1.
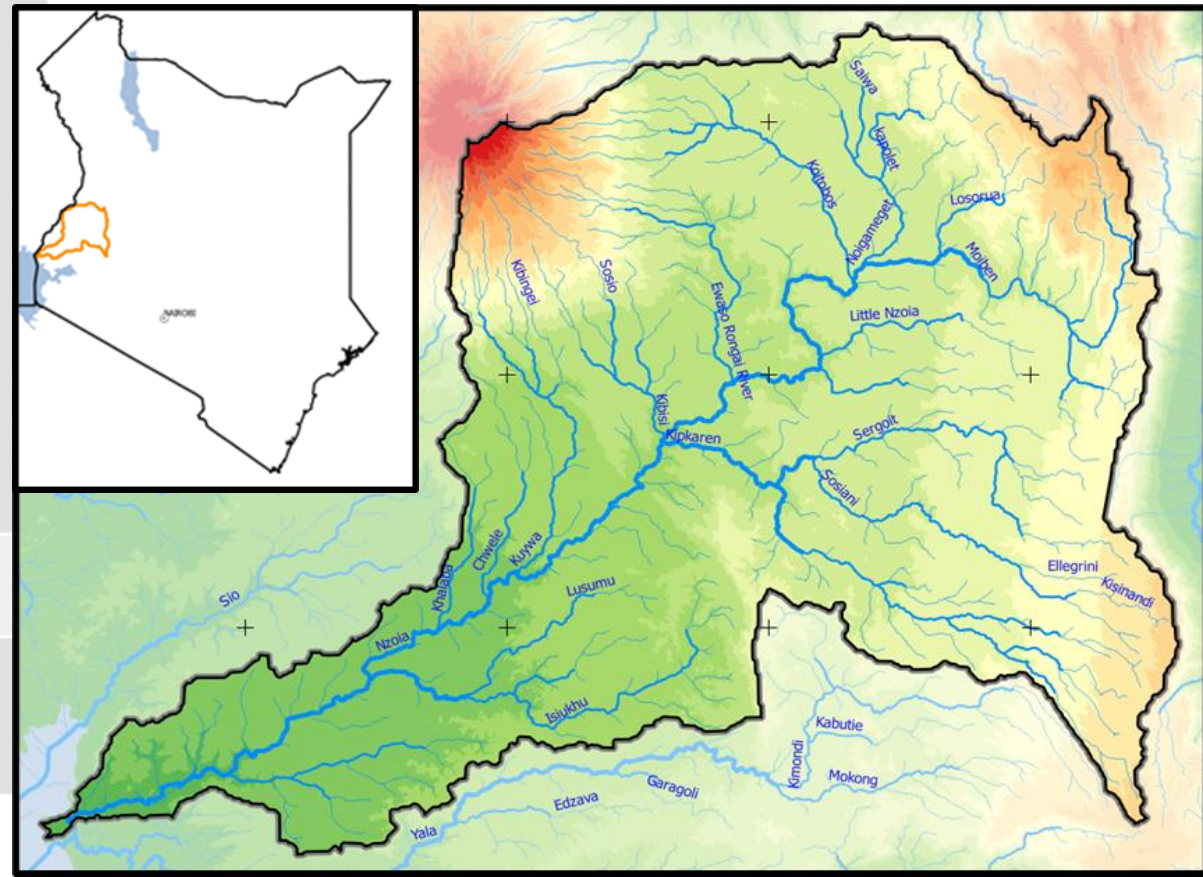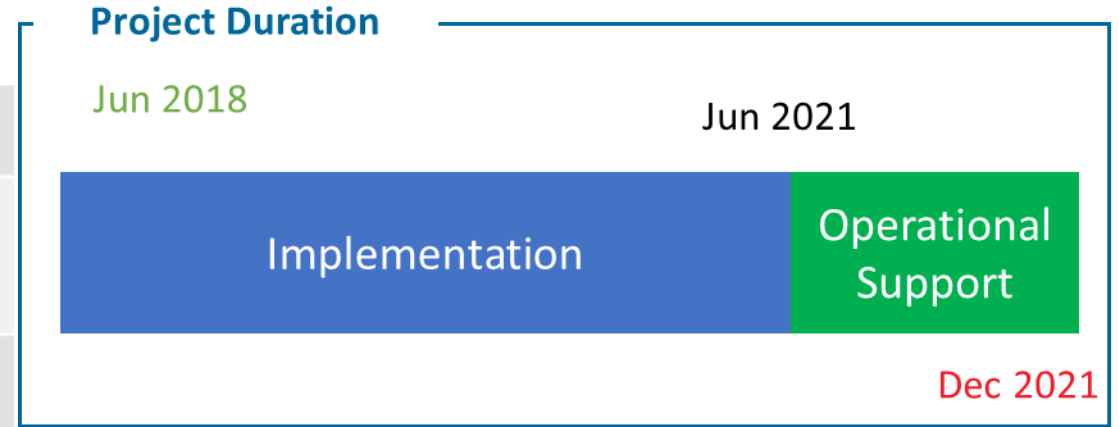
(UPGRADING of the Flood Forecasting and Early Warning System (FFEWS) for the Nzoia River Basin in Kenya

