1-2 Academic Meeting

1-2-1 Conference on the Chao Phraya Flood Management Master Plan

Conference on the Chao Phraya Flood Management Master Plan

Background

Responding the official request from Royal Thai Government, the technical assistance of updating flood management plan of the Chao Phraya River Basin has been started since January 2012 and will be wrapped up in coming June 2013.

The JICA consultant team has been working for wide range of studies on the Chao Phraya River flood management such as confirmation of topographical conditions and discharge capacities incorporating tidal effects, developing basin wide hydrological model, and preliminary economic, social and environmental assessment.

The titled conferences will exchange knowledge and experience among Thai academia, concerned government officials and the Study Team in order to deepen the understanding about the study results and improve the final output. In the 1st and 2nd conferences in May 2013, all the participants had active discussions and seemed to succeed in deepening understanding about the Flood Management Master Plan. Subsequent to them, 3rd and 4th conferences will be held as below.

Date and Venue:

1st Conference: May 22 2013, 9:00-12:00, at RID meeting room

2nd Conference: May 23 2013, 13:30-16:30, at RID meeting room

3rd Conference: June 10 2013, 13:30-17:30, at RID meeting room

4th Conference: June 11 2013, 13:30-17:30, at RID meeting room

Meeting subjects

1st Conference

Topic 1 Executive Summary

Topic 2 Runoff characteristics of the Chao Phraya River and approach for the Master Plan

Topic 3 Effectiveness of diversions; the Outer Ring Road channel, East and/or West diversion channels

2nd Conference

Topic 4 Effectiveness and adverse impact of Ayutthaya Bypass channel

Topic 5 Setup the design high water level considering secondary dyke and constraints of maximum height of dyke

3rd Conference

Topic 6 Optimal operation of existing dams

Topic 7 Follow-up discussions derived from previous conferences regarding;

- Flow capacity of downstream area, near the river mouth
- Effectiveness and limitation of all countermeasures
- Verification of the model by the inundation situation
- Flow distribution and discharge hydrograph, such as Sakae Krang and Tab Salao Rivers

4th Conference

Topic 8 Verification of flood control scenario by other rainfall patterns and another scenario

Topic 9 Consideration of flood mitigation in the Tachin River Basin

1-2-2 Questions and Answers Conference on the Chao Phraya Flood Management Master Plan (22 May, 2013)

Questions and Answers
Conference on the Chao Phraya Flood Management Master Plan

22 May 2013, 09.00 – 12.00 hrs.
Sippanondsa Ketudat meeting room, 1st Floor, Building 4
Office of the National Economic and Social Development Board

【QUESTIONS & ANSWERS, DISCUSSION RECORDS】

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1. A participant questioned about slides 13-16 of presentation that the reason why the discharges in the Sakae Krang River and Tab Salao River are different in slides 13 and 14. The participant also requested that JICA includes benefits of diversion channel in the final report.

JICA responded that the figure shows peak flow discharge. With the construction of diversion channel which made the water level in the Chao Phraya River decreased, it is easy to make discharge from the Sakae Krang River and the Tab Salao River flow in to the Chao Phraya River. If diversion channel is not going to be constructed, water level in the Chao Phraya River will be still high.

2. A participant questioned that in the slides from 13 – 16, how do JICA determine these canal capacities, especially for the Sakae Krang River and Tab Salao River (In Slide 13 "2011 Flood", Sakae Krang River is 0 m^3/s and Tab Salao River is 200 m^3/s. In Slide 14 "SCWRM M/P Full Menu", Sakae Krang River is 300 m^3/s and Tab Salao River is 800 m^3/s. Why numbers are different?).

JICA responded that the hydrograph of the Sakae Krang or Tab Salao Rivers gives the answer.

3. A participant commented that if the water is diverted to the diversion channel, the inundation of upstream side may be decreased, therefore the time of inundation also decrease. This should be included in the study report.

JICA responded that the figure shows the total area of inundation. The duration of inundation will be presented at the next meeting.

4. A Participant reminded that the 2011 flood was exceptional and it was not average occurring in Thailand. The participant questioned about the JICA proposal on the optimum dam operation that whether JICA used the right parameter in the simulation or not. Also, the participant requested JICA to clarify the peak discharge of the case without dam operations at Nakhon Sawan shown in slide 7, whether 6,587 m^3/s means the simulated data of the peak discharge without dam.

JICA agreed with the participant's comment regarding the dam operation that it is very challenging to answer the question about whether there are more effective dam operation exist or not. JICA considers the 2011 dam operation was the best all the above. In addition, in terms of the operation rule, there is always the room for the improvement. JICA clarified

that 6,587 m^3/s is the simulated peak discharge without dam, which means the natural discharge condition without dam.

5. A participant questioned 1) the reason why the discharge after optimizing the dam operation is still higher than the year 2011, 2) the flood volume in 2011 which was stored in 12.5 million Rai inundated area.

JICA replied that 1) the difference is made because one includes the countermeasures of construction of new dam and effective operation of existing dams, and another one only includes effective operation of existing dam.

6. A participant questioned that for the calculation of effectiveness of each countermeasure and internal rate of return, in addition to the inundation area, whether the depth and duration of inundation, and the local subsidence in terms of sea level were taking into account.

JICA replied that the depth and duration of inundation were already considered in the study. The duration in simulation is from July 1 to December 31st. Discharge from the Chao Phraya River and tributaries and also inundation areas are calculated for everyday. JICA answered that observed tidal level is used for the simulation and for the ground level the LiDAR topographic data is used.

7. A participant commended that the JICA study only includes the major rivers, and does not include the minor and small rivers. The flood damage is also occurred by the leakages through those small rivers. The participant also proposed to construct dykes along the coast as a solution.

8. A participant questioned 1) Page 13, whether the effects of the Sakae Krang River are reasonable or not as the figure shows different finding from the one worked in another working group, 2) assumption to use the 2011 Flood as a basis for the analysis is acceptable for long term planning or not, 3) the simulation without the dyke breach, this assumption is reasonable for the good planning or not, 4) JICA should present water level because in Thailand, overflow of dyke is always the issue.

9. A participant asked about whether the sea level is at 2 m above mean sea level or not.

JICA answered that sea level is observed data therefore not the constant value.

10. A participant asked about the accuracy of topographic survey used in simulation and whether JICA used LiDAR data for the area around Nakhon Sawan.

JICA replied that JICA used LiDAR data for topographic data, including Nakhon Sawan, which is precise and accurate with the error of 10 cm. For river channel, cross section data surveyed by RID was used.

11. A participant questioned that 1) whether inundation area was derived from satellite images, RADARSAT collected once or twice a week, or the data surveyed and

collected by GISTDA during flood in 2011, and 2) the reason why there is difference between the simulation result and GISTDA data.

JICA replied that GISTDA is a satellite image processing, which is why there are some differences between the GISTDA figure and the simulation result figure.

12. A participant questioned about 1) the method of runoff estimation in the flooding area, 2) the calibration of flood depth in the inundated area.

JICA replied that 1) Tissen method was applied to distribute the rainfall, and 2) the calibration was done by the comparison of water level and discharge in the river channel.

13. A participant questioned if the runoff coefficient can be roughly estimated.

JICA responded that this item will be presented in another meeting.

14. A participant asked to check the black lines of result in page 22 and 34.

JICA answered that the black line in page 22 is correct but there is mistake in page 34.

15. A participant questioned that 1) whether the 2011 case can be used as the base case, 2) any additional evidence which can prove the accuracy of the simulation results, 3) at the Nakhon Sawan station, the channel capacities for different combination of countermeasures such as with no dam, with effective dam operation etc, suggested by JICA is different from RID's findings. The effectiveness of the dam operation towards the Nakhon Sawan station need to be further discussed.

16. A participant commended that additional canals and tributaries need to be included so that Thai government can use this master plan as the river database system (development of national river inventory system).

JICA responded that some canals and tributaries are included as shown in the schematic diagram. If other tributaries or important canals need to be included, we could discuss this issue, however it is suggested by JICA that current river system is sufficient to simulate the 2011 flood.

17. A participant commented that the countermeasures must be effective for the flood mitigation as well as the drought mitigation.

JICA agreed with the participant's comment and responded that JICA proposed dam operation rule curve considering both flood and drought mitigations.

18. A participant questioned that with different land use in the future, whether the JICA proposed countermeasure would be different or not. The participant also questioned about the effectiveness of floodway.

JICA responded that it is a very important point; however JICA has only focused on current land use, therefore when the change in land use is significant, additional analysis must be

conducted. With the focus on the protection of the economic area (Bangkok and Ayutthaya areas), ring road dyke is much cost effective than the flood diversion.

19. A participant commended that 1) the model underestimates at the Bangsai area, 2) the objective of the study is 1 in 100 flood return period which must be clearly stated, 3) limitation must be stated, 4) rule curve information such as storing more water at the beginning of August etc, must be clearly stated.

JICA appreciated the suggestions.

Conference on the Chao Phraya Flood Management Master Plan

Organized by
Office of the National Economic and Social Development Board
Japan International Cooperation Agency

Attendees List: 22 May 2013

No.	Name-Surname	Title
Academics		
1	Dr. Sucharit Koontanakulwong	Chulalongkorn University
2	Dr. Phaisan Santitamnont	Chulalongkorn University
3	Dr. Sutat Weesakul	Director of Research Project, Asian Institute of Technology
4	Prof Dr. Thanawat Jarupongsakul	Chulalongkorn University
Thailand Development Research Institute (TDRI)		
5	Mr. Niphon Puapongsakorn	
Royal Irrigation Department		
6	Mr. Thongplew Kongjun	Director, Office of Water Management and Hydrology
7	Mr. Kanchadin Srapratoom	Chief of Loan Projects, Office of Project Management
8	Mr. Sompop Sucharit	Senior Expert of Irrigation Engineer
9	Mr.Thada Sukhapunnaphan	Director of Hydrology Division, Office of Water Management and Hydrology
10	Mr. Somchit Amnatsan	Head of Water Operation Group, Office of Water Management and Hydrology
11	Mr. Pakorn Phakdeepredasakul	Civil Engineer, Project Planning Group 4, Office of Project Management
12	Mr. Jakraphan Choyhiran	Civil Engineer, Project Planning Group 4, Office of Project Management
13	Dr. Phattaporn Mekpruksawong	Chief of Project Planning Group 1, Office of Project Management
Department of Water Resources (DWR)		
14	Mr. Kanapoj Wandee	Director of Water Operation Division
Office of the National Economic and Social Development Board (NESDB)		
15	Ms. Ladawan Kumpa	Deputy Secretary - General
16	Mr. Montree Boonpanich	Director, The office of Agriculture Natural Resource and Environment
17	Ms. Kanyave Payunsit	

18	Dr. Chamnong Paungpook	Policy and Plan Analyst, Senior Professional Level
19	Mr. Boonchub Songtakunsak	Policy and Plan Analyst, Senior Professional Level
20	Ms. Jinna Tansaraviput	Policy and Plan Analyst, Senior Professional Level
21	Ms. Aim-on Pruksuriya	Policy and Plan Analyst, Operational level
22	Mr. Pitsanu Woranapa	Policy and Plan Analyst, Senior Professional Level
23	Mr. Chanchai Rukkhawattanakul	Policy and Plan Analyst
24	Mr. Supapong Tansupap	Staff, NESDB
25	Ms. Nisarat Nantasen	Staff, NESDB
26	Ms. Kamonrat Pramotphan	Staff, NESDB
Japan International Cooperation Agency (JICA)		
27	Mr. Tatsuo Kunieda	JICA Expert to Royal Irrigation Department, Thailand
28	Mr. Yasuke Amano	Senior Expert
29	Mr. Hideaki Matsumoto	Deputy Director, Disaster Management Division 1, Global Environment Department
30	Mr. Takahiro Mishina	Component 1-2, Team Leader
31	Ms. Akira Watanabe	Engineer
32	Mr. Chuchat Suwut	JICA Study team
33	Ms. Nattamon Tanyapanit	JICA Study team
34	Ms. Kamolnit Ariyakamolpat	JICA Study team
35	Mr. Weerawat Ittipanyakul	JICA Study team
36	Ms. Siripen Sinpo	JICA Study team
37	Ms. Paweesuda Boonchuwong	JICA Study team

1-2-3 Questions and Answers Conference on the Chao Phraya Flood Management Master Plan (23 May, 2013)

Questions and Answers
Conference on the Chao Phraya Flood Management Master Plan

23 May 2013, 13.30 – 16.00 hrs.
Sippanondsa Ketudat meeting room, 1st Floor, Building 4
Office of the National Economic and Social Development Board

【QUESTIONS & ANSWERS, DISCUSSION RECORDS】

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1. A participant commented that RID is not responsible for all structures as some structures are managed by DOR, DOH and municipality. The participant raised his concern about conflicts among government agencies and social impacts.

JICA replied with sharing the measure taken by Japanese government about 40 to 50 years ago that all houses were moved out from the river courses to manage the situation. JICA suggested that from the engineering point of view, instead of heightening the primary dyke, the secondary dyke must be maintained.

2. A participant shared his appreciation for JICA to produce the H-Q curve. Also the participant questioned that whether using the averaged rating curve is appropriate or not.

JICA responded that the averaged rating curve is used to evaluate the averaged flow capacity during the flood. Therefore, the rating curve should be modified for another purpose, such as navigation purpose.

3. A participant questioned 1) the required size of the monkey cheek in order to accommodate flood water, 2) whether the secondary dyke was included in the simulation.

JICA suggested to see the Material No.4 for the required size of the monkey cheek and answered that the secondary dyke was included in the simulation.

4. A participant requested to elaborate further that 1) without dyke breach on the secondary dyke in the 2011 flood, what would be happened, 2) the channel capacity of the lower Chao Phraya River with the tidal effect.

JICA responded that 1) the simulation result of without dyke breach in the 2011 flood can be seen in Material No.4 page 24, 2) the flow capacity depends on tidal level, however according to the analysis the average flow capacity is 3,000 m^3/s as shown in Material No.2 page 28.

5. A participant commended that BMA has a plan to construct the dyke of 3.5 meter high and the channel capacity of the lower Chao Phraya River should not exceed 3,500 m^3/s. Another participant questioned the definition of the channel capacity as

3,500 m^3/s if it means that although water level increased at the lower Chao Phraya River, the water can be contained within the channel.

JICA responded that due to the limitation on observation data in this area, JICA is only able to present the calculation result. JICA recommends that it would be beneficial to obtain the H-Q relation per hour, rather than the data per day.

6. A participant questioned about 1) the assumption on the capacity calculation from Bang Sai to the Gulf of Thailand, 2) the reason behind why the inlet of the Outer Ring Road Diversion Channel is located as proposed.

JICA responded 1) by showing Figure 1.2.27 in Material 02 of page 1 to 28, and 2) the inlet location was selected in order to drain the water from the Pasak River.

7. A participant commented that it would be effective if the Ayutthaya bypass channel can drain water directly to the sea and the bypass does not contribute to increase the discharge.

JICA responded that the Ayutthaya bypass is proposed in order to increase the flow capacity in the bottle neck section in Ayutthaya; therefore, it does not increase the channel capacity further downstream.

8. A participant questioned that 1) the construction of Ayutthaya bypass can increase the flow from Bang Sai to the Gulf of Thailand, where the increased amount of water flow, and 2) the equation used for the simulation whether it was steep slope with upstream control or mild flow with downstream (tidal) control. The participant also questioned that whether JICA analysis is socially or logically acceptable or not.

JICA responded that the basic understanding is the lower channel has sufficient capacity to accommodate such increased flow. Ayutthaya bypass gives adverse impact, whereas Outer Ring Road Diversion Channel has positive impact. For the calculation, the observed sea level was used. JICA questioned that whether it is more socially acceptable if JICA proposal includes only the Outer Ring Road Diversion Channel.

9. A participant commented that 1) the real situation is three dimensional however the model is two dimensional, 2) the Ayutthaya bypass is a good idea however it can only improve the condition in the Ayutthaya area. In order to protect Bangkok, the construction of bypass directly from Bang Sai to the Gulf of Thailand is required. Another participant requested to elaborate further on the inundation pattern occurred in each inundated area.

JICA referred Material No.6 for the explanation.

10. A participant commented that the protected areas are different from the inundated areas in the 2011 flood. The participant expressed his concern on the adverse impacts on the enlarged protected areas.

JICA replied that the protected areas are based on Thai government's suggestion.

11. A participant requested to present the effectiveness of the proposed countermeasures for other flood.

JICA replied that the results will be presented at the next meeting in June.

12. A participant questioned about the current capability of flood protection system.

JICA responded that the objective of the study is to determine the optimum combination of countermeasures in order to accommodate 1 in 100 year flood return period event. The next step would be analyzing 1) the current capacity and 2) the method of improvement.

Conference on the Chao Phraya Flood Management Master Plan

Organized by
Office of the National Economic and Social Development Board
Japan International Cooperation Agency

Attendees List: 23 May, 2013

No.	Name-Surname	Title
Academics		
1	Assoc.Prof.Dr.Kampanad Bhaktikul	Dean of Faculty of Environment and Resource Studies, Mahidol
2	Dr. Phaisan Santitamnont	Chulalongkorn University
3	Dr. Sutat Weesakul	Director of Research Project, Asian Institute of Technology
4	Prof Dr. Thanawat Jarupongsakul	Chulalongkorn University
5	AssocProf.Dr. Usa Humphries	King Mongkut's University of Technology Thonburi
Royal Irrigation Department		
6	Mr. Kanchadin Srapratoom	Chief of Loan Projects, Office of Project Management
7	Mr. Sompop Sucharit	Senior Expert of Irrigation Engineer
8	Mr.Thada Sukhapunnaphan	Director of Hydrology Division, Office of Water Management and Hydrology
9	Mr. Jakraphan Choyhiran	Civil Engineer, Project Planning Group 4, Office of Project Management
10	Mr. Supanat Pariyachat	Chief of Project Planning Group 4, Office of Project Management
11	Mr. Wuttinan Phudenpa	Civil Engineer
Thailand Development Research Institute (TDRI)		
12	Ms. Nujpanit Narkpitaks	President Affairs Coordinator/ Researcher
13	Ms. Jidapa Meepean	Researcher
14	Ms. Devina Pande	Researcher
Office of the National Economic and Social Development Board (NESDB)		
15	Ms. Ladawan Kumpa	Deputy Secretary – General
16	Dr. Chamnong Paungpook	Policy and Plan Analyst, Senior Professional Level
17	Ms. Chanokamon Ruyaporn	Policy and Plan Analyst, Professional Level
18	Ms. Jinna Tansaraviput	Policy and Plan Analyst, Senior Professional Level
19	Ms. Aim-on Pruksuriya	Policy and Plan Analyst, Operational level
20	Mr. Pitsanu Woranapa	Policy and Plan Analyst, Senior Professional Level
21	Mr. Supapong Tansupap	Staff NESDB

22	Ms. Nisarat Nantasen	Staff NESDB
23	Ms. Kamonrat Pramotphan	Staff NESDB
Japan International Cooperation Agency (JICA)		
24	Mr. Yusuke Amano	Senior Expert
25	Mr. Hideaki Matsumoto	Deputy Director, Disaster Management Division 1, Global Environment Department
26	Mr. Tatsuo Kunieda	JICA Expert to Royal Irrigation Department, Thailand
27	Mr. Takahiro Mishina	Component 1-2, Team Leader
28	Ms. Akira Watanabe	Engineer
29	Mr. Chuchat Suwut	JICA Study team
30	Ms. Nattamon Tanyapanit	JICA Study team
31	Mr. Weerawat Ittipanyakul	JICA Study team
32	Ms. Siripen Sinpo	JICA Study team
33	Ms. Paweesuda Boonchuwong	JICA Study team
34	Ms. Gessarin Gunthawong	JICA Study team
35	Mr. Peerasak Chantngarm	Interpreter

1-2-4 Questions and Answers Conference on the Chao Phraya Flood Management Master Plan (10 June, 2013)

Questions and Answers
Conference on the Chao Phraya Flood Management Master Plan

10 June 2013, 13:00-17:00 hrs.
IEC 300 Room, 3rd Floor, IEC Building
Royal Irrigation Department

【QUESTIONS & ANSWERS, DISCUSSION RECORDS】

Questions & Answers

1. A participant argued there are no existing irrigation schemes from Nakhon Sawan to Chainat. They are mostly pump irrigation schemes. The irrigation systems from Chao Phraya Dam are found mostly downstream of Chainat and not between Nakhon Sawan and Chainat. The participant requested to clarify if the water is released for the purpose of irrigation.

JICA said that water is released for navigation and ecological reasons as well. Another participant asserted that the water that they discharged is irrigation water. The participant then echoed the report on Page 29 about the maximum amount of water supply to irrigation areas in the East and the West. In downstream of Nakhon Sawan, the minimum amount of water supply is about 120 MCM/month. Another participant commented that the discharge at the Chao Phraya is at least 70 m^3/s (50 m^3/s for water supply and 20 m^3/s for sanitation) during dry season.

2. A participant pointed out a number of issues:

   - RID's Mismanagement of the massive 2011 Floods was publicly blamed. The participant requested to clear that the simulation done by JICA was a post-flood simulation. In 2011, they did not expect the massive amount of water that hit the Chao Phraya River. The participant stressed that there is water shortage every other year in the country. In response to that, from April-May of 2011, they decided not to release waters (based on the excessive discharge of water in 2010).

   - Thailand experiences a bi-model peak flow twice a year (May and August), therefore the participant is concerned about having only one rule curve. The Rule Curve must ideally have two modes. The participant requested that the JICA Study Team to re-evaluate the effectiveness of this rule curve.

   - Bhumibol and Sirikit Dams' rule curves are based on the output of power distribution. According to A1, the JICA Study Team recommends to revise the lower rule curve of Sirikit Dam.

JICA responded to the fundamental question, "How much amount of water can pass Nakhon Sawan during Dry Season?" JICA came up with the 1,340 MCM/month. But if the Thai participants consider it is inaccurate; JICA will revise the report.

3. A participant said that the effective volume for both dams should be 12 billion m^3 for the whole (dry) season (November-April). The amount of water released and utilized are not the same for every month. The participant also recommended that assumption on water allocation to be checked.

JICA said that this can be found in Material 05-page 12 (as experienced on 1 November to 30 April 2006).

JICA requested to provide additional information about the ideal threshold and exact timing of the release of water from reservoirs. A participant replied that the threshold is at the Chao Phraya diversion dam. Thai government already has an existing system to monitor the discharge from Sirikit and Bhumibol Dams to Nakhon Sawan and Chao Phraya Dam.

4. A participant shared that in November, the EGAT (The Electricity Generating Authority of Thailand--agency that operates Bhumibol and Sirikit Dams) and RID will organize a meeting to identify the availability of water before planning for water distribution during dry season for next summer. This is more practical because it allows to provide advice to farmers about the amount of water available during dry season. The participant added that during the past 3 years, there was not enough water for irrigation in Thailand.

JICA said that if the 1,340 MCM/month estimate is not enough, then the simulation study is not applicable. A participant said that this is not a straight-forward response; farmers are relying on the decision made by the concerned agencies.

5. A participant asserted 1) the serious flood in 2011 was a result of misinterpretation of global climate change (La Nina and El Nino). JICA must consider these when drafting recommendations, and 2) JICA must provide two kinds of Rule Curves (one for dry year and one for wet year).

JICA said that there are several studies on climate change in Thailand. The studies revealed that drought in the country are not really severe in general. The occurrence of flood is more troublesome. JICA also have a 40-year record of La Nina and El Nino in a global scale. As for the two kinds of options, JICA stressed that they tried to combine all recommendations in one master plan. JICA recommends having only one rule in terms of dam management and water control. This is more practical and feasible for concerned agencies.

6. A participant shared that if the Thai government follows the one-way Rule Curve policy, they would not be able to allocate irrigation water. The general impression of the JICA

Master Plan is that it only focuses on flood control. The result of the operation will affect the water system scheme of the following years. Another participant argued that they cannot predict the type of year (dry or wet) that they will encounter. Another participant added that this is the reason why the Thai government has to use two model Rule Curves.

JICA replied that it is difficult to understand the point of this practice. A participant said Thai government would prefer forecasting based on an average amount of water rather than foreseeing a maximum amount (as prescribed by the Japanese). JICA responded that the feasibility of the Thai officers' proposals will be studied.

JICA said that they made an assumption about water distribution at the downstream of Nakhon Sawan, therefore JICA acknowledged the participant's opinion that the study is overly ideal.

ITEM 2: Flood Mark Survey
Questions & Answers

1. A participant commented that the size of the block would make a big difference on the survey result. Some blocks are bigger and possess more depth and volume. JICA must also consider if the area is protected or not-protected. Another participant asked if the survey can basically help agencies to identify high risk flood areas.

JICA said the flood mark survey is one of the main purposes of the JICA study. A participant pointed out the inaccuracy/inconsistency of pictures in the report. JICA responded that this is due to technical glitches and human error (e.g. memory retention of interview respondents).

2. A participant requested to elaborate further about the prediction of inundation in Pathumthani in late November. Another participant questioned that comparing real time event and GISDA, whether the model is enough to predict future floods.

JICA responded that the prediction is presented in the report (it is marked blue in the map). JICA responded the master plan simulation is effectively utilized for the planning purpose. In terms of the efficiency to predict new floods, rain even must be forecasted. JICA is currently conducting another project on flood forecasting information system. The technology/model is already shared with RID.

ITEM 3: Discharge Capacity near River Mouth
Questions & Answers

1. A participant said that the 3500 m^3/s forecast is being used for 30 years. The participant is doubtful of the validity of the simulation work (specially the 4,000 cubic meter forecast).

JICA said that the survey technique employed at the river mouth is impractical in other countries. JICA agreed with the participant's comment that it is very difficult to predict flow discharge at the river mouth. JICA suggested to predict the discharge (in Chao Phraya, Bang Sai) based on observed data.

2. A participant suggested that the final report should include the data with concrete evidence to support the proposal.

JICA responded that the JICA's proposal can raise important point of views in order to validate information of flow discharge at the Chao Phraya River. JICA agreed to present the concrete evidence in the report and recommended the Thai government agencies such as RID to carry out further survey or analysis which will be helpful for Thailand's better flood management system.

3. A participant commented that tidal waves may affect the traffic of the water in the Chao Phraya River. This may affect the flow in the channel particularly the adverse flow of sea water into the river mouth.

