



Ministry of Water, Sanitation and Irrigation



Agriculture Sectoral Integration Plan

KENYA WATER SECURITY AND CLIMATE RESILIENCE PROJECT

Implementation Support Consultancy (ISC) to Support
Strengthening of Water Resources Management and
Planning

August 2020



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Agriculture Sectoral Integration Plan

KENYA WATER SECURITY AND CLIMATE RESILIENCE PROJECT

Implementation Support Consultancy (ISC) to Support Strengthening of Water Resources Management and Planning

Prepared for:

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Executive Summary

E1. Background, context and objectives

The purpose of this Sectoral Integration Plan with regard to the **agricultural sector** in Kenya, is to ensure that the key findings and outputs from the six Basin Plans are properly integrated at sectoral level - in each of the six basins as well as in the country as a whole. The six major river basins of Kenya are Athi, Tana, Lake Victoria South (LVS), Lake Victoria North (LVN), Rift Valley (RV) and Ewaso Ng'iro North (ENN).

E2. Integrated Water Resources Management and Development Plan for the six basins

In order to comprehensively and systematically address the range of water resources related issues and challenges in the six basins and to unlock the value of water as it relates to socio-economic development, ten key strategic areas were formulated as shown below.

Table E1: Basin Plan - Key Strategic Areas and Objectives

Key Strategic Area		Strategic Objective
1	Catchment Management	To ensure integrated and sustainable water, land and natural resources management practices
2	Water Resources Protection	To protect and restore the quality and quantity of water resources of the basin using structural and non-structural measures
3	Groundwater Management	The integrated and rational management and development of groundwater resources
4	Water Quality Management	Efficient and effective management of water quality to ensure that water user requirements are protected in order to promote sustainable socio-economic development in the basin
5	Climate Change Adaptation	To implement climate change mitigation measures in the water resources sector and to ensure water resource development and management are adapted and resilient to the effects of climate change.
6	Flood and Drought Management	To establish and guide a structured programme of actions aimed at ensuring the prevention of, mitigation of, timeous response to, and recovery from, the harmful impacts of floods and droughts across the Basin or specific catchment area.
7	Hydromet Monitoring	An operational and well-maintained hydromet network supported by effective and functional data management and information management systems
8	Water Resources Development	To develop water resources as a key driver for sustainable economic and social development
9	Strengthened Institutional frameworks	To achieve an appropriate balance between operational functionality and the need for effective oversight and governance.
10	Enabling environment to support effective institutions	Improved regulatory responses to strengthen catchment based water resources management

The national estimated budget which is required for implementation of integrated water resources management and development activities up to 2040 in all basins and across all KSAs equals about **29 billion USD**. The **agricultural sector** is linked to about **11 billion USD** of the National Budget as shown in Table E2, which summarises the proposed implementation budgets from all six Basin Plans up to a planning horizon of 2040, for activities that are relevant to the agricultural sector. The KSA that demands the largest expenditure from an agricultural sector perspective is KSA8: Water Resources Development.

E3. Roadmap for sector integration

In order to ensure the successful implementation of the strategies and actions from the six Basin Plans and National Plan as they relate to agriculture, a Roadmap for Implementation is proposed. This Roadmap proposes that before any actions identified under the KSA implementation plans are implemented, there are preceding critical activities. These are as follows (Figure E1):

1. Immediate KSA activities
 - a. Strengthening of institutional capacity and coordination;
 - b. Imminent infrastructure feasibility and impact assessments;
 - c. Expand on the basin plan knowledge base
2. Financial Resource Mobilisation for the KSA activities
3. Implementation of the short to long-term KSA activities
4. Monitoring and Evaluation of the KSA activities

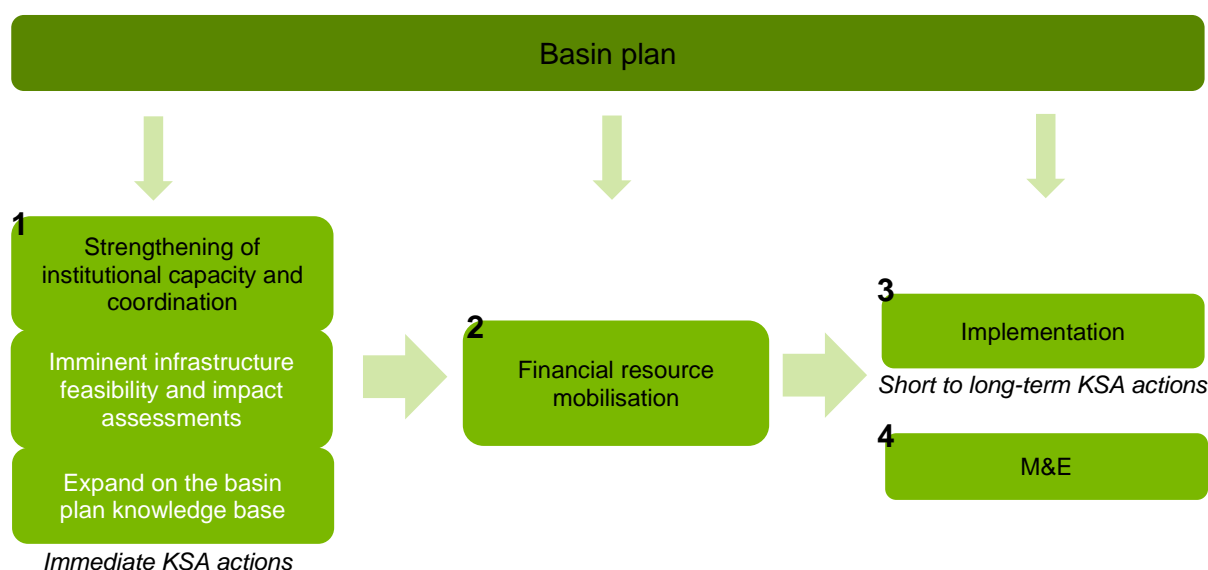


Figure E1: Roadmap for implementation of the Basin Plans

As the strengthening of institutional capacity and coordination is considered an immediate KSA activity, the engagement with role players from various institutions is a priority.

This Sectoral Integration Plan highlights KSAs and themes which are relevant to the **agricultural sector** and indicates what immediate actions are required.

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Table E2 Summarised IWRM budget for implementation activities linked to agriculture under specific Key Strategic Areas

Key Strategic Areas and Themes		Budget (USD Million)				
		2020-2022	2022-2025	2025-2030	2030-2040	Total
KSA 1	Catchment management	45	221	197	144	606
	Promote improved and sustainable catchment management					
	Sustainable water and land use and management practices					
	Natural resources management for protection & sustainable use					
	Rehabilitation of degraded environments					
KSA 2	Water resources protection	2	5	11	11	28
	Classification of water resources					
	Reserve determination					
	Determine Resource Quality Objectives					
	Conserve and protect ecological infrastructure					
KSA 3	Groundwater management and development	59	188	145	200	593
	Groundwater resource assessment, allocation and regulation					
	Groundwater development					
	Groundwater asset management					
	Conservation and protection of groundwater					
KSA 4	Water Quality Management	6	18	23	34	80
	Efficient and effective management of point and nonpoint sources of water pollution					
KSA 5	Climate change adaptation and preparedness	21	70	72	46	210
	Understand impacts of climate change on water resources at appropriate spatial scales					
	Climate change mitigation					
	Climate change adaptation					

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KSA 6	Flood and drought management	42	212	22	39	314
	Flood management					
	Drought management					
KSA 8	Water Resources Development	296	1 659	3 780	3 677	9 413
	Water storage and conveyance					
	Groundwater development					
KSA 10	Strengthen enabling environment to support institutions	13	17	1	2	34
	Develop institutional capacities to support improved IWRM&D					
Total		484	2 389	4 251	4 155	11 278

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Abbreviations and Acronyms

AGR	Artificial groundwater recharge
AMP	Aquifer Management Plan
ASAL	Arid or Semi-Arid Land
ASM	Artisanal and small-scale mining
AWWDA	Athi Water Works Development Agency
BOD	Biochemical Oxygen Demand
BWRC	Basin Water Resource Committee
CA	Conservation agriculture
CAAC	Catchment Area Advisory Committee
CDA	Coast Development Authority
CFA	Community Forest Association
CGs	County Governments
CIDP	County Integrated Development Plan
CMS	Catchment Management Strategy
CMU	Catchment Management Unit
COD	Chemical Oxygen Demand
CoK	Constitution of Kenya
CWSB	Coastal Water Services Board
CWWDA	Coastal Water Works Development Agency
DEC	District Environmental Committee
DEF	Drought Emergency Fund
DEM	Digital Elevation Model
DO	Dissolved Oxygen
DSS	Decision Support System
EDCs	Endocrine disrupting chemicals
EDE-CPF	Ending Drought Emergencies Common Programme Framework
EEZ	Exclusive Economic Zone
EIA	Environmental Impact Assessment
EMCA	Environmental Management and Coordination Act
ENSO	El Niño–Southern Oscillation
ERS	Economic Recovery Strategy
FEWS NET	Famine Early Warning Systems Network
FMCF	Forest Management and Conservation Fund
FRF	Flood Response Forum
GCA	Groundwater Conservation Area
GCM	Global Climate Model
GDEs	Groundwater dependent ecosystems
GDP	Gross Domestic Product
GIS	Geographical Information Systems
GMP	Groundwater Management Plan
GW	Groundwater

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ICZM	Integrated Coastal Zone Management
IDA	International Development Association
IDP	Integrated Development Plans
IPCC	Intergovernmental Panel on Climate Change
IUCN	International Union for Conservation of Nature
IWRM	Integrated Water Resource Management
JICA	Japan International Cooperation Agency
KCCAP	Kenya Climate Change Adaptation Programme
KCDP	Kenya Coastal Development Programme
KCSAS	Kenya Climate Smart Agriculture Strategy
KEWI	Kenya Water Institute
KFS	Kenya Forest Service
KMD	Kenya Meteorological Department
KNCP	Kenya National Cleaner Production Centre
KSA	Key Strategic Area
KWSCR	Kenya Water Security and Climate Resilience Project
KWT	Kenya Wildlife Trust
KWTA	Kenya Water Towers Agency
LIMS	Laboratory Information Management System
LPG	Liquefied Petroleum Gas
LSRWSS	Large Scale Rural Water Supply Scheme
MAE	Mean Annual Evaporation
MAP	Mean Annual Precipitation
MAR	Mean Annual Runoff
MCM	Million Cubic Metres
MoLPP	Ministry of Lands and Physical Planning
MoLRRWD	Ministry of Land Reclamation, Regional and Water Development
MTPs	Medium Term Plans
MWSI	Ministry of Water, Sanitation and Irrigation
NAP	National Adaptation Plan
NAS	Nairobi Aquifer Suite
NAWARD	National Water Resources Database
NCCAP	National Climate Change Adaptation Plan
NEMA	National Environment Management Authority
NEP	National Environment Policy
NET	National Environmental Tribunal
NGO	Non-Governmental Organisation
NIB	National Irrigation Board
NLC	National Land Commission
NMK	National Museums of Kenya
NPEP	National Petroleum and Energy Policy
NPS	Nonpoint source
NRW	Non-Revenue Water
NWHSA	National Water Harvesting and Storage Authority

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NWMP	National Water Master Plan
NWQMS	National Water Quality Management Strategy
PDB	Permit Database
POPs	Persistent organic pollutants
PPP	Public Private Partnership
PV	Photovoltaic
RCP	Representative Concentration Pathways
REA	Rural Electrification Agency
RO	Regional Office
RQOs	Resource Quality Objectives
RUSLE	Revised Universal Soil Loss Equation
SANBI	South African National Biodiversity Institute
SCMP	Sub-Catchment Management Plan
SDGs	Sustainable Development Goals
SEA	Strategic Environmental Assessment
SME	Small and Medium Enterprise
SOPs	Standard operating procedures
SRO	Sub-Regional Office
SSWRS	Small Scale Rural Water Supply Scheme
TA	Transboundary aquifer
TARDA	Tana and Athi River Development Authority
TNC	The Nature Conservancy
USAID	United States Agency for International Development
UWSS	Urban Water Supply System
W/S	Water Supply
WAP	Water Allocation Plan
WASREB	Water Services Regulatory Board
WASSIP	Water Supply and Sanitation Improvement Project
WFP	World Food Programme
Wp	Watt peak
WRA	Water Resources Authority
WRM	Water resources management (also integrated WRM)
WRMA	Water Resources Management Authority
WRUA	Water Resource User Association
WSB	Water Services Board
WSP	Water Service Provider
WSSP	Water Sector Strategic Plan
WSTF	Water Sector Trust Fund
WT	Water Tribunal
WWDA	Water Works Development Agency
WWF	World Wildlife Fund

1 Introduction

1.1 Background and context

Kenya is a water-scarce country and its water resources are currently threatened by various issues. Addressing these issues demand capacity for comprehensive water resources management and planning, coupled with extensive investment in climate resilient water infrastructure. To address these challenges, and to give effect to the constitutional requirement for devolution of functions from National to County level, the Government of Kenya has embarked on a wide-ranging water sector reform programme. As part of this programme, the Government of Kenya received financing from the World Bank toward the cost of implementing the Kenya Water Security and Climate Resilience Project (KWSCR-1), to be implemented through the Ministry of Water, Sanitation and Irrigation (MoWSI).

This Sectoral Integration Plan constitutes one of the deliverables under Sub-component 2.2 of the KWSCR-1. This sub-component aims to strengthen the capacity of the Water Resources Authority (WRA) as it relates to water resources management and planning through the development of tools, skills and infrastructure to deliver on its mandate. The outcome will be a stronger WRA institution that has strengthened capacity to carry out its core functions with regard to integrated basin management and planning in a manner that is based on extensive knowledge-driven analysis and that meets the expectations of key stakeholders.

1.2 Objectives of the Sectoral Integration Plan

Integrated Water Resources Management (IWRM) considers the environmental, social and economic aspects of a river basin, and ensures that these aspects are integrated into an overall management strategy. It aims to achieve a sustainable balance between the utilisation, development and protection of water resources.

The purpose of this Sectoral Integration Plan with regard to the **agricultural sector** in Kenya, is to ensure that the key findings and outputs from the six Basin Plans which were developed under KWSCR-1 are properly integrated at sectoral level - in each of the six basins as well as in the country as a whole.

Figure 1-1 displays the six major river basins of Kenya viz Athi, Tana, Lake Victoria South (LVS), Lake Victoria North (LVN), Rift Valley (RV) and Ewaso Ng'iro North (ENN).

1.3 Structure of the Sectoral Integration Plan

This report is structured as follows:

Section 2 provides an overview of the agricultural sector in Kenya and summarises key issues, challenges and trends in relation to this sector.

Section 3 presents an institutional overview, from a sectoral and IWRM perspective, in relation to agriculture in Kenya.

Section 4 presents strategies and themes which relate to the agricultural sector in Kenya, under ten key strategic areas.

Section 5 summarises key outputs, presents the broader context and provides high-level budgets and timelines as a proposed way forward for the integration of the Basin Plans with the agricultural sector.

Section 6 provides a conclusion.

Section 7 lists references.

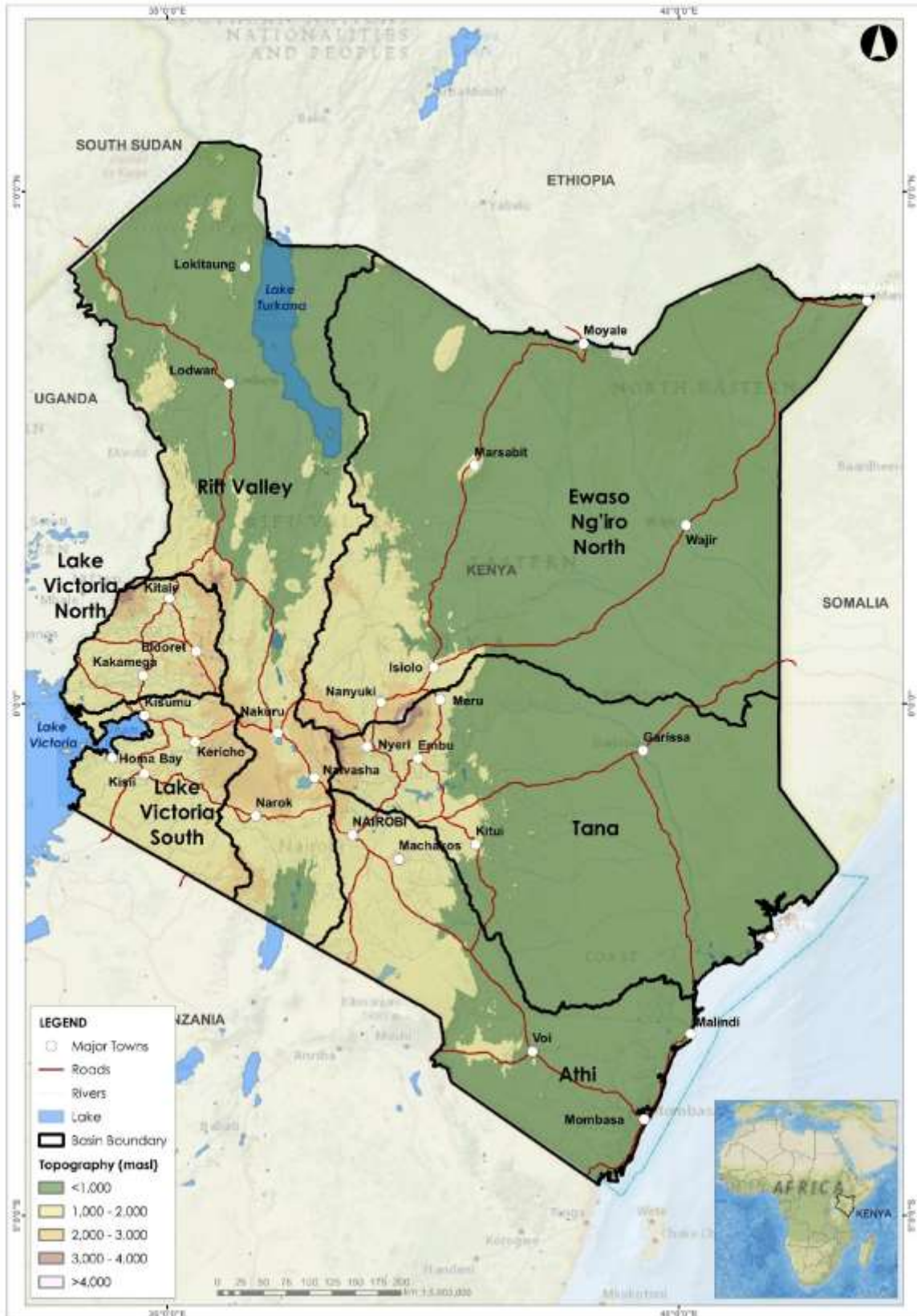


Figure 1-1: Overview map

2 Sectoral overview

2.1 Introduction

The Kenya Vision 2030 identified agriculture as one of the key sectors to deliver the annual economic growth rate of 10% envisaged under the economic pillar. However, there are many issues and challenges related to agriculture in Kenya linked to crop production, climate, water security, markets, finance, trade, institutional setups, land management, soil management and environmental sustainability. To achieve agricultural sector growth, transforming smallholder agriculture from subsistence to an innovative, commercially oriented and modern agricultural sector is critical. This needs to be supported by appropriate institutional reform in the agricultural sector. Agriculture is the most important sector of the Kenyan economy and agricultural sector growth and development is therefore crucial to Kenya's overall economic and social development. Agriculture ensures that the country is food secure, generates income and provides employment - both directly and indirectly - to the population.

Agriculture contributes 26% of Kenya's Gross Domestic Product (GDP) and provides 18% of direct formal employment and more than 70% of informal employment in the rural areas. Furthermore, it contributes another 27% to GDP through the manufacturing, distribution and service sectors (Ministry of Agriculture Livestock and Fisheries, 2016). Agriculture also contributes significantly to livelihoods and supports numerous related sectors and industries. Agricultural produce account for 65% of Kenya's total exports, which is not surprising taking into consideration that more than one-third of Kenya's agricultural products are exported. Tea, fresh cut flowers, fruits and vegetables are key foreign exchange earners, while sisal, cotton, fruits and vegetables are important cash crops. Kenya is a net importer of major foods, with main food commodities being imported being rice, edible oil, wheat and sugar. This is in spite of estimates that the agricultural sector in Kenya has the potential for self-sufficiency.

Figure 2-1 shows that horticulture and food crops jointly, contribute 65% to agricultural GDP in Kenya, while industrial crops and horticulture jointly account for more than 90% of agricultural exports (Water Resources Management Authority, 2013). Livestock and fisheries contribute 14% to agricultural GDP and only 6% to agricultural exports.

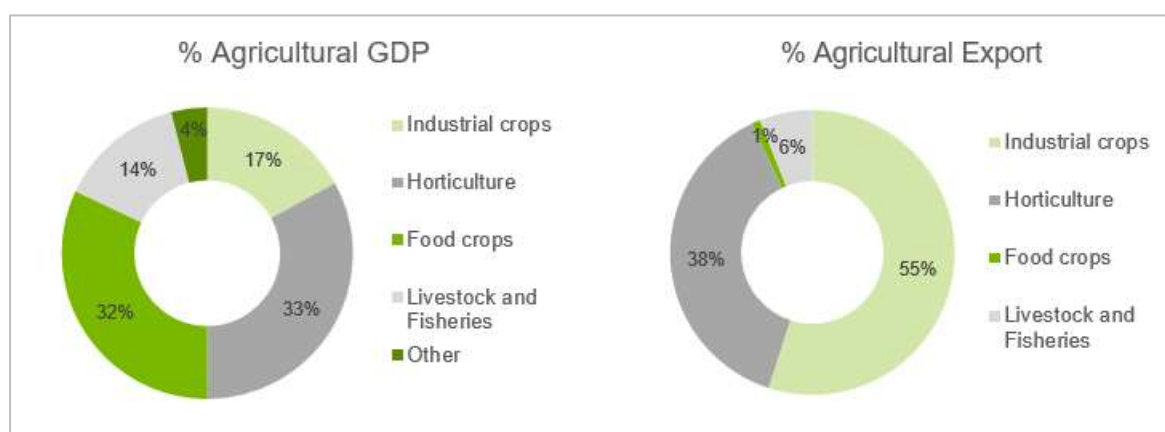


Figure 2-1: Contribution to agricultural GDP and Export of main agricultural sub-sectors

Agriculture in Kenya comprises of smallholders and a relatively small number of large-scale farmers and ranchers. Smallholders include subsistence farmers and pastoralists, and commercial farmers (small-scale) and ranchers - mainly confined to the high and medium rainfall areas. Small-scale farmers contribute almost 75% of total agricultural output (Ministry of Agriculture Livestock and Fisheries, 2016). Smallholders in Kenya have traditionally made important contributions to food security by producing most of their own food, which also provides an income generation opportunity for many smallholders who sell food at local markets. Smallholder farmers are mostly resource poor and as a result often produce below optimum. Conditions for smallholding farming is such that young people avoid agricultural production employment and instead migrate to urban areas. The average age of smallholders is about 65 years.

According to the Agricultural Sector Development Support Programme (ASDSP) Household Baseline Survey Report (Ministry of Agriculture Livestock and Fisheries, 2014), about 48% of households earn income from crop-related on-farm activities while about 38% of households earn income from livestock activities. The survey also found that more than 60% of households did not have enough food to meet their needs, while 66% were nutritionally insecure - attributed to poor diversification of food sources among households.

FAO (1993) classifies arid and semi-arid lands by determining the length of period in a year suitable for crops to grow, which is dependent on the supply of moisture from rainfall and in soil storage. This is referred to as the Length of Growing Period (LGP). ASALs are classified as follows in terms of LGP's: 1 day: hyper-arid; less than 75 days: arid; 75 to less than 120 days: semi-arid; and 120 to less than 180 days: moist semi-arid. 83% of Kenya constitutes Arid or Semi-Arid Land (ASAL), where resident communities are largely nomadic pastoralists or agro-pastoralists or ranchers. The remaining 17% receives adequate rainfall for it to be considered high and medium agricultural potential areas, mainly located in the upper catchments as shown below. This 17% of potentially arable land is constituted of cropland (31%), grazing land (30%) and forests (22%) (GoK, 2010). Other land uses include urban and industrial centres, infrastructure, markets, homesteads and game reserves.

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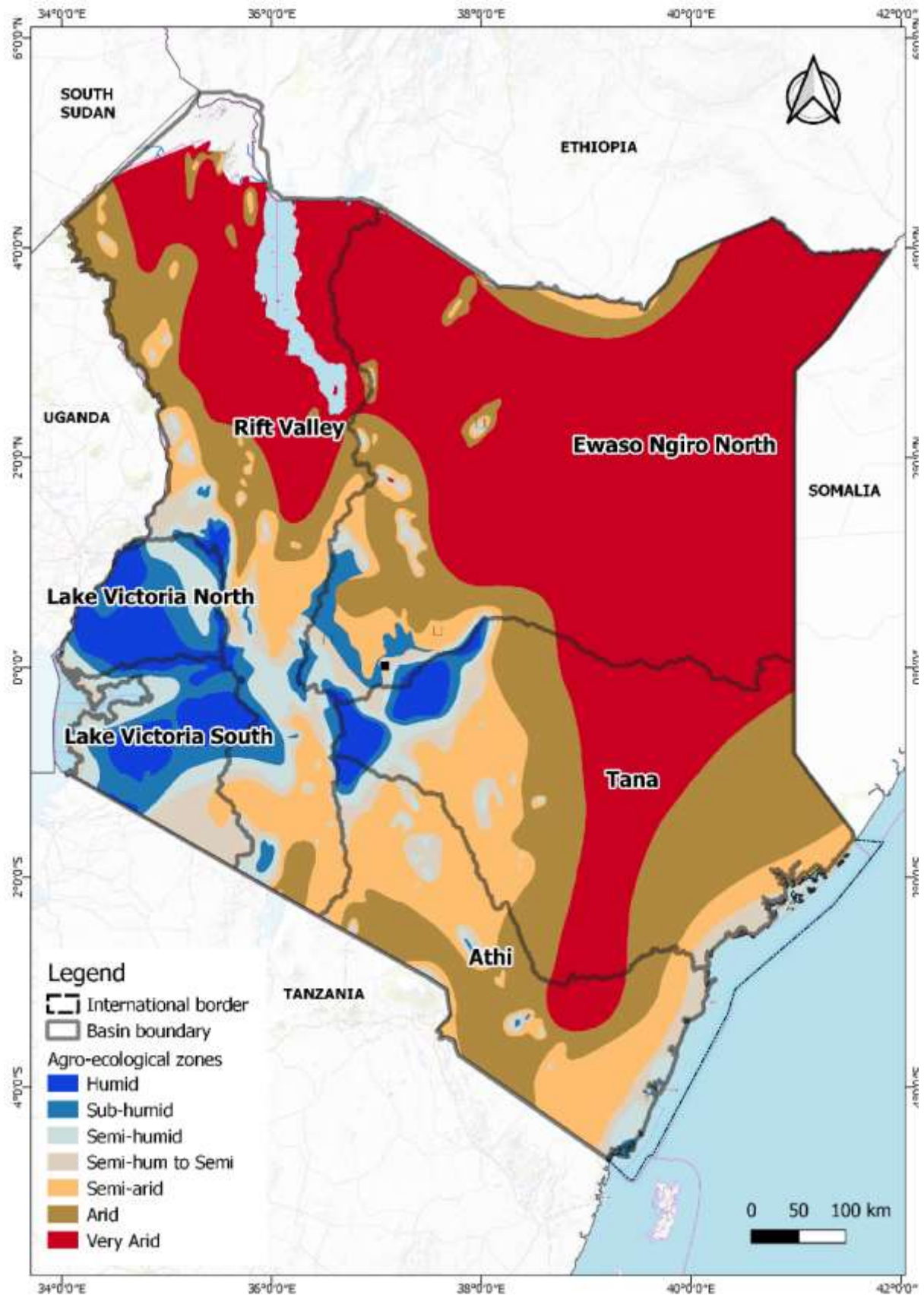


Figure 2-2: Agro-ecological zones in Kenya (FAO, 1996)

The remainder of this section provides a high-level overview of the **agricultural** sector in Kenya and how it relates to integrated water resources management. Furthermore, a brief overview of existing issues, challenges and trends is presented.

2.2 Main sub-sectors

The agricultural sector in Kenya can generally be categorised into crop production, livestock and fisheries. Crop production includes staple food and high-value crops as well as floriculture, while livestock and fisheries refer to meats and fish for immediate consumption e.g. poultry, goats, sheep, cattle and fish.

2.2.1 Crops

Crops in Kenya can be classified as one of four types:

- **Industrial crops** refer to primarily cash crops that are not for immediate consumption and often include primary processing e.g. tea, coffee, sugarcane, cotton, tobacco, sisal and barley.
- **Food crops** are typically staple crops for immediate consumption e.g. maize, wheat, rice, sorghum, cowpea and legumes.
- **Horticulture** refers to a mix of consumable and non-consumable crops e.g. vegetables, flowers, fruit, nuts and spices. Kenya is the world's 3rd largest exporter of cut flowers.
- **Oil crops** are plants that are grown primarily for the oil that they produce e.g. soybeans and canola as well as a number of other plants with other uses, such as avocados, grapes, and almonds. The major oil crops are typically used to produce edible oils.

Food crops constitute the majority of cultivated crops in Kenya, followed by horticultural, industrial and oil crops (see Figure 2-3).

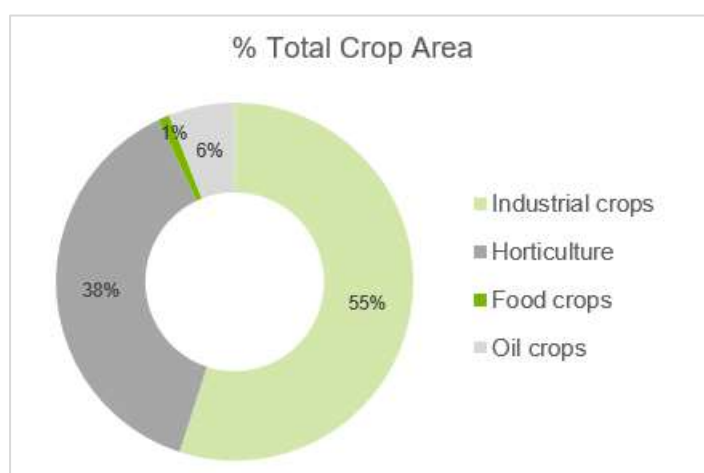


Figure 2-3: Cropping area by agricultural sub-sector (Water Resources Management Authority, 2013)

The Athi and Tana basins are where most of the food and horticulture crops are grown in Kenya, followed by Lake Victoria North and South as shown in Figure 2-4.

