

Ref. No.: MCL/GM/MLA/PO/SOCP/2022-23/235

Date: 05/08/2022

To,

The Divisional Forest Officer
Sundargarh Forest Division
District: Sundargarh, Odisha

Subject: Submission of additional information / documents in respect of point wise compliance of stipulated conditions of Stage-I FC approval for the proposal for non-forestry use of 349.709 ha forest land within total mining lease area of 2290.449 ha in favour of M/s Mahanadi Coalfields Limited for Siarmal OCP of Mahalaxmi Area in Sundargarh District (Odisha). Proposal No.: FP/OR/MIN/32796/2018

Ref No. 1. Stage – I FC approval of MoEF&CC, Govt. of India vide file no. 8-25/2021-FC dated 21.04.2022
2. Letter no. 2683/4F(MISC)/2022 dated 21.05.2022 of DFO, Sundargarh (Odisha).
3. Letter no. MCL/GM/MLA/PO/SOCP/2022-23/231 dated 31.07.2022.

Dear Sir,

In reference to Stage – I FC approval of MoEF&CC, Govt. of India vide file no. 8-25/2021-FC dated 21.04.2022 and subsequent letter no. 2683/4F(MISC)/2022 dated 21.05.2022 of DFO, Sundargarh (Odisha), point wise compliance of stipulated conditions of Stage-I FC approval for the proposal for non-forestry use of 349.709 ha forest land within total mining lease area of 2290.449 ha in favour of M/s Mahanadi Coalfields Limited for Siarmal OCP of Mahalaxmi Area in Sundargarh District (Odisha) (Proposal No.: FP/OR/MIN/32796/2018) was submitted vide letter no. MCL/GM/MLA/PO/SOCP/2022-23/231 dated 31.07.2022.

Further to the above, following additional information / documents are being submitted:-

1. An Undertaking in respect of Condition no. 4 (i) of Para A of Stage – I Clearance vide file No.8-25/2021-FC dated 21.04.2022 to the effect that "mitigative measures to minimize soil erosion and choking of stream shall be implemented within a period of three years with effect from the issuance of Stage-II clearance as per the approved scheme in consultation with the State Forest Department" as **Annexure – IV (B)**.
2. An Undertaking in respect of Condition no. 4 (ii) of Para A of Stage – I Clearance vide file No.8-25/2021-FC dated 21.04.2022 "to implement planting of adequate drought hardy plant species and sowing of seeds in the appropriate area within the mining lease area of Siarmal OCP to arrest soil erosion as per the approved scheme" as **Annexure – V (A)**.
3. An Undertaking in respect of Condition no. 4 (iii) of Para A of Stage – I Clearance vide file No.8-25/2021-FC dated 21.04.2022 "to implement the construction of check dam, retention / toe walls to arrest sliding down of the excavated material along the contour as per the approved scheme" as **Annexure - VI (A)**.
4. An Undertaking in respect of Condition no. 4 (iv) of Para A of Stage – I Clearance vide file No.8-25/2021-FC dated 21.04.2022 "to implement the approved scheme to stabilize the overburden dumps of Siarmal OCP by appropriate grading / benching, so as to ensure that angles of repose at any given place is less than 28°" as **Annexure – VII (A)**.


Project Officer
Siarmal OCP

5. An Undertaking in respect of Condition no. 4 (v) of Para A of Stage – I Clearance vide file No.8-25/2021-FC dated 21.04.2022 “to implement the approved top soil management plan to ensure ‘no damage’ to the top soil with strict adherence to the top soil management plan of Siarmal OCP” as **Annexure - VIII (A)**.
6. An Undertaking in respect of Condition no. 7 of Para A of Stage – I Clearance vide file No.8-25/2021-FC dated 21.04.2022 “to pay the demand raised by State Forest Department towards appropriate anticipated increased cost while implementation of the approved scheme for Gap planting and soil and moisture conservation activities to restock and rejuvenate the degraded open forests (having crown density less than 0.4), located in the area within 100 meters from outer perimeter of the mining lease boundary over 60 ha in Garjan Jore R.F. of Gopalpur Range of Sundargarh Forest Division” as **Annexure - XI (A)**.
7. An Undertaking in respect of Condition no. 8 of Para A of Stage – I Clearance vide file No.8-25/2021-FC dated 21.04.2022 “to implement the approved scheme for de-silting of village tanks and other water bodies so as to mitigate the impact of siltation of such tanks/ water bodies within 5 km from the mining lease boundary of Siarmal OCP” as **Annexure – XII (A)**.
8. An Undertaking in respect of Condition no. 9 (iii) of Para A of Stage – I Clearance vide file No.8-25/2021-FC dated 21.04.2022 “to implement the approved scheme for fencing, protection and regeneration of safety zone area of 7.5 meter strip within the mining lease boundary of Siarmal OCP over 18.59 ha to be maintained as green belt around mining lease and shall ensure dense canopy in the area” as **Annexure – XV (A)**.
9. An Undertaking in respect of Condition no. 9 (iv) of Para A of Stage – I Clearance vide file No.8-25/2021-FC dated 21.04.2022 “to pay the demand raised by State Forest Department towards appropriate anticipated increased cost while implementation of the approved scheme for afforestation of degraded forest land in extent one and half times of forest land in safety zone area in respect of Siarmal OCP” as **Annexure – XVI (A)**.
10. Further Clarification in respect of Condition no. 9 (ii) of Para A of Stage – I Clearance vide file No.8-25/2021-FC dated 21.04.2022:-
An undertaking to this effect is has been already enclosed as Annexure-XIV along with the compliance submitted vide letter no 231 dated 31.07.2022.
11. Further Clarification in respect of Condition no. 3 of Para B of Stage – I Clearance vide file No.8-25/2021-FC dated 21.04.2022:-

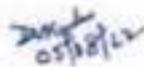
In compliance to the above condition it is submitted that the DGPS survey has been conducted over boundaries of forest land of 5.256 granted on patta, within the patch of 129 ha of degraded forest land proposed for CA land in Jamkani Reserved Forest. The map so generated has also been submitted.

This is to clarify that the generated map showing the surveyed area to be 5.448 ha, which is 0.192 ha (3.652%) more than the surveyed area i.e. 5.256 ha.

As per the ORSAC's note in the submitted DGPS map the DGPS survey map is correct with the confidence level upto 95%. So the deviation of 0.192 ha in the surveyed map is within the acceptable limit.

Therefore, the above clarification may kindly be accepted.

Yours faithfully,


Project Officer
Siarmal OCP
Mahalaxmi Area, MCL
Project Officer
Siarmal OCP
Maharadi Coalfields Limited

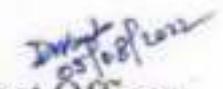
Annexure-IV (B)

UNDERTAKING

(Condition no. 4 (i) of Para A of Stage – I Clearance vide file No.8-25/2021-FC dated 21.04.2022)

I/we do hereby undertake that “mitigative measures to minimize soil erosion and choking of stream shall be implemented within a period of three years with effect from the issuance of Stage-II clearance as per the approved scheme in consultation with the State Forest Department”.


General Manager
Mahalaxmi Area, MCL
General Manager
Mahalaxmi Area
Mahanadi Coal Fields Limited


Project Officer
Siarmal OCP, MCL
Project Officer
Siarmal OCP
Mahanadi Coalfields Limited

Annexure-V (A)

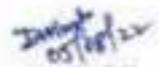
UNDERTAKING

(Condition no. 4 (ii) of Para A of Stage - I Clearance vide file No.8-25/2021-FC dated 21.04.2022)

I/we do hereby undertake "to implement planting of adequate drought hardy plant species and sowing of seeds in the appropriate area within the mining lease area of Siarmal OCP to arrest soil erosion as per the approved scheme"


General Manager
Mahalaxmi Area, MCL

General Manager
Mahalaxmi Area
Mahanadi Coal Fields Limited


Project Officer
Siarmal OCP, MCL

Project Officer
Siarmal OCP
Mahanadi Coalfields Limited

Annexure-VI (A)

UNDERTAKING

(Condition no. 4 (iii) of Para A of Stage - I Clearance vide file No.8-25/2021-FC dated 21.04.2022)

I/we do hereby undertake "to implement the construction of check dam, retention / toe walls to arrest sliding down of the excavated material along the contour as per the approved scheme."

General Manager,
Mahalaxmi Area, MCL

General Manager
Mahalaxmi Area
Mahanadi Coal Fields Limited

Project Officer
Siarmal OCP, MCL

Project Officer
Siarmal OCP
Mahanadi Coal Fields Limited

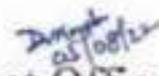
Annexure- VII (A)

UNDERTAKING

(Condition no. 4 (iv) of Para A of Stage – I Clearance vide file No.8-25/2021-FC dated 21.04.2022)

I/we do hereby undertake “to implement the approved scheme to stabilize the overburden dumps of Siarmal OCP by appropriate grading/ benching, so as to ensure that angles of repose at any given place is less than 28°.”


General Manager
Mahalaxmi Area, MCL
General Manager
Mahalaxmi Area
Mahanadi Coal Fields Limited


Project Officer
Siarmal OCP, MCL
Project Officer
Siarmal OCP
Mahanadi Coalfields Limited

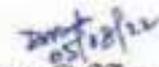
Annexure-VIII (A)

UNDERTAKING

(Condition no. 4 (v) of Para A of Stage – I Clearance vide file No.8-25/2021-FC dated 21.04.2022)

I/we do hereby undertake “to implement the approved top soil management plan to ensure ‘no damage’ to the top soil with strict adherence to the top soil management plan of Siarmal OCP.”


General Manager
Mahalaxmi Area, MCL
General Manager
Mahalaxmi Area
Mahanadi Coal Fields Limited


Project Officer
Siarmal OCP, MCL
Project Officer
Siarmal OCP
Mahanadi Coalfields Limited

Annexure-XI (A)

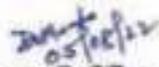
UNDERTAKING

(Condition no. 7 of Para A of Stage – I Clearance vide file No.8-25/2021-FC dated 21.04.2022)

I/we do hereby undertake that “to pay the demand raised by State Forest Department towards appropriate anticipated increased cost while implementation of the approved scheme for Gap planting and soil and moisture conservation activities to restock and rejuvenate the degraded open forests (having crown density less than 0.4), located in the area within 100 meters from outer perimeter of the mining lease boundary over 60 ha in Garjan Jore R.F. of Gopalpur Range of Sundargarh Forest Division”


General Manager
Mahalaxmi Area, MCL

General Manager
Mahalaxmi Area
Mahanadi Coal Fields Limited


Project Officer
Siarmal OCP, MCL

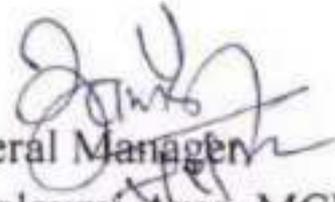
Project Officer
Siarmal OCP
Mahanadi Coalfields Limited

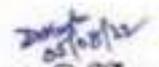
Annexure- XII (A)

UNDERTAKING

(Condition no. 8 of Para A of Stage – I Clearance vide file No.8-25/2021-FC dated 21.04.2022)

I/we do hereby undertake “to implement the approved scheme for de-silting of village tanks and other water bodies so as to mitigate the impact of siltation of such tanks/ water bodies within 5 km from the mining lease boundary of Siarmal OCP.”


General Manager
Mahalaxmi Area, MCL
General Manager
Mahalaxmi Area
Mahanadi Coal Fields Limited

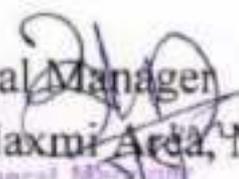

Project Officer
Siarmal OCP, MCL
Project Officer
Siarmal OCP
Mahanadi Coalfields Limited

Annexure-XV (A)

UNDERTAKING

(Condition no. 9 (iii) of Para A of Stage – I Clearance vide file No.8-25/2021-FC dated 21.04.2022)

I/we do hereby undertake “to implement the approved scheme for fencing, protection and regeneration of safety zone area of 7.5 meter strip within the mining lease boundary of Siarmal OCP over 18.59 ha to be maintained as green belt around mining lease and shall ensure dense canopy in the area.”


General Manager
Mahalaxmi Area, MCL
General Manager
Mahalaxmi Area
Mahanadi Coal Fields Limited


Project Officer
Siarmal OCP, MCL
Project Officer
Siarmal OCP
Mahanadi Coalfields Limited

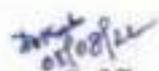
Annexure- XVI(A)

UNDERTAKING

(Condition no. 9 (iv) of Para A of Stage – I Clearance vide file No.8-25/2021-FC dated 21.04.2022)

I/we do hereby undertake that “to pay the demand raised by State Forest Department towards appropriate anticipated increased cost while implementation of the approved scheme for afforestation of degraded forest land in extent one and half times of forest land in safety zone area in respect of Siarmal OCP.”


General Manager
Mahalaxmi Area, MCL
General Manager
Mahalaxmi Area
Mahanadi Coal Fields Limited


Project Officer
Siarmal OCP, MCL
Project Officer
Siarmal OCP
Mahanadi Coalfields Limited



Ref. No.: MCL/GM/MLA/PO/SOCP/2022-23/ 23]

Date: 31/07/2022

To,
The Divisional Forest Officer
Sundargarh Forest Division
District: Sundargarh, Odisha

Subject: Submission of point wise compliance of stipulated conditions of Stage-I FC approval for the proposal for non-forestry use of 349.709 ha forest land within total mining lease area of 2290.449 ha in favour of M/s Mahanadi Coalfields Limited for Siarmal OCP of Mahalaxmi Area in Sundargarh District (Odisha). Proposal No.: FP/OR/MIN/32796/2018

Ref No. 1. Stage - I FC approval of MoEF&CC, Govt. of India vide file no. 8-25/2021-FC dated 21.04.2022
2. Letter no. 2683/4F(MISC)/2022 dated 21.05.2022 of DFO, Sundargarh (Odisha).

Dear Sir,

In reference to Stage - I FC approval of MoEF&CC, Govt. of India vide file no. 8-25/2021-FC dated 21.04.2022 and subsequent letter no. 2683/4F(MISC)/2022 dated 21.05.2022 of DFO, Sundargarh (Odisha), we are hereby submitting point wise compliance of stipulated conditions of Stage-I FC approval for the proposal for non-forestry use of 349.709 ha forest land within total mining lease area of 2290.449 ha in favour of M/s Mahanadi Coalfields Limited for Siarmal OCP of Mahalaxmi Area in Sundargarh District (Odisha). Proposal No.: FP/OR/MIN/32796/2018 as under:-

Conditions which need to be complied prior to handing over of forest land by the State Forest Department and compliance is to be submitted prior to Stage-II approval.

Compensatory Afforestation

The cost of compensatory afforestation at the prevailing wage rates as per compensatory afforestation scheme and the cost of survey, demarcation and erection of permanent pillars if required on the CA land, shall be deposited in State CAMPA account, through e-billan, by user agency. The CA will be maintained for 10 years. The scheme may include

⑦
Received
2.8.22



Project Officer
Siarmal OCP
Mahanadi Coalfields Limited

afforestation of indigenous species with appropriate provision for anticipated cost increase for work schedule for subsequent years;

Reply: Forest Land applied for diversion is 349.709 ha which includes Safety Zone of 3.93 ha. So, compensatory afforestation to be done over an area of 691.558 ha $((349.709 \text{ ha} - 3.93 \text{ ha}) \times 2)$. In compliance to the above point, it is submitted that the Divisional Forest Officer, Sundargarh Forest Division vide letter no. **2523/4F (MISC.)/2022** dated 09/05/2022 (enclosed as **Annexure I**) had raised the demand for payment of approved cost of compensatory afforestation Rs. 11,79,54,700/- & Rs. 1,54,13,200/- over 692.000 ha. Above CA schemes are for Satpurlia R.F. effective area - 581.00 ha and Jamkani R.F. - 111 ha respectively totaling CA area of 692.000 ha.

The User Agency has made the payment of **Rs. 65,04,30,880.00** (Rupees Sixty Five Crore Four Lakh Thirty Thousand Eight Hundred Eighty only) towards the State Specific Account, Odisha CAMPA A/c No. 150825832796370 of Union Bank Of India, IFSC Code UBIN0903710 on 09.06.2022 through RTGS mode vide **UTR No. SBIN222160788520**.

The challan payment includes **Rs. 13,33,67,900.00** towards cost of compensatory afforestation, Rs. 42,96,48,980.00 towards NPV of 349.709 ha of revenue forest land, and Rs. 8,74,14,000.00 towards Site Specific Wildlife Conservation Plan, as per the demand raised by the DFO, Sundargarh Forest Division.

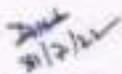
The copy of the E-Challan generated through Parivesh portal and the computer-generated e-payment statement is enclosed herewith as **Annexure I (A) & I (B)** respectively.

The user agency hereby undertakes to pay the appropriate anticipated increase cost for works scheduled for subsequent years. The undertaking is hereby attached as **Annexure I (C)**.

ii. **The KML files of diverted area, the CA areas, the proposed SMC treatment area and the WLMP area shall be uploaded on the e-Green watch portal with all requisite details prior to Stage II approval;**

Reply: In compliance to the above-mentioned point, the KML files & requisite details of diverted area, the CA areas, the proposed SMC treatment area and the SSWI/CP area have been duly uploaded on the e Green watch portal.

The screenshot images of e-Green watch portal while uploading the required documents is being attached herewith as **Annexure II**.


Project Officer
Sarmati OCP
Maharaja Confields Limited

2. **The user agency shall transfer the funds towards the cost of Net Present Value (NPV) of forest land being diverted under this proposal in accordance with the MoEF&CC's guidelines dated 6.01.2022 read with guidelines dated 19.01.2022:**

Reply- In compliance to the above, the Divisional Forest Officer, Sundargarh vide letter no. 2683/4F(MISC)/2022 dated 21.05.2022(enclosed as **Annexure III**) had raised the demand of **Rs. 42,96,48,980.00** towards the Net Present Value of **349.709 ha** of forest land proposed for diversion. Accordingly, the User Agency has made the payment of **Rs. 65,04,30,880.00** (Rupees Sixty Five Crore Four Lakh Thirty Thousand Eight Hundred Eighty only) towards the State Specific Account, Odisha CAMPA A/c No. 150825832796370 of Union Bank Of India, IFSC Code UBIN0903710 on 09.06.2022 through RTGS mode vide **UTR No. SBIN222160788520**.

The challan payment includes Ra. 13,33,67,900.00 towards cost of compensatory afforestation, **Rs. 42,96,48,980.00** towards NPV of **349.709 ha** of revenue forest land, and Rs. 8,74,14,000.00 towards Site Specific Wildlife Conservation Plan, as per the demand raised by the DFO, Sundargarh Forest Division.

The copy of the E-Challan generated through Parivesh portal and the computer-generated e-payment statement is enclosed herewith as **Annexure I (A) & I (B)** respectively.

3. **Compensatory levies to be realized from the User Agency under the project, shall be transferred/ deposited through E-challan, into the account of CAMPA pertaining to the State concerned through e-portal(<http://parivesh.nic.in/>):**

Reply: In compliance to the above, the User Agency has made the payment of **Rs. 65,04,30,880.00** (Rupees Sixty Five Crore Four Lakh Thirty Thousand Eight Hundred Eighty only) towards the State Specific Account, Odisha CAMPA A/c No. 150825832796370 of Union Bank Of India, IFSC Code UBIN0903710 on 09.06.2022 through RTGS mode vide **UTR No. SBIN222160788520**.

The challan payment includes **Rs. 13,33,67,900.00** towards cost of compensatory afforestation, Rs. 42,96,48,980.00 towards NPV of 349.709 ha of revenue forest land, and Rs. 8,74,14,000.00 towards Site Specific Wildlife Conservation Plan, as per the demand raised by the DFO, Sundargarh Forest Division.

The copy of the E-Challan generated through Parivesh portal and the computer-generated e-payment statement is enclosed herewith as **Annexure I (A) & I (B)** respectively.

4. **Following activities, as per approved plan/ schemes, shall be undertaken in the lease area by the User Agency under the supervision of the State Forest Department. Approved**

31/3/22
Project Officer
Sirmal OCP
Maharadi Coalfields Limited

scheme/plan shall be submitted to the Ministry along with compliance of Stage-I approval:

- i. Mitigative measures to minimize soil erosion and choking of stream shall be implemented within a period of three years with effect from the issue of Stage-II clearance in accordance with the approval plan in consultation with the State Forest Department.

Reply-In compliance to the above point, the scheme has been prepared in consultation with DFO, Sundargarh Forest Division for taking up mitigating measures to minimize soil erosion and choking of streams over an area of 20ha within mine lease boundary. The scheme has been duly approved by the RCCF, Rourkela Circle, Rourkela for financial outlay of Rs. 8,19,150/- (Rupees Eight Lakh Nineteen Thousand One Hundred Fifty only) vide Memo no. 2265/3F-761/2022 dated 16.07.22 (enclosed as **Annexure IV**).

The implementation of the proposed measures will be done by the user agency in consultation with the DFO, Sundargarh Forest Division.

The copy of the approved scheme for mitigative measures to be taken up to minimize soil erosion and choking of streams is enclosed herewith as **Annexure-IV (A)**.

- ii. **Planting of adequate drought hardy plant species and sowing of seeds in the appropriate area within the mining lease to arrest soil erosion in accordance with the approved scheme:**

Reply-In compliance to the above point, a scheme has been prepared in accordance with the mine plan and EMP for planting of adequate drought hardy plant species and sowing of seeds in the appropriate area within the mining lease to arrest soil erosion over 409.99 ha of backfilled area within the mined-out area in a cumulative phase manner. The scheme has been duly approved by the RCCF, Rourkela Circle, Rourkela for financial outlay of Rs. 16,02,02,610/- (Rupees Sixteen Crore Two Lakh Two Thousand Six Hundred Ten only) vide Memo no. 2265/3F-761/2022 dated 16.07.22 (enclosed as **Annexure IV**).

The implementation of the proposed measures will be done by the user agency in consultation with the DFO, Sundargarh Forest Division.

The copy of the approved scheme for planting of adequate drought hardy plant species and sowing of seeds in the appropriate area within the mining lease to arrest soil erosion is enclosed herewith as **Annexure-V**.

20/7/22
8/12/22
Joint Office of
RCCF, Rourkela
and District Forest
Officer, Sundargarh

- iii. **Construction of check dam, retention /toe walls to arrest sliding down of the excavated material along the contour in accordance with the approved scheme.**

Reply-In compliance to the above point, a scheme has been prepared for construction of check dam, retention /toe walls to arrest sliding down of the excavated material along the contour in accordance with the approved Mine plan and Environment Management Plan of the project.

The scheme has been duly approved by RCCF, Rourkela Circle, Rourkela for financial outlay of **Rs. 2,54,38,910/- (Rupees Two Crore Fifty-Four Lakh Thirty- Eight Thousand Nine Hundred Ten only)** vide Memo no. 2265/3F-761/2022 dated 16.07.22 (**enclosed as Annexure IV**).

The implementation of the proposed measures will be done by the user agency under technical expertise of the executing team of the project in consultation of State Forest Department.

The copy of the approved scheme prepared for construction of check dam, retention /toe walls to arrest sliding down of the excavated material along the contour is enclosed herewith as **Annexure-VI**.

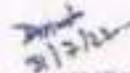
- iv. **Stabilize the overburden dumps by appropriate grading/ benching, in accordance with the approved scheme, so as to ensure that angles of repose at any given place is less than 28°.**

Reply- In compliance to the above point, a scheme has been prepared for the stabilization of the overburden dumps by appropriate grading/benching so as to ensure that angles of response at any given place is less than 28° in accordance with the approved Mine plan and Environment Management Plan of the project.

The scheme has been duly approved by the RCCF, Rourkela Circle, Rourkela for financial outlay of **Rs. 1,04,09,570/- (Rupees One Crore Four Lakh Nine Thousand Five Hundred Seventy only)**vide Memo no. 2265/3F-761/2022 dated 16.07.22 (**enclosed as Annexure IV**).

The implementation of the proposed measures will be done by the user agency under technical expertise of the executing team of the project in consultation of State Forest Department.

The copy of the approved scheme prepared to stabilize the overburden dumps by appropriate grading/ benching, in accordance with the approved scheme, so as to ensure that angles of repose at any given place is less than 28°is enclosed herewith as **Annexure-VII**.


Project Officer
Barmal OCP
Coalfields Limited

- v. **No damage shall be caused to the top-soil and the user agency with follow the topsoil management plan.**

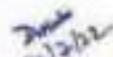
Reply- In compliance to the above point, a scheme has been prepared for top soil management to ensure 'no damage' to the top soil with strict adherence to the top soil management plan over 20 ha (2 nos. of temporary locations) in accordance with the Mining Plan and Environment Management Plan. The scheme has been duly approved by the RCCF, Rourkela Circle, Rourkela for financial outlay of Rs 4,01,600/- (**Rupees Four Lakh One Thousand Six Hundred only**) vide Memo no. 2265/3F-761/2022 dated 16.07.22 (**enclosed as Annexure IV**). The implementation of the proposed measures will be done by the user agency under technical expertise of the executing team of the project in consultation of State Forest Department.

The copy of the approved scheme for top soil management to ensure 'no damage' to the top soil with strict adherence to the top soil management plan is enclosed herewith as **Annexure-VIII**.

5. **Chhatajor Nallah located in the area has been proposed to be straightened by the user agency. Also, number of mines are operational in the area which may cause threat to hydrological regime viz. Basundhara River and its rivulets, therefore, a study on hydrological regimes of the area will be undertaken in consultation with the Water Resource Department and the same shall be submitted along with considered opinion of Water Resource Department of the State on the proposed straightening of Chhatajor nallah and proposed mitigating measures before Stage-II approval:**

Reply: In compliance to the above point, the User Agency (Siarnal Open Cast Coal Mining Project of M/s Mahanadi Coalfields Limited) have engaged a consultant namely M/s Kalinga Commercial Corporation Limited, Bhubaneswar on 13.05.2022 to study the hydrological regime of the area. **Chhatajor Nallah located in the area will not be straightened by the user agency. And the study of the hydrological regime has been undertaken towards the protection of the Basundhara River and its rivulets.** The consultant has already completed the field survey of the study area and preparing the Study Report. The report will elaborate the details of the study conducted by field surveys and plan and vision to develop an integrated approach for the protection of the Basundhara River on the proposed mining in the area along with cost estimates for execution of the plan. The consultant is expected to submit the report by 13.08.2022.

The report so prepared by the consultant will be submitted by the User Agency to Water Resource Department, Govt. of Odisha for obtaining considered opinion in compliance of the above condition of


Project Officer
Siarnal OCP
Mahanadi Coalfields Limited

MoEF&CC, Govt. of India. Opinion of Water Resource Department, Govt. of Odisha is likely to be obtained by 15.09.2022. Therefore, an undertaking is hereby being submitted as **Annexure IX** that the Study Report along with considered opinion of Water Resource Department, Govt. of Odisha will be submitted to the MoEF&CC, Govt. of India by 15.09.2022.

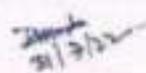
The user agency is also submitting in the said undertaking mentioning that the execution of the activities will be carried out as per the Study Report along with considered opinion of Water Resource Department, Govt. of Odisha, at project cost by Sirmal Open Cast Coal Mining Project of M/s Mahanadi Coalfields Limited.

6. **A Soil & Moisture Conservation (SMC) work plan to mitigate the impact of the proposed mining activity on the local rivulets (nallah) shall be prepared by the user agency in consultation with the State Forest Department and the same shall be submitted along with the Stage-I compliance. Cost of implementation of the provisions of the said plan will be deposited into the CAMPA and the same shall be intimated to the Ministry before Stage-II approval:**

Reply: In compliance to the above point, the user agency through CMPDI (Central Mine Planning and Design Institute, a subsidiary of Coal India Limited) has prepared a soil & moisture conservation (SMC) work plan over 357 ha of Jankani Reserved Forest of Gopulpur Range of Sundargarh Forest Division. The proposed forest land is a non-coal bearing reserved forest land located at the upstream of the Basundhara River, and forming a catchment area to the river.

The soil & moisture conservation (SMC) work plan has been duly approved by the RCCF, Rourkela Circle, Rourkela for financial outlay of Rs6,12,09,030/- (Rupees Six Crore Twelve Lakh Nine Thousand Thirty only). The Divisional Forest Officer, Sundargarh vide letter no. 4597/4F(MISC)/2022 dated 18.07.2022 (enclosed as **Annexure X**) raised the demand as per the scheme and accordingly, the User Agency has made the payment of Rs. 9,38,55,100 (Rupees Nine Crores thirty-eight lakh fifty-five thousand and one hundred only) towards the State Specific Account, Odisha CAMPA A/c No. 150825832796988 of Union Bank of India, IFSC Code UBIN0996335 on 25.07.2022 through RTGS mode vide UTR No. SBINR52022072596043074.

The challan payment includes **Rs. 6,12,09,030/-** towards soil and moisture Conservation (SMC) work plan to mitigate the impact of the proposed mining activity on the local rivulets (Nallah), **Rs. 2,91,17,860/-** towards scheme for gap planting and moisture conservation to restock and rejuvenate the degraded open forests located in the area within 100 m from outer perimeter of the mining lease, and


Project Officer
Sirmal OCP
Mahanadi Coalfields Limited

Rs. 35,28,210/- towards scheme for afforestation over 1.5 times of safety zone, as per the demand raised by the DFO, Sundargarh Forest Division.

The copy of the E-Challan generated through Parivesh portal with NEFT transaction detail, and payment status image on Parivesh portal is enclosed herewith as **Annexure X (A) & X (B)** respectively.

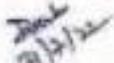
The copy of the approved soil & moisture conservation (SMC) work plan & plates are enclosed herewith as **Annexure X (C) and Annexure X (D)** respectively.

- 7. The user agency either himself or through the State Forest Department shall undertake gap planting and soil and water conservation activities to restock and rejuvenate the degraded open forests (having crown density less than 0.40), if any, located in the area within 100 from outer perimeter of the mining lease. The plan for plantation and SMC activities will be prepared and submitted to MoEF&CC before Stage-II clearance:**

Reply- In compliance to the above point, a scheme for gap planting and soil and moisture conservation activities to restock and rejuvenate the degraded open forests (having crown density less than 0.4), located in the area within 100 meters from outer perimeter of the mining lease boundary over 60 ha in GarjanJore R.F. of Gopalpur Range of Sundargarh Forest Division has been prepared and has been duly approved by RCCF, Rourkela Circle, Rourkela for financial outlay of **Rs. 2,91,17,860.00 (Rupees Two Crore Ninety-One Lakh Seventeen Thousand Eight Hundred Sixty only).**

The Divisional Forest Officer, Sundargarh vide letter no. 4597/4F(MISC)/2022 dated 18.07.2022 (enclosed as **Annexure X**) raised the demand as per the scheme and accordingly, the User Agency has made the payment of Rs. 9,38,55,100 (Rupees Nine Crores thirty-eight lakh fifty-five thousand and one hundred only) towards the State Specific Account, Odisha CAMPA A/c No. 150825832796988 of Union Bank of India, IFSC Code UBIN 0996335 on 25.07.2022 through RTGS mode vide UTR No. SBINR52022072596043074.

The challan payment includes Rs. 6,12,09,030/- towards soil and moisture Conservation (SMC) work plan to mitigate the impact of the proposed mining activity on the local rivulets (Nallah), **Rs. 2,91,17,860/-** towards scheme for gap planting and moisture conservation to restock and rejuvenate the degraded open forests located in the area within 100 m from outer perimeter of the mining lease, and Rs. 35,28,210/- towards scheme for afforestation over 1.5 times of safety zone, as per the demand raised by the DFO, Sundargarh Forest Division.


Project Officer
Sijamal OCP
Maharaja Coalfields Limited

The copy of the approved scheme for gap planting and soil and moisture conservation activities to restock and rejuvenate the degraded open forests (having crown density less than 0.4), located in the area within 100 meters from outer perimeter of the mining lease boundary is enclosed herewith as **Annexure XI**.

The copy of the E-Challan generated through Parivesh portal with NEFT transaction detail, and payment status image on Parivesh portal is enclosed herewith as **Annexure X (A) & X (B)** respectively.

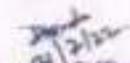
8. The user agency shall prepare a list of existing village tanks and other water bodies with GPS coordinates located within 5 km from the mine lease boundary. This list is to be duly verified by the concerned Divisional Forest Officer. The User Agency shall regularly undertake desilting of these village tanks and other water bodies so as to mitigate the impact of siltation of such tanks/ water bodies. A detailed approved plan for desilting of identified Ponds and water bodies to be prepared in consultation with forest department and shall be submitted to MoEF&CC before Stage-II approval:

Reply- In compliance to the above point, a scheme has been prepared for de-silting of village tanks and other water bodies so as to mitigate the impact of siltation of such tanks/ water bodies within 5 km from the mine lease boundary of Siamal Opencast Project.

The scheme has been duly approved by RCCF, Rourkela Circle, Rourkela for financial outlay of **Rs.18,74,09,500.00** (Rupees Eighteen Crore Seventy-Four Lakh Nine Thousand Five Hundred only) vide Memo no. 2265/3F-761/2022 dated 16.07.22 (enclosed as **Annexure IV**). The user agency will undertake the implementation of the provisions of the schemes in 10 years in consultation with State Forest Department.

A copy of the approved scheme, including the detailing of identified ponds/ village tanks/ water bodies and estimated cost for implementation for 10 years, is enclosed as **Annexure-XII**.

9. **Safety Zone Management:** Following activities at project cost shall be undertaken by the user agency for the management of safety zone as per the relevant guidelines issued by the Ministry's is guidelines:
 - I. User agency shall ensure demarcation of safety zone (7.5meter is strip all along the inner boundary of the mining lease area), and its fencing, protection and regeneration by


Project Officer
Siamal OCP
Jharkhand Coalfields Limited

erecting adequate number of six feet high RCC boundary pillars inscribed with the GPS coordinates with barbed wire fencing and deploying adequate number of watchers under the supervision of the State Forest Department;

Reply: In compliance to the above point, it is submitted that an area over 18.59 ha (7.5meter strip all along the inner boundary of the mining lease area) is demarcated for safety zone in the approved Mine Plan. The DGPS survey of mine lease boundary and safety zone boundary has been done by ORSAC. The DGPS map of mine lease boundary and safety zone area has been duly validated by vetting of ORSAC, Tahsildar and Divisional Forest Officer. The GPS coordinates so generated from the DGPS survey has been duly inscribed on RCC pillars. All pillars bear Back Bearing, Forward Bearing, pillar numbers, etc. The RCC pillars have been erected in accordance with the specifications, mentioned in the related guidelines stipulated in MoEF&CC. The DGPS surveyed maps of mine lease boundary and safety zone area are hereby attached as **Annexure-XIII and XIII (A)** respectively. The .kml file is hereby attached in the form of a soft compact disc.

ii. Boundary of the safety zone of the mining lease, adjacent to habitations/roads should be properly fenced by the user agency;

Reply: In compliance to the above point, an undertaking is hereby being submitted that boundary of the safety zone of the mining lease, adjacent to habitations/roads will be properly fenced by the user agency.

The undertaking to this effect is hereby enclosed as **Annexure-XIV**.

iii. Safety zone shall be maintained as green belt around mining lease and to ensure dense canopy in the area regeneration shall be taken up in this area by the user agency at project cost under the supervision of the State Forest Department;

Reply- In compliance to the above point, it is submitted that an area over 18.59 ha (7.5 meter is strip all along the inner boundary of the mining lease area) is demarcated for safety zone in the approved Mine Plan and a scheme has been prepared for block plantation of 1600 plants/ha with 10 years maintenance over 18.59 ha.

The scheme has been duly approved by RCCF, Rourkela Circle, Rourkela for financial outlay of **Rs.4,26,69,850.00(Rupees Four Crore Twenty-Six Lakh Sixty-Nine Thousand Eight Hundred Fifty only)** vide Memo no. 2265/3F-761/2022 dated 16.07.22 (enclosed as **Annexure IV**).The user

21/12/22
Project Officer
Bairmal OCO
Maharaja Pratap Singh College

agency will undertake the implementation of the provisions of the schemes in consultation with State Forest Department.

A copy of the approved scheme for fencing, protection and regeneration of safety zone area of 7.5-meter strip within the mining lease boundary over 18.59 ha, is enclosed herewith as **Annexure-XV**.

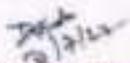
- iv. **Afforestation on degraded forest land to be selected elsewhere measuring one and a half times the area under safety zone, shall also be done at the project cost under the supervision of the State Forest Department. The degraded forest land (DLF) so selected will be informed to the MoEF&CC with shape files before Stage-II approval and afforestation will be done within three years from the date of Stage-II clearance and maintained thereafter in accordance with the approval plan in consultation with the State Forest Department; and**

Reply: In compliance to the above point, a scheme has been prepared for afforestation on degraded forest land over 5.895 ha i.e., 1.5 times the area under safety zone (3.93 ha) selected in Garjanjore RF of Gopalpur Range of Sundargarh Forest Division. The shape file of degraded forest land (DLF) selected over 5.895 ha i.e., 1.5 times the area under safety zone (3.93 ha) selected in Garjanjore RF of Gopalpur Range of Sundargarh Forest Division is attached herewith in the form of a compact disc.

The Divisional Forest Officer, Sundargarh vide letter no. 4597/4F(MISC)/2022 dated 18.07.2022 (enclosed as **Annexure X**) raised the demand as per the scheme and accordingly, the User Agency has made the payment of Rs. 9,38,55,100/- (Rupees Nine Crores thirty-eight lakh fifty-five thousand and one hundred only) towards the State Specific Account, Odisha CAMPA A/c No. 150825832796988 of Union Bank of India, IFSC Code UBIN0996335 on 25.07.2022 through RTGS mode vide UTR No. SBINR52022072596043074.

The challan payment includes Rs. 6,12,09,030/- towards soil and moisture Conservation (SMC) work plan to mitigate the impact of the proposed mining activity on the local rivulets (Nallah), Rs. 2,91,17,860/- towards scheme for gap planting and moisture conservation to restock and rejuvenate the degraded open forests located in the area within 100 m from outer perimeter of the mining lease, and **Rs. 35,28,210/-** towards scheme for afforestation over 1.5 times of safety zone, as per the demand raised by the DFO, Sundargarh Forest Division.

A copy of the approved scheme for afforestation on degraded forest land over 5.895 ha i.e., 1.5 times the area under safety zone (3.93 ha) selected in Garjanjore RF is enclosed herewith as **Annexure-XVI**.


Project Officer
Sirmal OCP
Mahanadi Coalfields Limited

The copy of the E-Challan generated through Parivesh portal with NEFT transaction detail, and payment status image on Parivesh portal is enclosed herewith as Annexure X (A) & X (B) respectively.

- v. **The State Government and the user agency shall ensure that safety zone is maintained as for the prescribed norms;**

Reply- In compliance to the above point, an undertaking by the user agency is hereby being submitted as Annexure XVII that the safety zone will be maintained as per the prescribed norms.

9. **The cost of felling of trees shall be deposited by the User Agency with the State Forest Department;**

Reply- In compliance to the above, it is agreed that the cost of tree felling will be deposited by the user agency with the State Forest Department. An undertaking to the above effect is enclosed as Annexure XVIII.

10. **Site Specific Wildlife Management Plan to mitigate the impact of project on wildlife of the area shall be prepared by the state Government in consultation with the PCCF and the Chief Wildlife Warden of the state as project cost and approved copy of the same along with detail of deposition of funds into the CAMPA account shall be submitted to the Ministry along with Stage -I compliance;**

Reply-In compliance to the above, it is submitted that the Divisional Forest Officer, Sundargarh has prepared the Site-Specific Wildlife Conservation Plan, which has been duly approved by the Principal Chief Conservator of Forests (Wildlife Warden), Odisha vide letter no. 3958/CWLW-FDWC-FD-0127-2021, dated 07/05/2022. A copy of the approved SSWLCP is enclosed as Annexure-XIX.

Accordingly, Divisional Forest Officer, Sundargarh vide letter no. 2516/4F (MISC) 2022 Dt. 09.05.2022 (enclosed as Annexure XIX - A) has raised demand for Rs. 8,74,14,000.00 (Rupees Eight Crore Seventy Four Lakh Fourteen Only) towards the Site Specific Wildlife Conservation Plan.

The User Agency has made the payment of Rs. 65,04,30,880.00 (Rupees Sixty Five Crore Four Lakh Thirty Thousand Eight Hundred Eighty only) towards the State Specific Account, Odisha CAMPA A/c


Project Officer
Sarmal OCP
Maharaja Coalfuels Limited

No. 150825832796370 of Union Bank Of India, IFSC Code UBIN0903710 on 09.06.2022 through RTGS mode vide UTR No. SBIN222160788520.

The challan payment includes Rs. 13,33,67,900.00 towards cost of compensatory afforestation, Rs. 42,96,48,980.00 towards NPV of 349.709 ha of revenue forest land, and **Rs. 8,74,14,000.00 towards Site Specific Wildlife Conservation Plan**, as per the demand raised by the DFO, Sundargarh Forest Division.

The copy of the E-Challan generated through Parivesh portal and the computer-generated e-payment statement is enclosed herewith as **Annexure I (A) & I (B)** respectively.

11. **State Government shall complete settlement of rights, in terms of the Scheduled Tribes and Traditional Forest Dwellers (Recognition of Forest Right) Act, 2006, if any, on the forest land to be diverted and submit the documentary evidence along compliance of stage-I approval as prescribed by this Ministry's Letter No. 11-9/1998-FC(Pt.) dated 03.08.2009 read with 05.07.2013, in support thereof; and**

Reply: In compliance to the stipulated condition, the copy of the certificate under the Scheduled Tribe and Traditional Forest Dwellers (Recognition of Forest Rights Act 2006) issued by the Collector, Sundargarh is enclosed herewith as **Annexure-XX**.

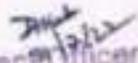
12. **The compliance report shall be uploaded on e-portal (<https://parivesh.nic.in/>).**

Reply: In compliance to the above point, the compliance report of Stage-I conditions, duly completed in all aspects has been uploaded on e-portal (<https://parivesh.nic.in/>).

- B. **Conditions which need to be complied on field after handing over of forest land to the user agency by the State Forest Department but the compliance in form of undertaking shall be submitted prior to Stage-II approval**

1. **Legal status of the diverted forest land shall remain unchanged;**

Reply: In compliance to the above point, the user agency hereby undertakes that the legal status of the forest land proposed for diversion will remain unchanged. An undertaking duly signed by the authorized signatory is attached herewith as **Annexure-XXI**.


Project Officer
Siamal OCP
Jharkhand Coalfields Limited

2. The compensatory afforestation degraded forest land, double in extend to the forest land being diverted i.e., 712.477 ha shall be raised by the State Forest Department and the project cost within three years from the date of grant of Stage-II approval;

Reply: In compliance to the above point, it is submitted that the Divisional Forest Officer, Sundargarh Forest Division vide letter no. 2523/4F (MISC) 2022 dated 09/05/2022 had raised the demand for payment of approved cost of compensatory afforestation Rs. 11,79,54,700/- & Rs. 1,54,13,200/- over 691.558 ha (Effective Area: 581.00 ha) at Satparlia R.F. and 111 ha at Jamkani R.F. respectively.

The User Agency has made the payment of Rs. 65,04,30,880.00 (Rupees Sixty-Five Crore Four Lakh Thirty Thousand Eight Hundred Eighty only) towards the State Specific Account, Odisha CAMPA A/c No. 150825832796370 of Union Bank of India, IFSC Code UBIN0903710 on 09.06.2022 through RTGS mode vide UTR No. SBIN222160788520.

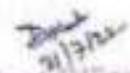
The challan payment includes Rs. 13,33,67,900.00 towards cost of compensatory afforestation, Rs. 42,96,48,980.00 towards NPV of 349.709 ha of revenue forest land, and Rs. 8,74,14,000.00 towards Site Specific Wildlife Conservation Plan, as per the demand raised by the DFO, Sundargarh Forest Division.

The copy of the E-Challan generated through Parivesh portal and the computer-generated e-payment statement is enclosed herewith as **Annexure I (A) & I (B)** respectively.

3. Boundaries of forest land of 5.256 granted on patta, within the patch of 129 ha of degraded forest land proposed for CA, shall be demarcated and digitalized and the same to be submitted to the IRO, along with digital Differential GPS map of 129 ha. The area shall be monitored regularly, on annual basis, to ensure no further encroachment on FRA patta land takes place in future;

Reply: In compliance to the above condition, the DGPS survey has been conducted by an empanelled agency of ORSAC over boundaries of forest land of 5.256 granted on patta, within the patch of 129 ha of degraded forest land proposed for CA land in Jamkani Reserved Forest. The DGPS map so generated has been authenticated by ORSAC, and vetted by the forest officials and the user agency.

The copy of the DGPS map duly vetted by ORSAC and concerned forest officials is attached herewith as **Annexure XXII** and soft copy of GPS coordinates of demarcated and digitalized area is attached herewith in the form of a compact disc.


Project Officer
Sajmal GGP
Maharadi Coalfields Limited

A copy of above enclosure is being submitted to the IRO, MoEF&CC, Bhubaneswar with Stage-I compliance in reference with the above conditions.

4. **At the time of payment of Net Present Value (NPV) at the present rate, the user agency shall furnish an undertaking to pay the additional amount of NPV, if so determined, as per the final decision of the Honorable Supreme Court of India;**

Reply: In compliance to the stipulated condition, the user agency hereby undertakes to pay the additional amount of NPV, if so determined, as per the final decision of Honorable Supreme Court of India.

An undertaking to the above effect is attached herewith as **Annexure- XXIII**.

5. **Tree should be felled in phased manner as per the requirement in the approved mining plan with prior permission of concern DFO;**

Reply: In compliance to the above, an undertaking to the effect that tree felling will be taken up strictly in phased manner as per the requirement in accordance with the approved mining plan with prior permission of the DFO Sundargarh Forest Division is attached herewith as **Annexure- XXIV**.

6. **The user agency shall explore the possibility of translocation of maximum number of trees identified to be felled and shall ensure that any tree felling can be done only when it is unavoidable and that too under strict supervision of the State Forest Department;**

Reply: In compliance to the above, an undertaking to the effect that the user agency shall explore the possibility of translocation of maximum number of trees identified to be felled and shall ensure that any tree felling shall be done only when it is unavoidable and that too under strict supervision of the State Forest Department is attached herewith as **Annexure- XXV**.

7. **The user agency shall undertake Mining in a phased manner after taking due care for reclamation of the mined over area. The concurrent reclamation plan as per the approved plan shall be executed by the User Agency from the very first year, and an annual report on implementation thereof shall be submitted to the Nodal Officer, Forest (Conservation) Act, 1980, in the concerned State Government and the concerned regional office of the Ministry. If it is found from the annual report that activities indicated in the concurrent reclamation plan and not being executed by the User Agency, the Nodal Officer or the**

20/12/22
Project Officer
Sirmal OCP
Mahanadi Coalfields Limited

concerned Addl. Principal Chief Conservator of Forest (Central) may direct that the mining activities shall remain suspended in such time such reclamation activities area satisfactorily executed;

Reply: In compliance to the above, an undertaking to the effect that the user agency will undertake Mining in a phased manner after taking due care for reclamation of the mined over area is attached herewith as **Annexure- XXVI**.

8. **The User Agency shall comply with the Honorable Supreme Court order on re-grassing, and re-grassing the mining area and any other area which may have been disturbed due to mining to restore them to a condition which fit for growth of fodder, flora, fauna etc. in a timely manner.**

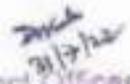
Reply: In compliance to the above, an undertaking to the effect that the user agency will comply with the Honorable Supreme Court order on re-grassing, and re-grassing the mining area and any other area which may have been disturbed due to mining to restore them to a condition which fit for growth of fodder, flora, fauna etc., in a timely manner is attached herewith as **Annexure- XXVII**.

9. **Period of diversion of the said forest land under this approval shall be for a period co-terminus with the period of mining lease proposed to be granted under the Mines and Minerals (Development and Regulation) Act, 1957, as amended and the Rules framed there-under;**

Reply: In compliance to the stipulated condition, an undertaking to the effect that the period of diversion of the 349.709 ha forest land under this proposal shall be for a period co-terminus with the period of the mining lease proposed to be granted under the Mines and Minerals (Development and Regulation) Act, 1957, and the rules framed there under as amended is attached herewith as an **Annexure-XXVIII**.

10. **The User Agency shall obtain the Environment Clearance as per the provisions of the Environment (Protection) Act, 1986, if required;**

Reply: In compliance to the stipulated condition, the copy of the Environment Clearance accorded in favor of Siarmal Open Cast Coal Mine Project, MCL is enclosed herewith as **Annexure- XXIX**.


Project Officer
Siarmal OCP
National Coalfields Limited

11. No labor camp shall be established on the forest land and the User Agency shall provide fuels preferably alternate fuels to the laborers and the staff working at the site so as to avoid any damage and pressure on the nearby forest areas;

Reply: In compliance to the stipulated condition, an undertaking to the effect that no labor camp will be constructed on the forest land and the laborers working at the site will be supplied with LPG is attached herewith as **Annexure- XXX**.

12. The boundary of the diverted forest land, mining lease and safety zone, as applicable shall be demarcated on ground at the project cost, by erecting 4 feet high reinforced cement concrete pillars, each inscribed with its serial number, distance from pillar to pillar and GPS coordinates;

Reply: In compliance to the above, the boundary of the diverted forest land, the mining lease and safety zone has already been demarcated with 4 feet height RCC pillar embedded two feet inside the soil and the specified information i.e. serial number, DGPS coordinates, front bearing and back bearing and distance from adjoining pillars have been inscribed on the pillars.

The DGPS survey of mine lease boundary undertaken through ORSAC(Odisha Space Application Centre) Bhubaneswar, the map so generated and validated by vetting of ORSAC, Tahsildar and DFO, Sundargarh Forest Division has been enclosed as **Annexure-XIII**. The map of lease area showing different kinds of forest land using DGPS survey data and latitude and longitude of each pillar will be submitted to the Divisional Forest Officer, Sundargarh before commencement of work on final forest clearance. An undertaking to the above effect is attached as **Annexure- XXXI**.

13. The layout plan of the mining plan/ proposed shall not be changed without the prior approval of the Central Government and the forest land shall not be used for any purpose other than that is specified in the proposal;

Reply: In compliance to the stipulated condition, an undertaking to the effect that the layout plan of the mining plan/ proposed shall not be changed without the prior approval of the Central Government and, the forest land proposed for diversion shall not be used for any purpose other than those shown in the diversion proposal is attached herewith as **Annexure- XXXII**.

21/12
Project Officer
Sarmal UCP
Wengerati Coalfields Limited

14. **The forest land proposed to be diverted shall under no circumstances be transferred to any other agency, department or person without prior approval of the Central Government.**

Reply-In compliance to the above cited condition, an undertaking to the effect that the forest land proposed to be diverted shall under no circumstances be transferred to any other agency, department or person without prior approval of the Central Government is attached herewith as **Annexure-XXXIII**.

15. **No damage to the flora and fauna of the adjoining areas shall be caused;**

Reply: In compliance to the above cited condition, an undertaking to the effect that the user agency will ensure that "No damage" to the flora and fauna of the adjoining areas shall be caused is enclosed herewith as **Annexure-XXXIV**.

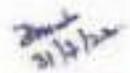
16. **The User Agency shall submit the annual self-compliance report in respect of the above stated conditions to the State Government, concerned Regional Office and to this Ministry by the end of March every year regularly;**

Reply: In compliance to the above cited condition, an undertaking to the effect that the User Agency shall submit the annual self-compliance report in respect of the above stated conditions to the State Government, concerned Regional Office and to this Ministry by the end of March every year regularly is enclosed herewith as **Annexure-XXXV**.

17. **Any other condition that the concerned Regional Office of the Ministry may stipulate with the approval of competent authority in the interest of conservation, protection and development of forests and wildlife;**

Reply: In compliance to the above cited condition, an undertaking to the effect that the user agency will comply to any other condition that the concerned Regional Office of the Ministry may stipulate with the approval of competent authority in the interest of conservation, protection and development of forests and wildlife is attached herewith as **Annexure-XXXVI**.

18. **The user agency shall comply all the provisions of all Acts, Rules, Regulations Guidelines, Honorable Court Order (s) and NGT Order (s) pertaining to this project, if any, for the time being in force, as applicable to the project; and**

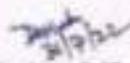

Project Officer
Siamat OCP
*Maharaja Gokulendra Limited

Reply: In compliance to the above cited condition, an undertaking to the effect that the User Agency shall comply all the provisions of all Acts, Rules, Regulations Guidelines, Honorable Court Order (s) and NGT Order (s) pertaining to this project, if any, for the time being in force, as applicable to the project is attached herewith as **Annexure-XXXVII**.

19. Violation of any of these conditions will amount violation of Forest (Conservation) Act, 1980 and the action would be taken as prescribed in para 1.21 of Chapter 1 of the Handbook of Comprehensive Guidelines of Forest (Conservation) Act, 1980 as issued by the Ministry's letter No. 5-2/2017-FC dated 28.03.2019.

Reply: In compliance to the above cited condition, an undertaking to the effect that the user agency will not act in violation of any of the conditions that amount violation of Forest (Conservation) Act, 1980, and comply to all the provisions of all Acts, Rules, Regulations Guidelines of Forest (Conservation) Act, 1980 is attached herewith as **Annexure-XXXVIII**.

In view of the above, the stage-I compliance report is being submitted for your kind perusal and onward transmission for stage-II approval in favor of Sirmal Open Cast Mining project for non-forestry use of 349.709 ha of forest land.


Project Officer,
Sirmal OCP,
Mahalaxmi Area,
Mahanadi Coalfields Limited
Project Officer
Sirmal OCP
Mahanadi Coalfields Limited



**OFFICE OF THE DIVISIONAL FOREST OFFICER,
SUNDARGARH FOREST DIVISION**



Phone No-06622-272243, E-Mail- dfo.sundargarh@odisha.gov.in

No. 2593 / 4F (MISC) / 2022/DL-09/05/2022

To

The Project Officer,
Siarnal OCP,
At/Po-Basundhara
Dist-Sundargarh
Pin-770076.

Sub:- Diversion of 349.709 ha. of forest land within total mining lease area of 2290.449 ha in Siarnal Open Cast Coal Mining Project by Mahanadi Coalfields Ltd. (MCL) in Sundargarh District, Odisha
-Demand for cost of Compensatory Afforestation Scheme.

Ref:- 1.Memo No.9689 dt.07.05.2022 of CCF, Forest Diversion & Nodal Officer, FC-Act.
2. Memo No.7946/FE&CC dt.29.04.2022 of OSD-Cum-Special Secretary to Government, FE & CC Department.

With reference to the subject cited above, the copy of Memo No.7946/FE&CC dt.29.04.2022 of OSD-Cum-Special Secretary to Government, FE & CC Department along with Stage-I approval order No. File No.B-25/2021-PC dt.21.04.2022 of Government of India, MoEF & LU are enclosed herewith to comply the Stage-I compliances for onward transmission to the RCCF, Rourkela.

Further, as per Memo No. 9689 dt.07.05.2022 of CCF, Forest Diversion & Nodal Officer, FC-Act/O the Principal Chief Conservator of Forests & HoFF, Odisha, Bhubaneswar has approved the financial outlay of Compensatory Afforestation Scheme over 581 ha & 111 ha at prevailing wage rate of Rs.326/- per man days .The details of Compensatory Afforestation fund is furnished below:-

Name of the Range	Identified CA Site	Identified CA area in ha	Approved cost in Rs.
1	2	3	4
Sundargarh	Satparlia RF	581 ha	11,79,54,700.00
Gopalpur	Jankani RF	111 ha	1,54,13,200.00
	Total:-	692ha	13,33,67,900.00

Hence, you are requested to deposit the NPV amount of Rs. 13,33,67,900.00 (Rupees Thirteen Crore-Thirty Three Lakh-Sixty Seven Thousand Nine Hundred) only in the state specific CAMPA Account maintained by Govt. of India through "E" payment mode by using the web portal of Ministry of Environment & Forests (CAMPA). Further, the evidence of deposited amount may be furnished to the undersigned for further needful action at this end.

Encl: - As above.

Yours faithfully,

[Signature]
31/7/22
Project Officer
Siarnal OCP
Mahanadi Coalfields Limited

[Signature]
09.05.22
Divisional Forest Officer
Sundargarh Forest Division

Memo No. 9524 / Dt.09.05.2022

Copy forwarded to the Chief Conservator of Forests, Forest Diversion & Nodal Officer, FC-Act, O/o the O/o the Principal Chief Conservator of Forests & HoFF, Odisha, Bhubaneswar for favour of your kind information and necessary action with reference to his Memo No.9685 dt.07.05.2022.

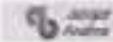
Prasad
04.05.22
Divisional Forest Officer
Sundargarh Forest Division

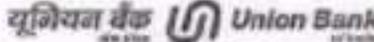
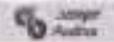
Memo No. 9525 / Dt.09.05.2022

Copy forwarded to the Regional Chief Conservator of Forests, Rourkela Circle, Rourkela for favour of your kind information and necessary action with reference to his Memo No.9688 dt.07.05.2022 of Chief Conservator of Forests, Forest Diversion & Nodal Officer, FC-Act, O/o the O/o the Principal Chief Conservator of Forests & HoFF, Odisha, Bhubaneswar.

Prasad
04.05.22
Divisional Forest Officer
Sundargarh Forest Division

Prasad
21/5/22
Project Officer
Sarmal OCP
Maharaja Coalfields Limited

AGENCY COPY	
  	
NEFT / RTGS CHALLAN for CAMPA Funds	
Date : 02-06-2022	
Agency Name.	SIARMAL OCP MAHANADI COALFIELDS LIMITED
Application No.	5932796370
MoEF/SG File No.	8-25/2021-FC
Location.	ORRISA
Address.	MCL Basundhara Area Sundargarh Sundargarh
Amount(In Rs)	₹5420880/-
Amount in Words (Sixty-Five Crore Four Lakh Thirty Thousand Eight Hundred and Eighty Rupees Only)	
NEFT/RTGS to be made as per following details,	
Beneficiary Name:	ORRISA CAMPA
IFSC Code:	UBIN0003716
Pay to Account No.	150825832796370 Valid only for this challan amount.
Bank Name & Address.	Union Bank Of India Ludhi Complex Branch, Block 11, CGO Complex, Phase I, Ludhi Road, New Delhi -110003
• This Challan is strictly to be used for making payment to CAMPA by NEFT/RTGS only	

BANK COPY	
  	
NEFT / RTGS CHALLAN for CAMPA Funds	
Date : 02-06-2022	
Agency Name.	SIARMAL OCP MAHANADI COALFIELDS LIMITED
Application No.	5932796370
MoEF/SG File No.	8-25/2021-FC
Location.	ORRISA
Address.	MCL Basundhara Area Sundargarh Sundargarh
Amount(In Rs)	₹5420880/-
Amount in Words (Sixty-Five Crore Four Lakh Thirty Thousand Eight Hundred and Eighty Rupees Only)	
NEFT/RTGS to be made as per following details,	
Beneficiary Name:	ORRISA CAMPA
IFSC Code:	UBIN0003716
Pay to Account No.	150825832796370 Valid only for this challan amount.
Bank Name & Address.	Union Bank Of India Ludhi Complex Branch, Block 11, CGO Complex, Phase I, Ludhi Road, New Delhi -110003
• This Challan is strictly to be used for making payment to CAMPA by NEFT/RTGS only	

After making successful payment, User Agencies may send a line of confirmation through
Email: helpdeskampa@corpbank.co.in

Note: After making the required payment through challan, if the payment status has not been updated even after 7 working days, then kindly mail a copy of your challan with transaction date to
Email: cb0371@unionbankofindia.com


 Project Officer
 Siarmal OCP
 Mahanadi Coalfields Limited



Date : 29 Jun 2022
 Account Number : 00000011489517059
 Description : CA-SURABHI-PUB OTH-ALL-INR
 Name : MCL BASUNDHARA AREA
 Currency : INR
 Corporate Address : MCL HQRS.
 JAGRITI VIHAR : BURLA
 ORISSA-768020
 Branch : BALINGA(04221)
 Rate of Interest (% p.a.) : 0.0%
 IFS Code : SBIN0004221
 Book Balance : 529308.12
 Available Balance : 529308.12
 Hold Value : 0.00
 MCD Balance : 0.00
 Uncleared Amount : 0.00
 Balance as on 9 Jun 2022 : 34,577.94

Account Statement from 9 Jun 2022 to 9 Jun 2022

Txn Date	Value Date	Description	Ref No./Cheque No	Branch Code	Debit	Credit	Balance
09/06/2022	09/06/2022	BY TRANSFER-INB Incent	CT5889912500004 TRANSFER FROM 99011077499 /	99022		70,80,40,000.00	70,80,74,077.94
09/06/2022	09/06/2022	TO TRANSFER-INB	32062100014897CKTS 080134 TRANSFER TO 3609635473 POOLING ACCOUNT GST MM /	99022	28,79,414.00		70,51,95,663.94
09/06/2022	09/06/2022	TO TRANSFER-INB	32062100014897CKTS 079555 TRANSFER TO 3609632800 POOLING ACCOUNT GST MM /	99022	1,47,29,867.00		69,04,65,796.94
09/06/2022	09/06/2022	CHQ TRANSFER-NFT UTR NO: SBIN221160796002- 154353 ORISSA CAMPA	/ 154353 ORISSA CAMPA	4221	69,04,30,980.00		4,00,34,816.94
09/06/2022	09/06/2022	CHQ TRANSFER-NFT UTR NO: SBIN221160796002- 154353 ODISHA STATE POLLUTION CONTROL	/ 154353 ODISHA STATE POLLUTION CONTROL	4291	4,00,00,000.00		34,348.94

**This is a computer generated statement and does not require a signature.


 Project Officer
 Siamet OCP
 Mahanadi Coalfields Limited

Annexure-I (C)

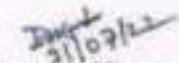
UNDERTAKING

(Condition no. 1(i) of Para A of file No.8-25/2021-FC)

- I/we do hereby undertake "to pay appropriate anticipated increase cost of compensatory afforestation for works scheduled for subsequent years."


General Manager
Mahalaxmi Area, MCL

General Manager
Mahalaxmi Area
Mahanadi Coal Fields Limited


Project Officer
Siarmal OCP, MCL
Project Officer
Siarmal OCP
Mahanadi Coalfields Limited



**OFFICE OF THE DIVISIONAL FOREST OFFICER,
SUNDARGARH FOREST DIVISION**



Phone No-06622-277283, E-Mail- dfo.sundargarh@odisha.gov.in

No. 2683 / 4F (MISC) / 2022/D/- 21 / 05/2022

To

The Project Officer,
Siarmal OCP,
At/Po-Basundhara
Dist-Sundargarh
Pin-770076.

Sub: - Diversion of 349.709 ha. of forest land within total mining lease area of 2290.449 ha in Siarmal Open Cast Coal Mining Project by Mahanadi Coalfields Ltd. (MCL) in Sundargarh District, Odisha
-Demand for Net Present Value (NPV) amount.

Ref: - 1.Stage-I approval Order No. File No.8-25/2021-FC dated, 21.04.2022 of MoEF & CC.
2. Memo No.9689 dt.07.05.2022 of CCF, Forest Diversion & Nodal Officer, FC-Act.
3. Memo No.7946/FE&CC dt.29.04.2022 of OSD-Cum-Special Secretary to Government, FE & CC Department.
4.This Office Letter No.2520 dt.09.05.2022.

Sir

With reference to the letter cited above, it is to inform you that, the Stage-I approval order has been accorded by Government of India, MoEF & CC vide approval order No. 8-25/2021-FC dated, 21.04.2022 and communicated by the OSD Cum Special Secretary to Government, FE & CC Department, CCF, Forest Diversion & Nodal Officer, FC-Act vide letter under reference.

You are requested to comply the Stage-I conditions stipulated by the MoEF & CC vide condition No.A (1 to 12) & B (1 to 19) of Stage-I approval order and submit the compliances to this Office at an early date.

In continuation to this Office letter No.2520 dt.09.05.2022 as per condition No.(A) 2 & (B) 4 of Stage-I approval order, you are liable to pay the Net Present Value(NPV) of the forest land over 349.709ha in accordance with the MoEF & CC Guideline dated.06.01.2022 & 19.01.2022. The revised calculation details of Net Present Value NPV value is furnished below:-

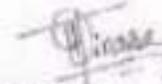
Village Name of the Revenue Forests	Total area allotted (in ha)	Canopy Density	Eco-Class	Rate of NPV per ha (in Rs.)	Total amount (in Rs.)
1	2	3	4	5	6
Siarmal	79.996	0.4	III(DP)	12,28,590	9,82,82,286.00
Gopalpur	94.181	0.4	III(DP)	12,28,590	11,57,09,835.00
Ratansara	48.470	0.4	III(DP)	12,28,590	5,95,49,757.00
Jhuprunga	53.812	0.4	III(DP)	12,28,590	6,61,12,885.00
Tumulia	64.092	0.4	III(DP)	12,28,590	7,87,42,790.00
Kulda	9.158	0.4	III(DP)	12,28,590	1,12,51,427.00
Total	349.709				Rs.42,96,48,980.00

Project Officer
Siarmal OCP

Hence, you are requested to deposit the NPV amount of Rs. 42,96,48,980.00 (Rupees Forty Two Crore Ninety Six Lakh Forty Eight Thousand -Nine Hundred Eighty) only in the state specific CAMPA Account maintained by Govt. of India through "E" payment mode by using the web portal of Ministry of Environment & Forests (CAMPA). Further, the evidence of deposited amount may be furnished to the undersigned for further needful action at this end.

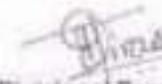
Further, as per the condition No.B(4) of Stage-I approval order, you are requested to submit an undertaking to pay the additional amount of Net Present Value (NPV), if so determined, as per the final decision of Hon'ble Supreme Court of India.

Yours faithfully


21.05.22
Divisional Forest Officer
Sundargarh Forest Division

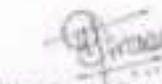
Memo No. 2684 /Dated 21 /05/2022

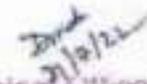
Copy forwarded to the Chief Conservator of Forests, Forest Division & Nodal Officer, Fo-Act, O/O the PCCF, Odisha for favour of kind information and necessary action in continuation to this Office Memo No.2521 dt.09.05.2022.


21.05.22
Divisional Forest Officer
Sundargarh Forest Division.

Memo No. 2685 /Dated 21 /05/2022

Copy forwarded to the Regional Chief Conservator of Forests, Rourkela Circle, Rourkela for favour of kind information and necessary action in continuation to this Office Memo No.2522 dt.09.05.2022.


21.05.22
Divisional Forest Officer
Sundargarh Forest Division.


21/5/22
Project Officer
Sarmal OCP
Maharaja Coalfields Limited



OFFICE OF THE REGIONAL CHIEF CONSERVATOR OF FORESTS, ROURKELA CIRCLE, AT/P.O.
PANPOSH, ROURKELA-769 004.

Memo No. 2265/3F-761/2022

Date: 16.07.2022

To: The Divisional Forest Officer,
Sundargarh Division.

Sub: Diversion of 349.709 ha of forest land within total mining lease area of 2290.449 ha in Sirmal Open cast Coal Mining Project by M/s Mahanadi Coalfields Limited(MCL) in Sundargarh District (Odisha)

X-Sub: Submission of 10 nos. of schemes relating to stipulation conditions imposed by MoEF & CC in Stage-i approval order.

Ref: Your Memo No.4515 Dtd.14.07.2022.

The following schemes prepared in compliance with the conditions stipulated in the Stage-i approval accorded in respect of the above diversion proposal at the current wage rate and submitted vide your Memo under reference are hereby technically approved for the amount as indicated against each.

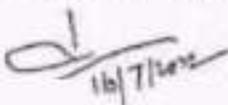
Sl. No.	Name of the scheme for which has been submitted by the DFO, Sundargarh	Technical approval by the RCCF, Rourkela Circle.
01	The scheme for mitigative measures to minimize soil erosion and choking of streams prepared in compliance with Condition No. 4(i) of para A with a total financial outlay of Rs.8,19,150/-.	Technically approved for Rs.8,19,150/- (Rupees eight lakh nineteen thousand one hundred fifty) only
02	The scheme for planting of adequate drought hardy plant species and sowing of seeds in the appropriate area within the mining lease area to arrest soil erosion prepared in compliance with Condition No. 4(ii) of para A with a total financial outlay of Rs.16,02,02,610/-.	Technically approved for Rs. 16,02,02,610/- (Rupees Sixteen Crore two lakh two thousand six hundred ten) only
03	The scheme for construction of check dams, retention / toe walls to arrest sliding down of the excavated material along the contour prepared in compliance with Condition No. 4(iii) of para A with a total financial outlay of Rs.2,54,38,910/-.	Technically approved for Rs. 2,54,38,910/- (Rupees two Crore fifty-four lakh thirty-eight thousand nine hundred ten) only
04	The scheme to stabilize overburden dumps by grading/benching so as to ensure the angles of repose at any given place is less than 28° prepared in compliance with Condition No. 4(iv) of para A with a total financial outlay of Rs.1,04,09,570/-.	Technically approved for Rs. 1,04,09,570/- (Rupees one crore four lakh nine thousand five hundred seventy) only
05	The scheme for Top soil management to ensure 'no damage' to the top soil with strict adherence to the top soil management plan prepared in compliance with Condition No. 4(v) of para A with a total financial outlay of Rs.4,01,600/-.	Technically approved for Rs.4,01,600/- (Rupees four lakh one thousand six hundred) only

[Signature]
Project Officer
Sirmal OCB

05	Soil & Moisture Conservation (SMC) work plan to mitigate the impact of the proposed mining activity on the local rivulets (nallah) prepared in compliance with Condition No.6 of para A with a total financial outlay of Rs.6,12,09,030/-	Technically approved for Rs.6,12,09,030/- (Rupees six Crore twelve lakh nine thousand thirty) only.
07	The Scheme for gap planting and soil & moisture conservation activities to restock and rejuvenate the degraded open forests located in the area within 100 meters from outer perimeter of the mining lease prepared in compliance with Condition No. 7 of para A with a total financial outlay of Rs.2,91,17,860/-	Technically approved for Rs. 2,91,17,860/- (Rupees two Crore ninety-one lakh seventeen thousand eight hundred sixty) only
08	The scheme for de-silting of the village tanks and other water bodies so as to mitigate the impact of siltation of such tanks/water bodies located within 05 Km from Mining Lease Boundary prepared in compliance with Condition No. 8 of para A with a total financial outlay of Rs.18,74,09,500/-.	Technically approved for Rs.18,74,09,500/- (Rupees eighteen Crore seventy-four lakh nine thousand five hundred) only.
09	The Scheme for fencing, protection and regeneration of the safety zone area of 7.5 meter strip within the mining lease boundary prepared in compliance with Condition No. 9(i) (ii) (iii) of para A with a total financial outlay of Rs.4,26,69,850/-	Technically approved for Rs. 4,26,69,850/- (Rupees four Crore twenty-six lakh sixty-nine thousand eight hundred fifty) only.
10	The Scheme for afforestation over one & half time of safety zone area over 5.895 ha. of degraded forest land identified in Garjanpahad RF of Gopalpur Range of Sundargarh Division prepared in compliance with Condition No.9(iv) of para A with a total financial outlay of Rs. 35,28,210/-	Technically approved for Rs.35,28,210/- (Rupees thirty-five lakh twenty-eight thousand two hundred ten) only

The technically approved schemes are returned herewith in triplicate for taking necessary action at your end.

Encl:- As above.


Regional Chief Conservator of Forests,
Rourkela Circle

Memo No.

Date:

Copy forwarded to the Chief Conservator of Forests (Forest Diversion & Nodal Officer, FC Act), O/o the Pr.CCF, Odisha for favour of kind information and necessary action with reference to Memo No.4516 dtd.14.07.2022 of the DFO, Sundargarh Division.

Regional Chief Conservator of Forests,
Rourkela Circle


Project Officer
Sirmal OCP
Maharadi Coalfields Limited

Scheme

for

"Mitigative measures to be taken up to minimise soil erosion and chording
of streams"

in compliance with

Condition 4 (I) of para A of Stage-I forest clearance – in-principle approval

vide letter no. f. no. 8-25/2021-fc dated 21st April 2022

of Govt. of India, Ministry of Environment, Forest & Climate Change,

New Delhi

for

Diversion of 349.709 hectares of forest land for "Siarmal Opencast Coal
Mining Project" within 2290.449 hectares of mining lease area

of

M/s Mahanadi Coalfields Limited.

in Sundargarh Forest Division of Dist. Sundargarh, Odisha

Scheme prepared for "Mitigative measures to be taken up to minimise soil erosion and chording of streams".

1. Brief Information

M/s Mahanadi Coalfields Limited (MCL), a subsidiary company of Coal India Limited is a Ministerial Company of nature and style public sector undertaking under Government of India, which was carved out to administer and mine out coal from the coal mines of Odisha, spread over Talcher and Ib valley coal fields.

Ib valley coal fields in Sundargarh and Jharsuguda Districts of Odisha contain large reserves of quarriable coal. Each area containing coal has been divided into several mining blocks, and Sirmal geological block is one of them. Sirmal opencast project is located in Sirmal geological block of Gopalpur tract in the north-western part of Ib valley coal fields. It lies between latitudes of 22°01'19"-22°03'59.99" N and longitudes of 83°37'09"-83°42'59.58" E. It is represented in Survey of India Topo sheet No. F44L12 (64/N/16). This project is having 1547.82 Mt (Minable Reserve) of quarriable coal reserve in Gopalpur, Jhupuranga, Sirmal, Ratanara, Tumala and Kulda villages. The entire area of Sirmal project involving six villages were acquired under Coal Bearing (Acquisition and development) Act, 1957 (CBA-1957) vide S.O. No. 1859 dated 10.07.1989 and S.O. No. 3055 dated 29.10.1990. The above land has been vested in MCL u/s 11(1) of the said Act vide SO No. 2592 dated 13.09.1990 and 43015 dated 30.03.1993. (Page-22 to 38/DF). Present proposal Sirmal OCP involves total area of 2290.449 ha which comprises of 349.709 ha of forest land, 473.792 ha of Govt. Non-Forest land and 1466.949 Tenancy land.

1. Location of the project:

The boundary of Sirmal block is as follows:

North	:	Chaturdhara and Dasundhara West blocks separated by Chaturdhara Nala and Raundhara River
West	:	Rampia & Dip side of Rampia.
East	:	Kulda Block separated by Chatajor nala
South	:	Prajapara Block.

Sundargarh town is the nearest revenue town & Dist. HQ, which is at a distance of 46 km. Bhubaneswar, the State Capital from the mines is 450 km. The company Headquarters is at Burla which is 150 km vis Sundargarh, Jharsuguda, Sambalpur. The nearest railhead is Hengir

railway station on Mumbai – Howrah line of South Eastern railway at a distance of about 35 km. The nearest domestic airport, Veer Surendra Sai airport, Jharsuguda at a distance of 30 km. Biju Patnaik International Airport, Bhubaneswar is at a distance of about 450 km. The nearest sea port – Paradip is at a distance of 550 km from the block.

State OCP has been accorded the Forest Stage I clearance including 349,709 ha of forest land from central government under Section 2 (b) of Forest (Conservation) Act 1980, Ministry of Environment, Forests and Climate Change in vide Letter No. F. No. 8-25/2021-FC Dated 21st April 2023. The FC has been accorded with a set of conditions to comply with and thus this scheme has been prepared to comply with Condition No. 4(V) of para-A of Stage-I in-principal approval.

3. Physiography & Drainage:

The topography of the block is represented by flat & sloppy ground. The ground slopes generally towards east and north-east and the drainage is through small streams, which in turn feed to river Basundhara. Basundhara River is flowing from west-to-east and ultimately drains into the IB River.

Distance of waterbodies from the mine is as follows (table 1):

Name of the Water Bodies	Distance
Chhata Jhor river/Nala	0 km
Basundhara river	0 km
Garia Nala	4.3 km
Jehha river	18 km
IB river	27 km

4. Climate:

Meteorological data collected from IMD, Bhubaneswar for Jharsuguda IMD station for the year 2013 have been referred for preparation of the following (table 2):

Item	Parameters	Particulars
Rainfall	Minimum	0.1 mm in Oct
	Maximum	118.8 mm in Aug
	Annual rainfall	1281.6 mm (Average annual rainfall is 1430 mm for last 22 years)
	Minimum	0.1 mm in Oct
Temperature range (monthly mean of daily temperature)	Minimum	6.9°C in Jan
	Maximum	46.7°C in May
Relative humidity range (monthly mean of daily RH)	Max at 8:30 hr	98% in Feb, Jun and Jul
	Min at 8:30 hr	26% in Apr and May
	Max at 17:30 hr	98% in Jul, Aug and Oct
	Min at 17:30 hr	11% in Apr
Wind speed range (monthly mean of daily wind speed)	Max at 8:30 hr	30 kmph in Oct
	Min at 8:30 hr	2 kmph
	Max at 17:30 hr	30 kmph in Oct
	Min at 17:30 hr	2 kmph

5. Geology:

The "Geological Report on Simal Block, Ib-River Coalfield," Odisha, was prepared by CMPDI in February 1997. Simal block spreading over an area of 5.00 sq.km. is a part of north-western sector of Ib-valley coalfield and in which coal bearing area is 4.24 sq. km. The coal seams occurring in Simal block are in the continuation of the adjoining block i.e., Kaida in the east.

6. Soil Type:

Soil may be defined as a mixture of rock and mineral with the organic matter. The soil of the M. L. area is classified as lateritic soil, lateritic with coal on the basis of its layer of formation. Soil is the net result of the action of climate and organisms especially plant on the earth crust. The pH value of the soil is normal ranging from 6.00 to 7.2.

7. Existing Vegetation:

The crop composition of forest area is mainly Sal (*Shorea robusta*) and its associates namely Bija (*Pterocarpus marsupium*), Mango (*Mangifera indica*), Keedu (*Diospyros melanocylon*), Mahul (*Madhuca indica*), Jamun (*Syzygium cumini*), Neem (*Azadirachta indica*), Bahada (*Terminalia bellerica*), Dhaura (*Anogeissus latifolia*), Aachhu (*Morinda tinctoria*), Karum (*Adina cordifolia*), Sahaj (*Terminalia tomentosa*), Char (*Muchanania lanata*), Kasi (*Astragala parviflora*), Sidha (*Lagerstroemia parviflora*), Sison (*Dalbergia latifolia*), Karia (*Chloranthus collina*), Dhaliki (*Woodfordia fruticosa*), Gambhari (*Gmelina arborea*), Karain (*Hellorhena neldyenterica*), Palas (*Butea monosperma*), Rheru (*Chloracylon sulcatum*), etc. Sal (*Shorea robusta*) is the pre-dominant species. The condition of the vegetation is dry deciduous Forest.

The condition No. 4(i) of para A of the Stage I approval envisages to prepare a plan for management of top soil. This scheme is being submitted in compliance with aforesaid condition of Ministry of Environment, Forest and Climate Change, Government of India.

❖ Factor responsible for soil erosion & choking of streams

The mining activities and overburden dumps are the major source of discharges of soil and other substances such as silt, loose stones, etc., for choking of any drainage system in the mining areas. The form of erosion observed in this region includes mainly rill and gully erosion. The storm water run-offs from the high lands, mine faces and OB dump slope areas carry substantial amounts of solids in the lower order streamlets and chokes the higher order streams. These lower order streamlets and gullies have erosion capacity due to medium gradient and transportation of rock fragments with the velocity of the stream and deposition of same in the connecting high order streams due to velocity of the stream and deposition of same in the connecting high order streams due to velocity drop. Streams can also erode by undercutting their banks resulting in mass-wasting processes like slumps or slides. When the undercut material falls into the stream, the fragments are transported and deposited in the stream bed. The other mode of sediment transportation is very nominal.

❖ Objectives;

The stipulated condition no. 4 (i) of para-A of stage-I approval reads "Mitigative measures to minimize soil erosion and choking of stream shall be implemented within a period

of three years with effect from the issue of Stage-II clearance in accordance with the approval plan in consultation with the State Forest Department."

To fulfill the above stipulation of the Stage-I approval which envisages mitigative measures to be taken up to minimize soil erosion and choking of streams, the scope of the scheme is as follows:

1. To prevent erosion of top soil.
2. To prevent obstruction of Natural water sources.
3. To undertake proper Management of overburden materials so as to prevent siltation in the streams.
4. To prevent overflow of eroded soils from the mining areas to the cultivate lands, natural streams and habitations.

Soil and moisture conservation activities is proposed to be taken up in identified areas of Mine lease boundary in various scales and the labels as a subsidiary activity beyond plantation and the other afforestation activities in order to improve moisture sustainability.

✦ **Soil & Moisture Conservation strategy and measures:**

The Strategy for implementation of the measures in order to achieve the objective and implementing the program efficiently in a well-planned strategy has been taken due care of and thus, the strategy adopted for Soil and moisture conservation in this area is discussed below:

a. **Floor treatment of catchment area**

Floor treatment will be given to the catchment area where the precipitation will touch the ground and will subsequently drain through the drainage line. It will form the focus area in the rain water harvesting. Feasible interventions will not only capture the rain water but will also enhance the retention period ultimately leading to increased infiltration.

b. **Drainage Line Treatment**

The micro catchments drain the rain water into drainage line and rain water flows from ridge to bottom and higher slope to lower slope in varying velocity. The primary objective of the drainage line treatment centers around reducing the velocity and increasing the retention of water at various levels. It is therefore, required to have appropriate interventions along drainage line to alter the pattern of rain water flow.

◇ Design of structures:

L. The Floor Treatment

L.1 Surface treatment for slope (0° to 30°)

L.1.1. Staggered Trenches:

The staggered trenches are primarily aimed to break the runoff. In a hectare of land up to 300 nos. of staggered trenches should be created. The dimension of the staggered trenches will be 2.5 m X 0.5 m X 0.5 m. It will help in conserving rainwater of the ML area and facilitate its percolation. Thus, adequate care should be taken during alignment of such trenches so that gullies are not formed by the water flowing downhill from the edges of the trench. The staggered trenches will be done over 5 ha at greenbelt area. Map showing location for staggered trenches is enclosed as Annexure-I.

• Specification of Staggered Contour Trenches (2.5 m x 0.5 m x 0.5 m)

Length: 2.5 m, Width: 0.5 m, Depth: 0.5m

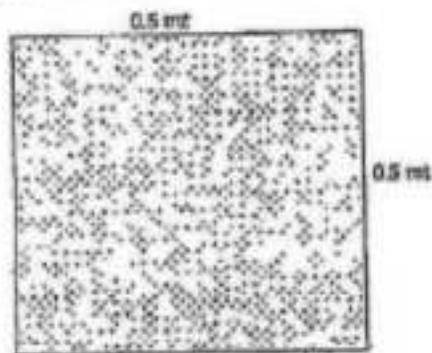
Cross Section- (0.5m x 0.5m) = 0.25 sq. m.

Earth Work-(2.5 m X 0.25 sq. m.) = 0.625 cum

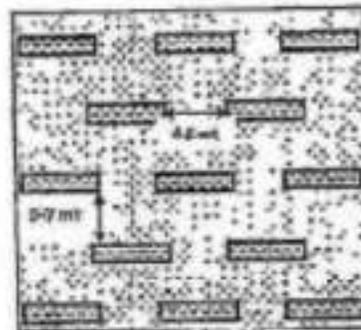
Table 3: Specification of trenches based on slope (As per PCCE approved norms, 2018)

	0-30° slope	Above 0-30° slope
Gap Between trenches (Horizontal)	4-5 m	2-3 m
Distance between contour lines	4-7 m	3-4 m
Cost for staggered trench per ha	19560/- for 300 nos. of Staggered trenches per ha	59670/- for 450 nos. of Staggered trenches per ha

Cross section of each slatted trench



Staggered Trenches Parallel to less than 30° slope



1.1.2. Percolation Pits:

The percolation pits of dimension 1.0 m X 1.0 m X 1.0 m shall be dug preferably within 0° to 15°. It will also store the runoff and conserve the same. Thus, the rainwater shall percolate into the area. In one hectare usually 200 number of percolation pits shall be dug to store runoff for enhanced population. A map showing location of the proposed 5 ha land percolation pits has been enclosed in Annexure-II.

Specifications:

Length- 1.0 m, Width- 1.0 m, Depth- 1.0 m

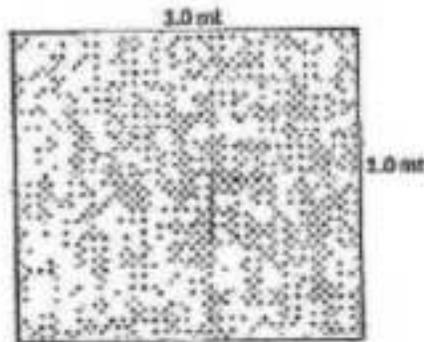
Cross Section- (1.0 m X 1.0 m) = 1.0 sq m

Earth Work-(1.0m X 1.0 sqm)

Spacing in a staggered manner- 5mX5m

Cost of 200 nos. of percolation Pit in One Hr=200 MD= Rs.65,200/- (Rs. 326/-per mandays)

Cross Section of each percolation pit



Percolation pits Design

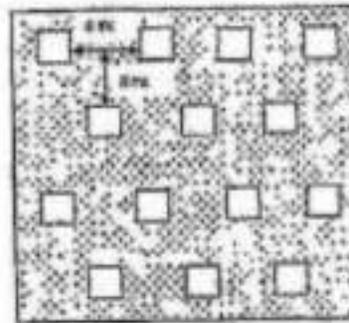


Table 5. Estimate cost for construction of staggered trenches and percolation pits for slope 0° to 30° in 1 ha

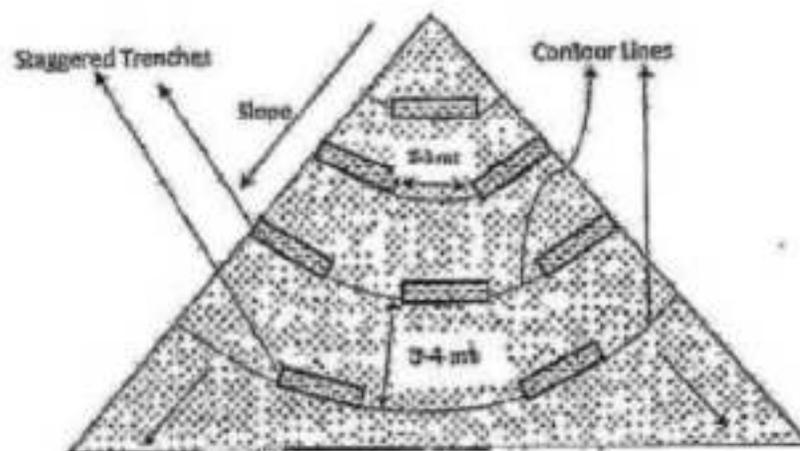
Sl. No.	S/MC Measure	Unit	Quantity (Per ha)	Man-days	Rate (per Man days)	Cost (In Rs.)	Remarks
1	Staggered Trencher (2.5 m x 0.5 m x 0.5m)	1 ha	300	60	326	19560	-
2	Percolation pits (1.0 m x 1.0 m x 1.0 m)	1 ha	300	64	326	20864	Percolation pits should be located preferable within 15-degree slope

1.2. Surface Treatment for slope more than 30°

1.2.1 Staggered Trenches:

In higher slopes, number of staggered trenches be enhanced up to 450 per hectare. At such slopes, contour intervals are to be reduced to make the structure stable and effective to store rainwater. The size of a Staggered Trenches will be 2.5 m X 2.5 X 2.5 m. Extra precautions should be taken for alignment since there are chances of increased soil erosion and gully formation at such elevations. In critical areas, determination of contour interval should not be odd. Rather use of relevant instruments will make the treatment error free and enhance their utility. It will stabilize the treated surface and conserve maximum water. A map showing location of the proposed 5 ha land for staggered trencher has been enclosed as Annexure III.

Staggered Trenches Design on more than 30° slope



1.2.2 Continuous Contour Trenches:

A trench along the contour line is quite beneficial structure to harvest rainwater. However, laying of the contour line correctly on the ground is vital for the stability of the structure. Retention of

rainwater in such trenches will assume additional pressure and is likely to break the bond at weak points. Hence it is recommended that help of A frame may be taken to delineate contour line on the ground. At appropriate intervals, passage for discharge of surplus rain water during continuous and torrenial relay days may be provided which should be pitched with stone to prevent erosion of soil. The specification and size of such trenches, as has been suggested, should be adhered for large interest of free movement of wildlife without any casualty. A map showing location of the proposed 3 ha land for Continuous Contour trenches has been enclosed as annexure-3

➤ Specifications of Continuous Contour Trenches (for 1 running meter length)

Top Width- 1.0 m, Bottom width-0.5 m, Depth- 0.5m

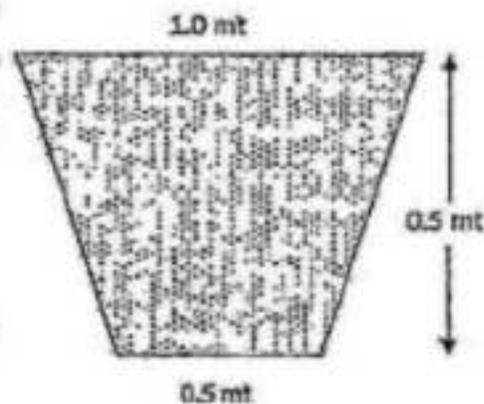
Cross Section- $((1.0\text{ m} + 0.5\text{m})/2 \times 0.5\text{ m}) = 0.375\text{ sq m}$

Earth Work- $(1.0\text{m} \times 0.375\text{ sqm}) = 0.375\text{ cum} = 0.38\text{ cum}$

Distance between contour lines (vertical) = 3-5m

Unit cost per 1 RM = 0.27 MD = Rs. 88/- (Rs. 126/- per man-days rate)

Cross Section



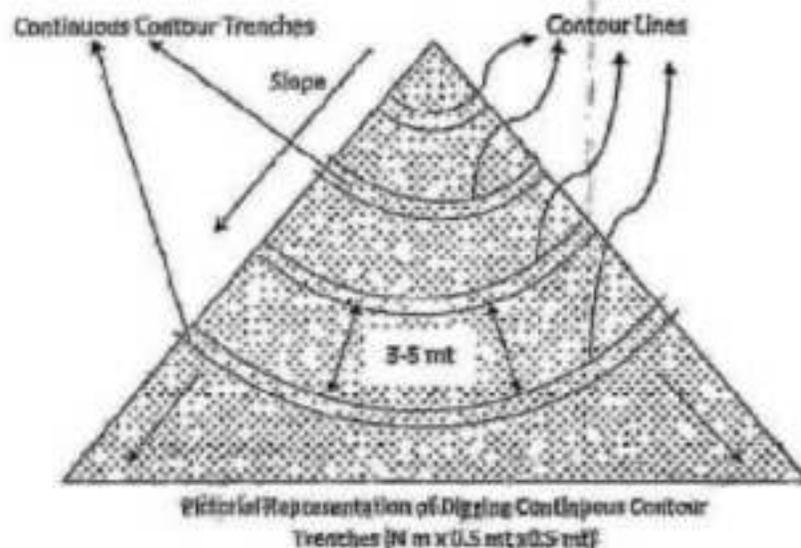


Table 2: Estimate cost for construction of staggered trenches and percolation pits slope 30 degree & above in 1 ha

Sl. No.	SMC Measure	Unit	Quantity (Per ha)	Man-days	Rate per Man days	Cost (In Rs.)	Remarks
1	Staggered Trenches (2.5 m x 0.5 m x 0.5 m)	1 hectare	450	195	326	63570	
2	Continuous contour trench Dimension (Cross section) (top width 1 m x depth 0.5 m x bottom width 0.5 m) (0.38 Cum)	1 Running metres	1 Running metres	0.27	326	88.02	it should run at least between 2 natural drainage lines but should not touch the edge of the drainage line.

(A) Size- 10' x 10' x 5'

(i) Requirement of boulder (Procured from quarry)

$\frac{1}{2} (10'+4') \times 10' \times 5' = 350$ cft or 9.90 cum

Cost of boulder @ Rs. 199/- per cum for 9.9- Rs. 1970.00/-

(ii) Labour for construction of LBCD for 1 cum

Mulla 1.04 No. x 326.00 = 339.40/-

Mason special 0.17 no. x 476.00 = 80.92/-

Stone pecker- 0.35 No. x 326.00 = 114.10/-

Total = 534.42/-

For 9.90 cum 9.90 x 534.42/- = 5290.758/-

(i) + (ii) = Rs. 1970.00/- + 5290.758/-

= Rs. 7260.758/-

Rate for 1 cum = Rs. 7260.758/9.90 = 733.409/-

= Rs. 733.409/-

A map showing location of the proposed 10 nos of LBCD structures over garland drain of OB dumps and quarry area has been enclosed as annexure-5

(B) Size- 10X10'X5'

(i) Requirement of boulder (Procured from quarry)

$\frac{1}{2} (10'+4') \times 10' \times 5' = 350$ cft or 9.90 cum

Cost of boulder @ Rs. 185/- per cum for 9.9- Rs. 1831.50/-

(ii) Labour for construction of LBCD for 1 cum

Mulla 1.04 No. x 326.00 = 339.40/-

Mason special 0.17 no. x 476.00 = 80.92/-

Stone pecker- 0.35 No. x 326.00 = 114.10/-

Total = 534.42/-

For 9.90 cum 9.90 x 534.42/- = 5290.758/-

(i) + (ii) = Rs. 1831.50/- + 5290.758/-

= Rs. 7122.258/-

Rate for 1 cum = Rs. 7122.258/9.90 = 719.42/-

= Rs. 719.42/-

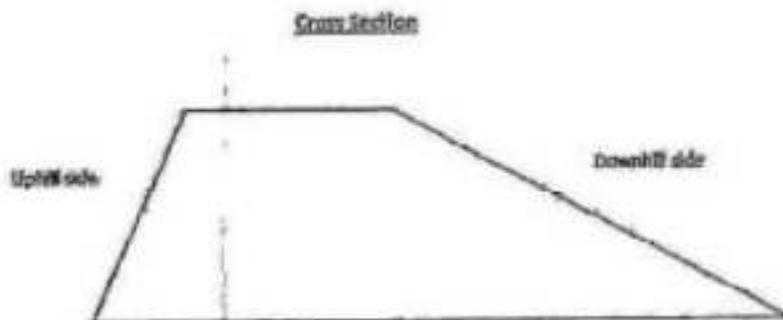
N.B.: The cost of transportation with lead of 5 km- Rs. 200/-(LS)

2. Drainage Line Treatment:

2.1.1 Loose boulders check dams (LBCD)

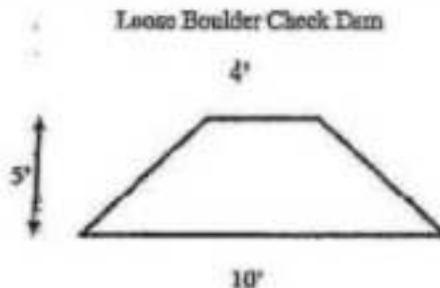
This structure is to be created across the drainage line for detention of runoff and reduction of velocity. Such structures should preferably have top width of 1 meter with upstream slope of 1:1 and downstream slope of 1:5.

Design of LBCD



The dimensions of each structure are dependent on several factors such as gradient, catchment size, etc. Hence, prescription of fixed dimension of LBCD is not contemplated. Since, the Cost norm for such structures is based in volume, implementation division will have desired flexibility to design such structures with appropriate dimensions.

On other side of the LBCD, trenches of prescribed dimension should be created to allow the vertically running water to spread on either side of the obstruction point which will reduce the velocity effectively. The length of such trenches should be at least twice the length of LBCD on either side. They may be in the form of a straight line or a curve with the curve towards uphill side. Such structures will also capture more rain water and enhance infiltration.



Abstract		
Sl. No.	Item	Remark
1	Loose Boulder Check Dam Constructed from boulder procured from quarry	Rs. 733,409/-
2	In-situ collected, broken and utilized for construction of LHCD	Rs. 719,42/-
3*	Cost of transportation within a lead of 5 Kms	Rs. 209,00/-

◆ **Executing Agency**

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. The entire work shall be carried out in coordination with the Forest Department.

Sl. No	Designation	Expertise
1	Dy. GM (Mining)	25 years' experience in Mining/Environment Survey.
2	Area Environment Officer	10 years' experience in Environment & Forest
3	Area Survey Officer	5 years' experience with pollution control & Environmental Management
4	Project Environment Officer	6 years' experience with Environment Management plan.

◆ **Requirement of Funds**

Sl. No.	Slope	EMC Measure	Units	Rate	Amount
1	0° to 30°	Surface Treatment-Staggered Trench	1500	65.29	97,800.00
2	0° to 30°	Surface Treatment-Percolation Pits	1000	104.32	1,04,320.00
3	30° & Above	Surface Treatment-Staggered Trench	2250	141.27	3,17,858.00

4	30° & Above	Surface Treatment- Continuous Contour Trench	2000 RM	88.02	1,76,040.00
5	30° & Above	Drainage Line Treatment- LBCD Type A	10	933.409	9334.09
6	30° & Above	Drainage Line Treatment- LBCD Type B	15	919.42	13791.30
Miscellaneous Expense					1,00,000.00
Total					8,19,143.39

Or say Rs. 8,19,150.00/-

The estimated cost for implementation of the above scheme (compliance to condition no 4 (i) of para A of the stage-I grant condition) will be Rs. 8,19,150.00 only. The above expenditure will be made within the period of three years from issue of Stage-II. Therefore, budget provision has been kept by the user agency for implementation of the above program. This budget will be subjected to increase in amount considering the increase in material cost and labor charges.


 General Manager
 Mahanadi Area Office
 Mahanadi Coal Fields Limited

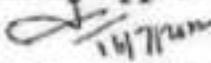

 Project Officer,
 Sarnal OCP
 Project Officer
 Sarnal OCP
 Mahanadi Coalfields Limited

Recommended for Approval


 Divisional Forest Officer
 DIVISIONAL FOREST OFFICER
 SARNAL FOREST DIVISION
 Sarnal Forest Division.

Approved.

