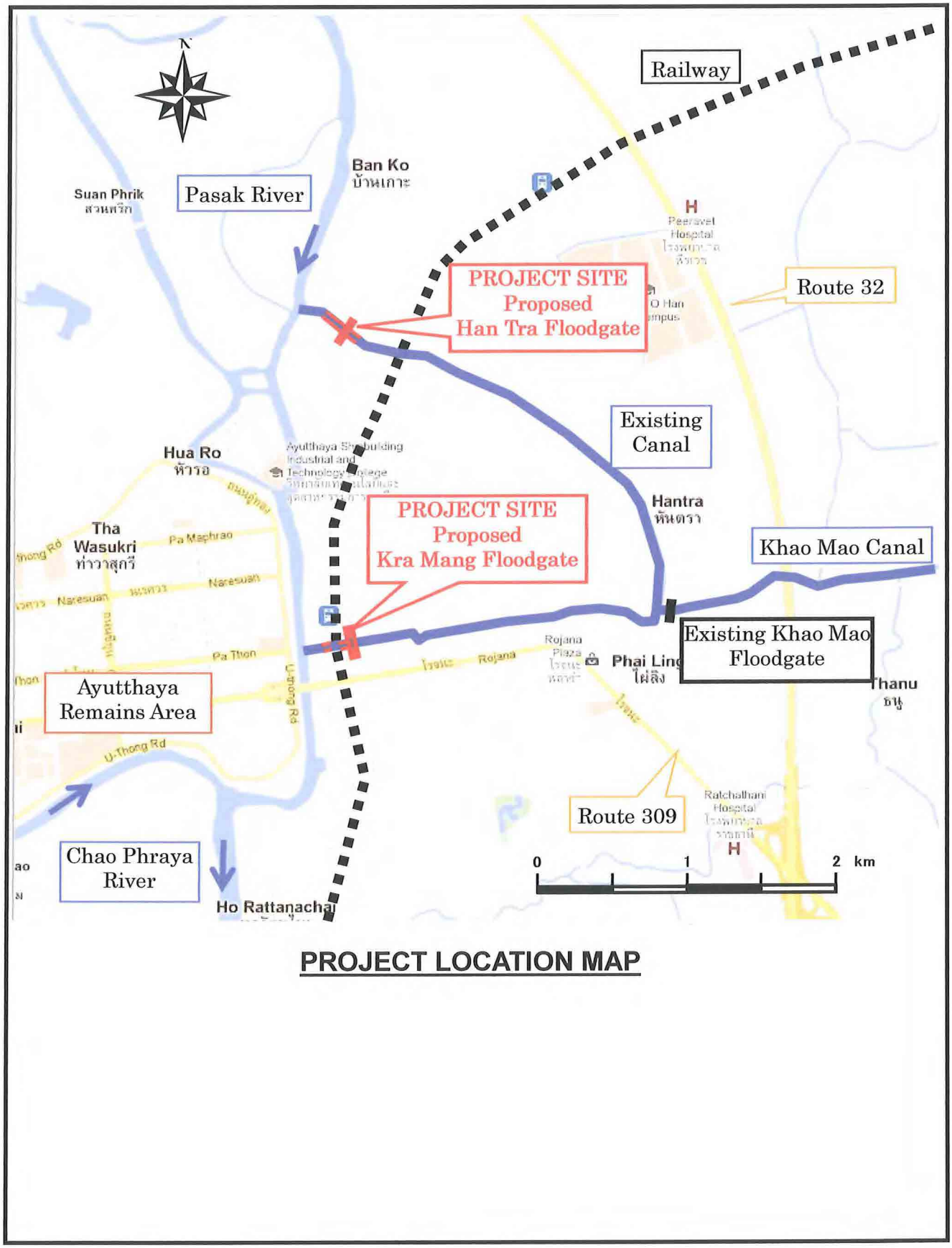
資料８

テクニカルノート

TECHNICAL NOTE

In the technical meetings held on the 15th day of May, 2012 attended by the Royal Irrigation Department (hereinafter called "RID") and the JICA Survey Team (hereinafter called "the Team"), the basic conditions for the design of two floodgates (Kra Mang and Han Tra) and river protection works were discussed. A list of attendance is shown in Attachment-1. The following design conditions set based on the meetings were reconfirmed between RID Regional Irrigation Office 10 and the Team.

