

**Minutes of the 68<sup>th</sup> Meeting of the Expert Appraisal Committee for River Valley and Hydroelectric Projects constituted under the provisions of EIA Notification 2006, held on 23<sup>rd</sup>- 24<sup>th</sup> September, 2013 at SCOPE Complex, New Delhi.**

The 1<sup>st</sup> Meeting of the Expert Appraisal Committee (EAC) for River Valley and Hydropower Projects was held during 23<sup>rd</sup> -24<sup>th</sup> September, 2013 at SCOPE Convention Centre, Opposite Jawaharlal Nehru Stadium, New Delhi. The meeting was chaired by Shri. Alok Perti, Chairman, EAC. Shri C. Achalender Reddy, Member, EAC could not attend the meeting due to pre-occupation. The list of EAC Members and officials/consultants associated with various projects who attended the meeting is annexed herewith.

The following Agenda items were taken-up in that order for discussions:-

**1<sup>st</sup> Day (23.9.2013)**

1. **Agenda Item No.1** : Welcome by Chairman and Confirmation of Minutes of the 67<sup>th</sup> EAC Meeting held on 6<sup>th</sup> June, 2013.

The Director (MoEF) & Member Secretary of newly constituted EAC welcomed the Chairman and members. All the members introduced themselves.

The minutes of the meeting of the 67<sup>th</sup> EAC Meeting held on 6<sup>th</sup> June, 2013 was confirmed. Thereafter, main agenda items were taken up for discussion.

2. **Agenda Item No.2** : Consideration of Project proposals for Scoping and Environmental Clearance.

The following project proposals were considered:

**Agenda Item No. 2.1 Rolep HEP (72 MW) in East Sikkim in Distt. Of Sikkim by Velankini Renewable Energy Pvt. Ltd.– For reconsideration of TOR.**

The project proponent made a detailed presentation on the project. This project was earlier considered by EAC in its meeting held on 1-2<sup>nd</sup> February, 2013. The committee noted that the environmental clearance (EC) to Rolep HEP (36 MW) in Sikkim was accorded on 25.2.2004. As no construction work was started even after 5 years, EC was cancelled in March 2009, as per provision of EIA Notification 1994 (the environmental Clearance was valid for 5 years for commencement of the work).

The project envisages construction of a 45 m high concrete gravity dam across Rangpo river (a tributary of Teesta River near Rolep village in East Sikkim District of Sikkim to generate 63 MW of hydropower. This is a run-of-the-river scheme. Total land requirement is about 37.52 ha, out of which 12.12 ha is forest land 25.4 ha is private land. Total catchment area is 183 Sq.km. Total submergence area is 3.85 ha. A surface

powerhouse is proposed on the left bank of the river with 3 units of 21 MW each. Six (6) numbers of households are likely to be affected due to this project. Total estimated project cost is about Rs. 630 Crores.

The project was earlier discussed in 64<sup>th</sup> EAC meeting held on 1<sup>st</sup>-2<sup>nd</sup> February 2013 and the observations of the committee sought information on the following:

- **Neora valley National Park in West Bengal is 15 km away, as stated under Environmental sensitivity (III). However boundary of West Bengal is indicated 18 km. In a scaled map the distance of the National Park from project site should be shown. The protected areas of Sikkim (Pangolakha and Kyongnosla WLS) which are 5-6 km from the project components have been completely overlooked. It is suggested that a map duly authenticated by the forest department showing the Sanctuary/National Park boundaries and the project components indicating the distance between them may be provided.**
- **The distance between TWL of Rolep HEP and FRL of downstream project Chuzachen HEP is about 500 m. A minimum distance of 1 km should be maintained between 2 projects in order to have free flow of river**
- **Only 1-season EIA data has been proposed instead of the standard 3-season EIA data**
- **The reason for a drastic difference between the 5- year average values and the values in the year 2000 is not clear. The proponent is to clarify as to which data may apply to the Rolep HEP in view of the design discharge of 25.6 m<sup>3</sup>/s (Page 7).**
- **It is also to be clarified, if there are other HEPs on the Rolep stream and on Rongpo chu that may have a cumulative effect on the river flow.**

**FORM 1:**

**(I) Basic Information**

- **Land Use/Land Cover -details of Private land as to whether it is Agriculture or Forest land and give FCC of the Project area in support of land cover are to be provided**
  - **1.30: It should be "YES" as forest will be affected. Include - Creation of reservoir of 26.5 ha due to submergence will be a new land use. This is to be verified.**
- (iii) A Location Map of Rolep HEP to be given**

**PFR:**

- (i) Details of Reservoir area and length are to be given**
- (ii) Detailed Location Map showing Forests – Protected area/WL Sanctuary/ National Park, etc are to be given**
- (iii) Terrestrial Ecology: Biotic Environment - Vegetation Cover – Powerhouse Site, Dam Site: The description given is not proper and without any scientific details. Proper scientific names of trees/ plants are to be given without any spelling mistakes in the names of Ferns.**

**Proposed TOR:**

- **Standard TOR for hydropower projects should be followed and the proposed TOR**

**General:**

- **The project documents are not prepared properly. The committee mentioned that the documents should have been prepared in an ordinary A4 size bond paper instead of this costly paper with all the details of the project components in order to get a clear picture of the project. The committee requested the project proponent taking the above comments into consideration, the form -1 and the project details are to be revised and submitted to Ministry for consideration during the next EAC meeting.**

- ***The committee has also noted that a legal issue has been brought to the notice of EAC about allotment of these 3 projects in Sikkim to M/s Velankani Energy Pvt. Ltd. The project proponent should ascertain that these projects have been allocated to them by Government of Sikkim. The Committee also observed that the Ministry may also write to Government of Sikkim for clarification on these projects about the allottee and status***

The project proponent gave a presentation before the EAC submitting details. The following emerged from the presentation:

The project proponent presented a detailed map authenticated by Forest Department, Government of Sikkim. It was clarified that the distance of Pangolakha Wildlife Sanctuary is 6.6 Km from dam site and 6.1 Km from powerhouse & distance of Kyongnosla Wildlife Sanctuary is 10 Km from dam site and 11.8 Km from powerhouse.

Details on hydrology were presented and daily discharge rainfall data (Jan- May) in Rangpo Chu at Rolep just downstream of the dam site for 5 years from 1991 to 1995 (gauged by Sikkim Government), daily discharge in Rangpo Chu at Rangpo Bridge for 15 years (1974 to 1977, 1979 to 1984 & 1990 to 1994) and daily discharge in Teesta river at Chungthang for 30 years (1980 to 2008 & 2011) were taken into consideration for water availability. Using 15 years Rangpo Bridge data & 19 years data derived from correlation with Teesta discharge at Chungthang and then transposed to Rolep dam site on proportionate catchment area basis.

The net head available for the project is estimated at 315 m after accounting for all losses at different components. As per MoEF guidelines, a minimum discharge of 30% during monsoon season and a minimum discharge of 20-30% during non-monsoon/non-lean months from the dam site for environmental purpose, the energy potential in 90% dependable year (which is the year 2000) have been calculated and the capacity has been fixed at 63 MW. The annual energy in the 90% dependable year works out to be 241.59 MU.

The project proponent has presented the L-Section of the drawing indicating shifting of powerhouse location maintaining a minimum distance of 1 Km of downstream project. The distance between the powerhouse of Rolep project and GATI dam is about 1.360 Km.

The EAC observed that hydrology and other related matters like optimal capacity will be examined by CWC/CEA. However, the project proponent must take into consideration release of environmental flow to calculate capacity of the project and if needed, should be revised.

As discussed during the 64<sup>th</sup> EAC meeting, the committee desired to know about the legal status of the project as the Chariman and Members & MoEF received a representation from M/s. Amalgamated Transpower (India) Ltd. The committee was informed that as per the minutes of the 64<sup>th</sup> EAC meeting, the MoEF has written a letter to Energy and Power Department, Government of Sikkim to inform the bona-fide allottee of 3 hydropower projects viz. Rolep, Ralong & Chakung Chu. The Government of Sikkim vide letter dated 7.5.2013 informed the Ministry of Environment & Forests that the letter

of intent for allotment of the projects has been bonafidely issued to M/s. Velankani Renewable Energy Pvt. Ltd and proposals submitted by them could be considered by the MoEF.

After detailed examination and scrutiny, the committee recommended the project for granting scoping clearance and approved the TOR with the following additional TORs:

- (i) The additional TORs specified/mentioned during 64<sup>th</sup> EAC meeting to be included in the revised TOR.
- (ii) A table of 10 daily water discharges in 90% dependable year showing the intercepted discharge at the dam, the environmental and other flow releases downstream of the dam and spill are to be provided in hydrology section of EIA.
- (iii) A site-specific study to be carried-out for establishing the proper environmental flow release during monsoon, non-monsoon and lean months. Environmental flow must mimic the pre-dam flow pattern of the river for sustaining the aquatic bio-diversity together with downstream user need and accordingly, water withdrawal for power generation is to be regulated. Minimum environmental flow release would be 20% of average of four months of lean period and 25% of flows during non-lean non-monsoon period corresponding to 90% Dependable year. The cumulative flow releases including spillage during monsoon period should be 30% of the cumulative inflows during the monsoon period corresponding to 90% dependable year.
- (iv) To include observed flow at G&D site, rainfall data and intermediate catchment mapping along with its contribution in EIA report.
- (v) Biodiversity study is to be carried-out by associating a reputed organization to be recommended either by WII, Dehradun or by ICFRE, Dehradun.
- (vi) Cumulative impact of upstream/downstream project is to be taken into account, if any.
- (vii) North-Eastern region is very rich in Biodiversity. A detailed study needs to be undertaken and detailed Biodiversity Conservation & Management Plan should be framed in **EMP**
- (viii) A detailed socio-economic study should be conducted with respect to cultural aspects of the region.
- (ix) **Dam Break Analysis and Disaster Management Plan:** The outputs of Dam Break Model should be illustrated with appropriate graphs and maps clearly bringing out the impact of Dam break scenario. Provision for early warning systems should be provided.
- (x) The Resettlement & Rehabilitation plan should as per the latest norms and R&R Plan, 2007 should be followed. The committee also suggested that the

project proponent should also keep in mind the land reforms act of Government of India, if it is enacted in R&R Plan. Empowerment of local community in the project activities should be ensured.

- (xi) Road construction outside the project, if any, wherein the forest land/private land/agricultural land involved, a separate clearance should have to be obtained from the concerned authorities as per the norms/rules.
- (xii) The proposed project falls within the boundary of Pangolakha Wildlife Sanctuary is 6.6. Km from dam site and 6.1 Km from powerhouse & distance of Kyongnosla Wildlife Sanctuary is 10 Km from dam site and 11.8 Km from powerhouse, and clearance from Standing Committee of NBWL to be obtained, if required.
- (xiii) The Scoping/TOR Clearance is being considered by MoEF subject to the outcome of the Arbitration involving the project and court order, if any, and the project proponent shall be bound by the decision of the MoEF arising out of such outcome of Arbitration/court order.

The representation of SANDRP on minimum free flow stretch and existence of National Park/Sanctuary were also discussed. The project proponent informed that they have ensured a minimum free flow stretch of 1 km by suitably shifting the power house towards upstream and permission of Standing Committee of NBWL shall be obtained by them.

The committee recommended the Scoping/TOR Clearance be subject to above condition and adherence/outcome of the arbitration/decision of the court.

**Agenda Item No. 2.2 Relong HEP in East Sikkim District, Sikkim by M/s. Velankini Renewable Energy Pvt. Ltd. – For reconsideration of TOR.**

The project proponent made a detailed presentation on the project. This project was earlier considered by the EAC in its meetings held on 27-28<sup>th</sup> April, 2012 & 2-3<sup>rd</sup> February, 2013.

The project envisages construction of 54 m high concrete gravity dam across Rangit river (a tributary to Teesta River) near Relong village in South Sikkim District of Sikkim to generate 126 MW of hydropower. This is a run-of-the-river scheme. Total land requirement is about 53.03 ha. Out of which 14.81 ha is forest land 38.22 ha is private land. Total catchment area is 305 Sq.km. Total submergence area is 4.7 ha. A surface powerhouse is proposed on the left bank of the river with 3 units of 43 MW each. The total estimates project cost is about Rs. 1260 Crores.

The project was earlier discussed in 57<sup>th</sup> EAC meeting held on 27-28<sup>th</sup> April, 2012 and 64<sup>th</sup> EAC meeting held on 1<sup>st</sup>-2<sup>nd</sup> Feb 2013 and the committee sought information on the following:

- (i) ***The project capacity was decided based on only 3 years water data. Water data at the project site from the existing projects in the upstream and downstream may be collected for a period of 20 years and project optimization may be carried out based on this data. Rainfall data may also be collected for the catchment area of each project for a period of 20 years.***
- (ii) ***L-section of Rangit River and Chakungchu stream showing locations of allotted and completed hydro electric projects and giving FRL, TWL elevations as well as the clear river flow distance between contiguous projects may be provided. If relevant information for all the projects is not available, the information pertaining to Ralong and Chakungchu projects and immediately U/S and D/s projects may be provided.***
- (iii) ***Muck dumping sites should be selected at least 30 m away from the HFL of the river/ stream and details shall be shown including location, quantity of muck to be disposed off vis-a-vis the total area for dumping.***
- (iv) ***The land requirement shall be given in hectares. The type and nature of land required for each component of the project may be indicated as per the Land use pattern. The land required for Dam seating and submergence should be highlighted separately.***
- (v) ***The dam structure and intake may be provided with vertical gates including sluice gates for flushing the silt.***
- (vi) ***Dam break analysis shall be made and included in the detailed project report.***
- (vii) ***During monsoon season, 30% of the flow and during lean period, a minimum of 20% of the flow needs to be discharged into the river therefore power potential and annual energy generation may be calculated based on the balance quantity of water.***
- (viii) ***A Table of 10-daily discharges in the 90% dependable year showing the intercepted discharge at the dam, the environmental and other flow releases D/S to the dam and spill may be provided.***
- (ix) ***In the dam construction Spillway crest is 31 m above bed, the space below spillway will be filled soon with bed load since flushing arrangement is not there. It will be desirable to provide a breast wall with bottom sluices for passing flood as well as sediments. This may be explored.***
- (x) ***MDDL may be recalculated to meet storage requirement due to seasonal flow variation. Without flushing, storage will be filled up soon. Sediment study (Bed and suspended loads) should be made to find life of reservoir.***
- (xi) ***The project proponent requested the committee to postpone to the next EAC meeting due to health ground. Therefore, the Committee has not considered the proposal on 1-2<sup>nd</sup> February, 2013. However, the information provided in earlier presentation regarding presence of protected areas (sanctuaries and national parks) within 15 km from project components seems to be incorrect. The proponent is required to provide a map duly authenticated by the forest department showing the Wildlife Sanctuary/National Park boundaries and the project components indicating the distance between them.***

The project proponent presented a detailed map authenticated by Forest Department, Government of Sikkim. It was clarified that the approximate distance of Kangchendzonga Biosphere Reserve is 4.05 Km from dam site and 7.05 Km from powerhouse & approximate distance of Maenam Wildlife Sanctuary is 1.8 Km from dam site and 3.6 Km from powerhouse. Three (3) Archaeological important places viz. Ralang Monastery (about 5 Km); Tashiding Monastery (about 5 Km) and Pemayangtse Monastery (about 9 Km) are also present within 10 Km radius of the project.

Details on hydrology were presented and daily discharge rainfall data (June 2011-July 2012) in Ralong Station and daily rainfall data Tadong for 29 years (1983 to 2011) were taken into consideration for water availability. 10 daily discharge data of Rangir River at Ralong gauge site just downstream of proposed dam site for 8 years from 1991 to 1997 and 2000 to 2001 and data derived from correlation with Teesta discharge at Chungthang and then transposed to Ralong flow at dam site on catchment area proportionate basis.

The net head available for the project is estimated at 235 m after accounting for all losses at different components. As per MoEF guidelines, a minimum discharge of 30% during monsoon season and a minimum discharge of 20-30% during non-monsoon/non-lean months from the dam site for environmental purpose, the energy potential in 90% dependable year (which is the year 1999) have been calculated and the capacity has been fixed at 126 MW. The annual energy in the 90% dependable year works out to be 521.62 MU.

The project proponent has presented the L-Section of the drawing indicating the upstream/downstream projects maintaining a minimum distance of 1 Km of downstream project. The distance between the proposed Ralong project to the tailrace of upstream Sada Mangder HEP (71 MW) project is 1.08 Km and distance between tailrace downstream NHPC Rangit-III HEP (60 MW) project diversion structure is about 1.650 Km.

