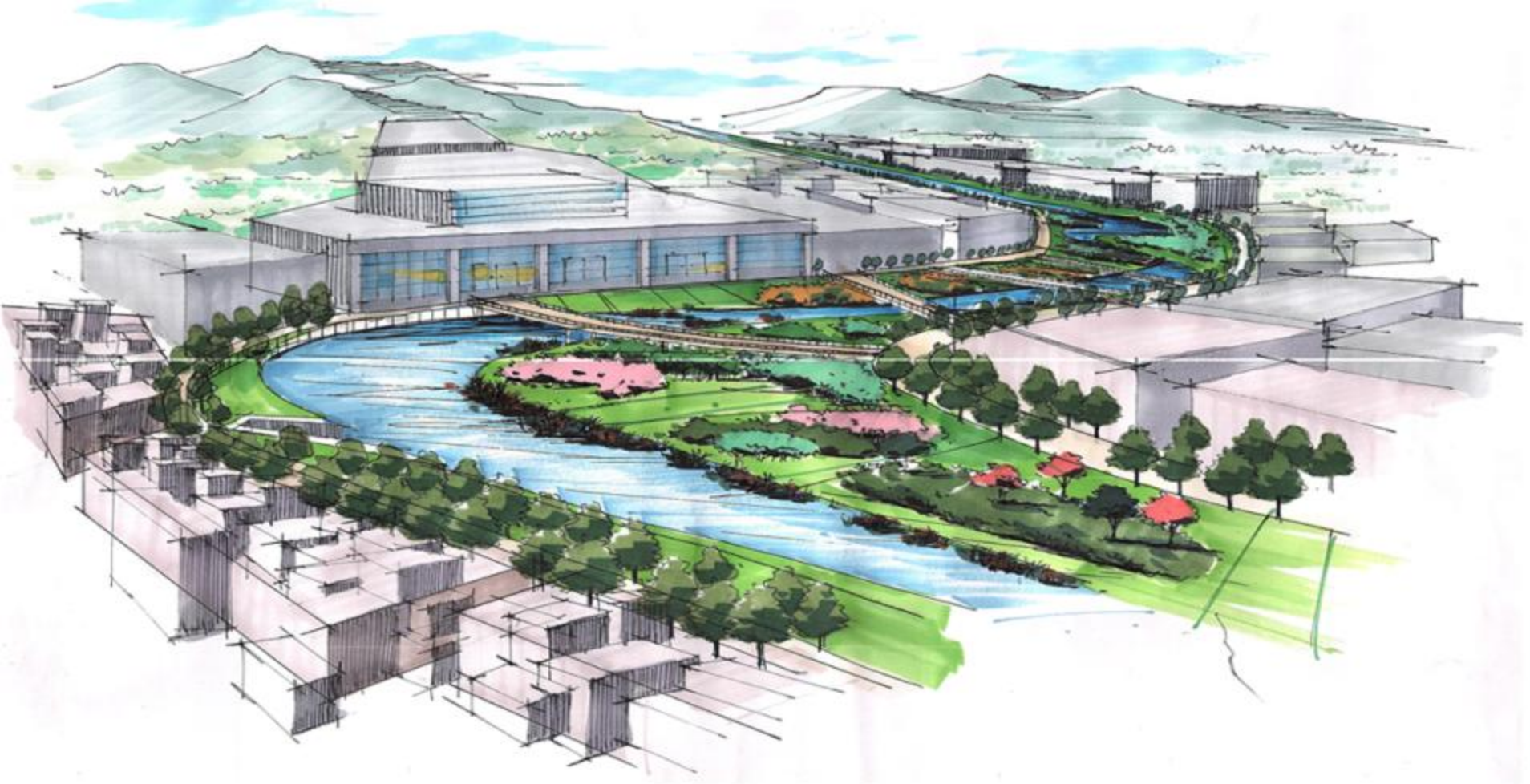


Regulation of Shenzhen River Stage IV
- A New Sustainable and Ecological Approach

深圳市治理深圳河办公室
SHENZHEN RIVER REGULATION OFFICE
SHENZHEN MUNICIPAL GOVERNMENT

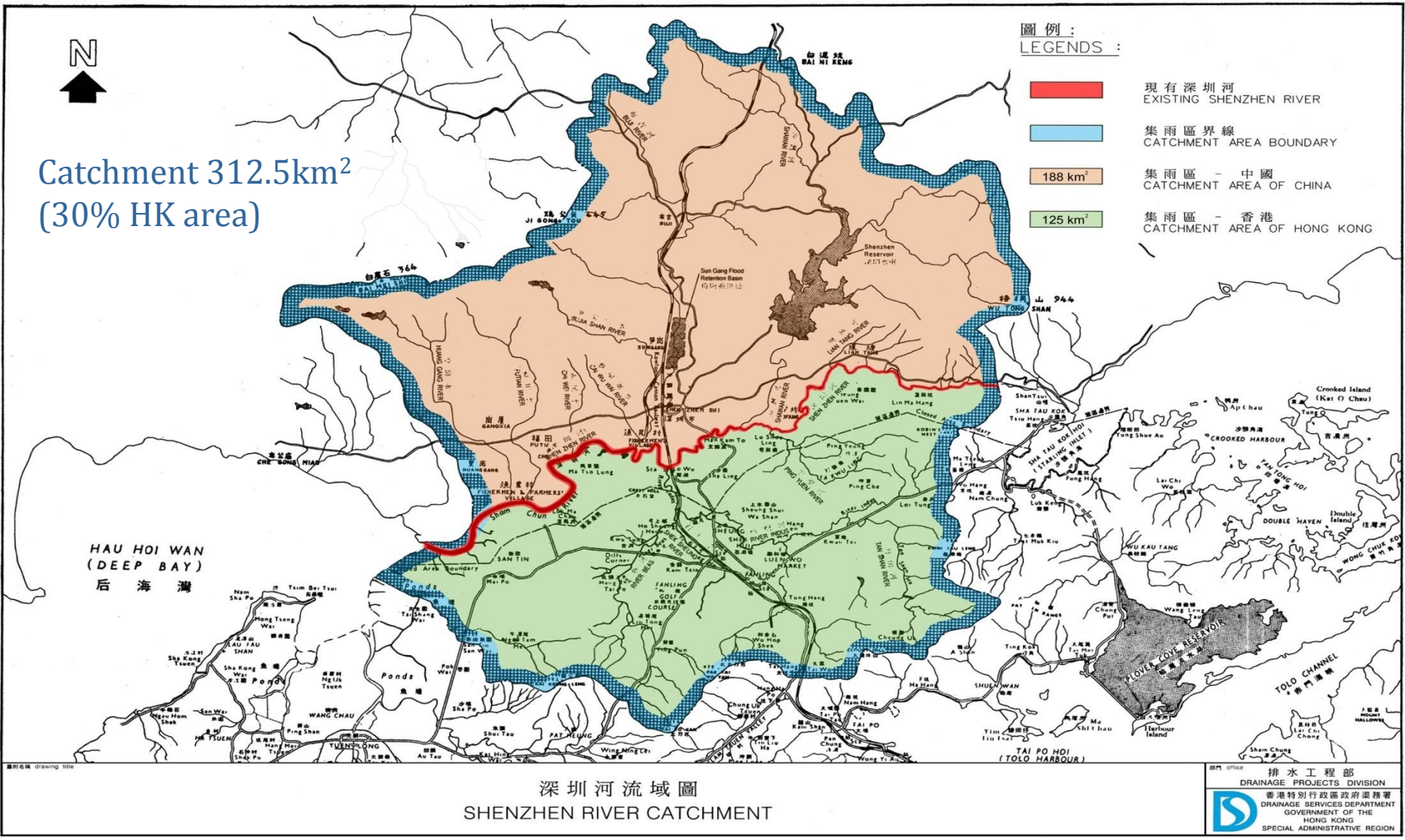
Drainage Services Department
渠務署

深圳市水务规划设计院
SHENZHEN WATER PLANNING & DESIGN

BLACK & VEATCH
Building a world of difference.

