back filling of inland mined out areas to bring the land profile to the near original topography. The mined out inland areas near to sea are back filled with an elevated height followed by plantation activities..

Around 6.0 – 6.6 lakh ton of tailing will be produced by feeding the 7.5 lakh ton of raw sand throughputfrom 180.00 Ha ML area and these tailing will be utilized for back filling in a scientific manner in the inland mined out areas.

Mining activity in the inland deposits are carried out with simultaneous back filling of mined out areas and hence it is an eco-friendly mining operation

5.0 USE OF MINERAL AND MINERAL REJECT

The following are to be furnished in the interest of mineral conservation.

a) Describe briefly the requirement of end-use industry specifically in terms of physical and chemical composition.

IRE is a major producer of mineral sands and is an ISO 9001:2008 certified organization. The products of IRE find acceptance in various customers in India and abroad.

The chemical characteristics and physical characteristics of the minerals are as below.

(TABLE 21)

Mineral	Physical (Grain size)	Chemical Composition
Ilmenite	50 mesh/140 mesh	TiO_2 – 59%, Fe_2O_3 – 17% to F_eO – 23.5%
Sillimanite	50 mesh/100 mesh	Aluminium Silicate Al_2O_3-60%, SiO_2 -36.34%
Zircon	50 mesh/140 mesh	Zirconium Silicate ZrO_2 – 65%
Rutile	50 mesh/140 mesh	TiO_2 -98%
Monazite	80 mesh/200 mesh	Complex rare earth Phosphate, ThO_2 8 to 10%

The ore is to be used for captive consumption in the mineral processing plant operated by IRE at Chavara.

The raw sand is concentrated in the DWUP mounted on the dredge. The concentrate product of DWUP has THM of 85%. The concentrate of the DWUP is the feed material for the mineral separation plant (MSP).

The Mineral Separation plant separates the various minerals utilizing the physical characteristics of the ingredient minerals. Low intensity magnetic separators separate the highly magnetic Ilmenite and high intensity magnetic separators separate weakly magnetic Monazite. The electrical conductivity of the mineral is utilized to separate the 'conductive' Rutile and 'non-conductive Zircon. FLOTEX separator using specific gravity difference is used for the separation of the Sillimanite.

Raw sand after concentration will undergo separation in MSP to produce minerals like Ilmenite, Rutile, Zircon, Monazite, Leucoxene and Sillimanite. The use of the minerals is given below:

Ilmenite - TiO2, FeO, Fe2O3 (98% grade....58% TiO2)

Ilmenite is magnetic and conducting with a specific gravity of 4.5

Rutile - TiO2 (92% grade, 95% TiO2)

Rutile isnon magnetic but is conducting with a specific gravity of 4.2

Zircon-ZrO2,SiO2(grade 97%, 65% ZrO2).

It is a non magneticnon conducting mineral with a specific gravity of 4.7

Monazite (95% grade ThO2-9%, RED-58%, U308-0.35%,P205- 29%)

It is a greenish yellow mineral with a specific gravity of 5.1 Monazite is a phosphate of Thorium (8 to 10%) and other rare earths.

Sillimanite :

Sillimanite is a silicate of aluminium and forms 2.3 percent of the deposits in certain areas. Sillimanite and two other aluminium silicates, having identical chemical composition,specific gravity of Sillimanite is 3.25

b) Give brief requirement of intermediate industries involved in upgradation of mineral before its end-use.

Raw sand after upgradation in HUP and will undergo separation in MSP to produce minerals like Ilmenite, Rutile, Zircon, Monazite and Sillimanite. The use of the minerals is given below:

Ilmenite - TiO2, FeO, Fe2O3 (98% grade....58% TiO2)

Ilmenite is magnetic and conducting with a specific gravity of 4.5. It is mainly used in the manufacture of titanium dioxide, a white pigment by the sulphuric acid digestion process and recently by the chloride process (chlorination followed by oxidation.). Because of whiteness and light scattering ability, titanium dioxide stands alone as a white pigment for paint, paper, rubber etc. It is also used for the production of Synthetic Rutile (Beneficiated Ilmenite) and further production of ferro titanium alloys.

Rutile - TiO2 (92% grade, 95% TiO2)

Rutile is non magnetic but is conducting with a specific gravity of 4.2. It is used for coating of welding electrode to stabilize the electric arc. Titanium dioxide reduces the viscosity of the metal droplets on the electrodes by yielding very small droplets that gives satisfactory welds. It is also used for the titanium dioxide pigment by the chloride process and for tetra chloride for the production of titanium metal/sponge.

Zircon-ZrO2,SiO2(Ceramic grade 98%,65% ZrO2 &Foundry grade 97%, 84% ZrO2).

It is a non magneticnon conducting mineral with a specific gravity of 4.7. Zircon is mainly used for the production of zirconium metal, ferro alloys and for refractory purpose. It is also used in abrasives, paints and chemicals. Zircon sand is usually preferred to silica sand because of its uniform grain size, higher melting point, low thermal expansion and resistances to moulden metal, acidic chemicals, slag etc. Zircon and its compounds are essentially used as opacifier in ceramic enamels and glazers because of their high reflectance and stability. Zirconium Oxide is being considered as a potential ceramic material for high temperature application engine components. Zirconium metal is chiefly used in the production of ferro silicon and other alloys. It is used in rockets, jets and commercial nuclear energy plants. Zircon alloy is used in nuclear reactor as a cladding material for the fuel.

Hafnium which always found in association and closely reassembling zirconium because of its high capture cross section for neutrons is used in the control devises of nuclear reactors.

Monazite (98% grade ThO2-9%, RED-58%, U308-0.35%,P205- 29%)

It is a greenish yellow mineral with a specific gravity of 5.1. Monazite is a phosphate of Thorium (8 to 10%) and other rare earths. It is feebly magnetic but is non conducting. Rare Earths are used in glass polishing, arc carbons, cracking catalyst flint for lighter and nodularising agents for iron. Rare Earths polishers are used in optical lenses, television tubes, mirror's face plate, other glass products and also as cracking catalyst in petroleum industry. Alloys of misch metal and iron are used in the manufacture of lighter flints, tracer bullets and luminescent projectiles. Misch metal is also used to make nodular iron. The more recent use of misch metal containing samarium is in the preparation of permanent magnets. Uranium also present in monazite in small percentages. Trisodium phosphate which is a byproduct obtained in monazite processing is used as a detergent in textiles and industrial water softening.

Sillimanite (92% grade, Al_2O_3-58%)

Sillimanite is a silicate of aluminium and forms 2.3 percent of the deposits in certain areas. Sillimanite and two other aluminium silicates, having identical chemical composition, are important minerals used as raw materials in the manufacture of high grade refractories and porcelain goods. Sillimanite refractory bricks are extensively used in glass making furnaces. specific gravity of Sillimanite is 3.25.

c) Give detail requirements for other industries, captive consumption, export, associated industrial use etc.

Requirements for other industries, captive consumption, export, associated industrial use as follows. (TABLE 22)

ILMENITE 'Q' GRADE

CHEMICAL ANALYSIS :

GUARANTEED :

TiO_2	58.00% (Min)

TYPICAL :

TiO_2	60.10%
Fe_2O_3	26.30%
FeO	10.50%
Al_2O_3	0.70%
Cr_2O_3	0.13%
V_2O_5	0.15%
MgO	0.40%
P_2O_5	0.14%
SiO_2	0.75%
Rare Earths	Trace
U	10 ppm
Th	160 ppm
ZrO_2	0.20%

RUTILE 'Q' GRADE

CHEMICAL ANALYSIS:

GUARANTEED:

TiO_2	95.00% (Min)

TYPICAL (%):

TiO_2	95.05%
Fe_2O_3	0.70%
P_2O_5	0.05%
ZrO_2	1.40%
SiO_2	1.00%
S	Trace

ZIRCON SAND 'Q' GRADE

CHEMICAL ANALYSIS:

GUARANTEED:

$ZrO_2(+HfO_2)$	64.00 % (Min)
TiO_2	0.40% Max
Fe2O3	0.13% Max
TYPICAL (%):	
$ZrO_2(+HfO_2)$	64.00- 65.00 %
SiO_2	32.00 – 33.00 %
TiO_2	0.30 – 0.40 %
Fe_2O_3	0.08 – 0.13 %
Al_2O_3	1.20 %

SILLIMANITE SAND 'Q' GRADE

CHEMICAL ANALYSIS:

GUARANTEED:

Al_2O_3	58.00 % (Min)
TYPICAL (%):	
Al_2O_3	59.30 %
SiO_2	37.10 %
TiO_2	0.40 %
Fe_2O_3	0.5 %
P_2O_5	0.05 %
ZrO_2	1.50 %
$Na_2O + K_2O$	0.50 %
CaO	0.60 %

The ore is to be used for captive consumption in the mineral processing plant Operated by IRE at Chavara.

c) Give detail requirements for other industries, captive consumption, export, associated industrial use etc.