Project Synopses

Budget:	3.5 million USD
Program:	Kenya Water Security and Climate Resilience Project (KWSCRP)
Components:	Consists of improving: • HydroMet network • FFEWS technology • Technical equipment at related offices • Warning dissemination • Risk Knowledge in the basin • Data and information flow • Community preparedness • Technical skills at institutions
Executing agency:	Water Resources Authority (WRA)
Arrangements:	MoU Meteorological office (KMD) and WRA

Project Duration

Jun 2018 — Jun 2021 — Dec 2021

Implementation — Operational Support

Presentation Outline

- **Common elements of a Flood Forecasting Early warning System (FFEWS)**

- **Key outcomes and impacts**

- **Sustainability Plan**

Context: Common Elements of a FFEWS

- Hydrology
- Meteorology
- Topography
- Social and structural

Human Resources
- Meteorologist
- Water and environment experts

Infrastructure
- Operation centre
- Computers
- Computing capability

- Data transmission channels
- When the flood will occur?
- Which areas may be inundated?
- What flood depth and velocity is expected?

Stakeholders
- Staff from government departments
- High level government decision makers
- Public and private infrastructure managers
- Civil contingency and emergency services

Possible response to warnings: Contingency plans

Real-time data collection

Modelling & forecasting

Early warning dissemination

Decision support

Response to warning

FEEDBACK/REVIEW

Assessment of the warning system after flood events to identify potential improvements
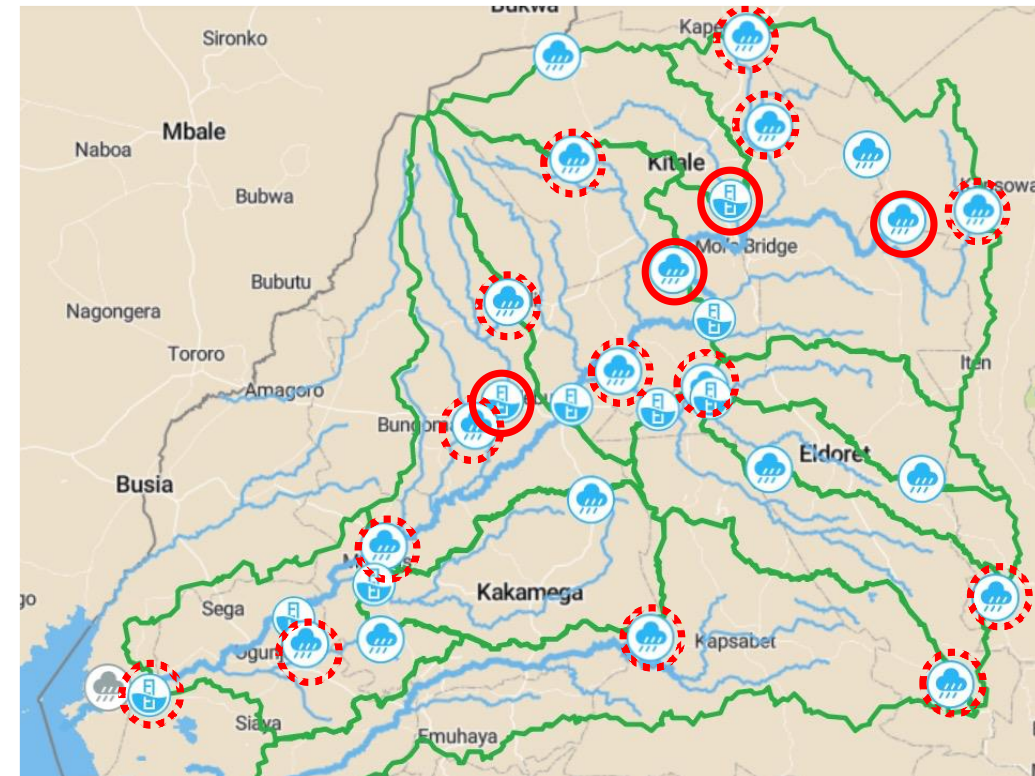
Key Outcomes – Improved real-time HydroMet network

Automatic Weather Stations Increased from 12 to 23

Automatic Water Level Stations Increased from 1 to 9

Data can be used as inputs into various environmental applications other than flood forecasting

New sites ⭕   Old sites ⭕

Key Outcome – Improved flood forecasting model

Hydrological Forcing for Rainfall Runoff model
Changed from only observed rainfall to include also rainfall forecasts

Periods when Forecasts are available
Increased from only during the week to 24/7

Forecast lead times / horizon
Increased from 3-days to up to 14 days

Number of Forecasts made (forecasting frequency)
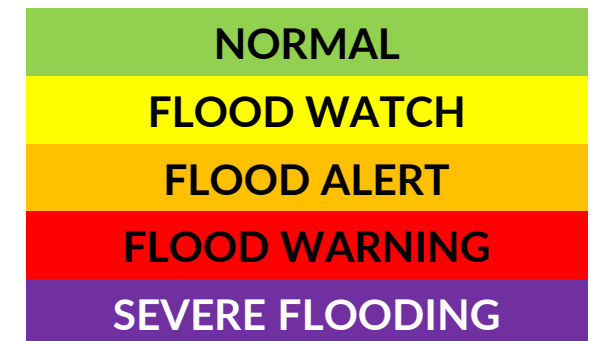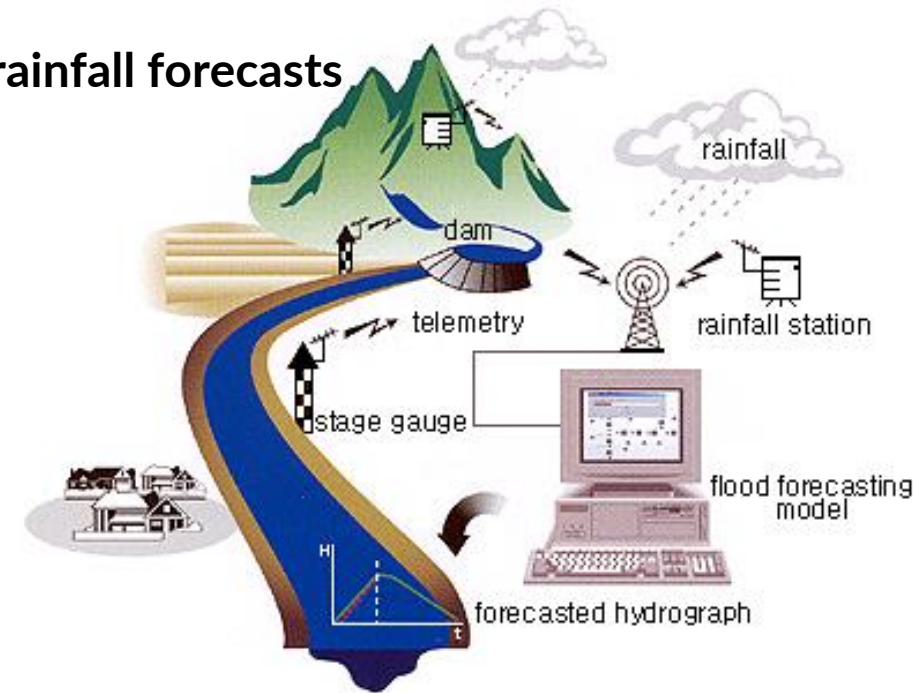Increased from once a day to every 3 hours