Technically Approved


 Regional Chief Conservator of Forests
 Rourkela Circle
 Regional Chief Conservator of Forest,

Rourkela Forest Division

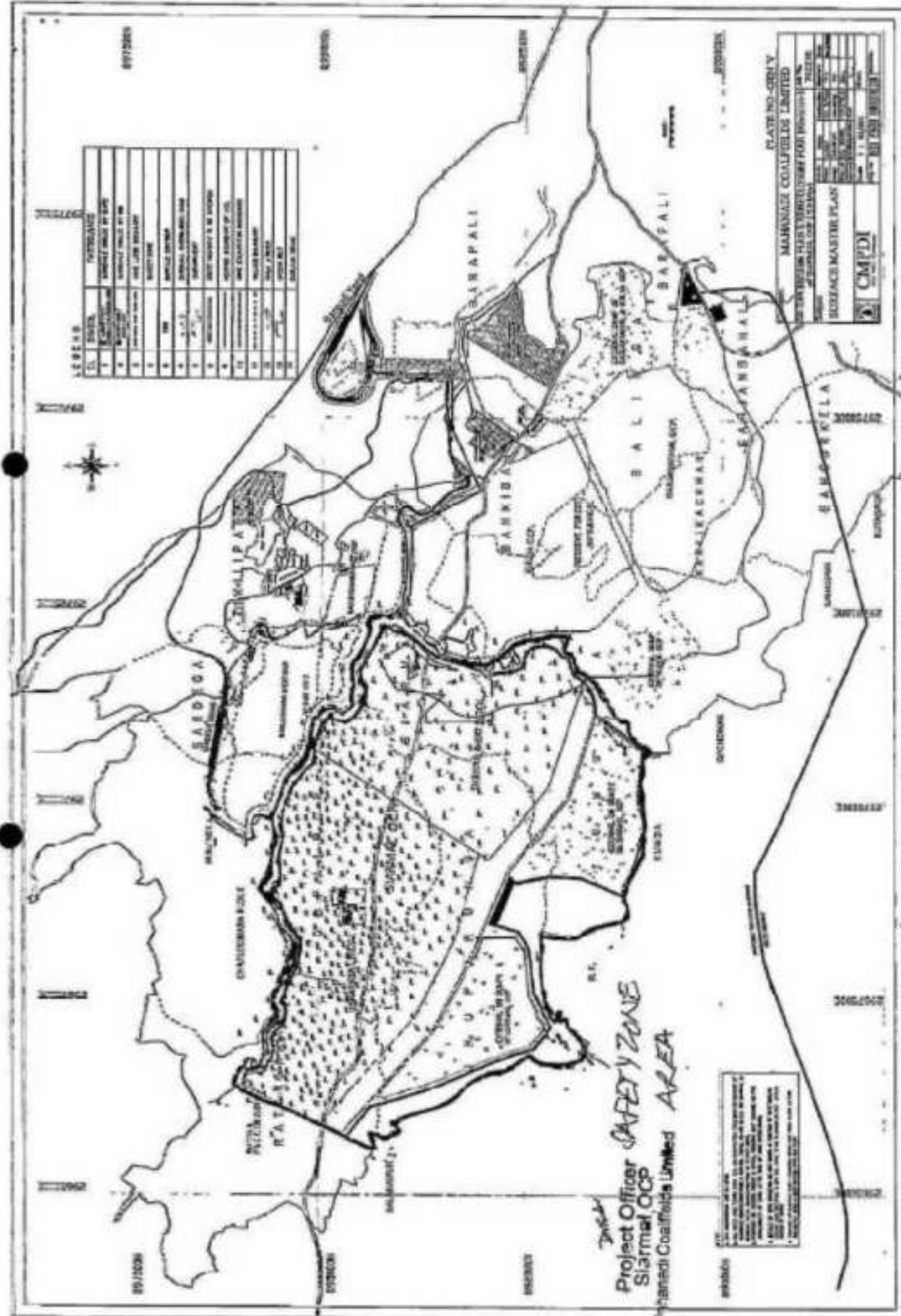
NO.	DESCRIPTION	DATE
1	ISSUED FOR PERMITS	10/10/08
2	ISSUED FOR PERMITS	10/10/08
3	ISSUED FOR PERMITS	10/10/08
4	ISSUED FOR PERMITS	10/10/08
5	ISSUED FOR PERMITS	10/10/08
6	ISSUED FOR PERMITS	10/10/08
7	ISSUED FOR PERMITS	10/10/08
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18	ISSUED FOR PERMITS	10/10/08
19	ISSUED FOR PERMITS	10/10/08
20	ISSUED FOR PERMITS	10/10/08

STATE NO. 0811V	
MAHARAJA COALFIELDS LIMITED	
SARMAKOPAN (PVT) LIMITED FOR PROSPECTING	
SURFACE MASTER PLAN	
SCALE: 1:1000	
DATE: 10/10/08	
DRAWN BY: M. S. SURESH	
CHECKED BY: M. S. SURESH	
APPROVED BY: M. S. SURESH	
CM/PI	

Project Officer SAFETY ZONE
Sijamal OCP
Maharaja Coalfields Limited AREA

NOTES:
1. THIS PLAN IS TO BE USED FOR THE PURPOSE OF THE SAFETY ZONE.
2. THE SAFETY ZONE IS THE AREA WITHIN WHICH THE PROSPECTING AND MINING OPERATIONS ARE TO BE CONDUCTED.
3. THE SAFETY ZONE IS TO BE MAINTAINED CLEAR OF ALL OBSTACLES AND BUILDINGS.
4. THE SAFETY ZONE IS TO BE MAINTAINED CLEAR OF ALL OBSTACLES AND BUILDINGS.
5. THE SAFETY ZONE IS TO BE MAINTAINED CLEAR OF ALL OBSTACLES AND BUILDINGS.

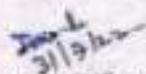
MAHARAJA COALFIELDS LIMITED SARMAKOPAN (PVT) LIMITED FOR PROSPECTING SURFACE MASTER PLAN SCALE: 1:1000 DATE: 10/10/08 DRAWN BY: M. S. SURESH CHECKED BY: M. S. SURESH APPROVED BY: M. S. SURESH CM/PI



Proposed locations for 15 nos. of LBCD-B structures with co-ordinates

Sl. No.	Latitude	Longitude
1	22° 3'48.60"N	83°40'32.74"E
2	22° 3'41.83"N	83°41'5.77"E
3	22° 3'45.07"N	83°41'48.24"E
4	22° 3'39.54"N	83°41'55.65"E
5	22° 3'30.01"N	83°42'46.68"E
6	22° 3'5.01"N	83°43'7.59"E
7	22° 2'56.11"N	83°42'52.78"E
8	22° 1'16.54"N	83°42'55.49"E
9	22° 1'9.39"N	83°42'30.98"E
10	22° 1'26.93"N	83°43'6.93"E
11	22° 3'50.26"N	83°40'15.16"E
12	22° 1'53.26"N	83°41'2.88"E
13	22° 1'33.68"N	83°41'40.64"E
14	22° 3'7.77"N	83°43'36.16"E
15	22° 2'43.67"N	83°40'18.79"E

All such structure activities at proposed locations will be undertaken only after in consultation with state forest department.


Project Officer
Sarnaf OCP
Maharadi Coalfields Limited

Google Image: Locations showing 15 nos. LBBCD of Type B within mining lease area



ANNEXURE - IV

Scheme

Prepared for

"Planting of adequate drought hardy plant species and sowing of seeds in the appropriate area within the mining lease to arrest soil erosion"

In compliance with

Condition No. 4 (II) of para-A of Stage-I forest clearance – in-principle approval

vide letter no. F. No. 8-25/2021-fc dated 21st April 2022

of Govt. of India, Ministry of Environment, Forest & Climate Change,

New Delhi

for

Diversion of 349.709 hectares of forest land for "Sirmal Opencast Coal Mining Project" within 2290.449 hectares of mining lease area

of

M/s Mahanadi Coalfields Limited.

In Sundargarh Forest Division of Dist. Sundargarh, Odisha

Scheme for "Planting of adequate drought hardy plant species and sowing of seeds in the appropriate area within the mining lease to arrest soil erosion."

1. Brief Information:

M/s Mahanadi Coalfields Limited (MCL), a subsidiary company of Coal India Limited is a Miniratna Company of nature and style public sector undertaking under Government of India, which was carved out to administer and mine out coal from the coal mines of Odisha, spread over Talcher and Ib valley coal fields.

Ib valley coal fields in Sundargarh and Jharsuguda Districts of Odisha contain large reserves of quarriable coal. Each area containing coal has been divided into several mining blocks, and Sirmal geological block is one of them. Sirmal opencast project is located in Sirmal geological block of Gopalpur tract in the north-western part of Ib valley coal fields. It lies between latitudes of 22°01'19"-22°03'59.99" N and longitudes of 83°37'09"-83°42'59.58" E. It is represented in Survey of India Topo sheet No. I44L12 (64/N/16). This project is having 1541.82 Mt (Mineable Reserve) of quarriable coal reserve in Gopalpur, Bhuparanga, Sirmal, Ramnagar, Tumalia and Kolda villages. The entire area of Sirmal project involving six villages were acquired under Coal Bearing (Acquisition and development) Act, 1957 (CBA-1957) vide S.O. No. 1869 dated 10.07.1989 and S.O. No. 3055 dated 29.10.1990. The above land has been vested in MCL u/s 11(I) of the said Act vide SO No. 2592 dated 13.09.1990 and 43015 dated 30.03.1993. (Page-22 to 38/DF). Present proposal Sirmal OCP involves total area of 2290.449 ha which comprises of 149.709 ha of forest land, 473.792 ha of Govt. Non- Forest land and 1466.949 Tenancy land.

2. Location of the project:

The boundary of Sirmal block is as follows:

- North : Chaturdham and Basundhara West blocks separated by Chaturdham Nala and Basundhara River
- West : Rampia & Dip side of Rampia.
- East : Kolda Block separated by Chhattajor nala

South : Prajapara Block.

Sandargach town is the nearest revenue town & Dist. HQ, which is at a distance of 46 km. Bhubaneswar, the State Capital from the mines is 450 km. The company Headquarters is at Burla which is 150 km via Sandargach, Jaresuguda, Sambalpur. The nearest railhead is Hengir railway station on Mumbai – Howrah line of South Eastern railway at a distance of about 35 km. The nearest domestic airport, Veer Surendra Sai airport, Jaresagach at a distance of 30 km. Biju Patnaik International Airport, Bhubaneswar is at a distance of about 450 km. The nearest sea port – Paradip is at a distance of 550 km from the block.

State OCP has been accorded the Forest Stage I clearance including 349.709 ha of forest land from central government under Section 2 (ii) of Forest (Conservation) Act 1980, Ministry of Environment, Forests and Climate Change in vide Letter No. F. No. 8-25/2021-FC Dated 21st April 2022. The FC has been accorded with a set of conditions to comply with and thus this scheme has been prepared to comply with Condition No. 4(V) of para-A of Stage-I in-principal approval.

3. Physiography & Drainage:

The topography of the block is represented by flat & sloppy ground. The ground slopes generally towards east and north-east and the drainage is through small streams, which in turn feed to river Basundhara. Basundhara River is flowing from west- to-east and ultimately drains into the Ib River.

Table 1. Distance of waterbodies from the mine is as follows:

Name of the Water Bodies	Distance
Chhata Jhor Nalla	0 km
Basundhara river	0 km
Garia Nala	4.3 km
Johha river	18 km
Ib river	27 km

4. Climate:

Meteorological data collected from IMD, Bhubaneswar for Jharsuguda IMD station for the year 2013 have been referred for preparation of the following table 2:

Item	Parameters	Particulars
Rainfall	Minimum	0.1 mm in Oct
	Maximum	118.8 mm in Aug
	Annual rainfall	1281.5 mm (Average annual rainfall is 1430 mm for last 22 years)
Temperature range (monthly mean of daily temperature)	Minimum	6.9°C in Jan
	Maximum	46.7°C in May
Relative humidity range (monthly mean of daily RH)	Max at 8:30 hr	98% in Feb, Jun and Jul
	Min at 8:30 hr	26% in Apr and May
	Max at 17:30 hr	98% in Jul, Aug and Oct
	Min at 17:30 hr	11% in Apr
Wind speed range (monthly mean of daily wind speed)	Max at 8:30 hr	30 kmph in Oct
	Min at 8:30 hr	1 kmph
	Max at 17:30 hr	30 kmph in Oct
	Min at 17:30 hr	1 kmph

5. Geology:

The "Geological Report on Siarnal Block, Ib-River Coalfield," Odisha, was prepared by CMPDI in February 1997. Siarnal block spreading over an area of 5.00 sq.km. is a part of north-western sector of Ib-valley coalfield and in which coal bearing area is 4.24 sq. km.

The coal seams occurring in Siarnal block are in the continuation of the adjoining block i.e., Kujds in the east.

6. Soil Type:

Soil may be defined as a mixture of rock and mineral with the organic matter. The soil of the M. L. area is classified as lateritic soil, lateritic with coal on the basis of its layer of formation. Soil is the net result of the action of climate and organisms especially plant on the earth crust. The pH value of the soil is normal ranging from 6.00 to 7.2.

7. Existing Vegetation

The crop composition of forest area is mainly Sal (*Shorea robusta*) and its associates namely Bija (*Pterocarpus marsupium*), Mango (*Mangifera indica*), Kendu (*Diospyros melanoxylon*), Mahul (*Madhaca indica*), Jaman (*Syngium cumata*), Neem (*Azadirachta indica*), Bahada (*Terminalia hallerica*), Dhaura (*Anogeissus latifolia*), Aachhu (*Morinda tinctoria*), Kurum (*Adina cordifolia*), Sahaj (*Terminalia tomentosa*), Char (*Buchanania lanzoe*), Kasi (*Miragyna parviflora*), Sidha (*Lagerstroemia parviflora*), Sissoo (*Dalbergia latifolia*), Karla (*Cleistanthus collinus*), Dhatki (*Woodfordia fruticosa*), Garbhari (*Gmelina arborea*), Kurin (*Hollarheum antidysenterica*), Palas (*Butea monosperma*), Bharu (*Chloroxylon rivetensis*), etc. Sal (*Shorea robusta*) is the pre-dominant species. The condition of the vegetation is dry deciduous Forest.

The condition no. 4 (II) of para-A of the stage-I approval envisages to prepare a plan for planting of adequate drought hardy plant species to arrest soil erosion. This scheme is being submitted in compliance with aforesaid condition of Ministry of Environment, Forest and Climate Change, Government of India.

◆ Objectives

The stipulated condition no. 4 (II) of para-A of stage-I approval reads 'Planting of adequate drought hardy plant species and sowing of seeds in the appropriate area within the mining lease to arrest soil erosion in accordance with the approved scheme.'

To fulfill the above stipulation of the Stage-I approval which envisages planting of adequate drought hardy plant species and sowing of seeds in the appropriate area within the mining lease to arrest soil erosion within the mine lease boundary, the scope of the scheme is as follows:

The objective of this scheme is to cater to creation, conservation and development vegetation, the main objectives of the scheme are as mentioned below:-

- To compensate the loss to vegetation due to operation of the mine.
- To restore the de-coaled backfilled area with vegetative richness
- To prevent spread of fugitive dust generated due to mining and allied activities.
- To reduce soil erosion.
- To help stabilize the slope of external over-burden dumps.
- To increase the green cover and improve aesthetics.
- To attract the birds, which area addressed as litmus of nature.
- To provide recreational value to colony inhabitants.

In this scheme, plantation of drought hardy species has been proposed upon quarry excavation area for afforestation. The backfilled surface will be duly levelled with appropriate gradient for afforestation and measures of soil erosion via. SMC activities. The top soil generated from the quarry area to be layered, and organic matter (animal dung, agricultural waste, kitchen waste, etc.) may be mixed with the upper layer of the soil. The levelling and grading will be undertaken of the top surface, bunds may also be created to check the water run-off.

The species proposed for the plantation are locally growing species with fast growth rate and ability to flourish even in poor soil quality. The choice of species will be done in consultation with DFO, Sundergarh keeping in mind the objective of creating and developing a rich biological regime, as envisaged in the mine plan and HMP plan.

Table 3, The proposed list of drought resistant tree species are as follows, which is to be sown in consultation with the forest department:

Sl. No.	Name of Species	Scientific Name	Usage
1	Amli	<i>Emblica officinalis</i>	Fruit, Medicinal & Flower
2	Asoka	<i>Saraca Asoca</i>	Fruit & Flower
3	Babul	<i>Acacia Nilotica</i>	Fruit bear & Medicinal

4	Bada Chikuoda	<i>Santania saman</i>	Fruit, Medicinal & Flower
5	Babala	<i>Terminalia bellirica</i>	Fruit, Medicinal & Flower
6	Bana Bhalia	<i>Semecarpus anacardium</i>	Flower
7	Bola	<i>Aegle marmelos</i>	Fruit bear
8	Neem	<i>Azadirachta indica</i>	Medicinal
9	Chem	<i>Buchanania lanzan</i>	Fruit bear
10	Kasi	<i>Bridelia retusa</i>	Fruit bear
11	Kataka	<i>Strychnos potatorum</i>	Fruit bear, Flower
12	Koolu	<i>Diospyros Melastoylon</i>	Fruit bear
13	Kimlars	<i>Acacia Catechu</i>	Fruit bear
14	Mol	<i>Lannea coromandelica</i>	Fruit bear
15	Bhini	<i>Soymbia febrifuga</i>	Fruit bear
16	Sison	<i>Dalbergia sison</i>	Fruit bear, Flower
17	Mahajeen	<i>Simaruba Glouca</i>	Fruit, Medicinal & Flower

It is proposed to plant the seedlings in dugout pits (45 cm X 45 cm X 45 cm) at spacing of 2.50 m in block plantation of 1600 seedlings per ha. The pits shall be filled with a mixture of good quality soil and organic manure (F Y M), the saplings shall be planted just after commencement of the monsoon to ensure maximum survival. The post planting care will be taken to replace casualties/ dead saplings, weed removal, watering and spraying of fertilizers etc.

Table S. Scheme for block plantation/ artificial regeneration of 1600 plants/ha (18 months old seedlings of forestry species)

Type of the Plantation	Plantation
No. of seedlings to be planted	1600 Nos per hectare
Spacing to be adopted	2.5m x 2.5m
Size of pits	45 cm X 45 cm X 45 cm

The above plantation scheme will be implemented in stage-wise cumulative manner as envisaged in the FMP & MP as given below (table 6):

Year	Backfilled area (in Ha)
15	80.00
20	100.00
25	74.00
30	55.00
34	55.00
35-38	45.99
Total	409.99

◆ **Executing Agency**

The present Scheme shall be executed by the User Agency having specialized departments headed by qualified persons with outsourced men 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. The entire work shall be carried out in coordination with the Forest Department.

Sl. No	Designation	Expertise
1	Dy. GM (Mining)	25 years' experience in Mining/Environment Survey.
2	Area Environment Officer	10 years' experience in Environment & Forest
3	Area Survey Officer	5 years' experience with pollution control & Environmental Management
4	Project Environment Officer	6 years' experience with Environment Management plan.

◆ **Requirement of Funds**

The scheme of 1600 plants per hectare have been prepared as per The One Time Cost Norm basis of matrix rate for the year 2022-23. The copy of relating plantation scheme with cost for the year 2022-23 is enclosed as Annexure-I.

Sl. No.	Description	Amount (In Rs.)
1	Cost of Block Plantation of 1600 plants per ha with 18 months old seedling over 409.99 ha @ Rs.3,25,623/- per ha with 10 years maintenance (One Time Cost Norm for the year 2022-23)	13,35,00,174.00
2	Watering arrangement: 20% of plantation cost (1)	2,67,00,434.80
	Total Cost	16,02,02,608.80

Financial cost estimated for compliance to condition no. 4 (ii) of para A of stage-I approval will be Rs. 16,02,02,610.00 (Rupees Sixteen Crores Two Lakh Two Thousand Six Hundred Ten Only). The above expenditure will be made as per the approval of scheme from the competent authority. Therefore, budget provision has been kept by the user agency for implementation of the above plantation program over a period of ten years. The funds are placed in the approved HIA and HMP plan. Hence separate funds are not placed for this purpose.


 General Manager,
 Mahanadi Coal Fields (MCL),
 Minhalaxmi Area

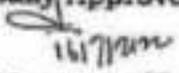
Mahanadi Coal Fields Limited


 Project Officer,
 Sarmal OCP (MCL),
 Sarmal OCP
 Mahanadi Coalfields Limited

Recommended for Approval.


 Divisional Forest Officer
 Sundergarh Forest Division
 Sundergarh Forest Division
 Sundergarh Forest Division

Approved.
 Technically Approved


 Regional Chief Conservator of Forests
 Kourkela Circle
 Regional Chief Conservator of Forest,
 Kourkela Forest Division

BASE COST NORM FOR COMPENSATORY AFFORESTATION (BLOCK PLANTATION) @ 1000 PLANTS PER HECTARE (18 months old seedling)						
WAGE RATE Rs-311/- PER MANDAY						
Sl. No	Name of work	Preferable Period of execution	No of Mandays	Labour Cost (Rs./ha.)	Material Cost (Rs./ha.)	Total cost (Rs./ha.)
1	2	3	4	5	6	7
0th Year (Advance work) Pre-Planting Operation						
1	Survey, Demarcation and Pillar pecking	Nov/Dec	1	311	0	311
2	Preparation of Treatment Map (Digital Map)	Nov/Dec	1	311	100	411
3	Site preparation (Clearing & removal of debris etc)	Nov/Dec	12	3732	0	3732
4	Creation of 4.00 mt wide trapdoor Path	Feb/Mar	1	311	0	311
5	Alignment and peckling	Feb/Mar	1	311	0	311
6	Digging of pits (45 cm x 45 cm x 45 cm) in hard and gravelly soil	Feb/Mar	64	19904	0	19904
7	Construction of Temporary Labour Shed, Drinking water facility and First Aid etc.	Jan/Mar	1	0	3000	3000
Total			82	25502	3000	28502
1st Year/Planting Year						
1	Refilling of pits by spreading the top soil of the site, application of Organic manure @ 1000/ha FYM @ making the same properly.	Jan/Feb	12	3732	8000	11732
2	Transportation of 18 months old polyprop seedlings in load truck / tractor from the nursery/Block nursery to planting site including loading & unloading. (Average load of 50 plants) & stacking the seedlings @ Rs.4/- per seedling (1750 nos.)	Jan/Aug	0	0	10500	10500
3	Watering the polyprop seedlings or planting pits	Jan/Aug	1	311	0	311
4	Overseeing of polyprop seedlings or load load from the stacking area individual digout pits within the planting site, applying insecticide, fertiliser & plaiting after sweeping the soil with other applied materials & peckling the soil properly around the planted seedlings	Jan/Aug	36	11196	0	11196
5	Cost of Fertiliser & Insecticide (a) NPK/urea fertilizer @ 50 gm/plant at base dose = 90kg @ Rs.20/- per kg = Rs. 1800.00 (b) Urea/Vermicompost/No-N/20a/any other fertilizer in two subsequent doses @ Rs. 1200.00 (c) Insecticide/ Bio-pesticide @ 5 gm/plant = 4 kg @ Rs.150/- per kg = Rs. 1200.00	Jan/Aug	0	0	4000	4000

Project Officer
Siarnel OCP
Maharaj Coalfields Limited.

**BASE COST NORM FOR COMPENSATORY AFFORESTATION (BLOCK PLANTATION)
@ 1600 PLANTS PER HECTARE (18 months old seedling)**

(99)

WAGE RATE Rs- 311/- PER MANDAY

Sl. No	Items of work	Estimated Period of Execution	No of Mandays	Labour Cost (IN Rs.)	Material Cost (IN Rs.)	Total cost (IN Rs.)
1	2	3	4	5	6	7
6	Casualty Replacement @ 16% (160 nos)	Jul/Aug	4	1244	0	1244
7	1st weeding & Mounding	Aug/Sept	15	4665		4665
8	2nd Weeding, Soil working (1st. diameter around the plants) and Mounding	Oct/Nov	20	6220	0	6220
9	Fire line tracing (2 m. wide fire line over 400 m long) including maintenance of irregular path	Feb/Mar	3	933	0	933
10	Weed & Ward including weeding as per requirement	Aug-Mar	12	3732	0	3732
Total			105	32653	13360	46013
2nd Year Maintenance						
1	Transportation of 160 seedlings from Nursery to plantation site including loading/unloading & conveyance by Tractor @ Rs.6/- per seedling	Jul	0	0	960	960
2	Casualty replacement- 16%	Jul	4	1244	0	1244
3	Cost of Fertilizer & insecticide A) Cost of Insecticide/ Bio-pesticide @ 3 gms/plant + 20 kg @ Rs.150/- per kg = Rs.120/- B) Urea, NPK, Bio-fertilizer/Vermicompost/Ma Gats/Any other fertilizer @ Rs. 400/-	Aug/Sept	0	0	4600	4600
4	Weeding (Complete weeding), Mounding & Soil working (1st. diameter around the plants)	Sep/Oct	20	6220	0	6220
5	Fire line tracing (2 m. wide fire line over 400 m long) including maintenance of irregular path	Feb/Mar	3	933	0	933
6	Weed & Ward including weeding as per requirement	Apr-Mar	12	3732	0	3732
7	Maintenance of Temporary Labour Shed, supplying water facility and First Aid etc				1000	1000
Total			49	12026	6560	18586

**BASE COST NURM FOR COMPENSATORY AFFORESTATION (BLOCK PLANTATION)
@ 2500 PLANTS PER HECTARE (10 months old seedling)**

WAGES @ Rs. 311/- PER MANDAY

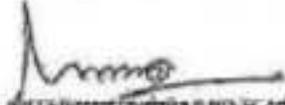
Sl. No	Items of work	Propable Period of Execution	No of Mandays	Labour Cost (In Rs.)	Material Cost (In Rs.)	Total cost (In Rs.)
1	2	3	4	5	6	7
3rd Year Maintenance						
3	Cost of Fertilizer (DAP/SP/10-20-20/Vermin compost/No Waste/any other fertilizer)	Sept/Oct	0	0	4600	4600
4	Weeding, Moulding & soil working (Int. lines/bw around the plots)	Sept/Oct	20	6220	0	6220
5	Fire line tracing (2 m. wide fire line over 400 m long) including maintenance of topsoil on path	Feb/Mar	3	933	0	933
6	Watch & Ward including watering as per requirement	Apr/May	18	5598	0	5598
7	Maintenance of Temporary Labour shed, Drinking water facility and fire-out etc.	Apr/May			1000	1000
Total			41	12751	5600	18351
4th Year Maintenance						
1	Fire line tracing (2 m. wide fire line over 400 m long) including maintenance of topsoil on path	Feb/Mar	3	933	0	933
2	Watch & Ward	Apr/May	18	5598	0	5598
Total			21	6531	0	6531
5th Year Maintenance						
1	Fire line tracing (2 m. wide fire line over 400 m long)	Feb/Mar	3	933.00	0	933
2	Watch & Ward	Apr/May	18	5598.00	0	5598
Total			21	6531	0	6531
6th Year Maintenance						
1	Fire line tracing (2 m. wide fire line over 400 m long)	Feb/Mar	3	933.00	0	933.0
2	Pruning of branches, Staking out of mainline plants	Jan/Mar	5	1555.00	0	1555.0
3	Watch & Ward	Apr/May	18	5598.00	0	5598.0
Total			26	8086.00	0	8086.0
7th Year Maintenance						
1	Fire line tracing (2 m. wide fire line over 400 m long)	Feb/Mar	3	933.00	0	933
2	Watch & Ward	Apr/May	18	5598.00	0	5598
Total			21	6531	0	6531
8th Year Maintenance						
1	Fire line tracing (2 m. wide fire line over 400 m long)	Feb/Mar	3	933.00	0	933
2	Watch & Ward	Apr/May	18	5598.00	0	5598
Total			21	6531	0	6531
9th Year Maintenance						
1	Fire line tracing (2 m. wide fire line over 400 m long)	Feb/Mar	3	933.00	0	933
2	Watch & Ward	Apr/May	18	5598.00	0	5598

137

BASE COST BOMF FOR COMPENSATORY AFFORESTATION (BLOCK PLANTATION) @ 1000 PLANTS PER HECTARE (FR must be old seedling)							
WAGE RATE Rs- 211/- PER MANDAY							
Sl. No	Items of work	Probable Period of execution	No of Mandays	Labour Cost (Rs Rs.)	Material Cost (Rs Rs.)	Total cost (Rs Rs.)	
1	2	3	4	5	6	7	
Total			21	4431	0	4431	
10th Year Maintenance							
1	Tree like tending (2 m. wide for 1st year 400 ft long)	Feb/Mar	3	633	0	633	
2	weeding & weeding	Apr/Jun	18	3798	0	3798	
Total			21	4431	0	4431	
Year wise Abstract of Cost Norm (Allowing seedling cost separately)							
Sl. No	Year	No. person days	Labour cost @ Rs. 211/- per day (Rs)	Material Cost	Monitoring, Evaluation, Inventory, Documenta tion, Other Overheads 3 (3%) of (4+5)	Cost of Seedlings @ (Rs. 20.21 per seedling)	TOTAL COST
1	2	3	4	5	6	7	8
1	1st year	02	2392	1000	1790.00	0	3050.00
2	1st year	105	22155	23100	1820.00	6854	14721.00
3	2nd year	47	9917	6500	1020.00	6250	21437.00
4	3rd year	40	8440	5000	910.00	0	14350.00
5	4th year	21	4431	0	375.00	0	6057.00
6	5th year	22	4642	0	216.00	0	6057.00
7	6th year	25	5275	0	404.00	0	6057.00
8	7th year	21	4431	0	375.00	0	6057.00
9	8th year	21	4431	0	375.00	0	6057.00
10	9th year	21	4431	0	375.00	0	6057.00
11	10th year	21	4431	0	375.00	0	6057.00
Total		448	104770	39010	10497	76070	202000

Note:

1. Priority must be given to the indigenous local species available nearby to the site of plantation.
2. If 16 indigenous fruit bearing trees must be preferred in plantation.
3. Site specific soil moisture conservation measures like LSC, ridges, Mounding, Mounded Trench, Contour Trench, Spaded Band, etc may be.
4. Close link fencing can be adopted in the CA plantation taken up outside the forest area and 10m/20m wide fencing may be.
5. Watering facilities for establishment of water & watering may be adopted as per the availability of water.
6. The Cost Norm of various items are to change with the approval of the concerned RCCPs keeping the overall cost norm fixed for each Biennial Year.


 A.C.U. Forest Division & HQ, FC Act

Scheme

Prepared for

**"Construction of check dams, retention/toe walls to arrest sliding down of
the excavated material along the contour"**

In compliance with

Condition no. 4 (iii) of Stage-I forest clearance – in-principle approval

vide letter no. F. no. 8-25/2021-fc dated 21st April 2022

of Ministry of Environment, Forest & Climate Change, Govt. of India,

New Delhi

for

**Diversion of 349.709 hectares of forest land for "Siarmal Opencast Coal
Mining Project" within 2290.449 hectares of mining lease area**

of

M/s Mahanadi Coalfields Limited.

in Sundargarh Forest Division of District Sundargarh, Odisha

Scheme prepared for "Construction of check dams, retention/tee walls to arrest sliding downs of the excavated material along the contour"

1. Brief Information:

M/s Mahanadi Coalfields Limited (MCL), a subsidiary company of Coal India Limited is a Miniratna Company of nature and style public sector undertaking under Government of India, which was carved out to administer and mine out coal from the coal mines of Odisha, spread over Talcher and Ib valley coal fields.

Ib valley coal fields in Sundergarh and Jharsuguda Districts of Odisha contain large reserves of quarriable coal. Each area containing coal has been divided into several mining blocks, and Sirmal geological block is one of them. Sirmal opencast project is located in Sirmal geological block of Gopalpur tract in the north-western part of Ib valley coal fields. It lies between latitudes of 22°01'19"-22°03'59.99" N and longitudes of 83°37'09"-83°42'59.58" E. It is represented in Survey of India Topo sheet No. F44L12 (64N/16). This project is having 1547.82 Mt (Mineable Reserve) of quarriable coal reserve in Gopalpur, Jhupuranga, Sirmal, Ratansora, Tunulia and Kuida villages. The entire area of Sirmal project involving six villages were acquired under Coal Bencing (Acquisition and development) Act, 1957 (CBA-1957) vide S.O. No. 1869 dated 10.07.1989 and S.O. No. 3055 dated 29.10.1990. The above land has been vested in MCL vide 11(I) of the said Act vide SO No. 2592 dated 13.09.1990 and 43015 dated 30.03.1993. (Page-22 to 28/DP). Present proposal Sirmal OCP involves total area of 2290.449 ha which comprises of 349.709 ha of forest land, 473.792 ha of Govt. Non-Forest land and 1466.949 Tenancy land.

2. Location of the project:

The boundary of Sirmal block is as follows:

- North : Chaturdhara and Barasidhara West blocks separated by Chaturdhara Nala and Hamnidhara River
- West : Rampia & Dip side of Rampia.
- East : Kuida Block separated by Chettajor nala
- South : Prajapara Block.

Sundergarh town is the nearest revenue town & Dist. HQ, which is at a distance of 46 km. Bhubaneswar, the State Capital from the mines is 450 km. The company Headquarters is at Burla which is 150 km via Sundergarh, Jharsuguda, Sambalpur. The nearest railway is

Hemgir railway station on Murabai – Howrah line of South Eastern railway at a distance of about 35 km. The nearest domestic airport, Veer Surendra Sai airport, Jharsuguda at a distance of 30 km. Biju Patnaik International Airport, Bhubaneswar is at a distance of about 450 km. The nearest sea port – Paradip is at a distance of 550 km from the block.

Sernal OCP has been accorded the Forest Stage I clearance including 349.709 ha of forest land from central government under Section 2 (b) of Forest (Conservation) Act 1980. Ministry of Environment, Forests and Climate Change in vide Letter No. F. No. E-25/2021-FC Dated 21st April 2022. The FC has been accorded with a set of conditions to comply with and thus this scheme has been prepared to comply with Condition No. 4(V) of para-A of Stage-I in-principal approval.

3. Physiography & Drainage:

The topography of the block is represented by flat & sloppy ground. The ground slopes generally towards east and north-east and the drainage is through small streams, which in turn feed to river Basundhara. Basundhara River is flowing from west- to-east and ultimately drains into the Ib River.

Table I. Distance of waterbodies from the mine is as follows.

Name of the Water Bodies	Distance
Chhata Jhorriver/Nala	0 km
Basundhara river	0 km
Garia Nala	4.3 km
Jolha river	18 km
Ib river	27 km

4. Climate:

Meteorological data collected from IMD, Bhubaneswar for Jharsuguda IMD station for the year 2013 have been referred for preparation of the following Table 2:

Item	Parameters	Particulars
Rainfall	Minimum	0.1 mm in Oct
	Maximum	118.8 mm in Aug
	Annual rainfall	1281.6 mm (Average annual rainfall is 1430 mm for last 22 years)
Temperature range (monthly mean of daily temperature)	Minimum	6.9°C in Jan
	Maximum	46.7°C in May
Relative humidity range (monthly mean of daily RH)	Max at 8:30 hr	98% in Feb, Jun and Jul
	Min at 8:30 hr	26% in Apr and May
	Max at 17:30 hr	98% in Jul, Aug and Oct
	Min at 17:30 hr	11% in Apr
Wind speed range (monthly mean of daily wind speed)	Max at 8:30 hr	30 kmph in Oct
	Min at 8:30 hr	2 kmph
	Max at 17:30 hr	30 kmph in Oct
	Min at 17:30 hr	2 kmph

5. Geology:

The "Geological Report on Sirmal Block, Ib-River Coalfield," Odisha, was prepared by CMPDI in February 1997. Sirmal block spreading over an area of 5.00 sq. km. is a part of north-western sector of Ib-valley coalfield and in which coal bearing area is 4.24 sq. km. The coal seams occurring in Sirmal block are in the continuation of the adjoining block i.e., Kolda in the east.

6. Soil Types:

Soil may be defined as a mixture of rock and mineral with the organic matter. The soil of the M. L. area is classified as lateritic soil, lateritic with coal on the basis of its layer of formation. Soil is the net result of the action of climate and organisms especially plants on the earth crust. The pH value of the soil is normal ranging from 6.00 to 7.2.

7. Existing Vegetation:

The crop composition of forest area is mainly Sal (*Shorea robusta*) and its associates namely Bija (*Pterocarpus marsupium*), Mango (*Mangifera indica*), Kendu (*Diospyros melanoxylon*), Mastui (*Madhuca indica*), Jamun (*Syzygium cumini*), Nona (*Azadirachta indica*), Belada (*Terminalia bellarica*), Dhawa (*Anogeissus latifolia*), Aschhi (*Morinda tinctoria*), Kurum (*Azadirachta indica*), Sahaj (*Terminalia tomentosa*), Char (*Buchanania laurifolia*), Kasi (*Odontaspis parviflora*), Sihu (*Lagerstroemia parviflora*), Siao (*Dalbergia latifolia*), Karla (*Cleistanthus collina*), Dhaili (*Woodfordia fruticosa*), Gumbaci (*Gmelina arborea*), Kartia (*Flourensia strobilifera*), Palas (*Butea monosperma*), Dhuru (*Chloroxylon swietenia*), etc. Sal (*Shorea robusta*) is the pre-dominant species. The condition of the vegetation is dry deciduous Forest.

The stipulated condition reads "Construction of check dam retention / toe walls to arrest sliding down of the excavated material along the contour in accordance with the approved scheme".

❖ Objectives

To fulfill condition no. 4 (III) of para A of the Stage-I approval issued vide letter no. F. No. 8-25/2021-FC, Dated 21st April 2022 of Ministry of Environment, Forest & Climate Change, New Delhi which provides for preparation of a plan for construction of check dams, retention / toe walls to arrest sliding down of the excavated materials along the contour. The scope of objectives are as follows:

- i) To control soil erosion from OR dump and mineral stock-piles.
- ii) To prevent erosion of sediment due to surface runoff.
- iii) To prevent the obstruction of natural water courses.
- iv) To complete construction activities efficiently before disturbed soils are exposed.
- v) To prevent overflow of eroded soil from the mining areas to the cultivable lands, natural streams and habitations.

❖ Proposed methodology:

To achieve the above objectives, it has been proposed to take up both biological and structural works for soil and water conservation.

In this scheme, considering the topography and contours of the lease area, emphasis has been given to arrest sliding down of excavated materials along the contour by constructing

retention/toe walls at specified locations within the mining lease. Locations have been properly selected within the leasehold and plans are listed in the following tables & maps.

◆ The salient features of the drainage management plan/scheme are as follows:

The topography of the block is represented by small hillocks & flat ground. The western part of the block is covered by small hillocks which are prominent in north western part. About 0.90 sq. km of this block is covered under dense forest and hillocks. The minimum and maximum elevations of the area are 260 m in east and 322 m in north western part respectively above the mean sea level. The ground slopes generally towards east and north-east and the drainage is through small streams, which in turn feed to river Baundhara. Baundhara river is flowing north-west to south-east and ultimately drained into Ib river.

During monsoon, heavy runoff may carry out silts and sediments so as to reduce the velocity of water flows into the natural drainage. Therefore a retention wall in both side of the Nala is proposed. Along with the above control measures, erosion from OB dump slope areas will be controlled by additional garland drain, toe walls etc. The main purpose of the work is to control soil erosion from OB dump and mineral stock-piles.

◆ Measures proposed to be adopted

• Structural Measures:

Vegetative means of erosion control are the most feasible and economic measures. However, as the pressure on land is increasing, it is felt necessary to bring even highly eroded land under utilization. In these lands, vegetative measures are not adequate to keep down the erosion. Some structural measures, therefore, serve as supplementary to vegetative measures. The objective behind building mechanical structural is to reduce the degree and length of the slope, reducing run-off and eventually, reducing soil erosion.

- A. Construction of toe/retaining wall all along garland drain of peripheral OB
- B. Stage-wise construction of garland drain on surface excavation periphery to collect surface run-off water
- C. Construction of settling tank along garland drain on excavation and OB areas
- D. Construction of catch drains at the foot of quarry and OB benches

The location of the garland drain, toe/retention wall and settling tanks are marked in the map enclosed as Annexure-I

B. Stage-wise construction of garland drain on surface excavation periphery to collect surface run-off water

Table 4. Detail Estimate of construction of Garland Drain for 100 m length

Sl. No.	Description of Items	No.	Length	Width	Height	Qty.	Unit	Rate (in Rs.)	Amount (in Rs.)
1	Cleaning of Jungles & bushes	1.0	200	1		1400	Sq. m	4.00	5600.00
2	Earth work in hard soil in embankment roads within 50 m initial load including rough dressing & breaking clods to maximum 5.00 cm to 7.00 cm & laying layers not exceeding 0.30 m depth as per specification approved by department along with proper compaction with H.R.R Excavation	1.00	200	2	0.75	300	cum	120.00	36000.00
3	Rough stone Dry packing with local boulder only labour charges (Local boulder will be supplied by the company through contractual manner)	2.00	3	2	0.3	3.6	cum	800.00	2880.00
			Rate per 100 m length				Total		44480.00

Total Amount required for 19000 meter garland Drain = 44480 x 190 km = Rs. 84,51,200/-

C. Estimate for construction of settling tank along garland drain on excavation and OB areas.

It is a process that involves separation of solid materials from natural rain water run-off. Sometimes this process is called sedimentation. When waste water is treated, a large quantum of materials is filtered out of the liquid by physical barriers. Even then, the water will contain some solids that need to be removed. A settling tank can also serve in collecting and protecting the surface water.

Table 5. Estimate for construction of 1 no. of settling tank

Sl. No	Description of Items	No.	Length	Width	Depth	Qty. (In Cum)	Rate	Amount (In Rs.)
1	Barth work in hard soil in embankment roads within 30 m initial lead & 1.50 m initial lift including rough dressing & breaking clods to maximum 5.00cm to 7.00 cm & laying layers not exceeding 0.30 m depth as per specification approved by department along with proper compaction with H. R.R. Extension.	1	4	3	1.5	18	120.00	2160.00
2	Rough Stone Dry packing with local boulder only labour charges (Local boulder will be supplied by our Company.	1	4	6	0.2	4.8	300.00	3840.00
3	Transportation charges for 5.00 km lead by truck load from quarry to work site with all cost of labour, T&P etc. all complete in all respect as per specification and direction of	As same as Item No-2				4.8	100.00	480.00
Estimated cost for construction 1 no. of settling tank								6480.00

Estimated cost for construction of 12 nos. of settling tanks=12 x 6480.00= Rs. 77,760.00/-

◆ **Construction of catch drains at excavation area and OR dumps**

A catch drain of appropriate size will be provided on foot of every bench of quarry and OR dumps as per DOMS norm. These drains will collect run-off water from nearby higher surfaces and direct it to main gradient drain and then finally to settling tank/sedimentation pond.

5. Inspection, monitoring and evaluation

After mining operation starts the scheme will be implemented. For successful implementation of the above mitigative measures, intensive inspection and technical guidance from concerned technical wing is required. Sufficient fee/conveyance charges for technical experts shall be provided by the user agency for proper execution of these programmes.

6. Executing agency

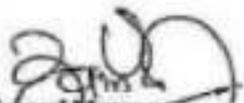
The works in the present Scheme shall be executed by the User Agency having specialized departments headed by qualified persons with outsourced man and machinery. To facilitate this, the user agency shall establish its own executing and supervision cells along with required infrastructure facilities.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

Sl. No	Designation	Expertise
1	Dy. GM (Mining)	25 years' experience in Mining/Environment Survey.
2	Area Environment Officer	10 years' experience in Environment & Forest
3	Area Survey Officer	5 years' experience with pollution control & Environmental Management
4	Project Environment Officer	6 years' experience with Environment Management plan.

7. Requirement of funds

Sl. No	Description	Amount (In Rs.)
1	Estimated cost for construction of 19000 meters of garland drain	84,51,200/-
2	Estimated cost of construction of toiletization wall.	1,69,09,950/-
3	Estimated cost for construction of 12 nos. of settling tanks	71,760/-
	Total	2,54,38,910/-

Financial cost now estimated for compliance to condition no. 4 (III) of para A will be Rs. 2,54,38,910/- The above expenditure will be made during the tenure of the project. Therefore, budget provision has been kept by the user agency for implementation of the above technical interventions. This budget will be subject to increase in amount considering the increase in material cost and labour charges. The funds are placed in the approved EIA and EMP plan. Hence separate funds are not placed for this purpose.


 General Manager,
 Mahanadi Area (MCA)
 Mahanadi Coal Fields Limited

Mahanadi Coal Fields Limited

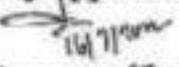

 Project Officer
 Sirmal OCP
 Sirmal OCB (MCA)
 Mahanadi Coal Fields Limited

Sujay Das.

Recommended for Approval


 Divisional Forest Officer
 Sirmal OCB (MCA)
 Mahanadi Coal Fields Limited

Approved by
 Technically Approved


 Regional Chief Conservator of Forests,
 Rourkela Circle
 Rourkela Forest Division

Scheme

Prepared for

"Stabilize the overburden dumps by appropriate grading/benching so as to ensure that angles of response at any given place is less than 28°."

in compliance to

Condition no. 4 (IV) of para A of Stage-I forest clearance – in-principle approval

vide letter no. f. no. 8-25/2021-fc dated 21st April 2022

of Ministry of Environment, Forest & Climate Change, Govt. of India,

New Delhi

for

Diversion of 349.709 hectares of forest land for "Siarmal Opencast Coal Mining Project" within 2290.449 hectares of mining lease area

of

M/s Mahanadi Coalfields Limited.

in Sundargarh Forest Division of District Sundargarh, Odisha

Scheme prepared for "Stabilize the overburden dumps by appropriate grading/benching so as to ensure that angles of repose at any given place is less than 28°."

1. Brief Information:

M/s Mahanadi Coalfields Limited (MCL), a subsidiary company of Coal India Limited is a Minister Company of nature and style public sector undertaking under Government of India, which was carved out to administer and mine out coal from the coal mines of Odisha, spread over Talcher and Ib valley coal fields.

Ib valley coal fields in Sundergarh and Jharsuguda Districts of Odisha contain large reserves of quarriable coal. Each area containing coal has been divided into several mining blocks, and Sirmal geological block is one of them. Sirmal opencast project is located in Sirmal geological block of Gopalpur tract in the north-western part of Ib valley coal fields. It lies between latitudes of 22°01'19"-22°03'59.59" N and longitudes of 83°37'09"-83°42'59.55" E. It is represented in Survey of India Topo sheet No. F44L12 (647816). This project is having 1547.82 Mt (Mineral Reserve) of quarriable coal reserve in Gopalpur, Jhupuranga, Sirmal, Retanara, Tamalia and Kuida villages. The entire area of Sirmal project involving six villages were acquired under Coal Bearing (Acquisition and development) Act, 1957 (CBA-1957) vide S.O. No. 1869 dated 10.07.1989 and S.O. No. 3055 dated 29.10.1990. The above land has been vested in MCL u/s 11(1) of the said Act vide SO No. 2592 dated 13.08.1990 and 43015 dated 30.03.1993. (Page-22 to 38/DP). Present proposal Sirmal OCP involves total area of 2290.449 ha which comprises of 349.709 ha of forest land, 473.792 ha of Govt. Non-Forest land and 1466.949 Tenancy land.

2. Location of the project:

The boundary of Sirmal block is as follows:

North : Chaturdhara and Basundhara West blocks separated by Chaturdhara Nala and Basundhara River
West : Rampia & Dip side of Rampia.
East : Kuida Block separated by Chattajor nala
South : Prabhara Block.

Sundargarh town is the nearest revenue town & Dist. HQ, which is at a distance of 46 km. Bhubaneswar, the State Capital from the mines is 450 km. The company Headquarters is at Baria which is 130 km via Sundargarh, Jharsuguda, Sandilpur. The nearest railroad is Himgir railway station on Mumbai - Howrah line of South Eastern railway at a distance of about 35 km. The nearest domestic airport, Veer Surendra Sai airport, Jharsuguda at a distance of 30 km. Biju Patnaik International Airport, Bhubaneswar is at a distance of about 450 km. The nearest sea port - Paradip is at a distance of 550 km from the block.

Sarnal OCP has been accorded the Forest Stage I clearance including 349.709 ha of forest land from central government under Section 2 (ii) of Forest (Conservation) Act 1980. Ministry of Environment, Forests and Climate Change in vide Letter No. F. No. 8-25/2021-FC Dated 21st April 2022. The FC has been accorded with a set of conditions to comply with and thus this scheme has been prepared to comply with Condition No. 4(V) of para-A of Stage-I in-principle approval.

3. Physiography & Drainage:

The topography of the block is represented by flat & sloppy ground. The ground slopes generally towards east and north-east and the drainage is through small streams, which in turn feed to river Basundhara. Basundhara River is flowing from west- to-east and ultimately drains into the Ib River.

Distance of waterbodies from the mine is as follows.

Name of the Water Bodies	Distance
Chhata Jhor river/Nala	0 km
Basundhara river	0 km
Garia Nala	4.3 km
Kilhu river	18 km
Ib river	27 km

4. Climate:

Meteorological data collected from IMD, Bhubaneswar for Jharuguda IMD station for the year 2013 have been referred for preparation of the following table 1:

Item	Parameters	Particulars
Rainfall	Minimum	0.1 mm in Oct
	Maximum	118.8 mm in Aug
	Annual rainfall	1281.5 mm (Average annual rainfall is 1430 mm for last 22 years)
Temperature range (monthly mean of daily temperature)	Minimum	6.9°C in Jan
	Maximum	46.7°C in May
Relative humidity range (monthly mean of daily RH)	Max at 8:30 hr	98% in Feb, Jun and Jul
	Min at 8:30 hr	26% in Apr and May
	Max at 17:30 hr	98% in Jul, Aug and Oct
	Min at 17:30 hr	11% in Apr
Wind speed range (monthly mean of daily wind speed)	Max at 8:30 hr	30 kmph in Oct
	Min at 8:30 hr	2 kmph
	Max at 17:30 hr	30 kmph in Oct
	Min at 17:30 hr	2 kmph

5. Geology:

The "Geological Report on Sarnal Block, B-River Coalfield," Odisha, was prepared by CMPDI in February 1997. Sarnal block spreading over an area of 5.00 sq. km. is a part of north-western sector of B-valley coalfield and in which coal bearing area is 4.24 sq. km. The coal seams occurring in Sarnal block are in the continuation of the adjoining block i.e., Kolda in the east.

6. Soil Type:

Soil may be defined as a mixture of rock and mineral with the organic matter. The soil of the M. L. area is classified as laterite soil, lateritic with coal on the basis of its layer of

formation. Soil is the net result of the action of climate and organisms especially plant on the earth crust. The pH value of the soil is normal ranging from 6.00 to 7.2.

7. Existing Vegetation:

The crop composition of forest area is mainly Sal (*Shorea robusta*) and its associates namely Bija (*Pterocarpus samarpium*), Mango (*Mangifera indica*), Kenda (*Diospyros melanoxylon*), Mahul (*Madhuca indica*), Jamun (*Syzygium cumini*), Neem (*Azadirachta indica*), Bahada (*Terminalia bellerica*), Dhaura (*Anogeissus latifolia*), Asokha (*Morinda toctoria*), Kunum (*Adina cordifolia*), Sahaj (*Terminalia tomentosa*), Char (*Buchanania lanzon*), Kazi (*Mitragyna parviflora*), Sidta (*Lagerstroemia parviflora*), Siroo (*Dalbergia latifolia*), Karla (*Cleistanthus collinus*), Dhatila (*Woodfordia fruticosa*), Gambhari (*Gmelina arborea*), Kusin (*Hollwheria undulatifera*), Palas (*Butea monosperma*), Bhura (*Chloroxylon rivetasia*), etc. Sal (*Shorea robusta*) is the pre-dominant species. The condition of the vegetation is dry deciduous Forest.

The stipulated condition reads "Stabilize the overburden dumps by appropriate grading/benching so as to ensure that angles of repose at any given place is less than 28°."

The condition No. 4 (IV) of para A of the Stage-I approval envisages to prepare a plan to stabilize the over burden dumps by appropriate grading/benching so as to ensure that angle of repose at any given place is less than 28°. The instant Scheme is being submitted in compliance with aforesaid Condition of Ministry of Environment, Forests & Climate Change, Government of India.

Major over burden is meant to backfill the quarry area but as per the approve mine plan there has been provision for 2 nos. of OB dumps for stacking of excavated materials, which needs to be managed for sustainability by technical and biological interventions. The activities to be undertaken for OB management are as follows:

- Backfilling, leveling, grading of top surface of OB dumps
- Landscaping of top surface of OB dumps
- Grassing of OB dump (if the dumps are to be re-handled during mine closure the same should be grass instead of bigger size tree plantation).
- Fencing, monitoring and maintenance of the biologically reclaimed areas.

◆ Overview of overburden dump areas

There is no non-coal bearing area in the block or towards south in dipside, the block is surrounded by Chaturdhara Nala, Basundhara River and Chatajor nala towards north and east respectively, so there is no favourable area for external dumping in close proximity. Only non-coal bearing area is available towards north of existing Basundhara west OCP, this area has been already selected for power plant to be set up by Mahasadi Basin Power Corporation Ltd, which is a subsidiary of MCL. So only the void in Basundhara West OCP can be filled up by some quantity of overburden from Simalal OCP. But construction of a bridge over Basundhara River is necessary to transport overburden, this bridge should be capable of withstanding load of heavy duty 190t rear dumpers suggested for overburden transport. Construction of this bridge may take long time, considering this fact it is proposed to dump initial overburden towards dip side of quarry-2 towards south-western side. From year7 to year10 some dumping will also be done into the voids of Basundhara west OCP.

External dump towards dip-side of quarry-2 will accommodate 89.25 MCUM of overburden and external dumping in this area will continue up to 8th year. This dump will have to be re-handled while extending the mine operation towards dip-side of the block after 38 years. Exploration in this dip side block should be completed before starting of external dumping. Economic viability of mining operations in the dip-side block can be studied only after detailed exploration. From 7th year this same external dump will be extended towards north in the future quarry area of quarry-2 by overburden from quarry-1, around 195.85 MCUM of overburden of quarry -1 from year 7 to year14 will be dumped in mining area of quarry-2, this huge volume of overburden has to be re-handled while working quarry-2 in year 29 to year 38.

Backfilling in the quarry-1 will be started from year-10, simultaneous backfilling and external dumping will be done upto year 18, from year 19 there will be no external dumping and total overburden can be backfilled. From year 12 to year 18 external overburden will be located beyond southern boundary of quarry-1. This dump will have to be re-handled while extending the mine operation towards dipside of the block. Exploration in this dipside block should be completed before starting of external dumping. Economic viability of mining operations in the dipside block can be studied only after detailed exploration. Average height of all the external dumps will be around 82-85 m. care has been taken to accommodate external dump in the notified boundary of MCL.

It is proposed to complete the construction of heavy duty bridge over Basundhara river within year 6 so that overburden from the mine can be transported beyond Basundhara river, the available void in Basundhara West OCP can be filled up by the overburden from Internal OCP in year 7 to year 10. Around 77.18 Mcum of overburden can be accommodated in exhausted Basundhara west OCP, some void towards dipside of this mine will not be filled for maintaining water reservoir considering scarcity of water in this area.

◆ **Stabilization of overburden dump**

It is proposed that the multiple dumping areas are proposed for overburden dump and hence for its reclamation and rehabilitation both technically and biologically so as to maintain the environment aspect of the area.

• **Technical Reclamation**

a. **External OB dumping**

The face of slope of external dump will be maintained at the natural angle of repose and at overall slope angle of 26°. Once the external dump will reach its predetermined level, top surface shall be leveled and graded. Gradient of surface shall be maintained less than 2% i.e. very gently sloping to prevent waterlogging. Drainage arrangement will be provided for smooth disposal of storm water to avoid gully formation. Garland/catch drains shall be provided around the external dump to drive the runoff water to sedimentation pond provided in order to avoid silt.

b. **Backfilling and Levelling of internal dump**

Major part of the quarry will be backfilled with overburden. The backfilling will be carried out in a phased manner. Once the backfilling has reached a certain predetermined reduced level, the plots will be levelled, graded and cleared of large stone pieces lying on the surface. The slope of the ground will be made very gentle as far as possible (preferably less than 2%). The graded and levelled area will be divided into small sectors and small check bunds will be constructed to retain moisture and humus in the soil. The outer slope of each bench will be kept at the natural angle of repose of the spoil material and at overall slope angle of 26° considering all benches.

• **Biological Reclamation**

For successful biological reclamation of the reclaimed area, preference will be given to endemic species and mixed culture. The species will be selected carefully from the following groups for quick reclamation:

- ✓ Nitrogen fixing tree species for fuel wood, timber and fodder
- ✓ Fruit bearing tree species
- ✓ Tree species with dense foliage for shade
- ✓ Flowering, medicinal and ornamental tree species.

Accordingly, a scheme has been prepared for sowing of grass seeds on over and around the OB dumps for stabilising the OB and ensuring protection from erosion.

◆ **Objectives**

The objectives of the scheme are as follows:

To fulfill the stipulation i.e. Condition no. 4 (IV) of para-A imposed in the Stage-I approval granted vide letter no. 8-25/2021-PC, Dated 21st April 2022 of MoEP&CC to prepare plan for stabilisation of over burden dumps by appropriate grading /banching so as to ensure that the angle of repose at any given place is less than 28°.

1. To adopt proper management and scheduling of overburden materials so as to minimize its spill over.
2. To provide methodologies and implement the proposed works in time bound manner to prevent slope failures there-by providing stable OB dumps slopes.
3. To stabilize the over burden dumps by plantation.

To prevent overflow of eroded soils from the fines, OB dump areas which lead to siltation in the streams/natural streams.

◆ **Measures Proposed**

The scheme envisages biological and technical measures for stabilisation of OB dumps, the measures with methodology are as following:-

A. Sowing of grass seeds over 386.08 ha on OB dumps slopes

The area identified over 386.08 ha on slope of the external dump no. 1 & 2 has been

enmarked for sowing of grass seeds. Major grassing activity will start from 10th year onwards as envisaged in the EMP & Mine plan. The sowing of grass on slope of the dumps will commence as soon as the first burn is ready. The terraces on the slopes will be sloped inward, prior to the commencement of the monsoon, the slopes and terraces will be covered with a layer of a mixture of top soil and organic manure and sprinkle water as per the requirement of moisture management and plantation need.

Table. Choice of Drought Tolerant grass varieties are as give below (table 2):

Name of Species	Usage
Vetiveria zizanioides	Non-Fodder
Themeda Triandra	Non-Fodder
Dichanthium	Non-Fodder
Gleburia	Non-Fodder
Eragrostis Ciliata	Non-Fodder
Cymbopogon	Lemon Grass
Stylohamata	Grass
Delbargia Sissoo	Sissoo
Bambusa spp	Bamboo
Acacia kataebu	Khair

Pellets can be made by mixing powder clay & farm yard manure in 5:1 ratio to which grass seeds will be added @ 5 kg / ha. The seeds of Themeda danidandra, Dichanthium, Gleburia, Eragrostis Ciliata etc. can be mixed and pellets can be made. The mixture will be made into balls of 2 cm dia and sundried during summer to be sown after de-wooding.

For uniform growth of grass and to prevent seeds being washed away, this work is to be completed before July. It is important to protect the area from fire by fire lines of 10 M wide. Phase-wise plantation activities on the OB dumps and excavated / mined out areas are dealt in the progressive mine closure plan

An area of 386.98 ha over burden dumps slopes in the mining lease area has been proposed to take up grassing with appropriate species to stabilize the overburden dumps. Mostly the indigenous species will be selected for this purpose in consultation with DFO, Sundargarh. However, the location and details are shown in the map as Annexure-I

Table 3. The cost estimate for sowing of grass per hectare is given below:-

Cost estimate for sowing of grass seeds in pellets per ha. (Labour rate 326/-per mandays)				
Sl. No	Purpose	Quantity/ Mandays	Unit Rate (in Rs.)	Amount (In Rs.)
1	De-weeding	2	326.00	652.00
2	Spreading of top soil	2 no.	326/labour	652.00
3	Cost of grass seed (5kg/per ha)	5 KG	250/kg	1250.00
4	FYM and good earth	10 Kg FYM 10 kg Powder Clay Soil	10/-Per Kg FYM 6/- Powder Clay Soil	160.00
5	Preparation of pellets	2 Nos	326/labour	652.00
6	Sowing of pellets	2 no.	326/labour	652.00
7	Misc. expenses			5000.00
The cost of sowing of grass seeds per hectare				9018.00

Total cost for sowing of grass seeds over an area of 386.08 ha = 386.08 x 9018= Rs

34,81,669.44/-

or Rs. 34,81,670/-

B. Stage-wise construction of garland drain on OB periphery to collect surface run-off water, the location of garland drain is shown in the map attached as above. (table 4)

I. Detail Estimate of construction of Garland Drain for 100mtr length									
Sl. No.	Description of Item	No	Length	Width	Height	Qty.	Unit	Rate	Amount
1	Cleaning of Jungles & bushes	1.0	200	1		1400	Sq. m	4.00	5600.00
2	Earth work in hard soil in embankment roads with in 50 mtr initial lead including rough dressing & breaking clods to maximum 5.00 c.m to 7.00 c.m & laying layers not exceeding 0.30 mtr. Depth as per specifications approved by department along with proper comparison with H.R.R Excavation	1.00	200	2	0.75	300	cum	120.00	36000.00
3	Rough stone Dry packing with local boulder only labour charges (Local boulder will be supplied by the company through contractual manner)	2.00	3	2	0.3	3.6	cum	800.00	2880.00
		Rate per one Hundred meter Length					Total		44480.00

Total Amount Required for 15800 meter Garland Drain ~44480X158~ Rs. 70,27,840/-

C. Plan for Construction of Settling Tanks:

It is a process that involves separation of solid materials from slurry. Sometimes this process is called sedimentation. When waste water is treated, a large quantum of materials is filtered out of the liquid by physical barriers. Even then, the water will contain some solids that need to be removed. A settling tank can be used to protect the surface water.

Location of the proposed 4 nos. settling tank are shown in the map attached as above.

Table 5 Estimate for construction 1 no. of settling tank

Sr. No	Description of items	No	Length	Width	Depth	Qty.	Unit	Rate (In Rs)	Amount (In Rs.)
1	Earth work in hard soil in embankment roads within 50 m initial lead & 1.50 m initial lift including rough dressing & breaking clods to maximum 3.00cm to 7.00 cm & laying layers not exceeding 0.30 m depth as per specification approved by department along with proper compaction with H. R.R Excavation.	1	4	3	1.5	18	Cum	120.00	2160.00
2	Rough Stone Dry packing with local boulder only labour charges (Local boulder will be supplied by our Company).	1	4	6	0.2	4.8	Cum	800.00	3840.00
3	Transportation charges for 5.00 km lead by truck load from quarry to work site with all cost of labour, T&P etc. all complete in all respect as per specification and direction of	At same as Item No-2				4.8	Cum.	100.00	480.00
Cost construction of 1 no. of settling tank									6480.00

Estimate cost for construction of 4 nos. of settling tanks =Rs 6480 x 4= 25,920/-

The de-silting of the settling tank will be taken up at regular intervals to prevent sedimentation and choking of streams.

In addition to above mentioned measures, followings are general precautionary measures to be adopted during OB/waste disposal:-

- i) The ultimate dump slope should be maintained at 20-22, i.e. less than 28° with individual terrace slopes not exceeding 27°.
- ii) Each terrace should be inward slope with catch drains at the inward slope of terrace.
- iii) Catch drains of the individual terrace should be connected to the perianal drain. Outside the periphery of dump. Catch drain is to be preferably made up of half concrete open pipes followed by settling tanks to avoid wash off, and it should have provision of benches at the outer side to reduce gully formation due to rainwater wash off.

In order to achieve slope stability, the best course is to have long term flattening of slope, providing toe wall and also by incorporating suitable drainage system to dissipate excess pore water pressure so as to increase the shear strength of the filled material.

◆ Executing agency

The present Scheme shall be executed by the User Agency having specialized departments headed by qualified persons with adequate 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. The entire work shall be carried out in coordination with the Forest Department.

Table 6

Sl. No.	Designation	Expertise
1	Dy. GM (Mining)	25 years' experience in Mining/Environment Survey.
2	Area Environment Officer	10 years' experience in Environment & Forest
3	Area Survey Officer	5 years' experience with pollution control & Environmental Management
4	Project Environment Officer	6 years' experience with Environment Management plan.

❖ Requirement of funds

The financial cost for technical and biological reclamation measures are envisaged as followings:-

Sl. No.	DESCRIPTION	Amount (In Rs.)
1	The estimated cost for sowing of grass seeds over 386.08 ha area	Rs. 33,55,810/-
2	The estimated cost for construction of 15.800 km garland drain	Rs. 70,27,840
3	The estimated cost for construction of 4 nos. of settling tanks	Rs. 25,920/-
	Total	Rs 1,04,09,570/-

This scheme has been prepared to comply to the condition No. 4 (IV) of para A of Stage-I approval granted by MoEF&CC in their letter no. F. No. 8-25/2021-FC, Dated 21st April 2022. The total estimated cost for executing the above measures is Rs 1,04,09,570/-, the fund is already placed in the mine plan at project cost, no separate funds required


General Manager,

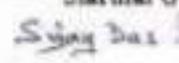
Mahalaxmi Area, (MCL)

Mahalaxmi Area

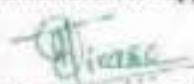
Mahanadi Coal Fields Limited


Project Officer,

Siarnal OCP, (MCL)

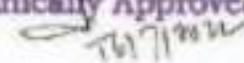

Siarnal OCP, (MCL)
Mahanadi Coal Fields Limited

Recommended for Approval.

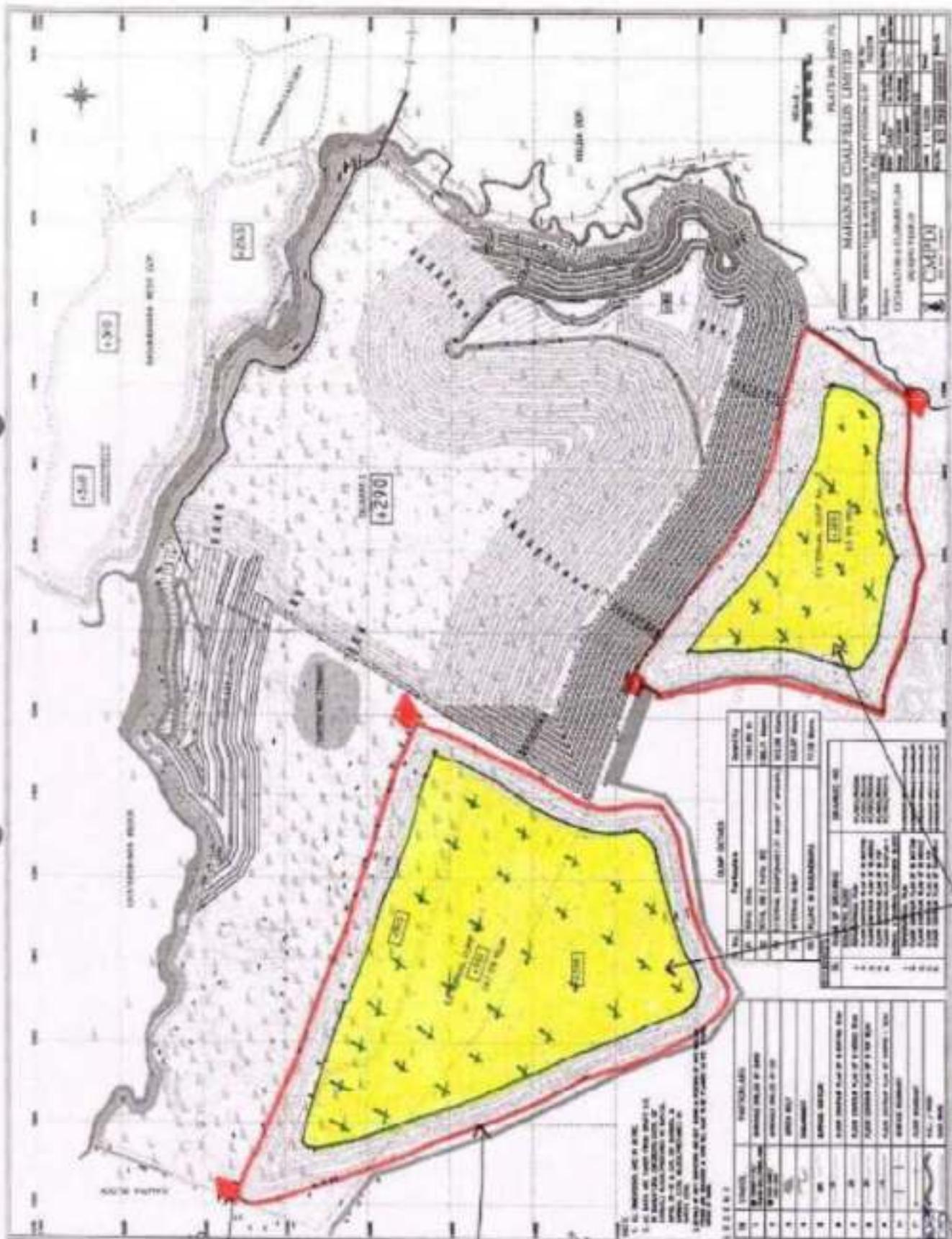

Divisional Forest Officer

DIVISIONAL FOREST OFFICER
BUNDARAHATI FOREST DIVISION.

Approved.
Technically Approved


Regional Chief Conservator of Forests
Rourkela Circle

Regional Chief Conservator of Forest,
Rourkela Forest Division.



EITLING TANK

JARLAND DRAIN
ALL
YOUNG
TO BE DUMP
EXEMPTED

NOTE:
1. ALL DIMENSIONS ARE IN METERS.
2. ALL DIMENSIONS ARE TO FACE UNLESS OTHERWISE SPECIFIED.
3. ALL DIMENSIONS ARE TO FACE UNLESS OTHERWISE SPECIFIED.
4. ALL DIMENSIONS ARE TO FACE UNLESS OTHERWISE SPECIFIED.

DRAIN DETAILS	
NO.	DESCRIPTION
1	100mm dia. 100mm deep
2	150mm dia. 150mm deep
3	200mm dia. 200mm deep
4	250mm dia. 250mm deep
5	300mm dia. 300mm deep
6	350mm dia. 350mm deep
7	400mm dia. 400mm deep
8	450mm dia. 450mm deep
9	500mm dia. 500mm deep
10	550mm dia. 550mm deep
11	600mm dia. 600mm deep
12	650mm dia. 650mm deep
13	700mm dia. 700mm deep
14	750mm dia. 750mm deep
15	800mm dia. 800mm deep
16	850mm dia. 850mm deep
17	900mm dia. 900mm deep
18	950mm dia. 950mm deep
19	1000mm dia. 1000mm deep
20	1050mm dia. 1050mm deep
21	1100mm dia. 1100mm deep
22	1150mm dia. 1150mm deep
23	1200mm dia. 1200mm deep
24	1250mm dia. 1250mm deep
25	1300mm dia. 1300mm deep
26	1350mm dia. 1350mm deep
27	1400mm dia. 1400mm deep
28	1450mm dia. 1450mm deep
29	1500mm dia. 1500mm deep
30	1550mm dia. 1550mm deep
31	1600mm dia. 1600mm deep
32	1650mm dia. 1650mm deep
33	1700mm dia. 1700mm deep
34	1750mm dia. 1750mm deep
35	1800mm dia. 1800mm deep
36	1850mm dia. 1850mm deep
37	1900mm dia. 1900mm deep
38	1950mm dia. 1950mm deep
39	2000mm dia. 2000mm deep
40	2050mm dia. 2050mm deep
41	2100mm dia. 2100mm deep
42	2150mm dia. 2150mm deep
43	2200mm dia. 2200mm deep
44	2250mm dia. 2250mm deep
45	2300mm dia. 2300mm deep
46	2350mm dia. 2350mm deep
47	2400mm dia. 2400mm deep
48	2450mm dia. 2450mm deep
49	2500mm dia. 2500mm deep
50	2550mm dia. 2550mm deep
51	2600mm dia. 2600mm deep
52	2650mm dia. 2650mm deep
53	2700mm dia. 2700mm deep
54	2750mm dia. 2750mm deep
55	2800mm dia. 2800mm deep
56	2850mm dia. 2850mm deep
57	2900mm dia. 2900mm deep
58	2950mm dia. 2950mm deep
59	3000mm dia. 3000mm deep
60	3050mm dia. 3050mm deep
61	3100mm dia. 3100mm deep
62	3150mm dia. 3150mm deep
63	3200mm dia. 3200mm deep
64	3250mm dia. 3250mm deep
65	3300mm dia. 3300mm deep
66	3350mm dia. 3350mm deep
67	3400mm dia. 3400mm deep
68	3450mm dia. 3450mm deep
69	3500mm dia. 3500mm deep
70	3550mm dia. 3550mm deep
71	3600mm dia. 3600mm deep
72	3650mm dia. 3650mm deep
73	3700mm dia. 3700mm deep
74	3750mm dia. 3750mm deep
75	3800mm dia. 3800mm deep
76	3850mm dia. 3850mm deep
77	3900mm dia. 3900mm deep
78	3950mm dia. 3950mm deep
79	4000mm dia. 4000mm deep
80	4050mm dia. 4050mm deep
81	4100mm dia. 4100mm deep
82	4150mm dia. 4150mm deep
83	4200mm dia. 4200mm deep
84	4250mm dia. 4250mm deep
85	4300mm dia. 4300mm deep
86	4350mm dia. 4350mm deep
87	4400mm dia. 4400mm deep
88	4450mm dia. 4450mm deep
89	4500mm dia. 4500mm deep
90	4550mm dia. 4550mm deep
91	4600mm dia. 4600mm deep
92	4650mm dia. 4650mm deep
93	4700mm dia. 4700mm deep
94	4750mm dia. 4750mm deep
95	4800mm dia. 4800mm deep
96	4850mm dia. 4850mm deep
97	4900mm dia. 4900mm deep
98	4950mm dia. 4950mm deep
99	5000mm dia. 5000mm deep
100	5050mm dia. 5050mm deep

Project Office
Suzmal
Maharaja Chalfelds Limited

1:1000 Scale of Contour and Elevation

Scheme

for

"Top soil management to ensure 'no damage' to the top soil with strict adherence to the top soil management plan"

in compliance with

Condition 4 (V) of para A of Stage-I forest clearance – in-principle approval

vide letter no. L no. 8-25/2021-fc, dated 21st April 2022

of Ministry of Environment, Forest & Climate Change, Govt. of India,

New Delhi

for

Diversion of 349.709 hectares of forest land for "Siarmal Opencast Coal Mining Project" within 2290.449 hectares of mining lease area

of

M/s Mahanadi Coalfields Limited.

in Sandargarh Forest Division of Dist. Sandargarh, Odisha

Scheme prepared for "No damage shall be caused to the top-soil and strict adherence to the prescribed top soil management plan"

1. Brief information:

M/s Mahanadi Coalfields Limited (MCL), a subsidiary company of Coal India Limited is a Ministry Company of nature and style public sector undertaking under Government of India, which was carved out to administer and mine out coal from the coal mines of Odisha, spread over Talcher and Ib valley coal fields.

Ib valley coal fields in Sandargadh and Sambuguda Districts of Odisha contain large reserves of quarriable coal. Each area containing coal has been divided into several mining blocks, and Sirmal geological block is one of them. Sirmal opencast project is located in Sirmal geological block of Gopalpur tract in the north-western part of Ib valley coal fields. It lies between latitudes of 22°01'19"-22°03'59.59" N and longitudes of 83°37'09"-83°42'59.58" E. It is represented in Survey of India Topo sheet No. F441J2 (64N/16). This project is having 1547.82 Mt (Quarriable Reserve) of quarriable coal reserve in Gopalpur, Jhuparanga, Sirmal, Ratansara, Tamulia and Kolda villages. The entire area of Sirmal project involving six villages were acquired under Coal Bearing (Acquisition and development) Act, 1957 (CBA-1957) vide S.O. No. 1869 dated 10.07.1989 and S.O. No. 3055 dated 29.10.1990. The above land has been vested in MCL u/s 11(1) of the said Act vide SO No. 2592 dated 13.09.1990 and 43015 dated 30.03.1993. (Page-22 to 38/DP). Present proposal Sirmal OCP involves total area of 2290,449 ha which comprises of 349,709 ha of forest land, 473,792 ha of Govt. Non-Forest land and 1466,949 Tenancy land.

2. Location of the project:

The boundary of Sirmal block is as follows:

North	:	Chaturdhar and Basundhara West blocks separated by Chaturdhar Nala and Basundhara River
West	:	Rampia & Dip side of Rampia.
East	:	Kolda Block separated by Chota/or nala.
South	:	Prajapara Block.

Sundergarh town is the nearest revenue town & Dist. HQ, which is at a distance of 46 km. Bhubaneswar, the State Capital from the mines is 450 km. The company Headquarters is at Barta which is 150 km via Sundergarh, Jharsuguda, Sambalpur. The nearest railroad is Himgir railway station on Mumbai – Howrah line of South Eastern railway at a distance of about 35 km. The nearest domestic airport, Veer Surendra Sai airport, Jharsuguda at a distance of 30 km. Biju Patnaik International Airport, Bhubaneswar is at a distance of about 450 km. The nearest sea port – Paradip is at a distance of 550 km from the block.

Simal OCP has been accorded the Forest Stage I clearance including 349.709 ha of forest land from central government under Section 2 (ii) of Forest (Conservation) Act 1980. Ministry of Environment, Forests and Climate Change in vide Letter No. F. No. 8-25/2021-FC Dated 21st April 2022. The FC has been accorded with a set of conditions to comply with and thus this scheme has been prepared to comply with Condition No. 4(V) of part-A of Stage-I in-principal approval.

3. Physiography & Drainage:

The topography of the block is represented by flat & sloppy ground. The ground slopes generally towards east and north-east and the drainage is through small streams, which in turn feed to river Basundhara. Basundhara River is flowing from west- to-east and ultimately drains into the Ib River.

Distance of waterbodies from the mines is as follows.

Name of the Water Bodies	Distance
Chhota Jhor Nala	0 km
Basundhara river	0 km
Guria Nala	4.3 km
Ichha river	18 km
Ib river	27 km

4. Climate:

Meteorological data collected from IMD, Bhubaneswar for Jharsuguda IMD station for the year 2013 have been referred for preparation of the following table:

Item	Parameters	Particulars
Rainfall	Minimum	0.1 mm in Oct
	Maximum	118.8 mm in Aug
	Annual rainfall	1281.6 mm (Average annual rainfall is 1430 mm for last 22 years)
Temperature range (monthly mean of daily temperature)	Minimum	6.9°C in Jan
	Maximum	46.7°C in May
Relative humidity range (monthly mean of daily RH)	Max at 8:30 hr	98% in Feb, Jun and Jul
	Min at 8:30 hr	26% in Apr and May
	Max at 17:30 hr	98% in Jul, Aug and Oct
	Min at 17:30 hr	11% in Apr
Wind speed range (monthly mean of daily wind speed)	Max at 8:30 hr	30 kmph in Oct
	Min at 8:30 hr	2 kmph
	Max at 17:30 hr	30 kmph in Oct
	Min at 17:30 hr	2 kmph

5. Geology:

The "Geological Report on Siamal Block, Ib-River Coalfield," Odisha, was prepared by CMPDI in February 1997. Siamal block spreading over an area of 5.00 sq.km. is a part of north-western sector of Ib-valley coalfield and in which coal bearing area is 4.24 sq. km. The coal seams occurring in Siamal block are in the continuation of the adjoining block i.e., Kukta in the east.

6. Soil Type:

Soil may be defined as a mixture of rock and mineral with the organic matter. The soil of the M. L. area is classified as lateritic soil, lateritic with coal on the basis of its layer of formation. Soil is the net result of the action of climate and organisms especially plant on the earth crust. The pH value of the soil is normal ranging from 6.00 to 7.2.

7. Existing Vegetation:

The crop composition of forest area is mainly Sal (*Shorea robusta*) and its associates namely Bija (*Pterocarpus marsipium*), Mango (*Mangifera indica*), Kendu (*Diospyros melanoxylon*), Masul (*Madhuca indica*), Jamun (*Syzygium cumini*), Neem (*Azadirachta indica*), Bahada (*Terminalia bellerica*), Dhauza (*Anogeonum lasiophita*), Aachla (*Morinda tomentosa*), Karun (*Adina cordifolia*), Sabaj (*Terminalia tomentosa*), Char (*Buchanania lanza*), Kral (*Mitragyna parviflora*), Sidha (*Leguminosia parviflora*), Sisoo (*Delbergia latifolia*), Karia (*Cleistanthus collinus*), Dhatki (*Woodfordia fruticosa*), Gatabhari (*Gmelina arborea*), Kuria (*Hollorhena antidyenterica*), Pala (*Butea monosperma*), Bura (*Chloroxylon swietenia*), etc. Sal (*Shorea robusta*) is the pre-dominant species. The condition of the vegetation is dry deciduous Forest.

The condition No. 4(V) of para-A of the Stage-I approval envisages to prepare a plan for management of top soil. This scheme is being submitted in compliance with aforesaid condition of Ministry of Environment, Forest and Climate Change, Government of India.

◆ Objectives:

To fulfill the stipulation, i.e., condition No. 4(V) of para-A "No damage shall be caused to the top soil and the user agency will follow the top soil management plan" imposed by Ministry of Environment, Forests & Climate Change, Government of India, vide letter no. F. No. 8-25/2021-FC Dated 21st April 2022 during the approval of Stage-I forest clearance, the following objectives have been scoped out:

- To identify top soil resources and to follow stripping guidelines for optimum recovery.
- To identify stockpile locations and dimensions.
- To identify surface areas suitable for stripping (to minimize over clearing).
- To manage and conserve the top soil reserves.
- To provide sufficient stable topsoil material for rehabilitation work of dumps, back filled areas and degraded lands.

◆ Top Soil Management:

Top soil will be properly stacked at earmarked dump site with adequate measures. It will be further utilized in re-spreading along the fringes of the site roads and reclamation of the backfilled area and external dumps for grazing. The top soil stockpiles will be of low

height and will be grassed to retain fertility. Besides this topsoil stacks, there will be temporary stacks near the excavation area and backfilled area where the top soil will be used of for concurrent laying without bringing the topsoil to the soil stack near the OB dump.

Top soil Management – (Including Action Plan for Top Soil Management)
(All Figures are Cumulative and in MM³)

Tentative Year		Top soil removal Plan	Spreading over Embankment	Spreading over Backfilled Area	Spreading over External OB Dump Area	Green Belt	Total Utilized
C1	2020-21						
Y-1	2021-22	0.11	-				
Y-3	2023-24	0.29	0.02				0.02
Y-5	2025-26	0.54	0.05				0.05
Y-10	2030-31	1.39	0.05				0.05
Y-15	2035-36	2.45	0.05	0.05	0.50		0.60
Y-20	2040-41	2.62	0.05	0.60	1.16		1.81
Y-25	2045-46	3.11	0.05	1.70	1.16		2.91
Y-30	2050-51	4.04	0.05	2.00	1.16		3.21
Y-35	2055-56	4.64	0.05	2.35	1.16		3.56
Y-40	2060-61	4.64	0.05	3.43	1.16		4.64
Total		23.83	0.42	10.13	6.3	0	16.85

➤ **Utilisation of top soil/sub-soil:**

- Spreading of top soil at levelled surface along permanent roads and embankment for afforestation activities.
- Spreading top soil on top surface of quarry area, backfilled and levelled, for grass generation.
- Spreading top soil on top surfaces and slopes of the OB dumps for biological interventions viz. plantation of trees, drought resistant hardy and grass generation.

- Spreading top soil on degraded surface proposed for landscaping within/outside the Mine Lease boundary.

➤ **The Importance of Top Soil Management:**

Since, top soil undergoes many changes during stripping, storage and preservation, the stacking of top soil should be done in such a manner that the NPK value of the soil remains intact. These are:

(A) Changes in topsoil due to storage:

- i) Stockpiling/stacking has profound effects on the physicochemical and biological properties.
- ii) biological activity deteriorates after 3 to 6 months of storage.
- i) Stockpiling/stacking reduces organic content and affects the organic compound concerned in soil aggregation.
- ii) Aggregate stability is reduced to some extent due to storage.

(B) Methodology of Stripping:

The method of stripping should be normally done by the scrapers only. The routing of scrapers during this operation must be planned to minimise the travel of machines to avoid compaction and damage of soil structure. Furthermore, careful control of operation is necessary to ensure planned stripping depths of the topsoil and sub-soil. These soils should be stripped and stored separately. Intermingling of these soils during stripping is not a good practice.

It is essential that topsoil stripping is carried out when it is as dry as possible to reduce the risk of compaction and damage to the soil structure by smearing and remoulding. Prolonged rainfall is unusable. The best part of the year is when evapo-transpiration exceeds precipitation, i.e., during the months of March-September.

(C) Geometry of Topsoil Heap:

The heap should be constructed to facilitate the following:

- To provide the maximum surface area for maintaining greater level of biological activity.

- To have slopes capable of sustaining vegetation to avoid erosion and gully formation.

As a rule of the thumb, the following stock geometry may be maintained as far as possible to preserve the topsoil and increase the shelf life.

(a) Height: The height for the top soil dumps vary according to the soil type such as:

- i) 4.0 m (Max) for sand soil
- ii) 2.0 m to 3.0 m for loamy soil
- iii) 1.0 m for heavy clayey soil
- iii) 0.5 m to 1.0 m for intermediate soil texture

(b) Slope: Wide slope of 1 in 3 (i.e 1:3.00 to the horizontal) if there is constraint in the availability of area, one or both of the following strategies can be adopted:

This excavated top-soil will be utilized for concurrent plantation works in the mine as per this plan. Some of the top soil will be stored temporarily until it can be used for plantation works/dump reclamation. This Topsoil Management Plan has provision for soil stripping and stockpiling procedure to minimize the top soil degradation and maximize availability of reliable soil for future rehabilitation. Prior to stripping, the area will be cleared by removing the unwanted growth. The proposed procedure for soil handling is given below which includes soil handling measures in order to optimize retention of soil characteristics (in terms of nutrient and micro-organisms) conducive to the growth of plants.

The proposed location of the top soil dump is marked in the plan attached.

- The topsoil stripping will be completed using bulldozers and tippers of smaller capacity in case of good quantum. In areas where the topsoil is relatively thin, the topsoil will be removed in such a way to prevent mixing of topsoil and sub-soils.
- Permanent measures include establishment of Vegetation (bushes & shrubs) and broadcasting of seeds of local shrubs/grasses will be resorted to mitigate soil erosion and dust emissions.
- Prior to use of the topsoil for reclamation, sample of the topsoil will be collected and chemical analysis including nitrogen, organic content and PH value will be done.
- Re-spreading of topsoil will be undertaken in the areas requiring reclamation.

Estimate of cost for sowing of grass seeds per hectare				
Cost of broadcasting of grass seeds per ha. Labour rate 326/-day				
Sl. No	Purpose	Quantity/Man-days	Unit Rate (in Rs.)	Amount (In Rs.)
1	De-weeding	2	326.00	652.00
2	Cost of grass seed 5kg/per ha	5 kg	250/kg	1,250.00
3	FYM and good earth:	10 kg FYM 10 kg Powder Clay Soil	10/- Per kg FYM 5/- Powder Clay Soil	160.00
4	Preparation of pellets	2 Nos	326/labour	652.00
5	Sowing of pellets	2 no,	326/labour	652.00
6	Misc. Expenses including watering, fireline tracing, etc			5,000.00
7	The cost of sowing of grass seeds per hectare			8,366.00
8	Watering arrangement; 20% of cost of sowing seeds (7)			1,673.20
9	Total cost of sowing of grass seeds per ha			10,039.20 Or 10,040/-

Total Cost for sowing of grass seeds over 10 ha area x 2 temporary locations = 20 x 2 x 10040 = Rs 4,01,600/-

The average rate of loading, transportation and unloading of top soil at dump location is Rs. 85/- per Cum with average load of 4 km. The rate is subject to change as per increase in related material rates.

The proposed temporary locations for top soil stock is shown in map is enclosed as Annexure I & II

◆ Executing Agency

The present Scheme shall be executed by the User Agency having specialized departments headed by qualified persons with 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. The entire work shall be carried out in co-ordination with the Forest Department.

Sl. No	Designation	Expertise
1	Dy. GM (Mining)	25 years' experience in Mining/Environment Survey.
2	Area Environment Officer	10 years' experience in Environment & Forest
3	Area Survey Officer	5 years' experience with pollution control & Environmental Management.
4	Project Environment Officer	6 years' experience with Environment Management plan.

◆ Requirement of Funds

The total cost for implementation of measures for top soil management will be Rs 4,01,600/- This budget will be subjected to increase in amount considering the increase in material cost and labor cost. The expenditure to be made from project cost as very well placed in EMP & MP.

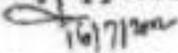

 General Manager
 Mahanadi Coal Fields Limited


 Project Officer,
 Siarnal OCP Project Officer
 Siarnal OCP
 Sing Das Mahanadi Coalfields Limited

Recommended for Approval.


 Divisional Forest Officer
 REGIONAL FOREST OFFICER
 BOURKELA FOREST DIVISION

Approved
 Technically Approved


 Regional Chief Conservator of Forest,
 BOURKELA FOREST DIVISION

Ref. No: MCL/GM/MLA/PO/SOCP/2022-23/

Date: 31/07/2022

Annexure-IX

UNDERTAKING

Subject: Non-forestry use of 349.709 ha forest land within total mining lease area of 2290.449 ha in Siarnal Open Cast Coal Mining Project of M/s Mahanadi Coalfields Limited in Sundargarh District, Odisha.

[Stage - I FC accorded vide file No.B-25/2021-FC of MoEF&CC, Govt. of India dated 21.04.2022]

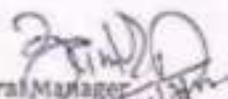
Siarnal Open Cast Coal Mining Project of M/s Mahanadi Coalfields Limited in Sundargarh District, Odisha has been accorded Stage - I FC by MoEF&CC, Govt. of India vide file No.B-25/2021-FC dated 21.04.2022 for Non-forestry use of 349.709 ha forest land within total mining lease area of 2290.449 ha.

In compliance of Stage - I FC Condition No. 5 of para A which is - "ChattajorNallah located in the area has been proposed to be straightened by the user agency. Also, number of mines are operational in the area which may cause threat hydrological regime viz. Basundhara River and its rivulets, therefore, a study on hydrological regimes of the area will be undertaken in consultation with the Water Resource Department and the same shall be submitted along with considered opinion of Water Resource Department of the State on the proposed straightening of Chattajornallah and proposed mitigating measures before stage II appraisal" the User Agency (Siarnal Open Cast Coal Mining Project of M/s Mahanadi Coalfields Limited) have engaged a consultant namely M/s Kalinga Commercial Corporation Limited, Bhubaneswar on 13.05.2022 to study the hydrological regime of the area. The consultant have already completed the field survey of the study area and preparing the Study Report. The report will elaborate the details of the study conducted by field surveys and plan and vision to develop an integrated approach for the protection of the Basundhara River on the proposed mining in the area along with cost estimates for execution of the plan. The consultant is expected to submit the report by 13.08.2022.

The report so prepared by the consultant will be submitted by the User Agency to Water Resource Department, Govt. of Odisha for obtaining considered opinion in compliance of the above condition of MoEF&CC, Govt. of India. Opinion of Water Resource Department, Govt. of Odisha is likely to be obtained by 15.09.2022.

We hereby undertake to submit the Study Report to MoEF&CC, Govt. of India along with considered opinion of Water Resource Department, Govt. of Odisha by 15.09.2022.

We further undertake that execution of the activities will be carried out as per the Study Report along with considered opinion of Water Resource Department, Govt. of Odisha, at project cost by Siarnal Open Cast Coal Mining Project of M/s Mahanadi Coalfields Limited.


General Manager
MCL, Mahaxmi Area
Mahanadi Coal Fields Limited


Project Officer
Siarnal Opencast Project
MCL, Mahaxmi Area
Project Officer
Siarnal OCP

Mahanadi Coalfields Limited



OFFICE OF THE DIVISIONAL FOREST OFFICER,
SUNDARGARH FOREST DIVISION



ANNEXURE-X

Phone No-06622-272241, E-Mail- dfo.sundargarh@odisha.gov.in

No. 4597 / 4F (MISC) / 2022/Dt- 18/07/2022

To

The Project Officer,
Siarnal OCP,
At/Po-Basundhara
Dist-Sundargarh
Pin-770076.

Subj: - Diversion of 349.705 ha. of forest land within total mining lease area of 2200.449 ha in Siarnal Open Cast Coal Mining Project by Mahanadi Coalfields Ltd. (MCL) in Sundargarh District, Odisha
-Demand for cost of 3 nos. of approved schemes for compliance of stage-I approval.

Ref: - This Office Memo No. 4515 Dtd. 14.07.2022.
Sir

With reference to the memo cited above, the 10 nos. of schemes have been approved by Regional Chief Conservator of Forests, Rourkela Circle to comply with the stipulations Condition No. A (4) (i), (ii), (iii), (iv), (v) Condition No. A (6), Condition No. A (7), Condition No. A (8), Condition No. A (9), (i), (ii), (iii), (iv) mentioned in the Stage-I approval. The detail of approved schemes are as follows:

1. The scheme for mitigative measures to minimize soil erosion and choking of stream in compliance with condition no. A (4) (i), approved by RCCF, Rourkela Circle.
2. The scheme for planting of adequate drought Hardy plant species and sowing of seeds in the appropriate area within the mining lease to arrest soil erosion in compliance with condition no. A (4) (ii), approved by RCCF, Rourkela circle.
3. The scheme for construction of check dams, retention /toe walls to arrest sliding down of the excavated material along the contour in compliance with condition no. A (4) (iii), approved by RCCF, Rourkela circle.
4. The scheme Stabilize the overburden dumps by appropriate grading/ benching, in accordance with the approved scheme, so as to ensure that angles of repose at any given place is less than 28° in compliance with condition no. A (4) (iv), approved by RCCF, Rourkela circle.
5. The scheme for Top soil management to ensure 'no damage' to the top soil with strict adherence to the top soil management plan with condition no. A (4) (iv), approved by RCCF, Rourkela circle.
6. Soil & Moisture Conservation (SMC) work plan to mitigate the impact of the proposed mining activity on the local rivulets (nallah) in compliance with condition no. 6 of para A, approved by RCCF, Rourkela circle.
7. The scheme for gap planting and soil and moisture conservation to restock and rejuvenate the degraded open forests located in the area within 100 from outer perimeter of the mining lease in compliance with condition no. 7 of para A, approved by RCCF, Rourkela Circle.
8. The scheme for de-silting of the village tanks and other water bodies so as to mitigate the impact of siltation of such tanks/water bodies located within 05 Km

Project Officer
Siarnal OCP
Mahanadi Coalfields Limited

- from mining lease boundary in compliance with condition no. 8 of para A, approved by RCCF, Rourkela Circle.
9. The scheme for fencing, protection and regeneration of safety zone area of 7.5 meter strip within the mining lease boundary in compliance with condition no. 9 (i) (ii) (iii) of para A, approved by RCCF, Rourkela Circle.
 10. The scheme for afforestation over one & half times of safety zone area over 5.895 ha of degraded forest land identified in Garjanbahal RF of Gopalpur Range of Sundargarh Division in compliance with condition no. 9 (iv) of para A, approved by RCCF, Rourkela Circle.

However, out of the above approved schemes, 3 nos. of schemes is to be implemented by Forest Department. The details of the schemes with approved financial outlay is as follows:

Sl. No.	Name of schemes	Amount (in Rs)
1	Soil & Moisture Conservation (SMC) work plan to mitigate the impact of the proposed mining activity on the local rivulets (Nallah) in compliance with condition no. 6 of para A	Rs. 6,12,09,030/-
2	The scheme for gap planting and soil and moisture conservation to restock and rejuvenate the degraded open forests located in the area within 100 from outer perimeter of the mining lease in compliance with condition no. 7 of para A.	Rs. 2,91,17,860/-
3	The scheme for afforestation over one & half times of safety zone area over 5.895 ha of degraded forest land identified in Garjanbahal RF of Gopalpur Range of Sundargarh Division in compliance with condition no. 9 (iv) of para A.	Rs. 35,28,210/-
	Total	Rs. 9,38,55,100/-

Hence, you are requested to deposit the amount of Rs. 9, 38, 55,100/- (**Rupees Nine Crore Thirty-Eight Lakh Fifty-Five Thousand One Hundred**) only towards approved schemes to comply condition nos. 6, 7 & 9 (iv) of Para A of Stage-I approval Order, payment should be made in the state specific CAMPA Account maintained by Govt. of India through "E" payment mode by using the web portal of Ministry of Environment & Forests (CAMPA). Further, the evidence of deposited amount may be furnished to the undersigned for further needful action at this end. The approved copies of the RCCF, Rourkela are enclosed herewith for your reference.

Enc:-As above

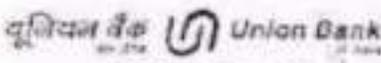
[Signature]
 Project Officer
 Sirmal OCP
 Mahanadi Coalfields Limited

Yours faithfully
[Signature]
 18-07-22
 Divisional Forest Officer
 Sundargarh Forest Division

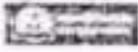
Memo No. 4598 /Dated 18/07/2022
 Copy forwarded to the Regional Chief Conservator of Forests, Rourkela Circle, Rourkela for favour of kind information with reference to his Memo No. 2265/3F-761/2022 dt.16.07.2022.

[Signature]
 18-07-22
 Divisional Forest Officer
 Sundargarh Forest Division.

BANK COPY



 युनियन बैंक Union Bank

NEFT / RTGS CHALLAN for CAMPA Funds

Date : 25-07-2022

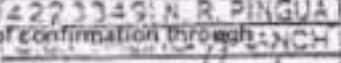
Agency Name.	SIARMAL OCP MAHANADI COALFIELDS LIMITED
Application No.	5832796588
MoEF/SG File No.	B-25/2021-FC
Location.	ORRISA
Address.	MCL Basundhara Area Sundargarh Sundargarh
Amount(in Rs)	93855100/-

Amount in Words: Nine Crore Thirty-Eight Lakh Fifty-Five Thousand One Hundred Rupees. Only

NEFT/RTGS to be made as per following details;

Beneficiary Name:	ORRISA CAMPA
IFSC Code: -	UBIN0996335
Pay to Account No.	150825832796588 Valid only for this challan amount.
Bank Name & Address:	Union Bank Of India Lodhi Complex Branch, Block 11, CGO Complex, Phase I, Lodhi Road, New Delhi -110003

* This Challan is strictly to be used for making payment to CAMPA by NEFT/RTGS only

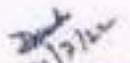
Send a line of confirmation through  if the payment status has not been updated your challan with transaction details.


 [Signature]

SBINR52020072596043074

Sumanth Sankar

Sujay Das.


 Project Officer
 Siarmal OCP
 Mahanadi Coalfields Limited


 25 JUL 2022



MCL

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FOR COMPANY USE ONLY

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The information given in this report is not to be communicated either directly or indirectly to the press or to any person not holding an official position in the CI/MCL.

**FINAL
REPORT
ON
SOIL MOISTURE CONSERVATION (SMC)
MEASURES IN THE AREA**

of

JAMKANI RESERVE FOREST OF GOPALPUR RANGE (357.00 Ha)

In Compliance to

Stage-I Forest Clearance Granted File No.8-25/2021-FC Dated: 21th April 2022
Ministry of Environment, Forests & CC of Govt. of India, New Delhi.

For

Diversion of 349.709 Ha of Forest land
Within Total Lease area of 2290.45 Ha.

SIARMAL OCP

M/s Mahanadi Coalfield Limited (MCL)
(Job No. -094722070)

(July 2022)



cmpdi
A Coal India Company

Project Officer
Siarmal OCP
Mahanadi Coalfields Limited

Central Mine Planning & Design Institute Ltd.

(A Subsidiary of Coal India Ltd.)

