

Subject: **Additional information as desired by EAC in 56th meeting held on 30-31st March 2012.**

In the 56th meeting of EAC held on 30th-31st March 2012, it was informed that the project Dam site location has been shifted due to geological aspects-mainly due to the presence of Uranium Ore in vicinity. The new location of the Dam now is 3.385 km downstream of the confluence of Kynshi and Wahblei Rivers while earlier it was only 0.422 km d/s of the confluence.

The top of Dam of Kynshi-II HE project has been lowered to EL 196 m from EL 243 m and the FRL has been reduced to El 193 m from El 240 m. The MDDL has also been reduced from El 228 m to El 183 m. The total Forest land involved has thus been reduced from 2169 ha to 695 ha and the submergence area reduced from 1867 ha to 521.53 ha.

Initially, after the MoA was signed, a presentation was made to EAC in its 40th meeting on 20.08.2010 wherein the project envisaged the Top of Dam as El 265m, FRL 260 m and total area required was 4199Ha & submergence as 2705 Ha.

The EAC, advised for reduction of affected areas. Thus, the layout was modified and presented to EAC in its 43rd meeting of EAC held on 13th Nov 2011. This layout envisaged the Top of Dam El 243m, FRL 240 and total area required as 2169 Ha & submergence as 1867 Ha.

The project was given scoping clearance after 43rd meeting of EAC held on 13.11.2010, vide letter J-12011/21/2010-IA-I dated 04.10.2011.

Subsequently, the chapters on water availability studies, Design Flood & Diversion Flood were submitted to CEA/CWC. After the detailed appraisal and required modifications, the water availability study and the Design Flood as well as Diversion Floods have been approved by CWC/CEA.

Power potential studies have now been carried out using the approved water availability studies and making due provision for the E-Flows as advised by the EAC in its 56th meeting held on 30th-31st March 2012. Two alternative scenarios have been analysed for power optimization studies wherein the E-Flows have been considered as follows:

- (i) considering the E-Flows as 30% (during monsoon), 20% (during lean months) and 25% (other remaining months), and

- (ii) as per E-Flows which were conveyed by EAC to us specifically at the time of giving a provisional go ahead in the 43rd EAC meeting held on 13.11.2010 for investigation i.e. 25% of the average of lean months, as also communicated vide MoEF letter no J-12011/21/2010-IA-I dated 4th Oct 2011.

The Salient Features of the project based on the present stage planning are attached herewith. A comparison of the salient features of the project presented in the 40th EAC meeting held on 20.08.2010, 43rd EAC meeting held on 13.11.2010, 56th EAC meeting held on 30th-31st March 2012 and as per present stage planning are also attached as **Appendix 1**.

In the last meeting i.e. 56th meeting, the EAC observed that since the Uranium ore deposits are present in the vicinity and above the submergence area, although, at present Uranium is not being extracted from these deposits but in case in future it is decided to mine these deposits, the project may hamper the extraction. Further, crossing of submergence over the Uranium ore deposits could be a health hazard also. It was decided that as a precaution, the Ministry may seek comments from the Ministry of Atomic Energy. The possibility of Uranium deposits getting a through flow path once the reservoir gets impounded needs examination. This was conveyed vide MoEF letter no J-12011/21/2010-IA-I dated 30.05.2012.

This aspect was under study by Atomic Mineral Deptt (AMD) Shillong of Ministry of Atomic Energy with UCIL and the study had been entrusted to MEKON. As desired by Govt of Meghalaya the requisite information about the Hydro Power Project was provided by Jaypee Meghalaya Power Ltd. (JMPL) to AMD/UCIL. The Uranium Corporation of India Ltd (UCIL) has agreed to clear the present proposal with some conditions vide letter dt 29th Dec 2014 addressed to Ministry of Power, Govt. of Meghalaya. The Secretary (Power), Government of Meghalaya informed about this to JMPL vide their letter no. POWER-124/2010/Pt-II/175 dated 12th Feb 2015. A copy of both the letters is attached as **Attachment 1 & 2**.

The EAC proposed to take the decision for ToRs in respect of Kynshi II HE project only after receipt of the comments from Ministry of Atomic Energy alongwith some additional information to be provided by JMPL, details of the same is tabulated below:

S.No.	Information as asked by EAC, MoEF in 56 th meeting	Details of Submission
1)	Cross Section of the new Dam site	<p>The X-section at the revised dam location, which is about 3.385 km downstream of the confluence of rivers Wahblei and Kynshi, is attached herewith as Plate 1.</p> <p>The earlier dam site was located at about 0.422 km d/s of the confluence.</p> <p>This has been necessitated due to need for reduction of the forest area and submergence area due to project reservoir and presence of Uranium ore in the vicinity.</p>
2)	Water availability Flow series	<p>Detailed water availability studies for the project have been approved vide CEA letter No 2/MEG/06/CEA/11-PAC/4926-28 dated 08.08.2012. Also the Design flood (PMF) & Diversion flood for the project have been approved vide CEA letter No 2/MEG/06/CEA/11-PAC/717-19 dated 31.01.2013. Copies of the same are attached herewith as Appendix 2a & 2b.</p>
3)	Calculation for generation of Power	<p>Considering the approved water availability series, the power optimisation studies have been carried out for the two scenarios as mentioned above viz.</p> <p>I. considering the E-Flows as 30% (during monsoon), 20% (during lean months) & 25% (other remaining months), and</p>

		<p>II. another as per provision of E-Flows which were conveyed by EAC at the time of giving a provisional go ahead in the 43rd EAC meeting held on 13.11.2010 for investigation i.e. 25% of the average of lean months.</p> <p>The Power generation as per Scenario-I is attached as Appendix 3A & 3B and as per Scenario-II is attached as Appendix 3C & 3D.</p> <p>Since at this stage when the E-Flows are known only tentatively and other project parameters are also under detailed study, an installation of 300MW at Main UGPH + 25 MW at Dam Toe PH installation is considered adequate which also fulfils the E-Flow norms generally prescribed for river valley hydro power projects.</p>
4)	L- Section and bed levels of river	The L- section showing the details in respect of bed level of River Kynshi from the confluence of Wahblei & Kynshi to sufficiently downstream of TRT outfall i.e. upto RD 17496.62m, i.e. a reach covering the locations of Old & New Dam axis, the confluence and TRT outfall is attached herewith as Plate 2 .
5)	Information regarding effect on fish migration from Bangladesh	The impact of Kynshi-II HEP on fish species migrating from Bangladesh, is proposed to be studied under "Impact Prediction" covered at para B(e) at Annexure V of Form 1 .
6)	DPR for the revised project	The Detailed Project Report (DPR) shall be prepared after the entire

		field investigation and related studies including EIA/EMP studies have been completed. However, a brief description of project alongwith relevant drawings and salient features is attached as Appendix 4.
7)	In Form 1 in Activity 1.1 in Background Note for area under Uranium deposits indicates that the total forest area will be reduced to 875.72ha while here forest area is 574 ha and other land area will be 301.72 which make a total of 875.72 ha. The exact figure of forest land involved may be provided as Form 1 provides 875.72ha but Annexure B says 742 ha. (695+47).	Updated Form-1 duly incorporating the corrections as advised by EAC is attached herewith as Appendix 5. Refer Annexure-IV showing Total area required as 695 Ha including submergence area of 521.52 Ha.
8)	This anomaly should be corrected. Also break-up of land use like agriculture land, Government land etc. may be specified. In activity 1.30 the answer should be "YES" since a large tract of forest, a repository of native species and genetic diversity will be affected. Likewise for row 10.1 and 10.3 for Environmental Sensitivity, these should be "YES".	The Form-1 is revised duly incorporating the details as required and attached herewith. Refer Appendix 5. The project envisages submergence of 521.53 Ha of forest land. In addition Dam, water conductor system, power house and other project appurtenances alongwith infrastructures would be constructed for which land to be acquired is 173.47 Ha. Total land requirement is 695.00 Ha. Permanent change in land use / land cover and topography is envisaged at the dam site, Submergence area, Power House Site, roads and residential complex locations during the operation

		<p>stage.</p> <p>About 521.53 Ha of land including 222 Ha of river portion would get converted into a reservoir. Land use pattern of muck disposal areas, quarry sites too will change with respect to their pre-project status. In addition, some buildings, i.e. project colony, office, roads etc. will be constructed which will be a modification of their existing land use.</p>
9)	Muck disposal sites for both the projects with its L-Section.	<p>A Contour Map showing Plan of Muck disposal sites with L-sections showing the distances & levels with reference to water edge corresponding to HFL, to assess the muck quantities likely to be accommodated is attached herewith as Plates 3A, 3B, 3C, 3D, 3E, 3F and 3G.</p>

Since the uploaded documents cannot be more than 5MB, some of the above listed exhibits and annexure are not being uploaded and shall be sent in CD and hard copy to Director (IA) & Member Secretary EAC, MoEF.

SALIENT FEATURES OF KYNSHI-II HEP

	As per Layout Presented in 40 th EAC meeting held on 20.08.2010	As per Layout Presented in 43 rd EAC meeting held on 13.11.2010	As per Layout Presented in 56 th EAC meeting held on 30-31.03.2012	As per Present Layout
1. Location				
• State	Meghalaya	Meghalaya	Meghalaya	Meghalaya
• District	West Khasi Hills	West Khasi Hills	West Khasi Hills	West Khasi Hills
• River	Kynshi	Kynshi	Kynshi	Kynshi
• Location of Dam Site	Located 0.422 km d/s near of the confluence of Kynshi & Wahblei rivers	Located 0.422 km d/s near of the confluence of Kynshi & Wahblei rivers	Located 3.385 km d/s near of the confluence of Kynshi & Wahblei rivers	Located 3.385 km d/s near of the confluence of Kynshi & Wahblei rivers
• Latitude	25° 18' 36"	25° 18' 36"	25° 17' 26"	25° 17' 42"
• Longitude	91° 06' 45"	91° 06' 45"	91° 8' 14"	91° 8' 12"
• Nearest BG Rail Head	Guwahati	Guwahati	Guwahati	Guwahati
• Nearest Airport	Guwahati	Guwahati	Guwahati	Guwahati
2. Hydrology				
• Catchment Area (sq.km.)	1945.00	1945.00	1965.00	1964.60
• Design flood (PMF) (cumec)	10000	10000	16000	15817
• Diversion Flood (cumec)				518
3. Dam				
• Type	Concrete gravity	Concrete gravity	Concrete gravity	Concrete gravity
• Top of Dam (m)	El.265	El. 243	El. 196	El. 196

• Foundation Rock Level at Dam Axis	El. 152	El. 152	El. 125	El. 125
• Height of Dam (from deepest River Bed Level)	133 m (from deepest foundation level)	91 m (from deepest foundation level)	63 m	63 m
• Length of Dam at Top (m)	773.0m	464.0m	216.20m	341.50m
4. Spillway				
• Gate Type	Crest Radial gate	Top sealing radial gate Sluice Type Spillway	Top sealing radial gate Sluice Type Spillway	Top sealing radial gate Sluice Type Spillway
• No.	12 nos.	7 nos.	8 nos.	8 nos.
• Size of Bays (W x H) m	11.6 x 10.0	9.0 x 7.5	13.50 x 9.0	13.50 x 9.0
• Crest Level (m)	El. 248.40	El. 190	El. 156	El. 156
• Energy Dissipation Arrangement	Stilling Basin (Length = 110m)	Flip Bucket Type (Radius = 22m)	Flip Bucket Type (Radius = 22.5m)	Flip Bucket Type (Radius = 22.5m)
• Plunge Pool (L x B)		100.50 x 25 (at EL 152 m)	122.60 x 10 (at EL 123 m)	122.60 x 10 (at EL 123 m)
5. Reservoir				
• FRL (m)	El. 260	El. 240	El. 193	El. 193
• MDDL(m)	El. 200	El. 228	El. 180	El. 183
• MWL (m) for Emergency conditions	El. 261.48	El. 240.75	El. 195.05	El. 195.80
• Storage Capacity at FRL (MCM)	1022	578.12	131.90	121.90
• Storage Capacity at MDDL (MCM)	100	383.64		74.86
• Live storage (MCM)	922	194.48		47.04
• Submergence Area at FRL (Ha)*	2705	1867	574	521.53

• Total area reqd. for the project including submergence area (Ha)*	4199	2169	875.72	695
6. Diversion Tunnel				
• No. & size			1 No., 9.5m Dia Horse Shoe shaped	1 No., 9.5m Dia Horse Shoe shaped
• Length (m)			362.45	362.45
7. Power Intake				
• No. & size of Inlet Tunnels	3 No. X 6.5 m Φ	2 No. X 7.5m(H) x 6.25m(W)	2 No. x 6.0m(H) x 7.0m(W)	2 No. x 6.0m(H) x 7.0m(W)
• Invert level at sill of Intake Gates	El. 185.25	El. 213.00	El. 170.00	El. 170.00
8. Head Race Tunnel				
• Numbers	One	One	One	One
• Size	11.0m dia, Circular, concrete lined	9.0m dia, Circular, concrete lined	9.0m dia, Circular, concrete lined	8.0m dia, Circular, concrete lined
• Type				
• Design discharge (cumec)	350	276	262	192.9
• Length (km)*	13.6	13.0	7.04	7.04
• Invert Levels				
At start of Tunnel (m)	EL. 187.00	EL. 211.50	EL. 167.0	EL. 170.0
At end of Tunnel (m)	El. 168.90	El. 149.49	El. 142.21	El. 137.50
9. Surge Shaft				
• Size	20 m dia, circular	18 m dia, circular	27 m dia, circular	27 m dia, circular
• Type	Restricted orifice type, open to sky	Restricted orifice type, open to sky	Restricted orifice type, open to sky	Restricted orifice type, open to sky
• Top level of Surge Tank	El. 278	El. 255	El. 215	El. 226

(m)				
• Vertical Height of Surge Shaft (m)	105	105	64.0	80.50
10. Pressure Shaft / Penstock				
• Main				
Numbers and Dia	03 / 3.0	03 / 5.0	03 / 4.25	03 / 4.0
Type	Underground, Circular, Steel lined	Underground, Circular, Steel lined	Underground, Circular, Steel lined	Underground, Circular, Steel lined
Length (m)	150 each	228 each	235.0 each	265.63 each
11. Power House Complex				
• Type	Underground	Underground	Underground	Underground
Powerhouse Cavern (L x B x H) m	110 x 22.0 x 50	110 x 22.0 x 50	110 x 22.0 x 50	114.120 x 21.0 x 45.5
Transformer Hall Cavern (Lx B x H) m	100.0 x 16.0 x 40	100.0 x 15.0 x 23.5	100.0 x 16.0 x 23.5	100.0 x 15.0 x 26.0
11a. Dam-Toe Power House				
• Type				Surface
Powerhouse (L x B x H) m				48.0 x 17.0 x 40.0 with 8.5m wide Annexe on U/S of Power House
12. Tail Race Tunnel				
No.	1 no.	1 no.	1 no.	1 no.
Size & Type	7.5 m dia,circular & concrete lined	9.0 m dia,circular & concrete lined	9.0 m dia, circular & concrete lined	8.0 m dia, circular & concrete lined
Length (m)	1500	950	358.0	346.0
Invert Level at TRT outfall (m)	El. 60.0	El. 19.0	El. -1.0	El. 0.0

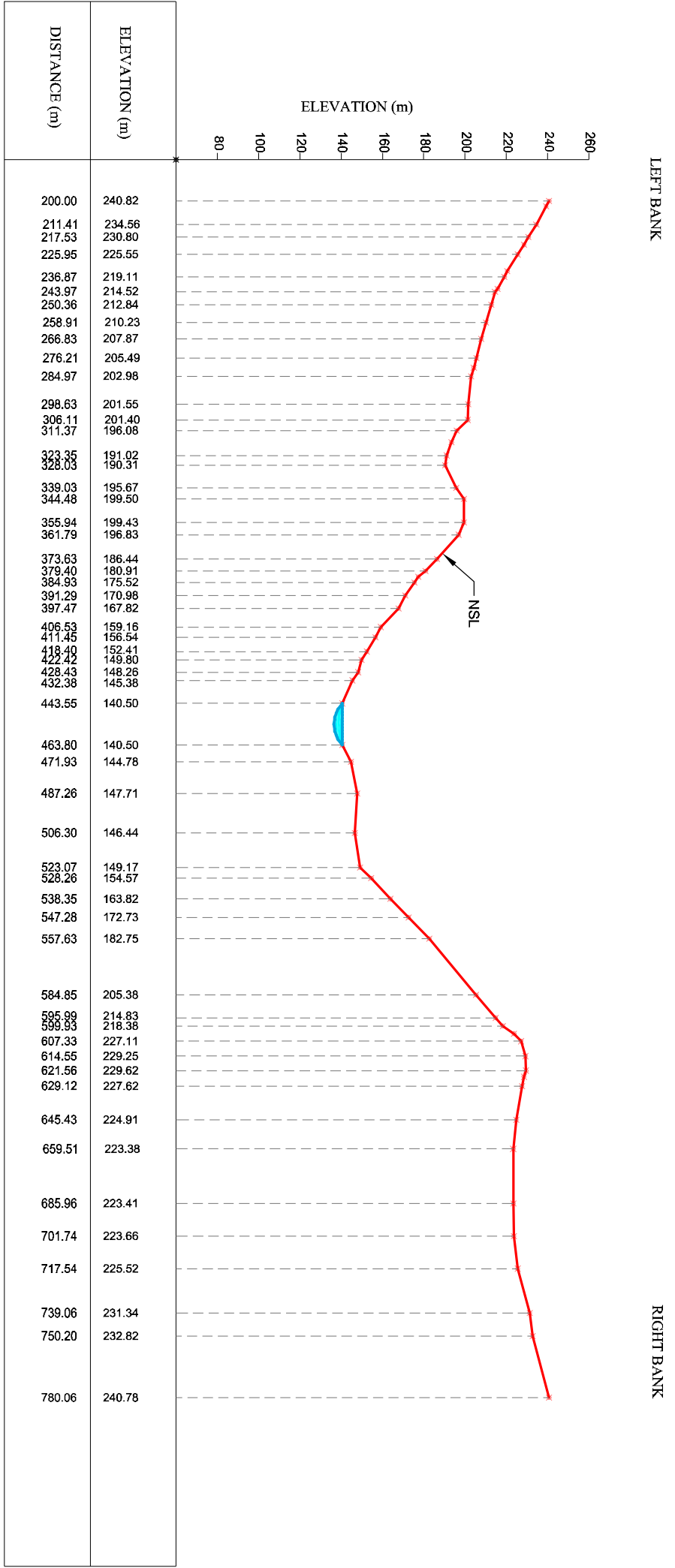
13. Pothhead Yard				
<ul style="list-style-type: none"> Type Size (m) 	Surface 75 x 50 at El. 245 on right bank	Surface 75 x 50 at El. 165 on right bank		Surface 75 x 50 at El. 150 on right bank
14. Power Generation				
Installed Capacity	450 MW	450 MW	400 MW	Refer Table Below
Annual Generation	1937 MU	2269 MU	1813 MU	Refer Table Below
PLF	49.47%	58.30%	54.30%	Refer Table Below


TABLE:

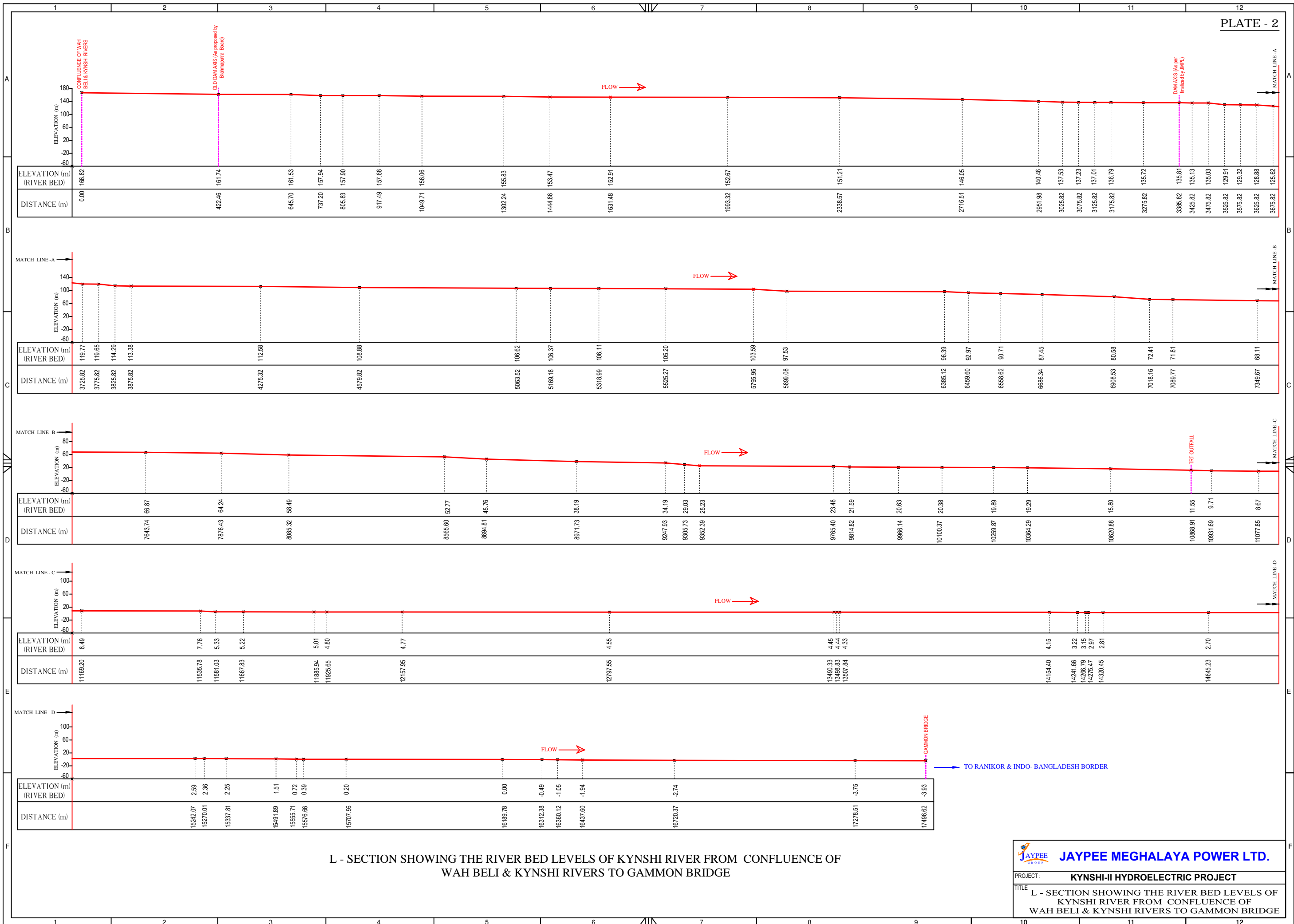
	Present Layout Scenario-I 30, 25 or 20 % of Average Flows	Present Layout Scenario-II 25 % of Average of Lean Flows
• Installed Capacity of MUGPH (MW)	300.00	300.00
• Gross Head	172.3	172.3
• Annual Generation MUGPH (MU)	1170.78	1343.91
• PLF of MUGPH (%)	44.55	51.13
• Installed Capacity of DTPH (MW)	25.00	25.00
• Annual Generation DTPH (MU)	117.92	71.12
• PLF of DTPH (%)	53.85	32.48
• Combined Annual Generation MUGPH + DTPH (MU)	1288.52	1415.03
• Combined PLF of UG & DTPH (%)	45.27	49.70