JICA explained the condition of flow discharge and adverse flow during flood season and replied that the difference of the discharge between high and low tides gets smaller once big flood occurs. This is one aspect that the Thai government agencies such as RID will be required to conduct further study in detail along with the tidal effect.

4. A participant questioned that if the capacity of the Chao Phraya River in Bang Sai is at 4,000 m^3/s and the capacity of the Chao Phraya River in Bangkok is also at 4,000 m^3/s, will flood occur between Bang Sai and Bangkok? The participant also mentioned that if this is the case then, there shouldn't be any floods in Nonthaburi and Pathumthani.

JICA replied that there is an inland water problem—they must have an inland pumping station to release water out.

5. A participant requested to elaborate further on the capacity of the Chao Phraya River in Bangkok which is 4000 m^3/s.

Conference on the Chao Phraya Flood Management Master Plan

Organized by
Office of the National Economic and Social Development Board
Japan International Cooperation Agency

Attendees List: 10 June, 2013

No.	Name	Post/Organization
Royal Irrigation Department		
1	Mr. Thada Sukhapunnaphan	Director, Hydrology Division
2	Mr. Somchit Amnatsan	Chief of Water Management Group
3	Mr. Supanat Pariyachat	Chief of Project Planning Group 4
4	Mr. Kanchadin Sraprathum	Chief of Loan Projects
5	Mr. Nirut Reansuwong	Senior Expert
6	Mr. Phaisan Phongnoraphat	Director, Operation and Maintenance Division RID 13
7	Mr. Chonlathep Thatree	Engineer, RID 3
8	Mr. Kanching Kawsard	Representative of Regional Irrigation Office 3
9	Mr. Sompop Sucharit	Senior Expert of Irrigation Engineer
10	Mr. Chatchai Boonbue	Director of Foreign Financed Project Administration Division
11	Mr. Pongsak Arulvijitskul	Expert Engineer, RID 11
12	Mr. Athaporn Punyachom	Chief of Water Management Branch, RID 10
13	Mr. Boonthum Panpiamphot	Chief of Water Management Branch
Academics		
14	Dr. Nuanchan Singkran	Faculty of Environment and Resource Studies, Mahidol
15	Dr. Phaisan Santitamnont	Faculty of Engineering, Chulalongkorn University
16	Dr. Sutat Weesakul	AIT Asian Institute of Technology
Japan International Cooperation Agency (JICA)		
17	Mr. Yusuke Amano	Senior Expert
18	Mr. Hideaki Matsumoto	Deputy Director, Disaster Management Division 1, Global Environment Department
19	Mr. Tomoya Kikuta	JICA Headquarter
20	Mr. Yojiro Miyashita	JICA Thailand Office

21	Mr. Tatsuo Kunieda	JICA Expert to Royal Irrigation Department, Thailand
22	Mr. Takahiro Mishina	Component 1-2, Team Leader
23	Mr. Kazuhiro Nakamura	Component 1-2
24	Mr. Chuchat Suwut	JICA Study team
25	Mrs. Kamonit Ariyakamonpat	JICA Study team
26	Mr. Werawat Ittipabyakul	JICA Study team
27	Ms. Gessarin Gunthawong	JICA Study team
28	Ms. Krittiya Peerphayak	JICA Study team
29	Ms. Paweesuda Boonchuwong	JICA Study team

1-2-5 Questions and Answers Conference on the Chao Phraya Flood Management Master Plan (11 June, 2013)

Questions and Answers
Conference on the Chao Phraya Flood Management Master Plan

11 June, 2013, 13:00-17:00 hrs.
IEC 300 Room, 3rd Floor, IEC Building
Royal Irrigation Department

【QUESTIONS & ANSWERS, DISCUSSION RECORDS】

Flood Cases in Thailand
Questions & Answers

1. A participant requested to verify the peak discharge in 1980 and 1995 shown in Table 5, Executive Summary Page 32.

JICA answered that at Bang Sai, the peak discharge is very large as presented in the Table. JICA Study Team selected only extreme rainfall cases to conduct this analysis.

2. A participant asked about spatial distribution of rainfall, especially about how the rainfall was enlarged to the simulated rainfall and how to calculate the averaged river basin rainfall.

JICA answered that enlarged weight was applied to each rainfall event which means the rainfall values were enlarged at all the points in same ratio. To calculate the averaged river basin rainfall, JICA Study Team applied Thiessen method.

3. A participant commented that it was interesting in reviewing the spatial distribution of rainfall to see the six different rainfall cases. If the majority of rainfall fell in upstream of reservoir, then the discharge will be the controlled-discharge, on the other hand, if the rainfall fell in the reach of downstream of reservoir, the discharge will be uncontrolled-discharge. The participant asked JICA Study Team whether they have considered such rainfall case.

JICA answered that if the rainfall intensively falls in upper river basin, we might catch some water in dam reservoir which means we can control discharge easier. If the rainfall falls in lower basin, there are not many effective control facilities, so it might be more challenging to control. However, the JICA Study's simulation does not consider any of these particular cases. The JICA Study Team places the project combinations in the simulation model and applies the enlarged rainfall. For example, the rainfall in 1980 fell relatively intensively in downstream of the Cao Phraya River Basin. As the result show, the proposed countermeasure combinations were able to accommodate such rainfall event effectively. Not only the 2011 flood event, the JICA Study Team has evaluated the proposed

countermeasure combinations against other rainfall events, including the enlarged ranfall cases. The countermeasure's effectiveness is basically owing to the Outer Ring Road, which is located downstream of the Chao Phraya River Basin.

4. A participant questioned the reasons behind the additional analysis applying other rainfall cases because the purpose of the study is just to focus on the 2011 flood.

Another participant responded that the various rainfall cases will provide the big picture about the flood situation in Thailand. This is important to give us a clear idea of how water moves in the Chao Phraya River and other neighboring rivers.

5. A participant suggested that for the 1970 peak discharge, the observed value is 4,420 m^3/s, however the peak discharge in Table 5 is 4,000 m^3/s. The participant questioned why the simulation result is different from the observed value.

JICA answered that the data in 1970 shows the results with a different land use (there was more forest area before). However, the 2011 conditions including land use and operation rule were applied in the simulation.

6. A participant requested to elaborate further on the effectiveness of the by-pass to divert the flood water, because the by-pass inlet is located on the Chao Phraya River at the upper stream of Bang Sai.

JICA answered that as shown in the Figure 26 on page 31 of Executive Summary, which describes the flow discharge distribution after the countermeasure combination was implemented. Ayuttaya by-pass would carry most of the flood water from east side of the Chao Phraya River, including the flow from the Pa Sak River.

7. A participant then asked that why the Pa Sak River Basin was not discussed much when there was a discussion about Nakhon Sawan and Bang Sai peak discharges.

JICA answered that this is based on the fundamental assumption which was derived from the Priority Protection Area proposed by the Thai Government (as shown in Figure 1, Page 5 of Executive Summary). According to the figure, the priority protection area is surrounded by two rivers, the north edge by the Pa Sak River and the west edge by the Chao Phraya River. Therefore, JICA Study Team proposed the countermeasure combinations which can effectively lower the water level along the reach of two rivers adjacent to the protection area.

The Evaluation of the Tha Chin River
Questions & Answers

8. A participant asked about the discharge capacity of the Tha Chin River. RID usually accepts the discharge of 250 m^3/s and the maximum discharge of 400 m^3/s. However the JICA's recommendation is 700 m^3/s.

JICA referred to Figure 1.2 of Page 1-2 of Material 01 which shows water level and discharge of the Tha Chin River. Between stations of 320km to 100 km from the river mouth, the discharge is less than 200 m^3/s observed upstream reach, and then the discharge drastically increased toward the mouth of river channel. This is due to the same reason as the one for the Chao Phraya River.

9. A participant asked if the discharge shown in Figure 1.2 is a net flow discharge.

JICA answered that it is the average of hourly discharge which is calculated by the simulation. According to Figure 1.20 of page 1-16 of Material 01 showed the H-Q Plotting in the Lower Tha Chin River, at the high tide, the reversed flow can be observed at the river section near the river mouth. On the other hand, during low tide, flow discharge is positive value. During the flood event, the discharge will be increased, however the water level will not be exceeded more than 2.00 m.

10. A participant questioned how to determine the H-Q curve for the downstream reach near the river mouth.

JICA answered that the JICA Study Team has tried to formulate the H-Q curve as shown; however no correlation was found.

11. A participant questioned about the methodology JICA applied to calculate the water level and flow discharge shown in Figure 1.20 of Material 01.

Another participant explained that even though the water level is the same, say at 2.00 m, due to the tidal effect, more than one discharge value will be recorded, one for the high tide (smaller discharge) and another for the low tide (larger discharge). The participant also commented that he appreciates JICA Study Team to prepare Figure 1.20 as this will provide the detailed information on the tidal effects on H-Q relationship. As the relationship is dynamic, it can only be calculated by using the equations, such as continuity, momentum, and energy equations.

JICA further elaborated that 10 km. area from the river mouth at the Chao Phraya River was severely affected by the reverse flow (tidal effect). According to the JICA's finding, the circles shown in the figure tend to move towards upper right, which means water level and discharge have the trend to be increased, during the flood event. Therefore, it was

concluded that the tidal effect plays an important role in controlling water level and flood discharge.

12. A participant questioned about model calibration for the Tha Chin River.

JICA replied that there is no water level data available, therefore only tidal data was used for calibration. JICA commented that RID faces challenges to observe discharge at the mouth of river as the discharge fluctuate constantly (ever changing water level). Therefore, the measurement has to be taken at least every hour in order to understand this natural phenomenon. Equipment such as H-ADCP can be utilized for such constant measurement; however the equipment range is quite short, actually shorter than the river channel width of 500 m. With the additional observed data at stations near the river mouth, the JICA Study Team would be able to tune its model up for better accuracy.

13. A participant commented that according to his past experience, the discharge measurement by such equipment is 20% larger than the actual rate. Therefore, BMA set the conservative discharge capacity of 3,500 m^3/s to the channel of the lower Chao Phraya River.

JICA replied that because it is difficult to observe tidal effect at the lower reach of the rivers, flow discharge must be assumed and determined before conducting the study. It is particularly important because the Tha Chin and Chao Phraya Rivers are the only two channels to discharge flood water.

14. A participant requested to elaborate the meaning of Figure 1.7 (Material 01).

JICA explained that this is a figure showing the discharge capacity of each cases, black line is the case when the water level is equal to the DHWL (Design High Water Level), whereas red and blue lines are the estimated discharge when the water levels are at the right and left bank heights, respectively. The JICA Study Team agrees to provide additional explanation of Figure 1.7 in the report.

15. A participant asked that why there is 500 m^3/s difference in the discharge capacity of existing river channel, between the maximum discharge found in Figures 1.7 (almost 1,000 m^3/s) and the discharge capacity in Figure 1.2 (1,500 m^3/s).

JICA answered that the discharge capacity presented in Figure 1.7 describes the actual channel capacity, whereas Figure 1.2 includes the volume of inundated water coming back from the inundated area to the channel. Ideally, flood water should only pass through the river channel, however in the case of the Tha Chin River, flood water inundated the adjacent areas with much higher water level as compared to the dyke height.

16. A participant commented that in 2011 inundation occurred at the mouth of the Tha Chin River which severely affected many people. Therefore, it is important to estimate the channel capacity at the river mouth. RID considers that the river capacity at the mouth of the Tha Chin River is 300 to 400 m^3/s, however the JICA Study analysis revealed that the capacity can be more than 400 m^3/s, at some location even close to 1,000 m^3/s. The participant questioned about the duration of the maximum discharge, because the maximum discharge will be observed at the low tides which assumed to be last for 5 minutes to half an hour. In addition, daily average flow discharge will not be useful for adjacent residents because this value does not provide them with clear information on when to evacuate.

JICA responded that for the warning purpose, it is important to look into the worst case, such as maximum water level and discharge. However, for the planning purpose, the daily average flow capacity is important in order to analyze how to deal with the large quantity of rainfall fell within the Chao Phraya River Basin, and also to determine the channel capacity.

17. A participant questioned to elaborate further on the boundary conditions of the calculation shown in Figure 1.7 of Material 01 and the assumptions of the calculation shown in Figure 1.2 of Materila 01.

JICA answered that as for the calculation of Figure 1.7, it includes the artificial high wall and also the flow only in the channel. This figure was used only to determine the discharge at each section. As for Figure 1.2, the results includes the inundate volumes which amount will be reduced once the dyke road is elevated. The simulation used the actual rainfall and assumed the overbank flow from the river. The inundate water was assumed to be returned back to the river channel not by overbank flow, but through control structures such as pump and sluice gate. The returning flow was only assumed when the water level in the channel recedes.

18. A participant commented that with the limited capacity of the Tha Chin River, some storage of 1 meter of water needs to be considered; this means that some overflow must be allowed to adjacent areas. Currently, a committee is working on to determine the location of primary and secondary dykes along the Tha Chin River. This dykes include DOH road that is located on approximately 1 km from the river channel on the east side and expected to increase the flow capacity 500-700 m^3/s. Another participant further elaborated that Phuttamonthon Sai 5 and 6 along the Tha Chin River at Nakhon Pathom serve as secondary dikes, however the participant disagrees with the idea of dyke construction. Historically, excess amount of water in the Chao Phraya River was stored in the upper/middle reach such as Sukhothai and Phitsanulok. With the dyke construction, overflow is controlled and these areas no

longer accommodate excessive amount of water. Therefore, the increased volume of flood water rushes to downstream which led the water level increase in the Tha Chin River.

JICA replied that the JICA Study Team does not propose the secondary dyke for the Tha Chin River due to the limitation of the available information. What the JICA Study proposes is the construction of four shortcuts which is effective to lower the water level in lower reach of the Tha Chin River.

19. A participant pointed out that Wat Chonglom Temple occupies the whole area to the Tha Chin River. Even though the four proposed shortcuts are constructed, with the restriction of Wat Chonglom, the increased volume of flood water is unable to flow into the sea.

JICA replied that the characteristics of the lower parts of the Tha Chin and the Chao Phraya Rivers is that, even though the discharge of flood water increases, the water level in the lower parts does not increase much. Therefore, no channel widening will be required. In addition, these shortcuts would provide the benefits by shortening the travel time of transportation as well as the travel time of flood water. This is a way to efficiently release the water out to the sea.

20. A participant commended that currently his committee is working on evaluating how to manage "ponding area" located in the western part of the Tha Chin River, especially the duration and timing of "ponding", control structures to manage the water flow in and out from "ponding area".

JICA replied that the JICA Study will state in the report regarding the basic precondition of inland water system, including the ponding system.

21. A participant commented that it is important to consider using the model proposed by JICA for the operational purposes as well.

JICA answered that the original purpose of this simulation model is just for planning purpose. To respond the requests by RID and DWR, JICA has launched another project to develop the simulation model for operational purposes. This model was effectively applied during the 2012 flood. Currently, another JICA Study Team responsible for the development of such model is working on to determine whether it is required to improve operational facilities and the way to transfer the model and technology to RID.

22. A participant requested to provide them with more information about 1) enforcement mechanisms on land use planning, which is the weak point in Thailand,

2) the step-by-step procedure that leads to implement countermeasures in the proposed master plan.

JICA answered that the land use control practice will be elaborated in the final report and executive summary. As for 2), the JICA Study Team will consider the suggestion made by the participant.

23. A participant observed that the study focused on the benefits and damages at the basin in lower region. Therefore it should not be compared with the full menu proposed by SCWRM. Another participant suggested that the report should include the remarks; benefits are calculated for the entire river basin.

JICA answered that the countermeasures proposed in Combinations 1 and 2 only emphasizes within the lower basin, however the benefit is determined for enter river basin. The JICA Study Team agreed to elaborate further on the calculation method on benefits in the report (benefit is expressed by the decreased amount of damages through countermeasures).

24. A participant commended that this master plan should be discussed openly with the public.

JICA replied that the JICA Study Team has held any meetings with the counterparts and also seminars to gather input from the concerned governmental agencies and the public on this study. At this moment, holding additional seminar (open to the public) is not the favorable option to JICA.

25. A participant recommended preparing a short version of the master plan in Thai.

No comments were provided from JICA.

26. Thai side discussed about which agencies and individuals will take responsibility on recommendations in this Report, especially to implement each countermeasure. A participant explained that Outer Ring Road was initially proposed by DOH, however current arrangement is not certain. Another participant suggested that the responsible agencies for the implementation of each countermeasure must be determined prior to the report submission.

27. JICA reminded the participants about the upcoming events as follows:

- **10 June:** **Technical Working Group Meeting**
- **13 June:** **Deadline for submission of comments on Executive Summary**
- **20 June:** **Final Seminar (Government agencies and department concerned will be invited)**

- **End of June: Provision of Draft Final Report**

Remarks: Within two weeks after Provision of DFR: Deadline for submission of comments on the Draft Final Report. All the questions and comments (in English) must be submitted to mishina@ctii.co.jp or watanabe-akira@ctii.co.jp

Conference on the Chao Phraya Flood Management Master Plan

Organized by

Office of the National Economic and Social Development Board

Japan International Cooperation Agency

Attendees List: 11 June, 2013

No.	Name	Post/Organization
Royal Irrigation Department		
1	Mr. Sompop Sucharit	Senior Expert of Irrigation Engineer
2	Dr.Phattaporn Mekpruksawong	Chief of Project Planning Group 4
3	Mr.Kanchadin Sraprathum	Chief of Loan Projects
4	Mr.Phaisan Phongnoraphat	Director, Operation and Maintenance Division RID 13
5	Mr.Athaporn Punyachom	Chief of Water Management Branch, RID 10
6	Mr.Chamnong Thammason	Irrigation Engineer Experienced.
7	Mr.Kanching Kawsard	Representative of Regional Irrigation Office 3
Academics		
8	Prof.Dr. Thanawat Jarupongsakul	Faculty of Science, Chulalongkorn University
9	Dr. Sucharit Koontanakulwong	Faculty of Engineering, Chulalongkorn University
10	Mr.Supote Thammasittirong	AIT Asian Institute of Technology
NESDB		
11	Ms. Suwannee Arunchokchai	Policy and Plan Analyst, Professional Level
Japan International Cooperation Agency (JICA)		
12	Mr. Yusuke Amano	Senior Expert
13	Mr. Hideaki Matsumoto	Deputy Director, Disaster Management Division 1, Global Environment Department
14	Mr.Tomoya kikuta	JICA Headquarter
15	Mr. Tatsuo Kunieda	JICA Expert to Royal Irrigation Department, Thailand
16	Mr. Takahiro Mishina	Component 1-2, Team Leader
17	Mr. Kazuhiro Nakamura	Component 1-2
18	Mr.Chuchat Suwut	JICA Study team
19	Mrs.Kamonit Ariyakamonpat	JICA Study team
20	Mr.Werawat Ittipabyakul	JICA Study team
21	Ms.Gessarin Gunthawong	JICA Study team
22	Ms. Krittiya Peerphayak	JICA Study team
23	Ms. Paweesuda Boonchuwong	JICA Study team

1-3 Seminar Record

1-3-1 Seminar Record for JICA Seminar 1 (25 January, 2013)

Record of Seminar
on the Comprehensive Flood Management Plan in the Chao Phraya River Basin
25 January 2013, 09.00 – 12.30 hrs.
Ballroom A, the Westin Grande Sukhumvit, Bangkok

Organization of Seminar

1. Seminar on the Comprehensive Flood Management Plan in the Chao Phraya River Basin was held on 25 January 2013 from 09:00 to 12:15 hrs at Ballroom A, the Westin Grande Sukhumvit, Bangkok. The seminar was organized by the Office of the National Economic and Social Development Board, the Royal Irrigation Department, the Department of Water Resources, and Japan International Cooperation Agency. It aimed at sharing a part of outputs of JICA project on Comprehensive Flood Management Plan in the Chao Phraya River Basin with all key stakeholders of the sequence of Thai government actions. The provisional agenda of the seminar is as attached. (Considering the availability of salient persons, the order of presentations was changed as reported below.)

2. Participants, 139 in total, were from NESDB, RID, MNRE, DWR, SCWRM, ONWF(SCC), TMD, BMA, DDPM, Royal Development Project Board, DPW, GISTDA, HAII, Universities, Mass Media (Channel 9, Daily News Newspaper), Embassy of Japan, MLITT of Japan, JICA, and JICA study teams.

Opening Remarks

3. Opening remarks were delivered by Mr. Lertviroj Kowattana, Director General, Royal Irrigation Department, Mr. Chaiporn Siripornpibul, Deputy Director General, Department of Water Resources, and Ms. Ladawan Kumpa, Deputy Secretary General, National Economic and Social Development Board.

4. Opening remarks speakers expressed appreciation to JICA and JICA study teams for their efforts to improve flood management in Thailand – Basic Plan of Flood Management System, Flood Risk Information System and Master Plan of Flood Management. They also gave thanks to relevant agencies for sharing information, working closely with JICA study team and spending valuable time to attend the seminar to share opinions with JICA study team. They hoped that the seminar would help successful flood management improvement to reduce economic damages from flooding that might unfortunately occur in future.

Background of JICA's Total Support for "Unbeatable Thailand"

5. Mr. Kimio Takeya, JICA Senior Advisor, explained the framework of "Project for Comprehensive Flood Management Plan for Chao Phraya River Basin". He emphasized that the basic concept of JICA revising Master Plan & Supporting Study was to (i) Respect and input the knowledge and experiences of Thailand; and (ii) Propose the best solution by integrating Thailand, Japanese and other technologies, knowledge and experiences without taking any behind to the schedule of Thai Government's effort.

Draft Flood Management Plan in the Chao Phraya River Basin

6. Mr. Yusuke Amano of JICA HQ presented the outline of Master Plan of Flood Management in the Chao Phraya River Basin including following items,

1. Concept of Master Plan;
2. Countermeasures studied in the JICA Study; and,
3. Proposed Best Combination of Countermeasures.

JICA proposed priority projects as follows:

1) Operation Efficiency of Existing Dams: especially Bhumibhol Dam, Sirikit Dam, Pasak Dam and Kwae Noi Dam are expected to have a flood control effect;
2) Construction of Outer Ring Road Diversion Channel; and,
3) Construction of Ayutthaya Bypass Channel.

7. There was a question about the activities of flood forecasting, and the linkage between the new rule curves of dams and flood forecasting. Mr. Amano responded that the Master Plan did not cover this topic and the answer would be given by FRICS (Component 3) who was responsible for the flood warning system project.

8. There was a comment that according to the sequence of each flooding during last big flood in 2011, the flood water traveled from the north and inundated the areas from Nakhon Sawan down to the south, but the Bangkok Metropolitan Area was protected. The questioner asked about if there was any rational explanation or suggestions on how to drain water from the north through the Bangkok area without flooding Bangkok.

9. Mr. Amano answered that to prevent the "areas to be protected" defined by Thai government from flooding, the JICA proposal: construction of Ayutthaya Bypass Channel and Outer Ring Road Diversion Channel would be very effective. Although other additional diversion channels might need to be constructed in the future, JICA recommended that the construction of these two channels should be given the high priority.

10. There was a comment that there were two ways of controlling flood, one was to make water flow as fast as possible to the sea and the other one was to store somewhere else like in retention areas. The questioner asked about the plans in terms of the conservation of retarding function, whether keeping the current function or proposing to improve the function.

11. Mr. Amano answered that there was another JICA Study Team which was looking into such topic to answer the question on how to build the resilient tambon against the flood and also how to utilize the retention areas to increase the productivities of agriculture and fisheries. The findings would be presented in one or two months.

12. There was a comment that if there was no significant improvement in the total inundation areas between the JICA proposal and the Thai government proposal, it could be said that the JICA proposal was not much better than the government plan. The questioner requested JICA to elaborate further on their proposal.

13. Mr. Amano answered that the JICA proposal was the most cost effective combination which gave equivalent flood mitigation results when the cost and effectiveness were compared with the Thai government proposal which included full menu. The Thai government proposal could mitigate flood very effectively, however the cost to implement all the countermeasures were very high. On the other hand, the JICA proposal had lower implementation costs as only two structural countermeasures to be implemented, but the effectiveness of flood mitigation was the same as the full menu proposed by the Thai government. Therefore, the JICA proposal was considered to be the most effective among all other combinations of countermeasures.

Draft Basic Plan of Flood Management Information System

14. Mr. Akihiko Nunomura, Executive Director, FRICS, presented a draft of Basic Plan of Flood Management Information System, which is the output of Component 3 of the Project. He explained that the draft plan summarized universally required items of the flood management information system of Thailand in the future, which all the proposing parties of the international competition should consider: It did not have a prejudice in favor of any of such proposals.

Outline of Flood Risk Information System

15. Mr. Nunomura continued his presentation on Flood Risk Information System, a prototype of which had been used during 2012 flood season among the registered monitors (Japanese firms and Thai officials of related organizations). After discussions with Thai officials and necessary amendments, the system (including Thai language version) was ready to be open to public. The system would provide the following information,

1. Past and present water-level and flow-rate
2. Forecast water-level and flow-rate for 7 days to come
3. Today's inundation situation
4. Forecast inundation area for 7 days to come

16. There was a question about the input data of the forecast for 7 days, and the forecasting method. Mr. Nunomura replied that the forecast values were estimated based on (i) observed upstream flow rate, (ii) observed upstream rainfall until the day, and (iii) forecast rainfall, which was generated by a global meteorological model. He added that among existing meteorological forecast data of TMD, JMA, and others, available data were being used.

Project for Flood Countermeasures for Thailand Agricultural Sector

17. Mr. Takeya explained the contents, the status quo, and the schedule of the project, under which a guideline for disaster resilient agriculture and agricultural community was being prepared through participatory planning process. The guideline was expected to assist development of "Tambon Disaster Resilient Plan", and eventually mitigate flood damage in the inundation area.

Closing Remarks

18. Mr. Kazuhiro Yoneda, JICA Chief Representative, delivered his closing remarks. He, extending his appreciation to NESDB for co-organizing the seminar, thanked the efforts of RID, DWR, and JICA study teams for formulating "Draft Basic Plan of Flood Management Information System" and "Draft Flood Management Plan in the Chao Phraya River Basin". He stressed that the Flood Management Plan was unparalleled comprehensive and holistic flood management plan for the Chao Phraya River Basin, and it was essential to reflect the both plans to the new TOR of the international competition, so that the basin wide planning and management consistency would be ensured, and better integration among different modules of the competition would be achieved. Lastly he thanked all the attendants for their participation and for their kind support and cooperation to JICA's cooperation project.