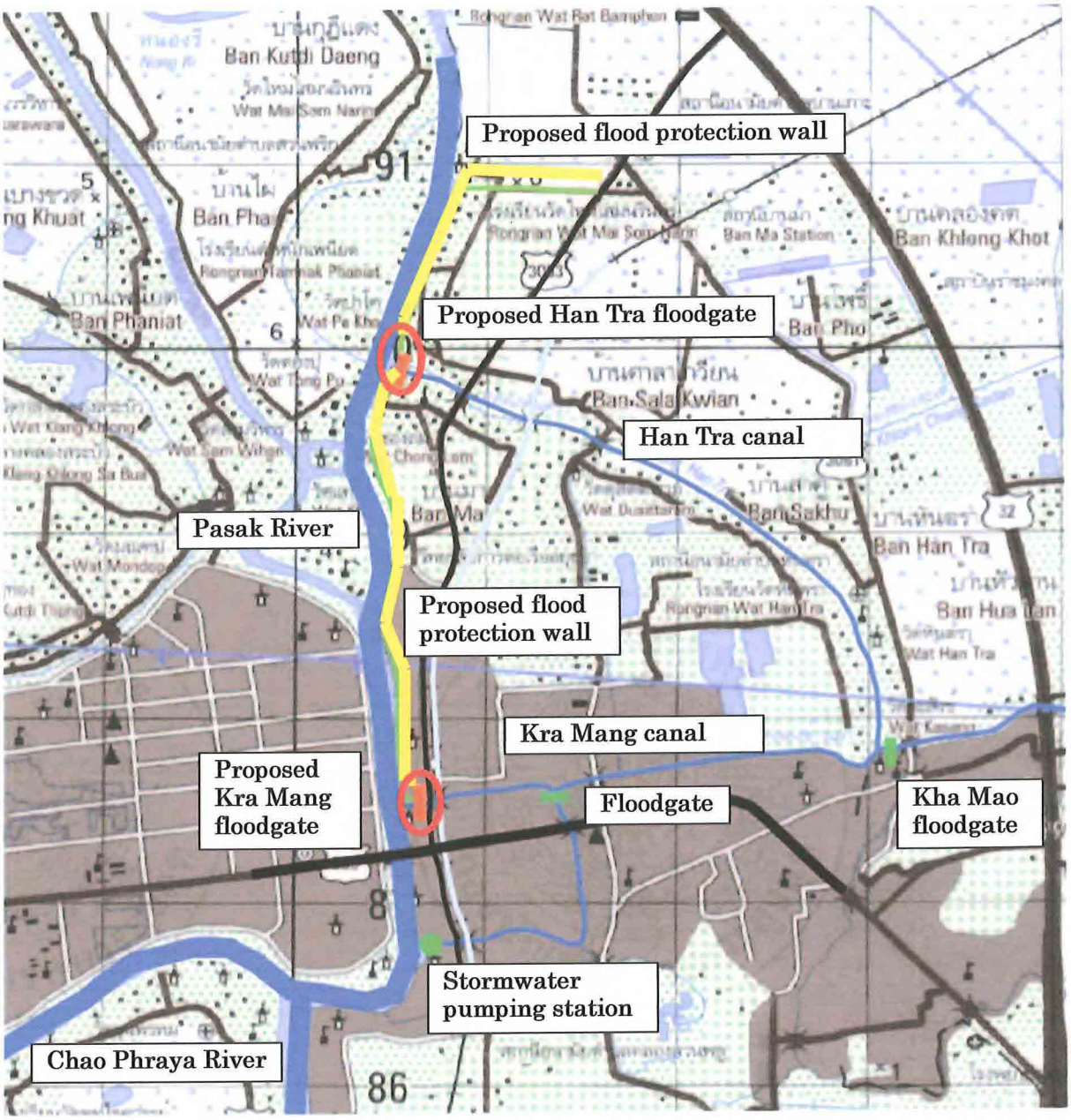
The Team stated that the agreed design conditions are tentative and that the final decision shall be made after further analysis and consultation with JICA and concerned parties in Japan, and RID Regional Irrigation Office 10 understood it.



PROJECT LOCATION MAP

REEVALUATION FOR FLOOD MITIGATION PLAN AT EASTERN AREA OF PASAK RIVER

Royal Irrigation Department (RID) under Ministry of Agriculture and Cooperatives (MOAC) had a flood mitigation plan at the eastern area of the left bank of the Pasak River. It consisted of two floodgates and permanent flood protection wall. The Han Tra floodgate was proposed at the confluence of the Pasak River and the Han Tra canal and The Kra Mang floodgate was also proposed at the confluence of the Pasak River and the Kra Mang canal. On the other hand, the permanent flood protection wall was proposed to connect between the Han Tra floodgate and the Kra Mang floodgate and from the Han Tra floodgate to the existing road located at about 2 km far from the Han Tra floodgate.



RID's Original Flood Mitigation Plan at the Eastern Area of the Left bank of the Pasak River

The Government of Thailand (GOT) requested the Government of Japan (GOJ) to carry out construction of two floodgates. And GOT planned to construct the permanent flood protection wall by own budget. In the public consultation meeting on February 2012, the stakeholders disagreed to construct the Kra Mang floodgate at the planned location and they requested to change the construction site from the original site (about 10m far from the Pasak Rivrer) to the site between the road bridge and the railway bridge. And

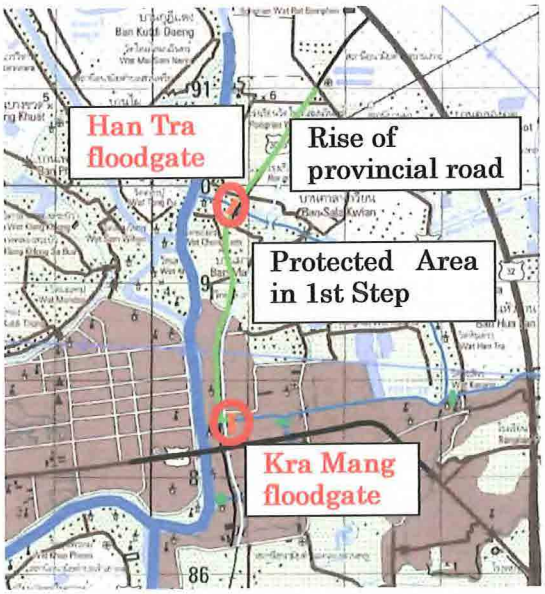
the flood protection wall construction was also disagreed because many resettlements were required along the Pasak River.