1. Introduction – Boundary River & Catchment

Catchment 312.5km^2
(30% HK area)



1. Introduction – Flooding before River Regulation

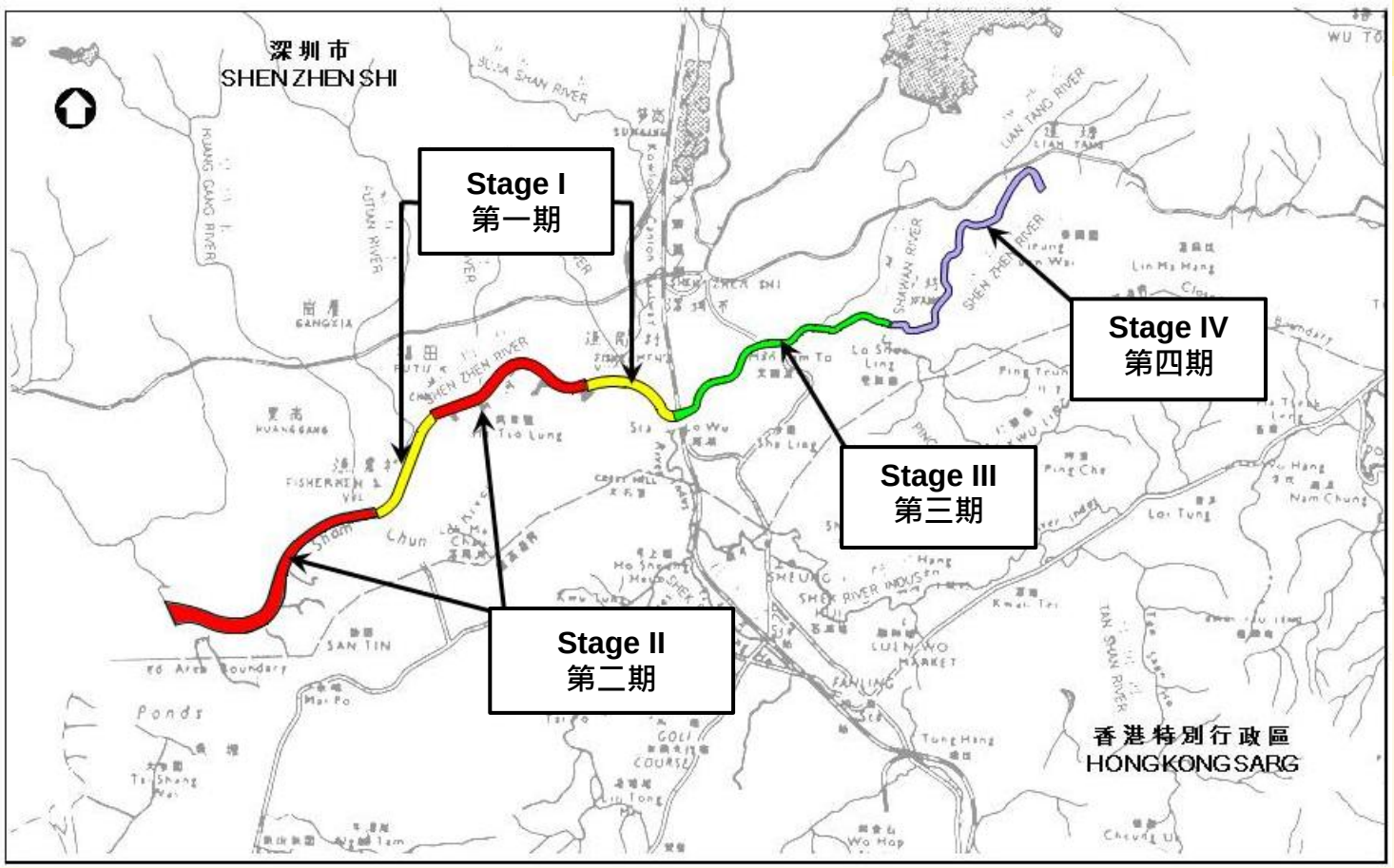
Lo Wu, September 1993

Muk Wu, September 1993

Ta Kwu Ling, August 2002

Ta Kwu Ling, May 2003

1. Introduction – Stages of River Regulation



13.5 kilometers of Shenzhen river was regulated under Stages I, II and III between 1995 and 2006.

1. Introduction - Completed Stages I, II & III Works

Shenzhen River Regulation Stage I

Shenzhen River Regulation Stage II

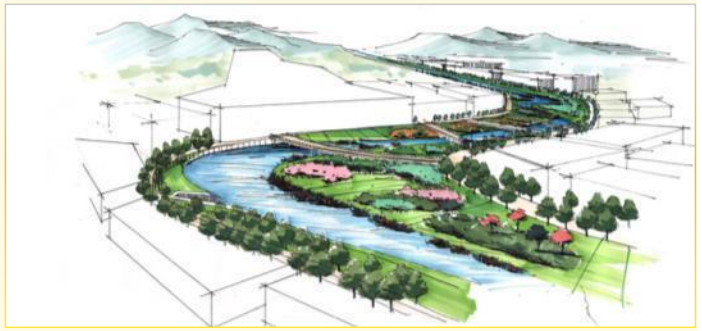
Shenzhen River Regulation Stage III

Shenzhen River Regulation Stage III

1. Introduction – Stage IV Regulation Works

Project Scope & Programme:

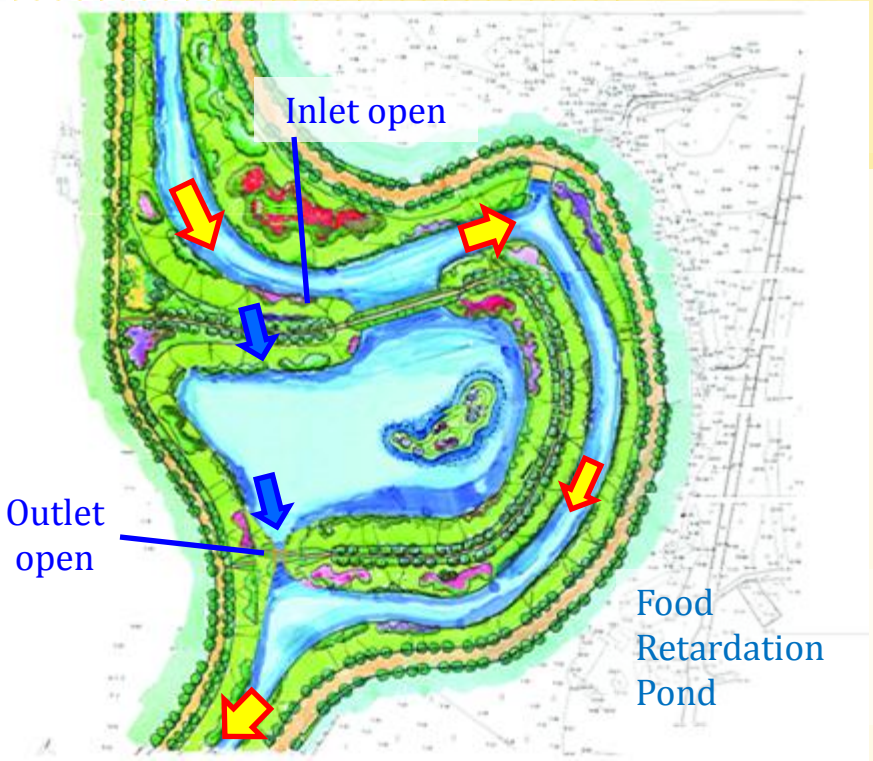
- Regulation of about 4.5km long river channel of Shenzhen River between Ping Yuen River and Pak Fu Shan
- Construction of a flood retardation basin with a capacity of about 80,000 m^3
- Commenced in August 2013 for scheduled completion in late 2017