The EAC observed that hydrology and other related matters like optimal capacity will be examined by CWC/CEA. However, the project proponent must take into consideration release of environmental flow to calculate capacity of the project and if need, to be revised.

As discussed during the 64<sup>th</sup> EAC meeting, the committee desired to know about the legal status of the project as the Chariman and Members & MoEF received a representation from M/s. Amalgamated Transpower (India) Ltd. The committee was informed that as per the minutes of the 64<sup>th</sup> EAC meeting, the MoEF has written a letter to Energy and Power Department, Government of Sikkim to inform the bon-fide allottee of 3 hydropower projects viz. Rolep, Ralong & Chakung Chu. The Government of Sikkim vide letter dated 7.5.2013 informed the Ministry that the letter of intent for allotment of the projects has been bonafidely issued to M/s. Velankani Renewable Energy Pvt. Ltd and proposals submitted by them could be considered by the MoEF.

After detailed examination and scrutiny, the committee recommended the project for granting scoping clearance and approved the TOR with the following additional TORs:

- (i) The Muck disposal sites should be selected at-least 30 m away from the HFL of the river/stream and details shall be shown including location, quantity of muck to be disposed off vis-à-vis the total area for dumping.

- (ii) In the dam construction spillway crest is 31 m above bed, the space below spill way will be filled soon with bed load since flushing arrangement is not there. It will be desirable to provide a breast wall with bottom sluices for passing flood as well as sediments. This may be explored.
- (iii) The dam structure and intake be provided with vertical gates including sluice gates for flushing the silt.
- (iv) Sedimentation study (Bed and suspended loads) should be made to find life of the reservoir.
- (v) A table of 10 daily water discharges in 90% dependable year showing the intercepted discharge at the dam, the environmental and other flow releases downstream of the dam and spill are to be provided in hydrology in the EIA.
- (vi) A site-specific study to be carried-out for establishing the proper environmental flow release during monsoon, non-monsoon and lean months. Environmental flow must mimic the pre-dam flow pattern of the river for sustaining the aquatic bio-diversity together with downstream user need and accordingly, water withdrawal for power generation is to be regulated. Minimum environmental flow release would be 20% of average of four months of lean period and 25% of flows during non-lean non-monsoon period corresponding to 90% Dependable year. The cumulative flow releases including spillage during monsoon period should be 30% of the cumulative inflows during the monsoon period corresponding to 90% dependable year.
- (vii) To include observed flow at G&D site, rainfall data and intermediate catchment mapping along with its contribution in EIA report.
- (viii) Biodiversity study is to be carried-out by associating a reputed organization to be recommended either by WII, Dehradun or by ICFRE, Dehradun.
- (ix) Cumulative impact of upstream/downstream project is to be taken into account, if any.
- (x) North-Eastern region is very rich in Biodiversity. A detailed study needs to be undertaken and detailed Biodiversity Conservation & Management Plan should be made in **EMP**.
- (xi) A detailed Socio-economic study should be conducted with respect to cultural aspects of the region.
- (xii) **Dam Break Analysis and Disaster Management Plan:** The outputs of Dam Break Model should be illustrated with appropriate graphs and maps clearly bringing out the impact of Dam break scenario. Provision for early warning systems should be provided.
- (xiii) The Resettlement & Rehabilitation plan should as per the latest norms and R&R Plan, 2007 should be followed. The committee also suggested that the project proponent should also keep in mind the land reforms act of

Government of India, if it is enacted in R&R Plan. Empowerment of local community in the project activities should be ensured.

- (xiv) Road construction outside the project, if any, wherein the forest land/private land/agricultural land involved, a separate clearance should have to be obtained from the concerned authorities as per the norms/rules.
- (xv) The Kangchendzonga Biosphere Reserve is at a distance of 4.05 Km from the proposed dam site and 7.05 Km from powerhouse & Maenam Wildlife Sanctuary is 1.8 Km from the proposed dam site and 3.6 Km from powerhouse and clearance from Standing Committee of NBWL to be obtained, if required.
- (xvi) As three (3) Archaeological important places viz. Ralang Monastery (about 5 Km); Tashiding Monastery (about 5 Km) and Pemayangtse Monastery (about 9 Km) are also present within 10 Km radius of the project, it may be ascertained if permission would be required from the Authorities concerned.
- (xvii) The Scoping/TOR Clearance is being considered by the Ministry subject to the outcome of the Arbitration involving the project and court order, if any, and the project proponent shall be bound by the decision of the MoEF arising out of such outcome of Arbitration/court order.

The representation of SANDRP on minimum free flow stretch and existence of National Park/Sanctuary were also discussed. The project proponent informed that they have ensured a free flow stretch of minimum 1 km suitably and permission of Standing Committee of NBWL would be obtained by them.

The committee recommended the Scoping/TOR Clearance subject to above condition and adherence/outcome of the arbitration/decision of the court, if any.

**Agenda Item No. 2.3 Chakung Chu HEP in North Sikkim District, Sikkim by M/s. Velankini Renewable Energy Pvt. Ltd. – For reconsideration of TOR.**

The project proponent made a detailed presentation on the project. This project was earlier considered by the EAC in its meetings held on 27-28<sup>th</sup> April, 2012 & 2-3<sup>rd</sup> February, 2013.

The project envisages construction of 43 m high concrete gravity dam across Chakung Chu stream (a major tributary to Teesta River) about 2 Km from Tong Village in North Sikkim District of Sikkim to generate 96 MW of hydropower. This is run-of-the-river scheme. Total land requirement is about 47.15 ha. Out of which 30.63 ha is forest land 16.52 ha is private land. Total catchment area is 90 Sq.km. Total submergence area is 3.95 ha. A surface powerhouse is proposed on the left bank of the river with 3 units of 32 MW each. The total estimates project cost is about Rs. 960 Crores.

The project was earlier discussed in 57<sup>th</sup> EAC meeting held on 27-28<sup>th</sup> April, 2012 and 64<sup>th</sup> EAC meeting held on 1<sup>st</sup>-2<sup>nd</sup> Feb 2013 and the committee information on the following:

- (i) ***The project capacity was decided based on only 3 years water data. Water data at the project site from the existing projects in the upstream and downstream may be collected for a period of 20 years and project optimization may be carried out based on this data. Rainfall data may also be collected for the catchment area of each project for a period of 20 years.***
- (ii) ***L-section of Rangit River and Chakungchu stream showing locations of allotted and completed hydro electric projects and giving FRL, TWL elevations as well as the clear river flow distance between contiguous projects may be provided. If relevant information for all the projects is not available, the information pertaining to Ralong and Chakungchu projects and immediately U/S and D/s projects may be provided.***
- (iii) ***Muck dumping sites should be selected at least 30 m away from the HFL of the river/ stream and details shall be shown including location, quantity of muck to be disposed off vis-a-vis the total area for dumping.***
- (iv) ***The land requirement shall be given in hectares. The type and nature of land required for each component of the project may be indicated as per the Land use pattern. The land required for Dam seating and submergence should be highlighted separately.***
- (v) ***The dam structure and intake may be provided with vertical gates including sluice gates for flushing the silt.***
- (vi) ***Dam break analysis shall be made and included in the detailed project report.***
- (vii) ***During monsoon season, 30% of the flow and during lean period, a minimum of 20% of the flow needs to be discharged into the river therefore power potential and annual energy generation may be calculated based on the balance quantity of water.***
- (viii) ***A Table of 10-daily discharges in the 90% dependable year showing the intercepted discharge at the dam, the environmental and other flow releases D/S to the dam and spill may be provided.***
- (ix) ***In the dam construction Spillway crest is 31 m above bed, the space below spillway will be filled soon with bed load since flushing arrangement is not there. It will be desirable to provide a breast wall with bottom sluices for passing flood as well as sediments. This may be explored.***
- (x) ***MDDL may be recalculated to meet storage requirement due to seasonal flow variation. Without flushing, storage will be filled up soon. Sediment study (Bed and suspended loads) should be made to find life of reservoir.***
- (xi) ***The project proponent requested the committee to postpone to the next EAC meeting due to health ground. Therefore, the Committee has not considered the proposal on 1-2<sup>nd</sup> February, 2013. However, the information provided in earlier presentation regarding presence of protected areas (sanctuaries and national parks) within 15 km from project components seems to be incorrect. The proponent is required to provide a map duly authenticated by the forest department showing the Wildlife Sanctuary/National Park boundaries and the project components indicating the distance between them.***

The project proponent presented a detailed map authenticated by Forest Department, Government of Sikkim. It was clarified that the approximate distance of Kangchendzonga Biosphere Reserve is 5.20 Km from dam site and 1.80 Km from powerhouse and within 10 Km study area of the project.

Details on hydrology were presented and daily rainfall data Chungthang rain gauge station from 1981 to 2011 & daily rain fall data for Singhok rain gauge station

(1994 to 2011) were taken into consideration for water availability. 10 daily discharge data are computed for 6 years for Chakung Chu stream gauged by Power Department appeared more reliable. The average run-off for the 6 years at Chakung Chu, Sanklang and intermediate catchment are 1199.05 mm; 2253.85 mm & 5065.88 mm. Using discharge 10 daily discharges arrived for Chakung Chu gauge station for 1980 to 2008 & 2011, the run-off varies from 7830 mm to 3415 mm. The 90% dependable year is identified as the year 1999 with annual run-off at 4000 mm. The 10 daily average discharges at Chakung Chu gauge station is transformed to discharges at dam site by catchment area proportionate basis. Then the power & energy potential for various installed capacities are then worked-out for the 90% dependable year.

The net head available for the project is estimated at 660 m after accounting for all losses at different components. As per MoEF guidelines, a minimum discharge of 30% during monsoon season and a minimum discharge of 20-30% during non-monsoon/non-lean months from the dam site for environmental purpose, the energy potential in 90% dependable year (which is the year 1999) have been calculated and the capacity has been fixed at 96 MW. The annual energy in the 90% dependable year works out to be 404.55 MU.

The project proponent has presented the L-Section of the drawing indicating the upstream/downstream projects maintaining a minimum distance of 1 Km of downstream project. No upstream project is identified yet and NHPC Teesta-V HEP (510 MW) project is about 30 Km away from HFL of the river.

The EAC observed that hydrology and other related matters like optimal capacity will be examined by CWC/CEA. However, the project proponent must take into consideration release of environmental flow to calculate capacity of the project and if need, to be revised.

As discussed during the 64<sup>th</sup> EAC meeting, the committee desired to know about the legal status of the project as the Chariman and Members & MoEF received a representation from M/s. Amalgamated Transpower (India) Ltd. The committee was informed that as per the minutes of the 64<sup>th</sup> EAC meeting, the MoEF has written a letter to Energy and Power Department, Government of Sikkim to inform the bon-fide allottee of 3 hydropower projects viz. Rolep, Ralong & Chakung Chu. The Government of Sikkim vide letter dated 7.5.2013 informed the Ministry that the letter of intent for allotment of the projects has been bonafidely issued to M/s. Velankani Renewable Energy Pvt. Ltd and proposals submitted by them could be considered by the MoEF.

After detailed examination and scrutiny, the committee recommended the project for granting scoping clearance and approved the TOR with the following additional TORs:

- (i) The Muck disposal sites should be selected at-least 30 m away from the HFL of the river/stream and details shall be shown including location, quantity of muck to be disposed off vis-à-vis the total area for dumping.

- (ii) Sedimentation study (Bed and suspended loads) should be made to find life of the reservoir.
- (iii) A table of 10 daily water discharges in 90% dependable year showing the intercepted discharge at the dam, the environmental and other flow releases downstream of the dam and spill are to be provided in hydrology in the EIA.
- (iv) A site-specific study to be carried-out for establishing the proper environmental flow release during monsoon, non-monsoon and lean months. Environmental flow must mimic the pre-dam flow pattern of the river for sustaining the aquatic bio-diversity together with downstream user need and accordingly, water withdrawal for power generation is to be regulated. Minimum environmental flow release would be 20% of average of four months of lean period and 25% of flows during non-lean non-monsoon period corresponding to 90% Dependable year. The cumulative flow releases including spillage during monsoon period should be 30% of the cumulative inflows during the monsoon period corresponding to 90% dependable year.
- (v) To include observed flow at G&D site, rainfall data and intermediate catchment mapping along with its contribution in EIA report.
- (vi) Biodiversity study is to be carried-out by associating a reputed organization to be recommended either by WII, Dehradun or by ICFRE, Dehradun.
- (vii) Cumulative impact of upstream/downstream project is to be taken into account, if any.
- (viii) North-Eastern region is very rich in Biodiversity. A detailed study needs to be undertaken and detailed Biodiversity Conservation & Management Plan should be made in **EMP**.
- (ix) A detailed Socio-economic study should be conducted with respect to cultural aspects of the region.
- (x) **Dam Break Analysis and Disaster Management Plan:** The outputs of Dam Break Model should be illustrated with appropriate graphs and maps clearly bringing out the impact of Dam break scenario. Provision for early warning systems should be provided.
- (xi) The Resettlement & Rehabilitation plan should be as per the latest norms and R&R Plan, 2007 should be followed. The committee also suggested that the project proponent should also keep in mind the land reforms act of Government of India, if it is enacted in R&R Plan. Empowerment of local community in the project activities should be ensured.
- (xii) Road construction outside the project, if any, wherein the forest land/private land/agricultural land involved, a separate clearance should have to be obtained from the concerned authorities as per the norms/rules.

- (xiii) The Kangchendzonga Biosphere Reserve is at a distance of 5.20 Km from the proposed dam site and 1.80 Km from powerhouse and within 10 Km study area of the project and clearance from Standing Committee of NBWL to be obtained, if required.
- (xiv) The Scoping/TOR Clearance is being considered by the Ministry subject to the outcome of the Arbitration involving the project and court order, if any, and the project proponent shall be bound by the decision of the MoEF arising out of such outcome of Arbitration/court order.

The representation of SANDRP on minimum free flow stretch and existence of National Park/Sanctuary were also discussed. The project proponent informed that they have ensured a free flow stretch of minimum 1 km suitably and permission of Standing Committee of NBWL would be obtained by them.

The committee recommended the Scoping/TOR Clearance subject to above condition and adherence/outcome of the arbitration/decision of the court, if any.

**Agenda Item No. 2.4 Sonthi Lift Irrigation Scheme in Gilbarga District of Karnataka by M/s. Krishna Bhagya Jala Nigam Ltd – For TOR**

Although the project was put up as one of the agenda items, the Government of Karnataka submitted that that they have recently requested MoEF for awarding deemed ToR for this project in accordance with provisions of EIA Notification, 2006. They were not in a position to present the case now. EAC did not discuss the project further.

**Agenda Item No. 2.5 Singtalur Lift Irrigation Scheme/Project on Tungabhadra River in Hammigi Village, Gadag District Karnataka- For Reconsideration of ToR .**

The Government of Karnataka proposes to utilize 18.55 TMC of water share under Krishna Water Tribunal for irrigation and for drinking water supply by constructing a 10 m high (from the deepest foundation level) and 387.5 m long barrage on Tungabhadra River upstream of Tungabhadra Dam. Out of 18.55 TMC, 15.991 TMC of water will be used for irrigation and 2.55 TMC will be used for drinking water purposes.

The project proposes to irrigate 77,197 ha of the command area by lift irrigation and will benefit 150 villages in Gadag, Koppal and Bellary Districts in Karnataka. Command area will receive irrigation from Head works through pumping/lifting. The total network of left bank canal will be 185.55 km and right bank canal will be of 40.13 km. Two lifts on right bank and 4 lifts on left bank shall be required to lift the water. The present cropping pattern is 100% Kharif over 68,922 ha and 17% of Rabi in 8,276 ha. The benefit-cost ratio will be 1.604.

An important issue is quick and unhindered release of design flood of Tungabhadra river draining 19,483 Sq. km through the barrage whose tail water level is only 2-3 meter above the FRL of Tungabhadra reservoir. In the event of catastrophic flood the back water level of Tungabhadra reservoir has to be checked so that free flow occurs through the barrage for the SPF condition.

Total land requirement for the project will be 4624.5 ha out of which submergence area is 1620 ha. Total forest land required will be 1.42 ha. Estimated cost for the project is Rs. 1894.50 Crores.

The project was earlier considered by EAC during 30.03.2012 and in its 63<sup>rd</sup> meeting held during 26<sup>th</sup>-27<sup>th</sup> December, 2012. The EAC sought additional clarifications/ information on the project before considering issuance of ToR. These clarifications/ information were provided by the State Government and these were to be discussed.