* As desired by EAC, MoEF

X-SECTION AT DAM AXIS
(3.385 km D/S OF CONFLUENCE OF KYNSHI AND WAHBELI RIVER)

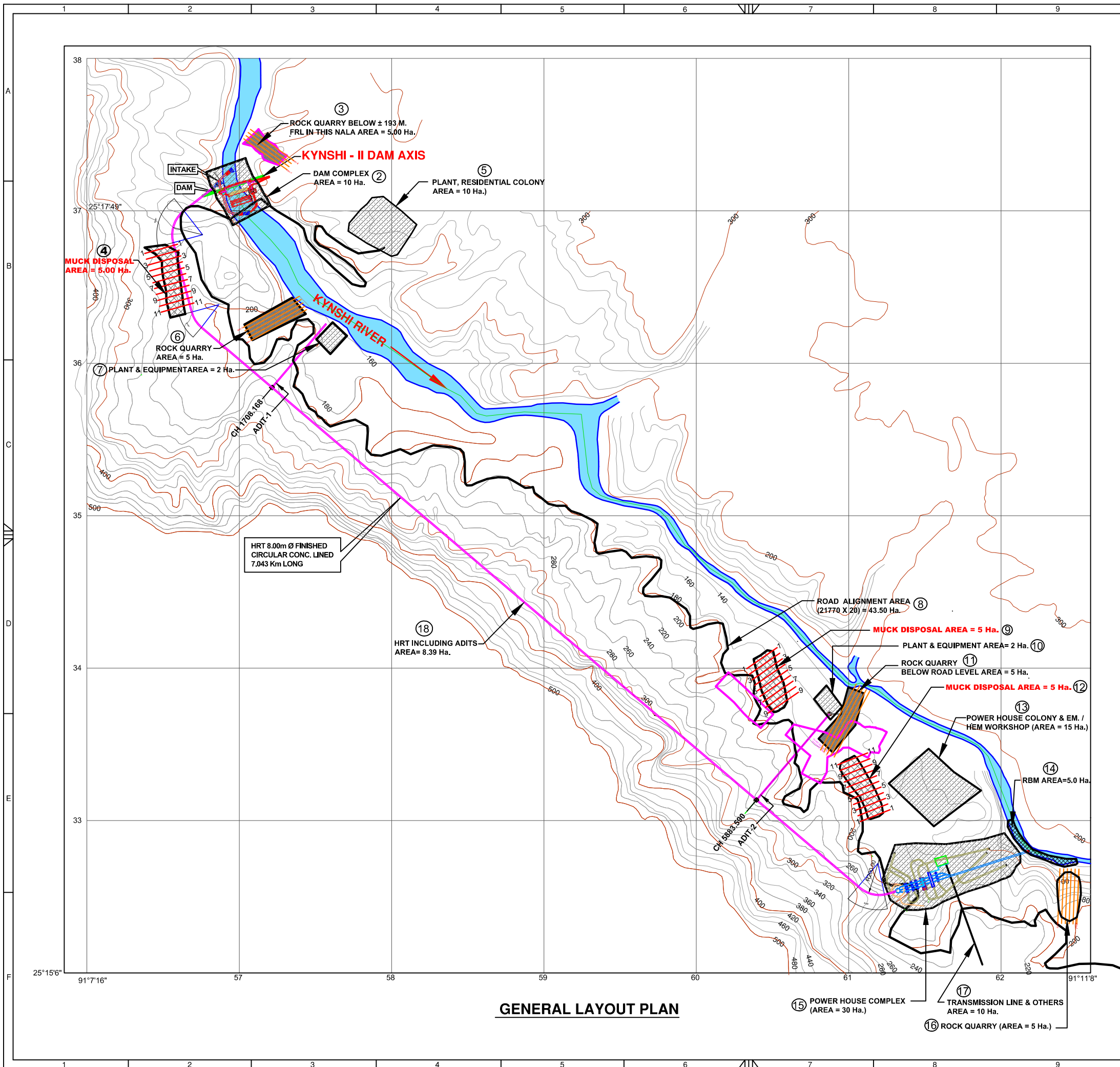
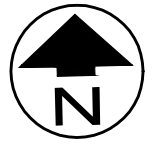



JAYPEE MEGHALAYA POWER LTD.
 PROJECT : KYNSHI HYDROELECTRIC PROJECT
 TITLE : X-SECTION AT DAM AXIS



L - SECTION SHOWING THE RIVER BED LEVELS OF KYNSHI RIVER FROM CONFLUENCE OF WAH BELI & KYNSHI RIVERS TO GAMMON BRIDGE

JAYPEE MEGHALAYA POWER LTD.
 PROJECT: **KYNSHI-II HYDROELECTRIC PROJECT**
 TITLE: **L - SECTION SHOWING THE RIVER BED LEVELS OF KYNSHI RIVER FROM CONFLUENCE OF WAH BELI & KYNSHI RIVERS TO GAMMON BRIDGE**



GENERAL LAYOUT PLAN

LEGEND

SL.NO	LEGEND	DESCRIPTION	AREA (IN Ha.)
1	[Symbol]	SUBMERGENCE UP TO EL .193.00M	521.53
2	[Symbol]	DAM COMPLEX	10.00
3	[Symbol]	ROCK QUARRY	5.00
4	[Symbol]	DISPOSAL AREA	5.00
5	[Symbol]	PLANT & COLONY	10.00
6	[Symbol]	ROCK QUARRY	5.00
7	[Symbol]	PLANT & EQUIPMENT	2.00
8	[Symbol]	PROJECT ROAD	43.50
9	[Symbol]	DISPOSAL AREA	5.00
10	[Symbol]	PLANT & EQUIPMENT	2.00
11	[Symbol]	ROCK QUARRY	5.00
12	[Symbol]	DISPOSAL AREA	5.00
13	[Symbol]	POWER & HOUSE COLONY	15.00
14	[Symbol]	RBM QUARRY	5.00
15	[Symbol]	POWER HOUSE COMPEX	30.00
16	[Symbol]	ROCK QUARRY	5.00
17	[Symbol]	TRANSMISSION LINES & OTHERS	10.00
18	[Symbol]	HRT INCLUDING ADITS	8.39
19	[Symbol]	MISCELLANEOUS	2.58
TOTAL			695.00

LEGEND

- [Symbol] **ROCK QUARRY**
- [Symbol] **4, 9, 12 MUCK DISPOSAL**
- [Symbol] **PLANT & INFRASTRUCTURE AREA**

NOTES

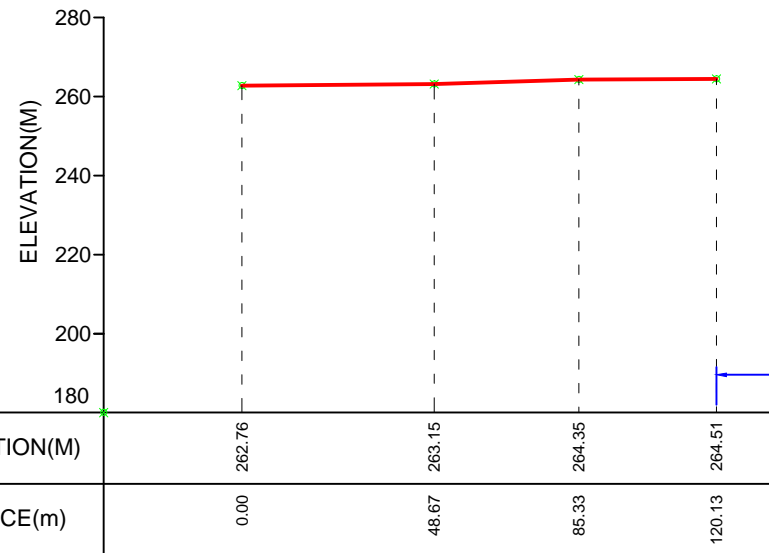
1. ALL DIMENSIONS AND LEVELS ARE IN m, UNLESS OTHERWISE SPECIFIED.

JAYPEE MEGHALAYA POWER LTD.

PROJECT : **KYNSHI-II HYDROELECTRIC PROJECT**

TITLE : **LAND ACQUISITION PLAN & MUCK DISPOSAL AREAS**

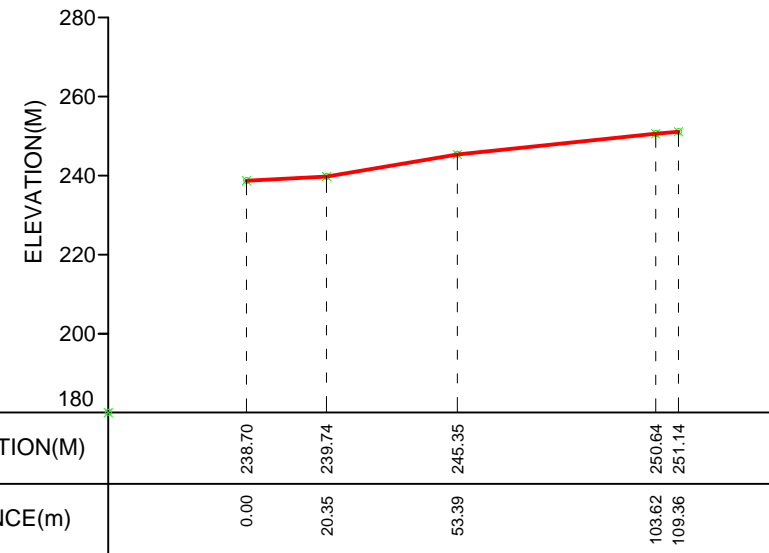
MUCK DISPOSAL CROSS SECTIONS AT LOCATION - ④



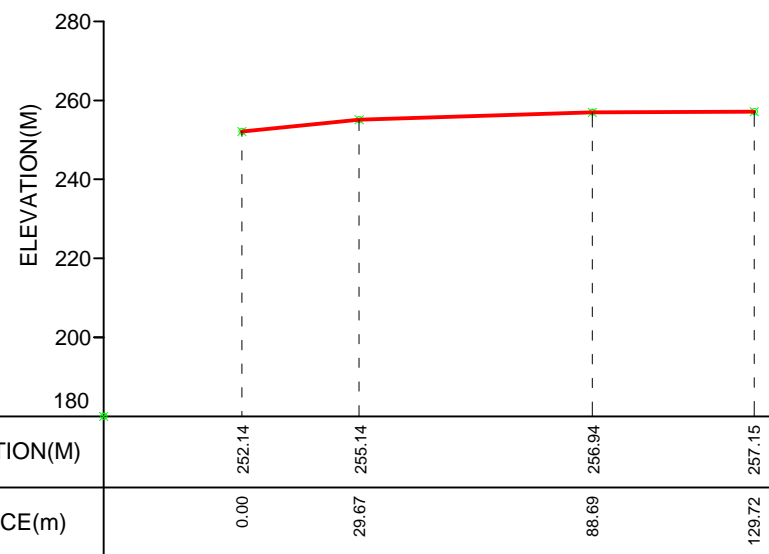
X-SECTION-1

NOTE:-
(Water Edge EL. at 133.30m, the muckdisposal area surface level is at EL. 230m & HFL at EL. 143.30m)

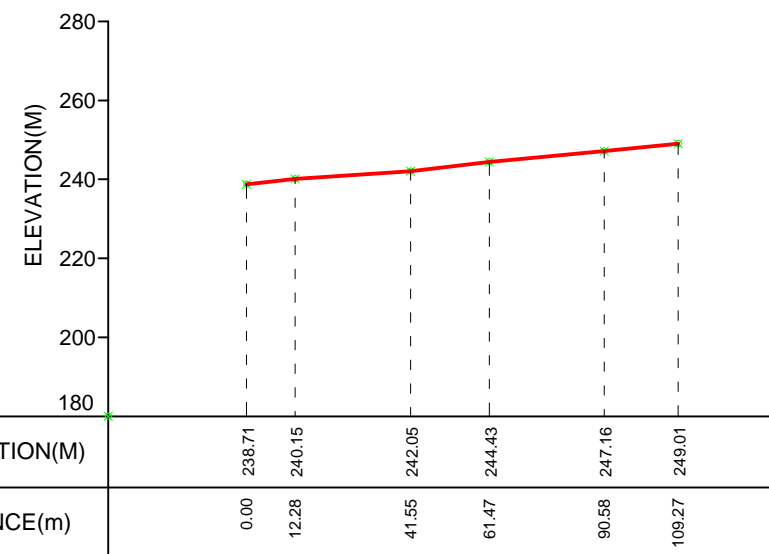
520m(Approx) Distance from river edge at HFL



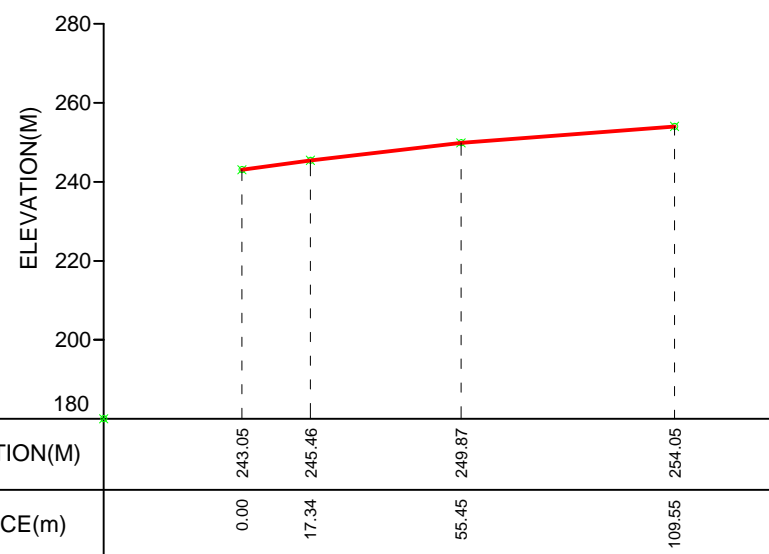
X-SECTION-4



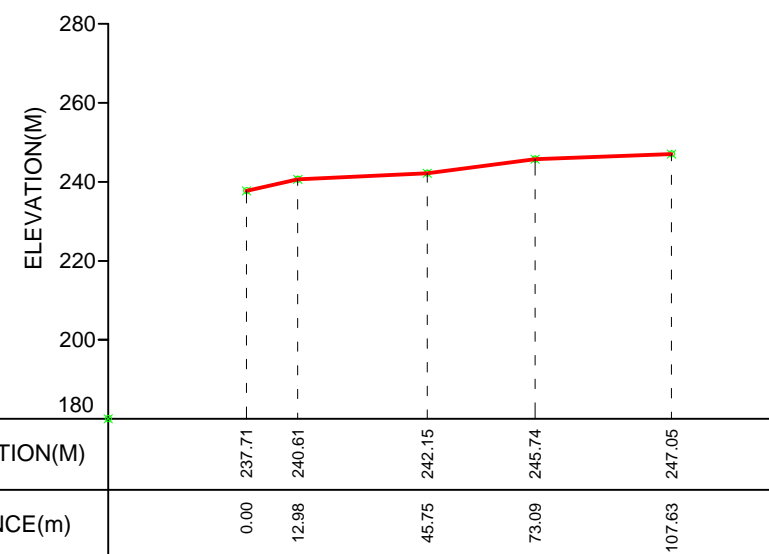
X-SECTION-2



X-SECTION-5



X-SECTION-3



X-SECTION-6

NOTES

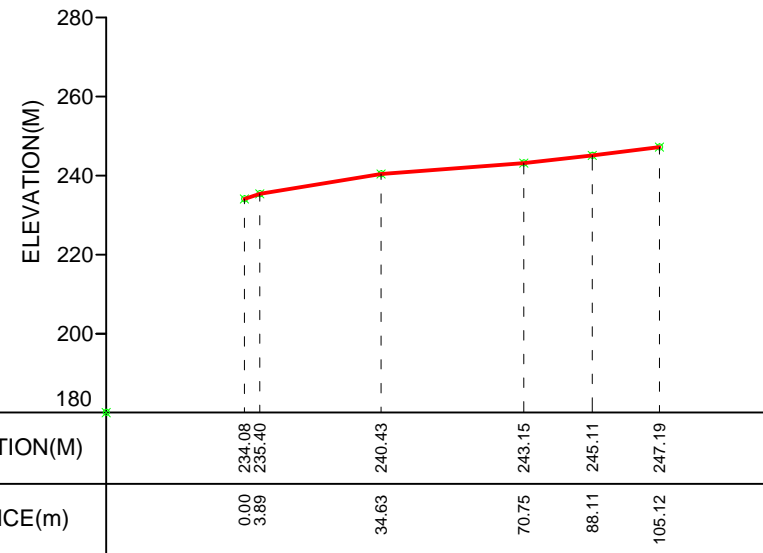
1. ALL DIMENSIONS AND LEVELS ARE IN m, UNLESS OTHERWISE SPECIFIED.
2. FOR LOCATION OF SECTIONS 1 TO 6, REFER PLATE 3A.

JAYPEE MEGHALAYA POWER LTD.

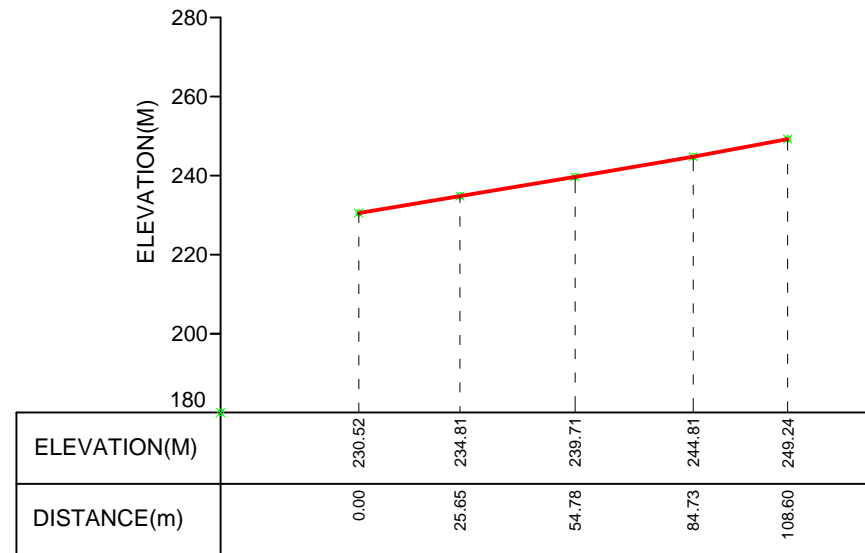
PROJECT : **KYNSHI-II HYDROELECTRIC PROJECT**

TITLE : **MUCK DISPOSAL AREA AT LOCATION - ④ (CROSS SECTIONS 1 TO 6)**

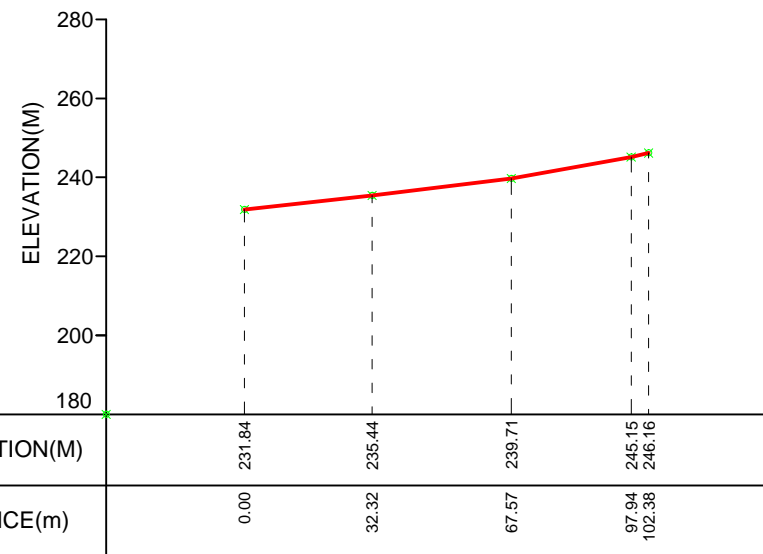
MUCK DISPOSAL CROSS SECTIONS AT LOCATION - ④