Requirements for other industries, captive consumption, export, associated industrial use as follows.

List of Customers : **(TABLE 23)**

Name of the Mineral	Name of the Industry
Ilmenite	M/s. Cochin Minerals & Rutile Ltd. Alwaye
	M/s.TTP Ltd., Trivandrum
Zircon	Ordanance Factory, Medak
	Singarenicolleieries Company ltd,.Kothegudam
Monazite	M/s.Indian Rare Earths Limited, OSCOM, Orissa.
Rutile	M/s Bhajrang Industries, Kota, Rajasthan

	M/s.Bhagawati Electrodes, Hyderabad
	M/s. V.C.A Minerals & Metals, Chennai
Sillimanite	M/s.ABREFPvt Ltd, Gummidipoondi.
	M/s.Amerys special Refractory, Morbi Dt., Gujarat
	M/s.ChaithanyaRefractory.PVT Ltd, Malancha WB.
	M/s.Industrial Ceramics, Hyderabad
	M/s.Kerala Refractory Industries, Varkala, Kerala
	M/s.Nobel Refractories, Wankaner, Gujarat
	M/s.Oasis Ceramics Pvt., Ltd., Ankeleshwar
	M/s.PatidarMinechem, Shapar
	M/s.S.K.Minechem, Rajkot, Rajasthan
	M/s.SEPR Refractories India PvtLtd,Palakkad, Kerala
	M/s Viswakarma refractories Pvt Ltd., Kolar

The ore is to be used for captive consumption in the mineral processing plant Operated by IRE at Chavara.

d) Indicate precise physical and chemical specification stipulated by buyers .

The chemical & Physical l specifications stipulated by buyers as below.

(TABLE 24)

Mineral	Physical (Grain size)	Chemical Composition
Ilmenite	50 mesh/140 mesh	TiO_2 – 59%, Fe_2O_3 – 17% to F_eO – 23.5%
Sillimanite	50 mesh/100 mesh	Aluminium Silicate Al_2O_3-60%, SiO_2 -36.34%
Zircon	50 mesh/140 mesh	Zirconium Silicate ZrO_2 – 65%
Rutile	50 mesh/140 mesh	TiO_2 -95%
Monazite	80 mesh/200 mesh	Complex rare earth Phosphate, ThO_2 8 to 10%

Ilmenite - TiO2, FeO, Fe2O3 (98% grade....58% TiO2)

Ilmenite is magnetic and conducting with a specific gravity of 4.5

Rutile - TiO2 (92% grade, 95% TiO2)

Rutile isnon magnetic but is conducting with a specific gravity of 4.2

Zircon-ZrO2,SiO2(grade 97%, 65% ZrO2).

It is a non magneticnon conducting mineral with a specific gravity of 4.7

Monazite (98% grade ThO2-9%, RED-58%, U308-0.35%,P205- 29%)

It is a greenish yellow mineral with a specific gravity of 5.1. Monazite is a phosphate

of Thorium (8 to 10%) and other rare earths.

Sillimanite :

Sillimanite is a silicate of aluminium and forms 2.3 percent of the deposits in certain areas. Sillimanite and two other aluminium silicates, having identical chemical composition, specific gravity of Sillimanite is 3.2.

e) Give details of processes adopted to upgrade the ROM to suit the user requirements.

The Raw sand collected is transported to HUP area and blended with raw sand mined from other mining lease areas to attain uniform feed quality . The blended raw sand is fed to HUP which is passed through a set of spirals and is separated in to Heavies and tailings. The Heavies are passed through WHIMS magnetic separator and the magnetic and non magnetic fractions thus obtained are stacked separately. The through put rate to HUP is about 100 tons per hour. The tailings/waste generated in HUP mainly consists of quartz are transported to mined out areas for back filling

Mineral Separation Plant

The individual minerals are separated at MSP depending upon their physical properties like:

Magnetic Susceptibility

Electrical Conductivity and

Specific Gravity.

The major constituents are Ilmenite, Rutile, Zircon, Monazite, Leucoxene and Sillimanite. A flow sheet of the process followed here is enclosed as Annexure 15.

Ilmenite, Leucoxene and Monazite are magnetic materials. The magnetic susceptibility of these materials aredifferent.Ilmenite is more magnetic and Leucoxene and Monazite are feebly magnetic.

Regarding Electrical conductivity, all the Titanium containing minerals (i.e. Ilmenite, Leucoxene and Rutile) are conducting and all others are non-conducting.

6.0 PROCESSING OF ROM AND MINERAL REJECT

a) If processing / Beneficiation of the ROM or Mineral Reject is planned to be conducted, briefly describe nature of processing / Beneficiation. This may indicate size and grade of feed material and concentrate (finished marketable product), recovery etc.

The Heavy Upgradation plant(HUP) and Mineral separation plant(MSP) is located at a distance of around 15 kms (in NK Block II) from this Mining lease area. Heavies up gradation plant(HUP) and Mineral separation plant(MSP) are common for all four mining leases including this Mining lease area

Primary Up gradation:-

Heavies Up gradation Plant (HUP)

The raw sand containing around 25 to 30% heavy minerals mined in the beaches is transported in trucks to plant area , Dredge Wet Upgradation Plant (DWUP) output along with other raw sand mined from other lease areas is fed to Heavies Upgradation Plant (HUP). In HUP, HM grade is upgraded to 90% HM by using WHIMS, LIMS and spiral gravity separators

Mineral Separation Plant

The processing of the ore/beach sand minerals will be carried out in the existing Mineral Separation Plant (MSP) at Karithura (Block II). The Raw sand collected is transported to HUP area and blended with raw sand mined from other mining lease areas to attain uniform feed quality (mineralogical analysis of the feed to HUP is in table below. The blended raw sand is fed to HUP which is passed through a set of spirals and is separated in to Heavies and tailings. The Heavies are passed through WHIMS magnetic separator and the magnetic and non magnetic fractions thus obtained are stacked separately. The through put rate to HUP is about 100 tons per hour. The tailings/waste generated in HUP mainly consists of quartz are transported to mined out areas for back filling.

The individual minerals are separated at MSP depending upon their physical properties like:

Magnetic Susceptibility, Electrical Conductivity , specific gravity

Specific Gravity.

The major constituents are Ilmenite, Rutile, Zircon, Monazite, Leucoxene and Sillimanite. A flow sheet of the process followed here is enclosed as Annexure 15.

Ilmenite, Leucoxene and Monazite are magnetic materials. The magnetic susceptibility of these materials aredifferent.Ilmenite is more magnetic and Leucoxene and Monazite are feebly magnetic.

Regarding Electrical conductivity, all the Titanium containing minerals (i.e. Ilmenite, Leucoxene and Rutile) are conducting and all others are non-conducting.

The specific gravity of the various Minerals are: -

1. Monazite – 5.10
2. Zircon - 4.70
3. Rutile - 4.20
4. Ilmenite - 4.5
5. Leucoxene - 3.50
6. Sillimanite – 3.25
7. Quartz – 2.65

Proposed annual raw sand will be 7.5 lakh tones of average 17 HM% from this lease which will be upgraded to 85% HM through spirals at site. Feed to HUP from this lease will be around 1.5 lakh ton of upgraded sand of average 85 % HM.

Total monazite production in IREL, Chavara will be about 12000 tons (2 tons /hour- 2 x 20 hours x 300 days) contribution from this ML will be 10.0% to 12.0% per year.

(TABLE 25)

Products	Details from lease area (180 Ha.)	
	Quantity	Percentage(%)
Raw sand	7.50 lakh ton	17 % HM
Feed to HUP	1.50 lakh ton	85 % HM
Feed to MSP	1.42 lakh ton	90 % HM
Minerals (ilmenite,rutile,zircon,sillimanite)	1.08 lakh ton	85 % Recovery
Unrecovered minerals (Monazite, Sillimanite, fines)	0.20 lakh ton	….

Monazite-rich fraction is stockpiled in demarcated earthen pits approved by AERB in resurvey no. 29

Since Monazite rich tailing fraction is obtained from separation from MSP which is in NK Block II (at Chavara village) and same is stockpiled in demarcated earthen pits approved by AERB in resurvey no.29 till 31.03.2013. Now Monazite rich fraction of 95 % purity is upgraded. It is very difficult to find the nonrecoverable fractions pertaining to individual mining leases. Since all raw sands are mixed before feeding into HUP/MSP plant.