1. Introduction – Flood Retardation and Ecological Concept

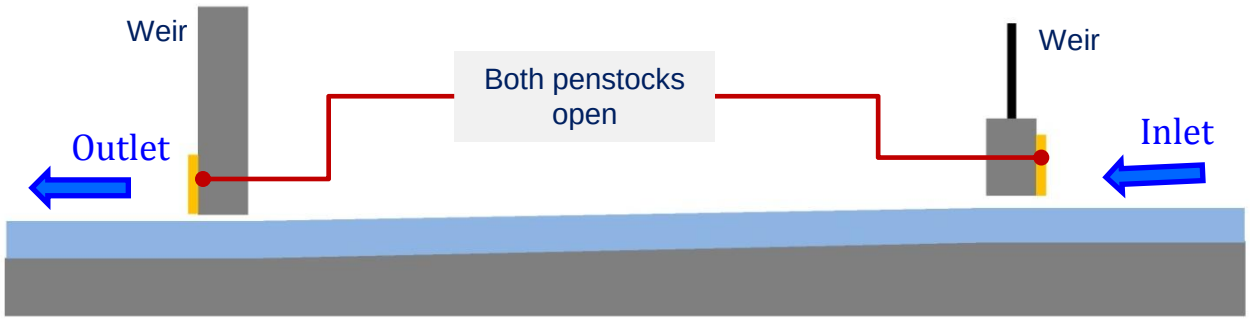
- Flood Retardation Pond to attenuate downstream peak flow within 230m^3/s under a 50-yr rainfall event.
- Ecological concept adopted in design

2. Flood Retardation Pond - Dry Weather Operation



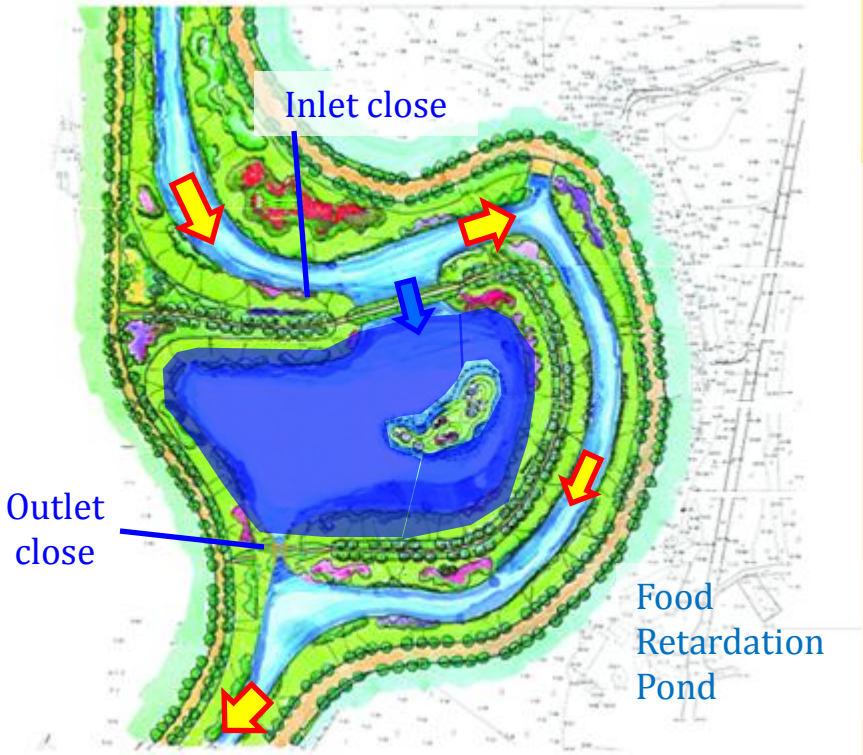
Dry weather operation:

- part of the flow enters via inlet
- returns to the river via outlet
- natural purification through the aquatic plantation in pond



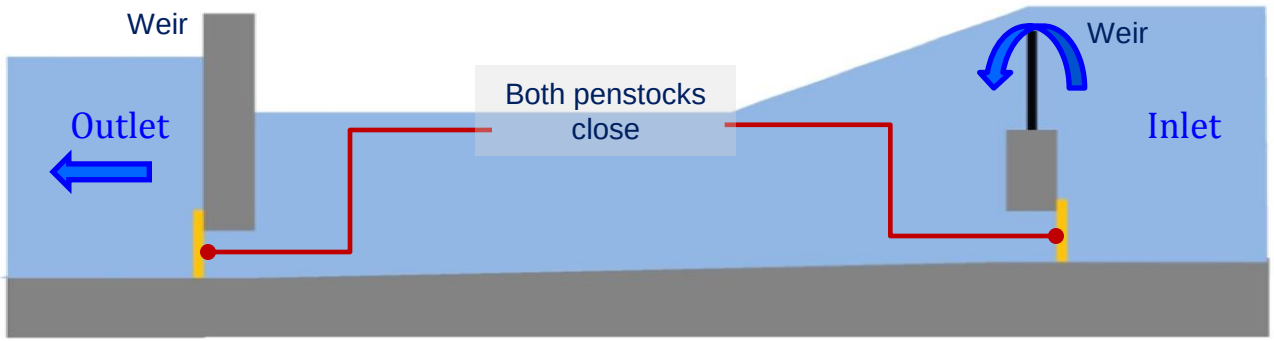
Cross Section of Food Retardation Pond

2. Flood Retardation Pond - Wet Weather Operation



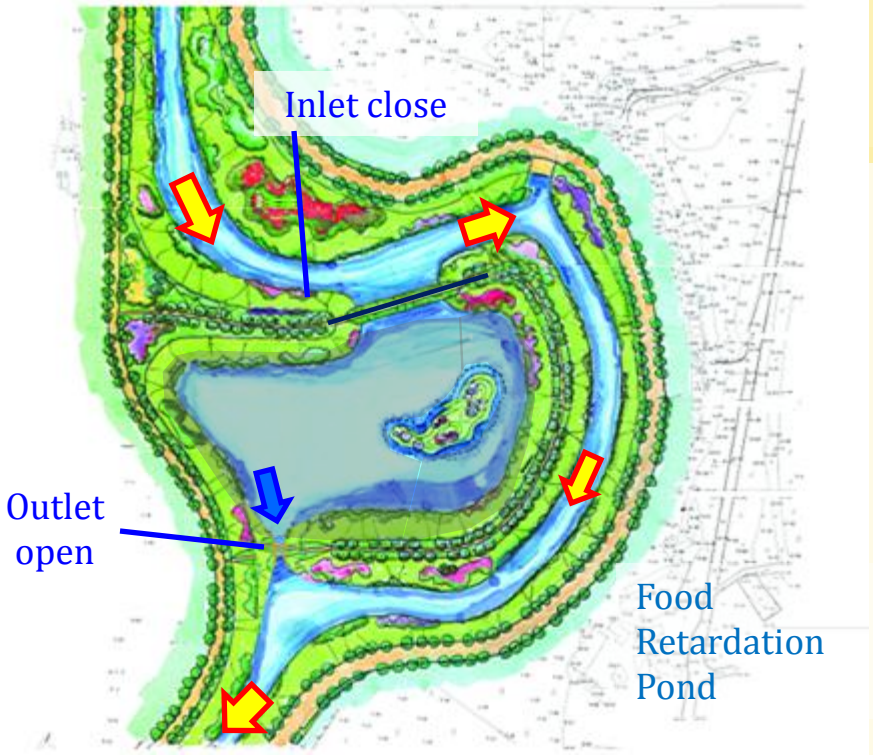
Rainstorm operation:

- part of runoff overflows the weir
- store in pond temporarily
- downstream flow thus limited to 230m^3/s in 50-year rainfall event