2.0 However, SANDRP, a New Delhi based NGO has brought to the notice of the EAC that the work in barrage portion has already been completed and therefore, violation of the MoEF guidelines project clearance is noticed. In this regard, the EAC was appraised that vide OM dated 12.12.2012 Ministry of Environment & Forests (MoEF) has delineated process to consider such cases. The content was read out in the meeting for information and perusal of the EAC as well as the project proponent.

3.0 EAC took a decision that a copy of representation as well as a copy of above said MoEF's OM be given to the State Government of Karnataka for necessary action and their response. On receipt of reply, MoEF may suggest future course of action in the matter. Technical clarifications were found to be otherwise generally satisfactory.

**Agenda Item No. 2.6 Shiggaon Lift Irrigation Scheme in Haveri District of Karnataka by M/s. Karnataka Neeravari Nigam Limited. – For Reconsideration of EC**

1. The proposed scheme envisages diversion of 42.45 M.Cum (1.5 TMC) of water by constructing a diversion weir across Varada river near Halasur village of Savanur Taluka and providing Sprinkler Irrigation facility to 9900 ha of command area in Shiggaon, Savanur and Hangal Taluks of Haveri district and benefiting to 30 villages (draught affected).
2. The scheme also envisages providing drinking water facility and sub soil replenishment by filling up of existing 5 minor irrigation tanks within the command area and construction of 6 bandaras. Filling of existing MI tanks in the command area would help in stabilization and replenishment of the underground water table in the region.
3. The villages coming under this scheme are poverty offended drought-prone area. Agriculture is the major economic activity. Low annual rainfall of the order of 532

- mm coupled with large variance in annual rainfall and uncertainty within a year causes the agriculture a risky venture. The people of the region have no other employment opportunities except agriculture. Hence providing irrigation and stabilizing the agricultural production, provides a much needed relief to the people.
4. The total water allocated for the proposed project was 42.45 M.Cum (1.5 TMC). But the current utilization of water for the proposed project is 31.696 M.Cum (1.12 TMC) by adopting Sprinkler Irrigation with piped conveyance system as suggested by EAC, MoEF and thereby saving **10.77 M.Cum (0.38 TMC) of water, thus water conservation is achieved** and the same water may be utilized for the scheme at later stages.
  5. The proposed irrigation is only in Khariff and the intensity of irrigation is kept at 100%. The benefit-cost ratio for the project is 1.28 and the total cost of the project is 238 crores as per 2007-08.
  6. The project **doesn't require diversion of forest land** and it **doesn't envisage cutting of trees** for construction activities. Hence, the project doesn't require Forest clearance under Forest (Conservation Act)-1980.
  7. The project **requires 45 ha of dry land for the construction** of pump house, office, etc and there is no rehabilitation and resettlement, no submergence in the scheme.
  8. The proposed project helps in substantial socio-economic development and upliftment of the people in the region by providing scientific irrigation facility for farmers.
  9. Bankapura Peacock Conservation Reserve is located in the command area of the project. Since, the project envisages sprinkler irrigation system by carrying water to the agricultural lands through HDPE pipes, there is no impacts on the reserve by any means. In turn indirectly, the project helps to provide the irrigation facility to the adjacent lands of the Reserve, so that the birds can get sufficient food all the time which exhibits mutualism.
  10. There are no impacts on the aquatic life/ecology from the proposed project; in turn it boosts the fishing activities due to the diversion weir construction which provides habitats for the same to breed.
  11. The total cost for implementation of mitigation measures as stated in EMP is Rs 68.82 Lakhs during the construction phase, Rs 21.82 Lakhs during the first three years of operation phase and Rs 50,000 for fourth year onwards for maintenance of green belt.
  12. Overall, the proposed project doesn't envisage serious impact on the physical, biological and social environment. Hence the project requires early Environmental Clearance from MoEF for its implementation, which in turn provides relief to the proposed beneficiaries of the command area region.
  13. ToR for the project was obtained from MoEF on **18.01.2011**

The project was earlier considered by EAC during its 58<sup>th</sup> meeting held on 1<sup>st</sup> – 2<sup>nd</sup> June, 2012. The EAC sought a number of additional clarifications/ information before reconsidering issuing EC. These clarifications/ information were provided by the State Government and therefore, the case was put up as an agenda item for discussion in EAC meeting.

2.0 However, SANDRP has brought to the notice of the EAC that the work in jack well cum pump house are already completed and thus, a violation of MoEF guideline is noticed. The EAC was appraised that vide OM dated 12.12.2012 the Ministry has certain guidelines to consider such violation cases. The content was read out in the meeting for information and perusal of the EAC as well as the project proponent.

EAC decided that a copy of representation as well as a copy of MoEF's said OM be given to State Government of Karnataka for necessary action and their reply. On receipt of reply, MoEF may suggest future course of action.

#### **Agenda Item No. 2.7 Revalidation of validity of ToR for -**

- (i) Tato-I HEP (186 MW) in Arunachal Pradesh by M/s. Velcon Pvt. Ltd.
- (ii) Heo HEP (240 MW) in Arunachal Pradesh by M/s. Velcon Pvt. Ltd. and
- (iii) Pauk HEP (145 MW) in Arunachal Pradesh by M/s. Velcon Pvt. Ltd.

With respect to these three projects, the project proponent explained the following:

- The MoEF granted the revised TOR's for all these three projects on 20<sup>th</sup> October, 2011 with a validity period of two years, up to 19<sup>th</sup> October, 2013.
- The proponent submitted all the three updated EIA and EMP reports conforming to the requirements, to APSCB on 18<sup>th</sup> July, 2012, to the Regional Office of MoEF Shillong on 30<sup>th</sup> August, 2012 and to the MoEF New Delhi on 5<sup>th</sup> September, 2012 for conducting public hearing.
- Member Secretary APSPCB, Arunachal Pradesh, Itanagar, fixed on 12<sup>th</sup> September, 2012 the date of public hearing as 17<sup>th</sup> October, 2012, and this was published in the Times of India News Paper on 15<sup>th</sup> September, 2012.
- Member Secretary APSPCB, Itanagar issued public notice on 12<sup>th</sup> October, 2012 ordering postponement of the Public Hearing on account of Law and Order problems, which are related to land ownership disputes between local clans.
- The new date of public hearing for these projects is yet to be fixed, and will depend on the settlement of Land Disputes. The Government of Arunachal Pradesh has initiated the procedures for the settlement of the land disputes which is under progress.

- The delay has occurred purely due to administrative reasons (non-availability of Land revenue registry in tribal areas, to be established by the GoAP) and beyond the control of Project Proponent).
- There is no change in project parameters.
- On 26<sup>th</sup> August, 2013, the project proponent has requested the MoEF to grant the Extension of the validity of the TOR for one year up to 19<sup>th</sup> October, 2014, for submission of the proposal for environmental clearance.

The EAC was informed that validity of ToR for these projects may be extended by one year in terms of MoEF's OM No. J-11013/41/2006-IA ( II) (I) dated 22.03.2010.

The EAC noted that the proponent have submitted EIA/EMP reports well within the validity period of ToRs to the Authorities concerned. Accordingly, EAC recommended granting one year extension of validity. However, no further extension would be considered and the project proponent shall have to complete public hearing and submit EAI/EMP reports to MoEF within the extended period of validity of ToRs.

## **Agenda Item No. 2.8 Diband Multipurpose Project (3000 MW) in Arunachal Pradesh by M/s. NHPC Ltd.- for Environment Clearance (EC).**

### **1. Introduction**

Diband Multipurpose Project (3000 MW) is proposed on River Diband in Arunachal Pradesh. The project has been conceived with dual objectives. Primary objective is flood moderation while secondary objective is electricity generation. Project involves two districts of Arunachal Pradesh viz. Lower Diband Valley and Diband Valley Districts. All the project components are located in Lower Diband Valley District while reservoir, length of which is 43 km, will fall in both Districts. Power house has been proposed on right bank, 250 m downstream of the dam axis.

### **2. Salient Features**

Location of Dam Site	1.5 km upstream of confluence of AshuPani with Diband at Munli Village
Catchment area	11276 sq km
Probable maximum flood	26230 cumecs
Full reservoir level	EL 545 m
Area under submergence	40.09 sq km
Diversion tunnel	3 Nos., 12 m dia., horseshoe shaped
Dam	288 m high concrete gravity dam
Head Race Tunnel	6 Nos., 9 m dia., horseshoe shaped
Pressure shaft	6 Nos., 7.5 m dia., circular

Power House	Underground, 3000 (12 X 250) MW
Tail Race Tunnel	6 Nos., 9 m dia., horseshoe shaped
Annual Energy Generation	11330 MU
Project cost	15886.39 crores (at Nov. 2007 PL)
Construction period	9 years from CCEA approval

Concurrence of CEA was obtained on 23.01.2008. PIB Clearance was obtained on 28.01.2008. Hon'ble Prime Minister of had laid down the foundation stone of Dibang Multipurpose Project on 31.01.2008.

### **3. Brief Status of Environmental Clearance**

Dibang Multipurpose Project (3000 MW) in Arunachal Pradesh was accorded Site Clearance Stage I & Stage II in January 2004 and December 2004, respectively as per EIA Notification, 1994. Accordingly, the EIA study was undertaken and EIA & EMP reports prepared. Further, NHPC submitted the application along with EIA & EMP reports to Arunachal Pradesh State Pollution Control Board (APSPCB) for initiating Public Hearing in February 2007. Public hearing for Lower Dibang Valley District only was held on 29.01.2008, after its postponement for several times, and the same for another district i.e. Dibang Valley District, could not be conducted due to public agitation. Thereafter, in-spite of several notifications by APSPCB, the public hearing could not be held for Dibang Valley District and postponed every time. Environmental clearance proposal was submitted by NHPC along with EIA & EMP reports and public hearing report of One District (i.e. Lower Dibang Valley District) to MoEF on 26.12.2008 for accord of environmental clearance.

Subsequently, MoEF vide letter dated 30.01.2009, intimated that extension of time for submission of project proposal under EIA Notification, 1994 has expired on 13.09.2008, hence, the proposal for Environmental Clearance needs to be submitted as per the provision of revised EIA Notification, 2006. Accordingly, NHPC submitted proposal to MoEF on 27.05.2009 to MOEF for approval of TOR as per EIA Notification 2006. MoEF accorded clearance for pre-construction activities and approved the TOR for EIA study on 17.08.2009. The EIA & EMP reports, prepared earlier, were revised by NHPC as per the approved TOR and submitted to Arunachal Pradesh State Pollution Control Board (APSPCB) for initiating the fresh public hearing process in both the districts (i.e. Lower Dibang Valley & Dibang Valley) on 26.08.2010 and also submitted the above documents to MoEF on 03.09.2010 for initiating the process of public consultation. APSPCB tried to conduct the public hearings in October 2011, but the same was again postponed due to adverse law and order condition.

NHPC has pursued the matter with State Government, MoP and MoEF for conducting the public hearings through APSPCB. Finally, APSPCB successfully conducted the public hearings for Lower Dibang Valley on 11.03.2013 at Roing and for Dibang Valley District on 13.03.2013 at New Anaya. In both meetings large number of

people participated. EIA & EMP reports along with proceedings of public hearings were submitted to MoEF on 27.05.2013 for accord of environmental clearance.

#### 4. Concerns Raised During Public Hearings

In general the people were satisfied with the EIA and EMP reports and proposed R&R plan and community and social development plan. R&R plan has been formulated in line with the State R&R Policy, 2008. They took keen interest in knowing the R&R package and community and social development (CSD) plan. However, during public consultation prior to public hearing and during public hearings of Dibang Multipurpose Project, in addition to community and social development plan more infrastructural development in both Lower Dibang Valley and Dibang Valley Districts were sought viz., up gradation of District Hospitals in both district, financial assistance for schools, colleges and polytechnic, and construction of cultural museum at Roing and ITI at Anini etc. Besides this for downstream people, the main concern was protection of downstream area in case of dam break / high flood. Keeping this in view, a lump sum provision of Rs. 17100lakhs has been proposed for consideration of MoEF for mitigative measures at downstream and other infrastructural facilities as raised during public hearings in addition to R&R and CSD plan.

#### 5. Land Requirement

S. No.	Category of Land	Area (ha)
1.	Unclassified State Forest (USF) including river bed and water body	5022.842
2.	Community land (Non forest cover	701.30
3.	Land under wet rice cultivation	70.00
	<b>Total</b>	<b>5794.142</b>

#### 6. Environmental Impact Assessment and Environmental Management Plans

EIA study was undertaken to assess the baseline status of physical, biological and socio-economic environment of the area. The study area was bifurcated into catchment area (1127600 ha) and directly draining catchment (59812 ha). Floral & faunal studies carried out in 10 km radius. Studies related to physical aspects like land use / land cover, soil, slope etc. for identifying critically degraded areas restricted to directly draining catchment. Baseline data on physical, ecological and socio-economic aspects were collected through primary surveys conducted in three different seasons of the year and from secondary sources. LISS – III image & SOI toposheets were used for generating thematic maps. Biodiversity aspects and Biodiversity Conservation & Management Plan of EIA & EMP of Dibang Multipurpose Project was reassessed by Dr. K. Haridasan, Ex-Scientist, State Forest Research Institute, Itanagar (Presently, Joint Director, Foundation for Revitalisation of Local Health Traditions, Bangalore) on the basis of field survey to project area and feedback / suggestions

received during the workshop held at Itanagar, which was attended by various scientists working in the region. These chapters were also reviewed by Dr. P. K. Hajra, Ex-Director, Botanical Survey of India.

## 7. Environmental Flow

As per the TOR approved by MoEF, additional study with respect to assessment of downstream impacts and estimation of environmental flow, impact of flood moderation in the downstream and Assam especially on Dibru-Saikhowa National Park, impacts on Aquatic Ecology due to modification of Flow Regime etc. was carried out by WAPCOS. Details are as under:

- Environmental flow was estimated through Building Block Method.
- In intervening stretch from dam site to TRT outlet (about 1.6 km), a minimum flow of 15 cumecs will be released from the dam.
- Based on the findings of energy optimisation vs. firm power optimisation study, WAPCOS has proposed to operate at least one turbine during lean season.
- This will lead to loss of 771.52 MU of energy. The loss in terms of average Annual Peaking Capability shall be 186.26 MW.
- Environmental Flows vis-à-vis proposed release of water is presented as under:

### Comparison of required Environmental Flows vis-à-vis proposed release of water

Month	Monthly average flow of 17 years (cumecs)	Percentage	Required Environmental Flow(cumecs)	Releases through machines as per study(cumecs)
May	1040.5	30	314	1294.48
June	1775.6	30	535	1332.60
July	1593.4	30	480	1090.77
August	1417.6	30	427	681.93
September	915.2	30	277	473.32
October	758.7	20	154	654.46
November	372.0	15	58	370.77
December	330.8	15	52	185.77
January	364.1	15	57	203.67
February	427.8	15	66	263.57
March	442.5	15	68	568.18
April	731.8	20	148	918.98

- Thus, it can be noted from above table that on account of loss in hydropower, the project shall maintain discharge higher than the required Environmental Flow downstream of power house for sustenance of aquatic life.
- In addition to this, release from Ashu Pani river which is joining River Dibang in between Dam and TRT outlet is also contributing water (2 cumecs to 11.8 cumecs) to Dibang river.

## 8. Cost of Environmental Management Plans

Various environmental management plans have been proposed in EMP to mitigate the impacts identified in EIA report. The plans and their cost are listed as under:

<b>EMP Component</b>	<b>Amount (Rs. in lakhs)</b>
Catchment Area Treatment	1039.34
Biodiversity Conservation & Management Plan	368.18
Fish Management	143.18
Green Belt Development	102.27
Geo-environmental Management Plan	965.19
Muck Disposal Plan	272.30
Restoration Plan for Quarry Areas	116.33
Landscaping & Restoration of Construction Area	172.58
Public Health Delivery System	273.58
Solid Waste Management & Sanitation Facilities	236.50
Energy Conservation Management Plan	51.14
Resettlement & Rehabilitation Plan	7673.60
Compensation of Land and Rights & Privileges	21369.58
Community and Social Development	4500.00
Disaster Management Plan	325.99
Maintenance of Air, Water and Noise Quality	30.68
Environmental Monitoring Programme	99.72
Concerns raised during public hearings	17100.00
<b>Sub-total (A)</b>	<b>54716.09</b>
Cost of NPV	39581.21
Cost of Compensatory Afforestation	14774.18
<b>Sub-total (B)</b>	<b>54355.39</b>
<b>Total (A+B)</b>	<b>109071.48</b>

After critically examining the proposal, EAC observed the following:

- Numbers of Fish species reported was found to be on lower side and NHPC was asked to verify this and report accurately.
- Number of plant species reported also appeared to be on lower side and to be rechecked by NHPC.
- At this altitude of the project (about 3000m), snow leopard should have been sighted. It may be erroneous to report that leopard was not found in the study area. Therefore, this may be relooked.
- Study area in back water/ submergence is also to be extended for proper inventory of both flora, fauna/bio-diversity.
- Cost estimates of various components of the Environment Management Plan (EMP) were examined and found to be highly on lower side. For example, cost of CAT, Biodiversity conservation, cost towards translocation during forest clearing, Hatchery for fish, Green Belt Development, Geo-environment Protection, environment monitoring cell etc. seemed to be highly underestimated. Unless, EMP components are adequately and realistically estimated, the safeguard measures may not be implemented properly.

