Appendix-11 Guideline for Formulation of IFMP-SZ

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National Unit for Disaster Risk Management (UNGRD)
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Autonomous Regional Corporation of Cundinamarca (CAR)
Department of Cundinamarca
Ministry of Environment and Sustainable Development (MADS)

Project for Strengthening Flood Risk Management Capacity in the Republic of Colombia

Guideline for Preparation of Integrated Flood Risk Management Plan for Hydrographic Subzone (IFMP-SZ)

June 2018

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PREFACE

The Project for the Strengthening of Flood Risk Management Capacity in the Republic of Colombia", JICA's technical cooperation project, was implemented with a project period of 3 years, between July 2015 and June 2018.

This project has an overall goal of "the reduction of flood risk in Colombia" and the project goal "to strengthen the capacities of Colombian institutions for flood risk management ". The expected outcomes are the following four elements, for which we carry out activities:

Output 1: Capacity on flood risk assessment is improved and concept of integrated flood management planning and river basin management is introduced

Output 2: Capacity on flood forecasting, warning and information dissemination to relevant organizations is improved (mainly IDEAM and UNGRD)

Output 3: Roles and responsibility of the central and local government for flood risk reduction are elucidated and enhanced (mainly UNGRD and IDEAM)

Output 4: Capacity of flood management planning is enhanced through formulation of integrated flood management plan (IFMP) in the pilot river basin

The IFMP-SZ was developed within the frame of the activities for Outcome 4, and it is a IFMP-SZ for the Rio Negro basin, which was selected as a pilot basin. Rio Negro basin is classified as a Hydrographic Subzone in Colombia. This project will not carry out independent activities for the collection of new information (survey of the cross section or topographic surveys, etc.), the preexisting information will be used to the maximum. The IFMP-SZ for the Rio Negro basin will be formulated as a provisional plan so that the participants learn the formulation processes. It should be remembered that a complete IFMP-SZ for the Rio Negro basin can be drawn upwith additional work and the results thereof.

In the activity for the formulation of IFMP-SZ in the pilot river basin, it was necessary to study the type of IFMP-SZ appropriate for Colombia that can be formulated and implemented as well as to verify the actual situation of the basin in Colombia and the related data, in order to carry out concrete activities.

Therefore, as part of the activities it was necessary to confirm that an appropriate plan was formulated for the Rio Negro pilot basin with the greatest possible effect that could be used as an example. It was also necessary to confirm the methods to achieve the above. An example is the use of satellite data as means to obtain basic data that meet a certain quality standard, so that the project is not limited by the current situation of the data in Colombia, where the availability of topographic data varies significantly from region to region.

It is our hope that this guide, which was elaborated by incorporating the lessons obtained through the activities in the pilot basin, will be used in different basins in Colombia, with diverse topographic and

meteorological characteristics, or basins that are generally very different from the pilot basin.

In the example of a Japanese river plan, there are concepts of flood control, water use and the environment of the river which are the pillars in order to design contents of the river improvement in accordance with the nature of the target river. Therefore, in rivers where the production of sediments is intense, the plan orients the reader in the definition of measures against sediments within the riverbed. If the river is located near areas that are extremely important from a socioeconomic point of view, the plan includes information on the severity of flood damage as well as measures such as strengthening of dikes. Although the river management plans have the common table of contents with respect to the basic items, the important element is the "description of the characteristics and response taking into account these characteristics" part.

In preparing the guide, the aforementioned was taken into account, and an attempt was made to differentiate the content. For example, a part can be applied in all the basins although the content is not very dense, and another part can be applied to all of Colombia despite the detailed contents. Special attention was paid to the contents so that the guide was not too general, lacking specificity, and therefore rendering it unusable. Also, an attempt was made to create a guide that can serve as guidelines for the integral management of floods in Colombia in the future.

1. What is the guideline on preparation of Integrated Flood Management Plan (IFMP-SZ) for Hydrographic Subzone?

1.1 Definition of Integrated Flood Management Plan for Hydrographic Subzone (IFMP-SZ)

Integrated management of flood risk is to "study damage and measures against floods, taking into account the entire basin from upstream to downstream from a broad point of view that includes social conditions such as the distribution of population or assets, fauna and flora, land use, distribution of precipitation, topography and geology in the basin and other information. " IFMP-SZ is a plan of the measures that are products of this study process.

In this guideline, the IFMP is defined as "a specialized flood control plan, which studies the basin from an integral point of view". This guideline presents the formulation of the IFMP especially for the hydrographic subzones (IFMP-SZ), and its target user are the public officials of relevant Environmental Authorities, the entities in charge of leading the formulation process, and workers from other relevant entities. This guideline explains the objective of the development of the IFMP-SZ, the methodology and the process of formulation.

Additionally, the guideline for the formulation of the IFMP for the principal river (IFMP-RP) will be prepared. The IFMP-RP and the IFMP-SZ, the first for the macro-basins and the second for the hydrographic subzones, will be formulated in such a way that they will be compatible with each other. The plan for the principal river and and the plans for the tributaries (hydrographic subzones) are expected to be compatible due to the use of both guides in the future.

The following table defines the key terms used in this guide.

Table 1.1.1 Definition of Terms

Terms	Definition/Explanation
Integrated Flood Risk Management Plan for Hydrographic Subzone (IFMP-SZ)	A plan for integrated flood risk management in a Hydrographic Subzone.
Integrated Flood Risk Management Plan for Principal River (IFMP-RP)	A plan for integrated flood risk management for the principal river.
Principal river	A river that has a mouth to the sea within the national territory, or a river that crosses the national border, and consists of several hydrographic subzones.
POMCA (Plan de Ordenación y Manejo de Cuencas Hidrológicas) (Management and Regualtion Plan for Basins)	A basin management and regulationt plan formulated for subzones. The content was regulated by decree 1076 of 2015.
PMA (Plan Maestro de Aprovechamiento (Master plan of Exploitation)	Master plan formulated by CORMAGDALENA in 2014 for the development of the Magdalena River.
Master Plan	"Master plan" is a general term; however, it refers to PMA when speaking of the Magdalena River.

1.2 Guideline's Position and Need

This guideline was developed for the study and formulation of IFMP-SZ in small basins classified as hydrographic subzones (SZ) in Colombia. IDEAM codes the hydrographic subzones in Colombia, and there are 43 subzones in the Caribbean basin, 105 in the Magdalena-Cauca basin, 73 in the Orinoco basin, 57 in the Amazon basin, and 33 in the Pacific basin.

It is mandatory to formulate the POMCA (Management and Regualtion Plan for Basins, acronym in Spanish) for each subzone.The items to be defined by the POMCA and the formulation methodology were established in Decree 1076 de 2015, and in 2013, the Ministry of Environment prepared the references for the formulation of the POMCA, including explanations on efforts related to disaster risk. However, the POMCA does not include concrete methods to understand the real situation of floods or to carry out flood analysis, nor flood prevention measures. In addition, river administrator that should lead the prevention of floods is not clearly defined, so it is not possible to take concrete actions.

The IFMP-SZ is a necessary tool to solve the above mentioned problems. The objectives of the IFMP-SZ are the following:

- Share the need to implement measures with the related entities since measures to mitigate floods are urgent in the target area.
- Clarify laws related to flood prevention, existing plans, and the sharing of responsibilities among relevant entities and share knowledge.
- Study effective and feasible flood prevention measures, organize them in a plan and share them.

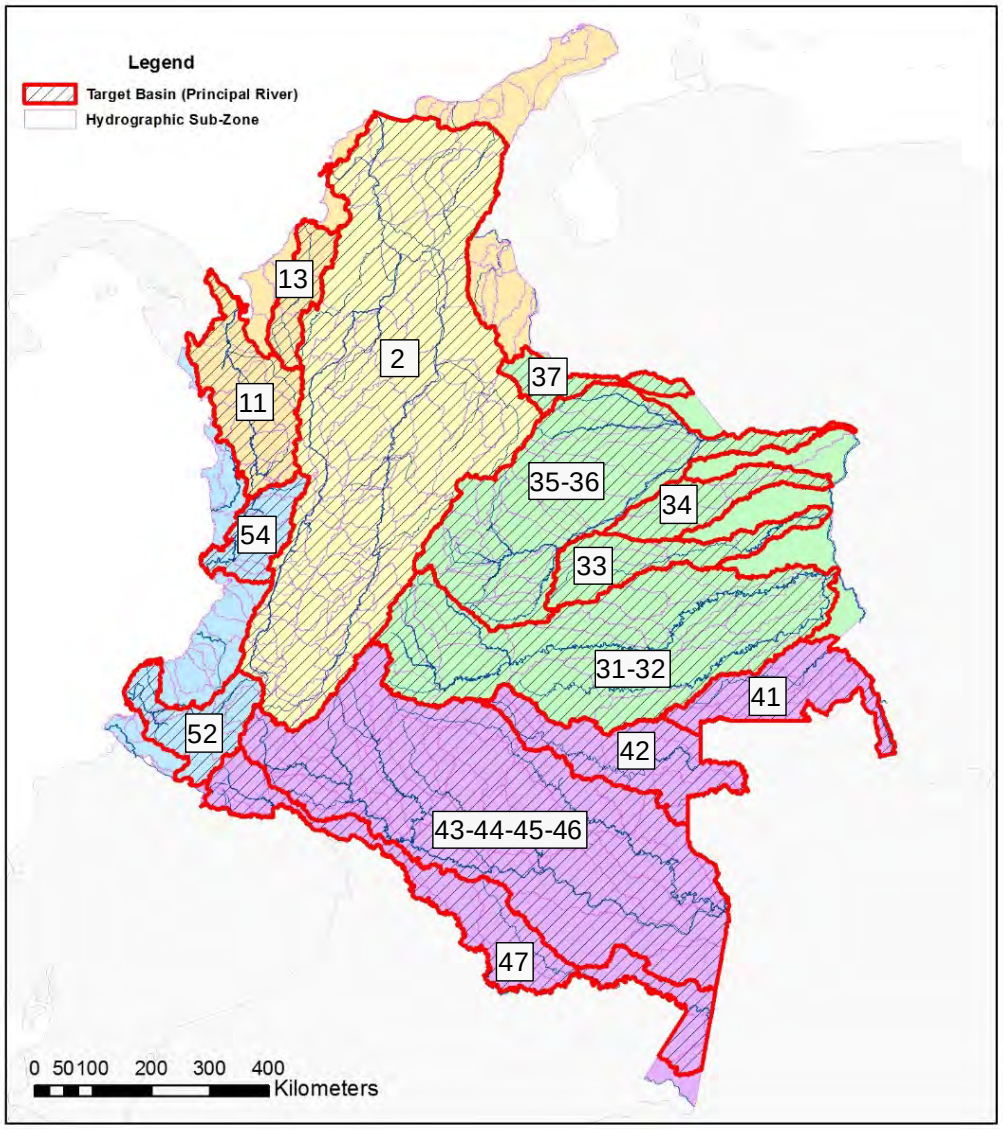
The position of this guideline are the following:

- Clearly present the objective of the IFMP-SZ, the content, the formulation process and method, as well as items to take into account, so that the entities that lead the flood prevention measures can elaborate an effective IFMP-SZ. The plan developed according to this guide will have characteristics that complement the risk component, especially of the POMCA.
- Write the most concrete contents possible for the officials of the relevant entities such as Environmental Authorities, among others, in the basin.
- This guideline is expected to be incorporated into the Protocol for the formulation of the risk component of the POMCA. This guide aims to complement topics such as the processes and the philosophy of the study of the measures based on the results of the risk assessment, as well as the method of evaluation of the measures, which are insufficient in the current protocols.
- This guideline is based on the general knowledge clarified so far. Each subzone has different characteristics, and to reflect them in the plan, it is recommended to adjust a part of the contents of this guide.

Additionally, the guideline for the formulation of the IFMP for the principal river (IFMP-RP) will be prepared. IFMP-RP and IFMP-SZ, the first for principal rivers and the second for hydrographic

subzones, will be formulated in such a way that they will be compatible with each other, as mentioned in Section 1.1. The plan for the principal river and and the plans for the tributaries (hydrographic subzones) are expected to be compatible due to the use of both guides in the future.

Below is the position of the principal rivers in the guide for the formulation of IFMP-RP as well as their names.



ID	Principal Rivers	Macro Basins
2	Magdalena Cauca	Magdalena Cauca
11	Atrato - Darién	Caribe
13	Sinú	
31-32	Inirida	Orinoco
	Guaviare	
33	Vichada	
34	Tomo	
35-36	Meta	
	Casanare	
37	Arauca	

ID	Principal Rivers	Macro Basins
41	Guania	Amazonas
42	Vaupes	
43-44-45-46	Apaporis	
	Caquetá	
	Yari	
	Caguán	
47	Putumayo	
52	Patia	Pacifico
54	San Juán	

The positions of macro-basin, hydrographic zones and hydrographic subzones are shown below.

The elaboration of the statement on the problem, as such, requires several phases:

1. Identification of the problem: involves the discovery of the topic or issue to be addressed.
2. Assessment of the problem: consists in the evaluation of the suitability, importance or relevance of the identified problem.
3. Formulation of the problem: elaboration of the problem in the form of a question. For example, "How does the emission of greenhouse gases affect global warming?"
4. Definition of the problem: review of the background of the topic, the theories or tendencies within which the subject is situated, etc.
5. Delimitation of the problem: assumes the precision and delimitation of the specific aspects of the subject that will be addressed.

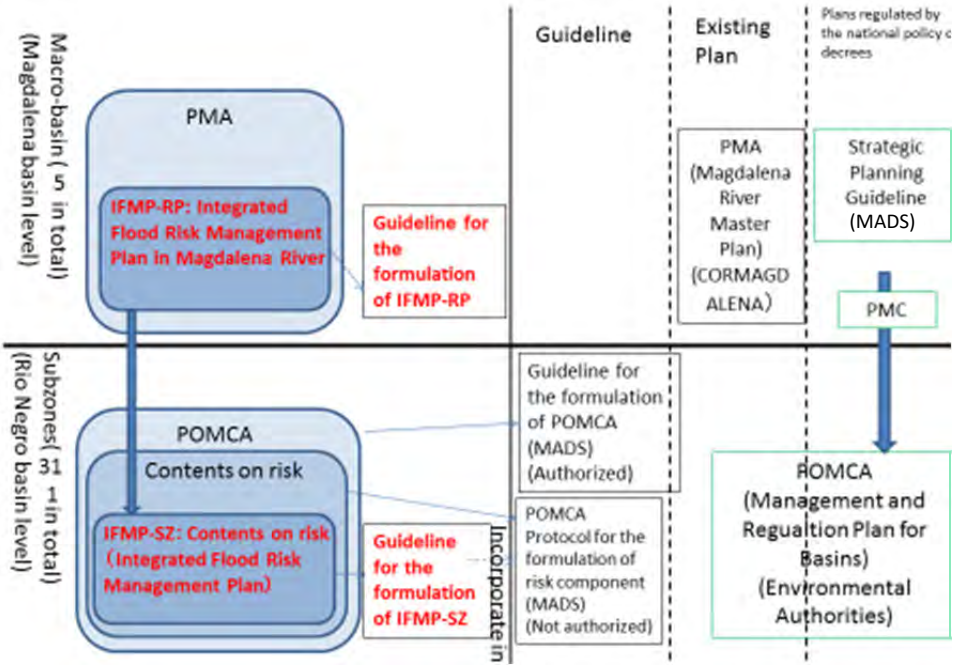
Macro-basins
5 nationwide
(Magdalena-Cauca basin level)

Hydrographic Zones
41 nationwide

Hydrographic Subzones
309-311 nationwide
(Rio Negro basin level)

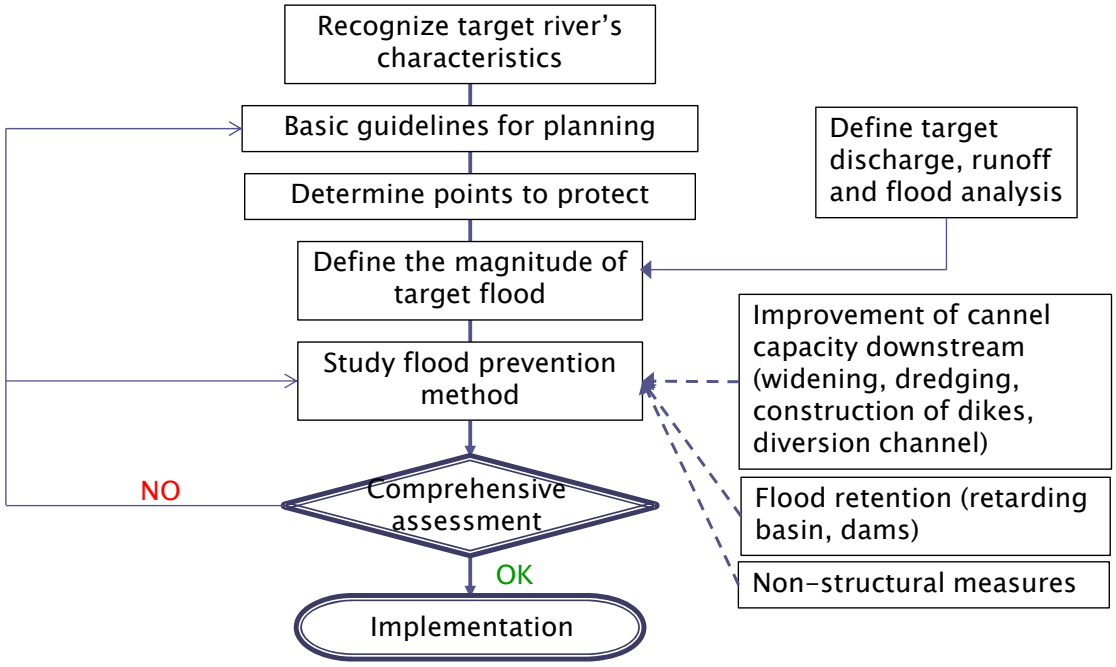
Categorization of basins in en Colombia

Below is the relationship between the subzone and the macro-basin, with the example of the Rio Negro basin, a subzone within the Magdalena River basin, one of the main rivers in Colombia.



1.3 Processes of the formulation of the plan and the items explained in the guideline

The subzones, which are targets of this guideline, are under different conditions; for example, some subzones still do not have the POMCA. However, the basic process for formulating the plan, the necessary items and the study contents are generally the same.The following figure shows the process of formulating the IFMP-SZ.



Source: JICA Project Team

Figure 1.3.1 Flow Chart for Preparation of IFMP-SZ

In the following table, the items that the IFMP-SZ must include are presented. This guide explains what is the content of each item of the following table and what is needed to create these contents.

Table 1.3.1 Items included in IFMP-SZ

Part	Chapter No.	Chapter / Contents
0. Background and General Overview	1.	Background - Definition of IFMP-SZ - Process of IFMP-SZ - Needs of IFMP-SZ - Others
	2.	General Overview - Purpose and Contents of IFMP-SZ in the Basin - Upper Level Plan
A. River/River Basin Characteristics	1.	Social characteristics
	2.	Topography and River conditions - Watershed delineation of the Basin - Hypsometric Analysis - River cross Section - River Longitudinal Profile - Longitudinal profile of channel width. - Longitudinal profile of channel flow capacity - Geological condition
	3.	Hydrology and Hydraulics - General meteorological, hydrological conditions - Water levels and Discharge at main hydrological stations - Daily Rainfall at main rainfall stations
	4.	Flood Damage - Inventory of Past Flood Disasters in the Basin - Detailed Analysis of Relationship between Flood Events and Hydrogical Coditions in the Basin
	5.	Recognition of the Basin
B. Planning of IFMP-SZ	1.	Basic Policy for Planning of IFMP-SZ
	2.	Target Section
	3.	Setting Design Scale - Rainfall-Runoff Modeling - Target Discharge Setting - Consideration of Future Conditions - Setting Design Scale
	4.	Target Discharge
	5.	Flood Hazard Area Assessment
	6.	Flood Control Scheme
C. Implementation Program	1.	Structural Measures
	2.	Non-Structural Measures
	3.	Priority of Measures
	4.	Comprehensive Evaluation
	5.	Monitoring Plan
	6.	Implementation Schedule
D. Allocation of Responsibility for Planning and Implementation of IFMP-SZ	1.	Current Situation and Issues
	2.	Discussion in the Workshops / Seminars
	3.	Allocation of Responsibility for Planning and Implementation of IFMP-SZ
E. Revision and Update of IFMP-SZ		

0. Background and General Overview

The IFMP-SZ is prepared per hydrographic subzone in order to design flood measures. The IFMP-SZ should be formulated while clarifying the context and position of the IFMP-SZ itself, as well as the relationship of the IFMP-SZ with the existing upper-level plans, such as POMCA

【Explanation】

The IFMP-SZ is developed per hydrographic subzone with the main objective of designing flood measures, while clarifying the relation of IFMP-SZ with existing plans and existing regulations. In part 0, the context, the position,and the importance of the IFMP-SZ is explained, as well as the relationship between the IFMP-SZ and existing plans, related regulations and related plans, as a stage prior to preparation.

1. Background

The context in which IFMP-SZ will be formulated is explained.

【Explanation】

Here, the definition of the IFMP-SZ, the entity responsible for its elaboration, the process of the elaboration and its necessity, as well as the context in which the IFMP-SZ is elaborated are explained. Below are the items that should be included in this chapter (numerals).

➢ Definition of IFMP-SZ

The definition of the IFMP-SZ is clarified. In addition, the entity responsible for its preparation is clarified.

➢ Process of IFMP-SZ

The process of formulating the IFMP-SZ (items to study) is explained. IFMP-SZ will be formulated following the process shown in the figure below.

1. Understand the characteristics of the river.
2. Determine the basic guidelines of IFMP-SZ.
3. Determine items in IFMP-SZ (design scale, etc.).
4. Study and evaluate the measures..

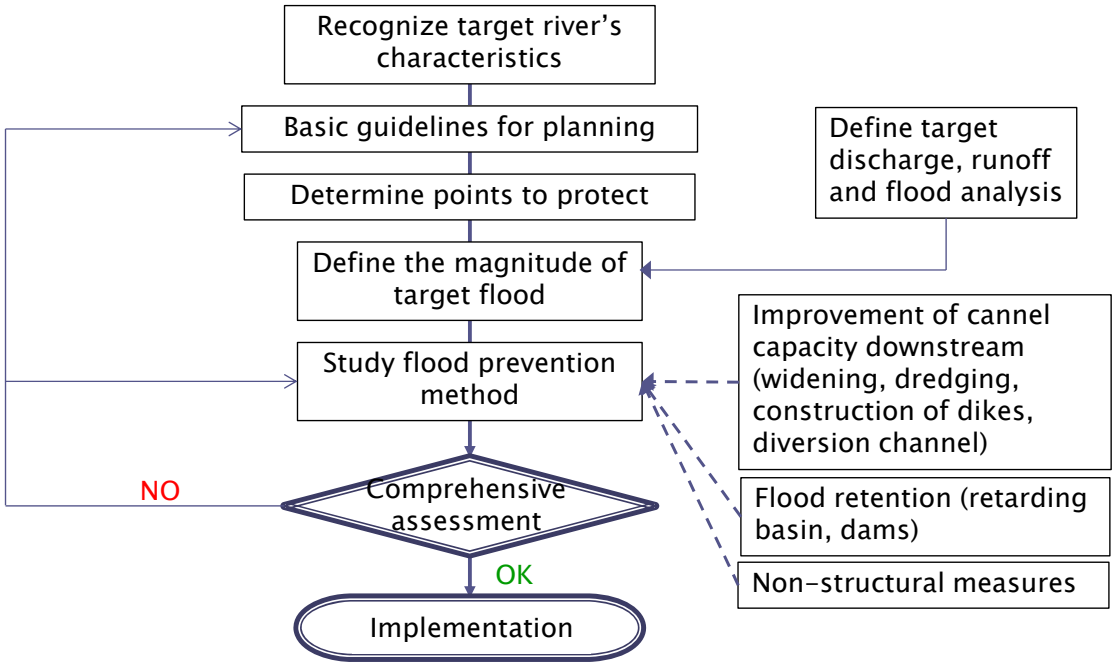


Figure 0.1 IFMP-SZ Formulation Process

➢ Needs of IFMP-SZ

The need for the IFMP-SZ is explained. For example, there is need to include flood risk component in the POMCA, which is an item required in the POMCA.

➢ Others

Other important items related to the formulation of the IFMP-SZ are explained. An example is the concept of the Water Round, etc.

2. General Overview

The general description of IFMP-SZ in the target basin is explained.

【Explanation】

Here, the purpose, structure, and the content of IFMP-SZ of the target basin are explained as a overview of IFMP-SZ in the target basin. Additionally, the existing plans, regulations and plans related to IFMP-SZ in the target basin are mentioned, and the relation of each one with IFMP-SZ is explained. The items (numerals) that should be included in this chapter are listed.

➢ Purpose and Contents of IFMP-SZ in the Basin

The purpose, structure and content of the IFMP-SZ are explained.

- Purpose

The purpose is to formulate the integral measures against floods that takes into account the entire basin for the basin.

This IFMP-SZ will be developed assuming that it will be part of the POMCA risk component (flood) in the future.

- Contents

This IFMP-SZ will include the following 5 components:

- 0. Background and General Overview : Summary of IFMP-SZ and the context of the formulation of the IFMP-SZ
- A. River Characteristic : Characteristics of the target Basin and the target River
- B. Planning of IFMP-SZ: Basic guidelines for IFMP-SZ
- C. Implementation Program : Concrete measures against floods
- D. Allocation of Responsibility for Planning of IFMP-SZ: Role sharing for the implementation of IFMP-SZ
- E. Revision and Update of IFMP-SZ

➢ Upper Level Plan

Here, the upper level plans for the IFMP-SZ of the target basin are explained. Examples include IFMP-RP in which the target river is included or the POMCA of the target basin, the development plans of the department or the municipalities that include areas of the target basin.

A. River/River Basin Characteristics

IFMP-SZ must have contents that reflect the characteristics of the target basin and the target river. Therefore, the characteristics of the basin and river are studied to reflect them in the plan.

【Explanation】

To study and formulate an effective and feasible plan, it is necessary to understand the characteristics of the basin precisely. In Part A, the contents and results of the study and the analysis of the characteristics of the basin are presented from different points of view. The method of study and analysis is explained below.

1. Social characteristics

Categorize the social characteristics of the basin.

【Explanation】

Here, the social characteristics of the basin are explained. Apart from the general and detailed information that helps to understand the profile of the basin, it is ideal to include content that contributes to the analysis, such as the population and material assets as well as their distribution, vulnerable elements and their distribution and the degree of vulnerability, and the limitations for the implementation of the measures upon studying the measures. Below are the items (numerals) that should be included in this chapter.

- List of Municipality in the watershed
- Population and its distribution
- Agricultural Activities
- Industrial Activities
- Mining Activities
- Fishing Activities
- Economic Activities in the Basin (comercial)
- Other economic activities in the basin (tourism, etc)
- Landuse condition
- Environmental condition including ecosystem
- Water use condition

To analyze social characteristics,it is essential to collect basic data. Below is a list of the basic data that should be collected and the entities manage these data, taking into account the experience in this project.

Item	Content	Source
Municipalities that make up the basin	List of municipalities in the basin	POMCA (Environmental Authorities)
Population / population distribution	Populations in the municipalities described above, future projection of the population and distribution of residential areas	POMCA (Environmental Authorities), DANE (National Administrative Department of Statistics), Department, Municipalities
Production in the basin	Information on agriculture, mining, tourism, etc. inside the basin	POMCA (Environmental Authorities), Statistics (Department)
Land use (current situation, future projection)	Information on the current situation of land use and future projection within the basin	POMCA(Environmental Authorities), POT/EOT(Municipalities), PDM (Development Plan) (Municipalities), PDD (Department)
Environment (current situation, regulation, plans)	Information on the current situation of the environment, future plans, and regulations within the basin	POMCA (Environmental Authorities)
Water use (current situation, future projection)	Information on the current situation of water use and future projection within the basin	POMCA (Environmental Authorities)

2. Topography and River Conditions

Categorize the topographic characteristics of the target basin.

【Explanation】

Here, the contents and the results of the study and the analysis of the topographic characteristics of the basin and the topographic and morphological characteristics of the channel are described. Ideally, the contents that can explain the characteristics of the flood in the basin and the contents related to the study of measures are explained and included. Below are the items (numerals) that should be included in this chapter.

➢ Watershed delineation of the Basin

The delimitation of the basin is presented if it is appropriate for the target basin to be divided into sub-basins that have a reasonable area (generally more than 1000km^2), according to tributaries or high, medium and low basins that have different characteristics, or if the delimitation of sub-basins has already been carried out. Ideally, the delimitation map of the sub-basins and the summary of each sub-basin (basin area and characteristics, etc.) are presented.

➢ Hypsometric Analysis

The content and results of the hypsometric analysis of the basin are described. Ideally, the map of the basin with different colors for different heights (hypsometric map), the hypsometric curve of the basin or the table that shows the area by height, and the characteristics are explained.

➢ River Cross Section

The contents and results of the analysis of the cross sections of the river in the basin are described. Ideally, the transversal sections are presented at the characteristic points of the river in the basin, such as the upper, middle and lower basins and the main tributaries, and characteristics and comparisons are explained.

➢ River Longitudinal Profile

The contents and results of the analysis of the shape and slope of the longitudinal profile of the main river and the main tributaries are described. Ideally, the conditions of changes in the slope of the riverbed using the longitudinal profile, locations of points where the slope changes, the degree of the slope of the channel within the basin using a diagram that shows the distribution of the channel by slope of the river, river bed and channel are explained, and the characteristics are clarified.

- Longitudinal profile of channel width

The contents and results of the analysis of the longitudinal change of the width of the main river and the main tributaries are described. Ideally, the width of the river is presented with figures and tables, and the characteristics are explained.

- Longitudinal profile of channel flow capacity

The contents and the results of the analysis of the longitudinal change of the flow capacity of the main river and the main tributaries are described. Ideally, the flow capacity of the main channel of the river is presented with figures and tables, the points where the flow capacity is not sufficient are clarified, and the reasons are explained (for example, it is a narrow part of the river).

- Geological condition

The geological conditions of the basin are described. Apart from the general and detailed information that helps to understand the profile of the basin, it is ideal to include the geological conditions that contribute to the definition of the current and past floodplains in the geological map and in the explanation of the geological classification.

To analyze topographic and morphological characteristics, it is essential to collect basic data. Below is a list of the basic data that should be collected and the entities that can provide it, taking into account the experience in this project.

Item	Content	Soure
Topographic maps (1/50,000, 1/25,000, 1/10,000)	Digital data (scanned) topographic maps	IGAC (A través del Departamento)
Delimitation of the basin	Delimitation of the target basin and delimitation of sub-basins within the basin	POMCA (Environmental Authorities), IDEAM
Satellite DEM data	DEM satellite data that covers the basin and has sufficient resolution (12m or 5m) Note: the data acquired in this project covers the entire Colombian national territory	Private sector
LIDAR data	LIDAR data within the watershed or along the riverbed	Environmental Authorities
Survey data (two-dimensional survey, longitudinal survey of the river and transversal survey of the river)	Results of the transversal and longitudinal surveys of the main river and tributaries, results of the two-dimensional survey of the areas where the flood is registered (urban centers)	Environmental Authorities, IDEAM (transversal data in the stations)

《Column》 Use of Satellite Data

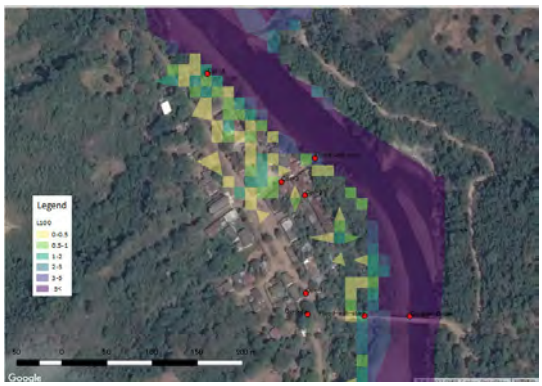
Regarding topographic data of the Rio Negro basin, JICA project's pilot basin, 1: 25,000 scale topographic maps have been prepared and are available throughout the national territory. However, there are only 1: 10,000 scale topographic maps in some regions. The contour line intervals of the topographic maps in Colombia are 25 m for the main curves in the 1: 25,000 scale maps, and 10 m for the 1: 10,000 scale maps . In case of Japan, the main curves are 10 m apart on the 1: 25,000 scale map, and it is 2-4 m on the 1: 10,000 scale maps. In other words, in terms of the interval of contour lines, Colombian maps are less accurate than Japanese maps despite being of the same scale.

In Japan, flood hazard maps (disaster risk reduction maps(flood)) are created with the scale 1: 10,000 to 1: 15,000. This resolution allows for the identification of the individual houses, and takes into account the accuracy of the altitude mentioned above. Therefore, Colombian maps of scale 1: 10,000 are not sufficient to elaborate the flood hazard map, from the point of view of the topographic maps' precision.

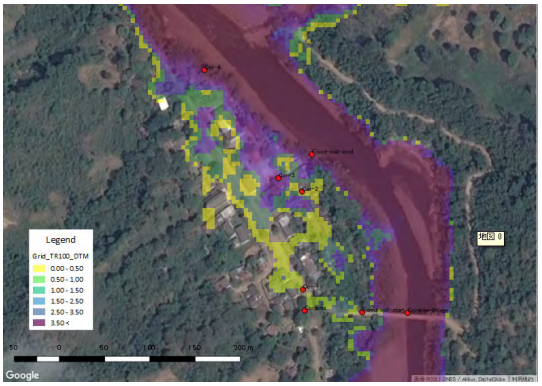
In this context, it was decided to use the satellite topographic data in this JICA project, taking into account its possibile use in Colombia. Since it must be usable throughout the Colombian territory and the price must be accessible, 1) WorldDEM, which has high resolution DSM data with less than 4m error vertically in a 12m pixel were selected (Reference: unit price 15 dollars / km^2 in December 2015).

Additionally, 2) 3D standard topographic data by AW3D, which are DTM data with a pixel size of 5m, were acquired for the area around the main channel of Rio Negro and the main tributaries. This is to improve the accuracy of the model and to study the possibility of its use in Colombia, since surface altitude data with 5m pixel size created based on satellite data had become available for greater areas in Colombia by July 2017 at a similar the price to WorldDEM.

The following figures are flood maps created with the 2 types of satellite data described above (includes the flood depth) (the satellite photos are from Google Map). In spite of the challenges related to the accuracy of the simulation model and the comparison with the real flood area, the satellite topographic data are expected to be useful in Colombia in the future as they have sufficient accuracy for the study of the location of the shelter and the evacuation route.



1) Flood map created with 12m DSM data



2) Flood map created with 5m DTM data

3. Hydrology and Hydraulics

Categorize the hydrological and hydraulic characteristics of the basin and the target river.

【Explanation】

Here, the contents and the results of the study and the analysis of hydrological and hydraulic characteristics of the basin are explained. Ideally, the contents that can explain the characteristics of the flood in the basin and contribute to the study of the measures are described and included. Below are the items (numerals) that should be included in this chapter.

➢ General meteorological, hydrological conditions

The summary of the meteorological and hydrological conditions of the basin is explained.

✧ General meteorological and hydrological conditions

Climatic elements that determine the meteorological and hydrological conditions are explained. For example, the fact that it is located in the intertropical convergence zone (ITCZ). It also includes meteorological and hydrological conditions in general such as the months in which the rainy season and the dry season occur and the average rainfall.

✧ Conditions of Hydrological Observation

The situations of the meteorological and hydrological observation of the basin are explained. It is ideal to organize the information of the stations in a single place, categorizingdata such as the station code, station name, type of equipment, municipality where the station is, location of the station in coordinates, height, period of observation, time of data classification (if it is a hydrological station, the HQ curves and the frequency at which the flow is measured), together with the map showing the locations, in a table, so that it is easy to use as a reference when studying the results of the analysis.

➢ Water levels and Discharge at main hydrological stations

The situation of water levels and discharge in the main hydrological stations (level, discharge) is explained. Ideally, the maximum values of the level and discharge and the results of the probability analysis (level, discharge) of the maximum values are presented, and the flow regime in high and low levels is explained.

➢ Daily Rainfall at main rainfall stations

The precipitation situation in the main hydrological stations is presented. Ideally, the annual maximum precipitation and the result of the probability analysis of the annual maximum value are presented and the annual precipitation, monthly precipitation, maximum precipitation per hour, and the frequency of torrential rain are explained.

To analyze hydrological and hydraulic characteristics,it is essential to collect basic data. Below is a list of the basic data that should be collected and the entities that can provide it, taking into account the experience in this project.

Item	Content	Source
Station data	A list that includes data from meteorological and hydrological stations in the basin, such as the station code, station name, type of equipment, municipality where the station is located, location of the station in coordinates, height, observation period, time of classification of data	Environmental Authorities, IDEAM
Rainfall data (daily, hourly)	Precipitation data (per month, per day, per hour) of the stations in the basin (and within the surrounding basins as needed)	Environmental Authorities, IDEAM
Level data	Level data (per day, per hour, peak level) of the stations in the basin	Environmental Authorities, IDEAM
Discharge data	Discharge data (per day, per hour, peak flow) of the stations in the basin	Environmental Authorities, IDEAM
Observed discharge data, transversal data for each station, H-Q curve	Observed discharge data and data of the cross section of the station (current and past), and H-Q curves (current and past), of the stations in the basin	Environmental Authorities, IDEAM

4. Flood Damage

Organize past floods to categorize items that serve as a reference for the IFMP-SZ, such as flood causes, the flood mechanism, and effective measures.

【Explanation】

Here, the contents of the study and the analysis of the characteristics of the flood and water-related disasters in the basin are explained. Ideally, the relationship between the social, topographic, hydrological and hydraulic characteristics of the basin of the previous chapters is explained, and the contents on the definition of the guidelines of the plan and the study of the measures are explained and included. Below are the items (numerals) that should be included in this chapter.

➢ Inventory of Past Flood Disasters in the Basin

The summary of flooding in the basin and water-related disasters is presented.

✧ Location and Frequency of Past Water-Related Disasters

The contents and results of the study and the analysis of the locations where water-related disasters occurred within the basin and their frequency are presented, based on the list of past disasters in the basin. Ideally, water-related disasters are classified according to the type of disaster (slow flood, flash flood, mud flow, debris flow) landslide, slope failure, etc.

✧ Past Major Flood Events

Major past disasters are selected within the basin, based on the list of past disasters, with indicators of information on disaster damage, such as number of affected people, number of affected homes, and flood area. In order to select the main disasters, one should not only review the individual (local) disaster information, but also consider whether disasters occurred in several places on similar dates, from the point of view of disaster propagation within the basin, to analyze the scale of disasters.

To clarify the criteria of the selection, ideally the analysis is carried out with quantitative information. In order to carry out an appropriate quantitative analysis, it is essential to organize the list of information on disasters, created from a quantitative, precise and fair point of view, using a unified format to collect the information.

➢ Detailed Analysis of Relationship between Flood Events and Hydrogical Coditions in the Basin

A detailed analysis carried out on main disasters, the hydrological conditions during the disaster, and the relationship between them, in order to understand the characteristics of the flood within the basin in a precise manner.

✧ Hydrological Conditions in Flood Events

The observed values of the level and the discharge in the main hydrological stations and the observed values of the precipitation in the main meteorological stations at the time of the occurence of the disaster within the basin are categorized and analyzed, and the results are presented. The analysis must be carried out with the appropriate time scale data (data per hour or per day), taking into account the time of occurence and the duration of the disaster, although there are limitations of usable data. It is recommended to carry out the analysis, not only with the precipitation data of the day of the disaster or a day before, but also with accumulated precipitation data for longer periods (3 days or 5 days rainfall, etc.), according to the need.

✧ Relationship between Heavy Hydrological Conditions and Occurrence of Flood Events

Apart from the "analysis of the hydrological conditions at the time of the occurence of the disaster," the "relationship between large flows and the occurrence of disasters" is analyzed, such as the conditions of the occurrence of disasters at the time when the maximum annual values of levels in the main stations were observed, and the results are presented. Ideally, not only the relationship between the occurrence of the disaster with the day on which an extreme value was observed in a single station but also with the day on which an extreme value of the average rainfall in the basin was observed, the day on which an extreme value was observed at several stations within the basin etc. are analyzed.

✧ Actual Flood Condition in Several Locations based on Flood Survey

For this item, conduct field surveys in places where past disasters occurred, confirm the specific situation at the time the disaster occurred, and present the results. Select places that experienced great damage in the past or places where disasters occurred for field surveys. In field surveys, items that contribute to the detailed analysis of disasters or to the study of measures are studied, such as the date and time of the occurrence of the disaster, the places of occurrence of the disaster (coordinates), the situationes of the damage, maximum depth, duration of the flood, disaster situations, causes of the disaster, actions taken before, during and after the disaster. Ideally, surveys are conducted so that the actual flood area and the depth of the flood can be visualized. Examples of the results of the field studies include calibration of the flood model or simulation.

In field surveys, study vulnerability and exposure that are important in the study of the cause of flood damage. In other words, the elements that are part of the cause of the damage are studied, such as the vulnerability of the structure in the river or buildings, or the location (exposure) of these, the lack of information such as early warning, environment for evacuation and the ability of residents to evacuate.

It is necessary to analyze the results of the above studies comprehensively. The following page shows the examples of the survey sheet used in field studies.

To analyze the flood characteristics,it is essential to collect basic data. Below is a list of the basic data that should be collected and the entities that can provide it, taking into account the experience in this project.

Item	Content	Source
List of disasters	A list of past disasters in the basin, including the date and time of the disaster occurrence, the places of occurrence of the disaster (coordinates), the situation of the damage, detailed disaster characteristics (the context in which the disaster occurred) , the maximum depth, duration of the flood, etc), causes of the disaster, the actions taken before, during and after the disaster. Ideally, a detailed list is drawn up per urban center.	Department, UNGRD, IDEAM (list of floods)
Disaster reports	Materials and reports that summarize the studies related to the disasters that have occurred and the results of the analysis.	Contents of the POT (municipalities), research centers such as SGC, departments, UNGRD
Results of the field surveys in places affected by the disaster	Resultados del estudio de campo en los lugares afectados por el desastre, incluyendo las entrevistas con los residentes.	Researcher (C / P and project team) and residents (through the study carried out by the researcher)

＜Example of Survey Sheet - 1＞

Survey Sheet

Location Name: **Reference No.:**

Inspector name	
Survey date & time	Date: Time:
Coordinate of survey point	Latitude: Longitude:
Interviewee	Name:
	Age: Male or Female: Male / Female
	Since when do they live: Since

<Flood information>

1. Flood in May, 2017

Maximum depth of flood water	m
Time of maximum depth	Time: Date:
Duration of inundation (time&date)	From: to:
Main cause of flood	Heavy rain / Water from main river / Small drainage capacity / Others ( )
Damage by Flood	

"Additional questions, if possible"

2. Maximum Flood in Past

Maximum depth of flood water	m
Time of maximum depth	Time: Date:
Duration of inundation (time&date)	From: to
Main cause of flood	Heavy rain / Water from main river / Small drainage capacity/ others ( )
Damage by Flood	

3. General flood conditions

Frequency of floods	Once a year / times per year Others ( )
Main cause of flood	Heavy rain / Water from main river / Small drainage capacity/ others ( )
Flood conditions	

＜**Example of Survey Sheet - 2 (1/2)** ＞

Interview sheet for confirmation of
required time for warning dissemination and evacuation completion

Date : _____

Interviewee and the belonging : _____

Name of municipality : _____

1. Basic confirmation items

Interview items	Answer
Organization in charge of evacuation order to residents	
✓ Name of the organization	
✓ Name of persons in charge	
✓ Contact No.	
Communication tool for evacuation order to residents	Tel・Wireless radio・Bell・Speaker・Publicity vehicle・ other ( )
Capacity and location of evacuation facility (Plot on a map)	
Evacuation route to evacuation facility (Indicate on a map)	

2. Required time for evacuation

Interview items	Answer
Past experience of evacuation drill	Yes・No Required time for evacuation completion: _____mins
① Required time for residents to prepare for starting evacuation (From receiving evacuation order to starting evacuation)	_____mins
② Required time to move to evacuation facility (From most remote households in inundation area to evacuation facility)	_____mins

3. Required time for warning dissemination

Interview items	Answer
Past experience of communication with upstream municipality	Yes・No
✓ Communication tool	

＜**Example of Survey Sheet - 2 (2/2)** ＞

✓ Organization of the upstream municipality, Name of person, Contact No. in charge	
✓ ③Required time to receive warning from upstream municipality, and confirm the situation	_____mins
(In case of warning dissemination by firefighters through Tel.)	
④ Emergency call of related officers (if necessary)	_____mins
⑤ Required time to call to related firefighting officers (number of persons times ** mins)	_____persons×_____mins＝_____mins
⑥ Dissemination time to residents (number of households times ** mins)	_____households×_____mins＝_____mins
(In case of warning dissemination by publicity vehicle)	
④ Emergency call of publicity vehicle if necessary	_____mins
⑤ Required time to move the publicity vehicle to evacuation target area	_____mins
⑥ Required time to disseminate warning by the publicity vehicle within the evacuation target area	_____mins

Total of the required time for warning dissemination and evacuation completion (①+②+③+④+⑤+⑥) : _____mins

4. Other interview items
   - Have you ever received warning from upstream municipality? If yes, how was the disaster affected situation in your municipality?
   - Have you ever affected flash flood from tributary of Rio Negro? If yes, how often are you affected compared with flood caused by Rio Negro main stream?

《Column》Analysis of the Relationship between Flood Occurance and Hydrological Conditions

In the JICA project, floods and their hydrological conditions were analyzed during the occurance in the Rio Negro pilot basin. Precipitation, water level, discharge, accumulated precipitation up to the date of occurance (of 3 or 5 days), or daily precipitation, and the conditions of the occurance of floods on close dates during which the maximum values of discharge (annual maximum) were recorded were studied. However, in spite of having carried out different types of analysis, several cases were observed where large hydrological values were not recorded on close dates before and after the date of the occurence of floods; therefore, a clear relationship between the occurence of floods and hydrological conditions is not established. The members of the C/P with a considerable experience in the hydrological data commented that according to their experience, in the Rio Negro basin, rainfall from1-2 weeks ago can influence the occurence of floods and that the relationship between precipitation and runoff is not simple. Additionally, the peak levels of the flood may not be recorded in the data used in the analysis (this is because the observation is twice a day as a base rule), or that the dates in the flood record may not be the dates of occurence of flood (they may be dates in which the report was made).

Highly reliable data is required to understand the phenomena correctly. The accumulation of highly reliable data allows for different types of analysis. In the future, the relevant entities are expected to accumulate different types of data in larger volume and to share them while considering how these data can be used.

5. Recognition of the Basin

Organize all the characteristics of the target basin.

【Explanation】

Taking into account the studies of the previous chapters, all the characteristics of the target basin are organized. Ideally, the features are organized integrally so that this content serves for Part B "Planning of IFMP-SZ".

B. Planning of IFMP-SZ

The IFMP-SZ should be a plan that is practical and easy to understand for all. For this purpose, the characteristics of the basin and target river should be studied sufficiently, to reflect them appropriately, and determine the guidelines of the plan.

【Explanation】

To study and formulate an effective and feasible plan, it is necessary to understand the characteristics of the basin sufficiently, reflect them in the plan appropriately and formulate the plan. In Part B, the basic guidelines of the plan are explained, which are the basis for formulating the plan that reflects the characteristics of the basin. To determine the guidelines of the plan, it is necessary to consider compatibility with the main river and the balance between the main river and the tributaries or between upstream and downstream. Below are the contents that this chapter should contain and the study method.

1. Basic Policy for Planning of IFMP-SZ

Determine the basic guidelines for the formulation of IFMP-SZ.

【Explanation】

For the formulation of IFMP-SZ, the important guidelines for the study and formulation are determined and presented clearly. The items to include in this section include the objective of the plan, the relationship with the main river, and the target floods of the plan, the types of flooding, and the target area. Below are the examples.

＜Examples＞

· Objective of the plan: avoid fatal victims in case of flood of the target designscale of the plan in target areas of the plan.

· Relationship with the main river: the conditions of the confluence point with the main river will be control elements of the downstream conditions to study the plan and perform flood calculation.

· Target flood: the target is slow flood and does not include sediment disasters.

2. Target Section

Determine the target areas of the measures plan in the IFMP-SZ.

【Explanation】

Select target areas for the flood prevention plan in the IFMP-SZ, and present the results. Select areas that should be protected from flood damage in relation to the design and implementation of structural measures

The target areas are determined according to the concentration of the population or assets, damage from past floods, vulnerability to flood damage from the topographic point of view, the relationship between the target area and the river, and future development plans.

3. Setting Design Scale

Determine the target scale of the plan (the magnitude of the target flood)

【Explanation】

The target deseign scale of the plan (design scale) is determined in the IFMP-SZ. The design scale refers to "the magnitude of the target flood of the plan." This is determined considering the size of the basin and the river, the socioeconomic importance of the basin, the balance between the main river and the tributaries (balance between upstream and downstream), and the future projection of the basin. An important criteria to consider is the maximum past (recorded) floods of the basin.

The design scale is usually expressed in terms of the hydrological return period. There is an idea that the use of precipitation as hydrological data is more practical because there is more accumulated data compared to the level or discharge data and because it is not affected by the change in the basin and in the channel. However, in Colombia, it is difficult to understand the relationship between rainfall, discharge and magnitude. In addition, the accumulation of precipitation data is not necessarily better than other data. Therefore, it is recommended to select appropriate data by basin. In any case, it is important to sufficiently analyze and understand the relationship between past disasters and hydrological data and the return periods of past floods when disasters occurred.

In Japan, "the magnitude of the target flood in the plan" is the same as "the magnitude of the flood to be controlled by structural measures". However, there is a methodology that defines "the magnitude of the target flood in the plan" and "the magnitude of the flood to control with structural measures" separately. If these are defined separately, "the magnitude of the flood to be controlled with structural measures" is less than "the magnitude of the target flood in the plan," and the floods that exceed "the magnitude of the flood to be controlled with structural measures" is usually controlled with non-structural measures.

To study the design scale, it is useful to use the results of the flood hazard assessment, presented later (Chapter 5).

Additionally, comments are made on the balance between the main river and the tributary. The hydrographic subzones covered in this guideline form parts of macro-basins or hydrographic zones. From the point of view of the rivers, it is common for these hydrographic subzones to be part of a section of a hydrographic zone or of a macro-basin, or that they are tributaries that flow into the main river of a macro-basin or a hydrographic areas. In such a case, to study the tributary plan, it is necessary to take into account the plan of the main river and the compatibility with the main river. For example, if the design scale of the main river is smaller than the tributary design scale, the structural measures in the tributary that allow the design scale flood to flow safely downstream can cause flood in the main river . It is not always necessary to have the same design scale in the main river and in the tributary; however, it is important to "study the plan taking into account the balance between the main river and the tributary river".

- Rainfall-Runoff Modeling

The use of the precipitation-runoff model in the definition of the design scale is described (if a model is developed, if it is possible to develop a model) or the analysis and results of the precipitation-runoff model are presented.

- Setting Target Discharge

The methodology to define the target discharge of the target flood of the plan is explained. The precipitation corresponding to the design scale is determined, and this value can be calculated with the precipitation-runoff model. However, it can also be calculated with the statistical probability analysis with the maximum annual value of the peak discharges of the past floods..

- Consideration of Future Conditions

The changes in the future conditions of the basin that affect its runoff mechanism, such as the change in land use, are explained.

- Setting the Design Scale

The defined design scale is explained. Ideally, here we explain not only the design scale as a conclusion but also the context and the contents of the discussions were taken to come to this conclusion

《Column》 Setting the Design Scale

In the JICA project, a discussion was held on the design scale with case studeies for the municipality of Caparrapi and the municipality of El Dindal, which are areas where flood damage has been observed frequently in the past in Rio Negro pilot basin. Studying the flood area and the flood depth on satellite photography with 4 return periods (2.33, 25, 50, and 100 years), which are the results of the flood simulation, the following points were discussed:

1) Areas to protect (example: protect the area with depth between X m and Y m within the flood area with the return period of Z years) or not protect (example: do not protect the area with depth greater than X m within the area of flood with the return period of Y years since that area is considered the channel).

2) How to protect (to what extent structural measures should be the option for response, what targets should be protected with non-structural measures (example: the area with a depth of less than X m within the flood area with the return period of Y years will not be protected with structural measures, since it does not show frequent damages and the damages are minimal, although non-structural measures will target it).

In the discussion, the development plan and the land use plan in the municipality of Caparrapi were confirmed, since it is necessary to know the projection of the area to be protected. Additionally, the populational composition of the area (if there is a large senior population or not), the projected cost of the measures as well as the cost effectiveness (B/C calculation) were taken into account. It was concluded that "structural measures will be put in place for floods with a return period of up to 50 years to prevent flooding, as it is an area with a large senior population. Flood damage greater than the 50-year return period will be minimized with non-structural measures. "

It is a great challenge to determine the target floods and the area to be protected in Colombia, where the area of the river is not yet clearly defined (it has not been defined in a way that clearly identifies the river area on the map). In the future, the basic principle and guidelines are expected be defined in Colombia, discussing different cases in several basins.

Workshop on setting the design scale

4. Target Discharge

Determine the target discharge of the plan.

【Explanation】

The target discharge of the plan is clearly defined and presented at the plan's control point.

In the case of Japan, the target flood's hydrograph for the structural plan in the flood prevention plan is the basic flood (the basic discharge). If there are no flood control structures, the peak discharge of the basic flood can be used as the (planned) design discharge without modifying it. In case of having flood control structures in the plan, the (planned) design discharge is defined by subtracting the controlled discharge from the basic discharge.

However, in Colombia, there are few examples of flood control structures. In addition, precipitation-runoff analysis is difficult in several areas because the hydrograph has not been prepared (they do not have enough data to perform the analysis). Therefore, it is assumed that for now it is necessary to define the target discharge of the plan using peak discharge values. However, in the future, ideally, the discharge is defined by the runoff model.

5. Flood Hazard Area Assessment

Flood analysis is performed to assess the flood hazard. Flood risk is assessed along with vulnerability analysis in the basin.

【Explanation】

Hydraulic analysis and flood analysis are carried out, and the area and depth of flood in target areas are calculated for different return periods. Data on assets of buildings and housingagricultural and industrial areas are used, (vulnerability data) and the flood risk is assessed.The results of the evaluation can be used in the study of the target scale of the structural measures or of the DRR maps (refer to Chapter 2 of Part C).

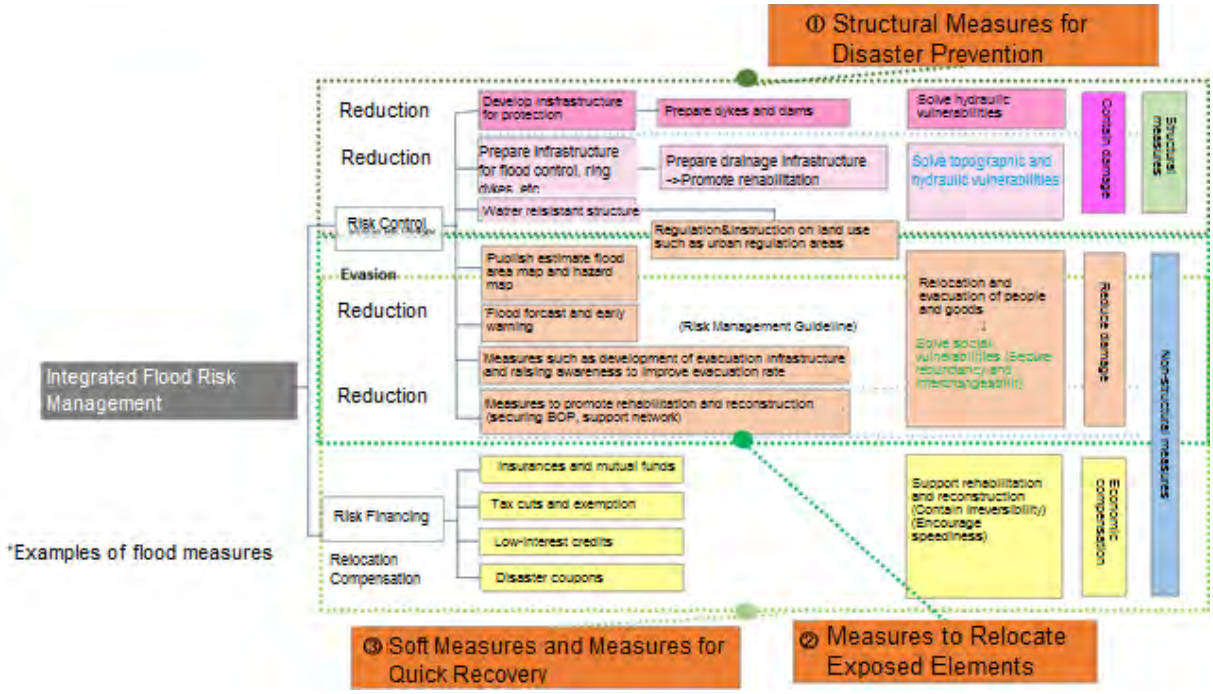
6. Flood Control Options

The flood measures that can be applied in the target basin are presented. Structural and non-structural measures are selected to mitigate floods as a basic idea of comprehensive flood prevention.

【Explanation】

The options of flood measures, structural measures and non-structural measures that can be applied in the target basin are presented, taking into account various characteristics of the basin and the

river, including the characteristics of the flood. Part C specifically explains what measures are applied in each target area and how to apply them.

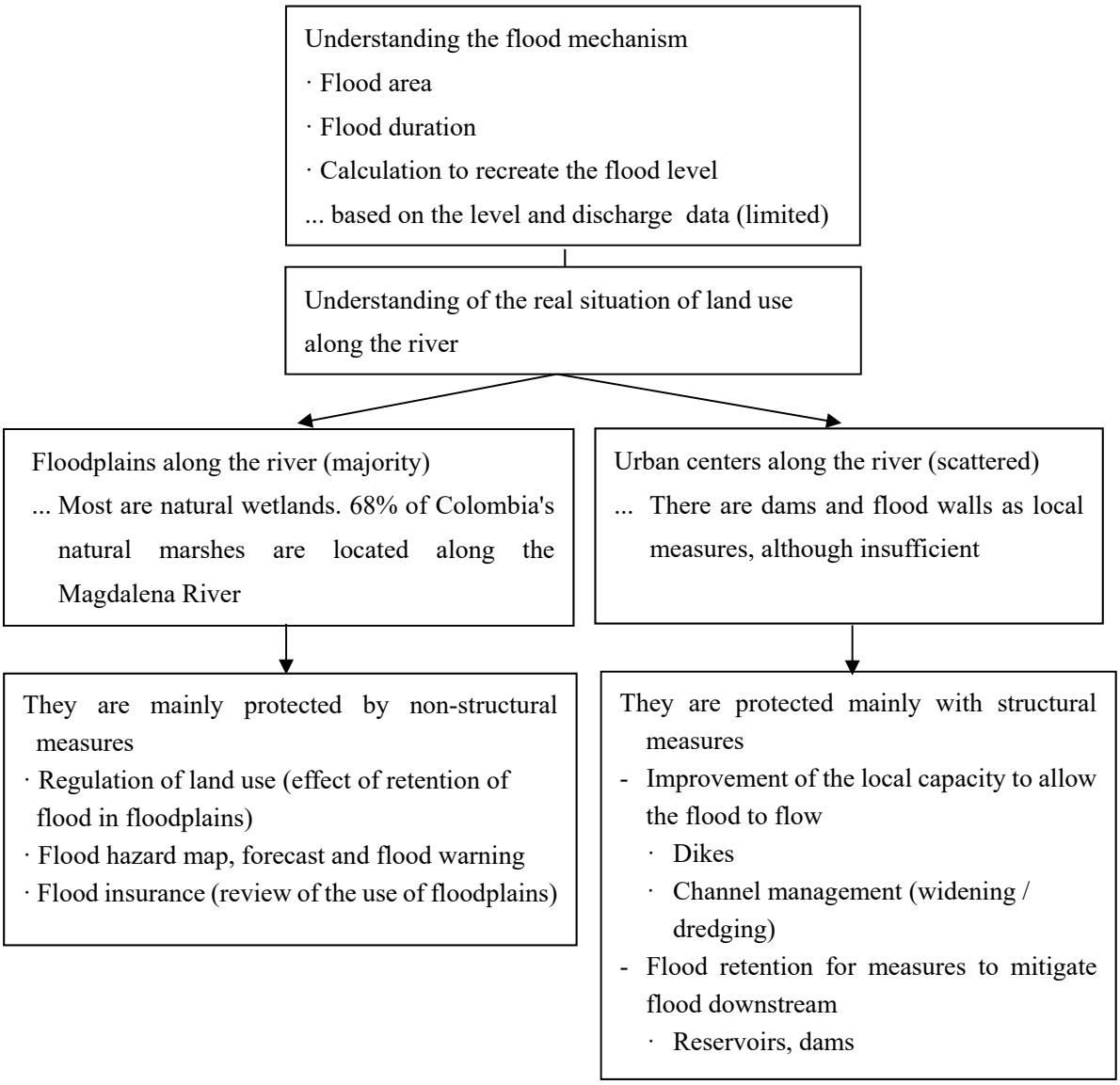


When considering flood prevention measures, in addition to measures in riverbeds and floodplains, we will also consider measures to control runoff from river basins to riverbeds, such as forest conservation, conservation of wetlands and marshes, and structures of control in the river basin.

Flood measures can be divided into two categories, structural measures and non-structural measures. The following table shows the main measures of each category:

Among these measures, in terms of structural measures for river channels and floodplains, it is necessary to examine several alternatives in consideration of the impact on other sectors, such as the use of rivers. Then, it is necessary to carry out an integral evaluation in an objective fashion, from the point of view of feasibility based on natural, social, technical and other limitations, social utility of the structure, economic efficiency, and environmental impact, etc.

Study and analysis of the need for response to flood risk



C. Implementation Program

Formulate an effective and concrete plan of measures to mitigate floods, taking into account the characteristics of the target basin and the target river, following the guidelines of the plan.

【Explanation】

To formulate and implement an effective and feasible plan, it is necessary to properly understand various characteristics of the target basin and the river, including the characteristics of the flood, formulate the guidelines that take these characteristics into account, with which the relevant entities they agree, and follow these guidelines to formulate a concrete plan in accordance with the reality of the entire basin and the points within the basin. In Part C, specific flood measures are explained, including the specific details of the structural and non-structural measures and their evaluation, and the monitoring plan that considers the revision of the plan and methods of implementation is presented. Below are the contents that this chapter should include and the study methods.

1. Structural Measures

Structural measures are effective as measures to directly reduce flood damage.When it comes to structural measures, it is important to seek a balance between its purpose, its effects, economic assessment, places that benefit from the measures and places that are negatively affected by the measures.

【Explanation】

Structural measures are effective to prevent flood damage to a certain extent.Structural measures can be divided into two categories: measures that improve the ability to allow the flood to flow, and measures that temporarily hold the flood around the river to slow runoff to the river and reduce peak flood discharge.

Options for Structural Measures

	By Strategies of Flood Control	In-stream	Watershed	Information
Prevention and Mitigation	Reducing Flooding			
	Dikes, levees and polders	✓	✓	
	Diversion channels, short-cut	✓	✓	
	Channel improvements	✓	✓	
	Dams and reservoirs	✓	✓	

1) Dikes/flood walls

Dike / flood wall is a structure to prevent the flood flow from overflowing into the area protected with the dike/flood wall. Dike / flood wall is a measure that works effectively when it is built continuously.

Since it is not realistic to contemplate the continuous installation of these structures along the entirety of the rivers in Colombia from the point of view of land use and cost, these structures are valid measures of local protection of (to circle) the municipalities along the river where the population and the assets are concentrated.

The rupture of dikes and flood walls is a direct cause of disasters. Therefore, its durability and safety are important. Normally, the dike is constructed using the sediments of the river bed and near the construction site. As there are some criteria on whether the particle size, viscosity, etc. of sediment are suitable materials for the dike, the technical document on the materials for dikes should be consulted.

Flood wall	**Dike**
- Prevent the entry of flood with a wall. - Structure of metal and concrete ▲ High implementation cost 	- Prevent the entry of flood with a slope of land. - As a base rule the sediments of the target river are used ▲ Cheaper than a flood wall, but require measures against erosion in steep rivers. 

2) Cut off work

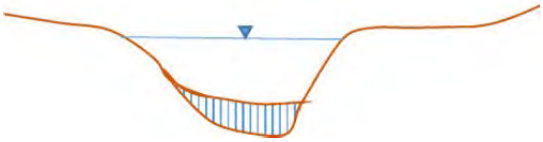
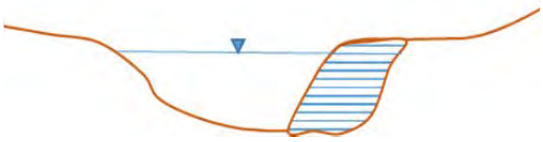
It refers to the measure where a meandering channel is straightened to increase its capacity to allow the flood flow.

By straightening the channel, the capacity of the channel to allow the flood to flow is increased, since the length of the channel is reduced and the slope of the riverbed is increased. However, in rivers that have a stable river bed with meanders, this stability will be lost. For example, upstream of the shortened section, water velocity is increased and sediment transport is facilitated, deepening the riverbed. In contrast, in waters below the shortened section, there is a possibility of sediment accumulation. It is important to take into account the above described to implement this measure, from a long-term stability point of view.

In Colombia, cut off work has been implemented in the Canal del Dique, in the section below the Magdalena River, in order to reduce the time required for navigation.

3) River channel improvement

It is a measure where the channel capacity is increased to allow the flood to flow, increasing the area of the cross section of the river by widening or dredging the channel.

Dredging the river bed	Channel expansion
- Carry out dredging in the channel bed, increase the channel area where water can flow and reduce the level of flooding. ▲ It requires hundreds of meters of dredging in the longitudinal direction. Maintenance problems 	- Expand the channel horizontally, increase the channel area where water can flow and reduce the level of flooding. ▲ Requires hundreds of meters of amplification in the longitudinal direction. Maintenance problems 

4) Reservoir / dams

Reservoir is a structure that counteracts flood by storing flooding outside the riverbed in the plains on temporarily to reduce the flow in the channel downstream the reservoir during the flood.The area where the wetlands extend along the river can now function as a natural reservoir in some cases. By preserving the current condition by regulating development, etc., it is possible to maintain the function of storing flood. If there are areas that can not be flooded around wetlands, such as residential areas, there is also a method of building a dike around the area that preserves the function of storing the waterand.

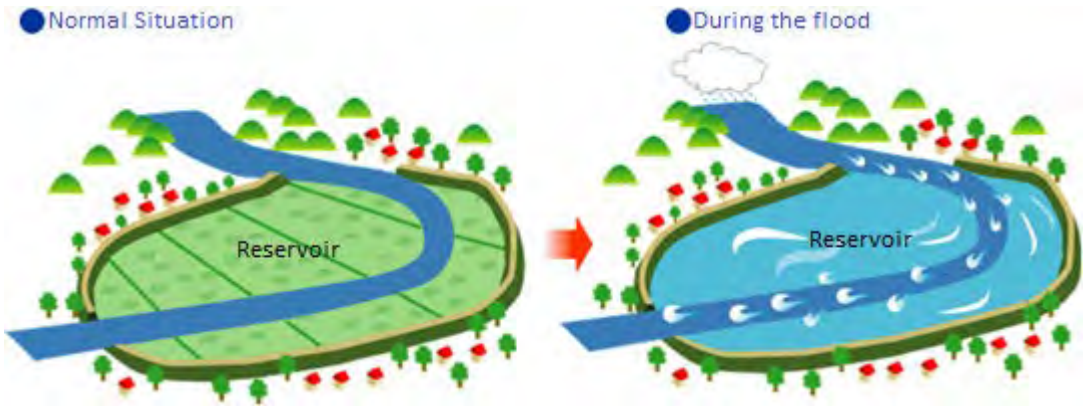


Figure Summary of the function of flood control with reservoir
(Source: Iwate Office of the river and national roads, Ministry of Land, Infrastructure, Transport and Tourism, Japan (MLIT))

The dam for flood control is a structure that controls the discharge of the channel below the dam during the flood by temporarily storing the river water in its reservoir. The water stored in the reservoir of the dam is gradually released downstream after the flood.

In Colombia, there are dams for hydroelectric generation or the water use. If the function of flood control is added, they are converted into multipurpose dams.

In Japan, there are several multipurpose dams that have functions of flood control, hydroelectric generation, water use and the environment.

Example of multipurpose dam
(Source: MLIT website)

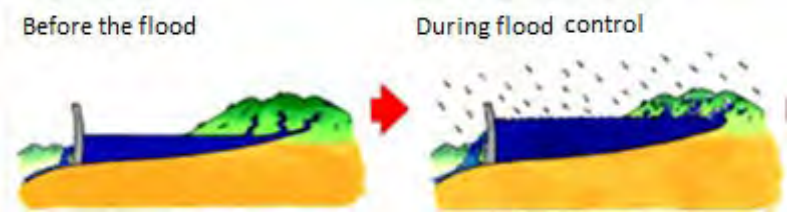


Figure Summary of flood control by dam (Source: Web page of the Chubu Region Planning Office, MLIT)

2. Non-Structural Measures

Non-structural measures are measures to reduce flood damage used along with structural measures. They are also measures that have the effect of minimizing damage in the event of a flood that exceeds the design scale of the structural measures plan.

【Explanation】

Structural measures represented by levees / retaining walls directly alleviate flood damage. However, if the flood design scale, levees alone can not mitigate floods completely. Non-structural measures are studied for such cases.

Options of Non-Structural Measures

	By Strategies of Flood Control	In-stream	Watershed	Information
Prevention and Mitigation	Preserving the Natural Resources of Floodplains	✓	✓	
	Floodplain zoning and land use regulation	✓	✓	
	Reducing Susceptibility to Damage	✓	✓	
	Floodplain regulation, storm water retention	✓	✓	
	Surface water infiltration		✓	
	Flood proofing buildings and facilities			
Preparedness and Response	Flood forecasting and warning	✓	✓	✓
Rehabilitation and Reconstruction	Flood insurance	✓	✓	✓

1) Land use regulations in floodplains

It is realistic to reduce flood damage by reducing the discharge with flood storage in the floodplains to control the flood in the principal rivers without dams that have immense floodplains.

For this purpose, it is important to consider the concept "floodplain management = land useregulation " as measures to mitigate floods.

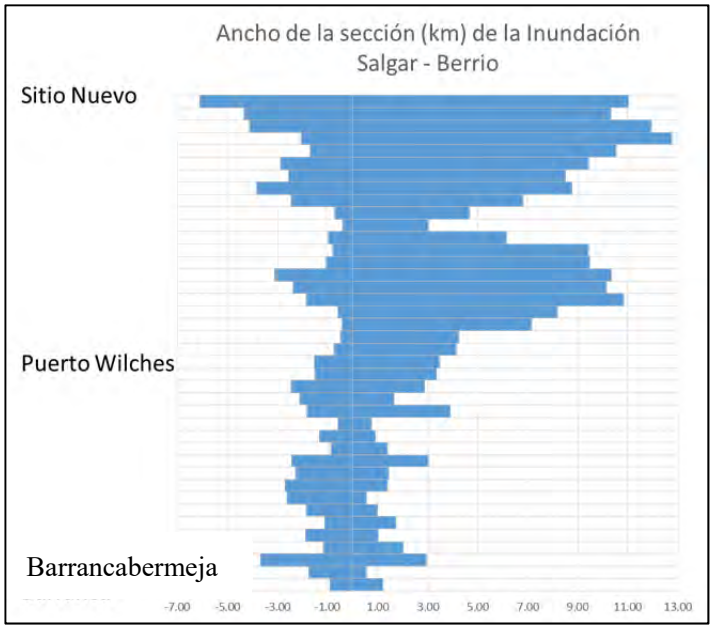
For example, approximately 68% of Colombia's natural wetlands are located in the Magdalena River basin. Therefore, wetlands and marches are important medium between developed areas and the river.

Wetlands and marshes in the basins store flood in the same manner as dams, and delay the runoff into the principal river, reduce the discharge and contribute to the reduction of flood damage. The conservation of these wetlands is not only an effective and feasible method from the point of view of the flood measures but also from the environmental and economic point of view.

The proportion of the flood that flows through the floodplains is high, and the development of the floodplains should be avoided as much as possible, in order to reduce flood damage.

Below is an example of the calculation of non-uniform flow, where the data set of the cross sections of the channel and floodplains were prepared with the topographic survey data (IDEAM) and the height data obtained by satellite images, taking into account the middle basin of the Magdalena River as the target area, based on the idea of "considering the floodplains as part of the river".

In this case, the flood width was maximum 17km during the flood, and that the flood can be seen flowing through the floodplains.



As presented in the chapter 3 according to the Ministry of the Environment and Sustainable Development, progress is being made in the revision of the Ronda Hidrica, taking into account the experiences of the 2010-2011 flood, as a basis for the land use regulation in floodplains.The key points of this process are the following:

· The Ronda will be delimited from the hydrological (floods), ecosystem and geomorphological points of view,

· The Ronda will be defined using the outer-most line of the three elements described above.

· The zone between the previous Ronda and the new Ronda will be a conservation zone.

