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AN OVERVIEW OF THE ENVIRONMENTAL MANAGEMENT
OF THE BAKUN HYDRO-ELECTRIC PROJECT
IN SARAWAK, MALAYSIA

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Outline

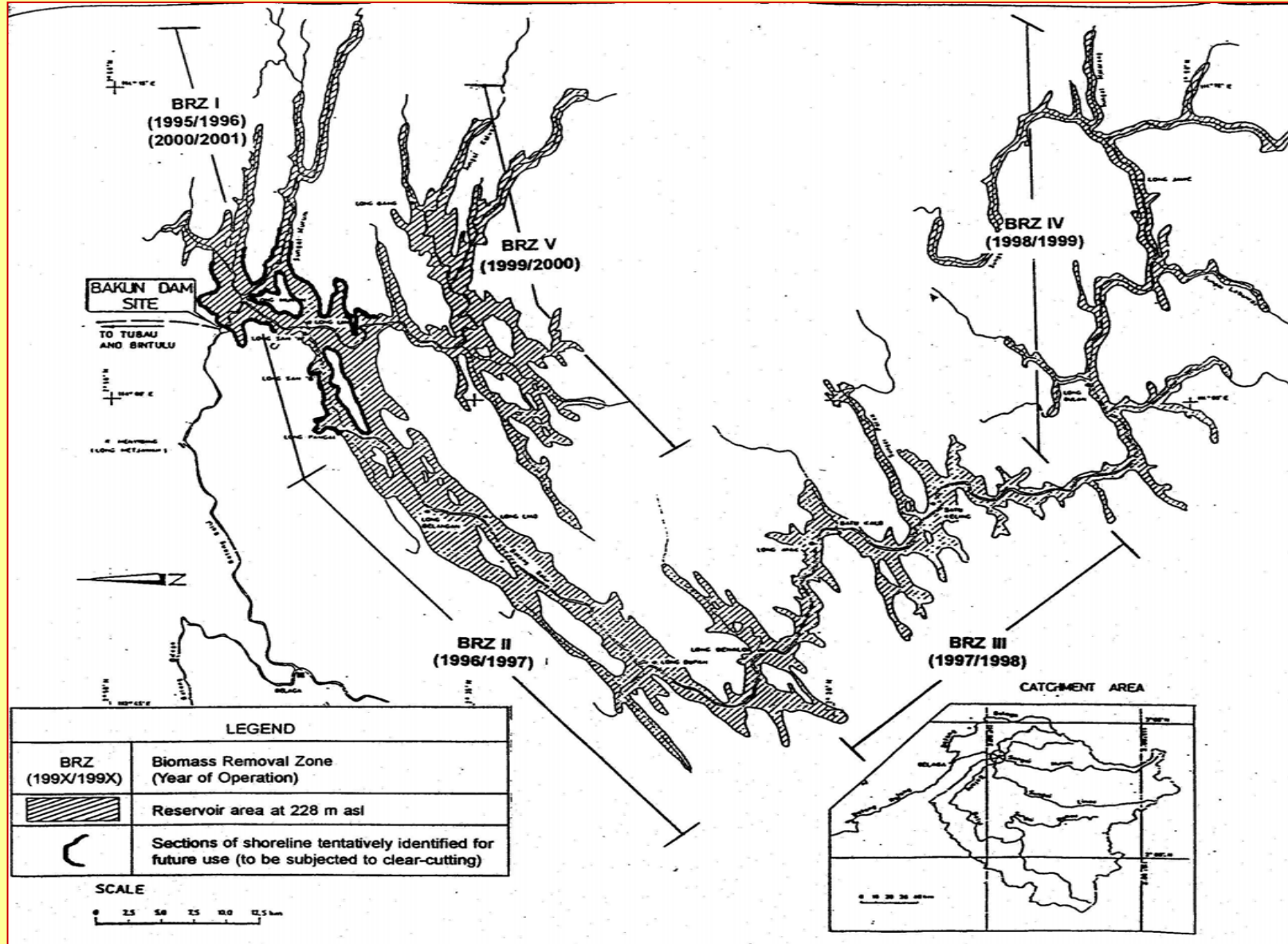
- **Project Introduction**
- **EIA & Major environmental issues identified**
- **Project Environmental Management Structure**
- **Environment Management Roles:**
 - **State Environmental Authority Level**
 - **Project Developer Level**
 - **Contractor Level**
 - **Env Review Committee Meeting**
 - **Env Co-ordination Meeting**
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- **Environmental Monitoring**
- **Environmental Auditing**
- **Environmental Reporting**
- **Compliance Enforcement**
- **Challenges Ahead**
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Bakun Hydroelectric Project Key Info

- ❖ Concrete faced rock fill dam (CFRD) of height 205m.
- ❖ Installed capacity = 2,400 MW (8X300MW)
- ❖ Reservoir area = 69,640 hectares
- ❖ Total storage volume = 43,800 mega cu. meter
- ❖ Catchment area =1.5 million hectares (15,052 sq. km)
- ❖ Project Concept - turnkey project, contractor responsible for both design and build.