MK

Attachment

Provisional Agenda on Comprehensive Flood Management Plan in the Chao Phraya River Basin
Organized by
Office of the National Economic and Social Development Board, Royal Irrigation Department,
Department of Water Resources, and Japan International Cooperation Agency
25 January 2013
Ballroom A, 7th floor, the Westin Grande Sukhumvit Hotel

8.30 – 9.00	Registration
9.00 – 9.20	Opening Remarks Mr. Arkhom Termpittayapaisith, Secretary General, National Economic and Social Development Board Mr. Lertviroj Kowattana Director General, Royal Irrigation Department Mr. Chaiporn Siripornpibul Deputy Director General, Department of Water Resources
9.20 – 9.25	Background of JICA's Total Support for "Unbeatable Thailand" by Kimio Takeya, JICA Senior Advisor
9.25 – 10.05	Presentation 1: Draft Basic Plan of Flood Management Information System by Akihiko Nunomura, Executive Director, FRICS
10.05 – 10.25	Questions & Answers
10.25 – 10.45	Presentation 2: Outline of Flood Risk Information System by Akihiko Nunomura, Executive Director, FRICS
10.45 – 11.00	Questions and Answers
11.00 – 11.15	Coffee Break
11.15 – 11.55	Presentation 3: Draft Flood Management Plan in the Chao Phraya River Basin by Yusuke Amano, JICA HQ
11.55 - 12.15	Questions and Answers
12.15 - 12.20	Presentation 4: Project for Flood Countermeasures for Thailand Agricultural Sector by Kimio Takeya, JICA Senior Advisor
12.20 – 12.30	Closing Remarks Mr. Kazuhiro Yoneda, JICA Chief Representative

Presentation by Mr. Amano, JICA HQ

Seated in the front row (from left to right) are
Mr. Goro Yasuda, Director of Overseas Project Division, MLITT, Japan
Mr. Kimio Takeya, JICA Senior Advisor
Mr. Kazuhiro Yoneda, JICA Chief Representative,
Mr. Kiminori Iwama, Economic Minister, Embassy of Japan
Mr. Lertviroj Kowattana, Director General, RID,
Ms. Ladawan Kumpa, Deputy Secretary General, NESDB,
Mr. Chaiporn Siripornpibul, Deputy Director General, DWR,
Dr. Apichat Anukulampai, Committee of SCWRM

Seminar Attendees' List

January 25, 2013 at 8.30 - 12.30

Ballroom A, 7th floor, The Westin Grand Sukhumvit Hotel

No.	Name-Surname		In charge
[THAI SIDE]			
Royal Irrigation Department			
1	Mr. Lertviroj	Kowattana	Director General
2	Mr. Chatchawal	Punyavateenun	Deputy Director General for Engineering
3	Mr. Thongplew	Kongjun	Director, Office of Water Management and Hydrology
4	Mr. Phaisan	Phongnoraphat	Director of Operation and Maintenance Division, RIO 13
5	Mr. Prayun	Yenjai	Representative of RIO 13
6	Mr. Vitoon	Thititanapak	Director of Operation and Maintenance Division, RIO 2
7	Mr. Kanching	Kawsard	Director of Operation and Maintenance Division, RIO 3
8	Mr. Chatchom	Chompradit	Director of Water Management
9	Mr. Thanar	Suwattana	Director of Project Planning Division, Office of Project Management
10	Mr. Phonchai	Klinkhachorn	Director of Hydrology and Water Management
11	Mr. Thada	Sukhapunaphan	Director of Hydrology Division
12	Mr. Somkiat	Prajamwong	Director, Office of Project Management
13	Mr. Supanant	Pariyachat	Chief of Project Planning Group 4
14	Mr. Kanchadin	Sraprathoom	Chief of Loan Project Branch
15	Mr. Somchit	Amnatsan	Chief of Water Management Group
16	Mr. Chonlathep	Thatee	Chief of Water Management Branch, RIO 3
17	Mr. Boonthum	Panpiamphot	Chief of Water Management Branch, RIO 4
18	Mr. Athaporn	Punyachom	Chief of Water Management Branch, RIO 10
19	Mr. Adisorn	Champathong	Irrigation Engineer, Professional Level
20	Ms. Phattaporn	Mekpruksawong	Chief of Project Planning Group 1
21	Mr. Theerapong	Pinthong	Irrigation Engineer
22	Mr. Chanin	Kongyai	Irrigation Engineer, RIO 12
23	Mr. Vich	Sriwongsa	Civil Engineer
24	Mr. Surachai	Laikanchanaphaibun	Water Resources Engineer
25	Ms. Bantitha	Khantisit	Water Resources Engineer
26	Mr. Suticha	Taeliem	Irrigation Engineer
27	Ms. Jitsuda	Inthuman	Technical Specialist
28	Ms. Patcharawee	Suwannik	Irrigation Engineer

29	Ms. Rojvat	Inrung	Irrigation Engineer
30	Mr. Tatsuo	Kunieda	JICA Expert to RID
31	Ms. Paweesuda	Boonchuwong	Secretary to JICA Expert
Office of the National Economic and Social Development Board			
32	Ms. Ladawan	Kumpa	Deputy Secretary General
33	Mr. phitsanu	Woranart	Plan and Policy Analyst, Senior Professional Level
34	Mr. Chamnong	Phowngpuk	Plan and Policy Analyst, Senior Professional Level
35	Mr. Boonchub	Songtakunsak	Plan and Policy Analyst, Senior Professional Level
36	Ms. Jinna	Tansarawiphut	Plan and Policy Analyst, Senior Professional Level
37	Ms. Suwannee	Arunchokchai	Plan and Policy Analyst, Professional Level
38	Ms.Kanyavee	Prayunsitthi	Plan and Policy Analyst, Professional Level
39	Ms. Aim-on	Phrueksuriya	Plan and Policy Analyst, Operational Level
40	Ms. Panittra	Ninphanit	Plan and Policy Analyst, Operational Level
41	Mr. Teeparat	Vacharangkura	Director of Central Region Economic and Social Development Office
Office of the Permanent Secretary, Ministry of Natural Resources and Environment			
42	Mr. Dunyarit	Homnan	Civil Engineer, Professional Level
Department of Water Resoureces			
43	Mr. Chaiporn	Siripornpibul	Deputy General Director
44	Ms. Sukontha	Aekaraj	Director, Bureau of International Cooperation
45	Mr. Phadet	Saengsawang	Acting of Director of Water Crisis Protection Center
46	Mr. Sathit	Sueprasoetsuk	Director of Specific Area Protection
47	Mrs. Wandee	Phatthanasathianphong	Scientist, Professional Level
48	Ms. Anchalee	Phenghuaro	Plan and Policy Analyst, Practitioner Level
49	Mr. Pramook	Duangkaew	Scientist, Practitioner Level
50	Mr. Chalermchon	Cho-In	Civil Engineer, Water Crisis Protection Center
51	Mr. Jirawat	Pracheapchai	Civil Engineer, Water Crisis Protection Center
52	Mr. Pinyo	Ketsa	Plan and Policy Analyst
53	Ms. Anya	Maneekham	Plan and Policy Analyst
54	Ms. Poramaporn	Sawanyaphanit	Civil Engineer
55	Ms. Sirirat	Poonma	Plan and Policy Analyst
56	Mr. Traithit	Ninnonsuk	Civil Engineer
Strategic Committee for Water Resources Management (SCWRM)			
57	Mr. Apichat	Anukulampai	Committee and Chairman, Technical and Project Appraisal Sub-Committee
58	Mr. Chukiat	Sapphaisal	Committee

59	Mr. Sombat	Yumuang	Committee and Chief of Geo-Informatics Research Center for Thailand (GISTHAI)
Office of the National Water and Flood Management Policy			
60	Ms. Ampanpin	Pinthukanok	Advisor
61	Ms. Suprani	Runghiranwirot	Advisor
62	Mr. Pipat	Rueangngam	Director, Water Management Center
63	Mr. Supapap	Phatsinghaseni	Civil Engineer, Professional Level
Office of the Royal Development Project Board			
64	Mr. Apisak	Sonwisut	Director of Project Cooperation Group
65	Ms. Sopitha	Bunprasong	Plan and Policy Analyst
66	Mr. Somyot	Ngoenthaworn	-
Department of Drainage and Sewerage			
67	Mr. Adisak	Khundee	Director, Department of Drainage and Sewerage
68	Mr. Chainat	Niyomthun	Deputy Director, Department of Drainage and Sewerage
69	Mr. Somsak	Meeudomsak	Electrical Engineer, Senior Professional Level
70	Mr. Surart	Jaroenchaisakul	Civil Engineer, Senior Professional Level
71	Mr. Chetsada	Chantharaprapha	Civil Engineer, Senior Professional Level
72	Mr. Sombat	Worasinwatthana	Civil Engineer, Senior Professional Level
73	Mr. Sansoen	Rueangrit	Civil Engineer, Professional Level
74	Mr. Na Thotsaphal	Chanloi	Civil Engineer, Professional Level
75	Mr. Bunyuen	Khuncharoen	Senior Technician
76	Mr. Visnu	Charoen	Civil Engineer, Professional Level
77	Mr. Prat	Thianchao	-
78	Mr. Suttipol	Kasertsomboon	Civil Engineer, Professional Level
Thai Meteorological Department			
79	Mrs. Ratana	Prakhammin	Meteorologist
80	Mr. Fatha	Matthawi	Meteorologist
81	Mr. Phat	Sukthawi	Meteorologist
Department of Disaster Prevention and Mitigation			
82	Mr. Thanabodi	Khrongyuti	Plan and Policy Analyst, Senior Professional Level
83	Ms. Chatchatporn	Bunphiranat	Director of Natural Disaster Planning Division
84	Mr. Prasong	Thammapala	Scientist, Information and Technology Center
Department of Public Works and Town & Country Planning			
85	Mr. Pisut	Sukhum	Civil Engineer, Senior Professional Level
86	Mr. Chaiya	Joemjutitam	Civil Engineer, Expert Level

87	Mr. Marupong	Tansatcha	Civil Engineer, Professional Level
Geo-Informatics and Space Technology Development Agency (GISTDA)			
88	Mr. Thudchai	Sansena	GIS Technician
89	Ms. Monchaya	Piboon	Officer
Hydro and Agro Informatics Institute (HAII)			
90	Ms. Piyamarn	Sisomphon	Researcher
91	Mr. Surajate	Boonya-Aroonnet	Researcher (Head of Hydro Modeling Section)
Chulalongkorn University			
92	Mr. Khwanchai	Phaekhoksung	Engineer, Faculty of Engineering
Srinakarinwirot University			
93	Mr. Sacha	Sethaputra	Civil Engineering Professor
94	Mr. Puripus	Sutornnont	
Asian Institute of Technology (AIT)			
95	Dr. Damien	Jourdain	
96	Mr. Anshul	Agarwal	PH.D. Student
97	Mr. Muhammad	Babur	Master Degree Student
98	Mr. Seemanta	Bhagabati	Researcher
Regional Integrated Multi-Hazard Early Warning System			
99	Mr. S.H.M.	Fakhrudin	Hydrology Team Leader
King Mongkut's University of Technology Thonburi			
100	Mr. Chaiwat	Ekkawatpanit	Head of Water Resources Engineering Division, Civil Engineering Department
101	Mr. Apin	Waraweerawat	Master Degree Student
Mass Media			
102	Mr. Chutsana	Tantayanon	Channel 9
103	Mr. Pharanyu	Ammee	Channel 9
104	Ms. Orachon	Suratchaseri	Journalist, Daily News
105	Mr. Wasawat	Otthawee	Journalist, Daily News

Seminar Attendees' List

January 25, 2013 at 8.30 - 12.30

Ballroom A, 7th floor, The Westin Grand Sukhumvit Hotel

No.	Name-Surname		In charge
[JAPANESE SIDE]			
Embassy of Japan			
1	Mr. Kiminori	Iwama	Economic Minister
2	Mr. Ryotaro	Hayashi	Second Secretary
Ministry of Land, Infrastructure, Transport and Tourism			
3	Mr. Goro	Yasuda	Director, Overseas Project Division, Policy Bureau
4	Mr. Rei	Itsukushima	Chief Official, Overseas Project Division, Policy Bureau
JICA			
5	Mr. Yusuke	Amano	Senior Advisor
6	Mr. Kimio	Takeya	Senior Advisor
7	Mr. Hideaki	Matsumoto	-
8	Mr. Kazuhiro	Yoneda	Chief Representative
9	Mr. Tomoyuki	Kawbata	Senior Representatve
10	Mr. Yojiro	Miyashita	Representative
11	Mr. Kobchai	Songsrisanga	Program Officer
Sunyu Consultants			
12	Mr. Teturo	Oda	
13	Mr. Pichai		
JICA Study Team			
14	Mr. Akihiko	Nunomura	Team Leader for Component 3
15	Mr. Minoru	Kuriki	Deputy Team Leader for Component 3
16	Mr. Yasushi	Inoue	Engineer
17	Ms. Wanlaya	Manutkasemsirikul	Secretary to Component 3
18	Mr. Takahiro	Mishina	Team Leader for Component 1-2
19	Mr. Hajime	Tanaka	Deputy Team Leader for Component 1-2
20	Mr. Masami	Katayama	Engineer (Component 1-2)
21	Mr. Makoto	Yajima	Engineer
22	Mr. Takayuki	Hatano	Engineer
23	Mr. Kazuhiro	Nakamura	Engineer

24	Mr. Hidehisa	Tamura	Engineer
25	Mr. Satoshi	Takata	Engineer
26	Ms. Akira	Watanabe	Engineer
27	Ms. Kamolnit	Ariyakamolpat	Interpreter
28	Ms. Nattamon	Tanyapanit	Interpreter
29	Ms. Karuna	Tuncharoen	Interpreter
30	Ms. Melyn	Chutumstid	Interpreter
31	Mr. Chuchat	Suwut	Senior Administrator
32	Ms. Nichapat	Rakpongthai	Administrator
33	Ms. Tantawan	Tanpibal	CAD Operator
34	Ms. Supajitra	Pruettivorawongse	CAD Operator

Record of Seminar
on the JICA's Support for the Chao Phraya River Basin
20 February 2013, 13.00 – 18.30 hrs.
Ballroom, the Westin Grande Sukhumvit, Bangkok

Organization of Seminar

1. Seminar on the JICA's Support for the Chao Phraya River Basin was held on 20 February 2013 from 13:00 to 18:30 hrs at Ballroom, the Westin Grande Sukhumvit, Bangkok. The seminar was organized by the Office of the National Economic and Social Development Board, the Royal Irrigation Department, the Department of Water Resources, and Japan International Cooperation Agency. It aimed at sharing JICA's Support for the Chao Phraya River Basin with all key stakeholders of the sequence of Thai government actions. The provisional agenda of the seminar is as attached. (Considering the availability of salient persons, the order of presentations was changed as reported below.)

2. Participants, 231 in total, were from NESDB, RID, DWR, MNRE, SCWRM, ONWF(SCC), DOH, DOR, OAE, TMD, BMA, DDPM, ORDPB, RTSD, DPW, GISTDA, HAII, TICA, Universities, Mass Media, Embassy of Japan, MLIT of Japan, JICA, and JICA study teams.

Welcome Addresses

3. Welcome addresses were delivered by Dr. Plodprasop Suraswadi, Deputy Prime Minister, and Mr. Shigekazu Sato, Ambassador, Embassy of Japan.

4. Dr. Plodprasop made a brief explanation on the climate and flood history in the country. He also explained the situation toward the water management has changed after the 2011 flood, from agriculture to flood control purpose. As a politician and the representative of the International Competition, Dr. Plodprasop expressed his decision mainly regarding 1) construction of two medium-size dams in Yom River in stead of Kaeng Sua Ten Dam, 2) both improvement of the existing canal in the east side and construction of a new floodways in the west side going to the sea. Even though Thailand is still on the way to have supports from foreigners like Japan, it's high time for Thailand people to decide by ourselves. Finally, Dr. Plodprasop concluded with extending his appreciations to Japan's supports for a long time and asked for a continuous support and investment in Thailand.

5. Mr. Sato welcomed all the meeting attendees on behalf of the Government of Japan. He briefly summarized the Japanese Government's assistance provided to the Thai Government in terms of the water resources management such as 1) the emergency assistance for the reconstruction of the damaged areas including the inundated seven industrial parks, 2) the mid and long term assistance for the development of "the Master Plan on the Chao Phraya River Basin" in 1999 and the revision of the Master Plan which results to be presented at the seminar today. He concluded with expressing his hope

that this revised Master Plan would be reflected in the Thai Government's Water Resources Management Plan so that the Thailand's flood countermeasures would be ready for the anticipated flood in the future, and the water resources would be effectively and efficiently utilized by the people concerned in Thailand.

Opening Remarks

6. Mr. Hiroto Arakawa, Vice President of JICA, delivered opening remarks. Mr. Arakawa briefly summarized the background history of the JICA's Master Plan Project by stating that this project was formally requested by the Honorable Prime Minister Yinluck Shinawatra to the Japanese Government on November 9, 2011. . He believed that the scientific analysis background with the detailed maps will surely bring the Thai Government with indispensable information for flood management, and this Master Plan provides the best solution from the viewpoint of the cost, construction period for structural measures as well as social and environmental impacts. Mr. Arakawa concluded that this Master Plan jointly prepared by the efforts made by Thai and Japanese is not the end but the beginning of the flood management actions for Chao Phraya River Basin.

Outline of JICA Flood Management and Mitigation Projects in Thailand by Mr. Takeya

7. Mr. Kimio Takeya, JICA Senior Advisor firstly introduced a general review of Japan's supports for the flood management in Thailand and explained what would be important for the future flood management. He showed necessary aspects for an effective flood management including cost effectiveness, protection of agricultural sector, flood forecasting, combination of structural and non-structural measures etc. Secondary, he emphasized on the priority of JICA's project in partnership with the plans of the Thai Government. At last, Mr. Takeya outlined the seminar.

Presentation 1: Comprehensive Flood Management Plan in the Chao Phraya River Basin by Mr. Amano

8. Mr. Yusuke Amano, JICA HQ presented the updated outline of Master Plan for the Chao Phraya River Basin, including following items:

1. Basic Flood Management Policy
2. How to Control Inundation
3. Best Combination of Structural/Non-structural Countermeasures
4. Project Evaluation
5. Points to Be Considered

9. Mr. Amano also explained an importance of combination of countermeasures from the academic and scientific points with precise topographical data and social conditions. In the presentation, two options of the combination based on the proposal shown in the last seminar on 25 Jan, 2013 (effective operations of existing dams, construction of Outer Ring Road Diversion Channel and

Ayutthaya Bypass Channel), were proposed and evaluated their priorities on an economical viewpoint. Mr. Amano also explained the impact of the storm surge and the climate change.

10. There was an inquiry from the floor on availability of LiDAR data. JICA answered that JICA has already transferred the data to Thai side. According to the JICA policy, it is expected that the data will be used openly not only by the government officials but also academics or any other entities.

11. There was an appreciation to the study on storm surge of the Gulf of Thailand. The presenter additionally explained that the study on storm surge was conducted for considering its impact to the flood discharge. If the sea level would have been changed due to any reason, the way of flood management and countermeasures would need to be changed since flooding was influenced by the sea level.

12. It was pointed out that the project cost of THB 508 billion for SCWRM Master Plan was not consistent with THB 350 billion which was prepared by the Thai government for the purpose of flood management. The presenter answered that the THB 508 bil. was newly and more precisely estimated by the study team.

13. It was questioned whether there is any difference of the inundation area even though the range of remaining inundated areas estimated by both SCWRM and JICA Master Plan are almost same; 16,000 square kilometers, and whether the economic evaluation was based on the present economic condition or future economic condition. The presenter answered that comparing with SCWRM plan, duration and depth of flood water in limited area would be longer than and mostly as same as JICA Master Plan. The damages vary depending on inundation depth and inundation area. The calculation of EIRR by JICA was based on damage estimation of assets considering depth, duration and inundation areas. The economic growth predicted by Thai government has already been incorporated in the estimation of EIRR. The study also refers to the protection area determined by Royal Thai Government.

14. JICA mentioned preliminary social and environmental impact assessment on proposed projects will be carried out in the project and can be shared in the final report. However the impacts will be smaller than SCWRM MP projects since the proposed length of the diversion channel was at only 100km, comparing to the east or west diversion channel whose length was at 250km.

Presentation 2: JICA Project for Agricultural Resiliency by Mr. Jongskul and Mr. Tetsuro Oda

15. Mr. Apichart Jongskul, Secretary General of Office of Agricultural Economics and Mr. Tetsuro Oda, Co-Leader of JICA Project Team made presentations for the project to recover agricultural damages by 2011 Flood and to promote medium and long term plans for mitigating damages in agricultural sector from the future flood. The project team established the Guideline including the following items:

1. Community-Based Disaster Risk Management
2. Community Water Resources Management
3. Flood Damage Reduction Measures in Agricultural and Livestock Sector
4. Income Generation Activities towards Recovery of Rural Livelihood
5. Networking, Supporting and Institution for Community Strengthening

16. The presenters pointed sustainability of flood countermeasure activities, importance of effective flood information delivery to local people, education for young generation, and awareness of changing social structure and life style in rural communities as findings.

Presentation 3: Basic Plan of Flood Management Information System by Mr. Nunomura

17. Mr. Akihiko Nunomura, Executive Director, FRICS, presented a Basic Plan of Flood Management Information System, which is the output of Component 3 of the Project, including following items:

1. Current Status and Issues (Information-related Issues Surfaced in 2011 Flood)
2. Function of Information in Flood Management (Society to be achieved through promotion of information sharing)
3. Basic Strategies of Flood Management Information System Construction (Things to be done holistically)
4. Specific Measures Development Plan of Flood Management Information System

18. He explained that the basic plan summarized universally required items of the flood management information system of Thailand in the future, which all the proposing parties of the international competition should consider: It did not have a prejudice in favor of any of such proposals.

19. Mr. Nunomura also presented on Flood Risk Information System. After discussions with Thai officials and necessary amendments, the system (including Thai language version) was ready to be open to public. The system would provide the following information,

1. Past and present water-level and flow-rate
2. Forecast water-level and flow-rate for 7 days to come
3. Today's inundation situation
4. Forecast inundation area for 7 days to come

20. It was questioned that how the information of water barriers was updated, such as dyke construction in the industrial estates and sandbag installation which affected the simulation. The Study team replied that the model developed by the study team has already incorporated major new water barriers and constructions. Also it was suggested that that the Thai government would take responsibility for looking after the models and updating the topographic data.

21. Regarding the minor difference between the GISTDA image and simulation results, the simulation runs using the data of RID and TMD and models; H08 and RRI which were respectively developed by ICHARM and IMPAC-T project. The simulation result is compared with GISDA image to check the consistency and accuracy.

22. It is noted that there were some measures planned such as floodways, utilizing existing canals and pumping stations to prevent the flood in the downstream. Therefore it is unnecessary to forecast inundation if Thailand had flood prevention measure by using all facilities.

23. It was suggested that the issue of the use of drainage system in Bangkok and its vicinity which had been blocked in 2011 flood situation be properly addressed in the study. It would be useful to improve existing drainage system and expected to show also its change which would affect any area. Moreover, JICA's help to propose social development method to cope with disaster is expected.

24. It was suggested from the floor that the impacts from the floodway from Nakhon Sawan to Samut Songkham which was presented by Deputy Prime Minister be studied by JICA. JICA answered that the study will consist of economic, agricultural, social and environment impacts assessment. JICA has a plan to show a total view of flood management in the Chao Phraya River basin, which would be finalized in the end of May.

Presentation 4: Integrated Study on Hydro-Meteorological Prediction and Adaptation to Climate Change in Thailand, IMPAC-T by Dr. Komori

25. Dr. Daisuke Komori, Research Associate Professor, University of Tokyo introduced the preliminary analysis on the climatological future river discharge change in the Chao Phraya River Basin as well as the mechanism of climate change. The impact of climate change in the global and regional level and adaptations against climate change were presented mainly with evidences based on existing academic researches. For the issue on the Chao Phraya River Basin, Dr. Koike showed no significant changes in climatological and annual mean river discharge in the most basin, but significant increase in precipitation and evaporation during the rainy season in the near future and the end of the 21st century.

Presentation 5: Rainfall-Runoff-Inundation Analysis by Dr. Sayama

26. Dr. Takahiro Sayama, Associate Professor, ICHARM showed the concept of a flood simulation model called "RRI Model" which ICHARM developed. The presentation included the brief results of simulations for 1) the Entire and 2) the Lower Chao Phraya River Basin, as well as long-term RRI analysis for climate change impact assessment. Dr. Sayama explained that inundation simulation in the Lower CPR Basin was improved with employment of Laser Profiler (LP) data. As for long-term simulation, the presentation indicated RRI will be able to qualify the sensitivity of inundation against six-month rainfall.

27. There was a recommendation from the floor that the analysis model should be updated according to the change of the situation in future and the analysis model should be modified accordingly.

28. Some audience expected that more information on RRI model could be downloaded through website, however it was not available currently. Dr. Sayama also expected to have further discussion on how to use the model effectively among him and model users. In addition, a professor of Chulalongkorn University used to work on RRI model.

Closing Remarks

29. Mr. Masami Fuwa, JICA Director General of Global Environmental Department, delivered his closing remarks. He extended his appreciation to all the participants for their active discussion and continuous interests to the seminar. It was emphasized that this international cooperation between Thai and Japanese sides is under taking upon the neutral agreement, and upon the official request from Thai Government, therefore the output of this technical cooperation which are fruit of cooperation with RID, DWR, Universities and all the Thai organizations concerned, should be benefit for the Thai people and Thai society. He suggested that we should continue our cooperation to develop the capacities of organizations concerned, and also all the precious comments received from participants today shall be useful in our future works. Finally he expressed his strong hope that the results of this technical cooperation will provide the Thai government to prepare more effective and efficient master plan of integrated flood management and water resources development.

