



**Ministry of
Environment, Water
and Natural Resources**



**Water Resources
Management Authority**



**Japan International
Cooperation Agency**

Manual for Community Based Flood Early Warning System (FEWS)

- 1) Assembling (Kenyan Parts) and Installation**
- 2) Operation and Maintenance**
- 3) Warning Standard**



June 2014

Japan International Cooperation Agency

Preface



The Government of Kenya established the Water Resources Management Authority (WRMA), through the sector reform brought by Water Act 2002. WRMA is the lead agency in the management of water resources in the country through six (6) regional offices and twenty six (26) sub – regional offices of the respective water resources catchment areas.

Since its operationalization in 2005, WRMA has made significant progress in making water resources recognized as being fundamental for socio-economic and environmental sustainability. In this regard, integrated floods management is viewed as necessary component in water resources management.

Based on the request from GOK, JICA carried out the “Study on the Integrated Flood Management (IFM) for Nyando River Basin (2006 – 2009)” as the Technical Cooperation Scheme and “Programme for Community based Flood Disaster Management to Adapt to Climate Change in the Nyando River Basin (2009-2011)”. This was a Grant Aid Programme with the aim of establishing a flood management system in the southern part of Lake Victoria Basin through IFM, where WRMA was the implementing agency. Through the above projects, community based flood management activities have been implemented through integrating non- structural and structural measures such as community based flood hazard mapping and construction of flood counter measure structures in prioritized flood prone areas.

Based on the achievement of Nyando project, the Project on Capacity Development for Effective Flood Management was formulated to expand IFM in other flood prone areas in Kenya. Three pilot river basins were selected namely: Isiolo, Gucha-Migori and Lumi to promote community based flood management activities. The main purpose of the project was to build institutional framework of flood management in the context of integrated water resource management for effective and sustainable implementation of community based activities. Through the project WRMA has developed strategies and guidelines in managing floods which have since been incorporated in the revised Catchment Management Strategies (CMS) and WRUA Development Cycle (WDC) manual. In order to develop capacity of WRMA officers in the field of community-based integrated flood management, a training system has been developed where the Project conducted IFM Training for WRMA officers who in turn trained the WRUAs. The Training Materials for community based flood management have been developed. These include supplemental manuals, lessons learnt and case studies.

A handwritten signature in blue ink, appearing to read 'John P. Olum'. The signature is stylized and written on a light blue background.

Eng. John P. Olum, HSC
Chief Executive Officer, WRMA



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Manual for Community Based Flood Early Warning System (FEWS) (1) Assembling (Kenyan Parts) and Installation



June 2014

Based on Manual of assembling of Hydrological Equipment
for community based flood warning (edition 1.00)

Revised by Noor Hussein

Manual for Community Based Flood Early Warning System (FEWS)

(1) Assembling (Kenyan Parts) and Installation

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INTRODUCTION

The World Conference for Disaster Reduction (1995 Japan) emphasized the importance of community-based disaster management (CBDM) in that community operated early warning (COEW) should be a key component.

COEW is necessary especially for communities located in small steep river basins because:

- Floods/debris flows/landslides occur by localized heavy rainfall within the river basin where the communities are located. However in most countries the national observation network is not so dense to cover all such basins.
- Floods/debris flows/landslides occur shortly after heavy rainfall. Therefore people should be warned immediately after rainfall. However in most countries the national early warning system may not be so quick in operation.

To meet such necessity water level equipment and rainfall equipment were developed in the Central America and the Caribbean.

- Water level equipment with automatic alarm function was developed by CONRED (Guatemala)/CEPREDENAC¹⁾ after Hurricane Mitch (1998) and has since been in use for COEW in Central America.
- Rainfall equipment of similar type was developed by the University of West Indies (Trinidad & Tobago)/CDERA/JICA²⁾ in 2004-2005 and has been distributed to Caribbean countries for COEW.

Of various types of equipments being used for COEW, these equipments may be the one suitable for a majority of communities because of the advantages mentioned in the next chapter. For a wider use of these equipments in developing countries, “Volunteers for the promotion of Community Early Warning (VCEW)” (Ref. End Note) has been producing them with some modification of the originals for donation to developing countries³⁾. The equipments are also being sent to international organizations for information sharing among variety of users in the world⁴⁾.

The intention of VCEW is not to provide the equipments to all communities of developing countries but to a limited number of organizations (government agencies, NGOs, academic institutes etc) in each country which will serve as the core for mass production and dissemination and will support communities in O/M, thus establishing a self-reliant system for production and use of the equipments in each country.

ADVANTAGES AND LIMITATIONS

Advantages:

1. Parts availability
 - The parts for making / replacing the worn out ones are easily available in most of the electronics shops near you, except the RELAY for the monitoring apparatus which may not be available anywhere in Kenya. But in its place we will use a Regulator (5-9 volts) depending on the buzzers voltage and a 10 ohms 2watts resistor (depending on buzzers voltage)
 - Parts are cheap and affordable
2. Simplicity
 - Any lay parson can assemble this monitor, but one is advised to do so under a supervision of a technician or trained volunteer. All safety measures must be observed.
3. Easy to Operate and maintain
 - Any trouble in O/M can be solved by the persons who assembled the equipment, without resorting to external help (technician) which may take less time and save money
4. Effective and safe measurement
 - The observer can measure heavy rainfall and sudden rise in water level without fail even if they occur in the mid-night, during a heavy down-pour and the observer is not near the monitor or at a distance. Due to the external LED rainfall/water level indicator.
 - The observer can measure rainfall and water level safely in the house without going out to the observation sites under storm, mid-night, at a safe distance and other difficult conditions.

Limitations

1. Rainfall/Water level monitors/equipment
 - Not for “real time observation”.
 - Not for “automatic recording”.
 - Requires frequent monitoring to avoid electric corrosion of sensor terminal.
 - Requires manual switching of power source in case of power failures i.e. from AC to DC
2. Rainfall equipment
 - Requires adding a pinch of salt to improve electric conductivity of rain water.
 - One needs to drain the accumulated rain in the container.
 - For accumulated rainfall and not for “intensity “(rainfall during any optional unit time).

Despite “Limitations”, the equipments will be suitable for COEW in Kenya due to “Advantages”, especially “Simple in structure” and “Easy O/M”. There are many cases where hydrological equipments are not working which were imported and installed with external assistance.

Figure 2: External LED level Indicator Circuit Diagram (E.L.L.I)



Rainfall equipment

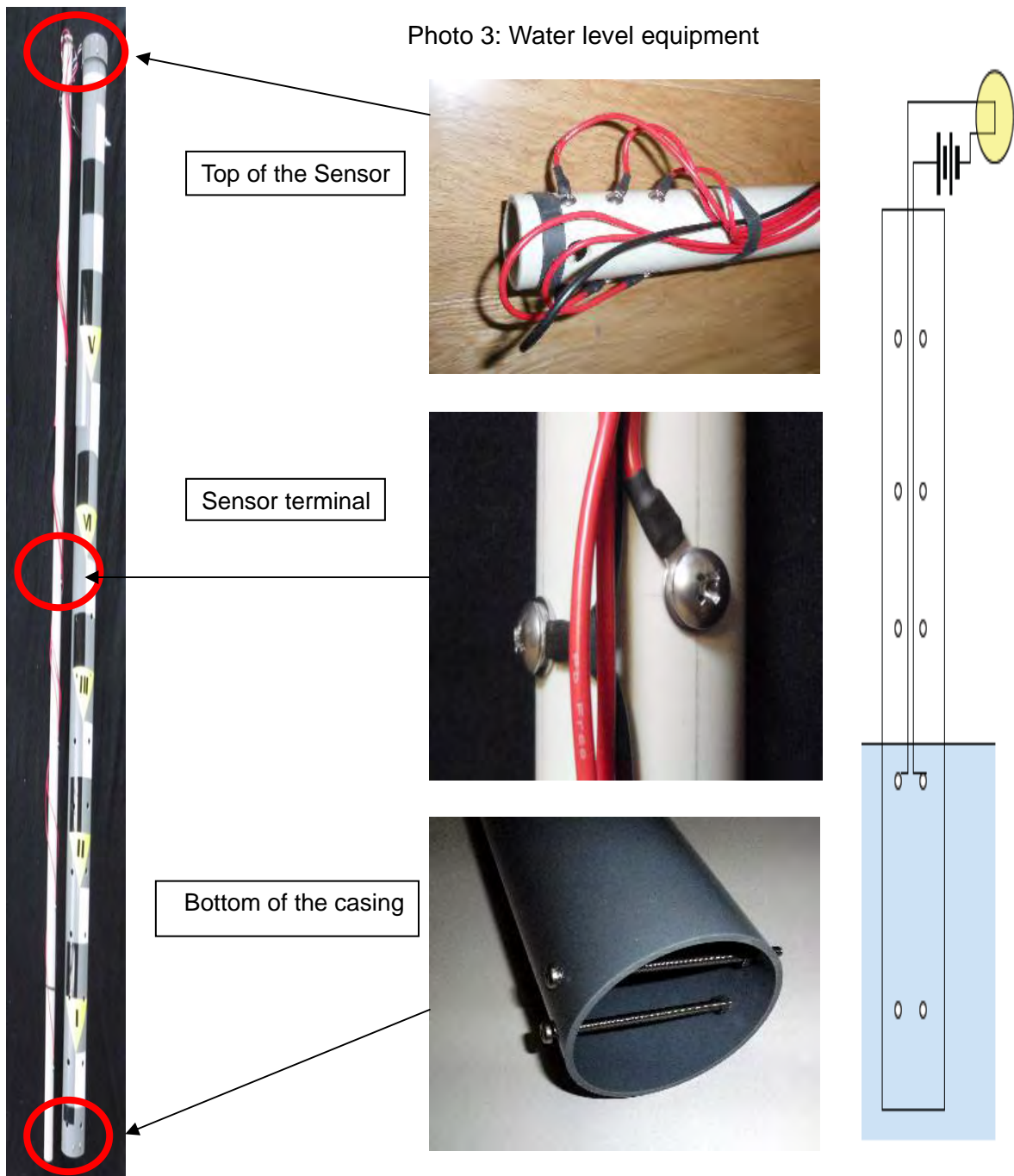


The size of the bottle depends on the rainfall amount. 2 liter bottles might be appropriate for many cases, but 3 liter or more can also be considered. When it is necessary to measure a larger amount of rainfall than the depth of the bottle, a smaller bottle can be used for the receiving part. The throw-in type equipment was developed for easier assembly and maintenance.

The sensor is to be installed outside the house and connected by a cable to the monitoring apparatus in the house. The connecting cable can be extended to more than 150 m.

Water level equipment

- Depth/velocity/floating rubbish etc. should be taken into account in the design and installation.



The sensor is to be installed by the river bank attached to the revetment/ a tree/ an artificial basement or a fabricated iron stand.

The sensor is connected by a 6 line cable to the monitoring apparatus in the house in the same manner as the rainfall equipment.

It is important to ensure that the cable and the sensor is installed in a safe zone (should not be stolen or damaged)



Attached to revetment (Nepal)

The bottom is to be set higher than the river bed because the measurement is made not for low water levels but of floods levels.

Attached to a tree, (Costa Rica)



Installation on the concrete basement,(Guatemala)



Installation on a metal fabricated stand (Kenya)

INSTALLATION AND OPERATION

Monitor:

- 1) Make sure the monitor was properly manufactured, tested and working properly.
- 2) Correctly connect the Rainfall/River sensors/apparatus correctly using either the color code of the 6core cable or the levels from 30mm-150mm if indicated on the cable.
- 3) Correctly connect the external LED level indicator (E.L.L.I) line as indicated on the monitor and on the cable of the E.L.L.I.(starting from 12v,30mm – 150mm as indicated on the monitor)
- 4) Plug in the power supply/source, turn on and taste the monitor.
- 5) Using a 6-line cable, 5 stages of accumulated rainfalls and water levels can be monitored, and the alarm buzzer can be activated at any of the selected stage of accumulated rainfall and water level.
- 6) If louder alarm is needed, correctly connect an external speaker to the external buzzer line on the monitor.
- 7) It is recommended to turn OFF either the LED switch or buzzer, because having the both LEDs and buzzer activated at the same time may cause instability in functionality of the buzzer.
- 8) For the rain observation, it is required to add a pinch of salt in the rain storage bottle before observation to improve electric conductivity of the rainwater.

Rainfall sensor:

- 1) Make sure the Rainfall sensor was properly manufactured and tasted
- 2) Correctly connect the 6 core line using either the color code of the 6core cable or the levels from 30mm-150mm if indicated on the cable to the monitor .
- 3) Do a taste to confirm your connections
- 4) The critical rainfall amount (for alarm, warning, evacuation etc) shall be determined based on the relationship between or the combination of rainfalls (accumulated rain) and the rainfall intensity
- 5) The rainfall intensity can be known from the accumulated rainfall and the time from the previous accumulated rainfall and the time.
- 6) The accumulated rain should be drained every morning at the fixed time.
- 7) When information on possible disaster (floods) is announced by the meteorological agency, the observer should be stand-by for observation.
- 8) Each time the accumulated rainfall reaches one of 5 stages, the observer records the amount and the time, and then informs the relevant person as per the communication chart established by WARMA/WRUA/RED CROSS.

N/B: It is required to add a pinch of salt in the rain storage bottle before observation to improve electric conductivity of the rainwater.

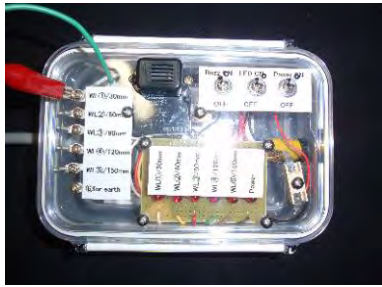
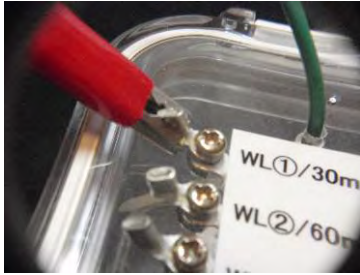




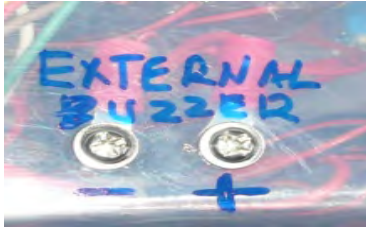
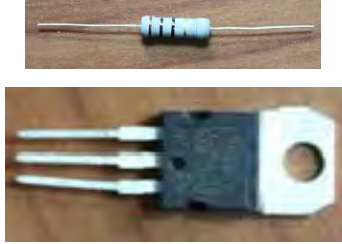

Water level sensor:

- 1) Make sure the River level sensors was properly manufactured and tasted.
- 2) Correctly connect the 6 core line using either the color code of the 6core cable or the levels from 30mm-150mm if indicated on the cable to the monitor .
- 3) Do a taste to confirm your connections
- 4) Operational procedure similar to the rainfall observation will be applied to the water level sensor.

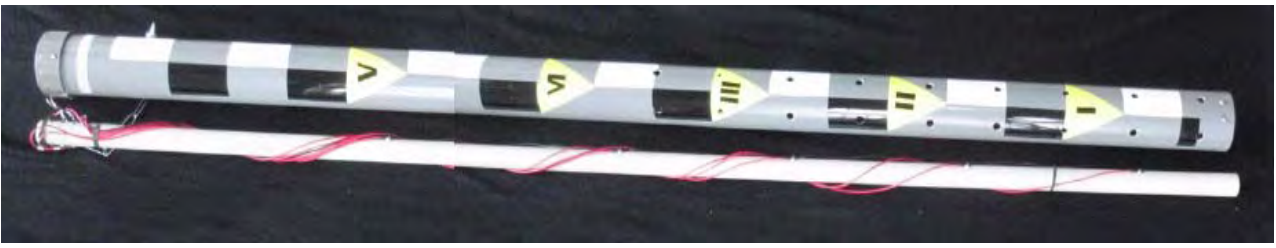


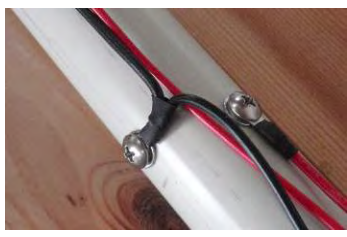
- 5) The sensor is to be installed by the river bank attached to the revetment/ a tree/ an artificial basement or a fabricated iron stand.
- 6) The sensor is connected by a 6 line cable to the monitoring apparatus in the house in the same manner as the rainfall sensor.
- 7) It is important to ensure that the cable and the sensor is installed in a safe zone (should not be stolen or damaged)
- 8) The critical water levels (for alarm, warning, evacuation etc) shall be determined based on the relationship between the water levels at the observation point and the intensity /amount of rainfall received upstream.
- 9) When a possible flood is announced by the meteorological agency, the observer should be stand-by for observation.
- 10) Each time the water level reaches one of the 5 stages; the observer records the water level and the time, and then informs the relevant person as per the communication chart established by WARMA/WRUA/RED CROSS.

DETAILS OF APPARATUS





Monitor

		
Front face	Selective terminal	Buzzer
		
Tong switch	I.L.L.I line	Selective terminal (back)
		
External buzzer	Regulator and Resistor	Fuse


Water Level Sensor (Equipment)

		
Casing(L:2 m, ϕ: 75mm) tube and Sensor pole(L:2m, ϕ:40mm)		
		
Head cover and connecting terminal	Bottom of casing tube	Sensor terminal

Rainfall Sensor (Throw-in Type)

		
<p>Total view</p>	<p>Installation</p> 	<p>Tin-can model</p>

External LED Level Indicator (E.L.L.I)


<p>Total view</p>

TOOLS AND PARTS


Table 1:









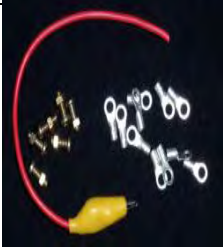
Tools for assembly

	Soldering iron for electric work		Screw driver
	Solder for electric work		
	Flux for soldering		
	Radio pliers		Mini driver Hexagonal nut driver for M3
	Rasp		Tap for M3 screw
	Metal cutting saw		Electric driver drill
	Cutter (small)		Awl
	Cutter (large)		
	Drills 2mm, 2.5mm, 3.1mm, 4.5mm 6.5mm, 9mm etc.		Press for aluminum terminal
	Measure and Ruler		Tester

Table 2:

Parts for Monitoring Apparatus

Appearance	Item	Model	Standard	Unit	No.	Reference. Price Kshs	Reference Cost Kshs
	Plastic case	Lunch box	0.5 liter	Pc	1		

	Universal basis	Standard	2.54mm pitch 72x47mm	Pc			
	Spacer for Basis	M3 6mm bolts And nuts	4 bolts 12 nuts	Pcs pcs	4 12		
	Regulator	(regulator number)	6 – 9volts	Pc	1		
	Heat sink	Standard		Pc	1		
	Resistor	10 amps 2 watts		Pc	1		
	Mechanical Buzzer		9v(3-12volt)	Pc	1		
	M3 Screw to fix buzzer	3mm	Bolt Nut	pcs pcs	4		
	Carbon resistor	½ W 330Ω		Pcs	5		
	Carbon resistor	½ W 430Ω		Pc	1		
	12v High brightness LED	Red		Pcs	6		
	Toggle switch			Pcs	3		
	Bagworm clip			Pc	1		
	M3 screw for selecting terminal	3mm		Mm	6		
	M3 nut			Mm	6		
	M3 squash Terminal	Round		Mm	5		
	Glass pipe fuse	N30C	2A	pc	1		





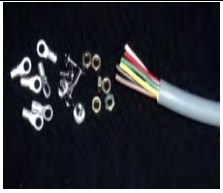





	Fuse holder			Pc	1		
	DC jack	Standard female		Pc	1		
	Wire (2) 12" long	6 lines cable	0.25or0.30 mm.sq.	Inches	2		
	Wire (3) 8" long	Black/red wire	Flex wire	Inches	3		
	Wire (1) 10" long	6 lines cable	0.5mm.sq.	Inches	1		
	M3 bolt		3mm	Pcs	6		
	M3 nut		3mm	Pcs	6		
	M3 squash Terminal			Pcs	6		
	Heat contract insulation tube or insulation tape	3mm & 4mm					
	AC converter	Input: 100-240V Output: 12V,2A		Pc	1		
TOTAL							

Table 3:

Parts for Rainfall Equipment (Throw-in type)

Appearance	Item	Model	Standard	Unit	No.	Reference price (Kshs)	Reference cost (Kshs)
	3 litter large neck bottle			pc.	1		
	Cable protector/ Trunk			Cm	20		
	M3 stainless Bolt	25mm		pcs.	10		
	M3 stainless Nut			pcs.	10		







	Stainless wire	φ0.7mm		Cm	20		
	6 lines cable	0.3mmsqr		m	1		
	M3squash terminal	Round		pcs.	6		
	M3 squash terminal	Y shaped		pcs.	6		
	Tin plate	2cmx20cm		pc	1		
	M3 stainless bolt	8mm		pcs.	3		
	M3 stainless nut			pcs.	3		
	Heat contract insulation tube or insulation tape	3mm & 4mm		roll	0.1		
TOTAL							

Table 4:

Parts for Water level Equipment (Height: 2m, Distance: 30m)

Appearance	Item	Model	Standard	Unit	No.	Reference Price (Kshs)	Reference cost (Kshs)
	Plastic pipe for sensor	φ40mm x 2m		pc.	1		
	Plastic pipe for casing	φ75mm x 2m		pc.	1		
	Stainless wood screw			pcs.	10		
	M4 Stainless washer			pcs.	10		
	M4 Squash terminal	Round		pcs.	10		
	Wire	Black		m	3		
	Wire	Red		cm	8		
	End cap	75mm		pc.	1		
	M3 Stainless bolt	6mm		pcs.	3		
	M5 Stainless bolt	100mm		pcs.	2		











	M5 Stainless nut			pcs.	4		
	M3 Stainless bolt	6mm		pcs.	6		
	M3 Squash terminal	Round		pcs.	6		
	Wire (1)	6 lines cable	0.3mm.sq.	m	30		
	M3 Squash terminal	Round		pcs.	6		
	M3 squash terminal	Y shaped		pcs.	6		
	Heat contract insulation tube or insulation tape	3mm & 4mm		roll	0.1		
	Color adhesive seal	Outdoor use	10cmx4 5cm	pcs	3		
TOTAL							

Table 5:
External LED light indicator (E.L.L.I)

Appearance	Item	Model	Standard	Unit	No.	Reference Price (Kshs)	Reference cost (Kshs)
	LED lights		12 volts	Pcs	80		
	Chip board/ply wood	9'' x 27''		pcs	2		
	Slim timber frames 1/2'' square	27''		Pcs	2		
	Slim timber frames 1/2'' square	8''		pcs	2		
	Tag nails 1/2''			Pcs	30		
	6core cable M3 Squash terminal	As long as needed Round		pcs	6		
TOTAL							

CONCLUSIONS

Volunteers for the promotion of Community Early Warning (VCEW) is a group of persons who wish to work voluntarily for the promotion of Community Operated Early Warning (COEW) in developing countries, making use of their respective experiences in developing countries and international organizations as well as in Japan.

There are various types of equipment ranging from simple one to advanced one, of which each community chooses the most suitable one considering the O/M capacity etc. VCEW wishes that the equipment it offers will be useful for a number of communities in the world.

VCEW further wishes that such an offer will lead to further development of hydrological equipment by voluntary groups, academic institutions, private firms etc. in the world so as to meet the needs of so many communities of different O/M capabilities and other conditions.

Members of VCEW :

- Mr. Hidetomi Oi : Ex-staff of Japanese Government (Min. of Construction), UN (UNDRO) and JICA. JICA expert in Nepal, the Caribbean, Central America and others.
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- Dr. Toshikatsu Omachi : Ex-staff of Japanese Government (Min. of Construction) and UN (ESCAP). JICA expert in Indonesia, Panama and others. Email: omachi-t@gyao.ne.jp
- Mr. Susumu Ueda : Electric engineer belonging to Electric Safety Association. Voluntary works for community early warning in Nepal and Japan. Email: sin@kisnet.ne.jp

Kenyan Manual :

Relay modifications/replacement and External LED Level Indicator (E.L.L.I) done by Noor Hussein Noor from Isiolo. (nhnur2@gmail.com)

Foot notes :

- 1) The development of water level equipment was initiated by Dr. Juan Carlos who worked for CEPREDENAC, UN Platform for the Promotion of Early Warning (UNPPEW) and is currently working for UN SPIDER. when he was working for CEPREDENAC.
- 2) The development of rainfall equipment was initiated by Prof. Jacob Opadeyi of University of West Indies, Trinidad and Tobago, He produced 50 units of rainfall equipment for distribution to CDEMA member countries and conducted training for concerned personnel of CDEMA member countries regarding the use of the equipment in 2007.
- 3) The equipment has been sent to Guatemala, El Salvador (SNET), Trinidad and Tobago (University of West Indies), Indonesia, Lao PDR, Sri Lanka, Nepal and Thailand (as of 1 October 2010)
- 4) The equipment has been sent to UN Platform for the Promotion of Early Warning (UN PEW), ESCAP, WMO, ICIMOD, CEPREDENAC and CDEMA (as of 1 October 2010).



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Manual for Community Based Flood Early Warning System (FEWS) (2) Operation and Maintenance



June 2014

Based on Manual of Maintenance Work for Simplified

Gauges edit 1.10

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MONTITOR

- 1) At the beginning of the rainy season: (1) check power source; (2) check the connection of the monitor, extension cable and water level gage or rain gage. Points to be checked are cable breakage, corrosion and weathering; check the LED lamps and buzzer by submerging or short-circuiting the sensor of the water level gage or rain gage.
- 2) Leave the power OFF in normal conditions to avoid electric corrosion of sensors. Check the power source once a week and when a heavy rain is expected.

RAIN GAGE

- 1) In the dry season, leave open the drain at the bottom of the storage tank.
- 2) At the beginning of the rainy season, (1) wash the storage tank, (2) visually inspect the condition of the sensor bolt, (3) visually inspect and pull the cord, and if necessary replace the sensor bolt and/or nut and the terminal of the cord.
- 3) The sensor bolt and nut erode due to submergence and electricity while the level is nominal. When stored rainwater is severely colored, wash the tank and check the condition of the sensor terminals and cords.
- 4) When a heavy rain is expected, (1) empty the storage tank, (2) put a pinch of salt* in the collection cup, (3) connect the level selection clip to the rain level chosen by the operator, (4) turn ON the Power and Buzzer switches, turn OFF the LED switch.



* Although rainwater is contaminated by polluted air, its electric nature is virtually the same as that of distilled water which does not conduct electricity. Ground water, river water and tap water contain enough minerals from soil and rocks, and conduct electricity.



- 5) Actions at the time of heavy rain are as follows:
 - (1) When a warning is issued or a dangerous heavy rain is forecasted by authorities:
 - record the time, empty the storage tank and close the tap, put salt in the collection cup, connect the level selection clip to the 60mm level, switch ON the power and buzzer, switch OFF the LED, and stand by.
 - (2) When the accumulated rain reaches the 60mm level:
 - record the time, inform local authorities, inform local residents and lead them to prepare for emergency, set the selection clip to the 90mm level (next level), and stand by (refrain from going out).
 - (3) When the accumulated rain reaches the 90mm level:
 - record the time, inform local authorities, inform local residents and lead them to commence evacuation of senior residents and residents with disabilities, set the selection clip to the 120mm level (next level), and continue to stand by (refrain from going out).

- start monitoring with 20-minute intervals by visual observation of the storage tank: Record the time and depth upon every observation. 10mm increase in 20 minutes is equivalent to 30mm/hr in intensity; the level going up one step within 1 hour indicates it has already reached the danger level (30mm/hr) for an outbreak of flash flood and sediment disaster.

WATER LEVEL GAGE

The water level gage is often installed at riverbanks or wasteland which is isolated with little supervision, and vulnerable from sediment, debris, driftwood, garbage, robbery and vandalism. Therefore, the location and method of installation must be selected carefully. To prevent vandalism, explain to local residents the need and importance of the facilities as an essential part of disaster mitigation education program. For the water level gage, in addition to inspection and maintenance required for the rain gage, daily maintenance should be conducted in accordance with the purposes and conditions of the location.

SETTING OF WARNING LEVEL

The “rain gage” and “water level gage” presented in this booklet are developed as a tool to provide key information to grasp the situation and to take appropriate actions in order to protect life and property from flood and sediment disasters caused by heavy rains. The rain gage detects accumulated rainfall at 5 levels (30mm, 60mm, 90mm, 120mm, and 150mm). While 5 levels of warning may seem too many as indices to start preparation and actions, determining which level is appropriate to prompt preparation and to take necessary actions may be difficult. The following is a procedure to determine action levels such as preparation and evacuation: install gages taking in to account past events, carefully accumulate experiences for 1 to 2 years, and finally choose the levels to start preparation and evacuation respectively from these 5 levels. Relocation of gages and adjustment of predetermined action levels can be done as required. It is also important to provide local residents with specific action programs including evacuation routes, shelters, communication with local authorities, communication among family members, and things to bring upon evacuation.

CONTACT DETAILS

For further information, please contact us.

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VCEW RAIN MONITORING RECORD

Year: 20

Place:

Observer:

	Date (MM/DD)	Time (HH/MM)	Note
Start of monitoring	/	:	
Level-1 (30mm)	/	:	
Level-2 (60mm)	/	:	
Level-3 (90mm)	/	:	
Level-4 (120mm)	/	:	
Level-5 (150mm)	/	:	
1 st Drain	/	:	Drained depth= mm
Level-1 (+30mm)	/	:	
Level-2 (+60mm)	/	:	
Level-3 (+90mm)	/	:	
Level-4 (+120mm)	/	:	
Level-5 (+150mm)	/	:	
2 nd Drain	/	:	Drained depth= mm
Level-1 (+30mm)	/	:	
Level-2 (+60mm)	/	:	
Level-3 (+90mm)	/	:	
Level-4 (+120mm)	/	:	
Level-5 (+150mm)	/	:	
	/	:	
	/	:	
End of monitoring	/	:	Total rain depth = mm

Note:



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Manual for Community Based Flood Early Warning System (FEWS) (3) Warning Standard



June 2014

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1. Establishing of Flood Warning Standards

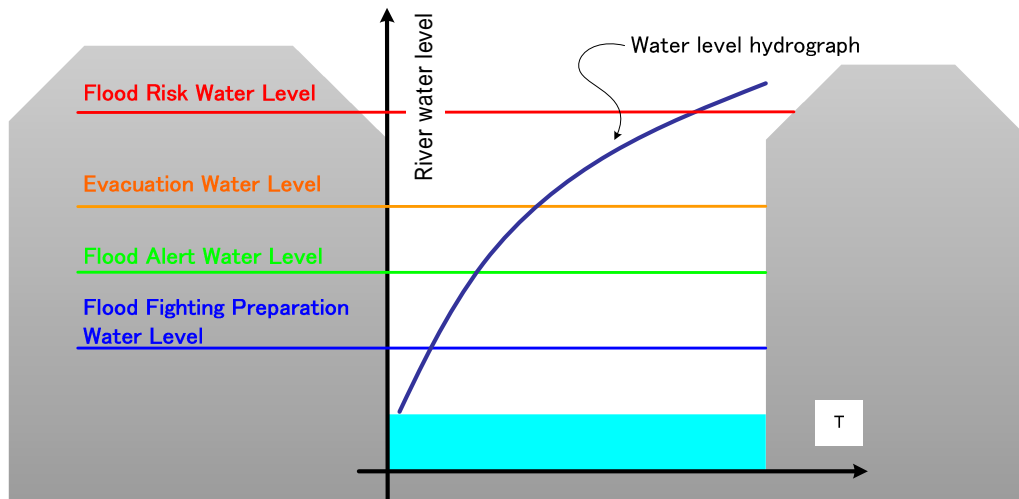
1.1. Overview

Flood forecast, flood warning and issuing of evacuation recommendation / evacuation order are the one of the mitigation countermeasures against flood. For issuing the warning, evacuation recommendation and order, it is necessary to set up the “Flood Risk Water Level (Dangerous Water Level)”, “Evacuation (Evacuation decision) Water Level” and so on.

Therefore, establishing of flood warning standards is mentioned in this manual.

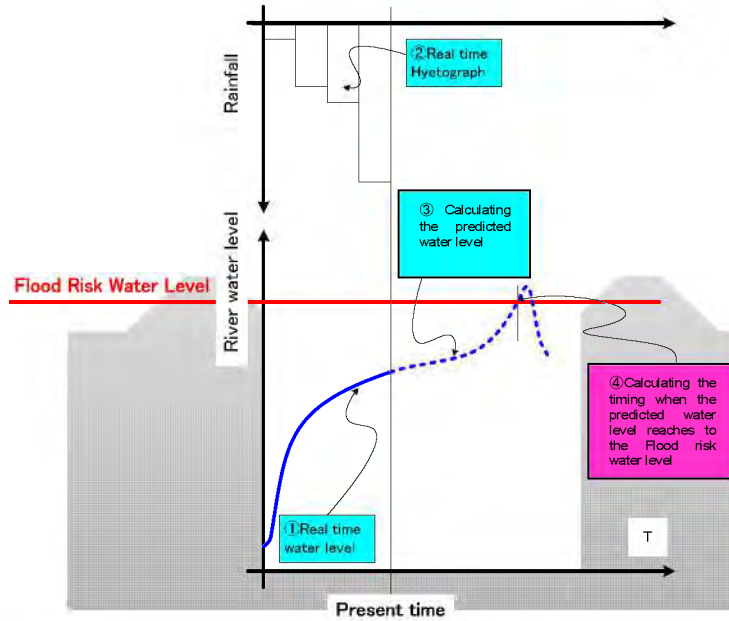
1.2. Flood warning standards

Because there is “Flood Fighting Act” in Japan, 4 types of designated water levels are set as warning standards in many designated rivers, especially in main rivers (large rivers and the rivers which flow through the town / city). 4 types of designated water levels are shown on the following figure.

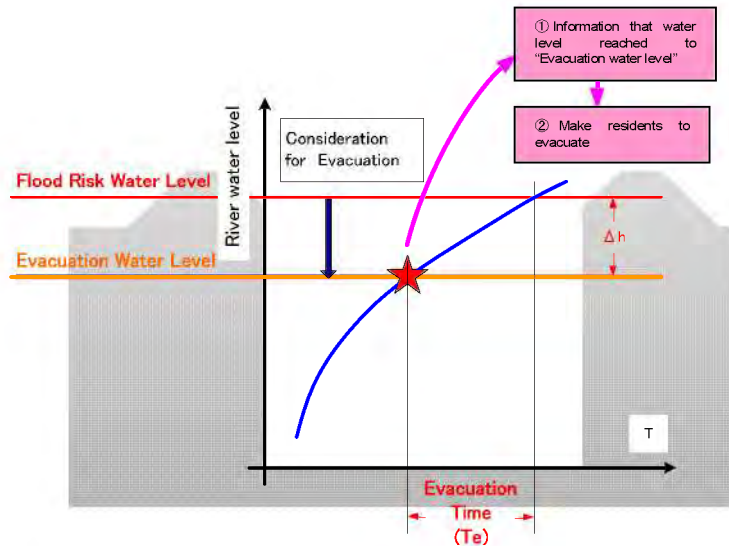


Water level name	Measure or Action
Flood Risk Water Level	Water level that has a high risk of the bank collapse and large-scale inundation (considerable number of house will be inundated).
Evacuation Water Level	Water level that governor of province / municipality / village shall issue evacuation recommendation / order and residents shall start to evacuate.
Flood Alert Water Level	Water level that governor of province / municipality / village shall inform the warning against the flood to the residents. And flood fighting corps shall be dispatched.
Flood Fighting Preparation Water Level	Water level that flood fighting corps shall be stand-by.

Regarding setting of warning standards, the diagrams of “Calculation of the timing when the predicted water level reaches to the Flood Risk Water Level” and “Setting Evacuation Water Level” are shown on the following figures.



Calculation of the timing when the predicted water level reaches to the Flood Risk Water Level



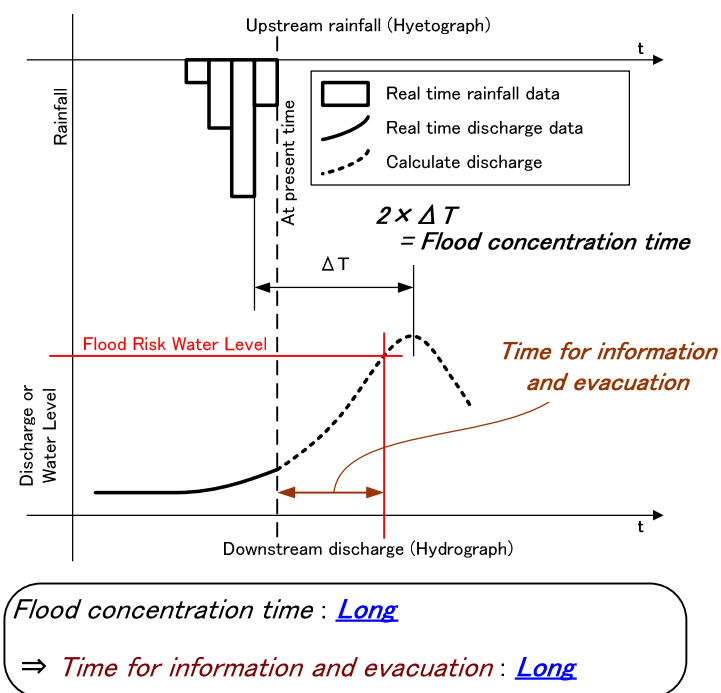
Setting Evacuation Water Level

Evacuation Water Level is set as lower level than Flood Risk Water Level, considering the evacuation time of the residents (the time required for the residents to evacuate to safer place) before flood.

1.2.1. Calculation of the timing when the predicted water level reaches to the Flood Risk Water Level

This method is used for the rivers which have the characteristics of long flood concentration time than the evacuation time of the residents (such as, flood concentration time = 2 hours / 6 hours). Besides, the water level observation station near from the target community is required to collect the real time hydrogeological data.

Calculation procedure is as described below.



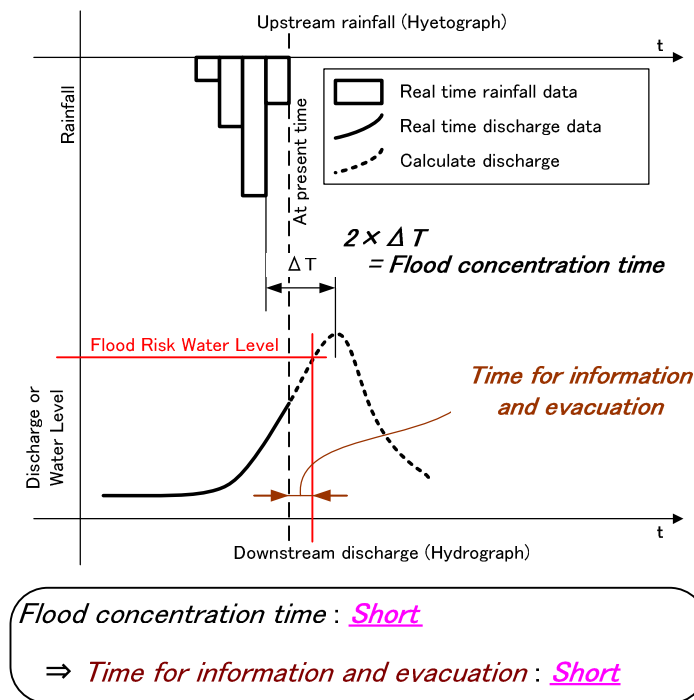
- Collect the real time water level data from the observation stations.
- Calculate predicted / forecasting discharge hydrograph by real time rainfall data of upstream rainfall observation stations.
- Convert the calculated predicted discharge hydrograph to water level hydrograph using rating curve (HQ-curve).
- Calculate the timing when the predicted water level reaches to the Flood Risk Water Level.
- Issue a warning to be on the alert for possible flood to the residents and issue the evacuation recommendation. One example of warning statement alarm is as mentioned below.
 "There is a risk of flood. Please evacuate to safer place until "hh : mm".

