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Report on Activities of Working Group on Hydrology (WGH) in 2013
(Item 7 of Provisional Agenda)

(Submitted by WGH)

ACTION REQUIRED:

This Committee is invited to:

- a) Review the activities of WGH conducted in 2013
- b) Approve the recommendations and AOP of WGH for 2014 and beyond

APPENDIX:

- I. Report on activities of Working Group on Hydrology (WGH) in 2013

REPORT ON ACTIVITIES OF WORKING GROUP ON HYDROLOGY (WGH) IN2013

In 2013, Working Group on Hydrology (WGH) of Typhoon Committee (TC) conducted a series of activities very positively referring to the decision of 45th Session of the Committee which was held in Hong Kong, 29 January-01 February 2013. This report was drafted on the base of the outcomes of 2nd WGH working meeting which was held in Seoul, Republic of Korea from 10 to 14 October 2013, and the discussion of the parallel session of TC 8th Integrated Workshop (IWS)/2nd Training and Research Coordination Group (TRCG) Forum which was held in Macao, China from December 2 to 6, 2013.

The report highlighted the main progresses and achievements on hydrological component in Members in past year, briefly described the activities of WGH conducted in 2013, and summarized the status of implementation of WGH AOPs 2013. Based on the communication among Members and the discussion at TC 8th IWS/2nd TRCG Forum, WGH proposed the AOPs for 2014 and beyond and consequently requested the TCTF allocation for supporting WGH activities in 2014.

THE SECOND WORKING MEETING OF WGH

- 1) The second WGH working meeting with the theme of “Extreme Flood and Flood Forecasting System in TC” was held in Seoul, Korea from 14 to 17 October 2013 at the kind invitation of Han River Flood Control Office (HRFCO), the Ministry of Land, Infrastructure and Transport (MOLIT), Republic of Korea with generous offering of financial support.
- 2) The second WGH working meeting achieved expected objectives including:
 - reviewing the activities of WGH;
 - reviewing the implementation progresses of WGH Annual Operating Plan (AOP);
 - reviewing the floods happened in Members;
 - sharing the experience on flood forecasting system and dam operation among Members;
 - discussing the proposal of activity plan for WGH in 2014; and
 - discussing the preparation of the 8th IWS/2nd TRCG Forum
- 3) The meeting was hosted by Han River Flood Control Office (HRFCO) of MOLIT in cooperation with Korea Institute of Construction Technology (KICT) and co-chaired by WGH chairperson Mr. Kamoto Minoru and Vice Chairperson Dr. Sang Heon LEE. The Director General of HRFCO Mr. Hajoon Park delivered his opening address and attended the meeting of 2nd day morning. Totally about 22 participants from Japan, Korea, Laos, Malaysia, Philippines, Thailand, Vietnam and TCS took part in the meeting.
- 4) The meeting was informed that the third WGH working meeting will be held in October 2014 with funding support from Republic of Korea. The participants of WGH recognized that the working meeting is a very important event for WGH to review the progresses of the AOPs and to prepare the IWS. WGH expressed its highest appreciation to Korea Government through HRFCO of MOLIT for supporting and organizing WGH annual working meeting.

WGH PARALLEL SESSION OF TC 8TH IWS/2ND TRCG FORUM

- 5) TC WGH had its parallel sessions during 8thIWS/ 2ndTRCG Forum, which was held in Macao, China from December 2 to 6, 2013, as the proposed program.
- 6) The Sessions were convened by Chairperson of WGH Mr. Minoru KAMOTO, Chief Researcher of International Centre for Water Hazard and Risk Management (ICHARM) of Japan, and co-chaired by Dr. LEE Sang Heon, Director of River Information Center HRFCO, Han River Flood Control Office, Ministry of Land, Infrastructure and Transport, Republic of Korea.
- 7) The Sessions were attended 29 participants totally including 24 delegates from 11 Members (China; DPR Korea; Japan; Hong Kong, China; Laos; Macao, China; Malaysia; the Philippines; RO Korea; Thailand; USA and Viet Nam), 3 invited keynote speakers and hydrologist of TCS. TC Secretary Mr. Olavo Rasquihno partially took part in WGH parallel session.
- 8) The WGH Sessions included following matters:
 - to review hydrological activities in Members
 - to discuss the topics with WGH sub-theme of hydrological role in the mitigation of hazards caused by tropical cyclones
 - to review the 2nd working meeting of WGH
 - to review implementation status of WGH AOP2013
 - to exchange information on priorities and key areas and to propose WGH AOPs for 2014 and beyond
 - to propose budget for WGH activities in 2014
 - to have scientific lectures related WGH AOPs
 - to discuss the WGH draft reports with conclusions and recommendations for presentation to 46th TC Session

ACTIVITIES ON HYDROLOGICAL COMPONENT IN MEMBERS

- 9) The representative from China; DPR Korea; Japan; Hong Kong, China; Laos; Malaysia; the Philippines; RO Korea; Thailand; Viet Nam presented their Member Reports related to hydrological component. The hydrological activities of Members in 2013 will be described in the Appendix of 46thSession Report.
- 10) In 2013, severe rainstorm, storm surge, flood, landslide events induced by tropical cyclones were occurred in Members, particularly in China, Japan, Malaysia, Philippines and Viet Nam. Hydrological Services in those Members provided effective forecasting and warning on reducing the impact of typhoon-related disasters.
- 11) China has made significant efforts on the aspect of reporting hydrological information of medium and small-sized reservoirs, and flood forecasting in the typhoon-affected regions in 2013. Up to now, the National Center is able to receive the real-time hydrological information from nearly 6000 reservoirs totally in the country; and the hydrological authorities in the typhoon-affected regions issued real-time flood forecasts for more than 2100 station-times.
- 12) The Ministry of Water Resources of China issued the National Standard of Hydrological Early Warning Signals and the National Standard of the Measures for Publicizing Hydrological Early Warning Signals and Relevant Management in 2013 for enhance public awareness of flood risk.