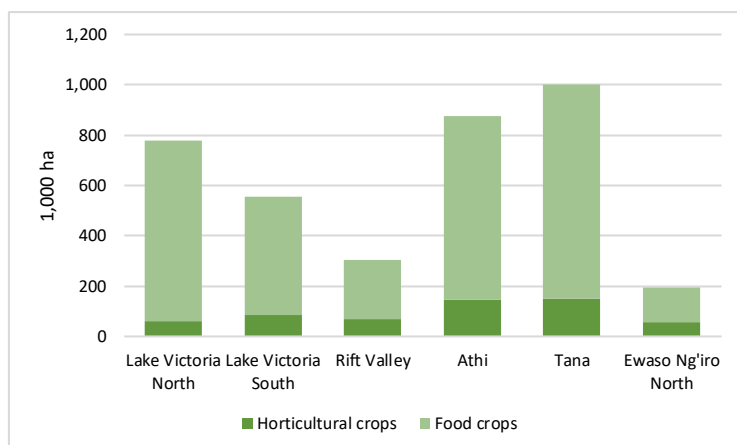


Figure 2-4: Food and horticultural cropping areas per basin (Water Resources Management Authority, 2013)

More than 70% of industrial crops grown in Kenya include tea and coffee. Figure 2-5 displays the main growing areas for tea and coffee.



Figure 2-5: Tea and coffee growing areas in Kenya (Managua, 2011; KALRO, 2017)

Most of the cultivated land in Kenya is used for rainfed agriculture and dryland farming, with only about 162,000 ha under irrigation. Rainfed agriculture refers to farming practices that rely on rainfall for crop water requirements, while dryland agriculture refers to farming in semi-arid areas using drought-resistant crops and moisture conservation methods. The main crop varieties which are grown in this way include maize, sorghum, cowpeas, green grams and pigeon peas.

Table 2-1 presents the main crops cultivated in Kenya, per crop type, as well as the area under each crop type. The three main annual crops grown across the country are maize and beans. A high proportion of households also grow perennial crops such as banana, coffee, tea and sugarcane

Table 2-1: Main crop types and areas (ha) (Water Resources Management Authority, 2013)

Industrial crops	Total:	481,569
Tea	187,855	Seed 32,200
Coffee	160,000	Sisal 29,255
Sugar	64,091	Pyrethrum 8,168
Food crops	Total:	4,331,907

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Maize	2,131,887	Millet	111,271
Beans	1,036,738	Sweet Potato	61,902
Sorghum	254,125	Cassava	60,473
Cowpea	197,980	Rice	22,966
Green Gram	159,910	Barley	18,832
Pigeon Peas	138,708	Cocoyam	4,549
Wheat	131,509	Yam	1,057
Horticulture		Total:	559,224
Vegetables	258,348	Flowers	3,213
Fruits	177,715	Asian Veg	1,840
Nuts	99,576	Herbs and Spices	1,142
African Leafy Veg	17,390		
Oil crops		Total:	100,812
Coconut	50,663	Sun	5,157
Cashew	30,455	Soya	1,734
Ground	12,803		

Table 2-2 shows the production levels of various crops and their values in 2014.

Table 2-2: Crop production in Kenya (Ministry of Agriculture Livestock and Fisheries, 2014)

Crop	Price (KES/t)	Production (t)	Value (KES billion)
Maize, dry	33,556	3,766,159	126.4
Tea	303,736	369,400	112.2
Irish potato	17,280	2,915,067	50.4
Beans	61,589	613,902	37.8
Roses	358,021	83,990	30.1
Sweet potato	31,112	859,549	26.7
Banana	16,812	58,175	23.4
Wheat	43,256	441,754	19.1
Coffee	387,755	49,000	19
Cassava	20,667	893,122	18.5
Mango	4,840	2,781,706	13.5
Tomato	32,343	397,008	12.8
Cabbage	11,580	700,000	8.1
Cowpea	69,111	113,961	7.9
Green gram	84,489	91,824	7.8
Sorghum	40,956	166,627	6.8
Millet	63,556	74,917	4.8
Kale	11,929	367,256	4.4
Sisal	91,509	27,866	2.6
Macadamia	53,969	35,582	1.9
Carrot	10,633	94,971	1
Cotton	35,338	11,772	0.4

2.2.2 Livestock

Livestock contributes four per cent of GDP in Kenya. Kenya's main export markets for meat products include United Arab Emirates, Tanzania and Uganda, while the main markets for hides and skins are Germany, United Kingdom, Netherlands and Italy. The total value of livestock products produced in Kenya in 2012 was KES 130 million, of which livestock slaughtered contributed about KES 76 million and mil production and process products about KES 40 million (MoALF, 2014).

Livestock plays an important economic and socio-cultural role among many Kenyan communities. The sub-sector employs 50% of the agricultural labour force and over 10 million Kenyans living in the Arid and Semi-Arid Lands (ASALs) derive their livelihood largely from livestock. About 60% of Kenya's livestock herd is found in the ASALs which constitute over 80% of the country. These support livelihoods through provision of food and wealth for Kenyans and significantly contribute to the national economy. The livestock sub-sector has the potential to provide adequate supply of all animal products to meet domestic needs and surplus for export.

Livestock farming in Kenya entails the rearing of cattle, sheep, goats, rabbit, camel, donkey, horses, and poultry and comprises mainly dairy and meat production, eggs, hides, skins and wool. The major constraint in livestock production is the high cost of inputs. With regard to cattle and goats, two types of livestock farming may be distinguished, namely traditional or pastoral and commercial. Subsistence livestock farming or nomadic pastoralism refers to extensive grazing on natural pasture involving constant or seasonal migration of nomads and their livestock and is confined to the arid and semi-arid districts of Kenya. The Maasai practice nomadism in the southern part of Kenya and the northern part of Tanzania. About 65 per cent of the red meat in Kenya is produced in the arid and semi-arid lands under the pastoral production system. According to the 2009 Kenya census (Kenya National Bureau of Statistics, 2009), Kenya has about 17.3 million cattle (14 million indigenous and 3.3 million exotic), 27 million goats, 17 million sheep, 2.9 million camels and 335,000 pigs. White meat, which includes poultry and pig are mainly produced by private commercial companies. The contribution of game meat is negligible, accounting for less than one per cent of the meat consumed. **Error! Reference source not found.** displays livestock density across Kenya.

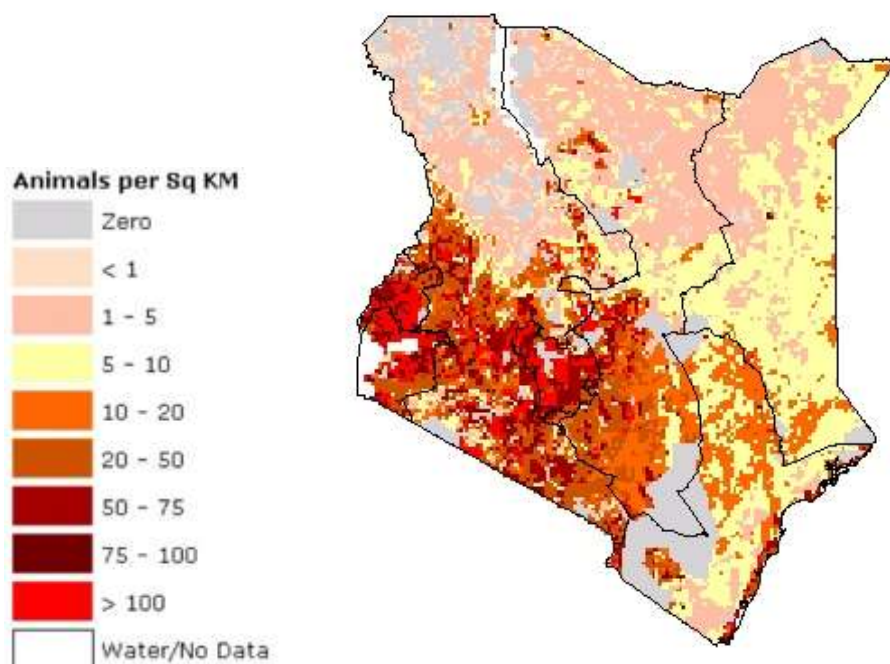


Figure 2-6: Livestock density in Kenya (FAO, 2015)

Pastoralists make up most of the small-scale livestock production in the rangelands. Landcover in rangeland areas are predominantly bushland, which is also suitable for many wildlife habitats. Wildlife-based tourism is often in competition with pastoralism and ranching as the gains from tourism often exceed the agricultural benefit.

For growth in the livestock subsector, there is recognition of the need to improve animal genetics, control of trade-sensitive diseases, value addition of livestock produce and increased access to markets that will greatly increase the industry's performance.

2.2.3 Fisheries

Kenya's fisheries sector includes inland waters, coastal waters and aquaculture. It contributes about 0.7 percent to the country's GDP. In 2017, the value of fish exports was in the order of USD 70 million. About 150 000 people in Kenya derive their livelihood from fishing and fish farming activities. The fisheries sector in Kenya produced about 134,000 tons in 2017 with Lake Victoria contributing about 70% to this number (FAO, 2019). Capture fish tonnage was about 122,000 and aquaculture 12,000 in 2017.

Freshwater aquaculture is an important contributor to Kenya's fisheries sector and its development has grown remarkably, making Kenya one of the fastest-growing major producers in Sub-Saharan Africa (Saunders, Menezes, Aguilar-Manjarrez, & Matere, 2017). Aquaculture production has risen since the late 1990s, with a focus on private, large-scale aquaculture development. However, the aquaculture sector suffers basic challenges such as inadequate knowledge and skills and inadequate supplies of quality feed and seed fish. Small-scale rural enterprises produce mainly Tilapia at a subsistence level.

The main issue in the capture fisheries sector is one of overcapacity in Lake Victoria and the symptoms of overexploitation (increasing conflict, overfishing, and falling incomes) that accompany it. This issue is being addressed in cooperation with neighboring countries through the Lake Victoria Fisheries Organization (LVFO), and through the Regional Plan of Action for the Management of Fishing Capacity in Lake Victoria that was agreed in March 2007. In the marine sector, one issue is the control of foreign flag vessels that are fishing tuna in the Exclusive Economic Zone and where illegal, unreported and unregulated (IUU) fishing is known to occur.

2.3 Irrigation

Kenya's irrigation sub-sector is classified into two broad categories based on whether it is public or privately owned. These categories can further be classified into national and institutional (for the public schemes) and either individual/firm or community-based smallholder schemes (for privately owned schemes). Public owned irrigation schemes are those on government-owned land that are developed and managed by public institutions.

It is estimated that more than 2 million people are employed in irrigation schemes and the agricultural production sectors supported by these schemes in Kenya. Public large-scale irrigation schemes in Kenya employ in the order of 900,000 people directly and indirectly, while private commercial farms employ a workforce of more than 80,000 (Ministry of Agriculture Livestock and Fisheries, 2016). As such, the irrigation sector in Kenya is very important to ensure social security and related sustainable livelihoods. Irrigation contributes to meeting the demands of national food security as well as supporting the sophisticated and emerging export markets for flowers, food, fibre and oil crops.

Although Kenya has ample land resources available, water for the cultivation of crops is limited in most basins with only 17% of Kenya's land area being suitable for rain-fed agriculture. Furthermore, surface water is unevenly spread, with 56% of Kenya's water resources concentrated in the Lake Victoria basins. While most of Kenya's arable land is cultivated for crop production, a very small proportion is irrigated. However, as the cropping and livestock production systems follow the annual rainfall patterns

which are highly variable and unreliable, it is well recognised that the country must embrace irrigation development to remain competitive in the global and regional arena.

Kenya has not fully developed her irrigation potential and there is significant opportunity to expand irrigation. However, this will require comprehensive investment in increased water storage and regulation.

Figure 2-7 displays the extent of dryland and irrigated areas in Kenya and shows that most irrigation is based in the Central, Mount Kenya and Nyanza regions of Kenya as well as along the Tana, Athi and Turkwel rivers.

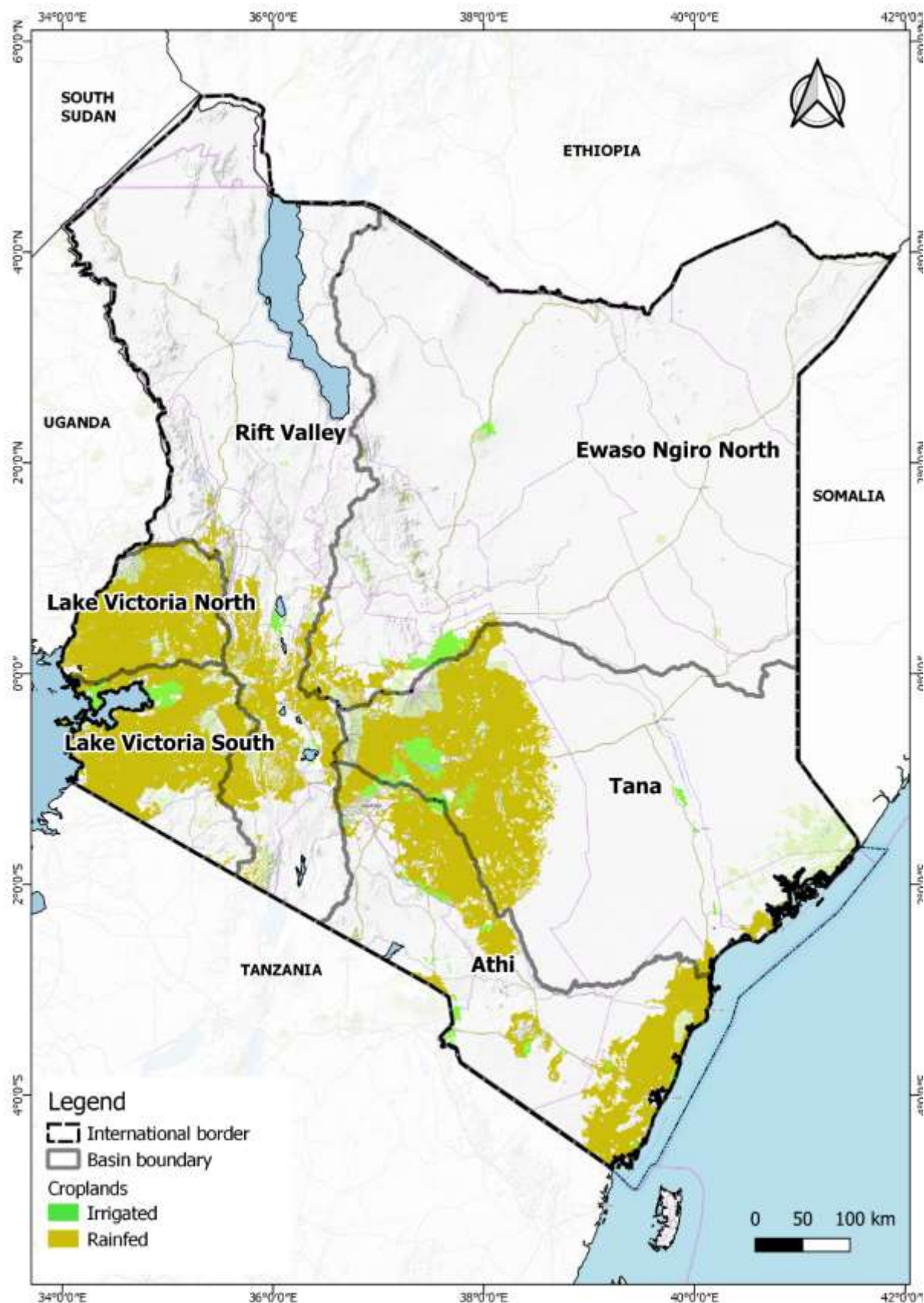


Figure 2-7: Irrigated and rainfed crops (RCMRD Kenya Crop Mask, 2015)

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Between 2010 and 2018, the area under irrigation in Kenya has increased from 142 000 ha to about 204 000 ha. Most irrigation occurs in the Athi and Tana basins. Current irrigation areas per basin are summarised in Table 2-3.

Table 2-3: Current irrigation areas per basin

Basin	Irrigation area (ha)		
	Small-scale / Private	Large-scale / Public	Total
Athi	62 544	2 000	64 544
Tana	72 457	26 473	98 930
LVS	11 108	5 508	16 616
LVN	1 449	2 180	3 629
RV	8 535	2 540	11 075
ENN	9 014	0	9 014
TOTAL	165 108	38 701	203 809

Kenya has a number of large-scale / public irrigation schemes spread across all basins, except the ENN Basin which has no large-scale irrigation. The total area under large-scale irrigation equals approximately 38 700 ha - about 20% of irrigated land in Kenya - as shown in Table 2-4¹. The Tana Basin has the largest area under large-scale irrigation. Most of the irrigation schemes are supplied via run-of-river abstractions.

Table 2-4: Existing large-scale irrigation schemes

Basin	Scheme	Irrigation area (ha)	Total (ha)
Athi	Galana Kulala Scheme	2 000	2 000
Tana	Mwea	10 117	26 473
	Bura	6 070	
	Hola	1 416	
	Kibirigwi	420	
	Lower Tana / Delta	4 200	
	Muringa	2 631	
	Mitunguu	1 619	
LVS	West Kano*	910	5 508
	Ahero	1 050	
	Lower Kuja	88	
	South West Kano	1 200	
	North West Kano	800	
	Kimira	1 460	
LVN	Dominion Farms	1 480	2 180
	Bunyala	700	
RV	Perkerra	890	2 540
	Wei Wei	570	
	Turkwel	1 080	

*West Kano Irrigation Scheme abstracts water for irrigation from Lake Victoria

¹ Information on existing large-scale irrigation schemes in the basin was obtained from the NWMP, the National Irrigation Board (NIB) and the Department of Irrigation at the Ministry of Agriculture, Livestock and Fisheries.

The community-based smallholder irrigation schemes belong to individuals/groups of farmers sharing a common irrigation system operating as irrigation water users associations (IWUAs), cooperatives or self-help groups. They produce the bulk of horticultural produce consumed in Kenya, appreciable amounts of export crops, grain staples and tubers. The smallholder irrigation area has gradually increased at an average rate of 1,200 ha per year, with new irrigation areas developed for 10 ha to 100 ha scale projects at locations near water sources. These farmers have strong intentions to increase their production with irrigation water (WRMA, 2013a)

Private commercial farms in Kenya utilise high technology and produce high-value crops for the local and export market, especially flowers and vegetables. Private irrigation areas have been extended in parallel with the development of export-oriented farming. In addition to the traditional irrigation farming for cash crops such as coffee, rice and pineapples, irrigated agriculture for horticultural crops such as cut flowers and beans for export to Europe has increased remarkably. The private sector has a strong incentive to increase their production if more irrigation water were available, since the export markets are large with huge demands, especially during the winter season in Europe.

Owing to the government policy to accelerate irrigation development, budget allocation has increased remarkably in the last decade. The implementation of feasibility studies, detailed design works and construction works for irrigation systems including rehabilitation and expansion of existing schemes, and new irrigation development have also been accelerated.

2.4 Water demands

The total current (2018) agricultural water demand in Kenya is estimated at 3,439 MCM/a. The 204,000 ha currently under irrigation requires an estimated 3,060 MCM/a, while livestock requirements total 313 MCM/a, and fisheries and wildlife 66 MCM/a as shown in Table 2-5.

The development of the six basin plans considered various developments scenarios. The result was a proposed sustainable development pathway in each basin taking into consideration, amongst other things, improved reliability of water supply for existing and proposed future irrigation, as well as the expected growth in livestock.

Table 2-5 shows the current and proposed growth in irrigation areas and corresponding irrigation water demands, as well as the expected growth in livestock, wildlife and fisheries water demands per basin by 2040. Future irrigation water requirements are expected to increase by 150% by 2040. Most of the increased water demand for irrigation will occur in the RV, Tana and Lake Victoria basins. The table also shows total agricultural water requirements as a percentage of total water available. Currently, agricultural water demands are 13% of the total water available, which is expected to increase to 30% by 2040.

Increasing the productivity of agricultural water use in Kenya is a national priority, given the country's low water endowment, growing population, and changing climate. Expanding the use of modern irrigation technology, such as drip and sprinkler systems, will be fundamental to achieving water productivity because of the potential for such systems to increase yields relative to water withdrawals. Furthermore, based on water balance calculations at sub-basin level which were undertaken for the Basin Plans, it is evident that water for future irrigation will have to be supplied mainly from surface water, supplemented from groundwater and water harvesting sources.

The future irrigation demands presented below therefore assume improved irrigation efficiencies and improved assurance of supply provided through storage in both large, often multi-purpose dams, as well as in small dams and pans.

The total livestock water requirement in Kenya is expected to increase significantly by 2040. Water harvesting measures such as small dams and/or pans have been identified as the most feasible for supplying this growth in demand, a large portion of which is expected to occur in the ASAL parts of Kenya. In high-rainfall areas there is potential to develop the dairy, poultry and pig industries, whilst in

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ASALs the availability of natural resources is linked to emerging industries although rangelands are chronically short of pasture and water (Government of Kenya, 2010a).

Table 2-5: Present day (2018) and future (2040) agricultural water requirements per basin (MCM/a)

Sector		Year	Athi	Tana	LVS	LVN	RV	ENN	Total
Irrigation	Area (ha)	2018	64 544	98 930	16 616	3 629	11 075	9 014	203 808
		2040	105 950	229 000	96 530	138 00	65 000	16 100	650 580
Irrigation		2018	1 028	1 407	256	40	204	125	3 060
		2040	1 416	3 161	850	1 100	920	224	7 671
Livestock	Water demand	2018	24	48	62	29	80	70	313
		2040	63	98	161	95	146	102	665
Wildlife/		2018	11	14	15	12	5	9	66
Fisheries		2040	14	21	21	16	10	9	91
Total agricultural water requirements		2018	1 063	1 469	333	81	289	204	3 439
		2040	1 493	3 280	1 032	1 211	1 076	335	8 427
Total water availability		2018	3 129	7 239	6 746	5 046	2 829	2 461	27 450
		2040	3 400	7 418	6 538	4 602	2 887	2 709	27 554
Agricultural requirements as % of total water available		2018	34%	20%	5%	2%	10%	8%	13%
		2040	44%	44%	16%	26%	37%	12%	31%

2.5 Key issues, challenges and trends

The water resources of Kenya are currently threatened by many issues. These include catchment degradation, pollution, inadequate monitoring networks, inadequate integrated basin planning and management, water availability and supply issues, inadequate resources, uneven spatial and temporal distribution of water resources, anthropogenic encroachment on environmentally sensitive areas, inadequate flood and drought management and various other issues. In addition to the above issues, each basin has location-specific challenges and issues which, coupled with its unique basin characteristics, are important considerations for effective water resources management and planning at basin and sub-basin level.

The agricultural sector in Kenya faces many challenges which affect its contribution to livelihoods and the improvement of socio-economic conditions. The Committee on World Food Security (CFS) defines sustainable agricultural development as follows:

Sustainable Agricultural Development (CFS, 2017)

Sustainable development is the management and conservation of the natural resource base and the orientation of technological and institutional change in such a manner as to ensure the attainment and continued satisfaction of human needs for the present and future generations. Such Sustainable development (in the agriculture, forestry and fisheries sectors) conserves land, water, plant and animal genetic resources, is environmentally non-degrading, technically appropriate, economically viable and socially acceptable.

In Kenya, as in many other African countries, the challenge is to facilitate agriculture to adopt environmentally sound, sustainable farming and management practices without reducing their incomes. To facilitate an understanding of the issues and challenges related to crops and livestock in Kenya and

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specifically on how these relate to water resources planning and management, this section groups some of the broader key issues into distinct categories.

Key issues for all six river basins in Kenya were identified through the basin planning process and categorised under the following main categories:

- Biophysical issues;
- Socio-economic issues;
- Water resources issues;
- Institutional issues.

Issues identified in conjunction with stakeholders were presented and addressed based on the framework as depicted in Figure 2-8.

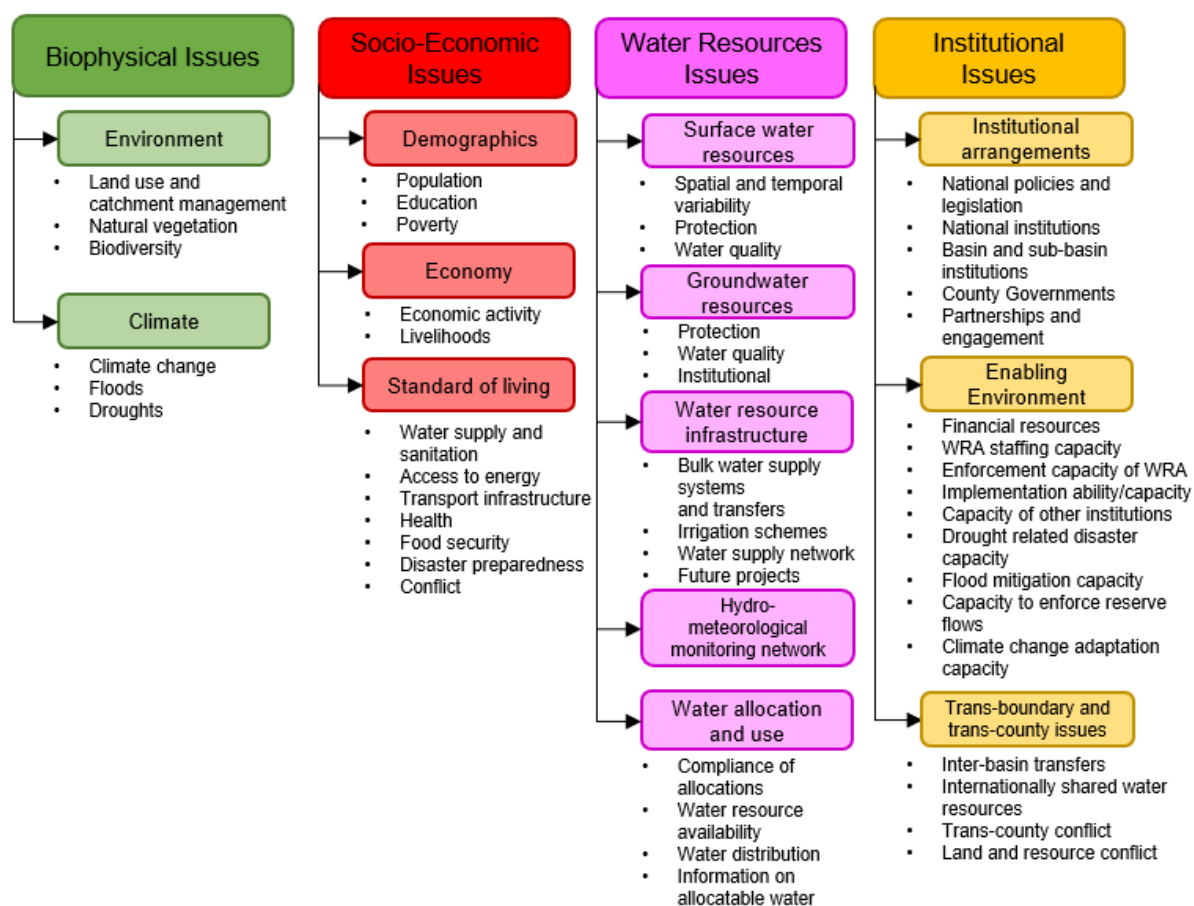


Figure 2-8: Key issues framework

Key biophysical, socio-economic, water resources and institutional issues related to the **agricultural sector in Kenya** are summarised in the following sub-sections.

2.5.1 Biophysical

2.5.1.1 Environment

The environment encompasses the land, vegetation and biodiversity of Kenya. Sustainable management of the land is necessary to maintain healthy vegetation and biodiversity. Issues arise through poor land use management and vegetation or biodiversity loss.



Agriculture is not only a source of a sustained food supply, but has environmental impacts, which result in socio-economic and human health impacts, some of which are listed below:

- Soil erosion and land degradation due to land clearing, overgrazing and poor farming practices.
- Land conversion and habitat loss due to expansion of livestock grazing and land clearing for crops.
- Wasteful or inefficient water consumption.
- Pollution due to chemical runoff, fossil fuel usage, animal methane and effluent waste linked to fertilisers, pesticides and livestock farming.
- Deforestation and loss of biodiversity.
- Eutrophication of water bodies.
- Wetland and riparian encroachment.
- Pastures in Kenya are traditionally common property areas and as a result of weakening traditional institutions and increased land pressure, many of these have become open-access areas. Due to a lack of pasture management in these areas, potential productivity gains and ecosystem services are often lost.

2.5.1.2 Climate

Climate issues in Kenya include the various impacts of climate change as well as inadequate preparedness for floods and droughts. Climate change appears to be taking effect in Kenya. Expected impacts include increased temperature, increased intensity and frequency of extreme climate events as well as unpredictable weather patterns.

Climate change impacts on agriculture

- Changing rainfall seasonality will have a particular impact on farm crop selection and planting regimes.
- With more rain falling as heavy storm events it will be less effective, and there will be increased erosion, increased streamflow (Omwoyo, Muthama, Opere, & Onwonga, 2017), and an increased risk of flooding and greater environmental degradation.
- Higher evaporative demand will also offset any benefits should rainfall possibly increase, also resulting in less effective rainfall (Omwoyo et al., 2017).
- These changes also have societal impacts through crop yields, as well as on the forestry industry which make proper sustained catchment management implementation even more essential. Most of the economic activities in Kenya are largely dependent on the climate (Government of Kenya, 2010b).

