

**SCHEME FOR  
PHASED RECLAMATION PLAN  
FOR KHONDBOND IRON & MANGANESE MINE  
OF TATA STEEL LIMITED**



**Village: Khondbond**

**Tehasil: Barbil**

**Sub-Division: Champua**

**District: Keonjhar, Odisha**

**Noamundi, Tata Steel Limited**



**CHAPTER - I**  
**BACKGROUND NOTE ON MINING LEASE**

**1 INTRODUCTION**

The Khondbond Iron & Manganese lease of M/s Tata Steel Limited was originally granted for a period of 30 years with effect from 17.01.1933 over an area of 12.17 sq. miles (3152.018 ha) including Joda West & Katamati blocks. The first lease renewal was granted for a period of 20 years from 17.01.1963 to 16.01.1983 over an area of 12.17 sq. miles (3152.018 ha) including Joda West & Katamati blocks.

During the second lease renewal, Khondbond formed an independent lease having an area of 1293.433 ha. Hence the second lease renewal was granted for the period of 20 years from 17.01.1983 To 16.01.2003 over an area of 1293.433 ha.

During the third lease renewal for the period of 20 years from 17.01.2003 to 16.02.2023, the Steel Company had applied for renewal of the mining lease over an area of 978.00 ha only vide letter no. MD/LO/1061/1205 dated 27.10.2001. The balance area of 315.433 ha was relinquished due to low potentiality of mineral on completion of the protective, reclamation and rehabilitation activities as mentioned in Final Mine Closure Plan duly approved by IBM vide letter no. 314(3)/2008-MCCM(CZ)/FMCP-02 dated 09.03.2009.

However, as per the MMDR Amendment Act 2015, the lease period has been extended upto 31.03.2030 over 978 ha vide letter no.3315/S&M, Bhubaneswar dated 18.04.2015 issued by Department of Steel & Mines, Govt. of Odisha. Accordingly the supplementary lease deed has been executed on 08.05.2015 over an area of 978 ha. Khondbond Iron & Manganese Mine falls in Baitarini Reserved Forest under Keonjhar Forest Division of Keonjhar district, Odisha. The ML area can be approached from Joda via Bichakundi by all weathered road.

Govt. of India, MoEF, had granted Forest Clearance over 453.15 ha of Forest land vide letter F No. 8-98/2004-FC Dt. 9.08.2006.

**Condition No. 9 of the aforesaid approval envisages that the concurrent reclamation plan shall be executed by the user agency.**

Therefore this scheme has been prepared in compliance with the said condition for execution in the ML on its approval by the competent authority.

**2 LOCATION OF THE ML AREA**

The mining lease area 978 ha is located in Survey of India Topo sheet No. 73 G/5 with:

**Latitude : 21°-54'-50" N and 21°-57'-47" N with**

**Longitude : 85°-21'-00" E and 85°-24'-17" E**



### 3 TOPOGRAPHY

The Khondbond Iron and Manganese Mines lies longitude between 85°-21'-00" E and 85°-24'-17" E and latitude 21°-54'-50" N and 21°-57'-47" N in Survey of India toposheet no. 73 G/5. The area has a widely undulating terrain with steep escarpments, moderately elevated plateau and narrow winding valleys. The extreme north and north west of the area lies on the southern slopes of Tiring pahar and southern portion of the western boundary of the block runs along the Satkutnia hill. The highest elevation is 755.43mRL. The contour extents from 750mRL to 558mRL. A major ridge is running almost centrally in NNE- SSW direction making the central portion elevated and slope towards east and west. However, there are intervening ridges and valleys running NW-SE direction arranged in an echelon pattern in the eastern portion. Steep valleys continue upto the lease boundary in the eastern portion.

The northern part of the lease area is covered under Baitarani Reserved Forest, with Sal as predominant forest crop trees. There is no hamlet or habitation falls within the leasehold area.

### 4 SOIL TYPE

Khondbond iron deposit belongs to Iron ore group in the Singhbhum Super Group formed during Pre-Cambrian era (c. 3100 Ma), of Dharwarian age as observed from the stratigraphic tables. The area consists of slightly metamorphosed sedimentary formations viz. Banded Hematite Jasper (BHJ), phyllites, shales with intercalations of lava flows & tuffs.

Soil at places is associated with iron ore and laterite boulders. Massive patches of BHJ are exposed predominantly in the north-western and north-eastern portion of the block. Iron ore exposures are patchy and mostly occur on hill slopes. Laterite occurs throughout with major concentration in northwestern and western part and some portion in the southeastern part. Shales highly leached, often ferruginous and with varying colours have been encountered in boreholes. Manganese occurs at places in the western and northwestern part as encountered and also in some exposures in association with laterite and shales.

Sometimes the soil is associated with iron ore pieces. Massive patches of banded hematite-jasper are exposed in different parts of the area with high concentration on the north-east and southern portions of the block and they usually occupy the top or higher slopes of the hills. Litho strata in the study area vary widely from hard rock to sandy loam. Areas at higher elevations are usually hard rock consisting of Banded Hematite Quartzite (BHQ) and Banded Hematite Jasper. The top soil in the area is scanty. Whatever top soil is available is rocky in nature. The pH of the soil is normal & ranging from 6.20 to 6.80. The lateritic area is rich in Iron and very often gritty in nature. Bushes were observed on this soil type.

### 5 CLIMATE

Tropical climate with hot and humid summer prevails in the region. Geographically, this region is located close to the Tropic of Cancer. The temperature in this region varies from 46°C in summer season to 5°C during the winter.



## **6 RAIN FALL DATA**

The annual mean rainfall is about 1269.1 mm and 78.3% of total rainfall is observed during the months of June to September.

## **7 DRAINAGE**

Kundra Nala, which is a tributary of River Baitarini is the main perennial source of water in the area. Kundra Nala flows towards the North West boundary of the mining lease. The drainage system of the area is guided by Baitarani River and Kundra Nala. The lease area forms a part of water divide zone of Baitarani River and Kundra Nala.

The rainwater from the mining lease flows into the perennial Kundra nallah on the north-west. This nallah also forms the boundary of the lease on the north west. Eastern portion of the lease block is drained by rain cuts, which remain dry practically throughout the year except during the monsoon. These watercourses feed the Joribar nallah, which is a tributary of the Baitarani River.

## **8 VEGETATION**

The leasehold has tropical and deciduous forests which are inhabited by animals of varied species. Total vegetation cover is about 65.64%, which includes Plantation/Grooves, Dense forest, open forest, scrub forest, forest plantation and land with scrub.