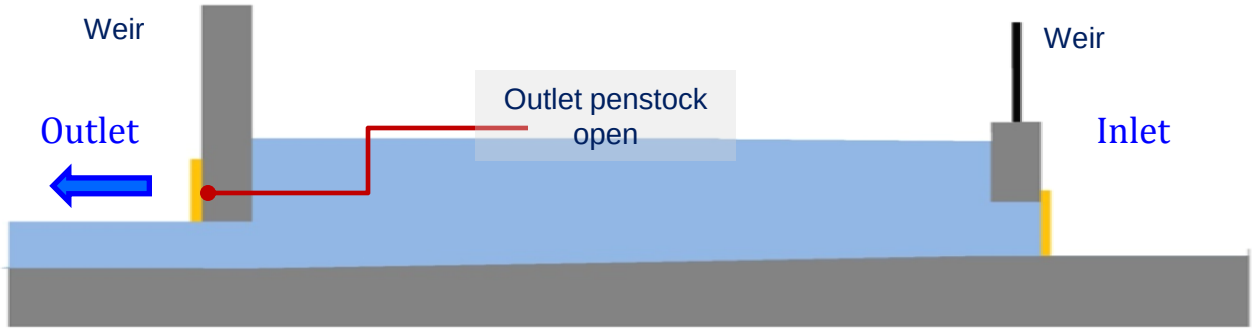
Cross Section of Food Retardation Pond

2. Flood Retardation Pond - After Rainstorm Event



After rainstorm operation:

- water release from pond via outlet

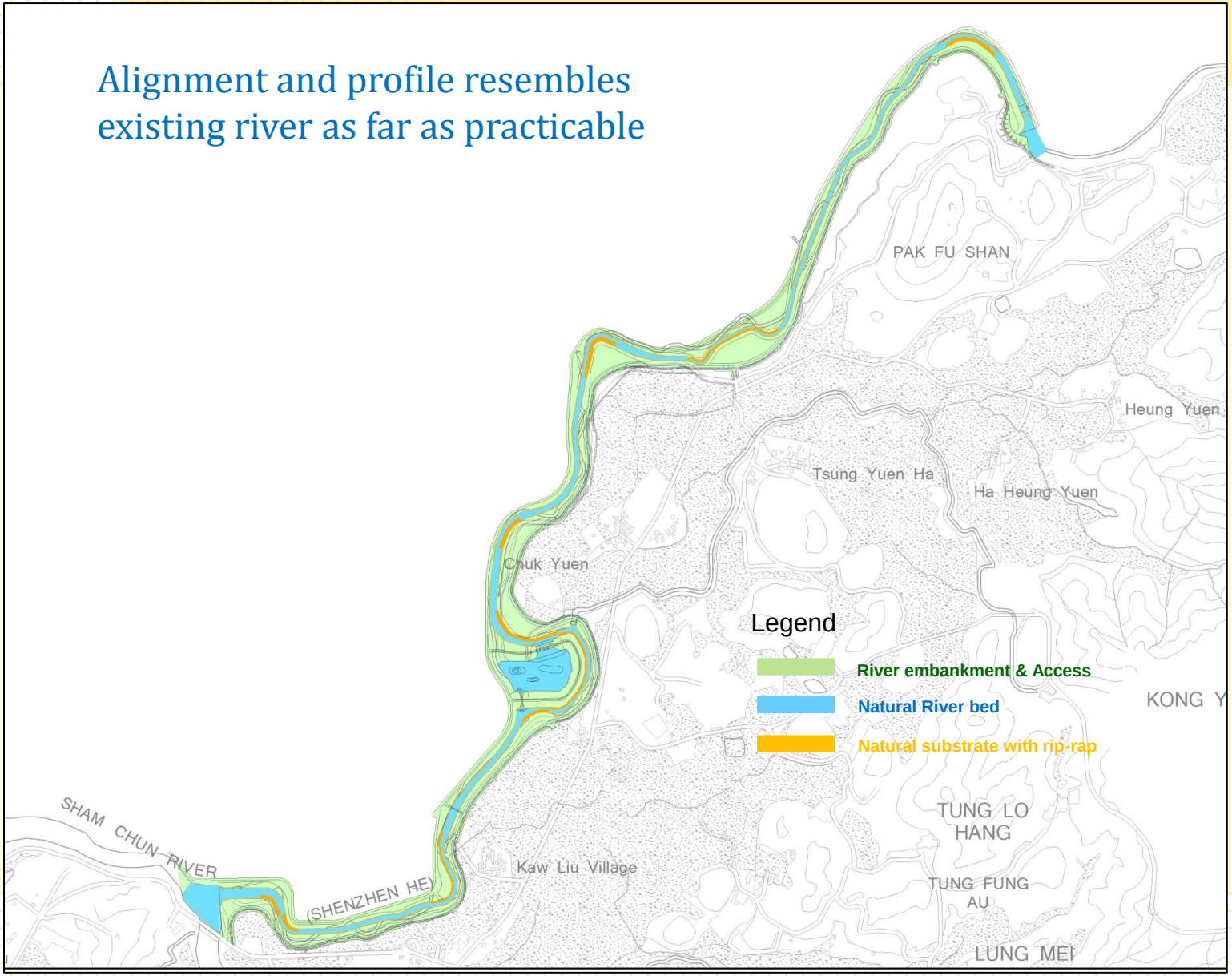


Cross Section of Food Retardation Pond

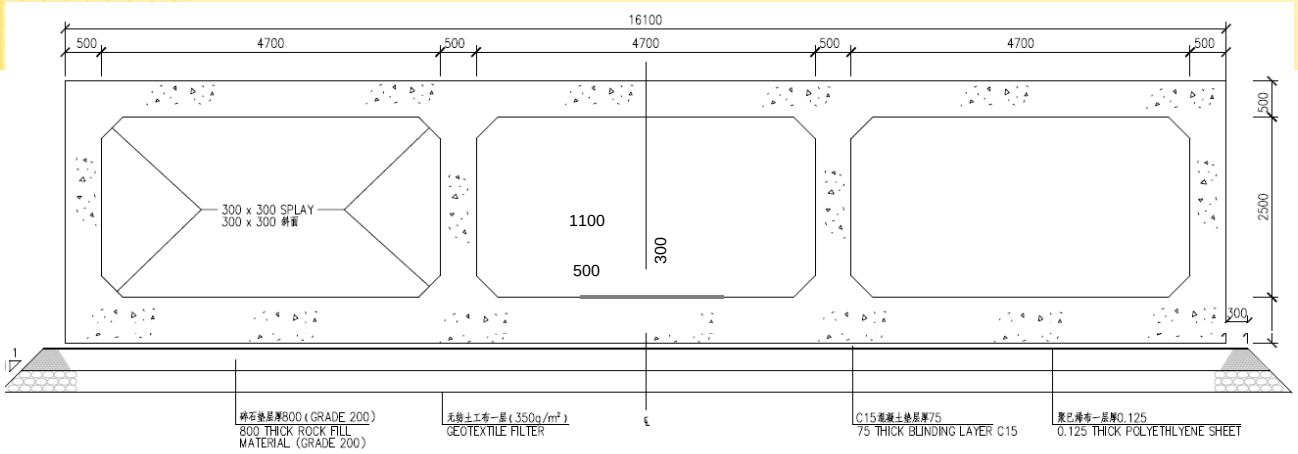
3. Ecological River Concept

3. Ecological River Concept – Alignment and Profile

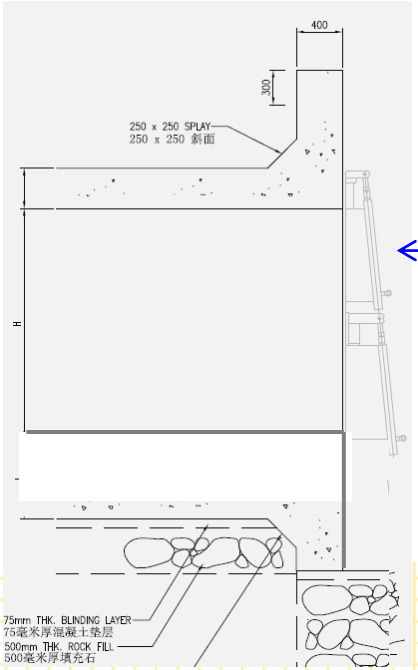
Alignment and profile resembles existing river as far as practicable



