



Kingdom of the Netherlands



Dutch Risk Reduction Team:
Reducing the risk of water related disasters

Scoping Mission Report

Kenya - Rift Valley - Baringo County

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DRR-Team Scoping Mission Report
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DRR-Team Kenya

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List of abbreviations

AfDB	African Development Bank
DANIDA	Danish International Development Agency
DRR	Disaster Risk Reduction
DRR-Team	Dutch Risk Reduction-Team
IFAD	International Fund for Agricultural Development
IWRM	Integrated Water Resources Management
JICA	Japan International Cooperation Agency
KMD	Kenya Meteorological Department
MTAP	Medium Term Arid and Semi-arid lands Project
NDMA	National Drought Management Authority
NEMA	National Environmental Authority
NIA	National Irrigation Agency
NWCPC	National Water Conservation & Pipeline Corporation
NWHSA	National Water Harvesting and Storage Authority
RVO	Rijksdienst Voor Ondernemend Nederland
RVWSB	Rift Valley Water Services Board (this will soon be RVWWDA)
RVWWDA	Rift Valley Water Works Development Agency
SIDA	Swedish International Development Cooperation Agency
SPA	Service Provision Agreements
TOR	Terms of Reference
WB	World Bank
WRA	Water Resources Authority
WRUA	Water Resources Users Association

Synopsis

Introduction

The Ministry of Water and Sanitation of Kenya requested for support from the Dutch DRR-Team in the Rift Valley Catchment area, especially Baringo county, considering the flood and drought risks in this area. As a result, after a pre-scoping mission in June 2019, a DRR-Team mission was executed from November 18th till November 22nd 2019, in close cooperation with WRA at the national (Nairobi), regional (Nakuru) and sub-regional (Kabarnet) level, as well as the County of Baringo in Kabarnet and sub-County in Marigat. The objective of the DRR-Team mission was to:

- Develop a strategy for Rift Valley catchment, with the sub-catchments in Baringo County as representative catchments, for flood and drought risk reduction
- Concrete recommendations for the short, middle and long term including next steps to be taken
- Governance: address which authority takes the lead taking action
- Financing: determine options for financing by donors

This report is the result of the DRR-Team mission. The report has been compiled with input and participation of the Kenyan government mandated institution Water Resource Authority (WRA). Hence this report is for the ownership and use by the WRA.

Flood risk

Flood hazard maps show that flood prevalence is high to very high with hundreds (up to 2,000) of people exposed to floods in the area south of Lake Baringo, including the downstream section of Perkerra River. These Marigat and Jemps flats areas are hit by floods (almost) every year. When floods occur, farm fields and their crop produce are swept away, as a result of which necessary harvests and incomes to sustain livelihoods are being lost, and damage to infrastructure occurs (roads, boreholes, small dams, schools, etc.). The economic exposure for this area (including the Perkerra irrigation scheme) expressed as annual GDP loss in USD ranges from 200 up to 14,000 USD. The flood hazard and flood risk has increased for the following reasons:

- The water levels of Lake Baringo have risen in recent years for inexplicable reasons, permanently flooding the banks and tourist facilities around Lake Baringo and increasing the flood hazard (backwater effect).
- Reportedly deforestation in the upstream parts of the Mau (Forest) Complex in Mogotio region along the border with Nakuru County.
- Poor agricultural practices of these same upstream cultivated lands, reducing the local water holding capacity of soils, causing flash floods and soil degradation and erosion.
- Silting of the downstream river stretches (especially Perkerra River and the Endao and Yatoi streams) and southern part Lake Baringo due to heavy sediment load;
- *Prosopis juliflora*, commonly known as 'Mathenge' or 'mesquite', a hardy and resilient invasive plant that blocks the flow of water, diverting the river channels.
- Increasing population.
- Negligent maintenance and sedimentation of the Chemeron Yatoi Dam.
- Climate change may further increase the impact of flood hazards.

Drought risk

Around 80% of Baringo County is Arid and Semi-Arid Land (ASAL) Area, which means it experiences (severe) droughts every year. Due to droughts people and assets are at risk:

- Every year the population suffers from water shortages where the water supply is not guaranteed by reservoirs, water pans, boreholes or a water tank; Many boreholes in sub-county Baringo South are impacted by high chloride or EC values (>4mS/cm) and at other locations by high fluoride levels due to over abstraction from aquifers of volcanic-rock origin, decreasing the water availability for domestic use.
- Farmers are fully dependent on rains or irrigation water, thereby facing water shortages for crops and failing harvests every year;
- Despite the construction of several water pans by the Baringo County Government over the past years, the presence and distribution of sufficient livestock watering points is still lagging behind, partly due to poor construction and sedimentation of existing water pans, as well as due to the foreign/trans-boundary movement of pastoralist groups (e.g. movement of Pokot pastoralists into Baringo County). As a result there are tribal conflicts over water and natural resources.
- Industrial/economic development, foremost the irrigated agriculture sector, is hampered by water shortages as its full potential cannot be utilized;
- The drought risk has increased due to degradation of the upstream areas (decreasing the water availability from rivers in the dry season), population growth and climate change.

Recommendations by the DRR-Team on flood and drought risk reduction

- *Safety assessment and rehabilitation Chemaron Yatoi Dam*
The Chemaron Yatoi dam has been abandoned and not been maintained, resulting in heavy overgrowth. Its integrity is no longer guaranteed and may be at risk. Moreover, the reservoir is heavily silted and its capacity has drastically reduced. Heavy rainfall may result in overtopping the dam and subsequently a dam break with catastrophic effects downstream. It is urgent to assess the risk of a dam break and mitigate the risk if necessary.
- *Flood and drought risk reduction strategy for the Rift Valley Catchment*
The DRR-Team comes to the following strategy for flood and drought risk reduction for the Rift Valley catchment.

Floods		Drought
	1. Prevention, non structural measures	
✓	✓ Soil and water conservation upstream	✓
✓	✓ Implementation of Early Warning System (EWS)	✓
✓	✓ Flood zoning	
	2. Store water, structural measures	
✓	✓ Check dams	✓
	✓ Water pans	✓
✓	✓ Reservoirs	✓
	3. Drain water, structural measures	
✓	✓ Levees, River training	
	✓ Upgrading irrigation scheme	✓

The ✓ marks indicate the effectiveness for flood and drought risk reduction.

This strategy is holistic in the sense that with almost all of the proposed interventions both flood and drought risk reduction is achieved. The strategy comes as a logical framework, including a priority order of interventions for the entire Rift Valley catchment where both floods and droughts occur.

- *Planning study Endao River*

The flood and drought risk of Perkerra river will be greatly reduced when the planned dam at Radat will be implemented in the next 10 years. The DRR-Team therefore focused on the other major catchment in the area with considerable flood and drought risks, the Endao River catchment. The DRR-Team proposes a catchment planning study for flood and drought risk reduction in Endao River basin, as a first implementation study of the proposed Rift Valley catchment flood and drought risk reduction strategy. Such a catchment planning study would assess the cost-benefits and pre-feasibility of all possible risk reduction interventions as proposed in the mentioned strategy. The result is a comprehensive set of interventions ready for a feasibility study and financing.

- *Capacity building*

One of the major issues that hamper flood and drought risk reduction is the lack of capacity at the WRUA's and WRA. The DRR-Team therefore proposes:

- Further strengthening capacity of WRUA's. The World Bank and Water Sector Trust Fund already initiated the upgrading WRUA's of which 14 are in Baringo; This recommendation therefore needs alignment with these ongoing initiatives.
- Strengthening capacity of WRA:
 - Upgrading the monitoring system
 - Set up of a validated dataset including (open) satellite data
 - Development of hydrological models for assessment and early warning
 - Improved communication with DRR staff of counties
 - Enhanced enforcement of permits (to prevent over pumping of wells)
 - Implementation of Flood Early Warning Systems (FEWS).

Prioritization and next steps to be taken by WRA

The table below presents an overview and prioritization of the recommendations, as follows:

- The highest priority for the short term has the safety assessment of Chemeron Yatoi dam and rehabilitation if necessary. The stability of the dam during floods is potentially at risk in its current state. A quick safety assessment can be done in a week and a full feasibility study in a year. A full rehabilitation will probably take 2 years.
- The second priority for the short term is a decision of the County Government on the proposed flood and drought risk reduction Strategy. This Strategy is the back bone of future implementation projects.
- Equally important is the capacity building of WRA. The monitoring system falls short, the hydrological database is in a poor condition, no models for assessments or forecasting are available and the enforcement capacity is inadequate. With a growing economy and population, the importance of adequate water management based on state-of-the-art data and assessment tools becomes more and more important.
- The planning study for Endao River would be the first implementation study of the proposed flood and drought risk reduction strategy and is therefore listed as the 3rd priority. Based on the outputs of the study, potential benefits will be the installation of a hydro power facility at Chirandich dam and the rehabilitation of a versatile irrigation scheme downstream near Lake Baringo.

Recommendation	Type *	Prio- rity	Costs (USD)	Benefits of implementation	Implemen- tation Time
Chemeron Yatoi Dam * safety assessment * Dam safety study * Feasibility studies * Full rehabilitation	9,3	1	10,000 200,000 750,000 50 million	* Dam breach prevention * Small scale hydropower, water supply and irrigation	1-12 Months for studies, 2 years for rehabilitation
Strategy for flood and drought risk reduction in Rift Valley catchment	1,8	2	No costs and direct benefits, decision making by the County Govt. on the generic strategy only. Costs and benefits in implementation projects.		1-12 Months
Capacity building WRA Rift Valley	9	2	> 1 million	Improved monitoring and enforcement	Appr. 5 years
Planning study Endao River	1,8	3	200,000	* Flood and drought risk reduction * 1.7 MW Hydropower, 500,000 USD annually * Rehabilitation of irrigation scheme	6 months
Capacity building WRUA Rift Valley	9	4	PM	Sustainability of WRUA	Appr. 5 years

* Type of intervention, categorised to WRA standards: 1) Water resources management, 2) Water resources regulation, 3) Water resources development, 4) Environmental conservation, 5) Development of alternative water sources, 6) Water supply and sanitation (rural and village levels since county governments seems to be taking care of the urban areas), 7) Enhancing livelihoods for the rural communities, 8) Development and implementation of disaster risk management plans (for floods and droughts), 9) Any other activity in support of disaster risk management.

- The capacity building of WRUA is an ongoing and continuing, step by step process already in Kenya. Although important for the water management, we here put it on the least high priority for follow up of the DRR-Team mission, considering the efforts that are already made. Instead of starting new initiatives, we advise to align well with ongoing initiatives of the World Bank and Water sector Trust Fund.

The first next step to be taken by WRA is to draw a concept note that describes the business case of the recommendations, as a key stepping stone for funding. A first assessment of potential financiers learns that funds for implementation projects are readily available, but funds for preliminary studies are limited. This requires keen attention in the follow up of the DRR-Team mission results. An overview of potential financiers and development partners is presented in the report.

Then funding needs to be found to commence the defined studies that are necessary for implementation of the recommendations.

The DRR-Team advises to form a Steering Committee for the implementation of the recommendations, in which all relevant stakeholders are invited. This could be in the form of advisory committees as already constituted by the Water Act.

1. INTRODUCTION

I. Background

Governments that have to deal with an urgent water issue can call for assistance by the Dutch Government. The Dutch Disaster Risk Reduction Team (DRR-Team) instrument puts together and sends out a team of experts to the requesting government. Within a limited period of time, this team is able to analyse the situation at hand. Concrete and practical recommendations are provided to address and prevent the assessed water related risk. This instrument is therefore confined to provision of expert advice that is synthesized in a mission report. The requesting government and its mandated institution(s) are expected to take follow-up actions.

The Ministry of Water and Sanitation of Kenya requested for support from the DRR-Team in the Rift Valley, especially Baringo county, considering the flood and drought risks in this area. Reference is made to Annex 1. As a first step a pre-scoping mission was executed from June 11th till June 14th 2019. During the pre-scoping mission the required focus of the full DRR mission was determined in close iteration with WRA at national (Nairobi), regional (Nakuru) and sub-regional (Kabarnet) level, as well as the County and sub-County Government located in Kabarnet and Marigat. Based on the pre-scoping mission results, it was decided to deploy a full DRR-Team mission from November 18th till November 22nd 2019. The composition of the DRR-Team and the scoping mission program is listed in the Annex. The result of the DRR-Team mission is presented in this report. The report has been compiled with input and participation of the Kenyan government mandated institution Water Resource Authority (WRA). Hence this report is for the ownership and use by the WRA.

