

**Ministry of Environment, Water and Natural Resources  
Water Resources Management Authority  
The Republic of Kenya**

**Project on Capacity Development  
for  
Effective Flood Management  
in  
Flood Prone Area  
in  
the Republic of Kenya**

**Final Report  
Volume 3 Appendices (1/2)**

**September 2014**

**JAPAN INTERNATIONAL COOPERATION AGENCY  
(JICA)**

**NEWJEC INC.**

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FOR  
EFFECTIVE FLOOD MANAGEMENT IN FLOOD PRONE AREA  
IN THE REPUBLIC OF KENYA**

**FINAL REPORT**

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As of March 2014

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**Capacity Assessment for WRMA**

## Pre-Project and Post-Project Capacity Assessment for WRMA

**Project Purpose:** In the Project target areas, institutional framework of flood management in the context of integrated water resource management is to be established for effective and sustainable implementation of community-based activities.

**Output 1)** At each level of WRMA (headquarters, regional offices and sub-regional offices), sustainable organizations in charge of flood management are to be strengthened.

**Output 2)** For promoting community-based activities with respect to flood management, WRMA staffs are to support WRUAs and communities are to be strengthened.

WRMA Capacity to be Developed	Required Capacity Element	Pre-Project Assessment ( 29 <sup>th</sup> to 30 <sup>th</sup> Nov. 2012 )	Target Group	Post-Project Assessment (4 <sup>th</sup> to 5 <sup>th</sup> June 2014)	Actions
1. [Personal aspects]					
1. To Develop a System for Collecting and Analyzing Information/Data with respect to Flood Phenomena	1-1 To collect and analyze information/data about rainfalls and river flows which may be the cause of floods	<p><b>Skills and expertise:</b></p> <ol style="list-style-type: none"> <li>1) Regarding collecting and analyzing information/data of rainfalls and river flows, which may be the cause of floods, staffs of WRMA-HQ, RO and SRO have skills and knowledge of low water, but they don't have enough skills and knowledge (few staffs with skills) of high water(lack of equipment for high flow measurement).</li> <li>2) Regarding the observation of rainfalls, WRMA staffs don't have enough knowledge and technique (few staffs with skills) for short-term interval rainfall observation.</li> <li>3) Regarding the observation of water levels and river flows, they don't have enough knowledge and technique for one-hour interval water level observation and high water discharge observation.</li> </ol> <p><b>Supplementary Notes:</b></p> <ol style="list-style-type: none"> <li>4) There are some opportunities for training the staffs of HQ, while there are few opportunities for training staffs of ROs and SROs.</li> <li>5) No technical instruction books for hydro/meteorological observation exist.</li> <li>6) WRMA staffs can collect data but cannot analyze and bank information/data.</li> </ol>	<b>SRO, RO, HQ</b>	<p><b>Improvements attributable to the Project</b> (To select "Very much improved", "Partially improved", and "Not improved yet")</p> <p>On collecting and analyzing information/data of rainfalls and river flows, which may be the cause of floods: ADCP available but other logistical (accessories) challenges in measuring high flows. <b>Partially Improved</b></p> <p>On the observation of rainfalls, WRMA staffs don't have enough knowledge and technique for short-term interval rainfall observation.</p> <ol style="list-style-type: none"> <li>1) Partially improved</li> <li>2) Partially improved (Reason shall be described)</li> <li>3) Partially improved</li> </ol> <p><b>Challenges remaining</b></p> <ol style="list-style-type: none"> <li>1) Additional equipment are required.</li> <li>2) Staff numbers are inadequate</li> <li>3) Accessories to equipment (cable ways)</li> <li>4) Vandalism to metallic installation</li> <li>5) Capacity to analyze</li> </ol>	<ul style="list-style-type: none"> <li>■ Cable ways to capture high flows</li> <li>■ On the job-training on the use of equipment</li> <li>■ Installation of automated gauge stations (telemetric)</li> </ul>
	1-2 To collect and analyze information/data on impacts and damages by floods	<p><b>Skills and expertise:</b></p> <ol style="list-style-type: none"> <li>1) WRMA-SRO staffs cannot collect and analyze information/data about the human damages, such as the number of missing persons and deaths, physical damages which constitute the number of destroyed houses and crops affected by floods, etc.</li> </ol>	<b>SRO</b>	<p><b>On WRMA-SRO staffs cannot collect and analyze information/data about the human damages, Partially Improved</b></p> <p><b>Improvements attributable to the Project</b></p> <ol style="list-style-type: none"> <li>1) Partially improved:                             <ol style="list-style-type: none"> <li>a. Trained WRMA staff designated as flood management officers</li> </ol> </li> </ol> <p><b>Challenges remaining</b></p> <ol style="list-style-type: none"> <li>1) Liason between WRMA and other stakeholders with crucial data</li> <li>2) Capacity to collect and analyses the data in a timely manner</li> </ol>	<ul style="list-style-type: none"> <li>■ Enhancement of liason with KRCS, Agriculture, Transport and Education sectors</li> <li>■ Strengthening of IFMC</li> <li>■ Enhance the capacity of WRUA in collecting data</li> <li>■ Establish/ enhance a system of data collection, analysis and dissemination</li> <li>■ Establishing knowledge centre at various levels</li> </ul>

WRMA Capacity to be Developed	Required Capacity Element	Pre-Project Assessment ( 29 <sup>th</sup> to 30 <sup>th</sup> Nov. 2012 )	Target Group	Post-Project Assessment (4 <sup>th</sup> to 5 <sup>th</sup> June 2014)	Actions
	1-3 To collect and analyze both the characteristics of river basins and cause and effect of floods by using maps	<u>Skills and expertise:</u> 1) WRMA-SRO staffs usually don't use maps in their works. 2) It is common that flooded areas have not been identified and delineated on maps. 3) Records on river course changes have not been identified and shown on maps. 4) Only for Lumi River, such kind of records was listed on a hand writing map. 5) WRMA-SRO staffs don't have maps, which show the location of rainfall stations and water level gauging stations. 6) The use of GIS maps remains minimal in WRMA-HQ.	SRO, RO	<b>On WRMA-SRO staffs usually don't use maps in their works-Partially improved</b> <b>Improvements attributable to the Project</b> 1) Partially improved: a. Maps are being used in the three pilot project areas b. Maps are also being used in water rights permit processing and WDC application 2) Partially improved: a. It has been done at the three pilot areas b. Training has incorporated delineation of flooded areas skills 3) Partially improved: a. The change of GuchaMigori river course has been identified and documented and shown on the map 4) Not improved yet 5) Very much improved: a. Maps showing rainfall and water level stations 6) Partially improved: a. GIS maps are being used in the reports, presentations etc <b>Challenges remaining</b> 1) Bullet 5 Maps are yet to be displayed 2) Bullet 6 Inadequate capacity in the use of GIS at the Regional offices	<ul style="list-style-type: none"> <li>■ Improve the use and display of maps</li> <li>■ Capacity building in the use of GIS</li> </ul>
	1-4 To summarize and apporint the status of floods and their damages	<u>Skills and expertise:</u> 1) WRMA-SRO staffs don't have enough skills and expertise to collect and analyze information/data of rainfalls, flow rates, geographical characteristics, flood affected areas, flood affected population, etc.	SRO	<b>Improvements attributable to the Project</b> 1) Partially improved: a) Data collection has improved as a result of some staff being trained, b) Some of the equipment have been distributed to the SROs c) Participation in the development of IFMP in the three pilot project areas, d) WRUA sensitization and training, e) Established CFMOs under the WRUA, f) Development of flood management module in the WDC manual g) Establishment of flood management department from the headquarters to the SROs h) Submitted flood disaster reports are available <b>Challenges remaining</b> <ul style="list-style-type: none"> <li>■ Inadequate equipment at the SRO,</li> <li>■ Developing of IFMP for the remaining 13 flood prone areas</li> <li>■ Inadequate system for flood data collection, analysis and dissemination</li> </ul>	<ul style="list-style-type: none"> <li>■ Procure and train staff on the use of the equipment,</li> <li>■ Establish the system for flood reporting and dissemination,</li> <li>■ To make a work plan and budget for the remaining 13 flood prone areas.</li> </ul>
	[Organizational aspects]	(Human, physical, financial, knowledge, etc.)			
	1-5 To collect and arrange information/data systematically and appropriately with respect to rainfalls and high water discharges	<u>Organization:</u> 1) There are no common methods of installation, maintenance and calibration of hydro/meteorological observation equipment. 2) There is no particular system for installation, maintenance and calibration of hydro/meteorological observation equipment. 3) Although there are staffs in charge of data collection, there are no instruction manuals for guiding volunteer observers. 4) There are no officers in charge of checking and statistically processing	SRO, RO, HQ	<b>Improvements attributable to the Project</b> 1) Partially improved: a) There are staffs that have been trained, b) Standard procedures for installation, and operation 2) Not improved yet 3) Not improved yet 4) Partially improved: a. Staffs trained on data have been posted to the some of the	<ul style="list-style-type: none"> <li>■ Develop observers' manual</li> <li>■ Establishing of data analysis section</li> <li>■ Establishment of instrument specialists office</li> <li>■ Enhance data management capacity</li> <li>■ Develop quality control manual for data management</li> </ul>

WRMA Capacity to be Developed	Required Capacity Element	Pre-Project Assessment ( 29 <sup>th</sup> to 30 <sup>th</sup> Nov. 2012 )	Target Group	Post-Project Assessment (4 <sup>th</sup> to 5 <sup>th</sup> June 2014)	Actions
		<p>data.</p> <p>5) Although staffs in charge of databases were stationed in SROs, ROs and HQ, there is no system to share the result of databases.</p> <p><b>Standing instructions:</b></p> <p>6) There are no such regulatory documents of posts.</p> <p><b>Budget Measures:</b></p> <p>7) Insufficient budget</p> <p><b>Equipment:</b></p> <p>8) WRMA-ROs have Acoustic Doppler Current Profilers (ADCPs) and Acoustic Doppler Velocity-meters (ADV).</p> <p>9) WRMA-SROs have SEBA Current Flow Meters ready.</p> <p>10) The number and the volume of hard disks of personal computers are not enough in WRMA-SROs.</p> <p><b>Supplementary Notes:</b></p> <p>11) Poor accessibility to hydro/meteorological observation stations with the exception of a few stations</p>		<p>SRO</p> <p>5) Partially improved:</p> <p>a. There is the year book available in the WRMA website</p> <p>b. There is feedback from the Headquarters to the Regional office on data analysis</p> <p>6) Partially improved</p> <p>a) The schedule was developed and communicated</p> <p>b) Flood survey sheets developed</p> <p>7) Partially improved</p> <p>a) There is budget line for Flood Management</p> <p>8) Partially improved</p> <p>a) Two more ADPs added for Kiambu and Narok Sub regions</p> <p>b) 16 No. officers trained in use of ADCPs mainly from sub regions/regions</p> <p>9) No improvement</p> <p>a) Non has been added and each sub region need SEBA current flow meters</p> <p>10) No improvement</p> <p>11) No improvement</p> <p><b>Challenges remaining</b></p> <ul style="list-style-type: none"> <li>■ Bullet 1 Calibration of equipment</li> <li>■ Bullet 1 Measuring the effectiveness on the use of procedures and manuals</li> <li>■ Bullet 2 There is no section on instrumentation</li> <li>■ Bullet 4 Inadequate staffs for data analysis</li> <li>■ Bullet 5 Inadequate capacity</li> <li>■ Bullet 7 Disbursement and voting of the fund</li> <li>■ Bullet 9 Servicing and calibration</li> </ul>	<ul style="list-style-type: none"> <li>■ Assess the effectiveness of use of the schedule and flood data survey sheet</li> <li>■ Work on work plan and come with clear budget</li> <li>■ To procure ADPs and train other 14 flood prone sub regions</li> <li>■ Improve on capacity of servers and number of computers at ROs and SROs</li> <li>■ Improve on interconnectivity of WRMA offices</li> <li>■ Automate hydromet stations with telemetric system</li> </ul>
1-6 To collect and analyze information/data about the effects and damages of floods		<p><b>Organization:</b></p> <p>1) There are no flood management staffs in ROs and SROs.</p> <p><b>Standing instructions:</b></p> <p>2) noexistent</p> <p><b>Budget Measures:</b></p> <p>3) Insufficient budget</p> <p><b>Equipment:</b></p> <p>4) The number of personal computers and vehicles are not enough in ROs and SROs.</p>	SRO, RO	<p><b>Improvements attributable to the Project</b></p> <p>1) Very much improved</p> <p>a) Staff trained and posted</p> <p>2) Partially Improved</p> <p>a) Flood survey data sheet developed</p> <p>3) Applies to above</p> <p><b>Challenges remaining</b></p> <ul style="list-style-type: none"> <li>■ Bullet 1 inadequate trained staff</li> <li>■ Bullet 1 no clear job description for FMOs</li> </ul>	<ul style="list-style-type: none"> <li>■ Training and deployment of FMOs</li> <li>■ Assess the effectiveness in the use of the forms</li> </ul>
1-7 To collect and analyze the characteristics of river basins and cause and effect of floods by using maps		<p><b>Organization:</b></p> <p>1) It is very rare to use maps in SROs, ROs and HQ.</p> <p>2) There are two staffs in HQ to be able to use GIS, whose skills are included to a medium or an upper class.</p> <p>3) There are two staffs to be able to use GIS in RO, whose skills are included to a beginner class.</p> <p>4) It is very hard for the staffs to use GIS for WRMA's works.</p> <p><b>Standing instructions:</b></p> <p>5) Nonexistent</p> <p><b>Budget Measures:</b></p> <p>6) insufficient budget</p> <p><b>Equipment:</b></p>	SRO, RO, HQ	<p><b>Improvements attributable to the Project</b></p> <p>5) Partially improved</p> <p>a) There has been increase in use of maps in pilot areas</p> <p>b) There has been capacity building in use of maps in other 13 flood prone sub regions</p> <p>6) Partially improved</p> <p>a) Some staff members have been trained in GIS</p> <p>7) Ditto</p> <p>8) Ditto</p> <p>10) As above</p> <p>11) As above</p> <p>12) As above</p>	<ul style="list-style-type: none"> <li>■ Enhance capacity to use maps</li> <li>■ Procure adequate GIS software licenses at SRO, RO and HQ</li> <li>■ Enhance staff capacity on use of GIS software</li> <li>■ Assess the effectiveness of the work instructions and the procedures</li> </ul>



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		7) The number of personal computers and vehicles are not enough in WRMA. <b>Supplementary Notes:</b> 8) Information/data are collected routinely, but not analyzed in graphs. 9) WRMA staffs don't identify and instruct mistakes of volunteer observers.		13) As above 14) Partially improved a) Work instructions and procedures available at relevant functional levels <b>Challenges remaining</b> ■ Prohibitive cost of license	
	1-8 Reports for summarizing the situation of flood damages will be shared nationwide through HQ and ROs.	<b>Organization:</b> 1) There are no Flood Management Officers in ROs and SROs. <b>Standing Instructions:</b> 2) nonexistent <b>Budget Measures:</b> 3) insufficient budget <b>Equipment:</b> 4) The number of personal computers and vehicles are not enough in WRMA. <b>Supplementary Notes:</b> 5) There are no flood disaster reports in WRMA.	SRO, RO, HQ	<b>Improvements attributable to the Project</b> ■ Covered above (1-4) 5) Partially Improved a) Regular reports have been submitted by SROs and ROs <b>Challenges remaining</b> ■	■ Include Flood management reports in the annual/quarterly water resources situation reports
Institutional aspects]					
	1-9 An agreement or a system on sharing of observed data of rainfalls, water levels and flow rates with related organizations	1) There are no agreements for exchanging and sharing observed data between WRMA—which is conducting hydro/meteorological observation— and KMD—which is conducting meteorological observation—. 2) WRMA should provide rainfall data to KMD. 3) WRMA and KMD come away with no agreements with respect to data sharing from the effort. 4) However, there is a framework of KMD's data sharing to both ASAL Secretariat—a platform of countermeasures against drought— and NPDRR—a national platform for disaster risk reduction formulated by the Government of Kenya—.	HQ	<b>Improvements attributable to the Project</b> 1) Not improved a) Attempts have been made to bring in understanding between KMD and WRMA on data sharing, results awaited. 2) 2-3 as above 4) As above <b>Challenges remaining</b> ■ Bullet 1 Pegging data access to revenue collection	■ Lobby for increased use of data in decision making

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2. To Analyze Cause and Effect of Floods by Using Related Information/Data					
[Personal aspects]					
	2-1 Basic knowledge of topographic maps and mapping technique	<p><b>Skills and expertise:</b> 1) WRMA staffs are short on experience in reading topographic maps and mapping processes, because topographic maps are not common in Kenya.</p> <p><b>Incentive:</b> 2) no incentive scheme</p> <p><b>Supplementary Notes:</b> 3) WRMA staffs have no chances for attending training seminars of reading maps and mapping technique. 4) WRMA staffs have no technical reference materials.</p>	SRO, RO, HQ	<p><b>Improvements attributable to the Project</b></p> <ol style="list-style-type: none"> <li>1) Partial improvement <ul style="list-style-type: none"> <li>➢ Development and transfer of flood hazard maps to the topographic maps</li> <li>➢ Display of rainfall and RGS stations on the topographic maps</li> <li>➢ Development of WRUA capacity</li> <li>➢ Delineation of flood prone areas on the topographic maps</li> </ul> </li> <li>2) Partial improvement <ul style="list-style-type: none"> <li>➢ Transfer of flood hazard maps to the topographic maps</li> <li>➢ Display of the hazard maps at strategic points</li> <li>➢ Utilized in the installation of the Early Warning Systems</li> <li>➢ Siting of intervention measures (structural measures)</li> </ul> </li> <li>3) Partially Improved <ul style="list-style-type: none"> <li>➢ On-site training on the development and reading of flood hazard maps</li> <li>➢ Participated in the development of flood hazard maps</li> </ul> </li> <li>4) Partially improved <ul style="list-style-type: none"> <li>➢ Development of the flood management module in the WDC manual</li> <li>➢ Development of flood hazard map manual</li> <li>➢ Evacuation drill guidebook</li> <li>➢ Flood management textbook for primary school education</li> <li>➢ Manual on evacuation centre</li> <li>➢ Manual on the Flood early warning systems</li> <li>➢ To include others in process of development</li> </ul> </li> </ol> <p><b>Challenges remaining</b></p> <ul style="list-style-type: none"> <li>■ The current topographic maps does not portray real ground situations</li> <li>■ Inadequate number of trained staff in map reading</li> <li>■ Limited awareness and accessibility to technical reference materials</li> </ul>	<ul style="list-style-type: none"> <li>■ Liaise with the Survey of Kenya to update the topographic map to portray water resources situation on the ground</li> <li>■ Capacity building on water resources map development and reading</li> <li>■ Dissemination of the technical reference materials</li> </ul>
	2-2 Basic knowledge of high water discharge observation	<p><b>Skills and expertise:</b> 1) WRMA staffs are short on experience and understanding in high water discharge observation, although WRMA staffs understand the importance of low water discharge observation.</p> <p><b>Incentive:</b> 2) no incentive scheme</p> <p><b>Supplementary Notes:</b> 3) WRMA staffs have limited opportunities for attending training seminars of high water discharge observation. 4) WRMA staffs have no technical reference materials.</p>	SRO, RO, HQ	<p><b>Improvements attributable to the Project</b></p> <ol style="list-style-type: none"> <li>1) Partial improvement <ul style="list-style-type: none"> <li>➢ A number of WRMA staff were trained in high flow discharge observations</li> <li>➢ WRMA staff have become Trainers of Trainers</li> <li>➢ More high water discharge observation equipment provided in the regions and sub regions and hence more experience by the staff.</li> </ul> </li> <li>2) Partial improvement <ul style="list-style-type: none"> <li>➢ With provision of more equipment and training there is increased motivation.</li> <li>➢ Facilitation of staff</li> </ul> </li> <li>3) Partially improved <ul style="list-style-type: none"> <li>➢ A number of WRMA staff were trained in high flow discharge observations</li> <li>➢ WRMA staff have become Trainers of Trainers</li> <li>➢ Acquisition of more high flow measurement equipment</li> </ul> </li> <li>4) Partially improved <ul style="list-style-type: none"> <li>➢ Operational manuals have been provided with newly acquired</li> </ul> </li> </ol>	<ul style="list-style-type: none"> <li>■ Carry out staff training needs assessment and projection</li> <li>■ Purchase, provide high water observation equipment and train WRMA officers in the remaining 14 sub regions</li> <li>■ Keep the provided manuals at the knowledge centres</li> </ul>

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	2-3 Basic knowledge of flood disaster databases	<p><b>Skills and expertise:</b></p> <p>1) WRMA staffs are short on experience in constructing a flood disaster database, although WRMA staffs understand the importance of it.</p> <p><b>Incentive:</b></p> <p>2) no incentive scheme</p> <p><b>Supplementary Notes:</b></p> <p>3) WRMA staffs have limited opportunities for attending training seminars for constructing and managing databases.</p>	SRO, RO, HQ	<p>equipment</p> <p><b>Challenges remaining</b></p> <ul style="list-style-type: none"> <li>■ Extremely rough flows are difficult to measure</li> <li>■ Limited high flow measurement equipment at the sub regional level</li> <li>■ Limited capacity to handle the equipment at the sub regional level</li> <li>■ Delayed facilitation</li> </ul> <p><b>Improvements attributable to the Project</b></p> <ul style="list-style-type: none"> <li>■ 1) Partially improved <ul style="list-style-type: none"> <li>➢ Collected information on the floods in the 3 pilot project areas</li> <li>➢ Use of the information to develop the flood management plan in the 3 pilot areas</li> <li>➢ Development of systematic collection of flood information</li> </ul> </li> <li>■ 2) Partially improved <ul style="list-style-type: none"> <li>➢ Deployment of FMO obliges them to collect flood disaster information</li> </ul> </li> <li>■ 3) partially improved <ul style="list-style-type: none"> <li>➢ WRMA Staff were trained in construction and management of data bases</li> </ul> </li> </ul> <p><b>Challenges remaining</b></p> <ul style="list-style-type: none"> <li>■ Limited experience in data base construction</li> </ul>	<ul style="list-style-type: none"> <li>■ Construction and management of the flood disaster data bases at the three pilot project areas and then the other thirteen flood prone areas</li> </ul>
	<p>[Organizational aspects]</p> <p>2-4 Framework for observing high water discharges</p>	<p>(Human, physical, financial, knowledge, etc.)</p> <p><b>Organization Framework:</b></p> <p>1) WRMA has no observation framework on high water discharges.</p> <p>2) Each WRMA Office is in her own way of discharge observation.</p> <p>3) For example, Kakamega RO is conducting a routine observation of discharges, while Kisumu RO has no observation of discharges.</p> <p>4) No ROs have conducted any observation of high water discharges.</p> <p><b>Standing Orders:</b></p> <p>5) nonexistent</p> <p><b>Budget Measures:</b></p> <p>6) not enough</p> <p><b>Equipment:</b></p> <p>7) ROs have deficient discharge observation instrument, although ROs have them.</p> <p><b>Supplementary Notes:</b></p> <p>8) WRMA has unclear practice and procedure for observing high water discharges.</p> <p>9) No manuals on discharge observation</p> <p>10) Only WRMA LVSC has done discharge observation.</p>	SRO, RO, HQ	<p><b>Improvements attributable to the Project</b></p> <ul style="list-style-type: none"> <li>■ 1) Partially Improved <ul style="list-style-type: none"> <li>➢ There is a monitoring schedule produced at the beginning of the Financial Year</li> </ul> </li> <li>■ 2) Partially improved <ul style="list-style-type: none"> <li>➢ Similar equipment supplied to the WRMA regions</li> <li>➢ There is coordination from the regional office</li> </ul> </li> <li>■ 3) Partially improved <ul style="list-style-type: none"> <li>➢ The 3 pilot regions now conduct regular observations of high discharges as per the monitoring schedule</li> </ul> </li> <li>■ 4) Partially improved <ul style="list-style-type: none"> <li>➢ All the 6 regions conduct regular high flow measurements</li> <li>➢ Two sub regions; Kiambu and Narok provided with high flow measurement equipment and conduct regular high flow measurements</li> </ul> </li> <li>■ 5) Partially improved <ul style="list-style-type: none"> <li>➢ There is a monitoring schedule produced at the beginning of the Financial Year</li> </ul> </li> <li>■ 6) Partially Improved <ul style="list-style-type: none"> <li>➢ A budget line in the financial year</li> </ul> </li> <li>■ 7) Partially improved <ul style="list-style-type: none"> <li>➢ Two sub regions have been equipped ( Kiambu and Narok)</li> </ul> </li> <li>■ 8) Partially improved <ul style="list-style-type: none"> <li>➢ There are documented instructions for high flow measurements</li> </ul> </li> <li>■ 9) Not improved <ul style="list-style-type: none"> <li>➢ No discharge observation manuals provided</li> </ul> </li> <li>■ 10) Very much improved</li> </ul>	<ul style="list-style-type: none"> <li>■ Purchase of high flow measurements equipment and training on the use(SRO)</li> <li>■ Develop the framework for high water discharge measurements</li> <li>■ Develop a manual for high water discharge measurements</li> <li>■ Adherence to the budget timelines</li> <li>■ Assess the effectiveness of the monitoring schedule</li> </ul>

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				<p>All regions have been provided with high flow measurement equipment and are doing the discharge measurements.</p> <p><b>Challenges remaining</b></p> <ul style="list-style-type: none"> <li>■ Inadequate equipment for high flow measurements</li> <li>■ Inadequate capacity</li> <li>■ Irregular disbursement of funds to facilitate the teams to carry out high flow measurements</li> <li>■ Inconsistent high flow measurements</li> <li>■ Lack of discharge observation manuals</li> <li>■ no framework for high water discharge measurements</li> </ul>	
	<p>2-5 Framework for developing and administering the flood disaster database in Kenya</p>	<p><b>Organization Framework:</b> 1) WRMA has not developed the flood disaster database in Kenya, although it recognizes the importance of the flood disaster database in Kenya.</p> <p><b>Standing Orders:</b> 2) nonexistent</p> <p><b>Budget Measures:</b> 3) N/A</p> <p><b>Equipment:</b> 4) available</p> <p><b>Supplementary Notes:</b> 5) JICA Consulting Team has offered a prototype of the flood disaster database in Kenya, which was made by disaster data compiled by an existing database "CRED". 6) WRMA has no manuals for developing databases.</p>	<p>SRO, RO, HQ</p>	<p><b>Improvements attributable to the Project</b></p> <ol style="list-style-type: none"> <li>1) Partially improved <ol style="list-style-type: none"> <li>a) A draft flood disaster database has been developed</li> </ol> </li> <li>2) Not improved</li> <li>3) N/A</li> <li>4) Partially improved <ol style="list-style-type: none"> <li>b) Equipment available</li> </ol> </li> <li>5) Not improved</li> <li>6) Not improved</li> </ol> <p><b>Challenges remaining</b></p> <ul style="list-style-type: none"> <li>■ Bullet 1: Lack of awareness of the importance of the flood disaster database in WRMA</li> <li>■ Bullet 2 Lack of procedure for collecting flood disaster data</li> <li>■ Bullet 5 Non adoption of prototype</li> <li>■ Bullet 6 No flood disaster database manual</li> </ul>	<ul style="list-style-type: none"> <li>■ Create awareness of the importance of the flood disaster database at all levels of WRMA</li> <li>■ Develop a procedure for collecting flood disaster data</li> <li>■ Review and adopt the prototype</li> <li>■ Develop a flood disaster database manual</li> </ul>
	<p>2-6 Framework for evaluating flood affected areas and flood damages</p>	<p><b>Organization Framework:</b> 1) WRMA has no evaluation framework on flood affected areas and flood damages.</p> <p><b>Standing Orders:</b> 2) nonexistent</p> <p><b>Budget Measures:</b> 3) N/A</p> <p><b>Equipment:</b> 4) nonexistent</p> <p><b>Supplementary Notes:</b> 5) Overlooking the data on flood affected areas and flood damages. 6) WRMA has not gained one of important tools for appealing flood management.</p>	<p>SRO, RO, HQ</p>	<p><b>Improvements attributable to the Project</b></p> <ol style="list-style-type: none"> <li>1) Partially improved <ol style="list-style-type: none"> <li>a) Flood disaster assessment has been incorporated in the WDC flood management module</li> <li>b) Submission of flood situation report quarterly reports</li> </ol> </li> <li>2) Partially improved <ol style="list-style-type: none"> <li>a) Documented instructions for submission of flood situation reports</li> </ol> </li> <li>3) Partially improved <ol style="list-style-type: none"> <li>a) Existence of budget on flood management</li> </ol> </li> <li>4) Partially improved <ol style="list-style-type: none"> <li>a) Procurement and disbursement of equipment including flood assessment eg GPS, Camera</li> </ol> </li> <li>5) Partially improved <ol style="list-style-type: none"> <li>a) Flood management is now WRMA's mandate</li> <li>b) Flood situation reports prepared</li> </ol> </li> <li>6) Partially improved <ol style="list-style-type: none"> <li>a) Flood management is now a WRMA mandate</li> <li>b) Flood damage data guidelines included in the WDC Manual</li> <li>c) Development of flood hazard maps</li> </ol> </li> </ol> <p><b>Challenges remaining</b></p> <ul style="list-style-type: none"> <li>■ Bullet 1&amp;6 Not all WRMA staffs are conversant with the revised WDC manual</li> <li>■ Bullet 1 Lack of clear evaluation framework of flood affected area</li> </ul>	<ul style="list-style-type: none"> <li>■ Rollout the revised WDC manual</li> <li>■ Procure equipment for flood survey</li> <li>■ Build capacity in evaluation framework on flood affected areas and flood damages</li> <li>■ Develop evaluation framework on flood affected areas and flood damages</li> </ul>

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				<ul style="list-style-type: none"> <li>and damage</li> <li>▪ Bullet 5&amp;6 inadequate capacity in evaluation of flood affected areas and damages</li> <li>▪ Bullet 4 Inadequate equipment for flood survey</li> </ul>	
[Institutional aspects]					
	2-7 Legal systems for assisting high water discharge observation	1) WRMA has no legal stipulation for making compulsory at high water discharge observation. <u>Supplementary Notes:</u> 2) Legal system should be set after the revised bill is passed. 3) The water bill doesn't mention about it, but the draft of the water bill mentions about it.	SRO, RO, HQ	<b>Improvements attributable to the Project</b> 1) No improvement 2) No improvement a. The bill has not been passed 3) No improvement a. The bill has not been passed <b>Challenges remaining</b> ▪ Water bill has not been discussed	<ul style="list-style-type: none"> <li>▪ Review of water resources management rules after passing of water bill</li> </ul>
	2-8 Legal systems for assisting to evaluate flood affected areas and flood damages	1) WRMA has no legal stipulation for making compulsory at evaluation of flood affected areas and flood damages, although since 2009 CRC has been collected disaster data, such as affected areas and damages by floods. <u>Supplementary Notes:</u> 2) Legal system should be set after the revised water bill is passed.	SRO, RO, HQ	<b>Improvements attributable to the Project</b> 1) No improvement 2) No improvement a. The bill has not been passed <b>Challenges remaining</b> ▪ Water bill has not been discussed	<ul style="list-style-type: none"> <li>▪ Review of water resources management rules after passing of water bill</li> </ul>
	2-9 Legal systems for assisting to develop and manage the flood disaster database in Kenya	1) WRMA has no legal stipulation for making compulsory at the flood disaster database in Kenya. <u>Supplementary Notes:</u> 2) Legal system should be set after the revised water bill is passed.	SRO, RO, HQ	<b>Improvements attributable to the Project</b> 1) No improvement 2) No improvement a. The bill has not been passed <b>Challenges remaining</b> ▪ Water bill has not been discussed	<ul style="list-style-type: none"> <li>▪ Review of water resources management rules after passing of water bill</li> </ul>

WRMA Capacity to be Developed	Required Capacity Element	Pre-Project Assessment (29 <sup>th</sup> to 30 <sup>th</sup> Nov. 2012)	Target Group	Post-Project Assessment (4 <sup>th</sup> to 5 <sup>th</sup> June 2014)	Actions
3. To Coordinate Relevant Stakeholders for Better Flood Management in Communities	[Personal aspects]				
	3-1 Basic knowledge on monitoring of rainfalls and water levels, and Early Warning System	<p><b>Skills and expertise:</b></p> <ol style="list-style-type: none"> <li>1) Both systems of monitoring of rainfalls and water levels, and Early Warning Systems have not been implemented.</li> <li>2) However, WRMA staffs have basic understanding on these systems.</li> </ol> <p><b>Incentive:</b></p> <ol style="list-style-type: none"> <li>3) no incentive scheme</li> </ol> <p><b>Supplementary Notes:</b></p> <ol style="list-style-type: none"> <li>4) There are no reference materials available to WRMA staffs.</li> </ol>	SRO, RO, HQ	<p><b>Improvements attributable to the Project</b></p> <ol style="list-style-type: none"> <li>1) Partially improved               <ol style="list-style-type: none"> <li>a) Community based early warning systems in Pilot Project areas are operational</li> <li>b) Network for information sharing is in place in the Pilot areas</li> </ol> </li> <li>2) Much improved               <ol style="list-style-type: none"> <li>a) Trainings on manufacture and installation of FEWS</li> <li>b) Some number of FEWS have been manufactured, installed and stored</li> </ol> </li> <li>3) Partially improved</li> <li>4) Partially improved               <ol style="list-style-type: none"> <li>a) Manuals developed</li> </ol> </li> </ol> <p><b>Challenges remaining</b></p> <ul style="list-style-type: none"> <li>■ Cost of maintaining the system in terms of power requirements and telephone</li> <li>■ Bullet 3 to get a sustainable incentive scheme</li> </ul>	<ul style="list-style-type: none"> <li>■ Installation solar powered systems</li> <li>■ Upscale FEWS in other identified areas within the pilot project sites</li> <li>■ Replicate to other flood prone areas</li> <li>■ Train more staff from other flood prone areas on manufacture and installation of FEWS</li> <li>■ Develop and implement an incentive scheme ( non monetary)</li> <li>■ Improve on the developed manuals</li> </ul>
3-2 Basic knowledge on Hazard Mapping	<p><b>Skills and expertise:</b></p> <ol style="list-style-type: none"> <li>1) Hazard Maps are not very common but WRMA staffs understand their importance in flood management.</li> <li>2) There are few occasions to experience making of Hazard Maps.</li> <li>3) WRMA staffs have experience to make community flood Hazard Map with JICA Project team.</li> </ol> <p><b>Incentive:</b></p> <ol style="list-style-type: none"> <li>4) no incentive scheme</li> </ol> <p><b>Supplementary Notes:</b></p> <ol style="list-style-type: none"> <li>5) There are few chances of receiving trainings on Hazard Maps.</li> <li>6) There are no reference materials available to WRMA staffs.</li> </ol>	SRO, RO, HQ		<p><b>Improvements attributable to the Project</b></p> <ol style="list-style-type: none"> <li>1) Partially improved               <ol style="list-style-type: none"> <li>a) Flood hazard maps developed for the three Pilot project areas</li> <li>b) Trainings of WRMA staff</li> </ol> </li> <li>2) Partially improved               <ol style="list-style-type: none"> <li>a) Staff in pilot areas participated in development of more flood hazard maps</li> </ol> </li> <li>3) As above</li> <li>4) Job description for FMOs</li> <li>5) Much improved               <ol style="list-style-type: none"> <li>a) ToTs has been undertaken hence there is internal capacity</li> </ol> </li> <li>6) Very much improved               <ol style="list-style-type: none"> <li>a) Manuals have been developed and are in use</li> </ol> </li> </ol> <p><b>Challenges remaining</b></p> <ul style="list-style-type: none"> <li>■</li> </ul>	<ul style="list-style-type: none"> <li>■ Develop hazard maps for all flood prone areas</li> <li>■ Enhance capacity of WRMA staff in Flood hazard map development</li> <li>■</li> </ul>
[Organizational aspects] (Human, physical, financial, knowledge, etc.)					
3-3 Methodologies and organizers for community-based flood responses (monitoring of rainfalls, water levels, flood damages, etc.)	<p><b>Organization Framework:</b></p> <ol style="list-style-type: none"> <li>1) WRMA is well aware of the importance of monitoring systems of water levels and flood damages, and Early Warning Systems and has an agreement on her intention to establish such systems in the near future.</li> </ol> <p><b>Standing Instructions:</b></p> <ol style="list-style-type: none"> <li>2) onexistent</li> </ol> <p><b>Budget Measures:</b></p>	SRO, RO, HQ	<p><b>Improvements attributable to the Project</b></p> <ol style="list-style-type: none"> <li>1) Partially improved               <ol style="list-style-type: none"> <li>a) WRMA with the community has established and operationalized FEWS in the three pilot areas</li> </ol> </li> <li>2) 2-5 as above</li> </ol> <p><b>Challenges remaining</b></p> <ul style="list-style-type: none"> <li>■</li> </ul>	<ul style="list-style-type: none"> <li>■ Upscale to other areas</li> </ul>	

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	<p>3-4 Methodologies and organizers for preparing and utilizing Hazard Maps</p>	<p>3) N/A  <b>Equipment:</b>  4) N/A  <b>Supplementary Notes:</b>  5) No technical reference materials available to WRMA staffs.  <b>Organization Framework:</b>  1) WRMA has developed water resource maps, but they don't have experience, methodologies and organizations to draw flood Hazard Maps.  <b>Standing Orders:</b>  2) nonexistent  <b>Budget Measures:</b>  3) N/A  <b>Equipment:</b>  4) There are no topographic maps and GIS software available.  <b>Supplementary Notes:</b>  5) Some WRUAs are trying to make Hazard Maps on their own.  6) JICA Project team is preparing prototype base maps using GIS.  7) There is no technical standard available for mapping.</p>	SRO, RO, HQ	<p><b>Improvements attributable to the Project</b></p> <p>1) Partially improved  a) Manuals in place  b) Trained staff and WRUA members</p> <p>2) 2-3 as above</p> <p>4) Partially improved  a) Topo sheets procured for the Pilot areas</p> <p>5) Partial improved  a) WRUA members and WRMA staff have together developed Flood Hazard maps for the pilot areas</p> <p>7) Partially improved  a) Base maps for pilot areas to form the technical standard for mapping</p> <p><b>Challenges remaining</b></p> <ul style="list-style-type: none"> <li>■ Few number of staff and WRUA members have been trained</li> </ul>	<ul style="list-style-type: none"> <li>■ Acquire topo sheets for other flood prone areas</li> <li>■ Enhance skills in WRUAs and WRMA staff to develop Flood hazard maps in other flood prone areas</li> <li>■ WRMA to develop base map for other Flood prone areas</li> <li>■ Review and adopt the standards in the base maps</li> </ul>
	<p>[Institutional aspects]</p> <p>3-5  Legal systems for collecting and disseminating information of communities' flood responses (monitoring of rainfalls, water levels and flood damages)</p>	<p>1) WRMA has no legal stipulation for collecting and disseminating information of community-based flood responses, in particular, flood-related information.</p>	SRO, RO, HQ	<p><b>Improvements attributable to the Project</b></p> <p>1) Partially improved  a) Flood management is WRMA mandate</p> <p><b>Challenges remaining</b></p> <ul style="list-style-type: none"> <li>■ Pending water bill</li> </ul>	<ul style="list-style-type: none"> <li>■ Full operationalization of flood management functions at all WRMA 1 levels</li> </ul>

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4. To Advise WRUAs Technically to Formulate SCMPs	[Personal aspects]				
	4-1 Basic knowledge on technical advices to community-based flood responses (evacuation, flood fighting, etc.)	<p><b>Skills and expertise:</b></p> <p>1) WRMA's current knowledge and skills on community-based flood responses (evacuation, flood fighting, etc.) is not very high.</p> <p>2) It is difficult for WRMA staffs to technically advise communities on their flood responses.</p> <p><b>Incentive:</b></p> <p>3) no incentive scheme</p> <p><b>Supplementary Notes:</b></p> <p>4) There are no technical reference materials available to WRMA staffs.</p>	SRO, RO, HQ	<p><b>Improvements attributable to the Project</b></p> <p>1) Very much improved:</p> <p>a) Capacity skills on community-based flood responses (evacuation, flood fighting, etc.) has been built for WRMA staff at all levels</p> <p>2) Very much improved:</p> <p>a) Training materials on community based flood management have been developed (eg evacuation drill guidebook and community flood hazard map development manual)</p> <p>b) Trained WRMA staff have participated in the training of WRUA (WRMA staff executed community driven flood hazard mapping and evacuation drill)</p> <p>3) Very much improved:</p> <p>a. Flood management is a mandate of WRMA</p> <p>b. Developed IFMP</p> <p>c. Inclusion of Flood management module in the revised CMS</p> <p>d. Incorporation of flood management module into the WDC manual</p> <p>e. Establishment of the IFMC</p> <p>f. WRMA staff working with the communities</p> <p>4) Very much improved:</p> <p>a) Development of various flood management manuals</p> <p>b) Revised WDC Manual</p> <p><b>Challenges remaining</b></p> <ul style="list-style-type: none"> <li>■ Few number of staff have been trained</li> <li>■ Lack of flood management chapter in the existing SCMPs</li> </ul>	<ul style="list-style-type: none"> <li>■ Capacity building of more WRMA staff on community-based flood responses (evacuation, flood fighting, etc.)</li> <li>■ Review the existing SCMPs with the aim of including flood management chapter</li> </ul>
4-2 Basic knowledge on technical advices for flood control works (structural measures against floods)	<p><b>Skills and expertise:</b></p> <p>1) WRMA staffs' current knowledge and skills on flood control works (structural measures) are limited.</p> <p>2) It is difficult for WRMA staffs to technically advise communities on their efforts to design, implement and manage flood control works.</p> <p><b>Incentive:</b></p> <p>3) no incentive scheme</p> <p><b>Supplementary Notes:</b></p> <p>4) There are no technical reference materials available to WRMA staffs.</p>	SRO, RO, HQ		<p><b>Improvements attributable to the Project</b></p> <p>1) Partially improved:</p> <p>a. Some WRMA staffs have been trained on flood countermeasures (structural measures)</p> <p>2) Partially improved:</p> <p>a. There are technical materials that WRMA staffs can use to technically advise communities on their efforts to design, implement and manage flood control works</p> <p>3) Very much improved</p> <p>a. Flood management is a mandate of WRMA</p> <p>b. Developed IFMP</p> <p>c. Inclusion of Flood management module in the revised CMS</p> <p>d. Incorporation of flood management module into the WDC manual</p> <p>e. WRMA staff working with the communities</p> <p>4) Very much improved</p> <p>a) There are technical reference material for flood control works available</p> <p><b>Challenges remaining</b></p> <ul style="list-style-type: none"> <li>■ Few number of staff have been trained</li> <li>■ Inadequate awareness and access to technical reference materials</li> </ul>	<ul style="list-style-type: none"> <li>■ Capacity building of more WRMA staff on flood countermeasures (structural measures)</li> <li>■ Create awareness and disseminate technical reference materials for flood control works</li> </ul>