Good growth of flowering plants, timber and fruits is prevalent. Prominent forest species like *Bassia Latifolia* (Mahua), *Terminalia Tomentosa* (Asan), *Butea Monosperma* (Kosi), *Shorea Robusta* (Sal), *Pleocarpus Marsupium* (Bija), *Magnifer Indica* (Mango), *Cosia Siamea* (Chakundi), *Shorea Robusta* (Sal) etc. are in abundance in the mining lease hold area.

## **CHAPTER – II**

### **OBJECTIVE OF THE PLAN**

The objectives of the proposed reclamation plan are as follows:

- Statutory compliance of condition no. 9 of the Stage – II approval of Govt. of India, MoEF.
- Prevention of erosion of loose materials from OB dump & erosion of top soil in non-working area.
- Prevention of obstruction of natural water sources.
- Proper Management of overburden materials so as to prevent siltation in the streams
- Prevention of overflow of eroded soils from the mining areas to the cultivable lands, natural streams and inhabitations.
- Proper Management and scheduling of overburden materials so as to minimize external dumping.
- Providing methodologies and implement the proposed actions in time bound manner to prevent slope failures there by providing stable OB dump slopes.
- Stabilization of the over burden dumps by artificial regeneration (plantation).
- Prevention of overflow of eroded soils from the fines, OB dump areas leading to siltation in the streams natural streams.



### **CHAPTER - III**

#### **PHASE WISE MINING ACTIVITY & MANAGEMENT OF OVER BURDEN DUMP**

##### **a) Salient Features of Proposed Mining Activity:**

The iron ore deposits of the lease have been explored extensively by core drilling. Based on the exploratory drilling data, the extent of the ore body has been interpreted in lateral as well as vertical direction and it has been found that iron ore bodies of Khondbond are patchy in nature and the estimated mineral reserve as on 01.08.2015 for the Iron Ore is 162.78 Million Tons & Mn Ore is 0.522 Million Tons. The Different ore zones are separated by wastes patches, as well as ore bodies itself comprises intercalated subgrades and wastes. Therefore, it has been anticipated that there shall be considerable dilution by way of mechanized mining operation which will further deteriorate the ROM quality. To make best use of the deposit, it has been proposed to beneficiate entire iron ore and converting the final products into iron ore lumps and fines of desired specifications suitable for Blast Furnace. In view of the above, it has been proposed to install a new beneficiation plant at Khondbond with State-of-the-Art beneficiation facilities. It shall be a major breakthrough in company's effort towards Scientific Mining and Mineral Conservation.

It has been also envisaged that to obtain consistent quality of Run-of-Mine to process plant, iron ore to beneficiation plant will be supplied from the different mining pits having different quality of iron ore. Therefore, multi pit mining is essential, which will require expansion of mining operation into fresh areas. As, all iron ore zones at Khondbond are located within forest land only, the proposed expansion of mining operation into new area will require forest clearances.

The expansion of Khondbond for iron ore will be associated with development of various infrastructure facilities i.e. approach road, conveyor corridor, power transmission line, water pipe lines, maintenance complex, workshop, administrative buildings ( including canteen, first aids station, time office), stacking and reclaiming facilities, dispatch facilities, magazine, water reservoirs, slurry pipeline ,tailing dams etc. GPS-based truck dispatch system has also been proposed for effective utilization of HEMM. A new approach route shall also be constructed along the conveyor corridor between Joda to Khondbond for smooth journey of men and material.

After the new beneficiation plant start operating at its full capacity of 8 MTPA , the existing crushing & screening Plant will be dismantled and may be transferred to other operating units of the company.

At present, the lease area has limited land available for the disposal of tailings, subgrade, waste and the construction of ore stockpiles as the mining activities shall be confined to the approved forest limits only till the forest clearance is granted for the applied area. However, in coming years, mine is poised for an expansion to meet the increased requirement of Company's Steel Plants and its sister concerns like Tata Sponge Iron Limited, Tata Metalliks



Limited, Ferro Alloy Plant, Joda and upcoming steel plants in Odisha. In line with the expansion programme, Environment Clearance has been obtained for production of 8.0MTPA (ROM) of Iron ore and 0.1 MTPA(ROM) of Manganese ore along with an iron ore beneficiation plant of 8.0MTPA throughput from MoEF vide letter no.J-11015/888/2007-IA.II (M) dated 21.12.2011. The total project area is 1019.472ha which includes mine lease area of 978 ha and an area of 41.472 ha for transport corridor, outside the mine lease. The major expansion activities will involve expansion of mining operations in new ore zones, commissioning of a new beneficiation plant & logistics facilities, development of access route, construction of slime dam and long distance conveyor corridor for transportation of finished products from Khondbond to Joda East sidings.

It is proposed that the finished product, sized ore and fines ore produced from Khondbond Iron Mine shall be transported to Company's Steel Plants at Jamshedpur & Kalinganagar and other sister concerns like TML, TSIL & Tayo by road via Joda East siding, Juruli siding, Nayagarh siding, Deojhar siding, Banspani Iron Mines siding(BIL) and other private siding.

The existing plant will continue to work upto 2017-18 whereas the new beneficiation plant is proposed to start partially from 2017-18 and will start operating in full capacity of 8 MTPA from 2018-19 onwards. After the operation of new beneficiation plant at full capacity, the existing old plant will stop operating. In the case of delay in commissioning of beneficiation plant, additional mobile crushing & screening plants will be set up during the plan period to meet the demand of steel plants. Iron ore to the beneficiation plant will be fed from different mining pits. During the remaining Scheme Period, P ore body, N Ore body, Pit7, Pit 5 and Area 13 (conveyor corridor/access road) will be the major source of iron ore to the beneficiation plant. These ore bodies are developed simultaneously so that consistent quality of Run-of-Mine can be fed to the beneficiation plant. After exhaustion of ore, Pit7 will be used for stacking of slime generated from the new beneficiation plant.

Year wise proposal for ROM and development for the next three years is given in table below:

**Table 1: Total Yearly Development Programme for Iron Ore Mining**  
(in Million Tons)

YEAR	ROM	SUBGRADE	WASTE	TOTAL EXCAVATION
2015-16	3.429	2.849	2.931	9.209
2016-17	5.446	2.134	2.752	10.332
2017-18	8.000	3.394	2.094	13.488
<b>TOTAL</b>	<b>16.875</b>	<b>8.377</b>	<b>7.777</b>	<b>33.029</b>

**Table 2: TOTAL YEARLY DEVELOPMENT PROGRAMME FOR MN ORE MINING**

Year	Overburden (CuM)	ROM Ore (Tonnes)	Total Excavation (CuM)
2015-16	380886	52000	404400
2016-17	323345	64000	350000
2017-18	219989	50000	240000
<b>Total</b>	<b>924220</b>	<b>166000</b>	<b>994400</b>



**b) Brief Description of Top Soil, Subgrade, Overburden / Waste and Mineral Reject**

About 109.01 ha fresh areas are likely to be broken for mining purpose during the plan period. Any top-soil generated shall be stacked separately at an earmarked place and shall be used for subsequent afforestation programme.