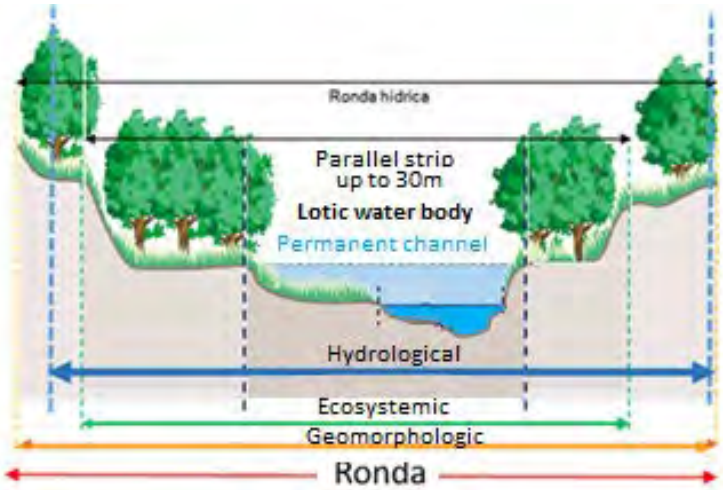


Figure Ronda taking into account 3 elements

Regarding the hydrological point of view (floods), the flood wirg the return period of 25 years is taken into account (calculation in process).

The process of legalization is in process. The figure that summarizes these concepts is presented below:

On the right is an example in Puerto Wilches prepared by the Ministry of Environment.

Red : outer-most line : Ronda (new)
Green : Hydrological area (flood area, 25 years return period)
Blue : old channel
Purple : geomorphological area

Figure Example of Delimiting New Ronda in Pto.Wilches

2) Forest Conservation

Forest conservation as measures to mitigate flooding refers to the control of the discharge and sediment runoff during the flood with the reduction of runoff in lands without vegetation by means of tree planting or the improvement of underground penetration of the precipitation through partial cutting of forests.

As shown in the following figure, planting trees on land without vegetation delays surface runoff, and surface runoff is reduced by the ease of underground penetration of precipitation and the consequent increase in secondary runoff. In case of cutting trees down for development, it is necessary to study appropriate measures, such as the limitation of the deforestation area, considering the influence of runoff from precipitation.

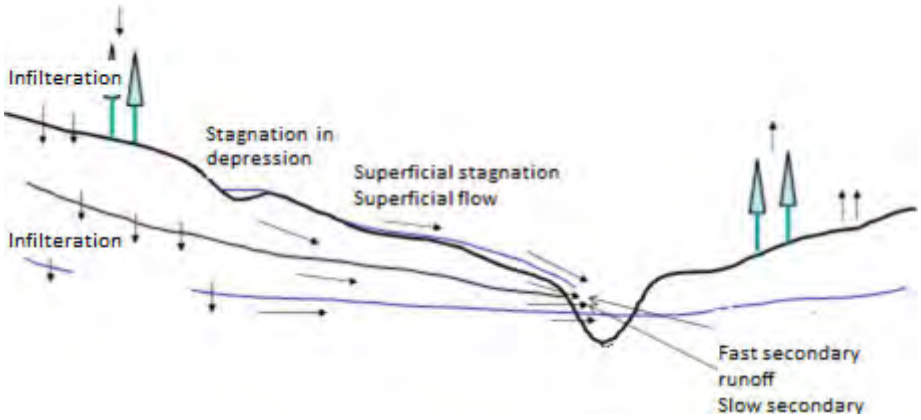


Figure　Mechanism of Precipitation Runoff

3)　Organization of the flood disaster risk reduction map

The disaster risk reduction map (flood) is a map that is made with the main goal of preventing damage to the population, providing residents with information related to flood and evacuation in a way that is easy to understand.

The disaster risk reduction map (flood) contains the projected flood area, the location of the shelters, and evacuation routes. Residents evacuate referring to this map in case of flooding, and flood damage is minimized.

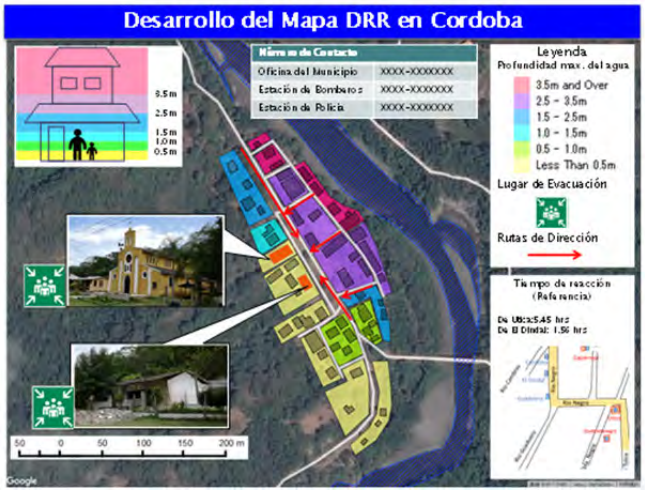


Figure　Example of Disaster Risk Reduction Map (flood)

4) Flood forcast and warning

Flood early warning refers to the issuance of alert as needed, which shows the water level and discharge during the flood and which serves as a reference for flood prevention activities due to overflow or increased water level of the river, or for evacuation of residents. The flood warning is issued based on the results of the observation of the level and precipitation and the results of the water level forecast based on the runoff calculation. Flood warning is used for flood prevention activities of departments and municipalities, and is communicated to local residents through municipalities and communication systems.

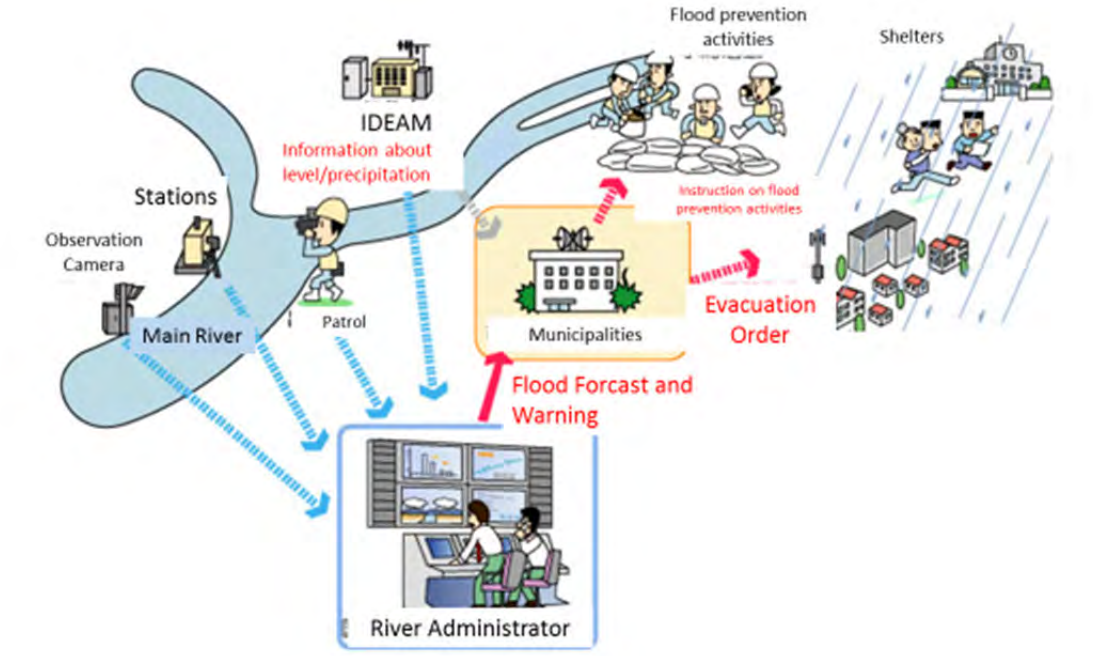


Figure Summary of the flood forecast and warning (Source: Website of the MLIT)

《Column》Other Non-structural Measures

Flood insurance is presented as an example of other non-structural measures.

Flood Insurance

Flood insurance is a way to regulate and guide the land use within the floodplains in order to prohibit or control the construction of housing in these areas.

Currently flood insurance does not exist in Colombia. However, in the United States there is an example of the flood insurance system led by the federal government.

In the case of the USA, it is basically forbidden to live in the floodplains. However, residents who decide to live in the floodplains are required to obtain flood insurance. In order for a resident to obtain flood insurance, their municipality must be affiliated with the flood insurance.

In the US, the federal government has no responsibility to compensate victims for flood damages.

In the US, FEMA (Federal Emergency Management Agency) performs risk mapping, risk assessment and plan formulation (the risk map program), identifies flood hazards and assesses the flood risks. This data is entered into the flood maps called FIRM (Flood Insurance Rate Map). These are the basis of support from the national flood insurance support program, community floodplain management standards, and conditions for affiliation with flood insurance.

Regulations in flood insurance in the US.

- Standard flood has 100-year return period
- The flood hazard area is divided into "floodway" and "fringes".
- The passage of the flood is determined by the engineering study of the river
- "Fringes" are the areas between the floodplains of the 100-year return period and the passage of the flood.

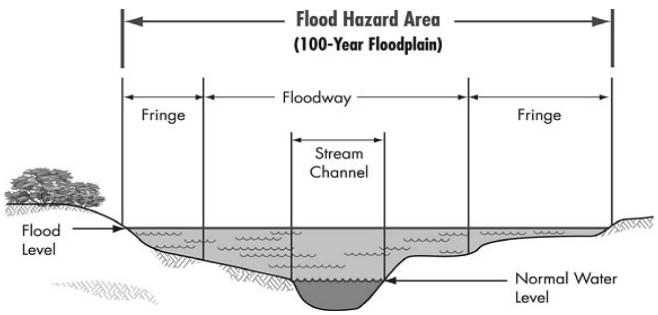


Figure Flood Hazard Area

3. Proptitizing Measures

Prioritize the planned measures

【Explanation】

The structural and non-structural measures planned in Chapter 1 and Chapter 2 are prioritized. The priority is studied by taking into account the effectiveness of the measure, the time required for the measure to take effect, social conditions and assets in the target area. Ideally, the guidelines and justifications for prioritization should be clarified and explained.

4. Comprehensive Evaluation

Carry out the comprehensive evaluation of the planned measures

【Explanation】

Comprehensive evaluation of the planned measures is carried out. The evaluation is performed by considering feasibility according to natural and social conditions, social benefit of the structures and economic efficiency. This is applied mainly to structural measures.

There are Initial Environmental Examination (IEE) and Environmental Impact Assessment (EIA), which are feasibility assessment methods according to natural and social conditions.

In terms of economic efficiency, the benefit-cost (B-C) or cost-benefit (B / C) assessments are proposed. The detailed explanation of the methods of the cost-benefit assessment (B / C) can be found in Appendix-2.

To perform comprehensive evaluation, it is essential to collect basic data. Below is a list of the basic data that should be collected and the entities that can provide it, taking into account the experience in this project.

Item	Content	Source
Data on distribution of buildings and homes	Footprint data containing the location of buildings and homes and sizes in the target area) (maps or GIS data)	Municipalities, departments, project team (digitization of satellite images))
Building information	Detailed information about the properties, such as types of property (public infrastructure, hospitals, schools, churches, housing, etc.), and the number of floors.	Municipalities, IGAC, corresponding entities (through UNGRD)
Detailed data on land use	Visual data on detailed land use such as delimitation of land use, crops on agricultural land (maps or GIS data).	POMCA (CAR), IGAC
Data on values of assets (price)	Value by area according to type of property, value of household items,	IGAC (on the values of goods in urban

	value of crops, value of public infrastructure, per target area (usually by municipality)	centers or rural areas by municipality, through UNGRD)
Data for the calculation of costs of the work	Cost of construction of the structure, cost of land required, cost of compensation, data necessary to calculate maintenance cost and administration per unit	Environmental Authorities, departments (ICCU)

5. Monitoring Plan

Formulated the monitoring plan to provide feedback to the formulated plan.

【Explanation】

The IFMP-SZ is about natural phenomena, and there is a limit to the conditions included in the planning stage. Additionally, the data in the hydrographic subzones of Colombia have not been organized, and the information necessary for the formulation of the plan is not well categorized. Therefore, it is necessary to carry out monitoring to provide feedback on the IFMP-SZ of the future. The IFMP-SZ is a plan that needs to be reviewed and corrected periodically.

There are two categories of monitoring: periodic monitoring and monitoring after the flood (after large discharge). Below are examples of items that should be monitored.

<Periodic monitoring>

- Collection and organization of precipitation and level data
- Observation of the flow
- Study of changes in the river bed
- Study of the use of the river and the ecosystem
- Study of the conservation of floodplains

<Monitoring during or after large discharge (flood)>

- Observation of the level and discharge data during the flood
- Study of changes in the riverbed
- Study of the use of the river and the ecosystem
- Study of water retention in floodplains

6. Implementation Schedule

Develop an implementation plan for the flood prevention plan and monitoring plan that were formulated.

【Explanation】

The implementation process is designed per stage (study / planning, implementation, maintenance) for each item of the measures of the flood prevention plan, including structural measures and non-structural measures, and the monitoring plan. They are presented with figures and tables.

A feasible implementation plan should be formulated, taking into account the budget of the entities responsible for implementation, etc.

D. Allocation of Responsibility for Planning and Implementation of IFMP-SZ

Define specific role sharing among responsible entities and relevant entities for the formulation and implementation of IFMP-SZ.

【Explanation】

In Colombia, it is not clear which entity is responsible for river administration and flood control, nor is it clear which entity should formulate the IFMP-SZ and implement the measures based on the IFMP-SZ. To study and formulate an effective and feasible plan and to implement the plan in an appropriate manner, the responsible entities and the division of responsibilities must be clarified. In Part D, the contents and results of the discussions and studies of the role sharing among entities related to the IFMP-SZ are described. Below the contents that should be included in this chapter and the method for discussion and study are explained.

1. Current Situation and Issues

Categorize the current situations of role sharing to formulate the IFMP-SZ and implement the activities based on the IFMP-SZ as well as the challenges in the target watershed.

【Explanation】

Current situations of the role sharing are categorized to formulate the IFMP-SZ and implement the activities based on the IFMP-SZ as well as the challenges in the target basin. To describe the current situations, entities that perform flood control and implement flood measures in the target basin are identified, the current contents of their activities and the legal justification are confirmed and analyzed, and the results are organized. The current challenges and the challenges discovered should also be categorized through the analysis of the current situation.

2. Discussion in the Workshops / Seminars

Discuss the role sharing related to the formulation of the IFMP-SZ and its implementation, the current situation, challenges and future perspective among the entities related to flood control.

【Explanation】

The entities related to flood control in the target basin should meet to discuss the items related to the formulation and implementation of the IFMP-SZ, the current situation of the role sharing, challenges and future perspective. The results of the discussion should be organized in an way that is easy to understan, with figures and tables.

Items to implement			Central Governmanet			Regional Government		
			UNGRD	MADS	IDEAM	CUNDINAMARCA (Departamento)	CAR	Municipio
Recognition of problems	Understand flood damage situations	Where did the flood occur? The magnitude of the damage (response just after disaster)	Support during large scale flood		Information providing	Support during mid scale flood		○
		The magnitude of the damage?						
		The cause of the flood?			○		○	○
	Comprehensive assessment and organization of problem (current situation)						△	
	Comprehensive assessment and organization of problem (ideal)		Support			Support	○	Support
Study measures	Determine the goal of flood risk management (current situation)						Support	○
	Determine the goal of flood risk management (ideal)			○	Information providing		○	○
	Where will these measures be implemented? (current situation)						Support	○
	Where will these measures be implemented? (ideal)			○	Information providing		○	○

○ : Principle entity

Items to implement				Central Governmanet			Regional Government		
				UNGRD	MADS	IDEAM	CUNDINAMARCA (Departamento)	CAR	Municipio
Implement structural measures	Planning of flood prevention structure	Flood wall / Bank protection etc	Study and design			Information providing		○	
			Works			Information providing	○	○	Support
			Maintenance and administration / Monitoring			Information providing	○	○	○
	Sediment control	Sediment retention dams (SABO dams)	Study and design			Information providing		○	
			Works			Information providing	○	○	Support
			Maintenance and administration / Monitoring			Information providing	○	○	○
		Dredging in the confluence with the tributary	Study			Information providing		○	
			Works (dredging etc)	Support			○	○	Support
			Maintenance and administration / Monitoring				○	○	○
Implement non-structural measure	Land use regulation	Disaster Risk Reduction Map (DRR Map)	Collect information and identify flood areas			○		○	○
			Runoff and flood analysis			Support		○	
			Creation and distribution of DRR Map			○		○	○
		Land use regulation in floodplains (Conservation of wetland)	Policy and guideline		○				
			Study and planning			Information providing		○	○
			Regulation / Monitoring					○	○
	Flood forecast and warning	Improvement of the flood forecast and warning system	Observation oof precipitation and water level			○	○	○	
			Water level forecast			○	○	○	
			Organization of the system (communication of information)	○		○	○	○	○
		Raise awareness among residents	Preparation of brochures and carrying out orientations				○		○
	Response to flood	Improvement of the flood response system		○			○		○
		Improvement of the issuance of evacuation order					○		○
		Improvement of flood response activities and establishment of shelter		○			○		○

○ : Principle entity

3. Allocation of Responsibility for Planning and Implementation of IFMP-SZ

Define the role sharing related to the formulation and implementation of the IFMP-SZ.

【Explanation】

The role sharing related to the formulation and implementation of the IFMP-SZ is summarized in such a way that the responsibility of each entity is clearly understood. The role sharing is organized and described so that each entity can carry out specific activities, detailing who performs the study of floods that will be the basis for the study of the plan, who performs the analysis, who carries out the comprehensive evaluation and defines basic guidelines, who plans and implements each structural or non-structural measure, who would be the main entity and who would be the support entity.

E. Revision and Update of IFMP-SZ

Review the content of IFMP-SZ at an appropriate time after preparation and update the content of the plans as needed.

【Explanation】

IFMP-SZ deals wuth natural phenomena, and there is a limit to the understanding conditions in the planning stage. Additionally, a flood of great magnitude can occur after the plan is formulated, causing a phenomenon that exceeds the assumptions in the planning stage. There may also be changes in entities related to flood prevention. In part E, the review and update of IFMP-SZ are explained, as well as the procedure and frequency. Ideally, the procedure and frequency are clearly indicated, for example, carrying out a periodic review (example: 5 years) with results of periodic monitoring, performing a discharge (flood) with monitoring results and flood studies, or after a change in the relevant entities, among others.

APPENDIX 1

Technical Guide on Necessary Works for River Planning focusing on Flood Control

Version 1.2

May 17th, 2016

JICA Project Team

TABLE OF CONTENTS

1 General

This guide was prepared for the river planning of Magdalena River and Rio Negro river basin in the course of the activity in JICA Project.

The target reader of this guide is the technical officer who will work for the flood risk management in Colombia under IDEAM, UNGRD, CAR. Department of Cundinamarca and MADS with CORMAGDALENA. Also it is believed that all the other responsible organizations for flood risk management are interested in this guide.

This current version (version 1.2 as of May 17th, 2016) is documented focusing on river planning process considering the Magdalena River, however it is expected this planning process is referred to other macro basins and sub-zones.

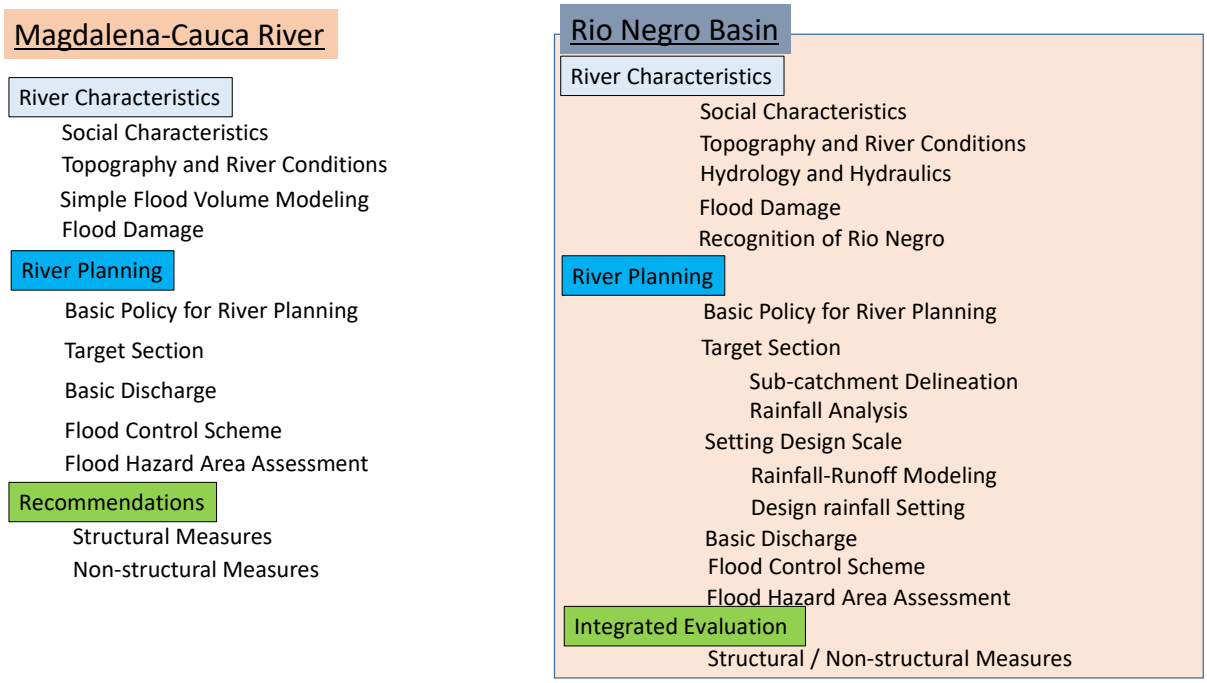
It is emphasized that the preparation process described in Chapter 3 of this guide would be the basis to understand the river characteristics for the river planning. It is recommended the work in Chapter 3 will be included in the POMCA of each sub-zone.

This guide shall be improved and modified further based on the discussion in the Workshops in the JICA Project.

2 Process of River Planning

The process of river planning is composed of 3 basic steps. They are “Understanding River Characteristics”,” River Planning itself” and “Comprehensive Evaluation”. Figure 2-1 shows the basic process together with the practical work items with a mind to the river planning for Magdalena River and Rio Negro according to the JICA Project scheme.

The main output of the river planning is the recommendation on structure measures and non-structure measures for the present and the future flood hazard area. The actual process to achieve the main output of the river planning should be different among the Magdalena River and the Rio Negro due to a lot of difference in terms of the river scale and physical and social characteristics.



Source: Workshop Material on Nov.3, 2015 by JICA Project Team

Figure 2-1 Contents of River Planning for Magdalena River and Rio Negro Basin

3 Preparation

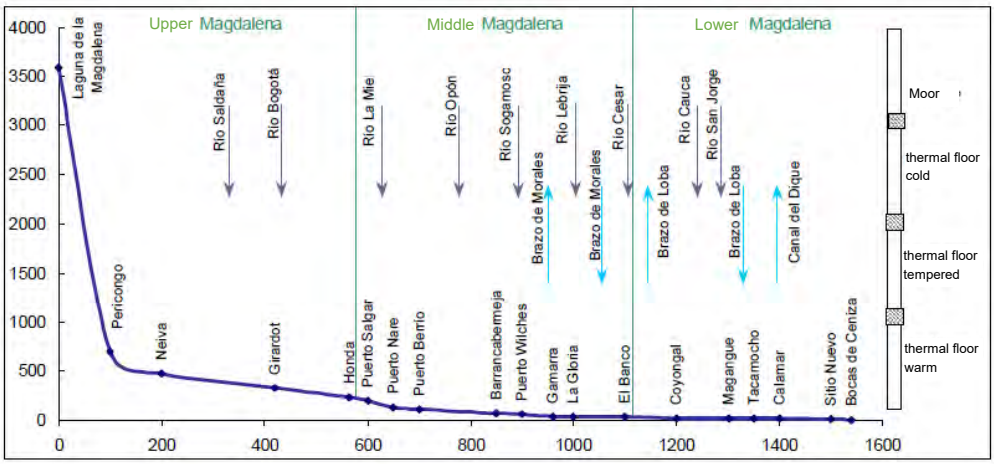
3.1 Longitudinal River Profile

3.1.1 Work 1: Longitudinal Profile of Elevation

In the river planning, the first thing to do is to see the longitudinal profile of the main river course from downstream to upstream. The profile should contain the lowest bed elevation, the elevations of both left and right bank, the lowest floodplain elevation of both banks, and the locations of artificial structure and its significant elevations.

Such longitudinal profile of a river can give us the following viewpoints.

- General river slope (steep, mild or flat) and its significant change from downstream to upstream
- General profile of river depth (between the lowest bed elevation and the bank elevation)



Source: Adaptado de CORMAGDALENA-IDEAM, 2001, and Longitudinal profile data provided by CORMAGDALENA

Figure 3-1 currently available Longitudinal River Profile for Magdalena River

Figure 3-1 is the currently available longitudinal river profile, often shown in many documents. For the river planning purpose, the following items should be added based on the river cross section data.

- lecho del río(riverbed)
- altura del dique(dyke height)
- altura de banco(bank height)
- altura de llanura de inundación(floodplain height)

Figure 3-2 shows the common process for preparation of river longitudinal profile.

In the case of Magdalena River middle reach, in IDEAM, there are the surveyed cross section data available from Puerto Salgar and El Banco. However, the cross section data is generally covering the river channel only. In order to prepare the profile of flood plain elevation, supplemental information such as digital elevation model is needed.

In the case of Rio Negro main stream, in CAR there is the surveyed cross section data available from the river origin to Utica. However, the cross section from Utica to Puerto Libre is not available. For this issue, digital elevation model such as WorldDEM TM 10m can be used to detect the river bank and floodplain elevation. However, WorldDEM TM 10m is the DSM (Digital Surface Model), so that the accuracy of ground elevation is lower than the topographical survey data.

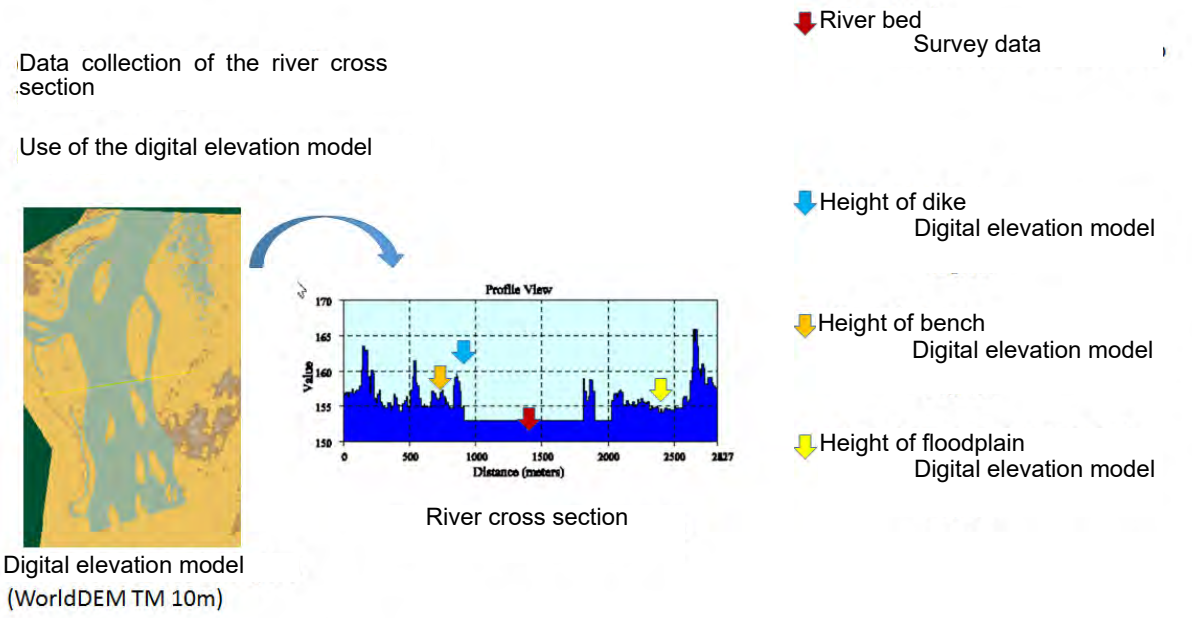


Figure 3-2 Common Process for Preparation of Longitudinal River Profile

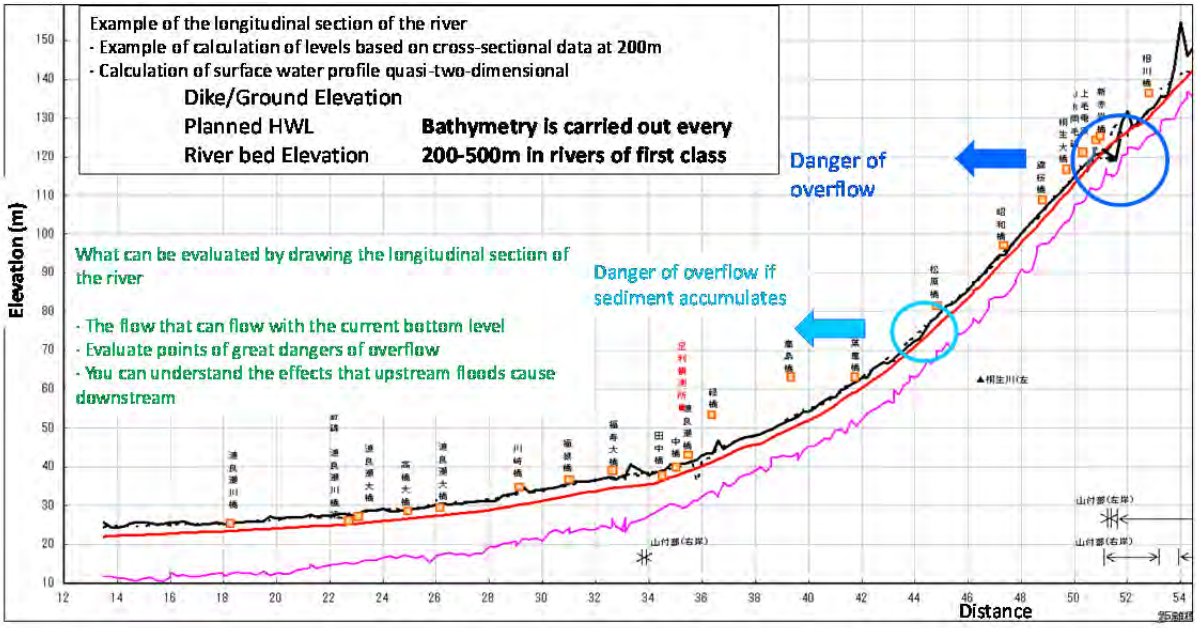


Figure 3-3 Example of Longitudinal River Profile

3.1.2 Work 2: Longitudinal Profile of Channel Width

The second thing to do is to see the longitudinal profile of the river width from downstream to upstream. The river width can be automatically evaluated by the bank location which was detected in the preparation of Work 1.

3.1.3 Work 3: Longitudinal Profile of Channel Flow Capacity

The third thing is to evaluate the channel flow capacity of the main river course and present the resultant capacity in m^3/s longitudinally from downstream to upstream. The channel flow capacity can be defined as the discharge in m^3/s which can pass through the river / channel below the bank elevation. The channel flow capacity is easy to calculate when the channel shape is artificial such as rectangular and trapezoidal, however in Colombia the channel is usually under natural conditions, so the evaluation of such natural river needs some work and a technique.

3.1.3.1 Hydraulic Basics

The flow capacity "Q" can be defined as follows,

$$\mathrm{Q} = \mathrm{K} \times I^{1/2}$$

$$\mathrm{K} = \frac{1}{n} \times A \times R^{2/3}$$

"K" is the Conveyance (m^3/s) of a channel cross section. "n" is the manning's roughness, "A" is the flow area (m^2), and "R" is the hydraulic radius of the cross section. "I" is the hydraulic slope of the concerned cross section.

Among the parameters mentioned in the above, "n" and "I" shall be given externally. The conveyance for natural river cross section can be calculated using the hydraulic software, for example HEC-RAS version 5.0.

3.1.3.2 How to evaluate the conveyance in natural river section

In IDEAM, there are the surveyed cross section data available from Puerto Salgar and El Banco as shown in Figure 3-4.

The practical work procedure to evaluate the channel flow capacity for each cross section is as follows.

Figure 3-4 Location of IDEAM Cross Section Data in Magdalena Medio

Step 1: Set up River Reach system and Input Cross Sections

Set up a river reach in Geometric Data window and input the cross section data. If there is already a river station of the cross section, it is recommended to set up the river reach system considering the steady flow simulation.

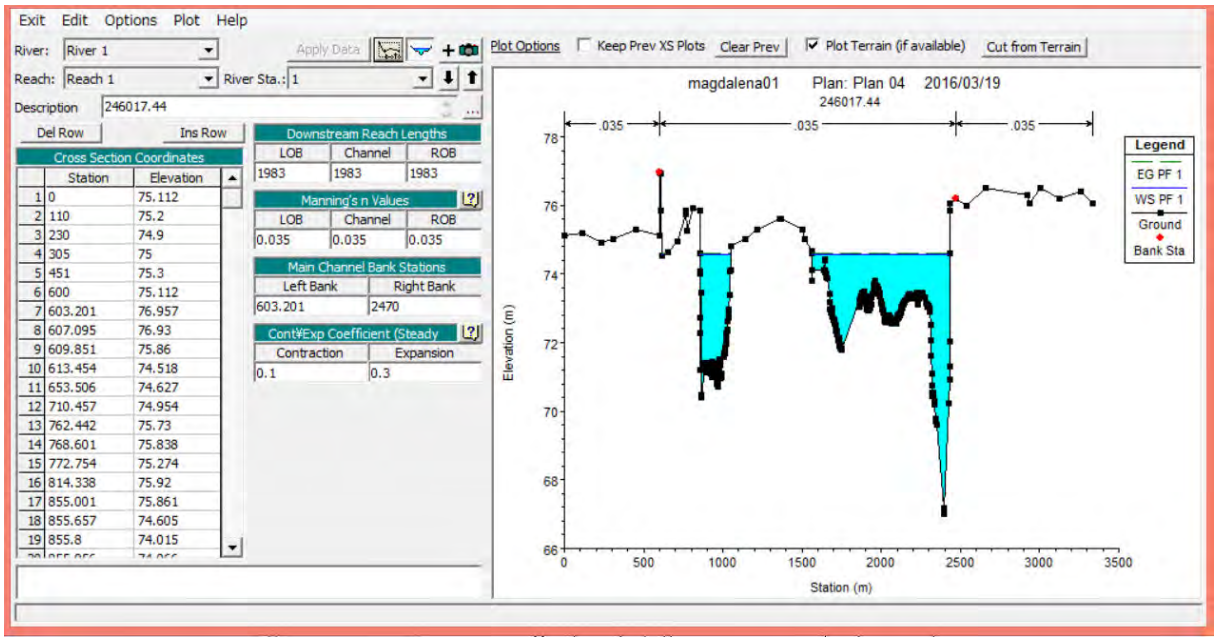


Figure 3-5 Cross Section Data Window

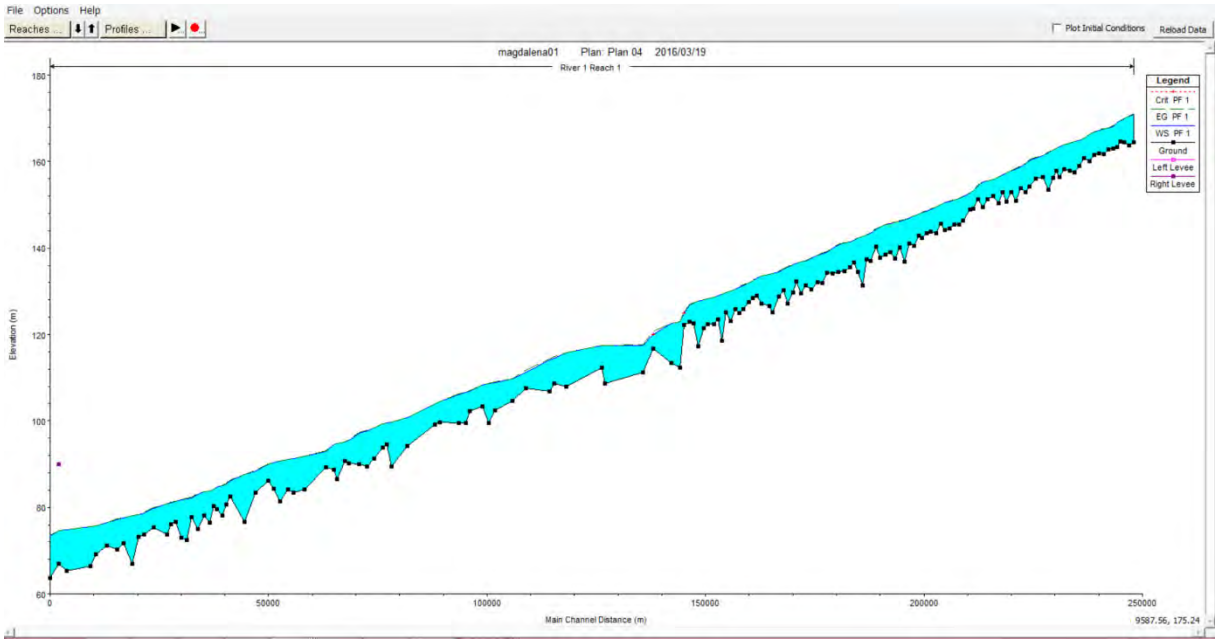


Figure 3-6 Longitudinal Profile of Bottom Elevation from Barrancabermeja to Puerto Salgar (250km)

Figure 3-7 Example Location of Cross Section near Puerto Salgar

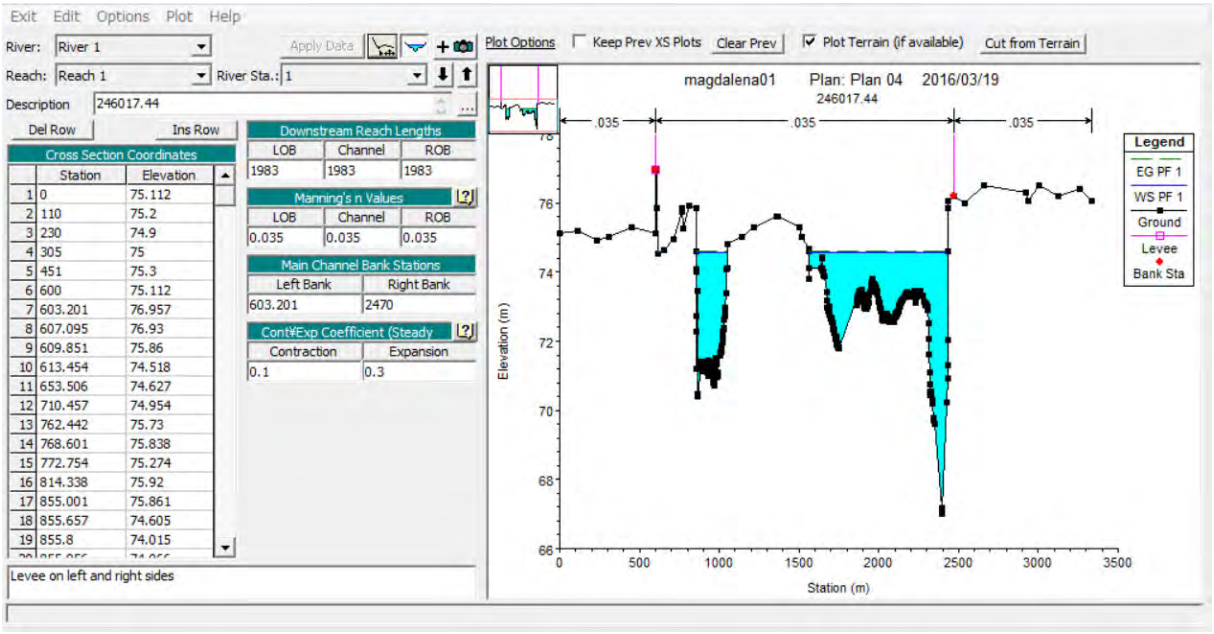
Step 2: Define Main Channel Bank Stations

In the Cross Section Data window, the main channel bank stations will be defined for left and right banks. This definition is quite important because the flow conveyance will be evaluated within the bank stations.

The bank station is basically the boundary between the river channel and the floodplain. For the river channel, the flow capacity should be evaluated. If an artificial dike is constructed, it should selected as the bank station.

Step 3: Set the Levee options

In the Cross Section Data window, select <Options>, <Levee>. Press the Default Button if the bank stations were properly set up in Step 2, the levee stations will be same as the bank stations. The elevation of the levee should be higher enough than the bank elevation as long as the overflow does not happen for the given discharge.



Step 4: Specifying the Bank Elevation Value to compute the flow Discharge

From the main menu, go to <Steady Flow Data window>, <Options>,<Set Changes in WS and EG>,<Add Multiple RS Locations>. And press <Known WS> tab. Then Multiple Location Print-Select Locations window is shown. Select the river and reach for which the channel flow capacity is calculated and press (All RS) and press OK. Then Set Internal Change in WS and EG window is shown, and all river cross section is listed up. In the column “Value”, the elevation at which the channel flow capacity is calculated can be input.

Please be certain that the Steady Flow Data shall be prepared separately for left bank case and right bank case because the input in the <Options> is different in the left and right banks.

HEC RAS allows us to use copy and paste operation. Prepare the data set for Left Bank and Right Bank elevations, separately in Excel worksheet and copy-paste in the HEC RAS from Excel.

Step 5: Performing Steady Flow Analysis

Perform Steady Flow Analysis giving 1 m3/s as the flow discharge and an appropriate Known Water level at the downstream boundary. The given discharge can be any value for the steady flow for this calculation.

This should be made for the left bank case and right bank case.

Step 6: Conveyance Data from Profile Output Table

The conveyance value can be shown in Profile Output Table. Go to <Option>, <Define> and add a column for the Channel Conveyance.

Step 7: Prepare Excel Worksheet of Cross section station and the Conveyance

In Excel, please prepare a table of cross section station and the corresponding conveyance. Giving the hydraulic slope value for each cross section conveyance, the channel flow capacity is calculated.

Finally, the channel flow capacity profile can be made as shown in Figure 3-8.

Until here, the Conveyance "K" at the Bank Elevation can be obtained. The flow capacity can be calculated as

$$Q = K \times I^{1/2}$$

Regarding the hydraulic slope "I", in the case of Magdalena Medio, I=1/2500 is appropriate for this exercise. In the practical planning, the hydraulic slope "I" should be selected to consider the topography.

The resultant flow capacity "Q" for each cross section for both banks can be presented as follows.

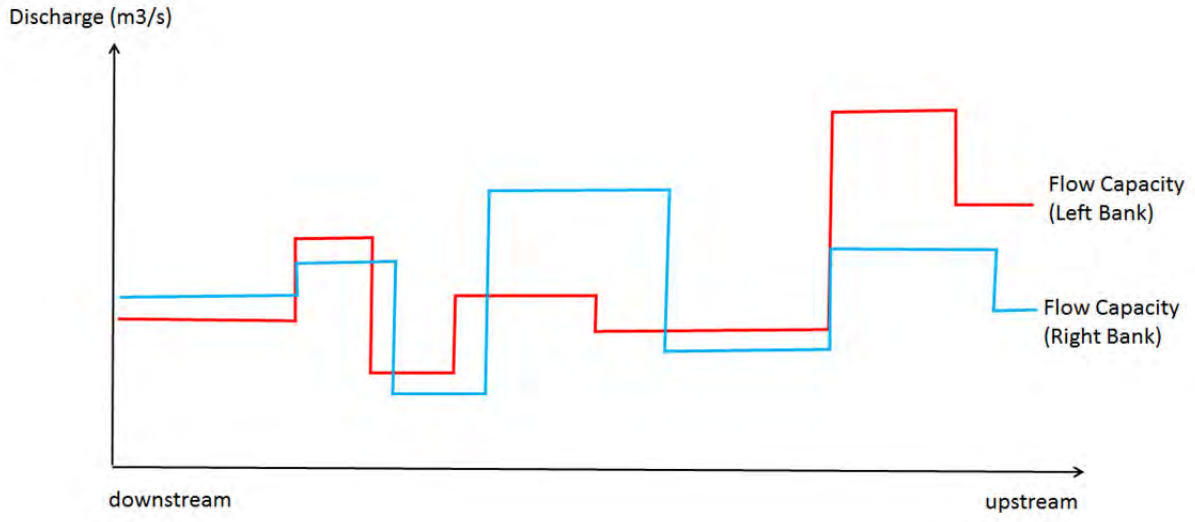


Figure 3-8 Image of Longitudinal Profile of Flow Capacity

3.2 Preparation for Basic Information on Past Flooding Events

3.2.1 Background

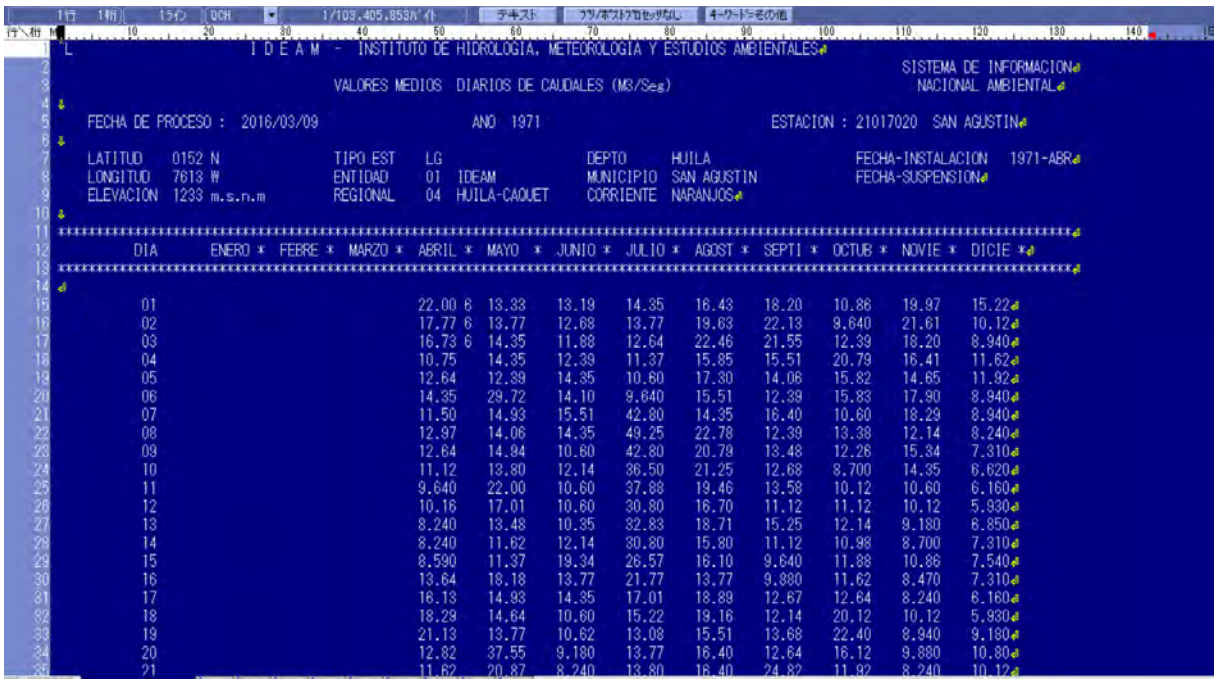
IDEAM has been monitoring the river discharge data and already established the data base system. In general, for the flood analysis the daily discharge is one of the most important data. Within the Rio Magdalena and Cauca basin, IDEAM has stored the following raw data in terms of the daily discharge.

- Magdalenadiario (983,269 rows)
- Magdalenadiario.tr5 (544,639 rows)
- Magdalenadiario.tr8

The file "Magdalenadiario" is a text file containing the daily discharge data per each year for all available stations. The example of the data file is shown in Figure 3-9. The number of row of the data file is 983,269 rows until 2015.

The file "Magdalenadiario.tr5" is a text file containing the daily discharge data arranged from the file "Magdalenadiario". The format is a matrix of date in a month in row and 12 months in column. The example of the data file is shown in Figure 3-10.The number of row of the data file is 544,639 rows.

The file "Magdalenadiario.tr8" is a text file containing the monthly discharge produced from the daily discharge value, basically.



```
L                I D E A M  -  INSTITUTO DE HIDROLOGIA, METEOROLOGIA Y ESTUDIOS AMBIENTALES
                                                                          SISTEMA DE INFORMACION
                          VALORES MEDIOS  DIARIOS DE CAUDALES (M3/Seg)      NACIONAL AMBIENTAL

 FECHA DE PROCESO :  2016/03/09              ANO  1971                ESTACION : 21017020  SAN AGUSTIN

 LATITUD   0152 N          TIPO EST   LG                 DEPTO      HUILA          FECHA-INSTALACION   1971-ABR
 LONGITUD  7613 W          ENTIDAD    01  IDEAM          MUNICIPIO  SAN AGUSTIN    FECHA-SUSPENSION
 ELEVACION 1233 m.s.n.m    REGIONAL   04  HUILA-CAQUET   CORRIENTE  NARANJOS

**********************************************************************************************************************
       DIA      ENERO *  FEBRE *  MARZO *  ABRIL *  MAYO  *  JUNIO *  JULIO *  AGOST *  SEPTI *  OCTUB *  NOVIE *  DICIE *
**********************************************************************************************************************

        01                          22.00 6  13.33   13.19   14.35   16.43   18.20   10.86   19.97   15.22
        02                          17.77 6  13.77   12.68   13.77   19.63   22.13   9.640   21.61   10.12
        03                          16.73 6  14.35   11.88   12.64   22.46   21.55   12.39   18.20   8.940
        04                          10.75    14.35   12.39   11.37   15.85   15.51   20.79   16.41   11.62
        05                          12.64    12.39   14.35   10.60   17.30   14.06   15.82   14.65   11.92
        06                          14.35    29.72   14.10   9.640   15.51   12.39   15.83   17.90   8.940
        07                          11.50    14.93   15.51   42.80   14.35   16.40   10.60   18.29   8.940
        08                          12.97    14.06   14.35   49.25   22.78   12.39   13.38   12.14   8.240
        09                          12.64    14.94   10.60   42.80   20.79   13.48   12.26   15.34   7.310
        10                          11.12    13.80   12.14   36.50   21.25   12.68   8.700   14.35   6.620
        11                          9.640    22.00   10.60   37.88   19.46   13.58   10.12   10.60   6.160
        12                          10.16    17.01   10.60   30.80   16.70   11.12   11.12   10.12   5.930
        13                          8.240    13.48   10.35   32.83   18.71   15.25   12.14   9.180   6.850
        14                          8.240    11.62   12.14   30.80   15.80   11.12   10.98   8.700   7.310
        15                          8.590    11.37   19.34   26.57   16.10   9.640   11.88   10.86   7.540
        16                          13.64    18.18   13.77   21.77   13.77   9.880   11.62   8.470   7.310
        17                          16.13    14.93   14.35   17.01   18.89   12.67   12.64   8.240   6.160
        18                          18.29    14.64   10.60   15.22   19.16   12.14   20.12   10.12   5.930
        19                          21.13    13.77   10.62   13.08   15.51   13.68   22.40   8.940   9.180
        20                          12.82    37.55   9.180   13.77   16.40   12.64   16.12   9.880   10.80
        21                          11.82    20.87   8.240   13.80   16.40   24.82   11.92   8.240   10.12
```

Figure 3-9 Example of Raw Data File for Daily Discharge Data from IDEAM

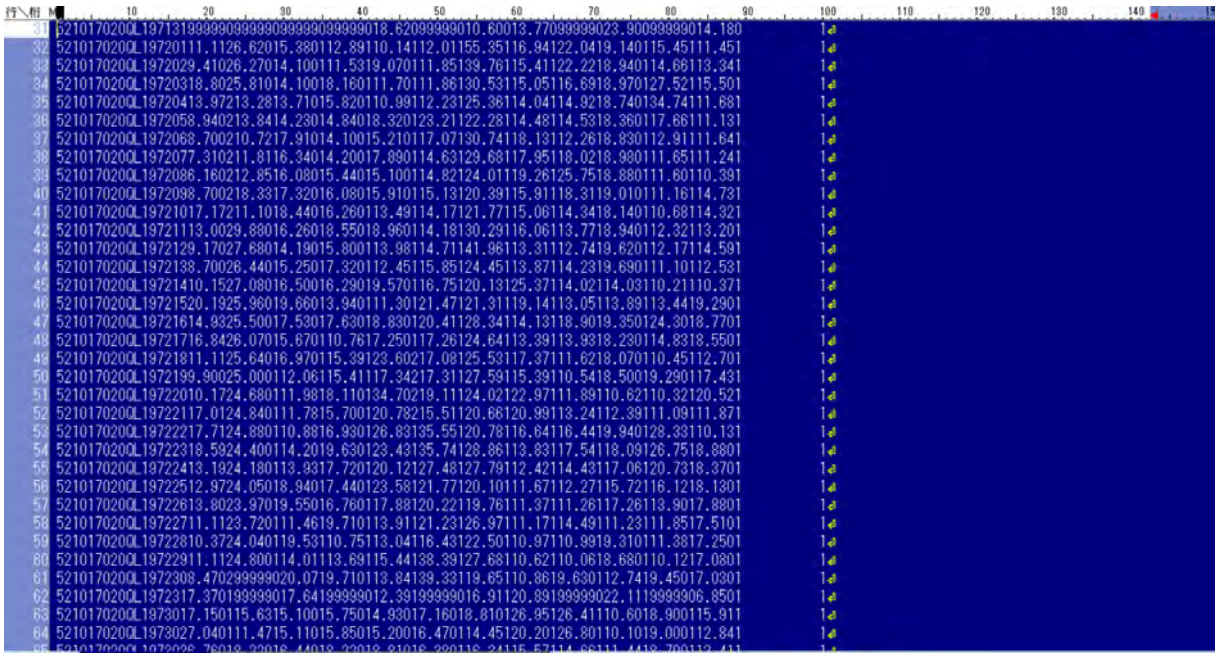


Figure 3-10 Example of Arranged Data File for Daily Discharge Data from IDEAM

The most useful data file is “Magdalenadiario.tr5” for the arranged daily discharge value. This file is already formatted in a systematic rule, however, for the river planning purpose, further arrangement of the data is needed as follows.

3.2.2 Work 4: To prepare the data availability table of all stations

The year in which each station has the data is varied in each station. In order to get the overview of the data availability, the following table should be prepared.

Station	1950	1951	1952	------	2012	2013	2014
Station A							
Station B							
Station C							

Station X							

Figure 3-11 Image of Data Availability Table

3.2.3 Work 5: To prepare the time series data set for each station

For the grasping the extreme value of each year for each station, and the usage for the hydrological and hydraulic analysis (modeling), the following table showing the time series data of each station should be prepared.

Date	Station A	Station B	Station C	Station D	----------	Station X	Station Y
1950/1/1	--						
1950/1/2	--						
1950/1/3	--						
---------	--						
---------	--						
2015/12/31	--						

Figure 3-12 Image of Data Time Series Table

3.2.4 Work 6: List of Annual Maximum Water level and/or Discharge with Date of Each Hydrological Station

This Table can be made from the output of Work 5 using Excel worksheet.

3.2.5 Work 7: Ranking of Past of Annual Maximum Water level and/or Discharge of Each Hydrological Station

This Table can be made from the output of Work 6 using Excel worksheet.

3.2.6 Work 8: Frequency Analysis of Annual Maximum water level and/or Discharge of Each Hydrological Station

This Table can be made from the output of Work 6.

In general, the frequencies analysis[1] shall be made using “Distribucion Normal”, “Distribucion Logaritmico-normal”, “Distribucion Pearson Tipo III”, “Distribucion Log pearson Tipo III” and “Distribucion Gumbel”. Among those methods, the best distribution shall be selected.

4 Study on Countermeasures for Magdalena River Middle Reach

4.1 Target Section

4.1.1 General

The Magdalena river basin is often described to separate into 3 areas. They are Upper Basin, Middle Basin and Lower Basin.

Upper Basin: Upstream of Honda (55,441 km^2)

Middle basin: From Honda to El Banco (84,216 km^2)

[1] German Monsalve Saenz, Hidrologia en la Ingenieria 2a edicion, Editorial Escuela Colombiana de Ingenieria.

Lower Basin: From El Banco to Calamar (117,781 km^2 including the Cauca Basin)

The inundation area along the Magdalena River is shown in Figure 4-1 according to the PMC. It is recognized that the middle reach suffered from the riverine flood and the lower reach suffered from the effect of influence of the Cauca River associated with the existence of natural wetland/lake.

Since the flood area in the Magdalena river basin is huge and has different characteristics in each area. In this Chapter, the discussion will focus on the Middle Reach as the first step due to the data availability and other Project progress in Colombia. However, the approach and methodology discussed in this Chapter could be referred in other areas such as the Lower Basin and other macro basins as well as the sub-zones (tributaries).

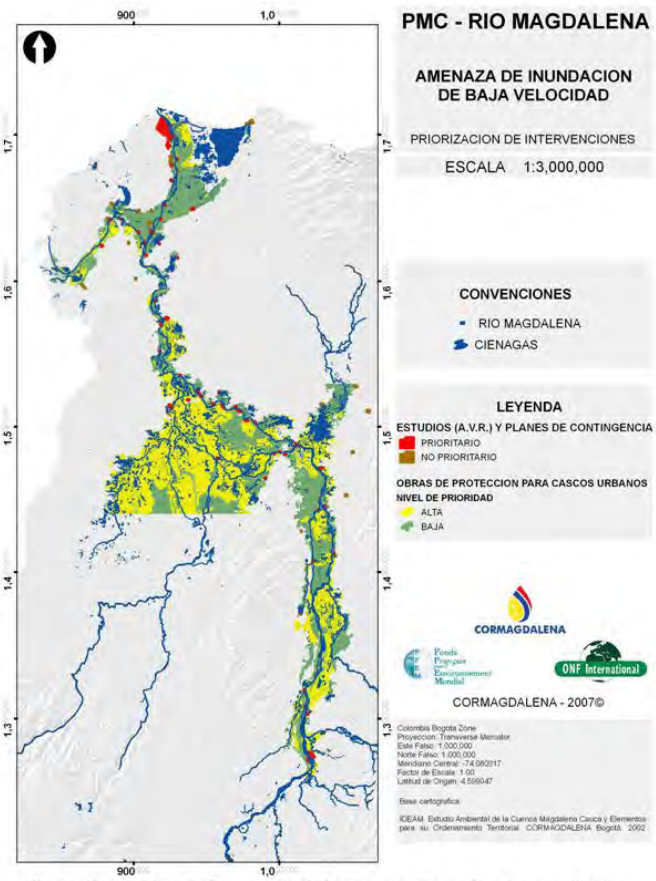


Ilustración 86: Mapa de Priorización de Intervenciones para Inundaciones de Baja Velocidad

Figure 4-1 Inundation Area in Magdalena River (Slow Flood)

4.1.2 Selecting Target Section in Middle Reach

The longitudinal profile of channel flow capacity can be useful for selecting target section. Figure 4-2 is an image of channel flow capacity profile overlapping the actual discharge including the overflow on floodplains.

As the usage of channel flow capacity profile, the following explanation can be made.

In Section 1 and Section 3, the actual discharge is beyond the channel flow capacities of both banks. So the overflow in the both banks is happening.

In Section 2, the actual discharge is beyond the channel flow capacity of the left bank while the channel flow capacity of the right bank is larger than the actual discharge. So the overflow in the left bank is happening.

In Section 4, the actual discharge is smaller than the channel flow capacities of the both banks. In this section, the flood flows in the channel and no overflow takes place.

In Section 5, the actual discharge is beyond the channel flow capacity of the right bank while the channel flow capacity of the left bank is larger than the actual discharge. So the overflow in the right bank is happening.

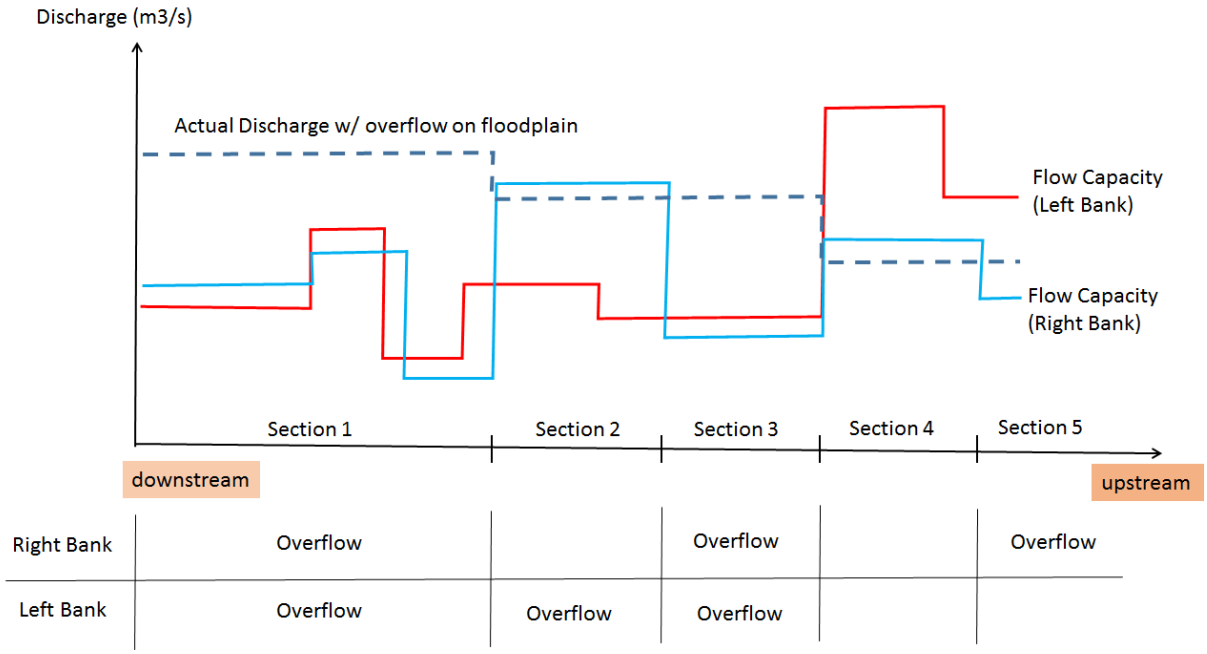


Figure 4-2 Usage of Channel Flow Capacity Profile for Selecting Target Area

As it can be understood, depending on the magnitude of the actual discharge, the overflow section will change. If the flood discharge increases, all sections from Section 1 to 5 will suffer from the overflow. On the contrary, if the flood discharge decreases, not beyond the channel flow capacities, the overflow section will be less.

In other words, for a certain magnitude of flood discharge given, if the channel flow capacity can be increase by structure measure such as dike and channel improvement, the overflow section can be less.

Also if the flood discharge can be reduced artificially until the channel flow capacity, for example, by storing the flood water in dam and retarding basin upstream, the overflow section can be less.

4.2 Setting Target Flood for the selected Sections

4.2.1 Work 9: Preparation of Peak Discharge and Inundation Area along the Rio Magdalena Medio

The actual discharge distribution mentioned in the previous section should be distributed along the Magdalena river middle reach. Figure 4-3 is prepared based on the Magdalena River M/P (2013). The following works are needed.

- Calculation of upstream Catchment Area of key hydrological station along the Magdalena River middle reach such Berrio, Sitio Nuevo and Barrancabermeja.
- Using the ratio of catchment area, the flood discharge is set for the hydrological stations based on the Discharge at El Banco.

El Banco	Barrancabermeja	Puerto Salgar	Honda		
139,657 km2	80,000 km2	58,032 km2	55,441 km2		
6,340			3,579	m3/s	Year to year average annual flood discharge
11,200			5,090	m3/s	Maximum Discharge on Record
14.95			4.45	Billion m3	Maximum year to year average monthly flood volume

Note: The values were referred from PMC(2013) , CORMAGDALENA by JICA Project Team.

Figure 4-3 Historical and Statistical Discharge Values along the Rio Magdalena Medio

- Next, for the already known inundation area map in the Magdalena river middle reach, the non-uniform water level calculation will be made in order to calibrate the relation between the flood discharge distribution and the resultant inundation area.
- Using the calibrated 1D model, the curve between the discharge at El Banco and the inundation area will be developed as shown in Figure 4-4.

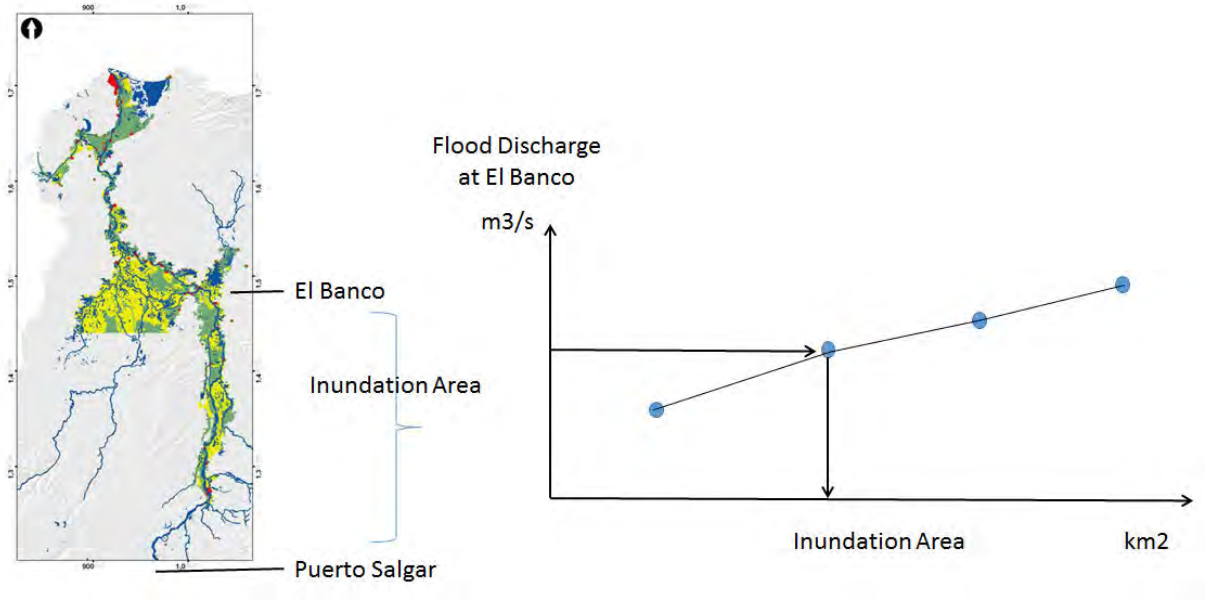


Figure 4-4 Preparation of Peak Discharge and Inundation Area along the Rio Magdalena Medio

4.2.2 Work 10: Setting Target Flood Level for Selected Section

This work is a kind of discussion among the stakeholders. Based on the results of Work 1, 2, 3, 4, 5, 6, 7, 8 and 9, the target flood level and the target section shall be decided for further study on flood control options.

4.3 Options for Flood Control in Target Section

If the target is to reduce inundation area X % against Y years return period or past specific year flood event, the general flood control options are as follows.

- River Improvement (River Bed Lowering/Widening /Steepening)
- Dike
- Dam at Upstream Honda
- Retarding Basin at Upstream Reach

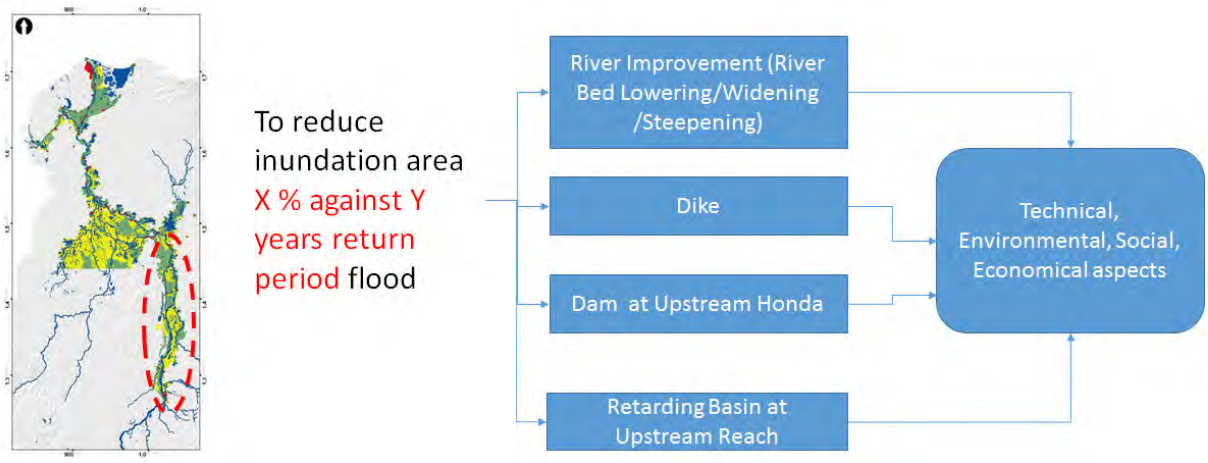


Figure 4-5 General Options of Flood Control

Among the above 4 options, River Improvement (River Bed Lowering/Widening /Steepening) and Dike are seeking the increasing of channel flow capacity in order to satisfy the target flood discharge as shown in Figure 4-6.

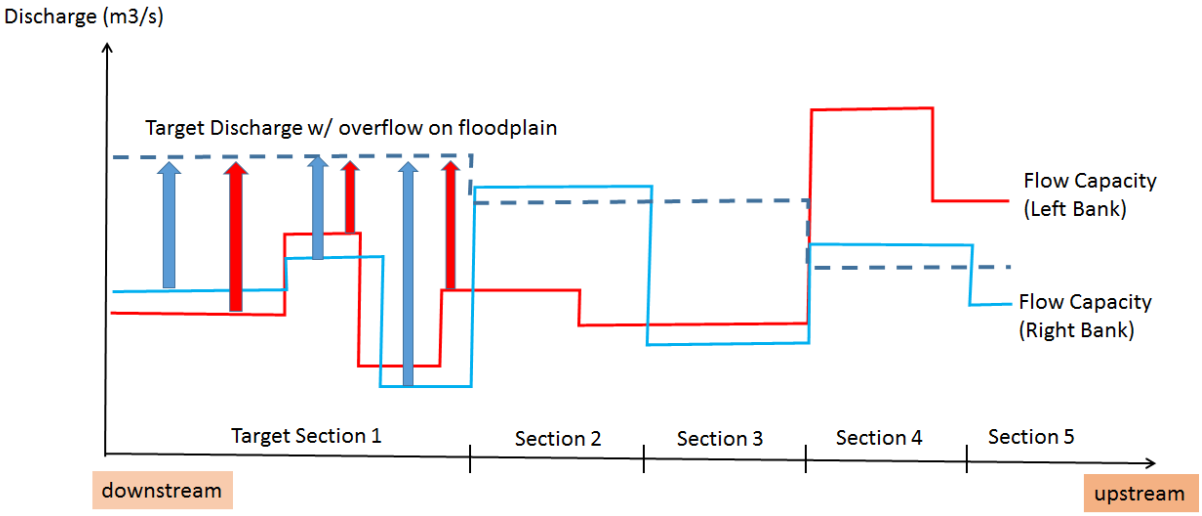


Figure 4-6 Concept of Increasing Channel Flow Capacity (Section 1)

Among the above 4 options, Dam at Upstream Honda and Retarding Basin at Upstream Reach are seeking the reducing flood discharge close to the present channel flow capacity or minimizing the river improvement work/dike as shown in Figure 4-7.

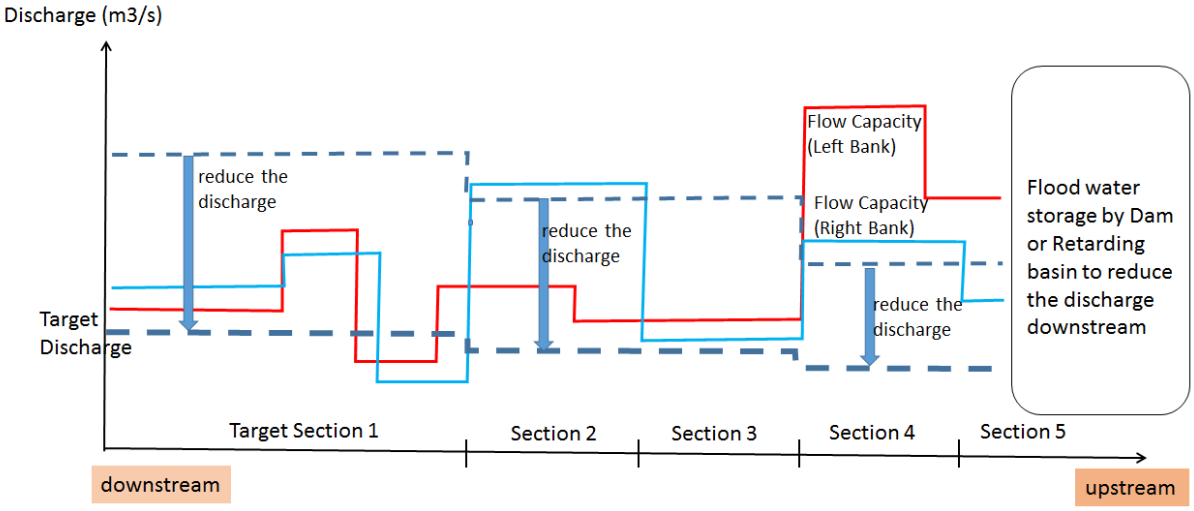


Figure 4-7 Concept of Reducing Flood Discharge by Flood Water Storage upstream (Section 1)

5 Study on Countermeasures for Rio Negro Basin

5.1 Target Section

5.1.1 General

JICA Project Team has reviewed the available data, report and visited the site to make interview for the officials in Municipalities in Cundinamarca. According to this, the main flood prone areas in the Rio Negro river basin have been listed up. The selected areas are Puerto Libre, Cordoba, El Dindal, Utica, Villeta and Pacho. The flood-prone areas are not limited to those.

In the course of river planning work, the target section will be identified among those candidate areas based on the quantitative analysis.