The tailing from the BWP / HUP plant containing mostly quartz are used for refilling in the mined out areas. The processed water will be sent to the settling ponds for slime removal and again re-used.

(TABLE 26)

Mineralogical analysis report of Feed to HUP

Minerals	(% weight)
Ilmenite	22.8

Garnet	0.4
Rutile	0.9
Leucoxene	0.3
Monazite	0.6
Zircon	2.8
Sillimanite	4.9
Shell+Quartz	66.9
Others	0.4
	100.0

b) Give a material balance chart with a flow sheet or schematic diagram of the processing procedure indicating feed, product, recovery, and its gradate each stage of processing.

MAG FRACTION (FEED TO ILMENITE CKT) AND MATERIAL BALANCE OF FEED TO HUP

(TABLE 27(a))

MATERIAL BALANCE (FEED CONTAINING 33 % HEAVY MINERALS) (TYPICAL FLOW SHEET)									
HUP CIRCUIT									
MINERALS	FEED TO HUP		MAG FRACTION		NON-MAG FRACTION		HUP TAILS		TOTAL
	(%WT)	QTY	(%WT)	QTY	(%WT)	QTY	(%WT)	QTY	QTY
ILMENITE	21.2	21.2	94.7	17.8	23	2.88	0.5	0.34	21.02
GARNET	0.4	0.4	0.5	0.09	0.3	0.04	0.2	0.14	0.27
RUTILE	1.5	1.5	0.3	0.06	9.4	1.18	0.1	0.07	1.30
LEUCOXENE	0.8	0.8	0.1	0.02	3.6	0.45	0.1	0.07	0.54
MONAZITE	0.6	0.6	0.3	0.06	7.3	0.91	0	0.00	0.97
ZIRCON	3.2	3.2	0.8	0.15	16.1	2.01	0.1	0.07	2.23
SILLIMANITE	4.9	4.9	0.7	0.13	19.8	2.48	1.3	0.89	3.50
SHELL+QUARTZ	67	67	2.5	0.47	19.1	2.39	97.5	66.98	69.84
OTHERS	0.4	0.4	0.1	0.02	1.4	0.18	0.2	0.14	0.33
	100	100	100	18.8	100	12.5	100	68.70	100

FEED TO MSP(Table 27(b))

MAG FRACTION (FEED TO ILMENITE CIRCUIT) (TYPICAL FLOW SHEET)							
MINERALS	ILMENITE PRODUCT		WET CIRCUIT		MONAZITE STOCK		TOTAL
	(%WT)	QTY	(%WT)	QTY	(%WT)	QTY	QTY

ILMENITE	98.5	16.86	6.5	0.05	62.90	0.55	17.47
GARNET	0.3	0.05	0.2	0.00	2.90	0.03	0.08
RUTILE	0.2	0.03	2.8	0.02	1.40	0.01	0.07
LEUCOXENE	0.1	0.02	1.1	0.01	0.70	0.01	0.03
MONAZITE	0.1	0.02	1.1	0.01	3.80	0.03	0.06
ZIRCON	0.2	0.03	15.4	0.12	1.40	0.01	0.17
SILLIMANITE	0.4	0.07	23.3	0.19	1.30	0.01	0.27
SHELL+QUARTZ	0.1	0.02	46.5	0.37	25.00	0.22	0.61
OTHERS	0.1	0.02	3.1	0.02	0.6	0.01	0.05
	100	17.12	100	0.80	100	0.88	18.80

(Table 27(c))

NON MAG FRACTION (FEED TO RUTILE CIRCUIT) (TYPICAL FLOW SHEET)											
HUP CIRCUIT											
MINERALS	RUTILE PRODUCT		WET CIRCUIT		MONAZITE CIRCUIT		ILMENITE PRODUCT		LEUCOXENE PRODUCT		TOTAL
	(%WT)	QTY	(%WT)	QTY	(%WT)	QTY	(%WT)	QTY	(%WT)	QTY	QTY
ILMENITE	0.0	0.00	6.8	0.53	29.4	0.43	90.0	1.75	0.60	0.00	2.71
GARNET	0.0	0.00	0.2	0.02	1.6	0.02	5.0	0.10	0.00	0.00	0.14
RUTILE	91.5	1.13	2.3	0.18	0.8	0.01	0.2	0.00	18.20	0.01	1.33
LEUCOXENE	6.5	0.08	1.9	0.15	5.9	0.09	0.3	0.01	79.70	0.03	0.35
MONAZITE	0.0	0.00	4.0	0.31	40.7	0.59	0.1	0.00	0.20	0.00	0.91
ZIRCON	2.0	0.02	23.8	1.87	7.0	0.10	0.9	0.02	1.10	0.00	2.01
SILLIMANITE	0.0	0.00	30.2	2.37	2.6	0.04	2.9	0.06	0.20	0.00	2.46
SHELL+QUARTZ	0.0	0.00	28.7	2.25	8.4	0.12	0.5	0.01	0.00	0.00	2.38
OTHERS	0.0	0.00	2.1	0.16	3.6	0.05	0.1	0.00	0.00	0.00	0.22
	100	1.23	100	7.84	100	1.45	100	1.94	100	0.04	12.46

(Table 27 (d))

WET CIRCUIT (FEED FROM ILMENITE AND RUTILE CIRCUIT I.E. FEED FROM NC IRMS)									
MINERALS	ZIRCON PRODUCT		SILLIMANITE PRODUCT		MONAZITE STOCK		TAILS AS REJECT		TOTAL
	(%WT)	QTY	(%WT)	QTY	(%WT)	QTY	(%WT)	QTY	QTY
ILMENITE	0.0	0.0	0.0	0.0	7.6	0.02	0.10	0.00	0.02
GARNET	0.0	0.0	0.0	0.0	2.2	0.00	0.20	0.00	0.01
RUTILE	0.3	0.01	0.2	0.0	16.4	0.03	0.10	0.00	0.05

LEUCOXENE	0.0	0.0	0.0	0.0	9.1	0.02	0.20	0.00	002
MONAZITE	0.1	0.0	0.0	0.0	35.1	0.07	0.00	0.00	0.08
ZIRCON	97.5	3.55	2.0	0.04	26.7	0.06	2.20	0.05	3.70
SILLIMANITE	1.2	0.04	94.6	2.03	0.8	0.00	44.20	1.00	3.08
SHELL+QUARTZ	0.8	0.03	3.0	0.06	1.3	0.00	52.20	1.18	1.28
OTHERS	0.1	0.00	0.2	0.0	0.8	0.00	0.80	0.02	0.03
	100	3.64	100	2.15	100	0.21	100	2.27	8.26

c) Explain the disposal method for tailings or reject from the processing plant.

The tailings from the BWP / HUP plant containing mostly quartz are used for refilling in the mined out areas. The processed water will be sent to the settling ponds for slime removal and again re-used. However, the tailing generated at BWP will be transported for back filling in the adjacent mined out areas

d) Quantity and quality of tailing /reject proposed to be disposed, size and capacity of tailing pond, toxic effect of such tailing, if any, with process adopted to neutralize any such effect before their disposal and dealing of excess water from the tailings dam.

The raw mineral sand contribution from 180.00.0 Ha ML area will be 7,50,000 ton. These tailing will be utilized for back filling in a scientific manner in the inland mined out areas. Tailing production annually from 180.00.0Ha ML area will be around 6.0 – 6.6 lakh ton from 7.50 lakh ton of ROM and this tailing will be used for back filling.

e) Specify quantity and type of chemicals if any to be used in the processing plant.

The discharged water from the plant will contain the slime as impurity and there will not be any chemical contaminants as no chemical is used in the process.

f) Specify quantity and type of chemicals to be stored on site / plant.

No chemicals shall be stored at site / plant

g) Indicate quantity (cum per day) of water required for mining and processing and sources of supply of water, disposal of water and extent of recycling Water balance chart may be given.

The processing plant Chavara works on zero discharge basis and all water is recycled.The only liquid effluent from the operations is water. A goodamount of water is recovered for re-use and the balance water is pumped back to the mining area along with quartz and slimes. Hence no treatment is contemplated. This waste is not likely to create any contamination of the ground water since no chemical will be used in the process as this is only a mining, concentration and

separation facility.

No adverse impact is expected due to seasonal collection of replenishable beach washings. However, in the adjacent Mining Lease hold inland area the following water quality management is followed:

a) Wherever dredging operations need to be carried out near the wells, it is being done by maintaining a safe distance.

b) The fresh water gradient towards the mining areas is maintained by close monitoring of the water table.

c) The dredge pond is started near the sea side and is progressed parallel to sea coast so that inland water table is not disturbed.

d) Wherever required, fresh water ridges will be built by digging a trench bordering the mining land and fresh water well areas.

e) The rain water collected around the mineral separation plant is drained inside the pond and utilized for plant operations.

f) Detailed monitoring of the water level in the mining lease and conducted to study the ground water characteristics with progress in dredging activities.