The subgrade material is found in the form of intercalated patches within the ore zone which has been delineated by exploratory drilling, sampling and assaying. This subgrade consists of ferruginous shale and clay material having high alumina (deleterious) with low iron content ranging from 45% to 58%. The mine development has been planned accordingly delineating iron ore (Fe>58%) for plant feed, subgrade patches (<45% & <58%Fe) and waste material (<45%Fe) for stacking. As such there is no program for disposal of subgrade outside the lease is stacked separately for future use for beneficiation and blending.

In iron ore mining at Khondbond, Overburden consists of removal of waste consisting of BHJ, Canga, Shale, poor Laterite etc. and subgrade having iron bearing material having Fe % between 50-58 %. The generation of subgrade & wastes during the next three years has been indicated in Table 10.3.

**Table 3: Generation of Iron Subgrade & Wastes during the Next Three Years (Cum)**

YEAR	SUBGRADE	WASTE	TOTAL EXCAVATION
2015-16	2.849	2.931	5.780
2016-17	2.568	3.114	5.682
2017-18	3.394	2.094	5.488
<b>TOTAL</b>	<b>8.810</b>	<b>8.139</b>	<b>16.95</b>

In iron ore mining, after the introduction of threshold limit of 45% fe ,the waste generated in the past was very less and used primarily for haul road & short ramp making, bench floor leveling and making berms, maintenance of roads, civil, preparation of slime dam wall and other infrastructure works. Any excess quantity of waste shall be dumped in proposed waste dumps. Subgrade generated was stacked for future use in subgrade dumps, whereas the fines generated from the processing plant consists primarily of low quality fines have been stored as fines stocks in areas ear-marked. Sub Grade Manganese Mineral: The Mn. content >10% & <25% in ROM of all size is considered as Sub Grade Manganese Mineral.

Manganese Mineral Fines: The fines generated during manual processing (dressing and sizing) of ROM (Size : < 6 mm) is considered as Mineral Fines. The mineral fines do not have a regular market throughout the year. It has got limited use and occasionally consumed by Ferro alloys making plants.

**Table 4: Generation of Manganese Waste during the Next Three Years**

(All figures are in CuM)

Year	OB/SB/IB (CuM)	Sub-Grade (MT)
2015-16	761772	10400
2016-17	646690	12800
2017-18	439978	10000



**c) Waste and Subgrade Material generation during conceptual period**

The quantity of waste to be handled during the life of the mine is approximately 47.17 million tonnes. Considering a bulk density of 2.5t/cu.m, the volume of waste generation will be 18.87 million cu.m. The waste shall be used for landfills, preparation of embankment for tailing dams, developing infrastructure facilities required for expansion program, making haul roads and short ramps to connect different levels, maintenance of haul road, berms etc. Any excess quantity of waste generated from the mining operations from different pits during the life of the mine shall be dumped in waste dumps. All waste dumps are planned on non-mineralized zones.

The quantity of subgrade to be handled during the life of the mine will be approximately 61.46 million tonnes. Considering the bulk density of 3.0 t/cu.m , the volume of subgrade generation will be 20.49 million cu.m. The subgrade encountered during the development of these areas shall be stacked in subgrade dumps.

In future, as the mining operations get expanded into new areas, it has been conceptualized that present operating pits shall be used for backfilling by dumping of waste and tailings after exhaustion of the mineral. As ore zones for iron and manganese ore at Khondbond are wide spread, it is envisaged that in future mining operation shall spread over large area covering most of unutilized land.

**d) Precautions and Protective Measures for Dumps****Iron Ore:**

Garland drain and toe wall will be provided around the dumps to arrest any surface run offs. Afforestation shall be done on dump slopes for stabilisation. The slopes of the dumps shall be maintained by dozing and levelling at suitable intervals to maintain overall slope less than 28 degree. Once the dumps mature, it will be stabilized by afforestation completely.

Iron Ore Waste Dumps will be developed by retreat method of dumping with maximum 15 metres terrace height and ultimate slope of the dump will be maintained at less than 28 degrees. Each terrace will have inward slope with catch drains at the inward side of the terrace. During monsoon extra precautionary measures will be undertaken after mining. The catch drains of the individual terrace will be connected to the garland drain outside the periphery of the dump. Each terrace will also have a provision of berms at the outer end to reduce gully formation due to rain water wash offs.

**Manganese Ore:**

Garland drain and toe wall has been provided around the dumps to arrest any surface run offs. Afforestation in the form of gap plantation shall be done on dump slopes for stabilization. The slopes of the dumps shall be maintained by dozing and leveling at suitable intervals to maintain overall slope less than 35 degree. Once the dumps mature, it will be stabilized by afforestation completely. In addition to this, retaining wall will be strengthened and the garland drains will be cleared after every monsoon. The backfilling will be done from bottom to top to achieve maximum compactness. The dump formed over the backfilling area will be developed by retreat



method of dumping with 10 meters terrace height and ultimate slope of the dump will be maintained at less than 35 degrees. Each terrace will have inward slope with catch drains at the inward side of the terrace. During monsoon additional precautionary measures will be undertaken. The catch drains of the individual terrace will be connected to the garland drain outside the periphery of the dump. These catch drains will preferably have half concrete open pipes followed by settling tanks to avoid wash offs. Each terrace will also have a provision of embankments at the outer end to reduce gully formation due to rain water wash offs.