13) The Ministry of Land, Infrastructure, Transport and Tourism (MLIT) of Japan immediately dispatched its Technical Emergency Control Force (TEC-FORCE) to the island to evaluate the extent of the damage and prevent secondary disasters. TEC-FORCE set up a video monitoring system to observe streams affected by debris flow and performed emergency ground surveying at all local streams and slopes considered to be at risk of further damage to clarify the possibility of secondary disasters before the approaching Typhoon Francisco (1327) arrived. The group also provided monitoring system information and the results of the emergency ground surveying to the local prefectural government and municipal office in order to support decisions relating to resident safety.

14) A dynamic hydrological and hydraulic computer models for the drainage systems managed by Drainage Services Department (DSD) of Hong Kong, China were developed to provide information on the risk of flooding, impacts of development and the performance of various flood protection options. These models would be updated under various ongoing and planned Drainage Master Plan (DMP) Review Studies. To cope with the latest development in the community and also the effects of changing weather patterns, DSD has commenced the review studies for DMPs of different regions in phases.

15) In order to reinforce the capability of urban flooding monitoring, Meteorological and Geophysical Bureau (SMG) of Macao, China is cooperating with Land, Public Works and Transport Bureau and Civic and Municipal Affairs Bureau to construct 8 brand new water level monitoring stations (WLMS), which are distributed in Macao peninsula, Taipa and Coloane, respectively. The new WLMS will come into operation in the beginning of 2014.

16) The forecasting modeling for several flood have been developed to support flood forecasting tasks in the Department of Irrigation and Drainage (DID), Malaysia, namely: (1) Integrated Flood Forecasting and River Monitoring System (IFFRM) for Klang Valley; (2) Atmospheric Model Based Rainfall & flood Forecasting System (AMRFF) for Pahang, Kelantan and Johor rivers; (3) Integrated Flood Forecasting and Warning System for Muda river basin; (4) Integrated Atmospheric and Radar-Satellite Model-Based Rainfall and Flood Forecasting for Sarawak river basin; (5) Integrated Flood Forecasting and Warning System Based on Real Time Radar Rainfall for Padas river basin; and (6) Integrated Flood Forecasting and Warning (IFFW) System for Dungun river basin. The meeting also noted the flood warning siren system using in Malaysia.

17) The severe disaster caused by strong wind of Typhoon Haiyan in Philippines and the activities conducted by PAGASA on forecasting and warning to Haiyan. PAGASA of Philippines has established the Flash Flood Alert System (FFAS) which will alert downstream communities in Cagayan de Oro City for impending flash flood resulting from intense rainfall (threshold) derived from the QPE of radar data and automatic weather stations.

18) Republic of Korea developed the Integrated Real-time Discharge Measurement System (IRDIMS) and is operating 46 sites in 2013. Also the waterfront zone flood information provision system based on GIS and Smartphone is developed in some areas of the Han river basin, and will be expanded to other major basins until 2017.

THE IMPLEMENTATION STATUS OF WGH AOP 2013

19) WGH seven on-going projects in 2013 are listed in table 1. The Summary of implementation status of WGH AOP2013 is shown in Appendix 1.

Table 1 Summary of WGH AOPs in 2013

	Projects	Diver	Duration
AOP1	Assessment System of Flood Control Measures on Socio-economic Impacts	Korea	2008-2014
AOP2	Extreme flood forecasting system	Korea	2012~2016

AOP3	Estimation for Socio-economic Impact of Sediment-related Disaster	Japan	2013~2015
AOP4	Development and Application of Operational System for Urban Flood Forecasting and Inundation Mapping (OSUFFIM) for Selected Pilot City	Macao, China /TCS	2013~2016
AOP5	Extension of Xin'anjiang Model Application in Selected River Basins in TC Members	China	2013~2016
AOP6	Guidelines for extreme flood risk management in TC region	Korea	2013-2015
AOP7	Study on Prediction of Debris flow and Shallow landslide by the Satellite Rainfall Data	Japan	2013-2017
AOP8	Project of Synergized Standard Operating Procedures for Coastal Multi-hazard Early Warning System (SSOP)	TCS	2013-2014

20) **AOP1: Assessment System of Flood Control Measures on Socio-economic Impacts**

HRFCO of MOLIT, in cooperation with KICT, finalized the Guideline of Structural Flood Control Measure Assessment System. The Guideline was intended to be printed and distributed at 9th Integrated Workshop.

The progresses on ASFCM application have made in selected river basins in TC Members, and there are still application requirements of this project from TC Members.

WGH was informed that this AOP will be extended one more year to 2014. The new case studies will be conducted in TC Members including Malaysia, Philippines, and Thailand. The meeting was informed that, HRFCO, in cooperation with KICT, will prepare the Guideline of ASFCM including the implementation and application (case study) in TC members and publish the report in 2014.

21) **AOP2: Extreme Flood Forecasting System**

The progressed of AOP2 in 2013 including:

- a) comparative analysis of the flood characteristics in TC members
- b) using the results of flood vulnerability analysis in 4 selected river basins in linkage with AOP6
- c) investigation of the Flood Forecasting System with on-line & 2013 field survey
- d) proposal of the establishment direction for the appropriate Extreme Flood Forecasting System

HRFCO of MOLIT of Korea, in cooperation with KICT and K-water successfully conducted the second field survey from 27 October to 02 November 2013 with 8 participants from Korea, Laos and Thailand. The necessary data was collected from selected river basins including Nakdong river in Korea, Chao Phraya river in Thailand, Pamanga river in Philippine, and Nam Ngum River in Lao PDR. The meeting noted that, the survey reached the expected goals including:

- a) to gather additory data set for AOP2 and AOP6 to set an optimal direction for making the guidelines for flood risk management and establishing flood forecasting system in TC region;
- b) to understand unique environmental, social and economic characteristics of each member counties for appreciate flood forecasting system; and
- c) to strengthen international cooperation to reduce flood damage by typhoon.

