



RECLAMATION AND AFFORESTATION SCHEME

**SUKINDA CHROMITE MINE
TATA STEEL LTD.**

**Mining Lease Area: 406.00 ha.
Forest Area : 330.972 ha**

For TATA STEEL LTD.
By their Constituted Attorney

A handwritten signature in blue ink, appearing to read 'Ganesh Prasad Sahu'.

(GANESH PRASAD SAHU)
Head (Ferro Alloys Production)
Ferro Alloys & Minerals Division

**RECLAMATION AND AFFORESTATION SCHEME
SUKINDA CHROMITE MINE
TATA STEEL LTD.**

1.0 Introduction

Tata Steel policy is to take care of and preserve the greenery in the leasehold area for ecological balance. Trees in non-mining area are protected unless otherwise cutting them becomes an absolute necessity. Only phase wise de-forestation is done by the company for advancement of mining and allied operation. The Reclamation and Afforestation Scheme of Sukinda Chromite Mine consists of the following steps:

- Review of Afforestation already done
- Top Soil Management
- Dump and Pit Reclamation
- Budgetary Provision for Afforestation

2.0 Reclamation & Afforestation already done

Afforestation in the Sukinda Chromite lease area has been taken up since long. Consequent upon the order of the Central Govt. dated 17.8.95 & the order of the Supreme Court, the lease-hold area of Company was reduced to 406 hectares from 1261.476 hectares during 1998. Many of the area of earlier plantation now fall outside our present leasehold. These afforestation activities were restricted to the vacant spots and geologically barren areas along with the slopes of waste dumps in every stage. The Detailed year-wise data since 1997-98 in reduced leasehold area is given below in the Table No. 1.

Table No - 1

| Year | Within ML Area | | Outside ML Area | |
|---------|-----------------|------------|---------------------------------|------------|
| | Nos. of Sapling | Area in Ha | Nos. of Sapling | Area in Ha |
| 1998-99 | 4000 | 1.7 | | |
| 1999-00 | 18000 | 4 | | |
| 2000-01 | 28342 | 2 | | |
| 2001-02 | 15000 | 0.5 | | |
| 2002-03 | 22000 | 1.5 | | |
| 2003-04 | 45500 | 1.5 | | |
| 2004-05 | 48000 | 1 | | |
| 2005-06 | 75000 | 2.5 | | |
| 2006-07 | 129500 | 5.75 | | |
| 2007-08 | 94000 | 4.42 | Additional Area (100ha)obtained | |
| 2008-09 | 85250 | 2.94 | 36750 | 1.76 |
| 2009-10 | 28000 | 3.9 | 56000 | 5.6 |
| 2010-11 | 25000 | 2 | 60000 | 6.5 |
| 2011-12 | 45000 | 4.5 | 35000 | 3.5 |
| 2012-13 | 5700 | 1.83 | 40000 | 6.5 |
| 2013-14 | 3700 | 1.32 | 54326 | 5.6 |
| 2014-15 | 4050 | 1.2 | 50100 | 5.1 |
| Total | 676042 | 42.56 | 332176 | 34.56 |

The number of Saplings planted is higher than that proposed because the company launched the "Green Millennium Countdown" under which large-scale afforestation was taken up. The above plantation was done within the lease area.

Total area covered under afforestation is about 42.56 Ha within the lease with 6.76 lakhs of saplings. Similarly 3.32 lakhs of sapling planted over 34.56 ha within the additional area of 100 ha obtained for waste disposal.

Apart from above massive plantations have been taken up by TSRDS (Tata Steel Rural Development Society) in nearby villages. TSRDS is a service oriented non- profit making organisation fully funded, supported & which is a sister concern of Tata steel. The self-help group of different nearby villages are actively participating & they are availing this opportunity from TSRDS. Saplings have been procured from Different Non- Govt. organisations, Govt. Agencies like District forest officers & training schools. Our TSRDS has also developed its own nursery & we are taking up some plantation for fruit bearing plants in near by schools & area developed by the villagers. TSRDS is also putting its sincere efforts outside the lease hold area in peripheral development scheme. So this is a continuous effort given by Tata steel from every corner for developing greenery all along.

The Detailed year-wise data since 1998-99 by TSRDS in villages is given below in the Table No. 2

TABLE-2

| VILLAGE PLANTATION | | | | |
|--------------------|-------------------------|--------------------------|--|---|
| Year | Total plantation (nos.) | Total plantation (acres) | Villages covered | Species |
| 1998-99 | 11771 | 9 | Kalarangi, Malarsahi, Sapua, Maruabil, Kakudia, Sitalbasa, Bhimatanger | Siris, Chakunda (D), Sisam, Accasia, Teak, Ukali Patas, Chakunda (B), Gamari, Krushna Chuda, Kaju |
| 1999-00 | 12335 | 10 | | |
| 2000-01 | 20437 | 16 | Kaduabandhi, Bhalkipatla | Siris, Chakunda (D), Sisam, Accasia, Teak, Ukali Patas, Chakunda (B), Gamari, Krushna Chuda, Kaju |
| 2001-02 | 10380 | 9 | Kaduabandhi, Girigamali, Kaduabandhi Mandir, Darjani, Bandhagaon | Siris, Chakunda (D), Sisam, Accasia, Teak, Sarifa, Soobabul, Neem, Chakunda (B), Gamari |
| 2002-03 | 9571 | 27 | Darjani, Kaduabandhi, Bandaniya | Siris, Chakunda (D), Sisam, Accasia, Teak, Sarifa, Soobabul, Neem, Chakunda (B) |
| 2003-04 | 24063 | 23 | Krushnapur, Bambilo, Siriyakholi, Kumursingha, Kaduabandi | Chakunda, Accasia, Tentuli, Babul, Sisam, Saguan, Piasal, Neem |
| 2004-05 | 25000 | 24 | Krushnapur, Bambilo, Maruabil, Bhimtanger, Chingudipal, Giringamali, & Darjani | Chakunda, Accasia, Subabul, Sisam, Gomhar, Neem, Goldmohar, Saguan, Piyasal |
| 2005-06 | 22430 | 26 | Krushnapur, Bambilo, Kakudia, Chingudipal | Chakunda, Accasia, Babul, Neem, Grafted mango |
| 2006-07 | 12665 | 60 | Kalarangi, Malarsahi, Sapua, Maruabil, Kakudia, Sitalbasa, Bhimatanger | Saguan, Gamari, Sisam, Krushnachuda, Neem, Grafted mango |
| 2007-08 | 7680 | 20 | Kakudia, Goramia, Kusumundia, Ransol, Kalarangi, Maruabil, Sitalbasa, Bandaniya Kankan | Chakunda, Accasia, Gamari, Saguan, Grafted mango |
| 2008-09 | 17504 | 23 | Kaduabandi, Giringamali, Siriakholi, Bhalkipatla, Maruabil, Kusumundia, Kakudia | Chakunda, Accasia, Grafted mango |

| | | | | |
|---------|--------|-----|--|---|
| 2009-10 | 25179 | 38 | Kankadpal, Kusumundia, Chingudipal, Kaliapani, Balkipatla, Krishnapur, Tomka Mangalpur Road Side, Kaduabandi, Kahudia, Siriakholi, Mhulkhal, Baruan | Accacia, Teak, Sisam, Chhatani, Mango, Coconut, Guava, Lemon, Gomhari, Saguan, Jatropa, Summeriaglocua |
| 2010-11 | 19180 | 26 | Kankadpal, Kusumundia, Chingudipal, Kaliapani, Benagadia, Krishnapur, Tomka Mangalpur Road Side, Kaduabandi, Kahudia, Siriakholi, Mhulkhal, Kharkhari, Seteswar, Bhimtangar, Kalarangi, Sapua, Maruabili | Accacia, Teak, Sisam, Chhatani, Arjuna, Nim, Mango, Sapeta, Lemon, Gomhari, Sirisa, Jatropa |
| 2011-12 | 25180 | 30 | Kalarangi School, Kusumundia School, Mahulkhal School, Kakudia School & village, Ransol School, Shiv Mandir, Chingudipal. | Mango, Guava, Lemon, Jackfruit, Karmnaga, Bel, Barkholi |
| 2012-13 | 4250 | 24 | Anal School, Rangamatia School, Batagaon, Kalarangi Gp High School, | Mango, Coconut, Lemon |
| 2013-14 | 6656 | 44 | Kakudia, Ransol, Kankadpal, Mathakhokasa, Odisa, Damsal, Rankia, Sukinda, Bambilo, Avenue plantation Sukinda to Birigoda Road Garamian, Benagadia, Birigoda, Chingudipal, Mathakargola, Bherubania | Mango, Lemon, Kaju and Saguan, Chhatia, Radha Chuda, Krishna chuda, Arjun, desi nimb, Maha nimb, Mango |
| 2014-15 | 1660 | 22 | Avenue plantation Chingudipal to Baguasahi Road, Kuhika, Kalarangi, Rangamatia, Ghaghia-sahi, Deogaon, Annatapur, Koripal, Gurujang, Chingudipal, Natore | Mango, Teak, Deodar, Chhatia, Radha Chuda, Krishna chuda, Jamun, Kadamb, desi nimb, Maha nimb, Karanj, Lemon, Guava |
| Total | 255941 | 431 | | |

Some part of the OB-II quarry from 2700E – 3000E over an area of 4.05ha in the western side has been backfilled after exhaustion of chrome ore. Subsequently backfilling is being done over the same area to accommodate maximum volume of overburden generated during mining operation.