The details of the toe wall and garland drains proposed to be constructed during the scheme period are given below:

**Table 5: Proposal for Garland Drains and Toe Wall around Dumps**

Year	DUMP	Garland Drain	Toe Wall
2015-16	Iron Ore Waste Dump No.-5a	500 mtr	500 mtr
	Iron Ore Waste Dump No.-5b	1000 mtrs	500 mtrs
2016-17	Iron Ore Subgrade Dump No.-C	800mtrs	800mtrs
	Iron Ore Temporary Waste Dump-A&B	400 mtrs	400 mtrs
	Iron Ore Waste Dump No.-1	800mtrs	800mtrs
2017-18	Iron Ore Temporary Waste Dump-A&B	400 mtrs	400 mtrs
	Iron Ore Waste Dump No.-7	600 mtrs	600 mtrs
	Iron Ore Subgrade Dump No.-2	800mtrs	800mtrs

In addition to above, boulder retaining wall is also proposed along the proposed conveyor corridor as given below:

**Table 6: Proposal for Retaining Wall along Conveyor Corridor**

Year	Dimension of boulder retaining wall	Length
2015-16	1.2m height X 1m width	400mtrs
2016-17	1.2m height X 1m width	400mtrs
2017-18	1.2m height X 1m width	375mtrs

#### e) Waste Dump Management:

All the proposed dumps will be developed by retreat method of dumping with ultimate slope of the dump is maintained at less than 28 degrees. Each terrace shall have inward slope with catch drains at the inward side of the terrace. The catch drains of the individual terrace shall be connected to the garland drain outside the periphery of the dump. Each terrace shall also have a provision of berms at the outer end to reduce gully formation due to rain water wash offs.

Dumps are designed to be in stages and stabilized through natural compaction by movement of heavy vehicles. Garland drain and toe-wall have been provided along the entire outer periphery in both the dumps. The slopes of the dumps are proposed to be reclaimed by the **"Method of Planting by Contour Trenching"**, which is described below:

#### f) Method of planting by contour trenching

On the long slopes, contour trenches are dug at 3 m interval along the contours. The excavated earth is stacked on the edge of the trench on the lower slope side to arrest the water flow that



comes due to rains and accumulates on the trenches and gradually seeps through the strata enabling the planted saplings to get water and nutrients regularly to ensure healthy growth.

**g) Method of re-handling of waste dump to ensure safety, stability and environmental aspects:**

- The ramp will be developed from top terrace to toe of the dumps for movement of shovel and dumpers while utmost care shall be taken to minimize the loss of saplings and damage to the environmental measures already in place.
- The overburden within the safety zone of 50m distance from perennial Kundra Nala will be evacuated from top to bottom by restricting the free surge of loose materials. The existing masonry retaining wall will remain intact.
- After evacuation, the terraces will be compacted and leveled with inward slope to prevent the gully formation along the slope and the ramp will be filled up.
- Subsequent to completion of re-handling, saplings will be planted over the slope and terrace for its stabilization.

**h) Reclamation of Waste Dump and Tailing Ponds**

Tata Steel envisages adopting State-of-the-Art technology for reclamation of the mined out pit and waste dumps in consultation with environmental and geological experts. Today, we conceptualize the post mining operations in the following manner:

- 1) Reclamation of the abandoned pit:** It is proposed to reclaim the mining benches after they reach the ultimate pit limits. It has been envisaged that some parts of mined out land of iron ore quarries shall be backfilled by waste and tailing, similarly manganese ore pits, as they get exhausted shall be back filled partly by waste encountered during excavation. The method of afforestation by **"Pitting and Planting"** will be followed to reclaim mined out area.
- 2) Afforestation of the abandoned dumps and back filled area: The method of "Planting by Contour trenching" will be followed.**
- 3)** The dump slopes shall also be strengthened by undertaking re-greening activities by planting grasses of Vetiver Zizcuaides and Jama Centronella varieties. The activities of afforestation shall be carried out by the our Environment Management Department which has in-house monitoring and analytical facilities.
- 4)** The bottom few benches shall be converted to a natural water reservoir.
- 5)** Land used by other ancillary purposes shall be afforested at the end of the life of mine. However, some of the infrastructure may be required to leave as it is for use by general population.

**i) Reclamation Status of Mined Out Land**

**Reclamation Status and proposal for the next three year:**

As the mining operation has just expanded, there is no possibility of any area getting abandoned. Hence, in the coming three years reclamation of mined out area has not been envisaged. Proposal for reclamation of mined out area during the plan period has been indicated in table given below in Table: 10.7.



**Table 7: Proposed Reclamation of Mining Area during the Plan Period**

Land already utilised for mining	Additional Land to be utilised for mining during the plan period	Total utilisation of land for mining at the end of plan period	Area already reclaimed	Area Reclaimed & Rehabilitated during the year (ha)	Mined out area at the end the year (ha)
139.92	102.53	242.45	2.77	Nil	242.45

At conceptual stage, post mining land use is given below in the Table 10.8:

**Table 8: Proposed Conceptual Reclamation Measures**

	CONCEPTUAL LAND DEGRADATION	PROPOSED RECLAMATION	
	Area in ha.	Area in ha.	Measures
Mining Excavation	586.415	451.545	Afforestation of top benches by plantation.
		7.66	Bottom benches shall be converted for water storage.
		118.21	Back-filling with waste & rejects and subsequent afforestation. (Iron part)
		2.77	Back filling by waste (Mn part)

During the plan period, it is proposed that the temporary dumps and subgrade dumps shall be stabilized by grass plantation as in future the subgrade shall be fed to the plant after the introduction of beneficiation technology to beneficiate the subgrade ore. The waste dumps shall be stabilized by planting trees. The proposed reclamation measures during the life of mine period are given below in Table No. 10.9:

**Table 9: Proposed Reclamation of Dumps during the Plan Period**

Year	Location	Area	Saplings	Proposed reclamation
2015-16	Mn waste dump 1&2		3000	Gap filling by plantation
2016-17	Iron ore waste dump 5A	1.5 ha	3725	Tree Plantation over dump slopes
	Iron ore waste Dump 5B	1.0 Ha	2500	Tree Plantation over dump slopes
	Mn waste dump 1&2		3000	Gap filling by plantation
2017-18	Iron ore waste dump 5A	2.0 ha	5000	Tree Plantation over dump slopes
	Iron ore waste dump 5B	1.0 Ha	2500	Tree Plantation over dump slopes
	Iron ore waste dump 1	1.0 Ha	2500	Tree Plantation over dump slopes
	Mn waste dump 1&2		3000	Gap filling by plantation



2019-23	Waste Dumps	6 Ha	15000	Tree Plantation over dump slopes
2023-28	Waste Dumps	6 Ha	15000	Tree Plantation over dump slopes
2028-33	Waste Dumps	10 Ha	25000	Tree Plantation over dump slopes

The year wise proposal for plantation is given below:

**Table 10: Proposed Plantation**

YEAR	PROPOSED PLANTATION
2018-2020	11788
2021-2025	69600
2026-2030	67500
<b>TOTAL</b>	<b>148888</b>

Further, during the life of the mine some of the mining pits shall be backfilled with overburden and tailings/ Slime after the iron ore/ manganese ore is exhausted from the pits. The method of afforestation by "**Pitting and Planting**" will be followed to reclaim mined out area. Some part of the Mined out area shall also be used as Water reservoir towards the Rain water harvesting measures. The period wise tentative plan for backfilling of pits with overburden/ tailing is indicated in the table given below:

**Table 11(a): Proposed Backfilling  
(Using overburden/ Slime)**

YEAR	PROPOSED BACKFILLING (Ha)
2016-2020	27.840
2021-2025	27.000
2026-2030	33.722
<b>TOTAL</b>	<b>88.562</b>



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**CHAPTER – IV****ENVIRONMENTAL IMPACT ASSESSMENT**

The following are the major activities which will take place during the plan period:

- Expansion & Construction of Beneficiation Plant,
- Construction of Slime Dam.
- Ore & Subgrade stacking & waste dumping in new areas.