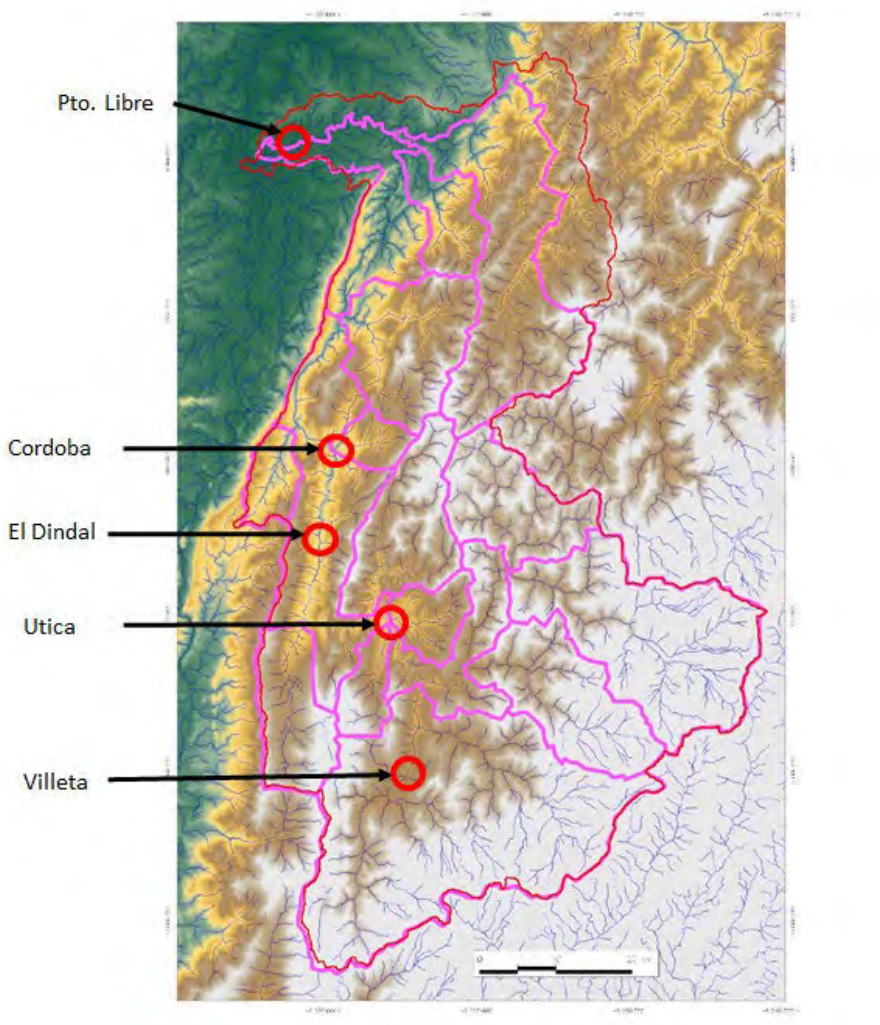


Figure 5-1 Location of Flood-prone Area in Rio Negro Basin

5.1.2 Selecting Target Section

Please refer to 4.1.2.

5.2 Setting Target Flood for the selected Sections

5.2.1 Work 9: Preparation of Basic Discharge Distribution

5.2.1.1 Matrix of Past Flood Events

Among the flood-prone areas shown in Figure 5-1, the information on Utica is comparatively well documented in many materials. As shown in below, Utica actually has suffered from the flood disasters in 1988, 1990, 2011 and 2014. In terms of the river planning for the entire Rio Negro river basin, it is important to check the simultaneity of such flood events in the basin. It means when a flood happened in Utica, it is important to check the flood occurrence in other areas upstream and downstream.

It is required to prepare a matrix as shown in Figure 5-2 based on the available information, report and the experiences of local people.

Flood events	Puerto Libre	Cordoba	El Dindel	Utica	Villeta	Pacho
19XX						
1988.11.7				Yes/Si		
19XX						
1990.5				Yes/Si		
2011.4.11				Yes/Si	Yes/Si	
2014.5.4				Yes/Si		

Figure 5-2 Matrix of Past Flood Events in Rio Negro River Basin

Depending on the past records on the flooding, the following river planning procedure may change slightly.

5.2.1.2 Sub-catchment Delineation

The sub-catchment delineation shall be conducted to consider the POMCA document as well as the location of flood-prone area and some key hydrological stations in the basin.

The reasons why it is necessary to consider the location of flood-prone area and some key hydrological stations area.

- The flood-prone area might be selected as one of the target area in the river planning. For such points, it is needed to calculate the flood discharge in the hydrological model.
- The key hydrological station might be a basic point for design discharge distribution and the key station for flood early warning. For such points, it is needed to calculate the flood discharge in the hydrological model.

The Table 5-1 shows the name of the sub-catchment and the area according to the POMCA documents. The exception is that downstream Río Negro area (2306-1) and Río Guaguaqui (2306-2) includes the physical area in Boyaca. The total basin area is de 4,584.2 km[22].

[2] The preliminary delimitation of Río Negro area under (2306-1) and Rio Guaguaqui (2306-2) was made by the JICA Team using the figures in the POMCA manually without using the profile file archive According to IDEAM profile, the area of the Black River basin is 4,572 km^2.

Table 5-1 Name of Sub-catchment and Area in POMCA

Name of Sub-catchment		Area (km^2)	Area (km^2)
2306-1	Rio Bajo Negro	298* (231.95)	1,423.0* (31%)
2306-2	Rio Guaguaqui	760* (495.97)	
2306-3	Rio Teran	108.02	
2306-4	Rio Macopay	256.11	
2306-5	Rio Cambras	69.34	1,078.7 (24%)
2306-6	Qda. Guatachi	53.16	
2306-7	Rio Guaduero	172.38	
2306-8	Rio Medio Negro 1	400.77	
2306-9	Rio Pata	228.11	
2306-10	Quebrada Negra	70.15	
2306-11	Quebrada Terama	84.76	
2306-12	Rio Medio Negro 2	162.27	2082.5 (45%)
2306-13	Rio Tobia	940.68	
2306-14	Rio Pinzaima	270.42	
2306-15	Rio Murca	219.68	
2306-16	Rio Alto Negro	489.46	
	Total	4,584.2	4,584.2

Source：CAR, ESTUDIO DE DIAGNÓSTICO, PROSPECTIVA Y FORMULACIÓN CUENCA RÍO NEGRO, (*) is the area including Boyacá

The Figure 5-3 is the overlapping of the sub-basin in the document of POMCA and IDEAM profile file called "river Zoning 2013" in terms of the Río Negro Basin. Flood prone areas are also shown. The locations of Córdoba and Villeta The Dindal are within the large sub-basin. It is recommended to identify smaller sub basins in those locations considering the calculation of flood discharge in a hydrological model if these areas are considered as very critical in river planning.

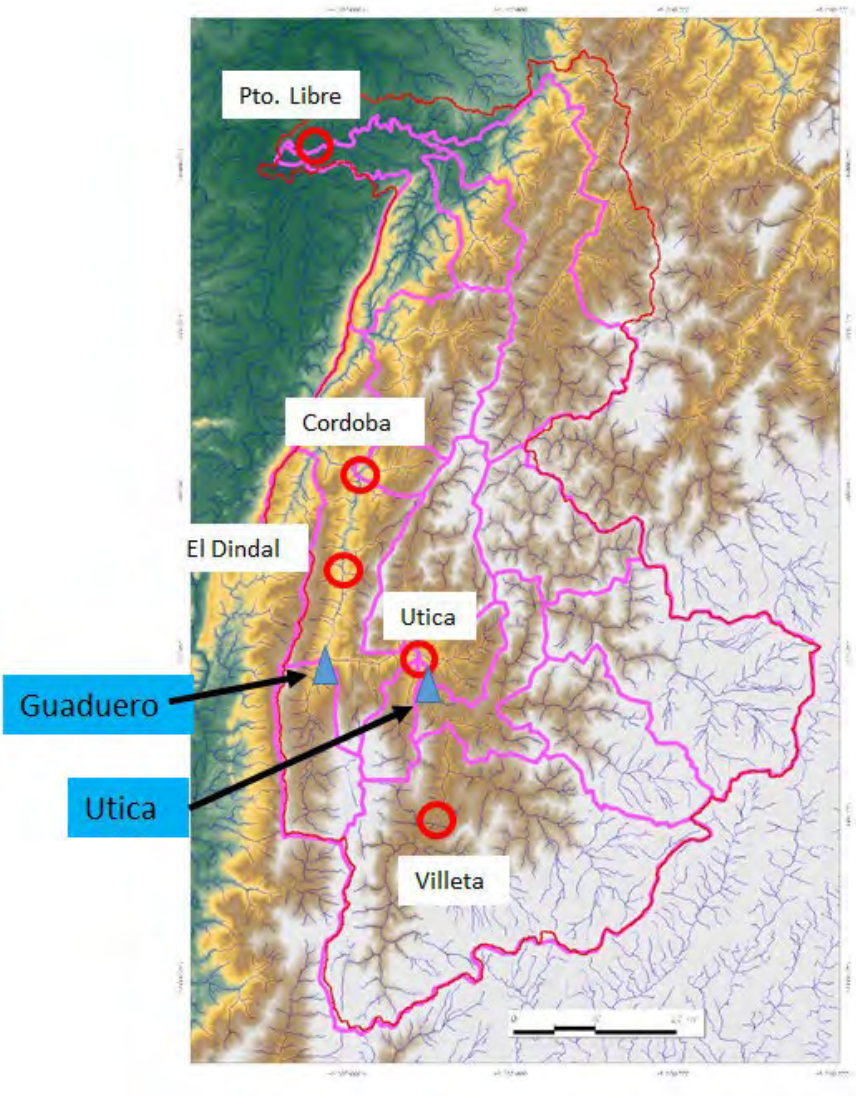


Figure 5-3 Present Sub-catchment and Location of possible Basic Points in Rio Negro Basin

Figure 5-5 is the location map of the hydrological stations of IDEAM inside and around Rio Negro basin. The hydrological stations in the basin are:

Puerto Libre, Colorados, Guaduero, Tobia, Charco Largo and Villeta.

If these hydrological stations have a record of appropriate past data, these may be considered appropriate for key hydrological stations. It is recommended to identify those locations in smaller sub basins considering the calculation of flood discharge in a hydrological model if those areas are considered as very critical reviews on the river planning.

Code	Name	Municipality	East (m)	North (m)	Altitude (m.s.l.m)	Type	Registry year
2306702	Colorados	Puerto Salgar	945794	1100394	286	LG	52 -02
2306704	Puerto Libre	Puerto Salgar	937649	1127241	180	LG	65 – 02
2306705	Guaduero	Guaduas	946145	1066476	410	LG	65 -02
2306706	Tobia	Nimaima	959076	1059095	620	LG	65 – 01
2306707	Villeta	Villeta	957220	1046194	790	LM	77 - 02
2306708	Charco Largo	La Palma	969359	1072304	940	LG	65 - 01

m.s.n.m: meters above sea level
LM: Limnimnetrica
LG: Limnigráfica

(Source: Description and featuring of Physical Media downstream Río Negro sub-catchment POMCA report -001-UT)

Figure 5-4 List of hydrological stations in Río Negro basin

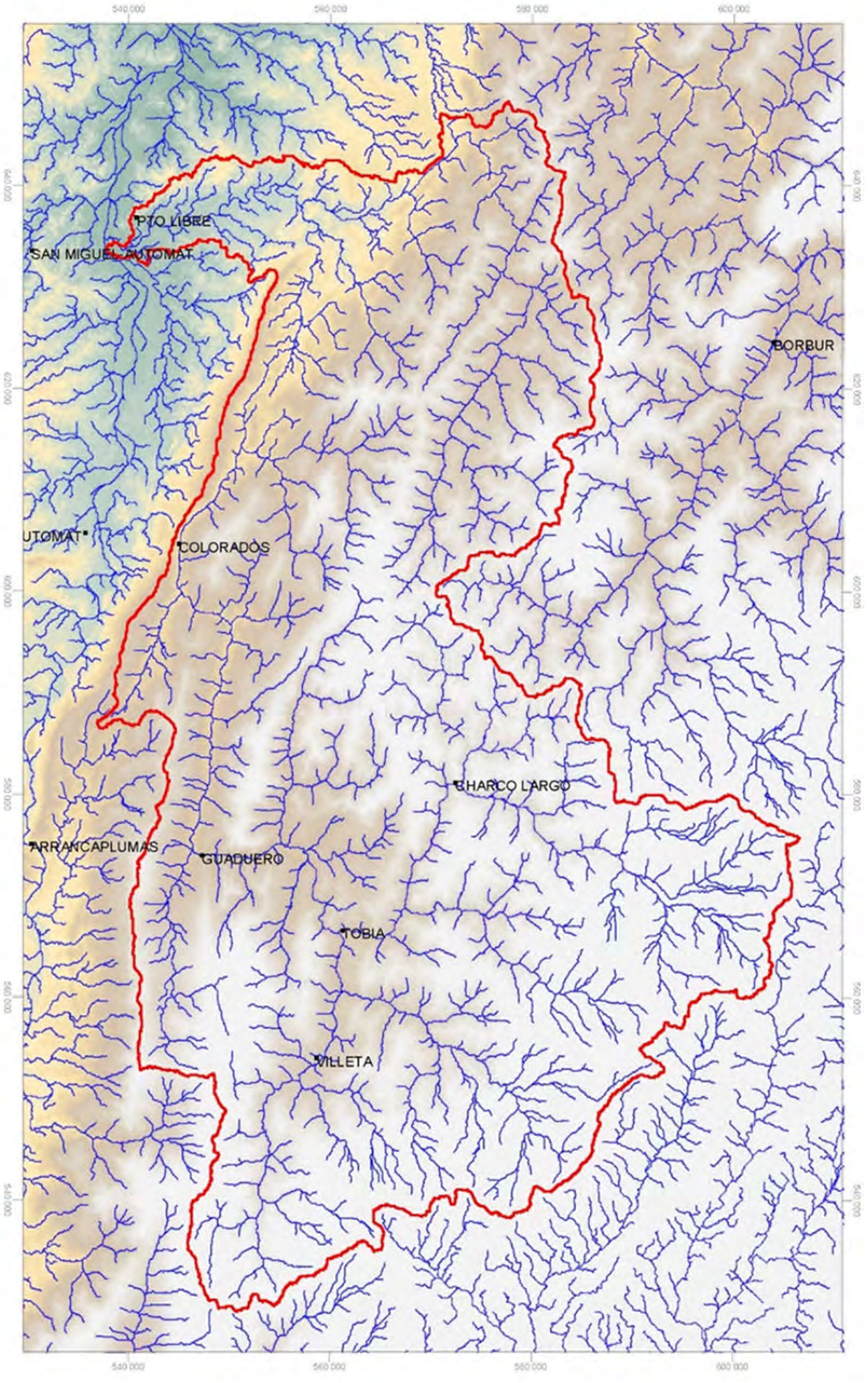


Figure 5-5 Location of hydrological stations inside and around Río Negro basin (prepared by IDEAM data)

5.2.1.3 Rainfall Analysis

The Flood water in Río Negro basin is associated with heavy rain events in the basin. Figure 5-7 shows the location of the climatological stations of IDEAM inside and around Río Negro basin.

Code	Name	East (m)	North (m)	Altitude (m.s.l.m)	Type	Registry year
2120629	Venecia	964155	1027480	2673	CP	57 - 06
2123007	San Juan de Rioseco	938721	1027776	1303	PM	74 - 04
2123009	Arrancaplumas	929813	1064669	245	PM	80 - 04
2123012	La Belleza	944278	1042517	1200	PM	86 - 04
2303502	Apto Palanquero	936929	1097821	172	CP	72 - 03
2306004	El Paraíso	955393	1079372	1450	PM	75 - 90
2306011	Caparrapí	955395	1083058	1270	PM	59 - 97
2306013	La Carlina	972004	1040658	1665	PM	65 - 88
2306014	El Tuscolo	940589	1051736	975	PM	71 - 06
2306015	Puerto Libre	940655	1127305	180	PM	74 - 06
2306016	San Pablo	957248	1092272	1200	PM	54 - 04
2306017	La Palma	964632	1083105	1462	PM	74 - 97
2306018	El Peñón	975710	1071973	1400	PM	74 - 06
2306019	Utica	955383	1064627	497	PM	74 - 06
2306020	Supatá	983099	1051713	1798	PM	74 - 04
2306022	Vianí	947966	1029612	1500	PM	74 - 88
2306025	Guaduas Scria Agricultura	942437	1051734	1060	PM	45 - 85

Code	Name	East (m)	North (m)	Altitude (m.s.l.m)	Type	Registry year
2306028	Villeta Scria Agricultura	955371	1044352	880	PG	45 - 75
2306029	El Silencio	964611	1040661	1425	PM	86 - 06
2306506	Santa Teresa	959058	1027762	2200	CO	89 - 06
2306507	Esc. Vocacional Pacho	988700	1061600	1940	CP	66-06
2306510	Sabaneta	975699	1033284	2475	CO	86 - 05
2306511	Yacopí	968334	1099639	1347	CO	58 - 06
2306512	La Cabrera	994188	1059084	2000	CO	71 - 06
2306517	Guaduas	942300	1015420	1000	CP	00 - 06
2312019	Los Pinos	1005190	1070730	3477	PM	73 - 06
2312024	Paime	992343	1084887	1038	PM	58 - 06
2312507	San Cayetano	1001580	1077514	2150	CO	64 - 99
2312508	Otanche	988563	1118063	1070	CO	
2312515	Villagomez	986799	1075672	1575	CO	97 - 06

m.s.n.m: meters above sea level
PM: Pluviometrica
PG: Pluviográfica
ME: Meteorológica
CP: Climatológica principal
CO: Climatológica ordinaria

(Source: Description and featuring of physical media of Río Negro sub-catchment POMCA -001-UT)

Figure 5-6 List of climatological stations in Rio Negro River Basin

First, it is necessary to confirm data availability for flood events that were mentioned in the Figure 5-2.

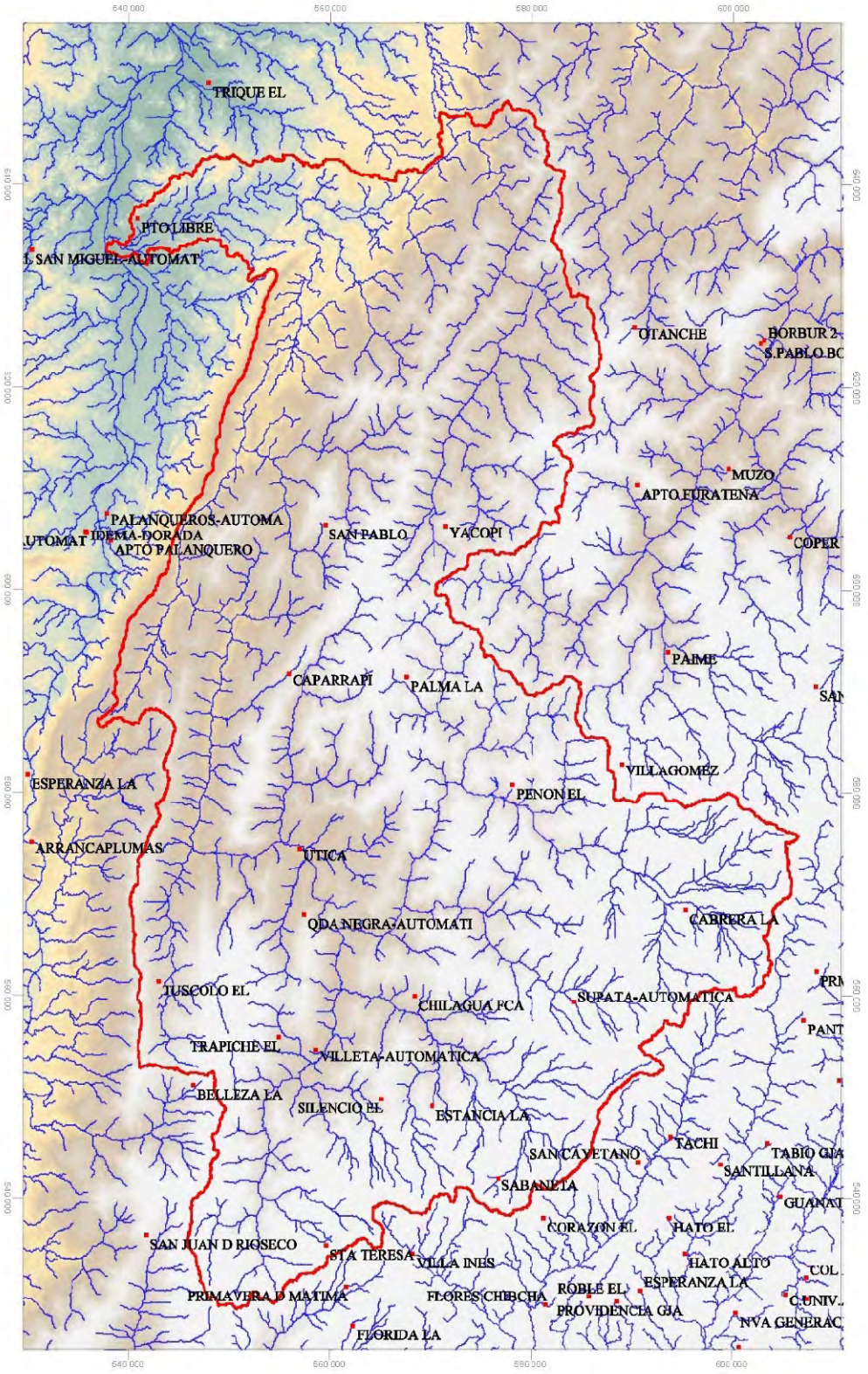


Figure 5-7 Location of the Climatological stations inside and around Rio Negro basin (prepared from IDEAM data)

The Figure 5-2 will show the past flood events in Río Negro Watershed. As a first step in the analysis of precipitation, it is necessary to prepare the table time series of precipitation (on a daily basis) for each flood event (mentioned in Figure 5-2) and for each precipitation station in the basin. The outline of Table is shown below.

Date	Station A	Station B	Station C	Station D	Station E	Station F
2011/4/1						
2011/4/2						
2011/4/3						

2011/4/10						
2011/4/11						
2011/4/12						
2011/4/13						
2011/4/14						

Figure 5-8 Temporary Series of daily rainfall on April 11th, 2011 Flood in Río Negro basin

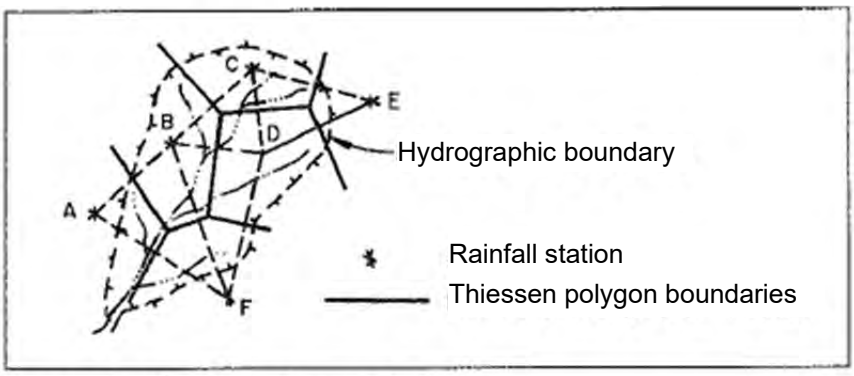
One of the most important points to check is whether the simultaneity of flood events is dominant or it is not much. This can be verified by rainfall data observed in the Basin

For each major precipitation event, the amount of precipitation across the basin should be calculated. For this calculation, the method of polygon Thiessen is one of the most popular ways.

For each event of major flood, the combination of the available precipitation stations may be different. Thiessen polygons should be prepared for each combination of available precipitation stations.

The amount of rainfall in the entire basin (time series) can be calculated as follows:

$$\bar{P} = \frac{\sum_{i=1}^{n} (A_i \times P_i)}{\sum_{i=1}^{n} A_i} \qquad (3.65)$$



n: Number of pluviometric devices
P_i: Recorded rainfall in the pluviometric device i
A_i: Area of influence corresponding to the pluviometric device i, resulting from the Thiessen polygon method

Figure 5-9 Method of Thiessen Polygons[3]

Thiessen coefficient of each station is the coefficient Ai total area of the basin. The total Thiessen coefficient of each station is 1.0. The data series of the average rainfall of the basin can be added as the column to the right of the column in Figure 5-10.

[4] German Monsalve Sáenz, Hidrología en la Ingeniería 2a edición

Date	Station A	Station B	Station C	Station D	Station E	**Average basin**
Thiessen coefficient	0.1	0.3	0.2	0.2	0.2	1.0
2011/4/1						
2011/4/2						
2011/4/3						

2011/4/10						
2011/4/11						
2011/4/12						
2011/4/13						
2011/4/14						

Figure 5-10 Temporary Series of daily rainfall averaged in the Basin for April 11th, 2011 Río Negro basin flood.

Figure 5-10 must be prepared separately for each event of major rainfall

5.2.1.4 Distribution of Basic Discharge (1st estimation)

The distribution of basic discharge in River Planning in Japan can be illustrated by a figure like Figure 5-11, which indicates the distribution of flood discharge target from downstream to upstream. Such distribution of the discharge is usually prepared by analysis of rainfall runoff for precipitation distribution along the Basin for a certain return period rainfall.

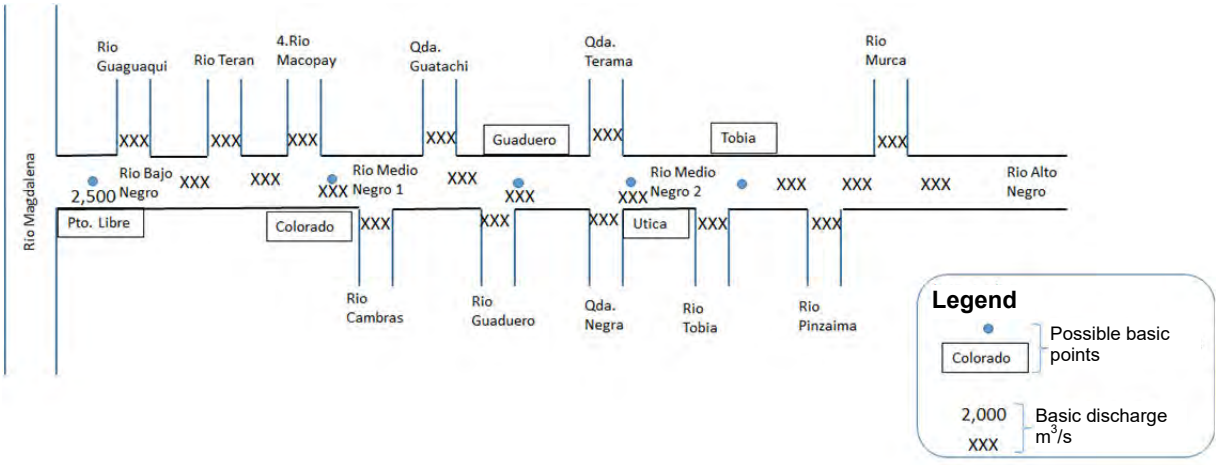


Figure 5-11 Image of the presentation of Basic Discharge Distribution

As emphasized several times in this document, one of the most important points is to check the simultaneity of the flood events in the Basin and see if they are dominant or not much. Since the approach to model precipitation runoff should depend on the nature of the simultaneity of flood events as shown below.

Simultaneity of flood events in the Basin	Approach for the Distribution of basic discharge
High simultaneity of flood events in the basin	Precipitation pattern along the Basin to give the rainfall runoff model along the Basin (hydrological model)
Low simultaneity of flood events in the Basin (The local flood event happening is dominant)	Independent precipitation pattern locally to give the rainfall runoff model along the Basin (hydrological model)

There is no clear criterion to decide whether the simultaneity of the events of flooding in the basin is high or low. To decide this the information that must be prepared in sections 5.2.1.1 and 5.2.1.3 is important and necessary for the selection of the approach for the distribution of Basic Discharge.

At this time (May-September 2016), it is recommended to study the distribution of discharge roughly however a more meaningful estimation is as follows,

The Rio Negro basin is divided into 3 main sections as shown in Figure 5-12.

With regard to the possible flood discharge in Río Negro Basin, POMCA has estimated the flood discharge in Puerto Libre for example; flood discharge of 20 years return period (Pearson type) is 1,611 m^3 / s in Puerto Libre.

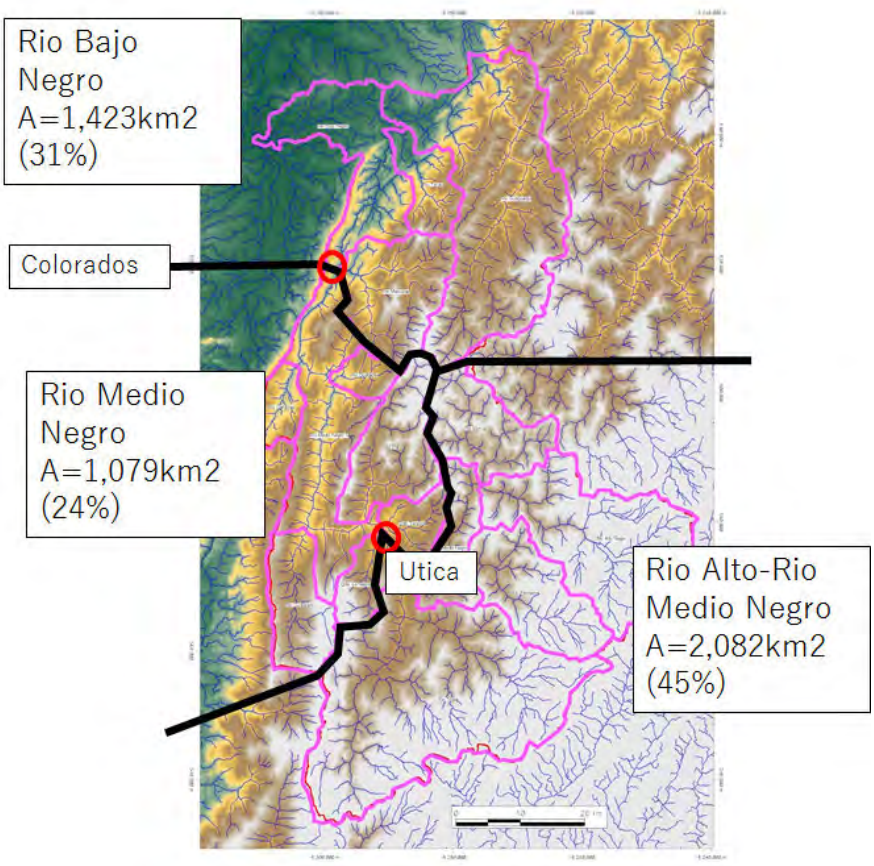
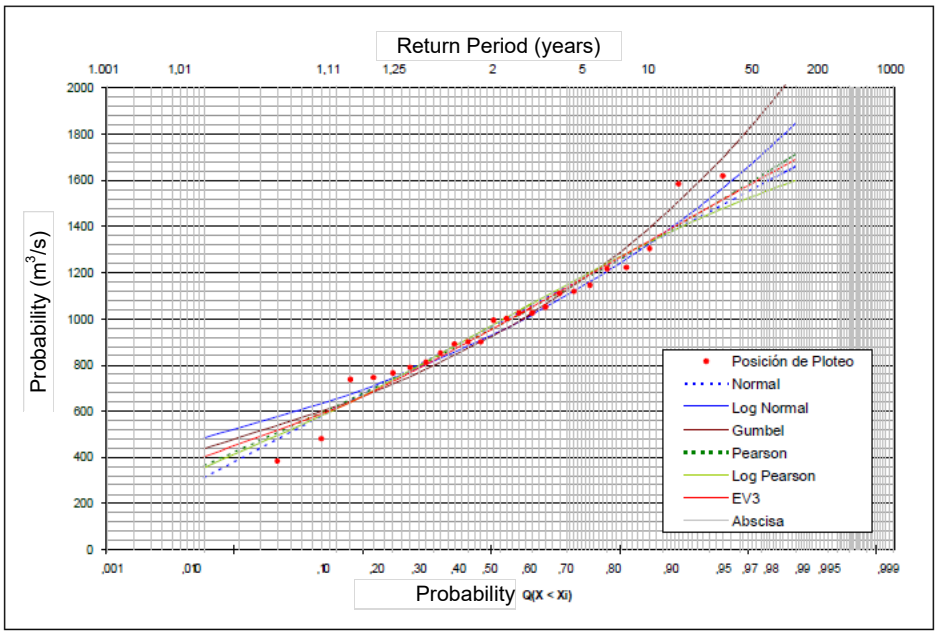


Figure 5-12 Main Sections of Río Negro Basin

Frequency Distribution of Maximum Discharge at Puerto Libre Station

Frequency Distribution	Maximum Discharge (m^3/sec.)					
	2 years	5 years	10 years	20 years	50 years	100 years
Normal	986.75	1230.80	1358.49	1463.91	1582.53	1661.59
Gumbel	943.21	1245.78	1446.11	1638.27	1887.00	2073.39
Pearson	974.76	1226.56	1365.27	1483.48	1620.52	1714.28
Log Pearson	990.81	1241.17	1361.83	1453.17	1545.30	1599.84
Log Normal	946.70	1206.17	1369.14	1520.16	1710.09	1849.69
EV3	975.06	1234.95	1371.74	1484.14	1609.56	1692.39
Average	969.55	1230.90	1378.76	1507.19	1659.17	1765.20

Frequency Distribution of Maximum Discharge at Puerto Libre Station



Frequency Distribution of Maximum Discharge at Downstream End of Rio Negro Basin

Frequency Distribution	Maximum Discharge (m^3/sec.)					
	2 years	5 years	10 years	20 years	50 years	100 years
Pearson	1058.91	1332.45	1483.13	1611.54	1760.42	1862.28

Figure 5-13 Analysis of probable flood discharge inside POMCA at Puerto Libre in Río Negro basin

A distribution discharge along the main river course can be calculated by the area coefficient method (the simplest way).

Table 5-2 Distribution of Discharge by the Area coefficient Method

Location	Basin Area	Area coefficient	Flood Discharge (20 years return period)
Puerto Libre	4,584	100 %	1,611
Colorados	3,161	69 %	1,112
Utica	2,082	45 %	725

It is worth comparing these flood discharges with the flow capacity analyzed in 3.1.3. The value above can be presented as shown in Figure 5-14. In the same way, many other locations can be estimated, however, the applicability of such single or modeling rainfall runoff detailed method must be examined according to the information obtained in 5.2.1.1 and 5.2.1.3.

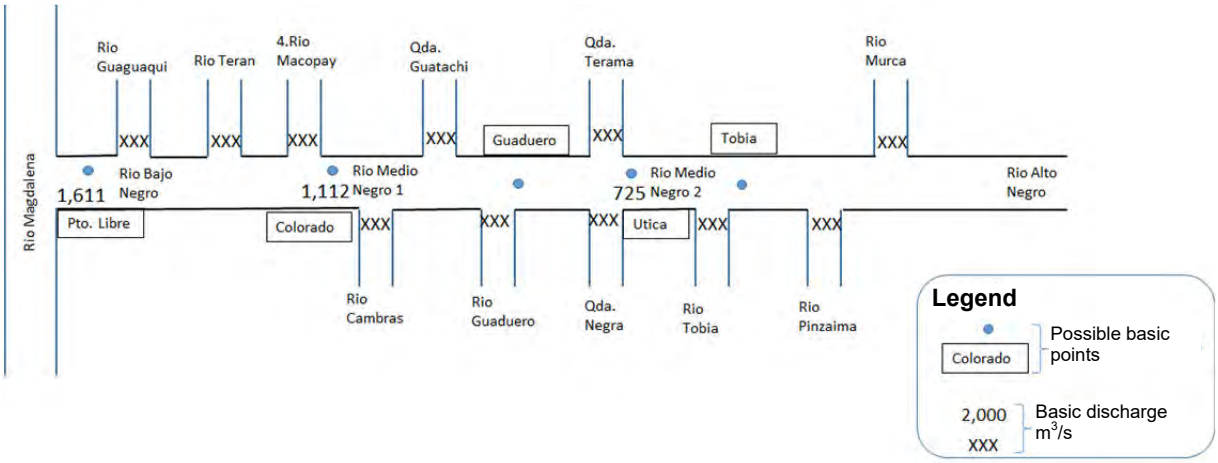


Figure 5-14 Image of the Basic Discharge Distribution Presentation

One of the advantages (merits) of rainfall and runoff model in river planning is that it allows the application for flood forecast based on the amount of rainfall upstream. In the practical procedure, the detailed precipitation runoff modelling has to be carried out making an estimation to have a proper judge.

5.2.1.5 Rainfall runoff model

To estimate the basic design of the discharge distribution, is useful the rainfall runoff model. The calibrated model of precipitation and runoff can produce the distribution of basic discharge with time series hydrograph to design the amount of time series of precipitation.

First it is necessary to prepare a rainfall runoff model calibrated. The procedure is as follows,

Step 1: Select Model Precipitation Runoff Model (software)

The basic requirements for rainfall runoff model (software)

- It can be considered the time series of the precipitation amount.
- the runoff calculation of continuous rainfall is possible not only to calculate a single peak discharge because flood hydrograph in any of the points are important in river planning for such a large Watershed as Río Negro.
- the model (software) should be popular, widely used in international communities.

In terms of Río Negro basin, IDEAM has used HEC-HMS (counting with soil moisture) for consistency, it is recommended to use the same model for planning in Río Negro.

Step 2: Establish a rainfall runoff model

Depending on the selected model (software), hydrological structure such as the system of sub basin and its parameters must be set as initial values

Step 3: Preparation of precipitation and discharge data for calibration Flood

For calibration work, a set of time series of discharge and rain should be prepared. Precipitation data are usually prepared for each sub catchment as decided in 5.2.1.2. The time series of discharge data are also weighted as shown in Figure 5-15.

Date	Puerto Libre	Colorados	Guaduero	Tobia	Villeta	Charco Largo
2011/4/1						
2011/4/2						
2011/4/3						

2011/4/10						
2011/4/11						
2011/4/12						
2011/4/13						
2011/4/14						

Figure 5-15 Daily water level / temporal series discharge April 11th, 2011 flood in Río Negro basin.

Step 4: Calibration

By changing parameters such as sub catchment runoff coefficients, the model tries to reproduce the flood hydrographs at least in Puerto Libre.

Step 5: Verification

Calibration work must be carried out for more than 2 flood events if data are available as model verification.

Precipitation data for major flood events are not always available for the entire area of the basin. In this case, the use of satellite images causes a precipitation data set that can be considered.

Data Name: Global Rainfall data - TRMM 3B42 (Calibrated)

Grid size: 0.25 degree grid

Temporal resolution: Every 3 hours from Jan.1, 1998 until Mar.31, 2015

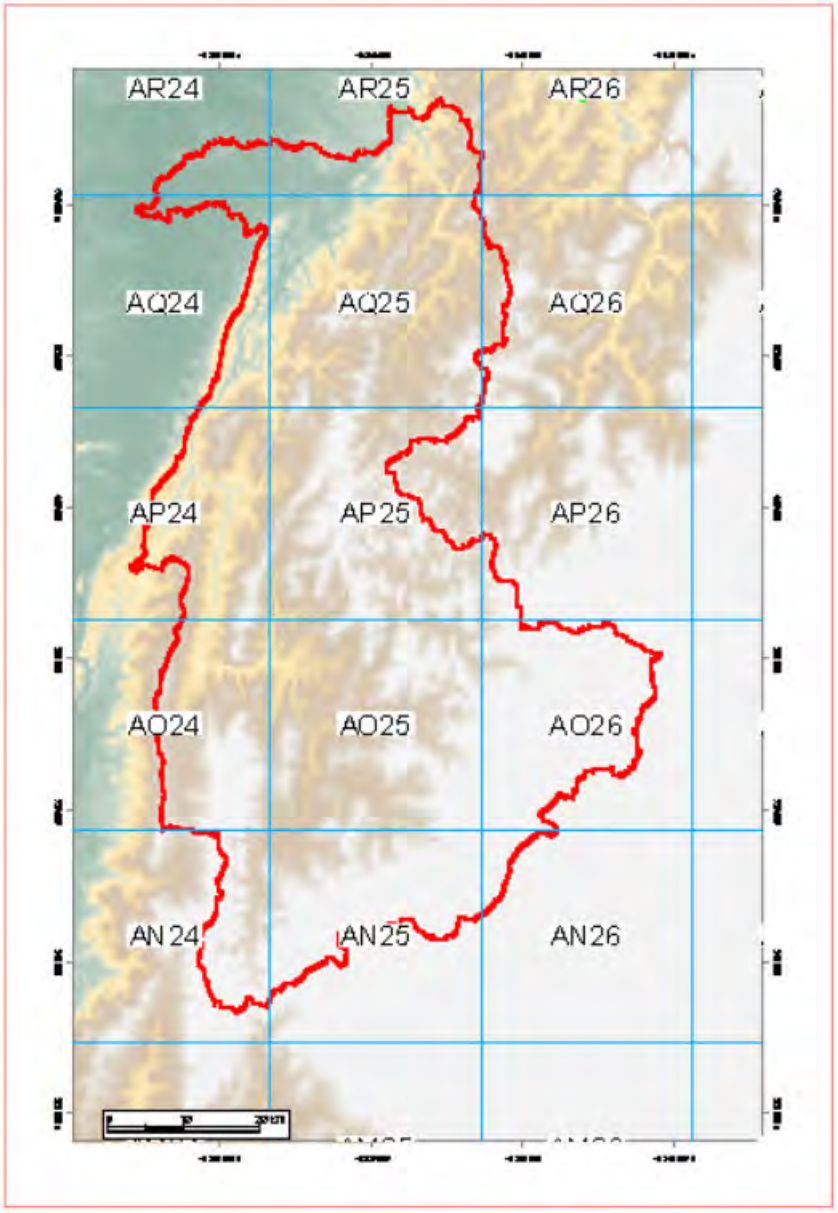


Figure 5-16 Location data grid of TRMM 3B42 in the Basin of Rio Negro

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5.2.1.6 Setting of design rainfall

The distribution of basic discharge has a context of return period. Such return period of flood is considered in establishing the precipitation design. When it comes to a return period of precipitation, always we think about the amount of precipitation in certain duration. For example, a design precipitation is expressed as an amount of 200 mm for duration of 3 days.

The duration corresponds to the time of concentration for the flood point (location) in which the basic discharge should be evaluated. In river planning, the selection of the duration of design rainfall is a significant parameter for the return period rainfall is decided according to the amount of rain in a long

time. Also, when the question about how many days or how many hours of precipitation occurs are the most effective for discharge flood in Cuenca, the answer is that the duration of design rainfall whose base is the flood concentration time.

The method for estimating the concentration time of flood must be addressed in the "Hydrology in Engineering, 2nd Edition" by German Monsalve Saenz (page 256). This reference has several equations for the concentration time of the flood. In addition to the time of concentration calculated flood, the visual comparison of the observed precipitation and flood hydrograph is needed to decide the time of concentration of flooding by the criterion of an engineer in the river planning.

The hyetograph precipitation design can be performed as shown in Figure 5-17. Assuming that an actual precipitation hyetograph was given whose peak is 9 hours the amount of precipitation is 64 mm. If the concentration time is 9 hours (design duration of precipitation for 9 hours) and the amount of design rainfall is 96mm for a certain period of return, the precipitation coefficient design for the amount of actual rainfall is 1.50. Using the coefficient 1.50, the hyetograph design of precipitation can be produced by multiplying the actual hyetograph 1.50 for 9 hours. The amount of precipitation out of peak 9 hours must be adjusted to consider the amount of precipitation design likely return period for a while longer duration.

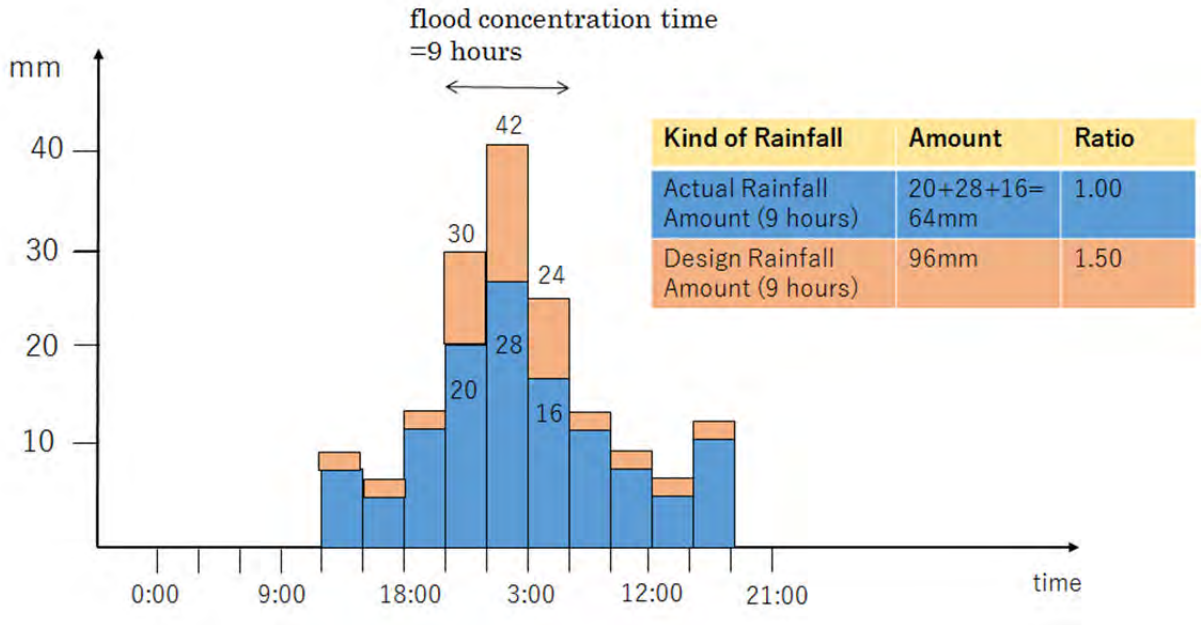


Figure 5-17 Elaboration of rainfall hyetograph Design as in the case of flood concentration time of 9 hours

The design of the amount of precipitation for a certain return period can be obtained by frequency analysis.

5.2.2 Work 10: Establishment of Flood Level Target for the Selected Section

This work is subject to discussion among stakeholders. According to the results of the works 1, 2, 3, 4, 5, 6, 7, 8 and 9, flood level target and target section it will be decided the section for further study on options for flood control.

5.3 Options for Flood Control in target section

If the goal is to reduce flood area against X% against X years return period or specific events of past flooding, general flood control options are:

- River Improvement (Damper / expansion / increase of the inclination of the riverbed)
- Dike
- Upstream dam
- Regulatory basin in the upstream section

APPENDIX 2

Guideline on Economical Evaluation on Flood Control Scheme - Structural Measures -

Version 1.0

September, 2017

JICA Project Team

TABLE OF CONTENTS

1 Background

This guideline was compiled from the contents of the draft manual for flood control economic survey prepared by the Ministry of Land, Infrastructure, Transportation and Tourism (MLIT), Japan, 2000. The flood control economic survey in Japan is performed to identify the economic benefits and cost-effectiveness of constructing flood control facilities such as levees and dams in order to ensure efficiency and transparency in each structural measure of flood control. The procedure of economical evaluation of flood control measures in this guideline was prepared according to the basic policy of the flood control economic survey in Japan inconsideration of existing status of data and information available for calculation of economic benefits and costs in Colombia.

The benefits obtained from constructing flood control facilities are increased disposable income produced by reducing casualties and direct or indirect asset damage caused by floods, benefits from improving the productivity of land by reducing flood damage, and security obtained by improving flood control safety. Flood control facilities are different from other social infrastructure that improves convenience such as roads. As described above, they are considered to be important foundations supporting social and economic activities. However, it is often difficult to measure the economic benefits obtained from constructing flood control facilities. Improvements to flood control facilities provide data for reviewing social and economic activities. It is generally difficult for the general public to feel the effects of constructing flood control faci1ities. It is also difficult to measure such effects in terms of market assets. Therefore, in an economic evaluation, the portion of damage-prevention such as increased disposable income produced by reducing direct or indirect asset damage caused by floods is calculated as possible benefits obtained by constructing flood control facilities.

Uncertainty also remains over the construction costs of flood control facilities. This means there are many cases in which the period and the investment plan required for constructing flood control facilities cannot be precisely determined. Although a rough construction sequence is determined, it is impossible to determine detailed construction period and schedule. Even if the total investment is the same, the present-value total cost at the evaluation point varies greatly depending on the construction period and the amount of investment for the period. Therefore, to make an economic evaluation, the construction period and the investment plan for the period must be prepared for evaluation on the basis of similar past projects according to project type and scale.

As explained above, it is extremely difficult to cover the benefits of constructing flood control facilities and all of the construction costs that form the basic data for an analysis of cost effectiveness. An economic evaluation of flood control measures must be performed while taking this point into account.

2 Purpose

Various effects of flood control projects that can be evaluated economically are considered to be the benefits of flood control projects. On the other hand, the costs of implementing flood control projects and the costs of maintaining facilities are calculated as the costs of a flood control project. The purpose of an economic evaluation of flood control measures is to evaluate economic efficiency by comparing both costs.

3 Scope

Based on this draft manual of flood control economic survey in Japan, the construction period and the investment plan in the period can be estimated at the planning stage of the project. This manual applies to a flood control economic survey for which the economic efficiency of a project can be evaluated. Specifically, it applies to the river improvement plan, reevaluation of river and dam projects, evaluation of new projects, etc.

4 Definition of Terms

Benefit

In this manual, the amount of damage that can be avoided by constructing flood control facilities is the benefit. Other benefits along with construction of flood control facilities and external uneconomic status, which is a negative benefit, are not covered by the flood control economic survey. They are considered separately in the comprehensive evaluation.

Cost

Costs incurred for construction and maintenance of flood control facilities that produce the benefits previously described.

Present value (present price)

Future monetary value that is calculated at the rate of current value

If current C_o (yen) is managed at compound interest (rate γ), it is $C_n = (1 + \gamma)^{n-1} C_o$ n years later. C_n n years later is $C_o = C_n / (1 + \gamma)^{n-1}$ at present value.

If there is no variation of prices in the future, land cost C remains as C n years later, but the present value is reduced over time.

Remaining value

Value of facilities in the future.

5 Basic Policy

Annual costs and annual benefits are compared for evaluating economic efficiency. The total costs

required for construction and maintenance of flood control facilities, and total benefits (reduction of damage) obtained from flood control facilities, are indicated as present values for comparison using a reduction rate as shown in Figure 5-1. The evaluation time (year when project starts for evaluating a new project) is the standard time for present value. The evaluation period is the construction period of flood control facilities and 50 years after completion of flood control facilities. The total costs (excluding remaining value of facilities) are calculated from the present value total sum of costs required for constructing flood control facilities and maintenance costs for 50 years after completion of flood control facilities, an d the total benefits are calculated from the present value total sum of the average reduction of damage expected annually. Such longitudinal profile of a river can give us the following viewpoints.

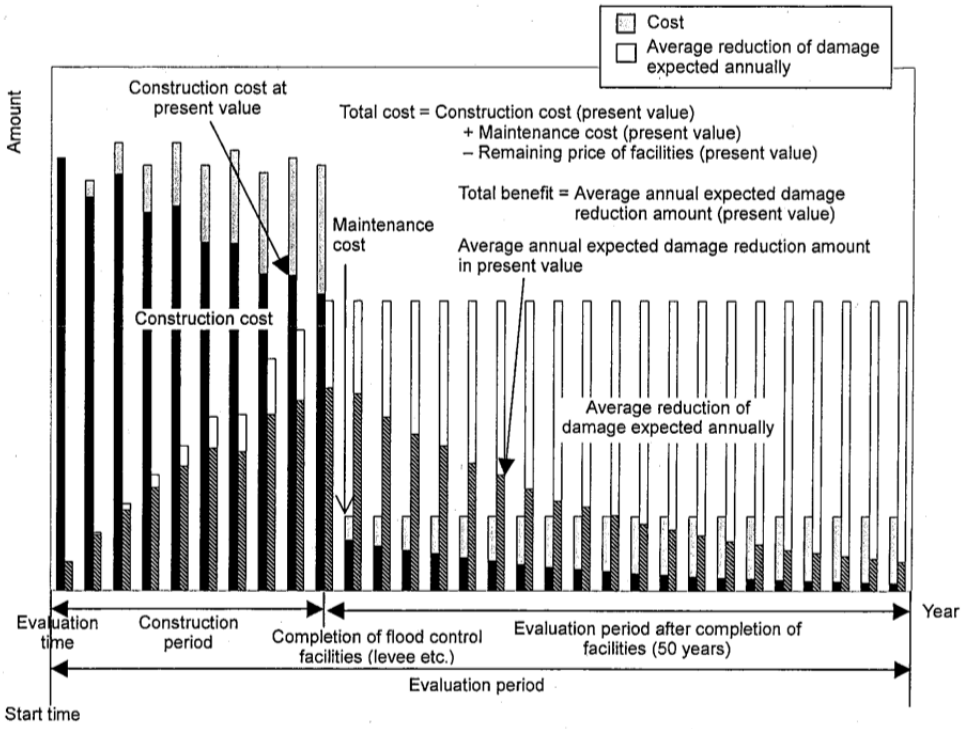


Figure 5-1 Policy for total cost and total benefit

As shown in Figure 5-1, when river improvement plans and river/dam projects are revaluated or when new projects are evaluated for adoption, benefits obtained from the investment plan of flood control facilities and construction of flood control facilities are indicated in chronological order. Then, construction cost, maintenance cost, average annual expected damage reduction amount for each year, etc. are indicated as a present value for ca1culating total costs and total benefits.

When a specific investment plan (construction cost, construction period and allocation of construction cost) is determined, the costs are calculated according to the plan. When a specific investment plan is not determined and only approximate construction costs are determined, the construction period and the allocation of construction cost are estimated on the basis of similar projects for ca1culating costs.

It is necessary to evaluate a flood control project as part of a series of projects. If it is not appropriate to make an economic evaluation of a project for a current channel, a retrospective evaluation to an appropriate point for an economic evaluation of a series of projects is made.

The major reasons for construction period of flood control facilities and 50 years after completion of flood control facilities being the evaluation period are as follows.

- The service lives of flood control facilities have physical and social aspects. For physical service life, appropriate maintenance can extend functions for a considerable number of years. In contrast, for social service life, the sense of value at that time or social requirement is greatly ref1ected on the facilities. Because the effect of such a value or a requirement is changed, it is not appropriate to forecast over a long period.
- In a reduction calculation, costs and benefits from 50 years after completion of flood control facilities are not very significant in present value terms.
- Under the Japanese taxation system, the service life of a levee is determined as 50 years and the service life of a dam is determined as 80 years.

6 Evaluation Flow

When an economic evaluation of flood control measures is performed, the calculation procedures for total costs and total benefits are as shown in Figure6-1.

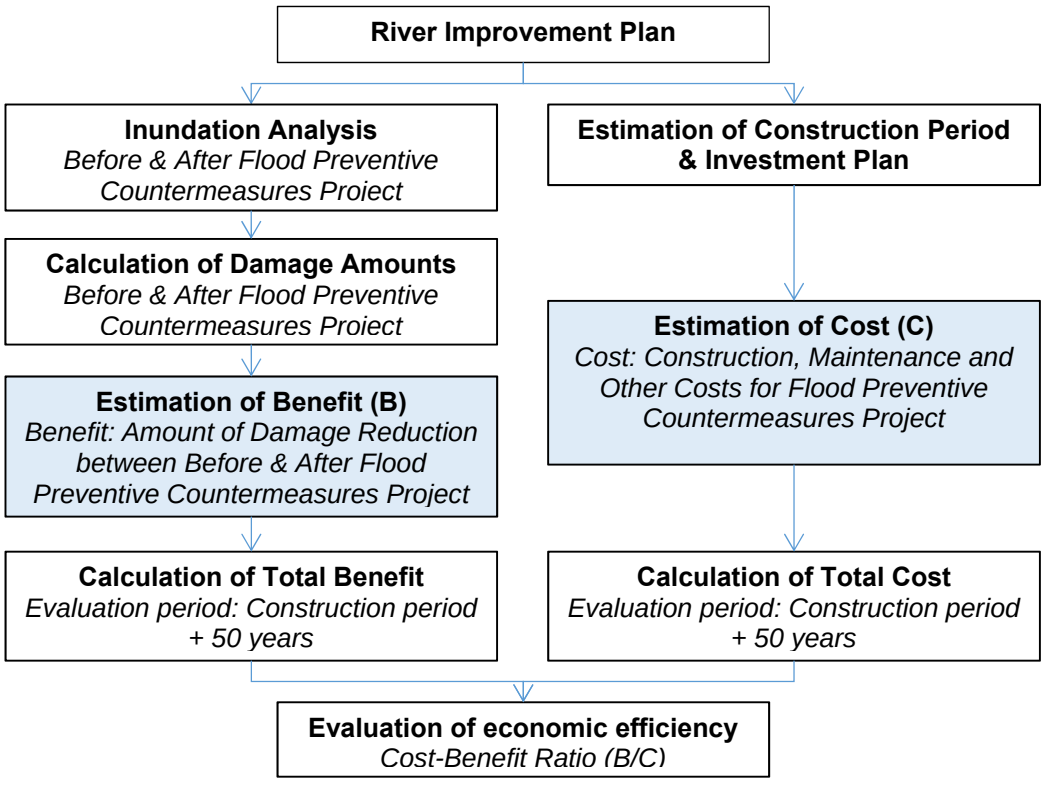


Figure 6-1 Evaluation flow of economic efficiency

7 Estimation of Benefits

7.1 Implementation of Inundation Analysis

As a first step of inundation analysis, a basic mesh grid is set in consideration of a cell size of digital elevation model available for flood analysis and other topographical status in targeted area. Then, inundated mesh grids and those inundation depths are estimated based on appropriate conditions of flood discharge using flood simulation model. For calculation of the benefit by flood control countermeasures, different scales of flood probabilities should be set with the largest design scale for both cases of before project of countermeasures and after ones.

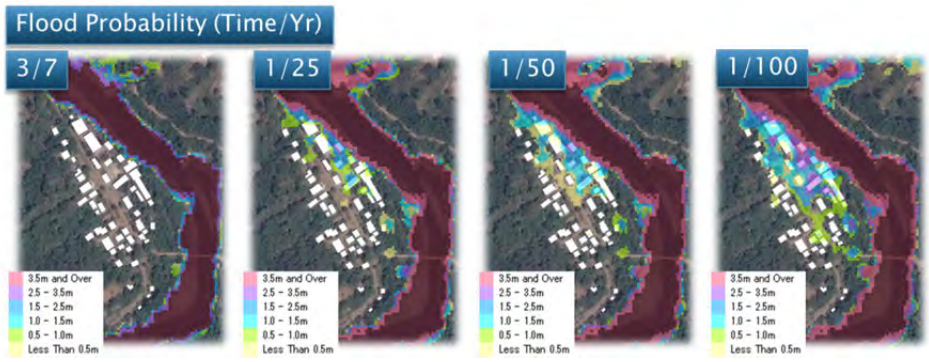


Figure 7-1 Output example of inundation analysis by different scales of flood probability

7.2 Calculation of Damage Amount

An amount of flood damage for each mesh is calculated with mesh data for assets and land forms, and with an inundation depth obtained from the result of inundation analysis. From the total value of these results, the amount of flood damage for each probability scale on the flood plain is calculated respectively.

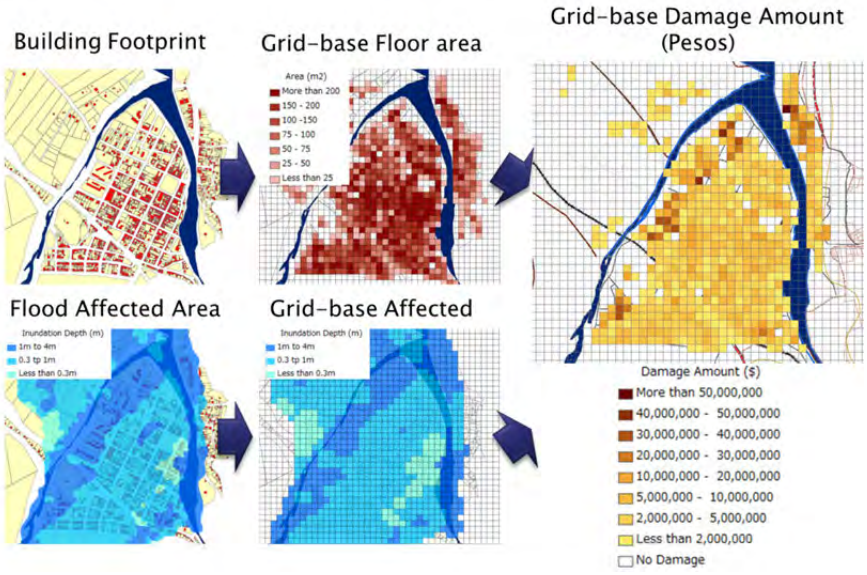


Figure 7-2 Example of gird-wise calculation of flood damage amount

In addition, by subtracting an amount of flood damage with countermeasures referred to as After Project (A_n) from it without countermeasures referred to as Before Project (B_n), an amount of damage reduction (D_n) is calculated. Then, the accumulating total of values calculated by multiplying an amount of damage reduction (D_n) and a value of flood probability (N_n) gives the expected annual average of damage reduction.

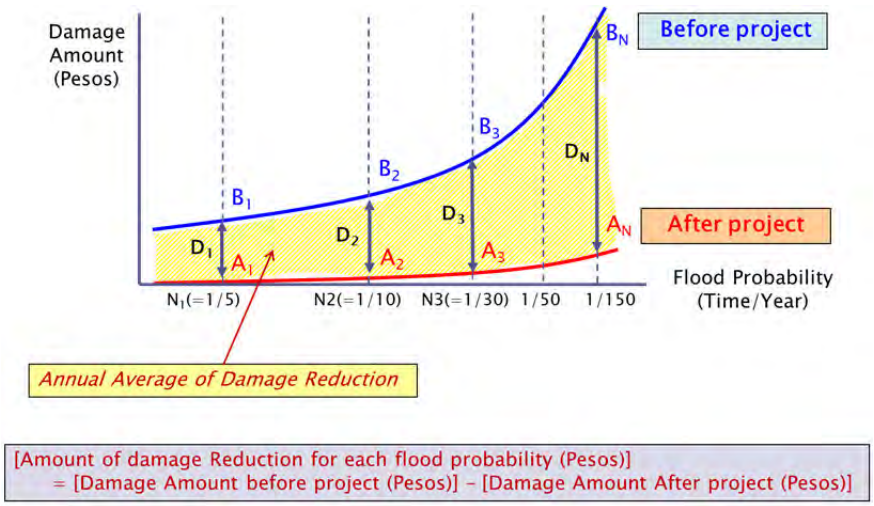


Figure 7-3 Conceptual diagram for calculation of annual average of damage reduction

7.3 Target Benefit of Economic Evaluation

In an economical evaluation of flood control measures, the preventive effects of flood damage are considered to be benefits. Economic effects of flood control measures are classified into major categories of preventing damage to Stock effects at the flood plain and Flow effects of project. Stock effects involve preventive effects of direct/indirect flood damage and upgrading effects of land use with the improved level of flood control safety.

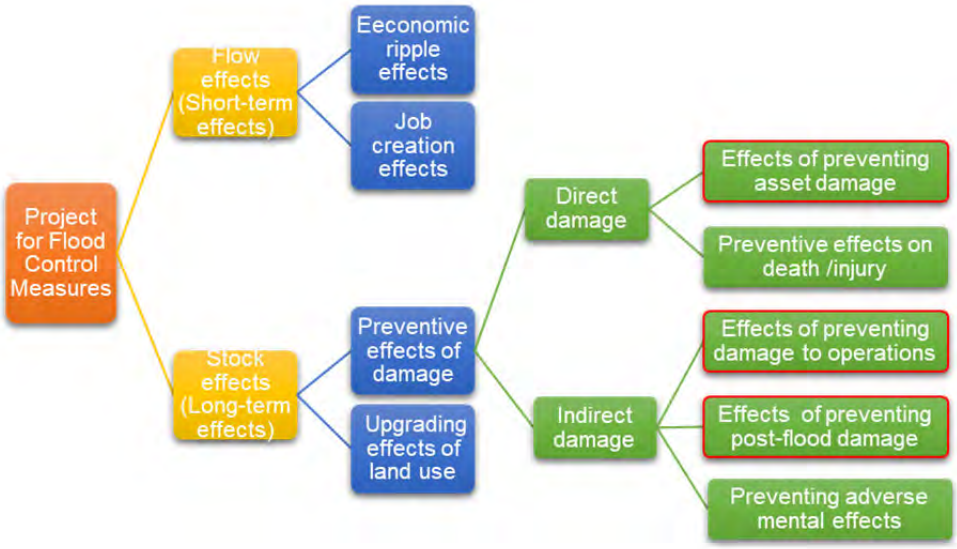


Figure 7-4 Classification of effects of flood control measures

At present, however, all damage preventive benefits are not always measured. It is not technically easy to measure the upgrading benefits of flood control facilities, and it is difficult to completely separate the benefits of upgrading from the benefits of preventing damage. Therefore, in the draft manual of flood control economic survey in Japan, the effects of preventing direct/indirect damage that can be economically measured at present are covered as benefits.

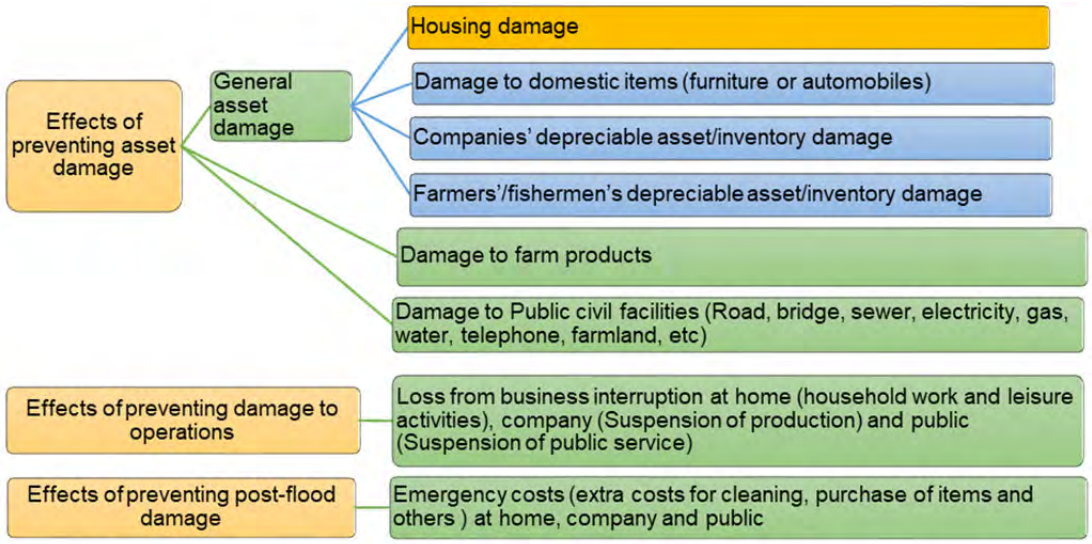


Figure 7-5 Major effects of preventing direct/indirect damage by flood control measures

7.3.1 Assets Applicable to Direct Damage

Damage to the following assets that are exposed to inundation is covered as direct damage.

(1) Housing

Residential buildings for general families and other buildings of companies are applicable.

(2) Domestic items

Furniture, electric appliances, c1othes, cars, etc. at home are applicable.

(3) Depreciable/inventory assets of companies

Production facilities and inventory among company assets exc1uding land and building are applicable.

(4) Depreciable/inventory assets of farmers/fishermen

Production facilities and inventory of farmer/fishermen assets exc1uding assets of general families and land and building are applicable.

((1) to (4) are referred to as General assets. The same applies to the sections below.)

(5) Farm products

Flooded rice and field crops are applicable.

(6) Public facilities

Road, bridge, sewer and city facilities, utility facilities such as electricity, gas, water, railroad, telephone, etc., assets of farmland and farming facilities damaged due to inundation are applicable.

7.3.2 Items Applicable to Indirect Damage

Damage that allows economic evaluation is covered as indirect damage.

Spread of damage from flood inside/outside the inundation area. Damage varies depending on social and economic activities of the inundation area and on the scale of inundation. It is difficult to describe all forms of damage. A method to measure damage economically and reasonably has not yet been established for all items.

For indirect damage, the following items that can be economically and statistically estimated at this stage are obtained for the time being. If an objective and reasonable measuring method that reflects the characteristics of the river for other damage can be established in the survey of each river, such damage may be inc1uded among indirect damage.

• Loss from interruption of business

• Emergency costs at home

• Emergency costs at company

7.4 Appearance of Benefits

In this case, for projects that might generate benefits from the construction of flood control facilities during the construction period, benefits during the construction period are known in chronological order. Thus, an evaluation including the construction period of flood control facilities is performed.

Construction of a levee is as outlined in the figure. Even during the construction period, the effect of levee construction appears along with investment costs.

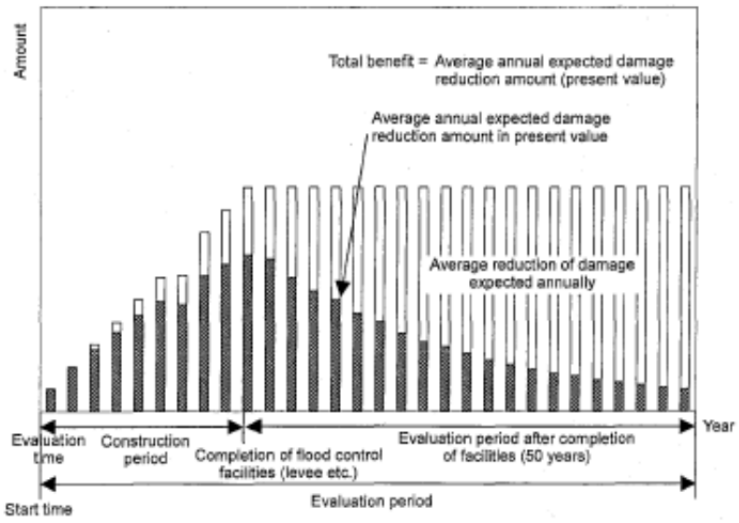


Figure 7-6 Appearance of benefits of levee

In contrast, for a dam, effects appear after completion of the dam and at the stage of use (e.g. stage of initial impoundment).

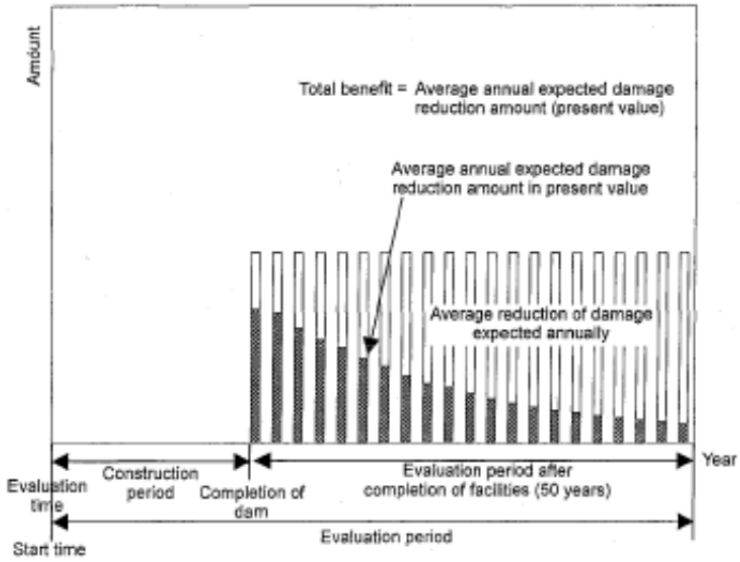


Figure 7-7 Appearance of benefits of Dam

As described above, it is important that benefits from the construction of facilities during the construction period should be known in chronological order to make an appropriate evaluation.

When the amount of damage (benefit of flood control project) is calculated, it is assumed that the current assets will not be changed in the future. When expansion of assets in the flood area in the future can be determined with specific and reasonable values, such expansion may be included in the calculation of assets. Thus, the amount of damage to assets may be calculated.

In this guideline, as described above, under the condition that the minimum amount of damage is

calculated, direct asset damage is immediately recovered. It is also estimated that social and economic activities after indirect damage including interruption of businesses of companies can return to normal within a minimum number of days. However, the relation between individual and local social/economic activities and a flood needs to be reviewed.

7.5 Preparation of Assets and Basic Figures

In principle, assets, basic figures such as number of families required for calculating the amount of damage in the flooded area are used for each calculation mesh of the flood simulation as below.