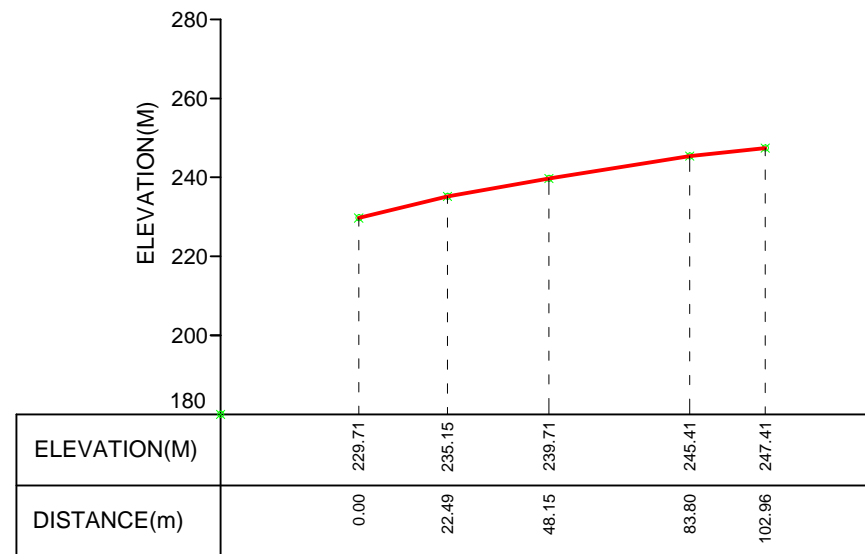
X-SECTION-7



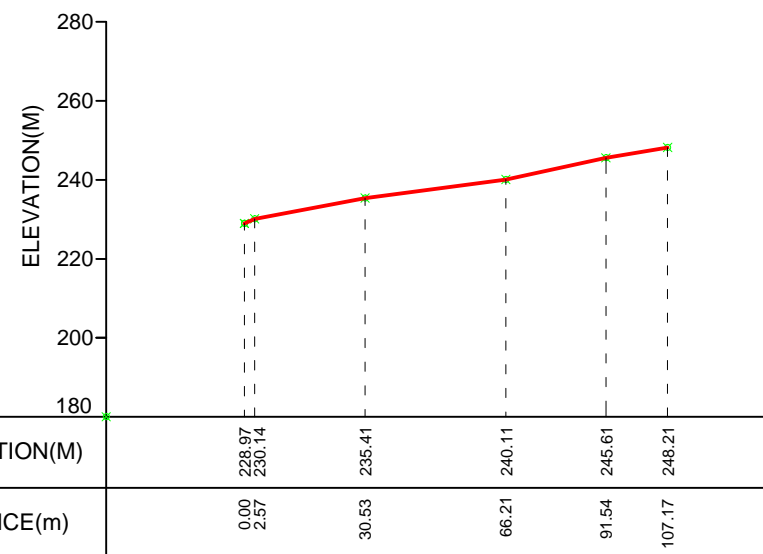
X-SECTION-10



X-SECTION-8




X-SECTION-11



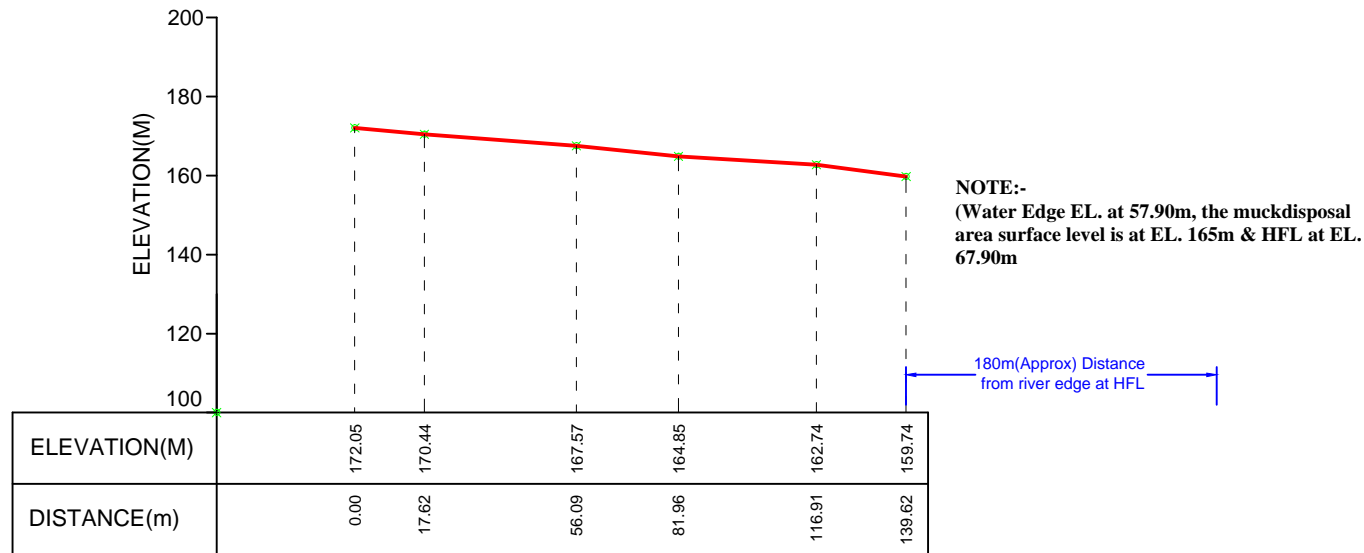
X-SECTION-9

NOTES

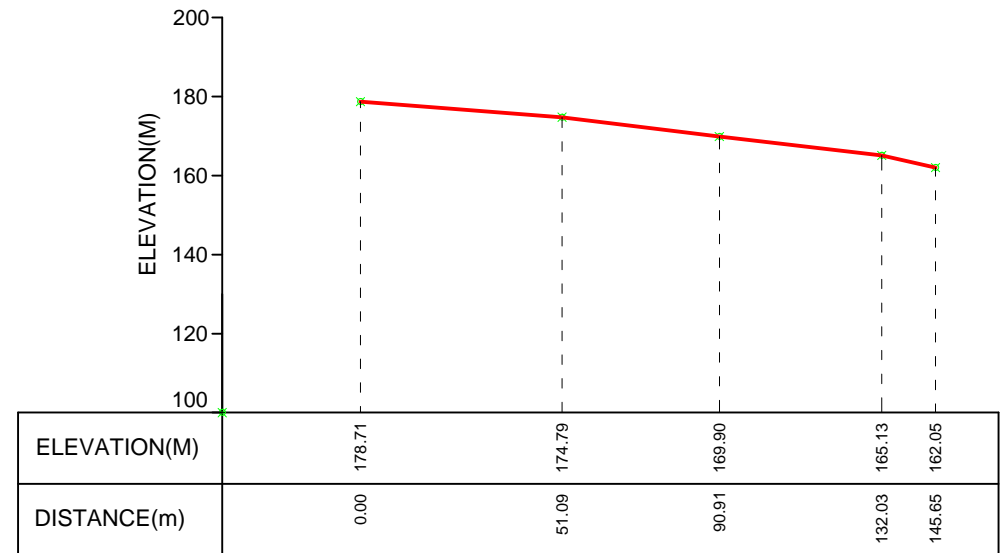
1. ALL DIMENSIONS AND LEVELS ARE IN m, UNLESS OTHERWISE SPECIFIED.
2. FOR LOCATION OF SECTIONS 7 TO 11, REFER PLATE 3A.

 JAYPEE MEGHALAYA POWER LTD.	
PROJECT :	KYNshi-II HYDROELECTRIC PROJECT
TITLE	MUCK DISPOSAL AREA AT LOCATION - ④ (CROSS SECTIONS 7 TO 11)

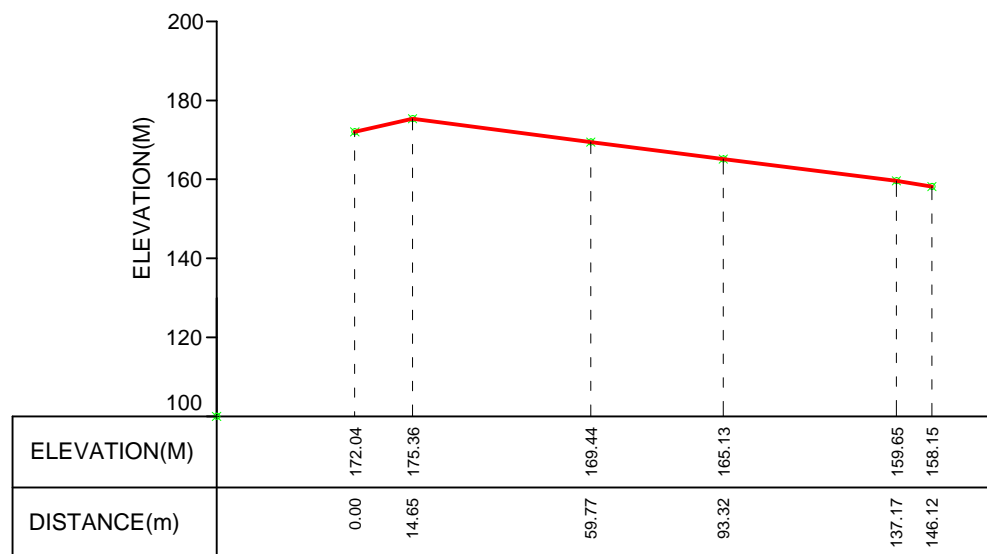
MUCK DISPOSAL CROSS SECTIONS AT LOCATION - ⑨



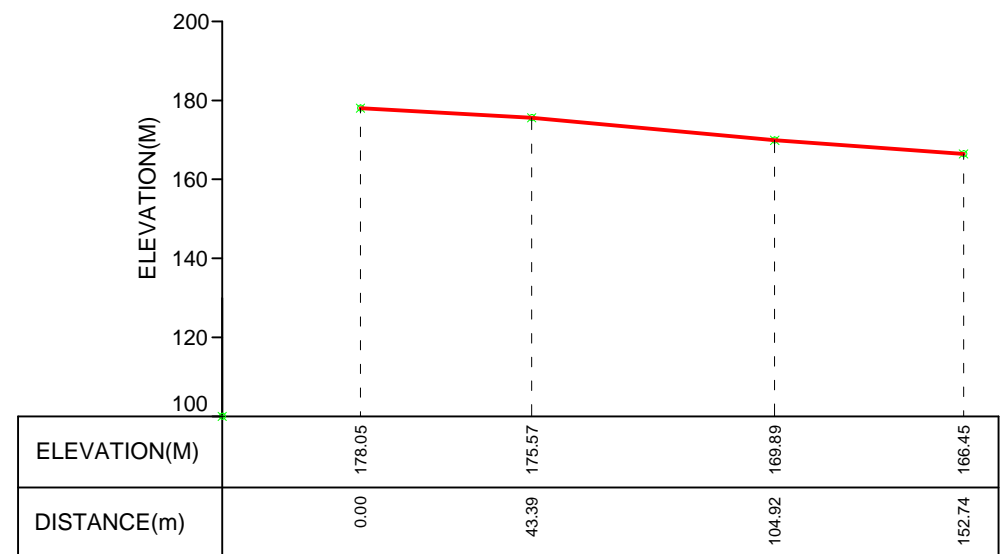
X-SECTION-1



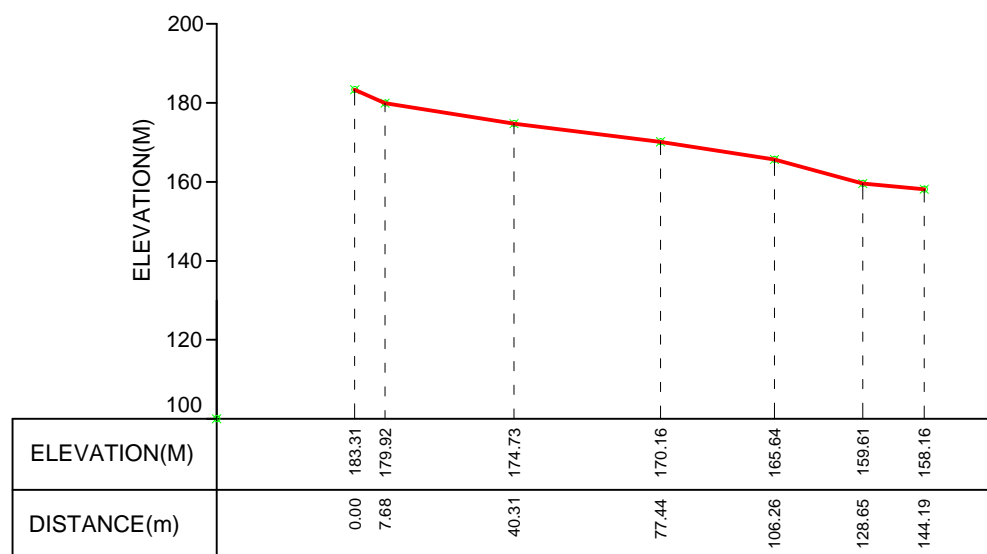
X-SECTION-4



X-SECTION-2



X-SECTION-5



X-SECTION-3

NOTES

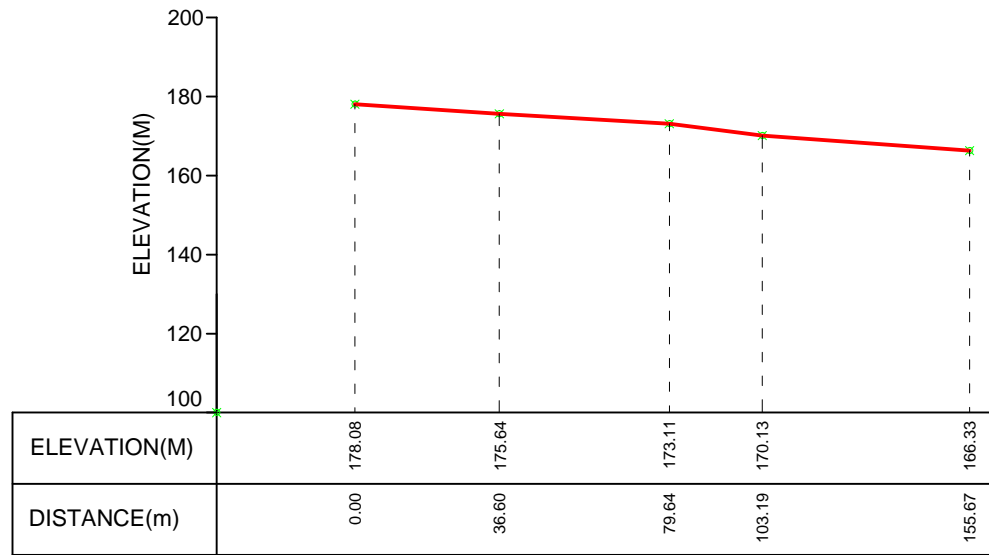
1. ALL DIMENSIONS AND LEVELS ARE IN m, UNLESS OTHERWISE SPECIFIED.
2. FOR LOCATION OF SECTIONS 1 TO 5, REFER PLATE 3A.

JAYPEE MEGHALAYA POWER LTD.

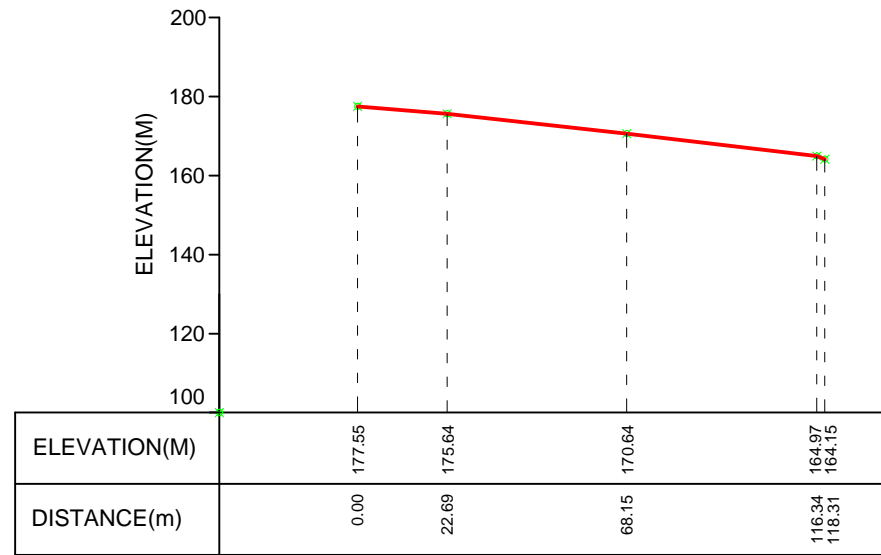
PROJECT : **KYNshi-II HYDROELECTRIC PROJECT**

TITLE : **MUCK DISPOSAL AREA AT LOCATION - ⑨ (CROSS SECTIONS 1 TO 5)**

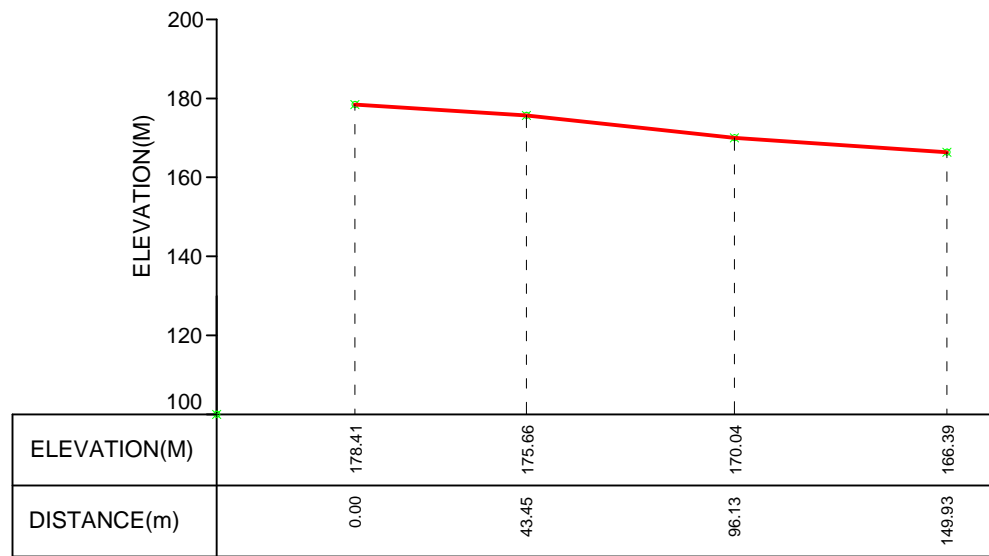
MUCK DISPOSAL CROSS SECTIONS AT LOCATION - ⑨



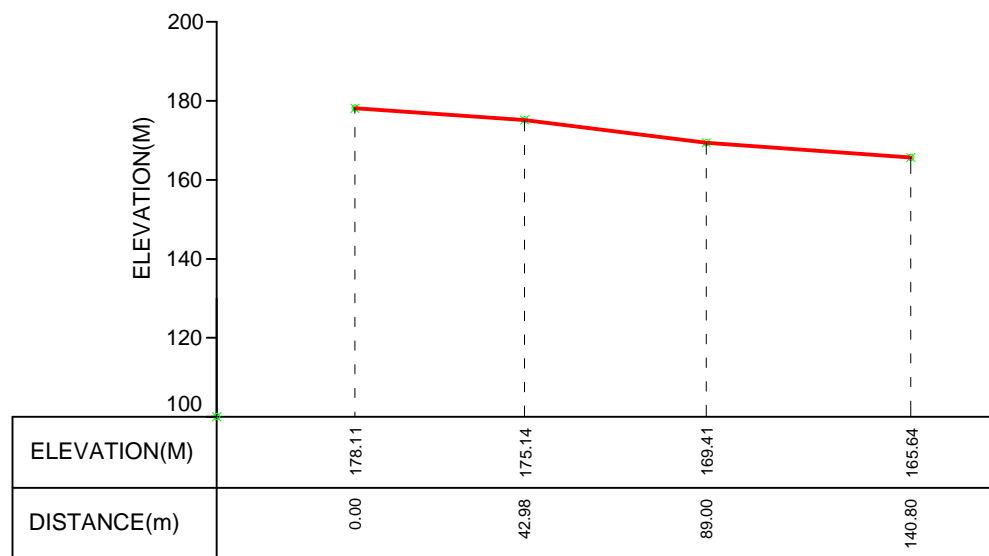
X-SECTION-6



X-SECTION-9




X-SECTION-7



X-SECTION-8

NOTES

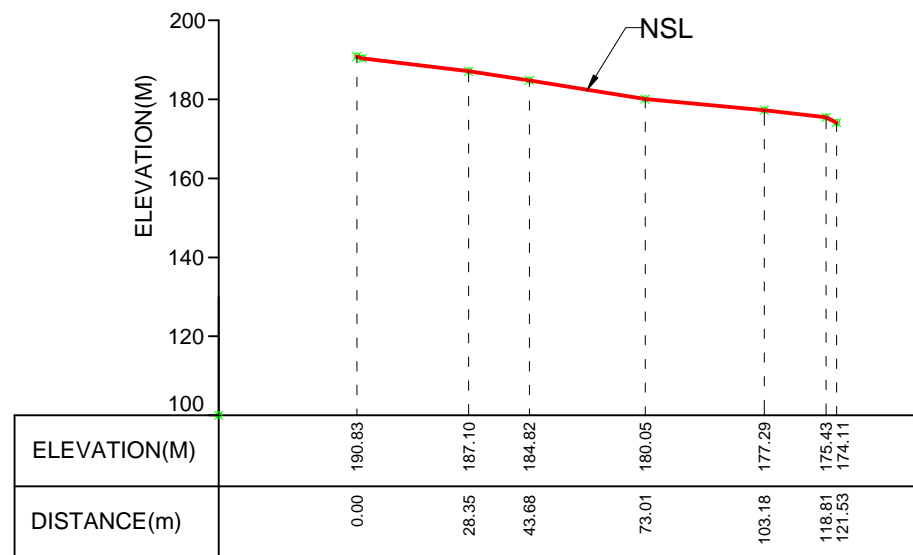
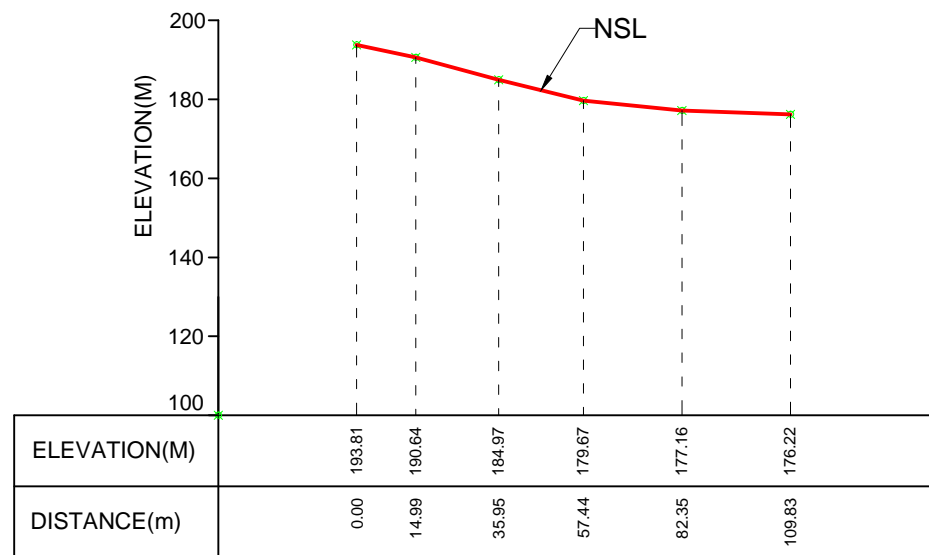
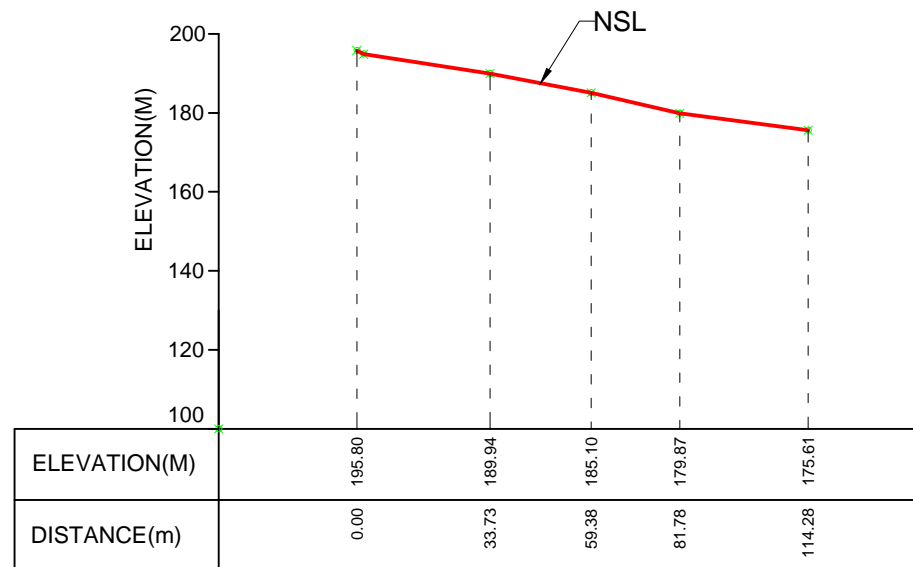
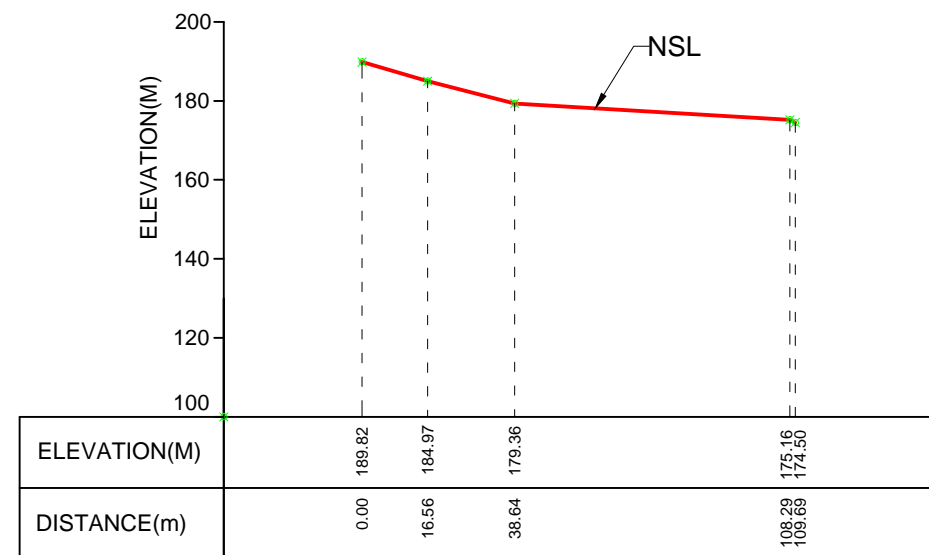
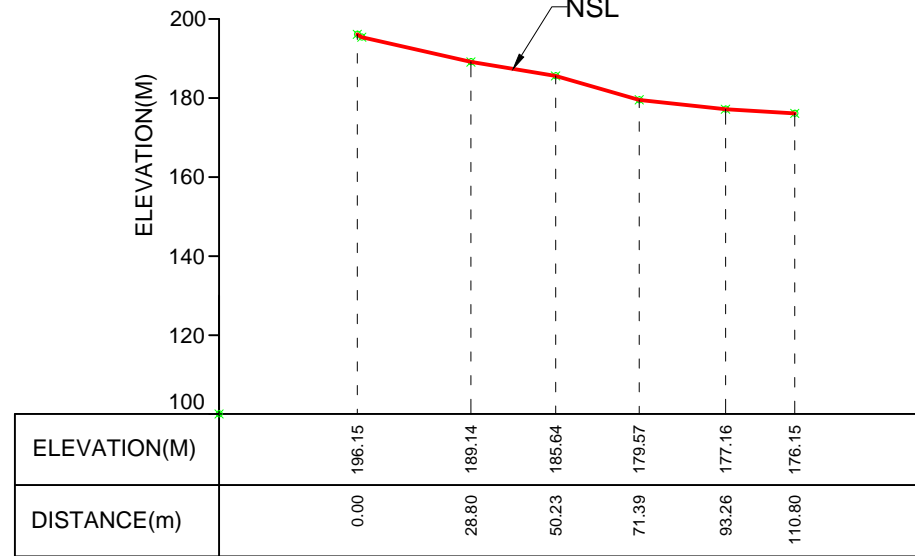
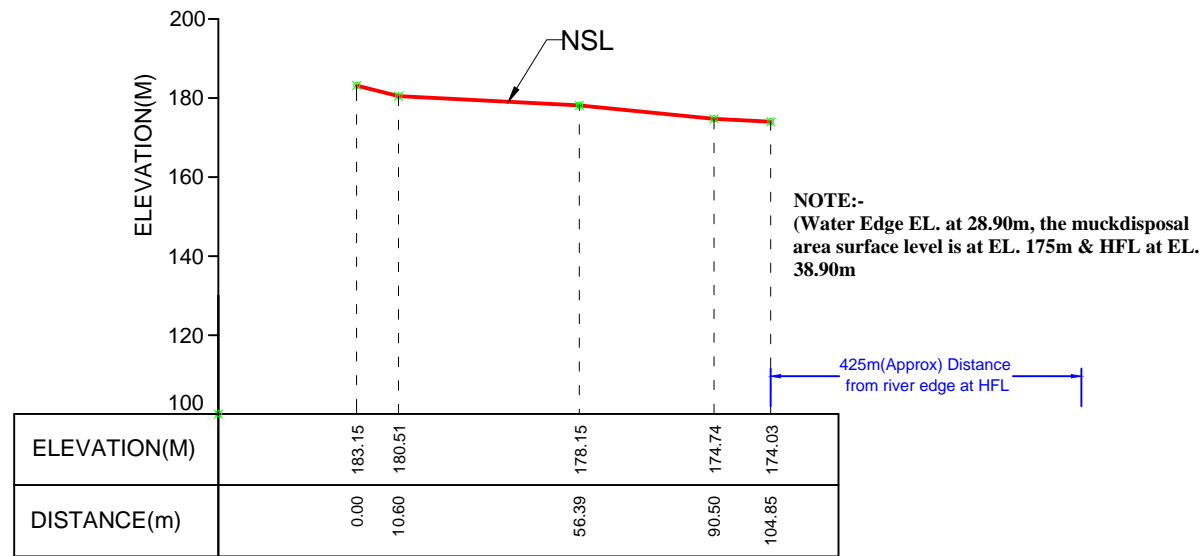
1. ALL DIMENSIONS AND LEVELS ARE IN m, UNLESS OTHERWISE SPECIFIED.
2. FOR LOCATION OF SECTIONS 6 TO 9, REFER PLATE 3A.