7.0 OTHER

a) Site services :-

A part of the mineral separation plant is situated in this mining lease. The mineral separation plant is provided with all facilities like drinking water, canteen, rest shelter, latrines and urinals, bathrooms, first aid centre, dispensary, vocational training centre, workshops for Electrical, Mechanical and Civil etc. Food at the canteen is supplied at subsidized rate. Medical facilities are available round the clock and the dispensary is equipped with an ambulance. Drinking water is supplied from the Sasthamkottalake which is at a distance of 18 kms from the lease area. Electric power supply is provided from the Kerala Electricity Board.

b)Employment Potential :

Employment potential of NK-IV EE, Ilmenite Mine

The anticipated employment, likely to be generated, is given in the table below. It includes managerial & supervisory staff directly employed by the company and skilled, semi skilled workers through contractual. **(TABLE 28)**

Manpower calculation for NK-IV EE, Ilmenite Mine		
Sl.No.	**Operations**	**No. of Persons required per day**
		Departmental
1	Mines Manager	1
2	Asst.Mines Manager & Mining Engineer	4
3	Geologist	1
	Sub-total	6
4	Un Skilled (Female)	3
5	Un Skilled	15

The mining lease area is consisting of inland deposit. The excavated raw sand will be transported through contractual tippers. It is proposed to deploy either a dredger or excavation by deploying excavator & tippers.

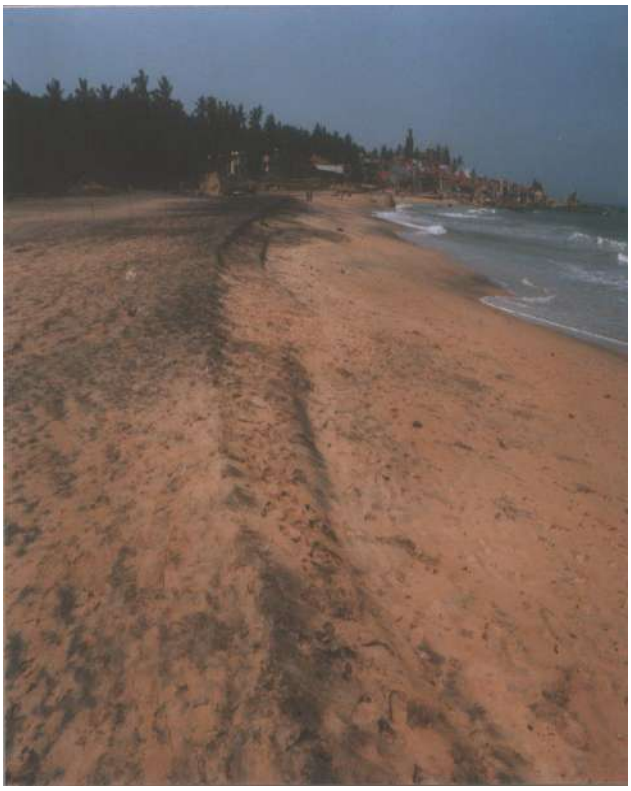
Around 205 contractual employees (also known as forum employees) are engaged daily out of which 38 are skilled persons. Apart from this, whenever Mining will be carried out in private holding areas, around 1200 persons on rotational basis will be engaged from among the land owners list who have parted their land to IREL for carrying out mining. Moreover, the villagers are also engaged in contractual work on short term basis as and when required.

Contract Employees per day :

Highly Skilled	**: 7**
Skilled	**: 7**
Semi-Skilled	**: 24**
Un-Skilled	**: 163**

8.0 PROGRESSIVE MINE CLOSURE PLAN UNDER RULE 23 OF MCDR'2017

8.1 Environment Base line information: Attach a note on the status of baseline information with regard to the following.



An assessment of the various ecological conditions that are likely to be affected by the mining operation is analysed. It is however worth mentioning that during the past several years of beach washing collections, no significant environmental impact has resulted on account of beach washing collection in the area.

The mining lease area has no agricultural, grazing, forest land in the close vicinity. There is no forestland in and around the mining lease area. The land includes private land and Government land (including canal and lake puramboke lease area

(TABLE29)

Type	EXTENT Ha	Percentage
Private Agriculture and Homestead	132.025	73
Govt including Canal and Lake	47.975	27
TOTAL	180	100

(i) Land-use pattern:

Present Land use pattern. (TABLE30)

No	**Activities**	**As on date (Hect)**
1	Area under inland mining	0.000
2	Storage of topsoil	0.000
3	Overburden/dump/Waste dump	0.000
4	Mineral storage	0.000
5	Infrastructure (Plant area, Pump house, work shop etc.,)	2.000

6	Road	0.000
7	Railways	0.000
8	Tailing pond	0.000
9	Effluent treatment plant	0.000
10	Mineral Separation Plant	0.000
11	*area under the sea	5.000
12	Mines, Refilled, and afforested area	0.000
13	Inhabitated Village areas – TS canal widened, lakh area and safety for water body, coastal replenishment	47.97.5
14	Undisturbed Area	125.02.5
Grand Total		180.00.0

i) Ground Water & Surface Water

The lease area and its course is north east to south west. The TS canal is connected intermittently with the Arabian Sea, which forms the western side of the mine lease area. There are no other perennial surface water sources in the mine lease area.

The ground water occurs in lenticular sand bodies under perched water table conditions. From the well inventory conducted in the area, it shows that the total depth of a well vary from 5 to 8m below ground level and the static water ranges from 4 to 6 m below ground level. The sand and sandy clay extends to the full depth of the wells. The water level comes to ground level during normal rainfall years. The water level starts depleting from January to June every year. The pH limit fixed for drinking water samples as per IS: 10500 is 6.5 to 8.5. During the study period, the pH was varying from 6.39 to 7.66 in case of ground water and 6.79 to 7.94 in case of surface water.

The desirable limit for chloride is 250mg/l as per IS: 10500 where as the permissible limit 1000 mg/l. Beyond this limit, the taste, corrosion and palatability are affected. The Chloride levels in the ground water samples collected in the study area were ranging from 23 mg/l to a maximum of 508 mg/l, where as in surface waters levels are observed as 20-16450 mg/l.

The desirable limit as per IS: 10500 for hardness is 300 mg/l where as the permissible limit for the same is 600 mg/l. Beyond this limit encrustation in water supply structure and adverse effects on domestic use will be observed. The hardness of the ground water samples collected from the study area is varying from 30 mg/l to 365 mg/l. In surface waters the hardness is observed as 60 to 5670 mg/l.

Fluoride is the other important parameter, which has the desirable limit of 1 mg/l and permissible limit of 1.5 mg/l. However the optimum content of fluoride in the drinking water is 0.6 to 1.5 mg/l. If the fluoride content is less than 0.6 mg/l, it causes dental cavities and above 1.5 mg/l it causes staining of tooth enamel, higher concentration in the range of 3 - 10 mg/l causes fluorosis. In the ground water samples of the study area, the fluoride value were in the range of 0.40 mg/l to 0.90 mg/l where as in the surface waters the fluoride is observed as 0.4 to 1.30 mg/l.

In order to get a detailed picture of the yield and quality of water, the Total Dissolved Solids content in wells was measured using the Dip Stick (portable TDS Meter) at selected wells in Neendakara – Chavara area. The particulars of wells are presented in Table below:

The study of hydrogeology and hydrochemistry of the entire area reveals more or less similar situation, the problems increasing towards west where the ground elevation decreases. The fresh water-salt water interface migrates inland during summer months.

The drinking water is supplied from the Kerala Water Authority.

(iii) Flora & Fauna:

The entire area is covered under beach deposit and no forest land is involved. Flora and fauna are absent in this area.
Land area of the plot is mainly cultivated area except the lake and canal area. The main cultivation was coconut and vegetables. There are no pronounced fauna in the area. The area for mining is not cultivated presently

(iv) Quality of air:

Air pollution due to dust or fumes are nil since this ML mining operations involving beach collection only. The fumes liberated by the trucks and loaders used for transporting the raw sand is negligible Ambient air quality Monitoring will be carried out for all the four quarters. The parameters selected for analyzing ambient air quality status were Respirable Particulate Matter (RPM), Suspended Particulate Matter (SPM) Oxides of Nitrogen (Nox), Sulphur dioxide (SO_2). A summary of ambient quality monitoring results for 24 hours average concentration are given below: **(TABLE-31)**

Locations	Values	SPM µg/m3	RPM µg/m3	SO2 µg/m3	NOx µg/m3
NK IV EE	Min	67.60	33.740	7.00	6.00
	Max	74.20	41.30	12.00	10.00

Locations	Values	SPM µg/m3	RPM µg/m3	SO2 µg/m3	NOx µg/m3
Ilmenite Mine	Mean	71.57	38.98	9.63	8.13

Control Measures for Air Quality / Dust Suppression

The pollution of air due to dust or fumes is nil since the complete mining operations are in wet process with electrically operated machineries. The fumes liberated by the trucks and loaders used for transporting the raw sand is negligible.

