

WA-DR-25-6/12  
 Office of the Engineer-in-Chief,  
 Water Resources, Secha Sadan, Unit-V,  
 Odisha, Bhubaneswar.  
 \*\*\*\*\*



No.  
 From,

15764 we

/Dated the 29.4.15

Er. Janaki Ballav Mohapatra,  
 Engineer-in-Chief, Water Resources,  
 Odisha, Bhubaneswar.

To

The Principal Secretary to Government,  
 Department of Water Resources, Odisha,  
 Bhubaneswar.

Sub:- Hirakud Dam – Mitigation measures for accommodating revised design flood -  
 Additional spillways.

Ref:- Letter No.611/WE dated 29.04.2015 and No.570 dated 25.04.2015 of Chief  
 Engineer, Dam Safety, Odisha, Bhubaneswar.

Sir,

The probable maximum flood (PMF) for Hirakud dam is  $69632 \text{ m}^3/\text{sec}$  against the  
 spillway discharging capacity of  $42450 \text{ m}^3/\text{sec}$ . The passing of PMF through the existing  
 spillway of Hirakud is a matter of concern towards safety of the dam. Since 1977,  
 Experts have been emphasizing on providing additional passage for the safe disposal of  
 the revised design flood.

The Dam Safety Review Panel headed by Sri A.D.Mohile, (Former Chairman,  
 CWC) visited the dam in 2004 & again during 2013 and suggested to give priority for  
 additional spillway.

To resolve the issue collective efforts are being made by the State DSO, UMB  
 team, CPMU for DRIP and CWC. In the meantime, the consulting group named Egis  
 (France) engaged by CPMU was assigned with this job. The Consultant visited the site  
 and after a thorough exercise suggested multiple options of structural and non-structural  
 measures.

As a follow up, a meeting was held in the chamber of Chairman, CWC on  
 12.03.2013 along with officials of CWC, CPMU, Egis and Engineer-in-Chief, Water  
 Resources, Odisha, Chief Engineer, Dam Safety and other officials. The objective of the  
 meeting was to narrow down the various options and evolved with a meaningful  
 conclusion basing on best engineering judgment. In the said meeting, it was suggested  
 by the Chairman, CWC to avoid pre-depletion of the reservoir during the flood event to  
 avoid flooding in the downstream and focus should be given on combination of

Handwritten notes and signatures:  
 J.M. S.S. (with signature)  
 K.P.S.  
 Director, SPMU (with signature)  
 6.5.15

Sd/-

(X)

additional spillway i.e. one in the left side near Gandhi Hillock and another in the right side dyke.

Further at the behest of Chairman, CWC, a joint Expert team from CPMU, Egis and World Bank visited Hirakud Dam from 13-15<sup>th</sup> March, 2015 to finalize the proposed feasible locations.

Finally, through their extensive engineering judgment and exercises, the report for arrangement for safe passing of PMF as recommended by the Project Director, DRIP, CWC has been received for favour of necessary approval of the Department and concurrence of Finance Department, Government of Odisha.

The enclosed letter of Project Director, DRIP, New Delhi may please be perused. The conclusive recommendation for alternative Case-1(C) of the report out of various alternatives has been finally accepted by the CPMU which envisages;

1. at the left bank in the 2<sup>nd</sup> saddle at left of Gandhi hillock (Annexure-25 of the report) with 5 nos. of spillway gates of size 15 x 15m (Phase-I)
2. another on the right bank of dyke having 8 gates of size 15 x 10m.

Relative advantage of the proposal :

At Gandhi Hillock

- 1) Relatively lesser excavation involved
- 2) Lesser spill channel width and lesser length of control structure
- 3) Protection works in the d/s area required for comparatively lesser discharge
- 4) Construction time will be reduced on account of parallel activities and lesser quantities at both sites.

At Right Dyke location :

- 1) Lesser spill channel width and lesser length of control structure
- 2) Lesser widening involved in Jhaun Jhor river
- 3) Relatively lesser land acquisition problems
- 4) Construction time will be reduced on account of parallel activities and lesser quantities at both sites.

The proposal for construction of additional spillway in the left side appears to be feasible and can be taken up in the Phase-I as the entire layout is located primarily on government land.

The implementation of the proposal shall result :

- 1) Safe passage of additional revised flood discharge so that the stress on the Hirakud dam is reduced
- 2) Creation of additional storage.

## ANNEXURE-1.1

- 3) Development of eco-tourism in the proposed extended portion of the reservoir.

The Project Director, CPMU has proposed a tentative schedule as below in order to complete the project within the DRIP period i.e. by April,2018.


	Description	Responsibility / Schedule
i.	Supply of required site survey data / investigations (as covered under para-11 of the report sent on 11.04.2015)	By WRD-Odisha (CE & BM, UMB) By end of June,2015.
ii.	Preparation of tender documents including specification drawings, technical specifications and bill of quantities	By CPMU Consultant By end of August,2015.
iii.	Approval of competent authority, no-objection of World Bank, Tender invitation / finalization and award of work	By WRD-Odisha (CE & BM, UMB) By end of November,2015
iv.	Mobilization of construction works	By end of December,2015

Further, the preliminary estimate for the proposed Phase-I PMF mitigation for the Hirakud Dam has been assessed as ₹350 crores by the CPMU (CWC) and have been agreed in principle by the World Bank for financing. However, since the present total allocation for Odisha under DRIP is only about 147 crores, it will be required to seek the approval of DEA and World Bank for enhanced state allocation.

In view of the above, as recommended by the CPMU (CWC), the proposal for providing an additional spillway for ensuring further safety of the Hirakud dam may kindly be approved with concurrence of Finance Department so that enhanced allocation for the state can be requested to World Bank through CPMU.

Yours faithfully,

- Encl: 1) Minutes of meeting held on 12.03.2015 with Chairman, CWC.  
2) Letter of PD, CPMU, New Delhi dated 22.04.2014.  
3) Report of Hirakud Dam – Arrangement for passing of PMF  
4) Final working report of Hirakud Dam – Arrangement for Passing Additional Discharge for Revised Design flood

  
Engineer-in-Chief, WR.

Memo No. 15765

Copy forwarded to the Chief Engineer, Dam Safety, Odisha, Bhubaneswar for favour of kind information and necessary action.

/Dated the 29.4.15

  
Engineer-in-Chief, WR.

**Minutes of the 11<sup>th</sup> Meeting of the Expert Appraisal Committee for River Valley and Hydroelectric Projects held on 30.01.2018 at Narmada Meeting Hall, Jal Wing, Indira Paryavaran Bhawan, Jor Bagh Road, New Delhi-3.**

The 11<sup>th</sup> meeting of the re-constituted EAC for River Valley & Hydroelectric Projects was held on 30.01.2018 with the Chairmanship (In the FN) of Dr. D.K. More and Dr. S.K. Jain (In the AN) in the Ministry of Environment, Forest & Climate Change at Narmada Meeting Hall, Ground Floor, Jal Wing, Indira Paryavaran Bhawan, Jorbagh Road, New Delhi. The following members were present.

- |    |                          |   |   |
|----|--------------------------|---|---|
| 1. | Dr. S.K. Jain            | - | Chairman (In the AN)                    |
| 2. | Dr. D.M. More            | - | Member & Chairman (In-charge in the FN) |
| 3. | Shri Sharvan Kumar       | - | Representative of CEA                   |
| 4. | Shri N.N. Rai            | - | Representative of CWC                   |
| 5. | Dr. B.K. Dash            | - | Director CIFRI                          |
| 6. | Dr. A.K. Sahoo           | - | Representative of Director of CIFRI     |
| 7. | Shri Chetan Pandit       | - | Member                                  |
| 8. | Dr. (Mrs.) Poonam Kumria | - | Member                                  |
| 9. | Dr. S. Kerketta          | - | Member Secretary                        |

Dr. R. Vasudeva, Dr. T.P. Singh, Dr. J.P. Shukla, Dr. S.R. Yadav, Dr. J.A Johnson, Dr. Vijay Kumar and Dr. Govind Chakrapani could not present due to pre-occupation. The deliberations held and the decisions taken are as under:

**Item No. 11.0 Confirmation of minutes of 10<sup>th</sup> EAC meeting.**

The Minutes of the 10<sup>th</sup> AC (River Valley & Hydroelectric Projects) meeting held on 24.11.2017 were confirmed.

**Item No. 11.1 Additional Study for Cumulative Impact assessment & Carrying Capacity Study (CIA & CCS) of Subansiri River Basin in Arunachal Pradesh by M/s IRGS – for reconsideration of presentation before EAC**

Earlier in its 9<sup>th</sup> EAC meeting of EAC held on 24.10.2017, the Consultant M/s IRG Limited, Gurgaon who conducted the additional study for Cumulative Impact assessment & Carrying Capacity Study (CIA & CCS) of Subansiri River Basin in Arunachal Pradesh gave a presentation on the river basin study as below:

There are three main tributaries joining Subhansiri River, Kurung river, Panyor River and Dikrong river. A total of 7 projects of total installed capacity 99 MW are proposed in Kurung River. Similarly, 9 each in Panyor River of total installed capacity 235.5 MW and Dikrong River of total installed capacity 289 MW have been proposed. The details are given in Table Nos. 1 to 3.

**Table-1: Details of Hydel Projects on Kurung River**

Sl. No.	Name of the HEP	Catchment Area (km <sup>2</sup> )	IC (MW)	Altitude (m)	FRL (m)	TWL (m)	Present Status	Developer (M/s.)
1.	Pein	320.69	8	473	--	--	DPR	Nido Energy Systems
2.	Siken	74.16	8	685	506.75	257	PFR	Geopong Enterprises
3.	Palin	155.62	15	615	786.65	570	DPR	Built Infrastructure
4.	Panyi	215.00	24	1087	915.00	--	PFR	Sowbhagya Energy
5.	Sichi	62.00	24	1060	750.00	--	PFR	SLS Power
6.	Pei	20.00	5	401	--	655	PFR	Apik Construction
7.	Phurchi	40.60	5	1100	1123	948	PFR	DLBB Projects P

**Table-2: Details of Hydel Projects on Panyor River**

Sl. No.	Name of the HEP	Catchment Area (km <sup>2</sup> )	IC (MW)	Altitude (m)	FRL (m)	TWL (m)	Present Status	Developer (M/s.)
1.	Adum Panyor	366.50	25	1,052	1,072	968	PFR	SALCON-BSS Joint Venture
2.	Panyor Lepa Middle	494.00	21	936	948	851	S & I	JMD Power Solutions Pvt. Ltd
3.	Pareng	119.00	14.5	1,416	1421.3	1,306	DPR	Virtuaal Pareng Hydro Pvt.
4.	Pareng-II	226.00	24	1,246	1,251	1,116.15	PFR	
5.	Pareng-III	228.00	21	1,108	11,150	1,001.1	PFR	
6.	Pareng-IV	315.00	24	938	946.0	857.88	PFR	
7.	Keyi	259.60	23	897	902.60	722.2	DFR	DD Hydro Power & Developers
8.	Panyor	494.00	80	783	--	--	S & I	Raajratna Energy Holding Pvt.
9.	Pith	67.22	13	1,042	--	--	DPR	Built Infra.

**Table 3: Details of Hydel Projects on Dikrong River**

Sl. No	Name of the HEP	Catchment Area (km <sup>2</sup> )	IC (MW)	Altitude (m)	FRL (m)	TWL (m)	Present Status	Developer (M/s.)
1.	Pare	824	110	238	245.15	169.82	EC 13.9.06	NEEPCO
2.	Turu	560	60	601	612	419.1	DPR	Turu Hydro Energy
3.	Dardu	710	49	386	400	261	DPR	KVK-ECI Hydro Energy Pvt.
4.	Par	420	52	809	848	630	No EC	
5.	Papum-pam	460	21	242	160	117.6	DFR	Meena Entrade & Engg.
6.	Senki	64.13	2	442	390	-	PFR	T.K. Engg. Consortium Pvt.
7.	Papum	184.20	15	334	--	--	PFR	Sonam Hydro Power Pvt. Ltd
8.	Doimukh	863.38	52	154	163.2	115.6	PFR	SJVNL
9.	Resing	87.65	6	1,298	1350	--	PPR	Geopong Enterprises

As per TOR of the study, primary and secondary data have been collected on the following:

- **Meteorology** - IMD stations located in the Subansiri basin/ in the vicinity of Subansiri basin boundary
- **Water Resources** - Central Water Commission, IMD, Project Specific Reports, Project Implementing Agencies
- Water Quality
- Land-use/Land cover
- Terrestrial Flora & Fauna, Aquatic flora and fauna
- Assessment of Environmental flows & Assessment of Downstream impacts
- The Environmental flow has been estimate by HEC-RAS model and following flow scenarios suggested:
  - i. The flow scenario at 90% dependable year series of the each HEPs has been used and average discharge of leanest 4 months, monsoon 4 months and non-lean & non-monsoon 4 months have been computed. The flow parameters i.e. water depth, velocity of flow and top flow width has been assessed for 10%, 15%, 20%, 30%, 40%, 50% and 100% release of

respective average of 3 seasons flows of each HEP to estimate the E-flow release during the lean, monsoon and non-lean/non-monsoon periods.

- ii. The HEC-RAS model has been used for steady flow water surface profile computations of HEP. The release computations and flow parameters are given in the following for each HEP :

Project (HEP)	IC (MW)	Lean Months (December – March)		Monsoon Months (June-September)		Non-monsoon/ Non-lean Months (Oct, Nov, April & May)	
		Release of ave. flow at 90% DY	Discharge (m <sup>3</sup> /s)	Release of ave. flow at 90% DY	Discharge (m <sup>3</sup> /s)	Release of ave. flow at 90% DY	Discharge (m <sup>3</sup> /s)
Par	52	20%	1.89	25%	6.61	25%	3.04
Turu	60	20%	2.46	25%	8.59	25%	3.95
Dardu	49	20%	3.19	25%	11.17	25%	5.13
Panyor	80	20%	6.79	25%	24.81	20%	12.82
Doimukh	52	20%	12.40	25%	40.71	25%	22.13
Pareng-II	24	20%	1.58	20%	8.66	20%	4.12
Pareng-III	21	20%	1.60	20%	8.73	20%	4.16
Pareng-IV	24	20%	2.21	20%	12.07	20%	5.74
Palin	15	20%	1.00	20%	1.58	20%	1.17
Pith	13	20%	0.48	25%	1.17	25%	0.77
Papum	15	20%	0.76	20%	5.27	20%	2.05
Adun Panyor	25	20%	1.95	20%	5.70	20%	3.68
Keyi	23	20%	1.20	20%	3.52	20%	2.27
Phurchi	5	20%	0.31	20%	1.37	20%	0.85
Siken	8	20%	0.31	20%	1.37	20%	0.85
Panyor Middle	21	20%	1.84	20%	8.38	20%	4.22

- i. For the other projects viz. Pein, Panyi, Sichi, Pei, Senki, Pareng and Resing whose Installed Capacity is less than <25 MW, the E-flows adopted are 20% of average lean months flow, 20% of average monsoon flow and 20% of average of non-monsoon/non-lean months flow at 90% dependable year (DY).
- ii. For Papumpare project with proposed capacity of 80 MW, the E-flow adopted is 20% of average lean months flow, 25% of average monsoon flow and 25% of average of non-monsoon/non-lean months flow at 90% dependable year.

#### Assessment of Downstream impacts

Downstream impacts are dependent on the water availability and position of HEP in the basin. In a cascade scenario, flow series e.g. from 0-18 hours, 18-22 hours and 22-24 hours have been estimated and cumulative discharges at downstream have been computed. The same have been arrived by using hydrodynamic routing model. The downstream impacts have been assessed based on peaking flow series under similar scenarios. The impact study due to peaking release from the projects on Panyor and Dikrong rivers, only release from the lower most project i.e. Doimukh project will be important. Accordingly, the impact study discharge scenario has been adopted to estimate the fluctuation in water level and discharge in the Dikrong river reach downstream of Doimukh HEP and these are presented in next page:

<b>Time period (h)</b>	<b>Release after power generation</b>	<b>E-flow release (cumec)</b>	<b>Total release (cumec)</b>
0-18	52.78	12.40	65.18
18-22	172.04	12.40	184.44
22-24	52.78	12.44	65.18

The peaking release will have minor impact in the river reach of Dikrong river downstream of Doimukh project during non-monsoon period. The non-monsoon peaking release from the projects on Panyor river and Dikrong will cause normal fluctuations in discharge and water level in Dikrong river up-to the confluence with Subansiri river/Brahmaputra river. In this reach of river the daily fluctuations in water level is about 20 cm to 40 cm. No change of fluctuations in Brahmaputra water level will occur due to peaking releases from projects in Panyor and Dikrong rivers as these peaking releases are of very small quantity in comparison to normal lean period discharge of Brahmaputra.

After detailed deliberations and considering all the facts of the project as presented by the Consultant, the EAC observed the following:

- a) The hydrological covered all the aspects and 25 HEPs in the 3 tributaries. However, the e-flows for all 3 seasons for 16 HEPs are only presented in the Table and remaining are in descriptive in nature. Hence for all 25 HEPs e-flow series have to be presented in the report.
- b) The floral data especially with respect to RET & indigenous species are not represented properly. These have to be presented properly in regard to data collected primarily and secondary sources could also be taken into account and should have to be incorporated in the report.
- c) The data on fisheries is also not represented properly. These have to be presented properly in regard to data collected primarily and secondary sources could also be taken into account and should have be incorporated in the report.

The EAC mentioned after incorporating all relevant data, the consultant has been advised to submit the report to the Ministry and the Ministry will forward the report to Dr. A. K. Sahoo, Rep. Director CIFRI and Dr. A. Johnson, Rep. Director WII for reconciliation of data. Thereafter, the final report will be reconsidered by EAC during its next meeting. Accordingly, finalization of the additional River Basin Study has been deferred.

Similarly, in 10<sup>th</sup> EAC meeting held on 05.12.2017, the following corrections were also made:

“In the RBS of Subansiri river, almost all the projects are located in the tributaries of the main river. The locations of the projects are known but water series are not available for these projects. Therefore, absolute value of e-flow cannot be determined and linked with the main river. It is suggested that the e-flow may be prescribed/recommended as per the standard ToR of the River Valley Projects.

The following portion of Para 3 (a) of page 18 of the minutes of 9<sup>th</sup> EAC meeting to be deleted:

- a) The hydrological covered all the aspects and 25 HEPs in the 3 tributaries. However, the e-flows for all 3 seasons for 16 HEPs are only presented in the Table and remaining are in descriptive in nature. Hence for all 25 HEPs e-flow series have to be presented in the report.”

The following are the reply of the Consultant provided during the meeting:

**Observation in the EAC meeting:**

a. The floral data especially with respect to RET & indigenous species are not represented properly. These have to be presented properly in regard to data collected primarily and secondary sources could also be taken into account and should have to be incorporated in the report.

Sl. No.	Comments	Status
1.	The information on floristic diversity more generic. For example, list contain information on endemic, threatened, cutival plants, timber sp., medicinal flora of Arunachal Pradesh (Table Nos. 6.18 to 6. 21) and the list is not specific to the study area i.e. Subansiri river basin. Provide the floral list, endemic flora, threatened plant species pertaining to the Subansiri river instead the state of Arunachal Pradesh.	Specific floristic data in the study area have been provided in Table 6.47 to 6.58 of the report. There are 62 endemic sp., of which 12 are threatened species reported in the study area (Table 6.59, Section 6.12). 36 RET species have been found in the study area and are included in Section 6.13. Out of 36 threatened sp., 6 are endangered, 15 are vulnerable, 13 are rare and 2 are indeterminate.
2.	The Diversity Index (Shannon, Margelif and Evenness Index) presented under respective sites are not correct. There are some issues in calculation and analysis of data. For example the evenness index values range from 0 to 1. It does not exceed 1. Similarly, high value of Shannon index (Maximum threshold is 4, please refer Biodiversity Index measures books) and Margelif species richness index. For example in Table-6.30, only one species of tree recorded but it is showing Shannon diversity value of 3.49 (it means high diversity tree species). It is not possible? Shannon diversity index cannot be determined single species.	The Shannon, Marglif and Evenness index under respective site have been recalculated and corrected (Section 6.10, Table 6).
3.	No proper unit values depicted in the graphs. The units of X and Y axis should be clearly given in all graphs. Similarly inference on legends (coloured bars) are not mentioned. For example Figure 6.14, it is mentioned that Q1, Q2, Q3, & Q4 label without any clarity. These should be rectified.	X axis represents Important Value Index of the species recorded during sampling. Y axis indicates floral species recorded during sampling. Q1, Q2, Q3 & Q4 represent quadrat number taken for biodiversity study (Section 6.10 Figs. 6.10 to 6.41).

b. The data on fisheries is also not represented properly. These have to be presented properly in regard to data collected primarily and secondary sources could also be taken into account and should have be incorporated in the report.