II. Objectives of the DRR-team scoping mission

The objective of the DRR-Team mission was to:

- Develop a strategy for the Rift Valley catchment, with the sub-catchments in Baringo County as representative catchments, for flood and drought risk reduction
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III. Study area

General description Baringo County

Baringo County is located in the Rift Valley and covers an area of approximately 11,000 km², and is located about 270 km northwest of Nairobi. The County is home to perennial rivers Perkerra, Kerio and Molo and seasonal streams such as Endao, Waseges and Emsos. It also is home to the natural lakes Baringo, Kamnarok and Bogoria. Lake Baringo and Bogoria are located in the Lobo Plain, which is covered mainly by salt-impregnated silts and deposits. The lakes support a wide array of aquatic life with the most notable one being the over 350 bird species. Baringo County also boasts of indigenous forests that are mostly located on the Tugen Hills in the western part of the county. The trend of the hills is north-south and mainly consists of volcanic rocks. The hills have steep slopes with prominent gullies, with on both sides of the hills escarpments with rivers and streams flowing through deep gorges. The elevation in the area ranges from a minimum of 720 metres above sea level (m asl) to 2478 m asl, with an average elevation of 1242 m asl.

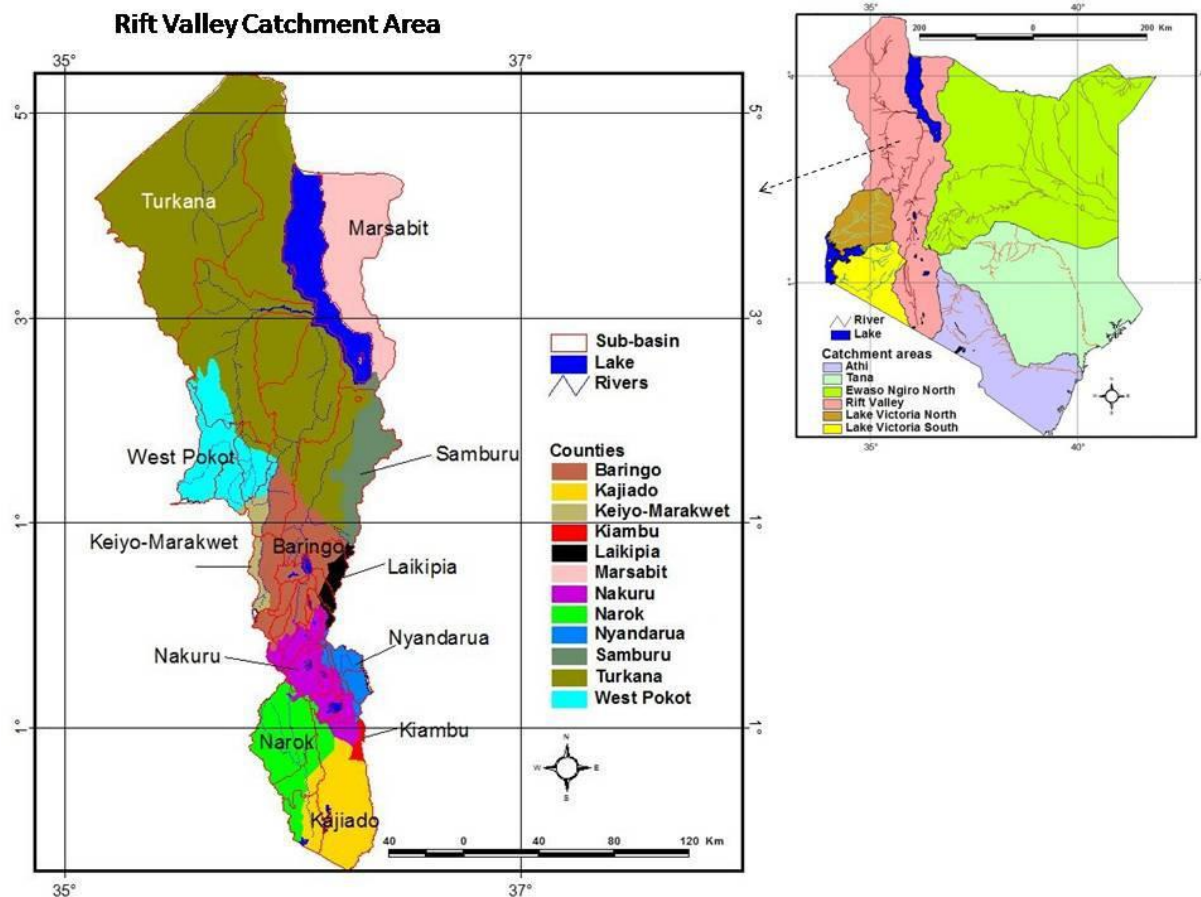


Figure 1. Overview map of the Rift Valley Catchment areas

Baringo is an Arid & Semi-Arid Land (ASAL) county, which is a region that suffers from a deficit of available water, a condition that can severely affect the effective use of the land for such activities as agriculture or stock-farming. Typical for ASAL regions is that for most months – if not all – the normal precipitation (P) is less than the normal or potential evapotranspiration (PET). Therefore water shortages are prevalent.

Economic Context

- Baringo County has a GDP per capita of KES 127,437 in 2017, which equals USD 2,545. It ranks 24th of the 47 Kenyan counties.¹ The County has a population of 5% with no formal education, 14% with primary education and 26% with a secondary level of education or above are working for pay. Work for pay is highest in Nairobi at 49%, which is almost twice the level of work for pay in Baringo for those with a secondary level of education or above.²
- Electricity connections in the county are just above 9.6% of the County Population. This situation is rapidly changing as the County in collaboration with the National Government invests more resources in power generation, transmission and distribution through its last mile program. The County is still below the national averages in the renewable improved energy sources.³ The vision is to make energy access memorable and sustainable⁴ as a key enabler for economic growth.

¹ Kenya National Bureau of Statistics, 2019

² Baringo County Integrated Development Plan, 2018 - 2022

³ Baringo County Integrated Development Plan, 2018 - 2022

⁴ County Fiscal Strategy Paper 2018/2019

- The county has a potential of 65,000 ha of land that can be put under irrigation but only 2236 of this has been utilized. There is need for the county to create more sources of water taking advantage of the County topographical landscape that is very much suitable for rivers upstream water collection to bring more land in the flat lowlands into utilization through gravity water which will in turn increase food production and reduce incidences of malnutrition and create wealth. In the summary of sector priorities the County mentions⁵ i) completion of ongoing water projects in urban and rural areas to increase the number of people connected to safe piped water and ii) completion of pans/small dams and multipurpose large-scale dams currently under various stages of implementation.

Water supply for domestic use in Baringo County

In the upstream part of the Endau stream and slightly below Kabarnet in elevation, the Karandich Dam is located. It is the primary drinking water supply source for Kabarnet town, serving an estimated 20,000 customers. Downstream in the Yatoi stream and 5km northwest of Marigat town, the abandoned and heavily silted Chemeron Yatoi Dam Reservoir is located. Although its primary function is supposedly flood protection, the water reservoir is also a prime water source for surrounding communities for domestic water use as well as a major livestock watering point in the region.

In the area there are also boreholes for domestic water supply, some of them are 100m deep, others go even up to 200m below ground level. Exact numbers of boreholes and their respective drilled depth and abstraction capacity has not been investigated during this DRR-Team mission. Aquifers are reportedly not depleted to such an extent that fully recharging in the wet season is impossible, but this was not confirmed by monitoring data. According to various sources do the boreholes in the Jemps flats, including Marigat town and Perkerra irrigation scheme, generally have fresh water. Groundwater sources closer to the lake and along its shoreline are, however, more saline and have an electrical conductivity (EC) of reportedly around 4mS/cm (classified as: brackish salt), and is normally not even desirable for livestock consumption.

⁵ County Fiscal Strategy Paper 2018/2019

2. FLOOD AND DROUGHT RISK BARINGO COUNTY

I. Hydrology of Lake Baringo catchment

With the focus of this DRR-Team scoping study on Lake Baringo catchment, the study area covers an area of 6,670km². The largest rivers are Molo and Perkerr, both originating from the Mau (Forest) Complex in the southern part of Baringo County and on the western wall of the Rift Valley catchment at an altitude of around 2,400m. Most of the water comes from these hill slopes, where annual rainfall is from 1,100mm to 2,700mm. The annual rainfall in the downstream Jemps flats is around 450mm, with annual evaporation rates of 1,650mm to 2,300mm.

The Perkerra River is the only perennial river in Baringo County and supplies water to the Perkerra irrigation scheme in the Jemps flats near Marigat town on the southern edge of Lake Baringo. Perkerra has a catchment of 1,207km². The flow rates are measured by WRA at a gauging station near the bridge at Marigat, although the coordinates cannot be correct; According to the dataset, the average flowrate is some 6 m³/s. There are some 14 flood events in the last 16 years. In a potential follow-up study this data will have to be analysed on (a) exact location, (b) statistical flood occurrence and (c) Flow Duration Curve.

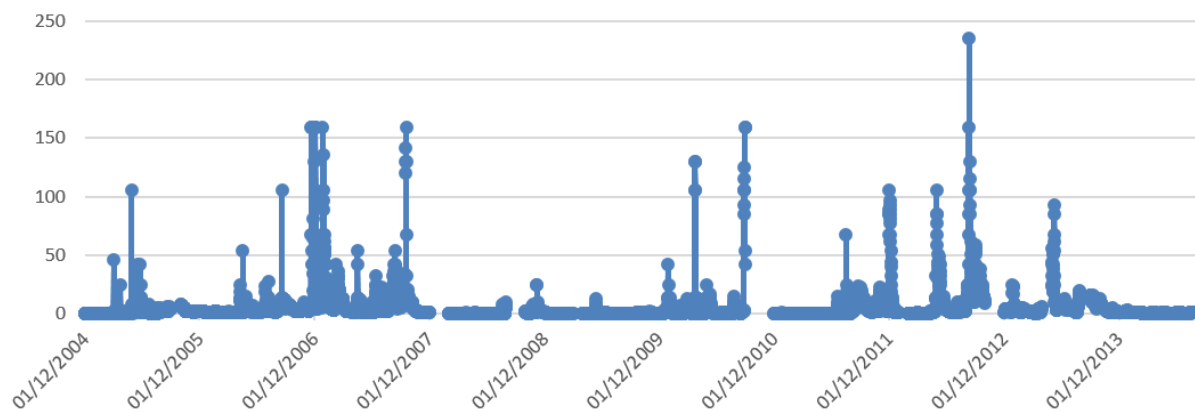


Figure 2: Perkerra River Flowrates (m³/s) according to data of WRA.

The upper catchment in the Mau Complex (Molo and Kuresoi areas) on the border with Nakuru County functions as the primary source of the Molo River. The Mau Complex is also one of Kenya's 'Water Towers' and therefore has an important hydrological function, as the underground water that the area brings is crucial in supplying many rivers that use this water to maintain their flow.

Other important identified streams in the Lake Baringo Catchment and as part of this study are Endau and Yatoi seasonal streams. Both streams originate from the eastern slopes of central Tugen Hills around Kabarnet town and flow eastwards towards Lake Baringo.

Lake Baringo itself has a surface area of 130km² at an elevation of 970m. Without an obvious outlet and besides evaporation losses (about 2200 mm per year) the water is assumed to seep through lake sediments into the faulted volcanic bedrock. As a result of soil erosion along the many rivers that feed the lake, much sediment is deposited in Lake Baringo. Between 1972 and 2003 the depth of the lake has fallen from 8m to 2.5m, and contracted from 160km² in 1960 to less than 108km² in 2001. Because the water depth is shallower, the evaporation losses are higher and the water therefore becomes more saline, while fish stocks are declining.