 **JAYPEE MEGHALAYA POWER LTD.**

PROJECT : **KYNSHI-II HYDROELECTRIC PROJECT**

TITLE : **MUCK DISPOSAL AREA AT LOCATION - ⑨
(CROSS SECTIONS 6 TO 9)**

MUCK DISPOSAL CROSS SECTIONS AT LOCATION - 12



NOTE:-
(Water Edge EL. at 28.90m, the muckdisposal area surface level is at EL. 175m & HFL at EL. 38.90m)

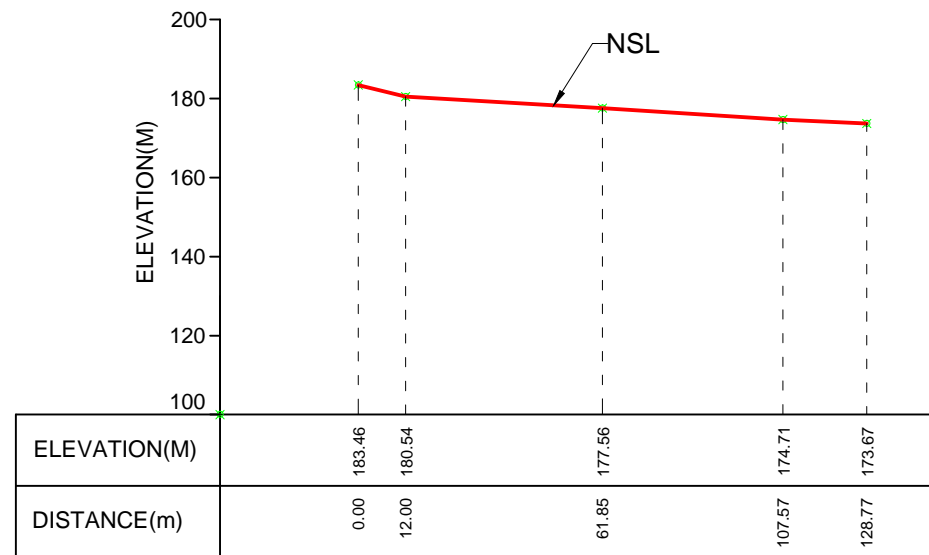
425m(Approx) Distance from river edge at HFL

NOTES

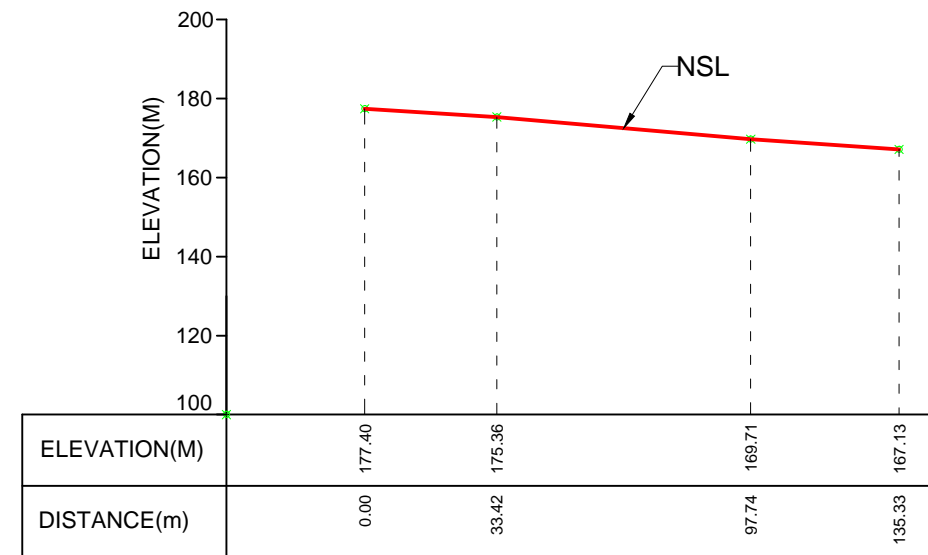
1. ALL DIMENSIONS AND LEVELS ARE IN m, UNLESS OTHERWISE SPECIFIED.
2. FOR LOCATION OF SECTIONS 1 TO 6, REFER PLATE 3A.

JAYPEE MEGHALAYA POWER LTD.
PROJECT : KYNSHI-II HYDROELECTRIC PROJECT
TITLE MUCK DISPOSAL AREA AT LOCATION - 12 (CROSS SECTIONS 1 TO 6)

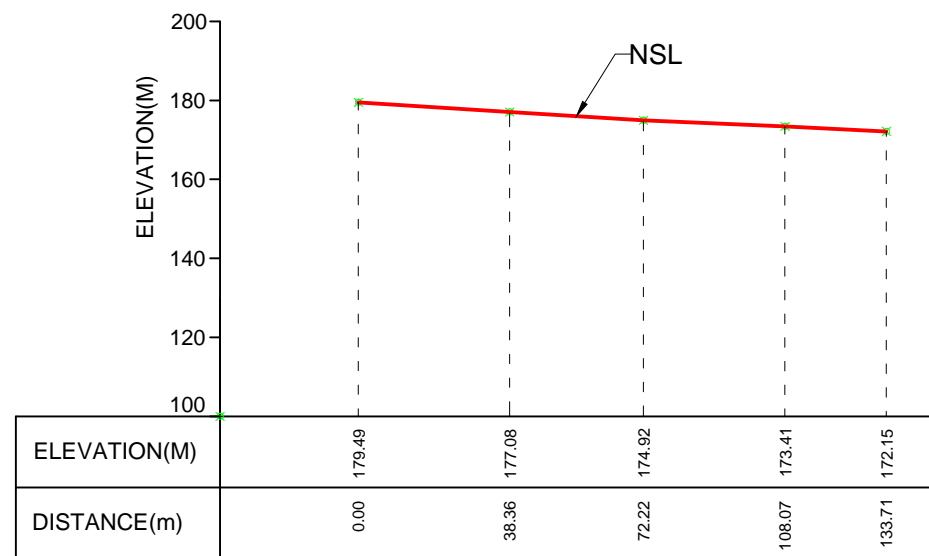
MUCK DISPOSAL CROSS SECTIONS AT LOCATION - 12



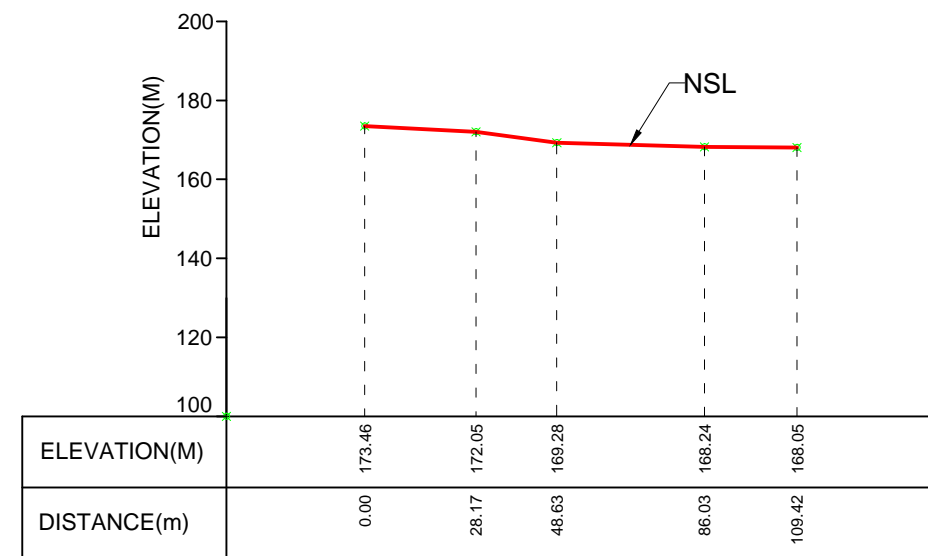
X-SECTION-7



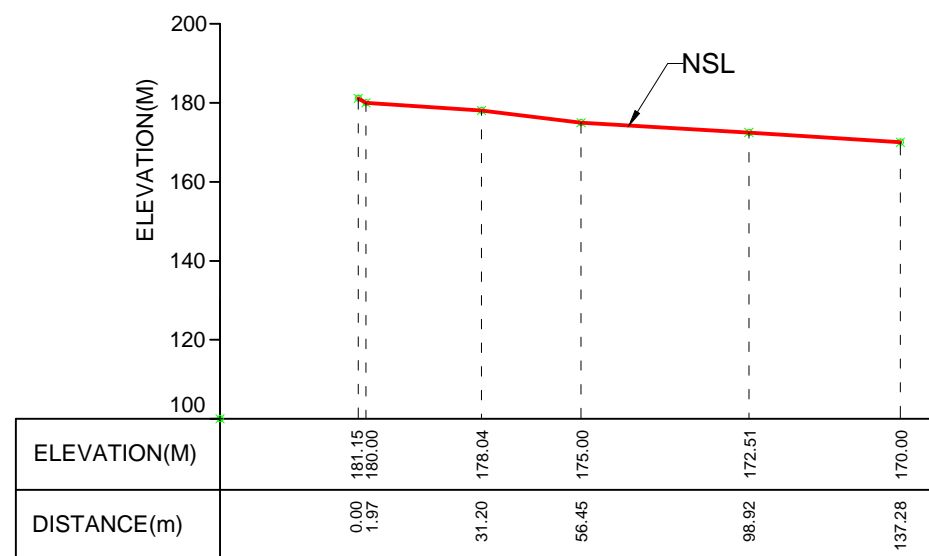
X-SECTION-10



X-SECTION-8




X-SECTION-11



X-SECTION-9

NOTES

1. ALL DIMENSIONS AND LEVELS ARE IN m, UNLESS OTHERWISE SPECIFIED.
2. FOR LOCATION OF SECTIONS 7 TO 11, REFER PLATE 3A.

 JAYPEE MEGHALAYA POWER LTD.	
PROJECT :	KYNSHI-II HYDROELECTRIC PROJECT
TITLE	MUCK DISPOSAL AREA AT LOCATION - 12 (CROSS SECTIONS 7 TO 11)

KYNISHI-II H.E. PROJECT, MEGHALAYA
Energy Calculation for 25 MW

Rated Head [m]= 51.76

Head Loss(m)= 1.15

FRL(m)= 193

% Avail.= 95.0%

MDDL(m)= 183

Overall Efficiency = 92.0%

Reservoir level during monsoon(m)= 183

Installed capacity (MW) = 25

Reservoir level during non-monsoon(m)= 193.00

Rated discharge(cumecs)= 53.5

Weighted average Reservoir level during non-monsoon(m)= 189.66

Environmental releases = 30% in monsoon

Tail Water level(m)= 136.75

20% in lean months

25% in remaining months

S. No.	Month	Period	No. of Days	Operating Reservoir Level	Releases for E & E i.e Dam toe PH	Tail Water Level	Head Loss	Net Head	Max. power	Energy as per Operating Head	Energy with 95% machine availability	Design Energy on Monthly Basis
				(m)	(Cumecs)	(m)	(m)	(m)	(MW)	(MU)	(MU)	(MU)
1	2	3	4	5	6	7	8	9=(5-7-8)	10	11	12	13
1	Jun	01--10	10	183.00	59.81	136.82	1.15	45.03	24.31	5.83	5.54	16.94
2		11--20	10	183.00	66.00	136.86	1.15	44.99	25.00	6.00	5.70	
3		21--30	10	183.00	146.02	137.20	1.15	44.65	25.00	6.00	5.70	
4	Jul	01--10	10	183.00	59.81	136.82	1.15	45.03	24.31	5.83	5.54	17.18
5		11--20	10	183.00	59.81	136.82	1.15	45.03	24.31	5.83	5.54	
6		21--31	11	183.00	59.81	136.82	1.15	45.03	24.31	6.42	6.10	
7	Aug	01--10	10	183.00	59.81	136.82	1.15	45.03	24.31	5.83	5.54	17.18
8		11--20	10	183.00	59.81	136.82	1.15	45.03	24.31	5.83	5.54	
9		21--31	11	183.00	59.81	136.82	1.15	45.03	24.31	6.42	6.10	
10	Sep	01--10	10	183.00	59.81	136.82	1.15	45.03	24.31	5.83	5.54	16.63
11		11--20	10	183.00	59.81	136.82	1.15	45.03	24.31	5.83	5.54	
12		21--30	10	183.00	59.81	136.82	1.15	45.03	24.31	5.83	5.54	
Energy Calculation during Monsoon period =												67.93
13	Oct	01--10	10	189.66	28.72	136.45	1.15	52.06	12.50	3.00	2.85	8.84
14		11--20	10	189.66	28.72	136.45	1.15	52.06	12.50	3.00	2.85	
15		21--31	11	189.66	28.72	136.45	1.15	52.06	12.50	3.30	3.14	
16	Nov	01--10	10	189.66	11.56	136.17	1.15	52.34	5.46	1.31	1.25	3.74
17		11--20	10	189.66	11.56	136.17	1.15	52.34	5.46	1.31	1.25	
18		21--30	10	189.66	11.56	136.17	1.15	52.34	5.46	1.31	1.25	
19	Dec	01--10	10	189.66	11.56	136.17	1.15	52.34	5.46	1.31	1.25	3.86
20		11--20	10	189.66	11.56	136.17	1.15	52.34	5.46	1.31	1.25	
21		21--31	11	189.66	11.56	136.17	1.15	52.34	5.46	1.44	1.37	
22	Jan	01--10	10	189.66	11.56	136.17	1.15	52.34	5.46	1.31	1.25	3.86
23		11--20	10	189.66	11.56	136.17	1.15	52.34	5.46	1.31	1.25	
24		21--31	11	189.66	11.56	136.17	1.15	52.34	5.46	1.44	1.37	
25	Feb	01--10	10	189.66	11.56	136.17	1.15	52.34	5.46	1.31	1.25	3.49
26		11--20	10	189.66	11.56	136.17	1.15	52.34	5.46	1.31	1.25	
27		21--28	8	189.66	11.56	136.17	1.15	52.34	5.46	1.05	1.00	
28	Mar	01--10	10	189.66	28.72	136.45	1.15	52.06	12.50	3.00	2.85	8.84
29		11--20	10	189.66	28.72	136.45	1.15	52.06	12.50	3.00	2.85	
30		21--31	11	189.66	28.72	136.45	1.15	52.06	12.50	3.30	3.14	
31	Apr	01--10	10	189.66	28.72	136.45	1.15	52.06	12.50	3.00	2.85	8.55
32		11--20	10	189.66	28.72	136.45	1.15	52.06	12.50	3.00	2.85	
33		21--30	10	189.66	28.72	136.45	1.15	52.06	12.50	3.00	2.85	
34	May	01--10	10	189.66	28.72	136.45	1.15	52.06	12.50	3.00	2.85	8.84
35		11--20	10	189.66	28.72	136.45	1.15	52.06	12.50	3.00	2.85	
36		21--31	11	189.66	28.72	136.45	1.15	52.06	12.50	3.30	3.14	
Total Energy during Non-Monsoon period(MU) =												50.00
Total Annual Energy (MU) =												117.92
Plant Load Factor =												53.85%

KYNASHI-II H.E. PROJECT, MEGHALAYA
Energy Calculation for 300 MW + 25MW Dam-Toe PH for 90% Dependable year
(with peaking considering during non-monsoon)

Rated Head [m]= 172.30	Head Loss(m)= 8.83	E&E releases(monsoon, 30% of average inflow) = 59.81
FRL(m)= 193	% Avail.= 95.0%	E&E releases(non-monsoon, 20% of average inflow) = 11.57
MDDL(m)= 183	Overall Efficiency = 92.0%	E&E releases(lean period, 25% of average inflow) = 28.73
Reservoir level during monsoon(m)= 183	Installed capacity (MW) = 300	Dam-toe PH capacity (MW) = 25
Weighed average reservoir level during non-monsoon(m)= 189.66	Rated discharge= 192.93	Evaporation losses= 0
TWL(max)= 8.53		