The Environment Impact Assessment for the above activities has been done in house by our Environmental Experts of our Environment Department located at Noamundi. The assessment for the above programs is detailed below:

**1. General Observations:**

Since the mine has been in operation over last several decades, the impacts of the past operations have already been reflected in the study results. Proposed activities are likely to add load of pollutants. These factors are to be considered in anticipated impact assessment and devising control measures.

**2. Air Quality:**

In our efforts to keep the impacts as minimum as possible, the following measures are taken, so that the ambient air quality with regard to Suspended Particulate Matter is maintained well within the prescribed limit .

- Use of drills provided with dust extraction and dust suppression systems
- Water sprinkling with 50 KL sprinklers on haul roads
- Proposal for about 500 m of haul road will be provided with fixed water sprinkling system for effective dust suppression.
- Proposal for Dry fog system will be installed at primary crushers.
- Effective and high efficiency dust extraction system is in place at the mineral handling plant. Loading and unloading areas including transfer points have been provided with dust suppression facilities.
- Green belt and afforestation has been done to restrict the propagation of fugitive dust generated
- Auto-emission checks of all the vehicles are done at regular intervals.
- Maintenance of mining equipment is done on regular basis.

Air Sampling is done for winter, summer and Post monsoon seasons and in each season eight 24-hourly samplings are done. Parameters analyzed are: Suspended Particulate Matter, Sulphur dioxide, Nitrogen Oxides and Carbon Monoxide. All the parameters are found well within the limit.

**3. Water Regime and Water Quality:**

The different measure for control of water pollution and conservation of water are,

- Construction of rainwater harvesting structures for use of rain water and augmentation of ground water table.
- Construction of series of check dams across the water courses for retention of suspended solids and flow of clear water during rainy season. This prevents



contamination of outside water bodies from the wash-offs of the lease area. The check dams are periodically de-silted to keep them efficient.

- Stabilization of waste dump slopes by timely vegetation with native species to prevent wash offs during rain. A total of 5.59 lakh saplings have been planted since beginning, to develop green belts in and around the mining lease area.
- Waste dumps are provided with toe walls and garland drains, to arrest washed off solids from the dump and to prevent the outside water source from pollution.
- Oil & Grease traps in the equipment workshop have been provided to trap oil & grease from the workshop effluent and the water is again reused for washing of vehicles and the oil so collected is handed over to authorized recyclers for reuse.
- Mining operation is limited on hill slopes and above the ground water table. Hence, there is no intersection of ground water table and hence no depletion of water table occurs because of our mining operation. Our activities such as rain water recharge wells, ponds, water holes, slime dams, massive plantation, etc help to recharge the ground water.
- Slime dam area has been chosen with great care taking into account of all environmental and technological aspects. Slime dam will be designed and constructed with zero discharge
- A water treatment plant & pump house is also proposed near Q Ore Body.
- The location of effluent treatment plant, water treatment plant, pump house, water pipe line for supplying water from pump house to water storage tank at the beneficiation plant.

In order to ensure the discharge of clear water from the lease area, three nos. of settling tanks have been provide at the toe of the dumps. The details of settling ponds are given below in Table 11.3:

**Table 12: Details of Existing Settling Ponds**

S.NO.	LOCATION	NORTHING	EASTING	SIZE (LXBXH)in m
1	Near Subgrade Dump3	12575	10200	15X4X4
2	Near Pillar No. 88	10950	9550	15X4X4
3	Near Mn waste dump2	14100	8700	15X4X4

In addition, following 3nos. of settling ponds are proposed during the scheme period:

S.NO.	LOCATION	NORTHING	EASTING	SIZE (LXBXH)in m
1	Near Pillar No.77	12700	9000	15X4X4
2	Near Topsoil Stock	13700	10500	15X4X4
3	Near Proposed Waste Dump 7	10500	9800	15X4X4

Similarly, 3 nos. of check dams have been constructed within the lease area to ensure discharge of clear water from the lease area. The details of Check dams are given below in table 11.4



**Table 13: Location of Check Dams**

S.NO.	LOCATION	NORTHING	EASTING	SIZE (LXBXH)in m
1	Near Mn Waste Dump1	14350	8400	30x3x4
2	Near Pillar 16B	13250	10650	30x3x4
3	Near Pillar 16A	12600	10600	30x3x4

In addition, following 4nos. of Check dams are proposed during the scheme period:

**Table 14: Details of Check Dam**

S.NO.	LOCATION	NORTHING	EASTING	SIZE (LXBXH)in m	YEAR
1	Near ML Pillar No. 16B	13550	10850	30x3x4	2015-16
2	Near ML Pillar No. 51	14000	8400	30x3x4	2016-17
3	Near ML Pillar No. 76	12800	8750	30x3x4	2017-18
4	Near ML Pillar No.15	11750	10400	30x3x4	2017-18
5	Near waste dump7	10500	9900	30x3x4	2017-18

It is to be noted that toe wall and garland drain has been provided at the toe of waste dump1 and subgrade dump2A. But as proposed in this scheme, these dumps shall be extended towards the lease boundary by adding two new terraces at the bottom in order to increase the capacity of these dumps. Therefore, new toe wall and garland drain shall be constructed after the development of new terraces at the bottom. In addition, toe wall and garland drains are also proposed at the toe of the new waste dumps, subgrade stacks and stock pile coming up during the plan period.