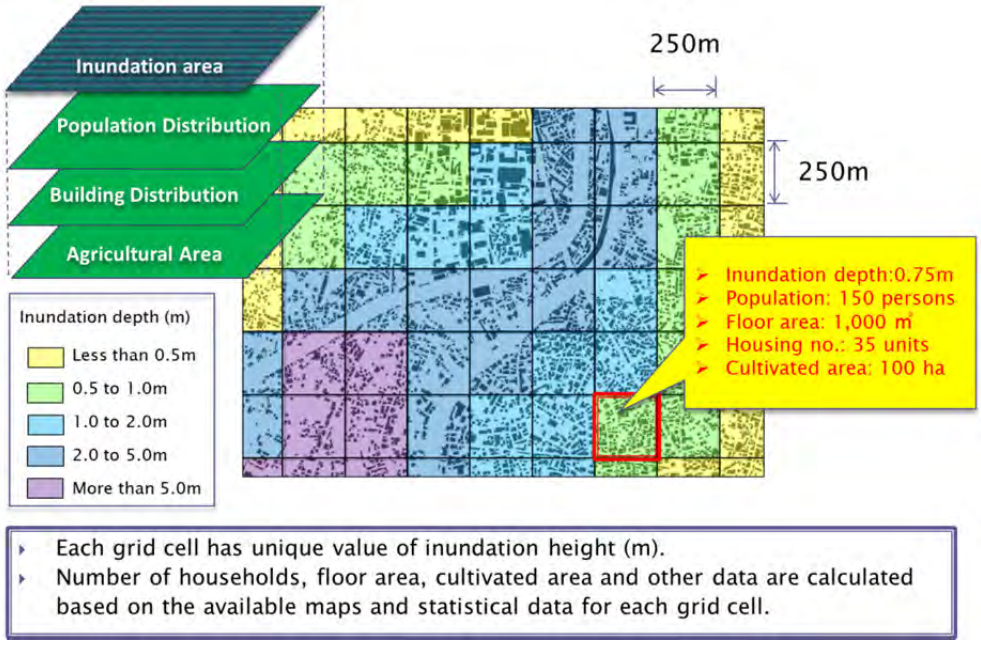


Figure 7-6 Conceptual Figure of gird-base data preparation

For calculation of grid-base floor area, building footprint data can be utilized as below.

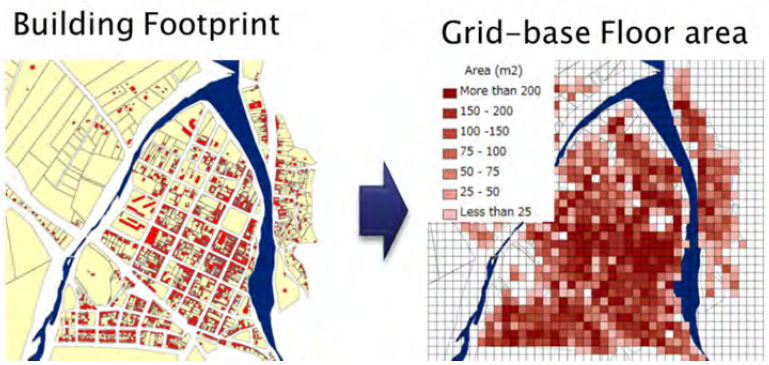


Figure 7-7 Example of data processing to calculate grid-base floor area

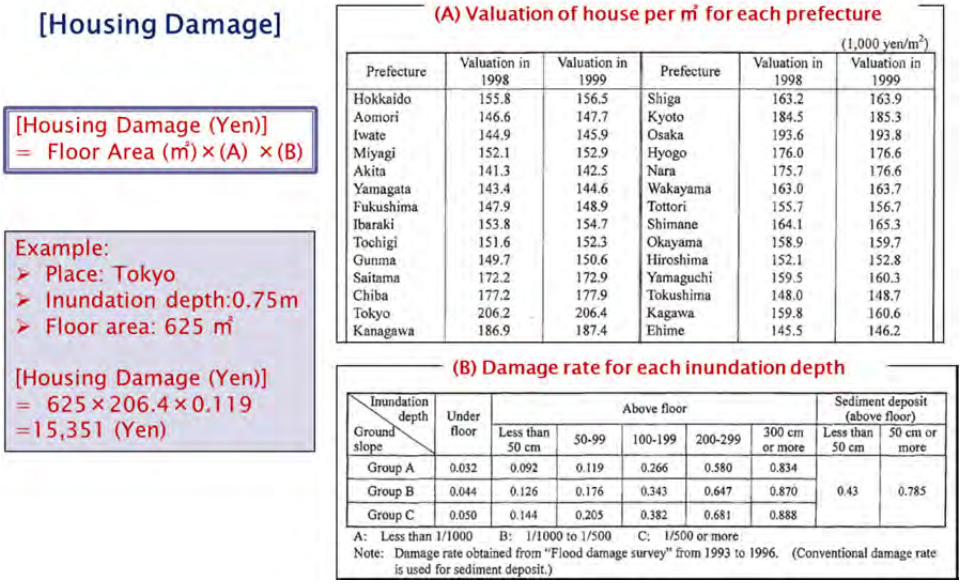
7.6 Calculation of Benefits

The case of housing damage amount is only covered in this guideline for explanation of calculation

procedures of benefits, because existing statistical data or relevant information available for calculation of other direct damage amount are very limited at present.

7.6.1 Calculation of Direct Damage Amount

A housing damage amount by grid is calculated by multiplying floor area, valuation of house per square meter and damage rate for each inundation depth as shown in Figure 7-8.



(A) Valuation of house per m² for each prefecture

(1,000 yen/m²)

Prefecture	Valuation in 1998	Valuation in 1999	Prefecture	Valuation in 1998	Valuation in 1999
Hokkaido	155.8	156.5	Shiga	163.2	163.9
Aomori	146.6	147.7	Kyoto	184.5	185.3
Iwate	144.9	145.9	Osaka	193.6	193.8
Miyagi	152.1	152.9	Hyogo	176.0	176.6
Akita	141.3	142.5	Nara	175.7	176.6
Yamagata	143.4	144.6	Wakayama	163.0	163.7
Fukushima	147.9	148.9	Tottori	155.7	156.7
Ibaraki	153.8	154.7	Shimane	164.1	165.3
Tochigi	151.6	152.3	Okayama	158.9	159.7
Gunma	149.7	150.6	Hiroshima	152.1	152.8
Saitama	172.2	172.9	Yamaguchi	159.5	160.3
Chiba	177.2	177.9	Tokushima	148.0	148.7
Tokyo	206.2	206.4	Kagawa	159.8	160.6
Kanagawa	186.9	187.4	Ehime	145.5	146.2

(B) Damage rate for each inundation depth

Inundation depth / Ground slope	Under floor	Above floor					Sediment deposit (above floor)	
		Less than 50 cm	50-99	100-199	200-299	300 cm or more	Less than 50 cm	50 cm or more
Group A	0.032	0.092	0.119	0.266	0.580	0.834	0.43	0.785
Group B	0.044	0.126	0.176	0.343	0.647	0.870		
Group C	0.050	0.144	0.205	0.382	0.681	0.888		

A: Less than 1/1000 B: 1/1000 to 1/500 C: 1/500 or more

Note: Damage rate obtained from "Flood damage survey" from 1993 to 1996. (Conventional damage rate is used for sediment deposit.)

Figure 7-8 Example of calculation of housing damage amount by gird

In case of Colombia, valuation of house per square meter per municipality which was estimated based on the price of properties in Colombia, IGAC, 2010 is utilized in this process. The estimated valuation data by municipality in Department of Cundinamarca is shown in Table 7-1.

Table 7-1 Valuation of house per square meter for each municipality

DIVIPOLA	MUNICIPALITY	TOTAL PROPERTY QUANTITY	TOTAL BUILT AREA (m2)	TOTAL VALUATION ($)	VALUATION ($/m2)
25019	ALBÁN	2,783	271,581	65,643,349,000	$ 241,708.18
25095	BITUIMA	1,940	86,660	23,404,648,500	$ 270,074.41
25148	CAPARRAPÍ	7,385	402,336	80,453,565,000	$ 199,966.11
25258	EL PEÑÓN	3,175	125,499	16,731,400,900	$ 133,319.00
25320	GUADUAS	13,756	1,326,390	288,898,943,000	$ 217,808.44
25328	GUAYABAL DE SÍQUIMA	2,920	234,156	72,233,619,000	$ 308,485.02
25394	LA PALMA	6,334	375,801	85,760,694,600	$ 228,207.73
25398	LA PEÑA	3,412	164,444	22,014,314,300	$ 133,871.19
25402	LA VEGA	8,764	938,409	651,969,400,000	$ 694,760.39
25489	NIMAIMA	2,337	155,568	44,790,420,500	$ 287,915.38
25491	NOCAIMA	3,417	272,306	68,545,322,000	$ 251,721.67
25513	PACHO	15,068	848,036	199,212,053,600	$ 234,909.90
25572	PUERTO SALGAR	5,735	624,111	324,395,168,000	$ 519,771.59
25592	QUEBRADANEGRA	3,089	219,997	75,468,906,000	$ 343,045.16
25658	SAN FRANCISCO	5,654	545,141	173,082,081,600	$ 317,499.66
25718	SASAIMA	5,689	656,436	145,198,888,000	$ 221,192.76
25777	SUPATÁ	3,634	143,427	54,375,330,300	$ 379,115.02
25823	TOPAIPÍ	3,091	81,970	9,312,346,600	$ 113,606.77
25851	ÚTICA	2,334	193,190	44,992,303,800	$ 232,891.47
25862	VERGARA	4,436	160,918	29,158,208,000	$ 181,199.17
25867	VIANÍ	2,208	96,682	15,885,213,100	$ 164,303.73
25871	VILLAGÓMEZ	1,517	55,379	6,942,350,400	$ 125,360.70
25875	VILLETA	12,370	1,396,899	615,442,646,100	$ 440,577.77
25885	YACOPÍ	9,500	297,501	62,455,538,500	$ 209,933.88

Source: Price of properties in Colombia, IGAC, 2010

The asset amount is multiplied by the damage rate corresponding to the inundation depth to calculate housing damage. At this time, the asset distribution in the mesh should be considered.

The damage rate in Table 7-2 is used. In Table 7-2, completely or partially collapsed houses due to increase of inundation depth is already considered.

Table 7-2 Damage rate for each inundation depth

	Less than 50cm	50 - 99cm	100 - 149cm	150 - 249cm	250 - 349cm	350cm or over

Inundation depth / Ground slope	Under floor	Above floor					Sediment deposit (above floor)	
		Less than 50 cm	50-99	100-199	200-299	300 cm or more	Less than 50 cm	50 cm or more
Group A	0.032	0.092	0.119	0.266	0.580	0.834	0.43	0.785
Group B	0.044	0.126	0.176	0.343	0.647	0.870		
Group C	0.050	0.144	0.205	0.382	0.681	0.888		

A: Less than 1/1000 B: 1/1000 to 1/500 C: 1/500 or more

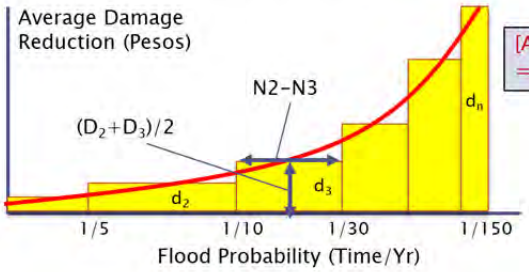
Note: Damage rate obtained from "Flood damage survey" from 1993 to 1996. (Conventional damage rate is used for sediment deposit.)

7.6.2 Expected Annual Average of Damage Reduction

As shown in Figure 7-3, for calculating expected annual average of damage reduction, an amount of damage reduction for each flood probability is summed up in consideration of duration of flood probability. The sheet to be utilized for calculation of expected annual average of damage reduction is shown in Table 7-3. It needs only to input amounts of damage reduction for each cases of before project and after one by flood probability.

Table 7-3 Calculation sheet for expected annual average of damage reduction

No.	Flood Probability (Time/Yr)	Damage Amount (Peso)			Average Damage Reduction in Section (Pesos)	Flood Probability in Section (Time/Yr)	Annual Average of Damage Reduction in Section (pesos)
		Before Project	After Project	Damage Reduction			
		(1)	(2)	(3)=(1)-(2)	(4)	(5)	(6)=(4)×(5)
0	$N_0(=1)$	B_0	A_0	D_0			
1	$N_1(=1/5)$	B_1	A_1	D_1	$(D_0+D_1)/2$	N_0-N_1	d_1
2	$N_2(=1/10)$	B_2	A_2	D_2	$(D_1+D_2)/2$	N_1-N_2	d_2
3	$N_3(=1/30)$	B_3	A_3	D_3	$(D_2+D_3)/2$	N_2-N_3	d_3
...	...	...	...	...	...	...	...
n	$N_n(=1/150)$	B_n	A_n	D_n	$(D_{n-1}+D_n)/2$	$N_{n-1}-N_n$	d_n



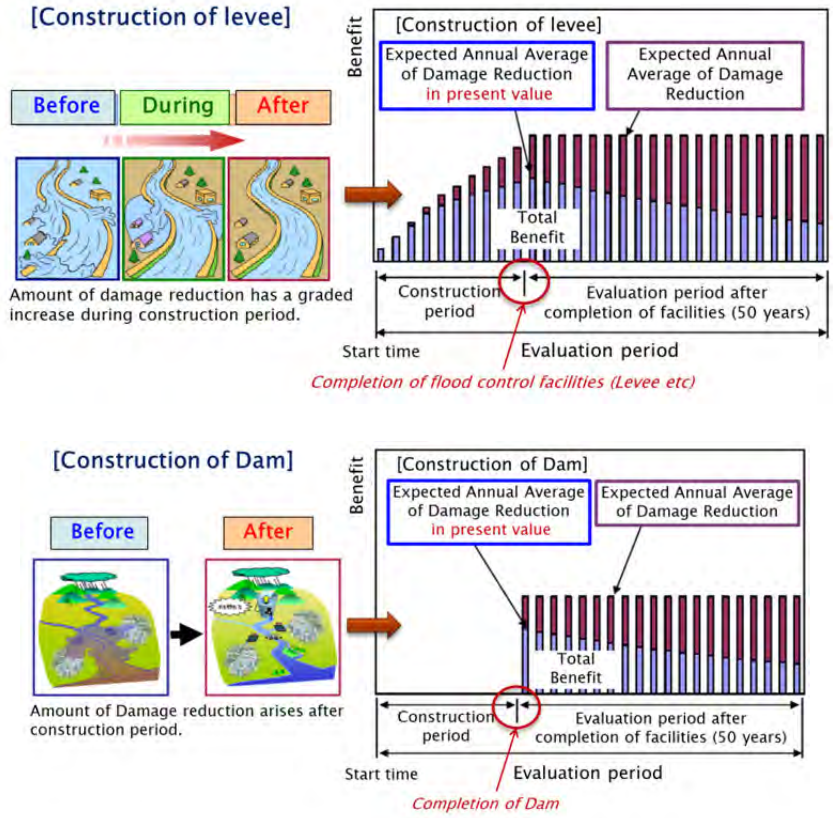
[Annual Average of Damage Reduction(pesos)]
= $\Sigma(n) = d_1+d_2+d_3+\cdots+d_n$

7.6.3 Total Benefit in Evaluation Period

Where, expected annual average of damage reduction is b_t, construction period is S, evaluation period is $S+50$ years, "Discount Rate" is r, total benefit B for $S+50$ years is calculated from the start of construction.

$$Total\ Benefit = \sum_{t=0}^{S+49} \frac{b_t}{(1+r)^t}$$

b_t: Average Reduction of Damage Expected Annually (Yen)
r: Discount rate (4%)
S: Construction period (year), t : Time (year)



"Discount Rate" means a rate to convert future monetary value (FV) into present value (PV) in order to unify each value of cost and benefit during evaluation period. The present value to be applied to public works by MLIT in Japan is set as 4% currently.

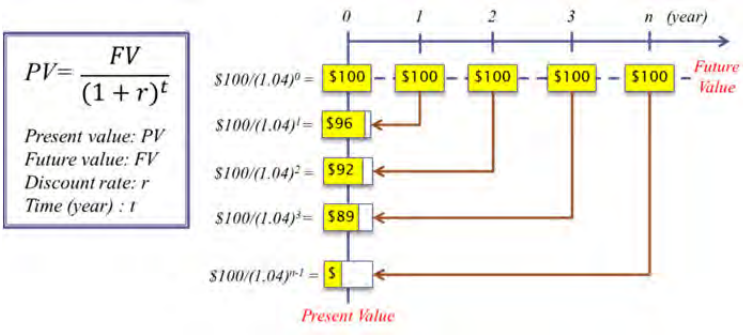


Figure 7-9 What is Present Value and Future Value?

8 Estimation of Costs

8.1 Costs Covered

The total construction costs from the start of the flood control project until completion of the flood control facility, and maintenance costs during the period of the evaluation are covered.

In principle, economic efficiency is currently evaluated for a river improvement plan, reevaluation of river/dam project and selection of a new project. Therefore, costs required in future for completing a flood control facility, and maintenance costs during the evaluation period are covered (Figure 8-1). The construction cost of facility, the land cost, the compensation cost, and the maintenance cost are calculated separately. Maintenance costs for 50 years are estimated. Any remaining value at the end of the evaluation period is deducted from the costs.

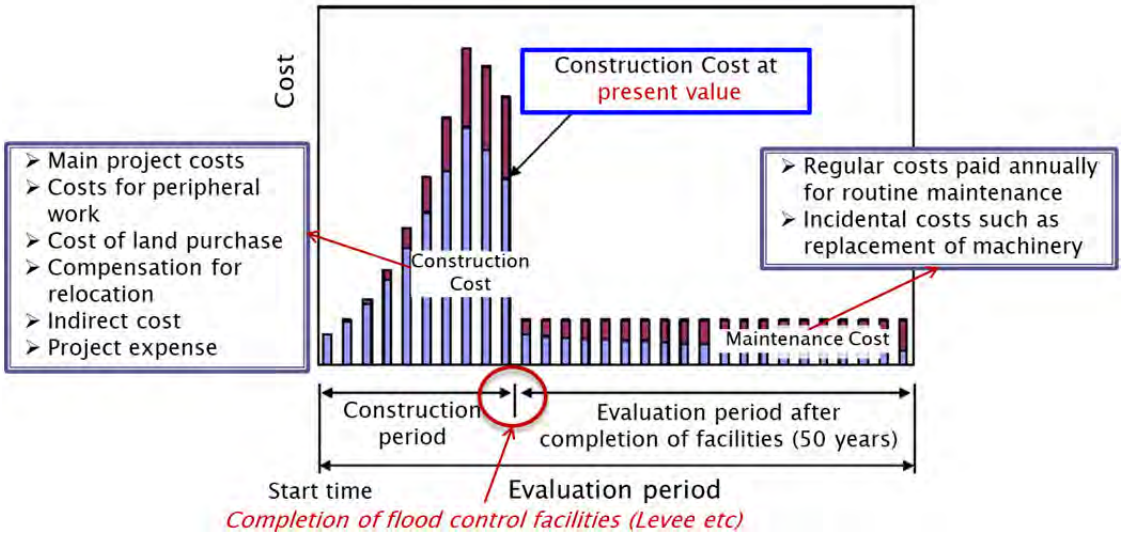


Figure 8-1 Total costs for construction and maintenance

However, if it is necessary to evaluate a flood control project as a series of projects, and if it is not appropriate to evaluate the economic efficiency of the project based on the current status of a river channel, the evaluation can be changed to the point in time when it is appropriate to evaluate economic efficiency for a series of projects. In this case, past cost is converted into present value from the actual records of construction cost, land cost, compensation cost, etc.

8.2 Estimating Construction Period and Investment Plan

If a specific investment plan (construction cost, construction period and allocation of construction cost) is already determined, the cost is calculated accordingly.

If no specific investment plan is determined and only the approximate construction cost is determined, a similar project in the past is used for estimating the construction period and allocating construction costs, an d for calculating the total cost.

8.3 Total Cost Estimating in Evaluation Period

Total cost is the sum of construction costs and maintenance costs converted into present value, from which the remaining value of the facility at the end of the evaluation period (construction period + 50 years) converted to the present value is deducted.

- Construction cost is calculated as annual construction costs C_t converted into present value for construction period S.

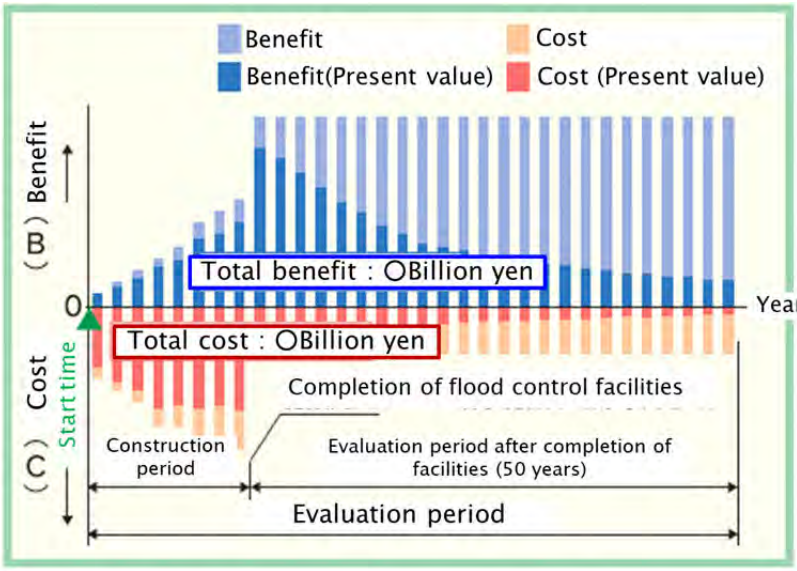
- Maintenance cost is calculated as annual maintenance costs m and incidental/regular maintenance costs M for facility replacement, for which payment is scheduled every $S+50$ years, converted into present value.

$$Total\ Cost = \sum_{t=0}^{S-1} \frac{c_t}{(1+r)^t} + \sum_{t=S}^{S+49} \frac{m+Mt}{(1+r)^t}$$

c_t: Construction cost (Yen)
m: Annual maintenance cost (Yen)
M_t: Incidental maintenance cost (Yen)
r: Discount rate (4%)
S: Construction period (year), t : Time (year)

9 Evaluation of Economic Efficiency

For the survey on the economic efficiency of flood control, total cost and total benefit gained from the investment are compared.



$$Cost\ Benefit\ Ratio = Total\ Benefit / Total\ Cost$$

APPENDIX 3

Improvement of flood forecasting and warning, and evacuation

October, 2017

JICA Expert Team

Table of Contents

1. Estimation of Flood Wave Propagation Time/Velocity

1.1 Background and Objective of Estimation of Flood Wave Propagation Time/Velocity

For an effective flood early warning system, it is important to install enough meteorological and hydrological observation stations, and provide residents with warning information for their evacuation. But, from the viewpoint of budget and operation of meteorological and hydrological observation stations, it is not easy to install them in all areas that require them, and it is difficult to provide detailed warning information.

There is a possibility for downstream municipality to understand water level fluctuation in advance by contacting upstream municipalities while the water level is rising. The areas that cannot receive the detailed warning information from national organization are expected to secure lead time for evacuation by cooperating with upstream municipalities.

As for a continental river such as Magdalena River, the flood water level usually rises in a few days, so the related municipality may start to take evacuation measures after confirming the rise in water level. On the other hand, as for a river of a scale such as Rio Negro River, the flood water level usually rises in a few hours; therefore, the related municipalities cannot secure enough lead time for evacuation if they start to take actions after confirming the water level starts rising. In fact, according to flood log from April 2011 created by a firefighter officer in Utica along Rio Negro River, Utica was inundated in an hour after issuing evacuation order, and then 35 households were affected by flood. Water level observation station, which is located in Charco largo (35 km upstream from Utica), recorded rise in water level 1-2 hours before the water level started rising in Utica.

For the purpose of improving flood early warning system through cooperation between upstream and downstream municipality, this chapter shows how to estimate flood wave propagation time/velocity, and its case study in Rio Negro basin.

1.2 Estimation Methods of Flood Wave Propagation Time/Velocity

1.2.1 Estimation by utilizing water level observation data

The flood wave propagation time can be estimated between water level observation stations. For this estimation, basically hourly water level data is needed.

For comparing water level data between upstream and downstream observation stations, it is expected to confirm the flood wave propagation time corresponding to each water level. But, if there is not enough data in these stations, it can be confirmed by referring to past inundation date and its water level data. If IDEAM has already set the danger level (Yellow, Orange and Red), this water level can be referred to for the estimation.

1.2.2 Calculation by empirical formula

It is difficult to estimate the flood wave propagation time by utilizing water level observation data, if enough hydrological observation stations are not installed, or the observation frequency is not sufficient. In this case, it can be calculated by an empirical formula despite the lack of the observation stations.

If there is river bed slope data, the flood wave propagation velocity can be calculated by utilizing the empirical formula. However, the results of the calculation by the empirical formula need to be verified by comparing them with the results estimated by observation data since the empirical formula cannot always apply to all rivers exactly. Also, there are many kinds of empirical formulas other than the one introduced in this chapter, so search and utilize another one if necessary.

1) Rzhiha formula (in case of H/L > 1/20): $W=20(H/L)^{0.6}$
2) Kraven formula (in case of H/L < 1/20): shown in the table below

River bed slope: H/L	Velocity: W (m/s)
>1/100	3.5
1/100 ~ 1/200	3.0
<1/200	2.1

The flood wave propagation velocity is calculated by utilizing two kinds of empirical formula with boundary value 1/20 of river bed slope as shown above.

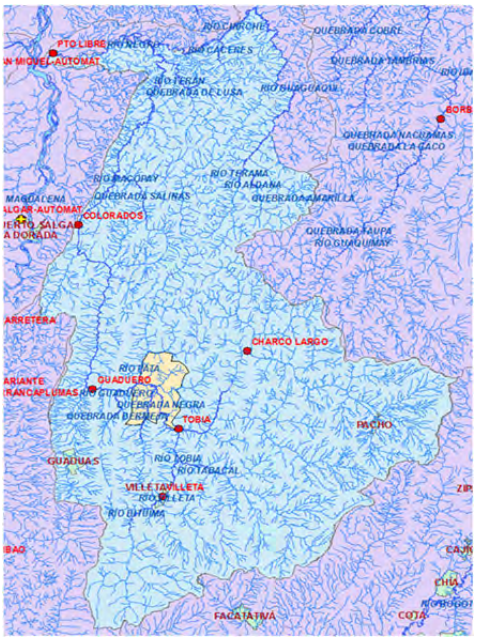
1.2.3 Estimation through interview with residents

For the purpose to verify the accuracy of flood wave propagation velocity calculated by empirical formula and observation data, interviews with residents shall be conducted. If upstream and downstream municipality already collaborate in providing each other with flood early warning, the time lag of high water level can be confirmed by the interview with residents through the past experience of flood.

1.3 Case study in Rio Negro River

1.3.1 Estimation by utilizing water level observation data

For the estimation of flood wave propagation velocity, five water level observation stations data (Charco Largo、Tobia、Guaduero、Colorodos and Pto Libre) are utilized. The location of each station is shown in the figure below.



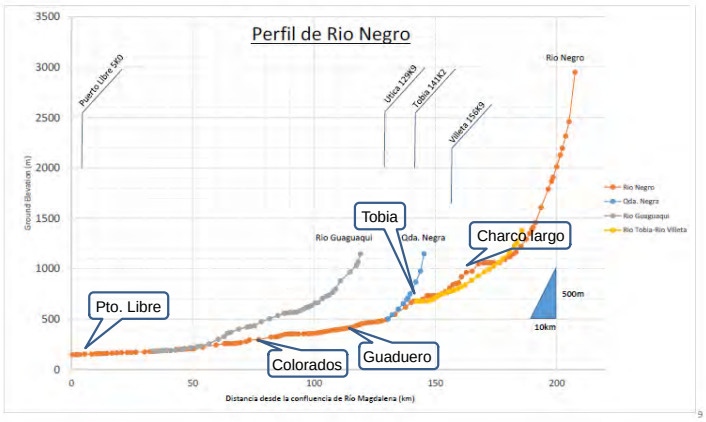


Figure Water Level Observation Stations in Rio Negro basin

Since hourly water level data in Rio Negro basin is quite limited, some events of rise in water level are extracted to analyze the water level fluctuation between upstream and downstream observation stations.

The results of analysis on water level fluctuation among Charco Largo, Tobia and Guaduero are show in the figure below.

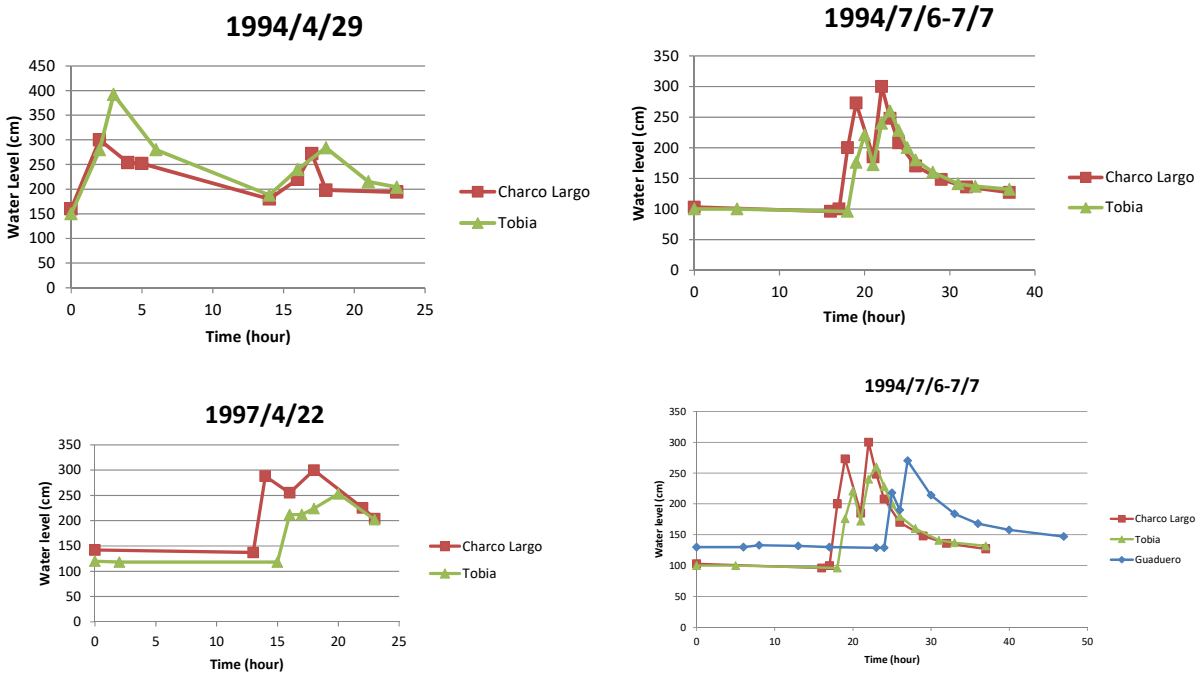


Figure Comparison of Water Level Fluctuation among Charco Largo, Tobia and Guaduero

These figures show that the flood wave propagation time from Charco Largo to Tobia is about 1 to 2 hours. Also, the one from Tobia to Guaduero is about 4 hours.

On the other hand, the following figure shows that the one from Tobia to Guaduero is about 2 to 3 hours, which is another event of rise in water level.

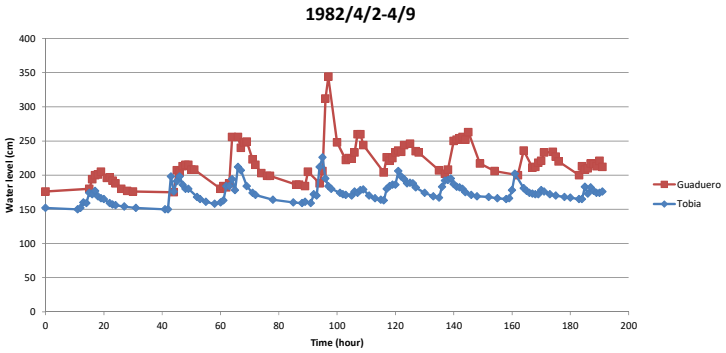


Figure Comparison of Water Level Fluctuation between Tobia and Guaduero

By comparing the water level fluctuation among Guaduero, Colorados and Pto Libre located in downstream of Rio Negro river, the flood wave propagation time is confirmed as about 2 hours between Guaduero and Colorados, and 9 to 10 hours between Colorados and Pto Libre as shown figure below.

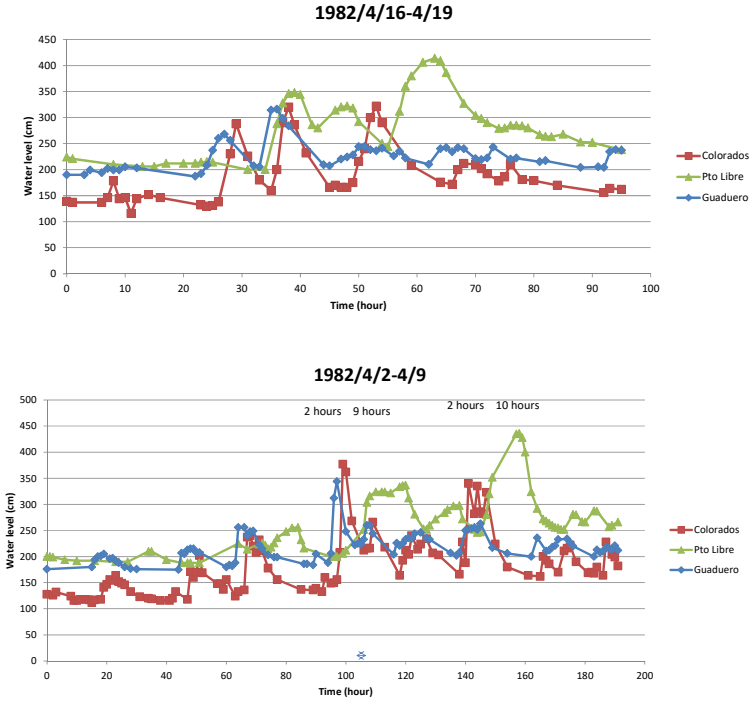
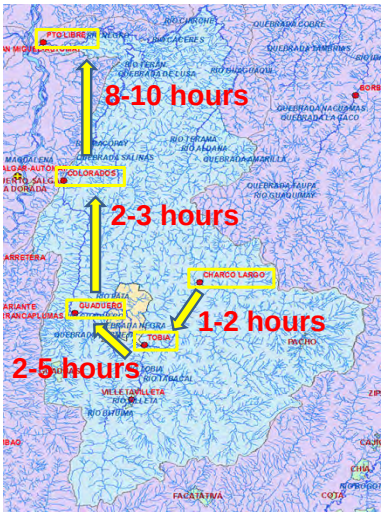


Figure Comparison of water level fluctuation among Guaduero, Colorados and Pto Libre

In summary, it takes half to one day for the flood to flow down from upstream to downstream in Rio Negro River. The flood wave propagation time between stations are shown in the figure below.



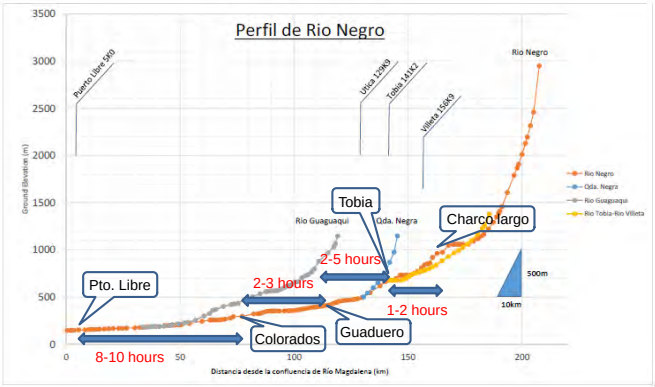


Figure Results of Analysis on Flood Wave Propagation Time among Water Level Observation Stations along Rio Negro River

1.3.2 Calculation by empirical formula

Rio Negro river bed slope is 1/20 at the elevation of about 1500 meters. In this section, the flood wave propagation velocity is calculated by utilizing two kinds of empirical formula as shown figure below.

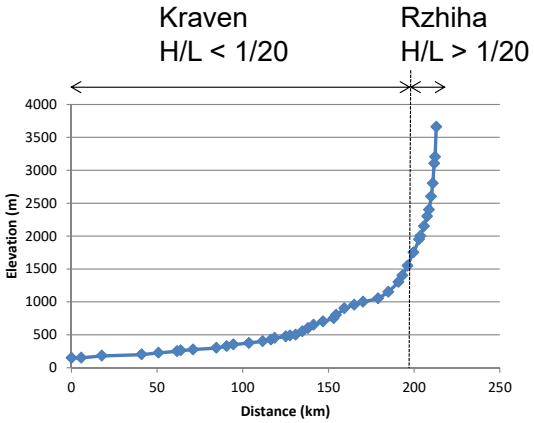


Figure Longitudinal Profile of Rio Negro River

The flood wave propagation velocity is calculated not only between water level observation stations but also for municipalities which has past flood experience without water level observation station as shown in the figure below.

The flood wave propagation time calculated by the empirical formula is about 1 hour longer compared to the one estimated by water level observation data. In order to be on the safe side on early warning, it shall be 1 hour shorter for practical use.

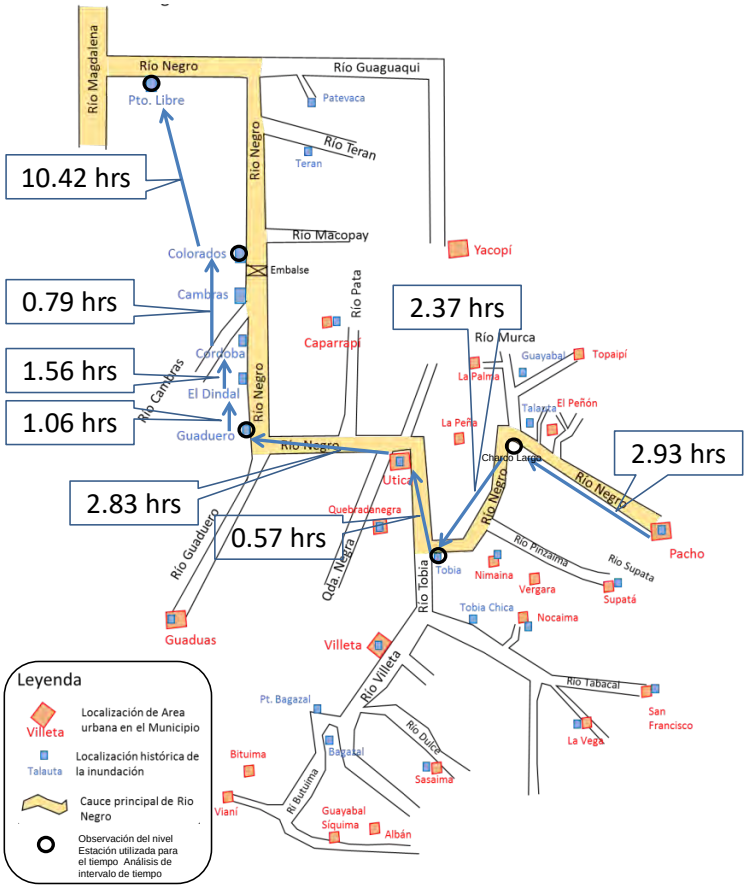


Figure Results of Flood Wave Propagation Time calculated by Empirical Formula along Rio Negro River

1.3.3 Estimation through interview with residents

In the Project, some interviews were conducted to confirm the actual flood situation in several municipalities in Rio Negro basin. Through the interviews, it was confirmed that several municipalities in Rio Negro basin are communicating with each other during flood by using telephone and WhatsApp (smartphone messenger application). In Cordoba located in downstream of Rio Negro river, the residents commented that they would surely have died if they had not received a warning from upstream municipality during 2011 flood. On the other hand, the criteria to disseminate a warning to downstream municipality are subjective judgement since the water level is observed visually without referring to a quantitative value. This aspect should be improved.

According to the results of interview at Colorados located in downstream of Rio Negro river, Colorados is receiving a warning from Utica, and it takes 3 to 4 hours to for the water level to rise after receiving the information from Utica. The flood wave propagation time between Utica and Colorados calculated by the empirical formula is 6.24 hours. The result of analysis in the previous section is generally based on facts, taking into account that the flood wave propagation time is calculated 1 hour longer than in reality and that it takes time to confirm the rise in water level in upstream municipality before disseminating a warning to downstream municipality.

1.4 Future Challenges

1.4.1 Consideration for the criteria for the flood events that happen simultaneously (on the same day) in different municipalities

Through the verification of water level data in this material, it was confirmed that flood events do not always happen simultaneously among municipalities in Rio Negro basin. In the future, rainfall data and water level data need to be expanded, and the relationship with simultaneous flood events in several municipalities along Rio Negro basin is expected to be verified. Based on the results of verification, IDEAM needs to consider how to apply them into issuance of warning.

1.4.2 Consideration for tributary

Through the interviews, it was confirmed that not only main river of Rio Negro but also its tributaries have a significant influence on flood. It is difficult in tributaries to secure lead time for evacuation since its length is shorter and its bed slope is greater than the main river. From now on, not only making evacuation decision by water level but also by rainfall amount is expected for flood early warning in tributaries of Rio Negro basin.

2. Estimation of Required Time for Warning Dissemination and Evacuation

2.1 Background and Objective

In order to operate an effective early warning system, it is important to issue a warning at a proper timing. For the issuance of warning, it is necessary to secure enough lead time before the event of a natural disaster through estimation of required time for warning dissemination and evacuation.

For flood early warning system in Rio Negro basin, which is the pilot basin in the Project, effective cooperation between upstream and downstream municipalities is suggested for its operation (refer to Chapter 1) under limitations posed by the fact that time-spatial network of meteorological and hydrological observation is not enough for the issuance of warning. In order to take proper evacuation actions, it is necessary to consider by when the downstream municipality should receive flood warning (information about the rise in water level) from which upstream municipality.

This material introduces how to estimate required time for warning dissemination and evacuation and its case study in Rio Negro basin. The target disaster is flood, but the results of estimation may be applied to the other disaster such as tsunami, landslide, and hurricane.

2.2 Examination method

2.2.1 Basic confirmation items

The following items shall be confirmed to estimate required time for warning dissemination and evacuation.

- Target area for flood evacuation

  It is necessary to prepare an inundation map. The target return period should be defined at the highest possible value (eg, 100-year return period) since this estimation influences non-structural measures which needs to cover the floods beyond the limits of structural measures.

- Number of evacuees

  The number of evacuees or households inside the target area for flood evacuation shall be counted.

- Candidate facility for evacuation

  A resilient facility for evacuation shall be selected outside the target area for flood evacuation.

- Evacuation route

  Evacuation route from the most remote household to the evacuation facility shall be confirmed. Also, the alternative routes shall be considered if dangerous locations exist along the evacuation route.

- Urgent call to related officers, evacuation guidance system

  Tools for announcement of evacuation, officer who urges the residents to evacuate, and the number of officers shall be confirmed.

2.2.2 Consideration items

In order to estimate the required time for warning dissemination and evacuation, it is necessary to carry out interviews on site in the target municipalities and make estimation on paper. The consideration items are shown in the table below.

Table Consideration Items on the Required Time for Warning Dissemination and Evacuation

Consideration items	Required time	
Required time for evacuation		
・Time for residents to prepare for starting evacuation	○○	mins
・Time to move to evacuation facility	○○	mins
Required time for warning dissemination		
(Receiving warning from upper stream municipality)		
・Time for the officer to observe river rise in water level visually in upper stream municipality	○○	mins
・Time to receive warning from upper stream municipality, and confirm the situation	○○	mins
(In case of warning dissemination by firefighters through Tel.)		
・Time to call and gather related officers if necessary	○○	mins
・Time to call relevant firefighting officers (number of persons times ** mins)	○○	mins
・Dissemination time to residents (number of households times ** mins)	○○	mins
Sum	○○	mins

Time for residents to prepare for starting evacuation is usually set as 10 to 20 minutes in Japan.

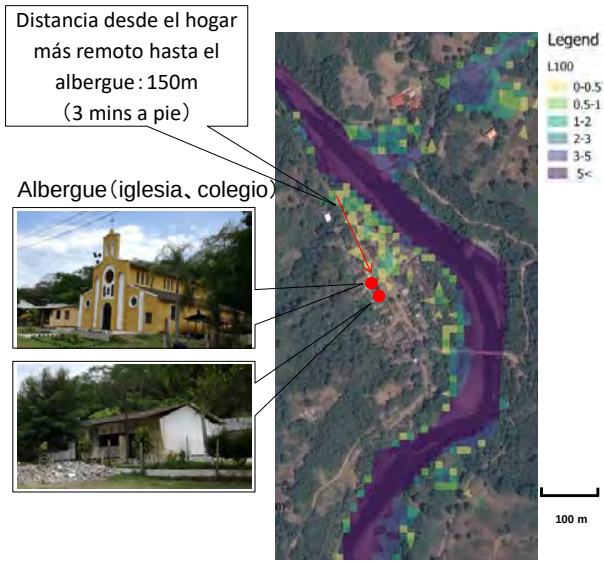
Time to move to evacuation facility can be estimated by the distance to the evacuation facility, and 60 m/mins walking speed of an elderly.

Required time for warning dissemination shall be confirmed through the results of past evacuation drill or experience of past disasters.

2.2.3 Estimation example

This section shows the estimation example at Cordoba, in Rio Negro basin.

100-year return period inundation map prepared in the Project and location of evacuation facility confirmed by interview are shown as below. The format sheet for interview is attached.



Source: JICA Expert Team

Figure 100-Year Return Period Inundation Map and Location of Evacuation Facility in Cordoba

In Cordoba, the person who is in charge of evacuation announcement visits the residents one by one, and it takes about 20 minutes to complete the evacuation.

Also, Cordoba collaborates with upstream municipalities by using telephone or WhatsApp (smartphone messenger application). In the interview with the residents, they commented that they would surely have died if they had not received a warning from upstream municipality during 2011 flood.

Cordoba implements evacuation drill once or twice a year under the instruction of the mayor. Through the interview with residents, it was confirmed that they need to bring household goods such as a refrigerator and clothes to the evacuation facility.

Through the interviews and paper estimation on a desk, the required time for warning dissemination and evacuation at Cordoba was estimated as 128 minutes as shown below.

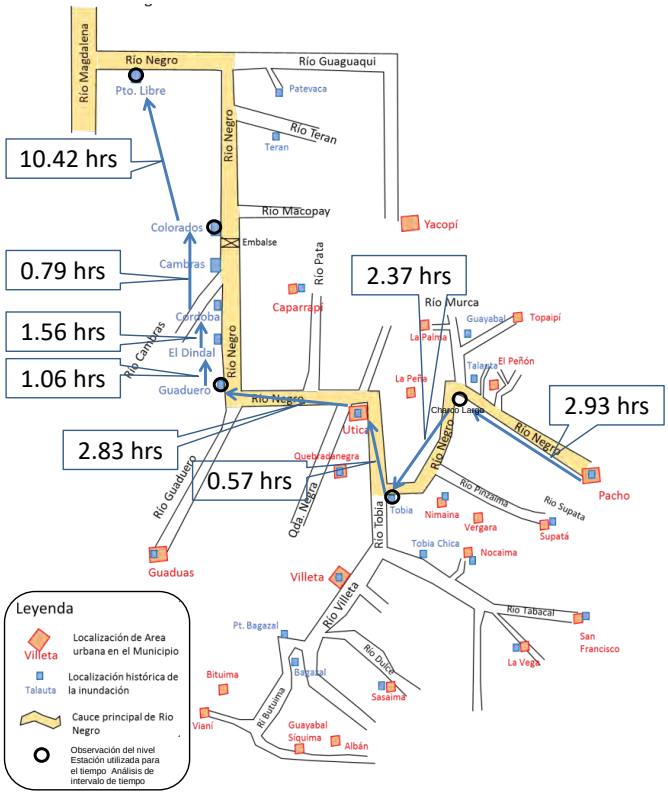
Table Required Time for Warning Dissemination and Evacuation in Cordoba

Ítems a considerar	Tiempo requerido
Tiempo requerido para evacuación	
• Tiempo para que los residentes se preparen para iniciar la evacuación	15 min
• Tiempo para que los residentes se desplacen hacia albergues	3 min
Tiempo requerido para difusión de alerta	
(Recibiendo la alerta de municipio aguas arriba)	
• Tiempo para que el funcionario observe el aumento del nivel del río en municipio aguas arriba	60 min
• Tiempo para recibir la alerta de municipio aguas arriba, y confirmar la situación	30 min
(En caso de difusión de alerta por teléfono por parte de los bomberos)	
• Tiempo para difusión a los residentes	20 min
Total	128 min

2.3 Utilization of the Results

2.3.1 Comparison of flood wave propagation time from upstream

The results of analysis in Chapter 1 are shown as below.



Source: JICA Projct Team

Figure Analysis of Flood Wave Propagation Time from Upstream

The required time for warning dissemination and evacuation, estimated by the procedure explained in this chapter shall be shorter than the flood wave propagation time from upstream shown above.

2.3.2 Case Study

In this Section, a case study at Cordoba in Rio Negro basin is presented.

The flood wave propagation time from upstream (Utica, Guaduero and El Dindal) to Cordoba was estimated as 5.45 hours, 2.62 hours and 1.56 hours respectively as shown in the above figure. Therefore, Cordoba needs to receive a warning from Utica or Guaduero since the required time for warning dissemination and evacuation at Cordoba is 2.13 hours. Through the interview, it was confirmed that Guaduero and Cordoba are not in touch with each other, so the strengthening cooperation between two municipalities is recommended based on the results of estimation in this material.

2.3.3 Strengthening cooperation with upstream municipality

It is necessary for upstream and downstream municipalities to consult how to cooperate with each other on flood early warning. The upstream municipality needs to select some triggers corresponding to the danger level to disseminate a warning to the downstream municipality. If there is a water gauge, quantitative trigger can be set by using water level. The downstream municipality needs to decide in advance how to take evacuation actions corresponding to the triggers from the upstream municipality. Also, basic information such as organization in charge, person in charge, communication tools, and telephone number shall be confirmed and shared for upstream and downstream municipality cooperation. These contents are to be confirmed in a statement of mutual agreement between municipalities.

2.4 Necessary Consideration

This chapter describes how to estimate the required time for warning dissemination and evacuation. But, the results of estimation need to be reviewed periodically since they can change due to the development of the residential area and change of the evacuation facility or the warning dissemination tool, etc. Also, these results should be checked with the results of evacuation drill.

For the cooperation between upstream and downstream municipalities, the dissemination of the warning should be determined by a quantitative factor such as water level criteria. For this purpose, hourly water level data shall be accumulated for a long period of time, and they shall be compared with disaster occurrence.

(Attachment) Interview Sheet to Confirm Required Time for Warning Dissemination and Evacuation

Date： _____

Interviewee and his/her position： _____

Name of municipality： _____

1. Basic Confirmation Items

Interview items	Answer
Person in charge of evacuation order	
✓ Organization in charge	
✓ Person in charge	
✓ Contact number	
Dissemination tool for residents	Tel・Wireless radio・Bell・Speaker・ The others (　　)
Location of evacuation facility and its capacity (Plot the location on a map)	
Evacuation route (Draw the direction on a map)	

2. Required time for evacuation

Interview items	Answer
Results of past evacuation drill	Done・Not done Time for the completion of evacuation： _____mins
① Time for residents to prepare for starting evacuation (From receiving evacuation order until starting evacuation)	_____mins
② Time to move to evacuation facility (Distance from the most remote household to evacuation place)	_____mins

3. Required time for warning dissemination

Interview items	Answer
Past experience with upstream or downstream municipalities for flood warning	Yes・No
✓ Contact tool	
✓ Organization and person in charge in upstream municipality, and their contact number	
③ Necessary time to confirm flood situation in upstream (In case of warning dissemination by firefighters through Tel.)	_____mins
④ Emergency call to related officers if necessary	_____mins
⑤ Time to contact to related firefighter officers (the number*○○mins)	_____persons×_____mins＝_____mins
⑥ Dissemination time in target inundation area（the number of households*○○mins）	_____household×_____mins＝_____mins

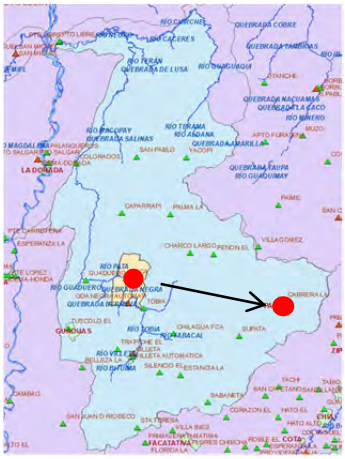
Sum of required time for warning dissemination and evacuation

（①＋②＋③＋④＋⑤＋⑥）：　_____mins

4. Other questions
   - Have you ever received a warning from upstream municipality? If you have, how was the disaster situation?
   - Have you ever been affected not only inundation from Rio Negro main river, but also from a tributary? If you have, how often does it occur comparing with inundation from the main river?

3. Good Practices at the Municipal Level Flood Early Warning

1. Reporting system from resident		
Municipality	Pacho, Utica, Soacha	
Background	For landslide and flashflood, there is a possibility of not securing enough lead time for evacuation after receiving warning. Therefore, the precursory phenomenon can be effective for the early warning.	
Contents	In Pacho, several residents report strange sound from mountains to firefighter officers during heavy rainfall. Then, they start taking some actions including evacuation order. In Utica and Soacha, the resident who lives upstream observes rise in water level and report to the relevant officers by telephone and wireless radio.	

2. Checking the upstream situation		
Municipality	Utica	
Background	By checking the upstream situation such as rainfall and water level before flood event, the downstream municipality can prepare something in advance.	
Contents	During heavy rainfall, Utica calls Pacho to check the upstream situation. In Rio Negro basin, there are some practices for the upstream municipalities to contact downstream, but the downstream municipalities seldom contact upstream.	

3. Water level observation and its dissemination by the resident		
Municipality	Soacha	
Background	IDEAM and CAR are installing water level observation stations, and water level can be observed by residents for flood warning.	
Contents	In Soacha, one of the residents is in charge of observing water level. During rise in water level, the information is disseminated by the resident using wireless radio.	

4. Own criteria to make evacuation decision		
Municipality	Villeta	
Background	For making evacuation decision at the municipal level, its criteria such as water level are not always set in all municipalities.	
Contents	In Villeta, they have their own criteria for evacuation decision which is evacuation advisory when the water level is 2 meters higher than the usual level and evacuation order when it is 3meter higher than the usual level.	

Appendix-12 Project Brief Note

JICA PROJECT BRIEF NOTE

Project for Strengthening Flood Risk Management Capacity in the Republic of Colombia

Project Site

1. Background and Challenges of the Project

The Republic of Colombia (Land area: 1,141,748 km^2, Population: about 47.1 million inhabitants according to the 2013 estimate by the National Administrative Department of Statistics (DANE).) is located on the fringe of the volcanic Andes with great rivers and presents vulnerabilities to weather and natural disasters. During La Niña between 2010 and 2011, 28 of the 32 departments in Colombia were affected by floods and landslides caused by massive heavy rains. This historical disaster wreaked 2.3 million affected people (5% of the national population) and 26 billion pesos (1.12 billion yen) for recovery and rehabilitation. Nine of the 10 major natural disasters in the last two decades in Colombia were floods and the affected population reached 8 million. (CRED EM-DAT. 2014). That is why floods are the most frequent disasters that cause large-scale damage in the Republic of Colombia.

In response, the Government of Colombia promulgated Decree 4147 of 2011 regarding responsibility of the National Unit for Disaster Risk Management (UNGRD), Law 1523 of

2012 regarding adaptation of the national policy on disaster risk management and establishment of the National System for Disaster Risk Management (SNGRD), Decree 1640 of 2012 regarding formulation of Management and Regulation Plan for a Basin (POMCA), Resolution 1907 of 2013 the Ministry of Environment and Sustainable Development (MADS) regarding technical guideline for the formulation of POMCA, Decree 1807 of 2014 regarding incorporation of risk management in Land Management Plan (POT). Other relevant regulations have been promulgated to accelerate efforts to prevent and reduce disasters by introducing the Disaster Risk Management in regional planning.

However, due to the protracted situation where risk management is defined as part of the environmental management, role sharing for managing flood risk among the institutions at national, departmental and municipal level is currently not sufficiently organized, and the activities related to flood risk management are not being implemented effectively. This causes problems such as insufficient exchange of observation data, and lack of maintenance and proper administration of the observation infrastructure.

Likewise, the National Institute for Environmental Studies (IDEAM) of the Ministry of Environment, Housing and Territorial Development is responsible for the hydrological and meteorological monitoring in addition to the publication of forecasts and warnings, but the results of the observation are not sufficiently proficient in the flood forecasting and warning as well as and the formulation of structural plan against flood.

To overcome these current challenges, it is essential to clarify responsibilities of relevant organizations related to flood risk management, develop methodology for risk assessment and flood forecasting and warning system as well as a river management plan. Additionally, there is a challenge in developing mechanism for the formulation of a river management plan at basin level.

2. Approach to Problem Solving

Duration of the Project

36 months from July 2015

Project Site

Rio Negro basin and Magdalena river

Counterparts

Implementing Agencies:

National Unit for Disaster Risk Management (UNGRD)

Institute of Hydrology, Meteorology and Environmental Studies (IDEAM)

Cooperative Agencies:

Autonomous Regional Corporation of Cundinamarca (CAR)

Department of Cundinamarca

Ministry of Environment and Sustainable Development (MADS)

Disaster Type

Disaster type that the Project deals with is flood.

Project Framework

Project purpose is to enhance capacity of Colombian institutions in flood risk management.

Expected Outputs are the following four items:

Output 1: Capacity on flood risk assessment is improved and concept of integrated flood management planning and river basin management is introduced.

Output 2: Capacity on flood forecasting, warning and dissemination of information to relevant organizations is improved.

Output 3: Roles and responsibility of the central and local government for flood risk reduction are clarified and enhanced.

Output 4: Capacity of flood management planning is enhanced through formulation of integrated flood management plan (IFMP) in the pilot river basin.

Project framework is shown in Figure 1.

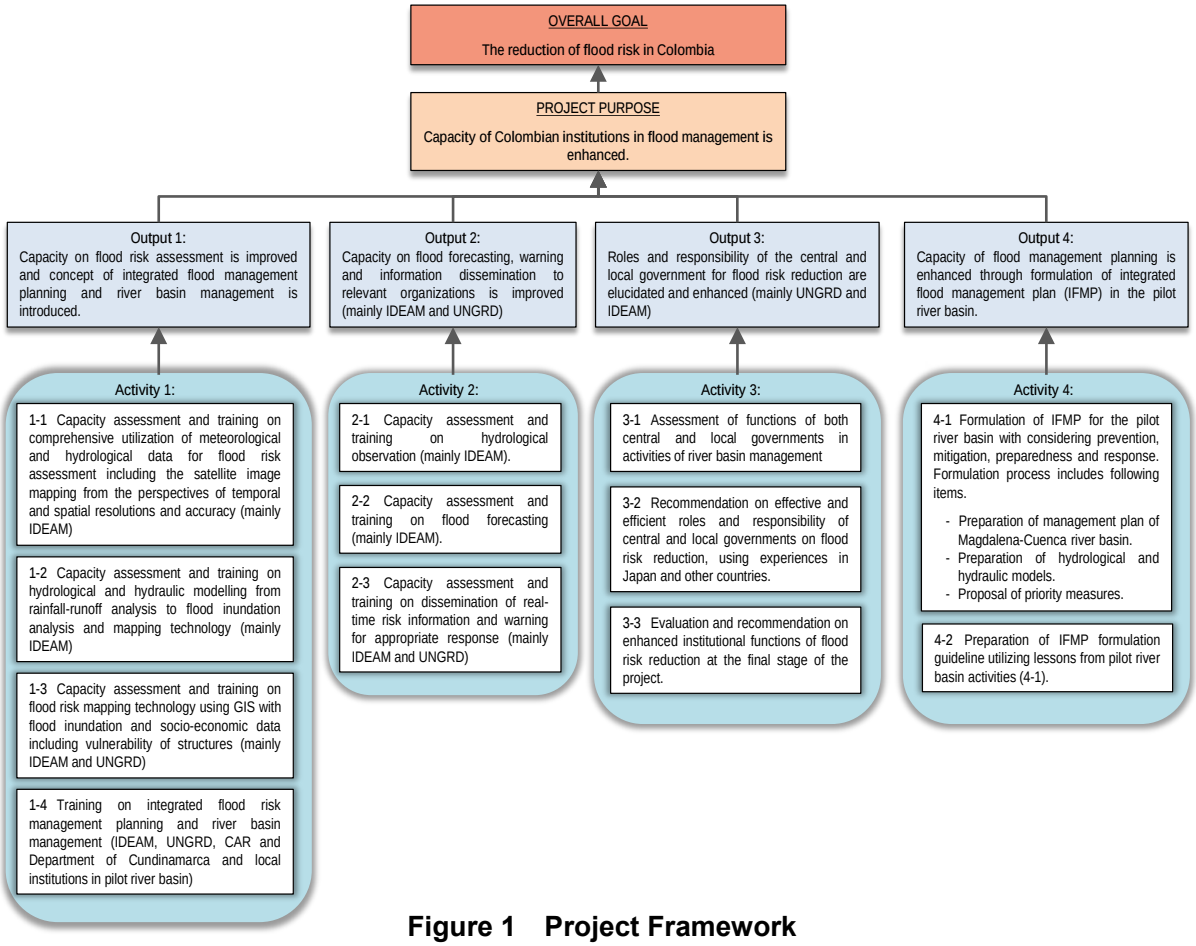


Figure 1 Project Framework

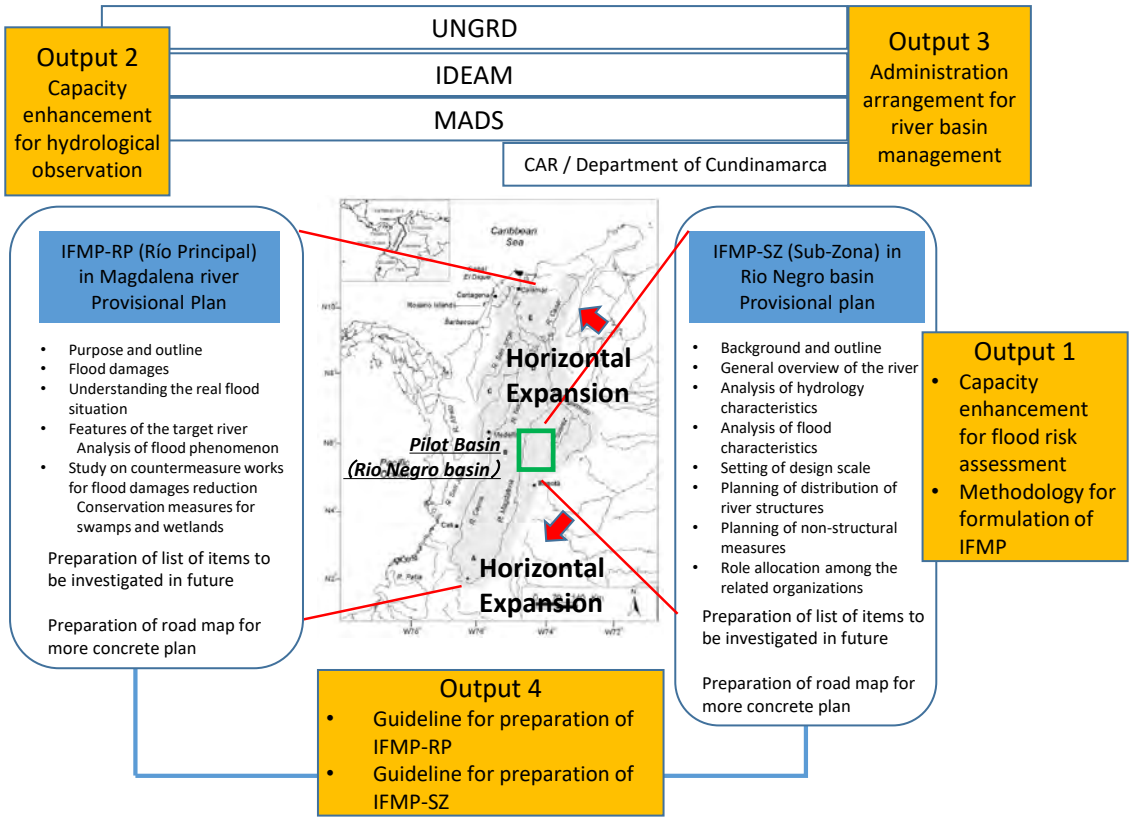


Figure 2 Relevance of Outputs in the Project and Expansion in Future

3. Results of the Approaches

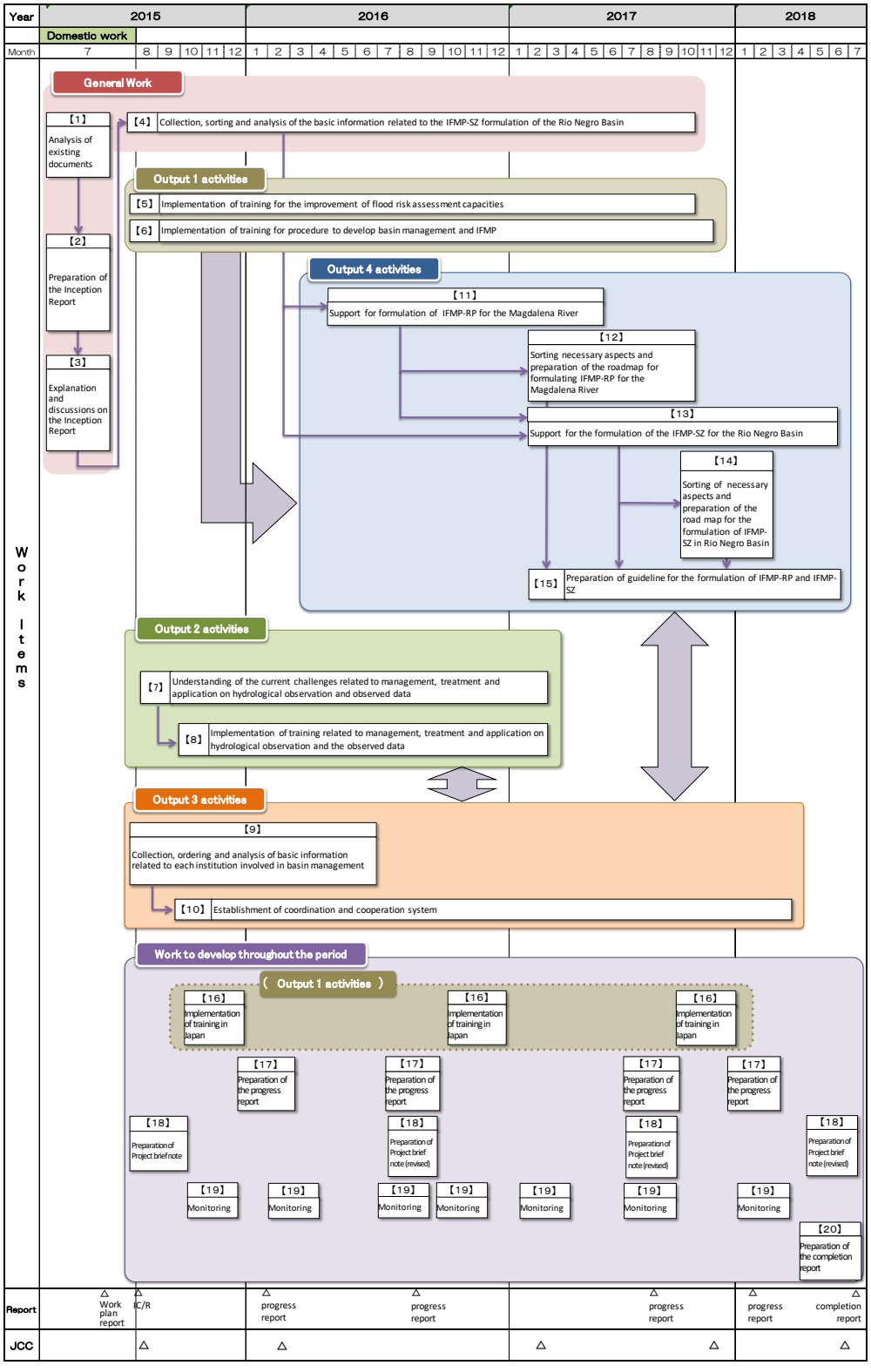


Figure 3 Overall schedule of the Project

[Output 1: Capacity on flood risk assessment is improved and concept of integrated flood management planning and river basin management is introduced.]

(1) Introduction and Tasks of the Risk Assessment Methodologies and Discussion on Application in Colombia.

Knowledge about the characteristics of flow and floods, theories and methodologies of hydraulic and hydrological modelling as well as flood risk assessment (economic assessment of flood control) was deepened through lectures, discussions and concrete tasks in the workshops. Through these activities, C/P's understanding on modeling skill using HEC-RAS and iRIC, preparation of DRR map, and B/C analysis methodology was enhanced.

Photo: Training of iRIC simulation

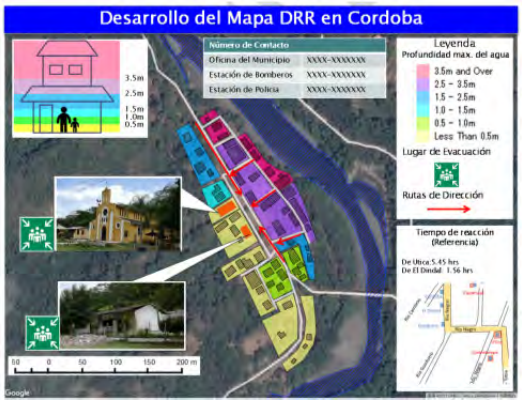


Figure 4 DRR map

(2) Workshops related to the Elaboration of the Integrated Flood Management Plan (IFMP)

Some lectures were given to explain theories and methodologies related to the formulation of the river plan and the watershed management plan and concrete study methods of important items. Additionally, Japanese methodologies were presented in some workshops for the plan formulation, and some discussions were carried out to study the proper methodology for the Colombian context and to see which Japanese methodologies are applicable.

Furthermore, the expert team provided detailed explanations about the content of the "Draft Guideline for River Planning" elaborated by them and the C/P performed concrete tasks. Also, there were field surveys on the rivers in order to deepen the knowledge and understand their features as well as their floods mechanisms.

(3) Trainings in Japan on the Integrated Flood and Watershed Management.

Three special training series in Japan were held during 20 days in 2015, 18 days in 2016, and 14 days in 2017 with the aim of "deepening knowledge about the current situation of management of floods and rivers in Japan in order to use it not only in the Project activities but also in the future formulation of strategies for floods and rivers in Colombia" inviting 24 officers in total. Participants learned about flood and river management and integrated flood management in Japan through field surveys, lectures and site visits to national, provincial and municipal level entities.

Photo: Training in Japan in November 2017

[Output 2: Capacity on flood forecasting, warning and dissemination of information to relevant organizations is improved.]

(4) Introduction of the Methodologies and Systems Related to Early Warning for Floods and Information Communication and Discussion on the Application in Colombia.

The current situation of the actions related to flood forecasting and warning in several municipalities inside the basin has been studied with the aim of preparing a proper system for the Colombian context.

"Workshop on Early Warning System for Municipalities in Rio Negro Basin" was held in Guaduas municipality hosted by Cundinamarca Department, cooperating with the expert team on February 17th 2017. In this Workshop, results of analysis on flood propagation velocity and lead time for evacuation were introduced to the participants, and the 11 participating municipalities in the basin recognized the importance of cooperation between upstream and downstream municipalities.

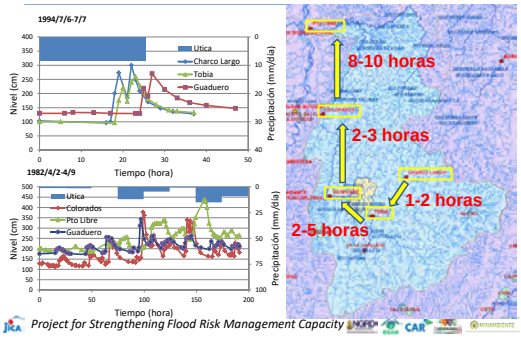


Figure 5 Analysis on flood propagation velocity

Based on the actual situation confirmed through these activities, a recommendation report for the improvement of flood forecasting and warning in Colombia was prepared by the expert team.

[Output 3: Roles and responsibility of the central and local government for flood risk reduction are clarified and enhanced.]

(5) Confirmation of the Responsibilities of Each Entity, Creation of Common Knowledge, and Deliberation on Future Role Sharing and its Legalization through Discussions among Relevant Entities.

There were discussions targeting Magdalena river and Rio Negro basin regarding current and future role sharing among the C/P entities and the relevant entities.

In the discussions, it was clarified that decisions made to implement concrete measures against floods are responsibilities (or based on the criteria) of the municipalities (or mayors). It was recognized that this is the main problem in formulating and implementing countermeasures against flood at basin level.

Photo: Discussion on Role Sharing

Clearly, a better understanding of the importance of flood risk management and concrete related activities as well as the need to understand and coordinate among the relevant entities had been achieved among the participants through the discussions with the C/P entities and other relevant entities. The C/P members have expressed that this type of discussion and coordination among government entities was necessary but had not been carried out before; they are very satisfied that this has been achieved through this project. It had been possible to deepen the understanding of the current situation and role sharing through them. Conducting these workshops had itself been contributing to the construction of a system of coordination and cooperation among entities related to flood risk management in Colombia.

Based on the discussion and agreement through these workshops, a recommendation report for the role allocation among the related entities was prepared by the expert team taking into account the capacity (skill, human and fiscal resources, etc.) related to flood risk management.

[Output 4: Capacity of flood management planning is enhanced through formulation of integrated flood management plan (IFMP) in the pilot river basin.]

The activities related to the Output 4 consist of supporting the formulation of IFMP-SZ (SZ is Sub-Zona in Spanish) in the Rio Negro river basin and creating guidelines for such formulation. First, the expert team hadassisted with the Magdalena river IFMP-RP (RP is Río Principal in Spanish) in order to clarify the position of Rio Negro river basin within the basin of the Magdalena, and then the expert team had supported the formulation of IFMP-SZ taking into account the balance with the main river.

(6) Studies of the Magdalena River

In this project, through reviewing CORMAGDALENA's existing master plan, this plan was studied with focus on the issues that had not been studied sufficiently such as the understanding and analysis of the flood phenomenon.