The meeting expressed its sincere appreciation to Korea Government through HRFCO for organizing this field survey with providing funding support, and also to the close cooperation from Philippines, Thailand and Laos PDR.

The meeting was informed the Plan for of AOP2 in 2014 and beyond including:

- a) conducting the 3rd field survey for data collection in selected Members
- b) confirmation of the establishment direction for the appropriate extreme flood forecasting system
- c) computational design of the suitable extreme flood forecasting system with PC-version

The meeting noted the comments and suggestions from field survey to 3 Members to improve their flood forecasting system, particularly the strategic plan for integrated flood risk management and integrated river basin management.

22) AOP3: **Project on Estimation for Socio-economic impact of Sediment-related Disaster**

AOP3 mostly was achieved its successor indicators in 2013. SABO Center of Japan side fixed the procedure and the data collecting format for surveying sediment-related disasters.

The meeting was informed that, the implementation plan of AOP3 for 2014 is mainly as bellow:

- to survey sediment-related disasters based on the procedure and the data collecting format from TC Members;
- to establish the “Sediment-related Disaster Record Database” for sharing the records among TC Members.

The Members were encouraged to nominate their contact persons for this project. Hong Kong, China has submitted its contact person for this project as requested after its 2nd WGH Working Meeting. It was suggested that the WGH focal points will be to contact persons in the Members for this project if no new persons are nominated before TC 46th Annual Session to be held in Bangkok, Thailand from 10 to 13 February 2014.

23) AOP4: **Development of Operational System for Urban Flood Forecasting and Inundation Mapping (OSUFFIM) for TC Members**

The grand application from the Science and Technology Development Fund (STDF) of Macao Government in 2013 for implementing the project of OSUFFIM, which was approved at 45th Annual Session held in Hong Kong as WGH AOP4, was withdrawn. WGH recognized the importance and necessity of development of a prototype real time OSUFFIM for Members to promote the capacity of early warning of urban flood and emergency response, particularly urban flood forecasting and inundation mapping. The Committee expressed its appreciation to Royal Irrigation Department (RID) of Thailand and Sun Yat-Sen University of China for their strong cooperation and support to the project during the preparatory. Also the Committee noted that the initial work which was conducted in 2013 should be a kind of fundamental preparatory work for developing OSUFFIM in future.

Referring to the full and deep communication between China and TCS, at the 8th IWS/ 2nd TRCG Forum, the representative of BOH of China expressed that China is willing to take the role of leading country for the project of OSUFFIM starting from 2014 and promised to provide necessary expertize support and to seek the possibility of funding support to the implementing this project. Sun Yat-Sen (SYS) University of China is willing to contribute this cooperation project for the Committee based on its existing achievement on urban flood inundation mapping. Prof. CHEN Yangbo, the head of the Laboratory of Water Disaster Management and Hydro-informatics (Laboratory of WDMH) of SYS University expressed that his Laboratory will seek the possibility of using the budget of its own project on UFRM to start necessary preparatory work for development of OSUFFIM prototype system.

Following the discussion at the 8th IWS/ 2nd TRCG Forum, the kick-off meeting for OSUFFIM implementation was held in Sun Yat-Sen University, Guangzhou, China from 27 to 28 December 2013 with participants from Bureau of Hydrology (BOH) and SYS University of China, Department of Irrigation and Drainage (DID) of Malaysia, Royal Irrigation Department (RID) of Thailand, National Center for

Hydro-Meteorological Forecasting (NCHMF) of Vietnam and hydrologist of Typhoon Committee Secretariat (TCS). The kick-off meeting achieved following results:

The participants affirmed the mechanism and structure of OSUFFIM implementation and identified the specific roles for System Development Team (SYS Uni., CHINA), Members of Pilot Cities and TCS in OSUFFIM implementation.

- a) The Members of pilot cities are encouraged to set up Working Groups at national level for the pilot study of OSUFFIM application in their countries.
- b) The Technical Committee was set up with the role of provision of technical guidance to this project and was proposed to be composed of experts from China, Japan, Republic of Korea, USA and the Project Leaders of Working Groups in Members of pilot cities. Prof. CHEN Yangbo was held up as the Chief Scientist of Technical Committee.
- c) The pilot cities was preliminarily proposed by participants based on the data availability as below:
 - China: Dongguan city and/or other city
 - Malaysia: Kuala Lumpur city in Klang valley or Kuantan City in Kuantan river basin
 - Thailand: Chiang Mai city in Mae Nam Ping river basin
 - Viet Nam: Hanoi city in Red river delta or Phu Yen city in Ba river basin
- d) The road map of OSUFFIM was preliminarily identified with taking into consideration the various situations in the Members as below:
 - 2014: the phase of technical preparatory, including establishment of working groups in the Members; prototype system perfecting; guidance material preparing; field survey; data collection.
 - 2015: the phase of application and technical training, including perfecting English version for the system; preparing technical documentation; training course; data collection and processing, model setting up and system configuration.
 - 2016: the phase of system testing, including: system installation and trial running in selected pilot cities; documentations drafting and training course.
 - 2017: the phase of system application and project finalization, including real-time operation; inundation mapping; workshop; and publication of technical report.
- e) The tentative implementation plans for the period of 2014 to 2017 were proposed. It was described for 2014 as below:
 - Technical preparation, set up of national working group
 - Date: January to March
 - Venue: TC members
 - Participating: TCS; BOH; LWDMH-SYSU; TC members
 - Leader: BOH of China in cooperation with TCS
 - Field investigation and data collection in selected Pilot Cities
 - Date: January to July
 - Venue: selected pilot cities
 - Participating: TCS; BOH; LWDMH-SYSU; representatives of pilot cities
 - Leader: hosting country in cooperation with LWDMH-SYSU

- OSUFFIM Chinese version design and development
 - Date: April to October
 - Venue: Guangzhou
 - Participating: TCS; BOH; LWDMH-SYSU
 - Leader: LWDMH-SYSU

- OSUFFIM implementation in pilot city of China
 - Date: September to November
 - Venue: Chinese pilot city
 - Participating: TCS; BOH; LWDMH-SYSU; representatives of Chinese pilot city
 - Leader: LWDMH-SYSU

- Short training course on data processing
 - Date: December
 - Venue: SYS University
 - Participants: 3 from Members of pilot cities
 - Leader: LWDMH-SYSU

f) The participants recognized that the proposed activities will be conducted from 2014 to 2017 subject to the availability of data, human resources and funding support from Members of pilot cities. The Members of pilot cities are encouraged to explore mobilization of the self-funding for supporting the activities related to the pilot studies of development and application of OSUFFIM in the countries.