Regional Institute-VII, Bhubaneswar

&

Environment Division, Kanke Road
Ranchi - 834008 (Jharkhand), India

CONTENTS

SL. NO.	PARTICULAR	Page No.
	LIST OF CONTENTS	i-iii
	ACKNOWLEDGEMENTS	iv-v
CHAPTER 1	INTRODUCTION	I-1-10
1.1	Introduction	I-2
1.2	Details of the Project	I-2-7
1.3	Description of the Nature and Size of the Project	I-7-9
1.4	Consultation with Forest Officials	I-9
1.5	Scope and Objective of the Work	I-10
1.6	Compliance of Observations	I-11
CHAPTER 2	SOIL MOISTURE CONSERVATION: AN OVERVIEW	II-1-12
2.1	Soil Moisture	II-2-3
2.2	Soil Erosion	II-4
2.3	Water Erosion	II-4-6
2.4	Wind Erosion	II-6
2.5	Ice Erosion	II-6-7
2.6	Consequences of Soil Erosion	II-7-9
2.7	Estimation of Soil Erosion	II-10-11
2.8	Soil and Moisture Conservation in the Forest Area	II-11
2.9	Nature of SMC Work	II-11-12
CHAPTER 3	SOIL CHARACTERIZATION & ECOLOGICAL SURVEY	III-2-20
3.1	Soil Quality	III-2
3.2	Methodology	III-2-3
3.3	Equipment and Instruments Used	III-3
3.4	Rationale Behind Sampling	III-3-4
3.5	Sampling Locations	III-4
3.6	Observations	III-5-8
3.7	Highlights Of Analytical Results	III-8
3.8	Soil Texture Diagram	III-9
3.9	Flora Details with Reference to Tree Species	III-10-20

SL. NO.	PARTICULAR	Page No.
CHAPTER 4	HYDROGEOLOGICAL STUDIES	IV-1-20
4.1	Groundwater Occurrence	IV-2-3
4.2	Topography And Drainage	IV-4
4.3	Climate And Rainfall	IV-5
4.4	Geology and Structure	IV-5-7
4.5	Aquifer Description	IV-7-9
4.6	Groundwater Flow and Aquifer Interaction	IV-9-14
4.7	Groundwater Level Trends	IV-14-15
4.8	Water Environment	IV-15-20
CHAPTER 5	SOIL MOISTURE INDEX AND SOIL LOSS ESTIMATION	V-1-24
5.0	Drone Survey	V-2
5.1	Methodology For Drone Survey	V-3-6
5.2	Land Use of Study Area	V-7-9
5.3	Soil Moisture Index	V-9-14
5.4	Revised Universal Soil Loss	V-15-24
CHAPTER 6	MITIGATION MEASURES AND COST ESTIMATION	VI-1-36
6.1	Mitigative Measures	VI-2
6.2	Mechanical Measures	VI-2-5
6.3	Agronomical Measures	VI-5-6
6.4	Contour Trench Works	VI-7
6.5	Mulching	VI-8-13
6.6	Suggestions and Recommendations	VI-13-20
6.7	Cost Estimate	VI-21-36
CHAPTER 7	SUMMARY AND CONCLUSIONS	VII-1-8
7.1	Introduction	VII-1
7.2	Mitigative Measures	VII-1
7.3	Expected Outcome in the Study Area After Implementation of The Proposed Control Measures	VII-7
7.4	Cost Estimates	VII-8
CHAPTER 8	DISCLOSURE OF THE CONSULTANT ENGAGED	VIII-1-17

SL. NO.	PARTICULAR	Page No.
ANNEXURE		
Annexure 1:	Letter of Assistant Inspector General of Forests	A-1-6
Annexure 2:	Letter from the office of Forest Officer Gopalpur Range	A-7

LIST OF PLATES

Sl. No.	Particular	Page
PLATE -1	Study Area Map w.r.to. Siarmal Oc	P-2
PLATE -2	Location Map of Siarmal OC	P-3
PLATE -3	Toposheet Map of the Study Area	P-4
PLATE -4	Study Area Map	P-5
PLATE -5	Orthomosaic Image	P-6
PLATE -6	Contour Map	P-7
PLATE -7	Location of Proposed Contour Trenches	P-8
PLATE -8	Proposed Location for Grassing	P-9
PLATE -9	Proposed Location for Mulching	P-10
PLATE -10	Location of Proposed Check Dams	P-11
PLATE -11	Location of Proposed Ponds	P-12
PLATE -12	Recharge Pit (Representative Location)	P-13
PLATE -13	Typical Section of Check Dam	P-14
PLATE -14	Typical Section of Surface Pond	P-14


 Project Officer
 Siarmal OCP
 Mahanadi Coalfields Limited

ACKNOWLEDGEMENTS

Name and Designation	Broad Area/level of association
CMPDI HQ, Ranchi	
Sri Manoj Kumar, Chairman Cum Managing Director	For formulation corporate level objective, sanctioning of resources and overall monitoring and guidance.
Sri S. K. Gomasta, Director(T/CRD)	For continuous guidance and for providing the required facilities during the course of the study.
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Dr. Santhan P. FAE(EB)	Ecological Studies
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Sri. R. C. Sahoo, GM(Mining)/ HoD(Environment)	For overall guidance and mobilization of resources
Sri T. K. Das, GM(Civil)	For scrutinizing necessary technical matters related to Civil Engineering in connection to the report and overall guidance.
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Sri R. Kumar, Dy. Manager (Civil)	
Sri Amul Patwal, Dy. Manager (Environment)	

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PCCF, Bhubaneswar and Forest Department, Sundargarh	For providing all possible arrangements for safe access to study area.
Siarmal, MCL	
Siarmal, MCL	For providing all necessary logistical help and support during the course of the study.

CHAPTER-1
INTRODUCTION

CHAPTER-1

INTRODUCTION

1. BACKGROUND

1.1 INTRODUCTION

The proposed Siarmal OCP is located in north-western central part of Ib River coalfield of Odisha, known as Gopalpur sector. This coalfield is the southern middle part of lower Gondwana basin of Son Mahanadi Valley and occupies an area of about 1460 sq.km. with potential coal bearing area of around 1050 sq.km. The IB River coalfield lies in between latitude 21°31' to 22°14' North and longitude 83°32'00" to 84°10'00" East and falls mainly in Sundergarh, Jharsuguda and Sambalpur districts of Odisha.

Siarmal OCP has been formulated within Siarmal & Siarmal Extension block and Banapatra (also known as Western Extension of Siarmal) block in the Gopalpur Sector of Ib-valley coalfield. Both are virgin blocks. The Mining plan is based on Geological Reports of Siarmal & Siarmal Extension Block and Banapatra Block and project report of Siarmal OCP. The proposed mine area lies in the south of Basundhara West OCP (8.0 Mty) on the southern side of Basundhara river. Basundhara West OCP is an ongoing project. To its east lies the Kulda OCP (14.0 Mty). The proposed project is a new project. Mine plan and Mine Closure Plan has been approved in 198th MCL Board held on 31-01-2018 .

1.2 DETAILS OF THE PROJECT

1.2.1 PROJECT PROPONENT

The Project Proponent is M/s Mahanadi Coalfield Limited (MCL). Mahanadi Coalfields Limited was carved out of South Eastern Coalfields Limited in 1992 with

its headquarters at Sambalpur. The MCL is a Government coal mining company owned by the Government of India.

1.2.1 LOCATION OF THE BLOCK

The proposed Siarmal OCP 50.0 Mty is located in the North-Western part of Ib Valley Coalfield in Sundergarh Districts of Orissa. Location particulars of Siarmal OCP 50.0 Mty are given below:

Table 1.1: Location details

Coalfield	IB Valley
Tahasil	Himgir
District	Sundergarh
Project	Siarmal OCP
Latitudes	22 ^o 01' 19" N & 22 ^o 03' 59.99" N
Longitudes	83 ^o 37' 09" E & 83 ^o 42' 59.58" E
Topo sheet No.	64 N /12 on RF 1:50,000

1.2.2 COMMUNICATION

Table 1.2: Communication details

Sl. No.	Item	Description
1.	Nearest revenue town & Dist. HQ	Sundergarh (46 km)
2.	Nearest road	Sundergarh-Raigarh Interstate highway passing adjacent to the OCP.
3.	Connection to the state capital	450 km to Bhubaneswar via NH-55

Sl. No.	Item	Description
4.	Connection to the company HQs	140 km to Sambalpur district HQ Sundargarh.
5.	Nearest railhead	Hingir railway station on Mumbai – Howrah line of South Eastern railway is at a distance of about 35km.
6.	Airport	Jharsuguda Airport is at a distance of about 70 km.

1.2.3 DETAILS OF LAND USES IN MINE LEASE AREA

Table 1.3: Pre Mining Land Use

Sl. No.	Type of Land	ML area (in Ha)
1.	Agricultural	1382.408
2.	Forest	349.709
3.	Waste land	126.216
4.	Grazing	131.789
5.	Surface water bodies	48.227
6.	Settlements	44.970
7.	Others	207.131
Mining Lease Area		2290.45

1.2.4 Block Boundary:

The block boundary of Siarmal is given below:

North	Northern boundary of the block is marked by East-West trending Basundhara river
South	Southern boundary is marked with arbitrary boundary of barren measure formation
East	Eastern boundary is limited by Kulda Block along Basundhara river, then followed by Chattajor Nala
West	Western boundary of the Block is limited by Eastern boundary of Western extension of (Banapatra Block)

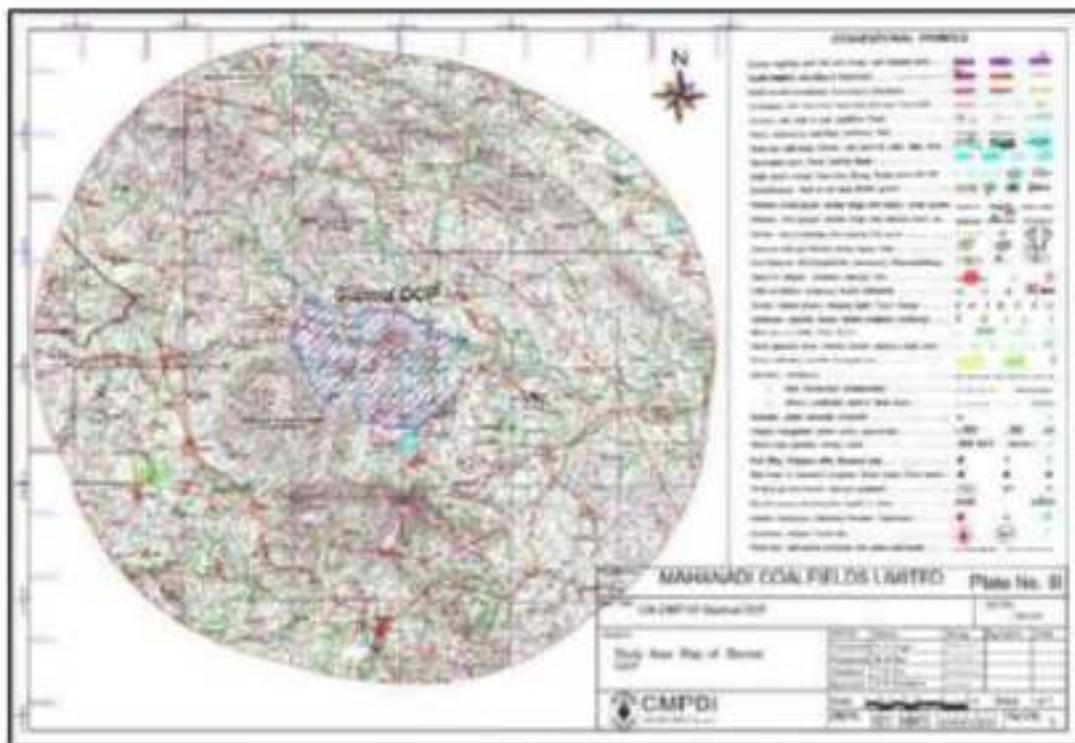


Fig No.1.1 : Location map of project

1.2.5 JUSTIFICATION FOR THE PROJECT

The consumers of MCL are linked to the company and not to any specific coalfield. The actual supply from any coalfield of MCL will depend upon the production and transport logistics. Under the above circumstances coalfield wise demand has been assessed based on the production share of these two coal field which is as below:

Table 1.4: Projected coal demand on MCL from Ib-valley coalfield.

(Fig. in Mt)

Sl. No	Particulars	2021-22	2026-27
1	Total Demand on MCL	244.83	274.134
2	Projected coal demand on Ib-valley coalfield	97.93	120.56
3	Coal Availability	73.82	85.32
	Gap	(-)24.11	(-)35.24

As per the above estimate, there is gap between demand and availability of MCL by from Ib-valley coalfield alone. Further new coal linkages have been given to MCL for which MCL has already issued LOA. The proposed project will meet the coal demand from the coalfield, especially to the new consumers and reduce the gap between demand and availability.

The coal seams in both the blocks under consideration for the project (Siarmal & Siarmal Extn. and Banapatra) are thick and occur at shallow depth. The entire net geological coal reserves of 1866.83 Mt has high quarriable potentiality.

Considering the coal demand on MCL and quarriable potential of the blocks, formulation of the present opencast mine for rated capacity of 50.0 Mty is justified.

1.2.6 DESCRIPTION OF CORE ZONE

The core zone of the project comprising of excavation zone, infrastructure area, OB dump sites, safety zone for blasting, etc., covers partly and/or fully the land from six (6) villages namely, Siarmal, Jhupuranga, Tumulia, Ratansar, Gopalpur and Kulda.

1.2.7 DESCRIPTION OF BUFFER ZONE

- The buffer zone i.e. area within 10 km radius from the periphery of the project boundary.
- Basundhara West OCP, Kulda OCP and Garjanbahal OCP are located in buffer zone.
- Basundhara river, Chattajhor and Telendra Nala flows adjacent to mine boundary.
- The reserve forests falling in the buffer zone are Kalatpani RF, Raghakar RF, Punjipahar RF, Ghogharpali RF, Jamkani RF, Garjanpahar RF, Jhatkhol RF, Lalma RF, Burhapahar RF, Pandripani RF, Balijori RF and Dhatukpahar RF.
- The Protected forests falling in the buffer zone are Koilanga PF, Kharudadi PF, Banjhacchar PF and Garhaghat PF.
- Ecologically sensitive areas such as national park, sanctuary, biosphere, etc. are not present within 10 km radius from the project.

1.3 CONDITION FOR COMPLIANCE REPORT FOR SEEKING STAGE-II APPROVAL

Assistant Inspector General of Forests, MoEF&CC submitted a letter to File No. 655502/2022/FC dated: 21st April, 2022 to the Addl. Secretary (Forests), Government of Odisha, Bhubaneswar regarding "Proposal for non-forestry use of

349.709 ha of forest land in favour of M/s Mahanadi Coalfields Limited for Siarmal Opencast Coal Mining Project in Sundergarh District (Odisha).

As per the directive of the Government of Odisha's letter No. 10F(Con)123/19 229/F&E dated 04.01.2020 for seeking prior approval of the Central Government under Section 2 of the Forest (Conservation) Act, 1980 and letter no. FE-DIV-0026-2021-3133/F&E dated 11.02.2021 forwarding additional information as sought by the Ministry vide its letter of even number dated 14.10.2020 the proposal was examined by the Forest Advisory Committee constituted by the Central Government under Section - 3 of the aforesaid Act. After careful examination of the proposal of the State Government and on the basis of the recommendations of the Forest Advisory Committee, and approval of the same by the competent authority of the MoEF&CC, New Delhi, the Central Government hereby accords 'in-principle' approval under Section - 2 of the Forest (Conservation) Act, 1980 for non-forestry use of 349.709 ha forest land in favour of M/s Mahanadi coalfields Limited for Siarmal Opencast Coal Mining Project in Sundergarh District (Odisha) subject to fulfilment of the stipulated conditions. ***The conditions related to soil-moisture conservation (SMC) are as under:***

"A. Conditions which need to be complied prior to handing over of forest land by the State Forest Department and compliance submission is to be submitted prior to stage-II approval

Point :

1)ii. The KML files of diverted area, the CA areas, the proposed SMC treatment area and the WLMP area shall be uploaded on the e-Green watch portal with all requisite details prior to stage II approval.

6) A Soil and Moisture Conservation (SMC) work plan to mitigate the impact of the proposed mining activity on the local rivulats (nallah) shall be prepared by the user agency in consultation with the State Forest Department and the same shall be submitted along with Stage-I compliance. Cost of implementation of the provision of the said Plan will be deposited into the

CAMPA and the same shall be intimated to the Ministry before Stage-II approval.

7) User agency either himself or through the State Forest Department shall undertake gap planting and soil and moisture conservation activities to restock and rejuvenate the degraded forests (having crown density less than 0.40), if any, located in the area within 100 meter from outer perimeter of the mining lease. The plan for plantation and SMC activities will be prepared and submitted to MOEF&CC before stage-II clearance"

1.4 CONSULTATION WITH FOREST OFFICIALS

A formal meeting between an official of MCL, CMPDI and DFO, Sundargarh Division was held on 25.05.2022 in the office of DFO, Sundargarh Division to discuss the fulfillment of the compliance lay down by Assistant Inspector General of Forests, MoEF&CC submitted a letter to Forest Conservation Division File No.8-25/2021-FC Dated: 21th April 2022.

The study area has been selected after a discussion with DFO Sundargarh Division dated 16.03.2022. An area of 357 ha forming catchment area for Basundhara river is identified in Jamkani Reserve Forest of Gopalpur Range.

Following the details of the identified SMC area:

1. Basundhara River flows from North to South direction as per natural slope.
2. The length of Basundhara river across the identified area is 3.48 km.
3. The catchment area identified is in adjacent (West direction) to the CA land Siarmal OCP, and Basundhara river is flowing almost between both areas from North to South.

On the basis of the above meeting, Aarav Unmanned Systems undertook UAV based survey for generation of high resolution orthomosaic image, DTM, DSM, and contour map of the proposed area for SMC study.

1.5 SCOPE AND OBJECTIVE OF THE WORK

- ❖ Existing Land Use pattern & Satellite imagery analysis.
- ❖ Soil characterization of the area in terms of type of soil, depth of soil, water holding capacity, humus and other organic/inorganic ingredients, key vulnerability for soil erosion.
- ❖ Soil erosion control techniques depending on the nature of soil/sediment, land/gradient etc. to protect chocking of streams like check dams, steps, bund etc.
- ❖ Micro watershed concept and soil and moisture conservation technique in the concerned area.
- ❖ Soil and moisture conservation Plan/report and cost estimate along with implementation schedules.
- ❖ As per the condition imposed by MoEF&CC in stage I Forest Clearance the soil and moisture conservation plan/report to be made in consultation with State Forest Department.
- ❖ The SMC plan/report prepared to be vetted and approved by State Forest Department.
- ❖ The final plan/report to be made after incorporating the suggestions provided by State Forest Department, if any.

1.6 COMPLIANCE OF OBSERVATIONS

Draft Report was submitted to MCL on 18th June 2022. The observations were given by DFO, Sundargarh on 29th June 2022. Further, a meeting was called in the office of DFO, Angul on 06.07.2022. In the meeting officials from MCL and CMPDI participated. A Powerpoint presentation was made CMPDI Team in the office of DFO, Sundargarh on 06.07.2022. The suggestion as made by DFO, Sundargarh has been complied in the final report.

CHAPTER-2

Soil Moisture Conservation: An Overview

CHAPTER-2

SOIL MOISTURE CONSERVATION: AN OVERVIEW

2.1 SOIL MOISTURE

Soil moisture is "the total amount of water, including the water vapor, in an unsaturated soil." Soil moisture—sometimes also called soil water—represents the water on inland surfaces that are not in rivers, lakes, or groundwater, but instead resides in the pores of the soil. In turn, soil moisture levels affect a range of soil and plant dynamics. Surface soil moisture is the water that is in the upper 10 cm of soil, whereas root zone soil moisture is the water that is available to plants—generally considered to be in the upper 200 cm of soil.

Water that enters a field is removed from a field by runoff, drainage, evaporation, or transpiration. Runoff is the water that flows on the surface to the edge of the field; drainage is the water that flows through the soil downward or toward the edge of the field underground; evaporative water loss from a field is that part of the water that evaporates into the atmosphere directly from the field's surface; transpiration is the loss of water from the field by its evaporation from the plant itself.

Water affects soil formation, structure, stability, and erosion but is of primary concern with respect to plant growth. Water is essential to plants for four reasons:

1. It constitutes 80%-95% of the plant's protoplasm.
2. It is essential for photosynthesis.
3. It is the solvent in which nutrients are carried to, into and throughout the plant.

4. It provides the turgidity by which the plant keeps itself in the proper position.

In addition, water alters the soil profile by dissolving and re-depositing mineral and organic solutes and colloids, often at lower levels, a process called leaching. In a loam soil, solids constitute half the volume, gas one-quarter of the volume, and water one-quarter of the volume of which only half will be available to most plants, with a strong variation according to matric potential.

Water moves in soil under the influence of gravity, osmosis and capillarity. When water enters the soil, it displaces air from interconnected macropores by buoyancy and breaks aggregates into which air is entrapped, a process called slaking. The rate at which a soil can absorb water depends on the soil and its other conditions. As a plant grows, its roots remove water from the largest pores (macropores) first. Soon the larger pores hold only air, and the remaining water is found only in the intermediate- and smallest-sized pores (micropores). The water in the smallest pores is so strongly held to particle surfaces that plant roots cannot pull it away. Consequently, not all soil water is available to plants, with a strong dependence on texture. When saturated, the soil may lose nutrients as the water drains. Water moves in a draining field under the influence of pressure where the soil is locally saturated and by capillarity pull to drier parts of the soil. Most plant water needs are supplied from the suction caused by evaporation from plant leaves (transpiration) and a lower fraction is supplied by suction created by osmotic pressure differences between the plant interior and the soil solution. Plant roots must seek out water and grow preferentially in moister soil microsites, but some parts of the root system are also able to remoisten dry parts of the soil. Insufficient water will damage the yield of a crop. Most of the available water is used in transpiration to pull nutrients into the plant.

2.2 SOIL EROSION

Soil erosion has affected land all over the world from small residential landscaped properties to large forests and deserts. Due to the action of rain and wind, some portion of soil gets eroded and transported naturally and at the same time disintegration of rocks goes on naturally at some places to form the soil. These are continuous processes that naturally balance the erosion and formation of soil.

Soil erosion is described as soil particles being shifted around due to the devastating impact of

- Water Erosion
- Wind and
- Ice melts

It is a natural process but, in most cases, human activity speeds up the process. Description of different types of soil erosion has been enumerated below in which above agencies have the major role: -

2.3 WATER EROSION

The investigation has shown that most of the soil erosion done by water is due to the impact of the falling raindrops. The erosion capacity of surface runoff is small and it acts only as a partner.

The water erosion process starts as soon as the rain starts. The two principal erosive agents that become active during the rain storm are:

- (a) Falling rain drops.
- (b) Flowing run-off

2.3.1 FALLING RAINDROPS

When a raindrop strikes the soil surface, it breaks down the clods and the aggregates of the soil and thus, the soil particles are torn loose from their

moorings in the soil mass. The energy of the falling water is applied from the above and is utilized in detaching the soil particles, while the energy of the surface runoff is applied parallel to the surface and is made used in transporting the dislodged soil particles.

The erosion caused by rain storms is also known as **Splash-Erosion-Process**. Another important fact that we must mention here is that the amount of erosion from hilly catchments is always more than that from flat catchments (provided all other conditions remain the same).

This is, because, when rain falls over the flat area, the incoming splash balances the outgoing splash; while when the raindrops strike the sloping land surfaces, a major proportion of the splash moves down. Hence, relatively larger quantities of soil are transported when catchments are sloping than the catchments are flatter.

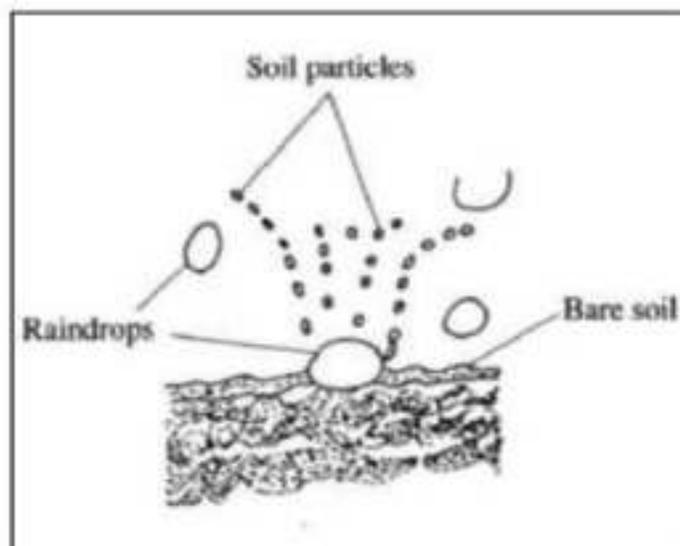


Fig 2.1: Splash Erosion

2.3.2 FLOWING RUN-OFF

The fraction of the rainfall which does not infiltrate (soak into) the soil will flow downslope under the action of gravity; it is then known as runoff or overland flow.

If the rain continues, the increasing depth of water will eventually increase. Overland flow that is released in this way is likely to flow downslope more quickly and in greater quantities (i.e. possess more flow power as a result of its kinetic energy), and so may be able to begin transporting and even detaching soil particles. Where it does so, the soil's surface will be lowered slightly. Lowered areas form preferential flow paths for subsequent flow, and these flow paths are in turn eroded further.

2.4 WIND EROSION

Soil erosion by wind may occur wherever dry, sandy, or dusty surfaces, inadequately protected by vegetation, are exposed to strong winds. Erosion involves the picking up and blowing away of loose fine-grained material within the soil. Damage from wind erosion is of numerous types. The most serious and significant by far, however, is the change in soil texture caused by wind erosion. Finer soil fractions (silt, clay, and organic matter) are removed and carried away by the wind, leaving the coarser fractions behind. This sorting action not only removes the most important material from the point of productivity and water retention, but leaves a more sandy, and thus a more erodable soil than the original. Wind erosion mainly depends upon the type of storm, speed, and duration.

2.5 ICE EROSION

Snow and glacier melt occur only in areas cold enough for these to form permanently. Typically, snowmelt will peak in the spring and glaciers melt in the

summer, leading to pronounced maximum flow in rivers affected by them. The determining factor in the rate of melting of snow or glaciers is both air temperature and the duration of sunlight. In high mountain regions, streams frequently rise on sunny days and fall on cloudy ones for this reason. Soil erosion due to ice melting is not applicable in this region because it is a tropical region and temperatures do not go down to the freezing point.

2.6 CONSEQUENCES OF SOIL EROSION

Damage from the soil erosion is of numerous types however the most serious and significant consequences are mentioned below-

- 1) Water Pollution
- 2) Improper water availability
- 3) Chocking of Streams
- 4) Change in soil texture

2.6.1 WATER POLLUTION

Water is the most essential requirement after air for the survival of any kind of life which needs more or less some quantity of water. It holds a pivotal position in the total environment so that if its availability is in optimum quantity, it can protect all aspects of the environment and if availability is less or more than the requirement then the quality of all aspects of the environment gets endangered. Water is made available by the nature in good quantity and quality in the form of rainwater, underground water, and through the river, Nala, ponds etc. This water gets affected due to disturbance in nature using man's activities associated with construction, mining activities, etc.

Mainly two types of actions cause water pollution.

- a) Mixing foreign substances with natural water causes physical and chemical changes.

- b) Interception or diversion of full or part of any waterway.

The operation of mining and allied activities of this project would have an impact on water quality through the generation of wastewater in the surrounding area in many ways. The source of such a polluted liquid effluent has an impact on water quality and these are discussed elaborately in the EMP report.

2.6.2 IMPROPER WATER AVAILABILITY

A lesser amount of the soil is covered with vegetation, mulches, crop residues, etc., more the soil is exposed to the impact of raindrops. When a raindrop hits bare soil, the energy of the velocity detaches individual soil particles from soil clods. These particles can clog surface pores and form many thin, rather impermeable layers of sediment at the surface, referred to as surface crusts. They can range from a few millimeters to one cm or more, and they are usually made up of sandy or silty particles. These surface crusts obstruct the passage of rainwater into the ground reservoir and reduce the water holding capacity of the earth a consequence surface runoff increases and cause more soil erosion. This eroded soil is transported and settled at depressed land, pond, stream/Nala, etc, and reduces the water holding capacity. Moreover, due to the low infiltration rate groundwater reservoir does not get a full recharge. So overall water holding capacity of the area gets reduced to a large extent and resulting in a shortage of water in the region during the dry time.

In another scenario, the increased speed and volume of the surface runoff generate at these places create a flood-like situation anywhere on the downstream side. These create improper water availability in the region.

2.6.3 CHOKING OF STREAMS

Rainfall water that does not infiltrate into the soil starts to flow downhill under the action of gravity. Initially, run-off moves down the slope as a thin

diffused film of water that has lost virtually all the kinetic energy which it possessed as falling rain. Thus, it moves only slowly, has a low flow power, and is generally incapable of detaching or transporting soil particles.

If the rain continues, the increasing depth of water will eventually increase. Overland flow that is released in this way is likely to flow downhill more quickly and in greater quantities (i.e. possess more flow power as a result of its kinetic energy), and so it may be able to begin transporting and even detaching and picking up the soil particles. When the speed of runoff is decreased, the carrying capacity of the runoff gets reduced, subsequently, sedimentation takes place, causing the choking of the stream. Following are the main area where maximum soil erosion takes place.

2.6.4 CHANGE IN SOIL TEXTURE

The most serious and significant effect of soil erosion, by far, is the change in soil texture caused by wind/water erosion. Finer soil fractions (silt, clay, and organic matter) are removed and carried away by the wind, leaving the coarser fractions behind. This sorting action not only removes the most important material from the standpoint of productivity and water retention but leaves a more sandy soil and thus a more erodible soil than the original. Successive removals eventually create such a soil condition wherein plant growth is minimized and erodibility is greatly increased. Damage results both from water erosion and the consequent dust storms. Control becomes more and more difficult. In the extreme, the sand begins to drift and form unstable dunes which encroach on better surrounding lands. Throughout recorded history, huge agricultural areas have been ruined for further agricultural use in this manner

2.7 ESTIMATION OF SOIL EROSION

Erosion is a natural geomorphic process occurring continually over the earth's surface and it largely depends on topography, vegetation, soil, and climatic variation and, therefore, exhibits pronounced spatial variability due to catchments heterogeneity and climatic variation.

Soil erosion is a three-stage process:

- (1) Detachment,
- (2) Transport, and
- (3) Deposition of soil.



Fig No. 2.2: Figure showing stages of soil erosion processes

Different energy source agents determine different types of erosion. There are five principal sources of energy that affect erosion such as wind, water, gravity, chemical reactions, and anthropogenic, such as tillage. Soil erosion begins with detachment, which is caused by the breaking down of aggregates by raindrop impact, sheering, or drag force of water and wind. Detached soil particles are transported by flowing water (overland flow and inter-flow) and wind, and deposited when the velocity of water or wind decreases by the effect of slope or ground cover. Three processes viz. dispersion, compaction, and crusting

accelerate the natural rate of soil erosion. These processes decrease structural stability, reduce soil strength, exacerbate erodibility and accentuate susceptibility to transported by overland flow, interflow, wind, or gravity. These processes are accentuated by soil disturbance (by tillage, vehicular traffic), lack of ground cover (bare fallow, residue removal or burning), and harsh climate (high rainfall intensity and wind velocity).

The above problems can be circumvented by describing the catchments into approximately homogeneous sub-areas using the Geographic Information System (GIS). In this study, the remote sensing and GIS techniques (through Satellites Imagine and interrelated software) were used for the derivation of spatial information, catchments description, data processing, etc.

2.8 SOIL AND MOISTURE CONSERVATION IN THE FOREST AREAS

Forest is the origin of the streams and rivers; therefore, it is very important to conserve soil and moisture in its catchment area. Soil and moisture Conservation works have become an integral part of Forest Development. Soil Moisture Conservation works in the forest area marked for the plantation activity are carried out on a micro- watershed basis. This approach is aimed at enhancing land productivity and increasing soil moisture availability for a longer period.

2.9 NATURE OF SMC WORKS

Emphasis is to be given to the drainage line treatment. SMC works on the site are carried out as per the site-specific approved treatment plan. Emphasis is to be given to contour line treatment with small and medium SMC works. The SMC and area development works are concerned, the entire area is to be treated

as a unit. In an area prone to Soil Erosion and degraded forest, following measures are suggested to increase moisture level:

- Earthen Pits
- Contour Trenches
- Check Dams
- Earthen Ponds
- Grassing
- Mulching

Various plantation models such as mangrove plantation, coastal border plantation, plantation as per the provision in different areas, soil and moisture conservation works of forest and plantation areas, maintenance & up-keep of plantation areas with different models are formulated for different areas.

CHAPTER-3

Soil Characterization & Ecological Survey

CHAPTER-3

SOIL CHARACTERIZATION & ECOLOGICAL SURVEY

3. INTRODUCTION

3.1 SOIL QUALITY

Soil is one of the most significant ecological factors on which plants depend for their nutrients; water and mineral supply. Indiscriminate deforestation, digging for minerals, and destruction of grazing lands for human habitation have done irreparable damage to the environment and even led to harsh climatic change. Some of the dangers posed by soil pollution are due to the fact that while the number of the earth's inhabitants are increasing, the earth's natural resources are by and large fixed as well as limited. Thus, the soil gets heavily polluted day by day by rapid anthropogenic activities and population explosion in developing countries.

Further, major mining activities affect the soil regime of the surrounding areas directly or indirectly. Hence, it becomes important to study soil quality as knowledge of soil parameters is essential for the planning and implementation of afforestation. Keeping the above aspects in view, four locations were selected to represent the entire area study area, and samples were collected from two depths viz. 0-30 and 30-60 cm during the study period.

3.2 METHODOLOGY

Soil samples were collected by digging a pit at the appropriate location from depths 0-30,30-60 and 60-90 cm with the help of a spade/ AGAR and a ' Khurpi'. The samples were brought to the CMPDI's laboratory at Ranchi and air-dried for a few days. The air-dried samples were then ground in an agate mortar with the help

of a wooden hammer and passed through a 2 mm (10mesh) sieve. The coarser materials were rejected and the sieved material was sampled by the standard Coning & quartering method (Ref. Jackson, M.L., 'Soil chemical analysis', Prentice Hall, India 1958).

The processed samples were analyzed for the different parameters according to the standard methods as described under Jackson, M.L., 'Soil Chemical Analysis, Prentice Hall, India 1958; millar, CE, turk, L.M. Foth, H.D. Fundamentals of Soil Science, John Wiley & Sons, Inc., New York, 1962, Indian Council of Agricultural Research, New Delhi, ' Hand Book of Agriculture', IS:2720 (Part IV), 1975 and IS:2720, Part (V), 1970 ; Methods of Soil Analysis, Part I & II, Black, CA et.al. American society of Agronomy, Inc. USA, 1965.

3.3 EQUIPMENT AND INSTRUMENTS USED

- a. Ion Chromatograph
- b. AAS
- c. pH Meter
- d. Conductivity Meter
- e. Double-Beam Spectrophotometer
- f. Standard Sieves
- g. Oven
- h. Muffle Furnace, etc.

3.4 RATIONALE BEHIND SAMPLING

The main aim of the soil testing is to assess the soil quality of the area for assessment of the production potential, selection of suitable species of plants for the green belt and afforestation as an anti-pollution measures. Thus, to assess the soil quality, nine nos. of samples were collected from three different locations at the rate of three samples per project from the depths of 0-30, 30-60 and 60-90 cm for the

study period. These sampling locations were selected in consultation with CMPDIL officials.

3.5 SAMPLING LOCATIONS

Details of sampling location are given below:

Table-3.1

Sampling location for soil quality assessment

Sl. No.	Name of Sampling Locations	Total No. of Samples	Remarks
01.	S-1	Three (0-30, 30-60 & 60-90 cm depth)	Degraded Land
02.	S-2	Three (0-30, 30-60 & 60-90 cm depth)	Degraded Land
03.	S-3	Three (0-30, 30-60 & 60-90 cm depth)	Forest
Total No. of Samples			09



Fig. 3.1: Soil Sampling locations

3.6 OBSERVATIONS

The observed characteristics of soil samples collected from four different locations are presented hereunder:

Table-3.2

Characteristics of soil: Sampling location: S-1

Sl. No.	Parameters- S-01	Date of Sampling: 29.04.2022		
		Observed Value		
		(0-30 cm)	(30-60 cm)	(60-90 cm)
1	Soil Texture	Sandy Loam	Sandy Loam	Sandy Loam
2	Grain Size, %			
	a) Sand	75.4	76.5	77.1
	b) Silt content	12.1	12.4	12.2
	c) Clay content	12.5	11.1	10.7
3	Porosity, %	52.61	51.97	50.29
4	Bulk Density, g/cm ³	1.29	1.31	1.34
5	pH	6.27	6.19	6.11
6	Elect. Conductivity (mS/cm at 20°C)	0.48	0.46	0.45
7	Water holding capacity (inches of water per foot of soil)	1.39	1.42	1.47
8	Infiltration Rate (mm/hr.)	25.14	25.06	24.87
9	Cation Exchange Capacity, meq/100 g	8.7	8.4	7.9
10	Organic Carbon %	0.21	0.16	0.13
11	Phosphorous as P ₂ O ₅ kg/ha	12.78	11.89	10.46
12	Potash as K ₂ O, kg/ha	57.62	53.21	49.07
13	Nitrogen as N, kg/ha	70	65	64

Table-3.3

Characteristics of soil sampling location: S-2

Sl. No.	Parameters- S - 02	Date of Sampling: 29.04.2022		
		Observed Value		
		(0-30 cm)	(30-60 cm)	(60-90 cm)
1	Soil Texture	Sandy Loam	Sandy Loam	Sandy Loam
2	Grain Size, %			
	a) Sand	60.1	61.2	62.4
	b) Silt content	24.6	24.6	23.8
	c) Clay content	15.3	14.2	13.8
3	Porosity, %	53.76	52.49	51.26
4	Bulk Density, g/cm ³	1.30	1.32	1.34
5	pH	5.68	5.49	5.41
6	Elect. Conductivity (mS/cm at 20°C)	0.44	0.42	0.40
7	Water holding capacity (inches of water per foot of soil)	1.46	1.41	1.37
8	Infiltration Rate (mm/hr.)	26.29	26.11	26.04
9	Cation Exchange Capacity, meq/100 g	9.8	9.2	8.8
10	Organic Carbon %	0.27	0.25	0.16
11	Phosphorous as P ₂ O ₅ kg/ha	11.29	10.57	09.31
12	Potash as K ₂ O, kg/ha	52.26	49.51	45.92
13	Nitrogen as N, kg/ha	73	71	62

Table-3.4

Characteristics of soil sampling location: S-3

Sl. No.	Parameters	Date of Sampling: 29.04.2022		
		Observed Value		
		(0-30 cm)	(30-60 cm)	(60-90 cm)
1	Soil Texture	Sandy Loam	Sandy Loam	Sandy Loam
2	Grain Size, %			
	a) Sand	63.7	65.1	66.5
	b) Silt content	16.6	16.3	16.1
	c) Clay content	19.7	18.6	17.4
3	Porosity, %	51.29	50.71	49.36
4	Bulk Density, g/cm ³	1.32	1.34	1.37
5	pH	5.65	5.37	5.18
6	Elect. Conductivity (mS/cm at 20°C)	0.40	0.49	0.49
7	Water holding capacity (inches of water per foot of soil)	1.46	1.48	1.51
8	Infiltration Rate (mm/hr.)	24.89	24.51	24.18
9	Cation Exchange Capacity, meq/100 g	7.6	7.1	6.9
10	Organic Carbon %	0.31	0.27	0.25
11	Phosphorous as P ₂ O ₅ kg/ha	12.26	11.59	10.67
12	Potash as K ₂ O, kg/ha	69.74	66.26	58.51
13	Nitrogen as N, kg/ha	105	98	95

Table-3.5
Soil Fertility Quality Standard w.r.t C: N:P: K

Sl. No.	PARAMETERS	QUALITY STATUS		
		Poor	Medium	Fertile
1	Organic Carbon %	<0.5	0.5 to 0.75	>0.75
2	Nitrogen as N, kg/ha	<280	280 to 560	>560
3	Phosphorus as P ₂ O ₅ , kg/ha	<23	23 to 57	>57
4	Potash as K ₂ O, kg/ha	<133	133 to 337	>337

3.7 HIGHLIGHTS OF ANALYTICAL RESULTS

The highlights of some of the parameters as depicted in analytical results presented in Tables – 5.2 to 5.4 are given hereunder:

(i) Texture

The texture of the soil is Sandy Loam.

(ii) pH

The pH of the soils ranged from 5.18 to 6.27.

(iii) Electrical Conductivity

The electrical conductivity varied from 0.40 to 0.49 dS/cm at 20°C.

(iv) Organic Carbon

The organic carbon ranged between 0.13 to 0.31 %. Organic carbon is one of the important characteristics of the soil and represents for fixation of nitrogen and survival of the various macro and microorganisms. It has been found that the soil samples of sampled are in the range of poor quality in case of degraded forest land as well as in forest land.

(v) Phosphorus as P₂O₅

The concentration of Phosphorous varied between 09.31 to 12.26 Kg/ha.

(vi) Potash as K₂O

The concentration of Potash ranged between 45.92 to 69.74 Kg/ha.

(vii) Nitrogen as N

The concentration of Nitrogen varied between 62 to 105 Kg/ha.

3.8 SOIL TEXTURE DIAGRAM

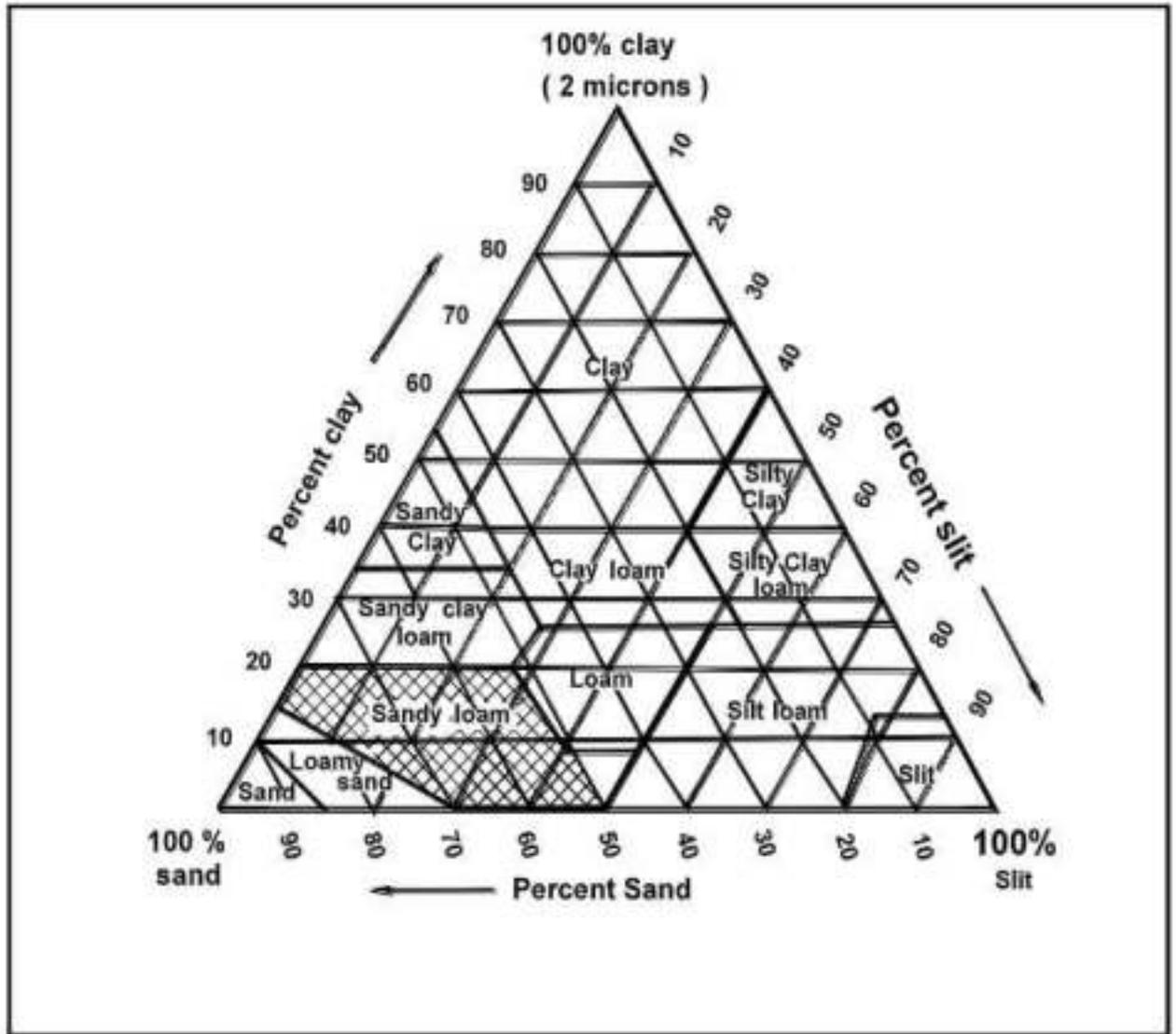


Fig 3.2 Soil Texture Diagram

3.9 FLORA DETAILS WITH REFERENCE TO TREE SPECIES

The trees are unique along the river and nalla boundaries of the site. Sal formation is characteristic and dense. In some places, dense patches of Mahua or Aam formation are observed. They are characteristically stout and vary from the vast canopy. Sal will have more trees but its canopy is narrow. The Mango canopy is characteristically vast and dense, which is very useful for the Birds, Mammals, and Other Organisms. Jamun trees also have a relatively broader canopy. The fruit trees always stand in the first place. Another important criterion is trees with bigger flowers. Seemal tree has big flowers with more nectar, which attracts birds, similarly mistletoe also longer flowers with nectar. It also attracts insects and birds. Mahua trees harbor more epiphytic orchids which are having very beautiful flowers. Chhar trees have more parasitic mistletoes. Earlier forest Eucalyptus plantations also developed a tall formation of vegetation.

Sal trees support varieties of climbers such as Ventilago, Dioscorea, Ichnocarpus, Embelia, Cissus, Butea, Mucuna, Hemidesmus, Asparagus, Tinospora, Hemidesmus etc. Kusum trees also have a bigger canopy often palm trees and Wild date pal also forms a nice formation, which provides the best nesting for birds, insects like their pollen more. Gigantic terminalia arjuna trees are observed on the river banks. Their trunk is exceptionally thick. We cannot forget the appreciation of the Moraceae fig species such as Banyan (*Ficus benghalensis*), Peepal(*Ficus religiosa*), Fig (*Ficus racemosa*), White fig (*Ficus virens*) Hill fig *Ficus mollis*, *Ficus amplissima*, *Ficus gibbosa*, *Ficus macrocarpa*. *Ficus benghalensis* and *Ficus religiosa* are very special with respect to their size and canopy. These trees can be planted in the forest areas, so they will grow faster and withstand hard climatic conditions and contribute to the good natural vegetation. *Aegle marmelos* is also an important tree in deciduous forests. Will bear fruits throughout the year. Kaaj tree (*Bridelia retusa*) is also a frequent tree in deciduous forests. *Terminalia bellirica* tree also has a stout trunk, tall canopy. *Boswellia serrata* is a characteristic tree with

relatively less foliage and stout branches. *Terminalia tomentosa*, *Holarrhena pubescence* is a frequent small shrub or medium-sized tree, with larger leaves with milky latex. One cannot forget the Haldu trees (*Haldina cordifolia*) for their magnanimous structure. In Orissa often sacred grooves are present near villages. The sacred groves have More *Alangium salvifolium* (Ankola) trees, *Diospyros ebenum* (Persimmon), *Diospyros montana*, *Kuchala*(*Strychnos nux vomica*), *Psydras dicoccum* (torch wood tree), Banyan, sal, fig, Jamun etc, *Pterocarpus marsupium*(Bijay) *Chloroxylum swietenia* (Bhirra) are considered as vulnerable trees. All these tree species need to be raised more in the afforestation programme and increase the wealth of our vegetation.



Fig. 3.3 : Chhar – *Buchanania cochinchinensis*, Mahua – *Madhuca longifolia*, Kendhu – *Diospyros melanoxylon*, Lendia – *Lagerstroemia parviflora*, Mohin – *Lannaea coromandelica*, Salaj – *Boswellia serrata*,



Fig 3.4 Chhar – *Buchanania cochinchinensis*, Mahua – *Madhuca longifolia*,
Kendhu – *Diospyros melanoxylon*, Lendia – *Lagerstroemia parviflora*, Salai –
Boswellia serrata



Fig 3.5 *Shora robusta* - Sal, Mohin – *Lannaea coromandelica*, Bhera - *Chloroxylon swietenia*, Karam- *Haldina cordifolia*, Bael - *Aegle marmelos*, Chhar – *Buchanania cochinchinensis*, Kurrah – *Holarrhena pubescence*



Fig 3.6 Sal- *Shorea robusta*, Mahua – *Madhuca longifolia*, Kari – *Miliusa tomentosa*, Sagwan – *Tectona grandis*, Ficus virens – Wild fig



Fig 3.7 Chhar – *Buchanania cochinchinensis*, Mahua – *Madhuca longifolia*, Bilawa- *Semecarpus anacardium*, Kendhu – *Diospyros melanoxylon*, Lendia – *Lagerstroemia parviflora*

Table 3.6 : List of Birds Associated fruit Trees found in the study area

S. No.	Scientific name	Family	Propagation by
1.	<i>Aglaia elaeagnoideae</i>	Meliaceae	Seeds
2.	<i>Aglaia hoslettiana</i>	Meliaceae	Seeds
3.	<i>Aglaia spectabilis</i>	Meliaceae	Seeds
4.	<i>Alangium salvifolium</i>	Alangiaceae	Seeds
5.	<i>Anthocephalus cadamba</i>	Rubiaceae	Seeds
6.	<i>Azadirachta indica</i>	Meliaceae	Seeds
7.	<i>Barringtonia acutanula</i>	Lecythidaceae	Seeds
8.	<i>Bombax ceiba</i>	Malvaceae	Seeds/cuttings
9.	<i>Calophyllum inophyllum</i>	Cluciaceae	Seeds
10.	<i>Canthium dicoccum</i>	Rubiaceae	Seeds
11.	<i>Carissa carandas</i>	Apocynaceae	Seeds
12.	<i>Cochlospermum religiosum</i>	Cochlospermaceae	Seeds
13.	<i>Cocos nucifera</i>	Arecaceae	Seeds
14.	<i>Cordia obliqua-ambota</i>	Boraginaceae	Seeds
15.	<i>Crateva adansoni</i>	Capparaceae	Seeds
16.	<i>Crateva magna</i>	Capparaceae	Seeds
17.	<i>Diospyros melanoxylon</i>	Ebenaceae	Seeds
18.	<i>Ehretia laevis tambalu</i>	Boraginaceae	Seeds
19.	<i>Ficus benghalensis</i>	Moraceae	Seeds
20.	<i>Ficus racemosa</i>	Moraceae	Seeds
21.	<i>Ficus religiosa</i>	Moraceae	Seeds
22.	<i>Flacourtia jangomas</i>	Flacourtiaceae	Seeds
23.	<i>Garcinia cowa</i>	Cluciaceae	Seeds
24.	<i>Garcinia xanthochymus</i>	Cluciaceae	Seeds
25.	<i>Gardenia latifolia</i>	Rubiaceae	Seeds
26.	<i>Gardenia resinifera</i>	Rubiaceae	Seeds
27.	<i>Homalium nepalense</i>	Flacourtiaceae	Seeds
28.	<i>Limonia acidissima</i>	Rutaceae	Seeds

S. No.	Scientific name	Family	Propagation by
29.	<i>Madhuca longifolia</i>	Sapotaceae	Seeds
30.	<i>Mangifera indica</i>	Anacardiaceae	Seeds
31.	<i>Melia azedirach</i>	Meliaceae	Seeds
32.	<i>Milium tomentosum</i>	Annonaceae	Seeds
33.	<i>Morus alba</i> (White mulberry)	Moraceae	Seeds/Cuttings
34.	<i>Naringe crenulata</i>	Rutaceae	Seeds
35.	<i>Ochna obtusata</i>	Ochnaceae	Seeds
36.	<i>Picrasma javanica</i>	Simaroubaceae	Seeds
37.	<i>Pittosporum wightii</i>	Pittosporaceae	Seeds
38.	<i>Salvadora persica</i> - Pilu, Tooth brush tree	Salvadoraceae	Seeds
39.	<i>Syzygium caryophyllifolium</i>	Myrtaceae	Seeds
40.	<i>Syzygium cerasoides</i>	Myrtaceae	Seeds
41.	<i>Syzygium fruticosum</i>	Myrtaceae	Seeds
42.	<i>Syzygium cumini</i>	Myrtaceae	Seeds
43.	<i>Tamarindus indica</i>	Leguminosae	Seeds
44.	<i>Terminalia cattappa</i>	Combretaceae	Seeds
45.	<i>Xyosma longifolium</i>	Salicaceae	Seeds
46.	<i>Zizyphus mauritiana</i>	Rhamnaceae	Seeds

3.9.1 Criteria for selection of plant/tree species for Afforestation

Keeping in view the climatic condition, the status of soil (Agro-climatic zone), and vegetation types, the following plant species are suitable for plantation for the proposed project site.

Table 3.7 : Lists of Plant Species for Green Belt Development

SI No.	Scientific Name	Common Name	Family	Sensitive / Tolerant to pollution	Habit	Regeneration	Evergreen / Deciduous
1.	<i>Acacia catechu</i>	Khair	Leguminosae	T	T	Seeds	Deciduous
2.	<i>Acacia ferruginea</i>		Leguminosae	T	T	seeds	Deciduous
3.	<i>Acacia leucophloea</i>	Safed babul	Leguminosae	T	T	seeds	Deciduous
4.	<i>Acacia polyacantha</i>		Leguminosae	T	T		Deciduous
5.	<i>Adenanthera pavonia</i>		Leguminosae	T	T	Seeds	Deciduous
6.	<i>Albizia amara</i>		Leguminosae	T	T	Seeds	Deciduous
7.	<i>Albizia lebbekii</i>	Sirish	Mimosaceae	T	T	By seed	Deciduous
8.	<i>Albizia thompsonii</i>		Leguminosae	T	T	Seeds	Deciduous
9.	<i>Albanthus excelsa</i>	Maharuk	Simarubaceae	T		By seed	Deciduous
10.	<i>Aphanamixis polystachya</i>	Mangai, panikusum	Meliaceae	T	T	Seed	Deciduous
11.	<i>Ardesia depressa</i>		Myrsinaceae	S	S	Seeds	
12.	<i>Ardesia solanacea</i>		Myrsinaceae	S	S	Seeds	
13.	<i>Bauhinia racemosa</i>	Kachnar	Caesalpinaceae	T	T	By seeding	
14.	<i>Bauhinia semia</i>		Leguminosae	T	T	seeds	Deciduous
15.	<i>Boswellia serrata</i> - salai		Burseraceae	T		Seeds/cuttings	Deciduous
16.	<i>Butea monosperma</i>	Palas	Fabaceae	T	T	By seeds	Deciduous
17.	<i>Carallia brachiata</i>		Rhizophoraceae	T	T	Seeds	Deciduous
18.	<i>Cassia fistula</i>	Golden shower	Caesalpinaceae	T	T	By seeds	Deciduous
19.	<i>Chukrasia tabularis</i>	Chikrasi	Meliaceae	T	T	Seeds	Deciduous
20.	<i>Citrus aurantium</i>	Nebu	Rutaceae	T	T	By seeds, Stem	Evergreen
21.	<i>Commiphora caudata</i>		Burseraceae	T		Seeds/cuttings	Deciduous
22.	<i>Dalbergia sissoo</i>	Sissoo	Leguminosae	T		By seeds, Root & Slum cuttings	Evergreen
23.	<i>Delonix elata</i>		Leguminosae	T	T	seeds	Deciduous
24.	<i>Dolichandron spacia</i>		Bignoniaceae	T	T	Seeds	
25.	<i>Dolichandron falcata</i>		Bignoniaceae	T	T	Seeds	
26.	<i>Eucalyptus cameldulensis</i>		Myrtaceae	T	T	Seeds	Deciduous
27.	<i>Eucalyptus citridora</i>		Myrtaceae	T	T	Seeds	Deciduous

SI No.	Scientific Name	Common Name	Family	Sensitive / Tolerant to pollution	Habit	Regeneration	Evergreen / Deciduous
26.	<i>Firmiana colorata</i>		Malvaceae	T		By seeds	
29.	<i>Garuga pinnata</i>		Burseraceae	T		Seeds/cuttings	Deciduous
30.	<i>Grewia diasperma</i>		Malvaceae	T		Seeds	Deciduous
31.	<i>Guazuma ulmifolia</i>		Malvaceae	T		By seeds	
32.	<i>Harpullia arborea</i>		Sapindaceae	T	T	Seeds	Deciduous
33.	<i>Heterophragma quadriloculare</i>		Bignoniaceae	T	T	Seeds	
34.	<i>Jacaranda mimosaeifolia</i>	Neeli Gulmohar	Caesalpiniaceae	S	T	By seeds	Deciduous
35.	<i>Kleinhovia hospita</i>		Malvaceae	S		By seeds	
36.	<i>Kydia calycina</i>	Poola	Malvaceae	T		By seeds	
37.	<i>Maesa indica</i>		Myrsinaceae	T	S	Seeds	
38.	<i>Malaleuca leucadendron</i> Kayaputi - cultivated	Kayaputi	Myrtaceae	T	T	Seeds	Deciduous
39.	<i>Mammea suriga</i>		Clusiaceae	T		By seeds	
40.	<i>Melia dubia</i>	Kadbevu	Meliaceae	T	T	Seeds	Deciduous
41.	<i>Mesua ferrea</i>		Clusiaceae	T		By seeds	
42.	<i>Millingtonia hortensis</i>	neem chameli,	Bignoniaceae	T	T	Seeds	
43.	<i>Oroxylum indicum</i>	Syonaka	Bignoniaceae	T	T	Seeds	
44.	<i>Protium serratum</i>		Burseraceae	T		Seeds/cutting	Deciduous
45.	<i>Pterospermum acerifolium</i>	bayur tree	Malvaceae	T		By seeds	
46.	<i>Pterospermum canescence</i>		Malvaceae	T		By seeds	
47.	<i>Pterospermum xylocarpum</i>		Malvaceae	T		By seeds	
48.	<i>Rademachera xylocarpa</i>		Bignoniaceae	T	T	Seeds	
49.	<i>Sapindus emarginatus</i>	Reetha	Sapindaceae	T	T	seeds	Deciduous
50.	<i>Saraca asoca</i>		Leguminosae	T	T	seeds	Deciduous
51.	<i>Schreberia swietenoides</i>	Weavers beam tree, Eksira	Oleaceae	T	T	Seeds	
52.	<i>Siphonodon celastrius</i>		Celastraceae	T	T	Seeds	Deciduous
53.	<i>Sterculia urens</i>	Kulu	Malvaceae	T		Seed	Deciduous
54.	<i>Sterculia villosa</i>	Elephant-ropes tree	Malvaceae	T		Seeds	Deciduous

Sl No.	Scientific Name	Common Name	Family	Sensitive / Tolerant to pollution	Habit	Regeneration	Evergreen / Deciduous
55.	<i>Stereospermum chelonoides</i>	Padri	Bignoniaceae	T	T	Seeds	
56.	<i>Stereospermum colais - chaipatoli</i>	chaipatoli	Bignoniaceae	T	T	Seeds	
57.	<i>Tarenna asiatica</i>	Good shrub lower stratum	Rubiaceae	T	S	Seeds	
58.	<i>Tectona grandis</i>	Teak	Verbenaceae	T	T	By seeds	Deciduous
59.	<i>Tetradium glabrifolium</i>		Rutaceae	T		Seeds	Deciduous
60.	<i>Toona ciliata</i>	Toon	Meliaceae	T	T	Seeds	Deciduous
61.	<i>Wendlandia heyneii</i>	Ukan Pansara	Rubiaceae	T	T	Seeds	
62.	<i>Xylocarpus xylocarpa</i>	Jambu	Leguminosae	T	T	Seeds	Deciduous
63.	<i>Xylocarpus gangeticus</i>		Meliaceae	T	T	Seeds	Deciduous
64.	<i>Xylocarpus granatum</i>		Meliaceae	T	T	Seeds	Deciduous
65.	<i>Xyosma longifolium</i>	Dandal, khatari	Annonaceae	T		By seeds	
66.	<i>Zizyphus xylocarpus</i>	Katber	Rhamnaceae	T	T	Seeds	Deciduous

CHAPTER-4

Hydrogeological Studies

CHAPTER- 4

HYDROGEOLOGICAL STUDY

4.1 GROUNDWATER OCCURRENCE

The permeable formations i.e. sand and sandstone within Gondwana formation behave as an aquifer. The coal seams and shales developed act as impermeable beds i.e. aquiclude.

The regional hydro-geological studies of Sundargarh district were carried out by Central Ground Water Board (CGWB), Ministry of Water Resources, Govt. of India, Bhubaneswar and had submitted a report in December 1995 as "Ground Water Resources and Development Potentials of Sundargarh district, Odisha. The aquifer characteristic of phreatic zone was tested by conducting pumping tests in open dug wells. The hydraulic characteristics of open wells in Gondwana sedimentary rocks are given below in table 4.1A.

Table 4.1A: Results of Pumping Test of Large Diameter Dug wells for Sedimentary (Gondwana) Formation, Ib Valley Coalfield, Odisha.

Sl. No.	Hydrogeological Details	Jhuprunga (DPT-III)	Dulanga (DPT-IV)	Grindola (DPT-V)
1.	Aquifer	Sand Stone	Sand Stone	Sand Stone
2.	Duration of test (min)	90.00	60.00	23.00
3.	Depth (m)	8.14	4.31	7.62
4.	Diameter (m)	4.31	5.50	2.94
5.	Static water level (m) bgl	5.11	2.90	6.38
6.	Discharge (lps)	3.30	1.10	4.20
7.	Draw down (m)	1.55	0.63	0.93
8.	Specific capacity (lit/min/m cross sectional area)	0.95	1.43	2.56

Source: CGWB, Govt. of India, Ministry of Water Resources, South Eastern Region, Bhubaneswar, Odisha.

It is observed from the above table that the specific capacity index ranges from 0.95 to 2.56 lit/min/m cross sectional area.

CGWB had drilled six exploratory boreholes in Gondwana formation for delineating occurrence and distribution of water bearing fractures. The hydrogeological details of the exploratory boreholes are given below in table 4.1B.

Table 4.1B: Location-wise Hydrogeological Details in Sedimentary (Gondwana) Rocks, Ib Valley Coalfield, Odisha.

Sl. No.	Hydrogeological details	Tumulia	Tumulia (O.W)	Gopalpur	Rangidhipa (Himgir)	Rangidhipa (O.W)	Taparia
1.	Geological formation	Sandstone and shale	Sandstone and shale	Sandstone and shale	Sandstone and shale	Sandstone and shale	Sandstone and shale
2.	Depth drilled (m) bgl	200.20	97.50	200.20	142.30	142.30	148.40
3.	Depth of fracture zone (m) bgl	90.00 – 95.00	--	--	26.40, 37.50, 42.60, 47.00, 59.00, 70.00, 134.00	26.40, 27.50, 42.60, 47.59, 70.00, 134.00	12.00, 15.00, 77.00, 96.00, 100.00
4.	Length of casing (m)	19.30	11.60	--	23.80	--	26.30
5.	Static water level (m) bgl	14.70	9.74	13.370	9.38	6.87	12.99
6.	Discharge (lps)	1.60	2.30	0.370	8.00	11.50	4.20
7.	Draw down (m)	42.00	42.19	--	15.11	11.99	18.96
8.	Transmissivity (m ² /day)						
	(a) Pumping Test	1.53	--	0.158	--	--	--
	(b) Slug test	5.54	--	1.719	14.32	--	--

Source: CGWB, Govt. of India, Ministry of Water Resources, South Eastern Region, Bhubaneswar, Odisha.

4.2 TOPOGRAPHY AND DRAINAGE

The area exhibits undulating topography with moderately dissecting hills and valleys. The general elevation of the project site is RL 500 m to RL 295 m.

The study area falls under the influence of Basundhara River predominantly, which are the tributary of Ib River which control the overall drainage pattern of the coalfield. Basundhara nala is one of the important drainage basin which covers large extent of Ib valley coalfield. The total catchment of the Basundhara Nala is estimated at 608 km². It is observed from the catchment characteristic of the Basundhara Nala basin, that the drainage network of the area is favorable for long extended discharge than to generate sudden peak discharge. There are a few ponds in the area and mainly used for domestic & irrigation purposes.

Drainage Map of the study area is given in Figure 4.1

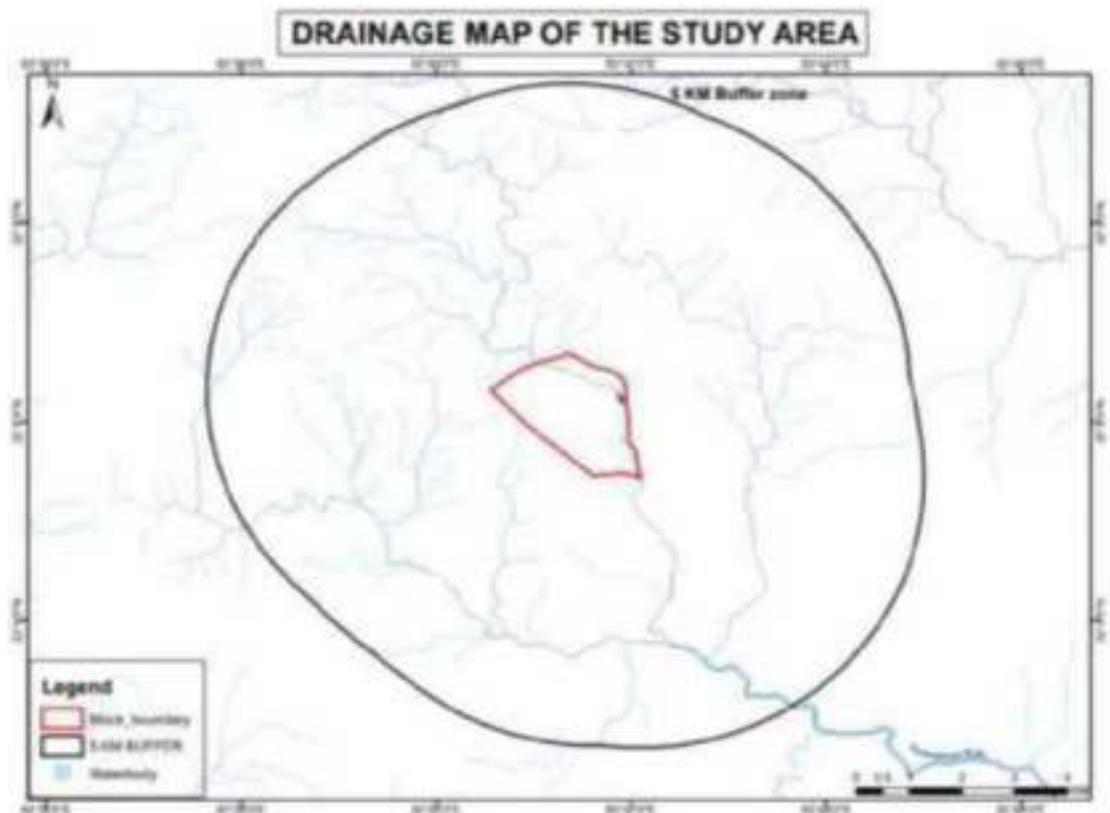


Figure 4.1: Drainage Map of the study area

4.3 CLIMATE AND RAINFALL

The climate of the area is tropical type characterized by hot summer and mild winter. The bulk of the precipitation is received from South-West monsoon. The monsoon breaks out in the third week of June and gradually withdraws towards the mid of September. Autumn season starts in the first week of October and lasts till the end of November. Winter is experienced in the month of December-Mid February followed by dry and scorching summer from March to Mid June. The maximum temperature goes up to 49°C and minimum temperature up to 9°C. The winds are generally light to gentle breeze. Annual mean wind velocity is 7 Km/hr with maximum speed of more than 20km/ hr has also been recorded. The average annual rainfall is 1317.8 mm. Almost 70% of the total rainfall is recorded during monsoon (July to August.) period. Humidity ranges (monthly mean of daily RH) are observed as Minimum 26% and Maximum 83%.

4.4 GEOLOGY AND STRUCTURE

Mostly soil, alluvium or weathered mantle cover the area under investigation. As such, the geological features of the block are interpreted mainly on sub-surface data. Though Talchir and Karharbari Formations have been encountered in boreholes drilled in nearby blocks, but they do not incrop or outcrop within the study area. However, Barakar Formation outcrops at places in nala tract/cutting. The generalized geological/stratigraphic succession of the study area as available from exploratory boreholes in the area is compiled below in table 4.4.A.

Table 4.4.A Stratigraphic succession of Study area

Group	Age	Formation	Thickness (m)		Lithology
			Min.	Max.	
	Recent	Recent deposits	1.53	21.35	Soil, Sub-soil etc.
GONDWANA SUPER GROUP	Lower Permian	Barakar Formation	22.00	353.00	Fine to coarse grained greyish feldspathic sandstone, Carbonaceous shale, siltstone with coal seams RAM-I to RAM-V & LAJ-I to LAJ-IV (13 seams) with splits in descending order
	Lower Permian	Karharbari Formation	3.45	71.54	Greyish white to white fine to coarse grained feldspathic sandstone and grits, greyish arenaceous shale, carbonaceous shale and coal seam (1 group in 3 splits)
	Upper Carboniferous to Lower Permian	Talchir Formation	Not encountered in BH.		Diamictite, sandstone, needle shale, turbidite, rhythmites.
----- Un-conformity -----					
Pre-Cambrian			Granite, mica schist & gneisses		

The strike of the strata has shown northwest – southeast trend with minor variation towards northern part. The strata dips 3° – 4° towards southwest. The same has increased to about 10° in the northern part with dip direction remaining towards south to southwest.

Geological Map of the study area is given in Figure 4.2

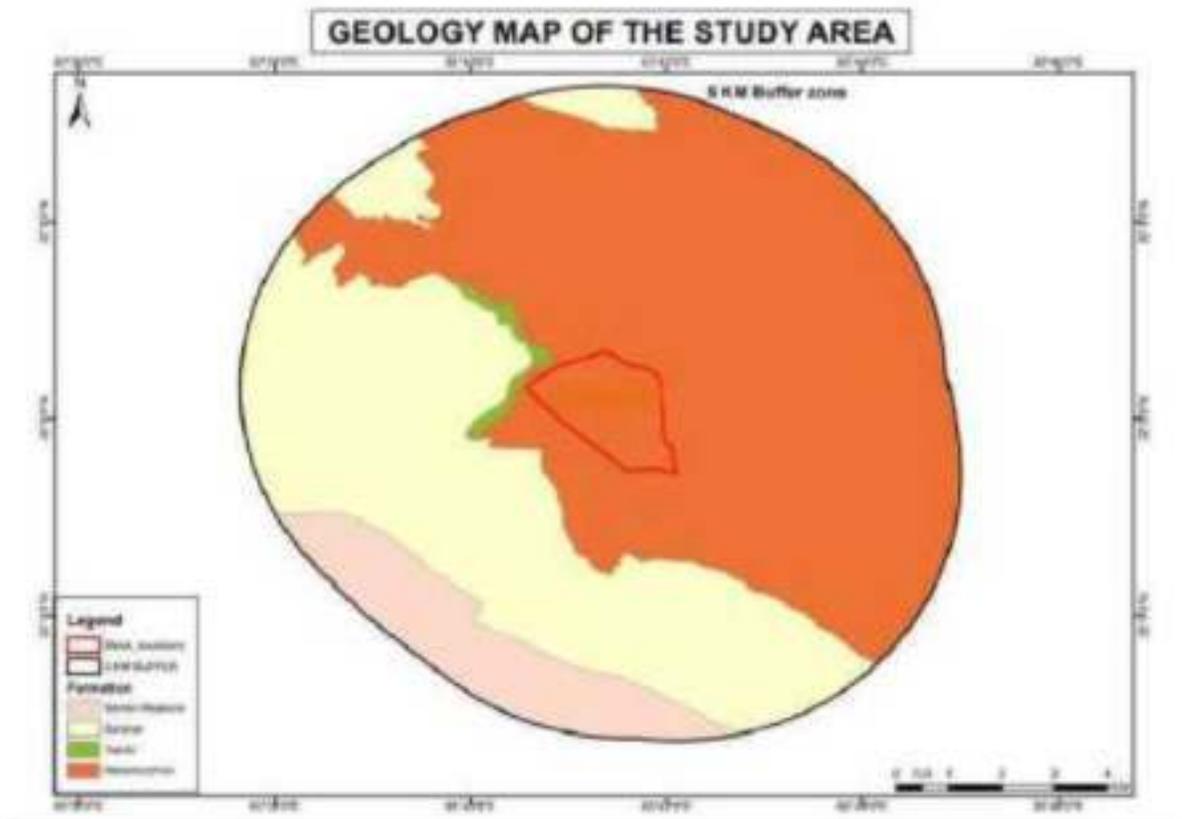


Figure 4.2: Geological Map of the study area

4.5 AQUIFER DESCRIPTION

The hydrogeological conditions vary from place to place depending upon the aquifer characteristics of the litho units, sources of groundwater recharge and the structural setting of the area. The hydrogeological units of the area are broadly categorized into three groups namely:

- A. Consolidated formations.
- B. Semi Consolidated formations
- C. Unconsolidated formations

- Consolidated formations: Except for small strips along major drainage courses, almost the entire district is occupied by the consolidated formations comprising of Precambrian metasediments of Gangpur series and Iron ore series and also granite gneiss, metasediments like amphibolite, epidiorite etc. Ground water is stored mainly in the secondary porosity resulting from

weathering and fracturing of the rocks. The aquifer materials are highly heterogeneous in character showing both vertical and lateral variations. The weathered residuum form the main repository of ground water, in which ground water occurs under water table condition and circulates through deeper fractures and fissures. Ground water occurs under confined to semi-confined condition in the deeper fractured zones. The water yielding capacity of fractured rocks largely depends on the extent (depth and degree) of fracturing, openness and size of fractures and extent of their interconnections to the near surface weathered zone. Usually two to four water bearing fracture zones occur down to a depth of 100 m bgl.

- **Semi consolidated formation:** The semi consolidated formation is constituted of sand stone, shales, conglomerates, grits etc belonging to Talcher, Barakar and Kamthis of lower Gondwana . The Barakar formation is very well developed and often constitute potential aquifer in the area. The coarse grained gritty sandstone on weathering give rise to porous sandy materials. Large diameter open wells and medium deep tube wells are feasible in this formation. The depth of the open wells ranges from 7.25m to 18.42m and the premonsoon depth to water level varies from 6.65m to 15.99m below ground level. The shale, sandstones of Talcher formation do not form productive aquifer. However the needle shales having intersecting joints often form moderately good aquifers.
- **Unconsolidated formation:** Laterites and alluvium of Sub-recent to Recent age constitute the unconsolidated formations. Laterites occurring as capping over older formations are highly porous in nature and form good aquifers to be tapped through dug wells. The alluvial deposits of recent origin occur as thin discontinuous patches along the prominent drainage channels. The alluvium strips constitute the most potential aquifers due to their high degree of porosity and permeability but are only limited in their occurrence. Ground water in these formations occurs under unconfined to semi-confined condition. These mainly consist of silt, sand with gravel & pebble, which form

potential shallow aquifers tapped through dug wells. The yield of the open wells is generally 5-6 lps though higher yield of 10 lps is not uncommon.

The hydrogeology Map of the area is given in Figure 4.3.

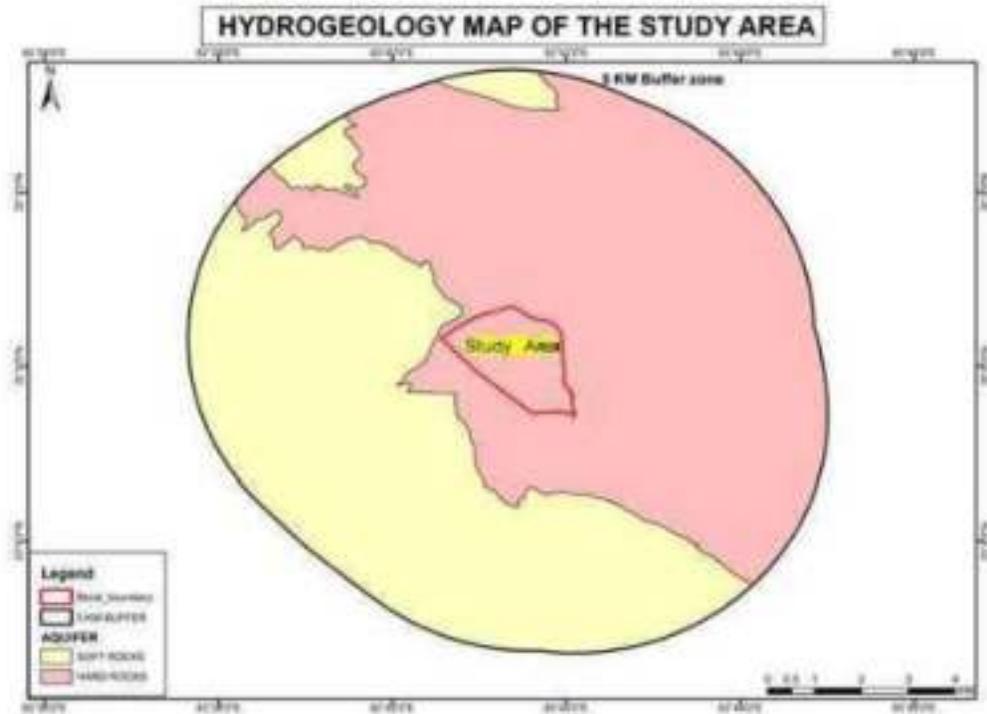


Figure 4.3: Hydrogeology Map of the study area

4.6 GROUNDWATER FLOW AND AQUIFER INTERACTION

Groundwater is a dynamic system. It always remains under the influence of periodic recharging and discharging factors. Due to this continuous influence, water levels of the aquifer system fluctuate and the range depends on the period of influence. The recharge to the ground water system is controlled by many factors such as rainfall, seepage from reservoirs, lakes, ponds, rivers and irrigation, etc. The output from the ground water system includes ground water withdrawal, natural seepage to rivers, evaporation from shallow water table and transpiration through vegetation.

Present ground water scenarios of the area are assessed from the open dug wells used for domestic water consumption in an around 5km buffer area. The details of selected hydrograph stations in and around Study area are given in Table 4.6 A. The water level in these wells represents hydraulic head of water table aquifers. The hydraulic heads of all observed wells are calibrated to reduced level. The hydraulic head of all hydrograph stations are connected to construct water table contour map. Groundwater flow maps & Depth to water level maps for study area for premonsoon and postmonsoon seasons are given in **figure 4.4, 4.4A & 4.5, 4.5A**. The altitude of water table in the 5 km buffer zone the project area ranges between 410 m above MSL to less 290 m above MSL. The generic groundwater flow direction is north to south.

Table 4.6A: Details of hydrograph stations in and around Study area

WELL ID	VILLAGE	LONGITUDE	LATITUDE	PRE-MON WATER LEVEL (mbgl)	POST-MON WATER LEVEL (mbgl)
GT-005	TIHURIA	83.6663207	22.12816	7.7	2.45
GT-006	BILEIBAHAL	83.6569183	22.15034	8.0	2.5
GT-010	KAHACHUAN	83.6904368	22.1398	7.5	2.7
GT-012	TITHEIANAGAR	83.7243309	22.12938	8.2	2.15
GT-013	SALINGIJHARIA	83.7268831	22.10727	6.0	2.45
GT-014	KALATPANI	83.7569306	22.07465	5.02	2.8
GT-031	RATANPUR	83.6607884	22.05868	5.5	1.8
GT-033	GANJAIBURH	83.6838421	22.11298	6.0	2.0
GT-034	SAMARA	83.7063174	22.11092	6.2	2.0
GT-035	SARDEGA	83.7218402	22.07101	6.0	2.2
GT-036	TIKLIPARHA	83.7361657	22.05821	6.05	2.4
GT-060	RAJAPARHA	83.6715485	22.06542	6.87	4.0
GT-062	BHOGRAKACHHAR	83.6247667	22.08915	6.9	2.6
GT-064	RENGALPANI	83.6281704	22.07902	5.95	2.1
GT-065	TELENDIHI	83.6864465	22.06315	6.0	2.0
GT-067	SALINGIJHARIA	83.7313708	22.09895	6.64	1.9
GT-068	RAMPIA	83.6664059	22.09757	6.1	1.75
GT-072	BANAPATRA	83.6864836	22.05681	5	1.5

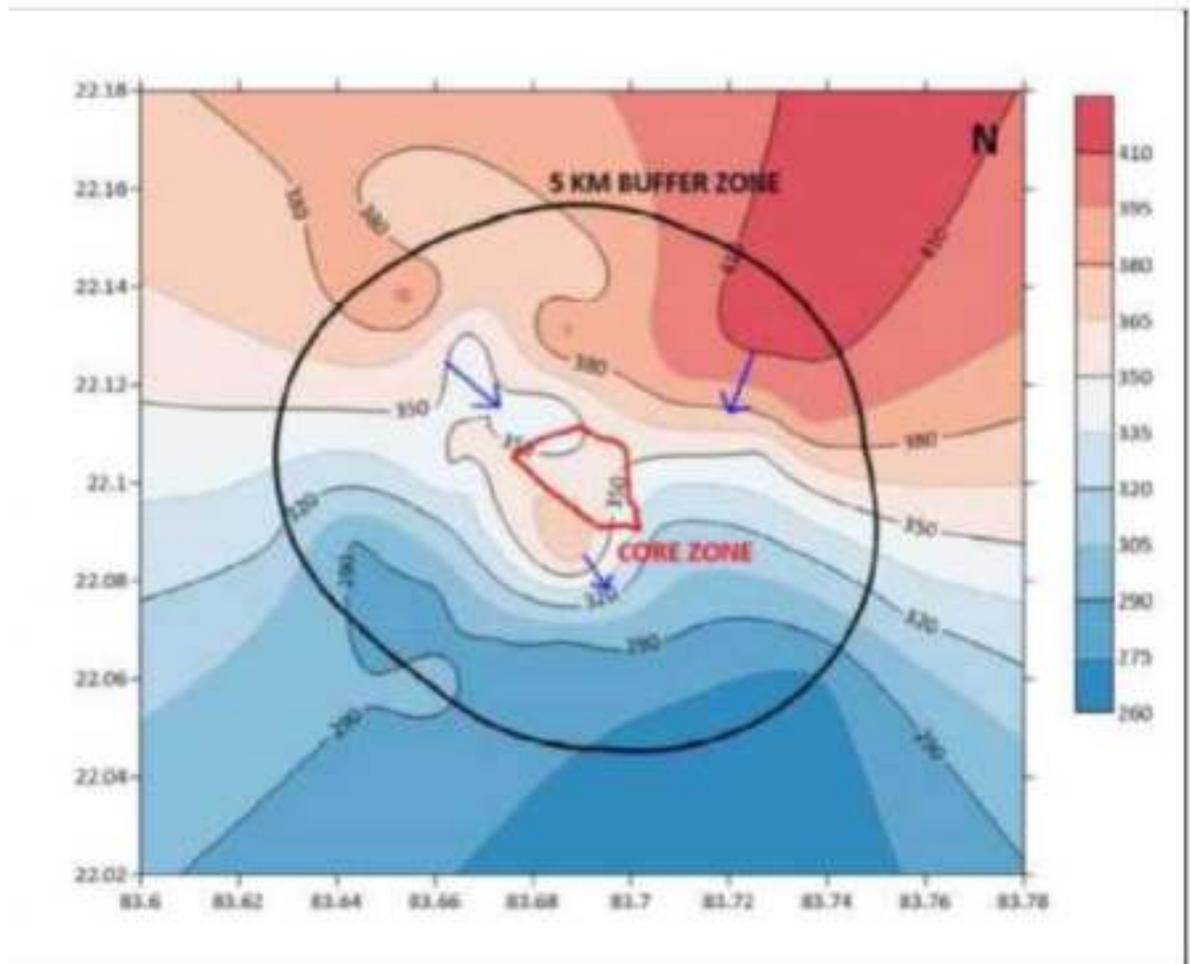


Figure 4.4: Groundwater flow map of Pre-monsoon season around Study area

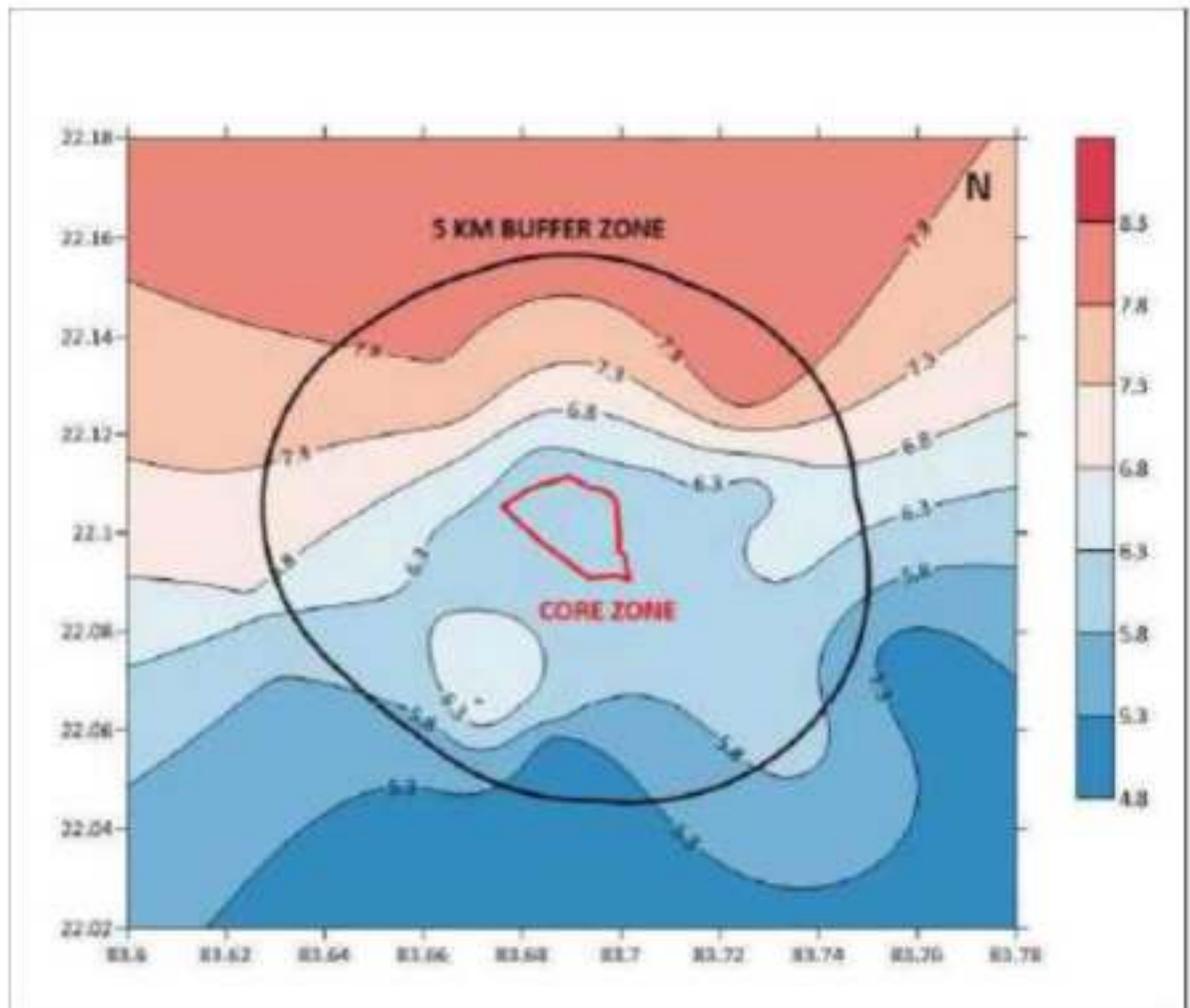


Figure 4.4 A: Depth to Water map of Pre-monsoon season around Study area

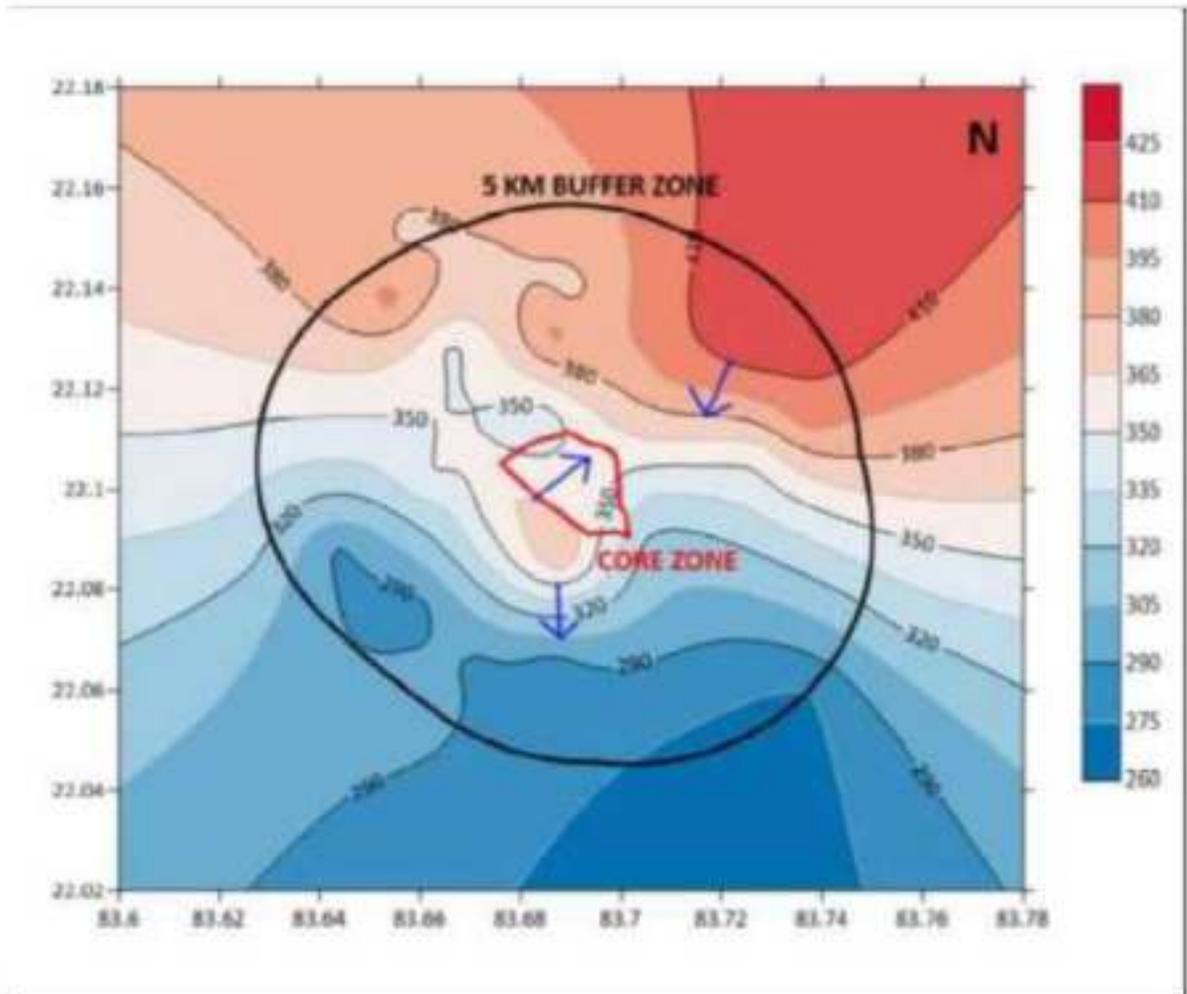


Figure 4.5: Groundwater flow map of Post-monsoon season around Study area

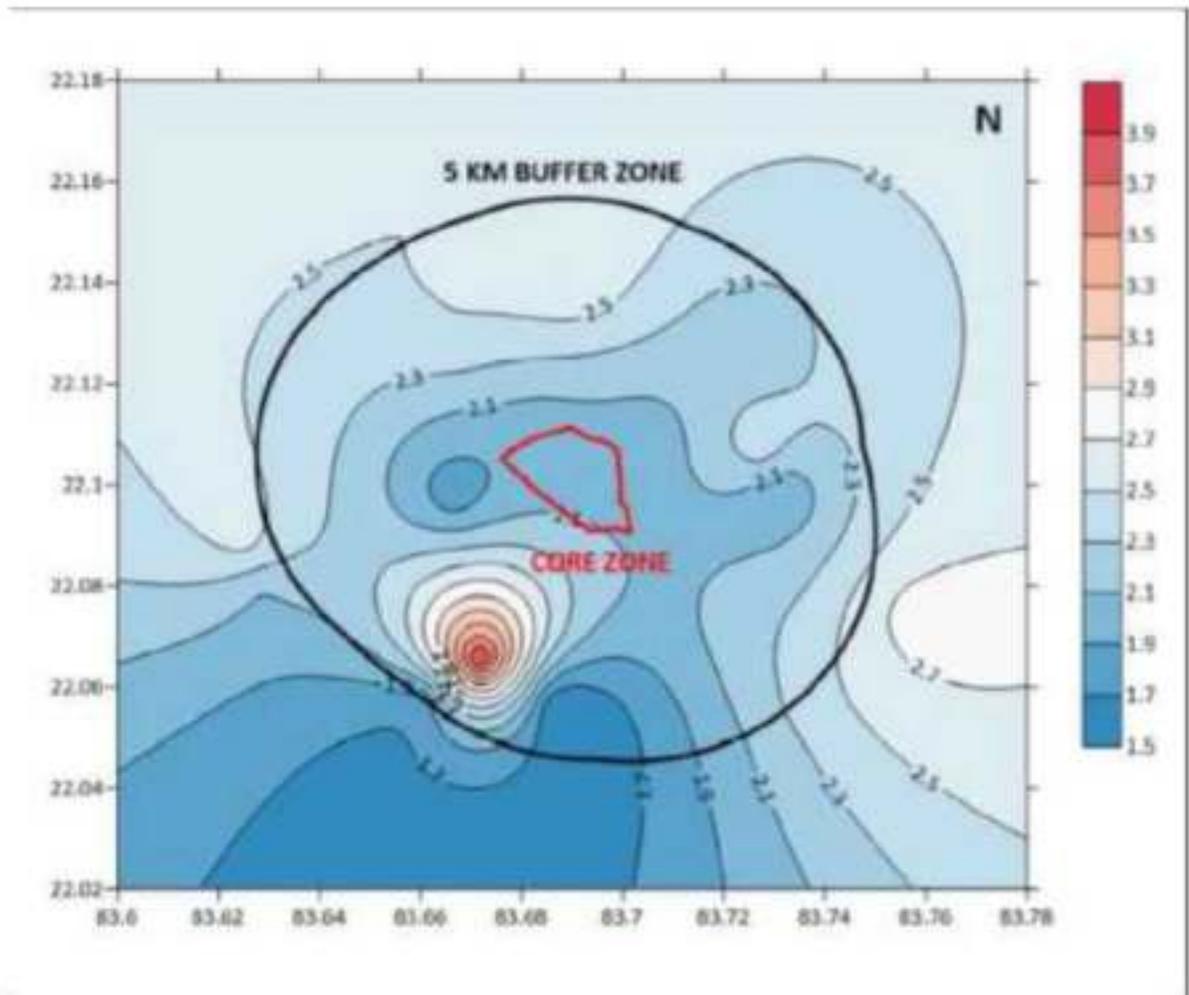


Figure 4.5A: Depth to Water map of Post-monsoon season around Study area

4.7 GROUNDWATER LEVEL TRENDS

In the present report, the monitored data has been presented and the overall picture of ground water storage behavior due to continuous abstraction of ground water has been analyzed for the April 2005 to Nov. 2019 from Village Sardega. The water level data of the month of April/May and November are taken as level of pre-monsoon and post-monsoon respectively. The present report depicts the behavior of ground water for the period of 15 years.

- **Sardega village dug well**

Post monsoon water level trend shows a marginal decreasing trend which signifies that the groundwater is affected by the overall utilization by the population and mining. Pre monsoon water levels shows a marginal increasing trend in the last 15 years and show a neutral trend. The long-term pre monsoon water level varies from 3.32 to 7.65 mbgl and post monsoon water level varies from 1.15 to 3.64 mbgl.



Figure 4.5: Hydrograph of Sardega dug well, Dist Sundergarh.

4.8 WATER ENVIRONMENT

The water quality characterization has been conducted by collecting water samples from the surface water of the forest area. The various purposes of surface water monitoring are to assess the water quality characteristics for critical parameters; to facilitate predication of the impact on water quality by the area.

4.8.1 METHODOLOGY

The grab sampling method was adopted for the collection of the surface water samples from different sources of water bodies.

Three nos. of surface water were collected as representative samples to assess the water quality of the area during the study period. The sampling locations were selected from the available water body in the area. These samples

were analyzed as per the "Standard Method for the Examination of Water & Waste Water" published by the American Public Health Association (APHA: 22nd Edition, 2012).

Samples for chemical analysis were collected in polyethylene containers. Samples collected for metal content were acidified with 1 ml. Conc. HNO₃ per liter. Samples for bacteriological analysis were collected in sterilized glass bottles. Some of the parameters such as temperature, pH, DO, alkalinity, total hardness and chloride, etc., which were liable to change with time were analyzed at the site with the help of an analytical kit, and one set of "Preserved" samples were brought to CMPDI's laboratory at Ranchi for detailed analysis of the remaining parameters stated in the tables.

4.8.2 MAJOR INSTRUMENTS USED

- Double-Beam Spectrophotometer
- Nephelometer
- Atomic Absorption Spectro - Photometer
- Conductivity Meter
- pH Meter
- Analytical Balance (Mettler)
- BOD Incubator
- High Speed Centrifuge
- Oven
- Muffle Furnace
- Ion Chromatography etc.

4.8.3 RATIONALE BEHIND SAMPLING

Any adverse impact or pollution consequence of water will have a serious effect on the environment. Thus, to assess the surface water quality, samples from different water bodies were collected from 3 different locations and analyzed for physicochemical and heavy metal parameters.

