UNIVERSITI SAINS MALAYSIA

First Semester Examination
Academic Session 2008/2009

November 2008

EAD 511/4 – River Management

Duration: 3 hours

Please check that this examination paper consists of **ELEVEN (11)** pages of printed material including appendix before you begin the examination.

Instructions: Answer **FOUR (4)** questions. All questions carry the same marks.

You may answer the question either in Bahasa Malaysia or English.

All questions **MUST BE** answered on a new sheet.

Write the answered question numbers on the cover sheet of the answer script.

1. Considering the simplified view of a major river Figure 1, discuss its many possible responses to the following:

(a) Construction and operation of reservoirs for power and flood control on Tributary A. Prior to construction of the dams, this tributary was a major source of sediment to the main channel.

[5 marks]

(b) Operation of locks and dams upstream of the confluence of Tributary A and the main channel. The locks and dams, coupled with dredging, are used to assure adequate low-water depths for navigation

[5 marks]

(c) The main channel in the middle reach is relatively straight and has been significantly narrowed and riveted to improve navigation conditions.

[5 marks]

(d) The floodway allows a large percent of high flows to escape down the floodway. Hydraulic conditions then are such that the diverted water is relatively free of coarse sediment resulting in excess sediments in the main channel downstream of the diversion.

[5 marks]

(e) A navigation channel is maintained on the major delta. The delta continues to elongate, flattening the upstream slope on the main channel.

[5 marks]