Number of Forecast Points (Nodes)
Increased from 1 site to 9 sites

Improved forecast accuracy (forecasting skill)
Model updating from telemetric data from 9 WL sites

Number of thresholds
Increased from 2-5

NORMAL
FLOOD WATCH
FLOOD ALERT
FLOOD WARNING
SEVERE FLOODING

Key Outcome – Improved dissemination Platform

Availability of data and information

https://wimes.meteo.go.ke/
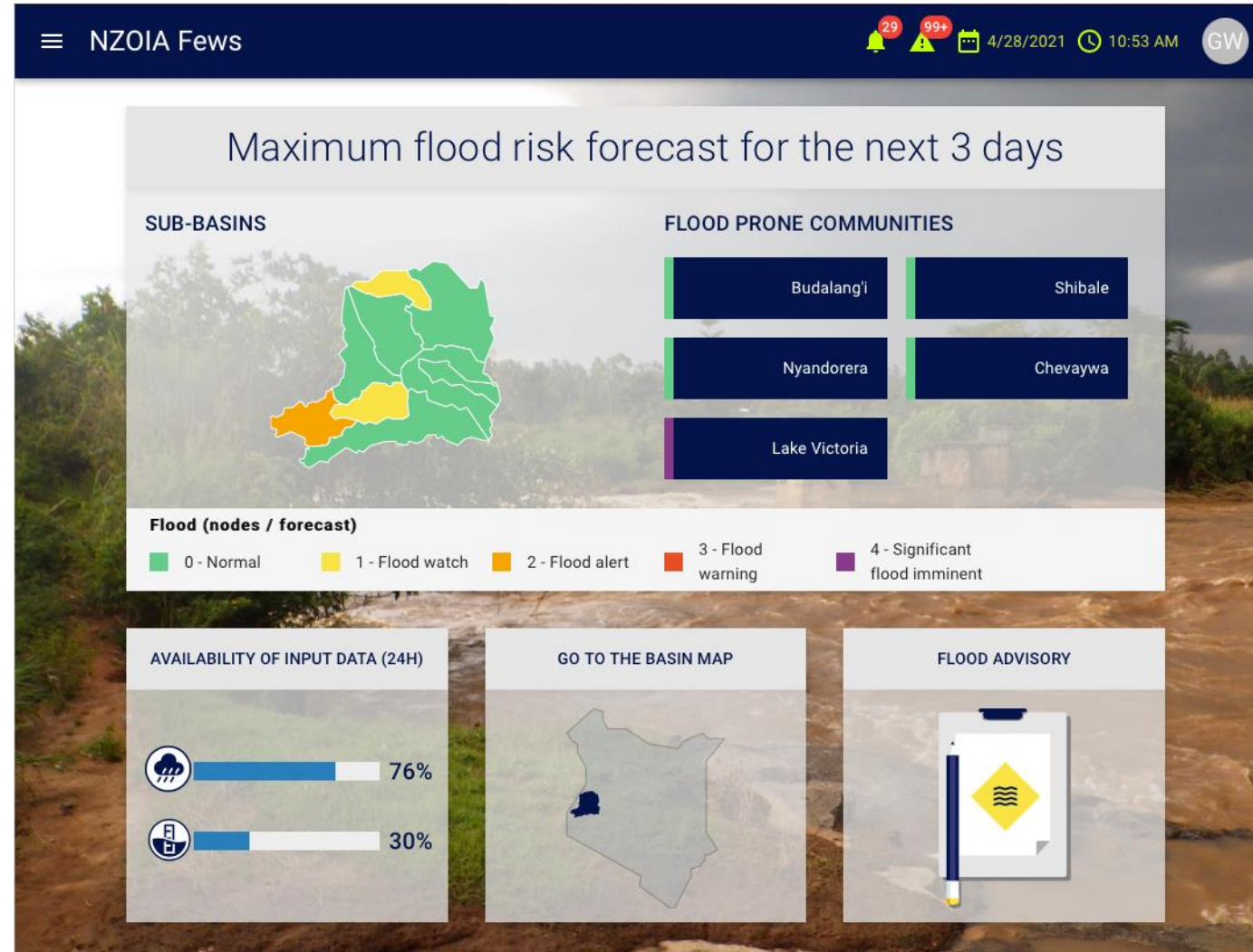
Flood Bulletin

