26.7 Analyses on channel stabilization plans

Various types of river training and channel stabilization facilities as well as dredging are discussed at all the key locations in terms of their arrangements, structures and effects.

The alternatives to be analyzed are selected, and their effects are examined by computer simulations for the dry and flood seasons, which correspond to the conditions of the site surveys, enabling comparison between the actual and simulated conditions.

26.7.1 Proposed alternatives of channel stabilization facilities

Three alternatives are selected for discussing channel stabilization works of the Red River in the Hanoi section to take in consideration during the mathematical simulations.

The different proposals (Alt. 1, Alt. 2, Alt. 3) are shown respectively in **Figure 26.7.1 (1)**, **Figure 26.7.1 (2)** and **Figure 26.7.1 (3)**. Their characteristics are as follows:

Alternative 1 : Dual channel system

Alternative 2 : Single channel system in the dry season

Alternative 3 : Single channel system in the dry season with winder channel width

Alternative 1 aims at stabilization and maintenance of the present alignment of the channel, not to change the primary features of the channel. **Alternative 2** is to intend the waterway to be a single channel by means of two weirs at the mouths of the second channel in order to close the second channel and to make the main channel stable and deep enough. **Alternative 3** is a modified plan of **Alternative 2** by widening the main channel to ameliorate the excessive increase in velocity, discharge and water level, taking account of hydraulic cross sections, or Sh/Q ratio. They include the following facilities and locations:

1) Group of groins (structure: permeable groins with varied length)

- Along the Vong La Sand Bar to deviate the Talweg to the right side.
- Right side downstream of Thang Long Bridge to guide the Talweg to the new Hanoi North Port.

- Upstream of the planned new Hanoi North Port to secure stable depth at the berths and to protect Vinh Ngoc and Tam Xa Banks.

2) Training Wall (Structure: Continuous walls)

- Along the left side of Tu Lien-Trung Ha Sand Bar to prevent a cut and to streamline the flow along the bar.
- Along the head and the left side of Nhat Tan Sand Bar to maintain the bar and to control the flow in front of new Hanoi North Port.

3) Bank Slope Protection (Structure: Concrete and stone covering, Sheet piles, etc.)

- Right bank at the upstream portion of Hanoi Port to prevent erosion of the slope beside the channel.
- Along the left bank of Bac Cau-Bo De Communes to streamline the flow and ameliorate the side effect to Tu Lien-Trung Ha Sand Bar, and the head of Bac Cau (Long-term) to prevent erosion and to maintain the entrance of the Duong River.
- Right bank at An Ninh to strengthen the entrance to the secondary channel.
- Left bank of Tam Xa (Long-term) to strengthen the bank.
- Along concave corners at Duyen Ha (Long-term) to secure the channel and to stop developing of meandering.

4) Weirs (Structure: Submerged gravel and stone mound)

- At the two mouths of the secondary channels at Nhat Tan Sand Bar and Tu Lien-Trung Ha Sand Bar.