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	4-3 Basic knowledge on technical advices to community level education for disaster prevention	<p><b>Skills and expertise:</b></p> <ol style="list-style-type: none"> <li>WRMA staffs' current knowledge and skills on community level education for disaster prevention are not prioritized.</li> <li>It is difficult for WRMA staffs to technically advise communities on their efforts to educate community members.</li> </ol> <p><b>Incentive:</b></p> <ol style="list-style-type: none"> <li>no incentive scheme</li> </ol> <p><b>Supplementary Notes:</b></p> <ol style="list-style-type: none"> <li>There are no technical reference materials available to WRMA staffs.</li> </ol>	SRO, RO, HQ	<p>for flood control works</p> <p><b>Improvements attributable to the Project</b></p> <ol style="list-style-type: none"> <li>Very much improved: <ol style="list-style-type: none"> <li>Flood management is a mandate of WRMA</li> <li>Developed IFMP</li> <li>Inclusion of Flood management module in the revised CMS</li> <li>Incorporation of flood management module into the WDC manual</li> <li>Establishment of the IFMC</li> <li>WRMA staff working with the communities</li> </ol> </li> <li>Very much improved <ol style="list-style-type: none"> <li>WRMA staff have been trained and can technically advise the community on flood management</li> </ol> </li> <li>Very much improved <ol style="list-style-type: none"> <li>The revised WDC manual</li> <li>Deployment of flood management officers</li> </ol> </li> <li>Very much improved <ol style="list-style-type: none"> <li>There are technical reference material for flood disaster education are available</li> </ol> </li> </ol> <p><b>Challenges remaining</b></p> <ul style="list-style-type: none"> <li>Language barrier</li> <li>Gender disparities</li> </ul>	<ul style="list-style-type: none"> <li>Collaborate with the local communities to interpret</li> <li>Community sensitization on active participation for all community members in flood management</li> </ul>
	4-4 Basic knowledge on technical advices to obtain funds for community-based activities	<p><b>Skills and expertise:</b></p> <ol style="list-style-type: none"> <li>WRMA staffs' current knowledge and skills on obtaining funds on flood management issue like WDC are not very high.</li> <li>It is difficult for WRMA staffs to technically advise communities on their efforts to apply for funds.</li> </ol> <p><b>Incentive:</b></p> <ol style="list-style-type: none"> <li>no incentive scheme</li> </ol> <p><b>Supplementary Notes:</b></p> <ol style="list-style-type: none"> <li>There are no technical reference materials available to WRMA staffs.</li> </ol>	SRO, RO, HQ	<p><b>Improvements attributable to the Project</b></p> <ol style="list-style-type: none"> <li>Very much improved: <ol style="list-style-type: none"> <li>Flood management activities are now eligible for WDC funding</li> </ol> </li> <li>Very much improved <ol style="list-style-type: none"> <li>There is a funding procedure</li> </ol> </li> <li>Not applicable</li> <li>Very much improved <ol style="list-style-type: none"> <li>There is funding procedure</li> </ol> </li> </ol> <p><b>Challenges remaining</b></p> <ul style="list-style-type: none"> <li>Limited number of sources of finances</li> </ul>	<ul style="list-style-type: none"> <li>Explore other additional sources of funding</li> </ul>
[Organizational aspects] (Human, physical, financial, knowledge, etc.)					
4-5 To establish methods and organizations to technically support WRUAs in their preparing SCMPs		<p><b>Organization Framework:</b></p> <ol style="list-style-type: none"> <li>WRMA staffs are currently not providing adequate technical support on flood management issues to WRUAs in their preparation of SCMPs.</li> </ol> <p><b>Standing Orders:</b></p> <ol style="list-style-type: none"> <li>nonexistent</li> </ol> <p><b>Budget Measures:</b></p> <ol style="list-style-type: none"> <li>N/A</li> </ol> <p><b>Equipment:</b></p> <ol style="list-style-type: none"> <li>N/A</li> </ol> <p><b>Supplementary Notes:</b></p>	SRO, RO, HQ	<p><b>Improvements attributable to the Project</b></p> <ol style="list-style-type: none"> <li>Partially improved: <ol style="list-style-type: none"> <li>Flood Management has been incorporated in the WDC manual(the flood management chapter is yet to be incorporated in the existing SCMPs)</li> </ol> </li> <li>Very much improved: <ol style="list-style-type: none"> <li>There is a WDC manual that has flood management training module</li> </ol> </li> <li>N/A</li> <li>N/A</li> <li>Very much improved</li> </ol>	<ul style="list-style-type: none"> <li></li> </ul>

WRMA Capacity to be Developed	Required Capacity Element	Pre-Project Assessment ( 29 <sup>th</sup> to 30 <sup>th</sup> Nov. 2012 )	Target Group	Post-Project Assessment (4 <sup>th</sup> to 5 <sup>th</sup> June 2014)	Actions
	4-6 To establish methods and organizations to technically support WRUAs in their applying for funds	5) There is no technical standard or materials in WRMA for providing technical advices to WRUAs. <b>Organization Framework:</b> 1) WRMA staffs are currently not providing adequate technical support to WRUAs under their application for funds. 2) WRMA is technically appraising the applications of WRUAs for funds. <b>Standing Orders:</b> 3) nonexistent <b>Budget Measures:</b> 4) N/A <b>Equipment:</b> 5) N/A <b>Supplementary Notes:</b> 6) There is no technical standard in WRMA for providing technical advices to WRUAs.	SRO, RO, HQ	a) There is the WDC manual <b>Challenges remaining</b> <b>Improvements attributable to the Project</b> 1) Partially improved a) Flood Management module included in the WDC manual  2) Not applicable 3) Very much improved a) Flood management module included in the WDC manual 4) N/A 5) N/A 6) Very much improved a) Flood management module included in the WDC manual <b>Challenges remaining</b> ■	■
[Institutional aspects]					
	4-7 Legal systems for technical support to WRUAs under their preparing SCMPs	1) WRMA has a mandate to provide technical support to WRUAs under their preparing SCMPs.	-	<b>Improvements attributable to the Project</b> 1) Very much improved a) Inclusion of Flood management training module in the WDC manual <b>Challenges remaining</b> ■	

WRMA Capacity to be Developed	Required Capacity Element	Pre-Project Assessment (29 <sup>th</sup> to 30 <sup>th</sup> Nov. 2012)	Target Group	Post-Project Assessment (4 <sup>th</sup> to 5 <sup>th</sup> June 2014)	Actions
5. To Formulate and Update Training Manuals on Flood Management and Conduct Training Seminars to HQ/RO/SRO Staffs of WRMA	[Personal aspects]				
	—	—			
	[Organizational aspects] (Human, physical, financial, knowledge, etc.)				
	5-1 To design WRMA's own technical development system	<p><b>Organization Framework:</b> 1) WRMA has not established her organization to design her own technical development system.</p> <p><b>Standing Orders:</b> 2) nonexistent</p> <p><b>Budget Measures:</b> 3) N/A</p> <p><b>Equipment:</b> 4) N/A</p> <p><b>Supplementary Notes:</b></p>	SRO, RO, HQ	<p><b>Improvements attributable to the Project</b></p> <p>1) Partially improved</p> <p>a) ToTs have been trained</p> <p>b) Training plan under implementation, 1<sup>st</sup> and 2<sup>nd</sup> stages have been implemented. The 3<sup>rd</sup> stage is under implementation</p> <p>2) Partially improved</p> <p>a) Training plan in place</p> <p><b>Challenges remaining</b></p> <ul style="list-style-type: none"> <li>■ Re-deployment of trained staff</li> <li>■ No clear job description resulting to overlaps and conflicts</li> </ul>	<ul style="list-style-type: none"> <li>■ Continuous training of the ToTs and FMOs</li> <li>■ Staff follow up assessment after training</li> </ul>
	5-2 To prepare WRMA's technical reference materials	<p><b>Organization Framework:</b> 1) WRMA has not prepared technical reference materials for her technical development system.</p> <p><b>Standing Orders:</b> 2) nonexistent</p> <p><b>Budget Measures:</b> 3) N/A</p> <p><b>Equipment:</b> 4) N/A</p> <p><b>Supplementary Notes:</b> 5) There is no technical standard available to WRMA staffs.</p>	SRO, RO, HQ	<p><b>Improvements attributable to the Project</b></p> <p>1) Partially improved</p> <p>a) Certain manuals have been developed and in process of finalization and publication (Manuals: High Flow measurements, Construction and maintenance of Flood management structures, manufacturing and installations of FEWS, monitoring of staff gauges, non- structural measures e.t.c)</p> <p>2) Partially improved</p> <p>a) Catalogues of manuals and training materials distributed during training</p> <p>5) Partially improved</p> <p>a) There is a technical standard material to be discussed for improvement by WRMA</p> <p><b>Challenges remaining</b></p>	<ul style="list-style-type: none"> <li>■ Publish and disseminate manuals</li> <li>■ Continual improvement of manuals</li> <li>■ Distribution of available manuals and training materials</li> <li>■ Initiate discussion towards development of technical standards for flood management</li> </ul>
5-3 To raise lecturers for the WRMA technical training courses at the 2 <sup>nd</sup> stage in Kenya	<p><b>Organization Framework:</b> 1) WRMA has not established a module to raise lecturers for her own technical development system.</p> <p><b>Standing Orders:</b> 2) nonexistent</p> <p><b>Budget Measures:</b> 3) N/A</p> <p><b>Equipment:</b> 4) N/A</p> <p><b>Supplementary Notes:</b></p>	SRO, RO, HQ	<p><b>Improvements attributable to the Project</b></p> <p>1) Very much improved</p> <p>a) ToTs have been trained and have undertaken training in the 2<sup>nd</sup> and 3<sup>rd</sup> stages</p> <p>2) Partially improved</p> <p>a) The approach of using ToTs has been established</p> <p><b>Challenges remaining</b></p>	<ul style="list-style-type: none"> <li>■ Set a clear frame work to guide future operation</li> </ul>	
5-4 To operationalize the WRMA technical training courses at the 2 <sup>nd</sup> stage in Kenya	<p><b>Organization Framework:</b> 1) WRMA is not currently operating technical development system.</p> <p><b>Standing Orders:</b> 2) nonexistent</p> <p><b>Budget Measures:</b> 3) N/A</p> <p><b>Equipment:</b></p>	SRO, RO, HQ	<p><b>Improvements attributable to the Project</b></p> <p>1) Very much improved</p> <p>a) Stage 1 and 2 completed, stage 3 ongoing</p> <p>b) Other trainings like IFAS have been conducted</p> <p>5) Not improved</p> <p>a) No guidelines or standards formulated</p> <p><b>Challenges remaining</b></p>	<ul style="list-style-type: none"> <li>■ Develop guidelines/ standards for operation of technical development system</li> </ul>	

WRMA Capacity to be Developed	Required Capacity Element	Pre-Project Assessment ( 29 <sup>th</sup> to 30 <sup>th</sup> Nov. 2012 )	Target Group	Post-Project Assessment (4 <sup>th</sup> to 5 <sup>th</sup> June 2014)	Actions
		4) N/A <b>Supplementary Notes:</b> 5) There is no standard for operation of the technical development system.		<ul style="list-style-type: none"> <li>■</li> </ul>	
[Institutional aspects]					
	5-5 Legal systems for the WRMA technical training courses at the 2 <sup>nd</sup> stage in Kenya	1) WRMA has no legal stipulation for establishing her own technical development system at this moment, but it will be incorporated with the draft water bill.	SRO, RO, HQ	<b>Improvements attributable to the Project</b> Very much improved; a) The use of ToTs has been implemented in the 2 <sup>nd</sup> stage training <b>Challenges remaining</b> <ul style="list-style-type: none"> <li>■ WRMA technical development should not be legal issue, it should be formalized internally.</li> </ul>	<ul style="list-style-type: none"> <li>■ To include training on flood management in the training policy and plan</li> </ul>

WRMA Capacity to be Developed	Required Capacity Element	Pre-Project Assessment (29 <sup>th</sup> to 30 <sup>th</sup> Nov. 2012)	Target Group	Post-Project Assessment (4 <sup>th</sup> to 5 <sup>th</sup> June 2014)	Actions
6. To Introduce a Concept of "River Basin Flood Management Plan (RBFMP)", which should be Set between the CMS and the SCMPs					
[Personal aspects]					
	6-1 Basic knowledge on Integrated Flood Management (IFM)	<p><b>Skills and expertise:</b> 1) WRMA staffs understand the necessity of IFM, but do not have acquired specific experiences to implement IFM and knowledge required.</p> <p><b>Incentive:</b> 2) N/A</p> <p><b>Supplementary Notes:</b> 3) There is no technical reference material available to WRMA staffs.</p>	SRO, RO, HQ	<p><b>Improvements attributable to the Project</b></p> <p>1) Very much improved:</p> <ul style="list-style-type: none"> <li>➢ Experience gained through the preparation of 3 No Draft IFMPs and implementation of pilot projects</li> <li>➢ Trainings carried out on IFM</li> <li>➢ The revision of CMSs includes IFM</li> </ul> <p>3) Very much improved</p> <p>a) Reference document such manuals and training materials are available</p> <p><b>Challenges remaining</b></p> <ul style="list-style-type: none"> <li>■</li> </ul>	<ul style="list-style-type: none"> <li>■ Finalization of IFMPs</li> <li>■ Revision of SCMPs to incorporate the IFM</li> <li>■ Up scaling the development of the IFMP to other flood prone areas.</li> </ul>
[Organizational aspects] (Human, physical, financial, knowledge, etc.)					
	6-2 To establish methods and organizations for making River Basin Flood Management Plans (RBFMPs)	<p><b>Organization Framework:</b> 1) WRMA understands the necessity of RBFMP but has not established organization to prepare RBFMPs.</p> <p><b>Standing Orders:</b> 2) nonexistent</p> <p><b>Budget Measures:</b> 3) N/A</p> <p><b>Equipment:</b> 4) N/A</p> <p><b>Supplementary Notes:</b> 5) There is no technical standard available to WRMA staffs.</p>	SRO, RO, HQ	<p><b>Improvements attributable to the Project</b></p> <p>1) Very much improved</p> <p>a) Flood management unit in HQ, RO and SROs</p> <p>b) IFMC operational in the pilot project areas</p> <p>2) Partially improved</p> <p>a) The process is ongoing but there is need for documentation</p> <p><b>Challenges remaining</b></p> <ul style="list-style-type: none"> <li>■ Trans-boundary issues in terms of participation in IFMCs and access to information/data.</li> <li>■ Comprehensive mapping of flood prone areas has not been done</li> </ul>	<ul style="list-style-type: none"> <li>■ Map and document all the flood prone areas that require IFMP</li> <li>■ Replicating the IFMP in the mapped out flood prone areas</li> <li>■ Implement the relevant aspect of Kenya-Tanzania MoU on Trans boundary Water Resources Management.</li> <li>■ Lobby the Ministry of EWRN for negotiation of MOUs on Trans boundary flood management</li> <li>■ Preparation of manuals/guidelines for preparation of IFMPs</li> </ul>
[Institutional aspects]					
	6-3 Legal systems for River Basin Flood Management Plans (RBFMPs)	<p>1) Each WRUA is mandated to prepare the SCMP for her sub-catchment, and WRMA prepare CMSs.</p> <p>2) A RBFMP is a concept newly proposed in the Project and there is no legal provision to prepare RBFMPs.</p>	SRO, RO, HQ	<p><b>Improvements attributable to the Project</b></p> <p>2) Partially improved</p> <p>a) Flood management is part of Water Resources Management functions</p> <p><b>Challenges remaining</b></p> <ul style="list-style-type: none"> <li>■</li> </ul>	<ul style="list-style-type: none"> <li>■ The revision of the WRM rules to mainstream RBFMP</li> </ul>

## **Appendix 2-1**

### **WRMA Flood damage data base**

# Water-Related Disaster Data in Kenya (1964 – 2011)

Source-1: CRED (Centre for Research on the Epidemiology of Disaster, Univ. Catholique de Louvain, Belgium)

Source-2: Flood Observatory of Univ. of Colorado

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Register No.		Start	End	Type	Location	River	Dead	Total Affected Residents	Affected Area (km <sup>2</sup> )	Estimated Damage (US\$ Million)	Other Nations Affected
CRED	Univ. of Colorado										
2010-9082		00/01/2010	00/00/2011	Drought	Marsabit District, Isiolo District, Moyale District			3,754,585			
	3646	08/05/2010	24/05/2010	Flood	Western Kenya, Amoni, Osuret, Asing'e, Among'ura, Kamolo and Osajai, Salabani location, Marigat District in Rift valley province		100	70,000	196,100		
2010-0285					(Western Kenya, Amoni location (Teso District))						
2010-0186		30/04/2010	30/04/2010	Landslide	Kitony village (Marakwet District)		10				
	3621	07/03/2010	03/05/2010	Flood	Marsabit North, Migori, and Urin Districts in South Nyanza, Mandera: North Rift, Pokot Central District		26	2,500	40,320		
2010-0094		01/03/2010	14/05/2010	Flood	Marsabit District, Turkana District, Moyale District		94	141,164			
	3589	21/12/2009	13/01/2010	Flood	Turkana East, Rarienda, Nairobi, Kajiado North, Narok, Rachuonyo, East Pokot, Mogotio, North Rift (Turkana East District, East and West Pokot Districts, Kenya-Ethiopia-Sudan roads cut.		21	30,000	176,700		
2009-0597		24/12/2009	12/01/2010		Nairobi province, Lake Turkana		40	91,350			
	3557	20/10/2009	28/10/2009	Flood	Tana Delta and Tana River, between Malindi and Garsen			2,000	197,700		Somalia Ethiopia
2009-0494		29/10/2009	04/11/2009	Flood	Mandera District, North eastern province		16	44,850			
2008-9302		00/07/2008	00/00/2009	Drought	Sacho township (Baringo District), Marigat District, Mukutani (East Pokot District)		4	3,800,000			
	3402	10/11/2008	12/11/2008	Flood	Western Kenya, Nzoia River			28,000	37,960		Uganda
2008-0513		08/11/2008	08/11/2008	Landslide	Chepkogoh village (Pokot District)		10	20			
2008-0483		10/11/2008	25/11/2008	Flood	Budalangi constituency (Busia District)		17	30,770			
2008-0483		04/10/2008	07/10/2008	Flood	Katilu location (Turkana District)		17	6,310			
	3394	14/10/2008	16/10/2008	Flood			3	10,000	45,130		Somalia
2008-0482				Flash flood	Mandera District			6,000			
	3321	13/06/2008	20/06/2008	Flood	Tana Delta District		16	8,658	40,030		
2008-0260											
	3294	20/04/2008	22/04/2008	Flood	Homa Bay-Asego Division-Wahambla and Got Kokech villages	River Rangwena		2,000	240		

Register No.		Start	End	Type	Location	River	Dead	Total Affected Residents	Affected Area (km <sup>2</sup> )	Estimated Damage (US\$ Million)	Other Nations Affected
CRED	Univ. of Colorado										
	3291	28/03/2008	02/04/2008	Flood	Nyanza province–Lower Nyakach Division–Rang’ui, North Nyakach, Pap Onditi and Asalo. Nyando District. Kasai, Kisumu’s Nyalenda slums	Nyando and Awach , Auji and Kibos	3	160	3,970		
2008–0129		20/03/2008			Chalbi District, Rachuonyo District		2	10,000			
	3290	17/03/2008	05/04/2008	Flood	Kenya–Coast province: Taita and Taveta Districts–Kimorigo, Eldoro and Marodo, Kimorigo, Mbogoni and Mahoo, Voi, Tanzania and Bondeni. Tanzania–Manyara region–Mimerani area Arusha	Voi, Lumi, Ruvu tributaries, Lake Jipe tributaries	1	9,600	50,220		Tanzania
2008–0127					Taita taveta District			700			
	3288	20/03/2008	02/04/2008	Flood	Rift valley province, Chalbi District, North Horr Constituency–Bubisa village, Mubisa area, Marsabit District, Meru Central District, Rachuonyo District–Naivasha area–Kodhoch, West Karachuonyo, Koyugi, Kawadhgone Nyongo and Wagwe, Onyege		2	10,000	21,280		
2007–0613		12/12/2007	15/12/2007	Flood	Taita taveta District		4	2,000	6,200		
	3240				Taita Taveta District, Voi, Wundanyi Division, Mwatate						
	3235	21/11/2007	16/12/2007	Flood	Tana River District–Garsen Division, Hweani , Mnazini, Bahati, Bura, Wenje, Garsen, Boji, Ozi and Kau, Tana Delta, Iskadeck	Tana	4	6,000	6,100		
2007–0408		15/08/2007	31/10/2007	Flood	Budalangi constituency (Busia District)		13	40,000			
2007–0356		10/08/2007	13/08/2007	Landslide	Kuvasali village (Lugari District)		20	6			
	3078	15/05/2007	14/06/2007	Flood	Coast province–Districts: Mombasa (Likoni, Kadongo, Moroto, Junda, Kadzonzo, Mushomoroni, Kisauni, Changamwe), Malindi, Kwale, Kilifi( Kikambala), Lamu (Witu, Mpeketoni, Soroko, Bomani), Kaloleni, Tana River District	Mwakuhenga, Mkuru	5	8,500	13,870		
2007–0177			11/06/2007		Mombasa District, Malindi District, Kwale District		2	651			
	3059	21/04/2007	30/04/2007	Flood	Busia District–Budalangi, Bwalwanga, Mukhunda, Sitiri	Nzoia	0	2,460	1,100		



Register No.		Sart	End	Type	Location	River	Dead	Total Affected Residents	Affected Area (km <sup>2</sup> )	Estimated Damage (US\$ Million)	Other Nations Affected	
CRED	Univ. of Colorado											
	2979	23/10/2006	04/01/2007	Flood	Kenya–Coast, North– Eastern, Western and Rift valley provinces–Isiolo (Ngamara, Malkagala, Merti, Gafarsa ). Garissa (Hagadera, Achantabak, Alikune, Janirot, Amuma, Boralgi, Dadaab Ifo), Tana River District (Bula Bahati, Mnazini, Witu, Hola through Wenje to Garsen).Mandera (El Wak) , Wajir (Guarar, Dajabula, Kursin ). Kilifi, Mombasa, Kwale, Lodwar, Moyale (Bori), Ijara, Merti division, Machakos, Modogashe, Mwingi, Nakuru, Nyando, Kisumu (Kajulu, Migori, Nyando) , Busia, (Budalangi, Maduma, South Bunyala). Lugari, Keiyo (Epke). Malindi, Kisumu, Nyanza area –South Somalia–Gedo region –Beledhawo, Garbaharey, Luq(Luuq), Barhere (Bardere), Jubba provinces–Kamsuma, Mugamba, Jilib, Buale, Jamame, Doble, Afmadow and Marere –Tanzania–Shinyanga area, Mwanza area, Magu District, Nyakaboja, Nyamikoma, Lugeye, Shimanilwe and Kabita. Kigoma region. Tabora (Uyui) –Uganda–	Kenya– Ewaso Nyiro,Uaso Nyiro. Tana river and tributaries, Ramisi, Lak Dera, Lak Bor,Lagahar, Ndarugu, Sosiani, Ramisi, Nzoia, Ongoche, Kuja, Migori, Ongoche, Nyamasaria, Sabaki, Awach, Ragana Somalia– Jubba river, Lach Dera, Lach Bissigh – Tanzania– Wembere, Mwanza –Uganda–River	150	700,000	950,000			Somalia Tanzania Uganda
2006–0624		23/10/2006	19/12/2006	Flood	Dadaab District, Kwale District, Garissa District		114	723,000				
	2976	15/10/2006	26/10/2006	Flood	Coast province–Kilifi and Kwale Districts–Kaloleni, Mazeras, Ramisi, Kisauni Division, Mombasa District, Mishomoroni, Kiembeni, Malindi	Kombeni, Kilindini	6	2,000	12,730			
	2837	04/04/2006	22/05/2006	Flood	Districts–Malindi, Kilifi, Kwale,Nyando, Homa Bay, Migori, Siaya, Rachuonyo, Isiolo, Samburu, Laikipia, Wajir, Garissa, Mandera	Uaso Nyiro, Sabaki, Tana, Migori, Kuja, Nzoia, Nyando, Garaha, Wembere	60	17,300	538,000			
2006–0587		15/10/2006	26/10/2006	Flood	Isiolo District, Garissa District, Lodwar town( Turkana District)		30	30,000				
2006–0234		25/04/2006	04/05/2006	Flood	Nyanza province, Mombasa District		8	13,000				
2006–0178		04/04/2006	22/05/2006	Flood	Isiolo District, Moyale District, Nairobi province		60	17,300				
2005–9719		00/12/2005	00/00/2006	Drought	Makueni District, Kitui District, Malindi District		27	3,500,000				
	2672	17/06/2005	20/06/2005	Flood	Western Kenya–Busia District–Bukhay, Walwasi		20	1,200	3,520			
2005–0526					Bukhay (Busia District), Walwasi ward (Busia district)							

Register No.		Start	End	Type	Location	River	Dead	Total Affected Residents	Affected Area (km <sup>2</sup> )	Estimated Damage (US\$ Million)	Other Nations Affected
CRED	Univ. of Colorado										
	2652	03/05/2005	03/06/2005	Flood	Kenya-Nyanza, Western, -Rift Valley, Coast and parts of North eastern provinces-Districts: Nyando (Kabonyo, Kakola, Kochogo, Ongeche.), Rachuonyo (Kayitir, Kawadhgone, Koyugi), Nyatike (Kaden), Migori, Garissa (Dadaab), Isiolo (Merti, Gulesa and Malkagala), Karachuonyo, Homa Bay (Kochia, West Kagan, Rangwe), Ijara, Tana River, Kisumu (Buoye, Winam, Kolwa), Kochia, Naivasha, Nakuru -Uganda-Mbale District	Kenya-Nyando, Kibos, Awattende, Maugo, Ombeyi, Athi, Ewaso Nyiro, Oluch, Mango and Awach Kagan Nyamasaria and Mahenya - Uganda-Namatala	4	40,000	443,200		Uganda
2005-0260		18/05/2005	24/05/2005	Flash flood	Rift valley province, Western regions		5	10,000			
2005-0215		23/04/2005	26/04/2005	Flash flood			1	25,000		0.5	
2004-9288		00/07/2004	00/00/2004	Drought	Kitui District, Mbeere District, Mwingi District		80	2,300,000			
2004-0659		26/12/2004	26/12/2004	Tsunami	Mombasa District		1			100	
	2467	09/04/2004	11/05/2004	Flood	Nyanza province-Districts: Nyando, Rachuonyo, Kisumu, Migori, Homabay, South West Kano, Nyakach, Miwani, Ombeyi, Nyatike, Kisii, Muhoroni, Ahero, Rangwe, Aywey. Rift valley province-Districts: Nakuru, Baringo, Turkana, Nyamira, Machakos, Marakwet. Towns: Rangwe, Karachuonyo, Kobuya, Nasigir, Naivasha, Eldoret, Laikipia. Budalangi-Busia District, Nairobi area.- Central- Thika, Murang'a, Nyeri, Kirinyaga Mt. Kenya region-Meru, Othaya, Kirinyaga- Western Kenya,-Ukambani- Coast province-Districts: Tana River, Taita Taveta, Homa Bay - Uganda-Mbale area	Kenya-Nyanza - Nyando, Mahenya, Sondu-Miriu, Sio, Awach, Ombeyi, Migori and Kuja, Tonde. Rift valley-Chemoron, Endao, Miriu, Athi Budalangi-Nzoia, Central-Thirikwa, Ndarugu, Thiriku, Mt. Kenya-Ruamuthambi, Nairobi area-Kirichwa, Ruaraka other rivers: Athi	50	15000	268,300		Uganda
2004-0194				Flood	Nairobi province, Tana river District			10,000			
2004-0152		09/04/2004	12/04/2004	Flash flood	Nyando District, Budalangi District		4	2,000			
	2334	26/08/2003	12/09/2003	Flood	Western Kenya-Busia,-Budalangi division of Siaya District, Ugenya and Alego-Usonga constituencies. Bunyala South villages neighbouring the Yala swamp	Nzoia, Yala	1	2,100	2,470		
	2331	24/08/2003	24/08/2003	Flood	Kerio valley-Chepsigot ward			400	2,920		

Register No.		Sart	End	Type	Location	River	Dead	Total Affected Residents	Affected Area (km <sup>2</sup> )	Estimated Damage (US\$ Million)	Other Nations Affected
CRED	Univ. of Colorado										
	2213	21/04/2003	04/06/2003	Flood	Kenya-Nyanza province -Districts; Nyando, Migori, Kisumu, Budalangi, Rift valley province-Districts: Nakuru, East Baringo, Kericho, Samburu, Koibatek, Nandi, West Pokot, Western province-Busia, Trans-Nzoia, Bungoma, Kakamega, Siaya, Sifuno, Eastern province-Districts: Turkana, Machakos, Yatta, Coast province-Ndera, Malindi, Garissa. -Eastern Uganda-Mbale District; Namalu area, Bugiri District, Bulidha sub-county, Kampala area	Kenya-Nyanza province-Nyando, Awach, Migori and Kuja. Rift valley province-Kositei, Cheptokwo, Nginyang, Iri, Kimondi, Chesita, Murumi, Swam, Orwa. Western province-Nzoia, Ombeyi. Eastern province-Turkwel, Kerio, Tinganga. Coast province-Tana, Sabaki. North eastern-Lak Dara and tributaries Eastern Uganda-Amaler and	77	1,000,000	291,400		Uganda
2003-0729	2118	04/01/2003	06/01/2003	Flood	Western Kenya-Kisumu, Manyatta, Dunga and Nyalenda Kisii Kisumu region	River Auji		300	390		
2003-0204		00/04/2003	00/05/2003	Flood	Nyando District, Kisumu District, Rachuonyo District		40	60,000			
2002-0800	2108	21/12/2002	23/12/2002	Flood	Marigat division in Baringo District, Ng'arua, Eldume, Sintaan Marigat division(Baringo District)	Perkerra river	6	3,000	750		
2002-0711	2088	17/11/2002	20/11/2002	Flood Flash flood	Central Kenya-Kiambu District-River Riaru from Kiambu town Kiambu District	Riaru	12	2,000	920		
2002-0689	2078	29/10/2002	04/11/2002	Flood	Eastern Kenya-Madogo division of Tana River District, Tana River, Marere River in Kinango area of Kwale District Madogo division (Tana River distrect)	Tana, Marere	14	20,000	77,900		
	2055	16/09/2002	19/09/2002	Flood	Mombasa, Matuga, Kipevu. Districts: Kwale, Kilifi, Mombasa, Taita Taveta				63,450		

Register No.		Start	End	Type	Location	River	Dead	Total Affected Residents	Affected Area (km <sup>2</sup> )	Estimated Damage (US\$ Million)	Other Nations Affected
CRED	Univ. of Colorado										
	1917	26/04/2002	28/05/2002	Flood	Kenya– Budalangi area in Nyanza province. Central Meru and Muranga Districts near Mt. Kenya. Nairobi area. Western Districts of Kisumu and Busia. Rivers: Mara, Tana, Sabaki --Uganda–Counties: Manjiya, Bubukwanga Districts: Mbale, Bundibugyo, Sironko. Towns: Kampala area, Kyambogo, Rwebisengo, Rwangara and Bweramole. Semliki river –Rwanda– Western and Central areas –Tanzania–Mbeya region, Geita District in Mwanza region	Kenya–Mara, Tana, Sabaki – Uganda–Semliki	160	168,000	1,019,000		Uganda, Tanzania, Rwanda
2002–0265					Migori District, Kisumu District, Nyando District		53	150,008			
2002–0248		30/04/2002	30/04/2002	Landslide	Meru District, Murang'a District		16				
	1915	29/04/2002	02/05/2002	Flood	Nairobi area. Nairobi river	Nairobi	2		3,830		
	1686	13/01/2001	14/01/2001	Flood	Nairobi and surrounding areas–Dagoretti, Kibera		4		4,350	0.038	
2001–0032					Nairobi province						
1999–9388		00/12/1999	00/00/2002	Drought	Baringo District, Garissa District, Isiolo District		85	2,300,000			
	1374	27/05/1998	31/05/1998	Flood	Nairobi		19	800	106,200		
	1298	01/01/1998	20/01/1998	Flood	Kenya–Voi, Nairobi–Mombasa Highway, Tsavo National park, Garissa –Tanzania–Lakes Victoria and Tanganyika, North Zambia, Mwanza District, Kilimanjaro region	Tana, Mkondoa	86	346,000	386,400		
1998–0443		00/05/1998	00/05/1998	Flood	Lake Victoria		40	200			
	1287	30/11/1997	03/12/1997	Flood	Garissa	Tana	11	10,000	8,840		
	1271	15/10/1997	23/10/1997	Flood	Coastal areas–Mombasa	Bogolo	23		34,480		
1997–0255		00/09/1997	00/09/1997	Flood	Kwale District, Kilifi District, Mombasa District		86	900,000		11.8	
1996–9326		00/01/1997	00/00/1998	Drought	Garissa District, Isiolo District, Wajir District			1,600,000			
	1064	08/04/1996	11/04/1996	Flood	Nyanza province: Kano, Lower Nyakach, Karachuonyo, Kisumu District (West Nyakach), Homabay District (East Karachuonyo)		0	1,000	12,430		
1996–0474					Nyanza province						
1994–9422		00/03/1994	00/00/1995	Drought	North eastern regions			1,200,000			
1991–9224		00/00/1991	00/00/1992	Drought	North eastern regions			2,700,000			
1990–0352		14/04/1990	15/04/1990	Flood			44				
	177	10/04/1988	10/05/1988	Flood	Nairobi area, Districts–Kisumu, South Nyanza, Laikipia, Nyando division in Western Kenya. Rivers: Tana, Nyando		60	10,000	89,600		
1983–9060		00/00/1984	00/00/1982	Drought				600,000			
1982–0107		00/10/1982	00/10/1982	Flash flood	Near Lake Victoria		75	3,000			
1979–9177		00/00/1979	00/00/1980	Drought	Turkana District			40,000			

Register No.		Start	End	Type	Location	River	Dead	Total Affected Residents	Affected Area (km <sup>2</sup> )	Estimated Damage (US\$ Million)	Other Nations Affected
CRED	Univ. of Colorado										
1977-0064		00/05/1977	00/05/1977	Flood			100	20,000		10	
1975-0008		00/00/1975	00/00/1975	Flood				16,000			
1971-9004		00/01/1971	00/00/1971	Drought	Country wide			150,000		1.5	
1968-0043		00/05/1968	00/05/1968	Flood	Nyanza province, Western province					0.05	
1965-9038		00/07/1965	00/00/1965	Drought				260,000			
1964-0025		00/05/1964	00/05/1964	Flood	Nyanza province, Western regions			15,000			

JICA Experts

## **Appendix 2-2**

### **Capacity of WRMA staff**

## Appendix B Capacity Assessment and Development Planning Matrix for WRMA

**Project Purpose:** In the Project target areas, institutional framework of flood management in the context of integrated water resource management is to be established for effective and sustainable implementation of community-based activities.

**Output 1)** At each level of WRMA (headquarters, regional offices and sub-regional offices), sustainable organizations in charge of flood management are to be strengthened.

**Output 2)** For promoting community-based activities with respect to flood management, WRMA staffs are to support WRUAs and communities are to be strengthened.

Objective: WRMA Capacity to be Developed	Required Capacity Element	Assessment at Current Capacity Level (Consultant's Assessment with Additional Inputs from Discussions in 1 <sup>st</sup> WG)	Capacity Development Needs (Consultant's Proposition with Additional Inputs from Discussions in 1 <sup>st</sup> WG)	Priority	Time Scope	Specific Method for Capacity Development to be Adopted in the Project	Target Group	Detailed Content to be Included in the WRMA Training Courses
	[Personal aspects]							
1. To Develop a System for Collecting and Analyzing Information/Data with respect to Flood Phenomena	1-1 To collect and analyze information/data about rainfalls and river flows which may be the cause of floods	<p><b>Skills and expertise:</b></p> <ul style="list-style-type: none"> <li>■ Regarding collecting and analyzing information/data of rainfalls and river flows, which may be the cause of floods, staffs of WRMA-HQ, RO and SRO have skills and knowledge of low water, but they don't have enough skills and knowledge of high water.</li> <li>■ Regarding the observation of rainfalls, WRMA staffs don't have enough knowledge and technique for short-term interval rainfall observation.</li> <li>■ Regarding the observation of water levels and river flows, they don't have enough knowledge and technique for one-hour interval water level observation and high water discharge observation.</li> </ul> <p><b>Supplementary Notes:</b></p> <ul style="list-style-type: none"> <li>■ There are some opportunities for training the staffs of HQ, while there are few opportunities for training staffs of ROs and SROs.</li> <li>■ No technical instruction books for hydro/meteorological observation exist.</li> <li>■ WRMA staffs can collect data but cannot analyze and bank information/data.</li> </ul>	Staffs of WRMA-HQ, RO and SRO will utilize the basic knowledge of general meteorology, general hydrology, general river engineering, rainfall observation, water level gauging, river flow observation, river survey, river investigation, data processing and statistical processing in their flood management works.  Some trained staffs of WRMA will be lecturers of the WRMA technical training courses at the 2 <sup>nd</sup> stage in Kenya.	[ I ]	short-term	<p><b>[Training in Kenya]</b> Creating instruction book about basic knowledge of meteorology, hydrology, river engineering, rainfall observation, water level gauging, river flow observation, river survey, river investigation, data processing and statistical processing  Training on the basic knowledge of meteorology, hydrology, river engineering, rainfall observation, water level gauging, river flow observation, river survey, river investigation, data processing and statistical processing</p>	SRO,RO,HQ	<ul style="list-style-type: none"> <li>■ Method of rainfall observation</li> <li>■ Method of water level observation</li> <li>■ Method of flow rate observation</li> <li>■ Method for scrutinizing hydro-meteorological data</li> <li>■ Hydro-meteorological statistics</li> </ul>
	1-2 To collect and analyze information/data on impacts and damages by floods	<p><b>Skills and expertise:</b></p> <ul style="list-style-type: none"> <li>■ WRMA-SRO staffs cannot collect and analyze information/data about the human damages, such as the number of missing persons and deaths, physical damages which constitute the number of destroyed houses and crops affected by floods, etc.</li> </ul>	From other related organizations and districts, WRMA-SRO staffs will obtain information/data related to flood damages.	[ I ]	short-term	<p><b>[Training in Kenya]</b> Technical training in Kenya to collect and analyze the human damages and physical damages by floods</p>	SRO	<ul style="list-style-type: none"> <li>■ Method for collecting flood damage data</li> <li>■ Method for evaluating flood damage amounts</li> </ul>
	1-3 To collect and analyze both the characteristics of river basins and cause and effect of floods by using maps	<p><b>Skills and expertise:</b></p> <ul style="list-style-type: none"> <li>■ WRMA-SRO staffs usually don't use maps in their works, because topographical maps have not been distributed in SRO offices.</li> <li>■ It is common that flooded areas have not been identified and delineated on maps.</li> <li>■ Records on river course changes have not been identified and shown on maps.</li> <li>■ Only for Lumi River, such kind of records was listed on a hand writing map.</li> <li>■ WRMA-SRO staffs don't have maps, which show the location of rainfall stations and water level gauging stations.</li> <li>■ The use of GIS maps remains minimal in WRMA-HQ.</li> </ul>	WRMA-SRO staffs will arrange the characteristics of river basins and the situation of river course changes by using topographic maps.  WRMA-SRO staffs will indicate the locations of rainfall stations and water level gauging stations on a map.	[ I ]	short-term	<p><b>[Training in Kenya]</b> Technical training to analyze the characteristics of river basins, flood affected areas, river courses by maps</p>	SRO,RO	<ul style="list-style-type: none"> <li>■ Method for designating flooded areas in communities</li> <li>■ Method for making a Hazard Map at community level</li> <li>■ Method for utilizing a Hazard Map at community level</li> <li>■ Method for making a Hazard Map at WRUA level</li> <li>■ Method for utilizing a Hazard Map at WRUA level</li> <li>■ Geographical Information System (GIS)</li> </ul>