It was indicated that the construction works of the floodgates and flood protection wall was not able to carry out same time.

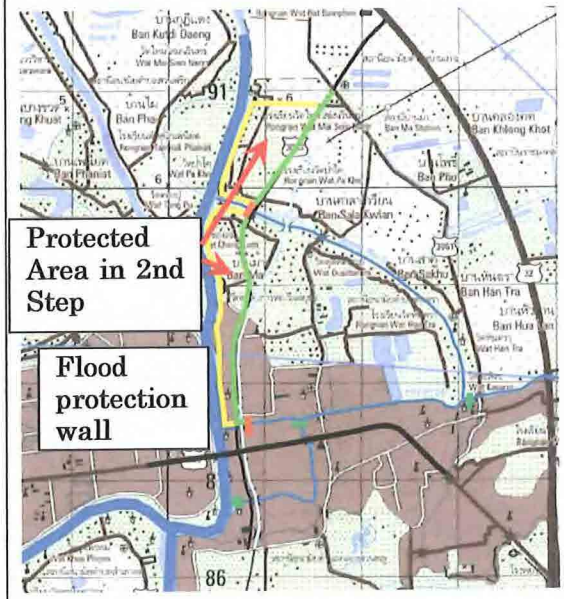
Therefore, the original plan was modified to stepwise development and RID agreed to it.

1st step (Grant Aid): Construction of two floodgates and to connect existing road by the wall. To protect eastern area of the existing road (Route 3053)

2nd step (GOT budget): Flood protection wall and connection wall between flood protection wall and the floodgates. To protect remaining area between the Pasak River and the existing road (Route 3053)



1st Step:
Construction of Han Tra and Kra Mang Floodgates by Japans' Grant Aid and Rise of Provincial Road by GOT Budget



2nd Step:
Construction of Flood Protection Wall along Pasak River by GOT Budget

Amended Flood Mitigation Plan at the Eastern Area of the Left bank of the Pasak River

DESIGN CONDITIONS AGREED BETWEEN RID AND THE TEAM

1. Design of Floodgates

1.1 Technical Reference for Designing

The following codes, standards, guidelines and manuals are principal used in establishing design conditions of structures:

- Thai Industrial Standard (TIS)
- Japanese Industrial Standard (JIS)
- American Society for Testing and Materials (ASTM)
- American Concrete Institute (ACI)
- Japan Society of Civil Engineers (JSCE)
- Technical Criteria for River Works of Japan
- Engineering Manual for Irrigation & Drainage of Japan
- Royal Irrigation Department (RID) Standard.
- American Institute of Steel Construction (AISC)
- Japan Association of Dam & Weir Equipment Engineering
- European Committee for Standardization (CEN)
- International Electrotechnical Commission (IEC)
- Standard of the Japanese Electrotechnical Committee (JEC)
- The Standards of the Japan Electrical Manufacture's Association (JEM)
- Japanese Cable-makers Association Standards (JCS)
- Provincial Electricity Authority (PEA)

1.2 Procurement of Gate System

Gate system will be procured from Japanese juridical persons incorporated and registered under the laws of Japan. The procurement of the gate system, which will be in conformity with the specifications of this Project, in Thailand under full responsibility of the aforementioned Japanese physical persons or Japanese juridical persons will be acceptable.

1.3 Kra Mang Floodgate

1.3.1 Location

Kra Mang floodgate proposed to construct newly at just the upstream of the railway bridge, near the Ayutthaya railway station, over Kra Mang canal