24) AOP5: Xin'anjiang Model Application in Selected River Basins in TC Members

The project on Xin'anjiang Model Application in Selected River Basins in TC Members (AOP5), led by Bureau of Hydrology (BOH) of China in cooperation with Department of Irrigation and Drainage (DID) of Malaysia, fully achieved the goals of implementation plan in 2013, including:

- a) BOH, in cooperation with Hohai University of China, accomplished the improvement and perfection of the English version of application platform for Xin'anjiang Model, and provided the instruction of Model;
- b) The training course was successfully conducted in Kuala Lumpur, Malaysia from October 21 to 25, 2013. China-side sent 2 resource persons from BOH and Hohai University to the course, and about 25 participants from Malaysia attended the course;
- c) DID, Malaysia has commenced developing flood forecasting system by using Xin'anjiang Model for Segamat River Basin of Malaysia. The system has been used on trial in the river basin and hopefully will be used in operation in 2014.

As requested by DID of Malaysia, BOH of China will conduct one week on-job-training in Beijing or/and Kuala Lumpur on flood forecasting model (Xin'anjiang Model) application for Malaysia and other interested Members in 2014 subject to available funding from TCTF.

DID Malaysia expressed that DID is willing to cooperate in organizing the programme if held in Malaysia. The representative from National Center for Hydro-Meteorological Forecasting (NCHMF) of Vietnam expressed the interest to join the above-mentioned on-job-training course.

25) AOP6: Guidelines for Extreme Flood Risk Management

The progresses of AOP6 in 2013 including:

- a) Suggestion of the Extreme Flood Definition in hydrologic and socio-economic aspects

- b) Discussion and confirmation of the Extreme Flood Definition
- c) Comparative flood vulnerability analysis in 4 selected river basins
- d) Investigation of flood features for the 4 selected Rivers with on-line & 2013 field survey to collect data including geographical characteristics (land use, river profiles, etc) and hydrological characteristics (mean annual precipitation & runoff, inundated areas, etc)

The meeting was informed the Plan for of AOP6 in 2014 including:

- a) Additional Investigation of flood features for the 4 selected Rivers with on-line & field survey and analysis of the flood characteristics
- b) Suggestion of the structural and non-structural countermeasures for extreme flood
- c) Suggestion of the draft of guideline for extreme flood risk management and refining, consulting with TC members

26) **AOP7: Study on Prediction of Debris flow and Shallow landslide by the Satellite Rainfall Data**

The roadmap of AOP7 from 2013 to 2017 was initiated as:

- FY 2013: Developing Prototype system (ICHARM) and Surveying of test fields
- FY 2014: Developing Prototype system (ICHARM), Correcting ground truth data on test fields, Analyzing on test fields, and Workshop on test fields
- FY 2015: Feasibility study of system on test fields, Workshop on test fields, and Developing System (ICHARM)
- FY 2016: Feasibility study of system on test fields, Workshop on test fields, Developing of System (ICHARM), and Developing of Training Program
- FY 2017: Improvement of system (ICHARM), Developing of Training Program, Workshop and Training

27) **AOP8: Project of Synergized Standard Operating Procedures for Coastal Multi-hazard Early Warning System (SSOP)**

The achievements/progresses and the initial plan in next steps of this cross cutting project of the Committee will be described in the Appendix of 46thSession Report.

The outcome and achievement of SSOP could greatly benefit the Members, and the Members should be encouraged to contribute this project.

28) The WGH AOPs in 2014 and beyond are summarized in table 2.

Table 2 The summary of WGH AOPs in 2014 and beyond

	Projects	Diver	Duration
AOP1	Assessment System of Flood Control Measures on Socio-economic Impacts	Korea	2008-2014
AOP2	Extreme flood forecasting system	Korea	2012~2016
AOP3	Estimation for Socio-economic Impact of Sediment-related Disaster	Japan	2013~2015

AOP4	Development and Application of Operational System for Urban Flood Forecasting and Inundation Mapping (OSUFFIM) for TC Members	China	2014~2017
AOP5	Extension of Xin'anjiang Model Application in Selected River Basins in TC Members	China	2013~2016
AOP6	Guidelines for extreme flood risk management in TC region	Korea	2013-2015
AOP7	Study on Prediction of Debris flow and Shallow landslide by the Satellite Rainfall Data	Japan	2013-2017
AOP8	Project of Synergized Standard Operating Procedures for Coastal Multi-hazard Early Warning System (SSOP)	TCS	2013-2014

OTHER ACTIVITIES AND TOPICS RELATED TO WGH

29) The Change of Probable Maximum Precipitation (PMP) in the region due to climate change could impact Probable Maximum Flood (PMF) and consequently impact infrastructure construction and standard of flood control. The progresses and achievements on PMP research made by prof. Bingzhang LIN, dean, College of Hydrometeorology, Nanjing University of Information Science & Technology (NUIST) could benefit TC Members. WGH noted the requirement from participants to consider the possibility of conducting seminar and/or training course for TC Members on PMP/PMF review and study taking into consideration climate change.

30) WGH successfully held its second working meeting with the theme of "Extreme Flood and Flood Forecasting System in TC" in Han River Flood Control Office (HRFCO) of Korea, Seoul from 14 to 17 October 2013 at the kind invitation of the Ministry of Land, Infrastructure and Transport (MOLIT), Korea with generous offering of financial support. The participants expressed its appreciation to the Government of Republic of Korea for hosting WGH working meeting annually starting from 2012.