Floods and droughts are not uncommon in Kenya. Floods occur almost annually in the coastal region. Urban flooding occurs due to inadequate stormwater drainage systems. Long-duration flooding occurs when a river overflows its banks. The risk of flooding is expected to increase, both in areas where flooding currently occurs and where the extent of flooding is relatively small, due to urbanisation and the effects of climate change. In general, there is inadequate capacity at local and regional level to manage flood-related disasters. Impacts of flooding related to agriculture include:

- Agricultural product and livestock loss
- Contamination of water resources
- Flooding also negatively impacts development within the country as issues of flood management are often the priority issue identified during sub-catchment management planning.



Figure 2-9: Seasonal flooding in Madera county impacting crop production (Madera County Government)

Droughts have various impacts ranging from direct impacts to people, to indirect impacts to the economy. The extent and magnitude of the effects of droughts vary across the country. Impacts of droughts on the agricultural sector include:

- Prolonged droughts affect the recharge levels of the country's water sources.
- Water use restriction levels are not clearly defined for the existing dams, which cause operational issues during times of drought.
- Due to a large amount of the farmlands in Kenya being rain-fed agriculture, droughts result in low crop yields, poor quality of produce, and a change in varieties.
- Although crop prices increase to counter the lower crop yields, the agricultural sector usually experiences a reduction in sales.
- The lack of water for cattle results in decreased milk production.
- Water scarcity also contributes to livestock diseases and deaths.
- There is concern that pastoralists and crop farmers may desert the agricultural sector in the hope of finding new work opportunities in the urban centres.
- Conflict arises between locals and pastoralists when the migration of the pastoralists' livestock increases competition for available resources (resource-based conflict).
- Livestock are preyed upon by wild animals, especially during a drought when food is scarce (i.e. conflict due to predation of livestock).

- Drought is the cause of many transboundary conflicts as it worsens water scarcity and thus results in County Government's prioritising water supply for their own residents (i.e. transboundary conflict).

2.5.2 Socio-economic

2.5.2.1 Demographics

- Increased population growth and urbanisation has increased the pressure on food production.
- Although there are multiple poverty eradication strategies being implemented in the country there are still challenges with reaching a large and increasing population. Increased poverty makes people more reliant on subsistence agriculture.
- Subsistence farming and natural resource use are the livelihoods of the rural poor. It is often subsistence farmers who encroach on forests, riparian and wetland areas as these areas receive a good amount of water for crops. Encroachment is usually driven by droughts.
- Inadequate education levels affect water resources management and agriculture in terms of information sharing with the public as well as the successful implementation of best practice measures. Education and literacy levels impact the ability to share information with the community.
- Population growth in the future, coupled with the impacts on climate change, will put further pressure on the already limited water resources and on food production.
- There is minimal understanding of catchment management and the protection of land and water resources as people think it is normal to live or farm within riparian areas or floodplains. This has resulted in catchment degradation.
- There is inadequate awareness and knowledge within communities on the impacts of climate change as well as adaptation strategies, which can be implemented at household and community level, such as reforestation and rainwater harvesting.

2.5.2.2 Economy and livelihoods

Economic development has a major influence on the development of water resources. With an increase in population expected there is a need to invest in infrastructure development. Furthermore, as discussed above, agriculture is the mainstay of Kenya's economy. Water scarcity has a direct impact on rain-fed and irrigated agriculture as well as livestock and an indirect impact on food processing industries. Economic activities linked to agriculture in Kenya, as discussed below, will influence the planning for water resources.



Image source:
www.businessdailyafrica.com/news/counties/Land-rates-up-five-times-for-Nandi-tea-firms/4003142-5031108-dgt0cs/index

- Livestock production is constrained by access to water and limitations thereof has influenced conflict amongst pastoralists.
- Through the promotion of aquaculture in Kenya, areas that are unsuitable for crop production such as rivers, wetlands, lakes and swamps are being promoted as areas for aquaculture, which may have a detrimental effect on water resources.

- Kenya's coffee is mainly sold in the international markets and with the decrease in price, coffee farmers in Kenya have been drastically affected as profits have plummeted. This has resulted in many of the coffee plantations being eradicated and replaced with housing and industrial developments (described above) as well as flower farms. This economic change affects the employment of the coffee industry and may result in people relocating to find work. It may be affecting the migration from the agricultural sector to urban areas.
- The flower farming industry in Kenya is increasing. Although historically flower farming has been dominated by large-scale bulk flowers for export to Europe, recently small-scale farmers are changing over to flower farming. The bulk flowers are usually grown in green houses and are run with sophisticated technology to produce optimal yields. Small-scale farmers grow summer flowers for a relatively low initial investment and a high, industry related gain. This change in land use may impact water requirements.
- Inefficiencies in the agricultural supply chain severely constrain growth in agricultural markets. These include limited storage and distribution facilities, lack of post-harvest services, poor transport infrastructure, exploitation by middle-men and lack of diversification into new global markets.
- Productivity levels in Kenya are significantly below potential for many crops, especially at smallholder farms. This may be attributed to many factors including high input costs especially for fertilizers and seed, limited extension services, poor animal husbandry, overdependence on rainfed agriculture, outdated used of technology, lack of access to markets, low cropping intensities, declining soil fertility, pests and diseases, droughts, floods, poor soil moisture management, lack of diversification and use of inappropriate varieties.
- Those engaging in livelihood activities are usually reliant on natural resources in a catchment. With increasing population and demand, natural resources are being degraded and therefore livelihood activities are not sustainable. Sources of livelihoods vary from pastoralism to subsistence agriculture and crop/livestock farming.
- Crop and livestock disease cause heavy loss through deaths, reduced productivity and loss of markets for products (Government of Kenya, 2010a). Managing livestock disease requires heavy investment in preparedness, surveillance and controls at entry ports. Lack of appropriate storage and poor handling have resulted in high post-harvest losses. Pesticides and pest control equipment is also expensive for small-scale farmers.
- Access to electricity is an important factor in raising living standards. Electrification can reduce poverty by increasing productivity, employment and time spent in school and reducing environmental degradation (UNDP, 2011). Areas without access to electricity use inefficient fossil fuels as a substitute. Over-exploitation of biomass can cause catchment degradation and requires a large amount of time for fuel gathering.
- Inadequate transport infrastructure contributes to food insecurity and limits future opportunities for development. Several roads become unusable during the rainy seasons as they become muddy or submerged. Sectors or industries which rely on transport, are therefore limited in their ability to travel to various parts of the country during the year.



The Constitution of Kenya (2010) is based on the identification of sustainable access to safe water and basic sanitation, as well as a healthy environment as a human right. Kenyans face various challenges in terms of their standard of living, which have been categorised into food security, disaster preparedness and conflict. These are discussed further below.

The National stunting level is 26%, wasting at 4%, underweight 11%. The overall Poverty Gap for Kenya as a country is 45% (Wiesmann, Kiteme, & Mwangi, 2016). Factors contributing to food security issues include:

- High population growth and low agricultural productivity in Kenya have led to agricultural production not meeting consumption.
- Low production is linked to the reliance on rain-fed agriculture, limited access to farming inputs, low uptake of new technology and influence of climate change.
- Populations in semi-arid counties are already facing food crises due to chronic drought.
- Food insecurity in the urban areas may arise due to the high cost of city living, unhygienic and crowded living conditions, as well as limited coping strategies (limited access to land and inter-generational support networks) (World Food Programme, 2016).



Figure 2-10: Subsistence farming in the riparian area of Kasarini Dam

- Changing rainfall patterns and prolonged droughts are an issue where pastoralism is the main livelihood activity. Droughts reduce pasture land and limit water resources, creating significant food security issues.
- With the crops being vulnerable to the weather conditions, price fluctuations occur depending on the crop yield for the season. When the crop production is low the price rises, while the price falls when the crop yield is high.
- Although food insecurity prevalence is higher in the rural areas, urbanised areas have many food-insecure households, mainly due to the high cost of living, unhygienic and crowded living conditions, as well as limited coping strategies (limited access to land and inter-generational support networks). Some urban by-laws prohibit farming and livestock keeping, giving preference to development of residential and commercial areas.

In areas where natural resources are degraded or where no disaster planning has taken place, communities are more vulnerable to the effects of the disasters. Impacts related to agriculture include:

- Fires can damage and destroy houses, forests, crops and grazing land.
- Floods can cause personal danger to communities and can also wash away good farming soil if there is no village-level emergency planning in place.
- In Kenya there is inadequate disaster response and disaster management protocols in place for communities. With the effects of a disaster often being devastating, the inadequate preparedness for these disasters increases and prolongs these effects as the relief work may be delayed in response to the disaster. As a result, the people and the economy are affected more when there is inadequate preparedness to a disaster event. The issues and challenges involved are discussed further below.
- The Government does not have the funds for disaster relief and rehabilitation to the damages occurred. The Government, and therefore the affected communities, are dependent on funds and aid from charities and organisations.

2.5.2.3 Conflict

Conflict within Kenya relating to agriculture fall into one of the following categories:

- Human-wildlife conflicts, principally among communities that live in proximity to wildlife areas such as the national parks.
- Illegal encroachment into the water towers and wetlands.
- Resource use conflicts from pastoralist communities.

- Illegal encroachment into the water towers and wetlands.
- Water use conflicts in which excessive upstream abstraction denies downstream, riparian users access to the water resource.
- Over-abstraction from rivers during the dry season.
- Water pollution by industries who do not comply with their license agreements.



2.5.3 Water resources

Water resources availability, management and development issues are key issues in the country. The main sub-issues related to agriculture are water quantity, quality, water allocation and use and inadequate infrastructure.

Water quantity issues in Kenya affecting agriculture include:

- Insufficient water to meet crop and livestock demands in certain locations and during certain times of the year.
- Domestic, industrial and irrigation demands are expected to increase in the future; thus, further exacerbating this issue.
- Sedimentation of seasonal rivers and pans is an issue as it limits already scarce water resources.
- There is concern that in the high lying headwater regions water is being over abstracted, leaving limited water resources for downstream users.



Water quality is both impacted by agricultural activities, while water quality also impacts irrigation, fisheries and aquaculture. Issues include:

- Urban pollution
- Non-point sources of pollution include agricultural chemicals (fertilisers and pesticides), unmanaged storm water, soil erosion, overgrazing and infrastructural developments.
- Sedimentation negatively affects the water quality of the rivers and limits surface water shortage. Agricultural activities are a major contributor to sediment loads in rivers. Also, stormwater from urban areas gets washed into rivers, carrying the sediments from the roads and pavements. Deforestation is another major contributor to increased sediment loads. It must be noted that the planting of cypress trees as an act of reforestation, an activity occurring in several forests, reduces the amount of sediment run-off; however, the land cover is reduced from natural forest to plantation, thereby contributing to sediment transport. Sediment loads are generally higher in the rainy seasons and lower in the dry seasons. Sediment that gets deposited in the ocean reduces the water quality, which impacts the fisheries and tourism sector.



One of the key challenges across most of Kenya is limited water resource availability. There is intense competition for water resources and pressure on prioritisation of water use. Managing and enforcing water allocations and use is one of the major challenges in the country. These challenges include:



- Non-compliance of allocations due to inadequate capacity and time in WRA to enforce compliance and to collect, record and analyse water resource monitoring data.
- There is also inadequate monitoring of actual water use for large water users and illegal abstractions taking place which are not monitored and removed.
- There is currently inadequate information on surface and groundwater availability for the purpose of water allocation management. Only limited estimates of allocatable water are available.
- Over-abstraction and illegal abstraction of groundwater also occurs.
- The discrepancy in water availability verses water demand creates challenges in allocation of water.
- Groundwater is used as a supplementary resource to surface water and is currently exploited without adequate knowledge of groundwater potential.
- The water supplied in Kenya is distributed unevenly in terms of both spatial and temporal contexts. The areas beyond the jurisdiction of the WSPs either have no water infrastructure or receive water through community water projects. These areas rely on a variety of unimproved water sources ranging from rock catchments, springs and wells. Most of these are unprotected and are at risk of contamination.
- Drying of springs, streams and rivers at certain times of the year attributed to unpredictable and unreliable rainfall and increased human activity.
- There is intense competition for water resources and pressure on prioritisation of water use where there are multiple sectors at play, such as large domestic demands, industrial sector, tourism and irrigated agriculture. These areas face the challenge of ensuring the equitable and sustainable allocation of water to domestic, industrial and agricultural users.

On top of current water supply shortages across Kenya, increasing demands due to population growth and urbanisation will further extrapolate this problem if no interventions are implemented. The key issues regarding water resources infrastructure in Kenya are described below.

- There are a few large-scale irrigation schemes in Kenya, while most of the small-scale agriculture is rain-fed. The lack of major irrigation schemes is a concern for the country. There are proposed irrigation schemes, which should help relieve the problem of food insecurity.
- There is a general lack of storage and flow regulation which significantly reduce climate resilience and leads to a very low assurance of water supply.

2.5.4 Institutional

Key institutional issues in Kenya which impact agriculture include inadequate capacity at WRUA level, inadequate knowledge of integrated water resource management at County Government levels, and inadequate reporting frameworks to the public. A lack of favourable agricultural-related policy, institutional and legal environments has traditionally been a significant constraint in the agricultural sector in Kenya. Key challenges within this domain include:

- Ineffective and inefficient inter-sectoral linkages and coordination for development of agriculture and its contribution to improved food and nutrition security.

- The consistently low rate of actual irrigation development compared to the targeted rate of development
- Lack of active and systematic data collection and management related to agriculture.
- Issues related to land acquisition which severely delay implementation of agricultural projects.
- Improper or incomplete design standards for irrigation infrastructure to ensure efficient and economical schemes.
- Lack of policy related to soil management. There are hardly any formal institutional arrangements between different institutions on matters relating to soil as a resource with policy and legal provisions relating directly or indirectly to soil management scattered in a number of policies and statutes. The main players in soil fertility management in Kenya include agricultural sector ministries, departments and agencies, as well as private sector, teaching institutions and farmer organizations.
- Weak governance in farmer organizations and farmer cooperatives that is essential for development of agricultural value chains, particularly product marketing.
- Inadequate demand-driven research for development in agriculture, low uptake of appropriate agricultural technologies and weak research-extension-farmer linkages.
- Low budgetary allocation to the agricultural sector.
- Inadequate funding for development, maintenance and operation of irrigation schemes – especially in the case of public and smallholder schemes - coupled with the often excessive cost of scheme construction has been a major constraint for development in the irrigation sector.
- Inadequate structured interactive farmer-government fora to address issues affecting the agricultural sector including poor irrigation support services.
- Low youth participation in agricultural development.
- Inadequate resources for monitoring, control and surveillance of agricultural resources.
- Low involvement of stakeholders in policy formulation, planning, implementation and management.
- Trans-boundary conflicts.

3 Institutional Overview

3.1 Introduction

The activities related to agriculture in Kenya and the implementation of associated strategies are not limited to the responsibility of one institution. Agriculture is cross cutting across sectors, geographical areas and political/administrative jurisdictions. Consequently, functions and responsibilities associated with agriculture in Kenya are spread across several institutional structures. This section outlines the water and agricultural sector institutional arrangements from national to county level and identifies the challenges for coordination between them. Subsequent to Kenya Vision 2030, which was completed in 2007, many strategies and development plans on the agriculture and irrigation sectors in Kenya have been developed to provide the direction for the development and the strengthening of these sectors.

In addition, to ensure that this Sectoral Integration Plan is representative and aligned with current plans and strategies related to water resources planning and management and agricultural development, relevant current plans and strategies were reviewed and are briefly described.

3.2 Legislative, Policy and Institutional Framework

3.2.1 Introduction

The Constitution of Kenya (2010) provides the basis for water resources management in the country and recognises this through the right to a clean and healthy environment, through the management and sustainable development of natural resources (which includes both surface and ground water), as well as through the economic and social right “*to clean and safe water of adequate quantities*”. Importantly, the State has the obligation to ensure that water is conserved, that development is managed to be sustainable and to ensure that the benefits accrued are shared equitably. Whilst it is noted that the utilisation of natural resources should be for the benefit of the people of Kenya, there is important emphasis placed upon the needs of marginalised communities. Also of importance is the recognition of the link between water and land. As such, this recognition provides the basis for improved integration in the planning, management and sustainable development of natural resources.

3.2.2 National policies

3.2.2.1 Water

Worldwide, there is increased recognition of the importance of water in terms of socio-economic development. This is increasingly emerging through the nexus discussions which acknowledge the interfaces between water, food, energy, and more recently, climatic risks. The findings of the World Economic Forum through their Global Risks Reports which repeatedly reflect water and climate related risks as being the most significant to economic growth.

At national level in Kenya, this sentiment has been mirrored in the development of various forms of national development plans. The **Kenya Vision 2030**, published in 2007, provides the national development blueprint. It is structured around economic, social and political dimensions and notes the important role of water in catalysing growth. National targets outlined in the Vision 2030 that have implications for the water sector include:

- Water and sanitation - to ensure that improved water and sanitation are available and accessible to all by 2030
- Agriculture - to significantly increase the area under irrigation by 2030 for increase of agricultural production

- Environment - to be a nation that has a clean, secure and sustainable environment by 2030
- Energy - to generate more energy and increase efficiency in the energy sector

The **Constitution of Kenya (2010)** provides the basis for water resources management in the country and recognises this through the right to a clean and healthy environment, through the management and sustainable development of natural resources (which includes both surface and ground water), as well as through the economic and social right “*to clean and safe water of adequate quantities*”. Importantly, the State has the obligation to ensure that water is conserved, that development is managed to be sustainable and to ensure that the benefits accrued are shared equitably. Whilst it is noted that the utilisation of natural resources should be for the benefit of the people of Kenya, there is important emphasis placed upon the needs of marginalised communities. Also of importance is the recognition of the link between water and land. As such, this recognition provides the basis for improved integration in the planning, management and sustainable development of natural resources.

The **Kenya National Water Resources Management Strategy (2006)** provides the overarching policy framework for water resource management and development in Kenya, despite a number of successive adjustments in the core water legislation. This consistency in policy intent has been critical in guiding the water sector, with legislative amendments being progressively utilised to improve and strengthen the way that policy is affected. At the time of its introduction, the ‘Sessional paper no. 1 of 1999 on national policy on water resources management policy and development’ (Government of Kenya, 1999) introduced key shifts in policy such as the separation of functions (including water resource management, water service delivery, policy, regulation, financing), the devolution of decision making to regional and local levels, the commercialisation of water (i.e. water to be treated as an economic and social good) and stakeholder participation through community and private sector participation.

3.2.2.2 Agriculture and land

The Kenya Vision 2030 identified agriculture as one of the key sectors to deliver the desired economic growth rate of 10% per annum and resulted in the development of various policies and strategies for the agricultural and irrigation sectors to guide the development, transformation and strengthening of these sectors. The transformation of smallholder agriculture from that of subsistence to an innovative, commercially oriented and modern agricultural sector has been identified as a fundamental component for achieving agricultural growth. It is realised that this transformation will be achieved through transforming key institutions in agriculture, livestock, forestry and wildlife to promote agricultural growth; increasing productivity of crops, livestock and tree cover; introducing land-use policies for better use of high- and medium-potential lands; developing more irrigable areas in ASALs for both crops and livestock; improving market access for smallholders through better supply chain management; and adding value to farm, livestock and forestry products before they reach local, regional and international markets.

Increasing the productivity of agricultural water use in Kenya is a national priority given the country’s low water endowment, growing population, and changing climate. Increasing productivity will also help contribute to achieving one of the primary targets of the Big Four Agenda; food security. Expanding the use of modern irrigation technology, such as drip and sprinkler systems, will be fundamental to achieving water productivity because of the potential for such systems to increase yields relative to water withdrawals.

The **National Agricultural Policy (2016)**, which is currently under review, undertakes to address the identified challenges in the agricultural sector by providing guidelines to the National and County governments; specifying the different roles towards ensuring household and National food and nutrition security; increasing agricultural production and productivity through the use of appropriate good quality and affordable inputs; facilitating access to premium domestic, regional and international markets and reducing post-harvest losses while promoting agribusiness, value addition and product development.

Other guidelines outlined in the Policy include strengthening inter-governmental relations, agricultural institutions, developing institutional linkages and enhancing collaboration in order to create harmony and synergy in developing agricultural resources; harnessing resources for improved agricultural output in partnership with the private sector and introducing appropriate financing and insurance systems in the agricultural sector; promoting demand-driven research and timely dissemination of research findings in the agricultural sector and conserving bio-diversity of different crops, livestock and fish. The broad objective of the Agricultural Policy (2016) is to improve food and nutrition security and maximize incomes through optimal utilization of resources in the agricultural sector. In actualizing the broad objective, the National and County governments will ensure that household and National food and nutrition security are attained through innovative and cost-effective measures linked to the country's long-term development goals.

Irrigation services in Kenya remain as an important function of the national government because of its important role in food security. The **Final Draft National Irrigation Policy (2017)** of the Ministry of Agriculture, Livestock and Fisheries (MoALF) presents a concise set of principles and guidelines, designated to facilitate rapid development and improved performance of the irrigation sector, based on the government's commitment to improve agricultural productivities for food security, poverty reduction, and employment and wealth creation. The implementation of the National Irrigation Policy will be realised through accelerated development of irrigation infrastructure, increased productivity per unit volume of water, increased water harvesting and storage, improved scheme management, enhanced stakeholder participation and improved business orientation in the sector. The Policy has proposed that the irrigation and drainage functions are performed by the Irrigation and Drainage Department (IDD), while the implementation and related services are provided by a reformed National Irrigation Board (NIB), namely the National Irrigation Service (NIS).

The **National Land Policy (2009)** was established to provide guidance towards equitable and sustainable land use for the wellbeing of Kenya's people and economy. It is a framework to address critical land related issues in the country, including equitable land access, historical injustices and disparities, land use conflicts and sustainable utilization and management of land and its resources. The Policy recognizes land as a significant finite resource that holds cultural heritage, which should be managed sustainably and productively for economic benefit as well provision of livelihoods. Land in Kenya is classified into Public Land, Community Land and Private Land. Communal land is based on traditional customary rights. Several statutes involving land use matters were enacted following the promulgation of the Constitution. However, lack of institutional coordination poses a challenge for effective land use management across the country. The National Land Use Policy was therefore established in 2017 to provide institutional coordination among the relevant stakeholders. Furthermore, the Policy seeks to optimize the utilization and productivity of land and its resources in a sustainable and equitable manner.

The **Final Draft National Livestock Policy (2019)** recognizes the role the sub-sector plays in the economy and thus guides national and county governments in the development and management of the livestock industry towards commercialization. This aligns with the Kenya Vision 2030 and the Constitution (2010). Subsistence livestock keeping is also important at a household level as it supports food and nutrition security, provides income, creates jobs and supports sustainable livelihoods. This policy seeks to enhance collaboration between national and county governments, livestock institutions and other stakeholders involved in service delivery. Furthermore, it promotes an enhanced enabling environment through training and capacity development.

The **National Policy for the Sustainable Development of Northern Kenya and other Arid Lands (2012)** (also referred to as the "Releasing our full potential" policy) refers to previous biased distribution of public investment established under colonial rule. Resources were directed towards the so-called 'high potential' areas of crop production, overlooking the wealth of lowland livestock-based economies and creating the deep inequalities in human development which we see in Kenya today. The defining feature of the ASALs is their aridity therefore the primary policy challenge is how to ensure food and nutrition security in a sustainable manner in environments that are prone to drought, where people's

access to and control over critical livelihood resources such as land is insecure, and where unpredictability is set to increase as climate change takes hold. Pastoralists in Kenya are found in all the arid counties and in some of the semi-arid. Pastoralism is the extensive production of livestock in rangeland environments. It takes many forms, but its principal defining features are livestock mobility and the communal management of natural resources. The main objectives of the Policy are to strengthen the integration of Northern Kenya and other arid lands with the rest of the country and mobilise the resources necessary to ensure equity and release the region's potential, to improve the enabling environment for development in Northern Kenya and other arid lands by establishing the necessary foundations for development, to develop alternative approaches to service delivery, governance and public administration which accommodate the specific realities of Northern Kenya and pastoral areas, and to strengthen the climate resilience of communities in the ASALs and ensure sustainable livelihoods.

3.2.2.3 Environment and natural resources

In conjunction with the 'Sessional paper no. 1 of 1999 on national policy on water resources management policy and development', the **National Environment Policy (NEP)** (Government of Kenya, 2013a) provides an important framework in terms of improved river basin management in that the NEP has the goal of ensuring a "*better quality of life for present and future generations through sustainable management and use of the environment and natural resources*". A key issue to distil from the 'Sessional paper no. 1 of 1999 on national policy on water resources management policy and development' and NEP concerns the recognition of the value and benefits that are accrued from ecological infrastructure. This refers to the naturally functioning ecosystems that deliver valuable services to people, such as water and climate regulation, soil formation and disaster risk reduction (SANBI, 2013). Our ability to ensure that ecological infrastructure is managed and maintained will be an essential dimension of our resilience against climate variability and climate change.

3.2.3 Legislation

The water and environmental legislation in Kenya have developed over time and this has enabled successive adjustments in order to improve the manner in which water (and other natural resources) are managed and sustainably developed.

3.2.3.1 Agriculture and land

There are a range of legislative instruments that underpin the development of agriculture in Kenya. Amongst these is the **Agriculture, Fisheries and Food Authority Act (Act No 13 of 2013)** which provides for the regulation and promotion of agriculture. This is supported through the establishment of the Agriculture, Fisheries and Food Authority that is charged with, in consultation with County Governments, administering the **Crops Act, (Act No 16 of 2013)** and the **Fisheries Act (Chapter 378 of 1989)**. The drive to increase agricultural development will require ongoing development in irrigation capacity. As such, a Final Draft **Irrigation Bill** was developed in 2015 intended to repeal the Irrigation Act (Chapter 347 of 2013). This amendment bill has yet to be enacted and provides for the establishment of a National Irrigation Development Service and strengthening of irrigation regulations. The **Fisheries Management and Development Act (Act No 35 of 2016)** was developed along with the establishment of the Kenya Fisheries Service to conserve, manage and develop Kenya's fisheries resources.

3.2.3.2 Water

The promulgation of the **Water Act 2016** aligned Kenya's water sector with the 2010 Constitution and enables amendments to support the improved management of water resources. The Water Act (Act No 12 of 2016) revises the institutional mandates of key water sector institutions and sets out the role of

counties in the water sector. The Act recognises that water related functions are a shared responsibility between the National Government and the County Governments. The mandate for the provision of water and sanitation services and the development of county water works is delegated to county governments. The Act defines a clear role for the WRA in the regulation of water resources, which provides a potential strengthening in the way that water resource development is regulated. The Act gives priority to domestic water users over irrigation and other water users. However, there are some ambiguities in the Act which require resolution in order to clarify institutional matters.

The national government remains in charge of the regulation of water services and water resources. It also continues to manage national public water works, which extend across more than one county by nature of the water resource they use and are funded from the national government budget.

The Water Act does not allocate detailed functions of national and county governments in water resource management but provides instead for a National Water Resource Strategy to address this.

The Act established some new institutions and made changes to others, as listed below:

- **Ministry of Water, Sanitation and Irrigation (MoWSI)** as the sector leader and coordinator, taking responsibility to policy development
- The **Water Resources Authority (WRA)**: mandated to protect, conserve, control and regulate the management and use of water resources and to support the Cabinet Secretary in policy formulation and the establishment of a National Water Resource Strategy. Their role includes the formulation and enforcement of procedures/regulations, water abstraction permitting and collecting of water use fees, flood mitigation and advising the Cabinet Secretary generally on the management and use of water resources. The Act requires the development of water resources allocation plans at basin level, and the WRA needs to permit the development of any water source (surface or groundwater).
- **Water Services Regulatory Board (WASREB)** for regulation of water services' providers. Its functions comprise: issuing of licenses to water services boards and approval of Service Provision Agreements, developing tariff guidelines and carrying out tariff negotiations, setting standards and developing guidelines for service provision, publishing the results of sector monitoring in the form of comparative reports.
- **National Water Harvesting and Storage Authority** for major water infrastructural development,
- **Water Tribunal** for dispute resolution,
- **Water Sector Trust Fund** for water services development towards the un-served and poor segments of the society in peri-urban and rural areas,
- **Water Works Development Agencies** to replace the Water Service Boards. The Water Act provides the Cabinet Secretary for Water with the power to establish an undefined number of Water Works Development Agencies to manage such national public water works, thus replacing the current Water Services Boards.
- **Basin Water Resources Committees** to replace Catchment Advisory Committees (CAACs).
- **Water Services Providers (WSPs)** who, with the **county governments**, provide water and sanitation services in the counties. Operations must be in accordance with a Service Agreement entered between each WSP and WASREB.
- In rural areas where services are not commercially viable, **counties** are now responsible for facilitating access to services, for developing the required infrastructure for distribution, and for contracting community associations, public benefit organizations or private operators to manage such systems (KEWASNET, 2017)
- The **Water Resource User Associations (WRUAs)**: provide community-based management of water resources and resolution of associated conflicts.

Key water sector institutions are shown in Figure 3-1.