Location of Proposed Kra Mang Floodgate

1.3.2 Main Body

1) Materials

Reinforced concrete made

2) Total Width of Floodgate

Span of piers: 8.0 m x 3 nos.
Pier width: 2.0 m x 4 nos.
Total width: 26.0 m

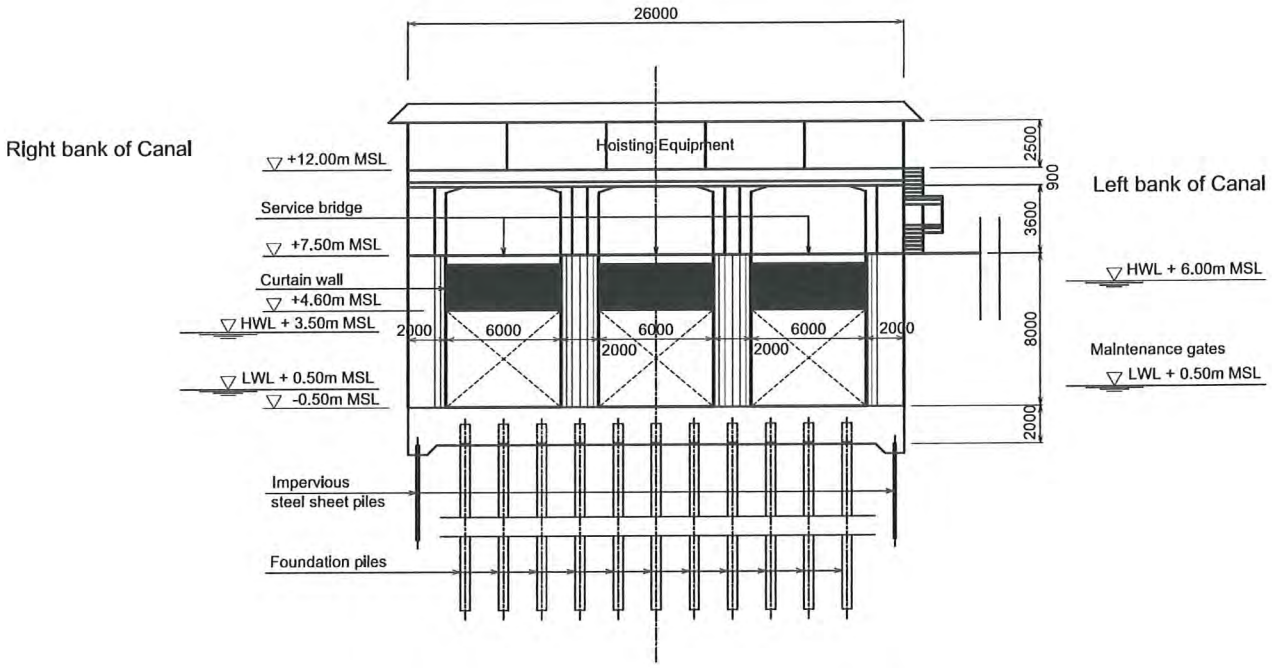
3) Design Water Level

Pasak side: HWL 6.0 m MSL as 2011 flood (same as HWL planned by RID)
LWL 0.5 m MSL

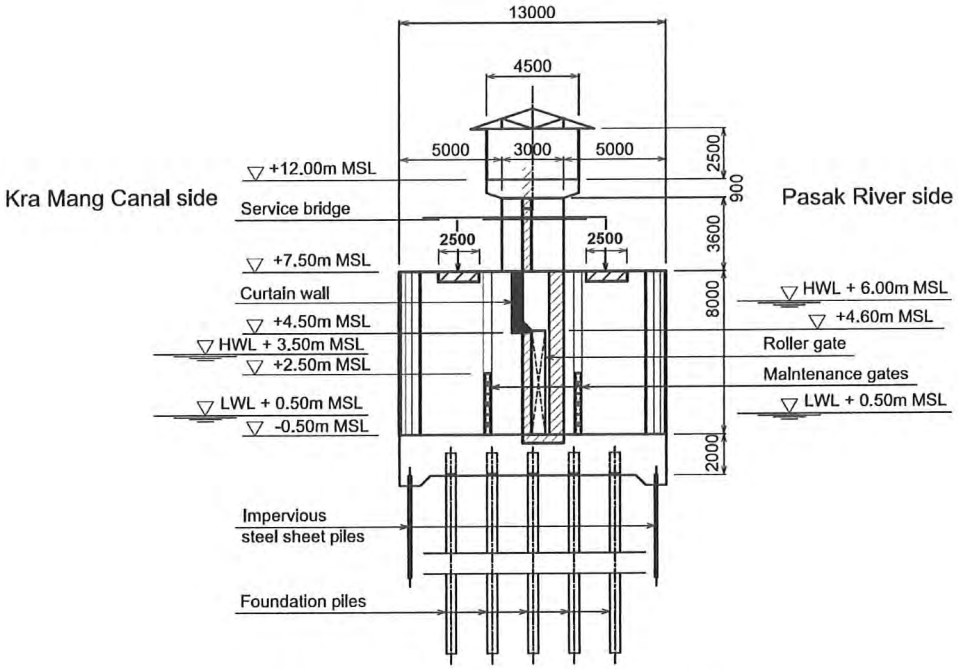
Canal side: HWL 3.5 m MSL same as at Khao Mao floodgate
LWL 0.5 m MSL

4) Freeboard

1.0 m above HWL 6.0m MSL



Front View of Proposed Kra Mang Floodgate



Section of Proposed Kra Mang Floodgate

1.3.3 Gates

1) Type
   Stainless steel made roller gates
2) Number of Gate
   Three (3) numbers
3) Clear Span
   6.0 m
4) Height
   5.1 m (5.0 m + Watertight area 0.1m)
5) Elevation of sill
   - 0.50 m MSL
6) Hoisting system
   Motorized wire-roped winch
7) Hoisting speed
   Ordinary time: 0.3m/min
   Emergent time: 1.5m/min
8) Lifting height
   Ordinary time: 5.0 m
   Inspection time: 6.0 m
9) Watertight system
   Rear 4 sided rubber watertight (Watertight at both sides of Pasak River and Canal)
   Curtain wall sealing at the upper area
10) Safety and protection device
   Device for the safety and protection of the gate leaves, electrical and mechanical equipment, and control circuit will be provided.
11) Power source
   3 phase x 4 wires x 380/220 V x 50 Hz
   Reception from the commercial electricity
12) Backup power source
   A generator will be considered.