31) The Guidelines of Urban Flood Risk Management (UFRM), as the final technical report of TC first cross-cutting project on UFRM in the TC area, was published as TC/TD-No. 0008 in December 2013 and distributed at 8th IWS/2nd TRCG Forum. WGH expressed its appreciation to all drafters from China; Hong Kong, China; Japan; Republic of Korea and Philippines who have contributed to the Guidelines, particularly Dr. Zhiyu LIU from Bureau of Hydrology (BOH) of China as chief drafter.

32) HRFCO in cooperation with KICT initiated webpage (<http://tcwgh.hrfo.go.kr>) for WGH which will focus on the purposes of enhancing the technical and information exchange related hydrological component.

33) The Vice-Chair of the WGH, Dr. LEE Sang Heon was invited with TC Secretary for attending the first IWS of Panel of Tropical Cyclone (PTC), which was held in Bangkok from 27 to 29 November 2013, and had assisted PTC in drafting the Terms of Reference (ToR) of the PTC WGM, WGH and WGD RR with reference the ToR of the TC WGs.

34) WGH noted the needs from Members on joint training and research, including the methodologies of inundation simulation modelling and risk mapping considering different phenomenon, satellite data utilization, damage assessment; QPE/QPF products for the purpose of Inundation simulation, and integrated scenario building for emergency response to typhoon-related disasters.

35) WGH noted the comments of that, one of the innovations that the WGH must pursue is the use or application of satellite based information (SBT) for promoting the accuracy and extending the leading-time of flood forecasting.

36) WGH noted the comments of that, WGH should consider one AOP for dealing with addressing medium to long-term hydrological forecasts in conjunction with WMO's CHy and Climate and Water Programme.

37) WGH expressed its appreciation to MOLIT of Republic of Korea for providing funding through HRFCO to support two hydrologists to participate in the TC 8th IWS/2nd TRCG Forum held in Macao, China.

38) BOH of China, based on communication with TCS, expressed that China is willing to nominate Ms. LI Yan, Deputy Director of Division of the River Forecasting Center, BOH od China, as Vice Chairperson from 46th Session to serve with TC-WGH.

BUDGET PROPOSED FOR WGH ACTIVITIES IN 2014

39) WGH proposed \$32,000USD TCTF totally, including \$23,000USD TCTF to support WGH activities in 2014 shown in table 3, and \$9,000USD TCTF to support WGH training activities in 2014 shown in table 4.

Table 3 The summary of budget of TCTF to support WGH activities in 2014

1	Support to attend Integrated Workshop (IWS) and other activities	10,000
2	Support the ASFCM Application in TC members - AOP1 led by Korea	3,000
3	Support to the data collection (3rd field survey) in selected Members for the project on Extreme Flood Forecasting System – AOP 2 led by Korea	3,000
4	Support activities related to OSUFFIM - AOP 4 led by China	4,000
5	Support to host the workshop for the project on Guidelines for extreme flood risk management in TC region led by Korea - AOP6 led by Korea	3,000
	Total	23,000

Table 4The Summary of Special Request Budget of TCTF for WGH Training in 2014

1	Support for on-job training course of Flood Forecasting (Xin'anjiang) Model Application in Beijing or/and Kuala Lumpur for selected river basins in Malaysia and other interested TC Members – AOP 5 led by China	5,500
2	Support TC Members for Operational System for Urban Flood Forecasting and Inundation Mapping (OSUFFIM) training – AOP4 led by China	3,500
	Total	9,000

CONCLUSIONS OF WGH

40) On the basis of the information of hydrological component provided by Members and findings of the 2nd WGH working meeting in October 2013 and TC 8th IWS/2nd TRCG Forum held in Macao, China in December 2013, the following conclusions were reached:

- a. The working meeting of WGH is very important to review hydrological activities and implementation status of WGH AOPs and to prepare IWS and annual session. The meeting should be continued.
- b. To improve the capacity on hydrological phenomena forecasting is a continual challenge in developing Members. WGH needs to continue conducting activities focusing on the capacity building in aspects of flood monitoring, simulation, forecasting, and analysis covering river flood, urban flood, sediment disasters, storm surge, etc.
- c. UFRM Guidelines, as a final outcome of TC Cross-cutting project of UFRM, was published as TC publication which collected the expertise and experience on urban flood risk management among TC Members, and will undoubtedly benefit Members. However, Members still expect concrete measure from Committee to promote the capacity on urban flood forecasting and inundation mapping. As the subsequent activity of TC Cross-cutting project of UFRM, development and application of OSUFFIM would play very meaningful and important role for Members to promote the capacity on the technique of urban flood forecasting and warning. Also, technical training courses on urban flood forecasting, inundation mapping and damage assessment should be considered as subsequent activities of the project of UFRM in the Committee.
- d. Inundation assessment under the combined risks of heavy rain, river flooding, waves and tides, and storm surge should be considered not only in coastal region but also in urban area in the Members with considering the damage assessment so that more relevant information could be provided to decision-makers of disaster risk reduction. The joint training and research among three components of meteorology, hydrology and disaster risk reduction.
- e. There is agreement on the necessity and importance to conduct PMP/PMF review and study in TC Members considering the change of rainfall pattern under climate change, which surely impacts the standard design for flood control, infrastructure construction, strategic plan, and consequently impact the effectiveness and efficiency of DRR emergency response. The scenario building under new PMP/PMF is necessary for promoting the capacity of typhoon-related DRR among Members.
- f. The Project of SSOP was successful implemented in 2013. The outcome and achievement could greatly benefit the Members and the contribution from Members is also very important for achieving the expected goals. WGH will continue contributing to the implementation of this project.
- g. Enhancement of the close collaboration with the AWG of WMO CHy, WMO RA II Working Group on Hydrological Forecasts and Assessments and RA V Working Group on Hydrological Services in several themes of common interest provides significant benefits to the Committee.