3.0 Top Soil Management

As the entire area within the lease has been utilised for mining and allied activities, no fresh forest area utilisation is envisaged during the entire lease period. However, whatever topsoil will be generated incidentally will be removed separately before its dilution and stacked separately at the earmarked site in 1 metre height topsoil dump. Top Soil will be preserved by planting grass on slopes and top of the dump. Such preserved topsoil will be utilised in subsequent monsoon for afforestation purpose in the mine lease area & waste dump slopes. The preservation manner is shown in Sketch-1.

4.0 Dump & Pit Reclamation

Mining Area

At present the entire lease -hold area is under active working. Since at present, there is no abandoned quarry available for reclamation, afforestation cannot be taken up in these areas. Therefore during initial years afforestation will be negligible and phasing reclamation concurrent with mining operation will not be possible since the ore body is dipping almost vertically which necessitates lateral extension of the quarry with increase in depth of the workings.

The reclamation of the quarried area will be carried out only after reaching the economic pit bottom by opencast method of mining. The reclamation in the worked out benches will be taken as by making pits of appropriate size and at regular intervals. Suitable soil preparation will be done by spreading a layer of sweet soil. Along the slopes suitable grasses will be planted to arrest the run-off and avoid soil erosion.

Waste Dumping Area.

Once dumping is complete, sweet earth and cow dung manure is spread, in the areas of necessity for proper plant growth, e.g. dump containing large boulders. Terraces on the slopes are kept inward. Deep pits of 0.5m to 0.75m are been dug on the slopes at an interval of 1m X 1.5m or less depending on fertility. Saplings are planted in the pits with a mixture of top soil and manure /fertiliser. At first, grass seeds are sown. This binds the dump slopes. The seeds of leguminous herbs, creepers and other competent species are also spread whenever required. After completion of one bench a passage of about 10m-15m width is left out from the sides and then second lead is taken in the form of another bench and similar biological reclamation is done. Once a dump is complete, trenches of 45cm X 45cm size is cut in the top flat region of the dumps to trap water. Pits (0.5m to 0.75m) are excavated in the contour trenches at intervals of 2m X 2m and will be filled with a mixture of top soil and manure/fertiliser. Garland drain is provided at the toe of old dumps to arrest run-off soil wash (Plate-2). At present inactive dumps have been afforested (Plate-1).

The process of inactive dump slopes being biologically stabilized with multi-species afforestation will continue. Toe walls for some of the active dumps will be taken up during the first year itself.

- ❖ During this five-year period of time (End of 2018) it is envisaged that reclaiming the slopes of the existing dumps & reclaim the part of excavated area through backfilling.
- ❖ During the third five-year period of time (End of 2023) it is envisaged that the part of the pit has been mined out .We propose to reclaim this part of the excavated area (at the top) to be backfilled & afforested.
- ❖ During the fourth five-year period of time (End of 2028) it is envisaged that the part of the pit has been mined out .We propose to reclaim this part of the excavated area (at the top) to be backfilled & afforested.
- ❖ During the end of life (End of 2033) it is envisaged that all the excavated areas which is partially backfilled except the untouched area & green belt coverage area to be afforested.

The details of the area is given in the table no. 3

Table No: 3

| Year | Plantation Target | | Backfilling of Quarries (ha) |
|---------|-------------------|--------|------------------------------|
| | Area (ha.) | Nos. | |
| 2013-18 | 13.50 | 33750 | 42.00 |
| 2018-23 | 42.00 | 105000 | 30.00 |
| 2023-28 | 68.40 | 170875 | 0.00 |
| 2028-33 | 85.20 | 213025 | 0.00 |
| Total | 209.1 | 522650 | 72.00 |

5.0 Bio-diversified Afforestation /Reclamation.

The species to be planted in the reclamation programme are given in Table no.3.

Table No.- 3

| Sl No. | Botanical Name | Common Name |
|--------|-----------------------|-------------|
| 1 | Albizzia lebbek | Siris |
| 2 | Prosopis juliflora | Juliflora |
| 3 | Melia azadirachta | Bakain |
| 4 | Terminalia arjuna | Arjun |
| 5 | Luceana lucocephala | Subabul |
| 6 | Melina arborea | Gamhar |
| 7 | Psidium guajava | Guava |
| 8 | Acacia auriculiformis | Acacia |
| 9 | Azadirachta indica | Neem |
| 10 | Terminalla tomentose | Asan |
| 11 | Zizypus jujube | Ber |
| 12 | Shorea robusta | Sal |
| 13 | Tectona grandia | Teak |
| 14 | Delbergia sisso | Sisham |

6.0 Method of Plantation

The company proposes to reclaim the mining pits and dumps by afforestation, when they are permanently abandoned. The afforestation of the dumps and mining benches will be done by the following methods.

(A) Method of Pitting & Planting:

- The worked out mining benches will be reclaimed by making pits of 0.5m x 0.5m x 0.5m size, 2m apart. The pits will then be filled with sweet earth, sand and cow-dung.
- Neem cake powders are proposed to be applied in the pit to protect the plants from white ants.
- Such ground preparation is proposed to be done before monsoon after which appropriate varieties of saplings will be planted during the monsoon.

The method of pitting and planting has been explained in Sketch-2

(B) Method of Planting by Contour Trenching:

This method is proposed for slopes wherein contour trenches are dug at 3m interval along the contour. 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 for healthy growth.

The method of pitting and planting has been explained in Sketch-3

Apart from above slopes of dumps shall also be stabilized by coir matting and subsequent plantation where ever possible.

(C) Protection and post plantation care:

Since the saplings are planted during monsoon watering of the plants is done only during dry spell. Further watering is done before applying chemical fertilisers and during dry days to ensure that the soil moisture is within the range of available water.

Besides basal dose of fertiliser, split application of fertiliser will be done for two more times after weeding and other intercultural operations.

Plants will be protected against insect pests, diseases etc., by applying pesticides as and when required. To save the plants from grazing by goats and cattle suitable fencing, trees guards will be provided. In addition regular watch and ward personnel will be ensuring the protection of these plants at vulnerable areas,. Mulching will also be provided at suitable places to check the soil evaporation loss especially during dry seasons.

7.0 Present Organization and Man Power

An Environment Management Department has been set up exclusively to monitor and executive all environment-related activities. This department has been occupied with well-experienced professionals drawn from different disciplines like mining, botany, horticulture and chemistry backgrounds and the organisational structure shown in Chart-1 These professionals are now regularly interacting and seeking advice from different Govt. forest officials, RPRC, Bhubaneswar & officials of MoEF to make the afforestation programme of mine, a success. Sukinda Chromite Mine, being an important Chrome Ore mine of the Company, receives due attention and care in all the environmental matters including afforestation and reclamation.

8.0 Financial projections of the proposed reclamation scheme

The financial projection for the proposed reclamation and afforestation scheme, based on the current prices as indicated in Table No.: 4 & the rate have been calculated per hectare plated. Based on these projections the budgetary provisions that are necessary to be made for entire plan period are given in Table No.-5

a) Cost estimate for reclamation & afforestation (estimation is for one ha.)

The cost estimates for reclamation and afforestation of one hectare area is as given below in Table no-4