1.3.4 Stoplogs

Stoplogs will be provided for repair and maintenance of the main roller gates during low water season.

1) Material: Metal

2) Size: 6.0 m (Clear span) x 1.0 m (Height) x 3 nos. x 2 sets (Pasak and Canal sides)

3) Hoisting device: Chain hoists

1.3.5 Service bridge

The service bridge will be provided among the piers at both sides of Pasak River and Canal for the convenience of the operation, inspection and maintenance works of the gate system.

The service bridges will be a foot bridge as follows,

1) Type: Reinforced concrete slab
2) Width: 2.5 m

1.3.6 Riverbank Protection

Riverbank protection for the right and left banks will be provided toward both Canal (upstream) and Pasak River (downstream) from the floodgate.

1) Length
   Canal side: Approximately 10 m
   Pasak side: To the embankment of the provincial road bridge
2) Type
   Canal side: Concrete retaining wall and sheet pile embedded concrete slope crib work
   Pasak side: Concrete retaining wall and Earth dyke

1.3.7 Riverbed Protection

Riverbed protection will be provided toward both Canal and Pasak River from the floodgate.

1) Length
   Canal side: Approximately 10 m
   Pasak side: To and underneath the provincial road bridge
2) Type:
   Canal side: Concrete apron with energy dissipater and Gabion mattress
   Pasak side: Concrete apron with energy dissipater and Gabion mattress

1.4 Han Tra Floodgate

1.4.1 Location

Han Tra floodgate will be also newly constructed at just the downstream of the provincial road bridge over Han Tra canal.

Location of Proposed Han Tra Floodgate

1.4.2 Main Body

1) Materials

Reinforced concrete made

2) Total Width of Floodgate

Span of piers: 8.0 m x 3 nos.
Pier width: 2.0 m x 4 nos.
Total width: 26.0 m

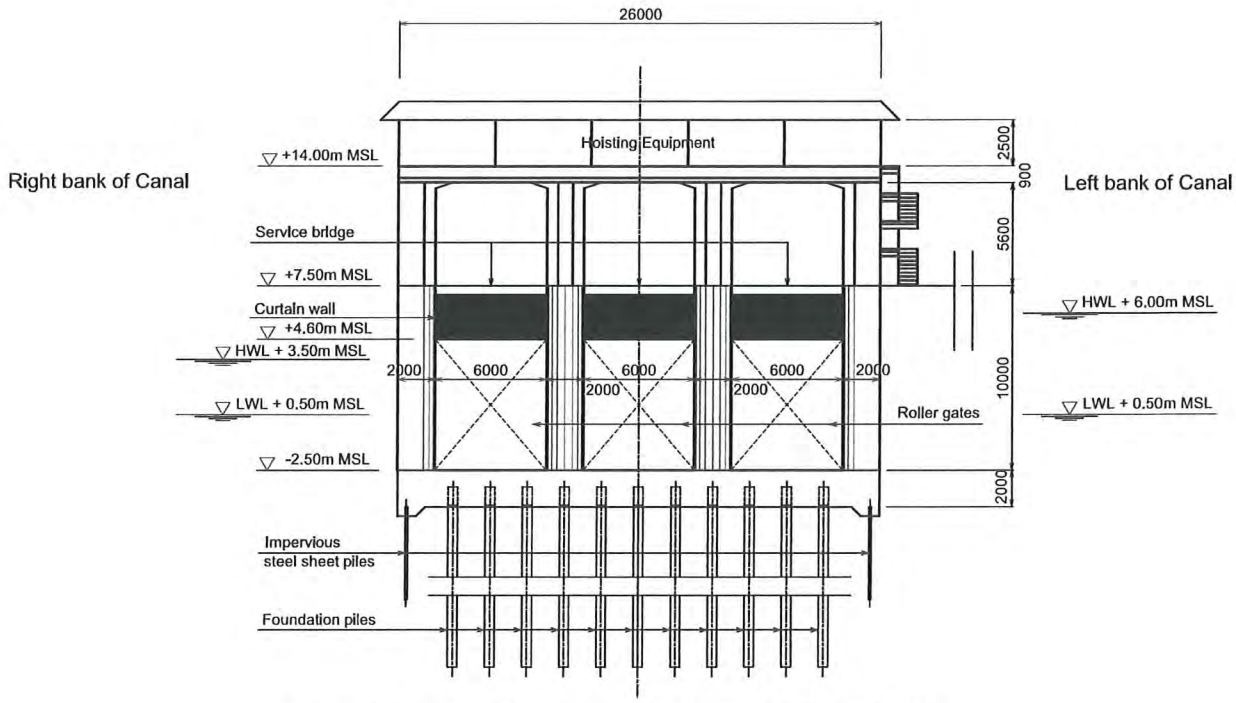
3) Design Water Level

Pasak side: HWL 6.0 m MSL as 2011 flood (same as HWL planned by RID)
LWL 0.5 m MSL