1.2.2. Setting Evacuation Water Level

This method is used for the rivers which have the characteristics of short flood concentration time than the evacuation time of the residents (such as, flood concentration time = 1 hours). Also, the place where there is no observation stations near from the target community or no real time hydrological data to conduct the flood forecasting. (Flood forecasting is applied to some main rivers in Japan. Using real time water level data and set Evacuation Water Level, evacuation information is issued at a lot of rivers in Japan)

In this case, simplified water level gauge (simplified Early Warning System, here after simplified EWS) can be applied and setting of Evacuation Water level is required. If there is a staff gauge / water level gauge near from the target community, it will be able to set Evacuation Water Level at the site and check the river water level.

Setting of Evacuation Water Level procedure is as described on following page.

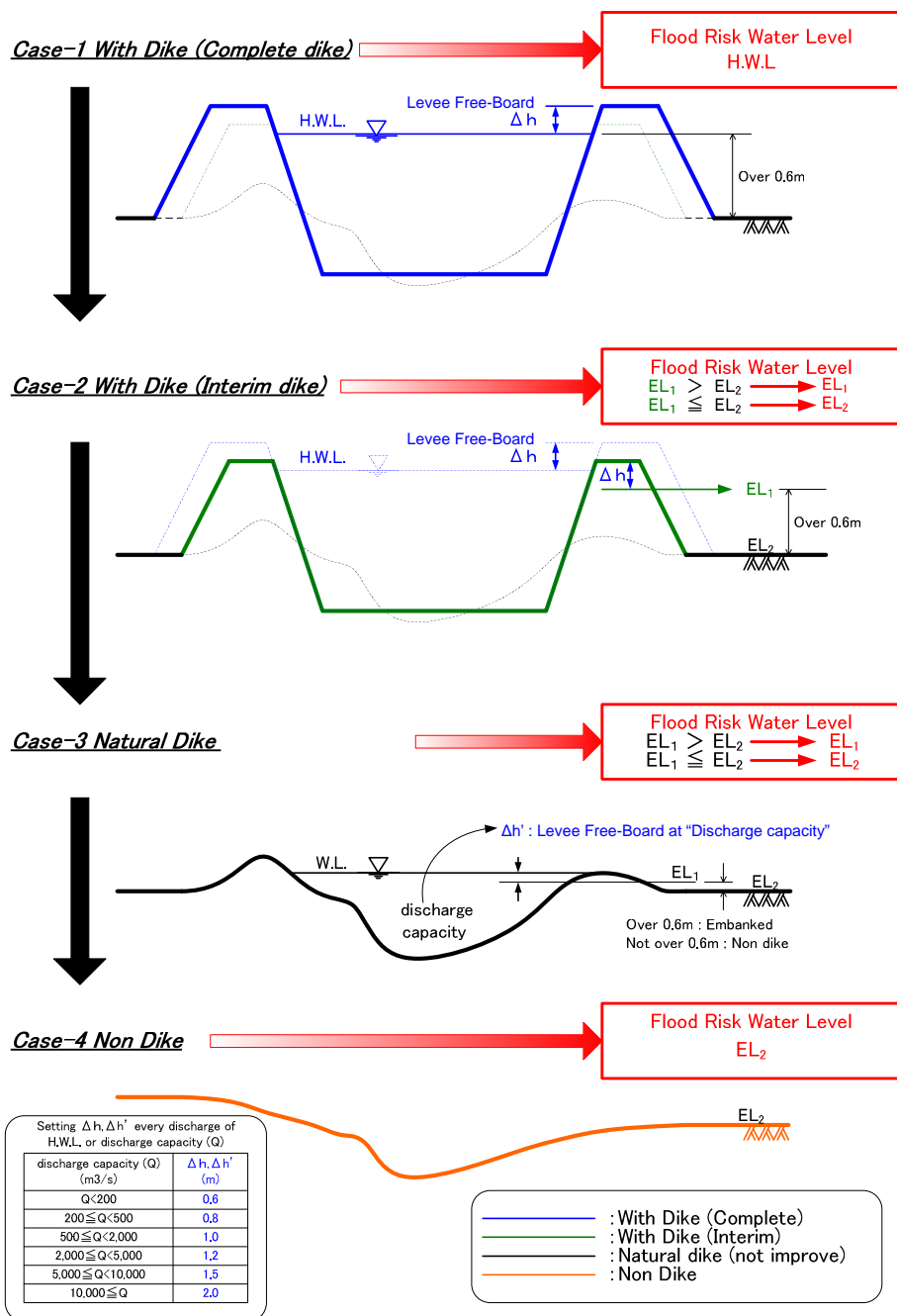


- Set Flood Risk Water Level (refer to next chapter). Flood Risk Water Level in target community is set based on evaluation of ground elevation at residential area (in Solomon Islands) and Evacuation Water Level is set based on expected amount of rise in water level during the in evacuation time (lead time) of residents
- Estimate / measure the evacuation time (lead time) of the residents through the evacuation drill
- Checking the amount of rise in water level during the lead time using the observed past flood hydrographs / calculated hydrographs (For example, “0.5m water level rise in 1 hour” or “2.0m water level rise in 1.5 hours”)
- If there is a simplified EWS, its monitor will issue a warning to the observer. Then, the observer needs to issue a warning (evacuation recommendation) to the residents using loud speaker, loud-hailer or hand siren.

If real time water level data is available, checking / comparing the water level and set Evacuation Water Level, the observer can issue a warning.

1.3. Method of setting up Flood Risk Water Level

Method of setting up Flood Risk Water Level in Japan is as shown on the following figure as an example. If the levee / dike is built at the site, Flood Risk Water Level is set based on the “Design Flow Discharge / Designed High Water Level (= H.W.L)” (High Water Level indicates the water level at the time that Design Flow Discharge flows at the cross-section). If there is no levee / dike, Flood Risk Water Level shall be set as “Ground elevation at residential area”.



1.4. Evacuation time

Evacuation time is composed of mainly 3 components described as below.

Evacuation Time = sum of (a), (b), (c)

(a) Time for distributing information

- Observer receives real time water level data
- If flood forecasting system is available, they need to convert / calculate flood information from water level data
- And then, observer distributes the flood information to residents
- Residents receive the information

It is estimated “for about 30 minutes” in Japan.

(b) Time for residents’ judgment of evacuation and ready for evacuation

- Residents decide to evacuate based on the flood information, their economic environment and mental / physical situations
- This period includes the time between the judgment / decision and starting of evacuation

It is estimated “for about 30 minutes” in Japan.

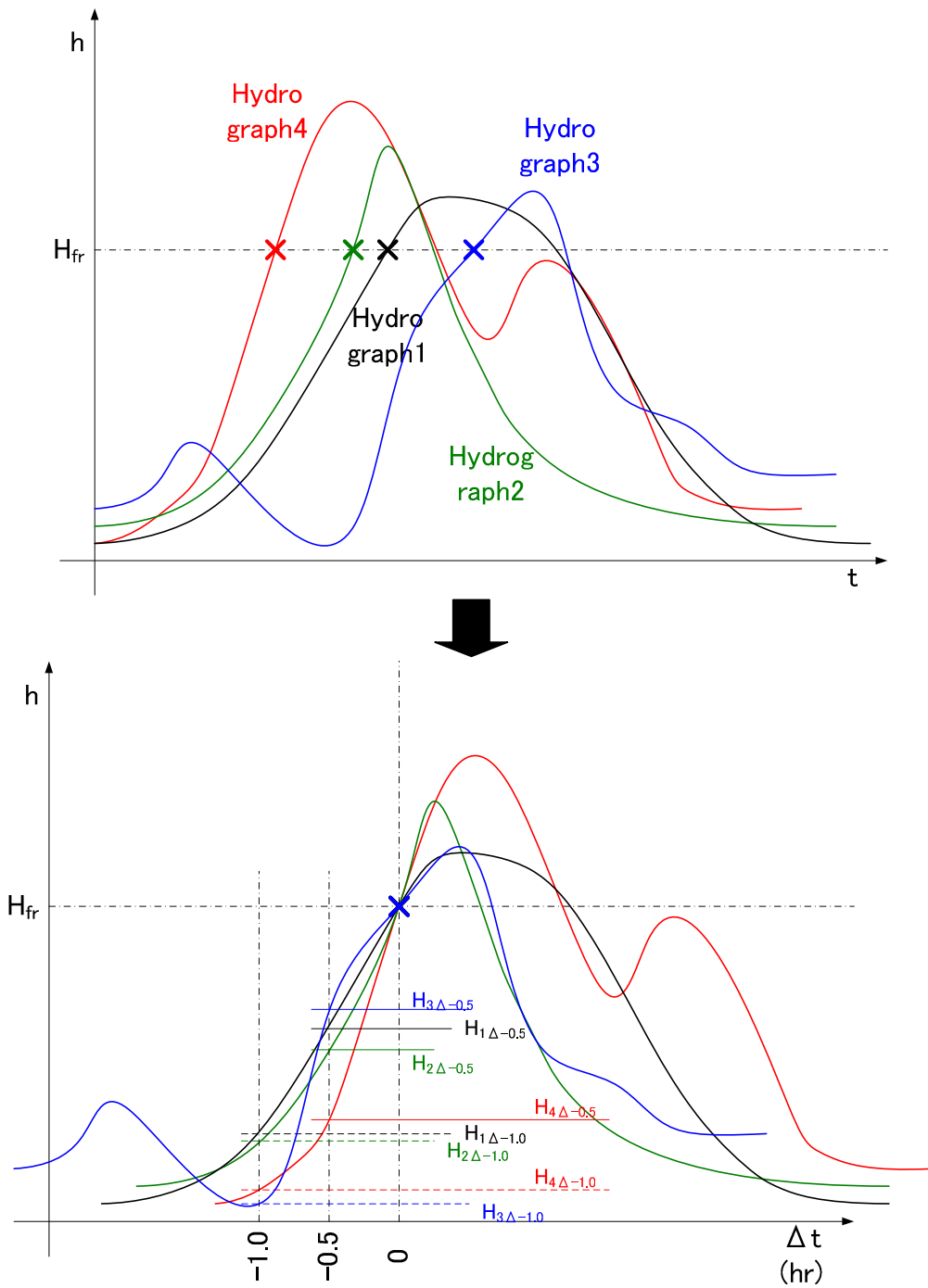
(c) Time for evacuation

- Time for evacuation indicates the travel time from residents’ place to evacuation place in consideration of “evacuation on foot in heavy rain carrying their emergency baggage

Moving speed is estimated as 2 km/hour in Japan, under the situation mentioned above.

1.5. Method of setting up Evacuation Water Level

Grasping the amount of rise in water level (based on observed / calculated hydrographs) is required to set Evacuation Water Level from Flood Risk Water Level and the evacuation time (lead time). The diagram of calculating the amount of rise in water level is shown on the following figures. Here, " H_{fr} " in the figure indicates "Flood Risk Water Level".



The largest amount of rise in water level in past flood shall be used for setting Evacuation Water Level. Calculation of Evacuation Water Level is as shown below, holding the previous figure up as an example. Here, “ $H_e @ \Delta$ ” indicates “Evacuation Water Level in certain evacuation time”.

$H_e @ \Delta-0.5 = H_{fr} - \text{Maximum value of } ("H_{fr} - H_1 @ \Delta-0.5", "H_{fr} - H_2 @ \Delta-0.5", "H_{fr} - H_3 @ \Delta-0.5", "H_{fr} - H_4 @ \Delta-0.5")$ <p style="text-align: right;">(*$H_{fr} - H_4 @ \Delta-0.5$ is the largest value in the figure)</p>
$H_e @ \Delta-1.0 = H_{fr} - \text{Maximum value of } ("H_{fr} - H_1 @ \Delta-1.0", "H_{fr} - H_2 @ \Delta-1.0", "H_{fr} - H_3 @ \Delta-1.0", "H_{fr} - H_4 @ \Delta-1.0")$ <p style="text-align: right;">(*$H_{fr} - H_3 @ \Delta-1.0$ is the largest value in the figure)</p>
$H_e @ \Delta-1.5 = \dots$

In the case of the previous figure, Evacuation Water Level should be much higher than the water level at the ordinary times, so it seems that “ $H_e @ \Delta-1.0$ ” is too safe against the flood, because the water level is still low (comparing the water level at ordinary times).

1.6. Monitoring

In any cases, establishing of Flood Warning Standards requires a number of observed past floods data. Therefore, observation is one of the most important parts.

On the other hand, flood forecasting and set Flood Risk Water Level / Evacuation Water Level are not always workable or correct (***CAUTION!!*** - **It is important to let residents understand that issuing warning does not mean that the flood will always occur after the warning. However, in case anything goes wrong, residents are supposed to evacuate after the receiving the evacuation information.**). Besides, issuing of warning requires the observer’s responsibility and evacuation requires personal responsibility. Therefore, set Flood Warning Standards shall be monitored and updated depending on the situation. Besides, monitoring / maintenance work of installed observation station and simplified EWS, continuous observer’s work, increasing the awareness of evacuation action in the community shall be required.

2. Warning Standard for Simplified Early Warning System

2.1. Simplified Water Level Gauge

As previously mentioned on chapter 1-2, warning standard for simplified water level gauge indicates “Evacuation Water Level”. Therefore, setting of warning shall be conducted in accordance with chapter 1-5.

For all the simplified water level gauges installed in Guadalcanal (as of Nov, 2012), expected amount of rise in water level during the in evacuation time of residents are estimated around 0.5 ~ 1.0 m. Besides, set Evacuation Water Levels are based on the resident’s past experience.

As a result, ideally speaking, evacuation time shall be measured through the evacuation drill and the amount of rise in water level shall be grasped using observed hydrological data during the flood term. And then, warning standard for simplified gauge shall be set based on that evacuation time and the amount of rise in water level. If it will not be available, past experience of overflow can be used for setting of standard.

2.2. Simplified Rainfall Gauge

To start with the conclusion, warning standard for simplified rainfall gauge should be set based on the past observed rainfall during the past flood near the target community.

Warning standards for all simplified gauges installed in Guadalcanal are now (as of Nov, 2012) set primarily as Level 4 (120mm). Actually, this warning standard is based on the past rainfall in Ba River basin in Fiji and also in Umasani River. In Ba River basin, they experienced the heavy rain (more than 120mm/day) 2 to 3 times in one year. As for Umasani River basin, according to the annual report of hydrological observation (refer to the tables shown below), heavy rain such as more than 100mm/day occurred once in 2011 (Oct.11th, 109.0 mm/day) and twice in 2012 (Mar.30th, 102.0 mm/day and May.23rd, 123.5 mm/day). However, even the heavy rainfall (around 120 mm/day) was observed at the station, overflow from the river did not occurred. Therefore, primarily set warning standard for simplified rainfall gauge would be appropriate.

Max Rainfall by the Day 2011 (mm/day)		Max Rainfall by the Day 2012 (mm/day)	
Rainfall	Accrual Date	Rainfall	Accrual Date
109.0	Oct.11	123.5	May.23

In any cases, warning standard for both simplified water level and rainfall gauges should be updated depending on the flood situation which will occur in the future.



Ministry of
Environment, Water and
Natural Resources



Water Resources
Management Authority



Japan International
Cooperation Agency

Project on Capacity Development
for Effective Flood Management in Flood Prone Area
in the Republic of Kenya
**MANUAL FOR WRMA ON FLOOD MANAGEMENT
EDUCATION IN WRUA AND PRIMARY SCHOOL**



July 2014
Japan International Cooperation Agency
NEWJEC Inc.



LINKING NATURE AND PEOPLE THROUGH TECHNOLOGY

Preface



The Government of Kenya established the Water Resources Management Authority (WRMA), through the sector reform brought by Water Act 2002. WRMA is the lead agency in the management of water resources in the country through six (6) regional offices and twenty six (26) sub – regional offices of the respective water resources catchment areas.

Since its operationalization in 2005, WRMA has made significant progress in making water resources recognized as being fundamental for socio-economic and environmental sustainability. In this regard, integrated floods management is viewed as necessary component in water resources management.

Based on the request from GOK, JICA carried out the “Study on the Integrated Flood Management (IFM) for Nyando River Basin (2006 – 2009)” as the Technical Cooperation Scheme and “Programme for Community based Flood Disaster Management to Adapt to Climate Change in the Nyando River Basin (2009-2011)”. This was a Grant Aid Programme with the aim of establishing a flood management system in the southern part of Lake Victoria Basin through IFM, where WRMA was the implementing agency. Through the above projects, community based flood management activities have been implemented through integrating non- structural and structural measures such as community based flood hazard mapping and construction of flood counter measure structures in prioritized flood prone areas.

Based on the achievement of Nyando project, the Project on Capacity Development for Effective Flood Management was formulated to expand IFM in other flood prone areas in Kenya. Three pilot river basins were selected namely: Isiolo, Gucha-Migori and Lumi to promote community based flood management activities. The main purpose of the project was to build institutional framework of flood management in the context of integrated water resource management for effective and sustainable implementation of community based activities. Through the project WRMA has developed strategies and guidelines in managing floods which have since been incorporated in the revised Catchment Management Strategies (CMS) and WRUA Development Cycle (WDC) manual. In order to develop capacity of WRMA officers in the field of community-based integrated flood management, a training system has been developed where the Project conducted IFM Training for WRMA officers who in turn trained the WRUAs. The Training Materials for community based flood management have been developed. These include supplemental manuals, lessons learnt and case studies.

A handwritten signature in blue ink, appearing to read 'John P. Olum', written over a light blue grid background.

Eng. John P. Olum, HSC
Chief Executive Officer, WRMA

ACKNOWLEDGEMENT

This booklet acknowledges all who have worked hard to enhance effective flood management in Kenya. It is imperative therefore to acknowledge the great efforts that have been undertaken in the Nyando River Basin through the noble assistance from Japan Government and the people wherein Japan Grant Aid Nyando Project was successfully implemented. During the Nyando Project the Teachers Handbook on Flood Management and Flood Management Textbook for Primary Pupils were developed and therefore this booklet has borrowed excerpts, pictures, figures and even text from those to grand books.

This booklet acknowledges the efforts undertaken by Asian Disaster Reduction Centre, we have learnt much from your efforts.

This booklet also acknowledges that some pages are direct copy of materials that have been produced before like Chapter 8 is copied word to word from the Trainers' Training Manual on Flood Disaster Management for the Project for Building of Communities' Capacity in Flood Disaster Management (Package 2). Chapter 3, Chapter 4, Chapter 6 and Chapter 7 has borrowed heavily from School Flood Safety Program: Flood Risk Preparation and Reduction "Teachers Information Booklet 2nd Edition- October 2009". While Chapter 5 has borrowed heavily from Flood Disaster Management Textbook for Primary Pupils for The Project For Building Of Communities' Capacity In Flood Disaster Management (Package 3) Under Nyando Project.

This booklet also acknowledges and appreciates the office of the Nyatike District Education Office that opened its door wide open and thereby allowing interaction of stakeholders with teachers within Nyatike Sub-county. This booklet therefore acknowledges the teachers and the school community at large from Sere Primary School, Agungo Primary School, Nyora Primary School and Kabuto Primary School that participated actively in the teachers Training on Effective Flood Management in Primary Schools Workshop and thus contributing immensely to the development of this booklet.

This booklet also acknowledges and appreciates the technical assistance and contribution of JICA Project Team, WRMA, LOGUMI WRUA and KRCS towards the development of this booklet.

PREAMBLE

Floods have been with us since Noah's time as recorded by the bible in Genesis Chapter 7 and 8. It is imperative therefore to understand floods, to know when they will occur, what to do when they occur and how to recover our daily livelihood after the floods. It is premised on this fact that an excerpt from the Flood Management Textbook for Primary Pupils a book developed under Japan Grant Aid Nyando Project on Flood Management is herein shared with us.

THE NARRATIVE: KODH UHURU

Once upon time in the land of Kano Plains in the days of our grandfathers, there was a great year that people of Kano Plains had never ever witnessed before.

The short rainy season of that particular great year was great one and the people of Kano Plains had cultivated their farms and they were waiting for a great abundant harvest.

The children were happy and there was a lot of dancing by the little girls wearing sisal skirts commonly known as 'Owalo' and the boys with their slings were hunting for birds mainly 'aluru'.

Then one day when the boys had gone hunting, they came back with a great catch of their prized game which included new species of birds that have never been seen before by the younger generation. The new species of birds captured were known as Okok and Wiwi. When the old men saw the two birds instead of being happy they became sad and said "Waah! The birds that come with floods are here with us we must prepare otherwise we will lose our harvest." No one took the old men seriously and therefore nothing was done!

The dancing continued and continued in vigour in the Kano Plains. The children were happy and everybody was talking and their conversation centred on how the harvest was going to be great. However the old men were gloomy and sad because they could not do anything on their own because of their age. The old men were indeed very old, as they had seen a lot of things in their lifetime.

The old men met and decided that they will ask their grandchildren to take the livestock to their relatives who lived in areas that were raised and were not easy to be affected by floods.

When they told the young boys about their plan, the boys were very happy because taking the livestock to the raised lands of Muhoroni and Awasi was an adventure. Therefore the boys obeyed their grandfathers and took the livestock to Awasi which was a day's journey.

On their way back home the boys heard the frogs crocking like they had never ever heard before in their young lives. They were amazed by the crocking noises of the frogs and they started imitating the crocking noise of the frogs "croockocroocko".

Meanwhile the girls in their sisal skirts danced all the way to the river and they too were surprised by the booming noise of the river water as it flowed towards the lake. It was at this exact time that the boys also passed crocking like frogs and the cacophony of the noises of the flowing water and the imitation of crocks by the boys sounded like music to the girls and they danced even the more.

Thereafter as the girls were drawing water from the river, one girl told her friends "I think the water in the river is rising!" her friends dismissed her and told her "you have been dancing too much and now the water is dancing in your eyes that is why you think the water in the river is rising."

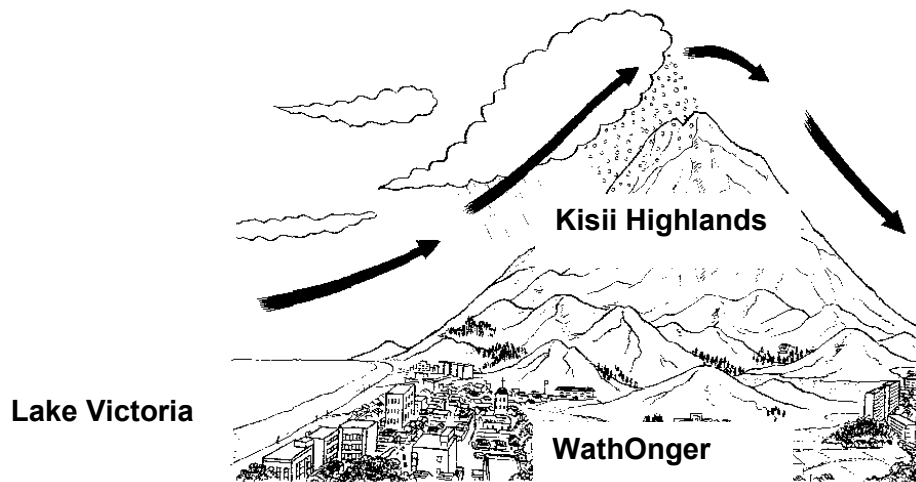


Figure 1:Wet Wind and Cloud bring about Excessive Rainfall

Both the boys and the girls arrived home at the same time and they narrated their experiences and no one took them seriously, everyone apart from the old men thought “after all it was the adventure, the spirit of harvest and the declaration of independence of Kenya famously known as Uhuru was the reason for their hallucinations.”

The old men were very pensive but kept quite since their opinions had been ignored. There and then the winds began blowing and the trees were whistling because of the winds that were blowing from where the sun rises that is the east.

Then the following day there was great rainfalls like never before in the Kano Plains. And before anyone realized what was happening the river busted its banks and the waters flowed everywhere in the plains.

There was massive destruction. Some of the children disappeared never to be seen to this day. The great harvest was washed away and the houses were damaged.

Everywhere people were running and moving out from their homes in large numbers, the sick people were carried on the young men’s back, the old men and women were driven on donkey carts to the raised safe places. The rain was so heavy very very heavy and it was called KodhUhuru that caused the flood disaster in the Kano Plains.

The only properties that were saved from the massive destruction were the livestock that the boys had taken to their relatives in the raised lands of Muhoroni and Awasi.

The great harvest was turned into great wailing as KodhUhuru ravaged the Kano plains. It was one of the worst floods to ever hit Kano Plains and it was named KodhUhuru, the name it still bares to this day. That is the end of my story.

LESSON LEARNT:

In the story there are new things that we learn and we shall understand them better in this chapter and the subsequent chapters.

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INTRODUCTION: OVERVIEW OF THE PROJECT

1. BACKGROUND OF THE PROJECT

The Republic of Kenya (hereinafter referred to as “Kenya”) experiences regular nationwide flooding during rainy season. These floods leads to approximately five thousand (5,000) people to be affected and causes financial damage of approximately JPY one hundred and sixty million (160,000,000) every year.

In 2003, the southern parts of Lake Victoria Basin including Nyando River Basin were affected by serious flooding which affected approximately twenty two thousand (22,000) people. In 2007, Garissa town which is located at the middle Tana River Basin was hit by severer flood and approximately JPY six hundred and eighty million (680,000,000) financial damage. According to the analysis reported in the fourth assessment report published by the Inter-governmental Panel on Climate Change (IPCC), it is anticipated that Climate Change will ultimately lead to generation of more occurrence of flood incidences.

The Government of Kenya (hereinafter referred to as “GOK”) in the sector reforms under the Water Act 2002 established Water Resources Management Authority (WRMA), which is under the Ministry of Water and Irrigation (MWI). WRMA acts as implementation organization in charge of overall water resource management of each catchment. WRMA set up is as follows: the headquarter, the six (6) regional Catchments and the thirty two (32) sub-regional Sub-catchments.

In 2004, WRMA formulated “Integrated Flood Management Policy” focusing on Lake Victoria Basin, which is one of the areas that suffers from severe flood damages. It was intended to promote Integrated Flood Management (IFM) to raise awareness of community and strengthen institutional capacity to allow flood mitigation, prediction and warning. Based on the request from GOK, JICA carried out the “Study on the Integrated Flood Management for Nyando River Basin (2006 – 2009)” as the Technical Cooperation Scheme and “Programme for Community based Flood Disaster Management to Adapt to Climate Change in the Nynado River Basin (2009-2011)” as the Grant Aid Programme with the aim of establishing a flood management system in the southern part or Lake Victoria Basin through IFM. Through the above projects, community based flood management activities have been implemented and deployed combining structural and non-structural measures such as workshops for mapping flood damaged areas and protection measures for building structures in prioritized communities. Some positive outcomes have since been realized.

GOK in essence aims to expand these activities, which were implemented in the area of Nyando River Basin only to other parts of the nation with a purpose to promote community based water resource management activities including flood management. GOK has been currently working on the institutionalization of Water Resource User Associations (WRUAs). WRUAs are managed by community members who are major beneficiary of water resources. A framework therefore has already been established which enables the WRUAs to receive funds from the Water Service Trust Fund (WSTF) sourced from technical support, official aid, and donor’s funds. This framework is known as WRUA Development Cycle (WDC).

GOK plans to utilize WDC framework to deploy nationwide community led activities based on IFM which integrates outcomes from previous JICA’s projects. However it is considered that GOK requires assistance in providing appropriate technical advice to relevant entities in IFM including WRUAs. This is

because the previous flood management activities carried out under JICA were not in line with WDC as well as other frameworks.

Therefore, this Project is expected to strengthen WRMA institutional ability through the capacity development on basic flood management to promote community based flood management activities within the WDC framework. This Project known as “The Project for Capacity Development for Effective Flood Management in Flood Prone Areas (hereinafter referred to as the “Project”) targets to pilot these activities in three river basins: Gucha Migori; Lumi; and EwasoNg’iro North.

This manual focuses how WRMA staff conducts flood management education to WRUA and school with utilization of the existing teachers manual in the Lower Gucha-Migori Sub-catchment.

2. BACKGROUND OF THE A RIVER BASIN

In this section, topographic aspects, WRMA office and WRUAs, and floods aspects are explained.

The Gucha Migori river basin is a vast expansive river basin that consist of two river system i.e. River Gucha system and R. Migori System. These two rivers merge at a confluence in Sango area in Central Kadem Location in Nyatike sub-county to become the wide R. Gucha Migori. The river thereafter flows and pours its water in Lake Victoria. R. Gucha has its source in Nyamira County in the Kisii highlands, while R. Migori has its source in Narok County specifically in EmuriaDikiri district.

The Gucha Migori river basin falls under the jurisdiction of WRMA-LVSC Southern Shoreline Sub Regional Office (SRO) as pertaining to the general water resource management inclusive of flood management. WRMA-LVSC Southern Shoreline in effort to effectively manage this river basin has collaborated with the community to establish Water Resources Users Association (WRUAs).

There are nine (9) WRUAs in Gucha Migori namely, Lower Gucha Migori (LOGUMI) WRUA, Ongoche WRUA (Nyatike district), Nyangweta WRUA (Kenyanya district), Middle Gucha WRUA (Gucha district), Nyarwaba WRUA (Nyamarambe district), Chirichiro WRUA (Masaba district), Nyamache WRUA (Nyamache district), Kenyamware WRUA (Nyamira district) Upper Migori WRUA (EmuriaDikiri district), are established within the Gucha Migori river basin. In the flood plain of R. Gucha Migori there is the LOGUMI WRUA that is located within the Lower Gucha Migori Sub-catchment and implements grass-roots water management in collaboration with WRMA.

The principal flood damages are destruction of houses, enforcement of long-term evacuation, heavy losses of crops in the farmlands, contamination of water resources by polluted water diffusion, growing worse sanitary conditions and impassable roads and longer period of flood water inundation of the villages within the flood prone areas etc.

3. PURPOSE OF WRMAS’ MANUAL BOOKLET ON FLOOD MANAGEMENT EDUCATION

This booklet provides the WRMA staff with basic knowledge on flood, flood hazard, means of protection and what to do before, during and after floods in WRUA/schools and methods to identify, prepare for and treat diseases caused by flood water. The oriented WRMA staff can use this booklet as a source of knowledge to disseminate to WRUA member and school children regarding flood safety measures.

Moreover, this booklet also provides teaching methods and exercises that can be used to teach WRUA member and school students on flood safety measures more effectively.

Together with the booklet, teaching aids such as pictures, posters, and Flood booklet have also been provided in the hope to make lessons more visible, practical and also attractive, which helps WRUA member and school children absorb the knowledge more easily.

The purpose of the booklet is to help in reducing disaster risk during the flood season, in terms of protecting people and enhancing public awareness through WRUA/school activities. Therefore, we would highly appreciate the booklet using widely.

We urge you to take this resource, digest it and disseminate its content to many generations in the hope that the communities of Kenya will become more resilient and better prepared for the risks that accompany its yearly floods, so that everyone has opportunities to understand better and live in harmony with floods.



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PlwJ1viliam !M-rn 1..}16.N6

Figure 1: Illustration of contended pupils who have properly prepare against floods

Chapter1: BACKGROUND OF FLOODS IN THE ARIVER BASIN

In this chapter, the mechanism of occurring floods, relative organizations, type, causes, effects, and history of floods are explained.

1.1 Definition of floods

Flood is a situation in which water from a river, stream, and channel overflows its banks and covers large areas of dry land like in the story of KodhUhuru we are told the river busted its bank because of heavy rains and it led to flooding in the area.

Flood can also occur when water from heavy rains cover large area of land that was dry before.

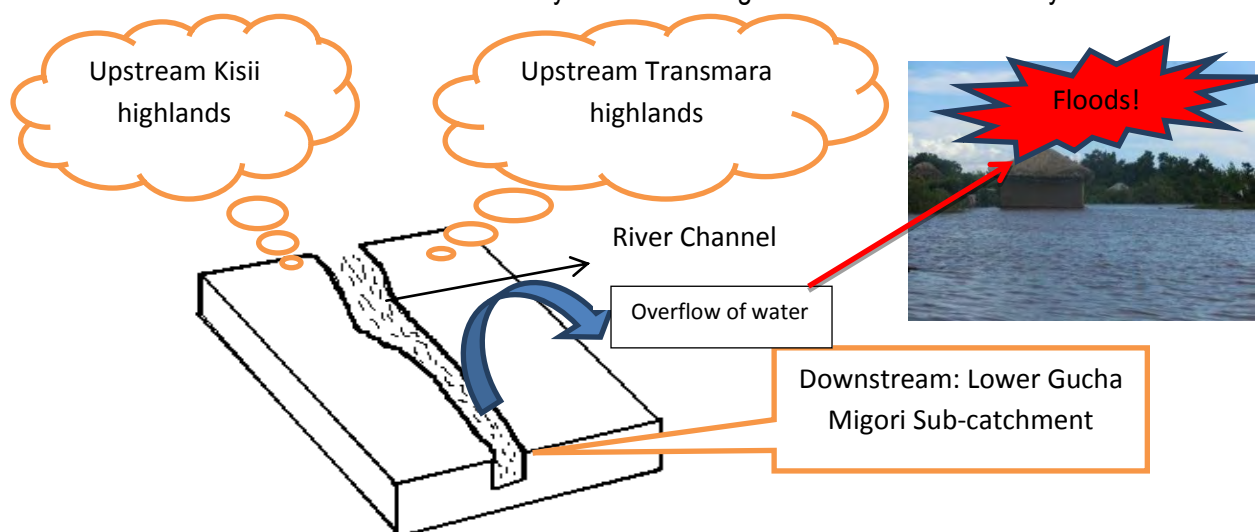


Figure 2:Illustration of floods

1.2 Terms and vocabulary used in flood management

There are certain words that are used in disaster management and in this chapter we are calling them major vocabularies that are used in disaster management. Below are a few examples of these vocabularies:

➤ **Hazard**

Hazard refers to a situation that poses threat to human life, public health, property or environment. Hazard may either be natural or man-made. Hazards may be geological (e.g. earthquakes), climatic (e.g. floods and drought), environmental (e.g. deforestation, pollution) or epidemic (industrial accidents or germs).

➤ **Emergency**

Emergency means an abrupt situation in which the life or well-being of humans are threatened and demands an appropriate prompt action to be taken to avert the threat. Emergency situation always require urgent intervention to prevent or mitigate the situation from escalating into a crisis.

➤ **Vulnerability**

Vulnerability is the lack of ability for a person or a community or a structure to protect himself or herself or itself from damage, injury or harm inflicted by a hazard. There are two types of vulnerability:

- a) Structural or physical vulnerability: is the extent to which a structure is likely to be damaged or disrupted when a hazard occurs. For instance a dyke that is porous and not properly compacted can easily be destroyed by floods.
- b) Human vulnerability: is the relative lack of capacity of a person or community to anticipate, cope with, resist and recover from the impact of a hazard. For example in Africa if an earthquake disaster occurs, most homes do not have bunkers and therefore there are no places to hid or run to and therefore the impact of the earthquake disaster will be severe.

➤ **Risk**

Risk refers to the possibility of a specific hazard to occur and its probable consequences for people, property and environment. Risk can also mean there are chances that a disaster will occur. There are places where people go in case a risk occurs. There are vocabularies that are used in disaster management in case of such occurrence for example

a) *Evacuation*

This is the process in which affected people move from their homes because of a disaster whether impending or occurring at the time of disaster and they seek for a safe place to temporarily settle.

b) *Evacuees*

These are people who are moving out of their homes in search of a safe place because of the impending or occurring disasters.

c) *Evacuation Places*

This can be a public facility such as a school or a church that is used for emergencies. In Gucha Migori river basin there are schools that have been identified as evacuation centers in other words during floods people use them temporarily as their homes while they wait for water to subside in their homes for example Nyora Primary and Kaburo Primary. When these schools are used as shelter by affected families then the schools are referred to as evacuation places.

d) *Evacuation Routes*

These are roads, foot-paths that are normally followed by people as they run away from their homes and go to places of safety mainly evacuation places.

1.3 Organizations and Agencies involved in flood management

There are various organizations and agencies involved in flood management in Gucha Migori River Basin and these organizations are known as stakeholders. Therefore the stakeholders in flood management in Gucha Migori are: Water Resources Management Authority-Lake Victoria South Catchment (WRMA-LVSC) Southern Shoreline Gucha Migori Office, Water Resources Users Association (WRUA) and specifically Lower Gucha Migori (LOGUMI) WRUA, Kenya Red Cross Society (KRCS), World Vision, District Disaster Management Committee (DDMC) specifically Nyatike DDMC, Community-based Flood

Management Organizations (CFMOs) among other stakeholders. Involvement of the stakeholders is important in order to enhance integrated flood management.

1.4 Types of floods

There are two main types of floods in the Gucha Migori River basin, namely; flash flood and river floods.

1) Flash floods

Flash floods occur within a few minutes or hours of excessive rainfall. It occurs on a large area but clears within a short time. Since flash floods do not always give a warning that they are going to occur, they often than not occur when most people are unprepared for it. Therefore people who live in areas prone to flash floods, are advised to plan all the time to protect their family and property. In Nyatike district the places that are commonly affected by flash floods include: Lwanda, Misiwi, Ratieny and Tito areas.

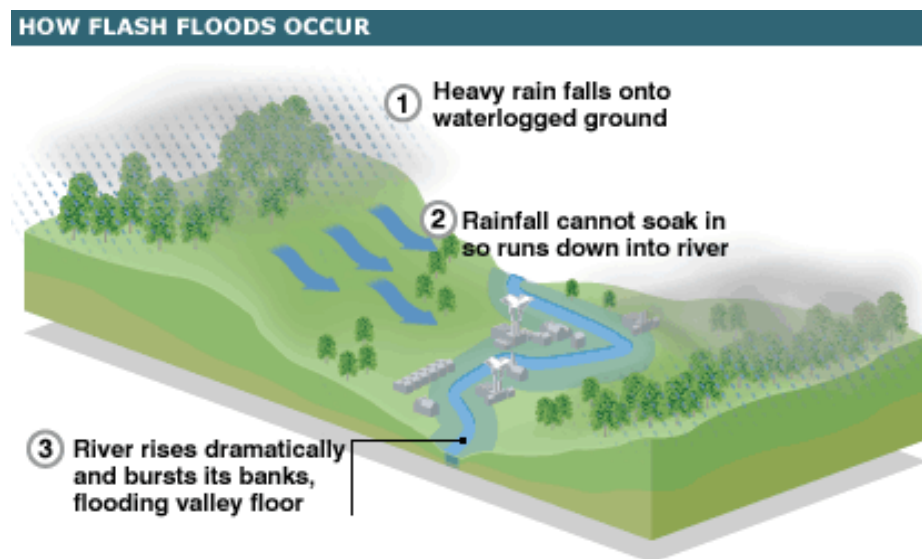


Figure 3: Illustration of flash floods

2) Riverine floods

Flooding along rivers is a natural and inevitable part of river life cycle. Riverine floods occur when rivers, stream or channels of water overflow their banks after heavy rainfall upstream. The heavy rainfall leads to the river water levels to rise and therefore intensive heavy rains will inevitably lead to the water levels to rise above the level that the river channel can contain the water within the channels and therefore the water overflows the banks and thereby leading to flooding.

In the Gucha Migori River Basin once the heavy rains are experienced in the upstream area i.e. Kisii Highlands or Transmara Highlands leading to



River Gucha Migori bursts its banks and its water floods and inundated the homes in Nyora village

increase of water flowing in R. Gucha and R. Migori respectively that inevitable leads to high levels of water in R. Gucha Migori and thereafter the river water breaks the bank and thereby leading to occurrence of floods. This flood lead to inundation of farmlands and continuous floods leads to inundation of homesteads leading to families moving out of their homes to go and temporary settle in the safe raised places.

1.5 Causes of floods

Floods are caused by several factors; some are natural while others are man-made.

Floods in the lower Gucha Migori River Basin occur seasonally or annually and it is a disaster when it occurs affecting many people. There are two ways in which floods occur in Gucha Migori Basin, namely:

- 1) Excessive rainfall covering the land.
- 2) When water overflows its natural channels.