Table No.- 4

Cost Of Estimates For Reclamation And Afforestation Of One Hectare Of Land

| Sl. No. | Item of work | Man days | Labour rate @ Rs. 280.00 | Labour Cost | Material cost | Total |
|---|--|----------|--------------------------|-------------|---------------|--------|
| 1 | 2 | 3 | 4 | 5=3 x 4 | 6 | 7=5+6 |
| 1st Year : Pre-Planting Operations | | | | | | |
| 1 | Survey, Demarcation & pillar posting | 2 | 0 | 560 | 0 | 560 |
| 2 | Site preparation | 8 | 0 | 2240 | 0 | 2240 |
| 3 | Alignment and spacing of pits | 2 | 0 | 560 | 0 | 560 |
| 4 | Digging of pitting (30 cm ³) | 40 | 0 | 11200 | 0 | 11200 |
| 5 | Nursery cost (one year old seedling) part. | 75 | 0 | 21000 | 25000 | 46000 |
| 6 | Contingencies & overheads (10% of Sl. 1 to 5) | 0 | 0 | 0 | | 6088 |
| Sub Total | | 127 | 0 | 35560 | 25000 | 66648 |
| 2nd Year : Planting of Seedlings | | | | | | |
| 1 | Carriage of seedlings to site cleaning including casuality replacement | 25 | 0 | 7000 | 0 | 7000 |
| 2 | Cost of insecticide & fertilizer | 20 | 0 | 5600 | 2000 | 7600 |
| 3 | 1 st Weeding (Complete Weeding) | 7 | 0 | 1960 | 0 | 1960 |
| 4 | Manuring | 5 | 0 | 1400 | 2500 | 3900 |
| 5 | 2 nd Weeding(Complete Weeding) | 5 | 0 | 1400 | 0 | 1400 |
| 6 | Soil working (50 cms. Radius around plants) | 8 | 0 | 2240 | 0 | 2240 |
| 7 | Fire line tracing (2m wide fire line over 400m long) | 3 | 0 | 840 | 0 | 840 |
| 8 | Soil conservation measures in the form of contour trenches of 2mt x 50cm D & drainage line treatment percolation pits etc. | 10 | 0 | 2800 | 0 | 2800 |
| 9 | Watch & ward and brush wood/live fencing at 15% length of periphery to prevent cattle entry | 7 | 0 | 1960 | 0 | 1960 |
| 10 | Watering at least 6 days in a month for 8 month (April to July & Dec. to March) on LS | | 0 | 0 | 0 | 100000 |
| 11 | Contingencies (10% of Sl 1 to 10) | | | | | 12970 |
| Sub Total | | 90 | 0 | 25200 | 4500 | 142670 |
| 3rd Year : Plantation Maintenance | | | | | | |
| 1 | Causality replacement with nursery cost | 12 | 0 | 3360 | | 3360 |
| 2 | Weeding | 6 | 0 | 1680 | | 1680 |
| 3 | Application of Fertilizer | 7 | 0 | 1960 | | 1960 |
| 4 | Cost of fertilizer | | | | 2500 | 2500 |
| 5 | Soil working (50 cms. Radius around plants) | 7 | 0 | 1960 | | 1960 |
| 6 | Fire line tracing (2m wide fire line over 400m long) | 3 | 0 | 840 | | 840 |
| 7 | Watch and ward | 15 | 0 | 4200 | | 4200 |
| 8 | Watering at least 6 days in a month for 8 month (April to July & Dec. to March) on LS | | 0 | 0 | | 100000 |
| 9 | Contingencies (10% of Sl 1 to 8) | | | | | 11650 |
| Sub Total | | 50 | 0 | 14000 | 2500 | 128150 |

| 4th Year : Plantation Maintenance | | | | | | |
|------------------------------------|---|----|---|-------|------|--------|
| 1 | Weeding and application of fertilizer | 7 | 0 | 1960 | | 1960 |
| 2 | Cost of Fertilizer | | | | 2500 | 2500 |
| 3 | Soil working (50 cms. Radius around plants) | 7 | 0 | 1960 | | 1960 |
| 4 | Fire line tracing (2m wide fire line over 400m long) | 3 | 0 | 840 | | 840 |
| 5 | Watch and ward | 15 | 0 | 4200 | | 4200 |
| 6 | Watering at least 6 days in a month for 8 month (April to July & Dec. to March) on LS | 0 | 0 | 0 | | 100000 |
| 7 | Contingencies (10% of Sl 1 to 6) | | | | | 11146 |
| Sub Total | | 32 | 0 | 8960 | 2500 | 122606 |
| 5th Year : Plantation Maintenance | | | | | | |
| 1 | Weeding & pruning | 15 | 0 | 4200 | | 4200 |
| 2 | Fire line tracing (2 mt. wide fire line over 400 mt. long) | 3 | 0 | 840 | | 840 |
| 3 | Watch and ward | 25 | 0 | 7000 | | 7000 |
| 4 | Contingencies (10% of Sl 1 to 3) | | | | | 1204 |
| Sub Total | | 43 | 0 | 12040 | | 13244 |
| 6th Year : Plantation Maintenance | | | | | | |
| 1 | Weeding and pruning | 15 | 0 | 4200 | | 4200 |
| 2 | Fire line tracing (2 mt. wide fire line over 400 mt. long) | 3 | 0 | 840 | | 840 |
| 3 | Watch and ward | 25 | 0 | 7000 | | 7000 |
| 4 | Contingencies (10% of Sl 1 to 3) | | | | | 1204 |
| Sub Total | | 43 | 0 | 12040 | | 13244 |
| 7th Year : Plantation Maintenance | | | | | | |
| 1 | Weeding and pruning | 15 | 0 | 4200 | | 4200 |
| 2 | Fire line tracing (2mt. wide fire line over 400 mt. long) | 3 | 0 | 840 | | 840 |
| 3 | Watch and ward | 25 | 0 | 7000 | | 7000 |
| 4 | Contingencies (10% of Sl 1 to 3) | | | | | 1204 |
| Sub Total | | 43 | 0 | 12040 | | 13244 |
| 8th Year : Plantation Maintenance | | | | | | |
| 1 | Weeding and pruning | 15 | 0 | 4200 | | 4200 |
| 2 | Fire line tracing (2mt. wide fire line over 400 mt. long) | 3 | 0 | 840 | | 840 |
| 3 | Watch and ward | 25 | 0 | 7000 | | 7000 |
| 4 | Contingencies (10% of Sl 1 to 3) | | | | | 1204 |
| Sub Total | | 43 | 0 | 12040 | | 13244 |
| 9th Year : Plantation Maintenance | | | | | | |
| 1 | Weeding and pruning | 15 | 0 | 4200 | | 4200 |
| 2 | Fire line tracing (2mt. wide fire line over 400 mt. long) | 3 | 0 | 840 | | 840 |
| 3 | Watch and ward | 25 | 0 | 7000 | | 7000 |
| 4 | Contingencies (10% of Sl 1 to 3) | | | | | 1204 |
| Sub Total | | 43 | 0 | 12040 | | 13244 |
| 10th Year : Plantation Maintenance | | | | | | |
| 1 | Weeding and pruning | 15 | 0 | 4200 | | 4200 |
| 2 | Fire line tracing (2mt. wide fire line over 400 mt. long) | 3 | 0 | 840 | | 840 |
| 3 | Watch and ward | 25 | 0 | 7000 | | 7000 |
| 4 | Contingencies (10% of Sl 1 to 3) | | | | | 1204 |
| Sub Total | | 43 | 0 | 12040 | | 13244 |
| 11th Year : Plantation Maintenance | | | | | | |
| 1 | Weeding and pruning | 15 | 0 | 4200 | | 4200 |

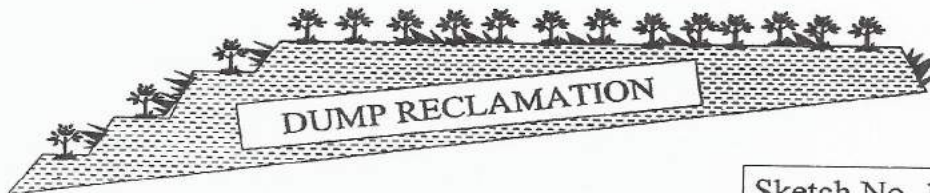
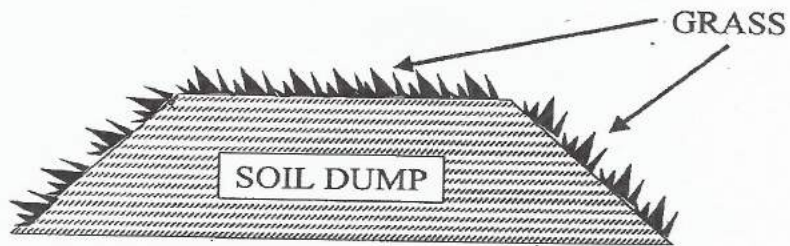
| | | | | | | |
|--------------------|---|-----|---|--------|-------|--------|
| 2 | Fire line tracing (2mt. wide fire line over 400 mt. long) | 3 | 0 | 840 | | 840 |
| 3 | Watch and ward | 25 | 0 | 7000 | | 7000 |
| 4 | Contingencies (10% of Sl 1 to 3) | | | | | 1204 |
| Sub Total | | 43 | 0 | 12040 | | 13244 |
| Grand Total | | 600 | 0 | 168000 | 34500 | 552782 |

Table No.5

| Year | Plantation Target | | Tentative Budget for Plantation (Rs Lakh) |
|---------|-------------------|--------|---|
| | Area (ha.) | Nos. | |
| 2013-18 | 13.50 | 33750 | 75 |
| 2018-23 | 42.00 | 105000 | 232 |
| 2023-28 | 68.40 | 170875 | 378 |
| 2028-33 | 85.20 | 213025 | 471 |
| Total | 209.1 | 522650 | 1156 |