3. Ecological River Concept – Ecological Connectivity with Tributaries



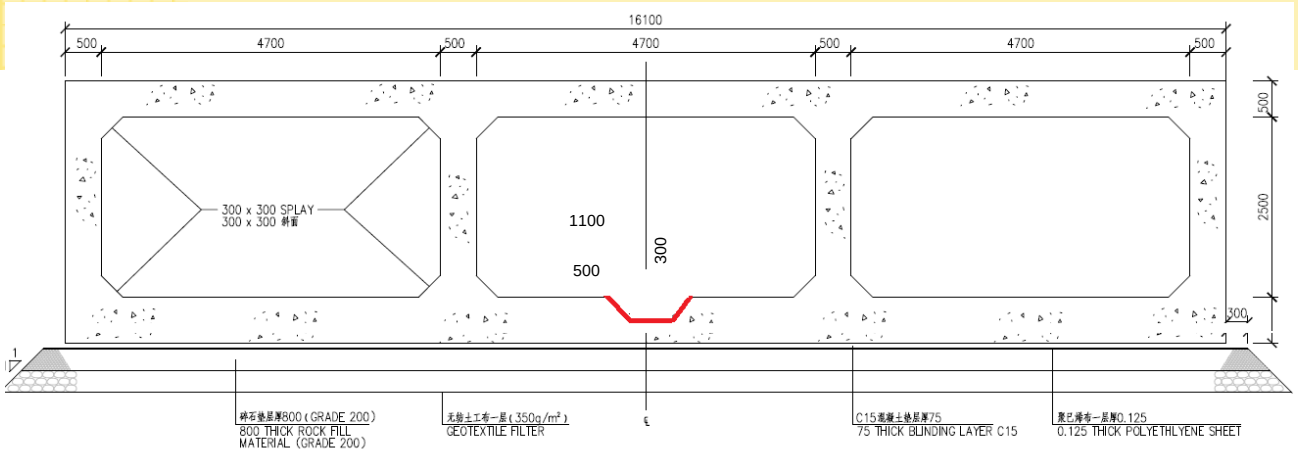
Typical Section (Original Design)



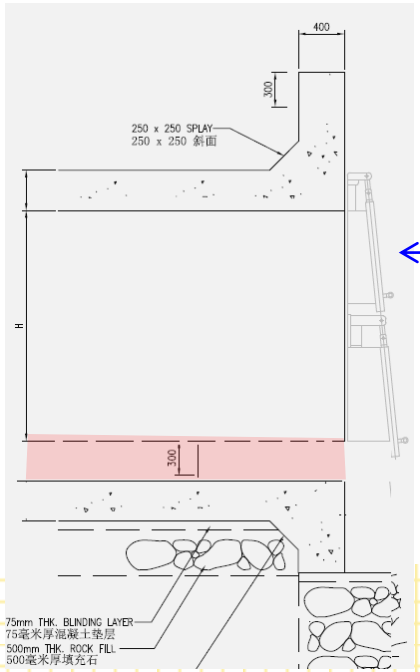
Flap Valve

No connectivity with tributary at Kong Yiu River when flap valve is closed.

3. Ecological River Concept – Ecological Connectivity with Tributaries



Typical Section (Revised Design)



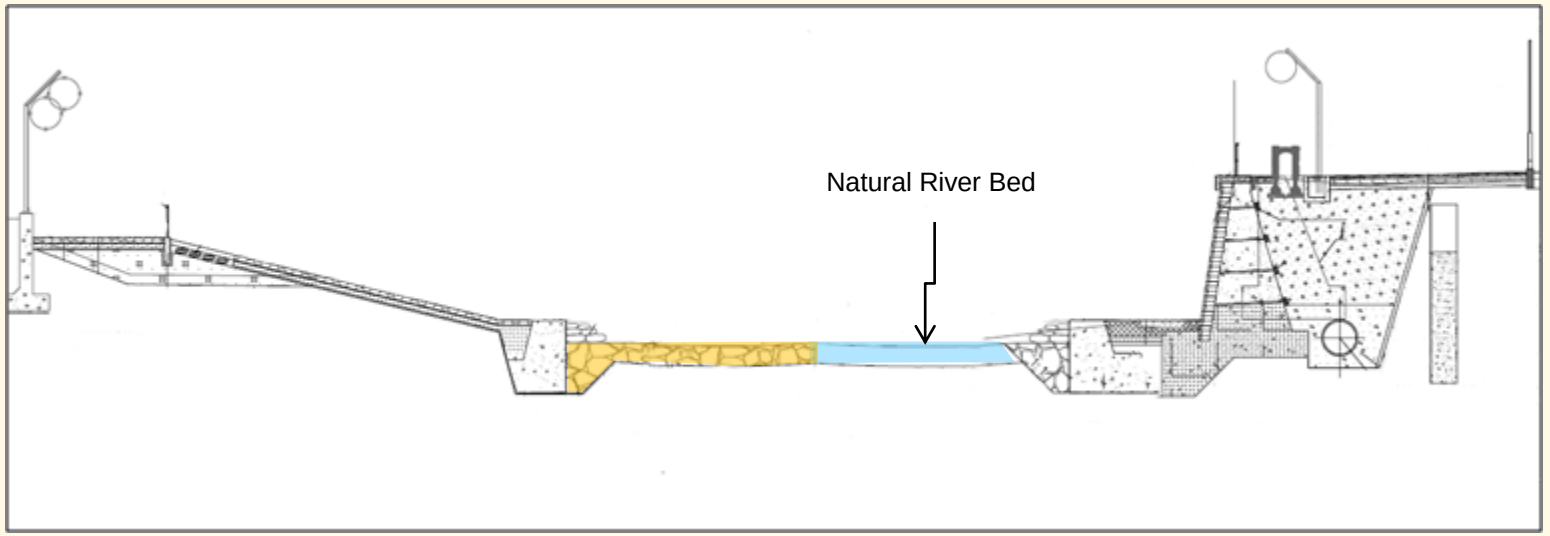
Flap Valve

Connectivity enhanced by:

1. providing a 300mm low flow channel as ecological passage below flap valve;

2. matched riverbed levels at river confluence.

3. Ecological River Concept – Maximise use of Natural Substrate

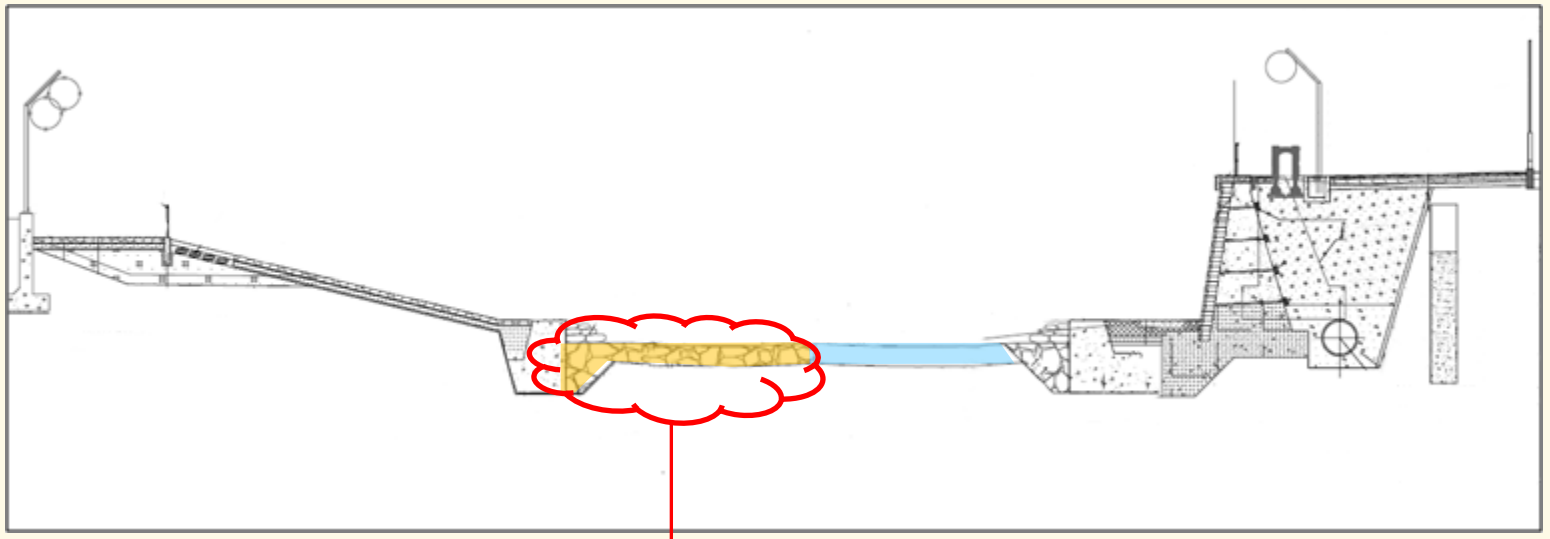


Original Design

Use of Riprap to form protection layer:

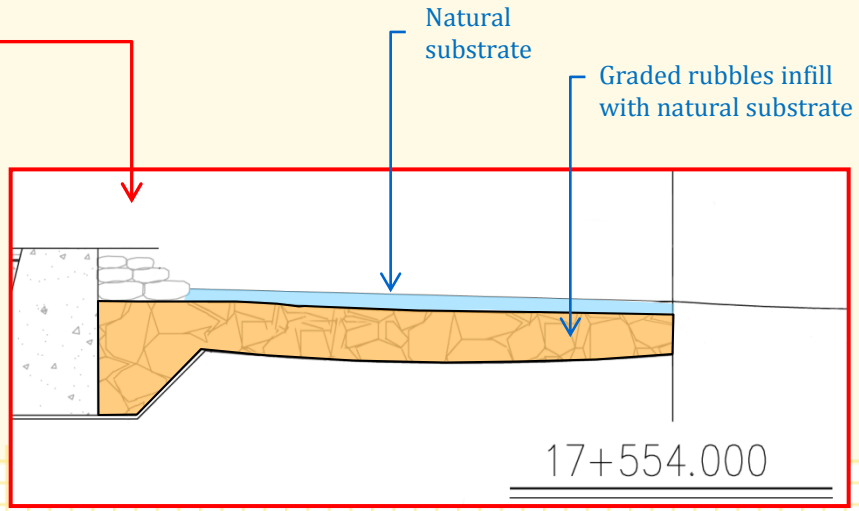
- Different size of rubble in riprap
- Provide at inner side of river bends

3. Ecological River Concept – Maximise use of Natural Substrate

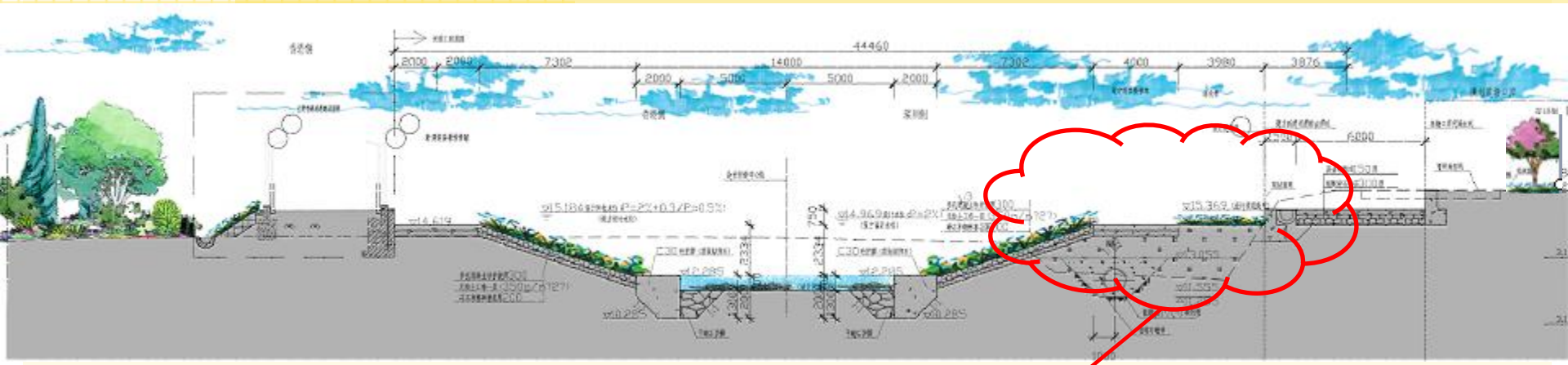


Revised Design

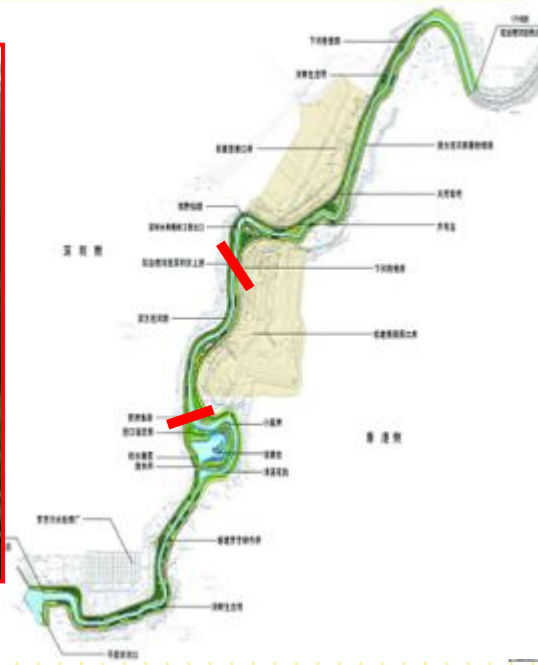
- Graded rubbles
- 100mm below river bed.
- Natural substrate infill & on top



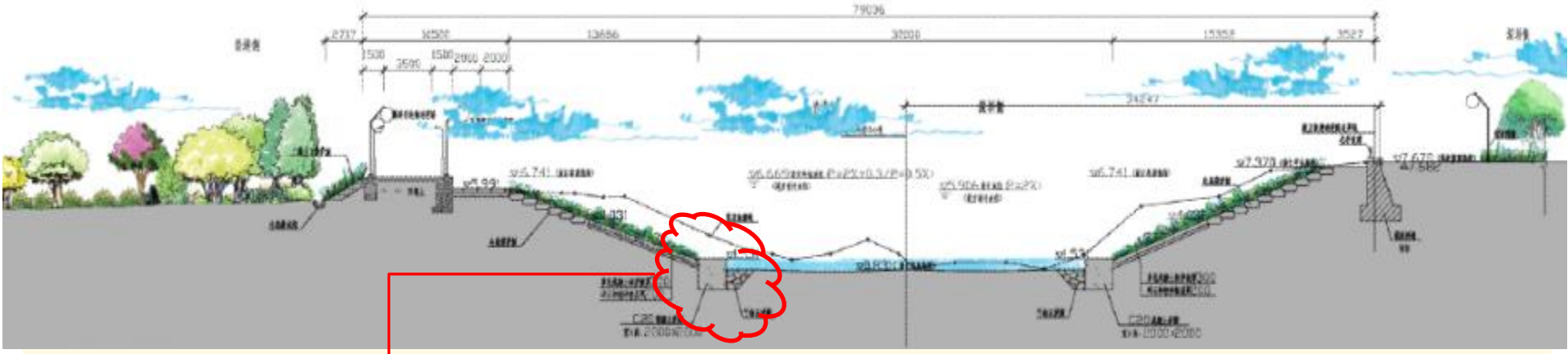
3. Ecological River Concept – Floodplain at River Bends