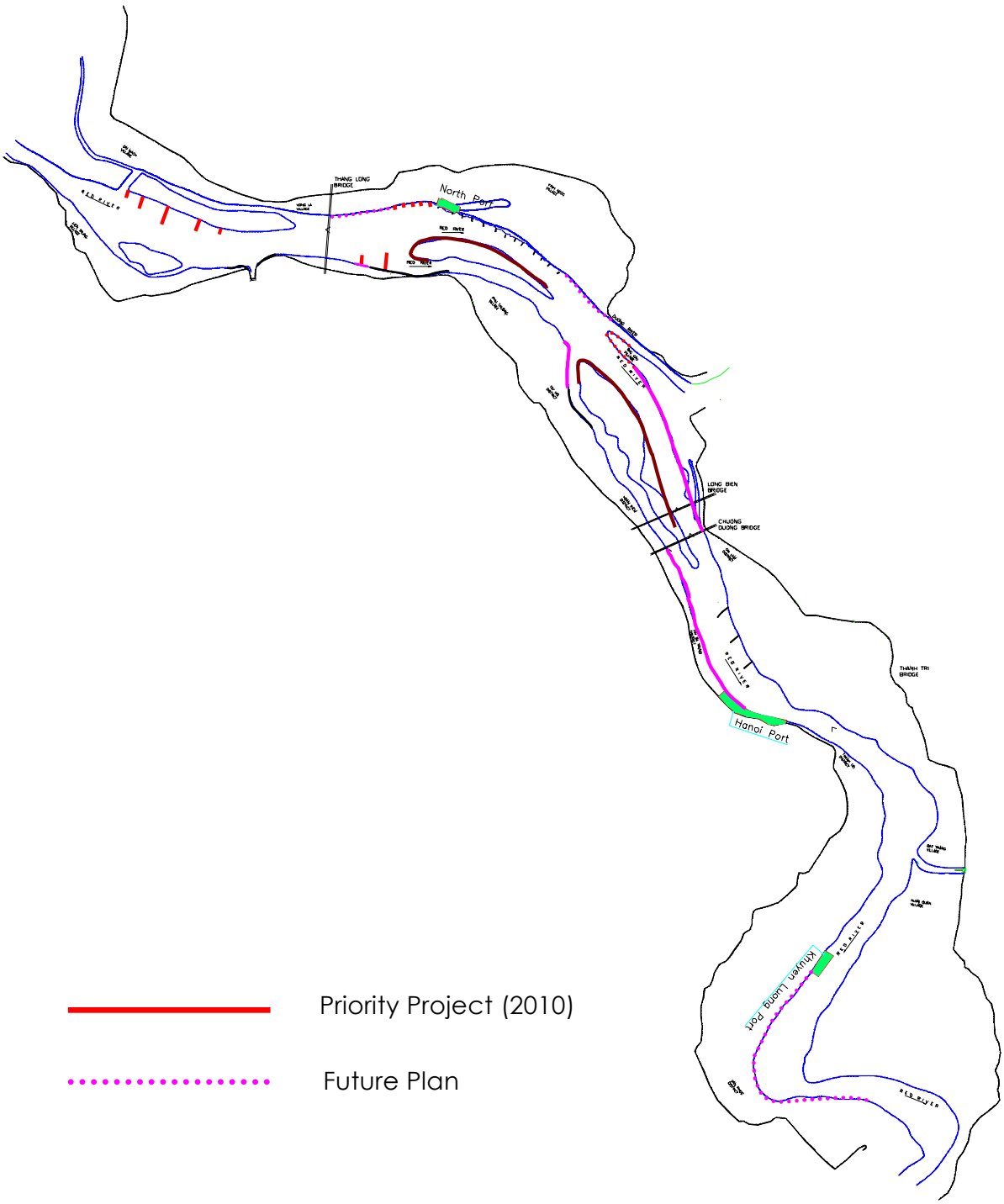

Figure 26.7.1 (1) Alternative 1 (Dual Channel System)