NHPC was therefore, asked to review and revise cost of EMP components on realistic basis and considering applicable local rates.

- An effective plan for conservation of cultural identity of tribal community to be proposed both during construction and post commissioning of the project.
- Attempts may be made to avoid submergence of huge area of rich forest land. It merits mention that due to the very high forest land submergence, forest clearance has not yet been accorded by FAC.
- Environmental Flow in the diverted portion of about 1.2 km i.e. between dam and TWL of dam toe PH is to be reassessed and a suitable quantity is to be proposed for release as per extant norms. 4% flow as suggested was found to be inadequate.

#### **On EIA report:**

- Among the various water quality parameters listed in the report, values of Total Alkalinity and Chlorides mentioned in the report are extremely low and shown in fractions and this needs proper justification.
- A total of 60 fish species have been listed from the river, which include admixture of few coldwater fishes (i.e. *Schizothorax* spp and *Tor* spp) and rest of the warm waters. In case of Western and Central Himalayan rivers, *Schizothorax* spp and *Tor* spp are never recorded along with the above warm water fishes. Hence, there is need to mention and explain, seasonal distribution of fishes to verify the availability during different season.

- *Neolissocheilus hexagonolepis* (chocolate mahseer) is a renowned endemic mahseer of the North Eastern Himalaya, which is missing from the list. This needs further verification and clarification.
- Likewise, most of the warm water fishes are listed from the river but Indian major carps are missing, which need further justification.
- *Oreochromis mossambicus*, an exotic African species, now recorded from some of the polluted rivers i.e. Ganga, Yamuna etc., is also listed from this pristine river ? This must be verified with utmost care.
- Besides mahseer, snowtrout and *Bagarius*, a few other fish species have been mentioned under migratory category, needs further clarifications.
- Golden mahseer, *Tor putitora* in Western and Central Himalayan region starts spawning from April onwards till July-August, but mentioned from mid-July onwards in this report.
- The status of the above 60 species in IUCN Redlist has been mentioned in the EIA report as- NA? While a few species are listed as Endangered/Near Threatened in IUCN 2013 List.

#### **On EMP report:**

- Possibility of exotic trout and common carp stocking has been discussed in the EMP, which is not desirable for this river.
- As both the coldwater and warm water fish species has been listed from the river, therefore there is need to construct fish hatcheries for coldwater as well as for warm water fishes, separately. The cold water fish hatchery needs indoor flow-through hatchery with over head water tank, hatching troughs & trays; feeding troughs, nursery ponds, rearing ponds and brooders ponds. For warm water fishes (IMC) a mini-hatchery with nursery, rearing and brooders ponds and proper water supply is required.
- Accordingly the budgetary estimates may be drawn with adequate provisions for construction of hatcheries for both the principal fish groups.

2.0 In addition, two representations have been received one each from All Tai Ahom Student Union, Jorhat and EIA Resource and Response Centre (ERC), New Delhi opposing the project on environmental grounds. The issue of downstream impact, suitable land for CA, impact on Bird Area, endangered fauna at project site, large diversion of forest land etc have been raised in these representations. A copy each of the representations was handed over to the NHPC to reply to all the issues raised.

On receipt of response to the above observations/comments and representations received, the proposal may be reconsidered by the EAC.

## **2<sup>nd</sup> Day (24.9.2013)**

### **Agenda Item No. 2.9 Lower Kopili HEP (120 MW) in Karbi Anglong & North Cachar Hill Districts of Assam by M/s. Assam Power Generation Corporation Ltd - For reconsideration of TOR.**

- (i) The project for granting ToR was considered first during 26<sup>th</sup>-27<sup>th</sup> December, 2012 and subsequently during 22<sup>nd</sup> – 23<sup>rd</sup> March, 2013 by EAC.

The project proponent has brought down the capacity from 150 MW to 120 MW factoring into dedicated release of environmental flow. Of this 120 MW, a dam toe power house of 10 MW has also been proposed with 2x2.5 m +1x5 MW combinations.

The EAC sought additional information/clarification to enable its reconsideration.

Accordingly, on receipt of clarification and additional information, the project was included for consideration of 68<sup>th</sup> EAC.

The technical clarifications were generally found satisfactory. But, high acidity of river water was considered to be a serious threat for both capital cost and life of electro-mechanical component of the project post commissioning. Therefore, the EAC felt the this may alter the economic & financial viability of the project. Therefore, the EAC requested the Assam Government to review its necessity at the first place. Because, per MW cost was very high which may also lead to higher cost of energy.

In addition, EAC deliberated on a representation received from South Asia Network on Dams, Rivers and people. A number issues have been raised which the EAC opined that Assam Government should respond adequately. A copy of the representation was handed over to the project proponent during the meeting.

On receipt of response on these, the project may be reconsidered by EAC.

### **Agenda Item No. 2.10 Revalidation of validity of ToR for Talong Londa HEP in Arunachal Pradesh by M/s. GMR Pvt. Ltd.**

The project proponent presented the details for the extension of the validity of TOR and requested the EAC for 1 year purely on administrative grounds.

The committee noted that the TOR for Talong HEP (225 MW) in East Kameng District of Arunachal Pradesh was accorded on 10.8.2010 and 2 year term ended on

9.8.2012. Thereafter, the Ministry granted extension of the validity of the Terms of Reference (TOR) for further 1 year i.e from 10.8.2012 to 9.8.2013 to the project.

The committee noted that the draft EIA/EMP reports were submitted to Arunachal Pradesh State Pollution Control Board for conducting the public hearing. The public hearing is yet to take place and thereafter the final EIA/EMP has to be prepared and submitted to MoEF. Although, as per OM dated March, 2010, the outer limit has been reached, the committee agreed for the extension of the validity of TOR for 1 year i.e. from 9.8.2013 to 9.8.2014 to finalize the EIA/EMP and submit to MoEF as the delay is on account of administrative reason and not on the part of project proponent. The committee also mentioned that this is the last & final extension and no further request will be considered.

The project proponent thus advised to pursue rigorously with Arunachal Pradesh State Pollution Control Board for early public hearing.

**Agenda Item No. 2.11 Revalidation of validity of ToR for Siang Lower HEP in Arunachal Pradesh by M/s. JP Ltd**

The project proponent presented the details for the extension of the validity of TOR and requested the EAC for 1 year purely on administrative grounds.

The committee noted that the TOR for Lower Siang HEP (2700 MW) in East Siang District of Arunachal Pradesh was accorded on 3.8.2010 with validity period of 2 years up to 2.8.2012. Thereafter, the Ministry granted extension of the validity of the Terms of Reference (TOR) for further 1 year i.e up-to 1.8.2013 to the project.

The committee noted that the draft EIA/EMP reports were submitted to Arunachal Pradesh State Pollution Control Board for conducting the public hearing. The APSPCB announced the date of public hearing for 3 times (i.e. 2010, 2011, 2012) and the public hearing was postponed on account of Law & Order problems.

The public hearing is yet to take place and thereafter the final EIA/EMP has to be prepared and submitted to MoEF. Although, as per OM dated March, 2010, the outer limit has been reached, the committee agreed for the extension of the validity of TOR for 1 year i.e. from 2.8.2013 to 2.8.2014 to finalise the EIA/EMP and submit to MoEF. The committee also mentioned that this is the last & final extension and no further request will be considered.

The project proponent thus advised to pursue rigorously with Arunachal Pradesh State Pollution Control Board for early public hearing.

**Agenda Item No. 2.12 Mohanpura Major Irrigation Project in Madhya Pradesh M/s. Water Resources Department, Government of Madhya Pradesh – For reconsideration of Environmental Clearance (EC).**

Mohanpura Multipurpose Project is planned across Newaj River in Rajgarh District of M. P. intercepting 3825 km<sup>2</sup> of basin area. The project has a composite dam 2640 m long, submerging 7057 ha of land, that affect 4782 families. Land required for canals is estimated as 152 ha.

The proposed Mohanpura dam shall be constructed near village Banskhedhi in district Rajgarh, Madhya Pradesh. The coordinates of the dam site are 23° 57'54" N and 76°46'37" E. The dam is proposed to be constructed across river Newaj having a catchment area of 3726 sq. km. The total cost of the project is envisaged as Rs. 282734.35 Lakhs.

The project with a Live Storage Capacity of 539.42 MCM envisages annual irrigation of 97750 ha., comprising of 35500 ha. in Kharif and 62250 ha. in Rabi over a CCA of 65000 ha. Water requirement is assessed as.

a) For irrigation	-	352.834 MCM
b) For drinking water	-	20 MCM
c) For industrial use	-	60 MCM
Total	-	432.834 MCM

### **Irrigation Planning**

The project has a 75% dependable yield estimated at 749.71 MCM for surface water and 74.971 MCM for ground water totaling 824.68 MCM. The basin receives an annual rainfall of the order of 800 – 1000 mm. Earlier EAC found an anomaly at pg. 190 which shows upstream surface water utilization as 139.31 MCM against a figure of 253.038 MCM for constructed projects shown at pg. 10 – 12. This was to be clarified as the 75% dependable yield would reduce considerably. The irrigation network is planned as a combination of:

- Flow irrigation through two gravity canals off taking from the reservoir on the left and right of the dam commanding 11235 ha. (net) and 16050 ha (gross).
- Pressurized irrigation by lifting from the reservoir on the left at Berampur and conveying a 18.775 km long pressure main to lift water to a delivery system near Parliyakhedhi tank at RL470 to command a CCA of 53765 ha.

The distribution network for pressure irrigation is shown through seven distributaries D 1 through D7 totaling 122 km in length, all of taking from the delivery cistern and linked to tanks en-route a tank at Parliyakhedhi serving as a balancing reservoir.

The project was considered by the EAC in its 67<sup>th</sup> meeting held during 6<sup>th</sup> June, 2013. The EAC has sought a number of clarifications for reconsideration.

In addition, SANDRP, a New Delhi based reputed NGO has written a letter to the EAC seeking clarifications on the project features. The developers were asked to clarify

doubts raised in the above letters relating to the project features that contradict with the assumptions made in the NWDA study of Parbati – Kalisindh – Chambal Scheme, a major issue is that the NWDA scheme envisaged a gross and live storage provision of 140 and 52.5 MCM respectively against the present proposal 616.27 and 539.42 MCM respectively because the NWDA proposed transferring 464 MCM from Patanpur dam to Mohanpura Reservoir to reduce the large submergence of Mohanpura Reservoir. It was clarified that the NWDA scheme as not been accepted by the M.P. Government and is not likely to be implemented in the near future. The M. P. Government wants immediate implementation of Mohanpura Project for poverty alleviation of the backward Rajgarh District. The EAC however sought clarification also on whether the Chambal River Sanctuary would be impacted, in which case clearance of NBWL would be necessary.

Other major issues raised were:

- Very high submergence and related R & R problems which were alleged to be inadequately addressed in the M. P. Proposal and lack of a proper S. I. A. Study.
- No Command Area Development Plan formulated and therefore introduction of irrigation may cause environmental degradation.

Issue/point wise clarifications have been submitted by Government of Madhya Pradesh. The EAC critically examined the proposal again and observed the following:

- (i) Animal/ faunal inventory may be rechecked and a proper conservation/ protection plan during submergence of reservoir may be made. Also, high irrigation may lead to dispersant of various species which have to protected.
- (ii) Arrangement to be made for livelihood of these PAFs who are likely to loose entire lands.
- (iii) Touch upon Fisheries, Migration and conservation issues and submit a plan. Also incorporate suitable fisheries management/enhancement plan for the newly constructed reservoir.
- (iv) A definitive and robust R&R plan has to be prepared and submitted. As per the report, only housing facility has been provided in 132 ha of Government land for PAFs who would be losing their entire lands and livelihoods. Neither land for land nor alternate livelihood means have been proposed and elaborated. Therefore, this was found to be inadequate.

2.0 In addition, representation has been received one each from Gharial Conservation Alliance, and SANDRP and was handed over to the State Government for reply. Major issues raised are about non response on SANDRP's earlier representation, source of data, inadequate faunal information and use of old data and methodology plagiarism.

EAC recommended that on receipt of proper response from Government of Madhya Pradesh on the above, the project could be reconsidered.

**Agenda Item No. 2.13 Turga Pumped Storage project (1000 MW) in district Purulia, West Bengal by West Bengal State Power Distribution Company Limited. -For TOR.**

The Purulia Pumped Storage Extension Project located in Purulia district of West Bengal has been proposed by West Bengal State Power Development Corporation Ltd (WBSPDCL). The scheme envisages utilization of the waters of the river Turga in Ayodhya hills for peak power generation on a Pumped storage type development, harnessing a maximum head of about 202.51 and Minimum head about 149.75 m. The project with a proposed installation of 1000 MW ( 4x250 MW) would afford an annual energy generation of 2190 Gwh. The upper dam site is located at Latitude 23° 14' 35" N; Longitude 86° 03' 59" E and the lower dam site is located at Latitude 23o 11' 30" N; Longitude 86° 03' 30" E. The project site is approachable by a motorable road taking off from Balrampur – Baghmundi state highway. The nearest rail head is located at Barabhum and nearest airport is located at Kolkata.

The Purulia Pumped Storage Extension project envisages construction of:

- A 79 m high Rockfill upper dam with central impervious clay core across river Turga to provide a live storage of 14.31 M cum with FRL at 495.0 m and MDDL at 474.0 m;
- A 69 m high Earthen lower dam with central impervious clay core constructed by raising existing irrigation dam across river Turga to provide a live storage of 14.00 M cum with FRL at 320.0 m and MDDL at 285.0 m;
- No. intake with trashracks having mechanical raking arrangement.
- No. 1.63 Km long, 7.5 m diameter circular steel lined headrace tunnel
- An underground power house having an installation of 4 Francis type reversible pump-turbine driven generating units of 250 MW
- No. 566 m long tail race tunnels to carry the power house releases to lower reservoir.

The Turga river drains a catchment area of about 13.72 sq. km at the proposed lower dam site and 4.2 aq. Km at upper dam site. The flow series for Purulia Pumped Storage extension Project were derived by using the Rainfall-runoff correlation equations used in nearby Purulia Pumped Storage . The monthly yield series have been developed for the period 1958-59 to 2007-08. The design flood has been assessed as 360 cumecs for lower dam and 150 cumecs for upper dam . The sediment rate of 1000 cum/sq. km/year has been considered.

The project envisages utilization of (4\*250) 1000 MW. The maximum head utilization is envisaged as 210 m. The submergence area of the project is 136.61 ha

comprising forest and private land. The total land requirement for the construction of various components is about 292 ha.

The lower reservoir is an existing reservoir for irrigation purpose and under operation. The present area of lower reservoir is 42.41 ha which will increase to 49 ha with increase in dam height from pre-project height of 20 m to 69 m. An additional area of 249.59 ha shall be acquired for the project. The break-up additional land includes 200.31 ha of forest land and 49.28 ha of private land.

The Storage in the upper and Lower Ponds has been provided for daily operation of the reversible pump-turbine units. There is no seasonal storage for power generation and therefore the inflows are stored only to the extent of the requirement for evaporation. The surplus waters flow down into river course. It will be ensured that the releases into the river course do not fall below 15% of the inflows into the pond in any period.

The project is estimated to cost Rs. 2372.86 Crores at January, 2012 price levels. The preliminary cost estimate of the project has been prepared as per guidelines of CEA / CWC. The breakdown of the cost estimates is given below:

• Civil Works	:	Rs. 1032.37	Crores
• Electro Mechanical Works	:	Rs. 1340.48	Crores
• Total	:	Rs. 2372.86	Crores

The tariff from the project at present day cost would be Rs. 5.57 KWh (levellised).