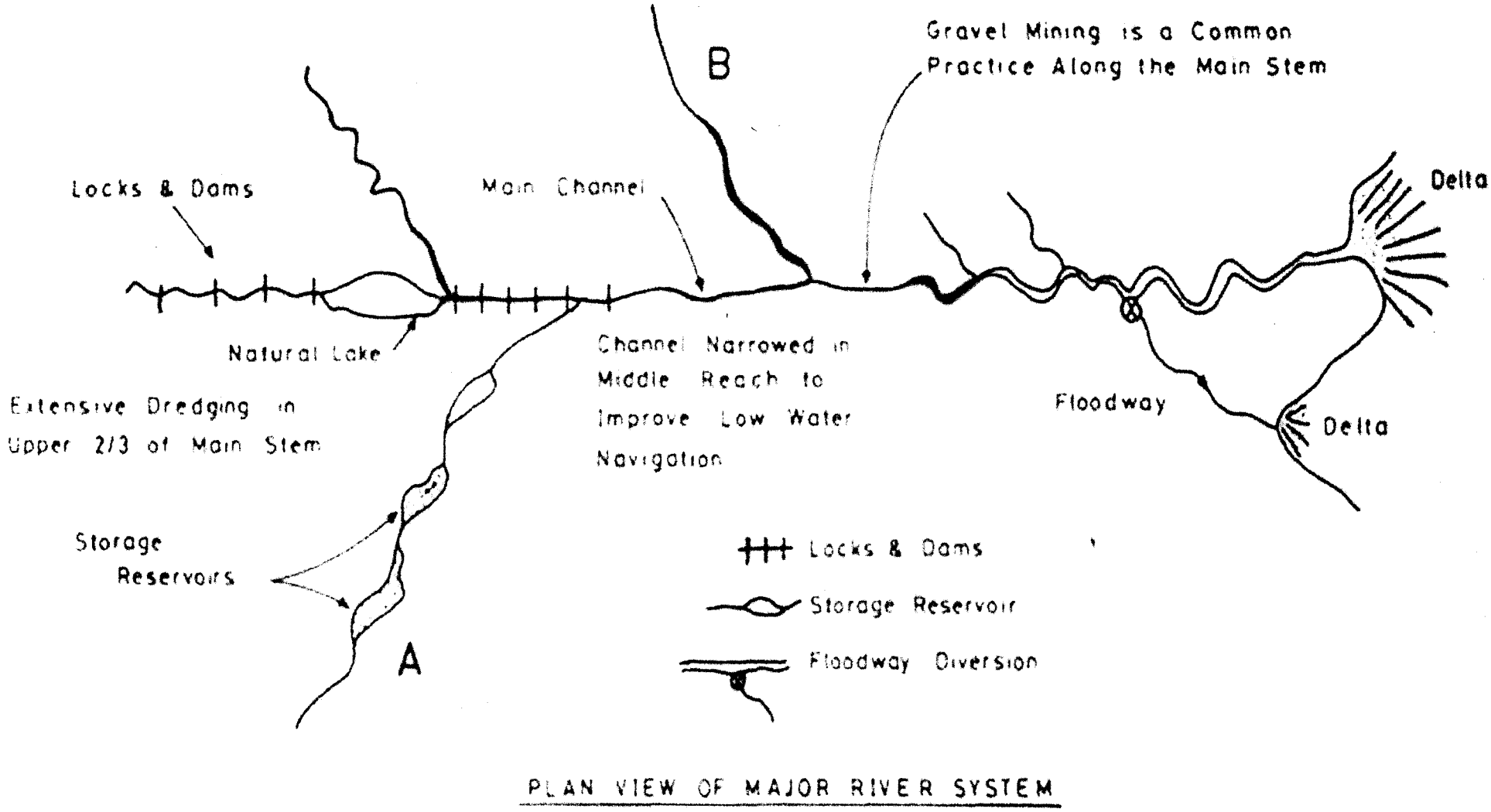

Figure 1 : Evaluation of river response to river development

2. Figure 2 shows the cross section of Sungai Muda during the October 2003 flood. The main channel and flood plains have Manning roughness values of 0.030 and 0.05 respectively. The longitudinal slope is 0.001.