Source) JICA Study Team

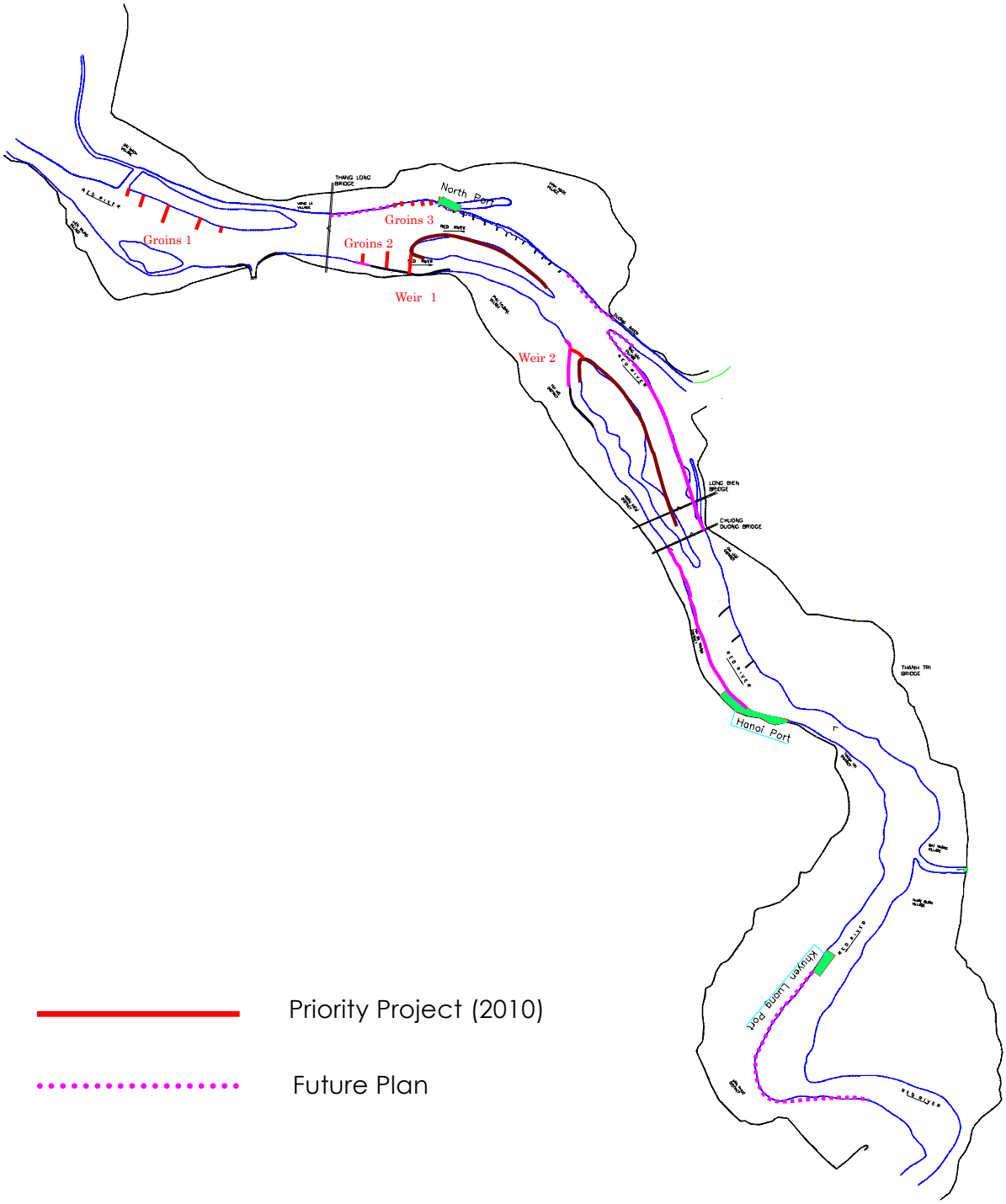

Figure 26.7.1 (2) Alternative 2 (Narrow Single Channel System)