SEMINAR AGENDA

The JICA's Support for the Chao Phraya River Basin

"From the Integrated Water Resource Management View Point"
Practical Solution for Flood Control, Agricultural Resiliency, Flood Forecasting, Climate Change and River Modeling

Organized by
Office of the National Economic and Social Development Board, Royal Irrigation Department, Department of Water Resources and Japan International Cooperation Agency

20 February 2013
Ballroom, 7th Floor, the Westin Grande Sukhumvit Hotel

13:00 - 13:30	**Registration**
13:30 - 13:45	**Welcome Address** Dr. Plodprasop Suraswadi , Deputy Prime Minister Mr. Shigekazu Sato, Ambassador, Embassy of Japan
13:45 - 14:00	**Opening Remarks** Mr. Hiroto Arakawa, Vice President, JICA
14:00 – 14:15	**Outline of the JICA Flood Management and Mitigation Projects in Thailand** Mr. Kimio Takeya, JICA Senior Advisor
14:15 – 14:45	**Presentation 1: Comprehensive Flood Management Plan in the Chao Phraya River Basin** Mr. Yusuke Amano, JICA HQ
14:45 – 14:55	**Questions & Answers**
14:55 – 15:15	**Coffee Break**
15:15 – 15:35	**Presentation 2: JICA Project for Agricultural Resiliency** Mr. Apichart Jongskul, Secretary General, Office of Agricultural Economics Mr. Tetsuro Oda, Co-Leader, JICA Project Team
15:35 – 15:45	**Questions and Answers**

15:45 – 16:05	**Presentation 3: Basic Plan of Flood Management Information System** Mr. Akihiko Nunomura, Team Leader, FRICS
16:05 – 16:15	**Questions & Answers**
16 :15 – 16:35	**Presentation 4: Integrated Study on Hydro-Meteorological Prediction and Adaptation to Climate Change in Thailand, IMPAC-T** Dr. Daisuke Komori, Research Associate Professor, Tokyo University
16:35 – 16:45	**Questions & Answers**
16:45 – 17:05	**Presentation 5: Rainfall-Runoff-Inundation Analysis** Dr. Takahiro Sayama, Associate Professor, ICHARM
17:05 – 17:15	**Questions & Answers**
17:15 – 17:20	**Closing Remarks** Mr. Masami Fuwa, Director General, Global Environment Department, JICA

Distinguished Guests

Seated in the front row (from left to right) are
Mr. Hiroto Arakawa, Vice President, JICA
Mr. Shigekazu Sato, Ambassador, Embassy of Japan
Dr. Plodprasop Suraswadi, Deputy Prime Minister
Advisor to Deputy Prime Minister

Seminar Attendees

9/10

Welcome Address by Dr. Plodprasop Suraswadi

RECORD OF FINAL SEMINAR

on the "Disaster Resilient Thailand"

~ Flood Management Plan for the Chao Phraya River Basin ~

~ Agri-Sector Flood Damage Mitigation Guideline ~

20 June 2013, 08:30 - 12.30 hrs.

Ballroom, 7th Floor, the Landmark Bangkok Hotel

Organization of Seminar

1. Final Seminar on the "Disaster Resilient Thailand" ~ Flood Management Plan for the Chao Phraya River Basin, Agri-Sector Flood Damage Mitigation Guideline ~ was held on 20 June 2013 from 08:30 to 12:30 hrs. at Ballroom, 7th Floor, the Landmark Bangkok Hotel. The seminar was organized by the Office of the National Economic and Social Development Board, the Royal Irrigation Department, the Department of Water Resources, and Japan International Cooperation Agency. It aimed at sharing 1) the most up to date findings on flood management of the Chao Phraya River Basin, 2) progress of works on Flood Management Information System and 3) outputs of the studies on countermeasures of Thailand's agricultural sector. The agenda of the final seminar is as attached.

2. Participants, 126 in total, were from NESDB, RID, DWR, MNRE, SWRC, ONWF, OAE, TMD, BMA, DDPM, ORDPB, DPW, GISTDA, HAII, Universities, Embassy of Japan, JICA HQ, JICA Thailand, JICA study team (Component 1-2, Component 3, and Agriculture Sector).

Welcome Addresses

3. Welcome addresses were delivered by Mr. Arkhom Termpittayapaisith, Secretary General, National Economic and Social Development Board and Mr. Lertviroj Kowattana, Director General, Royal Irrigation Department

4. Mr. Arkhom Tempittayapaisith welcomed all the seminar attendees. He briefly summarized the JICA's technical Supports to the Thai Government in terms of the flood protection and water resources management such as 1) revising the 1999 study on the integrated plan for the flood mitigation in the Chao Phraya, 2) developing the flood forecasting system, 3) digital mapping of the floodplain and 3) conducting the comprehensive study on Thai agricultural sector. He concluded with expressing the importance of the revised comprehensive flood management plan in the Chao Phraya River which would be certainly important tool and effective for integrated water resources management in Thailand.

5. Mr. Lertviroj Kowattana welcomed seminar participants on behalf of Royal Irrigation Department. He described that his department recently celebrated the 111th anniversary, and in the RID's remarkable history, JICA has been the key developing partner for the technical cooperation projects. Among those projects, this flood management plan will open the new phase in RID's history and would be helpful for Thailand to improve its water management. Mr. Kowattana concluded with expressing his sincere appreciation to the participants by all concerned agencies for their active cooperation, as well as Japanese government and JICA for the technical assistance.

Opening Remarks

6. Mr. Kiminori Iwama, Economic Minister, Representative from the Embassy of Japan, delivered opening remarks. Mr. Iwama briefly summarized the background history of the JICA's Master Plan Project by stating that this project was formally requested by the Honorable Prime Minister Yinluck Shinawatra to the Japanese Government on November 9, 2011. . He believed that

the scientific analysis background with the detailed maps will surely bring the Thai Government with indispensable information for flood management, and this Master Plan provides the best solution from the viewpoint of the cost, construction period for structural measures as well as social and environmental impacts. Mr. Iwama concluded that this Master Plan jointly prepared by the efforts made by Thai and Japanese is not the end but the beginning of the flood management actions for the Chao Phraya River Basin.

Presentation 1: Comprehensive Flood Management Plan in the Chao Phraya River Basin by Mr. Amano

7. Mr. Yusuke Amano, JICA Senior Advisor presented the results of JICA's study on the Comprehensive Flood Management Plan in the Chao Phraya River Basin. He described that the two most important matters are 1) reduction of flood risk and 2) utilization of floodwater in the Chao Phraya River. The study's results emphasized that although inundation cannot be eliminated, unexpected/uncontrolled inundation should be avoided.

8. The structural and non-structural countermeasures evaluated in this study are mainly based on the projects proposed by Strategic Committee for Water Resources Management (SCWRM) and Water and Flood Management Commission (WFMC). In the presentation, the findings of evaluation on each countermeasure were summarized. Based on the findings, JICA's study determined the best mix of structural and non-structural countermeasures with the academic and scientific supports as well as the precise topographic data established by LiDAR topographical survey.

9. Since the previous seminar on February 20, more detailed modeling works were conducted by taking into account the additional countermeasure in order to improve the Tha Chin River. Mr. Amano presented the revised values of project effectiveness in the form of EIRR, Benefit/Cost (B/C) and Net Present Value. Among three causes including SCWRM M/P Menu, Proposed Combinations 1 and 2, the estimated total costs of Combination 1 and 2 are less than 40% of SCWRM M/P cost. In addition, ERII and B/C values of Combination 1 and 2 are much higher than the one of SCWRM M/P. Therefore, it was concluded that Combination 1 and 2 are more desirable for project implementation.

Questions and Answers Session

10. A participant asked on the presented estimated costs for SCWRM M/P (1) whether these numbers were estimated by JICA study team as SCWRM project estimate is much lower than the presented cost and (2) whether SCWRM M/P estimated costs includes all construction costs, especially area protection measures for the economic zone in the Chao Phraya River basin, such as drainage system project (40 to 50 billion baths project). JICA answered that the presented cost was estimated based on the project information gathered from various documents prepared by the Thai Government. The same basis of cost was used to estimate the project cost for all combinations. JICA requested to provide additional information if JICA missed any SCWRM proposed projects in the cost estimate.

11. A participant asked (1) if it is possible to complete the construction within 5 years for the SCWRM Proposed plan and (2) regarding Ayutthaya by-pass channel, did JICA consider impacts on BMA as the by-pass channel would increase discharge which may flood BMA and affect the country's economy? JICA answered that (1) it is very challenging; however according to our evaluation it is possible to construct all the countermeasures proposed by JICA within 5 years. As for the SCWRM combination, JICA has not reviewed the duration of the project implementation. And (2) JICA agreed with the concern that the Ayutthaya by-pass channel would increase the discharge, however with the combination of countermeasures as proposed, BMA would be much safer.

12. A participant asked (1) whether JICA's countermeasures will also be effective for different rainfall pattern, especially for the intensive rainfall in the lower Chao Phraya River and (2) whether the road elevation in the model is current height or proposed height. JICA answered that (1) as presented in Page 33 of Executive Summary, the effectiveness of proposed combinations were

examined under six different rainfall patterns Based on this analysis, although the peak discharge is different depending on the rainfall events, it is concluded that the proposed countermeasure combinations can effectively manage extreme floods caused by various rainfall patterns. Regarding the precondition of road elevation, (2) the proposed dyke/road elevation were used.

13. A participant commented that LIDAR will be more useful if the additional information such as inundation duration and depth are included. JICA agreed that topographic data are very useful especially for land use control and flood mitigation.

14. A participant commented that as the proposed countermeasures take 3-5 years for implementation, are there any temporary approaches to solve flood problem during the implementation. JICA answered that structure measures takes time to implement, however non-structure measures can be implemented immediately. Later presenters will provide further information on such non-structural countermeasures for flood prevention.

15. A participant proposed urgent measures which can be implemented including construction of dykes around the sea and installation of pump to drain floodwater to the sea at Samutprakan, Samut Sakorn and Samut Songkram. JICA answered that the objective of JICA's study is to determine the best combination of countermeasures in order to manage flood flow in the Chao Praya River Basin. If the inland protection is to be examined drainage system needs to be studied.

16. A participant asked about the measures to protect the bank slope from erosion along Ayutthaya by-pass channel. JICA answered JICA considers bank protection measures along Ayutthaya by-pass channel and will be included in the final report.

17. A participant asked about the JICA's previous experience on similar study in another country. JICA answered that JICA only provides financial and technical support, and the implementation should be done by the country.

Presentation 2: Flood Management Information System by Mr. Minoru Kuriki, FRICS director

18. Mr. Minoru Kuriki presented that the purpose of Component 3 for the Project on Flood Management Plan for the Chao Phraya River Basin is improvement of a Flood Management System for the Chao Phraya River Basin. The activities consist of conducting a basic plan and action plan together with developing flood forecasting system for Thailand.

19. The basic plan was developed based on information needs of users, and was presented to Thai government organizations in February 2013 to explain method and functions of data management system. In addition, action plans are completed in this coming September.

20. The prototype of flood forecasting system was completed in September 2012 and improved through the cooperation of Thai officials. Moreover, development of the simulator functions such as effects of dam and water gate operation and emergency countermeasure scenarios (installation of large-scale sandbags and drainage pumps) has been being implemented to help Thai government on decision making to formulate appropriate countermeasures and operate facilities.

21. The abilities of the Flood Forecasting System are as follows: (i) Display current and 7-day forecast data of water level, flow rate and inundation area accurately (calibrated with historical actual data), (ii) Calculation of RRI model from ICHARM performs inundation area, divided into a mesh (900 m x 900 m), and (iii) Display the depth of inundation area by combining GISTDA images, LiDAR data and simulation of water movement.

22. The Flood Risk Information System of the Chao Phraya River Basin is going to be transferred to Thai government in September 2013 then Thai officials will take responsible for full-scale operation.

Questions and Answers Session

23. A participant asked two questions about utilization of LiDAR technology for forecasting. Firstly, LiDAR is a main technology applied for the calculation of flow rate or not. Secondly, whether the study team concern on water barriers such as roads and buildings which might cause an error. In the 2011 flood, no one had information of location of road or drainage ditch, which was an obstacle of water flow. JICA Study Team replied that LiDAR is a main input of the model which is more accurate than satellite surveying. In addition, senior advisor of JICA explained that LiDAR data may be not perfect data but it is the most accurate data and able to show the depth of inundation. To improve weakness of LiDAR, it was calibrated by satellite data (to see ground condition) in order to forecast trend of water flow. Moreover, Thailand may be the first country which is able to forecast the depth of inundation, while USA, EU countries and Japan provide only discharge rate data.

24. A participant asked on QPE forecast rainfall at the upper river basin and the lower river basin and use of the RRI model. JICA Study Team replied that historical rainfall data is more significant than forecast data of next 7-day rainfall, therefore flow rate data and past rainfall data are selected to use for the calculation of RRI model. Moreover, QPE data does not have much effect on the calculation. The study team has updated output data all the time by using daily observed data together with calibration with the situation of the lower river basin.

25. A participant asked why the high resolution of LiDAR data is not fully utilized. JICA Study Team explained that the model is developed in a way that it can calculate swiftly for daily data. Senior advisor of JICA added that LiDAR operates as area scanner to display difference of land height such as trees' location. JICA study team is delighted to deliver experience, technology and know-how in analysis. In addition, last two years, JICA and Single Command Center (SCC) led by Dr. Plodprasop Suraswadi agreed on scanning 26,000 km^2 of the Chao Phraya River Basin by utilization of LiDAR.

26. A participant asked on file logging function of the system. If someone tests the calculation and simulation, will the system record the simulation result of the user? JICA Study Team answered that data in the website is open-to-public data while simulation function is limited for Thai authorities to operate scenario simulation such as effects from water gate/dam operation and pumping installation.

27. A participant asked on rainfall data from other sources asides from Japan Meteorological Agency (JMA). JICA Study Team replied that the system downloads rainfall data from JMA, but in the future the study team hopes that TMD will support rainfall data to the system.

28. A participant suggested that SCC should be the organization which has authority to input data and manage the model. JICA Study Team responded that facility operation information are not opened for the general public, only for government organization who will conduct full-scale operation after system transfer.

29. A participant requested for accurate rainfall forecasting data to support works of BMA. JICA Study Team responded that 7-day rainfall forecasting data requires meteorological calculation. Nowcast based on radar rainfall data can forecast for a short period (3-6 hours only) and the short period data might be sufficient for BMA's operation. Senior Advisor to JICA also added that the JICA's model was developed to manage the entire Chao Phraya River Basin. However, Bangkok is different due to it is urban area which always affects from rainfall. Therefore, it is necessary for BMA to have efficiency water drainage system.

30. A participant suggested that if the system is able to give details on water barriers, it would be valuable information for users (operating organization) to formulate countermeasure to cope with disaster.

Presentation 3: JICA Project for Flood Countermeasures for Agricultural Sector by Mr. Tetsuro Oda Chief Representative, SANYU Consultants Inc., Bangkok Office

31. Mr. Tetsuro Oda, Co-Team Leader of JICA Agricultural Sector Flood Countermeasure Project presented the draft guideline for disaster- resilient agriculture and agricultural community, which shall be applied to flood risk areas and controlled inundation areas. Selecting 7 Tambons from 5 provinces in upper Chao Phraya River Basin and upper/ middle/ lower Delta, guidelines were formulated through pilot activities with community people in participatory way. The guideline consists of a general guideline and five thematic guidelines with supporting 22 technical papers. Model activities such as flood hazard map making, community monkey cheek development, transplanting method for paddy cultivation to shorten planting period, and feed storages for livestock were introduced among others. Fish capturing and simple processing are currently important income sources in flood prone area and might be supplemental income in water retention area in future.

32. Mr. Oda also reported that Joint Coordination Committee has agreed on draft guideline and Ministry of Agriculture and Cooperatives will apply this guideline as its official guideline. Concept of community resiliency shall be promoted in agricultural development along with H.M. King's Sufficiency Economy philosophy to cope with natural disaster, he added in the recommendation for Thai Government.

Closing Remarks

Mr. Minoru Miyasaka, Senior Advisor to the Director General, Global Environment Department, JICA extended his appreciation to all participants for their active discussion and involvement in the seminar as well as to the all concerned agencies to attend and address their opinions and comments on the comprehensive flood management plan.

FINAL SEMINAR
the "Disaster Resilient Thailand"
~ Flood Management Plan for the Chao Phraya River Basin ~
~ Agri-Sector Flood Damage Mitigation Guideline ~

Organized by
Office of the National Economic and Social Development Board, Royal Irrigation Department,
Department of Water Resources and Japan International Cooperation Agency

20 June 2013
Ballroom, 7th Floor, the Landmark Bangkok Hotel

AGENDA

08:30 - 09:00	**Registration**
09:00 - 09:30	**Welcome Address by Organizer** Mr. Arkhom Termpittayapaisith Secretary General, National Economic and Social Development Board Mr. Lertviroj Kowattana Director General, Royal Irrigation Department Mr. Niwatchai Khampee Deputy Director General, Department of Water Resources **Opening Remarks** Mr. Kiminori Iwama Economic Minister, Representative from the Embassy of Japan
09:30 - 10:10	**Presentation 1: Comprehensive Flood Management Plan in the Chao Phraya River Basin** Mr. Yusuke Amano Senior Advisor to the Director General, Global Environment Department, JICA
10:10– 10:30	**Question and Answer**
10:30 – 10:50	**Presentation 2: Flood Management Information System** Mr. Minoru Kuriki Director, Research Division II, FRICS
10:50 – 11:00	**Questions & Answers**
11:00 – 11:15	**Coffee Break**
11:15 – 11:55	**Presentation 3: JICA Project for Flood Countermeasures for Agricultural Sector** Mr. Tetsuro Oda Chief Representative, SANYU Consultants Inc., Bangkok Office
11:55 – 12:15	**Questions & Answers**
12:15 – 12:30	**Closing Remarks** Mr. Minoru Miyasaka Senior Advisor to the Director General, Global Environment Department, JICA
12:30 –	**Lunch**

Distinguished Guests

Seated in the front row (from left to right) are

Mr. Shuichi Ikeda, Chief Representative, JICA Thailand Office,
Mr. Kimio Takeya, Visiting Senior Adviser, JICA HQ,
Mr. Kiminori Iwama, Economic Minister, Representative from the Embassy of Japan,
Mr. Arkhom Termpittayapaisith, Secretary General, National Economic and Social Development Board,
Mr. Lertviroj Kowattana, Director General, Royal Irrigation Department

Seminar Attendees

Welcome Address by Mr. Arkhom Termpittayapaisith

ATTENDEES LIST

[Thai Side]

No.	Name	Post/ Organization
Office of the National Economic and Social Development Board (NESDB)		
1	Mr. Arkhom Termpittayapaisith	Secretary-General
2	Ms. Pojanee Autrotpinyo (Ms. Kanyawee Prayunsit) as representative	Director, Spatial Development Planning and Strategy Office
3	Dr. Chamnong Paungpook	Policy and Plan Analyst, Professional Level
4	Ms. Jinna Tansaraviput	Policy and Plan Analyst, Professional level
5	Ms. Aim-on Pruksuriya	Policy and Plan Analyst, Operational level
6	Mr. Phitsunu woranart	Policy and Plan Analyst, Professional level
7	Ms. Panittra Ninphanit	Policy and Plan Analyst, Professional level
8	Ms.Wararat Dulayapitak	PR officer
9	Ms. Nisarat Nanthasen	Administration office experienced
10	Mr. Punnachak Suthesong	Academician
Royal Irrigation Department (RID)		
11	Mr. Lertviroj Kowattana	Director-General
12	Mr. Chatchawal Punyavateenun	Deputy Director General for Engineering
13	Mr. Phonchai Klinkhachorn	Director of Hydrology and Water Management
14	Mr. Chonlathep Thatree	Chief of Water Management Branch, Operation and Maintenance Division, Regional Irrigation office 3, Phitsanulok
15	Mr. Boonthum Panpiampoth	Chief of Water Management Branch of Regional Irrigation Office 4, Kampangphet (Member of Technical Working Group)
16	Mr. Sanae Kheppukdee	Water planning Section, O&M Regional Irrigation office 13, Kanchanaburi
17	Dr.Akavit Johnpradit	Irrigation Engineer, Dam Safety Division
18	Ms.Nilobol Aranyabhaga	Hydrologist
19	Mr. Kanchadin Srapratoom	Chief of Loan Projects, Office of Project Management (Member of Technical Working Group)
20	Mr. Chatchom Chompradit	Director of Water Management
21	Mr. Thada Sukhapunnaphan	Director, Hydrology Division

22	Dr. Vich Sriwongsa	Director of Irrigation Water Management Telemetry Center Office
23	Mrs. Suwanna Euvananont	Senior Expert on Survey and Photogrammetry
24	Ms. Phattaporn Mekpruksawong	Chief of Project Planning Group 1, Office of Project Management
25	Mr. Teerawat Thumniyom	Irrigation Engineer
26	Ms. Jitsuda Inthuman	Technical Specialist
27	Mr. Kosit Lawsirirat	Specialist of Hydrology Consultant
28	Mrs. Phatcharawee Suwannik	Irrigation Engineer
29	Ms. Phatthra Siengsai	Mapping photo Technical ,Professional level
30	Mr.Ditthapong Mitrat	Irrigation Engineer
31	Mr.Krotsuwan Phosuwan	Irrigation Engineer Professional Level
32	Mr.Pongsak Arulvijitskul	Senior Expert Regional Irrigation Office 11
Department of Water Resources (DWR)		
33	Mr.Jirawat Ratisoonthorn	Director, Policy and Plan Division
34	Mr. Pinyo Ketsa	Policy and Plan Analyst
35	Mr. Phadet Saengsawang	Acting of Director of Water Crisis Prevention Center
36	Ms. Sirirat Poonma	Plan and Policy Analyst
37	Mr. Satit Sueprasertsuk	Director, Water Quality Crisis Prevention Division
38	Ms.Punyawee Sawanyapanich	Civil Engineer, Practical Level
39	Mrs.Wandee Pattanasatianpong	Scientist
40	Mr. Pramook Duangkaew	Scientist
41	Ms.Ratikarn Paptip	Hydrologist
42	Mr.Kamon Yoothong	Plan and Policy Analyst, Professional Level
43	Ms.Ampai Harakunaruk	Consultant
44	Mr.Kanapoj Wanna	
Thai Meteorological Department		
45	Mrs. Ratana Prakhamnin	Meteorologist
46	Mr. Fatha Matthawi	Meteorologist
47	Mr. Phat Sukthawi	Meteorologist
Hydro and Agro Informatics Institute (HAII)		
48	Mr. Royol Chitradon	Director
49	Dr. Surajate Boonya-Aroonnet	Head of Hydro Modeling Section

Geo-Informatics and Space Technology Development Agency (Public Organization); GISTDA		
50	Ms. Monchaya Piboon	Researcher
51	Mr. Thudchai Sansena	Researcher
52	Mr. Tatiya Chuentragoon	Chief of Image Processing and Value-Added Products Development Sub-division
Office of the Royal Development Project Board		
53	Ms. Sopita Boopasong	Policy and Plan Analyst
54	Asso. Prof. Seree Supharatid, Ph.D.	Director of Energy for Environment Center, Sirindhorn International Environmental Park
Bangkok Metropolitan Administration (BMA)		
55	Mr. Adisak Khundee	Director, Department of Drainage and Sewerage
56	Mr. Somsak Meeudomsak	Electrical Engineer, Senior Professional Level
57	Mr. Tharaphong Phetkong	Electrical Engineer, Senior Professional Level
58	Mr. Surart Jaroenchaisakul	Civil Engineer, Senior Professional Level
59	Mr. Chetsada Chantharaprapha	Civil Engineer, Senior Professional Level
60	Mr. Sansoen Rueangrit	Civil Engineer, Professional Level
61	Mr. Na Thotsaphal Chanloi	Civil Engineer, Professional Level
62	Mr. Visnu Charoen	Civil Engineer, Professional Level
63	Ms.Amraporn Jitprapai	Civil Engineer, Senior Professional Level
Department of Disaster Prevention and Mitigation		
64	Mr.Chatchai Phromlert (Mr.Ponpoj Penpas) as representative	Director-General (Deputy Director-General)
65	Mr. Thanabodi Khrongyuti	Plan and Policy Analyst, Senior Professional Level
66	Ms. Chatchatporn Bunphiranat	Director of Natural Disaster Planning Division
67	Mr.Prasong Thanmapala	Scientist, Information and Technology Center
68	Mr.Naruechit Kongnasiri	Civil Engineer Professional Level
Office of Agriculture Economic		
69	Mr.Chanchai Paethong	Plan and Policy Analyst
70	Mr.Para Jansuwan	Economist
71	Ms.Nongnuch Rutae	Expert for Agricultural statistics System
Ministry of Natural Resources and Environment		
72	Mr.Seree Sopondirekrat	Inspector General

Office of the National Water and Flood Management Policy (ONWF)		
73	Ms. Supranee Rungpirunviroj	Advisor to the Office of the National Water and Flood Management Policy
74	Mr. Supapap Patsinghasanee	Civil Engineer
75	Ms. Ampanpin Pintukanok	Advisor to the Office of the National Water and Flood Management Policy
76	Mr. Pipat Rueangngam	Director, Water Management Center
77	Mr.Chuchart Narong	Civil Engineer Senior Professional Level
78	Ms.Atchara Ratanakongwiput	-
Strategic Water Resource Committee (SWRC)		
79	Dr. Chukiat Sapphaisal	SWRC Committee
80	Mr. Rajatin Syamanont	SWRC Committee
81	Mr.Therasak Padungtantra	WIS/FTI
Department of Public Works and Town & Country Planning		
82	Mr. Pisut Sukhum	Civil Engineer, Senior Professional Level
83	Mr. Marupong Tansatcha	Civil Engineer, Professional Level
84	Ms. Chuthatip Achavasmit	Town Planner (Professional Level), Bureau of City Planning
85	Ms. Panisara Daorueang	Town Planner
Academic Institute		
86	Prof.Dr. Thanawat Jarupongsakul	Chulalongkorn University
87	Dr.Taravudh Thipdecho	AIT
88	Ms.Siripen Sinpo	AIT

[Japanese Side]

No.	Name	Title
Embassy Of Japan		
1	Mr.Kiminori IWAMA	Economic Ministry
2	Mr. Ryotaro Hayashi	Second Secretary
JICA HQ		
3	Mr. Minoru Miyasaka	Senior Adviser to the Director General, Global Environment Department
4	Mr. Kimio Takeya	Visiting Senior Adviser
5	Mr. Yusuke Amano	Senior Adviser to the Director General, Global Environment Department
6	Mr. Hideaki Matsumoto	Deputy Director, Disaster Management Division 1, Global Environment Department
JICA Thailand		
7	Mr. Shuichi Ikeda	Chief Representative
8	Mr. Tomoyuki Kawabata	Senior Representative
9	Mr. Hiroaki Nakahori	Representative
10	Mr. Yojiro Miyashita	Representative
11	Mr. Tatsuo Kunieda	JICA Expert to RID
12	Mr. Kobchai Songsrisanga	Program Officer
13	Ms. Paweesuda Boonchuwong	Secretary to JICA Expert to RID
JICA Study Team (Component 1-2)		
14	Mr. Takahiro Mishina	Team Leader
15	Mr. Akio Shichijugari	Engineer
16	Mr. Yoshitomo Yonese	Engineer
17	Mr. Kazuhiro Nakamura	Engineer
18	Ms. Akira Watanabe	Engineer
19	Ms. Nattamon Tanyapanit	Interpreter
20	Ms. Kamolnit Ariyakamolpat	Interpreter
21	Ms. Gessarin Gunthawong	Technical Assistant
22	Mr. Chuchat Suwut	Senior Administrator
23	Ms. Krittiya Peerphayak	Administrator
24	Ms. Supajitra Pruettivorawongse	Administrator

25	Ms. Nichapat Rakpongthai	Administrator
26	Mr. Weerawat Ittipanyakul	Technical Assistant
27	Mr. Peerasak Chantgham	Interpreter
28	Ms. Hathaikan Jiruedee	Administrator
JICA Study Team (Component 3)		
29	Mr. Minoru Kuriki	Deputy Leader
30	Mr. Yasushi Inoue	Project member
31	Ms. Nutthanicha Kasiolarn	Interpreter
32	Ms. Wanlaya Manutkasemsirikul	Secretary
JICA Study Team (Agriculture Sector)		
33	Mr. Tetsuro Oda	Co- Team Leader
34	Mr. Nakorn Najaroon	Community Disaster Management
35	Mr. Pichai Thongutha	Assistant Engineer of JICA Team
36	Mr. Densak Kaewsri	Study Team
37	Miss Katsuda Khunkaew	Study Team
38	Mr.Paisarn Boonyod	Study Team

1-4 Technical Workshop on Flood Analysis Model

Project for Comprehensive Flood Management Plan

For the Chao Phraya River Basin

Technical Workshop on Flood Analysis Model

July 16 and 17, 2013

Room 501, IEC Building RID

1. Outline of the Workshop

This technical workshop aims to 1) understand flood management on the Chao Phraya River adequately through the flood analysis and 2) evaluate and utilize the result of the flood analysis for effective flood management plan. In the study, JICA Study Team (JST) has developed the flood analysis model which consists of runoff model, flood routing model and inundation model. RID/DWR are required to examine this model and understand how/what this model describe the flood phenomenon on the Chao Phraya River system, especially 2011yr flood. And also, RID/DWR are required to understand the technical and scientific basis concluding to proposed M/P (combination-2).