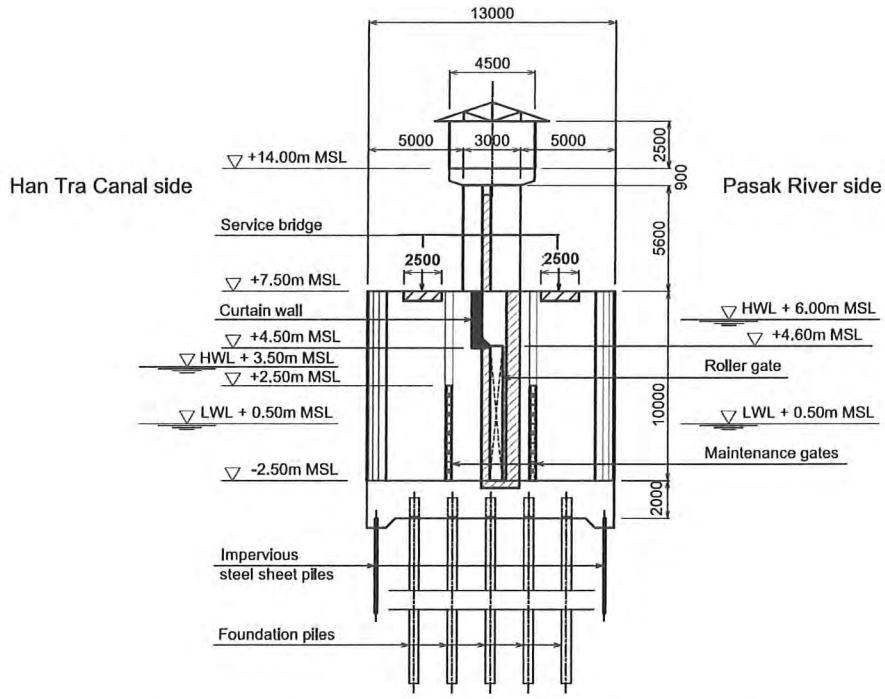
Canal side: HWL 3.5 m MSL same as at Khao Mao floodgate
LWL 0.5 m MSL

4) Freeboard

1.0 m above HWL 6.0m MSL



Front View of Proposed Han Tra Floodgate



Section of Proposed Han Tra Floodgate

1.4.3 Gates

1) Type
   Stainless or steel made roller gates
2) Number of Gate
   Three (3) numbers
3) Clear Span
   6.0 m
4) Height
   7.1 m (7.0 m + Watertight area 0.1m)
5) Elevation of sill
   - 2.50 m MSL
6) Hoisting system
   Motorized wire-roped winch
7) Hoisting speed
   Ordinary time: 0.3m/min
   Emergent time: 1.5m/min
8) Lifting height
   Ordinary time: 7.0 m
   Inspection time: 8.0 m
9) Watertight system
   Rear 4 sided rubber watertight (Watertight at both sides of Pasak River and Canal)
   Curtain wall sealing at the upper area
10) Safety and protection device
   Device for the safety and protection of the gate leaves, electrical and mechanical equipment, and control circuit will be provided.
11) Power source
   3 phase x 4 wires x 380/220 V x 50 Hz
   Reception from the commercial electricity
12) Backup power source
   A generator will be considered.

1.4.4 Stoplogs

Stoplogs will be provided for repair and maintenance of the main roller gates during low water season.

1) Material: Metal

2) Size: 6.0 m (Clear span) x 1.0 m (Height) x 5 nos. x 2 sets (Pasak and Canal sides)

3) Hoisting device: Chain hoists

1.4.5 Service bridge

The service bridge will be provided among the piers at both sides of Pasak River and Canal for the convenience of operation, inspection and maintenance of the gate system.

The service bridges will be a foot bridge as follows,

1) Type: Reinforced concrete slab

2) Width: 2.5 m

1.4.6 Riverbank Protection

Riverbank protection for the right and left banks will be provided toward both Canal (upstream) and Pasak River (downstream) from the floodgate.