RECOMMENDATIONS OF WGH

- 41) On the basis of the discussion and outcomes at 2nd WGH working meeting and parallel session of TC 8th IWS/2nd TRCG Forum, the WGH made the following recommendations to the Committee:
- a. To appoint with augmentation Ms. LI Yan, Deputy Division Director of BOH of China as Vice Chairpersons of WGH.
 - b. To allocate US\$32,000 from TCTF in total for supporting overall WGH activities for 2014 calendar year.

- c. To request WGH to continue conducting the project of OSUFFIM as one of subsequent activities of TC cross-cutting project of UFRM and request Members of Pilot Cities exploring mobilization the self-funding support for the pilot studies of development and application of OSUFFIM.
- d. To request TRCG to consider the possibility of organizing the seminar and/or training course for Members on urban flood forecasting, inundation mapping, PMP/PMF review and study taking into consideration climate change as subsequent activities of TC cross-cutting project of UFRM.
- e. To request Members of Pilot Cities exploring mobilization the self-funding support for the pilot studies and application of Xin'anjing model in selected river basins to promote the capacity of flood forecasting and warning.
- f. To request HRFCO, MOLIT of Republic of Korea to host WGH third working meeting in appropriate time with funding support.
- g. To request HRFCO, MOLIT of Republic of Korea to perfect WGH webpage and set up the linkage with TC website in cooperation with TCS and Members.
- h. To encourage Members to contribute the cross-cutting project of SSOP.
- i. To re-appoint the hydrologist of TCS Mr. Jinping LIU and the focal point of WGH, Ms. Hwi-Rin KIM, Republic of Korea as the liaison to WMO RA II and RA V WGHs for the Committee.
- j. To request WMO continue taking actions to facilitate involvement of WGH in the activities of WMO water and hydrology issues.
- k. To request WGH continue taking the action on the closest linkages between the two working groups of WMO RAI and the Committee which were identified at the Committee 43rd Session as:
 - UFRM and flash flood/debris flow/landslide prediction/warning under the RA II theme of Disaster Mitigation – Implementation of the WMO Flood Forecasting Initiative including Flash Flood Forecasting Capabilities; and
 - Assessment of the variability of water resources in a changing climate under the RA II theme of Water Resources Assessment, Availability and Use (surface water and ground water).
- l. To support WGH activities continue focusing on improving the ability to forecast hydrological phenomena and provide measures for the effectiveness of the improvements.

Appendix 1. WGH AOP 2013 Implementation Status

Appendix 2. WGH AOP 2014

Appendix 1. WORKING GROUP on HYDROLOGY (WGH) - AOP 2013 Implementation Status

SP's KRA and SG	Objective Number	Objective	Action	Other WGs Involved	TCS Responsibility	Expected Quarter Completed	Other Organizations Involved	Success Indicators	Funding Required	Funding Sources	Completed – Yes or No
KRA 1 SG 1 KRA 2 SG 2 KRA 4 SG 4a KRA 5 SG 6b KRA 6 SG 6b	1	Assessment System of Flood Control Measures on Socio-economic Impacts	To develop the manual of ASFCM and distribute to the TC members who want to apply the system		coordination	(a) First (b) Second (c) Third (d) Fourth		(a,b,c) To develop the system manual to help members' application of ASFCM in their own basins. (b,c,d) To consult the effect of the proposed flood control measures in selected basins	TCTF \$2,000 for developing the manual	MOLIT TCTF	(a,b,c) Yes (b,c,d)On going
KRA1 KRA 4 SG 4a SG 4b KRA5 SG 5a KRA 6 SG 6b	2	Extreme flood forecasting system	To develop the TC homepage for WGH members and investigate flood forecasting systems in the selected members		See above	(a) First (b) Second (c) Third (d) Fourth	RID of Thailand, PAGASA of Philippines Laos	(a,b) Development of the Korean and English version of TC homepage for WGH members (a,b) Development of the member's reports and data sharing page (b,c) Investigation of the current flood forecasting systems and operation conditions in the selected basins (b,c,d) Comparison of the flood forecasting systems of the selected members	TCTF \$3,000 for the investigation	MOLIT TCTF	(a,b)Yes (a,b)Yes (b,c)On going (b,c,d)On going
KRA 1 SG 1 KRA 2 SG 2 KRA 4 SG 4a KRA 6 SG 6b	3	Project on estimation for socio-economic impact of sediment-related disaster	to improve former projects with establish common collecting format and methods of investigation for disasters to estimate estimation for socio-economic impact of sediment-related disaster and to share common technical background in TC members.	WGDRR	See above	(a)First (b)Second (c)Third (d)Fourth		(a) Providing a draft format to collect the record of sediment-related disaster (b) Deciding the format to collect the record of sediment-related disaster (c) To report the results of survey based on the format by each TC members (d1) To make a "Sediment-related Disaster Record Database" to share the records in TC members (d2) To report and share the results of estimation of socio-economic impact		NILIM SABO	(a)Yes (b)Yes (c)on going (d1)No (d2)No