S. No.	Month	Period	No. of Days	Operating Reservoir Level	Initial Reservoir Storage	Closing Reservoir Storage	Inflow (10-daily discharge)	Evaporation losses	Net Inflow (10 daily discharge)	Releases for E & E	Inflow after releasing 20 cumecs discharge for dam toe Power house	Qty of inflow	Net Qty available	Tail Water Level	Head Loss (3 units running)	Net Head	Net Available Discharge	Peaking Turbine Discharge for Net Head	Max running Hrs with peak discharge	Spillage	Max. Peaking power	Energy as per Operating Head	Energy with 95% machine availability	Design Energy on Monthly Basis
1	2	3	4	5	6	7	8	9	10=(8-9)	11	12=(10-11)	13	14=(13+6-7)	15	16	17	18	19	20	21	22	23	24	25
				(m)	(Mcum)	(Mcum)	(Cumecs)	(Cumecs)	(Cumecs)	(Cumecs)		(Mcum)	(Mcum)	(m)	(m)	(m)	(Cumecs)	(Cumecs)	HRS	(Cumecs)	(MW)	(MU)	(MU)	(MU)
1	Jun	01--10	10	183.00	0.00	0.00	214.52	0.00	214.52	59.81	154.71	133.67	133.67	8.53	8.83	165.64	154.71	200.68	18.50	0.00	300.00	55.51	55.51	192.31
2		11--20	10	183.00	0.00	0.00	266.70	0.00	266.70	59.81	206.89	178.75	178.75	8.53	8.83	165.64	206.89	200.68	24.00	6.21	300.00	72.00	68.40	
3		21--30	10	183.00	0.00	0.00	346.72	0.00	346.72	59.81	286.91	247.89	247.89	8.53	8.83	165.64	286.91	200.68	24.00	86.23	300.00	72.00	68.40	
4	Jul	01--10	10	183.00	0.00	0.00	118.17	0.00	118.17	59.81	58.36	50.42	50.42	8.53	8.83	165.64	58.36	200.68	6.98	0.00	300.00	20.94	20.94	96.00
5		11--20	10	183.00	0.00	0.00	169.43	0.00	169.43	59.81	109.62	94.71	94.71	8.53	8.83	165.64	109.62	200.68	13.11	0.00	300.00	39.33	39.33	
6		21--31	11	183.00	0.00	0.00	150.35	0.00	150.35	59.81	90.54	86.05	86.05	8.53	8.83	165.64	90.54	200.68	10.83	0.00	300.00	35.73	35.73	
7	Aug	01--10	10	183.00	0.00	0.00	245.39	0.00	245.39	59.81	185.58	160.34	160.34	8.53	8.83	165.64	185.58	200.68	22.19	0.00	300.00	66.58	66.58	203.62
8		11--20	10	183.00	0.00	0.00	232.06	0.00	232.06	59.81	172.25	148.82	148.82	8.53	8.83	165.64	172.25	200.68	20.60	0.00	300.00	61.80	61.80	
9		21--31	11	183.00	0.00	0.00	252.31	0.00	252.31	59.81	192.50	182.95	182.95	8.53	8.83	165.64	192.50	200.68	23.02	0.00	300.00	75.97	75.24	
10	Sep	01--10	10	183.00	0.00	0.00	164.14	0.00	164.14	59.81	104.33	90.14	90.14	8.53	8.83	165.64	104.33	200.68	12.48	0.00	300.00	37.43	37.43	78.02
11		11--20	10	183.00	0.00	0.00	118.00	0.00	118.00	59.81	58.19	50.27	50.27	8.53	8.83	165.64	58.19	200.68	6.96	0.00	300.00	20.88	20.88	
12		21--30	10	183.00	0.00	0.00	114.76	0.00	114.76	59.81	54.95	47.47	47.47	8.53	8.83	165.64	54.95	200.68	6.57	0.00	300.00	19.71	19.71	
Energy Calculation during Monsoon period =																							569.95	
13	Oct	01--10	10	189.66	0.00	20.80	192.49	0.00	192.49	28.73	163.76	141.49	120.69	8.53	8.83	172.30	139.69	192.92	17.38	0.00	300.00	52.13	52.13	93.55
14		11--20	10	189.66	20.80	20.80	92.70	0.00	92.70	28.73	63.97	55.27	55.27	8.53	8.83	172.30	63.97	192.92	7.96	0.00	300.00	23.88	23.88	
15		21--31	11	189.66	20.80	20.80	71.46	0.00	71.46	28.73	42.73	40.61	40.61	8.53	8.83	172.30	42.73	192.92	5.32	0.00	300.00	17.54	17.54	
16	Nov	01--10	10	189.66	20.80	20.80	61.21	0.00	61.21	11.57	49.64	42.89	42.89	8.53	8.83	172.30	49.64	192.92	6.18	0.00	300.00	18.53	18.53	53.06
17		11--20	10	189.66	20.80	20.80	62.70	0.00	62.70	11.57	51.13	44.18	44.18	8.53	8.83	172.30	51.13	192.92	6.36	0.00	300.00	19.08	19.08	
18		21--30	10	189.66	20.80	20.80	52.95	0.00	52.95	11.57	41.38	35.76	35.76	8.53	8.83	172.30	41.38	192.92	5.15	0.00	300.00	15.45	15.45	
19	Dec	01--10	10	189.66	20.80	20.80	49.02	0.00	49.02	11.57	37.45	32.36	32.36	8.53	8.83	172.30	37.45	192.92	4.66	0.00	300.00	13.98	13.98	40.98
20		11--20	10	189.66	20.80	20.80	47.60	0.00	47.60	11.57	36.03	31.13	31.13	8.53	8.83	172.30	36.03	192.92	4.48	0.00	300.00	13.45	13.45	
21		21--31	11	189.66	20.80	20.80	44.58	0.00	44.58	11.57	33.01	31.38	31.38	8.53	8.83	172.30	33.01	192.92	4.11	0.00	300.00	13.55	13.55	
22	Jan	01--10	10	189.66	20.80	20.80	62.04	0.00	62.04	11.57	50.47	43.61	43.61	8.53	8.83	172.30	50.47	192.92	6.28	0.00	300.00	18.84	18.84	59.54
23		11--20	10	189.66	20.80	20.80	60.36	0.00	60.36	11.57	48.79	42.16	42.16	8.53	8.83	172.30	48.79	192.92	6.07	0.00	300.00	18.21	18.21	
24		21--31	11	189.66	20.80	20.80	66.35	0.00	66.35	11.57	54.78	52.07	52.07	8.53	8.83	172.30	54.78	192.92	6.82	0.00	300.00	22.49	22.49	
25	Feb	01--10	10	189.66	20.80	20.80	60.12	0.00	60.12	11.57	48.55	41.95	41.95	8.53	8.83	172.30	48.55	192.92	6.04	0.00	300.00	18.12	18.12	52.94
26		11--20	10	189.66	20.80	20.80	62.62	0.00	62.62	11.57	51.05	44.11	44.11	8.53	8.83	172.30	51.05	192.92	6.35	0.00	300.00	19.05	19.05	
27		21--28	8	189.66	20.80	20.80	64.38	0.00	64.38	11.57	52.81	36.51	36.51	8.53	8.83	172.30	52.81	192.92	6.57	0.00	300.00	15.77	15.77	
28	Mar	01--10	10	189.66	20.80	20.80	68.31	0.00	68.31	28.73	39.58	34.20	34.20	8.53	8.83	172.30	39.58	192.92	4.92	0.00	300.00	14.77	14.77	62.26
29		11--20	10	189.66	20.80	20.80	79.28	0.00	79.28	28.73	50.55	43.68	43.68	8.53	8.83	172.30	50.55	192.92	6.29	0.00	300.00	18.87	18.87	
30		21--31	11	189.66	20.80	20.80	98.43	0.00	98.43	28.73	69.70	66.25	66.25	8.53	8.83	172.30	69.70	192.92	8.67	0.00	300.00	28.62	28.62	
31	Apr	01--10	10	189.66	20.80	20.80	103.94	0.00	103.94	28.73	75.21	64.99	64.99	8.53	8.83	172.30	75.21	192.92	9.36	0.00	300.00	28.07	28.07	137.23
32		11--20	10	189.66	20.80	20.80	160.92	0.00	160.92	28.73	132.19	114.22	114.22	8.53	8.83	172.30	132.19	192.92	16.45	0.00	300.00	49.34	49.34	
33		21--30	10	189.66	20.80	20.80	189.03	0.00	189.03	28.73	160.30	138.50	138.50	8.53	8.83	172.30	160.30	192.92	19.94	0.00	300.00	59.83	59.83	
34	May	01--10	10	189.66	20.80	20.80	88.62	0.00	88.62	28.73	59.89	51.75	51.75	8.53	8.83	172.30	59.89	192.92	7.45	0.00	300.00	22.35	22.35	101.27
35		11--20	10	189.66	20.80	20.80	93.13	0.00	93.13	28.73	64.40	55.65	55.65	8.53	8.83	172.30	64.40	192.92	8.01	0.00	300.00	24.04	24.04	
36		21--31	11	189.66	20.80	0.00	140.52	0.00	140.52	28.73	111.79	106.25	127.05	8.53	8.83	172.30	133.68	192.92	16.63	0.00	300.00	54.88	54.88	
Total Energy during Non-Monsoon period(MU) =																				600.83				
Total Annual Energy (MU) = 1170.78																								
Plant Load Factor = 44.55%																								
Dam Toe(PH) MU = 117.92																								
Total MU(for 300MW PH +25MW PH) = 1288.70																								
Plant Load Factor(for 300MW PH +25MW PH) = 45.27%																								

KYNISH-II H.E. PROJECT, MEGHALAYA
Energy Calculation for 25 MW

Rated Head [m]= 51.76

FRL(m)= 193

MDDL(m)= 183

Reservoir level during monsoon(m)= 183

Reservoir level during non-monsoon(m)= 193.00

Weighted average Reservoir level during non-monsoon(m)= 189.66

Tail Water level(m)= 136.75

Head Loss(m)= 1.15

% Avail.= 95.0%

Overall Efficiency = 92.0%

Installed capacity (MW) = 25

Rated discharge(cumecs)= 53.5

Environmental Releases = 25% of average of lean months

S. No.	Month	Period	No. of Days	Operating Reservoir Level	Releases for E & E i.e Dam toe PH	Tail Water Level	Head Loss	Net Head	Max. power	Energy as per Operating Head	Energy with 95% machine availability	Design Energy on Monthly Basis
				(m)	(Cumecs)	(m)	(m)	(m)	(MW)	(MU)	(MU)	(MU)
1	2	3	4	5	6	7	8	9=(5-7-8)	10	11	12	13
1	Jun	01--10	10	183.00	14.45	136.28	1.15	45.57	5.94	1.43	1.36	12.76
2		11--20	10	183.00	66.00	136.86	1.15	44.99	25.00	6.00	5.70	
3		21--30	10	183.00	146.02	137.20	1.15	44.65	25.00	6.00	5.70	
4	Jul	01--10	10	183.00	14.45	136.28	1.15	45.57	5.94	1.43	1.36	4.20
5		11--20	10	183.00	14.45	136.28	1.15	45.57	5.94	1.43	1.36	
6		21--31	11	183.00	14.45	136.28	1.15	45.57	5.94	1.57	1.49	
7	Aug	01--10	10	183.00	44.69	136.67	1.15	45.18	18.22	4.37	4.15	12.35
8		11--20	10	183.00	31.36	136.52	1.15	45.33	12.83	3.08	2.93	
9		21--31	11	183.00	51.61	136.74	1.15	45.11	21.01	5.55	5.27	
10	Sep	01--10	10	183.00	14.45	136.28	1.15	45.57	5.94	1.43	1.36	4.07
11		11--20	10	183.00	14.45	136.28	1.15	45.57	5.94	1.43	1.36	
12		21--30	10	183.00	14.45	136.28	1.15	45.57	5.94	1.43	1.36	
Energy Calculation during Monsoon period =												33.37
13	Oct	01--10	10	189.66	14.45	136.28	1.15	52.23	6.81	1.63	1.55	4.82
14		11--20	10	189.66	14.45	136.28	1.15	52.23	6.81	1.63	1.55	
15		21--31	11	189.66	14.45	136.28	1.15	52.23	6.81	1.80	1.71	
16	Nov	01--10	10	189.66	14.45	136.28	1.15	52.23	6.81	1.63	1.55	4.66
17		11--20	10	189.66	14.45	136.28	1.15	52.23	6.81	1.63	1.55	
18		21--30	10	189.66	14.45	136.28	1.15	52.23	6.81	1.63	1.55	
19	Dec	01--10	10	189.66	14.45	136.28	1.15	52.23	6.81	1.63	1.55	4.82
20		11--20	10	189.66	14.45	136.28	1.15	52.23	6.81	1.63	1.55	
21		21--31	11	189.66	14.45	136.28	1.15	52.23	6.81	1.80	1.71	
22	Jan	01--10	10	189.66	14.45	136.28	1.15	52.23	6.81	1.63	1.55	4.82
23		11--20	10	189.66	14.45	136.28	1.15	52.23	6.81	1.63	1.55	
24		21--31	11	189.66	14.45	136.28	1.15	52.23	6.81	1.80	1.71	
25	Feb	01--10	10	189.66	14.45	136.28	1.15	52.23	6.81	1.63	1.55	4.35
26		11--20	10	189.66	14.45	136.28	1.15	52.23	6.81	1.63	1.55	
27		21--28	8	189.66	14.45	136.28	1.15	52.23	6.81	1.31	1.24	
28	Mar	01--10	10	189.66	14.45	136.28	1.15	52.23	6.81	1.63	1.55	4.82
29		11--20	10	189.66	14.45	136.28	1.15	52.23	6.81	1.63	1.55	
30		21--31	11	189.66	14.45	136.28	1.15	52.23	6.81	1.80	1.71	
31	Apr	01--10	10	189.66	14.45	136.28	1.15	52.23	6.81	1.63	1.55	4.66
32		11--20	10	189.66	14.45	136.28	1.15	52.23	6.81	1.63	1.55	
33		21--30	10	189.66	14.45	136.28	1.15	52.23	6.81	1.63	1.55	
34	May	01--10	10	189.66	14.45	136.28	1.15	52.23	6.81	1.63	1.55	4.82
35		11--20	10	189.66	14.45	136.28	1.15	52.23	6.81	1.63	1.55	
36		21--31	11	189.66	14.45	136.28	1.15	52.23	6.81	1.80	1.71	
Total Energy during Non-Monsoon period(MU) =												37.74
Total Annual Energy (MU) =												71.12
Plant Load Factor =												32.47%

KYNASHI-II H.E. PROJECT, MEGHALAYA
Energy Calculation for 300 MW + 25MW Dam-Toe PH for 90% Dependable year
(with peaking considering during non-monsoon)

Rated Head [m]= 172.30 Head Loss(m)= 8.83 E&E releases(lean period, 25% of average inflow) = 14.46
 FRL(m)= 193 % Avail.= 95.0% Dam-toe PH capacity (MW) = 25
 MDDL(m)= 183 Overall Efficiency = 92.0% TWL(max)= 8.53
 Reservoir level during monsoon(m)= 183 Installed capacity (MW) = 300 Evaporation losses= 0
 Weighed average reservoir level during non-monsoon(m)= 189.66 Rated discharge= 192.93

S. No.	Month	Period	No. of Days	Operating Reservoir Level	Initial Reservoir Storage	Closing Reservoir Storage	Inflow (10-daily discharge)	Evaporation losses	Net Inflow (10 daily discharge)	Releases for E & E	Inflow after releasing 20 cumecs discharge for dam toe Power house	Qty of inflow	Net Qty available	Tail Water Level	Head Loss (3 units running)	Net Head	Net Available Discharge	Peaking Turbine Discharge for Net Head	Max running Hrs with peak discharge	Spillage	Max. Peaking power	Energy as per Operating Head	Energy with 95% machine availability	Design Energy on Monthly Basis	
				(m)	(Mcum)	(Mcum)	(Cumecs)	(Cumecs)	(Cumecs)	(Cumecs)		(Mcum)	(Mcum)	(m)	(m)	(m)	(Cumecs)	(Cumecs)	HRS	(Cumecs)	(MW)	(MU)	(MU)	(MU)	
1	2	3	4	5	6	7	8	9	10 =(8-9)	11	12 =(10-11)	13	14=(13+6-7)	15	16	17	18	19	20	21	22	23	24	25	
1	Jun	01--10	10	183.00	0.00	0.00	214.52	0.00	214.52	14.46	200.06	172.85	172.85	8.53	8.83	165.64	200.06	200.68	23.93	0.00	300.00	71.78	68.40	205.20	
2		11--20	10	183.00	0.00	0.00	266.70	0.00	266.70	14.46	252.24	217.94	217.94	8.53	8.83	165.64	252.24	200.68	24.00	51.57	300.00	72.00	68.40		
3		21--30	10	183.00	0.00	0.00	346.72	0.00	346.72	14.46	332.26	287.08	287.08	8.53	8.83	165.64	332.26	200.68	24.00	131.59	300.00	72.00	68.40		
4	Jul	01--10	10	183.00	0.00	0.00	118.17	0.00	118.17	14.46	103.71	89.61	89.61	8.53	8.83	165.64	103.71	200.68	12.40	0.00	300.00	37.21	37.21	146.44	
5		11--20	10	183.00	0.00	0.00	169.43	0.00	169.43	14.46	154.97	133.90	133.90	8.53	8.83	165.64	154.97	200.68	18.53	0.00	300.00	55.60	55.60		
6		21--31	11	183.00	0.00	0.00	150.35	0.00	150.35	14.46	135.89	129.15	129.15	8.53	8.83	165.64	135.89	200.68	16.25	0.00	300.00	53.63	53.63		
7	Aug	01--10	10	183.00	0.00	0.00	245.39	0.00	245.39	14.46	230.93	199.53	199.53	8.53	8.83	165.64	230.93	200.68	24.00	30.26	300.00	72.00	68.40	212.04	
8		11--20	10	183.00	0.00	0.00	232.06	0.00	232.06	14.46	217.60	188.01	188.01	8.53	8.83	165.64	217.60	200.68	24.00	16.93	300.00	72.00	68.40		
9		21--31	11	183.00	0.00	0.00	252.31	0.00	252.31	14.46	237.85	226.06	226.06	8.53	8.83	165.64	237.85	200.68	24.00	37.18	300.00	79.20	75.24		
10	Sep	01--10	10	183.00	0.00	0.00	164.14	0.00	164.14	14.46	149.68	129.33	129.33	8.53	8.83	165.64	149.68	200.68	17.90	0.00	300.00	53.70	53.70	126.84	
11		11--20	10	183.00	0.00	0.00	118.00	0.00	118.00	14.46	103.54	89.46	89.46	8.53	8.83	165.64	103.54	200.68	12.38	0.00	300.00	37.15	37.15		
12		21--30	10	183.00	0.00	0.00	114.76	0.00	114.76	14.46	100.30	86.66	86.66	8.53	8.83	165.64	100.30	200.68	12.00	0.00	300.00	35.99	35.99		
																								690.53	
																								Energy Calculation during Monsoon period =	690.53
13	Oct	01--10	10	189.66	0.00	20.80	192.49	0.00	192.49	14.46	178.03	153.82	133.02	8.53	8.83	172.30	153.96	192.92	19.15	0.00	300.00	57.46	57.46	110.06	
14		11--20	10	189.66	20.80	20.80	92.70	0.00	92.70	14.46	78.24	67.60	67.60	8.53	8.83	172.30	78.24	192.92	9.73	0.00	300.00	29.20	29.20		
15		21--31	11	189.66	20.80	20.80	71.46	0.00	71.46	14.46	57.00	54.18	54.18	8.53	8.83	172.30	57.00	192.92	7.09	0.00	300.00	23.40	23.40		
16	Nov	01--10	10	189.66	20.80	20.80	61.21	0.00	61.21	14.46	46.75	40.39	40.39	8.53	8.83	172.30	46.75	192.92	5.82	0.00	300.00	17.45	17.45	49.82	
17		11--20	10	189.66	20.80	20.80	62.70	0.00	62.70	14.46	48.24	41.68	41.68	8.53	8.83	172.30	48.24	192.92	6.00	0.00	300.00	18.00	18.00		
18		21--30	10	189.66	20.80	20.80	52.95	0.00	52.95	14.46	38.49	33.26	33.26	8.53	8.83	172.30	38.49	192.92	4.79	0.00	300.00	14.37	14.37		
19	Dec	01--10	10	189.66	20.80	20.80	49.02	0.00	49.02	14.46	34.56	29.86	29.86	8.53	8.83	172.30	34.56	192.92	4.30	0.00	300.00	12.90	12.90	37.64	
20		11--20	10	189.66	20.80	20.80	47.60	0.00	47.60	14.46	33.14	28.64	28.64	8.53	8.83	172.30	33.14	192.92	4.12	0.00	300.00	12.37	12.37		
21		21--31	11	189.66	20.80	20.80	44.58	0.00	44.58	14.46	30.12	28.63	28.63	8.53	8.83	172.30	30.12	192.92	3.75	0.00	300.00	12.37	12.37		
22	Jan	01--10	10	189.66	20.80	20.80	62.04	0.00	62.04	14.46	47.58	41.11	41.11	8.53	8.83	172.30	47.58	192.92	5.92	0.00	300.00	17.76	17.76	56.19	
23		11--20	10	189.66	20.80	20.80	60.36	0.00	60.36	14.46	45.90	39.66	39.66	8.53	8.83	172.30	45.90	192.92	5.71	0.00	300.00	17.13	17.13		
24		21--31	11	189.66	20.80	20.80	66.35	0.00	66.35	14.46	51.89	49.32	49.32	8.53	8.83	172.30	51.89	192.92	6.46	0.00	300.00	21.30	21.30		
25	Feb	01--10	10	189.66	20.80	20.80	60.12	0.00	60.12	14.46	45.66	39.45	39.45	8.53	8.83	172.30	45.66	192.92	5.68	0.00	300.00	17.04	17.04	49.92	
26		11--20	10	189.66	20.80	20.80	62.62	0.00	62.62	14.46	48.16	41.61	41.61	8.53	8.83	172.30	48.16	192.92	5.99	0.00	300.00	17.97	17.97		
27		21--28	8	189.66	20.80	20.80	64.38	0.00	64.38	14.46	49.92	34.51	34.51	8.53	8.83	172.30	49.92	192.92	6.21	0.00	300.00	14.91	14.91		
28	Mar	01--10	10	189.66	20.80	20.80	68.31	0.00	68.31	14.46	53.85	46.53	46.53	8.53	8.83	172.30	53.85	192.92	6.70	0.00	300.00	20.10	20.10	78.76	
29		11--20	10	189.66	20.80	20.80	79.28	0.00	79.28	14.46	64.82	56.01	56.01	8.53	8.83	172.30	64.82	192.92	8.06	0.00	300.00	24.19	24.19		
30		21--31	11	189.66	20.80	20.80	98.43	0.00	98.43	14.46	83.97	79.81	79.81	8.53	8.83	172.30	83.97	192.92	10.45	0.00	300.00	34.47	34.47		
31	Apr	01--10	10	189.66	20.80	20.80	103.94	0.00	103.94	14.46	89.48	77.31	77.31	8.53	8.83	172.30	89.48	192.92	11.13	0.00	300.00	33.40	33.40	153.21	
32		11--20	10	189.66	20.80	20.80	160.92	0.00	160.92	14.46	146.46	126.54	126.54	8.53	8.83	172.30	146.46	192.92	18.22	0.00	300.00	54.66	54.66		
33		21--30	10	189.66	20.80	20.80	189.03	0.00	189.03	14.46	174.57	150.83	150.83	8.53	8.83	172.30	174.57	192.92	21.72	0.00	300.00	65.15	65.15		
34	May	01--10	10	189.66	20.80	20.80	88.62	0.00	88.62	14.46	74.16	64.08	64.08	8.53	8.83	172.30	74.16	192.92	9.23	0.00	300.00	27.68	27.68	117.78	
35		11--20	10	189.66	20.80	20.80	93.13	0.00	93.13	14.46	78.67	67.97	67.97	8.53	8.83	172.30	78.67	192.92	9.79	0.00	300.00	29.36	29.36		
36		21--31	11	189.66	20.80	0.00	140.52	0.00	140.52	14.46	126.06	119.81	140.61	8.53	8.83	172.30	147.95	192.92	18.41	0.00	300.00	60.74	60.74		
																								Total Energy during Non-Monsoon period(MU) =	653.38
																								Total Annual Energy (MU) =	1343.91
																								Plant Load Factor =	51.14%
																								Dam Toe(PH) MU =	71.12
																								Total MU(for 300MW PH +25MW PH) =	1415.03
																								Plant Load Factor(for 300MW PH +25MW PH) =	49.70%

KYN Shi-II HE PROJECT (300+25 MW) MEGHALAYA

A BRIEF DESCRIPTION OF PROJECT

1.0 GENERAL

Kynshi-II HE Project is located on the main river Kynshi, downstream of the confluence of rivers Kynshi and its most major right bank tributary Wahblei (**Fig 1**). The project was under investigation by Brahmaputra Board till Dec 2007. On 11th Dec 2007, a MoA was signed between Govt. of Meghalaya and Jaypee Group and however, MoA remained under abeyance upto May 2010. The project was reviewed in May 2010. Expert Appraisal Committee (EAC), MoEF was approached twice for approval of Terms of Reference (ToR) for formulation of Environmental studies, however, due to excessive submergence, EAC, MoEF asked for modifications in the Layout for reductions of submergence area. Accordingly, the project configuration has undergone major changes. Due to the presence of Uranium deposit in the reservoir area of the project, identified by Atomic and Mineral Deptt (AMD), Meghalaya the EAC, MoEF referred the issue to Govt. of Meghalaya for their opinion in this regard. As a result the ToRs for the project are yet to be approved. However a conditional concurrence to proceed with the field investigation work was given by MoEF while referring the matter to Govt. of Meghalaya.