In this workshop, first part will focus on the explanation of a general condition of Master Plan and also the outline about the flood analysis model, such as an instruction of "how to check the simulation result with MIKE-View (result viewer released by DHI)". Second part will provide a practical training on MIKE-11 and MIKE-FLOOD.

Main topics/tasks treated in this workshop are listed as following,

1) Explanation of hydrological and hydraulic model:
   JST provides the reason 1) why DHI MIKE Series was employed for flood analysis in the Chao Phraya River, 2) what kind of hydrological/hydraulic method was selected, 3) attempts to develop the model and 4) selection of input/boundary data to adopt characteristics of floods in the Chao Phraya River Basin.
2) Composition of flood analysis model:
   According to the pre-interview on this workshop, RID members are familiar with MIKE-11 (one-dimensional analysis) to some extent, however the knowledge and experience about the MIKE21 (two-dimensional analysis) and the linkage between MIKE-11 and MIKE-21 are limited and it is necessary to explain for RID/DWR memers.
3) Evaluation of simulation result:
   JST provides the method on "How to check and evaluate simulation results". The development of the flood analysis model like this Master Plan's model is very complex and time consuming. Therefore, prior to the result utilization, the simulation results and output derived by the model should be checked based on the basic hydrological/hydraulic knowledge, whether they are reasonable or not.
4) Software Practice
   To understand effectiveness and conveniences of the flood analysis model for developing the flood control plan, brief practice on MIKE-Series with sample models will be provided. Participants will use the analysis model (MIKE-Series) and carry out flood simulations by themselves.

2. Schedule and Contents

The draft schedule and contents of this workshop are shown in the next page. If RID/DWR have any additional requests on the program of this workshop or the flood analysis, JST will respond as much as possible.

Comprehensive Flood Management Plan for the Chao Phraya River Basin in the Kingdom of Thailand
Workshop on Flood Analysis Model

PROGRAM: MODELING WORKSHOP		
Target Persons:	Engineer belong to RID and DWR (approximately 10 persons)	
Description		
DAY 1		
9:00 - 12:00	**A. Flood Control Plan (Proposed Master Plan)**	
	A-0)	Purpose of Establishment of Flood Analysis Model
	A-1)	Basic concept of Master Plan (M/P) for flood management
	A-2)	Adaptability of M/P (Design rainfall)
	A-3)	Proposed M/P (Project Combination 2)
	B. Flood Analysis Model for M/P Study (with MIKE-FLOOD)	
	B-1)	What is flood analysis?
	B-2)	Outline of MIKE-Series
	B-3)	Development of the Flood Analysis Model
	B-4)	Hands-on Work Runoff Model, MIKE-11, MIKE-21 and MIKE-FLOOD
12:00 – 13:00	**LUNCH (will be provided at IEC 5th floor)**	
13:00 – 16:30	**B-5)**	Basic Operation of MIKE-View (Result Viewer)
	B-6)	How to Evaluate the Result of M/P
DAY 2		
9:00 – 12:00	**C. Practice on Flood Analysis**	
	C-1)	Effectiveness of Improvement of Dam Operation
	C-2)	Advantage/Disadvantage of Dike Elevation
	C-3)	Effectiveness of Dredging Work
12:00 – 13:00	**LUNCH (will be provided at IEC 5th floor)**	
13:00 – 16:30	**C-4)**	Effectiveness of Short Cut Channels (presentation ONLY)
	C-5)	Reason of Less Effectiveness of East/West Floodway for Lower Bangkok Area (presentation ONLY)
	C-6)	Influence of Sea Tide
	C-7)	Impact of Climate Change
	C-8)	Others

■Presentation Only
■Hands-On Work

Project for Comprehensive Flood Management Plan
For the Chao Phraya River Basin
Technical Workshop on Flood Analysis Model

July 16 & 17, 2013
IEC Building,
RID

Name List of Technical Workshop on Flood Analysis Model
Project for Comprehensive Flood Management Plan
For the Chao Phraya River Basin

Date: July 16, 2013
Location: RID IEC Building 5th Floor. (IEC 501)

[THAI SIDE]

No	Name-Surname	Title	Office	Organization
1	Ms.Phattaporn Mekpruksawong	Civil Engineer	Project Management	RID
2	Mr.Jakraphan Choyhiran	Civil Engineer	Project Management	RID
3	Mr.Chanin Songchon	Civil Engineer	Project Management	RID
4	Ms.Pattama Laviset	Irrigation Engineer	RIO 11	RID
5	Mr.Tharet Papakang	Irrigation Engineer	Water Management and Hydrology Group	RID
6	Mr.Chalermchon Cho-In	Civil Engineer	Water Crisis Prevention Center	DWR
7	Ms.Punyawee Sawanyapanich	Civil Engineer	Water Crisis Prevention Center	DWR

Observers

No.	Name-Surname	Title	Office	Organization
1	Mr.Somchit Amnatsan	Chief of Water Operation Group	Water Management and Hydrology	RID
2	Mr.Kanchadin Sraprathum	Chief of Loan Projects	Project Management	RID
3	Ms.Patcharawee Suwannik	Irrigation Engineer	Water Management and Hydrology	RID
4	Mr.Sitthichai Iamsa-ad	Civil Engineer	Project Management	RID
5	Mr.Somkid Aursri	Civil Engineer	Project Management	RID
6	Mr.Tatsuo KUNIEDA	JICA Expert to RID		

[JAPAN SIDE]

No.	Name-Surname	Office
1	Mr.Takahiro MISHINA	JICA Study Team Component 1-2, Team Leader
2	Mr.Kazuhiro NAKAMURA	JICA Study Team Component 1-2
3	Mr.Yoshitomo YONESE	JICA Study Team Component 1-2
4	Ms.Natsumi OKAMINE	JICA Study Team Component 1-2
5	Ms.Saeka YAMADA	JICA Study Team Component 1-2
6	Mr.Tatsuya KOGA	JICA Study Team Component 1-2
7	Ms.Akira WATANABE	JICA Study Team Component 1-2
8	Mr.Weerawat ITTIPANYAKUL	JICA Study Team Component 1-2
9	Mr.Peerasak Chantngarm	Interpreter
10	Ms.Nutthanicha Kasiolarn	Interpreter

Date: July 17, 2013
Location: RID IEC Building 5th Floor. (IEC 501)

[THAI SIDE]

No	Name-Surname	Title	Office	Organization
1	Ms.Phattaporn Mekpruksawong	Civil Engineer	Project Management	RID
2	Mr.Jakraphan Choyhiran	Civil Engineer	Project Management	RID
3	Mr.Chanin Songchon	Civil Engineer	Project Management	RID
4	Mr.Thanaroj Worraratprasert	Chief of Water Planing and Problem Solution Branch	RIO 12	RID
5	Mr.Tharet Papakang	Irrigation Engineer	Water Management and Hydrology Group	RID
6	Mr.Chalermchon Cho-In	Civil Engineer	Water Crisis Prevention Center	DWR
7	Ms.Punyawee Sawanyapanich	Civil Engineer	Water Crisis Prevention Center	DWR

Observers

No.	Name-Surname	Title	Office	Organization
1	Ms.Patcharawee Suwannik	Irrigation Engineer	Water Management and Hydrology	RID
2	Mr.Sitthichai Iamsa-ad	Civil Engineer	Project Management	RID
3	Mr.Tatsuo KUNIEDA	JICA Expert to RID		

[JAPAN SIDE]

No.	Name-Surname	Office
1	Mr.Takahiro MISHINA	JICA Study Team Component 1-2, Team Leader
2	Mr.Kazuhiro NAKAMURA	JICA Study Team Component 1-2
3	Mr.Yoshitomo YONESE	JICA Study Team Component 1-2
4	Ms.Natsumi OKAMINE	JICA Study Team Component 1-2
5	Ms.Saeka YAMADA	JICA Study Team Component 1-2
6	Mr.Tatsuya KOGA	JICA Study Team Component 1-2
7	Ms.Akira WATANABE	JICA Study Team Component 1-2
8	Mr.Weerawat ITTIPANYAKUL	JICA Study Team Component 1-2
9	Mr.Peerasak Chantngarm	Interpreter
10	Ms.Nutthanicha Kasiolam	Interpreter

ANNEX-2 TORs of Sub-Contracts

TERMS OF REFERENCE

FOR

INUNDATION SURVEY

1 INUDNATION SURVEY

1.1 PURPOSE OF THE SURVEY

The general objective of the survey is to gather data / information with regard to the actual flooding impact in the study area for a preparation of flood analysis.

1.2 COVERAGE OF THE SURVEY AND SELECTION OF THE SURVEY SITES

The survey shall cover all over the area of colored grids in Figure-1. The area is nearly equally estimated inundation area of 2011 flooding.

The select condition of survey site is;

1. Appropriate wide level land.
2. Easily approach by the car such as on the road, school ground, parking space for public building, precincts of temple, big garden and park, dry paddy field or wasteland with no glass near the road, etc.
3. The flood mark shall exist in or near the site.
4. Survey site shall not be selected more than one site at square grid (2km x 2km) highlighted in light green and light blue in Figure-1.
5. All survey sites shall be at appropriate distance from other survey sites.
6. If there is not the site descried above in the grid, such grid can be skipped for survey.
7. Estimated numbers of survey sites are about 6000.

The Consultant will show the example of the survey sites in the actual field.

1.3 SCOPE OF WORK

a. To record the coordinates of inundation survey positions by a handheld GPS at the center of the survey sites using the record sheet prepared by JICA Study Team (see Attachment I)

b. To record height relation between flood marks and the inundation survey sites.

c. To take photos of flood marks.

d. To interview nearest residents of the survey site using the questionnaire prepared by JICA Study Team (see Attachment I). If there is no person, the interview can be canceled at such place.

e. To take photos of surrounding condition of interview locations.

f. To collect and compile the results of questionnaires to electronic file (Microsoft Excel version 2003).

g. To send consultants daily the coordinates of inundation survey positions and height relation data explained in 1.3. b.

2 REPORTING

The Contractor shall submit the following outcomes to the JICA Study Team at the designate time:

(1) The Contractor shall submit daily the coordinates of inundation survey location downloaded from handheld GPS and height relation between flood marks and the flat ground of the inundation survey sites.
(2) The Contractor shall submit survey data and results files in Microsoft Excel (version 2003) and completed questionnaires collected in the field.
(3) The Contractor shall made survey maps including survey points with ArcGIS.
(4) The three (3) copies of survey reports including above two outcomes shall be submitted to the JICA Study Team.

3 PERIOD OF EXECUTION OF THE WORK

The Contractor shall commence the work immediately after the signing of the Contract Agreement and complete the work by submitting the survey report by the end of June 2012, after checking by the JICA study team.

4 EQUIPMENT, MATERIALS AND LABOR

All necessary equipment, transportation vehicles, materials (such as handheld GIS, level, staff, clinometer, ranging rod and digital cameras etc), and labor required for all the above-mentioned works shall be provided by the Contractor, as defined in the contract. Those costs shall be included in the cost estimate for the various items of the Bill of Quantities. The contract is concluded on lump sum basis.

5 PERMISSIONS AND PUBLIC RERATION

The Contractor shall arrange an official permission to execute the survey works at sites from the relevant authorities, if necessary.
The contractor shall maintain good relationships with local people in the survey area.

6 OTHER ISSUES

Any and all issues arising from or in connection with the conduct of the survey that is not mentioned above shall be settled by mutual consultation and agreement in good faith between the JICA Study Team and the Contractor.

7 STUDY AREA

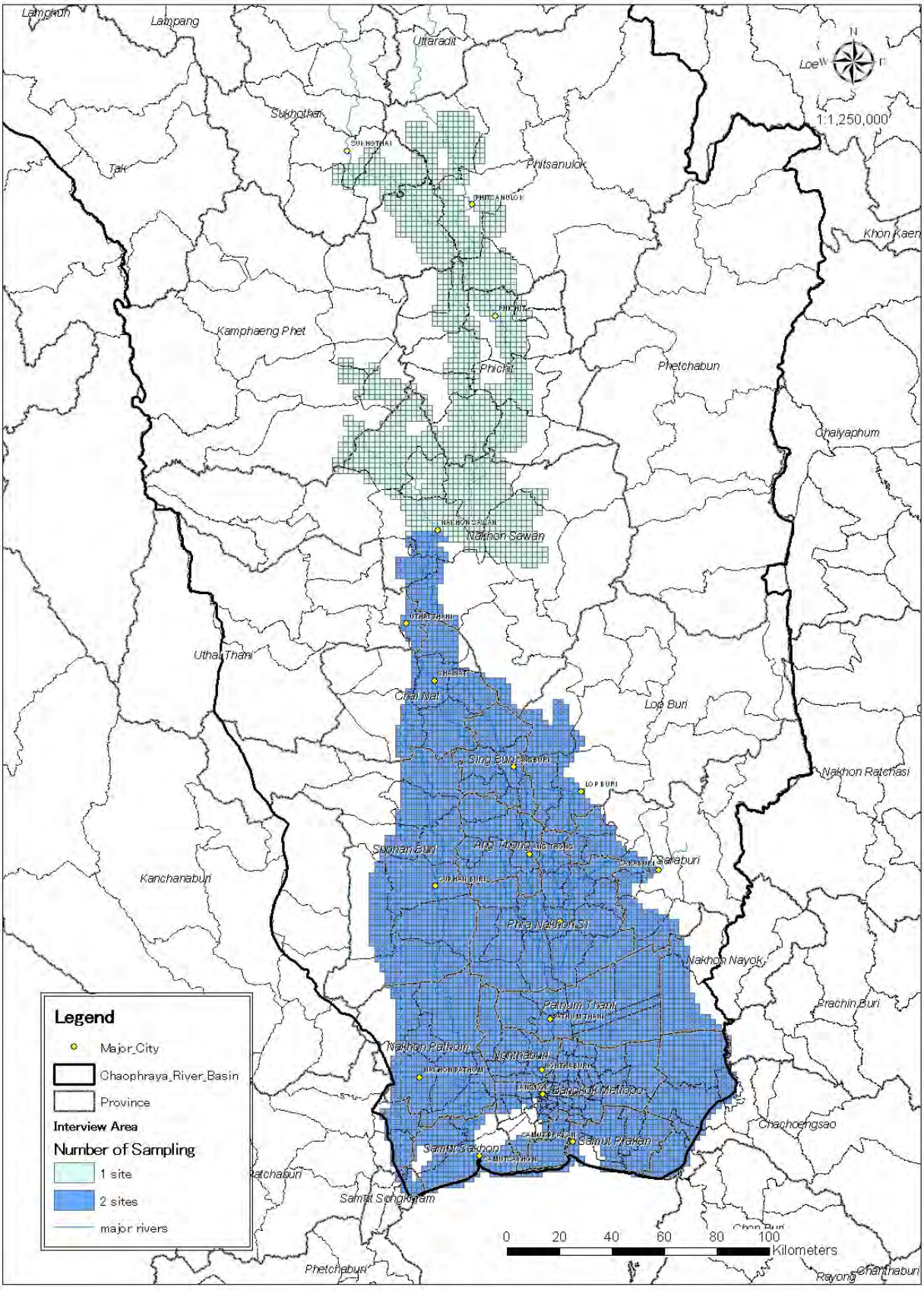


Figure-1 Proposed Interview Area

Attachment I

Flood Mark Survey Record Sheet
The Project on a Comprehensive Flood Management Plan for the Chao Phraya River Basin in the Kingdom of Thailand

Item	Record	
Date and time of Survey		Grid Number
Name of Surveyor		
GPS Marking Number		
Location Recorded in the field	Latitude : ° ′ . ″	
	Longitude : ° ′ . ″	
Location (Degree) By downloaded data	Latitude : . °	
	Longitude : . °	
Differential height	(Flood mark – Ground) : . m	
Photos on survey	Please attach a few picture images	

Questionnaire on Inundation Condition of 2011 Flood
The Project on a Comprehensive Flood Management Plan for the Chao Phraya River Basin in the Kingdom of Thailand

Item	Option	Please check ☐
Date and time of Interview Name of Interviewer		Grid Number
Name of Respondent Address of Respondent Occupation of Respondent Telephone Number, if any		
Location (The coordinates of interview place by handy GPS)	Latitude : ° ′ . ″ Longitude : ° ′ . ″	GPS marking number
1. Duration of flood inundation	The beginning of flood inundation (DD/MM) The end of flood inundation (DD/MM)	(/) (/)
2. Impact of flood inundation	A: The whole house was washed away B: The 1st floor was under water C: No major damages	A: ☐ B: ☐ C: ☐
3. How fast did inundation water flow down?	A: a foot's pace (3 to 4 km/h, about 1m/sec.) B: jogging pace (6 to 8 km/h, about 2m/sec.) C: running pace (more than 8km/h, more than 2m/sec.) D: Other [ ]	A: ☐ B: ☐ C: ☐ D: ☐

4. Process of inundation around your house Date (DD/MM)	inundation depth A: less than 0.2m D: 1m to 2m B: 0.2m to 0.5m E: 2m to 3m C: 0.5m to 1m F: more than 3m	Flow direction (from)
	A: ☐ B: ☐ C: ☐ D: ☐ E: ☐ F: ☐	N NE E SE S SW W NW N
	A: ☐ B: ☐ C: ☐ D: ☐ E: ☐ F: ☐	N NE E SE S SW W NW N
	A: ☐ B: ☐ C: ☐ D: ☐ E: ☐ F: ☐	N NE E SE S SW W NW N
	A: ☐ B: ☐ C: ☐ D: ☐ E: ☐ F: ☐	N NE E SE S SW W NW N
	A: ☐ B: ☐ C: ☐ D: ☐ E: ☐ F: ☐	N NE E SE S SW W NW N

Photos on survey	Please attach a few picture images

TERM OF REFERENCE

FOR

RIVER AND CANAL SURVEY (WEST)

The Master Plan of the Project for the Comprehensive Flood Management Plan for the Chao Phraya River Basin in Kingdom of Thailand is carried out during the beginning of February and the end of March 2013, under the technical cooperation of JICA (Japan International Cooperation Agency).

The basic specifications of the method in each survey works will be applied in the requirements in which was mutually agreed with the Cliant and the Contractor, in accordance with the Survey Specification for Overseas Development Study of JICA and the related standard specifications in Thailand.

1 Outline and Work Volume

(1) Check leveling for existing benchmarks

The purpose of check leveling is to confirm the accuracy with useful conditions of the respective existing benchmarks which have been established by the Royal Irrigation Department (hereinafter refer to as RID) and/or the Royal Thai Survey Department (hereinafter refer to as RTSD). The existing benchmarks to be surveyed and checked will be required to the Contractor by the Client's Engineer.

The method of check leveling shall be adopted the direct leveling or GPS survey by the static positioning in order to obtain the elevation (Mean Sea Level). If the GPS survey is carried out, the measurement time shall be at least one hour or more.

(2) Horizontal position of cross-section lines

The cross-section line shall be established the stake on the both banks of river and canal which was specified by the Client's Engineer. The measurement method shall be adopted the Handy GPS survey, traverse survey or the combination consist of the both measurements.

(3) River cross-section survey

The measurement method shall be adopted the combination consist of the Echo Thunder with GPS receiver and /or Total Station System.

- Total sections: approx. 31sections
- Average width to be measured: approx. 300 m
  Outside section: 20m from the edge of River banks

(4) Canal cross-section survey

The measurement method shall be adopted the combination consist of the Echo Thunder with GPS receiver and/or Total Station System.

- Total sections: approx. 73 sections
- Average width to be measured: approx. 100 m
  Outside section: 20m from the edge of both banks

(5) Drawing of River Longitudinal Profiles and Cross-section

The longitudinal profiles are plotted using the cross-section data.

- Standard drawing scale of longitudinal profile: Vertical: 1/200, Horizontal: 1/100,000
- Standard drawing scale of cross-sections:

0 m to 190m in survey width: Vertical = 1/250, Horizontal = 1/250
190m to 380m in survey width: Vertical = 1/250, Horizontal = 1/500
380m to 760m in survey width: Vertical = 1/250, Horizontal = 1/1000
760m or more in survey width: Vertical = 1/250, Horizontal = 1/2,500

The above specifications may be altered by the requirements of the Client's Engineer.

(6) Drawing of Canal Longitudinal Profiles and Cross-section

The longitudinal profiles are plotted using the cross-section data.
- Standard drawing scale of Longitudinal profile: Vertical: 1/200, Horizontal: 1/50,000
- Standard drawing scale of cross-sections: Vertical = 1/250, Horizontal = 1/250

The above specifications may be altered by the requirements of the Client's Engineer.

2 Work Schedule

The following work schedule will be required in order to carry out during the End of June and Mid. of September 2012).