Objective: WRMA Capacity to be Developed	Required Capacity Element	Assessment at Current Capacity Level (Consultant's Assessment with Additional Inputs from Discussions in 1 <sup>st</sup> WG)	Capacity Development Needs (Consultant's Proposition with Additional Inputs from Discussions in 1 <sup>st</sup> WG)	Priority	Time Scope	Specific Method for Capacity Development to be Adopted in the Project	Target Group	Detailed Content to be Included in the WRMA Training Courses
	1-4 To summarize and report the status of floods and their damages	<p><b>Skills and expertise:</b></p> <ul style="list-style-type: none"> <li>WRMA-SRO staffs don't have enough skills and expertise to collect and analyze information/data of rainfalls, flow rates, geographical characteristics, flood affected areas, flood affected population, etc.</li> </ul>	<p>WRMA-SRO staffs will collect and analyze information/data of rainfalls, flow rates and geographical characteristics as the causes of floods and to collect and analyze information/data of flood affected areas and affected population.</p> <p>WRMA-SRO staffs will formulate reports on the analyzed information/data.</p>	[ I ]	short-term	<p><b>[Technical advice by JICA experts, training in Kenya &amp; Japan]</b></p> <p>Technical training of writing flood Disaster reports</p> <p>Technical training of formulating flood disaster reports</p>	SRO	<ul style="list-style-type: none"> <li>Method for making a flood damage database</li> <li>Method for utilizing a flood damage database</li> <li>Flood-prevention activities in Japan</li> </ul>
[Organizational aspects] (Human, physical, financial, knowledge, etc.)								
	1-5 To collect and arrange information/data systematically and appropriately with respect to rainfalls and high water discharges	<p><b>Organization:</b></p> <ul style="list-style-type: none"> <li>There are no common methods of installation, maintenance and calibration of hydro/meteorological observation equipment.</li> <li>There is no particular system for installation, maintenance and calibration of hydro/meteorological observation equipment.</li> <li>Although there are staffs in charge of data collection, there are no instruction manuals for guiding volunteer observers.</li> <li>There are no officers in charge of checking and statistically processing data.</li> <li>Although staffs in charge of databases were stationed in SROs, ROs and HQ, there is no system to share the result of databases.</li> </ul> <p><b>Standing Orders:</b> There are no such regulatory documents of posts.</p> <p><b>Budget Measures:</b> Insufficient budget</p> <p><b>Equipment:</b></p> <ul style="list-style-type: none"> <li>WRMA-ROs have Acoustic Doppler Current Profilers (ADCPs) and Acoustic Doppler Velocity-meters (ADV).</li> <li>WRMA-SROs have SEBA Current Flow Meters ready.</li> <li>The number and the volume of hard disks of personal computers are not enough in WRMA-SROs.</li> </ul> <p><b>Supplementary Notes:</b></p> <ul style="list-style-type: none"> <li>Poor accessibility to hydro/meteorological observation stations with the exception of a few stations</li> </ul>	<p>WRMA HQ will prepare regulatory documents on the installation, operation and maintenance, and calibration of rainfalls, water levels and water flows.</p> <p>WRMA-SROs will keep observation records without data missing and wrong typing.</p> <p>WRMA-SROs will check and correct missing and wrong typing data.</p> <p>WRMA-RO will conduct statistical analysis of observed data.</p> <p>WRMA-HQ will establish a hydro/meteorological database, which all RO and SRO staffs can use them.</p> <p>WRMA-HQ will prepare annual reports of observed data by using the hydro-meteorological database.</p> <p>WRMA-HQ will publish and share the annual report with RO and SRO.</p>	[ I ]	short-term	<p><b>[Training in Kenya]</b></p> <p>Technical training on how to install, maintain and calibrate observation equipment</p> <p>Technical advice on constructing a system of installation, maintenance and calibration of observation equipment</p> <p>Technical advice and training on collecting observed data of rainfalls, water levels and flow rates</p> <p>Technical advice and training on methods of checking and statistical analysis of rainfalls, water levels and flow rates</p> <p>Technical advice and training on constructing a system for checking and statistical analysis of rainfalls, water levels and flow rates</p> <p>Technical advice and training on a database of rainfalls, water levels and flow rates</p> <p>Technical advice and training on methods for sharing annual reports of observed data</p> <p>Technical advice and training on a system for publishing annual reports of observed data</p>	SRO,RO,HQ	<ul style="list-style-type: none"> <li>Method of rainfall observation</li> <li>Method of water level observation</li> <li>Method of flow rate observation</li> <li>Method for scrutinizing hydro-meteorological data</li> <li>Hydro-meteorological statistics</li> <li>Method for managing the hydro-meteorological database</li> </ul>
	1-6 To collect and analyze information/data about the effects and damages of floods	<p><b>Organization:</b> There are no flood management staffs in ROs and SROs.</p> <p><b>Standing Orders:</b> nonexistent</p> <p><b>Budget Measures:</b> Insufficient budget</p> <p><b>Equipment:</b> The number of personal computers and vehicles are not enough in ROs and SROs.</p>	<p>Flood Management Officers will be stationed in ROs and SROs.</p> <p>To collect and analyze information/data about the effects and damage of floods will be listed in the mandate of WRMA.</p>	[ I ]	short-term	<p><b>[Technical advice by JICA experts, training in Kenya]</b></p> <p>Advice on organizational structures, human resources and budget</p>	SRO,RO	<ul style="list-style-type: none"> <li>Collecting method for flood damage data</li> <li>Method for evaluating flood damage amounts</li> <li>Method for designating flooded areas in communities</li> </ul>



Objective: WRMA Capacity to be Developed	Required Capacity Element	Assessment at Current Capacity Level (Consultant's Assessment with Additional Inputs from Discussions in 1 <sup>st</sup> WG)	Capacity Development Needs (Consultant's Proposition with Additional Inputs from Discussions in 1 <sup>st</sup> WG)	Priority	Time Scope	Specific Method for Capacity Development to be Adopted in the Project	Target Group	Detailed Content to be Included in the WRMA Training Courses
			Necessary equipment such as computers and vehicles will be deployed with an appropriate budget.			Technical training on the effect and damages of floods in Kenya		
	1-7 To collect and analyze the characteristics of river basins and cause and effect of floods by using maps	<p><b>Organization:</b></p> <ul style="list-style-type: none"> <li>■ It is very rare to use maps in SROs, ROs and HQ.</li> <li>■ There are two staffs in HQ to be able to use GIS, whose skills are included to a medium or an upper class.</li> <li>■ There are two staffs to be able to use GIS in RO, whose skills are included to a beginner class.</li> <li>■ It is very hard for the staffs to use GIS for WRMA's works.</li> <li>■ There are no staffs in WRMA to be able to use GIS.</li> </ul> <p><b>Standing Orders:</b> nonexistent  <b>Budget Measures:</b> insufficient budget  <b>Equipment:</b> The number of personal computers and vehicles are not enough in WRMA.  <b>Supplementary Notes:</b></p> <ul style="list-style-type: none"> <li>■ Information/data are collected routinely, but not analyzed in graphs.</li> <li>■ WRMA staffs can't identify and instruct mistakes of volunteer observers.</li> </ul>	<p>Flood Management Officers, who will be stationed in ROs and SROs, will use GIS in their daily works.</p> <p>To collect and analyze information/data about the effects and damage of floods will be listed in the mandate of WRMA.</p> <p>Necessary equipment such as computers and vehicles will be deployed with an appropriate budget.</p>	[ I ]	short-term	<p><b>[Technical advice by JICA experts, training in Kenya &amp; Japan]</b></p> <p>Advice on organizational structures, human resources and budget</p> <p>Technical training on Hazard Maps</p>	SRO,RO	<ul style="list-style-type: none"> <li>■ Method for designating flooded areas in communities</li> <li>■ Method for making a Hazard Map at community level</li> <li>■ Method for utilizing a Hazard Map at community level</li> <li>■ Method for making a Hazard Map at WRUA level</li> <li>■ Method for utilizing a Hazard Map at WRUA level</li> <li>■ Geographical Information System (GIS)</li> <li>■ Method for utilizing flood Hazard Maps in Japan</li> </ul>
	1-8 Reports for summarizing the situation of flood damages will be shared nationwide through HQ and ROs.	<p><b>Organization:</b> There are no Flood Management Officers in ROs and SROs.  <b>Standing Orders:</b> nonexistent  <b>Budget Measures:</b> insufficient budget  <b>Equipment:</b> The number of personal computers and vehicles are not enough in WRMA.  <b>Supplementary Notes:</b> There are no flood disaster reports in WRMA.</p>	<p>Flood Management Officers, who will be stationed in ROs and SROs, will prepare flood disaster reports.</p> <p>To collect and analyze information/data about the effects and damages of floods will be listed in the mandate of WRMA.</p> <p>Necessary equipment such as personal computers and vehicles will be deployed with an appropriate budget.</p>	[ I ]	long-term	<p><b>[Technical advice by JICA experts, training in Kenya &amp; Japan]</b></p> <p>Advice on organizational structures, human resources and budget</p> <p>Technical training on how to disseminate information about flood damages in Kenya</p>	SRO,RO	<ul style="list-style-type: none"> <li>■ Method for designating flooded areas in communities</li> <li>■ Method for making a flood damage database</li> <li>■ Method for utilizing a flood damage database</li> <li>■ Case examples for utilizing flood disaster databases in Japan</li> <li>■ Case examples for utilizing knowledge management system in Japan</li> </ul>
[Institutional aspects]								
	1-10 An agreement or a system on sharing of observed data of rainfalls, water levels and flow rates with related organizations	<ul style="list-style-type: none"> <li>■ There is no agreements for exchanging and sharing observed data between WRMA—which is conducting hydro/meteorological observation—and KMD—which is conducting meteorological observation—.</li> <li>■ WRMA should provide rainfall data to KMD.</li> <li>■ WRMA and KMD come away with no agreements with respect to data sharing from the effort.</li> <li>■ However, there is a framework of KMD's data sharing to both ASAL Secretariat—a platform of countermeasures against drought—and NPDRR—a national platform for disaster risk reduction formulated by the Government of Kenya—.</li> </ul>	WRMA will participate in NPDRR as an organization in charge of flood management.	[ I ]	long-term	<p><b>[Technical advice by JICA experts, training in Kenya]</b></p> <p>Prior consultation with all the ministries/organizations concerned</p> <p>Fostering a common awareness of the relevant ministries/organizations through workshops</p> <p>Agreements with the relevant ministries in JCC</p>	HQ	<ul style="list-style-type: none"> <li>■ Characteristics of flood disasters in Kenya</li> <li>■ Legal system for flood management in Kenya</li> <li>■ Demarcation for flood management in Kenya</li> <li>■ Flood management of WRMA</li> </ul>
[Personal aspects]								

Objective: WRMA Capacity to be Developed	Required Capacity Element	Assessment at Current Capacity Level (Consultant's Assessment with Additional Inputs from Discussions in 1 <sup>st</sup> WG)	Capacity Development Needs (Consultant's Proposition with Additional Inputs from Discussions in 1 <sup>st</sup> WG)	Priority	Time Scope	Specific Method for Capacity Development to be Adopted in the Project	Target Group	Detailed Content to be Included in the WRMA Training Courses
2. To Analyze Cause and Effect of Floods by Using Related Information/Data	2-1 Basic knowledge of topographic maps and mapping technique	<p><b>Skills and expertise:</b></p> <ul style="list-style-type: none"> <li>WRMA staffs are short on experience in reading topographic maps and mapping processes, because topographic maps are not common in Kenya.</li> </ul> <p><b>Incentive:</b> no incentive scheme</p> <p><b>Supplementary Notes:</b></p> <ul style="list-style-type: none"> <li>WRMA staffs have no chances for attending training seminars of reading maps and mapping technique.</li> <li>WRMA staffs have no technical reference materials.</li> </ul>	<p>WRMA staffs are to apply the basic knowledge of topographic maps and mapping techniques to flood management services.</p> <p>Lecturers for the WRMA technical training courses at the 2<sup>nd</sup> stage training in Kenya are to be selected out of WRMA staffs who have received the 1<sup>st</sup> stage training in Kenya.</p>	【 II 】	short-term	[Training in Kenya] Technical training on map literacy and mapping technique	SRO,RO,HQ	<ul style="list-style-type: none"> <li>Method for making a Hazard Map at community level</li> <li>Method for utilizing a Hazard Map at community level</li> <li>Method for making a Hazard Map at WRUA level</li> <li>Method for utilizing a Hazard Map at WRUA level</li> <li>Geographical Information System (GIS)</li> </ul>
	2-2 Basic knowledge of high water discharge observation	<p><b>Skills and expertise:</b></p> <ul style="list-style-type: none"> <li>WRMA staffs are short on experience and understanding in high water discharge observation, although WRMA staffs understand the importance of low water discharge observation.</li> </ul> <p><b>Incentive:</b> no incentive scheme</p> <p><b>Supplementary Notes:</b></p> <ul style="list-style-type: none"> <li>WRMA staffs have limited opportunities for attending training seminars of high water discharge observation.</li> <li>WRMA staffs have no technical reference materials.</li> </ul>	<p>WRMA staffs are to apply the basic knowledge of high water discharge observation to flood management services.</p> <p>Lecturers for the WRMA technical training courses at the 2<sup>nd</sup> stage in Kenya are to be selected out of WRMA staffs who have received the 1<sup>st</sup> stage training in Kenya.</p>	【 II 】	short-term	[Training in Kenya] Technical training on high water discharge observation	SRO,RO,HQ	<ul style="list-style-type: none"> <li>Method of utilization of rating curves low water H-Q curves &amp; high water H-Q curves</li> <li>Case example for utilization of rating curves low water H-Q curves &amp; high water H-Q curves</li> </ul>
	2-3 Basic knowledge of flood disaster databases	<p><b>Skills and expertise:</b></p> <ul style="list-style-type: none"> <li>WRMA staffs are short on experience in constructing a flood disaster database, although WRMA staffs understand the importance of it.</li> </ul> <p><b>Incentive:</b> no incentive scheme</p> <p><b>Supplementary Notes:</b></p> <ul style="list-style-type: none"> <li>WRMA staffs have limited opportunities for attending training seminars for constructing and managing databases.</li> </ul>	<p>WRMA staffs are to apply the basic knowledge of a flood disaster database to flood management services.</p> <ul style="list-style-type: none"> <li>Lecturers for the WRMA technical training courses at the 2<sup>nd</sup> stage in Kenya are to be selected out of WRMA staffs who have received the 1<sup>st</sup> stage training in Kenya.</li> </ul>	【 II 】	short-term	[Training in Kenya & Japan] Training on constructing a flood disaster database	SRO,RO,HQ	<ul style="list-style-type: none"> <li>Method for managing the hydro-meteorological database of WRMA</li> <li>Method for making a flood damage database</li> <li>Method for utilizing a flood damage database</li> <li>Case examples for utilizing flood disaster databases in Japan</li> </ul>
	[Organizational aspects] (Human, physical, financial, knowledge, etc.)							
2-4 Framework for observing high water discharges	<p><b>Organization Framework:</b></p> <ul style="list-style-type: none"> <li>WRMA has no observation framework on high water discharges.</li> <li>Each WRMA Office is in her own way of discharge observation.</li> <li>For example, Kakamega RO is conducting a routine observation of discharges, while Kisumu RO has no observation of discharges.</li> <li>No ROs have conducted any observation of high water discharges.</li> </ul> <p><b>Standing Orders:</b> nonexistent</p> <p><b>Budget Measures:</b> not enough</p> <p><b>Equipment:</b></p> <ul style="list-style-type: none"> <li>ROs have deficient discharge observation instrument, although ROs have them.</li> </ul> <p><b>Supplementary Notes:</b></p> <ul style="list-style-type: none"> <li>WRMA has unclear practice and procedure for observing high water discharges.</li> <li>No manuals on discharge observation</li> </ul>	<p>Framework for observing high water discharges is to be formed in WRMA.</p> <p>Framework for sharing discharge observation instruments between RO and SRO is to be formed in WRMA.</p> <ul style="list-style-type: none"> <li>Lecturers for the WRMA technical training courses at the 2<sup>nd</sup> stage in Kenya are to be selected out of WRMA staffs who have received the 1<sup>st</sup> stage training in Kenya.</li> </ul>	【 II 】	long-term	[Technical advice by JICA experts, training in Kenya & Japan] Technical advice and training on high water discharge observation	SRO,RO,HQ	<ul style="list-style-type: none"> <li>Flood management of WRMA</li> <li>Method for making a flood damage database</li> <li>Method for utilizing a flood damage database</li> <li>Case examples for utilizing flood disaster databases in Japan</li> </ul>	

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		<ul style="list-style-type: none"> <li>Only WRMA LVSC has done discharge observation.</li> </ul>						
	2-5 Framework for developing and administrating the flood disaster database in Kenya	<p><b>Organization Framework:</b></p> <ul style="list-style-type: none"> <li>WRMA has not developed the flood disaster database in Kenya, although it recognizes the importance of the flood disaster database in Kenya.</li> </ul> <p><b>Standing Orders:</b> nonexistent</p> <p><b>Budget Measures:</b> N/A</p> <p><b>Equipment:</b> available</p> <p><b>Supplementary Notes:</b></p> <ul style="list-style-type: none"> <li>JICA Consulting Team has offered a prototype of the flood disaster database in Kenya, which was made by disaster data compiled by an existing database "CRED".</li> <li>WRMA has no manuals for developing databases.</li> </ul>	<ul style="list-style-type: none"> <li>Framework for developing and administrating the flood disaster database in Kenya is to be formed in WRMA.</li> <li>The flood disaster database in Kenya is to be used as one of knowledge management tools for flood management.</li> <li>Lecturers for the WRMA technical training courses at the 2<sup>nd</sup> stage in Kenya are to be selected out of WRMA staffs who have received the 1<sup>st</sup> stage training in Kenya.</li> </ul>	【 II 】	long-term	<p><b>[Technical advice by JICA experts, training in Kenya &amp; Japan]</b></p> <ul style="list-style-type: none"> <li>Technical advice and training on developing the flood disaster database in Kenya</li> <li>Technical advice and training on administrating the flood disaster database in Kenya</li> </ul>	SRO,RO,HQ	<ul style="list-style-type: none"> <li>Flood management of WRMA</li> <li>Method for managing hydro-meteorological database of WRMA</li> <li>Method for making a flood damage database</li> <li>Method for utilizing a flood damage database</li> <li>Case examples for utilizing flood disaster databases in Japan</li> </ul>
	2-6 Framework for evaluating flood affected areas and flood damages	<p><b>Organization Framework:</b></p> <ul style="list-style-type: none"> <li>WRMA has no evaluation framework on flood affected areas and flood damages.</li> </ul> <p><b>Standing Orders:</b> nonexistent</p> <p><b>Budget Measures:</b> N/A</p> <p><b>Equipment:</b> nonexistent</p> <p><b>Supplementary Notes:</b></p> <ul style="list-style-type: none"> <li>Overlooking the data on flood affected areas and flood damages.</li> <li>WRMA has not gained one of important tools for appealing flood management.</li> </ul>	<ul style="list-style-type: none"> <li>Framework for evaluating flood affected areas and flood damages are to be formed in WRMA.</li> <li>Lecturers for the WRMA technical training courses at the 2<sup>nd</sup> stage in Kenya are to be selected out of WRMA staffs who have received the 1<sup>st</sup> stage training in Kenya.</li> </ul>	【 II 】	long-term	<p><b>[Technical advice by JICA experts, training in Kenya]</b></p> <ul style="list-style-type: none"> <li>Technical advice and training on evaluating flood affected areas and flood damages</li> <li>Technical advice and training on framework for evaluating flood affected areas and flood damages</li> </ul>	SRO,RO,HQ	<ul style="list-style-type: none"> <li>Flood management of WRMA</li> <li>Method for collecting flood damage data</li> <li>Method for evaluating flood damage amounts</li> <li>Method for designating flooded areas in communities</li> </ul>
	[Institutional aspects]							
	2-7 Legal systems for assisting high water discharge observation	<ul style="list-style-type: none"> <li>WRMA has no legal stipulation for making compulsory at high water discharge observation.</li> </ul> <p><b>Supplementary Notes:</b></p> <ul style="list-style-type: none"> <li>Legal system should be set after the revised bill is passed.</li> <li>The water bill doesn't mention about it, but the draft of the water bill mentions about it.</li> </ul>	<ul style="list-style-type: none"> <li>Compulsory observation on high water discharge is to be made in WRMA.</li> </ul>	【 II 】	long-term	<p><b>[Technical advice by JICA experts, workshop]</b></p> <ul style="list-style-type: none"> <li>Proposal for legal stipulation on compulsory observation of high water discharges</li> </ul>	SRO,RO,HQ	<ul style="list-style-type: none"> <li>Flood management of WRMA</li> <li>Method of utilization of rating curves : low water H-Q curves &amp; high water H-Q curves</li> <li>Case example for utilization of rating curves : low water H-Q curves &amp; high water H-Q curves</li> </ul>
	2-8 Legal systems for assisting to evaluate flood affected areas and flood damages	<ul style="list-style-type: none"> <li>WRMA has no legal stipulation for making compulsory at evaluation of flood affected areas and flood damages, although since 2009 CRC has been collected disaster data, such as affected areas and damages by floods.</li> </ul> <p><b>Supplementary Notes:</b></p> <ul style="list-style-type: none"> <li>Legal system should be set after the revised water bill is passed.</li> </ul>	<ul style="list-style-type: none"> <li>Compulsory evaluation for flood affected areas and flood damages are to be made in WRMA.</li> </ul>	【 II 】	long-term	<p><b>[Technical advice by JICA experts, workshop]</b></p> <ul style="list-style-type: none"> <li>Proposal for legal stipulation on compulsory evaluation for flood affected areas and flood damages</li> </ul>	SRO,RO,HQ	<ul style="list-style-type: none"> <li>Flood management of WRMA</li> <li>Method for collecting flood damage data</li> <li>Method for evaluating flood damage amounts</li> <li>Method for making flooded areas in communities</li> </ul>
	2-9 Legal systems for assisting to develop and manage the flood disaster database in Kenya	<ul style="list-style-type: none"> <li>WRMA has no legal stipulation for making compulsory at the flood disaster database in Kenya.</li> </ul> <p><b>Supplementary Notes:</b></p> <ul style="list-style-type: none"> <li>Legal system should be set after the revised water bill is passed.</li> </ul>	<ul style="list-style-type: none"> <li>Compulsory development and management and flood disaster database is to be made in WRMA.</li> </ul>	【 II 】	long-term	<p><b>[Technical advice by JICA experts, workshop]</b></p> <ul style="list-style-type: none"> <li>Proposal for legal stipulation on compulsory development and management on the flood disaster database in</li> </ul>	SRO,RO,HQ	<ul style="list-style-type: none"> <li>Flood management of WRMA</li> <li>Method for making a flood damage database</li> <li>Method for utilizing a flood damage database</li> </ul>

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						Kenya		
	[Personal aspects]							
3. To Coordinate Relevant Stakeholders for Better Flood Management in Communities	3-1 Basic knowledge on monitoring of rainfalls and water levels, and Early Warning System	<p><b>Skills and expertise:</b></p> <ul style="list-style-type: none"> <li>Both systems of monitoring of rainfalls and water levels, and Early Warning Systems have not been implemented.</li> <li>However, WRMA staffs have basic understanding on these systems.</li> </ul> <p><b>Incentive:</b> no incentive scheme</p> <p><b>Supplementary Notes:</b></p> <ul style="list-style-type: none"> <li>There are no reference materials available to WRMA staffs.</li> </ul>	<ul style="list-style-type: none"> <li>WRMA staffs will apply their basic knowledge on monitoring systems of rainfalls and water levels, and Early Warning Systems to their flood management activities like provision of information.</li> </ul> <p>WRMA will consider implementing EWS by using automatic observation data.</p> <p>Among WRMA staffs, who received the training in the Project, there will be a few staffs to lecture in the WRMA technical training courses at the 2<sup>nd</sup> stage in Kenya.</p>	[VI]	short-term	<p><b>[Training in Kenya &amp; Japan]</b></p> <ul style="list-style-type: none"> <li>To provide technical training on monitoring of rainfall and water level, and Early Warning</li> </ul>	SRO,RO,HQ	<ul style="list-style-type: none"> <li>Case examples for Early Warning Systems in Kenya</li> <li>Case examples for Early Warning Systems at community levels in Kenya</li> <li>Case example for distributing flood information via radios</li> <li>Case examples for utilizing Early Warning Systems in Japan</li> <li>Case examples for an Integrated Flood Warning System</li> <li>Case example for distributing flood information via TV and SMS in Japan</li> </ul>
	3-2 Basic knowledge on Hazard Mapping	<p><b>Skills and expertise:</b></p> <ul style="list-style-type: none"> <li>Hazard Maps are not very common but WRMA staffs understand their importance in flood management.</li> <li>There are few occasions to experience making of Hazard Maps.</li> <li>WRMA staffs have experience to make community flood Hazard Map with JICA Project team.</li> </ul> <p><b>Incentive:</b> no incentive scheme</p> <p><b>Supplementary Notes:</b></p> <ul style="list-style-type: none"> <li>There are few chances of receiving trainings on Hazard Maps.</li> <li>There are no reference materials available to WRMA staffs.</li> </ul>	<ul style="list-style-type: none"> <li>WRMA staffs will apply their basic knowledge on Hazard Maps and technically advise WRUAs whenever WRUAs make their own Hazard Maps.</li> <li>Among WRMA staffs, who received the training in the Project, there will be a few staffs to lecture in the WRMA technical training courses at the 2<sup>nd</sup> stage in Kenya.</li> </ul>	[VI]	short-term	<p><b>[Training in Kenya &amp; Japan]</b></p> <ul style="list-style-type: none"> <li>To provide technical training on making Hazard Maps</li> </ul>	SRO,RO,HQ	<ul style="list-style-type: none"> <li>Method for making a Hazard Map at community level</li> <li>Method for utilizing a Hazard Map at community level</li> <li>Method for making a Hazard Map at WRUA level</li> <li>Method for utilizing a Hazard Map at WRUA level</li> <li>Geographical Information System (GIS)</li> <li>Method for utilizing flood Hazard Maps in Japan</li> </ul>
	[Organizational aspects] (Human, physical, financial, knowledge, etc.)							
	3-3 Methodologies and organizers for community-based flood responses (monitoring of rainfalls, water levels, flood damages, etc.)	<p><b>Organization Framework:</b></p> <ul style="list-style-type: none"> <li>WRMA is well aware of the importance of monitoring systems of water levels and flood damages, and Early Warning Systems and has an agreement on her intention to establish such systems in the near future.</li> </ul> <p><b>Standing Orders:</b> nonexistent</p> <p><b>Budget Measures:</b> N/A</p> <p><b>Equipment:</b> N/A</p> <p><b>Supplementary Notes:</b></p> <ul style="list-style-type: none"> <li>No technical reference materials available to WRMA staffs.</li> </ul>	<ul style="list-style-type: none"> <li>WRMA will have established a network to collect and disseminate information on the results of rainfall and water level monitoring and other observations.</li> <li>Among WRMA staffs, who received the training in the Project, there will be a few staffs to lecture in the WRMA technical training courses at the 2<sup>nd</sup> stage in Kenya.</li> </ul>	[VI]	short-term	<p><b>[Technical advice by JICA experts, training in Kenya &amp; Japan]</b></p> <ul style="list-style-type: none"> <li>Technical training on monitoring systems for water levels and flood damages, and Early Warning</li> </ul>	SRO,RO,HQ	<ul style="list-style-type: none"> <li>Flood management of WRMA</li> <li>Method of rainfall observation</li> <li>Method of water level observation</li> <li>Method of flow rate observation</li> <li>Case examples for Early Warning Systems in Kenya</li> <li>Case examples for Early Warning Systems at community levels in Kenya</li> <li>Case example for distributing flood information via radios</li> <li>Case examples for utilizing Early Warning Systems in Japan</li> <li>Case examples for an Integrated Flood Warning System</li> <li>Case example for distributing flood information via TV and SMS in Japan</li> </ul>

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	3-4 Methodologies and organizers for preparing and utilizing Hazard Maps	<p><b>Organization Framework:</b></p> <ul style="list-style-type: none"> <li>WRMA has developed water resource maps, but they don't have experience, methodologies and organizations to draw flood Hazard Maps.</li> </ul> <p><b>Standing Orders:</b> nonexistent</p> <p><b>Budget Measures:</b> N/A</p> <p><b>Equipment:</b></p> <ul style="list-style-type: none"> <li>There are no topographic maps and GIS software available.</li> </ul> <p><b>Supplementary Notes:</b></p> <ul style="list-style-type: none"> <li>Some WRUAs are trying to make Hazard Maps on their own.</li> <li>JICA Project team is preparing prototype base maps using GIS.</li> <li>There is no technical standard available for mapping.</li> </ul>	<ul style="list-style-type: none"> <li>WRMA will establish organization to make, collect, update and manage Hazard Maps.</li> <li>WRMA will provide WRUAs with Hazard Maps.</li> <li>Among WRMA staffs, who received the training in the Project, there will be a few staffs to lecture in the WRMA technical training courses at the 2<sup>nd</sup> stage in Kenya.</li> </ul>	[VI]	long-term	<p><b>[Technical advice by JICA experts, training in Kenya &amp; Japan]</b></p> <ul style="list-style-type: none"> <li>Technical training on organization for technically advising to communities in case of preparing Hazard Maps.</li> </ul>	SRO,RO,HQ	<ul style="list-style-type: none"> <li>Flood management of WRMA</li> <li>Method for making a Hazard Map at community level</li> <li>Method for utilizing a Hazard Map at community level</li> <li>Method for making a Hazard Map at WRUA level</li> <li>Method for utilizing a Hazard Map at WRUA level</li> <li>Method for utilizing flood Hazard Maps in Japan</li> </ul>
	[Institutional aspects]							
	3-5 Legal systems for collecting and disseminating information of communities' flood responses (monitoring of rainfalls, water levels and flood damages)	<ul style="list-style-type: none"> <li>WRMA has no legal stipulation for collecting and disseminating information of community-based flood responses, in particular, flood-related information.</li> </ul>	<ul style="list-style-type: none"> <li>Establishment of WRMA's system to support community-based flood responses (collection and dissemination of flood-related information)</li> </ul>	[VI]	long-term	<p><b>[Technical advice by JICA experts, training in Kenya]</b></p> <ul style="list-style-type: none"> <li>Proposal for legal stipulation on compulsory provision for supporting community-based flood responses (collection and dissemination of flood-related information)</li> </ul>	SRO,RO,HQ	<ul style="list-style-type: none"> <li>Flood management of WRMA</li> <li>Method for designating flood damages in communities</li> <li>Method for evacuation</li> <li>Method for management of evacuation facilities</li> </ul>
	[Personal aspects]							
4. To Advise WRUAs Technically to Formulate SCMPs	4-1 Basic knowledge on technical advices to community-based flood responses (evacuation, flood fighting, etc.)	<p><b>Skills and expertise:</b></p> <ul style="list-style-type: none"> <li>WRMA's current knowledge and skills on community-based flood responses (evacuation, flood fighting, etc.) is not very high.</li> <li>It is difficult for WRMA staffs to technically advise communities on their flood responses.</li> </ul> <p><b>Incentive:</b> no incentive scheme</p> <p><b>Supplementary Notes:</b></p> <ul style="list-style-type: none"> <li>There are no technical reference materials available to WRMA staffs.</li> </ul>	<ul style="list-style-type: none"> <li>WRMA staffs will apply their knowledge on community-based flood responses (evacuation, flood fighting, etc.) and provide technical support to WRUAs when WRUAs are to execute flood response activities.</li> <li>Among WRMA staffs, who received the training in the Project, there will be a few staffs to lecture in the WRMA technical training courses at the 2<sup>nd</sup> stage in Kenya.</li> </ul>	[V]	long-term	<p><b>[Training in Kenya &amp; Japan]</b></p> <ul style="list-style-type: none"> <li>Technical training, in collaboration with CMDRR and KRCS, on community-based flood responses (evacuation, flood fighting, etc.)</li> </ul>	SRO,RO,HQ	<ul style="list-style-type: none"> <li>Method for designating flood damages in communities</li> <li>Method for relieving flood disaster victims</li> <li>Method for evacuation</li> <li>Method for management of evacuation facilities</li> <li>Practical training in Nyando Project site</li> <li>Cooperation among central government, local government, donors, and NGOs</li> <li>Case example for flood fighting activities in Japan</li> </ul>
	4-2 Basic knowledge on technical advices for flood control works (structural measures against floods)	<p><b>Skills and expertise:</b></p> <ul style="list-style-type: none"> <li>WRMA staffs' current knowledge and skills on flood control works (structural measures) are limited.</li> <li>It is difficult for WRMA staffs to technically advise communities on their efforts to design, implement and manage flood control works.</li> </ul> <p><b>Incentive:</b> no incentive scheme</p> <p><b>Supplementary Notes:</b></p> <ul style="list-style-type: none"> <li>There are no technical reference materials available to WRMA staffs.</li> </ul>	<ul style="list-style-type: none"> <li>WRMA staffs will apply their knowledge on flood control works (structural measures) and provide technical support to WRUAs when WRUAs are to implement flood control works.</li> <li>Among WRMA staffs, who received the training in the Project, there will be a few staffs to lecture in the WRMA technical training courses at the 2<sup>nd</sup> stage in Kenya.</li> </ul>	[V]	long-term	<p><b>[Training in Kenya &amp; Japan]</b></p> <ul style="list-style-type: none"> <li>Preparation of technical reference materials for designing, implementing and managing flood control works</li> <li>Technical training on provision of technical support for designing, implementing and managing flood control works</li> </ul>	SRO,RO,HQ	<ul style="list-style-type: none"> <li>Case example for small scale structural measures against floods at community level</li> <li>Case examples for constructing small scale structures against floods</li> <li>Case examples for operation and management of small scale structures against floods</li> <li>Practical training in Nyando Project site</li> <li>Case example for traditional river engineering in Japan</li> </ul>

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	4-3 Basic knowledge on technical advices to community level education for disaster prevention	<p><b>Skills and expertise:</b></p> <ul style="list-style-type: none"> <li>WRMA staffs' current knowledge and skills on community level education for disaster prevention are not prioritized.</li> <li>It is difficult for WRMA staffs to technically advise communities on their efforts to educate community members.</li> </ul> <p><b>Incentive:</b> no incentive scheme</p> <p><b>Supplementary Notes:</b></p> <ul style="list-style-type: none"> <li>There are no technical reference materials available to WRMA staffs.</li> </ul>	<ul style="list-style-type: none"> <li>WRMA staffs will apply his knowledge on community level education for disaster prevention and provide technical support to WRUAs when WRUAs are to carry out education activities.</li> <li>Among WRMA staffs, who received the training in the Project, there will be a few staffs to lecture in the WRMA technical training courses at the 2<sup>nd</sup> stage in Kenya.</li> </ul>	[V]	short-term	<p><b>[Training in Kenya &amp; Japan]</b></p> <ul style="list-style-type: none"> <li>Technical training on provision of technical support for community level education of disaster prevention</li> </ul>	SRO,RO,HQ	<ul style="list-style-type: none"> <li>Practical training in Nyando Project site</li> <li>Case example for flood fighting activities in Japan</li> <li>Case example for disaster education in Japan</li> </ul>
	4-4 Basic knowledge on technical advices to obtain funds for community-based activities	<p><b>Skills and expertise:</b></p> <ul style="list-style-type: none"> <li>WRMA staffs' current knowledge and skills on obtaining funds on flood management issue like WDC are not very high.</li> <li>It is difficult for WRMA staffs to technically advise communities on their efforts to apply for funds.</li> </ul> <p><b>Incentive:</b> no incentive scheme</p> <p><b>Supplementary Notes:</b></p> <ul style="list-style-type: none"> <li>There are no technical reference materials available to WRMA staffs.</li> </ul>	<ul style="list-style-type: none"> <li>WRMA staffs will apply their knowledge on funds and provide technical support to WRUAs when WRUAs are to apply for such funds.</li> <li>Among WRMA staffs, who received the training in the Project, there will be a few staffs to lecture in the WRMA technical training courses at the 2<sup>nd</sup> stage in Kenya.</li> </ul>	[V]	short-term	<p><b>[Training in Kenya]</b></p> <ul style="list-style-type: none"> <li>Technical training on provision of technical support for WRUAs' application procedures for funds</li> </ul>	SRO,RO,HQ	<ul style="list-style-type: none"> <li>Knowledge for utilizing various funds for flood management</li> <li>Case examples for utilizing funds for flood management</li> <li>Case examples for utilizing WSTF to flood management</li> </ul>
[Organizational aspects] (Human, physical, financial, knowledge, etc.)								
	4-5 To establish methods and organizations to technically support WRUAs in their preparing SCMPs	<p><b>Organization Framework:</b></p> <ul style="list-style-type: none"> <li>WRMA staffs are currently not providing adequate technical support on flood management issues to WRUAs in their preparation of SCMPs.</li> </ul> <p><b>Standing Orders:</b> nonexistent</p> <p><b>Budget Measures:</b> N/A</p> <p><b>Equipment:</b> N/A</p> <p><b>Supplementary Notes:</b></p> <ul style="list-style-type: none"> <li>There is no technical standard or materials in WRMA for providing technical advices to WRUAs.</li> </ul>	<ul style="list-style-type: none"> <li>WRMA will establish organization to apply her knowledge on flood management and provide technical support to WRUAs when WRUAs are preparing SCMPs.</li> <li>Among WRMA staffs, who received the training in the Project, there will be a few staffs to lecture in the WRMA technical training courses at the 2<sup>nd</sup> stage in Kenya.</li> </ul>	[V]	long-term	<p><b>[Technical advice by JICA experts, training in Kenya &amp; Japan, workshop]</b></p> <ul style="list-style-type: none"> <li>To providing advices and technical training to provide support to WRUAs under their preparing SCMPs</li> </ul>	SRO,RO,HQ	<ul style="list-style-type: none"> <li>Method for planning an Integrated River Basin Flood Management</li> <li>Case examples for planning flood management in SCMPs</li> <li>Overview for Considering Socio-Environmental Impact</li> <li>Case Examples of Integrated River Basin Flood Management in Japan</li> </ul>
	4-6 To establish methods and organizations to technically support WRUAs in their applying for funds	<p><b>Organization Framework:</b></p> <ul style="list-style-type: none"> <li>WRMA staffs are currently not providing adequate technical support to WRUAs under their application for funds.</li> <li>WRMA is technically appraising the applications of WRUAs for funds.</li> </ul> <p><b>Standing Orders:</b> nonexistent</p> <p><b>Budget Measures:</b> N/A</p> <p><b>Equipment:</b> N/A</p> <p><b>Supplementary Notes:</b></p> <ul style="list-style-type: none"> <li>There is no technical standard in WRMA for providing technical advices to WRUAs.</li> </ul>	<ul style="list-style-type: none"> <li>WRMA will establish organization to apply her knowledge on funds and provide technical support to WRUAs when WRUAs are applying for funds.</li> <li>Among WRMA staffs, who received the training in the Project, there will be a few staffs to lecture in the WRMA technical training courses at the 2<sup>nd</sup> stage in Kenya.</li> </ul>	[V]	long-term	<p><b>[Technical advice by JICA experts , training in Kenya]</b></p> <ul style="list-style-type: none"> <li>To providing advices and technical training to provide support to WRUAs under their applying for funds</li> </ul>	SRO,RO,HQ	<ul style="list-style-type: none"> <li>Procedures for acquiring funds</li> <li>Method for managing fund accounting</li> </ul>
[Institutional aspects]								
	4-7 Legal systems for technical support to WRUAs under their preparing SCMPs	<ul style="list-style-type: none"> <li>WRMA has a mandate to provide technical support to WRUAs under their preparing SCMPs.</li> </ul>	—	[V]	long-term	—	—	—



Objective: WRMA Capacity to be Developed	Required Capacity Element	Assessment at Current Capacity Level (Consultant's Assessment with Additional Inputs from Discussions in 1 <sup>st</sup> WG)	Capacity Development Needs (Consultant's Proposition with Additional Inputs from Discussions in 1 <sup>st</sup> WG)	Priority	Time Scope	Specific Method for Capacity Development to be Adopted in the Project	Target Group	Detailed Content to be Included in the WRMA Training Courses
5. To Formulate and Update Training Manuals on Flood Management and Conduct Training Seminars to HQ/RO/SRO Staffs of WRMA	[Personal aspects]							
	—	—	—	—	—	—	—	—
	[Organizational aspects] (Human, physical, financial, knowledge, etc.)							
	5-1 To design WRMA's own technical development system	<p><b>Organization Framework:</b></p> <ul style="list-style-type: none"> <li>WRMA has not established her organization to design her own technical development system.</li> </ul> <p><b>Standing Orders:</b> nonexistent</p> <p><b>Budget Measures:</b> N/A</p> <p><b>Equipment:</b> N/A</p> <p><b>Supplementary Notes:</b></p>	<ul style="list-style-type: none"> <li>WRMA will establish her own technical development system to train staffs in regions other than pilot areas by lecturers who have been trained in the 1<sup>st</sup> stage training in Kenya and nominated as lecturers.</li> <li>It is expected that in the WRMA technical training courses at the 2<sup>nd</sup> stage in Kenya lecturers are to be raised, reference materials are to be prepared, and training courses to be analyzed and executed.</li> </ul>	【 III 】	long-term	<p><b>[Technical advice by JICA experts , workshop]</b></p> <ul style="list-style-type: none"> <li>To providing advises and practices to WRMA's own technical development training</li> <li>Both JICA and the Project team are expecting the WRMA technical development system to be self-sustaining in WRMA's own capacity.</li> </ul>	SRO,RO,HQ	—
	5-2 To prepare WRMA's technical reference materials	<p><b>Organization Framework:</b></p> <ul style="list-style-type: none"> <li>WRMA has not prepared technical reference materials for her technical development system.</li> </ul> <p><b>Standing Orders:</b> nonexistent</p> <p><b>Budget Measures:</b> N/A</p> <p><b>Equipment:</b> N/A</p> <p><b>Supplementary Notes:</b></p> <ul style="list-style-type: none"> <li>There is no technical standard available to WRMA staffs.</li> </ul>	<ul style="list-style-type: none"> <li>WRMA will prepare and edit technical reference materials for her own technical development system.</li> </ul>	【 III 】	long-term	<p><b>[Technical advice by JICA experts , workshop]</b></p> <ul style="list-style-type: none"> <li>To providing support to make reference materials and programs for the WRMA technical development system</li> </ul>	SRO,RO,HQ	—
5-3 To raise lecturers for the WRMA technical training courses at the 2 <sup>nd</sup> stage in Kenya	<p><b>Organization Framework:</b></p> <ul style="list-style-type: none"> <li>WRMA has not established a module to raise lecturers for her own technical development system.</li> </ul> <p><b>Standing Orders:</b> nonexistent</p> <p><b>Budget Measures:</b> N/A</p> <p><b>Equipment:</b> N/A</p> <p><b>Supplementary Notes:</b></p>	<p>Lecturers for the WRMA technical development system will be selected from staffs who have received trainings in the 1<sup>st</sup> stage training in Kenya.</p> <p>WRMA will consider technical modules to be used in technical development.</p> <ul style="list-style-type: none"> <li>Lecturers will understand the objectives of the technical development system in WRMA and its contents.</li> </ul>	【 III 】	long-term	<p><b>[Technical advice by JICA experts, workshop]</b></p> <ul style="list-style-type: none"> <li>To provide advices on WRMA's raising lecturers for the technical development system</li> </ul>	SRO,RO,HQ	—	
5-4 To operationalize the WRMA technical training courses at the 2 <sup>nd</sup> stage in Kenya	<p><b>Organization Framework:</b></p> <ul style="list-style-type: none"> <li>WRMA is not currently operating technical development system.</li> </ul> <p><b>Standing Orders:</b> nonexistent</p> <p><b>Budget Measures:</b> N/A</p> <p><b>Equipment:</b> N/A</p> <p><b>Supplementary Notes:</b></p> <ul style="list-style-type: none"> <li>There is no standard for operation of the technical development system.</li> </ul>	<ul style="list-style-type: none"> <li>WRMA will operate the WRMA's own technical development system to train staffs of regions other than pilot areas.</li> </ul>	【 III 】	long-term	<p><b>[Technical advice by JICA experts, workshop]</b></p> <ul style="list-style-type: none"> <li>To provide advices on WRMA's establishment of standards for operation of the technical development system</li> <li>To provide advices on the WRMA technical development system</li> </ul>	SRO,RO,HQ	—	
[Institutional aspects]								

Objective: WRMA Capacity to be Developed	Required Capacity Element	Assessment at Current Capacity Level (Consultant's Assessment with Additional Inputs from Discussions in 1 <sup>st</sup> WG)	Capacity Development Needs (Consultant's Proposition with Additional Inputs from Discussions in 1 <sup>st</sup> WG)	Priority	Time Scope	Specific Method for Capacity Development to be Adopted in the Project	Target Group	Detailed Content to be Included in the WRMA Training Courses	
	5-5 Legal systems for the WRMA technical training courses at the 2 <sup>nd</sup> stage in Kenya	<ul style="list-style-type: none"> <li>WRMA has no legal stipulation for establishing her own technical development system at this moment, but it will be incorporated with the draft water bill.</li> </ul>	<ul style="list-style-type: none"> <li>WRMA will be mandated to operate her own technical development system.</li> </ul>	<b>【 III 】</b>	long-term	<b>[Technical advice by JICA experts, workshop]</b> <ul style="list-style-type: none"> <li>Proposal for legal stipulation on WRMA's establishment of the technical development system</li> </ul>	SRO,RO,HQ	<ul style="list-style-type: none"> <li>Flood management of WRMA</li> </ul>	
6. To Introduce a Concept of "River Basin Flood Management Plan (RBFMP)", which should be Set between the CMS and the SCMPs	[Personal aspects]								
	6-1 Basic knowledge on Integrated Flood Management (IFM)	<u>Skills and expertise:</u> <ul style="list-style-type: none"> <li>WRMA staffs understand the necessity of IFM, but do not have acquired specific experiences to implement IFM and knowledge required.</li> </ul> <u>Incentive:</u> N/A <u>Supplementary Notes:</u> <ul style="list-style-type: none"> <li>There is no technical reference material available to WRMA staffs.</li> </ul>	<ul style="list-style-type: none"> <li>WRMA staffs will apply her basic knowledge on IFM and provide technical support to WRUAs under her preparing SCMPs.</li> </ul>	<b>【 IV 】</b>	long-term	<b>[Training in Kenya &amp; Japan]</b> <ul style="list-style-type: none"> <li>To provide training on IFM</li> </ul>	SRO,RO,HQ	<ul style="list-style-type: none"> <li>Method for planning an Integrated River Basin Flood Management</li> <li>Case examples for planning flood management in SCMPs</li> <li>Overview for Considering Socio-Environmental Impact</li> <li>Case Examples of Integrated River Basin Flood Management in Japan</li> </ul>	
	[Organizational aspects] (Human, physical, financial, knowledge, etc.)								
	6-2 To establish methods and organizations for making River Basin Flood Management Plans (RBFMPs)	<u>Organization Framework:</u> <ul style="list-style-type: none"> <li>WRMA understands the necessity of RBFMP but has not established organization to prepare RBFMPs.</li> </ul> <u>Standing Orders:</u> nonexistent <u>Budget Measures:</u> N/A <u>Equipment:</u> N/A <u>Supplementary Notes:</u> <ul style="list-style-type: none"> <li>There is no technical standard available to WRMA staffs.</li> </ul>	<ul style="list-style-type: none"> <li>WRMA will consider the necessity of RBFMPs and contents of plans for the river basins she manages.</li> </ul>	<b>【 IV 】</b>	long-term	<b>[Technical advice by JICA experts , training in Kenya &amp; Japan ]</b> <ul style="list-style-type: none"> <li>To provide technical advices and training for establishing organization to formulate RBFMPs</li> </ul>	SRO,RO,HQ	<ul style="list-style-type: none"> <li>Flood management of WRMA</li> <li>Method for planning an Integrated River Basin Flood Management</li> <li>Case examples for planning flood management in SCMPs</li> <li>Overview for Considering Socio-Environmental Impact</li> <li>Case Examples of Integrated River Basin Flood Management in Japan</li> </ul>	
[Institutional aspects]									
6-3 Legal systems for River Basin Flood Management Plans (RBFMPs)	<ul style="list-style-type: none"> <li>Each WRUA is mandated to prepare the SCMP for her sub-catchment, and WRMA prepare CMSs.</li> <li>A RBFMP is a concept newly proposed in the Project and there is no legal provision to prepare RBFMPs.</li> </ul>	<ul style="list-style-type: none"> <li>WRMA will be mandated to prepare a RBFMP for each river basin she manages.</li> </ul>	<b>【 IV 】</b>	long-term	<b>[Training in Kenya &amp; Japan, workshop]</b> <ul style="list-style-type: none"> <li>Proposal for legal stipulation on preparation of RBFMPs</li> </ul>	SRO,RO,HQ	<ul style="list-style-type: none"> <li>Flood management of WRMA</li> <li>Method for planning an Integrated River Basin Flood Management</li> <li>Case examples for planning flood management in SCMPs</li> <li>Overview for considering Socio-Environmental Impact</li> <li>Case Examples of Integrated River Basin Flood Management in Japan</li> </ul>		

Priority Ranking:

**Priority 【 I 】 :** Objective-1 To develop a system for collecting information/data with respect to flood phenomena

**Priority 【 II 】 :** Objective-2 To analyze cause and effect of floods by using related information/data

**Priority 【 III 】 :** Objective-5 To formulate and update a training manual on flood management and conduct training seminars to HQ/RO/SRO staffs of WRMA

**Priority 【 IV 】 :** Objective-6 To introduce a concept of "River Basin Flood Management Plan (RBFMP)", which should be set between the CMS and the SCMPs

**Priority 【 V 】 :** Objective-4 To advice WRUAs technically to formulate SCMPs

**Priority 【 VI 】 :** Objective-3 To coordinate relevant stakeholders for better flood management in communities



## **Appendix 2-3**

### **Capacity of WRUA member**

## Appendix A WRUA and Community Capacity Assessment and Capacity Development Planning Matrix for WRMA

**Project Purpose:** In the Project target areas, institutional framework of flood management in the context of integrated water resource management is to be established for effective and sustainable implementation of community based activities.