**Response:** In response to above comment, report is being reframed and suggestions incorporated representing primary and secondary data properly. The report is being updated with addition of few photographs and information as suggested by Domain Experts.

Further, following clarification were also provided and incorporated in the CIA and CCS report:



- i. The fish species have been reported as per the primary field survey and the secondary information obtained from local fishermen, local market, etc. A large number of fish species reported from these sites were common, thus got names repeated in the reporting. Similarly, Chapter 7 has been revised as per the observation of the Domain Expert and names and numbers of the fish species have been included from both primary and secondary information.
- ii. Photographs of few preserved fish species have also been included in the report. Size of the fishes observed during primary survey i.e. during pre-monsoon are mostly between 10 to 20 cm size.
- iii. Relative fish abundance both order wise and family wise have been added in the report. As during the survey, very few fish species could be collected, thus only identification and presence of fishes were recorded.
- iv. Methods adopted for the study have also duly been provided in the chapter.

After deliberations and considering all the facts of the River Basin Study (RBS) as presented by the Consultant, **the EAC recommended for approval of the CIA and CCS report by the Ministry.** It has also been opined that as the domain experts have found the revised report in order and complete, the recommendation made in the RBS by the Consultant shall be followed in toto and may include in the main River Basin Study.

**Item No. 11.2 Parbati (Rinsi) Major Irrigation Project (48,663 ha) in District Rajgarh, Guna, Bhopal and Sehore of Madhya Pradesh-For consideration of fresh TOR <sup>(SEP)</sup>**

The project proponent made a detailed presentation of the project and *inter-alia* provided the following information:

The PP applied on line for grant of ToR 01.01.2018. The Parbati (Rinsi) major Irrigation project envisages construction of 22.70 m high and 1,330 m long concrete barrage across Parbati river (tributary of River Chambal) near village Rinsi in Rajgarh District of Madhya Pradesh to store 171.47 MCM of water to irrigate 48,663 ha of command area. The gross storage is 171.47 MCM and the live storage is 162.22 MCM water. The gross command area is 54,000 ha. The total submergence is about 3,719.13 ha (of which 38.50 ha is forest land, 2,434.42 ha is private land and 1,246.21 ha is revenue land). There is one wildlife sanctuary viz. Chidi Doh Sanctuary (Nursingharh Abhayaranya) coming in the submergence area. The catchment area of the project is 3,302 km<sup>2</sup>. The project ensures use of micro-irrigation scheme by the users. About 13 villages (3 fully +10 partially) are coming under submergence and 864 families are likely to be affected due to the proposed scheme. Total cost of the project is Rs. 1,732.17 crores. It is likely to be completed in 36 months.

After detailed deliberations and considering all the facts of the project as presented by the PP, the EAC recommended for grant of scoping/TOR clearance for the proposed project with the following observation/additional conditions along with the standard ToR:

- i. Three (3) season's data should be collected for the entire project.
- ii. Land acquired for the project shall be suitably compensated in accordance with the law of the land with the prevailing guidelines. Private land shall be acquired as per provision of Right to Fair Compensation and Transparency in Land acquisition, Rehabilitation and Resettlement Act, 2013.
- iii. The project involves about 38.50 ha of forest land. Forest clearance should be obtained as per the prevailing norms of Forest (Conservation) Act, 1980.
- iv. Name of the NABET accredited consultant be intimated for preparation of EIA/EMP report to the Ministry within one month from the date of grant of ToR.

### **Item No. 11.3 Additional Spillway of Hirakud Dam, Odisha in Sambalpur District- For consideration of fresh Environmental Clearance**

The Project Proponent (PP) along with the consultant viz., M/s Centre for Envotech and Management Consultancy Pvt. Ltd., Bhubaneswar, Odisha made a detailed presentation of the project and *inter-alia*, provided the following information.

ToR has been granted on 06.09.2017. Subsequently, the PP applied online on 04.01.2018 for grant of EC. The Public Hearing has been conducted on 08.12.2017. The Hirakud Dam built across river Mahanadi near Sambalpur, Odisha is one of the earliest major multi-purpose river valley projects of India, which was commissioned in 1957. Spanning an area of 743 km<sup>2</sup> when full, the reservoir is the most important water infrastructure of the state contributing water to the powerhouse having installed capacity of 307.5 MW, irrigating 2,64,478 ha of Culturable Command Area annually in Bargarh, Bolangir and Subarnapur Districts; and providing flood protection to 9,500 km<sup>2</sup> of Mahanadi Delta, which is thickly populated.

The total length of the dam and dykes is 25.8 km. The length of the main dam is 4,800 m with two spillways. The left spillway has 40 sluice gates and 21 crest gates. The right spillway has 24 sluice gates and 13 crest gates. The total discharging capacity of both the spillways is 42,450 m<sup>3</sup>/s (15 lakh cusec). Taking into account of the operational constraint of few gates the effective discharge is about 36,806 m<sup>3</sup>/s (13 lakh cusec). The Central Water Commission (CWC) in 1997, reassessed the Inflow Design Flood with up to date data. The revised design flood was computed as 69,632 m<sup>3</sup>/s (24.5 lakh cusec). In order to safely release the inflow design flood, the CWC advised to construct additional spillways at suitable locations. A joint expert team comprising of CWC, Egis-consultants of DRIP and World Bank visited Hirakud Dam site in March, 2015 to finalize the proposed feasible locations for the additional spillways. For safety of Hirakud dam, the CWC in consultation with dam safety experts have recommended construction of additional spillways at suitable locations adjacent to the Dam proper. The team of experts has examined several alternatives and has finalized the implementation as:

- i. **Phase-1:** Construction of additional spillways, 5 nos. of gates (15x15 m) each at the left bank 1<sup>st</sup> gap dyke of Hirakud dam near the 2<sup>nd</sup> saddle of Gandhi hillock with total discharging capacity 9,122 cumecs.
- ii. **Phase-2:** Another additional spillway at 13,100 ft along with the right dyke with 8 nos. gates each (15x10 m) size having total discharging capacity 13,571 cumecs will be taken up later on.

The option (1) will be taken up in the first phase for which the World Bank has agreed for necessary fundings. The Govt. of Odisha has administratively approved the project. The layout of the spillway and spill channel has been finalized. The Ministry of Water Resources, River Development and Ganga Rejuvenation, Government of India is closely monitoring the progress of the project, as it is related to the safety of the Hirakud dam.

#### **Clarification regarding change in Design Flood of Hirakud Dam**

Hirakud Dam, the largest ever earth dam in Asian sub-continent thus became operative in 1957 (1948 to 1957) and was dedicated to the people on 13th January by Pandit Jawaharlal Nehru, the then Prime Minister of India. The catchment of Mahanadi intercepted by Hirakud dam is 83,400 km<sup>2</sup>. Height of dam above deepest foundation level is 60.96 m. FRL/MWL of reservoir is at EL 192.024 m (630 ft). **The discharge capacity of spillway is 42,450 cumecs (15 lakh cusecs)**. The total length of the dam is 4,800 m (Earthen + concrete) out of which length of concrete portions of

the dam including spillway is 1148.43 m. The gross storage of dam is 8,136 MCM (year 1957) and 5,896 MCM (year 2000). The live storage is 5,818 MCM (year 1957) and 4,823 MCM (year 2000). A brief description of the earlier studies is given below.

#### **Earlier Studies for Assessment of Design Flood of Hirakud Dam**

Originally in 1947 the magnitude of maximum flood discharge (of unknown return period) at Naraj (Mahanadi delta head) was estimated as 44,457 cumecs (15.7 lakh cusecs) based on the long-term flood gauge observations. This was reduced in proportion to  $3/4^{\text{th}}$  power of the catchment area to obtain a figure of 32,564 cumecs (11.5 lakh cusecs) at the dam site.

Later, the International Engineering Company (IEC), from a study of the floods in the adjoining basin of Godavari, the flood data at Naraj and their experience from other major river basins of the world, evaluated the inflow design flood at 51,819 cumecs (18.3 lakhs cusecs) with a volume of 35,931 MCM (29 million acre ft).

Further studies made in 1952 showed that the 500 year return period flood would have a peak discharge of 42,474 cumecs (15 lakh cusecs) which was adopted as the spillway design capacity including sluices operating at MWL in reservoir. No flood hydrograph was perhaps assembled for this flood.

An Evaluation committee was formed by Govt. of Orissa (GOO) which had carried out flood routing studies with peak flows at 15 and 18.3 lakh cusecs. They derived the hydrograph for the former by patterning it on the hydrograph estimated by the International Engineering Company. Since, the spillway capacity of the same order as the peak of the inflow design flood (15 lakh cusecs) has been provided at the FRL, no routing seems to have been done originally for this flood. But routing studies made by the International Engineering Company for the maximum flood computed by them indicated the maximum water level going up to 634 ft. No restrictions on flood releases were assumed for flood moderation beyond a reservoir level 625 ft at which all gates were assumed to open fully. Since, the dam was finally designed with an FRL/MFL of 630 ft. So, no cognizance was given to moderation of flood above 625 ft level. The Evaluation Committee studies made later in 1962 also indicated an MWL 633.75 ft against the design FRL/MWL of 630 ft, when the 18.3 lakh cusecs (51,819 cumecs) flood was assumed to impinge at an initial reservoir level of 615 ft and full discharging capacity to the extent available is assumed right from the start of the flood.

*From the above, it can be said that the earlier design flood study was carried out using statistical approach (flood frequency analysis) and spillway capacity was provided corresponding to 500 year return period flood. This 500 year return period flood may be approximately considered equivalent to SPF as per the current practice of design flood estimation. **It may be note that in year 1947, the BIS code IS 11223-1985 (Indian Standard: Guideline for Fixing Spillway Capacity) was not in existence and design flood of 42,450 cumecs was roughly corresponding to 500 year return period flood. Considering the IS 11223-1985, the Hirakud dam qualifies for PMF, which is approximately equivalent to 10000 year return period flood.***

#### **Need for design flood review**

Historical information of inflow floods and the routed discharges from year to year after construction, is brought out in Appendix II of Annexure 3.1 of EIA report. It may be seen there from that an inflow as much as the design discharge of 42,475 cumecs (15 lakh cusecs) and a release as much as 31,148 cumecs (11 lakh cusecs) had taken place during July 1961 against the existing spillway capacity of 33,066 cumecs (11,67,720 cusecs). The evaluation committee had already observed that the dam

would be in danger if 51,819 cumecs (18.3 lakh cusecs) flow estimated by the International Engineering Company impinges on the reservoir.

A team of experts constituted by the Government of India (1974) for formulating reservoir operation rules for flood conservation and flood control downstream of Hirakud, *inter-alia* worked out an estimate of inflow design flood by hydro meteorological approach and placed the Probable Maximum Flood at 81,369 cumecs (28.74 lakh cusecs) and a volume of 21.140 million m<sup>3</sup> (17.11 Macft).

### **Current PMF Studies**

The provision of additional spillway in order to pass the PMF estimate of 81,319 cumecs (28.74 lakhs cusecs) was considered impracticable by the Orissa State engineers in view of local physiographic features and safe channel capacities existing in the downstream and so far remedial action has not been initiated. In the meantime in 1982, another severe storm had occurred in the catchment which also could have been a candidate storm for estimating PMP values. Thus, the PMF estimate of 1974 study needed updating and fresh review.

*Considering the IS:11223-1985, the Hirakud dam qualifies for PMF.* In the current review of PMF estimate, hydro meteorological approach was adopted. For design storm estimation over Hirakud catchment, 30 storms that occurred in and around Hirakud are considered, of which 12 severe most were selected taking together their duration, areal extent, central depths and DAD depths. Hirakud being such a big catchment of the order of 83,400 km<sup>2</sup> area, storms having areal extent as extensive as the catchment and duration of precipitation lasting as long as 3-days were searched for to excite full catchment to produce critical flood.

Although two 5 day storms have occurred in a period of 100 years from 1891 to 1992, examination of long period runoff data suggests that a 3-day storm is adequate to produce critical peak rate of runoff and volume under the saturated conditions and antecedent flow conditions expected during PMP situations (this view is also corroborated by the observations of Team of experts-1974).

When the above criterion is adopted, the number of severe storms for examination are reduced to 3 vis., (i) 28-30 June, 1925 (ii) 13-15 June, 1936 and (iii) 28-30 August, 1982, though the areal spread of August 1982 storm came out less than desired, it is included for through examination, since it produced greatest ever 3-day point depth (884 mm) in this region as a result of which the present review for Hirakud inflow flood arose.

Considering the above storms, the transposed depth, Standard Project Storm (SPS) and PMP depths were computed by a team of well known meteorologist after detailed deliberations and discussions with several experts.

For design flood study, the entire catchment was divided into 12 sub-catchments and a quasi distributed hydrological model setup was prepared to get the flood hydrograph of each sub catchment at its outlet. The flood hydrograph obtained at each sub catchment outlet was channel routed through the river downstream using Muskingum method. The routed flood hydrograph and lumped flood hydrograph of some sub catchment as per model set up were added together to get the PMF hydrograph at Hirakud dam site. **The estimated PMF value was 69,632 cumecs (25 lakh cusec).**

The method adopted in current design flood review study is a standard method, which is being used in India, China, USA and many other countries for PMF estimation. Further, the PMP computations are as per the standards practice of WMO.

### **The reason of difference in flood value in earlier and present study.**

AS per BIS code, Hirakud dam qualifies for PMF. Though there is no return period concept in PMF, however, the same is considered equivalent to 10,000 year return period flood. Using hydro meteorological approach the current estimated PMF for Hirakud dam is **69,632 cumecs (25 lakh cusecs)**. The earlier flood of (42,450 cumecs) 15 lakh cusecs correspond to 500 year return period flood.

### **Impacts due to construction of additional spillways**

- i. 9.44 ha forest area of Lamedungri forest range will be diverted due to construction of spill channel.
- ii. About 3,595 numbers of local species of trees are likely to be felled during construction.
- iii. 1,415 affected families are identified for displacement.
- iv. Ambient air quality may be affected during construction phase.
- v. Noise pollution will be felt due to blasting in daytime
- vi. Impact due to temporary construction of camps and labour camps.
- vii. **Downstream impact of release of water from the dam in the event of PMF/Dam failure:** There are a significant number of structures located along the Mahanadi River that could be affected due to a design flood arising out the failure of the dam. Cities and Towns like Sambalpur, Hirakud and Burla can suffer a likely disaster in the event of breach of the dam. Apart from that the water resulting from a breach can travel down the Mahanadi river, affecting the districts of Cuttack, Jagatsingpur, Khurda, Kendrapara and many others. The breach analysis contains profiles of the peak flood levels expected, as well as an estimation of the time from the beginning of the breach to the peak flood elevations.
- viii. 12 ha of land will be submerged in Hirakud dam between the new dyke to be constructed and existing dyke.

### **Mitigation measures taken to combat the impacts:**

- i. Proposal for diversion of 9.44 ha forest land for non-forest use has been initiated. Equivalent land has been identified in Bonai Tehsil for taking up compensatory afforestation. Erosion control measures and conservation plan will be taken up in consultation with the State Forest Department.
- ii. Loss of trees will be compensated by planting 10 times of the felled trees i.e., 35,950 plants through green belt plantation, avenue plantation, block plantation, etc. A plan to be made to raise these plantation.
- iii. Appropriate compensation package has been worked out according to the Guidelines of ORRP Rule 2006 and amended from time to time. It is proposed to resettle the PAFs in the R & R colony within the NAC of Hirakud town.
- iv. Regular water sprinkling shall be taken up in the construction areas including the roads to control dust generation. Workers at the site will be provided with Personal Protective Equipment (PPE).
- v. All blasting operations will be carried out by the licensed agencies as per guidelines of Explosive Act.
- vi. Proper drainage from the site will be ensured through construction of additional drains. Appropriate crossing structures will be provided to pass the natural drains in case these will be disturbed due to construction activities.
- vii. Free fuel will be supplied to the labour-force to prevent tree felling. Proper sanitation will be equipped in the camp. Free health check up will be ensured for all camped labourers. Free medicines, malaria eradication and first aid facilities will be provided to all the labour force.

### **R & R PLAN:**

- i. Three sites mainly government land are located at Basantapur, Rengalipalli and Larbanga for resettlement purpose of the families to be displaced. During Public Hearing, public raised objection that the sites are far away from the project site. They also appealed for provision of essential amenities in selected rehabilitation sites.
- ii. Hence, the project authority has identified one more site for rehabilitation of proposed displaced families at Solpali, Solbandh and Garmunda which are adjacent to each other and are located approximately 3 km away from the proposed displacement habitations as well as from the dam site. The sites chosen for resettlement at Garmunda and Solbandh are under Revenue Department and Plot No. 2 of Solbandh is in possession of Hirakud Dam, whereas the site of Solpali is under Department of Irrigation. In total, four sites were identified by Project Authority for rehabilitation purpose.
- iii. The compensation and other allowances as per Odisha Government R&R Policy, 2006 and Right to Fair Compensation and Transparency in Land acquisition, Rehabilitation and Resettlement Act, 2013 (RFCTLAR&R Act 2013). The R&R assistance currently based on 2014 prices will be indexed to 2018 prices as desired by the World Bank.

#### **Public Hearing:**

The Public Hearing meeting was conducted by Odisha State Pollution Control Board, Sambalpur on 08.12.2017 at Jawahar Udyan, Hirakud, Sambalpur, Odisha near the proposed dam site. During the public hearing, it was decided that after finalization of rehabilitation and resettlement site by the Core committee, the area will be developed and necessary amenities such as road, water source, electricity, health facilities etc. will be provided prior to handing over plots to the affected families. The rehabilitation process will be completed prior to implementation of project.

#### **Project benefits**

- i. **Safety of the Hirakud Dam** - Construction of additional spillway on the left dyke of Hirakud Dam will considerably relieve the pressure of Reservoir operation in the event of PMF management.
- ii. **Landscape improvement** - Landscape improvement in this area has been targeted after completion of the construction work. It would include area beautification and safeguard measures.
- iii. **Improvement to road communication** - After completion of the construction activities, the approach roads will be modernized with avenue plantation and lighting facilities etc. The new look will attract tourism prospect.
- iv. **Tourism Prospect** - The existing tourist attraction "Gandhi Minar" on the left flank of Hirakud Dam will be further modernized in consultation with the Tourism Development Department. The expanded activities will increase the source of income for the resettled families.
- v. **Infrastructural facilities in the R & R colony** - All required facilities are proposed for resettlement colony.
- vi. **Employment Potential** - About 200 skilled/ unskilled laborers are likely to be engaged in the construction work and plantation programme.

After detailed deliberations and considering all the facts of the project as presented by the PP, the EAC observed the following:

1. Land acquired for the project shall be suitably compensated in accordance with the law of the land with the prevailing guidelines. Private land shall be

acquired as per provision of Right to Fair Compensation and Transparency in Land acquisition, Rehabilitation and Resettlement Act, 2013.

2. The project involves about 9.44 ha of forest land. Forest clearance should be obtained as per the prevailing norms of Forest (Conservation) Act, 1980.
3. Plans for greenbelt development and reservoir rim treatment have to be made in consultation with State Forest Department. Preference shall also be given to plant local indigenous species.
4. Solid waste generated, especially plastic waste, should not be disposed of as landfill material. It should be treated with scientific approach and recycled.
5. The project will generate muck due to excavation which will be utilized for low lying reclamation within the project area along the spillway channel. The sites will be rejuvenated using integrated biological & biotechnological measures (both engineering and biological measures) and therefore, sufficient funds be allocated for the purpose.
6. Under Biodiversity Conservation and Management Plan the following programs have to be taken up:
  - a) Biodiversity Conservation Cell
  - b) Habitat Improvement Programme
  - c) Botanical Gardens with Butterfly Habitat
7. Tiger Toilet be introduced in the labour colony so that the neighbourhood environment is not degraded due to anthropogenic activities.
8. A committee among young youths (both male and females mass) be constituted to supervise the implementation of R & R work.
9. During release of water from the spillways, prior information to the people residing at the downstream of the dam (~50 km) should be given through different media.
10. ***The data on fisheries are not represented properly.*** Therefore, the EAC opined that the PP has to submit the above information to the Ministry and the Ministry will forward the same to Dr. A.K. Sahoo, Member & Rep. Director CIFRI and Dr. A. Johnson, Member & Rep. Director WII for reconciliation of data. This task will be completed by March 31, 2018.

After deliberations and considering all the facts of the project as presented by the PP and since the project does not propose any change in the reservoir or the downstream river, **the EAC recommended for grant of Environmental Clearance to the proposal** subject to submission of data by the PP as mentioned at Sl. No. 10 latest by March 10 to MoEF&CC.