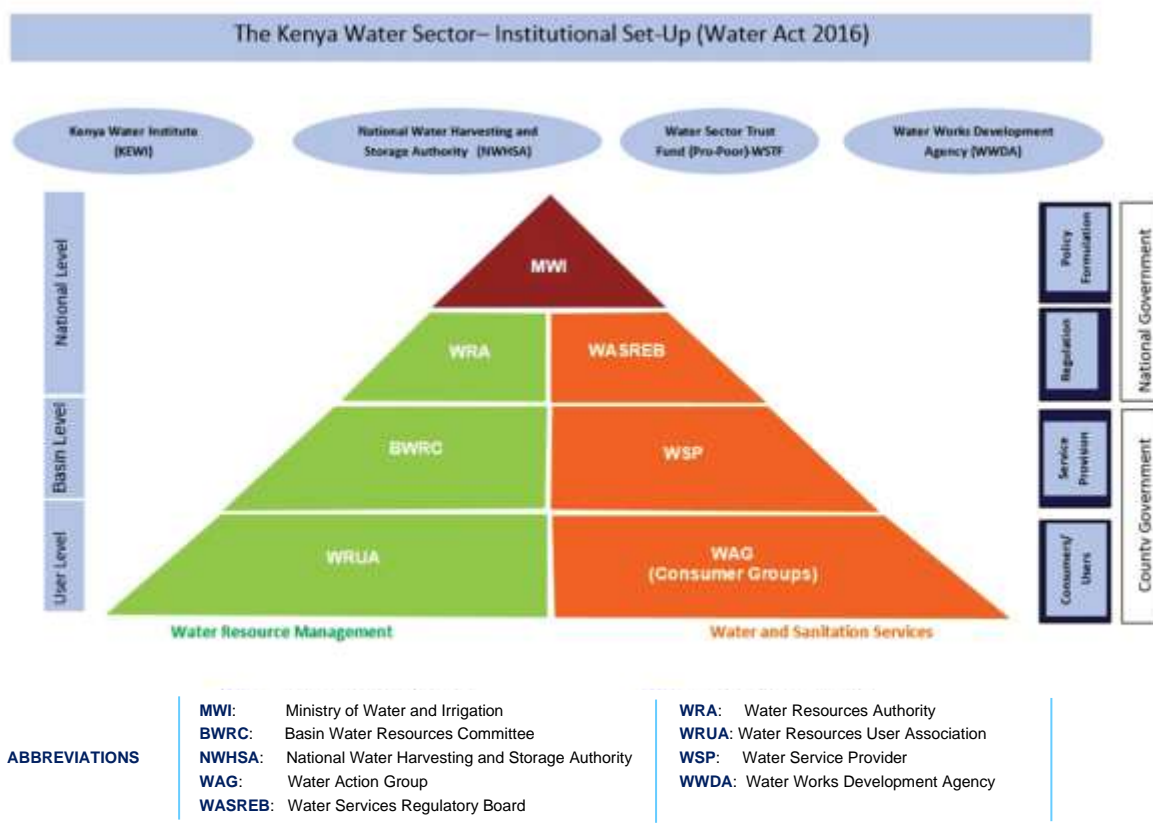


Figure 3-1: Kenya Water Institutions (Water Act 2016)

3.2.3.3 Environment and natural resources

The **Environmental Management and Coordination Act, 1999 (as amended 2015) Cap 387 (EMCA)** is the framework law on the environment in Kenya. The EMCA was enacted to provide an appropriate legal and institutional framework for the management of the environment in Kenya. The Act was amended in May 2015 and took effect on 17 June 2015.

The Act aims to improve the legal and administrative coordination of the diverse sectoral initiatives in the field of environment in order to enhance the national capacity for its effective management. In addition, the Act seeks to align the 77 sector specific legislations pertaining to the environment in a manner designed to ensure greater protection of the environment. This is in line with national objectives and sustainable development goals enunciated in the Agenda 21 of the Earth Summit held in Rio de Janeiro in 1992. The ultimate objective is to provide a framework for integrating environmental considerations into the country’s overall economic and social development. In terms of environmental management, the EMCA provides a comprehensive legal and institutional framework for the handling of all environmental issues in Kenya and covers all sectoral laws.

EMCA does not repeal the sectoral legislation but seeks to coordinate the activities of the various institutions tasked to regulate the various sectors. These institutions are referred to as Lead Agencies in EMCA.

The EMCA is supported by several subsidiary Regulations such as Solid Waste Management Regulations (2006), Environmental Management and Coordination (Water Quality) Regulations (2006) and Emissions Regulations (2007), as well as other pertinent International Environmental Regulations.

3.2.4 National institutions and mechanisms

3.2.4.1 National Ministries and departments

The 2010 Constitution provides for two tiers of Government with national government being broadly responsible for policy development and regulation to ensure that policies are effectively implemented. In the aftermath of the 2017 national elections, the national government in Kenya has undergone some changes in configuration to support a more effective and efficient Government. Whilst there are a number of Ministries that can be seen as enablers (e.g. Education, Justice etc), the key sector ministries from an agriculture and basin planning perspective include:

- Ministry of Agriculture, Livestock and Fisheries (MoALF)
- Ministry of Devolution and ASAL. (MoDASL)
- Ministry of Water, Sanitation and Irrigation (MoWSI)
- Ministry of Environment and Forestry (MoEF)

The **MoALF** has as its mandate to improve the livelihood of Kenyans and ensure food security by promoting competitive, commercially oriented fisheries, crop and livestock farming through creation of an enabling environment, and ensuring sustainable natural resource management. The Ministry was created in 2013 following the merge of the three ministries of agriculture, livestock development and marketing and fisheries. Its strategic objectives revolve around creating an enabling environment for agricultural development, increasing productivity and outputs in the agricultural sector, enhancing national food security, improving market access and trade and strengthening Institutional capacity. It has a number of core functions, including:

- Formulation, implementation and monitoring of agricultural legislations, regulations and policies
- Supporting agricultural research and promoting technology delivery
- Facilitating and representing agricultural state corporations in the government
- Development, implementation and coordination of programmes in the agricultural sector
- Regulating and quality control of inputs, produce and products from the agricultural sector
- Management and control of pests and diseases
- Collecting, maintaining and managing information on agricultural sector

The Agricultural State Department under the MoALF is responsible for advancing technology and infrastructure development, mechanisation, crop resources and agribusiness. The Livestock State Department looks after veterinary services and livestock resources, while the Fisheries State Department is responsible for aquaculture development. All three state departments drive policy research, regulation and market development in their respective agricultural sub-sectors.

The State Department for Development of the ASALs (SDDA) under the **MoDASL** is a special vehicle for affirmative action, mainstreaming development issues of ASALs, coordinating, implementing and fast-tracking investment for long term sustainable development. The SDDA strategic focus involves coordination of development for ASALs in terms of the formulation of policies and implementation of strategies for the development of ASALs, resilience building through programmes that will fill the social, economic and environmental gaps to increase the ability of ASALs communities to withstand shocks, and social and cultural integration through frameworks for management and resolution of cultural and resource-based conflicts.

The State Department of Irrigation Services under **MoWSI** has irrigation mandates of benefit to the agricultural sector. The Irrigation Services Department is the leading agency for irrigation and drainage development including operation and maintenance of the existing large-scale public irrigation and drainage facilities. It has offices, which provide services to irrigators and other stakeholders. Under the State Department of Irrigation, there are four departments: Department of Irrigation and Drainage;

Department of Irrigation Water Use Services; Department of Water Storage and Flood Control; Department of Land Reclamation. Some of its other mandates include:

- Formulate and review national irrigation policy and strategy in collaboration with the County Governments and other relevant stakeholders
- Oversee and coordinate irrigation sub-sector entities and agencies
- Collaborate and liaise with other agencies involved in irrigation development at local, regional and international levels
- Formulation of sub-sector regulations, standards and guidelines in collaboration with the county Governments and other relevant stakeholders
- Capacity building, coordinate technology and research development for the sub-sector
- Formulation of National projects and programmes in collaboration with County governments and other stakeholders
- Resource mobilization and financing of the sub-sector
- In consultation with County governments, develop a National Irrigation Master plan, Investment plan and respective Strategic plans
- Establish a national Irrigation and Drainage Management Information System (IDMIS)
- Monitoring and evaluation of irrigation sub-sector performance
- Undertake regulatory function for the sub-sector including conflict resolution mechanisms to deal with irrigation disputes
- Support in building the capacity of Irrigation Water Users Associations in consultation and collaboration with the counties and other stakeholders

The **MoEF** has three directorates applicable to the agriculture sector. The Directorate of Environment coordinates environmental and forestry policies and the implementation thereof as well as provides guidance on any environment-related issues. The Directorate of Forestry Conservation is mandated to manage and conserve forestry resources through policy formulation, conservation strategies and management of forest resource utilisation. Lastly, the Directorate of Climate Change guides and coordinates climate change-related matters, including implementation of the national climate change plans.

3.2.4.2 National level public entities

Whilst the Ministries have the broad ambit to develop policy, under legislation they have established various national level public entities that have the mandate to perform regulatory and developmental functions. These public entities that function at a national level are tabulated, in

Table 3-1.

Table 3-1: National level public entities that have relevance to integration of IWRM in the agriculture sector

Institution	Roles and responsibilities*
Ministry of Agriculture, Livestock and Fisheries (MoALF)	
Agriculture, Fisheries and Food Authority (AFFA)	<ul style="list-style-type: none"> - Administer Crops Act and Fisheries Act in accordance with the provisions of these Acts. - Promote best practices in, and regulate, the production, processing, marketing, grading, storage, collection, transportation and warehousing of agricultural and aquatic products excluding livestock products as may be provided for under the Crops Act, and the Fisheries Act.

Kenya Water Security and Climate Resilience Project

Institution	Roles and responsibilities*
	<ul style="list-style-type: none"> - Collect and collate data, maintain a database on agricultural and aquatic products excluding livestock products, documents and monitor agriculture through registration of players as provided for in the Crops Act and the Fisheries Act. - Responsible for determining research priorities in agriculture and aquaculture. - Advise National Government and County Governments on agricultural and aquatic levies for purposes of planning, enhancing harmony and equity in the sector. - Carry out such other functions as may be assigned to it by this Act, the Crops Act, the Fisheries Act and any written law while respecting the two levels of governments.
Kenya Fisheries Service	<ul style="list-style-type: none"> - Be accountable to the Cabinet Secretary for the exercise of functions of the Service. - Provide information and advice to the Cabinet Secretary on all matters pertaining to conservation management, standards, development and sustainable use of fisheries resources. - Provide recommendations to the Cabinet Secretary for overall policy in matters within the scope of the Act. - Collaborate with the Fish Marketing Authority (FMA) established under Section 198 of the Act and other agencies to ensure that trade in fish is carried out in accordance with the provision of this Act (Act No 35 of 2016). - Responsible for approving the annual budget and financial plan of the Service and provide oversight for all financial matters. - Provide policy guidance for the functions of the Service.
Kenya Agricultural and Livestock Research Organisation (KALRO)	<ul style="list-style-type: none"> - Formulate policy and make policy recommendations to the Cabinet Secretary on agricultural research. - Prioritize areas for, and co-ordinate, agricultural research in Kenya in line with the national policy on agriculture. - Determine and advise the Government on the resource requirements for agricultural research in Kenya both at the national and county level. - Regulate, monitor and ensure coordination of institutions, agencies and persons involved in agricultural research - Provide grants to research institutes and persons desirous of carrying out research and training programs which are consistent with the national research priorities and plans of KALRO. - Support and promote the training and capacity building in relation to agricultural research. - Establish platforms for the purposes of sharing research information, advancing research and transfer of technology and dissemination of information relating to advancements made in agricultural research.
Kenya Marine and Fisheries Research Institute (KMFRI)	<ul style="list-style-type: none"> - Conduct multidisciplinary and collaborative research on fish ecology, population dynamics, stock assessment and general aquatic ecology. - Collect and disseminate scientific information on fisheries and other aquatic resources and related natural products. - Study and identify suitable species for culture including development, adoption and transfer of rearing technology and procedure. - Study chemical and physical processes that affect productivity of aquatic ecosystems. - Monitor water quality and pollution in fresh and marine water environments. - Carry out socio-economic research on aspects relevant to fisheries, environment and other aquatic resources. - Establish a marine and freshwater collection for research and training purposes. - Offer training facilities to aquatic scientists. - Conduct research on fish quality control, post-harvest preservation and value addition technologies. - Conduct research on blue economy.
Ministry of Devolution and ASAL. (MoDASL)	
National Drought Management Authority (NDMA)	<ul style="list-style-type: none"> - Overall leadership and coordination of drought risk management programmes. - Implementation of policies and programmes relating to drought management. - Provides a platform for long-term planning and action, as well as a mechanism for solid coordination across Government and with all other stakeholders. - Has established offices in 23 ASAL counties considered vulnerable to drought.
Ministry of Water, Sanitation and Irrigation (MoWSI)	
Water Resources Authority (WRA)	<ul style="list-style-type: none"> - Formulate and enforce standards, procedures and Regulations for the management and use of water resources and flood mitigation. - Regulate the management and use of water resources. - Receive water permit applications for water abstraction, water use and recharge and determine, issue, vary water permits; and enforce the conditions of those permits.

Kenya Water Security and Climate Resilience Project

Institution	Roles and responsibilities*
	<ul style="list-style-type: none"> - Determine and set permit and water use fees as well as collect water permit fees and water use charges. - Provide information and advice to the Cabinet Secretary for formulation of policy on national water resource management, water storage and flood control strategies.
Water Services Regulatory Board (WASREB)	<ul style="list-style-type: none"> - Protect the interests and rights of consumers in the provision of water services. - Determine and prescribe national standards for the provision of water services and asset development for water services providers. - Evaluate and recommend water and sewerage tariffs to county water services providers and approve the imposition of such tariffs in line with consumer protection standards. - Set licence conditions and accredit water services providers. - Monitor and regulate licensees and enforce licence conditions.
National Water Harvesting and Storage Authority (NWHSA)	<ul style="list-style-type: none"> - 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. - Develop a water harvesting policy and enforce water harvesting strategies.
Water Works Development Agencies (WWDAs)	<ul style="list-style-type: none"> - Undertake the development, maintenance and management of the national public water works within its area of jurisdiction. - Operate water works and provide water services as a water service provider, as a transitional arrangement or as instructed by the WASREB. - Provide technical services and capacity building to such County Governments and water service providers within its area as may be requested.
Regional Development Authorities (RDAs)	<ul style="list-style-type: none"> - Promote integrated water resources development within jurisdictions to ensure equitable socio-economic development
National Irrigation Board (NIB)	<ul style="list-style-type: none"> - Conduct research and investigation into the establishment of national irrigation schemes. - Formulate and be responsible in conjunction with the WRA for the execution of policy in relation to national irrigation schemes. - Raise funds for the development of national irrigation schemes. - Design, construct, supervise and administer national irrigation schemes. - Manages two rice mills through subsidiary companies which serve as processing plants for milling and packaging rice bought from farmers in the respective schemes. - Under the Expanded National Irrigation Programme (ENIP), NIB is undertaking new development as well as rehabilitation of irrigation projects.
Ministry of Environment and Forestry (MoEF)	
National Environmental Management Authority (NEMA)	<ul style="list-style-type: none"> - Co-ordinate environmental management activities being undertaken by lead agencies and promote the integration of environmental considerations into development policies, plans, programmes and projects to ensure the proper management and rational utilisation of environmental resources. - Take stock of natural resources in Kenya and their utilisation and conservation. - Establish and review in consultation with the relevant lead agencies, land use guidelines. - Monitor and assess activities, including activities being carried out by relevant lead agencies, to ensure that the environment is not degraded by such activities and environmental management objectives are adhered to.
Kenya Water Towers Agency (KWTA)	<ul style="list-style-type: none"> - Coordinate and oversee the protection, rehabilitation, conservation, and sustainable management of Kenya's water towers. - Co-ordinate and oversee the recovery and restoration of forest lands, wetlands and biodiversity hot spots. - Promote the implementation of sustainable livelihood programmes in the water towers in accordance with natural resource conservation.

* The roles and responsibilities provided are not comprehensive but provides some of the key functions.

To achieve effective integrated planning and management, there is a need for integrated approaches between different departments and agencies at the national level. However, there are significant challenges in terms of ensuring the alignment in policy and legislation, which requires capacity in the respective institutions, to be able to work in an integrated manner and have the necessary systems to support this integration.

3.2.4.3 Non-core agricultural sector institutions

Other corporations and organisations closely related to the agricultural sector in Kenya include parastatals, commodity boards, research institutions, financial institutions, cooperatives and producer organisations. Examples include the Agricultural Development Corporation (ADC), the Agricultural Finance Corporation (AFC), the Coffee Board of Kenya, the Horticultural Crops Development Authority, the Kenya Dairy Board (KDB), Kenya Flower Council (KFC), Kenya Forestry Research Institute (KEFRI), Kenya Marine and Fisheries Research Institute (KMFRI), Kenya Plant Health Inspectorate Service (KEPHIS), Kenya Sugar Board, Kenya Sugar Research Foundation, National Cereals and Produce Board (NCPB), National Irrigation Board (NIB), New Kenya Co-operative Creameries, Pest Control Products Board (PCPB), Pyrethrum Board of Kenya, the Tea Board of Kenya, the Tea Research Institute of Kenya, Farmers organizations and Water User Associations. It is also important to realise that agriculture as a sector is predominantly a private business affair, with many private sector and commercial agents as important role players.

3.2.4.4 Joint Agricultural Sector Consultation and Cooperation Mechanism

The Joint Agricultural Sector Consultation and Cooperation Mechanism (JASCCM) was established in 2016 as part of the commitment of the national and county governments to jointly pursue effective development of the agricultural sector. The primary objective of JASCCM is the implementation of sector priorities defined in the 2016 Agricultural Policy and as such it has two primary goals: To transform crop, livestock and fisheries production into commercially oriented enterprises that ensure sustainable food and nutrition security; and to provide a framework for the support and intensification of cooperation and consultation between the National and County governments and among other stakeholders for enhanced development of crops, livestock and fisheries. The purpose of JASCCM therefore is to ensure that agriculture contributes to equitable national economic growth and increased food security through effective implementation of the four key pillars of Agricultural Policy, which are: Increasing production and productivity; Increasing market access; Enhancing National Food and Nutrition Security; and effective Sector and Institutional Reforms.

3.2.5 Regional and local level institutions

3.2.5.1 Agricultural extension services

The various State Departments under the MoALF have extension officers and farmer training programmes for engagement with county governments and local farmers. County Coordination Units (CCUs) and County Steering Committees (CSCs) have been instrumental in establishing sound and constructive linkages between national agricultural structures and county governments following devolution, despite the many challenges resulting from the devolution process. The CCUs and CSCs have the potential to play important roles in facilitating the coordination of agricultural investments and interventions at the county level, and in facilitating the provision of capacity building support towards sector coordination by the county governments. To ensure long-term agricultural sustainability at county level, the CSCs and CCUs need to seek and pursue all possible opportunities to strengthen their collaboration with and integration into the county structures and development agenda.

3.2.5.2 Directorate of Arid and Semi-Arid Lands Divisions

The State Department established field offices under the Directorate of ASALS to coordinate the implementation of programmes and projects in ASALS counties. Programmes are developed under the Community Social Integration Division, Special Programmes Division and Livelihood Support Division.

3.2.5.3 NEMA Regional Offices

There are eight NEMA regional offices that manage the county field offices in Kenya (Table 3-2). County Environmental Committees (CEC) are the District level bodies chaired by respective County Commissioners and bringing together representatives from all the ministries; representatives from local authorities within the province/district; two farmers/pastoral representatives; two representatives from NGOs involved in environmental management in the province/district; and a representative of each regional development authority in the province/district. To each CEC in the country is attached a County Environmental Coordinator who serves as the secretary to the CEC, and as the NEMA Officer on the ground, is charged with responsibility of overseeing environmental coordination among diverse sectors.

Table 3-2: NEMA regional offices

Region	Regional office	Counties
COAST REGION	Mombasa	Kilifi, Kwale, Lamu, Mombasa, Taita Taveta
CENTRAL	Isiolo	Embu, Isiolo, Kirinyaga, Laikipia, Marsabit, Meru, Tharaka-Nithi
NORTH LAKE	Kisumu	Bungoma, Busia, Kakamega, Kisumu, Siaya, Vihiga
NAIROBI METROPOLI	Nairobi	Kajiado, Kiambu, Machakos, Makueni, Muranga, Nairobi
NORTH EASTERN	Garissa	Garissa, Kitui, Mandera, Tana River, Wajir
NORTH RIFT	Eldoret	Elgeyo Marakwet, Nandi, Trans-Nzoia, Turkana, West Pokot, Uasin Gishu
SOUTH RIFT	Nakuru	Baringo, Nakuru, Kericho, Narok, Nyandarua, Samburu
SOUTH LAKE	Kisii	Bomet, Homa Bay, Kisii, Migori, Nyamira

3.2.5.4 County level agricultural institutions

County Coordination Units (CCUs) and County Steering Committees (CSCs) have been instrumental in establishing sound and constructive linkages between national agricultural structures and county governments following devolution, despite the many challenges resulting from the devolution process. The CCUs and CSCs have the potential to play important roles in facilitating the coordination of agricultural investments and interventions at the county level, and in facilitating the provision of capacity building support towards sector coordination by the county governments. To ensure long-term agricultural sustainability at county level, the CSCs and CCUs need to seek and pursue all possible opportunities to strengthen their collaboration with and integration into the county structures and development agenda.

3.2.6 Basin and sub-basin institutions

Noting the requirements of Integrated Water Resources Management, institutions have been established at basin and sub-basin levels to improve the day-to-day management of water resources as well as to improve the regulation and oversight required to ensure that water is efficiently used in accordance with water use permits. Under the auspices of the 2016 Water Act, this is achieved through the six Regional and 26 Sub-Regional Offices of the Water Resources Authority (WRA) and the Water Resource User Associations (WRUAs).

Each of the six basins in Kenya has a **WRA Regional Office (RO)** and a number of **Sub-Regional Offices (SROs)**. Each SRO looks after a number of Catchment Management Units (CMUs), delineated based on hydrological and water resource considerations. Water users apply for water permits through

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the relevant WRA SRO, and the application is then sent to the RO for processing. Class A to C permits are handled at RO level, while Class D permits are handled at Head Office. A hydrological or hydrogeological assessment report conducted by a qualified professional must be submitted by the water user with the application. Water permits are recorded in the Water Permit Database at the RO.

Table 3-3 WRA sub-regions, offices and CMUs

Basin	Sub-Region	WRA SRO	CMUs
Athi (RO: Machakos)	Upper Athi	Kiambu	Ruiru, Ndarugu
	Mbagathi - Nairobi	Nairobi	Mbagathi/ Nairobi
	Middle Athi	Kibwezi	Thwake
	Noltresh - Lumi	Loitokitok	Tsavo
	Coastal - Athi -Mombasa	Mombasa	Coastal Zone/ Mombasa
Tana (RO: Embu)	Upper Tana	Murang'a	Sagana-Gura, Lower Sagana, Upper Thika and Lower Thika
	Thiba	Kerugoya	Tana, Karaba, Ena and Thiba
	Kathita - Mutonga	Meru	Mutonga, Kathita, Ura / Tharaka
	Tiva - Tyaa	Kitui	Tiva and Lower Reservoirs
	Lower Tana	Garissa	Lower Tana, Ijara / Lamu
LVS (RO: Kisumu)	Northern Shorelines / Nyando	Kisumu	Northern Shorelines, Upper and Lower Nyando
	Southern Shorelines / Gucha-Migori	Kisii	Southern Shorelines, Gucha and Migori
	Mara / Sondu	Kericho	Sondu, Upper and Lower Mara
LVN (RO: Kakamega)	Kipkaren – Upper Yala	Eldoret	Kipkaren, Upper Yala
	Elgon – Cherangani	Kitale	Upper Nzoia, Middle Nzoia, Sio-Malaba-Malakisi, Mount Elgon
	Lower Nzoia - Yala	Siaya	Lower Nzoia, Lower Yala
RV (RO: Nakuru)	Lower Turkwel	Lodwar	Lake Turkana Basin, Lokitipi Plains
	Upper Turkwel	Kapenguria	Upper Turkwel
	Lakes Baringo/ Bogoria	Kabarnet	Upper Kerio, Suguta River, Lakes Baringo/ Bogoria
	Lakes Naivasha/ Nakuru	Naivasha	Lakes Nakuru/ Elementaita, Lake Naivasha
	South Rift Valley	Narok	Upper and Lower Ewaso Ng'iro South
ENN (RO: Nanyuki)	Engare Narok – Merghis Upper Ewaso Ng'iro	Rumuruti	Ewaso Narok, Nundoto
	Upper Ewaso Ng'iro	Nanyuki	Upper Ewaso Ng'iro, Nanyuki
	Middle Ewaso Ng'iro North Ewaso Laggas	Isiolo	Middle Ewaso Ng'iro, Lower Ewaso Ng'iro
	Ewaso Daua	Mandera	Daua, Ewaso Laggas, Lower Ewaso Ng'iro
	North Ewaso Laggas	Marsabit	Daua, Chalbi and Ewaso Laggas

At a more localised level, the establishment of the **Water Resource User Associations (WRUAs)** has been essential in ensuring a focus on the operational management functions within a sub-basin. WRA has delineated Kenya into 1 237 sub-catchment areas with the intention of forming Water Resources User Associations (WRUAs) for each. The WRUAs are community-based, voluntary associations made up of water users and riparian owners interested in proper management of their water resources and

were established to enable the collaborative management of water resources and to provide essential support in the resolution of conflicts concerning the use of water resources. Crucially, the Water Act 2016 makes provision for BWRCs to be able to finance WRUAs for services rendered under contract. To date, WRUAs have performed important local functions, but have faced an array of challenges that have served to hinder their effectiveness. Many of these are enabling factors such as capacity in terms of having sufficient skills and training, but also include such issues as inadequate equipment and insufficient financial resources. These challenges will require redress in order to support the implementation of this Basin Plan and realise the local level capacitation that can unlock the localised socio-economic development required to support Vision 2030. This is supported by the 2016 Water Act that provides in Section 29 (3) that “*basin area water resources management strategy shall facilitate the establishment and operation of water resources user associations*”.

Sub catchment management plans (SCMP) is a planning tool that is developed by the Water User Associations (WRUA) under regulation by the Water Resources Authority (WRA). Its main objective is to guide the implementation of water resources management and regulation activities within a defined period of time in any given sub catchment. The activities, in most cases, relate to catchment protection, pollution control and water infrastructure development.

The 2016 Water Act in effect strives to strengthen the management of water resources at the basin and sub-basin level, whilst strengthening the regulatory role of WRA both at national and basin scales. This not only removes the dichotomy that WRA faced as being manager and regulator, but also attempts to create a stronger management regime within the basins and sub-basins, noting that counties have a key role to play in water service delivery as well as ensuring that water is used efficiently within their jurisdictions. To this end, the 2016 Water Act introduced **Basin Water Resource Committees (BWRCs)** as a replacement for the previous Catchment Area Advisory Committees (CAACs), with a more managerial intent than the purely advisory role that was played by the CAACs. At this juncture, during what is effectively a period of transition, the BWRCs will initially provide a more advisory function, however, it will be critically important to learn from the challenges that were experienced with the CAACs so that the BWRCs become more effective in supporting water resource management. The regulatory function of the WRA will continue to be strengthened and, in the transition period, ring-fencing of staff within the Regional and Sub-Regional Offices will be essential to separate staff and functions that are managerial in nature, and as such, supportive of the BWRCs. The BWRCs fall under the WRA, and their responsibilities (which must be delegated by WRA) include the formulation of Basin Water Resources Strategies, management of basins, advice to WRA and the facilitation of WRUA establishment. The BWRCs may contract WRUAs as agents to perform certain duties in water resource management. There are conflicting mandates for the BWRCs in the Water Act (2016) where they have both advisory and management functions. ISC has an understanding that the BWRCs will remain advisory for the foreseeable future with a long-term plan of making the BWRCs have an executive role. There is a need to develop tools to support the operationalisation of the BWRCs, when they are finally established, and to ring-fence WRA staff at the Ros who will provide both technical and secretariat services to the BWRCs. The actual responsibility and how the BWRCs will work with WRA at the regional offices will only be clear once the mandates are agreed upon.

3.2.7 County governments

In accordance with the Constitution of Kenya (2010), a wide range of agricultural functions have been devolved to the County governments. In the case of the core Agricultural Sector, most service delivery functions have been devolved and are now the responsibility of county governments. The current division of functions between the two levels of government is guided by the Constitution and gives county governments a major role in the development of the Sector. The bulk of the functions for translating policies into tangible developments for the realization of agricultural commercialisation are also the responsibility of County governments. Despite initial challenges in the process of transferring functions to the County governments alongside initial institutional and financial resource constraints, the County governments are now well consolidated. Consequently, they play a critical role for converting

national policies into tangible developments for the realisation of food security and agricultural commercialisation. One issue of particular relevance however, is that the level of devolution is different for different sub-sectors of importance for the agriculture/water resources management interface. For example, while most functions in the core agriculture sector are devolved to the county governments, on the environmental, irrigation and water side the degree of devolution is less. This has been found to complicate cross-sectoral planning/implementation frameworks with regard to water resources planning and management and related infrastructure implementation.

Guided by the overarching objectives and principles of the county governments as set out in the Constitution, specific functions of counties are provided in Schedule Four of the Constitution. The role of county governments with reference to crop and animal husbandry, plant and animal disease control, fisheries, natural resources and environment (soil and water conservation) emanates from the Constitution of Kenya 2010. However, the Constitution does not explicitly provide for the irrigation function in its elaboration of county functions and roles. While at national level, irrigation functions have been clearly placed under the MoWSI, in different counties it has been placed in varying ministries or is missing entirely as a department.

3.2.8 Institutional coordination

Although the agriculture sector is a national priority, it is reliant on resources and coordination from various other sectors. As described above the institutions involved are based around the natural resources of crops, livestock, land and water. Due to the devolution of government, the county governments are involved with local level agriculture projects, with national input from the MoALF, MoDASL, MoWSI and MoEF through their local level institutions. Figure 3-2 indicates the key institutions involved in the coordination of the agricultural sector.

3.2.8.1 Agricultural extension, training and information services

Agricultural extension services in Kenya date back to the early 1900s. Extension services refer to a systematic process of working with producers or communities to help them acquire relevant and useful agriculture or related knowledge and skills to increase farm productivity, competitiveness and sustainability (Agriculture and Food Authority, 2017). This extension service is critical in achieving the transformation in smallholder agriculture to an innovative, commercially oriented and modern agriculture that addresses the socio-economic issues in communities.

Various Directorates under the AFFA provide technical input and advice to county governments. The Authority also conducts farmers' training programs aimed at increasing their knowledge on production technologies and prospects for various types of crops, through farmer training institutions. Extension officers are involved in on the ground catchment management activities, particularly for smallholder farmers. These smallholder farmers are most at risk to the impacts of climate change and infertile soils. Conservation agriculture has been promoted as a sustainable alternative for farmers to address the problem of declining soil fertility and provide the dual benefit of enhanced food production and adaptation/resilience to changing climatic conditions (Agriculture and Food Authority, 2017).

Technical advisory services are also offered by the NIB to smallholder farmers, in collaboration with county governments and other organisations. Other players that strengthen extension services include the private sector, NGOs, civil society and community-based and faith-based organizations. Numerous public institutions, such as universities, colleges and farmer and pastoral centres, as well as private institutions provide additional training and capacity building.