4.8.4 Sampling Locations

Details of sampling location are given :

Sampling Location for Surface Water

Sl. No	Name of Sampling Locations
01.	SW-1
02.	SW-2



Fig 4.7: Water Sampling locations

4.8.5 CHARACTERISTICS OF SURFACE WATER SAMPLES

The Physicochemical characteristics of three nos. of surface water samples collected locations have been presented here under:

➤ Physico-Chemical Characteristics Of Surface Water Quality

(Wherever not specified, characteristics are expressed in mg/l)

Date of Sampling: 29.04.2022

Sl.N o	Parameter	Sampling Stations				Detect ion Limit	BIS Standard & Method
		1	2	3	4		
1	Arsenic (as As), mg/l, Max	<0.002	<0.002			0.002	IS 3025/17:1988 R : 2003, AAS-VGA, Method
2	BOD (3 days 27°C), mg/l, Max	5.6	5.8			2.00	IS 3025/44: 1993, R: 2003 3 day incubation at 27°C
3	Cadmium(as Cd), mg/l, Max	<0.0004	<0.0004			0.0004	APHA, 23rd Edition AAS-GTA Method, 2017
4	Chlorides (as Cl), mg/l, Max	8	10			2.00	IS-3025/32:1988, R-2007, Argentometric Method
5	Copper (as Cu), mg/l, Max	<0.02	<0.02			0.02	IS 3025/42: 1992, R : 2009, AAS (Air-Ac-Flame)
6	Dissolved Oxygen, min.	6.4	6.2			0.10	IS 3025/38: 1989, R:2003, Winkler Azide Method
7	Fluoride (as F) mg/l, Max	0.27	0.28			0.02	APHA, 23rd Edition, SPADNS Method, 2017
8	Hexavalent Chromium, mg/l, Max	<0.01	<0.01			0.01	APHA, 23rd Edition, Diphenylcarbohydrazide, 2017
9	Iron (as Fe), mg/l, Max	<0.04	<0.04			0.04	IS 3025/53: 2009, R : 2009, AAS (Air-Ac-Flame)
10	Lead (as Pb), mg/l, Max	<0.001	<0.001			0.001	APHA, 23rd Edition AAS-GTA Method, 2017
11	Nitrate (as NO ₃), mg/l, Max	<0.5	<0.5			0.50	APHA, 23rd Edition, UV - Spectrophotometric, 2017
12	pH value	6.57	6.61			1.0	IS-3025/11:1983, R-1996, Electrometric Method
13	Phenolic compounds (as C ₆ H ₅ OH), mg/l, Max	<0.001	<0.001			0.001	APHA, 23rd Edition, 4- Amino Azopyrine Method, 2017
14	Selenium (as Se), mg/l, Max	<0.0005	<0.0005			0.0005	IS 3025/36:2003 AAS-VGA Method
15	Sulphate (as SO ₄) mg/l, Max	8.7	9.1			2.00	APHA, 23rd Edition Turbidity Method, 2017
16	Total Dissolved Solids, mg/l, Max	104	112			25.00	IS 3025/16:1984 R : 2006, Gravimetric Method
17	Total Suspended Solids, mg/l, Max	36.5	38.9			10.00	IS 3025/17:1984, R:1996, Gravimetric Method
18	Zinc (as Zn), mg/l, Max	0.006	0.021			0.005	IS 3025/49: 1994, R : 2009, AAS (Air-Ac-Flame)

4.8.6 RESULTS & DISCUSSION

The physicochemical characteristics of the surface water samples collected from the 3 locations have shown great resemblance with respect to the characteristics like temperature, turbidity, pH, color, odor, chloride, sulphate, total alkalinity, total hardness, TDS and heavy metals, etc.

From the results presented above in, it may safely be concluded that the Physico-chemical characteristics of the surface water samples had a good resemblance with respect to almost all the parameters.

4.8.7 GROUNDWATER QUALITY

The suitability of groundwater for drinking/irrigation/industrial purposes is determined keeping in view the effects of various chemical constituents present in water. The ranges of different chemical constituents present in groundwater in nearby village Lepripada is given in Table 4.8.7.A.

Table – 4.8.7.A

Groundwater Quality Data

	Indian Drinking Standards (IS-10500):2012		
	Village Lepripada Dug well	Acceptable	Permissible
Date of Sampling	Apr-2019		
p H	8.1	6.5-8.5	No Relaxation
EC ($\mu\text{S/cm}$ at 25 ° C)	350	-	-
TDS (mg/L)	178	500	2000
TH (mg/L as Ca CO ₃)	158	200	600
TA (mg/L as Ca CO ₃)	161	200	600
Ca (mg/L)	33	75	200
Mg (mg/L)	18.4	30	100
Na (mg/L)	9	-	-
K (mg/L)	3.5	-	-
CO ₃ (mg/L)	0	-	-
HCO ₃ (mg/L)	196	-	-
Cl ⁻ (mg/L)	12	250	1000
SO ₄ ²⁻ (mg/L)	1.2	200	400
F ⁻ (mg/L)	0.36	1	1.5

Source: CGWB

It is observed from the table, that groundwater in the village nearby to the study area is fit to be used for drinking purposes.

The suitability of groundwater for Irrigation purposes is an important aspect in this study. Good water quality promotes better plant growth. But when concentration of ions, are found in excess in the water, it affects the plant growth

and reduces the plant yield. Sodium Adsorption Ratio (SAR) SAR is an expression pertaining to cation makes up of water and soil solution and is used for characterizing the sodium hazard of irrigation water. The main problem with high sodium concentration is its effect on soil permeability & water irrigation. Sodium also contributes directly to the total salinity of the water and may be toxic to sensitive crops such as fruit trees. SAR is calculated from the following equation-

$$\text{SAR} = \text{Na}^+ / ((1/2(\text{Ca}^{2+} + \text{Mg}^{2+}))^{1/2}),$$

where Na^+ , Ca^{2+} and Mg^{2+} are all measured in meq/L (milliequivalents per liter).

The SAR value for Lephripada (1.8) also the EC ($\mu\text{S}/\text{cm}$) at 25°C is in the range less than 500. Therefore, the groundwater in the region is considered good for irrigation.

CHAPTER-5

SOIL MOISTURE INDEX AND SOIL LOSS ESTIMATION

5.0 DRONE SURVEY

In Siarmal OCP of Mahanadi Coalfield Limited, UAV based survey for the generation of high-resolution orthomosaic images, DTM, DSM, and contour map of the proposed area for SMC study was done. The study area has been selected after a discussion with DFO and the total area covering 357 Ha lies in the forest area near Sundargarh and Jharsuguda district. The bounding coordinate of the area falls between longitude $83^{\circ} 40' 32.4211''$ E to $83^{\circ} 42' 08.3763''$ E and latitude $22^{\circ} 05' 24.5211''$ N to $22^{\circ} 06' 43.3536''$ N. Location of the study area for UAV survey has been illustrated in the map (Fig 5.1). GCPs have been precisely measured on the ground using Spectra SP60 DGPS, and the post-processing of the data has been done using Survey office software. As the area lies in the forest, a number of GCPs had been restricted by approachability issues.



Fig 5.1: Location map and GCP plan of the study area

5.1 METHODOLOGY FOR DRONE SURVEY

Small category survey-grade UAV with Post Processing Kinematic (PPK) with almost 40 min endurance along with a 24MP camera as payload has been used by AUS for this project (Fig 5.2). The total weight of the drone was about 3.6 kg and it can cover approximately 1.5 sq km area in a single flight.

Considering the topography and forest cover in the area, Drone based optical sensor was used for accurate results.



Fig 5.2: AUS's Insight 2.0 PPK

Flight planning has been executed prior to the drone survey. For this, KML of the study area has been prepared using Google Earth (Fig -5.1). Then GCPs planned in such a way that it should be approachable and well distributed within the study area. Proper marking of GCPs has been done on the ground so that later they could be identified in the drone image also (Fig 5.3). The below image is showing one GCP marked as a white cross at the top right corner of the image.



Fig 5.3: Sample drone image of the area

The take-off location or the home location has been chosen on a flat open surface near the study area. The radio antenna with a signal range of 4 km and a ground control station has been set up near the home location. From east to west the study area seems to be extended approx. 2.5 kms. Hence, one flying point has been carefully chosen in such a way that UAV can cover the entire area, without having signal loss with the Ground Control Stations (GCS). After planning and placing all the GCPs in the ground, flight planning has been done using Skylink Mission Planning software. A sample drone image showing the trees and river has been shown below (Fig 5.3).

The final flight plan has been uploaded in the drone autopilot before every single flight. After completion of a single flight, the POS data, which stores the

positional information and image timing in excel format has been downloaded from the drone autopilot. The images from the memory card have also been copied and stored sequentially in a folder. All the images acquired through the UAV survey have been processed using Pix4D software. DGPS location of the GCPs has been used during data processing for geo-referencing of the images and generation of orthomosaic(Fig 5.4) as well as DTM. DEM extraction has been done by Micro Station software.

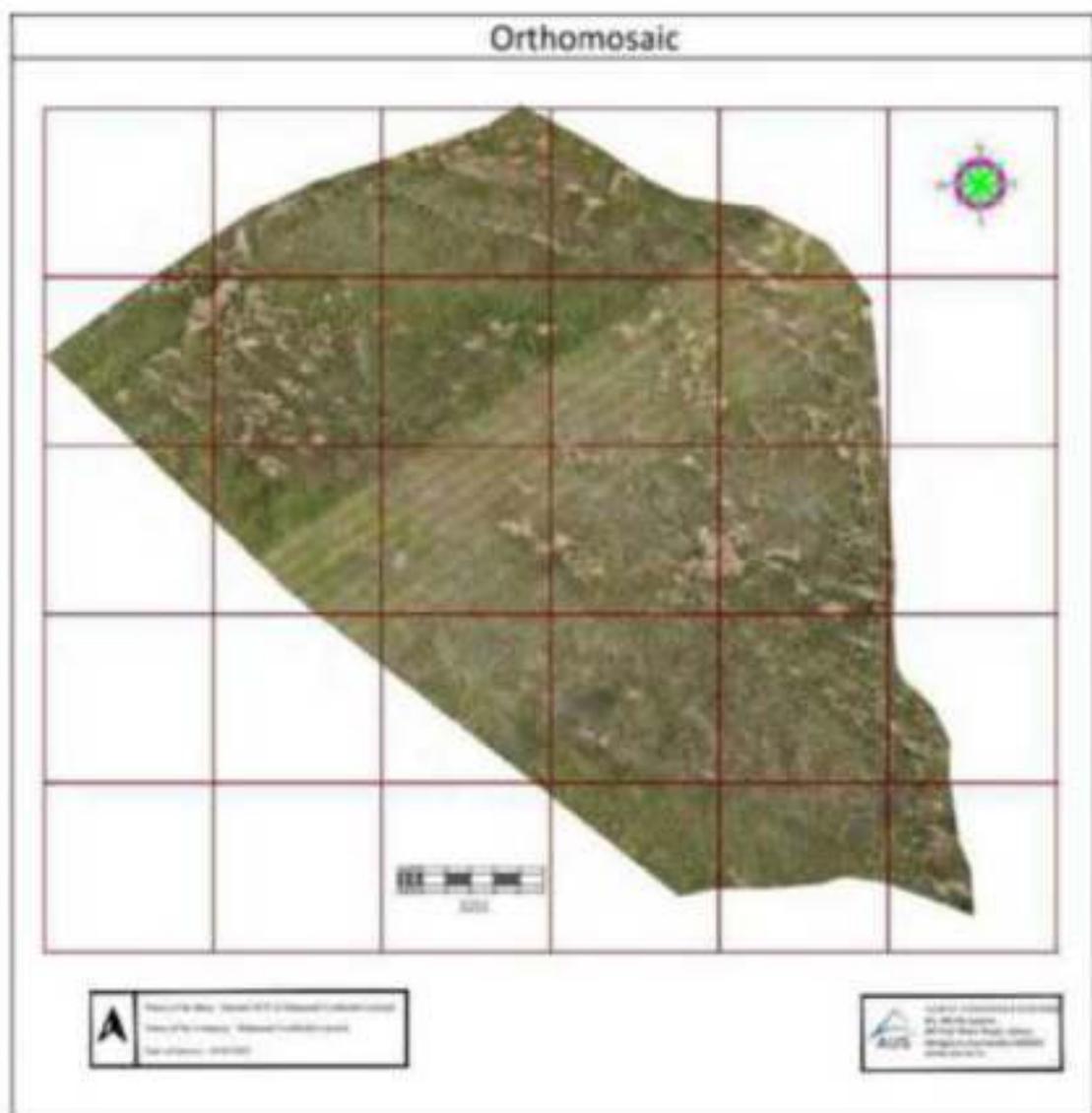


Fig 5.4: Orthomosaic of the study area

A contour map of 5m interval has also been generated as the final output (Fig 5.5).

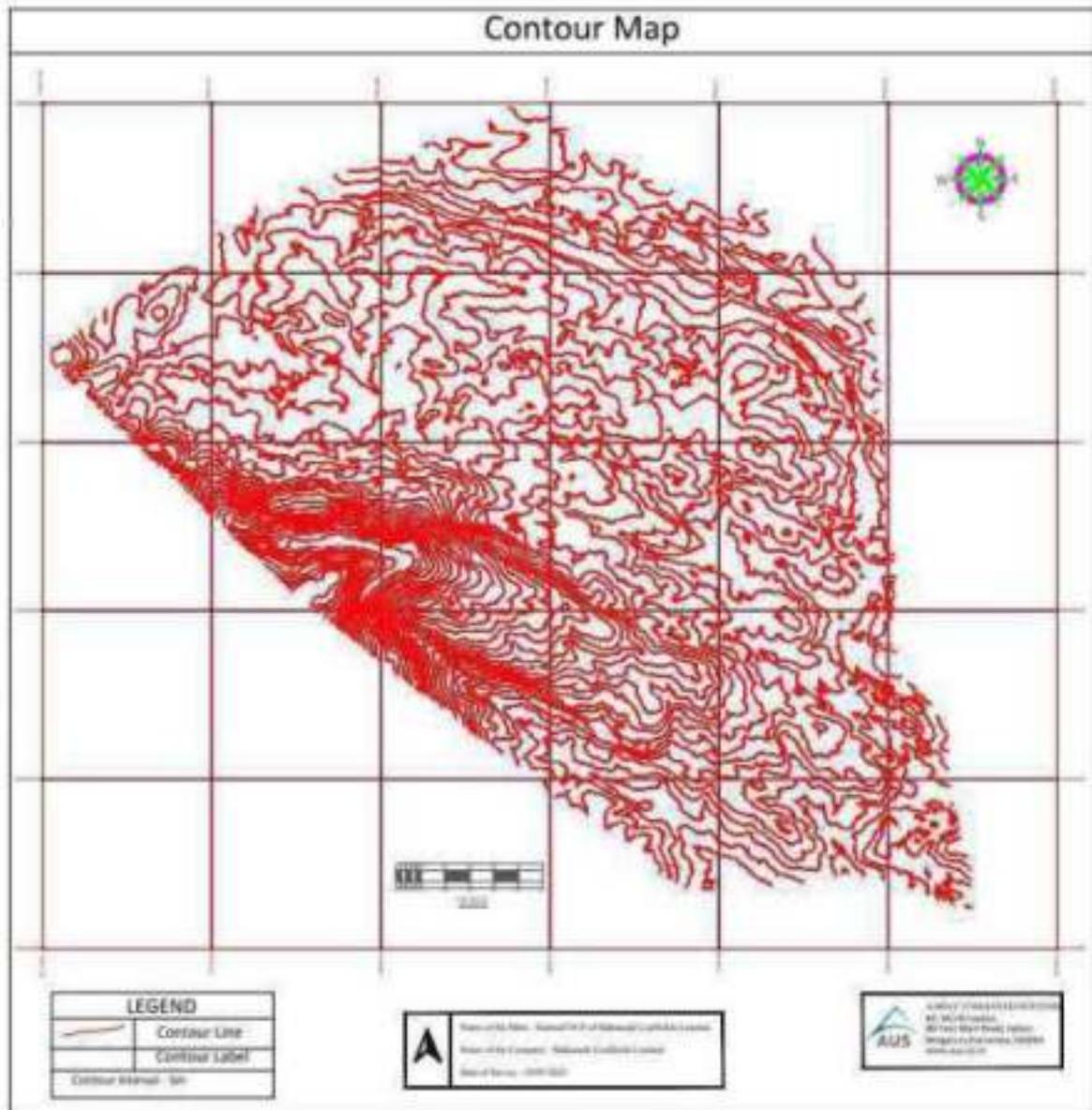


Fig 5.5: contour map of the study area

5.2 LAND USE OF STUDY AREA

The proposed area for soil moisture conservation is around 357 Ha of land which can be categorized into three main categories based on signatures got through sentinel images (Fig-5.6). A total of 181.92 ha of land falls in the dense forest land category where rich vegetation was available, 133.56 ha of land falls under degraded forest type of land where scattered vegetation has been noticed and 42.82 ha of land falls under the open land area where very less or no vegetation was available. Although in the study area seasonal streams were also present under open land area it cannot be distinguished for land use & landcover purpose.

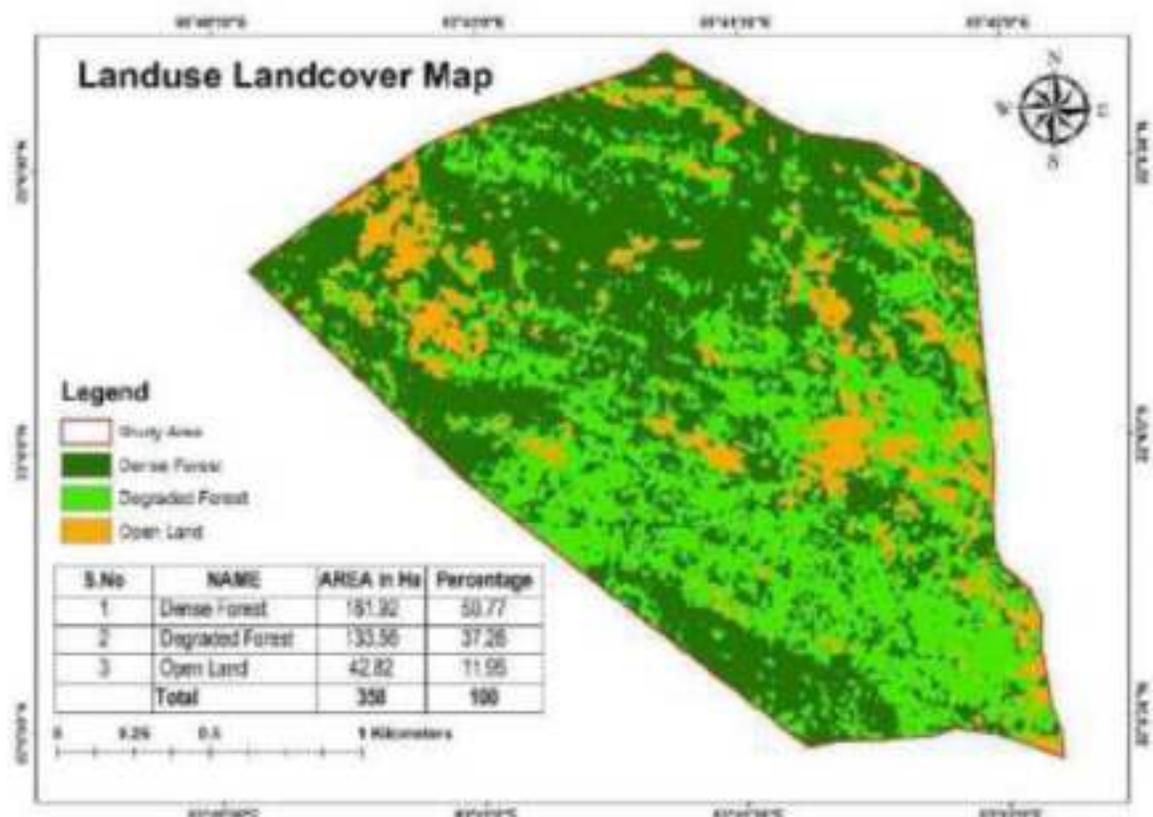


Fig-5.6 Landuse map of the study area using sentinel satellite image

The drainage map of the study area has been shown in fig-5.7-a. It can be

depicted from figure 5.7-a that the flow direction of all the streams is from the north-west direction to the south direction. Major one stream was present in the study area; others were only first-order streams. The major stream which is passing through the study area is the Basundhara River which is one of the major drainages of this area.

The topography of the study area is undulating. The elevation in the study area varies from 490 m to 290 m (fig-5.7-b). The western part of the study area is having a hill due to which it is elevated and the slope is towards the south-eastern side. Major drainage of the area is governed by the Basundhara River.



Fig-5.7(a): Drainage map of the study area

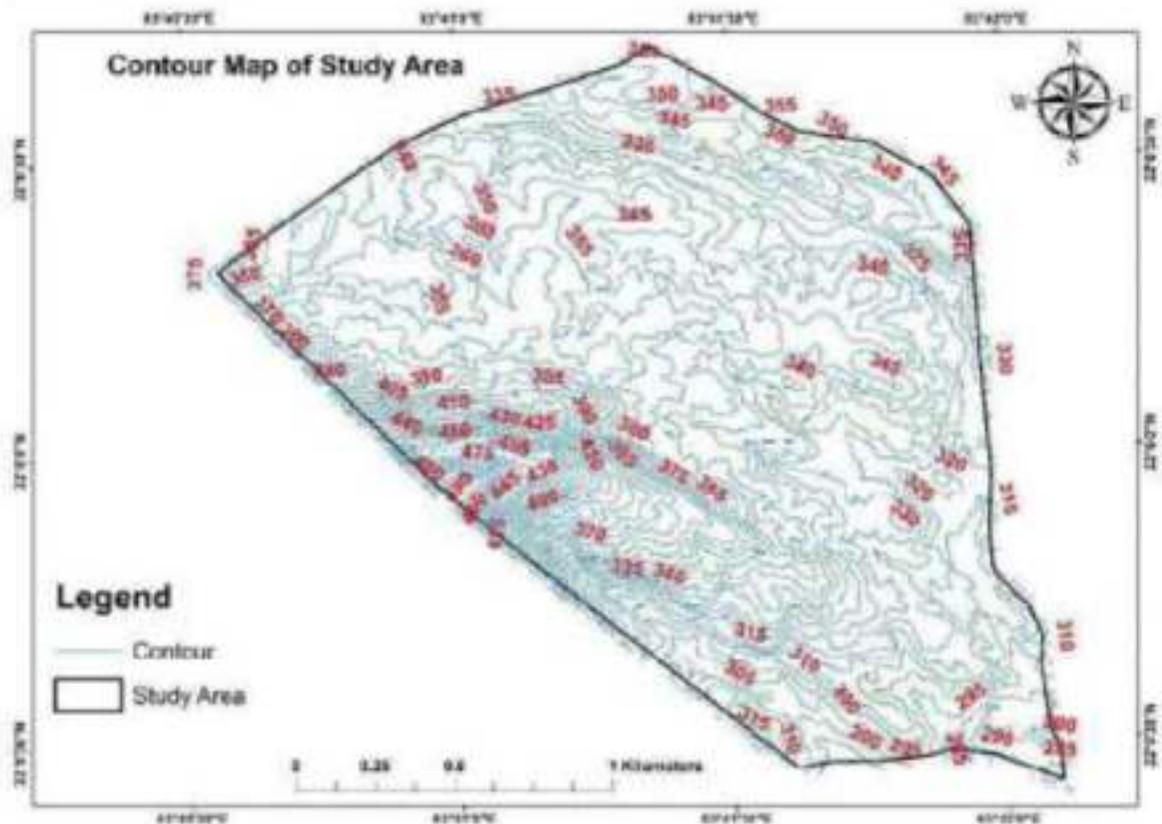


Fig-5.7(b): Contour map of the study area

5.3 SOIL MOISTURE INDEX

5.3.1 INTRODUCTION

Soil moisture is a key parameter that directly or indirectly influences the water cycle. The existence of forest cover and agriculture production mainly depend on rainfed areas as well as irrigation practices of the area. Climate change and the trend of increasing temperatures have a significant impact on forest cover. It is linked to various hydrological phenomena, such as drought, climate, and vegetation. The data collected for soil moisture analysis taken below the surface over the long term as well as higher temporal and spatial resolution data are valuable for assessing the extent and severity of drought quite accurately. Surface soil moisture is very sensitive and varies with space and time. Various studies have been done to assess soil moisture. Two methods of soil moisture measurement through remote sensing are based on the microwave part of the electro-magnetic

spectrum and thermal, infrared observation.

In situ measurements can provide an accurate estimation of soil moisture, but they are both time-consuming and expensive, and only represent a small area (a few square decimeters). Nevertheless, a number of strategies can be adopted to upscale the spatially sparse ground-based observations, which are invaluable for calibrating and validating land surface models and satellite-based soil moisture retrievals.

The soil moisture index (SMI) is defined as the proportion of the difference between the current soil moisture and the permanent wilting point to the field capacity and the residual soil moisture. The index values range from 0 to 1 with 0 indicating extreme dry conditions and 1 indicating extreme wet conditions.

5.3.2 METHODOLOGY

The soil moisture index is based on empirical parameterization of the relationship between land surface temperature (LST) and normalized difference vegetation index (NDVI) and calculated using Equation (5.1)

$$SMI = (LST_{max} - LST) / (LST_{max} - LST_{min}) \quad 5.1$$

where LST_{max} and LST_{min} are the maximum and minimum surface temperature for a given NDVI and LST is Land Surface Temperature. The surface temperature of a pixel for a given NDVI is derived using remote sensing data. LST_{max} and LST_{min} are calculated using Equations (5.2) and (5.3), respectively.

$$LST_{max} = a1 * NDVI + b1 \quad 5.2$$

$$LST_{min} = a2 * NDVI + b2 \quad 5.3$$

where $a1$, $a2$, $b1$, and $b2$ are the empirical parameters obtained by the linear regression (a present slope and b present intercept) defining both warm and cold edges of the data. First step in SMI calculation is the conversion of digital number (DN) to spectral radiance (L $W/m^2/sr/\mu m$) using Equation (5.4):

$$L = LST_{min} + (((LST_{max} - LST_{min}) / (QCAL_{max} - QCAL_{min})) * (DN - QCAL_{min})) \quad \text{---(5.4)}$$

where, LST_{min} and LST_{max} are spectral radiance calibration constants (Table

5.1); $QCAL_{max}$ and $QCAL_{min}$ are the highest and lowest quantized calibration pixel values, and DN is the Digital Number.

Table 5.1

Spectral radiance (L_{min} and L_{max}) values for thermal bands of Landsat imagery.(May-2022)

Landsat 5 (Band 6)		Landsat 8 (Band 10 and 11)	
Radiance maximum	Radiance minimum	Radiance maximum	Radiance minimum
1.238	15.303	0.1003	22.0018

Two inputs must be calculated (LST and $NDVI$) to be able to calculate LST_{max} and LST_{min} . LST (K) is calculated using Landsat 5 and Landsat 8 Thermal bands using Equation (5.5):

$$LST = Tb / [1 + (\lambda * Tb / C2) * \ln(\epsilon)] \quad (5.5)$$

where Tb (Equation (5.6)) is At-Satellite Brightness Temperature, λ is the wavelength of emitted radiance, $C2 = 1.4388 * 10^{-2}$ m K and it is presented with Equation (5.7) and ϵ is emissivity (typically 0.95).

$$Tb = (K2 / (\ln(K1 * \epsilon / L + 1))) \quad (5.6)$$

where $K1$ is the sensor-dependent calibration constant 1 and $K2$ is the sensor-dependent calibration constant 2 (Table 5.2). E is emissivity (typically 0.95), and L is the spectral radiance.

$$C2 = h * c / s \quad (5.7)$$

where, h is Planck's constant = $6.626 * 10^{-34}$ J s; c is the velocity of light = $2.998 * 10^8$ m/s, and s is the Boltzmann constant = $1.38 * 10^{-23}$ J/K.

Table 5.2

Landsat 5 and 8 thermal infrared (TIRS) thermal constant

Landsat 8 (Band 10)		Landsat 8 (Band 11)	
K1	K2	K1	K2
774.89	1321.08	480.89	1201.14

The ratio of the reflectivity differences for the NIR and the red band to their sum (NDVI) is calculated using Equation (5.8) :

$$\text{NDVI} = (\text{NIR} - \text{Red})/(\text{NIR} + \text{Red}) \quad (5.8)$$

The final step in the data collecting is the determination of empirical parameters by linear regression. To do so, statistical software was developed which was able to process the data for the same pixel from two raster sets, LST and NDVI.

5.3.3 RESULTS AND DISCUSSION

NDVI (Figure 5.8) and LST (Figure 5.9) are calculated based on essential data to obtain SMI calculation. NDVI values vary in the range of -1 to 1 where negative value indicate the absence of vegetation or poor vegetative cover, while positive values show dense and good vegetative cover. LST values are the temperature of the surface which is measured in °C. The SMI result is accessible with the values range within 0 to 1, where values close to 1 are regions with a lower vegetation cover and surface temperature which indicates that the surface has low infiltration and present a higher amount of soil moisture. the values close to 0 are the areas with a major vegetation cover and surface temperature and present a low level of soil moisture and increased infiltration capacity of the soil surface.

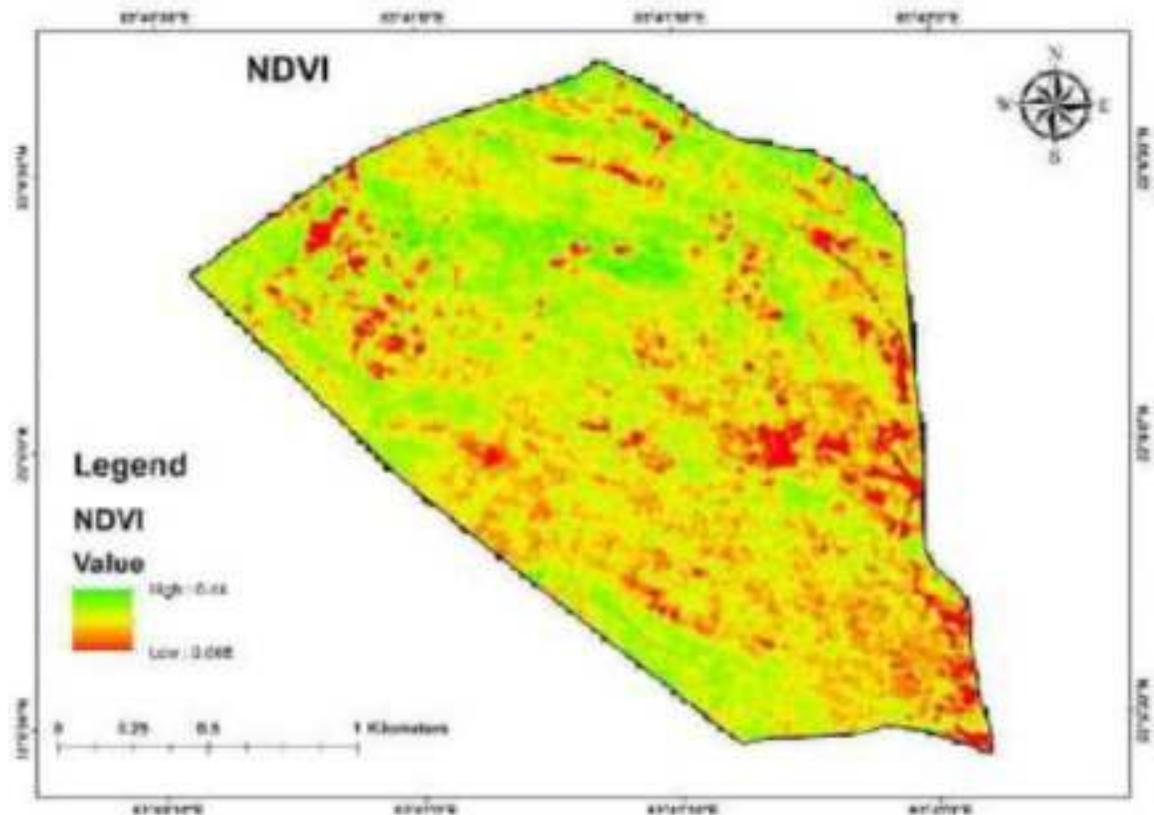


Figure 5.8: Normalized difference vegetation index (NDVI) map.

NDVI value in the study area is within the range of 0.098 to 0.44 as shown in Figure 5.8. Land surface temperature (Fig-5.9) value varies between a minimum of 39.35 °C and a maximum of 45.42 °C. The results of the soil moisture index map (Fig-5.10) of May 2022 indicate the soil moisture index was in the range of 0.43 to 0.64 as classified in different color gradients. Soil moisture of study is good and further, it can be enhanced by proposing different types of soil moisture conservation plans. In the study area, some red zone has been marked as moisture stressed compared to the other part of the study area, as shown in Figure 5.10 (red and yellow color). The values near 0.64 (green color) are forest cover which has good moisture as compared to the rest of the land cover. The results concluded that nearly 70 percent of the area was close to 0.43, which indicates a moisture deficit compared to the other part of the study area in the offseason. As per the index, value 1 represents a higher presence of water or moisture such as a water body like river or pond, and zero indicates minimum moisture content, such as dry areas. The soil moisture conservation activity must be done in those areas.

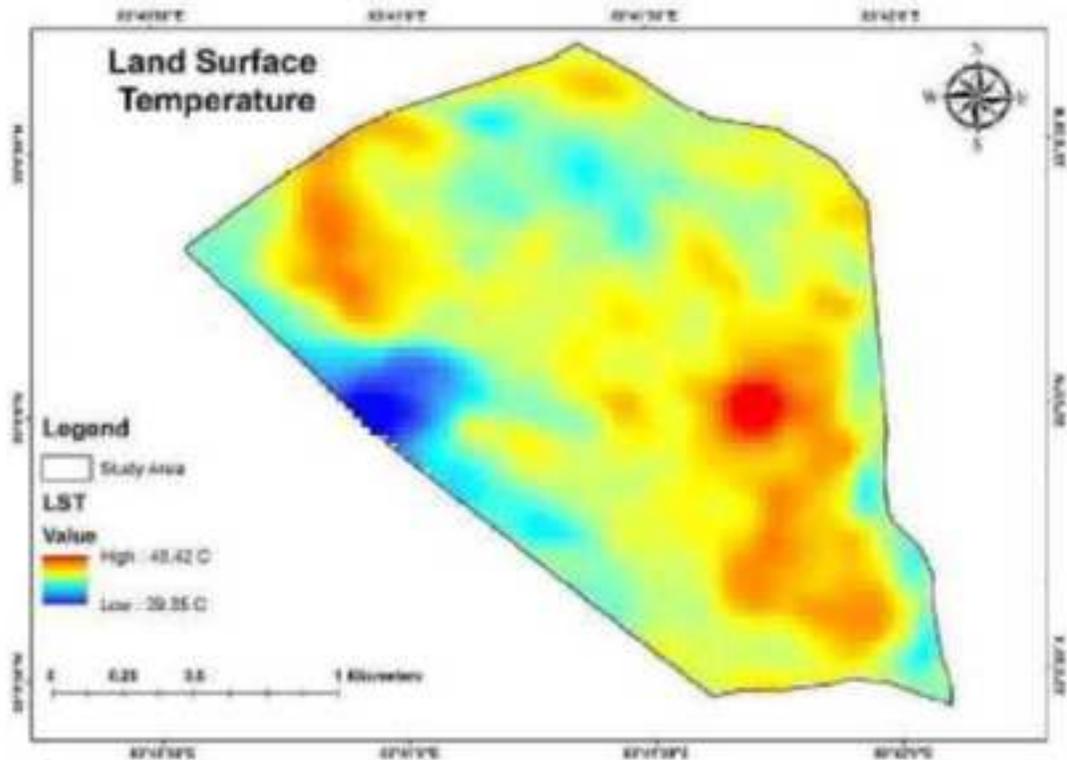


Figure 5.9: Land surface temperature (LST) map.

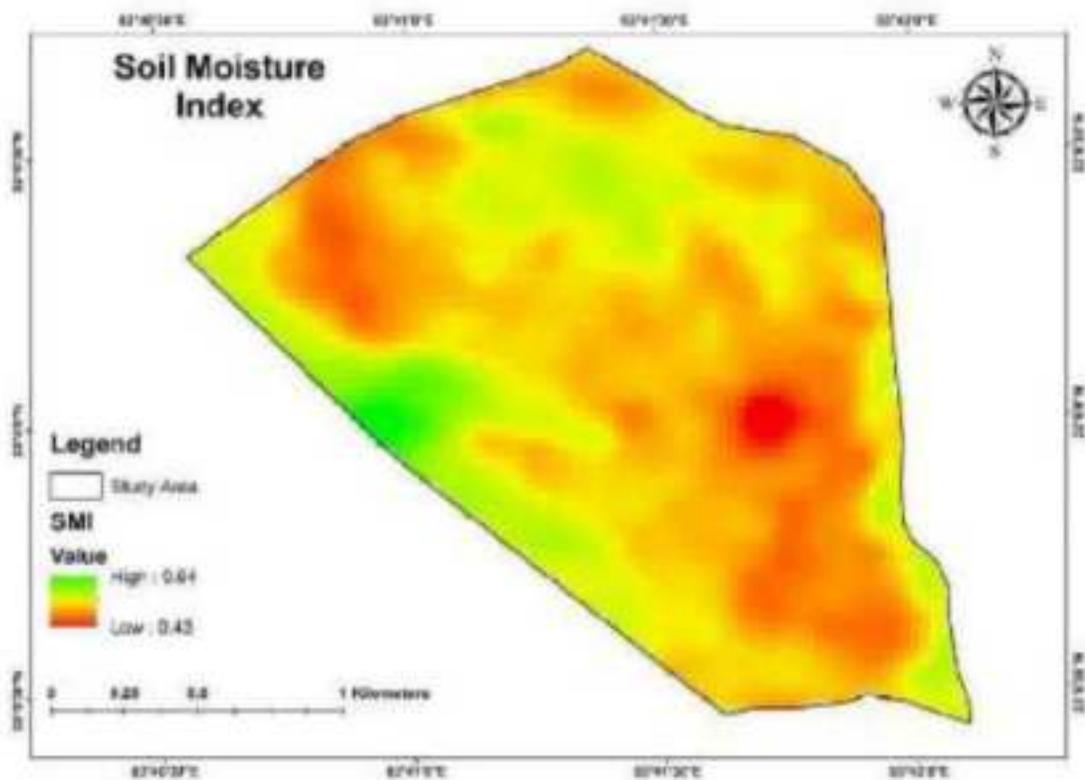


Figure 5.10.: Soil moisture index map of the study area.

5.4 REVISED UNIVERSAL SOIL LOSS

5.4.1 SOIL EROSION PROCESS

Soil erosion is a quite complex phenomenon that is governed by some natural processes where the end result is decreased soil fertility, depleted water quality, and above all reduced crop yields or loss in vegetation. Biophysical factors that comprise soil, climate, ground cover, terrain, and their interactions modify the soil erosion process. Terrain characteristics that affect soil erosion include slope gradient, slope length, aspect, and shape. The runoff mechanism is greatly influenced by the slope gradient impact and aspect. As the slope gradient increases, the infiltration component reduces, and generated runoff runs down the slope, the end result is more erosion. Soil erosion is described as a natural geomorphic (both ends process whose occurrence on the land's surface is quite continuous, and above all, it is more frequent and well distributed. This is because the surface of the Earth is exposed to water, wind, ice action, and gravitational forces at various spatiotemporal scales. The soil erosion process is accelerated by anthropogenic perturbations and improper land-use practices, whose impacts are felt on soil and the environment. Farming, habitation, terracing, deforestation, and overgrazing are some of the activities which lead to increased soil erosion rates. The soil erosion process has three distinct phases: detachability, transportability, and deposition. The soil erosion process begins with detachment, where the breakdown of soil particles occurs due to raindrop impact, shearing, and/or the drag force possessed by wind or even through forces that result from tillage activities. Detached soil particles are transported and thereafter get deposited as the force of the eroding agent subsides.

Water-induced soil erosion is reported to be the most extensive among the other soil erosion causes. This form of erosion is much dependent on land cover, surface gradient, and type of soil. Water erosion has a significant contribution to depletion of organic matter content and important soil nutrients; hence, the functionality of the soil is largely affected. According to Pimentel, farmlands are washed at a rate of between 10 and 40 tonnes, which is much more than the rate

of soil replacement. Water erosion has been identified as a worldwide problem because of the interrelationship between natural resources, population, and climate change.

5.4.2 SOIL EROSION MODELS

Soil erosion models make use of mathematical expressions so as to relate dominant parameters and processes that occur on the land's surface. The parameters involved include terrain characteristics, soil properties, land use/land cover, and weather variables. Soil erosion models describe detachment, transport, and deposition phases, which comprise the soil erosion process. Soil erosion models serve as important tools for planning because they enable the prediction of soil loss. Above all, models create a clear understanding of the entire soil erosion phenomenon and the resulting impacts. However, the choice of appropriate models for a particular soil erosion study is based on the objectives, catchment characteristics, and data available on the model's efficiency. Consequently, models differ based on complexity, involved processes, and data required to calibrate and use the model. In this study empirical model Revised Universal Soil Loss Equation (RUSLE).

5.4.3 REVISED UNIVERSAL SOIL LOSS EQUATION (RUSLE)

RUSLE model is a good example of an empirical model which is well recognized, widely accepted, and very much implemented in soil erosion studies. It is derived from the USLE model, and its application spans over 40 years. The model was designed and developed by a team of high-ranking scientists and some soil conservationists having vast experience in matters relating to soil erosion. It comprises mathematical equations that quantify the average soil loss on an annual basis at different geospatial scales. Many researchers had cited it as the best technology ever for estimation of soil loss in undisturbed areas characterized by overland flow, land surface experiencing disturbance, and recently or already reclaimed lands. Additionally, the model is very well applicable in ungauged catchments, its demand for data is quite moderate, and above all, it integrates well

with GIS enabling upscaling of the soil erosion process. The results of the RUSLE model are a representation of the sediment amount lost from a user-defined landscape. The superiority of the model is brought about by its prowess in accounting for different control management actions with minimal data requirements. The basic assumption that forms the foundation of the RUSLE model is that detachability and deposition processes are a function of sediment content. It is argued that until sediment load attains threshold capacity, soil detachment cannot occur. Therefore, the process of soil erosion is influenced by the flow carrying capacity and not by its source. Recent breakthroughs in spatial information technologies have augmented the prevailing methods in monitoring, analyzing, and above all managing resources. The spatial variation of soil erosion risk is brought about by heterogeneity in topography, geomorphology, geology, land cover, soil types, and land use. Such spatial variability of soil erosion parameters is easily and efficiently handled by geographic information systems (GIS). The trend has improved the accuracy, costs, and scales of application. The state-of-the-art technology geographic information system provides essential mapping interpolation techniques for creating a database that comprises input datasets for modeling soil erosion. Management of large datasets is made easier with the use of GIS; therefore, such spatial techniques provide a basis for the management of land upon the estimation of soil loss rates. In RUSLE, soil loss is predicted by converting the input data (rainfall data, soil data, digital elevation model, and land use) into a geographical information system format, following which it is implemented in the geospatial framework.

Many researchers worldwide have adopted this methodology to carry out soil erosion studies at different spatial scales. For instance, the following researchers studied soil loss in catchment areas by applying the RUSLE model, GIS, and remote sensing. The studies revealed that, apart from estimating soil erosion, the methodology was found to be satisfactory in identifying areas that had higher soil erosion risks. Further, geospatial tools facilitated the extraction of important information, which was deemed critical in implementing plans for soil conservation.

5.4.4 RUSLE Model Parameterization.

The model quantifies average annual soil loss (A) using five important factors, notably rainfall erosivity (R), soil erodibility (K), slope length and slope steepness (LS), cover management (C), and support practice (P).

$$A = R \times K \times LS \times C \times P \quad (5.9)$$

Where, A is the mean annual soil loss in t/ha/yr, R is the rainfall erosivity (MJ mm/ha/yr), K is the soil erodibility factor (t-ha-h/ MJ/mm), LS is the slope length and slope steepness factor (dimensionless), C is the cover management factor (dimensionless), and P is the support practice factor (dimensionless).

Rainfall is a precondition for any form of water erosion to materialize. The amount and even intensity of rainfall are the two important attributes of rainfall. Waterborne erosion is more pronounced when the two rainfall attributes are on the higher side. The rainfall erosivity factor (R) quantifies the erosive power possessed by rainfall, and it much depends on the rainfall's intensity and amount. The R factor is expressed as the sum of EI-values for each particular storm for a year and averaged over long periods of time (more than 20 years) so as to accommodate discernible recurring rainfall patterns. The abbreviation EI refers to the product of energy and maximum intensity of rainfall in 30 minutes. The amount of soil loss is proportional to the product of the total storm's energy, E (MJ/ha), and the storm's maximum intensity in a time of 30 min, I₃₀ (mm/h). The resulting product is known as the EI₃₀ index or commonly as the storm erosivity index expressed in MJmm/ha/h. The storm erosivity index reflects the amalgamated effect of soil particle dislodgement and runoff transportability to cause net erosion. The mean of the annual sums for the period under consideration gives the rainfall erosivity factor (R factor). Different researchers have developed equations from which the R factor has been derived and applied in different regions. For India following equation (5.10) can be used:

$$R = 50 + 0.389 \times P \quad (5.10)$$

Where, P is annual rainfall in mm

Table: 5.3 Annual rainfall as per IMD (30-year average)

DISTRICT	SUNDARGARH Rainfall in mm
JANUARY	14.50
FEBRUARY	16.00
MARCH	14.30
APRIL	14.30
MAY	42.30
JUNE	219.30
JULY	376.90
AUGUST	352.90
SEPTEMBER	195.60
OCTOBER	52.70
NOVEMBER	11.50
DECEMBER	7.50
Mean Annual	1317.80

5.4.5 SOIL ERODIBILITY FACTOR (K).

Different soils show varying degrees of resistance to water-related erosion. Soil erodibility is an essential requirement when estimating soil loss and also when implementing soil conservation activities. The characteristics of soil and its properties have a pronounced influence on soil erosion. There is effect is well represented by the soil erodibility factor. Hence, the K factor is affected by a variety of the soil's physicochemical properties. The K factor is simply defined as the inherent susceptibility of soil-to-soil erosion. The RUSLE model identifies the distribution of particle size, permeability, organic matter content, and structure of the soil as the critical physicochemical properties which affect erodibility. Quantitative determination of physicochemical properties of soils is carried out using conventional procedures in laboratories. Generally, soils that have low silt levels have less erodibility regardless of high fractions of both sand and clay. Different K factor algorithms have been developed and applied based on suitability and requirement (Table 5.4).

Table: 5.4: K-Factor for different soil type

SI no	Type of soil	K - Factor
1	Sand	0.02
2	Low Clay	0.05
3	High Clay	0.15
4	Sandy Soil	0.1-0.2
5	Silty Clay	0.26
6	Silty Loam	0.25-0.4
7	Silty Soil	0.4

5.4.6 TOPOGRAPHIC (LS) FACTOR

Slope length and slope steepness is the other main factor for estimating the soil loss which measures the sediment transport capacity of the flow. LS does not consider the 3D complexity of the topography but simply assumes soil loss increases with slope length and/or upslope contributing area. The LS- factor is calculated based on Eq. (5.11):

$$LS = \left(\text{Flow Accumulation} \times \frac{\text{Cell Size}}{22.13} \right)^{0.5} \times \left(\frac{\sin(\text{Slope})}{0.0896} \right)^{1.3} \quad - 5.11$$

The slope length (L) and slope steepness (S) define the landscape's topography, which mostly influences the extent of soil erosion. L and S are the two most important parameters with regard to soil erosion modeling and most importantly when calculating the transporting power of surface runoff. The LS factor, therefore, combines the effects of slope length and slope steepness, both of which account for the landscape's topographical effects on erosion. Hence, terrain effects on erosion processes are accounted for by the LS factor within the RUSLE model. Soil erosion is noted to increase when both the slope angle and length increase. This explains the sensitivity of terrain effects on soil erosion, and therefore determination of the LS factor needs to be accurate.

5.4.7 COVER MANAGEMENT FACTOR (C).

Vegetation cover ranks second behind terrain effects in influencing soil erosion rate. The parameters that define vegetation cover are mainly ground cover

and plant canopy cover, respectively. Spatial distribution of vegetation cover fraction requires accurate estimation and is of utmost importance in soil erosion matters. Vegetation cover prevents the soil from the impact of raindrops by dissipating the amount of energy they possess before reaching the soil surface. Moreover, vegetation cover intercepts rainfall, thereby encouraging more infiltration. In the RUSLE model, vegetation cover effects are accounted for by the cover management factor (C). The C factor is defined as the ratio of soil lost from cropped land under specified conditions to that lost from bare soil. It is much influenced by vegetation type, growth stage, and percent cover. The crop management factor is indicative of the influence of vegetation cover and specified management practices on soil erosion. The values have a range of between 0 and 1 depending on land cover types. C factor strongly relates to vegetation cover because it can be influenced by human beings to reduce erosion. The C factor is derived based on prior land uses, canopy shading factor, percent soil cover by crop remains, soil surface roughness, and above all soil moisture. Within the RUSLE model, the crop management factor is calculated using some empirical relationships that contain ground cover information. Satellite image information is an important input in the preparation of land cover maps, and as such, it has become an integral component in natural resources management. Traditionally, the C factor values have been spatially estimated by assigning values to land cover classes identified using remote sensing. Researchers have developed numerous methods for estimating the C factor based on normalized difference vegetation index (NDVI) for the assessment of soil loss using the RUSLE model. These methods make use of regression analysis to establish the correlation between C factor values (obtained from fieldwork or developed guide tables) and NDVI values obtained from remote sensing images. The regression equations (linear/ nonlinear) are generated by correlating NDVI values with corresponding C factor values (Eq-5.12).

$$C = 0.431 - 0.805 \text{ NDVI}$$

$$- 5.12$$

5.4.8 SUPPORT PRACTICE FACTOR (P).

Support Practice Factor (P). The support practice (P) factor is regarded as one of the most uncertain factors of the RUSLE model. The support practice factor relates strongly to the cover management factor because both reflect positive impacts resulting from management interventions in controlling soil erosion. The two factors differ in that the support practice factor quantifies the effects of some implementation that targets reducing the runoff and eventual soil loss. The most common support practices include the use of contours, terraces, crop strips, grassed waterways, and cross-slope cultivation. The P factor is expressed as the ratio between the rate and the amount of soil lost when a specific support practice is used and similar soil loss when row farming is executed in an up-and downslope manner. Typical P factor values range between 0 and 1. A value of 1 corresponds to lands without any support practice (especially grasslands and bare lands), while values which approach 0 are indicative of lands under specified support practices. Lower P factor values are indicative of effectiveness in conservation practices.

Table:5.5

Values of Crop Management factor

S.No	Cover %	Factor
1.	10	0.7
2.	20	0.5
3.	30	0.36
4.	40	0.26
5.	50	0.20
6.	60	0.15
7.	70	0.12
8.	80	0.10
9.	90	0.085
10.	100	0.075
11.	Waffle wall/ counterling	0.45
12.	Grass	0.17
13.	Terracing	0.9

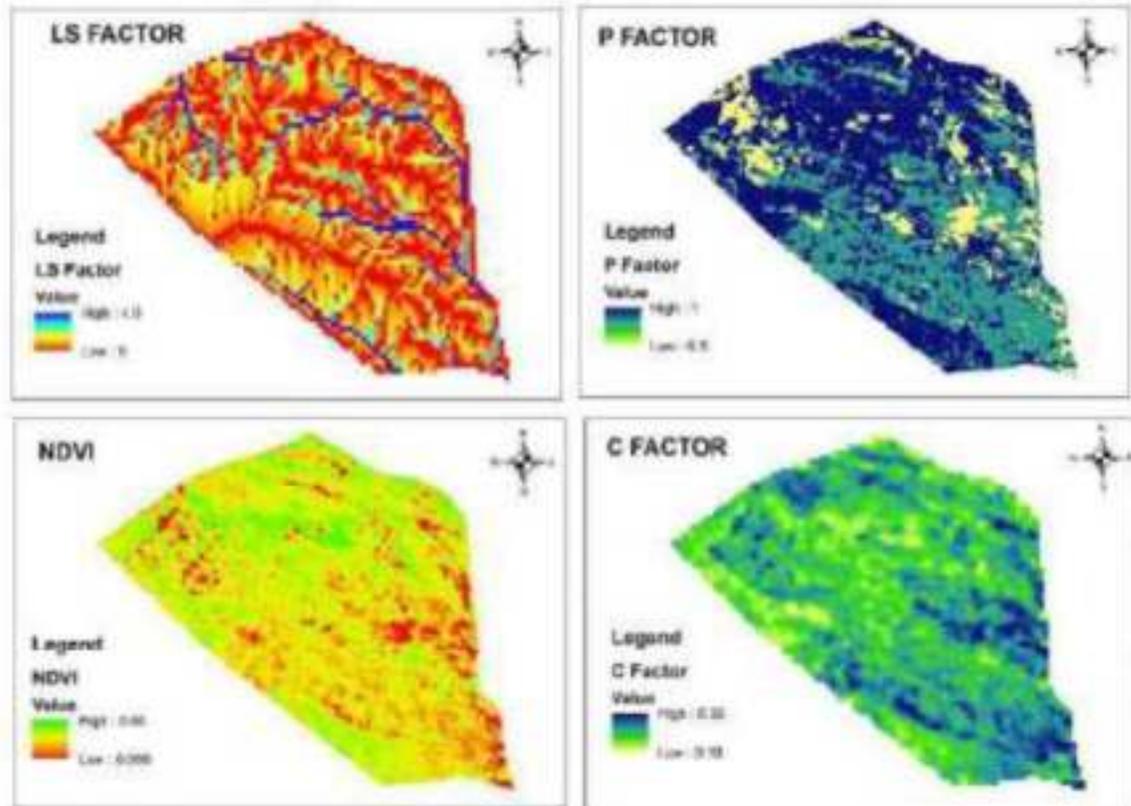


Fig 5.11 Derived factors for the study area

5.4.9 SOIL EROSION ESTIMATION.

The soil erosion severity map (Figure-5.12) was generated by overlaying all the parameter layers of RUSLE. Results indicated that the proposed area has a soil loss with a range of 0 to 118 t/ha/yr. Based on the soil erosion classification used, the estimated soil erosion was classified into four classes, namely, very slight (<5 t/ha), slight (5–15 t/ha), moderate (15-30 t/ha), sever (30-50 t/ha) and very severe (>50 t/ha) per annum. 83.18% of the area falls in the very slight erosion zone although around 6 % area comes under the moderate to very severe erosion zone where conservation is required to control soil erosion.

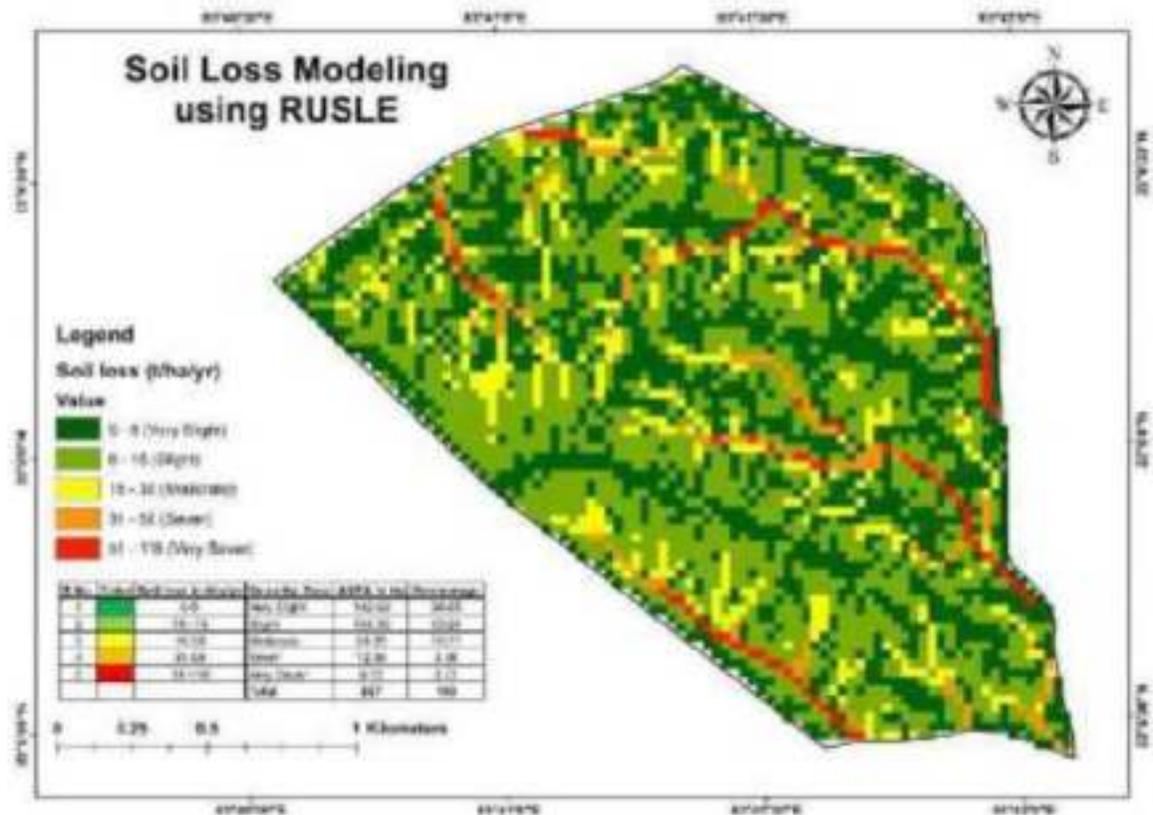


Fig 5.12 Soil loss from the study area

Table:5.6

Classification of soil loss from the study area

S.No.	Soil loss in t/ha/yr	Severity Zone	AREA in Ha	Percentage
1	0-5	Very Slight	142.62	39.95
2	06-15	Slight	154.35	43.24
3	16-30	Moderate	38.25	10.71
4	31-50	Sever	12.06	3.38
5	51-118	Very Sever	9.72	2.72
		Total	357.00	100

CHAPTER-6

MITIGATION MEASURES AND COST ESTIMATION

6.1 MITIGATIVE MEASURES

There are three methods for Soil Moisture Conservation (SMC) in the catchments, namely,

1. Agronomical Measures
2. Mechanical Measures
 - Catchment conservation works other than water harvesting structures: Those are implemented to minimize the soil erosion around the structures. In addition, those are also implemented to prolong the life span of water harvesting structures (check dams). Representative conservation works are as follows: Gully plugging works, contour trench works, terrace works, contour bunding works, mulching, plantation and filter strip works along the river, river/stream bank protection works etc.
 - Water harvesting structures: check dams (construction of embankment)
3. Non-structural measures: Land use regulation, public awareness for the forest, livelihood assistance/poverty alleviation, etc.

6.2 MECHANICAL MEASURES

- I. **Contour Bund:** Contour bunds are mechanical barriers built across the slope for the safe diversion of excess runoff and retention of eroded soil. The land area in between the two bunds gets levelled in due course of time. Due to the deposition of eroded soil along the bund, the latter takes the shape of a riser. These risers should be planted with grasses to check their erosion.

-
- II. **Graded Bunds:** The graded bund is a small earthen bund with a slight grade constructed across the slope for safe disposal of runoff. The graded bunds are recommended up to to 10% slope for areas where annual rainfall exceeds 800 mm, particularly on clayey and black soils with poor drainage. However, the efficacy of graded bunds gets reduced gradually beyond the 4% slope. The purpose of grading is to reduce the velocity of runoff water, for in-situ conservation of rainwater, and to minimize soil erosion.
 - III. **Bench Terrace:** Bench terraces are flat beds constructed on the hills across the slope. The height of the riser should not be more than one meter and the width of the bench terrace depends on the degree of slope. The bench terraces are important because they promote uniform distribution of soil moisture, irrigation water, etc. and control soil erosion. The bench terrace may be table top (level), outward sloping or inward sloping, with or without mild longitudinal grades. On steep slopes, it is better to construct terraces on the foothills for agricultural crops when soil depth is more than one meter.
 - IV. **Half Moon terrace:** Half-moon terraces are semi-circular beds of appropriate diameter with a shape resembling a half-moon. These terraces are recommended for fruit trees or other plantation crops on steep slopes.
 - V. **Grassed Waterways:** Grasses are well-known for their soil binding characteristics. They are most effective in moderating the flow and reducing the erosive velocity of runoff water, particularly on the rolling topography. The runoff water moves with high velocity down the slope, carrying with it soil and nutrients. If some suitable grasses are planted on the runoff route or natural channels, the soil and nutrient losses can be reduced. These grassed waterways are laid on the natural drainage lines in the watershed. Stilling basins or water ponds are constructed *en route* at appropriate locations, with earthen

and boulder pitched bunds for the retention of runoff water. By reducing the velocity of runoff water, erosion losses can be minimized.

- VI. Water Harvesting Ponds:** Water harvesting structures can be dug out for retaining runoff water on a seasonal or perennial basis. These are generally constructed down the slope. Earthen dams should be used for retaining silt load at an appropriate location on the slope of a watershed. The water thus harvested or stored can be used for pisciculture and other purposes.
- VII. Conservation Bench Terraces (CBT):** These are used to stabilize the yield of rainfed - crops by inter-field water harvesting. A part of the field is leveled to retain the runoff originating from the rest of the field.
- VIII. Gully Control Structures:** Gully control structures are provided to (i) reduce the erosive velocity of runoff water, (ii) facilitate the establishment of vegetation, and (iii) provide protection at points that cannot be adequately protected by other methods. Loose boulder check-dams perform well in gullies that do not carry much runoff and it also helps in silt deposition, thereby helping the stabilization of gully beds. Permanent gully control strati-fifes are constructed to control the overfalls either at the gully head or in the gully bed. Erosion from the extending heads and sides of the gully and main channel are the major sources of sediment. There is also a need to construct diversion bunds to divert surplus water to water harvesting structures or to the grassed waterways.
- IX. Contour Trenches:** Contour trenches are dug out, piling up the dugout earth on the lower side of the trench, for trapping, sediment, and runoff at the early stage of their movement. These trenches also improve soil moisture and favor the quick growth of trees and grasses.

-
- X. **Stream Bank and Torrents Control:** The vulnerable stream banks should be protected by providing spurs and retaining walls, etc. To control torrents, structures like bar-rages, paved channels, etc. need to be provided.

6.3 AGRONOMICAL MEASURES:

For preventing soil erosion on cultivated lands, proper choice of crops and cropping patterns is necessary, particularly on hill slopes. The protection through the vegetative shield, forest cover, grasses, crops and mulches, etc. are some important measures to prevent soil erosion. Such protection by absorbing the energy of rain impact prevents the loss of both water and soil. The following crop management practices can be useful in minimizing the erosion of soil and nutrients.

- I. **Cropping Systems** — Crops with the ability to develop canopy quickly provide early protection to the soil. Inter-planting of erosion-resistant crops like cowpea, soybean, etc. are also useful. Strip cropping of erosion-resistant legumes along with cereals can conserve rainwater and reduce the velocity of runoff.
- II. **Crop Geometry** — It is essential to manipulate the crop layout in the field in a manner that may prevent soil erosion. Closer spacing of rows across the slope can help in this regard.
- III. **Contour Cultivation** — Contour cultivation reduces the runoff to a large extent, thereby reducing the soil and nutrient losses. Contour cultivation, as well as furrows and ridges, have been found useful.
- IV. Low-intensity tillage favors the consolidation of soil through better structure, infiltration, and pore distribution. This imparts erosion resistance. A study of the conventional method of cultivation of maize 'with- zero tillage, with or without live mulch, has shown that runoff and soil losses are greatly

reduced with low-intensity tillage.

- V. **Grasses** - Grasses are perhaps the best friend of soil conservationists. Low and evenly distributed canopy and fibrous root systems with much binding capacity make grasses highly effective in controlling soil erosion. The performance of various grass species in controlling filling soil erosion and runoff losses at 9% and 11% slopes. The selection of grasses should be based on their production potential considering edaphic conditions and local preferences.
- VI. **Mulching**: Mulching is the placement of any organic or inorganic material over the top of a soil surface to protect it. Some of the benefits include reduced soil erosion, less compaction, moisture conservation, increased control of soil temperature, and a reduction in weed growth.

6.4 CONTOUR TRENCH WORKS

6.4.1 OBJECTIVE/FUNCTION

The contour trench works are the method of constructing the trenches along the contour lines of the slope. The objectives of the trench works are to retain water and sediment on the slope, to increase the water infiltration, to improve local soil moisture, and as the result, to reduce the runoff discharge and sediment to the downstream watershed.

There are three (3) types of contour trenches, that is continuous trenches, and interrupted (line and staggered) trenches. The continuous contour trenches are essentially used for moisture conservation in low rainfall areas. The staggered trenches are commonly used in Forest, in consideration of the rainfall condition of the study area.

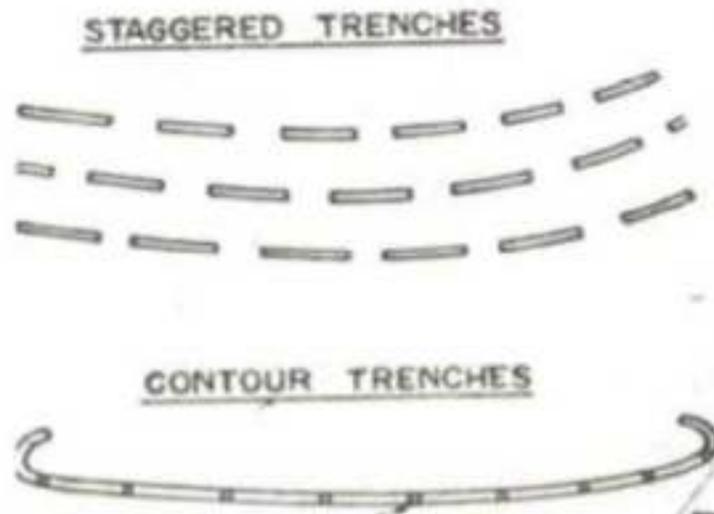


Fig. 6.1 Continuous and Staggered Contour Trenches

6.5 MULCHING

Mulching is an SMC practice in which a covering of cut grass, crop residues, or other organic materials is spread over the ground between rows of crops or around the trunks of trees. This practice helps to retain soil moisture to intercept the direct impact of raindrops on bare soil to reduce runoff and soil loss, to prevent weed growth, to reduce labor costs of weeding and enhance soil structure.

6.5.1 CLASSIFICATION OF MULCHES

(A) On the basis of organic matter

- a. **Organic mulches:** Organic mulches can be made of naturally occurring various substances which contain organic matter in it. Common examples of organic mulching are bark clippings, grass clippings, compost, dry leaves, straw etc.
- b. **Inorganic mulches:** Inorganic mulches are made up of inorganic substances which do not contains organic matter in it. Inorganic mulches include stones and gravels, polyethylene films, landscape materials, and rubbers.

(B) On the basis of living matter

- a. **Natural mulches:** Natural mulches are generally made up of naturally occurring materials. Organic mulches are also known as natural mulches. No prerequisite for the replacement of natural mulches because it decomposes readily.
- b. **Synthetic mulches:** Synthetic mulches are made of artificial non-living substances. Various types of synthetic mulch materials are available in the market for use in crop fields such as plastic films, plain and oiled paper, spun materials etc.

6.5.2 ORGANIC MULCHES

Organic mulches comprise materials like animal compost, grass clippings, straw of various crops, dried leaves, tree bark clippings and sawdust. It has an easily degradable capacity because nature of appealing slugs, insects, and worms that eat them and help them in rapid degradation, which results in the addition of some quantity of nutrient and organic material in the soil. Organic mulch has a large number of helpful features. Some of them are: soil moisture conservation by reducing the rate of evaporation, moderates soil temperature, lessening soil erosion, hindering the growth of weeds, cheers the growth of beneficial soil bio-organisms, and diminishing the blowout of soil-borne pathogens. Organic mulches after decomposition over time improve soil structure and increase the nutrient content of the soil. The illustration of different organic mulches and their usages are given below:

(A) Bark clippings

Bark clippings are long-lasting materials and permit appropriate aeration of the soil. It can be used properly in dry as well as wet regions and has more water holding capacity. In the wet region, if rain is too much the wood bark will reduce waterlogging condition after absorbing the excess water and if rain is too little, the wood bark will release the holding water, providing water to the plants in dry times also.

I. Bark (hardwood):

Hardwood bark clipping is the derivative of paper and timber industries and differs in sizes ranging from chips to bigger nuggets. It is mostly used nearby the shrubs and trees. Both colored and natural varieties of bark are obtainable. Colored varieties are generally a mixture of recycled wood waste comprising non-natural peroxides. Hardwood bark clippings have more nutrients than softwood but bark clippings are not effortlessly and plentifully

available and also phytotoxicity is caused by some bark products. These barks are slightly alkaline in nature.

II. Bark (softwood):

It is similarly a derivative of the wood and paper industries. A common example is pine bark and it is commonly used under large shrubs and trees. It is somewhat acidic in behaviour and takes more time to decay. These barks are obtainable in several sizes and generally applied to 2 to 4 inches of depth.

(B) Tree waste:

Generally, this mulch outcome from larger lumps of timbers. At the time of decomposition, the fresh tree chunks will utilize larger sums of nitrogen inside the soil. This type of mulch is specifically useful for making pathways.

(C) Leaf mulch:

Leaves are decent for mulching which is easily and profusely available. However, leaves are good for shielding inactive plants during the winter season by keeping them warm and it helps in starting germination throughout the winter season but they may be blown away even by the little speed of wind due to its lightweight. Bark, stone, or any other material which are useful in reducing wind speed, should be used to lessen these problems. It can be made at home by composting shredded leaves. Leaf mulch can be used in all types of gardens. Leaves infected with disease should be disposed instead of composting. The proper thickness of the leaf mulching is about 3 to 4 inches.

(D) Grass clippings:

Grass clippings are effortlessly and profusely available mulch materials in agriculture. It provides some quantity of nitrogen and

organic material into the soil if freshly incorporated in the soil. If green grass clippings are added to the soil, it can develop its root system and can create damage to the growth and development of crops. So, the use of dry grass is more favourable as mulch material. Grass clippings should be spread in thin layers for better results across perennial and vegetable beds and concave at the end of the growing season. Before adding extra layers let every layer dry. Grass clippings will mat if a thick layer of clipping is applied instead of thin layers. Grass clippings were taken from lawns which are treated with insecticides or herbicides never be used. It should apply at a depth of 2 to 3 inches.

(E) Composted animal manure:

The composted animal manure is an excellent choice for mulching material which advances the soil health, increases the population of microbes or bio-organisms, and adds nutrients to the soil. Compost is slightly acidic in nature. Compost does not have a better capability of weed suppression which is one noticeable drawback of composted animal manure. The use of fresh manure in crop fields sometimes results in the burning of plant roots. Before using as mulch manure should be well decomposed at temperatures between 54°C to 60 °C for a minimum of one week and 4 to 6 months of composting to eradicate potential disease micro-organisms. It is too used as mulching material in various nutrient-consuming florae like roses. 3-4 inches of depth is favourable for compost used as a mulch.

(F) Newspaper:

Newspaper mulching is helpful in adding some organic matter to the soil and controlling weeds. A thickness of 1 to 2 cm of newspaper sheet is required for mulching and the edge of the paper should be fastened with stones, gravel, pebbles, etc. Suppression of weed is done by the layers of white and black newspapers. Apply 2 to 3

layers of newspaper at a time and cover it with leaf mulch or grass clippings or any other organic materials so that it cannot blow away by the winds. Newsprint will ultimately decay and can be merged into the soil.

(G) Straw mulches:

Some examples of straw mulches are groundnut shells, cotton shells, Straws of paddy and wheat, crop stubbles, etc. which are used as mulches for moisture conservation on the soil surface. Even though nutrient content is less in straw but soil converts more productive after the decomposition of straw mulches. Straw mulches reduce the amount and rate of evaporation and lessen the amount of energy captivated by the soil.

(H) Sawdust:

Sawdust is obtained from the wood and furniture-making industry and is very deprived of nutritive value. It is slowly decomposable. It is acidic in nature so it should not be used in acidic soils.

6.5.3 BENEFITS OF ORGANIC MULCHING

A vital role is played by organic mulch in reflecting solar radiation. It reduces the rate of evaporation and keeps soil cooler. Prevent germination and growth of weeds, lessens erosion of soil, reduces runoff, increases moisture-retaining power of the soil, improves infiltration and percolation of water, advances the soil condition, makes soil porous, and augments better growth of roots. It can also maintain the soil temperature.

6.5.4 INORGANIC MULCHES

Inorganic mulches are commonly used to obstruct the germination of weeds and are also used for decoration. Inorganic mulches like stones, gravel, and rocks do not decompose voluntarily, so they do not participate in improving soil conditions but bio-degradable and photo-degradable plastic mulches are

readily decomposable and improve the soil condition as well after decomposition, because they are made from plant sugar or starches. Heat can be absorbed and reflected by rocks which are useful in dry and hot environmental conditions.

6.5.5 DISADVANTAGE OF INORGANIC MULCHING

Inorganic mulches, except in biodegradable plastic mulches, do not augment any nutrient in the soil because they do not decompose. In several cases, inorganic mulch will get damaged by the sun in several cases and starts looking damaged with time. It can increase the temperature of soil if established in large areas. Inorganic mulches like rubber may create harm to plants as it is toxic in nature.

6.6 SUGGESTIONS AND RECOMMENDATIONS

The soil of the proposed forest area is having less organic content which results in less soil moisture. Therefore, it is proposed to use an agronomical measure like mulching from locally available materials like straw, dry leaves, stubble, or similar materials.

6.6.1 MECHANICAL MEASURES

- A. **Contour Trench:** 5 number of trenches of size Lm x1m W × 0.6m D shall be constructed along the specified contour as shown in (Fig. 6.2). The details about the length and latitude and longitude of starting point and end point is given in table no-6.1.

Table: -6.1 Details of contour trenches with GPS location

S.No	Name	Length in m	X_Start	Y_Start	X_End	Y_End
1	CT-1	1425	83.679718	22.101851	83.685433	22.096973
2	CT-2	2720	83.676377	22.105038	83.686058	22.096548
3	CT-3	4000	83.681617	22.108888	83.686877	22.095933
4	CT-4	1360	83.685338	22.110121	83.698181	22.107433
5	CT-5	2100	83.697677	22.104403	83.688549	22.094522



Fig 6.2: Figure showing proposed location of Contour trench

- B. **Check Dam:** 10 nos. of check dam of different size have been suggested $L \times 0.5 \text{ m } W \times 0.6 \text{ m } H$ shall be constructed across the stream at the location specified in table 6.2 and also shown in Fig.6.3. The length of check dams are as given below:

- A) 15 m-1Nos
- B) 25 m- 1 Nos
- C) 30 m- 2 Nos
- D) 40 m- 6 Nos

Table: -6.2 Details of Check Dams with GPS location

S.No	Name	Length in m	X_Centroid	Y_Centroid
1	CD-1	15	83.686704	22.109004
2	CD-2	25	83.689597	22.108236
3	CD-3	40	83.693416	22.106401
4	CD-4	30	83.696619	22.105721
5	CD-5	30	83.6982	22.103968
6	CD-6	40	83.698924	22.101157
7	CD-7	40	83.698814	22.09912
8	CD-8	40	83.699105	22.096251
9	CD-9	40	83.700609	22.093336
10	CD-10	40	83.700553	22.091112

**Fig 6.3:** Figure showing proposed location of check dams

- C. **Catch Pit/Recharge Pit:** A total of 6,000 Pit of size 2 m L × 1m W × 0.8 m D shall be constructed across the slope at a spacing of 5 m and vertical/cross interval of 100m approx. Typical arrangement of recharge pit has been shown in figure-6.4.

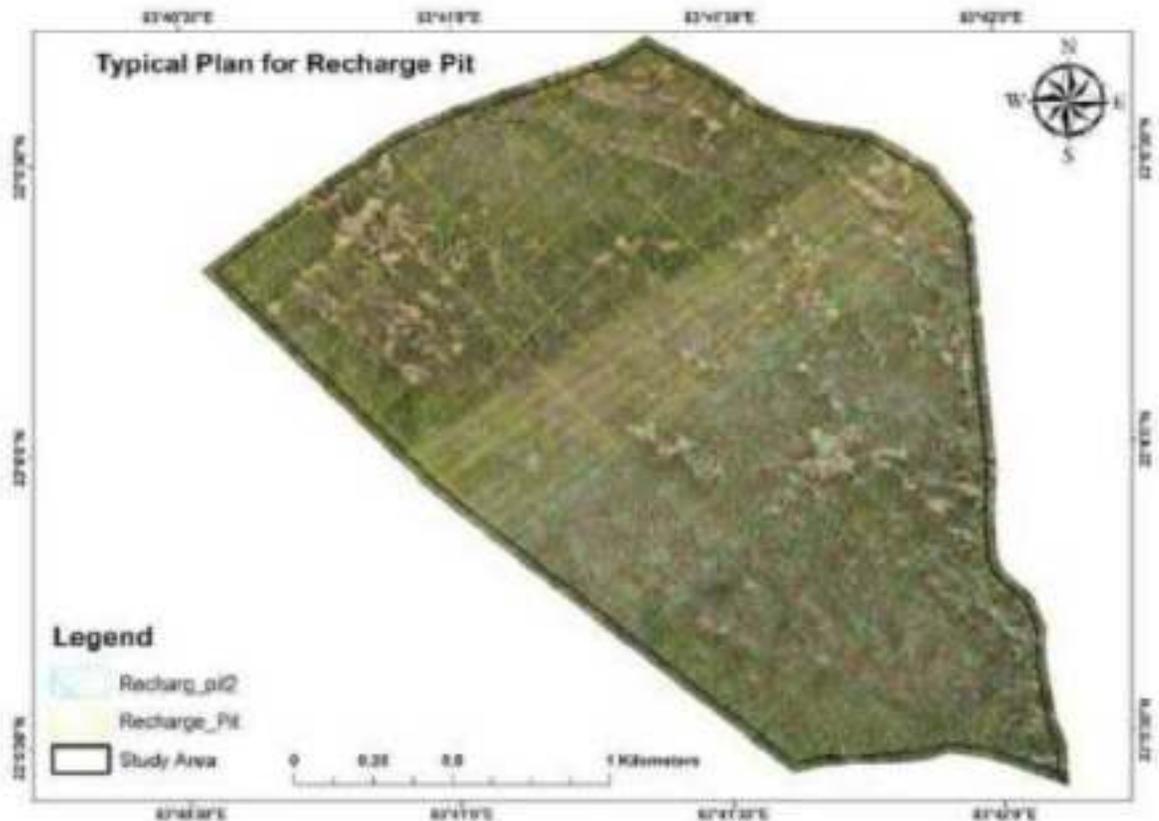


Fig 6.4 Figure showing typical arrangement of recharge pit (not to scale).

- D. **Surface Pond:** Two nos. of surface pond with stone pitching of size 50 m L × 30 m W × 2.5 m D and One No. of size 30 m L × 30 m W × 2.5 m D shall be constructed at the location specified in table 6.3 and also shown in Fig.6.5

Table: -6.3 Details of Ponds with GPS location

S.No	Name	X_Centroid	Y_Centroid
1	P1	83.695137	22.099436
2	P2	83.680445	22.106804
3	P3	83.689852	22.110804

Design Criteria

Two Pond in study area has been suggested of capacity of 3300 cum capacity (free board of 30 cm) and one pond of capacity 2340 cum. The total water collected in the proposed ponds through rainfall will be around 200 cum/year. The calculation has been shown in table 6.4

Table 6.4: Capacity of Proposed Ponds

Pond	C	A (in m ²)	I (in m annually)	Q (m ³ /year)
P1	1.00	1500	0.1317	197.55
P2	1.00	1500	0.1317	197.55
P3	1.00	900	0.1317	118.53

The rest water in pond will come through surface run-off from the micro-watershed. The calculation for each micro-watershed is given in table no- 6.5. Inlet for each is proposed in south direction considering the slope of the micro-watershed. The excess water of micro watershed will join the stream through natural slope of the area.

Table 6.5: Water discharge from micro-watershed.

Pond ID	Runoff Coefficient (C)	Area of watershed (in m ²)	Rainfall (I) (in m annually)	Q (m ³ /year)
P1	0.30	130000	0.1317	5136.3
P2	0.30	70000	0.1317	2765.7
P3	0.30	30000	0.1317	1185.3



Fig 6.5: Figure showing proposed locations of Ponds

6.6.2 AGRONOMICAL MEASURES:

- A. **Mulching:** Organic mulches comprising of materials like animal compost, cow dung, straw of various crops, dried leaves, or similar locally available material of 50 mm thickness shall be applied over an area of 183.86 ha land specified in table:6.6 and also shown in Fig.6.6

Table 6.6: Mulching Area

S.No	Name	Area in Ha
1	M1	112.80
2	M2	71.06
Total		183.86

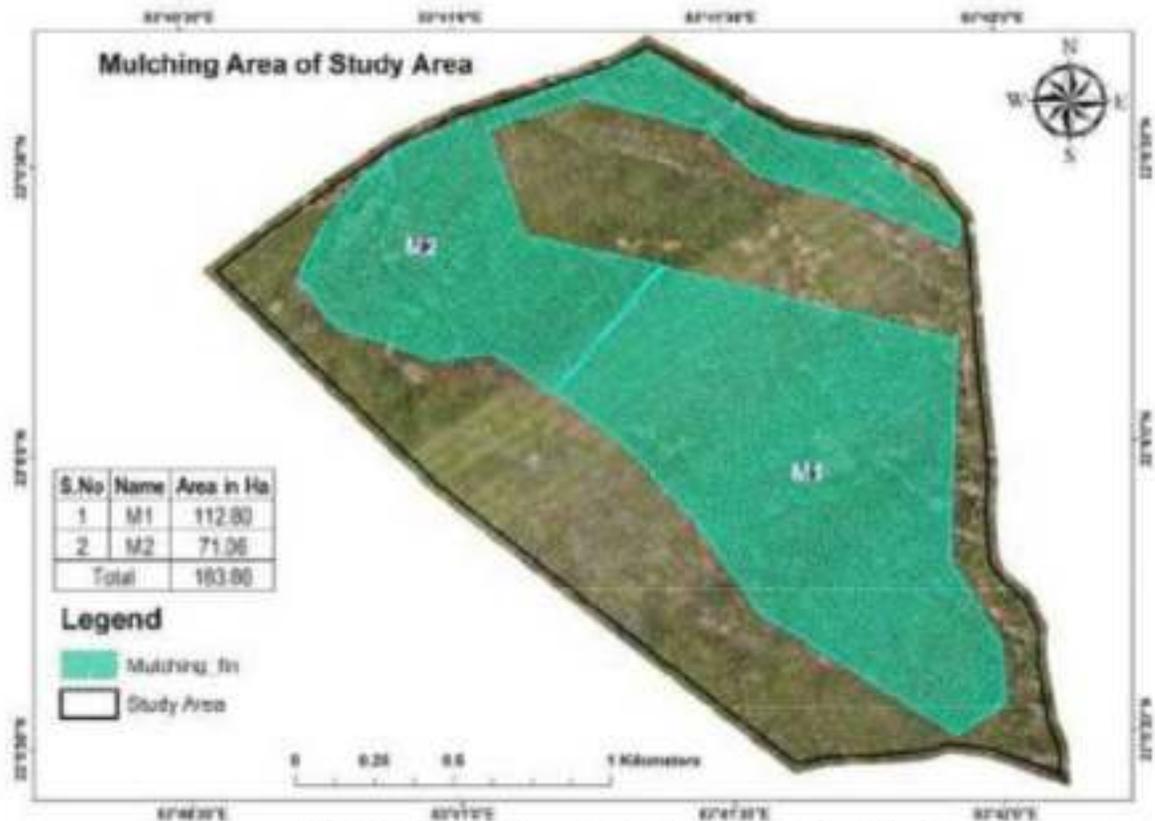


Fig 6.6: Figure showing the location of mulching

- B. Grassing:** Grassing with indigenous grass species over hatched area (10.50 ha) of degraded and open land as specified in Fig.6.7



Fig 6.7: Figure showing the location of grassing

6.7 COST ESTIMATE**Table 6.7: Year wise Abstract of SMC Measures**

SI No	Year	SMC Structure Cost	Maintenance of SMC structures @ 15% of initial year cost	Monitoring & Supervision @ 5% (in Rs)	Total
1	1st Year (2022-23)	1,84,58,217.00	-	9,22,910.85	1,93,81,127.85
2	2nd Year (2023-24)	1,79,75,726.00	27,68,732.55	10,37,222.93	2,17,81,681.48
3	3rd Year (2024-25)	-	54,65,091.45	2,73,254.57	57,38,346.02
4	4th Year (2025-26)	-	54,65,091.45	2,73,254.57	57,38,346.02
5	5th Year (2026-27)	-	54,65,091.45	2,73,254.57	57,38,346.02
6	6th Year (2027-28)	-	26,96,358.90	1,34,817.95	28,31,176.85
	Total	3,64,33,943.00	2,18,60,365.80	29,14,715.44	6,12,09,024.24
Rupees Six Crores Twelve Lakhs Nine Thousand Twenty-Four Rupees and Twenty-Four Paise only					

6.7 COST ESTIMATE**Table 6.7: Year wise Abstract of SMC Measures**

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5	5th Year (2026-27)	-	54,65,091.45	2,73,254.57	57,38,346.02
6	6th Year (2027-28)	-	26,96,358.90	1,34,817.05	28,31,176.85
	Total	3,64,33,943.00	2,18,60,365.80	29,14,715.44	6,12,09,024.24
Rupees Six Crores Twelve Lakhs Nine Thousand <i>Two</i> Hundred <i>Only</i> . -- <i>Rs 6,12,09,030/-</i>					

Dinase
 DIVISIONAL FOREST OFFICER
 BUNDARGARH FOREST DIVISION

set
 Project Officer
 Siamsi OCP
 Mahanadi Coalfields Limited

Technically Approved
16/7/2022
 Regional Chief Conservator of Forests
 Boudkela Circle

Sl. No.	Description	Item of Works	Unit	Quantity	Rate (DSR 2018)	Total Cost (in Rs.)	Location Reference
2nd Year (2023-24)							
8	Contour Trench	Earth Work in Soil	Cum	2016	181.85	3,66,609.60	CT2, CT3
		Earth Work in Ordinary Rock	Cum	2016	352.45	7,10,539.20	
9	Surface Pond	Earth Work in Soil	Cum	1125	181.85	2,04,581.25	P3
		Earth Work in Ordinary Rock	Cum	1125	352.45	3,96,506.25	
		Stone Pitching	Sqm	423.60	730.2	3,09,312.72	
10	Catch Pit	Earth Work in Soil	Cum	2400	181.85	4,36,440.00	3000 Catch Pit
		Earth Work in Ordinary Rock	Cum	2400	352.45	8,45,880.00	
11	Check Dams	Earth Work in Soil	Cum	84	181.85	15,275.40	CD3, CD6,CD7, CD8,CD9,CD10
		Earth Work in Ordinary Rock	Cum	84	352.45	29,605.80	
		RCC below Plinth	Cum	72.00	7718.25	5,55,714.00	
		RCC above Plinth	Cum	120.00	9306	11,16,720.00	
		Reinforcement for RCC work of 37.5 Cum @ 100kg/Cum	Kg	19200.00	83.5	16,03,200.00	
		Shuttering	Sqm	768.00	609.3	4,67,942.40	
12	Grassing	Grassing	Sqm	55000.00	36.7	20,18,500.00	G2, G3
13	Mulching/ Manuring	Mulching	Cum	35500.00	96.15	34,13,325.00	M2
		Manure	Cum	2750.00	229.95	6,32,362.50	
		Manure Spreading	Cum	2750.00	46.15	1,26,912.50	
14	Survey/ Demarcation	Survey/Demarcation	L/s			1,00,000.00	
Sub Total As on October 2018 (in Rs.)						1,33,49,427	
Current Updated Cost (@ 24.508% WPI)						1,66,21,105.00	
Contingencies @ 3%						4,98,634.00	
Sub (Total) -A						1,71,19,739.00	
Escalation Cost for 2nd Year (Assuming 5% Increase)						8,55,987.00	
Sub (Total) -B						1,79,75,726.00	
Maintenance of SMC structures @ 15% of initial year cost						27,88,732.55	
Sub (Total) -C						2,07,44,458.55	
Supervision & Monitoring , Evaluation & Documentation Cost @ 5%						10,37,222.93	
Grand Total (For 2nd Year) (in Rs.)						2,17,81,681.48	

Sl. No.	Description	Item of Works	Unit	Quantity	Rate (DSR 2018)	Total Cost (in Rs.)	Location Reference
3rd Year (2024-25)							
14	Maintenance of SMC structures @ 15% of initial year cost		L/s			27,68,732.55	
15	Maintenance of SMC structures @ 15% of Second year cost		L/s			26,96,358.90	
	Sub Total (A)					54,65,091.45	
	Supervision & Monitoring, Evaluation & Documentation Cost @ 5%					2,73,254.57	
	Grand Total (For 3rd Year) (in Rs.)					57,38,346.02	
4th Year (2025-26)							
16	Maintenance of SMC structures @ 15% of initial year cost		L/s			27,68,732.55	
17	Maintenance of SMC structures @ 15% of Second year cost		L/s			26,96,358.90	
	Sub Total (A)					54,65,091.45	
	Supervision & Monitoring , Evaluation & Documentation Cost @ 5%					2,73,254.57	
	Grand Total (For 4th Year) (in Rs.)					57,38,346.02	
5th Year (2026-27)							
18	Maintenance of SMC structures @ 15% of initial year cost		L/s			27,68,732.55	
19	Maintenance of SMC structures @ 15% of Second year cost		L/s			26,96,358.90	
	Sub Total (A)					54,65,091.45	
	Supervision & Monitoring , Evaluation & Documentation Cost @ 5%					2,73,254.57	
	Grand Total (For 5th Year) (in Rs.)					57,38,346.02	
6th Year (2027-28)							
20	Maintenance of SMC structures @ 15% of Second year cost		L/s			26,96,358.90	
	Supervision & Monitoring , Evaluation & Documentation Cost @ 5%					1,34,817.95	
	Grand Total (For 6th Year) (in Rs.)					28,31,176.85	
	Total Cost for 06 years of Project (in Rs.)					6,12,09,024.24	

Table 6.9 Proposed Estimate for Soil Moisture Conservation of the Project

Sl. No.	Description	Unit	Qty.	Rate (Rs.)	Amount (Rs.)
1	Earth work in excavation by mechanical means (Hydraulic excavator)/manual means over areas (exceeding 30 cm in depth, 1.5 m in width as well as 10 sqm on plan) including getting out and disposal of excavated earth lead upto 50 m and lift upto 1.5 m, as directed by Engineer-in-charge. All kinds of soil	Cum	13274.00	181.85	2413876.90
2	Earth work in excavation by mechanical means (Hydraulic excavator)/ manual means over areas (exceeding 30 cm in depth, 1.5 m in width as well as 10 sqm on plan) including getting out and disposal of excavated earth lead upto 50 m and lift upto 1.5 m, as directed by Engineer-incharge.	Cum	13274.00	352.45	4678421.30
3	Dry stone pitching 22.5 cm thick including supply of stones and preparing surface complete.	Sqm	1553.20	730.20	1134146.64
4	Providing and laying in position specified grade of reinforced cement concrete, excluding the cost of centering, shuttering, finishing and reinforcement - All work up to plinth level : 1:1.5:3 (1 cement : 1.5 coarse sand (zone-III): 3 graded stone aggregate 20 mm nominal size)	Cum	100.50	7718.25	775684.13
5	Reinforced cement concrete work in walls (any thickness), including attached pilasters, buttresses, plinth and string courses, fillets, columns, pillars, piers, abutments, posts and struts etc. above plinth level up to floor five level, excluding cost of centering, shuttering, finishing and reinforcement : 1:1.5:3 (1 cement : 1.5 coarse sand(zone-III) : 3 graded stone aggregate 20 mm nominal size)	Cum	167.00	9306.00	1554102.00
6	Steel reinforcement for R.C.C. work including straightening, cutting, bending, placing in position and binding all complete	Kg	26750.00	83.50	2233625.00
7	Centering and shuttering including strutting, propping etc. and removal of form for : Walls (any thickness) including attached pilasters, buttresses, plinth and string courses etc.	Sqm	1070.00	609.30	651951.00

Sl. No.	Description	Unit	Qty.	Rate (Rs.)	Amount (Rs.)
8	Providing & laying Selection no. 1 grass turf with earth 50mm to 60mm thickness of existing ground prepared with proper level and ramming with required tools wooden and then rolling the surface with light roller make the surface smoothen and light watering the same including maintenance for 30 days or more till the grass establish properly, as per direction of officer in charge	Sqm	105000.00	36.70	3853500.00
9	Mulching of land using cow dung/dry leaves/straw or similar items as per direction of officer in charge	Cum	91500.00	96.15	8797725.00
10	Supplying and stacking at site dump manure from approved source, including carriage upto 5 km lead complete	Cum	5250.00	229.95	1207237.50
11	Spreading of sludge, dump manure and/or good earth in required thickness as per direction of officer-in-charge (cost of sludge, dump manure and/ or good earth to be paid separately).	Cum	5250.00	46.15	242287.50
12	Survey/demarcation cost	LS			200000.00
	TOTAL as on October 2018:				27742557.00
	Current Updated Cost (WPI @24.508 %)				34541758.00
	Contingencies @3%				1036253.00
	GRAND TOTAL				35578011.00

Note: Estimate is based on DSOR 2018

WPI as on October 2018	122
WPI as on April 2022	151.9
% Increase	24.508

Table 6.10: Detailed Estimate

Sl. No.	Description	Nos.	Length (m)	Breadth (m)	Depth (m)	Quantity	Unit
	Earthwork						
	Contour trench	1.00	1425.00	1.00	0.60	855.00	
		1.00	2720.00	1.00	0.60	1632.00	
		1.00	4000.00	1.00	0.60	2400.00	
		1.00	1360.00	1.00	0.60	816.00	
		1.00	2100.00	1.00	0.60	1260.00	
	Catch Pit	6000.00	2.00	1.00	0.80	9600.00	
	Surface Pond	2.00	50.00	30.00	2.50	7500.00	
		1.00	30.00	30.00	2.50	2250.00	
	Check Dam	1.00	15.00	1.00	0.50	7.50	
		1.00	25.00	1.00	0.70	17.50	
		2.00	30.00	1.00	0.70	42.00	
		6.00	40.00	1.00	0.70	168.00	
					Total	26548.00	
					Say	26548.00	Cum
1	Earthwork in soil	50 % of	26548.00			13274.00	Cum
2	Earthwork in ordinary rock	50 % of	26548.00			13274.00	Cum
3	Stone pitching						
	Surface Pond	4.00	50.00	3.53		706.00	Sqm
		4.00	30.00	3.53		423.60	Sqm
		2.00	30.00	3.53		211.80	Sqm
		2.00	30.00	3.53		211.80	Sqm
					Total	1553.20	Sqm
4	RCC below plinth						
	Check Dam	1.00	15.00	0.50	0.40	3.00	Cum
		1.00	25.00	0.50	0.60	7.50	Cum
		2.00	30.00	0.50	0.60	18.00	Cum
		6.00	40.00	0.50	0.60	72.00	Cum
					Total	100.50	Cum
5	RCC above plinth						
	Check Dam	1.00	15.00	0.50	0.60	4.50	Cum
		1.00	25.00	0.50	1.00	12.50	Cum
		2.00	30.00	0.50	1.00	30.00	Cum
		6.00	40.00	0.50	1.00	120.00	Cum

Sl. No.	Description	Nos.	Length (m)	Breadth (m)	Depth (m)	Quantity	Unit
					Total	167.00	Cum
6	Reinforcement for R.C.C. work		267.50 m ³ @	100 kg/m ³	=	26750.00	Kg
7	Shuttering						
	Check Dam	2.00	15.00	1.00		30.00	Sqm
		2.00	25.00	1.60		80.00	Sqm
		4.00	30.00	1.60		192.00	Sqm
		12.00	40.00	1.60		768.00	Sqm
					Total	1070.00	Sqm
8	Grassing						
	As shown in map				Total	10.50	Hectare
						105000.00	Sqm
9	Mulching						
	As per Map shown		1830000.00	0.05		91500.00	Cum
10	Manure		105000.00	0.05		5250.00	Cum
11	Manure Spreading		105000.00	0.05		5250.00	Cum

**Table 6.11: Calendar program for the proposed activities
for 1st year**

Sl. No.	Description	Unit	Qty.	Rate (Rs.)	Amount (Rs.)
1	Earth work in excavation by mechanical means (Hydraulic excavator)/manual means over areas (exceeding 30 cm in depth, 1.5 m in width as well as 10 sqm on plan) including getting out and disposal of excavated earth lead upto 50 m and lift upto 1.5 m, as directed by Engineer-in-charge. All kinds of soil	Cum	7649.00	181.85	1390970.65
2	Earth work in excavation by mechanical means (Hydraulic excavator)/ manual means over areas (exceeding 30 cm in depth, 1.5 m in width as well as 10 sqm on plan) including getting out and disposal of excavated earth lead upto 50 m and lift upto 1.5 m, as directed by Engineer-incharge.	Cum	7649.00	352.45	2695890.05
3	Dry stone pitching 22.5 cm thick including supply of stones and preparing surface complete.	Sqm	1129.60	730.20	824833.92
4	Providing and laying in position specified grade of reinforced cement concrete, excluding the cost of centering, shuttering, finishing and reinforcement - All work up to plinth level : 1:1.5:3 (1 cement : 1.5 coarse sand (zone-III): 3 graded stone aggregate 20 mm nominal size)	Cum	28.50	7718.25	219970.13

Sl. No.	Description	Unit	Qty.	Rate (Rs.)	Amount (Rs.)
5	Reinforced cement concrete work in walls (any thickness), including attached pilasters, buttresses, plinth and string courses, fillets, columns, pillars, piers, abutments, posts and struts etc. above plinth level up to floor five level, excluding cost of centering, shuttering, finishing and reinforcement : 1:1.5:3 (1 cement : 1.5 coarse sand(zone-III) : 3 graded stone aggregate 20 mm nominal size)	Cum	47.00	9306.00	437382.00
6	Steel reinforcement for R.C.C. work including straightening, cutting, bending, placing in position and binding all complete	Kg	7550.00	83.50	630425.00
7	Centering and shuttering including strutting, propping etc. and removal of form for : Walls (any thickness) including attached pilasters, butteresses, plinth and string courses etc.	Sqm	302.00	609.30	184008.60
8	Providing & laying Selection no. 1 grass turf with earth 50mm to 60mm thickness of existing ground prepared with proper level and ramming with required tools wooden and than rolling the surface with light roller make the surface smoothen and light watering the same including maintenance for 30 days or more till the grass establish properly,as per direction of officer in charge	Sqm	50000.00	36.70	1835000.00
9	Mulching of land using cow dung/dry leaves/straw or similar items as per direction of officer in charge	Cum	56000.00	96.15	5384400.00
10	Supplying and stacking at site dump manure from approved source, including carriage upto 5 km lead complete	Cum	2500.00	229.95	574875.00

Sl. No.	Description	Unit	Qty.	Rate (Rs.)	Amount (Rs.)
11	Spreading of sludge, dump manure and/or good earth in required thickness as per direction of officer-in-charge (cost of sludge, dump manure and/ or good earth to be paid separately).	Cum	2500.00	46.15	115375.00
12	Survey/demarcation cost	LS			100000.00
	TOTAL as on October 2018:				14393130.00
	Current Updated Cost				17920599.00
	Contingencies @3%				537618.00
	GRAND TOTAL (in Rs.)				18458217.00

WPI as on October 2018	122
WPI as on April 2022	151.9
% Increase	24.508

Table 6.12: Detailed estimate for 1st Year

Sl. No.	Description	Nos.	Length	Breadth	Depth	Quantity	Unit
	Earthwork						
	Contour trench						
		1.00	1425.00	1.00	0.60	855.00	
		1.00	1360.00	1.00	0.60	816.00	
		1.00	2100.00	1.00	0.60	1260.00	
	Catch Pit	3000.00	2.00	1.00	0.80	4800.00	
	Surface Pond	2.00	50.00	30.00	2.50	7500.00	
	Check Dam	1.00	15.00	1.00	0.50	7.50	
		1.00	25.00	1.00	0.70	17.50	
		2.00	30.00	1.00	0.70	42.00	
					Total	15298.00	
					Say	15298.00	Cum
1	Earthwork in soil	50 % of	15298.00			7649.00	Cum
2	Earthwork in ordinary rock	50 % of	15298.00			7649.00	Cum
3	Stone pitching						
	Surface Pond	4.00	50.00	3.53		706.00	Sqm
		4.00	30.00	3.53		423.60	Sqm
					Total	1129.60	Sqm
4	RCC below plinth						
	Check Dam	1.00	15.00	0.50	0.40	3.00	Cum
		1.00	25.00	0.50	0.60	7.50	Cum
		2.00	30.00	0.50	0.60	18.00	Cum
					Total	28.50	Cum
5	RCC above plinth						
	Check Dam	1.00	15.00	0.50	0.60	4.50	Cum
		1.00	25.00	0.50	1.00	12.50	Cum
		2.00	30.00	0.50	1.00	30.00	Cum
					Total	47.00	Cum
6	Reinforcement for R.C.C. work	75.5 m ³ @	100 kg/m ³		=	7550.00	Kg
7	Shuttering						
	Check Dam	2.00	15.00	1.00		30.00	Sqm

Sl. No.	Description	Nos.	Length	Breadth	Depth	Quantity	Unit
		2.00	25.00	1.60		80.00	Sqm
		4.00	30.00	1.60		192.00	Sqm
					Total	302.00	Sqm
8	Grassing						
	As shown in map				Total	5.00	Hectare
						50000.00	Sqm
9	Mulching						
	As per Map shown		1120000.00	0.05		56000.00	Cum
10	Manure		50000.00	0.05		2500.00	Cum
11	Manure Spreading		50000.00	0.05		2500.00	Cum

**Table 6.13: Calendar program for the proposed activities
for 2nd year**

Sl. No.	Description	Unit	Qty.	Rate (Rs.)	Amount (Rs.)
1	Earth work in excavation by mechanical means (Hydraulic excavator)/manual means over areas (exceeding 30 cm in depth, 1.5 m in width as well as 10 sqm on plan) including getting out and disposal of excavated earth lead upto 50 m and lift upto 1.5 m, as directed by Engineer-in-charge. All kinds of soil	Cum	5625.00	181.85	1022906.25
2	Earth work in excavation by mechanical means (Hydraulic excavator)/ manual means over areas (exceeding 30 cm in depth, 1.5 m in width as well as 10 sqm on plan) including getting out and disposal of excavated earth lead upto 50 m and lift upto 1.5 m, as directed by Engineer-incharge.	Cum	5625.00	352.45	1982531.25
3	Dry stone pitching 22.5 cm thick including supply of stones and preparing surface complete.	Sqm	423.60	730.20	309312.72
4	Providing and laying in position specified grade of reinforced cement concrete, excluding the cost of centering, shuttering, finishing and reinforcement - All work up to plinth level : 1:1.5:3 (1 cement : 1.5 coarse sand (zone-III) : 3 graded stone aggregate 20 mm nominal size)	Cum	72.00	7718.25	555714.00
5	Reinforced cement concrete work in walls (any thickness), including attached pilasters, buttresses, plinth and string courses, fillets, columns, pillars, piers, abutments, posts and struts etc. above plinth level up to floor five level, excluding cost of centering, shuttering, finishing and reinforcement : 1:1.5:3 (1 cement : 1.5 coarse sand(zone-III) : 3 graded stone aggregate 20 mm nominal size)	Cum	120.00	9306.00	1116720.00
6	Steel reinforcement for R.C.C. work including straightening, cutting, bending, placing in position and binding all complete	Kg	19200.00	83.50	1603200.00

Sl. No.	Description	Unit	Qty.	Rate (Rs.)	Amount (Rs.)
7	Centering and shuttering including strutting, propping etc. and removal of form for : Walls (any thickness) including attached pilasters, butteresses, plinth and string courses etc.	Sqm	768.00	609.30	467942.40
8	Providing & laying Selection no. 1 grass turf with earth 50mm to 60mm thickness of existing ground prepared with proper level and ramming with required tools wooden and than rolling the surface with light roller make the surface smoothen and light watering the same including maintenance for 30 days or more till the grass establish properly,as per direction of officer in charge	Sqm	55000.00	36.70	2018500.00
9	Mulching of land using cow dung/dry leaves/straw or similar items as per direction of officer in charge	Cum	35500.00	96.15	3413325.00
10	Supplying and stacking at site dump manure from approved source, including carriage upto 5 km lead complete	Cum	2750.00	229.95	632362.50
11	Spreading of sludge, dump manure and/or good earth in required thickness as per direction of officer-in-charge (cost of sludge, dump manure and/ or good earth to be paid separately).	Cum	2750.00	46.15	126912.50
12	Survey/demarcation cost	LS			100000.00
	TOTAL as on October 2018:				13349427.00
	Current Updated Cost				16621105.00
	Contingencies @3%				498634.00
	GRAND TOTAL				17119739.00
	Escalation Cost for 2nd year assuming 5% increase				1598604.00
	Escalated Cost (Rs.)				17975726.00

Table 6.14: Detailed estimate for 2nd year

Sl. No.	Description	Nos.	Length	Breadth	Depth	Quantity	Unit
	Earthwork						
	Contour trench						
		1.00	2720.00	1.00	0.60	1632.00	
		1.00	4000.00	1.00	0.60	2400.00	
	Catch Pit	3000.00	2.00	1.00	0.80	4800.00	
	Surface Pond	1.00	30.00	30.00	2.50	2250.00	
	Check Dam	6.00	40.00	1.00	0.70	168.00	
					Total	11250.00	
					Say	11250.00	Cum
1	Earthwork in soil	50 % of	11250.00			5625.00	Cum
2	Earthwork in ordinary rock	50 % of	11250.00			5625.00	Cum
3	Stone pitching						
	Surface Pond	2.00	30.00	3.53		211.80	Sqm
		2.00	30.00	3.53		211.80	Sqm
					Total	423.60	Sqm
4	RCC below plinth						
	Check Dam	6.00	40.00	0.50	0.60	72.00	Cum
					Total	72.00	Cum
5	RCC above plinth						
	Check Dam	6.00	40.00	0.50	1.00	120.00	Cum
					Total	120.00	Cum
6	Reinforcement for R.C.C. work	192 m ³ @	100 kg/m ³		=	19200.00	Kg
7	Shuttering						
	Check Dam	12.00	40.00	1.60		768.00	Sqm
					Total	768.00	Sqm
8	Grassing						
	As shown in map				Total	5.50	Hectare
						55000.00	Sqm
9	Mulching						
	As per Map shown		710000.00	0.05		35500.00	Cum

Sl. No.	Description	Nos.	Length	Breadth	Depth	Quantity	Unit
10	Manure		55000.00	0.05		2750.00	Cum
11	Manure Spreading		55000.00	0.05		2750.00	Cum

CHAPTER-7

SUMMARY AND CONCLUSIONS

7.1 INTRODUCTION

In Siarmal OCP of Mahanadi Coalfield Limited, UAV based survey for the generation of high-resolution orthomosaic images, DTM, DSM, and contour map of the proposed area for SMC study was done. The study area has been selected after a discussion with DFO and the total area covering 357 Ha lies in the forest area near Sundargarh and Jharsuguda district.