#### **Item No. 11.4 Mawphu HEP (85 MW) Stage 2, Meghalaya – For reconsideration of Environmental Clearance**

Earlier in the 7<sup>th</sup> EAC meeting held during 24-25.08.2017, the Project Proponent (PP) and the Consultant, M/s WAPCOS, Gurgaon made a presentation of the project and *inter-alia*, provided the following information:

The Mawphu HEP Stage II (85 MW) project is proposed as a ROR scheme on the river Umiew in East Khasi Hills District of Meghalaya. The proposed dam site is located at about 3.17 km downstream of Umduna HEP (90 MW) Power House location and the Powerhouse site and is also located at about 2 km downstream of Thieddieng village on the right bank of the river.

The scoping clearance was accorded on 30.09.2014 for an installed capacity of 75 MW. The EIA/EMP studies have been carried out and completed based on the

standards ToR. In the meantime, the installed capacity of the project has undergone upward revision to 85 MW as per recommendation of CEA. Project parameters have remained unaltered with change in installed capacity barring changes in Powerhouse dimensions, Design Energy and Turbine-Generators. Expert Appraisal Committee considered the matter of upward revision to 85 MW in its meeting held on 02-03.06.2016. The Ministry granted revised scoping clearance on 18.7.2016.

The Mawphu HEP Stage-II (85 MW) project is proposed on Umiew river in East Khasi Hills district of Meghalaya. The project envisages construction of 51 m high and 140 m long concrete gravity dam (from the deepest foundation level) comprising 3 overflow blocks with spillway arrangement of 6 bays, each with radial gate of size 9x13.70 m and four non-overflow block. The river diversion arrangement consists of one diversion tunnel of 7.0 m dia., horseshoe shaped and 384 m long on the left bank with 18 m high upstream cofferdam and 6 m high downstream coffer dam. The power intake structure is of 16.0 m wide and 17.60 m high on the right bank with an inclined trash rack. A surface powerhouse is proposed with size 65.84 m (L) x 18.0 m (W) x 35.70 m (H) housing two vertical axis Francis Turbines each of 42.50 MW installed capacity. The TRT is of 10.0 m dia. and 70.29 m long (including Recovery Bay) to discharge water into the river.

The power potential studies have been carried out based on 26 years (1979-80 to 2004-05) generated flow series on 10-daily basis at dam site. The net storage capacity of the reservoir between MDDL at EL.464.00 m and FRL at EL.470.00m is 0.52 million m<sup>3</sup> and gross storage would be 1.55 MCM. The net head available for the turbine is 230.50 m and the design discharge is 40.81 cumecs without overload.

The submergence area in the reservoir of the project at FRL is 13 ha. The land will also be required for the project components and the same has been arrived as 97 ha based on preliminary assessment. Approximately 22 ha of forestland will be affected by the project. The total cost of the project (including IDC) is Rs. 907.35 crores. The levelised tariff has been calculated as Rs 5.94. The construction period for the proposed project will be 60 months.

#### **River Diversion & Construction of Cofferd Dam**

The river water will be diverted in 6<sup>th</sup> month after the start of construction during lean season flow. The river diversion shall be achieved by constructing a closure dyke. Thereafter, the construction of Cofferdam shall be undertaken. Upstream Cofferdam is to be made on overburden. The maximum height of the Cofferdam is 18 m from the riverbed level. The central core of the Cofferdam is filled with clay. Materials from excavation of Diversion Tunnel, DT inlet and outlet will be used for cofferdams. Filling of the cofferdam will be carried out in layers of not more than 100 cm each. Compaction roller will be used to compact in layers. Total quantity of rock fill in the Cofferdam is 71,690 cum and targeted average rate of placing rock fill shall be 4,320 cum.

#### **e-Flow**

The dependable flows for analysis of installed capacity etc. are based on 90% dependable year as per guidelines of CEA. For obtaining the dependable flows, unrestricted energy generation has been computed for all the 26 years. The years 1996-97 and 2002-03 works out to be the 90% and 50% dependable years, respectively.

The Umiew River is typically a hill stream, which has a fast water current with rich dissolved Oxygen. Most of the fishes inhabiting the river are well adapted to hill streams. A total of 18 species represented by three families has been reported from the



Umiew river. A total of four species (*Tor tor*; *Tor putitora*; *Glyptothorax cavia* and *Noemacheilus arunachalensis*) has been categorized as endangered (EN) species. However, five fish species (*Schizothorax richardsonii*; *Garra gotyla gotyla*; *Labeo dero*, *Pseudocheneis sulcatus*, *Euchiloganis hodgarti*) have been categorized as vulnerable (VU). However, these species are not restricted to the Umiew River. In spite of this, there is an urgent need to protect these endangered fish species dwelling the Umiew River. The dam construction activities will also create a problem for migratory fish species (*Tor tor*, *Tor putitora* and *Labeo dero*). These migratory fish species may move into the Siyom river, if they do not find passage into the Umiew River.

The PP informed that the e-flow releases have been calculated based on prescribed norms given in TOR i.e. environment flow to be released during monsoon months (i.e. from June to September) from the Dam will be 30% of the river discharge. During transition months (post monsoon months of October and November, and pre monsoon of April and May), the water to be released will be 25% of the river discharge and during non-monsoon months i.e. from December to March, the water to be released will be 20% of the river discharge. The details are given in the Table below.

**Table- Release of E-flows in 90% dependable year**

Season	Average flow (m <sup>3</sup> /s)	% of flow	Average E-flow (m <sup>3</sup> /s)
Lean Season (December-March)	4.23	20	<b>0.85</b>
Non-monsoon/Non-lean (October-November & April-May)	28.8 & 24.43	25	7.20 & 6.11
Monsoon (June – September)	46.28	30	13.89

#### **Geology of the project components Dam**

The geotechnical parameters collected during geological mapping indicates RMR value of outcrops of left bank as 55 to 62 (fair to good without rating adjustment) whereas that of right bank as 64 to 73 (good). Based on the surface mapping data and the geomorphic expression in the left bank/ abutment, it is inferred that the stripping limit shall be of the order of approx. 5 to 6m on the left bank. In the right abutment, however, the stripping limit as assessed from the surface data is of the order of 1 to 2 m approximately. Accordingly, acceptable foundation grade has been fixed for the dam. However the extent of excavation in abutment area shall be modified on the basis of slope mass rating for each abutment once the data from Drift are available on completion of drift.

#### **Head Race Tunnel**

Rock classes in various stretches of HRT as predicted on the basis of surface exposures details are 40% for Class-II, 45% for Class-III, 10% for Class-IV and 5% for Class-V. Low cover and weak zones apart from zones where seepage is anticipated are to be evaluated further by advance probing. Wedge analysis results indicate the formation of gravity wedges at certain reaches of the tunnel crown, for which appropriate support measures shall be provided.

#### **Surge Shaft**

A 10 m diameter surge shaft is to be excavated after removing the overburden of 27 m and 15.16 m of rock, the top of the surge shaft from where sinking will start

is at El. 492 m whereas rock is encountered at El. 507.16 m. For open excavation, initially about 10 m of overburden shall be in silty soil and would be followed by slope and its material characterized by medium sized angular to sub-angular rock blocks/fragments with silty matrix till El. 507 m. The overburden slopes mentioned above would contain rock blocks of partially disintegrated rock confined within a clayey matrix.

While excavating these zones instability is to get initiated, especially when the material will be saturated. As such the dressed slopes need to be provided with suitable drainage and soil anchors for stability. From El. 507m to El. 492m i.e. top of the surge shaft, the excavation shall be moderately strong, moderately to highly weathered granite gneiss with biotite schist banding. As no major shear zone was encountered during drilling, as such, no serious difficulty during the excavation of shaft is anticipated. In general there is an improvement in rock strength, weathering and opening of the joints with the depth barring few exceptions at El.491m, El.482m, El. 472m, El.451m and El.436m where RQD has been found to be low though the recovery remains constantly high. In such area provision of consolidation grouting shall be required for ground improvement. Considering the nature of rock encountered in drill holes and observed rock mechanic parameters, it is anticipated that the major part of Surge shaft shall negotiate fair to good rock with occasional patches of poor rock.

### **Dam Break Analysis**

For reasons of simplicity, wide applicability and the uncertainty in the actual mechanism, the HEC-RAS model has been used. The model uses failure time interval, terminal size and shape of the breach as the inputs. The shapes of the breach that can be considered by the model are rectangular, triangular and trapezoidal. The model is capable of adopting either storage routing or dynamic routing methods for routing floods through reservoirs depending on the nature of flood wave movement in reservoirs at the time failure.

A rectangular breach at an El. 472 MASL with side slope 1:0 and breach formation time as one hour has been considered in the study for Dam Break Analysis for Project. The magnitude of the simulated outflow hydrograph is 7120 cumecs corresponding to maximum stage elevation El. 465.16 MASL at km 1.10; it will be attenuated to 3,541 cumecs corresponding to maximum stage elevation of El. 432.50 MASL at km 12.81. The maximum flow and flood wave arrival time at various distances downstream of the dam is shown in the Table below:

**Table: Summary of wave profile in the event of Dam Break**

<b>Distance from dam (km)</b>	<b>Max. Elevation (MASL)</b>	<b>Maximum flow (cumec)</b>	<b>Time to Max. stage (Minutes)</b>
1.10	465.16	7120.1	05.36
2.23	460.21	6840.3	12.46
4.10	456.71	6620.1	17.80
6.40	452.10	5820.7	19.70
8.10	448.30	4976.2	24.30
10.76	436.10	4431.81	30.40
12.81	432.50	3540.71	34.31

The degree of alertness has to enhance during high stage of river manifested with sharp increase in discharge. Though there cannot be very sharp edge demarcation between different levels of emergency yet the following flood conditions have been contemplated and the preventive measures suggested against each as given in Table in next page:

**Table: Status of Emergency**

S.N.	Status of Emergency	Water Level	Preventive measures
1.	Normal Flood	Below FRL i.e. El. 470 MASL and flood discharge <9,970 cumec	Utmost vigil, observed in regulation of spillway gates
2.	Level-1Emergency	Rises above E. 470 MASL but flood discharge <9,970 cumec	(1) All gates fully operational (2) All the official should attend dam site. Local officials informed and warning system be kept on alert.
3.	Level -2 Emergency	Above FRL i.e. E. 470 MASL but below top of dam i.e. El. 472 MASL and the discharge continues rising above 9970 cumec	Communication & public announcement system should be put into operation and flood warning issued to people.
4.	Level-3 Emergency	Top of dam i.e. El. 472 MASL	(1) All staff from dam site, powerhouse & TRC outlets alerted to move to safer places (2) Possibility of dam failure should be flashed to District Administration.
5.	Disaster	Rising above El. 472 MASL and the breach appears in any form	District Admin. and Project authorities be intimated and only lifesaving measures should be resorted too.

**Muck generation and its disposal**

The project is likely to generate 15.95 lac m<sup>3</sup> of muck due to excavation. Out of which 50% is to be utilized for construction purpose and remaining 7.98 lac m<sup>3</sup> will be dumped in designated disposal sites (5 locations) covering an area of 13.25 ha for this purpose. The muck disposal sites are located at least 30 m away from river HFL. The drainage side bank of the area will be properly protected and stabilized with gibbon/retaining wall of suitable designated sections. The muck disposal sites shall be reclaimed/ restored with vegetation once capacity is utilized. An amount of Rs. 2.19 Crores has been allocated for this purpose.

**Catchment Area Treatment and Compensatory Afforestation**

The total catchment area at proposed dam is 320 km<sup>2</sup>. Out of this, high erosion category, which account for 57% of directly draining catchment area having a total area of 18,204 ha categorized, as very high priorities will be treated with both biological and engineering measures. The Catchment Area Treatment (CAT) Plan proposed in the EMP will be implemented in consultation with Meghalaya State Forest Department. An amount of Rs.1148.95 lakhs has been allocated for this purpose. The CAT plan will be implemented over a period of five years, i.e. in synchronization with the construction of the project.

The compensatory afforestation programme is proposed in 44 ha of forestland which is double the forestland diverted for the project and will be implemented in consultation with State Forest Department. An amount of Rs.67.65 lakhs has been

allocated for this purpose. Biodiversity Conservation and Management Plan has also been proposed with Meghalaya State Forest Department. An amount of Rs.205.74 lakhs has also been allocated for this purpose.

### **Fishery Management**

Fishery development and management plan are proposed for the conservation of fish in river. Under this programme development of Mahsheer and *snow trout* hatchery has been proposed to stock the reservoir and river Umiew for a length of 1 km on the upstream side and up to confluence with river Siyom on the downstream side. The rate of stocking is proposed as 100 fingerlings of about 30 mm size per km. For reservoir area, stocking shall be 1,000 fingerlings/ha of 30 mm size. The migratory fish species namely, Mahsheer and *snow trout* can be stocked. The plan will be implemented in consultation with Meghalaya State Fisheries Department. An amount of Rs. 1.307 Crore has been allocated for this purpose.

### **EIA Study**

Primary surveys have been conducted for three seasons namely, monsoon (August, 2014), post-monsoon (December, 2014) and pre-monsoon season (April, 2015). The data has been collected for flora, fauna, forest types and ecological parameters, geological and soil features. During these surveys data and information was collected on Physico-chemical, biological and socio-economic aspects of the study area. In addition, detailed surveys and studies were also conducted for understanding bio-diversity in the study area. Impact of project activities has been predicted using Mathematical Models and Overlay Technique (super-imposition of activity on environmental parameter). For intangible impacts, qualitative assessment has been done. As a part of study impacts likely to accrue during construction and operation phases on various aspects of Environment have been assessed accordingly.

The project was earlier considered by EAC in its meeting held on 24-25<sup>th</sup> August, 2017. It was noted that the Public Hearing was held on 5.5.2017 at Dainthlen, which was presided over by the Sub-Divisional Officer (Civil), Sohra Civil Sub Division, who was not equivalent to the rank of Addl. District Magistrate as required as per EIA Notification, 2006. In this regard, the Public Hearing has to be conducted again as per laid down procedure and with appropriate authority. Accordingly, the Ministry on 4.10.2017 requested M/s. NEEPCO Ltd to apply a fresh for environmental clearance after conducting the public hearing.

### **Public Hearing**

Meghalaya State Pollution Control Board organized the Public Hearing on 05.05.2015 at Dainthlen village, East Khasi Hill, Meghalaya with **the Chairmanship of Sub Divisional Officer, Sohra Civil and on 16.05.2017 at Trai, Mawthoh (Tezpatta) village, East Khasi Hill, Meghalaya** with the Chairmanship of Addl. District Collector for the propose project. One of the main issues of the public was to include Umblai village as part of impacted area of the project. Share in the profit to the villagers, representative of Dorbal Elaka Nongttan in the Board of Director of the project, 2% of the gross revenue from this project be utilized for sustainable development, one paisa per unit electricity generation be earmarked towards Green Cess, 1% of the project cost be used for construction of village roads, etc. In this regards, the PP committed that it will be implemented as per the Central Government Rules and Regulations. Besides, the other issues raised were on R & R, payment of compensation as per the new policy, implementation of CSR, development of village roads, provision of drinking water and electricity, provision of recreation and sports facilities, development of Vocational Training Centre, preference to PAFs for employment, construction of new school buildings, Free education, free health care

facility, etc. Three underprivileged students from the impacted village be selected every year to inculcate them free education. It was also proposed that the name of the project should be changed to Kongkhen HEP instead of Mawphu HEP as the project is located on Kongkhen river. The PP has agreed to almost all the proposals placed during the Public Hearing by the general public.

After deliberations and considering all the facts of the project as presented by the PP, the EAC *recommended* for grant of Environmental Clearance for the proposed project for Sl. No. 2 to Sl. No. 10 as additional conditions. However, for Sl. No. 1, the PP has to clarify whether the Sub-divisional Officer, Sohra Civil was of the rank or equivalent to Addl. District Magistrate on the date of conducting Public Hearing, otherwise the proposal shall be rejected.

1. Clarification to be obtained from PP whether the Sub-divisional Officer, Sohra Civil was of the rank or equivalent to Addl. District Magistrate on the date of conducting Public Hearing.
2. Before impounding of the water, Cofferdam is to be decommissioned for which a comprehensive plan is to be prepared so that once the project is commissioned; cofferdam should not create any adverse impact on water environment including the rock mass and muck used to create the Cofferdam.
3. Forest Clearance Stage I shall be submitted for grant of Environmental clearance.
4. CAT plan shall be prepared in synchronization with the construction of the project and submitted to the Ministry within three months of issuance of Environmental clearance.
5. Non-biodegradable wastes to be safely disposed of in accordance with safe environmental practices.
6. Water depth sensors shall be installed at a suitable location in the river to monitor the EF, and hourly data shall be collected, and converted to discharge. The Gauge and Discharge data in the form of Excel files shall be emailed to concerned regional office of MoEF and to concerned CWC office, on a weekly basis. Any deviation on the lower side shall be highlighted.
7. Local indigenous species of plants to be grown and maintained till their full growth including gap filling.
8. Skill mapping be undertaken for the youths of the affected project area and based on the skill mapping, necessary trainings to the youths be provided for their appropriate engagements in the Project.
9. Land acquired for the project shall be suitably compensated with the prevailing guidelines and all commitments made during the public hearing shall be fulfilled.
10. Six monthly compliance reports shall be submitted to Regional Office, MoEF & CC, Shillong without fail until completion of the modernization works.

Subsequently, it was clarified by the PP that the Sub-Divisional Officer, Sohra Civil was not of the rank or equivalent to Addl. District Magistrate on the date of conducting Public Hearing. Therefore, PP applied for extension of validity of ToR on 08.09.2017 online which has been granted on 04.10.2017, in accordance to Circular No. J-11013/41/2006-IA-II (I) (Part) dated 29.08.2017. The Public Hearing has again been conducted by the PP with the Chairmanship of Addl. District Magistrate on 09.11.2017 at Trai, Mawthoh (Tezpatta) village, East Khasi Hill, Meghalaya for the propose project. Then the PP applied on 13.12.2017 online informing that the Public Hearing has been reconducted with the Chairmanship of the Addl. District Magistrate at Trai, Mawthoh (Tezpattat) village, East Khasi Hill, Meghalay.

After deliberations and considering all the facts of the project as presented by the PP, **the EAC recommended for grant of Environmental Clearance to the**

**proposed proposal** with the following additional conditions in additions to the conditions mentioned in the 7<sup>th</sup> EAC meeting:

1. Solid waste generated, especially plastic waste, should not be disposed of as landfill material. It should be treated with scientific approach and recycled.
2. The project will generate muck due to excavation and shall be dumped at the earmarked areas including utilizing in the project construction area. The muck disposal sites will be rejuvenated using integrated biological & biotechnological measures (both engineering and biological measures) with the allocated funds for the purpose.
3. Under Biodiversity Conservation and Management Plan the following programs have to be taken up:
  - a) Biodiversity Conservation Cell
  - b) Habitat Improvement Programme
  - c) Botanical Gardens with Butterfly Habitat

**Item No. 11.5 76 MW Phata Byung Hydro Electric Project on Mandakini River in Rudraprayag District of Uttarakhand-For extension of validity of EC<sup>[1]</sup><sub>SEP</sub>**

The Project Proponent (PP) made a presentation of the project and *inter-alia*, provided the following information:

The Environmental Clearance to Phata-Byung was given on 18.02.2008. The PP applied for extension of validity of EC on 04.12.2018 online. Phata-Byung HEP (76 MW) in Rudrapryag District of Uttarakhand is implemented by M/s Lanco Mandakini Hydro Energy Power Limited and proposes to harness water of Mandakini river, a major tributary of river Alakananda. The project envisages construction of a 26 m high concrete dam at Sitapur village and an underground powerhouse near Byung village. The total land requirement is 22.72 ha for the construction of project. Out of which, about 17.77 ha of land is required for the project components viz., construction of dam, head race tunnel, surge shaft, power house and switchyard and balance 4.95 ha land is for the access roads to the project site. Out of 17.77 ha land, 16.37 ha is Forestland and 1.40 is private land. The total submergence is 4 ha. The Chief Wildlife Warden has certified that the project site is entirely outside the Kedarnath wildlife sanctuary area. There is no displacement of any population.

The construction activities started in October, 2008. A total of Rs. 939.65 Lakhs has already been deposited in CAMPA funds for implementation of CAT works by State Forest Department. As per the DFO Rudraprayag, an expenditure of Rs.357 lakhs has already been made towards the CAT works.