On a query from the chairman, the West Bengal Govt Agency informed that the peak demand at present is of the order of 7000 MW in summer and this is likely to be around 15,000 MW in 2020. Therefore, the project is very important for the State. It was also clarified that during non-peak and low demand time they will pump water and produce power during peak demand hours.

It was informed that land to be submerged are mainly private barren and partly agricultural.

The EAC after detailed scrutiny recommended to grant ToR subject to the following conditions:

- I. A table of 10 daily water discharges in 90% dependable year showing the intercepted discharge at the dam, the environmental and other flow releases downstream of the dam and spill are to be provided in hydrology chapter of the EIA.
- II. A site-specific study to be carried-out for establishing the proper environmental flow release during monsoon, non-monsoon and lean months. Environmental flow must mimic the pre-dam flow pattern of the river for sustaining the aquatic

bio-diversity together with downstream user need and accordingly, water withdrawal for power generation is to be regulated. Minimum environmental flow release would be 20% of average of four months of lean period and 25% of flows during non-lean non-monsoon period corresponding to 90% Dependable year. The cumulative flow releases including spillage during monsoon period should be 30% of the cumulative inflows during the monsoon period corresponding to 90% dependable year.

- III. Biodiversity study is to be carried-out by associating a reputed organization to be recommended either by WII, Dehradun or by ICFRE, Dehradun.
- IV. Cumulative impact of upstream/downstream project is to be taken into account, if any.
- V. A detailed study needs to be undertaken and detailed Biodiversity Conservation & Management Plan should be made in **EMP**
- VI. **Dam Break Analysis and Disaster Management Plan:** The outputs of Dam Break Model should be illustrated with appropriate graphs and maps clearly bringing out the impact of Dam break scenario. Provision for early warning systems should be provided.
- VII. The Resettlement & Rehabilitation plan should be as per the latest norms and R&R Plan, 2007 should be followed. The committee also suggested that the project proponent should also keep in mind the land reforms act of Government of India, if it is enacted in R&R Plan. Empowerment of local community in the project activities should be ensured.

**Agenda Item No. 2.14 Sip Kolar Link Medium project in District Sehore, Madhya Pradesh by M/s. Water Resources Department, Government of Madhya Pradesh – For EC.**

It was revealed that the consultants who prepared EIA/EMP Report was not accredited by NABET. In the ToR issued in February, 2013, it was mentioned that consultants have to be NABET accredited.

Therefore, EAC did not consider the report. The Government of MP clarified that they have themselves prepared the report but took some help from the institute. On this, EAC addressed to recast the report & resubmit.

**Agenda Item No. 2.15 Teesta Intermediate HEP (4x21 MW) of WBSEDCL in Darjeeling, West Bengal- For ToR.**

The Teesta Intermediate Hydro-Electric Project is located on river Teesta, near Melli village of Darjeeling District in West Bengal. Access to the project site lies from left bank from Siliguri- Gangtok route NH 31. All the project components are located on the left bank of the river with its power house at the barrage toe. The barrage site is

located at about 5km upstream on Teestat river from Teesta Rangit confluence. The nearest airport is at Bagdora and nearest rail head at New Jalpaiguri. The project is also connected by road with a distance of about 65 km from Siliguri.

The river Teesta is a major tributary of Brahmaputra river, which originates in the Himalayas. The river rising from the Himalayan hills is snow fed from the glaciers Zemu, Changane, Khanpu and gets enlarged by the contributions from a large number of tributaries. The river gets its name Teesta after the confluence of two streams namely Lachan Chu and Lachung Chu at Chungthang in North Sikkim. The river is joined by other tributaries namely Rangopo, Rangit, Raman, Rangli etc. before meeting Brahmaputra in Bangladesh. The river forms a common boundary between Sikkim and West Bengal state in India during its journey to Bangladesh.

Teesta Intermediate Hydro-Electric Project is contemplated for generation of hydro power in order of about 393.23 GWh per annum at 90% dependability. The project is proposed to be completed in a time frame of about Five years and Seven months, including the time for establishment of access roads and development of other infrastructural facilities. The project is considered to be economically viable and its early execution is expected for providing much needed power benefits to West Bengal.

The diversion barrage is envisaged to be a RCC raft of about 19.5 m in height with its top level at EL 241m, FRL at EI 240m and MDDL at EI 235 m. The barrage is provided with 7 bays each of 15m X 11.5m to surpass design discharge SPF of 11769m<sup>3</sup>/s. The intake structure shall consist four bell mouth opening with trash rack. A surface power house of 90m long x 28.0 m wide x 38 high has been provided to house 4 units of 21 MW Bulb turbines (total capacity 84 MW). A 222 m long Tail Race channel has been proposed to discharge the tailrace water directly into the river at an elevation of 218 m.

The annual energy from the project has been assessed as 393.23 GWh on 90% dependable basis. The project would also provide peaking benefits of 84 MW round the year. The Project is estimated to cost 7409.34 million.

The land requirement for Teesta Intermediate H.E. Project is 108 ha. The details are given as under:

<b>Component</b>	<b>Total (ha)</b>
Diversion structure including Reservoir	69
Power House and Switchyard Tail race	10
Dumping Yard	2.5
Borrow areas	2.5

Roads Colony	18
Miscellaneous	6
<b>Total</b>	<b>108</b>

As per the present level of investigations, about 18 ha of private land and 90 ha of forest land is to be acquired.

2.0 The EAC noted that the West Bengal Government has proposed this in lieu of a project with same name for which ToR was issued in 2009 but by proposing to shift the dam axis 5-6 km upstream from the original location. Therefore, it was regarded as a new project by the EAC as it has altogether changed scope of works, study area etc.

EAC observed that any new project should not be taken up in Teesta without a proper cumulative impact assessment study. The WBSPDCL informed that they would propose a study and bring draft ToR to EAC for approval. EAC also advised the WBSPDCL to consults CISME, Delhi University who conducted the Teesta carrying capacity for their view.

**Agenda Item No. 2.16 Cumulative Environmental Impact Assessment of Subansiri Sub-Basin in Arunachal Pradesh by M/s. Central Water Commission – For Basin Study**

The consultants appointed by CWC, MoWR for conducting the study explain the following:

The study area of Subansiri River Basin lies between latitude 27°N & 29° North and longitude 91°45' East & 94°45' East and administratively falls in Lower Subansiri, Upper Subansiri & Kurung Kumei districts of Arunachal Pradesh.

The length of the river Subansiri is 375 km up to its outfall in the Brahmaputra River. Nineteen (19) hydro electric projects are envisaged in the study area and have been covered in the basin level assessment. These are, Oju – I (1925 MW), Oju – II (2580 MW), Niare (1405 MW), Naba (1290 MW), Kurung Dam – I & II, Milli (75 MW), Sape (38 MW), Chomi (80 MW), Chela (75 MW), Tammu (55 MW), Nyapin (32 MW), Hiya (41 MW), Dengser (552 MW), Subansiri Lower (2000MW), Subansiri Middle (1600 MW), Subansiri Upper (2000 MW), Tago-I (55MW), Nalo ( 360MW) and Tamen (175MW) which have been described in Chapter 2. Out of 19 hydro power projects which are planned in the Subansiri basin, 7 pre-feasibility study reports and two DPR are available, of which one project is under construction. The details on other projects are not yet available. Details of HEPs on Subansiri River is given in Table 1.

**Table 1. Projects on Subansiri River (Cascade development) as per the ToR**

Sl. No.	Name of the project	Catchment Area (Sq.km)	Present IC (MW)	FRL m	Ht. of the dam (m)	Tail Water Level (m)
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Sl. No.	Name of the project	Catchment Area (Sq.km)	Present IC (MW)	FRL m	Ht. of the dam (m)	Tail Water Level (m)
1.	Oju – I	9827	700	1950	110	1670
2.	Oju – II	9979	1000	1650	90	1300
3.	Niare	11181	800	1280	100	1055
4.	Naba	11272	1000	1035	110	780
5.	Mili	-	75	1400	-	1200
6.	Sape	-	38	1155	-	1080
7.	Chomi	-	80	1040	-	920
8.	Chela	-	75	900	-	805
9.	Kurang I & II	2302	330	745	140	620
10.	Tamen	7595	175	320	-	250
11.	Tago – I	-	55	1080	-	790
12.	Subansiri Lower	34900	2000	205	116	-
13.	Subansiri Middle	7213	1600	460	203	-
14.	Subansiri Upper	14665	2000	460	214	-
15.	Nalo	12150	360	765	125	645
16.	Dengser	12581	552	630	100	490
17.	Tammu	-	55	310	-	220
18.	Nyepin	-	32	1060	-	920
19.	Hiya	-	41	880	-	745

A map of Subansiri Basin, showing Subansiri river, its tributaries, existing and proposed HEPs (19) was also explained.

Hydrological status of Subansiri basin has been assessed through Hydrologic Engineering Centre-River Analysis Centre (HEC-RAS) model; hydrological modeling has been carried out to assess the water depth, water velocity and top width for the lean season, monsoon and other months. The flow scenario of 90% dependable year series of each hydro electric project has been used and the average non-monsoon discharge of worst four consecutive months have been computed. The flow parameters i.e. water depth, velocity of flow and flow top width is assessed for 10%, 15%, 20%, 30%, 40%, 50% and 100% release of the average non-monsoon discharge

of worst four consecutive months in 90% dependable flow series of the respective hydro electric project. The flow parameters i.e. water depth, water velocity and top width for the lean season, monsoon and other months in the river reach downstream of different proposed projects in the basin has been assessed using (HEC-RAS) mathematical model developed by HEC.

In view of the above said considerations and factoring in modeling results water release in lean season may be kept between 10-15% for migration and sustaining ecological functions except Hiya and Nyepin HEP. Therefore, it is suggested that the minimum 20% water flow in lean season may be maintained at Hiya and Nyepin HEP for fish migration and maintenance of ecological functions.

All the projects in Subansiri Basin are ROR projects with pondage provisions to meet the peaking requirements only except the Subansiri Middle and Subansiri Upper HE Projects which have the provisions of flood cushions of 15 m and 10 m respectively for the flood mitigation measures apart from the pondage provisions. Hence, for downstream impact study due to peaking releases from these projects during the non-monsoon the following considerations have been made:

- Environmental flow and peaking releases of all the projects located upstream of Subansiri Upper HE Project will be re-regulated from Subansiri upper HE Project to meet its environmental flow and peaking discharge requirements
- Environmental flow and peaking releases of all the projects located upstream of Subansiri Middle (Kamala HE Project) will be re-regulated from Subansiri middle HE Project to meet its environmental flow and peaking discharge requirements.
- Environmental flow and peaking releases of Subansiri upper and Subansiri middle HE Projects will be re-regulated from Subansiri lower HE Project for its environmental flow release and peaking release requirements

With the completion of proposed dams, the flow in the downstream stretch of the river would be reduced considerably more so during the lean period. The most important changes that can be expected are: Reduced flow rate; Increase in water temperature; Reduction in availability of stenothermal aquatic animals i.e. animals which can adapt to only small temperature range; Increase in population of eurythermal species. i.e. species which can adapt to a large temperature range and Unless the desired flow is maintained downstream of the dam, river stretches at places are subjected to near desiccation.

### **Downstream Impacts on Assam**

About nineteen hydroelectric projects are planned in Subansiri basin. These projects are the part of cascade development of Subansiri and Kamala rivers along with their tributaries. The average discharge of Brahmaputra river during the monsoon period is more than 20000 cumec. Hence, the peaking release of the hydroelectric projects which is of the order of 1000 to 2000 cumec is not likely to make any significant change in the flow pattern of Brahmaputra river. During the non-monsoon

period (November to April) the average discharge of Brahmaputra river near Guwahati is generally of the order of 5300 cumec. Hence some change in flow pattern may be expected due to peaking releases from the Projects in the basin.

Most of the projects are likely to be operated at Minimum Draw Down Level (MDDL) during monsoon period and at Full Reservoir Level (FRL) during the non-monsoon period. Further, during the non-monsoon period the peaking discharge release of the projects in upper reaches of Subansiri basin will be utilized by the project at lower reaches of the basin and net peaking discharge from the lower most project of the basin in general will be the governing one for any impact study.

A summary of simulation results of non-monsoon discharge and water level pattern of pre project (natural condition) and post project scenario is summarized in Table 2.

**Table 2: Discharge and water level at salient locations for pre and post project scenario**

Location	Chainage d/s of Subansiri lower HEP	River Bed level	Pre Project Scenario		Post Project Scenario			
			(natural condition)		3 hours peaking @2579.20 cumec/hr		4 hours peaking @ 2579.20 cumec/hr	
			Dis- charge	Water level	Dis- charge	Water level	Dischar ge	Water level
(km)	(m)	(cumec)	(m)	(cumec)	(m)	(cumec)	(m)	
North Lakhimpur	40	89.01	538	92.55	465-830	92.26 - 93.21	338-995	91.90 - 93.33
Subansiri just before Brahma- putra confluence	89.5	72.39	538	83.72	405-758	83.76 - 83.77	461-866	83.82 - 83.84
Kaziranga	188.16	71.8	4117	81.99	4172- 4186	82.05	4265- 4281	82.12
Tezpur	221.18	67.22	4475	74.92	4538- 4543	74.95	4632- 4639	75
Guwahati	328.30	30.96	5377	40.63	5443	40.66	5537	40.72

From the above summary it can be seen that in general the peaking release have impact on discharge and water level pattern of Subansiri river up to about 1<sup>st</sup> 40 km downstream of the Subansiri HE Project. After 1<sup>st</sup> 40 km and up to the Subansiri Brahmaputra confluence the discharge and water level pattern tends to stabilize and fluctuation in water level diminishes. In Brahmaputra the impact of peaking release is almost nil as fluctuation in discharge is only few cumec. The consequent daily fluctuation in water level is at different locations along Brahmaputra is only 1 to 2 cm.

### **Impact on Aquatic Fauna**

Amongst the aquatic animals, it is the fish life that would be most affected. The migratory fish species, e.g. Mahaseers and snow trouts are likely to be adversely affected due to obstruction created by the proposed dams. The Mahaseer species undertake upstream migration in river Subansiri during summer and monsoon months for feeding and breeding. As the winter sets in the upper reaches, the species takes a downstream journey as far as up to its confluence with river Brahmaputra. In addition certain species of *Schizothorax* (Snow trout) also undertake migration from upper reaches during winter months. This fish species breeds in the lower reaches. The Mahaseers (*Tor tor*, *T. putitora* and *Acrossocheillus hexagonolepis*) migrate sometime in April-May. Geographically, the fish remains upstream much beyond Gerukamukh, Lower Subansiri, till optimal conditions are met for breeding during the months of August-September. The wide stretches of river Subansiri in the project area have deeper pools. A shallower area with gravel substratum is one of the essential requirements for spawning of Mahaseers. This situation is likely to change, once the dam is constructed. As a result of obstruction in the migratory route due to the construction of the dam, the Mahaseers are likely to congregate below the wall of the dam. For mature fish, upstream migration would not be feasible. This is going to be the major adverse impact of the project. Therefore, provision of fish ladder can be made in the proposed dams.

The construction of the proposed cascade development of HEPs in Subansiri basin will reduce water flow, especially during dry months, in the intervening stretch between the Head Race Tunnel (HRT) site and the discharge point of Tail Race Tunnel (TRT). Such a situation may affect particularly the benthic communities and fish. The natural flow in river is likely to be available after the confluence point of TRT and the river downstream, as Subansiri River is a perennial river.

### **Impact on Terrestrial Ecology**

Terrestrial ecology is one of the major parameters, which gets affected due to the construction of a hydroelectric project. The severity of impacts on terrestrial ecology mainly depends upon the area of submergence and the land requirement for the other project components i. e. Power house, dam, surge shaft, tunnels, adits, quarry sites, dumping areas and project colony, etc. The impacts are:

- Change in land use
- Loss of access of local communities to natural resources

Proposed HEPs namely Oju 1, Oju II, Niare, Naba, Nalo, Dengser, Subansiri Upper and Tammu are proposed in Upper Subansiri District which has 672.2 reserved forests and 2 ARF. Kurung I and II, Middle Subansiri, Middle Subansiri, Tamen and Tago-I are located in Lower Subansiri district which has 347.07 Reserved Forest and 337 area under Wildlife Sanctuary. Mili, Sape, Chomu, Chela, Nyapin and Hiya are located in Kurung Kumey district which has no RF, PF, ARF, VRF, WLS and NP. However, a total 5062.13 of Unclassified State Forest (USF) is reported in Lower Subansiri and Kurung Kumey districts.