**Output-1)** At each level of WRMA (headquarters, regional offices and sub-regional offices), sustainable organizations in charge of flood management are to be strengthened.

**Output-2)** For promoting community based activities of flood management, capacity of WRMA staffs to support WRUAs and communities is strengthened. **"GM"= Lower Gucha Migori / "LL" =Lower Lumi / "IS"=Isiolo**

WRUA and Community Capacity that WRMA supports to be developed	Capacity Element to be required	Assessment of current Capacity Level of WRUA (Consultant Team's Assessment with additional Inputs from Discussions in 1 <sup>st</sup> WG)	Development Needs of WRUA (Consultant Team's Proposition with additional Inputs from Discussions in 1 <sup>st</sup> WG)	Development Needs of WRMA (Consultant Team's Proposition with additional Inputs from Discussions in 1 <sup>st</sup> WG)	Priority	Time scope	Specific Method for Development adopted in the Project	Target Group	Content of Flood Management Module in WDC	
1. To Establish Framework of Flood Fighting Activities	[Personal aspects]									
	1-1 Knowledge for community based flood activities	<p><b>"GM"</b> WRUA can read the value of water gauge and manage a simple flood warning system in their community.</p> <p><b>"LL"</b> WRUA has been made for the protection levee temporary bridge and springs to ensure means of transportation, such as for the protection of agricultural land embankment.</p> <p><b>"IS"</b> WRUA doesn't have any particular activities of flood.</p>	WRUA needs to understand the outline of community based flood activities on flood disaster prevention	WRMA needs to explain the outline and role to play of community based activities on flood disaster prevention.	<b>[V]</b>	short-term	<p><b>[Lecture/site training]</b></p> <p>Explanation of community disaster prevention technic</p> <p>Facilitation training</p>	HQ,RO,SRO		
	[Organizational aspects] (human, physical, financial, knowledge)									
	1-2 to nurture leadership and ownership	<p><b>"GM, LL, IS"</b> WRUA have ownership in terms of water use, but their ownership for flood management has not been built yet.</p>	WRUA needs to develop, create and engage in their awareness on self-help for flood management.	WRMA needs to understand and explain to WRUAs the idea of "Self-help/mutual support/public assistance" for flood.	<b>[V]</b>	short-term	<p><b>[Lecture, site training]</b></p> <p>Explanation of the idea "self-help/mutual support/public assistance" with cases and experiences in Japan</p> <p>Facilitation training</p>	HQ,RO,SRO		
1-3 Establishing organizational structures for flood management activities (internal)	<p><b>"GM,LL,IS"</b> WRUA's constitution stipulate election of chairperson, secretary and treasurer, but internal group/committee is not organized in WRUA.</p> <p><b>"GM"</b> WRUA has a flood management sub-committee.</p> <p>1.</p>	WRUA or flood management sub-committee in WRUA need to activate	WRMA needs to facilitate their activation.	<b>[V]</b>	short-term	<p><b>[Local training lectures]</b></p> <p>Facilitation training to activate community groups</p>	RO,SRO			
[Institutional aspects]										

WRUA and Community Capacity that WRMA supports to be developed	Capacity Element to be required	Assessment of current Capacity Level of WRUA (Consultant Team's Assessment with additional Inputs from Discussions in 1 <sup>st</sup> WG)	Development Needs of WRUA (Consultant Team's Proposition with additional Inputs from Discussions in 1 <sup>st</sup> WG)	Development Needs of WRMA (Consultant Team's Proposition with additional Inputs from Discussions in 1 <sup>st</sup> WG)	Priority	Time scope	Specific Method for Development adopted in the Project	Target Group	Content of Flood Management Module in WDC	
	1-4 Establishing organizational structures for activities (external)	<input checked="" type="checkbox"/> Prevention against floods is insufficient in "GM, LL, IS" WRUA. There is a cooperative relationship between WRUA, district office, NGO, schools and Ministry of Water and Irrigation during floods. "GM, LL, IS" WRUA	WRUA needs the strong and cooperative relationship with authorities such as WRMA and district office at the time of emergency.	WRMA needs to coordinate to strengthen such kind of cooperation.	<b>[ V ]</b>	short-term	<b>[WG · OJT]</b> To propose cooperation with related organizations	RO,SRO		
2. To Analyse and Evaluate Flood Risks	[Personal aspects]									
	2-1 Understanding community's knowledge and perception of flood events	"GM" WRUA members share information each other about latest flood, using panel with photos and comments. "GM" WRUA members can make graph that shows the relation between river water level and inundation level. "IS" WRUA has already recognized the importance to observe rainfall level in upstream of Mt. Kenya and water level in upstream of Isiolo river. "LL" WRUA members understand that rainfall at Mt. Kilimanjaro is cause of flood and they can predict floods based on observing the rains.	WRUA needs to know the level of knowledge and awareness on flood issue of local residents.	WRMA needs to study the level of knowledge and awareness of local resident to share with WRUA.	<b>[ I ]</b>	short-term	<b>[WS · Discussion]</b> Training on WRMA's understanding for risks by area based on field study and information collecting	SRO		
	2-2 Understanding vulnerabilities against floods	The elders of the community hand down verbally about flood damage of their community in "GM,LL,IS" WRUA, but it is not documented.	WRUA needs knowledge about the risk of each community. WRUA needs to understand the problems that are caused by long inundation such as sanitary deterioration and loss of agricultural products.	WRMA needs to collect and organize flood records and information. WRMA needs to explain to WRUA about vulnerability of the area from above information.	<b>[ I ]</b>	short-term	<b>[WS · Discussion]</b> Training on WRMA's understanding for vulnerability by area based on field study and information collecting	SRO		
	[Organizational aspects] (human, physical, financial, knowledge)									
	2-3 Accumulating information and utilising analyses on community's experiences, responses in flood events	"GM" WRUA shares their experiences each other by using photos and panels and drawing hazard map. There is no particular activities in "LL, IS" WRUA	WRUA members need to manage the flood information by time series to share correct one.	WRMA needs to manage and collect information to upgrade and provide it for WRUA.	<b>[ I ]</b>	short-term	<b>[WG · OJT]</b> Guidance to record information	RO,SRO		
2-4 Keeping and updating knowledge on vulnerabilities against floods	"GM, LL, IS" WRUA members shares past flood damage information. They recognize the vulnerability of flood in the area.	WRUA needs to accumulate and manage to consider their flood management plan.	WRMA needs to evaluate vulnerability of the sub catchment area. WRMA needs to guide WRUA to put priority for countermeasures.	<b>[ I ]</b>	short-term	<b>[WG · OJT]</b> Presentation to take priorities of measures for vulnerability	RO,SRO			

WRUA and Community Capacity that WRMA supports to be developed	Capacity Element to be required	Assessment of current Capacity Level of WRUA (Consultant Team's Assessment with additional Inputs from Discussions in 1 <sup>st</sup> WG)	Development Needs of WRUA (Consultant Team's Proposition with additional Inputs from Discussions in 1 <sup>st</sup> WG)	Development Needs of WRMA (Consultant Team's Proposition with additional Inputs from Discussions in 1 <sup>st</sup> WG)	Priority	Time scope	Specific Method for Development adopted in the Project	Target Group	Content of Flood Management Module in WDC	
	2-5 Understanding of responding capacity of community in flood events	<b>"GM, LL, IS"</b> WRUA hold a meeting to consider flood management after disaster.	WRUA needs to understand the current responding capacity of community.	WRMA needs to share good practices of self-help activities with WRUA.	<b>【 I 】</b>	short-term	<b>【WG, site visit, discussion】</b> Presentation of good practices	HQ		
	2-6 Understanding of possible damages of flood events	<b>"GM"</b> WRUA make and share hazard map that shows the damage situation in the past (lost crops, livestock, destruction of infrastructure, human life, etc.) There is no particular activities in <b>"LL,IS"</b> WRUA	WRUA needs to improve accuracy in the updating the map and information. WRUA needs to understand the outline of flood damage mechanism.	WRMA needs to give WRUA information to improve their understanding of possible damage. WRMA needs to explain the outline of flood damage mechanism to WRUA.	<b>【 I 】</b>	short-term	<b>【WG, case study, site visit】</b> Guidance of information collection and its improvement	HQ,RO,SR O		
	[Institutional aspects]									
3. To Establish Organizations against Floods Disasters	[Personal aspects]									
	3-1 Establishing ownership and sense of responsibilities	WRUAs that are in high risk area have strong responsibility. <b>"GM"</b> WRUA has strong responsibility for flood management, but <b>"LL,IS"</b> WRUA have for water use, not for flood management.	WRUA needs to strengthen a sense of responsibility and foster will for flood management.	WRMA needs to make WRUAs understand the seriousness of flood damage. WRMA needs to explain the importance of self-help to reduce flood damage.	<b>【 III 】</b>	short-term	<b>【WG,OJT, site visit】</b> Explanation of disadvantage due to flood and importance to avoid spiral of poverty from flood disaster	HQ,RO,SR O		
	[Organizational aspects] (human, physical, financial, knowledge)									
	3-2 Understanding regional issues related to disaster prevention	<b>"GM, LL, IS"</b> WRUA hold a meeting about the flood disaster issue.	WRUA needs to understand characteristics of flood and measures to be taken in their communities. WRUA needs to recognize the importance of "mutual support" in their community.	WRMA needs to explain the importance of "mutual support" according to characteristics of each community.	<b>【 III 】</b>	short-term	<b>【Lecture, site training】</b> Guidance from the cases and experiences in Japan	HQ,RO,SR O		
	3-3 Nurturing sub-catchment leadership	WRUA leaders (especially in <b>"GM"</b> WRUA) have leadership within the WRUA. They lead to collect flood damage information at emergency by residents.	WRUA needs to maintain the current structure of leadership sustainably	WRMA needs to facilitate to maintain WRUA's leadership.	<b>【 III 】</b>	short-term	<b>【Lecture, site visit, training in Japan】</b> Guidance from the cases and experiences in Japan	RO,SRO		
3-4 Executing sub-catchment leadership nurturing activities	<b>"GM,LL,IS"</b> WRUA's constitution determine to assign chairperson and Secretary. The constitution of WRUA gives room for election of leadership.	WRUA constitution should define the role of leaders to lead during the flood disaster including evacuation and also have by-laws that addresses disaster emergency.	WRMA/SRO CMO needs to guide WRUA.	<b>【 III 】</b>	short-term	<b>【Case study WG, site visit】</b> Training for CMO of WRMA SRO to lead WRUA	RO,SRO			

WRUA and Community Capacity that WRMA supports to be developed	Capacity Element to be required	Assessment of current Capacity Level of WRUA (Consultant Team's Assessment with additional Inputs from Discussions in 1 <sup>st</sup> WG)	Development Needs of WRUA (Consultant Team's Proposition with additional Inputs from Discussions in 1 <sup>st</sup> WG)	Development Needs of WRMA (Consultant Team's Proposition with additional Inputs from Discussions in 1 <sup>st</sup> WG)	Priority	Time scope	Specific Method for Development adopted in the Project	Target Group	Content of Flood Management Module in WDC
	3-5 Organizing community, establishing voluntary disaster prevention group	"GM,LL,IS" WRUA have already established voluntary groups, but those groups are not for flood, but for water use. "GM" WRUA has flood management sub-committee.	WRUA needs to indicate and educate the role of those established groups.	WRMA needs to support and promote WRUA by disaster prevention issue.	【 III 】	short-term	<b>[Research challenges WG , OJT]</b> The project facilitates to cooperate with KRCS and other organization. .	RO,SRO	
	[Institutional aspects]								
	3-6 Position of WRUA in community based activities.	WRUAs correspond to realize community based activities on flood issues. WDC manual determine that WRUA can operate flood prevention activities using WSTF.	WRUA needs to sensitized a flood chapter in SCMP and be able to carry our flood prevention activities based on SCMP	WRMA needs to guide and support WRUA's community based flood management activities.	【 III 】	short-term	<b>[Lecture WG · OJT]</b> To show know-how of the method of community based activities through pilot projects.	RO,SRO	
	[Personal aspects]								
	[Organizational aspects] (human, physical, financial, knowledge)								
4. To Enlighten Community Members and Organizations	4-1 Risk Communication among WRUA members	The current risk communication in WRUA is mainly between executives, not between all WRUA members. "GM, LL, IS" WRUA	WRUA needs to have risk communication with all WRUA members.	WRMA needs to support WRUA's risk communication. To cooperate with NGO is an option.	【 II 】	short-term	<b>[Lecture, local training, training in japan ]</b> To guide risk communication with cases in Japan and cooperation with NGO	HQ,RO,SR O	
	4-2 Training community leaders for flood fighting activities	"GM" WRUA have flood management sub- committee. They discuss and consider flood damage and its measures. "LL,IS" WRUA doesn't have any leader on disaster prevention.	WRUA needs to be able to select leaders and encourage them.	WRMA needs to offer necessary information and support on leaders' training to WRUA.	【 II 】	short-term	<b>[Lecture, local training, training in Japan]</b> To introduce cases in Japan and good examples from NGOs and other donors.	RO,SRO	
	4-3 Preparing materials for disaster prevention enlightenment activities	WRUA records the past flood damage with photograph and etc. WRUA draws and shares maps that show flood phenomenon (inundation, river channel change, etc.) and situation of damage (loss of crops, livestock, destruction of infrastructure, human life, etc.) There is also a disaster educational materials provided by the KRCS.	WRUA needs to have capacity to develop hazard map based on their "flood sketch map" WRUA needs to know about educational materials and tools for disaster prevention.(such as for example CMDRR)	WRMA needs to advise WRUA on necessary information.	【 II 】	short-term	<b>[Training in Japan, site visit, lecture]</b> To introduce cases and experience in Japan	HQ,RO,SR O	

WRUA and Community Capacity that WRMA supports to be developed	Capacity Element to be required	Assessment of current Capacity Level of WRUA (Consultant Team's Assessment with additional Inputs from Discussions in 1 <sup>st</sup> WG)	Development Needs of WRUA (Consultant Team's Proposition with additional Inputs from Discussions in 1 <sup>st</sup> WG)	Development Needs of WRMA (Consultant Team's Proposition with additional Inputs from Discussions in 1 <sup>st</sup> WG)	Priority	Time scope	Specific Method for Development adopted in the Project	Target Group	Content of Flood Management Module in WDC
	4-4 Executing disaster prevention enlightenment activities	There is no particular activities in "GM, LL, IS" WRUA.	WRUA needs to have capacity to familiarize and carry out disaster prevention enlightenment activities in community.	WRMA needs to share and guide WRUA to familiarize and carry out disaster prevention enlightenment activities in community.	【II】	short-term	<b>[Training in Japan, site visit and lecture]</b> To guide disaster prevention enlightenment activities with cases in Japan and cooperation with NGO Guidance from the NGO with the cooperation of the cases and cases of Japan and other donors	HQ,RO,SRO	
	4-5 Consideration of vulnerable segment of community in activities	There is no particular activities in "GM, LL, IS" WRUA.	-WRUA needs to response to aid community people in emergency.	WRMA needs to provide WRUA with necessary information about necessity and measures of emergency response.	【II】	short-term	<b>[Training in Japan, site visit and lecture]</b> To guide based on cases and experiences in japan.	HQ,RO,SRO	
	[Institutional aspects]								
	[Institutional aspects]								
5. To Plan Flood Disaster Mitigation and Flood Control Measures	5-1 To include flood disaster preventing activities in "SCMPs".	In Gucha Migori and Lower Lumi, it have been already included. "GM, LL" WRUA, In "IS" WRUA, it will be included in the future.	WRUA needs to understand that it is not only targeted measures for flood measures and understandings of "SCMP" WRUA needs to have a knowledge of how to describe a plan for flood measures to "SCMP" -Flood management activities should be incorporated in the SCMP.	It can be explained how to describe an overview of "SCMP" and flood measures to WRUA members. WRMA needs to train WRUA in developing SCMP that mainstream flood management.	【IV】	short-term	<b>[WG Discussion, site visit, OJT]</b> A suggestion for the section related to the flooding description and "SCMP" in "WDC manual"	RO, SRO	
	[Organizational aspects] (human, physical, financial, knowledge)								
	5-2 To establish operating plans of community based disaster prevention activities	The flood disaster management plan has been included in "SCMP" "GM, LL" The plan has not been included in "SCMP" "IS"	WRUA needs to incorporate the plan into "SCMP". WRUA needs to educate its members about the crisis management and the guidelines for the development manual	-WRMA needs to make a technical instruction to the WRUA concerning the activities of disaster prevention. WRMA needs to Coordinate and ask the cooperation with various organizations.	【IV】	short-term	<b>[Training in Kenya-Lecture, site visit]</b> Guidance from the case of NGO and Case of Japan and other donors	RO, SRO	
	[Institutional aspects]								

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	5-3 Legislative framework for community disaster prevention plans	The plan has been included in "SCMP" <b>"GM, LL "</b> The plan is not included in "SCMP" <b>"IS"</b>	WRUA needs to have the ability to incorporate in "SCMP" and to carry out	WRMA needs to educate so that the WRUA can plan the contents of the draft or description of matter in "SCMP" WRMA needs to have the ability to stakeholder coordination in the planning and more upper level planning.	<b>【IV】</b>	short-term	<b>[WG · Discussion , Site visit, OJT]</b> Guidance from the case of NGO and case of Japan and other donors	RO, SRO,HQ	
	5-4 To secure communication channels in flood management plans	It has not been secured yet at present. <b>"GM, LL, IS"</b>	WRUA needs to be able to incorporate aspect of lobbying from WRUA to the Flood Management Plan through the Basin Committee, etc	WRMA needs to educate the WRUA can incorporate their aspect of lobbying into the Flood Management Plan	<b>【IV】</b>	short-term	<b>[Training in Kenya · Lecture, OJT]</b> Teaching so that the WRMA can establish the description matters and draft of the Flood Management Plan	RO, SRO,HQ	
[Personal aspects]									
6. To implement flood countermeasures	6-1 Basic understanding for structural measures against floods	Someone have the knowledge of embankment, culvert, but it is just limited.	WRUA needs to have the knowledge about the example list of structural measures	WRMA needs to have the ability of planning and designing. WRMA should supervise.	<b>【IX】</b>	middle-term	<b>[Training in Kenya · Lecture, OJT]</b> Teaching so that the description of matter into the Flood Management Plan, the contents of the draft may be planning. Instill a sense of ownership of an existing project to design WRMA	RO, SRO	
	6-2 To understand Hazard Maps, and disseminating information	With the help of PT, core facility inundation area, such as shelter, livestock and agricultural damage mapping, of human suffering is <b>"GM "</b> being made by the WRUA on the map in the hands of residents <b>"GM "</b> The trial of making hazard map have been started by referring the example of "Gucha Migori" <b>"LL, IS"</b>	WRUA needs to have the ability to disseminate the technique of hazard map making, WRUA needs to have the ability to practice in a pilot area non "Gucha Migori"	-WRMA needs to be familiar with the information should be provided and usefulness of hazard map -WRMA needs to have capacity to assist WRUA to develop flood hazard map.	<b>【IX】</b>	middle-term	<b>[Training in Kenya · Lecture, OJT]</b> Introduced WRMA examples of Japan, to understand the effect of the hazard map	RO, SRO,HQ	
	6-3 To establish knowledge management system	Enlightenment is done by using the warning display in the office of WRUA and comments to the panel photo of the floods in the past <b>"GM "</b> It has not been implemented <b>" LL, IS"</b>	WRUA needs to have a competence that can be formed by integrating a mechanism to share and measures of damage in each community, such as the performance of its reflection (Knowledge Management)	WRMA needs to have an ability to support information organization and integration of WRUA based on a implementation of Knowledge Management System	<b>【IX】</b>	middle-term	<b>[WS · Discussion, research]</b> Advise on the draft of the proposed WRMA Knowledge Management System	RO, SRO,HQ	
[Organizational aspects] (human, physical, financial, knowledge)									

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	6-4 To implement structural measures against floods	Not implemented in the GuchaMigori and Isiolo basin "GM, IS" Gabion works are implemented in the Lumi basin" LL "	WRUA needs to have an ability to do the project management of the life cycle for the order materials and services for carrying out	WRMA needs to have an ability to provide know-how for ordering procedures, the procurement and such as construction management concerning the project management of WRUA	【IX】	middle-term	【WG・site visit OJT】 Implement an OJT with the manual	RO, SRO	
	6-5 To establish Hazard Maps and disseminating information	Enlightenments for establishing hazard maps have been done "GM " It has started to establishing hazard maps " LL, IS"	WRUA needs to have an ability to plot and gather various information on paper and to distribute to residents	WRMA needs to provide a topographical map to WRUA. WRMA needs an ability to do an explanation of how to fill in systematically and present complete sample to WRUA..	【IX】	middle-term	【Training in Kenya・Lecture, practical guidance】 Guidance for creating a base map, getting information, how to maintenance and completion.	RO, SRO,HQ	
	6-6 To secure budget (WSTF) for implementing structural/non-structural measures	Dredging of drainage, Gabion works for protection of water source have been done by applying the fund for water utilization. " LL " The item for flood management has been established in "SCMP", and a new trial is planned. "GM " Nothing has done. " IS"	WRUA needs to have an ability to make an application for funds in flood control	WRMA needs to make an instruction to be able to apply for funds to WRUA. WRMA needs to provide some completed examples or standard formats .etc	【IX】	middle-term	【WS・Discussion, research】 Pointing out the problems and barriers on the application of funds, guidance on improvement measures WRMA	SRO,HQ	
	6-7 Planning of structural measures	Any structural measures have not been done "GM " There is a gabion work in Lumi There are some implementation examples conducted by "KRCS" " IS" [IS] (strictly speaking is not a subject WRUA)	WRUA needs to have basic understandings for river structures (such as knowledge of the features and strengths of each type and structure)	WRMA needs to have understandings throughout the life cycle of river structures and having implementation management capacity (investigation, design, construction, maintenance)	【IX】	middle-term	【WS-research】 Introduces the fact that through the case in Japan. Monitoring and advice.	RO, SRO	
	[Institutional aspects]								
	[Personal aspects]								
	[Organizational aspects] (human, physical, financial, knowledge)								
7. To Train Community Members for Flood Responses	7-1 Planning flood fighting/evacuation drills	There is no implementation of flood drill by WRMA"GM, LL, IS"	WRUA needs to have an ability to make/request NGO trainings for flood fighting drills upon implementation of the decision of the planning and implementation of a system for flood prevention training	To be required consultation of WRMA	【VIII】	middle-term	Should be discussed		



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	7-2 Evaluating and revising flood fighting/evacuation drills	There is no concrete implementation <b>"GM, LL, IS"</b>	WRUA needs to be able to establish a framework for the implementation results being evaluated. WRUA needs to be able to build a framework for reflection based on the evaluation and the lesson it. WRUA should be trained in flood fighting and evacuation drill skills.	WRMA needs to facilitate to support WRUA.	<b>【VIII】</b>	middle-term	Should be discussed		
	7-3 Drill for flood fighting / evacuation among various organizations	There is no concrete implementation <b>"GM, LL, IS"</b>	WRUA needs to have ability to publicity, scenario creation, adjustment related organizations (establishing the way for spiral up).	WRMA needs to facilitate to support WRUA.	<b>【VIII】</b>	middle-term	Should be discussed		
	[Institutional aspects]								
	[Personal aspects]								
	[Organizational aspects] (human, physical, financial, knowledge)								
8. To Respond to Emergency Events	8-1 Leading evacuation, providing care	Partly implemented but it cannot be said to be organized <b>"GM, LL, IS"</b>	WRUA needs to have an ability to be able to build a evacuation centre or route that can support the implementation of evacuation during flood	WRMA needs to facilitate to support WRUA.	<b>【VI】</b>	middle-term	Should be discussed		
	8-2 Flood fighting	There is no concrete implementation <b>"GM, LL, IS"</b>	WRUA needs to have an ability to decide upon implementation the roles and activities of members of planning and flood prevention	WRMA needs to identify materials for flood fighting	<b>【VI】</b>	middle-term	Should be discussed		
	8-3 Observation of flood event	They observe and record the water level[GM] They put photos and status at the time of flood on sketch map" <b>GM "</b> They provide the necessary information to DC on the line <b>"GM, LL, IS"</b>	WRUA needs to have an ability to understand what is to be monitored in real time during the flood, to determine the response.	WRMA needs to have an ability to provide instruction about implementation of real-time observation procedure during floods to WRUA	<b>【VI】</b>	middle-term	<b>[Training in Kenya·Lecture, site visit]</b> Showing the details a instruction and monitoring during flood case being implemented in Japan to WRMA	RO, SRO,HQ	
	8-4 Making a local decision of (early) warning and notification	Standards and rules reported to DC are unknown <b>"GM, LL, IS"</b>	WRUA needs to establish the documentation and reaffirmation of the agreement with the DC. WRUA needs to complete the flow of information-communication system	WRMA needs to be able to teach WRUA the determination of the information-communication flow system	<b>【VI】</b>	middle-term	<b>[Training in Kenya·Lecture]</b> Advise to check the local rules on the basis the case of local	RO, SRO,HQ	

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	8-5 Executing emergency rescue operation	Unknown They are left to the DDMC and NGO etc.? "GM, LL, IS"	WRUA needs to be able to prepare for disaster response. WRUA needs to have knowledge of medicine distribution.	WRMA needs to share information and communication channel with donors and stakeholders.	【VI】	middle-term	Should be discussed		
	[Institutional aspects]								
	8-6 Emergency information exchange structure and rules among organizations	They report and consult DC, WRMA / SRO, "GM, LL "	WRUA needs to be able to act according to the manual along the procedure for transmission of information with relevant agencies in the event of emergency.	WRMA needs to develop manual. It will enhance communication and flow of information during disaster.	【VI】	middle-term	Should be discussed		
9. To Restore and Reconstruct Livelihood, Daily Lives  (Limited to the part pertaining to the flood management of WRMA such as Recovery and reconstruction)	[Personal aspects]								
	[Organizational aspects] (human, physical, financial, knowledge)								
	9-1 Understanding of community needs	Discussion and confirmation in meetings. "GM, LL, IS"	WRUA needs to be able to request to relevant agency by collecting needs from the community.	To be required consultation of WRMA	【VII】	middle-term	Should be discussed		
	9-2 Executing works for restoration of infrastructures, housing and livelihood etc.	They are doing recovery works of roads/bridges destruction, culverts obstruction, dykes broken and waterways occluded (repair by sandbags and gabions)	WRUA needs to be able to reach out to relevant organizations. WRUA needs to have an ability to raise the competence of such materials.	To be required consultation of WRMA	【VII】	middle-term	Should be discussed		
	[Institutional aspects]								
	9-3 Allocation of budget for restoration works	Unknown			【VII】	middle-term			
9-4 Organizing relevant parties for reconstruction	WDC activities			【VII】	middle-term				

## Priority Ranking

- Priority 【 I 】 : objective 2 To analyze and evaluate risks  
Priority 【 II 】 : objective 4 To enlighten community members and organizations  
Priority 【 III 】 : objective 3 To establish organizations  
Priority 【 IV 】 : objective 5 To plan disaster reduction  
Priority 【 V 】 : objective 1 To establish framework of activities  
Priority 【 VI 】 : objective 8 To respond to emergency  
Priority 【 VII 】 : objective 9 To restore and reconstruction livelihood, daily lives and under recovery  
Priority 【 VIII 】 : objective 7 To train people  
Priority 【 IX 】 : objective 6 To implement countermeasures

## **Appendix 2-4**

### **Flood Management module of the WDC Manual**



**WRUA DEVELOPMENT CYCLE  
(WDC)**

**VERSION TWO**

**APRIL 2014**

## **PREFACE**

The decision to revise the WRUA Development Cycle (WDC) version I of 2008 arose from the lessons learnt during the implementation of the manual. This among others, was the need to include flood management, climate change and livelihood components. The framework follows the provisions in the Constitution of Kenya 2010 and the principles of Integrated Water Resources Management, both of which lay emphasis on the involvement, public participation and collaboration with local community.

The framework defines the arrangements between Water Resources Management Authority (WRMA) and Water Services Trust Fund (WSTF) regarding funding of water resource management activities through the Water Resource Users Association (WRUAs). It also provides adequate guidelines for other potential development partners with interest in WRUA activities.

It is worth noting that this document was revised before the enactment of the water Bill 2014 into law, and has therefore been based on the provisions of the Water Act 2002. We also note that the document has three complementary parts arranged in three different volumes covering the framework, operational guidelines and toolkit. It is advisable that the separate volumes be referred to as complementary parts and not in isolation.

I wish to acknowledge the participation of the steering committee comprising of members of staff from WRMA and WSTF who spearheaded the development of the revised version. We firmly believe that this WRUA DEVELOPMENT CYCLE VERSION 2 of 2014 will continue to provide useful guidelines in supporting water resource management at the local level in collaboration with WRUAs.

**Eng. Phillip Olum, HSC,**  
Chief Executive Officer  
Water Resources Management Authority

**Eng . Jacqueline Musyoki OGW**  
Chief Executive Officer  
Water Services Trust Fund

## **WDC LIST OF ABBREVIATIONS**

AGM	Annual general meeting
CAAC	Catchment Area Advisory Committee
CBOs	Community Based Organizations
CDF	Constituency Development Fund
COP	Codes of Practice
CPC	Community Project Cycle
HR	Human Resource
HRD	Human Resource Development
HQ	Head Quarter
IGA	Income Generating Activities
IWRM	Integrated Water Resources management
M&E	Monitoring and Evaluation
MEWNR	Ministry of Environment, Water and Natural Resources
MWI	Ministry of Water and Irrigation currently MEWNR
NWCPC	National Water Conservation and Pipeline Cooperation
NSIS	National Security Intelligence Service
QCA	Quality Control Agent
RO	Regional Office
SHGs	Self Help Groups
SCMP	Sub Catchment Management Plan
SO	Support organisation
SRO	Sub Regional office
WDC	WRUA development cycle
WRM	Water Resource Management
WRMA	Water Resources Management Authority
WRUA	Water Resource Users Association
WSB	Water Service Boards
WSP	Water Service Providers
WSTF	Water Services Trust Fund
UPC	Urban Project Cycle
MOA	Memorandum of Agreement
MOU	Memorandum of Understanding
LMG	Livelihood Micro Grant

## WDC DOCUMENT OVERVIEW

Vol.	Title	Content	Reference	Details
1	<b>WDC FRAMEWORK</b>	<ul style="list-style-type: none"> <li>• Introduction to WDC</li> <li>• Policy and Legislative Framework</li> <li>• Overview of WDC Approach</li> <li>• WRUAs</li> </ul>		
			<b>Appendix</b>	
2	<b>WDC OPERATIONAL GUIDELINES</b>	Eligible areas and activities	A1	WSTF – WRMA Memorandum of Agreement
		WDC Funding Process		
		WDC Financial Guidelines		
			A2	WRMA-Other Development Partners Memorandum of Agreement
			A3	WRMA-WRUA Memorandum of Understanding
			B	Categorisation of sub-catchments according to status
			C	WDC Standard Rates for WRUA
			D1	WDC Request for Funds (RFF)
			D2	WDC Fund Request Forwarding Form WRMA-WSTF
			E	Sub-Catchment Management Plan (outline)
			F	WDC Desk Appraisal
			G	WDC Field Appraisal
			H	WDC Activity Contract
			I	WDC Progress Report (outline)
			J	WRUA – SO contract (sample)
			K	Criteria for WRUA Registration with WRMA
	L	Implementation Plan (Excel Format)		
	M	WDC Projects Monitoring Tool (Annexes A-E)		
	N	Activity Monitoring Reporting Template		
			<b>Module</b>	
3	<b>WDC TOOLKIT</b>	Instructions to WDC Toolkit		
			1	Water Sector Reforms
			2	WDC Overview
			3	Catchment Characteristics
			4	SCMP Development
		5	Water Balance & Water Demand Management	

*WDC Overview*

		6	Water Allocation and Use
		7	Water Resource Protection
		8	Catchment and Riparian Conservation
		9	Flood Management
		10	Climate Change
		11	Infrastructure Development
		12	Alternative Livelihood
		13	Rights Based Approach and Poverty Eradication
		14	Institutional Development
		15	Monitoring and Information
		16	Financial Management
		17	Training Module Vol 2 Operational Guidelines



## MODULE 9: FLOOD MANAGEMENT

**Target Group** WRUA committee members,  
WRUA members,  
Stakeholders

### **Sessions**

- 1: Flood Disaster And Flood Management
- 2: Integrated River Basin Flood Management
- 3: Rainfall and Flood Observation
- 4: Community-Based Flood Hazard Map
- 5: Flood Early Warning
- 6: Flood Disaster Evacuation Programme
- 7: Communication, Public Awareness Raising and Disaster Education
  
- 8: Planning, Design, Construction, Operation, and Maintenance Of Flood Mitigation Facilities
- 9: Co-Operation between Upstream and Downstream Stakeholders And Co-Ordination

### **Overview**

This module addresses the need for WRUAs to understand aspects related to flood disaster and management, Integrated River Basin Flood Management. Rainfall and Flood Observation, community-Based Flood Hazard Map, flood Early Warning and flood Disaster Evacuation Programme. It also highlights in details communication, Public Awareness Raising and Disaster Education, planning, Design, Construction, Operation, and Maintenance of Flood Mitigation Facilities and co-Operation between Upstream and Downstream Stakeholders and Co-Ordination

### **SESSION 1: FLOOD DISASTER AND FLOOD MANAGEMENT**

#### **Topics:**

- 1: Introduction to the Causes and Effects of Floods
- 2: Understanding Flood Management
- 3: Flood Disaster Management

### **Overview**

This session introduces flood disaster and flood management with focuses on the causes and effects of floods, understanding flood management, and flood disaster management.



Figure-1 Relation between Cause and Effect

Table-1 Example of Relation between Cause and Effect

Cause	State of Function	Effect
Mosquitoes	Human Immunity Resistance	Malaria Disease
Spreading Flood Water	State of Sanitary Facilities	Water-borne Diseases
	Drainage Capacity of Roads	Traffic Congestion
Heavy Rainfall Amount	Channel Capacity	Flood

This session, therefore aims to enhance the understanding of Water Resources Users Association (WRUA) members and leaders, communities as well as the other stakeholders on:

- What is a flood?
- Where does a flood occur?
- What are the causes of floods? and
- Flood preparedness concept at the community level, etc.

The aim of this session is to have the participants gain the understanding that a community can minimize the impact of flood damages, even though it is difficult to control or reduce the flood itself.



Figure-2 Relation between Flood Hazard and Flood Disaster

This session also seeks to impart skills to WRUA leaders and other stakeholders regarding how to collaborate with similar groups and/or organizations within their respective sub-catchments in participating in the development of Flood Management System.

The four(4) phases of the Flood Disaster Management, i.e., Preparation, Response, Recovery, and Mitigation, are required for actions against flood disasters, which are shown in Figure-3.

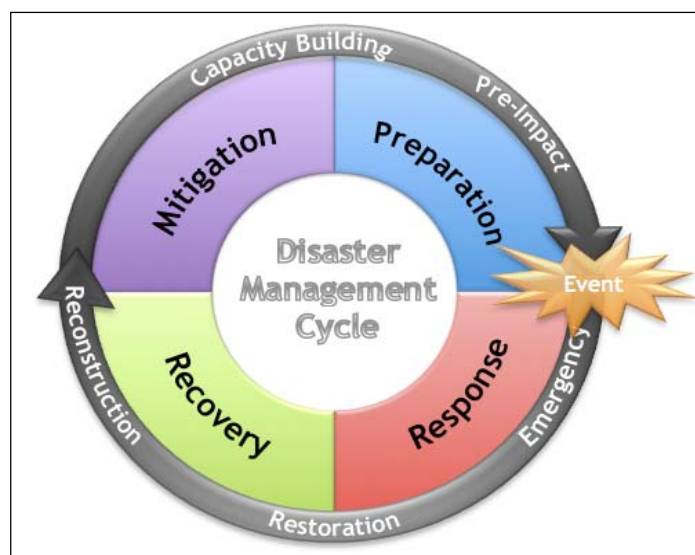


Figure-3 Disaster Management Cycle (DMC)

By the end of this training session, the participants will be able to develop Flood Management Plans (FMP) by themselves.

