

TERMS OF REFERENCE FOR INTEGRATED RIVER BASIN MANAGEMENT STUDY

A. Introduction

1. The government has requested the Agence Française de Développement (AFD) to provide technical assistance to undertake a study to optimize water resources benefits within the Southern Dong Nai River Basin. Terms of reference for the study are outlined below.

1. Background

2. Previous and ongoing river basin management studies for Phuoc Hoa and the Dong Nai river basin include (i) the Asian Development Bank (ADB) TA 3528-VIE study on Water Resources Management in the Dong Nai River Basin (September 2004) by Binnie, Black and Veatch which included the formulation of a river basin strategy, and (ii) the ongoing sustainable system management studies by Black and Veatch International (BVI), which will develop and operationalize sustainable management of the entire irrigation system by defining its overall multi-sector management objectives and develop performance standards to achieve these objectives. However, integrated management of water resources needs to take into account the demands of other major stakeholders in the use of these resources.

3. Upstream of Phuoc Hoa Barrage are three hydropower dams: Thak Mo, Can Don and Srok Phu Mieng. All have substantial storage but currently appear to operate independently. In recent years it has been realized that the success of the project relies heavily on the integrated water resources management (IWRM) of the lower Dong Nai Basin and in particular the complementary operation of the hydropower stations that guarantees minimum divertable dry season flows to the Phuoc Hoa system. IWRM is a key factor in the development of the Phuoc Hoa Project infrastructure and its integration with the Dau Tieng system. Operation of these reservoirs will be most critical in relation to Phuoc Hoa during periods of drought and flood.

4. The proposed study will formulate hydropower reservoir operating strategies that are complementary to the demands of downstream irrigation and DMI water users.

2. Objectives of the Study

5. The objectives of the study are to:

- i. Establish current hydropower reservoir operating strategies and rules following discussions with the hydropower operators.
- ii. Establish the demands of the Phuoc Hoa-Dau Tieng System and how this will develop over a 30-year horizon following discussions with Dau Tieng irrigation management company (IMC), the provincial IMCs, BVI and other stakeholders.
- iii. Determine the reliability of flows arriving at key operational locations in the Song Be that would permit operational modeling.
- iv. Develop strategies for hydropower reservoir operation to optimize benefits to hydropower and the Phuoc Hoa-Dau Tieng system demands and facilitated by developing an existing model.
- v. Discuss the more successful strategies with hydropower operators, Ministry of Natural Resources and Environment (MONRE) through the Dong Nai river basin organization (RBO) and the Ministry of Agriculture and Rural Development (MARD) and try to obtain a consensus on a preferred strategy with reservoir operating rules.

- vi. Incorporate the preferred strategy into the Dau Tieng-Phuoc Hoa IMC, Sustainable Management Plan, Part 3 Water Management and Operations Plan
- vii. Provide advice on what flow measurement and real time data transmittal facilities are required.

B. Terms of Reference for Consultants

1. International Water Resources and Operational Specialist (IWROS) (3 months)

- i. Review relevant reports on operation of water resources infrastructure in the lower Dong Nai Basin including the Phuoc Hoa Multipurpose Project feasibility study, the Water Resources Management in the Dong Nai River Basin, Final Report.
- ii. Direct the National Hydrologist/Water Resources Specialist in obtaining rainfall and riverflow data and determining reliable flows (80% and 95%) at key input locations for the river basin model.
- iii. Direct meetings with hydropower companies, MARD (ICMB9 and Dau Tieng IMC), MONRE and other stakeholders on current operating guidelines and rules for reservoirs in the lower Dong Nai basin and possible and acceptable strategies for IWRM once the Phuoc Hoa water resource plan (WRP) is completed.
- iv. Determine the updated proposed demands of the combined Phuoc Hoa –Dau Tieng System and the expected transfer requirements on a 10 day or half monthly basis over the next 30 years once all projected irrigation and domestic, municipal, and industrial (DMI) requirements have been met. This should take into account proposals for reliability supply to the different water uses as set out in the Draft sustainable management plan (SMP).
- v. Working with the National Hydrologist (and SIWRP if the Dong Nai MIKE BASIN model is chosen) upgrade the basin model to operate with mean, 1 in 5 year and 1 in 20 year¹ incoming flows at key nodes.
- vi. Direct the model operators in simulating possible operating strategies for hydropower facilities and resulting impacts on satisfying Phuoc Hoa- Dau Tieng System demands during mean, 1 in 5 and 1 in 20 years low rainfalls.
- vii. Identify a preferred strategy that provides the optimal benefits to all water uses subject to the service reliability standards set out in the draft SMP. Present these finding through a draft report to the key stakeholders through the Phuoc Hoa WRP Task Force that includes the hydropower operators.
- viii. Once agreement is made, develop draft operating rules for the three hydropower stations and any corresponding operating requirement for the Phuoc Hoa Barrage and integrate this into Part 3, Water Operations Management plan of the Dau Tieng-Phuoc Hoa IMC SMP.
- ix. With the National Hydrologist/Water Resource Specialist make recommendations for transmitting real time river flow data from the reservoir outlet facilities to the proposed water management control centers at Phuoc Hoa Barrage and the proposed Dau Tieng – Phuoc Hoa IMC control center in HCMC.