Before 16.06.2013, execution works of Phata-Byung HEP were progressing well and were ready for commissioning in September 2014. The devastating Mandakini river flood on 16.06.2013 caused severe damage to the project and construction work got on hold. Significant loss and damage has occurred to Phata Byung HE Project due to heavy rains and flash floods at Kedarnath. Some of the major damage and loss are listed below:

- The Dam structure (which was already raised to its full height) is severely damaged
- The entire reservoir area is completely filled with debris
- All major project equipment, machinery and other installations at site along the river have been either washed away or damaged beyond repairable condition
- Most of the construction material has been completely washed away

- Approach roads and internal project roads have been washed away with practically no access to some of the project components

This halted the project work for long time and the restoration work started after April 2014. The removal of debris and restoration activities for all the flood impacted project components was undertaken. Also substantial progress was achieved in Project Tunneling & lining works and other work fronts.

**The Present status of the project is as below:**

<b>Components</b>	<b>Progress</b>
Dam	Work on Dam Reconstruction is under Progress, Excavation Completed. Concreting 50 % Completed
Head Race Tunnel	99% of the HRT excavation has been completed. Concrete Lining is in progress between HRT Face 2 & Face 3 and Face 6 to Face 9
Surge Shaft	Restoration and Excavation of Surge Shaft is completed. Concrete lining is under progress
Pressure shaft	60% Excavation of Pressure shaft and tunnel is completed. Ferrule Erection (HM works) is under progress
Power House	100% of the Power House excavation has been completed. 30% Concrete completed

**Overall, about 70% of the project has been completed up to July, 2017.**

The estimated completion cost of the project, as approved by the Lenders was INR 1,133 Crore with completion in September, 2014 which will be revised further. The PP is requesting 3 years in order to complete all the works and commissioning of the project.

After detailed deliberations and considering all the facts of the project as presented by the PP including a public representation, as the provision exists, **the EAC recommended for grant of extension of validity of environmental clearance for another three years i.e. till 17.02.2021.**

**Item No. 11.6 Any other items**

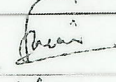



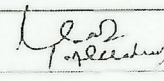
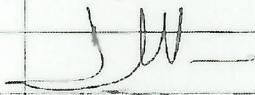

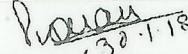
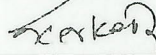
As there being no agenda item left, the meeting ended with a vote of thanks to the Chair.

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**LIST OF MEMBERS**

**11<sup>th</sup> MEETING OF RE-CONSTITUTED EXPERT APPRAISAL COMMITTEE (EAC) FOR RIVER VALLEY & HYDROELECTRIC PROJECTS**

**DATE :** 30<sup>th</sup> January 2018  
**TIME :** 10:30 AM to 5:30 PM  
**VENUE :** NARMADA HALL, INDIRA PARYAVARAN BHAWAN, NEW DELHI

Sl.No.	Name of Member	Signature
1.	Prof. Sharad Kumar Jain, Chairman	
2.	Shri. T. P. Singh Member	Abs
3.	Shri. Sharvan Kumar, Member	
4.	Shri N. N. Rai, Member	
5.	Dr. J.A. Johnson, Member	Abs
6.	Dr. B. K. Das/ Dr. AK Sahoo Member	 , 
7.	Dr. Vijay Kumar, Member	Abs
8.	Prof. Govind Chakrapani, Member	Abs
9.	Dr. Chetan Pandit, Member	
10.	Dr. Dinkar Madhavrao More, Member	
11.	Dr. R. Vasudeva, Member	Abs
12.	Prof. S.R. Yadav, Member	Abs.
13.	Dr. Jai Prakash Shukla, Member	Abs.
14.	Dr. Poonam Kumria Member	 30-1-18
15.	Dr. Kerketta, Member Secretary Director (IA-1)	 30/1/2018



2/20/2018

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**Subject:** Minutes of 12th EAC meeting of River Valley Projects

**To:** Dr S Kerketta <s.kerketta66@gov.in>

Dnkmr <dnkmr@yahoo.co.in>

**Cc:** S Kerketta <suna1466@rediffmail.com>

**Date:** 02/19/18 08:15 AM

**From:** Sharad Jain <s\_k\_jain@yahoo.com>

**Reply-To:** Sharad Jain <s\_k\_jain@yahoo.com>

11th\_EAC\_meeting\_30.01.2018\_SKJ.pdf (439kB)

11th\_EAC\_meeting\_30.01.2018\_SKJ.docx (95kB)

Dear Dr Kerketta,

I am sending the approved minutes of the 12th meeting of EAC (RVH). Dr More has concurred with the minutes of the part of the meeting that he chaired.

Pls see that the data mentioned in the minutes is carefully checked before uploading the minutes.

Regards,

Sharad Jain  
Chairman (EAC)

[https://mail.gov.in/iwc\\_static/layout/shell.html?lang=en&3.0.1.2.0\\_15121607](https://mail.gov.in/iwc_static/layout/shell.html?lang=en&3.0.1.2.0_15121607)

1/1

## Site Inspection Report

1	Name of the Project	Construction of Additional Spillway of Hirakud Dam Project, Burla
2	Name of the District / Division	Sambalpur/Sambalpur Forest Division
3	Date of Inspection	25.03.2017
4	Name & Designation of Inspecting Officer	Sri Santosh Joshi, IFS Divisional Forest Officer, Sambalpur Forest Division
5	Name & Designation of other officers who attending the inspection including representative of user Agency	(i) Sri Tejaraj Naik, Forest Ranger, Range Officer, Sambalpur Sodar Range (ii) Sri Chinnaya Ranjan Rout, Executive Engineer, Main Dam Division, Burla (iii) Sri Paulisti Patil, Asst. Executive Engineer, Left Bank, Burla Sub-Division (iv) Sri Ashok Kumar Naik, Asst. Engineer, First Gap Section, Hirakud (v) Sri Bijay Kumar Sahu, OCC, Sambalpur (vi) Sri M.M Adina, V.C.S.P.L, Sambalpur (vii) Sri Subrath Rath, V.C.S.P.L, Sambalpur.
6	Legal status of forest land with area proposed for diversion	Landungri Reserved Forest 9.441 ha.
7	If area required for diversion has been demarcated on the ground	Yes
8	Itemwise breakup of the forest land proposed for diversion	Reserved Forest 9.441 Ha. (Landungri RF)
9	Condition of vegetation and type of forest in the applied area	According to CHAMPION & SETH classification of forest type, this area comes under Northern Tropical Dry Deciduous Forest. The forest comprises predominantly by <i>Anacardium indicum</i> (Neem), <i>Cassia siamea</i> (Chakama), <i>Tectona grandis</i> (Teak), <i>Dalbergia sissoo</i> (Sissoo), <i>Albizia coriifolia</i> (Kuring)
10	Position of wildlife	This area does not harbour major wild fauna but due to intensive protection, the area is a paradise for good number of Herpeto fauna like Snakes, Calotes, Varanus, Monitor Lizards and Terrestrial Avi fauna and small mammals like Mongoose, Hare, Langours etc.
11	Whether the applied area is involved with any Eco-Sensitive zone / National Park / Sanctuary	No.
12	No of trees to be felled and its impact on the Eco-System.	115 Nos of trees of different species and sizes are involved in the forest area which will be compensated through compensatory Afforestation.
13	Detail of Broken up Area and reclamation done if any	Nil
14	Position of displacement of people and adequacy of rehabilitation if any	The project affected persons will be provided Rehabilitation and Resettlement as per the policy of 2006 of Govt. of Odisha as per undertaking given by the user Agency.

**ANNEXURE-3.1**

15	Position of rare and endangered species available or importance of the area from eco-social point of view.	There is no report of availability of rare and endangered species in this area. It is also not so important from eco-social point of view.
16	Non-forest land used in the project and non-Forest land selected for compensatory Afforestation included in the DLC report or not.	The non-forest area of 49.022 ha involved in the project is under the possession of irrigation Department as per the statement of Non-forest area shown in the Diversion Proposal. The area selected for compensatory Afforestation in Bonai Division is not covered under DLC report as exhibited in the scheme for compensatory Afforestation.
17	Suitability of identified non-forest area for compensatory Afforestation.	The Non-forest area of 9.441 ha identified for compensatory Afforestation is a single compact patch having adequate soil depth and is absolutely suitable for plantation and the said land is free from encroachment & encumbrance as per report of Divisional Forest Officer, Bonai Division annexed in the scheme for compensatory Afforestation enclosed in the Diversion Proposal.
18	Violation of Forest Conservation	There is no violation of the Forest (Conservation) Act 1980, in the proposed area.

Date:

  
S. Joshi, IFS

Divisional Forest Officer  
Sambalpur Forest Division  
Sambalpur

## **SCHEME FOR PLANTATION**

### **1.0 SELECTION OF SITE:**

A site will be selected preferably in the periphery of Hirakud Dam.

### **1.1 DETAILS OF THE SITE SELECTED:**

Due to biotic interference the vegetation of identified patches in Lam Dungri R.F. is in degraded condition. This includes bushy growth, pole size crop with scattered Pole crops. The growing stock is struggling against the biotic interference like grazing, fire hazard and encroachment.

#### **Crop Composition**

Acacia (*Acacia auriculiformis*), Mango (*Mangifera indica*), Amabada (*Spondias mangifera*), Amla (*Emblica officinalis*), Arjuna (*Terminalia arjuna*), Asan (*Terminalia alata*), Babul (*Acacia nilotica*), Bara (*Ficus bengalensis*) Bara Bakulia (*Dalbergia paniculata*), Bahada (*Terminalia bellerica*), Barakoli (*Zizyphus mauritiana*), Baula (*Mimosops elengi*), Bela (*Aegle marmelos*), Bhalia, Bheru (*Choloxylon switenia*), Bija (*Pterocarpus bengalensis*), Bahada (*Terminalia bellerica*), Bad Chakunda (*Samaia saman*), Char (*Buchnania lanzan*), Siris (*Albizia lebbek*), Dhaura (*Anogeissus latifolia*), Dimiri (*Ficus glomerata*), Eucalyptus (*Eucalyptus terreticornis*), Gambahar (*Gmelina arborea*), Gangasiuli (*Nyctanthes arbortristis*), Harida (*Terminalia chebula*), Jamun (*Syzygium cumini*), Kadamb (*Anthocephalus Kadamba*), Kanta Bamboo (*Dendrocalamus strictus*), Karanja (*Pongamia glabra*), Kasi (*Bridellia retusa*), Kendu (*Diospyros melanoxylon*), Kochila (*Strychnos nux-vomica*), Korei (*Hollarhena anti-dysenterica*), Kurum (*Adina cordifolia*).

#### **(a) Soil & Topography:**

Basically this is a hilly area. The ANR (Assisted natural Regeneration) with 800 plants per ha will be mainly raised in the foothill where the soil is loamy skeletal and coarse loamy.

#### **(b) Temperature / Rain fall:**

The average rain fall in this area is 1415.1 mm. Hot summer is felt from March to June and the maximum temperature has been recorded as 44.5°C and minimum temperature is 16.4°C.

### **1.2 SPECIAL OBJECTS OF MANAGEMENT:**

- i) To restrict the degradation by reducing the biotic interference to barest minimum and reverse the trend towards the process of restoration of vegetation.
- ii) To develop the forest by providing site-specific silvicultural treatment.
- iii) To facilitate the boosting of natural regeneration and ensure their establishment.

- iv) To take up appropriate soil moisture conservation measures to improve the soil and moisture regime.
- v) To improve the bio-diversity of this block.
- vi) To meet the need of the local villagers with regard to firewood and small timber depending upon the productivity (from silvicultural operations like thinning, subsidiary silvicultural operation, climber cutting, cutting of high stumps, double shoot cutting etc.)

### **1.3 ITEM OF WORK TO BE TAKEN UP:**

To achieve the objective narrated in the foregoing para, the following items of work are mainly prescribed to be taken up.

#### **i) Survey and Demarcation of Boundary**

The boundary line of this block will be cleared of weeds at a width of 5m and Stone pillars will be constructed/ repaired at every curvature. The proposed Compensatory Plantation Area will be surveyed and demarcated in the field by the User Agency at the Project cost by putting RCC pillars. Before one year of planting, the treatment area will be surveyed and demarcated in the field. Silvicultural cleaning will be done in this area to provide facility to dominant prominent species to grow faster than the others. The plantation area will be indicated by signboards at corner or at points of intersection with roads, inspection paths and boundary lines. The signboard should contain the name of the plantation site, area, year of planting, model of plantation, species preferred and other details.

#### **ii) Fencing**

As the area is nearer to the habitation and lies adjacent to the agricultural land there is every chances of biotic interference to the plantation area. Therefore, it has been proposed to provide green fencing all along the boundary.

#### **iii) PROTECTION MEASURE:**

The identified site of Lam Dungri R.F. is having very thin forest cover with a few scattered trees of miscellaneous species. Due to biotic interference and to save the area from damage, the following protection measures have been prescribed.

##### **(a) Watch and ward:**

The Compensatory Area will have to be protected by engaging watchers for **10 years**, i.e. till establishment of the planted trees and saplings. In addition at strategic locations entrance gate will be provided to check sudden trespass of cattle.

##### **(b) Motivation of people:**

As per Govt. resolution of 1993, the villagers of the project area have to be involved in protection of plantation raised under compensatory scheme. For this purpose, meeting will be conducted and local V.S.S will be associated with the field work from very inception of the plantation.

Plantation activities will be executed with the full involvement of the local Van Samrakhyan Samitees (VSS). Standard Entry Point Activities (EPA) will be included to ensure their participation.

### **1.4 PLANTATION:**

It has been intended to fell 5662 trees from the additional spill way area. As per guideline of Forest Dept. 10 times of the trees to be felled are to be planted.  $5662 \times 10 \text{ times} = 56620 / 800 \text{ plants per ha} = 71.0 \text{ ha}$  of plantation needs to be covered. The area will be stocked by way of raising plantations @ 800 plants per hectare in ANR model with the following species

1. Terminalia alata (Asan)
2. Pongamia piñata (Karanja)
3. Samania saman (Bada Chakunda)
4. Azadiracta indica (Neem)
5. Pterocarpus marsupium (Bija)
6. Emblica officinalis (Amla)
7. Terminalia belerica (Bahada)
8. Terminlia chebula (Harida)
9. Dalbergia latifolia (Pahadi sissou)
10. Cassia siamea (Chakunda)
11. Gmelina arborea (Gambhar)
12. Dendrocalamus strictus ( Salia Bamboo)

Different operations those will be taken up for plantation is as follows: -.

#### **i) Raising of nursery:**

Seedling required for this plantation shall be raised in an in-situ nursery in close vicinity of the planting site and perennial water sources. Nursery work will start one year in advance to the year of plantation, so that one year old seedlings will be available for plantation; Seeds shall be collected from plus/ selected trees and should be treated before dibbling. Poly-pot seedlings should be raised 20% extra than the actual requirement to compensate the casualties during nursery stage as well as planting time. Standard nursery practices will be followed for raising such nursery. Nursery will be raised one year prior to planting.

#### **ii) Alignment and pitting:**

Alignment and pitting will be taken up in the month of November-December and pits of size 30 cm x 30 cm x 30 Cm will be dug maintaining a spacing of 2.5 mtr x 2.5 mtr and dug up earth will be piled preferably on the northern aspect. Pitting will be done in vacant areas where plantation will be done. Rest of the areas will be tended to allow the natural regeneration to come up.

#### **iii) Actual planting:**

Seedlings of 45cm will be preferred for plantation. The seedlings will be planted in the dugout pits with initial dose of manure. Plantation should be taken up after first

regular shower of monsoon and should be completed by the end of July. Species should be planted as per the suitability of the soil condition. NPK fertilizer @ 30gms per plant should be given as basal dosage. Anti-termite treatment may be given if required. Casualties if any noticed should be replaced with the excess seedling raised for the purpose. During second year also casualty replacement will be done for which seedling shall be raised. Seedlings required for this project will be procured from DFO, Sambalpur Division's nursery.

#### **iv) Weeding, Soil working & manuring:**

For establishment and better growth of the planted seedling, circular weeding, soil working and manuring are necessary. It is prescribed that two weeding; soil working and manuring will be done during the first year and second year of plantation and one weeding and soil working during third year. During the first year and second year first weeding and manuring shall be carried out during August-September and the second one during October-November. First weeding shall be an entire area weeding (scraping) and the second will be of strip weeding along the contour. The weeding of third year will be a strip weeding which will be carried out during August.

Each weeding will be followed by a soil working around each plant at a radius of 0.5 mtr and manuring of each plant will be done @ 30 grms of NPK per plant.

### **1.5 INSPECTION, MONITORING & EVALUATION:**

It was told by Late H.F.Mooney, Conservator of Forests that every visit of Forest Officer to plantation site will add manure to the plantation. Therefore, to make this Afforestation scheme successful, intensive inspection of the plantation by forest field staff and the officers at the divisional level will be organized. Moreover for frequent monitoring & evaluation proper infrastructure facility shall have to be made in the scheme.

### **1.6 CONTROL:**

The nursery journal, the plantation journal and other records shall be maintained for each patch separately in accordance with the provision of "The Odisha Forest Plantation Manual 1977 indicating the Physical and financial achievements. Necessary entries with regard to plantation activities undertaken shall be entered in the journals and shall be produced before the inspecting officers. The date of inspection and comments of the visitor will also find place in the journal.

### **1.7 EXECUTIVE AGENCY:**

Authorities of Hirakud Dam Project will execute the work and provide protection to achieve 90% survivability at the end of 10<sup>th</sup> year. If they decide to outsource the Plantation work, they can take the help of Divisional Forest Officer, Sambalpur Forest Division through his staff to execute the scheme as per fund to be provided by Hirakud dam Project authority..

## **ANNEXURE -6.1**

### **1.8 FUNDING AGENCY:**

Chief Engineer, Hirakud Dam Project will provide the fund to DFO, Sambalpur.

### **1.9 DETAILS OF PLANTATION TO BE UNDERTAKEN**

a. Avenue Plantation along the road sides, canal bank etc. over 50 km @ 1,000 plants per K.M. i.e. 250 plants on either side in 2 x 2 rows = 50,000 Plants. Cost per K.M. with gabion is Rs.1,19,350/- + Cost of gabion Rs.63,250/- = Rs.1,82,600/- x 4 rows = Rs.6,69,800/- per K.M. x 50= **Rs.4,44,240/-**.

b. 6,620/- plants will be planted on vacant land @ 1600 plants per ha on Block model over 5.0 ha @ Rs.88,848/-= **Rs.2,66,54,400.00**.

### **1.10 TOTAL FINANCIAL OUTLAY FOR THE SCHEME:**

The total financial outlay of the scheme is **Rs. 4,06,60,664 or 4.07 Crores**.

### **TOTAL FINANCIAL OUT LAY**

<b>SL. No.</b>	<b>PARTICULARS</b>	<b>AMOUNT IN RS.</b>
01	Cost of Avenue Plantation over 100.0 K.Ms in 2 rows on either side @ Rs. 1,82,600/- x 4 rows x 100 K.Ms	7,30,40,000.00



**ANNEXURE -6.1**

	including cost of gabion (Tree guard). <b>ANNEXURE-9.1</b>	
02	Cost of Block Plantation over 300/0 ha @ Rs.88,848/- <b>ANNEXURE-9.2</b>	2,66,54,400.00
	<b>Total</b>	<b>9,96,94,400.00</b>
	Contingency 10%	99,69,440.00
	<b>Grand Total</b>	<b>10,96,63,840.00 or 10.97 Crores.</b>

**PLANT SITE MANAGEMENT**

**1. INTRODUCTION:**

For the construction purpose the major construction plants such as Stone Crusher Plants, batch mix plants, etc. will be required to be established. In case the contractor establishes his own plant he has to follow all the applicable statutory norms. The objective of this plan is:

- To ensure that statutory / regulatory requirements are complied with
- To ensure that safeguard measures are taken to avoid / mitigate / minimize environmental impacts.

The present section provides general guidelines for sitting of plants and environmental safeguard measures based on the statutory requirements:

**2. SITE SELECTION CRITERIA FOR BATCH MIX PLANT/ STONE CRUSHER PLANT:**

- 1.0 km away from settlement, school, hospital towards downwind directions.
- 1.0 km from any archaeological site.
- 1.0 km from ecologically sensitive areas i.e. forest, national park, sanctuary etc.
- 1.0 km from rivers, streams and lakes.
- 500 m from ponds.
- 500 m from National Highway, 250 m from State Highway, 100 m from District roads and other roads (The distance are to be measured from edge of Road to boundary of site).
- Away from agricultural land.
- Preference to barren land.

