

**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 to 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>[1]</sup><sub>SEP</sub>**

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 viz., (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 thorough 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 Cofferdam**

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 arunachalnensis*) 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**

| <b>Season</b>   | <b>Average flow<br/>(m<sup>3</sup>/s)</b> | <b>% of flow</b> | <b>Average E-flow<br/>(m<sup>3</sup>/s)</b> |
|---|---|------------------|---|
| Lean Season<br>(December-March)                           | 4.23                                      | 20               | <b>0.85</b>                                 |
| Non-monsoon/Non-lean<br>(October-November &<br>April-May) | 28.8 & 24.43                              | 25               | 7.20 & 6.11                                 |
| Monsoon<br>(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-1 Emergency   | Rises above E. 470 MASL but flood discharge <9,970 cumec  | (1) All gates fully operational<br>(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<br>(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 paise 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<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**

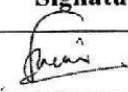


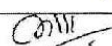
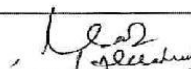
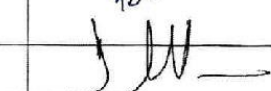

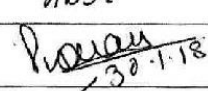
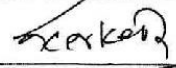
As there being no agenda item left, the meeting ended with a vote of thanks to the Chair.

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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,<br>Chairman              |    |
| 2.     | Shri. T. P. Singh<br>Member                       | Abs   |
| 3.     | Shri. Sharvan Kumar,<br>Member                    |   |
| 4.     | Shri N. N. Rai,<br>Member                         |   |
| 5.     | Dr. J.A.Johnson,<br>Member                        | Abs   |
| 6.     | Dr. B. K. Das/ Dr. AK Sahoo<br>Member             |  ,  |
| 7.     | Dr. Vijay Kumar,<br>Member                        | Abs   |
| 8.     | Prof. Govind Chakrapani,<br>Member                | Abs   |
| 9.     | Dr. Chetan Pandit,<br>Member                      |   |
| 10.    | Dr. Dinkar Madhavrao More,<br>Member              |   |
| 11.    | Dr. R. Vasudeva,<br>Member                        | Abs   |
| 12.    | Prof. S.R. Yadav,<br>Member                       | Abs.  |
| 13.    | Dr. Jai Prakash Shukla,<br>Member                 | Abs.  |
| 14.    | Dr. Poonam Kumria<br>Member                       | <br>30-1-18   |
| 15.    | Dr. Kerketta, Member Secretary<br>Director (IA-1) | <br>30/1/2018   |

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

Date: 02/19/18 08:15 AM

To: Dr S Kerketta <s.kerketta66@gov.in>,  
Dnkmore <dnkmore@yahoo.co.in>

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

Cc: S Kerketta <suna1466@rediffmail.com>

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

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

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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)