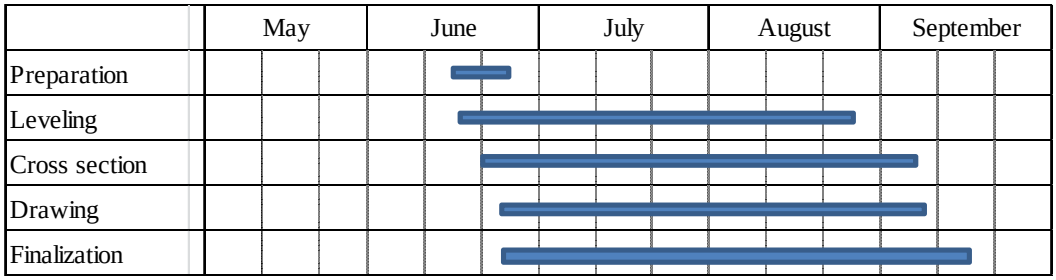


Fig. 1 Work Schedule

3 Survey Location

The survey locations are Listed below:

NO	River	Station Name	Center	
			E(UTM47)	N(UTM47)
99	Thachin	5+000	636916.0000	1495763.0000
100	Thachin	20+000	632686.0000	1503953.0000
101	Thachin	30+000	631116.0000	1508803.0000
102	Thachin	40+000	637066.0000	1511103.0000
103	Thachin	50+000	632266.0000	1514603.0000
104	Thachin	60+000	633466.0000	1518383.0000
105	Thachin	70+000	638166.0000	1523053.0000
106	Thachin	80+000	631386.0000	1523823.0000
107	Thachin	90+000	632266.0000	1527393.0000
108	Thachin	100+000	631736.0000	1536563.0000
109	Thachin	110+000	629936.0000	1543433.0000
110	Thachin	120+000	627126.0000	1550503.0000
111	Thachin	130+000	625556.0000	1559253.0000
112	Thachin	140+000	621976.0000	1564653.0000
113	Thachin	150+000	620166.0000	1571733.0000
114	Thachin	160+000	622656.0000	1579813.0000
115	Thachin	170+000	623816.0000	1588153.0000
116	Thachin	180+000	622676.0000	1592633.0000
117	Thachin	190+000	620116.0000	1600363.0000
118	Thachin	200+000	621136.0000	1607623.0000
119	Thachin	210+000	624096.0000	1615273.0000
120	Thachin	220+000	619706.0000	1622183.0000
121	Thachin	230+000	617846.0000	1629783.0000
122	Thachin	240+000	619236.0000	1636813.0000
123	Thachin	250+000	616596.0000	1644053.0000
124	Thachin	260+000	616306.0000	1650243.0000
125	Thachin	270+000	608936.0000	1655673.0000
126	Thachin	280+000	611286.0000	1662373.0000
127	Thachin	290+000	611646.0000	1667803.0000
128	Thachin	300+000	611656.0000	1673983.0000
129	Thachin	313+000	615796.0000	1683483.0000
	Thachin River	31 section		

Canal WGS84

NO	Center	
	E(UTM47)	N(UTM47)
1	639875.0412	1510978.7884
2	656159.4498	1516527.0250
3	648360.4771	1516186.6353
4	644828.9274	1523723.1740
5	642274.8700	1524407.3416
6	639769.5112	1523419.3626
7	643974.1172	1525540.7667
8	635636.8393	1526949.6536
9	652702.2737	1528090.2260
10	655927.3407	1529189.0642
11	659116.6955	1522954.6927
12	635072.3891	1529124.6921
13	639967.8155	1529555.8938
14	641465.7670	1530875.2980
15	643467.2341	1530085.0402
16	644515.4782	1530277.5750
17	644680.8330	1531571.7663
18	651136.0022	1537358.1350
19	654600.2334	1534823.2170
20	648523.8097	1541297.1766
21	656031.8324	1536924.7123
22	655880.4827	1534039.1415
23	656960.1825	1532195.6214
24	637968.0938	1538272.1659
25	634737.4612	1540502.7547
26	637425.4766	1540516.5748
27	631984.4845	1542168.1602
28	640007.7226	1543711.8657
29	639859.4016	1546972.4919
30	642942.9820	1544938.0923
31	645578.8341	1543222.1137
32	648485.0464	1543410.9036
33	656074.5744	1545298.6184
34	653266.4406	1546523.3786
35	650507.9510	1547241.6611
36	649230.8247	1548604.2749
37	655417.1421	1547603.9989
38	659639.2853	1540335.7404
39	635067.2109	1550685.2262
40	633736.3896	1552222.5423

NO	Center	
	E(UTM47)	N(UTM47)
41	629885.5434	1551006.0477
42	657792.7463	1559499.2344
43	655893.3918	1564649.3354
44	651084.4793	1564981.0431
45	647862.7229	1565242.6877
46	643417.3261	1565850.8726
47	645872.7864	1566668.8905
48	635353.0050	1564080.7533
49	634255.6691	1568480.6983
50	649242.3554	1563198.0209
51	633996.2431	1580843.6164
52	632660.5469	1586300.8956
53	629118.0943	1589868.7966
54	639276.1589	1586117.8351
55	647297.6521	1583579.7180
56	647768.1935	1581440.2897
58	644497.1752	1601974.3389
95	596721.8431	1596088.9946
96	612246.4766	1681583.6409
97	614744.6825	1662808.6186
98	617137.5820	1677470.3396
101	629134.8896	1648184.6980
102	634272.1625	1649216.3323
103	632684.0844	1648485.5044
104	631239.5542	1643345.2629
105	630349.0894	1620168.5969
113	625941.2085	1566582.0706
114	614335.0675	1626731.8431
115	616373.0196	1622862.7494
116	617637.2389	1600973.4634
117	623732.7360	1602480.8596
120	645854.2711	1541718.6213
121	612204.2466	1660381.8440

Canal 73 section

4 Survey standard

The following survey standard shall be applied based on the official rule in Thailand.

(1) Projection and horizontal coordinate system: UTM zone 47North

(2) Datum and Ellipsoid: WGS-84

(3) Vertical datum: Mean Sea Level

(4) Measurement: Metric System

5 General surveying method

(1) Horizontal control survey

The horizontal positioning shall be connected by the GPS method or Total Station method from the reference control points of RID and RTSD, if necessary in this survey work.

Prior to the commencement of the field measurements, the survey marks will be installed in proper positions along the planning route as well as on stable place, in accordance with the lines planned.

For example, the limits of closing error for control survey using the Total Station will be required to the followings:

a) Limits of closing error for the coordinates: 15cm+10cm $\sqrt{N}\sum S$

b) Limits of closing error for the heights: 24mm/ $\sqrt{N}$

N: Number of side

$\sum S$: Total length of traverse routes (unit: km)

For example, the tentative limit of the accuracy of GPS Receiver for control survey using the GPS will be required to the followings:

a) Static GPS surveying:

- Horizontal: ±5mm＋0.5ppm（RMS）
- Vertical: ±10mm＋1ppm（x baseline）（RMS）

b) Kinematic surveying:

- Horizontal: ±10mm＋1ppm (x baseline)（RMS）
- Vertical: ±20mm＋1ppm（x baseline）（RMS）

c) Handy GPS

- Horizontal: ±3m （RMS）

(2) Vertical control survey (leveling or GPS static method)

Vertical control survey shall be carried out to measure the elevation of survey points. The heights shall be connected from the existing benchmarks or existing control points. The following principal survey method will be required to the followings:

a) Measuring method: double-run depend on the condition of leveling routes

b) As a rule, limits of closing error:

- Check leveling: 50mm$\sqrt{}$s (s: km)

c) Reading unit: 1mm unit

d) Sensitivity of level instruments: more than 4’’/2mm

(3) Cross-section survey

Cross-section survey for the proposed rivers and canals shall be done at the required sections which were based on the coordinates along the river banks or canal banks.

The survey points shall be measured the water Level, time, date and changing points in terrain features, revetments, retaining walls, fences, building and so on. The deep water portions should be done using the Echo Sounder with GPS/or Total Station navigation system. Under the water of observation points interval is not more than 5m.

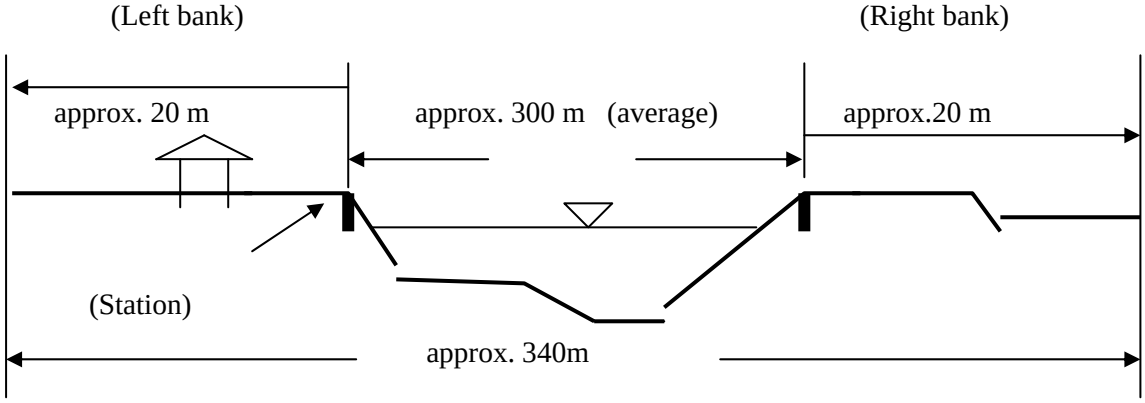


Fig. 2 Typical River Cross-section Face to Down Stream

Cross sections of respective canal shall be plotted the data which was obtained on the field survey.

Longitudinal profiles for the canal shall be plotted the heights of lowest riverbed and or ground, right bank and left bank respectively.

The following main specifications will be required:.

a) Accuracy of measuring points: Distance: 1:500

Elevation: 2cm+5mm$\sqrt{}$s (s: km)

b) Specification of drawing for cross-sections and longitudinal profiles: It will be instructed by the Client's Engineer.

c) Data format: DXF or DWG format of Auto CAD

6 Detail requirements

Detail requirements such as the practical survey work will be instructed on the documents by the Client's Engineer after discussing with the Contractor.

7 Supervision of the Work

The Client has the right to supervise all of the works and to approve the plan of operation, work methods and progress of the work. The Client also has the right to accept and reject the results of the work.

The Contractor should submit the following items to the Client's Engineer:

- Daily report of Field works (every survey team of progress).
- Law data (copy of observation sheet and calculation data) within 3day after finished site survey

- Draft drawing within 7day after finished site survey (A1size)

8 Final deliverables

The Contractor shall deliver in accordance with the period of each products or results which was agreed with the Client's Engineer.

The details of the following products and the results will be required by the Client's Engineer after discussing with the Client:

1) Printed cross sections:	2 sets
2) Printed index map for cross sections:	2 sets
3) Printed longitudinal profiles:	2 sets
4) Whole Drawing digital data:	2 sets
5) Whole field measurement data:	1 set
6) Used control points and Benchmarks of Descriptions :	2 sets
7) Final survey report:	2 sets
8) All data of softcopy (CD)	2 sets

Fig. 5 Survey Location of River and Canal Survey

TERM OF REFERENCE

FOR

RIVER AND CANAL SURVEY (EAST)

The Master Plan of the Project for the Comprehensive Flood Management Plan for the Chao Phraya River Basin in Kingdom of Thailand is carried out during the beginning of February and the end of March 2013, under the technical cooperation of JICA (Japan International Cooperation Agency).

The basic specifications of the method in each survey works will be applied in the requirements in which was mutually agreed with the Client and the Contractor, in accordance with the Survey Specification for Overseas Development Study of JICA and the related standard specifications in Thailand.

1 Outline and Work Volume

(1) Check leveling for existing benchmarks

The purpose of check leveling is to confirm the accuracy with useful conditions of the respective existing benchmarks which have been established by the Royal Irrigation Department (hereinafter refer to as RID) and/or the Royal Thai Survey Department (hereinafter refer to as RTSD). The existing benchmarks to be surveyed and checked will be required to the Contractor by the Client's Engineer.

The method of check leveling shall be adopted the direct leveling or GPS survey by the static positioning in order to obtain the elevation (Mean Sea Level). If the GPS survey is carried out, the measurement time shall be at least one hour or more.

(2) Horizontal position of cross-section lines

The cross-section line shall be established the stake on the both banks of river and canal which was specified by the Client's Engineer. The measurement method shall be adopted the Handy GPS survey, traverse survey or the combination consist of the both measurements.

(3) River cross-section survey

The measurement method shall be adopted the combination consist of the Echo Thunder with GPS receiver and /or Total Station System.

- Total sections: approx. 98 sections
- Average width to be measured: approx. 300 m

Outside section: 20m from the edge of River banks

(4) Canal cross-section survey

The measurement method shall be adopted the combination consist of the Echo Thunder with GPS receiver and/or Total Station System.

- Total sections: approx. 40 sections
- Average width to be measured: approx. 100 m

Outside section: 20m from the edge of both banks

(5) Drawing of River Longitudinal Profiles and Cross-section

The longitudinal profiles are plotted using the cross-section data.

- Standard drawing scale: Vertical: 1/200, Horizontal: 1/100,000

- Standard drawing scale of cross-sections:

0 m to 190m in survey width: Vertical = 1/250, Horizontal = 1/250
190m to 380m in survey width: Vertical = 1/250, Horizontal = 1/500
380m or more in survey width: Vertical = 1/250, Horizontal = 1/2,500

The above specifications may be altered by the requirements of the Client's Engineer.

(6) Drawing of Canal Longitudinal Profiles and Cross-section

The longitudinal profiles are plotted using the cross-section data.

- Standard drawing scale: Vertical: 1/200, Horizontal: 1/50,000

- Standard drawing scale of cross-sections: Vertical = 1/250, Horizontal = 1/250

The above specifications may be altered by the requirements of the Client's Engineer.

2 Work Schedule

The following work schedule will be required in order to carry out during the Middle of June and Mid. of September 2012).

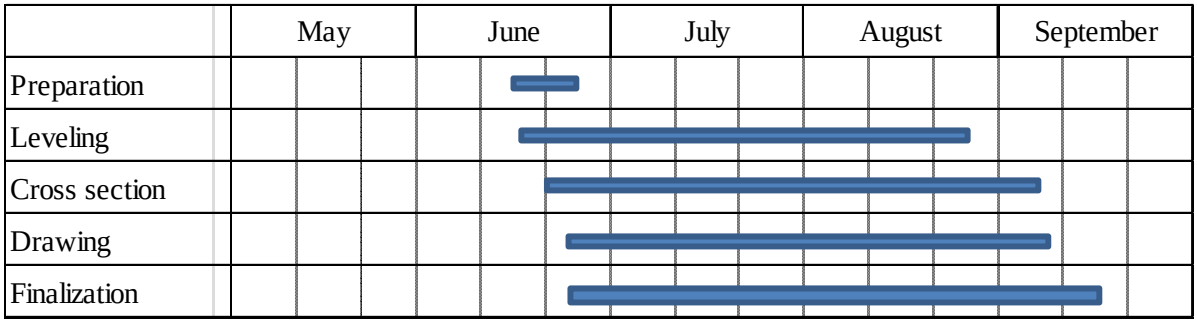


Fig. 1 Work Schedule

3 Survey Location

The survey locations are Listed below:

River Cross Sections

NO	River	Station Name	Center	
			E(UTM47)	N(UTM47)
1	BangBan	0+000	656504.9844	1584653.9550
2	BangBan	8+000	659893.5332	1588016.5370
3	BangBan	17+000	659977.2847	1595356.9670

River Cross Sections (cont.)

NO	River	Station Name	Center	
			E(UTM47)	N(UTM47)
4	Bangkaeo	0+000	664585.9196	1607306.6960
5	Bangkaeo	15+000	657490.5993	1613584.2240
6	BangLuang	0+000	652607.6859	1589096.6520
7	BangLuang	6+000	654629.7351	1593390.6530
8	BangLuang	13+000	657312.8523	1597839.4540
9	BangPranakhon	0+000	673656.4715	1600380.8330
10	BangPranakhon	13+000	672575.5877	1609605.9590
11	BangPranakhon	25+000	669662.9614	1619436.8780
12	Bangyai	0+000	651017.4757	1593695.2330
13	Bangyai	11+000	652373.6149	1602640.4400
14	Khlong_noi	0+000	667178.2958	1618531.9029
15	Khlong_noi	10+000	664523.8676	1623688.5920
16	Khlong_noi	20+000	662230.1980	1631489.1640
17	Khlong_noi	30+000	658468.4949	1639247.5510
18	Khlong_noi	39+000	652515.3796	1643434.8110
19	Lopburi	0+000	666801.0056	1587691.1980
20	Lopburi	10+000	667756.4899	1594720.5610
21	Lopburi	20+000	666991.6353	1603142.8560
22	Lopburi	30+000	665788.0957	1610234.5990
23	Lopburi	40+000	667316.7643	1616835.9700
24	Lopburi	50+000	670575.1884	1620830.3240
25	Lopburi	60+000	672426.0790	1628088.3490
26	Lopburi	70+000	673084.5821	1637136.6670
27	Lopburi	80+000	663820.6587	1637610.4840
28	Lopburi	90+000	656974.0880	1642816.6100
29	Lopburi	99+000	651680.9744	1645250.9570
30	Maenum_Noi	0+000	662552.5887	1570561.3460
31	Maenum_Noi	10+000	660494.6767	1579084.5240
32	Maenum_Noi	20+000	655356.8496	1584714.4980
33	Maenum_Noi	30+000	652370.4388	1587583.9990
34	Maenum_Noi	40+000	649160.6673	1595358.0460
35	Maenum_Noi	50+000	647642.3316	1602588.1780
36	Maenum_Noi	60+000	646110.2751	1611005.8410
37	Maenum_Noi	70+000	647864.2759	1616966.8950
38	Maenum_Noi	80+000	652459.7879	1622133.2130
39	Maenum_Noi	90+000	652482.7563	1629086.8700
40	Maenum_Noi	100+000	650258.1789	1636563.9300
41	Maenum_Noi	110+000	647013.6565	1643182.5360
42	Maenum_Noi	120+000	639825.0256	1647839.4580
43	Maenum_Noi	130+000	634971.1563	1654546.9180
44	Maenum_Noi	140+000	630167.9343	1658848.9850

River Cross Sections (cont.)

NO	River	Station Name	Center	
			E(UTM47)	N(UTM47)
45	Maenum_Noi	150+000	625211.0258	1664175.2370
46	Maenum_Noi	166+000	624138.7331	1676156.1360
47	Pasak	0+000	670045.6712	1586462.2220
48	Pasak	10+000	672188.6285	1595387.0330
49	Pasak	20+000	674680.2437	1602584.5770
50	Pasak	30+000	679731.1165	1603624.7520
51	Pasak	40+000	683239.8433	1607984.7170
52	Pasak	50+000	688805.5250	1610739.5060
53	Pasak	60+000	694021.6743	1610773.7550
54	Pasak	70+000	701016.5328	1610323.4700
55	Pasak	80+000	707271.0987	1607633.8730
56	Pasak	90+000	710739.5481	1610721.4630
57	Pasak	102+000	715774.5767	1614247.6220
58	Noi_Chaophraya	3+000	653401.6465	1632801.1012
59	Chaophraya	CP0+000	672042.6600	1498104.2900
60	Chaophraya	CP10+000	670279.7900	1505287.6200
61	Chaophraya	CP20+000	668479.8400	1510129.6200
62	Chaophraya	CP30+000	667888.8800	1515528.2400
63	Chaophraya	CP40+000	661690.0800	1513922.3400
64	Chaophraya	CP50+000	660820.8900	1521013.6600
65	Chaophraya	CP60+000	661987.1600	1529006.2900
66	Chaophraya	CP70+000	661002.3900	1536451.8800
67	Chaophraya	CP80+000	663152.5600	1542060.6700
68	Chaophraya	CP90+000	666329.4500	1548453.7900
69	Chaophraya	CP100+000	664715.2300	1556268.6700
70	Chaophraya	CP110+000	664191.9600	1563187.9700
71	Chaophraya	CP120+000	665502.9000	1569731.8000
72	Chaophraya	CP130+000	670530.9000	1575719.6800
73	Chaophraya	CP140+000	669909.5300	1584848.8800
74	Chaophraya	0+000	669980.1121	1585752.5110
75	Chaophraya	10+000	664331.9127	1589926.9050
76	Chaophraya	20+000	658074.3098	1595937.1790
77	Chaophraya	30+000	657134.4716	1604016.0960
78	Chaophraya	40+000	656003.4047	1612040.5290
79	Chaophraya	50+000	657117.7939	1619849.3510
80	Chaophraya	60+000	654416.4424	1628180.9580
81	Chaophraya	70+000	656387.0248	1635951.1050
82	Chaophraya	80+000	652747.9181	1642354.5400
83	Chaophraya	90+000	648746.5457	1649096.2850
84	Chaophraya	100+000	644324.0852	1656388.3710
85	Chaophraya	110+000	640512.2702	1664422.7520

River Cross Sections (cont.)

NO	River	Station Name	Center	
			E(UTM47)	N(UTM47)
86	Chaophraya	120+000	636710.3665	1670427.6540
87	Chaophraya	130+000	631046.7552	1678058.0130
88	Chaophraya	140+000	623693.8912	1676701.3600
89	Chaophraya	150+000	617895.3818	1682173.8270
90	Chaophraya	160+000	613477.1595	1688275.8080
91	Chaophraya	170+000	618169.7768	1695981.5350
92	Chaophraya	180+000	618539.1920	1700872.0830
93	Chaophraya	190+000	621837.2943	1705542.4340
94	Chaophraya	200+000	619126.1040	1711204.2950
95	Chaophraya	210+000	618393.4212	1717817.3480
96	Chaophraya	220+000	617365.8843	1722830.7040
97	Chaophraya	230+000	617956.7645	1730883.5260
98	Chaophraya	238+000	622434.3139	1736333.5290

Total river cross section = 98 sections

Canal Cross Sections

NO	Center	
	E(UTM47)	N(UTM47)
59	663779.3706	1593681.0248
66	688025.9258	1519953.5635
67	687494.0902	1525939.5995
68	686016.1878	1517847.7463
81	685605.4390	1606994.3858
85	690390.5068	1612886.8173
86	687461.1756	1619118.7419
87	686306.0283	1624123.3525
88	671882.4200	1646243.6481
89	652661.9718	1673053.7780
90	649926.5904	1679206.6702
91	621534.7053	1695397.3815
92	704050.7828	1577253.7524
93	704016.4950	1580349.1661
94	700437.4466	1586041.9314
99	622181.5713	1669470.4383
100	623377.0349	1670001.7386
106	636476.9702	1658229.7707
107	639403.5836	1654143.0077
108	641789.5576	1650484.8678
109	652064.2637	1624661.8892

NO	Center	
	E(UTM47)	N(UTM47)
109	652064.2637	1624661.8892
110	653469.3562	1624123.5671
111	676839.6190	1569632.7745
112	633541.7329	1676894.8014
118	671149.0639	1652533.0395
122	672810.7708	1516467.5075
123	673614.5808	1517573.1887
124	673288.8612	1587854.9545
125	673845.8470	1588049.1220
126	673999.8903	1588048.4391
127	674569.9625	1588074.3003
128	675482.7799	1588117.1382
129	676433.9121	1588316.6401
130	677358.2815	1588408.4335
131	678220.9688	1588525.6123
132	679057.2766	1588673.8409
133	679901.2475	1588682.0590
134	670887.7438	1560440.3199
135	672649.1612	1547931.0721

Total canal cross section = 40 sections

4 Survey standard

The following survey standard shall be applied based on the official rule in Thailand.

(5) Projection and horizontal coordinate system: UTM zone 47North

(6) Datum and Ellipsoid: WGS-84

(7) Vertical datum: Mean Sea Level

(8) Measurement: Metric System

5 General surveying method

(1) Horizontal control survey

The horizontal positioning shall be connected by the GPS method or Total Station method from the reference control points of RID and RTSD, if necessary in this survey work.

Prior to the commencement of the field measurements, the survey marks will be installed in proper positions along the planning route as well as on stable place, in accordance with the lines planned.

For example, the limits of closing error for control survey using the Total Station will be required to the followings:

a) Limits of closing error for the coordinates: 15cm+10cm $\sqrt{N}\sum S$

b) Limits of closing error for the heights: 24mm/ $\sqrt{N}$

N: Number of side

$\sum S$: Total length of traverse routes (unit: km)

For example, the tentative limit of the accuracy of GPS Receiver for control survey using the GPS will be required to the followings:

a) Static GPS surveying:

- Horizontal: ±5mm＋0.5ppm（RMS）
- Vertical: ±10mm＋1ppm（x baseline）（RMS）

b) Kinematic surveying:

- Horizontal: ±10mm＋1ppm (x baseline)（RMS）
- Vertical: ±20mm＋1ppm（x baseline）（RMS）

c) Handy GPS

- Horizontal: ±3m （RMS）

(2) Vertical control survey (leveling or GPS static method)

Vertical control survey shall be carried out to measure the elevation of survey points. The heights shall be connected from the existing benchmarks or existing control points. The following principal survey method will be required to the followings:

a) Measuring method: double-run depend on the condition of leveling routes

b) As a rule, limits of closing error:

- Check leveling: 30mm$\sqrt{}$s (s: km)

c) Reading unit: 1mm unit

d) Sensitivity of level instruments: more than 4''/2mm

(3) Cross-section survey

Cross-section survey for the proposed rivers and canals shall be done at the required sections which were based on the coordinates along the river banks or canal banks.

The survey points shall be measured the water Level, time, date and changing points in terrain features, revetments, retaining walls, fences, building and so on. The deep water portions should be done using the Echo Sounder with GPS/or Total Station navigation system. Under the water of observation points interval is not more than 5m.

Cross sections of respective canal shall be plotted the data which was obtained on the field survey.

Longitudinal profiles for the canal shall be plotted the heights of lowest riverbed and or ground, right bank and left bank respectively.

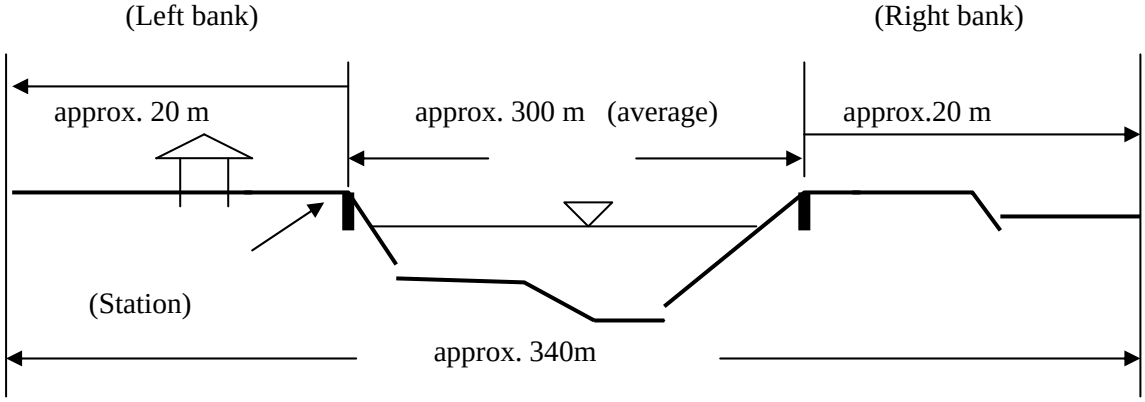


Fig. 2 Typical River Cross-section Face to Down Stream

The following main specifications will be required:.

a) Accuracy of measuring points: Distance: 1:500

Elevation: 2cm+5mm$\sqrt{}$s (s: km)

b) Specification of drawing for cross-sections and longitudinal profiles: It will be instructed by the Client's Engineer.

c) Data format: DXF or DWG format of Auto CAD

6 Detail requirements

Detail requirements such as the practical survey work will be instructed on the documents by the Client's Engineer after discussing with the Contractor.

7 Supervision of the Work

The Client has the right to supervise all of the works and to approve the plan of operation, work methods and progress of the work. The Client also has the right to accept and reject the results of the work.

The Contractor should submit the following items to the Client Engineer:

- Daily report (every survey team of progress).
- Law data (observation sheet and data) within 3day after finished site survey
- Draft drawing within 7day after finished site survey (A1size)

8 Final deliverables

The Contractor shall deliver in accordance with the period of each products or results which was agreed with the Client's Engineer.

The details of the following products and the results will be required by the Client's Engineer after discussing with the Client:

1) Printed cross sections:	2 sets
2) Printed index map for cross sections:	2 sets
3) Printed longitudinal profiles:	2 sets
4) Whole digital data:	2 sets
5) Whole field measurement data:	1 set
6) Used control points and Benchmarks of Descriptions :	2 sets
7) Final survey report:	2 sets
8) All data of softcopy (CD)	2 sets

Fig. 5 Survey Location of River and Canal Survey

TERMS OF REFERENCE

FOR

FLOOD RESPONSE OPERATION SURVEY

1 Background

There are many hydraulic control structures in the Chao Phraya River represented by two huge dams, Bhumibol and Sirikit dams. Particularly, in the deltaic area downstream of the Chao Phraya Dam, water-gates (regulators) and weirs were constructed to divert and supply the irrigation water to the wide rice paddies, where irrigation canal network was densely developed.