**1: Causes and Effects of Floods**

<p><b>Introduction</b></p>	<p>How to understand a Flood?</p> <p>A flood is a situation in which the water of a river, a stream, and/or a channel overflows its banks and covers large areas of dry land.</p> <p>The temporary water-covering of land, which is not normally covered with water, may include floods from rivers, from mountain areas, and from the sea in coastal areas.</p> <p>This session introduces general notions of ‘Hazard’, ‘Risk’, ‘Disaster’ and ‘Flood Management’.</p>
<p><b>Purpose of the topic</b></p>	<p>WRUA committee leaders/members and other stakeholders are required to clearly understand what a flood is, the causes and effects of floods, where they occur, and how best the community should be prepared in the event of a flood to prevent the occurrence of a disaster.</p> <p>The overall goal is that the participants will be able to mobilize and raise the required awareness of the importance of flood preparedness in the catchment areas.</p>
<p><b>Objectives</b></p>	<p>By the end of this session, the participants will have an understanding of:</p> <ol style="list-style-type: none"> <li>1) The definition of a flood;</li> <li>2) The occurrence of floods, their causes and effects;</li> <li>3) The definition of a flood disaster;</li> <li>4) Mobilizing and sensitizing a community and the WRUA members</li> </ol>

	<p>on flood preparedness; and</p> <p>5) How to manage a flood disaster in their operation areas.</p>
<b>Time period</b>	- 1hour
<b>Methodology</b>	<ul style="list-style-type: none"> <li>- Short presentation.</li> <li>- Questions and Answers.</li> <li>- Information sharing.</li> <li>- Discussions</li> </ul>
<b>Materials/Tools</b>	<ul style="list-style-type: none"> <li>- Illustrations shall be provided by the instructor.</li> <li>- Flip Charts.</li> <li>- Kenya Flood Safety Manual.</li> </ul>
<b>Content/Message</b>	<p><b>Step-I: Understanding of a flood</b></p> <p>The participants will try to share their ideas and thoughts on their understanding of what a flood is. This entails:</p> <p style="padding-left: 40px;">Illustration of water levels in a river;</p> <ul style="list-style-type: none"> <li>• Understanding of the river bank characteristics;</li> <li>• Rainfall patterns in the catchment area;</li> <li>• Population characteristics;</li> <li>• Land use characteristics---settlement patterns, farming practices, deforestation, and reforestation;</li> <li>• Water resources in the catchment area; and</li> <li>• Soil erosion and sediment deposition in ariver.</li> </ul> <p>The facilitator will define what a flood is.</p> <hr/> <p><b>Step-II: The causes of a flood</b></p> <p>Guide /note: The facilitator to ask the participants to differentiate between natural and human causes of floods below:</p> <ul style="list-style-type: none"> <li>• Increased rainfall amounts;</li> <li>• Catchment characteristics such as soil types, shape, slope angle, land use, etc.;</li> <li>• River channel siltation and sediment deposition;</li> <li>• Reservoir or dam embankment collapse causing downstream flooding; and</li> <li>• Human activities interfering with natural flows leading to the overflow on dry lands amongst others</li> </ul>

	<p><b>Step-III: Where do floods occur?</b></p> <p><b>The facilitator to probe the discussion which entails:</b></p> <ul style="list-style-type: none"> <li>• Land areas adjacent to the river channel (riparian areas);</li> <li>• Low lying areas in downstream catchments;</li> <li>• Flood plains; and lake</li> <li>• Deltas.</li> </ul> <hr/> <p><b>Step-IV: The effects of a flood</b></p> <p><b>The facilitator to probe the discussion which entails:</b></p> <p>Floods have good and bad effects. Bad effects to a society and human resources are designated as disaster.</p> <p><b>The bad effects are:</b></p> <ul style="list-style-type: none"> <li>• Increased soil erosion and environmental degradation;</li> <li>• Damages to property and crops;</li> <li>• Loss of human life and livestock;</li> <li>• Damages to physical facilities such as roads, houses, churches, hospitals, schools, bridges.</li> <li>• Disruption of communication and transport networks; and</li> <li>• Health problems by means of mosquito breeding causing malaria, pollution of both surface and ground water.</li> </ul> <p><b>The good effects are:</b></p> <ul style="list-style-type: none"> <li>• To promote breeding, nesting and feeding of fish, birds and wildlife;</li> <li>• To improve soil fertility(in the plains)</li> <li>• To be used for storage for future irrigation;</li> <li>• To recharge groundwater.</li> </ul>
<p><b>Review of knowledge of flood Impacts and how to prepare for disasters</b></p>	<p>The facilitator will ask the participants to identify the areas mainly affected by floods , the impacts and how to prepare for disasters in Kenya and in the respective rivers/streams in their sub catchment</p> <p>At this stage the WRUA members/leaders and other stakeholders are ready to be inducted on the flood disaster management contents and disaster preparedness mechanisms.</p>
<p><b>Conclusion</b></p>	<p>At this stage the WRUA members/leaders and other stakeholders are ready to be inducted on the flood disaster management contents and</p>

	disaster preparedness mechanisms.
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**2:Understanding Flood Management**

<b>Introduction</b>	<p>Flood management differs widely (before (pre), during, and after (post) floods) based on the following actions; At the National level, the flood management would be structural measures and/or non-structural measures. At the sub catchment level the flood management would aim at preserving lives and/or assets and/or infrastructures for the community members; and</p> <p>At the house hold level the flood management would aim at self-preservation actions and/or daily preparations for floods.</p> <p>Flood management plan includes structural (dykes, dams, drainage systems, evacuation structures) and non-structural (planning, community education and raising awareness, flood modeling and mapping, early warning systems).</p>
<b>Objectives</b>	By the end of the session, the participants will be able to understand the meaning of the steps involved in the flood management activities within their specific catchment areas.
<b>Time Period</b>	- 1 hour
<b>Methodology</b>	<ul style="list-style-type: none"> <li>- Discussions.</li> <li>- Questions and Answers.</li> <li>- Brainstorming.</li> </ul>
<b>Materials/Tools</b>	<ul style="list-style-type: none"> <li>- Papers.</li> <li>- Pens.</li> <li>- Cards.</li> <li>- Flip charts.</li> <li>- Examples of flood management regimes in Kenya</li> </ul>
<b>Session Guide: Discussion and Brainstorming</b>	<p>This session aims at understanding detailed flood management schemes.</p> <p>The discussion should build on existent community flood management strategies.</p> <p>The role of the group leader in this session will be to guide the discussions.</p> <p>The participants will be required to share with the others their understandings of flood management plans, importance of flood management plans, and how they are developed.</p> <p>The participants will be divided into groups of equal membership and sit in a roundtable for the discussion.</p>

	Each group shall appoint the Chair and the Rapporteur.
<b>Content/Message</b>	<p><b>Step-I: Flood management regimes</b></p> <p><b>The facilitator introduces the Flood management regime components</b></p> <p>The participants will identify the regimes in their sub catchment in each group</p> <p>Flood management regime is premised on four components:</p> <ul style="list-style-type: none"> <li>• Magnitude;</li> <li>• Duration;</li> <li>• Timing; and</li> <li>• Frequency.</li> </ul> <p>Flood types are defined by differentiating similar flood events based on their magnitude (i.e., peak flow), duration, timing, and frequency.</p>
	<p><b>Step-II: Importance of flood management plans</b></p> <p>The facilitator to ask the participants to plot the regime components (Magnitude, Duration, Timing, and Frequency)for the specified record(e.g. 20 years)</p> <p>Flood management regimes are used for flood risk assessment and planning purposes. Once the flood regimes are identified, the frequency of each type is calculated for the entire record.</p>
	<p><b>Step-III: How to develop flood management plans</b></p> <p>Flood management plan outlines the roles and responsibilities and describes flood management planning and management activities.</p>
<b>Outputs</b>	<p>The rapporteurs will write on a flip chart the discussion results and stick up them on walls.</p> <p>Each group will share and discuss the reports of other groups.</p> <p>The session should result in sharing the notion of the flood management mechanism by all the participants.</p>
<b>Session review</b>	Check the attainment of the objectives of this session by asking the participants to explain what they came up with the use of the flood management plan they have just formulated.

### **3:Flood Disaster Management**

<b>Introduction</b>	<p>A disaster is a sudden or gradual event that causes damages to and/or disruption of economic activities and patterns of life.</p> <p>Floods become disasters only when they seriously affect human life, livelihoods, and property and would require internal and external help.</p> <p>Disaster management is, therefore, a body of policy, administration</p>
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	<p>decisions, and operational activities, which govern various phases of a disaster at all levels.</p> <p>Disaster management usually consists of a multi-disciplinary team and requires complex co-ordination and management of a wide variety of activities.</p> <p>Disaster Management Cycle (DMC: see Figure-3) involves Monitoring, Assessment, Preparedness, Response, Restoration, and Rehabilitation (MAPRRR).</p>
<b>Objectives</b>	<p>By the end of the session, the participants will be able to:</p> <ol style="list-style-type: none"> <li>1) Understand the four (4) phases in sustainable and effective flood disaster management cycle; and</li> <li>2) Understand the importance of the MAPRRR in minimizing the impacts of flood disasters.</li> </ol>
<b>Phases in sustainable and effective Flood Disaster Management Cycle (FDMC)</b>	<ol style="list-style-type: none"> <li>1) <b>Flood Preparation:</b> Flood preparation involves hazard and vulnerability identification, frequency and consequence analysis, and disaster assessment according to the given criterion for designating a disaster. Flood preparation also involves planning how to respond to the flood; <ul style="list-style-type: none"> <li>• Examples: Preparing plans, emergency exercises/training/drills, flood early warning systems, etc.</li> </ul> </li> <li>2) <b>Response:</b> Efforts to minimize the hazard caused by a disaster. <ul style="list-style-type: none"> <li>• Examples: search and rescue, emergency relief, etc.</li> </ul> </li> <li>3) <b>Post Flood Recovery/Rebuild:</b> Restoring the community to normal living conditions. <ul style="list-style-type: none"> <li>• Examples: Temporary housing, grants, medical care, as well as repairing and reconstruction, damage compensation, review and suggestions for future management, etc.</li> </ul> </li> <li>4) <b>Flood Mitigation:</b> Minimizing the effects of a disaster. <ul style="list-style-type: none"> <li>• Examples: Building codes and zoning, vulnerability analyses, public education, etc., using structural and non-structural measures.</li> </ul> </li> </ol>
<b>Time period</b>	- 1 hour
<b>Methodology</b>	<ul style="list-style-type: none"> <li>- Lecture.</li> <li>- Guided discussions.</li> <li>- Sharing experiences.</li> </ul>
<b>Materials/Tools</b>	<ul style="list-style-type: none"> <li>- Papers.</li> <li>- Pens.</li> <li>- Flip charts.</li> <li>- Open space.</li> </ul>
<b>Session guide</b>	This session aims at enhancing participants' knowledge of flood preparedness concept to mitigate the effects of a flood disaster.
<b>Outputs</b>	This session should result in identifying the knowledge gaps between the participants on flood disaster management and ways they can address



	them.
<b>Review</b>	<p>Check the attainment of the objectives of this session by asking the participants to share their knowledge of flood disaster management plans.</p> <p>Allow the participants to list them up on a sheet of paper and discuss them as a group.</p>

## SESSION2: INTERGRATED RIVER BASIN FLOOD MANAGEMENT

### Topics:

- 1: Integrated River Basin Flood Management (IRBFM)
- 2: Introduction to Community Managed Flood Disaster Risk Reduction (CMFDRR)
- 3: Vulnerability Assessment
- 4: Flood Mitigation Non-Structural Measures including Community-based Measures

### Overview

In general, the Integrated Flood Management (IFM) comprises relevant laws, strategies, plans, and institutions.

This session introduces the Integrated River Basin Flood Management (IRBFM). IRBFM means integration of flood and water resource management within a river basin using a combination of measures that involve beneficial use of floods, concurrently with reducing the risks that floods can cause to humans and their activities.

The reason for introducing the Integrated River Basin Flood Management is to ensure that all the externalities can be taken care of. Among these externalities is the pollution that can occur during floods.

Non-structural measures should be taken to control pollution or contaminated deposits, because it is necessary to ensure that natural ecosystem that should be left intact with no interference by any mitigation measures in case of recurrence of flood disasters.

This session further introduces the use of non-structural measures against floods. It seeks to explore the applicability of these non-structural measures to a flood risk management plan.

Figure-9 below shows how IRBFM may be an integral part of flood management (IFM) under Integrated Water Resources Management (IWRM).

Presently our interest is basically to show the unity of a river basin planning regime.

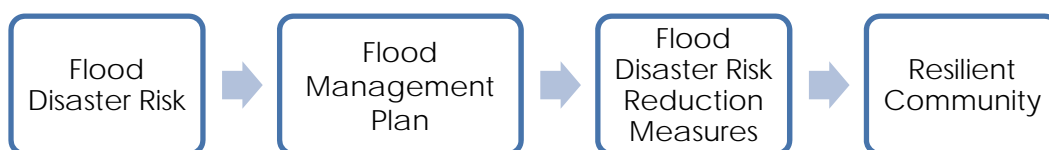


Figure-6 Roles of Flood Management Plan for Reducing Flood Disaster Risk



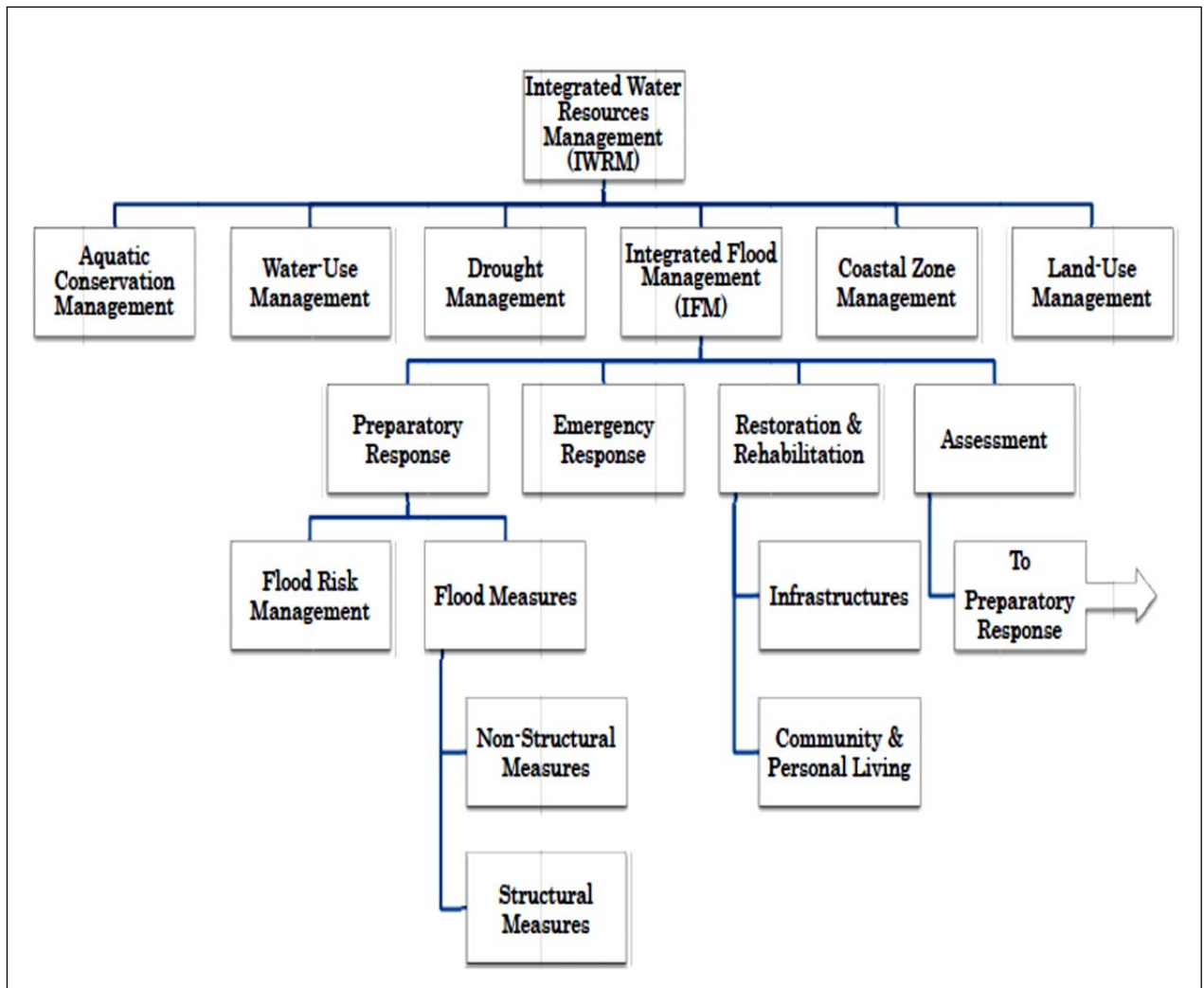


Figure-7 Proposed Framework of Integrated Flood Management in Kenya  
 (Source: JICA Project Team)

Table-2 Flood Management Project Effects on Flood Management

Flood Management Project Effects	Facility Effects	Direct Impact	Alleviation Effects on Direct Damages		Damage Abatement for Human Life
					Damage Abatement for Personal Property
					Damage Abatement for Agriculture, Forestry, and Fisheries Industry
					Damage Abatement for Public Utility Enterprises
					Damage Abatement for Lifeline Utilities
					Damage Abatement for other Utilities
		Indirect Impact	Alleviation Effects on Indirect Damages		Mitigation of Suspension/Stagnation in Production
					Abatement of Outgoings for Emergency Countermeasures
					Abatement of Blocking Life Function
					Abatement of Psychic Influence
			Regional Development	Land Development	Upgrading Land-Use
				Expanding Utilizable Land	
	Economic Expansion	Regional Development	Trigger for Production		
			Promotion for Distribution including Roads and Channels		
			Raising Income Levels		
			Expansion of Job Opportunities		
	Social System Improvement	Regional Development	Growth of Population		
			Promotion of Facilities Improvement		
			Fiscal Soundness		
	Ripple Effect for Flood Management Facilities		Enhancement of Residents' Life Quality		
			Conservation of Natural Environment		
			Improvement of Hygienic Environment		
			Enhancement of Amenity		
Development for Tourism Resources					
Investment Effects		Effect on Production Activities			
		Effect on Income Increase			
		Effect on Consumption Growth			
		Effect on Employment Increase			

Table-3 List of Structural and Non-Structural Measures for Flood Management

Structural Measures	Measures for Flood Reduction (FRR)	Measures to Improve Water Flows in River Channels, which are focused on Rivers	Excavation of River Channels
			Levee and Embankment
			Discharge Channels and Cut-Off Channels
			Floodgate
			Inland Water Drainage
			Riverbank Protection
			Spur Dike, etc.
		Measures to Control Run-off into Rivers, which are focused on River Basins	Dam
			Flood Control Facilities
			Effective Utilization of existent Facilities, etc.
		Measures to Control Flood Flows	Secondary Levees
			Open Levees
			Ring Levees, etc.
		Measures to Control Sediment Flows (Sabo Works)	Erosion Control Dam or Check Dam
	Channel Works		
Training Levees			
Groundsill, etc.			
Measures for Rehabilitation and Reconstruction		Disaster Prevention Facilities	
		Transportation Network	
		Disaster Prevention Operation Plan	
		Business Continuity Plan	
		Disposal of Flood-generated Waste, etc.	
Non-Structural Measures	Measures of Evacuation	Evacuation and its Guidance	
		Forecasting and Warning	
		Evacuation Facilities	
	Measures against Emergency	Flood Fighting	
		Cofferdam	
		Drainage Measures	
		Sandbag	
		Evacuation Drill	
		Training	
	Measures to Reduce Damages in Floodplains	Disaster Education, etc.	
		Raising Floors of Buildings	
Installing Electric and Machinery Equipment on higher places			
Regulation of Land-Use, etc.			

**1: Integrated River Basin Flood Management (IRBFM)**

<b>Introduction</b>	This session seeks to discuss the rationale and importance of a plan for Integrated River Basin Flood Management (IRBFM) in terms of flood risks and to clearly understand flood measures in an integrated way.
<b>Objectives</b>	The objectives are to enable the participants to understand: 1) Integrated River Basin Flood Management (IRBFM); 2) Community Managed Disaster Risk Reduction (CMDRR); 3) Vulnerability Assessment process; and 4) Non-structural flood mitigation measures including community-based measures.
<b>Time period</b>	- 1 hour.
<b>Methodology</b>	- Short presentation. - Questions and Answers. - Information sharing. - Discussions.
<b>Materials/Tools</b>	- Illustrations. - Flip charts. - Marking pens.
<b>Content/Message</b>	<p><b>Step-I: Integrated River Basin Flood Management (IRBFM)</b></p> <p>The Integrated Flood Management (IFM) is related to the central government, county government, communities, and the individual stakeholders.</p> <p>IFM integrates land and water resources development in a river basin and aims at maximizing the net benefits from the use of floodplains as well as aiming at minimizing the loss of lives and the property damages due to flooding (see Figure-7).</p> <hr/> <p><b>Step-II: Flood Mitigation using Non-Structural Measures</b></p> <p>The facilitator will introduce the participants to the Non-Structural Measures to mitigate flood damages. The measures include:</p> <ul style="list-style-type: none"> <li>• Spatial planning;</li> <li>• Early warning;</li> <li>• Evacuation plan;</li> <li>• Preparedness for disaster relief and flood proofing;</li> <li>• Emergency response;</li> <li>• Knowledge sharing; and</li> <li>• Community participation or Public Involvement (PI)</li> </ul> <hr/> <p><b>Step-III: Use of Forecasting and Warning System</b></p>

	<p>This entails:</p> <ul style="list-style-type: none"> <li>• Establishing an efficient Early Warning System (EWS);</li> <li>• Data gathering system involving rainfall intensity and distribution on a real-time scale;</li> <li>• Means of translating this information into a hydrograph and a possible flood event;</li> <li>• Quick and clear method of communicating the information from the relevant authorities to the areas and communities likely to be affected; and</li> </ul> <ul style="list-style-type: none"> <li>• Preparation for evacuation, relief efforts, and restoration mechanisms.</li> </ul>
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**2:Community Managed Flood Disaster Risk Reduction (CMFDRR)**

<b>Introduction</b>	<p>A risk refers to the possibility for a specific hazard to occur and its probable effectson people, property, and environment.</p> <p>In the present discussion, a risk means that there is a chance that a disaster can occur.</p> <p>A hazard refers to a situation that poses threat to human life, public health, property, or environment.</p> <p>Floods and droughts are regarded as climatic hazards.</p> <p>On the other hand, vulnerability is the lack of ability for a person, a community or an infrastructure to protect him/her/itself against the damage, injury, or harm inflicted by a hazard.</p> <p>The facilitator will define and give other examples of risk hazard and vulnerability and briefly explain the concept of Community Managed Disaster Risk Reduction (CMDRR).</p>
<b>Objectives</b>	<p>By the end of this session participants will:</p> <ol style="list-style-type: none"> <li>1) Understand the concept of Disaster Risk Reduction (DRR);</li> <li>2) Have their understanding of CMDRR enhanced;</li> <li>3) Explore the factors that influence adoption of CMDRR within catchment areas;</li> <li>4) Identify the main stakeholders in a CMDRR process; and</li> <li>5) Have their skills enhanced to assess risks in a humanitarian context in which they work.</li> </ol>
<b>Time period</b>	- 1 hour
<b>Methodology</b>	<p>- Lecture.</p> <p>- Group Discussions.</p> <p>- Information Sharing</p>
<b>Materials/Tools</b>	- Marking pens.

	<ul style="list-style-type: none"> <li>- Flip charts and sheets of paper.</li> <li>- Outline of groups to be involved.</li> </ul>
<b>Session Guide</b>	<p>Explore the role of the community and other stakeholders in the reduction of flood disaster risks.</p> <p>This session will involve group discussions among the participants and knowledge sharing.</p>
<b>Output</b>	<p>The participants will acquire skills of the community management of Flood Disaster Risk Reduction (CMFDRR) mechanisms.</p> <p>They will also understand the roles of key players in the process.</p>
<b>Description</b>	<p>Community Managed Disaster Risk Reduction (CMDRR) approach cultivates people's capacities to prevent and mitigate the impact of hazards on communities at risk.</p> <p>Disaster Risk Reduction (DRR) is achieved by enhancing individual survivability and community readiness.</p> <p>Building resilient communities means to strengthen the foundation of safety and enhance Disaster Risk Reduction measures.</p>
<b>Content/Message</b>	<p><b>Step-I: Understanding of CMFDRR</b></p> <p>The participants will be inducted into understanding the key issues involved in a CMFDRR process. The process entails:</p> <ul style="list-style-type: none"> <li>• Facilitating, documenting, and sharing of CMFDRR experiences as a part of policy advocacy;</li> <li>• Community resource mobilization;</li> <li>• Networking;</li> <li>• Monitoring and evaluation; and</li> <li>• Organizational learning.</li> </ul> <p>The participants will understand how to link community organizations with other actors who are active in Disaster Risk Reduction and how to access resources for CMFDRR.</p> <hr/> <p><b>Step-II: Factors that influence Adoption of CMFDRR within Catchment Areas</b></p> <p>This entails:</p> <ul style="list-style-type: none"> <li>• Livelihoods development;</li> <li>• Natural resources management;</li> <li>• Health systems development;</li> <li>• Disaster education; and</li> <li>• Community disaster resilience.</li> </ul> <p>Integrating DRR in the wider community development programmes ensures the sustainability of DRR practices and principles.</p>



	<p><b>Step-III: Main Stakeholders in a CMFDRR Process and their Capabilities:</b></p> <p>What can the following stakeholder do?</p> <ul style="list-style-type: none"> <li>• Community members;</li> <li>• NGOs;</li> <li>• Government; and</li> <li>• Private sectors, etc.</li> </ul>
	<p><b>Step-IV: Knowledge Sharing</b></p> <p>At this stage the WRUA members, WRUA committee members, and other stakeholders are ready to deepen their insight into the concept of CMFDRR and disaster preparedness mechanisms within their catchment areas.</p>

### **3: Vulnerability Assessment**

<p><b>Introduction</b></p>	<p>Vulnerability is the degree to which people, property, resources, systems, and cultural, economic, environmental and social activities (communities) are susceptible to harm, degradation, or destruction when exposed to a hostile agent or factor.</p> <p>Vulnerability Assessment is the process of identifying, quantifying, and prioritizing (or ranking) the vulnerabilities in a system or a community.</p> <p>Exposure is normally a factor of vulnerability but a distinction is usually made between exposure and vulnerability.</p> <p>Flood risk can be reduced not only by decreasing the magnitude of hazards but also by reducing exposure of people and their activities against flooding and by diminishing the vulnerability of flood-prone society.</p> <p>Vulnerability from the perspective of disaster management can be evaluated by assessing the threats from potential hazards on the population and infrastructures.</p> <p>Vulnerability Assessment may be conducted in the political, social, economic or environmental fields. It has a common meaning with Risk Assessment.</p> <p>The goal is mitigating or eliminating the most serious vulnerabilities for the most valuable resources.</p>
<p><b>Objectives</b></p>	<p>By the end of this session the participants will:</p> <ol style="list-style-type: none"> <li>1) Enhance their understanding of vulnerability;</li> <li>2) Explore the factors that influence vulnerability within the catchment areas; and</li> <li>3) Enhance their ability to assess vulnerability and risks in the</li> </ol>

	humanitarian context in which they work.
<b>Time period</b>	- 1 hour
<b>Methodology</b>	- Lecture. - Discussions. - Information sharing.
<b>Materials/Tools</b>	- Marking pens. - Flip charts and sheets of paper. - Outline of groups to be involved
<b>Session Guide</b>	Explore the role of the community and other stakeholders in Vulnerability Assessment.  The facilitator will involve stakeholders in group discussions and knowledge sharing.
<b>Content/Message</b>	The stakeholders will have catalogued their assets and capabilities in a ranking order and identified their potential levels of threats to floods.  <b>Step-I: Vulnerability Assessment</b>  Vulnerability Assessment is typically performed based on the following steps: <ul style="list-style-type: none"> <li>• Cataloging assets and capabilities (resources) in a system;</li> <li>• Assigning quantifiable values (or rank order, at least) and importance to those resources; and</li> <li>• Identifying the vulnerabilities or potential threats to each resource.</li> </ul> <b>Step-II: Disaster Control Planning</b>  Disaster control planning refers to assessing the options for reducing flood risks such as non-structural measures/actions by individuals such as flood proofing, land-use regulations, flood emergency measures (flood warning and evacuation).  The basic options include reduction of risk, exposure, and vulnerability.  The participants should be able to know the various options for reducing flood risks as summarized in the Table-4 below.
<b>Conclusion</b>	Participants now understand the importance of disaster control measures within their WRUAs and communities.  They may not have considered other options here. Let them list them.
<b>Discussion Questions</b>	Discuss what and where Flood Vulnerabilities are in your community, referring to the discussion example in Figure-8.

**Table-4 Disaster Control Planning for Non-Structural Measures**

Hazard Reduction	Exposure Reduction	Vulnerability Reduction
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<ul style="list-style-type: none"> <li>• Retaining water where it falls (increasing infiltration, rooftop storage)</li> <li>• Retention basins (natural wet lands or manmade depressions e.g., school grounds, household underground tanks)</li> <li>• Land-use management (e.g. house building codes in urban areas, appropriate spatial planning)</li> </ul>	<ul style="list-style-type: none"> <li>• Structural and non-structural measures and actions by individuals (flood proofing)</li> <li>• Land-use regulations</li> <li>• Flood emergency measures (flood warning and evacuation)</li> </ul>	<ul style="list-style-type: none"> <li>• Physical: improving the infrastructure, well-being, job opportunities, and living environment.</li> <li>• Constitutional: facilitating equal participation opportunities, disaster education and awareness, providing adequate skills and social support</li> <li>• Motivational: raising awareness and facilitating self-organization</li> </ul>
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Figure-8 Community Repairing a Culvert to reduce Vulnerability

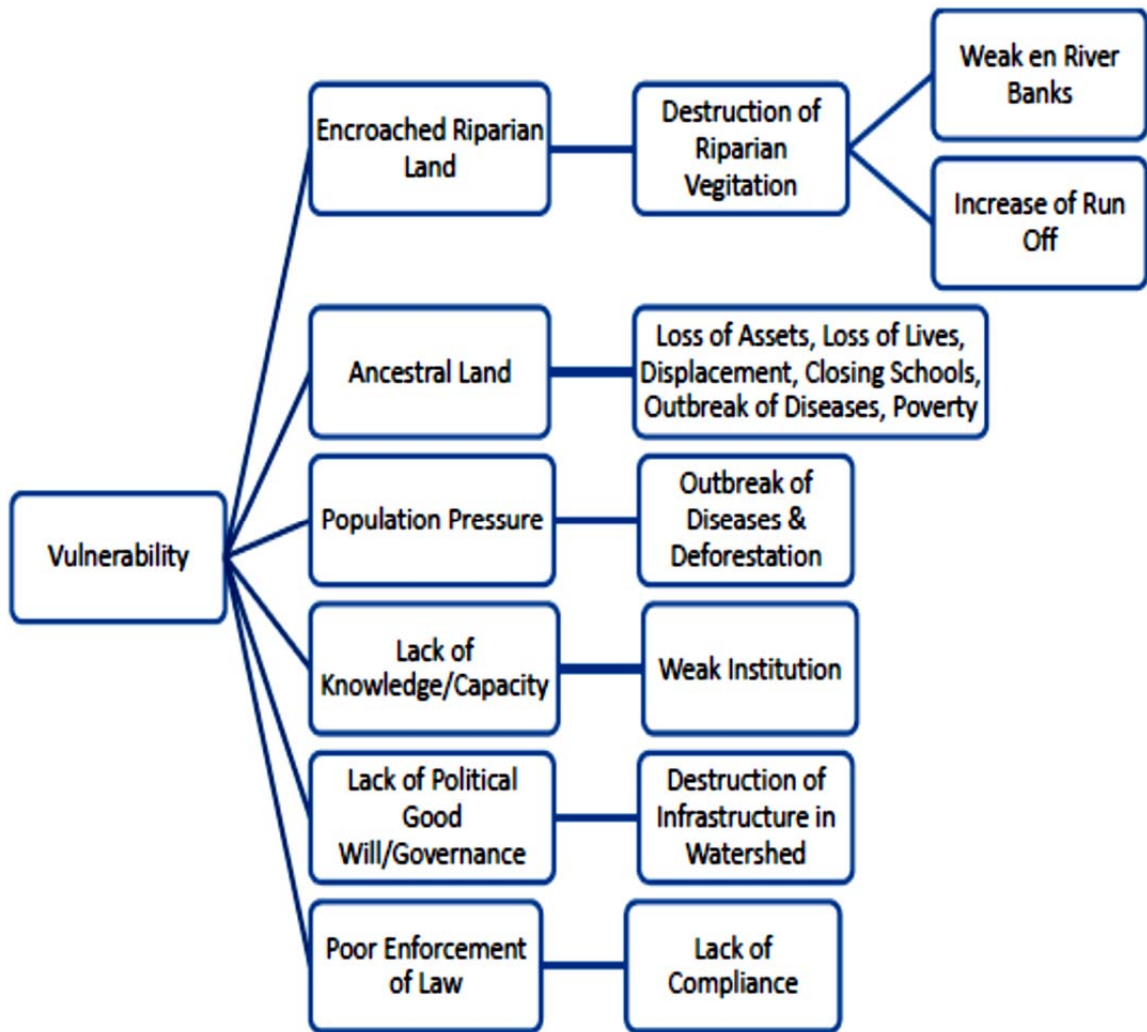


Figure-9 Example of Problem Trees discussed on Flood Vulnerability (1<sup>st</sup> Stage WRMA Training held on 14 October 2013)

**4: Non-Structural Measures for Flood Mitigation Including Community-based Measures**

<b>Introduction</b>	<p>Non-Structural Measures are summarized in Table-3 for future reference.</p> <p>Non-structural techniques include relocation; flood proofing, acquisition, and flood preparedness (see Table-3).</p> <p>Participants will discuss and share experiences regarding each of these Non-Structural Measures.</p>
<b>Objectives</b>	<p>At the end of the session, the participants will be able to:</p> <ol style="list-style-type: none"> <li>1) Understand measures or activities that reduce hazard, reduce exposure, and/or reduce vulnerability; and</li> <li>2) Understand process of Vulnerability Assessment in disaster management.</li> </ol>
<b>Time period</b>	<p>- 1 hour</p>
<b>Methodology</b>	<ul style="list-style-type: none"> <li>- Discussions.</li> <li>- Questions and answers.</li> <li>- Information sharing.</li> </ul>
<b>Materials/Tools</b>	<ul style="list-style-type: none"> <li>- Sheets of paper.</li> <li>- Pens.</li> <li>- Flip charts.</li> <li>- Vulnerability assessment map</li> </ul>
<b>Buy-Outs</b>	<p>A buy-out, also known as acquisition or relocation, means that the local government purchases the flood-prone houses and assists the homeowners in locating new houses out of the floodplain.</p> <p>The local government then returns the flood-prone area to a natural floodplain. Although this can be costly, it does eliminate the risk of flood damages to infrastructures and the risk to damage of human life and safety.</p>
<b>Flood warning</b>	<p>The flood warning system is also a non-structural measures for reducing damages and protecting lives.</p> <p>A Flood Early Warning System (FEWS) is important to convey important emergency alerts, notifications and updates during an emergency, such as flooding to the community residents.</p>

### SESSION 3: RAINFALL AND FLOOD OBSERVATION

**Topics:**

- 1: Rainfall Observation
- 2: Data and Statistical Processing of Rainfall
- 3: Flood Discharge Observation

**Overview**

This session presents various ways of making rainfall observations, collecting and statistical processing of rainfall data, and measuring discharge or flood water.

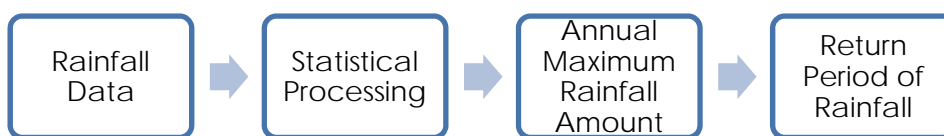


Figure-10 Relation between Rainfall Data and Statistical Processing

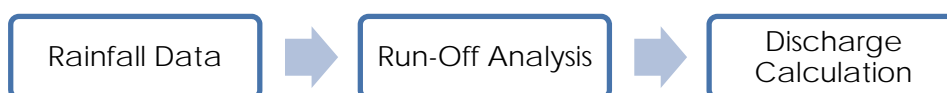


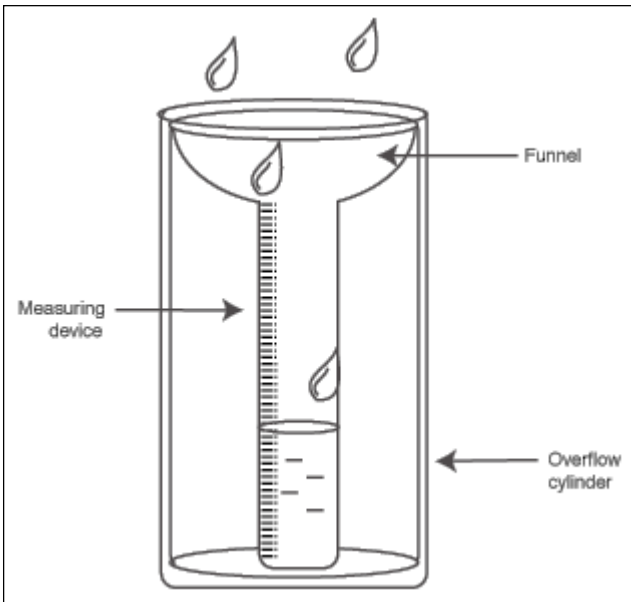
Figure-11 Relation between Rainfall Data and Calculated Discharge

This session also seeks to strengthen the capacity of the community, WRUAs and other stakeholders in the best practice methods of both rainfall observation and flood measurements.

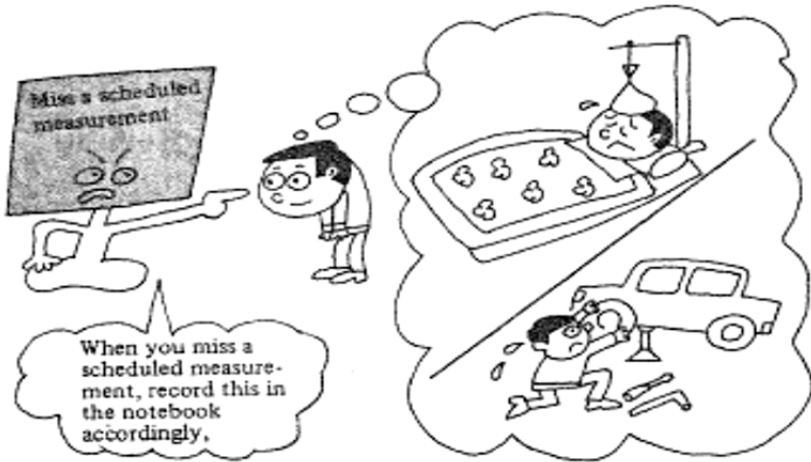
Relationship between rainfall data and run-off discharge may be translated into floods (Figure-12 and -13).

**1: Rainfall Observation**

<p><b>Introduction</b></p>	<p>The participants will be introduced to simple rainfall observation techniques and tools that are applicable to their catchment areas.</p> <p>The participants will also be introduced to the measurement of rainfall observation with accuracy.</p>
<p><b>Objectives</b></p>	<p>The objectives of this session are to enable the participants to understand:</p> <ul style="list-style-type: none"> <li>a) Methods of measuring daily rainfall amounts by using manual rain gauges;</li> <li>b) Methods of measuring hourly rainfall amounts by using automatic rain gauges; and</li> </ul>

	c) Techniques for translating rainfall amounts into hyetographs.
<b>Time period</b>	- 1 hour
<b>Methodology</b>	- Short presentation. - Question and Answers. - Visit to a Rain Gauge and River Gauging Station (RGS).
<b>Materials/Tools</b>	- Illustrations. - Flip charts. - Information sharing. - Discussions.
<b>Rainfall Observation</b>	<p>The facilitator in consultation with the participants will decide the possible procedures that can be used for rainfall observation:</p> <ol style="list-style-type: none"> <li>1) Distinction between daily rainfall amounts measured by manual measurement and hourly rainfall amount measured by automatic measurement;</li> <li>2) Distribution of rain gauges in the area;</li> <li>3) Measurement skills shared among the WRUA members and the community;</li> <li>4) Accuracy of the measurements;</li> <li>5) Causes of missing data; and</li> <li>6) Dissemination of the data gathered.</li> </ol> <div style="text-align: center;">  </div> <p style="text-align: center;">Figure-12 Rain Gauge—Manual Rainfall Measurement</p>
<b>Conclusion</b>	Rainfall may be measured continuously by using manual rain gauges and/or automatic rain gauges. This may be calculated as mm/day or mm/hr.

**2: Data and Statistical Processing of Rainfall**

<b>Introduction</b>	Participants will be introduced to methods of simple rainfall data analysis and statistical data processing.
<b>Objectives</b>	<p>The objectives of this session are to enable the participants to understand:</p> <ul style="list-style-type: none"> <li>• Various methods of rainfall data analysis and statistical data processing;</li> <li>• Techniques for displaying and sharing rainfall data;</li> <li>• Techniques for calculating the average value with missing data; and</li> <li>• Meaning of Return Period of heavy rainfall.</li> </ul>
<b>Time period</b>	- 1 hour
<b>Methodology</b>	<p>- Short presentation. - Questions and Answers.</p>
<b>Materials/Tools</b>	<p>- Sheets of graph paper. - Pencils.</p>
<b>Content/Message</b>	<p><b>Step-I: Rainfall Data Processing</b></p> <p>Types of rainfall data include:</p> <ul style="list-style-type: none"> <li>• Automatic hourly rainfall data;</li> <li>• Daily rainfall data;</li> <li>• Monthly rainfall data;</li> <li>• Yearly mean rainfall data; and</li> <li>• Return period for yearly maximum rainfall data.</li> </ul> <p><b>Step-II: Missing Data</b></p>  <p>Figure-13 Ways of coping with missing data Source: 'Hydrological Observation Explained in Pictures', Ministry of Construction, PP128, 1999</p> <p>WRMA and relevant organizations should be responsible for rainfall data</p>



	<p>collection and their analysis in the basin.</p> <p>WRUAs should also collect rainfall information.</p> <p>Discuss how such data may be collected and shared by means of mobile phones, community radios, etc.</p> <hr/> <p><b>Step-III: Illustrations of Data Analysis</b></p> <ul style="list-style-type: none"> <li>• Calculations of 24-hour rainfall, monthly and/or yearly average rainfall.</li> <li>• Rainfall hyetograph and cumulative rainfall amounts at a specific rainfall station.</li> </ul> <hr/> <p><b>Step-IV: Return Period</b></p> <p>In case of planning a structural measure against floods, it is common to introduce a concept of Return Period as a statistical quantity.</p> <p>A Return Period is usually to be calculated statistically by time series data of yearly maximum rainfall amounts. It is, therefore, important to make correct rainfall observation and accumulate accurate long-term data, for the sake of making a proper plan for structural measures against floods.</p>
<p><b>Conclusion</b></p>	<p>Rainfall data is the basis of flood run-off analysis and flood early warning.</p>
<p><b>Discussion Questions</b></p>	<div data-bbox="702 1086 1228 1769" data-label="Image"> <p>The illustration consists of two parts. The top part shows a person with a thought bubble containing a crossed-out 'Estimated value'. A speech bubble from a character above says 'Miss a scheduled measurement' with an angry face. A larger speech bubble below says 'WRONG! Do not use estimated values! Your judgement could be mistaken!'. The bottom part shows a person with a thought bubble containing a crossed-out 'Copy from a water level recorder.' and another crossed-out 'Estimated water level'. A speech bubble from a character above says 'These are wrong!'.</p> </div> <p style="text-align: center;">Figure-14 Prohibited matters in Rainfall Observation Source: 'Hydrological Observation Explained in Pictures', Ministry of Construction, PP128, 1999</p> <p>Discuss what attitudes toward measuring rainfall amounts and recording data are to be prohibited.</p>

### **3: Flood Discharge Observation**

<b>Introduction</b>	<p>Over-all goal of these sessions to enable the participants to be able to measure or approximate flood water level or discharge in their particular river basins.</p> <p>The facilitator will mention to other methods of indirect discharge measurements such as the use of weir or flume in small streams, which are not covered here.</p>
<b>Objectives</b>	<p>The objective of this session are to enable the participants to understand:</p> <ol style="list-style-type: none"> <li>a) Definition of discharge.</li> <li>b) Procedure of discharge measurements.</li> <li>c) Techniques for analyzing and displaying discharge data.</li> </ol>
<b>Time period</b>	- 1 hour
<b>Methodology</b>	<p>- Short presentation.</p> <p>- Questions and answers.</p>
<b>Content/Message</b>  (1)	<p><b>Step-I: Discharge Measurement Procedures</b></p> <p>The participants will be introduced to discharge measurement procedures which entails:</p> <ul style="list-style-type: none"> <li>• Determination of left and right river banks;</li> <li>• Cross-sectional distance across the river channel, channel width, measured in meters;</li> <li>• Depth (surface water level) measurements, taken in meters;</li> <li>• Use of a staff gauge in measuring water level, in meters;</li> <li>• Current meter and its use to determine the flow rate of the water (velocity), measured in meters/second (m/s); and</li> <li>• Discharge is obtained by multiply cross section width, by depth and by velocity, usually given in cubic meters per second (m<sup>3</sup>/s).</li> </ul> <p>The facilitator is to introduce the participants into the normal process of measuring flood or run-off discharge in a specific cross section of a river.</p> <hr/> <p><b>Step-II: Field Visit to River Gauging Station (RGS)</b></p> <p>The participants will:</p> <ol style="list-style-type: none"> <li>1) Understand what is meant by Regular Gauging Station (RGS);</li> <li>2) Understand the various components of RGS; and</li> <li>3) Be able to estimate flood discharge.</li> </ol>

Standing on one of the river banks, how do you determine the **Right** and **Left** river bank?