The expert team had explained methodologies for the participants to understand the characteristics of the Magdalena river as well as its process and characteristics of flood (flood retention capacity from floodplains), and C/P had started analyzing the flood characteristics of the midstream of the Magdalena river. Finally, the Magdalena river IFMP-RP (Provisional plan, Flood Part) was formulated.

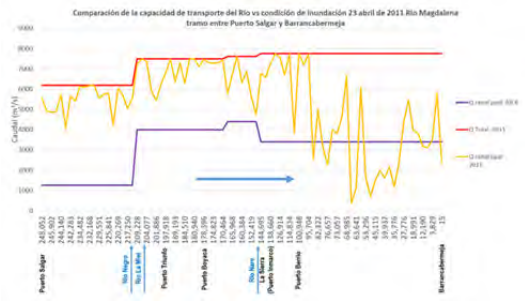


Figure 6 Analysis on Flood Retention Capacity in Main Channel

With the aim of formulation of more concrete plan for Magdalena river IFMP-RP, a roadmap for future activities after the Project was prepared. Also, a guideline for preparation of IFMP-RP was prepared for the other large rivers (Río Principal).

(7) Rio Negro basin Studies

Some topics such as understanding of the basin characteristics, information collection, implementation of disaster/hydrology/ hydraulic analysis, confirmation of planning process, and discussion on design scale were considered as part of the formulation of IFMP-SZ for Rio Negro basin through conducting some workshops. Likewise, site surveys in flood-affected area were implemented with the aim of understanding the actual disaster condition and collecting information for calibration on inundation analysis.

Photo: Site Survey in Rio Negro Basin

Through these activities, Rio Negro basin IFMP-SZ (Provisional plan), Roadmap for formulation of more concrete plan on Rio Negro basin IFMP-SZ, and Guideline for preparation of IFMP-SZ were finally prepared.

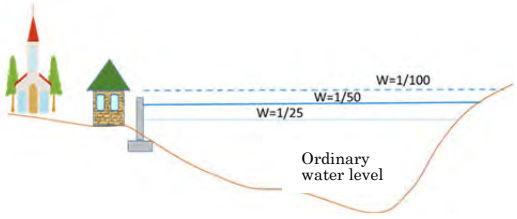


Figure 7 Study on Structural measures in IFMP-SZ

4. Efforts and Lessons in the Project Implementation

This project was evaluated as follows.

- The activities carried out in the project had high relevance from the point of view of the compatibility with Colombian laws and decrees, contribution to the Sendai Disaster Prevention Framework, and the compatibility with the Japanese policy on cooperation.
- The activities carried out in the project, such as the formulation of IFMP for Rio Negro, its guideline and road map had high effectiveness in, strengthening the C/P's capacities.
- The activities carried out in this project had high efficiency as there was no extension of the project implementation period or addition in human resources/equipment compared to the input plan at the beginning of the project.
- The activities carried out in this project had high impact as many entities that were not part of C/P participated in the activities actively such as CORMAGDALENA, the jurisdiction of which includes the Magdalena river, National Department of Planning, municipalities inside the Rio

Negro basin, among others.

- A document of collaboration was signed by C/P entities and a relevant entity (MADS, IDEAM and CORMAGDALENA) for future activities for the Magdalena River. Additionally, C/P entities promised to continue with the activities related to the flood risk management based on the activities of this project. Active and continuous implementation of activities is expected.

Recommendations for the Future Achievement of the Overall Goal

The following 4 recommendations were made for the reduction of flood risk in Colombia after the end of the project.

i. Continue the activities related to the flood risk management in collaboration with relevant entities.
ii. Incorporate the concept of integrated flood management in the Protocol for the elaboration of the risk management component in POMCA.
iii. Incorporate the contents of the study and the planning of IFMP-SZ (provisional plan) for Rio Negro basin in POMCA for Rio Negro basin, and carry out these activities in other hydrographic subzones.
iv. Implement structural and non-structural measures based on the contents of IFMP-SZ (provisional plan) for the Rio Negro basin.

Project implementation period
From July 2015 to July 2018
(This document was prepared in July 2018)

Appendix-13 Monitoring Sheets

TO CR of JICA Colombia OFFICE

PROJECT MONITORING SHEET

Project Title : Project for Strengthening Flood Risk Management Capacity in Republic of Colombia
Version of the Sheet: Ver.1.0（Term: Oct., 2015 – Nov., 2015）

Name:　Kenji Morita
Title: Chief Advisor
Submission Date: Nov.12, 2015

I. Summary

1　Progress

1-1 Progress of Inputs

The following Experts from Japan were inputted from October to November, 2015.
Mr. INOUE Kazunori, Deputy Team Leader, who is in charge of Flood Management (2), Hydrology, Hydraulics and Flood Forecasting, conducted his activity from Oct. 8, to Nov. 14 in Bogota and Cundinamarca.
Dr. TODO Masaki, who is in charge of River Planning, conducted his activity from Oct. 15, to Nov. 5 in Bogota and Cundinamarca.
Mr. HASEGAWA Hirotada, who is in charge of Disaster Risk Management Policy, conducted his activity from Oct. 26, to Nov. 12 in Bogota and Cundinamarca.

The following Counterpart Personnel from Colombia were inputted from October to November, 2015.
Mr. Julio Gonzalez from UNGRD, Mr. Fabio Bernal from IDEAM, Ms. Milena Castillo from CAR and Mr. Jaime Matiz from Department of Cundinamarca made smooth and good coordination with the Expert Team and the relevant organizations in terms of the JICA Project.

1-2 Progress of Activities

The progress of activities are described as follows. The number in parentheses is according to the item number specified in the Project Design Matrix.
(1.1) Capacity assessment and training on comprehensive utilization of meteorological and hydrological data for flood risk assessment including the satellite image mapping from the perspectives of temporal and spatial resolutions and accuracy (mainly IDEAM)

- In the course of the workshops on river planning procedures in Magdalena-Cauca Basin and Rio Negro River Basin held on Nov.3 and Nov.10 as well as ad hoc

meetings in IDEAM, the utilization of hydrological and meteorological data for the river planning was explained. Regarding the satellite image mapping, the Expert purchased WorldDEM TM for the Rio Negro Basin to utilize for river planning, especially hydrological, & topographical analysis.

(1.2) Capacity assessment and training on hydrological and hydraulic modelling from rainfall-runoff analysis to flood inundation analysis and mapping technology (mainly IDEAM)

- In the course of the workshops on river planning procedures in Magdalena-Cauca Basin and Rio Negro River Basin held on Nov.3 and Nov.10 as well as ad hoc meetings in IDEAM, the procedure of hydrological analysis and hydraulic modeling were presented as the basis of understanding of river characteristics and river planning process.

(1.3) Capacity assessment and training on flood risk mapping technology using GIS with flood inundation and socio-economic data including vulnerability of structures (mainly IDEAM and UNGRD)

- In the course of the workshops on sediment disaster held on Nov.12, 2015 at IDEAM, technology for sediment volume estimation which could be a good reference for sediment effect consideration in Rio Negro was presented. Also the risk assessment technology in Japan was explained citing Japanese Sediment Disaster Prevention Law.

(1.4) Training on integrated flood risk management planning and river basin management (IDEAM, UNGRD, CAR and Department of Cundinamarca and local institutions in pilot river basin)

- In the course of the workshops on river planning procedures in Magdalena-Cauca Basin and Rio Negro River Basin held on Nov.3, the river planning and management in Japan were briefly explained for all the C/P personals and the basic procedure of river planning for Magdalena-Cauca river basin and Rio Negro River Basin was proposed to the C/P.

(2.1) Capacity assessment and training on hydrological observation (mainly IDEAM)

- On Oct.19-20, 2015, the Expert Team and the C/P from IDEAM and Cundinamarca visited the hydrological stations in Magdalena River and Rio Negro River Basin. In the course of the site visit, the importance of the maintenance of sedimentation around the hydrological station (ultra-sonic measurement type) and the manual recording efforts by local people was confirmed among the Expert Team and the C/P.

(3.1) Assessment of functions of both central and local governments in activities of river basin management

- In the course of the workshops on administrative roles for river planning in

Magdalena-Cauca Basin and Rio Negro River Basin held on Nov.3 and Nov.10, at first the current roles of the C/P organizations were confirmed based on the previous study result by JICA. Also based on the river planning procedure, the specific roles of the C/P organizations for each planning step were discussed in those workshops and would be continuously discussed after November on Colombian side.

1-3 Achievement of Output

The achievements of output are described as follows. The number in parentheses is according to the item number specified in the Project Design Matrix.

(1.) Capacity on flood risk assessment is improved and concept of integrated flood management planning and river basin management is introduced

- The river planning concept in Japan and the practical procedures for Rio Negro River Basin was understood well by the C/P.
- The significance of the viewpoint of entire watershed from Magdalena-Cauca river basin to sub-catchment such as Rio Negro river basin was introduced, and the issue that the planning methodology should be varied according to the spatial scale of the river was understood by the C/P.

(2.) Capacity on flood forecasting, warning and information dissemination to relevant organizations is improved (mainly IDEAM and UNGRD)

- It was understood by the C/P that the flood forecasting, warning and information dissemination should be conducted based on the understanding of the river characteristics and the capacity of the river channel in the course of upcoming preparation of river planning.

(3.) Roles and responsibility of the central and local government for flood risk reduction are elucidated and enhanced (mainly UNGRD and IDEAM)

- The present roles and responsibility were confirmed based on the previous study result by JICA. Also based on the river planning procedure, the discussion on specific roles of the C/P organizations for each planning step was made.
- Regarding the role for Magdalena-Cauca River Basin Management, it was clarified among the Expert Team and the C/P that CORMAGDALENA is the primary body for the river management under the Colombian Constitution in 1991.

1-4 Achievement of the Project Purpose

It was understood that the river planning preparation for each sub-catchment in Colombia could contribute to the consideration of flood risk aspects into the environment

management plan and local land use plans, which would result into the reduction of flood risk in those areas.

1-5 Changes of Risks and Actions for Mitigation
N/A

1-6 Progress of Actions undertaken by JICA
N/A

1-7 Progress of Actions undertaken by Gov. of Colombia
N/A

1-8 Progress of Environmental and Social Considerations (if applicable)
N/A

1-9 Progress of Considerations on Gender/Peace Building/Poverty Reduction (if applicable)
N/A

1-10 Other remarkable/considerable issues related/affect to the project (such as other JICA's projects, activities of counterparts, other donors, private sectors, NGOs etc.)
Ministry of Environment is expected to join the Project as a C/P because the Ministry is responsible for the preparation of the planning policy for all the river basin in Colombia. The participation of the Ministry of Environment is beneficial for the Project purpose.

2 Delay of Work Schedule and/or Problems (if any)

2-1 Detail
N/A

2-2 Cause
N/A

2-3 Action to be taken
N/A

2-4 Roles of Responsible Persons/Organization (JICA, Gov. of Colombia)

N/A

3 Modification of the Project Implementation Plan

3-1 PO

N/A

3-2 Other modifications on detailed implementation plan

N/A

(Remarks: The amendment of R/D and PDM (title of the project, duration, project site(s), target group(s), implementation structure, overall goal, project purpose, outputs, activities, and input) should be authorized by JICA HDQs. If the project team deems it necessary to modify any part of R/D and PDM, the team may propose the draft.)

4 Preparation of Gov. of Colombia toward after completion of the Project

N/A

II. Project Monitoring Sheet I & II *as Attached*

Project Monitoring Sheet I (Revision of Project Design Matrix)

Project Title: Project for Strengthening Flood Risk Management Capacity
Implementing Agency: UNGRD, IDEAM, CAR and Department of Cundinamarca
Target Group: Staff of UNGRD, IDEAM, CAR and Department of Cundinamarca
Period of Project: three (3) years
Target Area: River basin of Rio Negro (direct target), and the whole country of Colombia (indirect target)

Version 1
Dated 12, 11, 2015

Narrative Summary	Objectively Verifiable Indicators	Means of Verification	Important Assumption	**Achievement**	**Remarks**
Overall Goal The reduction of flood risk in Colombia	1. Realization of flood management related Recommendations made through the project. 2. Number of Integrated Flood Management Plan (IFMP formulated for non-pilot river basin. (Or Ratio of POMCA which introduced the concept of Integrated Flood Management) (XX %)	1. Annual Reports of CP. 2. Policy paper on IFMP(POMCA)			
Project Purpose Capacity of Colombian institutions in flood management is enhanced.	1. Planning capacity regarding flood management 2. Capacity of flood forecasting and warning 3. Effective use and share of data for flood management 4. IFMP formulation guideline developed	1. Evaluation report of professional staff from all the CPs institutions' understanding of integrated flood management planning and river basin management 2. Coverage and number of hydrological station for flood forecasting and warning 3. Data exchange/ user agencies, quantity of data use 4. Formulation guideline	Vulnerability against flood disaster is not dramatically increased.	It was understood that the river planning preparation could contribute to the consideration of flood risk aspects into the environment management plan and local land use plans, which would result into the reduction of flood risk in those areas.	
Outputs 1. Capacity on flood risk assessment is improved and concept of integrated flood management planning and river basin management is introduced	1. Knowledge / understanding at IDEAM and CAR on river planning aspect in a) hydrologic & hydraulic modeling, and b) flood hazard/risk mapping 2. IDEAM, UNGRD and CAR's capacity enhancement on the technology of flood risk mapping including vulnerability analysis using GIS 3. Knowledge / understanding at IDEAM, UNGRD, CAR and Department on river basin wise IFMP	1. Ability test to measure understanding extent such as river planning methodology including longitudinal profile of river reach 2. Ability test to measure understanding extent such as flood risk mapping technology including thematic maps regarding flood disaster 3. Evaluation report of professional staff from all the CPs institutions' understanding of integrated flood management planning and river basin management	Hydrological and meteorological network of IDEAM and CAR is neither degraded nor diluted.	˜ The river planning concept in Japan and the practical procedures for Rio Negro River Basin was understood well by the C/P. ˜ The issue that the planning methodology should be varied according to the spatial scale of the river were was understood by the C/P. ˜ The present roles and responsibility were confirmed based on the previous study result by JICA. Also based on the river planning procedure, the discussion on specific roles of the C/P organizations for each planning step were was made.	
2. Capacity on flood forecasting, warning and information dissemination to relevant organizations is improved (mainly IDEAM and UNGRD)	1. Knowledge / understanding at IDEAM and CAR on hydrologic observation and data analysis 2. Recommendation on improvement of IDEAM's flood forecasting and warning	1. Ability test to measure understanding extent such as hydrologic observation and data analysis including satellite origin rainfall data 2. Recommendations report on flood forecasting and warning			
3. Roles and responsibility of the central and local government for flood risk reduction are elucidated and enhanced (mainly UNGRD and IDEAM)	1. Issues clarified and recommendations draw regarding flood risk management among UNGRD, IDEAM, CAR, department and municipalities 2. Matrix of informaiton inventory related to flood management (entity and type of information	1. Recommendation of role for Action plan of the relevant actors in flood risk management 2. Matrix of information inventory			
4. Capacity of flood management planning is enhanced through formulation of integrated flood management plan (IFMP) in the pilot river basin	1. Integrated Flood Management Plan (IFMP) of pilot river basin 2. IFMP formulation guideline developed	1. IFMP 2. IFMP formulation guideline			

Activities	Inputs		Pre-Conditions
1.1 Capacity assessment and training on comprehensive utilization of meteorological and hydrological data for flood risk assessment including the satellite image mapping from the perspectives of temporal and spatial resolutions and accuracy (mainly IDEAM)	**The Japanese Side** Expert - Chief Advisor/Expert of Flood Management - Expert of River Planning - Expert of Hydrology, Hydraulics, and Flood Forecasting - Expert of Warning Information Dissemination and Evacuation - Expert of Flood Risk Mapping, Flood Risk Assessment, and GIS - Expert of Disaster Risk Management Policy Machinery and Equipment - Desktop / Laptop Computer - Multifunction machine (Printer / Photocopy) - Inkjet Color Printer - Hydrological Analysis Software - GIS Software	**The Colombian Side** Administration: Project Director, Project Manager Counterpart personnel: C/P personnel from the relevant divisions under UNGRD, IDEAM and other institutions in the area of influence of the river basin. Facilities and Equipment - Office space - Office furniture, facilities and equipment Budgetary Arrangement by UNGRD, IDEAM and other institutions in the area of influence of the river basin Administration and local operation costs	Central and pilot region's institutions agreed upon the exchange of data needed and available at each agency.
1.2 Capacity assessment and training on hydrological and hydraulic modelling from rainfall-runoff analysis to flood inundation analysis and mapping technology (mainly IDEAM)			
1.3 Capacity assessment and training on flood risk mapping technology using GIS with flood inundation and socio-economic data including vulnerability of structures (mainly IDEAM and UNGRD)			
1.4 Training on integrated flood risk management planning and river basin management (IDEAM, UNGRD CAR and Department of Cundinamarca and local institutions in pilot river basin)			
1.4.1 Training in Colombia on; i) probabilistic hazard assessment of flood, ii) physical, environmental and social vulnerability analysis, iii) monitoring and evaluation of flood disaster risk, iv) management processes on flood events, v) flood disaster prevention and mitigation measures, and vi) development and operation of flood early warning systems			
1.4.2 Training in Japan on; i) strategies and policies for adaptation and flood risk management, ii) infrastructure models (housing, hospitals, schools, etc.) adapted to flood events, and iii) flood control schemes			<Issues and countermeasures> Ministry of Environment is expected to join the Project as a C/P because the Ministry is responsible for the preparation of the planning policy for all the river basin in Colombia. The participation of the Ministry of Environment is beneficial for the Project purpose.
2.1 Capacity assessment and training on hydrological observation (mainly IDEAM)			
2.2 Capacity assessment and training on flood forecasting (mainly IDEAM)			
2.3 Capacity assessment and training on dissemination of real-time risk information and warning for appropriate response (mainly IDEAM and UNGRD)			
3.1 Assessment of functions of both central and local governments in activities of river basin management			
3.2 Recommendation on effective and efficient roles and responsibility of central and local governments on flood risk reduction, using experiences in Japan and other countries.			
3.3 Evaluation and recommendation on enhanced institutional functions of flood risk reduction at the final stage of the project			
4.1 Formulation of IFMP for the pilot river basin with considering prevention, mitigation, preparedness and response. Formulation process includes following items. - Preparation of management plan of Magdalena-Cuenca river basin. - Preparation of hydrological and hydraulic models (mainly for IDEAM with the support of the regional autonomous corporations who will have the model to be used for them.) - Proposal of priority measures.			
4.2 Preparation of IFMP formulation guideline utilizing lessons from pilot river basin activities (4-1).			

TO CR of JICA Colombia OFFICE

PROJECT MONITORING SHEET

Project Title : Project for Strengthening Flood Risk Management Capacity in Republic of Colombia
Version of the Sheet: Ver.2.0（Term: Feb., 2016 – Mar., 2016）

Name:　Kenji Morita
Title: Chief Advisor
Submission Date: Mar. 7, 2016

I. Summary

1　Progress

1-1 Progress of Inputs

The following Experts from Japan were inputted from February to March, 2016.
Mr. MORITA Kenji, Chief Advisor, who is in charge of Flood Management (1), conducted his activity from Feb. 1, to Mar. 8 in Bogota and Cundinamarca.
Mr. FUJIMOTO Masato, who is in charge of Warning Information Dissemination and Evacuation, conducted his activity from Feb. 1, to Mar. 14 in Bogota and Cundinamarca.
Dr. FURUTA Akihiro, who is in charge of Flood Risk Mapping, Flood Risk Assessment, and GIS, conducted his activity from Feb. 16, to Mar. 14 in Bogota and Cundinamarca.

The following Counterpart Personnel from Colombia were inputted from February to March, 2016.
Mr. Julio Gonzalez from UNGRD, Mr. Fabio Bernal from IDEAM, Ms. Milena Castillo from CAR, Mr. Jaime Matiz from Department of Cundinamarca, Ms. Yolanda Calderon from MADS made smooth and good coordination with the Expert Team and the relevant organizations in terms of the JICA Project. Also, a lot of persons from C/P organizations actively participated to technical meetings and workshops, which were held under the JICA Project.

1-2 Progress of Activities

The progress of activities is described as follows. The number in parentheses is according to the item number specified in the Project Design Matrix.
(1.1) Capacity assessment and training on comprehensive utilization of meteorological and hydrological data for flood risk assessment including the satellite image mapping from the perspectives of temporal and spatial resolutions and accuracy (mainly IDEAM)

- In the workshop on flood forecasting and warning dissemination, which was held on

Feb. 16, 2016 in IDEAM, the methodology for utilization of hydrological and meteorological data for the flood forecasting and warning was explained. Also, possibility of application of the methodology and how to introduce the methodology to Colombia was extensively discussed among participants.

(1.3) Capacity assessment and training on flood risk mapping technology using GIS with flood inundation and socio-economic data including vulnerability of structures (mainly IDEAM and UNGRD)

- In the course of the technical meetings held on Feb. 19 and Feb. 29 and workshop to be held on Mar. 9 in IDEAM, Japanese methodology for flood risk assessment including economic evaluation and environmental evaluation of flood control project was presented and actual example of the economic evaluation in case of Utica was explained. Also, how to apply and introduce the methodology to Colombia was discussed among participants.

(1.4) Training on integrated flood risk management planning and river basin management (IDEAM, UNGRD, CAR and Department of Cundinamarca and local institutions in pilot river basin)

- In the workshop on introduction of contents/activities of training in Japan, which was held on Feb. 16 in IDEAM, and 2nd JCC held on Feb. 23, experiences and knowledge acquired in Japan and idea for how to apply and utilize them to Colombia was presented by participants of training in Japan in Nov. – Dec. in 2015 and shared to C/P and participants. Also, how to utilize them to Colombia was discussed among participants.

(2.1) Capacity assessment and training on hydrological observation (mainly IDEAM)

- In the workshop held on Feb. 25, the Expert Team and the C/P from UNGRD, CAR, and Cundinamarca visited the hydrological stations in Soacha municipality. In the course of the field reconnaissance in the workshop, the importance of the continuous and proper maintenance of the stations, training to local people for such proper maintenance and effectiveness of the hydrological observation for early warning was confirmed among the Expert Team and the C/P.

(2.3) Capacity assessment and training on dissemination of real-time risk information and warning for appropriate response (mainly IDEAM and UNGRD)

- In the workshop on flood forecasting and warning dissemination, which was held on Feb. 16 in IDEAM, the Japanese methodology and actual system for the flood forecasting and warning was presented. In the workshop held on Feb. 25 to visit Soacha municipality, the Expert Team and the C/P confirmed the actual system for flood early warning and dissemination at local level in Colombia. In these workshops and workshop to be held on Mar. 9, how to apply, utilize and expand such systems to

Colombia was discussed among the Expert Team, the C/P and participants.

(3.1) Assessment of functions of both central and local governments in activities of river basin management

- In the course of the meetings held on Feb. 9 with MADS and on Feb. 24 with CORMAGDALENA and workshops held on Mar. 2 in IDEAM, the current activities and roles of the relevant organizations especially MADS and CORMAGDALENA were explained from each organization and confirmed by participants.
- In the course of workshops held on Feb. 16 and Mar. 2 in IDEAM, based on the river planning procedure, the specific roles of the C/P organizations for each planning step were discussed.

1-3 Achievement of Output

The achievements of output are described as follows. The number in parentheses is according to the item number specified in the Project Design Matrix.

(1.) Capacity on flood risk assessment is improved and concept of integrated flood management planning and river basin management is introduced

- The methodology for utilization of hydrological and meteorological data for the flood forecasting and warning such as set-up of warning standard was understood by the C/P.
- Japanese methodology for flood risk assessment especially economic evaluation of flood control project was understood by the C/P. And how to apply and introduce the methodology to Colombia was actively discussed.
- The experiences and knowledge acquired in training in Japan and idea for how to apply and utilize them to Colombia was well understood and discussed by the C/P.

(2.) Capacity on flood forecasting, warning and information dissemination to relevant organizations is improved (mainly IDEAM and UNGRD)

- The methodology and actual system in Japan and Colombia for the flood forecasting and warning at national and local levels was understood by the C/P and how to apply and expand them effectively to Colombia was well discussed by the C/P.

(3.) Roles and responsibility of the central and local government for flood risk reduction are elucidated and enhanced (mainly UNGRD and IDEAM)

- The present roles and responsibility of relevant organizations were confirmed. Also based on the river planning procedure, the discussion on specific roles of the relevant organizations for each planning step was made by the C/P organizations and CORMAGDALENA. There were identified the items to strength in the flood management in Colombia, particularly in the activities among the institutions inside the legal frame.

1-4 Achievement of the Project Purpose

Ministry of Environment and Sustainable Development (MADS), which has responsibility for the preparation of the planning policy for all the river basin in Colombia, was approved as an official C/P organization of the Project, and CORMAGDALENA participated the workshop for role sharing of flood risk management. Cooperation among relevant organizations to flood risk management is gradually enhanced through activities of the Project by generating interaction spaces among the different entities that have competence in the flood risk management at different government levels. This has allowed to know the potentialities and existing weaknesses regarding to the roles and responsibilities.

1-5 Changes of Risks and Actions for Mitigation

N/A

1-6 Progress of Actions undertaken by JICA

N/A

1-7 Progress of Actions undertaken by Gov. of Colombia

N/A

1-8 Progress of Environmental and Social Considerations (if applicable)

N/A

1-9 Progress of Considerations on Gender/Peace Building/Poverty Reduction (if applicable)

N/A

1-10 Other remarkable/considerable issues related/affect to the project (such as other JICA's projects, activities of counterparts, other donors, private sectors, NGOs etc.)

CORMAGDALENA has prepared Basin Management Plan and Exploitation Master Plan for Rio Magdalena basin which include flood management part. Coordination of the Project activity to them should be considered.

2 Delay of Work Schedule and/or Problems (if any)

2-1 Detail

N/A

2-2 Cause

N/A

2-3 Action to be taken

N/A

2-4 Roles of Responsible Persons/Organization (JICA, Gov. of Colombia)

N/A

3 Modification of the Project Implementation Plan

3-1 PO

Ministry of Environment and Sustainable Development (MADS) was approved as an official counterpart organization in 2nd JCC on Feb. 23, 2016. Then, MADS was added to Implementing Agency, Target Group and Inputs from the Colombian side of PDM and some relevant parts of PDM and PO were revised.

3-2 Other modifications on detailed implementation plan

N/A

(Remarks: The amendment of R/D and PDM (title of the project, duration, project site(s), target group(s), implementation structure, overall goal, project purpose, outputs, activities, and input) should be authorized by JICA HDQs. If the project team deems it necessary to modify any part of R/D and PDM, the team may propose the draft.)

4 Preparation of Gov. of Colombia toward after completion of the Project

N/A

II. Project Monitoring Sheet I & II *as Attached*

Project Monitoring Sheet I (Revision of Project Design Matrix)

Project Title: Project for Strengthening Flood Risk Management Capacity
Implementing Agency: UNGRD, IDEAM, CAR, Department of Cundinamarca and MADS
Target Group: Staff of UNGRD, IDEAM, CAR, Department of Cundinamarca and MADS
Period of Project: three (3) years
Target Area: River basin of Rio Negro (direct target), and the whole country of Colombia (indirect target)

Version 2 (2-1)
Dated 23, 02, 2016 (07, 03, 2016)

Narrative Summary	Objectively Verifiable Indicators	Means of Verification	Important Assumption	Achievement	Remarks
Overall Goal The reduction of flood risk in Colombia	1. Realization of flood management related Recommendations made through the project.	1. Annual Reports of CP.			
	2. Number of Integrated Flood Management Plan (IFMP) formulated for non-pilot river basin. (Or Ratio of POMCA which introduced the concept of Integrated Flood Management) (XX %)	2. Policy paper on IFMP(POMCA)			
Project Purpose Capacity of Colombian institutions in flood management is enhanced.	1. Planning capacity regarding flood management	1. Evaluation report of professional staff from all the CPs institutions' understanding of integrated flood management planning and river basin management	Vulnerability against flood disaster is not dramatically increased.	MADS was approved as an official C/P organization, and CORMAGDALENA participated the workshop. Cooperation among relevant organizations is gradually enhanced through activities of the Project.	
	2. Capacity of flood forecasting and warning	2. Coverage and number of hydrological station for flood forecasting and warning			
	3. Effective use and share of data for flood	3. Data exchange/ user agencies, quantity of data			
	4. IFMP formulation guideline developed	4. Formulation guideline			
Outputs 1. Capacity on flood risk assessment is improved and concept of integrated flood management planning and river basin management is introduced	1. Knowledge / understanding at IDEAM and CAR on river planning aspect in a) hydrologic & hydraulic modeling, and b) flood hazard/risk mapping	1. Ability test to measure understanding extent such as river planning methodology including longitudinal profile of river reach	Hydrological and meteorological network of IDEAM and CAR is neither degraded nor diluted.	˜ Japanese methodology for flood risk assessment especially economic evaluation of flood control project was understood by the C/P. And how to apply and introduce the methodology to Colombia was actively discussed. ˜ The experiences and knowledge acquired in training in Japan and idea for how to apply and utilize them to Colombia was well understood and discussed by the C/P. ˜ The methodology and actual system in Japan and Colombia for the flood forecasting and warning at national and local levels was understood by the C/P and how to apply and expand them effectively to Colombia was well discussed by the C/P. ˜ Based on the river planning procedure, the discussion on specific roles of the relevant organizations for each planning step was made by the C/P organizations and CORMAGDALENA. There were identified the items to strength in the flood management in Colombia, particularly in the activities among the institutions inside the legal frame.	
	2. IDEAM, UNGRD and CAR's capacity enhancement on the technology of flood risk mapping including vulnerability analysis using GIS	2. Ability test to measure understanding extent such as flood risk mapping technology including thematic maps regarding flood disaster			
	3. Knowledge / understanding at IDEAM, UNGRD, CAR, Department and MADS on river basin wise IFMP	3. Evaluation report of professional staff from all the CPs institutions' understanding of integrated flood management planning and river basin management			
2. Capacity on flood forecasting, warning and information dissemination to relevant organizations is improved (mainly IDEAM and UNGRD)	1. Knowledge / understanding at IDEAM and CAR on hydrologic observation and data analysis	1. Ability test to measure understanding extent such as hydrologic observation and data analysis including satellite origin rainfall data			
	2. Recommendation on improvement of IDEAM's flood forecasting and warning	2. Recommendations report on flood forecasting and warning			
3. Roles and responsibility of the central and local government for flood risk reduction are elucidated and enhanced (mainly UNGRD and IDEAM)	1. Issues clarified and recommendations draw regarding flood risk management among UNGRD, IDEAM, CAR, MADS, department and municipalities.	1. Recommendation of role for Action plan of the relevant actors in flood risk management			
	2. Matrix of informaiton inventory related to flood management (entity and type of information)	2. Matrix of information inventory			
4. Capacity of flood management planning is enhanced through formulation of integrated flood management plan (IFMP) in the pilot river basin	1. Integrated Flood Management Plan (IFMP) of pilot river basin	1. IFMP			
	2. IFMP formulation guideline developed	2. IFMP formulation guideline			

Activities	Inputs		Pre-Conditions
1.1 Capacity assessment and training on comprehensive utilization of meteorological and hydrological data for flood risk assessment including the satellite image mapping from the perspectives of temporal and spatial resolutions and accuracy (mainly IDEAM)	**The Japanese Side** Expert - Chief Advisor/Expert of Flood Management - Expert of River Planning - Expert of Hydrology, Hydraulics, and Flood Forecasting - Expert of Warning Information Dissemination and Evacuation - Expert of Flood Risk Mapping, Flood Risk Assessment, and GIS - Expert of Disaster Risk Management Policy Machinery and Equipment - Desktop / Laptop Computer - Multifunction machine (Printer / Photocopy) - Inkjet Color Printer - Hydrological Analysis Software - GIS Software	**The Colombian Side** Administration: Project Director, Project Manager Counterpart personnel: C/P personnel from the relevant divisions under UNGRD, IDEAM, CAR, Department of Cundinamarca, MADS and other institutions in the area of influence of the river basin. Facilities and Equipment - Office space - Office furniture, facilities and equipment Budgetary Arrangement by UNGRD, IDEAM, CAR, Department of Cundinamarca, MADS and other institutions in the area of influence of the river basin Administration and local operation costs	Central and pilot region's institutions agreed upon the exchange of data needed and available at each agency.
1.2 Capacity assessment and training on hydrological and hydraulic modelling from rainfall-runoff analysis to flood inundation analysis and mapping technology (mainly IDEAM)			
1.3 Capacity assessment and training on flood risk mapping technology using GIS with flood inundation and socio-economic data including vulnerability of structures (mainly IDEAM and UNGRD)			
1.4 Training on integrated flood risk management planning and river basin management (IDEAM, UNGRD, CAR, Department of Cundinamarca, MADS and local institutions in pilot river basin)			
1.4.1 Training in Colombia on; i) probabilistic hazard assessment of flood, ii) physical, environmental and social vulnerability analysis, iii) monitoring and evaluation of flood disaster risk, iv) management processes on flood events, v) flood disaster prevention and mitigation measures, and vi) development and operation of flood early warning systems			
1.4.2 Training in Japan on; i) strategies and policies for adaptation and flood risk management, ii) infrastructure models (housing, hospitals, schools, etc.) adapted to flood events, and iii) flood control schemes			<Issues and countermeasures> Basin Management Plan and Exploitation Master Plan for Rio Magdalena basin which include flood management part. Coordination of the Project activity to them should be considered.
2.1 Capacity assessment and training on hydrological observation (mainly IDEAM)			
2.2 Capacity assessment and training on flood forecasting (mainly IDEAM)			
2.3 Capacity assessment and training on dissemination of real-time risk information and warning for appropriate response (mainly IDEAM and UNGRD)			
3.1 Assessment of functions of both central and local governments in activities of river basin management			
3.2 Recommendation on effective and efficient roles and responsibility of central and local governments on flood risk reduction, using experiences in Japan and other countries.			
3.3 Evaluation and recommendation on enhanced institutional functions of flood risk reduction at the final stage of the project			
4.1 Formulation of IFMP for the pilot river basin with considering prevention, mitigation, preparedness and response. Formulation process includes following items. - Preparation of management plan of Magdalena-Cuenca river basin. - Preparation of hydrological and hydraulic models (mainly for IDEAM with the support of the regional autonomous corporations who will have the model to			
4.2 Preparation of IFMP formulation guideline utilizing lessons from pilot river basin activities (4-1).			

TO CR of JICA Colombia OFFICE

PROJECT MONITORING SHEET

Project Title: Project for Strengthening Flood Risk Management Capacity in Republic of Colombia
Version of the Sheet: Ver.2.0（Term: May. 2016 – Aug., 2016）

Name:　Masato Fujimoto
Title:　Warning Information Dissemination and Evacuation
Submission Date: Aug. 4, 2016

I. Summary

1　Progress

1-1 Progress of Inputs

The following Experts from Japan were assigned from May to August, 2016.
Mr. INOUE Kazunori, Deputy Team Leader, who is in charge of Flood Management (2), Hydrology, Hydraulics and Flood Forecasting, conducted his activity from April 25th to May 27th, and from July 5th to July 22nd, 2016 in Bogota, Cundinamarca, Barrancabermeja, and Puerto Wilches.
Dr. TODO Masaki, who is in charge of River Planning, conducted his activity from April 25th to May 19th, and from July 5th to August 4th, 2016 in Bogota, Cundinamarca, Barrancabermeja, Puerto Wilches, and Honda.
Mr. HASEGAWA Hirotada, who is in charge of Disaster Risk Management Policy, conducted his activity from April 25th to May 12th, 2016 in Bogota.
Mr. FUJIMOTO Masato, who is in charge of Warning Information Dissemination and Evacuation, conducted his activity from July 10th to August 5th, 2016 in Bogota, Barrancabermeja, Puerto Wilches, and Honda.

The following Counterpart Personnel from Colombia were assigned from May to August, 2016.
Mr. Julio Gonzalez from UNGRD, Mr. Fabio Bernal from IDEAM, Ms. Milena Castillo from CAR, Mr. Jaime Matiz, Mr. William Barreto y Mrs. María Cristina Ruiz from Department of Cundinamarca, Mrs. Luz Francy Navarro and Yolanda Calderon from MADS made smooth and good coordination with the Expert Team and the relevant organizations in terms of the JICA Project. Also, several people from C/P organizations actively participated to technical meetings and workshops, which were held under the JICA Project.

1-2 Progress of Activities

The progress of activities is described as follows. The number in parentheses is according to the item number specified in the Project Design Matrix.

(1.3) Capacity assessment and training on flood risk mapping technology using GIS with flood inundation and socio-economic data including vulnerability of structures (mainly IDEAM and UNGRD)

- In the workshop held on May. 4th, the flood issues happening along the Rio Magdalena middle reach were discussed among participants. Also, the flood-prone areas in the Rio Negro river basin based on the field visits in 2015 were discussed among participants in the workshop held on May. 11th.
- In the 2 days of May 19 - 20, 2016, the field reconnaissance of Qda. La Negra was conducted by the all C/Ps, the officers from Utica and Quebradanegra municipalities. The participants recognized the accumulation of sediments on the Qda. La Chorrera, a main left side tributary of the Qda. La Negra upstream, the dynamic change of river width, riverbed material and river bed slope. In the workshops held on Jul. 15th and 28th, the results of the field reconnaissance were presented. Also, how to take structural measurement for the debris flow was discussed among participants.
- In the workshop held on Jul. 28th, Japanese efforts on preparation procedure of flood hazard map, and the importance of communicating evacuation information were introduced.

(1.4) Training on integrated flood risk management planning and river basin management (IDEAM, UNGRD, CAR and Department of Cundinamarca and local institutions in pilot river basin)

- In the workshop held on May 11th, the river laws in Japan were explained by the Expert Team, focusing on the historical background in Japan in terms of the significant needs of flood control in Japan for several centuries.
- In the workshops held on May 11th and 17th, the preparation work for the river planning for the Rio Magdalena middle reach was presented by IDEAM with great progress on the channel flow capacity profile in the whole section of the Rio Magdalena middle reach and the comparison with the flood discharge for various return periods.
- In the workshops held on May 11th and 17th, the updated draft guideline for the necessary work for the preparation of the river planning was explained by the Expert Team, focusing on the work for the Rio Negro river basin. Also, the schedule for the preparation of river planning in Rio Negro basin from June 2016 was proposed by CAR.
- In the workshop held on Jul. 15th, how to consider the coexistence among flood,

navigation, and environment was presented and discussed with the participation from CORMAGDALENA.

- In the workshops held on Jul. 22nd, the river preservation zone and flood discharge in Rio Magdalena middle reach were discussed among participants. Also the Expert team showed the rough estimate of flood discharge proportion on flood plain in Rio Magdalena middle reach in case of 2010-2011, and it was confirmed that detail calculation along Rio Magdalena middle reach will be proceeded by IDEAM.
- In the workshop held on Jul. 22nd, the analysis on natural environment condition such as geological/geographical features along Rio Magdalena middle reach was presented through the results of field reconnaissance on Jul. 19th in Barrancabermeja and Puerto Wilches.
- In the workshop held on Jul. 28th, the database of historical disaster events in Rio Negro basin was shared by Department of Cundinamarca, and how to utilize and update it was discussed among participants.

(2.3) Capacity assessment and training on dissemination of real-time risk information and warning for appropriate response (mainly IDEAM and UNGRD)

- In the workshop held on May 17th, the C/P organization's time line action at the time of April 18th, 2011 in Utica, Cundinamarca was confirmed.
- In the workshops on warning dissemination and evacuation action, which were held on Jul. 15th and 28th, the analysis on time lag of high water level among observation points in Rio Negro basin was presented, and how to enhance the cooperation between upper-stream and down-stream on early warning was discussed among participants.
- In the workshop held on Jul. 22nd, the current activities on flood early warning and evacuation actions in Puerto Wilches along Rio Magdalena middle reach were shared through the results of interview on Jul. 19th in Puerto Wilches.

(4.1) Formulation of IFMP for the pilot river basin with considering prevention, mitigation, preparedness and response.

- In the workshops held on May 11th and 17th, the preparation work for the river planning for the Rio Magdalena middle reach was presented by IDEAM with great progress on the channel flow capacity profile in the whole section of the Rio Magdalena middle reach and the comparison with the flood discharge for various return periods.
- In the workshop held on Jul. 22nd, the river preservation zone and flood discharge in Rio Magdalena middle reach were discussed among participants. Also the Expert team showed the rough estimate of flood discharge proportion on flood plain in Rio Magdalena middle reach in case of 2010-2011, and it was confirmed that detail

calculation along Rio Magdalena middle reach will be proceeded by IDEAM.

1-3 Achievement of Output

The achievements of output are described as follows. The number in parentheses is according to the item number specified in the Project Design Matrix.

(1.) Capacity on flood risk assessment is improved and concept of integrated flood management planning and river basin management are introduced

- The understanding on link between the basic concept of the MADS on RONDA and the viewpoint of the river planning approach which has been tried to introduce in this Project is proceeding.
- Through the field reconnaissance to Barrancabermeja and Puerto Wilches along Rio Magdalena middle reach, and the meeting with CORMAGDALENA (Honda visit), understanding on river prevention zone and its natural environment condition has developed. The detailed river planning has been getting started as the steady work by the C/P with varied flow calculation along Rio Magdalena middle reach based on the draft guideline for the preparation of river planning.

(2.) Capacity on flood forecasting, warning and information dissemination to relevant organizations is improved (mainly IDEAM and UNGRD)

- It was understood by the C/Ps that early warning efforts taking into account water level fluctuation between upper/down-stream can be one of the solution to secure more lead time for evacuation process. The detailed efforts on the upper/down-stream cooperation will be further discussed mainly for suggestion/recommendation into the current activities in Colombia such as Regional Council for Risk Management.

(4.) Capacity of flood management planning is enhanced through formulation of integrated flood management plan (IFMP) in the pilot river basin

- The proportion of flood discharge on flood plain in Rio Magdalena middle reach in case of 2010-2011 was roughly estimated by the Expert Team, and the detailed calculation has been getting started by IDEAM.

1-4 Achievement of the Project Purpose

In the course of the field reconnaissance of Barrancabermeja and Puerto Wilches along Rio Magdalena middle reach, the participants recognized the importance of flood plain area not only from the environmental point of view but also for flood management. Through sharing this common experience among the C/Ps, active discussion and detailed calculation on inundation process taking into account flood discharge in the flood plain area along Rio Magdalena middle reach has proceeded.

1-5 Changes of Risks and Actions for Mitigation
N/A

1-6 Progress of Actions undertaken by JICA
JICA project sent a letter to UNGRD in order to give the parameters for the next training, and the purpose is that UNGRD issues the corresponding invitation letters for the related entities and once the entities confirm the officers, JICA Colombia will send the official invitations.

1-7 Progress of Actions undertaken by Gov. of Colombia
N/A

1-8 Progress of Environmental and Social Considerations (if applicable)
N/A

1-9 Progress of Considerations on Gender/Peace Building/Poverty Reduction (if applicable)
N/A

1-10 other remarkable/considerable issues related/affect to the project (such as other JICA's projects, activities of counterparts, other donors, private sectors, NGOs etc.)

- It is recognized that each C/P is expecting the JICA outputs to reflect in some materials to be considered in his/her organization’s policy, plan and projects in near future.
- Some C/Ps are considering the need of specific sections and bathymetries in the Rio Negro River for the “implementation” in the JICA Project.

2 Delay of Work Schedule and/or Problems (if any)

2-1 Detail
N/A

2-2 Cause
N/A

2-3 Action to be taken
N/A

2-4 Roles of Responsible Persons/Organization (JICA, Gov. of Colombia)
N/A

3 Modification of the Project Implementation Plan

3-1 PO
N/A

3-2 Other modifications on detailed implementation plan
N/A
(Remarks: The amendment of R/D and PDM (title of the project, duration, project site(s), target group(s), implementation structure, overall goal, project purpose, outputs, activities, and input) should be authorized by JICA HDQs. If the project team deems it necessary to modify any part of R/D and PDM, the team may propose the draft.)

4 Preparation of Gov. of Colombia toward after completion of the Project

N/A

II. Project Monitoring Sheet I & II *as Attached*

Project Monitoring Sheet I (Revision of Project Design Matrix)

Project Title: Project for Strengthening Flood Risk Management Capacity
Implementing Agency: UNGRD, IDEAM, CAR, Department of Cundinamarca and MADS
Target Group: Staff of UNGRD, IDEAM, CAR, Department of Cundinamarca and MADS
Period of Project: three (3) years
Target Area: River basin of Rio Negro (direct target), and the whole country of Colombia (indirect target)

Version 2 (2-1)
Dated 23, 02, 2016 (04, 08, 2016)

Narrative Summary	Objectively Verifiable Indicators	Means of Verification	Important Assumption	**Achievement**	**Remarks**
Overall Goal The reduction of flood risk in Colombia	1. Realization of flood management related Recommendations made through the project. 2. Number of Integrated Flood Management Plan (IFMP) formulated for non-pilot river basin. (Or Ratio of POMCA which introduced the concept of Integrated Flood Management) (XX %)	1. Annual Reports of CP. 2. Policy paper on IFMP(POMCA)			
Project Purpose Capacity of Colombian institutions in flood management is enhanced.	1. Planning capacity regarding flood management 2. Capacity of flood forecasting and warning 3. Effective use and share of data for flood 4. IFMP formulation guideline developed	1. Evaluation report of professional staff from all the CPs institutions' understanding of integrated flood management planning and river basin management 2. Coverage and number of hydrological station for flood forecasting and warning 3. Data exchange/ user agencies, quantity of data 4. Formulation guideline	Vulnerability against flood disaster is not dramatically increased.	In the course of the field reconnaissance of Barrancabermeja and Puerto Wilches along Rio Magdalena middle reach, the participants recognized the importance of flood plain area not only from the environmental point of view but also for flood management. Through sharing this common experience among the C/Ps, active discussion and detailed calculation on inundation process taking into account flood discharge in the flood plain area along Rio Magdalena middle reach has proceeded.	
Outputs 1. Capacity on flood risk assessment is improved and concept of integrated flood management planning and river basin management is introduced	1. Knowledge / understanding at IDEAM and CAR on river planning aspect in a) hydrologic & hydraulic modeling, and b) flood hazard/risk mapping 2. IDEAM, UNGRD and CAR's capacity enhancement on the technology of flood risk mapping including vulnerability analysis using GIS 3. Knowledge / understanding at IDEAM, UNGRD, CAR, Department and MADS on river basin wise IFMP	1. Ability test to measure understanding extent such as river planning methodology including longitudinal profile of river reach 2. Ability test to measure understanding extent such as flood risk mapping technology including thematic maps regarding flood disaster 3. Evaluation report of professional staff from all the CPs institutions' understanding of integrated flood management planning and river basin management	Hydrological and meteorological network of IDEAM and CAR is neither degraded nor diluted.	¨ The understanding on link between the basic concept of the MADS on RONDA and the viewpoint of the river planning approach which has been tried to introduce in this Project is proceeding. ¨ Through the field reconnaissance to Barrancabermeja and Puerto Wilches along Rio Magdalena middle reach, and the meeting with CORMAGDALENA (Honda visit), understanding on river prevention zone and its natural environment condition has developed. The detailed river planning has been getting started as the steady work by the C/P with varied flow calculation along Rio Magdalena middle reach based on the draft guideline for the preparation of river planning. ¨ It was understood by the C/Ps that early warning efforts taking into account water level fluctuation between upper/down-stream can be one of the solution to secure more lead time for evacuation process. The detailed efforts on the upper/down-stream cooperation will be further discussed mainly for suggestion/recommendation into the current activities in Colombia such as Regional Council for Risk Management. ¨ The proportion of flood discharge on flood plain in Rio Magdalena middle reach in case of 2010-2011 was roughly estimated by the Expert Team, and the detailed calculation has been getting started by IDEAM.	
2. Capacity on flood forecasting, warning and information dissemination to relevant organizations is improved (mainly IDEAM and UNGRD)	1. Knowledge / understanding at IDEAM and CAR on hydrologic observation and data analysis 2. Recommendation on improvement of IDEAM's flood forecasting and warning	1. Ability test to measure understanding extent such as hydrologic observation and data analysis including satellite origin rainfall data 2. Recommendations report on flood forecasting and warning			
3. Roles and responsibility of the central and local government for flood risk reduction are elucidated and enhanced (mainly UNGRD and IDEAM)	1. Issues clarified and recommendations draw regarding flood risk management among UNGRD, IDEAM, CAR, MADS, department and municipalities. 2. Matrix of informaiton inventory related to flood management (entity and type of information)	1. Recommendation of role for Action plan of the relevant actors in flood risk management 2. Matrix of information inventory			
4. Capacity of flood management planning is enhanced through formulation of integrated flood management plan (IFMP) in the pilot river basin	1. Integrated Flood Management Plan (IFMP) of pilot river basin 2. IFMP formulation guideline developed	1. IFMP 2. IFMP formulation guideline			

Activities	Inputs		Pre-Conditions
1.1 Capacity assessment and training on comprehensive utilization of meteorological and hydrological data for flood risk assessment including the satellite image mapping from the perspectives of temporal and spatial resolutions and accuracy (mainly IDEAM)	**The Japanese Side** Expert - Chief Advisor/Expert of Flood Management - Expert of River Planning - Expert of Hydrology, Hydraulics, and Flood Forecasting - Expert of Warning Information Dissemination and Evacuation - Expert of Flood Risk Mapping, Flood Risk Assessment, and GIS - Expert of Disaster Risk Management Policy Machinery and Equipment - Desktop / Laptop Computer - Multifunction machine (Printer / Photocopy) - Inkjet Color Printer - Hydrological Analysis Software - GIS Software	**The Colombian Side** Administration: Project Director, Project Manager Counterpart personnel: C/P personnel from the relevant divisions under UNGRD, IDEAM, CAR, Department of Cundinamarca, MADS and other institutions in the area of influence of the river basin. Facilities and Equipment - Office space - Office furniture, facilities and equipment Budgetary Arrangement by UNGRD, IDEAM, CAR, Department of Cundinamarca, MADS and other institutions in the area of influence of the river basin Administration and local operation costs	Central and pilot region's institutions agreed upon the exchange of data needed and available at each agency.
1.2 Capacity assessment and training on hydrological and hydraulic modelling from rainfall-runoff analysis to flood inundation analysis and mapping technology (mainly IDEAM)			
1.3 Capacity assessment and training on flood risk mapping technology using GIS with flood inundation and socio-economic data including vulnerability of structures (mainly IDEAM and UNGRD)			
1.4 Training on integrated flood risk management planning and river basin management (IDEAM, UNGRD, CAR, Department of Cundinamarca, MADS and local institutions in pilot river basin)			
1.4.1 Training in Colombia on; i) probabilistic hazard assessment of flood, ii) physical, environmental and social vulnerability analysis, iii) monitoring and evaluation of flood disaster risk, iv) management processes on flood events, v) flood disaster prevention and mitigation measures, and vi) development and operation of flood early warning systems			
1.4.2 Training in Japan on; i) strategies and policies for adaptation and flood risk management, ii) infrastructure models (housing, hospitals, schools, etc.) adapted to flood events, and iii) flood control schemes			<Issues and countermeasures> JICA project sent a letter to UNGRD in order to give the parameters for the next training, and the purpose is that UNGRD issues the corresponding invitation letters for the related entities and once the entities confirm the officers, JICA Colombia will send the official invitations. ¨ It is recognized that each C/P is expecting the JICA outputs to reflect in some materials to be considered in his/her organization's policy, plan and projects in near future. ¨ Some C/Ps are considering the need of specific sections and bathymetries in the Rio Negro River for the "implementation" in the JICA Project.
2.1 Capacity assessment and training on hydrological observation (mainly IDEAM)			
2.2 Capacity assessment and training on flood forecasting (mainly IDEAM)			
2.3 Capacity assessment and training on dissemination of real-time risk information and warning for appropriate response (mainly IDEAM and UNGRD)			
3.1 Assessment of functions of both central and local governments in activities of river basin management			
3.2 Recommendation on effective and efficient roles and responsibility of central and local governments on flood risk reduction, using experiences in Japan and other countries.			
3.3 Evaluation and recommendation on enhanced institutional functions of flood risk reduction at the final stage of the project			
4.1 Formulation of IFMP for the pilot river basin with considering prevention, mitigation, preparedness and response. Formulation process includes following items. - Preparation of management plan of Magdalena-Cuenca river basin. - Preparation of hydrological and hydraulic models (mainly for IDEAM with the support of the regional autonomous corporations who will have the model to			
4.2 Preparation of IFMP formulation guideline utilizing lessons from pilot river basin activities (4-1).			

TO CR of JICA Colombia OFFICE

PROJECT MONITORING SHEET

Project Title: Project for Strengthening Flood Risk Management Capacity in Republic of Colombia
Version of the Sheet: Ver.2.0（Term: Oct. 2016 – Nov., 2016）

Name:　Akihiro Furuta
Title:　Flood Risk Mapping,
Flood Risk Assessment, and GIS
Submission Date: Nov. 15, 2016

I. Summary

1　Progress

1-1 Progress of Inputs

The following Experts from Japan were assigned from October to November, 2016.
Mr. MORITA Kenji, Chief Advisor, who is in charge of Flood Management (1), conducted his activity from Oct. 2, to Oct. 29, 2016 in Bogota.
Dr. TODO Masaki, who is in charge of River Planning, conducted his activity from Oct. 4 to Oct. 31, 2016 in Bogota.
Dr. FURUTA Akihiro, who is in charge of Flood Risk Mapping, Flood Risk Assessment, and GIS, conducted his activity from Oct. 19, to Nov. 15, 2016 in Bogota.

The following Counterpart Personnel from Colombia were assigned from October to November, 2016.
Mr. Julio Gonzalez from UNGRD, Mr. Fabio Bernal from IDEAM, Ms. Milena Castillo, Mr. Rafael Robles and Ms. Maryeny Caraballo from CAR, Mr. Jaime Matiz, Mr. William Barreto, Ms. María Cristina Ruiz and Mr. Wilson Garcia from Department of Cundinamarca, Ms. Yolanda Calderon, Ms. Luz Francy Navarro and Mr. Sergio Salazar from MADS made smooth and good coordination with the Expert Team and the relevant organizations in terms of the JICA Project. Also, several officers from C/P organizations actively participated to technical meetings and workshops, which were held under this JICA Project.

1-2 Progress of Activities

The progress of activities is described as follows. The number in parentheses is according to

the item number specified in the Project Design Matrix.

(1.3) Capacity assessment and training on flood risk mapping technology using GIS with flood inundation and socio-economic data including vulnerability of structures (mainly IDEAM and UNGRD)

- In the workshop held on Oct. 31 and the series of technical meetings held on Nov. 4 and Nov. 9 at IDEAM, it was discussed among participants that 1) how to apply and introduce the methodology for flood risk assessment including economic evaluation of flood control project to Colombia, and 2) The relationship between accuracy of the assessment and data/information can be collected. Based on the discussion on the technical workshops, preparation of an official letter was decided and counterpart members and relevant organization have to start data gathering.

(1.4) Training on integrated flood risk management planning and river basin management (IDEAM, UNGRD, CAR and Department of Cundinamarca and local institutions in the pilot river basin)

- For preparation of 2nd training in Japan, in order that participants can learn Japanese policy, strategy and actual activities for flood risk management more effectively, briefings were held on October 10th by C/Ps who attended 1st training in Japan last year in IDEAM and held on October 21st by JICA official in JICA Colombian office, and some additional explanation was given by Japanese experts in the workshops.

(3.2) Recommendation on effective and efficient roles and responsibility of central and local governments on flood risk reduction, using experiences in Japan and other countries

- In the workshop held on October 13th, recommendation on roles and responsibility on flood risk reduction, which was prepared by Japanese experts in the progress report in August 2016, was introduced to C/P.
- In the series of the meetings in October and November, future appropriate system and collaborative way among relevant organizations was discussed through exchanges of opinions and discussions by C/Ps regarding whether CORMAGDALENA and CIRMAG shall be invited/included to this Project as official counterparts or not. Then, C/P agreed that according to the Project schedule Magdalena River basin work must be done in December 2016, and also understanding the need of deepen works regarding integrated management for Magdalena River it was proposed the development of a second stage in the frame of this JICA Project, in which additional activities will be proposed about River Plan for Magdalena River and having CORMAGDALENA as official participant in the project and not just as guest.

(4.1) Formulation of IFMP for the pilot river basin considering prevention, mitigation, preparedness and response

- Flood mechanism in the middle reach of the Magdalena River basin has been analyzed and investigated by C/P and the progress was presented in the workshops held on October 13th and 31st. Technical meetings for the analysis were also held on October 19th and in ad-hoc base.
- Preparation policy and contents of management plan of Magdalena River basin was introduced and discussed in the workshops held on October 13th and 31st. However, MADS reaffirmed the need of going into detail about Magdalena River research.
- Progress of preparation work which has been implemented by C/P in Rio Negro Basin was introduced, and future work and its schedule were confirmed in the workshop held on October 13th.

1-3 Achievement of Output

The achievements of output are described as follows. The number in parentheses is according to the item number specified in the Project Design Matrix.

(1.) Capacity on flood risk assessment is improved and concept of integrated flood management planning and river basin management are introduced

- The understanding on the methodology for flood risk assessment including economic evaluation and relationship between accuracy of the assessment and data/information was well promoted.

(3.) Roles and responsibility of the central and local government for flood risk reduction are elucidated and enhanced (mainly UNGRD and IDEAM)

- The future appropriate system and collaborative way among relevant organizations was introduced through the progress report to the C/P.

(4.) Capacity of flood management planning is enhanced through formulation of integrated flood management plan (IFMP) in the pilot river basin

- Flood mechanism in the middle reach of the Magdalena River basin has been analyzed by C/P and issues and difficulties of the analysis were shared among C/P and relevant organizations.
- Preparation policy and contents of management plan of Magdalena River basin were shared and discussed among C/P and relevant organizations.
- Preparation work for formulation of IFMP in Rio Negro basin has been steadily developed by C/P.

- CAR and IDEAM carried out topobathymetric surveys in flood risk sectors in Rio Negro basin.
- CAR made the topobathymetric data analysis and processing of the information surveyed by CAR and IDEAM to overlap it with the Digital Elevation Model given by JICA Project.
- CAR introduced the procedure carried out to delimit Hydric *Ronda* of the water currents under CAR administrative area.

1-4 Achievement of the Project Purpose

Through the understanding on the methodology for flood risk assessment, discussion for collaborative way among relevant organizations and the analysis of flood mechanism of the Magdalena River by C/P, sharing entity progress, issues and difficulties, discussion on contents of the management plan of the Magdalena River and Rio Negro basins was carried out, also it has been promoted their understanding about necessity and importance of introduction of river management and flood risk management concepts to these basin plans.

1-5 Changes of Risks and Actions for Mitigation

N/A

1-6 Progress of Actions undertaken by JICA

N/A

1-7 Progress of Actions undertaken by Gov. of Colombia

IDEAM and CAR carried out topobathymetric surveys for the Project and also flow volume estimation exercises done by IDEAM at Magdalena middle reach through modeling and the proposal to intervene Rio Negro basin by CAR.

From the proposal introduced by MADS, it was proposed the introduction of Ronda concept in the context of the developing regulation by MADS with the aim of including it inside the integrated flood management plan, specially focusing on Magdalena River.

1-8 Progress of Environmental and Social Considerations (if applicable)

N/A

1-9 Progress of Considerations on Gender/Peace Building/Poverty Reduction (if applicable)

N/A

1-10 other remarkable/considerable issues related/affect to the project (such as other JICA's projects, activities of counterparts, other donors, private sectors, NGOs etc.)

- As a result of discussion on roles and responsibility of the central and local government for flood risk reduction, it was determined that CORMAGDALENA and CIRMAG participation was important in this project period as a management body of Magdalena river. After discussion among C/P, it was decided that these entities were important for the future flood management in Colombia, but not as official counterpart of this current project, since the half of period in this project has already been passed. Finally, it is determined that their participation in all the current project's activities and possible future project stage is relevant.
- As a result of the meeting among JICA Project, UNGRD, MADS and IDEAM in October, 2016 it was considered the possibility of developing a second Project stage, in order to develop deeply the river plan concept for Magdalena River, including CORMAGDALENA as C/P. In this sense, UNGRD, MADS and CORMAGDALENA are currently developing an agreement proposal regarding this second Project stage.

2 Delay of Work Schedule and/or Problems (if any)

2-1 Detail

N/A

2-2 Cause

N/A

2-3 Action to be taken

N/A

2-4 Roles of Responsible Persons/Organization (JICA, Gov. of Colombia)

N/A

3 Modification of the Project Implementation Plan

3-1 PO

N/A

3-2 Other modifications on detailed implementation plan

N/A

(Remarks: The amendment of R/D and PDM (title of the project, duration, project site(s), target group(s), implementation structure, overall goal, project purpose, outputs, activities, and input) should be authorized by JICA HDQs. If the project team deems it necessary to modify any part of R/D and PDM, the team may propose the draft.)

4 Preparation of Gov. of Colombia toward after completion of the Project

N/A

II. Project Monitoring Sheet I & II *as Attached*

Project Monitoring Sheet I (Revision of Project Design Matrix)

Project Title: Project for Strengthening Flood Risk Management Capacity
Implementing Agency: UNGRD, IDEAM, CAR, Department of Cundinamarca and MADS
Target Group: Staff of UNGRD, IDEAM, CAR, Department of Cundinamarca and MADS
Period of Project: three (3) years
Target Area: River basin of Rio Negro (direct target), and the whole country of Colombia (indirect target

Version 2 (2-1)
Dated 23, 02, 2016 (15, 11, 2016)

Narrative Summary	Objectively Verifiable Indicators	Means of Verification	Important Assumption	Achievement	Remarks
Overall Goal The reduction of flood risk in Colombia	1. Realization of flood management related Recommendations made through the project. 2. Number of Integrated Flood Management Plan (IFMP) formulated for non-pilot river basin. (Or Ratio of POMCA which introduced the concept of Integrated Flood Management) (XX %)	1. Annual Reports of CP. 2. Policy paper on IFMP(POMCA)			
Project Purpose Capacity of Colombian institutions in flood management is enhanced.	1. Planning capacity regarding flood management 2. Capacity of flood forecasting and warning 3. Effective use and share of data for flood management 4. IFMP formulation guideline developed	1. Evaluation report of professional staff from all the CPs institutions' understanding of integrated flood management planning and river basin management 2. Coverage and number of hydrological station for flood forecasting and warning 3. Data exchange/ user agencies, quantity of data use 4. Formulation guideline	Vulnerability against flood disaster is not dramatically increased.	Through the understanding on the methodology for flood risk assessment, discussion for collaborative way among relevant organizations and the analysis of flood mechanism of the Magdalena River by C/P, sharing entity progress, issues and difficulties, discussion on contents of the management plan of the Magdalena River and Rio Negro basins was carried out, also it has been promoted their understanding about necessity and importance of introduction of river management and flood risk management concepts to these basin plans.	
Outputs 1. Capacity on flood risk assessment is improved and concept of integrated flood management planning and river basin management is introduced	1. Knowledge / understanding at IDEAM and CAR on river planning aspect in a) hydrologic & hydraulic modeling, and b) flood hazard/risk mapping 2. IDEAM, UNGRD and CAR's capacity enhancement on the technology of flood risk mapping including vulnerability analysis using GIS 3. Knowledge / understanding at IDEAM, UNGRD, CAR, Department and MADS on river basin wise IFMP	1. Ability test to measure understanding extent such as river planning methodology including longitudinal profile of river reach 2. Ability test to measure understanding extent such as flood risk mapping technology including thematic maps regarding flood disaster 3. Evaluation report of professional staff from all the CPs institutions' understanding of integrated flood management planning and river basin management	Hydrological and meteorological network of IDEAM and CAR is neither degraded nor diluted.	˜ The understanding on the methodology for flood risk assessment including economic evaluation and relationship between accuracy of the assessment and data/information was well promoted. ˜ The future appropriate system and collaborative way among relevant organizations was introduced through the progress report to the C/P. ˜ Flood mechanism in the middle reach of the Magdalena River basin has been analyzed by C/P and issues and difficulties of the analysis were shared among C/P and relevant organizations. ˜ Preparation policy and contents of management plan of Magdalena River basin were shared and discussed among C/P and relevant organizations. ˜ Preparation work for formulation of IFMP in Rio Negro basin has been steadily developed by C/P. ˜ CAR and IDEAM were carried out topobathymetric surveys in flood risk sectors in Rio Negro basin. ˜ CAR made the topobathymetric data analysis and processing of the information surveyed by CAR and IDEAM to overlap it with the Digital Elevation Model given by JICA Project. ˜ CAR introduced the procedure carried out to delimit Hydric Ronda of the water currents under CAR administrative area.	
2. Capacity on flood forecasting, warning and information dissemination to relevant organizations is improved (mainly IDEAM and UNGRD)	1. Knowledge / understanding at IDEAM and CAR on hydrologic observation and data analysis 2. Recommendation on improvement of IDEAM's flood forecasting and warning	1. Ability test to measure understanding extent such as hydrologic observation and data analysis including satellite origin rainfall data 2. Recommendations report on flood forecasting and warning			
3. Roles and responsibility of the central and local government for flood risk reduction are elucidated and enhanced (mainly UNGRD and IDEAM)	1. Issues clarified and recommendations draw regarding flood risk management among UNGRD, IDEAM, CAR, MADS, department and municipalities. 2. Matrix of informaiton inventory related to flood management (entity and type of information)	1. Recommendation of role for Action plan of the relevant actors in flood risk management 2. Matrix of information inventory			
4. Capacity of flood management planning is enhanced through formulation of integrated flood management plan (IFMP) in the pilot river basin	1. Integrated Flood Management Plan (IFMP) of pilot river basin 2. IFMP formulation guideline developed	1. IFMP 2. IFMP formulation guideline			

Activities	Inputs		Pre-Conditions
1.1 Capacity assessment and training on comprehensive utilization of meteorological and hydrological data for flood risk assessment including the satellite image mapping from the perspectives of temporal and spatial resolutions and accuracy (mainly IDEAM)	**The Japanese Side** Expert - Chief Advisor/Expert of Flood Management - Expert of River Planning - Expert of Hydrology, Hydraulics, and Flood Forecasting - Expert of Warning Information Dissemination and Evacuation - Expert of Flood Risk Mapping, Flood Risk Assessment, and GIS - Expert of Disaster Risk Management Policy Machinery and Equipment - Desktop / Laptop Computer - Multifunction machine (Printer / Photocopy) - Inkjet Color Printer - Hydrological Analysis Software - GIS Software	**The Colombian Side** Administration: Project Director, Project Manager Counterpart personnel: C/P personnel from the relevant divisions under UNGRD, IDEAM, CAR, Department of Cundinamarca, MADS and other institutions in the area of influence of the river basin. Facilities and Equipment - Office space - Office furniture, facilities and equipment Budgetary Arrangement by UNGRD, IDEAM, CAR, Department of Cundinamarca, MADS and other institutions in the area of influence of the river basin Administration and local operation costs	Central and pilot region's institutions agreed upon the exchange of data needed and available at each agency.
1.2 Capacity assessment and training on hydrological and hydraulic modelling from rainfall-runoff analysis to flood inundation analysis and mapping technology (mainly IDEAM)			
1.3 Capacity assessment and training on flood risk mapping technology using GIS with flood inundation and socio-economic data including vulnerability of structures (mainly IDEAM and UNGRD)			
1.4 Training on integrated flood risk management planning and river basin management (IDEAM, UNGRD, CAR, Department of Cundinamarca, MADS and local institutions in pilot river basin)			
1.4.1 Training in Colombia on; i) probabilistic hazard assessment of flood, ii) physical, environmental and social vulnerability analysis, iii) monitoring and evaluation of flood disaster risk, iv) management processes on flood events, v) flood disaster prevention and mitigation measures, and vi) development and operation of flood early warning systems			
1.4.2 Training in Japan on; i) strategies and policies for adaptation and flood risk management, ii) infrastructure models (housing, hospitals, schools, etc.) adapted to flood events, and iii) flood control schemes			<Issues and countermeasures> ˜ As a result of discussion on roles and responsibility of the central and local government for flood risk reduction, it was determined that CORMAGDALENA and CIRMAG participation was important in this project period as a management body of Magdalena river. After discussion among C/P, it was decided that these entities were important for the future flood management in Colombia, but not as official counterpart of this current project, since the half of period in this project has already been passed. Finally, it is determined that their participation in all the current project's activities and possible future project stage is relevant. ˜ As a result of the meeting among JICA Project, UNGRD , MADS and IDEAM in October, 2016 it was considered the possibility of developing a second Project stage , in order to develop deeply the river plan concept for Magdalena River, including CORMAGDALENA as C/P. In this sense, UNGRD,, MADS and CORMAGDALENA are currently developing an agreement proposal regarding this second Project stage.
2.1 Capacity assessment and training on hydrological observation (mainly IDEAM)			
2.2 Capacity assessment and training on flood forecasting (mainly IDEAM)			
2.3 Capacity assessment and training on dissemination of real-time risk information and warning for appropriate response (mainly IDEAM and UNGRD)			
3.1 Assessment of functions of both central and local governments in activities of river basin management			
3.2 Recommendation on effective and efficient roles and responsibility of central and local governments on flood risk reduction, using experiences in Japan and other countries.			
3.3 Evaluation and recommendation on enhanced institutional functions of flood risk reduction at the final stage of the project			
4.1 Formulation of IFMP for the pilot river basin with considering prevention, mitigation, preparedness and response. Formulation process includes following items. - Preparation of management plan of Magdalena-Cuenca river basin. - Preparation of hydrological and hydraulic models (mainly for IDEAM with the support of the regional autonomous corporations who will have the model to be used for them.)			
4.2 Preparation of IFMP formulation guideline utilizing lessons from pilot river basin activities (4-1).			

TO CR of JICA Colombia OFFICE

PROJECT MONITORING SHEET

Project Title: Project for Strengthening Flood Risk Management Capacity in Republic of Colombia
Version of the Sheet: Ver.2.0（Term: Feb. 2017）

Name:　Kenji Morita
Title:　Chief Advisor
Submission Date: Feb. 24, 2017

I. Summary

1　Progress

1-1 Progress of Inputs

The following Experts from Japan were assigned in February, 2017.
Mr. MORITA Kenji, Chief Advisor, who is in charge of Flood Management (1), conducted his activity from Feb. 6 to Feb. 24, 2017 in Bogota.

The following Counterpart Personnel from Colombia were assigned in February, 2017.
Mr. Julio Gonzalez from UNGRD, Mr. Fabio Bernal from IDEAM, Ms. Milena Castillo, Mr. Rafael Robles and Ms. Maryeny Caraballo from CAR, Mr. Jaime Matiz, Mr. William Barreto, Ms. Magda Yamile Ruiz and Mr. Wilson Garcia from Department of Cundinamarca, Ms. Luz Francy Navarro from MADS made smooth and good coordination with the Expert Team and the relevant organizations in terms of the JICA Project. Also, several officers from C/P organizations actively participated to technical meetings and workshops, which were held under this JICA Project.

1-2 Progress of Activities

The progress of activities is described as follows. The number in parentheses is according to the item number specified in the Project Design Matrix.
(1.4) Training on integrated flood risk management planning and river basin management (IDEAM, UNGRD, CAR, Department of Cundinamarca, MADS and local institutions in the pilot river basin)

- In the workshop on introduction of contents/activities of training in Japan, which was held on February 10 in IDEAM, and 3rd JCC held on February 22, experiences, findings and

learnings acquired through the training in Japan and idea for how to apply and utilize them to Colombia was presented by participants of training in Japan in November in 2016 and shared to C/P and participants. Also, how to utilize them to Colombia was discussed among participants.

(2.3) Capacity assessment and training on dissemination of real-time risk information and warning for appropriate response (mainly IDEAM and UNGRD)

- In the workshop on early warning system for municipalities in Rio Negro basin, which was held on February 17 at “Plaza de la Constitución" in Guaduas municipality organized by Department of Cundinamarca and supported by JICA expert team, cooperation among municipalities from upstream to downstream of the basin was discussed. In the workshop, the Japanese expert team presented the results of analysis on time lag of high water level at flood events among observation points in Rio Negro basin, Department of Cundinamarca explained general overview of the early warning systems for the communities, and CAR introduced process of POMCA revision and adjustment.

(4.1) Formulation of IFMP for the pilot river basin considering prevention, mitigation, preparedness and response

- Draft plan of flood part of Magdalena River was explained and confirmed in the workshops held on February 10. In the workshop held on February 20, it was confirmed that the plan will be finalized reflecting comments from C/P to be made by the end of this February and revise of analysis part to be carried out by C/P by the end of this March.
- Ideas of road map which shows future necessary actions for river planning of Magdalena River was introduced by Japanese expert team in the workshop on February 10, and it was discussed in the workshop on February 20. In the workshop, it was confirmed that another idea of the road map will be prepared by CORMAGDALENA/CIRMAG and the road map will be continuously discussed.
- Data collection and hydrological and hydraulic analysis for formulation of IFMP in Rio Negro have been continuously carried out by C/P and the current situation and progress were presented in the workshops on February 10 & 20.
- Activities related to available information gathering started in order to carry out vulnerability analysis.

1-3 Achievement of Output

The achievements of output are described as follows. The number in parentheses is according to the item number specified in the Project Design Matrix.

(1.) Capacity on flood risk assessment is improved and concept of integrated flood management planning and river basin management are introduced

- The experiences and knowledge acquired in training in Japan and idea for how to apply and utilize them to Colombia was well understood and discussed by the C/P.

(2.) Capacity on flood forecasting, warning and information dissemination to relevant organizations is improved (mainly IDEAM and UNGRD)

- It was understood by the officials of relevant organizations, municipalities, that early warning efforts taking into account water level fluctuation between upstream and downstream can be one of the solution to secure more lead time for evacuation process. The concrete activities are expected to be discussed more and carried out by the municipalities under support of C/P organizations.