Republic of Kenya

Kenya Meteorological Department
National Flood Forecasting and Early Warning Centre

Flood watch bulletin for the Nzoia basin

bulletin produced on September 08, 2022 at 07PM local time

Automatically release flood bulletins after approval by dedicated staff

NZOIA Fews

29   99+   4/28/2021   10:53 AM   GW

Maximum flood risk forecast for the next 3 days

SUB-BASINS

FLOOD PRONE COMMUNITIES

Budalang'i   Shibale

Nyandorera   Chevaywa

Lake Victoria

Flood (nodes / forecast)

0 - Normal   1 - Flood watch   2 - Flood alert   3 - Flood warning   4 - Significant flood imminent

AVAILABILITY OF INPUT DATA (24H)   GO TO THE BASIN MAP   FLOOD ADVISORY

76%

30%

Key Outcome – Enhanced Capacity of staff

Enhanced technical capacity and skills of staff at KMD and WRA in O&M of HydroMET equipment and the FFEWS.

However, with regards to the O&M of the FEWS technology there are concerns that the objective of knowledge transfer and development of technical capacity has not been fully achieved.

Key Outcomes - Improved coordination and collaboration between institutions – Flood Centers

- Improved coordination and collaboration between institutions responsible (KMD and WRA) for flood forecasting and those responsible for communicating warning and community preparedness and awareness (Regional County Disaster management committees).

Established Flood Centres

- Didn't have a framework for collaboration
- KMD has key inputs – Observed and Forecasted Rainfall
- WRA has other key inputs – Water Level and Discharge
- As a result, Developed a framework for collaboration

N-FFEWC	**NATIONAL – FLOOD FORECASTING AND EARLY WARNING CENTRE (N-FFEWC)**
N-FMIAC NAIROBI	**NATIONAL – FLOOD MAPPING AND IMPACT ASSESSMENT CENTRE (N-FMIAC)**
R-FMC KAKAMEGA	**REGIONAL - FLOOD MAPPING CENTRE (R-FMC)**