- What is the direction of the river flow?
- What are you able to identify?
- Staff gauge – how is it calibrated?
- Current meter - how is it calibrated?

The participants will list up the various components in a River Gauging Station in a table and mention to them their functions.

Table-5 Elements of a River Gauging Station

Step	Identified Element	Functions
1	Staff gauge	On one site of the river bank-measures water surface elevation
2	Measuring rod	Part of the current meter-used to measure the depth of water
3		
4		
5		

Figure-15 Gucha-Migori River  
The river water level and velocity was high.



Figure-16 Water Level Gauge (unit: mm)

**Content/Message**

(2)

**Step-III: Discharge Calculation**

$$\text{Discharge } \{Q \text{ (m}^3\text{/s)}\} = \text{Cross-Section Area (m}^2\text{)} \times \text{Velocity (m/s)}$$

$$\text{Cross-Section Area (m}^2\text{)} = \text{Water Depth} \times \text{Water Width}$$

Discharge is calculated by three (3) elements, i.e. River Depth, River Width, and River Velocity.

This gives the volume of water flowing at that particular site of the river.

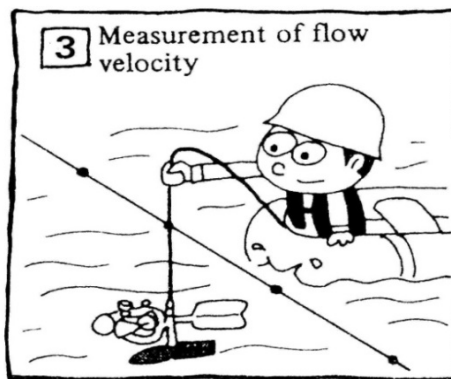
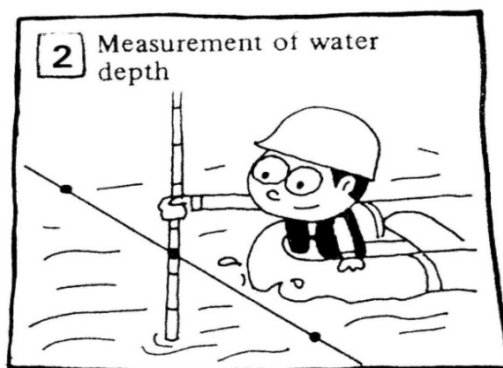
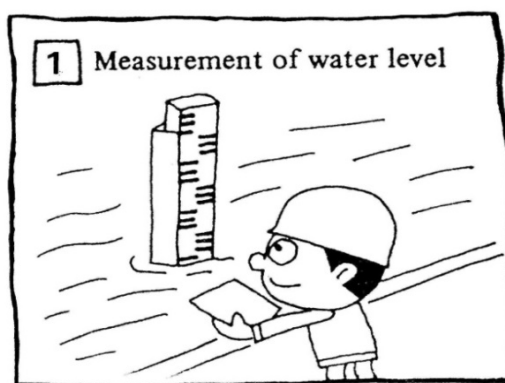


Figure-17 Three (3) Measuring Elements to determine Discharge (Q)  
Source: 'Hydrological Observation Explained in Pictures',

	<p>Ministry of Construction, PP128, 1999</p>
<p><b>Content/Message</b> <b>(3)</b></p>	<p><b>Step-IV: H-Q Rating Curve</b> This idea is for the participants to understand the relation between the water level, gauge height, and discharge in plotting a Discharge Rating Curve.</p>

	<div style="text-align: center;"> <p><b>Rating Curve</b></p> <p>The graph shows a non-linear relationship between flow and water level. The x-axis is Flow (m<sup>3</sup>/s) from 0 to 120, and the y-axis is Water Level (m) from 0 to 12. The curve passes through approximately (0,0), (10,4), (20,6), (40,7.5), (60,8.5), (80,9.5), and (100,10).</p> </div> <p style="text-align: center;">Figure-18 Relationship between Water Level and Discharge (Example of H-Q Rating Curve)</p>
<p><b>Content/Message</b> (4)</p>	<p><b>Step-V: Importance of Rainfall Observation and Water Level/Flood Discharge Measurements</b></p> <p>The participants will well understand the importance of rainfall observation and water level/flood discharge measurements.</p> <p>The participants will:</p> <ul style="list-style-type: none"> <li>• Enable WRUA members to know the available water resources in their catchments mainly from rainfall;</li> <li>• Develop water harvesting mechanisms in case of water shortage; and</li> <li>• Plan for Flood Disaster Risk Management, rescue, evacuation and recovering strategies.</li> </ul>
<p><b>Conclusion</b></p>	<p>The participants will gain enough basic knowledge of how to measure rainfall amounts, water levels and flood discharges.</p> <p>The information would be necessary to help/assist the community in coping with a disaster.</p>
<p><b>Discussion Questions</b></p>	<ol style="list-style-type: none"> <li>1) Discuss why the H-Q Rating Curve is necessary for flood management.</li> <li>2) Discuss what merits will be gained in setting a threshold on the data of rainfall amounts, water levels, and flood discharges.</li> </ol>

SESSION 4: COMMUNITY-BASED FLOOD HAZARD MAP

**Topics:**

- 1: Meaning and Purpose of Flood Hazard Map (FHM)
- 2: Community-based Flood Hazard Map (CFHM)
- 3: Preparations for Developing Community-based Flood Hazard Map

**Overview**

This session introduces the participants to the need of the development and application of a Community-based Flood Hazard Map (CFHM).

**1: Meaning and Purpose of Flood Hazard Map**

<p><b>Introduction</b></p>	<p>Developing a flood map in a target area is a central challenge for the flood management.</p> <p>The participants will be introduced to simple flood hazard mapping techniques and tools that are applicable to their catchment areas.</p> <p>This session is composed of the three (3) following steps:</p> <ol style="list-style-type: none"> <li>1) To invite all the stakeholders from the ecological zone river basin. The stakeholders are: <ul style="list-style-type: none"> <li>• WRUA committee members;</li> <li>• WRUA members;</li> <li>• GOK officials;</li> <li>• Community groups; and</li> <li>• Organizations within the community that have programmes of flood management.</li> </ul> </li> <li>2) To discuss why the Flood Hazard Map (FHM) is necessary.</li> <li>3) To outline the steps necessary for a flood hazard mapping process.</li> </ol>
<p><b>Meaning and Purpose of Flood Hazard Map</b></p>	<p>The facilitator will explain briefly that Flood Hazard Map is a tool for communicating the impact of a specific flood event in a particular community.</p> <p>It provides information on spatial distribution of inundation areas and its associated depths during the heaviest and annual average flooding.</p> <p>Flood Hazard Map, in general, is a tool for the presentation and dissemination of information on flood hazard (intensity, spatial range, inundation depth, duration time, frequency, etc.) and evacuation options (location of evacuation centers, evacuation routes, dangerous spots, etc.) in aid of quick and safe evacuation in the event of flood.</p>
<p><b>Nature and Distribution of a Flood Hazard Map</b></p>	<p>The community members should know the nature of the flood in extent and how it is distributed within the catchment area. This will be of help in planning the evacuation and rescue centers.</p> <p>Community participation in information dissemination and sharing</p>

	information to avert a flood hazard in the basin is essential.
<b>Flood Information input in to Flood Hazard Map</b>	<p>Table-6 below shows types of flood hazard information, evacuation information and general remarks to take into consideration during evacuation.</p> <p>The participants may add any other relevant information in their localities.</p>

**Table-6 Flood Hazard and Evacuation Information**

<b>Flood Hazard Information</b>	<b>Evacuation Information</b>	<b>Remarks</b>
<ul style="list-style-type: none"> <li>- Flood inundation area</li> <li>- Flood inundation depth</li> <li>- Flood duration time</li> </ul>	<ul style="list-style-type: none"> <li>- Evacuation centers</li> <li>- Evacuation path routes</li> <li>- Dangerous spots</li> <li>- Healthcare centers, etc.</li> </ul>	<ul style="list-style-type: none"> <li>- Addition of the information on the building used as residents’ land mark</li> <li>- Setting to the scale range that can have a common view</li> <li>- Consider of gender, age, health, etc. (the most vulnerable groups in the community: children, elderly/disable/sick people, and women)</li> </ul>

**2: Community-based Flood Hazard Map (CFHM)**

<b>Introduction</b>	<p>WRUA committee members and WRUA members will develop the skills to map out flood hazard zones within their catchment areas.</p> <p>Flood Hazard Map includes areas along with other variables of interest in the areas of operation between the flood hazard prone areas and evacuation centers and other existent health facilities, which should be covered by the community resource map.</p> <p>The participants will be sensitized on how to develop a Community-based Flood Hazard Map (CFHM). The mapping process is as important as the map itself.</p> <p>The goals of a community-based flood hazard mapping process are to:</p> <ul style="list-style-type: none"> <li>• Have the community members learn flood characteristics in their areas;</li> <li>• Assist flood-affected community members to know the important points like evacuation routes, evacuation centers, and other hotspot areas;</li> <li>• Assist the WRUA to interpret the real flood features on the ground and open up discussion among the community members and thereby raise flood awareness and sensitization within the community;</li> <li>• Assist the Government and other donor agencies to access the affected communities with ease; and</li> </ul>
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	<ul style="list-style-type: none"> <li>• Facilitate the transfer of experiences of historical flood incidences both past and present to the younger generation.</li> </ul>
<b>Purpose of the session</b>	Information sharing, discussion and planning
<b>Objective</b>	By the end of the session, the participants will have learned the process of developing a Community-based Flood Hazard Map.
<b>Time period</b>	- 1 hour
<b>Methodology</b>	<ul style="list-style-type: none"> <li>- Activity.</li> <li>- Guided discussions.</li> <li>- Brainstorming.</li> </ul>
<b>Materials/Tools</b>	<ul style="list-style-type: none"> <li>- Sheets of paper.</li> <li>- Pens.</li> <li>- Drawing Manila papers.</li> </ul>
<b>Session guide</b>	This session aims at supporting the participants to develop a Community-based Flood Hazard Map and encourage the WRUA members work together to ensure that the flood hazard map they develop will reflect their thoughts and address the flood risk management issues in their catchment areas.
<b>Content/Message</b>	<p><b>Step-I: Prerequisite Conditions for Community-based Flood Hazard Map</b></p> <p>Divide the participants into three thematic groups in order to work out a plan for each issue, which entails:</p> <ul style="list-style-type: none"> <li>• Flood inundation area, depth and time;</li> <li>• Evacuation centers, routes, and hotspots; and</li> <li>• Consideration of the most vulnerable groups; children, elderly/disabled/sick people, and women.</li> </ul> <p>Be sure to stick to high priority issues that are linked to the main issues within the sub-catchment.</p> <p>Each group should be able to draw a draft of a Flood Hazard Map.</p>
	<p><b>Step-II: Flood Inundation Area, Depth and Time</b></p> <p>Review the problems/factors identified in resultant flood hazard:</p> <ul style="list-style-type: none"> <li>• Rainfall distribution;</li> <li>• High Water characteristics;</li> <li>• Groundwater; and</li> <li>• Time and duration of High Water and rainfall intensity.</li> </ul>
	<p><b>Step-III: Evacuation Centers, Routes, Hotspots and Response</b></p> <p>Make clear main components of Flood Hazard Mapping:</p> <ul style="list-style-type: none"> <li>• To establish evacuation centers, routes, hotspots and healthcare facilities;</li> </ul>

	<ul style="list-style-type: none"> <li>• To establish the role of the WRUA committee members, the WRUA members, and other stakeholders in ensuring proper workings of the established Flood Hazard Map; and</li> <li>• To establish how the data for drawing the map are collected.</li> </ul>
	<p><b>Step-IV: Consideration of the most Vulnerable Areas</b></p> <p>a) Review Session 3 in Session 2.</p> <p>b) Identify which people in the community are vulnerable as you try to map out the flood risk zones in order to make the necessary precautionary steps.</p> <p>Consider the following area characteristics:</p> <ul style="list-style-type: none"> <li>• Degraded areas;</li> <li>• Erosion gullies;</li> <li>• Settlement in swamps and/or flood plains;</li> <li>• Road drainage;</li> <li>• Settlement on steep slopes; and</li> <li>• Number of children, elderly, disabled, sick people and women.</li> </ul> <p>c) Detect how these groups may be affected by flood risks within their areas of settlement.</p>
	<p><b>Step-V: Activity Planning Matrix</b></p> <p>For each issue, develop an approach and activities. Translate the approach into a specific output and activities to realize that output as per the matrix in Table-7 below.</p> <p>Flood Hazard Map provides information on spatial distribution of inundation areas and its associated depths during the heaviest and annual average flooding.</p>

**Table-7 Output and Activities Analysis for Planning Matrix**

Step	Output	Activity	Time Frame
1			
2			
3			
4			
5			

### **3: Preparations for Developing Community-based Flood Hazard Map**

<p><b>Introduction:</b></p>	<p>The training facilitator will introduce the participants into the main steps involved in the development of a Community-based Flood Hazard Map (CFHM).</p>
<p><b>Important Considerations in Preparation of Hazard Map</b></p>	<p>This entails:</p> <ul style="list-style-type: none"> <li>• Gender representation, which considers children, elderly/disabled/sick people, women, etc.;</li> <li>• Community members identify key flood-related landmarks;</li> <li>• Setting up of an open ground for easy interactions among community members in the process of developing a Flood Hazard Map that takes into consideration the view of the community;</li> <li>• Establish consensus on the language, symbols, signs, legend, colors, etc. to be used on the Flood Hazard Map, that must be easy to understand by all community members for its effective and efficient use, bearing in mind that the map is a communication tool with its message;</li> <li>• For village-based Flood Hazard Map, it is advisable for transect walk to be carried out to verify the various points and locations indicated on the draft Community-based Flood Hazard Map;</li> <li>• Explanation of the purpose of the Flood Hazard Map to the community;</li> <li>• Choose or identify one member of the community to lead in drawing the Community-based Flood Hazard Map; and</li> <li>• Last but not least, transfer the sketch from the ground to the Manila paper as the first draft, thereafter community members discuss the draft and come to a consensus on it and adopt the draft as it is or they review it based on the areas agreed upon.</li> </ul>
<p><b>Importance of the Community-based Flood Hazard Map</b></p>	<p><b>1) To WRMA, GOK Staff, and Other Stakeholders:</b></p> <p>A Flood Hazard Map can be utilized for the formulation of regional planning that includes:</p> <ul style="list-style-type: none"> <li>• Planning of structural measures against floods;</li> <li>• Road maintenance and improvement;</li> <li>• Planning for evacuation;</li> <li>• Drainage improvement;</li> <li>• Selection of sites for new evacuation facilities; and</li> <li>• Prioritization of communities to be strengthened against and prepared for flooding, etc.</li> </ul> <p><b>2) To the Community (WRUA Committee Members and WRUAMembers)</b></p> <p>A Flood Hazard Map can be utilized for evacuation information at the flooding and as a disaster prevention learning information.</p>



Figure-19 Community Members Draw a Flood Hazard Map in Wasiese Village on July 15, 2010

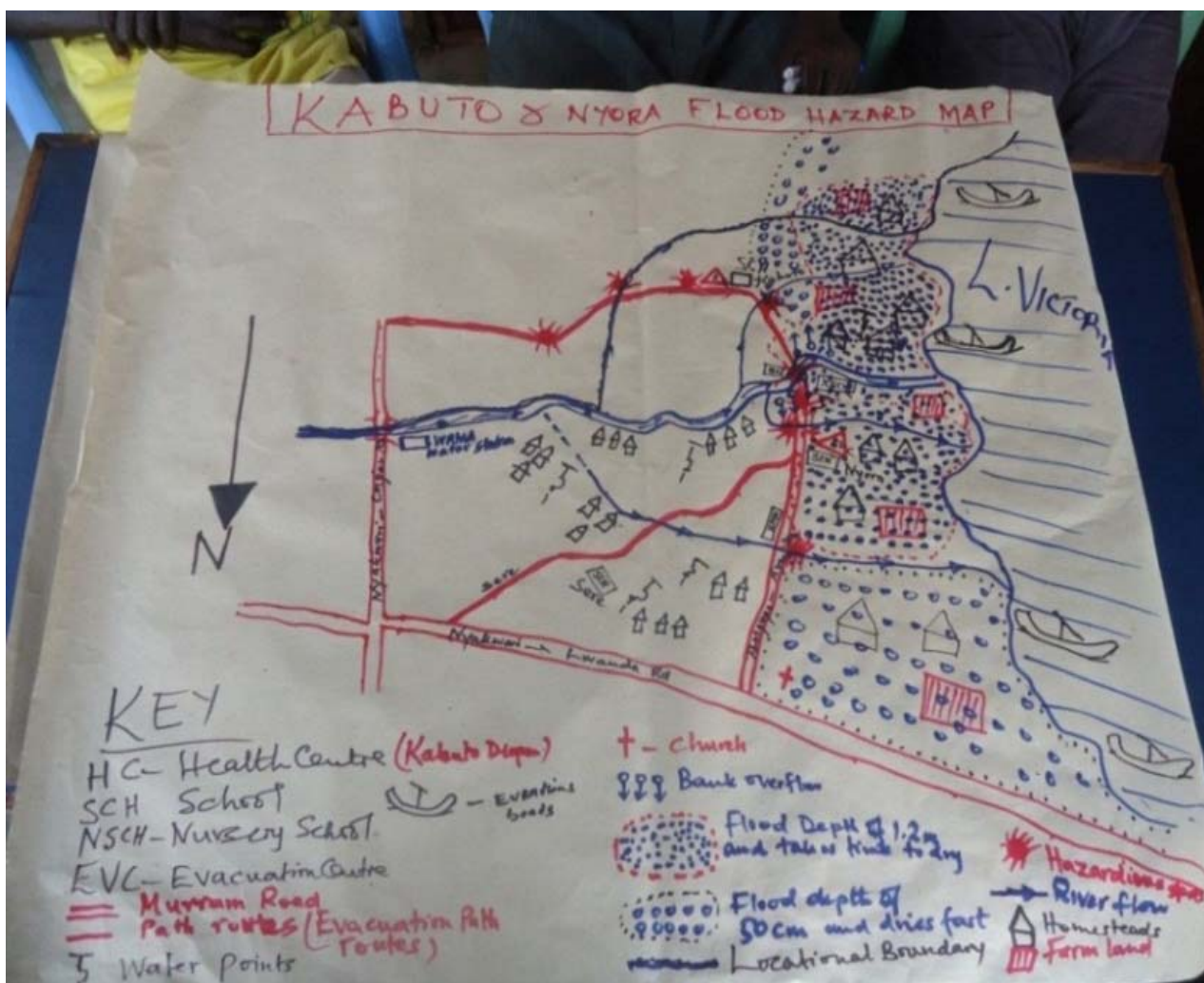


Figure-20 Example of a community Flood Hazard Map  
 On 18<sup>th</sup> June 2012 made by LOGUMI WRUA  
 for Kabuto and Nyora Villages in Lower Gucha Migori Sub-Catchment

## SESSION5: FLOOD EARLY WARNING

**Topics:**

- 1: Flood Early Warning System (FEWS)
- 2: Community-based Flood Early Warning (CFEW)

**Overview**

This session introduces the participants to the need for the development and application of community-based Flood Early Warning System (CFEWS).

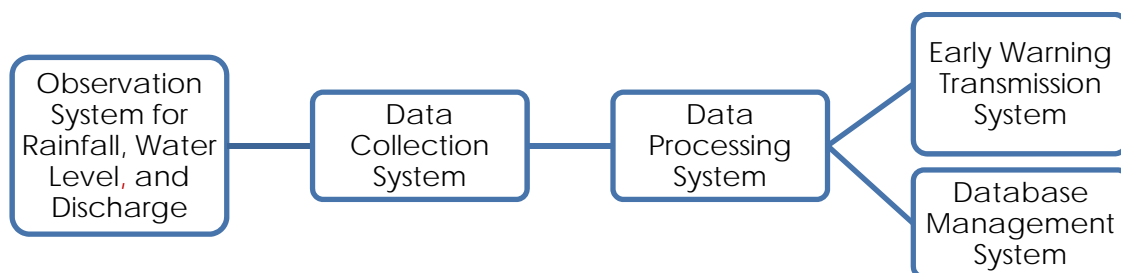
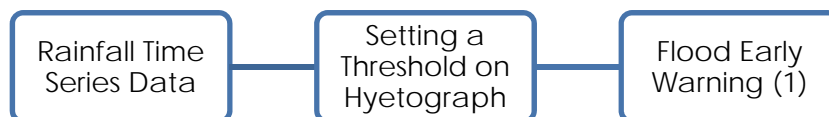


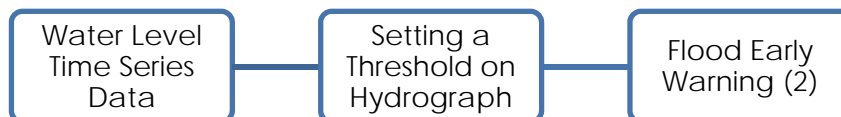
Figure-21 Framework of Flood Early Warning System (FEWS)

A Community-based Flood Early Warning System helps the community to identify the problem, brainstorm together, and share the proposed solutions.

1) Rainfall



2) Water Level



3) Discharge

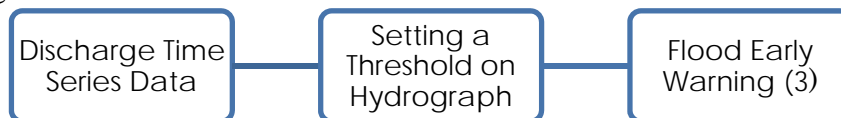


Figure-22 Methods for Issuing Flood Early Warning

**1: Flood Early Warning System (FEWS)**

<p><b>Introduction</b></p>	<p>The participants will be mobilized and sensitized on the need of and developing a workable Flood Early Warning System (FEWS).</p> <p>It is important to introduce the followings:</p> <ul style="list-style-type: none"> <li>• Early Warning System developed along Nzoia River Basin by World Bank and KMD; and</li> <li>• Rainfall gauge at a primary school as community-based action for Early Warning System.</li> </ul>
<p><b>Objectives</b></p>	<p>The objectives of this session are to enable the participants to understand:</p> <ol style="list-style-type: none"> <li>1) Elements of an Early Warning System; and</li> <li>2) Importance of Early Warning System in flood disaster mitigation.</li> </ol>
<p><b>Time period</b></p>	<p>-1 hour</p>
<p><b>Methodology</b></p>	<ul style="list-style-type: none"> <li>- Short presentation.</li> <li>- Questions and Answers.</li> <li>-Information sharing.</li> <li>- Discussions.</li> </ul>
<p><b>Materials</b></p>	<ul style="list-style-type: none"> <li>- Illustrations.</li> <li>- Flip charts.</li> <li>- Pens.</li> </ul>
<p><b>Content/Message</b></p>	<p><b>Step-I: Elements of Flood Early Warning System (FEWS)</b></p> <p>The facilitator will introduce the participants into the process of flood early Warning System and its main components. This entails:</p> <ul style="list-style-type: none"> <li>• Rainfall (Precipitation) forecast for a particular period of time;</li> <li>• Travel time from where the rain is falling to where participants are settled;</li> <li>• Rate of river water level rise;</li> <li>• River flood forecast (flood area and depth, arrival time of flood water); and</li> <li>• Optimum operation timing of river management facilities.</li> </ul> <p>Community-based Flood Early Warning System (CFEWS) is based on their experience in many cases.</p> <hr/> <p><b>Step-II: Importance of Flood Early Warning System (FEWS)</b></p> <p>The Flood Early Warning System is to:</p> <ul style="list-style-type: none"> <li>• Allow the information of flood risks to be transmitted at the real time ;</li> <li>• Allow the flood mitigation managers to plan in advance on responses required, evacuation and evacuation routes (if needed), healthcare centers, identification of hotspots, evacuation centers, etc.; and</li> <li>• Timely disseminate forecast and warning information to relevant stakeholders and communities.</li> </ul>

<b>Conclusion</b>	It is important to note that one crucial purpose behind flood forecasting and warning is to change people’s behavior to increase adaptations, save lives, and reduce damage to property and loss of human life.
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**Session 2: Community-based Flood Early Warning (CFEW)**

<b>Introduction</b>	<p>The participants will be mobilized and sensitized on the need of and developing a workable Flood early Warning System.</p> <p>The focus will be on Community-based Flood Early Warning System (CFEWS).</p> <p>Besides the earlier discussed topics on rainfall measurements, the magnitude and frequency of floods remains a vital component of the Community-based Flood Early Warning System.</p>
<b>Objective</b>	By the end of this session, the participants will be aware of the requirements for setting up a Community-based Flood Early Warning System.
<b>Time period</b>	- 1 hour
<b>Methodology</b>	<ul style="list-style-type: none"> <li>- Short presentation.</li> <li>- Questions and Answers.</li> <li>-Information sharing.</li> <li>- Discussions.</li> </ul>
<b>Content/Message</b>	<p><b>Step-I: Meaning of Flood Hydrograph</b></p> <p>What is a hydrograph?</p> <p>The facilitator will demonstrate graphical examples of monthly river discharges:</p> <ol style="list-style-type: none"> <li>1)Discuss why the community requires a flood hydrograph;             <ul style="list-style-type: none"> <li>• Identify the flood peaks and time-scale.</li> <li>• Brainstorm and develop mechanism of disseminating information regarding rise and fall of water levels clearly and quickly to the other community members.</li> </ul> </li> <li>2) Discuss response actions when a flood event occurs.</li> </ol> <hr/> <p><b>Step-II: Requirement for Development of a Community-based Flood Early Warning System</b></p> <p>This entails:</p> <ul style="list-style-type: none"> <li>• Establishing a proactive Flood Management Committee (FMC);</li> <li>• Establishing a working rapport with RGS meter reader assigned by the WRMA;</li> <li>• Establishing a coordination mechanism between various Flood Management Committee (FMC) members;</li> </ul>

	<ul style="list-style-type: none"> <li>• Assigning one of FMC members to regularly monitor the river levels by reading and recording the levels at RGS;</li> <li>• Flood management committee to hold meetings to discuss the river water levels vis-a-vis, the flood coverage areas, and flood depths in various parts of the affected areas;</li> <li>• Secretary to harmonize the collected information;</li> <li>• Secretary to develop a graph that takes into consideration the relationship between the two variables (river levels for each day and the expected flood depth) experienced in various places and areas affected;</li> <li>• WRUA and the community to hold a meeting to discuss and approve the graph; and</li> <li>• Adoption of the graph as a hydrograph for Flood Early Warning that can be used by the WRUA Flood Management Committee in preparation and response in case of flood occurrence after the warning is issued; the problem is how far and wide the mobile phones are used.</li> </ul>
	<p><b>Step-III: Importance of Community-based Flood Early Warning System</b></p> <p>The facilitator will try to elaborate on the merits of a Community-based Flood Early Warning System (see Figure-27 below). These merits include:</p> <ul style="list-style-type: none"> <li>• To make the community more proactive rather than reactive in flood management;</li> <li>• To make use of traditional knowledge of floods and indigenous adaptation methods;</li> <li>• To trigger early evacuation that can minimize the human suffering experienced during turbulent evacuation in the flood occurrence;</li> <li>• To assist the WRUA and the community to negotiate with relevant evacuation places that can minimize the disruptions of day to day business;</li> <li>• The WRUA and the community members can effectively discuss with relevant agencies and organizations in the preparation phase prior to floods; and</li> <li>• Effective planning that enables easy zoning and dispatching of flood management committee members to various flood-affected sites.</li> </ul>
	<p><b>Step-IV: Actual Cases for Community-based Flood Early Warning System</b></p> <p><b>1) Community-based Flood Early Warning System using Rain Gauge</b></p> <p>If it rains in mountain area, lower area will have a flash flood within some</p>



hours.

People who live in mountain area can make alert to lower stream residents in case of a heavy rainfall using convenient rain gauge data (See Figure-25).

- **Community-based Flood Early Warning System using River Gauge**

Convenient River Gauge shown in Figure-24 can alert the flood. The cost is approximately 2-300USD, and local people can maintain it by themselves.

For example, the National Coordination for Disaster Reduction of Guatemala (CONRED) makes the convenient River Gauges with automatic radio transmission by them, and distributes them to many points along the river basin.

The volunteers, who have been given mobile phones and handy radios by CONRED, have been reporting the current situation to CONRED in case of heavy rain and river level rises.



Figure-23 Installation of Convenient Rain Gauge



Figure-24 Convenient Rain Gauge and its Monitoring Instrument

<p><b>Conclusion</b></p>	<p>WRUA committee members and the community members are more equipped and prepared to cope with the flood risks that may arise when flooding occurs.</p>
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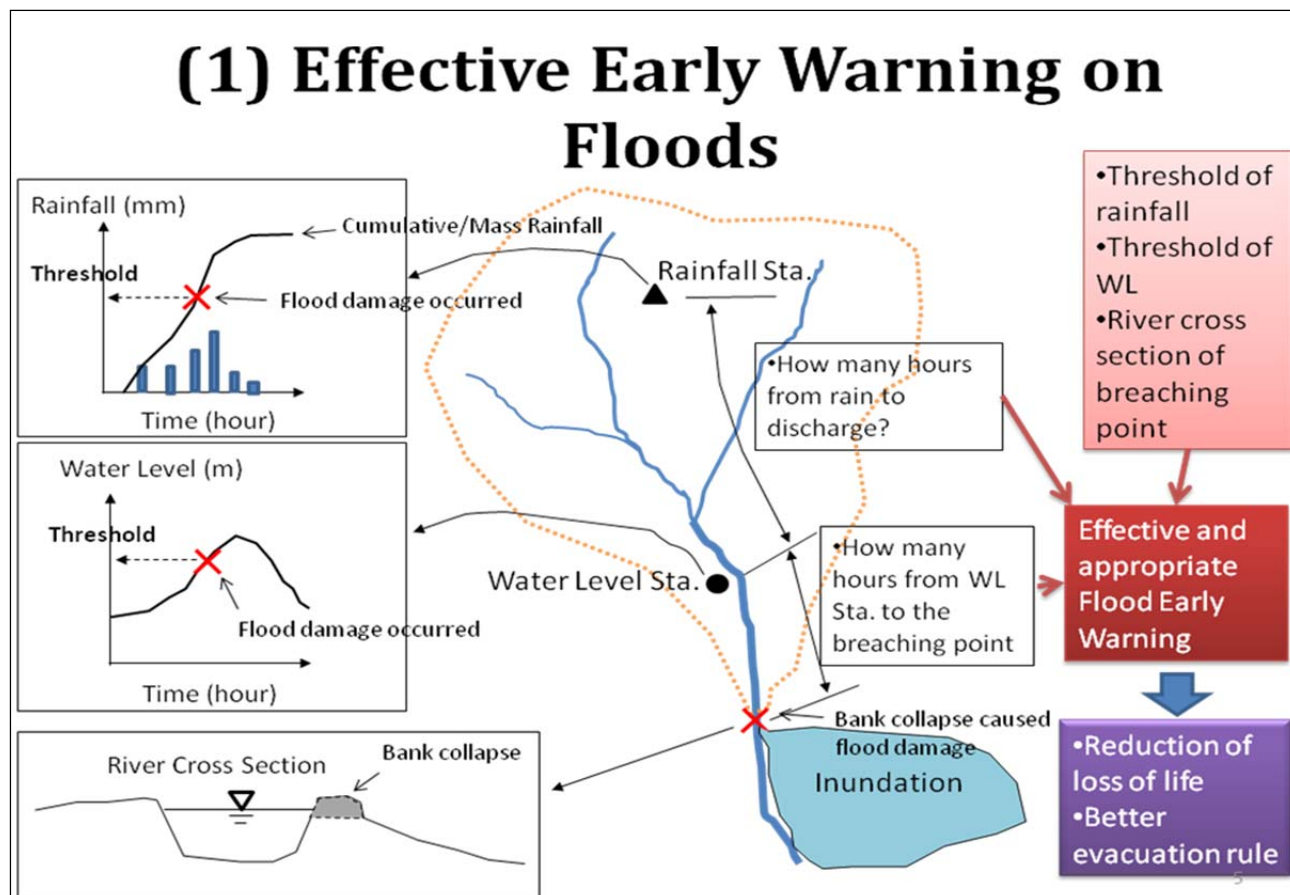


Figure-25 Effective Early Warning on Floods

## SESSION6: FLOOD DISASTER EVACUATION PROGRAMME

### Topics:

- 1: Evacuation Planning
- 2: Evacuation Centre Management

### Overview

This session presents the process and management of Flood Disaster Evacuation programme.

The key pillar of the programme is the development of a more responsive evacuation programme and process and management of evacuation centres.

Evacuation is the process in which affected persons move from their homes to a safer place to settle temporarily because of an impending disaster or the disaster that has just occurred.



Figure-26 Scheme of supposed Evacuation on a Flood Event

### 1: Evacuation Planning

<b>Introduction</b>	The facilitator will highlight the key issues needed for a proper working evacuation programme.
<b>Objectives</b>	The objectives of this session are to enable the participants to understand: 1) Steps necessary for a disaster evacuation planning; and 2) Execution of a Flood Evacuation Plan.
<b>Time period</b>	- 1 hour
<b>Methodology</b>	- Short presentation. - Questions and Answers. - Information sharing. - Discussions.
<b>Materials/Tools</b>	- Illustrations. - Flip charts. - Marking pens.
<b>Content/Message</b>	<b>Step-I: Disaster Evacuation Plan</b> The facilitator elaborates on the key steps necessary for a Flood Evacuation Plan, which entails: <ul style="list-style-type: none"> <li>• Identification of the flood-prone areas or zones;</li> <li>• Marking the affected areas;</li> <li>• Sending alarms to the affected people and directions on what is</li> </ul>

	<p>required to them;</p> <ul style="list-style-type: none"> <li>• Formulation of traffic diversion with a minimum impact on the regional transport system;</li> <li>• Regional population movement plan to deal with mass evacuation, displacement, or influx;</li> <li>• A compressive review and update of all preparedness plans currently in use to make them conform to the current crisis;</li> <li>• Marking of the evacuation routes and centers of stoppage;</li> <li>• Preparation of health care facilities;</li> <li>• Disaster education and post disaster counseling to allow the evacuees to cope with the situation; and</li> <li>• Post disaster recovery programme involving resettlement plans, relief transportation, and supply chains.</li> </ul>
	<p><b>Step-II: Evacuation Drills and Mock Experience</b></p> <p>1) Invite all the stakeholders from the flood hazard zone of the river basin. The stakeholders will include:</p> <ul style="list-style-type: none"> <li>• Water Service Boards (WSBs);</li> <li>• Water service providers(WSPs)</li> <li>• Water Resources Users’ Associations (WRUAs).</li> <li>• Schools, colleges, and other educational institutions;</li> <li>• County government and</li> <li>• GOK staff</li> <li>• Other CBOs, NGOs operating in the catchment and key organizations operating programmes on disaster management:</li> </ul> <p>2) Discuss why the Evacuation Drills are necessary.</p> <p>3) Agree with the way to conduct Evacuation Drills and mock experiences.</p> <p>4) The use of community sirens/whistles/drums for evacuation purposes.</p>
	<p><b>Step-III: Evacuation Drills Rules</b></p> <p>1) Discuss what is needed in conducting the drills:</p> <ul style="list-style-type: none"> <li>• Whistles/sirens/drums;</li> <li>• Assembling points;</li> <li>• Participants; and</li> <li>• Other necessary materials like tents for healthcare, mobile phones, chargers, etc.</li> </ul> <p>2) Discuss and develop the rules that govern the conduct of the Evacuation Drills:</p> <ul style="list-style-type: none"> <li>• Who manages the drills; and</li> <li>• The time to start and end, etc.</li> </ul>

	<ul style="list-style-type: none"> <li>• Who organizes the Evacuation Drills?</li> </ul>
	<p><b>Step-IV: Mock Experience</b></p> <p>At this stage the participants will give a feedback on their experiences during the evacuation.</p>
<b>Conclusion</b>	Community mobilization at this stage is essential, because it can give the required motivation and instill some sense of responsibility in carrying out evacuation in case of flood disasters.
<b>Exercise</b>	The participants will completely discuss the result of Table-8 depending on their experiences of floods in their areas.



Figure-27 Group Discussion on Flood Mitigation and Response in Kamuga Village on Aug. 20, 2010

Figure-29 Group Presentation on Evacuation in Kamuga Village on Aug. 20, 2010

Figure-28 CFMO organizes Community Members during Evacuation drilling Wasiese Village on Dec. 3, 2010



Figure-30 Community Members assist an injured Evacuee during Evacuation Drilling Mombasa Wangaya Village on Dec. 6, 2010


**Table-8Disaster Evacuation Plan**

Activity	Content/Input	Actor	Items to be confirmed
Identification of the flood-prone areas or zones	Flood hazard maps	WRUA/CBO/NGO in charge of flood disasters	Maps available for dissemination to all stakeholders
Marking the affected areas	Identified affected areas	Chairman of CBO/WRUA, NGO charged with flood disaster management	All affected areas are identified
Sending alarms to the affected people and directions on what is required to them	Megaphone, Siren	Assistant chief, village elder, WRUA and Chairman CBO/ NGO charged with flood disaster management	Availability of battery for megaphone, siren and identified escape route
Formulation of traffic diversion with a minimum impact on the regional transport system	Integrated Flood Management Plan (IFMP)	WRMA staffs (Flood Management Officers Regional and Sub-regional ),WRUA	IFMP available for dissemination to all stakeholders
Regional population movement plan dealing with mass evacuation, displacement or influx	Integrated Flood Management Plan	WRMA staffs (Flood Management Officers Regional and Sub-regional ),WRUA	IFMP available for dissemination to all stakeholders
A compressive review and update of all preparedness plans currently in use to make them conform to the current crisis	Integrated Flood Management Plan	WRMA staffs (Flood Management Officers Regional and Sub-regional ),WRUA	IFMP available for dissemination to all stakeholders
Marking of the evacuation routes and centers of stoppage	Evacuation guidebook	Assistant chief, village elder, WRUA and Chairman CBO/ NGO charged with flood disaster management	Evacuation guidebook is beneficial for dissemination to all stakeholders
Preparation of health care facilities	Community Flood management Manual	District Public Health Officer, WRUA and Chairman of CBO/ NGO charged with flood disaster management	Community Flood Management Manual is beneficial for dissemination to all stakeholders
Disaster education and post disaster counseling to allow the evacuees to cope with the situation	Community Flood management Manual	District Education Officer, WRUA, Head teacher and Chairman of CBO/ NGO charged with flood disaster management	Community Flood Management Manual is beneficial for dissemination to all stakeholders
Post disaster recovery programme involving resettlement plans and relief transportation and supply chains	Community Flood management Manual	WRMA staffs (Flood Management Officers Regional and Sub-regional ) and WRUA	Community Flood Management Manual is beneficial for dissemination to all stakeholders

**2: Evacuation Centre Management**

<b>Objectives</b>	By the end of this session, the participants will be able to: 1) Understand what is required in an evacuation center; 2) Understand the personnel needed in the evacuation center; and 3) Know the rules in the management of an evacuation center.
<b>Time period</b>	- 1 hour
<b>Methodology</b>	- Discussions. - Questions and Answers. - Brainstorming.
<b>Materials/Tools</b>	- Sheets of paper. - Pens. - Flip charts.
<b>Session guide</b>	This session aims at making use of the experience of the participants. The activity will stimulate discussion on the need for coordinated Evacuation Centre Management.
<b>Activity</b>	<ul style="list-style-type: none"> <li>• What is an evacuation center?</li> <li>• Where are evacuation places?</li> </ul>
<b>Content/Message</b>	<p><b>Step-I: Procedure</b></p> <p>This entails:</p> <ul style="list-style-type: none"> <li>• Ask participants to identify where they move when they evacuate;</li> <li>• Identify the gaps in therein in Evacuation Centre Management through group discussion and presentation;</li> <li>• Discuss how the gaps can be bridged;</li> <li>• Explain what can make a place a good evacuation center in the context of safety, accessibility, security, food security and hospitality; and</li> <li>• Pair ranking of safety, accessibility, security, food security and hospitality to prioritize the variables and identify which variable is to be given the highest priority.</li> </ul> <hr/> <p><b>Step-II: What is needed for a successful Flood Evacuation Programme?</b></p> <p>The following simple items may be available in any evacuation programme:</p> <ul style="list-style-type: none"> <li>• A cell-phone charger to afford communication among the evacuees;</li> <li>• A rope;</li> </ul>



	<ul style="list-style-type: none"> <li>• A life jacket;</li> <li>• A life ring;</li> <li>• A detachable ladder;</li> <li>• Assembly point; and</li> <li>• <b>Motor boats</b>, etc.</li> </ul> <p><b>Step-III: Pre-requisite for Management of an Evacuation Centre</b></p> <p>To be able to easily manage an evacuation center, the following would be necessary:</p> <ul style="list-style-type: none"> <li>• Specifically identified evacuation center or place;</li> <li>• Proper designated routes to the center that are free from traffic congestion;</li> <li>• Accessibility would be necessary;</li> <li>• Adequate staff to take care of the evacuees; and</li> <li>• Enough boat/vehicle ambulances and facilities.</li> </ul>  <p style="text-align: center;">Figure-31 Evacuation Activities during Dec. 2011 Floods Source: Kenya Red Cross Migori Branch</p>
	<p><b>Step-IV: Prerequisite Knowledge required for effective Management of an Evacuation Centre</b></p> <p>This entails:</p> <ul style="list-style-type: none"> <li>• Determine resources needed, mobilize and secure them;</li> <li>• Maintaining the evacuation center structure and equipment;</li> <li>• Preparing the evacuation center for use;</li> <li>• Operate the evacuation center with available resources;</li> <li>• Establish and maintain effective channels of communication with relevant agencies and support groups; and</li> <li>• Completing all tasks at closure.</li> </ul>
	<p><b>Step-V: Evacuation Centre Management Strategies</b></p> <p>This entails:</p>



	<ul style="list-style-type: none"> <li>• Make strategic alliances with other stakeholders on how to manage the center;</li> <li>• Avoid conflict in the management of the Centre with the help of designated staff in the center;</li> <li>• Proper communication to deal with real-time issues;</li> <li>• Engage all the stakeholders in more integrative approach;</li> <li>• Allow the various stakeholders to participate in their more specialized areas of undertaking;</li> <li>• Avail all the required equipment and materials for the evacuation exercise;</li> <li>• Use mobile clinic when necessary to take care of the most vulnerable group in the community;</li> <li>• Create confidence in the evacuees that everything is under control; and</li> <li>• Allow minimum movement among the evacuees and other stakeholders to reduce congestion and allow easy movement during the exercise.</li> </ul>
<p><b>Conclusion: Importance of well-managed Evacuation Centre</b></p>	<p>This affords the followings:</p> <ul style="list-style-type: none"> <li>• To serve and save life;</li> <li>• To allow quick evacuation;</li> <li>• To provide the evacuees with the necessary facilities during the time of the disaster; and</li> <li>• To avoid massive destruction and disruption of livelihoods.</li> </ul> <div data-bbox="592 1220 1270 1632" data-label="Image"> </div> <p>Figure-32Community Members evacuating into the Evacuation Centre due to the real Flood during the drill in Komwaga Village on Nov. 23, 2010</p>

## **SESSION7: COMMUNICATION, PUBLIC AWARENESS RAISING AND DISASTER EDUCATION**

### **Topic**

- 1: Capacity of Transmitting and Communication Skills
- 2: Communication of Desired Information to Schools
- 3: Effective Public Awareness Raising on Floods
- 4: Roles of Effective Communication Channels between the Government and Community in Mitigating Flood Risks

### **Overview**

This session provides the community, WRUA committee members, and WRUA members with the most effective communication method using simple community tools.