(4.) Capacity of flood management planning is enhanced through formulation of integrated flood management plan (IFMP) in the pilot river basin

- Draft plan of flood part of Magdalena River was formulated and the process to be done on its finalization was confirmed.
- The importance of the road map for future necessary actions for river planning of Magdalena River was well understood and discussed by C/P.
- Through activities for preparation of formulation of IFMP, it was recognized by the C/P the difficulty of collection of some specific data and the necessity of an integrated information system.
- The preparation activities for formulation of IFMP in Rio Negro basin such as hydrological and hydraulic analysis has been steadily developed by C/P.

1-4 Achievement of the Project Purpose

Through the activities such as sharing experiences and knowledge in the training in Japan, organization of basin-wider workshop, formulation of the plan including the analysis of flood mechanism of the Magdalena River, discussion of necessary future actions as the road map, and preparation of formulation of IFMP, managing capacity and cooperation among relevant organizations to flood risk management have been steadily enhanced.

1-5 Changes of Risks and Actions for Mitigation

N/A

1-6 Progress of Actions undertaken by JICA

N/A

1-7 Progress of Actions undertaken by Gov. of Colombia

- The revision of the technical document related to the methodological guideline for Ronda delimitation with the judicial office of MADS is about to finish, after will come the adjustments that this judicial office will ask and the administrative act is expected for this August.
- CAR inside the frame of Decree 1640 2012, has been carrying out the diagnosis phase in the process of formulation and adjustment of Rio Negro basin POMCA, through joint commission.

1-8 Progress of Environmental and Social Considerations (if applicable)

N/A

1-9 Progress of Considerations on Gender/Peace Building/Poverty Reduction (if applicable)

N/A

1-10 other remarkable/considerable issues related/affect to the project (such as other JICA's projects, activities of counterparts, other donors, private sectors, NGOs etc.)

- In the 3rd JCC on February 22, 2017, important topics to be strengthened related to flood management and the expected actions were confirmed. Also, future expectations were discussed.

2 Delay of Work Schedule and/or Problems (if any)

2-1 Detail

N/A

2-2 Cause

N/A

2-3 Action to be taken

N/A

2-4 Roles of Responsible Persons/Organization (JICA, Gov. of Colombia)
N/A

3 Modification of the Project Implementation Plan

3-1 PO

According to the change of timing of holding JCCs, which was confirmed in the 3rd JCC on February 22, PO was revised.

3-2 Other modifications on detailed implementation plan

N/A

(Remarks: The amendment of R/D and PDM (title of the project, duration, project site(s), target group(s), implementation structure, overall goal, project purpose, outputs, activities, and input) should be authorized by JICA HDQs. If the project team deems it necessary to modify any part of R/D and PDM, the team may propose the draft.)

4 Preparation of Gov. of Colombia toward after completion of the Project

N/A

II. Project Monitoring Sheet I & II *as Attached*

Project Monitoring Sheet I (Revision of Project Design Matrix)

Project Title: Project for Strengthening Flood Risk Management Capacity
Implementing Agency: UNGRD, IDEAM, CAR, Department of Cundinamarca and MADS
Target Group: Staff of UNGRD, IDEAM, CAR, Department of Cundinamarca and MADS
Period of Project: three (3) years
Target Area: River basin of Rio Negro (direct target), and the whole country of Colombia (indirect target)

Version 2 (2-1)
Dated 23, 02, 2016 (24, 02, 2017)

Narrative Summary	Objectively Verifiable Indicators	Means of Verification	Important Assumption	Achievement	Remarks
Overall Goal The reduction of flood risk in Colombia	1. Realization of flood management related Recommendations made through the project. 2. Number of Integrated Flood Management Plan (IFMP) formulated for non-pilot river basin. (Or Ratio of POMCA which introduced the concept of Integrated Flood Management) (XX %)	1. Annual Reports of CP. 2. Policy paper on IFMP(POMCA)			
Project Purpose Capacity of Colombian institutions in flood management is enhanced.	1. Planning capacity regarding flood management 2. Capacity of flood forecasting and warning 3. Effective use and share of data for flood management 4. IFMP formulation guideline developed	1. Evaluation report of professional staff from all the CPs institutions' understanding of integrated flood management planning and river basin management 2. Coverage and number of hydrological station for flood forecasting and warning 3. Data exchange/ user agencies, quantity of data use 4. Formulation guideline	Vulnerability against flood disaster is not dramatically increased.	Through the activities such as sharing experiences and knowledge in the training in Japan, organization of basin-wider workshop, formulation of the plan including the analysis of flood mechanism of the Magdalena River, discussion of necessary future actions as the road map, and preparation of formulation of IFMP, managing capacity and cooperation among relevant organizations to flood risk management have been steadily enhanced.	
Outputs 1. Capacity on flood risk assessment is improved and concept of integrated flood management planning and river basin management is introduced	1. Knowledge / understanding at IDEAM and CAR on river planning aspect in a) hydrologic & hydraulic modeling, and b) flood hazard/risk mapping 2. IDEAM, UNGRD and CAR's capacity enhancement on the technology of flood risk mapping including vulnerability analysis using GIS 3. Knowledge / understanding at IDEAM, UNGRD, CAR, Department and MADS on river basin wise IFMP	1. Ability test to measure understanding extent such as river planning methodology including longitudinal profile of river reach 2. Ability test to measure understanding extent such as flood risk mapping technology including thematic maps regarding flood disaster 3. Evaluation report of professional staff from all the CPs institutions' understanding of integrated flood management planning and river basin management	Hydrological and meteorological network of IDEAM and CAR is neither degraded nor diluted.	¨ The experiences and knowledge acquired in training in Japan and idea for how to apply and utilize them to Colombia was well understood and discussed by the C/P. ¨ It was understood by the officials of relevant organizations, municipalities, that early warning efforts taking into account water level fluctuation between upstream and downstream can be one of the solution to secure more lead time for evacuation process. The concrete activities are expected to be discussed more and carried out by the municipalities under support of C/P organizations. ¨ Draft plan of flood part of Magdalena River was formulated and the process to be done on its finalization was confirmed. ¨ The importance of the road map for future necessary actions for river planning of Magdalena River was well understood and discussed by C/P. ¨ Through activities for preparation of formulation of IFMP, it was recognized by the C/P the difficulty of collection of some specific data and the necessity of an integrated information system. ¨ The preparation activities for formulation of IFMP in Rio Negro basin such as hydrological and hydraulic analysis has been steadily developed by C/P.	
2. Capacity on flood forecasting, warning and information dissemination to relevant organizations is improved (mainly IDEAM and UNGRD)	1. Knowledge / understanding at IDEAM and CAR on hydrologic observation and data analysis 2. Recommendation on improvement of IDEAM's flood forecasting and warning	1. Ability test to measure understanding extent such as hydrologic observation and data analysis including satellite origin rainfall data 2. Recommendations report on flood forecasting and warning			
3. Roles and responsibility of the central and local government for flood risk reduction are elucidated and enhanced (mainly UNGRD and IDEAM)	1. Issues clarified and recommendations draw regarding flood risk management among UNGRD, IDEAM, CAR, MADS, department and municipalities. 2. Matrix of informaiton inventory related to flood management (entity and type of information)	1. Recommendation of role for Action plan of the relevant actors in flood risk management 2. Matrix of information inventory			
4. Capacity of flood management planning is enhanced through formulation of integrated flood management plan (IFMP) in the pilot river basin	1. Integrated Flood Management Plan (IFMP) of pilot river basin 2. IFMP formulation guideline developed	1. IFMP 2. IFMP formulation guideline			

Activities	Inputs		Pre-Conditions
1.1 Capacity assessment and training on comprehensive utilization of meteorological and hydrological data for flood risk assessment including the satellite image mapping from the perspectives of temporal and spatial resolutions and accuracy (mainly IDEAM)	**The Japanese Side** Expert - Chief Advisor/Expert of Flood Management - Expert of River Planning - Expert of Hydrology, Hydraulics, and Flood Forecasting - Expert of Warning Information Dissemination and Evacuation - Expert of Flood Risk Mapping, Flood Risk Assessment, and GIS - Expert of Disaster Risk Management Policy Machinery and Equipment - Desktop / Laptop Computer - Multifunction machine (Printer / Photocopy) - Inkjet Color Printer - Hydrological Analysis Software - GIS Software	**The Colombian Side** Administration: Project Director, Project Manager Counterpart personnel: C/P personnel from the relevant divisions under UNGRD, IDEAM, CAR, Department of Cundinamarca, MADS and other institutions in the area of influence of the river basin. Facilities and Equipment - Office space - Office furniture, facilities and equipment Budgetary Arrangement by UNGRD, IDEAM, CAR, Department of Cundinamarca, MADS and other institutions in the area of influence of the river basin Administration and local operation costs	Central and pilot region's institutions agreed upon the exchange of data needed and available at each agency.
1.2 Capacity assessment and training on hydrological and hydraulic modelling from rainfall-runoff analysis to flood inundation analysis and mapping technology (mainly IDEAM)			
1.3 Capacity assessment and training on flood risk mapping technology using GIS with flood inundation and socio-economic data including vulnerability of structures (mainly IDEAM and UNGRD)			
1.4 Training on integrated flood risk management planning and river basin management (IDEAM, UNGRD, CAR, Department of Cundinamarca, MADS and local institutions in pilot river basin)			
1.4.1 Training in Colombia on; i) probabilistic hazard assessment of flood, ii) physical, environmental and social vulnerability analysis, iii) monitoring and evaluation of flood disaster risk, iv) management processes on flood events, v) flood disaster prevention and mitigation measures, and vi) development and operation of flood early warning systems			
1.4.2 Training in Japan on; i) strategies and policies for adaptation and flood risk management, ii) infrastructure models (housing, hospitals, schools, etc.) adapted to flood events, and iii) flood control schemes			<Issues and countermeasures>
2.1 Capacity assessment and training on hydrological observation (mainly IDEAM)			
2.2 Capacity assessment and training on flood forecasting (mainly IDEAM)			
2.3 Capacity assessment and training on dissemination of real-time risk information and warning for appropriate response (mainly IDEAM and UNGRD)			
3.1 Assessment of functions of both central and local governments in activities of river basin management			
3.2 Recommendation on effective and efficient roles and responsibility of central and local governments on flood risk reduction, using experiences in Japan and other countries.			
3.3 Evaluation and recommendation on enhanced institutional functions of flood risk reduction at the final stage of the project			
4.1 Formulation of IFMP for the pilot river basin with considering prevention, mitigation, preparedness and response. Formulation process includes following items. - Preparation of management plan of Magdalena-Cuenca river basin. - Preparation of hydrological and hydraulic models (mainly for IDEAM with the support of the regional autonomous corporations who will have the model to be used for them.) - Proposal of priority measures.			
4.2 Preparation of IFMP formulation guideline utilizing lessons from pilot river basin activities (4-1).			

TO CR of JICA Colombia OFFICE

PROJECT MONITORING SHEET

Project Title: Project for Strengthening Flood Risk Management Capacity in Republic of Colombia
Version of the Sheet: Ver.2.0（Term: Apr. 2017 – Aug., 2017）

Name:　Masato Fujimoto
Title:　Warning Information Dissemination and Evacuation
Submission Date: Aug. 11, 2017

I. Summary

1　Progress

1-1 Progress of Inputs

The following Experts from Japan were assigned from April to August, 2017.
Mr. INOUE Kazunori, Deputy Chief Advisor, who is in charge of Flood Management (2), Hydrology, Hydraulics and Flood Forecasting, conducted his activity from April 16th to May 17th, 2017 in Bogota and Department of Cundinamarca.
Mr. MORITA Kenji, Chief Advisor, who is in charge of Flood Management (1), conducted his activity from May 14th to June 10th and from July 10th to August 5th 2017 in Bogota and Department of Cundinamarca.
Mr. FUJIMOTO Masato, who is in charge of Warning Information Dissemination and Evacuation, conducted his activity from July 10th to August 11th 2017 in Bogota and Department of Cundinamarca.

The following Counterpart Personnel from Colombia were assigned from April to August, 2017.
Ms. Lina Dorado and Ms. Joana M. Perez from UNGRD, Mr. Fabio Bernal and Ms. Maria Constanza Rosero from IDEAM, Ms. Maryeny Caraballo, Ms. Milena Castillo, Mr. Juan Carlos Loaiza and Mr. Fernando Ospina from CAR, Mr. Jaime Matiz, Mr. William Barreto, Ms. Maria Cristina Ruiz and Ms. Magda Yamile Ruiz from Department of Cundinamarca, Ms. Luz Francy Navarro, Ms. Yolanda Calderon and Ms. Linda Irene Gomez from MADS made smooth and good coordination with the Expert Team and the relevant organizations in terms of the JICA Project. Also, several officers from C/P organizations and relative organizations

actively participated to technical meetings and workshops, which were held under this JICA Project.

1-2 Progress of Activities

The progress of activities is described as follows. The number in parentheses is according to the item number specified in the Project Design Matrix.

(4.1) Formulation of IFMP for the pilot river basin considering prevention, mitigation, preparedness and response

- Process and methodology for preparation of IFMP was repeatedly explained by experts and practical trainings for some parts of the plan such as grasping river characteristic and setting design scale were carried out in a series of workshops in April to August.
- Data collection and hydrological and hydraulic analysis for formulation of IFMP in Rio Negro have been continuously carried out by C/Ps and experts, and the current situation and progress were presented in a series of workshops in April to August.
- Regarding enhancement of early warning system in Rio Negro basin, importance of cooperation between upstream and downstream municipalities was recognized through analyzing flood propagation velocity and lead time for evacuation, and conducting interview survey in flood affected area.
- Targeting to enhance warning accuracy issued by IDEAM in near future, characteristics, transition, and utilization of weather radar in Japan was introduced by the expert.
- As for planning on early warning system as non-structural measure in IFMP, the detailed contents were discussed corresponding to 4 key elements which were risk knowledge, monitoring & warning service, dissemination & communication, and response capability.
- Regarding the flood part of river plan for Magdalena River, its flood phenomenon analysis part was revised by C/P of IDEAM from February to May, 2017 and other part was also revised reflecting comments from C/Ps and persons concerned. The revised parts were confirmed in the workshop on May 30 and final version was shared among C/Ps and persons concerned.
- For the process of formulating Magdalena river plan, the related activities such as strategic plan for Macro basin prepared by MADS, and analysis with several sectors in Magdalena-Cauca macro basin implemented by DNP, were shared with the related C/Ps and the experts.
- Following the workshop on February, the road map which shows future necessary actions for river planning of Magdalena River was discussed in the workshop on May 30

and finalized gaining a consensus of participants in the workshop on June 5. But, more detailed description for each item in the roadmap was given through a series of workshops in July and August in accordance with comments from JICA HQs.

1-3 Achievement of Output

The achievements of output are described as follows. The number in parentheses is according to the item number specified in the Project Design Matrix.

(4.) Capacity of flood management planning is enhanced through formulation of integrated flood management plan (IFMP) in the pilot river basin

- The flood part of river plan for Magdalena River was finalized.
- The road map for future necessary actions for river planning of Magdalena River was discussed and given a detailed description.
- Through activities for preparation of formulation of IFMP, it was recognized by the C/P the difficulty of collection of some specific data and the necessity of an integrated information system.
- The preparation activities for formulation of IFMP in Rio Negro basin such as hydrological and hydraulic analysis has been steadily developed by C/P.
- Contents of planning on early warning system as non-structural measure in IFMP were developed.

1-4 Achievement of the Project Purpose

Through the activities such as formulation of the plan including the analysis of flood mechanism of the Magdalena River, discussion of necessary future actions as the road map, and preparation of formulation of IFMP, managing capacity and cooperation among relevant organizations to flood risk management have been steadily enhanced.

Discussion to conclude Memorandum of Agreement among CORMAGDALENA, MADS and IDEAM for implementation of future activity on Magdalena river plan which will be formulated during the Project has been started.

1-5 Changes of Risks and Actions for Mitigation

N/A

1-6 Progress of Actions undertaken by JICA

N/A

1-7 Progress of Actions undertaken by Gov. of Colombia

For the nomination of 3rd training in Japan which will be held from November 5th to 18th 2017, UNGRD shall inform the nominees to JICA Colombia office and the Expert Team once the participating entities (UNGRD, IDEAM, CAR, Cundinamarca Department and MADS) select them.

1-8 Progress of Environmental and Social Considerations (if applicable)

N/A

1-9 Progress of Considerations on Gender/Peace Building/Poverty Reduction (if applicable)

N/A

1-10 other remarkable/considerable issues related/affect to the project (such as other JICA's projects, activities of counterparts, other donors, private sectors, NGOs etc.)

N/A

2 Delay of Work Schedule and/or Problems (if any)

2-1 Detail

N/A

2-2 Cause

N/A

2-3 Action to be taken

N/A

2-4 Roles of Responsible Persons/Organization (JICA, Gov. of Colombia)

N/A

3 Modification of the Project Implementation Plan

3-1 PO

N/A

3-2 Other modifications on detailed implementation plan

N/A

(Remarks: The amendment of R/D and PDM (title of the project, duration, project site(s), target group(s), implementation structure, overall goal, project purpose, outputs, activities, and input) should be authorized by JICA HDQs. If the project team deems it necessary to modify any part of R/D and PDM, the team may propose the draft.)

4 Preparation of Gov. of Colombia toward after completion of the Project

N/A

II. Project Monitoring Sheet I & II *as Attached*

Project Monitoring Sheet I (Revision of Project Design Matrix)

Project Title: Project for Strengthening Flood Risk Management Capacity
Implementing Agency: UNGRD, IDEAM, CAR, Department of Cundinamarca and MADS
Target Group: Staff of UNGRD, IDEAM, CAR, Department of Cundinamarca and MADS
Period of Project: three (3) years
Target Area: River basin of Rio Negro (direct target), and the whole country of Colombia (indirect target)

Version 2 (2-1)
Dated 23, 02, 2016 (11, 08, 2017)

Narrative Summary	Objectively Verifiable Indicators	Means of Verification	Important Assumption	Achievement	Remarks
Overall Goal The reduction of flood risk in Colombia	1. Realization of flood management related Recommendations made through the project. 2. Number of Integrated Flood Management Plan (IFMP) formulated for non-pilot river basin. (Or Ratio of POMCA which introduced the concept of Integrated Flood Management) (XX %)	1. Annual Reports of CP. 2. Policy paper on IFMP(POMCA)			
Project Purpose Capacity of Colombian institutions in flood management is enhanced.	1. Planning capacity regarding flood management 2. Capacity of flood forecasting and warning 3. Effective use and share of data for flood management 4. IFMP formulation guideline developed	1. Evaluation report of professional staff from all the CPs institutions' understanding of integrated flood management planning and river basin management 2. Coverage and number of hydrological station for flood forecasting and warning 3. Data exchange/ user agencies, quantity of data use 4. Formulation guideline	Vulnerability against flood disaster is not dramatically increased.	Through the activities such as formulation of the plan including the analysis of flood mechanism of the Magdalena River, discussion of necessary future actions as the road map, and preparation of formulation of IFMP, managing capacity and cooperation among relevant organizations to flood risk management have been steadily enhanced. Discussion to conclude Memorandum of Agreement among CORMAGDALENA, MADS and IDEAM for implementation of future activity on Magdalena river plan which will be formulated during the Project has	
Outputs 1. Capacity on flood risk assessment is improved and concept of integrated flood management planning and river basin management is introduced	1. Knowledge / understanding at IDEAM and CAR on river planning aspect in a) hydrologic & hydraulic modeling, and b) flood hazard/risk mapping 2. IDEAM, UNGRD and CAR's capacity enhancement on the technology of flood risk mapping including vulnerability analysis using GIS 3. Knowledge / understanding at IDEAM, UNGRD, CAR, Department and MADS on river basin wise IFMP	1. Ability test to measure understanding extent such as river planning methodology including longitudinal profile of river reach 2. Ability test to measure understanding extent such as flood risk mapping technology including thematic maps regarding flood disaster 3. Evaluation report of professional staff from all the CPs institutions' understanding of integrated flood management planning and river basin management	Hydrological and meteorological network of IDEAM and CAR is neither degraded nor diluted.	˜ The flood part of river plan for Magdalena River was finalized. ˜ The road map for future necessary actions for river planning of Magdalena River was discussed and given a detailed description. ˜ Through activities for preparation of formulation of IFMP, it was recognized by the C/P the difficulty of collection of some specific data and the necessity of an integrated information system. ˜ The preparation activities for formulation of IFMP in Rio Negro basin such as hydrological and hydraulic analysis has been steadily developed by C/P. ˜ Contents of planning on early warning system as non-structural measure in IFMP were developed.	
2. Capacity on flood forecasting, warning and information dissemination to relevant organizations is improved (mainly IDEAM and UNGRD)	1. Knowledge / understanding at IDEAM and CAR on hydrologic observation and data analysis 2. Recommendation on improvement of IDEAM's flood forecasting and warning	1. Ability test to measure understanding extent such as hydrologic observation and data analysis including satellite origin rainfall data 2. Recommendations report on flood forecasting and warning			
3. Roles and responsibility of the central and local government for flood risk reduction are elucidated and enhanced (mainly UNGRD and IDEAM)	1. Issues clarified and recommendations draw regarding flood risk management among UNGRD, IDEAM, CAR, MADS, department and municipalities. 2. Matrix of informaiton inventory related to flood management (entity and type of information)	1. Recommendation of role for Action plan of the relevant actors in flood risk management 2. Matrix of information inventory			
4. Capacity of flood management planning is enhanced through formulation of integrated flood management plan (IFMP) in the pilot river basin	1. Integrated Flood Management Plan (IFMP) of pilot river basin 2. IFMP formulation guideline developed	1. IFMP 2. IFMP formulation guideline			

Activities	Inputs		Pre-Conditions
1.1 Capacity assessment and training on comprehensive utilization of meteorological and hydrological data for flood risk assessment including the satellite image mapping from the perspectives of temporal and spatial resolutions and accuracy (mainly IDEAM)	**The Japanese Side** Expert - Chief Advisor/Expert of Flood Management - Expert of River Planning - Expert of Hydrology, Hydraulics, and Flood Forecasting - Expert of Warning Information Dissemination and Evacuation - Expert of Flood Risk Mapping, Flood Risk Assessment, and GIS - Expert of Disaster Risk Management Policy Machinery and Equipment - Desktop / Laptop Computer - Multifunction machine (Printer / Photocopy) - Inkjet Color Printer - Hydrological Analysis Software - GIS Software	**The Colombian Side** Administration: Project Director, Project Manager Counterpart personnel: C/P personnel from the relevant divisions under UNGRD, IDEAM, CAR, Department of Cundinamarca, MADS and other institutions in the area of influence of the river basin. Facilities and Equipment - Office space - Office furniture, facilities and equipment Budgetary Arrangement by UNGRD, IDEAM, CAR, Department of Cundinamarca, MADS and other institutions in the area of influence of the river basin Administration and local operation costs	Central and pilot region's institutions agreed upon the exchange of data needed and available at each agency.
1.2 Capacity assessment and training on hydrological and hydraulic modelling from rainfall-runoff analysis to flood inundation analysis and mapping technology (mainly IDEAM)			
1.3 Capacity assessment and training on flood risk mapping technology using GIS with flood inundation and socio-economic data including vulnerability of structures (mainly IDEAM and UNGRD)			
1.4 Training on integrated flood risk management planning and river basin management (IDEAM, UNGRD, CAR, Department of Cundinamarca, MADS and local institutions in pilot river basin)			
1.4.1 Training in Colombia on; i) probabilistic hazard assessment of flood, ii) physical, environmental and social vulnerability analysis, iii) monitoring and evaluation of flood disaster risk, iv) management processes on flood events, v) flood disaster prevention and mitigation measures, and vi) development and operation of flood early warning systems			
1.4.2 Training in Japan on; i) strategies and policies for adaptation and flood risk management, ii) infrastructure models (housing, hospitals, schools, etc.) adapted to flood events, and iii) flood control schemes			<Issues and countermeasures> For the nomination of 3rd training in Japan which will be held from November 5th to 18th 2017, UNGRD shall inform the nominees to JICA Colombia office and the Expert Team once the participating entities (UNGRD, IDEAM, CAR, Cundinamarca Department and MADS) select them.
2.1 Capacity assessment and training on hydrological observation (mainly IDEAM)			
2.2 Capacity assessment and training on flood forecasting (mainly IDEAM)			
2.3 Capacity assessment and training on dissemination of real-time risk information and warning for appropriate response (mainly IDEAM and UNGRD)			
3.1 Assessment of functions of both central and local governments in activities of river basin management			
3.2 Recommendation on effective and efficient roles and responsibility of central and local governments on flood risk reduction, using experiences in Japan and other countries.			
3.3 Evaluation and recommendation on enhanced institutional functions of flood risk reduction at the final stage of the project			
4.1 Formulation of IFMP for the pilot river basin with considering prevention, mitigation, preparedness and response. Formulation process includes following items. - Preparation of management plan of Magdalena-Cuenca river basin. - Preparation of hydrological and hydraulic models (mainly for IDEAM with the support of the regional autonomous corporations who will have the model to be used for them.) - Proposal of priority measures.			
4.2 Preparation of IFMP formulation guideline utilizing lessons from pilot river basin activities (4-1).			

TO CR of JICA Colombia OFFICE

PROJECT MONITORING SHEET

Project Title: Project for Strengthening Flood Risk Management Capacity in Republic of Colombia

Version of the Sheet: Ver.2.0 (Term: Sep. 2017 – Mar., 2018)

Name: Kenji Morita
Title: Chief Advisor

Submission Date: March. 2, 2018

I. Summary

1 Progress

1-1 Progress of Inputs

The following Experts from Japan were assigned from September, 2017 to March, 2018.

Dr. FURUTA Akihiro, who is in charge of Flood Risk Mapping, Flood Risk Assessment, and GIS, conducted his activity from Sep. 2nd, to Oct. 4th, 2017 in Bogota.

Mr. MORITA Kenji, Chief Advisor, who is in charge of Flood Management (1), conducted his activity from Sep. 18th to Nov. 1st, 2017, from Nov. 19th to Nov. 29th, 2017 and from Feb. 5 to Mar. 2, 2018 in Bogota and Department of Cundinamarca.

Mr. KATAYAMA Takeshi, who is in charge of Disaster Risk Management Policy, conducted his activity from Oct. 8th to Oct. 26th, 2017 and from Feb. 5 to Mar. 2, 2018 in Bogota and Department of Cundinamarca.

Dr. TODO Masaki, who is in charge of River Planning, conducted his activity from Oct. 17th to Nov. 1st, 2017 and from Feb. 5 to Feb. 23, 2018 in Bogota.

The following Counterpart Personnel (C/P) from Colombia were assigned from September, 2017 to March, 2018.

Ms. Joana M. Perez from UNGRD, Mr. Fabio Bernal and Ms. Maria Costanza Rosero from IDEAM, Ms. Maryeny Caraballo, Mr. Juan Carlos Loaiza, Mr. Fernando Ospina and Mr. Oscar Santos from CAR, Mr. Jaime Matiz and Mr. William Barreto from Department of Cundinamarca, Ms. Luz Francy Navarro and Ms. Yolanda Calderon from MADS made smooth and good coordination with the Expert Team and the relevant organizations in terms of the JICA Project. Also, several officers from C/P organizations and relative organizations actively participated to technical meetings and workshops, which were held under this JICA

Project.

1-2 Progress of Activities

The progress of activities is described as follows. The number in parentheses is according to the item number specified in the Project Design Matrix.

(1.2) Capacity assessment and training on hydrological and hydraulic modelling from rainfall-runoff analysis to flood inundation analysis and mapping technology.

- Seminar for hydrological and hydraulic modelling, namely iRIC Seminar, was held from October 17 to October 20, 2017 aiming to transfer technologies of method of river flow calculations, riverbed morphology and flood analyses using a sophisticated river modelling software iRIC with the support of the Water Resource Engineering Research Group (GIREH) from the Faculty of Engineering of the National University.

(1.4) Training on integrated flood risk management planning and river basin management (IDEAM, UNGRD, CAR, Department of Cundinamarca, MADS and local institutions in the pilot river basin)

- The 3rd training in Japan was carried out from November 6 to November 17, 2017 with 7 participants (3 executives and 4 technicians).
- In the 4th JCC held on November 24, 2017, experiences, findings and learnings acquired through the training in Japan and idea for how to apply and utilize them to Colombia was presented by a representative of participants of 3rd training in Japan and shared to participants of the 4th JCC.

(3.2) Recommendation on effective and efficient roles and responsibility of central and local governments on flood risk reduction, using experiences in Japan and other countries.

- Allocations of responsibilities related to the planning of measures for the flood risk reduction in the Magdalena River basin and the Rio Negro basin were discussed in a series of workshop in October, 2017. Also, allocation of responsibilities related to the implementation of measures for the flood risk reduction in the Rio Negro basin was discussed in a series of workshop in October, 2017. Then, the draft of allocation of responsibilities related to the above was elaborated.
- Allocations of responsibilities regarding more detailed and concrete items of the above were continuously discussed in a series of workshop in February and March, 2018. Then, the final versions of allocations of responsibilities were elaborated

(4.1) Formulation of IFMP for the pilot river basin considering prevention, mitigation, preparedness and response

- Following the series of workshops in July and August, detailed description for each item in the roadmap, which shows future necessary activities for river planning of Magdalena River, was discussed in the workshops on September 27, 2017. The final version of the road map was confirmed among participants in the workshop on October 12, 2017.
- Process and methodology for preparation of IFMP was repeatedly explained by experts and practical trainings and discussions for some parts of the plan such as setting design scale, planning of structural measures and non-structural measures, and evaluation of the plan by B/C analysis were carried out in a series of workshops in September to November.
- First version of IFMP in Rio Negro was introduced in the workshop on November 1, 2017. The first version has been revised based on comments from C/Ps and some missing chapters have been added to it from December, 2017 to February, 2018. The second version was prepared, and explained and distributed to C/P on March 1, 2018.
- Discussion on road map which shows future necessary activities for preparing the more concrete version of IFMP in Rio Negro started and the direction of preparation of the road map was discussed in the workshop on November 22, 2017. The contents of the road map were introduced in the workshop in February, 2018 and discussed in the workshop in March, 2018. The final version of the road map was confirmed among participants in the workshop on March 1, 2018.
- Draft version of a guideline for formulating IFMP-RP (IFMP in principal rivers such as Magdalena River) was introduced to C/P in February, 2018 and its contents were discussed and revised in a series of workshops and technical meetings in February, 2018.
- Draft version of a guideline for formulating IFMP-SZ (IFMP in Hydrographic Sub-zones such as Rio Negro basin) was introduced to C/P in February, 2018 and its contents were discussed and revised in the workshop in March, 2018.
- The importance of the incorporation of IFMP-RP to the strategic plan was discussed.
- The importance of the incorporation of IFMPSZ to POMCA was discussed.

1-3 Achievement of Output

The achievements of output are described as follows. The number in parentheses is according to the item number specified in the Project Design Matrix.

(1.) Capacity on flood risk assessment is improved and concept of integrated flood management planning and river basin management is introduced.

- Participants of the seminar for hydrological and hydraulic modelling using iRIC acquired enough knowledge and technique of method of river flow calculations, riverbed morphology and flood analyses.
- The 3rd training in Japan was carried out and the participants of the training well understood Japanese policy and system of flood risk management.
- The experiences and knowledge acquired in 3rd training in Japan and idea for how to apply and utilize them to Colombia were introduced and understood among participants of 4th JCC.

(3.) Roles and responsibility of the central and local government for flood risk reduction are elucidated and enhanced (mainly UNGRD and IDEAM)

- Allocation of responsibilities related to the planning and implementation of measures for the flood risk reduction was well discussed and confirmed by the C/P.
- The C / P identified that the distribution of the concerted roles in the framework of the Project must be ratified to be applied to other basins.

(4.) Capacity of flood management planning is enhanced through formulation of integrated flood management plan (IFMP) in the pilot river basin

- Future necessary activities for formulating flood management plan inMagdalena River were well understood by the C/P and other participants and the road map for the future necessary activities were finalized and confirmed by them.
- Process and methodology for preparation of IFMP, especially topics on setting design scale, planning of structural measures and non-structural measures, and evaluation of the plan by B/C analysis were well understood by the C/P and other participants. The first version of IFMP in Rio Negro Basin was formulated and has been revised to prepare the final version.
- The necessity and importance of future additional activities for preparation of more concrete version of IFMP in Rio Negro Basin was understood by the C/P and other participants. The road map for the future necessary activities was finalized and confirmed by them.
- Contents of guidelines for formulating IFMP-RP and IFMP-SZ were well discussed and understood by the C/P and other participants. They have been revised to prepare the final versions.
- The C / P and other participants understood the need and importance of incorporating IFMPs into strategic plan or POMCA.

1-4 Achievement of the Project Purpose

Through the activities such as training of hydrological and hydraulic modelling, 3rd training in Japan, sharing experiences and knowledge in the training in Japan, discussion on allocation of responsibilities, discussion of necessary future activities as the road maps, preparation of formulation of IFMP in Rio Negro, and preparation of guidelines for formulation of IFMP-RP and IFMP-SZ, managing capacity and cooperation among relevant organizations to flood risk management have been steadily enhanced.

1-5 Changes of Risks and Actions for Mitigation

N/A

1-6 Progress of Actions undertaken by JICA

N/A

1-7 Progress of Actions undertaken by Gov. of Colombia

Discussion to conclude the Memorandum of Understanding among MADS, CORMAGDALENA and IDEAM for implementation of future activity on Magdalena flood management has been carried out and the advances of in the creation of this document were shared in the 4th JCC on November 24.

1-8 Progress of Environmental and Social Considerations (if applicable)

N/A

1-9 Progress of Considerations on Gender/Peace Building/Poverty Reduction (if applicable)

N/A

1-10 other remarkable/considerable issues related/affect to the project (such as other JICA's projects, activities of counterparts, other donors, private sectors, NGOs etc.)

N/A

2 Delay of Work Schedule and/or Problems (if any)

2-1 Detail

N/A

2-2 Cause
N/A

2-3 Action to be taken
N/A

2-4 Roles of Responsible Persons/Organization (JICA, Gov. of Colombia)
N/A

3 Modification of the Project Implementation Plan

3-1 PO
According to the change of schedule of some project activities, which was confirmed in the 4th JCC on November 24, 2017, PO was revised.

3-2 Other modifications on detailed implementation plan
N/A
(Remarks: The amendment of R/D and PDM (title of the project, duration, project site(s), target group(s), implementation structure, overall goal, project purpose, outputs, activities, and input) should be authorized by JICA HDQs. If the project team deems it necessary to modify any part of R/D and PDM, the team may propose the draft.)

4 Preparation of Gov. of Colombia toward after completion of the Project

N/A

II. Project Monitoring Sheet I & II *as Attached*

Hoja de monitoreo del Proyecto (revisión de PDM)

Nombre del Proyecto: Proyecto para el Fortalecimiento de la Capacidad de Manejo del Riesgo de Inundaciones
Instituciones de implementación: UNGRD, IDEAM, CAR, Departmento de Cundinamarca y MADS
Beneficiarios primarios: Personal de la UNGRD, el IDEAM, la CAR, el Departamento de Cundinamarca y el MADS
Duración: tres (3) años
Área beneficiaria: Cuenca del Río Negro (área beneficiaria directa); totalidad del territorio de Colombia (área beneficiaria indirecta)

Versión 2 (2-1)
Fecha 23, 02, 2016 (02, 03, 2018)

Resumen narrativo	Indicadores objetivamente verificables	Medios de verificación	Condiciones externas	**Logros**	**observaciones**
Meta Superior La reducción del riesgo de inundaciones en Colombia	1. Realización de las recomendaciones relativas a la gestión del riesgo de inundación, hechas a través del proyecto. 2. Número de planes de la gestión integral del riesgo de inundaciones (IFMP) formulados para las cuencas no-piloto. (O, tasa de POMCA que introdujeron el concepto del manejo integral de inundaciones (XX %))	1. Informes anuales de las instituciones contrapartes 2. Documentos de la política sobre IFMP (POMCA)			
Objetivo del Proyecto Fortalecer las capacidades de las instituciones colombianas para la gestión del riesgo de inundaciones.	1. Capacidad de planificación de la gestión de las inundaciones 2. Capacidad de los pronósticos y las alertas de las inundaciones 3. Uso e intercambio eficaz de datos para la gestión de las inundaciones. 4. Guía de la formulación de IFMP desarrollada por el proyecto	1. Informe de evaluación del entendimiento de la planificación del manejo integral de inundaciones y del manejo de cuencas de los profesionales de todas las instituciones de la contraparte 2. La cobertura y el número de la estación hidrológica para los pronósticos y las alertas de las inundaciones 3. El intercambio de datos / agencias usuarias, cantidad de uso de datos 4. Guía de la formulación	Vulnerabilidad frente a desastres de inundación no se incrementa dramáticamente	A través de actividades tales como capacitación en modelación hidrológica e hidráulica, tercera capacitación en Japón, intercambio de experiencias y conocimientos en la capacitación en Japón, discusión sobre asignación de responsabilidades, discusión de actividades futuras necesarias como hoja de ruta y preparación de la formulación de IFMP in Río Negro, y la preparación de las guías para la formulación de IFMP-RP e IFMP-SZ, la capacidad de gestión y la cooperación entre las organizaciones pertinentes para la gestión del riesgo de inundación se han mejorado constantemente.	
Resultados 1. Se fortalece la capacidad de evaluación del riesgo de inundaciones y se introduce el concepto de la planificación de la gestión integral del riesgo de inundaciones y del manejo de la cuenca.	1.Conocimientos y entendimiento del IDEAM y la CAR en los aspectos de planificación de los ríos a) la observación y el análisis hidrológico b) mapeo de amenazas/riesgos de las inundaciones 2. Fortalecimiento de capacidades del IDEAM, la UNGRD y la CAR en cuanto a la tecnología del mapeo de riesgos de las inundaciones, incluyendo el análisis de vulnerabilidad utilizando SIG 3. Conocimientos /entendimiento del IDEAM, la UNGRD, la CAR, el Departamento de Cundinamarca y el MADS sobre IFMP basados en las cuencas	1. Prueba de habilidad para medir el alcance del entendimiento así como la metodología de la planificación de los ríos incluyendo el perfil longitudinal del cauce 2. Prueba de habilidad para medir el alcance del entendimiento de la tecnología para el mapeo de riesgos como mapas temáticos sobre los desastres de las inundaciones 3. Informe de evaluación del entendimiento de la planificación del manejo integral de inundaciones y del manejo de cuencas de los profesionales de todas las instituciones de la contraparte	Redes hidrológicas y meteorológicas del IDEAM y la CAR ni son degradadas ni diluidas	□ Los participantes del seminario de modelación hidrológica e hidráulica utilizando iRIC adquirieron suficientes conocimientos y técnicas de métodos de cálculos del caudal de ríos, morfología del lecho del río y análisis de inundaciones. □ El tercer entrenamiento en Japón se llevó a cabo y los participantes de la capacitación entendieron bien la política japonesa y el sistema de gestión del riesgo de inundación. □ Las experiencias y conocimientos adquiridos en la 3ra capacitación en Japón y la idea de cómo aplicarlos y utilizarlos en Colombia fueron presentados y entendidos por los participantes de la 4° CCC. □ La repartición de responsabilidades relacionadas con la planificación e implementación de medidas para la reducción del riesgo de inundación fue bien discutida y confirmada por la C / P. □ La C / P identificó que la distribución de los roles concertados en el marco del Proyecto deberán ratificarse para replicar la experiencia en otras cuencas. □ Las actividades futuras necesarias para la formulación del plan de manejo de inundaciones del Río Magdalena fueron bien comprendidas por la C / P y otros participantes, y la hoja de ruta para las futuras actividades necesarias fue finalizada y confirmada por ellos. □ La C / P y otros participantes comprendieron bien el proceso y la metodología para la preparación del IFMP, especialmente los temas sobre la definición de la escala de diseño, la planificación de medidas estructurales y medidas no estructurales, y la evaluación del plan mediante análisis B / C. Se formuló la primera versión de IFMP en la cuenca de Río Negro y ha sido revisado para preparar la versión final. □ La C / P y otros participantes entendieron la necesidad y la importancia de futuras actividades adicionales para la preparación de una versión más concreta del IFMP en la cuenca de Río Negro. La hoja de ruta para las futuras actividades necesarias fue finalizada y confirmada por la C / P. □ Contenidos y la guía para la formulación de IFMP-RP y IFMP-SZ fueron discutidos y comprendidos por la C / P y otros participantes. Estos han sido revisados para preparar las versiones finales. □ La C / P y otros participantes entendieron la necesidad y la importancia de la incorporación de IFMPs en Planes Estratégicos o POMCA.	
2. Se fortalece la capacidad en el pronóstico de inundaciones, alerta y la difusión de la información para organizaciones relevantes (principalmente para IDEAM y UNGRD).	1. Conocimientos / entendimiento del IDEAM y la CAR de la observación hidrológica y el análisis de datos 2. Recomendaciones para el mejoramiento de pronósticos y alertas de inundaciones del IDEAM	1. Prueba de habilidad para medir el alcance del entendimiento así como la observación hidrológica y el análisis de datos incluyendo los datos originales satelitales de precipitación 2. Recomendaciones informe de pronósticos y alertas de inundaciones			
3. Se aclaran y fortalecen roles y responsabilidades del gobierno central y local para la reducción del riesgo de inundaciones (principalmente para UNGRD e IDEAM)	1. Aclaraciones y recomendaciones sobre la gestión del riesgo de inundación entre la UNGRD, el IDEAM, la CAR, el MADS, el Departamento de Cundinamarca y municipios del Departamento de Cundinamarca. 2. Matriz inventario de informacion relativa a la gestión del riesgo de inundaciones (entidades y tipo de información)	1. Recomendación de la división de responsabilidades para el plan de acción de los actores relevantes para la gestión del riesgo de inundaciones 2. Matriz del inventario de información			
4. Se fortalece la capacidad de la planificación del manejo de inundaciones a través de la formulación del plan de la gestión integral del riesgo de inundaciones (IFMP, siglas en inglés) en la cuenca piloto.	1. IFMP para la cuenca piloto 2. Guía de la formulación de IFMP elaborada	1. IFMP 2. Guía de la formulación de IFMP			

Actividades	Aportes		Pre-Condiciones
1.1 Evaluación de la capacidad y la capacitación en la utilización integral de los datos meteorológicos e hidroló gicos para la evaluación del riesgo de inundaciones, incluyendo el mapeo de imágenes de satélite desde las perspectivas de las resoluciones temporales y espaciales y la precisión (principalmente para IDEAM).	**Parte Japonesa** Expertos - Jefe Asesor(a) / Experto(a) en Manejo de Inundaciones - Experto en Planificación del Río - Experto(a) en Hidrología, Hidráulica y Pronóstico de Inundaciones - Experto(a) en Difusión de Información de Alertas y Evacuación - Experto(a) en Mapeo de Riesgo de Inundaciones, Evaluación del Riesgo de Inundaciones y SIG - Experto(a) en Políticas de Gestión del Riesgo de Desastres Equipos - Computador de escritorio / portátil - Impresora multifuncional (impresora / fotocopiadora) unidades - Impresora "Inkjet" a color - Software de análisis hidrológico - Software de SIG	**Parte Colombiana** Administración: Director del Proyecto, Gerente del Proyecto Personal de la contraparte: Personal de la C/P de la UNGRD, el IDEAM, la CAR, el Departamento de Cundinamarca, el MADS, y otras instituciones de la zona de influencia de la cuenca Instalaciones y equipamiento - Espacio de oficina - Mobiliario, instalaciones y equipamiento de oficina Gestión de presupuesto a cargo de: la UNGRD, el IDEAM, la CAR, el Departamento de Cundinamarca, el MADS, e instituciones de la zona de influencia de la cuenca Gastos administrativos y de funcionamiento local	Las instituciones centrales y regionales del área piloto acordaron el intercambio de datos necesarios y disponibles en cada institución.
1.2 Evaluación de la capacidad y la capacitación en la modelación hidrológica e hidráulica desde el análisis de precipitación-escorrentía para el análisis de las inundaciones y la tecnología de elaboración de mapas (principalmente para IDEAM).			
1.3 Evaluación de la capacidad y la capacitación en la tecnología de elaboración de mapas de riesgo de inundaciones, utilizando SIG con datos de inundaciones y datos socio-económicos, incluyendo la vulnerabilidad de las estructuras (principalmente para IDEAM y UNGRD).			
1.4 Evaluación de la capacidad y la capacitación en la planificación de la gestión integral de inundaciones y el manejo de la cuenca (para IDEAM, UNGRD, la CAR, el Departamento de Cundinamarca, el MADS, e instituciones locales de la zona de influencia de la cuenca)			
1.4.1. Capacitación en Colombia en; i) la evaluación de amenazas probabilísticas de inundaciones, ii) el análisis de vulnerabilidad física, ambiental y social, iii) el monitoreo y la evaluación del riesgo de desastres de inundaciones, iv) la gestión de los procesos de eventos de inundaciones, v) las medidas de prevención y mitigaci ón de desastres de inundaciones, y vi) el desarrollo y la operación de sistemas de alerta temprana de inundaciones			
1.4.2. Capacitación en Japón en; i) estrategias y políticas para la adaptación y la gestión del riesgo de inundaciones, ii) modelos de infraestructura (viviendas, hospitales, escuelas, etc.) adaptados a eventos de inundaciones, y iii) esquemas de control de inundaciones			<Temas y contramedidas>
2.1 Evaluación de la capacidad y la capacitación en la observación hidrológica (principalmente para IDEAM).			
2.2 Evaluación de la capacidad y la capacitación en el pronóstico de inundaciones (principalmente para IDEAM).			
2.3 Evaluación de la capacidad y la capacitación en la difusión de la información del riesgo en tiempo real y la alerta para una respuesta apropiada (principalmente para IDEAM y UNGRD).			
3.1 Diagnóstico de funciones del gobierno central y local en actividades de la gestión de cuencas.			
3.2 Recomendación sobre roles y responsabilidad efectiva y eficiente de los gobiernos central y local en la reducción del riesgo de inundaciones, aprovechando experiencias en Japón y otros países.			
3.3 Evaluación y recomendación sobre funciones institucionales fortalecidas de la reducción del riesgo de inundaciones en la etapa final del Proyecto.			
4.1 Formulación del IFMP para la Cuenca piloto incluyendo medidas de prevención, mitigación, preparaci ón y respuesta. El proceso de formulación deberá incluir los siguientes puntos: - Preparación del plan de gestión de la cuenca Magdalena-Cuenca - Preparación de modelos hidrológicos e hidráulicos (principalmente para IDEAM con el apoyo de las corporaciones autónomas regionales de la zona de influencia, quienes tendrán el modelo a disposición para su uso) - Proposición de medidas prioritarias			
4.2 Elaboración de la guía para la formulación de IFMP, con base en las lecciones aprendidas en actividades realizadas en la cuenca piloto (4.1)			

Appendix-13-2 Questionnaires used to Evaluate Degree of Achievement of Project Purpose and Outputs of the Project for Project Evaluation

Questionnaire/Answer Sheet B for Project Evaluation

Target Respondent: Each member of C/P organizations and each member of related organizations that participated in our Project

Name of Respondent	
Organization of Respondent	

Question No. B.1-1:

Objectively Verifiable Indicators	Means of Verification
Knowledge / understanding on river planning aspect in a) hydrologic & hydraulic modeling, and b) flood hazard/risk mapping	Ability test to measure understanding extent such as river planning methodology including longitudinal profile of river reach

Please evaluate degree of improvement/development of your knowledge and/or understanding regarding the following items by selecting your "Rank (figure)"from the table below by your own judgement:

Rank	5	4	3	2	1
Degree of knowledge/ understanding	very well	well	enough	a little	nothing

Items for Question No. B.1-1

a) Hydrologic & hydraulic modeling

B.1-1-1. As a preparation work for modeling, **methodology of analyses on river characteristic** such as 1) methodology of analyses on longitudinal profile of river elevation, longitudinal profile of channel width and longitudinal profile of channel flow capacity, which were explained in the Technical Guide prepared in the Project, and 2) methodology of field survey on the river

Please select your "Rank (figure)" by your own judgement:

	Rank
Before the Project start / Before participation to the Project	
Present / After participation to the Project	

B.1-1-2. As a preparation work for modeling, **methodology of analyses on hydrological conditions** such as preparation of data availability table of all stations, preparation of the

time series data set for each station, and preparation of list and ranking of past annual maximum value of each station, which were explained in the Technical Guide prepared in the Project

Please select your "Rank (figure)" by your own judgement:

	Rank
Before the Project start / Before participation to the Project	
Present / After participation to the Project	

B.1-1-3. As a preparation work for modeling, **methodology of analyses on flood conditions** such as collection and arrangement of data of past flood events, analyses on flood phenomena and/or flood damages in significant flood events, methodology of field survey on flood phenomena, and analysis of relation between flood phenomena and hydrological conditions

Please select your "Rank (figure)" by your own judgement:

	Rank
Before the Project start / Before participation to the Project	
Present / After participation to the Project	

B.1-1-4. **Methodology of hydrologic & hydraulic modeling** such as theory of modeling, usage of modeling/simulation software like HEC-RAS and/or iRIC, and method of calibration

Please select your "Rank (figure)" by your own judgement:

	Rank
Before the Project start / Before participation to the Project	
Present / After participation to the Project	

<u>b) Flood hazard/risk mapping</u>

B.1-1-5. **Methodology of making hazard map** by figuring simulation results such as flood area and/or flood water depths in various return periods' floods

Please select your "Rank (figure)" by your own judgement:

	Rank
Before the Project start / Before participation to the Project	
Present / After participation to the Project	

B.1-1-6. **Methodology of utilization of simulation results to planning on river and/or flood risk management**, for example, methodology of setting the target flood considering changes of flood area and/or flood water depths depending on changes of return periods

Please select your “Rank (figure)” by your own judgement:

	Rank
Before the Project start / Before participation to the Project	
Present / After participation to the Project	

Question No. B.1-2:

Objectively Verifiable Indicators	Means of Verification
Capacity enhancement on the technology of flood risk mapping including vulnerability analysis using GIS	Ability test to measure understanding extent such as flood risk mapping technology including thematic maps regarding flood disaster

Please evaluate degree of improvement/development of your knowledge and/or understanding regarding the following items by selecting your "Rank (figure)"from the table below by your own judgement:

Rank	5	4	3	2	1
Degree of knowledge/ understanding	very well	well	enough	a little	nothing

Items for Question No. B.1-2

B.1-2-1. **Concept and methodology of Japanese flood risk evaluation** such as flood control economic survey and B/C analysis

Please select your "Rank (figure)" by your own judgement:

	Rank
Before the Project start / Before participation to the Project	
Present / After participation to the Project	

B.1-2-2. Regarding flood risk evaluation / flood control economic survey, 1) **types of necessary data** such as assets of houses and buildings in flood prone area, 2) **present status of each data in Colombia**, and 3) **responsible organizations of each data in Colombia**

Please select your "Rank (figure)" by your own judgement:

	Rank
Before the Project start / Before participation to the Project	
Present / After participation to the Project	

B.1-2-3. **Concrete methods of flood risk evaluation / flood control economic survey by using GIS**, such as 1) converting simulated flood area and assets data to mesh data, and 2) analysis by the mesh

Please select your "Rank (figure)" by your own judgement:

	Rank
Before the Project start / Before participation to the Project	
Present / After participation to the Project	

B.1-2-4. **Methodology of B/C calculation** by comparison of benefit and cost of flood damage reduction measures

Please select your "Rank (figure)" by your own judgement:

	Rank
Before the Project start / Before participation to the Project	
Present / After participation to the Project	

B.1-2-5. **Methodology of preparation of disaster risk reduction map** (DRR map), which include flood area, shelter, evacuation route, emergency contact information and others

Please select your "Rank (figure)" by your own judgement:

	Rank
Before the Project start / Before participation to the Project	
Present / After participation to the Project	

Question No. B.2-1:

Objectively Verifiable Indicators	Means of Verification
Knowledge / understanding on hydrologic observation and data analysis	Ability test to measure understanding extent such as hydrologic observation and data analysis including satellite origin rainfall data

Please evaluate degree of improvement/development of your knowledge and/or understanding regarding the following items by selecting your "Rank (figure)"from the table below by your own judgement:

Rank	5	4	3	2	1
Degree of knowledge/ understanding	very well	well	enough	a little	nothing

Items for Question No. B.2-1

B.2-1-1. **Expected/necessary accuracy** (observation frequency and/or installation density of observation stations) **of hydrological observation and flood forecast & early warning corresponding to flood phenomena** in each river basin scale (slow flood in principal river like Magdalena River, flash flood or debris flow in Hydrographic Subzone like Rio Negro basin, etc.)

Please select your "Rank (figure)" by your own judgement:

	Rank
Before the Project start / Before participation to the Project	
Present / After participation to the Project	

B.2-1-2. **Calculation method of time lag of high water levels** (flood wave propagation velocity) **from upstream to downstream** through analyzing water level data or using empirical formula, and **its utilization for early warning** through collaboration between upstream and downstream municipalities

Please select your "Rank (figure)" by your own judgement:

	Rank
Before the Project start / Before participation to the Project	
Present / After participation to the Project	

B.2-1-3. **Quantitative consideration on interval time** from issuance of flood warning to evacuation completion (Estimation of required time for warning dissemination and

evacuation)

Please select your “Rank (figure)” by your own judgement:

	Rank
Before the Project start / Before participation to the Project	
Present / After participation to the Project	

B.2-1-4. **Validation on accuracy of hydrological data and the analysis results** through making interview with residents and/or summarizing the past disaster records

Please select your “Rank (figure)” by your own judgement:

	Rank
Before the Project start / Before participation to the Project	
Present / After participation to the Project	

B.2-1-5. **Characteristics/differences of precipitation phenomena** observed by weather radar **depending on type/specification** (wave length, spatial resolution, etc.) **of the radar**

Please select your “Rank (figure)” by your own judgement:

	Rank
Before the Project start / Before participation to the Project	
Present / After participation to the Project	

Questionnaire/Answer Sheet A for Project Evaluation

Target Respondent: Leaders of each C/P organization members and Leaders of organization members that participated in our Project

Name of Respondent	
Organization of Respondent	

Question No. A.1:

Objectively Verifiable Indicators	Means of Verification
Planning capacity regarding flood management	Evaluation report of professional staff from all the institutions' understanding of integrated flood management planning and river basin management

1) Did you/your organization prepare any report of professional staff (C/P members) regarding their' understanding of integrated flood management planning and river basin management ? For example, a report after training in Japan.

Yes		No	
Please put “X” in either column			

2) If yes, please share such a report to the Project Team.

Question No. A.2:

Objectively Verifiable Indicators	Means of Verification
Capacity of flood forecasting and warning	Coverage and number of hydrological station for flood forecasting and warning

1) Is there any change regarding coverage and number of hydrological station which your organization manages/managed for flood forecasting and warning?

Yes		No	
Please put “X” in either column			

2) If yes, please share lists of hydrological stations before the Project start (List of 2014 or early 2015) and present (end of 2017 or early 2018).

Necessary information of the lists are “Name of stations, code of stations, location (coordinate), type of station, installation year”.

Question No. A.3:

Objectively Verifiable Indicators	Means of Verification
Effective use and share of data for flood management	Data exchange/ user agencies, quantity of data use

1) As for data/information related to flood risk management, is there any change regarding conditions on 1) data exchange and/or 2) quantity of data utilization among organizations which participated or related to the Project?

Yes		No	
Please put “X” in either column			

2) If yes, pleas describe how change the conditions before the Project (early 2015) and present (2018).

Description:

Appendix-14 M/M of JCC

MINUTES OF MEETINGS
ON
THE FIRST JOINT COORDINATION COMMITTEE
ON
JAPANESE TECHNICAL COOPERATION
FOR
THE PROJECT FOR STRENGTHENING FLOOD RISK MANAGEMENT CAPACITY
IN THE REPUBLIC OF COLOMBIA
AGREED UPON AMONG
AUTHORITIES CONCERNED OF THE GOVERNMENT OF COLOMBIA
AND
JAPAN INTERNATIONAL COOPERATION AGENCY

The Japanese Monitoring Team (hereinafter referred to as "the Team") organized by Japan International Cooperation Agency (hereinafter referred to as "JICA") and Japanese research team visited the Republic of Colombia to hold the 1st Joint Coordination Committee (hereinafter referred to as "JCC") meeting of the Project for Strengthening Flood Risk Management Capacity (hereinafter referred to as "the Project") in Colombia and to launch research activity of the Project.

The JCC meeting was held on 13th August, 2015 at crisis room of UNGRD in Bogota. As a result, the Team, Japanese research team and the Colombian organizations concerned agreed on the matters referred to in the document attached hereto.

Bogota, August 13, 2015

HIDEMITSU SAKURAI	RICHARD ALBERTO VARGAS HERNÁNDEZ
Resident Representative	General Sub-Director
JICA Colombia Office	National Unit for Disaster Risk Management
Japan International Cooperation Agency (JICA)	(UNGRD)

NELSON OMAR VARGAS MARTÍNEZ
Hydrology Sub-Director
Institute of Hydrology, Meteorology
and Environmental Studies (IDEAM)

JERÓNIMO GORDILLO NAVARRETE
Government Secretary (In charge)
Department of Cundinamarca

HEIDY MILENA CASTILLO MONTAÑO
Assigned Professional to the Project
Autonomous Regional Corporation of
Cundinamarca (CAR)

ATTACHED DOCUMENT

1. Outline of the Project

The Japanese side explained the outline of the Project by referring the Record of Discussions (hereinafter referred to as "the R/D") signed on April 20th, 2015 and the draft Inception Report.

The both Japanese and Colombian sides (hereinafter referred to as "the both sides") agreed on the revised framework and implementation plan of the Project which is given as Project Design Matrix (hereinafter referred to as "The PDM") version 1 shown as Annex 1, Plan of Operation (hereinafter referred to as "The PO") version 1 shown as Annex 2. The PDM contains overall goal, project purpose, outputs, and activities of the Project and will be utilized for project management, implementation and monitoring. In addition, the PDM will be utilized as a reference material for evaluation. The PDM and PO could be reviewed if required by both sides when necessity arises in the course of implementation of the Project.

2. Project Organization

The both side confirmed assigned responsible personal as below.

(1) Project Implementation Organization

- Project Director
  UNGRD: Richard Alberto Vargas Hernández
- Project Manager
  UNGRD: Julio González Velandia
  IDEAM: Nelson Omar Vargas Martínez
- Counter Personal (hereinafter referred to as "C/P")
  UNGRD: Margarita Arias
  Rosa Niño
  IDEAM: Fabio Andrés Bernal Quiroga
  Oscar Martínez
  Department of Cundinamarca:
  Jaime Matiz Ovalle
  Onofre Sierra Gómez
  CAR: Heidy Milena Castillo Montaño

(2) Project Organization Chart : Annex 3

3. Monitoring Report

The both sides agreed that JICA and the project implementation organizations will jointly and regularly monitor the progress of the Project through the Monitoring Sheets (version 1 shown as

Annex 4) based on the PDM and the PO. JICA expert team submits the Monitoring Sheets to JICA Colombia office after having discussion with Colombian side and JICA Colombia office. The Monitoring Sheets shall be updated every six (6) months. Also, Project Completion Report shall be drawn up one (1) month before the termination of the Project.

Annex 1 : Revised Project Design Matrix: PDM
Annex 2 : Revised Plan of Operation: PO
Annex 3 : Project implementation structure
Annex 4 : Monitoring Sheet
Annex 5 : Participants list of 1st JCC

Annex 1 : Revised Project Design Matrix: PDM

Project Design Matrix: PDM (Version-1)

Project Title: Project for Strengthening Flood Risk Management Capacity
Period of Project: three (3) years
Target Area: River basin of Rio Negro (direct target), and the whole country of Colombia (indirect target)
Target Group: Staff of UNGRD, IDEAM, CAR and Department of Cundinamarca

Version 1
Dated 13. 08. 2015

Narrative Summary	Objectively Verifiable Indicators	Means of Verification	Important Assumption
Overall Goal The reduction of flood risk in Colombia	1. Realization of flood management related Recommendations made through the project.	1. Annual Reports of CP.	
	2. Number of Integrated Flood Management Plan (IFMP) formulated for non-pilot river basin. (Or Ratio of POMCA which introduced the concept of Integrated Flood Management) (XX %)	2. Policy paper on IFMP(POMCA)	
Project Purpose Capacity of Colombian institutions in flood management is enhanced.	1. Planning capacity regarding flood management	1. Evaluation report of professional staff from all the CPs institutions' understanding of integrated flood management planning and river basin management	Vulnerability against flood disaster is not dramatically increased.
	2. Capacity of flood forecasting and warning	2. Coverage and number of hydrological station for flood forecasting and warning	
	3. Effective use and share of data for flood management	3. Data exchange/ user agencies, quantity of data use	
	4. IFMP formulation guideline developed	4. Formulation guideline	
Outputs 1. Capacity on flood risk assessment is improved and concept of integrated flood management planning and river basin management is introduced	1. Knowledge / understanding at IDEAM and CAR on river planning aspect in a) hydrologic & hydraulic modeling, and b) flood hazard/risk mapping	1. Ability test to measure understanding extent such as river planning methodology including longitudinal profile of river reach	Hydrological and meteorological network of IDEAM and CAR is neither degraded nor diluted.
	2. IDEAM, UNGRD and CAR's capacity enhancement on the technology of flood risk mapping including vulnerability analysis using GIS	2. Ability test to measure understanding extent such as flood risk mapping technology including thematic maps regarding flood disaster	
	3. Knowledge / understanding at IDEAM, UNGRD, CAR and Department on river basin wise IFMP	3. Evaluation report of professional staff from all the CPs institutions' understanding of integrated flood management planning and river basin management	
2. Capacity on flood forecasting, warning and information dissemination to relevant organizations is improved (mainly IDEAM and UNGRD)	1. Knowledge / understanding at IDEAM and CAR on hydrologic observation and data analysis	1. Ability test to measure understanding extent such as hydrologic observation and data analysis including satellite origin rainfall data	
	2. Recommendation on improvement of IDEAM's flood forecasting and warning	2. Recommendations report on flood forecasting and warning	
3. Roles and responsibility of the central and local government for flood risk reduction are elucidated and enhanced (mainly UNGRD and IDEAM)	1. Issues clarified and recommendations draw regarding flood risk management among UNGRD, IDEAM, CAR, department and municipalities.	1. Recommendation of role for Action plan of the relevant actors in flood risk management	
	2. Matrix of informaiton inventory related to flood management (entity and type of information)	2. Matrix of information inventory	
4. Capacity of flood management planning is enhanced through formulation of integrated flood management plan (IFMP) in the pilot river basin	1. Integrated Flood Management Plan (IFMP) of pilot river basin	1. IFMP	
	2. IFMP formulation guideline developed	2. IFMP formulation guideline	

Activities	Inputs		Important Assumption
1.1 Capacity assessment and training on comprehensive utilization of meteorological and hydrological data for flood risk assessment including the satellite image mapping from the perspectives of temporal and spatial resolutions and accuracy (mainly IDEAM) 1.2 Capacity assessment and training on hydrological and hydraulic modelling from rainfall-runoff analysis to flood inundation analysis and mapping technology (mainly IDEAM) 1.3 Capacity assessment and training on flood risk mapping technology using GIS with flood inundation and socio-economic data including vulnerability of structures (mainly IDEAM and UNGRD) 1.4 Training on integrated flood risk management planning and river basin management (IDEAM, UNGRD, CAR and Department of Cundinamarca and local institutions in pilot river basin) 1.4.1 Training in Colombia on; i) probabilistic hazard assessment of flood, ii) physical, environmental and social vulnerability analysis, iii) monitoring and evaluation of flood disaster risk, iv) management processes on flood events, v) flood disaster prevention and mitigation measures, and vi) development and operation of flood early warning systems 1.4.2 Training in Japan on; i) strategies and policies for adaptation and flood risk management, ii) infrastructure models (housing, hospitals, schools, etc.) adapted to flood events, and iii) flood control schemes 2.1 Capacity assessment and training on hydrological observation (mainly IDEAM) 2.2 Capacity assessment and training on flood forecasting (mainly IDEAM) 2.3 Capacity assessment and training on dissemination of real-time risk information and warning for appropriate response (mainly IDEAM and UNGRD) 3.1 Assessment of functions of both central and local governments in activities of river basin management 3.2 Recommendation on effective and efficient roles and responsibility of central and local governments on flood risk reduction, using experiences in Japan and other countries. 3.3 Evaluation and recommendation on enhanced institutional functions of flood risk reduction at the final stage of the project 4.1 Formulation of IFMP for the pilot river basin with considering prevention, mitigation, preparedness and response. Formulation process includes following items. - Preparation of management plan of Magdalena-Cuenca river basin. - Preparation of hydrological and hydraulic models (mainly for IDEAM with the support of the regional autonomous corporations who will have the model to be used for them.) - Proposal of priority measures. 4.2 Preparation of IFMP formulation guideline utilizing lessons from pilot river basin activities (4-1).	**The Japanese Side** Expert - Chief Advisor/Expert of Flood Management - Expert of River Planning - Expert of Hydrology, Hydraulics, and Flood Forecasting - Expert of Warning Information Dissemination and Evacuation - Expert of Flood Risk Mapping, Flood Risk Assessment, and GIS - Expert of Disaster Risk Management Policy Machinery and Equipment - Desktop / Laptop Computer - Multifunction machine (Printer / Photocopy) - Inkjet Color Printer - Hydrological Analysis Software - GIS Software	**The Colombian Side** Administration: Project Director, Project Manager Counterpart personnel: C/P personnel from the relevant divisions under UNGRD, IDEAM and other institutions in the area of influence of the river basin. Facilities and Equipment - Office space - Office furniture, facilities and equipment Budgetary Arrangement by UNGRD, IDEAM and other institutions in the area of influence of the river basin Administration and local operation costs	Hydrological and meteorological network of IDEAM and CAR is neither degraded nor diluted. **Pre-Conditions** Central and pilot region's institutions agreed upon the exchange of data needed and available at each agency.

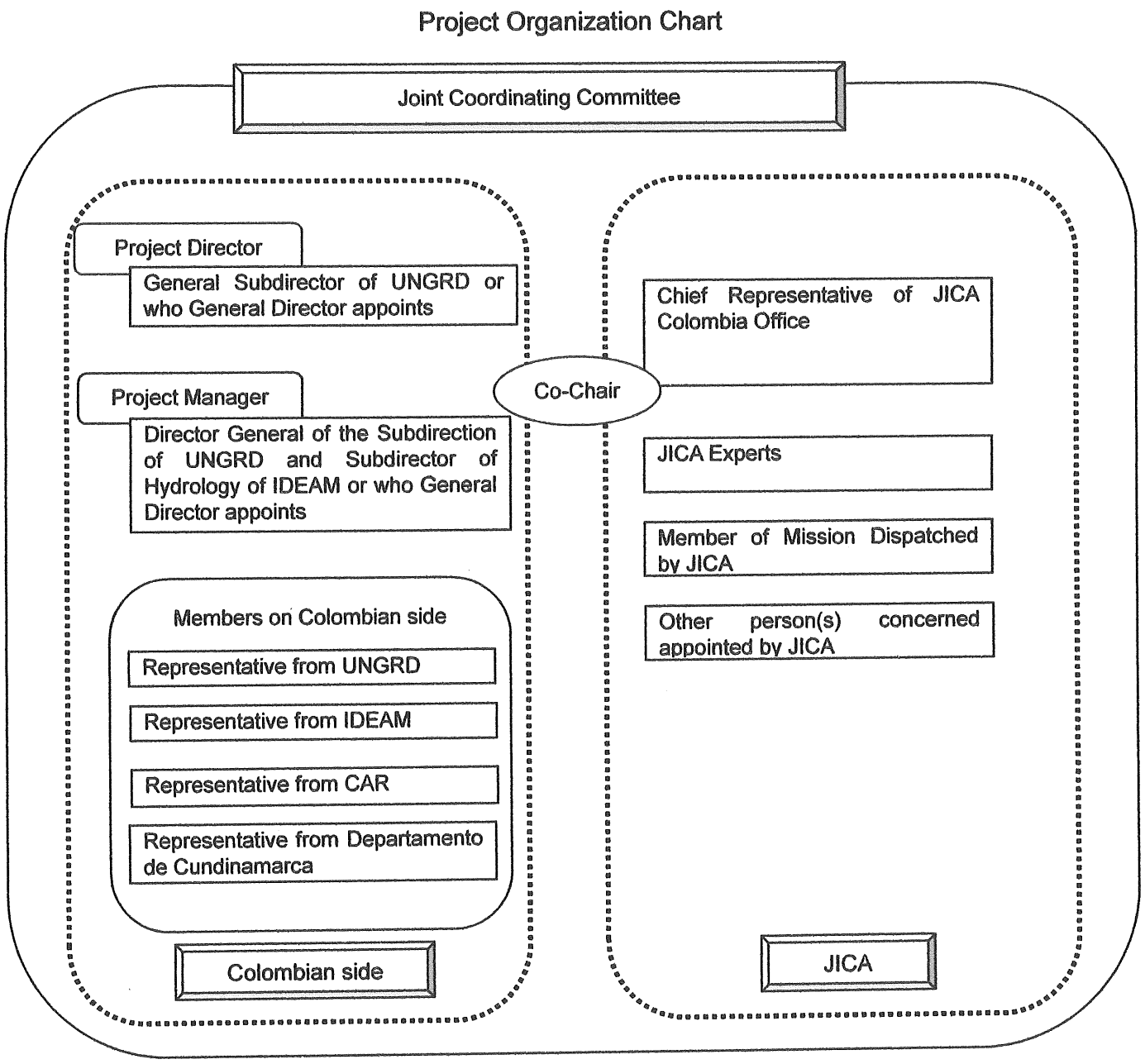
Annex 2 : Revised Plan of Operation: PO

Plan of Operation (PO) (Ver.1)

Project Name: Project for Strengthening Flood Management Capacity

		2015		2016				2017				2018	
		7-9	10-12	1-3	4-6	7-9	10-12	1-3	4-6	7-9	10-12	1-3	4-6
	JCC	▲				▲				▲			▲
Output1: Capacity on flood risk assessment is improved and concept of integrated flood management planning and river basin management is introduced.													
1-1.	Capacity assessment and training on comprehensive utilization of meteorological and hydrological data for flood risk assessment including the satellite image mapping from the perspectives of temporal and spatial resolutions and accuracy (mainly IDEAM).												
1-2.	Capacity assessment and training on hydrological and hydraulic modelling from rainfall-runoff analysis to flood inundation analysis and mapping technology (mainly IDEAM).												
1-3.	Capacity assessment and training on flood risk mapping technology using GIS with flood inundation and socio-economic data including vulnerability of structures (mainly IDEAM and UNGRD).												
1-4.	Training on integrated flood management planning and river basin management (IDEAM, UNGRD, CAR, Department of Cundinamarca and local institutions in pilot river basin).												
	1-4-1. Training in Colombia on; i) probabilistic hazard assessment of flood, ii) physical, environmental and social vulnerability analysis, iii) monitoring and evaluation of flood disaster risk, iv) management processes on flood events, v) flood disaster prevention and mitigation measures, and vi) development and operation of flood early warning system												
	1-4-2. Training in Japan on; i) strategies and policies for adaptation and flood risk management, ii) infrastructure models (housing, hospitals, schools, etc.) adapted to flood events, and iii) flood control schemes.												
Output2: Capacity on flood forecasting, warning and information dissemination to relevant organizations is improved (mainly IDEAM and UNGRD).													
2-1.	Capacity assessment and training on hydrological observation (mainly IDEAM).												
2-2.	Capacity assessment and training on flood forecasting (mainly IDEAM).												
2-3.	Capacity assessment and training on dissemination of real-time risk information and warning for appropriate response (mainly IDEAM and UNGRD).												
Output3: Roles and responsibility of the central and local goverament for flood risk reduction are elucidated and enhanced (mainly UNGRD and IDEAM).													
3-1.	Assessment of functions of both central and local governments in activities of river basin management.												
3-2.	Recommendation on effective and efficient roles and responsibility of central and local governments on flood risk reduction, using experiences in Japan and other countries.												
3-3.	Evaluation and recommendation on enhanced institutional functions of flood risk reduction at the final stage of the project.												
Output4: Capacity of flood management planning is enhanced through formulation of integrated flood management plan (IFMP) in the pilot river basin.													
4-1.	Formulation of IFMP for the pilot river basin with considering prevention, mitigation, preparedness and response. Formulation process includes following items. - Preparation of management plan of Magdalena-Cuenca river basin. - Preparation of hydrological and hydraulic models (mainly for IDEAM with the support of the regional autonomous corporations who will have the model to be used for them.) - Proposal of priority measures.												
4-2.	Preparation of IFMP formulation guideline utilizing lessons from pilot river basin activities (4-1).												

Annex 3 : Project implementation structure



Observers:

- Observers may attend upon agreement between Colombian side and JICA.