SP's KRA and SG	Objective Number	Objective	Action	Other WGs Involved	TCS Responsibility	Expected Quarter Completed	Other Organizations Involved	Success Indicators	Funding Required	Funding Sources	Completed – Yes or No
KRA 1 SG 1 KRA 2 SG 2 KRA 4 SG 4a KRA 6 SG 6b	4	Development of Operational System for Urban Flood Forecasting and Inundation Mapping (OSUFFIM)	to develop a prototype real time OSUFFIM for TC Members to promote the capacity of early warning of urban flood and emergency response, particularly urban flood forecasting and inundation mapping.		diver	(a)First (b)Second (c)Third (d)Fourth	SMG, Macao; Sun Yat-Sen University of China; TMD/RID of Thailand	(a1) kick-off meeting for discussion plan (a2) Survey of Pilot City— Hat Yai; (b1) Data collection, analysis and procession of the chosen pilot cities (Hat Yai) (b-c) developing system (d) report the progress at IWS	TCTF \$6000 for supporting activities related to OSUFFIM development	STDF of Macao; SYS Univ. ; TMD/ RID of Thailand; TCTF	(a1) Yes with delay (a2) Postponed (b1) postponed (b-c) postponed (d) postponed
KRA 1 SG 1 KRA 2 SG 2 KRA 4 SG 4a KRA 6 SG 6b	5	Extend application of Xin'anjiang Model in Selected River Basins in TC Members	To promote the Capacity of Flood Forecasting for TC Members; Use the Model in Pilot River basin in Malaysia in 2013		Coordination	(a)First (b)Second (c)Third (d)Fourth	BOH and Hohai University of China; DID of Malaysia	(a1) perfecting the English version of Model (China) (a2) select river basin and prepare necessary data by DID (b) Send profs/experts to Malaysia for training (c) Use the model on trial in flood season (d) report to TC IWS and Session	TCTF \$2000 to support experts for training course in Malaysia	BOH of China; DID of Malaysia	(a1) yes (a2) yes (b)yes (c) on going, (d) on going
KRA 1 SG 1 KRA 2 SG 2 KRA 4 SG 4a KRA 6 SG 6b	6	Guidelines for extreme flood risk management in TC region	To define the concept of extreme flood and host a workshop to develop the consensus about the guideline among the members		See above	(a)First (b) Second (c)Third (d) Fourth		(a) Development of the definition of extreme flood in TC region (b,c) preparedness of WGH meeting(workshop) for TC members to discuss about TC AOP including extreme flood risk management (c)host 2 nd WGH Working meeting (b,c,d) Development of consensus about the contents in the guideline among the members	TCTF \$2,000 for hosting the WGH meeting(workshop)	MOLIT TCTF	(a) Yes (b,c)Yes (c) Yes (b,c,d) No
KRA 1 SG 1 KRA 2 SG 2 KRA 4 SG 4a KRA 5 SG 5a KRA 6 SG 6b	7	Study on Prediction of Debris flow and Shallow landslide by the Satellite Rainfall Data	To study on prediction of debris flow and shallow landslide by the satellite rainfall data	WGDRR	See above	(a)First (b)Second (c)Third (d)Fourth	accept application	(b) kick-off meeting for discussion plan (c) accept proposal as pilot basin (d) Study on pilot basin	N/A	ICHARM	(b)No (c)on going (d)on going

SP's KRA and SG	Objective Number	Objective	Action	Other WGs Involved	TCS Responsibility	Expected Quarter Completed	Other Organizations Involved	Success Indicators	Funding Required	Funding Sources	Completed – Yes or No
KRA 1 SG 1 KRA 2 SG 2 KRA 4 SG 4a, SG 5a KRA 5 SG 5a SG 5b KRA 6 SG6b	8	Project of Synergized Standard Operating Procedures for Coastal Multi-hazard Early Warning System (SSOP)	To develop a Manual/Handbook of Synergized Standard Operating Procedures for Coastal Multi-hazard Early Warning Systems	WGM WGDRR TRCG	Coordination Focal Point	(a)First (b)Second (c)Third (d)Fourth	PTC, ESCAP, WMO, ADRC, IOC of UNESCO	(a) Workshop of SSOP (b) Piloting in selected countries (c-d) Drafting the Manual/Handbook of SSOP		ESCAP funding	(a) YES (b) on going (c-d) on going

SG1: To enhance cooperation among TC Members to reduce the number of deaths by typhoon-related disasters by half in the ten years of 2006 – 2015 (using the ten years of 1990 - 1999 as the base line).

SG2: To reduce the socio-economic impacts of typhoon-related disasters per GDP per capita by 20 per cent in the ten years of 2006- 2015 (using the ten years of 1990 - 1999 as the base line).

SG 3a: To identify and explore the beneficial use of resources such as rainfall brought by typhoon.

SG 3b: To study and promote the increasing use of typhoon-related beneficial effects among the Members.

SG 4a: To provide reliable typhoon-related disaster information for effective decision making in risk management in various sectors.

SG 4b: To strengthen capacity of the Members in typhoon-related disaster risk management in various sectors.

SG 4c: To enhance international and regional cooperation and assistance in the field of disaster risk reduction.

SG 5a: To promote and enhance culture of community-based disaster risk management among the Members.

SG 5b: To promote education, training and public awareness of typhoon-related disasters among the Members.

SG 6a: To facilitate RSMC capability to respond to the needs of the Members in forecasting and capacity building.

SG 6b: To improve capacity of Members to provide timely and accurate user-oriented and friendly tropical cyclone products and information.

SG 6c: To enhance capacity of Members' typhoon-related observation, monitoring, forecasting and warning.

SG 7a: To strengthen the capacity of Typhoon Committee to effectively discharge its responsibilities and functions described in this Strategic Plan and completed its stated mission in accordance with the Typhoon Committee's Statute.

SG 7b: To mobilize available resources and engage collaborators for the implementation of the strategic goals.

KRA 1: Reduced Loss of Life from Typhoon-related Disasters.

KRA 2: Minimized Typhoon-related Social and Economic Impacts.

KRA 3: Enhanced beneficial typhoon-related effects for the betterment of quality of life.

KRA 4: Improved Typhoon-related Disaster Risk Management in Various Sectors.

KRA 5: Strengthened Resilience of Communities to Typhoon-related Disaster.

KRA 6: Improved capacity to generate and provide accurate, timely and understandable information on typhoon-related threats.

KRA 7: Enhanced Typhoon Committee's Effectiveness, Efficiency and International Collaboration.