Reservoir





Resettlement

- 10,000 indigenous peoples (5 ethnic groups in 15 longhouse communities) resettled between 1997-1999
- From isolated village to well accessible settlement with modern facilities



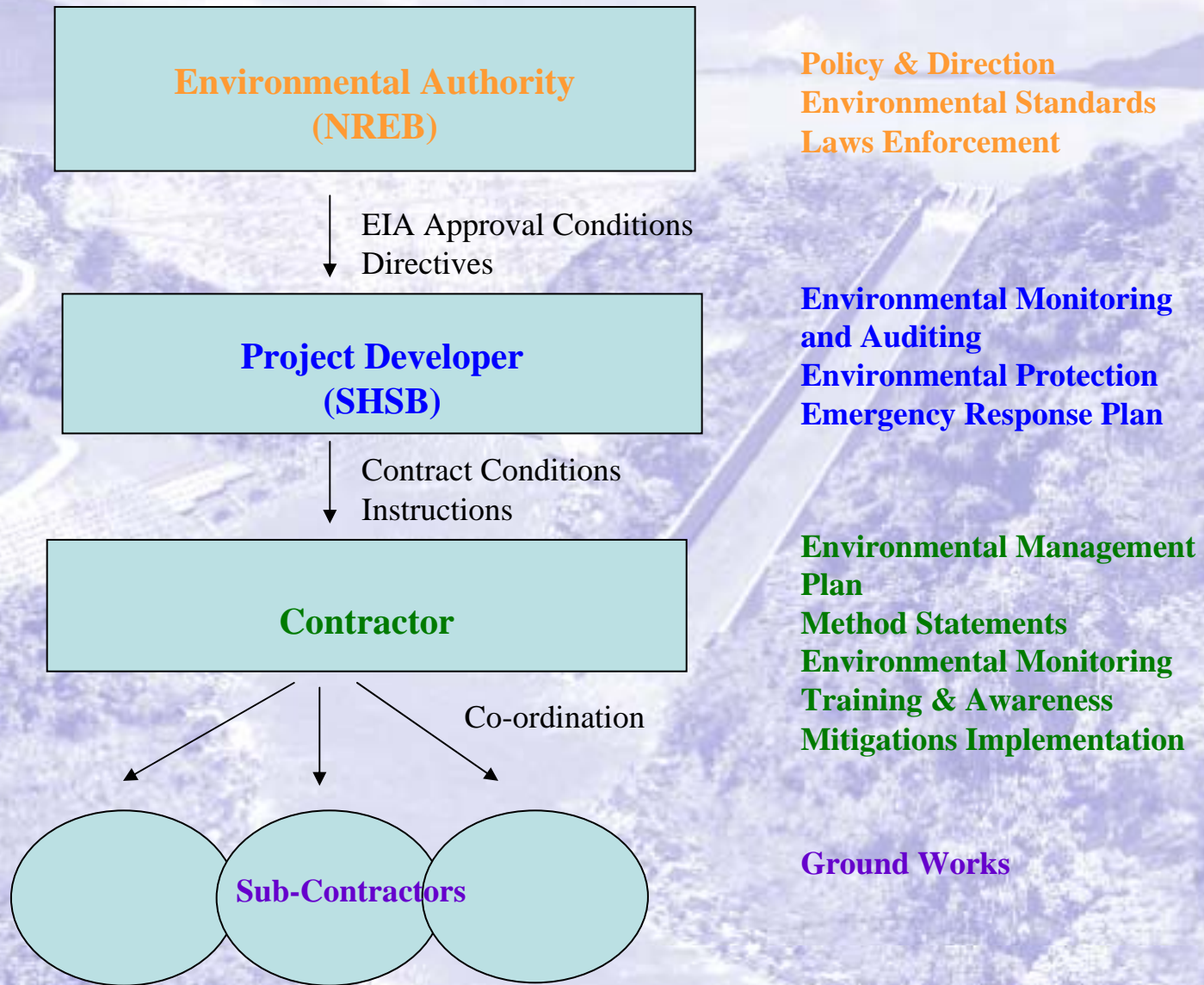
Environmental Impact Assessment (EIA)

- o Detailed EIA conducted in 1994-1995.
- o Report reviewed by expert review panel consisted of various experts from government agencies, institutions of higher learning and NGOs.
- o EIA report made available for public viewing and comment during review stage.
- o Major Environmental Requirements:
 - biomass removal plan
 - emergency response plan
 - quarterly environmental monitoring
 - independent environmental auditing