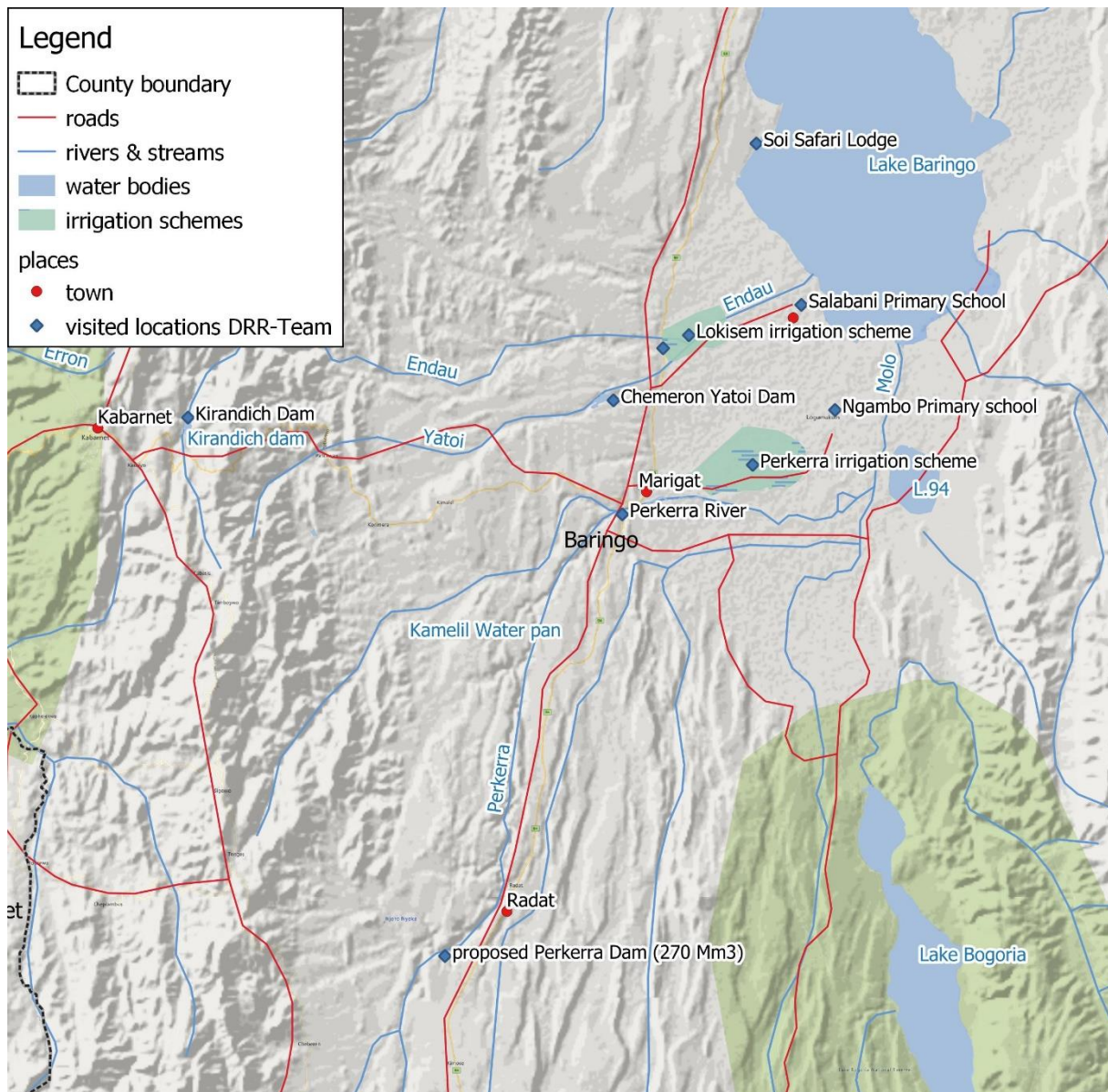


Figure 3. Overview map of study area sub-county Baringo South and the locations visited by the DRR-Team (Note: the proposed site for the Pekera dam at Radat is also shown on the map but has not been visited by the DRR-Team).

II. Dams and Reservoirs in Baringo catchment

Currently there are a number of existing or planned dams in Baringo County. The Kirandich Dam and the Chemeron Dam already exist. There are advanced plans to construct a large new dam in Perkerra River near Radat and there are plans to extend the Kirandich scheme with a second phase. These dams are described hereunder:

Kirandich Dam (existing dam)

This dam is a water supply dam for Kabarnet town and is located 3.3km east of Kabarnet. The rock-filled dam height is 52m, 220m long and with storage capacity is 4 million m³. The spillway is ungated. As the dam is located very upstream Endao River the catchment is just 30 km²(Kinyo, Kaplel, Kong'met, Terambus). A small water treatment plant draws currently some 180 m³/hr and pumps the treated water 350m up Kabarnet where it serves some 2000 connections. Three out of four pumps are in disrepair.



Figure 4: Kirandich Dam, Phase I (source: Google Earth).



Photos: Kirandich Dam, Phase I (Embankment, reservoir, water treatment plant).

Kirandich Dam Phase II (planned improvement of Phase I)

The 1.8 billion KES new water supply scheme will provide water supply to all 65,000 people in and around Kabernet. It will also involve extensions of water supply to Kabartonjo, Kaptorokwo, via Kabasis, Kituro, Kapkut and Kiboino areas. The project will involve enlargement of the existing spillway, de-siltation, 15 check dams, and monitoring equipment. About half of the funds will go to a new treatment plant. The project is driven by RVWSB and funded by the Italian Government. Site acquisition is ongoing and pipes have already been purchased. The project is too far upstream to have a significant impact on flood/drought control of the downstream area. Options for studies are:

- Hydropower potential
Apparently, hydropower is not considered but can actually easily be added to generate some extra electricity that can be used for the uphill pumping to Kabernet. A turbine can be placed between dam and water treatment. With a peak flow of 10 L/sec and 50m head, a turbine can generate approximately 1.7 MW (with 8 \$ct per KWH electricity about \$ 500,000 annually assuming a 50% capacity factor).
- Reservoir enlargement and de-silting The reservoir can be enlarged by adding height to the dam by raising the dam with 10-15m. The reservoir may double in volume due to the V-shape of the valley. Dead volume can be reduced by adding a gated spillway which enables flushing and flood control.

Chemeron Yatoi Dam

A dilapidated and abandoned dam is located north west of Marigat in Sub County Baringo South, and was visited by the DRR-Team. The estimated height of this tree-covered rockfill dam is 45-50m, and the length is 290m. This dam was probably abandoned some 15 years ago and an access road doesn't exist. Likely this reservoir is silted up and the state of repair of this scheme is critical bad and is a potential risk of a dam break.



Figure 5: Chemeron Dam (source: Google Earth).



Photos: Chemeron Dam (reservoir, bush on embankment, spillway, water abstraction)

Radat Dam

The Radat dam in Perkerra River has been proposed by the Irrigation Authorities, and a feasibility study was done. A copy of the FS has not been provided. The project costs of 15 billion KES would exceed the Kenya loan ceiling so an approval by Parliament is needed to raise that ceiling. Reportedly, the project faces resettlement and land acquisition problems as well, and is also delayed for that reason.

The main objective of the project is to regulate river Perkerra river flow to allow irrigation of 2020 Hectare of farmland of Perkerra Irrigation Scheme and provide water supply to the environs.

The dam has a 80m High zoned earth Embankment, 15m wide concrete bellmouth Spillway, 35m wide lined concrete auxiliary side spillway, 65m high dry intake tower, 2.5m diameter twin diversion culverts, 1MW hydro Power components, 35m Wide spillway bridge crossing, 1.2m twin steel offtake pipes.

The storage is 270 million m³. A 2000 Hectares irrigation would require some 2-3 m³/s of water. A 270 million m³ reservoir would have enough capacity for a few years of irrigation and seems rather large for its purpose. The impoundment would also take a few years, if it ever will fill up completely.

The average river flow is 6 m³/s (Figure 2) with peak flow rates to 200-658 m³/s, according to river flow data provided, although it is not clear at which location that was measured as the coordinates mentioned fall far outside the catchment.



Figure 6: Radat Reservoir after construction of 80m high dam.

As we assume that this project will continue in due time, we can safely assume that in the year 2030 this dam will exist and be partially impounded. Including procurement, detailed engineering, construction and commissioning the project may take 7 years after the approval of the funding.

In our opinion the drought/flooding situation in Baringo South subcounty will be partly/largely solved with the realisation of this Radat project. Partly because only half of the runoff of the Perkerra catchment can be captured in this dam which is located on one of two main tributaries. The other tributary still has no flood control system after completion of the Radat project.

Hence, because of the reduced risks after 2027-2030, the DRR-Team will focus on the areas North of Perkerra catchment.

III. Irrigation schemes in Sub-County Baringo South

Construction of the earlier mentioned Perkerra irrigation scheme in the delta of Perkerra River near the outflow in Lake Baringo, close to Marigat, was commenced during the Mau Mau Uprising in 1954, expanded in 1962, and currently supports about 670 farm households. The total potential irrigation area is 5,800 acres (2,340 hectares), but only 2,600 acres (approximately 1,000 hectares) are currently cropped through gravity furrow irrigation due to a shortage of water. Main crops cultivated are seed maize, followed at a large distance by beans, tomatoes, onions, papaya and watermelon, typically in a 2-season rotation system. The schemes water efficiency is around 2.5 L/ha, while with a properly functioning (furrow) irrigation system this would ideally be around 1.0 L / ha. The water shortage and inefficiency can also be seen in the crop yields; for seed maize, the current yield is around 2,000kg/acre, while this could be raised to 3,000kg/acre with improved water efficiency and irrigation techniques. The current market price is around 6,000Ksh/90kg bag. In the larger Jemps flats over 10,000 acres of land have irrigated or rainfed agriculture, cultivated by small-holder farmers. Mid-november 2019 they delivered 60,000 bags of seed maize, which represents a market value of approximately 360 million Kenyan shillings (Ksh).

Downstream of the Endao stream and Chemeron Yatoi Dam, north of Marigat near Lake Baringo, the Losikem irrigation scheme can be found, although it appears largely abandoned. The Losikem irrigation scheme is approximately 1,500 acres (600 hectares) in size, badly maintained and prone to flooding from Endao River and high water levels in lake Baringo. It is supposedly operated and owned by the Baringo County Government.

IV. Flood risk in Baringo county

The water levels of Lake Baringo have risen in recent years for (still) inexplicable reasons, permanently flooding the banks and tourist facilities around Lake Baringo and increasing the flood hazard (backwater effect). The satellite picture shown in Figure 7 after the severe flood of 2012 shows that especially the area south of Lake Baringo was hit. The brownish colour of the flooded areas and the rivers and also the south-eastern part of Lake Baringo indicate high sediment influx loads of rivers into the lake and, thus, siltation of the Lake.



Figure 7. Lake Baringo with flood prone areas indicated by the brown colours

In the past two decades heavy rains in many parts of the country have exceeded normal rains and have caused loss of lives and property as well as damage to property. Since the year 2002 the low-lying floodplain areas of Ngambo, Salabani and Kiserian around Marigat in Baringo County have experienced floods and its effects at certain times. These areas are located at the mouths of Pekera and Endao rivers and at the present shoreline of Lake Baringo.

In 2012 from July through August a combination of high Baringo Lake water levels and flash floods as a result of heavy rains resulted in flooding of properties and bursting of lake and river banks, closing down hotel businesses, displacing people and destroying property worth millions of shillings. This kind of flooding was never witnessed before in the history of Lake Baringo. River Perkerra also contributes to the problem by bursting its banks thus displacing people, destroying roads, crops, schools and dispensaries. Availability of river discharge, water level and disaster impact data to determine the real cause of the bursting of lake and river banks are scanty.

Based on discussions with stakeholders, articles in newspapers and on social media^{6,7,8}, documentation of Baringo County and satellite analysis the flood risk of Baringo County has been assessed by the DRR-Team. Also the flood hazard maps in the 'Baringo County Hazard Atlas⁹', developed by the Baringo County Government, NDMA and UNDP, were assessed, providing insight on flood prevalence, frequency, economic exposure, flood prone areas and its physical exposure.

⁶ <https://citizentv.co.ke/news/two-people-killed-by-floods-in-baringo-292188/>

⁷ <https://www.nytimes.com/2019/11/23/world/africa/kenya-floods.html>

⁸ <http://floodlist.com/africa/kenya-west-pokot-landslide-november-2019>

⁹ <https://apps.rcmrd.org/atlas/baringo/index.html>



Perkera River (top and right)



Flooded properties
Lake Baringo



Endao River



Flood mark in School in Ngambo irrigation
scheme near Marigat
Photos of the study area.