55 endemic species representing 21 families are reported from Subansiri Basin. Orchidaceae family has 14 species, followed by 5 each of Fumariaceae and Campanulaceae, 4 of Ranunculaceae, Magnoliaceae and Rubiaceae, 3 each of Balsaminaceae and Gesneriaceae, and 1 species each of family Illiciaceae, Schisandraceae, Vitaceae, Hydrangeaceae, Myrtaceae, Begoniceae, Pedaliaceae, Verbenaceae, Euphorbiaceae, Urticaceae, Agavaceae, Araceae and Cyperaceae. *Begonia aborensis* and *Pholidota wattii* are also assessed as Rare plants in Subansiri basin. Eight plants (2 vulnerable and 6 rare) are reported to occur in Subanisiri Basin which are assessed as Vulnerable and Rare. No endangered plant is reported to occur in Subansiri Basin.

### **Cumulative impact assessment of all projects**

The length of the river Subansiri is 375 km up to its outfall in the Brahamaputra River, of which approximately 212.51 km total length of Subansiri will be affected due to the proposed HEP on Subansiri River. Total 8 HEPs are proposed on the Subansiri river and only Lower Subansiri HEP is under Construction at Gerkamukh with capacity of 2000 MW.

Total area brought under submergence for dam and other project requirements is approx. 10, 032 ha of nine proposed HEPs. The extent of loss of forest in rest of the 9 projects is not available. HEP at Lower Subansiri is under construction.

Total 5821 ha area of Upper Subansiri district is under the forest; out of this 1758 ha forest area will be affected due to construction of proposed HEP on the Subansiri River. While Lower Subansiri district has 8673 ha forest area and approximately 1889 ha will be affected due to the project (21.7%). So, total area (Upper & Lower Subansiri districts) is 14494 ha; out of this 3647 ha area (approx 25%) will be converted into non-forest area. Therefore, assessment indicates that development of proposed hydropower projects in Subansiri would affect the forest area of the Subansiri Basin and terrestrial and aquatic flora/fauna.

A summary of cumulative impacts (River reach and Forest area) as assessed with the existing data is given in Table 3 below. The next steps include overall assessment of the impacts on account of hydropower development in the basin, which will be described in draft final report.

**Table 3: Cumulative Impacts of proposed development of HEPs on River Reach and Forest Area in Subansiri Basin**

District	Main River	Tributary	Total Length of River/Tributary (km)	Total Catchment Area (Sq. km)	Total Forest Area (ha)	Proposed HEP and its Capacity (MW)	Total length of River/Tributary (km)		Total Forest area Affected		Status of EC	Remarks
							Affected	Free Flow	Affected (ha)	% of total		
Upper Subansiri	Subansiri	Subansiri/Singit	375 (Up to its Outfall in Brahamaputra)	9827*	5821	Oju-I: 700	20.1		425	7.30	Not awarded	PFR is Available
				9979*		Oju-II: 1000	8.59		405	6.95		
				11181*		Niare: 800	9.83		48	0.82		
				11272*		Naba:1000	7.99		325	6.44		
				12150*		Nalo: 360	24.5		455	7.81	Term s of Reference is issued on 21 <sup>st</sup> March, 2012	
				17625		Dengser: 552	14.81		100	1.71	Not awar	

District	Main River	Tributary	Total Length of River/Tributary (km)	Total Catchment Area (Sq. km)	Total Forest Area (ha)	Proposed HEP and its Capacity (MW)	Total length of River/Tributary (km)		Total Forest area Affected		Status of EC	Remarks
							Affected	Free Flow	Affected (ha)	% of total		
Lower Subansiri					8673						ded	
				14665*		Upper Subansiri: 2000			48.89	-	Term s of Refer ence is issue d on 28 <sup>th</sup> April, 2011	
		-		Tammu: 55					-	No information available regarding the projects		
		Subansiri		34900*		Lower Subansiri: 2000			1889	21.76	EC awarded	

District	Main River	Tributary	Total Length of River/Tributary (km)	Total Catchment Area (Sq. km)	Total Forest Area (ha)	Proposed HEP and its Capacity (MW)	Total length of River/Tributary (km)		Total Forest area Affected		Status of EC	Remarks
							Affected	Free Flow	Affected (ha)	% of total		
Total			375				212.51	162.49	3647			

The EAC after deliberations observed the following:

- (i) The Consultants shall provide the report on downstream impact study. Cross section of river is also to be provided to facilitate visualizing the rise of water level in the downstream area.
- (ii) Soil erosion including type/class and intensity may touched upon including soil conservation aspects.
- (iii) Not only the big & medium sized projects, but micro HEPs are also to be included in the study. Data/information on these have to be obtained by the consultants and CWC is to help getting such information from State Government. This is important for a holistic and integrated examination/study.
- (iv) As far as possible, effect of sediment may be reported.
- (v) The primary data have to be highlighted.
- (vi) Selection of size and number of HEPs to also factor as to whether migration/movement of animals will be impeded.
- (vii) Migration of fish is also to be factored and measures for conservations to be proposed.
- (viii) Pictorial presentation rather than tabular may be done as far as possible.

2.0 Issues raised by South Asia Network on Dam, a copy of which was handed over to consultant are to be replied / explained properly.

3.0 The EAC asked the Consultants to also comply with the following:

- (i) Optimal number and locations of HEPs and similar projects to be planned in the basin conforming strictly to ecological and environmental sustainability is to be clearly delineated.
- (ii) Major parameters of the proposed projects such as approximate capacity, TRT & HRT lengths, their locations, height of dam/barrage, incorporation of flood moderation component, extent of submergence including forests land, loss of habitation & bio-diversity etc are to be indicated project wise.

(iii) If found essential for the overall interest of environment certain projects may be recommended to be dropped.

(iv) The recommendations of optimal number and size have to be based on the outcome of cumulative impact assessment study on riverine ecology, loss of bio-diversity in the catchment/ submergence, environmental flow requirement for different identified stretches/Dam locations, unaffected river stretches to be left out for free flowing purposes, presence of tribal population and likely socio-economic impact on them, location sanctuary/ biosphere, animal/elephant corridor for their safe and unhindered movement, Migratory fish and their conservation. The basis for recommendations have to be in line with cost and likely benefit to be accrued from the projects and to be clearly articulated.

(v) Also, the draft report has to be uploaded in the portal and published suitably for seeking comments/opinion from general public. Only after incorporating public opinion, the final report is submitted for further consideration.

(i) Optimal number including locations of HEPs and similar projects to be planned in the basin conforming strictly to ecological and environmental sustainability is to be clearly delineated.

(ii) Major parameters of the proposed projects such as approximate capacity, TRT & HRT lengths, their locations, height of dam/barrage, incorporation of flood moderation component, extent of submergence including forests land, loss of habitation & bio-diversity etc are to be indicated project wise.

(iii) If found essential for the overall interest of environment certain projects may be recommended to be dropped.

(iv) The recommendations of optimal number and size have to be based on the outcome of cumulative impact assessment study on riverine ecology, loss of bio-diversity in the catchment/ submergence, environmental flow requirement for different identified stretches/Dam locations, unaffected river stretches to be left out for free flowing purposes, presence of tribal population and likely socio-economic impact on them, sanctuary/ biosphere, animal/elephant corridor for their safe and unhindered movement, Migratory fish etc and to be clearly articulated.

(v) Also, the draft report has to be uploaded in the portal and published suitably for seeking comments/opinion from general public. Only after incorporating public opinion, the final report is submitted for further consideration.

## **Additional item with the permission of the Chairman:**

With the permission of the chairman, the following project was taken up:

### **2.17 :Terms of Reference (ToR) for conducting cumulative Environmental Impact Assessment Studies (CEIA) of Dibang and Kameng Sub Basin in Brahmaputra River Valley, Arunachal Pradesh-regarding by CWC, MoWR**

The EAC was informed that as per OM dated 28.5.2013 of the Ministry of Environment & Forests, carrying capacity studies or Cumulative Environment Impact Studies (CEIA )of all the river basins have to be completed within two years time from the date of issue of the OM. Pursuant to this OM, the CWC has now proposed to carry out cumulative basin studies of these two new river sub- basins.

The EAC noted that Cumulative impact assessment study of a river / river basin is an important and effective tool for consideration of Hydro electric power projects proposed in a cascading fashion. Among other things, the study will come out with optimum number of projects that could be planned on a river and its basin in an environmentally sustainable manner. The study will also enable ensuring a minimum free flowing stretch of a river as total numbers of projects recommended and would be known beforehand.

The EAC observed once such a report has been accepted by MoEF, the provisions of the report will need to be followed for consideration of individual projects. The CWC explained that they have proposed draft ToRs based on similar ToRs given earlier by EAC and also its incorporated observations offered during consideration of interim report of these basin studies. Therefore, robust ToRs have been prepared and proposed by CWC.

2.0 The EAC, while, agreeing with the draft ToRs proposed by CWC for the study (Annexure- II & III), requested CWC to, inter alia, ensure the following as the outcome of the report.

- I. Optimal number and locations of HEPs and similar projects to be planned in the basin conforming strictly to ecological and environmental sustainability is to be clearly delineated.
- II. Major parameters of the proposed projects such as approximate capacity, TRT & HRT lengths, their locations, height of dam/barrage, incorporation of flood moderation component, extent of submergence including forests land, loss of habitation & bio-diversity etc are to be indicated project wise.
- III. If found essential for the overall interest of environment certain projects may be recommended to be dropped.

- IV. The recommendations of optimal number and size have to be based on the outcome of cumulative impact assessment study on riverine ecology, loss of bio-diversity in the catchment/ submergence, environmental flow requirement for different identified stretches/Dam locations, unaffected river stretches to be left out for free flowing purposes, presence of tribal population and likely socio-economic impact on them, location sanctuary/ biosphere, animal/elephant corridor for their safe and unhindered movement, Migratory fish and their conservation. The basis for recommendations have to be in line with cost and likely benefit to be accrued from the projects and to be clearly articulated.
- V. Also, the draft report has to be uploaded in the portal and published suitably for seeking comments/opinion from general public. Only after incorporating public opinion, the final report is submitted for further consideration.

**3.0 The following additional ToRs are also to be added:**

- Study and ensure migration and safe passage/corridor for movement of animals.
- Conservation measures for migratory fish and local fish.
- Adequate soil erosion aspects and type
- Proper & scientific downstream study using latest applicable models, wherever found necessary to assess downstream impact.
- Environmental flow to be assessed and recommended in accordance with best suited techniques/ method for the river/river basin and has to be delineated in the report.

4.0 The EAC would appraise the interim Report and provide its observations and guidance. Thereafter, TAC of the CWC would ensure compliance to preparation of final Report following the provisions of ToRs.

5.0 The final report should be shared with Ministry of Power and State Government concerned who will ensure that only recommended projects as per the study report are implemented.

The meeting ended with a vote of thanks to the Chair.

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**List of EAC members and Project Proponents who attended 68<sup>th</sup> Meeting of Expert Appraisal Committee for River Valley & Hydro Electric Power Projects held on 23<sup>rd</sup> – 24<sup>th</sup> September, 2013 in New Delhi**

**A. Members of EAC**

- |     |                          |   |                                   |
|-----|--------------------------|---|-----------------------------------|
| 1.  | Shri Alok Perthi         | - | Chairman                          |
| 2.  | Dr. K. D. Joshi          | - | Member                            |
| 3.  | Dr. S. Sathya Kumar      | - | Member                            |
| 4.  | Dr. Vijay Kumar          | - | Member                            |
| 5.  | Dr. P. K. Choudhuri      | - | Member                            |
| 6.  | Shri Hardip Singh Kingra | - | Member                            |
| 7.  | Shri N. N. Rai           | - | Member                            |
| 8.  | Dr. S. K. Mishra         | - | Member                            |
| 9.  | Shri B. B. Barman        | - | Member Secretary & Director, MoEF |
| 10. | Dr. P. V. Subba Rao      | - | MoEF                              |

**B. Rolep HEP (72 MW) in East Sikkim in Distt. Of Sikkim by Velankini Renewable Energy Pvt. Ltd. – For reconsideration of TOR**

**C. Relong HEP in East Sikkim District, Sikkim by M/s. Velankini Renewable Energy Pvt. Ltd. – For reconsideration of TOR**

**D. Chankang Chu HEP in East Sikkim District, Sikkim by M/s. Velankini Renewable Energy Pvt. Ltd. – For reconsideration of TOR**

- |    |                         |   |                      |
|----|-------------------------|---|----------------------|
| 1. | Shri V. N. Rathnakar    | - | Director             |
| 2. | Shri V. Lakshmana       | - | Consultant           |
| 3. | Shri Rama Prasad        | - | Professor(RTD)       |
| 4. | Shri Rajib Ranjan Das   | - | Manager              |
| 5. | Dr. Suparna Mulick      | - | Asian Cons. (P) LTD. |
| 6. | Shri Partha Pratim Maji | - | Asian Cons. (P) LTD. |

**E. Singtalur Lift Irrigation Scheme/Project on Tungabhadra River in Hammigi Village, Gadag District Karnataka- For reconsideration of ToR .**

**F. Shiggaon Lift Irrigation Scheme in Haveri District of Karnataka by M/s. Karnataka Neeravari Nigam Limited. – For reconsideration of EC**

- |    |                          |   |                               |
|----|--------------------------|---|-------------------------------|
| 1. | D. Sathya Murthy         | - | Principal Secretary           |
| 2. | Shri K. M. K. Sharma     | - | Additional Executive Engineer |
| 3. | Shri Ashok Vasnad        | - | Chief Engineer                |
| 4. | Shri B. S. Chandrashekar | - | Executive Engineer            |

**G. Revalidation of validity of ToR for**

- (iv) Tato-I HEP (186 MW) in Arunachal Pradesh by M/s. Velcon Pvt. Ltd.**  
**(v) Heo HEP (240 MW) in Arunachal Pradesh by M/s. Velcon Pvt. Ltd. and**  
**(vi) Pauk HEP (145 MW) in Arunachal Pradesh by M/s. Velcon Pvt. Ltd.**

- |    |                     |   |                 |
|----|---------------------|---|-----------------|
| 1. | Shri Benoit Laborie | - | Director        |
| 2. | Shri V. K. Sharma   | - | Sr. Advisor     |
| 3. | Shri Khasim         | - | General Manager |

**H. Dibang Multipurpose Project (3000 MW) in Arunachal Pradesh by M/s. NHPC Ltd.-  
for Environment Clearance (EC).**

- |     |                       |   |                    |
|-----|-----------------------|---|--------------------|
| 1.  | Shri V. K. Maini      | - | General Manager    |
| 2.  | Shri Anjan Thakur     | - | Regional Director  |
| 3.  | Ms. Manjusha Mishra   | - | Manager            |
| 4.  | Dr. Aman Sharma       | - | General Manager    |
| 5.  | Shri A. K. Sarkar     | - | Executive Director |
| 6.  | Dr. A. K. Jha         | - | Assistant Manager  |
| 7.  | Dr. S. A. Khan        | - | Chief (Env.)       |
| 8.  | Shri B. Prabhakaran   | - | Chief (Geo)        |
| 9.  | Shri S. L. Kapil      | - | Chief (Geo)        |
| 10. | Shri M. G. Gokhle     | - | Chief Engineer     |
| 11. | Dr. Anuradha Bajpayee | - | District Manager   |

**I. Lower Kopili HEP (120 MW) in Karbi Anglong & North Cachar Hill Districts of Assam by M/s. Assam Power Generation Corporation Ltd - For reconsideration of TOR.**

- |    |                   |   |                        |
|----|-------------------|---|------------------------|
| 1. | Shri R. C. Jain   | - | Managing Director      |
| 2. | Shri A. C. Boruah | - | General Manager        |
| 3. | Dr. A. Sharma     | - | General Manager        |
| 4. | Dr. B. C. Jha     | - | Senior General Manager |

- |    |                   |   |                           |
|----|-------------------|---|---------------------------|
| 5. | Shri P. K. Khognd | - | Director General Manager  |
| 6. | Shri U. Dutta     | - | Assistant General Manager |
| 7. | Shri R. Kapoor    | - | Liaison Officer           |

**J. Revalidation of validity of ToR for Talong Londa HEP in Arunachal Pradesh by M/s. GMR Pvt. Ltd.**

- |    |                      |   |                          |
|----|----------------------|---|--------------------------|
| 1. | Shri S. Kannan       | - | Assistant Vice President |
| 2. | Shri Pravir Deshmukh | - | Assistant Manager        |
| 3. | Shri Moloy Maitra    | - | Manager                  |