The causes of flood in Gucha Migori River Basin may be classified into two main groups:

- ✓ Natural causes: The natural causes include excessive rainfall in the upstream (Kisii and Transmara highlands) and characteristics of the terrain in downstream of Gucha Migori River Basin i.e. steep gradient, meandering nature of R. Gucha Migori, the heavy siltation in the river channels and the velocity of the water.
- ✓ Man-made causes: These refer to the common practice of human beings i.e. farming, building homes and towns near rivers and other bodies of water which then contribute to the disastrous consequences of floods. These common practices are what are known as human activities and therefore these activities when they lead to flooding they are what are called Man-made causes which include:

1) Settlement pattern

Some people build their homes on waterways, blocking the water channels and thus causing flooding. Waterways are the normal channels, depressions or general areas; water passes through during the normal flow.

Water channels are defined depressions or natural canals through which water flows. These may include the river, stream, or drainage canals.

When people build their houses in these areas, they block the normal flow of water during rainy seasons thereby, causing flooding.



Community members farm in the riparian land because of the proximity to the river for purposes of irrigating their farms

2) Poor farming methods

The poor farming methods are the farming methods that lead to harmful impact to the environment or communities.

These poor farming methods include cultivating the riverbanks, hilltop cultivation, ploughing up and down the slope, overgrazing, overstocking, continuous cultivation etc.

These above mentioned agricultural activities lead to soil erosion and the eroded soil particles get deposited into the river channels leading to siltation that reduces the depth of the river by making the riverbed to be shallow and thus easy to overflow the banks and therefore causing floods.



Siltation as a result of soil erosion leading to shallow riverbed

3) Deforestation

Deforestation is the cutting down of trees without growing new ones to replace the cut down trees. Cutting down of trees in the forests in the upstream of Gucha Migori river basin has led to soil erosion. In Transmara Sub-county where the farming activities have intensified has led to deforestation. The eroded soil particles get deposited in the waterways in the lower catchments and therefore raising the river beds and therefore creating a recipe of causing flooding.

1.6 Effects of floods

When floods occur in the Gucha Migori River Basin there are good or bad experiences as a results offloods. The good and bad experiences are what are known as effects. Therefore floods lead to good and bad effects. The good effects can be viewed as advantages while the bad effects are considered as disadvantages.

a) Good effects of Flood

The good effects or advantages of floods include:

(1) Provision of breeding, nesting and feeding ground for fish, birds and wildlife

Floods provide ideal environment for breeding, nesting and feeding for fish, birds and even wildlife. When it rains in the upstream the water flows from the upstream carrying it nutrients for fish, birds and even wildlife. These nutrients nourish the aquatic lives and thereby making these living things fat and healthy for human consumption. It is important to note that during the floods the fish also swim to the flooded area in search of food and therefore they are easily trapped by communities living in these flood prone areas. n

(2) Improvement of soil fertility

During heavy rains in the upstream the rains causes soil erosion that eventually gets deposited in the downstream.

The communities in the upstream use manure, fertilizer for their farming and therefore when these soil is deposited in the downstream of Gucha Migori River Basin it implies that the farms in the downstream are properly enriched by the fertility from the upstream and therefore making the lands in the downstream productive.



Bumper harvest as a result of good yield

(3) Pasture regeneration

Flood improves soil moisture and promotes growth of grass which the livestock graze on. Floods also improve regeneration of the vegetation.

(4) Irrigation

Irrigation is the use of water, usually not natural rain water, to assist in the growing of agricultural crops in dry areas especially during periods of inadequate rainfall. For example in Lower parts of Gucha Migori River Basin, river water is used for irrigation of crops such as water melon, onions, kales (sukumawiki), tomatoes, and arrowroots. Currently National Irrigation Board is developing drainage canals that will use flood water for irrigation in Lower Gucha Migori Sub-catchment.

b) Bad effects of Flood

The bad effects (disadvantage) of floods in Gucha Migori River Basin include:

(1) Human and livestock death due to drowning

The floods lead to inundation with varying flood depth depending on the area. The flood water also flow at high velocity and because of the above mentioned characteristics floods leads to drowning of both human beings and livestock relatively shallow depths. Human beings and domestic animals such as chicken, goats, sheep, cattle etc. can easily be swept by currents of moving or turbulent water. For example, in the narrative of KodhUhuru of 1963, the story reveals that there were children that disappeared and they were never found.

(2) Water-related diseases

Floods destroy drainage systems in cities and even rural areas, causing raw sewage to spill out into bodies of water. The flood water sweeps over a large area carrying a lot of dirt. The dirt contaminates the surface water sources and the unprotected underground sources, making them unsafe for human and animal use. This may lead to outbreak of waterborne diseases such as:

- ❖ Malaria
- ❖ Typhoid
- ❖ Cholera
- ❖ Bilharzias
- ❖ Dysentery

(3) Disruption of human settlement

Floods destroy houses and especially houses that have weak foundations and weak wall structures are vulnerable to destruction by floods. The floods inundate homesteads for duration of more than two weeks in Nyatike Sub-county. During this inundation period the water weakens the structure of these houses it washes down the mud plastered walls. Inundation of homesteads makes the homes inhabitable and therefore forces affected family members to move out of their homes to safe raised places and therefore enhancing the vulnerability of these houses to destruction.

In such cases the human settlement is disrupted. Floods also



Evacuation from homes to safe raised places



cause people to be displaced from their natural homes thus disrupting their way of life.

Floods may also cause a lot of damage to an area by displacing people from their homes and ruining businesses. During this period some of them may not get shelter hence are exposed to extreme cold which may expose them to diseases like pneumonia.

Affected families settle at evacuation places

(4) Destruction of crops

Flood inundates the farmlands. During this period of farm inundation the flood water uproots and sweeps away crops such as millet, tomatoes, maize, vegetables etc. This destruction of crops leads to food shortages that ultimately lead to famine and starvation. It is usually common scenario for community members' hope of bumper harvest being dashed away by their crops being washed away by flood disaster.

(5) Disruption of learning

Floods also cause extensive damage to learning institutions such as schools by damaging classrooms, roads leading to school, school toilets and thereby disrupting the teaching programmes in such schools.

In some areas floods causes difficulty in accessing the schools even though some of these schools at that period are occupied by affected families for example Kabuto Primary School. In such cases teachers as well as pupils are not able to reach the schools.

During these times some schools are closed temporarily till the floods subside. A good example where floods interfere with teaching and learning is at Nyora, Sere and Kabuto Primary schools in Nyatike Sub-county.



Kabuto School hosts affected families and therefore disrupting learning programmes

(6) Disruption of transport and communication

Some major transportation routes pass through the water channels. In Nyando River Basin highways and other road systems either follow river valleys or cross them. Flood damages to these transportation systems such as blown culverts and wash-outs on rural roads and bridges and damages to major roads connecting the main markets disrupt transport and communication in the area. When such damages occur there is increased transportation costs and this also



Disruption of transport network making it difficult for pupils to move from one place to the other

seriously impacts on local businesses, let alone the cost of repairing the damaged roads. In addition, some traders take advantage of such situations to increase prices for goods and

services. An example is where bicycle transport goes higher due to floods.

(7) Promotes soil erosion

Soil erosion is the process of wearing down and washing away soil particles in the natural habitat and depositing them somewhere else. It usually occurs due to wind, water, or even landslides. When community members destroy vegetation covering the land such as trees or farm along the river banks they reduce vegetation cover on the surface of the soil.



Water surface run-off water during heavy rains leaves trail of trenches behind after eroding the soil

This kind of negative activity interferes with both soil structure and tree or vegetation roots that holds soil compacted in that particular place. In such a case the soil is therefore exposed to erosion and when floods come the soil is washed away. Floods therefore play an important role in promoting soil erosion.

The rain water surface run-off is noted in the hilly and places of steep gradient during heavy rainfall.

(8) Interferes with the social functions e.g. weddings, funerals

Flood disaster impacts negatively on social functions such as wedding, funerals etc. For instance when there are floods certain social ceremonies cannot take place and some of these ceremonies cannot be postponed and the consequences of postponing such ceremonies are dire for example funerals. In this regard therefore floods impact negatively on normal socio-economic lifestyle.

The table below is a summary of the good and bad effects of the floods:

Table 1 Good and Bad Effects of Floods

Good effects of floods	Bad effects of floods
1.) Provide breeding, nesting and feeding for fish, birds and wildlife	1.) Human and livestock death due to drowning
2.) Improves fertility of the soil	2.) Result in water-related diseases
3.) Flood can be used for irrigation	3.) Contamination of water source
4.) Allow pasture growth and re-growth	4.) Description of human settlement
5.) Refills underground water	5.) Destruction of crops
	6.) Disruption of learning
	7.) Disruption of transport and communication
	8.) Destruction of buildings

Source: Flood Management Textbook for Primary Pupils

Conclusion

We therefore can rightly conclude that flood can be harnessed as a resource. This means that if we manage floods effectively it can be of great benefit to the community in flood prone areas because we

cannot control the floods by stopping them because in most cases they are natural occurrence but we can manage the floods.

1.7 History of floods disaster in Nyatike

Floods in Lower Gucha Migori Sub-catchment are not a new phenomenal but have been on increase in intensity and impact over time. Based on oral tradition from the senior citizens in the area the history of heavy flood in Lower Gucha Migori is as follows: 1947, 1957, 1961, 1963, 1985, 1997-1998, 2006, 2011, 2012 and 2013. Currently Floods in Lower Gucha Migori SC occur annually with a current frequency of twice a year i.e. during the long rains (March to June) and during the short rains (October to December). Flood history in Lower Gucha Migori Sub-catchment is therefore summarized as follows:

- (i) There was major floods in 1947, 1957, 1961 after the heavy rainfall;
- (ii) In 1963, there were floods after heavy downpour of 1962-1963. The elderly members of the community point out that the 1962-63 rains led to heavy flooding that led to relocation some of their farms as Lake Victoria in hostile takeover took over the farmlands. They clarified that in some cases where it had been said the lake was receding was ironically the Lake leaving the land it had taken over;
- (iii) In 1985 there was heavy floods that led to displacement and eventual relocation of Kabuto Primary School;
- (iv) In 1990-92 heavy floods were again noted;
- (v) The other major flooding occurrence was in 1997 as a result of El-Nino rains.
- (vi) The other major incidence of flooding was in the year 2006 whereby R. Kuja changed its course from flowing through Aneko to the current flowing place of Kabuto-Nyora.
- (vii) The impact of 2006 flood included four schools relocating and moving into one school for various education programmes in those schools to continue at the one school that hosted them. This flood also led to massive and heavy evacuation of the affected community members and also the crops in the farmlands were swept away;
- (viii) In 2011 the area experienced heavy flooding in September-December short rains;
- (ix) The year 2012 the area experienced floods disaster leading to massive destruction of crops and some homes were damaged. The floods were experienced in April-June long rains;
- (x) Flash floods were experienced in Lwanda Township in late December 2012 after heavy rains in the area leading to evacuation of eight families for three hours, some houses were damaged and also some toilets collapsed;
- (xi) Heavy floods affected LOGUMI SC in the month of April and May 2013. Flash floods affected Lwanda Township in April while the river floods affected at least twelve villages leading to heavy evacuation in April and May; and
- (xii) The heavy floods in April and May 2013 caused houses in some parts of Kabuto and Nyora to sink in by fifty centimeters (50CM) as a result of long inundation period and the porous nature of the soil in the area in the month of June 2013.



Activity for WRUA member and students

- 1) Discuss with your family members some of the human activities that they do that enhances probability of flood occurrence.**
- 2) With your friends, discuss how your family or village has benefited from the flood in the last five years.**
- 3) Write a one page composition entitled During the last floods in Nyatike.**

Chapter2: Flood Hazard in the ARiver Basin

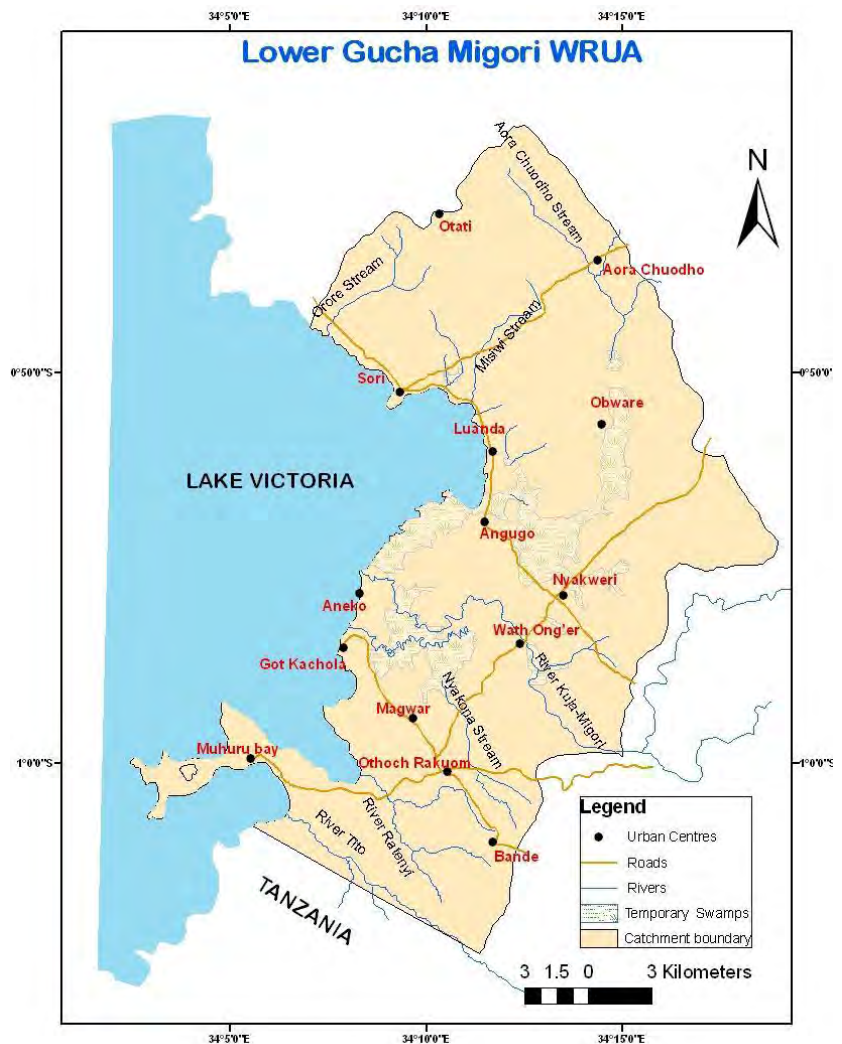
In this chapter, back ground of sub-catchment, mechanism of floods, countermeasures against floods, and impacts of floods are explained.

2.1 Background of LOGUMI Sub-catchment: Downstream of Gucha Migori River Basin

The Lower Gucha Migori (LOGUMI) Sub- catchment is not endowed with many rivers but has two permanent rivers i.e. River Gucha and River Migori which merge to become a wide river Gucha Migori river. Lake Victoria Basin also covers some areas of the Lower Gucha Migori Sub-catchment. Lake Victoria can also provide clear, safe and reliable water for livestock, domestic and industrial use. The two rivers have potential of being a source of more hydroelectric power that can add to the Gogo hydroelectric generation.

The sub-catchment is endowed with natural forest and hill topography, which forms an important component of Lake Victoria basin. However degradation of environment is evident as a result of farming activities and de-forestation is being experienced currently.

There is also noticeable desertification in sub- catchment. This calls for investment in the irrigation and reforestation programmes to improve the environment and enhance food security in the long run.



Source: LOGUMI WRUA SCMP

Figure 4 Satellite Map of LOGUMI Sub-Catchment

2.2 Floods in Lower Gucha Migori Sub-catchment

The main causes of floods in Lower Gucha Migori Catchment are the heavy rains in the upstream that leads to heavy surface run-off water to flow into both R. Gucha and R. Migori systems. The surface run-off water erodes soil as it flows into the river leading to heavy sedimentation of the river channel as the water flows downstream. The heavy sediments are deposited downstream leading to shallow river channel in

the downstream and with heavy and at a high speed river flows downstream the water overflows its banks leading to floods.

In the downstream area flash floods also do occur mainly because of the neighboring hilly areas within the Lower Gucha Migori Sub-catchment for example in Lwanda, Misiwi and Tito areas. In those areas there are hills and during heavy rains in the downstream the rain surface water run-off flow at a high speed and thereby causing flash floods in the above mentioned areas. For example in Lwanda the neighboring hills experience heavy rains and the rain water flow along the feeder murrum roads at high speed and this leads to flooding of Lwanda township that sometimes lead to affected families to evacuate to Lwanda Primary School for at least three hours to one day. The flash floods lead to damage of houses and losses of properties, crops and livestock.

The countermeasures against floods are important because the numbers of people affected by floods are more than three thousand (3000) including children and the flood inundation period is two weeks to two months depending on the flood intensity.

2.3 Floods impact on schools in Lower Gucha Migori Sub-catchment

Currently there are two annual flooding seasons that occurs in Lower Gucha Migori.e. during the Long Rains Seasons and Short Rain Seasons. The long rain season is from March to June while short rain season is from October to December. Floods occur in the lower parts of R. Gucha Migori i.e. Nyora and Kabuto areas but other areas like Aneko, AekoRatieny, Kimai, Lwanda, Misiwi, Tito among other areas are affected also. The main cause of floods in Lower Gucha Migori Sub-catchment is as a result of river water breaking the riverbanks and



A young kindergarten pupil wades through water after flood occurrence

overflowing onto land where there are farms, human settlement and schools.

The historic floods of 1998 and 2002 in the Lower Gucha Migori resulted in an emergency situation of largescale proportions with most schools relocating to Nyakweri Primary School. Most schools were inundated with flood water. School pupils and children are the most vulnerable during the flood season.Floods occur and last for more than 3 months per year and this disrupts learning in school leading to interference with academic performance.



Children unable to go to school due to flood impact in Nyora Village

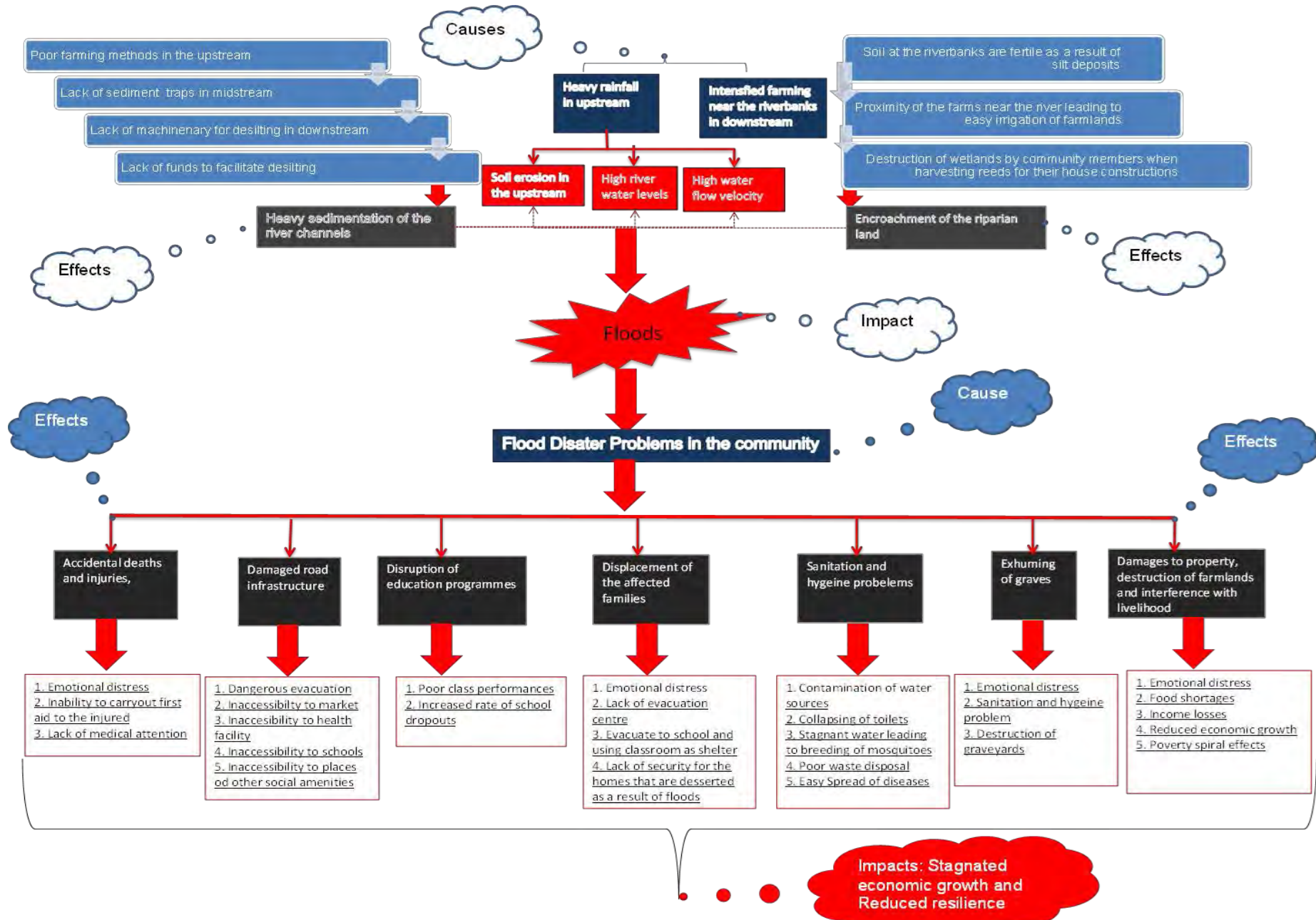


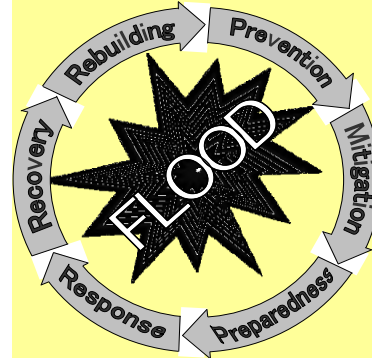
Figure 5 Causes, Effects and Impacts of floods in Lower Gucha Migori Sub-catchment

Chapter3: Flood Safety Measures at Household Level

3.1 Floods Management Components

The following actions comprise the components of flood management and can be divided into five major activities as follows:

- 1) Flood Prevention
- 2) Flood Preparedness
- 3) Flood mitigation
- 4) Flood Response
- 5) Recovery/Rebuilding



Source: Flood Management Textbook for school pupils

Figure 6 Flood Management Cycle

The activities involved in the components of flood disaster management can be undertaken at three levels, namely;

- a) Self help: These are activities that are undertaken solely by community members;
- b) Mutual help: These are activities that are undertaken by community but with assistance from other organizations that work within the area;
- c) Official help: These are activities that are undertaken solely by the Government

3.2 Floods Management at Household Level

Household can be defined as 1) adomestic unit consisting of the members of a family who live together along with nonrelatives such as servants. And 2) The living spaces and possessions belonging to such a unit.

This chapter therefore provides an overview of interventions that can be undertaken by the community themselves i.e. what community members or even family units can do on their own at the household level to manage floods and therefore reduce damage.

Why Household Interventions?

When the community members take responsibility and implement household level flood management then the following benefits can accrue from such noble intervention:

- i. Protection of lives during floods i.e. reduction on human casualty;
- ii. Protection of assets i.e. reduction of economic losses;
- iii. Enhancement of community responsibility;
- iv. Develops community resilience; and
- v. Enables quick recovery from the adverse impacts of natural disaster.

3.3 Pre-flood phase (before floods)- preparedness

a) Flood early warning information and communication systems

Before floods especially riverine floods occur there are always flood early warnings issued either by nature or by relevant stakeholders. Nature warns us by appearance of certain bird species, croaking of frogs etc. Relevant stakeholders issue alerts through radio, chief's baraza etc.

The following activities are important to be observed at household level:

- ✓ Regularly listen to radio or watch TV other sources of information to keep yourself abreast of facts on weather and flood watch alerts and ensure that your family also are informed of daily weather condition and relevant warnings.
- ✓ Do not question the warning information but rather follow such warnings religiously.
- ✓ Do not be selfish with the received information but rather share information with your neighbors.
- ✓ Have and keep contact information of your relatives, village elder and sub-location chief.
- ✓ And know the nearest health-care centre, evacuation places and rescue post available.

b) Building capacity and raising awareness

- ✓ Learn previous flood experience and preparedness undertaken during those floods.
- ✓ Understand that dynamism is key to any success and therefore update regularly the experience of flood preparedness.
- ✓ Develop a flood plan Have a plan for emergency situation.
- ✓ Swimming can be what saves someone's life therefore regularly build and improve your capacity of swimming.
- ✓ Share with your family members of the planned flood preparedness activities.

c) Asset and life protection

- ✓ Know the usual flood depth of the area and ensure that the levels of houses are raised above expected flood level.
- ✓ Ensure safety tools such as canoes and anything that can assist in floating such as life-jackets are available or easily accessible.
- ✓ Build separate and highly raised up places for poultry to protect them from floods.
- ✓ Build embankments around the homestead and skirting around the house to keep flood water out of your compound and your house.
- ✓ Assign roles and tasks for family members.
- ✓ Closely tie furniture to prevent them from being swept away by flood water and also hang utensils on the ceiling to prevent them from being swept away during floods.
- ✓ Move livestock to high raised areas.
- ✓ Keep your books in water-resistant bags and keep them in above raised places.

d) Food and health safety

- ✓ Store firewood i.e. collect and tie firewood and store them at places above the flood depth.
- ✓ Store food, water, medicine for man and animals and keep them at places above flood depth and ensure that the stored materials are easily accessible during floods.
- ✓ Store water treatment tabs like aqua tabs and water guard.
- ✓ Plant vegetable in pots and raise them by tying the pots up above the flood depth.

e) Community activities

- ✓ Join community based groups like WRUA and CFMO and other volunteer groups and support community activities where possible.
- ✓ Be quick to assist your neighbor by knowing and understanding their vulnerability especially for old persons, disable person, children and expectant mothers.

f) Evacuation

- ✓ Participate actively during community based evacuation drills.
- ✓ Understand the evacuation plan and follow the direction therein and support others during evacuation.
- ✓ Understand and know the evacuation routes.

- ✓ Ensure bringing safety objects such as life vest,
- ✓ Actively evacuate before the transport networks are disrupted.

3.4 Flooding Phase (during Floods): - response

Flooding phase is characterized by response to floods. The affected families respond to floods by evacuating while the stakeholders respond to floods by offering assistance to the affected families. During Flooding phase major activities are monitoring and taking action for emergency situations. The following activities should be undertaken:

- ✓ Strictly prohibit luxurious swimming or boat rowing i.e. do not allow children to go swimming or boating in swollen rivers, canals, lakes
- ✓ Ensure that children do not play around the banks of rivers, canals, water pans etc.
- ✓ Watch out for snakes and other poisonous animals in flood water.
- ✓ When going out to the field ensure that at least you go out with another person.
- ✓ When pupils leave school for home or vice-versa ensure that the pupils walk in group and never alone.
- ✓ Monitor rains and flood levels at all times.
- ✓ Regularly pay attention to special members in family such as young children, old persons, disable persons or pregnant women.
- ✓ Regularly check the safety of animals, drinking water, food, medicine etc.
- ✓ Regularly check the safety of fences, house.
- ✓ Get transportation means and safety equipment ready.
- ✓ Properly treat water and food before use to prevent epidemic.
- ✓ Always update family members on situations of flood for taking proper actions on time.
- ✓ Rearrange all things to adapt the change of flood level.
- ✓ Make decision and evacuate on time if necessary.
- ✓ In emergency case, call the nearest health station or rescue post.

The following activities should be undertaken when living at evacuation places:

- ✓ Ensure all family members are safe and present at evacuation place.
- ✓ Ensure you that you name is registered at the evacuation place
- ✓ Consciously abide by the safety measures, rules and regulation set at the evacuation place.
- ✓ Do not go back home until you confirm that it is safe to go back.

3.5 Post Flood Phase (After Floods): - Recovery

Everything that has a beginning must have an end. Floods come and eventually they go away. After the floods the activities are geared towards recovery and rehabilitation. The following activities should be undertaken:

- ✓ Support neighbors who need help
- ✓ Join relief activities or provide relief to community.
- ✓ Restore back the evacuation place to the orderly state as you found it when you moved at the evacuation place.
- ✓ Set up rehabilitation plan and ensure safety of all family members.
- ✓ Identify priority activities.
- ✓ Assign works to family members.
- ✓ Prepare/mobilize resources and support.
- ✓ Ensure that your house is safe and there are no poisonous animals residing there as a result of your absence.
- ✓ Ensure and maintain good sanitation and hygiene.
- ✓ Carry out damage assessment
- ✓ Prepare a check-list with a priority order, such as rehabilitating the toilet, cleaning house, etc.
- ✓ Restore as planned from the list.
- ✓ Look for external support where necessary.

Chapter 4: Flood Safety Measures in School

This chapter focuses on helping the teachers and pupils to not only get acquainted on flood safety measures in school but on what they can do to ensure their safety and safety of those affected by floods. Measures are the activities a person, institution etc. can undertake to mitigate the problem.

4.1 School flood safety measures

There is always something that someone can do to solve a problem no matter how little or how big the solution(s) may be. Therefore it is imperative to have that kind of mind-set as a school community that there is something that the school community can do during flood problem. There are measures that can be undertaken during floods at the school level to ensure the safety of its pupils, teachers, staffs, infrastructure and equipment. The main roles that the schools can play in managing floods can be described as follows:

- ❖ **As core of public awareness raising**– through parent, student and teacher networks
- ❖ **As evacuation places**, if the schools are located on higher ground.
- ❖ **As a support system to the young**, when flood victims are of school age.

There are specific preparedness measures that can be undertaken by the school to at least ensure safety its occupants (pupils, teachers and staffs) or even to facilitate recovery from flood disaster. These activities are as listed below:

Before flood activities

- ✓ Understand the flood history of the area.
- ✓ Familiarize yourself with the geographical features of the area where the school is.
- ✓ Always have mobile contact local flood disaster management unit.
- ✓ Develop a school disaster management plan and share it with the students and parents. The plan should clearly define actions to take in case of hazards (not just flood).
- ✓ Teach and train pupils on basic first aid and water rescue (or other life saving techniques, depending on the frequent hazard in the area).
- ✓ Sensitize school pupils on safety measures at household level as part of the school lessons.
- ✓ Help students to brainstorm on family safe plans. Invite subject experts to school and hold seminars on health care during the flood season.
- ✓ Provide health related information, especially on water borne diseases caused by flood water, to pupils, teachers, school staff and parents. Invite subject experts to school and hold seminars.
- ✓ Paste an emergency contact list on a noticeboard including contact details of local emergency management agencies. It should be shared with the students and their parents.
- ✓ Organize evacuation drills and exercises for pupils.
- ✓ Develop an inventory for the schools properties.
- ✓ Identify safe areas within the community and address safe evacuation routes for evacuation. This is particularly important in case of quick as well as slow onset disasters.
- ✓ Update flood information and effective emergency response measures so that pupils and teachers know and actively prepare for.
- ✓ Keeping abreast of facts at all times by school staffs and pupils by continuously listen to radio for flood information and contacting relevant stakeholders like WRMA, Kenya Red Cross Society and WRUA.
- ✓ Teachers and pupils should open up drainages and ensure that all the drainages will allow easy flow of water.

During flood activities

Upon receiving the flood warning,

- ✓ At the issuance of the first warning, arrange equipment and books in safe places. Remove and tie tightly all the heavy objects that could be moved by flood water and cause damages.
- ✓ When the warning is issued do not push the pupils to still go to school but allow them to be away from school but encourage them to study even when they are not at school.
- ✓ Have a full register of all the pupils in the school at the time of warning and ensure that they are protected from danger.
- ✓ Make announcement of the school closure to the community and giving reasons to why the school shall remain closed and inform the parents to take good care of their children such that none of the pupils abscond with school after the floods.
- ✓ Have a plan to protect school's properties during the flood season.
- ✓ Switch off all power supply mains to prevent electrocution and associated fire hazards.
- ✓ Assign staffs to be on shift and ready to respond to flood.

If the school is used as a safe shelter,

- ✓ Keep first aid kit ready.
- ✓ Reserve drinking water.
- ✓ Make sure the school floor is higher than the anticipated flood level.
- ✓ Identify how many people can stay at the school and inform the local authority to ensure that school resources are not overstretched.
- ✓ Raise the level of toilets in the school area.
- ✓ Keep a portable radio powered by battery.
- ✓ Keep flash lights (at least 2) powered by battery.
- ✓ Know the routes to a safer area in case the flood is more severe than expected.
- ✓ Have means of transportation such as boats, small boats, etc. to be ready for evacuation if necessary.

After the flood

- ✓ Clean up the classrooms thoroughly to make sure all objects in touch with contaminated flood water are now clean and tidy. Seek help from students and the communities
- ✓ Assess and record all damages, identify needed supports, and report to the education authority for immediate repair.
- ✓ Announce the school's reopening dates to the community and inform the parents to ensure that all their children go back to school.
- ✓ Organize activities where pupils can help in community rehabilitation efforts.
- ✓ Beside the Government's supports, the school should mobilize more supports from private organizations as well as mass organizations to help the school recover quickly.
- ✓ Reach out to the affected families especially pupils and offer counselling services to help them overcome the trauma.
- ✓ Seek for pupils whose name were in the register before floods but are no longer attending classes.

Supporting the flood affected staffs and the students

- ✓ Keep records and analyze the number of students and staffs who are affected by flood.
- ✓ Provide support to affected staff and students. Have a school-wise support plan.
- ✓ Provide students opportunities to express their feelings. This can help them overcome the trauma of loss and grief.

- ✓ Relief activities from political and social organizations.
- ✓ Provide activities to reduce trauma, such as writing essays, art projects and etc. Younger kids who have difficulties in expressing their emotions can apply this way to release stress.
- ✓ Contact parents or relatives of affected pupils and staff. By working together, healing process can be quicker.
- ✓ Train teachers and staff on psycho-social care and support for disaster victims. To be able to recognize children's reaction to traumatic situations can help formulate an appropriate support system.
- ✓ Have experience sharing section in the class where students can freely share their own personal experience and receive peer support.

Head teacher and other senior staffs

- ✓ Be ready to give command and instructions on response activities after flood.
- ✓ Establish the linkage among local authority, other affected schools in the province/district and the local disaster management agencies to do damage inventory and have support activities accordingly.
- ✓ Provide extra support to students and staff with deceased in the family and hold memorial services as appropriate.
- ✓ Provide direct interventions.

4.2 Safety on the way to school

4.2.1 - Flood risks and ways to school

The main means of transportation during flood season are boats and canoes.

In rural and border areas, many pupils have to go to school by small boats through long rivers and large fields, without life vests or floating things. Without equipping enough skills to respond to emergency situation during flood season, children become the most vulnerable group in community.

4.2.2 - Safety measures on the way to school

Safety on the way to school is the top important objective of education management during flood season. *What should we do to ensure children's safety on the way to school during flood season?*

- ✓ Organize taking children to school and back home by safe means of transport such as not over loaded, equipped enough with life vests, and means of communication when necessary (Mobile phone, loud-speaker).
- ✓ Continuously follow up warning information and do not go sailing while it has signal of storm, whirlwind
- ✓ Select the route not much affected by flood. Keep away from strong flow. Be careful when crossing bridge, canal junction - strong current.
- ✓ Do not go on the uninhabited route. Should go on crowded route, with a lot of trees to have support when necessary
- ✓ Do not go through exposed fields.
- ✓ Assign tasks before starting see off and pick up children.
- ✓ If children can go to school by themselves, parents and teachers should help children to assess the level of safety and have necessary safety requirements for them.

Children should be active themselves!

- ✓ Learn to swim and become good swimmers.
- ✓ Equip themselves with life-vest or floating things when going out.
- ✓ Obey the safety waterway regulations.
- ✓ Learn how to save drowning people. Be ready to help others when necessary.

- ✓ In emergency situation, it's easier and more active with tidy clothes and suitable books

Chapter 5 - Flood Early Warning System

5.1 What is an early warning system?

In the Bible the Book of Genesis Chapter 7 the world experiences floods leading to heavy losses until in Chapter 8 God says He will never again use flood water to punish the inhabitants of the earth. Key lesson is the power that is in water and when it comes as floods it causes huge destruction. It is therefore, important that the people living in flood prone areas should ideally have a clear understanding of the signs that nature issues as flood warnings before floods occur.

There are several warnings that are observed by communities living in the flood prone areas immediately before floods. An early warning system is to alert population under threat of a potential disaster (in this case a damaging flood) in the near future, and serve as starting points for individuals and groups to make decisions and take timely protective actions.

In Gucha Migori river basin the following signs are warnings that warn us of the impending floods:

- a) Increased peculiar (strange croaking) noise of frogs croaking like in the story of KodhUhuru when the boys heard the frog croaking it was a warning of impending floods;



Peculiar noise of frogs



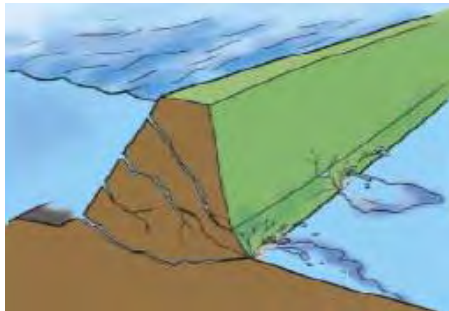
Strong Eastward winds

- b) Strong wind blowing like in the story of KodhUhuru after the children had narrated their experience the wind began blowing and trees whistled as a result of the winds;



Certain species of birds

- c) Appearance of certain species of migratory birds, locally known as "Okok" and "Wiwi" like in the narrative above we saw the boys caught new species of birds that they had never seen before;



Rising of river water level

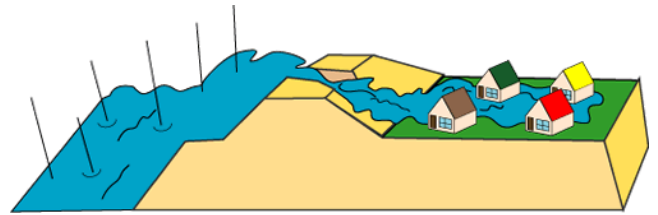
- d) Rising of river water level in the narrative the girl at the river saw that the river water was rising high;

- e) Foaming of river water with flotsam;



Flotsam and foam

f) Noise of overflowing water like in the above story of KodhUhuru the girls heard the noise of the river booming like they had never heard before



Overflowing water

5.2 -What are flood warning and forecasting?

It is a message informing of the impending danger (flood), i.e., when water level is higher than the warning level.

5.2.1. Flood Forecasting– Content of Flood warning

a) Floods

- ❖ Croaking of frogs
- ❖ Migration of birds, locally called *opiga*
- ❖ Cloud patterns in the atmosphere
- ❖ Changes in the wind blow patterns (sea breeze)
- ❖ Loosing of leaves by a species of trees 'ngou'. This happens before flood.
- ❖ Flight of white birds called 'Okok'
- ❖ Red ants come to the earth surface
- ❖ Increase in the volume of water in the river
- ❖ Presence of a certain type of termite called 'Onyoso'
- ❖ Information from the meteorological department through radio, TV and provincial administration.

b) Drought

- ❖ Movement of butterflies
- ❖ Swarming of grasshoppers 'Kungu' that feeds on vegetation
- ❖ Too much sunshine (La Nina)
- ❖ Presence of cold wind
- ❖ Presence of mud fish in large numbers
- ❖ Migration of birds especially weaver birds
- ❖ Shedding of deciduous trees

c) Diseases

- ❖ Colds and flu
- ❖ Untidy environment (presence of bushes ,stagnant water, presence of broken tins and pots)
- ❖ Contamination of water from the source.
- ❖ Presence of grasshoppers (gnats). Worms (Kungu).
- ❖ Natural drought
- ❖ Cold winds during

Chapter 6: Common Diseases during flood season

This section can be used to teach pupils and students at primary and secondary school respectively.