Trees overgrowing the Chemeron Yatoi
Dam

The flood hazard map of Baringo sub-county South (Figure 8 on page 16) shows that flood prevalence is high to very high with hundreds (up to 2,000) of people exposed to floods in the area south of Lake Baringo, including the downstream section of Perkerra River. These Marigat and Jemps flats areas are hit by floods (almost) every year. When floods occur, farm fields and their crop produce are swept away, as a result of which necessary harvests and incomes to sustain livelihoods are being lost, and damage to infrastructure occurs (roads, boreholes, small dams, schools, etc.). The economic exposure for this area (including the Perkerra irrigation scheme) expressed as annual GDP loss in USD due to floods ranges from 200 up to 14,000 USD (Figure 9 on page 17).



Figure 9. Flood Economic Exposure Map, extracted from the Baringo County Hazard Atlas (2018)

The flood hazard and flood risk has increased because of:

- Reportedly deforestation in the upstream parts of the Mau (Forest) Complex in Mogotio region along the border with Nakuru County. Large-scale deforestation supposedly also valid for the Tugen Hills (around Kabarnet), although the severity of land degradation around Kabarnet was not confirmed by observations during the DRR-Team field visit in November 2019;
- Poor agricultural practices of these same upstream cultivated lands, reducing the local water holding capacity of soils and causing rapid rainfall run-off and soil degradation, including erosion, forming of deep gullies and landslides;

- Silting of the downstream river stretches (especially Perkerra River and the Endao and Yatoi streams) and southern part Lake Baringo due to heavy sediment load;
- *Prosopis juliflora*, commonly known as 'Mathenge' or 'mesquite', is a hardy and resilient invasive plant which spreads at an alarming rate in tropical and sub-tropical regions of the world. It blocks the flow of water, diverting the River channels, while its deep root system can cause water stress due to its high water consumption and evapotranspiration values;
- Increasing population, housing and arable land encroachment in riparian and flood zones, and poor drainage in urban areas;
- Climate change may further increase the impact of flood hazards.
- Negligent maintenance and sedimentation of the Chemeron Yatoi Dam. As a result the Dam is in a poor condition as already described in paragraph II. A dam break is a major flood risk for the areas downstream the dam. The area at risk is presented in Figure 10.



Figure 10. Area directly downstream Chemeron Dam. The valley at risk is some 30m deep, 2.2 km long from dam to road, and has small scattered settlements.

V. Drought risk in Baringo County

Around 80% of Baringo County is Arid and Semi-Arid Land (ASAL) Area, which means it experiences (severe) droughts every year. This mainly applies to the low-lying Kerio Valley and Lobo Plain, which includes Lake Baringo and Lake Bogoria and covers most parts of northern, central and eastern Baringo County, at an altitude between 970m and 1,500m above sea level. See also Figure 11 from the Baringo County Hazard Atlas.

Due to degradation of the upstream areas and the increase of flash floods after intense rainfall, the water availability from rivers in the dry season decreases, thereby increasing the drought hazard. Many boreholes in sub-county Baringo South are impacted by high chloride or EC values (>4mS/cm) and at other locations by high fluoride levels due to over abstraction from aquifers of volcanic-rock origin, decreasing the water availability for domestic use.

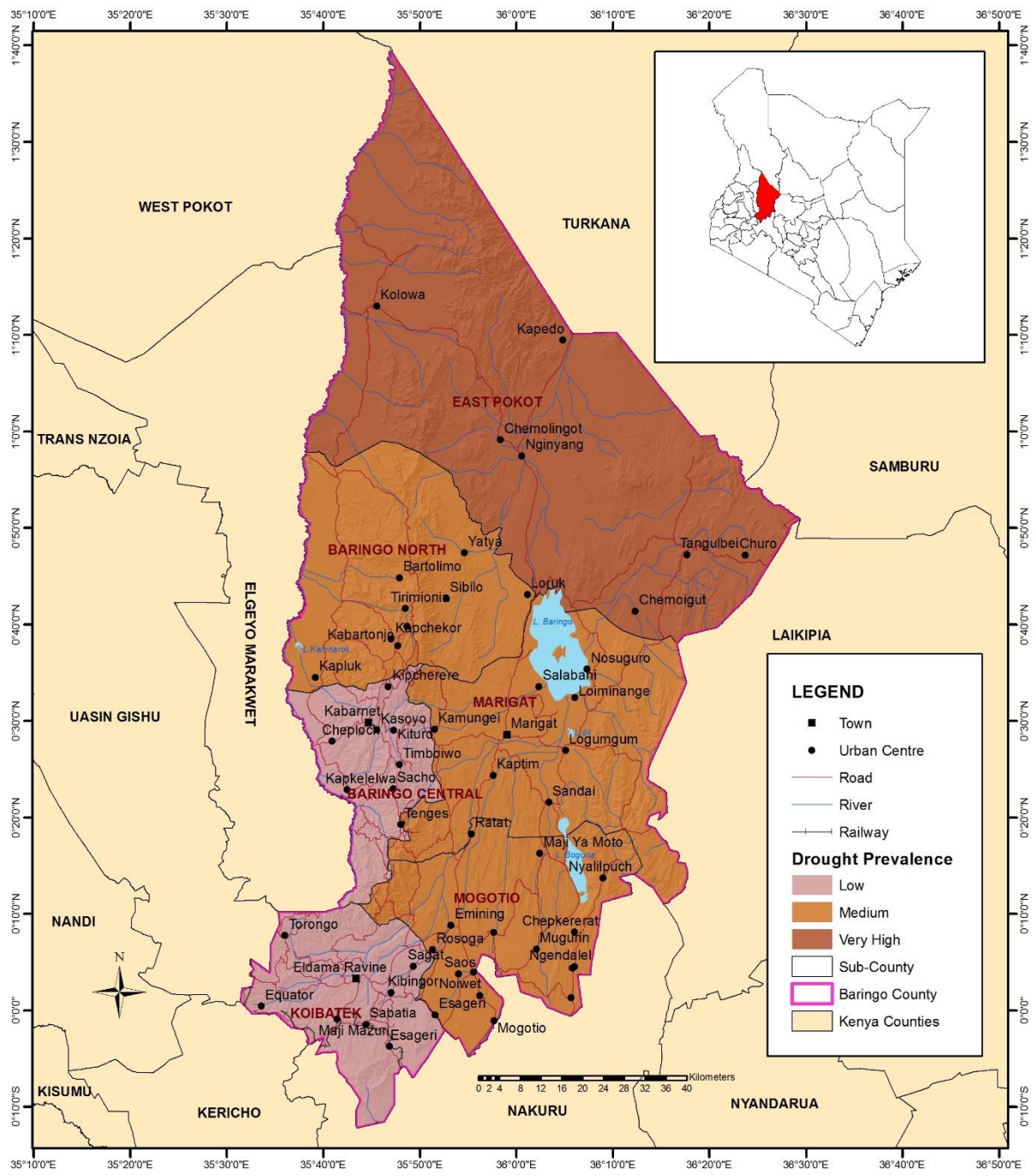


Figure 11. Drought Prevalence Map, extracted from the Baringo County Hazard Atlas (2018)

Due to droughts people and assets are at risk:

- Every year the population suffers from water shortages where the water supply is not guaranteed by reservoirs, water pans, boreholes or a water tank;
- Farmers are fully dependent on rains or irrigation water, thereby facing water shortages for crops and failing harvests every year;
- Despite the construction of several water pans by the Baringo County Government over the past years, the presence and distribution of sufficient livestock watering points is still lagging behind, partly due to poor construction and sedimentation of existing water pans, as well as due to the foreign/trans-boundary movement of pastoralist groups (e.g. movement of Pokot pastoralists into Baringo County);

- As a result there are tribal conflicts over water and natural resources on a yearly basis between different pastoralist groups (e.g. Pokot vs. Baringo) as well as between (nomadic) pastoralist and settled farmers;
- Industrial/economic development, foremost the irrigated agriculture sector, is hampered by water shortages as its full potential cannot be utilized;
- The drought risk will increase due to population growth and climate change.

VI. Issues that hamper flood and drought risk reduction

There are a number of issues that hamper flood and drought risk reduction in the Rift Valley catchment:

- Lack of a joint, clear and holistic (integrated) long-term vision how to combat the negative impacts of flooding and drought;
- Lack of funding in general towards flood and drought risk reduction;
- Lack of coordination between different (governmental) organizations, strengthened or, on the contrary, thanks to unclear mandates and responsibilities per authority / department, while the governance for disaster risk reduction (DRR) in Kenya remains largely reactive¹⁰. A good example of this is the fact that no authority has to date (yet) taken responsibility for rehabilitating and tackling the heavily neglected Chimeron Yatoi Dam, which is in immediate breakthrough danger and a direct threat to human lives;
- Capacity of the water resources user associations (WRUAs) falls short because of:
 - Lack of structural funding, involvement and knowledge building;
 - Lack of motivation, no remuneration through WRA or counties, albeit largely voluntary associations;
 - Hence, many WRUAs are not operational nor have developed a catchment management plan (CMP)
- Capacity of WRA Rift Valley regional and sub-regional offices are not in accordance with international standards (conclusions valid for many of the sub-catchments):
 - The monitoring of quantity and quality of surface and groundwater sources is poor and has degraded over past years, also due to vandalism and corrosion of loggers;
 - Data availability and models for assessments is incomplete or largely absent;
 - Lack of enforcement of permits for boreholes (over-pumping is the standard);
 - Flood management plans have not been made and formalised;
 - Although a formal Early Warning System (EWS) is in place, making meteorological predictions and warnings for upcoming drought and climatic hazards, a Flood Early Warning System (FEWS) is not yet been implemented in Baringo County;
- From the DRR-Team field visits it appears that the National Drought Management Authority (NDMA) and the Kenya Meteorological Department (KMD) staff at regional or county level generally have more flood and drought prediction information than the WRA (sub-)regional offices (hazard maps, straightforward EWS & FEWS, etc.).

¹⁰

<https://www.ke.undp.org/content/kenya/en/home/operations/projects/DisasterRiskReduction/governance-for-drr-in-kenya-.html>

3. STRATEGY FOR FLOOD AND DROUGHT RISK REDUCTION IN THE RIFT VALLEY CATCHMENT

I. Introduction

Based on i) the flood and drought risk of Baringo County, ii) the issues that hamper risk reduction and iii) discussions with stakeholders, the DRR-Team comes to the following strategy for flood and drought risk reduction for the Rift Valley catchment. This strategy is holistic in the sense that with almost all of the proposed interventions both flood and drought risk reduction is achieved. The strategy comes as a logical framework, including a priority order of interventions for the entire Rift Valley catchment, where both floods and droughts occur.

II. Strategy

The outline of the strategy is shown in figure below. The ✓ marks indicate the effectiveness of the measures with regard to flood and drought risk reduction.

Floods		Drought
	1. Prevention, non structural measures	
✓	✓ Soil and water conservation upstream	✓
✓	✓ Implementation of Early Warning System (EWS)	✓
✓	✓ Flood zoning	
	2. Store water, structural measures	
✓	✓ Check dams	✓
	✓ Water pans	✓
✓	✓ Reservoirs	✓
	3. Drain water, structural measures	
✓	✓ Levees, River training	
	✓ Upgrading irrigation scheme	✓

Priority 1: Prevention

The first priority is to implement non-structural measures that focus on prevention of flood and drought risk. These non-structural measures can be implemented at relatively low cost, while at the same time resulting in considerable risk reduction. These measures are therefore potentially very cost-effective. The proposed interventions are:

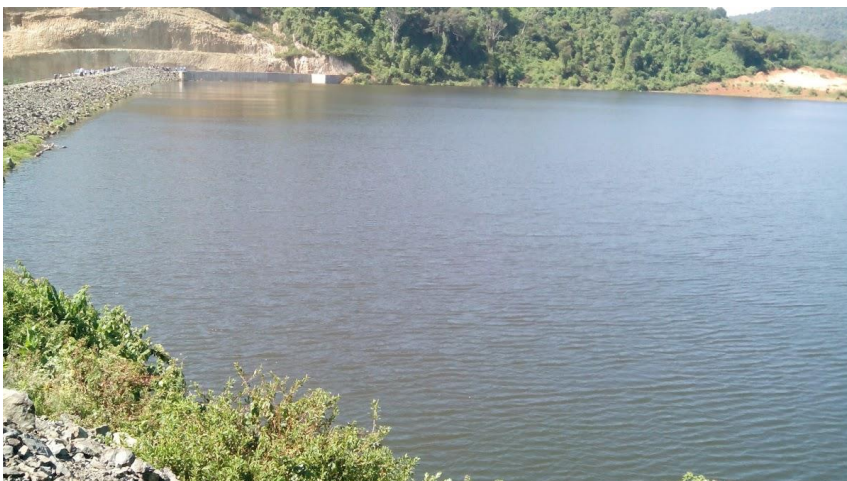
- Soil and water conservation (SWC) measures in upstream and degraded parts of the catchment, including steep slopes and in eroded gullies. Prevention of soil erosion by e.g. stopping deforestation and ploughing the agricultural lands parallel to the altitude contours, infiltrating rainfall into the ground water and preventing rapid rainfall runoff, combined with rainwater harvesting and 3R ('Recharge, Retention & Reuse of water')¹¹ measures, etc.
- Flood zoning: the implementation and enhancement of a policy or law that prevents encroachment of flood prone areas. The existing flood hazard maps available at County level can be used without further processing for delineation of the flood zones.