**3. STATUTORY REQUIREMENTS:**

- Obtaining NOC [Consent-to-Establish (CtE) and Consent to Operate (CtO)] under Air and Water Acts from the State Pollution Control Board (SPCB) before start of installation.
- Complying with the terms and conditions laid down in the CtE and CtO, which generally include providing Dust containment cum suppression system for the equipment, Construction of wind breaking walls along periphery of plant sites, construction of the metal roads within the premises, regular cleaning and wetting of the ground plantation, periodic (monthly) pollution monitoring i.e. ambient air, noise and stack emission
- Obtain certificates from manufacturer for type approval and conformity of production for Diesel Generator (DG) set. For DG sets of capacity up to 1000 KVA, the noise level at 1m from the enclosure surface shall not exceed 75 dB (A)

**4. POLLUTION CONTROL MEASURES:**

- Ensure adequate stack height as stipulated in CtE, install emission control devices such as bag house filters, cyclone separators, water scrubbers etc., as attached with the plant by the manufacturer or stipulated in CtE.
- Bag house filter / multi-cone cyclone for emission control. For bag house, cartridge filters reported to be more efficient than fabric filters.
- The stone crusher plants should be installed with operational water sprinklers over jaw crusher, conveyor belts and vibratory screens.
- Pollution control measures for Diesel Generator (DG) set i.e. stack height, acoustic enclosure etc.
- Periodical maintenance of all the plant and equipments to keep the plants in order.
- Damaged bag-house and filters should be immediately replaced.
- All the workers shall use all the time helmets, footwear, earplugs, nasal masks etc. when the plants are operational. During maintenance of plants also the workers involved in maintenance will not enter the plant premises without PPE.
- No workers should be allowed to work in loose clothes near conveyor belts.
- Proper lighting arrangement shall be made around plant site if the plants are operated during dark hours.
- Provision of readily available first aid kit, fire fighting equipments at the plant site at appropriate location to respond in case of accident.
- Periodical monitoring of air quality and noise levels as per conditions stipulated under the statutory clearance from SPCB. Whenever the emission exceeds the permissible level the plants should be stopped and necessary repairing works of faults will be done to bring down the emission levels.
- The office complex, residential units shall be constructed on upwind direction from the plant site.

Contractor shall prepare and submit its EHS management plan for the installation and operation of batch mix/stone crusher plants and submit the same to the Executive Engineer/ESMC in advance.

**BORROW AREAS MANAGEMENT PLAN**

**1. INTRODUCTION:**

Embankment or dyke constructions materials are to be brought from borrow areas designated for the purpose. Borrow areas cause significant adverse environmental impacts if appropriate mitigation measures are not taken. The scope of this guideline includes measures that are required during project planning and design stage, preconstruction, construction stage and post construction stage. Borrow areas are related only to canal embankment, dam dyke and road construction activities.

**2. PROJECT PLANNING AND DESIGN STAGE:**

Design measures for reduction in the quantity of the earthwork will have to be undertaken to reduce the quantity of material extracted and consequently decrease the borrow area requirement. The DPR shall contain Guidelines for locating site of borrow areas and borrow material specifications.

**3. IDENTIFICATION OF THE BORROW AREAS:**

Specific locations of borrow areas will be identified by contractor. The selection and recommendations of borrow areas will be based on environmental as well as civil engineering considerations. Location of source of supply of material for embankment or sub-grade and the procedure for excavation or transport of material shall be in compliance with the environmental requirements of MoEF&CC. The Contractor will obtain environmental clearance from as per EAI Notification, 2006.

Certain precautions have to be taken to restrict unauthorized borrowing by the contractor. No borrow area shall be opened without permission of the Engineer. The borrowing shall not be carried out in cultivable lands, unless and until, it shall be agreed upon by the engineer that there is no suitable uncultivable land in the vicinity for borrowing or private landowners are willing to allow borrowing on their fields.

**Borrow Area Identification:**

- Identify areas having present land use as barren land, riverside land.
- Prefer areas of highland with respect to surroundings;
- Avoid locating borrow area close to any road (maintain at least 30m distance from ROW and 10 m from toe of embankment, whichever is higher);
- Should be at least 1.0 km away from inhabited areas;
- Minimum distance of about 1.0 km from ecologically sensitive area i.e. Reserve Forest, Protected Forest, Sanctuary, wetland etc.;
- Minimum distance of about 1.0 km from school, hospital and any archaeological sites;
- Having adequate approach road with minimum length of earthen road;
- Ensure that unsuitable soft rock is not prominent within the proposed depth of excavation which will render rehabilitation difficult;

- Controlled operation as per agreed / approved plan
- Prior approval of Rehabilitation Plan considering terrain, land use and local need;
- Restricting operation as agreed by landowner and approved by the engineer in Charge.

**4. PRE-CONSTRUCTION STAGE:**

The contractor shall identify the borrow area locations in consultation with the individual owners in case of private lands and the concerned department in case of government lands, after assessing suitability of material. The suitable sites shall be selected and finalized in consultation with the Engineer in charge.

Borrowing to be avoided on the following areas:

- Lands close to toe line.
- Irrigated agricultural lands (In case of necessity for borrowing from such lands, the topsoil shall be preserved in stockpiles.);
- Grazing land.
- Lands within 1km of settlements;
- A distance of 1km should be maintained from environmentally sensitive areas such as Reserve Forests, Protected Forests, Sanctuary, wetlands.
- Designated protected areas / forests.
- Unstable side-hills.
- Seepage areas.
- Areas supporting rare plant/ animal species;
- Ensure unsuitable soft rock is not prominent within the proposed depth of excavation which will render rehabilitation difficult.

**5. CONSTRUCTION STAGE:**

No borrow area shall be operated without Environment Clearance & Environment Clearance condition. In addition, the contractor should adopt precautionary measures to minimize any adverse impacts on the environment. Checklists for monitoring borrow areas operation and management has been prepared (Table 1).

**Table 1: Checklist for Monitoring Borrow Area Operation and Management**

<b>Attributes</b>	<b>Requirements</b>
Access Road	Access road shall be used for hauling only after approval.
Top soil preservation	Top soil, if any, shall be stripped and stored at corners of the area before the start of excavation for material collection; Top soil should be reused / re-laid as per agreed plan; In case of riverside, borrow pit should be located not less than 15m from the toe of the bank, distance depending on the magnitude and duration of flood to be withstood. In no case shall be borrow pit be within 1.5m from the Toe line of the proposed embankment.

## **ANNEXURE -6.3**

Depth of excavation	For agricultural land, the total depth of excavation should be limited to 150cm including top 30 cm for top soil preservation; For river side borrow area, the depth of excavation shall be regulated so that the inner edge of any borrow pit, should not be less than 15m from the toe of the bank and bottom of the pit should not cut the imaginary line of 1:4 projected from the edge of the final section of the embankment. To avoid any embankment slippage, the borrow areas will not be dug continuously and the size and shape of borrow pits will be decided by the Engineer in charge.
Damage to surrounding land	Movement of man and machinery should be regulated to avoid damage to surrounding land. To prevent damages to adjacent properties, the Contractor shall ensure that an undisturbed buffer zone exists between the distributed borrow areas and adjacent land. Buffer zone shall be 3 m wide or equal to the depth of excavation whichever is greater.
Drainage control	The Contractor shall maintain erosion and drainage control in the vicinity of all borrow pits and make sure that surface drains do not affect the adjacent land or future reclamation. This needs to be rechecked by the Engineer in charge.
Dust Suppression	Water should be sprayed on kutcha haul road twice a day or as may be required to avoid dust generation during transportation of material; Depending on moisture content, 0.5 to 1.5% water may be added to excavated soil before loading during dry weather to avoid fugitive dust emission.
Covering material for transport material	Material transport shall be provided with tarpaulin cover
Personal Protective Equipment	Workers should be provided with helmet, gumboots and air mask and their use should be strictly enforced.
Redevelopment	The area should be redeveloped within agreed timeframe on completion of material collection as per agreed rehabilitation plan.

### **6. POST CONSTRUCTION STAGE:**

All reclamation shall begin within one month of abandonment of borrow area, in accordance with the redevelopment plan. The site shall be inspected by the Engineer in charge after implementation of the reclamation plan. Certificate of Completion of Reclamation is to be obtained by the Contractor from the landowner that "the land is

restored to his satisfaction". The final payment shall be made after the verification by Engineer in charge.

**7. OPERATION:**

No borrow area will be operational without written consent of the land owner. To avoid any embankment slippage, the borrow areas will not be dug continuously, and the size and shape of borrow pits will be decided by the engineer. The contractor shall evolve site-specific redevelopment plans for each borrows area location, which shall be implemented after the approval of the Supervision /Independent Consultant.

Precautionary measures as the covering of vehicles will be taken to avoid spillage during transport of borrow materials. To ensure that the spills, which might result from the transport of borrow materials do not impact the settlements, it will be ensured that the excavation and carrying of earth will be done during day time only. The unpaved surfaces used for the haulage of borrow materials will be maintained properly. A general guideline will be followed in the line of MoEF&CC conditions as follows:

- The borrowing/excavation activity shall be restricted to a maximum depth of 2 m below general ground level at the site.
- The borrowing/excavation activity shall be restricted to 2m above the ground water table at the site.
- The borrowing/excavation activity shall not alter the natural drainage pattern of the area.
- Appropriate fencing will be provided all around the borrowed/excavated pit made to prevent any mishap.
- Measures shall be taken to prevent dust emission by covering of borrowed/excavated earth during transportation.
- Safeguards shall be adopted against health risks on account of breeding of vectors in the water bodies created due to borrowing/excavation of earth.
- Workers / labourers shall be provided with PPE. The use of PPE at all time during works will be ensured.
- A berm shall be left from the boundary of adjoining field having a width equal to at least half the depth depth of proposed excavation.
- A minimum distance of 15 m from any civil structure shall be kept from the periphery of any excavation area.

Borrowing of earth shall be carried out at locations recommended as follows:

**Non- Cultivable Lands:** Borrowing of earth will be carried out up to a depth of 2.0 m from the existing ground level. Borrowing of earth shall not be done continuously. Ridges of not less than 8 m width shall be left at intervals not exceeding 300m. Small drains shall be cut through the ridges, if necessary, to facilitate drainage. Borrow pits shall have slopes not steeper than 1 vertical in 4 horizontal.

**Productive Lands:** Borrowing of earth shall be avoided on productive lands. However, in the event of borrowing from productive lands, under circumstances as described above, top soil shall be preserved in stockpiles. At such locations, the depth of borrow pits shall not exceed 45 cm and it may be dug out to a depth of not more than 30 cm after stripping the 15 cm top soil aside.

**Elevated Lands:** At locations where private owners desire their fields to be leveled, the borrowing shall be done to a depth of not more than 2m or upto the level of surrounding fields.

**Borrow pits along Roadside:** Borrow pits shall be located 10 m away from the toe of the embankment. Depth of the pit should be such that the bottom of the pit shall not fall within an imaginary line of slope 1 vertical to 4 horizontal projected from the edge of the final section of the bank. Borrow pits should not be dug continuously. Ridges of not less than 8 m width should be left at intervals not exceeding 300m. Small drains should be cut through the ridges to facilitate drainage.

**Borrow pits on the riverside:** The borrow pit should be located not less than 15m from the toe of the bank, distance depending on the magnitude and duration of flood to be withstood.

**Community/ Private Ponds:** Borrowing will be carried out at locations, where the private owners (or in some cases, the community) desire to develop lands (mostly low-lying areas) for pisciculture purposes and for use as fishponds.

**Borrow Area near Settlements:** Borrow pit location shall be located at least 0.8km from village and settlements. If unavoidable, they should not be dug for more than 30 cm and should be drained.

**8. BORROW AREA REDEVELOPMENT:**

Each borrow area should be rehabilitated immediately after completion of extraction of materials to the satisfactions of the land owner and the Engineer. The borrow area shall be redeveloped appropriately as per approved plan and landowner's requirement. The borrow pits may be developed into pond after leveling the bottom and slope maintenance. The borrow pits may be refilled with earth materials covered with fertile to soil. The upland used as borrow area shall be leveled matching with the level of surrounding area. No scare created due to borrowing of earth should be left unattended. The Contractor should provide completion certificate of redevelopment of each borrow pit issued by the land owner.

**9. CHECKLIST FOR INSPECTION OF REHABILITATION AREA**

Inspection needs to be carried out by the Engineer in charge for overseeing the redevelopment of borrow areas as per the plan. The checklist for the inspection by the Engineer in charge is given below.

- Compliance of post-borrowing activities and land use with the restoration plan;



- Drainage measures taken for inflow and outflow in case borrow pit is developed as a detention pond;
- Leveling the bottom of the borrow areas;
- In case the borrow area is on private property, the contractor shall procure written letter from Land owner for satisfaction on rehabilitation. In case of no rehabilitation is desired by the landowner, the letter should include statement “no responsibility of contractor in the event of accident”.
- Condition of the reclaimed area in comparison with the pre-borrowing conditions.

**10. STATUTORY CLEARANCE FOR BORROW AREA:**

Regarding the borrow area for ordinary soil, the Contractor has to obtain environmental clearance from State Environmental Impact Assessment Authority (SEIAA) or District Environmental Impact Assessment Authority (DEIAA) of MoEF&CC vide their notification no. S.O. 141(E) dated 15<sup>th</sup> January 2016. If the area of a borrow area is less than 5 Ha then this will be treated as Category-B-2 Project and will be appraised and approved based of only Form-1. No EIA study will be required for such area. However if the size of the borrow area is more than 5 Ha then it will be categorized as “Category-B1” and therefore will require EIA study, based on which the SEIAA will give clearance for the same.

**PROCEDURE FOR ENVIRONMENTAL CLEARANCE FOR MINING OF MINOR MINERALS INCLUDING CLUSTER:**

The following policy shall be followed for environmental clearance of mining of minor minerals including cluster situation: -

1. The data provided by the States (Sustainable Sand Mining Guidelines) shows that most of the mining leases for minor minerals are of lease area less than 5 hectare. It is also reported that in hill States getting a stretch in river with area more than 5 hectare is very uncommon. So the size of lease for minor minerals including river sand mining will be determined by the States as per their circumstances.
2. The mining of minor minerals is mostly in clusters. The Environment Impact Assessment or Environment Management Plan is required to be prepared for the entire cluster in order to capture all the possible externalities. These reports shall capture carrying capacity of the cluster, transportation and related issues, replenishment and recharge issues, geo-hydrological study of the cluster area. The Environment Impact Assessment or Environment Management Plan shall be prepared by the State or State nominated Agency or group of project proponents in the Cluster or the project proponent in the cluster.
3. There shall be one public consultation for entire cluster after which the final Environment Impact Assessment or Environment Management Plan report for the cluster shall be prepared.
4. Environmental clearance shall be applied for and issued to the individual project proponent. The individual lease holders in cluster can use the same Environment

### **ANNEXURE -6.3**

- Impact Assessment or Environment Management Plan for application for environmental clearance. The cluster Environment Impact Assessment or Environment Management Plan shall be updated as per need keeping in view any significant change.
5. The details of cluster Environment Impact Assessment or Environment Management Plan shall be reflected in each environmental clearance in that cluster and DEAC, SEAC, and EAC shall ensure that the mitigative measures emanating from the Environment Impact Assessment or Environment Management Plan study are fully reflected as environmental clearance conditions in the environmental clearance's of individual project proponents in that cluster.
  6. A cluster shall be formed when the distance between the peripheries of one lease is less than 500 meters from the periphery of other lease in a homogeneous mineral area.
  7. Form 1M, Pre-Feasibility Report and mine plan for Category 'B2' projects for mining of minor minerals shall be prepared by the Registered Qualified Person or Accredited Consultants of Quality Council of India, National Accreditation Board for Education and Training. The Environment Impact Assessment or Environment Management Plan for Category 'A' and Category 'B1' projects shall be prepared by the accredited consultants of Quality Council of India, National Accreditation Board for Education and Training.
  8. The SEIAAs shall have supervisory jurisdiction over the DEIAAs and decisions of DEIAA shall be reviewed by the SEIAA without prejudice to any provisions under any existing law.

**ANNEXURE -6.3**

**Schematic Presentation of Requirements on Environmental Clearance of Minor Minerals including cluster situation**

Area of Lease (Ha)	Category of Project	Requirement Of EIA / EMP	Requirement Of Public Hearing	Requirement Of EC	Who can prepare EIA/ EMP	Who will apply for EC	Authority to appraise/ grant EC	Authority to monitor EC compliance
<b>EC Proposal of Sand Mining and other Minor Mineral Mining on the basis of individual mine lease</b>								
0– 5 ha	B2	Form –1M, PFR and Approved Mine Plan	No	Yes	Project Proponent	Project Proponent	DEAC/ DEIAA	DEIAA, SEIAA SPCB, CPCB MoEF&CC Agency
> 5 ha and < 25 ha	B2	Form –1M, PFR and Approved Mine Plan	No	Yes	Project Proponent	Project Proponent	SEAC/ SEIAA	Nominated by MoEF&CC
<b>EC Proposal of Sand Mining and other Minor Mineral Mining in cluster situation</b>								
Cluster area of mine leases up to 5 ha	B2	Form –1M, PFR and Approved Mine Plan	No	Yes	State, State Agency, Group of Project Proponents, Project Proponent	Project Proponent	DEAC/ DEIAA	DEIAA, SEIAA SPCB, CPCB MoEF&CC Agency nominated by MoEF&CC
Cluster area of Mine leases > 5 ha and < 25 ha with no Individual lease > 5 ha	B2	Form –1M, PFR and Approved Mine Plan	No	Yes	State, State Agency, Group of Project Proponents, Project Proponent	Project Proponent	DEAC/ DEIAA	
Cluster of mine leases of area ≥ 25 hectares with individual lease size < 50ha	B1	Yes	Yes	Yes	State, State Agency, Group of Project Proponents, Project Proponent	Project Proponent	SEAC/ SEIAA	
Cluster of any size with any of the individual lease ≥ 50ha	A	Yes	Yes	Yes	State, State Agency, Group of Project Proponents, Project Proponent	Project Proponent	EAC/ MoEFCC	

**QUARRY AREA MANAGEMENT PLAN**

**1. INTRODUCTION:**

Quarries generally required to provide material for concrete works and road construction sites, can have significant adverse environmental effects, especially on ecologically sensitive areas. Quarries can become environmental hotspots and can significantly affect the visual appearance of an area. Special mitigation and management measures are often required to avoid or minimise the environmental and impacts of due to quarry operations. The EMP stipulations will be applicable for new quarries to be identified and operated by contractors. In case contractor use the existing licensed quarry a copy of the valid quarry license and lease / sub-lease agreement should be submitted to the Project Proponent. Contractor shall submit a plan delineating how he shall comply with requirements stipulated in this plan and elsewhere in the EMP on quarrying activity.

**2. PROJECT PLANNING AND DESIGN STAGE:**

Design measures for reduction in the quantity of the chips and metals required for concrete works will have to be undertaken to reduce the quantity of material to be quarried and consequently decrease the quarry area requirement. The DPR shall contain Guidelines for locating quarry site and quarry material specifications.

**3. IDENTIFICATION OF THE QUARRY SITES:**

Specific locations of quarry site will be identified by contractor. The selection and recommendations of quarry site will be based on environmental as well as civil engineering considerations. Location of source of supply of material and transport of material shall be in compliance with the environmental requirements of MoEF&CC.

However, following guidelines should be followed for selection of new quarry.

- Only licensed quarry will be used.
- New quarry will be at least 2.0 km away from the settlement, forest and other ecologically sensitive areas
- Minimum 500m away from water bodies.
- The Contractor shall identify alternative quarry sites along the whole corridor based on required quantity and environmental consideration and obtained approval from the Engineer in Charge.

**4. PRE-CONSTRUCTION STAGE:**

- The Contractor has to obtain Quarry Lease Deed / License from the Department of Mines and Geology and provide copy of the same to the Project Proponent prior to start of the material extraction.
- The Contractor shall estimate water requirement for dust suppression at quarry sites during operation and for water spraying on *kutchra* (non-metal)

haul road and ensure availability water by identifying sources and obtaining necessary permission.

- The Contractor shall prepare quarry sites operation and redevelopment plan considering surrounding land uses, local needs and agreement with the landowner.
- Permits for transportation, storage and use of explosive, as will be required, shall be obtained from the Controller of Engineer, controlled blasting e.g. using less charge, restricting depth and diameter or drill holes, cut-off blasting etc., and shall be undertaken.

**5. OPERATION STAGE:**

No quarry area shall be operated without Environment Clearance.

- Only licensed blaster i.e. short-firer certificate holder will be responsible for quarry Blasting.
- Quarry operation will be undertaken in stages with adequate benching.
- In addition, the contractor should adopt precautionary measures to minimize any adverse impacts on the environment.

Checklists for monitoring quarry site operation and management has been furnished in Table 1.