Key Outcome – Improve physical infrastructure at Flood Centers

Refurbishment and equipping: N-FFEWC

R-FMC 3-way workstation

Server Rack

Renovated office with workstation

N-FMIAC Centre and Server Room

Key Outcome: Improved community preparedness

Community Briefing on FFEWS

Design Workshop consultation on FFEWS

Sensitizing CMDS (Kakamega, Siaya, Busia) on flood contingency planning

Initial flood mapping training with villagers

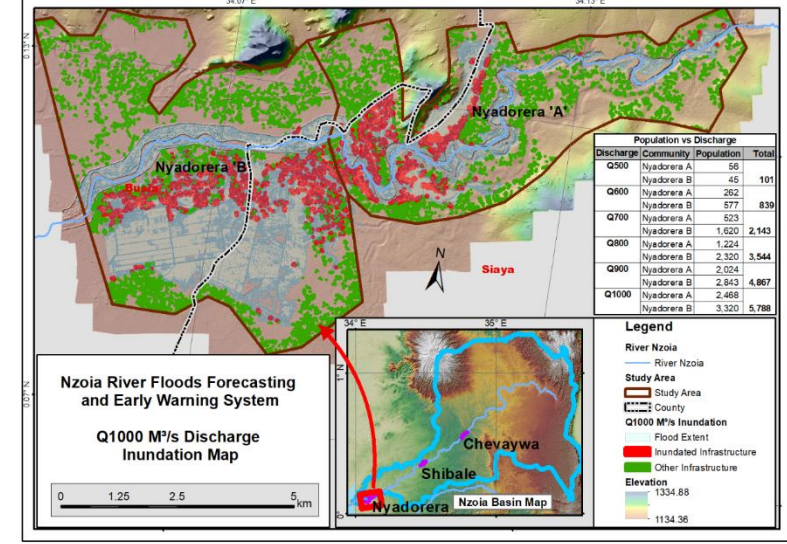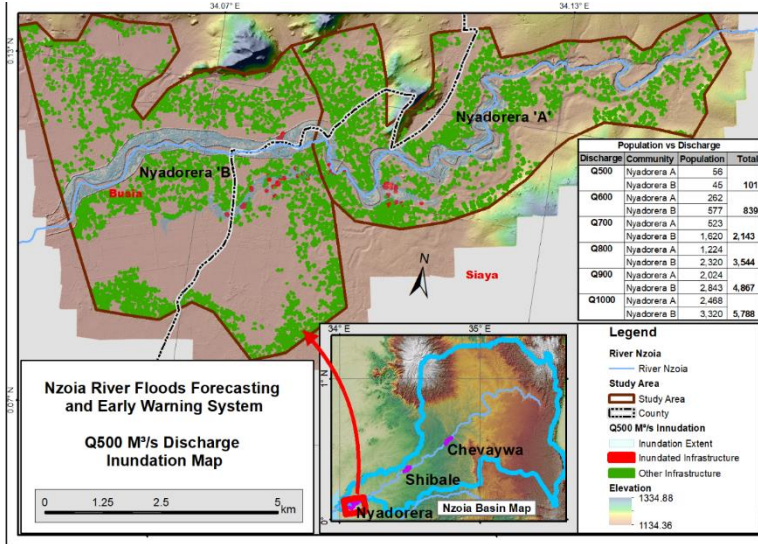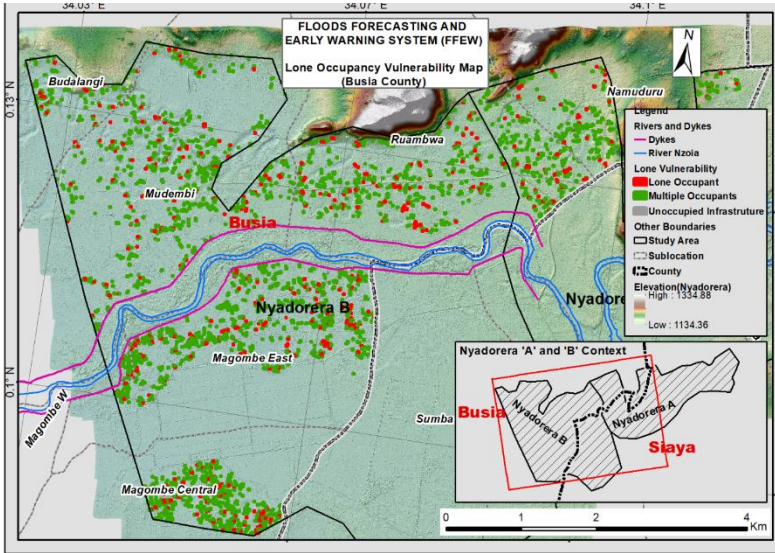Villagers outlining their understanding of the flooding dynamics.