SKETCH-1

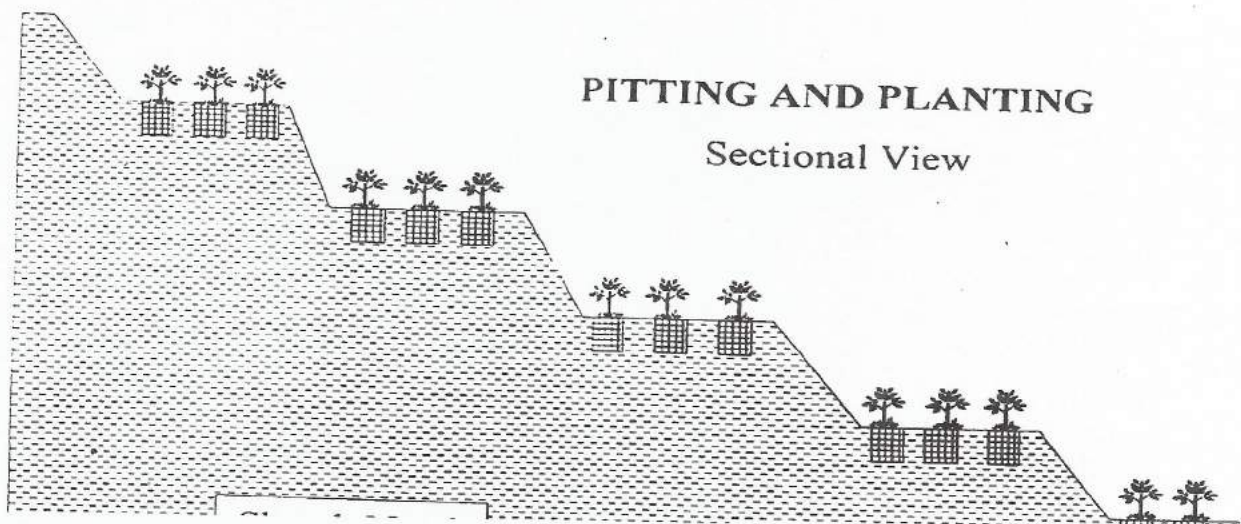
PRESERVATION OF TOP SOIL



Sketch No. 1

SKETCH-2

METHOD OF RECLAMATION AND AFFORESTATION IN MINED OUT AREA



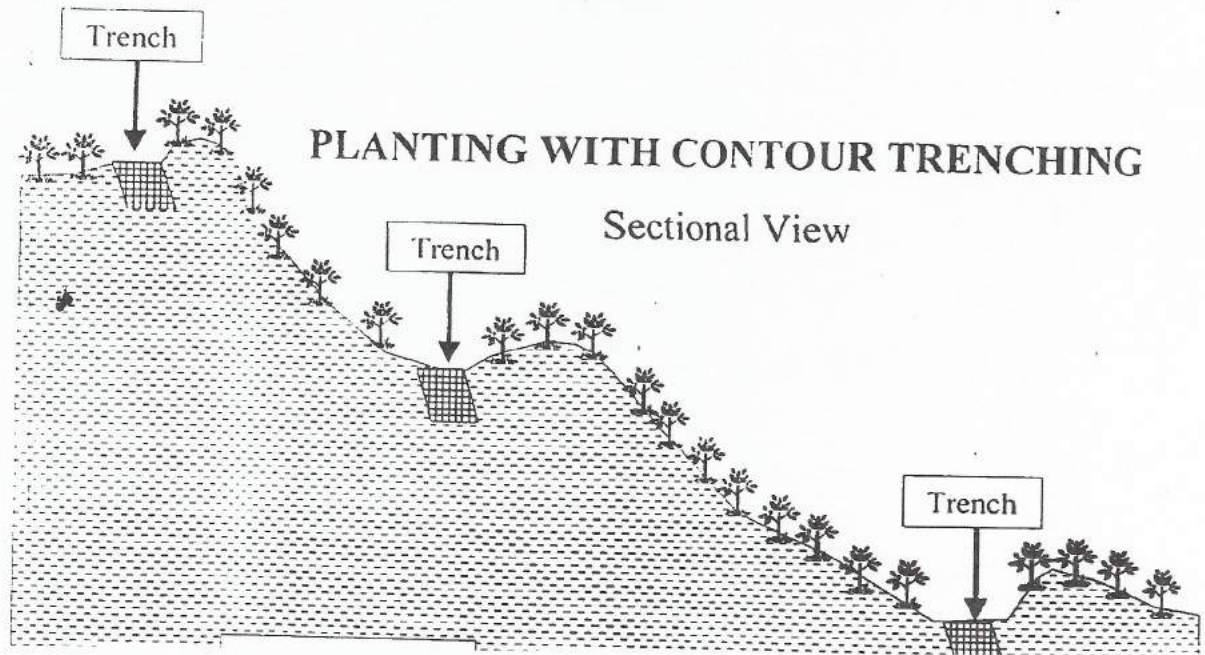
For TATA STEEL LTD.
By their Constituted Attorney

(Signature)

(GANESH PRASAD SAHU)
Head (Ferro Alloys Production)
Ferro Alloys & Minerals Division

SKETCH-3

**METHOD OF RECLAMATION AND
AFFORESTATION IN MINED OUT AREA**



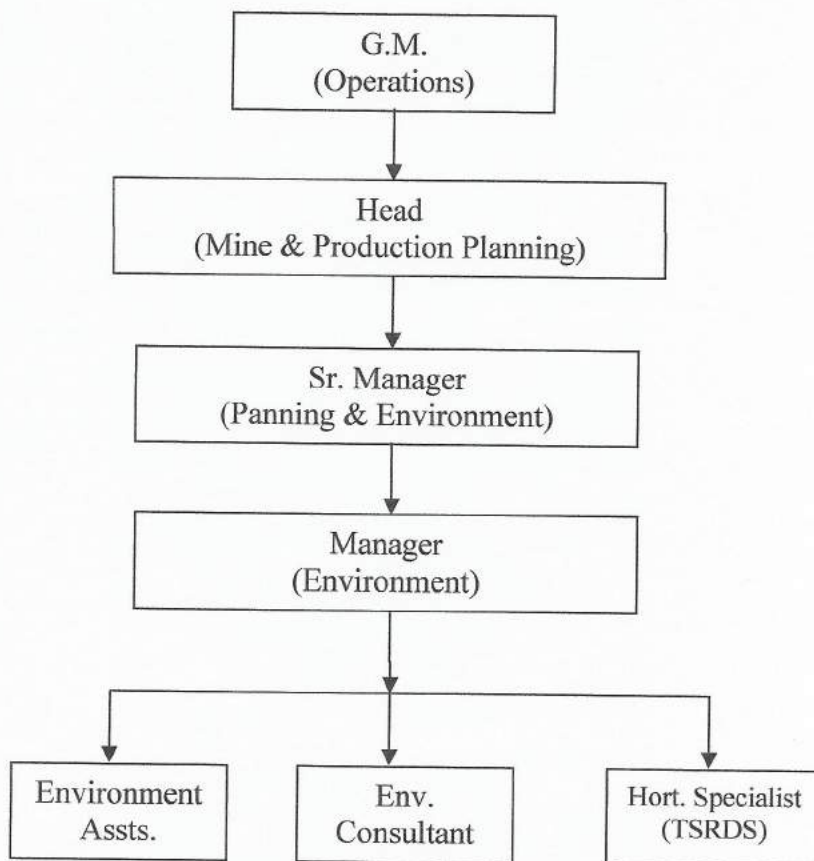
For TATA STEEL LTD.
By their Constituted Attorney

Ganesh Prasad Sahu

(GANESH PRASAD SAHU)
Head (Ferro Alloys Production)
Ferro Alloys & Minerals Division

CHART-1

**Organisation Chart
Mine Production Planning & Environment**



For TATA STEEL LTD.
By their Constituted Attorney

(GANESH PRASAD SAHU)
Head (Ferro Alloys Production)
Ferro Alloys & Minerals Division

BIOLOGICAL RECLAMATION PLAN **SUKINDA CHROMITE MINE, TATA STEEL LIMITED**

Introduction:

Sukinda leasehold of Tata Steel Limited is flanked by the chromite leases owned by Orissa Mining Corporation, Jindal & FACOR in its three sides viz; north, east and west, while the southern side is bounded by Mahagiri hills. Chromite deposits in Sukinda Valley were discovered during late 40s. Tata Steel had obtained 1813 hectares area for mining lease for a period of 20 years with effect from 12.01.1953 and the mine was opened for production in December, 1960. The lease had subsequently been renewed on 15.04.1977 (with effect from 12.01.1973) for a period of 20 years and at the time of renewal; the area was reduced to 1261.476 hectares. During second renewal of mining lease, the lease-hold area has been further reduced to 406 hectares. The Tata Steel Limited (earlier Tata Iron & Steel Company Limited) secured a mining lease over an area of 7 sq. miles i.e. 1813.45 hectares in Sukinda Valley of Jajpur District in the State of Odisha from the then Maharaja of Sukinda Garh. After the abolition of Estate, Govt. of Odisha ratified the mining lease obtained from the King with effect from 12.01.1953.

Subsequently, 1st renewal of the mining lease was granted for a period of 20 years with effect from 12.01.1973 over a reduced area of 1261.476 ha.

The 2nd renewal lease deed was executed on 18.05.1998 for period of 20 years with effect from 12.01.1993 over a further reduced area of 406 ha.

Based on 3rd renewal application, Govt. of Odisha passed the Express Order vide letter no. 9414/III(CR) SM-22/2014/SM, dated 01.12.2014 for 3rd renewal of the mining lease over an area of 406 ha. for a period of 20 years till 11.01.2033.

Approval for diversion of entire forest land of 73.697 ha. (also broken up area prior to 25.10.1980) within the lease area of 406 ha. was accorded by MoEF vide letter no. 8-78/96-FC dated 27.01.1998 for 2nd renewal period.