1) Length

Canal side: To the embankment of the provincial road bridge

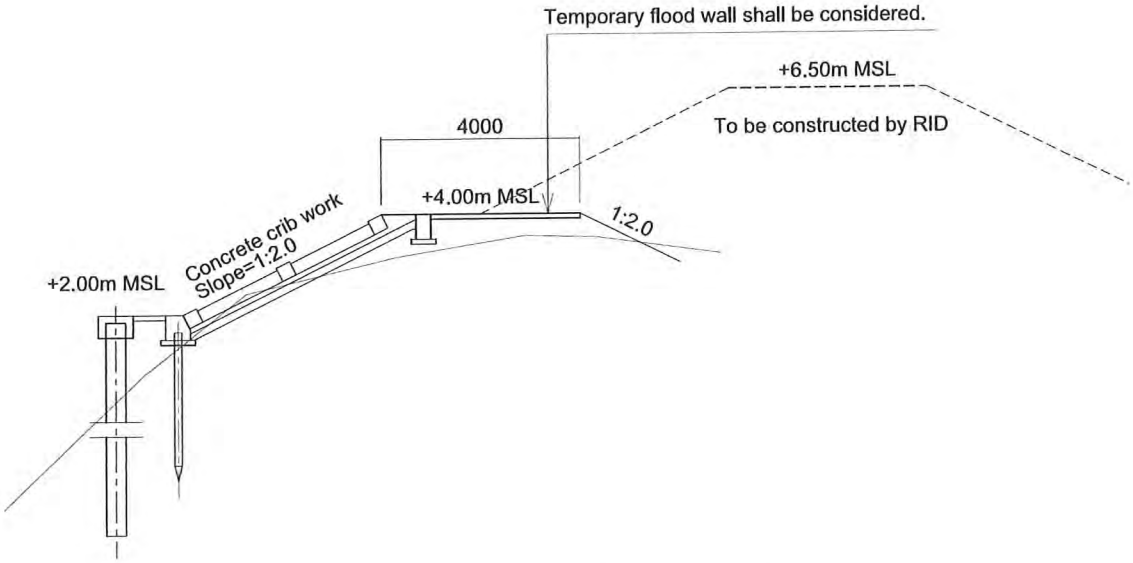
Pasak side: River protection work down to the confluence of Pasak River will be studied waiting for the result of an environmental and social study conducted by the Consultant.

Location of Riverbank Protection

2) Type

Canal side: Concrete retaining wall

Pasak side: Concrete retaining wall and sheet pile embedded concrete slope crib work with a temporary retaining wall



Typical Cross Section of Riverbank Protection

1.4.7 Riverbed Protection

Riverbed protection will be provided toward Canal and Pasak River from the floodgate.

1) Length

Canal side: To and underneath the provincial road bridge

Pasak side: Approximately 20 m

2) Type:

Canal side: Concrete apron with energy dissipater and Gabion mattress

Pasak side: Concrete apron with energy dissipater and Gabion mattress

1.5 Parameters for Concrete Structural Design

The parameters for the design of concrete structures are tabulates as follows.

1) Unit weight of materials

Unit weight of construction materials *(KN/m³){kgf/m³}*

Materials	Unit weight
Steel	77.0 {7,850}
Stainless steel (SUS304)	77.8 {7,930}
Reinforced concrete	24.5 {2,500}
Plain concrete	23.0 {2,350}
Cement mortar	21.0 {2,150}
Sand・Gravel・Crushed stone	18.6 {1,900}
Water	9.8 {1,000}
Timber	8.0 {800}

2) Reinforcement

The reinforcement for concrete based on TIS-24-2527 (for deformed bars) and TIS-20-2527 (for round bars) will be used. The design parameters are tabulates as follows.

Physical constant of reinforcement *(N/mm²){kgf/cm²}*

Material	Unit weight
Young's modulus	2.0×10^5 {2.1×10^6}
Shear elastic modulus	7.7×10^4 {8.1×10^5}
Linear expansion coefficient	12×10^{-6}
Poisson's ratio	0.30

Allowable stress of deformed rebars *(N/mm²){kgf/cm²}*

kind of stress and component \ Kind of rebar			SD30
Tensile stress	In case influence of impact load or an earthquake is not included in the combination of load	General component	150{1,500}
		The component prepared in underwater or below the groundwater level	150{1,500}
	The basic value in the case of including the influence of impact load or an earthquake in the combination of load		150{1,500}
Compressive stress			150{1,500}

3) Concrete

Design strength of concrete *(N/mm²){kgf/cm²}*

Kind of component	Design strength f'c
Plain concrete	18 {180}
Reinforced concrete	21 {210}

Young's modulus of concrete *(N/mm²){kgf/cm²}*

Design strength	21 {210}
Young's modulus	2.35×10^{4} $\{2.35\times10^{5}\}$
Young's modulus ratio	15
Linear expansion coefficient	10×10^{-6}

Allowable stress of concrete for reinforced concrete *(kgf/cm²)*

Design strength	f'c	-	210
Extreme fiber stress in compression	fc	0.45f'c	94.5
Shear stress :			
Plain concrete at beam	Vc	$0.29(f'c)^{1/2}$	4.2
Plain concrete at joist	Vc	$0.32(f'c)^{1/2}$	4.6
With reinforcement at shear stress	Vc	$1.32(f'c)^{1/2}$	19.1
Slabs and foundations, along the edge	Vc	$0.53(f'c)^{1/2}$	7.7
Bearing stress :			
On full area	fc	0.25f'c	52.5
On one-third area or less	fc	0.37f'c	77.7
Bond stress			
Deformed bars without special anchorage	U	0.05f'c	10.5

Source: The Teaching of Concrete, Department of Civil Engineering, Faculty of Engineering, Chulalongkorn University, 1980

Allowable stress of plain concrete *(N/mm²){kgf/cm²}*

The kind of stress	Allowable stress	Comment
Extreme fiber stress in compression	f'c/4 ≦ 5.5 {55}	f'c : Design strength of concrete
Bending tensile stress	f'c/80 ≦ 0.3 {3}	
Shear stress	f'c/100 + 0.15 {1.5}	
Bearing stress	0.3f'c ≦ 6.0 {60}	