3.2.8.2 Marketing and finance of agriculture

The marketing of agricultural produce is critical for the viability for stakeholders in the agricultural sector. The Agriculture Sector Development Strategy (ASDS) (Government of Kenya, 2010) identifies challenges within marketing chains affecting the commercialisation and profitability of agricultural

produce, including lack of transparency and long market chains with several players resulting in inefficient response to feedback between producers and consumers.

Cooperatives play a vital role in the marketing of various agricultural products, including coffee, dairy products, honey, fish and livestock (Government of Kenya, 2010). Agricultural cooperatives constitute 46% of the country-wide cooperatives.

The Agricultural Finance Corporation (AFC), a state institution, provides long-term credit to farmers. However, the main source of financial support is provided by savings and credit cooperatives (SACCOs), NGOs and community-based lending institutions.

3.2.8.3 Development and management of agriculture

Irrigation

The NIB was established and incorporated in 1966 as a state corporation through the Irrigation Act. The NIB is currently managing all the national irrigation schemes and conducts operational research. It also manages two rice mills through subsidiary companies which serve as processing plants for milling and packaging rice bought from farmers in the respective schemes. Under the ENIP, NIB is undertaking new development as well as rehabilitation of irrigation projects.

The NIB is the main irrigation authority in charge of developing national and public irrigation schemes. The NIB liaises with the cabinet secretary and county governments to raise funds for irrigation schemes (national, public and smallholder).

Kenya has six Regional Development Authorities (RDAs) established under specific Acts of parliament. The RDAs mandate is to plan, implement and coordinate development programmes in regions under their jurisdiction to ensure development through integrated planning and management. The RDAs include Kerio Valley Development Authority, the Lake Basin Development Authority, Tana River and Athi River Development Authority, Ewaso Ngiro South River Basin Development Authority, Ewaso Ngiro North River Basin Development Authority, and the Coast Development Authority. The RDAs provide many opportunities in attracting investments related to agricultural development to achieve sustainability and complement the government's efforts in wealth and employment creation. All the Regional Development Authorities have strategic plans.

Pastoralism

Land and water is also important to pastoralists, although the importance of the resource is linked to treating it as common property freely available for all with livestock (Levine & Pavanello, 2012). The management of natural resources is thus inseparable from the management of relationships between the pastoralist clans and ethnic groups. Pastoralists move their herds in seasonal patterns, according to the conditions of each year. This movement is managed to maintain the right balance of species in the best possible condition over the long term through careful control of grazing (Levine & Pavanello, 2012). Management requires a set of rules and requires the right institutional framework. This is mainly set by groups of elders, who constitute customary authorities.

Inadequate management and regulation of the rangelands has resulted in pastoral activities that are incompatible with the capacity of the land, such as overgrazing, which results in vegetation loss and soil erosion. Since 2013, Counties are given mandate to independently plan their land, however this has created siloed planning and has led to loss of coordination regarding the management of natural resources such as wildlife and water. Given the boundless nature of water, there is need for policy action to ensure integration of planning and decision-making at a trans-county level.

An analysis conducted by United Nations Office for the Coordination of Humanitarian Affairs (OCHA) in Kenya stated that there were over 112 deaths due to conflict of resources in pastoralist areas between January and May of 2011. Compared to the 68 deaths during the same period in 2010, this indicated an increase in deaths due to conflict.

Fisheries

The Fisheries Management and Development Act of 2016 (Act No. 35 of 2016) established the Kenya Fisheries Advisory Council with the function to advise government on policy formulation for fisheries development and management, fisheries resources access and allocation and education and capacity building within the sector. Furthermore, this Act also established Kenya Fisheries Service, which is responsible for the conservation, management and development of Kenya's fisheries resources.

3.2.8.4 Drought management

The National Drought Management Authority (NDMA) is a public body established by the National Drought Management Authority Act of 2016. It has the mandate to exercise overall coordination over all matters relating to drought management including implementation of policies and programmes relating to drought management. The NDMA provides a platform for long-term planning and action, as well as a mechanism for solid coordination across Government and with all other stakeholders. The Authority has established offices in 23 ASAL counties considered vulnerable to drought.

Although the WRA implements water use restrictions during times of drought, reference water levels for the restrictions are not clearly determined, leading to operational issues. The inadequate drought disaster management programme and plan is likely due to inadequate technical expertise in drought planning.

3.2.8.5 Soil conservation

Soil conservation as a component of conservation agriculture practices is critical from an agriculture/water resources management perspective. A new policy framework on Soil Management in Kenya, compiled by the MoALF, is currently in Final Draft form and will soon be in place.

The key institutions involved with soil management in Kenya include the MoALF, the National Agricultural Soil Management Agency (to be established with the mandate of overseeing and regulating the nations' soils' resource use and management), KALRO, Universities and other institutions of higher learning, AFFA, KEPHIS, MENR, NEMA, KEBS, Radiation Board and the NLC.

Overall there is a need to upgrade existing laboratory facilities as well as construct new facilities at ROs and SROs in order to improve operational efficiency of the WRA. For example, the WRA laboratory facilities in Murang'a SRO are not equipped to analyse certain parameters regarding water quality such as Total Suspended Solids (TSS).

Partnerships are very important for different categories of users within the basins. Initial discussions with WRA indicate that there are a few partnerships in place, majority being nationwide partnerships with key strategic partners whose focus is nationwide. Given the strategic need to have more localised partnerships e.g. with industries in the basins etc., more effort needs to be vested in ensuring this becomes a reality. This is particularly needed as some of the potential partners have already entered into agreements with other players on the ground such as KFS, NEMA, Kenya Water Towers Agency (KWTA), NGOs etc.

3.2.8.6 Climate adaptation

The Climate Change Act of 2016 makes provision for the establishment of the National Climate Change Council (NCCC) which will give oversight and guidance on the integration of climate into the national development and policy-making processes. The NCCC will ensure that climate change is treated as a cross-cutting developmental and environmental issue. The coordination of climate change activities is currently the responsibility of the National Climate Change Secretariat (NCCS) in the MoEF. The NCCS works with climate change coordination units in different ministries, departments and agencies to ensure that climate change is mainstreamed in the different sectors of the economy. NEMA is a National Implementing Entity (NIE) for the Adaptation Fund and the Green Climate Fund (GCF). The National

Treasury is the National Designated Authority for the GCF. The NDMA oversees adaptation and resilience building in the ASALs.

The GoK has developed various climate change tools to steer climate change response including and not limited to the National Climate Change Action Plan (Government of Kenya, 2013e), NDC submitted to UNFCCC in 2016 and the National Adaptation Plan (Government of Kenya, 2016a). The issue arises with inadequate knowledge and ability to implement these adaptation strategies as well as insufficient staff capacity. Available funding and investments for continuous implementation, assessment and maintenance of the strategies poses an issue. WRA does not have a department or desk to specifically address climate change issues, rather climate change is blended into programme and project activities on a case by case basis.

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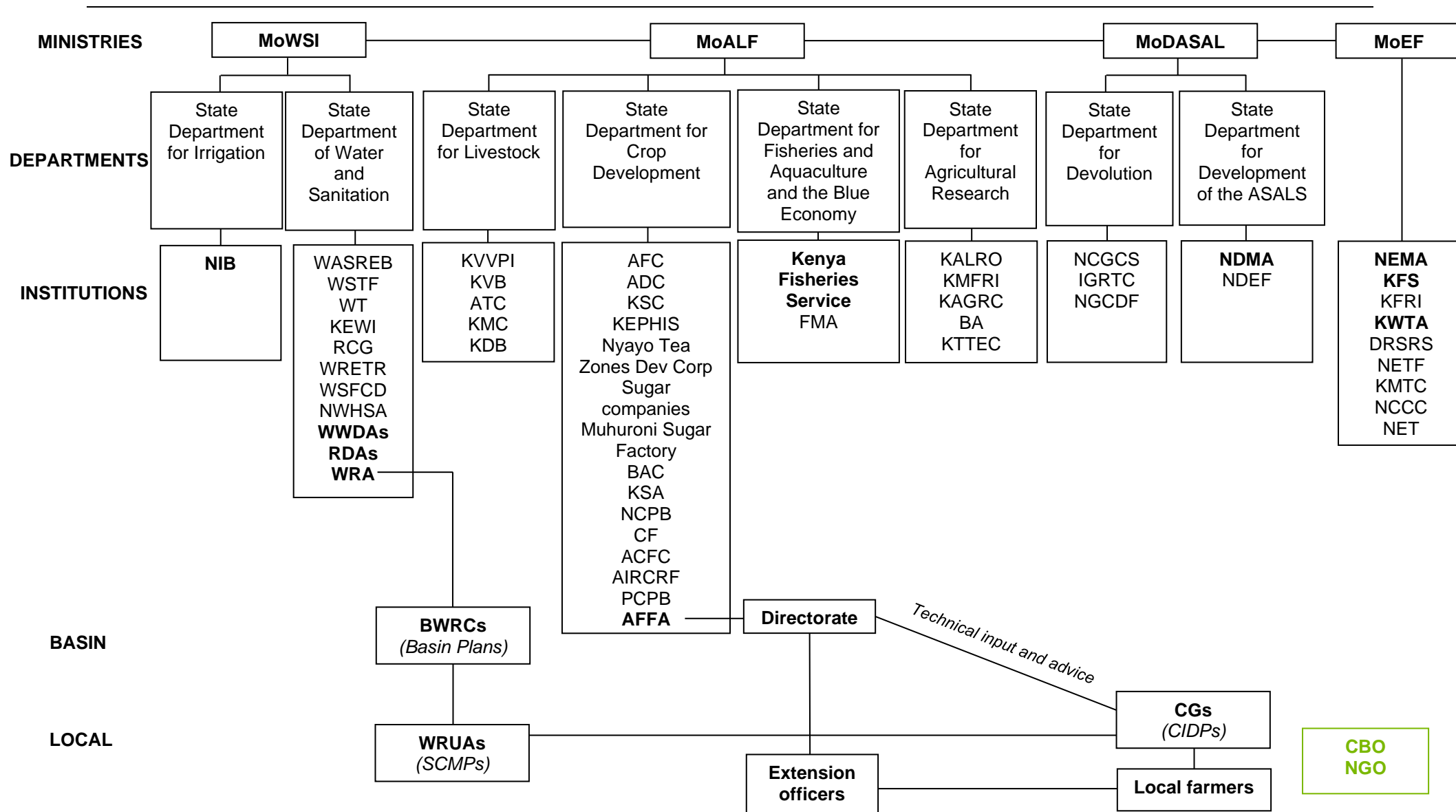


Figure 3-2: Key institutions involved in the agriculture sector in Kenya

3.3 Existing Planning

3.3.1 Agriculture

3.3.1.1 Agricultural Sector Development Strategy (2010-2020)

The Agricultural Sector Development Strategy (ASDS) (Government of Kenya, 2010a) is the overall national policy document for the sector ministries and all stakeholders in Kenya. The overall development and growth of the sector is anchored in two strategic thrusts: increasing productivity, commercialization and competitiveness of agricultural commodities and enterprises; and developing and managing key factors of production. This will require support from enabling sectors such as the water and environmental sector. Strategic objectives include the need to rehabilitate and protect water catchments due to issues such as increased runoff, flash floods, reduced infiltration, erosion and siltation, and limited water resource base. Improved water security will also assist in achieving the overall goal of increased agricultural productivity.

3.3.1.2 Irrigation and Drainage Master Plan

The overarching objective of the Irrigation and Drainage Master Plan (MoWI, 2009) were to identify and map out the irrigation and drainage potential and formulate an irrigation and drainage sector master plan to guide and facilitate quick development of the potential irrigation land. Short term, medium term and long-term development plans and strategies were developed to meet the irrigation and drainage potential in accordance with the Kenya Vision 2030 targets. Specific objectives included determine and map out surface and ground water resource potential for irrigation including possible water storage for all drainage basins; for each of the water resources identified, delineate and map out all the possible irrigation areas for all the basins in terms of irrigation suitability classes based on the soils and topography and water resources; identify and map out all the seasonally water logged agricultural areas and classify them on the basis of suitability for drainage / flood protection and water management for purpose of growing crops; determine unit cost for the development of the irrigation and drainage potential as per irrigation systems; identify possible constraints that hamper development of irrigation and drainage and recommend possible measures; and develop short term, medium term and long term development plans and strategies to develop the irrigation and drainage potential and meet or surpass the Kenya Vision 2030 targets.

For the irrigation development sub-sector, the following interventions were highlighted in the Master Plan to increase agricultural production: finalising and implementing the national irrigation policy and legal framework; intensifying and expanding irrigation; improving rainwater harvesting and storage for agriculture; rehabilitation and protecting water catchments; and implementing the irrigation flagship projects.

3.3.1.3 SDDA Strategic Plan (2018-2022)

The SDDA Strategic Plan focuses on four key areas: coordination of development in ASALS, resilience building, social and cultural integration and governance. Lessons learnt from the previous planning period (2013-2017) were the need to strengthen collaboration mechanisms to support coordination of activities in the ASALS and the need for a coordinated multi-sectoral approach to implementation of development programmes in the ASALS for maximum benefit to the communities.

3.3.1.4 Ending Drought Emergencies initiative (2014-2022)

The Kenya Ending Drought Emergencies (EDE) (Government of Kenya, 2014) initiative is an approach that recognises that droughts cause emergencies. The EDE is part of the second Kenya Vision 2030 Medium Term Plan and is being implemented through a common programme framework that will ensure stronger alignment and coordination of investment and activity between the National Government, the county governments and Development Partners. The EDE strategy builds on the National Policy for the Sustainable Development of Northern Kenya and other Arid Lands. It commits the government to end the worst of the suffering caused by drought by 2022, using two main strategies. The first is to strengthen the basic foundations for growth and development, such as security, infrastructure and human capital; the second is to strengthen the institutional and financing framework for drought risk management. The EDE initiative will accelerate investment in development foundations as well as strengthen the institutions responsible for managing drought risks.

3.3.1.5 Kenya Climate Smart Agriculture Strategy (2017-2026) and Implementation Framework (2018-2027)

The Kenya Climate Smart Agriculture Strategy (Government of Kenya, 2017) is based on the fact that the changes in climate and weather patterns will expose the rain-fed farming systems, especially the arid and semi-arid lands, to more climate related vulnerabilities. This will predispose farming communities to food insecurity and poverty through loss of the productive assets and the weakening of coping strategies and resilience. On the other hand, the agriculture sector contributes to the climate change problem through emissions arising from inefficiencies in crop, livestock, fisheries and forestry production systems. These inefficiencies lead to greater levels of enteric fermentation in livestock, poor manure and agro-based waste management systems, improper land preparation systems, inefficient input and resource use in crop management systems as well as inefficiencies that raise emissions from agro-based machinery. Innovative and transformative measures are therefore urgently required to assist stakeholders in the sector across the agricultural value chains to cope with effects of current and projected change in climate patterns. Climate smart agriculture (CSA) has been identified as a viable approach to provide solutions towards increased agriculture sector productivity while addressing impacts of changing climate. CSA involves farming techniques which are meant to reduce water supply needs and increase resilience to changes in rainfall.

3.3.1.6 Agricultural Sector Transformation and Growth Strategy and National Agriculture Investment Plan (2019-2024)

Kenya's National Agriculture Investment Plan (NAIP) for 2019-2024 is the five-year investment plan accompanying the country's 10-year Agriculture Sector Transformation and Growth Strategy (ASTGS). The NAIP is designed to accelerate Kenya's agricultural transformation in alignment with the Big Four Presidential Agenda, Comprehensive Africa Agriculture Development Programme (CAADP), the United Nations Sustainable Development Goals (SDGs) and Kenya's Medium-Term Plan III. The ASTGS introduces nine flagships under three anchors and enablers. Those linked to the water sector are as follows:

- Anchor 2 – Increase agricultural output and value addition
 - FLAGSHIP 4: Unlock 50 new large-scale private farms (bigger than 2,500 acres) and sustainable water supply for more than 150,000 acres of irrigation from existing infrastructure
- Anchor 3 – Boost household food resilience
 - FLAGSHIP 6: Boost the food resilience of 1.2 million farming and pastoralist households in arid and semi-arid lands (ASALs) through community-driven intervention design
- Enablers
 - FLAGSHIP 9: Monitor two key food system risks - those addressing sustainability and climate, and a second category for crisis management for pests, diseases and global price shocks

3.3.2 Water resources management and development

3.3.2.1 National Water Master Plan

The NWMP 2030 was completed in 2013 and covers all six river basins in Kenya. For each basin, the NWMP 2030 provides information related to water resources, water demands, high level water allocations, economic evaluations of proposed interventions and implementation programmes. In addition, the NWMP 2030 presents development plans related to water supply, sanitation, irrigation, hydropower and water resources. The aim of the plan was to form a framework for the development and management of Kenya’s water resources in line with the country’s social and economic development goals. The specific objectives of the NWMP 2030 were set based on the National Water Policy 1999, as well as the targets identified in the Kenya Vision 2030. The NWMP 2030 includes nine Sectoral Development Plans covering different sectors.

3.3.2.2 Regional development plans

The RDAs within the six basins (Table 3-4) are responsible for development activities within their respective areas of jurisdiction. The development plans of these regional bodies will need to be updated with the proposed development options from the Basin Plans and will need to consider agriculture as a key component to ensure the sustainability of the proposed developments. The RDAs provide many opportunities in attracting investments related to agricultural development to achieve sustainability and complement the government’s efforts in wealth and employment creation.

Table 3-4: Regional development bodies

Basin	Development Authority
Athi	Tana and Athi River Development Authority (TARDA)
	Coast Development Authority (CDA)
Tana	Tana and Athi River Development Authority (TARDA)
	Coast Development Authority (CDA)
LVS	Lake Basin Development Authority (LBDA)
LVN	Lake Basin Development Authority (LBDA)
RV	Kerio Valley Development Authority (KVDA)
	Ewaso Ng’iro South Basin Development Authority (ENSDA)
ENN	Ewaso Ng’iro North River Basin Development Authority (ENNDA)

3.3.2.3 Catchment management strategies (2015-2022)

Each of the six basins have a Catchment Management Strategy (CMS) for the period 2015-2022. The CMS provides a vision and framework for the management of water resources and related land resources in the basins and outlines how the concept of integrated water resources management should be implemented at catchment level. It proposed water resources and related strategies for:

- **Protection of the right to water:** Management approaches; Water balance and demand management; Water allocation and use management
- **Water resource protection:** Water resource protection; Catchment protection and conservation
- **Resource augmentation adaptation and development:** Flood and drought management; Climate change adaptation; Water resources infrastructure development; Rights based approach; Livelihoods enhancement
- **Implementation, information management and financing:** Institutional strengthening; Monitoring and management; Financing and implementation

Strategic activities relating to agriculture fall under the catchment protection and conservation strategy and include promotion of productive and sustainable agricultural practices and harmonization of programmes in rehabilitation of land use, agriculture, forests, wildlife and settlement.

3.3.2.4 Sub-catchment management plans

WRA has delineated Kenya into 1 237 sub-catchment areas with the intention of forming WRUAs for each. These WRUAs are at varying stages of development across the country (Table 3-5). The sub catchment management plan (SCMP) is a planning tool that is developed by the WRUAs under regulation by the WRA. Its main objective is to guide the implementation of water resources management and regulation activities within a defined period of time in any given sub catchment. The activities, in most cases, relate to catchment protection, pollution control and water infrastructure development. Being the lowest planning tool developed to implement the National Water Master Plan and the basin area plan, it is directly held in the custody of the WRUAs who are in charge of its implementation. The plan is a resource mobilization tool that the WRUA uses to source for implementation funds and other resources.

The Constitution 2010, Fourth Schedule Part 2, section 10, outlines water resource management as a function of the county government. This devolvement of the conservation role to the counties creates a direct linkage between the SCMP and the County Integrated Development Plan (CIDP). The county sets aside funds for the management of catchments that are absorbed through the implementation of SCMP or directly through CIDP identified activities. The regulation of the process to ensure the catchments are well protected and the harmony of the two planning perspectives rests with the Authority.

The six Basin Plans have been used as a reference document in the preparation of the SCMPs. As SCMPs are the resource mobilization tool for the WRUAs, these will have an impact on the land and water resources within protected areas and tourist destinations.

Table 3-5: Stages of formation of WRUAs and number of SCMPs developed

	Athi	Tana	LVS	LVN	RV	ENN
No. sub-catchments	309	240	137	106	175	270
WRUA formed	150	170	106	94	83	92
SCMPs developed	53	77	46	34	48	50

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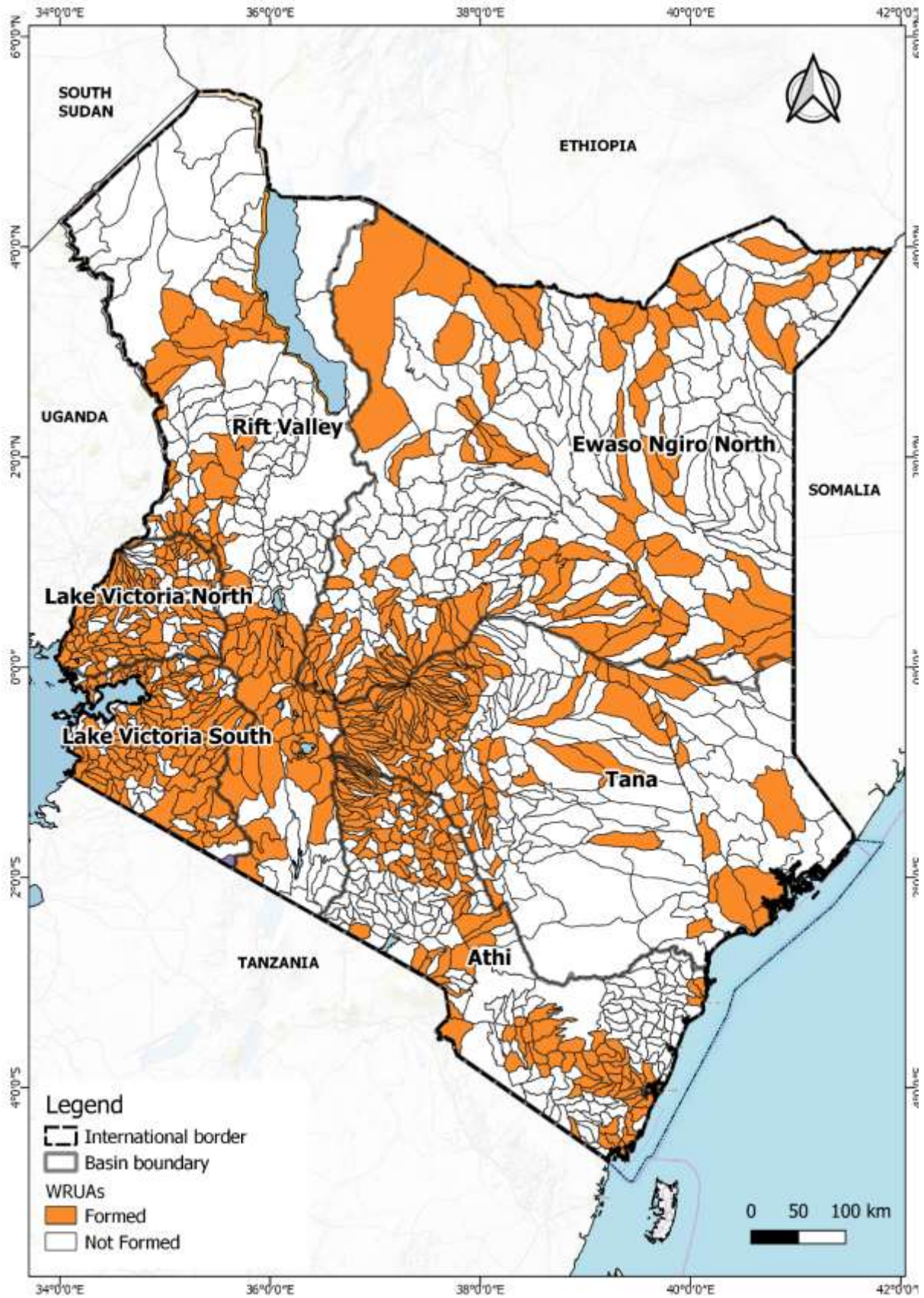


Figure 3-3: WRUA status

3.3.2.5 Projects planned by Water Works Development Agencies

Following the enactment of the Water Act 2016, Water Services Boards (WSBs) have transformed into Water Works Development Agencies (WWDAs). The WWDAs have ongoing and proposed projects that vary from rehabilitation of water supply schemes, extension of service lines, construction of storage tanks and drilling and equipping of boreholes in all the counties, to major dam and water resource projects. The projects planned by WWDAs will need to be updated with the proposed development options from the Basin Plans.

Table 3-6: Water Works Development Agencies in the six basins of Kenya

Basin	Development Agency
Athi	Athi Water Works Development Agency (AWWDA)
	Tanathi Water Works Development Agency (Tanathi WWDA)
	Coast Water Works Development Agency (CWWDA)
Tana	Tana Water Works Development Agency (Tana WWDA)
	Coast Water Works Development Agency (CWWDA)
	Northern Water Works Development Agency (NWWDA),
	Tanathi Water Works Development Agency (Tanathi WWDA)
LVS	Lake Victoria South Water World Development Agency (LVSWWDA)
	Rift Valley Water Works Development Agency (RVWWDA)
LVN	Lake Victoria North Water Works Development Agency (LVNWWDA)
RV	Rift Valley Water Works Development Agency (RVWWDA)
ENN	Northern Water Works Development Agency (NWWDA)

3.3.3 Environmental management

3.3.3.1 NEMA strategic plan (2019-2024)

The NEMA strategic plan provides a situational analysis of the previous strategic plan and outlines future objectives and strategies. The objective of promoting a sustainable blue economy and promoting green and circular economy will require cooperation with the agriculture and water sectors. Key challenges with the previous strategic plan period (2013-2018) were inadequate funding, low implementation of the devolved environmental functions, overlap in mandates with lead agencies and poor land use planning.

3.3.3.2 Kenya National Adaptation Plan (2015-2030)

The Kenya National Adaptation Plan (NAP) (Government of Kenya, 2016) provides a background of Kenya's national circumstances, including socio-economic circumstances; and future climate scenarios that the country needs to consider in decision making, planning and budgetary processes. A vulnerability analysis is also presented against the identified hazards in the National Climate Change Action Plan (NCCAP), namely drought, floods, and sea level rise. It proposes macro-level adaptation actions and sub-actions in 20 planning sectors (including agriculture), categorising them into short-, medium- and long-term time frames. For each sector, the NAP identifies gaps, estimates costs of the macro-level actions projected to 2030, and identifies key institutions required for their implementation. It also proposes adaptation indicators at county, sectoral and national levels for monitoring and evaluation (M&E).

An institutional challenge is the lack of a centralised climate finance tracking system, which disables the government to effectively track its climate change initiatives and the costs thereof. The Kenya Climate Fund was proposed by the NCCAP, discussed further below. It is critical that the government

addresses this to improve management, coordination and reporting of climate finance, which will also assist in future applications for financial assistance. Other than financial gaps, the NAP identifies awareness, capacity building, technology and research as major gaps in most of the sectors.

3.3.3.3 National Climate Change Action Plan and National Adaptation Plan (2018-2022)

The NCCAP (Government of Kenya, 2013) framework is highly relevant to the link between agriculture and water resources planning and management. Climate change is a major risk enhancer in relation to water security and agriculture. The NCCAP supports efforts towards the implementation of the Kenya Constitution 2010 and the attainment of Vision 2030. It addresses the enabling aspects of finance, policy and legislation, knowledge management, capacity development, technology requirements and monitoring and reporting. The comprehensive NCCAP document is supported by almost sixty technical reports developed by teams of international consultants guided by Kenya based thematic working groups and under the oversight of a multi-sectoral multi-stakeholder taskforce.

3.3.3.4 Kenya Forest Services Strategic Plan (2017-2022)

According to the KFS Strategic Plan (2017-2022) the KFS flagship projects involve rehabilitation of water towers (i.e. Mau Escarpment, Mt. Kenya, Aberdare Ranges, Cherangany Hills and Mt. Elgon) and management of water catchments; conservation and management of mangroves forests; farmland and dry land tree-planting initiative; forest plantation development; forest protection and security programme; promotion of bamboo establishment and utilization; and control of invasive species. Tree planting is being promoted in order to realise the 10% forest and tree cover increase by 2030 and promotes commercial tree species in ASALs in order to control desertification and improve livelihoods.

The Forest Management and Conservation division under the KFS is charged with the management and conservation of the natural forests in Kenya, of which most form water towers. Strategic outputs involve increasing percentage cover through tree planting and gazettement of new forests; as well as improving livelihoods. The Division includes forest biodiversity conservation, participatory forest management and fire management, natural forest management, licencing and eco-tourism.

3.3.3.5 Upper Tana-Nairobi Water Fund

The Nature Conservancy (TNC) has developed a business case for the Upper Tana-Nairobi Water Fund. Current partners and investors are: Nairobi City Water & Sewerage Company, Kenya Electricity Generating Company (KenGen), Pentair Inc, Coca Cola, East Africa Breweries Ltd, International Centre for Tropical Agriculture (ICTA), Global Environment Facility (GEF), The Government of Kenya, Water Resources Management Authority (WRMA), Tana & Athi Rivers Development Authority (TARDA), International Fund for Agriculture (IFAD) and Frigoken Kenya Ltd. The fund's business case showed that a \$10 million USD investment in water fund-led conservation interventions is likely to return \$21.5 million USD in economic benefits over a 30-year timeframe.

3.3.3.6 Green Climate Fund

The GCF was established by the UNFCCC in 2010. Its purpose is to provide financial support for initiatives by developing countries in mitigating their greenhouse gas emissions and in response to climate change. The GCF mobilises resources mainly from developed countries and channels it towards communities that are most vulnerable to the effects of climate change, including Least Developed Countries and African States. The Fund has enabled direct access to national and sub-national organisation, so that international intermediaries are not a necessity. NEMA in Kenya and the Acumen Fund, Inc., in sub-Saharan Africa and South Asia, are two entities with accredited direct access relevant to Kenya. Currently, the GCF has supported eight projects in Kenya by providing about 800 million USD.