The renewal Forest Diversion Proposal for the 3rd renewal of the mining lease was submitted 2 years prior expiry of the lease and MoEF accorded the Stage - I clearance vide letter no. F.No. 8-78/1996-FC(pt.1), dated. 03.11.2014.

Moreover, in accordance to the MMDR (Amended) Act'2015, the lease got extended till 31.03.2020 and the Forest Clearance accorded by MoEF vide letter no. 8-78/96-FC dated 27.01.1998 for 2nd renewal period is deemed to be valid till 31.03.2020.

Location:

The mining lease area of 406 ha falls under the Survey of India Topo Sheet No. F45N12 (73-G/12), F45N16 (73-G/16), F45T9 (73-H/9) & F45T13 (73-H/13). The extent of Latitude and Longitude is furnished below;

| Latitude | | Longitude | |
|--------------|--------------|--------------|--------------|
| From | To | From | To |
| 21°00'39.60" | 21°02'05.81" | 85°44'27.10" | 85°46'22.37" |

Sukinda Chromite Mine is connected with Jajpur Keonjhar Road Railway Station on the Howrah-Chennai trunk line of East Coast Railways by 52 km all weather road. JK Road

Railway Station is 336 km from Tata Nagar Railway Station via Kharagpur and is 337 km from Howrah, 100 km from Bhubaneswar and 156 km from Paradip, the nearest port on the Eastern Coast.

The all-weather road connecting Sukinda Chromite Mine with JK Road Railway Station meets NH-200 at Mangalpur at a distance of 21 km and Express Highway No.1 connecting Daitari with Paradip at Duburi at a distance of 32 km from the mine.

Sukinda Chromite Mine comprises 406 ha of land in villages Karangiatta, Kaliapani, Mahulkhal & Forest Block No. 27 in the revenue district of Jajpur, Sub-Division Jajpur and Thana Kaliapani.

The land classification of mining lease area of 406 ha. are as;

| | | |
|---------------------------|---|------------|
| a) Forest Block No 27 | : | 73.612 ha |
| b) K.F. | : | 0.085 ha |
| c) K.F.(as on 25.10.1980) | : | 330.972 ha |
| Total Forest land | : | 404.669 ha |
| d) Non-forest | : | 1.331 ha |
| Grand Total | : | 406.000 ha |

Topography: Sukinda Valley, best known as hosting the treasure of chrome wealth in the country is located in the eastern state of Odisha, India. This valley is bounded by Tomka-Daitari Range in North and Mahagiri Range (707.69m) in South having a general slope of 18-20° towards South-West with isolated mountain and ridges, ranging from 40m to 60m m in height. The area has a tropical to sub-tropical climate with rainfall during monsoon months of June – September.

Geology: The ultra mafites of Sukinda Valley along with the associated chromite ore bodies are intrusive in to the lower sequence of the basal group of Iron Ore Super Group. Presently, the iron ore Super Group is represented in the form of Daitary hill range in the north and Mahagiri hill range in the South, running NE-SW direction. The ultramafites except the young pyroxinite band have undergone extensive weathering resulting in the development of Ni-Co bearing laterites.

The regional structure of the Pre-Cambrian rocks of the Sukinda Valley is a cross folded doubly plunging syncline with the culminated fold axis striking ENE-WSW which parallel to the main fold axis of the eastern Ghats Orogenic belt. The plunge of the main folds axis trends a NNE-SSE and is sub parallel to the cross folded axis of the eastern Ghat Orogenic belt.

The chromite bearing Ultramafic rocks had intruded in the synformal syncline, as laccoliths and was co folded along with the other meta sediments in to the present form of doubly plunging synform. The whole groups of rock were then affected by two parallel faults coinciding with the southern and northern margins of the ultramafic body. Movement along the fault and shearing has resulted in "Stretching" of the chromite band to "Boudin as seen the OB I and OB III of the valley.

Drainage: Damsal Nallah is the main perennial nallah, which flows in the southwest direction and located towards the northern side of the leasehold. The nallah also serves as the natural water source in the area. Various tributaries and small nallahs both from the northern & southern slopes of Mahagiri & Daitari hill range join on to the Damasal nallah. This type of

Drainage system forms a dendrite pattern. At places, sub parallel, to parallel drainage patterns are also observed.

Climate: Sukinda Chromite Mine enjoys four different seasons in a year. During summer from March to middle of June, the temperature varies from 24°C to 47°C. During the rains i.e from mid-June to mid-October, south-west rains cover the area with precipitation varying between 845 to 1485 mm. The area experiences cyclonic weather during monsoon period. The month-wise rain fall for last five years is being furnished below;

| Year wise Rain fall (mm) | | | | | | | |
|--------------------------|---------|---------|---------|---------|---------|---------|---------|
| Month/ Year | 2008-09 | 2009-10 | 2010-11 | 2011-12 | 2012-13 | 2013-14 | 2014-15 |
| Apr | 3.60 | 0.00 | 64.77 | 72.39 | 5.08 | 68.48 | 44.45 |
| May | 16.20 | 66.04 | 134.62 | 105.69 | 3.81 | 175.63 | 136.5 |
| June | 288.33 | 86.86 | 104.14 | 204.03 | 71.12 | 328.36 | 136.65 |
| July | 276.74 | 421.25 | 242.57 | 107.32 | 99.06 | 327.63 | 393.64 |
| Aug | 265.89 | 366.09 | 196.18 | 245.15 | 158.76 | 160.9 | 388.12 |
| Sept | 410.40 | 200.77 | 171.18 | 328.46 | 244.48 | 45.72 | 149.43 |
| Oct | 8.89 | 119.38 | 97.88 | 12.7 | 62.23 | 333.34 | 125.69 |
| Nov | 8.89 | 10.16 | 11.43 | 0 | 146.05 | 0 | 0 |
| Dec | 0.00 | 0.00 | 48.26 | 0 | 0 | 0 | 2.54 |
| Jan | 0.00 | 2.54 | 0.00 | 39.37 | 5.08 | 0 | 1.27 |
| Feb | 0.00 | 0.00 | 2.84 | 0 | 12.7 | 5.08 | 2.54 |
| Mar | 3.81 | 19.05 | 24.58 | 0 | 36.75 | 39.37 | 12.7 |
| Total | 1282.75 | 1292.14 | 1098.45 | 1115.11 | 845.12 | 1484.51 | 1393.53 |

Autumn last from mid-November with pleasant weather having temperature between 18°C to 33°C. The winter starts from mid-November and continues till end of February. The temperature drops to 8°C during peak winter.

The area is humid during monsoon and the relative humidity goes up to 90%. However the annual average relative humidity is 65%. The wind speed is generally light to moderate. High speed wind occurs in summer and monsoon seasons. Predominant wind direction in the area for all season are SWS, SSW whereas NNE during the post monsoon.

LAND USE PATTERN:

Consequent upon the order of the Central Govt. dated 17.8.1995 & the order of the Supreme Court, the lease-hold area of Company was reduced to 406 hectares from 1261.476 hectares.

Purpose-wise break-up of the total land required (already broken & to be broken). Details given below and indicated in the Land Use Plan bearing Drawing No. FAMD/L&L/SCM/A/03/2015 Dated 15.04.2015 marked as **Plate-III**.

The State Government vide letter no.'s III (G) SM-34/96-7747 Bhubaneswar, dt.07.08.1996 and 22012/ DMG, dated 21.08.1996 has demarcated the reduced lease over 406 ha during its 2nd renewal, in pursuance of the Central Govt. Order no. 5(22)/95 MIV dated 17.08.1995 and orders of Hon'ble Supreme dated 23.07.1996. The requirement of land and land use pattern

has been determined by the Central Government as mentioned in its order (Ref.: page no. 6 of the order no. 5(22)/95 MIV dated 17.08.1995).

In line with the above, the land use pattern of the entire lease area of 406 ha which has already been fully utilized and diverted, with its break-up within Forest and non-forestland is given in the tables below. Accordingly, a safety zone of 15 ha has been kept within the adjoining forestland and outside our mining lease-hold area of 406 ha, as approved during the previous diversion of the entire forestland of 73.697 ha within the mining lease.