6.1. CAUSES AND TREATMENT FOR DIARRHOEA

Clues for primary school children

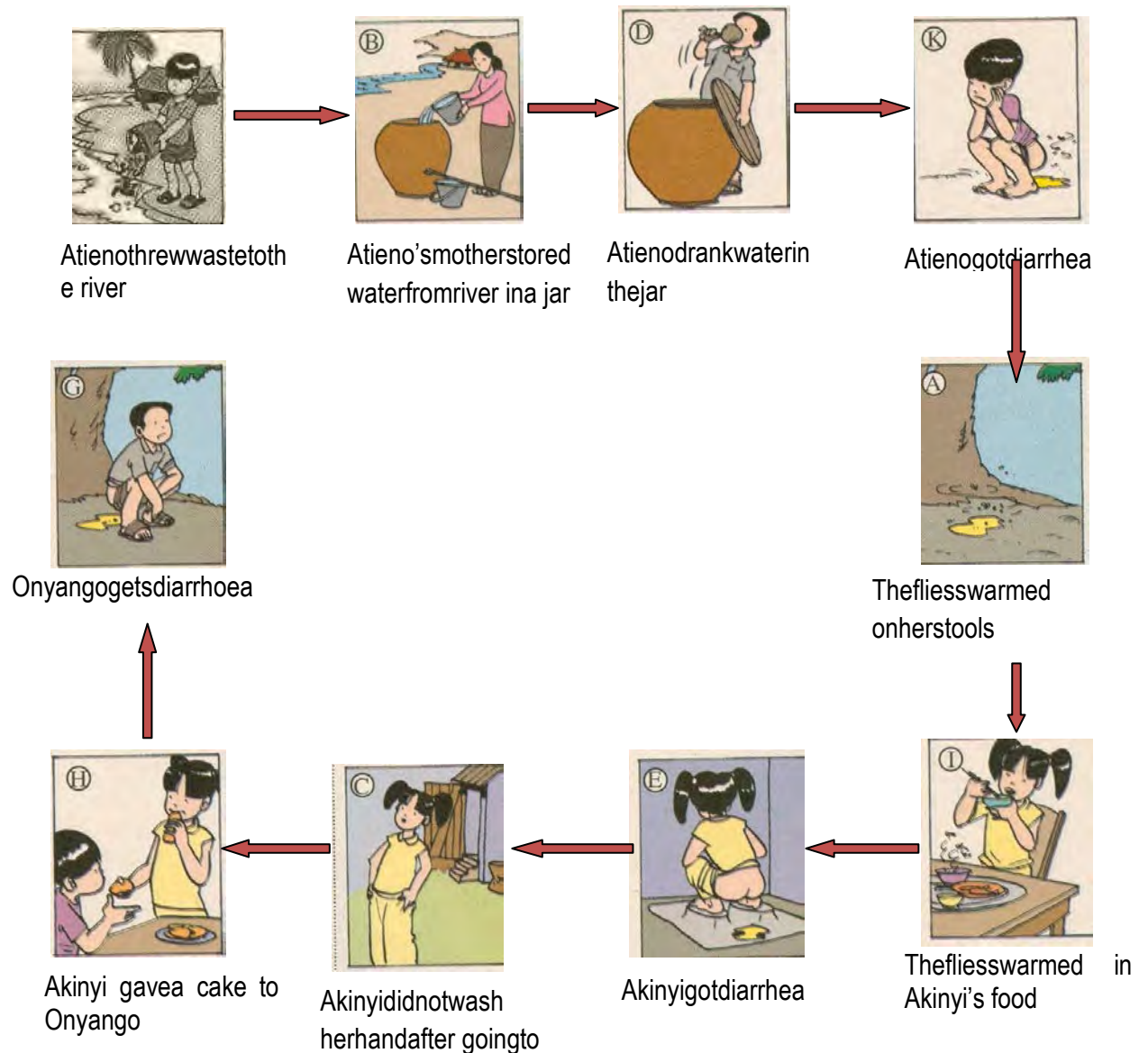


Figure 7 Description of spread of diarrhea

How to prevent diarrhea:

Table 2 How to prevent Diarrhea

<i>Cut the following messages and put in a suitable position in the above story</i>	<i>Keys</i>
Wash hands before eating and after visiting toilets	<i>Between picture No 8 and 9</i>
Put garbage in the dustbin	<i>Between picture No 1 and 2</i>
Use hygienic toilet	<i>Between picture No 4 and 5</i>
Keep food off flies	<i>Between picture No 6 and 7</i>
Drink boiled water	<i>Between picture No 2 and 3</i>

6.2. ACUTE DIARRHOEA FOR CHILDREN

1. How can you know a child got diarrhea?

Answer:

- ✓ Visit toilet more than 10 times per day.
- ✓ Watery feces.
- ✓ Feces has a sour smell.
- ✓ Blood in feces or mucus in feces.
- ✓ Continuously vomit or a few times per day. It often happens after a meal.
- ✓ Maybe the child got fever.
- ✓ Refuse to eat.

2. What is the harm of diarrhea?

Answer:

- ✓ May die.
- ✓ May get malnutrition.
- ✓ Easy to get other diseases.

3. What is the cause of diarrhea?

Answer:

- ✓ Eat or drink food contaminated with bacteria causing diarrhea.

4. How to prevent diarrhea?

Answer:

- ✓ Eat and drink safely.
- ✓ During the first 4 months of the baby's life, always feed them with breast milk.

5. What are safe eating and safe drinking?

Answer:

- ✓ Food and drink must be washed and cooked properly.
- ✓ Food and drink must be fresh and clean.
- ✓ Keep food off flies.
- ✓ Wash hands properly before touching food.

6. What do you do when your child gets diarrhea?

Answer:

- ✓ Give children plenty of water especially ORS liquid, and let them drink gradually.
- ✓ Feed children as usual (Breast milk, fruits and food)

7. How can you have ORS liquid?

Answer:

- ✓ Buy it at a drugstore.

- ✓ Dissolve 1 sachet of ORS with 1 liter of boiled water. Must dissolve the whole sachet at one time.

8. If you can't get sachet of ORS you can make it by yourself with the following formula:

Answer:

- ✓ 1 tea spoon of salt.
- ✓ 1 liter of boiled water
- ✓ Put everything in one bottle and then shake

9. We can feed the child with salt gruel.

Answer:

- ✓ 6 bowls of water
- ✓ 1 handful of rice
- ✓ 1 pinch of salt

Put everything into a pot and cook around 15 minutes, then get the salt gruel liquid for the child to drink or eat if they want.



All needed thing to make salt rice soup



Six bowls of water



A handful of rice



A pinch of salt

10. After dissolving ORS, we can use it during the day after 24 hours. If there is some left over, we should throw it away.

11. What should we do when a child vomits?

Answer:

- ✓ 10 minutes after vomiting, the child should be given ORS liquid.

12. If the child still got diarrhea and vomits, what should we do?

Answer:

- ✓ Take the child to hospital.

6.3. FEVER

1. What is fever?

When the temperature of the body is over 37°C is so-called fever. When a child gets fever, we should follow up his/her temperature regularly.

2. Is fever a disease?

No. It is the resistance of the body to disease-causing substances and agents.

3. The cause:

- ✓ Virus, bacteria (Flu, cold...)
- ✓ Strange protein (i.e. when having vaccine)
- ✓ Other causes such as when a baby has milk teeth, loss of water when suffering diarrhea, and so on.

4. Levels:

- ✓ Minor level: from $37.5 - 38^{\circ}\text{C}$
- ✓ Average level: from $38 - 39^{\circ}\text{C}$
- ✓ High level: from $39 - 40^{\circ}\text{C}$
- ✓ Very high level: over 40°C

You have to use a thermometer to take the temperature of the body. For baby and children it is good to take temperature at the anus if taking temperature at the armpit, add 0.5°C to the shown number from the thermometer.

5. What should we do when a child gets fever?

- ✓ Take their clothes off.
- ✓ Let them lie down at cool and quiet places with fresh air but not windiness.
- ✓ Give them plenty of water, fruit juice, and should feed them easy-digested food such as gruel and soup. When they've got fever they don't want to eat. Therefore we should feed them many times per day.
- ✓ When the temperature is over 38°C , we should clean the child's body to reduce fever. (See the next section)
- ✓ We can give the child medicine to reduce fever such as Paracetamol.

N/B: Don't give medicine which contains Aspirin. It is good to follow the advices of the doctor if you can visit one.

6. When should we take a child to the hospital?

- ✓ The fever lasts more than 3 days.
- ✓ High fever level (39-40°C) with pale complexion and suffocating
- ✓ Fever with diarrhea, stomachache or painful joints
- ✓ Fever with rash, bleeding and jaundice.
- ✓ Fever with stiff neck, swelling fontanel vomiting and convulsion.

Instruction on reducing Fever by using a Wet Towel

Requirements:

- ✓ 1 basin of warm water
- ✓ 3 clean towels

Procedure:

- ✓ Take off the child's cloths.
- ✓ Let the child lie down at cool and quiet places with fresh air but not windiness
- ✓ Deep 2 towels into warm water and then squeeze them and put one on the armpit and one on the groin of the child at the same side. Use the third towel to clean the child's body and face.
- ✓ And then swap the side.
- ✓ Turn the child to one side to clean the back.
- ✓ Clean the child with warm damp towel in 15 minutes, and then check the temperature of the child. If it is ok we use dry towel to dry the child's body.



All necessary things for reducing fever



Put warm damp towel on the child's armpit and groin



Use warm damp towel to clean the body



Turn to one side to clean the back

CHAPTER 7: SCHOOL FLOOD SAFETY PROGRAM

This chapter aims at introducing the steps to be followed when conducting School Flood Safety Program and how to organize festival such as School Flood Safety Day. For purposes of our study we can state that there are five(5) steps to be followed and they include:

- ✓ Assessment of Flood Risk in schools
- ✓ Developing School Flood Management Plan
- ✓ Teacher orientation on Flood Hazards
- ✓ Students orientation on Flood Hazards
- ✓ Designing public awareness activities in school.

7.1-Assessment of Flood Risk in schools

7.1.1. Why flood risk should be assessed in schools

- ✓ To review status of capacity and vulnerabilities of your schools
- ✓ To identify what are the risks can be happened to your schools during flood season.
- ✓ To forecast strength of flood and capacity of your schools to cope with flood
- ✓ To identify vulnerability in both your schools' facilities and students
- ✓ To have a proper school flood management plan to strengthen capacity of your schools and better emergency response approaches.

7.1.2. Sample of school flood risks assessment form

School impact assessment form

School name:.....

County:.....

Sub-county:.....

1. General information:

1.1. Teachers information

Table 3 Sample of Teachers Information Form

Total	Male	Female	No. of persons trained on flood hazards		No. of persons who need support	
			Male	Female	Cannot swim	others

1.2. Pupils information

Table 4 Sample of Pupils Information Form

Total	Male	Female	No. of pupils trained on flood hazards		No. of pupils who need support	
			Male	Female	Cannot swim	others
STD 1						
STD 2						
STD 3						
STD 4						
STD 5						
STD 6						
STD 7						
STD 8						

1.3. Status of school facilities:

Q.1. a) Has your school ever been flooded during flood season in last 3 consecutive years?.....

b) If yes, how high was the water level?.....

Q.2. How many pupils in your school drown during last flood season?.....

Q.3. How far is your school from the main road?.....

Q.4. a) Is your school near a river?.....

b) If yes how far is it from the river?.....

c) How dangerous is the river?.....

d) Are there any safety signals installed?.....

Q.5. a) Do pupils go to school during the flood season?.....

b) If yes how do they manage to reach the school.....

Please tick where appropriate with reference to the state of your school.

Table 5 Sample of Form for the status of the School

1.	The walls of the school are made of	concrete	wood	soil	thatch	
2.	The roof of the school is	tiles	tole	Corrugated iron	cottage	
3.	The floor of the school is	tiles	cement	soil		
4.	The school is	new	old	strong	weak	Nearly collapsed

Q.6. How efficient is the communication system in your school?

- (i) Good
- (ii) Not good

Q.7. (a) Does your school have lifesaving equipment like life-vests, school map for emergencies, any means of transport?

- (i) Yes
- (ii) No
- (b) If yes specify.....

2. Flood risks and vulnerabilities assessment:

2.1. General information on impacts of flood in previous year

2.2. Forecasting strength of flood in the year

2.3. Items maybe affected by flood

Table 6 Sample of Form for Vulnerability Assessment

No	Items	Unit	Quantity	Remark

2.4. Identify who are vulnerable? Why

Table 7 Sample of Form for Vulnerable persons

No	Name	What are risks?	Why?	Remark

3. Recommendation:

Table 8 Sample of Form for Recommendations

No	Items	Activities	Expectation	Responsibilities	Cooperation
	Structural measures					
	Non-structural measures					
					

7.2-Developing School Flood Management Plan

7.2.1. School Flood Management Plan:

This is a list of activities that teachers and students agree to follow before, during and after flood. A school flood risk reduction plan identifies activities to reduce flood related risks in a school. It has been shown that those affected by flood are the ones best able to deal with a disaster, therefore the school contingency plan builds on this coping strategy ensuring that the teachers and students are better prepared for disasters. It must be ensured that different school children and teachers are represented and will have a voice in the contingency planning process. This will contribute to the school owning and sustaining the plan.

7.2.2. Steps to make a School Flood Management Plan

Step 1: Identification of objectives of the plan

- ✓ To make the school secure against flood.
- ✓ To plan and implement flood reduction activities in the school.
- ✓ To effectively prepare and respond to flood.
- ✓ To train and build awareness among students, teachers, parents and School Management Committees about flood.
- ✓ To coordinate with local government offices and other emergency services.

Step 2: Formation of School Flood Management Task Force

Group 1: School Flood Management Board

- ❖ School Management Board (Principal, Vice principal, General Secretary, etc.)
- ❖ Group of former teachers
- ❖ Group of active students

Group 2: Local agency partners

- ❖ Red Cross
- ❖ World Vision
- ❖ Youth
- ❖ WRUAs
- ❖ Blue Cross
- ❖ Women union
- ❖ Health

N/B: Assign responsibilities of each group, group members in accordance to each period of flood.

- ❖ For example: before flood, group A is responsible to organize training for teachers and students while group B is designing public awareness activities, etc.

Step 3: Assessment on school flood risk impacts

- ✓ Resource inventory
- ✓ Assessment on hazards, vulnerable and capacity at school level
- ✓ Identifying risk, possible problems.
- ✓ Solutions.

Step 4: Preparation of School Flood Management Action Plan

- ✓ Before flood: including preparedness activities (structural and non-structural measures) such as upgrading school yards, building school fences, facilities, safety equipments, training for teachers and students on flood hazards, public awareness activities, swimming lesson for school children, etc.
- ✓ During flood: including response activities. Activities for emergency situation should be highlighted. Increasing close cooperation with other local agencies partners as mentioned in the list above to cope with emergency more effectively.

- ✓ After flood: including recovery activities. School Flood Management Board in cooperation with other relevant agencies to review the School Flood Management Plan. Identify strengths and weaknesses of the previous period.

Table 9 Sample of School Flood Management Action Plan Form

Period	Propose DRR activities	Sub-activities	Objectives	Target number	How?	When	What resources?	Person Responsible
Before flood	Structural measures							
	Upgrading school facilities	-School yards -Window -Doors -Roof -Floor etc				
	Safety equipment	-Communication -Life-vest -Transportation means -First aid kit etc						
	Non-Structural measures							
	Capacity building	-Training for teachers -Training for pupils						
	Public awareness activities	-School flood safety campaign -Developing evacuation materials etc	drill					
During flood						
.....								
.....								
After flood								

Step 5: Developing school evacuation map and flood risk map

- ✓ An evacuation map shows safety way in a school.
- ✓ Get students' involvement to develop this map.
- ✓ Teach students how to use the map. Evacuation simulation can be conducted in combination with other school activities.
- ✓ A map showing risks around the school should also be developed to help ensure students safety outside school. And do not forget roles of students in building up materials and activities.

7.3-Teacher orientation on Flood Hazards

Educational institution is a major public infrastructure which can create long lasting impacts on future generation. The overwhelming impacts of disasters on children, particularly those attending schools in times of disaster is the evidence that immediate solutions need to be sought to ensure that children get access to un-interrupted education and their safety improved at home or at schools.

Teachers are considered as the pillars of society with high moral regards. The extent of their influence goes beyond the school boundary and orienting them in flood risk reduction has far-reaching impacts.

Hence, building capacity on flood hazards for school teachers can help reduce vulnerabilities at schools. That leads to more effective education and safer for school children. This approach can be considered enhancing long term development.

In the seminar, teachers are introduced:

- ✓ General understanding on flood hazards and other disaster.
- ✓ Knowledge, experience on flood management at school and household.
- ✓ Health care and early warning system.
- ✓ Discussion on possible activities can be undertaken at schools to educate students and enhance public awareness on flood risk reduction.
- ✓ Evaluation of flood impacts and developing flood management plan at school level.

7.4-Student orientation on Flood Hazard

Children are the most vulnerable group in community. Therefore, equipping them with general understanding on flood hazards and how to cope with emergency situation can help to reduce human loss.

They are effective communication agents in the communities, willing and enthusiastic in sharing knowledge and information without any reservation.

It is expected that after being oriented, school teachers will come back to their schools, together with school management board build up school flood management plan and provide orientation for other colleagues and students in their schools.

Orientation for students can be through extra-curricular and out-door activities, into class activities.

7.5 - Designing public awareness activities in schools

Children's participation should not be seen as an isolated event but a process where children are constantly supported, encouraged and engaged by adults.

To have larger impacts to community's awareness on flood risk reduction, public awareness activities organized by schools should be planned and conducted in cooperation with relevant agencies at local levels.

The objectives of the public awareness activity in schools are not only for their school teachers, staffs, students but also for wider community living in the areas. Event experiences can be shared with other neighboring districts, provinces, etc. for better approaches and effects.

Following is a sample activity which schools can conduct at their schools:

School Flood Safety Campaign Day:

The objectives of Festival on School flood safety Day are to help students and community to:

- ✓ Get to know the geographical features of their school.
- ✓ Get to know the flood features in the region
- ✓ Enhance the communication network.
- ✓ Develop orientation for flood preparedness plan.
- ✓ Update information on flood and measures to cope with flood. Enhance knowledge, experience and skills on emergency management during flood season.
- ✓ Enhance the swimming capacity for children.
- ✓ Review information on flood safety measures.
- ✓ Know how to prevent common diseases in flood season.
- ✓ Identify safe places and routes for evacuation.

Recommended activities:

- ✓ Exhibition of safety objects.
- ✓ Quiz
- ✓ Game,
- ✓ Role-play,
- ✓ Drawing and painting, painting analysis
- ✓ Film show,
- ✓ Experience exchange with local people.
- ✓ Developing school map
- ✓ Identifying flood prone areas to draw map of the channels surrounding and danger warning board.

Chapter 8: First Aid

8.1 Basic First Aid

Basic first aid was taught importance of basic first aid knowledge was discussed. How to conduct basic first aid for cuts, fainting, shock, miscarriages, bites, resuscitation and so on were highlighted to the villagers.

First Aid - this is a help given in the case of accident or sudden illness before the casualty is handed over to the doctor or medically trained person

8.2. Objectives of first aid

- ✓ To save life
- ✓ To prevent further injury
- ✓ To promote recovery
- ✓ To send for medical aid or transport the casualty to medical care

8.3 Role of First Aides

- ✓ History-to give story of the accident or illness
- ✓ Sympathy – any sensation described by the casualty e.g. pain thirsty, faintness
etc.
- ✓ Signs – any unusual features such as swelling or change in the normal body
function

8.4 Resuscitation

This is the basic life support done to rescue breathing

a) Airway

Signs of airway blockage:

- ✓ Abnormal breathing e.g. snoring
- ✓ The casualty may become agitated
- ✓ Paradoxical chest movements
- ✓ Increasing effort in breathing

b) Rescue breathing

- Safety : ensure that the area is safe for you, the casualty and bystanders
- Response : gently tap the casualty on the shoulders and give simple commands e.g. open your eyes.
- Airway : check inside the mouth for any obvious obstruction and clear if possible.
- Breathing : look, listen and feel for seconds. If there is no breathing start rescue breathing as follows:
- ✓ With the casualty lying flat, put the head backward (head tilt) and support the jaw using the “pistol grip”
 - ✓ Breathe into the casualty's mouth and watch for the chest to rise.

- ✓ If the pulse is absent, start cardio pulmonary resuscitation (CPR) i.e. two effective mouth breaths and thirty chest compression (30:2)

8.5 Airway Disorders (Chocking and Drowning)

- a) Chocking is caused by inadequate chewing of food or through attempting to eat while talking. This can be controlled by properly chewing of food and avoiding talking while eating.

In children chocking is caused by swallowing small objects such as marble, peanuts or small buttons, hence they should be protected from them.

First Aid procedure for Adult and Children is as follows

i) Backblows

- ✓ Lean them forward with their head and shoulders down and hit them firmly between the shoulder blade three times (incase of adults use your arms while incase of children use three middle fingers.)

ii) Upright abdominal thrust

- ✓ stand behind the casualty with one between the ribs
- ✓ Place the other hand over fist
- ✓ Make inward and upward movements

Sign and Symptoms of airways disorder are:

- i) Weak cry
 - ii) Infective cough i.e. one that fails to dislodge the object
 - iii) Difficulty in breathing
 - iv) Skin turns blue (sign of inadequate oxygen in the body)
- b) Drowning is caused by obstruction of throat airways by water. There are two experiences of drowning as indicate below:
 - i) This is death caused by obstruction of airway by water
 - ii) Near drowning death after 24hrs while out of water

The First Aid procedure steps are as follows:

- ✓ Life jackets or inflated tubes can be used to save somebody from drowning
- ✓ No compression should be done to the casualty;
- ✓ The victim should be laid down in drowning recovery position.

8.6 Bites and Stings

a) Snake bites

- ✓ Most snakes bite on the ankle or lower leg, therefore thick socks and strong shoes should be worn when walking through long grass or scrubs

First Aid procedure is as follows:

- ✓ Immediately apply firm pressure over the bite site
- ✓ Keep the casualty calm and at complete rest
- ✓ Apply a firm roller bandage over the whole limb i.e. from the fingers /toes to the shoulder/waist
- ✓ Refer the casualty to the hospital

b) Dog Bites

First Aid procedure is as follows:

- ✓ Clean wound with tap water
- ✓ Cover the wound with clean cloth
- ✓ Rest the bitten part (immobilize)
- ✓ Find out on immunization e.g. last tetanus injection given
- ✓ Refer to medical aid

c) Bee Sting

First Aid procedure is as follows:

- ✓ If breathing or circulation fail, start resuscitation at once and seek urgent medical assistance.
- ✓ Apply ice packs to the bite site and seek urgent medical advice
- ✓ After a bee sting, the barb may be felt in the skin. It should be removed promptly by brushing or scraping sideways; never pull the sting out as more venom will be injected.

8.7 Transportation of Victims

These are used when the first Aides is alone

a) Drag

- ✓ Fold the casualty's arms across the chest then grasp their clothing and pull the casualty.

b) Human crutch

- ✓ Stand next to the casualty and place their arm around your shoulders for support. Then place your arm around their back and hold their belt or clothing.

c) Hand seats

- ✓ Hand seats are used when the casualty can help you by placing their arms around your shoulder. This can be used by two First Aides.

d) Stretchers

- ✓ Should be carried by four to six First Aid attendants.

e) Blanket

- ✓ It is used when the casualty cannot walk or help themselves;
- ✓ The blanket is rolled lengthwise for half its width;
- ✓ Lay the blanket next to the casualty;
- ✓ The blanket is rolled at the same time both sides and
- ✓ Gently roll the same time following the commands with one person supporting the head.

8.8 Bleeding and Wounds

a) External bleeding: this is where the blood is seen oozing out and an open cut is left on the body.

First Aid procedure is as follows:

- ✓ Wash the wound if bleeding isn't excessive;
- ✓ Stop the bleeding by applying firm pressure on the wound with the casualty at rest and then
- ✓ Refer the injured person to the hospital

b) Internal bleeding: this is where there is bleeding as a result of internal organ injuries that cause a major bone for example pelvis to break

Signs and symptoms:

- i) Complain of pain, tenderness and swelling in the affected area and may show signs and symptoms of shock
- ii) Blood may be seen if it is coughed up or vomited or if it escapes through the ear, nose or body openings

First Aid procedure is as follows:

- ✓ Help the casualty to lie down in the most comfortable position
- ✓ Raise the legs if injuries permit
- ✓ Apply direct and indirect pressure
- ✓ Loosen any tight clothing at neck and waist and cover the casualty lightly to maintain body temperature

8.9 Foreign Bodies in Eyes, Ears and Nose

First Aid procedure of the following organs is as follows:

a) Ears

- ✓ Pour clean vegetable oil (salad)
- ✓ Let the casualty rest with the affected ear facing down
- ✓ Refer to medical personnel

b) Eyes

- ✓ Pour clean water and let it flow out with the object
- ✓ Be careful and don't allow it flow to the ears or other eye.

c) Nose

- ✓ Let the casualty block the other nose and blow
- ✓ If no change refer to the hospital

N/B never use objects like needles, match box sticks and the likes to remove foreign bodies, this may cause further injury.

8.10 Emergency Child Birth

a) This is an unplanned /sudden way of giving birth. Miscarriage can also be referred to as an emergency childbirth.

b) Emergency childbirth / miscarriage can lead to death through excessive bleeding if not taken well care of.

- ✓ Fainting- this may be caused by bad news or nervous excitement or injury and illness. The casualty looks shocked, feels faint and dizzy and may collapse Put the casualty in a comfortable position
- ✓ Make a pad and apply pressure on the bleeding place (padding)
- ✓ Refer the casualty to the hospital immediately.

8.11 Fainting and Shock

- a) Fainting- this may be caused by bad news or nervous excitement or injury and illness. The casualty looks shocked, feels faint and dizzy and may collapse

First Aid procedure is as follows:

- ✓ Lay the casualty down and raise the legs
- ✓ Loosen any tight clothing at the neck and waist
- ✓ Food and drinks should not be given
- ✓ Seek medical attention

- b) Shock- this is caused by reduced flow of blood through the body. Severe vomiting serious bleeding can cause shock.

Signs and Symptoms

- i) Feeling faint or looking pale;
- ii) Cold and clammy skin;
- iii) Weak and rapid pulse;
- iv) Feels sick and may vomit;
- v) May be thirsty from loss of body fluids and
- vi) Unconsciousness

First Aid procedure is as follows:

- ✓ Loosen any tight clothing at the neck and waist
- ✓ Keep the area quiet and allow the casualty plenty of fresh air
- ✓ Cover the casualty lightly to maintain body temperature but do not overheat. Protect the underneath surface of the body from heat or cold.
- ✓ Comfort and reassure the casualty while checking all injuries that have been found and manage.

REFERENCE

- Askew, A., (1991) "Learning to live with floods", in Nature and Resources, Vol. 27 No. 1, p.4-8
- Cuny, F.C., (1999). "Living with floods"; Alternatives for Riverine floods.
- DMC (1986). Natural Hazards; Causes and Effects.
- University of Wisconsin Board of Regents/IFRC (2000). Disaster Preparedness Training Module.
- Khan, H.R., (2000). "Flood and Flood Preparedness; Disaster management Course, Asian Disaster Preparedness Centre, Asian Institute of Technology, Bangkok, Thailand.
- Smith, K. (1996). Environmental Hazards; Assessing risk and Reducing disaster, Routledge, London UK
- UNDP (1992). Environmental Disaster Management: Preventive and Mitigative measures.
- UNDRO (1984). Disaster Prevention and Mitigation; A compendium of current knowledge, Vol.11, "Preparedness aspects", United Nations, New York.
- U.S. Department of Health and Human Services, Substance Abuse and Mental Health Services Administration.(2000). Training manual for mental health and human services workers in major disasters, second edition.Washington, DC.
- Training course curriculum on Planning and Implementation of Flood Preparedness Program at Provincial and District Levels – Project on Capacity Building for Planning and Implementation of Flood Preparedness Program at Provincial and District levels in the Lower Nyatike Basin (Phase 2) Feb 05 – Apr 06
- School Disaster Management Plan, Children's Participation in Disaster Risk Reduction(CPDRR) Project – Plan Bangladesh Oct 07 – Dec 08
- Booklet of Health Care for Primary School Children - Save The Children Australian –New Zealand
- School Flood Safety Program: Flood Risk Preparation and Reduction "Teachers Information Booklet 2nd Edition- October 2009"
- Flood Disaster Management Textbook for Primary Pupils forThe Project For Building Of Communities' Capacity In Flood Disaster Management (Package 3) Under Nyando Project
- Trainers' Training Manual onFlood Disaster Management for the Project for Building of Communities'

Capacity in Flood Disaster Management (Package 2)

Kenya Red Cross Society (2009) First Aid Training Manual New Edition

World Bank- Emergency Safe water System Handbook

GLOSSARY

Abbreviations, concepts and terminologies

ALERT –Automated Local Evaluation in real time.

CARE- Co-operative for American Relief Everywhere

C.B.O- Community Based Organizations.

CFMO- Community Flood Management Organizations

FAO- Food and Agricultural Organization

JICA- Japan International Co-operation Agency

Japan ODA- Japan Overseas Development Assistance

KRCS- Kenya Red Cross Society

LOGUMI-Lower Gucha Migori

N.G.O- Non Governmental Organizations

UNDP- United Nations Development Programme

UNICEF- United Nation Child Education Fund

WRMA- Water Resources Management Authority

WRUA- Water Resources Users Association

WV-World Vision

Dumping -Carelessly throwing away of unused products (waste) in a place

Earthquake- Great trembling/tremor of the earth

Gradient - the way the land lies especially when it is steep

Landslides- Great mud slide that normally occurs along hillsides

Topography-the way the land lies.

KodhUhuru-The heavy rains that came during independence(1962-1963)

Wailing – Continual weeping

Pensive- Being In great thoughts about something

Lake Victoria (Nam Lolwe)-A mass of water named after Queen Victoria

Predict- To be able to foresee what will happen



JAPAN
Official Development Assistance

1. GENERAL INFORMATION OF THE PROJECT

1.1 The Implementation Agency

Recipient : Government of the Republic of Kenya represented by Water Resources Management Authority (WRMA), Ministry of Water and Irrigation (MWI).

1.2 The Employer

Implementing Agent : Japan International Cooperation Agency (JICA)

1.3 The Consultants

Name : NEWJEC Inc.

1.4 Project

Name : The Project on Capacity Development for effective Flood Management in Flood Prone Areas

1.5 Non-Structural Measures Component

Implementer : Kenya Red Cross Society



Linking nature and people through technology





**Ministry of
Environment, Water
and Natural Resources**



**Water Resources
Management
Authority**



**Japan International
Cooperation Agency**

**MANUAL ON EVACUATION DRILL
FOR
THE PROJECT ON CAPACITY DEVELOPMENT
FOREFFECTIVE FLOOD MANAGEMENT
IN FLOOD PRONE AREA**



July 2014

Japan International Cooperation Agency

NEWJEC Inc.



LINKING NATURE AND PEOPLE THROUGH TECHNOLOGY

Preface



The Government of Kenya established the Water Resources Management Authority (WRMA), through the sector reform brought by Water Act 2002. WRMA is the lead agency in the management of water resources in the country through six (6) regional offices and twenty six (26) sub – regional offices of the respective water resources catchment areas.

Since its operationalization in 2005, WRMA has made significant progress in making water resources recognized as being fundamental for socio-economic and environmental sustainability. In this regard, integrated floods management is viewed as necessary component in water resources management.

Based on the request from GOK, JICA carried out the “Study on the Integrated Flood Management (IFM) for Nyando River Basin (2006 – 2009)” as the Technical Cooperation Scheme and “Programme for Community based Flood Disaster Management to Adapt to Climate Change in the Nyando River Basin (2009-2011)”. This was a Grant Aid Programme with the aim of establishing a flood management system in the southern part or Lake Victoria Basin through IFM, where WRMA was the implementing agency. Through the above projects, community based flood management activities have been implemented through integrating non- structural and structural measures such as community based flood hazard mapping and construction of flood counter measure structures in prioritized flood prone areas.

Based on the achievement of Nyando project, the Project on Capacity Development for Effective Flood Management was formulated to expand IFM in other flood prone areas in Kenya. Three pilot river basins were selected namely: Isiolo, Gucha-Migori and Lumi to promote community based flood management activities. The main purpose of the project was to build institutional framework of flood management in the context of integrated water resource management for effective and sustainable implementation of community based activities. Through the project WRMA has developed strategies and guidelines in managing floods which have since been incorporated in the revised Catchment Management Strategies (CMS) and WRUA Development Cycle (WDC) manual. In order to develop capacity of WRMA officers in the field of community-based integrated flood management, a training system has been developed where the Project conducted IFM Training for WRMA officers who in turn trained the WRUAs. The Training Materials for community based flood management have been developed. These include supplemental manuals, lessons learnt and case studies.

A handwritten signature in blue ink, appearing to read 'John P. Olum'. The signature is stylized and written on a light blue background.

Eng. John P. Olum, HSC
Chief Executive Officer, WRMA

ACKNOWLEDGEMENT:

Community based Flood Management was implemented in the Nyando River Basin and various manuals were developed as outputs including the evacuation drill guidebook. This guidebook therefore takes cognisance of the previous work done and acknowledges that this guidebook has borrowed heavily from the previous evacuation drill guidebook under the Nyando Project.

PROLOGUE:

The Role of WRUAs in Flood management

The Water Resources Users Association (WRUA) are organizations that work closely with Water Resources Management Authority (WRMA) at community level. The WRUA are mandated by an Act of Parliament to be an organization at community level that is mandate in engaging in water resources management at sub-catchment level. Currently Flood Management is one of the mandate of WRMA and therefore by extension WRUAs.

The WRUAs operate within the WDC Module and are therefore required to develop Sub-catchment Management Plan (SCMP). It is therefore within the SCMP that the WRUAs are able to come up with strategy on how to manage floods within there sub-catchments. But in summary the role of WRUA in Flood Management entails:

Developing Community Flood Hazard Maps:It is salient this map be drawn for effective risk reduction strategies to be developed. These maps should clearly show local resources, routes of evacuation and tools used for interventions like evacuation signboards and places of medical care. In essence the hazard maps like Flood Hazard Map should assist in the preparing of plans which can reduce the danger in a community.

Coordination and communication during floods: This involves utilization of emergency communication network before, during and after disaster and the roles that each organization is active in. It also involves coordination procedures between the community and the District Disaster management Committee and the Relief Agencies in the area. The WRUA should be involved in Information dissemination and activity of stakeholders before, during and after the floods.

Contingency planning:This is defined as a forward planning process in a state of uncertainty or emergency whereby scenarios and objectives are agreed upon. In order to achieve this it will require that the managerial and technical aspects be defined and potential response systems put in place in order to prevent or have a better response to an emergency. The process involves: Analyzing potential emergencies and their humanitarian impacts; prioritizing potential emergencies; develop appropriate plans, including establishing clear goals, setting objectives, policies and procedures to deal with prioritized potential emergencies; and ensuring necessary preparedness measures and follow-up action taken.

Evacuation:This is defined as moving from areas affected by floods to raised dry places for safety purposes. The process of evacuations begins with the discovery of the impending floods or by occurrence of the floods in the area.

During these periods of floods the inundated water results at times results into epidermis especially waterborne diseases. WRUAs as community based association that are involved in the management of water resources have a big role to play during flood disaster. WRUAs can involve and engage the communities in preparation of flood disaster by carrying out evacuation drills.

Survey of the Structural measures in place: WRUA officials carry out a survey of the existing structures in the villages thereafter draw the contingency plan on how to improve the structures and thereafter engage other stakeholders in effort to commence improvement of these structures in readiness for floods. WRUA thereafter assist the communities in opening up Blocked Drainages and desilting of river channels and water pans, reconstruction of the breached dykes by sandbags and any other mutual assistance that WRUA can manage to help the communities with.

Flood disaster is divided into three major phases the pre-disaster phase which mainly entails preparation works in readiness for floods; the impact phase is the actual occurrence of the flood disaster that leads to relief emergency phase where various stakeholders respond to the impact of floods by mainly assisting the affected families; and the post-flood phase which mainly entails reconstruction, rehabilitation and recovery.

I) Non disaster or Inter disaster Phase

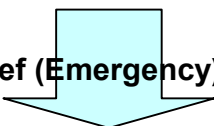
II) Pre disaster Phase



III) Impact Phase



IV) Relief (Emergency) Phase



V) Reconstruction or Rehabilitation / Recovery Phase

Source: Trainers Training Manual on Flood Disaster Management

**EVACUATION DRILL GUIDE-BOOK
FOR
THE FLOOD PRONE AREA IN KENYA**

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CHAPTER 1 PREPARATORY STAGE

1.1 Preparatory Meeting

Preparatory meeting is held by the Water Resource User Association (WRUA) or WRUA sub-committee for the Community Flood Management Organization (CFMO) (hereinafter referred as “WRUA/CFMO”), where date and time for the drill is proposed. All members of the WRUA/CFMO are expected to assist in mobilizing the community and participating in the evacuation drill event. The following issues are to be discussed and agreed upon in this meeting:

Points to Check:

- **Briefing of Guests at the Drill Venue**
- **Notify the police about the evacuation drill date for security purposes and obtaining a license for a public meeting**
- **During the meeting a tentative programme schedule is drawn which indicates the time the drill will commence and when it ends.**
- **Identify the speakers who will address the gathering**



Briefing of Guests at the venue

1.2 Confirmation of Executing Board and Organisation

WRUA/CFMO organized the executing committee prior to the implementation of evacuation drills. The organization chart shown in Figure 1 consists of five groups, namely, Executing Board, Community members, Advisory Group, KRCS, NGOs and Observers from Government agency and stakeholders. Participation of students and pupils is favourable for getting knowledge for flood management as part of disaster management education.

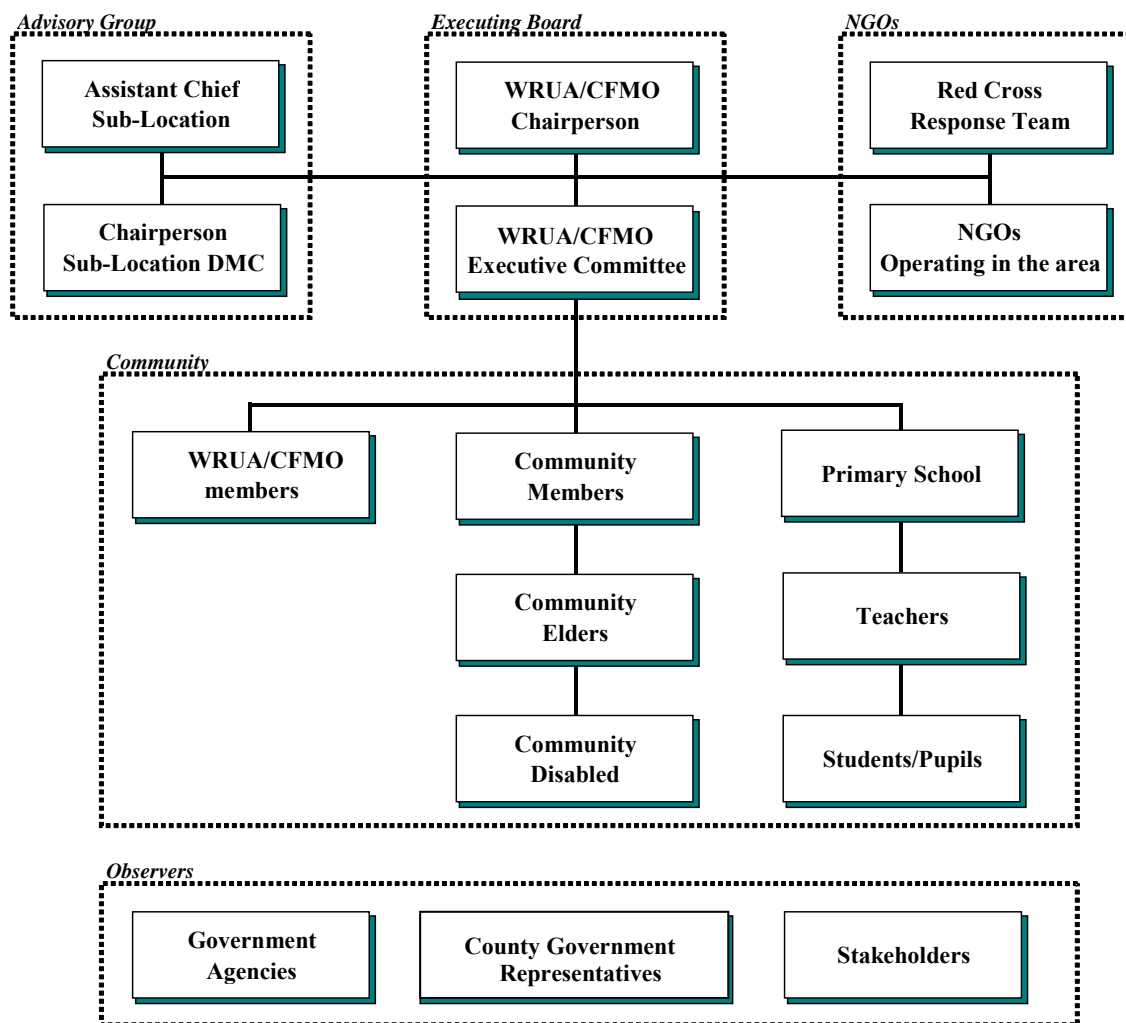


Figure 1: Organization Chart of Evacuation Drill

1.3 Implementation Programme on how to evacuate in case of flood disaster

Evacuation Drill is a kind of simulation of the real flood disaster occurrence scenario which therein demands affected community members to evacuate.