On the other hand, the drainage pumping stations were constructed together with floodgates to protect the Bangkok Metropolis. Along the coast of Thai Gulf, more than 10 pumping stations were constructed to drain the flood water inundated in the Chao Phraya Floodplain.

During the 2011 Flood the structures were well operated to mitigate the damages, while the effects were less than the expected due to (1) the structures were designed for irrigation water supply, so that their functions to control flood water were limited, (2) the operation was severally conducted without an integrated management, and (3) inadequate or no information required for effective operation was provided. Then, it is said that the flood damages shall have been reduced if the integrated operation could be attained under a single administration.

It is, therefore, proposed that the inventory and review on the existing structures/facilities will be conducted with (1) their operation manual/guideline, (2) the actual operation in the 2011 Flood, and (3) preparation/transmission/receipt of information for the operation in order to develop an effective operation system of the hydraulic control structures/facilities in the Chao Phraya River Basin.

2 Objective

The objectives of this Survey are (1) To identify the present operation mechanism and its problems to effect for flood mitigation, (2) To study on the new operation mechanism effective for flood mitigation and (3) To prepare the flood information network required for the effective operation mechanism. The flood information network shall be incorporated to the results of other two surveys; “Questionnaire Survey on Flood Inundation and Damages” and “Flood Impact Study”.

3 Survey Area

(1) Hydraulic Control Structures

Structures and facilities which may contribute the flood flow of Chao Phraya River will be subject to the survey, as follows:

Structures	Water Course	Name of Structure	Administration
Dam			
	Ping	Bhumibol Dam	EGAT
	Nan	Sirikit Dam	EGAT
	Kwae Noi (Nan)	Kwae Noi Dam	RID
	Wang	Kiew Lom Dam	RID
	Wang	Kiew Kor Ma Dam	RID
	Pasak	Pasak Dam	RID
	Sakae Krang	Tap Sa Lao Dam	RID
	Thachin	Kra Siew Dam	RID
Regulator/ Weir			
	Yom	Mae Yom Weir	RID
	Nan	Phisanulok Diversion Weir	RID
	Thap Salao	Thap Salao Diversion Weir	RID
	Yom to Nan	Control Regulator	RID
	Yom to Nan	Control Regulator No.1	RID
	Yom to Nan	Control Regulator No.2	RID
	Chao Phraya	Chao Phraya Dam	RID
	Suphan	Phonlatep Head Regulator	RID
		Bun Thabot Regulator	RID
		Sam Chool Regulator	RID
		Pho Phraya Regulator	RID
	Noi	Borommathat Head Regulator	RID
		Channasut Regulator	RID
		Yang Mani Regulator	RID
		Phak Hai Rgulator	RID
	Noi - Suphan	Ladchand Regulator	RID
	Chainat - Pasak	Manorom Head Regulator	RID
		Chongkae Regulator	RID
		Koke Kathiem Regulator	RID
		Reong Rand Regulator	RID
	Chainat - Ayutthaya	Maharaj Head Regulator	RID
	Makamthao-Uthong	Makamthao-Uthong Head Regulator	RID
	Pasak	Rama VI Barrage	RID
Pumping Station			
	Chao Phraya	Only P.S. discharging to Chao Phraya	RID/BMA
	Thachin	Only P.S. discharging to Thachin	RID
	Pasak	Only P.S. discharging to Pasak	RID
	Along Coast	Only P.S. discharging to Coast	RID

(2) Flood Information Dissemination

The government offices handle the flood information such as RID, EGAT and BMA which are responsible for operation of the structures and facilities, DWR, TMD, etc. as well as the provincial governments. Further, DDPM which is responsible for the disaster prevention and management shall be also included together with its regional centers.

4 Scope of Works

(3) Collection of Data

Operation Manuals and Guidelines

Together with operation manuals of structures/facilities, the guidelines showing links of commands will be collected.

Records of Operation together with Hydrologic and Hydraulic Conditions

The commands and conditions for operation as well as information obtained will be clarified in order to grasp the mechanisms of flood response operation.

The operation records of structures/facilities will be collected together with hydrologic and hydraulic conditions such as water levels and flow rates.

(4) Interview Survey

In addition to the data collection, the interview with the person-in-charge will be conducted to confirm and clarify what were recorded:

Detailed conditions of operation and information obtained

The detailed conditions of operation and information obtained during the 2011 Flood.

Conditions of Structures

Some regulators (water gates) were destroyed by the flood, the conditions and causes of destruction will be confirmed and clarified through the interview.

Information Received and Transmitted

For the operation, there were important information were received by the operator in addition to the commands and orders by the superior offices. Those information will be collected and sorted into some categories. Other information required for smooth operation will be also identified. The information on the conditions of structures and surrounding as well as operation which were transmitted to the superior offices will be collected.

(5) Analysis on hydrologic and hydraulic conditions during the 2011 Flood

Hydrologic Analysis

The flood conditions at the structure sites will be analyzed referring to the attached Figure 1: Chao Phraya River and Canal System. The flood discharges at the structure site will be estimated if the data are available such as the sections and water levels.

Conditions of Structures

The analysis will be undertaken if the actual flood conditions of the structure sites exceeded the design conditions of structures or surrounding conditions such as canal's capacity, dike height, etc. Then, the causes to destroy the structures will be definitively identified.

Information Required for Smooth Operation

The information required for an effective operation of the structure will be studied together with the expected method of transmission.

(6) Reporting

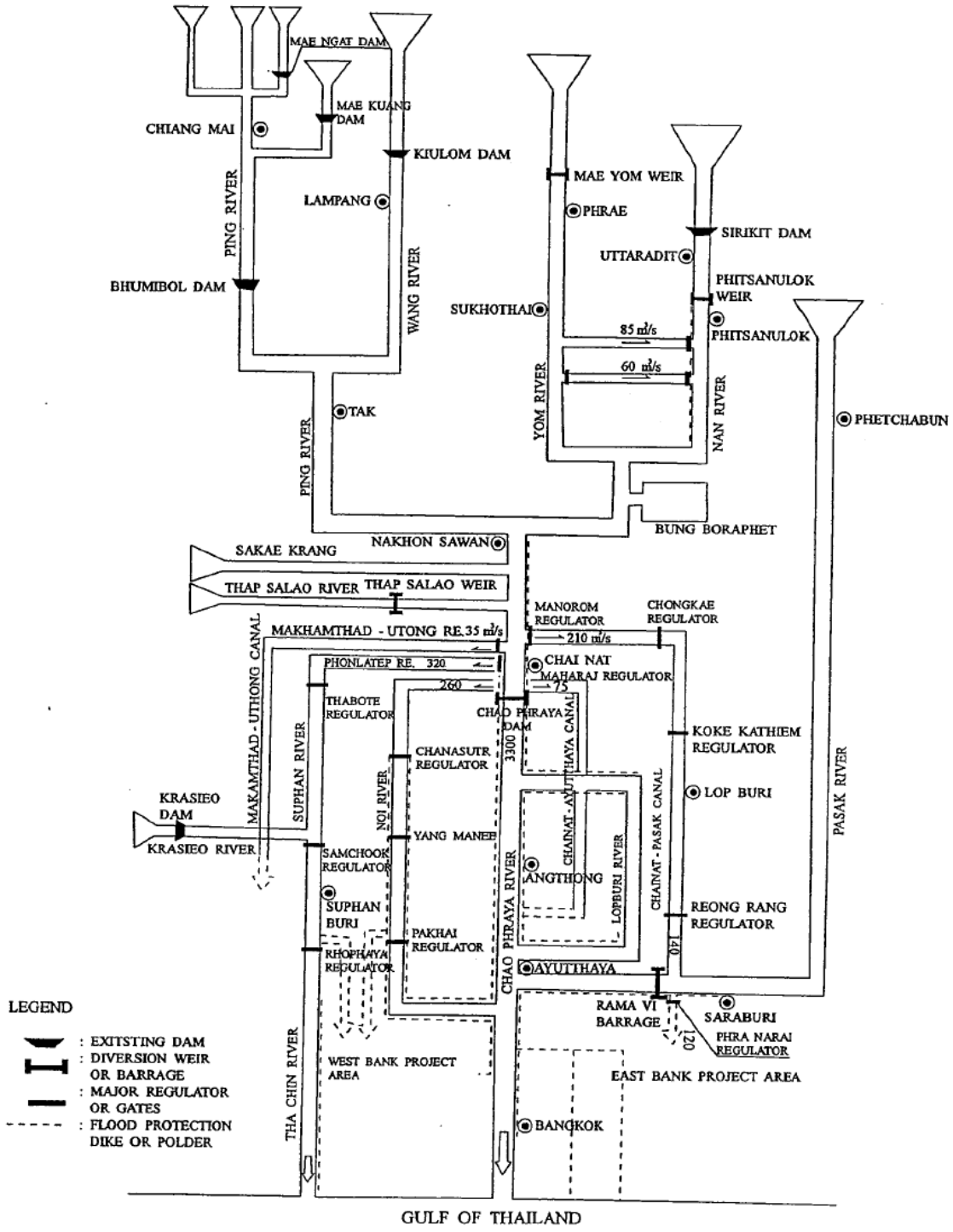
In the course of the Survey, an Inception Report will be compiled/submitted within 1 month after commencement. The Interim Report will be prepared within 2 months and the draft Final Report within 3 months.

5 Schedule

Survey period is assumed at 3 months and major survey items are shown below:

Item	Activities	2012											
		August				September				October			
		W1	W2	W3	W4	W1	W2	W3	W4	W1	W2	W3	W4
1	Collection Data and Interview Survey Works			▪▪▪▪	▪▪▪▪	▪▪▪▪	▪▪▪▪	▪▪▪▪	▪▪▪▪				
	- Northern Area of Thailand			▪▪▪▪	▪▪▪▪	▪▪▪▪	▪▪▪						
	- Middle Area of Thailand						▪▪▪▪	▪▪▪▪	▪▪▪				
	- Bangkok and Nearby Area							▪▪▪▪	▪▪▪▪				
2	Analysis									▪▪▪▪	▪▪▪▪	▪▪▪▪	▪▪▪▪
3	Reporting					1/				2/		3/	4/

Note: 1/: Inception Report, 2/: Interim Report, 3/: Draft Final Report , 4/: Final Report


MAE NGAT DAM
MAE KUANG DAM
CHIANG MAI
KIULOM DAM
LAMPANG
PING RIVER
WANG RIVER
BHUMIBOL DAM
TAK
PING RIVER
MAE YOM WEIR
PHRAE
SIRIKIT DAM
UTTARADIT
PHITSANULOK WEIR
SUKHOTHAI
85 m³/s
PHITSANULOK
60 m³/s
YOM RIVER
NAN RIVER
PHETCHABUN
BUNG BORAPHET
NAKHON SAWAN
SAKAE KRANG
THAP SALAO RIVER
THAP SALAO WEIR
MANOROM REGULATOR
CHONGKAE REGULATOR
MAKHAMTHAD - UTONG RE.35 m³/s
210 m³/s
PHONLATEP RE. 320
CHAI NAT MAHARAJ REGULATOR
260
75
THABOTE REGULATOR
CHAO PHRAYA DAM
MAKAMTHAD - UTHONG CANAL
SUPHAN RIVER
CHANASUTR REGULATOR
3300
KOKE KATHIEM REGULATOR
CHAINAT - AYUTTHAYA CANAL
KRASIEO DAM
NOI RIVER
LOP BURI
KRASIEO RIVER
YANG MANEE
SAMCHOOK REGULATOR
ANGTHONG
LOPBURI RIVER
CHAINAT - PASAK CANAL
SUPHAN BURI
REONG RANG REGULATOR
PAKHAI REGULATOR
RHOPHAYA REGULATOR
CHAO PHRAYA RIVER
AYUTTHAYA
120
PASAK RIVER
RAMA VI BARRAGE
SARABURI
PHRA NARAI REGULATOR
WEST BANK PROJECT AREA
EAST BANK PROJECT AREA
THA CHIN RIVER
BANGKOK
GULF OF THAILAND
LEGEND
: EXITSTING DAM
: DIVERSION WEIR OR BARRAGE
: MAJOR REGULATOR OR GATES
: FLOOD PROTECTION DIKE OR POLDER

TERMS OF REFERENCE

FOR

QUESTIONNAIRE SURVEY

1 Background and Objectives

The 2011 Flood has claimed 803 human lives over the economic damages and losses estimated at 40 Billion USD. It is believed that huge damages and losses were attributed by an insufficient and incorrect flood information and warning delivered by the government agencies, while the 2011 Flood was brought by the extraordinary rainfall and the damages were much raised due to the rapid urban and industrial development in the lower floodplain of Chao Phraya River.

Moreover, the residents living in the floodplain have little awareness as they are somehow accustomed with the flooding conditions.

In the Master Plan prepared by the Strategy Committee of Water Resources Management, the Royal Thai Government, which composed of the long-term and the short-term (urgent) plans advocates the necessity to establish a comprehensive water and flood information system. Particularly in the short-term plan, the flood forecasting and warning system has been urged to establish. Therefore, it is required to analyze the actions taken before and during the flood as well as what information to be significant for proper response operations and activities by the residents as well as local communities in order to prevent and mitigate flood damages.

On the other hand, the review and evaluation on long-term plan shall require basic data of damageable assets and properties to assess how much the flood damages and losses could be reduced, and eventually if each component as well as the whole scheme could be technically sound and economically feasible. The basic data shall be collected on the actual basis, which could be attained through the interviews with the residents and communities who had experienced the 2011 Flood.

A technical assistance has been provided by the Japan International Cooperation Agency (JICA) in collaboration with the Royal Thai Government Agencies to study for drawing a comprehensive Master Plan of flood management for the Chao Phraya River Basin. In the course of the Study, this questionnaire survey is provided, 1) To identify the actions taken by the residents and communities before and during the 2011 Flood and 2) To collect data and information on the damages and losses as well as the damageable assets by the floods.

2 Scope of Works

This survey will be undertaken with three steps as follows:

(1) Collection and arrangement of relevant data and information.

- Identify Tambon (Sub-district) included in the flooding area of the 2011 Flood referring to the Map of Proposed Interview Area (under the Inundation Survey, as attached hereto).
- Collect the profiles and related statistical data by Tambon (Sub-district)
- Arrange the data and information related to the questionnaires by Tambon

(2) Questionnaire Survey

1,200 sites (respondents) are expected to interview based on the Map where 6,000 points were subject for interview in the Inundation Survey. Questionnaire survey will be mainly conducted with for aspects as follows[1]:

A: Property of respondent
B: Flood conditions at the point of respondent
C: Information and actions before and during the floods
D: Damages and losses by the flood

The survey area is divided into two (2) sub-areas in Nakhon Sawan: upper and down stream, respectively.

[1] For Items B and C, other two major floods included for comparison purpose to the 2011 Flood

360 sites in upper stream and 840 in down stream will be selected evenly by district. Preferable respondents should be those who settle at the buildings as indicated below. In addition, respondents with the ages of 40 or more, and settling at the corresponding building since its establishment are more preferable.

No.	Category	Upper stream Nakhon Sawan		Down stream Nakhon Sawan		Total No. surveyed
		No. surveyed	%	No. surveyed	%	
1	House (Prrivate)	255	85	768	85	1,023
2	House (Farmer's)					
3	House (Shop-Medium/Small)					
4	House (Small Restaurant/Canteen)					
5	Shop (Medium/Emporium/Market)	1	0.3	2	0.2	3
6	Factory (Large/Medium)	8	2.7	23	2.6	31
7	Factory (Small)	27	9	81	9.0	108
8	Restaurant	1	0.3	4	0.4	5
9	Hotel (100 rooms or more)	1	0.3	4	0.4	5
10	Hotel (Less than 100 rooms)					
11	School (Elementary/Middle)	2	0.7	5	0.6	7
12	School (High/Univ.)					
13	School (Kindergarten and Others)					
14	Hospital	4	1.3	11	1.2	15
15	Hospital (Medical clinic)					
16	Government Buildings	1	0.3	2	0.2	3
	Total	**300**	**100**	**900**	**100**	**1,200**

(3) Analysis and Reporting

In order to identify the major issues in flood information and warning, actions taken by the residents and communities will be analyzed and arranged. Particularly, the data of assets shall be compiled for every Tambon (Sub-district) into the excel file for used of flood damage estimation for several flood patterns.

3 Survey Area

The survey area will be, as attached, the 2011 flooded area in the lower Chao Phraya River Basin.

4 Survey Schedule

All works is expected to be completed by the end of September, 2012, as shown below:

	Survey Item	July	August	September
1.	Data Collection			
2.	Questionnaire Survey			
3.	Analysis and Reporting			

QUESTIONNAIRE

Date _____ Interviewer Name _____

A. RESPONDENT

Respondent Name (Mr/ Mrs) _____ Age: _____

Address _____

Tel./Cell No. _____

GPS Information:

Waypoint No.: _____

Longitude (E): _____

Latitude (N): _____

A.1 Is the Respondent of residence or establishment or others?

- ☐ Residence *(Please proceed to A.1-1)*
- ☐ Establishment *(Please proceed to A.2)*
- ☐ Others, pls specify _____ *(Please proceed to A.3)*

A.1-1 Civil status ☐ Single ☐ Married ☐ Widow

A.1-2 Educational attainment

Level	Grade/Year
none	
Elementary	
High School	
Vocational	
College	

A.1-3 Number of family staying in the current residence: _____ persons

A.1-4 Conditions of residence

A.1-4.1 Building type: ☐ Stand-alone ☐ Terrace-house ☐ Apartment/Condominium

A.1-4.2 Number of stories: _____

A.1-4.3 (Total) Floor area: _____ m^2

A.1-4.4 (Ground) Floor elevation: _____ m

A.1-5 How long have you lived in this place?

☐ 1 – 10 yrs ☐ 11 – 20 yrs ☐ 21 – 30 yrs ☐ 31 – 40 yrs ☐ > 40 yrs

- (Jump to B) –

A.2 What is the business of establishment?

- ☐ Store, pls specify commodity for sale: _____ _____
- ☐ Factory, pls specify the products: _____ _____
- ☐ Restaurant, pls specify the number of tables: _____
- ☐ Hotel, pls specify the number of rooms: _____

☐ Others, pls specify: _____

A.2-1 Number of workers (employees): _____ persons

A.2-2 Position of respondent in the establishment:

Level	Years in Position
Worker	
Administrative	
Executive	
President/Head	
Owner	

A.2-3 Conditions of building

A.2-3.1 Building type: ☐ Wood ☐ Brick ☐ Concrete ☐ Steel-frame

A.2-3.2 Number of stories: _____

A.2-3.3 (Total) Floor area: _____ m^2

A.2-3.4 (Ground) Floor elevation: _____ m

A.2-4 How long has the business been operated?

☐ 1 – 10 yrs ☐ 11 – 20 yrs ☐ 21 – 30 yrs ☐ 31 – 40 yrs ☐ > 40 yrs

- (Jump to B) -

A.3 What is the building for?

☐ School: (☐ Nursery/kinder, ☐ Elementary, ☐ Middle, ☐ High, ☐ Collage)

☐ Hospital, ☐ public or ☐ private Pls specify the number of beds: _____

☐ Government office, pls specify the functions: _____

☐ Others, pls specify: _____

A.3-1 Number of workers (employees): _____ persons

A.3-2 Position of respondent in the building/office:

Level	Years in Position
Worker	
Administrative	
Executive	
President/Head	
Owner	

A.3-3 Conditions of building

A.3-3.1 Building type: ☐ Wood ☐ Brick ☐ Concrete ☐ Steel-frame

A.3-3.2 Number of stories: _____

A.3-3.3 (Total) Floor area (m^2): _____ m^2

A.3-3.4 (Ground) Floor elevation: _____ m

A.3-4 How long has the office/building been operated?

☐ 1 – 10 yrs ☐ 11 – 20 yrs ☐ 21 – 30 yrs ☐ 31 – 40 yrs ☐ > 40 yrs

- (Jump to B) -

B. FLOOD CONDITIONS

(Hints for Interviewer: Questionnaire inclusive of 1995 Flood for residents living more than 20 years and inclusive of 2006 for residents living more than 10 years)

B.1 Where is the flood coming from?

2011 Flood	Recent major floods		Other floods, if any
	(1995 Flood)	*(2006 Flood)*	*Year* (_____)
☐ from the river ☐ from the canals ☐ from the roads	☐ from the river ☐ from the canals ☐ from the roads	☐ from the river ☐ from the canals ☐ from the roads	☐ from the river ☐ from the canals ☐ from the roads

B.2 Duration and depth of flooding

2011 Flood	Recent major floods		Other floods, if any
	(1995 Flood)	*(2006 Flood)*	*Year* (_____)
Max. flood depth above floor level: _____ m	Max. flood depth above floor level: _____ m	Max. flood depth above floor level: _____ m	Max. flood depth above floor level: _____ m
Duration of flood above floor level: ___ hours ___ days	Duration of flood above floor level: ___ hours ___ days	Duration of flood above floor level: ___ hours ___ days	Duration of flood above floor level: ___ hours ___ days

B.3 How long was the flooding in your place?

(pls. enter starting day/ month and ending day/month in the box)

2011 Flood	Recent major floods		Other floods, if any
	(1995 Flood)	*(2006 Flood)*	*Year* (_____)
____/____ *day/month* ___/____ *day/month*	____/____ *day/month* ___/____ *day/month*	____/____ *day/month* ___/____ *day/month*	____/____ *day/month* ___/____ *day/month*
____ *days*	____ *days*	____ *days*	____ *days*

C. FLOOD WARNING AND RESPONSE OPERATION

C.1 Did you receive flood information and warning? ☐ ***Yes*** ☐ ***No***

*For Respondents answering **Yes***

C.2 From whom did you receive flood information and warning?

2011 Flood	Recent major floods		Other floods, if any
	(1995 Flood)	*(2006 Flood)*	*Year* (_____)

☐ radio/TV ☐ neighbors ☐ gov't officials ☐ police ☐ others, pls specify _____	☐ radio/TV ☐ neighbors ☐ gov't officials ☐ police ☐ others, pls specify _____	☐ radio/TV ☐ neighbors ☐ gov't officials ☐ police ☐ others, pls specify _____	☐ radio/TV ☐ neighbors ☐ gov't officials ☐ police ☐ others, pls specify _____

C.3 What information was needed for your proper response actions?

2011 Flood	Recent major floods		Other floods, if any
	(1995 Flood)	*(2006 Flood)*	*Year* (_____)
☐ detailed flood conditions (scale, expected time to reach) ☐ estimated inundation area ☐ evacuation route and sites	☐ detailed flood conditions (scale, expected time to reach) ☐ estimated inundation area ☐ evacuation route and sites	☐ detailed flood conditions (scale, expected time to reach) ☐ estimated inundation area ☐ evacuation route and sites	☐ detailed flood conditions (scale, expected time to reach) ☐ estimated inundation area ☐ evacuation route and sites

C.4 Did you evacuate during the disaster/flood? ☐ ***Yes*** ☐ ***No***

*For Respondents answering **No***
C.5 Why you did not evacuate?

2011 Flood	Recent major floods		Other floods, if any
	(1995 Flood)	*(2006 Flood)*	*Year* (_____)
☐ flood was not critical ☐ no advice, too late ☐ nowhere to evacuate ☐ others, pls. specify _____	☐ flood was not critical ☐ no advice, too late ☐ nowhere to evacuate ☐ others, pls. specify _____	☐ flood was not critical ☐ no advice, too late ☐ nowhere to evacuate ☐ others, pls. specify _____	☐ flood was not critical ☐ no advice, too late ☐ nowhere to evacuate ☐ others, pls. specify _____

*For Respondents answering **Yes***
C.6 When did you evacuate?

2011 Flood	Recent major floods		Other floods, if any
	(1995 Flood)	*(2006 Flood)*	*Year* (_____)
☐ before the flooding ☐ during the flooding after ___ days of the start of flooding	☐ before the flooding ☐ during the flooding after ___ days of the start of flooding	☐ before the flooding ☐ during the flooding after ___ days of the start of flooding	☐ before the flooding ☐ during the flooding after ___ days of the start of flooding

C.7 Where did you evacuate?

2011 Flood	Recent major floods		Other floods, if any
	(1995 Flood)	*(2006 Flood)*	*Year* (_____)
☐ went to higher places ☐ temple/church ☐ school ☐ others, pls. specify _____	☐ went to higher places ☐ temple/church ☐ school ☐ others, pls. specify _____	☐ went to higher places ☐ temple/church ☐ school ☐ others, pls. specify _____	☐ went to higher places ☐ temple/church ☐ school ☐ others, pls. specify _____

C.8 Who helped you in evacuating?

2011 Flood	Recent major floods		Other floods, if any
	(1995 Flood)	*(2006 Flood)*	*Year* (_______)
❑ gov't officials ❑ police/military ❑ neighbors ❑ NGO (please specify) ______ ____________	❑ gov't officials ❑ police/military ❑ neighbors ❑ NGO (please specify) ______ ______________	❑ gov't officials ❑ police/military ❑ neighbors ❑ NGO (please specify) ______ ______________	❑ gov't officials ❑ police/military ❑ neighbors ❑ NGO (please specify) ______ ______________

C.9 Type of transportation for evacuation?

2011 Flood	Other major floods		Other floods, if any
	(1995 Flood)	*(2006 Flood)*	*Year* (_______)
❑ on foot ❑ tuk-tuk ❑ motorcycle ❑ cars ❑ others, pls specify _______________ _______________	❑ on foot ❑ tuk-tuk ❑ motorcycle ❑ cars ❑ others, pls specify _______________ _______________	❑ on foot ❑ tuk-tuk ❑ motorcycle ❑ cars ❑ others, pls specify _______________ _______________	❑ on foot ❑ tuk-tuk ❑ motorcycle ❑ cars ❑ others, pls specify _______________ _______________

D. FLOOD DAMAGES (Farmers and Residents)

D.1 What damages did you experience during the flooding?