Annex 4 : Monitoring Sheet

Project Monitoring Sheet I (Revision of Project Design Matrix)

Project Title: Project for Strengthening Flood Risk Management Capacity
Implementing Agency: UNGRD, IDEAM, CAR and Department of Cundinamarca
Target Group: Staff of UNGRD, IDEAM, CAR and Department of Cundinamarca
Period of Project: three (3) years
Target Area: River basin of Rio Negro (direct target), and the whole country of Colombia (indirect target)

Version 1
Dated 13. 08. 2015

Narrative Summary	Objectively Verifiable Indicators	Means of Verification	Important Assumption	Achievement	Remarks
Overall Goal The reduction of flood risk in Colombia	1. Realization of flood management related Recommendations made through the project	1. Annual Reports of CP.			
	2. Number of Integrated Flood Management Plan (IFMP) formulated for non-pilot river basin. (Or Ratio of POMCA which introduced the concept of Integrated Flood Management) (XX %)	2. Policy paper on IFMP(POMCA)			
Project Purpose Capacity of Colombian institutions in flood management is enhanced.	1. Planning capacity regarding flood management	1. Evaluation report of professional staff from all the CPs institutions' understanding of integrated flood management planning and river basin management	Vulnerability against flood disaster is not dramatically increased.		
	2. Capacity of flood forecasting and warning	2. Coverage and number of hydrological station for flood forecasting and warning			
	3. Effective use and share of data for flood management	3. Data exchange/ user agencies, quantity of data use			
	4. IFMP formulation guideline developed	4. Formulation guideline			
Outputs 1. Capacity on flood risk assessment is improved and concept of integrated flood management planning and river basin management is introduced	1. Knowledge / understanding at IDEAM and CAR on river planning aspect in a) hydrologic & hydraulic modeling, and b) flood hazard/risk mapping	1. Ability test to measure understanding extent such as river planning methodology including longitudinal profile of river reach	Hydrological and meteorological network of IDEAM and CAR is neither degraded nor diluted.		
	2. IDEAM, UNGRD and CAR's capacity enhancement on the technology of flood risk mapping including vulnerability analysis using GIS	2. Ability test to measure understanding extent such as flood risk mapping technology including thematic maps regarding flood disaster			
	3. Knowledge / understanding at IDEAM, UNGRD, CAR and Department on river basin wise IFMP	3. Evaluation report of professional staff from all the CPs institutions' understanding of integrated flood management planning and river basin management			
2. Capacity on flood forecasting, warning and information dissemination to relevant organizations is improved (mainly IDEAM and UNGRD)	1. Knowledge / understanding at IDEAM and CAR on hydrologic observation and data analysis	1. Ability test to measure understanding extent such as hydrologic observation and data analysis including satellite origin rainfall data			
	2. Recommendation on improvement of IDEAM's flood forecasting and warning	2. Recommendations report on flood forecasting and warning			
3. Roles and responsibility of the central and local government for flood risk reduction are elucidated and enhanced (mainly UNGRD and IDEAM)	1. Issues clarified and recommendations draw regarding flood risk management among UNGRD, IDEAM, CAR, department and municipalities.	1. Recommendation of role for Action plan of the relevant actors in flood risk management			
	2. Matrix of informaiton inventory related to flood management (entity and type of information)	2. Matrix of information inventory			
4. Capacity of flood management planning is enhanced through formulation of integrated flood management plan (IFMP) in the pilot river basin	1. Integrated Flood Management Plan (IFMP) of pilot river basin	1. IFMP			
	2. IFMP formulation guideline developed	2. IFMP formulation guideline			

Activities	Inputs		Pre-Conditions
1.1 Capacity assessment and training on comprehensive utilization of meteorological and hydrological data for flood risk assessment including the satellite image mapping from the perspectives of temporal and spatial resolutions and accuracy (mainly IDEAM)	**The Japanese Side** Expert - Chief Advisor/Expert of Flood Management - Expert of River Planning - Expert of Hydrology, Hydraulics, and Flood Forecasting - Expert of Warning Information Dissemination and Evacuation - Expert of Flood Risk Mapping, Flood Risk Assessment, and GIS - Expert of Disaster Risk Management Policy Machinery and Equipment - Desktop / Laptop Computer - Multifunction machine (Printer / Photocopy) - Inkjet Color Printer - Hydrological Analysis Software - GIS Software	**The Colombian Side** Administration: Project Director, Project Manager Counterpart personnel: C/P personnel from the relevant divisions under UNGRD, IDEAM and other institutions in the area of influence of the river basin. Facilities and Equipment - Office space - Office furniture, facilities and equipment Budgetary Arrangement by UNGRD, IDEAM and other institutions in the area of influence of the river basin Administration and local operation costs	Central and pilot region's institutions agreed upon the exchange of data needed and available at each agency.
1.2 Capacity assessment and training on hydrological and hydraulic modelling from rainfall-runoff analysis to flood inundation analysis and mapping technology (mainly IDEAM)			
1.3 Capacity assessment and training on flood risk mapping technology using GIS with flood inundation and socio-economic data including vulnerability of structures (mainly IDEAM and UNGRD)			
1.4 Training on integrated flood risk management planning and river basin management (IDEAM, UNGRD, CAR and Department of Cundinamarca and local institutions in pilot river basin)			
1.4.1 Training in Colombia on; i) probabilistic hazard assessment of flood, ii) physical, environmental and social vulnerability analysis, iii) monitoring and evaluation of flood disaster risk, iv) management processes on flood events, v) flood disaster prevention and mitigation measures, and vi) development and operation of flood early warning systems			
1.4.2 Training in Japan on: i) strategies and policies for adaptation and flood risk management, ii) infrastructure models (housing, hospitals, schools, etc.) adapted to flood events, and iii) flood control schemes			<Issues and countermeasures>
2.1 Capacity assessment and training on hydrological observation (mainly IDEAM)			
2.2 Capacity assessment and training on flood forecasting (mainly IDEAM)			
2.3 Capacity assessment and training on dissemination of real-time risk information and warning for appropriate response (mainly IDEAM and UNGRD)			
3.1 Assessment of functions of both central and local governments in activities of river basin management			
3.2 Recommendation on effective and efficient roles and responsibility of central and local governments on flood risk reduction, using experiences in Japan and other countries.			
3.3 Evaluation and recommendation on enhanced institutional functions of flood risk reduction at the final stage of the project			
4.1 Formulation of IFMP for the pilot river basin with considering prevention, mitigation, preparedness and response. Formulation process includes following items. - Preparation of management plan of Magdalena-Cuenca river basin. - Preparation of hydrological and hydraulic models (mainly for IDEAM with the support of the regional autonomous corporations who will have the model to be used for them.) - Proposal of priority measures.			
4.2 Preparation of IFMP formulation guideline utilizing lessons from pilot river basin activities (4-1).			

Annex 5 : Participants list of 1st JCC

	NAME	ENTITY
1.	Andrés Uribe Orozco	APC
2.	Liliana Sánchez	APC
3.	Catalina Jiménez	APC
4.	Richard Vargas	UNGRD
5.	Diego Peña	UNGRD
6.	Julio González	UNGRD
7.	Gerardo Jaramillo	UNGRD
8.	Antonio López	UNGRD
9.	Camila Chaparro	UNGRD
10.	Omar Vargas	IDEAM
11.	Christian Euscátegui	IDEAM
12.	Diana Quimbay	IDEAM
13.	Fabio Andrés Bernal	IDEAM
14.	Oscar Martínez	IDEAM
15.	Clara Lamo	IDEAM
16.	Wilson Becerra	IDEAM
17.	Natalia Soto	IDEAM
18.	Alberto Pardo	IDEAM
19.	Carlos Manuel Montaño Barrantes	CAR
20.	Milena Castillo	CAR
21.	Carolina Cárdenas	CAR
22.	Jerónimo Gordillo Navarrete	Department of Cundinamarca
23.	Jaime Matiz Ovalle	Department of Cundinamarca
24.	Onofre Sierra Gómez	Department of Cundinamarca
25.	Lina Paola Mora Navarro	Department of Cundinamarca
26.	Ayza Trujillo	Department of Cundinamarca
27.	Osamu Inagaki	Japanese embassy
28.	Hidemitsu Sakurai	JICA Colombia
29.	Catalina Bastidas	JICA Colombia
30.	Hitoshi Baba	JICA
31.	Ginga Nakadai	JICA
32.	Kenji Morita	JICA Project Team
33.	Kazunori Inoue	JICA Project Team
34.	Masaki Todo	JICA Project Team
35.	Akihiro Furuta	JICA Project Team
36.	Hirotada Hasegawa	JICA Project Team

MINUTES OF MEETINGS
ON
THE SECOND JOINT COORDINATION COMMITTEE
ON
JAPANESE TECHNICAL COOPERATION
FOR
THE PROJECT FOR STRENGTHENING FLOOD RISK MANAGEMENT CAPACITY
IN THE REPUBLIC OF COLOMBIA
AGREED UPON AMONG
AUTHORITIES CONCERNED OF THE GOVERNMENT OF COLOMBIA
AND
JAPAN INTERNATIONAL COOPERATION AGENCY

The 2nd Joint Coordination Committee (hereinafter referred to as "JCC") meeting of the Project for Strengthening Flood Risk Management Capacity (hereinafter referred to as "the Project") in Colombia was held on February 23rd, 2016 at Monserrate room of Tryp Embajada hotel in Bogota. As a result, Japan International Cooperation Agency (hereinafter referred to as "JICA") Colombian office, Japanese expert team and the Colombian organizations concerned agreed on the matters referred to in the document attached hereto.

Bogota, February 23rd, 2016

SATOSHI MUROSAWA
Resident Representative
JICA Colombia Office
Japan International Cooperation Agency (JICA)

GRACIELA MARÍA USTARIZ MANJARRES.
General Sub-Director
National Unit for Disaster Risk Management (UNGRD)

NELSON OMAR VARGAS MARTÍNEZ
Hydrology Sub-Director
Institute of Hydrology, Meteorology
and Environmental Studies (IDEAM)

JULIO ROBERTO SALAZAR PERDOMO
Director of Special Administrative Unit for
Disaster Risk Management (UAEGRDC)
Department of Cundinamarca

HEIDY MILENA CASTELLO MONTAÑO
Assigned Professional to the Project
Autonomous Regional Corporation of
Cundinamarca (CAR)

LUIS ALFONSO ESCOBAR TRUJILLO
Director of Integrated Water Resources
Management
Ministry of Environment and Sustainable
Development (MADS)

ATTACHED DOCUMENT

1. Inviting New Counterpart Organization to the Project

The Japanese side explained the necessity and importance of participation of MADS to the Project for more effective activities of the Project.

Both Japanese and Colombian sides (hereinafter referred to as "the both sides") agreed on the participation of MADS to the Project as an official counterpart organization and dispatching Counterpart Personnel (hereinafter referred to as "C/P") from MADS to the Project. Based on this agreement, the both sides also agreed on revising framework and implementation plan of the Project which are given as Project Design Matrix (hereinafter referred to as "The PDM") version 2 shown as Annex 1, Plan of Operation (hereinafter referred to as "The PO") version 2 shown as Annex 2.

2. Project Organization

The both sides confirmed assigned responsible personal as below.

(1) Project Implementation Organization

- Project Director
  UNGRD: Graciela María Ustariz Manjarres.
- Project Manager
  UNGRD: Julio González Velandia
  IDEAM: Nelson Omar Vargas Martínez
- C/P
  UNGRD: Antonio López Reales
  Claudia Rocio Cante Maldonado
  IDEAM: Fabio Andrés Bernal Quiroga
  Oscar Martínez
  Department of Cundinamarca:
  Julio Roberto Salazar P.
  William Barreto
  Nancy Patricia Venegas
  Jaime Matiz O.
  Onofre Sierra Gómez
  María Cristina Ruiz
  Juan Manuel Acero
  CAR: Heidy Milena Castillo Montaño
  Jhon Sánchez Aranguren
  Héctor Hernán Leguizamon O.

MADS: Yolanda Calderón
Sergio Salazar
Luz Francy Navarro

(2) Project Organization Chart : Annex 3

Annex 1 : Revised Project Design Matrix: PDM

Annex 2 : Revised Plan of Operation: PO

Annex 3 : Revised Project implementation structure

Annex 4 : Participants list of 2nd JCC

Project Design Matrix: PDM (Version-2)

Project Title: Project for Strengthening Flood Risk Management Capacity
Period of Project: three (3) years
Target Area: River basin of Rio Negro (direct target), and the whole country of Colombia (indirect target)
Target Group: Staff of UNGRD, IDEAM, CAR, Department of Cundinamarca and MADS

Version 2
Dated 23. 02. 2016

Narrative Summary	Objectively Verifiable Indicators	Means of Verification	Important Assumption
Overall Goal The reduction of flood risk in Colombia	1. Realization of flood management related Recommendations made through the project.	1. Annual Reports of CP.	
	2. Number of Integrated Flood Management Plan (IFMP) formulated for non-pilot river basin. (Or Ratio of POMCA which introduced the concept of Integrated Flood Management) (XX %)	2. Policy paper on IFMP(POMCA)	
Project Purpose Capacity of Colombian institutions in flood management is enhanced.	1. Planning capacity regarding flood management	1. Evaluation report of professional staff from all the CPs institutions' understanding of integrated flood management planning and river basin management	Vulnerability against flood disaster is not dramatically increased.
	2. Capacity of flood forecasting and warning	2. Coverage and number of hydrological station for flood forecasting and warning	
	3. Effective use and share of data for flood management	3. Data exchange/ user agencies, quantity of data use	
	4. IFMP formulation guideline developed	4. Formulation guideline	
Outputs 1. Capacity on flood risk assessment is improved and concept of integrated flood management planning and river basin management is introduced	1. Knowledge / understanding at IDEAM and CAR on river planning aspect in a) hydrologic & hydraulic modeling, and b) flood hazard/risk mapping	1. Ability test to measure understanding extent such as river planning methodology including longitudinal profile of river reach	Hydrological and meteorological network of IDEAM and CAR is neither degraded nor diluted.
	2. IDEAM, UNGRD and CAR's capacity enhancement on the technology of flood risk mapping including vulnerability analysis using GIS	2. Ability test to measure understanding extent such as flood risk mapping technology including thematic maps regarding flood disaster	
	3. Knowledge / understanding at IDEAM, UNGRD, CAR, Department and MADS on river basin wise IFMP	3. Evaluation report of professional staff from all the CPs institutions' understanding of integrated flood management planning and river basin management	
2. Capacity on flood forecasting, warning and information dissemination to relevant organizations is improved (mainly IDEAM and UNGRD)	1. Knowledge / understanding at IDEAM and CAR on hydrologic observation and data analysis	1. Ability test to measure understanding extent such as hydrologic observation and data analysis including satellite origin rainfall data	
	2. Recommendation on improvement of IDEAM's flood forecasting and warning	2. Recommendations report on flood forecasting and warning	
3. Roles and responsibility of the central and local government for flood risk reduction are elucidated and enhanced (mainly UNGRD and IDEAM)	1. Issues clarified and recommendations draw regarding flood risk management among UNGRD, IDEAM, CAR, MADS, department and municipalities.	1. Recommendation of role for Action plan of the relevant actors in flood risk management	
	2. Matrix of informaiton inventory related to flood management (entity and type of information)	2. Matrix of information inventory	
4. Capacity of flood management planning is enhanced through formulation of integrated flood management plan (IFMP) in the pilot river basin	1. Integrated Flood Management Plan (IFMP) of pilot river basin	1. IFMP	
	2. IFMP formulation guideline developed	2. IFMP formulation guideline	

Annex 1 : Revised Project Design Matrix: PDM

Activities	Inputs		Important Assumption
1.1 Capacity assessment and training on comprehensive utilization of meteorological and hydrological data for flood risk assessment including the satellite image mapping from the perspectives of temporal and spatial resolutions and accuracy (mainly IDEAM) 1.2 Capacity assessment and training on hydrological and hydraulic modelling from rainfall-runoff analysis to flood inundation analysis and mapping technology (mainly IDEAM) 1.3 Capacity assessment and training on flood risk mapping technology using GIS with flood inundation and socio-economic data including vulnerability of structures (mainly IDEAM and UNGRD) 1.4 Training on integrated flood risk management planning and river basin management (IDEAM, UNGRD, CAR, Department of Cundinamarca, MADS and local institutions in pilot river basin) 1.4.1 Training in Colombia on; i) probabilistic hazard assessment of flood, ii) physical, environmental and social vulnerability analysis, iii) monitoring and evaluation of flood disaster risk, iv) management processes on flood events, v) flood disaster prevention and mitigation measures, and vi) development and operation of flood early warning systems 1.4.2 Training in Japan on; i) strategies and policies for adaptation and flood risk management, ii) infrastructure models (housing, hospitals, schools, etc.) adapted to flood events, and iii) flood control schemes 2.1 Capacity assessment and training on hydrological observation (mainly IDEAM) 2.2 Capacity assessment and training on flood forecasting (mainly IDEAM) 2.3 Capacity assessment and training on dissemination of real-time risk information and warning for appropriate response (mainly IDEAM and UNGRD) 3.1 Assessment of functions of both central and local governments in activities of river basin management 3.2 Recommendation on effective and efficient roles and responsibility of central and local governments on flood risk reduction, using experiences in Japan and other countries. 3.3 Evaluation and recommendation on enhanced institutional functions of flood risk reduction at the final stage of the project 4.1 Formulation of IFMP for the pilot river basin with considering prevention, mitigation, preparedness and response. Formulation process includes following items. - Preparation of management plan of Magdalena-Cauca river basin. - Preparation of hydrological and hydraulic models (mainly for IDEAM with the support of the regional autonomous corporations who will have the model to be used for them.) - Proposal of priority measures. 4.2 Preparation of IFMP formulation guideline utilizing lessons from pilot river basin activities (4-1).	<u>The Japanese Side</u> <u>Expert</u> - Chief Advisor/Expert of Flood Management - Expert of River Planning - Expert of Hydrology, Hydraulics, and Flood Forecasting - Expert of Warning Information Dissemination and Evacuation - Expert of Flood Risk Mapping, Flood Risk Assessment, and GIS - Expert of Disaster Risk Management Policy <u>Machinery and Equipment</u> - Desktop / Laptop Computer - Multifunction machine (Printer / Photocopy) - Inkjet Color Printer - Hydrological Analysis Software - GIS Software	<u>The Colombian Side</u> <u>Administration:</u> Project Director, Project Manager <u>Counterpart personnel:</u> C/P personnel from the relevant divisions under UNGRD, IDEAM, CAR, Department of Cundinamarca, MADS and other institutions in the area of influence of the river basin. <u>Facilities and Equipment</u> - Office space - Office furniture, facilities and equipment <u>Budgetary Arrangement by UNGRD, IDEAM, CAR, Department of Cundinamarca, MADS and other institutions in the area of influence of the river basin</u> Administration and local operation costs	Hydrological and meteorological network of IDEAM and CAR is neither degraded nor diluted. <u>Pre-Conditions</u> Central and pilot region's institutions agreed upon the exchange of data needed and available at each agency.

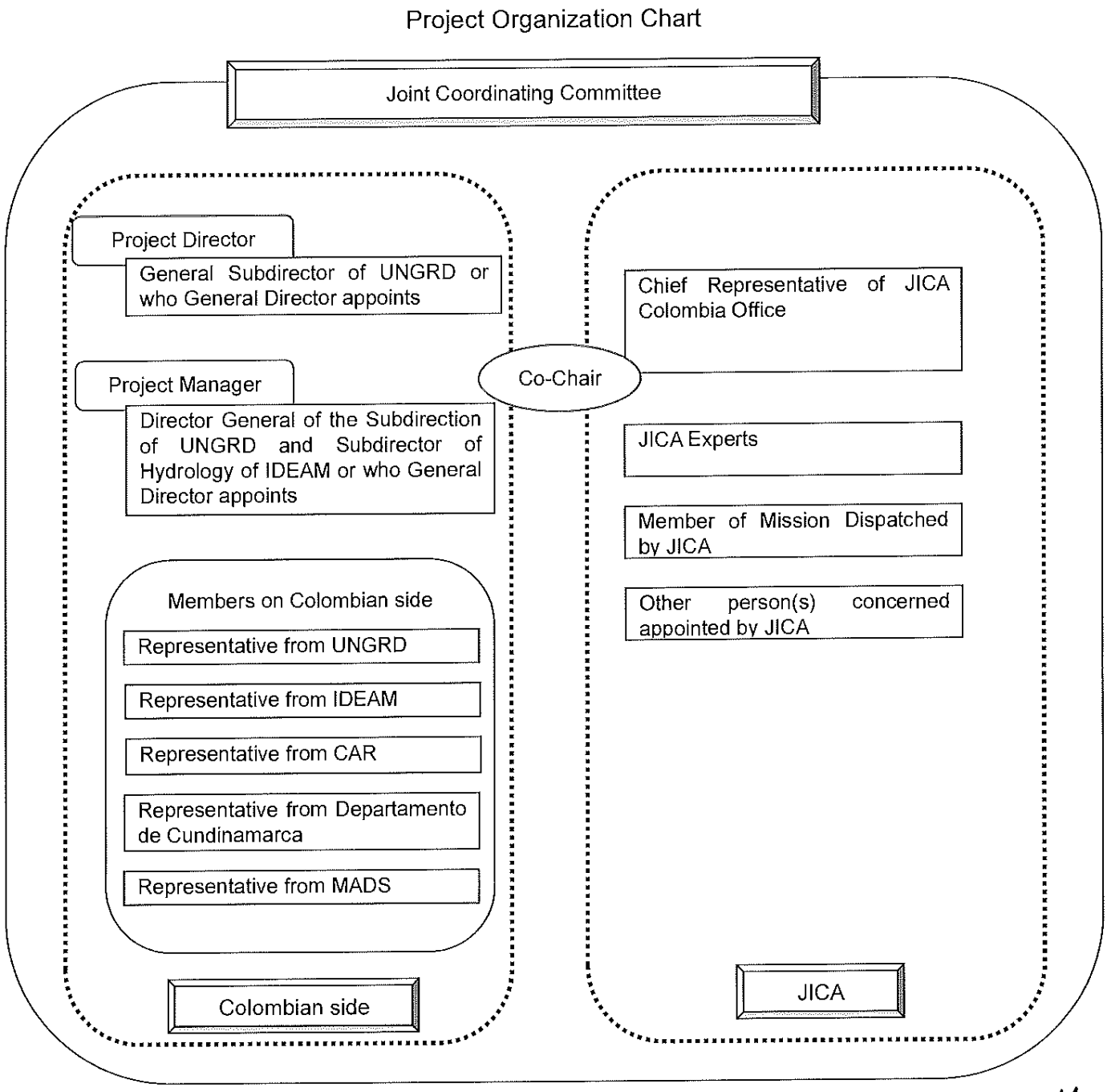
Annex 2 : Revised Plan of Operation: PO

Plan of Operation (PO) (Ver.2)

Project Name: Project for Strengthening Flood Management Capacity

		2015		2016				2017				2018	
		7-9	10-12	1-3	4-6	7-9	10-12	1-3	4-6	7-9	10-12	1-3	4-6
JCC		▲		▲		▲				▲			▲
Output1: Capacity on flood risk assessment is improved and concept of integrated flood management planning and river basin management is introduced.													
1-1.	Capacity assessment and training on comprehensive utilization of meteorological and hydrological data for flood risk assessment including the satellite image mapping from the perspectives of temporal and spatial resolutions and accuracy (mainly IDEAM).												
1-2.	Capacity assessment and training on hydrological and hydraulic modelling from rainfall-runoff analysis to flood inundation analysis and mapping technology (mainly IDEAM).												
1-3.	Capacity assessment and training on flood risk mapping technology using GIS with flood inundation and socio-economic data including vulnerability of structures (mainly IDEAM and UNGRD).												
1-4.	Training on integrated flood management planning and river basin management (IDEAM, UNGRD, CAR, Department of Cundinamarca, MADS and local institutions in pilot river basin).												
	1-4-1. Training in Colombia on; i) probabilistic hazard assessment of flood, ii) physical, environmental and social vulnerability analysis, iii) monitoring and evaluation of flood disaster risk, iv) management processes on flood events, v) flood disaster prevention and mitigation measures, and vi) development and operation of flood early warning system												
	1-4-2. Training in Japan on; i) strategies and policies for adaptation and flood risk management, ii) infrastructure models (housing, hospitals, schools, etc.) adapted to flood events, and iii) flood control schemes.												
Output2: Capacity on flood forecasting, warning and information dissemination to relevant organizations is improved (mainly IDEAM and UNGRD).													
2-1.	Capacity assessment and training on hydrological observation (mainly IDEAM).												
2-2.	Capacity assessment and training on flood forecasting (mainly IDEAM).												
2-3.	Capacity assessment and training on dissemination of real-time risk information and warning for appropriate response (mainly IDEAM and UNGRD).												
Output3: Roles and responsibility of the central and local government for flood risk reduction are elucidated and enhanced (mainly UNGRD and IDEAM).													
3-1.	Assessment of functions of both central and local governments in activities of river basin management.												
3-2.	Recommendation on effective and efficient roles and responsibility of central and local governments on flood risk reduction, using experiences in Japan and other countries.												
3-3.	Evaluation and recommendation on enhanced institutional functions of flood risk reduction at the final stage of the project.												
Output4: Capacity of flood management planning is enhanced through formulation of integrated flood management plan (IFMP) in the pilot river basin.													
4-1.	Formulation of IFMP for the pilot river basin with considering prevention, mitigation, preparedness and response. Formulation process includes following items. - Preparation of management plan of Magdalena-Cuenca river basin. - Preparation of hydrological and hydraulic models (mainly for IDEAM with the support of the regional autonomous corporations who will have the model to be used for them.) - Proposal of priority measures.												
4-2.	Preparation of IFMP formulation guideline utilizing lessons from pilot river basin activities (4-1).												

Annex 3 : Revised Project implementation structure



Observers:

- Observers may attend upon agreement between Colombian side and JICA.

Annex 4: Participants list of 2nd JCC

	NAME	ENTITY	Position
1.	Andrés Uribe	APC	Demand Management Director
2.	Liliana Sánchez	APC	Japan´s Desk Commissioned
3.	Carlos Iván Marquez Perez	UNGRD	General Director
4.	Julio González V.	UNGRD	Specialized Professional Risk Knowledge Section
5.	Margarita Arias	UNGRD	Coordinator of International Cooperation
6.	Nelson Omar Vargas	IDEAM	Hydrology Sub-Director
7.	Fabio Andrés Bernal	IDEAM	Assigned Professional to the Project
8.	Diana Quimbay	IDEAM	Chief of International Cooperation
9.	Nestor Franco	CAR	General Director
10.	Heidy Milena Castillo	CAR	Assigned Professional to the Project
11.	Cesar Clavijo	CAR	Director of Monitoring and Environmental Modeling
12.	Jaime Matiz O.	Department of Cundinamarca	Specialized Professional
13.	Luis Alfonso Escobar T.	MADS	Director of Integrated Water Resources Management
14.	Yolanda Calderón	MADS	Adviser
15.	Carolina González	MADS	International Affair Office
16.	Satoshi Murosawa	JICA Colombia	Resident Representative
17.	Yuki Kuraoka	JICA Colombia	Project Formulation Adviser
18.	Catalina Bastidas	JICA Colombia	Technical and Finance Cooperation Area
19.	Kenji Morita	JICA Project Team	Chief-Advisor/ Flood Risk Management
20.	Akihiro Furuta	JICA Project Team	Expert of Flood Risk Mapping, Flood Risk Assessment and GIS
21.	Masato Fujimoto	JICA Project Team	Expert of Warning Information Dissemination and Evacuation

MINUTES OF MEETINGS

ON

THE SECOND JOINT COORDINATION COMMITTEE

ON

JAPANESE TECHNICAL COOPERATION

FOR

THE PROJECT FOR STRENGTHENING FLOOD RISK MANAGEMENT CAPACITY

IN THE REPUBLIC OF COLOMBIA

AGREED UPON AMONG

AUTHORITIES CONCERNED OF THE GOVERNMENT OF COLOMBIA

AND

JAPAN INTERNATIONAL COOPERATION AGENCY

The 2nd Joint Coordination Committee (hereinafter referred to as "JCC") meeting of the Project for Strengthening Flood Risk Management Capacity (hereinafter referred to as "the Project") in Colombia was held on February 23rd, 2016 in Bogota. As a result, Japan International Cooperation Agency (hereinafter referred to as "JICA") Colombian office, Japanese expert team and the Colombian organizations concerned agreed on the matters referred to in the document attached hereto.

SATOSHI MUROSAWA
Resident Representative
JICA Colombia Office
Japan International Cooperation Agency (JICA)

GRACIELA MARÍA USTARIZ M.
General Sub-Director
National Unit for Disaster Risk Management (UNGRD)

NELSON OMAR VARGAS MARTÍNEZ
Hydrology Sub-Director
Institute of Hydrology, Meteorology
and Environmental Studies (IDEAM)

Department of Cundinamarca

HEIDY MILENA CASTILLO MONTAÑO
Assigned Professional to the Project
Autonomous Regional Corporation of Cundinamarca (CAR)

ELIZABETH GOMEZ SÁNCHEZ
General Secretary
Ministry of Environment and Sustainable Development (MADS)
Date: 7 JUN 2016

ATTACHED DOCUMENT

1. Inviting New Counterpart Organization to the Project

The Japanese side explained the necessity and importance of participation of MADS to the Project for more effective activities of the Project.

Both Japanese and Colombian sides (hereinafter referred to as "the both sides") agreed on the participation of MADS to the Project as an official counterpart organization and dispatching Counterpart Personnel (hereinafter referred to as "C/P") from MADS to the Project. Based on this agreement, the both sides also agreed on revising framework and implementation plan of the Project which are given as Project Design Matrix (hereinafter referred to as "The PDM") version 2 shown as Annex 1, Plan of Operation (hereinafter referred to as "The PO") version 2 shown as Annex 2.

2. Project Organization

The both side confirmed assigned responsible personal as below.

(1) Project Implementation Organization

- Project Director
  UNGRD: Graciela María Ustariz M.
- Project Manager
  UNGRD: Julio González Velandia
  IDEAM: Nelson Omar Vargas Martínez
- C/P
  UNGRD: Margarita Arias
  Rosa Niño
  IDEAM: Fabio Andrés Bernal Quiroga
  Oscar Martínez
  Department of Cundinamarca:
  Jaime Matiz Ovalle
  Onofre Sierra Góme
  Maria Cristina Ruiz
  Juan Manuel Acero
  CAR: Heidy Milena Castillo Montaño

MADS: Integrated Water Resource Management Director

Project Organization Chart : Annex 3

Annex 1 : Revised Project Design Matrix: PDM

Annex 2 : Revised Plan of Operation: PO

Annex 3 : Revised Project implementation structure

Annex 4 : Participants list of 2nd JCC

Annex 1 : Revised Project Design Matrix: PDM

Project Design Matrix: PDM (Version-2)

Project Title: Project for Strengthening Flood Risk Management Capacity
Period of Project: three (3) years
Target Area: River basin of Rio Negro (direct target), and the whole country of Colombia (indirect target)
Target Group: Staff of UNGRD, IDEAM, CAR, Department of Cundinamarca and MADS

Version 2
Dated 23, 02, 2016

Narrative Summary	Objectively Verifiable Indicators	Means of Verification	Important Assumption
Overall Goal The reduction of flood risk in Colombia	1. Realization of flood management related Recommendations made through the project.	1. Annual Reports of CP.	
	2. Number of Integrated Flood Management Plan (IFMP) formulated for non-pilot river basin. (Or Ratio of POMCA which introduced the concept of Integrated Flood Management) (XX %)	2. Policy paper on IFMP(POMCA)	
Project Purpose Capacity of Colombian institutions in flood management is enhanced.	1. Planning capacity regarding flood management	1. Evaluation report of professional staff from all the CPs institutions' understanding of integrated flood management planning and river basin management	Vulnerability against flood disaster is not dramatically increased.
	2. Capacity of flood forecasting and warning	2. Coverage and number of hydrological station for flood forecasting and warning	
	3. Effective use and share of data for flood management	3. Data exchange/ user agencies, quantity of data use	
	4. IFMP formulation guideline developed	4. Formulation guideline	
Outputs 1. Capacity on flood risk assessment is improved and concept of integrated flood management planning and river basin management is introduced	1. Knowledge / understanding at IDEAM and CAR on river planning aspect in a) hydrologic & hydraulic modeling, and b) flood hazard/risk mapping	1. Ability test to measure understanding extent such as river planning methodology including longitudinal profile of river reach	Hydrological and meteorological network of IDEAM and CAR is neither degraded nor diluted.
	2. IDEAM, UNGRD and CAR's capacity enhancement on the technology of flood risk mapping including vulnerability analysis using GIS	2. Ability test to measure understanding extent such as flood risk mapping technology including thematic maps regarding flood disaster	
	3. Knowledge / understanding at IDEAM, UNGRD, CAR, Department and MADS on river basin wise IFMP	3. Evaluation report of professional staff from all the CPs institutions' understanding of integrated flood management planning and river basin management	
2. Capacity on flood forecasting, warning and information dissemination to relevant organizations is improved (mainly IDEAM and UNGRD)	1. Knowledge / understanding at IDEAM and CAR on hydrologic observation and data analysis	1. Ability test to measure understanding extent such as hydrologic observation and data analysis including satellite origin rainfall data	
	2. Recommendation on improvement of IDEAM's flood forecasting and warning	2. Recommendations report on flood forecasting and warning	
3. Roles and responsibility of the central and local government for flood risk reduction are elucidated and enhanced (mainly UNGRD and IDEAM)	1. Issues clarified and recommendations draw regarding flood risk management among UNGRD, IDEAM, CAR, MADS, department and municipalities.	1. Recommendation of role for Action plan of the relevant actors in flood risk management	
	2. Matrix of informaiton inventory related to flood management (entity and type of information)	2. Matrix of information inventory	
4. Capacity of flood management planning is enhanced through formulation of integrated flood management plan (IFMP) in the pilot river basin	1. Integrated Flood Management Plan (IFMP) of pilot river basin	1. IFMP	
	2. IFMP formulation guideline developed	2. IFMP formulation guideline	

Activities	Inputs		Important Assumption
1.1 Capacity assessment and training on comprehensive utilization of meteorological and hydrological data for flood risk assessment including the satellite image mapping from the perspectives of temporal and spatial resolutions and accuracy (mainly IDEAM) 1.2 Capacity assessment and training on hydrological and hydraulic modelling from rainfall-runoff analysis to flood inundation analysis and mapping technology (mainly IDEAM) 1.3 Capacity assessment and training on flood risk mapping technology using GIS with flood inundation and socio-economic data including vulnerability of structures (mainly IDEAM and UNGRD) 1.4 Training on integrated flood risk management planning and river basin management (IDEAM, UNGRD, CAR, Department of Cundinamarca, MADS and local institutions in pilot river basin) 1.4.1 Training in Colombia on; i) probabilistic hazard assessment of flood, ii) physical, environmental and social vulnerability analysis, iii) monitoring and evaluation of flood disaster risk, iv) management processes on flood events, v) flood disaster prevention and mitigation measures, and vi) development and operation of flood early warning systems 1.4.2 Training in Japan on; i) strategies and policies for adaptation and flood risk management, ii) infrastructure models (housing, hospitals, schools, etc.) adapted to flood events, and iii) flood control schemes 2.1 Capacity assessment and training on hydrological observation (mainly IDEAM) 2.2 Capacity assessment and training on flood forecasting (mainly IDEAM) 2.3 Capacity assessment and training on dissemination of real-time risk information and warning for appropriate response (mainly IDEAM and UNGRD) 3.1 Assessment of functions of both central and local governments in activities of river basin management 3.2 Recommendation on effective and efficient roles and responsibility of central and local governments on flood risk reduction, using experiences in Japan and other countries. 3.3 Evaluation and recommendation on enhanced institutional functions of flood risk reduction at the final stage of the project 4.1 Formulation of IFMP for the pilot river basin with considering prevention, mitigation, preparedness and response. Formulation process includes following items. - Preparation of management plan of Magdalena-Cauca river basin. - Preparation of hydrological and hydraulic models (mainly for IDEAM with the support of the regional autonomous corporations who will have the model to be used for them.) - Proposal of priority measures. 4.2 Preparation of IFMP formulation guideline utilizing lessons from pilot river basin activities (4-1).	<u>The Japanese Side</u> <u>Expert</u> - Chief Advisor/Expert of Flood Management - Expert of River Planning - Expert of Hydrology, Hydraulics, and Flood Forecasting - Expert of Warning Information Dissemination and Evacuation - Expert of Flood Risk Mapping, Flood Risk Assessment, and GIS - Expert of Disaster Risk Management Policy <u>Machinery and Equipment</u> - Desktop / Laptop Computer - Multifunction machine (Printer / Photocopy) - Inkjet Color Printer - Hydrological Analysis Software - GIS Software	<u>The Colombian Side</u> <u>Administration;</u> Project Director, Project Manager <u>Counterpart personnel;</u> C/P personnel from the relevant divisions under UNGRD, IDEAM and other institutions in the area of influence of the river basin. <u>Facilities and Equipment</u> - Office space - Office furniture, facilities and equipment <u>Budgetary Arrangement by UNGRD, IDEAM and other institutions in the area of influence of the river basin</u> Administration and local operation costs	Hydrological and meteorological network of IDEAM and CAR is neither degraded nor diluted. <u>Pre-Conditions</u> Central and pilot region's institutions agreed upon the exchange of data needed and available at each agency.

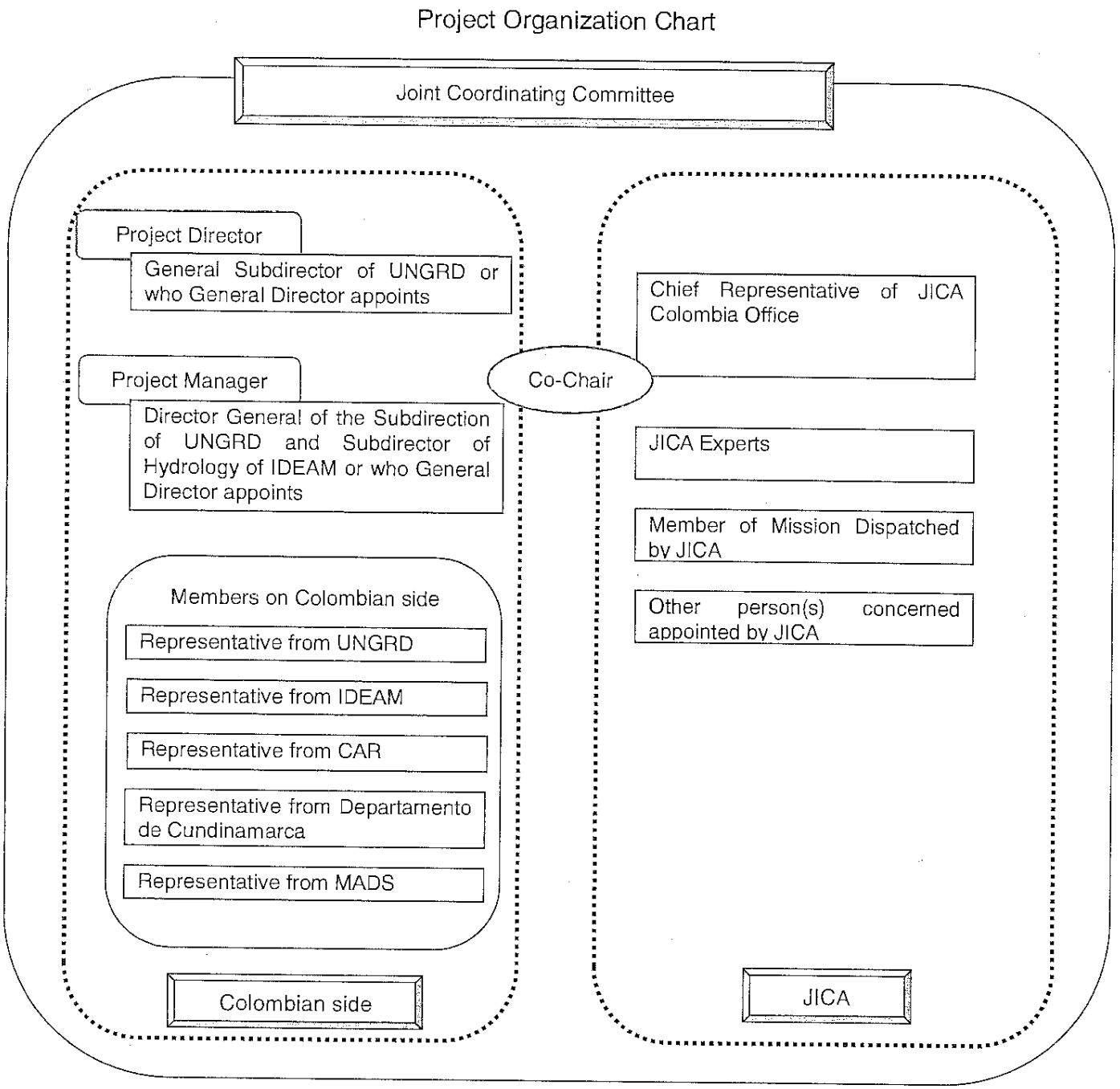
Annex 2 : Revised Plan of Operation: PO

Plan of Operation (PO) (Ver.2)

Project Name: Project for Strengthening Flood Management Capacity

		2015		2016				2017				2018	
		7-9	10-12	1-3	4-6	7-9	10-12	1-3	4-6	7-9	10-12	1-3	4-6
JCC		▲		▲		▲				▲			▲
Output1: Capacity on flood risk assessment is improved and concept of integrated flood management planning and river basin management is introduced.													
1-1.	Capacity assessment and training on comprehensive utilization of meteorological and hydrological data for flood risk assessment including the satellite image mapping from the perspectives of temporal and spatial resolutions and accuracy (mainly IDEAM).												
1-2.	Capacity assessment and training on hydrological and hydraulic modelling from rainfall-runoff analysis to flood inundation analysis and mapping (technology (mainly IDEAM).												
1-3.	Capacity assessment and training on flood risk mapping technology using GIS with flood inundation and socio-economic data including vulnerability of structures (mainly IDEAM and UNGRD).												
1-4.	Training on integrated flood management planning and river basin management (IDEAM, UNGRD, CAR, Department of Cundinamarca, MADS and local institutions in pilot river basin).												
1-4-1.	Training in Colombia on; i) probabilistic hazard assessment of flood, ii) physical, environmental and social vulnerability analysis, iii) monitoring and evaluation of flood disaster risk, iv) management processes on flood events, v) flood disaster prevention and mitigation measures, and vi) development and operation of flood early warning system												
1-4-2.	Training in Japan on; i) strategies and policies for adaptation and flood risk management, ii) infrastructure models (housing, hospitals, schools, etc.) adapted to flood events, and iii) flood control schemes.												
Output2: Capacity on flood forecasting, warning and information dissemination to relevant organizations is improved (mainly IDEAM and UNGRD).													
2-1.	Capacity assessment and training on hydrological observation (mainly IDEAM).												
2-2.	Capacity assessment and training on flood forecasting (mainly IDEAM).												
2-3.	Capacity assessment and training on dissemination of real-time risk information and warning for appropriate response (mainly IDEAM and UNGRD).												
Output3: Roles and responsibility of the central and local government for flood risk reduction are elucidated and enhanced (mainly UNGRD and IDEAM).													
3-1.	Assessment of functions of both central and local governments in activities of river basin management.												
3-2.	Recommendation on effective and efficient roles and responsibility of central and local governments on flood risk reduction, using experiences in Japan and other countries.												
3-3.	Evaluation and recommendation on enhanced institutional functions of flood risk reduction at the final stage of the project.												
Output4: Capacity of flood management planning is enhanced through formulation of integrated flood management plan (IFMP) in the pilot river basin.													
4-1.	Formulation of IFMP for the pilot river basin with considering prevention, mitigation, preparedness and response. Formulation process includes following items. - Preparation of management plan of Magdalena-Cuenca river basin. - Preparation of hydrological and hydraulic models (mainly for IDEAM with the support of the regional autonomous corporations who will have the model to be used for them.) - Proposal of priority measures.												
4-2.	Preparation of IFMP formulation guideline utilizing lessons from pilot river basin activities (4-1).												

Annex 3 : Revised Project implementation structure



Observers:

- Observers may attend upon agreement between Colombian side and JICA.

Annex 4: Participants list of 2nd JCC

	NAME	ENTITY	Position
1.		APC	
2.		APC	
3.		UNGRD	
4.		UNGRD	
5.		UNGRD	
6.		IDEAM	
7.		IDEAM	
8.		IDEAM	
9.		CAR	
10.		CAR	
11.		CAR	
12.		Department of Cundinamarca	
13.		Department of Cundinamarca	
14.		Department of Cundinamarca	
15.		MADS	
16.		MADS	
17.		MADS	
18.	Satoshi Murosawa	JICA Colombia	Resident Representative
19.	Yuki Kuraoka	JICA Colombia	Project Formulation Adviser
20.	Catalina Bastidas	JICA Colombia	Technical and Finance Cooperation Area
21.	Kenji Morita	JICA Project Team	Chief-Advisor
22.	Akihiro Furuta	JICA Project Team	Expert/Flood Risk Management. Flood Risk Assessment and GIS
23.	Masato Fujimoto	JICA Project Team	Expert/Warning Information Dissemination and Evacuation

MINUTES OF MEETINGS
ON
THE THIRD JOINT COORDINATION COMMITTEE
ON
JAPANESE TECHNICAL COOPERATION
FOR
THE PROJECT FOR STRENGTHENING FLOOD RISK MANAGEMENT CAPACITY
IN THE REPUBLIC OF COLOMBIA
AGREED UPON AMONG
AUTHORITIES CONCERNED OF THE GOVERNMENT OF COLOMBIA
AND
JAPAN INTERNATIONAL COOPERATION AGENCY

The 3rd Joint Coordination Committee (hereinafter referred to as "JCC") meeting of the Project for Strengthening Flood Risk Management Capacity (hereinafter referred to as "the Project") in Colombia was held on February 22nd, 2017 at Protocol Lounge at the Cundinamarca Department in Bogota. As a result, Japan International Cooperation Agency (hereinafter referred to as "JICA") Colombian office, Japanese expert team and the relevant Colombian organizations concerned agreed on the matters referred to in the document attached hereto.

Bogota, February 22nd, 2017

SATOSHI MUROSAWA
Resident Representative
JICA Colombia Office
Japan International Cooperation Agency (JICA)

GRACIELA MARÍA USTARIZ MANJARRES.
General Sub-Director
National Unit for Disaster Risk Management (UNGRD)

N.O.V.M.

NELSON OMAR VARGAS MARTÍNEZ
Hydrology Sub-Director
Institute of Hydrology, Meteorology
and Environmental Studies (IDEAM)

WILSON LEONARD GARCIA FAJARDO
Director of Special Administrative Unit for
Disaster Risk Management (UAEGRDC)
Department of Cundinamarca

NESTOR GUILLERMO FRANCO
GONZALEZ
General Director
Autonomous Regional Corporation of
Cundinamarca (CAR)

LUZ HICELA MOSQUERA MOSQUERA
Director of Integrated Water Resources
Management
Ministry of Environment and Sustainable
Development (MADS)

ATTACHED DOCUMENT

1. Progress of the activity up to now

The Japanese expert team reported progress of the Project to all participants, and Colombian side confirmed its progress.

2. Topics identified to be strengthened related to flood management

Representatives of counterpart organizations introduced the following important topics identified to be strengthened related to flood management through the activities of this Project and the expected actions, and these were confirmed by all the participants.

- Magdalena River Plan
- Articulation among the Institutions, regulations and planning tools.
- Integrated Information Systems for Risk Management

3. Explanation on experiences from training in Japan

One of the representatives of participants of 2nd training in Japan introduced their experiences, findings and knowledge obtained through the training and ways to utilize them to enhance flood risk management in Colombia to all the participants. Colombian side confirmed that those valuable findings shall be shared widely among persons/organizations related to flood risk management at every occasion.

4. Amendment of Plan of Operation (PO)

Both Japanese and Colombian sides confirmed the change of schedule to hold JCCs. Based on this confirmation, both Japanese and Colombian sides also confirmed revised schedule of implementation plan of the Project which are given as Plan of Operation (hereinafter referred to as "The PO") version 2-1. This revised version is shown as Annex 1.

5. Future expectations

As a general outcome of the project regarding institutional responsibility, alternatives will be proposed to enhance flood management capability. These alternatives will be the base for the proposals to be made to the Colombian government in order to create regulatory changes that may be incorporated in the National Development Plan 2018-2022. The results obtained in the first phase of the project allowed for the identification of the opportunity and necessity to make progress in the knowledge and inclusion of planning elements for Magdalena-Cauca macro basin in the framework of River Planning in Japan. Additionally, these results highlighted the need to carry out a deeper analysis of roles and responsibilities from each institution in charge of the environmental and risk

management in the country.

Annex 1 : Revised Plan of Operation: PO

Annex 2 : Participants list of 3rd JCC

Plan of Operation (PO) (Ver.2-1)

Project Name: Project for Strengthening Flood Management Capacity

		2015		2016				2017				2018	
		7-9	10-12	1-3	4-6	7-9	10-12	1-3	4-6	7-9	10-12	1-3	4-6
JCC		▲		▲				▲			▲		▲
Output1: Capacity on flood risk assessment is improved and concept of integrated flood management planning and river basin management is introduced.													
1-1.	Capacity assessment and training on comprehensive utilization of meteorological and hydrological data for flood risk assessment including the satellite image mapping from the perspectives of temporal and spatial resolutions and accuracy (mainly IDEAM).												
1-2.	Capacity assessment and training on hydrological and hydraulic modelling from rainfall-runoff analysis to flood inundation analysis and mapping technology (mainly IDEAM).												
1-3.	Capacity assessment and training on flood risk mapping technology using GIS with flood inundation and socio-economic data including vulnerability of structures (mainly IDEAM and UNGRD).												
1-4.	Training on integrated flood management planning and river basin management (IDEAM, UNGRD, CAR, Department of Cundinamarca, MADS and local institutions in pilot river basin).												
	1-4-1. Training in Colombia on; i) probabilistic hazard assessment of flood, ii) physical, environmental and social vulnerability analysis, iii) monitoring and evaluation of flood disaster risk, iv) management processes on flood events, v) flood disaster prevention and mitigation measures, and vi) development and operation of flood early warning system												
	1-4-2. Training in Japan on; i) strategies and policies for adaptation and flood risk management, ii) infrastructure models (housing, hospitals, schools, etc.) adapted to flood events, and iii) flood control schemes.												
Output2: Capacity on flood forecasting, warning and information dissemination to relevant organizations is improved (mainly IDEAM and UNGRD).													
2-1.	Capacity assessment and training on hydrological observation (mainly IDEAM).												
2-2.	Capacity assessment and training on flood forecasting (mainly IDEAM).												
2-3.	Capacity assessment and training on dissemination of real-time risk information and warning for appropriate response (mainly IDEAM and UNGRD).												
Output3: Roles and responsibility of the central and local government for flood risk reduction are elucidated and enhanced (mainly UNGRD and IDEAM).													
3-1.	Assessment of functions of both central and local governments in activities of river basin management.												
3-2.	Recommendation on effective and efficient roles and responsibility of central and local governments on flood risk reduction, using experiences in Japan and other countries.												
3-3.	Evaluation and recommendation on enhanced institutional functions of flood risk reduction at the final stage of the project.												
Output4: Capacity of flood management planning is enhanced through formulation of integrated flood management plan (IFMP) in the pilot river basin.													
4-1.	Formulation of IFMP for the pilot river basin with considering prevention, mitigation, preparedness and response. Formulation process includes following items. - Preparation of management plan of Magdalena-Cuenca river basin. - Preparation of hydrological and hydraulic models (mainly for IDEAM with the support of the regional autonomous corporations who will have the model to be used for them.) - Proposal of priority measures.												
4-2.	Preparation of IFMP formulation guideline utilizing lessons from pilot river basin activities (4-1).												

Annex 2: Participants list of 3rd JCC

	NAME	ENTITY	POSITION
1.	Santiago Molina	APC	Coordinator-Demand Management
2.	Juan Sandoval	APC	Demand Management Direction
3.	Julio González V.	UNGRD	Specialized Professional Risk Knowledge Section
4.	Margarita Arias	UNGRD	Coordinator of International Cooperation
5.	Antonio Jose López	UNGRD	International Cooperation Officer
6.	Nelson Omar Vargas	IDEAM	Hydrology Sub-Director
7.	Fabio Andrés Bernal	IDEAM	Assigned Professional to the Project
8.	Jorge A. González	IDEAM	Specialized Professional
9.	Diana Quimbay	IDEAM	Chief of International Cooperation
10.	Estefania Salas	IDEAM	International Cooperation Officer
11.	Heidy Milena Castillo	CAR	Assigned Professional to the Project
12.	Rafael Iván Robles	CAR	Advisor to General Director
13.	Maryeny Caraballo	CAR	POMCA- Technician
14.	Sonia Perdomo	CAR	International Cooperation Officer
15.	Jaime Matiz O.	Department of Cundinamarca	Specialized Professional
16.	William Barreto	Department of Cundinamarca	Sub-Director UAEGRD
17.	Magda Yamile Ruiz	Department of Cundinamarca	Risk Sub-Director UAEGRD
18.	Christian Cruz	Department of Cundinamarca	International Cooperation Officer
19.	Luz Francy Navarro	MADS	Specialized Professional
20.	Carolina González	MADS	International Affaire Office
21.	Diana Vargas	CORMAGDALENA	Specialized Professional SDSN
22.	Claudia S. Martínez	CORMAGDALENA	Specialized Professional
23.	Cesar Garay	CIRMAG	Executive Director
24.	Diego Rubio	DNP	Advisor
25.	Yuki Kuraoka	JICA Colombia	Project Formulation Adviser
26.	Catalina Bastidas	JICA Colombia	Technical and Finance Cooperation Area
27.	Kenji Morita	JICA Project Team	Chief-Advisor/ Flood Risk Management

MINUTES OF MEETINGS
ON
THE FOURTH JOINT COORDINATION COMMITTEE
ON
JAPANESE TECHNICAL COOPERATION
FOR
THE PROJECT FOR STRENGTHENING FLOOD RISK MANAGEMENT CAPACITY
IN THE REPUBLIC OF COLOMBIA
AGREED UPON AMONG
AUTHORITIES CONCERNED OF THE GOVERNMENT OF COLOMBIA
AND
JAPAN INTERNATIONAL COOPERATION AGENCY

The 4th Joint Coordination Committee (hereinafter referred to as "JCC") meeting of the Project for Strengthening Flood Risk Management Capacity (hereinafter referred to as "the Project") in Colombia was held on November 24th, 2017 at Rooms A, B and C of UNGRD in Bogota. As a result, Japan International Cooperation Agency (hereinafter referred to as "JICA") Colombian office, Japanese expert team and the relevant Colombian organizations concerned agreed on the matters referred to in the document attached hereto.

Bogota, November 24th, 2017

SATOSHI MUROSAWA	CARLOS IVAN MARQUEZ
Resident Representative	General Director
JICA Colombia Office	National Unit for Disaster Risk Management
Japan International Cooperation Agency (JICA)	(UNGRD)

NELSON OMAR VARGAS MARTÍNEZ
Hydrology Sub-Director
Institute of Hydrology, Meteorology
and Environmental Studies (IDEAM)

WILSON LEONARD GARCIA FAJARDO
Director of Special Administrative Unit for
Disaster Risk Management (UAEGRD)
Department of Cundinamarca

NESTOR GUILLERMO FRANCO
GONZALEZ
General Director
Autonomous Regional Corporation of
Cundinamarca (CAR)

JAIRTON DIEZ DIAZ
Director of Integrated Water Resources
Management
Ministry of Environment and Sustainable
Development (MADS)

ATTACHED DOCUMENT

1. Progress and outcomes of the activity up to now and the future perspective

The Japanese expert team reported progress and outcomes of the Project up to now and future perspective of the Project to all participants, and the Colombian side confirmed them.

2. Future activities for effective flood risk management and cooperation among related institutions

The representative of counterpart organizations explained the importance of the macro-basin introducing the data from the basin, flood maps and information on the institutional framework that includes municipalities and the institutions, and then explained the road map for formulation of river plan in the Magdalena River, which shows a list of necessary activities with schedule and main responsible entities. This list was prepared through discussions in the workshops of this Project. He also introduced the Memorandum of Understanding, in which MADS, IDEAM and CORMAGDALENA expressed willingness to work together to improve the national capacities in the flood management and resilience of the GREAT MAGDALENA RIVER communities and MAGDALENA, and thus, to build a Phase II work project to be presented to JICA.

3. Explanation on experiences from training in Japan

Ms. Yolanda Calderon, representing the participants of 3rd training in Japan, introduced her experiences and knowledge obtained through the training and ways to utilize them to enhance flood risk management in Colombia to all the participants. Colombian side confirmed that those valuable findings shall be shared widely among persons/organizations related to flood risk management.

4. Amendment of Plan of Operation (PO)

Both Japanese and Colombian sides confirmed the change of schedule of some project activities. Based on this confirmation, both Japanese and Colombian sides also confirmed revised schedule of implementation plan of the Project which are given as Plan of Operation (hereinafter referred to as "The PO") version 2-2. This revised version is shown as Annex 1.

5. Future expectations

As a general outcome of the project regarding institutional responsibility, mechanisms to incorporate the results from the Project in different tools for territorial planning and management will be proposed, in order to enhance flood management capability. Additionally, these results highlighted the need to carry out a deeper analysis of roles and responsibilities from each institution in charge of the environmental and risk management in the country.

The results obtained in the first phase of the project allowed for the identification of the opportunity and necessity to make progress in the knowledge and inclusion of planning elements for Magdalena-Cauca macro-basin in the framework of River Planning in Japan. They will be the base for the proposals to be made to the National Planning Department (DNP) in order for them to be incorporated in the National Development Plan 2018-2022.

Annex 1: Revised Plan of Operation: PO

Annex 2: Participants list of 4th JCC

Plan of Operation (PO) (Ver.2-2)

Project Name: Project for Strengthening Flood Management Capacity

		2015		2016				2017				2018	
		7-9	10-12	1-3	4-6	7-9	10-12	1-3	4-6	7-9	10-12	1-3	4-6
JCC		▲		▲				▲			▲		▲
Output1: Capacity on flood risk assessment is improved and concept of integrated flood management planning and river basin management is introduced.													
1-1.	Capacity assessment and training on comprehensive utilization of meteorological and hydrological data for flood risk assessment including the satellite image mapping from the perspectives of temporal and spatial resolutions and accuracy (mainly IDEAM).												
1-2.	Capacity assessment and training on hydrological and hydraulic modelling from rainfall-runoff analysis to flood inundation analysis and mapping technology (mainly IDEAM).												
1-3.	Capacity assessment and training on flood risk mapping technology using GIS with flood inundation and socio-economic data including vulnerability of structures (mainly IDEAM and UNGRD).												
1-4.	Training on integrated flood management planning and river basin management (IDEAM, UNGRD, CAR, Department of Cundinamarca, MADS and local institutions in pilot river basin).												
	1-4-1. Training in Colombia on; i) probabilistic hazard assessment of flood, ii) physical, environmental and social vulnerability analysis, iii) monitoring and evaluation of flood disaster risk, iv) management processes on flood events, v) flood disaster prevention and mitigation measures, and vi) development and operation of flood early warning system												
	1-4-2. Training in Japan on; i) strategies and policies for adaptation and flood risk management, ii) infrastructure models (housing, hospitals, schools, etc.) adapted to flood events, and iii) flood control schemes.												
Output2: Capacity on flood forecasting, warning and information dissemination to relevant organizations is improved (mainly IDEAM and UNGRD).													
2-1.	Capacity assessment and training on hydrological observation (mainly IDEAM).												
2-2.	Capacity assessment and training on flood forecasting (mainly IDEAM).												
2-3.	Capacity assessment and training on dissemination of real-time risk information and warning for appropriate response (mainly IDEAM and UNGRD).												
Output3: Roles and responsibility of the central and local government for flood risk reduction are elucidated and enhanced (mainly UNGRD and IDEAM).													
3-1.	Assessment of functions of both central and local governments in activities of river basin management.												
3-2.	Recommendation on effective and efficient roles and responsibility of central and local governments on flood risk reduction, using experiences in Japan and other countries.												
3-3.	Evaluation and recommendation on enhanced institutional functions of flood risk reduction at the final stage of the project.												
Output4: Capacity of flood management planning is enhanced through formulation of integrated flood management plan (IFMP) in the pilot river basin.													
4-1.	Formulation of IFMP for the pilot river basin with considering prevention, mitigation, preparedness and response. Formulation process includes following items. - Preparation of management plan of Magdalena-Cuenca river basin. - Preparation of hydrological and hydraulic models (mainly for IDEAM with the support of the regional autonomous corporations who will have the model to be used for them.) - Proposal of priority measures.												
4-2.	Preparation of IFMP formulation guideline utilizing lessons from pilot river basin activities (4-1).												

Annex 2: Participants list of 4th JCC

	NAME	ENTITY	POSITION
1.	Juan Sandoval	APC	Demand Management Direction
2.	Lina Dorado	UNGRD	Knowledge Sub-Director
3.	Joana Pérez.	UNGRD	Specialized Professional
4.	Lina Martinez	UNGRD	International Cooperation
5.	Antonio Jose López	UNGRD	International Cooperation Officer
6.	Omar Franco T.	IDEAM	General Director
7.	Maria Costanza Rosero	IDEAM	Specialized Professional
8.	Estefania Salas	IDEAM	International Cooperation Officer
9.	Maryeny Caraballo	CAR	POMCA- Technician
10.	Rafael Iván Robles	CAR	Advisor to General Director
11.	Wilson García	Department of Cundinamarca	UAEGRD Director
12.	Jaime Matiz O.	Department of Cundinamarca	Specialized Professional
13.	Magda Yamile Ruiz	Department of Cundinamarca	Risk Sub-Director UAEGRD
14.	Ricardo Cifuentes	Department of Cundinamarca	International Cooperation Officer
15.	Yexon Alexis Mojica	Department of Cundinamarca	International Cooperation Officer
16.	Jairton Diez Diaz	MADS	Integral Water Resource Management Director
17.	Luz Francy Navarro	MADS	Specialized Professional
18.	Yolanda Calderón	MADS	Adviser
19.	Carlos Andrés Quiza	CORMAGDALENA	DSN Sub-Director
20.	Diana Vargas	CORMAGDALENA	Specialized Professional SDSN
21.	Vanessa Juliao	CORMAGDALENA	Advisor
22.	Diego Rubio	DNP	Advisor
23.	Satoshi Murosawa	JICA Colombia	Resident Representant
24.	Diego A. Martínez	JICA Colombia	Cooperation Program Coordinator
25.	Kenji Morita	JICA Project Team	Chief-Advisor/ Flood Risk Management

MINUTES OF MEETINGS
ON
THE FOURTH JOINT COORDINATION COMMITTEE
ON
JAPANESE TECHNICAL COOPERATION
FOR
THE PROJECT FOR STRENGTHENING FLOOD RISK MANAGEMENT CAPACITY
IN THE REPUBLIC OF COLOMBIA
AGREED UPON AMONG
AUTHORITIES CONCERNED OF THE GOVERNMENT OF COLOMBIA
AND
JAPAN INTERNATIONAL COOPERATION AGENCY

The 5th Joint Coordination Committee (hereinafter referred to as "JCC") meeting of the Project for Strengthening Flood Risk Management Capacity (hereinafter referred to as "the Project") in Colombia was held on June 28th, 2018 at Protocol Lounge at the Cundinamarca Department in Bogota. As a result, Japan International Cooperation Agency (hereinafter referred to as "JICA") Colombian office, Japanese expert team and the relevant Colombian organizations concerned agreed on the matters referred to in the document attached hereto.

Bogota, June 28th, 2018

SATOSHI MUROSAWA	CARLOS IVAN MARQUEZ
Resident Representative	General Director
JICA Colombia Office	National Unit for Disaster Risk Management
Japan International Cooperation Agency (JICA)	(UNGRD)

NELSON OMAR VARGAS MARTÍNEZ
Hydrology Sub-Director
Institute of Hydrology, Meteorology and Environmental Studies (IDEAM)

GERMAN RIBERO GARRIDO
Director of Special Administrative Unit for Disaster Risk Management (UAEGRD)
Department of Cundinamarca

NESTOR GUILLERMO FRANCO GONZALEZ
General Director
Autonomous Regional Corporation of Cundinamarca (CAR)

JAIRTON DIEZ DIAZ
Director of Integrated Water Resources Management
Ministry of Environment and Sustainable Development (MADS)

ATTACHED DOCUMENT

1. **Project activities, outcomes, achievements and evaluation results, and future expected activities after the end of the Project**

The Japanese expert team reported activities implemented through the Project and outcomes from the Project, explained achievements and evaluation results of the Project and future expected activities after the end of the Project. The Colombian side confirmed and agreed them.

2. **Monitoring plan from the end of the Project to Ex-post Evaluation for the achievement of overall goal**

The Japanese expert team explained a draft monitoring plan from the end of the Project to ex-post evaluation for the achievement of overall goal, which will be jointly carried out by JICA and C/P entities. Both Japanese and Colombian sides discussed and finally agreed the monitoring plan that the frequency of the monitoring will be approximately once a year, and JICA Colombia will send the monitoring check sheet to UNGRD, who will verify the situation in each C/P entity and send the answers to JICA Colombia, with support from IDEAM. The monitoring check sheet is shown as Annex 1.

3. **Amendment of Project Design Matrix (PDM)**

Both Japanese and Colombian sides confirmed the revision of Objectively Verifiable Indicators and Means of Verification for overall goal in the PDM, which were reviewed in conformity with monitoring plan. This revised version of PDM (Version-3) is shown as Annex 2.

4. **Future activities for effective flood risk management and cooperation among related institutions**

The representative of C/P organizations explained the importance of the macro-basin and explained the road map for formulation of IFMP-RP for the Magdalena River, which shows a list of necessary activities with schedule and main responsible entities. This list was prepared through discussions in the workshops of this Project. He also reported the signing of the Memorandum of Understanding, in which MADS, IDEAM and CORMAGDALENA expressed willingness to work together to improve the national capacities in the flood management and resilience of the GREAT MAGDALENA RIVER communities and MAGDALENA, and thus, to build a Phase II project to be presented to JICA.

5. Future activities for utilization and expansion of outcomes of the Project

The participants discussed how to use and replicate the results of the Project throughout the country now onwards. The participants agreed that the necessary activities will be implemented under the coordination of the UNGRD who summoned the C/P entities during the second week of July 2018 to initiate the respective follow-up of the project.

6. Future expectations

As a general result of the project with respect to institutional responsibility, mechanisms will be proposed to incorporate the results in the different planning and administration instruments of the territory. In this committee, the importance of carrying out the respective negotiations with the new government for the inclusion of the project on the integral flood management plan of the Magdalena River in the new Development Plan and consequently in the annual action plans of the different entities was highlighted.

In addition, these results highlighted the need to carry out a deeper analysis of the roles and responsibilities of each institution in charge of environmental and risk management in the country.

The results of this project will be presented at the CARMAC MAGDALENA CAUCA, which will be held on June 29, 2018 in the city of Cali to be used as input for the implementation of the strategic plan.

Annex 1: Monitoring Check Sheet
Annex 2: Revised Project Design Matrix: PDM
Annex 3: Participants list of 5th JCC

Annex 1 : Monitoring Check Sheet

Monitoring Items		Degree of Achievement of the Goals for the Post-Project Evaluation			
		Not started	In progress	Description(The degree of progress (%) and specific explanation and information on the status of implementation*)	Finished
1.	Number of coordination meetings between entities for the implementation of indicators 2, 3 and 4. (To confirm the state of continuity of collaborative activities among the entities related to flood risk management (exchange of opinions, discussions, and the implementation of concrete measures))	☐	☐		☐
2.	There is a protocol for the incorporation of in POMCAS that involves the concept of integrated flood management. (To confirm the status of implementation of the activities for the incorporation of the results of the project in the existing legal instruments)	☐	☐		☐
3.	Number of POMCAs that introduce the concept of integrated flood management.(To confirm the status of implementation of the activities for the incorporation of the project results (studies and plans of IFMP-SZ for the Rio Negro basin (provisional plan)) in the existing POMCA for the Rio Negro basin and to confirm the status of implementation of IFMP formulation activities in other hydrographic subzones, the incorporation of the methodologies of this project in the study and analysis as well as their incorporation in POMCA)	☐	☐		☐
4.	Number of reduction measures implemented in the pilot basin of the project.(To confirm the status of implementation of specific activities based on the content of IFMP-SZ (structural and non-structural measures) for the Rio Negro basin (provisional plan))	☐	☐		☐

* In case there are problems in the implementation, provide an explanation.

Annex 2 : Revised Project Design Matrix : PDM

Project Design Matrix: PDM (Version-3)

Project Title: Project for Strengthening Flood Risk Management Capacity
Period of Project: three (3) years
Target Area: River basin of Rio Negro (direct target), and the whole country of Colombia (indirect target)
Target Group: Staff of UNGRD, IDEAM, CAR, Department of Cundinamarca and MADS

Version 3
Dated 28. 06. 2018

Narrative Summary	Objectively Verifiable Indicators	Means of Verification	Important Assumption
Overall Goal The reduction of flood risk in Colombia	1. Number of coordination meetings among entities for the implementation of indicators 2, 3 and 4.	Meeting minutes Road map (a schedule with the activities to ne carroed out in the coordination meetings) Monitoring check sheet	
	2. A protocol for the incorporation of DRM in POMCAS that involves the concept of integrated flood management exists.	Adjusted Protocol	
	3. Number of POMCAs that introduce the concept of integrated flood management.	Updated POMCAs with the concept of integrated flood management. New POMCAs with the concept of integrated flood management.	
	4. Number of reduction measures implemented in the pilot basin of the project.	Reports on implemented measures Photographs of the implemented measures	
Project Purpose Capacity of Colombian institutions in flood management is enhanced.	1. Planning capacity regarding flood management	1. Evaluation report of professional staff from all the CPs institutions' understanding of integrated flood management planning and river basin management	Vulnerability against flood disaster is not dramatically increased.
	2. Capacity of flood forecasting and warning	2. Coverage and number of hydrological station for flood forecasting and warning	
	3. Effective use and share of data for flood management	3. Data exchange/ user agencies, quantity of data use	
	4. IFMP formulation guideline developed	4. Formulation guideline	
Outputs 1. Capacity on flood risk assessment is improved and concept of integrated flood management planning and river basin management is introduced	1. Knowledge / understanding at IDEAM and CAR on river planning aspect in a) hydrologic & hydraulic modeling, and b) flood hazard/risk mapping	1. Ability test to measure understanding extent such as river planning methodology including longitudinal profile of river reach	Hydrological and meteorological network of IDEAM and CAR is neither degraded nor diluted.
	2. IDEAM, UNGRD and CAR's capacity enhancement on the technology of flood risk mapping including vulnerability analysis using GIS	2. Ability test to measure understanding extent such as flood risk mapping technology including thematic maps regarding flood disaster	
	3. Knowledge / understanding at IDEAM, UNGRD, CAR, Department and MADS on river basin wise IFMP	3. Evaluation report of professional staff from all the CPs institutions' understanding of integrated flood management planning and river basin management	
2. Capacity on flood forecasting, warning and information dissemination to relevant organizations is improved (mainly IDEAM and UNGRD)	1. Knowledge / understanding at IDEAM and CAR on hydrologic observation and data analysis	1. Ability test to measure understanding extent such as hydrologic observation and data analysis including satellite origin rainfall data	
	2. Recommendation on improvement of IDEAM's flood forecasting and warning	2. Recommendations report on flood forecasting and warning	
3. Roles and responsibility of the central and local government for flood risk reduction are elucidated and enhanced (mainly UNGRD and IDEAM)	1. Issues clarified and recommendations draw regarding flood risk management among UNGRD, IDEAM, CAR, MADS, department and municipalities.	1. Recommendation of role for Action plan of the relevant actors in flood risk management	
	2. Matrix of informaiton inventory related to flood management (entity and type of information)	2. Matrix of information inventory	
4. Capacity of flood management planning is enhanced through formulation of integrated flood management plan (IFMP) in the pilot river basin	1. Integrated Flood Management Plan (IFMP) of pilot river basin	1. IFMP	
	2. IFMP formulation guideline developed	2. IFMP formulation guideline	

Annex 2 : Revised Project Design Matrix : PDM

Activities	Inputs		Important Assumption
1.1 Capacity assessment and training on comprehensive utilization of meteorological and hydrological data for flood risk assessment including the satellite image mapping from the perspectives of temporal and spatial resolutions and accuracy (mainly IDEAM) 1.2 Capacity assessment and training on hydrological and hydraulic modelling from rainfall-runoff analysis to flood inundation analysis and mapping technology (mainly IDEAM) 1.3 Capacity assessment and training on flood risk mapping technology using GIS with flood inundation and socio-economic data including vulnerability of structures (mainly IDEAM and UNGRD) 1.4 Training on integrated flood risk management planning and river basin management (IDEAM, UNGRD, CAR, Department of Cundinamarca, MADS and local institutions in pilot river basin) 1.4.1 Training in Colombia on; i) probabilistic hazard assessment of flood, ii) physical, environmental and social vulnerability analysis, iii) monitoring and evaluation of flood disaster risk, iv) management processes on flood events, v) flood disaster prevention and mitigation measures, and vi) development and operation of flood early warning systems 1.4.2 Training in Japan on; i) strategies and policies for adaptation and flood risk management, ii) infrastructure models (housing, hospitals, schools, etc.) adapted to flood events, and iii) flood control schemes 2.1 Capacity assessment and training on hydrological observation (mainly IDEAM) 2.2 Capacity assessment and training on flood forecasting (mainly IDEAM) 2.3 Capacity assessment and training on dissemination of real-time risk information and warning for appropriate response (mainly IDEAM and UNGRD) 3.1 Assessment of functions of both central and local governments in activities of river basin management 3.2 Recommendation on effective and efficient roles and responsibility of central and local governments on flood risk reduction, using experiences in Japan and other countries. 3.3 Evaluation and recommendation on enhanced institutional functions of flood risk reduction at the final stage of the project 4.1 Formulation of IFMP for the pilot river basin with considering prevention, mitigation, preparedness and response. Formulation process includes following items. - Preparation of management plan of Magdalena-Cauca river basin. - Preparation of hydrological and hydraulic models (mainly for IDEAM with the support of the regional autonomous corporations who will have the model to be used for them.) - Proposal of priority measures. 4.2 Preparation of IFMP formulation guideline utilizing lessons from pilot river basin activities (4-1).	<u>The Japanese Side</u> <u>Expert</u> - Chief Advisor/Expert of Flood Management - Expert of River Planning - Expert of Hydrology, Hydraulics, and Flood Forecasting - Expert of Warning Information Dissemination and Evacuation - Expert of Flood Risk Mapping, Flood Risk Assessment, and GIS - Expert of Disaster Risk Management Policy <u>Machinery and Equipment</u> - Desktop / Laptop Computer - Multifunction machine (Printer / Photocopy) - Inkjet Color Printer - Hydrological Analysis Software - GIS Software	<u>The Colombian Side</u> <u>Administration:</u> Project Director, Project Manager <u>Counterpart personnel:</u> C/P personnel from the relevant divisions under UNGRD, IDEAM, CAR, Department of Cundinamarca, MADS and other institutions in the area of influence of the river basin. <u>Facilities and Equipment</u> - Office space - Office furniture, facilities and equipment <u>Budgetary Arrangement by UNGRD, IDEAM, CAR, Department of Cundinamarca, MADS and other institutions in the area of influence of the river basin</u> Administration and local operation costs	Hydrological and meteorological network of IDEAM and CAR is neither degraded nor diluted. <u>Pre-Conditions</u> Central and pilot region's institutions agreed upon the exchange of data needed and available at each agency.