It is imperative therefore for the WRUA/CFMO to organize the Evacuation Drill as if it were an actual evacuation scenario. The procedures elaborated below are typical procedures that should be undertaken in case there is a flood disaster that demands evacuation. These procedures therefore should be followed when implementing Evacuation Drill.

The procedures are as follows:

(1) Understand the Situation of the Impending Floods

For example: On this and that day, it was reported that there was heavy rains pounding at the upstream area causing the river and stream water levels to rise above normal. This therefore implies that in the village xxx the rising of the river levels implies an early warning sign for floods in the river basin. As a result, the community in village xxx is at risk of being affected by flood disaster.

Based on this information on rising of river water levels, reported

by WRUA/CFMO officials that patrol to monitor the river, the WRUA/CFMO chairman thereafter announces immediate evacuation of those community members in village xxx to safer grounds.

(2) Roles to all the Key WRUA/CFMO Members

It is important that roles of each actor be assigned before the evacuation drill is carried out. Table 1 shown typical role of the each member's role.

Table 1 Assignment of Roles

Items for Checking	Activity	Assigned Personnel	Items of Confirmation
Confirmation of river water level. This is a daily routine exercise but for the Evacuation Drill it is explained in the WRAP UP MEETING	WRUA/CFMO member carries out patrol to confirm river water level, and report the high possibility of flood from the river to WRUA/CFMO chairman by mobile.	WRUA/CFMO member	Existing method of patrol (confirmer, check point, method of confirmation of river water level) and timing for report.
Request aid. This the second step after confirmation of inevitable evacuation the WRUA/CFMO chair request for aid. During the drill this part is explained during the WRAP UP MEETING	WRUA/CFMO chairman reports increasing river water level above river bank/dike and a possible evacuation situation to DMC (Sub-Location) by mobile, and requests for aid from the DMC.	WRUA/CFMO chairman	
Announcement of evacuation. The WRUA/CFMO Chairman informs the village elder who sounds the alarm for community members to evacuate. This event is dramatized in the Evacuation Drill as it is done in the actual evacuation scenario.	WRUA/CFMO chairman instructs the executive committee members to evacuate community members to the nearest evacuation centre.	WRUA/CFMO chairman	
	WRUA/CFMO members move from homestead to homestead warning community members to evacuate.	WRUA/CFMO members	Announce method (siren, drum, shouting)
Set up an evacuation centre. WRUA/CFMO officials take the lead in organizing the evacuation centre to ensure orderly occupation and also register the evacuees to ascertain the numbers, the injured and assess the damage caused on human and property when registering. WRUA/CFMO official responsible is the Secretary. This is how it should be done both in actual scenario and Evacuation Drill	WRUA/CFMO members set up reception for evacuees at the evacuation centre	WRUA/CFMO members	Basic necessities should be made available like water, food and firewood
Reporting a number of evacuees. The number of evacuees should be noted down then communicated to other stakeholders like KRCS, Provincial Administration by the WRUA/CFMO Chairperson via mobile phone. This is depicted in the Evacuation Drill and it is undertaken in the actual evacuation scenario.	Reception counts a number of evacuees and reports total number with a proper breakdown, i.e. the sick, the injured, children, and pregnant women to WRUA/CFMO chairman.	WRUA/CFMO member	Vulnerable persons, the injured and the sick.
	WRUA/CFMO chairman report a number of evacuees and evacuation place condition to Assistant Chief.	WRUA/CFMO chairman	
Emergency treatment This scenario is dramatized by the WRUA/CFMO members and an elaborate first aid technique transfer is explained by a person with first aid skills during the evacuation drill. In actual scenario WRUA/CFMO members should be able to administer basic first aid to the injured	Assess the injuries and thereafter provide basic treatment (first aid). Below are guidelines on injuries and first aid administration: 1) Resuscitation A-Airway B-Breathing -Look -Listen -Feel C.P.R-Cardiopulmonary Resuscitation 2) Airway Disorders	KRCS/ trained first-aid attendant	It is important that WRUA/CFMO members acquire basic First-Aid administration to assist the injured especially on the major injuries that evacuees suffer as a result of evacuation

	Chocking Drowning (near drowning) 3) Foreign bodies in the eye, ear and nose -Eyes-pour cool clean running water -Ears-pour vegetable oil -Nose-blow one side 4) Bleeding and wounds -Clean the wounds and stop bleeding 5) Bites and Stings Bites-dogs, snakes, cats Stings, bees, wasps, ants etc. 6) Transportation-Moving casualty from one place to another -Fireman's crawl -Stretchers -Hand lifts 7) Fainting and Shock -Recovery position		
In-case of an evacuation drill a Wrap-up meeting must be organized.	Wrap-up meeting which reviews the evacuation process and problems encountered are highlighted and discussed.	WRUA/CFMO Executive Committee facilitates	Scheduled speakers address the participants.

Point to note: It is important to note that the drill is a simulation of the real flooding scenario and whatsoever that is needed to ensure safe evacuation should be carried out during Evacuation Drill.

Also areas that need to be improved should be highlighted during Evacuation Drill and incorporated into the evacuation programme guide to improve on safe evacuation.

(3) Procurement of refreshment

The WRUA/CFMO should develop a budget for implementing Evacuation Drill. The budget should be simple void of unnecessary expenses. The main expense during the drill should be refreshment and hiring of public address system. Refreshment should be simple for example sodas or drinking water for at least three hundred (300) participants.

(4) Sharing of information to relevant stakeholders

It is important that information on the proposed Evacuation Drill (including the budget) be shared with the relevant stakeholders. WRUA/CFMO should take the initiative of sharing the information with WRMA Sub-regional Office; and thereafter share the information with the Deputy County Commissioner of the Sub-county and KRCS; and also share the information with the relevant offices in the County Government setup.

1.4 Typical Evacuation Drill Timetable

WRUA/CFMO should establish a timetable for evacuation drill. This timetable should be shared with other stakeholders and community members that will participate in the Evacuation Drill.

Table 2 shows an example of time table for evacuation drill.

Table 2 Timetable for Evacuation Drill (Example)

Time	Case	Activity	Subject
8.00	Guest arrive	Briefing of Guests on the essence of the Drill	WRUA/CFMO Chairman
09.00	Community still at home and daily activity in each house. Suddenly river level rises abnormally	Wailing of a community member who has seen the swollen river	Parents give command to everyone
09.10	Overflow of river leading to floods	Siren goes on and announcement of overflow and evacuation starts.	WRUA/CFMO and clan elder
9.15	Movement to evacuation centre	WRUA/CFMO members are positioned to give direction on the routes to evacuation centre	Community People
9.26	Community move in mass to evacuation centre	secretary of the WRUA/CFMO to take roll call while the organizing secretary assess the damages	WRUA/CFMO team
9.40	Assisting the vulnerable to safety	The old, the sick and the young are assisted to the evacuation centre with the help of youths	Community health workers, Youths and WRUA/CFMO
09.45	Wrap up Meeting: Assessment of the routes and preparedness	1. Assess the routes 2. Areas of improvement 3. Missing people (the forgotten)	WRUA/CFMO Chairman
09.50	Basic First Aid	Instruction on necessary steps in flood emergency	Kenya Red Cross
10.20	Re-cap	Review of the day	WRUA/CFMO Secretary
10.30	Closing Ceremony	Refreshment/Lunch and Sharing	WRUA/CFMO Chairman
11.00	Departure		

CHAPTER 2 EXECUTION OF AN EVACUATION DRILL

2.1 Step 1: Commencement of Drill

The evacuation drill commences with a village community member discussing with fellow community member on issues of floods and exclaims "...did you hear the announcement by WRUA/CFMO Chairman that the river water level is raising and we need to start evacuating!" Then the other community member wails loud "Floods! Floods! Evacuate from your homes, do not waste time evacuate immediately!"

Thereafter WRUA/CFMO member mainly the Chairperson thereafter briefs the participants from the community members, invited guests and other stakeholders of the evacuation drill event based on the timetable and the processes involved in the evacuation. The member doing the briefing must emphasize the need for time management. Thereafter he or she declares the evacuation drill commencement..

Points to Check

- **WRUA/CFMO Chairperson distributes roles among the executive and committee members to assist the evacuees**
- **Youths direct evacuees to the evacuation centre**
- **Chairperson impression that he or she is in contact with the local provincial administration (assistant chief) and if possible the assistant chief should be part of the members in the meeting**
- **Chairperson's impression is that he or she was in constant communication with the sub-location disaster management committee chairperson**

2.2 Step 2: Causing alert by various tools

WRUA/CFMO chairperson immediately after briefing the participants delegates to the CFMO chairperson or clan elder or CFMO organizing secretary to alert people to evacuate.

The drill therefore starts when the CFMO chairperson or clan elder or an appointed person sounds alarm and alerts the villagers to evacuate immediately because of the impending floods that are about to occur any moment from that time. He or she instructs community members to evacuate to a particular evacuation centre that is already prepared for them.

Points to Check

- **The alert is made loud enough for all to hear**
- **The youths are on stand-by to assist the vulnerable**
- **The alert is to warn people on the flood situation and need to evacuate to a particular centre**



Announcement of Evacuation to the community to move as alert

2.3 Step 3: Evacuation of community members to evacuation centre.

The community members should evacuate immediately to the evacuation centre on hearing the alarm sound.

The case scenario is that the waters are yet to burst the banks but the signs are

visible that the river water will soon burst the banks and cause flooding in the village. Therefore the community members evacuation should be very organized and orderly without bring about element of confusion but with the sense of urgency must be visible and eminent.

Points to Check

- Participation of village elders in assisting the community during evacuation
- The importance of mobile phone as a way of enhancing communication during disaster particularly floods
- Assistance to the vulnerable persons like the disabled, pregnant women, children, sick people
- Registration and of evacuees and their number noted down and given to the chairperson of WRUA/CFMO and assistant chief

2.4 Step 4: Dissemination of information for External Assistance

As the community members are evacuating the Assistant Chief and the WRUA Chairperson should be coordinating and making calls for help from the Sub-county national administration office and other government agencies like Ministry of Health. The chairperson or assistant chief also calls like the KRCS and NGOs operating in the area for assistance.

Points to Check

- Mobile phone communication between the chairperson and assistant chief concerning requesting for relief assistance to the evacuees (in cases where the assistant chief is not available during the drill)
- Assistant chief makes a phone call to the district provincial administration. The name of the department must be mentioned and a proper description of the flood situation is made.
- Assistant chief or chairperson calls KRCS. The approximate number of the affected persons and households, what is lacking at the evacuation centre in terms of basic needs, number of the injured or sick persons should be mentioned.



Vulnerable evacuees wait for medical assistance that has been communicated by WRUA/CFMO Chair and local Chief to the response agencies.

2.5 Step 5: Settling of Evacuees at the Evacuation Centre

The affected community members move into the evacuation centre and thereafter are referred to as evacuees. The evacuees are registered by the WRUA/CFMO as they enter into the evacuation centre. The WRUA/CFMO chairperson takes the leading role in ensuring peaceful settlement of evacuees. Village elders play an important role in helping them to settle down at the evacuation centre. WRUA/CFMO members ask questions to assess the status of properties left behind or missing and whether the water had breached any river banks yet.

Points to Check

- **Evacuees are registered as they settle at the evacuation centre for initial registration**
- **Chairperson plays a pivotal role in the settling of evacuees**
- **Village elders assist in the settling of evacuees**
- **Injuries and damage assessment done mainly by WRUA/CFMO executive committee members**
- **Ensuring the safety of the vulnerable especially children, the aged, disables and pregnant women**



Initial registration of Evacuees as they settle at the evacuation centre.

2.6 Step 6: First Aid demonstration

Based on the hazards and injuries that are likely to occur during evacuation, WRUA/CFMO members must demonstrate on their own the first aid treatment on emergency cases. Thereafter a demonstration on the same emergency cases is carried out by a qualified first aider or KRCS official.

Points to Check

- **The first-aid demonstration is carried out by a competent first-aid trained attendant.**
- **First-aid attendant must state that first-aid is not in itself a complete medical treatment but a step whereby the risky medical condition is minimized as the injured person is taken to hospital for medical treatment**
- **Demonstration should deal mainly with injuries that are prevalent during the flooding period e.g. drowning, cuts, bleeding, fainting, shock and snake bites among other like related injuries**



First Aid provision at Evacuation time

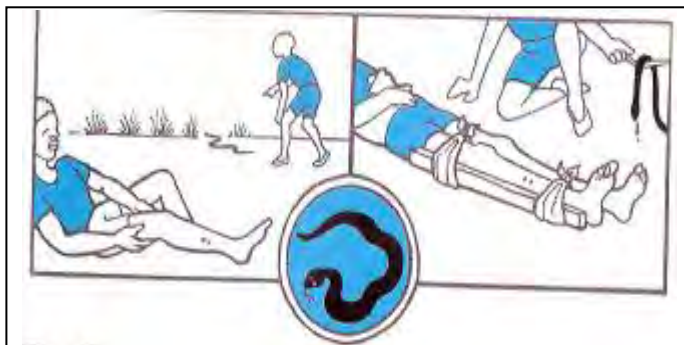


Figure2: Illustrations Showing the First Aid during Evacuation

2.7 Step 7: Evaluation and Assessment of Flood Damage.

WRUA/CFMO executive committee carryout an evaluation and assessment of the flood damage by administering a questionnaire survey to the evacuees in efforts of establishing the damage level of their homesteads, the challenges encountered when evacuating, assistance to the vulnerable and properties salvaged.

Points to Check

- **Evacuees are asked the number of persons in a homestead and how many people they evacuated with**
- **Evacuees are asked the extend of the damaged in their homes e.g. damaged houses in the homestead**
- **Evacuees must indicate the difficulties and challenges they encountered while evacuating**
- **Evacuees are asked if they assisted any one during evacuation the sick or the vulnerable in the community like the disabled, pregnant women or children**
- **An evacuee states the properties he or she has moved with into the evacuation centre.**



Evaluation and assessment of flood damage through questionnaire survey by executive committee on the evacuees.

2.8 Step 8: Wrap up Meeting

This is the final meeting that wraps up the whole evacuation drill. Accordingly persons scheduled to address the participants should be as arranged by WRUA/CFMO.

The Secretary of the WRUA becomes the Master of Ceremony (MC). His first assignment is to moderate a short session wherein the participants points out the challenges noted during the Evacuation Drill and the areas that should be improved during the actual evacuation. The MC thereafter calls the relevant persons as per the timetable to address the participants.

The speeches must be short speeches of not more than five minutes per person. The MC thereafter invites the WRUA/CFMO chairman thereafter to addresses the participants and passes a vote of thanks to the successful implementation of the Evacuation Drill. Thereafter the WRUA Chairperson declares the end of the Evacuation Drill and calls in a participant to pray in closing.

Points to Check

- **Speakers should keep time and operate within the five minutes time frame**
- **Speakers should focus on issues concerning flood management**
- **Gender should be consider when selecting the speakers**
- **The chairperson should address the highlighted challenges and difficulties of the evacuees and make proposals of possible solutions**
- **The chairperson should highlight the WRUA/CFMO's efforts towards flood managements in terms of the activities that are being carried out by the WRUA/CFMO**
- **The number of the affected persons and households, what is lacking at the evacuation centre in terms of basic needs, number of the injured or sick persons should be mentioned.**



A key stakeholder (Provincial Administration at location level) addresses the question raised by community on making evacuation routes safer.



**Ministry of
Environment, Water and
Natural Resources**



**Water Resources
Management
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**Japan International
Cooperation Agency**

**Manual for Developing
Community Flood Hazard Map
for the Project on Capacity Development
for Effective Flood Management
in Flood Prone Area**



July 2014

Japan International Cooperation Agency

NEWJEC Inc.



LINKING NATURE AND PEOPLE THROUGH TECHNOLOGY

Preface



The Government of Kenya established the Water Resources Management Authority (WRMA), through the sector reform brought by Water Act 2002. WRMA is the lead agency in the management of water resources in the country through six (6) regional offices and twenty six (26) sub – regional offices of the respective water resources catchment areas.

Since its operationalization in 2005, WRMA has made significant progress in making water resources recognized as being fundamental for socio-economic and environmental sustainability. In this regard, integrated floods management is viewed as necessary component in water resources management.

Based on the request from GOK, JICA carried out the “Study on the Integrated Flood Management (IFM) for Nyando River Basin (2006 – 2009)” as the Technical Cooperation Scheme and “Programme for Community based Flood Disaster Management to Adapt to Climate Change in the Nyando River Basin (2009-2011)”. This was a Grant Aid Programme with the aim of establishing a flood management system in the southern part of Lake Victoria Basin through IFM, where WRMA was the implementing agency. Through the above projects, community based flood management activities have been implemented through integrating non- structural and structural measures such as community based flood hazard mapping and construction of flood counter measure structures in prioritized flood prone areas.

Based on the achievement of Nyando project, the Project on Capacity Development for Effective Flood Management was formulated to expand IFM in other flood prone areas in Kenya. Three pilot river basins were selected namely: Isiolo, Gucha-Migori and Lumi to promote community based flood management activities. The main purpose of the project was to build institutional framework of flood management in the context of integrated water resource management for effective and sustainable implementation of community based activities. Through the project WRMA has developed strategies and guidelines in managing floods which have since been incorporated in the revised Catchment Management Strategies (CMS) and WRUA Development Cycle (WDC) manual. In order to develop capacity of WRMA officers in the field of community-based integrated flood management, a training system has been developed where the Project conducted IFM Training for WRMA officers who in turn trained the WRUAs. The Training Materials for community based flood management have been developed. These include supplemental manuals, lessons learnt and case studies.

A handwritten signature in blue ink, appearing to read 'John P. Olum'. The signature is stylized and written on a light blue background.

Eng. John P. Olum, HSC
Chief Executive Officer, WRMA

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1. Background

Hazard maps have been recognized as an instrument for disaster management in many countries in recent years. However, most of them are literally only maps indicating dangerous spots and no useful for practical applications of disaster reduction.

In March 2003, the Ministry of Land, Infrastructure & Transport (MLIT) in Japan developed a "Flood Hazard Map Manual for technology transfer".

Utilizing the manual, the Asian Disaster Reduction Center (ADRC), with the cooperation with Fuji Tokoha University, developed an exercise for "Community Based Flood Hazard Mapping".

The exercise is a simple and cost effective tool used to raise public awareness while fostering the active participation of the community. The tool was also developed bearing in mind that in order to raise public awareness and to ensure smooth evacuation when a flood or another disaster is imminent, maps must be user-friendly and easily understandable for the community.

According to a survey recently conducted in Japan, among the residents who evacuated, those who had seen such hazard maps were 1.5 times greater in number, and they evacuated one hour earlier than their counterparts who had not seen a map.



A community member identified leads in drawing the map on the ground and thereafter the map is drawn on a manila paper

Source: JICA PCDEFM

Figure 1 Community member draws community map on the ground and thereafter transferred to manila paper

It is therefore imperative to note that:

Collection of Flood information not only hydrological data (water gauging, flow volume etc.) and flood damage data during the flooding period but also geographical information should be collected.

If various data collected including the above data and are properly stored, it is possible

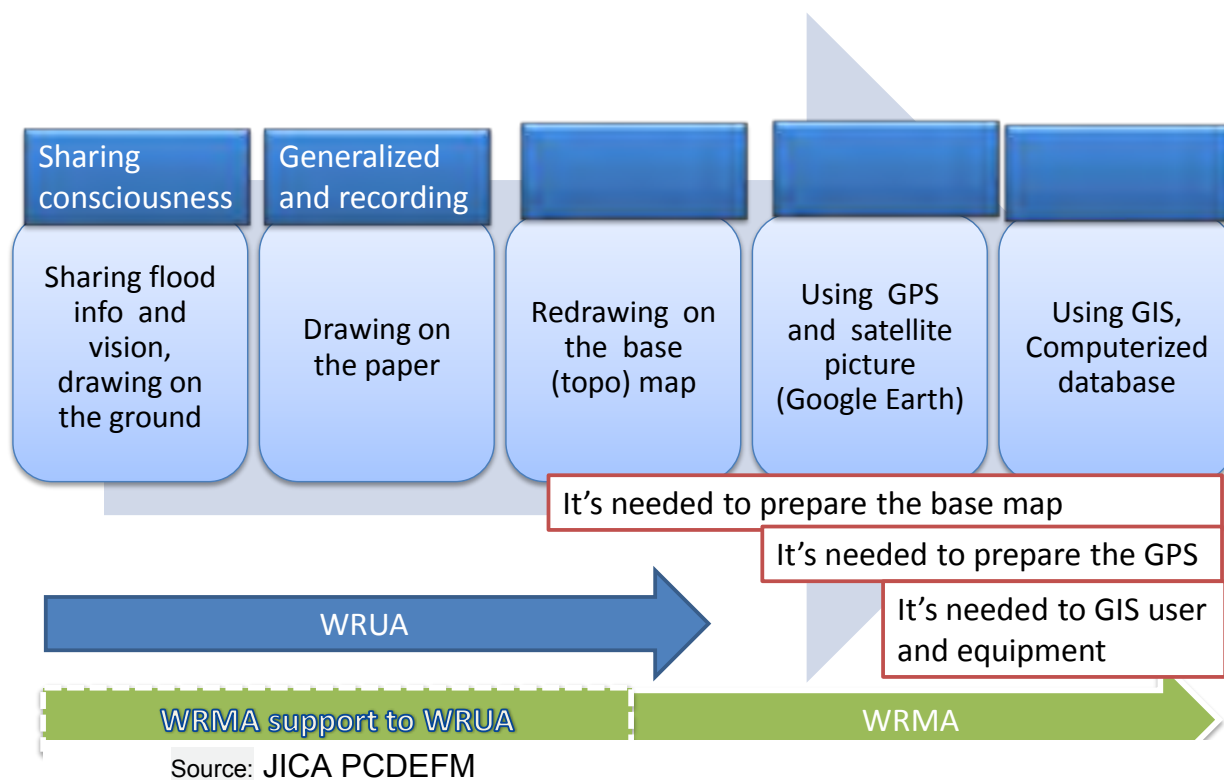


Figure 2: Summary of processes of developing community-driven flood hazard map

2. Introduction

Flood hazard mapping as a discipline aims at delineating flood hazard areas along streams and lakes using design flood levels established as part of flood hazard studies.

2.1 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:

$$\text{Risk} = \text{Hazard} \times \text{Vulnerability.}$$

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 of land by water on the land normally not covered by water. This shall include floods from rivers, mountain torrents, and floods from the sea in coastal areas.
- ❖ **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.
- ❖ **A floodplain or flood plain** is an area of land adjacent to a stream or river that stretches from the banks of its channel to the base of the enclosing valley walls and experiences flooding during periods of high discharge.
- ❖ **Floodplain map** is a map that indicates 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 map** is a map that details a flood plain and indicates the 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.
- ❖ **Floodway** is a portion of the flood hazard area where water flows are deepest, fastest and most destructive. The floodway typically includes the main channel of a stream and a portion of the adjacent overbank area. New development should be discouraged in the floodway.
- ❖ **Flood Fringe** are areas inundated by the flood, but which do not experience a strong current and the water in the flood fringe is generally shallower and flows more slowly than in the floodway.

- ❖ **Flood risk map** is the map that indicates 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.
- ❖ **Flood Damage** is the amount of destruction or damage, either in health, financial, environmental functional and/or other terms as a consequence of an occurrence of a flood hazard.

3. Developing Community-driven Flood Hazard Map

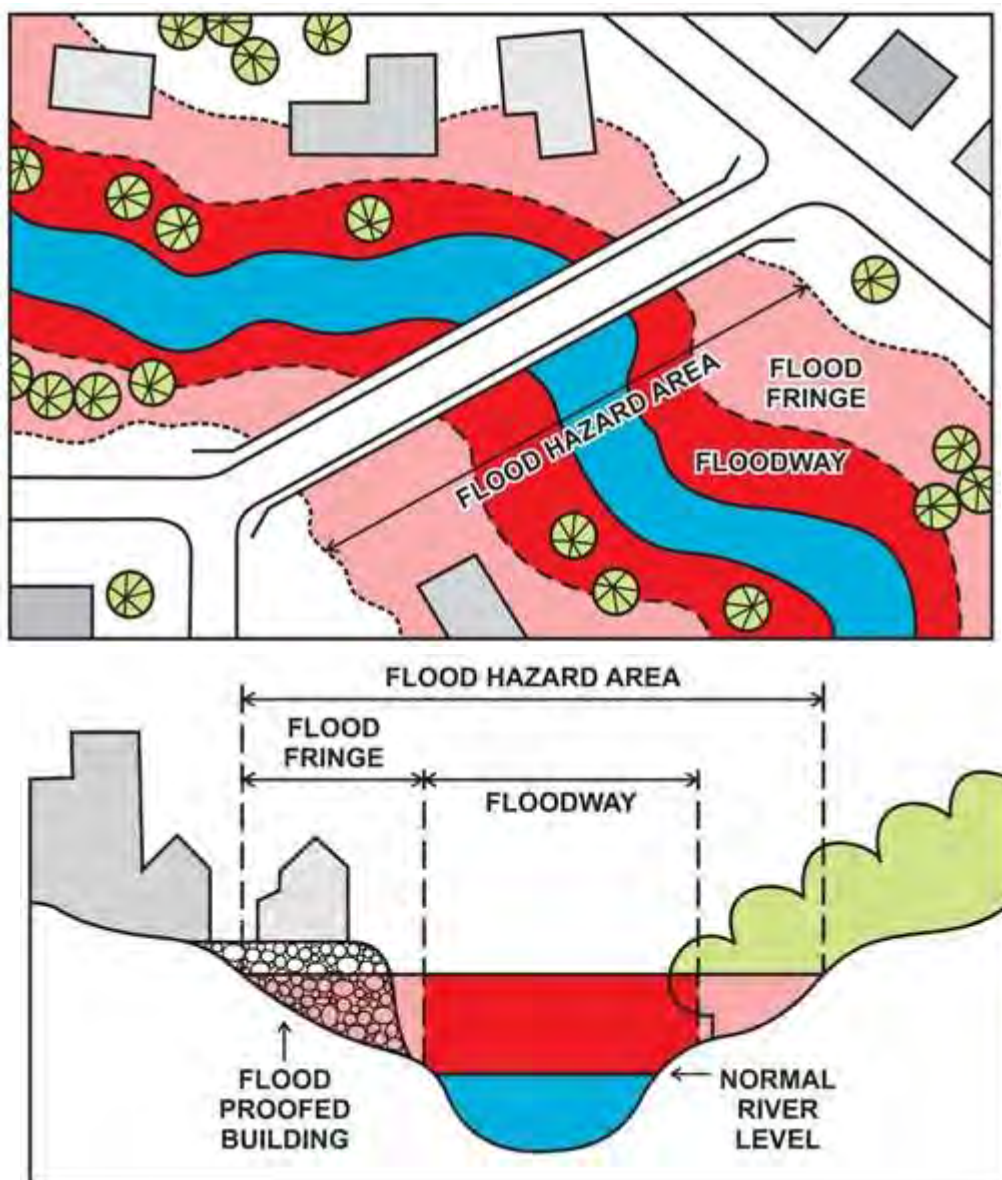
Community-driven Flood Hazard Map is therefore a flood hazard map that is developed by community members and it features flood characteristics of the area. It entails the flood direction flow, the depth of flood in particular areas, the flood inundation duration, the evacuation routes, the evacuation places, rescue centres, health facilities, water points and the homesteads in the area.

Objectives 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 organizations 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 Hazard Area Diagrams



Source: Alberta.ca > Environment and Sustainable Resource Development > Water > Programs / Services > Flood Hazard Identification Program > Flood Hazard Mapping

Figure 3: Example of a flood hazard map

Flood hazard map is a tool for communicating the impact of a specific flood event in a particular community. Flood hazard map provides information on spatial distribution of inundation areas and its associated depth during the heaviest and annual average flooding.

Flood hazard map therefore 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 flooding.

Community driven flood hazard map is a tool developed by community members from a particular area that is generally affected by floods for purposes of understanding flood hazard in the area by delineating the flood affected area based on the following guiding principles: The source of flood i.e. the flood flow direction, the flood depth at specific places, flood inundation period. The community members also identify the porous flood hotspot within their flood prone area, the evacuation routes, the evacuation centre(s), health facilities, water drinking points among other social amenities.

Basic information required on a community flood hazard map includes the following:-

- i) Flood hazard information: Flood inundation area; Flood inundation depth; and Flood Duration time
- ii) Evacuation information: Evacuation centres, Evacuation path routes, Dangerous spots, and Healthcare center, etc.
- iii) Other information: Addition of the information on the building used as residents' land mark

When developing the Flood Hazard Map the following salient issues should be considered:

- ✓ Gender representation which considers women, aged, children, etc;
- ✓ Community members identify key flood related landmarks ;
- ✓ Setting up of an open ground the process of developing flood hazard map which takes into consideration the views of the community;
- ✓ Consensus building on the language, symbols , signs, legend, colours etc to be used on the flood hazard map

4. Preparatory Works for Community-driven Flood Hazard Mapping

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

5. ADRC Approach in developing Community-driven Flood Hazard Map

The following steps are advocated by ADRC when developing Community Flood Hazard Map:

- 1) Members of the community along with experts and local government officials walk around the town or village to find out about, among others aspects, ‘inundation areas’, ‘evacuation centres & routes’, ‘expected problems in disaster management activities’, ‘disaster related facilities’ and communication channels’.
- 2) They then transfer the field observations and information onto a map using different colours to facilitate visual understanding.
- 3) Participants should discuss the ‘possible disasters’, problems to be expected in disasters’

and ‘possible countermeasures’.

6. What therefore constitute a Community-driven Flood Hazard Map?

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 flooding.

The following items are considered important and they should constitute the community driven flood hazard map i.e.:

a) Basic Information

Flood Hazard Information

- Flood inundation area
- Flood inundation depth
- Flood Duration time

Evacuation Information

- Evacuation centers,
- Evacuation path routes
- Dangerous spots,
- Healthcare center, etc

b) Other information

- Addition of the information on the building used as residents' land mark
- Setting to the scale range which can have a common view
- Consider of gender and the aged, young, etc.

7. Methodologies of developing Community-driven Flood Hazard Map

To develop the Flood Hazard Map the following should be considered:

1. Gender representation which considers women, aged, children, etc;
2. Community members identify key flood related landmarks ;
3. Setting up of an open ground the process of developing flood hazard map which takes into consideration the views of the community;
4. Consensus building on the language, symbols , signs, legend, colours etc to be used on the flood hazard map;

5. For village based flood hazard map it is advisable for a transect walk to be carried out to verify the various points and locations indicated on the draft community flood hazard map;
6. Explanation of the purpose and objective of flood hazard map to the community;
7. Identify one member of the community to lead in drawing the community flood hazard map; and last but not least
8. Transfer the sketch from the ground to the manilla paper as the first draft and after discussion the draft is adopted as it is or they review as per community consensus.

8. Importance of Local Knowledge in Community-driven Flood Hazard Map

It is important to utilize local knowledge when developing the community flood hazard map. Why use local knowledge?

- ✓ Community members that live in that geographical location know their area better than the outsiders. They know their surrounding environment and the areas that are prone to disasters;
- ✓ Local knowledge also allow the planners to rapidly survey needs and opportunities for mitigation needs; and
- ✓ Local knowledge also contributes different viewpoints and concerns that helps in mapping out hazardous conditions.

9. Implementation of Community-driven Flood Hazard Map

- (1) Introduction to community flood hazard mapping
- (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










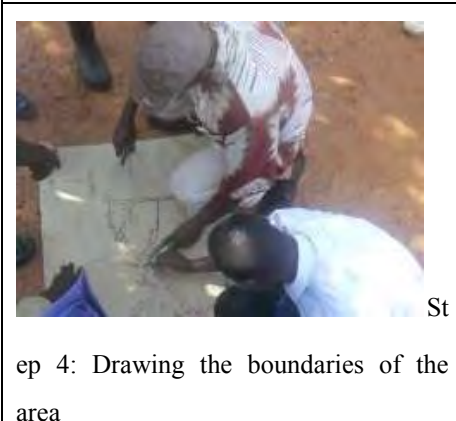
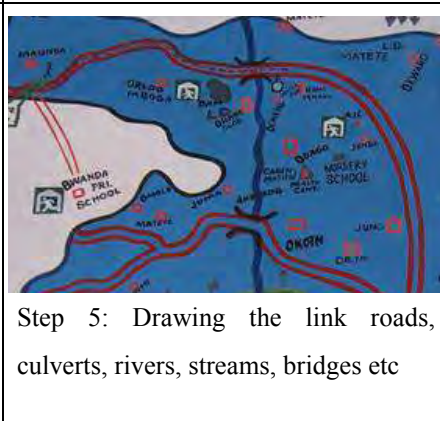

		
<p>Arrangement of material</p>	<p>Explanation of the steps in drawing hazard map</p>	<p>Identifying a person to lead in drawing the map</p>
		
<p>Drawing the boundaries of the area</p>	<p>Drawing the link roads, culverts, rivers, streams, bridges etc</p>	<p>example of community drawn flood hazard map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

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

 <p>Step 1: Arrangement of material</p>	 <p>Step 2: Explanation of the steps in drawing hazard map</p>	 <p>Step 3: Identifying a person to lead in drawing the map</p>
 <p>Step 4: Drawing the boundaries of the area</p>	 <p>Step 5: Drawing the link roads, culverts, rivers, streams, bridges etc</p>	 <p>Example of community drawn flood hazard map</p>

Source: JICA PCDEFM

Figure 4: Processes of developing community driven flood hazard map

10. Merits of Community Flood hazard mapping

(1) To WRMA

Flood Hazard Map can be utilized for formulation of regional planning, which includes; Road improvement planning for evacuation, drainage improvement, selection of sites for new evacuation facilities, prioritization of communities to be strengthened against and prepared for flooding, etc.

(2) To Community

Flood Hazard Map can be utilized for evacuation information during floods and as tool for learning disaster prevention learning information at the usual.

11. Advantages of Community Flood hazard mapping

- ✓ Makes the community know the flood characteristics in their area,
- ✓ It assists the affected to know the important points like Evacuation Routes, Evacuation Centres and other hotspot areas,

- ✓ Assists the WRUA to interpret the real flood features on the ground and opens up discussion among the community members thereby enhancing flood awareness and sensitization within the community,
- ✓ Assists the Government, KRCS, JICA and other donors to access the affected communities with ease and
- ✓ It also facilitates the transfer of historical flood incidences both past and current to the younger generation.

12. Point to note on community flood hazard map

- ✓ In the case of a flood, hazard maps need to include not only inundation areas and depth but also information such as evacuation centres & routes, disaster management centres, dangerous spots, communication channels and systems, evacuation criteria, tips for evacuation including emergency kits and other items needed in evacuation, and mechanisms and symptoms of hazards.
- ✓ The community must be provided with relevant information regarding hazard maps and how to utilize them. Most importantly, how effectively hazard maps are used depends on the level of community awareness. The members of the community must be taught how to understand potential disasters in their area from the map to take appropriate countermeasures.
- ✓ It is imperative to note that the success of community flood hazard map does not only lie in just developing the map but continuous review and updating such map.

13.Examples of Community-driven Flood Hazard Map



Figure 5: Example of community driven flood hazard map (Lower Lumi sub-catchment on 08 Nov, 2012)

Community-driven flood hazard map pasted on a signboard and installed within flood prone area.



Figure 6: Example of community driven flood hazard map (Nyando Sub-Catchment, Kamuga village)

14. How to use community flood hazard mapping to update topographical map

Flood Hazard Map can be utilized to update the topographical maps. The following are steps to take when updating topographical map:

- (1) Step 1; Transfer the information on Community flood hazard map to a topographical map



Marking out the river and water channels



Marking out the inundation places

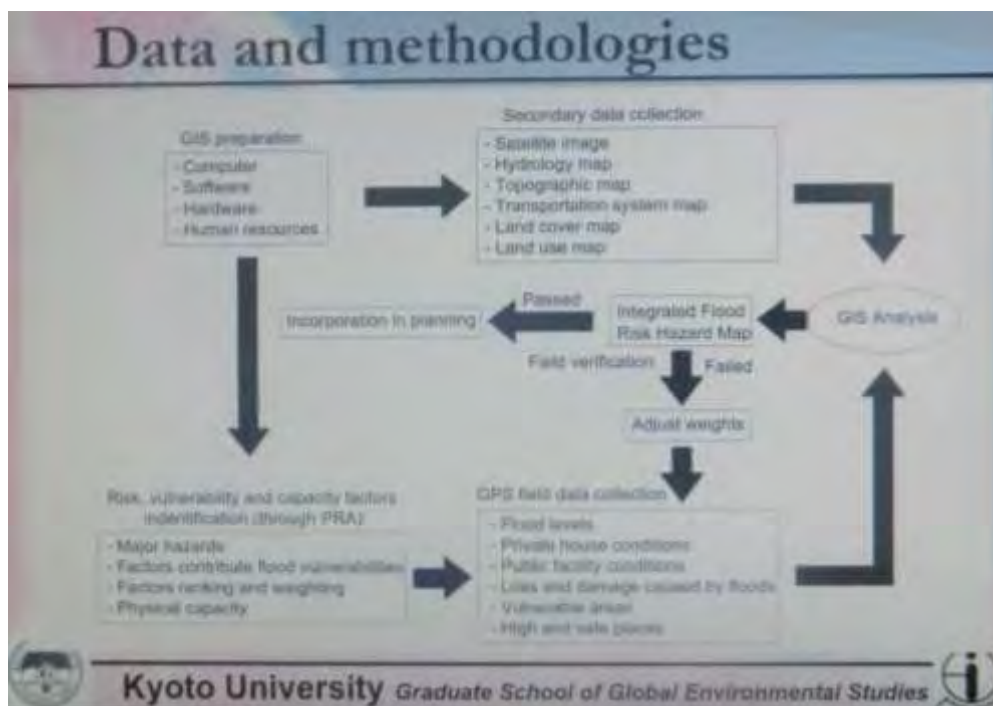


Marking out the flood water flow direction

(2) Step 2; Add Flood Risk Information and Evacuation Information to the Base map.