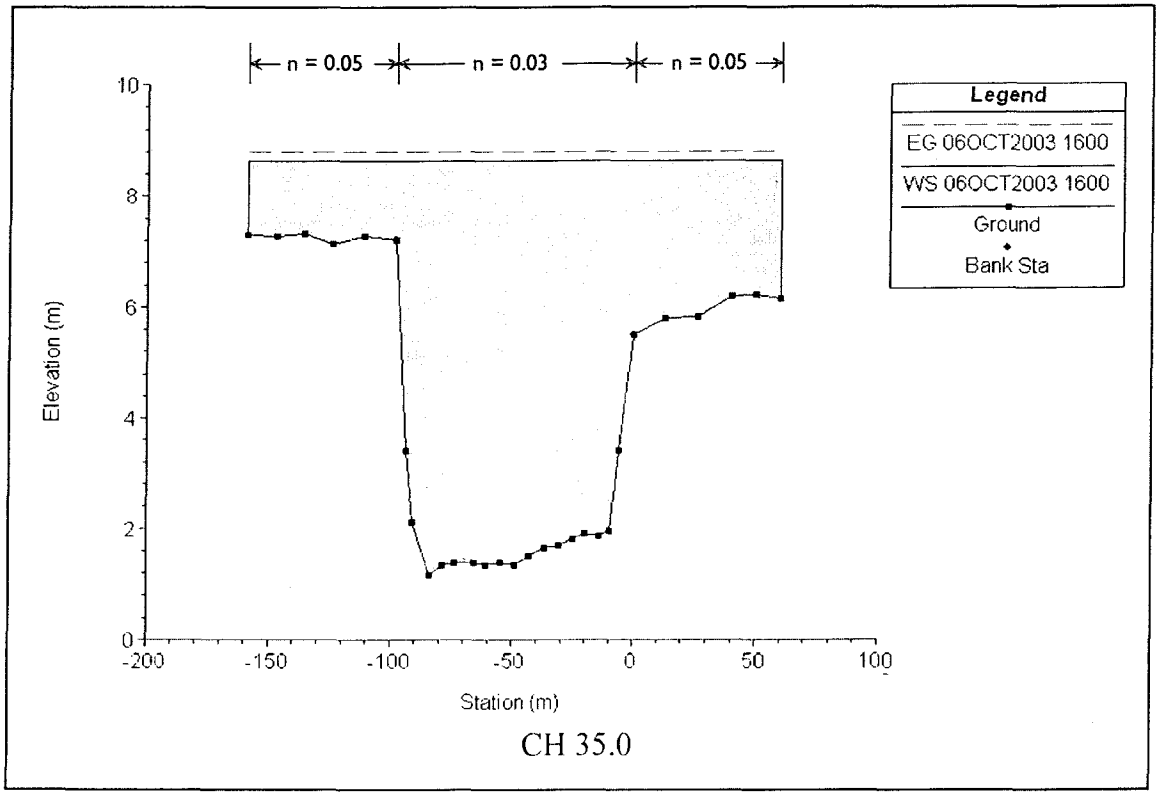

Figure 2 : Sungai Muda at Pinang Tunggal

(a) Determine the flood discharge at Pinang Tunggal under the existing cross section as shown in Figure 2.

[10 marks]

(b) Figure 2 shows that overflow to floodplains has occurred. What is the appropriate design cross section to reduce the flood depth in the floodplains taking into account the need to build bunds at both banks?

[15 marks]

3. A wide irrigation canal having a slope of 0.01 is to deliver $10m^3/s$ water. The canal is grassed and protected from scour. The bed material consist of coarse alluvial gravel with d_{50} of 20mm. Assume the specific gravity of the bed material Ss = 2.65, kinematic viscosity = $1.00E\text{-}06m^2/s$ and the flow is turbulent

(a) Referring to Shield Diagram (Figure 3), prove that d = 11RS

[5 marks]

(b) Combining with Manning equation and Strickler's equation, determine the minimum width for the canal. Strickler's equation defines $n = \frac{d^{1/6}}{26}$.

[5 marks]

(c) If the canal is to carry a flow of 0.5m depth, determine the minimum gravel size to prevent bed scouring and the new water discharge.

[10 marks]

(d) Compute Bed Load using Meyer - Peter - Muller Equation if there is no bed protection to 1(c)

[5 marks]

4. Floods are the most common water related hazard in Malaysia. They cause damage to properties, crops, and sometimes loss of life. Flood can be categorized as flash flood and monsoon flood

(a) Identify five causes or factors contributing to floods

[5 marks]

(b) Discuss briefly how development (if not properly planned) will affect the water quality and quantity

[10 marks]

(c) Explain how the Integrated River Basin Management able to address the water resources issues and problems

[10 marks]

5. Peace City is a very dynamic and prosperous city. Currently, the Peace River system is the only source of water supply for the entire river basin. In order to cope with the population growth and economic expansion, and because of lack of available land, the City Council of Peace City proposed a new township further inland as shown in Figure 4.

(a) List the three main models of river basin organization

[5 marks]

(b) Prepare a River Basin Management Plan to ensure that there is sufficient water for all future uses that include the maintenance of the environment, and water for domestic and agricultural consumption within the Peace River Basin. For sustainable development, the plan should consider:

- Safeguarding the quantity and quality of water for domestic, industrial, commercial and agricultural uses;
- Maintaining the ecological integrity of the river basins through proper management of water resources to sustain the aquatic and riparian ecosystems; and
- Ensure the health of the rivers and enhance the scenic quality and other innate assets within the river basin systems.

[20 marks]