¹¹ [en.wikiversity.org/wiki/Rainwater_harvesting/3R_\(Recharge,_Retention_%26_Reuse\)](https://en.wikiversity.org/wiki/Rainwater_harvesting/3R_(Recharge,_Retention_%26_Reuse))

Priority 2: Storage of water by structural measures.

In case the priority 1 measures are not feasible, or not sufficient to obtain the required flood and drought risk reduction, the 2nd priority measures are to be taken into consideration. These are structural measures to store excess water in the wet season. The proposed interventions are:

- Small check dams in the river bed, slowing down the runoff and creating some storage of water in the river bed. These check dams should be replicated to obtain a significant effect.
- Water pans, storage of a small volume of water during floods in pans close to the smaller tributaries, utilizing these water volumes in the dry season for e.g. watering the life stock. Also these water pans should be replicated to obtain a significant effect.
- Reservoirs, large scale storage of water behind a concrete or rock fill dam in the river. Dams/reservoirs can be very effective and the mountainous landscape of the Rift Valley catchment is favorable for implementation. Dams/reservoirs however also require big investments, the implementation takes a long time and land ownership and resettlement issues further complicate the implementation.



Photos:

Example of a check dam (top, left), example of a water pan (top, right), Chemususu dam and reservoir (bottom left).

Priority 3: Drainage of water by structural measures

In case the priority 1 and 2 measures are not feasible, or not sufficient to obtain the required flood and drought risk reduction, the 3rd priority measures are to be taken into consideration. These are structural measures to drain the remaining flood waters safely in the downstream low lying deltas. Typical measures are levees and river training works to fix the river in its bed where settlements, irrigation schemes, irrigation inlet structures and other infrastructure is present. When implementing the flood protection works, rehabilitating and upgrading of the downstream irrigations schemes becomes more attractive since the risk of losing these investments due to floods decreases.



Photo: example of a levee and river training works.

III. Implementation and application of the strategy

The proposed flood and drought risk reduction strategy can be applied as a generic starting point for the plans that are made by the Counties in the Rift Valley catchment. Its implementation needs to be done on catchment level, since each catchment has its own characteristics and problems to be solved. Implementation of the strategy means decision making on the flood and drought risk reduction interventions. For each catchment, the feasibility and cost-effectiveness of all possible interventions, starting with the priority 1 category and ending at priority 3, needs to be assessed. The result is a package of interventions per catchment, ready for feasibility studies, design, build, operate and maintenance, including the financing.

Since many stakeholders are relevant for catchment plans prepared by the Counties, it is advised to form a Steering Committee with the County Govt. in the lead and all stakeholders on board. Typical stakeholders would be the Sub-counties, NIA, WRA, etc. This could be in the form of advisory committees as already constituted by the Water Act, to be decided by WRA.

4. CONCRETE RECOMMENDATIONS

I. Introduction

Following the generic flood and drought risk reduction strategy for the entire Rift valley catchment as proposed in Chapter 0, in the next paragraphs II-IV we present our other concrete recommendations, including a cost estimate. These recommendations follow directly from the findings of the scoping mission as presented in the previous chapter and discussions with stakeholders, especially WRA, the County of Baringo and Sub County Baringo South. Paragraph V describes the governance aspects of these recommendations and paragraph VI the options for financing. Paragraph VII puts the recommendations in a priority order for follow up and in the final paragraph we describe the next steps to be taken.

II. Recommendation: Capacity building in the Rift Valley

One of the issues that hamper flood and drought risk reduction is the lack of capacity at the WRUA's and WRA. We therefore propose:

- Further strengthening capacity of WRUA's. (The World Bank funded already the upgrading of 260 WRUA's of which 14 are in Baringo).
- Strengthening capacity of WRA:
 - Upgrading the monitoring system
 - Set up of a validated dataset including open data sources
 - Development of hydrological models for assessment and early warning
 - Improved communication with DRR staff of counties
 - Enhanced enforcement of permits (to prevent over pumping)
 - Implementation of Flood Early Warning Systems (FEWS).

At this stage, no cost estimate has been made since first the extent of the capacity building needs to be determined. A full upgrading of the monitoring system of WRA Rift Valley region in accordance with international standards alone would probably require an investment of more than 1 million USD.

III. Recommendation: Rehabilitation of Chemeron Yatoi Dam

As described in Chapter 2, the Chemaron Yatoi dam has been abandoned and not been maintained, resulting in heavy overgrowth. Its integrity is no longer guaranteed and may be at risk. Moreover, the reservoir is heavily silted and its capacity has drastically reduced. Heavy rainfall may result in overtopping the dam and subsequently a dam break with catastrophic effects downstream. It is very urgent to assess the risk of a dam break and mitigate the risk if necessary. The Ministry of Water and irrigation in Kenya has published in 2015 the "PRACTICE MANUAL FOR SMALL DAMS, PANS AND OTHER WATER CONSERVATION STRUCTURES IN KENYA". According to this publication, this dam can be considered "Class C: high risk, large dam". We strongly advice the following steps to be taken:

1. Dam safety analysis

Large trees on the embankment will in due time compromise the structural integrity of the dam. A peak flood event may cause overtopping of the dam with a potential to break the dam. This risk has to be investigated by a small team consisting of an ICOLD certified

dam safety (dam instrumentation engineer) expert, a hydraulic expert, a geotechnical expert and a GIS expert. A comprehensive dam safety study would cost approximately USD 200,000. A quick safety assessment by 1 expert having a walk-over of 2 days would cost much less.

2. A Feasibility study of the dam Rehabilitation

Such a feasibility study would involve intensive geotechnical drilling and assuming that no data can be found anymore, there will be a need for topographic and hydrological surveys. Assuming that there will be a need for a gated outlet and spillway (currently absent) there will be a need for some serious design work.

An FS of only the dam rehabilitation, with a concept design is estimated USD 350,000 plus some USD 300,000 for the geotechnical, topographic and hydrology surveys.

It is always recommended to install a gauging station in the river upstream and collect river flow data over a longer period/seasons. Such a station cost USD 1000 but there has to be an operator taking the readings. An automated gauge will cost some USD 5000. Alternatively, to obtain a historic time series of river flow data for better understanding of the risk of floods and overtopping of the dam, a hydrological model of the catchment can be developed. Since the catchment is ungauged, first a hydrologic model needs to be developed of the gauged Perkerra River that has some flow data (that first need to be validated thoroughly). The model characteristics (calibration parameters) can then be transposed to the model of the Chemeron Yatoi catchment. Such a modelling study typically would cost around USD 50,000.

3. A feasibility study for the reservoir rehabilitation

This study involves a bathymetric survey using a single beam dual frequency digital survey echo sounder should be used and fitted on the survey boat. Depth data and position will be recorded by the navigation computer system during the surveys.

Side scan sonar and sub-bottom profiler survey will be carried out at the same time as the side scan sonar survey along all survey lines to identify as a minimum the nature of the sediments within the top 5m of the seabed. The sub-bottom profiler primary objective is to identify underlying sediment thickness and provide detail on sediment composition.

The 3D contours of the silt layer can be determined and a dredging plan with portable dredgers can be made. Depositing the dredged sludge and CFD modeling of the reservoir to prevent future siltation are part of the study.

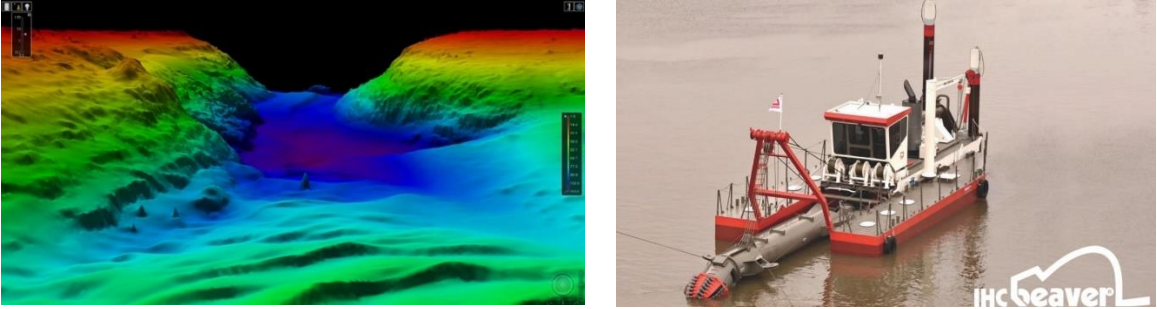


Figure 12. Side scan sonar contours and portable cutter suction dredger.

Such a study would cost approximately USD 75,000 including the survey.

4. Feasibility study for the downstream areas

A study and concept design for the water usage downstream the dam, and diverting the water to Endao irrigation schemes would cost approximately USD 250,000 including surveys.

5. Construction and rehabilitation of the dam and reservoir

Rehabilitation of the dam and reservoir includes the following:

- Removal and replacement of top layers from the embankment
- Desilting of the reservoir by portable dredgers, safe disposal of the sludge
- Adding gated sluice-gates and an improved spillway
- Dam height can be increased to enlarge the volume of the reservoir
- Add mini hydropower to gain revenues
- Downstream, channel the water to irrigated lands near Endao River

A cost estimate at this stage is just guessing, but if we assume a new dam of this size would cost USD 100 million, the rehabilitation of it would be some 30-50% of that amount. The costs for resettlement and land acquisition are nil.

The downstream works would also need a capital investment, approximately USD 10 million assuming this is some canalization over a length of 10 km.

A potential approach to consider: Lease the dam to a private developer who can develop mini hydropower. This business case will depend strongly on the costs of rehabilitation of the dam.

IV. Recommendation: Planning study Endao River

The flood and drought risk of Perkerra river will be greatly reduced when the planned dam at Radat will be implemented in the next 10 years or so. We therefore focus on the other major catchment in the area with considerable flood and drought risks, the Endao River catchment. We propose a catchment planning study for flood and drought risk reduction in Endao River basin, as a first implementation study of the proposed Rift Valley catchment flood and drought risk reduction strategy (Chapter 0). Such a catchment planning study would assess the cost-benefits and pre-feasibility of all possible risk reduction interventions as proposed in Chapter 0. The result is a comprehensive set of interventions ready for a feasibility study and financing. Notwithstanding the required assessment of all possible interventions, special attention should be given to the following topics:

Data and Hydrological modelling

Although general rainfall and evaporation data and statistics are available, for Endao River no water level and discharge data is available since the river is ungauged. A Hydrological and hydraulic model of the catchment needs to be developed to obtain a better insight in water availability in the dry season and floods in the wet season. The model should have Lake Baringo as a downstream boundary to enable modelling of the back water effect of the Lake. For calibration and validation of the model the following approach is suggested:

- Modelling of the gauged Perkerra River and transposition of the calibration parameters to the Endao River catchment model, dependent on soil and vegetation characteristics of both catchments. A thorough validation of the water level and discharge data of Perkerra river is necessary.
- Validation of the model results for floods can take place on basis of satellite images of the flood extend. Including Landsat images a data series of over 30 years can be collected on the flood extend, even if the satellite did not pass during a flood its marks can be detected e.g. on sediment deposits and erosion patterns.
- Additional validation of the flood extend and also the amount of flow in the dry season can be obtained by input of local inhabitants, specialists of WRA and WRUA and indigenous knowledge.