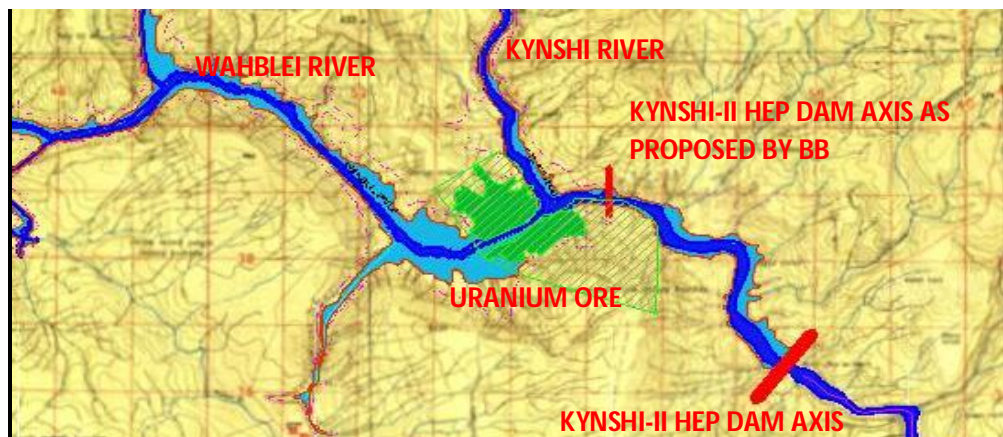


FIG 1: KYN Shi-II HEP DAM AXIS

Brahmaputra Board had planned 113m high concrete gravity dam, 0.422 km d/s of confluence of Kynshi and Wahblei rivers. The project layout envisaged the FRL at EL 260m with a Dam toe Power House having an installed capacity of 450MW.

2.0 CHANGES MADE IN THE LAYOUT

In order to meet the requirement of EAC, MoEF for substantial reduction of submergence area and to plan the project in such a manner that extraction of most of the Uranium Ore deposit is possible at any stage of the Hydro Power project, following modifications in the layout of the project have been incorporated:

- In the first stage, after the 40th EAC, MoEF meeting on 20.08.2010, the top of Dam was lowered from EL 265m to EL 243m i.e. by 22m and the FRL was lowered from EL 260m to EL 240m i.e. by 20m. The total submergence area was accordingly reduced from 4199Ha to 2169 Ha i.e. reduction of submergence to 51.66 % as compared to initially planned submergence area.
- However, when the issue of presence of Uranium was raised by AMD Meghalaya, JMPL optimized the layout to accommodate the possibility of extraction of Uranium ore deposit in the reservoir area of the project. As such the Dam Axis had to be shifted downstream from the initial location of Dam Axis proposed by Brahmaputra Board to about 3.385 km d/s of the confluence of rivers Kynshi and Wahblei, away from mining area. The top of Dam at this location was further lowered and kept at EL 196m with FRL being at EL 193.0m.
- Thus, in the second stage, after 43rd EAC, MoEF meeting on 13.11.2010, the top of Dam was lowered from EL 243m to EL 196m and the FRL was lowered from EL 240m to EL 193m i.e. by about 47m. The submergence also was further reduced from 1867 Ha to 521.53Ha, which is about 28% of the submergence area when the FRL of the dam was at EL 240m.

3.0 PRESENT STATUS

Water availability studies, Diversion Flood studies as well as Design Flood studies for the project were submitted to CEA/CWC, which have been examined and approved.

Power optimisation studies based on the approved water availability and the installed capacity for the Dam-Toe as well as Main Power house have tentatively been worked out and the details are to be submitted to CEA for their appraisal and approval.

5.0 PLANNING & DESIGN STUDIES CARRIED OUT TO FINALISE THE LAYOUT & SIZE OF VARIOUS PROJECT COMPONENTS:

5.1 PROJECT COMPONENTS (Refer Plates 4A, 4B, 4C, 4D, 4E, 4F, 4G and 4H)

Kynshi-II HEP (300 + 25) MW is located in West Khasi Hill District of Meghalaya. It is a run of the river (RoR) scheme. A gross head of 172.30m available is proposed to be utilized for power generation. The main Power House will have an installed capacity of 300 MW.

The project comprises the following main components:

- (i) 63m high concrete Dam;
- (ii) 08 Spillway blocks;
- (iii) 9.5m diameter horse shoe shaped, 362.45 m long Diversion Tunnel on the right bank;
- (iv) The Power Intake Structure located just upstream of the Main Dam on right bank;
- (v) Head Race Tunnel 8.0m diameter, 7.04 km (approx) in length;
- (vi) Surge Shaft 27m diameter, 80.5 m high;
- (vii) Three steel lined Pressure Shafts, each of 4.0m diameter and 265.63m long;
- (viii) Underground Power House Complex consisting of two parallel caverns one for power House and another for transformer hall;
- (ix) Tail Race system comprising of Draft tubes, Tail Race Tunnel 346m long with a downstream surge gallery by converting a 7.5m D shaped adit of having a length of 378.12m.
- (x) A Surface Switchyard;
- (xi) The Power House will have three Francis turbine/generators each of 100 MW.
- (xii) A Dam-toe Power House with one Kaplan turbine/generator unit of 25 MW.

5.2 Dam Complex

The dam envisages 20 blocks, 12 are provided as non-overflow blocks and remaining 08 blocks are overflow spillway blocks, for passing of PMF. Two NOF blocks towards left bank side have been utilized as power dam blocks and are provided with intake structures for Dam-Toe Power House. This provision has

essentially been made to utilize the water required to be released for Environmental flows (E-flows).

The Hydraulic Design Studies to finalize the breast wall profile, U/S and D/S curves of spillway blocks, adequacy of spillway for passing the PMF for normal and emergency conditions, have been carried out as per BIS. Various configurations for energy dissipation arrangement were studied and finally, under the given conditions, a flip bucket arrangement with downstream plunge pool has been considered as most suitable.

Each of the Overflow and Non-overflow blocks have been checked independently for stability, considering the shear and seismic design parameters in line with the provisions of IS codes 1893 and 6512.

Provisions in respect of Miscellaneous items such as Drainage of Dam body, Ventilation of Galleries, Consolidation Grouting, Curtain Grouting and Drainage Arrangement for relief in Uplift pressure, arrangement of Sump for collecting the Drainage water & its Dewatering by providing a pump house at appropriate location with outlet at suitable location and elevation, Contraction Joints, Water Stops, Formed Drains etc. is planned and provided as per the provisions in the relevant IS codes.

As proposed by UCIL the necessary grouting for seepage control and channelization of streams wherever considered necessary for Uranium ore extraction within the reservoir area of Kynshi-II HEP shall be provided.

5.3 Water Conductor System

Water conductor system comprises of intake, head race tunnel, surge shaft, pressure shaft, Draft tube, TRT and downstream surge gallery.

5.3.1 Intake

The Intake Structure is located on the right bank. The crest level of intake is kept at El. 170.0 m. A breast wall with bell mouth entry is provided at the inlet. Beyond the bell mouth entry, the size of each intake duct is 7.0 m (W) x 6.0 m (H). The discharge of 192.9 cumec shall pass through the intake structure. At entry of intake, a trashrack arrangement inclined at 70° with horizontal has been provided for restricting the entry of large size pebbles, floating debris etc in the water conductor system. Each of the intake sluices has been provided with gates operation as well as for maintenance. The angle between Dam axis and intake axis has been kept as 110° for smooth entry of flow.

5.3.2 HRT

An 8.0m dia, circular Head Race Tunnel, 7.04 km long, is located on the right bank of Kynshi River. The diameter of the HRT has been finalized based on economic diameter studies and hydraulic flow conditions.

The HRT is proposed to be excavated with the help of two adits of 6.5 m size D-shaped. Adit-1 is about 326.60 m long and Adit-2 is about 302.32 m long. One of the Adit shall ultimately be provided with hinged type gate in its concrete plug to facilitate for accessing the HRT for inspection, repair and maintenance during O&M stage. The typical rock support system for five types of rocks has been designed.

The Head Race Tunnel is proposed to be lined with concrete lining. In the portions of poor geological reaches, near junctions with adits and in transition reach just upstream of Surge Shaft, reinforced concrete lining will be provided.

5.3.3 Surge Shaft

It is proposed to provide 27.0m dia, circular in shape, open to sky type Surge Shaft. The Surge Shaft has Orifice Slab with orifice of 4.25m dia at El 145.50m. The Surge Shaft is proposed to be located in a hill with top at EL 226m, on the right bank of river Kynshi. The invert level of Head Race tunnel, at its junction with the Surge Shaft will be El 137.5 m.

The head loss in the entire water conductor system has been computed using manning's coefficient. The minimum area of the surge shaft is governed by Thoma Criteria given in IS : 7396.

The hydraulic transient studies for the combined water conductor system comprising of HRT, Surge shaft, Pressure shafts, Turbines, downstream surge gallery and Tail Race Tunnel have been performed. While carrying out the transient studies all possible modes of operation such as sudden load rejection, sudden load rejection followed by partial to full acceptance and restarting of units' flow in the HRT etc. as stipulated in IS 7396 have been considered.

Design Criteria / guidelines in the IS 7396, stipulate that the maximum upsurge is to be contained within the surge shaft under the highest reservoir level, with a free board of 1.5 m. Similarly in the case of lowest downsurge, a minimum free board allowance of 2m shall always be available. The vertical shaft of 27.0 m dia extends

upto El 226m with orifice at EL 145.50m, containing surges well within the available height.

5.3.4 Pressure Shaft

Three pressure shafts of 4.0 m internal dia off-take at the bottom of surge shaft to feed three turbines installed in the Powerhouse. The penstocks have three components; Top Horizontal, Vertical and Bottom Horizontal. The penstocks shall be steel lined in its entire reach.

The steel liner design shall be based on internal and external water pressures duly considering the rock participation in sharing of the internal pressures and considering the effect of embedment while verifying the adequacy of the liner for external pressures.

The liner shall be checked for extreme operating conditions and permissible stresses in the steel depending upon the operating condition and resulting forces on the liner.

5.3.5 Downstream Surge Gallery

In order to absorb the fluctuations of requirement of water downstream of powerhouse and variation in its levels, a downstream surge gallery, by converting the adit of 7.5m D shaped- 378m long to be used for facilitation of construction of TRT, has been provided. The support system is provided similar to that of Adits. Subsequent to its use as adit, it is proposed to provide concrete lining throughout the length of this adit to be used as surge gallery. The provision of downstream surge gallery and its adequacy has been checked in unison with u/s surge tank, as per provisions of IS: 7396, against resonance.

5.4 Main Underground Power House Complex

The Power House complex comprises of mainly two caverns i.e. Power House Cavern and Transformer Hall cavern. The tentative sizing of the cavern based on EM requirement for Francis turbines is as follows:

- | | | |
|------|-------------------------|-----------------------------|
| (i) | Power House Cavern | 114.12(L) x 21(W) x 45.5(H) |
| (ii) | Transformer Hall Cavern | 100(L) x 15(W) x 26(H) |

The rock support system of Power House & Transformer Hall cavern is based on an integrated design approach, comprising of the conventional empirical design and numerical analysis. The empirical design approach is based on Rock Mass Quality and associated parameters and the two dimensional, plane strain numerical analysis is carried out using software "PHASE2". The general support system comprising of rock bolts and shotcrete has been finalized based on the results of numerical modelling with due consideration of empirical approach leading to a pattern rock bolting and uniform thickness of Shotcrete. The stability analysis of underground wedges formed by intersection of structural discontinuities has also been carried out using UNWEDGE software from Rocscience, Inc.

A 41m thick rock pillar is proposed between the two caverns. The stresses and strength factors i.e. factor of safety available on the periphery of the cavern rock has been assessed and studied in PHASES and which was found to be within the permissible limits and no serious overlapping of stresses is observed.

Two construction adits are proposed for excavation of Power House cavern. The 7.5m D shaped Main Access tunnel (MAT) meets the cavern on machine hall floor at EL 12.5. Another adit of 7.5m D-shaped meets the control block end of power house cavern at EL 26.5m. This adit is proposed to be used as Ventilation Tunnel (VT) later on, during operational stage of the project. Similarly, two adits are proposed for the excavation of Transformer Hall cavern. A 6.5m D shaped Adit off-taking from MAT meets the top of cavern at EL 32.0 and another adit of 6.5m D shaped off-takes from VT and meets the bottom of Transformer Hall at EL 12.5m.

5.5 Dam-Toe Surface Power House Complex

One unit of 25 MW is proposed to be installed to optimally utilize the varied E-flows to be released from main dam. The surface dam toe Power House is proposed just downstream of Power Dam blocks on the left bank of the Dam. The dimensioning of the Power House is 44.50(L) x 17.50(W) x 47.5(H) with 8.0m wide Annexe on the upstream side of the Power house.

All the above studies would be further detailed and fine tuned before finalization of Detailed Project Report (DPR) of the project.

FORM 1

KYNshi HYDRO ELECTRIC PROJECT (STAGE-II)- 325 MW, MEGHALAYA

(I) Basic Information

S. No.	Item	Details
1.	Name of the project/s	Kynshi Hydro Electric Project (Stage-II)
2.	S. No. in the schedule	1 (c)
3.	Proposed capacity/area/length/tonnage to be handled/command area / lease area/number of wells to be drilled	300 MW + 25 MW
4.	New/Expansion/Modernization	New
5.	Existing Capacity/Area etc.	-
6.	Category of Project i.e. 'A' or 'B'	'A'
7.	Does it attract the general condition? If yes, please specify.	No
8.	Does it attract the specific condition? If yes, please specify.	No
9.	Location	
	Plot/Survey/Khasra No.	
	Village	Dam site is near village Poidblai and Power House is near Ranikor. The dam axis is located at about 3.385 Km downstream of the confluence of Kynshi & Wahblei rivers. The project location map is enclosed as Exhibit-1 in the Brief description of the Kynshi II HE Project (Annexure-I).
	Tehsil / District HQ	Nongstoin
	District	West Khasi Hills
	State	Meghalaya
10.	Nearest railway station/airport along with distance in kms.	a) Railway Station–Guwahati (235kms from Project site) b) Airport-Shillong (120 kms) for small aircrafts c) Airport–Guwahati (230kms from Project site)
11.	Nearest Town, city, District Headquarters along with distance in kms.	Nearest Town - Ranikor District HQ – Nongstoin (62 km)
12.	Village Panchayats, Zilla Parishad, Municipal Corporation, Local body (complete postal addresses with telephone nos. to be given)	Sh. Manstudy Nongrem Chief Executive Member Khasi Hills Area Development Council Nongstoin West Khasi Hills District, Meghalaya Phone 0364-2241601

S. No.	Item	Details
13.	Name of the applicant	Jaypee Meghalaya Power Ltd.
14.	Registered Address	Jaypee Meghalaya Power Ltd. Sector-128, Gautam Budha Nagar, NOIDA, (UP) - 201304 (India)
15.	Address for correspondence :	Jaypee Meghalaya Power Ltd. Tower-1, 2 nd Floor, Nirman Sadan, Sector 128, Gautam Budha Nagar NOIDA, -201304 (U.P.)
	Name	Shri Pankaj Gaur
	Designation(Owner/Partner/CEO)	Director
	Address	Jaypee Meghalaya Power Ltd. Tower-1, 2 nd Floor, Nirmaan Sadan, Sector 128, Gautam Budha Nagar NOIDA, -201304 (U.P.)
	Pin Code	201304
	E-mail	pankaj.gaur@jalindia.co.in
	Telephone No.	Off : 0120 – 4963100
	Fax No.	0120 - 4964420
16.	Details of Alternative Sites examined, if any. Location of these sites should be shown on a topo sheet	Initially dam axis was located at 0.422km d/s on confluence of Rivers Wahblei and Kynshi. Presently the dam axis is located at 3.385 km d/s of the confluence. The said dam axes are shown in Exhibit-II .
17.	Interlinked Projects	There is a proposal of Uranium Mining project in the vicinity of Kynshi-II Project. The hydro project has been planned in such a way that extraction of Uranium deposits in the vicinity is possible at any time i.e. before, concurrently or after hydro project is constructed. The issue has now been examined specifically and UCIL has cleared the project with some conditions which are implementable by JMPL (Refer letter of UCIL)
18.	Whether separate application of interlinked project has been submitted?	Will be submitted at appropriate time by the respective agency responsible for implementation of that project.
19.	If yes, date of submission	-
20.	If no, reason	-
21.	Whether the proposal involves approval/clearance under: if yes, details of the same and their status to be given. (a) The Forest (Conservation) Act, 1980? (b) The Wildlife (Protection) Act, 1972? (c) The C.R.Z Notification, 1991?	Yes No No
22.	Whether there is any Government Order/Policy relevant/relating to the site?	Memorandum of Agreement between Govt. of Meghalaya and Jaiprakash Power Ventures Ltd. dated 11.12.2007 for

S. No.	Item	Details
		implementation of Kynshi II HE Project in accordance to which a Special Purpose Vehicle in name of Jaypee Meghalaya Power Ltd. has been incorporated for implementing this project.
23.	Forest land involved (hectares)	695.00 Ha
24.	Whether there is any litigation pending against the project and/or land in which the project is propose to be set up? (a) Name of the Court (b) Case No. (c) Orders/directions of the Court, if any and its relevance with the proposed project.	No

Activity

- 1. Construction, operation or decommissioning of the Project involving actions, which will cause physical changes in the locality (topography, land use, changes in water bodies, etc.)**

S. No.	Information/Checklist confirmation	Yes / No	Details thereof (with approximate quantities /rates, wherever possible) with source of information data
1.1	Permanent or temporary change in land use, land cover or topography including increase in intensity of land use (with respect to local land use plan)	Yes	<p>The project envisages construction of 63m high (from the deepest river bed level EL 133.00m) concrete gravity dam with submergence of 521.53 ha of forest land including river reach. The water conductor system, power house and other project appurtenances alongwith infrastructures would also be constructed for which land to be acquired is 173.47 ha. Total land requirement for this proposal is 695.00 ha.</p> <p>Permanent change in land use/land cover and topography is envisaged at the dam site, Submergence area, Power House Site, roads and residential complex locations during the operation stage.</p> <p>About 521.53 ha of land which includes 222 ha of river portion would get converted into a reservoir. Land use pattern of muck disposal areas, quarry sites too will change with respect to their pre-project status. In addition, some buildings i.e. project colony, office, roads etc. will be constructed which will be a modification of their existing land use.</p> <p>The project detail in respect of the revised layout is given in Annexure-I and the salient features are given in Annexure-II.</p> <p>As per the present level of investigations, land to be acquired for various project components is given in Annexure-III.</p> <p>The ownership status of the land to be acquired shall be</p>

S. No.	Information/Checklist confirmation	Yes / No	Details thereof (with approximate quantities /rates, wherever possible) with source of information data
			finalized as a part of Detailed Project Report, which would be prepared.
1.2	Clearance of existing land, vegetation and buildings?	Yes	The project site is not located close to any major habitations. As per the present level of investigations, about 695.00 ha of private / forest land is to be acquired. At some places, wherever necessary, the forest land would need to be cleared for the project. No buildings, homesteads, etc. are proposed to be acquired for the project.
1.3	Creation of new land uses?	Yes	<p>The break up of land requirement is given as below, also refer Annexure-IV & Plate- 3A :</p> <p>Reservoir at FRL 193.0m : 521.53 Ha Dam & Appurtenant works : 10.00 Ha HRT including adits : 8.39 Ha Surge shaft including adits : 1.00 Ha Pressure shaft including adits : 2.0 Ha Power House including adits : 30.00 Ha Switch yard incl. cable tunnel : 10.00 Ha Tail race : 1.00 Ha Dumping yard : 15.00 Ha Borrow areas/quarry : 25.00 Ha Road : 43.50 Ha Colony : 25.00 Ha Miscellaneous : 2.58 Ha</p> <p style="text-align: center;">Total : 695 Ha</p> <p>The reservoir area to be developed due to the project shall be a new land use with respect to the pre-project status, which is mainly under vegetation.</p>
1.4	Pre-construction investigations e.g. bore holes, soil testing?	Yes	Drill holes and drifts for Rock testing and soil testing. River discharge measurement and topographical survey at locations of various project components and river reaches will be done.
1.5	Construction works?	Yes	<p>At this stage it is proposed to investigate and study probable layout options nevertheless, the project component sizes, salient features etc. of the actual project to be finally executed would be known after the DPR is finalized.</p> <p>However, Salient features of the revised layout i.e. present proposal are given below:</p> <ul style="list-style-type: none"> - A concrete gravity dam of 63 m height from the deepest river bed level. - A centrally located spillway with 8 bays of 9m x 13.5m dimensions (size is tentative and may vary) - An 8m dia circular, head race tunnel 7.04 km length. - A surge shaft at the end of head race tunnel, 27m diameter dia circular and 80.5m height. - An underground power house with an installed capacity of (3 x 100) 300 MW and a dam toe

S. No.	Information/Checklist confirmation	Yes / No	Details thereof (with approximate quantities /rates, wherever possible) with source of information data
			<p>surface power house having installed capacity of 25 MW.</p> <p>Total installed Capacity = 300 + 25 = 325 MW.</p> <p>In addition to above, following infra-structure works will also be carried out:</p> <ul style="list-style-type: none"> ▪ Access Roads ▪ Office and Staff Complex ▪ Other Infrastructural works ▪ Borrow / Disposal areas <p>The project layout is enclosed as Exhibit-III</p>
1.6	Demolition works?	No	
1.7	Temporary sites used for construction works or housing of construction workers?	Yes	About 25.0 Ha of land will be used for housing and other temporary works.
1.8	Above ground buildings, structures or earthworks including linear structures, cut and fill or excavations	Yes	Above ground structures are Dam & appurtenant works, Switchyard, Road and Buildings. These components would require an area of 131.08 Ha.
1.9	Underground works including mining or tunneling?	Yes	Components of the Project viz. Intake Tunnels, Desilting chambers, HRT, Surge shaft, Valve Chamber, Pressure shaft, Power House, Transformer Cavern and Tail Race Tunnel are under ground.
1.10	Reclamation works?	Yes	<p>The construction site shall be suitably leveled and depressions will be backfilled and suitably compacted.</p> <p>The construction of the proposed project, including its various appurtenances e.g. dam, power house, approach roads, labour camps, project colony, borrow area & dumping areas etc. would alter the existing topography and physiography. Although, no major alteration of the area is expected as the present layout option has been so conceived that no major impacts on this account are anticipated. It is proposed to landscape the area, so that it integrates with the natural surroundings and the beauty of the area is restored.</p> <p>The details of landscaping and restoration plan shall be covered as a part of the EIA study.</p>
1.11	Dredging?	No	
1.12	Offshore structures?	No	
1.13	Production and manufacturing processes?	Yes	Hydroelectric power generation of 1415 million units annually.
1.14	Facilities for storage of goods or materials?	Yes	Temporary facilities for storage of cement/ steel / equipment shall be developed.
1.15	Facilities for treatment or disposal of solid waste or liquid effluents?	Yes	During construction phase, labour colonies are proposed to be located at number of sites.