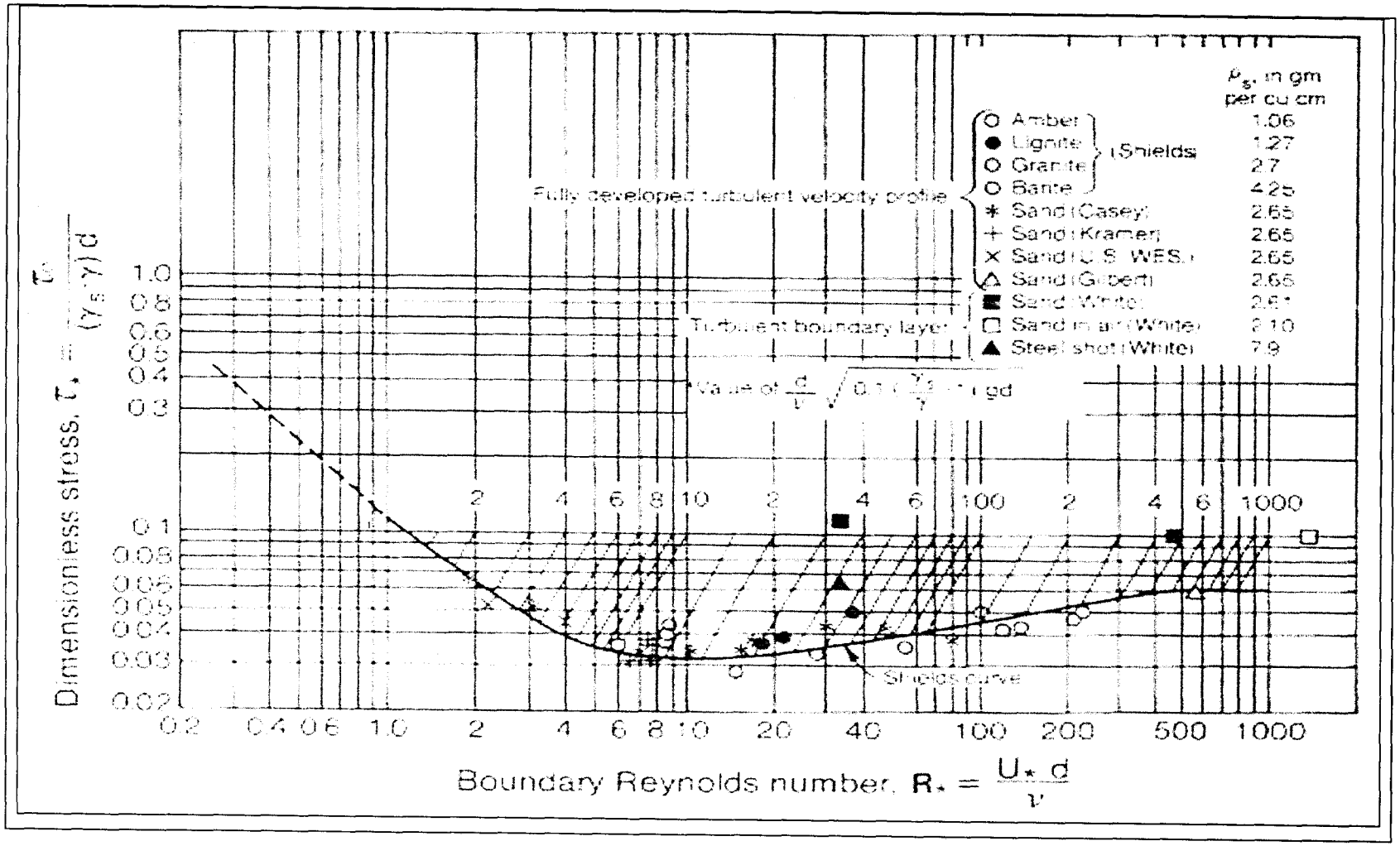

Figure 3: Shield Diagram

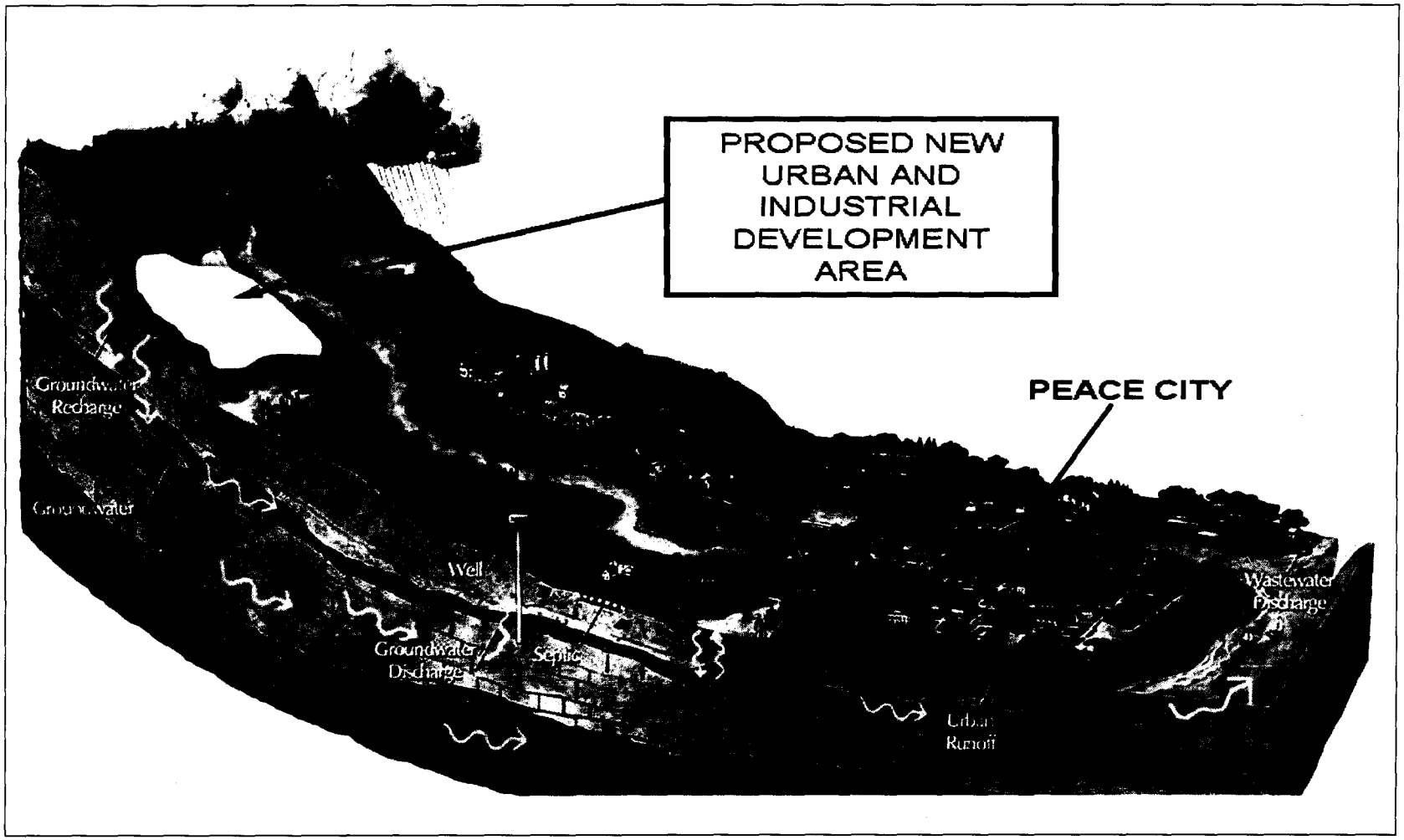

Figure 4 : Peace River Basin

ATTACHMENT 1

What Is Good Integrated River Basin Management?

It is generally accepted that there are five overarching attributes that must be addressed if river basins are to be managed in a sustainable way:

1. Clear and strong institutional arrangements, supported by clear regulations, decrees, or agreements coupled with well-defined implementing procedures
2. Good water-related data, information, systems, and models readily available to the river basin partners and those agencies and bureaus operating within the basin
3. A complete suite or package of basin-wide policies, procedures, and strategies to guide water and natural resource planning, management, and administration, based on the very best information and knowledge that is available
4. An appropriate form of communication and participation for all basin stakeholders and partners
5. Basin sustainability performance indicators and an agreed approach to monitor and report on how the basin is being managed, how the resources are being consumed and protected, and how the relevant organizations themselves are addressing their functions and responsibilities: that is, whether the key "players" are accountable for their actions, or the lack thereof.