**K. Revalidation of validity of ToR for Siang Lower HEP in Arunachal Pradesh by M/s. JP Ltd**

- |    |                      |   |                           |
|----|----------------------|---|---------------------------|
| 1. | Shri P. K. Alagh     | - | Senior Vice President     |
| 2. | Shri Yogender Sharma | - | Assistant General Manager |
| 3. | Shri J. P. Bhatt     | - | Scientist                 |
| 4. | Dr. Dorje Dawa       | - | Scientist                 |
| 5. | Shri Ashok Kumar     | - | Assistant                 |
| 6. | Shri Jitendra Thakur | - | Dy. Chief Engineer        |

**L. Mohanpura Major Irrigation Project in Madhya Pradesh M/s. Water Resources Department, Government of Madhya Pradesh – For reconsideration of Environmental Clearance (EC).**

- |    |                           |   |                        |
|----|---------------------------|---|------------------------|
| 1. | Manish Singh              | - | Principal Director     |
| 2. | Shri M. G. Choubey        | - | Engineer-in-Chief      |
| 3. | Shri B. M. Sharma         | - | Chief Engineer         |
| 4. | Shri Rajeev Kumar         | - | Chief Engineer         |
| 5. | Dr. S. K. Tyagi           | - | Chief (Ecologist)      |
| 6. | Shri Shiv Mohan Dixit     | - | Senior Engineer        |
| 7. | Shri Kamta Prasad Kadiyam | - | Sub-Divisional Officer |
| 8. | Shri Jagdish Singh Pawar  | - | Com.- Project          |

**M. Turga Pumped Storage project (1000 MW) in district Purulia, West Bengal by West Bengal State Power Distribution Company Limited. -For TOR.**

- |    |                    |   |                 |
|----|--------------------|---|-----------------|
| 1. | Shri O. P. Chibber | - | General Manager |
|----|--------------------|---|-----------------|

- |     |                     |   |                         |
|-----|---------------------|---|-------------------------|
| 2.  | Shri A. Tripathi    | - | Head CO                 |
| 3.  | Shri R. N. Saha     | - | Chief Engineer          |
| 4.  | Shri S. Chakraborty | - | Chief Engineer          |
| 5.  | Shri D. Gupta       | - | Resident Director       |
| 6.  | Shri Desidas Dutta  | - | Director                |
| 7.  | Shri Amitava Sen    | - | Superintendent Engineer |
| 8.  | Shri A. K. Bhowmick | - | Superintendent Engineer |
| 9.  | Shri Tanmoy Das     | - | Consultant              |
| 10. | Shri S. D. Gowswamy | - | Consultant              |

**N. Sip Kolar Link Medium project in District Sehore, Madhya Pradesh by M/s. Water Resources Department, Government of Madhya Pradesh – For EC.**

- |    |                           |   |                        |
|----|---------------------------|---|------------------------|
| 1. | Manish Singh              | - | Principal Director     |
| 2. | Shri M. G. Choubey        | - | Engineer-in-Chief      |
| 3. | Shri B. M. Sharma         | - | Chief Engineer         |
| 4. | Shri Rajeev Kumar         | - | Chief Engineer         |
| 5. | Dr. S. K. Tyagi           | - | Chief (Ecologist)      |
| 6. | Shri Shiv Mohan Dixit     | - | Senior Engineer        |
| 7. | Shri Kamta Prasad Kadiyam | - | Sub-Divisional Officer |
| 8. | Shri Jagdish Singh Pawar  | - | Com.- Project          |

**O. Teesta Intermediate HEP (4x21 MW) of WBSEDCL in Darjeeling, West Bengal- For ToR.**

- |     |                     |   |                         |
|-----|---------------------|---|-------------------------|
| 1.  | Shri O. P. Chibber  | - | General Manager         |
| 2.  | Shri A. Tripathi    | - | Head CO                 |
| 3.  | Shri R. N. Saha     | - | Chief Engineer          |
| 4.  | Shri S. Chakraborty | - | Chief Engineer          |
| 5.  | Shri D. Gupta       | - | Resident Director       |
| 6.  | Shri Desidas Dutta  | - | Director                |
| 7.  | Shri Amitava Sen    | - | Superintendent Engineer |
| 8.  | Shri A. K. Bhowmick | - | Superintendent Engineer |
| 9.  | Shri Tanmoy Das     | - | Consultant              |
| 10. | Shri S. D. Gowswamy | - | Consultant              |

**P. Subansiri Sub-Basin in Arunachal Pradesh by M/s. Central water Commission –  
For Basin Study**

- |                            |   |                         |
|----------------------------|---|-------------------------|
| 1. Shri Gurpreet Singh     | - | Environmentalist        |
| 2. Dr. M. A. Khalid        | - | Chief Executive Officer |
| 3. Shri Sanjeev S. Narayan | - | General Manager         |
| 4. Shri Amit Jain          | - | Managing Director       |
| 5. Shri Krishna Kumar      | - | General Manager         |
| 6. Shri G. Naga Mohan      | - | Director                |
| 7. Shri R. K. Khanna       | - | Consultant              |

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**TERMS OF REFERENCE FOR DIBANG SUB BASIN**

- I **To conduct Environmental Impact Assessment studies for Dibang sub basin in ARUNACHAL PRADESH, due to development of Hydro Electric projects in Dibang sub basin and its effect on downstream of the river in Brahmaputra basin in Assam**

**Dibang Sub-basin in Arunachal Pradesh**

**1. INTRODUCTION**

The basin study envisages providing optimum support for various natural processes and allowing sustainable activities undertaken by its inhabitants. The same is determined in terms of the following

- Inventorisation and analysis of the existing resource base and its production, consumption and conservation levels.
- Determination of regional ecological fragility/sensitivity based on geo-physical, biological, socio economic and cultural attributes.
- Review of existing and planned developments as per various developmental plans.
- Evaluation of impacts on various facets of environment due to existing and planned development.

The study should involve assessment of stress/load due to varied activities covering, e.g. exploitation of natural resources, industrial development, population growth which lead to varying degree of impacts on various facets of environment. The basin study should also envisage a broad framework of environmental action plan to mitigate the adverse impacts on environment which should be in the form of :

- Preclusion of an activity
- Infrastructure development
- Modification in the planned activity
- Implementation of set of measures for amelioration of adverse impacts.

The basin study is a step beyond the EIA, as it incorporates an integrated approach to assess the impacts due to various developmental projects.

**2. STUDY AREA**

The study area to be covered as a part of the Basin Study is for entire Dibang Basin. The study should be based on secondary as well as primary data collection.

### 3. PROJECTS ENVISAGED IN DIBANG BASIN

**Fourteen (14) projects are envisaged in the study area to be covered in the Dibang basin. The details of the same are given below in Table.**

**Table: Projects proposed on Dibang River (Above 25MW Capacity)**

Sl. No	Name of the project	Catchment Area (sq.km)	Present I.C. (MW)	FRL (m)	Ht. of the Dam (m)	
					From deepest foundation	Above River bed
1	Sissiri	610	100	510	142.5	--
2	Mihundon	968	400	1670	--	65
3	Agoline	1550	375	1250	95	--
4	Etalin	Dri-R-3685 Tangon-R-2573	3097	Dri-1045 Tan-1050	Dri-101.5 Tan- 80	--
5	Dibang	11276	3000	545	288	--
6	Amulin	2175	420	1440	75	--
7	Emini	2600	500	1270	85	--
8	Attunli	2072	500	1360	105	--
9	Emra -I	1500	275	--	--	--
10	Emra-II	1426	216	860	120	--
11	Elango	381	150	1130	80	--
12	Malinye	--	335	--	--	--
13	Etabue	443	165	1690	78	--
14	Ashupani	110	30	640	--	25

(Source: Central Electricity Authority, New Delhi)

### 4. DATA COLLECTION:-

In the present study emphasis should be laid on terrestrial and aquatic ecology. The estimation of supportive capacity of the basin should involve the preparation of the existing scenario i.e., the preparation of detailed data base of the basins. This should be accomplished through the steps outlined in following sections.

#### 4.1 METEOROLOGY:-

The information on various meteorological aspects is to be collected from India Meteorological Department (IMD) for meteorological stations located within the basin

area or in vicinity to the basin boundary. The information on various aspects such as rainfall, temperature wind, humidity etc. will be collected.

#### **4.2 WATER RESOURCES:-**

The information on following aspects should be collected:

- Review of drainage characteristics of the basin, including various surface water bodies like rivers and lakes.
- Data collection and review of past studies/reports/data etc.
- Review of existing water sharing agreements for meeting various need-based existing and future demands viz. municipal, irrigation, power generation and industrial.
- Analysis of all, past assessment of the water availability and assessing the water availability, as per updated data for the system as a whole and at existing ongoing/proposed project locations on annual/monsoon/non-monsoon and monthly basis.
- Estimation of sediment load at various points in the basin based on available secondary data.
- Identification of perennial sources of water and their designated usages.

#### **4.3 WATER QUALITY:-**

As a part of the studies, secondary data is to be collected for water quality in the study area. In addition to above, information on human settlement, sewage generated and mode of collection, conveyance treatment and disposal of sewage should also be collected.

**The water quality monitoring should be conducted at 20 (twenty) locations in the study area. The frequency of sampling should be once per month for 12 months.**

The various parameters include pH, Dissolved Oxygen (DO), Electrical conductivity (EC), Total Suspended Solids (TSS), Total Dissolved Solids (TDS), Total Alkalinity, Total Hardness, Biochemical Oxygen Demand(BOD), Chemical Oxygen Demand(COD), Nitrates, Chlorides, Sulphates, Phosphates, Sodium, Calcium, Magnesium, Potassium, Iron, Manganese, Zinc, Cadmium, Lead, Copper, Mercury, Total Chromium, Total Coliform.

#### **4.4 FLORA:**

The following data should be collected from various secondary sources for river Dibang and its tributaries in the basin area :

- Characterization of forest types in the study area and extent of each forest type.
- Information on general vegetation pattern and floral diversity.
- Presence of economically important species in the basin area.
- Presence of Rare, Endangered and Threatened floral species as per the categorization Botanical Survey of India's Red Data list in the basin area.
- Presence of endemic floral species found in the basin area, if any should be assessed as a part of the basin study.
- Location of wild life sanctuaries, national parks, biosphere reserves if any, in the study area
- Specific survey methods for sampling methodology to be adopted for Flora.

**The field studies should be conducted for sampling at 20 (twenty) locations to collect primary data on terrestrial ecology in the study area. The monitoring should be conducted for all three seasons.** The following should be covered as a part of the EIA study.

- Identification of forest type and density, bio-diversity in the study area.
- Preparation of comprehensive checklist of flora (Angiosperms, Gymnosperms, Lichens, Pteridophytes, Bryophytes, Fungi, Algae etc.) with Botanical and local name.
- Importance Value Index of the dominant vegetation at various sampling locations.
- Frequency, Abundance and density of each species of Trees, Shrubs and Herbs at representative sampling sites should be estimated.
- Identification and listing of plants of genetically, biologically, economical and medicinal importance.
- Major forest produce, if any, and dependence of locals on the same in the forests observed in the study area.

In addition, based on the published literature including various research papers, the information on forest types, presence of various species, biological diversity etc. should be collected for the study area.

#### **4.5 FAUNA:**

The following data to be collected from various secondary sources for the study area:

- Inventory of Birds (resident, migratory), land animals including mammals, reptiles, amphibians, fishes etc reported & surveyed in the basin area should be prepared.

- Presence of RET faunal species as per the categorization of IUCN Red Data list and as per different schedules of Indian Wildlife Protection Act, 1972 in the basin area.
- Presence of endemic faunal species found in the basin area, if any should be assessed as a part of the Basin Study.
- Existence of barriers and corridors for wild animals, if any in the basin area should be covered as a part of the study.
- Identification of threats to wildlife in the region.
- Presence of National Park, Sanctuary, Biosphere, Reserve Forest etc. in the basin area should be assessed.
- Specific survey methods for sampling methodology to be adopted for Fauna.

During ecological survey, identification of faunal species should be carried out simultaneously. Indirect observations of mammals should be carried out by identification of tracks, droppings (scal), claw marks and calls, etc. The listing of faunal species by direct observation techniques should be carried out. The detailed list of faunal species should be formulated based on forest records and published literature.

#### **4.6 AQUATIC FLORA AND FAUNA:**

The following data should be collected from various secondary sources for river Dibang and its tributaries in the basin area :

- Presence of major fish species
- Inventory of migratory fish species & migratory routes of various fish species
- Presence of major breeding and spawning sites.

**The field studies should be conducted for sampling at 20 (twenty) locations to collect** primary data on aquatic ecology & fisheries in the study area. The density and diversity of phytoplankton, zooplankton should be estimated. In addition, primary productivity should be monitored at various locations to be covered as a part of the study.

The diversion of water for hydropower generation leads to reduction in flow downstream to the dam site up to disposal of tail race outfall. This leads to diverse impacts on riverine ecology. The dam could also act as a barrier for migration of fishes. The data on prevailing fish species should be collected from the Fisheries Department. **To augment the existing data, a fisheries survey should be conducted at 20 (twenty) locations in the study area. The survey should be conducted once per month for 12 months.** **The details of the monitoring work should be carried out as per the following:**

- **Assessment of biotic** resources with special reference to primary productivity, zooplanktons, phytoplanktons, benthos, macrophytes, macro-invertebrates and fishes in the study area.
- Population densities and diversities of phytoplanktons, zooplanktons, benthos, macrophytes, macro-invertebrates and fish shall be estimated. Diversity indices of these ecological groups should also be calculated separately.
- Fish composition
- Migratory route of migratory fishes
- Spawning & breeding grounds of fish species, if any, should be identified.

## 5 IMPACTS DUE TO HYDROPOWER DEVELOPMENT

The impacts on terrestrial and aquatic ecology should be studied. The scenario to be considered for assessment in the present study should be based on the hydropower projects presented in Table. The key aspects to be covered are listed as below:

- Modification in hydrologic regime due to diversion of water for hydropower generation.
- Depth of water available in river stretches during lean season and its assessment of its adequacy vis-a-vis various fish species.
- Length of river stretches with normal flow due to commissioning of various hydroelectric projects due to diversion of flow for hydropower generation.
- Impacts on discharge in river stretches during monsoon and lean seasons due to diversion of flow for hydropower generation.
- Impacts on water users in terms of water availability and quality
- Impacts on aquatic ecology including riverine fisheries as a result of diversion of flow for hydropower generation.
- Assessment of maintaining minimum releases of water during lean season to sustain riverine ecology, maintain water quality and meet water requirement of downstream users.
- Impact due to loss of forests
- Impact on RET species & impacts on economically important plant species.
- Impacts due to increased human interference
- Impacts due to agricultural practices.
- Study the impact of cascade development and make recommendations on the requirement of free flowing stretch between two projects. Ecological inventory and geomorphology for different stretches of river to be delineated.
- Information on river stretch affected and forest area affected by each project needs to be modified to include additional details of catchment area; total forest area of the sub basin and the area getting affected and total river length, stretch affected and free flowing.

- Undertake environmental flow release assessment for the entire **year i.e. covering lean, non-lean non- monsoon and monsoon periods,** based on methodology such as BBM and make recommendations for each stretch.
- Hydro Dynamic Study for assessment of Environmental flow release should be linked with the fauna, habitat requirement for assessment of environmental flow releases for entire year.
- Modelling study carried out to assess the impact of peaking discharge should be concluded with recommendations for mitigation of such impacts.
- Sampling sites, forest cover and forest type should be listed and illustrated sub basin wise. Endemic species of fishes in the sub basin may be tabulated.
- Downstream impact study should be done up to **Guwahati.**
- Impact of sand mining, boulder mining, etc need to be included in the study.
- Impact on overall balance of sediment due to construction of a number of projects needs to be included in the report.
- The main objective of the study is to bring out the impacts of dams being planned on the main river and its tributaries. At the end of the Report there should be a separate Chapter synthesizing the results of each component so that a holistic picture of impacts could be emerged which should lead to Recommendations.
- Impact assessment should also include “Impacts due to construction of approach roads for the HEPs”.
- Source of secondary information used in the report/to be used in the report should be revealed and credit given accordingly.
- Detailed maps of each Sub-Basin have to be provided separately for each parameter such as forest cover, forest type, vegetation, location of sampling sites, etc. For each forest type it will be appropriate to give altitudinal range (for some it is given), its location in Dibang Sub-Basin in separate maps.
- For betterment of analysis, it may be appropriate to categorize dams as Operational/ Under Construction/ EC, Scoping, Not Allotted yet, This will facilitate decision making on dropping of any dam, if it is required from environmental angle.