(A) Forest & N.F. area already broken prior to 25.10.1980:

| Sl. No. | Pattern of Utilization | Area in Hect. | | | | | | | | Grand Total | Total Forest land in the lease | Remarks |
|-------------|--|-----------------------------------|-------|---|---------|----------|-------------------|--------|---------|--|--------------------------------|---------|
| | | (As per HAL RoR) Stage-I Approved | | Area applied for diversion, forest land as on 25.10.1980 (As per SABIK RoR) | | | | | | | | |
| | | Forest Block No.27 | K.F. | Total Forest | K.F | N.F.Land | Total Forest Land | | | | | |
| A | Mining | 46.062 | 0 | 46.062 | 153.708 | 0 | 153.708 | 199.77 | 199.77 | | | |
| B | Storing of Mineral/Ore (Stack yard) | 0.41 | 0 | 0.41 | 36.67 | 0 | 36.67 | 37.08 | 37.08 | | | |
| C | Dumping of OB * West Disposal, Feed Dump & Tailing Pond) | 15.29 | 0 | 15.29 | 37.835 | 0.295 | 37.835 | 53.42 | 53.125 | OB Dump 37.47ha & Tailing Pond 5.85ha. Total 53.420ha. | | |
| D | Storing of Tools & Machineries (Store & Workshop) | 0 | 0 | 0 | 2.79 | 0 | 2.79 | 2.79 | 2.79 | | | |
| E | Construction of Building, Power Station(COB Plant & ETP) | 0 | 0 | 0 | 18.7 | 0 | 18.7 | 18.7 | 18.7 | | | |
| F | Township/Housing Colony (Camp area) | 0 | 0.085 | 0.085 | 35.233 | 0.862 | 35.233 | 36.18 | 35.318 | | | |
| G | Construction of Road, Ropeway, Rly. Line etc. | 7.19 | 0 | 7.19 | 11.819 | 0.041 | 11.819 | 19.05 | 19.009 | | | |
| H | Magazine | 0.48 | 0 | 0.48 | 0 | 0 | 0 | 0.48 | 0.48 | | | |
| I | Green Belt | 4.18 | 0 | 4.18 | 34.217 | 0.133 | 34.217 | 38.53 | 38.397 | | | |
| Grand Total | | 73.612 | 0.085 | 73.697 | 330.972 | 1.331 | 330.972 | 406 | 404.669 | | | |

(B) Safety Zone Area:

| Plan Showing Safety Zone area Plate No IV and Drawing No FAMD/L&L/SCM/A /04/2015 Dated 15.04.2015 is enclosed with FDP | Area in hectares | | | | | |
|--|--------------------|-------|--------------|-----------|----------|---------------------------------------|
| | Forest Block No 27 | K.F. | Total Forest | N.F. Land | G. Total | Remarks |
| | 15.000 | -- | 15.000 | -- | 15.000 | Outside the ML area |
| | 1.408 | 7.584 | 8.992 | -- | 8.992 | Inside the ML area along the boundary |

(C) Forest & N.F. area to be broken : NIL

(D) Total Land required.

| Area in Hect. | | | | | | | |
|-----------------------------------|-------|--------------|---|-----------|-------------------|-------------|--------------------------------|
| (As per Hal ROR) Stage-I Approved | | | Area applied for diversion, forest land as on 25.10.1980 (As per Sabik ROR) | | | Grand Total | Total Forest land in the lease |
| Forest Block No.27 | K.F. | Total Forest | K.F | N.F. Land | Total Forest Land | | |
| 73.612 | 0.085 | 73.697 | 330.972 | 1.331 | 332.303 | 406 | 404.669 |

The Company's reduced lease-hold of 406 hectares includes 404.669 hectares of forest land as per SABIK ROR which was broken up prior to 25.10.1980. The Ministry of Environment & Forests has already cleared the DRP submitted for diversion of 73.697 ha. broken-up forest land . For the purpose of analysis the total leasehold can be broadly divided in to following three segments.

- 1) Mining Area
- 2) Waste dump Area
- 3) Other Area

MINING AREA

Out of 199.770 Hec. of mining area, we have two quarries i.e. OB X & OB II both of which are active and will remain active till the existing lease lasts. Both the quarries comes under this broken up forest land. Both the quarries are being worked out, by unloading from top downwards by removing overburden systematically from top of the hill. Due to the nature of the ore body, lateral expansion is inevitable.

The OB X quarry which is in the friable ore band where orebody is thin vertically dipping towards north. This quarry is having floor R.L. of 24 m. at present can be developed with the opencast method up to -25 mRL. However, present opencast Ultimate Pit depth has been

designed upto 10 mRL. This will need lateral expansion of the quarry towards north as well as south.

Moreover, as the lumpy ore band is very thin and dipping almost vertical and located very close to the foot hill of the Mahagiri hill, the overburden to ore ratio is very high in this quarry. Presently, the floor RL of the quarry is about 30m at places which is the Ultimate Pit Depth for the quarry. Backfilling has started from the eastern side of the pit and the entire quarry shall be backfilled in coming years after exhaust of mineral in the western side. The quarries will remain active in coming five years and more for the purpose of mining and backfilling.

The Steel Company proposes to reclaim the open pits by back filling after the opencast working reaches its ultimate pit bottom depths and the mineable reserves by opencast methods are exhausted. Wherever possible such backfilling shall be done from the bottom upwards in a retreating fashion.

Presently, as per the approved Mining Plan the overburden is being backfilled in our OB-II quarry w.e.f 01.04.2014 after the opencast mineable reserves got exhausted. Presently 10.6 ha of OB-II quarry have already been backfilled and will be continued till 2020.

WASTE DUMP AREA

As the waste dump area provided within the demarcated reduced lease-hold is very limited and the one waste dump inside the reduced area is active and will remain active for the next one year. The total dump area within the leasehold is 53.125 Hectares.

An area of 100 ha has been provided for dumping of Over Burden, the diversion same has been accorded vide Ministry of Environment & Forests, Govt of India letter No. 8-28/2004-FC dated 11th May' 2005. The allotted area is adjacent to the southern lease boundary of the Company's chromite mining lease-hold & comprises of village Kusumundia (part), village Mahulkhal (part) and the Forest block No. 27 (southern part). Presently there is no dumping of overburden is done in the area after Supreme Court Judgement in Goa matter.

OTHER AREA

Plantation has been proposed by the side of the roads inside the colony and also by the side of roads connecting the quarries, COB Plant dump workshop magazine etc.. Plantation will be done on both the sides of the roads. The Company has already done some avenue plantation. In order to avoid direct visibility of open pits from a distance and for screening of dust & noise peripheral plantation has been envisaged around the pits. Peripheral plantation shall be done around the COB Plant and also around the ore stock piles and colony quarter in the camp area.

FOREST & VEGETATION:

On the basis of type of land, vegetation can be divided into 4 types:

(a) Plants growing/grown on overburden dumps: The overburden dumps which are not in current use are taken for plantation by pitting and trenching or by use of coir mats. Now overburden dumping is going on in 2nd & 3rd phase of allotted area of 100 ha. Now the inactive, saturated dumps within leasehold area are taken for biological reclamation in phased manner. Once the forestry is developed on overburden dumps, the terraced formations of dumps will form better landscaping.

The Overburden benches that have attained 75 m. height has been planted with Lemon grass (as per the advice of Regional Research Laboratory, Bhubaneswar) and other plant species as per the direction of Regional Plant Resource Centre, Bhubaneswar at the slopes to stabilise it and prevent the washout of the overburden (Plate-1).

For further prevention of pollution, the overburden dumps have been provided with garland drains at the toe all around the dumps to arrest the washouts, if any from the dumps (Plate-2).

(b) Forests: Total forest land involved in the mining lease area is 404.669 ha. 73.697 hectares of lease-hold area is under forest as per HAL RoR and additional 330.972 ha as per SABIK RoR. This entire area has been broken prior to 25.10.1980 & the Diversion Proposal has also been approved by the MoEF over 73.697 ha. The entire applied area is coming under the classification of forest land.

(c) Plantation: Green belt has already been developed between the mining and the residential area. In the office premises and in the residential areas plantation has been done to reduce the level of dust, noise and for increase in aesthetic values (Plate-3). The Company had developed a modern nursery within the lease-hold adjacent to the hospital & air strip, which is now coming outside the reduced lease-hold area of 406 hectares. Recently a beautiful park has also been developed within the camp premises. The important trees planted comprise of Delonix regia, Plectroforum, Dalbergia sisoo, Artocarpus heterophyllea, Syzigium cumini, Azadiracta indica etc.

The year wise plantation till date with in Mining Leasehold area of 406 ha is as given below in Table-1:

Table-1

| Year | Within ML Area | | Outside ML Area | |
|---------|-----------------|------------|-----------------|------------|
| | Nos. of Sapling | Area in Ha | Nos. of Sapling | Area in Ha |
| 1998-99 | 4000 | 1.7 | | |
| 1999-00 | 18000 | 4 | | |
| 2000-01 | 28342 | 2 | | |
| 2001-02 | 15000 | 0.5 | | |
| 2002-03 | 22000 | 1.5 | | |
| 2003-04 | 45500 | 1.5 | | |
| 2004-05 | 48000 | 1 | | |
| 2005-06 | 75000 | 2.5 | | |
| 2006-07 | 129500 | 5.75 | | |

| | | | | |
|---------|--------|-------|---------------------------------|-------|
| 2007-08 | 94000 | 4.42 | Additional Area (100ha)obtained | |
| 2008-09 | 85250 | 2.94 | 36750 | 1.76 |
| 2009-10 | 28000 | 3.9 | 56000 | 5.6 |
| 2010-11 | 25000 | 2 | 60000 | 6.5 |
| 2011-12 | 45000 | 4.5 | 35000 | 3.5 |
| 2012-13 | 5700 | 1.83 | 40000 | 6.5 |
| 2013-14 | 3700 | 1.32 | 54326 | 5.6 |
| 2014-15 | 4050 | 1.2 | 50100 | 5.1 |
| Total | 676042 | 42.56 | 332176 | 34.56 |

Apart from above massive plantations have been taken up by TSRDS (Tata Steel Rural Development Society) in nearby villages. TSRDS is a service oriented non- profit making organisation fully funded, supported & which is a sister concern of Tata steel. The self-help group of different nearby villages are actively participating & they are availing this opportunity from TSRDS. Saplings have been procured from Different Non- Govt. organisations, Govt. Agencies like District forest officers & training schools. Our TSRDS has also developed its own nursery & we are taking up some plantation for fruit bearing plants in nearby schools & area developed by the villagers. TSRDS is also putting its sincere efforts outside the lease hold area in peripheral development scheme. So this is a continuous effort given by Tata steel from every corner for developing greenery all along.