**Table 1: Checklist for Monitoring Quarry Area Operation and Management**

<b>Attributes</b>	<b>Requirements</b>
Top soil preservation	Top soil, if any, shall be stripped and stored at corners of the area before the start of quarrying for material collection; Top soil should be reused / re-laid as per agreed plan.
Damage to surrounding land	Movement of man and machinery should be regulated to avoid damage to surrounding land. To prevent damages to adjacent properties, the contractor shall ensure that an undisturbed buffer zone exists between the quarry areas and adjacent land.
Dust Suppression	Water should be sprayed on kutcha haul road twice a day or as may be required to avoid dust generation during transportation of material;
Covering material for transport material	Material transport shall be provided with tarpaulin cover
Personal Protective Equipment	Workers should be provided with helmet, gumboots and air mask and their use should be strictly enforced.
Redevelopment	The area should be redeveloped within agreed timeframe on completion of material collection as per agreed rehabilitation plan.

**6. REDEVELOPMENT OF QUARRY AREA:**

All the quarries should be rehabilitated as per approved rehabilitation plan immediately after completion of quarry material extraction. The restoration of Quarry will be done as per the conditions of the owner before handing over the site back to the owner.

Following rehabilitation works may be taken up with the consent of owner:

***Option A: Revegetating the quarry to merge with surrounding landscape.***

This is done by conserving and reapplying the topsoil for the vegetative growth.

***Option B: Development exhausted quarries as water bodies:*** The pit shall be reshaped and developed into pond, for harvesting rainwater. This option shall only be considered where the location of quarry is at the lowest point, i.e. surrounding area/natural drainage slopes towards it.

**7. PROCEDURE FOR ENVIRONMENTAL CLEARANCE OF QUARRY SITES (MINOR MINERAL):**

The following policy shall be followed for environmental clearance of mining of minor minerals including cluster situation: -

1. The size of lease for minor minerals including river sand mining will be determined by the States as per their circumstances.
2. The mining of minor minerals is mostly in clusters. The Environment Impact Assessment or Environment Management Plan is required to be prepared for the entire cluster in order to capture all the possible externalities. These reports shall capture carrying capacity of the cluster, transportation and related issues, replenishment and recharge issues, geo-hydrological study of the cluster area. The Environment Impact Assessment or Environment Management Plan shall be prepared by the State or State nominated Agency or group of project proponents in the Cluster or the project proponent in the cluster.
3. There shall be one public consultation for entire cluster after which the final Environment Impact Assessment or Environment Management Plan report for the cluster shall be prepared.
4. Environmental clearance shall be applied for and issued to the individual project proponent. The individual lease holders in cluster can use the same Environment Impact Assessment or Environment Management Plan for application for environmental clearance. The cluster Environment Impact Assessment or Environment Management Plan shall be updated as per need keeping in view any significant change.
5. The details of cluster Environment Impact Assessment or Environment Management Plan shall be reflected in each environmental clearance in that cluster and DEAC, SEAC, and EAC shall ensure that the mitigative measures emanating from the Environment Impact Assessment or Environment Management Plan study are fully reflected as environmental clearance

## **ANNEXURE – 6.4**

conditions in the environmental clearance's of individual project proponents in that cluster.

6. A cluster shall be formed when the distance between the peripheries of one lease is less than 500 meters from the periphery of other lease in a homogeneous mineral area.
7. Form 1M, Pre-Feasibility Report and mine plan for Category 'B2' projects for mining of minor minerals shall be prepared by the Registered Qualified Person or Accredited Consultants of Quality Council of India, National Accreditation Board for Education and Training. The Environment Impact Assessment or Environment Management Plan for Category 'A' and Category 'B1' projects shall be prepared by the accredited consultants of Quality Council of India, National Accreditation Board for Education and Training.
8. The SEIAAs shall have supervisory jurisdiction over the DEIAAs and decisions of DEIAA shall be reviewed by the SEIAA without prejudice to any provisions under any existing law.

**ANNEXURE – 6.4**

**Schematic Presentation of Requirements on Environmental Clearance of Minor Minerals including cluster situation**

Area of Lease (Ha)	Category of Project	Requirement Of EIA / EMP	Requirement Of Public Hearing	Requirement Of EC	Who can prepare EIA/ EMP	Who will apply for EC	Authority to appraise/ grant EC	Authority to monitor EC compliance
<b>EC Proposal of Sand Mining and other Minor Mineral Mining on the basis of individual mine lease</b>								
0– 5ha	B2	Form –1M, PFR and Approved Mine Plan	No	Yes	Project Proponent	Project Proponent	DEAC/ DEIAA	DEIAA SEIAA, SPCB CPCB, MoEF&CC Agency
> 5 ha and < 25 ha	B2	Form –1M, PFR and Approved Mine Plan	No	Yes	Project Proponent	Project Proponent	SEAC/ SEIAA	nominated by MoEF&CC
<b>EC Proposal of Sand Mining and other Minor Mineral Mining in cluster situation</b>								
Cluster area of mine leases up to 5 ha	B2	Form –1M, PFR and Approved Mine Plan	No	Yes	State, State Agency, Group of Project Proponents, Project Proponent	Project Proponent	DEAC/ DEIAA	DEIAA SEIAA SPCB, CPCB MoEF&CC Agency nominated by MoEF&CC
Cluster area of Mine leases > 5 ha and < 25 ha with no individual lease > 5 ha	B2	Form –1M, PFR and Approved Mine Plan	No	Yes	State, State Agency, Group of Project Proponents, Project Proponent	Project Proponent	DEAC/ DEIAA	
Cluster of mine leases of area ≥ 25 hectares with individual lease size < 50ha	B1	Yes	Yes	Yes	State, State Agency, Group of Project Proponents, Project Proponent	Project Proponent	SEAC/ SEIAA	
Cluster of any size with any of the individual lease ≥ 50ha	A	Yes	Yes	Yes	State, State Agency, Group of Project Proponents, Project Proponent	Project Proponent	EAC/ MoEF&CC	



## **EXPLOSIVE MANAGEMENT**

### **1. INTRODUCTION:**

Explosives are used for blasting of rocks as the project area where spillway will come is a hilly terrain. Secondly in the quarrying of stones explosives are used. The explosives contain chemicals and the use of explosives should be properly managed to avoid pollution of environment. Therefore an explosive management plan is mentioned. Explosives use management will have the primary goal of limiting loss of ammonia nitrates to quarried material, pit areas, and water bodies, which could subsequently leach into runoff. Explosives storage will be controlled and runoff from storage areas contained although it is expected that all blasting activities will be completed during winter months prior to any freshet runoff.

### **2. OBJECTIVE:**

The objectives of the Explosives Management Plan can be described as follows:

- Communicate a methodical approach to explosives management for the Project.
- Ensure that infrastructure constructed for explosives is compliant with all applicable regulations.
- Ensure that structures are constructed to prevent any safety or environmental incidents relating to onsite explosives storage.
- Ensure that handling of explosives is done in a manner that will minimize the possibility of safety or environmental incidents.
- Prescribe safe and environmentally sound measures for disposal or destruction of explosives.
- Prescribe procedures for safe blasting.
- Prescribe procedures for dealing with spills of explosives materials.
- Indicate the chain of responsibility for explosives management.

### **3. TRANSPORTATION OF EXPLOSIVE MATERIALS:**

The handling of explosives to the site and on the site will be carried out by the supplier and blasting contractor under a license to conduct such work.

Transportation of explosives from the explosive supplier to the quarry areas will be conducted in such a manner as to safeguard human health and prevent impacts on the environment. The transfer will be arranged so that:

- Delays between the points of transfer are minimized
- Explosives are not left at any location other than designated locations
- Explosives are not left unattended during transportation.

**4. TYPES OF EXPLOSIVE USED:**

- Bulk ammonium nitrate fuel oil (ANFO);
- Emulsion (bulk and packaged);
- Non-electric initiation tubes ;
- Pentolite boosters;
- Electric detonators;
- Detonating cord; and
- Inline delays.

**5. BEST MANAGEMENT PRACTICES:**

Only trained and certified persons will work with explosives. The explosives personnel will undertake formal training and on-the-job training to ensure compliance with legislation. Internal audits and inspections of all components related to the explosives management will be conducted on a regular basis by qualified personnel, and the results recorded according to quality and safety standard operating procedures. All recommendations and orders made by regulators and inspectors will be responded to and acted upon accordingly.

- Specific fire procedures as per the Federal Explosives Act
- First Aid
- Transportation of Dangerous Goods (TDG)
- Blasting Certificate
- Workplace Hazardous Materials Information System (WHMIS)

**6. STORAGE:**

All explosives and accessories will be stored at the planned magazine site and explosive storage facility site. The magazine and the explosive storage facility are 300 m apart and roughly 1,800 m from any other infrastructure as per the distance requirements

## **RISK AND DISASTER MANAGEMENT PLAN**

### **1.0 INTRODUCTION:**

Risk assessment is a systematic method of identifying and analyzing the hazards associated with an activity and establishing a level of risk for each hazard. The hazards cannot be completely eliminated and thus there is a need to define and estimate an accident risk level possible to be presented either in quantitative or qualitative way. Risk assessments will help to prioritize risks and provide information on the probability of harm arising and severity of harm by understanding the hazard, combine assessments of probability and severity to produce an assessment of risk and it is used in the assessment of risk as an aid to decision making.

In recent years the concept has begun to achieve more acceptances within the ranks of water resources management. Application of risk analysis to dams raises a unique set of problems, because each dam is a unique system within its own distinctive environment. A spillway forms a part of the main dam system. While dam safety is a major concern, in the context of the present project, the risks involved during the construction of the spill way has been focussed here.

Further the hazard may Natural Hazard or Manmade Hazard.

### **1.1 ENVIRONMENTAL RISK MANAGEMENT:**

Most water resources projects, by and large designed with the environmental sustainability are not altogether free from Risks and hazards which may appear during the entire implementation period. Due importance is therefore attached to the review of environmental design considerations, identification of areas involving risks and hazards along with appropriate mitigative measures in the management plan. This approach proceeds from the conviction that the development objectives cannot be materialized fully unless disaster mitigation is built in to the development process.

#### **1.1.1 Risk Management:**

Risk as defined is the probability of harm or likelihood of harmful occurrence being released and its severity. An environmental hazard entails a set of circumstances which lead to the direct or indirect degradation of the environment and becomes a cause of damage to the life of people, property or environment.

##### **A. Assessment - Approach:**

- To identify the potentiality hazardous areas so that necessary safety measures can be adopted to minimize the probability of accidental events & failure of design.
- To identify the potential areas of environmental disasters, which can be prevented by proper design of installations and controlled operation.

**B. Management Procedure:**

- Set up a committee of experts to probe the cause of such events, estimate the probable losses and suggest remedial measures for implementation so that in future such events or similar events do not reappear.

**1.2 Review of the Environmental Design Considerations:**

Sl. No.	Design objectives	Reviews and accomplishments
1.	<ul style="list-style-type: none"> <li>• Should confirm to aesthetically satisfying structures as well as the landscape.</li> <li>• Should cause minimal disturbance to the ecology of the area.</li> </ul>	<ul style="list-style-type: none"> <li>• The proposed additional Spill way of Hirakud Dam will be located on the left bank dyke on the second saddle of the Gandhi Hillock with releasing arrangements through 5 gates each of size 15mX15 M. The physiography of the area comprises hills, valleys and plains-hills up to height of 278m being in the central part. The construction of spill way therefore will change the aesthetics. However, new landscape will develop which shall be aesthetically satisfying</li> <li>• As the hills will be demolished for construction of Spillway the ecology will be disturbed.</li> </ul>
2	<p>Structural design considerations</p> <ul style="list-style-type: none"> <li>• Design of the structures should be safe from stability considerations</li> <li>• Utilizable materials in the structure should not disturb the ecology</li> <li>• Prevent excessive soil erosion during construction phase which may transport the sediment load to the downstream.</li> <li>• During construction of spill way, the spoil piles should be properly shaped.</li> </ul>	<ul style="list-style-type: none"> <li>• The structural design will be undertaken in the state Designs organization with due consideration of codes and standard procedure.</li> <li>• Quarry location has been identified far away from the project site; whereas sand will be quarried from the ____ location.</li> <li>• The spill way will be a concrete and masonry structure to be founded in solid rock having negligible erosion.</li> <li>• Apart from re-use of the excavated earth materials in the spill way bank, the rest will be</li> </ul>

		used for construction of recreation areas.
3.	<p>Landscape Consideration</p> <ul style="list-style-type: none"> <li>• Damages to the Vegetative cover due to construction should be minimum.</li> <li>• Burrow pits/ Borrow areas should be shaped and revegetated.</li> <li>• Quarried operations should be minimum conforming to requirement.</li> </ul>	<ul style="list-style-type: none"> <li>• The existing access route will be renovated; with plantation on the road side.</li> <li>• Spill way side borrow pits shall be revegetated.</li> <li>• Quarries are located at far away places. Quarry operation by agencies shall be regulated as per guidelines.</li> </ul>

**1.3 Risks Assessment during Construction Period:**

The construction of the spill way shall primarily comprise of the following activities:

- Leveling and excavation of the spill way area, which will involve use of earth moving equipment like dozers, scrappers, excavators, diggers etc.
- Construction of Spill way which will involve masonry and concrete work. For this purpose Heavy duty trucks shall be used for transport of building material like cement, sand, stone chips, rods etc. Cranes may be used for haulage of material.

Risks and Hazards involved during the construction process can be of significant magnitude if due care is not taken to be minimized through proper mitigation measures.

These are broadly discussed below in **Table No. 1**.

**Table No. 1: Potential Environmental Hazards and Mitigation Measures (During Construction Period)**

Sl. No	Activities	Impact	Hazard Potential	Remarks	Proposed Mitigation measures
1.	Excavation by Drilling and Blasting	Noise- Dust & Accident	Moderate Pollution	Occurs for temporary period	<ul style="list-style-type: none"> <li>• Excavation through machinery</li> <li>• Blasting operation as per prevailing explosive guidelines.</li> <li>• Controlled blasting should be done to avoid fling objects</li> <li>• Ensure effective warning system.</li> </ul>

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2.	Disposal of solid waste construction debris	- Dust pollution - Land degradation	Moderate	For temporary period	<ul style="list-style-type: none"> <li>• Carriage/ Transportation of mucks by covered transport vehicles (Trucks)</li> <li>• Sprinkling of water over the dumping yard and Haul roads.</li> </ul>
3.	Water Pockets in burrow pits	Water/Land pollution	Breeding of disease vectors	For a temporary period	<ul style="list-style-type: none"> <li>• Small burrow pits to be avoided</li> <li>• Bigger pits to be fairly leveled connected to drains and slopes turfed.</li> </ul>
4.	Migration of labour force	Occupational Health problem	Moderate	For a temporary period	<ul style="list-style-type: none"> <li>• Labour camps will be properly maintained.</li> <li>• Ensure health delivery to labourers free of fees.</li> </ul>
5.	Pollution of flow water source	Unsuitable for domestic use	Moderate	For Temporary period	<ul style="list-style-type: none"> <li>• Dirking water will be supplied to workers at the construction site as well as in labour camps.</li> </ul>
6.	Other Manmade disaster/Risks	Accident	Occasional	Rare occurrences	<ul style="list-style-type: none"> <li>• Fire extinguishers will be kept ready for electric fires- Forest fires etc.</li> <li>• Safety measures for vehicular traffic.</li> </ul>

### 1.3.1 Anticipated Hazards and Mitigation Measures:

#### 1. Air Pollution:

- The earth moving machinery, cranes and transporting truck should conform to permissible BS standard i.e. BS III or BS IV so as to limit the emission level of pollutants like SO<sub>2</sub>, NO<sub>x</sub> etc.
- The idling running of construction equipments should be avoided to reduce green house gas emission.
- Regular vehicle and construction equipment/machines should be done.

- To prevent dust pollution on roadways the material being transported in trucks need to be covered.
- The operators must be trained ones with valid license.

**2. Accidents during handling of Materials:**

While handling materials mechanically suitable safety appliances should be used. Rigging and hauling jobs to be carried out by suitably trained and certified operators.

**3. Safe Operation and Safe Maintenance Procedures:**

Safe operation procedures and safe maintenance procedures should be issued to operators, maintenance personnel and the contractual workers who are engaged in operation and maintenance/construction jobs. The documents should incorporate subjects like fire safety, housekeeping, safety in material handling, motor vehicle operational safety, safety in entering and working in a confined space, electrical safety, welding and cutting metals, ladder safety, road safety etc.

**4. Portable Electrical Appliances:**

Electrical appliances like Hand lamps, electrical hand drills etc can cause electrocution. Such appliances must be thoroughly checked before being handled.

**5. Operation of Cranes:**

Operation of cranes must be done by trained operators who must pass the specified test. The placement of crane vis-a-vis the boom length, load and placement distance must be supervised by qualified engineer for lifting of load. The cranes must be load tested and certified by competent person **authorized by Director of Factories and Boilers, Odisha**

**6. Hot Mix Plant:**

The hot mix plant shall be operated by skilled operators. Operation procedure must be explained to the persons handling the plant

**1.4 Risks Assessment Process:**

The State Government Water Resource Department and has process a Dam Break Analysis and Disaster Management Plan for operation that

**1.5 Anticipated hazards of Natural Calamities**

The project may be subjected to risks of extreme natural calamities like high cloud burst, Cyclones, Landslides and Earth quake etc. Mitigation measures against these extreme meteorological events are highlighted below.

**Table No. 2: Risks & Mitigation measure**

<b>Sl. No.</b>	<b>Potential Indicators</b>	<b>Period of Occurrence</b>	<b>Likely Risk &amp; Disasters</b>	<b>Mitigation Measures Proposed</b>
1.	Strom Rainfall Cloud burst Historic Flood	Rare Occurrence	- Very high Floods - Submergence of area - Likely loss of property	<ul style="list-style-type: none"> <li>• Considered in the study of river hydrology</li> <li>• Barrage structure is designed to pass 100 yrs Design Flood</li> <li>• Strengthen warning system to open barrage gates prior to flood impinge</li> </ul>
2.	Cyclone	Periodic Occurrence	<ul style="list-style-type: none"> <li>• No risks to structures</li> <li>• Moderate risks for electric towers &amp; other installations</li> </ul>	<ul style="list-style-type: none"> <li>• No severe cyclone recorded in past decades.</li> <li>• Use stand by electricity supply (Generators)</li> <li>• Alternative arrangement for water supply to colony</li> </ul>
3.	Earth quake(Seismic Zone III)	Rare Occurrence	Moderate Risks to above ground structures	<ul style="list-style-type: none"> <li>• The structures will be designed with recommended seismic coefficient.</li> <li>• Check structures for any damage/ deformity in the post quake period</li> </ul>
4.	Land Slides	Not noticed in the past	No risks	<ul style="list-style-type: none"> <li>• The area has been geologically mapped by G.S.I and found to exhibit stable rock on the hill slopes</li> </ul>

**1.6 Disaster due to Structural failure:**

- Disaster due to failure structures is a remote possibility as because the proposed, spillway structure will be constructed with concrete and masonry over competent rock foundation.



- However, risks due to operational failure of installations may not be ruled out altogether. It may appear if the gates do not operate smoothly either due to mechanical defects or due to human error.
- If such an event ever occurs, there may be flooding devastations to the downstream areas involving loss of property and concurrently some human lives.
- The Environment Ministry as well as the State Government has attached greater emphasis on Disaster Risk Reduction (DRR) planning and management interventions.

### **1.7 DAM BREAK ANALYSIS AND DISASTER MANAGEMENT PLAN.**

The maximum hazard may manifest in the form of flood due to dam break. Hence there is need for dam break analysis. The dam break analysis has two objectives viz; (i) assessment of hazard potential of the dam break and ii) to provide an approach to Disaster Management Plan.

In order to assess the hazard potential of the dam, a Maximum Credible Failure (MCF) scenario is required to be visualized. The MCF scenario considered for the study is a 100-year flood coupled with a dam break, as suggested by CWC guidelines. The scenario should be given as an input to any dam break software, by which the flood/channel routing studies are carried out. The maximum water level that would be attained at various points on the downstream in case of dam break should be marked on a detailed contour plan of the downstream in case of dam break should be marked on a detailed contour plan of the downstream area to obtain the extent of inundation. The available contour map should have resolution lesser than increment in water levels due to dam break so that the inundation map could be prepared.