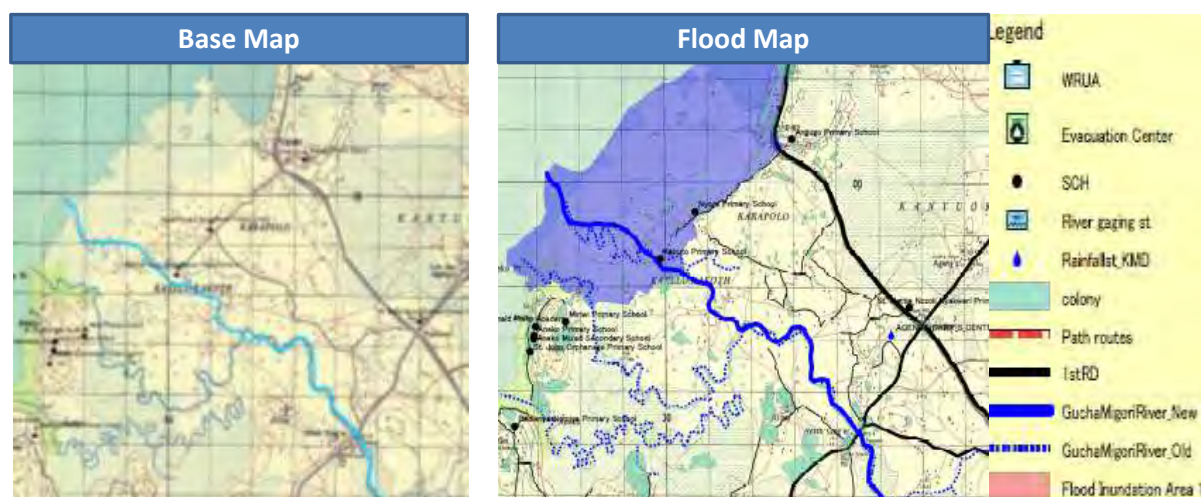
Key information during this steps include: flood risk information (- Flood inundation area, Flood inundation depth and Flood Duration time) and evacuation information (Evacuation center, Evacuation path route, Dangerous point, Water points, Healthcare center, etc);

(3) Step 3; Use GIS software to develop efficient data management system; and



Source: Kyoto University Graduate School of Global Environment Studies

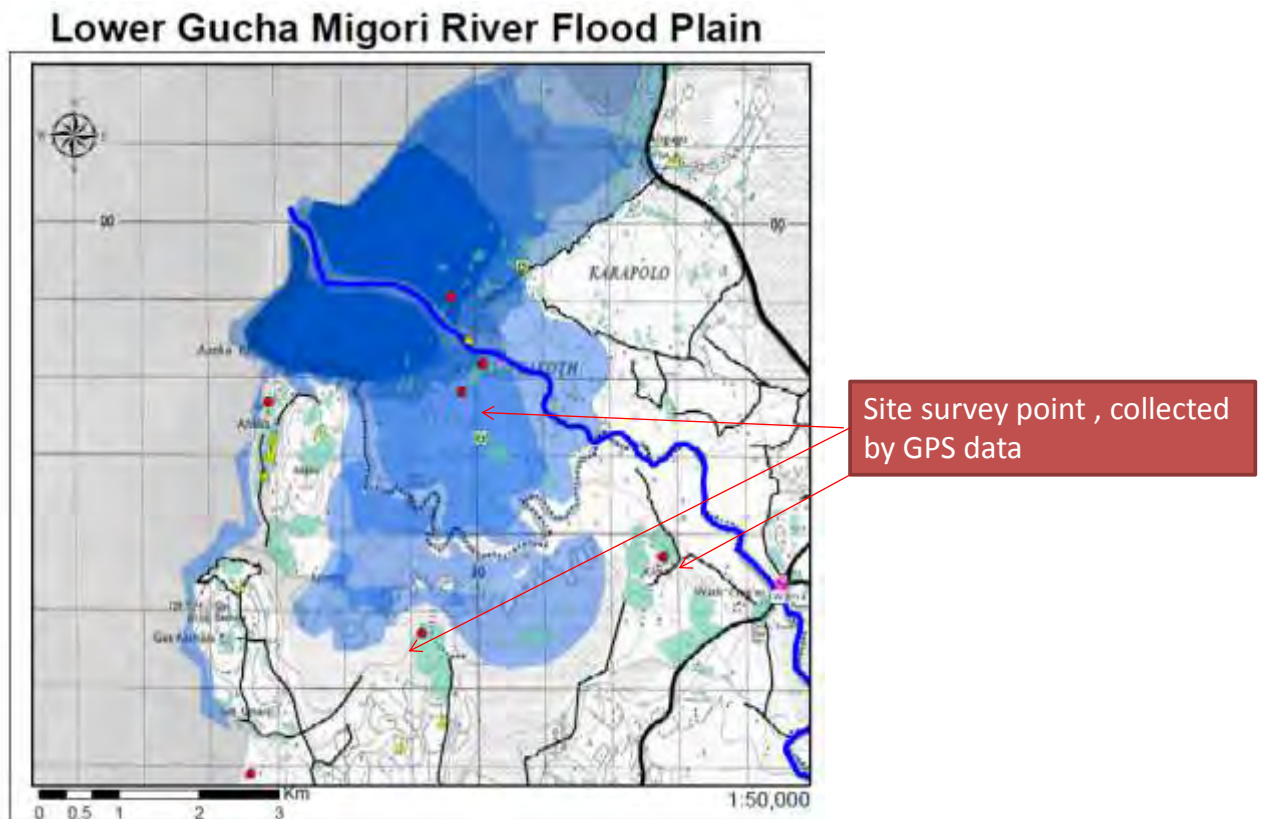
Figure 7: How to use GIS Software in Flood Hazard Mapping



Source: JICA PCDEFM

Figure 8: Using Base Map to develop Flood Map

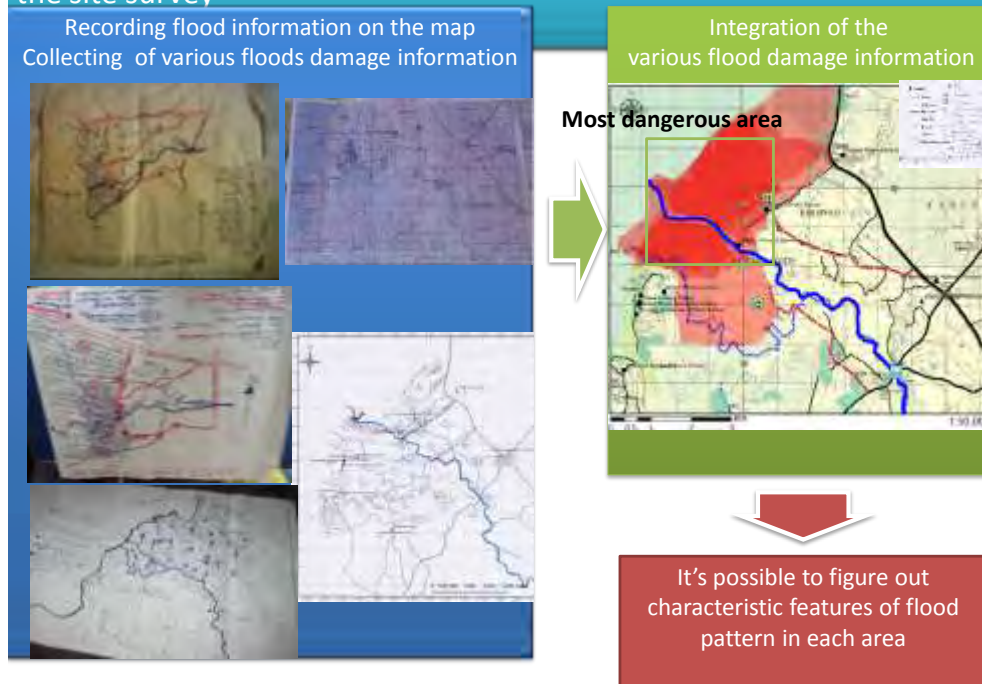
(4) Step 4; entails site visits and collection GPS coordinates of various points;



Source: JICA PCDEFM

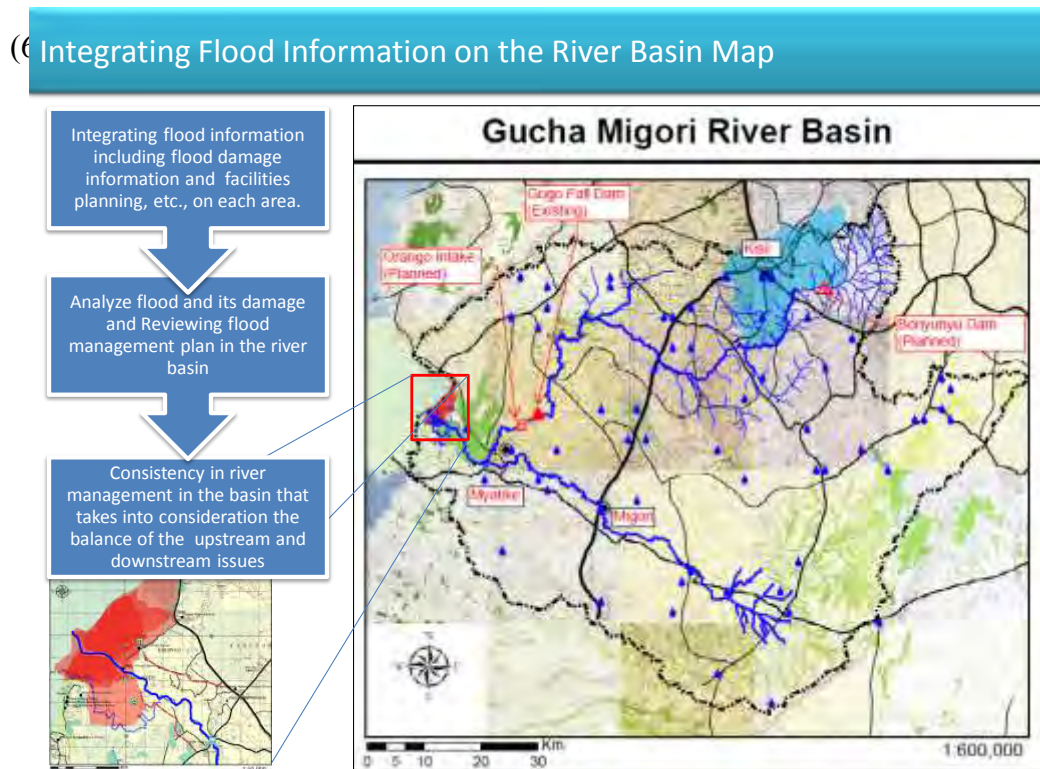
Figure 9: Map indicating the sites visited to collect GPS coordinates

(5) Step 5; entails Integrating the past flood hazard information and data collected during the site survey



Source: JICA PCDEFM

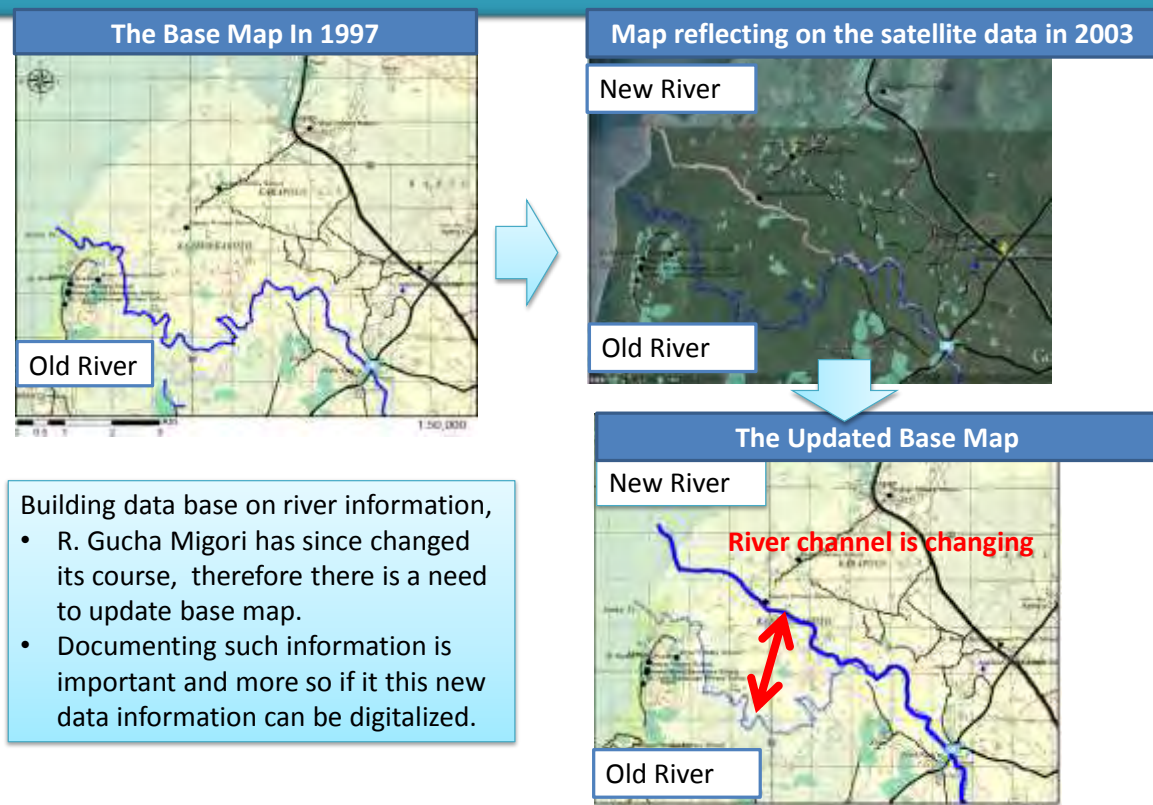
Figure 10: Integrating past flood record



Source: JICA PCDEFM

Figure 11: Integrating Flood information on the River Basin Map

(7) Step6: Updating base map and information by using satellite data









Source: JICA PCDEFM

Figure 12: Updating base map and information by using satellite data

(8) Step 8 ; Photo Album of developing community flood hazard map in three pilot areas

Community Flood Hazard Mapping in LOWER LUMI SC

	
<p>Date :05-11-2012 Place : Project Team Office NHIF Building Description : Explanation on how to use community flood hazard map</p>	<p>Date :05-11-2012 Place : WRMA-Athi Regional Office Description : Meeting with WRMA RO officer in progress</p>
	
<p>Date : 06-11-2012 Place : WRMA-Nolturesh (Loitotok) SRO Description :Meeting with WRMA RO and SRO officers in progress</p>	<p>Date : 06-11-2012 Place : Lower Lumi Hall in Taveta Description :Lower LUMI WRUA members drawing Community Flood Hazard Map</p>
	
<p>Date : 07-11-2012 Place : Lower Lumi SC Taveta District Description : WRUA members explain the flood conditions that lead to formation of gullies</p>	<p>Date : 07-11-2012 Place : Lower Lumi SC Taveta District Description : WRUA members fat verge of completion of community flood hazard map</p>




Source: JICA PCDEFM

Community Flood Hazard Mapping in LOWER GUCHA MIGORI SC

	
<p>Date :13-11-2012 Place : WRMA-LVSC Regional Office Description : Explanation of the importance of geographical data</p>	<p>Date :13-11-2012 Place : Oyugis Town Description : Explanation of the importance of geographical data and planned site activities</p>
	
<p>Date : 14-11-2012 Place : LOGUMI WRUA Office Description : Discussing the principles entailed in transferring community flood hazard map to topographical map</p>	<p>Date : 14-11-2012 Place : Nyora Primary School Description : School teacher explains how the school is often used as evacuation centre during floods disaster</p>
	
<p>Date : 15-11-2012 Place : LOGUMI WRUA Office Description : WRUA members draw community flood hazard map</p>	<p>Date : 15-11-2012 Place : LOGUMI WRUA Office Description : WRUA members transferred the community flood hazard map to the topographical map</p>

Source: JICA PCDEFM

Community Flood Hazard Mapping in ISIOLO SC

	
<p>Date :19-11-2012 Place : ENNCA regional Office Description : Courtesy call to Regional Manager</p>	<p>Date :20-11-2012 Place : Isiolo WRUA Office Description : Flood Hazard Map drawing</p>
	
<p>Date : 21-11-2012 Place : Bula Pesa location Description : Site visit to Flood Prone Areas</p>	<p>Date : 21-11-2012 Place : Isiolo Project Site Description : Comparison of Community drawn Flood hazard map and actual site condition</p>
	
<p>Date : 22-11-2012 Place : Kambi Ya Juu location Description : Urban settlements affected by flooding of Marire river</p>	<p>Date : 20-11-2012 Place : Isiolo WRUA office Description : Community drawn Flood Hazard map</p>

Source: JICA PCDEFM



Ministry of
Environment, Water and Natural
Resources



Water Resources
Management Authority



Japan International
Cooperation Agency

Project on Capacity Development
for Effective Flood Management in Flood Prone Area
in the Republic of Kenya
**Lessons Learnt
from
Pilot Activities**



July 2014

Japan International Cooperation Agency

NEWJEC Inc.

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A handwritten signature in blue ink, appearing to read 'John P. Olum'. The signature is stylized and written on a light blue background.

Eng. John P. Olum, HSC
Chief Executive Officer, WRMA

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Chapter 1 Background of the project

1. The Project Overview

The Republic of Kenya (hereinafter referred to as “Kenya”), experiences regular nationwide flooding during rainy season. These floods leads to approximately five thousand (5,000) people to be affected and causes financial damage of approximately JPY one hundred and sixty million (160,000,000) every year.

In 2003, the southern parts of Lake Victoria Basin including Nyando River Basin were affected by serious flooding which affected approximately twenty two thousand (22,000) people. In 2007, Garissa town which is located at the middle Tana River Basin was hit by severe flood and approximately JPY six hundred and eighty million (680,000,000) financial damage. According to the analysis reported in the fourth assessment report published by the Inter-governmental Panel on Climate Change (IPCC), it is anticipated that Climate Change will ultimately lead to generation of more occurrence of flood incidences.

The Government of Kenya (hereinafter referred to as “GOK”) in the sector reforms under the Water Act 2002 established Water Resources Management Authority (WRMA), which is under the Ministry of Water and Irrigation (MWI). WRMA acts as implementation organization in charge of overall water resource management of each catchment. WRMA set up is as follows: the headquarter, the six (6) regional Catchments and the thirty two (32) sub-regional Sub-catchments.

In 2004, WRMA formulated “Integrated Flood Management Policy” focusing on Lake Victoria Basin, which is one of the areas that suffer from severe flood damages. It was intended to promote Integrated Flood Management (IFM) to raise awareness of community and strengthen institutional capacity to allow flood mitigation, prediction and warning. Based on the request from GOK, JICA carried out the “Study on the Integrated Flood Management for Nyando River Basin (2006 – 2009)” as the Technical Cooperation Scheme and “Programme for Community based Flood Disaster Management to Adapt to Climate Change in the Nynado River Basin (2009-2011)” as the Grant Aid Programme with the aim of establishing a flood management system in the southern part of Lake Victoria Basin through IFM. Through the above projects, community based flood management activities have been implemented and deployed combining structural and non-structural measures such as workshops for mapping flood damaged areas and protection measures for building structures in prioritized communities. Some positive outcomes have since been realized.

GOK in essence aims to expand these activities, which were implemented in the area of Nyando River Basin only to other parts of the nation with a purpose to promote community based water resource management activities including flood management. GOK has been currently working on the institutionalization of Water Resource User Associations (WRUAs). WRUAs are managed by community members who are major beneficiary of water resources. A framework therefore has already been established which enables the WRUAs to receive funds from the Water Service Trust Fund (WSTF) sourced from technical support, official aid, and donor’s funds. This framework is

known as WRUA Development Cycle (WDC).

GOK plans to utilize WDC framework to deploy nationwide community led activities based on IFM which integrates outcomes from previous JICA's projects. However it is considered that GOK requires assistance in providing appropriate technical advice to relevant entities in IFM including WRUAs. This is because the previous flood management activities carried out under JICA were not in line with WDC as well as other frameworks.

Therefore, this Project is expected to strengthen WRMA institutional ability through the capacity development on basic flood management to promote community based flood management activities within the WDC framework. This Project known as "The Project for Capacity Development for Effective Flood Management in Flood Prone Areas (hereinafter referred to as the "Project") targets to pilot these activities in three river basins: Gucha Migori; Lumi; and EwasoNg'iro North. For the purposes of this report Gucha Migori River Basin will be the focus and particularly the Lower Gucha-Migori Sub-catchment.

2. Executive Summary

The following report contains a case study that analyses how the non-structural measures were successfully implemented in Gucha Migori River Basin specifically Lower Gucha Migori (LOGUMI) Sub-catchment ((SC).

The purpose of the case study is to extract lesson learnt from the implementation of the non-structural measures in LOGUMI SC. Case study is the actual implementation of non-structural measures flood management activities.

Through our analysis of the respective non-structural measures flood management activities implemented in LOGUMI SC, we found that, although the activities varied in their implementation but the goals of such activities was to enhance effective flood management in LOGUMI SC. In each of the activities involved revealed strong community participation and initiatives. We found that community participation and engagement and the ability for cooperation, coordination and sharing of knowledge on flood management was key for sustainable and effective flood management in LOGUMI SC.

Chapter 2 Case Studies in Lower Gucha Migori Sub-catchment

Case 1 Non-structural measures in Lower Gucha Migori Sub-catchment

LOGUMI WRUA members being trained on Flood Early Warning System



Source: JICA Project Team



KENYA

1. The profile of Lower Gucha Migori Sub-catchment

Gucha-Migori River Basin cuts across five counties i.e. Nyamira County, Kisii County, Narok County, Homa Bay County and Migori County. The Gucha-Migori River Basin is therefore located on the south-western corner of the Lake Victoria Basin in western Kenya. The R. Gucha has its source in the of Nyamira county, which rise up to nearly 3,000 m.amsl at Kiabonyoro peak GPS location Altitude1653M South 00034'07.6" East 034058'50.3".

The Migori River has its source in Chepalungu forest, at altitudes of around 2,000 m.amsl, and drains a large area west of the Sirian Escarpment which shields the Maasai Mara to the east. The two rivers together have a catchment area which spans over 6,900 km² in Nyamira, Kisii, Migori and a section in the western-most Narok counties. At the confluence of R. Gucha and R. Migori near Macalder Mines, about 30 km from their mouth on Lake Victoria the mean annual runoffs (MAR) of the Gucha and Migori rivers are estimated at 1,083 and 609 Mm³/year respectively.



Flood damage is enormous in Gucha Migori River Basin. In the upstream Kenyena Sub-counties the area encounters flash floods that mainly damages the farmlands and disrupts traffic. In the mid-stream the area of Oyani encounters flash floods and riverine floods that destroys farmlands and disrupts transport networks. In the downstream area suffers from both flash floods in the area surrounded by hills like Lwanda, Tito and Misiwi areas, while places in the flood plains like Nyora, Kabuto, Kimai, Sere, Aeko and Aneko suffers from riverine floods with inundation period of three weeks to two months.

2. Objective of the project

- To build the capacity of LOGUMI WRUA members to effectively manage floods within LOGUMI SC

3. Summary of result

It was predetermined by the Project that only Non-structural Measures against floods will be implemented in LOGUMI SC. The major assumptions in flood management in LOGUMI SC were that flood management entailed heavy high cost structural measures and that the community role in flood management was being passive.

As a result of LOGUMI WRUA interaction with the Project great strides have been made. Community-driven Flood Management Action Plan was developed and thereafter incorporated in the revised LOGUMI SCMP, Community-driven Flood Hazard Map for four areas have been drawn, Community-driven Flood Hydrograph for purposes of flood early warning had been developed, Community-based Flood Early Warning System has been established, flood education programme undertaken in four schools and evacuation drill implemented. The LOGUMI WRUA Chairperson stated that during the entry of JICA Project Team in LOGUMI SC wherein the expectations of the community were leaned towards heavy structural measures but when the scope of the Project in LOGUMI was explained she pointed was heartbroken. But after undergoing through the various training, workshops and interactions with other stakeholders, she now understands why the training were important! She added that now LOGUMI community members were in control of their own destiny! Using a Luo proverb she said it is better to train a person on how to fish than just giving that person fish to eat! She added that LOGUMI WRUA were now able to know importance of any flood structure that when they will be constructed in the area O&M will be per excellence!! She also stated that LOGUMI WRUA had written proposal soliciting for funds to construct an evacuation centre at Nyora village to Japan Embassy.

4. Good points

- The Community-driven Flood Management Action Plan was developed through community participation entailing brainstorming, consensus building and adoption of the plan.
- LOGUMI WRUA revised the LOGUMI SCMP wherein the flood management activities were incorporated.
- Excursion visit to the Nyando River Basin exposed LOGUMI WRUA to community based flood management wherein the WRUA members were exposed to buildings with raised foundations

above the flood depth. The WRUA members were also exposed to the Community-based Flood Management Organizations (CFMOs).

- After the excursion visit LOGUMI WRUA were able to influence change of design for toilets earmarked for construction in schools located within flood prone areas. The design was changed and all the toilets constructed are raised above the flood depth.
- The LOGUMI WRUA established the Flood Management Sub-committee that was tasked with pre-flood, flood response and post floods planning for corresponding activities.
- The LOGUMI WRUA also carried out a sensitization programme wherein they sensitized the communities in flood prone areas on the importance of self-help in flood management that led to establishment of eleven CFMOs in LOGUMI SC.
- LOGUMI WRUA participated actively in the Integrated Flood Management Committee (IFMC) meetings leading to cooperation with the WRUAs from the upstream.

5. Implementation of capacity building activities

The implementation of non-structural measures entailed workshops, excursion site visits, community sensitization meetings and training.

Table 1 Summary of Workshops

Date of Meeting	Attendants		Venue	Main Agenda
	Organization	No. of Attendants		
Feb. 15 to 28, 2012	JICA Project Team WRMA-LVSC LOGUMI WRUA	1 2 30	LOGUMI WRUA Office	Development of Community-driven Flood Management Action Plan
Mar. 22 to 29, 2012	JICA Project Team WRMA-LVSC LOGUMI WRUA	1 2 30	LOGUMI WRUA Office	Review of LOGUMI SCMP with aim of incorporating Community-driven Flood Management Action Plan into the SCMP
May 02, 2012	JICA Project Team WRMA-LVSC LOGUMI WRUA	1 2 50	LOGUMI WRUA Office	Development of Community-driven Flood Hazard Map
June 18, 2012	JICA Project Team WRMA-LVSC LOGUMI WRUA	1 2 50	LOGUMI WRUA Office	Review of Community-driven flood hazard map
Oct. 03 to 04, 2012	JICA Project Team WRMA-LVSC LOGUMI WRUA	2 2 50	LOGUMI WRUA Office	Transferring of community-driven flood hazard map to topographical map
Oct. 15 to 23, 2012	LOGUMI WRUA	50	LOGUMI WRUA Office	Development of Community-driven Flood Hydrograph by LOGUMI WRUA
Nov. 15 to 23, 2012	JICA Project Team WRMA-LVSC LOGUMI WRUA	2 2 50	LOGUMI WRUA Office	Development of Community-driven Flood Hazard Map for other flood prone areas in LOGUMI SC

(Source: JICA PCDEFM)

Table 2 Summary of Excursion Exchange Site Visits

Date of Meeting	Attendants		Venue	Main Agenda
	Organization	No. of Attendants		
Mar. 24 to 28, 2013	JICA Project Team WRMA LOGUMI WRUA GIZ	5 6 5 1	Nyando River Basin and LOGUMI SC	Exposure of WRUA members to the Nyando Project and understanding the flood management activities in LOGUMI SC

	Lower Lumi WRUA	3		
	Isiolo WRUA	3		
Feb. 18 to 21, 2014	KRCS	1	Isiolo SC	Training on community-based flood early warning system (CBFEWS) and observation installed CBFEWS
	WRMA-Isiolo	2		
	LOGUMI WRUA	10		
	Isiolo WRUA	5		
	Lower Lumi WRUA	10		
June 24-25, 2014	JICA Project Team	5	Lumi River Basin, Taveta	Observation of community-based flood management activities in Lower Lumi SC and discussion of the future activities of the WRUAs in flood prone areas
	WRMA	20		
	LOGUMI WRUA	5		
	Isiolo WRUA	5		
	Lower Lumi WRUA	15		
	Migori County	-		
	Meru County	1		
	Taveta County	1		
JICA Kenya	2			

(Source: JICA PCDEFM)

Table 3 Summary of Community Sensitization Meetings

Date of Meeting	Attendants		Venue	Main Agenda
	Organization	No. of Attendants		
Feb. 15 to 17, 2012	JICA Project Team	1	LOGUMI WRUA Office	Community Sensitization on importance of community-based flood management
	WRMA-LVSC	2		
	LOGUMI WRUA	30		
Sept. 6 to 8, 2012	JICA Project Team	2	LOGUMI WRUA Office and stakeholders' offices	Sensitization of LOGUMI WRUA on the need for Integrated Flood Management Committee (IFMC)
	WRMA-LVSC	2		
	LOGUMI WRUA	30		
Sept. 24, 2013	JICA Project Team	1	Tulu and Got Kachola	Community sensitization on establishment of Community-based Flood Management Organizations at village level
	WRMA-LVSC	2		
	LOGUMI WRUA	5		
	Tulu CFMO	30		
	Got Kachola CFMO	30		
Sept. 24, 2013	KRCS	5	Nyora Primary School	Community sensitization on KRCS activities for the Project on Flood Management activities
	WRMA-LVSC	1		
	LOGUMI WRUA	50		
	Community Members	150		
May 23, 2014	JICA Project Team	5	Nyora Primary School	Community sensitization on effective evacuation during flood disaster through the implementation of evacuation drill
	WRMA-	8		
	LOGUMI WRUA	30		
	CFMOs	60		
	Community members	250		

(Source: JICA PCDEFM)

Table 4 Summary of the Flood Management Training

Date of Meeting	Attendants		Venue	Main Agenda
	Organization	No. of Attendants		
Dec. 3 to 6, 2013	KRCS	5	LOGUMI WRUA Office	Training on Community-driven Disaster Management
	JICA Project Team	1		
	WRMA-LVSC	3		
	LOGUMI WRUA	30		
Dec. 9 to 11, 2013	KRCS	5	LOGUMI WRUA Office	Training on Community-based Floods Early Warning System
	JICA Project Team	1		
	WRMA-LVSC	3		
	LOGUMI WRUA	30		
Jan 13 to 16, 2014	JICA Project Team	1	LOGUMI WRUA Office	Training of teachers on infusion strategies and flood management programmes in school
	WRMA-LVSC	2		
	LOGUMI WRUA	15		
	Teachers	8		

	School Committee	4		
Jan 2014 and still ongoing	Teachers and pupils Sere Primary school	300	Four schools in LOGUMI SC	Teaching of pupils on Flood Management through infusion of the subject into school syllabus and also through role play and drama
	Teachers and pupils Nyora Primary school	350		
	Teachers and pupils Kabuto Primary school	290		
	Teachers and pupils Angugo Primary school	350		
May 19 to 25, 2014	JICA Project Team	5	Casablanca Hotel Hall	Training on Flood Management with focus on Community-driven flood management activities
	WRMA-LVSC	8		
	LOGUMI WRUA	30		
	CFMOs	12		
	Middle Gucha WRUA	1		
	Upper Magor WRUA	1		
Ongoche WRUA	1			

(Source: The JICA PCDEFM)

6. Development of Community Driven Flood Management Action Plan

The development of draft community-based flood management plan that started on 24th February 2012 was completed on 22nd March 2012. The LOGUMI WRUA members have since mutually and consensually agreed on the community-based flood management action plan including the implementation schedule.

The implementation schedule is divided into short-term, mid-term and long-term spans of implementation.

6.1 Short-term schedule

The activities for short-term schedule in the Community-based Flood Management Action Plan developed by LOGUMI WRUA are summarized in the Table 3.

The short-term implementation targets activities that can be achieved within the next five years.

Table 5 Activities targeted for short-term implementation

Activity	Estimated cost of activity (Ksh.)	When the activity to be carried out	Responsible WRUA office for implementation
Proposed Preparedness Activity			
1) Capacity building of WRUA	5,000,000	July 2012-Dec 2013	WRUA Management Committee
2) Construction of a new evacuation centre and improvement of the existing evacuation places	7,000,000	Jan 2013-Oct. 2013	WRUA Management Committee
3) Construction of footbridge to enforce accessibility of evacuees to evacuation centre at Kabuto area	20,000,000	Jan 2013-Aug 2013	WRUA Management Committee
4) Develop posters with description of the flood condition in a particular area specifically flood depth, direction to evacuation centre and the distance remaining to arrive at the evacuation centre	60,000	Sept. 2012-Dec 2012 and Feb. 2013-May 2013	WRUA Management Committee
5) Desilting of water pans and removal of blockades and obstacles from the river channels	3,650,000	March 2012-March 2013	WRUA Management Committee
6) Planting of vegetations along the riparian areas and starting a tree nursery in the sub-catchment	300,000	June 2013	WRUA Management Committee
7) Protect and conservation of wet lands from rapid destruction	300,000	July 2012	WRUA Management Committee
8) A proposal request to NWCPC to survey the river Gucha and Migori for	10,000	Jan 2013	WRUA Management Committee

gabion construction at the breached points for riverbank protection			
9) Equip each household with a disaster kit that has a mosquito net, torch, telephone contacts of WRUA executive and pain killer drugs; and	1,600,000	Sept. 2012 and March 2013	WRUA Management Committee
10) Writing a proposal to government to construct dykes along the river banks	10,000	Jan 2013	WRUA Management Committee
Proposed Responses Activity			
11) Capacity building of WRUA	5,000,000	July 2012-Dec 2013	WRUA Management Committee
12) Construction of storage facilities at the evacuation centre for food, firewood, tents, drugs, household utensils and other items safe keeping	4,000,000	Jan 2013-Oct. 2013	WRUA Management Committee
13) Construction of well designed toilets (pit latrines) that can with stand flood water pressure and not collapse with septic tanks that can be used to collect waste water	6,000,000	Jan 2013-Oct. 2013	WRUA Management Committee
14) WRUA shall develop community flood hazard map for the sub-catchment and thereafter painted on signboard. Five signboards were proposed to be installed thereafter in five locations in the sub-catchments	100,000	Jan 2013-April 2013	WRUA Management Committee
15) Develop posters with description of the flood condition the items that are important to carry, safety measures to consider during evacuation and how to live in an evacuation centre	60,000	Sept. 2012-Dec 2012 and Feb. 2013-May 2013	WRUA Management Committee
16) Procuring dustbins and digging of composite pit at the evacuation centre for garbage collection to improve sanitation at the centre;	10,000	March 2012 and again September 2013	WRUA Management Committee
17) Drilling of 4 borehole and installation of 2 water tanks to harness the roof harvesting of rain water and thereafter treatment of the water using water treatment tabs	6,000,000 for borehole and 120,000 for watertanks	July 2012-April 2013	WRUA Management Committee
18) A Flood Management committee shall be established by the WRUA consisting of one executive member of the WRUA and four other WRUA members that will be tasked with assessment of flood damage and thereafter report to the WRUA Management Committee for requisite actions to be taken based on the recommendation by the flood management committee.	77,500 which entails money for mobile phone airtime, transport cost for hiring boat for one month during floods and stationaries	March 2012	WRUA Management Committee
Proposed Rehabilitation Activity			
19) Capacity building of WRUA and community sensitization exercise	5,000,000	July 2012-Dec 2013	WRUA Management Committee
20) Maintenance of all infrastructures constructed for purposes of managing floods in the sub-catchment	1% of the cost of the infrastructure in question. An estimate of O&M is 100,000	May 2012-July 2012 and Jan to March 2013	WRUA Management Committee
21) WRUA shall establish a flood management planning committee that deals with planning on flood disaster and enable the capacity of these team built to enable them carry out there task of planning and thereafter report to management committee of the WRUA	Operational cost of the committee estimated at Ksh. 10,000	March 2012	WRUA Management Committee
22) Construction of 14 culverts to improve drainage thereby improving evacuation routes in the area	5,000,000	Jan 2013-Aug 2013	WRUA Management Committee
23) Proposal to relevant organization to provide mobilelets (mobile toilets) to each homestead in the most affected areas of Kabuto, Nyola and Luanda	10,000	Jan 2013	WRUA Management Committee

(Source: The JICA PCDEFM)

6.2 Mid-term schedule

The activities for mid-term schedule in the Community-based Flood Management Action Plan developed by LOGUMI WRUA are summarized in the Table 4.

The mid-term implementation targets activities that can be achieved within the next eight years

Table 6 Activities targeted for mid-term implementation

Activity	Estimated cost of activity (Ksh.)	When the activity to be carried out	Responsible WRUA office for implementation
Proposed Preparedness Activity			
1) Construction of a drainage canals and check dams in the hilly areas	15,000,000	Aug. 2013-Mar. 2015	WRUA Management Committee
2) Planting of vegetation along the riparian areas and starting a tree nursery in the sub-catchment	300,000	June 2013	WRUA Management Committee
Proposed Rehabilitation Activity			
3) Construction of 14 culverts to improve drainage thereby improving evacuation routes in the area	5,000,000	Jan 2013-Aug 2013	WRUA Management Committee

((Source: The JICA PCDEFM))

6.3 Long-term schedule

The activities for long-term schedule in the Community-based Flood Management Action Plan developed by LOGUMI WRUA are summarized in the Table 5.

The long-term implementation targets activities that can be achieved within the next ten and above years

Table 7 Activities targeted for long-term implementation

Activity	Estimated cost of activity (Ksh.)	When the activity to be carried out	Responsible WRUA office for implementation
Proposed Preparedness Activity			
1) Construction of dyke along R. Kuja	150,000,000	Aug. 2013-Mar. 2025	WRUA Management Committee
2) Digging of water pans in eight locations to check floods	24,000,000	July 2012-July 2015 continuously to 2025	WRUA Management Committee
3) Construction of gabions along the breached parts of R. Kuja	20,000,000	Aug. 2015-Mar. 2018 and thereafter incremental continuous activity to 2025	WRUA Management Committee
Proposed Rehabilitation Activity			
4) Establishment of proper dissemination of information system to line ministries and stakeholders to ensure there is follow up exercise for reconstruction of various socio-economic infrastructures that are damaged as a result of floods. Also collecting feedback and data from the various stakeholders that intervene in floods in order to develop WRUA database on floods in the sub-catchment	1,000,000	July 2012-Dec 2013 and thereafter continuous upgrading to Dec. 2020	WRUA Management Committee

((Source: The JICA PCDEFM))

7. Review of the Sub-catchment Management Plan (SCMP)

After the development of LOGUMI WRUA Community Flood Management Action Plan the Project Team assisted LOGUMI WRUA to incorporate the flood management activities proposed in the plan into the SCMP.

The SCMP was thereafter adopted by LOGUMI WRUA and the same SCMP was submitted to WRMA-LVSC Gucha Migori Sub-regional office and WRMA-LVSC Regional office.

8. Development of Flood Hazard Maps

The Lower Gucha Migori WRUA members identified the villages in LOGUMI SC that are worst hit areas by floods as Kabuto, Nyora, Luanda, Misiwi, Tito and Ayieko areas. A discussion with the WRUA revealed that the Kabuto and Nyora were at one time considered as one and same village and it they were separated into two only after the area was divided by R. Gucha Migori. LOGUMI WRUA requested that the two areas be considered as one village.

It was therefore agreed that a flood hazard map be developed for Kabuto-Nyora area, then Luanda-Misiwi area and thereafter Aeko-Aneko area. These maps having been developed by LOGUMI WRUA were pasted on the inside wall of LOGUMI WRUA office.

9. Developing Topographical-Map based on Community Flood Hazard Map

The Project Team noted that the current topographical map were not current because the maps did not show the change of the river course. Therefore the Project Team with LOGUMI WRUA using the Community Flood Hazard Map updated the topographical map to show the current conditions.

10. Nyando Excursion Visit and WRUA Exchange Visit to LOGUMI SC

The excursion visit and exchange programme to LOGUMI SC involved various parties that included the JICA Project Team (Chief Advisor to the Project; the Project Team Leader; and three Project Supervisors from Gucha Migori, Lumi and Isiolo river basins); WRMA FMU Headquarters; WRMA-LVSC Regional Office, WRMA LVSC Kisii and Kisumu Sub-regional Offices; WRUAs from LOGUMI, Lower Lumi and Isiolo; and GIZ.