The areas under this lease are surrounded on one side by the mine lease boundary of IREL in the west, Cherusserybhagom village in the north, NH-66 in the eastern side and Puthenthura towards the south. The land comprises of Government poromboke land, private land without any forest land. There are no industries other than the MSP of IREL. Since most of the mining operations are carried out by wet process, the chances of polluting the atmosphere with dust, fume etc, is almost nil. The exhaust from the very few diesel equipments will be negligible.

(v) Noise level:

There will be no drilling and no blasting. The noise will be from few earth moving machinery and the dredge. As the mining area is free from inhabitation, this will not affect anybody. There will be no degradation of the environment due to higher noise levels .It is seen that in all of our existing operations, the noise levels are within the permissible limits. In future also the noise levels are expected to be in permissible limits only. Wherever required ear plugs/ear muffs will be supplied to the employees to protect them from high noise level. Regular monitoring of dust and noise levels are conducted and recorded.

PREVENTIVE MEASURE TO CHECK NOISE POLLUTION:

Better mining operational practices, scheduled preventive maintenance for mining equipment and green belt development all along the lease boundary will be adopted to keep the noise level within control. Planting of trees would be confirming to the guidelines for noise abatement

Radioactivity:

In order to ascertain the doses of radiation received by the employees during work, they are provided with TLD badges. These badges are periodically monitored for finding out the doses of radiation received by each employee. Based on the monitoring done, it will be ensured that the radiation doses received by each employee is within the permissible limit set by the statutory authorities. The monitoring of radiation prone areas will be carried out as per the guidelines issued by the Atomic Energy Regulatory Board so that no person receives excess doses of radiation.

(vi)Ground vibrations:

There will be no blasting hence there will be no vibrations generated by blasting.

(vii) Human settlements:

HUMAN SETTLEMENTS

The human settlements in the inland mining area will be given compensation for acquiring the land and after completion of the mining activities, the mined out areas are refilled using the plant rejects and mining waste for rehabilitation. Places of worship will be shifted away from the mining area with the consent of all stakeholders.

Public Buildings, Places and Monuments:

There are no historical places of interest monuments, pilgrimage centers around the Mining lease area.

Sanctuary is located in the vicinity of leasehold.

No Sanctuary is located in the vicinity of leasehold.

8.2 Impact Assessment: Attach an Environmental Impact Assessment Statement describing the impact of mining and beneficiation on environment on the following:

ENVIRONMENT IMPACT ASSESSMENT STATEMENT

The impact of mining activities on the coastal and inland environment is very insignificant. Periodical environmental data monitoring is being conducted regularly through Kerala Pollution Control Board, Trivandrum.

The environmental data generated for ambient air, noise. Ground & Surface water level and Quality, Soil quality during the previous plan period also showing the conformity the least environmental impact due to mining.

ENVIRONMENT IMPACT ASSESSMENT STATEMENT:

i) LAND ENVIRONMENT :

Land use pattern after five years (TABLE -32)

No	Activities	As on date (Hect)	End of five year of mining plan Period(Hect)	End of life of Mine (In Hectares)
1	Area under inland mining	0.000	6.000	0.000
2	Storage of topsoil	0.000	0.000	0.000
3	Overburden/dump/Waste dump	0.000	0.000	0.000
4	Mineral storage	0.000	0.000	0.000
5	Infrastructure (Plant area, Pump	2.000	2.000	1.000

	house, work shop etc.,)			
6	Road	0.000	0.000	0.000
7	Railways	0.000	0.000	0.000
8	Tailing pond	0.000	0.000	0.000
9	Effluent treatment plant	0.000	0.000	0.000
10	Mineral Separation Plant	0.000	0.000	0.000
11	*area under the sea	5.000	5.000	5.000
13	Mines, Refilled, and afforested area	0.000	17.74	126.02.5
14	Inhabitated Village areas – TS canal widened, lakh area and safety for water body, coastal replenishment	47.975	47.97.5	47.97.5
15	Undisturbed Area	125.02.5	101.28.5	0.000
Grand Total		180.00.0	180.00.0	180.00

a) Land and Land Subsidence:

. The entire area is covered under inland deposit

Aesthetic Environment and Tourist Spots (if any)

The Mining lease area neither endowed with environmentally aesthetic attributes not is an attractive place for tourists.

b) Soil and Land use Pattern

SOIL

Soil samples were collected and analyzed for constituents including pH, water holding capacity, texture, lime status, soluble nitrogen, phosphorous and potassium etc.

Agriculture

The mining lease area is not cause any harm to the agricultural field in the surroundings. Further, the agricultural lands used for mining will be reclaimed to the maximum possible for farming of agricultural products.

With the commencement of mining operations employment (both direct and indirect) opportunities will inherently force a change in the occupational structure partially. Consequently with increased economic status, modernized agricultural practices would be adopted which will result in not only better crop yield, but also reduce the pressure on particular operation.

Additionally, the wastelands and fallow lands upon mining and suitable reclamation will result in beneficial rehabilitation of the derelict lands. Emphasis will be on restoration of mined out lands to agricultural practices.

c) Forest

None of the mining lease area is covered under forest area and almost the entire land is covered under beach inland deposit.

d) Flora and Fauna

The entire area is covered under beach inland deposit and no forest land is involved. Flora and fauna are absent in this area.

AIR:

Air pollution due to dust or fumes are nil since this ML mining operations involving beach collection only. The fumes liberated by the trucks and loaders used for transporting the raw sand is negligible Ambient air quality Monitoring will be carried out for all the four quarters. The parameters selected for analyzing ambient air quality status were Respirable Particulate Matter (RPM), Suspended Particulate Matter (SPM) Oxides of Nitrogen (Nox), Sulphur dioxide (SO_2). A summary of ambient quality monitoring results for 24 hours average concentration are given below: **(TABLE-33)**

Locations	Values	SPM µg/m3	RPM µg/m3	SO2 µg/m3	NOx µg/m3
NK IV EE Ilimenite Mine	Min	67.60	33.740	7.00	6.00
	Max	74.20	41.30	12.00	10.00
	Mean	71.57	38.98	9.63	8.13

Control Measures for Air Quality / Dust Suppression

The pollution of air due to dust or fumes is nil since the complete mining operations are in wet process with electrically operated machineries. The fumes liberated by the trucks and loaders used for transporting the raw sand is negligible.

The areas under this lease are surrounded on one side by the mine lease boundary of IREL in the west, Cheriazheekal village in the north, Kozhikode in the eastern side and Thazchakadavu(KMML Boundary) towards the south. The land comprises of Government poromboke land, private land without any forest land. There are no industries other than the MSP of IREL. Since most of the mining operations are carried out by wet process, the chances of polluting the atmosphere with dust, fume etc, is almost nil. The exhaust from the very few diesel equipments will be negligible.

Dust suppression by water sprays

There is no dust generation in the mines as the operation involves only beach collection. However, the dust generated during transportation activities is suppressed by sprinkling water on haul roads.

Ambient air quality Monitoring was carried out for summer season (April, May and June). The parameters selected for analyzing ambient air quality status were Respirable Particulate Matter (RPM), Suspended Particulate Matter (SPM) Oxides of Nitrogen (Nox), Sulphur dioxide (SO_2). A summary of ambient quality monitoring results for 24 hours average concentration are given below:

ii) WATER ENVIRONMENT:

Ground Water & Surface Water

Water regime is typical of coastal area. About 27% of this plot (on the eastern side) is covered by Lake and T.S.Canal. The western side of the plot is close to the sea. Both the sea and the lake are saline and are subject to tidal movement.

From the well inventory conducted in the adjacent area it shows that the total depth of the well vary from 5 to 8 m below ground level and the static water ranges from 4 to 6 m below ground level. The sand and sandy clay extends to the full depth of the wells. No well has penetrated the entire thickness of top alluvial sand. The recuperation rate is ranging from 8 to 12 hours. The water level comes to ground level during normal rainfall years. The water level starts depleting from January to June of every year.