An assessment of the consequences of a dam failure on downstream areas is required and should include the following:

- An estimation of the magnitude of the dam break flood hydrographs resulting from hypothetical dam failure occurring with the reservoir at normal storage elevation and maximum storage elevation.
- A general description of the areas d/s that could be affected by flood water from a dam failure.
- Delineation of an inundation map delineating the maximum areal extent of flooding that could be produced by a dam failure. Inundation mapping should extend to a point d/s where the dam break flood would no longer pose a risk to life. This is often interpreted to be coincident with the point where inundation from the dam failure is within the 100 year floodplain for the affected watercourse.

The approach to Disaster Management Plan should delineate the needed organization for emergency response, outlines system of emergency preparedness

consisting of emergency control centre, warning and communication systems and procedures of emergency preparedness.

In general, the DMP should describe procedures for responding to unusual or emergency situations and procedures for initiation of notification or warning of individuals who may be at risk in downstream areas. As a minimum, the EAP should include the following:

- Notification procedures (preferably in the form of a flow chart) and responsibilities for notifying d/s residents in the event of an impending dam failure
- A notification list that include the names and telephone number of all affected d/s residents, dam owner and operator, local emergency official, and appropriate government agencies (including the dam safety office)
- Specific instructions for responsible parties to be followed at the dam site in response to emergencies such as floods, equipment failures, or other unusual events where the situation is evolving slow enough that immediate remedial action can be effective to prevent failure.
- Procedures to follow for emergency situations which probably would not lead to dam failure, but still could represent a hazard for downstream residents.

A general outline has been mentioned in the preceding paragraphs. Detailed disaster management plan need to be prepared by Dam Authorities in conjunction with State Government Officials for the main dam along with the additional spillway.

**ENVIRONMENT HEALTH SAFETY MANAGEMENT PLAN**

**1.0 INTRODUCTION:**

The Contractor will prepare their own Safety manual on Occupational Health and Safety for safety of all personnel working under the project and will be in line with the General Rules and Regulations on Occupational Health and Safety (OHS) in Building and Other Construction Workers (Regulation of Employment and Condition of Service) Act, 1996 and World Bank EHS guidelines on health and safety.

**1.0 SAFETY OF WORKERS:**

The Occupational Health and Safety program will aim to ensure that the workplace is safe and healthy by addressing the hazards and risks at the workplace; outlining the procedures and responsibilities for preventing, eliminating and minimizing the effects of those hazards and risks; identifying the emergency management plans for the workplace or workplaces; and, specifying how consultation, training and information are to be provided to employees at various workplaces.

Some of the risks/hazards associated with workplaces are due to working close to or at blasting sites, excavation area, excavation of trenches for spill and approach channels, hill cutting, construction of spillway and associated with the various project construction activities. Other risks associated with the project construction phase include risk of increase of vector borne and other different diseases.

**1.1 PPEs REQUIREMENT:**

Risks to the health and safety of workers can be prevented by provision of Personal Protective Equipment (PPEs) to all workers. This will be included in the construction cost for the Contractor. Depending on the nature of work and the risks involved, contractors must provide the following protective equipment without any cost to the workers.

- i. Helmet shall be provided to all workers or visitors visiting the site for protection of the head against impact or penetration of falling or flying objects.
- ii. Safety belt shall be provided to workers working at heights (more than 20 ft) such as roofing, painting and plastering.
- iii. Safety boots shall be provided to all workers for protection of feet from impact or penetration of falling objects on feet.
- iv. Ear protecting devices shall be provided to all workers and will be used during the occurrence of extensive noise.
- v. Eye and face protection equipment shall be provided to all welders to protect against sparks.
- vi. Respiratory protection devices shall be provided to all workers during occurrence of fumes, dusts, or toxic gas/vapour.

- vii. Safety nets shall be provided when workplaces are more than 25 feet (7.5 m) above the ground or other surfaces where the use of ladders, scaffolds, catch platforms, temporary floors or safety belts is impractical.
- viii. First Aid Box with all essential first aid items will be kept and maintained at the work site.
- ix. The Contractor will have to make arrangement with nearby doctor/ health centre for attending injured person due to accident.

The specific PPE requirements for each type of work are summarized below.

**Table 1: PPE Requirement List**

<b>Type of Works</b>	<b>Type of PPEs requirement</b>
Elevated work	Safety helmet, safety belt (height greater than 20 ft), footwear for elevated work.
Handling work safety	Helmet, leather safety shoes, work gloves.
Welding and cutting work	Eye protectors, shield and helmet, protective gloves.
Grinding work	Dust respirator, earplugs and eye protectors.
Work involving handling of chemical substances	Dust respirator, gas mask, chemical-proof gloves. Chemical proof clothing, air-lined mask, eye protectors.
Wood working	Hard hat, eye protectors, hearing protection, safety footwear leather gloves and dust respirator.
Blasting	Hard hat, Safety Shoes, eye and hearing protection
Concrete and masonry work	Hard hat, eye protectors, hearing protection, safety footwear leather gloves and dust respirator.
Excavation, heavy equipment, motor graders, and bulldozer operation	Hard hat, safety boots, gloves, hearing protection.
Quarries and Borrow area operations	Hard hat, eye protectors, hearing protection, safety footwear leather gloves and dust respirator.

**2. PROPOSED HEALTH MANAGEMENT PLAN:**

Health Management Plan for people in the adjoining area of the project and workmen engaged in the project is prepared based on the information collected on the existing health status, prevailing disease and other information on the health and hygiene. The information was collected from the existing PHCs and District Hospital and the health workers of the area.

There are adequate health facilities in the project affected area with primary health centers in each block and Community health center.

**2.1 Likely impacts on health due to the project:**

**2.1.1 Health Impacts in Construction Phase:**

Possible impacts on health of the local resident and impacts on the workmen engaged in construction site are detailed below.

**2.1.2 Health Impacts due to deterioration of the Work Place Ambient Air and Mitigation Measures:**

Due to the running of Construction Machineries and Heavy Vehicles, emissions like SO<sub>2</sub>, No<sub>x</sub> and dust emission due to movement of heavy vehicles and Earth Moving equipment will take place. The emissions may cause respiratory problems like asthma and other diseases.

**Mitigation Measure:**

- Wet excavation of exposed surfaces shall be adopted. Frequent water sprinkling at least thrice a day shall be carried out in the project activity area. Service roads along banks of main canal and branches shall be metaled.
- The heavy vehicles like trucks, excavators, diggers, scrappers, dozers etc shall comply to specified BS standard like BS III or BS IV.
- The vehicles are to be maintained routinely to avoid untoward emission
- Idle running vehicles and construction equipment should be avoided.

**2.1.3 Anticipated Health impacts due to Water Pollution:**

- To accommodate the influx of labour force during construction make-shift arrangements shall be provided. The sanitation of the labor camp area is normally not kept hygienic and tidy. This may cause water born diseases like Typhoid, Cholera & Gastroenteritis etc.
- The localized stagnation of water in borrow pit areas is expected during construction which may spread bacteria related diseases if suitable preventive action is not taken.

**Mitigation Measures:**

- Proper sanitation and hygiene facilities will be provided at camp site to avoid disease related to sewage pollutants.
- Antibacterial insecticides need be sprayed on accumulated water in borrow pits during rainy season.
- The project proponent shall undertake various awareness program by organizing different camps where awareness on prevention and control of various diseases such as Malaria, Dengue, Cholera, Gastroenteritis, STD, AIDS, and Cancer etc. shall be focused.
- Temporary labor camps shall be provided with sewage facilities and the hygiene of the camp shall be looked onto.
- The laborers shall be provided with fuel gas for cooking.
- Construction site will have health/first aid facility including adequate supply of sterilized dressing materials and appliances and suitable transport to take the injured person to the nearest hospital.

- Drinking Water shall be provided to the camp and at work site.

**Controlling Water borne diseases**

Various measures recommended for control of water borne diseases are given below.

- It is recommended that details of incidence of various water borne diseases in the project areas and blocks be collected to detect any particular trend.
- Detailed water quality monitoring program be designed and implemented. In areas showing incidence of water-borne diseases, intensive water quality monitoring need to be done.
- Adequate training at village level needs to be given. Drinking water must be regularly tested for the following tests;
  - Orthotolodine tests for chlorine
  - Lead Acetate paper test for bacterial infection.
- Development of sanitation facilities in the project area
- Disposal of solid waste and sewage from various sources at appropriate sites located at suitable distance from drinking water sources. The sites can be selected in consultation with the local administration.
- Provision of on-site chlorination facilities at appropriate locations in the area.
- Provision of chlorine tablets to the population which cannot be served with chlorinated water.

**2.5 Health Impacts due to improper Solid Waste Disposal:**

Solid Wastes if not disposed off or dumped properly may cause air or water pollution which will affect health and hygiene of the residents in the area.

**Waste Management Plan:**

- People or labor staying during construction and operation phase of the project site may generate wastes from different sources. Wastes are the Primary problems during the construction phase of the project which may affect the human life as well as the construction process and the environment.
- After completion of the project, the site will be covered with vegetation. Landscaping will be done in open areas with gentle gradient in the land surfaces so as to avoid soil erosion.
- Water drainage system for draining the surface runoff will be provided. Proper storage of the construction materials will be ensured.
- Waste collection site to be maintained for the collection of the construction waste. Construction waste will be dumped in the designated area.
- Paint brushes, roller, excess paints and containers of paints will be disposed off as per Hazardous Waste Management Rule 2016. Similarly, solid waste generated in the site due to human activities will be collected and disposed properly.
- Construction and Demolition Waste shall be disposed of as per Construction and Demolition Waste Rules 2016.

**2.6 Anticipated Health Impacts in Operation phase and Health Facilities:**

**The spillway:**

- The additional spillway is being proposed as it is anticipated that the existing spillways may not be capable to discharge the water as per the PMF. The existing staff of the Dam will operate the additional spillway.
- There is an established township at Hirakud for the employees of the Dam. The township being located about 10 km away from the project site, there is no health impact anticipated during the operation phase.
- The existing hospital facility at Hirakud will cater to the needs of the staff.
- In the operation phase of the project solid waste generated from different sources will be properly collected and disposed to maintain hygiene condition.
- No indiscriminate disposal of garbage will be allowed within the complex. Proper waste collection system shall to be maintained.
- Solid waste generated from the residential area will be separated as biodegradable and non biodegradable which will be collected and stored differently. Stored bins send to the approved agency for final disposal.
- All hazardous wastes will be disposed as per hazardous waste management and handling rules.

To ensure good health of the Workmen and local people in the area the following activities also will be looked into:

✓ **Public Awareness Program**

It is proposed that a detailed health awareness program be implemented in the project and the surrounding areas. The objectives of the program are to:

- Enhance knowledge, awareness about various diseases and actions to be taken in case of an epidemic.
- Develop community education messages to provide the community with information about recognizing the illness, how to prevent transmission and when to seek treatment.
- Initiate proper communication with the community as soon as epidemic or public health problem is identified.

As a part of the awareness program, locals should be made aware of the following measures about various commonly prevalent diseases in the area.

- Signs and symptoms of the disease
- Feasible and cost-effective preventive measures
- When to come to the health facility for consultation and treatment
- Immunization recommendations, if any.

The message should be clear and concise in local language. Special care should be taken that sentiments and cultural beliefs of the target population are not hurt. The awareness programs could use the following means of communication.

- Radio
- Television
- Newspaper
- Meeting with health personnel, community, religious and political leader.
- Posters
- Presentations at markets, health centers, schools women's & other community groups, service organizations, religious centers.

Select and use a community liaison or health staff to serve as spokesperson for interaction within media and provide information related to the epidemics

✓ **Vaccination Program:**

The borrow pits developed due to construction activities provide harboring ground water for increase of mosquito population and develop the risk of malaria, dengue and elephantiasis during rains. Proper preventive measures need be taken to maintain hygienic conditions in the area. Besides, arrangement must be made to distribute medicines and anti-malaria drugs as and required. Various vaccination program shall be arranged periodically for workmen and locals of the project site.

✓ **Health Check up of Workmen of the Project and adjoining areas:**

In spite of various mitigation measures to abate air, noise and water pollution, still health workmen and locals may be affected. Therefore, periodic health checkup need to be done. The project authorities should plan for check up of heart, lung, eye and audiometric test, existence of Communicable diseases among the work force etc.

✓ **Health Extension Activities**

The health extension activities will have to be carried out in the villages situated within the study area. It is important to inculcate hygienic habits of environmental sanitation especially with respect to water pollution by domestic wastes. There would be possibility of the transmission of communicable diseases due to migration of labor population from other areas at the construction site. It is proposed to strengthen the health institutions like community centers and primary health centers already available in these blocks. The project authorities can take the initiative and release certain funds at least for first five years to streamline the medical assistance for malaria and gastroenteritis disorders. Following medical facilities are available in the blocks.

**Medical facilities available in the locality:**

The Sambalpur Town, Hiraikud Township and Burla Township are within the approachable distance of the project site. The following Health care facilities are available in the area.

- Veer Surendra Sai Medical College & Hospital,
- Burla District Headquarters Hospital, Sambalpur
- Dr. Janardan Pujari Maternity Hospital, Sambalpur
- Area Hospital, Hiraikud, Sambalpur



PHC near by the location

- Debeipali PHC
- Chanurpur PHC
- Dhanupali PHC

The doctors from the Hospitals and Health Centers may be organized to work as a part of the command area health system and the dispensaries in various blocks will make regular visits to the villages and organize health promotional activities with the active participation of the local village leaders, NGOs and available local health functionaries. The health functionaries would undertake the following tasks as a part of health promotional activities;

- Collect water samples to ascertain the potability of water from different sources so as to monitor regular disinfection of drinking water source.
- Maintain close surveillance on incidence of communicable diseases in these villages.
- Maintain close liaison with the community leaders and health functionaries of different departments, so that they can be mobilized in case of an emergency.

However, the Directorate of Health Services under Health Department is to be consulted for suggesting a conducive Health Management Plan with physical and financial propositions for implementation. The project authorities would provide funds as a part of Corporate Social Responsibilities (CSR) program.

**Budget Estimate for Health Management Plan**

<b>Sl. No.</b>	<b>Particulars</b>
1	Free Medicine for laborers and affected people in the adjoining area
2	Periodical Health Check up of Workers and local people
3	Vaccination and immunization program
4	Spraying of insecticides to prevent spread of Malaria and other vector borne diseases
5	Expenses towards workmen getting treatment in the local hospitals.

Residential accommodation is to be provided to the essential staff in the camps. The Water Resources Department, Government of Odisha may like to seek expert opinion before selecting the appropriate insecticide for malaria control. Malaria Research Centre, Delhi can provide assistance to the district administration in this matter. The frequency of monitoring could be once in 15 days. A special van needs to be provided for this purpose. In addition, larvae eating fish species, i.e. Gambusia affine and Bermuda need to be introduced in various water bodies, so as to control the mosquito growth.

✓ **Disease Prevention**

**Communicable Diseases:**

Communicable diseases pose a significant public health threat worldwide. Health hazards typically associated with large development projects are those relating to poor sanitation and living conditions, sexual transmission and vector-borne infections. Communicable diseases of most concern during the construction phase due to labor mobility are sexually-transmitted diseases (STDs), such as HIV/AIDS. Recognizing that no single measure is likely to be effective in the long term, successful initiatives typically involve a combination of behavioral and environmental modifications has been suggested by the World Bank which are mentioned as below.

Recommended interventions at the project level include:

- Providing surveillance and active screening and treatment of workers
- Preventing illness among workers in local communities by:
  - Undertaking health awareness and education initiatives, for example, by implementing an information strategy to reinforce person-to-person counseling addressing systemic factors that can influence individual behavior as well as promoting individual protection and protecting others from infection, by encouraging condom use.
  - Training health workers in disease treatment.
  - Conducting immunization programs for workers in local communities to improve health and guard against infection.
  - Providing health services.
- Providing treatment through standard case management in on-site or community health care facilities. Ensuring ready access to medical treatment, confidentiality and appropriate care, particularly with respect to migrant workers.
- Promoting collaboration with local authorities to enhance access of worker's families and the community to public health services and promote immunization

**Vector-Borne Diseases:**

Reducing the impact of vector-borne disease on the long-term health of workers is best accomplished through implementation of diverse interventions aimed at eliminating the factors that lead to disease. Project proponent, in close collaboration with community health authorities, can implement an integrated control strategy for mosquito and other arthropod-borne diseases that might involve:

- Prevention of larval and adult propagation through sanitary improvements and elimination of breeding habitats close to human settlements.
- Elimination of unusable impounded water.
- Increase in water velocity in natural and artificial channels.
- Considering the application of residual insecticide to dormitory walls.
- Implementation of integrated vector control programs.
- Promoting use of repellents, clothing, netting, and other barriers to prevent insect bites.

## **ANNEXURE -6.7**

- Use of chemoprophylaxis drugs by non-immune workers and collaborating with public health officials to help eradicate disease.
- Monitoring and treatment of migrating populations to prevent disease spread.
- Collaboration and exchange of in-kind services with other control programs in the project area to maximize beneficial effects.
- Educating project personnel and area residents on risks, prevention, and available treatment.
- Monitoring communities during high-risk seasons to detect and treat cases.
- Distributing appropriate education materials.

**CONSTRUCTION AND LABOUR CAMPS MANAGEMENT**

**1.0 INTRODUCTION:**

The scope of this guideline pertains to the siting, development, management and restoration of construction and labourers camps to avoid or mitigate impacts on the environment. The area requirement for the construction camp shall depend upon the number of labourers employed and the extent of machinery deployed. The following sections describe the siting, construction, maintenance, provision of facilities in the camps and finally rehabilitation of the construction and labourers camps. These are described in three stages, pre-construction, construction and post-construction stage. The issues related to construction camps are similar in the case of road construction and hence have been taken together.

**2.0 PRE-CONSTRUCTION STAGE:**

Identification of site for construction and labour camps is the first task. The Contractor shall identify the site for construction camp in consultation with the individual owners in case of private lands and the concerned department in case of Government lands. The suitable sites shall be selected and finalized in consultation with the Engineer in charge. Table 1 gives the lands that could be avoided for construction camps and conversely those that could be preferred.

**Table 1: Selection Criteria for Camp site.**

<b>Avoid the following</b>	<b>Prefer the following</b>
<ul style="list-style-type: none"><li>• Lands close to habitations</li><li>• Irrigated agricultural lands.</li><li>• Lands belonging to small farmers.</li><li>• Lands under village forests. Lands within 100m of community water bodies and water sources as rivers.</li><li>• Lands within 100m of watercourses.</li><li>• Low lying lands.</li><li>• Lands supporting dense vegetation.</li><li>• Grazing lands and lands with tenure rights.</li><li>• Lands where there is no willingness of the landowner to permit its use.</li></ul>	<ul style="list-style-type: none"><li>• Waste lands.</li><li>• Waste Lands belonging to owners who look upon the temporary use as a source of income.</li><li>• Community lands or government land not used for beneficial purposes.</li><li>• Private non-irrigated lands where the owner is willing.</li><li>• Lands with an existing access road.</li></ul>

The contractor will work out arrangements for setting up his facilities during the duration of construction with the land owner/concerned department. These arrangements shall be in the form of written agreement between the contractor and the land owner (private/government) that would specify:

- a) Photograph of the proposed camp site in original condition;

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- b) Activities to be carried out in the site;
- c) Environmental mitigation measures to be undertaken to prevent land, air, water and noise pollution;
- d) Detailed layout plan for development of the construction and labourer camp that shall indicate the various structures to be constructed in the camp including temporary drainage and other facilities; and
- e) Restoration plan of camp site to previous camp conditions.

The arrangements will be verified by the Engineer in charge to enable redressal of grievances at a later stage of the project.

### **2.1 SETTING UP OF LABOUR CAMP:**

The contractor shall provide free of cost in the camp site, temporary living accommodation to all the migrant workers employed by him till completion of construction/maintenance work is in progress.

- The Contractor agency will setup their camping locations at different places as would be identified.
- Each labour camp may house 50 imported labourers.
- These camps should be located away from the existing village or semi urban households to prevent likely social conflicts.
- Necessary permissions may be obtained from the respective revenue/municipal authorities.
- Temporary house structures should be provided by the contractor agencies to accommodate the labourers and their families, with provision of minimum infrastructure facilities, like water supply, sanitation and electricity etc.
- A minimum area of 6 sq.mts per person shall be provided.
- The rooms of labourer shall be well lighted and ventilated.

**The facilities to be provided for the labourers are discussed below:**

#### **a) Drinking Water**

Towards the provision and storage of drinking water at the construction camp, the contractor shall ensure the following.

- The contractor shall provide for a continuous and sufficient supply of potable water in the camps, in earthen pots or any other suitable containers.
- If any water storage tank is provided, the bottom of the tank will be kept at least 1mt. above from the surrounding ground level.
- The contractor shall identify suitable community water sources for drinking. Only in the event of non-availability of other sources of potable water, the Contractor shall obtain water from an unprotected source only after the testing for its potability. Where water has to be drawn from an existing open

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well, the well shall be properly chlorinated before water is drawn from it for drinking. All such wells shall be entirely closed in and be provided with dust proof trap door.