S. No.	Information/Checklist confirmation	Yes / No	Details thereof (with approximate quantities /rates, wherever possible) with source of information data
			<p>About 1200 labourers and technical staff are likely to congregate in the area during construction phase. The increase in population is expected to be of the order of 3000 during peak construction time. The average per capita solid waste generated is of the order of 210 gm/day/person. The solid waste likely to be generated from labour camps shall be of the order of 0.63 tonne/day. Adequate facilities for collection, conveyance and disposal of solid waste shall be developed.</p> <p>For solid waste collection, number of masonry storage vats shall be constructed at appropriate locations in various labour camps. These vats shall be emptied at regular intervals and the collected waste can then be transported to landfill site.</p> <p>Covered trucks to collect the solid waste from common collection point and transfer it to the disposal site should be put to service. A suitable landfill site shall be identified in consultation with the local administration to contain municipal waste from various project township, labour colonies, etc.</p> <p>The sewage generated from construction staff colony shall be treated in a sewage treatment plant.</p> <p>One community toilet can be provided per 10 persons. The sewage from the community toilets can be treated in a sewage treatment plant (STP) comprising of aerated lagoon and secondary settling tank. For each labour camp, a sewage treatment plant can be commissioned. The effluent from the STP can be disposed in natural water body. The drinking water facilities and waste disposal sites will be located away from each other.</p>
1.16	Facilities for long term housing of operational workers?	Yes	A colony with 30 quarters shall be constructed near dam site for housing staff in operation phase.
1.17	New road, rail or sea traffic during construction or operation?	Yes	Additional road traffic.
1.18	New road, rail, air waterborne or other transport infrastructure including new or altered routes and stations, ports, airports etc?	Yes	<p>Approx 25 km of access roads may be required to be constructed for various components of the project.</p> <p>The exact length and alignment will be finalized in DPR after detailed surveys.</p>
1.19	Closure or diversion of existing transport routes or infrastructure leading to changes in traffic movements?	No	
1.20	New or diverted transmission lines or pipelines?	Yes	New Transmission Lines for power evacuation.
1.21	Impoundment, damming,	Yes	Impoundment of water of Kynshi and Wahblei rivers for

S. No.	Information/Checklist confirmation	Yes / No	Details thereof (with approximate quantities /rates, wherever possible) with source of information data
	culverting, realignment or other changes to the hydrology of watercourses or aquifers?		power generation, water to be released again in Kynshi river after power generation.
1.22	Stream crossings?	Yes	Stream crossing by way of construction of a bridge over Kynshi River.
1.23	Abstraction or transfers of water form ground or surface waters?	No	
1.24	Changes in water bodies or the land surface affecting drainage or run-off?	No	
1.25	Transport of personnel or materials for construction, operation or decommissioning?	Yes	2000 Construction workers. Steel : 100000 Tons Cement : 8 Lakh MT Sand : 10 Lakh Cum Aggregates : 20 Lakh Cum Diesel : 800 MT
1.26	Long-term dismantling or decommissioning or restoration works?	No	
1.27	Ongoing activity during decommissioning which could have an impact on the environment?	No	The prevailing norms at the time of decommissioning, if any shall be applicable as per standard guidelines.
1.28	Influx of people to an area in either temporarily or permanently?	Yes	During project construction phase, 1200 labourers and technical staff will congregate at the project site. The total temporary increase in population shall be 3000. During project operation phase, about 50 persons will be deployed.
1.29	Introduction of alien species?	No	
1.30	Loss of native species or genetic diversity?	Yes	The project envisages acquisition of about 695 Ha of forest land including 222 Ha of river bed area. Out of 695 Ha, the 521.53 Ha is for submergence area of reservoir. The impacts on native species or genetic diversity shall be assessed as a part of EIA Study. If required, appropriate Biodiversity Conservation and Management plan for the Native, Rare & Endangered floral and faunal species getting affected due to the project shall be proposed in the EMP report.
1.31	Any other actions?	No	

2. Use of Natural resources for construction or operation of the Project (such as land, water, materials or energy, especially any resources which are non-renewable or in short supply):

S. No.	Information/checklist confirmation	Yes / No	Details thereof (with approximate quantities /rates, wherever possible) with source of information data
2.1	Land especially undeveloped or agricultural land (ha)	Yes	The project envisages acquisition of about 695 Ha of forest land including 222 Ha of river bed area. Out of 695 Ha, the 521.53 Ha is for submergence area of reservoir. The quantum of land to be acquired and its ownership status of the land to be acquired for the project shall be assessed as a part of DPR preparation. Based on the ownership status of land to be acquired for the project, appropriate compensatory measures shall be recommended.
2.2	Water (expected source & competing users) unit: KLD	Yes	Kynshi River and Adjoining tributaries /Nallahs. No competing users are observed. During construction and operation phases, small quantity of water would be required for meeting domestic requirements for construction staff/ technical staff. The water would be analyzed and would be disinfected, if required. The quantity of water required during construction and operation phases would be 0.56 mld and 0.03 mld respectively. However, there will be upstream users
2.3	Minerals (MT)	No	
	Construction material – stone, aggregates, sand / soil (expected source – MT)	Yes	Source of material may be River bed material (coarse aggregate & sand). The exact details shall be found out after investigations. Exact quantity shall be known after investigations and detailed design.
	Forests and timber (source – MT)	No	Use of timber not envisaged.
	Energy including electricity and fuels (source, competing users) Unit: fuel (MT), energy (MW)	Yes	Total requirement of power for various activities of the project is proposed to be met by DG sets as no grid power is available in the project area. The power requirement is proposed to be met through installing DG sets of suitable capacities. Since supply of the total required construction power from DG sets would not be an economic option, possibility of importing power by constructing lines from the nearest grid sub-station need to be explored during the detailed report stage to minimize the requirement of power from DG sets.
2.7	Any other natural resources (use appropriate standard units)	No	

3. Use, storage, transport, handling or production of substances or materials, which could be harmful to human health or the environment or raise concerns about actual or perceived risks to human health.

S. No.	Information/Checklist confirmation	Yes / No	Details thereof (with approximate quantities/rates, wherever possible) with source of information data
3.1	Use of substances or materials, which are hazardous (as per MSIHC rules) to human health or the environment (flora, fauna, and water supplies)	Yes	Explosive will be required during construction phase. All the safety measures as per the explosive act and relevant IS codes shall be followed at site.
3.2	Changes in occurrence of disease or affect disease vectors (e.g. insect or water borne diseases)	Yes	Sewage and solid waste generated at the construction staff colony/ project colony shall be adequately treated/ disposed to avoid unhealthy conditions. Adequate treatment/ disposal units will be commissioned during project construction and operation phases. Appropriate Management measures shall be suggested as a part of EIA study.
3.3	Affect the welfare of people e.g. by changing living conditions?	Yes	The details of various welfare schemes for local people shall be outlined as a part of the Comprehensive EIA Report. The schemes shall be finalized in consultation with local administration
3.4	Vulnerable groups of people who could be affected by the project e.g. hospital patients, children, the elderly etc.,	Yes	There could be vulnerable groups of people who could be affected by the project e.g. hospital patients, children, the elderly etc. The details shall be collected as a part of the EIA study.
3.5	Any other causes	No	

4. Production of solid wastes during construction or operation or decommissioning (MT/month)

S.No.	Information/Checklist confirmation	Yes / No	Details thereof (with approximate quantities/rates, wherever possible) with source of information data
4.1	Spoil, overburden or mine wastes	Yes	The muck generated during construction phase shall be disposed at designated disposal sites. Various activities proposed as a part of the management plan are given as below: <ul style="list-style-type: none"> • Land acquisition for muck dumping sites • Civil works (construction of retaining walls, boulder crate walls etc.) • Dumping of muck • Leveling of the area, terracing and implementation of various engineering control measures e.g.,

S.No.	Information/Checklist confirmation	Yes / No	Details thereof (with approximate quantities/rates, wherever possible) with source of information data
			<p>boulder crate wall, masonry wall, catch-water drain.</p> <ul style="list-style-type: none"> • Spreading of soil • Application of fertilizers to facilitate vegetation growth over disposal sites. <p>For stabilization of muck dumping areas following engineering and biological measures have been proposed</p> <p>Engineering Measures</p> <ol style="list-style-type: none"> i) Wire crate wall ii) Boulder crate wall iii) R.C.C iv) Catch water Drain <p>Biological Measures</p> <ul style="list-style-type: none"> • Plantation of suitable tree species and soil binding species • Plantation of ornamental plants • Barbed wire fencing <p>The details of the muck management plan shall be suggested as a part of the EIA Study.</p>
4.2	Municipal waste (domestic and or commercial wastes)	Yes	<p>About 1200 labour and technical staff are likely to congregate in the area during construction phase. The increase in population is expected to be of the order of 3000. The average per capita solid waste generated is of the order of 210 gm/day/person. The solid waste likely to be generated from labour camps shall be of the order of 0.63 tonne/day. Adequate facilities for collection, conveyance and disposal of solid waste shall be developed.</p> <p>For solid waste collection, number of masonry storage vats should be constructed at appropriate locations in various labour camps. These vats should be emptied at regular intervals and the collected waste can then be transported to landfill site.</p> <p>Covered trucks to collect the solid waste from common collection point and transfer it to the disposal site should be put to service. A suitable landfill site shall be identified in consultation with the local administration to contain municipal waste from various project township, labour colonies, etc.</p> <p>The sewage generated from construction staff colony shall be treated in sewage treatment plant. One community toilet can be provided per 10 persons. The sewage from the community latrines can be treated in a sewage treatment plant (STP) comprising of aerated lagoon and secondary settling tank. For each labour camp, a sewage treatment plant can be commissioned. The effluent from the STP can be disposed in natural water body. The drinking water facilities and waste disposal sites will be located away from each other.</p>

S.No.	Information/Checklist confirmation	Yes / No	Details thereof (with approximate quantities/rates, wherever possible) with source of information data
4.3	Hazardous wastes (as per Hazardous Waste Management Rules)	No	
4.4	Other industrial process wastes	No	
4.5	Surplus product	No	
4.6	Sewage sludge or other sludge from effluent treatment	Yes	During construction phase, sludge from the sewage treatment plant shall be dried in sludge drying beds. The dried sludge will be used as manure.
4.7	Construction or demolition wastes	No	
4.8	Redundant machinery or equipment	No	Redundant machinery/equipment shall be taken back out of the project to new sites.
4.9	Contaminated soils or other materials	No	
4.10	Agricultural wastes	No	
4.11	Other solid wastes	No	

5. Release of pollutants or any hazardous, toxic or noxious substances to air (Kg/hr)

S.No.	Information/Checklist confirmation	Yes / No	Details thereof (with approximate quantities/rates, wherever possible) with source of information data
5.1	Emissions from combustion of fossil fuels from stationary or mobile sources	Yes	The operation of various construction equipments requires combustion of fuel. Normally diesel is used in such equipments. The major pollutant which gets emitted as a result is SO ₂ . The SPM emission is minimum due to low ash content in diesel. The short term increase in SO ₂ , even assuming all the equipments are operating at a common point is expected to be quite low. Thus, no adverse impacts on ambient air quality are anticipated.
5.2	Emissions from production processes	No	
5.3	Emissions from materials handling including storage or transport	Yes	During construction phase there will be increase in vehicular movement. Construction material will be brought and stored at various sites. Due to blowing of wind especially when environment is dry, some of the stored material can get entrained in the atmosphere. However, impacts on this account are not expected to be significant.
5.4	Emissions from construction activities including plant and equipment	Yes	Ref 5.1
5.5	Dust or odours from	No	

S. No.	Information/Checklist confirmation	Yes / No	Details thereof (with approximate quantities/rates, wherever possible) with source of information data
	handling of materials including construction materials, sewage and waste		
5.6	Emissions from incineration of waste	No	
5.7	Emissions from burning of waste in open air (e.g. slash materials, construction debris)	No	
5.8	Emissions from any other sources	No	

6. Generation of Noise and Vibration, and Emissions of Light and Heat:

S. No.	Information/Checklist confirmation	Yes / No	Details thereof (with approximate quantities/rates, wherever possible) with source of information data with source of information data
6.1	From operation of equipment e.g. engines, ventilation plant, crushers	Yes	Noise will be generated during construction phase as a result of operation of construction equipment. As a part of the Comprehensive EIA study, detailed noise modeling study shall be conducted to predict the increase in noise level due to various construction activities including operation of various construction equipment, increased vehicular movement, etc.
6.2	From industrial or similar processes	No	
6.3	From construction or demolition	No	
6.4	From blasting or piling	Yes	80 to 90 dB(A)
6.5	From construction or operational traffic	Yes	<p>During construction phase, there will be increase in vehicular movement for transportation of construction material.</p> <p>Based on past experience, impacts on ambient noise levels due to operation of construction equipment and increased vehicular movement is not expected to be significant. However, this aspect shall be covered in detail though detailed modeling study as a part of the EIA study.</p>

S. No.	Information/Checklist confirmation	Yes / No	Details thereof (with approximate quantities/rates, wherever possible) with source of information data
			For mitigation of impacts due to blasting, appropriate measures will be suggested as a part of EIA study.
6.6	From lighting or cooling systems	No	
6.7	From any other sources	No	

7. Risks of contamination of land or water from releases of pollutants into the ground or into sewers, surface waters, groundwater, coastal waters or the sea:

S. No.	Information/Checklist confirmation	Yes/ No	Details thereof (with approximate quantities/rates, wherever possible) with source of information data
7.1	From handling, storage, use or spillage of hazardous materials	No	During the process of power generation no hazardous wastes will be generated. The hazardous waste like used/waste oils that will be generated from the DG sets, transformer etc. will be stored in designated leak proof drums and auctioned to the registered vendors of the respective State Pollution Control Board (SPCB) or Central Pollution Control Board (CPCB) for recycling or as directed by SPCB.
7.2	From discharge of sewage or other effluents to water or the land (expected mode and place of discharge)	Yes	Discharge of treated Sewage and waste effluents. Proper mitigation measures will be adopted in EIA/EMP. Treated waste after appropriate treatment will be reused to watering the plantations or discharged into the river stream during construction / operation phase.
7.3	By deposition of pollutants emitted to air into the land or into water	No	No pollutant shall be emitted to air during the course of power generation and operation. Hydropower projects do not involve any combustion of fossil fuel which may cause air pollution.
7.4	From any other sources	No	
7.5	Is there a risk of long term build up of pollutants in the environment from these sources?	No	

8. Risk of accidents during construction or operation of the Project, which could affect human health or the environment

S. No.	Information/Checklist confirmation	Yes/ No	Details thereof (with approximate quantities/rates, wherever possible) with source of information data
8.1	From explosions, spillages, fires etc from storage, handling, use or production of hazardous substances	Yes	Explosives shall be used very carefully by the experienced and certified persons. Blasting shall be done in accordance with the rule applicable of such work confirming all codes in respect of safety of human being and other objects.
8.2	From any other causes	No	
8.3	Could the project be affected by natural disasters causing environmental damage (e.g. floods, earthquakes, landslides, cloudburst etc)?	Yes	The proposed project is located in an area categorized as Zone-V as per seismic zoning Map of India (IS 1893:2002). The structural design will adequately take care of this aspect. Areas prone to landslides shall be identified during further project related investigations. Appropriate treatment measures, if required, shall be suggested.

9. Factors which should be considered (such as consequential development) which could lead to environmental effects or the potential for cumulative impacts with other existing or planned activities in the locality

S. No.	Information/Checklist confirmation	Yes/ No	Details thereof (with approximate quantities/rates, wherever possible) with source of information data
9.1	Lead to development of supporting. utilities, ancillary development or development stimulated by the project which could have impact on the environment e.g.: <ul style="list-style-type: none"> • Supporting infrastructure (roads, power supply, waste or waste water treatment, etc.) • housing development • extractive industries • supply industries • other 	Yes	About 1200 persons are likely to be deployed during construction phase. The availability of infrastructure could be a problem during the initial construction phase. As a part of Environmental Management Plan, following facilities shall be developed for the construction staff/ technical staff likely to be deployed during project construction phase : <ul style="list-style-type: none"> - Potable water supply - Community toilets and sewage Treatment plant. - Free fuel like LPG/ Kerosene - Solid waste management - Dispensary/First-aid post
9.2	Lead to after-use of the site, which could have an impact on the environment	No	
9.3	Set a precedent for later developments	Yes	Job opportunities will improve significantly in the project area and its surrounding. At present most of the population sustain on agriculture and allied activities. There are no major industries or other avenues of occupation in the area. The project will open a large number of jobs to the local population both during construction and operation phases.

S. No.	Information/Checklist confirmation	Yes/ No	Details thereof (with approximate quantities/rates, wherever possible) with source of information data
9.4	Have cumulative effects due to proximity to other existing or planned projects with similar effects	Yes	Map showing location, FRL and TWL of Kynshi-I HEP, and Kynshi-II HEP is attached herewith. Refer Exhibit-IV

10. Environmental Sensitivity

S. No.	Areas	Name / Identity	Aerial distance (within 15 km.) Proposed project location boundary
10.1	Areas protected under international conventions, national or local legislation for their ecological, landscape, cultural or other related value	Yes	Indo-Bangladesh border is 4 Km from Tail Race Tunnel.
10.2	Areas which are important or sensitive for ecological reasons - Wetlands, watercourses or other water bodies, coastal zone, biospheres, mountains, forests	Yes	There are no reserve forests, National Park, Wild life sanctuary, Tiger/Elephant reserve, biosphere reserve etc in and around the project catchment. However, the project lies in a mountainous terrain with forests.
10.3	Areas used by protected, important or sensitive species of flora or fauna for breeding, nesting, foraging, resting, over wintering, migration	Yes	Based on the present level of investigations, areas used by protected, important or sensitive species of flora or fauna for breeding, nesting, foraging, resting, over wintering, migration are not located within 15 km from the project site. However, this aspect shall be confirmed as a part of field studies to be conducted during EIA study.
10.4	Inland, coastal, marine or underground waters	No	
10.5	State, National boundaries	No	
10.6	Routes or facilities used by the public for access to recreation or other tourist, pilgrim areas	No	
10.7	Defence installations	No	
10.8	Densely populated or built-up area	No	
10.9	Areas occupied by sensitive man-made land uses (<i>hospitals, schools, places of worship, community facilities</i>)	No	
10.10	Areas containing important, high quality or scarce resources (<i>ground water resources, surface</i>)	Yes	There is a proposal of Uranium Mining project in the vicinity of Kynshi-II Project. The hydro project has been planned in such a way that extraction of Uranium deposits in the vicinity is possible at any time i.e.

S. No.	Areas	Name / Identity	Aerial distance (within 15 km.) Proposed project location boundary
	<i>resources, forestry, agriculture, fisheries, tourism, minerals)</i>		before, concurrently or after hydro project is constructed. The issue has now been examined specifically and UCIL has cleared the project with some conditions which are implementable by JMPL (Refer letter of UCIL)
10.11	Areas already subjected to pollution or environmental damage. <i>(those where existing legal environmental standards are exceeded)</i>	No	
10.12	Areas susceptible to natural hazard which could cause the project to present environmental problems <i>(earthquakes, subsidence, landslides, erosion, flooding or extreme or adverse climatic conditions)</i>	Yes	The project is located in Zone-V as per seismic zoning Map of India (IS 1893: 2002). The structural design will adequately cover this aspect. Areas prone to land slides shall be identified, during further investigations. Appropriate treatment measures, if required, shall be suggested.

(IV). Proposed Terms of Reference for EIA studies: Attached as **Annexure-V**.

BRIEF DESCRIPTION OF THE KYNshi-II H.E. PROJECT

1.0 General

The Kynshi-II H.E. Project is proposed to be constructed on the Kynshi River with a dam proposed at about 3.385 km downstream of the confluence of Wahblei, the biggest tributary of Kynshi and about 37 km downstream of the proposed Kynshi Stage- I Project. The location and layout of this project has been modified and proposed now after revisions of the earlier proposed layout wherein the Dam was located at about 0.422 km downstream of confluence of Wahblei and Kynshi rivers. The dam height has been reduced from 110 m to 63 m, mainly with the aim to reduce forest land and to avoid submergence of mineral deposit area.

The present scheme is primarily aimed at energy generation with incidental flood control benefits as the flood peaks are likely to get moderated.

2.0 Basin Development

The conception of Kynshi-II project has its genesis in the hydroelectric survey of India conducted by the erstwhile Central Water and Power Commission of India way back in the early fifties. In one of their publication of 1957, it was shown that the north flowing rivers of Meghalaya have a potential of almost 750 MW at 60% load factor while the south flowing rivers have a potential of about 1050 MW. In a particular study on development of Kynshi Basin, the CW&PC estimated a potential of 1500 MW at 60% load factor. Since 1975, the Central Water Commission carried out investigation by starting hydrological data collection and prepared a "Pre-feasibility Report for Development of Kynshi basin" and submitted it to the Government of India in 1986.

There are two projects which have been identified so far in this basin i.e. Kynshi-I (300 MW) and Kynshi-II. The investigation works of these projects were initially done by Brahmaputra Board. The catchment area of river Kynshi within the Indian Territory lies in between latitude 25⁰ 15' N & 25⁰ 55' and Longitude 90⁰ 45' & 91⁰ 50' E. The basin area up to the Kynshi Stage-II dam site is 1964.6 sq. km. During its course, several tributaries including Umkyrtha and Wahblei join the Kynshi within the Indian territory before the

river emerges into the Bangladesh plains, crossing the Indian border near Ranikor township.

3.0 Project

The proposed project area of Kynshi Stage-II is located in the West Khasi Hill district of Meghalaya and is about 162 kms from State capital Shillong. The proposed Concrete Gravity Dam, 63m high is situated near Poidblai village and 3X100MW underground Power house is located near Ranikor, about 62 km away from Nongstoin, headquarters of West Khasi Hill district having latitude $25^{\circ} 17' 42''$ N and Longitude $91^{\circ} 08' 12''$ E. The Power House is located about 7.0 km downstream of the proposed dam axis on the right bank of the river. One 8.0m dia Head Race Tunnel having a length of 7.04 kms has been proposed on the right bank of Kynshi alongwith 80.5m high Surge Shaft and three 4.0m dia steel lined Pressure Shafts and one 8.0m dia 0.346 kms long Tail Race Tunnel.

Salient features of the project are attached herewith as **Annexure-II**.

4.0 Access

The project site is about 80 km away from Nongstoin, the head quarters of West Khasi Hill district, which is located at a distance of 65 km from Shillong. From Nongstoin, one has to travel to Wahkaji (45 km) a small township, up to which an all weather motorable road exists. The dam site is located at about 35 km away from Wahkaji. There is a dry weather jeepable road upto Nongrinnieng village (EL 1060m). A track from Nongrinnieng leads to the left high bank of the river (EL 310m). The dam axis (EL 150m) can be approached on foot through a thick forest of bamboo. The track is very steep due to the elevation difference of almost 160m. Alternatively the dam site can be approached via Ranikore. There exists an all weather road upto Ranikore and from there the dam site can be approached by boat through Kynshi river.