Data to be collected for the hydrological modelling of both Perkerra River (necessary since Endao river is ungauged) and Endao River:

- Rainfall and evaporation data and statistics (ground measurements and satellite data (NASA TRRM and GPM, both freely available));
- DTM (NASA SRTM and Airbus WorldDEM, both freely available);
- From these DTM's also rough cross sections of the river and the floodplain can be taken if the DTM was dated in the dry season.
- Delineation of the catchment, river and tributaries, soil types, land use characteristics and vegetation characteristics.
- Water level and discharge data of Perkerra river
- Water level data of Lake Baringo, or a time series of the extend of the Lake on basis of satellite data to reconstruct the historic water levels.
- Flood extend and dry season flow volumes based on satellite data, ground observations, input of specialists of WRA and WRUA and indigenous knowledge.

The data needs to be stored in a proper database.

Kirandich dam

As described in Chapter 2.II, plans are currently being made for expansion of the Kirandich dam. The 1.8 billion KES new water supply scheme will provide water supply to all 65,000 people in and around Kabernet. It will also involve extensions of water supply to Kabartonjo, Kaptorokwo, via Kabasis, Kituro, Kapkut and Kiboino areas. The project will involve enlargement of the existing spillway, de-siltation, 15 check dams, and monitoring equipment. About half of the funds will go to a new treatment plant.

The project is driven by RVWSB and funded by the Italian Government. Site acquisition is ongoing and pipes have already been purchased.

The project is too far upstream to have a significant impact on flood/drought control of the downstream area.

In the planning study the following topics need to be addressed regarding Kirandich dam:

- Hydropower potential
Apparently, hydropower is not considered yet but can actually easily be added to generate some extra electricity that can be used for the uphill pumping to Kabernet. A turbine can be placed between dam and water treatment. With a peak flow of 10 L/sec and 50m head, a turbine can generate approximately 1.7 MW (with 8 \$ct per KWH electricity about \$ 500,000 annually assuming a 50% capacity factor).

- Reservoir enlargement and de-silting
The reservoir can be enlarged by adding height to the dam by raising the dam with 10-15m. The reservoir may double in volume due to the V-shape of the valley. Dead volume can be reduced by adding a gated spillway which enables flushing and flood control.

Rehabilitation irrigation scheme

Downstream in the Endao River Basin, in between the Nakuru- Sigor (B4) road and Lake Baringo, the Losikem irrigation scheme can be found, although it appears largely abandoned. The Losikem irrigation scheme is approximately 1,500 acres (600 hectares) in size, badly maintained and prone to flooding from Endao River and high water levels in lake Baringo. It is supposedly operated and owned by the Baringo County Government. Rehabilitation of this scheme is an important topic for assessment.

Costs of study

We estimate the costs of a planning study for Endao river approximately 200,000 USD.

V. Governance aspects

WRA is the main Client of the DRR-Team mission, this report is the ownership of WRA and therefore WRA is in the lead for follow up of the recommendations presented in this report.

In this section we describe which institutions and authorities are stakeholders for implementation of the recommendations, given the institutional setting in Kenya as summarised in the Annex.

The table below presents these stakeholders.

Recommendation	Stakeholders
Capacity building WRUA	WRA County Govt.
Capacity building WRA	WRA
Implementation of Rift Valley catchment strategy	County Govt. WRA NIA
Rehabilitation of Chemeron Yatoi Dam	NWWSA, RVWWDA, County Govt. WRA
Planning study Endao River Basin	County Govt. WRA

Since many stakeholders are relevant, we propose to further identify those stakeholders and invite them to a Steering Committee for guidance of the implementation of the recommendations. Such a Steering Committee could also be realized as basin advisory committees that are already constituted by the Water Act.

VI. Options for financing

General perspective on funding options

The recommendations described in this report result in investment options for flood and drought risk reduction that by themselves are not viable, but nonetheless result in net economic / public benefit. This means they should mainly be assessed on the basis of additionality and net economic impact. Furthermore, the projects are not yet investment ready.

- The fact that these projects are not yet investment ready mean project development facilities that are available to the public sector could be interesting to explore. This is a way of de-risking the project in the preparation phase.
- Because the projects are not viable in itself means the government should consider trying to de-risk the project as much as possible in the implementation phase. There are different ways to de-risk transactions, namely 1) viability gap funding (grants and concessional finance), 2) guarantees and insurances (e.g. to cover currency risk).

The next table gives examples of de-risking facilities available internationally with presence and/or operations in Kenya. Please note that the list is the result of a quick scan and eligibility has not been confirmed with the managers of the facilities.

Preparation phase (project development facilities)	Implementation phase (project financing and funding)
The African Water Facility (AWF) provides grants and expert technical assistance to implement innovative water projects and raise investment for water projects throughout Africa - providing grants for project preparation with measures to strengthen water governance and water knowledge management.	EU-Africa Infrastructure Trust Fund. The EU-AITF combines long-term investments from development finance institutions (loans, risk capital, etc) with grant monies to gain financial and qualitative leverage as well as project sustainability. Grants can be provided in the form of technical assistance, interest rate subsidies, investment grants, financial instruments that include guarantees, insurance premia, equity investments and so on.
IFC PPP Advisory Services provides advice to governments to implement a variety of public private partnerships in infrastructure and other public services to enhance quality and improve efficiency in public services. The aim should be to ultimately develop the project as a PPP.	USAID/DCA’s partial credit guarantee. The DCA uses partial credit guarantees to mobilize local financing in developing countries. USAID typically guarantees 50% of the total debt capital mobilized in each transaction. DCA partners with several different types of entities, including (1) co-guarantors who partner to share risk, and (2) resource partners who contribute to funding the cost of a DCA guarantee.
PPIAF (multi-donor TA facility hosted by	PIDG – GuarantCo is a facility for providing guarantees to

Preparation phase (project development facilities)	Implementation phase (project financing and funding)
the WB) provides technical assistance and knowledge grants to governments to support the creation of an enabling environment for the provision of infrastructure services by the private sector. Clients include national governments, PPP units, regulators, and sub-national entities, including municipalities and utilities.	lenders that enhance the credit for local currency debt issuance by the private, municipal and parastatal infrastructure sectors in low and low-middle income countries. Specifically, GuarantCo allows the length of debt offerings (tenor) to be extended and other terms improved for borrowers. Products include: partial credit and partial risk guarantees, first loss guarantees, tenor extension or liquidity guarantees and can provide joint guarantees or counter guarantees.

In addition to these facilities Kenya has access to the country's portfolios with the DFIs, through which concessional finance for the implementation phase of the recommendations of the DRR-Team is available.

Development partners

The DRR-Team has had the opportunity to conduct interviews with a selection of development partners as potential funders/ financiers for the recommendations made by the DRR-Team. We refer to the annex for an overview and description of the funders financiers. Interviews have been conducted with the climate change unit in the Treasury, AfDB, DANIDA, JICA, Sida, WSTF and The World Bank. This paragraph describes the observations resulting from the interviews.

1) Climate change unit in the Treasury

The Climate change unit in Treasury is interested in receiving proposals for enhancement of the flood and drought risk reduction in the Rift Valley. A first step for WRA is to draw a concept note that describes the business case.

2) Investors (especially banks like AfDB) are looking for ready projects

'Project readiness was a term often used during the interviews. Especially the DFIs have significant budgets lined up for projects in Kenya. So it was confirmed that there is no lack of financing, but rather a lack of (viable) projects. A project is considered ready by the investors when a feasibility study has been conducted. On the basis of this feasibility, DFIs can do due diligence on the project. The county of Baringo does not have projects currently in that stage, as far as the team has been able to assess.

3) More project preparation funds (PPFs) are needed

To reach the stage in which a project is considered ready by investors, project preparation funds are needed. These are needed for:

- A planning study for Endao River Basin. This study shall compare different combinations of interventions;
- The study for rehabilitation of the Chemeron Yatoi Dam.

AfDB has a project preparation fund (the African Water Fund), but the current status is that it has almost been depleted.

4) *Support for the feasibility stage may be possible in case of government commitment*

Although the development partners do not have programs available where the County can tap into, from the interviews we understand that some development partners can be provide support when a county shows strong commitment towards a project. Especially during our conversation with JICA it was explained that on the basis of a concept note from the county JICA might be able to offer project support.

5) *Large infrastructure projects are easier to finance than a set of smaller interventions*

In the current landscape there is from a financing perspective an incentive to do bigger projects, the smaller projects are more difficult to finance. This has to do with the risk-return profile of projects, sectoral focus of financiers and transaction costs. The higher the ticket size, the lower the relative transaction costs for a financier.

6) *Summary options for project development and implementation/construction*

The table below gives a summary of options for financing as identified during the DRR-Team mission.

	Project development	Implementation/ Construction
Climate change unit Treasury	Yes if taken to Cabinet and approved by Parliament	Yes
The African Development Bank (AfDB)*	Through the AWF, but almost depleted	Yes, country portfolio available
Danish International Development Agency (DANIDA)*	Would be possible in theory, but focus on WRM / DANIDA funds channelled through WSTF could possibly be used	No
Japan International Cooperation Agency (JICA)*	In case the county shows commitment and a concept paper	Yes
Swedish International Development Cooperation Agency (Sida)*	No	No
The Water Sector Trust Fund (WSTF)	Development partners channel grants through WSTF	No
The World Bank (WB)	Possibly, in case private sector investments are anticipated DevCo might be suitable	Yes

As described, there is a lack of preparation funds, defined as grants needed in the phase when the potential of the project is not clear, so commercial investors are not yet involved. The County Government of Baringo can explore project preparation facilities that are part of the Project Preparation Facilities Network (PPFN), launched in 2014. PPFN is a “network of funding facilities and institutions dedicated to developing sustainable infrastructure in Africa through improving project preparation, working to increase the number of viable, well-prepared, investment-ready infrastructure projects” (icafrika.org). Examples of members are PPIAF, TAF and DevCo. Although it is worth exploring, we think most of the funds have a specific focus which will exclude the projects mentioned in this report.

VII. Prioritization

In Chapter 0 we presented a generic and holistic strategy for flood and drought risk reduction, followed by three concrete recommendations in this Chapter. In this paragraph we present an overview of the recommendations including the estimate of the costs, the potential benefits of implementation and implementation time needed, and we propose a prioritization:

Recommendation	Type *	Prio- rity	Costs (USD)	Benefits of implementation	Implemen- tation Time
Chemeron Yatoi Dam * safety assessment * Dam safety study * Feasibility studies * Full rehabilitation	9,3	1	10,000 200,000 750,000 50 million	* Dam breach prevention * Small scale hydropower, water supply and irrigation	1-12 Months for studies, 2 years for rehabilitation
Strategy for flood and drought risk reduction in Rift Valley catchment	1,8	2	No costs and direct benefits, decision making by the County Govt. on the generic strategy only. Costs and benefits in implementation projects.		1-12 Months
Capacity building WRA Rift Valley	9	2	> 1 million	Improved monitoring and enforcement	Appr. 5 years
Planning study Endao River	1,8	3	200,000	* Flood and drought risk reduction * 1.7 MW Hydropower, 500,000 USD annually * Rehabilitation of irrigation scheme	6 months
Capacity building WRUA Rift Valley	9	4	PM	Sustainability of WRUA	Appr. 5 years

* Type of intervention, categorised to WRA standards:

1. Water resources management
2. Water resources regulation
3. Water resources development
4. Environmental conservation
5. Development of alternative water sources
6. Water supply and sanitation (rural and village levels since county governments seems to be taking care of the urban areas)
7. Enhancing livelihoods for the rural communities
8. Development and implementation of disaster risk management plans (floods and droughts)
9. Any other activity in support of disaster risk management

The highest priority for the short term has the safety assessment of Chemeron Yatoi dam and rehabilitation if necessary. The stability of the dam during floods is potentially at risk in its current state. A quick safety assessment can be done in a week and a full feasibility study in a year. A full rehabilitation will probably take 2 years.

The second priority for the short term is a decision of the County Government on the proposed flood and drought risk reduction Strategy. This Strategy is the back bone of future implementation projects.

Equally important is the capacity building of WRA. The monitoring system falls short, the hydrological database is in a poor condition, no models for assessments or forecasting are available and the enforcement capacity is inadequate. With a growing economy and population, the importance of adequate water management based on state-of-the-art data and assessment tools becomes more and more important.

The planning study for Endao River would be the first implementation study of the proposed flood and drought risk reduction strategy and is therefore listed as the 3rd priority. Based on the outputs of the study, potential benefits will be the installation of a hydro power facility at Chirandich dam and the rehabilitation of a versatile irrigation scheme downstream near Lake Baringo.