This session seeks to strengthen the communication skills and systems of WRUAs and communities to be able to communicate more effectively, clearly, and quickly.

### **1: Capacity of Transmitting and Communication Skills**

<b>Introduction</b>	The facilitator will assess the community’s capacity in communication skills and transmission of information related to flood hazards.
<b>Objectives</b>	The objectives of this session are to enable the participants to understand: <ol style="list-style-type: none"> <li>a) Effective ways of communication;</li> <li>b) Methods of information transmission;</li> <li>c) Nature and regional characteristics of flood hazards; and</li> <li>d) How to estimate the distances between the flood-prone areas and evacuation centers and other existent health facilities by means of mapping of flood hazard areas.</li> </ol>
<b>Time period</b>	- 45 minutes.
<b>Methodology</b>	<ul style="list-style-type: none"> <li>- Short presentation.</li> <li>- Questions and Answers.</li> <li>- Information sharing.</li> <li>- Discussions.</li> </ul>
<b>Materials/Tools</b>	<ul style="list-style-type: none"> <li>- Illustrations.</li> <li>- Flip charts.</li> <li>- Marking pens.</li> <li>- Map of the catchment basin.</li> </ul>
<b>Content/Message</b>	<p><b>Step-I: Effective Ways of Communication</b></p> <p>The participants will be inducted into the effective ways of communication in relation to flood hazards, which entails:</p> <ul style="list-style-type: none"> <li>• An understanding of what is communication and what makes a good communication;</li> </ul>

	<ul style="list-style-type: none"> <li>• Roles of the sender of the message and the receiver of the message; and</li> <li>• Clarity/conciseness elements in communication.</li> </ul>
	<p><b>Step-II: Methods of Information Transmission</b></p> <p>The participants will be inducted into the best methods of communication in relation to flood hazards, which entails:</p> <ul style="list-style-type: none"> <li>• The use of mobile phones;</li> <li>• Monitoring of cloud movements to predict impending weather variation;</li> <li>• Organized community groups;</li> <li>• The use of barazas to relay the message; and</li> <li>• The use of local FM radios to broadcast short-time forecast on an oncoming flood event.</li> </ul>
	<p><b>Step-III: Understanding Flood Hazards</b></p> <p>The participants will be inducted on flood hazards including the affected areas and the places of rescue, which thus entails:</p> <ul style="list-style-type: none"> <li>• Mapping of flood-prone areas and warning people there; and</li> <li>• Sharing information on the places where community members can reach in case of flood occurrence.</li> </ul>

**2: Communication of Desired Information to Schools**

<b>Introduction</b>	<p>This session intends to introduce the participants to ways and methods of creating flood disaster awareness in schools.</p> <p>This is expected to have a wider coverage and to reach many people by using the school going children.</p>
<b>Objectives</b>	<p>The objectives of this session are to enable the participants to understand:</p> <ol style="list-style-type: none"> <li>1) Need of using schools as centers to relay messages on flood disasters; and</li> <li>2) Use of school curriculum to disseminate information on floods within their WRUAs and communities.</li> </ol>
<b>Time period</b>	- 1 hour
<b>Methodology</b>	<ul style="list-style-type: none"> <li>- Short presentation.</li> <li>- Questions and Answers.</li> <li>- Information sharing.</li> <li>- Discussions.</li> </ul>
<b>Materials/Tools</b>	<ul style="list-style-type: none"> <li>- Illustrations.</li> <li>- Flip charts.</li> </ul>
<b>Content/Message</b>	<b>Step-I: Teaching of Flood Disaster in Schools</b>

The participants will be inducted to the best methods of teaching flood disaster issues in schools, which entails:

- Development of the subject contents on Flood Management;
- School Curriculum development by identifying the necessary topics to be covered;
- Decision making on the level at which the Disaster Prevention Course can be introduced (primary or secondary school level); and
- Development of materials that can be used with ease in communities.



Figure-33 School Pupils dramatize to target Audience of Community Members in R. Nyando Basin.

The narrative entitled Koth Uhuru: a story of the heavy rainfall in 1961-1963 that led to heavy floods in the country during handover of Nyando Project (2009-2011) to the community on Nov. 21, 2011.



Figure-34 School Pupils keenly study a Community Flood Hazard Map put up on a signboard in Odesso Village.

**Step-II: Teaching Methods/Materials regarding Disaster Education**

This entails:

- The use of lectures, demonstrations, video tapes, etc.;

	<ul style="list-style-type: none"> <li>• Allow the students to experience on-site trainings in those areas already inundated by floods;</li> <li>• The facilitator will hold a demonstration on the available methods;</li> <li>• Preparation of pamphlets for distribution among the young school children, which are written in simple language and with pictures on best practices for Disaster Prevention; and</li> <li>• The use of a flood disaster map.</li> </ul> <p><b>Step-III: Expected Outcomes</b></p> <p>This entails:</p> <ul style="list-style-type: none"> <li>• A wide coverage of affected communities;</li> <li>• New knowledge imparted into the young minds;</li> <li>• Development of a more robust method of flood disaster communication network; and</li> <li>• Development of a specific method of response to flood disasters; plan for evacuation and recovery measures.</li> </ul> <p><b>Step-IV: New Type of Disaster Drill</b></p> <p>New type Disaster Drill, which makes children feel enjoyment in it. (See Figure-39: Iza! Kaeru Caravan)</p> <p>Children are learning in an enjoyable format; a new type disaster reduction training programme for children involving their parents.</p>
<p><b>Conclusion</b></p>	<p>The participants have been equipped with the necessary knowledge and will be prepared to share the knowledge and information gained at WRUA level in local and regional areas.</p>



Figure-35 Iza! Kaeru Caravan 1 (Japan)



Figure-37 Iza! Kaeru Caravan 3 (Japan)



Figure-36Iza! Kaeru Caravan 2(Japan)



Figure-38Iza! Kaeru Caravan 4  
(Japan)

### **3: Effective Public Awareness Raising on Floods**

<p><b>Introduction</b></p>	<p>This session introduces the participants to the role that Public Awareness of floods and Flood Disaster Education in schools plays an important part in Integrated Flood Management (IFM):</p> <ul style="list-style-type: none"> <li>• Communication should improve local awareness so as to reduce and minimize flood damages;</li> <li>• Provide information on risks and evacuation;</li> <li>• Facilitate communication according to the level of understanding and existing knowledge on flood disasters;</li> <li>• Incorporate local stories on historical floods and traditional measures against flooding;</li> <li>• Understand the roles of Structural and Non-Structural Measures such as levees, dams, natural basin storage, etc.;</li> <li>• Incorporate knowledge on Flood Management into the School Curriculum;</li> <li>• Facilitate understanding of the roles of National Government, County Government, local communities and individuals (Public Assistance, Mutual-Help and Self-Help); and</li> <li>• Understand the roles of citizen groups and volunteers.</li> </ul>
<p><b>Objectives</b></p>	<p>By the end of this session, the participants will be able to:</p> <ol style="list-style-type: none"> <li>1) Raise public awareness on floods; and</li> <li>2) Inculcate best methods of message transmission about floods.</li> </ol>
<p><b>Time period</b></p>	<p>- 1 hour</p>
<p><b>Methodology</b></p>	<ul style="list-style-type: none"> <li>- Discussions.</li> <li>- Questions and Answers.</li> <li>- Information sharing.</li> <li>- Discussions.</li> </ul>
<p><b>Materials/Tools</b></p>	<ul style="list-style-type: none"> <li>- Papers.</li> <li>- Pens</li> <li>- Cards.</li> </ul>

	<p>- Flip charts</p>
<p><b>Discussion and Brainstorming</b></p>	<p>This session aims at bringing out detailed ways of raising public awareness of flood disasters.</p> <p>The discussions should build on existent indigenous knowledge of flood disasters and how the communities have developed coping mechanisms over time.</p> <p>The role of the group leader in this session is to guide the discussion and encourage active participation of the members.</p> <p>The participants will:</p> <ul style="list-style-type: none"> <li>• Discuss their understanding of flood disasters and how to create and raise awareness among the community members and the WRUAs;</li> <li>• Be divided into groups of eight (8) representing the entire proportionate participants, and each member in the group is required to list up and write down his/her understanding of Public Awareness Raising among the community members; and</li> <li>• Be expected to draw Table-9 below and mark their methods of Public Awareness Raising within their communities.</li> </ul> <p>Several activities may be carried out at the village level, which includes:</p> <ul style="list-style-type: none"> <li>• Visiting villages to hold Flood Disaster Awareness meetings;</li> <li>• Putting up flood preparedness posters and Flood Hazard Maps at a local baraza meeting place;</li> <li>• Joining the community during the weekly meeting with their local chief; and</li> <li>• Sensitizing teachers and pupils during parents meetings in schools within the catchment.</li> </ul> <p>Other activities include planned series of activities that are well coordinated, such as having evacuation drills, broadcasting radio programmes on floods, and carrying out a disaster education programme in schools.</p> <p>Less frequent and yet useful activities could be done in the annual community event like culture day that integrates Community-based Disaster Activities (CDA) and is therefore able to reach many community members who interact and attend the popular culture day event.</p>
<p><b>Exercise</b></p>	<p>Work in groups and complete Table-9 below.</p> <p>Each member in each group will be expected to include as many variables as possible that can be used to raise public awareness.</p> <p>The facilitator will elaborate on the need to promote community awareness</p>

	<p>and to strengthen community resilience in the following ways in efforts to reduce the flood risks:</p> <p>4) Well-designed public communication campaigns have contributed enormously to educating the public; and</p> <p>5) Conveying the intended message over a large geographical area to a vast and diversified audience.</p>
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**Table-9 Various Methods of Public Awareness Raising**

Major Flood Disaster Issue	Public Awareness Raising Method	Mark indicating Means used
Increased water levels	The use of radio, phones, etc. to send messages	
Increased rainfall intensities	The use of mobile phones, emails	
Community flood hazard map	The use of billboards, etc.	

**4: Roles of Effective Communication Channels between the Government and Community in Mitigating Flood Risks**

<b>Introduction</b>	<p>As already shown in Session 1, flood risks can be seen as a combination of the magnitude of the flood hazard expressed in terms of frequency, the severity with respect to the exposure of the elements to flooding, and the vulnerability of the community at risk.</p> <p>The participants will be inducted into understanding the importance of effective communication in coping with flood risks.</p> <p>A hierarchy of communication channels will be established within the community and the respective WRUAs in order to sensitize them about the need and the roles of good communication systems in disaster risk management.</p> <p>Communication flow channels with respect to information dissemination and activities of stakeholders are shown in detail in (see figure 39 below) in cases of Pre-Flood, In-Flood, and Post-Flood, respectively.</p> <p>This will focus on the causes and effects of floods on the community, catchment area, and the environment in general.</p> <p>This mobilization will create the required public awareness of the roles and importance of Flood Risk Communication (FRC).</p>
<b>Objectives</b>	<p>The objectives of this session are to enable the participants to understand:</p> <ol style="list-style-type: none"> <li>1) The roles of communication in Flood Risk Management (FRM);</li> <li>2) The importance and meaning of communication in flood risks;</li> <li>3) The causes and effects of floods and their impacts on the community;</li> </ol>



	<p>4) The concept, principles, and channels of disaster communication;</p> <p>5) How to familiarize with some communication participatory techniques/skills and tools for community members;</p> <p>6) How to distinguish between methods and levels of disaster communication in different situations and with different stakeholders and the government; and</p> <p>7) How to conduct effective disaster communication for community members in avoiding flood risk.</p>
<b>Time period</b>	-1 hour
<b>Methodology</b>	<ul style="list-style-type: none"> <li>- Short presentation.</li> <li>- Questions and Answers.</li> <li>- Information sharing.</li> <li>- Discussions.</li> </ul>
<b>Materials/Tools</b>	<ul style="list-style-type: none"> <li>- Illustrations.</li> <li>- Flip Charts.</li> <li>- Pens.</li> </ul>
<p><b>Discussion and Brainstorming:</b></p> <p><b>Roles of Communication in Flood Risk Management</b></p>	<p>The participants will brainstorm on the roles of flood risk communication, which entails:</p> <ul style="list-style-type: none"> <li>• Evidence of an impending flood risks;</li> <li>• Identification and the use of the best communication channel to reach as many people as possible (see table 9 above)</li> </ul> <p>Discussion on why communication between the WRUA committee members, stakeholders, and the government is necessary; and</p> <ul style="list-style-type: none"> <li>• Agreement with the way forward.</li> </ul>



Figure-39 Posters showing (a) Evacuation Tips and (b) Early Warning Awareness



## **SESSION8: PLANNING, DESIGN, CONSTRUCTION, OPERATION,AND MAINTENANCE OF FLOOD MITIGATION FACILITIES**

### **Topics:**

- 1:Planning and Designing of Flood Mitigation Measures
- 2:Flood Mitigation Structural Measures including Community-based Measures
- 3:Operation and Maintenance of Flood Mitigation Structural Measures

### **Overview**

This session provides the participants with the overall planning, designing, operation, and maintenance of Flood Mitigation measures.

It also seeks to impart skills to the WRUA leaders and the community members regarding the best practices to plan, design, maintain and operate simple Flood Mitigation facilities within their respective sub-catchments.

### **1: Planning and Designing of Flood Mitigation Measures**

<b>Introduction</b>	The facilitator discusses the available flood mitigation measures and their implication in minimizing the flood damage impacts on the community and their properties.
<b>Objectives</b>	The objectives of this session are to enable the participants to understand: <ol style="list-style-type: none"> <li>1.The types of flood mitigation measures.</li> <li>2.The use of flood mitigation measures.</li> </ol>
<b>Time period</b>	- 1 hour.
<b>Methodology</b>	<ul style="list-style-type: none"> <li>- Short presentation.</li> <li>- Questions and Answers.</li> <li>- Information sharing.</li> <li>- Discussions.</li> </ul>
<b>Materials/Tools</b>	<ul style="list-style-type: none"> <li>- Illustrations.</li> <li>- Flip charts.</li> <li>- Pens.</li> </ul>
<b>Content/Message</b>	<p><b>Step-I: Types of Flood Mitigation Structures</b></p> <p>The facilitator will induct the participants to the various methods of flood mitigation.</p> <p>Flood damage reduction consists of two basic techniques, i.e. structural and non-structural techniques.</p> <p>Structural methods modify the flood and “take the flood away from people” by measures such as levees, floodwalls, dams, dredging, and channelization.</p> <p>Non-structural flood damage reduction techniques basically “take the people away from the floods” leaving the flood to pass unmodified by means of training and sensitization of community members.</p>

	<p>Both structural and non-structural techniques consist of the measures listed in Table-3 above.</p> <p>The facilitator will explain what these measures entail.</p> <hr/> <p><b>Step-II: Planning of Flood Mitigation Measures</b></p> <p>The existent common process of flood risk management includes the following aspects:</p> <ol style="list-style-type: none"> <li>1) Risk Assessment: hazard and vulnerability identification, frequency and consequence analysis, and risk assessment according to given criteria for risk acceptance.</li> <li>2) Protection: structural and non-structural measures.</li> <li>3) Preparedness and Response to Emergency: planning for disaster relief, flood forecasting warning, evacuation, rescue, and humanitarian assistance.</li> <li>4) Post-Recovery: repairing and reconstruction, damage compensation, review of and suggestions for future management.</li> <li>5) It should also include the following steps:             <ul style="list-style-type: none"> <li>• To organize to prepare the plan;</li> <li>• Public Involvement (PI);</li> <li>• To coordinate with other agencies;</li> <li>• To assess the hazard;</li> <li>• To set goals;</li> <li>• To evaluate the problem;</li> <li>• To draft an Action Plan; and</li> <li>• To adopt the plan.</li> </ul> </li> </ol> <hr/> <p><b>Step-III: Design of Flood Mitigation Measures:</b></p> <ul style="list-style-type: none"> <li>• Flood mitigation measures are designed to alter the behaviour of the flood itself by reducing flood levels and/or velocities, or by excluding flood water from the areas of risks.</li> <li>• They are made to confine the water within the river channel or to temporary store the flood water for some time before being released to recover the necessary river flow volume downstream the structure.</li> <li>• Afford the necessary protection against the flood water to the buildings, property, and loss of human life.</li> </ul>
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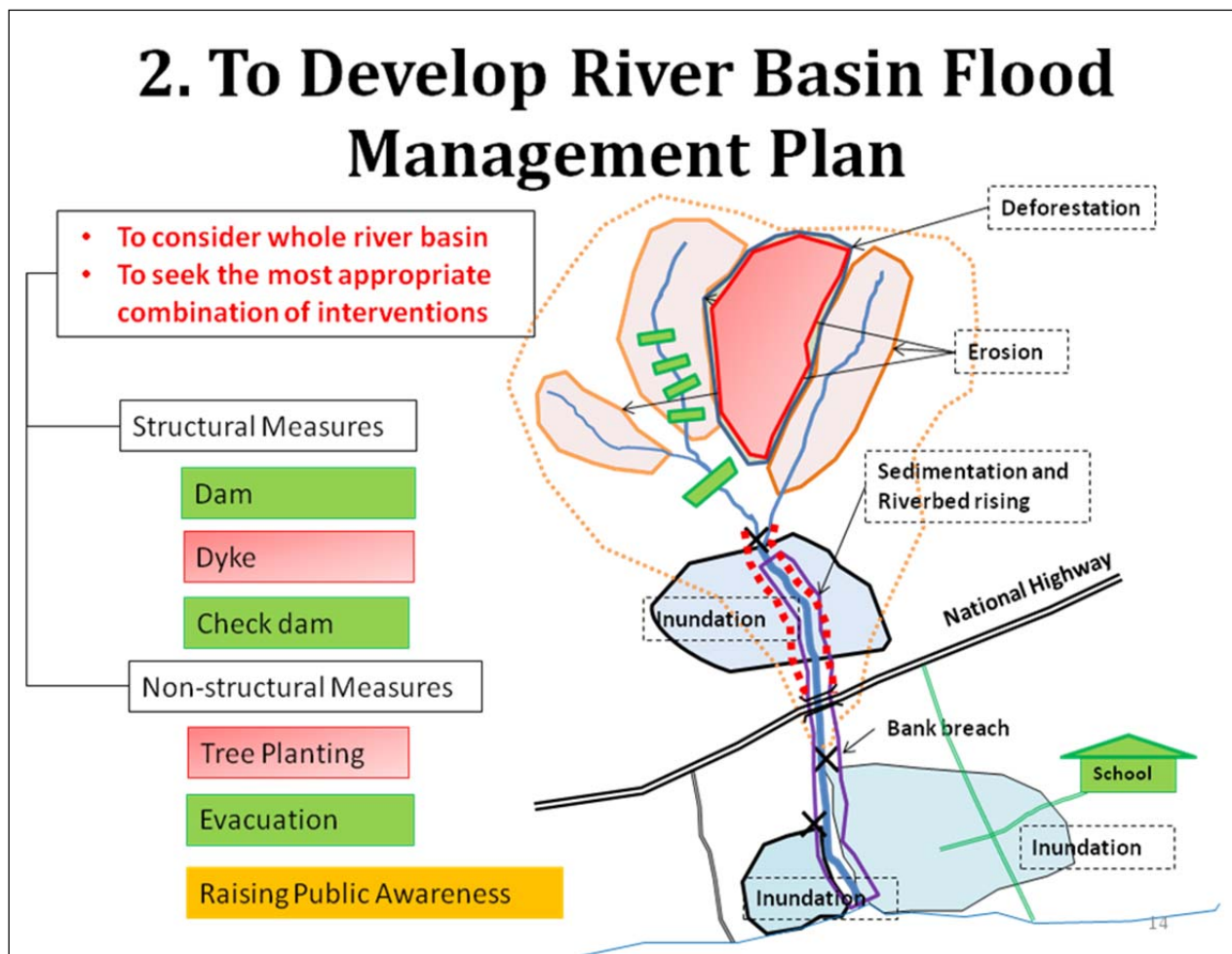



Figure-40 Elements of the River Basin Flood Management Plan

### 2:Flood Mitigation Structural Measures Including Community-based Measures

<p><b>Introduction</b></p>	<p>The facilitator discusses the available flood mitigation measures and their implication in minimizing the flood damage impacts on the community and their properties.</p> <p>The types of structural measures examined in this session include levees, floodwalls, and dredging.</p> <p>Levees and floodwalls are freestanding structures located adjacent to or away from the buildings that can prevent the encroachment of floodwaters.</p> <p>Dredging the flood-prone waterway may allow the waterway to carry more floodwater, reducing the depth of floodwaters.</p>
<p><b>Objectives</b></p>	<p>The objectives of this session are to enable the participants to understand:</p> <ol style="list-style-type: none"> <li>1)The types of flood mitigation measures; and</li> <li>2) The use of flood mitigation measures.</li> </ol>

<b>Time period</b>	- 1 hour.
<b>Methodology</b>	<ul style="list-style-type: none"> <li>- Short presentation.</li> <li>- Questions and Answers.</li> <li>- Information sharing.</li> <li>- Discussions.</li> </ul>
<b>Materials/Tools</b>	<ul style="list-style-type: none"> <li>- Illustrations.</li> <li>- Flip charts.</li> <li>- Pens.</li> </ul>
<b>Content /message</b>	To familiarize the participants with these flood damage reduction measures. General descriptions are presented below.
<b>Levees</b>	<p>Typically, levees are constructed of compacted fill taken from the impervious soil locally available.</p> <p>Depending upon the availability of suitable local soil, levees can be one of the least expensive flood damage reduction measures.</p> <p>Levees have the advantage of being compatible with the landscape since they are easy to shape and are covered with grass as demonstrated in the Figure-41below.</p> <div data-bbox="604 969 1294 1435" data-label="Image"> <p>The image shows a wide, grassy embankment or levee. A person is walking away from the camera on the right side of the embankment. The background consists of a dense line of green trees under a clear blue sky. The ground is covered in well-maintained green grass.</p> </div> <p style="text-align: center;">Figure-41A Typical Levee</p> <p>Unlike other flood proofing measures, a well-designed and well-constructed levee results in no water pressure on its structures themselves.</p> <p>Consequently, as long as the levee holds or is not overtopped, the building should not be exposed to damaging hydrostatic or hydrodynamic force.</p> <p>Another advantage of this technique is that there is no need to make major structural alterations on the flood-prone buildings.</p>
<b>Floodwalls</b>	<p>These are similar to levees; floodwalls also keep water away from the building.</p> <p>However, floodwalls are constructed of stronger materials, are thinner, take less space, and generally require less maintenance than levees.</p> <p>Floodwalls can be constructed by using a variety of designs and materials,</p>

	<p>such as steel sheet piles and concrete.</p> <p>However, flood walls are typically more expensive than levees, and they require closure structures to access to the waterway.</p>  <p style="text-align: center;">Figure-42A Typical Floodwall</p>
<p><b>Excavation</b></p>	<p>Excavation faces the problem of maintenance in many cases. It should sometimes be filled with sediments very fast.</p> <p>Excavation should be done by using machines.</p>
<p><b>Dredging</b></p>	<p>Waterways change over time, sometimes they are aggraded (filled with sediments), and sometimes they are eroded.</p> <p>Dredging deeper and/or wider waterways can provide more capacity for floodwaters, lowering the flood water level; however, the dredging must be done on a regular basis.</p> <p>A site to place the dredged materials must also be identified.</p>
<p><b>Flood Proofing</b></p>	<p>Dry flood proofing typically involves sealing the exterior building walls with waterproofing compounds, impermeable sheets, or other materials. It also uses shields for covering and protecting openings against floodwaters.</p> <p>Shields can be used on doors, windows, vents, and other openings.</p> <p>Sewer lines need to be fitted with check valves that shut when flood water rises in the sewer to prevent backup and flooding inside the building.</p> <p>In evaluating the feasibility of flood-proofing techniques, important analysis/design criteria must be considered such as flood characteristics (level, duration, and velocity); elevation of the first habitable floor, the type and condition of construction, lot size, the location and type of utilities, accessibility, etc.; building codes, zoning/site restrictions, flood insurance guidelines, etc.; and owner/community input and reasonable aesthetics.</p> <p>Generally, dry flood proofing should only be employed in buildings</p>



	<p>constructed of concrete blocks or brick veneer on a wood frame.</p> <p>Weaker construction materials may fail at much lower water depths by the hydrostatic pressure.</p> <p>The brick or concrete block walls may not proof a flood above a height of approximately three feet, due to the danger of structural failure by hydrostatic force, unless a structural engineer has confirmed that the building is designed to cope with the force.</p>
<p><b>Elevation</b></p>	<p>Elevation involves raising the flood-prone buildings in place so that the lowest floor is above the flood level, for which flood proofing protection is required.</p> <p>The buildings are jacked up and set on the new or extended foundations above the level of protection.</p> <p>For houses that include basements, the basements can be filled in, the house should be raised, and a new living space can be added to compensate for the lost basement space.</p>
<p><b>Channelization</b></p>	<p>Channelization or channel modification (also called Conveyance Improvements) typically means modifying a stream by activities such as straightening, widening, narrowing, and/or lining with concrete.</p> <p>Narrowing the channel would reduce its flood capacity.</p> <p>In very narrow areas, the only channelization activity that could possibly be effective would be to line the channel with concrete to speed up the flow and possibly reduce water surface elevations.</p> <div data-bbox="541 1176 1356 1675" data-label="Image"> <p style="text-align: center;">Channelwidening/deepening, under construction.</p> </div> <p><b>Figure-43 Channel Widening to accommodate Flood Water</b></p> <p>Channel modification is an artificial change of the characteristics of a channel, typically for the purpose of reducing flood damages by increasing its overall conveyancecapacity.</p> <p>This can be accomplished by widening and/or deepening the channel, reducing the friction by removing woody vegetation, or by occasionally adding a concrete lining.</p>



<b>Importance of Structures</b>	Flood mitigation structures are designed to alter the behaviour of the flood itself by reducing flood levels and/or velocities, or by excluding flood waters from areas of risks to afford reduced flood damages to the communities, their properties, and human lives.
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**3:Operation and Maintenance of Flood Mitigation Structural Measures**

<b>Introduction</b>	The participants will be introduced to the process of Operation and Maintenance (O&M) of flood mitigation structures and their importance in minimizing the flood disaster impacts on the community.
<b>Objectives</b>	The objectives of this session are to enable the participants to learn: 1) Operation of flood mitigation structures; and 2) Maintenance of flood mitigation structures.
<b>Time period</b>	- 1 hour.
<b>Methodology</b>	- Short presentation. - Questions and Answers. - Demonstrations.
<b>Materials/Tools</b>	- Illustrations. - Flip charts. - Pens.
<b>Content/Message</b>	<p><b>Operation and Maintenance of Flood Mitigation Structures:</b></p> <ul style="list-style-type: none"> <li>• Flood mitigation structures require constant checks involving maintenance and repairs, though this may be done after a flood event;</li> <li>• Civil engineers should be involved both in the Construction and Operation and Maintenance (O&amp;M) of the structures;</li> <li>• Community members need also to know the basic repair and maintenance of some of the structures like dykes and levees through labour provision to stabilize the structures after a flood event;</li> <li>• Removal of debris, logs and other materials need to be done immediately so that the flood water can recede and the next flood water can pass without causing floods. In such mutual assistance tasks, community members should be involved; and</li> </ul> <ul style="list-style-type: none"> <li>• Sandbags are beneficial materials for Operation and Maintenance (O&amp;M). Sandbags could reinforce river banks, gabions around springs, house foundations, etc.in case of a low level flooding (see Figure-44, Figure 45 and Figure-546).</li> </ul>

<b>Conclusion</b>	Mobilization at this stage is essential because it will give the required motivation and instill some sense of ownership to the WRUA members.
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Figure-44 Vetiver System



Figure-45 Putting Sand/Soil into Sandbags



Figure-46 Setting Sandbags in front of Door

## **SESSION9: CO-OPERATION BETWEEN UPSTREAM AND DOWNSTREAM STAKEHOLDERS AND CO-ORDINATION**

### **Topics:**

- 1:Co-operation and Co-ordination between Upstream and Downstream WRUAs in a River Basin
- 2:Roles of Co-operation and Co-ordination
- 3: Co-operation with County Government, WRUA and Sub County Disaster Management Committee (SCDMC)

### **Overview**

This session, first, presents modalities for the upstream and downstream WRUA co-operation.

It also seeks to impart skills to the participants, WRUA committee leaders, and its members how to work in collaboration with upstream and downstream WRUAs within a river basin.

Second, it presents co-operation and co-ordination process among the WRUA members and other stakeholders in dealing with flood disaster risks.

Finally, it seeks to impart skills to the WRUA leaders to work in collaboration with other groups with similar objectives within their respective sub-catchments.

### **1: Co-operation and Co-ordination between Upstream and Downstream WRUAs in a River Basin**

<b>Introduction</b>	This session tries to examine the areas of co-operation and co-ordination between different WRUAs in the upstream and downstream scale or left bank and right bank within a river basin.
<b>Objectives</b>	The objectives of this session are to enable the participants to understand: <ol style="list-style-type: none"> <li>1) Why it is important to co-operate; and</li> <li>2) How to identify the areas of co-operation and co-ordination by WRUAs within a river basin.</li> </ol>
<b>Time period</b>	- 1 hour.
<b>Methodology</b>	<ul style="list-style-type: none"> <li>- Short presentation.</li> <li>- Questions and Answers.</li> <li>- Information sharing.</li> <li>- Discussions.</li> </ul>
<b>Materials/Tools</b>	<ul style="list-style-type: none"> <li>- Illustrations.</li> <li>- Flip charts.</li> <li>- Marking pens.</li> </ul>
<b>Content/Message</b>	<p><b>Step-I: Areas of Co-operation and Co-ordination</b></p> <p>The facilitator will guide the participants in identifying the areas necessary for co-operation and co-ordination in trying to mitigate flood disaster risks.</p>

	<p>This covers the following areas and aspects.</p> <p>1) Identifying the areas of co-operation and information sharing such as:</p> <ul style="list-style-type: none"> <li>• Hydro-meteorological monitoring network to record and predict rainfall patterns and flood event;</li> <li>• Establishing Community-based Flood Early Warning System (CFEWS);</li> <li>• Mapping flood-prone areas and ensuring that all the WRUAs are informed accordingly;</li> <li>• Establishing focal committee members for easy communication; and</li> <li>• Networking among the WRUA members in both the upstream and downstream areas in the river basin.</li> </ul> <p>2) This allows for real-time flood mitigation planning, co-ordination, evacuation, response and rescue operation in order to:</p> <ul style="list-style-type: none"> <li>• Avoid damages to downstream flood mitigation structures;</li> <li>• Reduce flood risks in the downstream areas;</li> <li>• Prepare for evacuation; and</li> <li>• Provide flood early warning to the downstream sections of the river, etc.</li> </ul>
	<p><b>Step-II: Importance of Co-operation and Co-ordination of Activities in River Basin among WRUAs and Community Members</b></p> <p>The participants are expected to take part in a brainstorming session among them to generate ideas about the areas of co-operation and co-ordination within their river basin.</p> <p>These areas should focus on:</p> <ul style="list-style-type: none"> <li>• Water use demands among the users;</li> <li>• Equitable sharing of the water resources and sustainability;</li> <li>• Networking and knowledge sharing among the WRUAs;</li> <li>• Communication networks on flood disaster risks;</li> <li>• Collaboration with other stakeholders; and</li> <li>• Active community participation and ownership.</li> </ul>
	<p><b>Step-III: WRUA and Community Participation</b></p> <p>This should focus on the need for all the stakeholders to be involved in decision making through the following ways:</p> <ul style="list-style-type: none"> <li>• Initial community and WRUA meetings for identifying the areas of co-operation and co-ordination;</li> <li>• Drawing the areas that need to be addressed; and</li> <li>• Making a Plan of Action for implementation of the purposes.</li> </ul>

	<p><b>Step-IV: Outcomes</b></p> <p>At this stage the WRUA members and community members are ready to share the knowledge gained with other stakeholders.</p>
<b>Conclusion</b>	The participants have enough understanding of the importance of networking, co-operation and co-ordination among the affected communities and the WRUAs.

## **2:Roles of Co-operation and Co-ordination**

<b>Introduction</b>	<p>This session aims at coming up with detailed framework that can be used to achieve a well-structured co-operation and co-ordination to cope with a flood in the effort of the Flood Disaster Risk Reduction Programme.</p> <p>The discussions should be based on existent known areas of co-operation and co-ordination among the affected WRUAs.</p> <p>The participants will discuss the development of a Plan of Action amongst others.</p>
<b>Objectives</b>	<p>By the end of the session, the participants will be able to:</p> <ul style="list-style-type: none"> <li>• Understand the necessity of co-operation in Flood Risk Management (FRM); and</li> <li>• Understand the importance of co-ordination.</li> </ul>
<b>Time period</b>	- 1 hour
<b>Methodology</b>	<ul style="list-style-type: none"> <li>- Discussions.</li> <li>- Questions and Answers.</li> <li>- Brainstorming.</li> </ul>
<b>Materials/Tools</b>	<ul style="list-style-type: none"> <li>- Sheets of paper.</li> <li>- Pens.</li> <li>- Flip charts</li> </ul>
<b>Development of a Plan of Action for Co-operation and Co-ordination</b>	<p>The participants will select a group leader to lead the discussion from among them. In the group discussion the participants should strive to answer the following questions to review the necessary issues in their proposed Plan of Action:</p> <ul style="list-style-type: none"> <li>• What are the existent flood risk mitigation measures in your area?</li> <li>• What issues would you like the WRUA committee to address (here some objectives will be developed)?</li> <li>• Which stakeholder should take the leading role within the catchment?</li> <li>• What are the roles of the community in the Plan of Action?</li> <li>• Who will execute the Plan of Action?</li> <li>• What is the time frame for the implementation of the Flood Risk Reduction Plan of Action?</li> </ul>

	<p>Once all the participants have answered these questions, the leader will provide them with the expected Plan of Action with some blanks and let them fill in it in groups.</p> <p>After this all the participants will report and agree with the Plan of Action to be adopted.</p>
<b>Conclusion</b>	<p>This session should result in the development of a flood risk reduction plan of action involving the upstream and downstream WRUA members.</p> <p>In order to check the attainment of the objectives of the session, the participants will be asked to explain a Flood Risk Reduction Plan of Action that they have come up with for implementation.</p>

### **3: Co-operation with County Government, WRUA, and Sub County Disaster Management Committee (SCDMC)**

<b>Introduction</b>	The participants will be introduced into the need for both co-operation and co-ordination of a Flood Disaster Risk Reduction programme.
<b>Objectives</b>	<p>The objectives of this session are to enable the participants understand:</p> <ol style="list-style-type: none"> <li>1) Clear understanding of basin linkages --- upstream/downstream, actors, institutions, planning levels;</li> <li>2) Administrative arrangements for disaster management --- national to local levels;</li> <li>3) Water resources management at the national government level; and</li> <li>4) Roles of key institutions in flood management --- data and information gathering and dissemination, early warning, planning, rescue operations and recovery.</li> </ol>
<b>Time period</b>	- 1 hour
<b>Methodology</b>	<ul style="list-style-type: none"> <li>- Short presentation.</li> <li>- Questions and Answers.</li> <li>- Information sharing.</li> <li>- Discussions.</li> </ul>
<b>Materials/Tools</b>	<ul style="list-style-type: none"> <li>- Illustrations.</li> <li>- Flip charts.</li> <li>- Pens.</li> <li>- Sheets of Paper.</li> </ul>
<b>Content/Message</b>	<p><b>Step-I: Power and function of the Cabinet Secretary and Water Resources Institutions</b></p> <p>The facilitator will explain the power and function of the Cabinet Secretary.</p> <p>This involves Mechanisms of co-operation and co-ordination (shown in Figure-47) , Water Resources Institutions such as Water Resources Management Authority, Catchment Area Advisory Committees(CAACs), Water Resource Users Association, National</p>

	<p>Water Conservation and Pipeline Corporation(NWCPC) , and Water Service Trust Fund (WSTF), and functions and responsibilities of National Disaster Operation Centre (NDOC).</p> <p><b>Step-II: Roles and functions of the County Government</b></p> <p>The facilitator will explain the roles and functions of the County Government. National/County Governments institutional flow chart is shown in Figure48.</p> <p><b>Step-III: Roles and Responsibility of CDMC and SCDMC</b></p> <p>The facilitator will explain the roles and functions of Community Disaster Management Committee (CDMC), Sub County Disaster Management Committee (SCDMC).</p> <p><b>Step-IV: Roles and Functions of WRUA, Community, and Other Actors</b></p> <p>The facilitator will explain the roles and functions of WRUA and community during pre-flood disaster phase, during flood, and post flood disaster.</p> <p>Community first to despondence, importance of local information, WRUA’s assessment of the flood depth, WRUAs collaboration, and CFMOs at village level will be explained.</p> <p>Private sector participation and media in flood management will be explained.</p>
<p><b>Output</b></p>	<p>At this stage the participants will learn the importance of a smooth chain of co-operation and co-ordination among the key players in the development of flood disaster risk reduction and management programme.</p> <p>Furthermore, following results of cooperation and coordination will be understood by the participants:</p> <ul style="list-style-type: none"> <li>• Real-time flood mitigation planning, co-ordination, evacuation, response and rescue operation Avoid damage to downstream flood mitigation structures;</li> <li>• Reduce flood risks in the downstream areas;</li> <li>• Prepare for evacuation; and</li> <li>• Provide early warning to the downstream sections of the river.</li> </ul>
<p><b>Conclusion</b></p>	<p>This process is likely to instill some sense of the need for all the stakeholders to co-operate and co-ordinate the activities geared towards disaster risk reduction by the various methods adopted within their catchment areas.</p>

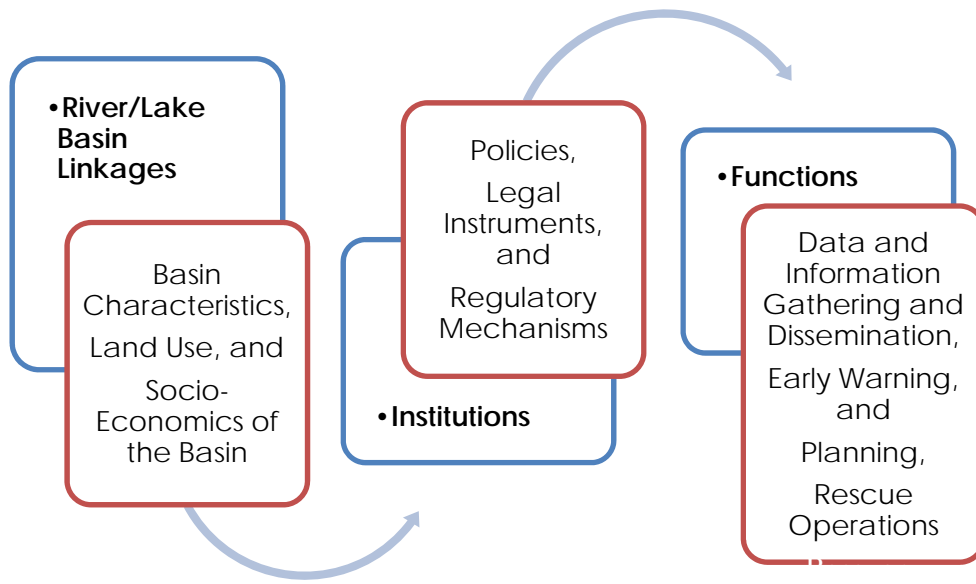


Figure 47 Mechanisms of Co-operation and Co-ordination

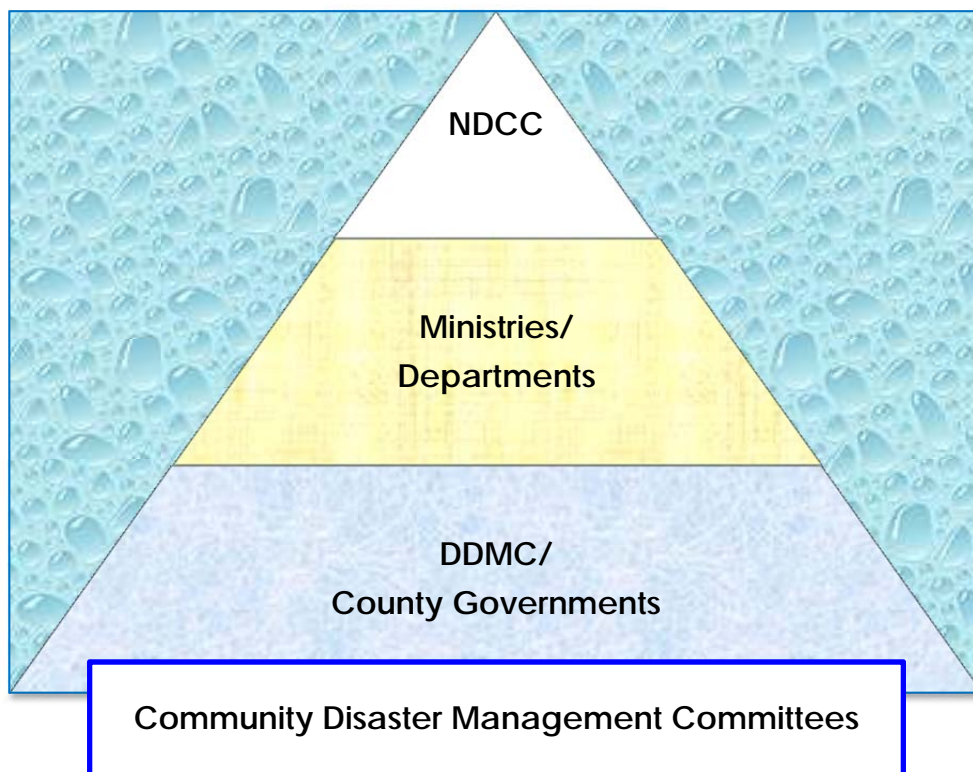


Figure 48 National/County Governments Institutional Flow Chart



## **Appendix 3-1**

### **Reports of community based flood hazard map**

**Developing Community Based Flood Map  
for  
Geographical Data for Flood Management Plan  
in  
Effective Flood Management in the Pilot Project Area**



**GUCHA-MIGORI: Site visit Report**

**NOVEMBER 2012**

## **GEOGRAPHICAL DATA: MAPPING OF FLOOD PRONE AREAS**

### **1. Objective**

- To meet the Regional Office and Sub-regional office WRMA, and request them to assign a staff during the visit to Lower Gucha Migori. This aims at capacity building of WRMA staff to be able to collect geographical data especially on mapping of the area that experience flooding;
- To meet the LOGUMI WRUA members and enhance their capacity further on developing Community Flood Hazard Map and also transferring these features on community hazard map to the topographical map; and
- To record the coordinates of various landmarks, flood prone areas including the depth and inundation period, evacuation centre, identify evacuation routes, health facilities and raised areas that normally are not affected by floods.