10.1 Nyando Excursion Visit

The excursion visit to Nyando was held from 24th March to 26th March 2013. The following sites were visited:

- (i) Rae Kanyaika Primary School in Mowlem village whereby raised evacuation centre, raised borehole and raised toilets were observed. A meeting with school management committee and Mowlem CFMO was also held;
- (ii) Rae Kanyaika Village was also visited and small culverts were observed;
- (iii) Ofunyu Primary School in Kamuga village whereby raised evacuation centre, raised borehole and raised toilets were observed. A meeting with school management committee and Kamuga CFMO was also held;
- (iv) Kokwaro Village in which a raised road and evacuation centre constructed under the pilot projects that were packaged in the Master Plan Study (2006-2008);
- (v) Kamagaga Village was also visited and footbridge, community flood hazard map signboard, raised evacuation centre and raised toilets were observed; and
- (vi) Achuodho Primary School in Achuodho village whereby raised evacuation centre, raised borehole and raised toilets were observed. A meeting with Achuodho CFMO, Nyando WRUA and WinamNyamasaria WUA was also held.

10.2 The Excursion Visit to Nyando River Basin observations by LOGUMI WRUA

Day 1: 25th March, 2013

The WRUA members were taken for a field visit at various sites within Nyando area. The aim was to observe various projects that were supported by JICA as a flood management projects. The participants in the excursion visit were able to observe the following facilities like raised boreholes, raised toilets, raised evacuation centres, small culverts and pedestrian bridges were visited. The participants were also able to interact with the communities wherein these structures were constructed and these community members were able to explain the various training they received on flood management and how they are using those skills in flood management in the area. The participants also observed the education programme on flood management in one of the schools in Nyando River Basin. In the evening the JICA Project Team was able to show the participants a video recording of an evacuation drill activity in the Nyando River Basin.

LOGUMI WRUA members were able to note the following on the day one of visitation:

- The raised structures were slightly above 1.2M which the community members pointed out was above the flood depth in the area;
- The education programme on flood management was an important activity in enhancing flood management. The participants noted that primary pupils were able to understand natural early warnings of floods like appearance of some bird species as an indicator that it was going to flood;
- The evacuation drill that prepares the community for effective and safe evacuation was an important activity that if properly understood reduces human casualty;

The lessons learnt from day one visitation are as follows:

- The raised structures were good model that should be replicated in all flood prone areas. LOGUMI WRUA members were initially reluctant in identifying Nyora Primary School as an evacuation place because during the worse flood situation in the area the flood water flows into the classroom where the evacuees seek shelter. But with the raised structure like evacuation centre and toilets in a place like Nyora Primary School will play an important role because the affected families can move to the school without fear that in case the flood situation worsens leading to water flowing to the school, they will be forced to move to another evacuation place.
- The education programme on flood management was an effective tool in sensitization on flood management and also on informing the young generation on the flood problem within their area and thereby socializing these pupils in effective ways of flood management. Such education programme should be conducted also in LOGUMI SC.

- The efficacy of evacuation drill especially when the evacuation drills are conducted at least once in a year. LOGUMI WRUA in their Flood Management Plan had proposed such activity that should be implemented at least once per year.

Day 2: 26th March, 2013

Day 2 visit commenced at 9:00 am. All the participants met at Imperial Hotel and thereafter left for the field trip. The following were observed during day 2 site visit:

- Two raised evacuation centre whereby one was constructed at chief's camp and the other at school compound; raised toilets were also observed one constructed at the chief camp which was a two compartment toilet and the other a ten compartment toilet constructed in the school compound; footbridge that enhanced accessibility to a Kigoche primary school; culverts that also enhanced accessibility to Achuodho School were observed and the raised borehole constructed at the school compound;
- The participants also interacted with the community members in the two villages and in one of the village the community members were still asking the JICA Project Team to assist them with constructing a nursery school yet the village had an evacuation centre that could be used as a nursery. In the other evacuation centre at Achuodho School was poorly maintained with most windows broken and not repaired.

The lessons learnt from day two visitation are as follows:

- 1) The footbridge that enhances accessibility to an evacuation place or other social amenities was an important structure. The footbridge observed in Nyando enabled the pupils to access the school even during floods and also evacuees can easily access such facility during floods. In LOGUMI SC accessibility to Kabuto dispensary is a major problem during floods but with such facility like footbridge then community members can easily access the healthcare at the Kabuto Health Centre.
- 2) The culverts both big and small are important structures in improving evacuation routes for example at Achuodho School the participants observed culverts constructed at the entry point of the school and thus enhancing accessibility. In LOGUMI area some of the hotspot areas on the evacuation route to evacuation centre can be improved with construction of culverts in those areas.
- 3) The CFMOs in Nyando River Basin played an important role during implementation of the Nyando Project but the CFMOs have remained stagnant after the Project. The CFMO dependency on external help was noted and this does not augur well with flood management within their areas because the CFMOs are not taking steps towards effective flood management but rather are making excuses on why they have not made any steps after the

project towards effective flood management. The CFMO have not even made steps to join WRUA within their jurisdiction but they are still begging for structures that they can easily have on their own like fencing evacuation centre or even the request for nursery school when there is an evacuation centre within their village is preposterous.

- 4) The deconstruction of LOGUMI WRUA members' assumption that LOGUMI SC was the only worst hit area with floods. The excursion visit to Nyando River Basin was an eye opener to the participants that floods do not only affect LOGUMI SC but other areas too and that there is what community members on their own can do to manage these floods. In the Nyando villages are organized in the CFMOs that are able to issue evacuation notice during floods, community members are involved in O&M of the structures constructed within their village, and community members can cooperate with schools that act as evacuation places for effective evacuation and management of the evacuation centres within the schools.

10.3 The Exchange Visit to LOGUMI SC observations

The visiting WRUA members visited LOGUMI WRUA for two days. The purposes of the visit were to:

- Community based flood observation and early warning system
- Community based flood hazard mapping
- Observation on flood affected areas
- Explanation and demonstration of flood water discharge observation by using ADCP

Day 3: 27th March, 2013

The day's activity began by Mr. Boit of WRMA teaching the participants on how to develop community based flood hazard maps. The second session entailed the LOGUMI WRUA explaining to the participants how they developed including the steps that LOGUMI WRUA took in the community-based flood early warning system. Third activity was accompanying the Project Team to various sites within the LOGUMI SC and explaining the flood situation to the participants. That last activity of the day was a joint lunch amongst all the participants that were involved in the Exchange visit to LOGUMI SC.

Lesson learnt

- That one step that a community takes can change the whole perception and the direction the community goes towards. The community based flood early warning system was a step LOGUMI WRUA members made in effort to manage floods within the SC but has become a point of reference even among the LOGUMI WRUA members.
- That what one knows is not the end of knowledge. The discussions amongst the participants revealed that the community based early warning can be improved and even made more effective through data and information sharing with WRMA.

- The borehole at former Kabuto primary school can be repaired by LOGUMI WRUA without external help but by just the use of the borehole manual and innovation using locally available materials.

Day 4: 28th March, 2013

The day's activity began by Mr. Ngessa of WRMA teaching the participants on how to observe and monitor high flows using ADCP machine. The second session entailed a discussion on the morning teaching on the use of ADCP. Third activity was discussion by participants on good practices observed during the Nyando Excursion Visit and Exchange Visit to LOGUMI. That last activity of the day was a joint lunch amongst all the participants that were involved in the Exchange visit to LOGUMI SC.

Lesson learnt

- That observing water levels was good but it was much better to understand the amount of water discharged during high flows.
- That Flood Management does not only entail responding to floods but preparation works in anticipation of floods and post floods activities.
- The importance of team work, sharing of information with other stakeholders.

Conclusions

The five days that entailed Nyando Excursion Visit and WRUA Exchange Visit to LOGUMI were an eye opener to the LOGUMI WRUA both on effective flood management and the power of unity within the organization. In summary the following are key lessons that LOGUMI WRUA learnt from the two above mentioned visits:

- Practical learning through observation was an appropriate avenue for learning good flood management practices as was the case with Nyando Excursion Visit;
- The importance of structural measures in flood management cannot be overemphasized. Though it is important to have these structures to enhance flood management in an area but it is prudent that the capacity of the communities in flood prone area be developed through training for example of Operation and Maintenance of these structures among other training on flood management;
- The community members in these flood prone areas have a lot of knowledge on the floods that affects them and all they need is a platform to share this information. It is in sharing information that the strengths, weaknesses and opportunities within the community can be drawn out, tap into and harnessed to ensure effective flood management;
- The importance of developing building codes for flood prone areas whereby houses, schools and other public building including toilets should have their foundation raised above the flood depth in that area; and

- A facility like Evacuation Centre is a multipurpose facility, which can be used as evacuation centre during floods, examination centre during exams, utility hall during community functions. This kind of facility can therefore be used for the mutual benefit of the entire community if it is constructed in an area.

Major Benefit of the Excursion Visit to Nyando: Raised Toilets

On 12th September 2013 LOGUMI WRUA explained to the Project Team the planned toilet construction in four schools located in flood prone areas. LOGUMI WRUA stated their dissatisfaction with the proposed design for the toilets for schools in flood prone area. In response to April-May 2013 Floods wherein UNCEF had responded by releasing some funds to World Vision (target area LOGUMI SC) to construct toilets in the primary schools that were affected by floods. The LOGUMI WRUA members stated that because of lack of forum for sharing information, led the WRUA members to come to the knowledge of the construction of the when World Vision made a public advertisement for procurement of the contractor.

Based on the above reported dissatisfaction of LOGUMI WRUA, the WRUA officials visited World Vision Nyatike Office to discuss with World Vision on the proposed design of the toilets. The LOGUMI WRUA explained to World Vision of their exchange visit to Nyando that was organized by JICA Project Team. They recounted their observation of structures constructed in the Nyando that included a ten and a two compartment toilets that were raised above flood depth such that when it floods the toilets stand firm above the flood water. They pointed out that the areas earmarked for construction of toilets in LOGUMI SC were flood prone areas with flood water inundating some parts of the school compound. They informed World Vision that if the toilets design was not going to be changed then the toilets will be only usable during dry season but when the area gets flooded the toilets will not be used and furthermore the flood water would make the toilets to overflow leading to contamination of water. The LOGUMI WRUA therefore proposed to World Vision for change of design of the proposed toilets to be replicas of the raised type the same kind of toilets they had observed in the Nyando. World Vision agreed to the LOGUMI WRUA proposal and agreed to raise the toilets foundations by at least 50CM above the ground which in essence implies the raised toilets would be above the flood depth. The flood depth in the compounds of the selected school is approximately 30CM. The toilets consist of three compartments with an extra compartment for disabled persons. The raised toilets have since been constructed.



Fig 1 Raised Toilet at Nyora Primary School

11. Development of community-driven flood early warning hydrograph

The LOGUMI WRUA developed a hydrograph using the River Gauging Station (RGS) 1KB05, WathOnger. In the WRUA hydrograph the flood threshold based on the river level is four metres (4M) reading at the RGS. At that point for purposes of flood early warning indicates that floods would affect farmlands both in Kabuto and Nyora villages and at 4.2M the homesteads are affected. It is prudent therefore to note that in between April and May 2013 for more than thirty days the river levels were above 4M thereby leading to long duration of floods that led to heavy and longer periods of evacuations by affected families. The figure 1 below is a graph that indicates the number of days vis-à-vis river levels for April-May 2013 floods based on the morning and evening readings as recorded for 1KB05 WathOnger.

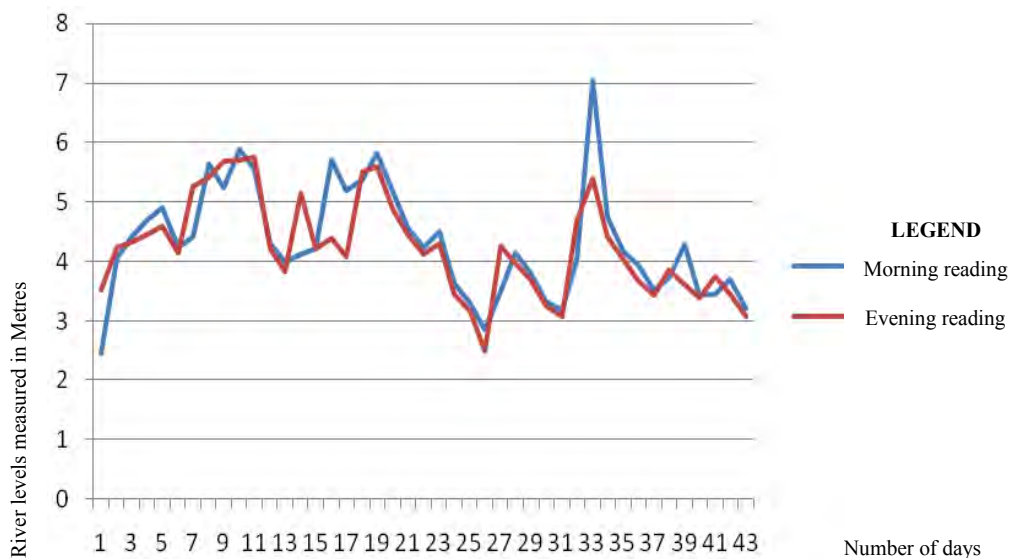


Figure 2 A hydrograph for April-May 2013 Floods

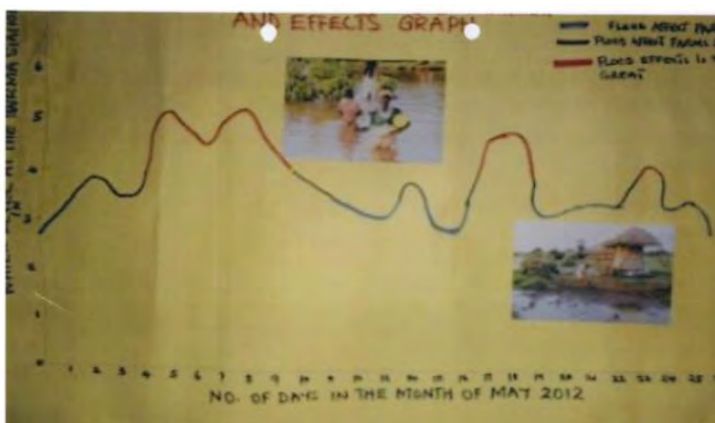


Figure 3 Community developed hydrograph for flood early warnings

12. The assistance for obtaining activity budgets in Lower gucha migori sub-catchment

On 8th July 2013 LOGUMI WRUA wrote a letter requesting for financial and technical support to carryout community-based flood management structures to enhance flood management within

LOGUMI SC. In their letter the LOGUMI WRUA pointed out that the community members were willing to contribute their labour for purposes of constructing a simple dyke around Nyora School and a raised road in Kabuto village.

LOGUMI WRUA is now exploring the way of development for substantial school function as a school is one of the evacuation centre when floods come. Against this, the project team facilitated to obtain WSTF funds for flood measures by including the flood related elements in SCMP. In addition, the project team also facilitated to obtain the “Grass Root Grant Aid Program” provided by Japanese Government.

First, the project team encouraged LOGUMI WRUA to get the application documents of Grass Root Grant Aid Program, and then explained the contents or application conditions to the secretary. Now we are proceeding the preparation before submission by exchanging the draft and revision of the document.

The contents for submission is the application of raised up evacuation centre in Lower Gucha Migori sub-catchment.

On the other hand, construction of “Nyando type raised up toilets” were already done in Lower Gucha Migori based by the proposal from LOGUMI WRUA.

The common scheme from the information or lessons learnt in WRUA and WRMA will be applied to the activities for obtaining the budgets. In the future, the activities for obtaining the budgets will be expanded to many other areas through the scheme like this.

APPLICATION FORM FOR JAPAN'S GRANT ASSISTANCE
FOR GRASSROOTS HUMAN SECURITY PROJECTS

1. APPLICANT

(1) Name of the Applicant
Lower Gucha-Migori Water Resources Users Association (LOGUMI WRUA)

(2) Address
PO BOX 18-40402 Nyatike, Migori County

(3) Phone Number
+254727078980
Fax Number or E-mail Address
logumiwrua@yahoo.com

(4) Responsible Individual (Authorized Individual to sign the Grant Contract) (Name)
Mr. Ruth Nanjala
(Title)
Chairperson

(5) Has your organization received any financial/technical assistance from foreign governments, international organizations or NGOs? If yes, please describe the content of the assistance.

Technical Assistance from GIZ for developing sub-catchment management plan (SCMP)

Technical Assistance in developing community flood hazard maps from JICA PCDEEM Project Team

(6) Please answer the following questions, according to the nature of your organization.

(a) Non-Governmental Organization (NGO)

(i) Year of Establishment
2008

(ii) Number of Staffs
LOGUMI WRUA has seven staffs:
1) Ruth Nanjala, Chairperson;
2) Joshua Ouma Ojwang, Secretary;
3) John Adek Odiong, Vice Chairman
4) Benet Adhiambo Mwal, Treasurer
5) Patrick Ochieng, Vice Secretary
6) Andrew Olembu Osewe, Chair Flood management Committee and
7) Symon Orieno Awidhi, Secretary Flood management Committee

(iii) Purpose of Establishment
To enhance community active involvement in sustainable water resources

Fig 3 The Application Document Submitted to Japan Embassy by LOGUMI WRUA

13. The establishment of the Community-driven Flood Management Organization

The LOGUMI WRUA established Flood Management Sub-committee which was tasked with flood management. The Flood Management Sub-committee having responded to floods in the

sub-catchment proposed the establishment of the Community-driven Flood Management Organizations (CFMOs) at the village level after the order of their observation during the Nyando excursion Visit. The purpose of the CFMO was to enhance effective flood management at the grassroots level (village). The Current status of the newly established CFMOs that LOGUMI WRUA spearheaded their establishment are currently eleven CFMOs that have been established namely Kabuto CFMO, Nyora CFMO, Tulu CFMO, Kimai/Kuja CFMO, Obaluanda CFMO, Sere CFMO, Aeko (Got Kachola) CFMO, Aneko CFMO, Onyongo CFMO, Tito CFMO and Ratieny CFMO. Six of these CFMOs have already established organizational structure through elections of the office bearers and one of the CFMO has already registered as Community Based Organization (CBO) with the Department of Social Services i.e. Tulu CFMO while four others are in the process of registration.

NAME	REGISTRATION WITH GOK	LOG. WRUA
1. TULU CFMO	YES	YES
2. Kabuto CFMO	NO	YES
3. Nyora CFMO		YES
4. Ratieny CFMO	YES	YES
5. Aeko CFMO	YES	YES
6. Tito CFMO	YES	YES
7. Kimai/Kuja CFMO	NO	YES
8. Obaluanda CFMO	YES	YES
9. Onyongo CFMO	NO	YES
10. Aneko CFMO	NO	YES
11. Sere CFMO	NO	YES



Fig 4 List of established CFMOs pasted on the inside wall of LOGUMI WRUA office

14. Site Visit to the downstream of Gucha Migori by the Upstream WRUA

The establishment of the Integrated Flood Management Committee led to close cooperation between upstream WRUAs and downstream WRUAs which culminated in the site visit by upstream WRUAs to the downstream. The purpose was to enhance the understanding of flood conditions in the downstream by the upstream WRUAs.

The upstream WRUAs visited downstream of Gucha Migori in particular LOGUMI SC. This enabled an environment for discussion that led to agreement by the upstream WRUA to actively

participate in the CBFWEWS by agreeing that the rain gauges be installed in the upstream and the upstream WRUAs will identify an observer who will communicate with LOGUMI WRUA in case of the heavy rains in the upstream.

	
<p>Description : Joshua Ouma demonstrating the use of early warning system at WathOnger</p>	<p>Description : participants discussing on the cause of floods on the downstream</p>

15. Installation of Community-based Flood Early Warning System

After the training of LOGUMI WRUA members on Community Early Warning that was done in October 2013, JICA Project Team assisted LOGUMI WRUA to install the early warning system.

15.1 Installation of water level gauge and sensor

Installation of water level gadget inclusive of a sensor switch was carried out on 5th December 2013. The JICA Chief Advisor and Project Supervisor guided the LOGUMI WRUA in the installation of the water level gauge gadget at WathOnger next to RGS 1KB05 WathOnger. The LOGUMI WRUA members participated actively in the installation of the water level gauge gadget.

The LOGUMI WRUA are their own added vandalism proofs pipes to protect the water gauge gadget from vandalism and also reinforced its support to prevent the harsh river water to uproot and ferry away the water level gauge gadget.



Fig 5 Water Level Gauge Gadget with vandalism proof installed by LOGUMI WRUA

15.2 Installation of rain gauge and sensor

It is noted that the floods that wreck LOGUMI SC have their source in the upstream which

encounters heavy rainfall leading to high flows in R. Gucha Migori and thereby causing floods. It was agreed therefore the rain gauges be installed in the upstream.

- i. After discussion it was agreed by consensus that the rain gauge and its accompaniment gadgets be installed at St. Pancras Kiongongi High School. The selected place is a secondary school and it currently does not have electricity but the electrical wiring in the school has been done and there is a Kenya Power Company meter box already installed and poles for electrical wires have been mounted. The school principal pointed out that within the next one month the school will have electricity. He also clarified that there is a place where they charge battery that they use before electricity is supplied to the school;



Fig 6 St. Pancras Kiong’ongi Site that was mutually agreed upon by Middle Gucha WRUA

- ii. At Emuria Dikiri High School, the teachers, and students were highly anticipating the installation and that they had dug a shallow hole for pipe placements. The school also had a weather station of wind vane and evaporation and they only lacked a rain gauge. The Principal stated also that the school has been working closely with the Upper Magor WRUA. He added that it is Upper Magor WRUA that supplies water to the school and he was happy with the installation of the rain gauge gadget. He therefore assign the school watchman and geography teacher as observers in addition to the Upper Magor WRUA member that had been assigned as an observer.
- iii. At Kanga Onditi Primary School, the teachers, and pupils were happy with the installation and assisted in the digging of shallow hole for pipe placements. The school teacher stated that the school was going to work closely with the Ongoche WRUA. The Ongoche WRUA assigned one of its members who live near the school, the school watchman and a teacher as observers.
- iv. During the installation a manual for assemble and installation of community based FEWS was given to Middle Gucha and Upper Magor WRUA for purposes of their reference and to enhance operation and maintenance of the installed rain gauge and its gadgets.

16. Summary of KRCS Project Activities in Project Area

The KRCS implemented the non-structural measures component of the Project in all the three pilot project areas.

In Lower Gucha Migori the KRCS have been engaging the LOGUMI WRUA, KRCS Volunteers and community members in the implementation of the activities.

The summary of the KRCS activities in the Project Area is as per the Table 2 below:

Table 8 Summary of the KRCS Activities in Gucha Migori River Basin

Date	Activities & Venue	Participants	Remarks
26 th Sept. 2013	KRCS Non-structural measures Kick-off meeting held at Nyora Primary School	KRCS, WRMA, LOGUMI WRUA, DEO, DC and Community members	The meeting was well attended and KRCS explained to the community the objectives of the activities, when, where and how these activities would be implemented.
19 th Nov. 2013	Stakeholders Meeting held at KRCS Migori Branch Boardroom	KRCS, JICA Project Team, LOGUMI WRUA, Migori County Government, Head teachers of schools in flood prone areas, youth and women representatives	The meeting was well attended and KRCS explained to the stakeholders the activities they intended to undertake in the LOGUMI SC.
3 rd -6 th Dec. 2013	LOGUMI WRUA Training on Community based Disaster Management	KRCS, LOGUMI WRUA, JICA Project Team	Average attendance of 30-40 WRUA members. The training materials were relevant to the subjects.
9 th -11 th Dec. 2013	LOGUMI WRUA Training on Community based Early Warning	KRCS, LOGUMI WRUA, WRMA-LVSC Kisii Office, JICA Project Team	WRMA counterpart staff participated in the training as one of the trainer. KRCS also carried out Focal Group Discussion (FGD) to understand the traditional early warning system.
18 th Dec. 2013	Presentation of KRCS activities in LOGUMI SC during Gucha Migori IFMC	Stakeholders within Gucha Migori	KRCS Project Officer made a presentation on the current progress of activities being implemented by KRCS in LOGUMI SC.
13 th -15 th Jan. 2014	Teachers' Training on Flood Disaster Management	Teachers from Sere, Nyora, Angugo and Kabuto primary School	About 95% in attendance and materials developed under the Japan Grant Aid Project were used.
16 th Jan. 2014 and is still continuing	Teachers teaching pupils on Flood Disaster Management in Schools	Pupils in classes 4 to 7 in Sere, Nyora, Angugo and Kabuto primary School	The Teacher Booklet on Flood Management was being developed
27 th Feb 2014	KRCS Project Officer made a presentation on Education Programme on Flood Management	IFMC members	PowerPoint presentation was developed on the relevant subject

(Source: The JICA PCDEFM)

17. Milestones in Flood Management Gucha Migori River Basin

- a) The list for the prospective IFM Committee members for Gucha Migori River Basin has been developed;
- b) Community based flood management Action Plan has since been developed: In the months of February and March 2012 the Project Team and the WRUA were involved in developing the community based flood management action plan. During this period the flood disaster cycle was core area that the plan revolved round about it. Flood disaster preparedness, response and reconstruction were discussed with various activities being proposed thereafter.
- c) The Community-based Flood Management Action Plan has since been incorporated in the SCMP. The reviewed SCMP has been officially submitted to the WRMA SRO and also recently a softcopy of both the Community-based Flood Management Action Plan and reviewed SCMP for LOGUMI WRUA was given to the Assistant Technical Manager in charge of Community Development WRMA-LVSC Regional Office.
- d) Newsletter Production: There is a monthly Newsletter the Integrated Flood Management Newsletter that is produced each month and it carries the briefs of the progress of the Project in the Southern Shoreline Gucha Migori. Eight issues hitherto now have been as at October 2012.

In each of the issues at least fifteen copies of the Newsletter are distributed to the LOGUMI WRUA. The LOGUMI WRUA further redistributes this Newsletter to other stakeholders and also uses the Newsletter for sensitization of its members on issues of flood management.

- e) The LOGUMI WRUA wrote a column in the Newsletter 4th and 5th edition wherein in 4th edition the WRUA introduced the LOGUMI WRUA and the process of its establishment. In the 5th edition the LOGUMI WRUA expounded upon their vision and mission.
- f) Development and review of Flood Hazard Maps: The flood hazard map for Kabuto-Nyora area; for Tito-Ratienyi area; and for Luanda-Misiwi area.
- g) LOGUMI WRUA proactive participation in Flood Management in the Lower Gucha Migori Sub-catchment.
- h) The LOGUMI WRUA chairman and the District Commissioner Nyatike District attended the Workshop on effective flood management organized under the Project.
- i) Discussion with respective stakeholders' targeted to as prospective IFM Committee members has done and was fruitful with many stakeholders showing willingness to be part of the IFM Committee members.
- j) The Menu for Community-based Flood Management activities was developed and has been circulated to various stakeholders. The menu also puts up case for building resilience a key in ensuring effective flood management is achieved.

- k) The second Workshop on Integrated Flood Management was held on 12th February 2013. During the workshop the Supervisor Gucha Migori made a presentation, Mr. Boit former counterpart staff to the Project in Gucha Migori made a presentation and LOGUMI WRUA Secretary Mr. Joshua Ouma also made a presentation.
- l) Seven LOGUMI WRUA members visited Nyando River Basin during the excursion visit to Nyando River Basin and had a firsthand experience of the Nyando Project and also had positive interaction with Community members in Nyando including Community-based Flood Management Organizations (CFMOs) and WRUAs located in Nyando.
- m) LOGUMI WRUA hosted a team consisting of Project Team, WRMA, GIZ and WRUAs from Isiolo and Lower Lumi for two days. During the two days LOGUMI WRUA explained to the visitors the nature, the operations, the success of LOGUMI WRUA within the Lower Gucha Migori SC.
- n) LOGUMI WRUA was actively involved in the response to floods in April 2013. It worked closely with World Vision Nyatike and KRCS Migori. The LOGUMI WRUA also stationed two of its members at the Nyora Evacuation Place.
- o) LOGUMI WRUA installed a ten thousands litres (10000 lts) water tanks at New Jerusalem Children Home to harvest rain water from the vast roof catchment of the church in order to reduce the water surface run-off in the area during the rainy seasons.
- p) LOGUMI WRUA has sensitized community members to establish Community-driven Flood Management Organizations (CFMOs) that has led to eleven CFMO hitherto to be established.
- q) LOGUMI WRUA members were involved in the open lecture held in Nairobi for community based early warning system by using community develop rain gauges and river gauge gadgets.
- r) LOGUMI WRUA members were trained in Community-based Disaster Management and Community-based Early Warning by KRCS.
- s) LOGUMI WRUA assisted by JICA Project Team installed Community-based Flood Early Warning System.
- t) LOGUMI WRUA working closely with WRMA and KRCS mobilized teachers within LOGUMI SC who were thereafter trained by Kenya Red Cross Society on teaching of pupils on the subject of Disaster Management and in particular Flood Disaster Management.
- u) Pupils in four Schools in LOGUMI SC currently are being taught Flood Management Concepts that are being infused into school syllabus.



WRUA members explain the area where the river changed its course



Community-driven flood management Action Plan development after a brainstorming session



WRUA Flood Management Sub-committee member carries out flood assessment



WRUA Secretary explains to members a point during the workshop on development of community action plan



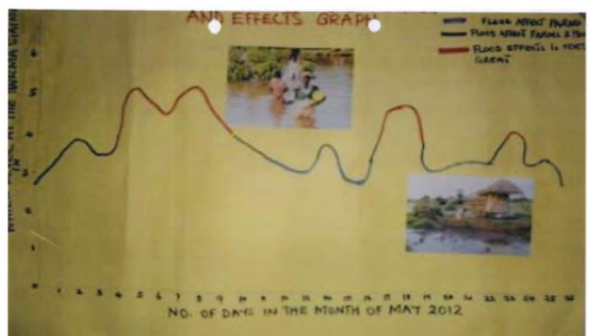
WRUA members draw community-driven flood hazard map



Community driven flood hazard map features are transferred to topographical map



WRUA members draw community driven flood hazard maps for other areas in LOGUMI SC that are flood prone



Community-driven hydrograph that was developed by LOGUMI WRUA



Training on community-based disaster management in progress



Explanation on how the community-based flood early warning system works



Installation of a rain gauge and sensor at Emuria Dikiri Secondary School



Community-based Flood Management training for LOGUMI WRUA during the third stage WRMA training



WRUA Secretary explains how the CBFWS works vis-à-vis the river gauge installed



Community sensitization on effective evacuation through execution of evacuation drill



Excursion visit to Nyando where WRUA members were exposed to concept of raised foundations for building in flood prone areas



Excursion visit to Nyando river basin



Excursion visit to Nyando where WRUA members were exposed to concept of community flood hazard map that had been pasted on the installed signboards



Excursion visit to Nyando where WRUA members were exposed to concept of footbridges to enhance accessibility in flood prone areas



Excursion visit to isiolo river basin where WRUA members observed CBEFWS installed in flood prone areas



Excursion visit to isiolo river basin where WRUA members observed riverbank protection in flood prone areas



Excursion visit to Lumi river basin where WRUA members observed raised evacuation hall constructed in a school in flood prone areas



Excursion visit to Lumi river basin where WRUA members observed raised toilet constructed in a school in flood prone areas



Teacher at Sere Primary School trains pupils on flood management through infusion into the social studies class



MI WRUA Management Committee meet and discuss issues with JICA's final evaluation team

LOGU



Raised toilet constructed at Nyora Primary School located in flood prone areas, LOGUMI WRUA influenced the design change from ground level design to raised above flood depth design

18. Challenges

- There is a need for structural measure to compliment the non-structural measures.
- The capacity of WRUA to develop good financial proposals should be enhanced.
- The excursion visits should consist of all the management committee and sub-committees members.
- WRUA should be linked and assisted in relating with stakeholders that can fund the WRUA activities.
- The Community-based Flood Management Action Plan should be incorporated into the SCMP, be shared with the CDF committee and County Government to ensure that all the activities proposed in the action plan are implemented

a) Duration

Project Duration: 2011 to 2014

b) Related organizations

WRMA-LVSC Gucha Migori SRO

KRCS Migori Branch

LOGUMI WRUA

c) Type of activities

- Non-structural measures

d) Contacts

WRMA-LVSC Gucha Migori SRO

LOGUMI WRUA

CFMOs

Chapter 3 Lessons Learnt in Lower Gucha Migori Sub-catchment

Case 1 Non-structural measures in Lower Gucha Migori Sub-catchment

1. INTRODUCTION

The Project on Capacity Development for effective flood management in flood prone areas implemented a capacity building programmes on effective flood management for WRMA and WRUA. The training for WRMA was divided into three stages: Stage 1 was the training of WRMA staffs by JICA PCDEFM Team; Stage 2 was the training of WRMA staffs by the flood management trained WRMA staffs; and stage 3 were the training of WRUA members by the flood management trained WRMA staffs. The stage 3 was implemented in Gucha Migori river basin when WRMA staff trained LOGUMI WRUA on community based effective flood management. It was during that training that the sentiments of the LOGUMI WRUA Chairlady are herein quoted:

“She said that during the entry of JICA Project Team in LOGUMI wherein the expectations of the community were heavy structural measures but when the scope of the Project in LOGUMI was explained she pointed was heartbroken. But after undergoing through the various training, workshops and interactions with other stakeholders, she now understands why the trainings were important! She added that now LOGUMI community members were in control of their own destiny! Using a Luo proverb she said it is better to train a person on how to fish than just giving that person fish to eat! She added that LOGUMI WRUA were now able to know importance of any flood structure that when they will be constructed in the area O&M will be per excellence!! She also stated that LOGUMI WRUA had written proposal soliciting for funds to construct an evacuation centre at Nyora village to Japan Embassy.”

2. LESSONS LEARNT

2.1 Community Participation and involvement in Flood Disaster Management

The concept of the Community Managed Disaster Risk Reduction (CMDRR) was the focal point in the implementation of the Project. The Project Team entry point to the community was through LOGUMI WRUA which is a community based grassroots organization. Through this concept the community members through the LOGUMI WRUA and assistance from the Project Team were able to develop the following:

- a) Community-driven Flood Management Action Plan, that was later incorporated in the LOGUMI WRUA SCMP;
- b) Community-driven Flood Hazard Maps, that was later used to update the topographical map;
- c) Community-driven flood early warning hydrograph;
- d) Community based Flood Early Warning System; and
- e) Establishment of Community-driven Flood Management Organizations (CFMOs) in LOGUMI SC for effective flood management at grassroots village level.

2.2 Support for establishment of the WRUA Flood Management Sub-Committee

The Community-driven Flood Management Action Plan proposed the establishment of Flood Management Sub-committee in the LOGUMI WRUA set up.

In the WRUA Development Cycle(WDC) Manual provides for establishment of the “Management committee” and following three sub-committee under the “Management committee” i.e. Finance sub-committee; Procurement sub-committee; and Monitoring sub-committee

Imperatively based on the Community-driven Flood Management Action Plan and in consideration of the massive flood damage in LOGUMI SC the Project Team considered supported LOGUMI WRUA in the establishment of Flood Management sub-committee.

Flood Management sub-committee aims at effective flood management vis-à-vis the three phases of floods i.e. pre-floods, during floods (response) and post-floods. In consideration of the vastness of the sub-catchment, extensive flood damage, longer inundation periods among other challenges, the flood management sub-committee therefore endeavors for establishment in CFMO (Community driven Flood Management Organization) under the LOGUMI WRUA after the establishment.

CFMO is structured after the order of Community Based Organization (CBO) that acts for improvement of various problems in the community with various funds as money source. Flood disaster is not an exception and therefore CFMO are community-based organization that aims at tackling flood problems at village level. The CFMOs are registered under social service division of Ministry of Gender, Children & Social service.

2.3 Support of Establishment of CFMO under WRUA (Water Resources User Association)

Community Flood Management Organizations (CFMOs) are voluntary self-help groups established in the flood prone areas for the purpose of managing flood hazard. The main aim of instituting CFMOs is to ensure long term flood management in these particular flood prone areas. As a community based self-help group it strives to continuously enhance the community’s capacity to maintain sustainable flood management.

The CFMOs have the following objectives:

- a) To improve the livelihood of the target communities through provision of appropriate disaster management tools, in particular flood management drills that should take into consideration the protection of human and physical resources of the concerned communities
- b) To disseminate information of their experiences and performances to the adjacent communities for further extension and multiplication of these experiences into the neighbouring communities in the flood prone areas.
- c) To build capacity of community-based Flood management Organizations in order for the communities to be able to properly manage floods by themselves and minimize the flood damages to their lives, livelihood and properties

In the “Nyando Project”, CFMO were established at the village community level and not under the WDC framework and therefore as CBO (Community Based Organization) the CFMOs vent to access funds was limited.

Under the JICA PCDEFM the CFMOs in LOGUMI SC were established under the LOGUMI WRUA and the CFMOs are corporate members of LOGUMI WRUA and therefore the CFMOs through are able to access the fund of WSTF (Water Service Trust Fund) and other resources. The question that can be raised herein therefore is how did LOGUMI WRUA understand the concept of CFMOs?

1) Background of CFMO Promotion Support

“Exchange Visit” was carried out in March 2013 to WRUA’s pilot project area in order to inspect the flood management activities at Nyando Project and exchange opinions.

LOGUMI WRUA identified the CFMO through the Exchange Visit, and CFMO became established on trial under WRUA. The activities of CFMO have been established and some are metamorphic still due to transition in flood management in LOGUMI SC.

2) Theadvantages for having established CFMO under WRUA are as follows:

- WSTF fund can be utilized for the activities.
- Individualand specific flood management can be operated at respective communities governed by WRUA.




In the flood management activities of CFMO, CFMO’s personnel are performing close activities in the community and play roles to enhance the community’s Resilience against the flooding in the community in such terms as ability enhancement for rescue when flooding, smooth evacuation for damage mitigation and skill for flood forecast with necessary countermeasures.




Information share on experience and countermeasure in the past flooding is being promoted in the community as well.

Construction of small scale of structure against flooding and refurbishment of the structures damaged by flooding, are also carried out by the community.

Specific activities of CFMO are as shown below.

Table 9 Summary of the CFMOs Activities in LOGUMI SC

No.	Role	Photo	Remarks
1	Safety measures enhancement		Maintain safety of the target communities. CFMOs play an important role in evacuation and therefore they must conversant with basic first aid
2	Evacuation drill		Enhancement of disaster prevention consciousness
3	Life improvement through skill-acquisition for flood management		Improvement of technique for understanding cause and effects of floods and developing appropriate countermeasure

4	Knowledge improvement by information sharing on flooding experience		Disseminate experiences and performances of the target communities to the adjacent communities for further extension and multiplication of knowledge
5	Provision of flood damage information		Showing inundation depth and evacuation route in the inundated area when developing community-driven flood hazard map
6	Maintenance of structure provided for flooding countermeasure		Improvement of drainage canal by removing debris and clearing the drainage to allow free flow of water

(Source: The JICA PCDEFM)

Following advantages and issues have been revealed in the CFMO's activities at Logumi WRUA so far.

Table 10 Advantages of CFMO based on their activities

No.	Advantage	Remarks
1	Likely to be supported to the local community By such developing partner as administrative organization, non-governmental organization and donor	Similar organization to CBO
2	Composed by voluntary and positive members	Having strong mind in local consciousness by nature
3	Having strong consciousness of the activities as the persons concerned	

4	Possible to become contact between donor and community member	Having dual viewpoint as inhabitant and as developer
5	Likely to mobilize the persons easily due to old acquaintance with community members	
6	Familiar with local topography and geography and having protective mind toward the inhabitants with knowledge of dangerous spots when flooding	
7	Appropriate for communication and information exchange with neighboring villages	Habitual local interchange and similar language

(Source: The JICA PCDEFM)

Table 11 Disadvantages of CFMO based on their activities

No.	Issue	Remarks
1	Much dependence on the chairman's leadership for operation, thus, likely to be declined in case of chairman's shift	
2	Possibly to become private organization by the persons who established CFMO	Making such warehouse for flood management personal belonging
3	No supervisory organization	Required for high moral and self-purification of the personnel
4	Unrestricted performance due to no definite obligations to WRUA	Limited control of WRUA

(Source: The JICA PCDEFM)

As reviewed above, CFMO has smooth understanding with the community members within the village setup and is likely to proceed with positive and detailed performance in consideration of high consciousness and independence of its activities.