The capacity building of WRUA is an ongoing and continuing, step by step process already in Kenya. Although important for the water management, we here put it on the least high priority for follow up of the DRR-Team mission, considering the efforts that are already made. Instead of starting new initiatives, we advise to align well with ongoing initiatives of the World Bank and Water sector Trust funds.

VIII. Next steps to be taken by WRA

In the previous paragraphs we described the recommendations that resulted from the DRR-Team mission. Here we describe the next steps that are critical for implementation of these recommendations.

The first next step to be taken by WRA is to draw a concept note that describes the business case of the recommendations, as a key stepping stone for funding. A first assessment of potential financiers and development partners is listed in the annex. Then funding needs to be found to commence the defined studies that are necessary for implementation of the recommendations.

The next step, as described, is to form a Steering Committee for the implementation of the recommendations, in which all relevant stakeholders are invited. This could be in the form of advisory committees as already constituted by the Water Act, to be decided by WRA.

Annexes

Annex 1: Request for DRR-Team by Kenyan Government



REPUBLIC OF KENYA
MINISTRY OF WATER AND SANITATION
OFFICE OF THE PRINCIPAL SECRETARY

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REF.MWI/PARAS/10/50/Vol. IV (105)

22nd November, 2018

The Principal Secretary
The National Treasury
Treasury Building
NAIROBI.

Dear

**RE: APPLICATION FOR THE NETHERLANDS DISASTER RISK REDUCTION (DRR)
INSTRUMENT – WATER RESOURCES CONSERVATION**

Reference is made to a letter from the Ambassador of the Embassy of the Kingdom of the Netherlands to the Cabinet Secretary Ministry of Water & Sanitation ref. NAI-G/2018/175 dated June 28, 2018 responding to the Ministry's request for the Disaster Risk Reduction (DRR) Instrument. A copy of the letter under reference is attached.

The Embassy of the Kingdom of the Netherlands has informed the Ministry of Water and Sanitation of the availability of the referenced instrument that is funded by the Netherlands Government. This instrument provides experts with international experience that work with the local experts to assess existing or anticipated water related disasters and/or risks.

In this regard the Ministry through the Water Resources Authority has prepared a Concept Note for analysis of water related risks in the Rift Valley Basin. The Rift valley basin is particularly selected due to the increasing concern at the high level of environmental degradation threatening the largest water tower, Mau complex Furthermore parts of the catchment are prone to extreme drought, including such areas as, Turkana, Baringo, Marsabit, and Samburu.

Annex 2: DRR-Team composition and scoping mission program

The DRR-Team on behalf of RVO existed of:

- Durk Klopstra (team leader and hydrologist)
- Rob Winters (finance and governance specialist)
- Rudolf Muijtjens (dam specialist)
- Stefan de Wildt (water conservation specialist)

The following meetings were organised by the Dutch Embassy to deliver the objectives of the Scoping mission:

- November 18th: kick-off at WRA Nairobi
- November 18th – 20th: Field trip together with staff of WRA, discussions at the Sub County office of Baringo South at Marigat, Irrigation Authority at Marigat and WRA sub-regional office at Kabarnet, where also staff of the County Baringo was present.
- November 21st: meetings with the National Treasury, DANIDA, SIDA, AfDB and Unicef in Nairobi.
- November 22nd: meeting with JICA and wrap up at WRA headquarters in Nairobi.



Photo of meeting at Sub-county office Baringo-South in Marigat.

Annex 3: Institutional setting of water management in Kenya

Introduction

As in other countries, multiple organisations have a direct or indirect role in water management. In this paragraph we describe these organisations and we zoom in specifically on water resources management, disaster risk reduction and Water Works Project Development¹². We note that for the purpose of the project, we explicitly include other organisations that are usually not pictured when describing the institutional setting in the water sector. These organisations – even as their main task is not about water management – are also relevant in the context of this flood and drought challenge in Baringo. The figure below includes in addition to the ‘water institutions’ also the National Treasury, County Government, National Irrigation Agency and National Environment Management Authority (NEMA).

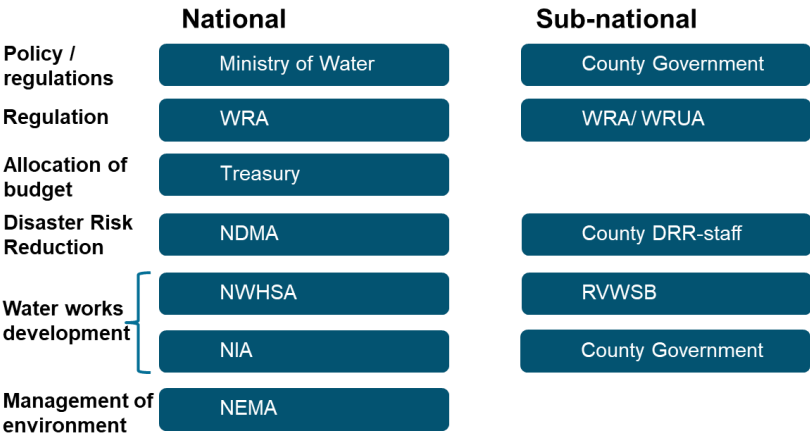


Figure 13.Roles and responsibilities

Policy / Regulatory Framework and Allocation of Budget

The **Ministry of Water and Sanitation** in Kenya is mainly responsible for regulation of the water sector and the ministry is responsible for functioning of the regulatory environment and the responsible government institutions in the water sector. The Kenyan constitution firmly distributes the functions between the two levels of government, with the national government being tasked with the management and protection of water resources and the county governments being tasked with the provision of water and sanitation services and the implementation of the national government policies on natural resources, including soil and water conservation.

As such, the roles and responsibility of the **County Government** include (according to the National Water Policy of 2012):

- Ensuring access to water and sanitation according to constitutional rights;
- Managing catchments and protection by implementing water catchment activities at the county level;
- Protecting the interests of under-served consumers by enacting regulations ensuring progressive achievement of the right to water;

¹² We realize that within the short time span of the DRR-Team mission this overview is not 100% complete and should be completed by WRA in the follow up where necessary.

- Providing financial management through fiscal and investment planning by developing five-year plans incorporating an investment and financing plan for the provision of water services;
- Safeguarding integrity, good governance and performance in water supply service delivery;
- Ring-fencing of income in the water sector and management autonomy. Counties can also participate in increasing the mobilization and efficient use of funds;
- Ensuring and coordinating the participation of communities in governance;
- Cooperating and coordinating with other counties to ensuring smooth intercounty sharing of water resources;
- Contributing to research and development in the water sector.

The National Treasury is responsible for the allocation of the government's budget for implementing partners and specific projects. This allocation is obviously subject of approval by cabinet and parliament. The Treasury is also the contractual partner for lending partners, who can invest in specific projects. Loans focused on the water sector are usually being channelled through the Treasury.

The Water sector institutional framework - Draft Water Policy¹³

While recognizing that there was a water policy of 2012, it is also important to note that there is a draft water policy which is now at an advanced level to enactment. It will be in operation in a short while. It is based on the current water act 2016. The provisions in this policy should therefore be considered when discussing the legal and policy framework and institutional set up in this context. Below the relevant section 6.2 is quoted for this purpose.

The institutional framework governing the water sector in Kenya draws its structure and mandate from the constitutional framework, and the enabling legislation. Constitutionally, a devolved system of government has been established in Kenya, which confers the national government key roles in, among other areas, policy and standards setting, consumer protection, water resources management, national public works, and responsibility regarding realization of the human right to water. Aside from water sector institutions, whose roles are defined in water legislation, there are public and community entities that play different roles that impact water resource management, storage and water services, including entities in irrigation, forestry, energy, regional development, environment and finance.

County governments are expressly required by Constitution to implement national government policies on natural resources and environmental conservation, including soil and water conservation. In addition, water and sanitation services are devolved functions, as part of county public works. In terms of practical delivery of water sector functions, there are areas where national and county jurisdiction overlap, or result in concurrent roles. This for instance areas where the national and county governments, as part of the Kenyan State, have responsibility over realization of the human right to water. In addition, the Constitution classifies water resources as part of public land, and vests these on the national government where it comprises all rivers, lakes and other water bodies. The adoption of basin water resources management in Kenya has resulted in creation of intergovernmental basin committees, under the regulatory authority of the national government, to manage water resources at national level.

The provision of water services, although classified a county function by the Constitution, will in various instances raise the question of bulk transfer of water across administrative

¹³ This section was provided by WRA after having reviewed the draft report.

county boundaries. In addition, the development of bulk water infrastructure, whether from rainwater harvesting, storage of surface water, or ground water harvesting, may require significant financial investments by the national government, while the infrastructure will serve the mandate of the counties. The development of an integrated system of investment planning for development of water resources, storage and supply is therefore necessary”.

Water Resources Management

WRA is the Water Resources Authority under the Ministry of Water and sanitation:¹⁴

- WRA has the legal mandate to regulate, monitor, assess and allocate water resources
- WRA has adopted Integrated Water Resources Management (IWRM) approach in its operations as a means to ensure stakeholder participation and to adopt a holistic view of management of the water resources incorporating the environmental, social and economic context of the water resources
- WRA has already engaged and established Water Resources Users Associations (WRUAs) who undertake water conservation activities at the grass roots in partnership with other stakeholders including counties, private sector, civil society, women, men, youth and vulnerable groups.
- WRA has structures and technical capacity nationally, at the basin and sub basin levels that implement water resources management activities to ensure protection, conservation of water sources and access to water in good quality and quantity. This further ensures sustainable water supply, flood control including dam safety, enhanced storage and sustainable conservation of our water catchment areas
- WRA is in transition from WRMA under the water act 2016 and various structural adjustments are likely to be made. Reference is made to the added mandate of flood management which might force WRA to provide for a department to deal with floods. Additionally, WRA is also reviewing the WRM Regulations to become more effective. In this regard, the regulations once enacted should be implemented in full. There will be need to support institutional strengthening of WRA and its affiliate institutions to effectively implement these regulations and especially where they will be required to take full responsibility for water related disaster particularly those related to floods and failure of water infrastructure. WRA is likely to set up a fully-fledged unit to deal with these and experts will be needed to support. The unit will deal with such matters as:
 - Strict regulation of water infrastructure development, operation and maintenance. This will require special skills in design, supervision of construction, instrumentation for monitoring and risk analysis and reporting.
 - Preparation of infrastructure break analysis will be key.
 - Preparation of the water infrastructure operation modalities and decommissioning procedures.
 - Development and implementation of codes of practice in this subsector.
 - Professional and experts panel among others.

The other part here would be the measures that WRA would put in place to monitor and gather adequate and reliable data and information to help in forecasting and modelling of rainfall patterns to help diffuse looming disasters.

¹⁴ Reference is made to the ToR

This information and data will be crucial in designing, construction, operation and decommissioning of water infrastructure. A complete and fully operational water resources monitoring network would be very crucial. The data and information system would also be very necessary to operate and maintain sustainably. This system will involve monitoring of the source, the resource and use.

To secure the lifespan of these water retaining structures and also to reduce significantly runoff, an intensive catchment conservation programme should be set up. Key to this would be a big component on strengthening and support to WRUAs to implement conservation programmes.

WRA's organisation is decentral, with offices on sub catchment level, catchment level and national level. There are 7 offices on catchment level, since there are 7 catchments distinguished in Kenya. The national, regional and sub-regional offices make annual plans on water resources management (such as water allocation plans) on their own scale. The staff of sub-regional offices, in many cases delegated to local contacts of WRUA, is also responsible for data collection, such as reading of the water level gauges and meteorological gauging stations. Data goes to the regional office and then to headquarters in Nairobi. The staff of WRUA consists of volunteers and does not get paid for their services. The capacity building of the WRUA's and the development of the annual plans (in many cases executed by consultants) is financed by the Water Sector Trust Fund.

Drought Management (NDMA)

Drought Disaster Management is the mandate of the National Drought Management Authority (NDMA). The mandate of NDMA is "exercise overall coordination over all matters relating to drought risk management": www.ndma.go.ke.

Disaster Risk Reduction

At the County level of Baringo, two DRR staff members are active for disaster risk reduction. The DRR staff of the county gets a weekly weather forecast and early warnings for floods (when relevant) and droughts (monthly) on a rough scale from the NDMA. Plans for upgrading the information by means of dashboards have been made and wait for final funding. The DRR staff has also rough flood and drought hazard and risk maps. The DRR-Team found that WRA seemed to be unaware of these maps and information.

