Serial No.: 0049

NATURAL RESOURCES AND ENVIRONMENT BOARD SARAWAK

[Incorporated under the Natural Resources And Environment Ordinance (Chapter 84 - Laws of Sarawak 1958 Ed.)]

EIA REPORT/EIS/EMP APPROVAL

Terms and Conditions of Approval in accordance with the provisions of the Natural Resources & Environment (Cap. 84 - Laws of Sarawak) and Natural Resources & Environment (Prescribed Activities) Order

Name of Project	:	THE BAKUN HYDROELECTRIC PROJECT
Main Activity	:	CONSTRUCTION, OPERATION AND MANAGEMENT OF DAM AND ANCILLARY FACILITIES
Project Proponent	:	SARAWAK HIDRO SDN. BHD. TINGKAT 6, BLOCK F KOMPLEKS JPM JALAN DATO' ONN 50606 KUALA LUMPUR TEL.: 03-26988320, 03-26988321 FAX: 03-26988377
Date of Approval	:	20 FEBRUARY 2002
Reference No.	:	(29) NREB/6-12/45

[YB Dr. JAMES DAWOS MAMIT]
DEPUTY CHAIRMAN
NATURAL RESOURCES & ENVIRONMENT BOARD
SARAWAK

ISSUE	MITIGATING MEASURES RECOMMENDED BY THE ENVIRONMENTAL CONSULTATION	REFERENCE IN THE EIA REPORT	ENDORSED BY NREB	
			IN TOTAL	WITH THE FOLLOWING VARIATIONS
(B) OPERATIONAL PHASE				
1. DAM DESIGN & SAFETY	a) The "Operation and Maintenance Guidelines For Dam", recommended by Jabatan Kerja Raya, Malaysia shall be adopted by Sarawak Hidro Sdn. Bhd.	Additional	√	
	b) Quantitative Risk Analysis (QRA) that includes assessment on Societal Risk shall be updated from time to time.	Additional	√	
	c) Sarawak Hidro Sdn. Bhd. shall ensure that the construction of the dam complies to the dam design and design safety standards in accordance with the approved engineering plan to minimize risk and possible failure or breakage.	Additional	√	
2. EARTHQUAKE AND NATURAL SEISMICITY	a) Due to reports of local earthquakes of small to medium magnitude (of 3 to 6 on the Richter Scale) and the most intense tremor of 5.1 with its epicentre located about 100 km east of Sibu in February 1994, the dam safety shall be evaluated regularly.	Figure 3.5, page 3-19; page 3 –3	√	
	b) The project proponent should take advantage the bedding planes existing in the proposed dam site to design, locate and build the dam. A microclimate seismograph network will be installed to monitor seismicity in the dam site and avoid areas within fault line. Dam safety shall be re-evaluated regularly.	Pages 3-3, 2-12, 3-17, 6-30 (Ex-10), A2-30	√	

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3. PROBABILITY OF DAM BREAK AND AVERAGE INDIVIDUAL RISK	a) The project proponent shall ensure that the probability of occurrence of a dam break is almost nil or to be 4.46×10^{-5} per year.	Pages 9-1,9-2	√	
4. MINIMUM RIVER FLOW DOWNSTREAM OF THE DAM	During the **reservoir impoundment period**, it is recommended that: a) The initial release from the dam shall not be less than$150m^3/s$, with close monitoring of the water and salinity levels downstream. The release should be immediately increased to $300m^3/s$ or more when there is indication of adverse impacts on the downstream aquatic environment, navigation and other potentially irreversible change in the estuarine environment.	Pages 7-19, 7-20	√	
	b) The impoundment shall start during the wet month; i.e. the "landas" period of heavy rainfall and **initial** release from the dam shall not fall below a **minimum** level of $150m^3/s$. This level shall be continuously monitored and regulated throughout the impoundment period.	Additional	√	
	c) The reservoir filling should commence during the month of high precipitation (e.g. between September-April) so as to take advantage of the high accrual flows from the downstream tributaries.	Pages 7-19, 7-20 AP3B: page 6-15	√	