### **2. Overall Itinerary**

#### **a) 13 November 2012 (Tuesday)**

- 08:00: Arrival of JICA Expert and Project Supervisor for Isiolo
- 09:00: Meeting with Regional Office, WRMA-LVSC
- 11:00: Leave Kisumu for Kisii to meet WRMA-LVSC Southern Shoreline, Kisii
- 12:30: Meeting with WRMA-LVSC Southern Shoreline, Kisii Sub-regional Manager
- 13:30: Meeting with WRMA-LVSC Southern Shoreline, staff
- 14:00: Leave Kisii for Homa Bay to observe the WRMA's automated rainfall station
- 15:00: Observation of rainfall station and hold meeting with District Water Officer
- 17:00: Return to Kisii Town

#### **b) 14 November 2012 (Wednesday)**

- 08:30: Meet at Sub-regional Office and leave for Lower Gucha Migori SC
- 11:00: Meeting with three LOGUMI WRUA members to accompany the team for site visit
- 11:30: Recording of GPS coordinates and take pictures in Kabuto, Nyora and Luanda
- 17:00: Return to Kisii Town

#### **c) 15 November 2012 (Thursday)**

- 08:30: Meet at Sub-regional Office and leave for Lower Gucha Migori SC
- 11:00: Meeting with LOGUMI WRUA members to accompany the team for site visit
- 11:30: Recording of GPS coordinates, take pictures in Tulu, Ayeko, Aeko and Ratienyi
- 17:30: Return to Kisii Town

#### **d) 16 November 2012 (Friday)**

- 09:30: Meet at Sub-regional Office and leave for Lower Gucha Migori SC
- 12:00: Meeting with LOGUMI WRUA members to draw the SC flood hazard map
- 14:30: Recording of GPS coordinates, take pictures in Tito and Muhuru Bay
- 17:30: Return to Kisii Town

### **3. Site/Organization/Person Visited**

- i. WRMA-LVSC Regional Office, Kisumu
- ii. WRMA-LVSC Sub-regional Office Southern Shoreline, Kisumu
- iii. District Water Office, Homa Bay
- iv. LOGUMI WRUA

### **4. Counterpart Personnel Accompanied**

- i. Mr. Kibati, WRMA-LVSC Sub-regional Office Southern Shoreline, Kisumu

### **5. Accompanied Personnel (Japanese side)**

- i. Mr. Naonori OKAWA

### **6. Major Findings**

- i. WRMA-LVSC Regional office does not have a GIS expert, but they have staff who can competently use the GIS software.
- ii. WRMA-LVSC Regional office staff who can use the GIS software was away on official assignment for two weeks, therefore he could not accompany the Project Team to Lower Gucha Migori SC.
- iii. WRMA-LVSC Sub-regional office do not have the GIS software neither do the office have an officer who can operate the GIS software.
- iv. WRMA-LVSC Sub-regional office has an officer who can help community develop community flood hazard map. But he is currently preparing for transfer to another station and was also engaged in an official assignment in Oyugis.
- v. Data collection and storage challenge; WRMA came to existence in 2005. Before 2005 data collection and storage was the responsibility of the Ministry of Water and Irrigation (MWI), and some of the data is still with MWI and is yet to be shared with or transferred to WRMA;
- vi. The old men and women have information that is engraved in their hearts that is profitable if it can be collected, recorded and stored as data. For example one old man was able to describe the history of heavy flood other than the annual regular in Lower Gucha Migori as follows: 1947, 1957, 1961, 1963, 1985, 1997-1998, 2006, and 2011;
- vii. LOGUMI WRUA are able to develop a community flood hazard map and they had developed a community flood hazard for the most affected area of Kabuto-Nyora area;
- viii. LOGUMI SC experiences flash floods that are as a result of heavy rainfall in the hilly areas. The flash flood is experienced mainly in Luanda, Misiwi, Tito and Ratienyi areas. The SC also experiences the riverine floods as a result of river bursting its banks and the main area affected are Kabuto, Nyora, Aeko and Kimai. There is also backflow

water from the lake that causes floods in Aneko and Aeko areas; and

- ix. LOGUMI WRUA area of jurisdiction is vast, and therefore effort to come up with one flood hazard map for the Sub-catchment by the community is not easy and therefore need for three separate community flood hazard map. One map for Kimai, Kabuto, Nyora, Tulu, Aneko and Aeko; another map for Luanda Misiwi area and last but not least map consisting of Ratienyi, Tito and Muhuru Bay.

## 7. Meetings

### 7.1 Meeting with WRMA-LVSC Regional Office

The meeting took place on 13<sup>th</sup> November 2012 at WRMA-LVSC Regional Office in Kisumu. The following persons were in attendance:

- 1) Mr. Willis MEMO who represented the Regional Manager;
- 2) Mr. Naonori OKAWA the JICA Expert;
- 3) Mr. Jared OTIENO Flood Management Activities Supervisor for Isiolo;
- 4) Mr. Clement NGIDA Flood Management Activities Supervisor for Gucha Migori.



Meeting with WRMA-LVSC Regional Office

The following salient issues were discussed:

- ✓ GIS: There are officers in the regional office who have basic knowledge on GIS software operations while there is a staff who is not a GIS expert but can competently use the software;
- ✓ GIS software is installed in some of the computers at the Regional Office;
- ✓ Matter arising: The Regional Office wanted information if the staff at the Regional Office can be trained on how to transfer the community flood hazard map to the topographical map using GIS software.

### 7.2 Meeting with Sub-regional Manager WRMA Kisii

The meeting took place on 13<sup>th</sup> November 2012 at Nyabenda Hotel in Oyugis Town. The following persons were in attendance:

- 1) Mr. Bilancio MATURWE, the Sub-regional Manager;
- 2) Mr. Joseph Boit, the CMO and WRMA counterpart staff to the Project;
- 3) Mr. Naonori OKAWA the JICA Expert;
- 4) Mr. Jared OTIENO Flood Management Activities



Meeting with WRMA Kisii Sub-regional Office

Supervisor for Isiolo;

5) Mr. Clement NGIDA Flood Management Activities Supervisor for Gucha Migori.

The following salient issues were discussed:

- ✓ Community Flood Hazard Map: The Sub-regional manager pointed out that the only one staff who had the capacity in developing community flood hazard map received transfer letter to another station, and the staff had not yet transferred the technique to other staff;
- ✓ Capacity development: The SRO does not have personnel who can use the GIS software (which is not installed in any of the computers at the SRO). Sub-regional manager requested that the capacity of the SRO should be built in the GIS software operation;
- ✓ Challenges at the SRO: The Sub-regional manager revealed that there was a challenge with data management at the SRO. He clarified that the SRO does not have staff that can download data from the automated station, and therefore they had to rely on Kisumu leading to gaps in data collection. He explained to the team that currently the SRO has five RGS automated stations under their care though only one is located on Gucha Migori system. He further stated that there are two automated rainfall stations under the care of SRO. 1KB05 Wath Onger station was installed in 1998 and rehabilitated in 2010. Another challenge that the SRO faces is rampant vandalism of the hydro-met stations. Another challenge that the SRO faces is the limited number of computers at the SRO with three computers serving fourteen staff.
- ✓ GPS Gadgets: WRMA-LVSC Southern Shoreline, Kisii has two GPS gadget that they use for data collection. The Sub-regional manager also requested that the staff at the SRO be capacity built in the use of GPS gadget not only in recording data but downloading the data to the computer and where necessary analysis the data.
- ✓ Meeting with WRMA at the SRO: The meeting at the SRO was a courtesy call because at the meeting with Sub-regional manager, he assigned the staff Mr. NJIHIA to accompany the Project Team to the Lower Gucha Migori.

### 7.3 Meeting with District Water Officer

The meeting took place on 13<sup>th</sup> November 2012 at District Water Office in Homabay Town. The following persons were in attendance:

- 1) Mr. Samuel NJIHIA, CMO WRMA Kisii;
- 2) Mr. ATHERO, the Water Rights Officer;
- 3) Mr. Naonori OKAWA the JICA Expert;
- 4) Mr. Jared OTIENO Flood Management





Activities Supervisor for Isiolo;

5) Mr. Clement NGIDA Flood Management Activities Supervisor for Gucha Migori.

The automated rainfall station is located at the District Water Office (DWO).

- ✓ Data Management: The district water officer stated that initially the storage of data was with the DWO and as a result of transition triggered by Water Act of 2002 that made many DWOs think that they were going to be redundant, and therefore these DWOs were not keen on taking care of the data and therefore misplacement of these data.
- ✓ Geographical data: There are no maps indicating the areas of supply only one map that is a photocopy of the plan for the supply.
- ✓

#### 7.4 Meeting with Community Members

During the excursion field trip the Project Team interacted with the community members at various site locations and discussed the flood issues in their respective areas. The following salient issues emerged during the discussions:

- ✓ Kimai area: Community members informed the Project Team that there is a natural depression that acts as a water pan and is able to collect flood water with depth of between 1M to 1.5M over the inundation period of six months though the water level reduces overtime;



Natural depression area location being showed by Community members

- ✓ Kabuto area: Head teacher explained that the school was constructed by the community with assistance from world vision which constructed one class. He further pointed out that the water tanks and hand washing points were provided by Afya Plus which is an organization under USAID. He also clarified that during flood disaster community members evacuate to school and the school administration gives the affected families two classes that they use as a place of refuge;



Water tank at Kabuto School, the school is an evacuation place

- ✓ Nyora area: Community members explained that the former Kabuto School had a borehole that community members use as a water point due to the clean water that they draw from the borehole. The borehole is currently damaged and



Water point at former Kabuto School, the borehole is currently damaged

community members are unable to use it. Head teacher at Nyora explained that the school is used by community members as an evacuation place when their homes are affected. He clarified that only when the floods are heavy that is when the school is also affected leading to evacuation of the evacuees to Nyakweri Primary School. He further stated that the last time such heavy floods was in 2006;

- ✓ Luanda area: Community members pointed out that the area is affected by flash floods. The major impact of the flash floods is destruction of the farmlands and caving in of toilets leading to sanitation problems. The flash floods are caused by the heavy rains in the nearby hills. The health personnel at the nearby health facility explained that the floods affect the health facility with the flood depth of 30CM. The health personnel further explained that a wing for in-patient admission is under construction;



Community member points at the source of flash floods

- ✓ Nyakweri area: The teachers at school explained that the school is at a raised location and is never affected by floods. The clarified that during floods community members evacuate to the school whereby they settle at the school play ground and KRCS provide tents and other relief services to the evacuees;
- ✓ Ogongo area in Tulu: Community members explained that during flood the water overflows into the old river channel that over flows their farms. The old man in the area explain the flood history in the area as follows:1947, 1957, 1961, 1963, 1985, 1997-1998, 2006, and 2011;
- ✓ Aneko area: Community members explained that the R. Gucha-Migori changed its course at the entry point to the Lake Victoria four points including the current entry point at Kabuto-Nyora area. The old man explained to the Project Team that the pressure of the back flow from the Lake Victoria was heavier than the pressure of the river flow especially when flooding leading to the back flow of the water back to the river channel leading the river to change its course in the process;



The third location point where R. Gucha-Migori changed course on the old channel

- ✓ Aeko area: Community members explained that the floods mainly affected the farmlands. They



Community members explain the effects of floods in Aeko area



further explained that the homesteads are affected by floods as a result of back flow from the Lake Victoria. The flood depth in the area is 50CM with a duration of three to four weeks; and

- ✓ Ratienyi area: Community members explained that there is R. Ratienyi that has its source in the neighbouring hills that leads to floods during heavy rains. The flood affects mainly the farmlands and livestock and in case of heavy floods the nearby homesteads are affected. The flood depth in the area is 50CM to 1M with inundation duration of three to four weeks.

## 8. Site Visits for recording of GPS Coordinates

### Day 1

**Target for Day 1:** Collection of GPS coordinates of various landmarks, evacuation centres, health facilities, schools, water points, dangerous spots, evacuation routes and affected homes and farmlands in Kabuto-Nyora area and Luanda. Discuss with community members on flood issues to get more flood information from community members.

**Conditions:** The LOGUMI WRUA were participating in a WSTF training in Homa Bay and therefore they assigned three members to accompany the Project Team during the process of recording GPS coordinates and taking pictures.






**Note:** It is important to note that the LOGUMI WRUA members' capacity on developing community flood hazard map had been realized in June 2012 wherein the Kabuto-Nyora area Flood Hazard Map was developed.

### Observations:

- 1) It was observed that in Kimai area there is a natural depression that acts as a water pan that collects water during flooding with a depth of over one meter during the onsets of floods and reduces both in the area coverage and depth overtime of six months. The community pointed out that in case it rains in the area while the water in the depression is plenty it leads to flooding of the nearby homes leading to evacuation. Two danger points along the evacuation route were also noted;
- 2) It was observed that in Kabuto area that during floods community members evacuate to Kabuto primary school. The school has part of the classes having mud-walled classes which are eroded. The head teacher explained that during floods when evacuees move to school, the school management gives evacuees two classes to use as rescue places. Kabuto Dispensary the only health facility in the area is marooned with flood water leading to difficulty in accessing the facility. The floods in Kabuto are as a result of R. Gucha Migori bursting its banks. There is heavy erosion of the riverbanks on the right side of the river where Kabuto is located but the water seems to overflow the Nyora side more than Kabuto side. Though community people pointed out that there are streams that also overflow into Kabuto

- after excessive water of R. Gucha Migori flowing into these streams. There are danger spots that were noted that gives some evacuees difficulties to access the evacuation centre and even the health facilities. Community members also pointed out that using boats to cross the river during floods was dangerous.
- 3) It was observed in Nyora area that it is the most affected and the former Kabuto school that was located in Nyora area was relocated to its current location due to floods in the area, the former school is currently used as a water point due to the borehole that has fresh clean water having been drilled there. During floods in Nyora most areas accessibility is by boats. The farmlands in the area are affected. The community members move to Nyora primary that acts as an evacuation place for evacuees. The evacuees use the field and the church that is located in school for rescue with KRCS providing tents that evacuees use. During heavy floods Nyora primary school also gets affected that leads the evacuees to move to Nyakweri Primary School that is at a raised place and evacuees use the school playing ground as a rescue place with KRCS providing tents to the evacuees. There are danger spots that were noted in Nyora with one place that has a seasonal stream having a flood depth of 1.2M during heavy floods.
  - 4) It was observed in Luanda area that the area is affected by the heavy rains in the nearby hills that lead to flash floods as the water move downstream to the lake at high velocity. The major damages include collapsing of toilets, washing away of crops in the farms and destroying homes that are located on the path of the flash floods.
  - 5) It was observed that Nyakweri Primary School and the area is located in the raised places and is never directly affected by floods. Nyakweri school acts as an evacuation places for most evacuees during flooding. It was also noted that during heavy floods three schools moved to Nyakweri primary school to continue with their education programmes at Nyakweri Primary School. The school has toilets but they are not enough when evacuees move to the school leading to overstretching of resources at Nyakweri school.

**Conclusion:** The target for day one activities was realized. It is important to note that culverts were proposed by community members as an intervention measures for the danger spots. It was also proposed by community that an evacuation centre be constructed that can carter for affected families in Kabuto and Nyora areas and the community members capacity on proper evacuation procedures and management of evacuation centre be developed.

	
<p>Place : District Water Office compound Homabay Description : Observation of the automated rainfall station</p>	<p>Place : LOGUMI WRUA Office Description : Project Team and the LOGUMI WRUA discuss on ways of transferring of the flood hazard map to topographical map</p>
	
<p>Place : R. Gucha Migori at Wath Onger Description : Observation of the automated river-gauge station</p>	<p>Place : Kimai village Description : Natural depression that acts as water pan with a diameter of about 100M</p>
	
<p>Place : R. Gucha-Migori Description : Eroded river banks wherein the water overflows and floods Kabuto</p>	<p>Place : Kimai-Kabuto boundary Description : danger spot during flooding that makes accessibility difficult community have proposed culvert as intervention measure</p>



	
<p>Place : Kabuto Primary school Description : Kabuto primary school at the new location and it acts as evacuation place</p>	<p>Place : Kabuto village Description : Danger spot during flooding that makes accessing Kabuto school difficult</p>
	
<p>Place : Kabuto Village Description : Kabuto dispensary a health facility in the area that gets marooned during flood</p>	<p>Place : Former Kabuto Primary school Description : Water point in the area but the borehole got damaged recently</p>
	
<p>Place : Nyora Primary School Description : An evacuation place that also during heavy floods get inundated</p>	<p>Place : Luanda area Description : Health Facility in the area that has a dispensary</p>
	
<p>Place : WRMA-LVSC Regional Office Description : JICA expert explains to WRMA-LVSC</p>	<p>Place : LOGUMI WRUA Office Description : JICA Expert meet with WRUA Executive</p>

## Day 2

**Target for Day 2:** Collection of GPS coordinates of various landmarks, evacuation centres, health facilities, schools, water points, dangerous spots, evacuation routes and affected homes and farmlands in Tulu, Ayeko, Aeko and Ratienyi. Discuss with community members on flood issues to get more flood information from community members.

**Conditions:** The LOGUMI WRUA members availed themselves for the activity and the manual for community hazard map development was distributed to them. Two members were assigned to accompany the Project Team during the process of recording GPS coordinates and taking pictures and interview with community members.









**Note:** The initial plan was to have the LOGUMI WRUA members' transfer the Flood Hazard Map to the topographical map. But due to the concluded WSTF training leading to fatigue to the members and quorum could not be mobilized and it was agreed that site visits to be carried out instead.

### Observations:

- 1) It was observed that in Tulu area there is a stream that taps from the overflow of the flooding water from R. Gucha Migori leading to floods in the area with flood depth of over 50CM (fifty centimeters). The fields that are used as grazing lands get flooded leading to loss of livestock.
- 2) At Ogengo area the community members were able to describe the flood in the area during the flood as a result of the overflow from the old channel.
- 3) It was observed that in Ayeko area where the old R. Gucha Migori channels passes through gets affected by the backflow of water from the Lake Victoria leading to floods that wash away the crops in the farmlands. The old channel is dry but during floods the excessive water from the new channel flow through the old channel. The community members pointed out that the place where the old channel flows into the Lake Victoria as a danger point with deaths recorded during floods. The community members also pointed out that hippopotamus infestation of the area makes the place even more dangerous.
- 4) It was observed in Aeko area that it is mostly affected by the excessive flood water from R. Gucha Migori that strays to the area as it flows downstream to L. Victoria and thereby affecting the farmlands. The community members also pointed out that the backflow from the L. Victoria affects their homes leading to damages of houses with flood depth of 1M (one metre) noted.
- 5) It was observed in Ratienyi area that the area is affected by the heavy rains in the nearby hills that lead to flash floods which also leads to the seasonal streams in the area to overflow leading to the destruction of the farmlands and heavy losses of the livestock.

**Conclusion:** The target for day two activities was realized.



	
<p>Place : Agenga Chief's camp Description : Vandalized KMD rainfall station</p>	<p>Place : Tulu area Description : Gullies along the road</p>
	
<p>Place : Tulu Area Description : Grazing land that gets inundated 50cm depth</p>	<p>Place : Ayeko old channel entry point to lake Description : Danger spot that deaths have been recorded</p>
	
<p>Place : Aeko village Description : The area where farmlands have been abandoned due to floods</p>	<p>Place : Aeko Village Description : Community member points the depth of floods that affects Aeko</p>
	
<p>Place : Aeko village Description : The area where the backflow from adjacent lake floods the area</p>	<p>Place : Nyangenda Primary School Description : Raised place near Aeko that is not affected by floods</p>

**Note for Day 2 activities:** It is was proposed that Tulu, Ayeko and Aeko be incorporated in Kabuto-Nyora Community Flood Hazard Map while Ratienyi area be part of the Tito, Muhuru Bay community flood hazard map that will be developed by WRUA.

### Day 3

**Target for Day 3:** LOGUMI WRUA members to draw the community flood hazard map of their geographical jurisdiction indicating the salient flood features. Project Team to collect GPS coordinates of affected area in Tito area and visit the automated rainfall station at Muhuru Bay. Transferring of the features on community flood hazard map and observed features to the topographical map. Discuss with community members on flood issues to get more flood information from community members.

**Conditions:** The LOGUMI WRUA members attended the meeting and stated that they were able to draw the map by themselves. Two members were assigned to accompany the Project Team during the process of recording GPS coordinates and taking pictures.

**Note:** The LOGUMI WRUA jurisdiction is vast and some areas are affected by flash floods from heavy rains while other areas are as a result of the river bursting its banks or backflow from the lake affecting some of these areas.

### Observations:






- 1) It was observed that in Tito area there is a stream that has its source in the hills and during the heavy rains the area is flooded by the stream water as it flows to the Lake Victoria at Muhuru Bay.
- 2) It was difficult for LOGUMI WRUA to draw the community flood hazard map of Lower Gucha Migori Sub-catchment on A2 paper. The map was drawn but capturing the flood features including the names of the village proved difficult for LOGUMI WRUA members.

**Conclusion:** The target for day three activities was not effectively realized. The Project Team was able to collect GPS coordinates of affected area in Tito area and visit the automated rainfall station at Muhuru Bay. The LOGUMI WRUA were able to draw the sub-catchment map and were able to add the flood features, but the map by itself was difficult to understand by community members. It was unanimously agreed therefore that WRUA develops three maps as follows: 1) Kabuto, Nyora. Ayeko and Aeko map, Luanda-Misiwi map and Ratienyi, Tito, Muhuru Bay map.

### Lesson learnt:

- 1) That during the development Community Flood Hazard Map all gender must be represented including the aged.
- 2) One person should be appointed by community to lead in the drawing of the map.
- 3) In case there are many people in attendance the participants should be divided into groups and after drawing each group make a presentation thereafter the participants agree on various points of dispute and one map is drawn.



	
<p>Place : LOGUMI WRUA Office Description : LOGUMI WRUA members draw flood hazard map for Lower Gucha Migori SC</p>	<p>Place : LOGUMI WRUA Office Description : JICA Expert explains to the WRMA SRO staff on the process of transferring the community hazard map to topographical map</p>
	
<p>Place : Tito area Description : WRUA member points flood direction</p>	<p>Place : Tito area Description : Blocked stream channel that floods Tito area</p>
	
<p>Place : Muhuru Bay Description : Honorium WRMA gauge reader shows how he reads the manually</p>	<p>Place : Muhuru Bay Description : Honorium WRMA gauge reader hands the records of the last four months to WRMA staff</p>
	
<p>Place : Muhuru Bay Description : Vandalized automated rainfall station</p>	<p>Place : LOGUMI WRUA Office Description : Topographical map with hand-marked flood features</p>



## ***Definitions of terminologies***

*Vulnerability*: the degree of fragility of a (natural or socio-economic) community or a (natural socioeconomic) system towards natural hazards. It is a set of conditions and processes resulting from physical, social, economical and environmental factors, which increase the susceptibility of the impact and the consequences of natural hazards.

Vulnerability is determined by the potential of a natural hazard, the resulting risk and the potential to react to and/or to withstand it, i.e. its adaptability, adaptive capacity and/or coping capacity.

*Hazard*: A potential event that could cause loss of life or damage to property or environment

*Risks*: The scientific approach defines the risk as the probability and extent of damage due to a particular flood. Conventionally the risk is expressed by the notation ***Risk = Flooding x Vulnerability*** .

Flood related risk refers to the probability of harmful consequences, or expected losses resulting from interactions between natural hazards and vulnerable conditions.

*Disaster*: The serious disruption of the functioning of society causing widespread human, material or environmental losses which exceed the ability of the affected communities to cope using their resources. Disasters occur when negative effects of the hazards are not well managed.

*Flood*: a temporary covering by water of land normally not covered by water. This shall include floods from rivers, mountain torrents, Mediterranean ephemeral water courses, and floods from the sea in coastal areas, and may exclude floods from sewerage systems.

*Flood risk*: the combination of the probability of a flood event and of the potential adverse consequences to human health, the environment and economic activity associated with a flood event.

*Flood plain maps* indicate the geographical areas, which could be covered by a flood according to one or several probabilities: floods with a very low probability or extreme events scenarios; floods with a medium probability floods with a high probability.

*Flood hazard maps* are detailed flood plain maps complemented with: type of flood, the flood extent; water depths or water level, flow velocity or the relevant water flow direction. In the community flood hazard mapping process, the community members along with the executing agencies and the concerned governmental officials, demarcate flood hazardous areas, evacuation centres and evacuation routes.

Objective s of flood hazard maps:

- i) Understand the characteristics of flood in the community;
- ii) Understand the weaknesses to floods in the community;
- iii) Increase awareness of personal flood mitigation measures; and
- iv) Assist the establishment and strengthening of community organisations for flood disaster mitigation.

N/B: It is desirable that community flood hazard maps should be shown on the community board for dissemination of proper evacuation routes and places dangerous to the community.

*Flood risk map*: indicate potential adverse consequences associated with floods under several probabilities, expressed in terms of: the indicative number of inhabitants potentially affected; type of economic activity of the area potentially affected; installation which might cause accidental pollution in case of flooding.

*Damage*: the amount of destruction or damage, either in health, financial, environmental functional and/or other terms as a consequence of an occurred hazard.

## Developing Community Flood Hazard Map







### Preparatory Work

1. Arrangement of Place
2. Arrangement of Map and Stationary
3. Formulation of Program

### Implementation

1. Introduction
2. Explanation of the Steps in drawing Hazard Map;
3. Identification of the person who will lead in drawing the community flood hazard map;
4. Implementation of Step 1: Analysis of the current condition
  - (a) Draw the boundary of the area;
  - (b) Identification of the major link roads within the area;
  - (c) Drawing of current natural conditions in the communities (residential area, agricultural land, grass land, forest, river, hilly area etc.);
  - (d) Drawing of community transport and communication infrastructure (road and culverts , footpaths, drainage, bridges, dykes, fields etc.); and
  - (e) Drawing of other community infrastructures (office, school, hospital, church, evacuation facility, kiosk, storage etc.)
5. Implementation of Step 2: Analysis of community vulnerability
  - (a) Drawing source and direction of the flooding water into the affected area;
  - (b) Drawing past flooded areas and duration of inundation;
  - (c) Indicating on the map the places of past serious accident and damages during flood period
  - (d) Indicating on the map evacuation route, evacuation place, resource activity, communication etc
6. Formulation of countermeasures  
Discussion on community based necessary actions such as resource, evacuation route, evacuation center management, communication etc.

**Table: Graphic images for the steps involved in drawing community flood hazard map**

		
<p>Arrangement of material</p>	<p>Explanation of the steps in drawing hazard map</p>	<p>Identifying a person to lead in drawing the map</p>
		
<p>Drawing the boundaries of the area</p>	<p>Drawing the link roads, culverts, rivers, streams, bridges etc</p>	<p>example of community drawn flood hazard map</p>

## REPORT ON VISIT TO LUMI RIVER BASIN PROJECT AREA ON 6<sup>TH</sup> -9<sup>TH</sup> NOVEMBER 2012.

### Objectives of the Visit:

1. To Introduce new JICA Expert on Mapping to Regional Office and Sub-regional Office
2. To meet Lower Lumi WRUA Members and Conduct a training on Flood Hazard Mapping
3. Site Visits to the hot spots and marking using GPS of the Project Sites.

### Day one – 6<sup>th</sup> November 2012 – Meeting at WRMA Regional Office in Machakos

#### Present

Naori OKAWA	JICA Expert- Mapping
Clement NGIDA	NEWJEC – Kisii Supervisor
Robert OWAGA	NEWJEC – Loitokitok Supervisor
John NGILU	Surface Water Officer Athi River Catchment

The meeting began with the introduction of the participants. The present officer available at the Machakos Regional Office was the Surface water Officer, Mr. Ngilu. He apologized on behalf of the Regional Manager who was away on official business. Mr. Okawa the mapping expert explained the mission for his visit and at the office and subsequently to the sub regional office and the Lower Lumi River basin. His main assignment was for the preparation of the flood hazard map for the Lumi River Basin. He also inquired whether there was any staffs in the region or sub region that were proficient in using GIS. Mr. Ngilu said there were no particular staff assigned for the GIS although there three members who had undergone some training including himself. Mr. Ngilu also inquired whether it was possible to train the regional office on the preparation of the flood hazard maps. We passed on the information from the headquarters during the last project meeting that it would be useful if a staff member from the regional office accompanied us for the exercise. After consultations with his Regional Manger it was agreed that Mr. Ngilu would accompany us for the exercise in Taveta.

### Day two – 7<sup>th</sup> November 2012 – Meeting at WRMA Sub- Regional Office in Loitokitok

#### Present

Naori OKAWA	JICA Expert- Mapping
Clement NGIDA	NEWJEC – Kisii Supervisor
Robert OWAGA	NEWJEC – Loitokitok Supervisor
John NGILU	Surface Water Officer- Athi Catchment Area
Joseph MAINA	Catchment Management Officer-Nolturesh-Lumi Sub Region

The meeting commenced with the introduction of Mr. Okawa to Mr. Maina the Catchment Management Officer for Nolturesh Lumi SRO. Mr. Okawa then explained his assignment in Lower Lumi to Mr. Maina. This involved conducting training to the Lower Lumi WRUA members to prepare

flood hazard maps, the preparation of the maps and finally a field survey on the flooding hotspot s within the basin. Finally the identified flooding hot spots and important landmarks in the basin such as the main water sources, the schools, churches, evacuation centres and evacuation routes together with their data i.e. latitudes longitudes and elevations would be incorporated into the flood hazard map. All the above accurate data would them be incorporated into the area topographic maps that had already been prepared. Mr. Maina was also incorporated into the team that was to visit Lower Lumi for the exercise in drawing the flood hazard map.

### **Conducting Training on Development of Flood Hazard Maps with Lower Lumi WRUA**

The training on the development of the flood hazard maps involved:

i) Definition of terminologies

This involved teaching the community on the various terminologies involved in flood management activities such as vulnerability, disaster, flooding, risk, damage, flood hazard maps and flood risk maps.

ii) Step by step explanation of the process for developing the community flood hazard maps

#### **Preparatory Work**

1. Arrangement of Place
2. Arrangement of Map and Stationary
3. Formulation of Program

#### **Implementation**

1. Introduction
2. Explanation of the Steps in drawing Hazard Map;
3. Identification of the person who will lead in drawing the community flood hazard map;
4. Implementation of Step 1: Analysis of the current condition Draw the boundary of the area;
  - (a) Identification of the major link roads within the area;
  - (b) Drawing of current natural conditions in the communities (residential area, agricultural land, grass land, forest, river, hilly area etc.);
  - (c) Drawing of community transport and communication infrastructure (road and culverts , footpaths, drainage, bridges, dykes, fields etc.); and
  - (d) Drawing of other community infrastructures (office, school, hospital, church, evacuation facility, kiosk, storage etc.)
5. Implementation of Step 2: Analysis of community vulnerability
  - (a) Drawing source and direction of the flooding water into the affected area;
  - (b) Drawing past flooded areas and duration of inundation;
  - (c) Indicating on the map the places of past serious accident and damages during flood period
  - (d) Indicating on the map evacuation route, evacuation place, resource activity, communication etc
6. Formulation of countermeasures  
Discussion on community based necessary actions such as resource, evacuation route, evacuation center management, communication etc.

iii) The practical part of the exercise where the WRUA members first drew the map of the area on the ground using the readily available materials like twigs flowers stones and fruits.

iv) Transferring the map drawn on the ground to paper (Rough draft)

- v) Transferring the draft to a final copy with all the necessary corrections from the WRUA members themselves.
- vi) Incorporating the flood hazard map to the topographic map using the accurate data from the field visits which included the GPS position from the landmarks visited.

### **DAY Three – 8<sup>th</sup> November 2012 – Preparation of Final Copy of Map and Field Visits**

The WRUA Members were divided into two groups, one group was to accompany the project team to the various flooding hotspots in the area and the rest of the group would continue with the work of finalizing and refining the maps they had begun drawing the previous day. The field survey would include the following

- i) Identification of place ( School, Evacuation Centre/place, Hospital etc)
- ii) Depth of flooding (< 0.5m,>0.5 m)
- iii) Duration of flooding( in weeks or months)
- iv) Type of flooding(Flash floods/Riverine/Gulleys)
- v) Direction of the flood flows.
- vi) Longitude, latitude and altitude.

The areas visited on this day included Lake Jipe and Jipe Vilage, Rekeke, Kimala Mata and Kimorigo. The main gulleys causing flooding in Lower Lumi from the Tsavo West National Park were also marked and their details taken.

### **Day Four-9<sup>th</sup> November 2012 Transfer of Flood Hazard Map to Topographic map and Field Visits**







The project team and the WRUA members used the data that had been collected the previous day to incorporate the flood hazard map that had been prepared into the topographic map for the Lower Lumi flood plain.






Thereafter the project team and selected WRUA members embarked on the second field survey. The areas visited on the second day included Abori School Kimorigo Dispesary, Abori church, Njoro Kubwa Canal and Kitobo Springs while collecting all the required data. The previous day in the evening there had been heavy rains in the area. As a result some of the photos shown can be used in distinguishing the area before a heavy storm and after a heavy storm. The photos are included below for comparison.



	
<p>Date : 7<sup>th</sup> November 2012 Description : Mr. Okawa JICA Expert explains a point at Nolturesh Lumi SRO Location : Nolturesh –Lumi SRO</p>	<p>Date : 21<sup>st</sup> September 2012 Description : Mr. Okawa JICA Expert explains a point at Nolturesh Lumi SRO Location : Nolturesh –Lumi SRO</p>
	
<p>Date : 8<sup>th</sup> November 2012 Description : Counterpart Staff introduces days agenda Location : Danida Hall, Taveta</p>	<p>Date : 8<sup>th</sup> November 2012 Description : Kisii Supervisors explains the process of preparation of Flood Hazard Map Location : Danida Hall, Taveta</p>
	
<p>Date : 8<sup>th</sup> November 2012 Description : WRUA members participate in drawing map on the ground Location : Danida Hall, Taveta</p>	<p>Date : 8<sup>th</sup> November 2012 Description : Transferring the map from the ground to paper Location : Danida Hall, Taveta</p>



	
<p>Date : 8<sup>th</sup> November 2012 Description : Preparing the final copy of the Flood hazard map from the rough draft Location : Danida Hall</p>	<p>Date : 8<sup>th</sup> November 2012 Description : Lake Jipe Gauging Station (Landmark) Location : Lake Jipe</p>
	
<p>Date : 8<sup>th</sup> November 2012 Description : Gulleys channeling flood waters to Lower Lumi ( Masaini) Location : Rekeke</p>	<p>Date : 8<sup>th</sup> November 2012 Description : Final Draft of Flood Hazard Map Location : Danida Hall, Taveta</p>
	
<p>Date : 8<sup>th</sup> November 2012 Description : Mafete gully in dry condition Location : Taveta Town</p>	<p>Date : 9<sup>th</sup> November 2012 Description : Mafete gully after a storm Location : Taveta Town</p>

	
<p>Date : 8<sup>th</sup> November 2012 Description : Route to Abori School before storm Location : Road to Abori School</p>	<p>Date : : 9<sup>th</sup> November 2012 Description : Route to Abori School after storm Location : Road to Abori School</p>
	
<p>Date : 8<sup>th</sup> November 2012 Description : House in village before storm Location : Kimorigo</p>	<p>Date : : 9<sup>th</sup> November 2012 Description : House in village after storm Location : Kimorigo</p>
	
<p>Date : 8<sup>th</sup> November 2012 Description : Evacuation place located in Eldoro village Location : Eldoro Village</p>	<p>Date : : 9<sup>th</sup> November 2012 Description : Abori School with flood marks Location : Kimorigo</p>



## MINUTES OF MEETING BETWEEN JICA EXPERT AND WRMA NANYUKI RO, ISIOLO SRO AND WRUA MEMBERS

### 1. Objective

- To make community Flood Hazard map at middle zone of Isiolo river
- To assess the existing flood problems and various intervention that are put in place
- To explain to WRMA RO and SRO on the importance of keeping flood data.

### 2. Discussions

#### 1) Day 1, meeting at Nanyuki RO

##### Attendance

##### WRMA

- Mr. S.W. Wan'gombe – DTCM (Regional Manager ENNCA)

##### JICA PROJECT TEAM

- Mr. Naonori OKAWA JICA Expert (GIS)
- Mr. Clement NGIDA Project supervisor – Kisii
- Mr. Jared OTIENO Project supervisor - Isiolo

The meeting took place at Regional Manager Office on November 19, 2012 at 5.50 p.m. Mr. Okawa explained the purpose of the meeting and the activity for the week in Isiolo sub – region area. During the discussion, Regional Manager (RM) informed the meeting of the capacity of RO, and SRO staff on GIS user and knowledge. In the RO, there are 2no. WRMA staff who can use GIS and in Isiolo SRO, only 1no. staff who is the SRM who can use GIS. RO has one PC which is installed GIS software. There are a number of GPS gadgets in the RO and 3no. in SRO in Isiolo. Mostly the GPS gadgets are mainly used in boreholes, water pans, dams and intake works data, no much effort has been put to use GPS in flood related data.

The RO has only one report on the past floods of 8<sup>th</sup> September 2010, which affected Kiandongoro area in Rumuruti Sub-regional office.

The biggest challenge that was pointed by RM was the lack of flow of information from WRMA HQ to RO and SRO. This made it impossible to facilitate RO staff to join the Project team in community hazard map development. However, the GIS experts at RO were on a short course training outside the country.



Meeting at WRMA ENNCA Regional Office at Nanyuki explaining the purpose of the visit

## 2) Day 2, meeting at WRMA SRO at Isiolo

### Attendance

#### WRMA

- Mr. George Karichu – Accountant/Administrator
- Mr. Gideon Gituma – SWO
- Mr. Collins Odhiambo - WCO

#### JICA PROJECT TEAM

- Mr. Naonori OKAWA JICA Expert (GIS)
- Mr. Clement NGIDA Project supervisor – Kisii
- Mr. Jared OTIENO Project supervisor - Isiolo

The meeting took place at WRMA SRO in Isiolo on November 20, 2012 at 9.30 a.m. Mr. Okawa explained the purpose of the visit. He explained the importance of collecting flood data in terms of water depth, water volume and rainfall data for proper flood damage analysis. In drawing community hazard map, there is need to include the young, old, middle age and women, this will enhance analysis of flood map and flood danger points.

Mr. Clement explained the need for WRMA SRO staff to attend the activities in community hazard map development. This will enhance the capacity of WRMA staff to expand to other flood prone areas within the sub-region since the concentration was on the middle part of Isiolo sub catchment. The issue of flow of information arose; the SRO either did not receive any communication either from WRMA HQ or RO.



Meeting at WRMA SRO at Isiolo explaining the purpose of the visit and steps in developing community hazard map

### **Workshop on development of community Hazard map**

The workshop took place at Isiolo WRUA office at Maili Saba on November 20, 2012. Mr. Clement led the community in explaining the importance of Flood map and why it must be drawn by the community both across the ages and gender. The chairman of the Isiolo WRUA explained the various challenges facing the community and why the attendance was not very well as expected. The various challenges identified by the chairman were as follows:

- Community calendar is busy since this is the long rainy season in the area, many members were busy attending to their farm lands.

- The community believes in hand outs, if there is no such provision for the opportunity cost of attending the meeting, not many will attend.
- Many development partners in the area are also adapting from giving out incentives to the community whenever they attend meeting, this has led to low esteem for the community to attend such meetings. However, there is element of change of attitude in some members of the community and they are encouraging each other to attend such important meeting since the benefit is for the community and generations to come.

The chairman explained to the meeting various instances that the community has succumb to losses as a result of floods. He urged members to be positive as the exercise will increase our survival tactics during the floods and minimize loss to properties.

The community having understood the necessity of the flood hazard map, choose one member to draw under the guidance of the rest of the community members. The project team also helped to guide the community on hazard map development and the exercise went on smoothly. On the map, the community identified flood danger points, affected areas and priority of danger points based on the collateral damage the community has experienced.



1. Isiolo WRUA Office at Maili Saba (Chairman welcoming, WRMA SRO staff and JICA Expert )
2. Mr. Clement explaining the need and steps in developing community hazard map.
3. Isiolo WRUA chairman start to sketch flood hazard map by drawing main road
4. WRUA member corrects mistake in first draft flood hazard map.

The community after drawing the first sketch of the flood map, they pointed out the mistakes and drew the second draft that was acceptable by all members. The hazard map mainly covered the middle zone of the Isiolo sub catchment. The upper and lower region hazard maps were to be developed by the community/WRUA and WRMA officials in the next step of the activities.



Drawing and finalizing the second draft of the community Flood hazard map