Appendix 2. WORKING GROUP on HYDROLOGY (WGH) - AOP 2014

SP's KRA and SG	Objective Number	Objective	Action	Other WGs Involved	TCS Responsibility	Expected Quarter Completed	Other Organizations Involved	Success Indicators	Funding Required	Funding Sources
KRA 1 SG 1 KRA 2 SG 2 KRA 4 SG 4a KRA 5 SG 6b KRA 6 SG 6b	1	Assessment System of Flood Control Measures on Socio-economic Impacts	Distribute the ASFCM Guideline to the TC members who want to apply the system and consult the ASFCM application in TC regions		coordination	(a) First (b) Second (c) Third (d) Fourth		(a,b) To collect of the TC member's comments of the ASFCM Guideline (c,d) Distribute the ASFCM Guideline and consult the effect of the ASFCM application in TC regions	TCTF \$3,000 for application	MOLIT TCTF
KRA1 KRA 4 SG 4a SG 4bKRA5 SG 5a KRA 6 SG 6b	2	Extreme flood forecasting system	To operate the TC homepage for WGH members and design the extreme flood forecasting system		See above	(a) First (b) Second (c) Third (d) Fourth	RID of Thailand, PAGASA of Philippines Laos	(a,b,c,d) To operate the TC WGH homepage and collect of the TCmember's comments of the homepage (d) To amend the TC WGH homepage (c,d) To design the extreme flood forecasting system	TCTF \$3,000 for the investigation	MOLIT
KRA 1 SG 1 KRA 2 SG 2 KRA 4 SG 4a KRA 6 SG 6b	3	Project on estimation for socio-economic impact of sediment-related disaster	to improve former projects with establish common collecting format and methods of investigation for disasters to estimate estimation for socio-economic impact of sediment-related disaster and to share common technical background in TC members.	WGDRR	See above	(a)First (b)Second (c)Third (d)Fourth		(a) Providing a draft format to collect the record of sediment-related disaster (b) Deciding the format to collect the record of sediment-related disaster (d1) To make a "Sediment-related Disaster Record Database" to share the records in TC members (d2) To report and share the results of estimation of socio-economic impact		MLIT NILIM SABO TCTF

SP's KRA and SG	Objective Number	Objective	Action	Other WGs Involved	TCS Responsibility	Expected Quarter Completed	Other Organizations Involved	Success Indicators	Funding Required	Funding Sources
KRA 1 SG 1 KRA 2 SG 2 KRA 4 SG 4a KRA 6 SG 6b	4	Development of Operational System for Urban Flood Forecasting and Inundation Mapping (OSUFFIM)	To develop a prototype real time OSUFFIM for TC Members to promote the capacity of early warning of urban flood and emergency response, particularly urban flood forecasting and inundation mapping.		diver	(a)First (b)Second (c)Third (d)Fourth	Sun Yat-Sen University of China; RID of Thailand DID, Malaysia NHMS, Vietnam	(a1) set up of national working group (a2) Survey of Pilot City in Thailand and China (b1) Survey of Pilot Cities in Malaysia (b-c1) Data collection in pilot cities (b-c2)Chinese version development (c-d1) implementation in China (c-d2)technical material preparing (d3) report the progress at IWS	TCTF \$4000 for supporting activities related to OSUFFIM development TCTF \$3500 for OSUFFIM training course	SYS Univ ; RID, Thailand; DID, Malaysia NHMS, Vietnam TCTF
KRA 1 SG 1 KRA 2 SG 2 KRA 4 SG 4a KRA 6 SG 6b	5	Extend application of Xin'anjiang Model in Selected River Basins in TC Members	To promote the Capacity of Flood Forecasting for TC Members; Use the Model in Pilot River basin in Malaysia in 2013		Coordination	(a)First (b)Second (c)Third (d)Fourth	BOH and Hohai University of China; DID of Malaysia	(a-b)Application of Xinanjiang model for Segamat River (a-b) Improve English version of Model. (b-c) On-Job-Training course (b-c) Application of model for another selected river (b-c) Report on trial in flood season (c-d) Test run with the help of experts for new river (d) Project report at IWS and Anunal Session	\$5500	TCTF BOH, China DID, Malaysia
KRA 1 SG 1 KRA 2 SG 2 KRA 4 SG 4a KRA 6 SG 6b	6	Guidelines for extreme flood risk management in TC region	To develop the flood control measures for extreme flood and host a workshop to develop the consensus about the guideline among the members		See above	(a) First (b) Second (c) Third (d) Fourth		(a,b) Development of consensus about the contents in the guideline among the members (b,c) preparedness of WGH meeting(workshop) for TC members to discuss about TC AOP including extreme flood risk management (c)host WGH Working meeting (b,c,d) To develop the structural & non-structural flood control measures for extreme flood	TCTF \$3,000 for hosting the WGH meeting(workshop)	MOLIT TCTF
KRA 1 SG 1 KRA 2 SG 2 KRA 4 SG 4a KRA 5 SG 5a KRA 6 SG 6b	7	Study on Prediction of Debris flow and Shallow landslide by the Satellite Rainfall Data	To study on prediction of debris flow and shallow landslide by the satellite rainfall data	WGDRR	See above	(a)First (b)Second (c)Third (d)Fourth	accept application	(a-d) Developing Prototype system (ICHARM) (a-d) Correcting ground truth data on test fields (a-d) Analyzing on test fields (c-d) Workshop on test fields	N/A	PWRI/ICHARM

SP's KRA and SG	Objective Number	Objective	Action	Other WGs Involved	TCS Responsibility	Expected Quarter Completed	Other Organizations Involved	Success Indicators	Funding Required	Funding Sources
KRA 1 SG 1 KRA 2 SG 2 KRA 4 SG 4a, SG 5a KRA 5 SG 5a SG 5b KRA 6 SG6b	8	Contribution to the development of SSOP Manual and SSOP Training	(a) To review and comment on the SSOP Manual and related Documents (b) To review and provide input into planned SSOP Training	WGH WGDRR TRCG	1 st -4 th	TCS, Members, ESCAP WMO PTC ADPC ABU	Seven beneficiary Members	NO	SSOP Budget	Project Manager, Steering Committee, and Task Team

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SG 4c: To enhance international and regional cooperation and assistance in the field of disaster risk reduction.

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