## 6 **OUTCOME OF THE STUDY:**

The study should be linked as Cumulative Impact Assessment for Dibang sub basin should cover the following aspects:-

- Flow Regime
- Flood Plain including wetlands
- Aquatic ecology
- River Morphology
- Sediment Transportation/erosion and deposition

- Impact on human activities and livelihood
  - i) Considering the total length of the main river in the basin and the HEPs already existing and planned for future development, how many more HEPs may be allowed to come up. In other words, how much of the total length of the river that may be tunneled inclusive of the tunneling requirement of all the projects that have been planned for development so that the integrity of the river is not grossly undermined.
  - ii) What may be criteria for downstream impact study in terms of length of the river downstream to the tail water discharge point and what may be the parameters of such a study. Currently the norm is 10 km radius area, which is inadequate for major projects.
  - iii) If the states do not change their policy of allotting elevation-wise river reaches for hydropower development, what criteria the EAC may adopt in restricting the river reach for hydropower development. Alternatively, what should be the clear river length of uninterrupted flow between the reservoir tip at FRL of a downstream project and the tail water discharge point of the immediate upstream project.
  - iv) What will be the scientific procedure to decide on the minimum lean season flow that must be maintained in the downstream of a dam/barrage and based on such a procedure, what minimum lean season flow must be ensured by the hydropower developer in various reaches of a long river in relation to the aquatic lives and downstream water use.
  - v) For peaking stations, what extent of diurnal flow variation may be considered safe for the aquatic life. There are examples where the release is drastically reduced during the long time for reservoir filling and the huge discharge flows through the river during the few hours of peak power generation. This is detrimental to the aquatic environment of the downstream stretch of the river.
  - vi) For muck disposal, what may be minimum distance that must be maintained between the outer boundary of the muck disposal sites and the river bank. If such a site is not available at the indicated distance and long haulage of muck may be involved for safe muck disposal at sites further away, what may be the pros and cons of including the enhanced cost of muck disposal in the project budget. Thus, the study may highlight on the existing norms, cost of haulage per tonne-kilometer, the percentage of the haulage cost of the total project cost and the extent to which the power may be more expensive to generate.

The key outcomes of the study should be to:

1. Provide sustainable and optimal ways of hydropower development of Dibang river, keeping in view of the environmental setting of the basin.
2. Assess requirement of environmental flow for the entire **year i.e. covering lean, non-lean non- monsoon and monsoon periods** with actual flow, depth and velocity at different levels.
3. Downstream impacts on Assam up to Guwahati due to hydropower development in Dibang basin in Arunachal Pradesh.
4. Management of impact and mitigation measures.

## **7 INTERIM REPORT:-**

An Interim Report on the study should be submitted after 6 months for review. The Expert Appraisal Committee after examining the same would suggest, mid-course corrections, if any.

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**TERMS OF REFERENCE FOR KAMENG (EXCLUDING BICHOM) SUB BASIN**

- I **To conduct environmental impact assessment studies for Kameng sub basin (excluding Bichom) in ARUNACHAL PRADESH, due to development of Hydro Electric projects in Kameng sub basin and its effect on downstream of the river in Brahmaputra basin in Assam**

**Kameng Sub-basin in Arunachal Pradesh**

**1. INTRODUCTION**

The basin study envisages providing optimum support for various natural processes and allowing sustainable activities undertaken by its inhabitants. The same is determined in terms of the following

- Inventorisation and analysis of the existing resource base and its production, consumption and conservation levels.
- Determination of regional ecological fragility/sensitivity based on geo-physical, biological, socio economic and cultural attributes.
- Review of existing and planned developments as per various developmental plans.
- Evaluation of impacts on various facets of environment due to existing and planned development.

The study should involve assessment of stress/load due to varied activities covering, e.g. exploitation of natural resources, industrial development, population growth which lead to varying degree of impacts on various facets of environment. The basin study should also envisage a broad framework of environmental action plan to mitigate the adverse impacts on environment which should be in the form of :

- Preclusion of an activity
- Infrastructure development
- Modification in the planned activity
- Implementation of set of measures for amelioration of adverse impacts.

The basin study is a step beyond the EIA, as it incorporates an integrated approach to assess the impacts due to various developmental projects.

## 2. STUDY AREA:

The study area to be covered as a part of the Basin Study is for entire Kameng Basin. The study should be based on secondary as well as primary data collection.

## 3. PROJECTS ENVISAGED IN KAMENG BASIN (EXCLUDING BICHOM):

Twenty five (25) projects are envisaged in the study area to be covered in the Kameng basin. The details of the same are given below in Table.

**Table: Projects proposed on Kameng River (Above 25MW Capacity)**

Sl. No.	Name of the Project	Catchment Area (Sq.km)	Present I.C (MW)	FRL(m)	Ht.of the dam (m)	
					From deepest foundation	Above River bed
1	Chanda	627	110	1192.5	44.5	44.5
2	Badao	791	70	767.5	19.5	19.5
3	Talong	2814	225	488	108.5	108.5
4	Kameng Dam (Bana)	7514	600	440	--	108
5	Bhareli Lifting Dam Stage-I (Kameng-I)	8699	1120	355	123	123
6	Bhareli Lifting Dam St-II (Kameng-I)	8540	600	214	77	77
7	Rebby	--	30	--	--	--
8	Para	--	55	--	--	--
9	Saluk	--	47	--	--	--
10	Lachung	350	40	--	--	--
11	Phanchung	317	56	600	22	22
12	Tarang warang	157.5	36	822	19	19
13	Tenga Storage	940	600	1130	--	113
14	Papu (Papu storage)	557	90	695	--	48
15	Pasar Storage	--	32	1112	--	1100
16	Seba/Sebu	405.03	80	367	19	19
17	Pakke-I(Pakke Bung-I)	168.58	40	865	17	17
18	Pachuk I	--	--	--	--	--
19	Pachuk II	--	--	--	--	--
20	Pachuk II Lower	--	--	--	--	--

21	Marjingala Lower	--	--	--	--	--
22	Marjingala	--	--	--	--	--
23	Papu Valley	--	--	--	--	--
24	Meyong	--	--	--	--	--
25	Saskangrong	--	--	--	--	--

(Source: Central Electricity Authority, New Delhi)

#### 4. DATA COLLECTION

In the present study emphasis should be laid on terrestrial and aquatic ecology. The estimation of supportive capacity of the basin should involve the preparation of the existing scenario i.e., the preparation of detailed data base of the basins. This should be accomplished through the steps outlined in following sections.

##### 4.1 METEOROLOGY:

The information on various meteorological aspects is to be collected from India Meteorological Department (IMD) for meteorological stations located within the basin area or in vicinity to the basin boundary. The information on various aspects such as rainfall, temperature wind, humidity etc. will be collected.

##### 4.2 WATER RESOURCES:

The information on following aspects should be collected:

- Review of drainage characteristics of the basin, including various surface water bodies like rivers and lakes.
- Data collection and review of past studies/reports/data etc.
- Review of existing water sharing agreements for meeting various need-based existing and future demands viz. municipal, irrigation, power generation and industrial.
- Analysis of all, past assessment of the water availability and assessing the water availability, as per updated data for the system as a whole and at existing ongoing/proposed project locations on annual/monsoon/non-monsoon and monthly basis.
- Estimation of sediment load at various points in the basin based on available secondary data.
- Identification of perennial sources of water and their designated usages.

##### 4.3 WATER QUALITY:

As a part of the studies, secondary data is to be collected for water quality in the study area. In addition to above, information on human settlement, sewage generated and

mode of collection, conveyance treatment and disposal of sewage should also be collected.

The water quality monitoring should be conducted at 30 (thirty) locations in the study area. **The frequency of sampling should be once per month for 12 months.** The various parameters include pH, Dissolved Oxygen (DO), Electrical conductivity (EC), Total Suspended Solids (TSS), Total Dissolved Solids (TDS), Total Alkalinity, Total Hardness, Biochemical Oxygen Demand(BOD), Chemical Oxygen Demand(COD), Nitrates, Chlorides, Sulphates, Phosphates, Sodium, Calcium, Magnesium, Potassium, Iron, Manganese, Zinc, Cadmium, Lead, Copper, Mercury, Total Chromium, Total Coliform.

#### **4.4 FLORA:**

The following data should be collected from various secondary sources for river Kameng and its tributaries in the basin area :

- Characterization of forest types in the study area and extent of each forest type.
- Information on general vegetation pattern and floral diversity.
- Presence of economically important species in the basin area.
- Presence of Rare, Endangered and Threatened floral species as per the categorization Botanical Survey of India's Red Data list in the basin area.
- Presence of endemic floral species found in the basin area, if any should be assessed as a part of the basin study.
- Location of wild life sanctuaries, national parks, biosphere reserves if any, in the study area

The field studies should be conducted for sampling at 30 (thirty) locations to collect primary data on terrestrial ecology in the study area. **The monitoring should be conducted for all the seasons.** The following should be covered as a part of the EIA study.

- Identification of forest type and density, bio-diversity in the study area.
- Preparation of comprehensive checklist of flora (Angiosperms, Gymnosperms, Lichens, Pteridophytes, Bryophytes, Fungi, Algae etc.) with Botanical and local name.
- Importance Value Index of the dominant vegetation at various sampling locations.
- Frequency, Abundance and density of each species of Trees, Shrubs and Herbs at representative sampling sites should be estimated.
- Identification and listing of plants of genetically, biologically, economical and medicinal importance.

- Major forest produce, if any, and dependence of locals on the same in the forests observed in the study area.
- Standard survey method for sampling methodology needs to be adopted for Flora.

In addition, based on the published literature including various research papers, the information on forest types, presence of various species, biological diversity etc. should be collected for the study area.

#### **4.5 FAUNA:**

The following data be collected from various secondary sources for the study area:

- Inventory of Birds (resident, migratory), land animals including mammals, reptiles, amphibians, fishes etc reported & surveyed in the basin area should be prepared.
- Presence of RET faunal species as per the categorization of IUCN Red Data list and as per different schedules of Indian Wildlife Protection Act, 1972 in the basin area.
- Presence of endemic faunal species found in the basin area, if any should be assessed as a part of the Basin Study.
- Existence of barriers and corridors for wild animals, if any in the basin area should be covered as a part of the study.
- Identification of threats to wildlife in the region.
- Presence of National Park, Sanctuary, Biosphere, Reserve Forest etc. in the basin area should be assessed.

During ecological survey, identification of faunal species should be carried out simultaneously. Indirect observations of mammals should be carried out by identification of tracks, droppings (scal), claw marks and calls, etc. The listing of faunal species by direct observation techniques should be carried out. The detailed list of faunal species should be formulated based on forest records and published literature.

#### **4.6 AQUATIC FLORA AND FAUNA:-**

The following data should be collected from various secondary sources for river Kameng and its tributaries in the basin area :

- Presence of major fish species
- Inventory of migratory fish species & migratory routes of various fish species
- Presence of major breeding and spawning sites.

The field studies should be conducted for sampling at 30 (thirty) locations to collect primary data on aquatic ecology & fisheries in the study area. The density and diversity of phytoplankton, zooplankton should be estimated. In addition, primary productivity should be monitored at various locations to be covered as a part of the study.

The diversion of water for hydropower generation leads to reduction in flow downstream to the dam site upto disposal of tail race outfall. This leads to diverse impacts on riverine ecology. The dam could also act as a barrier for migration of fishes. The data on prevailing fish species should be collected from the Fisheries Department. To augment the existing data, a fisheries survey should be conducted at 30 (thirty) locations in the study area. **The survey should be conducted once per month for 12 months.** The details of the monitoring work should be carried out as per the following:

- Assessment of biotic resources with special reference to primary productivity, zooplanktons, phytoplanktons, benthos, macrophytes, macro-invertebrates and fishes in the study area.
- Population densities and diversities of phytoplanktons, zooplanktons, benthos, macrophytes, macro-invertebrates and fish shall be estimated. Diversity indices of these ecological groups should also be calculated separately.
- Fish composition
- Migratory route of migratory fishes
- Spawning & breeding grounds of fish species, if any, should be identified.

## **5. IMPACTS DUE TO HYDROPOWER DEVELOPMENT:**

The impacts on terrestrial and aquatic ecology should be studied. The scenario to be considered for assessment in the present study should be based on the hydropower projects presented in Table. The key aspects to be covered are listed as below :

- Modification in hydrologic regime due to diversion of water for hydropower generation.
- Depth of water available in river stretches during lean season and its assessment of its adequacy vis-a-vis various fish species.
- Length of river stretches with normal flow due to commissioning of various hydroelectric projects due to diversion of flow for hydropower generation.
- Impacts on discharge in river stretches during monsoon and lean seasons due to diversion of flow for hydropower generation.
- Impacts on water users in terms of water availability and quality
- Impacts on aquatic ecology including riverine fisheries as a result of diversion of flow for hydropower generation.

- Assessment of maintaining minimum releases of water during lean season to sustain riverine ecology, maintain water quality and meet water requirement of downstream users.
- Impact due to loss of forests
- Impact on RET species & impacts on economically important plant species.
- Impacts due to increased human interferences
- Impacts due to agricultural practices.
- Study the impact of cascade development and make recommendations on the requirement of free flowing stretch between two projects. Ecological inventory and geomorphology for different stretches of river to be delineated.
- Information on river stretch affected and forest area affected by each project needs to be modified to include additional details of catchment area; total forest area of the sub basin and the area getting affected and total river length, stretch affected and free flowing.
- Undertake environmental flow release assessment for the entire **year i.e. covering lean, non-lean non- monsoon and monsoon periods**, based on methodology such as BBM and make recommendations for each stretch.
- Hydro Dynamic Study for assessment of Environmental flow release should be linked with the fauna, habitat requirement for assessment of environmental flow releases for entire year.
- Modelling study carried out to assess the impact of peaking discharge should be concluded with recommendations for mitigation of such impacts.
- Sampling sites, forest cover and forest type should be listed and illustrated sub basin wise. Endemic species of fishes in the sub basin may be tabulated.
- Downstream impact study should be done up to Guwahati.
- Impact of sand mining, boulder mining, etc need to be included in the study.
- Impact on overall balance of sediment due to construction of a number of projects needs to be included in the report.
- The main objective of the study is to bring out the impacts of dams being planned on the main river and its tributaries. At the end of the Report there should be a separate Chapter synthesizing the results of each component so that a holistic picture of impacts could be emerged which should lead to Recommendations.
- Impact assessment should also include “Impacts due to construction of approach roads for the HEPs”.
- Source of secondary information used in the report/to be used in the report should be revealed and credit given accordingly.
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- For betterment of analysis, it may be appropriate to categorize dams as Operational/ Under Construction/ EC, Scoping, Not Allotted yet, This will facilitate decision making on dropping of any dam, if it is required from environmental angle.

## 6. OUTCOME OF THE STUDY:

The study should be linked as Cumulative Impact Assessment for Kameng sub basin should cover the following aspects:-

- Flow Regime
  - Flood Plain including wetlands
  - Aquatic ecology
  - River Morphology
  - Sediment Transportation/erosion and deposition
  - Impact on human activities and livelihood
- vii) Considering the total length of the main river in the basin and the HEPs already existing and planned for future development, how many more HEPs may be allowed to come up. In other words, how much of the total length of the river that may be tunneled inclusive of the tunneling requirement of all the projects that have been planned for development so that the integrity of the river is not grossly undermined.
- viii) What may be criteria for downstream impact study in terms of length of the river downstream to the tail water discharge point and what may be the parameters of such a study. Currently the norm is 10 km radius area, which is inadequate for major projects.
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- xii) For muck disposal, what may be minimum distance that must be maintained between the outer boundary of the muck disposal sites and the river bank. If such a site is not available at the indicated distance and long haulage of muck may be involved for safe muck disposal at sites further away, what may be the pros and cons of including the enhanced cost of muck disposal in the project budget. Thus, the study may highlight on the existing norms, cost of haulage per tonne-kilometer, the percentage of the haulage cost of the total project cost and the extent to which the power may be more expensive to generate.

The key outcomes of the study should be to:

- 5. Provide sustainable and optimal ways of hydropower development of Kameng river, keeping in view of the environmental setting of the basin.
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- 7. Downstream impacts on Assam up to Guwahati due to hydropower development in Kameng basin in Arunachal Pradesh.
- 8. Management of impact and mitigation measures.

## **7. INTERIM REPORT:-**

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