But due to lack institutionalized framework that makes the CFMO independent from the office bearers that manage CFMO, there are possibilities of the CFMO becoming a private organization in terms of operational function and authority.

3) Development of CFMO to Other WRUA

Since CFMO is operating for flood management in the smaller community unit than WRUA, it is easy to target priority issue and assign the personal resource for carrying out the accident prevention activities in the community.

From the above viewpoint, the Project Team supported to establish CFMO in the Lower LUMI WRUA aiming at CFMO's level development as follows.

- ✓ Orientation to and Opinion Exchange with Lower LUMI WRUA and School Persons:
 The Project Team explained CFMO substance and circumstances at Logumi WRUA to Lower LUMI WRUA as well as advantageous matters and issues, and exchanged opinions on the establishment possibility of CFMO.

✓ Orientation at IFMC (Integrated Flood Management Committee)

The Project Team explained the substance of CFMO, its establishment and operating circumstances at Logumi WRUA and current advantageous matters and issues in order to grasp the possibility of its establishment at Lower LUMI and possible overcoming of the issues.

An indication was raised that capacity development of the leader for CFMO should be much important through the introduction of Nyando Project case.

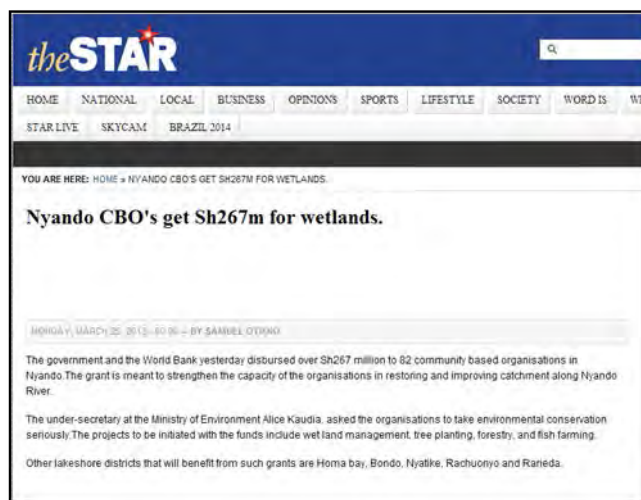
The Project Team supported CFMO in Nyando Project and it operated sufficiently while the Project Team instructed, however, it quickly declined after leave of the Project Team because of fund-shortage, transfer of the school principal without successor of the responsible person and lack of powerful leader.

It is requisite to provide powerful leader in the CFMO under WRUA without donor and to promote such leader sustainably in order to maintain CFMO.

Head Teacher of Eldoro Primary School vigorously mentioned that the local educational organization would involve in the promotion of the vanguard.

4) Activities Being Taken for Capacity-Building Necessary for Establishment of CFMO

Financial support for Logumi WRUA has already been requested toward other donors and county government. As for Nyando Project, existing CBO has received much fund. Such fund disbursement news are made a lot, and the following shows an example of the fund disbursement.



Source: <http://www.the-star.co.ke/news/article-113706/nyando-cbos-get-sh267m-wetlands>

Fig. 7 News of Fund Disbursement of Nyando CBO

It will be possible to realize the establishment of CFMO and its operation for Lower LUMI in connection with Logumi WRUA.

In fact, the fund from the county government for road construction using sand bags at Lower LUMI will be realized, thus, CFMO can possibly receive the fund from the county based on the CFMO's preparation of the proposal.

As mentioned hereinabove, CFMO can be established through the application toward Social Service Division of Ministry of Gender, Children & Social Service to obtain certification as CBO and to establish its bank account.

Lower LUMI WRUA is preparing the application with close contact with Logumi WRUA. Personnel composition of CFMO will be of about 30 persons comprising of female, tribe group, local leader and teacher and advisor comprising of administrative organization in the district level, persons of DMC (Disaster Management Committee), teacher, areal health center, large-scale farmer (member of WRUA), non-governmental organization and other CBO.

2.4 Excursion Visits to other flood prone areas to enhance capacity in flood management



• The influence in changing toilet design to raised toilet



UN OCHA provide assistance of construction of toilets in the schools in the flood prone areas that were affected by floods in Lower Gucha Migori sub-catchment. The assistance was channeled through World Vision Nyatike. LOGUMI WRUA realizing that the toilet construction was being carried out visited World Vision Nyatike Office and realized that the design of the proposed toilets was normal flat toilets.

Lower Gucha Migori WRUA having visited Nyando and having observed the raised toilets constructed in the Nyando by Japan Grant Aid Project. LOGUMI WRUA considered that the raised toilet model was the prototype of toilets to be constructed in flood prone areas raised their concerns with World Vision on the design of the proposed toilets. After discussion between LOGUMI WRUA and World Vision it was mutually agreed that the raised toilet above the flood depth were ideal in flood prone areas. The World Vision therefore changed the designed from flat to raised toilets. The raised toilets have since been constructed in the four schools.

This is one good example of advantages of excursion visits to other flood prone areas because it enhances exposure and learning from other areas cases, not just hearing the rumors, but seeing for themselves the real flood management facilities and activities.

The Nyando Excursion Visit triggered LOGUMI WRUA members' enthusiasm that led to influencing the change of toilets design to fit the prototype model that is ideal for flood prone areas. The Project Team considers this as a proper and representative case of the Nyando Project being replicated in other areas.

	
<p>Place : Rae Kanyaika Primary School Description : Project visiting Team observe the raised toilet</p>	<p>Place : Nyora Primary in Nyora Village Description : The Head Teacher explains the raised toilet constructed at the School</p>

	
<p>Place : Kabuto Primary in Kabuto Village Description : Raised toilet under construction in Kabuto Primary</p>	<p>Place : Sere Primary in Sere Village Description : A raised toilet with a ramp for the disabled at Sere Primary School</p>

(Source: The JICA PCDEFM)

2.5 The assistance for obtaining activity budgets in Lower guchamigori sub-catchment

Primary schools have been used as evacuation places for affected community members in Lower Gucha Migori SC. This in essence implies disruption of learning programmes in the schools used evacuation places which eventually lead to poor performances in the National Examination. The abuse, misuse and overuse of school facilities by evacuees that move into this school leads to the school management committee to sometimes rejection of the evacuees to use school facilities. Also the schools sometimes forces the evacuees to move out of the school immediately the floods inundation reduces while yet some of the houses in the homes are yet to be constructed.

The LOGUMI WRUA is therefore now exploring the ways of constructing evacuation centres within public institutions like schools that the affected community members can use during flood disaster. Against this backdrop, the Project Team facilitated the incorporation of flood management activities into the SCMP that enables LOGUMI WRUA to obtain WSTF funds for flood measures. In addition, the project team also facilitated to obtain the “Grass Root Grant Aid Program” provided by Japan Government.

First, the Project Team encouraged LOGUMI WRUA to get the application documents of Grass Root Grant Aid Program, and then explained the contents or application conditions to the LOGUMI WRUA Executive Committee including the Secretary. The application has since been submitted to Japan Embassy and the Embassy responded by giving LOGUMI WRUA new application forms to be handwritten filled and thereafter be submitted back to the Emabassy.



The subject matter for the application is the raised up evacuation centre at Nyora Primary in Nyora Village Lower Gucha Migori sub-catchment. It is important to note that the construction of “Nyando type raised up toilets” has since been done at Nyora Primary School as already explained in this report.



The common scheme from the information or lessons learnt in WRUA and WRMA will be applied to the activities for obtaining the budgets. In the future, the activities for obtaining the budgets will be expanded to many other areas through the scheme like this.

2.6 Targeting pupils through Flood Management Education Programme

Excursion Visit to Nyando Project also exposed LOGUMI WRUA to flood management approach where flood management subject was infused into school syllabus. The LOGUMI WRUA members were quite impressed by knowledge on flood management that the Primary schools' pupils in Nyando exhibited. It was based on this excursion visit observations that LOGUMI WRUA requested the Project Team to assist them in flood management sensitization to school pupils. WRMA and JICA Project Team discussed with KRCS Migori Branch that agreed to have flood management education programme for primary schools. The flood management education programme is currently ongoing. Through the Project Team the support of the Nyatike Sub-county Education Office was achieved. The primary schools wherein the education programme on flood management is being undertaken intend to develop school flood management action plan. Pupils of these schools also have developed drama and poems that aims at sensitization on flood management. In Sere Primary a school flood hazard map was drawn by pupils. In Kabuto primary school a role play depicting evacuation challenges and consequences of ignoring flood early warnings and in Nyora primary an evacuation drill was undertaken including instruction on basic first aid for injuries acquired as a result of flood damage.

It is imperative to note that a textbook for primary pupils for flood management in LOGUMI SC was developed. This in essence is a replication of the non-structural measures targeting school pupils that was implemented in the Nyando Project. LOGUMI WRUA intends to spread the education programme on flood management in all flood prone areas in the sub-catchment. This kind of community initiatives including flood management education programme should be supported in other areas that are affected by floods in the country.

	
<p>Description : School pupils at Sere Primary drew a school flood hazard map</p>	<p>Description :Primary pupils at Kabuto Primary dramatize a flood led evacuation</p>

	
<p>Description :A basic first aid drill being conducted by KRCS at Nyora Primary</p>	<p>Description : A Flood Management Textbook for Primary School developed under PCDEFM</p>

(Source: The JICA PCDEFM)



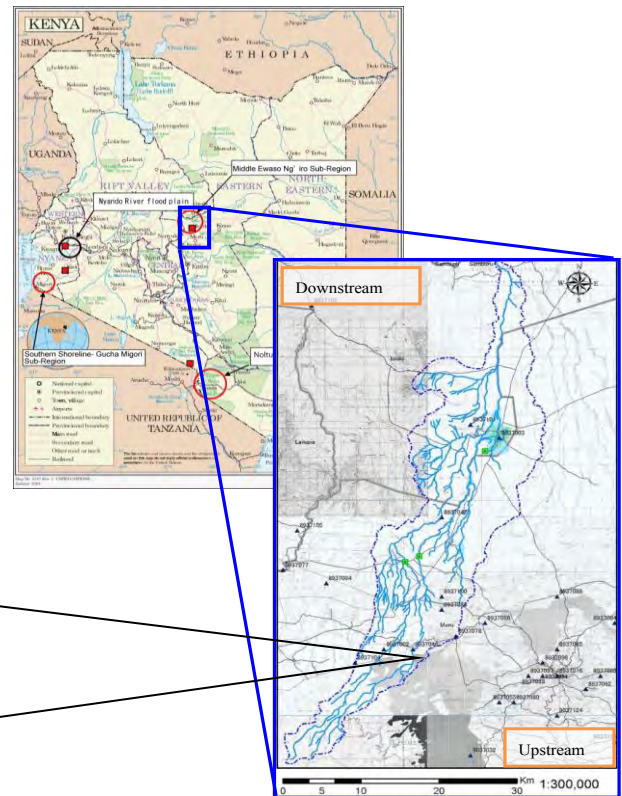
Source: JICA PCDEFM

Fig. 8A Flood Management Textbook for Primary School

Chapter 4 Case Studies in Isiolo Sub-catchment

Structural measures in Isiolo Sub-catchment

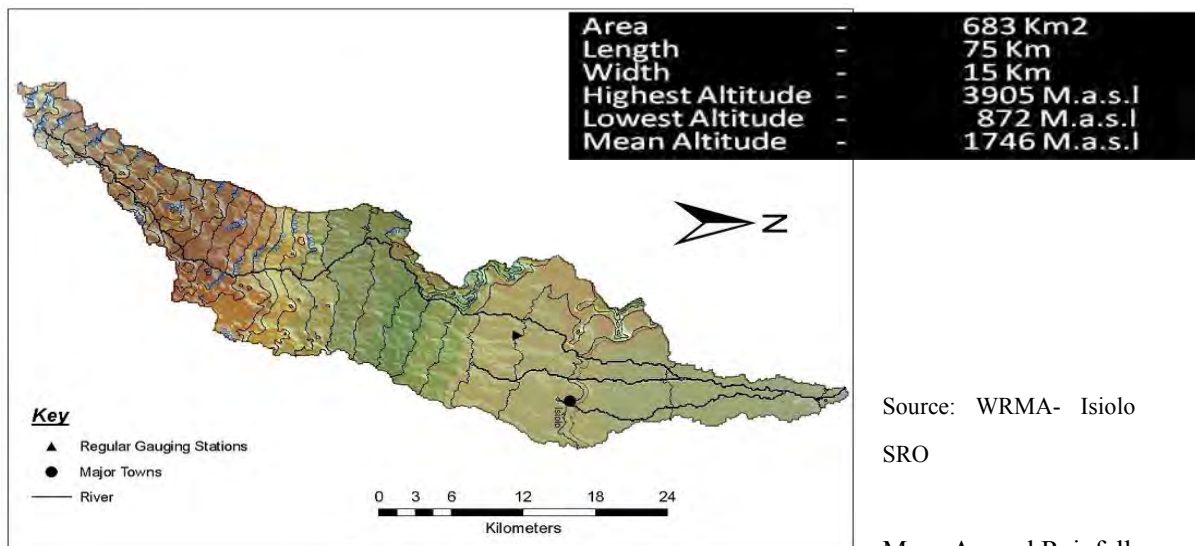
River Bank Protection Work at Eastern Marania River, Matunda Full Gospel Church, Buuri District was done.



Source: JICA Project Team

1. The profile of Isiolo Sub-catchment

Isiolo river basin is located at piedmont of Mt. Kenya, terrain slope is generally steep, the time from rainfall to flooding is short, and also flood peak flow rate is large.



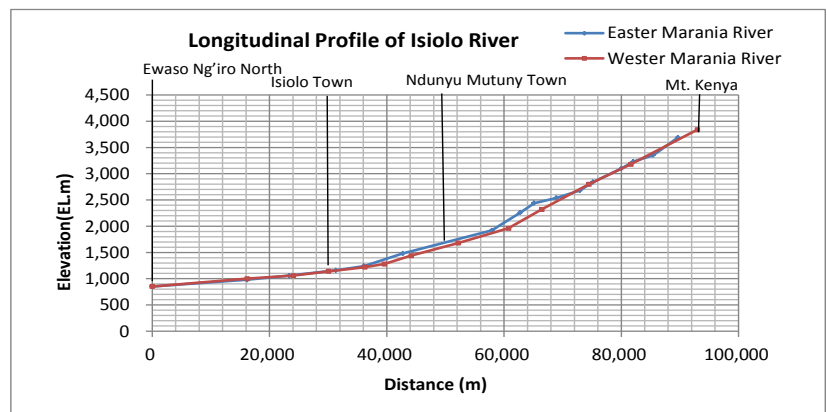
Source: WRMA- Isiolo SRO

Mean Annual Rainfall

ranges from 950 mm in the high altitude areas of Mt. Kenya to around 450 mm at the lowest point; Bimodal with maxims in April and November; MAR approximately 600 – 650 mm within Isiolo town; Increase in rainfall intensity (storms) of short duration.

The Regional Office for Ewaso Ng'iro North Catchment Area is in Nanyuki. Isiolo is the Sub Region Office of WRMA, also known as Middle EwasoNg'iro Sub Regional Office of (SRO). For general water resource management including flood management, Isiolo WRUA was established in Isiolo river basin. Isiolo WRUA conducts water resources management in the grass-roots level in collaboration with WRMA.

Recently, floods occur in the Isiolo River Basin year by year. Floods have major adverse effects on agricultural products, livestock, houses, infrastructures such as road, weirs, water intake and etc., lives and properties, bountiful surface soil runoff, sediment deposition in farming land, loss of stockpiled food causing poor nutrition, pollution of water resources, health problems such as waterborne diseases, increasing of conflicts on water resources among other effects.



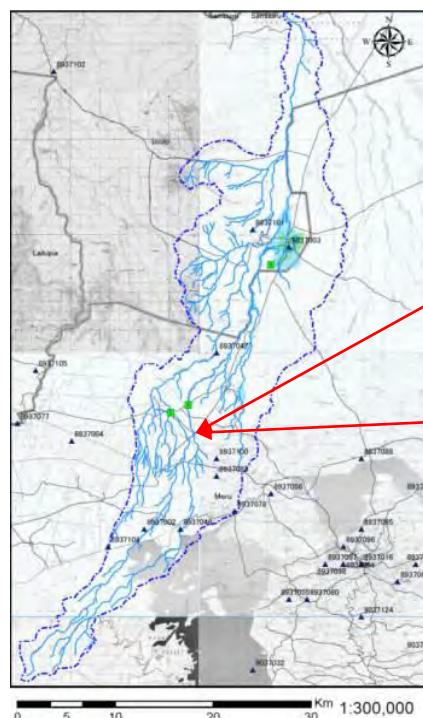
Source: JICA Project Team

2. Objective of the project

- To keep off erosion by countermeasures to protect river bank
- To select the countermeasure to be able to maintained by community ownership, and to transfer technology and methodology for maintenance.

3. Summary of results

The river bank protection work was conducted at the crossing point of A2 highway and Eastern Marania River. Bank erosion is found in the downstream of the bridge. Bank erosion is approximately 40-meter-long; 4-meter-high; 12meter-wide (width of water surface). When river water come though the culvert under A2 highway, water velocity becomes faster, it attacks left side of river bank, then the erosion is generated.



Source: JICA Project Team



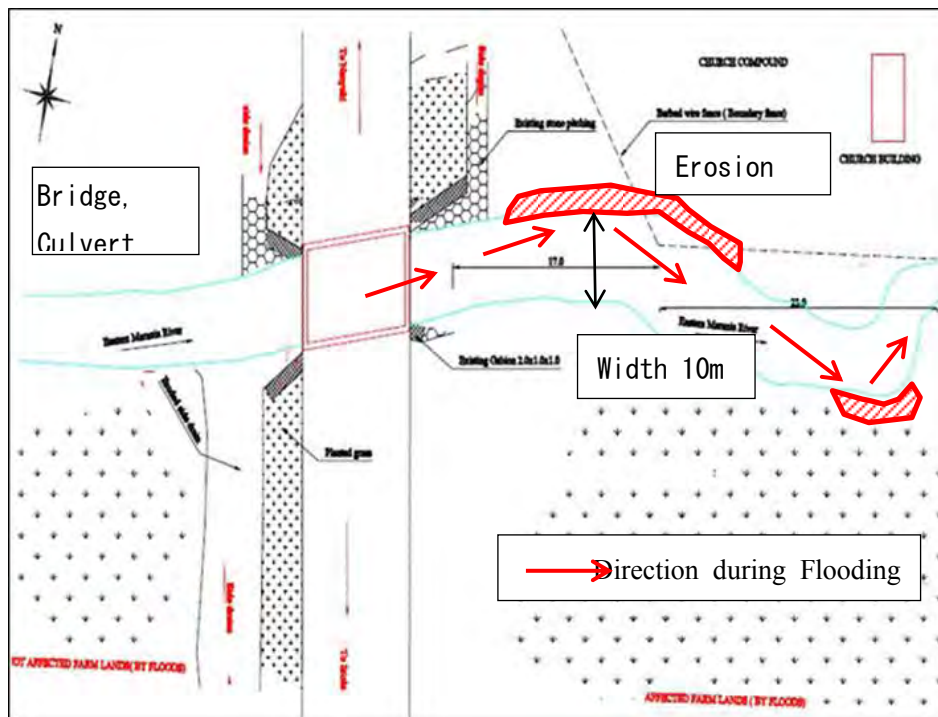
Eroded bank before protection



After bank protection using gabion box

In the light of bank erosion at the water colliding front of the site, high-strength type of river bank

protection is required. Therefore, multi-layered gabion mattress should be installed at this site where road and river are crossing. Reasons for selection of this type of protection are shown in below; 1) local contractors are able to construct this type of work, 2) required equipment of this type of work is available from local and, 3) it has the advantage of easy maintenance. For these reasons, multi-layered gabion mattress works on this site was selected.



4. Good points

- The river bank protection by use of gabions was adopted since community would be able to maintain.
- O/M training was conducted for learning how to make and maintain gabions.
- According to the site situation and new phenomena, plan was modified.



Community onsite Operation and maintenance training

5. Contributions of local community

- WRUA provided boulders for gabions
- Church community members participated O/M training.
- After completion, community is in charge of maintenance.

An MOU between WRMA, WRUA and JICA community was made in which the community take the ownership of the structure including its maintenance.

6. Challenges

- It took time to determine the location and type of construction because the considerations of effectiveness, amount of budget, construction period, and community contribution were necessary.
- The steps of contract were too complicated for WRUA procurement subcommittee.
- Contractor began construction without topographical survey.
- After determining the construction work by the community meeting, the actual construction began three months later. For this reason, the increased interest and contribution willingness of community was reduced.
- The community was to provide boulders free of charge as a contribution of community. However, it was very hard to gather boulders by community without lunch and travel fee, therefore WRUA provided boulders instead of the community.
- When construction started, it appeared that only 7 layers gabion wall was available due to hard rock at river bed, instead of 9 layers in the original design for drilled scour protection. To keep secure structure, the wall design was modified to set 1 layer in front of the bottom as a parallel type scour protection.
- During construction, holes made by running water were checked at the back side of the wall, and they would threaten the stability after reach the wall. According to the investigation of water path, overflowed rainwater from the road side ditch was suggested. So it was decided to prevent water overflow by arrangement of gabions parallel to road side ditch.

7. Duration

Planning: Jul. Aug. 2013

Construction: Nov. 2013 – Feb. 2014

O/M Training WS: 11th Dec. 2013

Completion Ceremony: 17th Mar. 2014

8. Related organizations

WRMA Isiolo SRO

Contractor (WASO BUILDING & ROAD WORKS CO. LTD)

Isiolo WRUA

9. Budget

- 5mil KES

10. Contacts

WRMA Isiolo SRO

Isiolo WRUA

Chapter 5 Lessons Learnt in Isiolo Sub-catchment

River Bank Protection Work at Eastern Marania River, Matunda Full gospel church, Buuri District

1. INTRODUCTION

The Project on Capacity Development for effective flood management in flood prone areas carried out Pilot Project in Isiolo River Basin. The Project had component for both structural and non-structural measures to counter floods. Various structural countermeasures to floods were proposed and after thorough evaluation using certain parameters, river bank protection emerged as the most appropriate short term counter measure to floods in Isiolo river basin.

In the course of implementation of river bank protection using gabion mattress, various challenges were experienced. The challenges were experienced right from the pre – construction stages to construction completion stage. Out of this, various lessons were learnt and recommendations proposed.

2. LESSONS LEARNT

2.1 Pre- construction Stage

The pre- construction stages involved planning and survey, design and procurement. Most important in this case was the procurement process. Since the Project was simulating the WDC manual, the WRUA procurement committee was involved in this stage. Below were the lesson learnt in the procurement stage:

- The WRUA procurement committee was not aware of their roles, and most committee members were less educated, too old to understand the meaning of procurement and its process.
- The WRUA procurement committee has no data base for eligible contractors or suppliers to be engaged in similar project.
- During short listing of contractors, the WRUA procurement committee could not clearly evaluate the documents submitted by the interested contractors, they relied on views and recommendations made by the WRMA and the JICA Project Team.

Recommendations

- There should be continuous capacity building for the WRUA Procurement committee on the meaning of procurement and the processes involved.

- For continuity in operation of the WRUA, the committee membership should consider gender and youth.
- The WRUA Procurement committee should liaise with WRMA to develop data base of eligible contractors and supplies for their future projects.
- The Project Team and WRMA should develop a manual on meaning of procurement and the processes involved.
- The Procurement manual should include basic criteria for evaluation of interested bidders and procedure of negotiations with the successful bidder.

2.2 Construction Stage

The construction stage for river bank protection works involved the, community participation, supervision works, monitoring by the WRUA monitoring committee and on site operation and maintenance training. The major challenge was in the community participation and monitoring of the construction process of the river bank protection by the WRUA monitoring committee; this formed the basis of the following lessons;

- The community participation was below the threshold set by the WDC manual (15% of the total cost of the project should be community contribution), this was attributed to lack of experience in handling donor funded project and separation of scope of services of contractor and community contribution.
- The WRUA monitoring committee had no prior information on the scope of the construction works; this was attributed to by lack of WRUA management committee meeting to share information on the progress of the river bank protection works.
- The site was located far away from the residential of the WRUA monitoring committee; this brought logistical challenge to carry out regular monitoring of the construction process.

Recommendations

- There should be a continuous capacity building to the community on the processes involved in implementation of donor funded projects, scope of contractor services and community contribution to the project.
- There should frequent WRUA management committee meeting to share information on the progress of the activities of the Project, challenges and way forward.
- There selection of each WRUA subcommittee should represent each zone of the WRUA coverage, this will ensure that when a project is implemented in WRUA coverage, that particular site has a member in the subcommittee.

- There should be ad hoc committee to manage a specific project at a specific time, this will ensure smooth implementation process by both the community and the project implementers.
- A prototype checklist for monitoring construction works/ or any activity implemented by WRUA or any other donor should be developed to guide the WRUA monitoring committee in executing their duties.

2.3 Completion of Construction Stage

During completion of construction stage, the Monitoring and Evaluation committee were engaged in the completion inspection and made recommendations on the outstanding works that should be completed by the contractor. The output of the completion inspection was a report done by the secretary of the WRUA monitoring committee, a copy was shared by the Contractor and WRMA Sub region office (Isiolo).

A checklist was made for the monitoring committee to be used in the inspection after the expiry of the defects liability notification period. At this stage there was no major challenge experienced.

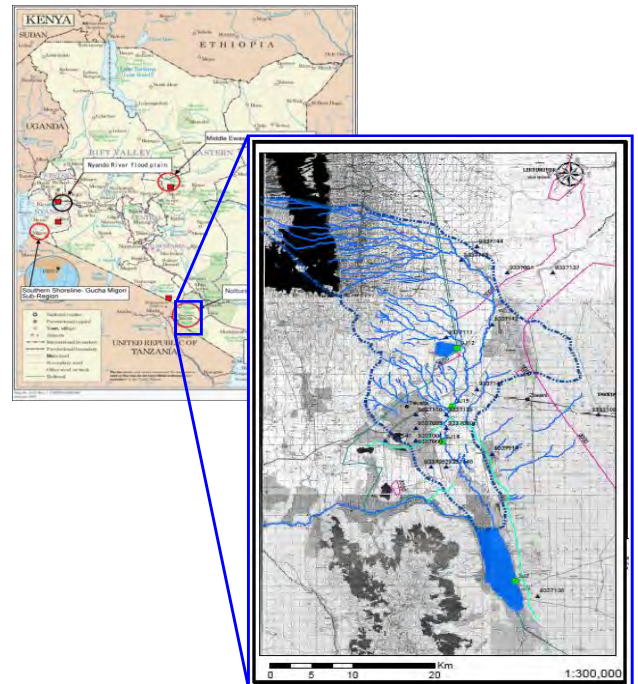
2.4 Maintenance stage

The JICA Project Team and WRMA are in the final stage of preparation of operation and maintenance manual to be used by WRMA monitoring and evaluation committee. Since there was an onsite operation and maintenance training, the manual will guide as reference of what was practically done at site. In the draft manual is the contact person in case of any major repair that is beyond the capacity of the WRUA.

Chapter 6 Case Studies in Lower Lumi Sub-catchment

Structural measures in Lower Lumi Sub-catchment

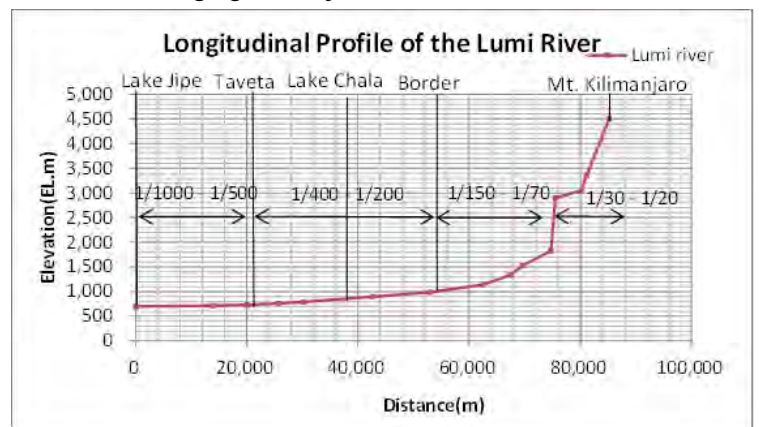
Evacuation facilities at Eldoro Primary School, Kimorigo, Lower Lumi was done.



1. The profile of Lower Lumi Sub-catchment

The source of Lumi River is the eastern slope of Mt. Kilimanjaro, and 1/4 of river basin size belongs to Tanzania. The Lumi River flows down toward south east, then flows down to south and flows into Lake Jipe at Kenya. Thus the Lumi River is an international river. The uppermost area in this basin, the slope is steep. And downstream area, the topographic slope is pretty gentle, then low level ground spreads out as flood plain. The Lumi river basin is belonging to the jurisdiction of WRMA

Nolturesh-Lumi Sub Regional Office (SRO) concerning the general water resource management inclusive flood management. In addition, 2 WRUAs such as “Upper Lumi WRUA” and “Lower Lumi WRUA” are established in the Lumi river basin, and both WRUAs implement grass-roots water management in corroboration with WRMA.



Flood damages are destruction of houses, enforcement of long term evacuation, agricultural product including livestock loss, contamination of water resource by polluted water diffusion, growing worse sanitary conditions and muddy road condition etc. The reason of floods occurred are long term inundation depending on overflow from the Lumi river or broken dyke by reaching storm water from the heavy rain at Mt. Kilimanjaro. Also, destruction of roads or bridges and loss of livestock have been occurred by the effect of flash flood

in the tributaries or small channel of the Lumi River.

2. Objective of the project

- To secure evacuation facilities for local residents

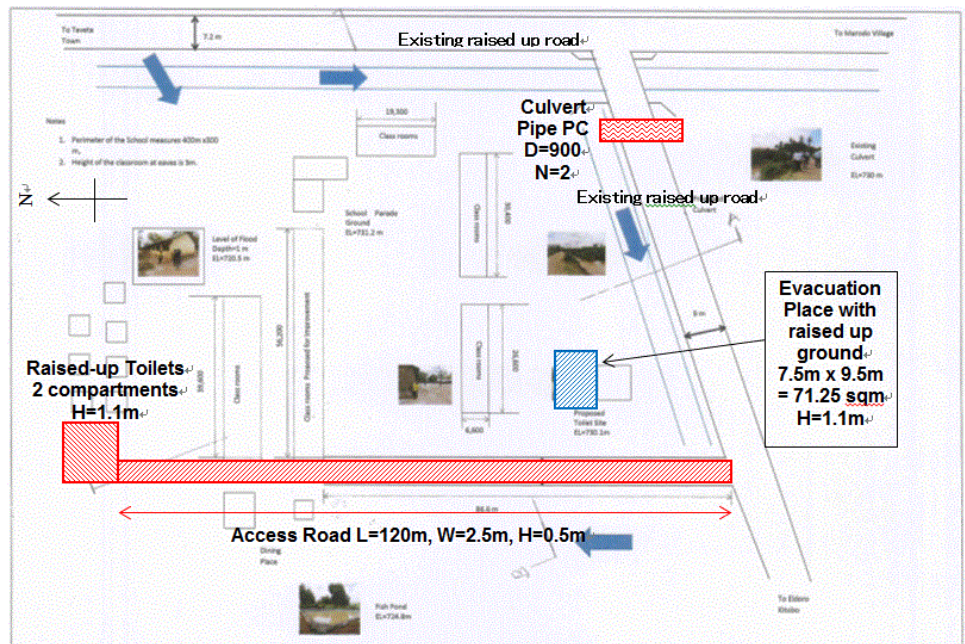
3. Summary of results

There is a problem of shortage of evacuation places; inundation continues approximately 2 months with 1 meter depth in Kimorigo location during rainy season.

Eldoro primary school, selected as evacuation center, is located at Eldoro A Village, 3km from Kimorigo A Village, approximately 10 km to the south of Taveta town center. The ground was inundated but shallow level (30cm Ave.).

In this project, 1) Raised up

Evacuation place, 2) Raised up Toilets, 3) Raised up access road, and 4) Culvert pipe for drainage were planned in the Eldoro primary school.



4. Good points

- The method with Do-nou technology was adopted since community would be able to maintain the road after the completion of the project
- A selected number of the WRUA and community members participated in the Donou Technology training in Kiambu. They became the road construction leaders in the construction site.
- O/M training was conducted for learning how to make and maintain facilities.
- The site where the training was conducted in Kiambu was different from the conditions in Eldoro Primary School. The design for Eldoro Primary School was modified to suit the site.
- The contractor employed the local community for some of the construction works including skilled and unskilled labour. This was beneficial to the community in giving them new skills and also as an income generating activity.
- Improvement of the drainage system for the school community when the culvert is constructed to maintain the flow of flood water away from the school.



Preparation of the road surface and drainage



Arrangement of the Do-nou bags on the road



Demonstration of the works by community Raised-up Toilet



5. Contributions of local community

- WRUA and school community members participated Do-nou technology method training course at Kiambu conducted by CORE. The training included 3 members from the school and Eldoro Community and 3 members from the Lower Lumi WRUA.
- Each pupil from the school provided 5 plastic bags as Do-nou bag. However the bags were not enough and the school management committee added more Do-nou bags during the actual construction of the Do-nou road.
- The local community also provided the borrow pit for the exploitation of the murrum to be place inside the Donou bags. The project team provided the transportation of the material from the borrow pit to the site.
- WRUA and school community members conducted the access road construction with Do-nou technology method. A total of 304 parents were involved in the construction of the road.
- WRUA and school community participated O/M workshop of the evacuation facilities.
- After completion, school community is in charge of maintenance.

6. Challenges

- It was taken the time to determine the location and type of construction because the considerations of effectiveness, amount of budget, construction period, and community contribution were necessary.
- The steps of contract were too complicated for WRUA procurement subcommittee.
- The contractor delayed to submit the bank guarantee for getting advanced payment; therefore the contractor had to begin the part of non-materialworks. This was the first time the contractor had been involved in the kind of project requiring the advance payment bank guarantee and his bank was also no very familiar with the process.
- WRUA monitoring subcommittee due to the distances from their residences to the project site. In WSTF funded project some money is set aside for the monitoring committee. The project team provided the money for the transportation from February and two members were now involved in the monitoring. However the Secretary of the WRUA was involved in the monitoring right from the commencement of the construction.
- The construction commenced just before the beginning of the short rainy season. As a result there was suspension of works from November to December during the rains as the site was flooded and no works could be carried out.
- During the construction of the toilet there were a lot of problems with the ground water because the water table is very high. This interfered with the time schedule during the excavation of the pit. The problem also persisted during the pit walling. There had to be dewatering daily for about 2 hours before the commencement of the works.

7. Duration

Planning: Jul. Aug. 2013

Construction: Nov. 2013 – Mar. 2014

Do-nou technology method training at Kiambu: 15-16 Jan. 2014

O/M Training WS: Mar. 2014

Completion Ceremony: 11th Mar. 2014

8. Related organizations

WRMA Loitokitok SRO

Contractor (FRANJI ELECTRICALS AND GENERAL SUPPLIES LIMITED)

Lower Lumi WRUA

CORE

9. Budget

- 5mil KES

10. Contacts

WRMA Loitokitok SRO

Lower Lumi WRUA

CORE Kenya

School Management Committee of Eldoro Primary School

Chapter 7 Lessons Learnt in Lower Lumi Sub-catchment

Evacuation facilities at Eldoro Primary School, Kimorigo, Lower Lumi

1. INTRODUCTION

The Project on Capacity Development for effective flood management in flood prone areas carried out Pilot Project in Lumi River basin. The Project had component for both structural and non-structural measures for life protection against floods. Various structural countermeasures to floods were proposed and after thorough evaluation using certain parameters, evacuation facilities emerged as the most appropriate short term counter measure to floods in Lower Lumi.

In the course of implementation of evacuation facilities, various challenges were experienced. The challenges were experienced right from the pre – construction stages to construction completion stage. Out of this, various lessons were learnt and recommendations proposed.

2. LESSONS LEARNT

2.1 Pre- construction Stage

A) Bidding Process

The bidding process involved the Project Team, WRMA and the WRUA Members.

- Only 6 contractors from 22 contractors of long list were submitted EOI in case of the construction of evacuation facilities in Lower Lumi.
- The pre-qualification for the contractors was carried out and only 5 contractors selected for the next tendering stage. And no communication was provided for the contractors not selected.

Recommendations

- It should be considered to hold an explanatory meeting to long listed contractors to get attention to the contract.
- It is better to send notification to the unsuccessful contractors for keeping connections with them.

B) Procurement

The procurement process was carried tog with WRMA and the WRUA procurement sub-committee.

During the evaluation for short listing certain observations were made from the WRUA Procurement sub-committee. The observations made were:

- The WRUA Procurement sub-committee did not clearly understand the key documents to be verified during the evaluation process.
- It was the first time for the Procurement sub-committee to carry out this

kind of evaluation and they should utilize it during other WSTF projects. It was a good kind of capacity development for the committee.

Recommendations

- For proper transfer of knowledge to the entire community youths should be included in the procurement sub-committee and other sub-committees within the WRUA set up.
- The WDC manual is not very clear on certain matters regarding the procurement; such matters like evaluation criteria for Specific projects should be included in the WDC manual.

Out of the 5 contractors who were sent bid documents and those who were responsive only 3 contractors were considered for the next stage of bidding.

- According to the previous guideline of JICA, at least 3 companies were needed for keeping numbers for bidding because of possibility not to attend bidding. And it is revised to 5 companies in the new guideline of JICA.
- In the PCDEFM pilot project, 5 contractors were short listed to the next stage of bidding. All the short listed Contractors collected the Bid Documents. 3 contractors submitted the Bid Documents before the deadline of submission. However, 2 Contractors were disqualified for late submission of Bid Documents hence their Documents were neither received nor opened.

C) Financial Issues

According to the contract, the contractor was supposed to provide an advance payment guarantee before the advance payment could be paid.

- The contractor had difficulties in procuring the advance payment from his bank. It led to a very long delay before the guarantee was provided and the delay in procurement of some materials.

Payment Mode:

- The payment was to be done in three batches, advance payment, final payment and payment for the retention. The work was scheduled to be completed within 90 days, however due to poor weather the construction period was extended. This led to the contractor to have problems of cash flow.

Recommendations

- To confirm the possibility of getting the guarantee by bank for advanced

payment is essential.

- An interim payment should be considered.

2.2 Construction Stage

A) Siting

At the first stage of the planning of the siting of the various structures within the school, it was very brief planning. Thus the surveying and the actual siting by the contractor, they needed some discussions;

- The school through the headmaster requested for some modifications such as the place of toilet had been sited very close to the kitchen. This was not acceptable under the rules of the public health department.

Recommendations

- It is better to discuss the planning with detailed design drawing.
- The toilet should be at least 20 meters away from the kitchen area.

B) Construction

The contractors procured both the skilled workers and unskilled workers from the community which benefitted the local community both economically and by giving some of them new skills.

The local community was very cooperative during the implementation of the project. The WDC manual expects the local community to contribute at least 15% of the project in cash or through labour. The local community agreed to contribute their labour and do-nou bags for the construction of the community road. This showed it is easy to mobilise the community in the schools because they feel they have a sense of belonging to the project.

Recommendations

- It is essential to hold the explanatory meeting with stakeholders including local residents to get understanding of contribution for the project.
- The activity manual will help understanding of their necessary contributions.

3. Maintenance Stage

The operation and maintenance of the structural measures have to be carried out for the

sustainability of the structures.

The project is based at a primary school but it is under the management of the WRUA and the school. Therefore a memorandum of understanding (MOU) between the school management committee, Lower Lumi WRUA and WRMA were signed for the sustainable management and operation.

Recommendations

- Before the handing over of the project the training for O&M should be carried out.
- There need to be a MOU between the school, the WRUA and WRMA on the modalities for the management and the operation of the structures