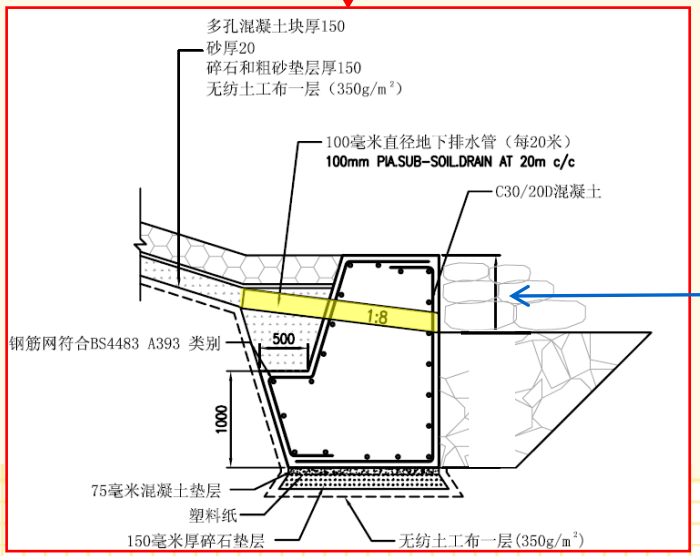
Floodplains at river bends to provide suitable ecological habitats



3. Ecological River Concept – Ecological Connectivity

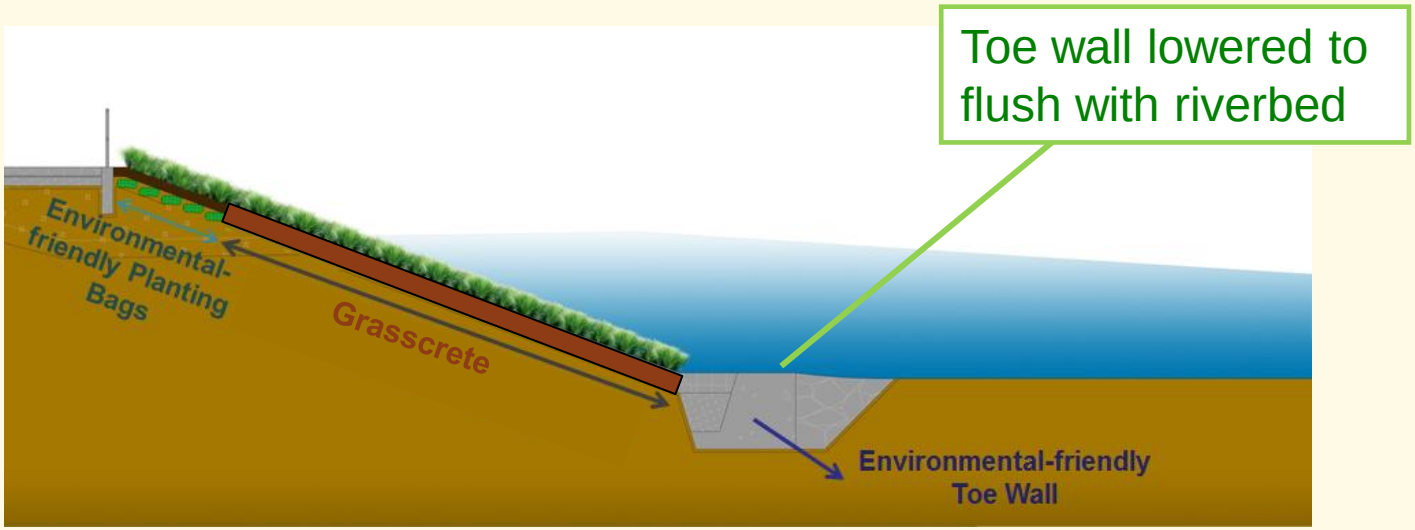


Typical Cross-Section in Original Design

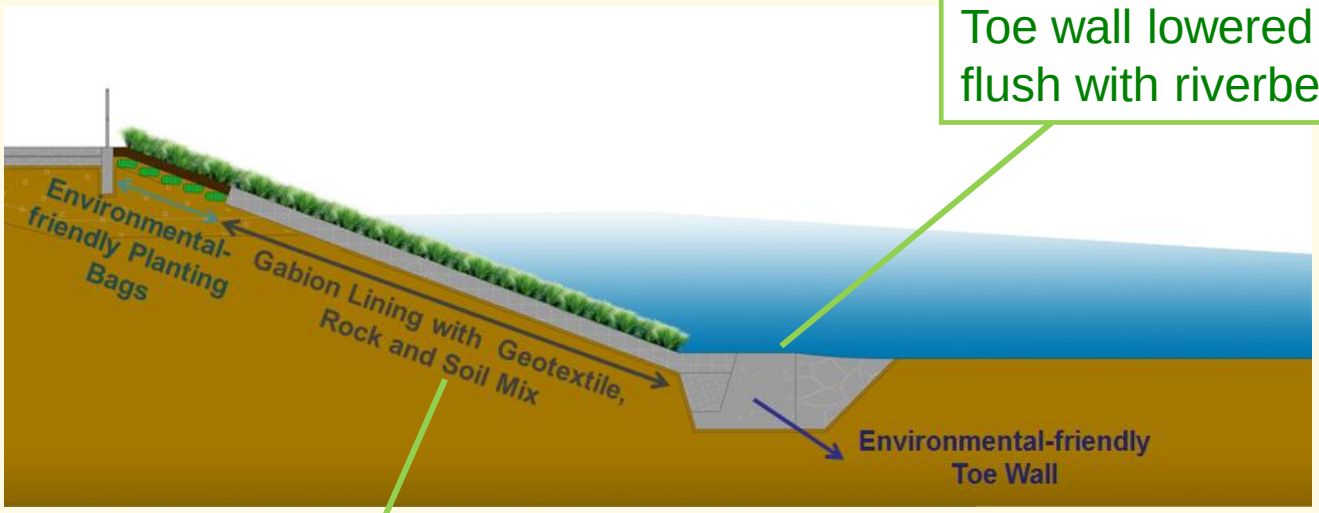


700mm step in original toe wall design prohibits connectivity between river and riverbank.

3. Ecological River Concept – Ecological Connectivity



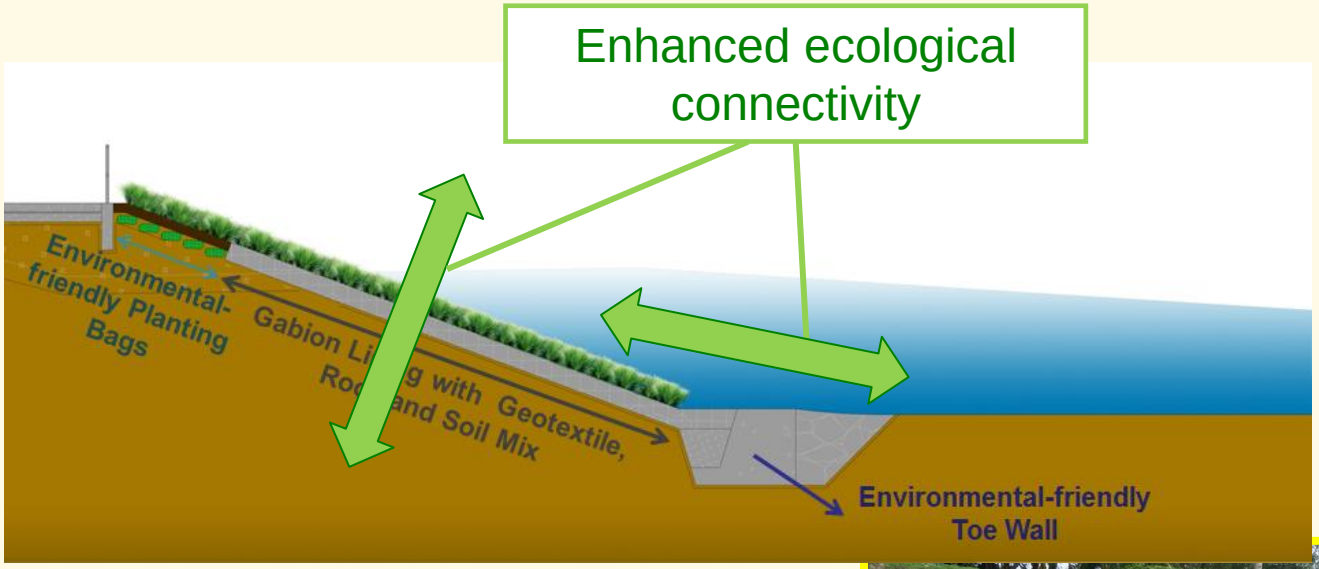
3. Ecological River Concept – Ecological Connectivity