KYNshi – II H.E. PROJECT
SALIENT FEATURES OF THE PROJECT LAYOUT

GENERAL	
1. LOCATION	
• State	Meghalaya
• District	West Khasi Hills
• River	Kynshi
• Location of Dam Site	Located 3.385 km d/s near of the confluence of Kynshi & Wahblei rivers
• Latitude	25° 17' 42"
• Longitude	91° 8' 12"
• Nearest BG Rail Head	Guwahati
• Nearest Airport	Guwahati
• Nearest Airport	Shillong (for small aircrafts)
2. HYDROLOGY	
• Catchment Area (sq.km.)	1964.60
• Design flood (PMF) (cumec)	15817
• Diversion Flood (cumec)	518
3. DAM	
• Type	Concrete gravity
• Top of Dam (m)	El. 196
• Deepest river Bed Level at Dam Axis	El. 133
• Height of Dam (from deepest river bed)	63 m
• Length of Dam at Top (m)	341.50m
4. SPILLWAY	
• Gate Type	Top sealing radial gate Sluice Type Spillway
• No.	8 nos.
• Size of Bays (W x H) m	9.0 x 13.50
• Crest Level (m)	El. 156
• Energy Dissipation Arrangement	Flip Bucket Type (Radius = 22.5m)

• Plunge Pool (L x B)	122.60 x 10 (at EL 123 m)
5. RESERVOIR	
• FRL (m)	El. 193
• MDDL(m)	El. 183
• MWL (m) for Emergency conditions	El. 195.80
• Gross Storage Capacity at FRL (MCM)	63.14
• Storage Capacity at MDDL (MCM)	23.91
• Live storage (MCM)	39.23
6. DIVERSION TUNNEL	
• No. & size	1 No., 9.5m Dia Horse Shoe shaped
• Length (m)	362.45
•	
7. POWER INTAKE	
• No. & size of Inlet Tunnels	2 No. x 6.0m(H) x 7.0m(W)
• Invert level at sill of Intake Gates	El. 170.00
8. HEAD RACE TUNNEL	
• Numbers	One
• Size and Type	8.0m dia, Circular, concrete lined
• Design discharge (cumec)	192.9
• Length (km)	7.04 km
• Invert Levels	
At start of Tunnel (m)	EL. 170.0
At end of Tunnel (m)	El. 137.50
9. SURGE SHAFT	
• Size	27 m dia, circular
• Type	Restricted orifice type, open to sky
• Top level of Surge Tank (m)	El. 226
• Vertical Height of Surge Shaft (m)	80.50
10. PRESSURE SHAFT/PENSTOCK	
• Main	
Numbers and Dia	03 Nos 4.0m dia
Type	Underground, Circular, Steel lined

Length (m)	265.63 each
11. POWER HOUSE COMPLEX	
• Type	Underground
Powerhouse Cavern (L x B x H) m	114.120 x 21.0 x 45.5
Transformer Hall Cavern (Lx B x H) m	100.0 x 15.0 x 26.0
11a. DAM-TOE POWER HOUSE	
• Type	Surface
Powerhouse (L x B x H) m	44.53 x 17.5 x 47.5 with 8.0m wide Annexe
12. Tail Race Tunnel	
No.	1 no.
Size & Type	8.0 m dia, circular & concrete lined
Length (m)	346.0
Invert Level at TRT outfall (m)	El. 0.0
13. Pothhead Yard	
• Type	Surface
• Size (m)	75 x 50 at El. 150 on right bank
14. POWER GENERATION	

	CASE-I 30, 25 or 20 % of Average Flows	CASE-II 25 % of Average of Lean Flows
• Installed Capacity of MUGPH (MW)	300.00	300.00
• Annual Generation MUGPH (MU)	1170.78	1343.91
• PLF of MUGPH (%)	44.55	51.13
• Installed Capacity of DTPH (MW)	25.00	25.00
• Annual Generation DTPH (MU)	117.92	71.12
• PLF of DTPH (%)	53.85	32.48
• Combined Annual Generation MUGPH + DTPH (MU)	1288.52	1415.03
• Combined PLF of UG & DTPH (%)	45.27	49.70

KYN Shi – II H.E. PROJECT (MEGHALAYA)

<p>Max. Height of Dam = 63m from the river bed</p> <p>Top of dam = EL. 196m</p> <p>FRL = EL. 193m</p> <p>MDDL = EL. 183m</p>	<p>Approx. Length of HRT = 7.043 km</p> <p>Installed capacity(Tentative) =300+25MW</p> <p>Approx. Annual Generation = 1415 MU</p>
--	---

Project Component	Area (Ha)
Reservoir at FRL 193.0m	521.53
Dam & Appurtenant works	10.00
HRT including adits	8.39
Surge shaft including adits	1.00
Pressure shaft including adits	2.0
Power House including adits	30.00
Switch yard including cable tunnel	10.00
Tail race	1.00
Dumping yard	15.00
Borrow areas/quarry	25.00
Road	43.50
Colony	25.00
Miscellaneous	2.58
Total	695

ANNEXURE-V

TERMS OF REFERENCE FOR CONDUCTING COMPREHENSIVE EIA STUDY FOR KYNSHI HYDRO ELECTRIC PROJECT (Stage-II) Meghalaya

1. Policy, Legal and Administrative Framework

The Ministry of Environment and Forests (MoEF), Government of India (GoI) has issued a notification called EIA Notification 2006 on Sept. 14, 2006. As per this notification the proposed project falls under Category 'A'. The project requires Environmental Clearance from Ministry of Environment and Forest (MoEF). A Comprehensive EIA study is a pre-requisite for obtaining Environmental Clearance.

The Comprehensive EIA study will be conducted for the project area and the area within 10 km on either side of the project appurtenances. The study area comprises the following:

- Submergence area.
- Area within 10 km of the periphery of submergence area and other project appurtenances.
- Catchment area intercepted at proposed dam site.

2. Scoping and Assessment of Alternatives

Scoping is a tool which gives direction for selection of impacts due to the project activities on the environment. As a part of the study, scoping exercise will be conducted selecting various type of impacts which can accrue due to a hydroelectric project. Based on the project features, site conditions, various parameters to be covered as a part of the EIA study were selected. The results of scoping analysis are presented in Table below.

Scoping Matrix adopted for CEIA study for the proposed Kynshi hydroelectric project (stage-II), Meghalaya

Aspects of Environment	Likely Impacts
A. Land Environment	
Construction phase	<ul style="list-style-type: none">- Increase in soil erosion- Pollution by construction spoils- Acquisition of land for labour colonies- Solid waste from labour camps/ colonies.
Operation phase	<ul style="list-style-type: none">- Acquisition of land for various project appurtenances- Loss of agricultural and forest land due to submergence
B. Water resources & water quality	

Aspects of Environment	Likely Impacts
Construction phase	<ul style="list-style-type: none"> - Increase in turbidity of nearby receiving water bodies - Degradation of water quality due to disposal of wastes from labour, colony and construction sites
Operation phase	<ul style="list-style-type: none"> - Modification of hydrologic regime
C. Aquatic Ecology	
Construction phase	<ul style="list-style-type: none"> - Increased pressure on riverine fisheries as a result of indiscriminate fishing by the labour population. - Reduced productivity due to increase in turbidity levels as a result of disposed off effluents from construction sites.
Operation phase	<ul style="list-style-type: none"> - Impacts on spawning and breeding grounds - Degradation of riverine ecology - Impacts on migratory fish species - Impact on aquatic ecology due to drying of the river stretch
D. Terrestrial Ecology	
Construction phase	<ul style="list-style-type: none"> - Increased pressure from labour to meet their fuel wood requirements - Adverse impacts on flora and fauna due to increased accessibility in the area and increased influx of human population - Loss of forest due to construction of road and other project appurtenances
Operation phase	<ul style="list-style-type: none"> - Loss of forests in the submergence area - Impacts on wildlife movement - Impacts on wildlife habitats
E. Socio-Economic Aspects	
Construction phase	<ul style="list-style-type: none"> - Increased employment potential during the project construction phase - Development of allied sectors leading to greater employment - Pressure on existing infrastructure facilities. - Cultural conflicts and law and order issues due to migration of labour population
Operation phase	<ul style="list-style-type: none"> - Loss of lands - Loss of private properties - Impacts on archaeological and cultural monuments, if any - Impacts on mineral reserves, if any
F. Air Pollution	

Aspects of Environment	Likely Impacts
Construction Phase	<ul style="list-style-type: none"> - Impacts due to fuel combustion in various construction equipment - Impacts due to increased vehicular movement - Fugitive emissions from various sources - Impacts due to emissions of DG sets
G. Noise Pollution	
Construction Phase	<ul style="list-style-type: none"> - Noise due to operation of various construction equipment - Noise due to increased vehicular movement - Impacts due to blasting - Increased noise levels due to operation of DG sets
H. Public Health	
Construction Phase	<ul style="list-style-type: none"> - Increased incidence of water related diseases - Transmission of diseases by immigrant labour population
Operation phase	<ul style="list-style-type: none"> - Increased incidence of vector borne diseases

Based on the Scoping matrix, the environmental baseline data shall be collected. The project details will be superimposed on environmental baseline conditions to understand the beneficial and deleterious impacts due to the construction and operation of the proposed project.

Methodology

Primary surveys will be conducted in various seasons to collect data on flora, fauna, forest types, ecological parameters, soil, ambient air quality, noise, water quality. During these surveys data and information will be collected on physico-chemical, biological and socio-economic aspects of the study area. In addition, detailed surveys and studies will also be conducted for understanding bio-diversity in the study area. The details of primary data to be collected are given in Table below:

Details of primary data to be collected

Description	No. of locations	Frequency of Sampling
AIR Ambient air quality monitoring (24 hourly samples), twice a week for 4 weeks at two major construction sites Parameters : PM ₁₀ , PM _{2.5} , SO ₂ , NO ₂	4	Three seasons (Summer, post-monsoon and Winter)
WATER Samples to be collected from various representative locations in the study area	10	Three seasons (Summer, monsoon and Winter)

Description	No. of locations	Frequency of Sampling
Parameters : Temperature, pH, Electrical Conductivity, Total Dissolved Solids, Salinity, Alkalinity, Total Hardness, Chlorides, Sulphates, Fluorides, Phosphates, Calcium, Magnesium, Sodium, Potassium, Iron, Chromium, Lead, Cadmium, Mercury, Zinc, DO, BOD, COD, Total Coliform, Faecal Coliform		
SOIL Sampling in the catchment area Parameters : pH, N,P,K, organic mater soil texture	15	Three seasons (Summer, monsoon and Winter)
NOISE Hourly readings taken for 24 hours (Leq.)	5	Three seasons (Summer, monsoon and Winter)
Terrestrial Ecology Parameters: Density, Diversity and abundance of various floral species. Presence of various faunal species as observed during the ecological survey shall also be recorded and studied	10	Three seasons (Summer, Monsoon, and Winter)
Fisheries Parameters : Presence and occurrence of various fish species and migratory routes, if any.	10	Three seasons (Summer, monsoon and Winter)
Aquatic Ecology Parameters: Density, diversity and abundance of various phytoplanktons, zooplanktons, periphytons, macro-invertebrates, primary productivity	10	Three seasons (Summer, Monsoon and Winter)

To examine the cascading effect, a clear map showing the approved/under construction/completed HEPs on the both U/S and D/S to this project. The information will be analysed to establish the total length of interference of natural river flow, the total length of tunnelling of the river and the committed unrestricted release from the site of diversion into the main river.

Various maps providing salient features of the project shall be depicted in proper scale map of at least 1:15,000 like.

- The location map of the proposed project.
- The project layout shall be superimposed on a contour map of ground elevation showing main project features shall be depicted in a scaled map.
- Drainage map of the catchment up to the project site.
- Soil map of the study area.
- Geological and seismotectonic maps of the study area showing main project features.

- Remote sensing studies, interpretation of satellite imagery, topographic sheets along with ground verification shall be used to develop the land use/land cover pattern of study area using overlay mapping techniques viz. Geographic Information Systems (GIS). False colour composite (FCC) generated from satellite data of study area shall also be presented.

A. BASELINE DATA

1. Geological and Geophysical Aspects

- Geography & physiography of the project area.
- Design discharge & its RI (Recurrence interval).
- Regional Geology and structure of the catchment.
- Seismicity, tectonics and history of past earthquakes in the area.
- Critical review of the geological features around the project area.
- Impact of project on geological environment.
- Justification for location & execution of the project in relation to structural components (dam/barrage height).

2. Seismo-tectonics:

Study of Design Earthquake Parameters

A site specific study of earth quake parameters will be done. The results of the site specific earth quake design parameters will be sent for approval of the NCSDP (National Committee of Seismic Design Parameters, Central Water Commission, New Delhi for large dams.

3. Hydrology of the basin

- Hydro-meteorology, drainage systems.
- Catastrophic events like cloud bursts and flash floods, if any would be documented.
- For estimation of Sedimentation rate direct sampling of river flow is to be done during EIA to get actual silt flow rate (to be expressed in ha-m km-2 year-1). The one year of EIA study will provide an opportunity to do this for ascertaining the actual silt flow rate.
- Water availability for the project and the aquatic fauna.
- Design discharge and its recurrence interval.

4. Biological Resources

i. Flora

- General vegetation pattern and floral diversity viz. trees, shrubs, grasses, herbs, significant microflora etc. Vegetation should cover all groups of plants including lichens and orchids.
- Forests and forest types.
- Water body inundating forest area.
- Vegetation profile, no. of species in the project area, etc.
- Community Structure through Vegetation mapping.
- Species Diversity Index (Shanon-Weaver Index) of the biodiversity in the project area as well as plant fossil & phytoplankton.
- Documentation of economically important plants, medicinal as well as timber, fuel wood etc.
- Endemic, endangered and threatened species.

- Impact of impoundment and construction activities on the vegetation.
- Cropping and Horticulture pattern and practices in the study area.
- Location of any Biosphere Reserve, National Park or Sanctuary in the vicinity of the project , if any.
- For categorization of sub-catchments into various erosion classes and for the consequent CAT plan, the entire catchment (Indian portion) is to be considered and not only the directly draining catchment.

ii. Fauna

- Fauna study should be carried-out for all group of animals
- Inventorisation of terrestrial wildlife and present status
- Zoogeographic distribution/affinities, Endemic, threatened and endangered species and animal fossil

iii. Avifauna

- Fauna study should be carried-out for all group of animals
- Status
- Resident/Migratory/Passage migrants
- Zoogeographic distribution/affinities, endemic, threatened and endangered species & animal fossils
- Impact of project on threatened/endangered taxa, if any
- Inventorisation of terrestrial wildlife and present status along with schedule of the species

iv. Aquatic Ecology

- Aqua- fauna like macro-invertebrates, zooplankton, phytoplanktons, benthos etc.
- Conservation Status

Fish and Fisheries

- Fish migrations, if any
- Breeding grounds
- Impact of dam building on fish migration and habitat degradation
- Overall ecological impact upto 10 Km d/s from the confluence of the TRT with the river and the impact of untreated and waste water in to the river and the alternatives explored.

5 Conservation areas and status of threatened/endangered taxa

- Biotic Pressures
- Management plan for conservation areas and threatened/endangered taxa

6. **Remote Sensing & GIS studies – various maps** Various maps providing salient features of the project need to be depicted in proper scale map of at least 1:15,000 like project layout shall be superimposed on a contour map of ground elevation showing main project features (*viz.* location of dam, head works, main canal, branch canals, quarrying *etc.*) shall be depicted in a scaled map.

- Delineation of critically degraded areas in the directly draining catchment on the basis of Silt Yield Index as per the methodology of AISLUS
- The location map of the proposed project.
- Land use and land cover mapping
- Drainage pattern/map
- Soil map of the study area
- Geo-physical features, slope and relief maps Geological and seismotectonic maps of the study area showing main project features.

Remote sensing studies, interpretation of satellite imagery, topographic sheets along with ground verification shall be used to develop the land use/land cover pattern of study area using overlay mapping techniques viz. Geographic Information Systems (GISs). False colour composite (FCC) generated from satellite data of study area should be presented

- Demarcation of Snow fed and rain fed areas for a realistic estimate of the water availability.

7. Socio-economic aspects

- Land details*
- Demographic profile
- Ethnographic Profile
- Economic structure
- Development profile
- Agricultural practices
- Cultural and aesthetics sites
- Infrastructure facilities: education, health and hygiene, communication network,
- Impact on socio-cultural and ethnographic aspects due to dam building report.

**Report would include list of all the Project Affected Families with their names, education, land holdings, other properties, occupation, etc.*

8. Socio-cultural aspects based upon study on Ethnography of the area.

9. Collection of data pertaining to water (physico-chemical and biological parameters), air and noise environment and likely impact during construction and post-construction periods.

10. Air Environment

- Baseline Information on ambient air quality in the project area covering aspects like PM₁₀, SO₂, NO₂
- Noise Environment
- Traffic density in the project area

11. Construction Methodology and Schedule including the tunnel driving operations, machinery and charge density, etc.

B. IMPACT PREDICTION

The following impacts of the project should be assessed

- (a) Air**
 - Changes in ambient levels and ground level concentrations due to total emissions from point, line and area sources
 - Effects on soils, material, vegetation, and human health
 - Impact of emissions DG sets used for construction power if any, on air environment.
- (b) Noise**
 - Changes in ambient levels due to noise generated from equipment, blasting operations and movement of vehicles
 - Effect on fauna and human health
- (c) Water**
 - Changes in quality
 - Sedimentation of reservoir
 - Impact on fish fauna
 - Impact of sewage disposal
- (d) Land**
 - Changes in land use and drainage pattern
 - Changes in land quality including effects of waste disposal
 - Riverbank and their stability
 - Impact due to submergence
- (e) Biological**
 - Deforestation and shrinkage of animal habitat
 - Impact on fauna and flora (including aquatic species if any) due to decreased flow of water
 - Impact on rare and endangered species, endemic species, and migratory path/route of animals, if any
 - Impact on breeding and nesting grounds, if any
 - Impact on animal distribution, migration routes (if any), habitat fragmentation and destruction due to dam building activity
 - Impacts on migration of fish species from Bangladesh
- (f) Socio-economic Aspects**
 - Impact on the local community including demographic changes
 - Impact on economic status
 - Impact on human health
 - Impact on increased traffic
 - Impact on Holy Places and Tourism
- (g)** Downstream impact on water, land & human environment due to drying up of the river at least 10 km downstream of the dam.
- (h)** Positive as well as negative impacts likely to be accrued due to the project are to be listed.
- (i)** Positive impacts like benefits from carbon trading.

C. ENVIRONMENTAL MANAGEMENT PLAN

1. **Resettlement and Rehabilitation (R&R)** plan will be prepared with due consultation with Project Affected Families (PAFs). It shall include community development strategies and a list containing name of PAFs, age, educational qualification, family size, sex, religion, caste, source of income, house with type and amount of land holding, house/land to be acquired, any other property, possession of cattle, etc. The provision of the prepared R&R plan would be according to the National Resettlement and Rehabilitation Policy (NRRP – 2007). Detailed budgetary estimates would be provided.

In addition to Socio-economic aspects of the study area, a separate chapter on socio-cultural aspects based upon study on Ethnography of the area will be included.

2. **Muck Disposal Plan.**- Suitable sites for dumping of excavated material would be identified in consultation with the State Pollution Control Board and Forest Department. Cross-sections of muck disposal sites would be given.
3. **Catchment Area Treatment Plan** shall be prepared micro-watershed wise. Areas/watersheds falling under 'very severe' and 'severe' erosion categories are required to be treated. Delineation of micro-watersheds in the entire river catchment intercepted at the damsite and mapping of critically degraded areas requiring various biological and engineering treatment measures. Identification of area for treatment based upon Remote Sensing & GIS methodology and Silt Yield Index (SYI) method of AISLUS coupled with ground survey. The steps to be followed are listed as below:
 - (a) Catchment Area Treatment Plan to be prepared using Silt Yield Index method.
 - (b) Delineation of sub watersheds in the catchment area.
 - (c) Land use pattern using satellite data with ground truth verification will be prepared
 - (d) Slope map of the catchment shall be prepared using Survey of India topo-sheets
 - (e) Mapping of critically degraded areas based on Integration of Remote Sensing technique, GIS methodology and Silt Yield Index method.
 - (f) Preparation of phase wise Catchment Area Treatment (CAT) Plan using biological and engineering measures for sub-watersheds with very high and high erosion intensity.
 - (g) Estimation of cost required for implementation of CAT plan.
 - (h) Spatial Information in each micro watershed shall be earmarked on maps in the scale of 1:50,000. The CAT plan shall be prepared with year-wise Physical and financial details.
 - (i) Layout map showing land slide/land slip zones if any, around the reservoir periphery needs to be prepared. Suitable engineering and biological measures for the identified land slip zones treatment must be provided with physical and financial schedule.

4. **Public Health Management Plan** including the provisions for drinking water facility for the local community.
5. **Compensatory Afforestation** in lieu of the forest land required for the project will be proposed. Choice of plants will be made in consultation with State Forest Department.
6. **Forest Protection Plan**
7. **Reservoir RIM Treatment Plan**
8. **Creation of Green Belt Plan** - Suitable species of plants for the proposed green belt along periphery of reservoir (Reservoir Rim Treatment Plan), colonies, approach road, canals etc. must be suggested. Complete plan with physical and financial details and layout of the proposed sites of green belt development will be included.
9. **Biodiversity Conservation and Wild life Management Plan** - Suitable Biodiversity conservation plan in consultation with State Forest Department will be included.
10. **Wild Life Conservation Plan**
11. **Fishery Management Plan** including base line data on catch composition, fish density, fish standing crop, fish population dynamics in and around project area, presence of migratory/endangered fish if any will be checked and mitigation measures would include monitoring the impact of the proposed construction on the fish resources.
12. **Fisheries Conservation Plan** for conservation/management of fishes. Probability of having fish ladder or fish pass is will be examined in case there is any migratory fish species in the area.
13. **Dam Break Analysis and Disaster Management Plan.** The outputs of Dam Break Model would be illustrated with appropriate graphs and maps clearly bringing out the impact of dam break scenario. Dam break study shall be conducted covering the following steps:
 - (a) Development or identification of the inflow hydrograph to the reservoir at the time of failure
 - (b) Routing of the hydrograph through the reservoir
 - (c) Estimation of the outflow hydrograph from the failed structure
 - (d) Modeling the movement of the flood wave downstream to determine travel time, maximum water level reached, inundated areas, etc.
 - (e) Formulation of Disaster Management Plan
14. **Study of Design Earthquake Parameters:** A site specific study of earth quake parameters will be done. The results of the site specific earth quake design parameters will be sent for approval of the NCSDP (National Committee of Seismic Design Parameters, Central Water Commission, New Delhi for large dams.
15. **Management during the Road Construction**
16. **Sanitation & Solid Waste Management Plan** for domestic waste from colonies and labour camps, etc.
17. **Energy Conservation Measures.**
18. **Restoration and landscaping of working Areas:** reclamation of borrow pits

(quarry sites), muck disposal and construction areas.

19. **Water and Air Quality & Noise Environment Management** during construction and post-construction periods.
20. **Local Area Development Plan** to be formulated in consultation with the Revenue Officials and Village Panchayats.
21. **Tribal area development plan** as the area is predominantly tribal inhabited.
22. Mitigations measures to check Jhum (shifting) cultivation in the catchment area with provision for alternative and better agricultural practices. CAT Plan shall cover impact of shifting cultivation.
23. Construction Methodology and Equipment Planning including the tunnel driving operations, machinery and charge density, etc.
24. A scientific study shall be done to assess the downstream requirement of water to decide minimum assured release of water for maintaining the aquatic ecology and water quality of river.

D. ENVIRONMENTAL MONITORING PROGRAMME

25. The Environmental Impact Assessment is basically an evaluation of future events. It is necessary to continue monitoring certain parameters identified as critical by relevant authorities under an Environmental Monitoring Programme. This would anticipate any environmental problem so as to take effective mitigation measures. An Environmental Monitoring Programme will be formulated for implementation during project construction and operation phases. The cost estimates and equipment necessary for the implementation of this programme shall also be covered as a part of the Comprehensive EIA study.

Environmental Monitoring Programme with physical & financial details covering all the aspects of EMP. A summary of cost estimate for all the plans, cost for implementing all Environmental Management Plans including the cost for implementing environmental monitoring programme should be given. Provision for an Environmental Management Cell should be made.