Source) JICA Study Team

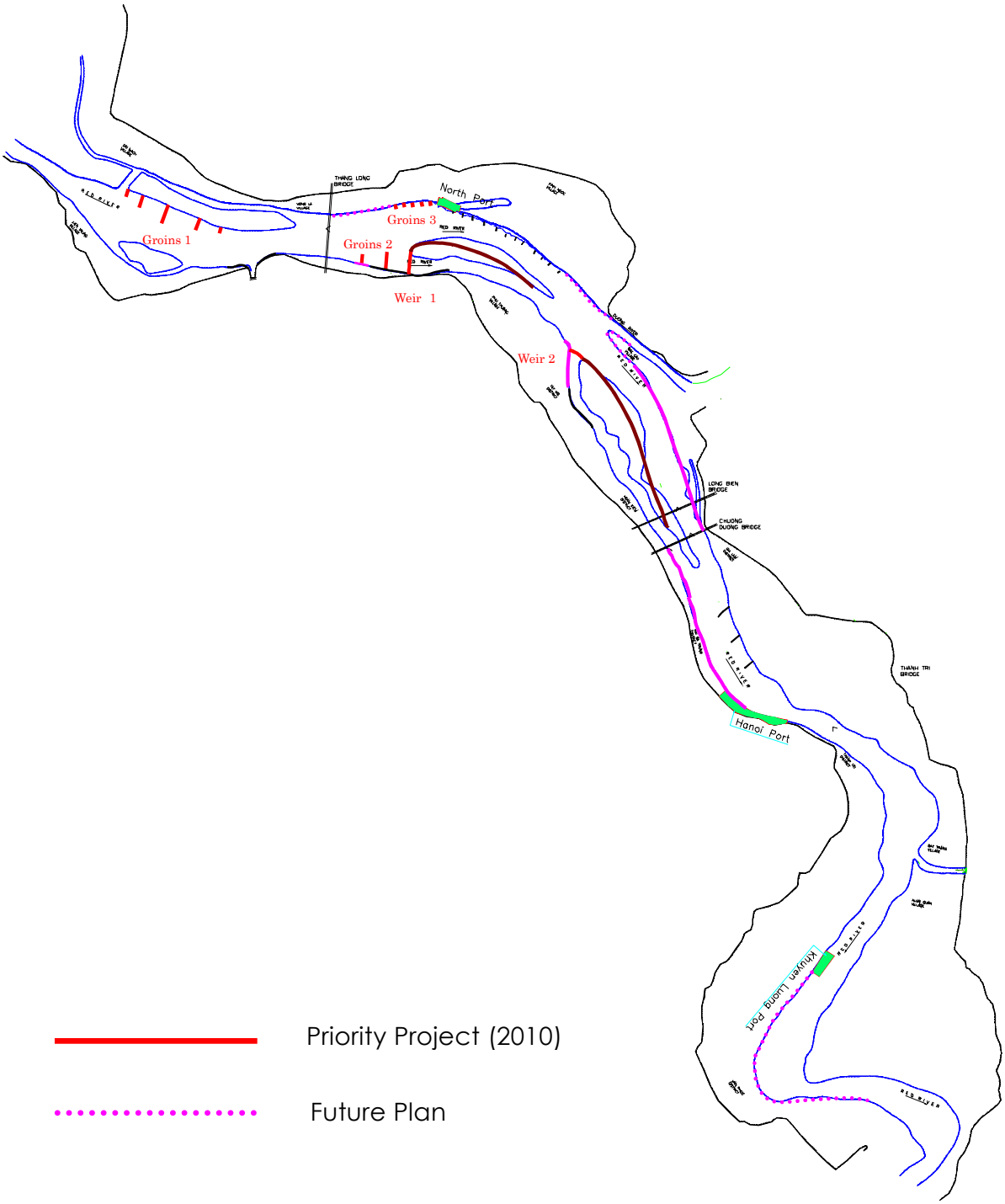

Figure 26.7.1 (3) Alternative 3 (Wide Single Channel System)

Source) JICA Study Team

26.7.2 Positioning of proposed structures

The positioning of the training walls is based upon the basic philosophy mentioned above: the basic idea to control morphological processes in the studied river reach is to aim at a constant uniform flow along a single channel river.

Section 1 is the stable section of the river and is used as a model to measure the other sections based on the Sh/Q ratio. The exact position of the training walls (and so the width of the hydraulic section), is determined in an iterative way based on the same ratio.

The upper crest levels of the submerged weirs are fixed at 6.5 m. The height of the upper crest of the training wall and river bank protection is no fixed at a stationary level. The height of the upper crest will depend on the height of the local bank. The river bank protection will lean against the existing natural river border. This level is necessary to stabilize the structure and will not be determined on a fixed level.

26.7.3 Conceptual cross-sectional profiles of proposed structures

The following figures in **Figures 26.7.2 (1)** to **(4)** are illustrative schemes of the river training works: groins, submerged weir, training wall and river bank revetment.