2011 Flood	Other major floods		Other floods, if any
	(1995 Flood)	*(2006 Flood)*	*Year* (_______)
❑ none ❑ human life ❑ farm crops ❑ livestock/poultry ❑ agri. machine ❑ houses/building ❑ furniture/fixture ❑ equipment ❑ others (vehicle, etc) __________________ __________________	❑ none ❑ human life ❑ farm crops ❑ livestock/poultry ❑ agri. machine ❑ houses/building ❑ furniture/fixture ❑ equipment ❑ others (vehicle, etc) __________________ __________________	❑ none ❑ human life ❑ farm crops ❑ livestock/poultry ❑ agri. machine ❑ houses/building ❑ furniture/fixture ❑ equipment ❑ others (vehicle, etc) __________________ __________________	❑ none ❑ human life ❑ farm crops ❑ livestock/poultry ❑ agri. machine ❑ houses/building ❑ furniture/fixture ❑ equipment ❑ others (vehicle, etc) __________________ __________________

D.1-1 Were any family member injured or dead by floods:

❑ Injured ____persons ❑ Dead ____ persons

D.1-2 Was your farm flooded:

- ☐ rice ____ % of total ____ rai
- ☐ farm of _____ : ____ % of _____ rai flooded.
- ☐ farm of _____ : ____ % of _____ rai flooded.
- ☐ farm of _____ : ____ % of _____ rai flooded.
- ☐ farm of _____ : ____ % of _____ rai flooded.

D.1-3 Were your livestock/poultry lost due to flood:

- ☐ livestock _____: ____ (number) were lost due to flood
- ☐ livestock _____: ____ (number) were lost due to flood
- ☐ livestock _____: ____ (number) were lost due to flood
- ☐ poultry _____: ____ (number) were lost due to flood
- ☐ poultry _____: ____ (number) were lost due to flood
- ☐ poultry _____: ____ (number) were lost due to flood
- ☐ poultry _____: ____ (number) were lost due to flood

D.1-4 Damages on agricultural machinery _____% of total value

D.1-5 Damages on houses/buildings: _____ % of total value

D.1-6 Damages over the fixture and furniture: _____ % of total value

D.1-7 Damages over the equipment (such electric/electronic appliances): ____ % of total value

D.1-8 Damages over outdoor facilities (vehicle, motorcycle, bicycle, etc): ____ % of total value

D.1-9 Recovery ratio after cleaning/washing:

☐ Agri. machinery __ % ☐ Furniture __ % ☐ Fixture __ %
☐ Outdoor __ % ☐ Equipment __ %

D.2 Flood Losses

D.2-1 Diseases acquired during the flooding?

- ☐ skin disease
- ☐ minor fever and flu (colds)
- ☐ diarrhea
- ☐ others, pls. specify _____

D.2-2 How many days you were not able to receive services of electricity and water supply?

☐ Electricity ____ days ☐ Water ____ days

D.2-3 How did you compensate and spend for electricity and water?

- ☐ Electricity: Compensated by _____ and spent ____ Baht/day
- ☐ Water: Compensated by _____ and spent ____ Baht/day

D.2-4 How long did you and your family members were not able to go to your job and/or school?

- ☐ Job: ____ persons stopped for ____ days
- ☐ School: ___ persons stopped for ____ days

E. FLOOD DAMAGES (Establishments)

E.1 What damages did you experience during the flooding?

2011 Flood	Other major floods		Other floods, if any
	(1995 Flood)	*(2006 Flood)*	*Year* (_____)

☐ none ☐ human life ☐ fixed assets ☐ inventory assets ☐ buildings ☐ facility/equipment ☐ others (vehicle, etc) _____ _____	☐ none ☐ human life ☐ fixed assets ☐ inventory assets ☐ buildings ☐ facility/equipment ☐ others (vehicle, etc) _____ _____	☐ none ☐ human life ☐ fixed assets ☐ inventory assets ☐ buildings ☐ facility/equipment ☐ others (vehicle, etc) _____ _____	☐ none ☐ human life ☐ fixed assets ☐ inventory assets ☐ buildings ☐ facility/equipment ☐ others (vehicle, etc) _____ _____

E.1-1 Were any worker of your establishment injured or dead by floods:

☐ Injured ____persons ☐ Dead ____ persons

E.1-2 Were your fixed assets damaged due to flood:

☐ Value of fixed assets: Baht _____ million

☐ Estimated damages : Baht _____ million

E.1-3 Were your inventory assets damaged due to flood?

☐ Value of inventory assets: Baht _____ million

☐ Estimated damages : Baht _____ million

E.1-4 Were your building/store/factory damaged due to flood?

☐ Value of building: Baht _____ million

☐ Estimated damages : Baht _____ million

E.1-5 Damages over the equipment/facilities

☐ Value of equipment/facility: Baht _____ million

☐ Estimated damages: Baht _____ million

E.1-6 Damages over outdoor facilities (vehicle, motorcycle, bicycle, etc)

☐ Value of outdoor facilities: Baht _____ million

☐ Estimated damages : Baht _____ million

E.1-7 Recovery ratio after cleaning/washing:

☐ Fixed asset __ % ☐ Inventory asset __ % ☐ Equipment __ % ☐ Outdoor __ %

E.2 Flood Losses

E.2-1 How many days you were not able to receive services of electricity and water supply?

☐ Electricity ____ days ☐ Water ____ days

E.2-2 How did you compensate and spend for electricity and water?

☐ Electricity: Compensated by _____ and spent ____ Baht/day

☐ Water: Compensated by _____ and spent ____ Baht/day

E.2-3 How long did the establishment was not able to resume operation?

☐ No operation: ____ days

☐ Until full operation: ___ days

F. MEDIA AVAILABILITY DURING 2011 FLOOD

F.1 What was the most useful & reliable media to get the information on flood situation in 2011?

- ☐ Newspaper
- ☐ TV
- ☐ Radio
- ☐ Internet
- ☐ Tweet (via SNS like Twitter, Facebook etc.)
- ☐ Meetings
- ☐ Others, pls specify

F.2 Did you have Internet access during the flood in 2011?

- ☐ Yes ----> Go to F.2-1 and following questions
- ☐ No ----> Go to F.3

F.2-1 How to connect Internet during the flood (most frequently)

- ☐ Wired
- ☐ Wireless (Wi-Fi)
- ☐ Others, pls specify

F.2-2 Location of Internet access

- ☐ Own home
- ☐ Internet connection shop (e.g. Internet Café)
- ☐ Place available Internet (e.g. Restaurant, Coffee house)
- ☐ Others, pls specify

F.2-3 Frequency of using Internet *Frequency standard: less 1 hour per a time

- ☐ Frequently a day
- ☐ Once a day
- ☐ A few times a week
- ☐ Once a week
- ☐ Less often

F.3 What was the most useful information that you acquired?

- ☐ Radio/TV
- ☐ Neighbor
- ☐ Gov't officials
- ☐ Police
- ☐ Others, pls specify

F.4 What was the most wanted information, but could not be acquired?

- ☐ Radio/TV
- ☐ Neighbor
- ☐ Gov't officials
- ☐ Police
- ☐ Others, pls specify

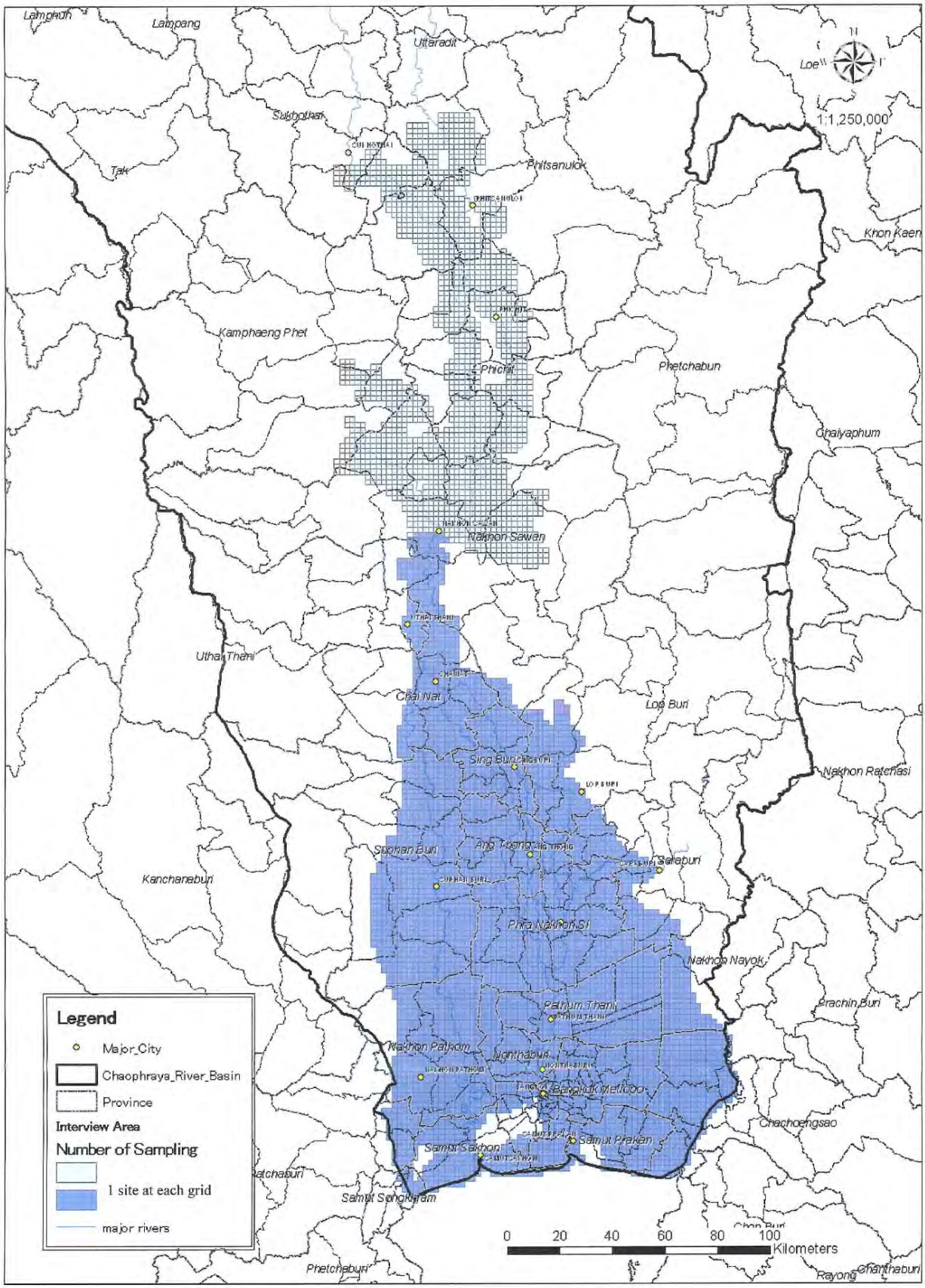


Figure-1 Proposed Interview Area

TERMS OF REFERENCE

FOR

FLOOD IMPACT SURVEY

1 Background and Objectives

By the 2011 Flood, the total damages were estimated at THB 630 billion and losses at THB 795 billion which will be accumulated over 3 years. Most of the damages and losses are in the manufacturing sector, which represents 38% of Thai GDP (PDNA, the World Bank). The ten industrial estates which are located in Ayutthaya, Pathum Thani, Bangkok and Samut Phrakhan have been driving the manufacturing sector of Thai and were severely affected in particular.

A technical assistance has been provided by the Japan International Cooperation Agency (JICA) in collaboration with the Thai Government Agencies to study for drawing a comprehensive Master Plan of flood management for the Chao Phraya River Basin.

In the course of the study, the questionnaire survey is undertaken for obtaining the data/information of damages and losses in the manufacturing sector, particularly the ten industrial estates located in the flooding area of the 2011 Flood. The results of questionnaire survey will be utilized for assessment of the impacts of the 2011 Flood, and eventually for the important factor to draw the comprehensive Master Plan of flood management.

2 Scope of Works

2.1 Data and Information Collection/Processing

The relevant data and information for the 10 industrial estates will be collected and processed to facilitate 2.2 Questionnaire Survey. The sources of data collection are enumerated, but not limited to follows:

- Bureau of Investment, Ministry of Finance
- Industrial Estate Authority, Ministry of Industry
- Japan Economic and Trade Organization (JETRO), Thailand
- Thailand Board of Investment

The collected data and information will be processed into the following table.

<u>General in Thailand</u>

Area / Item	(1) Chao Phraya River Basin (CPBR)	(2) Thailand	Ratio of CPRB (3) = (1) / (2)
Number of Industrial Estates			
Number of Factories (Companies) in			
Total Area of Estates (ha)			
Number of Employees (Workers)			

In Chao Phraya River Basin

Item \ Area	(1) Flooded Industrial Estate	(2) Non Flooded Industrial Estate	Ratio of CPRB (3) = (1) / (2)
Number of Industrial Estates			
Number of Factories (Companies) in			
Total Area of Estates (ha)			
Number of Employees (Workers)			

2.2 Questionnaire Survey

The interview will be conducted with the operators and/or persons-in-charge of factories located in the ten industrial estates in Pathum Thani, Ayutthaya, Bangkok and Samut Prakan as follows:

No.	Industrial Estate	Location	No. of Factories (Companies)	Area of Estate (ha)	Flood Day and Depth
Flooded Industrial Estates			**804**		
1	Saha Rattana Nakorn	Ayutthaya	42	230.56	Oct. 04, 2.5m
2	Rojana	Ayutthaya	218	1,452.00	Oct. 09, 2.5m
3	Hi-Tech	Ayutthaya	143	380.00	Oct. 13, 2.0m
4	Factory Land	Ayutthaya	93	34.5	Oct. 16, 1.0m
5	Bang Pa-In	Ayutthaya	84	313.00	Oct. 14, 2.0m
6	Nava Nakorn	Pathum Thani	190	1,037.60	Oct. 17, 1.0m
7	Bangkadi	Pathum Thani	34	188.00	Oct. 20, 0.5m
Non-flooded Estates			**653**		
8	Bang Chan	Bangkok	83		No flood
9	Lat Krabang	Bangkok	283	409.4	No flood
10	Bangpoo	Samut Prakan	287	875.0	No flood
Total			**1,457**		

Number of interviewees (factories) in totally 10 estates is approximately estimated at 1,460, the sampling (interviewing) shall be more than 70% (more than 1,000 samples). Further, it is preferred that the interviewee of each factory/company could be owner, general manager or officer-in-charge or the factory/company who knows plan/program of flood preventive works assisted by an operator or a worker who stayed in the 2011 Flood.

3 Questionnaire

The questionnaires which are grouped into five (5) categories will be given by the interviewers for every factory (1,457) as below:

(1) General Information

(2) Flood Conditions, Damages and Losses

(3) Flood Prevention Works

(4) Flood Information and Warning

(5) Response Action and Operation

(6) Expectations with the Thai Government

(7) Business Plan

4 Survey Schedule

All works is expected to be completed by the end of September, 2012.
The questionnaires are enumerated as follows:

QUESTIONNAIRE

Conduct of Interview	Date:	Time:	No.
Interviewer Name:			

I. General

I-1. Respondent

Name:	Age:	Position in Company:
Company Name:		Industrial Estate:
Company Address:		E-mail:

I-2. Manufacturing of Company:

☐ Food ☐ Textile ☐ Chemical ☐ Steel/non-ferrous metals ☐ General Machinery

☐ Electric/Electronics machinery ☐ Transportation machinery ☐ Precision instrument

☐ Others _____

Years of Operation:	Starting in (Month) : (Year) :	Total: Months
Number of Employees: persons	Area of Factory: m^2	
Amount of Monthly Production: THB million		
Amount of Fixed Asset: THB million	Amount of Inventory Asset: THB million	

II. Flood Conditions of Industrial Estate

II-1. Flood Experiences

Has your factory been flooded in the year ☐ **1995** ☐ **2006** ☐ **2011** Other year _____	
Was your factory flooded in the 2011?	☐ ***Yes*** ☐ ***No***

If ***Yes***, continue to proceed with **next** questionnaire. If ***No***, jump to **III**.

II-2. Flood Damages

Maximum Inundation Depth: m		Inundation Duration: days
Estimated Damage:	Building:	THB million
	Facilities/Equipment:	THB million
	Inventory Assets:	THB million
	Others:	THB million
	Workers: Injured ____ persons dead ____ persons	

II-3. Production (Operation)

☐ Date of Stopping Operation: dd - mm	☐ Reduction of Operation : ( ) %
Main Cause of Operation Stop or Reduction	
☐ Direct damages on machineries	☐ Cut of supply chains (materials and products)
☐ Lack of employees (laborers)	☐ Other reasons _____

Duration of Production Reduction (if any):	( ) %	Days
Duration of Production (Operation) Stoppage:		Days

II-4. Insurance

If the damages could be covered by an insurance	☐ ***Yes***	☐ ***No***
If ***Yes***. What and how much are the damages covered?		
☐ Factory building		( ) %
☐ Facilities/Equipment		( ) %
☐ Workers		( ) %
☐ Others, _____		

III. Flood Prevention Works

III-1. Knowledge about flood conditions of the industrial estate where your factory is located.

Do you have knowledge that the industrial estate is located in the flood-prone area of the Chao Phraya River Basin?	☐ ***Yes*** ☐ ***No***
If ***Yes***, how much do you expect that the industrial estate could be protected from the flood?	
☐ Any flood ☐ Usual flood ☐ Only inner drainage ☐ No expect	

III-2. Existing flood prevention works for factory

Do you provide any flood prevention works for your factory (compound)?	☐ ***Yes***	☐ ***No***	
If ***Yes***, please fill the following.			
☐ Flood levee Height ____a. MSL	☐ Drainage pump Capacity ___ m^3/s	☐ Drainage channel Length _____ m	☐ Others _____

III-3. Plans of the flood prevention works for factory

Do you have plans to strengthen the flood prevention measures for your factory?	
☐ ***Yes.*** _____	☐ ***None***
If ***Yes***, please provide the estimated cost for new flood prevention works. THB _____ million	

III-4. Business Continuity Plan (BCP)

III-4.1 Do you have BCP aside from some structural prevention measures?

☐ ***Yes.*** We have prepared BCP in the year _____.		☐ ***None***
If ***Yes***, does your BCP include action plans for the flood disaster?	☐ ***Yes***	☐ ***No***
III-4.2 Please describe the required works and actions to be undertaken by the Thai Government for mitigation and recovery of flood disaster, which are not covered by your BCP.		
For mitigation: _____		
For recovery: _____		

III-5. Existing Works for Industrial Estate

Was there any flood prevention works for your industrial estate?				
☐ Flood levee Height ____a. MSL	☐ Drainage pump Capacity ___ m^3/s	☐ Drainage channel Length _____ m	☐ Others _____	☐ None

III-6. Plans and Programme of the Works for Industrial Estate

Does your industrial estate have plans to strengthen the flood prevention measures?	
☐ ***Yes.*** _____	☐ ***None***
If ***Yes***, please provide us the estimated cost for new flood prevention works. THB _____ million	

IV. Information and Warning

IV-1. Information on Flood

IV-1.1 From whom/what you received Information (Alert/Warning) of Flood ?		
☐ TV/Radio/Newspaper	☐ Industrial Estate Office	☐ Other Factories (Neighbors)
☐ Local Government	☐ Others _____	☐ No Information
IV-1.2 Contents of Information?		
☐ Flood Condition (Where and when flooded)	☐ Evacuation alert	
☐ Advice what to do	☐ Others _____	

IV-2. Information Network

Is the industrial estate provided with information network?	☐ ***Yes***	☐ ***No***
If ***Yes***, what is media of the network?		
☐ Exclusive telephone line	☐ Public telephone line	☐ Paper circulation
☐ Internet website	☐ Others _____ _____	

IV-3. Plans of Flood Information and Warning Dissemination

Does your industrial estate have plans of a network for flood information?	☐ ***Yes***	☐ ***No***
If Yes, what is media of the network?		
☐ Exclusive line	☐ Use pubic line	☐ Internet web site Others _____

V. Response Action and Operation

V-1. Actions taken before Flood

☐ Informing and asking assistance	☐ Preparation for Flood Fighting (Diking, etc)
☐ Water proofing, Arranging, etc. for factory	☐ No action

V-2. Actions taken during Flood

☐ Evacuation	☐ Conduct preventive measures
☐ Others _____	☐ No action

V-3. Actions taken immediate after Flood

Recovery/Rehabilitation: _____	Duration: days	Cost: THB million
Employee: ☐ Layoff ( ) %	☐ Resignation ( ) %	☐ Others _____

VI. Expectations with the Thai Government

VI-1. Flood prevention and mitigation works

What do you expect with the Thai Government for flood prevention work?		
☐ Flood prevention works for Chao Phraya River	☐ ***Yes***	☐ ***No***
☐ Flood prevention works for the industrial estates	☐ ***Yes***	☐ ***No***
☐ Others, if any. _____		
Do you know the Thai Government prepared Master Plan?	☐ ***Yes***	☐ ***No***

VI-2. Flood information dissemination

Are you satisfied with the flood information disseminated in 2011 Flood?		☐ ***Yes***	☐ ***No***
If ***No***, what do you suggest to improve the information dissemination system of the Thai Government?			
☐ Unified information source	☐ Information itself	☐ Dissemination method	
☐ Others _____ _____			

VI-3. Flood warning system

Are you satisfied with the flood warning system of the Thai Government?	☐ ***Yes***	☐ ***No***
If ***No***, what do you suggest to improve the flood warning system?		
☐ Establish the unified organization for flood warning	☐ Detailed information based on analysis	
☐ Earlier and time-serial warning	☐ Warning including response guidance	
☐ Others _____		

_____

VI-4. Flood response operation

Are you satisfied with the assistance and relief operation by the Thai Government?	☐ ***Yes***	☐ ***No***
If ***No***, what do you suggest to improve the assistance and relief operation?		
☐ Establish the relief operation team	☐ Provide adequate facilities/equipment	
☐ Others _____ _____		

VI-5. Recovery and rehabilitation

Are you satisfied with assistances provided by the Thai Government for recovery and rehabilitation?	☐ ***Yes***	☐ ***No***
If ***No***, what kind of assistance do you expect for early recovery/rehabilitation from the Thai Government?		
☐ Immediate rehabilitation works for basic infrastructures (electricity, water supply, transportation, etc.)		
☐ Financial assistance such as temporary tax exemption and provision of soft loan for rehabilitation		
☐ Others _____ _____		

VII. Business Plan

VII-1. Current condition of factory operation			
How is the current condition of factory operation (production) compared to that before the 2011 Flood.			
☐ Same as before	☐ Increased than before	☐ Decreased than before	☐ No operation
VII-2. Future plan			
What is the plan with your factory?			
☐ Same	☐ Expand	☐ Scale-down	☐ Close
☐ Others _____ _____			

TERMS OF REFERENCE

FOR

THE VERIFICATION SURVEY

FOR THE WATER LEVEL OBSERVATION DATA

1 THE FIELD WORK AND DATA ARRANGEMENT

1.1 Purpose of the Survey

The purpose of this survey is to verify the Datum Level of water level observation data and confirmation of condition of water level observation stations.

1.2 Survey Location

The survey will be conducted at the twenty-four (24) stations as listed below.

[Chao Phraya River]	C.2, C.3, C.7A, C.13 (DS & US), C.29, C.29A, C.30, C.35, C.36, C.37, TC.4, TC.12, TC.22, TC.55, TC.54 (Phra Chunlachomklao Fort), Pak Nam Chao Phraya
[Tha Chin River]	T.1, T.10, T.13, T.15, Pak Nam Tha Chin
[Pasak River]	S.5, S.9, S26

The survey location shall be finalized by the Client's Engineer at the site.

1.3 Work Schedule

The Contractor shall commence the works immediately after signing of the Contract.

The whole of the works such as field observations, calculations, arrangement of data and reporting etc. shall be completed before the November 30th, 2012.

The raw field observation data shall be submitted within one day after the observation, then the works shall be submitted time to time when it becomes suitable shape for using for verification.

The work schedule will be varied with the agreement of both parties depend on the situation of the works.

1.4 Description of the Work

(1) The station Benchmarks shall be surveyed by the direct leveling from the RTSD (Royal Thai Survey Department) 1st order Benchmark or equivalent Benchmarks approved by the Client's Engineer. In case there is no station Benchmark, temporary benchmark will be set up if necessary. The leveling shall be carried out by forward and backward round method. Observation error between forward and backward shall be less than $10\sqrt{s}$ mm, s being the observation distance in km. The paid leveling distance is one-way distance of go and back, it is not the cumulative distance of go and back.

(2) The station Benchmarks or temporary benchmarks also shall be surveyed by the GPS leveling. GPS shall be Bi-frequencies Stations and working in a static mode with at least 5 tracking satellites per site. The GPS data shall be assessed by the ambiguity (must be FIX) and Geometric dilution of precision (GDOP<=5). Reference control Benchmarks shall be more than 2points. Then elevation shall be corrected by Geoid model by Royal Thai Survey Department.

(3) The water staff gauge shall be surveyed by direct leveling from station Benchmarks or temporary benchmarks to confirm the condition of water staff gauge.

(4) The water level shall be observed by water staff gage or based on the station Benchmarks or temporary benchmarks at near the station by appropriate duration and interval.

(5) Photos and record of the position by handy GPS shall be taken for all the stations, benchmarks and water staff gauges.

2 FINAL DELIVERABLES

The Contractor shall deliver in accordance with the period of each products or results, which shall be agreed with the Client's Engineer.

The final deliverables are as follows ;

(1) Report 1 set

- Arranged results
- Location map
- Description of control Benchmarks
- Printed calculation sheets
- Raw field observation sheets
- Photos

(2) Soft copy of all data (CD) 1 set

3 EQUIPMENT, MATERIALS AND LABOR

All necessary equipment, transportation vehicles, materials (such as precise GPS instruments, handheld GPS, leveling instruments, staves, digital cameras, nails, paints etc.), and labor required for all the above-mentioned works shall be provided by the Contractor, as defined in the contract. Those costs shall be included in the cost estimate for the various items of the Bill of Quantities. The contract is concluded on lump sum basis.

4 PERMISSIONS AND PUBLIC RERATION

The Contractor shall arrange an official permission to execute the survey works at sites from the relevant authorities, if necessary.

The contractor shall maintain good relationships with local people in the survey area.

5 OTHER ISSUES

Any and all issues arising from or in connection with the conduct of the survey that is not mentioned above shall be settled by mutual consultation and agreement in good faith between the JICA Study Team and the Contractor.