The bounding coordinate of the area falls between longitude $83^{\circ} 40' 32.4211''$ E to $83^{\circ} 42' 08.3763''$ E and latitude $22^{\circ} 05' 24.5211''$ N to $22^{\circ} 06' 43.3536''$ N. Location of the study area for UAV survey has been illustrated in the map.

Ground Control Points (GCPs) have been precisely measured on the ground using Spectra SP60 DGPS, and the post-processing of the data has been done using Survey office software. As the area lies in the forest, a number of GCPs had been restricted by approachability issues.

7.2 MITIGATIVE MEASURES

Based on the field visits, soil sample analysis, Orthomosaic image of the study area and contour map of the area, following Mechanical and Agronomical mitigation measures have been suggested to increase moisture level:

1. Contour Trenches
2. Check Dams
3. Catch Pit/Recharge Pit
4. Surface Pond

5. Mulching:
6. Grassing

7.2.1 CONTOUR TRENCHES

5 number of trenches of size $L \text{ m} \times 1 \text{ m} \text{ W} \times 0.6 \text{ m} \text{ D}$ to be constructed along the specified contour.

The details about the length and latitude and longitude of stating point and end point is given in table below:

Table No.-7.1 Details of contour trenches with GPS location

S.No	Name	Length in m	X_Start	Y_Start	X_End	Y_End
1	CT-1	1425	83.679718	22.101851	83.685433	22.096973
2	CT-2	2720	83.676377	22.105038	83.686058	22.096548
3	CT-3	4000	83.681617	22.108888	83.686877	22.095933
4	CT-4	1360	83.685338	22.110121	83.698181	22.107433
5	CT-5	2100	83.697677	22.104403	83.688549	22.094522

7.2.2 CHECK DAM

- 10 nos. of check dam of different size have been suggested $L \times 0.5 \text{ m} \text{ W} \times 0.6 \text{ m} \text{ H}$ to be constructed across the stream at the location specified.
- The length of check dams is as given below:
 - A) 15 m- 1Nos
 - B) 25 m- 1 Nos
 - C) 30 m- 2 Nos
 - D) 40 m- 6 Nos

Table No.- 7.2 Details of Check Dams with GPS location

S.No	Name	Length in m	X_Centroid	Y_Centroid
1	CD-1	15	83.686704	22.109004
2	CD-2	25	83.689597	22.108236
3	CD-3	40	83.693416	22.106401
4	CD-4	30	83.696619	22.105721
5	CD-5	30	83.6982	22.103968
6	CD-6	40	83.698924	22.101157
7	CD-7	40	83.698814	22.09912
8	CD-8	40	83.699105	22.096251
9	CD-9	40	83.700609	22.093336
10	CD-10	40	83.700553	22.091112

7.2.3 CATCH PIT/RECHARGE PIT

- Catch Pit/Recharge Pit: A total of 6,000 Pit of size 2 m L × 1m W × 0.8 m D to be constructed across the slope at a spacing of 5 m and vertical/cross interval of 100m approx.

7.2.4 SURFACE POND

- Two nos. of surface pond with stone pitching of size 50 m L × 30 m W × 2.5 m D and One No. of size 30 m L × 30 m W × 2.5 m D to be constructed at the location specified

Table 7.3 Details of Ponds with GPS location

S.No	Name	X_Centroid	Y_Centroid
1	P1	83.695137	22.099436
2	P2	83.680445	22.106804
3	P3	83.689852	22.110804

Design Criteria of Pond

- Two Pond in study area has been suggested of capacity of 3300 cum capacity (free board of 30 cm) and one pond of capacity 2340 cum.

Table 7.4 Capacity of Proposed Ponds

Pond	C	A (in m ²)	I (in m annually)	Q (m ³ /year)
P1	1.00	1500	0.1317	197.55
P2	1.00	1500	0.1317	197.55
P3	1.00	900	0.1317	118.53

Table 7.5 Water discharge from micro-watershed.

Pond ID	Runoff Coefficient (C)	Area of watershed (in m ²)	Rainfall (I) (in annually) m	Q (m ³ /year)
P1	0.30	130000	0.1317	5136.3
P2	0.30	70000	0.1317	2765.7
P3	0.30	30000	0.1317	1185.3

- Water in pond will come through surface run-off from the micro-watershed.
- Inlet for each is proposed in south direction considering the slope of the micro-watershed.
- The excess water of micro watershed will join the stream through natural slope of the area.

7.2.5 MULCHING

Organic mulches comprising of materials like animal compost, cow dung, straw of various crops, dried leaves, or similar locally available material of 50 mm thickness to be applied over an area of 183.86 ha land.

Table 7.6 Mulching Area

S.No	Name	Area in Ha
1	M1	112.80
2	M2	71.06
Total		183.86

7.2.6 GRASSING

- Grassing with indigenous grass species over hatched area (10.50 ha) of degraded and open area.

7.3 EXPECTED OUTCOME IN THE STUDY AREA AFTER IMPLEMENTATION OF THE PROPOSED CONTROL MEASURES

- I. Increase in the soil moisture content in the study area: After construction of contour trenches, Percolation pit, Check Dams, and Surface ponds.
- II. During the soil testing of the study area, different nutrients like Organic Carbon, Phosphorus, Potash Nitrogen etc were found deficient.
- III. After the implementation of the proposed Agronomic control measures like Mulching and Grassing the water holding capacity of the study area will increase. It will also help in the improvement in soil quality parameters.
- IV. The Above mechanical and Agronomical control measures will help in the control soil erosion.
- V. The proposed control measures will help in the improvement of the soil moisture index of the degraded forest area.

7.4 COST ESTIMATE

Table 7.8: Year wise Abstract of SMC Measures

SI No	Year	SMC Structure Cost	Maintenance of SMC structures @ 15% of initial year cost	Monitoring & Supervision @ 5% (in Rs)	Total
1	1st Year (2022-23)	1,84,58,217.00	-	9,22,910.85	1,93,81,127.85
2	2nd Year (2023-24)	1,79,75,726.00	27,68,732.55	10,37,222.93	2,17,81,681.48
3	3rd Year (2024-25)	-	54,65,091.45	2,73,254.57	57,38,346.02
4	4th Year (2025-26)	-	54,65,091.45	2,73,254.57	57,38,346.02
5	5th Year (2026-27)	-	54,65,091.45	2,73,254.57	57,38,346.02
6	6th Year (2027-28)	-	26,96,358.90	1,34,817.95	28,31,176.85
	Total	3,64,33,943.00	2,18,60,365.80	29,14,715.44	6,12,09,024.24
Rupees Six Crores Twelve Lakhs Nine Thousand Twenty-Four Rupees and Twenty-Four Paise only					

CHAPTER-8

DISCLOSURE OF THE CONSULTANT ENGAGED

About CMPDI



FIG. – 8.1 CMPDI Corporate Office, Ranchi

Central Mine Planning & Design Institute Limited (CMPDIL) is a Government of India enterprise having its corporate headquarters at Ranchi in India. It is a fully owned subsidiary of Coal India Limited (CIL) and a Schedule – B Company. It is a Mini Ratna (Category I) company since June, 2019. CMPDI is also an ISO 9001: 2015 certified since 28th March, 2017. There are seven Regional Institutes (Asansol, Dhanbad, Ranchi, Nagpur, Bilaspur, Singrauli & Bhubaneswar) headed by Regional Directors. The highest authority of CMPDI is Chairman cum Managing Director (CMD).

Its registered Corporate office is situated at Gondwana Place, Kanke Road, Ranchi-834 008, a capital city of Jharkhand state. It operates through seven strategically located Regional Institutes over six states territories of India.

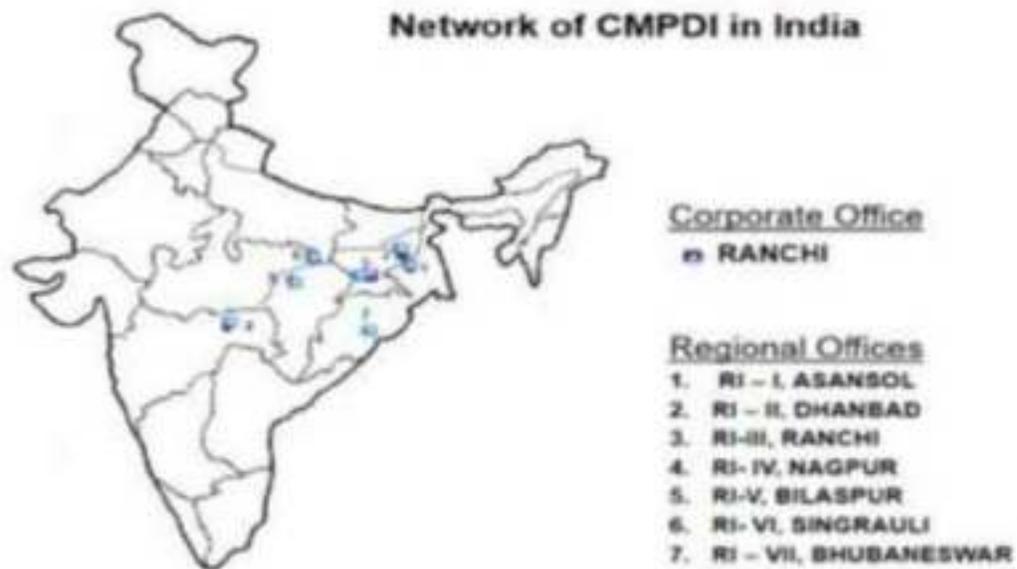


FIG. – 8.2 Locations of Regional Institute of CMPDI

Details of all the seven institutes including its corporate office are given as below:

Sl. No.	Offices	Addresses		Tel / Fax
		Postal	Website	
1	Corporate, Ranchi	Gondwana Place, Kanke Road, Ranchi-834 008, Jharkhand	http://www.cmpdi.co.in	+91 651 2230483, 2230116 / +91 651 2231447, 2232249
2	Regional Institute-I, Asansol	West End, GT Road. Asansol-713 301, West Bengal.	http://www.cmpdi.co.in	+91 341 2253504 / +91 341 2250935
3	Regional Institute-II, Dhanbad	Koyala Bhawan, Koyla Nagar, Dhanbad-826 005, Jharkhand	http://www.cmpdi.co.in	+91 326 2230789, 2230850, 2230103, 2230105/+9132 6 2265575

Sl. No.	Offices	Addresses		Tel / Fax
		Postal	Website	
4	Regional Institute-III, Ranchi	Gondwana Place, Kanke Road, Ranchi-834 008, Jharkhand	http://www.cmpdi.co.in	+91 6512231506 / +91 651 2231501
5	Regional Institute-IV, Nagpur	Kasturba Nagar, Jaripatka, Nagpur-440 014, Maharashtra.	http://www.cmpdi.co.in	+91 0712 2642134 / +91 0712 2643231
6	Regional Institute-V, Bilaspur	SECL Complex, Seepat Road, Bilapur, Chhattisgarh.	http://www.cmpdi.co.in	+91 7752 246482 / +91 7752 246481
7	Regional Institute-VI, Singrauli	CWS Colony, P.O. Jayant Colliery, Sidhi-486 890, Madhya Pradesh.	http://www.cmpdi.co.in	+91 7805 222172 / +91 7805 277600
8	Regional Institute-VII, Bhubaneswar	Samantapuri, Near Janta Maidan, Bhubaneswar-751 013, Orissa.	http://www.cmpdi.co.in	+91 0674 2394760, 2394357, / +91 0674 2395128

All the above regional institutes are dedicated to rendering services to seven subsidiaries of the CIL as flows:

Sl. No.	Institutes	Dedicated to
1	Regional Institute-I, Asansol	Eastern Coal fields Ltd.(ECL)
2	Regional Institute-II, Dhanbad	Bharat Coking Coal Ltd.(BCCL)
3	Regional Institute-III, Ranchi	Central Coalfields Ltd(CCL)
4	Regional Institute-IV, Nagpur	Western Coalfields Ltd(WCL)
5	Regional Institute-V, Bilaspur	South Eastern Coalfields Ltd(SECL)
6	Regional Institute-VI, Singrauli	Northern Coalfields Ltd.(NCL)
7	Regional Institute-VII, Bhubaneswar	Mahanadi Coalfields Ltd(MCL)

CMPDI (HQ.) Ranchi renders services to NEC & Non-CIL clients and specialized assignments for both CIL & non-CIL clients.

Establishment background

The company was formerly known as Coal Mines Authority Limited. And, the Central Mine Planning & Design Institute Limited (herein after called as CMPDI) is a planning & design division of Coal India Limited (hereinafter called as CIL) as per Memorandum of Association of the company. The CIL is a holding company since November 01, 1975, and the CMPDIL is one of its subsidiaries since then. It is under Ministry of Coal, Government of India.

Strength & Resources

Manpower

CMPDI has total Manpower 2977 (832 Executives , 2145 Non Executives) as on 01.05.2022. It has multidisciplinary technical executive professionals who combine innovation and initiative to deliver faster and effective solutions in planning, implementation and management of projects.

Resources

CMPDI is equipped with modern laboratory facilities for undertaking various analytical works to supplement its services. It has well equipped network of six environmental laboratories located in various coalfields to regularly monitor air, water, Soil and noise parameters. **The Environment Laboratory at Ranchi is accredited with NABL (National Accreditation Board for Testing and Calibration Laboratories).** The environment lab is also having recognition of CPCB since 1997 and also working under ISO-9001:2015 Certification. Besides its own strength, CMPDI has access to the vast resources with its principal, CIL, India's largest coal producer and a **Maharatna Company**.

Environment Laboratory at a glance



Fig: 8.3 Environment Laboratory at CMPDI HQ, Ranchi

Recognition

CMPDI is recognized as preferred consultant by Indian and overseas clients, United Nation agencies and international financial institutions, and the company is registered with

- World Bank
- Asian Development Bank
- African Development Bank
- United Nations Development Programme

Main Functional area

The main functional area of the CMPDI is to provide adequate and up-to-date planning, design and technological supports to the CIL and its coal producing subsidiaries to enable them to produce the planned quantity of coal efficiently and economically with due attention to safety, conservation, quality and environment. In addition to these, CMPDI also provides necessary consultancy for clients outside the CIL in India and abroad. The Quality Management System of CMPDI, Ranchi is certified under international standard-ISO 9001:2015, Services covered under are as follows:

1. Consultancy in Mineral Exploration and Environmental Management.
2. Planning & Design in Mining, Civil & Architectural Engineering, Coal Preparation & Utilization, Electrical & Mechanical Engineering, Mining Electronics, Geomatics and Mine Construction.
3. Laboratory testing facilities for the above.
4. Technical & Management Training in Mineral & Mining Sector.

Nature of consultancy rendered

CMPDI has been offering services in the fields enumerated in table below:

Sl.No.	Services offered
1	Exploration & Resource Evaluation
2	Mine Planning & Design Services
3	Infrastructures Engineering
4	Environmental Services
5	Beneficiation Services

Sl.No.	Services offered
6	Management Services
7	Specialized Services
8	Laboratory Services
9	ITC in Mining
10	Research & Development

Exploration & resource Evaluation

New generation exploration technology coupled with skilled manpower has made CMPDI a twenty first century leader in mineral exploration, deposit modeling, resource evaluation, resource management, mining geology, hydro-geological & geophysical studies, engineering geological investigations, etc. Services rendered under this head are described in brief :

Sl. No.	Subheads of Services	Services rendered in
1	Geological Support for mining	Production support or mine development drilling and prediction of faults and pinch / wash outs
		Delineation of roof / floor and dirt bands
2	Drilling	Coring-Diamond rotary drills up to a capacity of 1280 m depth
		Non-coring-Direct rotary and DTH drills for hydro-geological investigations, dewatering, etc.
3	Deposit modelling	Using geo-statistical and geological software packages including MINEX and in-house developed CEMPGEODOC and SASLINT software
4	Resource Evaluation	Deposits of coal, lignite, manganese, iron ore (magnetite and hematite), phosphorite, coal bed methane, etc.
5	Resource Management	Strategic planning for future exploration depending upon market demand.
		Updating of reserve / resource of individual blocks or coalfields.
6	Hydro-geological studies	Systematic ground water investigations.
		Mining hydro-geological studies.

Sl. No.	Subheads of Services	Services rendered in
7	Geo-engineering works	Determination of strength properties of rocks and coal and RQD (Rock Quality Designation) to assess strength characteristics of strata.
8	Master Planning for assessment of resource potential-with respect to CBM (Coal Bed Methane) globally an emerging environment friendly alternate energy source.	Creation of data packages of potential CBM blocks
		Resource evaluation of CBM / CMM / AMM.
		Formulation of policy guidelines for harnessing CB resources.
		Implementation of CIL-ONGC Consortiums venture in developing CBM in coalfields.

To provide quality services, CMPDI is effectively utilizing technology like remote sensing, combination drilling (coring and non-coring), multi-probe geophysical borehole logging, seismic refraction survey, etc.

CMPDI has already undertaken over 500 integrated exploration projects in varying geological and terrain conditions.

Mine Planning & Design Services

CMPDI is a premier consultant in open pit and underground mine planning & design in coal, lignite and other minerals. It has prepared more than 950 mining project reports with individual capacity up to 70 Million tonne per annum. CMPDI uses advance software like MINEX for resource modeling, mine planning and scheduling of open cast and underground mine projects. It has helped its subsidiaries to achieve unprecedented production growth from open cast mines in their organizations. Its experience in mechanized underground mining technology spans exploitation of coal seams from 1.00 m to 20 m thickness, at different gradients from flat to 75^o; with soft to extremely hard coal; liable to spontaneous heating and gassiness and under varying roof strata conditions. Services offered to are manifold and are enumerated briefly blow:

SI No.	Services Offered
1	Master planning of coalfield
2	Perspective planning
3	Conceptual engineering studies
4	Techno-economic feasibility studies
5	Detailed project reports
6	Detailed engineering with working drawings
7	Mine ventilation and transport planning
8	Operational planning
9	Mining plans for mining lease
10	Mine capacity assessment
11	Performance analysis of equipment
12	Prediction of surface subsidence through numerical modeling software.
13	Geo-physical logging, Seismic survey, Resistivity survey etc.

Infrastructure Engineering

CMPDI provides engineering logistic or support services for development of infrastructure. It has developed multi-disciplinary engineering skills for implementing projects of various complexities. In particular, it has offered complete planning and design services for architectural planning, civil, structural, electrical and mechanical engineering in various projects; important of them are enumerated here:

SI No.	Services Offered
1	Planning of large capacity, high speed bulk material handling plants.
2	Turnkey execution of coal handling plants.
3	Planning of high voltage sub-stations.
4	Planning of workshops of various types and capacities.
5	Township planning including roads, water supply, water supply system, drainage, water / sewerage treatment plants and detailed planning and design of all township infrastructure.
6	Site selection for pit head thermal power plants based on remote sensing data.
7	Rail corridor alignment through remote sensing

8	Techno-economic feasibility study of captive power plants based on pulverized coal and FBC technology.
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Environmental Services

CMPDI holds a position of eminence in the field of environmental planning, impact assessment, management and environmental engineering in coal and other sectors. **CMPDI is accredited by National Board of Education and Training (NABET), an organ of Quality Council of India (QCI), New Delhi as an EIA consulting organization for four sectors namely Mining of Minerals including opencast/underground mining, Offshore and Onshore oil and Gas exploration, development & production, Thermal power plants and Coal Washeries.** CMPDI has prepared more than 600 EMPs for coal mining projects (incl. washery & clusters) and obtained Environment Clearance for more than 450 projects. Also, CMPDI has prepared Mine Closure Plans for more than 425.

Environmental Services Rendered by CMPDI:

- Environmental Impact Assessment/ Environmental Management Plan
- Regional Environmental Management Plan
- Routine Environmental Monitoring and Base data generation.
- Planning & design of Sewage Treatment Plants (STPs)
- Design of Effluent Treatment Plants (ETPs) for coal projects
- Schemes for Rainwater Harvesting
- Environmental Statements (Audit Report)
- S&T / R&D studies
- Final Mine Closure Plan for UG & OC projects
- OB Dump Reclamation Action Plan for OC projects
- Study of Environmental Problems of Eco-Sensitive Regions
- Studies related to disposal of fly ash in abandoned mines

A few of the new areas in which CMPDI has diversified are environmental & hydrogeological studies for disposal of fly ash, development of air quality model,

bio-treatment of industrial effluents, carrying capacity base development planning, watershed modeling and rain water harvesting. Services offered with respect to environmental quality; monitoring, engineering, management and planning are briefly given as below:

Sl. No.	Subheads of Services	Services rendered
1	Environmental Monitoring	Air quality
		Water quality
		Noise level
		Soil Quality
		Micro-meteorological studies
		Stack monitoring
2	Environmental Laboratory facilities	Air Analysis:
		Suspended Particulate Matter
		Respirable Particulate Matter (PM ₁₀ & PM _{2.5})
		Oxides of Sulphur (SO _x)
		Oxides of Nitrogen (NO _x)
		Carbon Monoxide (CO)
		Total Hydro Carbon (C _n H _n)
		Total Dust (Settleable)
Water Analysis:		
Physical Parameter - pH, Colour, Temp, Turbidity		
Suspended Solids, Dissolved Solids, etc.		
Chemical and Biological (BOD, COD, Heavy Metals and trace elements as per statutory requirement)		
Soil:		
Soil Texture, Porosity, Bulk Density, pH Elect.		
Conductivity, Water holding capacity, Infiltration Rate		
Cation Exchange Capacity, Organic Carbon, Phosphorous, Potash Nitrogen etc.		
Noise:		
Noise Intensity Survey		
Leq Value of Noise		
3	Environmental Engineering	Water treatment plants
		Industrial / Municipal effluent treatment and recycling plants
		Hazardous waste disposal site engineering
		Municipal effluent disposal site engineering
4	Natural Resource management	Land use planning
		Rain water harvesting
		Watershed management plans

Sl. No.	Subheads of Services	Services rendered
5	Regional planning	Regional environment management plans
		Regional environment status plans
6	Environment Assessment plans	Environment Assessment plans
7	Special studies	Review of existing mining and environment policies, legislations, standards and mechanisms for monitoring compliance, institutional strengthening for regulatory and counterpart institutions.
		Study of environmental problems and action plan for restoration of environmental quality, Mine closure planning.

Beneficiation Services

CMPDI specializes in planning, design and construction of new washeries and modification of existing washeries for coal and mineral beneficiation. Services with respect to beneficiation offered to are given as below:

SI No.	Services Offered to for
1	Planning of coal and mineral beneficiation plants.
2	Preparation of feasibility / project reports including macro level analysis, washability studies, environmental impact assessment and techno-economic analysis.
3	Technical studies, performance evaluation and operation & maintenance related consultancy for existing washeries.
4	Pilot scale studies and trials.

Management Services

Following descript management services enumerated in table below, have been offered by CMPDI to different organizations or bodies.

Sl. No.	Subheads of Services	Services rendered for
1	Coal Investment promotion Services	Assistance to Government of India in identification and assessment of coal mining properties for investments through private sector participation.
2	Quality Management Services	Consultancy for implementation, certification and maintenance of ISO 9001 Quality Management System and its industry specific translations
3	Human Resource Management	Creating knowledge and skill based workforce, CMPDI through its Staff Training College (STC) imparts training to its clients' personnel. Under UNDP, CMPDI has trained professionals from Nigeria, Sultanate of Oman and North Korea. Through its STC it has organized training programmes under five major categories such as (i) Technical (ii) Managerial (iii) Computer application, (iv) Quality Skills, (v) Quality System, etc. It has also organized & conducted off-campus training programmes with respect to Quality System at various subsidiaries of the CIL

CMPDI diversified into management system consultancy in 1998. While continuing to provide consultancy for ISO 9001 Quality Management System (QMS) and ISO 14000 Environmental Management System (EMS), it made forays into consultancy for ISO 17025:2017 (Testing and calibrating laboratories) under consultancy scope as:

- Creation of Management system.
- Providing training support.
- Implementation, certification and post certification support.

Specialized Services

With a view to catering to specific requirements of clients, CMPDI has been providing field oriented specialized services to its clients. Descript services rendered under this category have been remote sensing, terrestrial survey, blasting, ventilation design & gas assessment in underground mines, energy

audit and non-destructive testing. Main services rendered are described in brief here:

Sl. No.	Subheads of Services	Services rendered in
1	Geomatics	Geomatics services in mining sector ranging from topographical survey, base line data generation and monitoring of land use / land cover for environmental management, water resource survey and coal mine fire mapping. It has also imparted expertise services in the fields of remote sensing applications, terrain mapping, co-relation survey for underground mines, GPS / GIS survey, cartography and digital image processing.
2	Blasting	Carrying out controlled blasting & ground vibration study, vibration monitoring, fragmentation improvement studies, random sampling and testing of explosive and accessories and performance evaluation of new explosives with sophisticated testing equipment in both coal and non-coal sectors.
3	Non-destructive Testing (NDT)	Services for Non-destructive testing of components of machinery, installations and other structural elements have been provided on site during periodic maintenance to avoid accidental failure.
4	Ventilation and Gas Survey	CMPDI has been offering services for ventilation monitoring, planning and design of ventilation system including gas assessment and testing for underground mines.
5	Energy Audit	CMPDI is empaneled as an accredited energy auditor with Govt. of West Bengal and Petroleum Conservation Research Association (PCRA) under ministry of Petroleum and Natural Gas, Govt. of India. Over 130 reports on electrical and diesel energy conservation have been prepared.
6	Inspection Services	CMPDI has been rendering pre-dispatch third party inspection services for plants and equipment at the manufacturers workstations for materials procured by its clients.
7	Captive power plants	Reports on optimum utilization, conceptual notes and tender documents.

Laboratory Services

CMPDI has well-equipped laboratories for carrying out investigations and analysis for geo-chemical, petrography, coal washability and geo-mechanic

properties.

For coal and lignite characterization, CMPDI has laboratories with highly skilled manpower and state of art equipment. The data generated by these laboratories form basis for characterization and grading of coal in exploration, mine feasibility reports, washery designs and down-stream utilization. Brief description of Laboratory Services rendered by CMPDI is given as below:

Sl. No.	Subheads of Services	Services rendered in
1.	Environment Laboratory	CMPDI has a well-equipped environmental laboratory to undertake the entire spectrum of environmental studies. The environmental laboratory is recognized by NABL & Central Pollution Control Board, Ministry of Environment & Forests, Government of India and accredited with ISO-9001:2015 certification.
2	Geo-chemical Laboratory	CMPDI has been rendering geo-chemical analysis like proximate & ultimate analysis, GCV determination of coal and lignite and other special tests through microprocessor based automatic calorimeter and analyzer.
3	Petrographic Laboratory	CMPDI has been carrying out evaluation for hydro carbons, oil shales and coal bed methane for coal coke and source rock through sophisticated microscopes, identifying mineral phases in coal, rocks and metals through X-Ray diffractometer, and Micro-area analysis & cleat studies for CBM through Scanning Electron Microscope accredited by International Committee for Coal and Organic Petrology (ICCP).
4	Mining Laboratory	CMPDI has been determining physico-mechanical properties of rocks for design inputs for mine planning and other technical services and undertaking testing of roof supports and building materials for design support systems for underground workings.
5	Washery Laboratory	CMPDI has been determining washability characteristics of coarse, small and fine coal and shattering & pulverizing characteristics of coal for assistance in planning and design of coal beneficiation plants.

ITC Services in Mining

CMPDI has been gearing up itself fully meet challenges of IT sector requisite for mining industries as per IT implementation scheme with a view to revolutionizing

mining industry and mining operations in coming years. IT services provided by CMPDI have been as tabulated here:

SI No.	Services Offered to for
1	Mine communication and mine safety systems
2	Establishing internet and internet facilities
3	Real time fleet management system for large opencast mines using GIS & GPS.
4	Land information system using enterprise GIS.

R & D Services

The Research & Development activities in coal and lignite is being administered through the Scientific Advisory Committee (SSRC) with Secretary (Coal) as its Chairman. The committee is entrusted with the task of planning, budgeting and overseeing the implementation of R & D programme in coal & lignite sector and also for application of research findings. And, CMPDI is the Nodal Agency to coordinate S & T / R &D activities in coal and lignite Sector and assist SSRC in areas mentioned herein after.

CMPDI applied research and development in the field of mining, beneficiation, utilization, environment, exploration, etc. serving as nodal agency for all S & T schemes funded by Ministry of Coal and R & D schemes funded by R & D Board of the CIL (constituted in August 1995). Field oriented research projects including transfer and absorption of new technology concerning main areas of coal research have been as follows:

- Production, productivity and safety.
- Coal beneficiation and utilization.
- Environment and Ecology.

ANNEXURE-1

155502/2022/FC

File No.8-25/2021-FC

169

Government of India
Ministry of Environment, Forest and Climate Change
(Forest Conservation Division)

Indira Paryavaran Bhawan,
Jorbagh Road, AIGanj,
New Delhi - 110003.
Dated: 2 April, 2022

To,
The Addl. Chief Secretary (Forests),
Government of Odisha,
Bhubaneswar.

Sub: Proposal for non-forestry use of 349.709 ha forest land in favour of M/s Mahanadi Coalfields Limited for Sarmal Opencast Coal Mining Project in Sundergarh District (Odisha) – reg.

Sir,

I am directed to refer to the Government of Odisha's letter No. FE-DIV-FLD-0118-2021-16201/ FSBCC dated 13.09.2021 on the above subject seeking prior approval of the Central Government under Section 2 of the Forest (Conservation) Act, 1980 and letter no. 18581/9F(MG)-35/2021 dated 03.11.2021, 2466/9F(MG)-35/2021 dated 08.09.2022 and 3992/9F(MG)-35/2021 dated 22.03.2022 forwarding additional information as sought by the Ministry vide its letters of even number dated 5.10.2021, 24.12.2021 and 8.03.2022 and to say that the proposal has been examined by the Forest Advisory Committee constituted by the Central Government under Section - 3 of the aforesaid Act.

After careful examination of the proposal of the State Government and on the basis of the recommendations of the Forest Advisory Committee, and approval of the same by the competent authority of the MoEF&CC, New Delhi, the Central Government hereby accords 'in-principle' approval under Section - 2 of the Forest (Conservation) Act, 1980 for non-forestry use of 349.709 ha forest land in favour of M/s Mahanadi Coalfields Limited for Sarmal Opencast Coal Mining Project in Sundergarh District (Odisha) subject to fulfilment of the following conditions:

A. Conditions which need to be complied prior to handing over of forest land by the State Forest Department and compliance is to be submitted prior to Stage-II approval

1. Compensatory Afforestation:

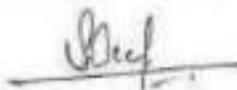
- i. The cost of compensatory afforestation at the prevailing wage rates as per compensatory afforestation scheme and the cost of survey, demarcation and erection of permanent pillars, if required on the CA land, shall be deposited in State CAMPA account, through e-challan, by the user agency. The CA will be maintained for 10 years. The scheme may include afforestation of indigenous species with appropriate provision for anticipated cost increase for works scheduled for subsequent years;
- ii. The KML files of diverted area, the CA areas, the proposed SMC treatment area and the WLMP area shall be uploaded on the e-Green watch portal with all

655502/2022/FC

File No.B-25/2021-FC

1691

- requisite details prior to Stage II approval;
2. The User Agency shall transfer the funds towards the cost of Net Present Value (NPV) of the forest land being diverted under this proposal in accordance with the MoEF&CC's guidelines dated 6.01.2022 read with guidelines dated 19.01.2022;
 3. Compensatory levies to be realized from the User Agency under the project shall be transferred/ deposited, through e-challan, in to the account of CAMPA pertaining to the State concerned through e-portal (<https://parivesh.nic.in/>);
 4. Following activities, as per approved plan / schemes, shall be undertaken in the lease area by the User Agency under the supervision of the State Forest Department. Approved scheme/plan shall be submitted to the Ministry along with compliance of Stage-I approval:
 - i. Mitigative measures to minimize soil erosion and choking of stream shall be implemented within a period of three year with effect from the issue of Stage-II clearance in accordance with the approved Plan in consultation with the State Forest Department.
 - ii. Planting of adequate drought hardy plant species and sowing of seeds, in the appropriate area within the mining lease to arrest soil erosion in accordance with the approved scheme;
 - iii. Construction of check dams, retention /ton walls to arrest sliding down of the excavated material along the contour in accordance with the approved scheme;
 - iv. Stabilize the overburden dumps by appropriate grading/benching, in accordance with the approved scheme, so as to ensure that angles of repose at any given place is less than 25%; and
 - v. No damage shall be caused to the top-soil and the user agency will follow the top soil management plan.
 5. Chattajornallah located in the area has been proposed to be straightened by the user agency. Also a number of mines are operational in the area which may cause threat to hydrological regime viz. Sasundhara river and its rivulets, therefore, a study on hydrological regimes of the area will be undertaken in consultation with the Water Resource Department and the same shall be submitted along with considered opinion of Water Resource Department of the State on the proposed straightening of Chattajo rnallah and proposed mitigating measures before stage-II approval;
 6. A Soil and Moisture Conservation (SMC) work plan to mitigate the impact of the proposed mining activity on the local rivulets (nallah) shall be prepared by the user agency in consultation with the State Forest Department and the same shall be submitted along with Stage-I compliance. Cost of implementation of the provisions of the said Plan will be deposited into the CAMPA and the same shall be intimated to the Ministry before Stage-II approval.
 7. User agency either himself or through the State Forest Department shall undertake gap planting and soil & moisture conservation activities to restock and rejuvenate the degraded open forests (having crown density less than 0.40), if any, located in the area within 100 meter from outer perimeter of the mining lease. The plan for plantation and SMC activities will be prepared and submitted to MoEF&CC before Stage-II Clearance;
 8. The User Agency shall prepare a list of existing village tanks and other water bodies with GPS co-ordinates located within five km from the mine lease boundary. This list is to be duly verified by the concerned Divisional Forest



655502/2022/FC

File No.8-25/2021-FC

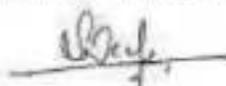
1692

- Officer. The User Agency shall regularly undertake desilting of these village tanks and other water bodies so as to mitigate the impact of siltation of such tanks/water bodies. A detailed approved plan for desilting of identified ponds and water bodies to be prepared in consultation with forest department and shall be submitted to MoEF& CC before Stage-II approval;
9. **Safety Zone Management:** Following activities, at project cost, shall be undertaken by the user agency for the management of safety zone as per relevant guidelines issued by the Ministry's guidelines:
- i. User agency shall ensure demarcation of safety zone (7.5 meter strip all along the inner boundary of the mining lease area), and its fencing, protection and regeneration by erecting adequate number of 6 feet high RCC boundary pillars inscribed with DGPS coordinates with barbed wire fencing and deploying adequate number of watchers under the supervision of the State Forest Department;
 - ii. Boundary of the safety zone of the mining lease, adjacent to habitation/roads, should be properly fenced by the user agency;
 - iii. Safety zone shall be maintained as green belt around mining lease and to ensure dense canopy in the area, regeneration shall be taken up in this area by the user agency at project cost under the supervision of the State Forest Department;
 - iv. Afforestation on degraded forest land to be selected elsewhere, measuring one and a half times the area under safety zone, shall also be done at the project cost under the supervisions of the State Forest Department. The degraded forest land (DFL) so selected will be informed to the MoEF& CC with shape files before Stage-II approval and afforestation will be done within three years from the date of Stage-II clearance and maintained thereafter in accordance with the approved Plan in consultation with the State Forest Department; and
 - v. The State Government and the user agency shall ensure that safety zone is maintained as per the prescribed norms;
9. The cost of felling of trees shall be deposited by the User Agency with the State Forest Department;
10. *Site specific Wildlife Management Plan to mitigate the impact of project on wildlife of the area shall be prepared by the state Government in consultation with the PCCF & Chief Wildlife Warden of State at project cost and an approved copy of the same along with detail of deposition of funds into the CAMPA account shall be submitted to the Ministry along with Stage-I compliance;*
11. State Government shall complete settlement of rights, in term of the Scheduled Tribes and Traditional Forest Dwellers (Recognition of Forest Rights) Act, 2006, if any, on the forest land to be diverted and submit the documentary evidence, along with compliance of Stage-I approval, as prescribed by this Ministry's letter No. 11-9/1998-FC (Pt.) dated 03.08.2009 read with 05.07.2013, in support thereof; and
12. The compliance report shall be uploaded on e-portal (<https://parivesh.nic.in/>).
8. **Conditions which need to be complied on field after handing over of forest land to the user agency by the State Forest Department but the compliance in form of undertaking shall be submitted prior to Stage-II approval**
1. Legal status of the diverted forest land shall remain unchanged;
 2. The Compensatory afforestation over degraded forest land, double in extent to



635502/2022/FC

- the forest land being diverted i.e. 712.477 ha. shall be raised by the State Forest Department at the project cost within three years from the date of grant of Stage - II approval;
3. Boundaries of forest land of 5.256 ha granted on patta, within the patch of 129 ha of degraded forest land proposed for CA, shall be demarcated and digitized and the same shall be submitted to the concerned IRO, along with digital Differential GPS map of 129 ha. The area shall be monitored regularly, on annual basis, to ensure no further encroachment beyond FRA patta land takes place in future;
 4. At the time of payment of the Net Present Value (NPV) at the present rate, the user agency shall furnish an undertaking to pay the additional amount of NPV, if so determined, as per the final decision of the Hon'ble Supreme Court of India;
 5. Trees should be felled in phased manner as per the requirement in the approved Mining Plan with prior permission of concerned DFO;
 6. The user agency shall explore the possibility of translocation of maximum number of trees identified to be felled and shall ensure that any tree felling shall be done only when it is unavoidable and that too under strict supervision of the State Forest Department;
 7. The User Agency shall undertake mining in a phased manner after taking due care for reclamation of the mined over area. The concurrent reclamation plan as per the approved mining plan shall be executed by the User Agency from the very first year, and an annual report on implementation thereof shall be submitted to the Nodal Officer, Forest (Conservation) Act, 1980, in the concerned State Government and the concerned Regional Office of the Ministry. If it is found from the annual report that the activities indicated in the concurrent reclamation plan are not being executed by the User Agency, the Nodal Officer or the concern Add. Principle Chief Conservator of Forests (Central) may direct that the mining activities shall remain suspended till such time, such reclamation activities are satisfactorily executed;
 8. The User Agency shall comply with the Hon'ble Supreme Court order on re-grassing, and re-grass the mining area and any other areas which may have been disturbed due to mining to restore them to a condition which is fit for growth of fodder, flora, fauna, etc. in a timely manner;
 9. Period of diversion of the said forest land under this approval shall be for a period co-terminus with the period of the mining lease proposed to be granted under the Mines and Minerals (Development and Regulation) Act, 1957, as amended and the Rules framed there-under;
 10. The User Agency shall obtain the Environment Clearance as per the provisions of the Environmental (Protection) Act, 1986, if required;
 11. No labour camp shall be established on the forest land and the User Agency shall provide fuels preferably alternate fuels to the labourers and the staff working at the site so as to avoid any damage and pressure on the nearby forest areas;
 12. The boundary of the diverted forest land, mining lease and safety zone, as applicable, shall be demarcated on ground at the project cost, by erecting four feet high reinforced cement concrete pillars, each inscribed with its serial number, distances from pillar to pillar and GPS coordinates;
 13. The layout plan of the mining plan/ proposal shall not be changed without the prior approval of the Central Government and the forest land shall not be used for any purpose other than that specified in the proposal;



655502/2022/FC

File No.8-25/2021-FC

1694

14. The forest land proposed to be diverted shall under no circumstances be transferred to any other agency, department or person without prior approval of the Central Government;
15. No damage to the flora and fauna of the adjoining area shall be caused;
16. The User Agency shall submit the annual self-compliance report in respect of the above stated conditions to the State Government, concerned Regional Office and to this Ministry by the end of March every year regularly;
17. Any other condition that the concerned Regional Office of this Ministry may stipulate with the approval of competent authority in the interest of conservation, protection and development of forests & wildlife;
18. The user agency shall comply all the provisions of the all Acts, Rules, Regulations, Guidelines, Hon'ble Court Order (s) and NGT Order (s) pertaining to this project, if any, for the time being in force, as applicable to the project; and
19. Violation of any of these conditions will amount to violation of Forest (Conservation) Act, 1980 and action would be taken as prescribed in para 1.21 of Chapter 1 of the Handbook of comprehensive guidelines of Forest (Conservation) Act, 1980 as issued by this Ministry's letter No. 5-2/2017-FC dated 28.03.2019.

After receipt of compliance report on fulfilment of the conditions mentioned above, the proposal shall be considered for final approval under Section-2 of the Forest (Conservation) Act, 1980. Transfer of forest land shall not be affected till final approval is granted by the Central Government in this regard.

Yours faithfully,
 Sd/-
(Sandeep Sharma)

Assistant Inspector General of Forests

Copy to:

1. The PCCF (HoFF), State Forest Department, Government of Odisha, Bhubaneswar
2. The PCCF & Nodal Officer (PCA), O/o PCCF, State Forest Department, Government of Odisha, Bhubaneswar
3. The Regional Officer (Central), Integrated Regional Office of MoEF&CC at Bhubaneswar
4. User Agency
5. Monitoring Cell, FC Division, MoEF&CC, New Delhi
6. Guard File

Signed by Sandeep Sharma
Date: 21-04-2022 16:28:24
Reason: Approved

ANNEXURE-2

4F

16/03/22

OFFICE OF THE RANGE OFFICER GOPALPUR RANGE, GOPALPUR
 Email: rangeofficer@gopalpur@gmail.com
 Memo No. 119^(A) / date 16/03/2022

To: The Divisional Forest Officer,
Sundargarh Forest Division

Sub: Compliance of observation of FNC regarding Soil & Moisture Conservation (SMC) work plan in its meeting held on 21.02.2022 for the proposal of non-forestry use of 349 700 ha. of forest land within total mining lease area of 2250 449 ha in Starbhal OCP of Mahanadi Coalfields Limited.

-Submission of Identity 357 ha forest land for SMC work regarding.

Ref- Memo No.130049/Mac/Dt.11.03.2022 of the Divisional Forest Officer, Sundargarh Division.

Sr. In reference to your Memo No. cited above, joint survey done with MCL staff for search of suitable catchment area towards upstream of Basundhara River at nearest non-coal bearing forest area.

An area of 357 ha forming catchment area for Basundhara River is identified in Jankan Reserve Forest of Gopalpur Range.

Following are the details of the identified SMC area:

1. Basundhara River flows from North to South direction as per natural slope.
2. The Length of Basundhara River across the identified area is 3.40 km.
3. The catchment area identified is in adjacent (West direction) to the CA land Starbhal OCP, and Basundhara River is flowing almost between both areas from North to South.

This is to inform you that identified land is suitable for soil and Moisture Conservation (SMC) work for increasing ground water level, mitigating soil erosion and moisture management in the catchment Treatment Area.

This is for favour of your kind information and necessary action.

Encl- 1. Topo-sheet showing SMC area
 2. Co-ordinate of the identified SMC Area
 3. Softcopy of KM.

Yours faithfully,

 Gopal Krishna Singh
 Forest Officer, Sundargarh Forest Division



Plates

PLATE-1: STUDY AREA MAP W.R.TO. SIARMAL OC

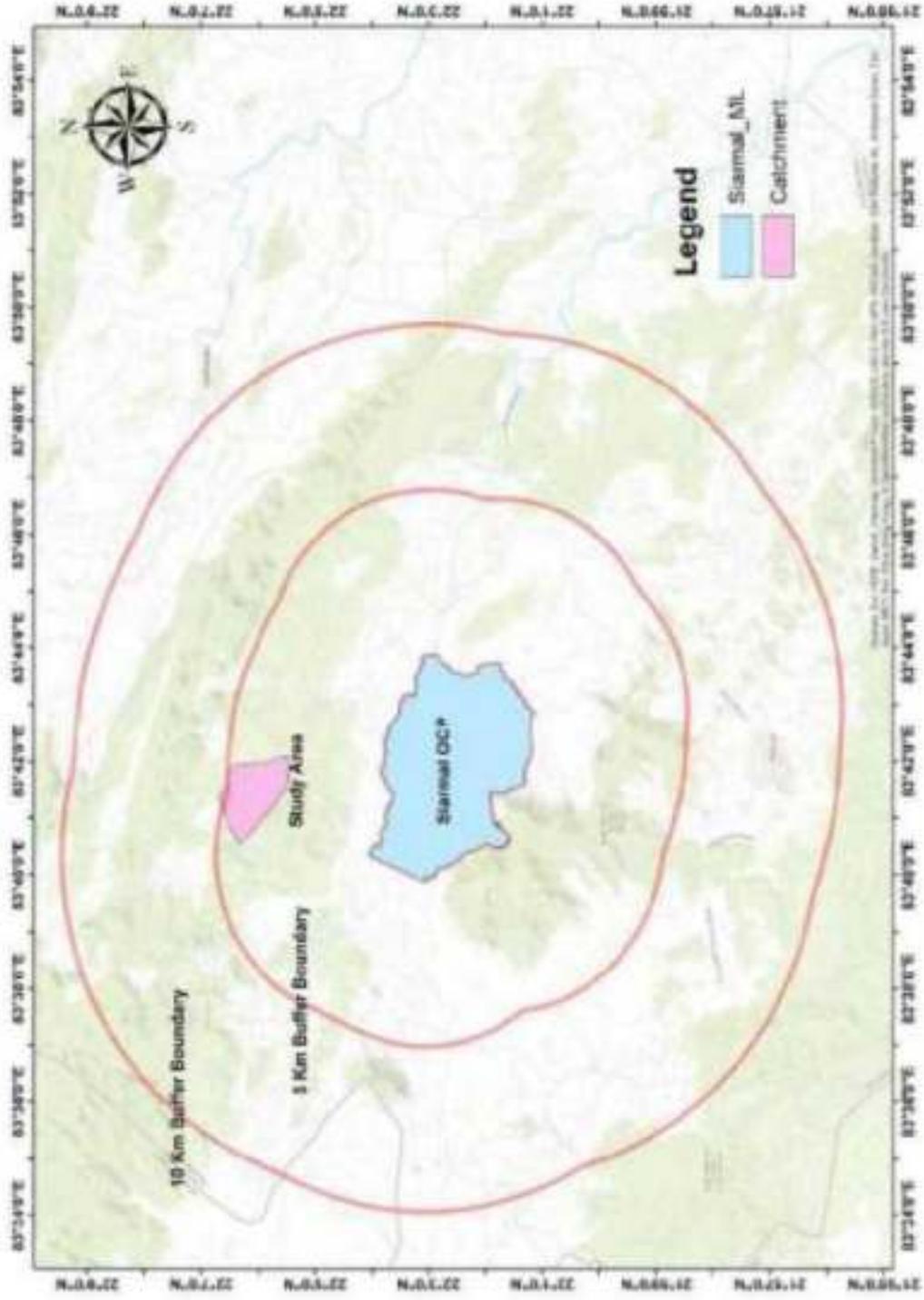


PLATE-3: TOPOSHEET MAP OF THE STUDY AREA

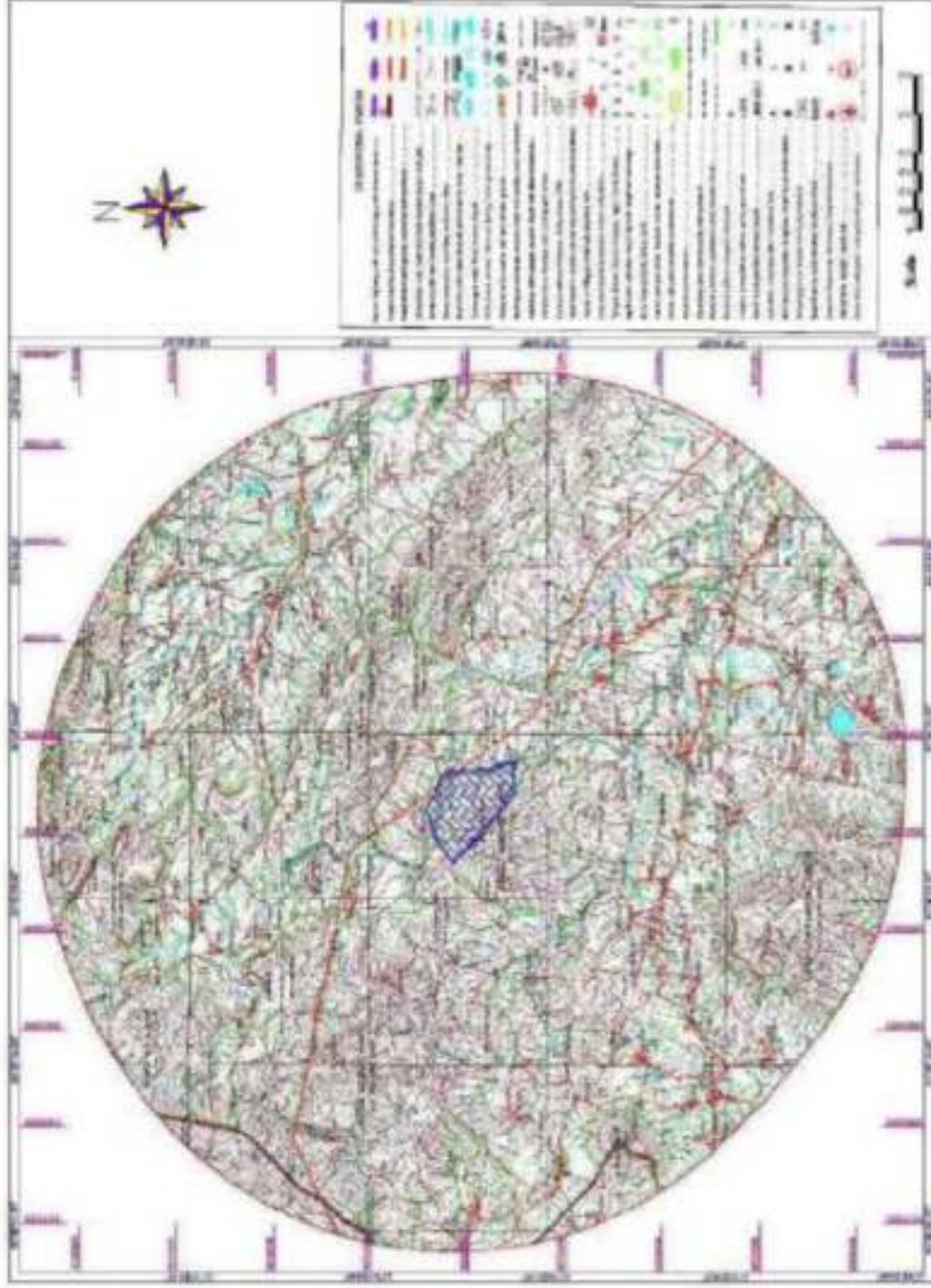


PLATE-4: STUDY AREA MAP

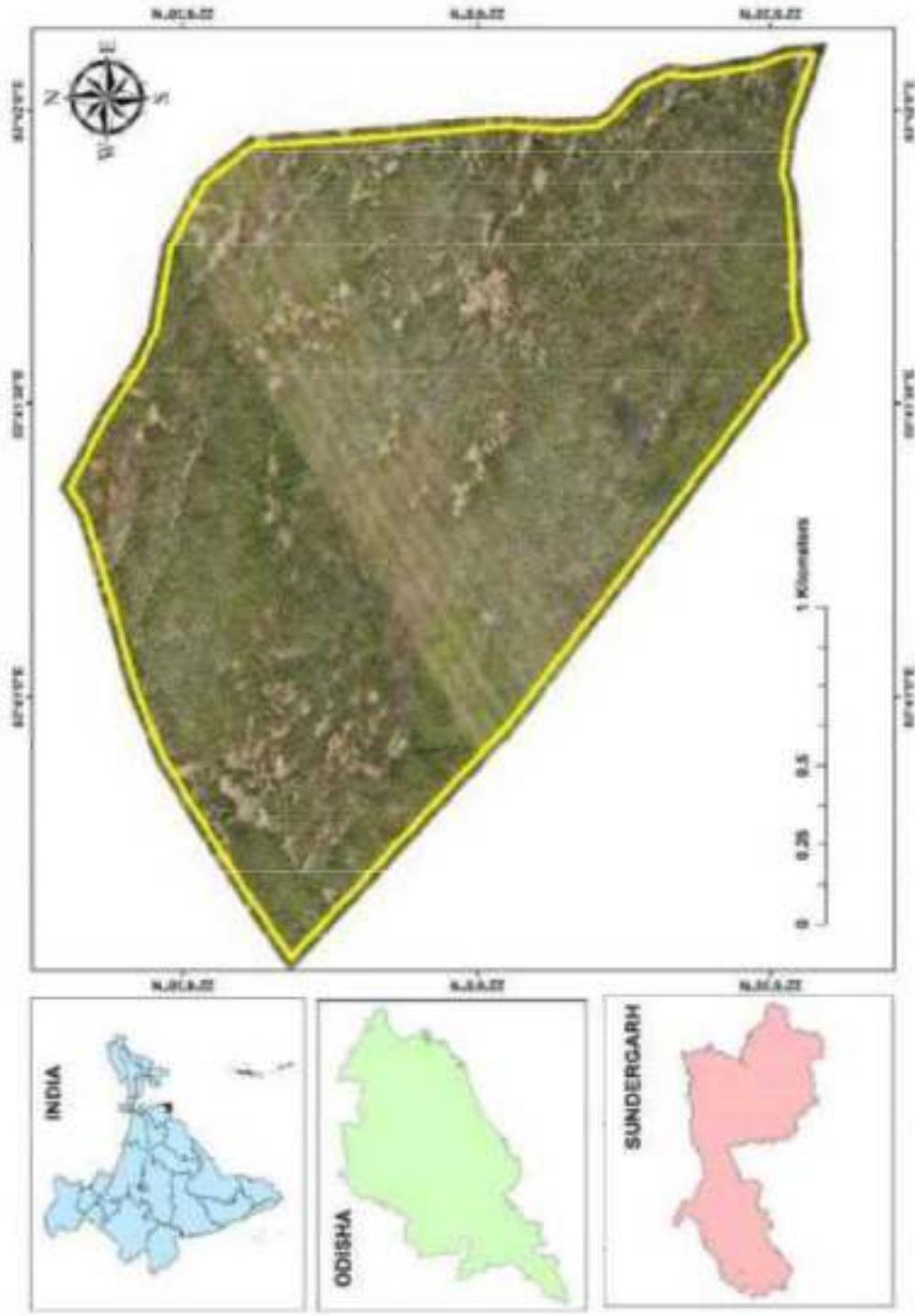


PLATE-5: ORTHOMOSAIC IMAGE

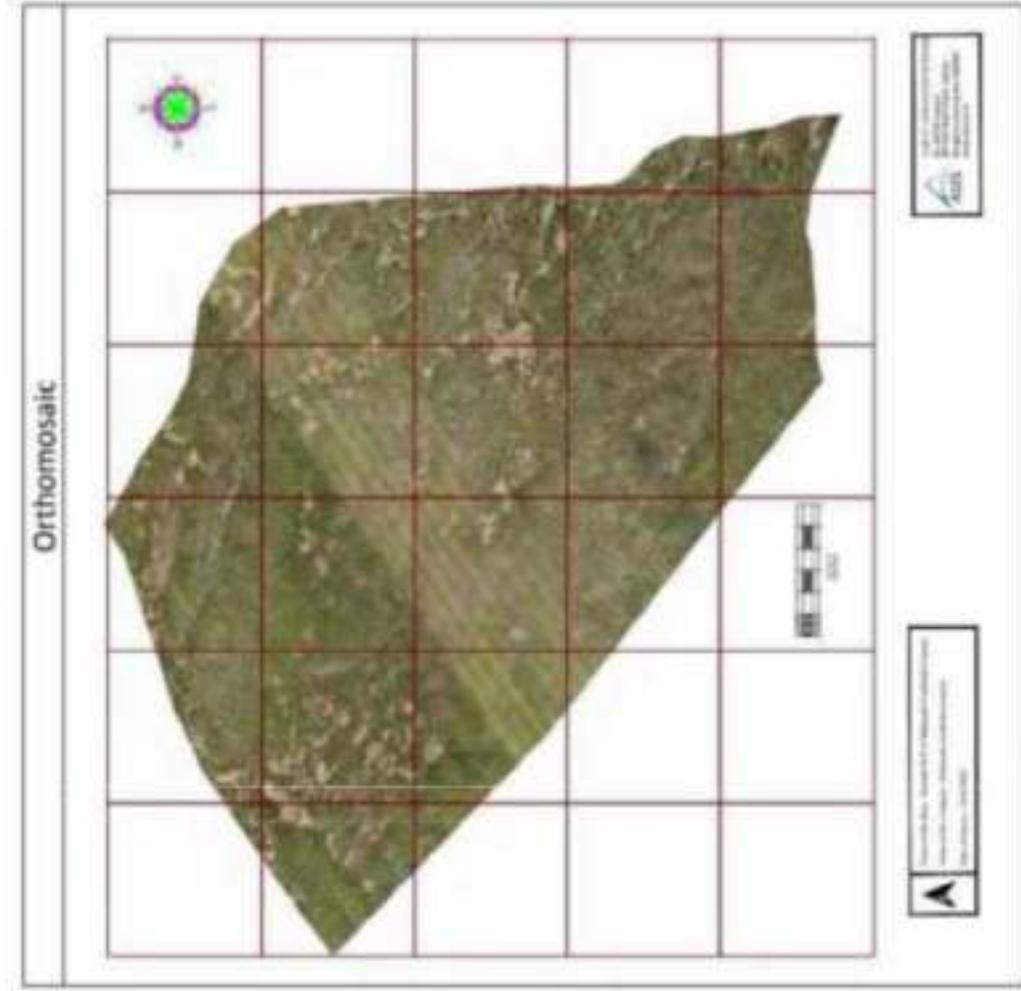


PLATE-7 LOCATION OF PROPOSED CONTOUR TRENCHES

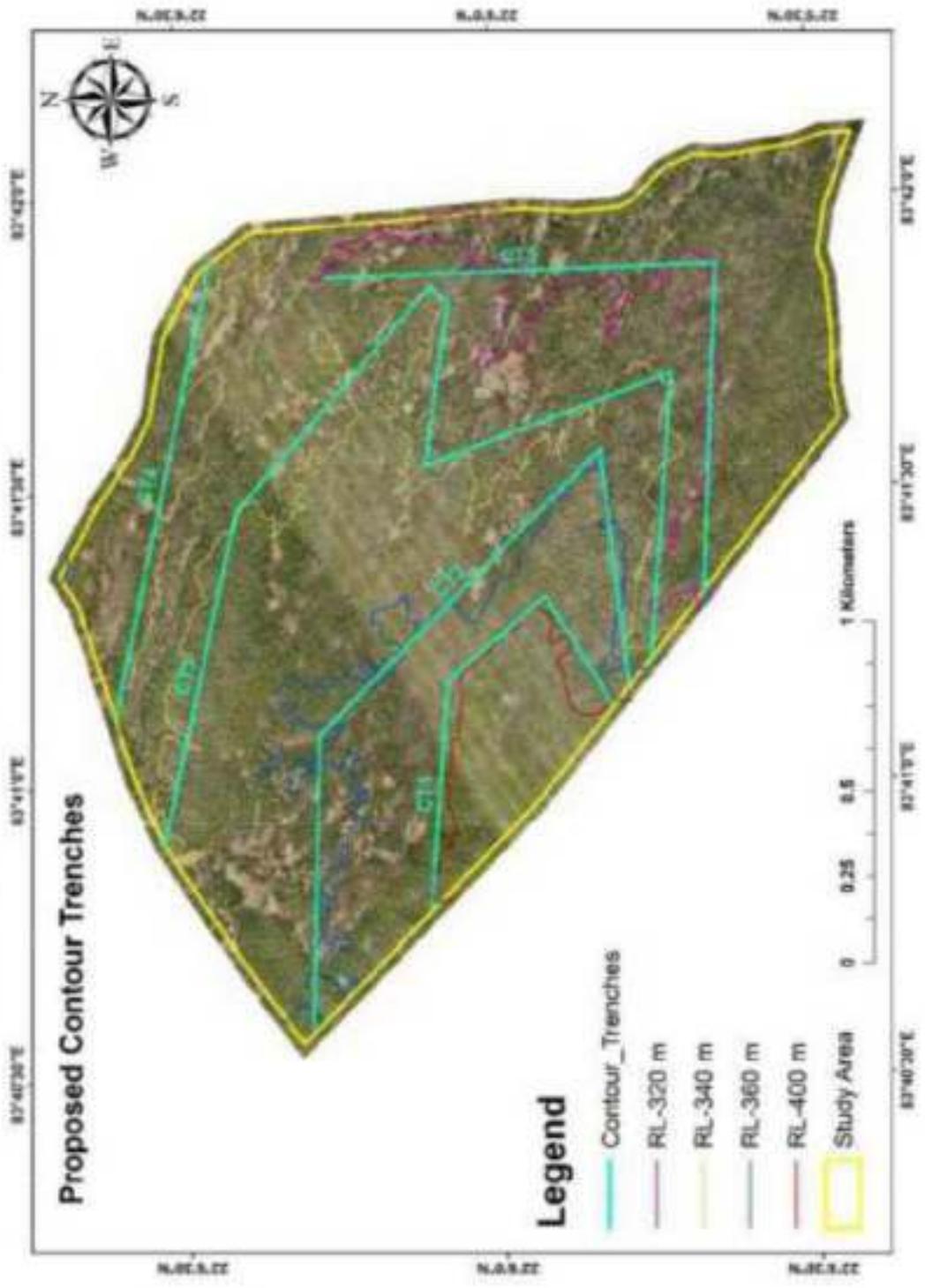


PLATE-8 PROPOSED LOCATION FOR GRASSING



PLATE-9 PROPOSED LOCATION FOR MULCHING

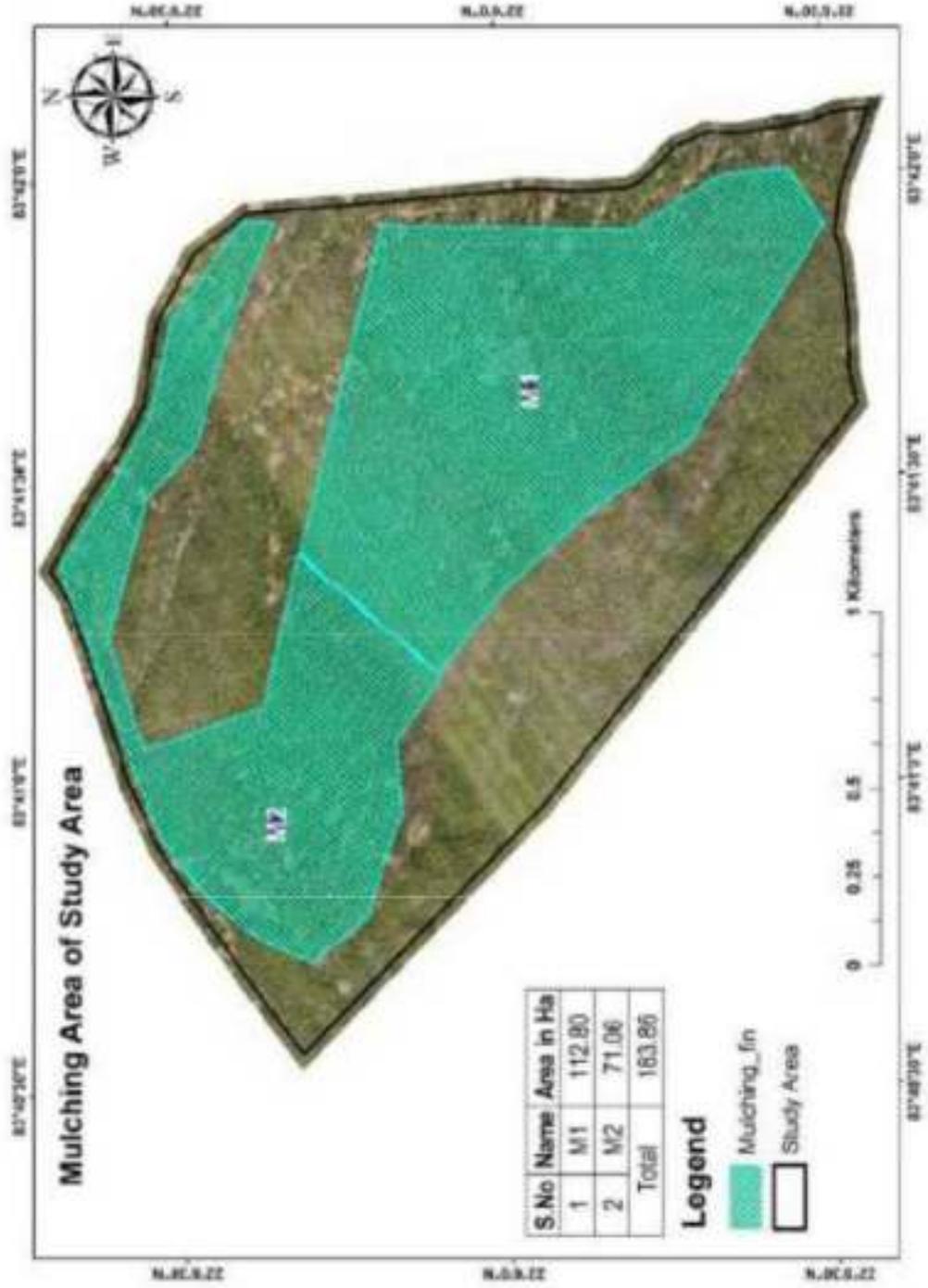


PLATE-10 LOCATION OF PROPOSED CHECK DAMS

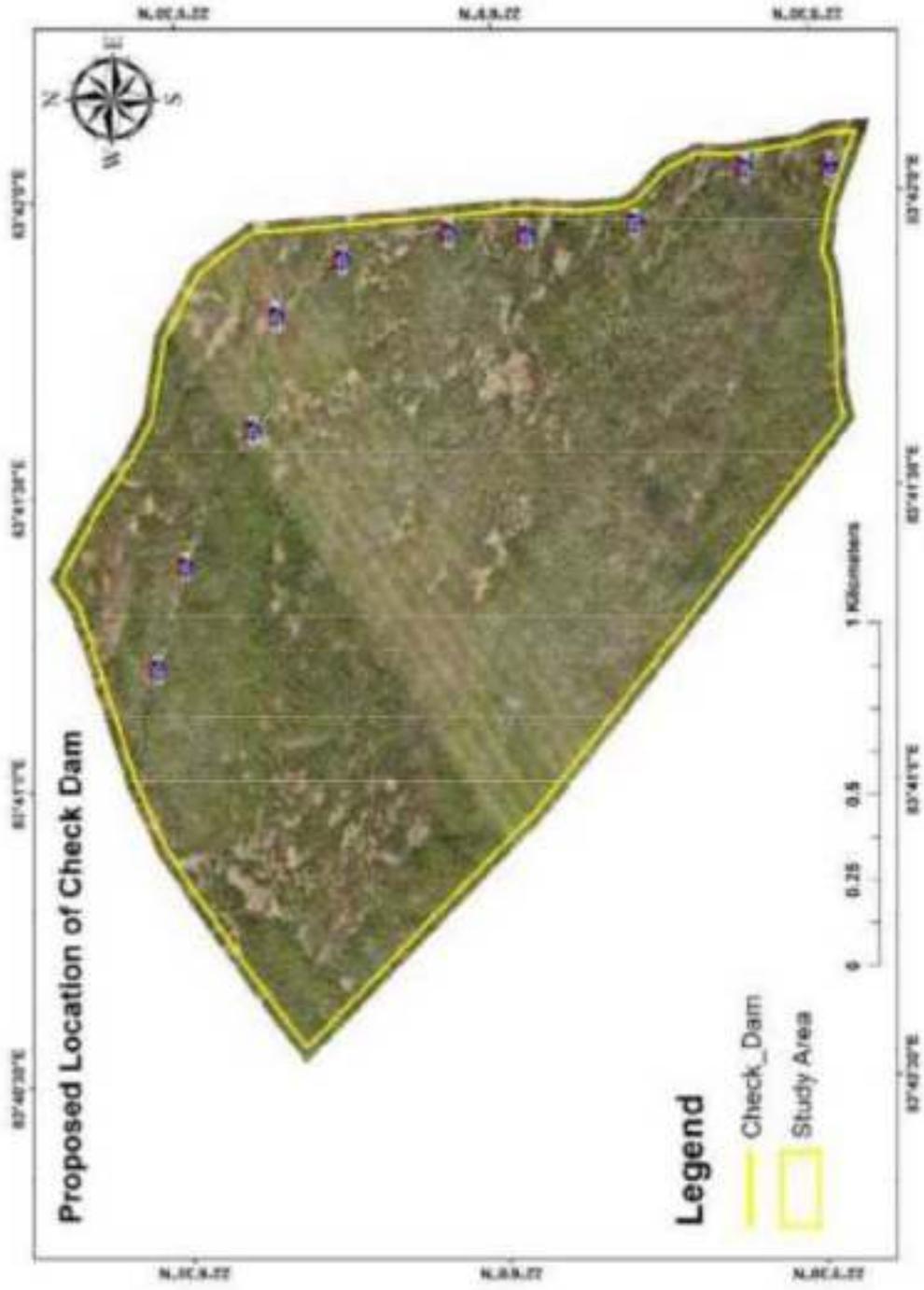


PLATE-11 LOCATION OF PROPOSED PONDS

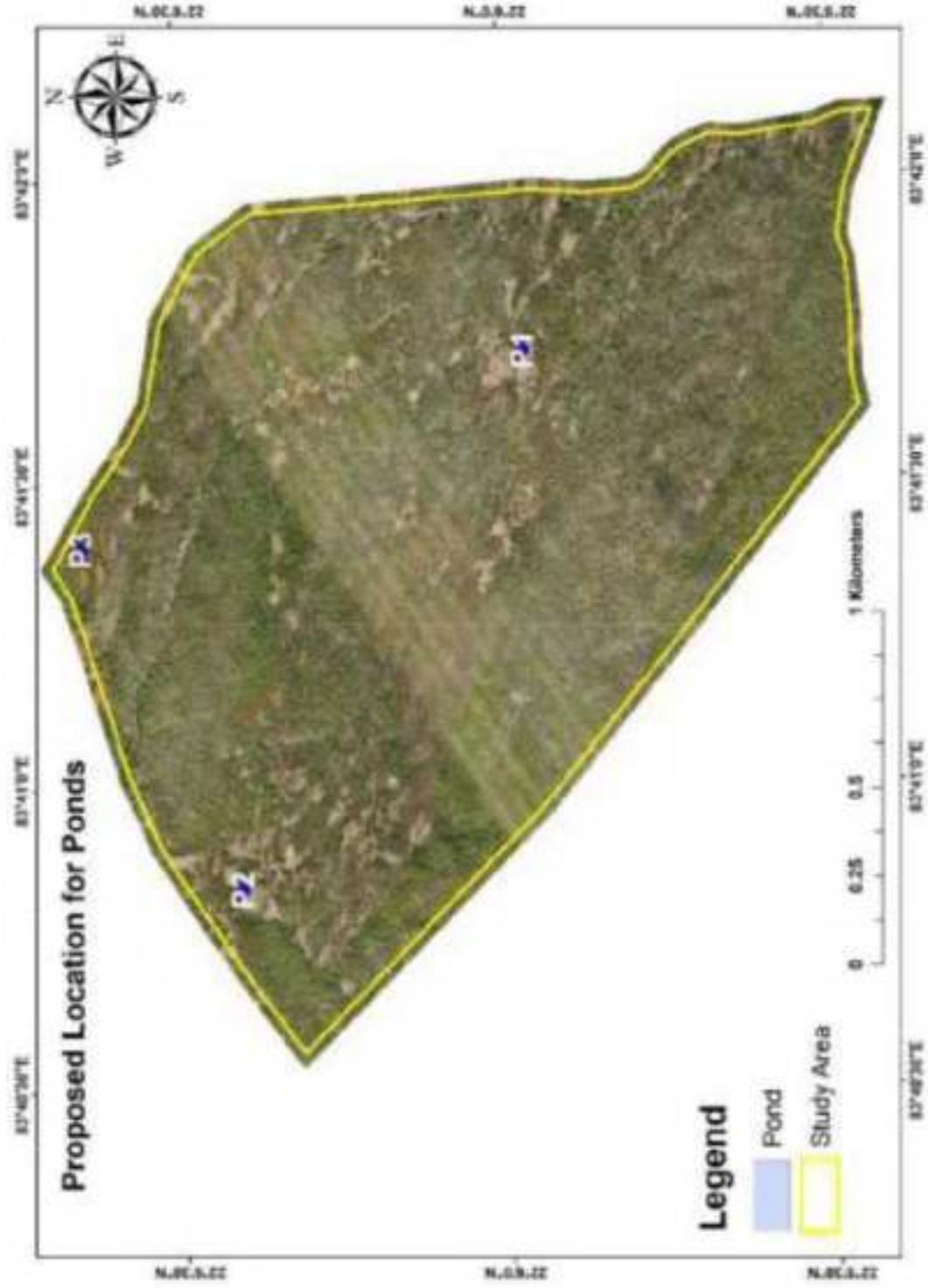


PLATE-12 Recharge Pit (Representative Location)

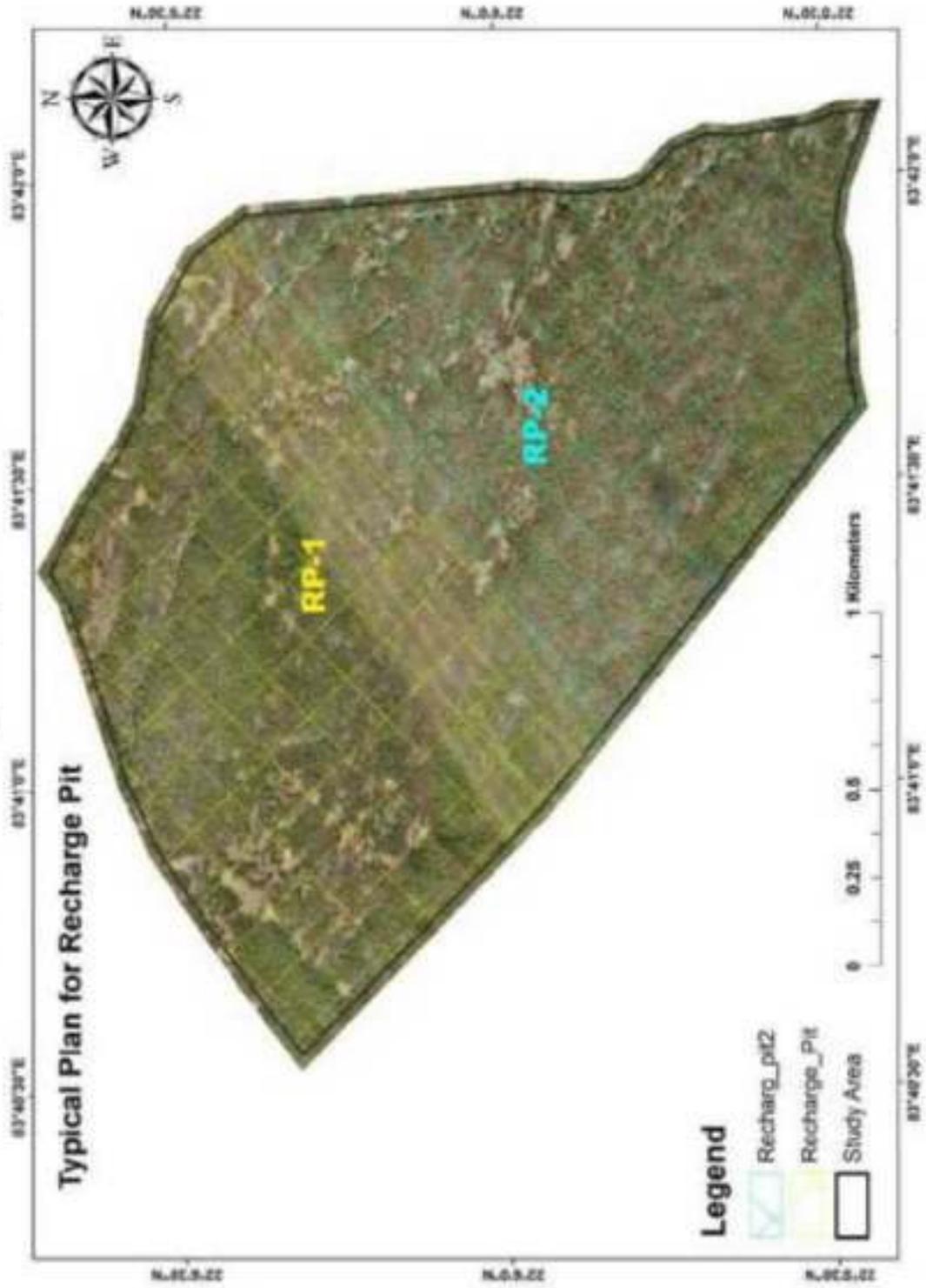
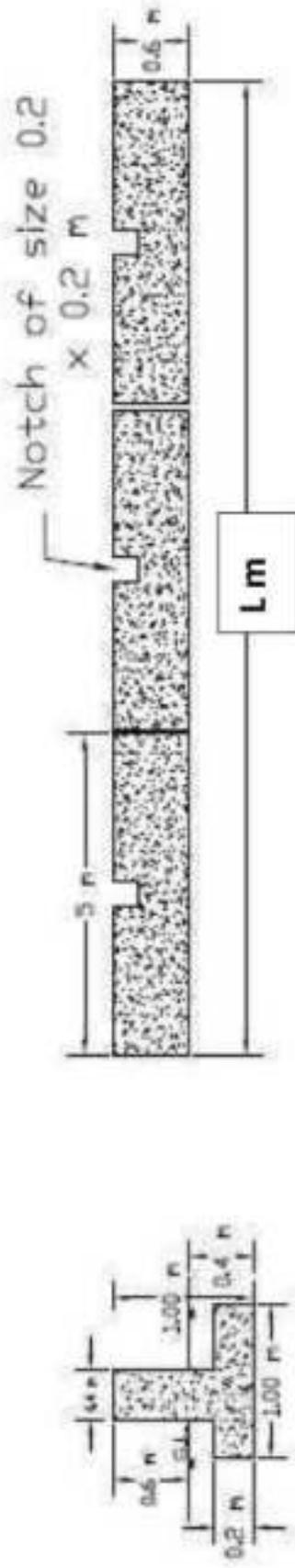
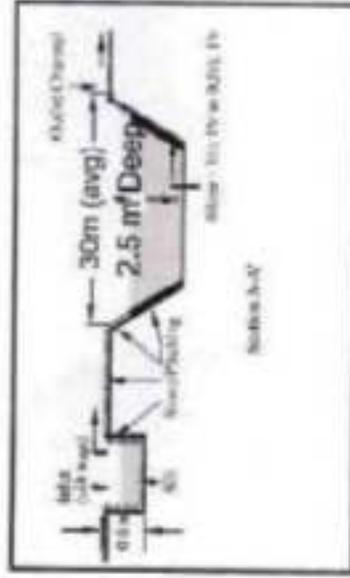
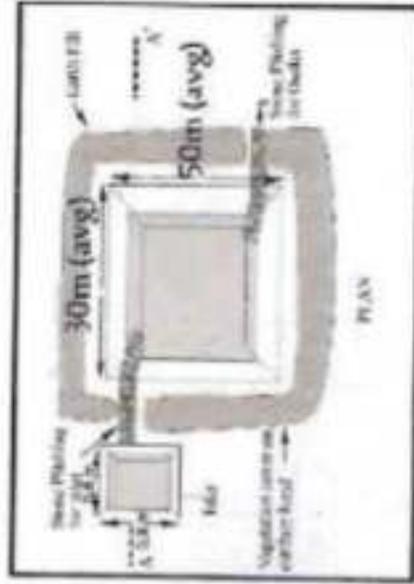


PLATE-13 TYPICAL SECTION OF CHECK DAM



TYPICAL SECTION OF CHECK DAM

PLATE- 14: TYPICAL SECTION OF SURFACE POND



TYPICAL SECTION OF SURFACE POND

Signature
Project Officer
Siama: OCP
Maharadi Coalfields Limited

LIST OF PLATES

Sl. No.	Particular	Page
PLATE -1	Study Area Map w.r.to. Siarmal Oc	P-2
PLATE -2	Location Map of Siarmal OC	P-3
PLATE -3	Toposheet Map of the Study Area	P-4
PLATE -4	Study Area Map	P-5
PLATE -5	Orthomosaic Image	P-6
PLATE -6	Contour Map	P-7
PLATE -7	Location of Proposed Contour Trenches	P-8
PLATE -8	Proposed Location for Grassing	P-9
PLATE -9	Proposed Location for Mulching	P-10
PLATE -10	Location of Proposed Check Dams	P-11
PLATE -11	Location of Proposed Ponds	P-12
PLATE -12	Recharge Pit (Representative Location)	P-13
PLATE -13	Typical Section of Check Dam	P-14
PLATE -14	Typical Section of Surface Pond	P-14

**SITE SPECIFIC
WILDLIFE CONSERVATION PLAN
FOR
SIARMAL OPEN CAST MINING
PROJECT
OF
M/S MAHANADI COALFIELDS LIMITED
DISTRICT- SUNDARGARH, ODISHA**



**Prepared By- Divisional Forest Officer,
Sundargarh Forest Division, Odisha**

CONTENTS

Sl. No	Particulars	Page No.
1	Chapter-I Introduction	
A	Brief Description of the project	4-6
B	Cost of the project	7
C	Location of the Project	7
D	Nature and extent of land required	7-8
E	Conditioned imposed in stage-1 if any	8
2	Chapter-II Project and Impact Area	
A	Description of the Project area/ Core Zone and its impact area	9-11
B	Description of Buffer Zone / Zone of Impact.	11-13
C	Land Use Detail	14-15
D	Human Habitations	15-16
E	Flora & Fauna, Wildlife Habitats and movement of patterns of megafauna and Wildlife corridor	16-23
F	Human-Wildlife Conflict details in the area	24
G	Other projects and their impact area in the impact area of the project proposed	24-25
3	Chapter – III Probable Impacts of the Project on Flora and Fauna	
A	Impact on flora	26
B	Impact on fauna	27
C	Project and ancillary activities on Flora and Fauna	27-28
4	Chapter-IV Mitigation Measures Intended	
	Habitat Improvement Measures & Interventions	29
1	Development of Meadows	30
2	Bamboo/ Fodder Development by Seed Ball	30-31

3	Renovation of Existing Check Dams	31
4	Construction of Check Dams	31-32
5	Provision of Salt Licks	33
6	Grass cutter & Trimming Saw	33
7	Renovation of Existing Solar Fencing	33
8	Construction of watch tower.	34
9	Deployment of Fire Fighting squad	34-35
10	Purchase of Tranquilizer and medicines	35
11	Providing Rescue Van	35
12	Providing Cage	36
13	Providing Drone Camera	36
14	Trap Camera	36
15	Binoculars	36
16	Animal Health Camp	36
17	Alternate Fuel to villagers	37
18	Alternate Livelihood to villagers (Bee and Mushroom Cultivation)	37
19	Provision of Iron Removal/Purifier Kits to households	38
20	Incentive to VSS	38
21	Public Awareness	38
22	Monitoring and evaluation	39
5	Chapter- V Abstract of Interventions and Financial Implication and Monitoring	
A	Abstract of interventions	40-43
B	Physical Flow Chart	44-47
C	Financial Flow Chart	48-51
6	Chapter –VI Maps and Annexures	52
A	Topo sheet showing Core and Buffer Zone of proposed project	ANNEXURE -1

B	Map showing other projects & drainage within Buffer Zone of proposed project	ANNEXURE - II
C	Land Use/ Cover mappings of Core and Buffer Zone	ANNEXURE - III
D	Map showing distance of Protected Areas(PAs) from the project site	ANNEXURE - IV

Chapter-I Introduction

A) Brief Description Of The Project:

Siarmal Open Cast Coal Mining Project in Sundargarh District is a project of Mahanadi Coal Fields Ltd. (MCL), a Government of India Public Sector Undertaking company, dedicated to win coal from different coal mines located in Odisha. The Siarmal & Siarmal Extension and Banapatra Blocks are located in north-western central part of Ib River Coalfield of Orissa, known as Gopalpur sector. This coalfield is the southern middle part of lower Gondwana basin of Son Mahanadi Valley and occupies an area of about 1460 sq.km, with potential coal bearing area of around 1050 sq. km. The Ib River Coalfield lies between latitude 21°31' to 22°14' North and longitude 83°32'00" to 84°10'00" East and falls mainly in Sundargarh, Jharsuguda and Sambalpur District of Odisha. The total area of project is 2290.449 Ha, out of which the total forest land is only 349.709 Ha. The Siarmal OCP lies between the latitude 22°01'19" to 22°03'59.09" N and longitude 83° 37' 09" to 83°42'49.58" E. The location of the site for coal mining operation fully depends upon nature's deposit of minerals and geological structure of the coal seam. District headquarter Sundargarh, on the State Highway-10 (Sambalpur to Rourkela), is at a distance about 46 km. from the coal blocks. The Sundargarh (Odisha) - Raigarh (Chhattisgarh) all weather road passes through the blocks. The blocks are also connected by block top road with two important towns of Odisha namely Rourkela at 145 km and Jharsuguda at 75 km. The blocks come under Hemgir Tahasil and Balinga police station in the district of Sundargarh, Odisha. The blocks are around 6 km, south-west of Basundhara West Colliery and are connected by part metallic road. The blocks are connected by road to the State of Bhubaneswar through State Highway-10 and National Highway-

42, with a total distance of around 450 km. The blocks are well connected with MCL HQ at Sambalpur situated at a distance of about 100 km.

Nearest rail head is the Sardega railway siding, situated between 22°04'08.83" to 22°04'12.08" North and Longitude 83°42'41.01" to 83°43'08.38" East. The total length of the track line from Jharsuguda to Sardega Railway siding is 53.1 km and the distance of Barpali yard from Sardega railway siding is 8.72 kms. The nearest port at Bay of Bengal is Paradip and situated at a distance of about 600 km. from the block. The Jharsuguda airport is the nearest airport from the block (Approx. 45 KM).

Siarmal OCP is coming under Coal India Limited (CIL) which has been dispensed by the Government of India. The acquisition of land coming under the project covers 06 (Six) villages viz. Gopalpur, Siarmal, Jhupurungs, Ratansara, Tumulia & Kulda in Sundargarh Forest Division of Sundargarh District, and stands acquired by the Central Government and the ownership is vested with MCL. The details of notifications against which the land was acquired under CBA (A&D) is as mentioned below:

Sl. No	Particulars	Date
1	Date of notification under section 4(i) of CBA(A&D) Act, 1957	13/11/1984 (Ib Block-VIII) & 24/07/1987 (Ib Block -XI)
2	Date of notification under section 7(j) of CBA(A&D) Act, 1957	27/05/1987 (Ib Block-VIII) & 25/09/1989 (Ib Block -XI)
3	Date of notification under section 9(i) of CBA(A&D) Act, 1957	10/07/1989 (Ib Block-VIII) & 29/10/1990 (Ib Block -XI)
4	Date of notification under section 11(i) of CBA(A&D) Act, 1957	13/09/1990 (Ib Block-VIII) & 30/03/1993 (Ib Block -XI)

SITE SPECIFIC WILDLIFE CONSERVATION PLAN FOR SIARMAI OCP PROJECT, MCL

1b Block VIII - Sardjga (800.18 Ac), Gopalpur (part)(3080.22 Ac), Jhuprunga (1862.78 Ac), Ratansara (1849.75 Ac)=7632.93 Acres.

1b Block XI- Tiklipara (1743.85 Ac), Siarmai (852.34 Ac), Gopalpur (part)(140.67 Ac), Tumulia (2351.32 Ac), Kalikachhar (511.94 Ac), Kulda (542.85 Ac), Bankibahal (838.33 Ac), Balinga (1234.64 Ac), Garjanbahal (798.35 Ac), Kirpsira (1680.11 Ac) & Japti Jungle (Lalma RF) (420.00 Ac)=12209.33 Acres

The project covers 06 (Six) villages viz. Gopalpur, Siarmai, Jhuprunga, Ratansara, Tumulia & Kulda in Sundargarh Forest Division of Sundargarh District, and stands acquired by the Central Government and the ownership is vested with MCL. Out of several coal mines, Siarmai Open Cast Coal Mining Project has a rated capacity 50.0 MTY. The user agency has applied for diversion of 349 709 ha of forest land under the Forest (Conservation) Act, 1980. Forest land break-up is as given below.

Land use detail of forest land (In Ha.)			
Mining	Safety Zone	Embankment, OB Dump, Blasting Zone & Others	Total
260.769	3.930	85.010	349.709

Village wise Break-up of forest land proposed for diversion in the core area.

Sr. No	Village Name	Area (In Ha.)
1	Siarmai	79.996
2	Gopalpur	94.181
3	Ratansara	48.470
4	Jhuprunga	53.812
5	Tumulia	64.002
6	Kulda	9.158
	Total	349.709

B) Cost of the project : 3766.36 Crores (INR)

C) Location of the Project

The total area of the project is 2290.449 Ha, out of which the total forest land is only 349.709 Ha. The location of the site for coal mining operation fully depends upon nature's deposit of minerals and geological structure of the coal seams.

Range	Gopalpur
Division	Sundargarh
Block	Hemgir
District	Sundargarh

D) Nature and extent of land required

The proposed Siarmal Open Cast Coal Mining Project includes the following categories of land duly authenticated by Tahaldar, Hemgir and village wise land schedule of forest lands as given under.

S I N o.	Distr ict	Divisio n	Village/ Range/ Tehsil	Forest area Proposed for diversion (in ha.)	Total Non- Forest Area	Grand Total
1.	SUNDARGARH	SUNDARGARH	Siarmal/ Gopalpur/ Hemgir	79.950	126.681	206.657
2.			Gopalpur/ Gopalpur/ Hemgir	94.181	499.361	593.541
3.			Ratansara/	48.47	199.722	248.192

SITE SPECIFIC WILDLIFE CONSERVATION PLAN FOR SJARJAL OCP PROJECT, MCL

		Gopalpur/ Hemgir			
4.		Jhupurunga /Gopalpur Hemgir	53.812	693.970	747.782
5		Tumulia/ Gopalpur/ Hemgir	64.092	406.09	470.192
6		Kuida/ Gopalpur/ Hemgir	9.158	17.928	27.085
Total			349.709	1940.74	2290.449

The purpose-wise breakup of forest land and non-forest land for requirement of this project as furnished below:-

Sl No	Purpose of Utilization	Forest Land (in Ha)	Non-Forest Land (in Ha)	Total area (in Ha)
1	Mining	260.769	14.662	275.431
2	Infrastructure	3.630	1303.423	1307.353
3	7.5 meters Safety Zone	85.010	622.655	707.665
Total		349.709	1940.740	2290.449
Forest Land proposed under FCA to be diverted		349.709		

- E) **Conditioned imposed in stage-1 if any**
Proposal is under process for Stage-1 clearance.

Chapter-II

Project and Impact Area

- A) **Description of the Project area and Core Area and its impact area**
- The Siarmal & Siarmal Extension and Banapatra Blocks are located in north-western central part of Ib River Coalfield of Orissa, known as Gopalpur Sector. This coalfield is the southern middle part of lower Gondwana basin of Son Mahanadi Valley and occupies an area of about 1460 sq.km with potential coal bearing area of around 1050 sq.km. Siarmal OCP is an XI Plan project of MCL. The Project Report is based on Geological Reports of Siarmal & Siarmal Extension Block and Banapatra Block which are also virgin coal blocks. The proposed mine area lies towards south of Basundhara West OCP (7.0 Mty) on the southern side of Basundhara river. Basundhara West OCP is an ongoing project. Sanctioned Kulda OCP (10 Mty) lies to the east of proposed mine. Kulda OCP was sanctioned in January, 2005 by Govt. of India. Coal production from this mine has been 5.54 Mt in 2011-12. Rampia/Dip Extension of Rampia Block lies to the west of proposed Siarmal OCP (40 Mty) A sum total of 1866.83 million tonnes net proved geological reserves for the coal seams viz. IB BOT to LAJ-IV have been estimated over an area of 14.07 sq.km in combined Siarmal & Siarmal Extension and Banapatra blocks. The coal seams in both the blocks under consideration for the project (Siarmal & Siarmal Extn. and Banapatra) are thick and occur at shallow to moderate depth. The entire coal reserves of 1866.83 Mt have high quarriable potentiality. Considering the coal demand on MCL and quarriable potential of the blocks, formulation of the present opencast mine for rated capacity of 40.0 Mty is justified.

GEOLOGICAL STRUCTURE

Detailed exploration in both the blocks has established the existence of Barakar and Karharbari Formations under thin blanket of soil, sub-soil and laterite. It is located in the axial zone of the basin. The major southern part of the block shows monoclinical structures with uniform southerly dip, whereas, northern part is highly disturbed where the strike exhibits little dragging effect causing minor anticlinal & synclinal features. There is also the variation in dip in the northern part where it is generally steeper than that of southern part. The strike of the strata has shown northwest – southeast trend with minor variation towards northern part. The strata dips 3° – 4° towards southwest. The same has increased to about 10° in the northern part with dip direction remaining towards south to southwest. In total 28 number of faults with throw varying from 0 to 120 m have been deciphered in combined Siarmal & Siarmal Extn. and Banapatra blocks. Out of seven faults interpreted in Siarmal & Siarmal Extn. block, six faults extends to Banapatra block and hence common in both the blocks. Most of the faults trend east to west.