Water Works Project Development

The DRR-Team has observed during the mission that 4 organisations can potentially initiate and develop water works projects from their respective function. These are:

- The National Water Harvesting and Storage Authority (NWHSA)
- Rift Valley Water Services Board (this will soon be renamed as Rift Valley Water Works Development Agency);
- National Irrigation Agency;
- County Government of Baringo.

The **NWHSA** is a parastatal under the Ministry of Water and Sanitation and replaces the National Water Conservation & Pipeline Corporation (NWPC). The NWHSA is basically

the national implementor of water projects, which it implements on behalf of the national government. The functions and powers of the Water Storage Authority shall be to (strategic plan pending for approval):¹⁵

- Undertake on behalf of the national government, the development of national public water works for water resources storage and flood control;
- Maintain and manage national public water works infrastructure for water resources storage;
- Collect and provide information for the formulation by the Cabinet Secretary of the national water resources storage and flood control strategies
- Develop a water harvesting policy and enforce water harvesting strategies;
- Undertake on behalf of the national government strategic water emergency interventions during drought; and
- Advise the Cabinet Secretary on any matter concerning national public water works for water storage and flood control.

The **RVWSB** is one of the eight Water Services Boards established by the Government of Kenya under the Water Act 2002 as part of the reforms in the water sector. Water Services Boards are in charge of asset management through Service Provision Agreements (SPAs) with the Kenyan water companies. The 2016 Water Act defines national public water works as water works:

- Whose water resources transcend county borders;
- That are financed by the national government's share of national revenue; and
- Are intended to serve a function of the national government.

Reforms in the Kenyan water sector (2016) have provided for the transition of the Water Services Boards to Water Works Development Agencies (and devolution of water services to County Governments), abbreviated to WWDAs.

Water Works Development Agencies (WWDAs) are agencies of the national government and they are responsible for the:

- Development, maintenance and management of national public works;
- Operation of the national public water works and the provision of water services as a water service provider, until the responsibility for the operation and management of the water works is handed over to the county government, joint committee or CCA;
- Provision of technical services and capacity building for county governments and water service providers within their regions.

The **National Irrigation Agency (NIA)**¹⁶ focuses its activities in:

- Coordination of construction and rehabilitation of major irrigation and drainage infrastructure.
- Operation and maintenance of major irrigation and drainage infrastructure
- Administering land in the public schemes and providing technical advice to farmers

During the mission it has become clear that the NIA can act as an initiator of water works projects, when the main purpose of these projects is to enable new irrigation schemes.

¹⁵ <http://www.waterauthority.go.ke/index.php/about-us/who-we-are/24-home>

¹⁶ Until recently known as the National Irrigation Board (NIB)

While the DRR-team observes that the **County Government** is usually not the initiator of water works projects, the county does have policy ambitions in this area. To realize these ambitions, the county shall often work together with for the RVWSB or the NIA. The County is however responsible for part of the maintenance and operation of the water infrastructure.

Management of the environment, and environmental policy

The **National Environment Management Authority (NEMA)** is a Kenyan government agency responsible for the management of the environment, and environmental policy. They play an important role when it comes to safeguarding the impact of operations in water management on the quality of the environment.

In addition to its role as an environmental regulatory body, NEMA additionally implements its own projects. NEMA has vast experience in the field of climate change adaptation and mitigation, co-implementing projects ranging from US\$ 10 million to US\$ 255 million with local and international organizations. Some of its past and current activities include building resilience to climate change and adaptive capacity of vulnerable communities, environmental management, coastal development, technical assistance and natural resource management.

Annex 4: Development partners

Within the scope of this project it has not been possible to map all the funders who could possibly be interested in (parts of) the potential projects. For the purpose of this project we distinguish between:

- Grant providers (funders): they are able to provide grants for either funding project development or for viability gaps of projects. These can be bilateral development partners, Kenyan State funds (e.g. the WSTF) and grant facilities within multilaterals.
- Financiers and equity investors: Financiers finance projects that have a – for them – reasonable return. This return depends on the investor’s motives (e.g. a DFIs use concessional interest rates, commercial banks will require market returns). DFIs and impact investors can also invest equity in a project or company.

We have mainly explored the options for public financing and funding and not the options for private financing, because at this point in time no private project developers for these specific projects have been identified. With most of the organisations in the table below, we have been able to conduct interviews.

Table: A selection of funders/ financiers

Organisation	Description
The African Development Bank (AfDB)*	The AfDB is a multilateral development finance institution. The overarching objective of the African Development Bank (AfDB) Group is to spur sustainable economic development and social progress in its regional member countries (RMCs), thus contributing to poverty reduction. The Bank Group achieves this objective by: <ul style="list-style-type: none"> • Mobilizing and allocating resources for investment in RMCs; and • Providing policy advice and technical assistance to support development efforts.
Danish International Development Agency (DANIDA)*	DANIDA is the brand used by the Ministry of Foreign Affairs of Denmark when it provides humanitarian aid and development assistance to other countries, with focus on developing countries. It works in select countries referred to as programme countries and provides support to NGOs as well as governmental agencies.
Japan International Cooperation Agency (JICA)*	JICA is a governmental agency that coordinates Official Development Assistance for the government of Japan. It is chartered with assisting economic and social growth in developing countries, and the promotion of international cooperation. Instruments of JICA are Technical Assistance, Grants and Loans.
Swedish International Development Cooperation Agency (Sida)*	Sida is a government agency of the Swedish Ministry for Foreign Affairs. Sida is responsible for organization of the bulk of Sweden's official development assistance to developing countries.
The Water Sector Trust Fund (WSTF)	WSTF is a Kenyan State Corporation under the Ministry of Water and Sanitation and established under the Water Act, 2016, with the mandate to provide conditional and unconditional grants to the Counties and to assist in financing the development of and

	management of water services in the marginalised and underserved areas. WSTF is a government institution and therefore not seen as a donor/development partner in the government institutional setup, but listed here only to get a complete overview of financing options.
The World Bank (WB)	The World Bank Group is one of the world's largest sources of funding and knowledge for developing countries. Its five institutions share a commitment to reducing poverty, increasing shared prosperity, and promoting sustainable development. The World Bank's work in Kenya supports the government's Vision 2030 development strategy, which aims to accelerate sustainable growth, reduce inequality, and manage resource scarcity.

* Has been interviewed during the DRR-Team mission.

The Water Sector Trust Fund currently has three programmes financed by 1) The governments of Finland and Sweden, 2) The International Fund for Agricultural Development (IFAD) and 3) Denmark (DANIDA). The Kenyan government covers operational costs of the Water Fund while other funds support the development of projects depending on the funding agreements of specific partners. Within the framework of devolution, the development partners are now accessing the beneficiaries through the counties. The EU is supporting the WSTF in County Baringo.

The governments of Finland and Sweden support WRUA activities in the six counties of Kwale, Laikipia, Migori, Nandi, Narok and Tharaka Nithi. The Rural Utilities Programme is an improved version of the former Community Project Cycle whose focus is to work with legal entities in the counties to enhance their capacity to apply for, design, manage, implement and maintain their own water and sanitation facilities in a sustainable manner.

DANIDA supports WRUA activities in the six counties of Garissa, Isiolo, Lamu, Marsabit, Tana River and Wajir in a programme known as Medium Term Arid and Semi-arid lands Project (MTAP). So far DANIDA has supported the programme in two phases, MTAP I & II.

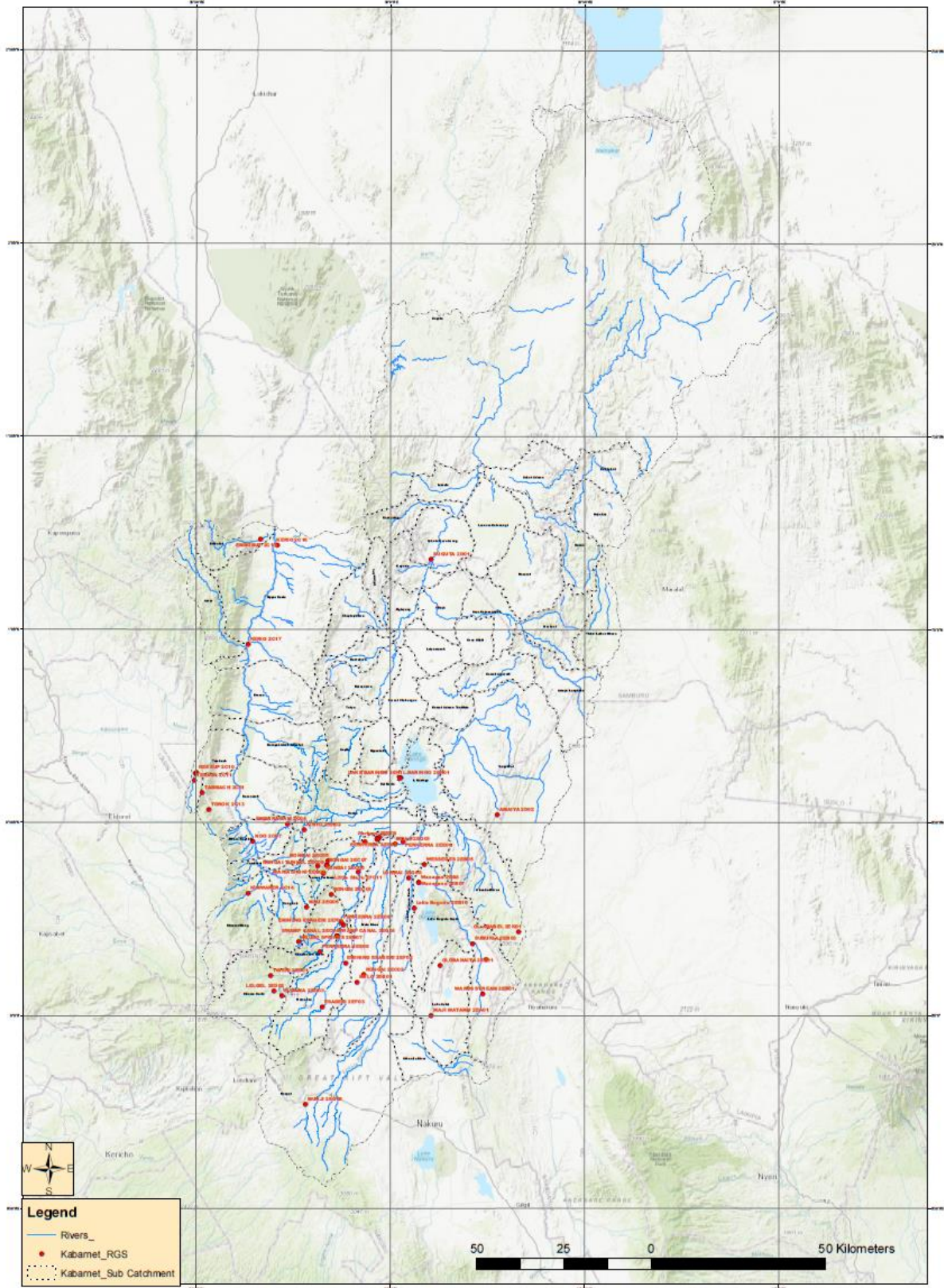
JICA currently invests in 3 projects/ programs in the water sector in Kenya. In Makueni County JICA invests in the Thwake Multipurpose Dam with a storage capacity of 594 MCM on the Athi River. JICA runs a water supply and sanitation program in 40 towns in Kenya with ticket sizes of USD 10-20 m each. And JICA invests in a sewerage project in Nairobi.

The World Bank funded already the upgrading of 260 WRUA's of which 14 are in Baringo and the WSTF also focusses on capacity building of WRUA's.

Annex 5: Monitoring network of WRA Rift Valley

As can be seen in the figure below, the monitoring network of Sub regional office WRA at Kabarnet is mostly concentrated south of Lake Baringo.

KABARNET RGS MONITORING NETWORK



WRA has 29 water level gauging stations, of which 17 have been destroyed by floods. 2 telemetric gauging stations are operational, one of them in Perkerra River. WRA also operates 8 rainfall stations, of which 2 are not operational, and one evaporation pan. In the overview of the monitoring network in the annex it can be seen that it is mainly located in the southern part of the area at command. Groundwater monitoring is completely missing.

Water level gauges are observed twice a day by an honorarium gauge reader. Data is monthly transferred to WRA in hardcopy. In addition, WRA staff used to conduct discharge measurement by current meter once a month, but this has stopped because the current meters are not operational anymore. Rating curves or therefore outdated (or absent).