Major Environmental Issues Identified

- loss of biodiversity and natural habitats
- involuntary displacement of inhabitants
- deterioration of water quality
- disruption of river base flow and downstream flood plain water level alteration
- saline intrusion
- siltation and sedimentation
- floatable vegetative debris
- sewage, scheduled wastes, construction and domestic garbage
- socio-economic issues
- safety and health

Environmental Management Structure of Bakun HEP



State Environmental Authority Level (NREB)

- **NREB empowered under the Natural Resources and Environment Ordinance, a state law.**
- **Setting policy direction of environmental protection and enhancement for the project development.**
- **Set EIA approval conditions for compliance .**
- **Set environmental standards.**
- **Officers specifically assigned to oversee project development and to attend monthly site meetings.**
- **Frequent meetings and discussions with other relevant government agencies to revise policies and directions in environmental protection - multi-discipline nature of environmental issues.**

Cont.

- Carries out many co-ordination works for the various components and phases of the project development when it involves the participation of other government agencies.
- Conduct monthly compliance auditing of project development.
- Issues directives to rectify non-conformance when irregularities are detected.
- Officers are stationed full time at the project site during critical periods.

Project Developer Level (SHSB)

- Full responsibility to comply with all the terms and conditions attached to the approval of the EIA.
- In term included these conditions in work contracts to ensure compliance by its contractors.
- Important contract condition - an environmental manager and an environmental consultancy firm be engaged to ensure that the construction activities are carried out in an environmentally acceptable manner.
- Full time environmental officers overseeing the performance of its contractors and fulfillment of the contract requirements. Loaned Officer from NREB to assist in environmental management.
- SHSB requires the main civil works contractor to designate 3% of the contract sum for Health, Safety, Security and Environment .

Cont.

- Constantly monitors to ensure that all NREB and legislative requirements are adhered to.
- Ensures that contractors have suitable organization structure where environmental management responsibilities are well defined.
- All method statements for works are carefully vetted to ensure that the environmental issues are well addressed.
- Major environmental issues are highlighted during Weekly Site Meeting or Monthly Progress Meeting with contractor.
- Instruction for rectification is issued whenever non-conformance is spotted. Stop-work-order is issued when non-conformance is serious,
- Implement Quality Assurance System to track Non-Conformance Notifications issued to see that rectification is carried out.
- Formulates and implements Emergency Response Plan for both the construction and operational period.

Contractor Level

- Before commencement of work, contractor is required to formulate an environmental management plan (EMP).
- EMP prepared only by licensed environmental consultant who will be responsible for the environmental monitoring and reporting.
- EMP - an action plan containing the necessary arrangements, procedures, steps and measures to achieve environmental conservation, pollution control, regulatory compliance and enhancement of environmental performance of project.
- Engage qualified Environmental Manager to oversee environmental management on ground.
- Implementing contract and statutory requirements and coordinate the works of all its sub-contractors.

Environmental Review Committee Meeting

- Meeting quarterly to evaluate environmental performance, findings of the environmental monitoring and auditing, comments from statutory authority, employer, concerns and complaints from relevant parties such as the public and nearby residents.
- Committee members from top management of contractor and major sub-contractors.
- Environmental Manager of SHSB attends as observer.
- Environmental Consultant provides guidance during committee meeting.
- Determine cause of non-conformances or deficiencies, adequacy of environmental awareness training programs and reviewing of the work methods or procedures.
- Decision or corrective actions are promptly conveyed to the project management team through meetings.

Environmental Co-ordination Meeting

- Held monthly or whenever necessary.
- With all sub-contractors to resolve environmental matters that arise from their daily operation, especially issues common to all.
- Looks into directives and instructions issued by the authority and the developer and findings of the environmental monitoring and auditing.

Environmental Awareness Training

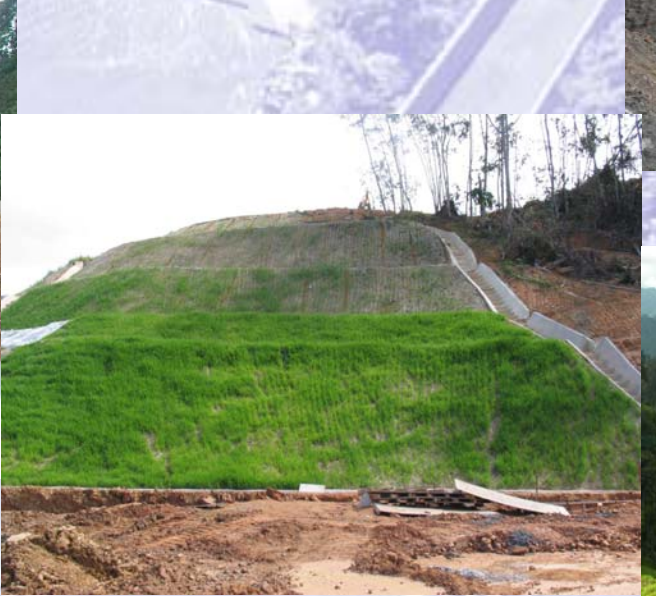
- Targeted at work supervisors.
- To get supervisory personnel to familiarize with the project site and to generate awareness of the environmental aspects related to the various activities of the project.
- Emphasizes on the identification of potential or actual significant environmental impacts of their works, mitigation measures and environmental benefits generated by improved personal performance.
- Designed to aim at getting the participants to understand better their roles and responsibilities in relation to implementation of EMP and the importance of conforming to EMP and other pertinent environmental requirements.