Geophysical resistivity survey reveal that the thickness of fresh water aquifer ranges from 8 to 16 meters below ground level followed by the formation with poor quality water and fresh rock. The depth to bed rock ranges from 15 to 20 m below ground level.

The hydro geological survey undertaken in the area reveals that the thickness of coastal aquifer ranges from 10 to 20 m below ground level. The fresh water aquifer thickness varies between 6 to 10 m below ground level. The present water table is between 4 to 6m below ground level, depending up on the topography of the area. A test was conducted in an open dug well located east of Administrative building in the factory premises in order to determine the aquifer characteristics.

The total depth of the well is 7.70 m below measuring point with a diameter of 8.30 metres. The water level in the well pre and post-test were 5.16 m and 5.36 m respectively below M.P. The well was pumped for 3 hours with a discharge rate of 5 liters/second and the total draw down was only 0.20m. The total quantity of water pumped for three hours was 53000 liters. The recovery was observed and within 40 minutes the pre-pumping level was restored. Water sample pre and post-test collected from the well and the analysis reveal an EC value of 740 Micro ohms/cm at 25 Dec. C.

Based on the test results the T.K. and C/A values are worked out as 69554 Litres Per Day/ft., 8365 lpd/ft2 and 0.026 lps/ft. respectively.

There is no need of water for mining operations.

No adverse impact is expected due to seasonal collection of replenishable beach washings. However, in the adjacent Mining Lease hold inland area the, following water quality management is followed:

a) The fresh water gradient towards the mining areas is maintained by close monitoring of the water table.

b) The rain water collected around the mineral separation plant is harvested inside the rainwater harvesting pond.

c) To prevent saline back water entry from the sea into the Valliyar River during the summer months, a check dam is constructed in Valliyar River.

c) Regular monitoring of Water Samples in the nearby surface waters and ground water bodies is being carried out by in house Health Physics Unit.

GROUND WATER CONDITIONS

In this type of coastal aquifer, the fresh water and salt water interface is defined by Ghyben-Herzberq relation which states that the interface depth is 40 times below by which the fresh water table elevation lies above sea level. Wherever the oscillation in the pumping of fresh water in upstream side is at higher magnitude and the water table gradient towards sea is not maintained, the quality change takes place.

Water table

The ground water study in the adjacent mining blocks indicate presence of limited ground water potential for makeup water requirement. Large scale pumping without water management will lower the water level below +1

Ground Water Recharge

The Principal source of recharge to the ground water in this area is rainfall. Due to the absence of perennial water source in the core and buffer zone.

CONTROL MEASURES FOR WATER QUALITY

Since the major cause of surface water pollution during the opencast mining activities in this mine is wash off from outside / inside dumps and erosion from freshly excavated areas. The analysis of water from various points like nallas, wells and rivers reveals that all the parameters are well below the prescribed limits by KSPCB.

Control measures to be adopted are:

The peripheral bund will help that soil is not carried away by storm water.

Stabilization of bund slope to prevent erosion and it will be done by providing agave plantation in bund slopes.

During dewatering operations the pumped out water will not have any change in turbid water entering the natural courses.

Ground vibrations:

A part of an area under this lease is TS Canal and the remaining area are surrounded on one side by the adjacent Mining Lease and others side by Government puramboke lands without any forest. No blasting.

Acid mine drainage, if any

No acid mine drainage

Socio-economics

Educational Facilities:-

Malayala medium state board higher secondary schools are available near the town to cater the education for villager's children living in and around the factory and mines. Scholarship facilities for employee's children as well as to the school toppers are given for pursuing higher education.

Hospital:

The hospital is located at Chavara & Kollam in a well-constructed building. Medical treatments including supply of specialist care, medicines are given to the employees and other persons living in and around the mines and factory at free of cost. E.C.G facility is also provided in the dispensary. Phone/mobiles facilities will be used in the mines to contact the Doctors and the Hospital round the clock. Ambulance will also been provided which can be summoned immediately over phone. Staffs are provided in the dispensary round the clock to attend to the emergency cases.

Health care facilities:

Regularly health camps are organized at our dispensary to cater to the need of the persons living in and around the mines area and factory area at free of cost. Specialist from various health fields like eye, cardiac care, diabetes, orthoetc are called from Kollam and Trivandram hospitals to give specialized health care to the people.

For the welfare of the children of the employees and villager's living around mines and factory, vaccination camps are regularly organized at our dispensary.

Drinking water facility:

Bore wells are dug in the villages in and around the mines at our company's cost to cater to the need of the villagers for drinking water. For the nearby villages, sintex water tanks are kept in prominent locations which are filled up daily with drinking water supplied through a water tanker from the factory.

The lakes in and in around villages are deepened with our mine machineries regularly every year just before the onset of monsoon season in order to accumulate and store the rain water in the lakes for the use of villagers for their domestic purposes.

Road & Bridges constructions:

For the villages in around the mines and factory permanent roads laying works are taken from time to time by the company.

Children park:

A park for the children of employees residing in the colony will be provided with a good lawn and sliding board and other playing mutes.

Quality of life:

The standard of living of the villagers has drastically improved as most of them are employed in the factory or in the mines. Because of this they are able to provide good education to their children and improve their quality of life. Most of the employees who are presently employed in the mines and factory are the third generation in the family working for the factory and mines continuously.

Indirect employment opportunities are created for the local people living in around the mines area motivating them by giving suitable contractual jobs like transportation of limestone from mines to factory, Afforestation work at mines etc.

Community center:

A community center is constructed at our colony premises to organize marriage functions and other traditional rituals of employee's family and other villager's at a nominal rate.

Temple renovation work:

Company is taking utmost interest & contributing in renovating the existing temples in around the mines area and factory at company's cost enabling the villagers to celebrate their temple functions every year in a grand manner. The management grants donations to various temples for conducting scheduled annual poojas.

Rainwater harvesting:

Recently our company has initiated the rain water harvesting practices inside our company and colony premises to store the rainwater and effectively use the same during the summer season.

Public Buildings, Places and Monuments:

There are no historical places of interest monuments, pilgrimage centers around the mining lease area.

Environmental proposals and the status of compilation at the end of the plan period.

(TABLE-34)

SL. NO.	ITEM	PROPOSALS FOR NEXT SCHEMEOFMINING PERIOD
1	2	5
1.	Top soil storage	Top soil – Nil
2.	Land reclamation and rehabilitation	Tailing - high silica sand generated in the separation plant is being used for backfilling of t ML mined out areas
3.	Waste dump management	Does not arise No waste is generated during mining operations. The tailings generated from MSP will be transported by tippers to the mined out lease area.
4.	Afforestation programme with precautions for survival and protection of plantation	It is proposed to plant about 1800 nos. of saplings in five years in the excavated and refilled area at the rate of 500 trees per annum.
5.	Quality of air.	Quarterly Periodical environmental monitoring of air quality conducted as per IBM/MoEF norms
6.	Quality of water. Surface & ground water	Quarterly Periodical environmental monitoring of water quality conducted as per IBM/MoEF norms.
7.	Noise level	Quarterly Periodical environmental monitoring of Noise level conducted as per IBM/MoEF norms.
8.	Treatment of mine water including surface and ground water.	There will be no toxic effluent, hence, no treatment of ground and surface water is proposed.
9.	Re-circulation of treated water.	Not applicable as no toxic effluent is going to be produced or discharged from the mine.

8.3 Progressive reclamation Plan :

In the preceding chapter, an attempt was made to assess the likely impact on the environment due to various mining activities. This chapter describes the scheme for environmental management, the proposed abatement measures to minimize the likely environmental degradation that may be caused due to the mining operations at proposed Mining Project.

Considering the scale and methodology of mining operations in the project area as discussed earlier, no significant environmental degradation is expected. The micro level eco system and socio economic setup of the villages is likely to improve. Environmental control measures and techniques are discussed below to mitigate any adverse effect owing to the mining activities.

8.3.1. Mined-Out Land:

Mined out area will be back filled simultaneously to restore the original topography. Presently around 0.00 Ha is mined and back filled. At the end of the life of the mine, the area refilled and afforested will be around 111.025 Ha.

The safety barrier along the mining lease boundary shall be utilized for casurina and coconut plantations after the cessation of mining operations.