Annex 3: Participants list of 5th JCC

	NAME	ENTITY	POSITION
1.	Santiago Molina	APC	Demand Management Direction
2.	Juan Sandoval	APC	Demand Management Direction
3.	Lina Dorado	UNGRD	Knowledge Sub-Director
4.	Joana Pérez.	UNGRD	Specialized Professional
5.	Antonio Jose López	UNGRD	International Cooperation Officer
6.	Omar Franco T.	IDEAM	General Director
7.	Nelson Omar Vargas	IDEAM	Hydrology Sub-Director
8.	Fabio Andrés Bernal	IDEAM	Specialized Professional
9.	Diana Quimbay	IDEAM	International Cooperation
10.	Catherine Fonseca	IDEAM	International Cooperation
11.	Rafael Iván Robles	CAR	Advisor to General Director
12.	Maryeny Caraballo	CAR	POMCA- Technician
13.	Cesar Carrillo	Department of Cundinamarca	Planning Secretary
14.	Diana Paola Garcia	Department of Cundinamarca	Cooperation and Institutional Linkage
15.	Germán Ribero	Department of Cundinamarca	UAEGRD Director
16.	William Barreto	Department of Cundinamarca	Technical Sub-Director
17.	Magda Yamile Ruiz	Department of Cundinamarca	Risk Sub-Director UAEGRD
18.	Jaime Matiz O.	Department of Cundinamarca	Specialized Professional
19.	Maria Cristina Ruiz	Department of Cundinamarca	Specialized Professional Planning
20.	Ricardo Cifuentes	Department of Cundinamarca	International Cooperation Officer
21.	Yexon Alexis Mojica	Department of Cundinamarca	International Cooperation Officer
22.	Jairton Diez Diaz	MADS	Integral Water Resource Management Director
23.	Luz Francy Navarro	MADS	Specialized Professional
24.	Yolanda Calderón	MADS	Adviser
25.	Diego Montes	MADS	International Cooperation Office
26.	Diana Vargas	CORMAGDALENA	Specialized Professional
27.	Takatoshi Yamamoto	Japanese Embassy	First Secretary
28.	Satoshi Murosawa	JICA Colombia	Resident Representant
29.	Mashami Sunada	JICA Colombia	Project Advisor
30.	Mari Asano	JICA Colombia	Public Relations
31.	Masami Ikuta	JICA Colombia	Cooperation Program Coordinator
32.	Kenji Morita	JICA Project Team	Chief-Advisor/ Flood Risk Management
33.	Masaki Todo	JICA Project Team	Expert of River Planning

Appendix-15 R/D, M/M

MINUTES OF MEETING
BETWEEN
JAPAN INTERNATIONAL COOPERATION AGENCY
AND
THE AUTHORITIES CONCERNED
OF THE GOVERNMENT OF REPUBLIC OF COLOMBIA
FOR
PROJECT FOR STRENGTHENING THE NATIONAL SYSTEM FOR DISASTER RISK MANAGEMENT BY DEVELOPING CAPACITIES TO REDUCE THE RISK FOR THE FLOOD THREATS

The Detailed Planning Survey Team (hereinafter referred to as "the Team"), organized by Japan International Cooperation Agency (hereinafter referred to as "JICA") and headed by Mr. Katsuji MIYATA, visited Republic of Colombia from October 13th to November 2nd, 2014 for the purpose of formulating "Project for Strengthening the National System for Disaster Risk Management by Developing Capacities to Reduce the Risk for the Flood Threats", in response to the request made by the Government of the Republic of Colombia (hereinafter referred to as "GOC") toward the Government of Japan (hereinafter referred to as "GOJ").

During its stay, the Team exchanged its views and had a series of discussions for the purpose of working out the details of the Project with officials of National Unit for Disaster Risk Management, Institute of Hydrology, Meteorology and Environmental Studies and the authorities concerned of the GOC.

As a result of the discussions, the Team and the authorities concerned of the GOC agreed on the matters referred to in the document attached hereto.

The Minutes of Meeting is written both in English and Spanish, both of which are equally official. The English text shall prevail in case of any divergence of interpretation.

Bogota, D.C., October 23, 2014

KATSUJI MIYATA
Team Leader
Detailed Planning Survey Team
Japan International Cooperation Agency (JICA)

CARLOS IVAN MARQUEZ PEREZ
Director General
National Unit for Disaster Risk Management (UNGRD)

OMAR FRANCO TORRES
Director General
Institute of Hydrology, Meteorology and Environmental Studies (IDEAM)

SILVIA MARGARITA CARRIZOSA CAMACHO
Director (e)
Colombian Presidential Agency of International Cooperation (APC-Colombia)

ATTACHED DOCUMENT

1 Title of the Project

Both side agreed that the title of the Project will be "Project for Strengthening Flood Risk Management Capacity" (hereinafter referred to as "the Project") which was modified from the original title "Project for Strengthening the National System for Disaster Risk Management by Developing Capacities to Reduce the Risk for the Flood Threats".

2 Project Implementing Agency

The Implementing Agency of the Project is National Unit for Disaster Risk Management (hereinafter referred to as "UNGRD") and Institute of Hydrology, Meteorology and Environmental Studies (hereinafter referred to as "IDEAM").

3 Target Area

Direct Target: River basin of Rio Negro (no. 2306)
Indirect Target: Whole country of Colombia

4 Duration of the Project

The cooperation period of the Project will be three (3) years from the date of arrival of the first JICA expert in Colombia.

5 Master Plan of the Project

(1) Overall Goal

The reduction of flood risk in Colombia

(2) Project Purpose

Capacity of Colombian institutions in flood risk management is enhanced.

(3) Output and activities

1) Output 1: Capacity on flood risk assessment is improved and concept of integrated flood risk management planning and river basin management is introduced

Activities:

1-1) Capacity assessment and training on comprehensive utilization of meteorological and hydrological data for flood risk assessment including the satellite image mapping from the perspectives of temporal and spatial resolutions and accuracy (mainly IDEAM)

1-2) Capacity assessment and training on hydrological and hydraulic modeling from

rainfall-runoff analysis to flood inundation analysis and mapping technology (mainly IDEAM)

1-3) Capacity assessment and training on flood risk mapping technology using GIS with flood inundation and socio-economic data including vulnerability of structures (mainly IDEAM and UNGRD)

1-4) Training on integrated flood management planning and river basin management (IDEAM, UNGRD, CAR, Department of Cundinamarca, Department of Boyaca and local institutions in pilot river basin)

1-4-1) Training in Colombia on; i) probabilistic hazard assessment of flood, ii) physical, environmental and social vulnerability analysis, iii) monitoring and evaluation of flood disaster risk, iv) management processes on flood events, v) flood disaster prevention and mitigation measures, and vi) development and operation of flood early warning systems

1-4-2) Training in Japan on; i) strategies and policies for adaptation and flood risk management, ii) infrastructure models (housing, hospitals, schools, etc.) adapted to flood events, and iii) flood control schemes

2) Output 2: Capacity on flood forecasting, warning and information dissemination to relevant organizations is improved (mainly IDEAM and UNGRD)

Activities:

2-1) Capacity assessment and training on hydrological observation (mainly IDEAM)

2-2) Capacity assessment and training on flood forecasting (mainly IDEAM)

2-3) Capacity assessment and training on dissemination of real-time risk information and warning for appropriate response (mainly IDEAM and UNGRD)

3) Output 3: Roles and responsibility of the central and local government for flood risk reduction are elucidated and enhanced (mainly UNGRD and IDEAM)

Activities:

3-1) Assessment of functions of both central and local governments in activities of river basin management

3-2) Recommendation on effective and efficient roles and responsibility of central and local governments on flood risk reduction, using experiences in Japan and other countries.

3-3) Evaluation and recommendation on enhanced institutional functions of flood risk reduction at the final stage of the project

4) Output 4: Capacity of flood risk management planning is enhanced through formulation of integrated flood risk management plan (IFMP) in the pilot river basin

Activities:

4-1) Preparation of hydrological and hydraulic models for the pilot river basin (field investigation conducted upon necessity) (mainly for IDEAM with the support of the regional autonomous corporations who will have the model to be used for them.)

4-2) Formulation of IFMP including measures of i) prevention & mitigation and ii) preparedness & response*

4-3) Implementation of priority measures in IFMP (e.g. establishment of floods early warning criteria and formulation of risk map) (Japanese experts advices on Colombian activities)

4-4) Preparation of IFMP formulation guideline utilizing lessons learned from pilot river basin activities (4-1), (4-2) and (4-3)

Remark: *

i) Prevention & mitigation:

Structural measures, risk mapping, hazard zoning and land use regulation (territorial regulations) etc.

ii) Preparedness & response:

Flood early warning systems, community level flood risk management activities, support in the preparation of risk management plans, etc.

(4) Project Design Matrix (PDM)

Both sides agreed to use tentative Project Design Matrix (hereinafter referred to as "PDM") Version-0 shown in Annex I of draft Record of Discussions (hereinafter referred to as "R/D") as a tool for monitoring, evaluation and management of the activities of the Project. The PDM will be modified as needed at the project implementation stage after mutual consultations between JICA and the Colombian side.

(5) Plan of Operation

The tentative Plan of Operation (hereinafter referred to as "PO") Version-0 for the whole project period is shown in Annex II of draft R/D. The activities of the Project are subject to change within the scope of draft R/D when necessity arises in the course of the Project implementation.

6 Record of Discussions

The draft R/D, shown in Attachment 1 which stipulates the framework of the Project, shall be finalized and signed by the representative of JICA Colombia Office and GOC after notification of approval from implementation of the Project by JICA Headquarters.

7 Administration of the Project

(1) Counterpart (hereinafter referred to as "C/P")

1) Project Director

General Subdirector of UNGRD or who General Director appoints will bear overall responsibility for implementation, administration, monitoring and evaluation of the Project.

2) Project Managers

Director General of the Subdirection of UNGRD and Subdirector of Hydrology of IDEAM or who General Director appoints from IDEAM will bear overall responsibility for management of the project.

3) C/P Personnel

C/P personnel are expected to work closely with the JICA Experts who will be assigned by the time of signing of R/D

Technical Working Group will be formed as needed.

(2) Joint Coordination Committee

Joint Coordination Committee (hereinafter referred to as "JCC") will be held at least once a year and whenever deems it necessary. A list of proposed member of JCC is shown in Annex VI of draft R/D. The functions of JCC are as follows:

- To review the progress of the Project;
- To exchange views and ideas on major challenges which will arise during the implementation period of the Project;
- To assess the appropriateness of the PDM during the course of the Project and suggest revision, if necessary; and
- Any other related issues.

8 Measures to be Undertaken by the Colombian Side

Both sides agreed the following items:

- The Colombian side will provide adequate office space for the Project team at UNGRD and IDEAM and take in charge of procurement of other necessary materials for office function (for instance, electricity and water supply, Internet access, telephone line, and furniture).
- The Colombian side confirmed that they will take necessary measures to ensure

allocation of certain amount of budget for the activities for the Project.

- Grant privileges, exemptions and benefits to the JICA experts and their families, which are no less favorable than those granted to experts and members of the missions and their families of third countries or international organizations performing similar missions in Republic of Colombia.
- Other privileges, exemptions and benefits will be provided in accordance with the Agreement on Technical Cooperation signed on 22nd December, 1976 between the Government of Japan and the Government of Republic of Colombia.
- The Colombian side bears operation and maintenance expenses necessary for the implementation of the Project.
- The Colombian side bears expenses for transportation within Colombia and maintenance of the equipment provided by JICA.

9 Other Matters

(1) Disaster Type

Disaster type that the Project deals with will be flood.

(2) Pilot River Basin

Rio Negro (no. 2306)

(3) Training in Japan

The Japanese side explained its policy based on "the Official Development Assistance (hereinafter referred to as "ODA") Charter" and JICA's regulation on training that training participant in Japan should be civilian.

The Colombian side understands JICA's policy and the Colombian side promised that necessary number of civilian C/P is to be assigned as counterpart for the Project.

(4) Close relationship within Colombian side

Both sides understood that the close relationship within the authorities concerned of Colombian side in charge of flood risk assessment and flood risk reduction in Colombia is important to implement the Project smoothly and effectively. UNGRD and IDEAM should take necessary measures for coordinating with CAR, Department of Cundinamarca, Department of Boyaca and the local institutions in the area of influence of the river basin and for collecting the data and information required for the Project implementation from those institutions.

(5) Objectively Verifiable Indicators

The baseline survey / initial capacity assessment survey will be conducted at the

beginning of the Project. Both sides agreed that the objectively verifiable indicators should be refined upon the completion of the survey that is to be conducted during the initial 1 month of the Project implementation.

(6) Collaboration and coordination with other project

Both sides would take necessary measures for collaboration and coordination with other project implemented by Donors, relevant organizations and JICA in order to secure the maximum benefit for the Project and to avoid the duplication of activities.

(End of document)

Attachment 1 Draft Record of Discussions

Attachment 1
DRAFT

RECORD OF DISCUSSIONS

ON

PROJECT FOR STRENGTHENING THE NATIONAL SYSTEM FOR DISASTER RISK MANAGEMENT BY DEVELOPING CAPACITIES TO REDUCE THE RISK FOR THE FLOOD THREATS

IN

REPUBLIC OF COLOMBIA

AGREED UPON BETWEEN

THE AUTHORITIES CONCERNED OF THE GOVERNMENT OF REPUBLIC OF COLOMBIA

AND

JAPAN INTERNATIONAL COOPERATION AGENCY

Bogota, D.C., *********

HIDEMITSU SAKURAI
Resident Representative
JICA Colombia Office
Japan International Cooperation Agency (JICA)

CARLOS IVAN MARQUEZ PEREZ
Director General
National Unit for Disaster Risk Management (UNGRD)

OMAR FRANCO TORRES
Director General
Institute of Hydrology, Meteorology and Environmental Studies (IDEAM)

SILVIA MARGARITA CARRIZOSA CAMACHO
Director (e)
Colombian Presidential Agency of International Cooperation (APC-Colombia)

Based on the minutes of meetings on the Detailed Planning Survey on the Project for Strengthening the National System for Disaster Risk Management by Developing Capacities to Reduce the Risk for the Flood Threats (hereinafter referred to as "the Project") signed on [date] between National Unit for Disaster Risk Management (hereinafter referred to as "UNGRD"), Institute of Hydrology, Meteorology and Environmental Studies (hereinafter referred to as "IDEAM") and Colombian Presidential Agency of International Cooperation (hereinafter referred to as "APC-Colombia") and the Japan International Cooperation Agency (hereinafter referred to as "JICA"), JICA held a series of discussions with UNGRD, IDEAM, APC-Colombia and relevant organizations to develop a detailed plan of the Project.

Both parties agreed the details of the Project and the main points discussed as described in the Appendix 1 and the Appendix 2 respectively.

Both parties also agreed that UNGRD, IDEAM, the counterpart to JICA, will be responsible for the implementation of the Project in cooperation with JICA, coordinate with other relevant organizations and ensure that the self-reliant operation of the Project is sustained during and after the implementation period in order to contribute toward social and economic development of Republic of Colombia.

The Project will be implemented within the framework of the Agreement on Technical Cooperation signed on 22nd December, 1976 (hereinafter referred to as "the Agreement") and the Note Verbales exchanged on 30th May, 2013 between the Government of Japan (hereinafter referred to as "GOJ") and the Government of Republic of Colombia.

The Record of Discussions is written both in English and Spanish, both of which are equally official. The English text shall prevail in case of any divergence of interpretation.

Appendix 1: Project Description
Appendix 2: Main Points Discussed
Appendix 3: Minutes of Meetings on the Detailed Planning Survey

Appendix 1

PROJECT DESCRIPTION

Both parties confirmed that there is no change in the Project Description agreed on in the minutes of meetings on the concerning Detailed Planning Survey on the Project signed on [date] (Appendix 3).

I. BACKGROUND

The Republic of Colombia, located in the central Andes, has 11 active volcanos and various topographic characteristics, and because of that, the risk of natural disasters is extremely high. The Andes is split up into Cordillera Occidental in the west, Cordillera Central in the central, and Cordillera Oriental in the east. Cordillera Occidental and Cordillera Central have 3,000m-class and 5,000-class mountains, respectively. The major rivers are Río Magdalena which is the fourth largest river basin in the South America and Río Cauca and flow to the Caribbean Sea. Guaviare River which connects to Rio Negro in Brazil is also located in the eastern Colombia.

Flood is the most serious and large-scaled natural disasters in Colombia. The historical natural disaster occurred by La Nina in 2010-2011 with approximately 3 million affected people in Colombia by torrential rainfall and floods. In reaction to the disaster, the government of Colombia has started to establish disaster risk management structure including "Sistema Nacional para la Gestión del Riesgo de Desastres (SNGRD)" and "Unidad Nacional para la Gestión del Riesgo de Desastres (UNGRD)". However, the role and responsibilities of the involved institutions in the disaster management, coordination development between central administration and local governments, still need to be strengthened and progress on coordination between the central and local governments is still slow. Therefore, Colombia today has the opportunity to strengthen SNGRD, promoting the elaboration and implementation mechanism of flood risk management plans at a river basin level.

In National Development Plan (2010-2014), the risk prevention is listed as one of the five priority items and provision of high quality public service for adaptation to climate change and reduction of vulnerability is set as its policy. The enhancement of SNGRD is also mentioned in the plan as the objectives for the integrated risk management. UNGRD, the coordinating organization for SNGRD, is responsible to preside the comprehensive disaster management in coordination with relevant organizations. The close coordination with Instituto de Hidrología, Meteorología y Estudios Ambientales de Colombia (IDEAM), an organization responsible for dissemination of hydromet information at national level, is indispensable.

Under such circumstances, the Government of Republic of the Colombia has requested the Government of Japan to implement the project on strengthening of disaster management capacity. In response, the Government of Japan has accepted the request.

II. OUTLINE OF THE PROJECT

Details of the Project are described in the Logical Framework (Project Design Matrix: PDM) (Annex I) and the Tentative Plan of Operation (Annex II).

1. Input

(1) Input by JICA

(a) Dispatch of Experts

Details of the dispatch of experts are described in Annex III.

(b) Training

JICA will receive the Colombian personnel connected with the Project for technical training(s) in Japan.

(c) Machinery and Equipment

JICA will provide such machinery, equipment and other materials (hereinafter referred to as "the Equipment") necessary for the implementation of the Project as listed in Annex IV.

In case of importation, the machinery, equipment and other materials under II-1 (1) (c) above will become the property of the UNGRD and IDEAM upon being delivered C.I.F. (cost, insurance and freight) to the Republic of Colombia authorities concerned at the ports and/or airports of disembarkation.

Input other than indicated above will be determined through mutual consultations between JICA, UNGRD, IDEAM and APC-Colombia during the implementation of the Project, as necessary.

(2) Input by the Colombian counterpart

The Colombian counterpart will take necessary measures to provide at its own expense:

(a) Services of counterpart personnel and administrative personnel from UNGRD, IDEAM, CAR, Department of Cundinamarca and Department of Boyaca and local institutions in the area of influence of the river basin, as referred to in II-2;
(b) Suitable office space for experts with necessary equipment;
(c) Supply or replacement of machinery, equipment, instruments, vehicles, tools, spare parts and any other materials necessary for the implementation of the Project other than the equipment provided by JICA;
(d) Information as well as support in obtaining medical service;
(e) Credentials or identification cards;
(f) Available data (including maps and photographs) and information related to the Project;
(g) Running expenses necessary for the implementation of the Project;
(h) Expenses necessary for transportation within Republic of Colombia of the equipment referred to in II-1 (1) as well as for the installation, operation and maintenance thereof; and
(i) Necessary facilities to the JICA experts for the remittance as well as utilization of the funds introduced into Republic of Colombia from Japan in connection with the implementation of the Project

2. Implementation Structure

The Project organization chart is given in the Annex V. The roles and assignments of relevant organizations are as follows:

(1) UNGRD

(a) Project Director

General Subdirector of UNGRD or who General Director appoints will bear overall responsibility for implementation, administration, monitoring and evaluation of the Project.

(b) Project Manager

Director General of the Subdirection of UNGRD or who General Director appoints will bear overall responsibility for management of the project.

(c) Counterpart Personnel

C/P personnel are expected to work closely with the JICA Experts who will be assigned by the time of signing of R/D.

(2) IDEAM

(a) Project Manager

Subdirector of Hydrology of IDEAM or who General Director appoints will bear overall responsibility for management of the project.

(b) Counterpart Personnel

C/P personnel are expected to work closely with the JICA Experts who will be assigned by the time of signing of R/D.

(3) CAR

(a) Counterpart Personnel

C/P personnel are expected to work closely with the JICA Experts who will be assigned by the time of signing of R/D.

(4) Department of Cundinamarca

(a) Counterpart Personnel

C/P personnel are expected to work closely with the JICA Experts who will be assigned by the time of signing of R/D.

(5) Department of Boyaca

(a) Counterpart Personnel

C/P personnel are expected to work closely with the JICA Experts who will be assigned by the time of signing of R/D.

(6) JICA Experts

The JICA experts will give necessary technical guidance, advice and recommendations to UNGRD, IDEAM, CAR, Department of Cundinamarca and Department of Boyaca on any matters pertaining to the implementation of the Project.

(7) Joint Coordinating Committee

Joint Coordinating Committee (hereinafter referred to as "JCC") will be established in order to facilitate inter-organizational coordination. JCC will be held at least once a year and whenever deems it necessary. JCC will approve an annual work plan, review overall progress, conduct evaluation of the Project, and exchange opinions on major issues that arise during the implementation of the Project. A list of proposed members of JCC is shown in the Annex VI.

3. Project Site(s) and Beneficiaries

(1) Project Site

-Direct Target: River basin of Rio Negro (no. 2306)

- Indirect Target: whole country of Colombia

(2) Direct Beneficiaries

- Staff of UNGRD, IDEAM, CAR, Department of Cundinamarca and Department of Boyaca in the influential zone of the pilot river basin

(3) Indirect Beneficiaries

- People in Republic of Colombia

4. Duration

The Project will be carried out for approximately three (3) years from the date when a JICA expert arrives in Republic of Colombia for the commencement of the Project as shown in Annex II (Tentative Plan of Operation).

5. Reports

UNGRD, IDEAM and JICA experts will jointly prepare the following reports in English.

(1) Monitoring Sheet on semiannual basis until the project completion

(2) Project Completion Report at the time of project completion

6. Environmental and Social Considerations

UNGRD and IDEAM agreed to abide by JICA Guidelines for Environmental and Social Considerations' in order to ensure that appropriate considerations will be made for the environmental and social impacts of the Project.

III. UNDERTAKINGS OF THE COUNTERPART – THE REPUBLIC OF COLOMBIA

1. The Counterpart of the Republic of Colombia will take necessary measures to:

(1) ensure that the technologies and knowledge acquired by the Republic of Colombia nationals as a result of Japanese technical cooperation contributes to the economic and social development of Republic of Colombia, and that the knowledge and experience acquired by the personnel of Republic of Colombia from technical training as well as the equipment provided by JICA will be utilized effectively in the implementation of the Project; and

(2) grant privileges, exemptions and benefits to the JICA experts referred to in II-1 (1) above and their families, which are no less favorable than those granted to experts and members of the missions and their families of third countries or international organizations performing similar missions in Republic of Colombia.

2. Other privileges, exemptions and benefits will be provided in accordance with the Agreement on Technical Cooperation signed on 22nd December, 1976 between the Government of Japan and the Government of Republic of Colombia.

IV. MONITORING AND EVALUATION

JICA, UNGRD and IDEAM will jointly and regularly monitor the progress of the Project through the Monitoring Sheets based on the Project Design Matrix (PDM) and Tentative Plan of Operation (PO). The Monitoring Sheets shall be reviewed every six (6) months.

Also, Project Completion Report shall be drawn up one (1) month before the termination of the Project.

JICA will conduct the following evaluations and surveys to mainly verify sustainability and impact of the Project and draw lessons. UNGRD and IDEAM are required to provide necessary support for them.

1. Ex-post evaluation three (3) years after the project completion, in principle
2. Follow-up surveys on necessity basis

V. PROMOTION OF PUBLIC SUPPORT

For the purpose of promoting support for the Project, UNGRD and IDEAM will take appropriate measures to make the Project widely known to the people of the Republic of Colombia.

VI. MISCONDUCT

If JICA receives information related to suspected corrupt or fraudulent practices in the implementation of the Project, UNGRD, IDEAM and relevant organizations shall provide JICA with such information as JICA may reasonably request, including information related to any concerned official of the government and/or public organizations of the Republic of Colombia.
UNGRD, IDEAM and relevant organizations shall not, unfairly or unfavorably treat the person and/or company which provided the information related to suspected corrupt or fraudulent practices in the implementation of the Project.

VII. MUTUAL CONSULTATION

JICA, UNGRD and IDEAM will consult each other whenever any major issues arise in the course of Project implementation.

VIII. AMENDMENTS

The record of discussions may be amended by the minutes of meetings between JICA, UNGRD and IDEAM.
The minutes of meetings will be signed by authorized persons of each side who may be different from the signers of the record of discussions.

Annex I Project Design Matrix: PDM
Annex II Tentative Plan of Operation
Annex III List of Japanese Experts
Annex IV List of Equipment
Annex V Project Organization Chart
Annex VI Joint Coordinating Committee

Project Design Matrix: PDM (Version-0)

Project Title: Project for Strengthening the National System for Disaster Risk Management by Developing Capacities to Reduce the Risk for the Flood Threats
Duration: three (3) years
Target Area: River basin of Rio Negro (direct target), and the whole country of Colombia (indirect target)
Target Group: Staff of UNGRD, IDEAM, CAR, Department of Cundinamarca and Department of Boyaca

Narrative summary	Objectively Verifiable Indicators	Means of Verification	Important Assumption
Overall Goal: The reduction of flood risk in Colombia	1. Realization of flood risk management related recommendations made through the project. 2. Number of Integrated Flood Risk Management Plan (IFMP) formulated for non-pilot river basin. (Or Ratio of POMCA which introduced the concept of Integrated Flood Risk Management) (XX %)	1. Annual Reports of CP. 2. Policy paper on IFMP (POMCA)	
Project Purpose: Capacity of Colombian institutions in flood risk management is enhanced.	1. Analysis capacity regarding flood disaster (enhancement degree) 2. Accuracy of flood forecasting and warning (improvement degree) 3. Effective use and share of data for flood risk management 4. IFMP formulation guideline developed	1 & 2. Ability test & effect measurement by JICA experts 3. Data exchange/ user agencies, quantity of data use 4. Formulation guideline	Vulnerability against flood disaster is not dramatically increased.
Outputs: 1. Capacity on flood risk assessment is improved and concept of integrated flood risk management planning and river basin management is introduced	1. IDEAM's capacity on technology of; a) hydrologic & hydraulic modeling, and b) flood risk mapping (enhancement degree) 2. IDEAM and UNGRD' capacity enhancement on the technology of vulnerability analysis using GIS (enhancement degree) 3. Knowledge / understanding at IDEAM, UNGRD, CAR, and Department on river basin wise IFMP (enhancement degree)	Ability test & effect measurement by JICA experts	Hydrological and meteorological network of IDEAM and CAR is neither degraded nor diluted.
2. Capacity on flood forecasting, warning and information dissemination to relevant organizations is improved (mainly IDEAM and UNGRD)	1. IDEAM's capacity on technology of hydrologic observation and data analysis (enhancement degree) 2. Recommendation on IDEAM's flood forecasting and warning	1. Effect measurement by JICA experts 2. Recommendations report on flood forecasting and warning	
3. Roles and responsibility of the central and local government for flood risk reduction are elucidated and enhanced (mainly UNGRD and IDEAM)	1. Issues clarified and recommendations draw regarding flood risk administration among UNGRD, IDEAM, CAR, department and municipalities. 2. Matrix of data holder by data type related to flood risk management	1. Terms of reference of actors in flood risk management 2. Matrix	
4. Capacity of flood risk management planning is enhanced through formulation of integrated flood risk management plan (IFMP) in the pilot river basin	1. Hydrological and hydraulic model developed 2. Integrated Flood Risk Management Plan (IFMP) of pilot river basin 3. IFMP formulation guideline developed	1. Model developed 2. IFMP 3. IFMP formulation guideline	

Annex I

Activities	Inputs	
1.1 Capacity assessment and training on comprehensive utilization of meteorological and hydrological data for flood risk assessment including the satellite image mapping from the perspectives of temporal and spatial resolutions and accuracy (mainly IDEAM) 1.2 Capacity assessment and training on hydrological and hydraulic modelling from rainfall-runoff analysis to flood inundation analysis and mapping technology (mainly IDEAM) 1.3 Capacity assessment and training on flood risk mapping technology using GIS with flood inundation and socio-economic data including vulnerability of structures (mainly IDEAM and UNGRD) 1.4 Training on integrated flood risk management planning and river basin management (IDEAM, UNGRD, CAR, Department of Cundinamarca, Department of Boyaca and local institutions in pilot river basin) 1.4.1 Training in Colombia on; i) probabilistic hazard assessment of flood, ii) physical, environmental and social vulnerability analysis, iii) monitoring and evaluation of flood disaster risk, iv) management processes on flood events, v) flood disaster prevention and mitigation measures, and vi) development and operation of flood early warning systems 1.4.2 Training in Japan on; i) strategies and policies for adaptation and flood risk management, ii) infrastructure models (housing, hospitals, schools, etc.) adapted to flood events, and iii) flood control schemes	**Japanese side** Expert - Chief Advisor/Expert of Flood Management - Expert of Hydrology, Hydraulics, and Flood Forecasting - Expert of Warning Information Dissemination and Evacuation - Expert of Flood Risk Mapping, Flood Risk Assessment, and GIS - Expert of Disaster Risk Management Policy Machinery and Equipment - Desktop / Laptop Computer - Multifunction machine (Printer / Photocopy) - Inkjet Color Printer - Hydrological Analysis Software - GIS Software **Colombia side** Administration: Project Director, Project Manager Counterpart personnel: C/P personnel from the relevant divisions under UNGRD, IDEAM and other institutions in the area of influence of the river basin Facilities and Equipment - Office space - Office furniture, facilities and equipment Budgetary Arrangement by UNGRD, IDEAM, and other institutions in the area of influence of the river basin Administration and local operation costs	Hydrological and meteorological network of IDEAM and CAR is neither degraded nor diluted.
2.1 Capacity assessment and training on hydrological observation (mainly IDEAM) 2.2 Capacity assessment and training on flood forecasting (mainly IDEAM) 2.3 Capacity assessment and training on dissemination of real-time risk information and warning for appropriate response (mainly IDEAM and UNGRD)		
3.1 Assessment of functions of both central and local governments in activities of river basin management 3.2 Recommendation on effective and efficient roles and responsibility of central and local governments on flood risk reduction, using experiences in Japan and other countries. 3.3 Evaluation and recommendation on enhanced institutional functions of flood risk reduction at the final stage of the project		
4.1 Preparation of hydrological and hydraulic models for the pilot river basin (field investigation conducted upon necessity) (mainly for IDEAM with the support of the regional autonomous corporations who will have the model to be used for them.) 4.2 Formulation of IFMP including measures of i) prevention & mitigation and ii) preparedness & response. 4.3 Implementation of priority measures in IFMP (e.g. establishment of floods early warning criteria and formulation of risk map) (Japanese experts advices on Colombian activities) 4.4 Preparation of IFMP formulation guideline utilizing lessons learned from pilot river basin activities (4-1), (4-2) and (4-3)		Pre-conditions Central and pilot region's institutions agreed upon the exchange of data needed and available at each agency.

Remark: Indicators should be refined upon the completion of the baseline survey that is to be conducted during the initial 1 month of the project implementation

Tentative Plan of Operation (Version-0)

Project Name: Project for Strengthening the National System for Disaster Risk Management by Developing Capacities to Reduce the Risk for the Flood Threats

		1st Year				2nd Year				3rd Year			
		1st	2nd	3rd	4th	1st	2nd	3rd	4th	1st	2nd	3rd	4th
JCC		▲			▲				▲				▲
Output1: Capacity on flood risk assessment is improved and concept of integrated flood risk management planning and river basin management is introduced.													
1-1.	Capacity assessment and training on comprehensive utilization of meteorological and hydrological data for flood risk assessment including the satellite image mapping from the perspectives of temporal and spatial resolutions and accuracy (mainly IDEAM).												
1-2.	Capacity assessment and training on hydrological and hydraulic modelling from rainfall-runoff analysis to flood inundation analysis and mapping technology (mainly IDEAM).												
1-3.	Capacity assessment and training on flood risk mapping technology using GIS with flood inundation and socio-economic data including vulnerability of structures (mainly IDEAM and UNGRD).												
1-4.	Training on integrated flood risk management planning and river basin management (IDEAM, UNGRD, CAR, Department of Cundinamarca, Depattment of Boyaca and local institutions in pilot river basin).												
	1-4-1. Training in Colombia on; i) probabilistic hazard assessment of flood, ii) physical, environmental and social vulnerability analysis, iii) monitoring and evaluation of flood disaster risk, iv) management processes on flood events, v) flood disaster prevention and mitigation measures, and vi) development and operation of flood early warning system												
	1-4-2. Training in Japan on; i) strategies and policies for adaptation and flood risk management, ii) infrastructure models (housing, hospitals, schools, etc.) adapted to flood events, and iii) flood control schemes.												
Output2: Capacity on flood forecasting, warning and information dissemination to relevant organizations is improved (mainly IDEAM and UNGRD).													
2-1.	Capacity assessment and training on hydrological observation (mainly IDEAM).												
2-2.	Capacity assessment and training on flood forecasting (mainly IDEAM).												
2-3.	Capacity assessment and training on dissemination of real-time risk information and warning for appropriate response (mainly IDEAM and UNGRD).												
Output3: Roles and responsibility of the central and local government for flood risk reduction are elucidated and enhanced (mainly UNGRD and IDEAM).													
3-1.	Assessment of functions of both central and local governments in activities of river basin management.												
3-2.	Recommendation on effective and efficient roles and responsibility of central and local governments on flood risk reduction, using experiences in Japan and other countries.												
3-3.	Evaluation and recommendation on enhanced institutional functions of flood risk reduction at the final stage of the project.												
Output4: Capacity of flood management planning is enhanced through formulation of integrated flood risk management plan (IFMP) in the pilot river basin.													
4-1.	Preparation of hydrological and hydraulic models for the pilot river basin (field investigation conducted upon necessity)(mainly for IDEAM with the support of the regional autonomous corporations who will have the model to be used for them.)												
4-2.	Formulation of IFMP including measures of i) prevention & mitigation and ii) preparedness & response												
4-3.	Implementation of priority measures in IFMP (e.g. establishment of floods early warning criteria and formulation of risk map) (Japanese experts advices on Colombian activities)												
4-4.	Preparation of IFMP formulation guideline utilizing lessons learned from pilot river basin activities (4-1), (4-2) and (4-3)												

Annex II

Annex III

List of Japanese Experts

Fields of experts to be covered by the Japanese experts are as follows:

1. Chief Advisor/Expert of Flood Risk Management
2. Expert of Hydrology, Hydraulics, and Flood Forecasting
3. Expert of Warning Information Dissemination and Evacuation
4. Expert of Flood Risk Mapping, Flood Risk Assessment, and GIS
5. Expert of Disaster Risk Management Policy
6. Other Experts, if necessity arises, upon mutual consultation

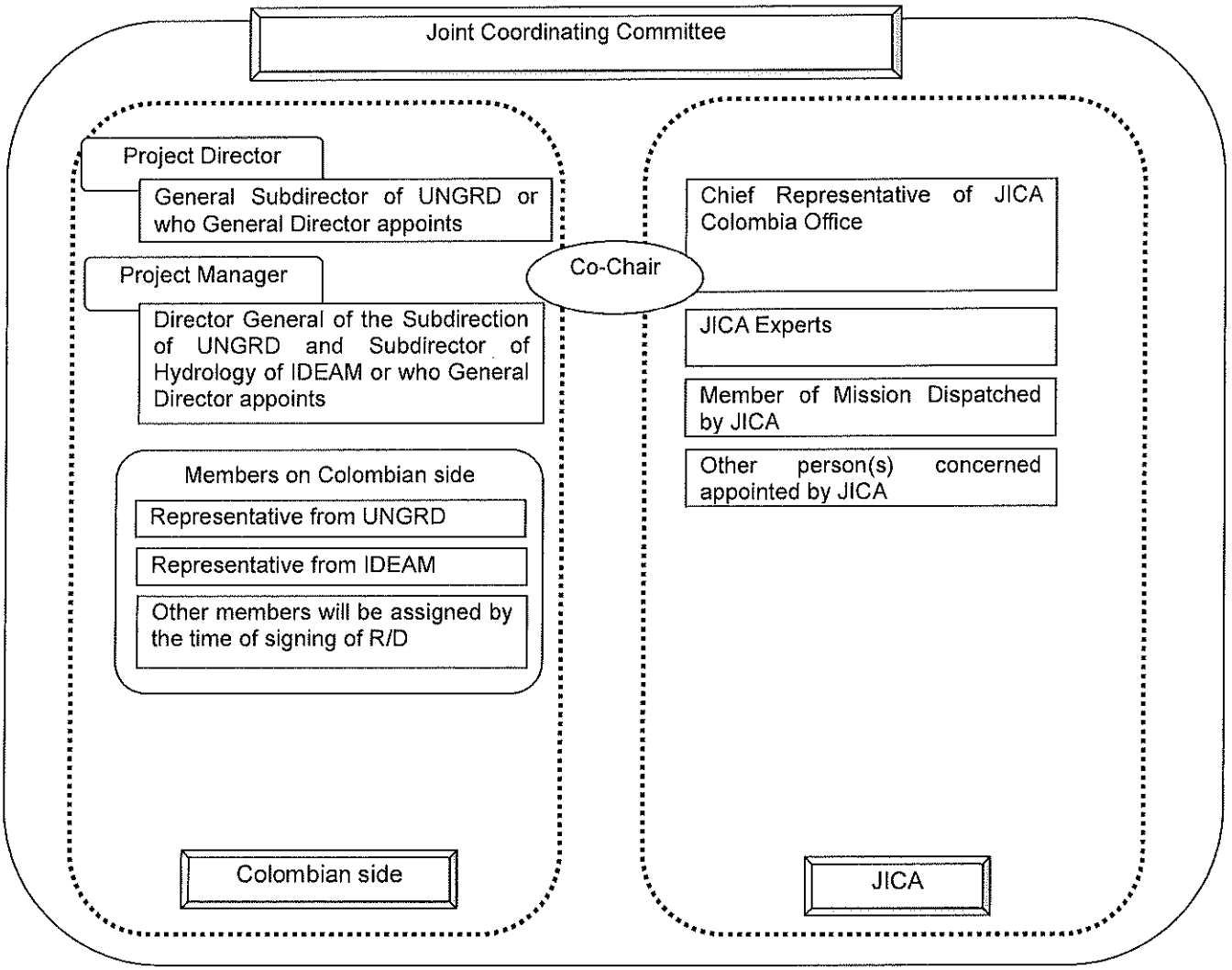
Annex IV

List of Equipment

1. Desktop / Laptop Computer : 2 sets
2. Multifunction machine (Printer / Photocopy) : 2 units
3. Inkjet Color Printer: 2 units
4. Hydrological Analysis Software: 2 sets
5. GIS Software: 2 sets
6. Other equipment mutually agreed upon as necessary for implementation of the Project

Annex V

Project Organization Chart



Observers:

- Observers may attend upon agreement between Colombian side and JICA.

Annex VI

Joint Coordinating Committee

1. Function

For the effective and successful implementation of the Project, the Joint Coordination Committee will be established in order to make decisions relevant to the Project. The Joint Coordination Committee will meet when necessary and annually in order to fulfill the following functions:

(1) To supervise the annual work plan of the Project in line with the Project Design Matrix and Plan of Operation;
(2) To review the annual and overall progress of the Project and to evaluate the accomplishment of the annual targets and achievement of the objectives;
(3) To find out proper ways and means of solution of the major issues arising from and in connection with the Project;
(4) To evaluate PDM during the course of the Project and suggest revision, if necessary; and
(5) Any other related issues.

2. Committee Members

The Committee will be composed of the chairperson and the members. The rules and guidelines for the management of the committee will be determined at the initial stage of the Project. The agreed composition is as follows:

(1) Chairperson:
Director General, UNGRD

(2) Members on Colombian side:
1) Representative from UNGRD (including Project Director)
2) Representative from IDEAM (including Project Manager),
3) Other members will be assigned by the time of signing of R/D.

(3) Members on Japanese side:
1) Chief Representative of JICA Colombia Office
2) JICA Experts
3) Members of Mission Dispatched by JICA
4) Other person(s) concerned appointed by JICA

Note: Official(s) of the Embassy of Japan may attend the Committee meeting as observer(s).

Appendix 2

MAIN POINTS DISCUSSED

1. Target disaster type is flood and does not include sediment disaster such as landslide and debris flow.

2. IDEAM requested to include training on radar data analysis in activity (1-1). This topic will be included if radar output data from aeronautic civil will be available to IDEAM and the data format is adequate for the analysis purpose.

3. Implementation of priority measures in activity (4-3) assumes that Colombian side implements the activities with its own cost, and Japanese experts provide technical advice to the Colombian activities.

4. Both sides understood that the close relationship within the authorities concerned of Colombian side in charge of flood risk assessment and flood risk reduction in Colombia is important to implement the Project smoothly and effectively. UNGRD and IDEAM should take necessary measures for coordinating with CAR, Department of Cundinamarca and Department of Bayaca and for collecting the data and information required for the Project implementation from those institutions.

RECORD OF DISCUSSIONS

ON

PROJECT FOR STRENGTHENING FLOOD RISK MANAGEMENT CAPACITY
IN

REPUBLIC OF COLOMBIA

AGREED UPON BETWEEN

THE AUTHORITIES CONCERNED
OF THE GOVERNMENT OF REPUBLIC OF COLOMBIA

AND

JAPAN INTERNATIONAL COOPERATION AGENCY

Bogota, D.C., April 20, 2015

HIDEMITSU SAKURAI
Resident Representative
JICA Colombia Office
Japan International Cooperation Agency (JICA)

CARLOS IVAN MARQUEZ PEREZ
Director General
National Unit for Disaster Risk Management (UNGRD)

OMAR FRANCO TORRES
Director General
Institute of Hydrology, Meteorology and Environmental Studies (IDEAM)

ALEJANDRO GAMBOA CASTILLA
Director
Colombian Presidential Agency of International Cooperation
(APC-Colombia)

ALVARO CRUZ VARGAS
Governor
Department of Cundinamarca

ALFRED IGNACIO BALLESTEROS ALARCÓN
Director General
Autonomous Regional Corporation of Cundinamarca (CAR)

Based on the minutes of meetings on the Detailed Planning Survey on the Project for Strengthening Flood Risk Management Capacity (hereinafter referred to as "the Project") signed on October 23, 2014 between National Unit for Disaster Risk Management (hereinafter referred to as "UNGRD"), Institute of Hydrology, Meteorology and Environmental Studies (hereinafter referred to as "IDEAM") and Colombian Presidential Agency of International Cooperation (hereinafter referred to as "APC-Colombia") and the Japan International Cooperation Agency (hereinafter referred to as "JICA"), JICA held a series of discussions with UNGRD, IDEAM, APC-Colombia and relevant organizations to develop a detailed plan of the Project.

Both parties agreed the details of the Project and the main points discussed as described in the Appendix 1 and the Appendix 2 respectively.

Both parties also agreed that UNGRD, IDEAM, the counterparts to JICA, will be responsible for the implementation of the Project in cooperation with JICA, coordinate with other relevant organizations and ensure that the self-reliant operation of the Project is sustained during and after the implementation period in order to contribute toward social and economic development of the Republic of Colombia.

The Project will be implemented within the framework of the Agreement on Technical Cooperation signed on 22nd December, 1976 (hereinafter referred to as "the Agreement") and the Note Verbales exchanged on 30th May, 2013 between the Government of Japan (hereinafter referred to as "GOJ") and the Government of the Republic of Colombia.

The Record of Discussions is written both in English and Spanish, both of which are equally official. The English text shall prevail in case of any divergence of interpretation.

Appendix 1: Project Description
Appendix 2: Main Points Discussed
Appendix 3: Minutes of Meetings on the Detailed Planning Survey

Appendix 1

PROJECT DESCRIPTION

Both parties confirmed that there is no change in the Project Description agreed on in the Minutes of Meetings on the concerning Detailed Planning Survey on the Project signed on October 23, 2014 (Appendix 3).

I. BACKGROUND

The Republic of Colombia, (hereinafter referred to as "Colombia") located in the central Andes, has 11 active volcanos and various topographic characteristics, and because of that, the risk of natural disasters is extremely high. The Andes is split up into Cordillera Occidental in the west, Cordillera Central in the central, and Cordillera Oriental in the east. Cordillera Occidental and Cordillera Central have 3,000m-class and 5,000-class mountains, respectively. The major rivers are Río Magdalena which is the fourth largest river basin in the South America and Río Cauca and flow to the Caribbean Sea. Guaviare River which connects to Rio Negro in Brazil is also located in the eastern Colombia.

Flood is the most serious and large-scaled natural disasters in Colombia. The historical natural disaster occurred by La Nina in 2010-2011 with approximately 3 million affected people in Colombia by torrential rainfall and floods. In reaction to the disaster, the Government of Colombia has started to establish disaster risk management structure including "Sistema Nacional para la Gestión del Riesgo de Desastres (SNGRD)" and "Unidad Nacional para la Gestión del Riesgo de Desastres (UNGRD)". However, the role and responsibilities of the involved institutions in the disaster management, coordination development between central administration and local governments, still need to be strengthened and progress on coordination among the central and local governments is still slow. Therefore, Colombia today has the opportunity to strengthen SNGRD, promoting the elaboration and implementation mechanism of flood risk management plans at a river basin level.

In the National Development Plan (2010-2014), the risk prevention is listed as one of the five priority items and provision of high quality public service for adaptation to climate change and reduction of vulnerability is set as its policy. The enhancement of SNGRD is also mentioned in the plan as the objectives for the integrated risk management. UNGRD, the coordinating organization for SNGRD, is responsible to preside the comprehensive disaster management in coordination with relevant organizations. The close coordination with Instituto de Hidrología, Meteorología y Estudios Ambientales de Colombia (IDEAM), an organization responsible for dissemination of hydromet information at national level, is indispensable.

Under such circumstances, the Government of Colombia has requested the GOJ to implement the project on strengthening of disaster management capacity. In response, the Government of Japan has accepted the request.

II. OUTLINE OF THE PROJECT

The details of the Project are described in the Logical Framework (Project Design Matrix: PDM) (Annex I) and the Tentative Plan of Operation (Annex II).

1. Input

(1) Input by JICA

(a) Dispatch of Experts

The details of the dispatch of experts are described in Annex III.

(b) Training

JICA will receive the Colombian personnel connected with the Project for technical training(s) in Japan.

(c) Machinery and Equipment

JICA will provide such machinery, equipment and other materials (hereinafter referred to as "the Equipment") necessary for the implementation of the Project as listed in Annex IV.

In case of importation, the machinery, equipment and other materials under II-1 (1) (c) above will become the property of the UNGRD and IDEAM upon being delivered C.I.F. (cost, insurance and freight) to Colombia authorities concerned at the ports and/or airports of disembarkation.

Input other than indicated above will be determined through mutual consultations among JICA, UNGRD, IDEAM and APC-Colombia during the implementation of the Project, as necessary.

(2) Input by the Colombian counterpart

The Colombian counterpart will take necessary measures to provide at its own expense:

(a) Services of counterpart personnel and administrative personnel from UNGRD, IDEAM, Autonomous Regional Corporation of Cundinamarca (hereinafter referred to as "CAR"), Department of Cundinamarca and local institutions in the area of influence of the river basin, as referred to in II-2;
(b) Suitable office space for experts with necessary equipment;
(c) Supply or replacement of machinery, equipment, instruments, vehicles, tools, spare parts and any other materials necessary for the implementation of the Project other than the equipment provided by JICA;
(d) Information as well as support in obtaining medical service;
(e) Credentials or identification cards;
(f) Available data (including maps and photographs) and information related to the Project;
(g) Running expenses necessary for the implementation of the Project;
(h) Expenses necessary for transportation within Colombia of the equipment referred to in II-1 (1) as well as for the installation, operation and maintenance thereof; and
(i) Necessary facilities to the JICA experts for the remittance as well as utilization of the funds introduced into Colombia from Japan in connection with the implementation of the Project

2. Implementation Structure

The Project organization chart is given in the Annex V. The roles and assignments of relevant organizations are as follows:

(1) UNGRD

(a) Project Director

General Subdirector of UNGRD or person appointed by the General Director will bear overall responsibility for implementation, administration, monitoring and evaluation of the Project.

(b) Project Manager

Person appointed by the General Director will bear overall responsibility for management of the Project.

(c) Counterpart Personnel (hereinafter referred to as "C/P")

Personnel who will be assigned by the time of signing of R/D is expected to work closely with the JICA Experts.

(2) IDEAM

(a) Project Manager

Subdirector of Hydrology of IDEAM or person appointed by the General Director will bear overall responsibility for management of the Project.

(b) C/P

Personnel who will be assigned by the time of signing of R/D is expected to work closely with the JICA Experts.

(3) CAR

(a) C/P

Personnel who will be assigned by the time of signing of R/D is expected to work closely with the JICA Experts.

(4) Department of Cundinamarca

(a) C/P

Personnel who will be assigned by the time of signing of R/D is expected to work closely with the JICA Experts.

(5) JICA Experts

The JICA experts will give necessary technical guidance, advice and recommendations to UNGRD, IDEAM, CAR, and Department of Cundinamarca on any matters pertaining to the implementation of the Project.

(6) Joint Coordinating Committee

Joint Coordinating Committee (hereinafter referred to as "JCC") will be established in order to facilitate inter-organizational coordination. JCC will be held at least once a year and whenever deems it necessary. JCC will approve an annual work plan, review overall progress, conduct evaluation of the Project, and exchange opinions on major issues that arise during the implementation of the Project. A list of proposed members of JCC is shown in the Annex VI.

3. Project Site(s) and Beneficiaries

(1) Project Site

-Direct Target: River basin of Rio Negro (no. 2306)

- Indirect Target: whole country of Colombia

(2) Direct Beneficiaries

- Staff of UNGRD, IDEAM, CAR and Department of Cundinamarca in the influential zone of the pilot river basin

(3) Indirect Beneficiaries

- People in Colombia

4. Duration
The Project will be carried out for approximately three (3) years from the date when the first JICA expert arrives in Colombia as shown in Annex II (Tentative Plan of Operation).

5. Reports
UNGRD, IDEAM and the JICA experts will jointly prepare the following reports in English.
(1) Monitoring Sheet on semiannual basis until the project completion
(2) Project Completion Report at the time of project completion

6. Environmental and Social Considerations
UNGRD and IDEAM agreed to abide by JICA Guidelines for Environmental and Social Considerations' in order to ensure that appropriate considerations will be made for the environmental and social impacts of the Project.

III. UNDERTAKINGS OF THE COUNTERPART – THE REPUBLIC OF COLOMBIA

1. The Counterparts of Colombia will take necessary measures to:
   (1) ensure that the technologies and knowledge acquired by Colombia nationals as a result of Japanese technical cooperation contributes to the economic and social development of Colombia, and that the knowledge and experience acquired by the personnel of Republic of Colombia from technical training as well as the equipment provided by JICA will be utilized effectively in the implementation of the Project; and
   (2) grant privileges, exemptions and benefits to the JICA experts referred to in II-1 (1) above and their families, which are no less favorable than those granted to experts and members of the missions and their families of third countries or international organizations performing similar missions in Colombia.

2. Other privileges, exemptions and benefits will be provided in accordance with the Agreement on Technical Cooperation signed on 22nd December, 1976 between GOJ and the Government of the Republic of Colombia.

IV. MONITORING AND EVALUATION

JICA, UNGRD and IDEAM will jointly and regularly monitor the progress of the Project through the Monitoring Sheets based on the Project Design Matrix (PDM) and Tentative Plan of Operation (PO). The Monitoring Sheets shall be reviewed every six (6) months.

Also, Project Completion Report shall be drawn up one (1) month before the termination of the Project.

JICA will conduct the following evaluations and surveys to mainly verify sustainability and impact of the Project and draw lessons. UNGRD and IDEAM are required to provide necessary support for them.

1. Ex-post evaluation three (3) years after the project completion, in principle
2. Follow-up surveys on necessity basis

V. PROMOTION OF PUBLIC SUPPORT

For the purpose of promoting support for the Project, UNGRD and IDEAM will take appropriate measures to make the Project widely known to the people of Colombia.

VI. MISCONDUCT

If JICA receives information related to suspected corrupt or fraudulent practices in the implementation of the Project, UNGRD, IDEAM and relevant organizations shall provide JICA with such information as JICA may reasonably request, including information related to any concerned official of the government and/or public organizations of Colombia.

UNGRD, IDEAM and relevant organizations shall not, unfairly or unfavorably treat the person and/or company which provided the information related to suspected corrupt or fraudulent practices in the implementation of the Project.

VII. MUTUAL CONSULTATION

JICA, UNGRD and IDEAM will consult each other whenever any major issues arise in the course of Project implementation.

VIII. AMENDMENTS

The Record of Discussions may be amended by the Minutes of Meetings between JICA, UNGRD and IDEAM.

The Minutes of meetings will be signed by authorized persons of each side who may be different from the signers of the Record of Discussions.

Annex I Project Design Matrix: PDM
Annex II Tentative Plan of Operation
Annex III List of Japanese Experts
Annex IV List of Equipment
Annex V Project Organization Chart
Annex VI Joint Coordinating Committee

Project Design Matrix: PDM (Version-0)

Project Title: Project for Strengthening Flood Risk Management Capacity
Duration: three (3) years
Target Area: River basin of Rio Negro (direct target), and the whole country of Colombia (indirect target)
Target Group: Staff of UNGRD, IDEAM, CAR and Department of Cundinamarca

Narrative summary	Objectively Verifiable Indicators	Means of Verification	Important Assumption
Overall Goal: The reduction of flood risk in Colombia	1. Realization of flood risk management related recommendations made through the project. 2. Number of Integrated Flood Risk Management Plan (IFMP) formulated for non-pilot river basin. (Or Ratio of POMCA which introduced the concept of Integrated Flood Risk Management) (XX %)	1. Annual Reports of CP. 2. Policy paper on IFMP (POMCA)	
Project Purpose: Capacity of Colombian institutions in flood risk management is enhanced.	1. Analysis capacity regarding flood disaster (enhancement degree) 2. Accuracy of flood forecasting and warning (improvement degree) 3. Effective use and share of data for flood risk management 4. IFMP formulation guideline developed	1 & 2. Ability test & effect measurement by JICA experts 3. Data exchange/ user agencies, quantity of data use 4. Formulation guideline	Vulnerability against flood disaster is not dramatically increased.
Outputs: 1. Capacity on flood risk assessment is improved and concept of integrated flood risk management planning and river basin management is introduced	1. IDEAM's capacity on technology of; a) hydrologic & hydraulic modeling, and b) flood risk mapping (enhancement degree) 2. IDEAM and UNGRD' capacity enhancement on the technology of vulnerability analysis using GIS (enhancement degree) 3. Knowledge / understanding at IDEAM, UNGRD, CAR, and Department on river basin wise IFMP (enhancement degree)	Ability test & effect measurement by JICA experts	Hydrological and meteorological network of IDEAM and CAR is neither degraded nor diluted.
2. Capacity on flood forecasting, warning and information dissemination to relevant organizations is improved (mainly IDEAM and UNGRD)	1. IDEAM's capacity on technology of hydrologic observation and data analysis (enhancement degree) 2. Recommendation on IDEAM's flood forecasting and warning	1. Effect measurement by JICA experts 2. Recommendations report on flood forecasting and warning	

3. Roles and responsibility of the central and local government for flood risk reduction are elucidated and enhanced (mainly UNGRD and IDEAM)	1. Issues clarified and recommendations draw regarding flood risk administration among UNGRD, IDEAM, CAR, department and municipalities. 2. Matrix of data holder by data type related to flood risk management	1. Terms of reference of actors in flood risk management 2. Matrix	
4. Capacity of flood risk management planning is enhanced through formulation of Integrated Flood Risk Management Plan (IFMP) in the pilot river basin	1. Integrated Flood Risk Management Plan (IFMP) of pilot river basin 2. IFMP formulation guideline developed	1. IFMP 2. IFMP formulation guideline	

Activities	Inputs	
1.1 Capacity assessment and training on comprehensive utilization of meteorological and hydrological data for flood risk assessment including the satellite image mapping from the perspectives of temporal and spatial resolutions and accuracy (mainly IDEAM) 1.2 Capacity assessment and training on hydrological and hydraulic modelling from rainfall-runoff analysis to flood inundation analysis and mapping technology (mainly IDEAM) 1.3 Capacity assessment and training on flood risk mapping technology using GIS with flood inundation and socio-economic data including vulnerability of structures (mainly IDEAM and UNGRD) 1.4 Training on integrated flood risk management planning and river basin management (IDEAM, UNGRD, CAR, Department of Cundinamarca and local institutions in pilot river basin) 1.4.1 Training in Colombia on; i) probabilistic hazard assessment of flood, ii) physical, environmental and social vulnerability analysis, iii) monitoring and evaluation of flood disaster risk, iv) management processes on flood events, v) flood disaster prevention and mitigation measures, and vi) development and operation of flood early warning systems 1.4.2 Training in Japan on; i) strategies and policies for adaptation and flood risk management, ii) infrastructure models (housing, hospitals, schools, etc.) adapted to flood events, and iii) flood control schemes	**Japanese side** Expert - Chief Advisor/Expert of Flood Management - Expert of River Planning - Expert of Hydrology, Hydraulics, and Flood Forecasting - Expert of Warning Information Dissemination and Evacuation - Expert of Flood Risk Mapping, Flood Risk Assessment, and GIS - Expert of Disaster Risk Management Policy Machinery and Equipment - Desktop / Laptop Computer - Multifunction machine (Printer / Photocopy) - Inkjet Color Printer - Hydrological Analysis Software - GIS Software	Hydrological and meteorological network of IDEAM and CAR is neither degraded nor diluted.
2.1 Capacity assessment and training on hydrological observation (mainly IDEAM) 2.2 Capacity assessment and training on flood forecasting (mainly IDEAM) 2.3 Capacity assessment and training on dissemination of real-time risk information and warning for appropriate response (mainly IDEAM and UNGRD)	**Colombia side** Administration:	

3.1 Assessment of functions of both central and local governments in activities of river basin management 3.2 Recommendation on effective and efficient roles and responsibility of central and local governments on flood risk reduction, using experiences in Japan and other countries. 3.3 Evaluation and recommendation on enhanced institutional functions of flood risk reduction at the final stage of the project	Project Director, Project Manager <u>Counterpart personnel:</u> C/P personnel from the relevant divisions under UNGRD, IDEAM and other institutions in the area of influence of the river basin	
4.1 Formulation of IFMP for the pilot river basin with considering prevention, mitigation, preparedness and response. Formulation process includes following items. -Preparation of management plan of Magdalena - Cauca river basin. -Preparation of hydrological and hydraulic models (mainly for IDEAM with the support of the regional autonomous corporations who will have the model to be used for them.) -Proposal of priority measures. 4.2 Preparation of IFMP formulation guideline utilizing lessons learned from pilot river basin activities (4.1).	<u>Facilities and Equipment</u> - Office space - Office furniture, facilities and equipment <u>Budgetary Arrangement by UNGRD, IDEAM, and other institutions in the area of influence of the river basin</u> Administration and local operation costs	<u>Pre-conditions</u> Central and pilot region's institutions agreed upon the exchange of data needed and available at each agency.

Remark: Indicators should be refined upon the completion of the baseline survey that is to be conducted during the initial 1 month of the project implementation

Annex I

Annex II

Tentative Plan of Operation (PO) (Ver.0)

Project Name: Project for Strengthening Flood Risk Management Capacity

		1st Year				2nd Year				3rd Year			
		1st	2nd	3rd	4th	1st	2nd	3rd	4th	1st	2nd	3rd	4th
	JCC ▲				▲				▲				▲
Output1: Capacity on flood risk assessment is improved and concept of integrated flood management planning and river basin management is introduced.													
1-1.	Capacity assessment and training on comprehensive utilization of meteorological and hydrological data for flood risk assessment including the satellite image mapping from the perspectives of temporal and spatial resolutions and accuracy (mainly IDEAM).												
1-2.	Capacity assessment and training on hydrological and hydraulic modelling from rainfall-runoff analysis to flood inundation analysis and mapping technology (mainly IDEAM).												
1-3.	Capacity assessment and training on flood risk mapping technology using GIS with flood inundation and socio-economic data including vulnerability of structures (mainly IDEAM and UNGRD).												
1-4.	Training on integrated flood management planning and river basin management (IDEAM, UNGRD, CAR, Department of Cundinamarca and local institutions in pilot river basin).												
	1-4-1. Training in Colombia on; i) probabilistic hazard assessment of flood, ii) physical, environmental and social vulnerability analysis, iii) monitoring and evaluation of flood disaster risk, iv) management processes on flood events, v) flood disaster prevention and mitigation measures, and vi) development and operation of flood early warning system												
	1-4-2. Training in Japan on; i) strategies and policies for adaptation and flood risk management, ii) infrastructure models (housing, hospitals, schools, etc.) adapted to flood events, and iii) flood control schemes.												
Output2: Capacity on flood forecasting, warning and information dissemination to relevant organizations is improved (mainly IDEAM and UNGRD).													
2-1.	Capacity assessment and training on hydrological observation (mainly IDEAM).												
2-2.	Capacity assessment and training on flood forecasting (mainly IDEAM).												
2-3.	Capacity assessment and training on dissemination of real-time risk information and warning for appropriate response (mainly IDEAM and UNGRD).												
Output3: Roles and responsibility of the central and local government for flood risk reduction are elucidated and enhanced (mainly UNGRD and IDEAM).													
3-1.	Assessment of functions of both central and local governments in activities of river basin management.												
3-2.	Recommendation on effective and efficient roles and responsibility of central and local governments on flood risk reduction, using experiences in Japan and other countries.												
3-3.	Evaluation and recommendation on enhanced institutional functions of flood risk reduction at the final stage of the project.												
Output4: Capacity of flood management planning is enhanced through formulation of integrated flood management plan (IFMP) in the pilot river basin.													
4-1.	Formulation of IFMP for the pilot river basin with considering prevention, mitigation, preparedness and response. Formulation process includes following items. -Preparation of management plan of Magdalena Cauca river basin. -Preparation of hydrological and hydraulic models (mainly for IDEAM with the support of the regional autonomous corporations who will have the model to be used for them.) -Proposal of priority measures.												
4-2.	Preparation of IFMP formulation guideline utilizing lessons learned from pilot river basin activities (4.1)												

Annex III

List of Japanese Experts

Fields of experts to be covered by the Japanese experts are as follows:

1. Chief Advisor/Expert of Flood Risk Management
2. Expert River Planning
3. Expert of Hydrology, Hydraulics, and Flood Forecasting
4. Expert of Warning Information Dissemination and Evacuation
5. Expert of Flood Risk Mapping, Flood Risk Assessment, and GIS
6. Expert of Disaster Risk Management Policy
7. Other Experts, if necessity arises, upon mutual consultation

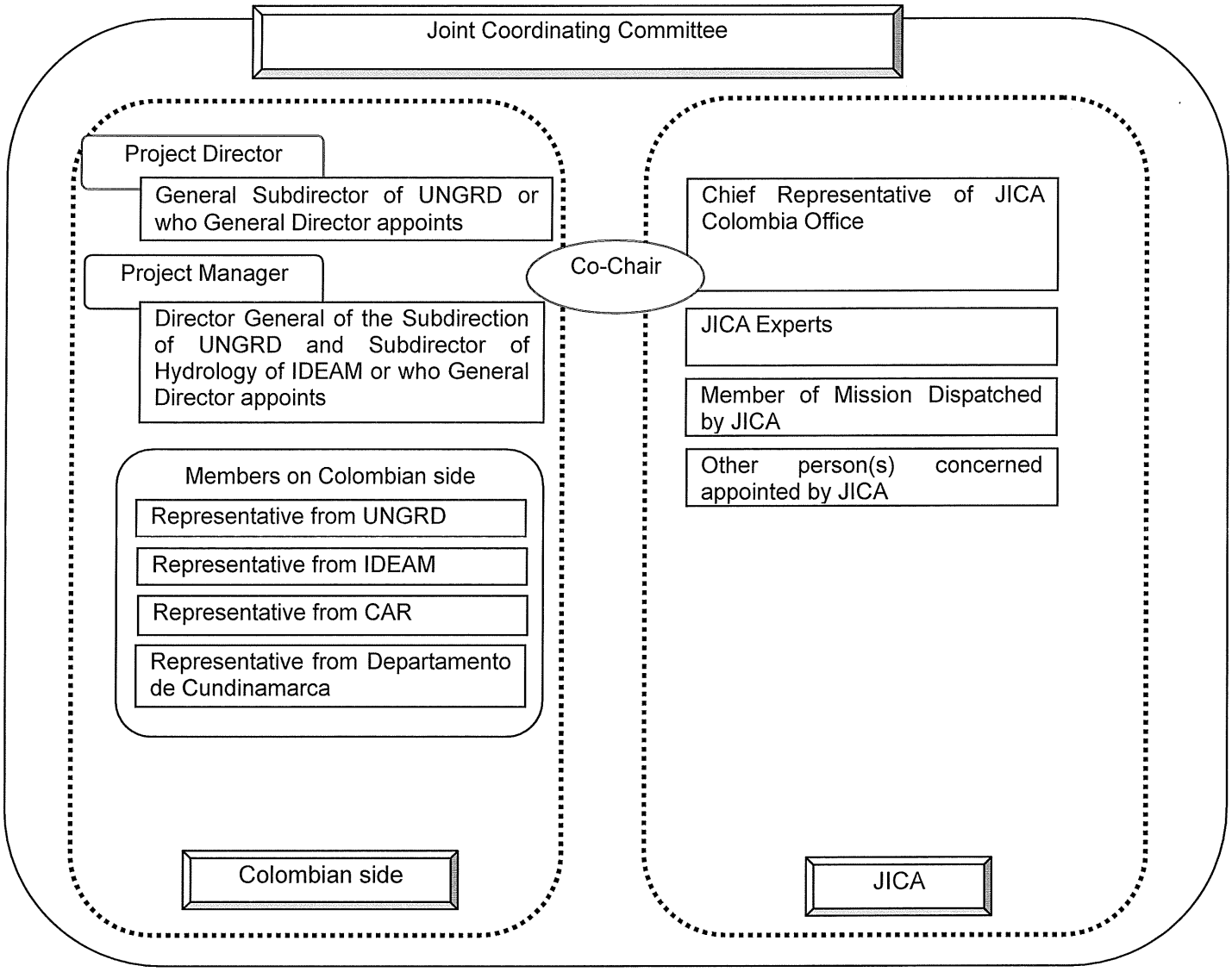
Annex IV

List of Equipment

1. Desktop / Laptop Computer : 2 sets
2. Multifunction machine (Printer / Photocopy) : 2 units
3. Inkjet Color Printer: 2 units
4. Hydrological Analysis Software: 2 sets
5. GIS Software: 2 sets
6. Other equipment mutually agreed upon as necessary for implementation of the Project

Annex V

Project Organization Chart



Observers:

- Observers may attend upon agreement between Colombian side and JICA.

Annex VI

Joint Coordinating Committee

1. Function

For the effective and successful implementation of the Project, the Joint Coordination Committee will be established in order to make decisions relevant to the Project. The Joint Coordination Committee will meet when necessary and annually in order to fulfill the following functions:

(1) To supervise the annual work plan of the Project in line with the Project Design Matrix (PDM) and Plan of Operation (PO);
(2) To review the annual and overall progress of the Project and to evaluate the accomplishment of the annual targets and achievement of the objectives;
(3) To find out proper ways and means of solution of the major issues arising from and in connection with the Project;
(4) To evaluate PDM during the course of the Project and suggest revision, if necessary; and
(5) Any other related issues.

2. Committee Members

The Committee will be composed of the chairperson and the members. The rules and guidelines for the management of the committee will be determined at the initial stage of the Project. The agreed composition is as follows:

(1) Chairperson:
Project Director

(2) Project Director Members on Colombian side:
1) Representative from UNGRD (including Project Director)
2) Representative from IDEAM (including Project Manager),
3) Representative from CAR
4) Representative from Departamento de Cundinamarca

(3) Members on Japanese side:
1) Chief Representative of JICA Colombia Office
2) JICA Experts
3) Members of Mission Dispatched by JICA
4) Other person(s) concerned appointed by JICA

Note: Official(s) of the Embassy of Japan may attend the Committee meeting as observer(s).

Appendix 2

MAIN POINTS DISCUSSED

1. Target disaster type is flood and does not include sediment disaster such as landslide and debris flow.

2. IDEAM requested to include training on radar data analysis in activity (1-1). This topic will be included if radar output data from aeronautic civil will be available to IDEAM and the data format is adequate for the analysis purpose.

3. Both sides understood that the close relationship within the authorities concerned of Colombian side in charge of flood risk assessment and flood risk reduction in Colombia is important to implement the Project smoothly and effectively. UNGRD and IDEAM should take necessary measures for coordinating with CAR, Department of Cundinamarca and for collecting the data and information required for the Project implementation from those institutions.

Appendix-16 Record of Expert Visits

1．Work in Colombia

Name (Fields)		2015 Jul	Aug	Sep	Oct	Nov	Dec	2016 Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	2017 Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	2018 Jan	Feb	Mar	Apr	May	Jun	Jul	days	M/M
Kenji Morita (Chief Advisor/ Flood Risk Management (1))	projected		(33)						(37)								(30)				2/6-2/26						(30)		(30)			(20)					(30)		210	7.00
	actual	7/27-8/26	(31)						2/1-3/10	(39)							10/2-10/31	(30)			(21)			5/14-6/12	(30)	7/10-8/7	(29)	9/18-11/3	(47)	11/19-12/1	(13)		2/5-3/5	(29)				5/28-7/8	(42)	311	10.37
Kazunori Inoue (Deputy Chief Advisor/ Flood Risk Management (2) / Hydrology, Hydraulics, and Flood Forecasting)	projected		(30)		(45)						(30)			(30)							(45)																(30)	210	7.00
	actual	7/27-8/25	(30)		10/8-11/16	(40)					4/25-5/29	(35)	7/5-24	(20)								4/16-5/19	(34)																159	5.30
Masaki Todo (River Planning)	projected		(20)		(25)						(30)			(30)			(30)				(30)						(30)		(30)								(30)		255	8.50
	actual	7/27-8/16	(21)		10/15-11/7	(24)					4/25-5/21	(27)	7/5-8/6	(33)			10/4-11/2	(30)											10/16-11/3	(19)			2/5-2/25	(21)				6/3-7/2	(30)	205	6.83
Masato Fujimoto (Warning Information Dissemination and Evacuation)	projected								(45)			(35)														(30)												110	3.67
	actual								2/1-3/16	(45)				7/9-8/7	(30)											7/10-8/13	(35)												110	3.67
Akihiro Furuta (Flood Risk Mapping, Flood Risk Assessment, and GIS)	projected		(25)						(35)				(30)													(30)												120	4.00
	actual	7/27-8/20	(25)						2/16-3/16	(30)							10/19-11/17	(30)										9/2-10/6	(35)											120	4.00
Hirotada Hasegawa (Disaster Risk Management Policy)	projected		(25)		(20)						(20)																												65	2.17
	actual	7/27-8/20	(25)		10/26-11/14	(20)					4/25-5/14	(20)																												65	2.17
Takeshi Katayama (Disaster Risk Management Policy)	projected																									(20)										(30)		50	1.67
	actual																												10/8-10/28	(21)			2/5-3/5	(29)						50	1.67
																																					Subtotal for Work in Colombia	projected	1,020	34.00
																																						actual	1,020	34.00

2．Work in Japan

Kenji Morita (Chief Advisor/Expert of Flood Risk Management (1))	projected																																						15	0.75
	actual	7/22-24	(3)																									12/18-20	(3)	1/18-19,30	(2)(1)	3/8-9,12	(3)	4/9-10,23-24	(2) (2)	5/15-17	(3)	7/11-13	(3)	22	1.10
Kazunori Inoue (Deputy Chief Advisor/Expert of Flood Risk Management (2) / Expert of Hydrology, Hydraulics, and Flood Forecasting)	projected																																						10	0.50
	actual	7/22-24	(3)																																				3	0.15
Masaki Todo (River Planning)	projected																																						10	0.50
	actual	7/22-24	(3)																													1/19,22-23	(3)		4/12-13,17-18	(4)				10	0.50
																																					Subtotal for Work in Japan	projected	35	1.75
																																						actual	35	1.75
																																					Total	projected	35.75
																																						actual	35.75

Joint Coordination Committee (JCC)			△						△												△								△							△				