The Detailed year-wise data since 1998-99 by TSRDS in villages is given below in the Table No. 2

Table-2

| VILLAGE PLANTATION | | | | |
|--------------------|-------------------------|--------------------------|--|---|
| Year | Total plantation (nos.) | Total plantation (acres) | Villages covered | Species |
| 1998-99 | 11771 | 9 | Kalarangi, Malarsahi, Sapua, Maruabil, Kakudia, Sitalbasa, Bhimatanger | Siris, Chakunda (D), Sisam, Accasia, Teak, Ukali Patas, Chakunda (B), Gamari, Krushna Chuda, Kaju |
| 1999-00 | 12335 | 10 | | Siris, Chakunda (D), Sisam, Accasia, Teak, Ukali Patas, Chakunda (B), Gamari, Krushna Chuda, Kaju |
| 2000-01 | 20437 | 16 | Kaduabandhi, Bhalkipatla | Siris, Chakunda (D), Sisam, Accasia, Teak, Ukali Patas, Chakunda (B), Gamari, Krushna Chuda, Kaju |
| 2001-02 | 10380 | 9 | Kaduabandhi, Girigamali, Kaduabandhi Mandir, Darjani, Bandhagaon | Siris, Chakunda (D), Sisam, Accasia, Teak, Sarifa, Soobabul, Neem, Chakunda (B), Gamari |
| 2002-03 | 9571 | 27 | Darjani, Kaduabandhi, Bandaniya | Siris, Chakunda (D), Sisam, Accasia, Teak, Sarifa, Soobabul, Neem, Chakunda (B) |
| 2003-04 | 24063 | 23 | Krushnapur, Bambilo, Siriyakholi, Kumursingha, Kaduabandi | Chakunda, Accasia, Tentuli, Babul, Sisam, Saguan, Piasal, Neem |
| 2004-05 | 25000 | 24 | Krushnapur, Bambilo, Maruabil, Bhimtanger, Chingudipal, Giringamali, & Darjani | Chakunda, Accasia, Subabul, Sisam, Gomhar, Neem, Goldmohar, Saguan, Piyasal |

| | | | | |
|---------|--------|-----|--|---|
| 2005-06 | 22430 | 26 | Krushnapur, Bambilo, Kakudia, Chingudipal | Chakunda, Accasia, Babul, Neem, Grafted mango |
| 2006-07 | 12665 | 60 | Kalarangi, Malarsahi, Sapua, Maruabil, Kakudia, Sitalbasa, Bhimatanger | Saguan, Gamari, Sisam, Krushnachuda, Neem, Grafted mango |
| 2007-08 | 7680 | 20 | Kakudia, Goramia, Kusumundia, Ransol, Kalarangi, Maruabil, Sitalbasa, Bandaniya Kankan | Chakunda, Accasia, Gamari, Saguan, Grafted mango |
| 2008-09 | 17504 | 23 | Kaduabandi, Giringamali, Siriakholi, Bhalkipatla, Maruabil, Kusumundia, Kakudia | Chakunda, Accasia, Grafted mango |
| 2009-10 | 25179 | 38 | Kankadpal, Kusumundia, Chingudipal, Kaliapani, Balkipatla, Krishnapur, Tomka Mangalpur Road Side, Kaduabandi, Kahudia, Siriakholi, Mhulkhal, Baruan | Accacia, Teak, Sisam, Chhatani, Mango, Coconut, Guava, Lemon, Gomhari, Saguan, Jatropa, Summeriaglocua |
| 2010-11 | 19180 | 26 | Kankadpal, Kusumundia, Chingudipal, Kaliapani, Benagadia, Krishnapur, Tomka Mangalpur Road Side, Kaduabandi, Kahudia, Siriakholi, Mhulkhal, Kharkhari, Seteswar, Bhimtanger, Kalarangi, Sapua, Maruabili | Accacia, Teak, Sisam, Chhatani, Arjuna, Nim, Mango, Sapeta, Lemon, Gomhari, Sirisa, Jatropa |
| 2011-12 | 25180 | 30 | Kalarangi School, Kusumundia School, Mahulkhal School, Kakudia School & village, Ransol School, Shiv Mandir, Chingudipal. | Mango, Guava, Lemon, Jackfruit, Karmnaga, Bel, Barkholi |
| 2012-13 | 4250 | 24 | Anal School, Rangamatia School, Batagaon, Kalarangi Gp High School, | Mango, Coconut, Lemon |
| 2013-14 | 6656 | 44 | Kakudia, Ransol, Kankadapal, Mathakhokasa, Odisha, Damsal, Ranki a, Sukinda, Bambilo, Avenue plantation Sukinda to Birigoda Road Garamian, Benagadia, Birigoda, Chingudipal, Mathakargola, Bheru bania | Mango, Lemon, Kaju and Saguan, Chhatia, Radha Chuda, Krishna chuda, Arjun, desi nimb, Maha nimb, Mango |
| 2014-15 | 1660 | 22 | Avenue plantation Chingudipal to Baguasahi Road, Kuhika, Kalarangi, Rangamatia, Ghaghia-sahi, Deogaon, Annatapur, Koriapal, Gurujang, Chingudipal, Natore | Mango, Teak, Deodar, Chhatia, Radha Chuda, Krishna chuda, Jamun, Kadamb, desi nimb, Maha nimb, Karanj, Lemon, Guava |
| Total | 255941 | 431 | | |

Soil: The soil ranges in colour from brown, reddish brown, brownish red, brownish black. The texture is clayey sand to sandy loam. The reaction in the soil is usually neutral. The soil is porous with good water holding capacity. The Organic matter content and phosphorus is high in planted over burden dumps and top soil supports proper plant growth.

Land use pattern - The mine being worked out by open cast methods. Concerted efforts are being put to reclaim the dumping and degraded areas with systematic afforestation programme. The company has engaged CMRI, Dhanbad and M/s SRK consultants of South Africa to study the feasibility of underground mining within the reduced lease-hold as a measure towards land reclamation.

Stage plan for reclamation - As a matter of policy, the Company takes care of preserving the greenery in the leasehold areas in the interest of ecological development as follows:

i) Trees in the non-mining areas are protected unless otherwise cutting of them becomes absolute necessity. Wherever possible trees are to be uprooted and transplanted and followed up to ensure survival.

ii) Large scale afforestation is taken up in mining areas.

iii) There is a provision to reclaim the land to be mined out in future in the same process in OB-II quarry.

The entire reclamation area is proposed to be utilised and afforested in various stages and in different manner, keeping in view the land use, as briefly indicated below:

Mining Area - At present the entire lease -hold area is under active working. Since at present, there is no abandoned quarry available for reclamation, afforestation can not be taken up in these areas. Therefore during initial years afforestation will be negligible and phasing reclamation concurrent with mining operation will not be possible since the ore body is dipping almost vertically which necessitates lateral extension of the quarry with increase in depth of the workings. Further, once the opencast mining is over after exhaust of mineable reserves, the pits shall be utilised for backfilling of overburden. Once, the capacity of backfilling is reached, it shall be reclaimed through plantation.

The reclamation in the worked out benches will be taken as by making pits of appropriate size and at regular intervals. Suitable soil preparation will be done by spreading a layer of sweet soil. Along the slopes suitable grasses will be planted to arrest the run-off and avoid soil erosion.

Waste Dumping Area - Once dumping is complete, sweet earth and cow dung manure is spread, in the areas of necessity for proper plant growth, e.g. dump containing large boulders. Terraces on the slopes are kept inward. Deep pits of 0.5m to 0.75m are been dug on the slopes at an interval of 1m X 1.5m or less depending on fertility. Saplings are planted in the pits with a mixture of top soil and manure /fertiliser. At first, grass seeds are sown. This binds the dump slopes. The seeds of leguminous herbs, creepers and other competent species are also spread whenever required. After completion of one bench a passage of about 10m-15m width is left out from the sides and then second lead is taken in the form of another bench and similar biological reclamation is done. Once a dump is complete, trenches of 45cm X 45cm size

is cut in the top flat region of the dumps to trap water. Pits (0.5m to 0.75m) are excavated in the contour trenches at intervals of 2m X 2m and will be filled with a mixture of top soil and manure/fertiliser. Garland drain is provided at the toe of old dumps to arrest run-off soil wash. At present inactive dumps have been afforested.

Peripheral Plantation: In order to avoid direct visibility of open pits from a distance and for screening of dust & noise peripheral plantation has been envisaged around the pits. Peripheral plantation is done around the COB Plant and also around the ore stock piles and colony quarter in the camp area. After cessation of mining activities, plantation will be done in the upper quarry benches.