3.3.4 County Integrated Development Plans

CIDPs are prepared every five years by counties as a road map for development. The plan touches on all sectors devolved to county governments, providing a plan towards improvement. Catchment protection and water and sanitation services are devolved functions and as such feature in all CIDPs.

A review of the CIDPs showed that planned activities related to agriculture mainly revolve around development of new water sources including boreholes and small dams/pans, promoting and providing extension services for conservation agriculture, increased livestock and fisheries productivity through enabling policy, and improving market access for the sub-sectors.

The key development aspects of each CIDP which are relevant to water resources management in the counties related to agriculture are briefly described in Table 3-7.

Table 3-7: Key aspects of the CIDP in relation to agriculture

Basin	County	Agriculture
Athi	Kiambu CIDP (2018-2022)	Programmes include improved extension services; an enabling policy for increased productivity; increased productivity through conservation agriculture, farming resources, soil and water conservation, increased area under irrigation, agricultural mechanization services, upgrading of Waruhiu Agricultural Training Centre (ATC), agricultural inputs and financing; increased fisheries productivity through enabling policy, aquaculture development and marketing; increased livestock productivity through enabling policy, livestock production and management, disease management, product value addition and marketing.
	Nairobi CIDP (2018-2022)	Agro-based industries are located in the high agricultural potential areas with poor linkages to markets. The county intends to enhance access for these industries. On-going projects include: installation of green houses and water harvesting; construction of poultry units/rabbit hutches/fish tanks for youth groups. New projects include construction of fish ponds and fish markets, establishment of multi-storey gardening units and installation of food processing machines.
	Machakos CIDP (2018-2022)	Programmes include enabling policy, mechanisation, farming resources, improved extension services, disease management, soil and water conservation, irrigation schemes and earth dams, greenhouses, diversified agro-enterprises, conservation agriculture, priority value chains, increased indigenous livestock, adoption of appropriate fodder and forage under different climatic zones, increased livestock productivity, improved income from sale of livestock, increased fish production, improved cooperative functioning.
	Kajiado CIDP (2018-2022)	Programmes include improving extension services, reduced incidence of crop pest and disease attack, supply of agricultural machines, soil and water conservation, supply of farm inputs, post-harvest management, small scale irrigation and value addition, climate smart agriculture promoted and Agricultural Sector Development Support Project (ASDSP II).
	Makueni CIDP (2018-2022)	Agriculture is considered to be a sector which enhances household income and is a priority for economic empowerment in the county. Increased productivity will be achieved through fruit and other horticultural crops development, production and marketing of drought tolerant cereals and legumes, enhancing agricultural mechanisation, integrated beef and marketing, dairy development, honey development, enhancing feed and fodder production, crop and livestock pest control. Improved food security will be promoted through irrigation and water conservation and enhancing access to farm inputs. Reduced post-harvest losses will also be managed.

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Basin	County	Agriculture
	Taita Taveta CIDP (2013-2017)	Agriculture growth is being promoted through improving food security and incomes of farmers. Agro-processing and value addition is also promoted. The livestock and fisheries industry are also to be improved. On-going projects include procurement of seed, plantlets and seedlings; procurement of fertilizer and manure; desilting and excavating water pans; irrigation and agro-processing materials; rehabilitation of farms; livestock improvement project; fish ponds.
	Kwale CIDP (2013-2017)	Programmes include improved extension services, establishing disease-free zones, farmers production and marketing cooperatives, irrigated agriculture along major rivers and introduce rain water harvesting, affordable farm inputs.
	Kilifi CIDP (2018-2022)	78.5% of the county is agricultural land, over 90% of the population depend on agriculture, dependent of rain-fed agriculture. Programmes include modernizing, promoting capacity building, improving production, livelihoods, dairy and beef cattle farming, fish production and marketing, land regularization and research and development.
	Mombasa CIDP (2018-2022)	Programmes to improve agriculture include crop development through support services, farmer inputs, marketing and value addition and post-harvest management; livestock development through support services, livestock productivity management and marketing and value addition; fisheries development through support services, fish production management and marketing and value addition; and co-operatives development.
Tana	Nyeri CIDP (2018-2022)	Programmes include agricultural management (i.e. crop development, fish production management and extension programmes), agricultural training services, livestock production management, veterinary services and agriculture mechanization services. Flagship projects include establishing the Wambugu ATC Centre of Excellence.
	Murang'a CIDP (2018-2022)	Programmes include training and extension services, food and nutrition, livestock support services, veterinary disease and pest control, livestock breeding and fisheries support services. Flagship projects include the Dairy Development Programme and the Fruit Trees Development Programme.
	Kiambu CIDP (2018-2022)	Programmes include improved extension services; an enabling policy for increased productivity; increased productivity through conservation agriculture, farming resources, soil and water conservation, increased area under irrigation, agricultural mechanization services, upgrading of Waruhiu ATC, agricultural inputs and financing; increased fisheries productivity through enabling policy, aquaculture development and marketing; increased livestock productivity through enabling policy, livestock production and management, disease management, product value addition and marketing.
	Kirinyaga CIDP (2018-2022)	Programmes include livestock resources management and development (i.e. livestock disease management and control, livestock extension and capacity building and aquaculture development), crop development and management.
	Embu CIDP (2013-2017)	Programmes include livestock development and management, veterinary services management, crop development and management and food security schemes (e.g. fisheries development and management), irrigation development and management (i.e. water harvesting and irrigation schemes, irrigation schemes infrastructure development). Flagship programmes include developing new markets, improving access roads, expanding irrigation works and implementing post-harvest management systems. Ongoing projects include Karambari Earth Dam and ALLPRO shallow well improvement.
	Tharaka-Nithi CIDP (2018-2022)	Programmes include crop production, livestock development, veterinary services and fisheries development. Flagship projects include establishing a Livestock Improvement Centre and the Integrated Aquaculture Irrigation Project.
	Meru CIDP (2018-2022)	Programmes include crop development, tree crop development, soil conservation, fertility management and water harvesting, inputs supply support, value addition/agro-processing, livestock production and management, veterinary services, fisheries development and agriculture mechanisation.

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Basin	County	Agriculture
	Isiolo CIDP (2018-2022)	Programmes include the rehabilitation and expansion of irrigation schemes, providing increased agriculture mechanisation services, crop development and management, agribusiness and market development, livestock market development, training and extension services, veterinary services management, fisheries and cooperative development.
	Garissa CIDP (2018-2022)	Programmes include crop production and management, livestock production and management, fisheries and cooperative development.
	Tana River CIDP (2018-2022)	Programmes include food security, improved nutrition and sustainable agriculture (i.e. irrigation development, agribusiness development, extension and capacity building, nutrition and food safety), agricultural infrastructure development, livestock extension services, livestock marketing, drought mitigation, veterinary services and fisheries services.
	Kitui CIDP (2018-2022)	Programmes include crop development and food security, agribusiness development (i.e. agricultural extension services, livestock development, veterinary services and fisheries development. Flagship project include the Beekeeping and Honey Production Project and the Ndengu Revolution Project.
	Machakos CIDP (2018-2022)	Programmes include enabling policy, mechanisation, farming resources, improved extension services, disease management, soil and water conservation, irrigation schemes and earth dams, greenhouses, diversified agro-enterprises, conservation agriculture, priority value chains, increased indigenous livestock, adoption of appropriate fodder and forage under different climatic zones, increased livestock productivity, improved income from sale of livestock, increased fish production, improved cooperative functioning.
	Kilifi CIDP (2018-2022)	Programmes include modernizing, promoting capacity building, improving production, livelihoods, dairy and beef cattle farming, fish production and marketing, land regularization and research and development.
	Lamu CIDP (2018-2022)	Programmes include extension advisory services, crop production and productivity (i.e. farm mechanisation, pest and disease control, climate change adaption), value addition, fisheries development services, veterinary services, livestock production and productivity. Flagship projects include the Mega Irrigation Project, the establishment of a cotton ginnery and a fruit processing factory plant.
LVS	Kisumu CIDP (2018-2022)	Programmes include irrigation schemes infrastructure development, livestock development and management, fisheries development and management. Flagship programmes include rice production development, expansion of the Mboha, Nyamthose and Kano irrigation schemes.
	Kericho CIDP (2018-2022)	Programmes include livestock development and management, crop development and management, fisheries development and management.
	Vihiga CIDP (2018-2022)	Programmes include crop and land development, apiculture (bee keeping) initiatives, veterinary services, livestock production and management, agricultural extension services, promotion of fish farming, promotion of smallholder irrigation and greenhouse farming, crop diseases and pest control.
	Siaya CIDP (2018-2022)	Programmes to improve and grow agriculture include expanding the extension services, increasing the land under irrigation, increasing the quality and quantity of farm produce, improving storage of farm produce, enhancing livestock disease control, improving access to markets, making fish stocks more sustainable, improving storage of harvested fish, making credit more available to farmers. Flagship projects applying to the whole county include subsidising farm inputs and implementing the multi strategic food reserve. Flagship projects located in Siaya are: a mechanisation project, and the modernisation of the Siaya Agricultural Training College.
	Kisii CIDP (2018-2022)	Programmes include crop and livestock development, (i.e. extension and training services, pest and disease control, crop marketing services, dairy production, value addition/agro-processing), fisheries development, veterinary services and agricultural training services.

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Basin	County	Agriculture
	Nyamira CIDP (2018-2022)	Programmes include crop development, agribusiness development and value addition, livestock development and management, fisheries development and management. Flagship programmes include establishing the Nyamira Fish Multiplication Training Centre and the Agricultural Resource Centre in Kitaru, Borabu Sub-county.
	Homa Bay CIDP (2018-2022)	Programmes include crop development services, livestock development, fisheries development, agribusiness development services, food security enhancement (i.e. climate smart agriculture) and veterinary services.
	Migori CIDP (2018-2022)	Programmes include crop development and management (i.e. improving agricultural productivity and value addition), livestock production services, veterinary services and fisheries development. Flagship projects include the County Agriculture Integrated Input Access Project.
	Nandi CIDP (2018-2022)	Agriculture is a vital source of income for households and the county; and is a priority for economic empowerment in the county. The goal for the sector is to increase food and nutritional security, commercialisation of agriculture, and effective and efficient marketing systems in the sector. This will be achieved through crop and livestock development, increased access to irrigation, soil and water conservation, and increased agricultural extension and training. Flagship projects planned for implementation throughout the county include the installation of a milk processing plant, a maize milling plant, a coffee milling plant, soil fertility management, poultry hatcheries and artificial insemination services and milk coolers.
	Bomet CIDP (2018-2022)	Programmes include improving administration and support services, crop development and management, livestock, fisheries and veterinary services, establishing agricultural training centres and the Bomet Tea Agency.
	Narok CIDP (2018-2022)	Programmes include training and extension services, sustainable environmental management and inclusion, crop development and management, fisheries development and management and veterinary services development.
	Nakuru CIDP (2018-2022)	Programmes include training and extension services, livestock resource management and development, crop development and fisheries development.
LVN	Bungoma CIDP (2018-2022)	Sector priorities are to increase agricultural production and productivity; increase access to critical farm inputs (including access to water and irrigation), improve agricultural markets and value addition; and strengthen institutional capacity.
	Busia CIDP (2018-2022)	Agriculture will be modernised by the development of Agriculture and Extension Policy; development of Land Use Policy; increasing investment in irrigation agriculture, crops and livestock diversification and the maintenance of indigenous genetic seed banks. Rain fed agriculture areas with growth potential were identified as Teso South, Teso North and Nambale. Areas of irrigated agriculture and livestock were identified as Samia, the Bunyala Matayos "Blue economy" and Bunyala.
	Kakamega CIDP (2018-2022)	Programmes include: improving agricultural extension services as well as research and training; promotion of climate smart agricultural practices; livestock development; increasing area of land under irrigation; increasing fish productivity and production; and increasing crop production and productivity;
	Trans Nzoia CIDP (2018-2022)	Programmes include land, soil and water conservation, promotion of climate smart agriculture, capacity building, increasing agricultural productivity and profitability, livestock productivity improvement including livestock disease control, promotion of fisheries, promotion of crop diversification, and the establishment of model farms and an Agricultural Training Centre.

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Basin	County	Agriculture
	Uasin Gishu CIDP (2018-2022)	Investing in increased agricultural production and productivity will ensure food security and improved nutritional status for the residents of the county. Programmes to achieve this include increasing livestock, crop and fish production and by adding value to agricultural products. Extension services will be improved, post-harvest management will be supported through provision of adequate storage facilities and driers, farm inputs (e.g. seeds, fertilizers and artificial insemination) will be subsidised, especially for small scale farmers, livestock disease will be controlled, irrigation and greenhouse farming will be initiated, agriculture will be mechanized, and fish farming will be promoted.
	Nandi CIDP (2018-2022)	Agriculture is a vital source of income for households and the county; and is a priority for economic empowerment in the county. The goal for the sector is to increase food and nutritional security, commercialisation of agriculture, and effective and efficient marketing systems in the sector. This will be achieved through crop and livestock development, increased access to irrigation, soil and water conservation, and increased agricultural extension and training. Flagship projects planned for implementation throughout the county include the installation of a milk processing plant, a maize milling plant, a coffee milling plant, soil fertility management, poultry hatcheries and artificial insemination services and milk coolers. A category B slaughterhouse will be constructed at Kapsabet, heifer development and a seed multiplication centre will be established at Kaimosi and Kimwani, and the Kaimosi ATC will be revamped, and a seedling nursery, animal feed mill and a Farm Demonstration Unit will be established there.
	Siaya CIDP (2013-2017)	Programmes to improve and grow agriculture include expanding the extension services, increasing the land under irrigation, increasing the quality and quantity of farm produce, improving storage of farm produce, enhancing livestock disease control, improving access to markets, making fish stocks more sustainable, improving storage of harvested fish, making credit more available to farmers. Flagship projects applying to the whole county include subsidising farm inputs and implementing the multi strategic food reserve. Flagship projects located in Siaya are: a mechanisation project, and the modernisation of the Siaya Agricultural Training College.
	Vihiga CIDP (2018-2022)	Programmes to improve agriculture include improving crop, livestock and fish production and productivity through increased support services, farmer inputs, marketing and value addition and post-harvest management; and the development of co-operatives. Flagship projects are: the upgrading of Mwitoko fish Farm in Luanda; banana value chain development and commercialisation; and county subsidies for farm inputs such as fertiliser and certified seeds.
	Elgeyo Marakwet CIDP (2018-2022)	Programmes include crop development, agricultural extension and training services, sustainable land management, irrigation, livestock development, trade and industry development, cooperative development, veterinary services, tourism development, and trade and industry development.
RV	Turkana CIDP (2013-2017)	Programmes include developing agricultural markets and products, establishing a training centres for farmers, expanding existing irrigation schemes and providing agricultural mechanisation. Flagship projects include developing an Integrated Food Security Master Plan and developing innovative agricultural technologies.
	West Pokot CIDP (2018-2022)	Programmes include crop development and management, agribusiness development and marketing, irrigation development and management, livestock production, livestock disease management and control, fisheries development and management
	Marsabit CIDP (2018-2022)	Programmes include crop and land development, food security initiatives, crop pests and disease management and control, agribusiness and value addition, climate change action plan, contingency for disaster management, livestock production and management, promotion of climate smart practices, Kenya Smart Agriculture Project, beekeeping and veterinary services.

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Basin	County	Agriculture
	Baringo CIDP (2018-2022)	Programmes include crop and land development, fisheries development and management, livestock development and management. Flagship projects include the establishment of Napeleny, Napeikore, Kangoria, Kariron & Kopo-Akalis Irrigation Schemes.
	Nakuru CIDP (2018-2022)	Programmes include training and extension services, livestock resource management and development, crop development and fisheries development.
	Narok CIDP (2018-2022)	Programmes include training and extension services, sustainable environmental management and inclusion, crop development and management, fisheries development and management and veterinary services development.
	Kajiado CIDP (2018-2022)	Programmes include improving extension services, reduced incidence of crop pest and disease attack, supply of agricultural machines, soil and water conservation, supply of farm inputs, post-harvest management, small scale irrigation and value addition, climate smart agriculture promoted and Agricultural Sector Development Support Project (ASDSP II).
	Elgeyo Marakwet CIDP (2018-2022)	Programmes include crop development, agricultural extension and training services, sustainable land management, irrigation, livestock development, trade and industry development, cooperative development, veterinary services, tourism development, and trade and industry development.
	Nyandarua CIDP (2018-2022)	Programmes include crop development, livestock development, veterinary services and fisheries development. Flagship projects include, construction of a potato processing plant and a sugar beet processing plant, bamboo farming, establishing a milk processing plant in OI Kalou and providing countywide agricultural extension services.
	Samburu CIDP (2018-2022)	Programmes include livestock development and management, veterinary services management, crop development and management, food security schemes (i.e. fisheries development and management, irrigation development and management (i.e. water harvesting and irrigation schemes, irrigation schemes infrastructure development). Flagship programmes include promotion of agribusiness, strategic feedlots, disease free compartments, pasture and fodder establishment, promotion of agritourism and ending drought emergencies (i.e. range seeding, livestock identification, slaughter house construction, drought escaping crops and promoting conservation agriculture).
ENN	Laikipia CIDP (2018-2022)	Programmes include livestock development and management, veterinary services management, fisheries development and management, irrigation development and management (i.e. water harvesting and irrigation schemes, irrigation schemes infrastructure development). Flagship programmes include promotion of agribusiness, strategic feedlots, disease free compartments, pasture and fodder establishment, promotion of agritourism and ending drought emergencies (i.e. range seeding, livestock identification, slaughter house construction, drought escaping crops and promoting conservation agriculture).
	Samburu CIDP (2018-2022)	Programmes include livestock development and management, veterinary services management, crop development and management, food security schemes (i.e. fisheries development and management, irrigation development and management (i.e. water harvesting and irrigation schemes, irrigation schemes infrastructure development). Flagship programmes include promotion of agribusiness, strategic feedlots, disease free compartments, pasture and fodder establishment, promotion of agritourism and ending drought emergencies (i.e. range seeding, livestock identification, slaughter house construction, drought escaping crops and promoting conservation agriculture).
	Marsabit CIDP (2018-2022)	Programmes include crop and land development, food security initiatives, crop pests and disease management and control, agribusiness and value addition, climate change action plan, contingency for disaster management, livestock production and management, promotion of climate smart practices, Kenya Smart Agriculture Project, beekeeping and veterinary services.

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Basin	County	Agriculture
	Meru CIDP (2018-2022)	Programmes include crop development, tree crop development, soil conservation, fertility management and water harvesting, inputs supply support, value addition/agro-processing, livestock production and management, veterinary services, fisheries development and agriculture mechanisation.
	Isiolo CIDP (2018-2022)	Programmes include the rehabilitation and expansion of irrigation schemes, providing increased agriculture mechanisation services, crop development and management, agribusiness and market development, livestock market development, training and extension services, veterinary services management, fisheries and cooperative development
	Garissa CIDP (2018-2022)	Programmes include crop production and management, livestock production and management, fisheries and cooperative development.
	Wajir CIDP (2018-2022)	Programmes include irrigation development and management (i.e. water harvesting and irrigation schemes, irrigation schemes infrastructure development), improved extension services, agricultural mechanisation services, training and extension services, veterinary services management, livestock production services, fisheries development and management
	Mandera CIDP (2018-2022)	Programmes include training and extension services, crop production and development, providing agricultural mechanisation services, soil conservation, fisheries development and management, veterinary services management and irrigation development and management (i.e. water harvesting and irrigation schemes, irrigation schemes infrastructure development).

4 Relevant Key Strategic Areas

4.1 Introduction

To comprehensively and systematically address the range of water resources related issues and challenges in the basins and to unlock the value of water as it relates to socio-economic development, ten Key Strategic Areas (KSAs) were formulated for the Basins as presented in Table 4-1. The key aim of these KSAs is to provide a clear way forward for the integrated management and development of the water resources of the basins as a pathway towards a future which achieves a sustainable balance between utilisation and development of water resources and the protection of the natural environment, i.e. minimising environmental and social impacts and maximising socio-economic benefits, taking into consideration the availability of water.

Table 4-1: Key Strategic Areas and Objectives

Key Strategic Area		Strategic Objective
1	Catchment Management	To ensure integrated and sustainable water, land and natural resources management practices
2	Water Resources Protection	To protect and restore the quality and quantity of water resources of the basin using structural and non-structural measures
3	Groundwater Management	The integrated and rational management and development of groundwater resources.
4	Water Quality Management	Efficient and effective management of water quality to ensure that water user requirements are protected in order to promote sustainable socio-economic development in the basin
5	Climate Change Adaptation	To implement climate change mitigation measures in the water resources sector and to ensure water resource development and management are adapted and resilient to the effects of climate change.
6	Flood and Drought Management	To establish and guide a structured programme of actions aimed at ensuring the prevention of, mitigation of, timeous response to, and recovery from, the harmful impacts of floods and droughts across the Basin or specific catchment area.
7	Hydromet Monitoring	An operational and well-maintained hydromet network supported by effective and functional data management and information management systems
8	Water Resources Development	To develop water resources as a key driver for sustainable economic and social development
9	Strengthened Institutional frameworks	To achieve an appropriate balance between operational functionality and the need for effective oversight and governance.
10	Enabling environment	To enhance human and institutional capacities for sustainable management of the water, land, ecosystems and related resources

Strategies and themes which are relevant to the **agricultural sector** under each KSA are presented below. (The Basin Plans provide a comprehensive list of all themes and strategies under each KSA.)

Implementation Plans for the KSAs constitute the next step towards implementation of the strategies and themes under each KSA and are discussed in Section 5.

4.2 Catchment Management

4.2.1 Introduction

Water resources degradation is intimately linked to land degradation and influenced by various catchment management and land use factors. Implementing effective catchment management therefore requires a bigger picture perspective and an understanding of the role of natural resource use within a water resources context. People, animals and plants constitute those components of a catchment that make use of the physical resources of land and water. Misuse of these resource elements will therefore lead to unstable natural and social systems, often resulting in further land and water degradation. Integrated catchment management acknowledges the relationships between households, villages, communities and the broader catchment and envisages that individuals take ownership of their role in catchment management - as opposed to a top-down approach lead by legislation and regulations. This is the cornerstone of Integrated Water Resources Management. A key issue in many catchments in Kenya relates to the influence of population pressures on the existing landscape-biodiversity dynamics. With an increasing demand for natural resources and under the influence of historic-political and socio-economic drivers, the human footprint has pushed many natural systems beyond a stable threshold. Any disruption to the natural system impacts the human population, more so in rural areas where communities still live and work very closely to the natural environment.

The objective of Catchment Management is to enable communities, county governments and other relevant governing bodies and institutions to implement integrated catchment management interventions through increased knowledge. As water is the common link among resource users in a catchment, it is appropriate that the catchment is used as a planning unit for resource management. Integrated catchment management is aimed at deriving the greatest possible mix of sustainable benefits for future generations and the communities in a catchment, whilst protecting the natural resources upon which these communities rely. This approach seeks to maintain a balance between the competing pressures exerted by the need to maintain natural resources in the long-term, against the need for continuous economic growth and use of these resources.

4.2.2 Strategy

Catchment Management is important for the **Agricultural** sector. In order to comprehensively and systematically address the Catchment Management issues and challenges in the basins, Table 4-2 presents specific Themes and Strategies under Catchment Management which are critical for the agricultural sector.

Table 4-2: Strategic Framework - Catchment Management

1	Key Strategic Area:	Catchment Management
1.1	Theme:	Promote improved and sustainable catchment management
1.1.1	Promote sustainable land development and planning	
<p>NEMA Environmental Sustainability Guidelines for Ministries, Departments and Agencies (MDAs) defines sustainability as meaning “meeting the needs of the present without compromising the ability of future generations to meet their own needs”. Sustainability is defined as not being an end goal, but rather a journey that MDAs should take to improve the social equity, environmental, and economic conditions in their jurisdiction.</p> <p>In order to reduce the degradation of land and water resources, a sustainable management approach must be implemented. It is important that resource management activities not only apply to new activities, but rehabilitation of degraded resources is critical in order to ensure sustainable management of ecosystem functions and availability of resources for future generations. Degradation of resources will continue if no action is implemented and resources will be further depleted.</p>		

1	Key Strategic Area:	Catchment Management
MDAs should explore the environmental issues within their operations, develop appropriate interventions and document the same in the form of an environmental sustainability policy.		
1.1.2	Strengthen participatory approaches	
<p>The National Environment Policy (Government of Kenya, 2013a) guiding principles emphasises the inclusion of communities in decision making. These participatory approaches need to be strengthened for sustainable catchment management as communities are closely connected with resources in a catchment. Communities need to take ownership of catchment management activities, and this can be achieved through participatory processes through SCMPs, agricultural extension services and IDPs.</p> <p>The aim of SCMPs is to plan the activities of the sub-catchment in an efficient and sustainable manner to achieve optimum benefits for all in the sub-catchment, through making use of available resources in a sustainable and efficient manner. The process and purpose of a SCMP is to empower the people of the sub-catchment to make decisions and take responsibility for and promote the collective action for the rehabilitation, sustainable management and utilisation of their natural resources. The SCMP is developed by the community of the sub-catchment, for the community of the sub-catchment. The SCMP addresses the resources available to the village community and their needs.</p> <p>Agricultural extension officers and Farmers Field Schools from the AFFA need to be aware of the SCMPs and ensure that catchment management activities fit in with this plan.</p> <p>County Governments are also required to consider the SCMPs in the CIDPs.</p> <p>Appropriate catchment management activities should be considered from theme 1.2. to 1.4.</p>		
1.2	Theme:	Sustainable water and land use and management practices
1.2.1	Promote water conservation and management at catchment level	
<p>Water conservation and management is considered a priority throughout Kenya due to high water use and limited supply. Water is important for both urban use and agricultural use; therefore, water management and access to water are important. Access can be improved through community or household storage of water and through resource protection. Access to water is also improved through water efficiency and through recycling water. Temporal access to water is also important as the seasonality of water resources in various parts of Kenya lead to various outcomes, such as certain areas experiencing water scarce seasons and human/wildlife conflict as pastoralists move into National Parks in search of water.</p> <p>Water resource management has been identified as a strategic objective in most county IDPs, with strategies involving water harvesting, storage and treatment. Catchment management activities that can also be implemented to promote water conservation and management are as follows (Braid & Lodenkemper, 2019):</p> <ol style="list-style-type: none"> 1. Water use efficiency and recycling <p>By improving water efficiency through suitable crop selection, proper irrigation scheduling, effective irrigation techniques, and using alternative sources of water for irrigation, it will be possible to increase water availability and make the water last longer. These also address point source protection of water collection points. These activities should be implemented by smallholder farmers.</p> <ul style="list-style-type: none"> ○ Water use efficiency ○ Wastewater recycling ○ Excess water reuse 2. Water harvesting and storage <p>By providing access to additional water by harvesting water (collecting runoff) and storing water. By harvesting water, farmers can increase the area they irrigate, grow crops in the dry season, and support livestock. Water storage at the household or village level improves access to water, and reduces the labour burden, by reducing the number of trips to boreholes. These activities should be implemented in the semi-arid regions of Kenya. Ridging and swales should be implemented on steep hillslopes where small scale farming is being practiced.</p> <ul style="list-style-type: none"> ○ Roof runoff and storage 		

1	Key Strategic Area:	Catchment Management
		<ul style="list-style-type: none"> ○ Below ground storage ○ Road runoff ○ Ridging ○ Swales <p>3. Groundwater protection and Infiltration</p> <p>By providing information to improve groundwater resources, particularly the infiltration of rainwater into the soil, thereby increasing availability of water stored in the rooting zone and groundwater. Increased water availability in the rooting zone reduces dependence on surface water irrigation and provides increased potential for cultivation during dry seasons. Increased groundwater feeds the spring and improves surface water flow lower down the catchment as well as the level of water in wells close-by. These activities should be implemented as a priority in groundwater recharge zones.</p> <ul style="list-style-type: none"> ○ Contour bunds ○ Zai planting pits ○ Infiltration trenches ○ Spring protection and management
1.2.2	Promote soil conservation and management at catchment level	
	<p>Soil erosion, deforestation, poor agricultural practices, loss of soil fertility, inadequate runoff management and gully formation each contribute to the degradation of land resources with resultant impacts on the catchment both up and downstream. To reduce land degradation, mitigate degradation and implement sustainable land use practices, various aspects of sustainable land management are required. Implementing these techniques and practices will minimise the loss of topsoil (through erosion) and reduce the erodibility of a catchment.</p> <p>The steeper regions of the landscape which do not have a dense vegetation cover are more prone to high levels of erosion than the lower plains. Improved erosion and runoff control measures and sediment trapping will improve resilience to floods and erosion. In the lower plains rangeland management should be implemented to prevent overgrazing. The movement of livestock up slopes and over rivers also needs to be managed as this can lead to eroded paths.</p> <p>Although there are many different parties involved in providing soil conservation and management advice, it is recommended that consensus is built, and a consistent message is given by the SCMPs, CIDPs and Extension Officers.</p> <p>Most of the county IDPs promote soil and water conservation as a key programme, with the objective to promote sustainable land use and environmental conservation. Activities that are promoted are on farm water harvesting structures (i.e. terraces), tree planting during rainy season, use of organic manure, river bank protection, rehabilitation of degraded land and gully control, excavation of water pans, construction of check dams/sand dams and desilting of water pans. Catchment management activities that can be implemented to promote soil conservation and management are as follows (Braid & Lodenkemper, 2019):</p> <ol style="list-style-type: none"> 1. Rangeland management 2. Erosion and runoff control measures 3. Gully management and sediment trapping 4. Stream/River bank management 	
1.2.3	Promote conservation agriculture and improved farm management	
	<p>One of the most important natural resources is the soil. Healthy and fertile soils produce good yields of crops; whereas poor or degraded soils produce low and unreliable yields. Soil health is a function of rooting depth, nutrient fertility, structure, organic matter content, below-ground biodiversity and water holding capacity – all of which are related. Ensuring soils remain healthy and fertile requires a variety of management techniques including climate-smart farming practices and nutrient management.</p>	