Post Mining after cessation of mining activities (Area in Hectare)

(TABLE- 35)

No	Activities	As on date	End of five year of Mining plan Period	End of life of Mine
1	Area under inland mining	0.000	6.00	0.000
2	Storage of topsoil	0.000	0.000	0.000
3	Overburden/dump/Waste dump	0.000	0.000	0.000
4	Mineral storage	0.000	0.000	0.000
5	Infrastructure (Plant area, Pump house, work shop etc.,)	2.000	2.000	1.000
6	Road	0.000	0.000	0.000
7	Railways	0.000	0.000	0.000
8	Tailing pond	0.000	0.000	0.000
9	Effluent treatment plant	0.000	0.000	0.000
10	Mineral Separation Plant	0.000	0.000	0.000
11	*area under the sea	5.000	5.000	5.000
13	Mines, Refilled, and afforested area	0.000	17.74	126.02.5
14	Inhabitated Village areas – TS canal widened, lakh area and safety for water body, coastal replenishment	47.97.5	47.97.5	47.97.5
15	Undisturbed Area	125.02.5	101.28.5	0.000
Grand Total		180.00.0	180.00.0	180.00.0

8.3.2 Topsoil Management:

This is not applicable in this case as the top soil contains the maximum percentage of heavy minerals.

Existing afforestation in the refilled area:

Major part of the mined out area in all the lease areas are back filled with tailing sand followed by plantation (casuarinas, coconut, mango, teak, jackfruit etc,) mixed with general afforestation. To facilitate plant growth and improve survival rate of the saplings, small pits are dug on the sand and filled with soil, coconut husk and kitchen waste from the kitchen. Usually this activity is done before the onset of the monsoon. Native and fast growing, deep rooted plant species like casuarinas and coconuts which are adaptable to the local climatic condition are preferred for plantation in the back filled areas. The management consults the District Forest Officer and concerned officers regularly for proper guidance.

Casurina and coconut plantation has been carried out after back filling the inland dredged / mined out areas. Usually this is done before the onset of monsoon. Every year about 500 saplings are proposed to be planted in the back filled areas. More than 5,000 trees have been planted till date over the back filled areas, MSP surrounding area, guest house area etc. with a survival rate of more than 80%. Plantation will be carried out in phased manner over all the back filled areas. A nursery is developed by IREL, Chavara outside the mine lease area in company's land for supplying saplings to the mines for plantation.

(TABLE-36)

Year	No. of Trees Planted	Area	%of Survival	Species
Upto 2000	1000		75%	
2001	500		75%	
2002	500	Exhausted and Refilled	75%	Casurina, Coconut
2003	500		75%	
2004	500		80%	
2005	500		80%	
2006	500		80%	
2007	500		80%	
2008	500		80%	
2009	500		80%	
2010	500		80%	
2011	500		80%	
2012	500		80%	
2013	500		80%	

The proposed phase wise plantation programme within the mine lease area is given .

Afforestation Programme for the balance scheme period .

(TABLE-37)

Year	No. of Saplings	Area Covered (Ha)	Survival rate(%)	Places of plantation	Species
2016-17	150	2.00	80	Refilled area	Coconut and casurina
2017-18	150	2.00	80	Refilled area	
2018-19	500	6.00	80	Refilled area	
2019-20	500	6.00	80	Refilled area	
2020-21	500	6.00	80	Refilled area	
Total	1800	22.00			

Mine Layout and Afforestation Plan is enclosed. Refer Plate No. 6.

8.3.3 Tailing Dam Management.

Not applicable since the complete Mining lease hold area is covered under beach and mining activity & regularly carried out for exploiting replenishable Beach washings sand. However, the tailing are being used for refilling the mined out area and afforestation programme is being carried out systematically in the adjacent inland mining lease hold areas.

HUP tailing are simultaneously transported to the inland mined out areas for back filling. Hence, there is no separate tailing pond for storage of tailing is required to be maintained. A desliming pond is maintained near the HUP for re circulation of water. A settling pond for MSP wet section is maintained to settle the fines and re circulation of water.

8.3.4 Acid mine drainage, if any and its mitigative measures.

No acid mine drainage.

8.3.5 Surface subsidence mitigation measures through back filling of mine voids or by any other means and its monitoring mechanism.

The information on protective measures for reclamation and rehabilitation works year wise may be provided as per the following table.

SUMMARY OF YEARWISE PROPOSAL FOR ITEM NO. 8.3

Inland deposits:

The mining will commence only after obtaining surface rights or consent from the land ownerThe inland areas of the mining lease areas will be mined by either

1) Dredging operation or
2).Excavator – Tipper combination

The Dredge & Wet Up gradation Plant (DWUP) is operated for mining the mineral deposit to the full depth of mineral body and up-gradation of HM% in a floating plant. The throughput capacity of the DWUP is 125 t per hour. The raw sand containing 17% HM is upgraded to output containing about 85% HM.

The DWUP comprises of a dredge which is the main excavating equipment with a bucket wheel cutter mounted on a ladder lift. The Bucket Wheel ladder is lowered and lifted by hydraulically operated winches. The bucket wheel and the gravel pumps are also driven hydraulically. The ladder lift is designed for a dredging depth of 6-8 metres. Anchoring ropes are provided for swinging the dredge and bucket wheel. Spud carriage ways are provided for movement of the DWUP and also for anchoring the plant when there is no operation. The sideway movement of the dredge is achieved by hydraulically operated slew winches. Two rear anchors are provided for additional safety during rough weather conditions.

The dredge slurry is pumped to a surge bin through a rotating trammel screen. The screen is of 3 mm aperture and made of polyurethane. The trommel removes the pebbles, roots and trash materials. The screened sand slurry is collected in surge bin from where it is pumped to a set of desliminghydrocyclones. The deslimed sand slurry is repulped and pumped to the gravity spirals.

The gravity separation are done in 4 stages viz. Rougher, Cleaner, Scavenger, and Scavenger- cleaner spirals. This upgrades the HM grade up to 85%. The tailing consisting mostly of quartz are pumped to the dredged out area for back filling. The heavy mineral output is pumped to the land based hydrocyclone to stockpile which are transported by loader & tipper combination to HUP.

In some areas, mining operation can not be carried out by dredging because of restricted/ small extent of land. For operation of dredge, continuous availability of land having an extent of 4 to 5 Ha is required. Since the area is thickly populated and land acquisition is a big challenge, wherever sufficient land is not available, surface mining by deploying excavators is done up to a depth of 6 meter and the and the excavated material is directly transported to Spiral Unit at the site for upgradation and then upgraded sand is transported to HUP for further up gradation. A dewatering pump is deployed for keeping the excavation pit dry.

The tailings of the Heavies Upgradation Plant is transported back to mined out areas for backfilling activity followed by plantation.

Inland Mining

i) Depth of Mining	Up to 8 m depth from Surface is excavated by deploying excavators or by dredging operation.
ii) Type of Mining	“A” other than fully Mechanized
iii) Type of Loading	Mechanized
iv) Area of mining	Inland areas
v) Maximum Lead distance from the Mineral Separation plant.	18Kms

(TABLE-38)

TEMS		DETAILS	2016-17 Year			2017-18 Year			2018-19 Year			2019-20 Year			2020-21 Year		
			Proposed	Actual	Remarks	Proposed	Actual	Remarks	Proposed	Actual	Remarks	Proposed	Actual	Remarks	Proposed	Actual	Remarks
A)	Dump management	Area Afforested	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil
		No. of saplings planted	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil
		Cumulative no. of plants	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil
		Cost including watch and care during the year	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil
B)	Management of worked out benches.	Area available for rehabilitation (ha	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil
		Afforestation done(ha)	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil
		No of saplings planted in the year	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil
		Cumulative no of plants	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil
		Any other method of rehabilitation (specify)	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil
		Cost including watch and care during the year	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil
C)	Reclamation &Rehabilitation by back filling.	Void available for Backfilling (L x B x D) pit wise /stope wise	7.5Ha	Nil	Nil	7.5Ha	Nil	Nil	7.5Ha	Nil	Nil	7.5Ha	Nil	Nil	7.5Ha	Nil	Nil
		Void filled by waste /tailings	6.0Ha	Nil	Nil	6.0Ha	Nil	Nil	6.0Ha	Nil	Nil	6.0Ha	Nil	Nil	6.0Ha	Nil	Nil
		Afforestaion on the backfilled area	6.0Ha	Nil	Nil	6.0Ha	Nil	Nil	6.0Ha	Nil	Nil	6.0Ha	Nil	Nil	6.0Ha	Nil	Nil
		Rehabilitation by making water reservoir	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil
		Any other means (specify)	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil
D)	Rehabilitation of waste land with in lease wise	Area available (ha)	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil
		Area rehabilitated	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil
		Method of rehabilitation	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil
E)	Others (specify)		Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil

8.4 Disaster Management and Risk Assessment:

The manual beach washings collection is not carried out , since the deposit is having only the Inland deposit with in the mining lease area. to the depth of 7.0 mts. During the mining activity natural calamities like Tsunami, Earth Quake, Storm Thunders etc. may happen. Presently in the existing practices, the mining activity is generally suspended during stormy weathers. IREL, Chavara has formed high level committee to act during natural calamities and emergency situations.