Premium coefficient of allowable stress

Combination of loads		Premium coefficient
Primary load except live load and impact load + Influence of an earthquake		1.5
Combination of loads during construction	In case the stress at the time of completion becomes remarkably low	1.5
	In case the stress at the time of completion becomes comparable as allowable stress	1.25

4) Seismic coefficient

Horizontal coefficient $k_h = 0.1$

Vertical coefficient Not considered

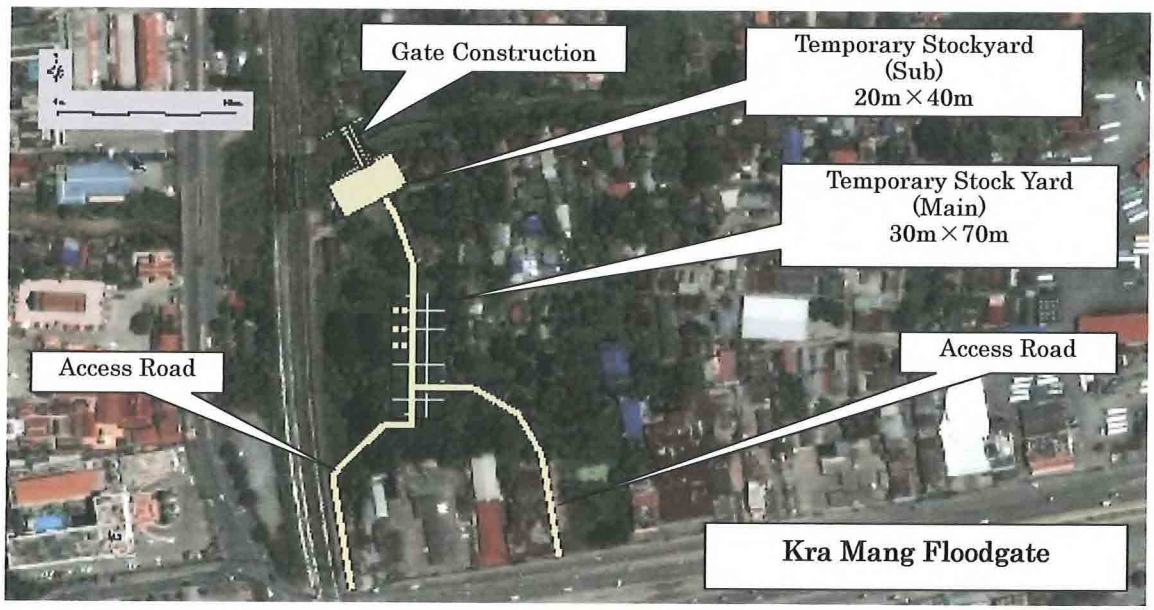
At the project sites of Ayutthaya

Seismic coefficient for the structural design is obtained in accordance with PGAo/G announced by Dr. Pennung Wanitchai, 2001.

PGAo is acceleration-dependent seismic risk in 50 year return period while G is gravity force.

2. Temporary Stockyards and Contractor's Base Camps

Temporary stockyards including the contractor's base camps for the storage of the construction materials and machineries, and the access roads are proposed to set up at the following locations adjacent to the proposed flood gates throughout the construction period.



Lop Buri in May 15, 2012

Mr. Weerawot SIRIKUL
Chief Engineer
RID Regional Irrigation Office 10

Mr. Takahiro MISHINA
Chief Engineer
JICA Survey Team

Mr. Suparat KOSUMAPINUN
Design Group
RID Regional Irrigation Office 10

Mr. Chensak SUPHAKUL
Engineer
RID Regional Irrigation Office 10

Mr. Prasit SITHIYOS
Geologist
RID Regional Irrigation Office 10

LIST OF ATTENDANCE

Preparatory Survey on the Flood Prevention Project of
East Side of the Pasak River in Ayutthaya in the Kingdom of Thailand

Date: 15th May, 2012

Location: Conference room, RID Region 10 office

	Name	Affiliation	Position	Mobile Phone	Signature
1.	Mr. Weerayot SIRIKUL	Chief Engineer	RID 10	0848746196	
2	MR. PRASIT SITHIYOS	Geologist	Geological Group RID. 10	081-893-2466	
3	MR. SUPARAT KOSUMAPINUN	Irrigation Engineering	Design Group	081-6152901	
4.	MR. CHENSAK SUPHAKUL	Irrigation Engineer	RID. 10	081-4211319	
5	Mr. Minoru KIMISHIMA	COST ESTIMATER,	JICA STUDY Team		
6.	Mr. KAJIURA	Structural Design Engineer	〃		梶浦 建樹
	Mr. Tatsuji Ito	Civil Engineer	〃		
	Mr. Y. Azuma	Structural Design Eng.	〃		
	Mr. Masaki ISHII	Structural Design Engineer	〃		石井昌樹
	Mr. Somkiat Maurud	Design Engineer	TEAM	081-9010872	
	Mr. Chawalit Chamnan	Hydraulic Structure Engineer	TEAM	0497674 5046	
	Sineenat Chaisakda nukool	Hydraulic Structure Engineer	TEAM	089-8362413	