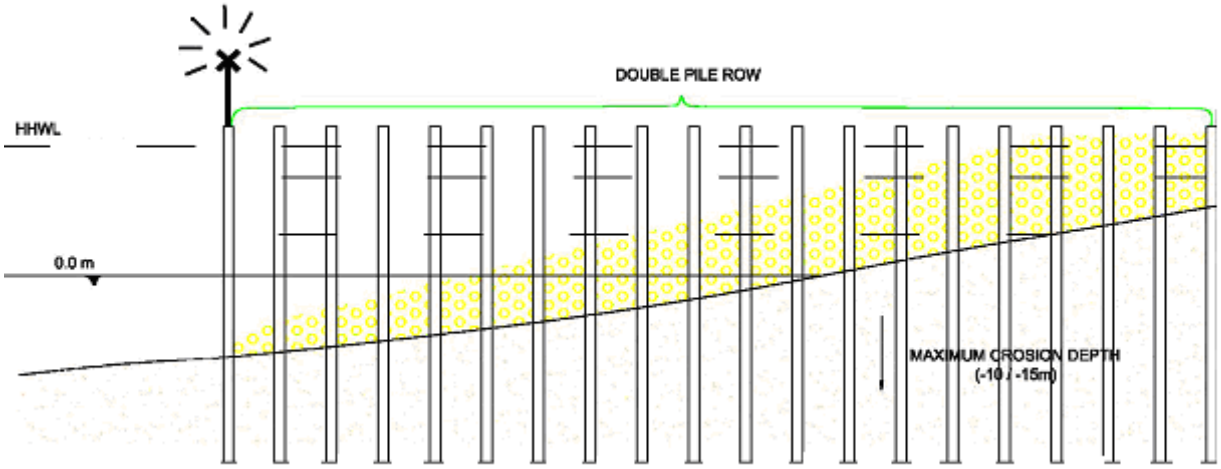

Figure 26.7.2 (1) Conceptual Cross-sectional View of Groins

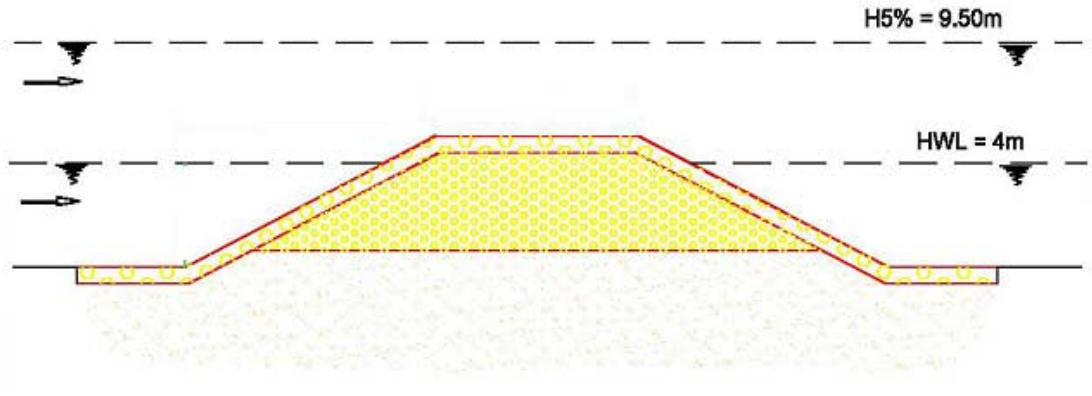

Figure 26.7.2 (2) Conceptual Cross-Sectional View of Submerged Weir

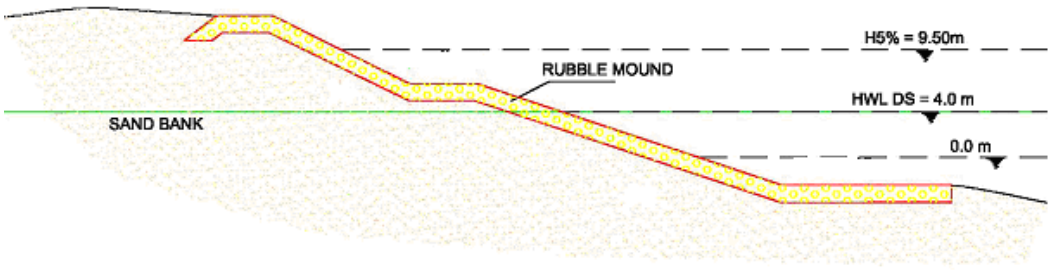

Figure 26.7.2 (3) Conceptual Cross-sectional View of Training Wall

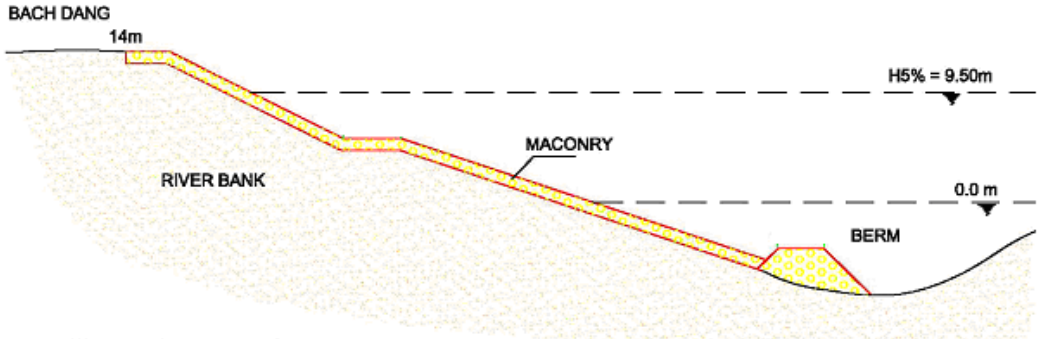

Fig. 26.7.2 (4) Conceptual Cross-sectional View of the River Bank Revetment