COAL SEAMS

In Siarmal & Siarmal Extension and Banapatra block total 16 nos. of coal horizons/seams have been identified. Barakar formation contains 13 nos. of coal seams from RAM-I to RAM-V and LAJ-I to LAJ-IV along with their splits. The Parkhani seam has also been encountered within Barakar Formation but has been rendered non-potential due to its deterioration in quality and its highly interbanded nature. Ib seam occurs within Karharbari Formation in three splits viz. Top, Middle & Bottom.

COAL RESERVES

Thus, a sum total of 1866.83 million tonnes of net proved geological reserves for the coal seams viz. IB BOT to LAJ-IV have been estimated in Siarmal & Siarmal Extension and Banapatra Blocks.

DESCRIPTION OF CORE AREA

The project covers 06 (Six) villages viz. Gopalpur, Siarmal, Jhupurunga, Ratansara, Tumulia & Kulda in Sundargarh Forest Division of Sundargarh District.

B) Description of Buffer/ Impact Zone

The detail buffer/impact zone upto 10 km from the periphery boundary of the project as detailed below:-

Detail	Buffer/ Impact zone
National park / Sanctuary	NIL
Biosphere Reserve / Tiger Reserve / Elephant Reserve / any other Reserve	NIL
Forest (RF / PF / unclassified)	Kaletpeni RF, Raghakar RF, Punjipahar RF, Panikhula RF, Ghogharpali RF, Jankani RF, Garjanpahar RF, Jhatkhol RF, Baljori RF, Satparlia RF, Kalamegha RF, Hundarakhol RF, Giripahar RF.
Other projects	Basundhara West OCP and Kulda OCP
River	Basundhara river and Chhatenjora river
Ecologically sensitive areas such as national park, sanctuary, biosphere, etc.	NIL
Habitat for migratory birds	NIL
Corridor for animals of Schedule I & II of the Wildlife (Protection)	NIL

Act, 1972	
Archaeological sites Notified / Others	None
Defense installation	None
Industries/Thermal power plants	None
Airport	None
Railway lines	Proposed Jharsuguda – Barpali - Sardaga railway line under construction 4-5 km
National / State Highway	SH 10 1.0 km [* Buffer zone in case of ML area up to 25 ha, is to be considered as 5 km all around the periphery of the Project Impact area

PROJECT IMPACT AREA

The impact area comprises of about 60 villages. The population structure of these villages are furnished below.

Sr. No.	Name of villages	Total Numbers of Households	Total	Male	Female
1	Arjundarh	95	408	210	198
2	Baladbandha	57	221	111	110
3	Baljori	41	169	89	80
4	Balinga	286	1028	541	487
5	Banjakachhar	27	125	67	58
6	Banjachhar	0	0	0	0
7	Bankibahal	161	566	326	240
8	Barpali	357	1563	787	776
9	Bijahan	79	310	153	157
10	Bilalihal	59	224	107	117
11	Bleimunda	276	1121	544	577
12	Bindujharia	95	377	191	186
13	Budajharia	54	218	112	106
14	Chatakpur	67	301	152	149
15	Chhateber	234	1111	572	539
16	Dhanrasi	70	292	146	146
17	Dusuka	231	959	490	469

SITE SPECIFIC WILDLIFE CONSERVATION PLAN FOR SARMAL ODF PROJECT, MCL

18	Dunguridhi	156	672	327	345
19	Durubaga	227	972	491	481
20	Gaikanpali	133	490	257	233
21	Gerjanbehal	209	1288	710	578
22	Haldikhol	16	61	28	33
23	Hemgir	20953	84559	42670	41889
24	Jampali	333	1835	790	1045
25	Jareikeia	248	1238	628	610
26	Kadaliharle	5	14	6	8
27	Kehachue	40	168	86	82
28	Katarbaga	87	298	154	144
29	Khuntipani	26	121	61	60
30	Kripsira	261	982	498	484
31	Kodbahal	141	643	265	278
32	Kuchedega	204	896	440	456
33	Kulbira	747	2731	1359	1372
34	Kund	206	834	436	398
35	Kurumkela	396	1537	768	769
36	Kusara	143	568	277	291
37	Kufabaga	108	402	216	186
38	Lalbiluan	6	30	16	14
39	Latapani	38	121	61	60
40	Lebedajore	79	322	162	160
41	Mahulpali	130	488	241	247
42	Manoharpur	109	464	231	233
43	Mendra	140	538	274	264
44	Mundelkhet	232	970	497	473
45	Ostali	93	363	186	344
46	Paramanandpur	25	120	58	62
47	Ramlata	68	275	137	138
48	Sampinda	70	269	137	132
49	Sarangihana	110	425	211	214
50	Sardega	112	416	205	211
51	Satjoria	156	566	322	344
52	Shahanspur	228	807	422	415
53	Tangarha	288	1439	736	703
54	Thithatagar	29	110	50	60
55	Tihuria	99	430	218	212
56	Tiklipara	190	740	347	393
57	Toparia	687	2604	1299	1305
58	Tumbajore	326	927	462	465
59	Tumbikhai	23	97	48	49
60	Tumula	858	3311	1650	1661

C) Land-Use Detail

DETAILS OF LAND USAGE (PRE-MINING)				
Sl. No.	Land Use	Within ML Area (Ha)	Outside ML Area (Ha.)	Total (Ha.)
1	Grazing land	131.789	0	131.789
2	Surface water-bodies	48.227	0	48.227
3	Forest land	349.709	0	349.709
4	Waste land	126.216	0	126.216
5	Settlements	44.970	0	44.97
6	Others- Solid Waste Management Area	207.131	0	207.131
	TOTAL	2290.45	TOTAL	2290.45

DETAILS OF LAND USAGE (POST-MINING)					
Sl. No.	Land Use	Plantation (Ha.)	Water Body (Ha.)	Public Use (Ha.)	Total (Ha.)
1	Green Belt	93	0	0	93
2	External OB Dumps	386.08	0	0	386.07
3	Excavation/ Quarry	549.69	410.00	586.64	1546.33
4	Top Soil Storage	0	0	0	0
5	Other- Embankment	18.00	0	10.3	28.3
6	Built-Up Area (colony/ office)	8.00	0	34.82	42.62
7	Virgin area	0	0	193.93	193.93
8	Internal OB Dumps	0	0	0	0

9	Roads	0	0	0	0
	Total	1054.77	410.00	825.69	2200.45

D. Human Habitation and R&R provision in core zone

Particulars	Core Zone
No. of PAFs	2583
No of Villages	6
No of Households	2229
No. of ST Families to be displaced/ affected	1504
No. of SC Families to be displaced/ Affected	500

The main occupation is agriculture based, also many PAFs have been employed in MCL under R&R provisions as per direction of Hon'ble Claims Commission.

The Rehabilitation and Resettlement in the six villages namely Siamal, Jhupurunga, Tumulia, Ratansara, Gopalpur and Tiklipara falling in the project area is being carried out under the direction of "Claims Commission" set up by Hon'ble Supreme Court for the purpose. The major adverse impact will be displacement and rehabilitation / resettlement of affected people including change in culture, heritage & related features.

Details of rehabilitation & resettlement are given below:

- a) Land Compensation
- b) Structure Compensation
- c) Compensation of Trees, plants, ponds, wells, etc. in the tenancy lands
- d) Employment
- e) Cash in lieu of employment
- f) Monetary Compensation

- g) Rehabilitation
- h) Resettlement

NTFP collection, Method of collection and impact on Wildlife

Various types of NTFP viz. Kendu leaf, Mahua flower & seeds, Sial leaves,

fruits, flowers, roots, bark, gums, fiber etc. of various species used to be freely collected from the forest area in past. The Kendu leaves, are collected by the forest department in a time tested systematic manner. But for the other, the local people collect all other NTFP in an unorganized way as they had rights to collect the produce from the protected forests. Collection of NTFP from the forest area definitely has a negative impact as it leads to habitat degradation and disturbance, which results in shortage of food and cover of wild animals. The collection of Mahua flower and seed may lead to outbreak of forest fire as the ground is cleaned by burning.

E) Flora & Fauna, Wildlife Habitats and movement of patterns of megafauna and Wildlife corridor.

Sl. No.	Vernacular Name	Botanical Name	Sl. No.	Vernacular Name	Botanical Name
1	Achhu	Morinda tinctoria	29	Amba	Mangifera indica
2	Ambada	Spondius mangifera	30	Ankuta	Alangium lamarckii
3	Ania	Emblica officinalis	31	Arjuna	Terminalia arjuna
4	Asan	Terminalia tomentosa	32	Ashoka	Saraca asoca
5	Aswatha	Ficus religiosa	33	Acacia	Acacia auriculiformis
6	Agasti	Sebania grandiflora	34	Agnisikha	Gloriosa superba
7	Ambta	Bauhinia racemosa	35	Babul	Acacia nilotica
8	Bahada	Terminalia	36	Bandhana	Desmodium

SITE SPECIFIC WILDLIFE CONSERVATION PLAN FOR SIARMAI ODF PROJECT, MCI

		belerlea			oojeinensis
9	Bara	Ficus bengalensis	37	Barkoli	Zizyphus jujuba
10	Barada	Bauhinia retusa	38	Barbakulia / Dhobi	Delbergia paniculata
11	Baruna	Crataeva religiosa	39	Bestura	Litsea polyantha
12	Batra	Melia composita	40	Behenta	Limonia acidissima
13	Bela	Aegle marmelos	41	Bhalla	Semecarpus anacardium
14	Bhendama rdan / Genduli / Girchini	Sterculia urens	42	Bheru	Chloroxylon swietenia
15	Dije/Piasol	Pterocarpus marsupium	43	Rura / Simuli	Bombax ceiba
16	Bhaincha	Flacourtia indica	44	Chadaigodi	Vitex pedunculata
17	Champa	Michelia champaca	45	Chandan	Santalum album
18	Chakundi	Cassia siamea	46	Chara	Buchenania lanzan
19	Chhatan	Astonia scholaris	47	Chauli	Elaeodendron glaucum
20	Chhuinpaluli	Sterospermum aungustifolium	48	Cashew	Anacardium occidentale
21	Dalasingha/ Kumbharchi kini	Canthium didymum	49	Dhala Sirisa	Albizia procera
22	Damkurudu / Katarang	Gardenia latifolia	50	Debadaru	Polyalthia longifolia
23	Dhaman	Grewia tilaefolia	51	Dhaura	Anogeissus latifolia
24	Dhaurang	Holoptelia integrifolia	52	Dimiri	Ficus glomerata
25	Gambhan	Gmelina arborea	53	Gandhapalas	Millusa velutina
26	Gangasuli	Nyctanthes arbortristis	54	Genduli	Sterculia urens
27	Ghodstanja	Albizia stipulata	55	Giringa	Pterospermum haynearum
28	Gohira	Acacia leucophloea	56	Gotha	Croton oblongifolius
				i	
57	Gundi	Melilotus philippinensis	89	Haldu/Kurum/ Mundi	Adina cordifolia

SITE SPECIFIC WILDLIFE CONSERVATION PLAN FOR SIARMA ODF PROJECT, MCL

56	Halanda	Diospyros montana	90	Horida	Terminalia chebula
59	Hinjala	Barringtonia acutangula	91	Hentala	Licuala peltata
60	Jaisanda	Litsea sebifera	92	Jamu	Syzygium cumini
61	Jari	Ficus infectoria	93	Jentha	Artocarpus lakoocha
62	Kadamba	Anthocephalus cadamba	94	Karamanga	Averrhoa carambola
63	Katha Champa	Plumeria rubra	96	Kartha	Feronia limonia
64	Kalucha	Diospyros sylvatica	96	Kala Sirisa	Aibizzia lebeck
65	Kanchan	Bauhinia purpurea	97	Kansa	Hymenodictyon excelsum
66	Kangada	Xylocarpus xylocarpa	98	Kapesie	Kydia calycina
67	Karada	Cleistanthus collinus	99	Karanja	Pongamia glabra
68	Kasi	Bridelia retusa	100	Kendu	Diospyros melanoxylon
69	Katakala	Strychnos potatorum	101	Keruan	Sonneratia apetala
70	Kurein	Holarrhena antidysenterica	102	Khair	Acacia catechu
71	Khakada	Casuarina elliptica	103	Kharsan	Ficus glaberrima
72	Kochila	Strychnos nuxvomica	104	Kodala	Sterculia villosa
73	Kalyan / Tertuli	Tamarindus indica	105	Kangada / Tangana	Xylocarpus xylocarpa
74	Kumbhi	Careya arborea	106	Kusuma	Scheuchera oleosa
75	Kuruma	Adina cordifolia	107	Lembura Moi	Bursera serrata
76	Mahalinba	Gmelina azadirachata	108	Mohula	Madhuca indica
77	Mankadake ndu	Diospyros embryopteris	109	Manjari / Paldhua	Rythina indica
78	Mitlunia	Mitragyna parvifolia	110	Moi	Lanea grandis
79	Mundi	Mitragyna parvifolia	111	Mukha	Schrebera swietenoides
80	Nima	Azadirachta indica	112	Nageswar	Mesua ferrea
81	Oau	Dillenia indica	113	Oetha	Ficus religiosa
82	Paladhua	Brythina indica	114	Palasa	Butea monosperma

SITE SPECIFIC WILDLIFE CONSERVATION PLAN FOR SIAMAL ODP PROJECT, MCL

83	Panasa	Artocarpus heterophyllus	115	Panigambhari	Trewia nudiflora
84	Patuli	Stereospermum suaveolens	116	Phasi	Anogeissus acuminata
85	Pitamoi	Garuga pinnata	117	Piasala	Pterocarpus marsupium
86	Rai	Dillenia pentagyna	118	Rohini	Soymida febrifuga
87	Rakta Chandan	Pterocarpus santalinus	119	Rithaphala	Sapindus laurifolia
88	Saguan	Tectona grandis	120	Sahada	Streblus asper
				ii	
121	Sal	Shorea robusta	129	Salai	Boswellia serrata
122	Salaps	Caryota urens	130	Sidha	Lagerstoemia parviflora
123	Simili	Bombax ceiba	131	Sweta Simili	Ceiba pentandra
124	Sirsa (Dhala)	Albizia procera	132	Sirsa (Kala)	Albizia lebeck
125	Sisoo	Dalbergia latifolia	133	Suam	Soymida febrifuga
126	Sunari	Cassia fistula	134	Sugandhi	
127	Tala	Borassus flabellifer	135	Tria	Albizia odoratissima
128	Tela kuruan	Ixora parviflora	136	Tentuli / Tamarind	Tamarindus indica
B	BAMBOO				
137	Daba baunsa	Bambusa arundinacea	139	Balangi baunsa	Oxytenanthera nigrocollata
138	Sala baunsa	Dendrocalamus strictus	140	Pani baunsa	Bambusa palda
C	SHRUBS				
141	Agnijal	Vernonia roxburghii	164	Guakoli	Maba boxifolia
142	Anka-Koli	Carissa spinarum	165	Jhumpuri	Phyllochlamys spinosa
143	Arakha	Calotropis gigantea	166	Kantakoli	Zyzyphus oenoplia
144	Arguna	Cycas Circinalis	167	Khirkoli	Mimusops hexendra
145	Baincha koli	Fleocourtia tangamos	168	Lajakoli	Mimosa pudica

SITE SPECIFIC WILDLIFE CONSERVATION PLAN FOR SARMAL OCP PROJECT, MCL

146	Baula	Mimusops elengi	100	Lantana (Naga air)	Lantana camara
147	Basanga	Adhatoda vasica	170	Lodha	Symplocos racemosa
148	Begunia	Vitex negundo	171	Mamani	Antidesma diandrum
149	Beta (Gouri)	Calamus latifolius	172	Mura	Helectris isora
150	Beta (Kanta)	Calamus guruba	173	Mersunga	Muraya koenigi
151	Beta (Pari)	Calamus viminalis	174	Nageiry	Lantana camara
152	Bhuin nima	Andrographis paniculata	175	Naibeli	Sipadese fruticosa
153	Bhaila	Semecarpus anacardium	176	Narguni	Atiantia monophylla
154	Bhersunga	Murraya koenigi	177	Panjamu	Wedlandia excreta
155	Bhuin Anala	Phyllanthus niruri	178	Phanaphana	Oroxylum indicum
156	Bichhuati	Tragia involuta	179	Patalagaruda	Rauwolfia serpentina
157	Chakundi	Casia tora	180	Pokasungha	Eupatorium odoratum
158	Dhatki	Woodfordia fruticosa	181	Randanturi	Desmodium cephalotes
159	Dudura	Datura stramonium	182	Randantakat hi	Flemingi-a- chappier
160	Dunkoi	Opilia amantacea	183	Siju	Euphorbia royalenna
161	Giliri	Indigofera pulchella	184	Soyam nai	Ichnocarpus fruticosa
162	Ghurudu	Gardenia gummifera	185	Tilei	Wedlandia tinctoria
163	Gangesiuli	Nyctanthes arboristis	186		
D	CLIMBERS				
187	Anantamula	Hemidesmus indicus	197	Guluchi	Tinospora cordifolia
188	Asadua	Capparis horrida	198	Gila	Ertada acandens
189	Atundi	Combretum decandrum	199	Kaincha	Abrus precatorius
190	Baldanka	Mucuna pruriens	200	Malati	Aganosma dichotome
191	Benemali	Jasminum arborescens	201	Marda	Millettia rooomosa
192	Buduli	Butea Superba	202	Muturi	Smilax

23	Neula	Common mangoose	Herpestes eduardsi
24	Odha	Common otter	Lutra lutra
25	Sambar	Sambar	Cervus unicolour
26	Saliapetani	Small Indian civet	Viverricula indica
BIRDS			
1	Bani	Indian myna	Acridotheres tristis
2	Banakukuda	Jungle fowl (Red)	Gallus gallus
3	Bhadabhadalia	Roller / Blue jay	Coracias bengalensis
4	Bhaliakhal	Common grey horn bill	Tikos birostris
5	Chatak	Pied crested cuckoo	Clammator jacobinus
6	Dahuka		Ananronis phoenicury
7	Deulia para	Pigeon	Anasomus oseitans
8	Gendalis	Open billed stork	Anasomus oseitans
9	Char chatia	House scariw	Passar domesticus
10	Gocara chadhei		Molpates cafer
11	Haladi Basanta	Black headed oriole	Oriolus xanthornus
12	Harada Chadhei		Crecapus phoenicopterus
13	Kajalapati	Black drongo	Dicrurus maerocerus
14	Kau (at)	King crow	Corvus splendens
15	Kau (Damara)	Jungle crow	Corvus macrohytes
16	Kochilakhal	Malabr pied Horn Bill	Anthrocoeros coronatus
17	Koil	Indian cuckoo	Eudynamis scolopachus
18	Kumbhatua	Crow pheasant	Cantropus sinensis
19	Kapta	Dove	Streptopelchin oensis
20	Mayura	Peacock	Pavo cristatus
21	Mechharanka	Pied King fisher	Ceryle rudis
22	Panikua	Little cormorant	Phalacrocorax niger
23	Pecha	Owl	Athena brama
24	Sari	Hyna	Gracula religiosa
25	Sua	Parrot	Pittacula eupilia
26	Sarguna	King vulture	Sacrongyas calvus
27	Sankhachila	Kite brahminy	Heliastur indus
REPTILES AND AMPHIBIANS			
1	Ahraj	King Cobra	Naja Hannah
2	Ajagarh	Indian python	Pythonmolurus
3	Chanda Boda	Russels viper	Viper russelli
4	Chil	Common Indian Krait	Bungarus caeruleus
5	Dhamana	Rat snake	Ptyas mucosus

SITE SPECIFIC WILDLIFE CONSERVATION PLAN FOR SPERMAL OCP PROJECT, MCL

6	Gokhar	Indian cobra	Naja naja naja
7	Laudorkia	Common green whip snake	Dryophis nasutus
8	Pani dhanda	Checkered keel back	Natrix piscator
9	Rana	Banded krait	Bungarus fasciatus
10	Tampa	Monocellata cobra	Naja Naja kuothia
LIZARDS			
1	Bahurupi	Indian chameleon	Chamaeleon zeylanicus
2	Champainali	Mabuya	Mabuya bibro
3	Endua	Common garden lizard	Calotesversicolor
4	Godhi	Cargelandmonitor	Vernus monitor
5	Jhitpiti	House lizard	Homidactylus flaviridis
TORTIES AND TORTOISES			
1	Kainchha	Land tortoise	Testudo elonguta
2	Pani Kainchha	Water turtle	Lissemys punctan granose
3	Kainchha	Land tortoise	Testudo elonguta
FISHES			
Sl. No.	Local Name	Latin Name	
1	Basa	Wallagonia attu	
2	Baigarada	Glossogobius giuris	
3	Shakura	Catla catla	
4	Changa	Ophiocephalus gachua	
5	Chitale	Notopterus chitale	
6	Dand-khiri	Esomus dandrica	
7	Ilisi	Hilsa ilisa	
8	Jalanga	Pangasius	
10	Jallah	Chela argentea	
11	Kantia	Myotus cavasius	
12	Kerandi	Barbus ambassis	
13	Magura	Clarias batrachus	
14	Mirkali	Cirrhina mrigala	
15	Mahurahi	Amblypharyngodon mola	
16	Phali	Notopterus notopterus	
17	Rohi	Labeo rohita	
18	Serana	Barbus serana	
19	Seula	Ophiocephalus striatus	
20	Singi	Heterophneustes fossil	
21	Todi	Mastecombeilus armatus	

The Revenue forest land Proposed for diversion doesn't form a part of National Park, Wild life Sanctuary, Biosphere Reserve, Tiger Reserved or any other Corridor. There is no rare/endangered/unique species of flora and fauna found in the area.

F) Human-Wildlife Conflict details in the area

Odisha has reported sighting of the Black Panther for the first time in its forests. The photographic evidence came in from Hemgir Forest Range under Sundargarh Forest Division. Pictures of the Black Panther, or melanistic leopard as it is called, were captured repeatedly by camera traps installed in Garjan Pahad Reserve Forest under Hemgir range. Hence, efforts for its protection & conservation need to be made at division level.

In case of HEC, there are very less depredation incidents due to elephants in last few years. however, seasonal movement of elephants is there with few crop damage & house damage incidents.

Community managed solar fencing in 5 villages namely Rampia, Purna, Behra Munda, Khajurbahal and Khursi in Hemgir Tahsil was done.

Few leopard attack cases have been recorded & human injury due to leopard attack recorded in 2019-20.

G) Other projects or their impact area in the impact area of the project proposed

1. Basundhara East Coal Block.
2. Kulda OCP and Dip Side of Kulda Coal Block.
3. Prajapora & Dip side Extension
4. Garjanbahal OCP and Dip side of Garjanbahal.
5. Dulunda of NTPC
6. Meenakshi Coal Block
7. Meenakshi B & DIP Extension

SITE SPECIFIC WILDLIFE CONSERVATION PLAN FOR SHARMA OCP PROJECT, MCL

Number of Site specific Wild life Conservation plan has been prepared for the area, as given below:-

List of Projects for which SSWLCP has been prepared & approved				
Sl. No.	Project Name	Approved WLCP Amount in Lakhs Rs		Total
		U/A	Forest Department	
1	Bankibahal to Karika Railway Siding- Road Project	67.80	128.50	196.30
2	ACB(India) Ltd- Conveyor Belt Project	9.914	16.395	26.309
3	MCL (Garjanbehel OCP)	NA	NA	NA
4	NTPC (Daripail)	10.00	371.04	381.04
5	MGR (OPGC) Rail Project	NA	NA	NA
6	NTPC (Dulanga)	0	236.30	236.30
7	Jharsuguda- Gopalpur Rail Line	NA	NA	408.21

Map showing areas of all the mine projects enclosed as Annexure-1.

Chapter – III

Probable Impacts of the Project on Flora and Fauna

Due to ongoing mining activities in and around the project area Threats to Forest Flora is inevitable there is local demand for fuel wood, Cattle grazing, Collection of NTFP, collection of small timber and building materials. Some portion of these materials were being collected from the forests areas covered under the project. Now after implementation of the project, these biotic pressures will be shifted to the surrounding forests. The additional pressure due to diversion of forest land for mining purpose will cause further degradation of the surrounding Reserve Forests and within the impact area in particular.

Threats to Forest Fauna: Due to ongoing mining activities in and around the project area, the wildlife habitat has been disturbed and therefore important wild animals are not present in the area. However some animals along with elephants are found in parts of the Reserved Forests within the impact area

A. Impact on flora

There is no additional forest land for proposed project. Both core and buffer zones are found to be free from ecologically sensitive and biologically rich areas/habitats, such as national parks, sanctuaries, biosphere reserves and areas rich in genetic resources.

The movement and operation of the above vehicles will result in the following problems.

- a. A large work force will move in and around the project area creating disturbance.
- b. Movement of a number of heavy vehicles and operation of HEMM and other equipment will produce large quantities of dust and noise.

- c. The workforce may depend on the surrounding forest area for collection of fuel, small timber etc. and further degrade the forest.
- d. The dust generated in the mining process will settle on the plant leaves and inhibit the growth of plants.

B. Impact on fauna

As the fauna is closely related to and dependent on the flora, there will be movement of species away from mine lease area due to noise, vibrations and lights. This project is an ongoing project and there are other ongoing projects adjacent to the proposed project, the fauna of the area will not be disturbed.

The following may be the perceived impact:

- a. Due to deposit of large amount of dust on grasses and fodder plants, there will be shortage of palatable fodder for the animals.
- b. The movement of the Heavy vehicles and machineries will generate a lot of noise creating panic among the wild animals.
- c. The vehicular lights will also scare the animals.
- d. The movement of the vehicles may also cause accidental death of the animals.

C. Project and ancillary activities on Flora and Fauna

The enhancement of forest area occurs due to measures like biological reclamation of backfilled area, arboriculture / afforestation, compensatory afforestation creation of greenbelt and avenue plantation. Water body will be constructed in the interior part of the forest area for the beneficial to the fauna to meet the water scarcity particularly in summer season based on the movement of wild animals.

This project will have no detrimental impact on diversity of floral species within terrestrial and aquatic habitats and control measures to reduce the impact on fauna

The balance in the regional population will be maintained in natural course, owing to existing undisturbed forest areas in the vicinity of the

project. The increase in green cover due to implementation of various measures like biological reclamation of backfilled area, arboriculture / afforestation adopted by the mine establishment will be an added bonus.

The mine will be a "zero-discharge" one. If required, water is discharged only after suitable treatment. No adverse impact on downstream aquatic life of surface water courses is expected.

The project is not likely to have impact on the faunal species diversity within the terrestrial and aquatic habitats.

Supply of clean drinking water by providing iron purifying kits to the villages. Scarcity of clean drinking water is noticed in the villages coming under this project area in both core and buffer zone areas. Most of the areas the fluoride contain water is being used by the local people which lead to hazardous disease. In order to ensure clean drinking water to the villagers the distribution of 350 nos. of Iron Purifying Kits in fringe villages, situated close to the forest areas. The following fringe village have been identified for the distribution of Iron Purifying Kits at household level up to 350 units.

- A. Bada rampia
- B. Purna
- C. Julumbaham
- D. Khajurjharan
- E. Behramunda
- F. Jamjharia

Chapter-IV

Mitigation Measures Intended

Siarmal OCP project area is 2290.449 ha. The tract is having massive Coal Deposit. The zone of impact is also having number of Coal Mines.

Whole part of the zone impact is coming in Sundargarh Division. As there are multiple mining projects with overlapping zone of impacts, hence the area of zone of impact has been expanded Lephripada range in order to compensate the overlap & repetition of the measures in the same area. Moreover Lephripada area is having a good forest with ample wildlife presence & movement including carnivorous like tiger & leopards. Hence wildlife mitigation measures are justifiably being expanded in this zone. Interventions being undertaken also after deliberate discussion with Range Officer Gopalpur, Hemgir and Lephripada.

The other wild life animals found in the area are:-

hyena (*hyena hyena*), porcupine (*Hystrix indica*), spotted deer (*Axis axis*), rhesus macaque (*Macaca mulatta*), wild boar (*Sus scrofa*), barking deer (*Muntiacus muntjak*), black bear (*Melursus ursinus ursinus*), Jackel (*Canis aureus*), indian hare (*Lepus nigricollis*) and mongoose (*Herpestes edwardsi*) are seen in and around the forest land. Birds like common doves (*Streptopelia decaocto*), Myenas (*Acridotheres tristis*), Jungle crow (*Corvus splendens*), indian cuckoo (*Eudynamis scolopaceus*), etc are seen. Common reptiles and lizards like Common krait (*Bungarus caeruleus*), rat snakes (*Ptyas mucosus*), common garden lizards (*Varanus bengalensis*).

A. Habitat Improvement Measures & Interventions Intended

The following interventions are proposed for implementation by the Forest department.

1 Development of Meadows:

In Garjan Pahad Reserved Forest the presence of Leopard/ Panther has been reported. The presence of leopard is extending from Forest of Hemgir Range to Forests of Chhattisgarh.

The prey base is to be improved to sustain the carnivorous animals in the Zone of Impact, Hence it is proposed to develop meadows / small grass patches along the existing water course inside the Forest. It is proposed to take up grassland in patches of vacant land. Mostly Doob Grass (*Cynodon dactylon*) and Mutha grass (*Cyperus rotundus*) is to be developed.

For development of Grassland a sum of rupees 30,000/- per hectare in the 1st year, and maintenance in two years interval i.e. 4th year, 7th year and 10th year, a sum of Rs. 10,000/- per maintenance is proposed. Hence a sum of Rs. 60,000/- per hectare is suggested. For 20 ha, a sum of Rs. 12 lakh is required. Hence a sum of rupees 20 lakh is provided in this plan.

2 Bamboo/ Fodder development by Seed ball:

Hemgir area is having dry Bamboo break and vast stretches of Bamboo forests are observed.

In due course of time, Bamboo forest are now in the path of degradation. It is required to enrich the bamboo forest with bamboo and other fodder species by seed sowing (Seed Ball Method).

It is to be undertaken by throwing of Seed balls of bamboo and other fodder species @ 1,00,000 numbers of seed ball year @ Rs. 15/- per seed ball for 10 years. This enrichment program will be taken up in Garjan Pahad RF having Bamboo. Area near to habitation is required to be avoided. Along with Bamboo other fodder species seeds are to be mixed and used in seed ball.

The seeds of various species are to be collected and broadcasted in appropriate ratio. Palatability of species by animals especially liked by elephant is to be given due importance.

Precautionary measures: Seed should be matured and collected from good seed bears. Seed showing/Broadcasting should be taken up within 15th June every year.

For 1,00,000 seed balls @ Rs. 15 per ball, a sum of Rs. 15.00 lakh per year is provided for broadcasting/ sowing of Bamboo and other seeds in the pre monsoon period that is within 15th of June every year. This intervention is to be carried out in a phased manner for 10 years. Hence a sum of Rs. 150 lakh is proposed in this plan.

3. Renovation of existing Check Dam

Apart from construction of new check dams, there has been provision made for renovation of check dams need repair works, hence 2 nos of check dams to be renovated as per intervention intended in Garjan Pahad RF and Dhanubansan RF.

4 Construction of Check Dam

In order to mitigate water crisis for the wild animals particularly in summer season of Lephripada range areas, there is provision for construction of 2 Nos. of RCC check dams, both are in Basundhara Nala local call Biloi nala of Godha Ghat DPF under Lephripada range as it is coming in the buffer zone area of the project. It is useful to check the runoff water at this location for improvement of flora and fauna of the forest area. Moving of leopard has been noticed in the above proposed check dam areas which will be helpful to cater to the improvement of flora and fauna in that areas.

The GPS co-ordinates with images of both of the proposed RCC check dams as under->

1. Latitude- 22.152512 Longitude- 83.668707



2. Latitude- 22.156093 Longitude- 83.660258



Precautionary measures:

- a) It may be developed/ maintained just after Rain e. i. after October /November every year
- b) It may be close to water bodies.
- c) It may be away from applications to avoid men-animal conflict.

5. Provision of Saltlicks

Different wild animals require cover for different purposes. Cover for breeding, parturition, escape and shelter are common to all categories of wild animals. Carnivores require ambush covers to hunt their prey. Providing adequate forest cover to different wild animals within their habitat is necessary for shelter and protection of wild animals from weather, predators and enemies. Keeping in view this aspect, it has been prescribed to fell even those mature trees, which create a lasting gap in the canopy. It is also prescribed not to fell trees near water holes, wallows, and saltlicks to maintain cover. In case of rehabilitation working circle it has been prescribed for mixed plantations instead of monoculture, to create ground flora and middle storey to provide cover for different types of wild animals. Tree cover around the stream, water holes and salt licks shall also be maintained and improved.

6. Grass Cutter & Trimming Saw

A provision has been made for Grass Cutter for fire prevention in plantation area, Trimming saw for clearing road side forest fire and provision of net for seed collection of forest families.

7. Renovation of Existing Solar Fencing

There are existing solar Fencing in many places of the Division. Due to minor problems it is not functional at present. The defects noticed are

- > Damaged to Solar fencing (Post, wires)
- > Defect at Power system,

➤ Defect in transmission of Power

It is proposed to maintain these fencings available at sites mentioned below.

Location & Length of Solar Fencing requiring maintenance

Sl No	Location	Length (KM)	Status	Amount (in Lakh) for renovation
1	Rampia	3.9	Partially functioning	4
2	Puma	3.4	Not functioning	3.5
3	Rehera Munada	6.7	Partially functioning	7
4	KHajur Bahal	3.7	Partially functioning	4
5	Khursi	1.7	Not functioning	2
Total 5 Location		19.4		20.50

For repair & maintenance a sum of Rs. 20.50 lakhs indicated above is provided in this plan.

8. Construction of watch tower

It is propose to construct a watchtower near Dangakhol area to have a close watch on Animal Movement. There will be a provision of a room at the base of the watch tower to accommodate a staff to be stationed day and night. The watch tower will be fenced by Elephant Proof Trench with all Logistics and Accommodation facilities. The proposed cost is about 20 lakh and provision in this plan is made accordingly.

9. Deployment of Fire Fighting squad

A provision of 25 nos of blowers @ Rs. 65,000/- each has been intended Also provision is made for 2 nos. of firefighting squad arrangement for Gopalpur and Duduka section, from February to June every year, The cost of one firefighting squad is derived as given under.

Cost Estimate for one Firefighting Squad. (5 persons for 5 months for 10 years)				
Sl No.	Description	Rate	Amount	Total (In Lakh)
1	Wages of Squad members	315/- per day	5X315X150X10	23.625
2	Hired Vehicle	35,000 per Month for 5 month per year	35000X5X10	17.50
3	PoL cost	15000/- per month per 5 month per year	15000X5X10	7.50
4	Recharge of Mobile set	Rs. 5000/- per year	5000X10	0.50
5	Training of squad members	Rs. 15,000/- per year	15,000X10	1.50
6	Camp equipment	Rs. 75,000/- per year	75000X10	7.50
Total				58.125

10. Tranquilizing Gun and medicines

Purchase of 2 Nos of tranquilizing gun @ Rs. 3 Lakh each and medicines and equipment related costing around Rs. 2.5 lakh each gun have been intended in this plan.

11. Rescue Van

It is proposed to provide rescue van for wild animals along with necessary treatment of rupees 30.00 lacs proposed in this plan.

12. Providing cage

To help in shifting of rescued animals, it is proposed to provide cage with iron bars and other 50 devices. Two cages (One for carnivorous and another for herbivorous) A sum of rupees 15.00 Lakh @ 7.50 lakh is for each village provided in this plan.

13. Providing Drone Camera

In order to have a watch on movement of elephants in the area, it proposed to provide one Drone Camera to the Division to be placed at Hemgir Range. A sum of Rs. 5.00 is provided in the plan.

14. Trap Camera

It is supposed to provide 20 numbers of Trap Cameras to be fixed in Garjan Pahad / Garjan Pahad RF to monitor the movement of animals. A sum of Rs. 5.00 Lakh @ Rs. 25,000/- per trap camera is proposed in this plan.

15. Binoculars

There has been provision made for of Rs. 4 nos. of binoculars for night vision and normal vision each.

16. Animal Health Camp:

There are many villages / habitations either inside the forests or very close to forests. Their cattle are used to graze in the forests and probable carrier of contagious diseases (viral, fungal). Their immunization and health measures will go a long way in preventing spread of disease to wild animals mostly herbivorous. It is proposed to conduct animal health camp in consultation with Veterinary doctor/ Animal Husbandry Department for these villages in every year for 5 years. To conduct such animal health camp a sum of rupees 1.5 lakh @ 25,000/- per year is suggested.

17. Alternate Fuel to villagers

In order to reduce pressure on forest for fuel wood in the vicinity of project. It is proposed to provide LPG connection and refilling cost to 70 families @ 10,000/- per connection. (Initial connection Rs. 5,000/- and re-filling for 1 year Rs 5,000 per connection/ family). It is proposed to cover Khajur Behal village in total and motivate them not to use any firewood for cooking purpose.

Hence a sum of Rs. 7.00 lakh has been provided in this plan budget. Families will be selected by Range Officer in consultation with VSS so as to achieve the objective of this provision. This will help in conservation of flora and fauna to a great extent.

18. Alternate Livelihood to villagers (Core Area)

Due to leasing out of land for mining purpose, many people are losing their agricultural land. Their income has been reduced from agriculture. It is proposed to provide assistance for alternate livelihood to them. On interaction with villagers, it is observed that bee keeping and mushroom cultivation can be introduced through individual family or through an SHG. It is proposed to introduce bee keeping in 50 families @ 10 bee units per family and mushroom cultivation 25 groups/ family

For mushroom cultivation detail of process may be referred from any text on Mushroom cultivation for horticulture department or nearest KVK office. A sum of Rs. 0.50 lakh per unit of mushroom cultivation is suggested. Hence a sum of

- (i) Rs. 35.00 lakh for 500 units (box) of bee keeping @ Rs. 7 lakhs on 100 boxes) and
- (ii) Rs. 12.50 lakh for mushroom cultivation by 25 groups is provided in this plan

19. Provision of iron removal kits to House Holds

As the water table in this area affected with high iron content, hence households in the affected villages will be provided with iron removal kits which include a small filter & ancillary items. It is very easy to use & can be used without any electricity requirement. Beneficiaries per village will be identified & provided with the kit. Around 350 beneficiaries in identified villages will be provided with the iron removal kit. (Kit @ 2000 per kit X 350 beneficiaries = 7.00 Lakh)

20. Incentive to VSS

VSS actively involved in forest production, fire protection and intelligence collection. It is felt to give incentives in cash or kind to maintain their interest and sustain their involvement. It is proposed to provide incentive 4 VSS every year (2 VSS is from Gopalpur Range and 2 VSS from Hemgir Range.) Rs. 20,000/- will be provided as incentive to VSS. It may be in cash or kind as a required and as decided by the DFO Sundargarh. A sum of rupees 8.00 lakh is required and, Hence a sum of Rs. 8.00 Lakh is provided in this plan for 10 years.

21. Public Awareness

Awareness campaigns to be conducted in interior parts of the rings on various issues like forest and its effect, wildlife and human relation. Role of wetland in climate amelioration etc. It is proposed to conduct one such camp every year at a cost of rupees 50,000/-per camp. For ten such camps a sum of rupees 5.00 lakh is proposed in this plan for 10 years.

22. Monitoring and Evaluation

For monitoring and periodical evaluation of various interventions suggested above, it is proposed to carry out an independent evaluation on 5th year of the implementation. A sum of 5 lakh is provided in this plan.

1. One Bolero may be allotted to this division for taking patrolling & protection duty along with monitoring in the supervision of the department work.
2. Wages of driver of the vehicle may be paid for 10 years as per the remuneration of the driver.
3. Fuel cost to be provided for 10 years of the above vehicle including protection duty to be taken by government vehicle.
4. One tractor fitted with water tanks & Hose pipe motor.
5. One GIS based monitoring centre construction, with all required hardware and software system, and a GIS consultant on hiring basis for 10 years at Sundargarh to track movements of wildlife. This will help in informed planning for protection of wildlife.

Chapter- V

Abstract of Interventions and Financial Implication and Monitoring

A. Abstract of Interventions

Sl No	Interventions	Unit	Rate	Quantum	Amount in Lakh	Remark
Habitat Improvement						
1	Development of Meadows	Ha	0.60L	20 Ha	12.00	Garjan Pahad RF (Comp. 19,20)
2	Bamboo/ fodder development by Seed Ball	Nos	15/-	10,0000 per yr for 10 yrs	150.00	Garjan Pahad RF, appropriate on slopes, species to be decided by the DFO
3	Renovation of existing check dams	Nos	6.0 L & 7.5 L	2	13.50	Garjan Pahad RF and Dhanubansan RF
4	Construction of new check dams	Nos	20	2	40.00	Godha Ghat DPF under Laphripada range
5	Improvement of existing Salt licks	Nos.	0.10 L	10 Nos. per year for 10 yrs	10.00	Near watch towers
6	A. Grass Cutter	No.	35000/-	18	6.30	Fire prevention ^{prevention} in the Plantation areas
	<i>Signage on cutting paths for animals, Dotted Dots have it as HWC material for awareness and indication of law</i>				9.90	
	B. Power saw & Trimming saw	No.	30000/-	12	3.60	Trimming road side/ forest fire
	C. Net for collecting mahul seeds	No.	5000/-	50	2.5	Forest families

Protection and Surveillance						
7	Renovation of Existing Solar Fencing:	RKM	19.40, 5 locations		20.50	Rampia, Purna, Behra, Munda, Khajurbahal, Khursi, Good response but not maintained.
8	Construction of watch tower & fencing work	No	25.00 L	1	25.00	Odisha-CG border (Hemgir/ Gopalpur)
	a) Camping Gear	Unit	00.60L	10	6.00	For squad staying inside forest camp.
9	a) Deployment of Fire Fighting Squad	Unit	58.125	2	116.25	Gopalpur, Tapria & Duduka sections mainly
	b) Blower	Unit	00.65L	25	16.25	
10	Purchase of Tranquilizing gun & medicine	Unit	5.50L	2	11.00	
Infrastructure						
11	Providing a rescue van	No.	30.00 L	1	30.00	MAC
12	Providing Cage	NO.	7,5 L	2	15.00	1 For carnivore and 1 for herbivore, MAC
13	Providing drone camera (Night Vision)	No.	5.00 L	1	5.00	At Hemgir Range for surveillance.
14	Trap Camera	No.	00.25L	20	5.00	Garjan Pahad / Garjan Pahad RF

15	A.Binoculars- Night vision	No.	00.50 L	4	2.00	Patrolling
	B.Binoculars- Normal vision	No.	00.15	4	0.60	Patrolling
VSS involvement & Public Support						
16	Animal Health Camp	Annual	0.25 L	5	1.25	To be conducted with Veterinary Doctor
17	Alternate fuel to villages:	Family	0.10L	70	7.0	Khajurbahal Village
18	Alternate livelihood to villagers					
	A. Bee Keeping	Family	7.00L for 100 boxes	50 Families X 10 Box	35.00	
	B. Mushroom Cultivation	Unit	0.50L	25 Groups	12.50	SHG/family may be promoted
19	Provision of Distribution Iron purifying kits in fringe villages	No.	350 Households in each Villages for 6 villages	@ Re. 2000/- each	7.00	
20	Incentive to VSS	No.	0.20 L	4 VSS for 10 years	8.00	
21	Public Awareness Camp	No.	0.50 L	10	5.00	
22	Monitoring and evaluation					Periodical
	One Bolero for Division for taking patrolling & protection duly.	1	1 Unit		12.00	
	Wages of driver	1	1X12X10	@15000/- per month for 10 tears	24.00	
	POL cost	LS	Rs.15,000/- per month	for 10 years	18.00	

SITE SPECIFIC WILDLIFE CONSERVATION PLAN FOR SIAHMAL OCP PROJECT, MCL

Tractor fitted with water tanks & Hose pipe C motor	1	Tractor Rs. 6 Lakh, Water tank Rs. 2 lakh, Diesel motor 0.20 lakh,	Fuel expense Rs. 10 L for 10 years.	18.20	To be utilized to mitigate fire in road side forest area. Also useful for watering the plantation areas.
GIS monitoring Centre/ Building	LS	1	25.00L	25.00	
GIS Software and Hardware	LS	1	35.00L	35.00	Workstation, UPS, Plotter, GIS Software, etc.
GIS consultant		Rs. 30,000 ^{25,000} per month, for 10 years	30,000 ^{25,000} X 12 X 10	30.00	
S. Total				728.45	
Add 20% for cost escalation				145.69	
Total				874.14	

Countersigned

 Regional Chief Conservator of Forests
 Rourkela Circle, Rourkela


 DIVISIONAL FOREST OFFICER
 SUNDARGARH FOREST DIVISION

Approved

 Principal Chief Conservator of Forests
 (Wildlife) & Chief Wildlife Warden
 Odisha, Bhubaneswar

5B) Physical Flow Chart.

Sl No	Activities	Target	1 st	2 nd	3 rd	4 th	5 th	6 th	7 th	8 th	9 th	10 th
1	Development of Meadows	20 Ha	20			Maint.						Maint.
2	Bamboo/ fodder development by Seed Ball	10 Lakh	1L									
3	Renovation of existing check dams	2 Nos	2									
4	Construction of new check dams	2 Nos	1	1								
5	Improvement of existing Salt licks	100 Nos	10	10	10	10	10	10	10	10	10	10
6	A.Grass Cutter	18 Nos	18									
	B.Power saw & Trimming saw	12 Nos	12									
	C.Net for collecting mahul seeds	50 Nos	50									

SITE SPECIFIC WILDLIFE CONSERVATION PLAN FOR SARMAL OCP PROJECT, NICL

7	Renovation of Existing Solar Fencing:	19.40 RKM	19.40																	
8	Construction of watch tower & fencing at Odisha-CG border	1 No.	1 No																	
9	a) Deployment of Fire Fighting Squad	2 Unit	2																	
	b) Blower	25 Unit	25																	
10	Purchase of Tranquilizing gun & medicine	2 Nos	2																	
11	Providing a rescue van	1 No.	1																	
12	Providing Cage	2 NO.	2																	
13	Providing drone camera (Night Vision)	1No.	1																	
14	Trap Camera	20 No.	10	10																
15	a) Binoculars- Night vision	4Nos	4																	

SITE SPECIFIC WILDLIFE CONSERVATION PLAN FOR SIAMMAL COP PROJECT, MC.

22 Monitoring and Evaluation												
Purchase of One Bolero for Division for taking patrolling & protection duty.	1	1										
Wages of driver	1	1	1	1	1	1	1	1	1	1	1	1
POL cost	LS											
Tractor fitted with water tanks & Hose pipe C motor	1	1										
GIS monitoring Centre	1 Nos	1										
GIS Software and Hardware	1	1										
GIS consultant for 10 years	10 Nos	1	1	1	1	1	1	1	1	1	1	1



DIVISIONAL FOREST OFFICER
SUNDARBARI FOREST DIVISION

SITE SPECIFIC WILDLIFE CONSERVATION PLAN FOR SIARJAL OCP PROJECT, MCL

5C) Financial Flow Chart (In Lakh)

Sl No	Activities	Target	1 st	2 nd	3 rd	4 th	5 th	6 th	7 th	8 th	9 th	10 th
1	Development of Meadows	12.00	6.00			2.00			2.00			2.00
2	Bamboo fodder development by Seed Ball	150.0	15.00	15.00	15.00	15.00	15.00	15.00	15.00	15.00	15.00	15.00
3	Renovation of existing check dams	13.50	13.50									
4	Construction of new check dams	40.00	20.00	20.00								
5	Improvement of existing Salt licks	10.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
6	A.Grass Cutter	6.30	6.30									
	B.Power saw & Trimming saw	5.60	3.50									
	C.Net for collecting mahul seeds	2.50	2.50									
7	Renovation of Existing Solar	20.50	20.50									

SITE SPECIFIC WILDLIFE CONSERVATION PLAN FOR SARNAL OCP PROJECT, MCA

POL cost	18.0	1.80	1.80	1.80	1.80	1.80	1.80	1.80	1.80	1.80	1.80	1.80	1.80	1.80
Tractor fitted with water tanks & Hose pipe C motor, Fuel for 10 Years	18.20	9.20	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
GIS monitoring Centre	25.00	25.00												
GIS Software and Hardware	35.00	35.00												
GIS consultant for 10 Years	30.00	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Sub-Total	728.45	465.55	51.75	25.75	27.75	25.75	27.75	25.5	25.5	27.5	25.5	25.5	25.5	27.5
Add 20% Escalation	145.69	93.19	10.35	5.15	5.55	5.15	5.55	5.15	5.1	5.5	5.1	5.1	5.1	5.5
G. Total	874.14	559.14	62.1	30.9	33.3	30.9	33.3	30.9	30.6	33	30.6	30.6	30.6	33

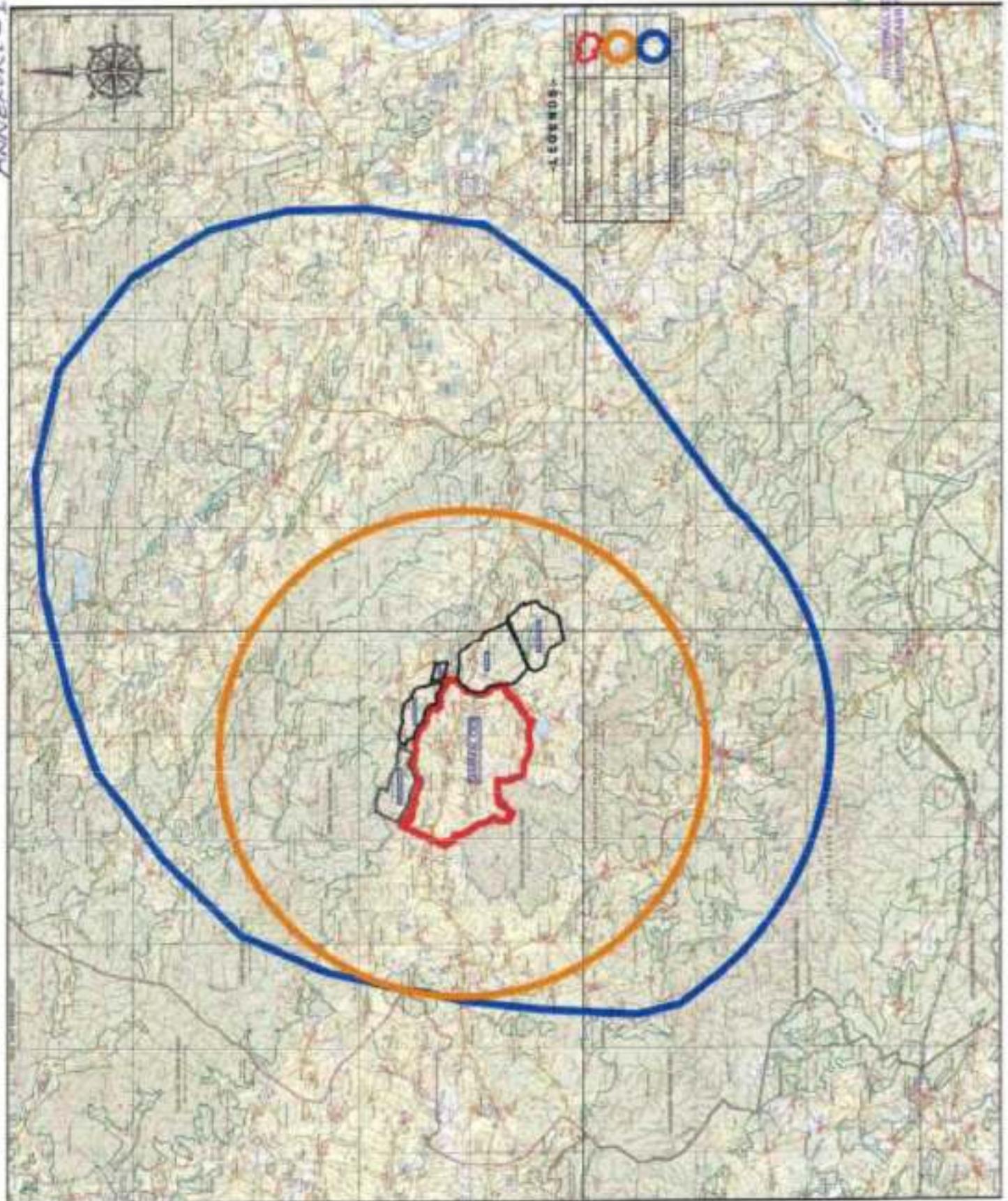

 DIVISIONAL FOREST OFFICER
 SUNDARGARH FOREST DIVISION

Chapter VI

Maps and Annexures

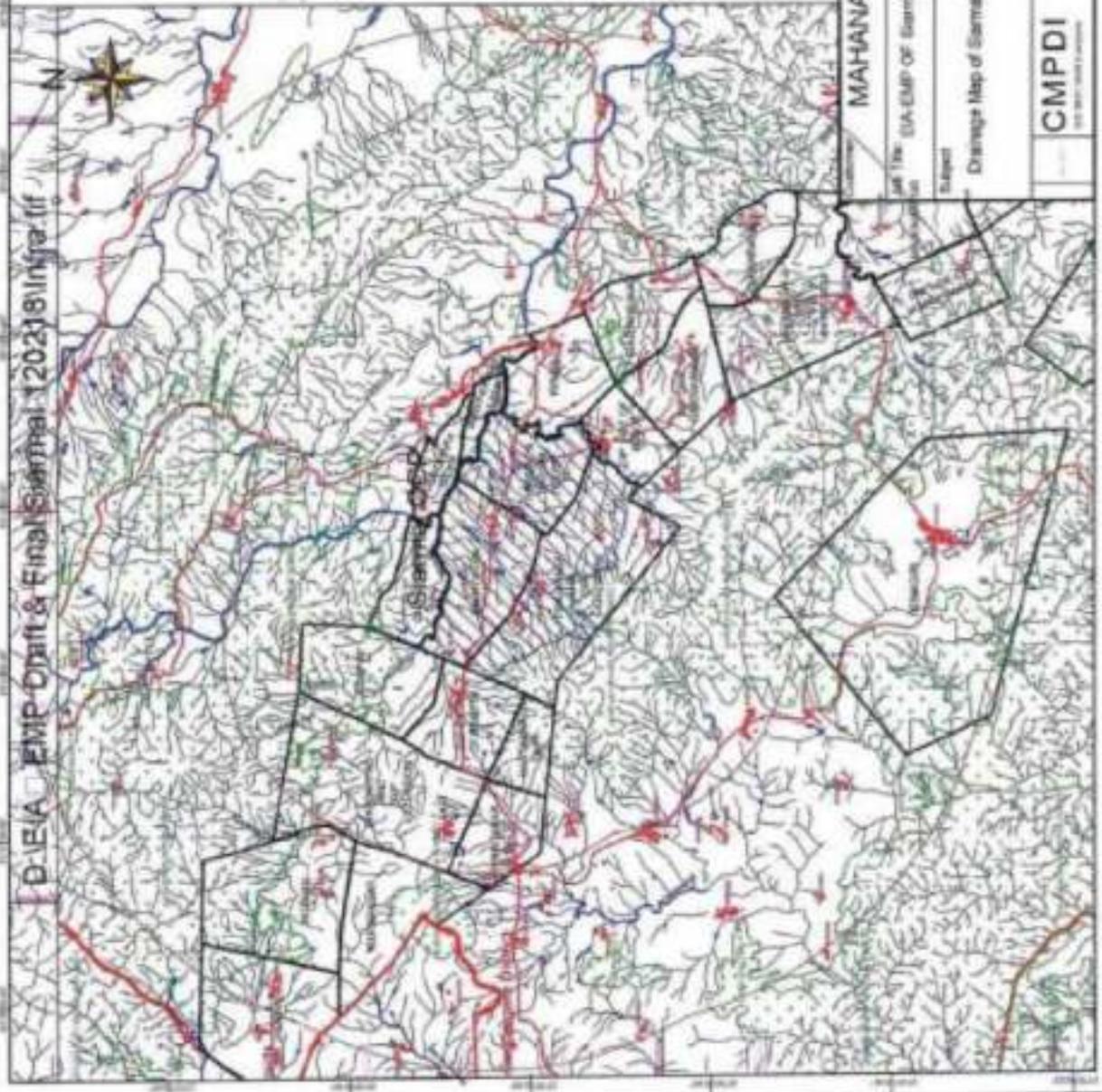
A	Topo sheet showing Core and Buffer Zone of proposed project	ANNEXURE - I
B	Map showing other projects & drainage within Buffer Zone of proposed project	ANNEXURE - II
C	Land Use/ Cover mappings of Core and Buffer Zone	ANNEXURE - III
D	Map showing distance of Protected Areas(PAs) from the project site	ANNEXURE - IV

ANNEXURE - I



GREEN
DISTRICT OFFICER
MADRAS
FOREST DIVISION

P/EIA EMP Draft & Final Sarnal 1202381ntra.tif



LEGEND

-  NATIONAL HIGHWAY
-  STATE HIGHWAY / MDR
-  COAL TRANSPORTATION ROAD
-  OTHER ROAD
-  INFRASTRUCTURE
-  SETTLEMENT
-  RIVER / NALLAH / NADI / JHOR
-  WATERBODY / POND
-  EXISTING RAILWAY LINE
-  FOREST
-  VILLAGE



MAHANADI COALFIELDS LIMITED Plate No. V

Job Title: EIA-EMP OF Sarnal OCP

Job No: 2013/24

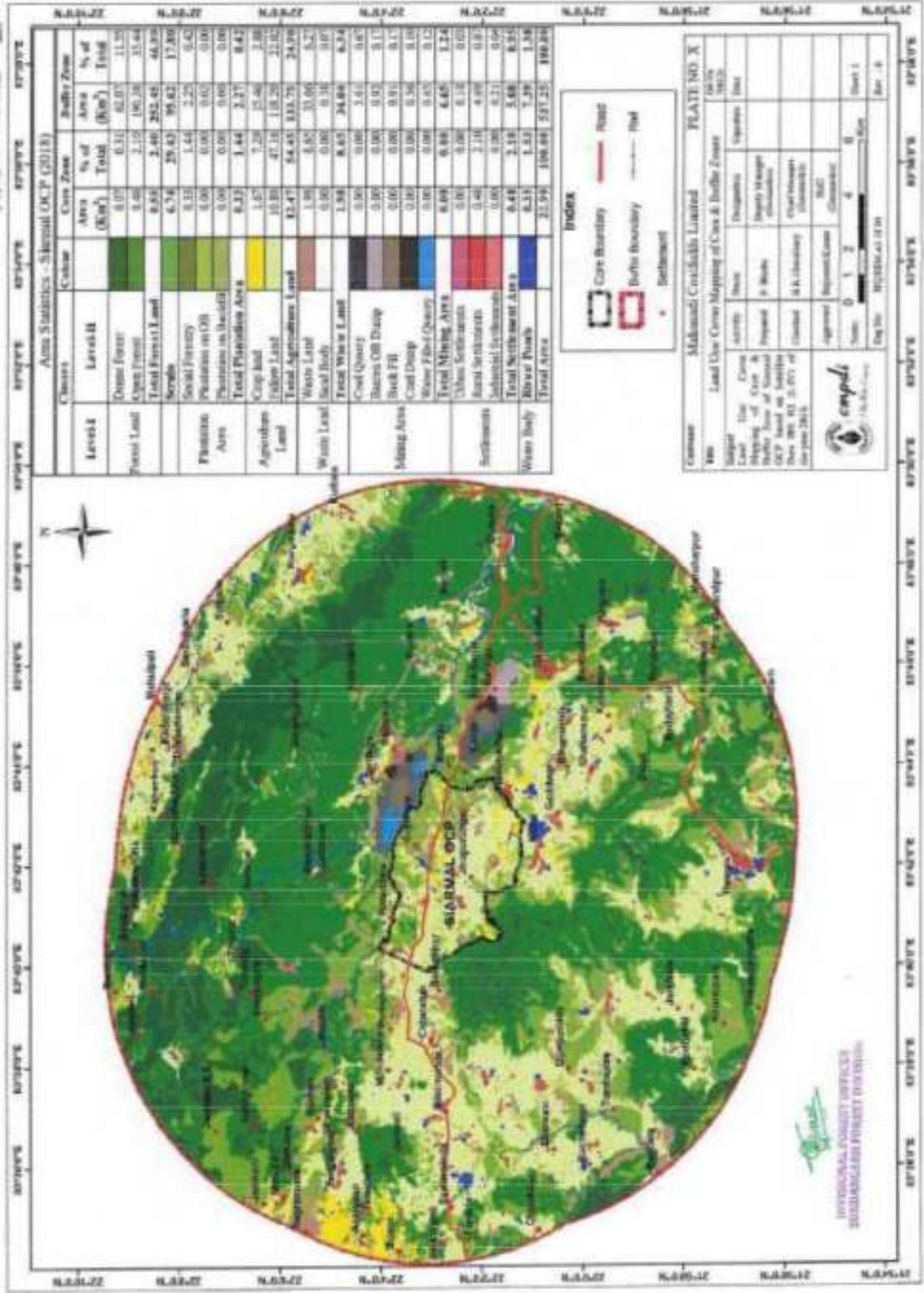
Subject: Drainage Map of Sarnal OCP

Activity	Name	Design	Signature	Date
Prepared	S. S. Singh			
Checked	S. S. Singh			
Approved	S. S. Singh			

CMPDI
CENTRAL MINING & PETROLEUM DIVISION

Scale	1:50,000	1:25,000	1:10,000	1:5,000	1:2,500	1:1,000
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Doc No	2013/24					
Sheet	1 of 1					
REV/No	0					

ANNEXURE - II



Area Statistics - Sirmaral OCP (GIS)

Level I	Level II	Cluster	Code	Area (Km ²)	% of Total	Area (Km ²)	% of Total
Forest Land	Dense Forest Open Forest	Forest	1001	0.07	0.31	62.07	11.25
				9.48	3.15	190.28	33.64
				6.76	2.40	252.45	46.99
Plantation Area	Social Forestry Plantation on (N) Plantation on (B) Total Plantation Area	Forest	1002	0.13	1.44	2.25	0.42
				0.06	0.06	0.02	0.00
				6.23	1.44	2.27	0.42
Agriculture Land	Crop land Fallow Land Total Agriculture Land	Forest	1003	1.67	7.29	15.46	2.88
				10.80	47.18	118.29	21.92
				12.47	44.45	133.75	24.80
Waste Land	Waste Land Total Waste Land	Forest	1004	1.29	5.85	33.09	6.27
				0.16	0.06	0.16	0.03
				1.98	8.65	24.84	4.62
Mining Area	Coal Quarry Bauxite Old Dump Stock Pile Coal Dump Waste Filled Quarry Total Mining Area	Forest	1005	0.16	0.06	3.41	0.63
				0.05	0.02	0.02	0.00
				0.06	0.00	0.01	0.00
Settlements	Urban Settlements Rural Settlements Subsidiary Settlements Total Settlement Area	Settlement	1006	0.16	0.06	0.36	0.07
				0.00	0.00	0.21	0.04
				6.48	2.78	5.68	1.04
Waste Body	Riverside Ponds Total Area	Settlement	1007	6.33	1.43	7.29	1.38
				23.94	106.69	537.25	100.00

INDEX

- Core Boundary
- Buffer Boundary
- Road
- Settlement

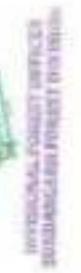
Mekong's Criticals Limited

FLATE NO. X

Map No.	Scale	Date	Author	Checked	Approved	Scale	Date
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Scale: 0 1 2 4 8 Km

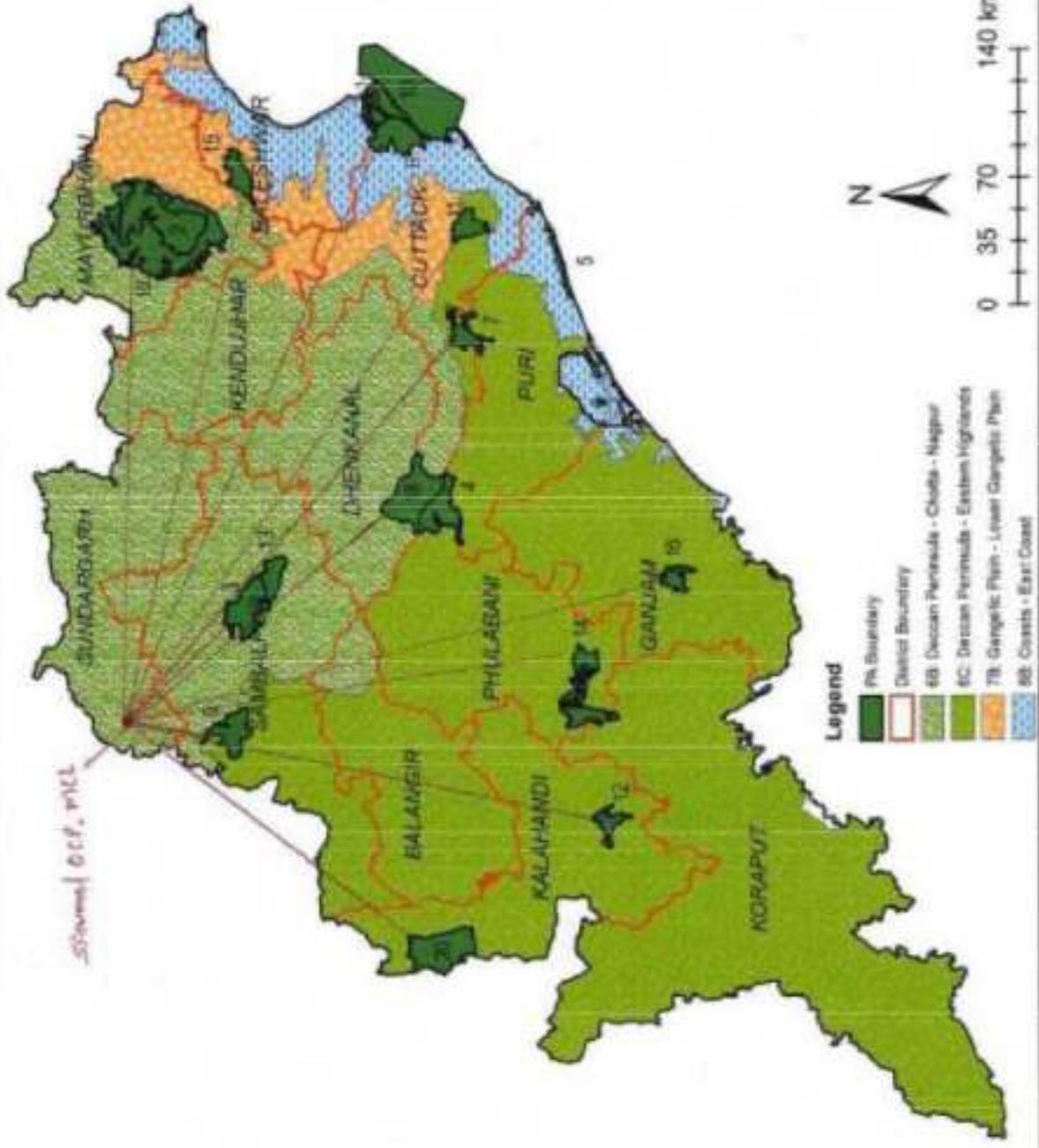
Date: 10/04/2015



 NATIONAL FOREST OFFICER
 SIRMARAL FOREST DIVISION

Wildlife Protected Areas in Odisha

S.N.	PA Name	Area in km ²
1	Bhitarkanika NP	145.00
2	Simpal NP	845.79
3	Baorama WLS	304.03
4	Baispa II WLS	168.35
5	Balukhand Koran. WLS	71.72
6	Bhitarkanika WLS	525.00
7	Chandaka Dampara WLS	175.29
8	Chilika (Halaban) WLS	18.53
9	Debrigarh WLS	246.91
10	Gaharnaitha (Marine) WLS	3435.00
11	Haragarh WLS	191.06
12	Karapat WLS	147.66
13	Khalaburni WLS	116.09
14	Kotagarh WLS	389.50
15	Kudaha WLS	272.75
16	Lakhari Valley WLS	185.87
17	Nandankhan WLS	14.16
18	Sabico de Gorge WLS	745.52
19	Simpal WLS	1354.20
20	Sunabeda WLS	500.00



ODISHA FOREST OFFICE
Bhubaneswar-751003

राज्य वन विभाग
बिहार विद्यापीठ, कोलकाता

IT and GIS & GIS Cell-2015

85°0'0"E

20°0'0"N

20°0'0"N

85°0'0"E

Scheme

prepared for

"Gap planting and soil and moisture conservation activities to restock and rejuvenate the degraded open forests (having crown density less than 0.4), located in the area within 100 meters from outer perimeter of the mining lease boundary over 60 ha in Garjan Jore R.F. of Gopalpur Range of Sundargarh Forest Division"

in compliance with

Condition no. 7 of para A of Stage-I forest clearance – in-principle approval

vide letter no. File. No. S-25/2021-FC, dated 21st April 2022

of Ministry of Environment, Forest & Climate Change (FCA Division), Govt. of India, New Delhi

for

Diversion of 349.709 hectares of forest land for "Sirmal Opencast Coal Mining Project" within 2290.449 hectares of mining lease area

of

M/s Mahanadi Coalfields Limited

in Sundargarh Forest Division of Dist. Sundargarh, Odisha

"Gap planting and soil and moisture conservation activities to restock and rejuvenate the degraded open forests (having crown density less than 0.4) if any, located in the area within 100 meters from outer perimeter of the mining lease"

1. Brief Information:

M/s Mahanadi Coalfields Limited (MCL), a subsidiary company of Coal India Limited is a Miniratna Company of nature and style public sector undertaking under Government of India, which was carved out to administer and mine out coal from the coal mines of Odisha, spread over Talcher and Ib valley coal fields.

Ib valley coal fields in Sundargarh and Jharsuguda Districts of Odisha contain large reserves of quarriable coal. Each area containing coal has been divided into several mining blocks, and Siarnal geological block is one of them. Siarnal opencast project is located in Siarnal geological block of Gopalpur tract in the north-western part of Ib valley coal fields. It lies between latitudes of 22°01'19"-22°03'59.99" N and longitudes of 83°37'09"-83°42'59.58" E. It is represented in Survey of India Topo Sheet No. F44L12 (54/N/16). This project is having 1547.82 Mt (Mineable Reserve) of quarriable coal reserve in Gopalpur, Jhupurunga, Siarnal, Ratansara, Tumulia and Kulda villages. The entire area of Siarnal project involving six villages were acquired under Coal Bearing (Acquisition and development) Act, 1957 (CBA-1957) vide S.O. No. 1869 dated 10.07.1989 and S.O. No. 3055 dated 29.10.1990. The above land has been vested in MCL u/s 11(1) of the said Act vide SO No. 2592 dated 13.09.1990 and 43015 dated 30.03.1993. (Page-22 to 38/DP). Present proposal Siarnal OCP involves total area of 2290.449 ha which comprises of 349.709 ha of forest land, 473.792 ha of Govt. Non-Forest land and 1466.949 Tenancy land.

2. Location of the project:

The boundary of Siarnal block is as follows:

- North : Chaturdhara and Basundhara West blocks separated by Chaturdhara Nala and Basundhara River
- West : Rampia & Dip side of Rampia.
- East : Kulda Block separated by Chaturdhara Nala
- South : Prajapura Block.

Sundargarh town is the nearest revenue town & Dist. HQ, which is at a distance of 46 km. Bhubaneswar, the State Capital from the mines is 450 km. The company Headquarters is at

Burla which is 150 km via Sundargarh, Jharsuguda, Sambalpur. The nearest railhead is Hemgir railway station on Mumbai – Howrah line of South Eastern railway at a distance of about 35 km. The nearest domestic airport, Veer Surendra Sai airport, Jharsuguda at a distance of 30 km. Biju Patanalk International Airport, Bhubaneswar is at a distance of about 450 km. The nearest sea port – Paradip is at a distance of 550 km from the block.

Siarnal OCP has been accorded the Forest Stage I clearance including 349.709 ha of forest land from central government under Section 2 (ii) of Forest (Conservation) Act 1980. Ministry of Environment, Forests and Climate Change in vide Letter No. F. No. 8-25/2021-FC Dated 21st April 2022. The FC has been accorded with a set of conditions to comply with and thus this scheme has been prepared in comply with Condition No. 4(V) of para-A of Stage-I in-principal approval.

3. Physiography & Drainage:

The topography of the block is represented by flat & sloppy ground. The ground slopes generally towards east and north-east and the drainage is through small streams, which in turn feed to river Basundhara. Basundhara River is flowing from west- to-east and ultimately drains into the Ib River.

Distance of waterbodies from the mine is as follows.

Name of the Water Bodies	Distance
Chhota Jhor river/Nala	0 km
Basundhara river	0 km
Garia Nala	4.3 km
Ichha river	18 km
IB river	27 km

4. Climate:

Meteorological data collected from IMD, Bhubaneswar for Jharsuguda IMD station for the year 2013 have been referred for preparation of the following tables:

Item	Parameters	Particulars
Rainfall	Minimum	0.1 mm in Oct
	Maximum	118.8 mm in Aug
	Annual rainfall	1281.6 mm (Average annual rainfall is 1430 mm for last 22 years)
Temperature range (monthly mean of daily temperature)	Minimum	6.9°C in Jan
	Maximum	46.7°C in May
Relative humidity range (monthly mean of daily RH)	Max at 8:30 hr	98% in Feb, Jun and Jul
	Min at 8:30 hr	26% in Apr and May
	Max at 17:30 hr	98% in Jul, Aug and Oct
	Min at 17:30 hr	11% in Apr
Wind speed range (monthly mean of daily wind speed)	Max at 8:30 hr	30 kmph in Oct
	Min at 8:30 hr	2 kmph
	Max at 17:30 hr	30 kmph in Oct
	Min at 17:30 hr	2 kmph

5. Geology:

The "Geological Report on Siamal Block, Ib-River Coalfield," Odisha, was prepared by CMPDI in February 1997. Siamal block spreading over an area of 5.00 sq. km, is a part of north-western sector of Ib-valley coalfield and in which coal bearing area is 4.24 sq. km. The coal seams occurring in Siamal block are in the continuation of the adjoining block i.e., Kulda in the east.

6. Soil Types:

Soil may be defined as a mixture of rock and mineral with the organic matter. The soil of the mining lease area is classified as lateritic soil, lateritic with coal on the basis of its layer of formation. Soil is the net result of the action of climate and organisms especially plant on the earth crust. The pH value of the soil is normal ranging from 6.00 to 7.20.

7. Existing Vegetation:

The crop composition of forest area is mainly Sal (*Shorea robusta*) and its associates namely Bija (*Pterocarpus marsupium*), Mango (*Mangifera indica*), Kendu (*Diospyros aestivacrylon*), Maltai (*Madhuca indica*), Javan (*Dyoscorea cumini*), Netra (*Azadirachta indica*), Bahada (*Terminalia bellerica*), Dhawa (*Anacardium latifolia*), Anaha (*Morinda tinctoria*), Kurum (*Adina cordifolia*), Sohai (*Terminalia tomentosa*), Chir (*Buchanania lanzoi*), Kad (*Azadirachta parviflora*), Sidha (*Leguminaria parviflora*), Sisso (*Dalbergia latifolia*), Karia (*Cleistanthus collina*), Dhatiri (*Woodfordia fruticosa*), Gambhari (*Gmelina arborea*), Karein (*Holliarhena antilyanensis*), Palas (*Butea monosperma*), Ibars (*Chlorocylon swietenia*), etc. Sal (*Shorea robusta*) is the pre-dominant species. The condition of the vegetation is dry deciduous forest.

The proposed site for gap plantation has dense growth of open mix jungle mainly Sal forest and its associates. The available growth is degraded due to biotic pressure like logging, grazing and fire wood collection. As far as possible, care shall be taken to select indigenous species for plantation which are associates of local species.

8. Location:

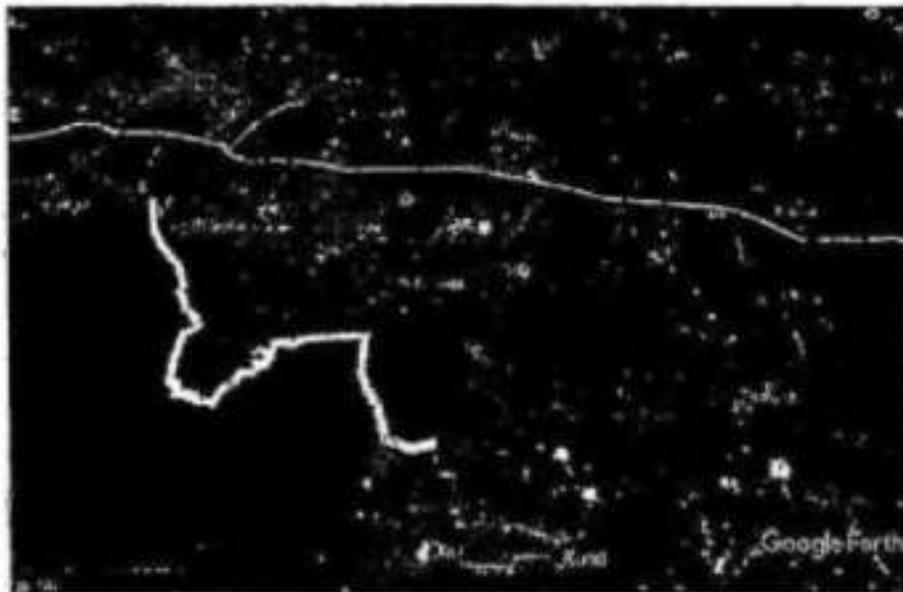
The only forest land boundary shared by mining lease boundary of Simal OCP is Gajjagor Reserved Forest. The identified degraded forest land located on south-west boundary of the mining lease area. A stretch of 6.6 km forest boundary is identified along the outer perimeter of mining lease boundary, hence forming 66 ha of forest land considering 100 meter width as per the stipulated condition.

Based on the DSS report of the total identified degraded forest land i.e. 66 ha. 60 ha degraded forest land is open forest/ non forest, and 6 ha is moderately dense forest. The scheme envisages ANR plantation and soil and moisture conservation measures over 60 ha degraded forest land in consultation with state forest department.

Fig-1 Schematic map showing Siamal OCP and surrounding forests.



Fig-2 Google Earth map showing location of identified DFL and mine lease boundary of Siamal OCP



The stipulated condition reads " *The user agency either himself or through the State Forest Department shall undertake gap planting and soil and water conservation activities to restock and rejuvenate the degraded open forests (having crown density less than 0.40), if any, located in the area within 100 from outer perimeter of the mining lease. The plan for plantation and SMC activities will be prepared and submitted to MoEF&CC before Stage-II clearance.* "

◆ **Objectives:**

The main objective of the present scheme is to fulfil the condition no. 7 of para A which envisages to undertake gap plantation/afforestation and soil moisture conservation works inside the forest area identified within 100 m strip from the outer perimeter of the mining lease boundary where the forest density is less than 0.4 in consultation with the forest department.

This scheme envisages the following objectives:

- a) To enhance the environmental condition of around the mine lease area.
- b) To conserve, protect and develop soil and moisture of degraded forest area.
- c) To restore the area with artificial regeneration.
- d) To demarcate and fence the area in ground to dispense with biotic interferences.
- e) To improve the micro edaphic conditions by undertaking suitable soil and moisture conservation measures.
- f) To create awareness among the local villagers for protection and maintenance of the plantation in particular the adjoining forests for ensuring enrichment of the ecosystem.

9. Proposed measures:

To achieve the above objectives, it has been proposed to take up ANR plantation of 200 plants/ha over 60 ha of degraded reserved forest for gap planting and soil and moisture conservation measures to restock and rejuvenate the degraded open forests (having crown density less than 0.4) if any, located in the area within 100 meters from outer perimeter of the mining lease.

The plantation scheme has been prepared on basis of the one time cost norm for 200 plants per ha with 10 years maintenance including fencing with bamboo twigs, provision for water

through solar bore-well with fitted with drip system. The project cost has been calculated as per the per ha cost for the current year 2022-23 derived from the matrix model of the one time cost norm.

❖ **Preliminary activities for gap planting:**

At the outset, an operation should aim at tending (climber cutting, cleaning, double shoot cutting, pruning etc.) of the existing crop for the growth of promising principal species of the locality for ensuring better growth of the plants. It includes removal of inferior, diseased, malformed, dead, drying and defective tree growth and disposal of them by distributing it among the local VSS members. Apart from it, wood eradication is also an integral part as they interfere with the growth of both planted species and natural regeneration.

The detail of the operation to be carried out is as follows-

- i) Cutting of herbs and shrubs interfering with the growth of the promising species.
- ii) Cutting back of individual top broken poles interfering with growth of well -formed pole cops.
- iii) Cutting back of malformed and diseased species.
- iv) Cutting of climbers up to hand reach.
- v) Sharp cutting of high stumps flush to the ground to get a smooth Stoll with least damage to the cortex.
- vi) Singling of coppice shoots coming out from stools and retaining the most promising one.
- vii) Pruning of the branches of the pole crops up to hand reach.

During the 1st year, climber cutting, and cutting of high stumps, weeds and malformed and diseased species will be done. In the next two years, cutting back of malformed individuals and singling of coppice shoots in case of desired species will be done in the subsidiary silvi cultural activities.

❖ **Soil and moisture conservation measures**

Soil and moisture conservation measures will be undertaken in the complete area irrespective of the density of vegetation to conserve water and enrich growth of the vegetation in the area. The envisaged in the one time cost norm are staggered trench, percolation pits, contour trench, graded earthen bunds, LBCD, wire mesh LBCD, sub surface

dyke, & WHS as per the slope and site requirement on the LS. The detail of soil and moisture conservation measures, financial estimates and program schedule is duly mentioned the cost norm enclosed with the scheme.

❖ **Planting & post-planting**

The area will be re-stocked by raising plantation @ 200 plants per ha in ANR mode in 60 ha.

As far as possible, care shall be taken to select indigenous species for plantation which are associates of local species.

The list of species to be adopted for the plantation is as follows:-

Sl. No	Name Species	Scientific Name
1	Arjuna	Terminalia arjuna
2	Amle	Embliza officinalis
3	Bamboo	Dendrocalamus strictus
4	Karanja	Pongamia pinnata
5	Asan	Terminalia alata
6	Sisoo	Dalbergia sisoo
7	Gaulluar	Gmelina arborea
8	Neem	Azadirachta indica
9	Hurida	Terminalia chebula
10	Bahda	Terminalia belerica
11	Kasi	Bridelia retusa

❖ **Alignment and stacking**

Alignment, stacking and pitting will be taken up in the month of March-April, pits of size 45 cm x 45 cm x 45cm will be dug maintaining a spacing of 2.5 m @ 500 plants per ha as per gap patches.

❖ **Executing agency**

All the works under this scheme shall be executed by Sudargari Forest Division.

❖ Requirement of funds

Estimate for Brushwood Fencing, ANR Plantation, and Soil & Moisture Conservation over 60 ha DFL within 100 meters from outer perimeter of the mine lease boundary.

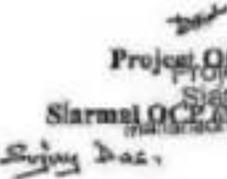
Sl. No.	Particulars	Amount (In Rs.)
1	Cost of ANR plantation @ 200 plants per ha with 18 months old seedling with 10 years maintenance over 60 ha @ Rs. 1,00,938.00 per ha	60,56,280.00
2	Cost of brushwood fencing with bamboo twigs over 7,125 running meter (Three sides of the area) @ Rs. 419.864/- per meter.(Rs.1,04,966/- per 250m/ha) with 5 years maintenance	29,91,531.00
3	Soil & moisture conservation work @ 37,415/- per ha over 60 ha	22,44,900.00
4	Watering provision with Solar bore-well with fitted with drip system over 60 ha @ Rs. 2,33,786/- per ha for 5 years	1,40,27,160.00
5	Total Plantation Cost (1+2+3+4)	2,53,19,871.00
6	15% of (5) total plantation cost towards EPA/Incentives to VSS including monitoring & evaluation.	37,97,980.65
7	Grand Total	2,91,17,851.65

Or say Rs. 2,91,17,860.00/-

The above cost and work schedule is proposed based on the One Time Cost Norm for compensatory afforestation. The rate has been taken for the Matrix Model for the year 2022-23. The copies of the relating cost norm is enclosed as annexure- I, II & III

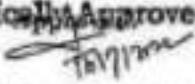
The total estimated cost of the implementation of proposed scheme will be Rs. 2,91,17,860.00 (In words Rupees Two Crore Ninety-one Lakh Seventeen Thousand Eight Hundred Sixty) only. The above expenditure will be made over the period of next ten years. The approved cost of the scheme will be deposited in CAMPA a/c of state forest department.


General Manager
Mahalaxmi Area
Mahalaxmi Area (MCL)


Project Officer
Sirmal OCP
Sirmal OCP (MCL)

Recommended for Approval.


Divisional Forest Officer
Sundargarh Forest Division
Sundargarh Forest Division.

Technically Approved

Regional Chief Conservator of Forests
Rourkela Circle

Regional Chief Conservator of Forest,
Rourkela Forest Division

135

ANNEXURE 6						
Bore-Op Niche for Compensation Afforestation through Aided Natural Regeneration (ANR) @ 200 Seedlings/ha, (10 months old seedling)						
WAGERATE Rs- 711/- PER-MONDAY						
S. No	Items of work	Probable Period of Execution	No of Mandays	Labour Cost (Rs/Rs)	Material Cost (Rs/Rs)	Total cost (Rs/Rs)
0th Year (Advance work) Tree-Planting Operation						
1	Survey, delimitation and Pili marking	Nov/Dec	2	622	0	622
2	Preparation of Treatment Map (Digital Map)	Nov/Dec	3	711	110	821
3	Site preparation	Nov/Dec	3	622	0	622
4	Agricultural operations including stubble or weed cutting of cluster, High stump cutting, singling of stumps & removal of cut material by dry burning or bulldozer to blank space.	Jan/Feb	15	4665	0	4665
5	Alignment and marking for digging of pits	Feb/Mar	0.5	106	0	106
6	Digging of pits (45 cm x 45 cm X 45 cm) in hard soil gravelly soil	Feb/Mar	8	2488	0	2488
Total			28.5	8962.5	109.9	9072.4
1st Year / 1st Year						
1	Mulching of pits by spreading the dug out soil of the pits, application of organic compost/ COM/ FYM @ 10kg/ha covering the exposed soil.	Jan/Jul	1.5	466.5	109.9	576.4
2	Transplantation of 10 months old polythene bag seedlings in hired truck/tractor from the nurseries/fields to planting sites including loading & unloading (Average cost of 10000/-) & Seedling @ 1000/-/Seedling (100 nos)	Jul/Aug	0	0	1320	1320
3	Watering polythene bag seedlings at planting sites at plantation	Jul/Aug	0.5	152.5	0	152.5
4	Conservation of polythene bag seedlings in 1st year. In the 1st year the seedling site to be visited regularly to check the plant growth, applying insecticide, herbicide & planting after weeding the soil with cover applied materials and pressing the soil properly around the planted seedling.	Jul/Aug	4.5	1199.5	0	1199.5
5	Cost of Pili Mark & Survey (i) Survey Site - 1000/- @ 50 gms/ha (ii) Pili Mark - 1000/- per ha (iii) Survey - 1000/- (iv) Pili Mark - 1000/- (v) Survey - 1000/- (vi) Pili Mark - 1000/- (vii) Survey - 1000/- (viii) Pili Mark - 1000/- (ix) Survey - 1000/- (x) Pili Mark - 1000/-	Jul/Aug	0	0	600	600
6	Capacity Improvement @ 1000 (20 nos)	Jul/Aug	0.5	152.5	0	152.5
7	Soil weeding & Mulching	Aug/Sep	2	622	0	622
8	Final Weeding & Mulching (1st time after 1st year)	Oct/Nov	2	622	0	622
9	Final Weeding & Mulching (2nd time after 2nd year)	Nov/Dec	2	622	0	622
10	Watch & Ward including weeding & mulching	Aug/Nov	11	2488	0	2488
Total			23	7158	2920	10078
2nd Year Maintenance						

Project Officer
Sirmar OCP
Mahanadi Concoils Limited

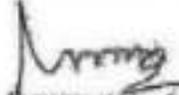
Sl. No.	Items of work	Preferable Period of Execution	No of Man-days	Labour Cost (In Rs.)	Material Cost (In Rs.)	Total cost (In Rs.)
1	Transportation of 20 seedlings from Nursery to plantation site including loading, unloading & conveyance by Tractor @ Rs.5/- per seedling	Jul	0	5	120	120
2	Planting for canopy replacement	Jul	0.5	185.5	0.0	185.5
3	Cost of Insecticide/ Fungicide/ Fertilizer/ Pesticide @ 5 gram/plate - 0.1 Kg @ Rs.250/- per kg - Rs.15/- [1] Urea/SPG/DAP/Ammonia/Ammonium sulphate/Ammonium nitrate/other fertilizers Rs.500/-	Jul	0	0	375	375
4	Weeding (Complete weeding), Manuring & Soil working. (1m. Diameter around the plants)	Sept/Oct	4	1246	0.0	1246
5	Fire line tracing (2 m. wide fire line over 400m long) & inspection path	Feb/Mar	3	933	0.0	933
6	Watch & Ward including watering as per requirement	Apr/Mar	12	3732	0.0	3732
Total			19.5	6011.5	605.0	6709.0
3rd Year Maintenance						
3	Cost of Fertilizer - Urea/SPG/DAP/Ammonia/Ammonium sulphate/Ammonium nitrate/other fertilizers - Rs.500/-	Sept/Oct	0	0	560	560
4	Weeding (Complete weeding), Manuring & Soil working. (1m. Diameter around the plants)	Aug/Sep	4	1246	0	1246
5	Fire line tracing (2 m. wide fire line over 400m long) & inspection path	Feb/Mar	3	933	0	933
6	Watch & Ward including watering as per requirement	Apr/Mar	12	3732	0	3732
Total			19.0	5969.0	560.0	6469.0
4th Year Maintenance						
1	Fire line tracing (2 m. wide fire line over 400m long) & inspection path	Feb/Mar	3	933	0	933
2	Watch & Ward including watering as per requirement	Apr/Mar	12	3732	0	3732
Total			15	4665	0	4665
5th Year Maintenance						
1	Fire line tracing (2 m. wide fire line over 400 m length) & inspection path	Feb/Mar	3	933.00	0	933
2	Watch & Ward including watering as per requirement	Apr/Mar	12	3732.00	0	3732
Total			15.0	4665.0	0	4665
6th Year Maintenance						
1	Fire line tracing (2 m. wide fire line over 400 m length) & inspection path	Feb/Mar	3	933.00	0	933
2	Watch & Ward including watering as per requirement	Apr/Mar	12	3732.00	0	3732
Total			15.0	4665.0	0.0	4665.0
7th Year Maintenance						
1	Fire line tracing (2 m. wide fire line over 400 m length) & inspection path	Feb/Mar	3	933.00	0	933
2	Watch & Ward including watering as per requirement	Apr/Mar	12	3732.00	0	3732
Total			15.0	4665.0	0.0	4665.0
8th Year Maintenance						

Sl. No	Items of work	Probable Period of Execution	No of Man-days	Labour Cost (Rs Rs.)	Material Cost (Rs Rs.)	Total cost (In Rs.)
1	Fire line tracing (2 m. wide fire line over 400 m length) Inspection work	Feb/Mar	7	933.00	0	933
2	Watch & Ward including watering as per requirement	Apr/May	11	3732.00	0	3732
Total			18.0	4665.0	0.0	4665.0
9th Year Maintenance						
1	Fire line tracing (2 m. wide fire line over 400 m length) Inspection work	Feb/Mar	7	933.00	0	933
2	Watch & Ward including watering as per requirement	Apr/May	11	3732.00	0	3732
Total			18.0	4665.0	0.0	4665.0
10th Year Maintenance						
1	Fire line tracing (2 m. wide fire line over 400 m length) Inspection work	Feb/Mar	7	933.00	0	933
2	Watch & Ward including watering as per requirement	Apr/May	11	3732.00	0	3732
Total			18.0	4665.0	0.0	4665.0

Year wise Abstract of Cost form (showing seeding cost separately)

Sl. No	Year	No. person days	Labour cost @ Rs. 111/- per day (Rs)	Material Cost (In Rs.)	Monitoring, Evaluation, Training, Documents, Sub and Other Contingency (5%) of (4+5)	Cost of Seedlings @ Rs. 20.00 per seedlings	TOTAL COST
1	2	3	4	5	6	7	8
1	01st year	21.5	2386.5	100	4386.5	0.00	9400.0
2	1st year	25.0	2775.0	200	4975.0	11500.00	21500.0
3	2nd year	19.5	2154.5	100	3254.5	1000.00	9000.0
4	3rd year	19.0	2109.0	100	3209.0	1000.00	8000.0
5	4th year	15.0	1665.0	0	1665.0	0.00	4000.0
6	5th year	15.0	1665.0	0	1665.0	0.00	4000.0
7	6th year	15.0	1665.0	0	1665.0	0.00	4000.0
8	7th year	15.0	1665.0	0	1665.0	0.00	4000.0
9	8th year	15.0	1665.0	0	1665.0	0.00	4000.0
10	9th year	15.0	1665.0	0	1665.0	0.00	4000.0
11	10th year	15.0	1665.0	0	1665.0	0.00	4000.0
Total		195.0	60645.0	4235.0	2309.0	12090	79276.0

- Note**
1. Priority work requiring 100% independent work should be available nearby to the site of the forest.
 2. 10% independent work should be provided in the forest.
 3. For purchase of equipment like the 1000, 500, 1000, 500, 1000, 500, 1000, 500, etc. may be taken up.
 4. Each 10% independent work should be taken up nearby to the forest and should be provided nearby to the forest.
 5. Working facilities for protection of water & land may be provided as per the availability of water.
 6. The purchase of various items of the forest should be approved by the forest officer and should be provided nearby to the forest.


 A. K. K. K. (Forest Officer & NO, FC, etc.)

114

Wearing Water - W-1	
Wearing provision to CA Plantation	
Solar heating with Bore well system for 5 Ha Plantation field with drip system. Wearing rate @ Rs.311/-	
Year of Installation (0th Year)	
1. Cost of borewell	1,50,000
2. Installation of solar water & other system	200,000
3. Cost of 15 Ha @ bearing & water well equipment	31,000
4. Water Storage Tank/ Pumps etc.	1,50,000
5. Cost of 5 Ha @ drip system including 20 micropipes & filters etc. with 12% GST	267,000
Total	6,17,000
6. Cost of Water @ wearing rate (Rs. 311/1/1) @ 10,10,000/-	1,02,000
1st Year Wearing	
7. Net cost to be recovered	0
Total	
0	
2nd Year Wearing	
8. Maintenance of system @ 1% of total cost of installation	6,170
Total	
6,170	
3rd Year Wearing	
9. Maintenance of system @ 1% of total cost of installation	6,170
Total	
6,170	
4th Year Wearing	
10. Maintenance of system @ 1% of total cost of installation	6,170
Total	
6,170	
5th Year Wearing	
11. Maintenance of system @ 1% of total cost of installation	6,170
Total	
6,170	

Abstract					
Sl. No.	Year	Wearing days	Labour cost @ Rs. 311/1/1 per day	Material Cost	Total cost (Rs.)
1.	0th year	0	00	1,02,000.0	1,02,000.0
2.	1st year	0	00	00	00
3.	2nd year	0	00	61,700	61,700
4.	3rd year	0	00	61,700	61,700
5.	4th year	0	00	61,700	61,700
6.	5th year	0	00	61,700	61,700
Total		0	0	1,92,100	1,92,100

APCC (Forest Division & MCD, FC Act)

Sd/-
Project Officer
 Sirmal OCP
 Mahanadi Coalfields Limited

13

Matrix for Watering W1 (Solar Borewell) fitted with Drip System (per Ha)

Sl. NO.	Compliance month Year	In Rupees																	
		I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	XIII	XIV	XV	XVI	Total Cost	
	Base Month	180005	0	8174	8174	8174	8174	8174	8174	8174	8174	8174	8174	8174	8174	8174	8174	8174	227051
1	2011-02	50000	0	2011	9-03	9005	9005	9005	9005	9005	9005	9005	9005	9005	9005	9005	9005	9005	9005
2	2012-03		19200	0	9402	3090	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	9005
3	2013-04			10000	0	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	9005
4	2014-05				10000	0	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	9005
5	2015-06					10000	0	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	9005
6	2016-07						10000	0	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	9005
7	2017-08							10000	0	1000	1000	1000	1000	1000	1000	1000	1000	1000	9005
8	2018-09								10000	0	1000	1000	1000	1000	1000	1000	1000	1000	9005
9	2019-10									10000	0	1000	1000	1000	1000	1000	1000	1000	9005
10	2020-11										10000	0	1000	1000	1000	1000	1000	1000	9005

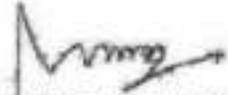

 Project Officer
 APDC Forest Division & NO, FC Act
 Siamal OCP
 Mahanad Co. Ltd. 30d

17c

Annexure-2-B			
Cost Norms for creation of On-site primary structures with shell finished for 100 Nos. per year of Malware (2009)			
WADE (APR No-0117-2009)			
Sl.No	Item of Works	Unit/Rate/Period of Execution	Total Cost
1st Year (2nd Year/3rd Year)			
1	Nil		0
2nd Year			
2	Self Conservation structure structures like Staggered Trench, Percolation pit, Curbar trench, Grated catchment tank, LDCI, Manholes, LDCI, Sub station Dye & WIS as per the design & the requirement of	Apr/May	10,215
3rd Year			
3	Maintenance of SMC structures @ 15 % of initial year cost	Apr/May	1,092
4th Year			
4	Maintenance of SMC structures @ 15 % of initial year cost	Apr/May	1,092
5th Year			
5	Maintenance of SMC structures @ 15 % of initial year cost	Apr/May	1,092
6th Year			
6	Maintenance of SMC structures @ 15 % of initial year cost	Apr/May	1,092
Total			32,583.0

Sl. No	Year	Execution days	Labour cost @ Rs. 214/- per day	Material Cost	Total cost (Rs)
1	1st year	50	10,700	30	10,730
2	2nd year	50	10,700	20,215	30,915
3	3rd year	50	10,700	20,215	30,915
4	4th year	50	10,700	20,215	30,915
5	5th year	50	10,700	20,215	30,915
6	6th year	50	10,700	20,215	30,915
Total			60,000	122,540	182,540.0

Different types of SMC structures may be taken up as per the scope & requirements of the project/contract of the design & specification of different structures should study this document.