For Manganese Ore bearing area, garland drain and toe wall has been provided around the dumps to arrest any surface run offs. Afforestation in the form of gap plantation shall be done on dump slopes for stabilization. The slopes of the dumps shall be maintained by dozing and leveling at suitable intervals to maintain overall slope less than 28 degree. Once the dumps mature, it will be stabilized by afforestation completely. In addition to this, retaining wall will be strengthened and the garland drains will be cleared after every monsoon. The backfilling will be done from bottom to top to achieve maximum compactness. The dump formed over the backfilling area will be developed by retreat method of dumping with 10 metres terrace height and ultimate slope of the dump will be maintained at less than 28 degrees. Each terrace will have inward slope with catch drains at the inward side of the terrace. During monsoon, additional precautionary measures will be undertaken. The catch drains of the individual terrace will be connected to the garland drain outside the periphery of the dump. These catch drains will preferably have half concrete open pipes followed by settling tanks to avoid wash offs. Each terrace will also have a provision of embankments at the outer end to reduce gully formation due to rain water wash offs.

The details of the toe wall and garland drains proposed to be constructed during the scheme period are given below:



**Table 15: Proposal for Garland Drains and Toe Wall around Dumps**

Year	DUMP	Garland drain	Toe Wall
2015-16	Iron Ore Waste Dump No.-5A	500 mtr	500 mtr
	Iron Ore Waste Dump No.-5B	1000 mtrs	500 mtrs
2016-17	Iron Ore Subgrade Dump No.-C	800mtrs	800mtrs
	Iron Ore Temporary Waste Dump-A&B	400 mtrs	400 mtrs
	Iron Ore Waste Dump No.-1	800mtrs	800mtrs
2017-18	Iron Ore Temporary Waste Dump-A&B	450 mtrs	450 mtrs
	Iron Ore Waste Dump No.-7	600 mtrs	600 mtrs
	Iron Ore Subgrade Dump No.-2	800mtrs	800mtrs

In addition to above, boulder retaining wall is also proposed along the proposed conveyor corridor as given below:

**Table 16: Proposal for Retaining Wall along Conveyor Corridor**

Year	Dimension of boulder retaining wall	Length
2015-16	1.2m height X 1m width	400mtrs
2016-17	1.2m height X 1m width	400mtrs
2017-18	1.2m height X 1m width	375mtrs

#### **4. Ground Vibration, Fly Rocks and Noise Exposures:**

The following mitigating measures are being taken to reduce noise impact:

- i. Ear muffs to all personnel in high noise areas
- ii. Control rooms and operators cabins are provided with A/C.
- iii. Enclosure to high noise generating machines
- iv. Rubber padding and bushes in the vibrating units.
- v. CIMFR has been engaged for blast study and their recommendations are strictly followed to ensure that blast-induced ground vibrations remain within safe limits, by using delay detonation system to maintain the charge per delay to an optimum level.
- vi. Green cover around mine and plant to protect the surroundings.

Noisy operations have been identified and monitoring of noise levels are regularly done during summer, Post Monsoon and winter seasons.

It is envisaged that there will be no additional issues associated with ground vibration, fly rocks and exposure to noise because of the increase in production.

#### **5. Acid Mine Drainage**

There is no acid mine drainage.



## 6. Soil Erosion

Check dams and settling tank have been constructed within the lease area to prevent Soil erosion and surface run offs arising out of mining and allied operations at Khondbond Iron Mine,

## 7. Socio-economic conditions:

There is no residential area within core-zone or near to the lease area belonging to lessee. There is no proposal for construction of colony. Hence there is no likely hood of effect of outside people or influx on the existing local population. The lessee is spending substantial amount through Tata Steel Rural Development Society for peripheral developments such as education, health, sports, afforestation etc. Further, the expansion activities will also generate immense employment for local population. Hence the benefits to the community and its economy because of this project are quite appreciable.

## 8. Historical Monuments

There are no historical monuments within a radius of 10 kilometers from the area of activity. Hence, there will not be any impact on historical monuments.

### CHAPTER - V

#### PROPOSED EXPENDITURE FOR RECLAMATION PLAN, INSPECTION, MONITORING AND EVALUATION & EXECUTION OF WORK

##### 1. PROPOSED EXPENDITURE FOR RECLAMATION PLAN

Table 17: SUMMARY OF PROPOSAL

Details of Proposed Reclamation Works	Proposed Reclamation Expenditure ( in Rs.)			
	Unit	2015-16	2016-17	2017-18
Cost including watch and care of plantation during the year	Rs. 60/ plant	<b>1,80,000</b> (3,000 Sapling In gap filling)	<b>5,53,500</b> (9,225 Sapling in 2.5 Ha area)	<b>6,30,000</b> (10,500 Sapling in 3.0 Ha area)
De-silting of garland drains & settling tank	Lump sum	<b>50,000</b>	<b>50,000</b>	<b>50,000</b>
Construction/ Re-strengthening of parapet walls/ retaining wall at toe of dumps	Rs.450 /cum	<b>10,12,500</b> Aprox 2250 Cu.M	<b>12,82,500</b> Aprox 2,850 Cu.M	<b>11,92,500</b> Aprox 2,650 Cu.M
Construction of Garland drain	Rs 125/cum	<b>2,25,000</b> 1500m X 1.2m X 1m 1800 Cu.M	<b>3,00,000</b> 2000m X 1.2m X 1m 2400 Cu.M	<b>3,33,000</b> 2200m X 1.2m X 1m 2664Cu.M
Construction of Settling Ponds/ Tanks	Lump sum	<b>50,000</b>	<b>50,000</b>	<b>50,000</b>
Construction of Check Dams along	Lump sum	<b>61,200</b>	<b>61,200</b>	<b>61,200</b>



slope of valleys etc.				
Ambient Air Quality	Lump sum	1,50,000	1,50,000	1,50,000
Water Quality	Lump sum	55,000	55,000	55,000
Noise Level Survey	Lump sum	32,000	32,000	32,000
Ground Vibration	Lump sum	2,45,000	2,45,000	2,45,000
Soil Testing	Lump sum	25,000	25,000	25,000
Sub Total	Rs	20,85,700	28,04,700	28,11,200
Proposed cost of inspection, monitoring and evaluation (15% of total cost)		3,12,855	4,20,630	4,23,555
Total Cost including cost of inspection, monitoring & evaluation		23,98,555	32,24,830	32,47,255
Cost of escalation (20% of total Cost)		4,79,711	6,44,966	6,49,451
Grand Total (Rs)		28,78,266	38,69,796	38,96,706

The expenditure towards various monitoring activities in respect with environmental parameters (Ambient air quality, water quality, noise quality monitoring, ground vibration study, soil testing) would continue beyond the year 2017-18 and approximate expenditure towards the above would be Rs 5,07,000/- per annum. Further beyond the plan period, the expenditure towards the plantation activity till the end of life of mine would be as follows:

**Table-17: Expenditure towards Plantation**

YEAR	PROPOSED PLANTATION (Nos.)	PROPOSED EXPENDITURE (Rs)
2018-2020	11788	707280
2021-2025	69600	4176000
2026-2030	67500	4050000
<b>TOTAL</b>	<b>148888</b>	<b>8933280</b>

## 2. INSPECTION, MONITORING AND EVALUATION

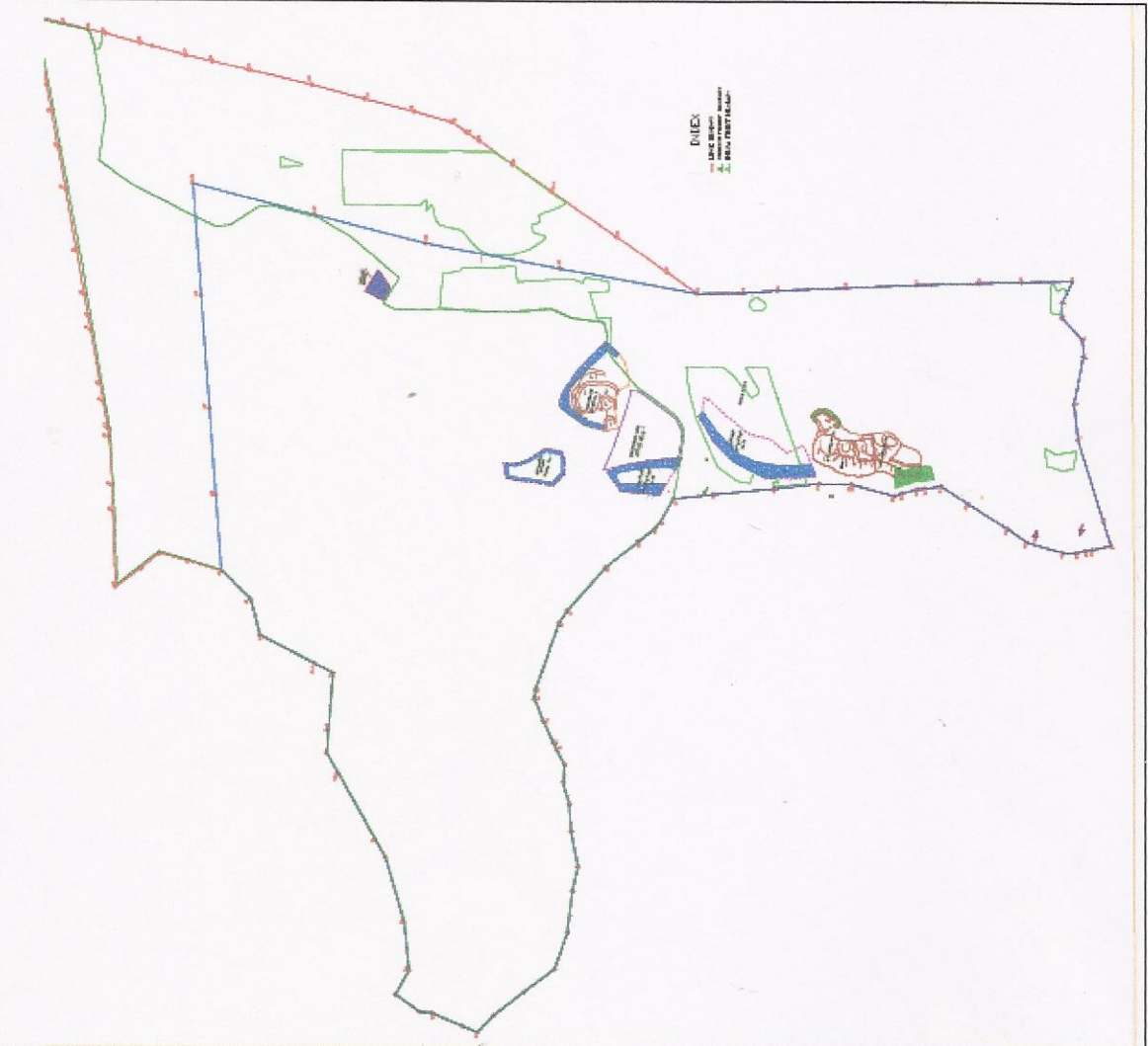
The execution of reclamation plan will be inspected and monitored under the supervision of state Forest Department and authorities of Mining Department. Sufficient fuel/ conveyance charges for technical experts shall be provided by the user agency for proper execution of these programs. Budgetary provision of 15% of the total project cost has been earmarked on this score.

## 3. EXECUTING AGENCY

The works in the present Scheme shall be executed by the User Agency having specialized departments headed by qualified persons with outsourced man and machinery. To facilitate this, the user agency shall establish its own executing and supervision cells along with required infrastructural facilities. In order to maintain the quality of work, in-house supervision through competent personnel shall be provided.