1	Key Strategic Area:	Catchment Management
<p>Most of the county IDPs promote soil fertility improvement and agroforestry but a more holistic approach would be to consider conservation agriculture and improved farm management as follows (Braid & Lodenkemper, 2019):</p> <ol style="list-style-type: none"> 1. Climate-smart agriculture <ul style="list-style-type: none"> ○ Conservation agriculture ○ Natural farming (small scale) 2. Nutrient management <ul style="list-style-type: none"> ○ Compost ○ Natural fertilizer ○ Micro dosing ○ Weeding ○ Agroforestry 		
1.2.4	Promote erosion control measures	
Refer to Strategy 1.2.2.		
1.2.5	Promote soil fertility management	
Refer to Strategy 1.2.2.		
1.3	Theme:	Natural resources management for the protection and sustainable use of natural resources
1.3.1	Improved wetlands and lake management	
<p>According to the CMS's wetlands are under pressure from human encroachment for settlement, expansion of crop production, urbanization, property development and livestock grazing. These wetlands need protection from degradation and restoration of their functional capacities.</p> <p>Although significant wetlands are protected from use (refer to KSA 2), in certain cases seasonal wetlands are utilized by surrounding communities. It is important to not only conserve what is existing, but also improve the farming practices and grazing in wetlands for more sustainable utilisation and reduced impacts (Braid & Lodenkemper, 2019).</p> <ol style="list-style-type: none"> 1. Wetland conservation 2. Wetland rehabilitation 3. Sustainable utilization of wetlands 		
1.3.2	Promote alternative/sustainable livelihoods	
<p>Communities rely on natural resources to live and earn an income. Over utilisation leads to the depletion of natural resources. Natural resources need to be managed and utilised in a sustainable manner, to maximise the goods and services received from them, while still maintaining their function and production capacity. Natural forests, grasslands and wetlands are finite resources that must be managed sustainably; similarly, alien vegetation can provide useful resources but needs to be managed to prevent uncontrollable spread.</p>		
1.3.3	Improved solid waste management	
<p>To ensure that catchment management activities and resource protection activities can be implemented, it is important that activities around the household, farm and village are also sustainable and of a high standard. These include activities such as waste management. Waste management involves the generation, collection, transportation, and disposal of garbage, sewage and other waste products. Responsible waste management is the process of treating solid wastes and offers a variety of solutions for waste with the ultimate aim of changing mind-sets to regard waste as a valuable resource rather than something that must be thrown away. The government is constitutionally bound to provide sanitation services to all of its citizens, this includes the removal and proper treatment of solid waste. In reality this is not being done in many parts of the country, particularly in</p>		

1	Key Strategic Area:	Catchment Management
	<p>remote rural areas. Water resources nearby urban areas are particularly at risk, as evident in the county IDPs. It is important to ensure that the mindset of waste management extend to individuals and communities as it is important for a clean and safe environment.</p> <ol style="list-style-type: none"> 1. Household waste management 2. Village waste management 3. Buy back centres 	
1.3.4	Improved forestry management	
	<p>Forests are important to return moisture to the air through evapotranspiration, which then generates rain, as well as to stabilise soils with their root systems; they can also be rich in terms of biodiversity as well as stores of carbon. Sustainable management of forests both natural and plantation, for reforestation of areas where forests have been removed including the selection of beneficial tree species.</p> <p>The Vision 2030 requires the country to work towards achieving a forest cover of at least 10% of the land area to ensure sustainable resource use, growth and employment creation. The National Forest Policy (Ministry of Environment and Natural Resources, 2014) indicates that the sustainable management of forests includes:</p> <ul style="list-style-type: none"> • Indigenous forests • Plantation forests • Dryland forests • Urban forests and roadside tree planting • Farm forestry <p>To achieve the national forest cover target of 10% of land area, the major afforestation effort will have to be in community and private lands. Dryland forests offer great potential for intensified afforestation but woody vegetation in the arid and semi-arid areas are unique and require special attention. Most county IDPs promote reforestation through agroforestry, and in some cases water catchment areas are being protected through the use of alien trees (i.e. eucalyptus). Consideration needs to be made to the objective of these programmes as there could be significant long-term challenges associated with planting trees with high water requirements in counties with limited water supply.</p>	
1.3.5	Removal of alien invasive species	
	<p>Community knowledge base on how to sustainably manage invasive and alien species should be strengthened. This is because there is knowledge but not strong understanding on the general approaches to sustainably manage invasive and alien plant species. The KFS and KWTA need to consider alien invasive vegetation management as invasive alien plant species are a threat to water resources and water availability. By managing them and preventing their further spread, these plants can also provide useful resources and alternatives to rapidly depleting indigenous vegetation.</p> <ol style="list-style-type: none"> 1. Controlling alien invasive vegetation 2. Utilising and controlling blue gum (eucalyptus) trees 3. Utilising and controlling pine trees 4. Utilising and controlling Bamboo 5. Utilising and controlling Prosopis species 6. Utilising and controlling water weed/hyacinth 	
1.3.6	Improved fisheries management	
	<p>Promote the sustainable development and management of fisheries in lakes, dams, wetlands and rivers.</p>	
1.3.7	Improved energy management	
	<p>To ensure that catchment management activities and resource protection activities can be implemented, it is important that activities around the household, farm and village are also sustainable and of a high standard. These</p>	

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1	Key Strategic Area:	Catchment Management
<p>include activities such as energy management. Renewable sources of energy should be promoted to generate electric power for use in the household, or community, as a replacement for the burning of wood or charcoal.</p> <p>Most county IDPs promote “green energy” as an alternative fuel to wood and charcoal.</p>		
1.3.8	Improved sand mine management	
<p>Develop policies for sand harvesting. Consider alternative sources of sand.</p>		
1.4	Theme:	Rehabilitation of degraded environments
1.4.1	Rehabilitation and Restoration Plan	
<p>Develop a restoration and rehabilitation programme. Also refer to Strategy 1.2.2.</p>		
1.4.2	Land restoration and rehabilitation of specific priority areas	
<p>Implement restoration and rehabilitation programme.</p>		
1.4.3	Site specific rehabilitation of degraded riparian areas	
<p>Rehabilitation planning, implementation and associated management is a long-term commitment to a natural resource. The successful rehabilitation of freshwater ecosystems, and thus the overall resilience and sustainability of the system, can only be achieved through engagement of all the stakeholders reliant on the natural capital.</p> <p>Through the Reserve process (KSA2) studies should be conducted to delineate riparian areas of significant water resources. These studies are required to understand the riparian functioning so that an effective rehabilitation strategy can be developed. The level and type of rehabilitation adopted is case/site specific, as rehabilitation planning is largely dependent on the extent and duration of historical and current disturbances, the cultural landscape in which the ecosystem is located and the opportunities available for rehabilitation. Understanding the overall functioning of the system, particularly in a landscape where the community is dependent on the natural resource, is key for the success of any rehabilitation project. This is further supported by ensuring that an adaptive management approach is incorporated into the planning and aftercare of the system, thus ensuring the ecosystem is maintained at a desirable level and offering it resilience to stressors.</p>		
1.4.4	Site specific rehabilitation of degraded wetlands	
<p>Prioritize wetlands in need of rehabilitation. Once these have been prioritised, rehabilitation and restoration plans should be developed, that will result in increased natural vegetation cover. Local CBOs and NGOs should be involved in this process.</p>		
1.4.5	Site specific rehabilitation of Gazetted forests or protected forests that have been degraded	
<p>Gazetted forests or protected forests that have been degraded need to have new trees planted in order to meet the Kenya Vision 2030. When KFS engage in re-planting trees, it should be done considering appropriate soil and water conservation techniques and beneficial/natural trees as a part of an integrated catchment management approach.</p> <p>According to the CMS’s several forest reserves have had significant vegetation cover loss or are under threat of encroachment. There was also a high probability of significant decline of the mangrove along the Indian Ocean Coast between 2001 and 2013. The county IDPs have promoted tree planting for agroforestry, woodlots for alternative energy and provided education about the detrimental effects of deforestation for communities and the environment.</p>		
1.4.6	Mining area rehabilitation	
<p>Mining removes the protective covering from the land and exposes soils to soil erosion as well as pollution impacts. During mining activities exposed soils must be revegetated and soil conservation techniques implemented.</p>		

4.3 Water Resources Protection

4.3.1 Introduction

Water is critical to social and economic development but also supports key ecological systems which underpin human wellbeing and provides essential ecosystem goods and services. According to the Kenya Water Act (2016), a water resource is defined as “any lake, pond, swamp, marsh, stream, watercourse, estuary, aquifer, artesian basin or other body of flowing or standing water, whether above or below the ground, and includes sea water and transboundary waters within the territorial jurisdiction of Kenya”. It is important to differentiate between surface and groundwater resources as these are treated differently within the context of water resources protection: surface water resources include rivers (i.e. stream, watercourse), wetlands (i.e. lakes, ponds, swamp, marsh, spring) and estuaries, while groundwater resources refer to aquifers and artesian basins.

The 2016 Water Act also outlines the designation of Basin areas, with functions of Basin Water Resource Committees (BWRCs) within each Basin clearly stated. Furthermore, the Act defines the establishment and functions of Water Resource Users Associations (WRUAs) i.e. associations of water resource users at the sub-basin level in accordance with Regulations prescribed by the Authority. These associations are community based for collaborative management of water resources and resolution of conflicts concerning the use of water resources.

Protection of water resources in Kenya therefore starts at the National level with the WRA developing policies and legislation for protection of water resources. BWRCs then enact these measures to fulfil the water resource quality objectives for each class of water resource in a basin and need to put in place measures for sustainable management of the water resources; whilst at the sub-basin level more local level community-based management occurs through WRUAs.

4.3.2 Strategy

Water Resource Protection is important for the **Agricultural** sector. In order to comprehensively and systematically address the Water Resource Protection issues and challenges in the basins, Table 4-3 presents specific Themes and Strategies under Water Resource Protection which are critical for the agricultural sector.

Table 4-3: Strategic Framework - Water Resources Protection

2	Key Strategic Area:	Water Resources Protection
2.1	Theme:	Classification of water resources
2.1.1	Determine the baseline for Resource Directed Measures: Surface and groundwater assessments at appropriate scales to inform the classification of water resources in the basin.	
Water Quality and Quantity assessments are required in order to set a baseline for Resource Directed Measures. This baseline will inform the classification and resource quality objectives for the significant water resources in Kenya.		
2.1.2	Determine Class of water resources	
Determining the Class of a water resource is the first step in the Water Resource Management cycle. A vision for the desired future state of water resources results in Ecological Categories for water resources based on the level of protection or increasing levels of risk. Ultimately the determined Class of a resource will determine the Reserve and associated Resource Quality Objectives that are set to achieve it.		
2.2	Theme:	Ecological Reserve
2.2.1	Reserve determination	

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2	Key Strategic Area:	Water Resources Protection
<p>In order to protect the water resources of Kenya the environmental Reserve needs to be determined. The total water resource (surface and groundwater) is made up of what is available for allocation or use and the Reserve. The Reserve (in terms of quantity and quality) is made up of what is needed to satisfy the basic human needs of people who are or may be supplied from the water resource (i.e. Basic Human Needs) and what is needed to protect aquatic ecosystems in order to secure ecologically sustainable development and use of the water resource (i.e. Ecological Reserve). The water requirements of the ecosystem must therefore be met before any allocation may be made. This forms part of the Water Resource Management cycle, which is an adaptive management approach focused on goal-setting. Once the environmental reserve is defined then the resource quality objectives can be determined for priority water resources.</p>		
2.2.2	Reserve compliance	
<p>Water Quantity is a key driver of water resources; therefore, its management is critical in the maintenance of ecosystems and for the provision of water for socio-economic purposes. Once the environmental reserve has been set then the flows required to maintain the reserve need to be managed. Implementing the operating rules to ensure that the releases from infrastructure required by users and the ecology are met in time and at EWR site. This may consist of the operation of dams, abstractions and other infrastructure as well as management through licensing and implementation of restrictions. Compliance hydrological monitoring is required, based largely on the continuous monitoring at a network of flow and water level gauges. Compliance monitoring is also required, based on monitoring low flows and water levels at gauging weirs and boreholes.</p>		
2.3	Theme:	Determine Resource Quality Objectives
2.3.1	Set Resource Quality Objectives	
<p>Determine the Resource Quality Objectives for prioritised water resources in Kenya.</p>		
2.4	Theme:	Conservation and protection of ecological infrastructure
2.4.1	Integrate environmental considerations into basin development and planning	
<p>Water is critical to social and economic development but is also a critical component in supporting key ecological systems which underpin human wellbeing as well as providing essential ecosystem goods and services. A strategic social and environmental assessment is therefore an important component of the Classification of water resources. The Classification of water resources requires a balance between social and environmental considerations.</p>		
2.4.2	Groundwater protection	
<p>Rehabilitate polluted aquifers, springs and wells as part of Catchment Management Plan. Groundwater source protection zones defined by WRA and gazetted under Water Act 2016.</p>		
2.4.3	Riparian areas protection	
<p>Riparian areas, as defined by WRA, gazetted under Water Act 2002 and WRM Regulations 2007, currently under amendment by Attorney General in accordance with revised definition agreed on at sixteenth meeting held on 2 June 2020 by the National Development Implementation and Communication Cabinet Committee.</p>		
2.4.4	Ecosystem services protection	
<p>Water is critical to social and economic development but is also a critical component in supporting key ecological systems which underpin human wellbeing as well as providing essential ecosystem goods and services. In particular, certain environmentally sensitive areas are reliant on the protection of water resources. Although environmentally sensitive areas are defined by NEMA, this information should be provided to WRA during the Classification of water resources in order for WRA to classify and protect according to the Water Act 2016.</p>		

4.4 Groundwater Management

4.4.1 Introduction

Groundwater has provided and will continue to provide much of the water needed for livelihoods and development for many communities and industries in Kenya. Numerous rural communities and small towns across the Republic depend on groundwater from boreholes and shallow wells for their domestic and livestock needs, and to support other economic activities. Spring flow and baseflow contribute significantly to maintaining streamflow, particularly during dry seasons. Groundwater management is known to be one of the most important, least recognised and highly complex of natural resource challenges facing society (Foster, 2000).

Groundwater in Kenya is currently not managed in a coherent fashion (Mumma, Lane, Kairu, Tuinhof, & Hirji, 2011). A final Final Draft National Policy on Groundwater Resources Development and Management was published in 2013 (Ministry of Water and Irrigation, 2013), but despite the best of intentions, groundwater remains poorly understood and poorly managed. The policy document highlights a number of specific issues:

- Availability and vulnerability of groundwater resources in Kenya are poorly understood
- Institutional arrangements for groundwater management in Kenya, including management capacity and financing are weak
- Very limited integrated water resources management in Kenya, with groundwater and surface water typically being treated as separate water resources
- Very limited groundwater quality management in Kenya

In addition to the National Policy on Groundwater Resources Development and Management, the National Water Quality Management Strategy (Ministry of Water and Irrigation, 2012) addresses groundwater protection in S. 2.7. It recommended the “Development of Ground Water Protection programs” without defining or describing them. The NWQMS lays out the following “strategic responses”:

- Extraction of groundwater at sustainable rates to avoid seawater intrusion.
- Intensifying groundwater quality monitoring by sinking observation boreholes.
- Establishing a monitoring program for selected production wells to capture any changing trends.
- Requiring all borehole owners to have their water tested periodically as part of the water quality monitoring programme.
- Maintain updated database of borehole data.

A groundwater management strategy is influenced by hydrogeological, socio-economic and political factors and is informed by both policy and strategy. This Groundwater Management Plan is necessary for the integrated and rational management and development of groundwater resources in the Tana Basin. It aims to capture and integrate a basic groundwater understanding, describes sustainable management measures and presents an action plan with clear objectives and desired outcomes. It also estimates the financial requirements needed for implementation and the timeframe for its implementation. It is not a static instrument. As resources monitoring and data analysis takes place across the planning period, improvements and even whole new aspects may need to be incorporated.

The key objectives of the Plan include:

- Conserve the overall groundwater resource base and protect its quality
- Recognise and resolve local conflicts over resource allocation (abstraction or pollution)

4.4.2 Strategy

Groundwater Management is important for the **Agricultural** sector. In order to comprehensively and systematically address the Groundwater issues and challenges in the basins, Table 4-4 presents specific Themes and Strategies under Groundwater Management which are critical for the agricultural sector.

Table 4-4: Strategic Framework – Groundwater management

3	Key Strategic Area:	Groundwater management
3.1	Theme:	Groundwater resources assessment, allocation, regulation
3.1.1	Groundwater assessment – assess groundwater availability in terms of quantity	
	Assessing groundwater resource quantity is an essential pre-requisite for any water management process. Nationally, the Kenya Groundwater Mapping Project (47 Counties, 2017-2023; Government of Kenya, 2017b) should be implemented and supported. In parallel, more detailed estimates of sustainable groundwater yield in priority areas / aquifers should be undertaken.	
3.1.4	Groundwater allocation	
	<p>National Resource Quality Objectives (RQOs) should be developed (KSA2). In relation to a groundwater resource, the RQO means the quality of all aspects of the resource and could include any or all of the following (Colvin, Cave, & Saayman, 2004):</p> <ol style="list-style-type: none"> a) Water levels, groundwater gradients; storage volumes; a proportion of the sustainable yield of an aquifer and the quality parameters required to sustain the groundwater component of the Reserve for basic human needs and baseflow to springs, wetlands, rivers, lakes, and estuaries. b) Groundwater gradients and levels required to maintain the aquifer's broader functions. c) The presence or absence of dissolved and suspended substances (naturally occurring hydrogeochemicals and contaminants). d) Aquifer parameters (e.g. permeability, storage coefficient, recharge); landscape features characteristic of the aquifer type (springs, sinkholes, caverns); subsurface and surface ecosystems in which groundwater plays a vital function; bank storage for alluvial aquifers that support riparian vegetation. e) Aquatic biota in features dependent on groundwater baseflow, such as rivers, wetlands, and caves, or biota living in the aquifer itself or the hyporheic zone. Terrestrial plants and ecosystems dependent on groundwater. f) Land-use and water use which impact recharge quantity or quality. Subterranean activities, such as mining or waste disposal, that affect the aquifer directly. The control of land-based activities by aquifer protection zoning of land-use. g) Any other groundwater characteristic. 	
	<p>It is clear that RQOs can include any requirements or conditions that may need to be met to ensure that the water resource is maintained in a desired and sustainable state or condition.</p> <p>The Guidelines for the Development of Water Allocation Plans in Kenya (Water Resources Authority, 2018b) discuss the determination of water balances and accommodates both surface water and groundwater. Current groundwater potential by sub-basin in Kenya should be determined from the assessment of available groundwater and the current use (from the abstraction survey). Groundwater allocation plans should be developed. Groundwater allocation varies according to the importance of, and knowledge base for, a given aquifer:</p> <ul style="list-style-type: none"> • POOR and MINOR aquifers: 25% of test discharge in an individual borehole is the safe allocable volume. Where an aquifer is reasonably well described (i.e. representative transmissivity values are available, as is the width, length and hydraulic gradient across the aquifer), then Darcy's Law (Darcy, 1856) may be used to determine mean through-flow ($Q = -k.i.A$). In this case, total allocable water should be 25% of average through-flow. 	

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3	Key Strategic Area:	Groundwater management
	<ul style="list-style-type: none"> • For MAJOR aquifers, the approach proposed in the NWMP 2030 is proposed. The NWMP 2030 adopts a cautious approach to determining sustainable groundwater abstraction; this is defined as 10% of recharge, but specifically excludes the riparian zone, which it determines as total river length x 1km. Recharge was defined as annual renewable resource minus annual surface water runoff, with 'annual renewable resource' defined as precipitation minus evapotranspiration. • For STRATEGIC and SPECIAL aquifers that are not (or not yet) designated Priority Aquifers and subjected to modelling, the NWMP 2030 approach should be used. • For Priority Aquifers that have been modelled, allocable GROUNDWATER is 10% of mean annual recharge. Mean annual recharge should, wherever possible, take into account both wet and dry years in order to recognise natural recharge variability. • The allocation of GROUNDWATER from aquifers that experience episodic recharge or are fossil aquifers remains unresolved, e.g. the Merti aquifer (Blandenier, 2015). How they should be treated in Kenya requires further debate and ultimately, a policy decision. <p>All of the above require the completion of the aquifer classification exercise.</p>	
3.2	Theme:	Groundwater development
3.2.1	Aquifer recharge	
	<p>Estimates of recharge per sub-basin in the six river basins were undertaken as part of this Consultancy. These are not based on ground studies, geophysics, drilling or modelling; therefore, it is necessary to conduct a preliminary assessment of recharge areas from existing data.</p> <p>Definition of Recharge Areas: At present, the accurate definition of the recharge areas for almost all aquifers remains unclear. This makes it difficult to protect such areas. (Exceptions: Kikuyu Springs Recharge Zone; Msambweni Aquifer; Chyulu Hills Aquifer). Recharge areas for Priority Aquifers should therefore be defined.</p> <p>Augmenting/preserving natural recharge: The Sponge City Kajiado concept (Oord, 2017), aims to manage and improve natural recharge by protecting land where significant recharge occurs. Other 'Sponge City' initiatives may be possible in other ASAL Basement aquifers.</p> <p>Managed aquifer recharge: First mentioned in the 1999 Policy document (Government of Kenya, 1999) and the Water Design Manual (Ministry of Water and Irrigation, 2005), Managed Aquifer Recharge is covered in the Water Resources Management Rules (2007). Efforts were made to encourage managed aquifer recharge by developing a Code of Practice that discussed methods and management approaches, and considered a few instances of MAR potential in Kenya (Water Resources Management Authority, 2007). It has been developed further since (Water Resources Management Authority, 2015b; A Njuguna, personal communication, December 2018), but has yet to be published. A study of the potential for Managed Aquifer Recharge in Kenya, commissioned by the National Water Conservation & Pipeline Corporation in 2006, provides a useful introduction to MAR and describes a number of possible MAR schemes across the country.</p> <p>At a practical level, sand dams (masonry or concrete weirs across sand rivers which accumulate coarse sands that act as a storage reservoir) also act as MAR structures (Borst & de Haas, 2006; Mutiso, 2003). These are in widespread use in ASALs underlain by siliceous metamorphic Basement and have been in use for decades.</p> <p>Ad hoc Managed Aquifer Recharge: Ad hoc Managed Aquifer Recharge was observed during the 2010-11 borehole Census of Nairobi (Athi Basin). Ad hoc Managed Aquifer Recharge may occur in the remaining five basins but has yet to be described.</p> <p>Unintentional Aquifer Recharge: In the Rift Valley Basin, at a farm south west of Lake Naivasha, rainwater runoff from greenhouses is diverted away from the site and in doing so traverses a fault expressed at surface. This structural feature absorbs most of the runoff from a 30 ha surface area, estimated at 0.18 MCM/yr.</p>	

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3	Key Strategic Area:	Groundwater management
	<p>Managed Aquifer Recharge potential: The scope of, and potential for, managed aquifer recharge has been assessed at various levels across the country, with the main research area being the NAS (Athi Basin). The limited understanding of existing aquifers (extent, potential storage) limits the application of MAR.</p> <p>Managed aquifer recharge could also be employed as saltwater intrusion protection. Infiltration basins could recharge rainwater runoff from roads. Also, recharge via sand dams in seasonal streams in areas underlain by siliceous metamorphic Basement.</p>	
3.2.2	Local groundwater development	
	<p>Areas of unexploited groundwater resources should be identified and linked to small centre water demand estimates to determine if groundwater resources could meet these demands. Local groundwater development is largely ad hoc at present, heavily under-written at the WWDA and County level for rural water supply (single or a few boreholes to meet demands of small rural centres, schools and other institutions).</p>	
3.2.3	Large-scale groundwater development	
	<p>The potential for groundwater development at a large scale should be assessed as part of integrated planning for bulk water resources development (Refer to Strategy 8.2.1), specifically as part of updated master planning for bulk water resources development to Nairobi and Mombasa and as part of regional water supply schemes.</p> <p>Specific aquifers that hold good potential and should be assessed are as follows:</p> <ul style="list-style-type: none"> ● The Merti aquifer ● The Neogene (i.e. Miocene/Pliocene) aquifer system ● The Nairobi Aquifer Suite 	
3.2.4	Conjunctive use	
	<p>Areas of unexploited groundwater resources should be identified and linked to water demand estimates to determine if groundwater resources could meet these demands as part of conjunctive use schemes.</p>	
3.4	Theme:	Conservation and protection of groundwater
3.4.1	Source protection	
	<p>GW vulnerability assessment: Once a National Policy for the Protection of Groundwater has been formulated and put into place (see KSA 9), Vulnerability Assessments should be conducted for groundwater.</p> <p>Saltwater intrusion prevention: As above for saltwater intrusion prevention; assess significance of groundwater saltwater intrusion, prioritise and select aquifers requiring active intervention to contain or reverse saltwater intrusion. Draw up Plans for intervention to prevent, mitigate or reverse seawater intrusion;</p> <p>Groundwater conservation areas (GCAs): As above for GCAs; assess which aquifers or parts of aquifers require formal protection. Draw up Plans for the protection of Priority Aquifers or parts of Priority Aquifers.</p> <p>Groundwater dependent ecosystems (GDEs): As above for GDEs; assess which aquifers contain important GDEs. Draw up Plans to protect important GDEs.</p>	
3.4.2	Rehabilitation of polluted aquifers, springs and wells	
	<p>Where groundwater protections have failed, measures need to be taken to address polluted aquifers. Here aquifers, springs and wells are lumped together as ‘aquifers’.</p> <p>Define Kenya’s polluted aquifers: Use the Guidelines for Groundwater Quality Surveys in Kenya (Water Resources Authority, 2018a) to define the extent of polluted aquifers, and determine what pollutants are present. Follow guidance presented in the NWQMS (Ministry of Water and Irrigation, 2012).</p>	

3	Key Strategic Area:	Groundwater management
	<p>For each polluted aquifer, determine the optimum and most cost-effective way to rehabilitate it. The approach to be adopted will depend on the following:</p> <ul style="list-style-type: none"> • Whether the aquifer is confined or unconfined; • The nature of the pollutant; e.g. dense non-aqueous phase liquids (DNAPLs) require a different treatment approach – pump, treat, return - compared with an aquifer polluted with human wastewater – eliminate the pollution source(s) followed by natural attenuation and remediation; • Whether the source of the pollution is diffuse or from a point source; • The affected aquifer area. • Prioritise aquifers for rehabilitation and implement rehabilitation programmes. 	

4.5 Water Quality Management

4.5.1 Introduction

Water quality is the physical, chemical, biological and aesthetic properties of water that determine its fitness for its intended use, and that are necessary for protecting the health of aquatic ecosystems.

Water quality management is the maintenance of the fitness for use of surface and groundwater resources, on a sustainable basis, by achieving a balance between socio-economic development and water resources protection. Fitness for use is an evaluation of how suitable water is for its intended purpose (e.g. domestic, agricultural or industrial water supply) or for protecting the health of aquatic ecosystems. The fitness for use evaluation is based on scientific evidence in the form of water quality guidelines or standards for different water uses (e.g. drinking water standards). The business of water quality management is the ongoing process of planning, development, implementation and administration of Kenyan water quality management policies, the authorisation of water uses that impact on water quality, and monitoring and auditing all these activities.

This section provides an introduction of the key water pollutants responsible for the deterioration of water quality in the basin, the point and non-point sources associated with the pollutants, and overview of the water quality status and threats in the basin, and a strategic framework for water quality management in the basins.

4.5.2 Strategy

Water Quality Management is important for the **Agricultural** sector. In order to comprehensively and systematically address the Water Quality Management issues and challenges in the basins, Table 4-7 presents specific Themes and Strategies under Water Quality Management which are critical for the agricultural sector.

Table 4-5: Strategic Framework - Water Quality Management

4	Key Strategic Area:	Water Quality Management (SW and GW)
4.2	Theme:	Promote sound water quality management governance in the basins
<p>With so many institutions involved in different aspects of water quality management in the basins, it is inevitable that there may be uncertainty about the mandate of each institution with respect to water quality management. This objective can be met by clarifying the mandates, the and roles and responsibilities of the different institutions involved in the basins. This can be achieved by reviewing the mandates, and roles and responsibilities of institutions. It is also important that there be effective arrangements between role players with regard to water quality management to ensure that cooperative governance of water quality is achieved. This can be accomplished by establishing mechanisms for cooperation between government institutions on water quality management and pollution control issues.</p>		

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4	Key Strategic Area:	Water Quality Management (SW and GW)
<p>Two strategies have been identified to help alignment, collaboration, and institutional efficiency.</p>		
4.2.1	Harmonise policies and strategies to improved water quality management	
<p>There are a number of institutions involved in different aspects of water quality and pollution management (e.g. WRA, NEMA, MoA, NIB, counties, basin authority, PCPB, etc.). Their policies, strategies and plans are not always aligned because they are responsible for different aspects of water resources management in the basins. WRA should advocate alignment of strategies to serve a common purpose of rehabilitating urban rivers and streams in the basins.</p>		
4.2.2	Coordination and cooperation mechanism on water quality issues established at a catchment level	
<p>WRA should establish a coordination and cooperation mechanism to ensure there is alignment of actions to address water pollution management in the basins.</p> <p>Participate in river clean-up campaigns of rivers. This can be achieved by using the inter-agency task-force to mobilize resources, carry out clean-ups, creating awareness, and where appropriate, demolishing structures in riparian buffers.</p>		
4.3	Theme:	Efficient and effective management of point and nonpoint sources of water pollution
<p>The water quality challenges in the basins will require efficient and effective management of pollution sources, as well as mitigating the symptoms of pollution in rivers, reservoirs, and lakes.</p> <p>Point sources - Monitoring of compliance with Kenyan domestic and industrial effluent standards should be strengthened. All effluent monitoring data should be stored in a central database (Mike Info in this case). Protocols should be implemented for enforcing standards, and for dealing with non-compliant dischargers. To meet this goal, producers of wastewater should be encouraged to treat wastewater at source. This can be achieved by identifying industrial polluters with no wastewater treatment and not meeting effluent standards and directing them to implement onsite wastewater treatment. It can also be achieved by requiring onsite wastewater treatment at all new industries being established. Consideration should also be given to the design and construction of centralised WWTWs and sludge treatment facilities for large urban centres, and to progressively connect households and large wastewater producers to the sewerage network. Lastly, the focal areas of the Kenya National Cleaner Production Centre (KNCPC) should be supported, and industries should be encouraged to participate in this initiative.</p> <p>Nonpoint sources - Nonpoint sources of pollution probably have the greatest impacts on water quality in the basins.</p> <p>Erosion and sedimentation from agricultural lands is probably a major concern and interventions to manage its impacts should be implemented. It has also been the focus of may soil conservation initiative undertaken in Kenya over many years. Reducing erosion and sedimentation also has a large positive impact on water pollution as many pollutants adhere onto sediment particles, and intercepting the particles before they enter water courses, also prevents these pollutants from entering streams, rivers, and lakes. To meet this objective, a number of target sources have been identified dealing with urban stormwater, riparian buffer strips, hydrocarbon pollution, runoff from informal settlements, other agricultural impacts, and runoff from unpaved roads.</p> <p>The management of stormwater in urban areas is important because it is the conduit for transporting pollutants into urban streams, and eventually nearby rivers and lakes. This requires promoting the use of structural stormwater control and treatment facilities (e.g. instream detention ponds) in urban areas, as well as reducing stormwater runoff by improved rainfall infiltration systems, efficient drainage network, and improved rainwater harvesting by households, complexes, and commercial buildings. Riparian buffer strips is an important measure to intercepting and filter polluted runoff. The installation and maintenance of riparian buffer zones and vegetated buffer strips should be promoted and enforced. Hydrocarbon pollution from the dumping of used oil into stormwater drains can contaminate large volumes of water rendering it unfit for use. The installation of oil separators at all garages and vehicle workshops should be enforced, and illegal dumping of used oil at informal workshops should be policed and culprits be prosecuted.</p> <p>A number of strategies have been identified to focus management of water pollution.</p>		
4.3.6	Sedimentation from unpaved roads	

4	Key Strategic Area:	Water Quality Management (SW and GW)
Control sediment pollution from unpaved roads by erecting sediment traps or vegetated buffer strips next to dirt and paved roads. Maintain stormwater drainage to prevent erosion next to roads and rehabilitate dongas near roads.		
4.3.7	Management of agricultural impacts on sediments, nutrients, and agrochemicals	
Control nutrients pollution from agricultural activities (N & P) in all farmed areas within the Basin by compiling & maintaining inventories of fertilizer use, and monitoring nutrients in receiving water bodies (rivers, reservoirs and lakes).		
Control agrochemical (pesticides and herbicides) residue pollution from farmlands by compiling an inventory of pesticide usage in the basin and monitoring affected water bodies for residues. Promote efficient use agrochemicals in the agricultural sector.		
Promote best irrigation management practices and encourage irrigators to retain, treat and recycle irrigation return flows before discharging it to the environment.		
Encourage adoption of good land management practices such as avoiding overstocking and overgrazing, avoiding cultivation on steep slopes or use terracing, minimum tillage, etc.		