¹ In determining low flows the hydrologist should analyze the 6 month dry season rainfalls as wet season rainfall during a dry season can disguise the severity of the drought or determine the return period value for each individual month.

2. National Hydrologist and Water Resources Specialist (4 months)

- i. Collect all relevant reports on operation of water resources infrastructure in the lower Dong Nai Basin in both English and Vietnamese. Review and translate key sections of Vietnamese reports into English pertaining to operation of the three hydropower stations on Song Be and recent agreements on Phuoc Hoa-Dau Tieng water requirements.
- ii. Obtain up-to-date rainfall and riverflow data from the various collecting agencies in the Song Be and Sai Gon catchments as well as water release data from the three hydropower companies. Using a rainfall runoff model in combination with river flow data and hydrological techniques generate at least 30 years simulation data at key modeling nodes assuming the hydropower reservoirs are in place. Clearly set out assumptions and initially simulate the existing operating modes. The hydrological model should determine mean and reliable flows (80% and 95%) at key input nodes on the river basin model.
- iii. Attend and minute meetings with hydropower companies, MARD (ICMB9 and Dau Tieng IMC), MONRE and other stakeholders on current operating guidelines and rules for reservoirs in the lower Dong Nai basin and possible and acceptable strategies for IWRM once the Phuoc Hoa WRP is completed.
- iv. Using existing crop water requirement and water use models for Phuoc Hoa – Dau Tieng system determine the updated proposed demands and the expected transfer requirements on a 10 day or half monthly basis over the next 30 years once all projected irrigation and DMI requirements have been met. This should take into account proposals for reliability supply to the different water uses as set out in the Draft SMP.
- v. Working under direction from the IWROS (and SIWRP if the Dong Nai MIKE BASIN model is chosen) upgrade the basin model to operate with mean, 1 in 5 year and 1 in 20 year² incoming flows at key nodes including the hydropower outlets.
- vi. Model (or direct the SIWRP Operators if that model is used) in simulating possible operating strategies for hydropower facilities and resulting impacts on satisfying Phuoc Hoa- Dau Tieng System demands during mean, 1 in 5 and 1 in 20 low rainfall years.
- vii. Working with the IWROS identify a preferred strategy that provides the optimal benefits to all water uses subject to the service reliability standards set out in the draft SMP. Present these finding through a draft report in Vietnamese to the key stakeholders through the Phuoc Hoa WRP Task Force that includes the hydropower operators.
- viii. Translate draft operating rules for the three hydropower stations and any corresponding operating requirement for the Phuoc Hoa Barrage and integrate this into Part 3, Water Operations Management plan of the Dau Tieng-Phuoc Hoa IMC SMP, Vietnamese version.
- ix. With the National Hydrologist/WR Specialist make recommendations for transmitting real time river flow data from the reservoir outlet facilities to the proposed water management control centers at Phuoc Hoa Barrage and the proposed Dau Tieng – Phuoc Hoa IMC control center in HCMC.

² In determining low flows the hydrologist should analyze the 6 month dry season rainfalls as wet season rainfall during a dry season can disguise the severity of the drought or determine the return period value for each individual month.

Table 1: Cost Estimate and Financing Plan

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Item	Total Cost
A. Donor funding ^a	
1. Consultants	
a. Remuneration and Per Diem	
i. International and Regional Consultants	72.0
ii. National Consultants	20.0
b. International and Local Travel	8.0
c. Reports and Communications	2.0
2. Miscellaneous Administration and Support Costs	10.0
3. Training, Seminars and Conferences	5.0
4. Surveys	0.0
5. Contingencies	8.0
Subtotal (A)	125.0
B. Government Financing	
1. Office Accommodation and Transport	10.0
2. Remuneration and Per Diem of Counterpart Staff	15.0
3. Others	15.0
Subtotal (B)	40.0
Total	165.0

^a Funded by Agence Française de Développement and administered by the Government.