Picture 1: Proposed Reclamation in the next three years

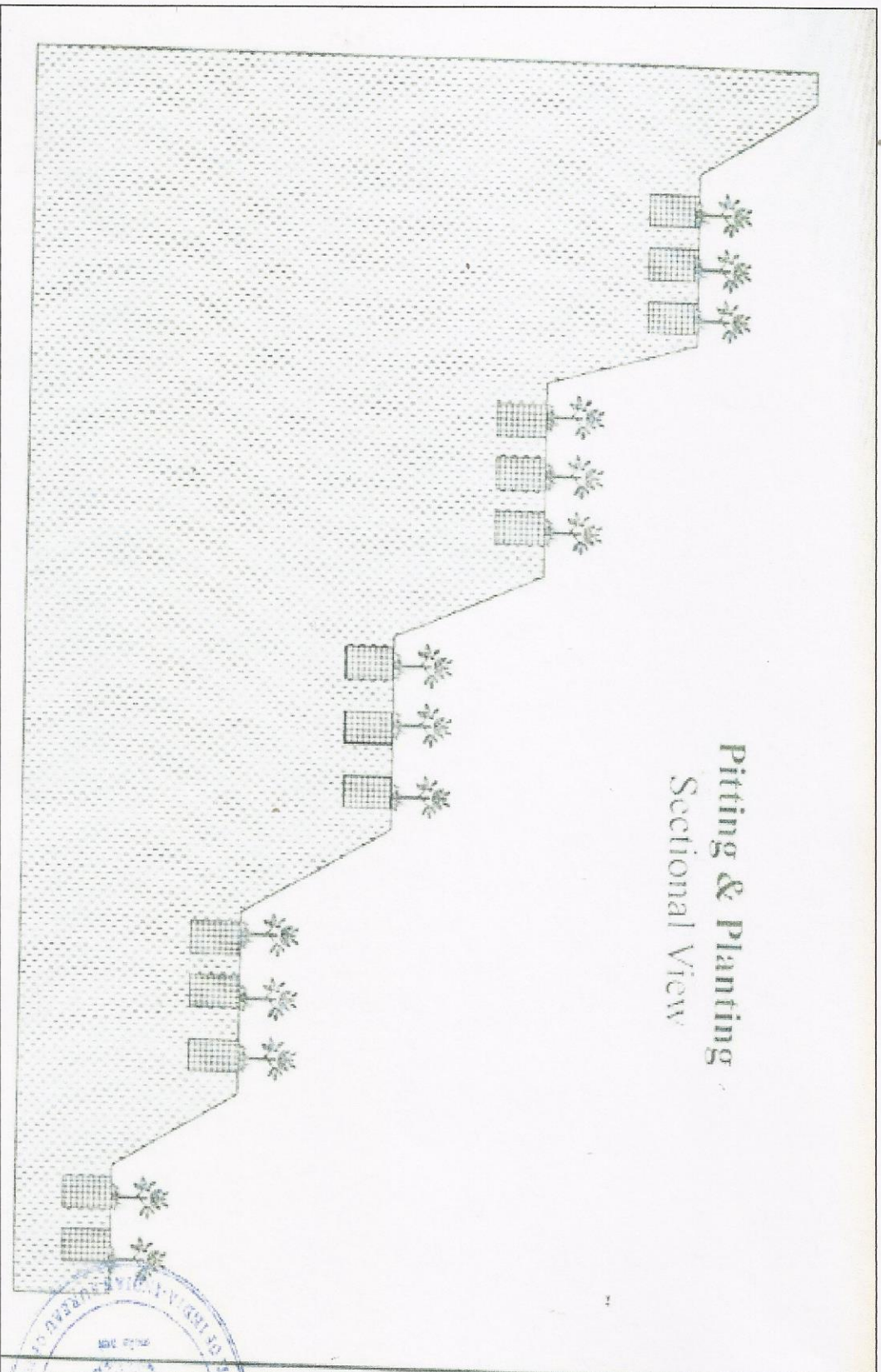


FOR AND ON BEHALF OF  
TATA STEEL LIMITED  
BY THEIR CONSTITUTED ATTORNEY

*McThomas*  
M. C. THOMAS

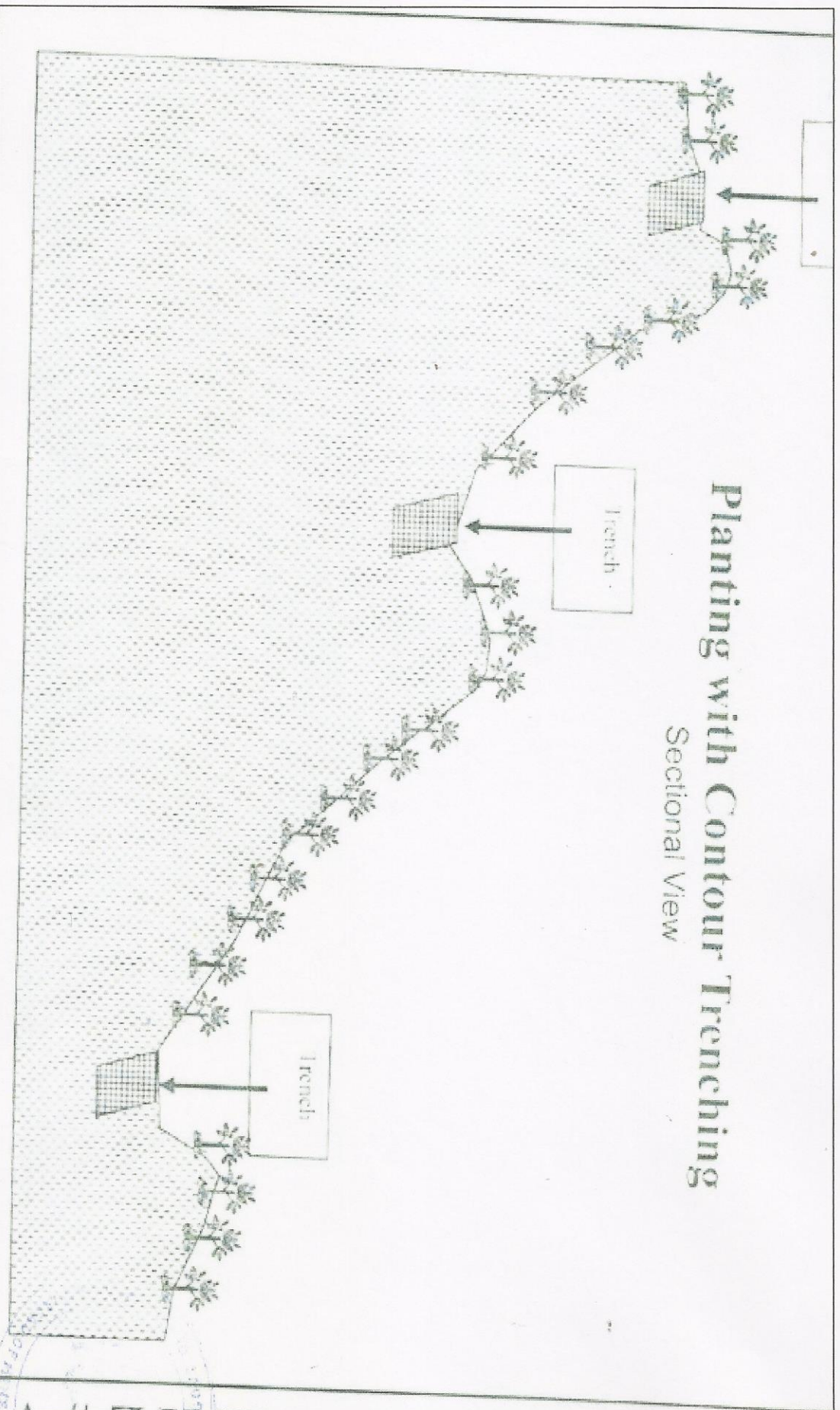


Picture 2: Pitting and Planting





Picture 3: Plantation with Contour Trenching





Picture 4: Plantation on the Dump Slope





Picture 5: Plantation on the Dump Area





Picture 6: Toe wall around the Dump



FOR AND ON BEHALF OF

TATA STEEL LIMITED

by THEIR CONSTITUTED ATTORNEY

*McMenamy*

M. C. THOMAS



Picture 7: Toewall





Picture 8: Garland Drain