Avenue Plantation: Plantation has been done by the side of the roads inside the colony and also by the side of roads connecting the quarries, COB Plant dump workshop magazine etc.. Plantation will be done on both the sides of the roads. The Company has already done some avenue plantation.

Species Recommended for Plantation: Keeping the local weather conditions and nature of soil in view, the following plants have been considered while recommending the species for plantation;

- (a) Natural growth of existing species and survival rate of various saplings already planted.
- (b) Suitability of a particular plant species for particular type of area.
- (c) Creation of Bio-diversity
- (d) Socio-economic & aesthetic values of plants.

| Sl No. | Botanical Name | Common Name |
|--------|-----------------------|-------------|
| 1 | Albizzia lebbek | Siris |
| 2 | Prosopis juliflora | Juliflora |
| 3 | Melia azadirachta | Bakain |
| 4 | Terminalia arjuna | Arjun |
| 5 | Luceana lucocephala | Subabul |
| 6 | Melina arborea | Gamhar |
| 7 | Psidium guajava | Guava |
| 8 | Acacia auriculiformis | Acacia |
| 9 | Azadirachta indica | Neem |
| 10 | Terminalla tomentosa | Asan |
| 11 | Zizyphus jujube | Ber |
| 12 | Shorea robusta | Sal |
| 13 | Tectona grandis | Teak |
| 14 | Delbergia sisso | Sisham |

Site preparation

Once dumping is complete, sweet earth and cow dung manure is spread & then plantation work is carried out.

Pit size & spacing

The pit size is 0.25m x 0.5m or more depending on the nature of soil and kind of species to be planted. Pit digging operation will be coupled with bush cleaning so that the pits will get sufficient time to be exposed to sun for further operation and to avoid competition for the inputs. For regular plantation i.e. in mining area and open space the spacing between the adjacent saplings will be 2m. and for dump plantation the spacing will vary from 1m to 2m. whereas for avenue /ornamental plantation the spacing may increase upto 6m. depending on the soil type and species under plantation. These pits will be filled up with sweet earth, organic manure and sand (if required). Neem cake powder, BHC will also be applied to protect the plants from white ants. Pit preparation will be completed before monsoon so that planting operation can be taken care of at the onset of monsoon.

Protection and post plantation care.

Since the saplings are planted during monsoon watering of the plants is done only during dry spell. Further watering is done before applying chemical fertilisers and during dry days to ensure that the soil moisture is within the range of available water.

Besides basal dose of fertiliser, split application of fertiliser will be done for two more times after weeding and other intercultural operations.

Plants will be protected against insect pests, diseases etc., by applying pesticides as and when required. To save the plants from grazing by goats and cattle suitable fencing, tree guards will be provided. In addition regular watch and ward personnel will be ensuring the protection of these plants at vulnerable areas. Mulching will also be provided at suitable places to check the soil evaporation loss especially during dry seasons.

Nursery Technique

For success of afforestation programme, availability of the required species of saplings is the basic requisite. The Tata Steel Rural Development Society (TSRDS) has developed a nursery farm of capacity 1 lakh saplings per year in the lease area for supply of different types of species. In addition to this TSRDS encourages local village women to grow saplings which are then brought either to the mines or are utilised for village plantation to create awareness among the local population to grow and protect the trees.

In the nursery, the seeds of required species are obtained and germinated in the nursery bed from where the seedlings are transplanted into polythene bags filled with a mixture of top and

cow dung manure. The seedlings are allowed to grow at least one and half ft high in the polythene bags before plantation. The same procedure will followed in future also.

Reclamation & Afforestation Plan:

The company has a systematic approach towards the green belt programme which includes forestry on dumps, camp and peripheral plantation. The density of forest proposed over the dumps is about 2500 trees per hectare, when fully developed. This is going to be more than the existing density of the nearby area. This forest growth along with the confined water bodies has a positive impact on local climate. The plantation along the quarry periphery, around COB plant, along the roads & in and around offices has helped in improving the landscape.

Apart from greening of the overburden dumps, the peripheral plantation within township will enhance the aesthetics of the area in coming future. The green belt so developed acts as noise and dust barrier. The plantation include such species which have been found to be quite popular in this area, such as, Neem, Cashew, Sal, Jamun, Sisu, Mango, Guava, Jackfruit, Teak, Accacia and Mahul etc. Depending upon the species, the spacing will vary from 1.5 m. to 5.0 m. Normally, saplings which are at least 2/3 years old, averaging 60 cm. in height are only accepted for plantation.

The entire requirement of plants/ saplings is met by either TSRDS (Tata Steel Rural Development Society), Forest Department or Regional Plant Resource Centre, Bhubaneswar from their nurseries. Apart from their own nurseries, TSRDS encourages local villages in developing nurseries from where they supply the required plants.

Necessary post- plantation care in the form of barbed-wired fencing, individual tree guards, trenches around the plantation and guarding etc. is provided as per requirement. The watering of the plants during dry season continues till the plants can be self-sustaining. The survival is to the tune of 70 to 80%. For financial assistance to the programme adequate fund has been provided for plantation & maintenance purposes and the budgetary provision is made each year for these jobs.

Status of year wise proposed and actual tree plantations as well as total area proposed and actual area covered for tree plantation from 1998-99 is furnished in Annexure-A. Proposal of reclamation by backfilling and dump plantation till Lease period is also planned, which is given in Annexure-B.


The reclamation of the quarried area will be carried out after reaching the economic pit bottom by opencast method of mining. Then the quarry will be suitably restored by back-filling. The waste dump area within the reduced lease-hold and the portion of the waste dumping area within the applied area after reaching its maximum holding capacity will be covered with terraced forest growth with an expected density of 2500 trees per hectare. The plantation will include species most suitable to local condition.

Annexure-A**Year Plantation Planned and Actual Done**

| Year | Plan (Within ML) | | Actual (within ML) | | Plan (Outside ML) | | Actual (Outside ML) | |
|---------|------------------|------------|--------------------|------------|---------------------------------|------------|---------------------|------------|
| | Nos. of Sapling | Area in Ha | Nos. of Sapling | Area in Ha | Nos. of Sapling | Area in Ha | Nos. of Sapling | Area in Ha |
| 1998-99 | 4000 | 1.620 | 4000 | 1.700 | | | | |
| 1999-00 | 4000 | 1.620 | 18000 | 4.000 | | | | |
| 2000-01 | 5000 | 2.020 | 28342 | 2.000 | | | | |
| 2001-02 | 5000 | 2.020 | 15000 | 0.500 | | | | |
| 2002-03 | 5000 | 2.020 | 22000 | 1.500 | | | | |
| 2003-04 | 10000 | 4.000 | 45500 | 1.500 | | | | |
| 2004-05 | 2500 | 1.000 | 48000 | 1.000 | | | | |
| 2005-06 | 6250 | 2.500 | 75000 | 2.500 | | | | |
| 2006-07 | 14375 | 5.750 | 129500 | 5.750 | | | | |
| 2007-08 | 13550 | 5.420 | 94000 | 4.420 | Additional Area (100ha)obtained | | | |
| 2008-09 | 3000 | 1.200 | 85250 | 2.940 | 8750 | 3.500 | 36750 | 1.760 |
| 2009-10 | 4000 | 1.600 | 28000 | 3.900 | 17750 | 7.100 | 56000 | 5.600 |
| 2010-11 | 0 | 0.000 | 25000 | 2.000 | 20000 | 8.000 | 60000 | 6.500 |
| 2011-12 | 11250 | 4.500 | 45000 | 4.500 | 8750 | 3.500 | 35000 | 3.500 |
| 2012-13 | 4625 | 1.900 | 5700 | 1.830 | 21375 | 8.550 | 40000 | 6.500 |
| 2013-14 | 6250 | 2.500 | 3700 | 1.320 | 20000 | 8.000 | 54326 | 5.600 |
| 2014-15 | 4000 | 1.600 | 4050 | 1.200 | 19875 | 7.950 | 50100 | 5.100 |
| TOTAL | 102800 | 41.270 | 676042 | 42.560 | 116500 | 46.600 | 332176 | 34.560 |

Note: Actual plantation in additional area is less than plan due to delay in phased allotment of land

For TATA STEEL LTD.
By their Constituted Attorney



(GANESH PRASAD SAHU)
Head (Ferro Alloys Production)
Ferro Alloys & Minerals Division

Annexure-B

Reclamation & Afforestation Proposal within Lease Hold area

| Year | Plantation Target | | Backfilling of Quarries (ha) |
|---------|-------------------|--------|---------------------------------|
| | Area (ha.) | Nos. | |
| 2013-18 | 13.50 | 33750 | 42.00 |
| 2018-23 | 42.00 | 105000 | 30.00 |
| 2023-28 | 68.40 | 170875 | 0.00 |
| 2028-33 | 85.20 | 213025 | 0.00 |
| Total | 209.1 | 522650 | 72.00 |

**For TATA STEEL LTD.
By their Constituted Attorney**


(GANESH PRASAD SAHU)
Head (Ferro Alloys Production)
Ferro Alloys & Minerals Division