- Every water supply or storage shall be at a distance of not less than 15m from any wastewater / sewage drain or other source of pollution. Water sources within 15m proximity of toilet, drain or any source of pollution will not be used as a source of drinking water in the project.
- A pump shall be fitted to covered well used as drinking water source, the trap door shall be kept locked and opened only for cleaning or inspection, which shall be done at least once a month.
- Else a new well can be constructed and a pump will be fitted to the well for drinking water purpose of the labourers at the camp.

### **b) Washing and Bathing Facilities**

In every site, adequate and suitable facilities for washing clothes and utensils shall be provided and maintained for the use of contract labor employed therein. Separate and adequate bathing shall be provided for the use of male and female workers. Such facilities shall be conveniently accessible and shall be kept in clean and hygienic conditions.

### **c) Toilets Facilities**

Each labour camp should be provided with community toilets with septic tank and soak pit arrangement. Sanitary arrangements, latrines and urinals shall be provided in every work place separately for male and female workers. The arrangements shall include:

- A latrine for every 15 labourers or part thereof.
- Every latrine shall be under cover and so partitioned as to secure privacy, and shall have a proper door and fastenings.
- Where workers of both sexes are employed, there shall be a display board of "For Men Only" or "For Women Only" outside each block of latrine and urinal in the language understood by the majority of the workers.
- The latrines and urinals shall be adequately lighted and shall be maintained in a clean sanitary condition at all times and should have a proper drainage system.
- Water shall be provided in or near the latrines and urinals by storage in suitable containers.

### **d) Supply of Free Fuel**

- These labour forces may adopt unscrupulous methods of cutting trees and bushes for meeting their fuel wood requirement which would destroy the adjacent green cover and affect the local ecology.

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- The project authorities would ensure supply of free fuel to these labourers through the contract agencies so as to prevent such unscrupulous activities.
- Arrangement may be made with the local Civil Supply Authorities for Supply of kerosene oil at a fixed quota.
- Use of LPG gas cylinders may also be encouraged for intending labourers.

The contract specification should include these fuel supplies free of cost to the labour force within the bid value of relevant contract items.

### **e) Waste Disposal**

- Disposal of sanitary wastes and excreta shall be into septic tanks.
- Kitchen waste water shall be disposed into soak pits/kitchen sump located preferably at least 15 meters from any water body. Sump capacity should be at least 1.3 times the maximum volume of wastewater discharged per day. The bottom of the pit should be filled with coarse gravel and the sides shored up with board, etc. to prevent erosion and collapse of the pit. New soak pits shall be made ready as soon as the earlier one is filled.
- Solid wastes generated in the kitchen shall be reused if recyclable or disposed off in land fill sites.
- Provide segregated garbage bins in the camps and ensure that these are regularly emptied and disposed off in a hygienic manner as per the Comprehensive Solid Waste Management Plan approved by the Environmental Expert of PMU.
- The camping area should be periodically sprayed with Bleaching powder and other disinfectants.

### **f) Medical and First Aid Facilities**

Medical facilities shall be provided to the labourers at the construction camp. Visits of doctor shall be arranged twice a month wherein routine checkups would be conducted for women and children. A separate room for medical checkups and keeping of first aid facilities should be built. The site medical room should display awareness posters on safety facilitation hygiene and HIV/AIDS awareness.

First Aid Box will be provided at every construction camp site and under the charge of a responsible person who shall always be readily available during working hours. He shall be adequately trained in administering first aid-treatment. Formal arrangement shall be prescribed to carry injured person or person suddenly taken ill to the nearest hospital.

The first aid box shall contain the following.

- 6 small sterilized dressings

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- 3 medium size sterilized dressings
- 3 large size sterilized dressings
- 3 large sterilized burns dressings
- 1 (30 ml) bottle containing 2 % alcoholic solution of iodine
- 1 (30 ml) bottle containing salvolatile
- 1 snakebite lancet
- 1 (30g) bottle of potassium permanganate crystals
- 1 pair scissors
- Ointment for burns
- A bottle of suitable surgical antiseptic solution

In case, the number of labour exceeds 50, the items in the first aid box shall be doubled.

The contract agency should arrange to carry out the following anti-malarial measures.

- Supply of mosquito nets.
- Supply of mosquito repellents to the labourers.
- Periodic cleaning of the area to destroy stagnant water pockets as well as spraying of disinfectants through health workers.
- Supply of preventative medicines to all labour force free of cost.
- Ensure imparting free treatment to the affected people through local health centres.

### **g) Provision of Shelter during Rest**

The work place shall provide four suitable sheds, two for meals and two for rest (separately for men and women). The height of the shelter shall not be less than 3.0m from the floor level to the lowest part of the roof. These shall be kept clean.

### **h) Crèches:**

In case 20 or more women workers are employed, there shall be a room of reasonable size for use of children under the age of six years. The room should have adequate light and realisation. A caretaker is to be appointed to look after the children. The use of the room shall be restricted to children, their mothers and the caretaker.

## **2.2 FIRE FIGHTING ARRANGEMENT:**

The following precautions need to be taken:

- Demarcation of area susceptible to fires with cautionary signage;
- Portable fire extinguishers and/or sand baskets shall be provided at easily accessible locations



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- in the event of fire; Contractor shall educate the workers on usage of these equipments.

### **2.3 INTERACTIONS WITH HOST COMMUNITIES:**

To ensure that there is no conflict of the migrant labor with the host communities, the contractor shall issue identity cards to labourers and residents of construction camps.

### **3.0 CONSTRUCTION STAGE:**

Construction camps shall be maintained free from litter and in hygienic condition. It should be kept free from spillage of oil, grease or bitumen. Any spillage should be cleaned immediately to avoid pollution of soil, water stored or adjacent water bodies.

The following precautions need to be taken in construction camps.

- Measures to ensure that no leaching of oil and grease into water bodies or underground water takes place.
- Wastewater should not be disposed into water bodies.
- Regular collection of solid wastes should be undertaken and should be disposed off safely.
- All consumables as the first aid equipment, cleaning equipment for maintaining hygiene and sanitation should be recouped immediately.
- The debris/scrap generated during construction of camp site should be kept in a designated and barricaded area.

The Engineer in charge will monitor the cleanliness of construction camp sites and ensure that the sites are properly maintained throughout the period of the contract.

### **4.0 POST CONSTRUCTION STAGE:**

At the completion of construction, all construction camp facilities shall be dismantled and removed from the site. The site shall be restored to a condition in no way inferior to the condition prior to commencement of the works. Various activities to be carried out for site rehabilitation include:

- Oil and fuel contaminated soil shall be removed and transported and buried in waste disposal areas.
- Soak pits, septic tanks shall be covered and effectively sealed off.
- Debris (rejected material) should be disposed off suitably
- Ramps created should be leveled.
- Underground water tank in a barren/non-agricultural land can be covered. However, in an agricultural land, the tank shall be removed.
- If the construction camp site is on an agricultural land, top soil can be spread so as to aid faster rejuvenation.

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- Proper documentation of rehabilitation site is necessary. This shall include the following: –
  - Photograph of rehabilitated site;
  - Land owner consent letter for satisfaction in measures taken for rehabilitation of site;
  - Undertaking from contractor; and Certification from Engineer in charge.

In cases, where the construction camps site is located on a private land holding, the contractor would still have to restore the campsite as per this guideline. Also, he would have to obtain a certificate for satisfaction from the landowner.

**National Ambient Air Quality Standard (as per MoEF Notification of 16 Nov., 2009)**

Sl. No.	Pollutant	Time Weighted Average	Concentration in Ambient Air		
			Industrial, residential, Rural and Other Area	Ecologically Sensitive Area	Methods of Measurement
1	Sulphur Dioxide (SO <sub>2</sub> ), µg/m <sup>3</sup>	Annual * 24 hours **	50 80	20 80	- Improved West and Gaeke - Ultraviolet fluorescence
2	Nitrogen Dioxide (NO <sub>2</sub> ), µg/m <sup>3</sup>	Annual * 24 hours **	40 80	30 80	- Modified Jacob & Hochheiser (Na-Arsenite) - Chemiluminescence
3	Particulate Matter (size < 10µm or PM <sub>10</sub> ) µg/m <sup>3</sup>	Annual * 24 hours **	60 100	60 100	- Gravimetric - TOEM - Beta attenuation
4	Particulate Matter (size < 2.5µm) or PM <sub>2.5</sub> µg/m <sup>3</sup>	Annual * 24 hours **	40 60	40 60	- Gravimetric - TOEM - Beta attenuation
5	Ozone (O <sub>3</sub> ) µg/m <sup>3</sup>	8 hours ** 1 hour **	100 180	100 180	- UV photometric - Chemiluminescence - Chemical Method
6	Lead (Pb) µg/m <sup>3</sup>	Annual * 24 hours **	0.50 1.0	0.50 1.0	- AAS/ICP method after sampling on EPM 2000 or equivalent filter paper - ED-XRF using Teflon filter
7	Carbon monoxide (CO), mg/m <sup>3</sup>	8 hours ** 1 hour **	02 04	02 04	- Non dispersive Infra Red (NDIR) spectroscopy
8	Ammonia (NH <sub>3</sub> ) µg/m <sup>3</sup>	Annual * 24 hours **	100 400	100 400	- Chemiluminescence - Indophenol blue method
9	Benzene (C <sub>6</sub> H <sub>6</sub> ) µg/m <sup>3</sup>	Annual *	05	05	- Gas chromatography based continuous analyzer - Adsorption followed by GC analysis
10	Benzo(a) Pyrene (BaP)–particulate phase only, ng/m <sup>3</sup>	Annual *	01	01	- Solvent extraction followed by HPLC/GC analysis
11	Arsenic (As), ng/m <sup>3</sup>	Annual *	06	06	- AAS/ ICP method after sampling on EMP 2000 or equivalent filter paper
12	Nickel (Ni), ng/m <sup>3</sup>	Annual *	20	20	- AAS/ ICP method after sampling on EMP 2000 or equivalent filter paper

\* Site taken twice a week 24 hourly at uniform intervals.

\*\* 24 hourly or 08 hourly or 01 hourly mentioned values, as applicable, shall be complied with 98% of the time in a year, 2% of the time; they may exceed the limits but not on two consecutive days of monitoring.

**SCHEDULE**

(see rule 3(1) and 4(1))

**NOISE STANDARD**

Area Code	Category of Area / Zone	Limits in dB(A) Leq*	
		Day Time	Night Time
(A)	Industrial area	75	70
(B)	Commercial area	65	55
(C)	Residential area	55	45
(D)	Silence Zone	50	40

- Note:-
1. Day time shall mean from 6.00 a.m. to 10.00 p.m.
  2. Night time shall mean from 10.00 p.m. to 6.00 a.m.
  3. Silence zone is an area comprising not less than 100 metres around hospitals, educational institutions, courts, religious places or any other area which is declared as such by the competent authority
  4. Mixed categories of areas may be declared as one of the four above mentioned categories by the competent authority.

\* dB(A) Leq denotes the time weighted average of the level of sound in decibels on scale A which is relatable to human hearing.

A "decibel" is a unit in which noise is measured.

"A", in dB(A) Leq, denotes the frequency weighting in the measurement of noise and corresponds to frequency response characteristics of the human ear.

Leq: It is an energy mean of the noise level over a specified period.

**PHYSICO-CHEMICAL PARAMETERS OF GROUND WATER SAMPLES**

Sl. No.	Test parameters	Unit	Norms as per IS: 10500-2012	
			Acceptable Limit	Permissible Limit
1	Colour	Hazen	5	15
2	Odour	-	AL	AL
3	Taste	-	AL	--
4	Turbidity	NTU	1	5
5	pH Value @ 25°C	-	6.5-8.5	No Relaxation
6	Total Hardness (as CaCO <sub>3</sub> )	mg/l	200	600
7	Iron (as Fe)	mg/l	0.3	No Relaxation
8	Chloride (as Cl)	mg/l	250	1000
9	Total Dissolved Solids	mg/l	500	2000
10	Calcium (as Ca)	mg/l	75	200
11	Magnesium (as Mg)	mg/l	30	100
12	Copper (as Cu)	mg/l	0.05	1.5
13	Manganese (as Mn)	mg/l	0.1	0.3
14	Sulphate (as SO <sub>4</sub> )	mg/l	200	400
15	Nitrate (as NO <sub>3</sub> )	mg/l	45	No Relaxation
16	Fluoride (as F)	mg/l	1.0	1.5
17	Phenolic Compounds (as C <sub>6</sub> H <sub>5</sub> OH)	mg/l	0.001	0.002
18	Mercury (as Hg)	mg/l	0.001	No Relaxation
19	Cadmium (as Cd)	mg/l	0.003	No Relaxation
20	Selenium (as Se)	mg/l	0.01	No Relaxation
21	Arsenic (as As)	mg/l	0.01	0.005
22	Cyanide (as CN)	mg/l	0.05	No Relaxation
23	Lead (as Pb)	mg/l	0.01	No Relaxation
24	Zinc (as Zn)	mg/l	5	15.0
25	Total Chromium (as Cr)	mg/l	0.05	No Relaxation
26	Total Alkalinity as (CaCO <sub>3</sub> )	mg/l	200	600
27	Aluminium (as Al)	mg/l	0.03	0.2
28	Boron (as B)	mg/l	0.5	1.0

NB: CL-Colourless, AL-Agreeable

**PHYSICO-CHEMICAL PARAMETERS OF SURFACE WATER SAMPLES**

<b>Sl. No.</b>	<b>Test Parameters</b>	<b>Unit</b>	<b>Max. Tolerance Limit as per IS 2296 : Class C</b>
1	Colour, Max.	Hazen	300
2	pH value @ 25°C	-	6.5 to 8.5
3	Iron as Fe, Max.	mg/l	50
4	Chloride as Cl, Max.	mg/l	600
5	Total Dissolved Solids, Max.	mg/l	1500
6	Dissolved Oxygen, Min.	mg/l	4
7	BOD for 3 days at 27°C, Max.	mg/l	3
8	Oil & Grease, Max.	mg/l	0.1
9	Copper as Cu, Max.	mg/l	1.5
10	Sulphate as SO <sub>4</sub> , Max.	mg/l	400
11	Nitrate as NO <sub>3</sub> , Max.	mg/l	50
12	Fluoride as F, Max.	mg/l	1.5
13	Anionic detergent	mg/l	1
14	Cadmium as Cd, Max.	mg/l	0.01
15	Selenium as Se, Max.	mg/l	0.05
16	Arsenic as As, Max.	mg/l	0.2
17	Cyanide as CN, Max.	mg/l	0.05
18	Phenolic compound as C <sub>6</sub> H <sub>5</sub> OH, Max.	mg/l	0.005
19	Lead as Pb, Max.	mg/l	0.1
20	Zinc as Zn, Max.	mg/l	15
21	Hexavalent Chromium as Cr <sup>+6</sup> , Max.	mg/l	0.05
22	Total Coliform, Max.	MPN/ 100ml	5000

**MUCK DUMPING & ITS MANAGEMENT**

**1. INTRODUCTION:**

Muck will be generated from the digging of spill way and demolition of social infrastructures like houses, temples, schools, etc. Deposition of these mucks can cause serious adverse environmental impacts. The scope of this guideline includes measures that are required during project planning and design stage, preconstruction, construction stage and post construction stage.

**2. IDENTIFICATION OF THE DUMPING AREAS:**

Specific locations of muck dumping areas will be identified by contractor. The selection and recommendations of dumping area will be based on environmental as well as engineering & social considerations. The dumping shall not be carried out in cultivable lands, unless and until, it shall be agreed upon by the engineer that there is no suitable uncultivable land in the vicinity for dumping or private landowners are willing to allow dumping on their fields.

**Dumping Area Identification:**

- Identify areas having present land use as barren land, away from river front;
- dumping area should not interfere with any natural drainage system;
- Prefer areas of lowland with respect to surroundings;
- Avoid locating dump area too close to any road (maintain at least 15m distance from ROW and 10m from toe of embankment, whichever is higher);
- Should be at least 1.0 km away from inhabited areas, school, hospital and any archaeological sites;
- Having adequate approach road with minimum length of earthen road;
- the dumping surface should preferably hard & rocky;
- Prior approval of Dump Management Plan considering terrain, land use and local need;

**3. DUMPING OF MUCKS AND ITS MANAGEMENT**

The useful material generated from demolition will be utilized for construction of housed for displaced person at their own cost. Balance surplus material will be carefully disposed in dumping area which will be about 20% of the demolition muck.

The type of material to be generated due to excavation and cutting will be mainly soil and rocks. The total quantity of excavated materials including all kind of soil and rocks has been estimated as 3755050 Cum. Out of this quantity about 1641830 Cum will be utilized for construction and allied activities, 1963220 Cum of the excavated materials will be utilised for landscaping along the spill channel to raise the ground level matching with the embankment to avoid water logging and the balance unutilised quantity of about 150000 cum will be required to dump at suitable dumping area.

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So the Muck generated from the digging of spill way and demolition will be dumped in the ear marked dumping area. Following steps will be practiced while dumping mucks and maintaining it;

- Precautionary measures such as the covering of vehicles will be taken to avoid spillage & dust generation during transport of mucks.
- Retaining wall of 1m height & 0.5m width followed by garland drain of 1m width and 0.5m depth will be provided around the proposed dumps.
- The contractor will construct at least 2 no. of settling tanks in suitable locations and also connected with the garland drain to arrest the soil that comes during rains despite the above measures.
- The settled water should be used in construction activity and plantation.
- To ensure that the spills, which might result from the transport of muck materials do not impact the environment, it will be ensured that the carrying of muck will be done during day time only.
- Workers / labourers shall be provided with PPE. The use of PPE at all time during works will be ensured.
- The ultimate dump slope to be maintained around 28°.
- The dump edge will be covered with bund. A garland drain will be constructed adjacent to proposed dump, following the contour & different terrace will be connected to the catch drain. The drainage pattern should be such that the runoff will be channelized to the catch drain before releasing to the garland drain outside the periphery of dump. Catch drain preferably to be made up of half concrete with number of cemented stairs to check the heavy flow off of water as well as to reduce gully formation due to constant run off.

Dumping area should be rehabilitated immediately after completion of dumping of materials to the satisfactions of the land owner and the Engineer. The Contractor should provide completion certificate of proper management of each dump issued by the land owner, if required.

The methods to be adopted for stabilization of dumps are as follows:

- **Vegetative /Biological Measures :**
  - a. Undertaking Plantation will be done on the dump surface, broadcasting of seeds of *Stylo hamata* etc.
- **Bio-engineering Measures :**
  - a. Coir matting followed by grass plantation
- **Structural measures :**
  - a. Terracing of slopes, plugging of gullies by construction of catch drain
  - b. Construction of Garland drains, Check dam, Settling tank,



**3.1 Vegetative /Biological Measures**

Taking into consideration the site specific soil condition, indigenous species growing naturally are proposed to be planted. The topsoil to be encountered during mining of earth material will be spread over during plantation on muck & spill dump areas. Prior to that broadcast grass seeds on the slope of terrace to bind the soil. It is also proposed to plant hardy species such as Agave, Pongamia, Neem as they can survive in degraded and poor soils along the slope & toe of dump and prove to be most useful for controlling soil erosion.

**3.2 Bio-Engineering Measures**

Bio-engineering approach is proposed to be adopted with a view to retain loose spoils/ fines being transported from various waste /fines dumps to the water course. Muck spoils are typically devoid of organic matter and the micro-flora count is not very conducive for plant. So in spite of plantation, survival and growth is observed to be very less. To combat this problem, actions are needed to supplement the organic carbon need and at the same time develop a micro eco-system with organisms tolerant to harsh environment. These requirements can be fulfilled by coir matting followed by grass/herbs plantation.

**3.3 Structural Measures**

Wash offs and rolling down of excavated materials from the dump slopes give way to slope failures and the dumps become unstable. Hence structural measures like construction of Catch drain, Garland drain, Check dam, Settling tank, Loose boulder structure etc. should be adopted for prevention of wash offs and to arrest excavated material from OB dump.

**4. CHECKLIST FOR INSPECTION OF REHABILITATED DUMP**

Inspection needs to be carried out by the Engineer in charge for overseeing the rehabilitation of dump as per the plan. The checklist for the inspection by the Engineer in charge is given below;

- Compliance of dumping activities and land use with the restoration plan;
- Drainage measures taken for flow of rain water from drain and its collection in settling pond;
- Leveling the dump slop and green coverage
- Condition of the dumped area in comparison with the pre-dumping conditions & its surrounding landscapes.