M/s.Indian Rare Earths limited has formulated a disaster management plan for Emergency Preparedness & Responses

The salient features are elaborated as below:

- Emergency response Organization
- Communication System
- Action on the site
- Facilities available at site.

Emergency Response organization

Following officers of the mines will be responsible for co ordination in case of emergency situated in any section of the mine.

Emergency Response organization

Following officers of the mines will be responsible for co ordination in case of emergency situated in any section of the mine.**(TABLE-39)**

Person	Contact No.	Responsibility
Head of the Unit Shri S Surya Kumar,	9447142739	Site Controller
Section In charge Shri S.Jayachand,	9847019905	Accident Controller/ Communication officer
Employee who gives the first information about the accident/accident Shri LingrajPatnaik,	9439347363	Primary Controller
HOD (HRM) / Shri Jayapalan	9446084247	Liaison officer

Key Personnel and their responsibility

Site Controller

The head of the department/Mine agent shall have overall responsibility for controlling the incident/accident and directing the personnel.

- To prepare full proof plan for control of accident like, landslides, subsidence flood and other natural calamities
- To inform statutory bodies of the State and central Government.

  To inform communication officer about the emergency, control centre and assembly point.
- To provide all assistance and call for Fire Squad, Security Officer and other services required for removing/control of danger.
- To ensure that all necessary personnel to be assemble at assembly point.

Accident Controller/Shift In charge

- Mock rehearsal of plan prepared for accident.
- To withdraw men/machines from the affected area with priority for safety of personnel, minimize damage to the machines, environment and loss of material.
- To act as accident controller to all the later arrived.
- To make a report based on the facts and figure and submit to the Site Controller

Primary Controller

- To inform the Accident Controller / shift in charge from the nearest means of communication about the location and the nature of accident.
- To assist in clearing any obstruction in relief of accident.
- To carry out all instructions of accident controller.

Capability of Lessee: Following facilities are available at Plant.

- Public addressing system
- Telephones/ Mobile handsets
- Runners/messenger
- Emergency alarm
- Fire fightingequipments& accessories with trained manpower
- Full fledge dispensary
- Training center

- Fire tender, Ambulance

Facilities available out side

- Government Hospital at Kollam & Chavara
- Dr.Nair's Hospital, Kollam
- SSM Hospital , Kollam
- Benziger Hospital , Kollam
- Upasana Hospital , Kollam
- A.M.Hospital , Kollam
- Pearl Hospital, Kollam.

However, considering extreme situation, District authority including police would be informed about any off site emergency if situation arises.

In addition to the above, IREL, Chavara undertakes the Radiational Monitoring in systematic way to overcome hazards.

The ROM from the Mine is supplied to the Mineral Separation Plant located in an adjacent Mining lease area where minerals like Ilmenite, Rutile, Zircon, Monazite, and Sillimanite are separated from the Ore. In this, Monazite is a Phosphate of Thorium (8 to 10%) and other rare earths. Uranium also present in Monazite in small percentage. Since this phosphate of Thorium is a radioactive material, IREL, Chavara has been carrying out following protective measures:

Within our Mineral Separation Plant premises there is fully equipped Health Physics Unit (HPU) Lab under the control of full time Health Physicist, who is directly appointed by BARC, DAE. The HP Lab is equipped with monitoring equipments like Gun monitor, Survey Meter, Scintillometeretc

The radiation monitoring is carried out in two types.

1. Area monitoring 2. Personnel monitoring

Area monitoring is nothing but monitoring radiation level at different places in and around the work places.

Personnel monitoring is evaluating the radiation dose received by a person at the work place.

The radiation dose received by radiation worker can also be determined by the use of a

Thermo-luminescent dosimeter (TLD). The dosimeter consists of three pellets made of CaSO4. The pellets are placed in a metallic frame work and enclosed by a plastic cassette, containing three different pellets. These pellets are known as thermo luminescent phosphor discs. When heated after exposures to radiation, they emit light. The intensity of the emitted light can be measured. It is directly proportional to the amount of radiation absorbed by the pellets. It is a property that is made use of in measuring the accumulated dose.

Mainly all persons working in Monazite section are monitored closely and if their annual dose limit is exceeded, they will be transferred to other section on job rotation basis. But till now no persons have exceeded the annual permissible limit of 20 mSv.

Apart from the above, the following protective measures such as keeping distance from radioactive source, spending minimum time by providing shield for the source and use of protective equipments etc.

Safe Transport of Radioactive material:

Transport of radioactive material (Monazite) is carried out by packing in Silos.
Thus following the safety code AERB/SC/TR-1, issued by Atomic Energy Regulatory Board (AERB), Mumbai, carries out this transport of monazite. The scope of the regulations includes method of packing, labeling and marking on the packages. This would help in the identification of the packages containing radioactive material. However, monazite rich fraction are stockpiled separately in earthen pits as per AERB guidelines. But presently from 2014-15, we are upgrading the Monazite to 95 %.

Facilities available out side

As per Risk Assessment studies, the possibility of “Offsite” emergency situation are ruled out as proposed mine is not likely to pose any offsite emergency and hence does not call for any preparation of an off-site emergency plan.

Further the residential quarters and living area are far from the mine.

However, considering extreme situation, District authority including police would be informed about any offsite emergency if situation arises.

8.5 Care and maintenance during temporary discontinuance: An emergency plan for the situation of temporary discontinuance due to court order or due to statutory requirements or any other unforeseen circumstances may indicate measures of care, maintenance and monitoring of status of discontinued mining operations expected to re-open in near future.

When the mine is temporarily discontinuance due to any unforeseen circumstances the following care and maintenance shall be carried out: -

- Notice to be served to the all concerned authority
- The mining pit area shall be covered by temporary fencing
- All access roads / openings to the working pits shall be closed as per rule.
- Warning shall be display on “Notice Board” at appropriate places
- Security personnel shall be posted at every danger point.
- No unauthorized person shall be allowed to enter into the mine without prior permission of the management.
- All men and machinery shall be withdrawn from the mine and shall be kept in a compact and safe place.

All safety precautions shall be taken care off as per rule.

8.6 Financial Assurance:

Table indicating the Breakup of areas in the Mining lease for calculation of Financial assurance. (as per circular 4/2006)

(TABLE-40)

Sl. No	Head	Area put on use at start of Mining plan (in Ha.)	Additional requirement during plan period (In Ha.)	Total (In Ha.)	Area considered as fully reclaimed & rehabilitated (in Ha.)	Net area considered for calculation (in Ha.)
		A	B	C = A+B	D	E=C- D
1	Area under mining	0.00.0	23.74	23.74	17.74.0	6.00.0
2	Storage for topsoil	0.00.0	0.00.0	0.00.0	0.00.0	0.00.0
3	Waste dump	0.00.0	0.00.0	0.00.0	0.00.0	0.00.0
4	Mineral storage	0.00.0	0.00.0	0.00.0	0.00.0	0.00.0
5	Infrastructure	2.00.0	0.00.0	2.00.0	0.00.0	2.00.0
6	Road	0.00.0	0.00.0	0.00.0	0.00.0	0.00.0
7	Railways	0.00.0	0.00.0	0.00.0	0.00.0	0.00.0
8	Tailing pond	0.00.0	0.00.0	0.00.0	0.00.0	0.00.0
9	Effluent treatment plant	0.00.0	0.00.0	0.00.0	0.00.0	0.00.0
10	Mineral separation plant	0.00.0	0.00.0	0.00.0	0.00.0	0.00.0
11	Township	0.00.0	0.00.0	0.00.0	0.00.0	0.00.0
12	Others to specify Area safety for water In habitated Village areas – TS canal widened, lake area and safety for water body, coastal replenishment	47.97.0	0.00.0	47.97.0	47.97.0	0.00.0
13	Others to specify (undisturbed area)	106.29.0	0.00.0	106.29	106.29.0	0.00.0
Grand Total		156.26.0	23.74.0	180.00.0	172.00.0	8.00.0

Net area put to use for mining & allied services for the proposed scheme period is 8.00 Ha. As per rule 27(1) (2) of MCDR 2017, an amount of Rs 24,00,000/- (Rupees Twenty four Lakh only) as financial assurance @ Rs. 3,00,000/- per Ha/- has been submitted to Regional

Controller of Mines, IBM , Bangalore for the period of five years from 2016 to 2021 (Annexure 14).

C SUNDAR
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IREL, CHAVARA, KOLLAM- 691583,
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