Some Key Factors to Consider about IRBM

1. Integrated river basin management is often a new concept for developing countries and can be quite different from the existing, much more centralized and less participative institutional and regulatory models.
2. Changing to these new concepts will often be resisted, as it changes the power sharing arrangements and areas of influence, causes much tension and "wrestling" for positions, and disrupts how business is currently undertaken. It requires the sharing of data and information, open cooperation, and the development of trust and confidence.
3. The coordination and facilitation role within IRBM often introduces new horizontal linkages across administrative zones such as provinces and counties, or across disciplines such as water resources, soil, land, forestry, and environmental protection, where previously strong vertical lines of command and control existed. It often proves very challenging to marry the two approaches into a strong management matrix for integrated river basin management.
4. To encourage such a high degree of change, background studies, evaluations, and justifications as to why IRBM is worthwhile need to be undertaken. There must be a good understanding of how each country undertakes its water resources business. Then the change process must be tailored or adapted to suit these attitudes and processes
5. It is good practice to assess, evaluate, and plan in detail, and to seek and obtain commitment—but to implement slowly and in agreed stages.
6. It is advisable to adopt the simplest institutional model or set of changes that will produce the desired level of improvement in basin management.

i. Experience has shown that is it best to refrain from adopting a model wholesale from elsewhere in the world without extensive review; no "one size fits all" exists.

ii. It is also advisable to refrain from encouraging a new basin organization to take over the functions of existing organizations. It is better to strengthen the effectiveness of existing organizations and have the new basin organization concentrate on those aspects that are not being done well and to serve as the coordinator and facilitator of planning, management, monitoring, reporting, and auditing functions.

The 15 Briefing Notes

Conceptual and Institutional Issues

1. A Background to Integrated River Basin Management– What is integrated river basin management (IRBM) and what institutional options suit IRBM
2. Creating and Empowering a River Basin Organization– Defining the issues and determining the appropriate institutional framework
3. Organizational Planning for a River Basin Organization– Setting the direction, defining the priorities, planning the actions, monitoring the results

Good Water-related Data and Information

4. Water-related Data and Information Management– Meeting the information needs of all basin partners and stakeholders
5. Developing a Water-related Resource Inventory for a River Basin– Knowing the health or condition of a basin's natural resources
6. System Modeling in River Basin Management– Simulating and optimizing the response of a river basin's hydrology and hydraulics to changes in land and water use

Basin-wide Policies and Strategies

7. River Basin Planning and Management– Participatory approaches to planning a sustainable river basin
8. Transboundary Water Sharing– Developing and allocating reasonable and equitable water shares across boundaries
9. Notification and Evaluation of Projects of Basin-wide Significance– The role of the basin organization or the responsible agency in ensuring proposed projects and actions comply with basin-wide policies and rules

Basin-wide Policies and Strategies

10. Licensing/Permitting of Water Diversions and Use– The role of the basin organization in ensuring competent water permitting systems and usage monitoring throughout the basin
11. Charging for Water Resources Management– Developing efficient water pricing structures and tariffs for the management, monitoring, supply, and distribution of the water resources in a basin.

Communication and Participation

12. Stakeholder Partnerships, Participation, and Funding– Promoting good river basin governance and establishing funding initiatives to support long-term basin development and protection
13. Raising the Awareness of the Basin Community– A package of communication initiatives to inform schools, villages, towns, and the community in general about IRBM

Monitoring and Assessing Sustainability

14. Setting and Managing Basin Sustainability Performance Indicators– The role of the basin organization in developing and reporting on a set of performance indicators to assess basin sustainability
15. The Finishing Touches to the Creation of a River Basin Organization– Setting clear directions, informing and motivating staff, respecting the needs of both stakeholders and staff