WRA Official outlining the FEWS in the Lugali baraza

- On the issue of Vandalism – sensitizing on hydromet equipment and need to protect the equipment
- Focal groups - Interpret the bullets
- Working with counties on contingency planning

YEAR
KWPF ANNIVERSARY

Key Outcome – Improved flood risk Knowledge in the Basin

Improved risk knowledge in the Nzoia Basin through the flood risk and vulnerability mapping activities

County	Community	Total Population	Vulnerable Population				
			Multiple (No Disability)	Multiple (Disability)	Lone (No Disability)	Lone (Disability)	Total
Busia	Nyandorera A	2,093	1229	84	46	6	1,365
	Nyandorera B	12,254	7962	1283	295	50	9,590
Total		14,347	9,191	1,367	341	56	10,955
Percentage of the total vulnerable			83.9%	12.5%	3.1%	0.5%	100.0%

County	Community	Total Population	Lone Vulnerability by gender Vulnerable Population				
			Multiple (Female)	Multiple (Male)	Lone (Female)	Lone (Male)	Total
Busia	Nyandorera A	2,093	298	1,015	15	37	1,365
	Nyandorera B	12,254	2,596	6,649	118	227	9,590
Total		14,347	2,894	7,664	133	264	10,955
Percentage of the total vulnerable			26.4%	70.0%	1.2%	2.4%	100.0%

MINISTRY OF WATER, SANITATION & IRRIGATION

MINISTRY OF WATER, SANITATION & IRRIGATION

KAKAMEGA COUNTY FLOODS CONTIGENCY PLAN

BUSIA COUNTY FLOODS CONTIGENCY PLAN

Key Impacts – Increased number of people supported

Enhanced flood protection for about 35,000 vulnerable people in the Lower Nzoia catchment

Communities covered by the FEWS
Increased from 1 to 4

Counties supported
Increased from 1 to 3 (7)
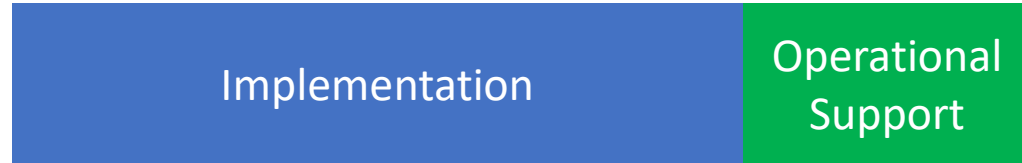
Beneficiaries
Increased from 8,300 to 35,000

Sustainability Plan

Activities for sustainability

Jun 2018

Jun 2021

Present

Implementation	Operational Support

Dec 2021

- Technical **training** of staff:
  - Operate and maintain equipment
  - Operate and maintain FFEWS technology
- **Allocation** of staff to O&M the system
- Budget allocation for operations and maintenance of HydroMet equipment and warning dissemination
- MoU between KMD and WRA including:
  - Monitoring and Evaluation System
  - Respective responsibilities
  - Coordinated planning and funding

Challenges and Strategy

Jan 2022

Present

Operational Phase

- Challenges
  - Budgetary challenges – O&M of HydroMet network
  - Inadequate training of staff in FFEWS technology
  - Collaboration between WRA and KMD - input data

- Strategy
  - Maintenance plan – annual budget allocations. But there are deeper administrative issues.
  - Awareness campaign towards decision makers to support annual budget allocations.
  - Technical Assistance for continuous training
  - Information campaigns towards enforcing the Collaboration framework (MoU)

10 YEAR KWPF ANNIVERSARY

Video Presentation

Thank you!