 A/CP (Power) Malware R.Y.C. (CA&I)

Project Officer
Sirmal OCP
 Mahant Coalfield Limited

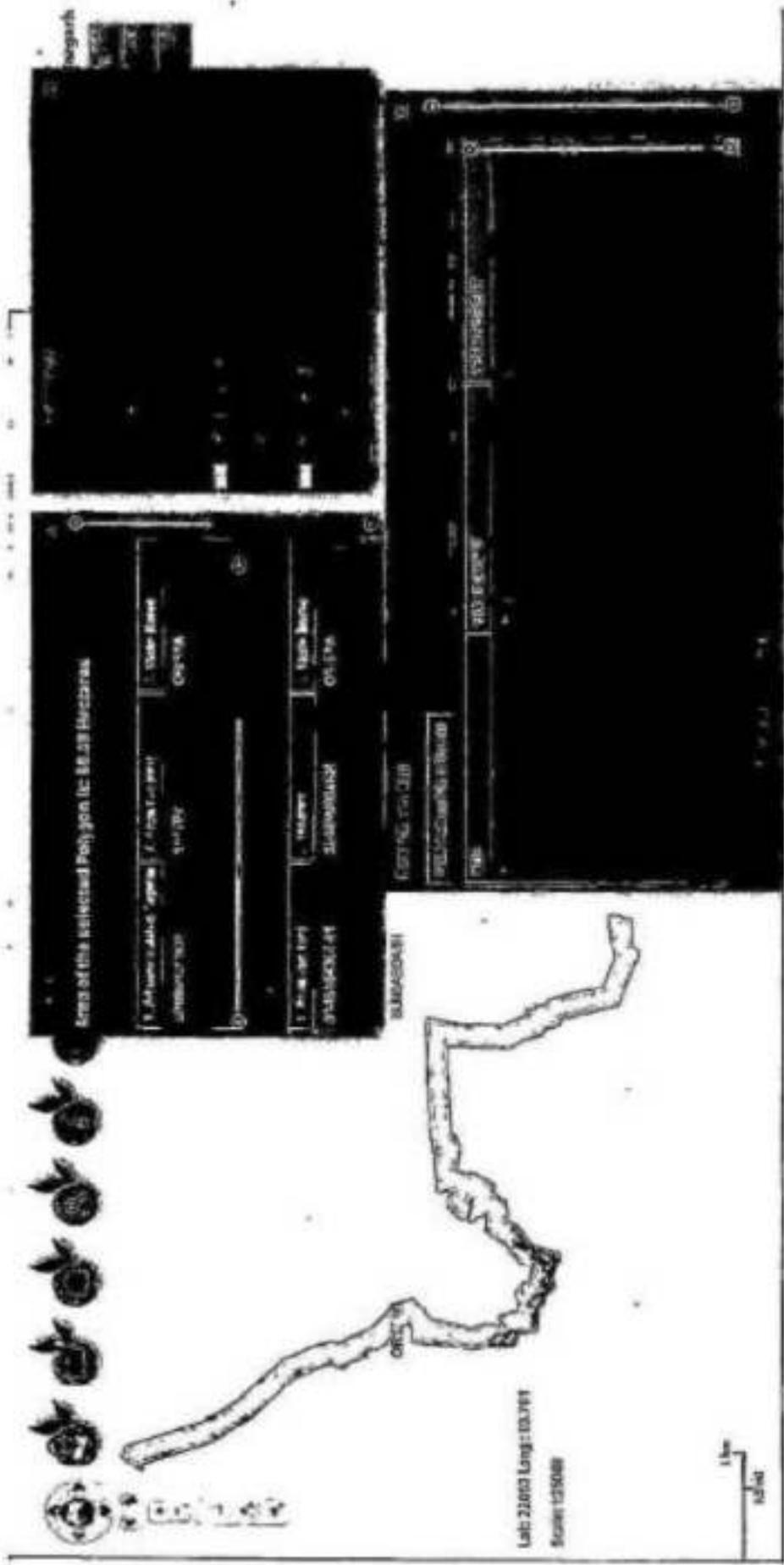
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Matrix for [SMC]

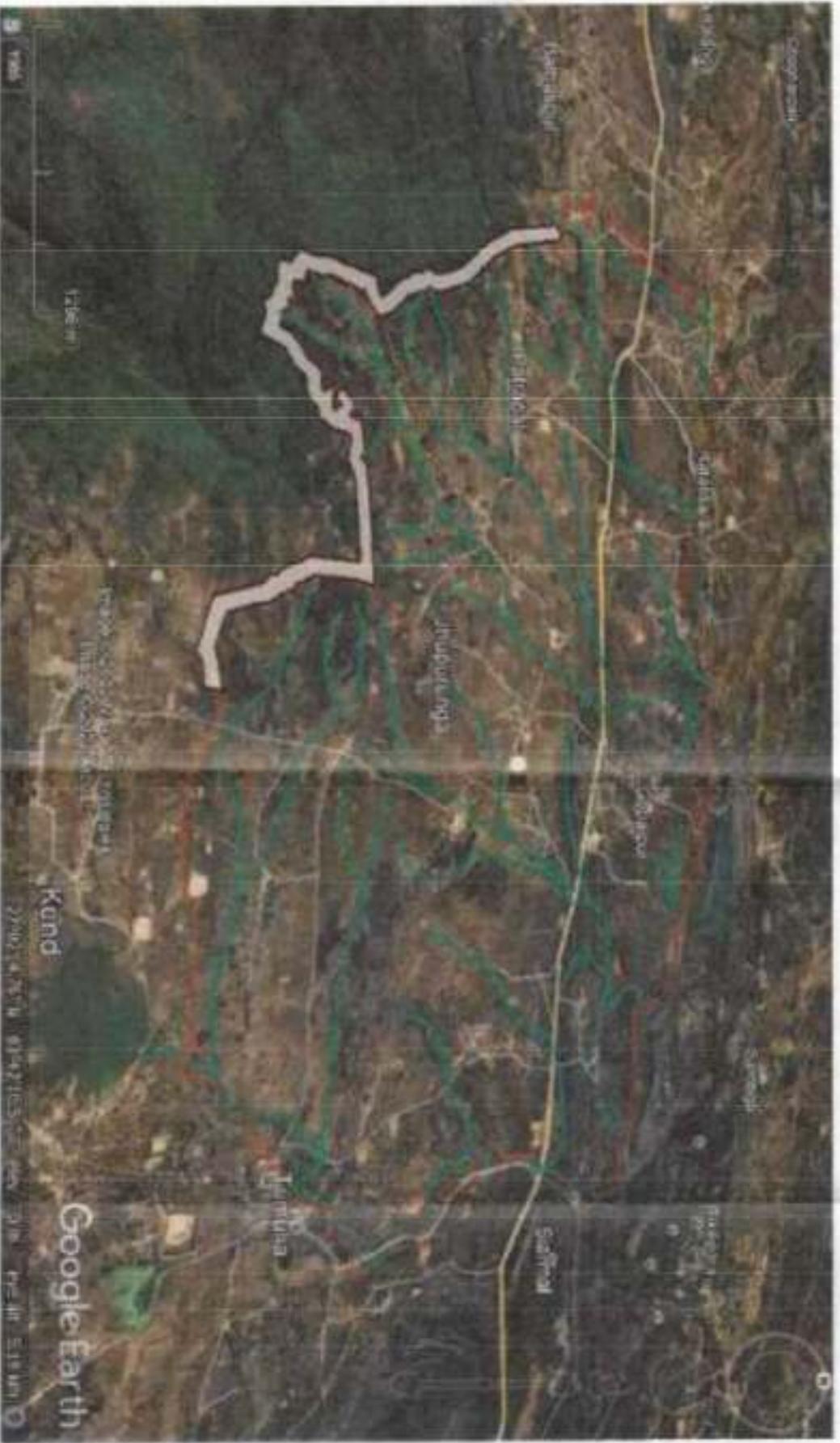
Sl. No.	Reference	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	Total	
1	2021-22	0	3022	3022	3022	3022	3022	3022	3022	3022	3022	3022	3022	3022	3022	3022	3022	3022	3022	3022	3022	3022	3022
2	2022-23	0	3022	3022	3022	3022	3022	3022	3022	3022	3022	3022	3022	3022	3022	3022	3022	3022	3022	3022	3022	3022	3022
3	2023-24	0	3022	3022	3022	3022	3022	3022	3022	3022	3022	3022	3022	3022	3022	3022	3022	3022	3022	3022	3022	3022	3022
4	2024-25	0	3022	3022	3022	3022	3022	3022	3022	3022	3022	3022	3022	3022	3022	3022	3022	3022	3022	3022	3022	3022	3022
5	2025-26	0	3022	3022	3022	3022	3022	3022	3022	3022	3022	3022	3022	3022	3022	3022	3022	3022	3022	3022	3022	3022	3022
6	2026-27	0	3022	3022	3022	3022	3022	3022	3022	3022	3022	3022	3022	3022	3022	3022	3022	3022	3022	3022	3022	3022	3022
7	2027-28	0	3022	3022	3022	3022	3022	3022	3022	3022	3022	3022	3022	3022	3022	3022	3022	3022	3022	3022	3022	3022	3022
8	2028-29	0	3022	3022	3022	3022	3022	3022	3022	3022	3022	3022	3022	3022	3022	3022	3022	3022	3022	3022	3022	3022	3022
9	2029-30	0	3022	3022	3022	3022	3022	3022	3022	3022	3022	3022	3022	3022	3022	3022	3022	3022	3022	3022	3022	3022	3022
10	2030-31	0	3022	3022	3022	3022	3022	3022	3022	3022	3022	3022	3022	3022	3022	3022	3022	3022	3022	3022	3022	3022	3022

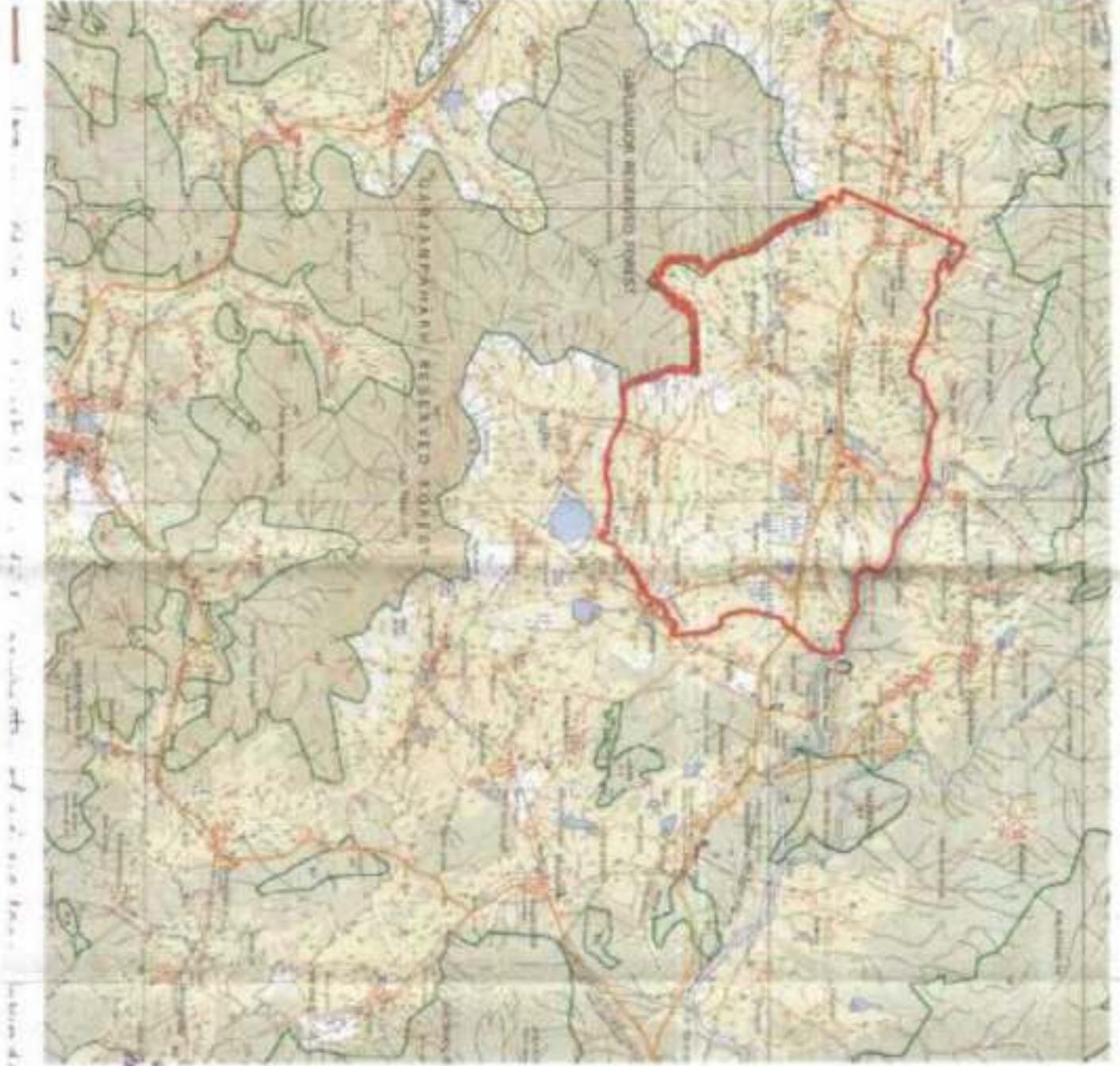
[Signature]
 A/CCP (Forest Division & MO, FC, AEC)

2024
 Project Officer
 Sirmal, OCP
 Mahanadi Coalfields Limited



Google Image: Location image of 100 m strip of forest land at outer perimeter of mine lease boundary, proposed for Gap planting and SMC activities.





Scale 1:50,000
Datum: NAD 83
Projection: UTM
Zone: 18N
Units: Meters

Project: Forest
Map: Forest
Date: 2010

Forest Range Office
Department of Natural Resources

Scheme

Prepared for

"De-silting of village tanks and other water bodies so as to mitigate the impact of siltation of such tanks/ water bodies within 5 km from the mining lease boundary"

in compliance with

Condition no. 8 of para A of Stage-I forest clearance – in-principle approval

vide letter no. f. no. 8-25/2021-fc, dated 21st April 2022

of Ministry of Environment, Forest & Climate Change, Govt. of India,
New Delhi

for

Diversion of 349.709 hectares of forest land for "Starml Opencast Coal Mining Project" within 2290.449 hectares of mining lease area

of

M/s Mahanadi Coalfields Limited.

In Sundargarh Forest Division of Dist. Sundargarh, Odisha

Scheme prepared for "De-silting of village tanks and other water bodies as to mitigate the impact of siltation of such tanks/ water bodies within 5 km from the mining lease boundary"

1. Brief Information:

M/s Mahanadi Coalfields Limited (MCL), a subsidiary company of Coal India Limited is a Miniratna Company of nature and style public sector undertaking under Government of India, which was carved out to administer and mine out coal from the coal mines of Odisha, spread over Talcher and Ib valley coal fields.

Ib valley coal fields in Sundergarh and Bargarh Districts of Odisha contain large reserves of quarriable coal. Each area containing coal has been divided into several mining blocks, and Sirmal geological block is one of them. Sirmal opencast project is located in Sirmal geological block of Gopalpur tract in the north-western part of Ib valley coal fields. It lies between latitudes of 22°01'19"-22°03'59.99" N and longitudes of 83°37'09"-83°42'59.58" E. It is represented in Survey of India Topo sheet No. F44L12 (64N/16). This project is having 1547.82 Mt (Minerale Reserve) of quarriable coal reserve in Gopalpur, Bupurunga, Sirmal, Ratanara, Tumulia and Kolda villages. The entire area of Sirmal project involving six villages were acquired under Coal Bearing (Acquisition and development) Act, 1957 (CBA-1957) vide S.O. No. 1869 dated 10.07.1989 and S.O. No. 3055 dated 29.10.1990. The above land has been vested in MCL via 11(1) of the said Act vide S.O. No. 2592 dated 13.09.1990 and 43015 dated 30.03.1993, (Page-22 to 38DP). Present proposal Sirmal OCF involves total area of 2290.449 ha which comprises of 349.709 ha of forest land, 473.792 ha of Govt. Non- Forest land and 1466.949 Tenancy land.

2. Location of the project:

The boundary of Sirmal block is as follows:

- North : Chaturbhara and Basundhara West Blocks separated by Chaturbhara Nala and Basundhara River.
- West : Rampia & Dip side of Rampia.
- East : Kolda Block separated by Chattrajor nala.
- South : Pratejara Block.

Sundergarh town is the nearest revenue town & Dist. HQ, which is at a distance of 46 km. Bhubaneswar, the State Capital from the mines is 450 km. The company Headquarters is at

Buda which is 150 km via Sundargarh, Jharsuguda, Sambalpur. The nearest railhead is Hengir railway station on Mumbai – Howrah line of South Eastern railway at a distance of about 35 km. The nearest domestic airport, Veer Surendra Sai airport, Jharsuguda at a distance of 30 km. Biju Patnaik International Airport, Bhubaneswar is at a distance of about 450 km. The nearest sea port – Paradip is at a distance of 550 km from the block.

Siarnal OCP has been accorded the Forest Stage I clearance including 349,709 ha of forest land from central government under Section 2 (i) of Forest (Conservation) Act 1980, Ministry of Environment, Forests and Climate Change in vide Letter No. F. No. 8-25/2021-FC Dated 21st April 2022. The FC has been accorded with a set of conditions to comply with and thus this scheme has been prepared to comply with Condition No. 4(V) of para-A of Stage-I in-principle approval.

3. Physiography & Drainage:

The topography of the block is represented by flat & sloppy ground. The ground slopes generally towards east and north-east and the drainage is through small streams, which in turn feed to river Basundhara. Basundhara River is flowing from west- to-east and ultimately drains into the Ib River.

Distance of waterbodies from the mine is as follows.

Name of the Water Bodies	Distance
Chhata Jhor Nala	0 km
Basundhara river	0 km
Garia Nala	4.3 km
Ichha river	18 km
Ib river	27 km

4. Climate:

Meteorological data collected from IMD, Bhubaneswar for Jharsuguda IMD station for the year 2013 have been referred for preparation of the following table:

Item	Parameters	Particulars
Rainfall	Minimum	0.1 mm in Oct
	Maximum	118.8 mm in Aug
	Annual rainfall	1281.6 mm (Average annual rainfall is 1450 mm for last 22 years)
Temperature range (monthly mean of daily temperature)	Minimum	6.9°C in Jan
	Maximum	46.7°C in May
Relative humidity range (monthly mean of daily RH)	Max at 8:30 hr	98% in Feb, Jan and Jul
	Min at 8:30 hr	26% in Apr and May
	Max at 17:30 hr	98% in Jul, Aug and Oct
	Min at 17:30 hr	11% in Apr
Wind speed range (monthly mean of daily wind speed)	Max at 8:30 hr	30 kmph in Oct
	Min at 8:30 hr	2 kmph
	Max at 17:30 hr	30 kmph in Oct
	Min at 17:30 hr	2 kmph

5. Geology:

The "Geological Report on Simal Block, Ib-River Coalfield," Odisha, was prepared by CMPDI in February 1997. Simal block spreading over an area of 5.00 sq.km. is a part of north-western sector of Ib-valley coalfield and in which coal bearing area is 4.24 sq. km. The coal seams occurring in Simal block are in the continuation of the adjoining block i.e., Kolda in the east.

6. Soil Types

Soil may be defined as a mixture of rock and mineral with the organic matter. The soil of the M. L. area is classified as lateritic soil, lateritic with coal on the basis of its layer of formation. Soil is the net result of the action of climate and organisms especially plant on the earth crust. The pH value of the soil is normal ranging from 6.00 to 7.2.

7. Existing Vegetation:

The crop composition of forest area is mainly Sal (*Shorea robusta*) and its associates namely Bija (*Pterocarpus marsipian*), Mango (*Mangifera indica*), Kendu (*Diospyros melanoxylon*), Mahi (*Madhuca indica*), Jamun (*Syzygium cumini*), Neeru (*Anacardium indicum*), Bahda (*Terminalia bellerica*), Dhawa (*Anagallis latifolia*), Aschu (*Morinda toctoria*), Kurian (*Adina cordifolia*), Sabaj (*Terminalia tomentosa*), Char (*Buchanania lanzan*), Kasi (*Mitragyna parviflora*), Sidha (*Lagerstroemia parviflora*), Sisoo (*Dalbergia latifolia*), Karla (*Cleistanthus colinus*), Dhatiki (*Woodfordia fruticosa*), Gumbhari (*Gmelina arborea*), Kuria (*Mollanthea antioyenterica*), Palas (*Butea monosperma*), Bheru (*Chloroxylon swietenia*), etc. Sal (*Shorea robusta*) is the pre dominant species. The condition of the vegetation is dry deciduous Forest.

The condition No. 8 of para-A of the Stage-I approval envisages to prepare a plan for de-siltation of waterbodies. This scheme is being submitted in compliance with aforesaid condition of Ministry of Environment, Forest and Climate Change, Government of India.

◆ Objectives:

The stipulated condition no. 8 of para-A of stage-I approval reads "The user agency shall prepare a list of existing village tanks and other water bodies with GPS coordinates located within 5 km from the mine lease boundary. This list is to be duly verified by the concerned Divisional Forest Officer. The User Agency shall regularly undertake desilting of these village tanks and other water bodies so as to mitigate the impact of siltation of such tanks/ water bodies. A detailed approved plan for desilting of identified ponds and water bodies to be prepared in consultation with forest department and shall be submitted to MoEF&CC before Stage-II approval."

To fulfill the above stipulation of the Stage-I approval which envisages de-silting of village tanks and other water bodies so as to mitigate the impact of siltation of such tanks/ water bodies within 5 km from the mine lease boundary, the scope of the scheme is as follows:

- (a) To mitigate the impact of siltation of village tanks & other water bodies.
- (b) To ensure conservation of water in and around the project site.
- (c) Planning for optimum use and conservation of water resources.

(d) Development and management of the resources to achieve higher sustainable production without deterioration in the resource base and any ecological imbalances.

Water conservation can be achieved by creating water storage capacity in village tanks & other water bodies through water harvesting structures and check dams. A number of perennial streams radiates around the project area. The important streams and their tributaries that are controlling the drainage in and around the leasehold area are primarily Chhata Jor Nala & Braundhars River. Efforts will be made to conserve the water bodies (ponds) developed over the years, both natural and man-made by de-siltation interventions over the next ten years.

❖ De-siltation of water tanks and water bodies:

Location of the proposed ponds with GPS coordinates are as given below.

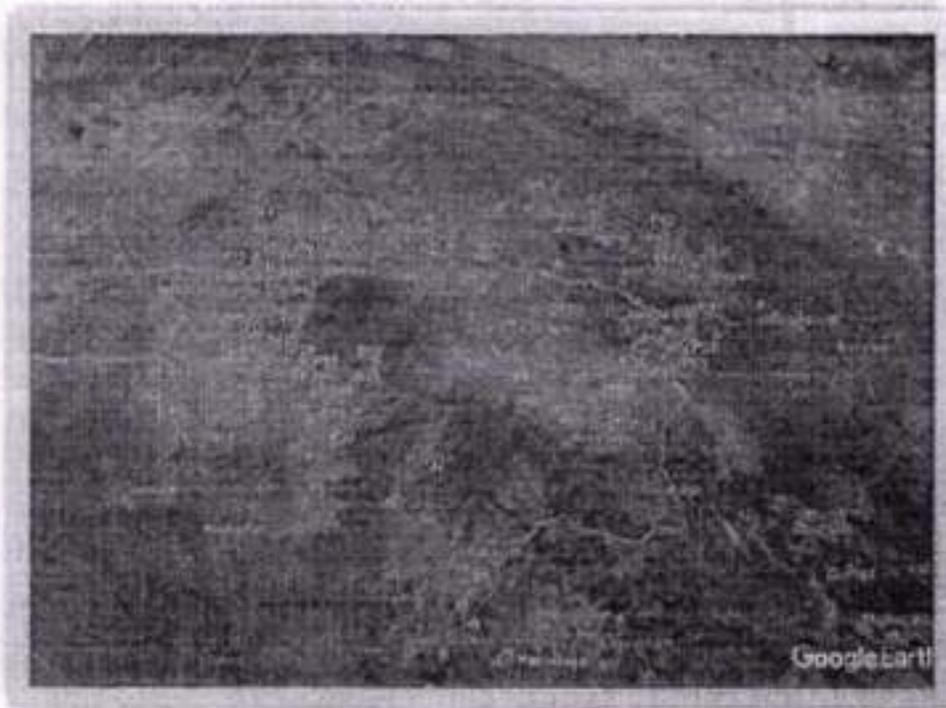


Figure 1: Google map showing the location of Water tanks and waterbodies

Source: Google Earth Pro.

◆ The cost of de-siltation has been taken @ Rs. 135.25/- per Cum as per 2.6.1 (Standard Operating Rates) of 2021, MCL.

◆ Table1: List of ponds

Icon	Village	Northing	Easting	Area (m ²)	Quantity (m ³)	Amount (in Rs.)
P1	RF, Near Sarampia	22° 5'16.96"N	83°30'51.06"E	9000	11500	1825875.00
P2	Mundalkhet	22° 49.03"N	83°37'26.91"E	1600	2400	324600.00
P3	Mundalkhet	22° 3'49.41"N	83°37'32.15"E	2400	3600	486900.00
P4	Mundalkhet	22° 3'44.97"N	83°37'38.10"E	2100	3150	426037.50
P5	Mundalkhet	22° 3'30.03"N	83°37'22.07"E	33600	50400	6816600.00
P6	Mundalkhet	22° 3'32.51"N	83°37'51.50"E	8900	13200	1785300.00
P7	Mundalkhet	22° 3'30.05"N	83°37'53.08"E	2400	3600	486900.00
P8	Bhilaimunda	22° 3'4.16"N	83°37'36.29"E	1800	2700	365175.00
P9	Bhilaimunda	22° 2'47.37"N	83°37'32.57"E	1200	1800	243450.00
P10	Bhilaimunda	22° 2'49.96"N	83°37'12.92"E	4800	7200	973800.00
P11	Bhilaimunda	22° 2'52.18"N	83°37'11.06"E	10200	28900	3895200.00
P12	Bhilaimunda	22° 2'53.25"N	83°37'13.40"E	5500	8250	1115812.50
P13	Bhilaimunda	22° 2'42.21"N	83°37'18.10"E	1800	2700	365175.00
P14	Bhilaimunda	22° 2'45.93"N	83°37'4.75"E	1400	2100	284025.00
P15	Bhilaimunda	22° 2'26.09"N	83°37'8.91"E	1000	1500	202875.00
P16	Garjanjore	22° 2'14.79"N	83°37'44.84"E	11000	16500	2231625.00
P17	Garjanjore	22° 2'15.49"N	83°37'57.66"E	2900	4350	588337.50
P18	Garjanjore	22° 2'3.20"N	83°37'58.22"E	2300	3450	466612.50
P19	Garjanjore	22° 2'4.81"N	83°37'46.61"E	1400	2100	284025.00

P20	Garjanjore	22° 25.41"N	83°37'23.67"E	1300	1950	263737.50
P21	Garjanjore	22° 1'47.48"N	83°37'51.76"E	29600	44400	6005100.00
P22	Garjanjore	22° 1'53.35"N	83°37'57.55"E	2100	3150	426037.50
P23	Kuarkola	22° 0'52.07"N	83°37'45.69"E	28000	42000	5680500.00
P24	Kuarkola	22° 0'49.66"N	83°37'45.72"E	2200	3300	446325.00
P25	Dunguridibi	22° 0'40.57"N	83°38'13.52"E	1000	1500	202875.00
P26	Dunguridibi	22° 0'32.94"N	83°38'41.77"E	1900	2850	385462.50
P27	Dunguridibi	22° 0'22.51"N	83°38'42.07"E	1200	1800	243450.00
P28	Dunguridibi	22° 0'26.81"N	83°38'46.49"E	320	480	64920.00
P29	Kendudibi	21°59'57.00"N	83°39'2.51"E	57200	85800	11604430.00
P30	Kendudibi	21°59'22.90"N	83°39'6.07"E	4100	6150	831787.50
P31	Kendudibi	21°59'17.48"N	83°39'17.08"E	2400	3600	486900.00
P32	Julenbar	21°58'44.85"N	83°40'56.23"E	5700	8550	1156387.50
P33	Sahaspur	21°59'40.84"N	83°44'2.17"E	22100	33150	4485537.50
P34	Kutabaga	21°59'44.75"N	83°44'52.61"E	16500	24750	3347437.50
P35	Kutabaga	21°59'25.83"N	83°44'46.46"E	1000	1500	202875.00
P36	Garjanbahal	22° 0'36.49"N	83°45'2.82"E	20000	30000	4057500.00
P37	Garjanbahal	22° 0'39.33"N	83°45'41.59"E	5200	7800	1034930.00
P38	Garjanbahal	22° 0'49.72"N	83°45'50.56"E	1100	1650	223162.50
P39	Garjanbahal	22° 1'0.61"N	83°46'9.81"E	1600	2400	321600.00
P40	Garjanbahal	22° 1'11.64"N	83°46'11.45"E	1000	1500	202875.00
P41	Garjanbahal	22° 1'32.93"N	83°46'21.78"E	1200	1800	243450.00
P42	Barpali	22° 2'22.19"N	83°46'28.46"E	1300	1950	263737.50
P43	Kusara	22° 3'3.54"N	83°46'15.07"E	2900	4350	588337.50
P44	Kusara	22° 3'8.58"N	83°46'0.34"E	12400	18600	2515650.00
P45	Kusara	22° 3'21.13"N	83°45'59.13"E	10000	15000	2028750.00
P46	Tiklipara	22° 3'10.34"N	83°45'7.42"E	2500	3750	507187.50
P47	Tiklipara	22° 3'47.44"N	83°44'38.57"E	15900	23850	3225712.50
P48	Sardaga	22° 4'24.11"N	83°43'44.91"E	46000	69000	9332250.00
P49	Tumulia	22° 1'19.40"N	83°43'28.37"E	1100	1650	223162.50
P50	Tumulia	22° 1'30.39"N	83°43'34.82"E	1900	2850	385462.50
P51	Tumulia	22° 1'0.59"N	83°43'27.96"E	80000	132000	17853000.00

P52	Kendudih	21°59'24.67"N	83°39'31.18"E	1000	1500	202875.00
P53	Kendudih	21°59'26.41"N	83°39'49.31"E	3900	5850	791212.50
P54	Kendudih	21°59'3.92"N	83°39'15.95"E	300	450	60862.50
P55	Kendudih	22° 0'1.66"N	83°39'42.02"E	1400	2100	284025.00
P56	Kendudih	22° 0'7.68"N	83°39'47.57"E	463	694.5	93931.13
P57	Kendudih	22° 0'23.55"N	83°40'6.67"E	1000	1500	202875.00
P58	Kendudih	22° 0'14.33"N	83°39'16.58"E	1000	1500	202875.00
P59	Karakela	22° 1'1.78"N	83°38'32.01"E	290	435	58833.75
P60	Karakela	22° 1'3.84"N	83°38'26.33"E	210	315	42603.75
P61	Karakela	22° 1'3.91"N	83°38'18.56"E	1400	2100	284025.00
P62	Karakela	22° 1'5.32"N	83°38'15.25"E	274	411	55587.75
P63	Karakela	22° 1'13.47"N	83°38'9.67"E	1000	1500	202875.00
P64	Karakela	22° 1'17.80"N	83°38'9.49"E	352	528	71412.00
P65	Karakela	22° 1'3.86"N	83°38'1.50"E	235	352.5	47675.63
P66	Karakela	22° 1'5.09"N	83°37'52.33"E	87	130.5	17650.13
P67	Garjanjore	22° 1'40.43"N	83°38'42.34"E	4200	6300	852075.00
P68	Garjanjore	22° 1'58.18"N	83°38'29.16"E	1000	1500	202875.00
P69	Chhatabar	22° 2'46.23"N	83°38'17.85"E	1000	1500	202875.00
P70	Chhatabar	22° 2'58.33"N	83°38'15.29"E	4900	7350	994087.50
P71	Chhatabar	22° 2'26.48"N	83°38'21.60"E	13600	20400	2759100.00
P72	Chhatabar	22° 2'57.20"N	83°38'31.99"E	4900	7350	994087.50
P73	Chhatabar	22° 2'37.15"N	83°38'49.79"E	2600	3900	405730.00
P74	Chhatabar	22° 3'2.68"N	83°39'6.58"E	2700	4050	547762.50
P75	Balhaspur	22° 3'4.83"N	83°39'13.82"E	1600	1500	202875.00
P76	Balhaspur	22° 3'7.23"N	83°39'37.26"E	454	681	92105.35
P77	Balhaspur	22° 3'33.75"N	83°39'46.77"E	4300	6450	872362.50
P78	Balhaspur	22° 3'30.13"N	83°39'57.59"E	1200	1800	243450.00
P79	Ratanstra	22° 3'23.33"N	83°40'7.53"E	2900	4350	588337.50
P80	Ratanstra	22° 3'28.89"N	83°40'13.42"E	2600	3900	527475.00
P81	Barpai	22° 2'45.86"N	83°46'46.14"E	2800	4200	568050.00
P82	Garjanbhai	22° 0'34.45"N	83°45'59.25"E	1800	2700	365175.00
P83	Garjanbhai	22° 0'22.56"N	83°45'50.99"E	1400	2100	284025.00

P84	Sahaspur	21°59'42.65"N	83°43'58.68"E	4100	8150	831757.50
P85	Sahaspur	21°59'42.80"N	83°43'52.56"E	2600	3900	527475.00
P86	Sahaspur	21°59'56.60"N	83°43'29.87"E	1300	1950	263737.50
P87	Sahaspur	22° 0'4.30"N	83°43'25.07"E	2700	4050	547762.50
P88	Gaddwar	22° 0'25.98"N	83°43'0.67"E	7100	3150	426057.50
P89	Gaddwar	22° 0'18.42"N	83°42'42.44"E	2000	3000	405750.00
P90	Gaddwar	22° 0'21.27"N	83°42'32.35"E	383	574.5	77701.13
Dam 1	Kund	22° 0'39.45"N	83°42'43.53"E	340000	510000	88977500.00
				923768	1385652	187409433.00

◆ Executing Agency

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. The entire work shall be carried out in coordination with the Forest Department.

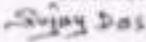
Sl. No	Designation	Expertise
1	Dy. UM (Mining)	25 years' experience in Mining/Environment Survey.
2	Area Environment Officer	10 years' experience in Environment & Forest
3	Area Survey Officer	5 years' experience with pollution control & Environmental Management
4	Project Environment Officer	6 years' experience with Environment Management plan.

◆ Requirement of Funds

The estimated cost for 91 nos. of identified waterbodies within 5 Km radius from the mine lease boundary for de-siltation up to 1.5 m depth for a total of 13,85,652 Cum of silt (compliance to condition no. 8 of para A of the stage I grant) will be Rs. 18,74,09,500.00

only. The above expenditure will be made over the next ten years period. Therefore, budget provision has been kept by the user agency for implementation of the above programme over a period of next ten years. This budget will be subjected to increase in amount considering the increase in material cost and labor charges.

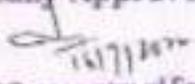

General Manager,
Maharani Area (MCL),
Maharajm Area
Maharadi Coal Fields Limited


Project Officer,
Sarmal OCP (MCL)

Sarmal OCP
Maharadi Coal Fields Limited

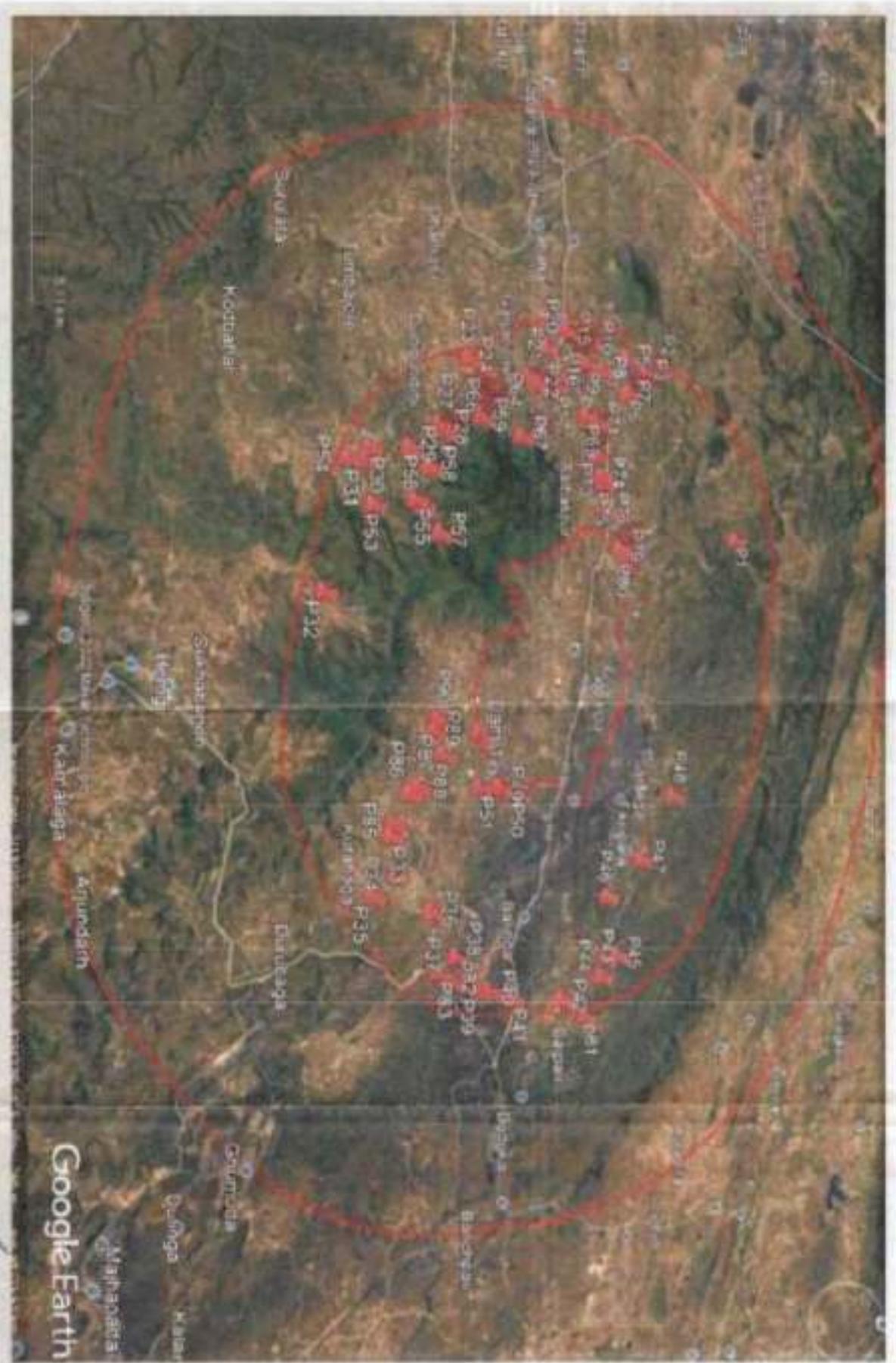
Recommended for Approval


Divisional Forest Officer

Sundargarh Forest Division
DIVISIONAL FOREST OFFICER
SUNDARGARH FOREST DIVISION

Approved.
Technically Approved

Regional Chief Conservator of Forests
Rourkela Circle
Regional Chief Conservator of Forest,
Rourkela Forest Division

Google Image: Locations of waterbodies proposed for de-siltation





ODISHA SPACE APPLICATIONS CENTRE (ORSAC)

Department of Science & Technology, Govt. of Odisha

Registered No. 5671

P. K. Mallick, IAS
Chief Executive

Date: 29.07.2022
Office of the General Manager,
Mahalaxmi Area

ORSAC/PR/0825/2020-22/251R(7) DL 12.7.22

To

**General Manager,
Mahalaxmi area, Mahanadi Coalfields Ltd,
At/PO-Basundhara, Dt-Sundergarh, Odisha-770076.**

Sub: Supply of DGPS Survey M.L. area map in respect of Siarmal OCP, Mahalaxmi Area of Mahanadi Coal field Ltd in Sundergarh district.

Ref: Your Letter No. MCL/MLA/GM/2021-22/36, dt.01.02.2022.

Sir,

Inviting a reference to the subject and letter cited above, please find enclosed herewith the soft and hard copy output map for Siarmal OCP, Mahalaxmi Area generated based on the field DGPS survey data of the joint survey team comprising of officers from ORSAC, Revenue, Forest & Mining Department. It is pertinent to mention that the above lease area is superimposed on the Geo-referenced village cadastral map of the area based on the output of the field joint survey undertaken during June, 2022.

You are requested to receive the deliverable as mentioned above and acknowledge the same to this office. Further, it is to inform you that the output should not be used for any other purpose than it is meant for.

Yours faithfully,

(Signature)
11.07.22
CHIEF EXECUTIVE

Encl: 6 Maps & 1 CD.

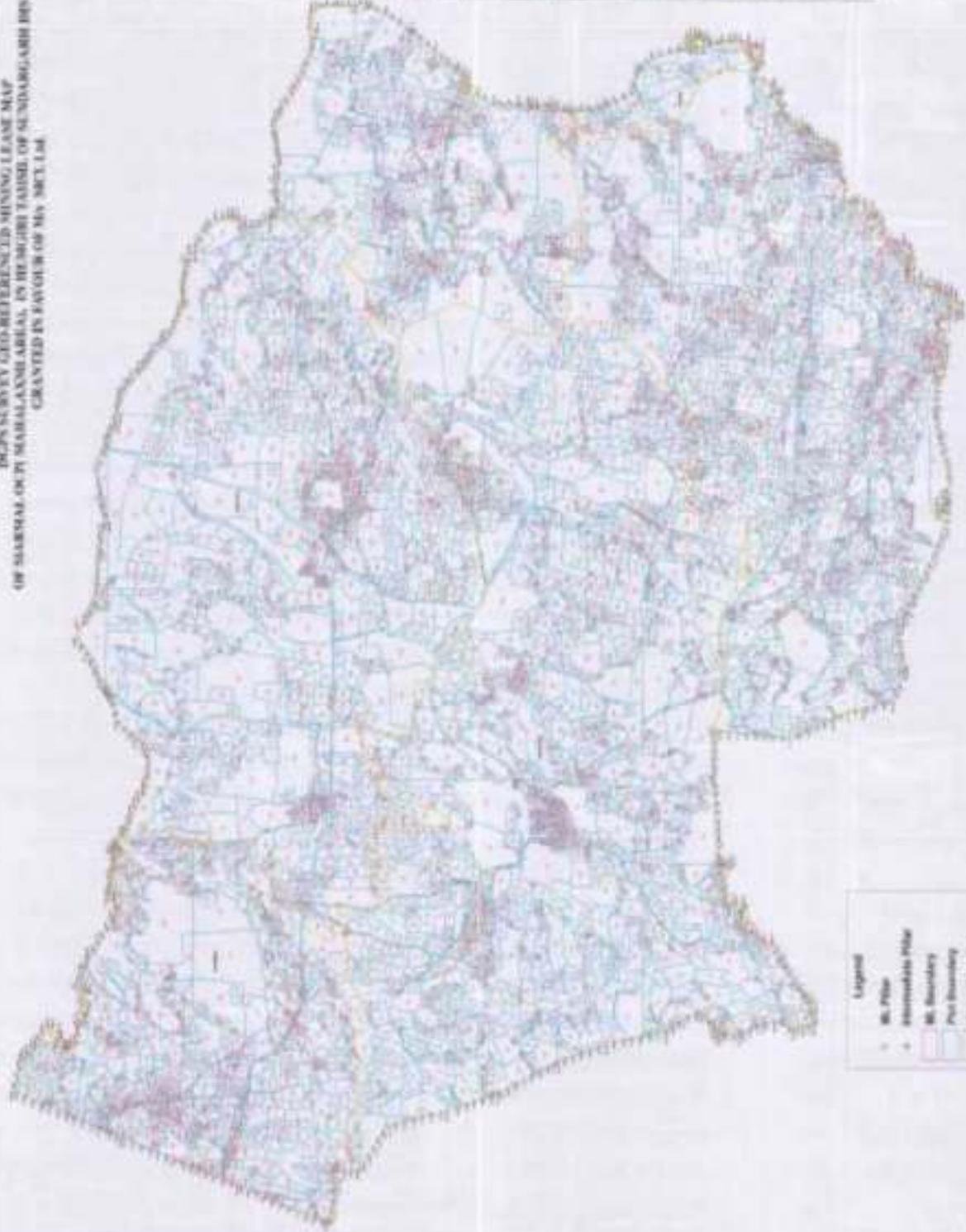
Copy to:

- 1) The Director of Mines, Odisha for kind information and necessary action.
- 2) The Collector, Sundergarh for information and necessary action.
- 3) The DFO, Sundergarh for information and necessary action.
- 4) The DDM, Rourkela for information and necessary action.
- 5) The Tahsildar, Hengiri for information and necessary action.
- 6) M/s DBL Siarmal Coal Mines Private Ltd, for information and necessary action.

(Signature)
Project Officer
Siarmal OCP
Mahanadi Coalfields Limited

(Signature)
General Manager
Mahalaxmi Area
Mahanadi Coal Fields Limited

DGPS SURVEY GEO-REFERENCED SHINGO LEASE MAP
OF MARMAI-0071 MAHALAKSHI AREA, IN THE TOWNSHIP OF SUNDRAGARH DISTRICT
GRANTED IN FAVOR OF M/S. MCT, LTD.



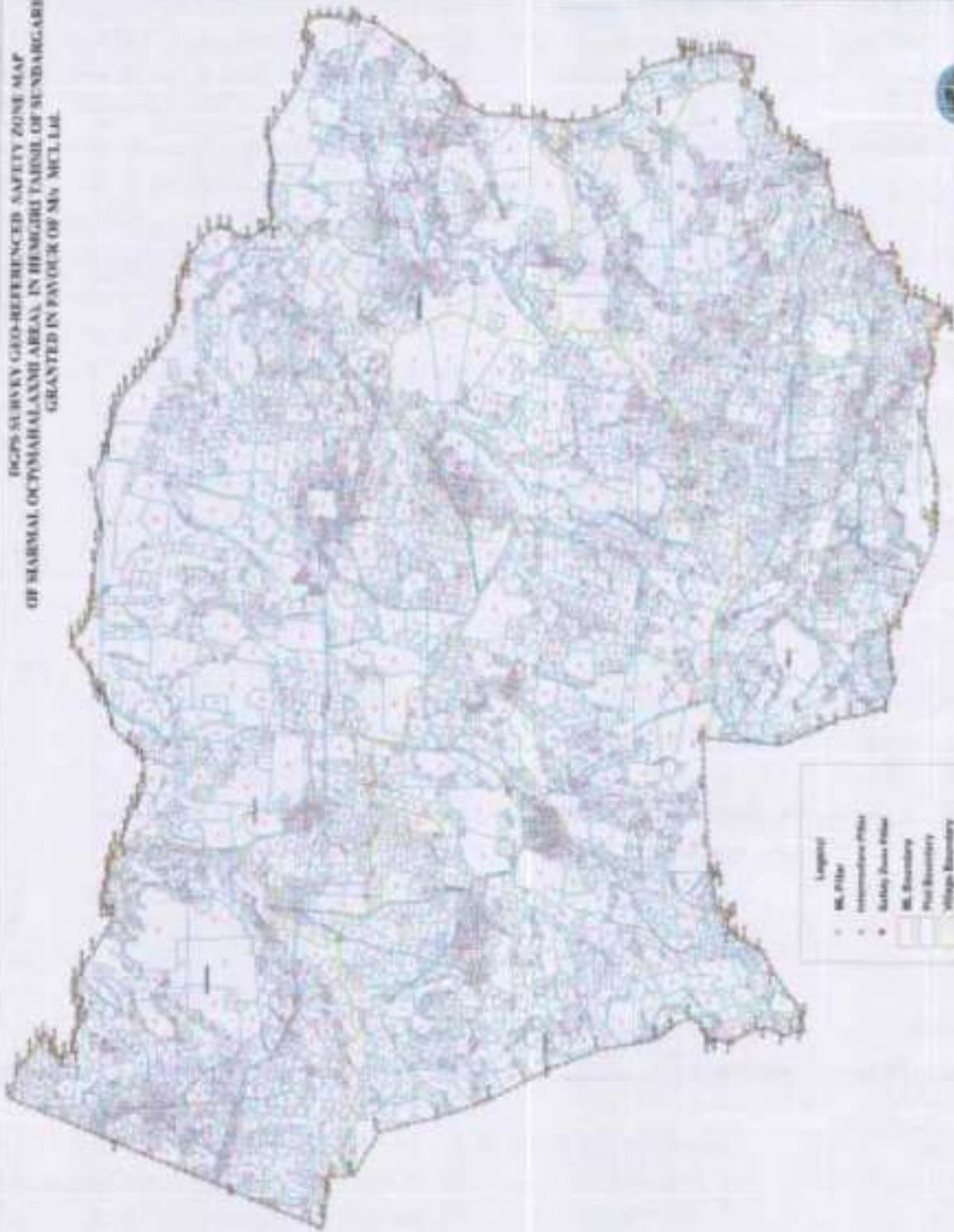
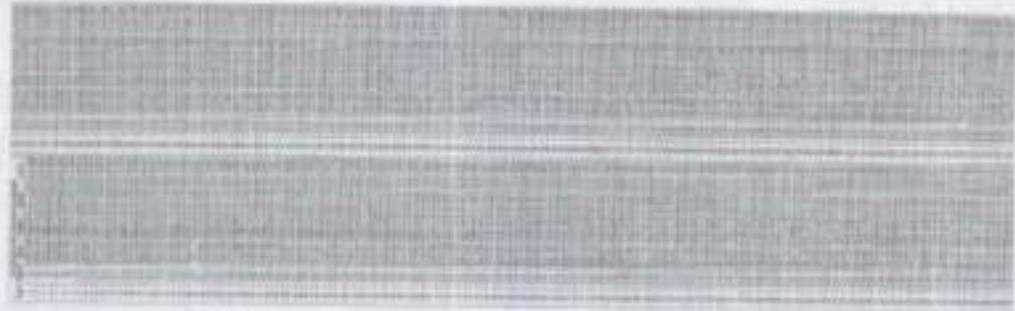
- Legend
- M. Pillar
 - ▲ Intersectable Pillar
 - M. Boundary
 - P. Boundary
 - Village Boundary

Scale: 1:50,000



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[Official stamp]

DGPS SURVEY GEO-REFERENCED SAFETY ZONE MAP
OF SHARMAL OCCUPATIONAL AREA, IN THE NORTH TOWN OF SUNDBARGARH DISTRICT
GRANTED IN FAVOUR OF M/s. MCLLE



- Legend**
- ML Piller
 - Interlocking Piller
 - Safety Zone Piller
 - ML Boundary
 - Panch Boundary
 - Village Boundary
 - Safety Zone Boundary



[Handwritten signature]
[Official stamp]

Scale: 1:50,000

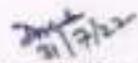
Annexure-XIV

UNDERTAKING

(Condition no. 9 (ii) of Para A of file No.8-25/2021-FC)

I/we do hereby undertake "to ensure the boundary of the safety zone of the mining lease, adjacent to habitations/roads is properly fenced".


General Manager
Mahalaxmi Area, MCL
General Manager
Mahalaxmi Area


Project Officer
Siarmal OCP, MCL
Project Officer
Siarmal OCP
Mahanadi Coalfields Limited

Scheme

Prepared for

Fencing, protection and regeneration of safety zone area of 7.5 meter strip
within the mining lease boundary

(18.59 ha)

in compliance with

Condition no. 9 (i) (ii) (iii) of Para A of Stage-I forest clearance – in-
principle approval

vide letter no. F. No. 8-25/2021-FC dated 21st April 2022

of Govt. of India, Ministry of Environment, Forest & Climate Change,

New Delhi

for

Diversion of 349.709 hectares of forest land for "Siarmal Opencast Coal
Mining Project" within 1290.45 hectares of mining lease area

of

M/s Mahanadi Coalfields Limited.

in Sundargarh Forest Division of Dist. Sundargarh, Odisha

Scheme for fencing, protection and regeneration of safety zone area of 7.5 meter strip within the mine lease boundary (18.59 ha).

1. Brief Information:

M/s Mahanadi Coalfields Limited (MCL), a subsidiary company of Coal India Limited is a Miniratna Company of nature and style public sector undertaking under Government of India, which was carved out to administer and mine out coal from the coal mines of Odisha, spread over Talcher and Ib valley coal fields.

Ib valley coal fields in Sundargarh and Jharsuguda Districts of Odisha contain large reserves of quarriable coal. Each area containing coal has been divided into several mining blocks, and Siarnal geological block is one of them. Siarnal opencast project is located in Siarnal geological block of Gopalpur tract in the north-western part of Ib valley coal fields. It lies between latitudes of 22°01'19"-22°03'59.99" N and longitudes of 83°27'09" - 83°42'59.55" E. It is represented in Survey of India Topo sheet No. F44L12 (84/N/16). This project is having 1547.82 Mt (Mineable Reserve) of quarriable coal reserve in Gopalpur, Bopuranga, Siarnal, Ratanara, Tamulia and Kulda villages. The entire area of Siarnal project involving six villages were acquired under Coal Bearing (Acquisition and development) Act, 1957 (CBA-1957) vide S.O. No. 1869 dated 13.07.1989 and S.O. No. 3055 dated 29.10.1990. The above land has been vested in MCL u/s 11(1) of the said Act vide SO No. 2502 dated 13.06.1990 and 43015 dated 30.03.1993. (Page 22 to 28/DP). Present proposal Siarnal OCP involves total area of 2296.449 ha which comprises of 349.709 ha of forest land, 473.792 ha of Govt. Non-Forest land and 1466.949 Tenancy land.

2. Location of the project:

The boundary of Siarnal block is as follows:

North	:	Chetirdham and Basundhara West blocks separated by Chattardhara Nala and Basundhara River
West	:	Rampia & Dip side of Rampia.
East	:	Kulda Block separated by Chattaror nala
South	:	Prajapara Block.

Sundargarh town is the nearest revenue town & District HQ, which is at a distance of 46 km. Bhubaneswar, the State Capital from the mines is 450 km. The company Headquarters is at Bura which is 150 km via Sundargarh, Jharsuguda, Sambalpur. The nearest railhead is Hengir railway station on Mumbai - Howrah line of South Eastern railway at a distance of about 35 km. The nearest domestic airport, Veer Surendra Sai airport, Jharsuguda at a distance of 30 km. Biju Patnaik International Airport, Bhubaneswar is at a distance of about 450 km. The nearest sea port - Paradip is at a distance of 550 km from the block.

State/OCF has been accorded the Forest Stage I clearance including 349.709 ha of forest land from central government under Section 2 (ii) of Forest (Conservation) Act 1980, Ministry of Environment, Forests and Climate Change in vide Letter No. F. No. E-25/2021-FC dated 21st April 2022. The FC has been accorded with a set of conditions to comply with and thus this scheme has been prepared to comply with Condition No. 4(V) of para-A of Stage-I in-principal approval.

3. Physiography & Drainage:

The topography of the block is represented by flat & sloppy ground. The ground slopes gradually towards east and north-east and the drainage is through small streams, which in turn feed to river Basundhara. Basundhara River is flowing from west-to-east and ultimately drains into the Ib River.

Distance of waterbodies from the mine is as follows.

Name of the Water Bodies	Distance
Chhota Jhor Nala	0 km
Basundhara river	0 km
Garia Nala	4.3 km
Ichha river	18 km
Ib river	37 km

4. Climate:

Meteorological data collected from IMD, Bhubaneswar for Jharnuguda BCD station for the year 2013 have been referred for preparation of the following table:

Item	Parameters	Particulars
Rainfall	Minimum	0.1 mm in Oct
	Maximum	118.8 mm in Aug
	Annual rainfall	1281.6 mm (Average annual rainfall is 1430 mm for last 22 years)
	Minimum	0.1 mm in Oct
Temperature range (monthly mean of daily temperature)	Minimum	6.9°C in Jan
	Maximum	46.7°C in May
Relative humidity range (monthly mean of daily RH)	Max at 8:30 hr	98% in Feb, Jun and Jul
	Min at 8:30 hr	26% in Apr and May
	Max at 17:30 hr	98% in Jul, Aug and Oct
	Min at 17:30 hr	11% in Apr
Wind speed range (monthly mean of daily wind speed)	Max at 8:30 hr	30 kmph in Oct
	Min at 8:30 hr	2 kmph
	Max at 17:30 hr	30 kmph in Oct
	Min at 17:30 hr	2 kmph

5. Geology:

The "Geological Report on Siarnal Block, Ib-River Coalfield," Odisha, was prepared by CMPDI in February 1997. Siarnal block spreading over an area of 5.00 sq. km. is a part of north-western sector of Ib-valley coalfield and in which coal bearing area is 4.24 sq. km.

The coal seams occurring in Siarnal block are in the continuation of the adjoining block i.e., Kula in the east.

6. Soil Type:

Soil may be defined as a mixture of rock and mineral with the organic matter. The soil of the M. L. area is classified as lateritic soil, lateritic with coal on the basis of its layer of formation. Soil is the net result of the action of climate and organisms especially plant on the earth crust. The pH value of the soil is normal ranging from 6.00 to 7.2.

7. Existing Vegetation:

The crop composition of forest area is mainly Sal (*Shorea robusta*) and its associates namely Bija (*Pterocarpus marsipium*), Mango (*Mangifera indica*), Konda (*Diospyros melanocylon*), Mahul (*Madhua indica*), Jamun (*Syzygium cumini*), Neem (*Azadirachta indica*), Bahada (*Terminalia bellerica*), Dhaura (*Anogeissus latifolia*), Aachhu (*Morinda tinctoria*), Kurum (*Azadirachta indica*), Sahaj (*Terminalia tomentosa*), Char (*Buchanania lanzan*), Kasi (*Miragyna parviflora*), Sidha (*Lagerstroemia parviflora*), Sissoo (*Dalbergia latifolia*), Karla (*Cleistanthus collinus*), Dhatki (*Woodfordia fruticosa*), Gambhari (*Gmelina arborea*), Kurein (*Holoptelea integrifolia*), Pulas (*Butea monosperma*), Bheru (*Chloroxylon swietenia*), etc. Sal (*Shorea robusta*) is the pre-dominant species. The condition of the vegetation is dry deciduous Forest.

The Condition no. 9 (i), (ii) and (iii) of the Stage-I approval envisages to prepare a plan for fencing, protection and regeneration of safety zone area of 7.5 m strip within the mine lease boundary. This scheme is prepared in compliance with aforesaid condition of Ministry of Environment, Forest and Climate Change, Government of India.

◆ Objectives:

The stipulated conditions, i.e., no. 9 (i), (ii) and (iii) of stage-I approval reads as following:

Safety Zone Management: Following activities at project cost shall be undertaken by the user agency for the management of safety zone as per the relevant guidelines issued by the Ministry's guidelines:

- I. User agency shall ensure demarcation of safety zone (7.5 meter is strip all along the inner boundary of the mining lease area), and its fencing, protection and regeneration by erecting adequate number of six feet high RCC boundary pillars is scribbled with the GPS coordinates with barbed wire fencing and deploying adequate number of watchers under the supervision of the State Forest Department;*
- II. Boundary of the safety zone of the mining lease, adjacent to habitations/roads should be properly fenced by the user agency;*
- III. Safety zone shall be maintained as grass belt around mining lease and to ensure dense canopy in the area, regeneration shall be taken up in this area by the user agency at project cost under the supervision of the State Forest Department;*

To fulfill the above stipulation of the Stage-1 approval which envisages fencing, protection and regeneration of safety zone area of 7.5 m strip within the mine lease boundary, the scope of the scheme is as follows:

- (a) Block plantation of 1800 plants per ha with 18 months old seedling with 10 years maintenance over 18.59 ha.
- (b) Barbed Wire fencing with pillar of prescribed size & dimensions for Safety Zone area over 18.59 ha.
- (c) Provision of One iron gate for every 1 km perimeter.

Apart from above scope, DGPS survey has been conducted by ORSAC and corner pillars and intermediate pillars with duly inscribed FB, BB, DGPS coordinates & pillar numbering are being erected on prescribed distance. The pillar's size, dimensions and specifications are as per PCCF approved norm. This scope of work will be submitted separately.

The safety zone area is properly demarcated and fenced with barbed wire fencing over length of 24.8 km around a safety zone to prevent biotic interference for protection of the plantation and to get natural regeneration. An area of 18.59 ha (consisting 3.93 ha forest land, 8.086 ha GNF and 6.576 ha tenancy land) is kept within mining lease area for the provision of safety zone for fencing, protection and regeneration.

The block plantation scheme has been prepared as per the plantation norm of The One-time Cost Norm for 1600 plants per ha and the cost has been estimated based on the matrix model for the year 2022-23 of the One time cost norm which is enclosed as Annexure- I.

Scheme for block plantation/ artificial regeneration of 1600 plants/ha (18 months old seedling of forestry species)	
Type of the Plantation	Conventional Plantation
No. of seedlings to be planted	1600 Nos. per hectare
Spacing to be adopted	2.5 m x 2.5 m
Size of pits	45 cm x 45 cm x 45 cm

Proposed choice of species for plantation

Common name	Scientific Name
Amla	<i>Emblica officinalis</i>
Karanj	<i>Pongamia pinnata</i>
Bihada	<i>Terminalia belirica</i>
Krumachuda	<i>Delonix regia</i>
Mahaneem	<i>Simarouba glauca</i>
Neem	<i>Azadirachta indica</i>
Sisoo	<i>Dalbergia sisoo</i>
Belu	<i>Agla marmelos</i>
Simul	<i>Bombay coiba</i>

The choice of final species to be planted will be made in consultation with the DFO, Sandargadh Forest Division.

1. Planting Technique:

Out of the above species, the intensity of the plantation for fuel wood yielding species such as *Acacia*, *Chakunda*, etc., shall be planted up to 40 % of the total number of plants, the timber species like *Sisoo*, etc., up to 60 % shall be planted in the pits.

2. Plantation Methodology:

For plantation the seedling will be collected from the forest department nursery. Planting of 18 month old seedling of above proposed species shall be taken up. The pits will be filled with a mixture of good quality soil and organic manure (FYM). The sapling will be planted just after commencement of the monsoon to ensure maximum survival. Soil and moisture conservation wicks proposed so that sloppy terrain could hold moisture on surface and increase ground water level, which will be beneficial for better regeneration of the plantation.

3 Soil Type:

The soil type occurring in the area is mostly sandy loam having good soil depth, pH of the soil varies from 6 & 7. The site is having gentle slope with less soil erosion.

When the area of safety zone is degraded, top soil will be spread over the area before undertaking plantation work.

4 Protection:

It is proposed to carry out barbed wire fencing around the safety zone area over 24, 786.6 m x 7.5 m (L*B) by using RCC pillars of the dimensions (6"X4"X8ft, L*B*H) to be erected with CC at dugout of 1.5'x 1.5' x1.5' dimension. The Barbed wire (2 ply barbed wire), estimated length of 9.56 m/meter for 7 strands horizontal and 2 nos. diagonal strings between 2 pillars at a distance of 2.5 meters and provision of One iron gate for every 1 km perimeter (4'X5'). The fencing work will be consciously done especially adjacent to common road/habitations to comply with stage-1 condition no. 9 (ii).

The cost of pillar posting, barbed wire fencing and iron gate is estimated Rs. 714/- per meter as per approved specifications and cost norm at current wage rate. Total length for fencing work is $(24785.6 \text{ ML perimeter} + 7.5 \text{ M of safety zone breadth}) \times 2 = 49,588 \text{ RM}$. The total estimated cost for the fencing work would be $= 49588 \text{ RM} \times \text{Rs. } 714/\text{- per meter} = \text{Rs. } 3,54,05,832/\text{-}$. A copy of PCCF approved norm is enclosed as Annexure II.

The above-mentioned expenditure is proposed to be done at project cost as per provision in EMP A Mining Plan by the user agency.

4 Weeding:

Post planting operation and weeding shall be taken up followed with application of fertilizer at the time of soil working in the month of August. Second weeding should be repeated in the month of October along with half-moon trenching around each plant. Weeding and soil working will be repeated during 2nd year and 3rd year. In the 3rd year weeding and soil working manuring will be done.

6 Watch and Ward:

For effective protection of area watch and ward shall be provided, during the project period by the user agency.

7. Inspection, Monitoring and Evaluation

After mining operation starts this scheme will be implemented. For successful implementation of the above mitigative measures, intensive inspection and technical guidance from concerned technical wing is required. Sufficient fuel/conveyance charges for technical experts shall be provided by the user agency for proper execution of these programs.

◆ Executing Agency

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. The entire work shall be carried out in coordination with the Forest Department.

Sl. No.	Designation	Expertise
1	Dy. GM (Mining)	25 years' experience in Mining/Environment Survey.
2	Area Environment Officer	10 years' experience in Environment & Forest
3	Area Survey Officer	5 years' experience with pollution control & Environmental Management.
4	Project Environment Officer	6 years' experience with Environment Management plan.

† Requirement of Funds

Sl. No.	Description	Amount (In Rs.)
1	Cost of Block Plantation of 1600 plants per ha with 18 months old seedling over 18.59 ha @ Rs.3,25,423/- per ha with 10 years maintenance (One Time Cost Norms for the year 2022-23)	60,33,332.00
2	Watering arrangements: 20% of plantation cost (1)	12,10,666.40
3	Barbed Wire fencing with pillar of prescribed size & dimensions for Safety Zone area over 18.59 ha. Total length for fencing work is ((24786.6 ML perimeter + 7.5 M of safety zone breadth) x 2) = 49588 KM X Rs. 714/- per meter including Provision of One iron gate for every 1 km perimeter (4'X5'), (as per FCCF approved norm)	3,54,05,832.00
	Total Cost	4,26,69,830.40 Or 4,26,69,850/-

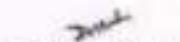
Financial requirement estimated for implementation of the above scope of work to comply with condition no. 9 (i) (ii) (iii) will be Rs. 4,26,69,850/-.

The above expenditure will be made over the ten years period as per the plantation norms. Therefore, budget provision has been kept by the user agency for implementation of the

above plantation program over a period of ten years. The funds are placed in the approved EIA and EMP plan. Hence, separate funds are not placed for this purpose.



General Manager,
Maharaja A/Co (MCL)
Maharaja A/Co
Maharaja Coal Fields Limited.



Project Officer,

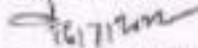
Sarmal OCF(MCL) Officer
Sarmal OCF
Maharaja Coal Fields Limited

Recommended for Approval.



Divisional Forest Officer
DIVISIONAL FOREST OFFICER
SUNARSAH FOREST DIVISION.

Technically Approved



Regional Chief Conservator of Forests
Regional Chief Conservator of Forests,

Burkela Forest Division

L40

BASE COST NIAN FOR COMPENSATORY AFForestation (BLDCR PLANTATION) @ 1400 PLANTS PER HECTARE (18 months old seedling)						
WAGE RATE Rs- 311/- PER MANDAY						
Sr No	Name of work	Preferable Period of Execution	No of Mandays	Labour Cost (In Rs.)	Material Cost (In Rs.)	Total cost (In Rs.)
1	2	3	4	5	6	7
03 Year (Advance work) Pre-Planting Operation						
1	Survey, Demarcation and Piling pointing	Nov/Dec	2	622	0	622
2	Preparation of Topsoil (Top 10 cm)	Nov/Dec	1	311	100	411
3	Site preparation (Clearing & removal of obstacles)	Nov/Dec	12	3732	0	3732
4	Creation of 1.5 m wide (specimen path)	Nov/Dec	1	311	0	311
5	Alignment and staking	Feb/Mar	2	622	0	622
6	Dipping of site (45 cm x 45 cm x 45 cm) in hard and gravelly soil	Feb/Mar	64	19904	0	19904
7	Construction of Temporary Labour Shed, Drinking water facility and First Aid etc.	Jan/Mar	5	0	3500	3500
Total			93	31500	3600	29100
1st Year/Planting Year						
1	Refilling of pits by adhering the dug soil of the pits, application of Organic compounds/ COM/ FYM & mixing the same properly.	Jan/Jul	12	3732	8000	11732
2	Transportation of 18 months old polyact seedlings from truck/tractor from the nursery/Neighbour territory to planting site including loading & unloading. (Average load of 10 plants) & Stacking the seedling @ Rs.1/- per seedling (1747 nos.)	1-17/Jul	6	0	17470	17470
3	Watering the polyact seedlings at planting site	Jul/Aug	3	933	0	933
4	Convergence of polyact seedlings or hard soil from the stacking site to individual digger pits within the planting site, applying insecticide, fertilizers & plowing after accepting the soil with other applied materials & covering the soil properly around the planted seedlings.	Jul/Aug	36	11196	0	11196
5	<u>Cost of Fertilizer & Insecticide</u> (a) NPK/200 fertilizer @ 20 gms/plant or basal dose = 60kg @ Rs.15/- per kg = Rs. 2400.00 (b) urea/1000gms per/ha (Secondary other fertilizer @ 200 gms/plant) dose @ Rs. 1,200.00 (c) insecticide/ 20-grammable @ 2 gms/plant @ Rs. 150/- per kg = Rs. 1200.00	Jul/Aug	0	0	4800	4800

Project Officer
Siamat OC
Maharaja College Limited

99

BASE COST NORM FOR COMPENSATORY AFFORESTATION (BLOCK PLANTATION) @ 1400 PLANTS PER HECTARE (18 months old seedling)						
WAGE RATE Rs- 211/- PER MANDAY						
Sl. No	Items of work	Preferable Period of Execution	No of Mandays	Labour Cost (Rs Rs.)	Material Cost (In Rs.)	Total cost (In Rs.)
2	3	4	5	6	7	
4	Quality Replacement @ 10% (140 nos.)	Jul/Aug	4	1244	0	1244
7	1st weeding & Mearing	Aug/Sep	15	4665	0	4665
8	2nd Weeding, Soil working (1m. diameter around the plants) and Mearing	Oct/Nov	20	6220	0	6220
9	Fire line tracing (2 m. wide fire line over 400 m long) including maintenance of inspection path	Feb/Mar	3	933	0	933
10	Watch & Ward including watering as per requirement	Aug-Mar	12	3732	0	3732
Total			103	31033	0	31033
2nd Year Maintenance						
1	Transportation of 140 seedlings from Nursery to plantation site including loading, unloading & conveyance by Tractor @ Rs.6/- per seedling	Jul	0	0	900	900
2	Quality replacements 10%	Jul	1	1211	0	1211
3	<u>Cost of Fertilizer & Insecticide</u> A) Cost of Insecticide/ Bio-pesticide @ 5 gms./plant = 60 Kg @ Rs.150/- per kg = Rs.120/- B) Urea/NPK/Bio-In (Bayer/Versulumpost)/Ma (Dona)/any other fertilizer @ Rs. 440/-	Aug/Nov	0	0	4600	4600
4	Weeding (Complete weeding), Mearing & Soil working (1m. diameter around the plants)	Sep/Oct	20	6220	0	6220
5	Fire line tracing (2 m. wide fire line over 400 m long) including maintenance of inspection path	Feb/Mar	3	933	0	933
6	Watch & Ward including watering as per requirement	Apr-May	18	5598	0	5598
7	Maintenance of Temporary Labour Shed, Drinking water facility and First Aid etc.				1000	1000
Total			41	13491	6500	20001

**BASE COST NORM FOR COMPENSATORY AFFORESTATION (BLOCK PLANTATION)
@ 1600 PLANTS PER HECTARE (10 months after sowing)**

93

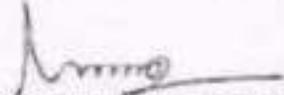
WAGE RATE Rs. 311/- PER MANDAY

Sl. No.	Items of work	Favourable Period of Execution	No of Mandays	Labour Cost (In Rs.)	Material Cost (In Rs.)	Total cost (In Rs.)
1	2	3	4	5	6	7
3rd Year Maintenance						
2	Use of Fertilizer/Slur/NPK/20:20:20/Slur/urea/vermicompost/No. 30/30/30 or other fertilizer	Sep/Oct	8	0	400	400
4	Weeding, Mounding & Soil working (1m diameter around the plants)	Sep/Oct	20	6220	0	6220
2	Fire line tracing (2 m. wide fire line over 800 m long) including maintenance of respective path	Feb/Mar	3	933	0	933
6	Watch & Ward including watering as per requirement	Apr/Mar	18	5598	0	5598
7	Maintenance of Temporary Labour Shed, Drinking water facility and first-aid etc.	Apr/Mar			1600	1600
Total			49	13751	1496	15247
4th Year Maintenance						
1	Fire line tracing (2 m. wide fire line over 400 m long) including maintenance of respective path	Feb/Mar	3	933	0	933
2	Watch & Ward	Apr-Mar	18	5598	0	5598
Total			21	6531	0	6531
5th Year Maintenance						
1	Fire line tracing (2 m. wide fire line over 400 m long)	Feb/Mar	3	933.00	0	933
2	Watch & Ward	Apr/Mar	18	5598.00	0	5598
Total			21	6531.00	0	6531
6th Year Maintenance						
1	Fire line tracing (2 m. wide fire line over 400 m length)	Feb/Mar	3	933.00	0	933.0
2	Truncation of branches, fire line cut of multiple shrubs	Jan/Mar	5	1555.00	0	1555.0
3	Watch & Ward	Apr/Mar	18	5598.00	0	5598.0
Total			26	8086.00	0	8086.0
7th Year Maintenance						
1	Fire line tracing (2 m. wide fire line over 400 m length)	Feb/Mar	3	933.00	0	933
2	Watch & Ward	Apr/Mar	18	5598.00	0	5598
Total			21	6531	0	6531
8th Year Maintenance						
1	Fire line tracing (2 m. wide fire line over 800 m length)	Feb/Mar	3	933.00	0	933
2	Watch & Ward	Apr/Mar	18	5598.00	0	5598
Total			21	6531	0	6531
9th Year Maintenance						
1	Fire line tracing (2 m. wide fire line over 400 m length)	Feb/Mar	3	933.00	0	933
2	Watch & Ward	Apr/Mar	18	5598.00	0	5598

BASS COST NORM FOR COMPENSATORY AFFORESTATION (BLOCK PLANTATION) @ 1600 PLANTS PER HECTARE (10 rows @ 160 seedling)							
WAGE RATE Rs. 313/- PER MANDAY							
No. No	Items of work	Preferable Period of Execution	No. of Mandays	Labour Cost (In Rs.)	Material Cost (In Rs.)	Total cost (In Rs.)	
1	2	3	4	5	6	7	
Total			21	6573	0	6573	
10th Year Maintenance							
1	Fire line tracing (2 m. wide fire line over 400 m length)	Feb/Mar	2	626	0	626	
2	Watch & Ward	Apr/Mar	19	5947.00	0	5947.00	
Total			21	6573	0	6573	
Year wise Abstract of Cost Norm (showing seedling cost separately)							
No. No	Year	No. person days	Labour cost @ Rs. 313/- per day (Rs)	Material Cost	Maintenance, Evaluation, Learning, Demonstration and other Costing @ 5% of (4+5)	Cost of Seedlings @ Rs. 50/35 per seedling	TOTAL COST
1	2	3	4	5	6	7	8
1	0th year	02	2502	2000	175.00	0	2777.00
2	1st year	095	29715	23200	1970.00	895.00	117310.00
3	2nd year	48	15024	4264	1026.00	902	20676.00
4	3rd year	45	14115	5466	911.00	0	19592.00
5	4th year	31	9703	0	424.00	0	10127.00
6	5th year	21	6573	0	325.00	0	6898.00
7	6th year	14	4382	0	214.00	0	4596.00
8	7th year	11	3443	0	164.00	0	3607.00
9	8th year	11	3443	0	164.00	0	3607.00
10	9th year	11	3443	0	164.00	0	3607.00
11	10th year	11	3443	0	164.00	0	3607.00
Total:		435	132175	35032	8407	96296	276288

Note:

1. Priority must be given to the indigenous local species available nearby to the site of plantation.
2. 10% indigenous fruit bearing trees must be preferred in plantation.
3. Site specific Soil conservation work like LRCB, Gully Plugging, Ripped Trench, Contour Trench, Divided Row etc. may be
4. Chain link fencing can be adopted in Or CA plantation to cut up outside the forest area and flexible wire fencing may be
5. Watering facilities for procurement of water & watering may be adopted as per the availability of water.
6. The Cost Norm of various items can be changed with the approval of the concerned SCCRs keeping the overall cost norm fixed for each financial year.


APCCP Member (Signature & No. IC Art)

ESTIMATE FOR BARBED WIRE FENCING

As per PCCF, Bhubaneswar Office order no. 1335/12F (A/Ms.) 25/2018 dated 18/12/2018.

01.	02 ply barbed wire (5 Rmt per Kg)	
	1 Straight Strand x 1000 Mt	= 7000Mt
	2 Diagonal Strand = $2 \times (6.5') + (8.2') = 2 \times 10.50$ ft	
	= 21.00 ft x 400 nos = 8400 ft or	= 2100Mt
		= 9560Mt

Requirement of barbed wire per Km

Cost per KM = $9560/3 = 3187$ Kg @ Rs 80/kg = Rs. 1,52,960.00

02. Construction of RCC Pillars of size

Length - 8 FT, Bottom width 5'x6' ; Top width 4'x4'

Reinforced with iron rods with proper curing

$$\left(\frac{8 \times 5 \times 6}{2} \right) \times \frac{6-4}{2} = 1.34 \text{ cu ft or } 0.038 \text{ cum.}$$

i) Cost of c.c. work $1.34 = 0.038$ Cum Rs. 5637.17/Cum = 213.83

ii) Cost of rod including cutting, bending and blading
 $0.038 \text{ cu ft} \times 100 \text{ nos} \times 10 \text{ @ Rs. } 12375.00/100 = 470.25$

iii) Contingency (15%) including

Curing, stacking, provision of hooks etc. = 95.06

Rs. 728.89 or Rs. 729/-

Requirement of pillars per KM

Spacing = 2.5mt x 2.5mt

Requirement = $1000 \text{ mt} / 2.5 \text{ mt} = 400$

Stout Pillar in every 10th pillar = $(400/10) \times 2 = 80$

480 Nos

Cost of pillar per KM = 480 @ 729/- = Rs. 3,49,920.00

03. Fixing fixing of RCC pillars in position with hlg metal (4cm) in C.M (1:4:8)

i) Digging of pits $1.5 \times 1.5 \times 1.5 = 3.375 \text{ cu ft/pit}$

For 480 pits, $480 \times 3.375 = 1620 \text{ cu ft or } 45.86 \text{ cum @ Rs. } 14018/100 \text{ cum} = \text{Rs. } 6333.25/-$

ii) Fixing of pillars with 4cm hlg metal in C.M 1:4:8

Pit size - $1.5 \times 1.5 \times 1.5 = 3.375 \text{ cu ft}$

Deduct $1/3^{\text{rd}}$ of butt of pillar i.e. $3.375/3 = (-) 1.125 \text{ cu ft}$

Total c.c. work per pillar = 2.25 cu ft

For 480 pillars = $480 \times 2.25 = 1080 \text{ cu ft or } 30.577 \text{ cum @ Rs. } 3776.46/\text{Cum} = \text{Rs. } 1,15,472.81/-$

Handwritten Signature
 Project Officer
 District OCS
 Mahanadi Development

Cement	3.23 cum @ Ra. 630.06	Ra. 2034.90
Mason 2 nd Class	0.80 cum @ Ra. 390/day	Ra. 312.00
Men Mulla	4.60 Nos @ Ra. 326/day	Ra. 1499.60
		Ra. 5627.17/Cum.

4. Cutting bending, binding, straightening and tying the gills and placing in position including cost of MS of Top Steel & binding wires etc.

Ref. A/R-2006 Item No.9 Page 52

Taking output for 1QT.

Cost and carriage of HYSD steel including 5%

For wastage and overlapping	1QT	1.05	\$500.00	Ra. 5775.00
Binding Wire (CI)	Kg	8	\$0.00	Ra. 640.00
Labour for cutting bending shifting of site tying and placing in position. 10date	Each	0.44	400.00	Ra. 184.80
Black Smith special	Each	4	400.00	Ra. 2080.00
Semi-skilled Mulla	Each	8	400.00	Ra. 3600.00
				Ra. 12279.80/QT

Project Officer
Sikmal, OCP
Maharaja Coalfates Limited

महानदी कोयलाखाने लिमिटेड
महानदी कोयलाखाने लिमिटेड
Mahanadi Coalfields Limited
(A subsidiary of Coal India Limited)

MAHANADI COALFIELDS LIMITED
A Subsidiary of Coal India Limited
DY.G.M.(MIN)/PROJECT OFFICER
SIARMAL OCP, MAHALAXMI AREA
RFP.O., Basonchhara, Distt. Sundergarh
(Orissa), Pin. Code No.770076



Ref.No.: NCL/GM/MLA/PO/SOCP/2022-23/215

Date: 14/07/2022

UNDERTAKING

I/We undertake that a scheme for fencing, protection and regeneration of safety zone area of 18.59 ha is hereby being submitted to comply with the stage-I condition by MEO&CC (FCA Div.) as follows:

"*1. Safety Zone Management: Following activities at project cost shall be undertaken by the user agency for the management of safety zone as per the relevant guidelines issued by the Ministry's guidelines:*

- i. User agency shall ensure demarcation of safety zone (7.5 meter is strip all along the inner boundary of the mining lease area), and its fencing, protection and regeneration by erecting adequate number of six feet high RCC boundary pillars is scribed with the GPS coordinates with barbed wire fencing and deploying adequate number of watchers under the supervision of the State Forest Department;*
- ii. Boundary of the safety zone of the mining lease, adjacent to habitations/roads should be properly fenced by the user agency;*
- iii. Safety zone shall be maintained as green belt around mining lease and to ensure dense canopy in the area, regeneration shall be taken up in this area by the user agency at project cost under the supervision of the State Forest Department."*

I/We hereby undertake that we will submit the DGPS survey map of mining lease boundary, safety zone boundary and pillar posting details with the final compliance submission of Stage-I FC conditions.


Project Officer
Siarmal OCP, Mahalaxmi Area, MCL
Project Officer
Siarmal OCP
Mahanadi Coalfields Limited

Scheme

for

"Afforestation on degraded forest land over 5.895 ha i.e. 1.5 times the area under safety zone (3.93 ha) selected in Garjanpahad RF of Gopalpur Range of Sundargarh Forest Division."

in compliance with

Condition no. 9 (IV) of para A of Stage-I Forest clearance – in-principle approval

vide letter no. f. no. S-25/2021-fc, dated 21st April 2022

of Ministry of Environment, Forest & Climate Change, Govt. of India,

New Delhi

for

Diversion of 349.709 hectares of forest land for "Siarmal Opencast Coal Mining Project" within 2290.449 hectares of mining lease area

of

M/s Mahanadi Coalfields Limited.

in Sundargarh Forest Division of Dist. Sundargarh, Odisha

Scheme prepared for "Afforestation on degraded forest land to be selected elsewhere measuring one and a half times the area under safety zone, shall also be done at the project cost under the supervision of the State Forest Department."

1. Brief Information:

M/s Mahanadi Coalfields Limited (MCL), a subsidiary company of Coal India Limited is a Miniratna Company of nature and style public sector undertaking under Government of India, which was carved out to administer and mine out coal from the coal mines of Odisha, spread over Talcher and Ib valley coal fields.

Ib valley coal fields in Sundargarh and Jharsuguda Districts of Odisha contain large reserves of quarriable coal. Each area containing coal has been divided into several mining blocks, and Siarnal geological block is one of them. Siarnal opencast project is located in Siarnal geological block of Gopalpur tract in the north-western part of Ib valley coal fields. It lies between latitudes of 22°01'19"-22°03'59.99" N and longitudes of 83°37'09"-83°42'59.58" E. It is represented in Survey of India Topo sheet No. F44L12 (64/N/16). This project is having 1547.82 Mt (Mineable Reserve) of quarriable coal reserve in Gopalpur, Jhupuranga, Siarnal, Ratarasara, Tumulia and Kulda villages. The entire area of Siarnal project involving six villages were acquired under Coal Bearing (Acquisition and development) Act, 1957 (CBA-1957) vide S.O. No. 1869 dated 10.07.1989 and S.O. No. 3055 dated 29.10.1990. The above land has been vested in MCL u/s 11(1) of the said Act vide SO No. 2592 dated 13.09.1990 and 43015 dated 30.03.1993. (Page-22 to 38/DP). Present proposal Siarnal OCP involves total area of 2290.449 ha which comprises of 349.709 ha of forest land, 473.792 ha of Govt. Non- Forest land and 1466.949 Tenancy land.

2. Location of the project:

The boundary of Siarnal block is as follows:

North : Chaturdhara and Basundhara West blocks separated by Chaturdhara Nala and Basundhara River
West : Kampa & Dip side of Rampa.
East : Kulda Block separated by Chattaajor nala
South : Prajapara Block.

Sundargarh town is the nearest revenue town & Dist. HQ, which is at a distance of 46 km. Bhubaneswar, the State Capital from the mines is 450 km. The company Headquarters is at

Birsa which is 150 km via Sundargarh, Jharsuguda, Sambalpur. The nearest railhead is Himgir railway station on Mumbai – Howrah line of South Eastern railway at a distance of about 35 km. The nearest domestic airport, Veer Surendra Sai airport, Jharsuguda at a distance of 30 km. Biju Patnaik International Airport, Bhubaneswar is at a distance of about 450 km. The nearest sea port – Paradip is at a distance of 550 km from the block.

Starmal OCP has been accorded the Forest Stage I clearance including 349.709 ha of forest land from central government under Section 2 (ii) of Forest (Conservation) Act 1980. Ministry of Environment, Forests and Climate Change in vide Letter No. F. No. 8-25/2021-FC Dated 21st April 2022. The FC has been accorded with a set of conditions to comply with and thus this scheme has been prepared to comply with Condition No. 4(V) of para-A of Stage-I in-principal approval.

3. Physiography & Drainage:

The topography of the block is represented by flat & sloppy ground. The ground slopes generally towards east and north-east and the drainage is through small streams, which in turn feed to river Basundhara. Basundhara River is flowing from west-to-east and ultimately drains into the Ib River.

Distance of waterbodies from the mine is as follows.

Name of the Water Bodies	Distance
Chhata Ihor river/Nala	0 km
Basundhara river	0 km
Garia Nala	4.3 km
Jehha river	18 km
IB river	27 km

4. Climate:

Meteorological data collected from IMD, Bhubaneswar for Jharsuguda IMD station for the year 2013 have been referred for preparation of the following table:

Item	Parameters	Particulars
Rainfall	Minimum	0.1 mm in Oct.
	Maximum	118.8 mm in Aug
	Annual rainfall	1281.6 mm (Average annual rainfall is 1430 mm for last 22 years)
Temperature range (monthly mean of daily temperature)	Minimum	6.9°C in Jan
	Maximum	46.7°C in May
Relative humidity range (monthly mean of daily RH)	Max at 8:30 hr	98% in Feb, Jun and Jul
	Min at 8:30 hr	26% in Apr and May
	Max at 17:30 hr	98% in Jul, Aug and Oct
	Min at 17:30 hr	11% in Apr
Wind speed range (monthly mean of daily wind speed)	Max at 8:30 hr	30 kmph in Oct
	Min at 8:30 hr	7 kmph
	Max at 17:30 hr	30 kmph in Oct
	Min at 17:30 hr	2 kmph

5. Geology:

The "Geological Report on Siarnal Block, Ib-River Coalfield," Odisha, was prepared by CMPDI in February 1997. Siarnal block spreading over an area of 5.00 sq. km. is a part of north-western sector of Ib-valley coalfield and in which coal bearing area is 4.24 sq. km. The coal seams occurring in Siarnal block are in the continuation of the adjoining block i.e., Kuida in the east.

6. Soil Type:

Soil may be defined as a mixture of rock and mineral with the organic matter. The soil of the M. L. area is classified as lateritic soil, lateritic with coal on the basis of its layer of formation. Soil is the net result of the action of climate and organisms especially plant on the earth crust. The pH value of the soil is normal ranging from 6.00 to 7.2.

7. Existing Vegetation:

The crop composition of forest area is mainly Sal (*Shorea robusta*) and its associates namely Bijs (*Pterocarpus marsupium*), Mango (*Mangifera indica*), Kendu (*Diospyros melanoxylon*), Mahul (*Madhuca indica*), Jamun (*Syzygium cumini*), Neem (*Azadirachta indica*), Bahada (*Terminalia bellarica*), Dhaura (*Anogeissus latifolia*), Aachhu (*Morinda tinctoria*), Kurum (*Adina cordifolia*), Sahaj (*Terminalia tomentosa*), Char (*Buchanania lanzan*), Kasi (*Mitragyna parviflora*), Sidha (*Lagerstroemia parviflora*), Sisoo (*Dalbergia latifolia*), Karla (*Clatantia collina*), Dhatiki (*Woodfordia fruticosa*), Gambhari (*Gmelina arborea*), Kurein (*Hollarkena antidysenterica*), Palas (*Butea monosperma*), Bheru (*Chloroxylon swietenia*), etc. Sal (*Shorea robusta*) is the pre-dominant species. The condition of the vegetation is dry deciduous Forest.

The stipulated condition reads "Afforestation on degraded forest land to be selected elsewhere measuring one and a half times the area under safety zone, shall also be done at the project cost under the supervision of the State Forest Department. The degraded forest land (DF) so selected will be informed to the MoEF&CC with shape files before Stage-II approval and afforestation will be done within three years from the date of Stage-II clearance and maintained thereafter in accordance with the approval plan in consultation with the State Forest Department, and".

♦ Objectives:

This scheme envisages the following:

- a) To enhance the environmental condition of locality.
- b) To conserve soil and moisture of degraded forest area.
- c) To restore the area with artificial regeneration.

1. Area:

The compensatory afforestation in degraded forest @ 1.5 times of the safety zone area (3.930 ha) has been proposed over an area of 5.895 ha in Garjanpahad RF of Gopalpur Range. A google map showing location 5.895 ha of degraded forest land of Safety Zone Area Plan is enclosed as Annexure-I.

2. Location:

As per the guidelines under Forest Conservation Act 1980, an area in extent to 1.5 times of forest land in the safety zone area has been identified in Garjanpahad Reserved Forest of

Forest of Gopalpur Range in the District of Sundargarh, where a degraded forest patch of 5.895 ha is earmarked. A topo sheet map showing location of the earmarked degraded forest area is enclosed as Annexure- II.

3. Climate:

The climate condition of the area is dry deciduous forest having average annual rainfall of 200 Cm and maximum temperature 48^o centigrade in summer from March to June. Winter spell November to February and rainy season prevails from July to September.

4. Soil Type:

The soil type occurring in the area is mostly sandy loam having good soil depth, Ph of the soil varies from 6 to 8. The site is having gentle slope with least soil erosion.

5. Natural Vegetation:

Garjanpahad is a degraded R.F having gaps which have been selected to take up ANR plantation @ 500 seedlings per ha. The existing vegetation includes poles of Sal, Asan, Dhaura, Kurum, Harida, Bahada and Khaira etc.

6. Choice Of Species:

The existing prominent natural species will be retained and tended for further growth. The indigenous species of the area shall be planted and supplemented. A mixture of species selected is enlisted below:

Sl. No.	Common name	Scientific Name
1	Asan	<i>Terminalia tomentosa</i>
2	Amla	<i>Emblica officinalis</i>
3	Sal	<i>Shorea robusta</i>
4	Bija	<i>Pterocarpus marsupium</i>
5	Bamboo	<i>Dendrocalamus strictus</i>
6	Bahada	<i>Terminalia bellerica</i>
7	Chakunda	<i>Cassia siamea</i>
8	Dhaura	<i>Anogeissus latifolia</i>
9	Harida	<i>Terminalia chebula</i>

10	Kurum	<i>Adina cordifolia</i>
11	Karanja	<i>Pongamia pinnata</i>
12	Neem	<i>Azadirachta indica</i>
13	Sisoo	<i>Dalbergia sisoo</i>
14	Teak	<i>Tectona grandis</i>
15	Maharoom	<i>Sesuvium glabrum</i>
16	Khadi	<i>Acacia catechu</i>

7. Planting Species:

Out of the above species the intensity of the plantation for fuel wood yielding species such as Acacia, Chikunda, Khair, Dhaura shall be planted up to 60 % of the total number of plants, the timber species like Teak, Sisoo, Bija, and Asana up to 30 %, Bamboo 5 % and fruit bearing NTFP species like Amla, Harida, Bahada, Neem, Karanja shall plant up to 5% of the total number of plants in the pits as spacing mentioned above.

8. Plantation Methodology:

For the purpose of raising the seedling a temporary nursery shall be set up nearest to the plantation site, where availability of water and communication is ensured. Planting of 18 months old seedling of above species shall be taken up.

9. Plantation Mode:

In the scheme the area has provision of demarcation and survey jointly by user agency and forest department. A map will be prepared by the field officials and ANR plantation will be taken up with plant population of 500 per ha for which 18-month-old seedling to be planted. Fitting will be done during monsoon. & post planting operation will be taken up as per guidelines of the plantation manual.

Type of the Plantation	ANR Plantation
No. of seedlings to be planted	500 Nos per hectare
Spacing to be adopted	2.5m x 2.5m
Size of pits	45 cm X 45 cm X 45 cm

10. Fencing & Boundary Maintenance:

As per the One Time Cost Norm the brushwood fencing has been proposed over a total of 1493 m perimeter boundary of the identified degraded forest land with Rs. 419,864/- per running meter cost, based on cost estimate of Rs. 1,04,966/- with an average length of 250 running meters per ha for 1 ha for the 2022-23 of the matrix model of the One-time Cost Norm with maintenance for 5 years.

11. Implementing Agency:

Divisional Forest Officer, Sundargarh Forest Division, shall implement the scheme.

12. Project Costs:

Condition no. 9, IV of para A of Stage-I approval stipulated as "Afforestation on degraded forest land to be selected elsewhere measuring one and a half times the area under safety zone, shall also be done at the project cost under the supervision of the State Forest Department. The degraded forest land (DPL) so selected will be informed to the MoEF&CC with shape files before Stage-II approval and afforestation will be done within three years from the date of Stage-II clearance and maintained thereafter in accordance with the approval plan in consultation with the State Forest Department; and". The cost of implementation of the project is estimated as given under:

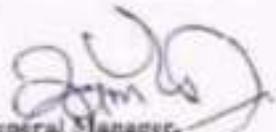
Enclosed copy of cost norm and matrix model for ANR Plantation @ 500 plants per ha with 18 months old seedling ha with 10 years maintenance, Cost of Brushwood fencing with bamboo twigs, Soil & Moisture Conservation work, and Watering provision with Solar borewell with fitted with Drip System.

Sl No.	Description	Amount (In Rs.)
i	Cost of ANR Plantation @ 500 plants per ha with 18 months old seedling over 5.895 ha @ Rs. 1,42,904/- per ha with 10 years maintenance	8,42,419.08
ii	Cost of Brushwood fencing with bamboo twigs over boundary of 5.895 ha DPL @ Rs. 1,04,966/- per ha for 250 m average length, Rs. 419,864/-per meter x 1493 m perimeter	6,26,837.00
iii	Soil & Moisture Conservation work @ 37,415/- per ha over 5.895 ha	2,20,561.42
iv	Watering provision with Solar borewell with fitted with Drip System over 5.895 ha @ Rs. 2,33,786/- per ha for 5 years	13,78,168.47
v	Total Plantation Cost(i+ii+iii+iv)	30,68,005.97

vi	15% of (v) total plantation cost towards EPA/Incentives to VSS including Monitoring & Evaluation	4,60,200.90
vii	Total (vi+vii)	35,28,206.87

Estimated total cost of ANR plantation @ 500 plants per ha with 18 months old seedling over 5.895 ha @ Rs. 1,42,904/- per ha with 10 years maintenance = Rs 35,28,206.87/- or say Rs 35,28,210/- (Rupees Thirty-five Lakh Twenty-Eight Thousand Two Hundred Ten) Only.

As proposed, the implementation of the project will be done by DFO, Sundargarh, the above estimated project cost will be deposited in CAMPA a/c as per approval of the project.

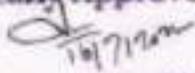

 General Manager,
 Mahanadi Area (MCL)
 Mahanadi Area
 Mahanadi Coal Fields Limited


 Project Officer,
 Sirmal OCP (MCL)
 Sirmal OCP
 Mahanadi Coalfields Limited

Recommended for Approval.


 DIVISIONAL FOREST OFFICER
 SUNDARGARH FOREST DIVISION
 Sundargarh Forest Division.

Technically Approved


 Regional Chief Conservator of Forests
 Rourkela Circle

Regional Chief Conservator of Forest,
 Rourkela Forest Division

vi	15% of (v) total plantation cost towards EPA/Incentives to VSS including Monitoring & Evaluation	4,60,200.90
vii	Total (vi+vii)	35,28,206.87

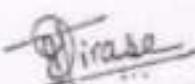
Estimated total cost of ANR plantation @ 500 plants per ha with 18 months old seedling over 5.895 ha @ Rs. 1,42,904/- per ha with 10 years maintenance = Rs 35,28,206.87/- or say Rs 35,28,210/- (Rupees Thirty-five Lakh Twenty-Eight Thousand Two Hundred Ten) Only.

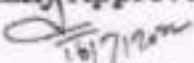
As proposed, the implementation of the project will be done by DFO, Sundargarh, the above estimated project cost will be deposited in CAMPA a/c as per approval of the project.


 General Manager
 Mahanadi Area Office
 Mahanadi Area
 Mahanadi Coal Fields Limited


 Project Officer,
 Sirmal OCP (AFCD)
 Project Officer
 Sirmal OCP
 Mahanadi Coalfields Limited

Recommended for Approval.


 DIVISIONAL FOREST OFFICER
 SUNDARGARH FOREST DIVISION
 Sundargarh Forest Division.

Technically Approved

 Regional Chief Conservator of Forests
 Rourkela Circle
 Regional Chief Conservator of Forest,
 Rourkela Forest Division

Base Cost Norms for Compensatory Afforestation through Aided Natural Regeneration (ANR) @ 500 Seedlings/Ra.