Toe wall lowered to flush with riverbed

Grasscrete replaced by gabion

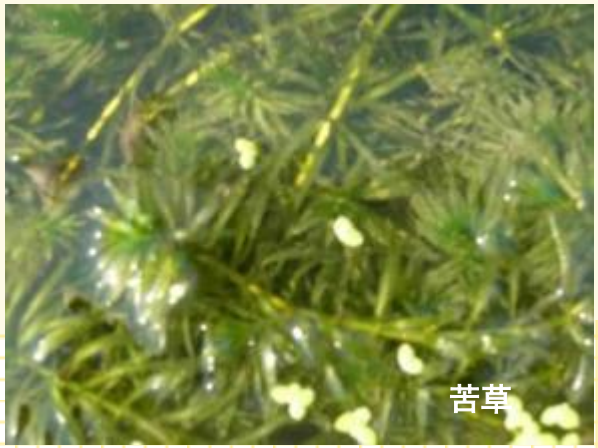
3. Ecological River Concept – Ecological Connectivity



Example on use of gabion / ecological bag at riverbank

3. Ecological River Concept in Flood Retardation Pond

Suitable aquatic plants and riparian vegetation provided to enhance the water quality and the ecological value



4. Hydraulic Modelling Approach – Computer Modelling

Existing Flood Extent under 50-year Rainfall Event

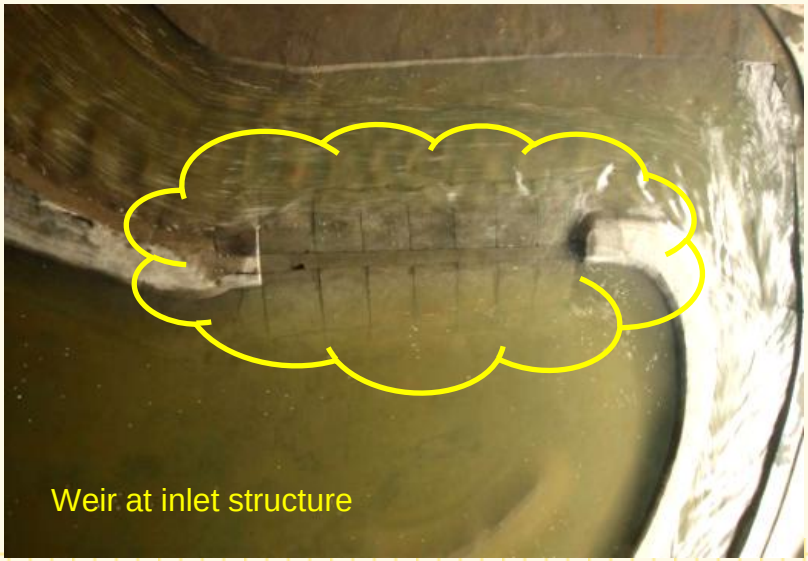
4. Hydraulic Modelling Approach – Computer Modelling

Improved Flood Extent under 50-year Rainfall Event

4. Hydraulic Modelling Approach – Physical Modelling

Simulates flow patterns inside the Flood Retardation Pond

Different weir levels were tested to optimize the design, thus minimising hydraulic impact to downstream river



Weir at inlet structure

4. Hydraulic Modelling Approach – Physical Modelling

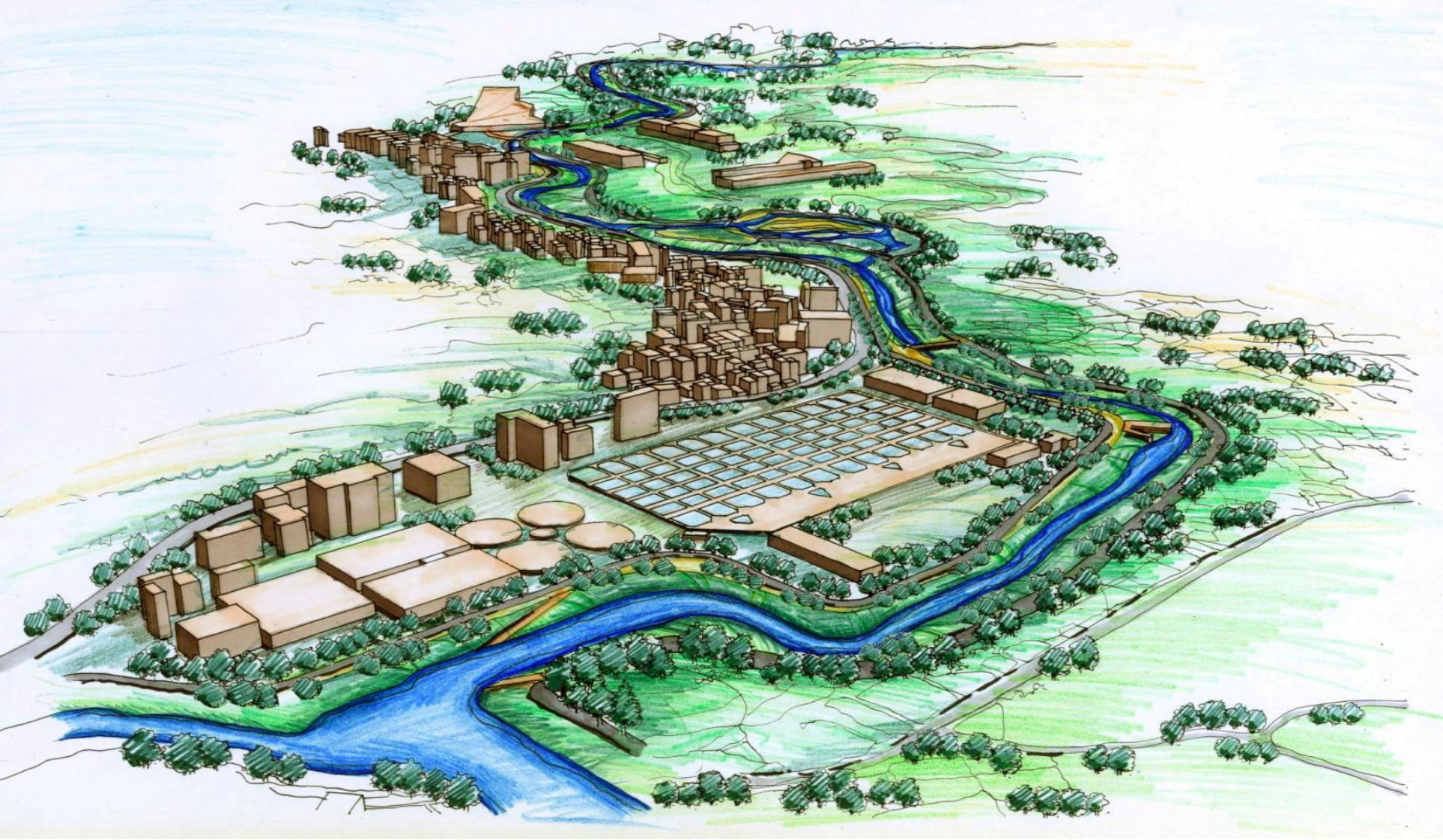
Shapes of weir and flow diversion wall optimised to achieve even and steady flow through the overflow weir

5. Conclusion – A New Sustainable and Ecological Approach

Use of flood retardation pond
for flow attenuation

Adopt ecological river concept in
design and detailing

Computer modelling coupled
with the use of physical model



THE END

THANKS

2014.11

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