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* *continue*	d) During the dam impoundment period, the release from the dam shall be at $300m^3/s$ so as to ensure the acceptable flow level for downstream water users is maintained.	Additional	√	
	e) In order to avoid the possible intrusion of salt water further upriver which may affect the salinity level at the water intake point near Sibu as well as affecting the aquifers of the Rajang Delta, intake structures should be operated to allow for surface withdrawal during operations of the reservoir to the exact possible. Surface withdrawal will maximize discharge of aerated waters to the downstream river. The release from the dam shall be regulated at all times.	AP6: pages 3-101, 3-108, 3-123	√	
	f) In order to avoid the degradation of downstream water quality particularly the possible depletion of Dissolved Oxygen during the first 5 years subsequent to reservoir impoundment, further aeration of released water from the spillway will be achieved through artificial rapid and "flip bucket" designs on the spillway outlet. Artificial rapids will also assist in the release of Hydrogen Sulfide from the water and in mitigating against river bed erosion from the swift water current.	AP6: pages 6-15, 6-22, 6-23, 6-24	√	

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** continue*	g) Fish populations should be conserved by altering the rate of filling to accommodate the movement of native stream fishery from the zone of inundation into the streams. Some species and populations will respond more or less favorable to high or low water levels at some point in the life cycle and time of year (i.e., migration of juvenile clarias).	AP6: pages 3-108, 3-123	√	
	h) The change of the river morphology in the downstream parts of the dam in terms of erosion and depositional features will affect estuarine stability. In this regard, dredging works might be necessary at Kapit in order to lower the river bed level so as to increase the navigational depth during low flows.	AP3B: page 5-14	√	In the event where dredging is deemed necessary, Sarawak Hidro Sdn. Bhd. shall undertake the necessary measures to alleviate the problems.
	i) Reduction of stream flushing flows from the upper reaches will cause river influences to silt up and might lead to changes in river course. Hence, during normal operation of the dam, it is recommended that the dam maintains regulated flows throughout its life service. Flow regulations is required to increase the average flows during the normal low-flow periods of the year. (Release of flow back to its normal level will improve water quality parameters downstream)	AP3B: pages 4-14, 6-15 AP6: pages 3-123, 3-128	√	

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	j) Hydrological stations equipped with on-line system shall be set up at the Drainage and Irrigation gauging stations at Kapit, Nanga Benin and Belaga.	Additional	√	
	k) Real time simulation of the downstream river flow shall be carried out.	Additional	√	
5. IMPACT OF FLOOD FLOW FROM SECONDARY STREAM ON MAIN RIVER	a) The project proponent shall carry out occasional release of flushing flow from the dam in order to control the impact of flood flow from secondary streams on the main river.	Page 7-19 AP3B: page 5-14	√	
6. COASTAL AND ESTUARINE ENVIRONMENT	a) The project proponent shall release occasional flushing flows (about 1300 cumecs) in order to provide the sediment flushing capacity in the river downstream of the dam.	AP3B: page5-14	√	
	b) The project proponent shall maintain regulated flows throughout its life service. Flow regulation is required to increase the average flow during the normal low-flow period of the year.	Page 5-14	√	
	c) The initial release from the dam should not be less than 150 m^3/sec with close monitoring of the water and salinity levels downstream. The release should be immediately increased to 300 m^3/sec or more when there is indication of adverse impacts on the downstream aquatic environment, navigation and other potentially irreversible changes in the estuarine environment.	AP3B: page 6-15	√	

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7. WATER QUALITY	a) Best management practices, as described in the Bakun HEP-EIA-Appendix 6: Environmental Management Plan during operation phase shall be implemented.	Page A2-17	√	
8. ABANDONMENT (LIFE SPAN OF THE DAM)	a) A safety and risk assessment should be conducted regularly (preferably annually) on the general integrity of the dam structures, which may deteriorate over time.	Pages 6-47, A2-17	√	
	b) Best management practices, as described in the Bakun EIA - Appendix 6: Environmental Management Plan under site clean up and decommissioning, shall be implemented.	Page A2-17	√	
	c) Site Decommissioning Plan shall be implemented.	AP6: page 3-112	√	
	d) Dam site/structural dismantling shall be carried out with careful planning.	AP6: pages 3-111, 3-112	√	
	e) Waste clean up (with prior determination of toxic components) shall be carried out.	AP6: pages 3-111, 3-112	√	
	f) Preparation of site for redevelopment shall be executed.	AP6: pages 3-111, 3-112	√	
9. MICROCLIMATE	a) None listed in EIA Report; hence, follow provision in Section 2.2.1.12 of the Conditions.	Additional	√	
10. WRECKAGES OF VEHICLES, MACHINERIES AND USED PARTS	a) Wreckages vehicles, machineries and used parts shall be placed in designated junk yards, the sites of which are to be identified by the Natural Resources and Environment Board Sarawak and Sarawak Hidro Sdn. Bhd. Upon completion of the project, these junked vehicles, machineries and parts shall be removed from the site.	Additional	√	