WAGE RATE Rs-311/- PER MANDAY						
Sl. No	Items of work	Preferable Period of Execution	No of Mandays	Labour Cost (in Rs.)	Material Cost (in Rs.)	Total cost (in Rs.)
0th Year (Advance work) Pre-Planting Operation						
1	Survey, Demarcation and Pegging	Nov/Dec	2	622	0	622
2	Preparation of Treatment Map (Digital Map)	Nov/Dec	1	311	100	411
3	Site preparation	Nov/Dec	2	622	0	622
4	Criticalized operations including clearance of weed, cutting of shrubs, High water piling, striping of shrubs & removal of cut out after drying from the field to black space.	Jan/Feb	12	3732	0	4632
5	Alignment and marking for digging of pits	Jan/Mar	1	311	0	311
6	Digging of pits (40 cm x 40 cm x 40 cm) in hard and gravelly soil	Feb/Mar	20	6220	0	6220
Total			43	12795	100	13695
1st Year/Planting Year						
1	Refilling of pits by shoring up deposit of the soil, application of organic manure/compost/FYM & mixing the same perfectly.	Jan/Jul	1	311	2200	2711
2	Transportation of 18 metric ton polythene bag seedlings in load truck /tractor from the nursery/High nursery to planting site including loading & unloading (Average load of 30 Hrs) & Stacking the seedling @ 400/- Seedling (2500 nos)	Jul/Aug	4	0	2000	2000
3	Watering polythene bag seedlings at stacking site of plantation	Jul/Aug	1	311	0	311
4	Carriage of polythene bag seedlings on road from the stacking site to individual digger pits within the planting site, applying manure/ fertilizer & planting after prying the soil with other applied materials and pressing the soil perfectly around the planted seedling	Jul/Aug	11	3421	0	3421
5	Cost of Fertilizer & Insecticide (a) NPK/ Bio fertilizer @ 50 gm/plant as basal dose x 25kg @ Rs.20/- per kg = Rs. 725.00 (b) Urea/Vermicompost/Mc Xerta/bag other fertilizer @ Rs. 375.00 (c) Insecticide/ Bio pesticide @ 3 gm/plant x 25 kg @ Rs.150/- per kg = Rs. 375.00	Jul/Aug	0	0	1500	1500
6	Excavty Replacement @ 10% (01 nos)	Jul/Aug	1.0	463.5	0.0	463.5
7	Intervening & Harvesting	Aug/Sept	0	1822	0	1822

Project Officer
 Shrihari, OCB
 Mahanadi Coalfields Limited

S. No	Items of work	Preferable Period of Execution	No of Handdays	Labour Cost (In Rs.)	Material Cost (In Rs.)	Total cost (In Rs.)
4	Soil Weeding, Soil working (1m. diameter around the plants) & Weeding	Oct/Nov	0	2400	0	2400
5	Fire line tracing & inspection path	Feb/Mar	3	933	0	933
10	Watch & Ward including watering as per requirement	Apr/Mar	0	2400	0	2400
Total			41.5	12966.5	7308.0	20274.5
2nd Year Maintenance						
1	Transcription of 20 seedlings from Nursery to plantation site including loading, unloading & transport by Tractor @ Rs.50/- per hour	Jan	0.0	0.0	2000.0	2000.0
2	Manure application	Jan	1.5	466.5	0.0	466.5
3	Cost of Fertilizer & Herbicide A) Cost of Insecticide/ Bio pesticide (Thiodan/ Dielder) @ 2 gms./plant - 25 kg @ Rs.150/- per kg = Rs.3750 B) Urea/DAP/Bio-fertilizer/Vermicompost/Ms. Manure (any other) @ Rs. 1000/-	July/Aug	0	0	1427.5	1427.5
4	Weeding (Complete weeding), Mounding & Soil working (1m. diameter around the plants)	Aug/Oct	0	2400	0	2400
5	Fire line tracing (2 m. wide fire line) & inspection path	Feb/Mar	3	933	0	933
6	Watch & Ward including watering as per requirement	Apr/Mar	12	3732	0	3732
Total			24.5	7629.5	1427.5	9057.0
3rd Year Maintenance						
3	Cost of Fertilizer Urea/DAP/Bio-fertilizer/Vermicompost/Ms Manure (any other) @ Rs. 1000/-	July/Aug	0	0	1400.0	1400.0
4	Weeding (Complete weeding), Mounding & Soil working (1m. diameter around the plants)	Aug/Oct	0	2400	0	2400
5	Fire line tracing (2 m. wide fire line) & inspection path	Feb/Mar	3	933	0	933
6	Watch & Ward including watering as per requirement	Apr/Mar	12	3732	0	3732
Total			23.0	7133.0	1400.0	8533.0
4th Year Maintenance						
1	Fire line tracing (2 m. wide fire line) & inspection path	Feb/Mar	3	933	0	933
2	Watch & Ward including watering as per requirement	Apr/Mar	12	3732	0	3732
Total			15.0	4665.0	0.0	4665.0
5th Year Maintenance						
1	Fire line tracing (2 m. wide fire line over 400 m length)	Feb/Mar	3.0	933.00	0	933
2	Watch & Ward including watering as per requirement	Apr/Mar	12	3732.00	0	3732
Total			15.0	4665.0	0.0	4665.0
6th Year Maintenance						
1	Fire line tracing (2 m. wide fire line over 400 m length)	Feb/Mar	3	933.00	0	933
2	Watch & Ward including watering as per requirement	Apr/Mar	12	3732.00	0	3732
Total			15.0	4665.0	0.0	4665.0
7th Year Maintenance						
1	Fire line tracing (2 m. wide fire line over 400 m length)	Feb/Mar	3	933.00	0	933
2	Watch & Ward including watering as per requirement	Apr/Mar	12	3732.00	0	3732
Total			15.0	4665.0	0.0	4665.0
8th Year Maintenance						
1	Fire line tracing (2 m. wide fire line over 400 m length) & manual application	Feb/Mar	3	933.00	0	933
2	Watch & Ward including watering as per requirement	Apr/Mar	12	3732.00	0	3732
Total			15.0	4665.0	0.0	4665.0
9th Year Maintenance						
1	Fire line tracing (2 m. wide fire line over 400 m length)	Feb/Mar	3	933.00	0	933
2	Watch & Ward including watering as per requirement	Apr/Mar	12	3732.00	0	3732
Total			15.0	4665.0	0.0	4665.0
10th Year Maintenance						
1	Fire line tracing (2 m. wide fire line over 400 m length)	Feb/Mar	3	933.00	0	933
2	Watch & Ward including watering as per requirement	Apr/Mar	12	3732.00	0	3732
Total			15.0	4665.0	0.0	4665.0

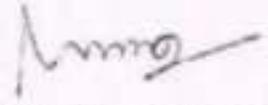
Yearwise Abstract of Cost Norm (showing seedling cost separately)


 Project Officer
 State OCP
 Mahanadi Coalfields Limited

Sl. No.	Items of work	Probable Period of Execution	No of Mandays	Labour Cost (In Rs.)	Material Cost (In Rs.)	Total cost (In Rs.)	
Sl. No.	Year	No. person days	Labour cost @ Rs. 311/ per day (No.)	Material Cost	Measuring Equipment, Services, Documentation and Other Expenditure (In Rs.)	Cost of Seedling @Rs. 21.25 per seedling	TOTAL COST
1	2	3	4	5	6	7	8
1	1st year	61	12751.5	1000	545.00	0.00	13296.50
2	2nd year	41.5	12404.5	4000	993.00	27,771.00	40607.50
3	3rd year	45.0	12150.0	1221.0	552.00	2216.00	13939.00
4	4th year	23.0	7153.5	1000.0	347.00	0.00	8500.50
5	5th year	15	4665.0	0.0	122.00	0.00	4787.00
6	6th year	18	5598.0	0.0	128.00	0.00	5726.00
7	6th year	15	4665.0	0.0	125.00	0.00	4790.00
8	7th year	18	5598.0	0.0	125.00	0.00	5723.00
9	8th year	18	5598.0	0.0	125.00	0.00	5723.00
10	9th year	18	5598.0	0.0	125.00	0.00	5723.00
11	10th year	18	5598.0	0.0	125.00	0.00	5723.00
	Total	335.0	72081.0	10637.0	3177.0	30167.0	121167.00

Notes:

1. Priority shall be given to the indigenous local species available locally in the area of plantation.
2. 10% indigenous bird seedling should be provided in plantation.
3. Use of certified commercial seed like LDC, Dolly Plugging, Merged Trench, Nuclear Trench, Graded Seed, etc. may be allowed.
4. Stake fork seeding may be adopted in the CA plantation. Litter up outside the forest area and Bamboo hedge fencing may be provided in CA plantation.
5. Mulching facilities for preservation of water & watering may be adopted as per the availability of water.
6. The Cost Norms of various items may be changed with the approval of the concerned DDOs keeping the overall cost norms fixed for each financial year.



APCCF (Forest Division & No. FC Act)

Matrix for Model-II A (ANR-500 Plants/ Ha)

Sl. No.	Commence model Year	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	XIII	XIV	XV	XVI	XVII	XVIII	XIX	XX	Total Cost
1	2021-22	13408	48817	13318	2990	6808	4800	6000	4800	4800	4800	4800	4800	4800	4800	4800	4800	4800	4800	4800	4800	130798
2	2022-23		14079	15081	14056	20816	6126	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	142004
3	2023-24			16476	26075	16369	11350	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	6000	150011
4	2024-25				15513	59404	15717	11937	6754	7091	7447	7810	8030	8021	9652							15754
5	2025-26					16093	62376	14508	17503	7932	7447	7810	8030	8021	9652	9000						160435
6	2026-27						7108	60406	17005	13509	7447	7810	8030	8021	9652	9600						173276
7	2027-28							10994	68068	14104	14806	7810	8030	8021	9652	9000						182270
8	2028-29								18026	71100	19104	14806	8030	8021	9652	9000						191510
9	2029-30									10799	23836	20029	13281	8621	9652	9000						200000
10	2030-31										10799	23836	20029	13281	9652	9000						211341

In Rupees

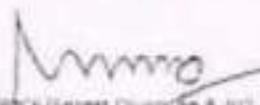
ANR Forest Division & HQ, B. A. C. U.

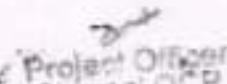
Project Officer
Sierra GCP
Shri. S. S. Choudhary

Fencing Model P 1

Fencing for Compensatory Plantation raised inside the Forest Areas using Bamboo Twigs & Thorns						
WAGE RATE Rs. 211/- PER DAY						
S. No	Items of work	Probable Period of Execution	Man days	Wages	Material cost (Rs)	Total Cost (Rs. per Ha.)
5th Year Maintenance						
1	BNL		0	0	0	0
1st Year Maintenance						
1	Supply of average parameters of 250000/ha. or 10000/ha. (Half bundle Bamboo Twigs/ha @ 120/bundle) Labour: Material = 4040 (approx)	Sept/Oct	30	6330	1433	23663
2	Double strand bamboo fence (2" outer rail & 2" above rail) 250/0 - 120-1-120 Nos. of Bamboo poles 1 Bamboo (approx) 24" height = 3 poles 120/0 = 48 Bamboo @ 200/Bamboo	Sept/Oct		0	8100	8100
3	Preparation of Bamboo poles, Digging of holes of 2 ft. depth & fixing Bamboo poles @ 20 poles/ha	Sept/Oct	6.5	1371.5		2021.5
4	Double wire iron strand Bamboo fence (200/0) 24" above ground and other one 4 ft. above ground	Sept/Oct		0	4200	4200
5	Making Bamboo fence, Fixing the Factor & Fencing the same as double strand up to 11000/ha @ Rs 21/-/Day	Sept/Oct	9	2799		2799
6	2000 @ 125 kg = 62.5 kg @ Rs. 70/kg	Sept/Oct		0	4375	4375
7	Making one Bamboo fence gate with simple L-shape			0	5000	5000
TOTAL			45.5	14100.5	20600.5	44701
Rate per running mt. 10725/ 2500 = 4290/ha						
2nd Year Maintenance						
1	Repair & Maintenance of Bamboo Fence including Material cost	Feb./Mar	20	4220	1500	5720
Rate per running mt. 7220/ 2500 = 28.88 or say Rs. 31/ha						
3rd Year Maintenance						
1	Repair & Maintenance of Bamboo Fence including Material cost	Feb./Mar	20	4220	575	4795
Rate per running mt. 11000/ 2500 = 4.40 or say Rs. 46/ha						
4th Year Maintenance						
1	Repair & Maintenance of Bamboo Fence including Material cost	Feb./Mar	20	4220	575	4795
Rate per running mt. 11000/ 2500 = 4.40 or say Rs. 46/ha						
5th Year Maintenance						
1	Repair & Maintenance of Bamboo Fence including Material cost	Feb./Mar	20	4220	575	4795
Rate per running mt. 11000/ 2500 = 4.40 or say Rs. 46/ha						

Abstract				
S. No	Year	No person days	Labour cost @ Rs. 211/- per day	Total cost (Rs.)
1	5th year	00	00	00
2	1st year	45.5	9596.5	44701
3	2nd year	20.0	4220.0	5720
4	3rd year	20.0	4220.0	4795
5	4th year	20.0	4220.0	4795
6	5th year	20.0	4220.0	4795
Total		125.5	26076.5	62181


 Project Officer
 Forest Division & NO, FC Act


 Project Officer
 Sigma OCP
 Mahanadi Co. Ltd

Matrix for Model F-1 Fencing (Bamboo Twig)

In Rupees

Sl. No.	Contract start year	Bids																Total Cost		
		I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	XIII	XIV	XV	XVI			
	Start Year	0	45728	7710	11805	11805	11805													
1	2021-22	0	48287	8511	13791	14008	23083													90980
2	2022-23		0	50409	8017	14059	23083	15940												100005
3	2023-24			0	10701	0344	23083	15940	16137											110014
4	2024-25				0	50200	9803	13941	16137	11524										115725
5	2025-26					0	58005	10340	18030	17024	18437									127132
6	2026-27						61221	12063	20634	19126	19438									147088
7	2027-28							0	64787	11428	18034	19438								147088
8	2028-29								67020	11926	20007	20006								148000
9	2029-30									0	20006	22247	20006							148000
10	2030-31										0	2410	1824	21803	22431	2802				150294

AP/CI - Bidding Evaluation & POC, F. No.1

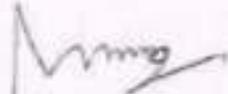
Office of the
Director
Public Works
Department
Government of Karnataka
Bengaluru

118

Annexure-11			
Cost norms for creation of Complementary Afforestation with Stabilization of Soil & Conservation of Moisture (1000)			
WAGS 6418 PO-313/- P.H. 663			
Sl.No	Item of Works	Preferable Period of Execution	Total Cost
5th Year (Pre-Planting Operation)			
1	Nil		0
1st Year			
2	Soil Conservation measure structures like Staggered Trench, Percolation pit, Contour trench, Graded earthen bund, LINC, Wire mesh LINC, Slope surface Dyke & WIS as per the design & site requirement as L1	Apr/Sep	20,215
2nd Year			
3	Maintenance of SMC structures @ 15 % of initial year cost	Apr/Oct	3,032
3rd Year			
4	Maintenance of SMC structures @ 15 % of initial year cost	Apr/Oct	3,032
4th Year			
5	Maintenance of SMC structures @ 15 % of initial year cost	Apr/Oct	3,032
4th Year			
5	Maintenance of SMC structures @ 15 % of initial year cost	Apr/Oct	3,032
Total			32,245.0

Abstract					
Sl. No	Year	No. person days	Labour cost @ Rs. 251/- per day	Material Cost	Total cost (Rs.)
1	1st year	48	12048	0.00	12048.00
2	2nd year	18	4518	20,215.00	24733.00
3	3rd year	18	4518	3,032.00	7550.00
4	4th year	18	4518	3,032.00	7550.00
5	4th year	18	4518	3,032.00	7550.00
6	5th year	18	4518	3,032.00	7550.00
Total		120	30090	32,245.00	62,335.00

Different types of SMC structures may be taken up as per the scope & requirements of the plantation site out of the design & specification of different structures annexed along this document.


 Project Officer
 Sirmar OCP
 Mahanadi Coalfields Limited


 Project Officer
 Sirmar OCP
 Mahanadi Coalfields Limited

Matrix for (SMQ)

Sl. NO	Component Serial No.	Base Items																		Total Cost
		I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	XIII	XIV	XV	XVI			
1	2021-22	2	2021	2126	2142	2010	2010	2085	2070										2583	
2	2021-23		3		22287	3109	3036	3036	3069	4054									37412	
3	2021-24				0	23613	3334	3170	3070	4047	4267								80284	
4	2024-25					0	24371	3038	3038	4044	4265	4400							41246	
5	2021-25					0	21208	3038	3038	4044	4267	4478	4294						43319	
6	2024-27								0	20200	4264	4264	4400	4294	4339				45475	
7	2021-28									0	20445	4477	4294	4307	5114				47749	
8	2024-29										0	20647	4294	4300	5114				50136	
9	2024-30									0	11360	4306	5218	5140	5717				52042	
10	2024-31									0	22024	5114	5440	5715	6035				55274	

in Rupees

APCC (Forest Division) & NO. FC Act



12

Matrix for Watering W1 (Solar Borewell) fitted with Drip System (per Ha)

Sl. No.	Commencement Year	In Rupees										Total Cost												
		I	II	III	IV	V	VI	VII	VIII	IX	X		XI	XII	XIII	XIV	XV	XVI						
	Base Item	153486	0	8174	8174	8174	8174																	
1	2021-22	153486	0	9031	9483	9935	10358																	222853
2	2022-23		171660	0	9482	9936	10332	10784																233788
3	2023-24			180343	0	8938	9433	9911																245476
4	2024-25				189715	0	2032	2063	2094															257753
5	2025-26						199738	0	12954	13508	14062	14616	15170	15724	16278	16832	17386	17940	18494	19048	19602	20156	20710	270639
6	2026-27								22854	0	1502	1502	1502	1502	1502	1502	1502	1502	1502	1502	1502	1502	1502	284171
7	2027-28																							298386
8	2028-29																							313296
9	2029-30																							328564
10	2030-31																							345432

[Signature]
 APLCT (Forest Division & NO, FC Act)

[Signature]
 Project Officer
 Starmul OSCP
 Mahanadi Command Unit

OFFICE OF THE FOREST RANGE OFFICER, GOPALPUR RANGE GOPALPUR

Letter No. 3194 Dt. 15.7.22

To,

The Divisional Forest Officer,
Sundargarh Forest Division, Sundargarh

Subj: Diversion of 349.709 ha of forest land within total mining lease area of 2290.449 ha in Sirmal Open cast Mining project by Mahanadi Coalfields Limited, District- Sundargarh, Odisha.

- Compliance stipulated conditions of stage-I approval for the proposal for non-forestry use of 349.709 ha forest land within total mining lease area of 2290.449 ha in Sirmal OCP of Mahanadi Area of Mahanadi Coalfields Limited.

- Submission of suitability report of identified 5.92 ha (Effective area 5.895 ha) degraded forest land regarding.

Ref: Letter No. 3194 /4F(Misc.) Dt. 16.06. 2022 of the Divisional Forest Officer, Sundargarh Division.

Sr.

In reference to the letter mentioned above, for compliance of stipulated conditions of stage-I approval accorded to Sirmal Opencast Project.

The condition 9 (f) reads "Afforestation on degraded forest land to be selected elsewhere measuring one and a half times the area under safety zone, shall also be done at the project cost under the supervision of the State Forest Department. The degraded forest land (DLF) so selected will be informed to the MoEF&CC with shade files before Stage-II approval and afforestation will be done within three years from the date of Stage-II clearance and maintained thereafter in accordance with the approval also in consultation with the State Forest Department."

In compliance to the above condition, 5.895 ha of degraded forest land is required for afforestation, our team conducted joint survey with MCL staff for search of suitable degraded forest land.

An area of 5.92 ha degraded forest land has been identified in Garjan Pehad Reserved Forest of Gopalpur Range, which is suitable for ANR plantation of 500 plants per ha.

This is for favor of your kind information and necessary action.

Enc:- As above.

Received

15.7.22

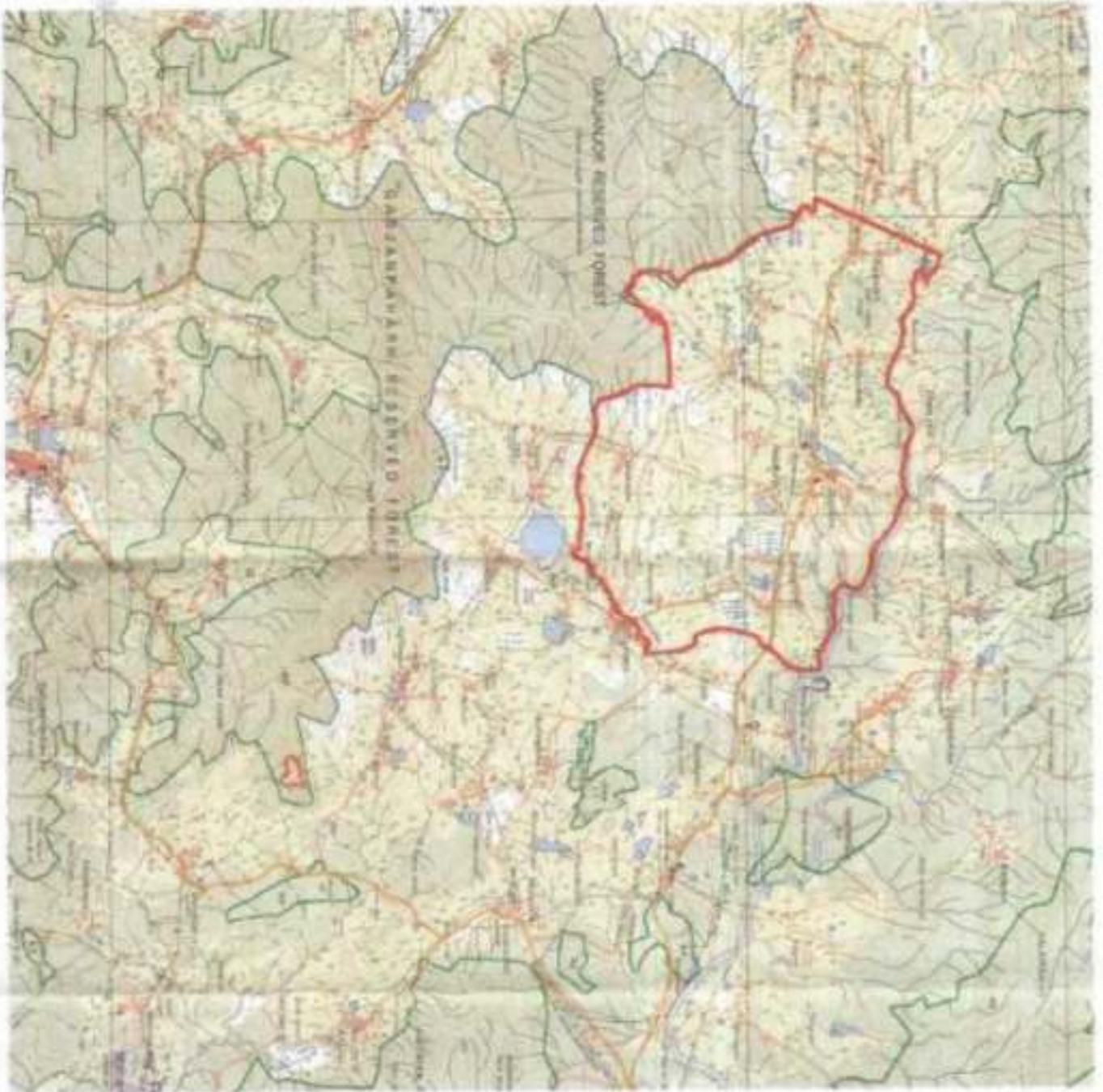


Yours Faithfully

Forest Range Officer
Gopalpur Range
Sundargarh



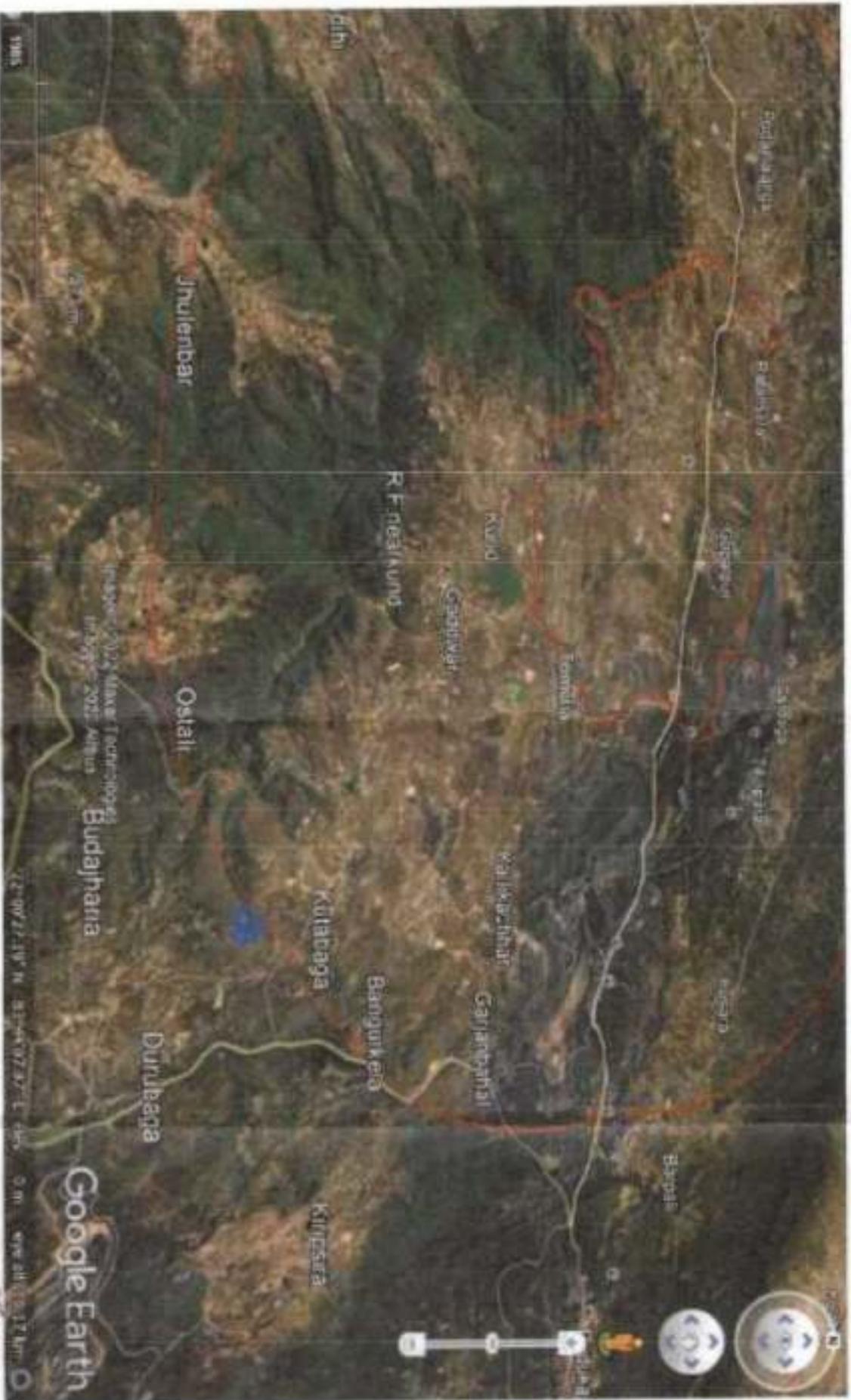
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Project Office
National ODS
www.ods.org.uk

[Signature]
District Range Officer
Cumbria Range

Google Image: Location of DFL proposed in extent to 1.5 times of forest land in safety zone area.
5.92 ha (Effective Area 5.895 ha) Garjan Pahad RF, Gopulpur Range, Sundargarh Forest Division



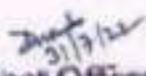


UNDERTAKING

(Condition no. 9 (v) of Para A of file No.8-25/2021-FC)

I/we do hereby undertake "to ensure in co-ordination with the State Forest Department that safety zone is maintained as per the prescribed norms."


General Manager
Mahalaxmi Area, MCL
General Manager
Mahalaxmi Area
Mahanadi Coal Fields Limited


Project Officer
Siarnal OCP
Mahalaxmi Area, MCL

Annexure-XVIII

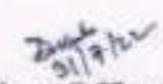
UNDERTAKING

(Condition no. 9 of Para A of file No.8-25/2021-FC)

I/we do hereby undertake that “the cost of felling of trees will be deposited with the State Forest Department.”


General Manager
Mahalaxmi Area, MCL

General Manager
Mahalaxmi Area
Mahanadi Coal Fields Limited


Project Officer
Siarmal OCP, MCL
Project Officer
Siarmal OCP
Mahanadi Coalfields Limited



OFFICE OF THE PRINCIPAL CHIEF CONSERVATOR OF FORESTS (WILDLIFE) &
CHIEF WILDLIFE WARDEN, ODISHA

Government of Odisha, Forest, Environment & Climate Change Department
PRAKRLITI BHAWAN, PLOT NO. 1455, SAHEED NAGAR, BHUBANESWAR, 751007
Phone: 0674-2602250, Website: www.wildlife.odisha.gov.in, Email: odishawildlife@gmail.com

No. 2458 /CWLW-FDWC-FD-0127-2021
Bhubaneswar, Dated the 07 May, 2022

To

The Project Officer
Sirmal OCP
At/PO-Basunchara,
Dist- Sundargarh
PIN- 770076

Sub: Proposal for non-forestry use of 340.709 ha forest land in favour of M/s Mahanadi Coalfields Limited for Sirmal Opencast Coal Mining Project in Sundargarh District (Odisha) - Approval of Site Specific Wildlife Conservation Plan.

Sir,

It is to intimate that you have to implement a Site Specific Wildlife Conservation Plan for the above project in compliance to the condition No.10 under Para-A stipulated in the letter in File No.8-25/2021-FC dated 21.04.2022 of Government of India, MoEF&CC, FC Division, New Delhi while granting Stage-I approval for the above diversion proposal.

The Site Specific Wildlife Conservation Plan in respect of the above project is hereby approved with financial forecast of ₹874.14 lakh (Rupees Eight crore seventy-four lakh fourteen thousand) only for implementation of the activities in Sundargarh Division, as detailed in the approved plan. The total cost of ₹874.14 lakh (Rupees Eight crore seventy-four lakh fourteen thousand) only may be deposited in State CAMPA fund through e-portal (<https://parivesh.nic.in>) for implementation of activities in project impact area within Sundargarh Forest Division.

It is further requested to take note of the following conditions for future compliance.

- The plan may be revisited after 5 years and the user agency will give undertaking to contribute towards the revised cost of the Conservation Plan till the project period, if any.
- Should there be need for Site Specific Wildlife Conservation Plan after expiry of the present plan period, the user agency shall submit another such plan at least one year before expiry of the present Conservation Plan and deposit the outlay amount upon its approval. In case of delay, it will be dealt as per law for violations of Forest (Conservation) Act, 1980 and Environment (Protection) Act, 1986.
- The user agency shall give an undertaking to bear the differential cost in case of enhancement of wage rate during implementation of the plan.

Yours faithfully

PCCF (WL) & CWLW, Odisha

Encl: 2 copies approved SSWLCP

P.T.O.

Project Officer
Sirmal OCP
Mahanadi Coalfields Limited



Memo No. 3969 Idt 08/05/2022

Copy forwarded for information and necessary action to the -

1. Special Secretary to Government of Odisha, FE&CC Department with reference to that department memo No.FE-DIV-FLD-0118-2021-7945/F&E dt 29.04.2022
2. Principal Chief Conservator of Forests, Odisha
3. Regional Chief Conservator of Forests, Rourkela Circle
- ✓ 4. Divisional Forest Officer, Sundargarh (T) Division along with a copy of approved SSWLCP

PCCF (WL) & CWLW, Odisha

Received

11-05-22





**OFFICE OF THE DIVISIONAL FOREST OFFICER,
SUNDARGARH FOREST DIVISION**



Phone No-06622-272243, E-Mail- dfo.sundargarh@odisha.gov.in

No. 2516 / 4F (MISC) / 2022/Dt-09/05/2022

To

The Project Officer,
Siarmal OCP,
At/Po-Basundhara
Dist-Sundargarh
Pin-770076.

Sub- Diversion of 349.709 ha. of forest land within total mining lease area of 2290.449 ha in Siarmal Open Cast Coal Mining Project by Mahanadi Coalfields Ltd. (MCL) in Sundargarh District, Odisha
-Demand for cost of Site Specific Wildlife Conservation Plan .

Ref- 1.Stage-I approval Order No. File No.8-25/2021-FC dated, 21.04.2022 of MoEF & CC.
2. Letter No.3958 dt.07.05.2022 of PCCF (WL) & CWLW, Odisha.

Sir

With reference to the letter cited above, as per condition No.10 under Para-A of Stage-I approval order No. File No.8-25/2021-FC dated, 21.04.2022 of MoEF & CC ,the Site Specific Wildlife Conservation Plan has been approved by the Principal Chief Conservator of Forests(Wildlife) & Chief Wildlife Warden , Odisha , Bhubaneswar vide his letter No.3958 dt.07.05.2022 with the financial forecast of Rs.874.14 lakh , relating to 349.709 ha of forest land for Siarmal OCP.

Hence, you are requested to deposit the amount of Rs.874.14 lakh (**Rupees Eight Crore Seventy Four Lakh-Fourteen Thousand**) only towards Site Specific Wildlife Conservation Plan in the state specific CAMPA Account maintained by Govt. of India through "E" payment mode by using the web portal of Ministry of Environment & Forests (CAMPA). Further, the evidence of deposited amount may be furnished to the undersigned for further needful action at this end. The approved copy of the PCCF (WL) & CWLW, Odisha is enclosed herewith for your reference.

Yours faithfully

D. Prasad
09/05/22
Divisional Forest Officer
Sundargarh Forest Division

Memo No. 2517 /Dated 09/05/2022

Copy forwarded to the Principal Chief Conservator of Forests, (Wildlife) & Chief Wildlife Warden, Odisha for favour of kind information and necessary action with reference to his Memo No.3959 dt.07.05.2022.

D. Prasad
09/05/22
Divisional Forest Officer
Sundargarh Forest Division.

ANNEXURE - XX

Annex - VIII



OFFICE OF THE COLLECTOR & DISTRICT MAGISTRATE, SUNDARGARH
(Revenue Section)

No. 6217 VIII-05/2021 / Dt. 14.07.2021

To

The Divisional Forest Officer,
Sundargarh Forest Division, Sundargarh

Sub:

Diversion of forest land measuring an area 349.709 Ha. for non-forest purpose in favour of Siarmal OCP of M/s. MCL, Hemgir.

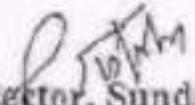
Ref:

This Office letter No. 5411 dt. 28.06.2021

Sir,

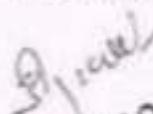
With reference to the letter on the subject cited above, I am to furnish herewith the revised certificate regarding compliance of Scheduled Tribes and other traditional forest dwellers (Recognition of forest Right) Act-2006 in respect of diversion of forest land measuring an area 349.709 Ha. for non-forest purpose in favour of Siarmal OCP of MCL in concerned villages Kulda, Gopalpur, Jhupurunga, Siarmal, Tumulia and Ratansara under Hemgir Tahasil for taking further course of action at your end.

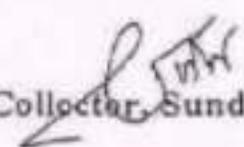
Yours faithfully,


Collector, Sundargarh

Memo No. 6218 / Rev. Dt. 14.07.2021

Copy to General Manager, MCL, Basundhara Area for information and necessary action.


Project Officer
Siarmal OCP


Collector, Sundargarh

FORM NO. II
(for projects other than linear projects)
Government of Odisha
Office of the District Collector, Sundergarh

No. 6216 dt. 14.07.2024

(REVISED CERTIFICATE)

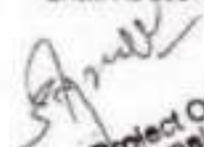
TO WHOMSOEVER IT MAY CONCERN

In compliance of the Ministry of Environment and Forests (MoEF), Government of India's letter No. 11-2/98-FC(Pt) dt. 3rd August, 2009 wherein the MoEF issued guidelines on submission of evidences for having initiated and completed the process of settlement of rights under the Scheduled Tribes and Other Traditional Forest Dwellers (Recognition of Forest Rights) Act, 2006 ('FRA' for short) on the forest land proposed to be diverted for non-forest purposes, it is certified that 349,709 hectares of forest land proposed to be diverted in favour of Siarnal OCP of M/s Mahanadi Coalfields Limited (MCL) for mining purpose in Sundergarh District falls within jurisdiction of village(s) Kulda 9,155 ha., Gopalpur 94,180 ha., Jhupurunga 63,812 ha., Siarnal 79,956 ha., Tumulla 64,091 ha. & Ratansara 48,470 ha. total 349,709 ha. in Hengli Tahsil.

It is further certified that:

- The complete process for identification and settlement of rights under the FRA has been carried out for the entire 349,709 hectares of forest land proposed for diversion. A copy of records of all consultation and meetings of the Forest Rights Committee(s), Gram Sabha(s), Sub-Division Level Committee(s) and the District Level Committee are enclosed as annexure 1 to annexure 10.
- The proposal for such diversion (with full details of the project and its implications, in vernacular/ local language) have been placed before each concerned Gram Sabha of forest-dwellers, who are eligible under the FRA.
- The each of concerned Gram Sabha(s), has certified that all formalities/ processes under the FRA have been carried out, and that they have given their consent to the proposed diversion and the compensation and ameliorative measures, if any, having understood the purpose and details of proposed diversion. A copy of certificate issued by the gram sabha of villages(s) Kulda, Gopalpur, Jhupurunga, Siarnal, Tumulla & Ratansara is enclosed as annexure 1 to annexure 6.
- The discussion and decisions on such proposals had taken place only when there was a quorum of minimum 50% of the members of Gram Sabha present.
- The diversion of forest land for facilities managed by the Government as required under section 3 (2) of the FRA have been completed and the Grama Sabhas have given their consent to it.
- The rights of Primitive Tribal Groups and pre-Agricultural Communities, where applicable have been specifically safeguarded as per section 3 (1) (e) of the FRA.

Encl.: As above


Project Officer
Siarnal OCP


Signature
(Full name and official seal of the District Collector)



OFFICE OF THE TAHSILDAR, HEMGIR

(Revenue & Disaster Management Deptt., Govt of Odisha)

e-mail id: tah.hemgiri-od@nic dot.in, Phone: 06621-387124, PIN: 770013

No. 1043 / Date: 06/07/2021

To
The Additional District Magistrate,
Sundargarh

Subject : Proposal for diversion of 349.709 Ha. of Revenue forest kism land of village Kuida, Gopalpur, Jhupurunga, Siarmal, Tumulla & Ratansara under Hemgir Tahsil for Siarmal Opencast Project of M/s.Mahanadi Coalfields Limited, Basundhara Area.

Ref. : Your letter No.472-VIII-05/2021, dated.18.01.2021.

Dear Sir,

With reference to the subject cited above & in continuation of this office letter No.176, dt.28.01.2021 & 872 dt. 03.06.2021, I am hereby submitting a land schedule of plot no. 1200 of Khata no. 260 of Tumulla Village which has somehow been excluded in the earlier submitted land schedule of Siarmal Project of MCL. The same may please be included for FRA purpose.

Sl.no.	Khata no.	Plot no.	Kisam	Area (Ac)	Area Required (Ac)	Remarks
01	260	1209	Jungle	0.88	0.54	

The said land is coming under Jungle kism and no one is in possession of the said land and so far no claim has been received.

This is for your kind information and needful action.

Yours faithfully,

Tahsildar
Hemgir

TAHSILDAR
HEMGIR

Memo No. 1044 / Date 06/07/2021

Copy submitted to the Sub-Collector, Sadar, Sundargarh for favour of information and necessary action.

Project Officer
Siarmal OCP

Tahsildar
Hemgir

TAHSILDAR
HEMGIR

LAND SCHEDULE OF FOREST LAND PROPOSED FOR DIVERSION

Sl. No.	Name of the Tehsil	Name of the village	Khata No.	Plot No.	Kisam	Required Area In Ac.	Total required area in Ac. Or Ha.
1	2	3	4	5	6	8	9
1	Hemgir	Kulda	32	1	Patra Jungle	0.25	22.63 or 9.158
2			32	55	Patra Jungle	1.23	
3			32	7R	Patra Jungle	0.62	
4			32	32	Patra Jungle	1.24	
5			32	34	Patra Jungle	0.15	
6			32	16	Patra Jungle	0.38	
7			32	35	Patra Jungle	2.45	
8			32	453	Patra Jungle	0.77	
9			32	42	Jungle	1.24	
10			32	40	Patra Jungle	5.95	
11			32	44	Jungle	3.78	
12			32	46	Jungle	1.91	
13			32	48	Patra Jungle	0.52	
14			32	54	Patra Jungle	1.23	
15			22	385	Jungle	0.10	
16	Hemgir	Gopalpur	184	362	Jungle	11.42	232.72 or 94.280
17			184	364	Jungle	1.32	
18			184	705	Jungle	7.38	
19			184	711	Jungle	7.23	
20			183	763	Jungle	5.78	
21			184	773	Jungle	2.35	
22			184	783	Jungle	0.65	
23			184	784	Jungle	1.70	
24			184	954	Jungle	0.22	
25			184	955	Jungle	5.20	
26			184	975	Jungle	4.62	
27			184	982	Jungle	2.62	
28			182	1011	Jungle	12.74	
29			184	1023	Jungle	3.30	
30			184	1066	Jungle	0.50	
31			184	1128	Jungle	10.83	
32			184	1136	Jungle	4.95	
33			184	1153	Jungle	0.72	
34			184	1209	Jungle	0.76	
35			182	1451	Jungle	4.87	
36	184	1459	Jungle	2.18			
37	184	1466	Jungle	1.57			
38	184	1477	Jungle	17.60			
39	184	1485	Jungle	21.65			
40	184	1492	Jungle	2.25			
41	184	1494	Jungle	2.53			
42	184	1498	Jungle	7.80			
43	184	1501	Jungle	12.87			
44	184	1511	Jungle	1.52			

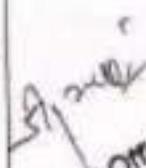
Sy...
Project Officer
Siamal OCP

45						
46	Hemgir	Gouelpur	184	1514	Jungle	2.13
47			184	1523	Jungle	5.30
48			184	1526	Jungle	5.40
49			184	1538	Jungle	3.04
50			184	1547	Jungle	2.98
51			184	1549	Jungle	5.00
52			102	1553	Jungle	2.05
53			184	1561	Jungle	2.64
54			184	1568	Jungle	1.28
55			184	1600	Jungle	1.48
56			184	1603	Jungle	2.27
57			184	1613	Jungle	2.00
58			184	1616	Jungle	3.30
59			184	1619	Jungle	3.00
60	182	1621	Jungle	11.37		
61	184	1632	Jungle	4.03		
62	184	1680	Jungle	0.55		
63	184	1689	Jungle	2.24		
64	184	1697	Jungle	12.40		
65	Hemgir	Ihopuranga	240	363	Jungle	1.32
66			238	389	Jungle	2.70
67			240	457	Jungle	4.45
68			240	460	Jungle	1.41
69			240	462	Jungle	1.27
70			240	550	Jungle	4.53
71			240	676	Jungle	1.05
72			238	668	Gramya Jungle	3.85
73			240	693	Jungle	1.08
74			240	695	Jungle	1.05
75			240	734	Jungle	1.95
76			240	750	Jungle	0.86
77			240	772	Jungle	0.75
78			238	795	Gramya Jungle	15.00
79	240	801	Jungle	1.27		
80	238	803	Jungle	3.00		
81	240	815	Jungle	2.31		
82	238	880	Gramya Jungle	4.73		
83	238	885	Gramya Jungle	8.84		
84	238	1036	Gramya Jungle	4.00		
85	240	1203p	Jungle	0.27		
86	240	1303	Jungle	2.92		
87	238	1321	Jungle	3.68		
88	240	1349	Jungle	0.65		
89	238	1392	Gramya Jungle	14.85		
90	238	1405	Gramya Jungle	18.30		
91	238	1415	Gramya Jungle	1.13		
92	238	1418	Gramya Jungle	1.65		
93	238	1423	Gramya Jungle	2.09		
94	238	1426	Gramya Jungle	6.62		
		238	1428	Gramya Jungle	3.71	

131.97 or
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Agarwal
Project Officer
Siarmal OCP

95			240	1435	Jungle	1.62
96			238	1440	Gramya Jungle	5.73
97			238	1442	Gramya Jungle	2.08
98	Hemgir	Irupurunga	240	766	Jungle	1.25
99			51	35	Gramya Jungle	21.75
100			51	37	Gramya Jungle	4.92
101			51	42	Gramya Jungle	11.22
102			51	71	Gramya Jungle	12.65
103			51	97	Gramya Jungle	0.98
104			51	175	Gramya Jungle	2.25
105			51	201	Gramya Jungle	0.10
106	Hemgir		51	203	Saala Jungle	0.50
107			51	671	Saala Jungle	0.27
108			51	694	Saala Jungle	0.14
109			51	695/855	Saala Jungle	0.08
110			51	619/873	Jungle	1.39
111			53	13	Jungle	10.75
112			53	19	Jungle	0.30
113			53	27	Saala Jungle	0.68
114			53	29	Jungle	5.95
115			53	32	Saala Jungle	1.46
116			53	33	Jungle	0.50
117			53	38	Saala Jungle	0.42
118			53	39	Saala Jungle	0.18
119			53	41	Saala Jungle	0.50
120			53	44	Saala Jungle	1.50
121	Hemgir	Siamol	53	45	Saala Jungle	0.05
122			53	46	Saala Jungle	0.68
123			53	49	Patra Jungle	0.20
124			53	50	Saala Jungle	1.82
125			53	54	Saala Jungle	0.62
126			53	55	Saala Jungle	0.08
127			53	64	Saala Jungle	0.10
128			53	65	Jungle	0.80
129			53	68	Jungle	0.86
130			53	70	Saala Jungle	0.54
131			53	72	Saala Jungle	0.70
132			53	74	Jungle	0.54
133			53	87	Saala Jungle	0.10
134			53	88	Saala Jungle	0.61
135			53	89	Saala Jungle	0.25
136			53	93	Saala Jungle	0.20
137			53	96	Saala Jungle	0.21
138			53	99	Jungle	3.38
139			53	101	Jungle	0.20
140			53	102	Saala Jungle	0.44
141			53	103p	Jungle	7.13
142			53	150	Saala Jungle	0.15
143	Hemgir		53	152	Saala Jungle	0.25
144			53	153	Saala Jungle	0.50


 Protect Officer
 Siamol OCP

145		53	154	Saala Jungle	0.46
146		53	155	Saala Jungle	0.09
147		53	158	Saala Jungle	0.27
148		53	159	Saala Jungle	0.37
149		53	160	Saala Jungle	0.03
150		53	171	Saala Jungle	0.05
151		53	172	Saala Jungle	0.88
152		53	177	Saala Jungle	6.14
153		53	178	Saala Jungle	2.28
154		53	179	Saala Jungle	0.08
155		53	181	Saala Jungle	0.94
156		53	182	Saala Jungle	0.30
157		53	187	Saala Jungle	0.62
158	Hemgir	53	188	Saala Jungle	2.12
159		53	180	Jungle	0.40
160		53	191	Saala Jungle	0.18
161		53	192	Jungle	0.30
162		53	193	Patrao Jungle	0.17
163		53	196	Jungle	0.13
164		53	197	Saala Jungle	0.30
165		53	198	Jungle	1.20
166		53	200	Saala Jungle	1.75
167		53	202	Saala Jungle	2.82
168		53	204	Saala Jungle	0.32
169		53	205	Saala Jungle	0.21
170		53	208	Jungle	0.16
171		53	209	Jungle	1.30
172		53	210	Saala Jungle	0.15
173	Hemgir	53	212	Saala Jungle	0.11
174		53	218	Jungle	0.12
175		53	229	Jungle	0.11
176		53	244	Saala Jungle	0.25
177		53	246	Saala Jungle	0.19
178		53	247	Saala Jungle	0.50
179		53	248	Saala Jungle	0.20
180		53	249	Saala Jungle	0.08
181		53	250	Saala Jungle	0.05
182		53	253	Saala Jungle	0.14
183		53	255	Saala Jungle	0.19
184		53	256	Saala Jungle	0.16
185		53	257	Saala Jungle	0.10
186		53	262	Saala Jungle	0.96
187		53	267	Saala Jungle	1.66
188	Hemgir	53	269	Saala Jungle	0.06
189		53	271	Saala Jungle	0.11
190		53	274	Saala Jungle	0.04
191		53	276	Saala Jungle	3.24
192		53	281	Saala Jungle	0.25
193		53	286	Saala Jungle	0.70
194		53	287	Saala Jungle	0.21

Hemgir

Hemgir

Hemgir

Sirmal

Signature
Project Officer
Sirmal OCP

197.67 or
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Hemgir

Sirmal

Hemgir

Hemgir

Tumukla

Signature
Project Officer
Sirmal OCP

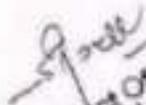
53	301	Jungle	0.11
53	568p	Seala Jungle	0.30
53	570	Jungle	11.87
53	582	Seala Jungle	0.12
53	585	Jungle	0.80
53	587p	Jungle	2.09
53	588p	Jungle	0.49
53	619	Jungle	7.06
53	669	Jungle	13.03
53	670	Seala Jungle	0.21
53	696	Jungle	18.40
53	713	Jungle	0.48
53	717	Seala Jungle	0.25
53	718	Seala Jungle	0.84
53	723	Jungle	1.35
53	724	Seala Jungle	0.13
53	728	Jungle	2.22
53	731	Jungle	1.89
53	780p	Jungle	0.49
53	788P	Jungle	0.44
53	16/819	Seala Jungle	0.05
53	58/821	Seala Jungle	0.65
53	47/830	Seala Jungle	0.04
53	47/831	Seala Jungle	0.10
53	47/832	Seala Jungle	0.08
53	52/833	Seala Jungle	0.15
53	59/834	Seala Jungle	0.14
53	69/835	Seala Jungle	0.05
53	80/837	Seala Jungle	0.07
53	85/839	Seala Jungle	0.05
53	90/840	Seala Jungle	0.12
53	290/848	Seala Jungle	0.12
53	18	Seala Jungle	0.09
260	156	Jungle	0.61
260	940	Jungle	10.00
260	1081	Jungle	2.90
260	1090	Jungle	4.95
260	1093	Jungle	1.08
260	1095	Jungle	1.13
260	1097	Jungle	7.72
260	1102	Jungle	13.42
260	1109	Jungle	0.80
260	1115	Jungle	3.34
260	1117	Jungle	8.12
260	1128	Jungle	0.77
260	1131	Jungle	0.92
260	1156	Jungle	0.70
260	1171	Jungle	16.07
260	1182	Jungle	8.30
260	1208	Jungle	0.34

158.37 or
64.091

245		260	1214	Jungle	3.52	
246		260	1218	Jungle	0.80	
247		260	1221	Jungle	1.97	
248	Hamgir	260	1227	Jungle	4.54	
249		260	1235	Jungle	0.71	
250		260	1244	Jungle	12.11	
251		260	1273	Jungle	0.78	
252		Tumula	260	1276	Jungle	6.78
253			260	1323	Jungle	0.60
254			260	1342	Jungle	1.62
255			260	1348	Jungle	5.20
256			260	1409	Jungle	0.54
257			260	1417	Jungle	0.45
258	260		1425	Jungle	0.12	
259	258		1430	Gramya Jungle	37.05	
260	Hamgir		193	935	Jungle	0.76
261			193	1092	Patra Jungle	3.26
262		193	1094	Patra Jungle	0.91	
263		192	1095	Jungle	0.07	
264		193	1097	Jungle	2.20	
265		191	1143	Sal Jungle	0.08	
266		193	1131	Jungle	2.44	
267		194	1132	Sal Jungle	0.73	
268		193	1140	Patra Jungle	0.32	
269		191	1141	Sal Jungle	0.06	
270	Ratansara	191	1143	Sal Jungle	0.08	
271		193	1144	Patra Jungle	1.07	
272		191	1145	Sal Jungle	0.11	
273		191	1146	Sal Jungle	0.26	
274		193	1148	Patra Jungle	0.36	
275		193	1160	Patra Jungle	0.12	
276		191	1167	Sal Jungle	0.11	
277		191	1198	Sal Jungle	0.47	
278		Hamgir	191	1199	Sal Jungle	0.12
279			191	1200	Sal Jungle	0.16
280	191		1201	Sal Jungle	0.58	
281	191		1202	Sal Jungle	0.50	
282	191		1203	Sal Jungle	0.27	
283	191		1204	Gramya Jungle	27.50	
284	193		1206	Patra Jungle	2.33	
285	193		1207	Patra Jungle	0.08	
286	193		1209	Patra Jungle	0.08	
287	Project Officer Siarmal OCP		193	1210	Patra Jungle	4.56
288		191	1212	Sal Jungle	0.18	
289		193	1216	Patra Jungle	0.06	
290		193	1217	Patra Jungle	1.75	
291		193	1218	Patra Jungle	0.06	
292		193	1220	Jungle	1.62	
293		193	1222	Jungle	0.11	
294		193	1225	Jungle	6.62	

119.77 or
48.470

295	Hemgir	Katansera	193	1236	Jungle	0.16
296			193	1237	Jungle	0.23
297			191	1238	Sai Jungle	0.12
298			191	1240	Sai Jungle	0.20
299			193	1781	Jungle	5.22
301			193	1782	Jungle	0.26
302			193	1784	Jungle	0.31
303			191	1790	Gramya Jungle	28.82
304			193	1791	Jungle	13.46
305			193	1793	Jungle	0.51
306			191	1795	Bada jungle	0.32
307			193	1796	Jungle	0.05
308			193	1798	Jungle	4.66
309			193	1802	Jungle	0.22
310			193	1825	Jungle	0.14
311			193	1839	Jungle	0.25
312			193	1841	Jungle	0.18
313			193	1855	Jungle	2.77
314			193	1857	Jungle	0.09
					193	986/2018(Part)
			Total area in Ac.			864.13
			Total area in Ha.			349.709


 Project Officer
 Sirmal OCP


 Signature
 (Full name and official seal of the District Collector)

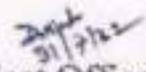


UNDERTAKING

(Condition no. 1 of Para Bof file No.8-25/2021-FC)

- I/we do hereby undertake that “the legal status of the diverted forest land shall remain unchanged”.


General Manager
Mahalaxmi Area, MCL
General Manager
Mahalaxmi Area
Mahanadi Coal Fields Limited


Project Officer
Siarnal OCP, MCL
Project Officer
Siarnal OCP
Mahanadi Coalfields Limited

MAP SHOWING COMPENSATORY AFFORESTATION AREA IN JAMKANI R.F. OF M/s MCL, SIARMAL OCP



NO.	NAME	AREA
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NO.	NAME	AREA
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DECLARATION

I, the undersigned, being the authorized officer of the Government of Karnataka, do hereby certify that the area shown in the map is the area reserved for the purpose of afforestation and the same is available for the purpose of afforestation.

Signature: _____

Designation: _____

Department: _____



- Legend**
- 1 Afforestation area reserved for the purpose of afforestation
 - 2 Afforestation area reserved for the purpose of afforestation
 - 3 Afforestation area reserved for the purpose of afforestation



UNDERTAKING

(Condition no. 4 of Para Bof file No.8-25/2021-FC)

I/we do hereby undertake "to pay the additional amount of NPV, if so determined, as per the final decision of Honorable Supreme Court of India."

General Manager

Mahalaxmi Area, MCL

General Manager
Mahalaxmi Area
Mahanadi Coal Fields Limited

Project Officer

Siarnal OCP, MCL

Project Officer
Siarnal OCP
Mahanadi Coalfields Limited

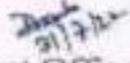
UNDERTAKING

(Condition no. 6 of Para B of file No.8-25/2021-FC)

I/we do hereby undertake "to explore the possibility of translocation of maximum number of trees identified to be felled and shall ensure that any tree felling shall be done only when it is unavoidable and that too under strict supervision of the State Forest Department."


General Manager
Mahalaxmi Area, MCL

General Manager
Mahalaxmi Area
Mahanadi Coal Fields Limited


Project Officer

Siarmal OCP, MCL
Project Officer
Siarmal OCP
Mahanadi Coalfields Limited

UNDERTAKING

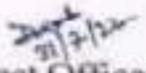
(Condition no. 5 of Para B of file No.8-25/2021-FC)

I/we do hereby undertake "tree felling shall be taken up strictly in phased manner as per the requirement in accordance with the approved mining plan with prior permission of the DFO Sundargarh Forest Division."


General Manager
Mahalaxmi Area, MCL

General Manager
Mahalaxmi Area

Mahanadi Coalfields Limited


Project Officer

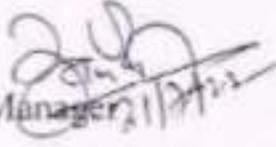
Siarmal OCP, MCL
Project Officer
Siarmal OCP

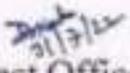
Mahanadi Coalfields Limited

UNDERTAKING

(Condition no. 7 of Para B of file No.8-25/2021-FC)

I/we do hereby undertake "mining will be done in a phased manner after taking due care for reclamation of the mined over area. The mining activity will be done in consonance with the approved Mining Plan with Progressive Mine Closure Plan for reclamation of the mined out area, as submitted with the diversion proposal"


General Manager
Mahalaxmi Area, MCL
General Manager
Mahalaxmi Area
Mahanadi Coal Fields Limited

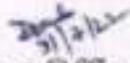

Project Officer
Siarmal OCP, MCL
Project Officer
Siarmal OCP
Mahanadi Coalfields Limited

UNDERTAKING

(Condition no. 8 of Para B of file No.8-25/2021-FC)

- I/we do hereby undertake “to comply with the Hon’ble Supreme Court order on re-grassing, and re-grassing the mining area and any other area which may have been disturbed due to mining to restore them to a condition which fit for growth of fodder, flora, fauna, etc., in a timely manner”

- 
General Manager
Mahalaxmi Area, MCL
General Manager
Mahalaxmi Area
Mahanadi Coal Fields Limited

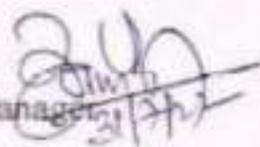
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Project Officer
Siarnal OCP, MCL
Project Officer
Siarnal OCP
Mahanadi Coalfields Limited

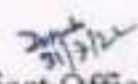
Annexure-XXVIII

UNDERTAKING

(Condition no. 9 of Para B of file No.8-25/2021-FC)

- I/we do hereby undertake "that the period of diversion of the 349.709 ha forest land under this proposal shall be for a period co-terminus with the period of the mining lease proposed to be granted under the Mines and Minerals (Development and Regulation) Act, 1957, and amended and the Rules framed there-under.


General Manager
Mahalaxmi Area, MCL
General Manager
Mahalaxmi Area
Mahanadi Coal Fields Limited


Project Officer
Siarnal OCP, MCL
Project Officer
Siarnal OCP
Mahanadi Coalfields Limited

F. No. J-11015/230/2014-IA-II(M)
Government of India
Ministry of Environment, Forest and Climate Change
(Impact Assessment Division)

2nd Floor Vayu Wing,
Indira ParyavaranBhawan,
Jorbagh Road, N Delhi - 3
Email: lk bokolia@nic in Tel: 011-20819417
Dated: 05th May, 2022

To
The Chief General Manager (CP&P)
M/s Mahanadi Coalfields Limited
PO - Jagruti Vihar, Burla,
Sambalpur-768 020 (Odisha)
E-mail: egmenvt2014@gmail.com

Sub: Siarmal Opencast coal mining project of 40 MTPA (Normative)/50 MTPA (peak) of M/s Mahanadi Coalfields Limited in mine lease area of 2290.45 ha (Project Area - 2580.45 ha) located in District Sundargarh (Odisha) - For Reconsideration of Environmental Clearance - reg.

Sir,

This has reference to your online proposal No. IA/OR/CMIN/24164/2014 dated 15th July, 2019 submitted to this Ministry for grant of Environmental Clearance (EC) in terms of the provisions of the Environment Impact Assessment (EIA) Notification, 2006 under the Environment (Protection) Act, 1986 for Expansion of Siarmal Opencast coal mining project of 40 MTPA (Normative)/50 MTPA (peak) of M/s Mahanadi Coalfields Limited in mine lease area of 2290.45 ha (Project Area - 2580.45 ha) located in District Sundargarh (Odisha).

2. The project/activity is covered under category 'A' of item i(a) 'Mining of Minerals' the Schedule to the EIA Notification, 2006

3. The proposal was considered by the sectoral Expert Appraisal Committee (EAC) in its 47th meeting held on 22nd August, 2019, 1st meeting held on 17-18 August, 2020 and on 27th meeting held on 4th March, 2022. The details of the project, as per the documents submitted by the project proponent, and also as informed during the meeting, are reported to be as under -

- (i) The project area is covered under Survey of India Topo-Sheet No. 64N/12 (RF 1:50000) and is bounded by the geographical coordinates ranging from to 22o 01' 19" to 22o 03' 59 90" North and longitudes 83o 37' 09" to 83o 42' 49 58" East
- (ii) Coal linkage of the project: Basket linkage
- (iii) Project does not fall in the Critically Polluted Area (CPA) where the MoEF&CC's vide its OM dated 13th January, 2010 has imposed moratorium on grant of environment clearance.

AS
Project Officer
Siarmal OCP
Mahanadi Coalfields Limited

- (iv) Employment generation: Direct employment to 3773 persons will be provided from the project.
- (v) The project is reported to be beneficial in terms of improvement in physical and social infrastructure like roads, school building, provision of drinking water, community hall, plantation etc. Increase in employment potential. Contribution to the Exchequer (both State and Central Govt). Improvement of Electrical Power Generation and availability of electricity in rural areas. Overall economic growth of the country.
- (vi) It is greenfield project.
- (vii) Terms of reference was granted on 20-02-2015 and again revised ToR was granted on 09.07.2018.
- (viii) Total mining lease area as per block allotment is 2290.45 Ha. Mining Plan (Including Progressive Mine Closure Plan) has been approved by 198th MCL Board held on 31-01-2018.
- (ix) The land usage pattern of the project is as follows:

Pre Mining Land Use

Sl. No	Type of Land	Within ML area	Outside ML area	Total Area
1	Agricultural	1382.408	0.00	1382.408
2	Forest	349.709	0.00	349.709
3	Waste land	126.216	0.00	126.216
4	Grazing	131.789	0.00	131.789
5	Surface water bodies	48.227	0.00	48.227
6	Settlements	44.970	0.00	44.970
7	Others	207.131	290.00	497.131
Total		2290.45	290.00	2580.45

Land Use Break Up- Post-Mining

Sl. No.	Land Use Category	Land use in Ha.				Total
		Plantation	Water Body	Public -Use	Undisturbed	
1	Quarry excavation area	409.99	549.69	586.64	0.00	1546.32
2	Safety Zone	18.59	0.00	0.00	0.00	18.59
3	OB dump (external)	386.08	0.00	0.00	0.00	386.08
4	Embankment	18.00	0.00	0.00	10.30	28.30
5	Infrastructure	8.00	0.00	0.00	34.82	42.82
6	Undisturbed Area	74.41	0.00	0.00	193.93	268.34
7	Residential Colony	14.00	0.00	56.00	0.00	70.00
8	Others (R&R and Diversion of road & railway link)	38.00	0.00	182.00	0.00	220.00
Total:		967.07	549.69	824.64	239.05	2580.45

8. Total geological reserve reported in the mine lease area is 1895.43 MT with 1618.21 MT mineable reserves. Out of total mineable reserve of 1618.21 MT, 1547.82 MT are available for extraction. Percent of extraction is 95.65%.

20/12/20
 Project Officer
 Sirmal OCP
 - Coalfields Limited

17

- xi 16 seams with thickness ranging from 1m-27m are workable. Grade of coal is G-11. Stripping ratio 1.47 cum/tonne while gradient is 3o to 5o
- xii Method of mining operations envisages by Opencast Mining method by Shovel - Dumper in OB and Surface miner, pay loader & tipper in coal
- xiii Life of mine is 38 years
- xiv The project has two external OB dumps in an area of 386.08 ha with 82-85 m height and 184.72 Mm³ of OB and two internal OB in an area of 996.63 ha with 2007.79 Mm³ of OB is envisaged in the project
- xv Total quarry area is 1546.32 ha out of which backfilling will be done in 996.63 Ha while final mine void will be created in an area of 549.69 Ha with a depth of 155 m. Backfilled quarry area of 996.63 ha shall be reclaimed with plantation. Final mine void will be converted into a water body
- xvi Transportation of coal has been proposed partly by dumper and in pit conveyor system in mine pit head, from surface to siding by Conveyor transport and at sidings by Pay loader; Silo to rail wagon by rapid loading system.
- xvii Reclamation Plan in a total area of 1553.71 Ha, comprises of 386.08 Ha of external dump and 996.63 ha of internal dump. In addition to this, an area of 18.59 Ha included in the safety zone, 18.0 Ha in embankment and 74.41 Ha for blasting danger zone has also been proposed for green belt development.
- xviii 349.709 ha of forest land has been reported to be involved in the project. Approval under the Forest (Conservation) Act, 1980 for diversion of 349.709 ha of forest land for non-forestry purposes has been submitted vide proposal no. FP/OR/MIN/32796/2018 to MoEF&CC. The proposal has been considered in the FAC meeting scheduled on 21.02.2022. Additional information sought by MoEF&CC for which reply has been submitted on 28.02.2022.
- xix No National Parks, Wildlife Sanctuaries and Eco-Sensitive Zones have been reported with 10 km boundary of the project.
- xx No schedule-I species reported while conducting the baseline flora fauna study. However, Site Specific wildlife conservation plan will be submitted by the PP during EC Stage I compliance.
- xxi The ground water level has been reported to be varying between 1.85 m to 8.42 m during pre-monsoon and between 1.15 m to 4.57 m during post-monsoon. Total water requirement for the project is 10704 KLD.
- xxii Application for obtaining the approval of the Central Ground Water Authority has been obtained vide CGWA/NOC/MIN-ORIG/2020/9246 dated 09.12.2020.
- xxiii Public hearing for the project of 50 MTPA capacity in an area of 2290.45 ha was conducted on 03.01.2019 at Kundren playground at Siarmal Village, Tehsil Hemgir, Dist-Sundargarh. Major issues raised in the public hearing includes Employment, Payment of Compensation, R & R, Dust pollution and issues regarding blasting.
- xxiv Consent to Operate for the existing capacity will be obtained from the State PCB after the grant of EC from MoEF&CC.
- xxv Chattarjhor stream is flowing towards East of the boundary lease. The nallah will be straightened in consultation with the Water Resource Department of the State Government.
- xxvi As it is a new project, regular monitoring of ambient air quality and the documented report will be submitted to Regional Office, MoEF&CC, and Bhubaneswar and also to MoEF&CC along with half yearly EC compliance report after the grant of EC.
- xxvii No court cases, violation cases are pending against the project of the PP. However, the R&R of all the villages falling in this project area are being carried out under the direction of "Claims Commission" appointed by Hon'ble Supreme Court of India.
- xxviii The project does not involve violation of the EIA Notification, 2006 and amendment issued thereunder. The coal production from the mine has not yet started.

10

Project Officer
Siarmal OCP
Meharadi Coalfields Limited

- xxix The project involves 2427 project affected families. R&R of the PAPs will be done as per Orissa Rehabilitation and Resettlement Policy 2006 under the directions and supervision of Hon'ble Claims Commission formed by the Hon'ble Supreme Court of India.
- xxx Total cost of the project is Rs 3756.36 Crores. Cost of production is Rs 311.65/- per ton. CSR cost is Rs 2 per ton or 2% of the average net profit of the Company of the three immediately preceding financial years whichever is higher. R&R cost is Rs 678.04 Crores. Environment Management Cost is Rs 738.26 Crores.

4. The proposal was considered by the sectoral Expert Appraisal Committee (EAC) in its 27th EAC meeting held on 4th March, 2022 and recommended for grant of Environment Clearance through Video conferencing. Based on recommendations of the EAC, the Ministry of Environment, Forest and Climate Change hereby accords approval Expansion of Siarnal Opencast coal mining project of 40 MTPA (Normative)/50 MTPA (peak) of M/s Mahanadi Coalfields Limited in mine lease area of 2475.47 ha located in District Sundargarh (Odisha), under the provisions of Environment Impact Assessment Notification, 2006 and subsequent amendments/circulars thereto subject to the compliance of the following terms & conditions / specific conditions for environmental safeguards as stated below -

- i. PP shall submit Stage-I Forest Clearance of 349.709 ha prior to grant of Environment Clearance
- ii. PP shall obtain CTO for 40 MTPA (Normative)/50 MTPA (Peak) from State Pollution Control Board prior of commencement of mining operations
- iii. PP shall implement in-pit conveyor system with silo loading facility till railway siding within 2 years (March-2024) and No road transportation shall be allowed beyond this time; accordingly, SPCB shall not grant CTO for road transportation
- iv. No diversion shall be allowed for Chantanjhor and Telendra stream and SPCB while granting the CTO under Water Act, shall ensure this. Adequate protection measure on either side of stream bank shall be taken by PP with tree plantation. It should be ensured that no mine drainage except rain water shall join the stream. Action plan for its protection shall be submitted to IRO, MoEF&CC within 6 months
- v. PP shall comply yearwise Environment control measures lists submitted as per email dated 13th March, 2022 to Ministry i.e. For FY 2022-23-Rs. 2395.90 Lakhs, FY-2023-24- Rs. 1643.00 Lakhs, FY 2024-26-Rs. 758.0 Lakhs and FY 2025-26 - Rs. 480.40 Lakhs.
- vi. PP shall limit the activities of mining in its mine lease area only. No OB Dumping and infrastructure activity should be proposed and dumped on forest land. Accordingly revised Mine Plan should be submitted (if required) and submitted to Ministry
- vii. PP shall provide about 120 ha of grazing near the proposed R&R site and 20 ha of water bodies to be created in the form of ponds
- viii. PP shall comply with the recommendation of sub-committee's site visit report which is proposed in the case of EC of Basundhara West OCP
- ix. PP to install 2 continuous ambient air quality monitoring stations at suitable locations in consultation of SPCB. The real time data so generated shall be uploaded on company website. In addition, data should also be displayed digitally at entry and exit gate of mine lease area for public display. Data shall be linked to website of SPCB/CPCB. Monitoring station shall be installed within 1 year period and action taken report shall be submitted to IRO with photographs.

- x. PP shall make use of advanced computer simulation techniques for design and execution of blasting operation in the mine. PP shall make use of Electronic Delay Detonators for optimal blasting in coal and OB rock to minimize the environmental impacts of blasting such as ground vibration, fly rocks and excessive dust generation.
- xi. PP shall deploy atleast 20% of overall fleet of dumpers/trucks as electrical or CNG/LNG based dumpers/trucks for transportation of coal/OB etc.
- xii. PP shall engage third party independent expert agency for monitoring/auditing of compliance of EC conditions every year.
- xiii. No village road shall be used for transportation of coal and no road transport route shall be adopted, which is passing through any sensitive location such as schools, hospitals etc. PP shall take legal undertaking from its consumers accordingly.
- xiv. PP to develop public redressal system due to project activities through manual entry, whatsapp number or any other mean which is convenient to local people. The complaints so gathered shall be disposed of at GM project level on monthly basis.
- xv. PP shall implement all listed activities which includes Fixed type sprinklers, trolley mounted and mobile fog cannons of 40 mts throw, wind barrier at coal stockyard, plantation etc with different timeline till December, 2023. Six monthly report should be supported with photograph to comply with this condition.
- xvi. PP shall plant 1,50,000 nos. of native trees with broad leaves along the transportation route in three years to prevent the effect of air pollution. After completion of tree plantation, number of trees shall be duly endorsed from District Forest Officer.
- xvii. PP shall deploy only 40-50 tonnes covered trucks/dumper to reduce fleet size till Rapid loading system and conveyor belt system is commenced (i.e. till March, 2024).
- xviii. PP shall engage dedicated agency for plantation in mine site by April, 2022 instead of depending on State Forest Department. PP may seek inputs and expertise from forest department.
- xix. The detail of the activity proposed Community Development for Peripheral Villages as proposed of Rs. 10.75 Lakh with time bound action plan to be provided to Ministry IRO.
- xx. An amount of Rs. 984.89 lakh proposed for wildlife conservation plan should be submitted to the Govt. of Odisha, Forest & Environment Dept and the copy of receiving to be submitted to Ministry's IRO.
- xxi. PP shall protect the pond/ water body present towards the South eastern boundary and make it for sustainable use for villages with consultation with gram panchayat. The cost occurring in this regard shall be borne by the company.
- xxii. PP shall prepare Basundhara River conservation plan with respect to its quality check, beatification, plantation along the boundary and construction of over bridge if required and converge with plan of state government prepared for river rejuvenation.
- xxiii. PP shall implement Peripheral tree plantation along the mine lease area with miyawaki method of 50 mts width within 2 years through independent expert.
- xxiv. PP shall explore an action plan for implementation of sand segregation plant to extract sand and aggregate (since quantity of OB is higher) to reduce agricultural land degradation.
- xxv. PP also to provide drinking water facilities like installation of RO with proper water supply pipe fittings to nearby rural areas and also to install hand pumps by seeking consent from panchayat of the villages located within the study area of 10 km radius buffer zone within two years.
- xxvi. PP to install solar lights within 1 year from the grant of this EC along the road used for transportation of minerals to avoid the accidents at night and also seek its maintenance. PP is asked to also identify the rural areas for installation of solar light.

Signature
District Officer
Bairmor OCP
Maharaja Coalfields Limited

Handwritten mark

- with its maintenance within the study area of 10 km radius buffer zone within one year
- xxvii. PP to provide sanitation facility like bio toilets to the villages located within the study areas within 1 year from the grant of this EC
- xxviii. PP shall construct new multispecialty (50 beds) hospital in the 10 km of the project area within 3 years for local people out of approved budget. This shall be done in consultation of DM of the district.
- xxix. Proponent shall appoint an Occupational Health Specialist for Regular and Periodical medical examination of the workers engaged in the Project and maintain records accordingly, also, Occupational health check-ups for workers having some ailments like BP, diabetes, habitual smoking, etc. shall be undertaken once in six months and necessary remedial/preventive measures taken accordingly. The Recommendations of National Institute for ensuring good occupational environment for mine workers shall be implemented, The prevention measure for burns, malaria and provision of anti-snake venom including all other paramedical safeguards may be ensured before initiating the mining activities.
- xxx. Chattanjhor stream may disturb the catchment area of that water body so it was asked by PP not to disturb it and to protect it and check its quality regularly
- xxxi. PP shall conduct need base assessment survey in study area in one year from the date of issue of EC and accordingly, Persons of nearby villages shall be given training on livelihood and skill development to make them employable.
- xxxii. The illumination and sound at night at project sites disturb the villages in respect of both human and animal population. Consequent sleeping disorders and stress may affect the health in the villages located close to mining operations. Habitations have a right for darkness and minimal noise levels at night. PPs must ensure that the biological clock of the villages is not disturbed, by orienting the floodlights/ masks away from the villagers and keeping the noise levels well within the prescribed limits for day light/night hours
- xxxiii. PP shall pay to farmers of agricultural land if there is any loss due to pollution found by concerned District Commissioner as per extent rules or norms.
- xxxiv. Hon'ble Supreme Court in an Writ Petition(s) Civil No. 114/2014, Common Cause vs Union of India & Ors vide its judgement dated 8th January, 2020 has directed the Union of India to impose a condition in the mining lease and a similar condition in the environmental clearance and the mining plan to the effect that the mining lease holders shall, after ceasing mining operations, undertake re-grassing the mining area and any other area which may have been disturbed due to their mining activities and restore the land to a condition which is fit for growth of fodder, flora, fauna etc. Compliance of this condition after the mining activity is over at the cost of the mining lease holders/Project Proponent. The implementation report of the above said condition shall be sent to the Regional Office of the MoEF&CC.

4.1 The grant of environmental clearance is further subject to compliance of the Standard EC conditions as under.

(a) Statutory compliance

- (i) The project proponent shall obtain forest clearance under the provisions of Forest (Conservation) Act, 1986, in case of the diversion of forest land for non-forest purpose involved in the project.

20/01/20
 Project Officer
 Siamal OCP
 Mineral Complex Limited

103

- (ii) The project proponent shall obtain clearance from the National Board for Wildlife, if applicable
- (iii) The project proponent shall prepare a Site-Specific Conservation Plan / Wildlife Management Plan and approved by the Chief Wildlife Warden. The recommendations of the approved Site-Specific Conservation Plan/Wildlife Management Plan shall be implemented in consultation with the State Forest Department. The implementation report shall be furnished along with the six-monthly compliance report (in case of the presence of schedule-I species in the study area)
- (iv) The project proponent shall obtain Consent to Establish/Operate under the provisions of Air (Prevention & Control of Pollution) Act, 1981 and the Water (Prevention & Control of Pollution) Act, 1974 from the concerned State pollution Control Board/ Committee.
- (v) The project proponent shall obtain the necessary permission from the Central Ground Water Authority.
- (vi) Solid/hazardous waste generated in the mines needs to be addressed in accordance to the Solid Waste Management Rules, 2016/Hazardous & Other Waste Management Rules, 2016.

(b) Air quality monitoring and preservation

- (i) Continuous ambient air quality monitoring stations as prescribed in the statute be established in the core zone as well as in the buffer zone for monitoring of pollutants, namely PM_{10} , $PM_{2.5}$, SO_2 and NO_x . Location of the stations shall be decided based on the meteorological data, topographical features and environmentally and ecologically sensitive targets in consultation with the State Pollution Control Board. Online ambient air quality monitoring stations may also be installed in addition to the regular monitoring stations as per the requirement and/or in consultation with the SPCB. Monitoring of heavy metals such as Hg, As, Ni, Cd, Cr, etc to be carried out at least once in six months.
- (ii) The Ambient Air Quality monitoring in the core zone shall be carried out to ensure the Coal Industry Standards notified vide GSR 742 (E) dated 25th September, 2000 and as amended from time to time by the Central Pollution Control Board. Data on ambient air quality and heavy metals such as Hg, As, Ni, Cd, Cr and other monitoring data shall be regularly reported to the Ministry/Regional Office and to the CPCB/SPCB.
- (iii) Transportation of coal, to the extent permitted by road, shall be carried out by covered trucks/conveyors. Effective control measures such as regular water/mist sprinkling/rain gun etc shall be carried out in critical areas prone to air pollution (with higher values of $PM_{10}/PM_{2.5}$) such as haul road, loading/unloading and transfer points. Fugitive dust emissions from all sources shall be controlled regularly. It shall be ensured that the Ambient Air Quality parameters conform to the norms prescribed by the Central/State Pollution Control Board.
- (iv) The transportation of coal shall be carried out as per the provisions and route envisaged in the approved Mining Plan or environment monitoring plan. Transportation of the coal through the existing road passing through any village shall be avoided. In case, it is proposed to construct a 'bypass' road, it should be so constructed so that the impact of sound, dust and accidents could be appropriately mitigated.
- (v) Vehicular emissions shall be kept under control and regularly monitored. All the vehicles engaged in mining and allied activities shall operate only after obtaining 'PUC' certificate from the authorized pollution testing centres.

(vi) Coal stock pile/crusher/feeder and breaker material transfer points shall invariably be provided with dust suppression system. Belts-conveyors shall be fully covered to avoid air borne dust. Side cladding all along the conveyor gantry should be made to avoid air borne dust. Drills shall be wet operated or fitted with dust extractors.

(vii) Coal handling plant shall be operated with effective control measures w.r.t various environmental parameters. Environmental friendly sustainable technology should be implemented for mitigating such parameters.

(c) Water quality monitoring and preservation

(i) The effluent discharge (mine waste water, workshop effluent) shall be monitored in terms of the parameters notified under the Water Act, 1974 Coal Industry Standards vide GSR 742 (E) dated 25th September, 2000 and as amended from time to time by the Central Pollution Control Board.

(ii) The monitoring data shall be uploaded on the company's website and displayed at the project site at a suitable location. The circular No J-20012/1/2006-IA 11 (M) dated 27th May, 2009 issued by Ministry of Environment, Forest and Climate Change shall also be referred in this regard for its compliance.

(iii) Regular monitoring of ground water level and quality shall be carried out in and around the mine lease area by establishing a network of existing wells and constructing new piezometers during the mining operations. The monitoring of ground water levels shall be carried out four times a year i.e. pre-monsoon, monsoon, post-monsoon and winter. The ground water quality shall be monitored once a year, and the data thus collected shall be sent regularly to MOEFCC/RO.

(iv) Monitoring of water quality upstream and downstream of water bodies shall be carried out once in six months and record of monitoring data shall be maintained and submitted to the Ministry of Environment, Forest and Climate Change/Regional Office.

(v) Ground water, excluding mine water, shall not be used for mining operations. Rainwater harvesting shall be implemented for conservation and augmentation of ground water resources.

(vi) Catch and/or garland drains and siltation ponds in adequate numbers and appropriate size shall be constructed around the mine working, coal heaps & OB dumps to prevent run off of water and flow of sediments directly into the river and water bodies. Further, dump material shall be properly consolidated/ compacted and accumulation of water over dumps shall be avoided by providing adequate channels for flow of silt into the drains. The drains/ ponds so constructed shall be regularly de-silted particularly before onset of monsoon and maintained properly. Sump capacity should provide adequate retention period to allow proper settling of silt material. The water so collected in the sump shall be utilised for dust suppression and green belt development and other industrial use. Dimension of the retaining wall constructed, if any, at the toe of the OB dumps within the mine to check run-off and siltation should be based on the rainfall data. The plantation of native species to be made between toe of the dump and adjacent field/habitation/water bodies.


Project Officer
Sirmal OCP
Maharaja College, Lambur

(vii) Adequate groundwater recharge measures shall be taken up for augmentation of ground water. The project authorities shall meet water requirement of nearby village(s) after due treatment conforming to the specific requirement (standards)

(viii) Industrial waste water generated from CHP, workshop and other waste water, shall be properly collected and treated so as to conform to the standards prescribed under the standards prescribed under Water Act 1974 and Environment (Protection) Act, 1986 and the Rules made there under, and as amended from time to time. Adequate ETP /STP needs to be provided

(ix) The water pumped out from the mine, after siltation, shall be utilized for industrial purpose viz watering the mine area, roads, green belt development etc. The drains shall be regularly desilted particularly after monsoon and maintained properly

(x) The surface drainage plan including surface water conservation plan for the area of influence affected by the said mining operations, considering the presence of river/rivulet/pond/lake etc, shall be prepared and implemented by the project proponent. The surface drainage plan and/or any diversion of natural water courses shall be as per the approved Mining Plan/EIA/EMP report and with due approval of the concerned State/Gol Authority. The construction of embankment to prevent any danger against inrush of surface water into the mine should be as per the approved Mining Plan and as per the permission of DGMS or any other authority as prescribed by the law.

(xi) The project proponent shall take all precautionary measures to ensure riverine/riparian ecosystem in and around the coal mine up to a distance of 5 km. A riverine/riparian ecosystem conservation and management plan should be prepared and implemented in consultation with the irrigation / water resource department in the state government.

(d) Noise and Vibration monitoring and prevention

(i) Adequate measures shall be taken for control of noise levels as per Noise Pollution Rules, 2016 in the work environment. Workers engaged in blasting and drilling operations, operation of HEMM, etc shall be provided with personal protective equipments (PPE) like ear plugs/muffs in conformity with the prescribed norms and guidelines in this regard. Adequate awareness programme for users to be conducted. Progress in usage of such accessories to be monitored

(ii) Controlled blasting techniques shall be practiced in order to mitigate ground vibrations, fly rocks, noise and air blast etc., as per the guidelines prescribed by the DGMS

(iii) The noise level survey shall be carried out as per the prescribed guidelines to assess noise exposure of the workmen at vulnerable points in the mine premises, and report in this regard shall be submitted to the Ministry/RO on six-monthly basis

(e) Mining Plan

(i) Mining shall be carried out under strict adherence to provisions of the Mines Act 1952 and subordinate legislations made there-under as applicable

(ii) Mining shall be carried out as per the approved mining plan (including Mine Closure Plan) abiding by mining laws related to coal mining and the relevant circulars issued by Directorate General Mines Safety (DGMS)

113

Dr. P. S. Srinivasan
Secretary
Ministry of Coal
Government of India
New Delhi

(iii) No mining shall be carried out in forest land without obtaining Forestry Clearance as per Forest (Conservation) Act, 1980

(iv) Efforts should be made to reduce energy and fuel consumption by conservation, efficiency improvements and use of renewable energy

(f) Land reclamation

(i) Digital Survey of entire lease hold area/core zone using Satellite Remote Sensing survey shall be carried out at least once in three years for monitoring land use pattern and report in 1:50,000 scale or as notified by Ministry of Environment, Forest and Climate Change(MOEFC) from time to time shall be submitted to MOEFCC/Regional Office (RO)

(ii) The final mine void depth should preferably be as per the approved Mine Closure Plan, and in case it exceeds 40 m, adequate engineering interventions shall be provided for sustenance of aquatic life therein. The remaining area shall be backfilled and covered with thick and alive top soil. Post-mining land be rendered usable for agricultural/forestry purposes and shall be diverted. Further action will be treated as specified in the guidelines for Preparation of Mine Closure Plan issued by the Ministry of Coal dated 27th August, 2009 and subsequent amendments.

(iii) The entire excavated area, backfilling, external OB dumping (including top soil) and afforestation plan shall be in conformity with the "during mining" "post mining" land-use pattern, which is an integral part of the approved Mining Plan and the EIA/EEMP submitted to this Ministry. Progressive compliance status vis a vis the post mining land use pattern shall be submitted to the MOEFCC/RO

(iv) Fly ash shall be used for external dump of overburden, backfilling or stowing of mine as per provisions contained in clause (i) and (ii) of subparagraph (8) of fly ash notification issued vide SO 2804 (E) dated 3rd November, 2009 as amended from time to time. Efforts shall be made to utilize gypsum generated from Flue Gas Desulfurization (FGD), if any, along with fly ash for external dump of overburden, backfilling of mines. Compliance report shall be submitted to Regional Office of MoEF&CC, CPCB and SPCB

(v) Further, it may be ensured that as per the time schedule specified in mine closure plan it should remain live till the point of utilization. The topsoil shall temporarily be stored at earmarked site(s) only and shall not be kept unutilized. The top soil shall be used for land reclamation and plantation purposes. Active OB dumps shall be stabilised with native grass species to prevent erosion and surface run off. The other overburden dumps shall be vegetated with native flora species. The excavated area shall be backfilled and afforested in line with the approved Mine Closure Plan. Monitoring and management of rehabilitated areas shall continue until the vegetation becomes self-sustaining. Compliance status shall be submitted to the Ministry of Environment, Forest and Climate Change/ Regional Office

(vi) The project proponent shall make necessary alternative arrangements, if grazing land is involved in core zone, in consultation with the State government to provide alternate areas for livestock grazing, if any. In this context, the project proponent shall implement the directions of Hon'ble Supreme Court with regard to acquiring grazing land

Project Officer
Shrihari OCP
Maharashtra Environment & Forest Department

M

(g) Green Belt

(i) The project proponent shall take all precautionary measures during mining operation for conservation and protection of endangered/endemic flora/fauna, if any, spotted/reported in the study area. The Action plan in this regard, if any, shall be prepared and implemented in consultation with the State Forest and Wildlife Department.

(ii) Greenbelt consisting of 3-tier plantation of width not less than 7.5 m shall be developed all along the mine lease area as soon as possible. The green belt comprising a mix of native species (endemic species should be given priority) shall be developed all along the major approach/ coal transportation roads.

(h) Public hearing and Human health issues

(i) Adequate illumination shall be ensured in all mine locations (as per DGMS standards) and monitored weekly. The report on the same shall be submitted to this ministry & its RO on six-monthly basis.

(ii) The project proponent shall undertake occupational health survey for initial and periodical medical examination of the personnel engaged in the project and maintain records accordingly as per the provisions of the Mines Rules, 1955 and DGMS circulars. Besides regular periodic health check-up, 20% of the personnel identified from workforce engaged in active mining operations shall be subjected to health check-up for occupational diseases and hearing impairment, if any, as amended time to time.

(iii) Personnel (including outsourced employees) working in core zone shall wear protective respiratory devices and shall also be provided with adequate training and information on safety and health aspects.

(iv) Implementation of the action plan on the issues raised during the public hearing shall be ensured. The project proponent shall undertake all the tasks/measures as per the action plan submitted with budgetary provisions during the public hearing. Land oustees shall be compensated as per the norms laid down in the R&R policy of the company/State Government/Central Government, as applicable.

(v) The project proponent shall follow the mitigation measures provided in this Ministry's OM No.Z-11013/5712014-IA.11 (M) dated 29th October, 2014, titled 'Impact of mining activities on habitations-issues related to the mining projects wherein habitations and villages are the part of mine lease areas or habitations and villages are surrounded by the mine lease area'.

(i) Corporate Environment Responsibility

(i) The company shall have a well laid down environmental policy duly approved by the Board of Directors. The environmental policy should prescribe for standard operating procedures to have proper checks and balances and to bring into focus any infringements/deviation/violation of the environmental/forest/wildlife norms/conditions. The company shall have defined system of reporting infringements/deviation/violation of the environmental/forest/wildlife norms/conditions and/or shareholders/stake holders.

Dr. Rajat Kumar
Sajmal OCP
Minister, Coal and Lignite

(ii) A separate Environmental Cell both at the project and company head quarter level, with qualified personnel shall be set up under the control of senior Executive, who will directly to the head of the organization

(iii) Action plan for implementing EMP and environmental conditions along with responsibility matrix of the company shall be prepared and shall be duly approved by competent authority. The year wise funds earmarked for environmental protection measures shall be kept in separate account and not to be diverted for any other purpose. Year wise progress of implementation of action plan shall be reported to the Ministry/Regional Office along with the Six Monthly Compliance Report

(iv) Self environmental audit shall be conducted annually. Every three years third party environmental audit shall be carried out

(j) Miscellaneous

(i) The project proponent shall make public the environmental clearance granted for their project along with the environmental conditions and safeguards at their cost by prominently advertising it at least in two local newspapers of the District or State, of which one shall be in the vernacular language within seven days and in addition this shall also be displayed in the project proponent's website permanently

(ii) The copies of the environmental clearance shall be submitted by the project proponents to the Heads of local bodies, Panchayats and Municipal Bodies in addition to the relevant offices of the Government who in turn has to display the same for 30 days from the date of receipt.

(iii) The project proponent shall upload the status of compliance of the stipulated environment clearance conditions, including results of monitored data on their website and update the same on half-yearly basis.

(iv) The project proponent shall monitor the criteria pollutants level namely, PM_{10} , SO_2 , NO_x (ambient levels) or critical sectoral parameters, indicated for the projects and display the same at a convenient location for disclosure to the public and put on the website of the company

(v) The project proponent shall submit six-monthly reports on the status of the compliance of the stipulated environmental conditions on the website of the ministry of Environment, Forest and Climate Change at environment clearance portal

(vi) The project proponent shall follow the mitigation measures provided in this Ministry's OM No Z-11013/5712014-IA II (M) dated 29th October, 2014, titled 'Impact of mining activities on habitations-issues related to the mining projects wherein habitations and villages are the part of mine lease areas or habitations and villages are surrounded by the mine lease area'

(vii) The project proponent shall submit the environmental statement for each financial year in Form-V to the concerned State Pollution Control Board as prescribed under the Environment (Protection) Rules, 1986, as amended subsequently and put on the website of the company

(viii) The project authorities shall inform to the Regional Office of the MOEFCC regarding commencement of mining operations

(ix) The project authorities must strictly adhere to the stipulations made by the State Pollution Control Board and the State Government

(x) The project proponent shall abide by all the commitments and recommendations made in the EIA/EMP report, commitment made during Public Hearing and also that during their presentation to the Expert Appraisal Committee

(xi) No further expansion or modifications in the plant shall be carried out without prior approval of the Ministry of Environment, Forests and Climate Change

(xii) Concealing factual data or submission of false/fabricated data may result in revocation of this environmental clearance and attract action under the provisions of Environment (Protection) Act, 1986

(xiii) The Ministry may revoke or suspend the clearance, if implementation of any of the above conditions is not satisfactory

(xiv) The Ministry reserves the right to stipulate additional conditions if found necessary. The Company in a time bound manner shall implement these conditions.

(xv) The Regional Office of this Ministry shall monitor compliance of the stipulated conditions. The project authorities should extend full cooperation to the officer (s) of the Regional Office by furnishing the requisite data / information/monitoring reports.

(xvi) The above conditions shall be enforced, inter-alia under the provisions of the Water (Prevention & Control of Pollution) Act, 1974, the Air (Prevention & Control of Pollution) Act, 1981, the Environment (Protection) Act, 1986, Hazardous and Other Wastes (Management and Trans-boundary Movement) Rules, 2016 and the Public Liability Insurance Act, 1991 along with their amendments and Rules and any other orders passed by the Hon'ble Supreme Court of India / High Courts and any other Court of Law relating to the subject matter.

5. The proponent shall abide by all the commitments and recommendations made in the EIA/EMP report and also that during presentation to the EAC. All the commitments made on the issues raised during public hearing shall also be implemented in letter and spirit.

6. The proponent shall obtain all necessary clearances/approvals that may be required before the start of the project. The Ministry or any other competent authority may stipulate any further condition for environmental protection. The Ministry or any other competent authority may stipulate any further condition for environmental protection.

7. Any appeal against this environmental clearance shall lie with the National Green Tribunal, if preferred, within a period of 30 days as prescribed under Section 16 of the National Green Tribunal Act, 2010.

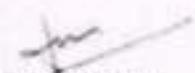
8. The coal company/project proponent shall be liable to pay the compensation against the illegal mining, if any, and as raised by the respective State Governments at any point of time, in terms of the orders dated 2nd August, 2017 of Hon'ble Supreme Court in WP (Civil) No 114/2014 in the matter of 'Common Cause Vs Union of India & others.

Regional Office of
Saurashtra OCP
Saurashtra Coalfields Limited

9. The concerned State Government shall ensure no mining operations to commence till the entire compensation for illegal mining, if any, is paid by the project proponent through their respective Department of Mining & Geology, in strict compliance of the judgment of Hon'ble Supreme Court.

10. This environmental clearance shall not be operational till such time the project proponent complies with the above said judgment of Hon'ble Supreme Court, as applicable, and other statutory requirements.

This issues with the approval of the competent Authority


(Lalit Bokolia)
Director

Copy to:

1. The Secretary, Ministry of Coal, Shastri Bhawan, New Delhi.
2. The Additional Principal Chief Conservator of Forests, Regional office (EZ), Ministry of Environment & Forests, A-31, Chandrasekharpur, Bhubaneswar- 751023 (Odisha).
3. The Secretary, Department of Environment & Forests, Government of Orissa, Secretariat, Bhubaneswar (Odisha).
4. Chairman, Central Ground Water Authority, Jangpura House, 18/11, Man Singh Road Area, New Delhi, Delhi 110001
5. The Chairman, Orissa State Pollution Control Board, Parivesh Bhawan, A 118, Nilkanthanagar, Unit VIII, Bhubaneswar - 751012 (Odisha).
6. District Collector, Sundargarh, Government of Odisha
7. Monitoring File /Record File
8. PARIVESH Portal


(Lalit Bokolia)
Director

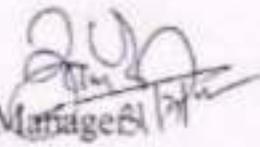

Project Officer
Sudhakar OCP
Maharaja Cochintha Limited

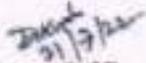


UNDERTAKING

(Condition no. 11 of Para Bof file No.8-25/2021-FC)

- I/we do hereby undertake that "no labor camp will be constructed on the forest land and the laborers working at the site shall be supplied with LPG"

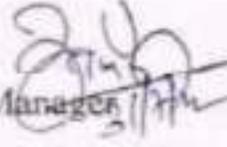

General Manager
Mahalaxmi Area, MCL
General Manager
Mahalaxmi Area
Mahanadi Coal Fields Limited

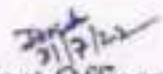

Project Officer
Siarmal OCP, MCL
Project Officer
Siarmal OCP
Mahanadi Coalfields Limited

UNDERTAKING

(Condition no. 12 of Para B of file No.8-25/2021-FC)

- I/we do hereby undertake that "The boundary of the diverted forest land, mining lease and safety zone, as applicable shall be demarcated on ground at the project cost, by erecting 4 feet high reinforced cement concrete pillars, each inscribed with its serial number, distance from pillar to pillar and GPS coordinates"

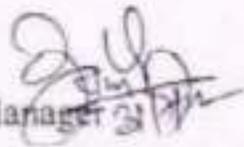

General Manager
Mahalaxmi Area, MCL
General Manager
Mahalaxmi Area
Mahanadi Coal Fields Limited

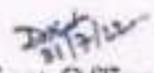

Project Officer
Siarmal OCP, MCL
Project Officer
Siarmal OCP
Mahanadi Coalfields Limited

UNDERTAKING

(Condition no. 13 of Para B of file No.8-25/2021-FC)

- I/we do hereby undertake that "the layout plan of the mining plan/ proposed shall not be changed without the prior approval of the Central Government and the forest land proposed for diversion shall not be used for any purpose other than those specified in the diversion proposal"

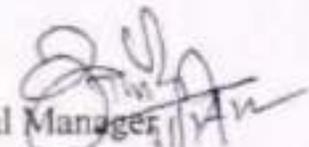
● General Manager 
Mahalaxmi Area, MCL
General Manager
Mahalaxmi Area
Mahanadi Coal Fields Limited

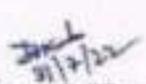

Project Officer
Siarmal OCP, MCL
Project Officer
Siarmal OCP
Mahanadi Coalfields Limited

UNDERTAKING

(Condition no. 14 of Para B of file No.8-25/2021-FC)

I/we do hereby undertake that "the forest land proposed to be diverted shall under no circumstances be transferred to any other agency, department or person without prior approval of the Central Government"


General Manager
Mahalaxmi Area, MCL
General Manager
Mahalaxmi Area
Mahanadi Coal Fields Limited


Project Officer
Siarmal OCP, MCL
Project Officer
Siarmal OCP
Mahanadi Coal Fields Limited



UNDERTAKING

(Condition no. 15 of Para B of file No.8-25/2021-FC)

I/we do hereby undertake "to ensure 'No damage' to the flora and fauna of the adjoining areas shall be caused."

General Manager
Mahalaxmi Area, MCL

General Manager
Mahalaxmi Area
Mahanadi Coal Fields Limited

Project Officer

Siarnal OCP, MCL
Project Officer
Siarnal OCP
Mahanadi Coalfields Limited

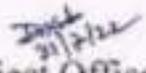


UNDERTAKING

(Condition no. 16 of Para B of file No.8-25/2021-FC)

I/we do hereby undertake “to submit the annual self-compliance report in respect of the conditions to the State Government, concerned Regional Office, and the Ministry of Environment, Forests and Climate Change by the end of March every year regularly.”

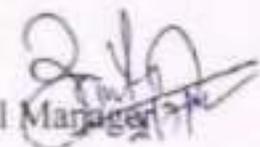

General Manager
Mahalaxmi Area, MCL
General Manager
Mahalaxmi Area
Mahanadi Coal Fields Limited

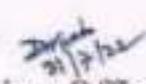

Project Officer
Siarmal OCP, MCL
Project Officer
Siarmal OCP
Mahanadi Coalfields Limited

UNDERTAKING

(Condition no. 17 of Para B file No.8-25/2021-FC)

I/we do hereby undertake "to comply any condition that the Regional Office of the Ministry of Environment, Forests and Climate Change stipulate with the approval of competent authority in the interest of conservation, protection and development of forests and wildlife."

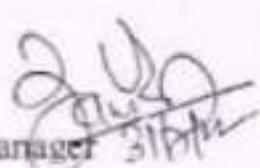

General Manager
Mahalaxmi Area, MCL
General Manager
Mahalaxmi Area
Mahanadi Coal Fields Limited


Project Officer
Siarmal OCP, MCL
Project Officer
Siarmal OCP
Mahanadi Coalfields Limited

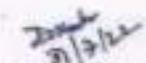
UNDERTAKING

(Condition no. 18 of Para B file No.8-25/2021-FC)

I/we do hereby undertake "to comply all the provisions of all Acts, Rules, Regulations Guidelines, Honorable Court Order (s) and NGT Order (s) pertaining to this project, if any, for the time being in force, as applicable to the project."


General Manager
Mahalaxmi Area, MCL

General Manager
Mahalaxmi Area
Mahanadi Coal Fields Limited

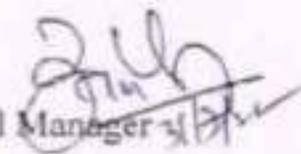

Project Officer
Siarmal OCP, MCL

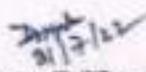
Annexure-XXXVIII

UNDERTAKING

(Condition no. 19 of Para B file No.8-25/2021-FC)

I/we do hereby undertake "to not act in violation of any of the conditions that amount violation of Forest (Conservation) Act, 1980, and comply to all the provisions of all Acts, Rules, Regulations Guidelines of Forest (Conservation) Act, 1980."


General Manager
Mahalaxmi Area, MCL
General Manager
Mahalaxmi Area
Maharadi Coalfields Limited


Project Officer
Siarnal OCP, MCL
Project Officer
Siarnal OCP
Maharadi Coalfields Limited