Tool Box Meeting

- Held weekly at the foremen and workers level.
- Necessary requirements and instructions from the management are conveyed directly to the ground staff.



Erosion Prevention & Control



Innovation of workers - turning used tyres into attractive vegetable growing pots



Environmental Protection Measures



Containment bund for fuel tanks



Oil sump



Centralized used oil storage before disposal



Hydro-seeding and slope protection immediately after excavation

Environmental Monitoring

➤ NREB

- Monthly during normal period, frequency increased during critical period.
- When the need arises, officers stationed full time at site.

➤ SHSB

- Environmental personnel carried out regular inspection.
- Joint inspection with Contractor's Environmental Manager carried out monthly or when need arises.

➤ Contractor

- Monthly environmental monitoring on air, water and noise quality .
- Annual flora, fauna and aquatic resources assessment.
- Annual downstream riverine and estuarine morphology changes.
- Environmental personnel carried out regular inspection.

Water & Air Quality Monitoring



Water sampling & in-situ testing



Measuring particular matter (PM10) level



Dust fall gauge

Environmental Auditing

- *Defined as* “A periodic, systematic and objective verification process of obtaining and evaluating audit evidence to determine whether specified environmental activities, management systems, occupational hygiene, safety, and emergency preparedness standards, or information about these matters conform with audit criteria and communicating the results of this process to the client.”
- Conducted once in every three months by independent auditors.

Environmental Reporting

- ❖ **Contractor submits monthly environmental report to SHSB.**
- ❖ **SHSB submits quarterly environmental monitoring and independent auditing report to the NREB.**



Compliance Enforcement

- **NREB :**
 - Impose penalty in accordance to the provisions of the environmental laws and orders.
- **Statutory Penalty :**
 - Monetary compound up to RM 9,000 per offence for minor offences; or
 - Direct court prosecution in more serious violations whereby the penalty could include jail terms.
- **SHSB :**
 - Penalties for non-compliance to Health, Safety and Environment stipulated in the contract document.
 - SHSB reserves the right to deduct the penalties from the contract sum.
 - Normally imposes penalty on non-compliances for repetitive violations to deter recurrence.
- **Imposing of penalty is always the last resort, self-regulating is encouraged.**

Challenges Ahead

- Ensure the dam is constructed in accordance with international standards.
- Siltation and sedimentation control - average annual rainfall of 4,100mm, annual average sediment inflow rate of 36 million tons/year.
- Large volume of biomass during reservoir preparation to be disposed of.
- Monitoring of impacts of the dam on the environment of downstream areas would take a long time and a lot of resources.
- Formulate comprehensive Catchment Management Plan.
- Effectiveness of the Emergency Response Plan yet to be tested.

An aerial photograph of a large dam and reservoir. The dam is a long, straight concrete structure with a spillway on the right side. The reservoir is a large body of water behind the dam. The surrounding landscape is lush green forest. In the background, there are mountains under a cloudy sky. The text "PROJECT PHOTOS" is overlaid in the center of the image in a blue, outlined font.

PROJECT PHOTOS



Bakun Reservoir



Project Site View in early 2003



Auxiliary Cofferdam & Diversion Inlet



Diversion Outlet



Balui River upstream of Dam



View of Dam Site looking from upstream



View of Dam Site Looking from downstream



Left Bank



Right Bank



Powerhouse Slopes



Construction Adit



Spillway & Power Intake Excavation



Dam Embankment Rock Filling



Conclusion

- Clear and specific contract conditions are necessary so that environmental requirements could be fulfilled and implemented.
- Good method statements for all works which addresses the relevant environmental matters is essential.
- Feasible and practical mitigations are frequently best determined on the ground.
- Approach adopted for the environmental management of the Bakun HEP has proven to be practical and effective.
- Environmental protection and enhancement effort of the Bakun HEP can reach international standards in achieving sustainable development.



Thank You