4.6 Climate Change Adaptation

4.6.1 Introduction

In the face of a changing climate, adaptation and resilience are Africa's and indeed Kenya's priority responses to address vulnerabilities and risks. The 15th African Ministerial Conference on the Environment 2015 strongly promoted investment in building resilience as a top funding priority and an integral part of national development funding. This aligns very well with Kenya's approach of mainstreaming climate adaptation in national and sub-national development planning.

The Kenya National Climate Change Response Strategy (NCCRS) (Government of Kenya, 2010b) acknowledged that the impacts of observed and projected climatic change pose serious threats to sustainable development. These predominantly relate to severe weather and changes in the climate extremes which will reduce the resilience in many sectors of the economy.

The Climate and Development Knowledge Network in their Government of Kenya Adaptation Technical Analysis Risk Report (Government of Kenya, 2012) identified various sectors in Kenya which are at-risk, either directly or indirectly, from climate change. These sectors include agriculture, livestock and fisheries, manufacturing, retail and trade, water, health, financial services, tourism, urban and housing sectors, infrastructure, energy, transport, natural resources and environment, political and social sectors.

The Climate Change Act 2016 aims to strengthen climate change governance coordination structures and outlines the key climate change duties of public and non-state actors. It establishes a high-level National Climate Change Council chaired by the President, a Climate Change Directorate as the lead technical agency on climate change affairs, and a Climate Change Fund as a financing mechanism for priority climate change actions/interventions. Climate desks/units have subsequently been established in certain line ministries staffed by relevant climate change desk officers. The Act is to be applied across all sectors of the economy, and by both the national and county governments. Mainstreaming of climate change has to some extent been undertaken at the county government level, where some counties have taken measures to include climate change in their County Integrated Development Plans (CIDPs) and to develop relevant county legislation.

The National Climate Change Action Plan (NCCAP) 2013 to 2017 (Government of Kenya, 2013e) sets out a vision for a low carbon development pathway for Kenya and lists specific adaptation and mitigation

actions for each national planning sector to support this vision. One of the “big wins” identified in the Final Draft NCCAP 2018-2022 relates to “improved water resources management”.

The Final Draft NCCAP 2018-2022 (Government of Kenya, 2018) builds on the first Action Plan (2013-2017) and provides a framework for Kenya to deliver on its Nationally Determined Contribution (NDC) under the Paris Agreement of the United Nations Framework Convention on Climate Change. The Final Draft NCCAP 2018-2022 guides the climate actions of the national and county governments, the private sector, civil society and other actors as Kenya transitions to a low carbon climate resilient development pathway. It identifies strategic areas where climate action over the next five years is linked to Kenya’s Big Four Agenda, recognising that climate change is likely to limit the achievement of these pillars. One of the “big wins” identified in the Final Draft NCCAP 2018-2022 relates to “improved water resources management”. Of particular relevance to water resources management and planning is “Food and Nutrition Security” where food security may be threatened through climate change-driven declines in agricultural productivity. The Final Draft NCCAP 2018-2022 also prioritises seven climate change actions (Table 4-6), three of which (nos. 1 to 3) align very strongly with the planning and management of water resources.

Table 4-6: Priority climate change actions (Government of Kenya, 2018)

1. Disaster Risk (Floods and Drought) Management	Reduce risks to communities and infrastructure resulting from climate-related disasters such as droughts and floods.
2. Food and Nutrition Security	Increase food and nutrition security through enhanced productivity and resilience of the agricultural sector in as low-carbon a manner as possible.
3. Water and the Blue Economy	Enhance resilience of the water sector by ensuring access to and efficient use of water for agriculture, manufacturing, domestic, wildlife and other uses.
4. Forestry, Wildlife and Tourism	Increase forest cover to 10% of total land area; rehabilitate degraded lands, including rangelands; increase resilience of the wildlife and tourism sector.
5. Health, Sanitation and Human Settlements	Reduce incidence of malaria and other diseases expected to increase because of climate change; promote climate resilient buildings and settlements, including urban centres, ASALs and coastal areas; and encourage climate-resilient solid waste management.
6. Manufacturing	Improve energy and resource efficiency in the manufacturing sector.
7. Energy and Transport	Climate-proof energy and transport infrastructure; promote renewable energy development; increase uptake of clean cooking solutions; and develop sustainable transport systems.

The Kenya NAP 2015 to 2030 (Government of Kenya, 2016a) builds on the NCCRS and NCCAP and promotes adaptation as the main priority for Kenya, while also proposing that adaptation and development goals complement each other. Some of the key objectives of the NAP which are applicable to the Basin Plans include understanding the importance of adaptation and resilience building actions in development; integrating climate change adaptation into national and county level development planning and budgeting processes; and enhancing the resilience of vulnerable populations to climate shocks through adaptation and disaster risk reduction strategies.

Within the context of the Basin Plans, the objective of this component of the Plan is to understand the degree to which climate change will compromise the water resources sector and how those impacts will in turn alter the exposure to food security and to flood and drought risk. This component will also explore opportunities presented by climate change such as climate financing.

4.6.2 Strategy

Climate Change is important for the **Agricultural** sector. In order to comprehensively and systematically address the Climate Change issues and challenges in the basins, Table 4-7 presents specific Themes and Strategies under Climate Change Mitigation, Adaptation and Preparedness which are critical for the agricultural sector.

Table 4-7: Strategic Framework - Climate Change Mitigation, Adaptation and Preparedness

5	Key Strategic Area:	Climate Change Adaptation and Preparedness
5.1	Theme:	Understand impacts of climate change on water resources at appropriate spatial scales
5.1.1	Quantify climate change impacts (rainfall & temperature) on surface water and groundwater resources and demands in the basins at appropriate scales for planning and management	
This is undertaken through research and public consultation processes, and where necessary, engaging with the private sectors for further insights. As the impacts will be felt in a practical sense, this process should focus more on the in-situ impacts, thresholds and exposer accounts rather than as a technical theoretical review.		
5.1.2	Assess relevance, and scale of potential social, environmental and economic climate change impacts as defined in NCCAP in the basins and its relation to water resources planning and management; prioritise areas for interventions	
This will assess climatic trends to evaluate frequency and magnitude of events resulting in flooding events. Furthermore, the highlighting of hotspot area will act as a pre-emptive measure building resilience. Assessment of meteorological data relative to the ENSO cycle may provide forewarning into future drought occurrence and severity. Furthermore, there should be analysis of rainfall onset and cessation, particularly in rainfed agricultural areas and areas highly reliant on surface water rather than reticulation. Assessment of meteorological data relative to the ENSO cycle may provide forewarning into future drought occurrence and severity. Furthermore, there should be analysis of rainfall onset and cessation, particularly in rainfed agricultural areas and areas highly reliant on surface water rather than reticulation. Engage local private sector, NGOs and knowledgeable individuals to facilitate wider experience transfer of adaptation practices. Engage local private sector, NGOs and knowledgeable individuals to facilitate wider experience transfer of adaptation practices		
5.2	Theme:	Climate change mitigation
5.2.1	Undertake reforestation	
Promote protection of sensitive areas and ensure that natural systems are not compromised. Prevent slash and burn agriculture. Promote active reforestation initiatives and give education of ecosystem services of forests beyond utilisation as a timber resource.		
5.2.2	Promote the generation and use of clean energy	
Endorse the usage of renewable energy source as more than just hydropower, wind power and solar geysers		
5.2.4	Improve efficiency of water use	
Promote water use which is energy efficient e.g. solar heating, energy efficient water treatment, reducing water use which will save energy etc.		
5.3	Theme:	Climate change adaptation
5.3.1	Promote climate resilient infrastructure	
Promote the development in low risk areas and increase setback from rivers and ocean interfaces. Build to increased threshold specifications to address future climate impacts for both road and stormwater infrastructure		
5.3.2	Climate-related disaster risk management	
Reduce the risk of disasters linked to climate change e.g. floods, droughts, health-related risks, crop production etc. by understanding the potential threats and risks and by implementing structural and non-structural mitigation measures.		

5	Key Strategic Area:	Climate Change Adaptation and Preparedness
5.3.3	Promote water conservation	
		Employ likely increased stress impact principles promoting soil quality, better drainage and weed/disease control in agricultural practices
5.3.4	Promote agroforestry	
		Enhance the CO ₂ sink by promoting varied land usage to increase biodiversity and minimise soil erosion and increase soil nutrients retention. Actively plant living fences, medicinal and fruit trees.
5.3.5	Mainstream climate change adaptation in water resources strategy, planning and management at basin and catchment level	
		Implementation and enforcement of practical mainstreaming practices and enhance the awareness of potential climate impacts on communities to promote uptake of adaptation.
5.3.6	Enhance resilience of agriculture sector through climate smart agriculture	
		Employ likely increased stress impact principles promoting soil quality, better drainage and weed/disease control in agricultural practices.

4.7 Flood and Drought Management

4.7.1 Introduction

Floods and droughts are caused by extreme climatic events and can have devastating consequences for the socio-economic welfare of rural and urban communities and regions.

Flooding of land surfaces occurs when heavy rainfall leads to runoff volumes that exceed the carrying and storage capacities of stream channels and urban drainage systems. In the process, crop and grazing lands, villages and urban neighbourhoods become inundated, transport infrastructure destroyed, and powerlines flattened. Floods can cause displacement of people, loss of life (human and livestock), increases in water related-diseases, severe soil erosion, land-slides, increased food insecurity and significant losses to the economy of a region.

Drought can be defined as an extended period (consecutive months or years) of unusually low rainfall, depleted soil moisture and groundwater levels and a severe reduction in availability of surface water resources in streams, reservoirs and lakes. Drought can be referred to as a “creeping disaster” since its effects accumulate slowly and may linger for years after the termination of the event. Droughts can decimate dryland crop production, severely curtail irrigated crop production, cause severe loss of life of livestock and game, diminish freshwater fish-stocks, result in severely restricted municipal and industrial water supplies and give rise to substantial losses to the economy of a region.

It follows from the above that systematic preparedness planning for floods and droughts is an imperative to ensure mitigation of and protection against the above negative consequences of extreme floods and droughts.

4.7.2 Strategy

Drought Management is important for the **Agricultural** sector. In order to comprehensively and systematically address the Drought issues and challenges in the basins, Table 4-8 presents specific Themes and Strategies under Flood and Drought Management which are critical for the agricultural sector.

Table 4-8: Strategic Framework – flood and drought management

Key Strategic Area 6		Flood and drought management
6.2	Theme:	Drought management
6.2.1	Formalise institutional roles and partnership collaborations.	
<p>The government institutions and agencies and other stakeholders with partnership roles in drought management are as follows²:</p> <ul style="list-style-type: none"> • NDMA • NDMU (including its County Coordinators) • NDOC • KMD • National WRA and Regional and Sub-Regional WRA Offices • County Governments and County Disaster Risk Management Committees • BWRCs • WRUAs • Village Disaster Risk Management Committees • Ministry of Agriculture, Livestock and Fisheries as well as Ministry of Health • Kenya Red Cross Service • International Relief Aid Agencies • NGOs <p>Formalising and aligning the roles of and proactive partnership collaborations among the above entities are crucial to ensuring that the above objectives of the drought response protocol are achieved. To this end, it is proposed that the <i>Drought Response Forum (DRF)</i> be established that integrates all drought-relevant resource mobilisations and related interventions in each basin by the various collaboration partnerships listed above. The <i>DRF</i> must operate under the auspices of the NDMA and, to ensure continuity, it must be served by a Secretariat. The Secretariat can be physically housed in a drought-prone counties' offices. Furthermore, the activities of the <i>DRF</i> must be systematised through the development of appropriate standard operating procedures (SOPs.)</p>		
6.2.2	Develop drought response protocol.	
<p><i>The drought response protocol:</i> The drought response protocol follows a <i>multi-stakeholder</i> approach and comprises a structured set of inter-connected institutional and partnership roles, focus areas and mechanisms to prepare for, respond to and recover from a drought disaster. The components of the protocol are as follows:</p> <ul style="list-style-type: none"> • Formalised institutional roles and partnership collaborations. • A drought preparedness plan that is understood by both institutional actors and communities in drought-prone zones. • SOPs that comprise sequential response actions: monitoring ⇔ early warning alerts ⇔ severity trigger alerts ⇔ pro-active resource mobilisations ⇔ recovery interventions. <p><i>Objectives of the drought response protocol:</i></p> <ul style="list-style-type: none"> • Minimise the impact of water shortages on the quality of life of affected communities. 		

² There are currently three bills seeking to establish a National Disaster Management Authority and a National Disaster Management Fund. However, the three bills differ in content and structure e.g. proposed governance structure, membership and functions among other things. The mandates of NDMA, NDOC and NDMU overlap in various ways. The Disaster Risk Management Bill, currently under consideration by parliament, is aimed at bringing NDMA, NDOC and NDMU together as a new “Disaster Risk Management Authority.” The sponsors of the bills will have to sit and agree on how to collapse the three bills into one or alternatively, the first bill to pass through all the stages of development will be adopted and the rest will be nullified.

Key Strategic Area 6	Flood and drought management
	<ul style="list-style-type: none"> • Minimise environmental impacts. • Ensure equitable allocation of water despite systematic restrictions of supply. • Accelerate restoration of prior homestead environments and livelihoods of affected communities.
6.2.3	Improve drought preparedness.
	<p>The above <i>DRF</i> must address five primary drought response needs, i.e. <i>drought monitoring, drought early warning, drought severity assessment, mitigation interventions and recovery interventions</i>.</p> <p>Currently, <i>drought monitoring, drought early warning</i> and <i>severity assessment</i> are conducted by the NDMA, who issues regular Drought Early Warning Bulletins for ASAL counties, with inputs from KMD, the above two Ministries and WRA Offices. Regarding <i>mitigation interventions</i> and <i>recovery interventions</i>, NDMA oversees two coordinating bodies at the national level that bring together various stakeholders in drought preparedness. These are the Kenya Food Security Meeting and the Kenya Food Security Steering Group. At the county level, this is organised under County Steering Groups.</p> <p>The drought severity assessments of the national and county-level coordinating structures of the NDMA relevant to the basins must be reviewed and deliberated by the collaboration partnership participants in the <i>DRF</i>. In the case of an adverse severity assessment, the <i>DRF</i> participants will have a common point of reference from which to launch and systematically coordinate their various drought-relevant resource mobilisations and related interventions in the basins.</p>
6.2.4	Develop drought early warning system
	<p>The NDMA currently issues regular Drought Early Warning Bulletins for ASAL counties.</p> <p>SOP responses based on the Bulletins' early warning findings and alerts must be an integrating force in the above <i>DRF</i>. The sub-county scale of the Bulletins' reporting ensures that such responses can be spatially accurately focused. Furthermore, such informed responses will secure appropriate and timeous resource mobilisations and humanitarian interventions across all the collaborating partnerships at county, sub-county and local community scales across the drought-prone counties in the basins.</p> <p>The Famine Early Warning Systems Network (FEWS NET), which produces monthly reports and maps detailing current and projected food insecurity in a number of regions in the world, has a Regional Office in Kenya and FEWS NET outputs will support the deliberations by the participants in the <i>DRF</i>.</p>
6.2.4	Capacity development
	<p>Capacity for drought management in the basins will be assessed according to three categories, namely, <i>funding, organisational alignment</i> and <i>institutional technical skills</i>. The outcomes of these assessments will inform the strategy for development of capacity in each of the three categories.</p> <p><i>Funding</i>: The funding strategy is to secure a standing allocation from the recently-established National Drought Emergency Fund (DEF) to the basins drought-prone counties to ensure that finance for early drought response will always be available when needed. This will avoid the hitherto time-consuming approach of emergency budgetary re-allocations, which is also counter-productive, because it takes resources away from the long-term development that should enhance resilience to drought.</p> <p><i>Organisational alignment/collaboration</i>: The strategy is to expand organisational capacity in the Athi Basin by aligning the drought response roles and responsibilities of the government institutions/agencies, International Relief Aid Agencies, Kenya Red Cross, NGOs and other stakeholders with partnership roles in drought management. The vehicle for this strategy will be the <i>Drought Response Forum (DRF)</i> introduced above.</p> <p><i>Institutional technical skills</i>: The strategy is to strategically expand institutional technical skills relevant to drought response activities across three different sets of competencies, namely, (i) competence at translating Drought Early Warning Bulletin information to support prioritisation of resource mobilisations for humanitarian interventions; (ii) competence at logistical planning of required interventions followed by subsequent operationalisation; (iii) competence at communicating technical and logistical information in multi-stakeholder environments.</p>

4.8 Hydro-meteorological Monitoring

4.8.1 Introduction

An operational and well-maintained hydro-meteorological network is critical to support the WRA with its key functions related to water resources planning, regulation and management in the basins. The WRA is responsible for all aspects related to the monitoring (quantity and quality) of surface and groundwater in Kenya, including the construction and maintenance of monitoring stations, related equipment, data collection, transmission, capturing and storage, and dissemination.

4.8.2 Strategy

An adequate and efficient hydro-meteorological monitoring network is critical for water resource planning but is not considered a priority in the **agricultural sector**.

4.9 Water Resources Development

4.9.1 Introduction

Water resources planning and development relate to large-scale water resources and related infrastructure which will support socio-economic development in the basins to improve water availability and assurance of supply for current and projected future water use in the basin, while taking into consideration environmental sustainability. The rationale for the development of the basin plans was to assess whether the basin's water resources are sufficient to meet the expected growth in water requirements with 2040 as the planning horizon. The approach entailed an evaluation of the need for and the capacity of large-scale water resources development interventions such as dams and transfers, some of which include multi-purpose projects. Most of the interventions which were considered were already identified as part of previous planning studies. Proposed schemes should be implemented in conjunction with management interventions i.e. water conservation and demand management initiatives. Such an approach, in combination with the phased development of new infrastructure, will allow an adaptive development strategy towards improving climate resilience.

4.9.2 Strategy

Water Resources Development is important for the **Agricultural** sector. In order to comprehensively and systematically address the Water Resources Development issues and challenges in the basins, Table 4-9 presents specific Themes and Strategies under Water Resources Development which are critical for the agricultural sector.

Table 4-9: Strategic Framework – Water resources development

8. Key Strategic Area		Water resources development
8.3	Theme:	Water storage and conveyance
8.3.1	Implement large dams	
To utilise the available water resources in the country and to improve the reliability of supply will require significant storage of water during the wet seasons – specifically as part of the water supply systems to major urban areas and for the various large-scale irrigation schemes being planned. The proposed dams should be investigated in more detail and implemented in line with the investment plan.		
8.3.2	Maintain existing dams	

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8. Key Strategic Area		Water resources development
<p>There is a need to dredge existing dams to improve the capacity volume. Enhanced catchment management will decrease erosion and siltation of existing dams, and dredging will be required on a less frequent basis.</p>		
8.3.3	Compile infrastructure development programme for small dams and pans	
<p>At sub-basin scale, there is a need for storage of surface water on tributaries to improve the reliability of supply for local domestic, livestock and small-scale irrigation use. Studies should be initiated, and an infrastructure development programme should be compiled to guide the phased implementation of storage at sub-basin scale.</p>		
8.3.4	Provide other types of storage	
<p>Sand dams, artificial recharge and water harvesting should be investigated and implemented where feasible to provide storage of water during the wet season for use during the dry season, especially in areas without reliable river flows.</p>		
8.3.5	Upgrade/new water transfers	
<p>There are a number of inter and intra-basin transfers which convey water from springs, abstraction points and adjacent basins to demand nodes. Proposed expansion of these transfers should be implemented timeously to ensure reliability of supply in line with future water demands.</p>		
8.4	Theme:	Groundwater development
8.4.1	Develop groundwater resources	
<p>Implement under Strategic Theme 3.2</p>		
8.6	Theme:	Water for agriculture
8.6.1	Large scale irrigation development	
<p>Extensive large-scale irrigation development is possible in the country but will require storage. This includes both new irrigation and the upgrading of existing schemes. Certain originally proposed developments should also be scaled down in light of constraints associated with water availability, environmental concerns and assurance of supply.</p>		
8.6.2	Small scale irrigation development	
<p>Small scale irrigation in the basin should be encouraged due to the significant socio-economic benefits associated with this. Water supply should be improved and/or expanded by means of storage (small dams) and boreholes.</p>		
8.6.3	Promote water conservation in irrigation	
<p>As part of the sustainable scenarios proposed in the Basin Plans, increased irrigation efficiency and reduced water demand for large-scale irrigation accounts largely for more sustainable water use. Water use efficiency can be increased through the rehabilitation or improvement of irrigation technologies and techniques, and through the use of smart metering.</p>		
8.6.4	Aquaculture development	
<p>The new large dams to be developed within the basin will provide opportunities for aquaculture and this should be promoted.</p>		
8.6.5	Improved livestock watering	
<p>The reliability of water supply to meet livestock water demands across all basins should be improved through the construction of small dams, including sand dams on tributaries of the main rivers. These dams will provide carry-over storage and reduce the risk of water shortages during the dry season. Local groundwater sources should also be utilised to augment surface water supplies for livestock watering</p>		
8.6.6	Improved water supply reliability at local scale	
<p>Implement under Strategies 8.3.3 and 3.2.2</p>		

4.10 Institutional Strengthening and Enabling Environment

4.10.1 Introduction

In effect, the key aspect of any institutional reform process is to find an appropriate balance between operational functionality and the need for effective oversight and governance. Despite the various efforts that have been targeted at improving the institutional framework in the basins, there still remain challenges that warrant dynamic and progressive approaches to address them. Thus, this Plan provides the opportunity to integrate institutional reforms with the various elements of water resources management and development, noting that these reforms are an important part of ensuring that this Plan is implemented. Whilst, the various technical dimensions of this Plan are of significant importance, it does need to be highlighted that the ability of institutions to implement, oversee and review approaches accordingly will determine the efficacy of the basin plan.

Noting the variability of the climate and the potential impacts of climate change, the ability of institutions to manage adaptively will become increasingly important. In addition, the importance of the basins in terms of Kenya's socio-economic development cannot be underestimated. This will require strengthened inter-governmental approaches and inter-sectoral partnerships. These will be imperative noting the importance of the water-food-energy nexus, and will need to not only ensure improved levels of inter-sectoral planning, but equally improved effectiveness and efficiency from better implementation alignment as well as coordinated oversight. This is especially important when one notes the ongoing capacity constraints that face most sectors.

Whilst there will be ongoing pressures to develop and use water resources to enable socio-economic growth and development in the basins, the need to ensure that this takes place in a sustainable manner will become increasingly imperative. The shifts towards strengthening the regulatory role of the WRA, aligned to the 2016 Water Act, are important and will have an impact on the institutional roles and responsibilities within the basins. Hence, the drive to enable better coordinated resource development will be balanced by an improvement in the regulatory response by WRA. This will mirror and support the drive at a national level to strengthen catchment-based water resources management.

4.10.2 Strategies

An Enabling Environment is important for the **Agricultural** sector. In order to comprehensively and systematically address the Enabling Environment issues and challenges in the basins, Table 4-10 presents specific Themes and Strategies under Enabling Environment which are critical for the agricultural sector.

Table 4-10: Strategic Framework – Enabling environment to support effective water resources planning and management

10	Key Strategic Area:	Enabling environment to support effective water resources planning and management
10.1	Theme:	Develop institutional capacity
10.1.3	Strengthen partnerships	
The importance of inter-sectoral engagement in water resource management and development has increasingly been recognised. This will support the development of more aligned planning approaches to both management and development, as well as provide additional capacity support when and where appropriate. This could also introduce efficiencies that adjust institutional capacity requirements. To this end, there is a need for the development of a partnership framework that provides the basis for the approach towards partnerships. This will then be implemented through the ongoing development of partnership arrangements over time.		
10.1.4	Strengthen stakeholder engagement	
The importance of stakeholder engagement cannot be over emphasised. The improvement in the development of water resource management and development solutions, the improvement in alignment of operational activities		

10	Key Strategic Area:	Enabling environment to support effective water resources planning and management
<p>and the development of a sense of ownership of the management regime all provide the basis for more robust and sustainable management. There is a clear understanding that there is a need to improve upon the levels of stakeholder engagement and this cuts across the various institutions that play a role in water resource management and development. In this regard, the development of an agreed upon basin-wide framework for engagement is a key first step, supported then by the implementation of this framework. A key element of this, will include improving the functionality of the existing forum.</p>		

5 Key outcomes

5.1 Introduction

This section establishes a link between the findings and outcomes of the basin planning process and the effective implementation of the recommended strategies within the framework of IWRM and with specific relevance to **agriculture**. It contextualises the basin plans and recommends specific themes and interventions along with cost estimates for implementation of actions related to **agriculture** in the respective basins.

The future of agricultural growth in Kenya depends on intensification and substitution towards high-value products as well as an expansion of cultivable area through irrigation and improved water resources planning and management.

Subsequent to Kenya Vision 2030, which was completed in 2007, many policies and strategies on the agriculture and irrigation sectors in Kenya have been developed to provide the direction for the development and the strengthening of these sectors. These include policies and planning documents related to the core agricultural sector as well as the devolved context of the agricultural sector, irrigation, climate adaptation, soil management and drought management. Furthermore, the Kenya National Water Master Plan of 1992 was updated in 2012.

Kenya has not fully developed her irrigation potential and there is significant opportunity to expand irrigation. A key output from the Basin Plans which were developed under KWSCR-1, was the significant increase in irrigation area which is expected by 2040. This increase will mainly occur in the Tana and LVN basins. However, this will require comprehensive investment in increased water storage facilities and regulation.

5.2 Context

Within a global context, the adoption of the United Nations Sustainable Development Goals (SDGs) (UN, 2015) is an opportunity to enact an integrated approach to water resources management. Consequently, the Key Strategic Areas (KSAs) which lie at the heart of the six Basin Plans provide various synergies with the SDGs. Furthermore, it is important to note that the successful implementation of the Basin Plans will depend on the degree to which concurrent and future planning in each basin, at various levels, is aligned with the proposed development plans for the water sector. The development plans for the agricultural sector also need to be aligned with the basin plans.

5.2.1 Linkages with Basin Plans

The six Basin Plans which were developed as part of KWSCR-1 are key deliverables toward the overall objective of the KWSCR, namely to strengthen WRA's capacity in terms of tools, skills and infrastructure to deliver on its mandate for water resources regulation in the country. It constitutes IWRM and Development Plans for the six river basins, which consider the environmental, social and economic aspects of each basin, address the key issues and challenges, and ensure that these aspects are integrated into overall management strategies. The Basin Plans aim to achieve a sustainable balance between the utilisation, development and protection of water resources and provide a clear pathway for the sustainable utilisation and development of the water resources of Kenya. It is also important to remember that the Plans are "living documents", which should accommodate adjustments and/or updates. Ideally the Basin Plan should be reviewed and updated every five years.

The purpose of this Sectoral Integration Plan with regard to the **agricultural sector** in Kenya, is to ensure that the key findings and outputs from the six Basin Plans which were developed under

KWSCR-1 are properly integrated at sectoral level - in each of the six basins as well as in the country as a whole.

5.2.2 Linkages with the UN sustainable development goals

Since adoption of the UN 2030 Agenda for Sustainable Development, the Government of Kenya, as a member of the United Nations, has committed to the integration of the SDGs into national and county policy and planning frameworks. The UN 2030 Agenda is based on global sustainable development goals and covers the five critical pillars: people, planet, prosperity, peace and partnerships. It contains 17 goals and 169 targets that provide broad guidelines for sustainable development. The 17 Goals are all interconnected, and the aim is that these should be achieved by 2030. Although SDG 6 is directly related to water, under IWRM all the SDGs are considered important. This six Basin Plans include actions that not only address specific issues associated with each KSA, but also integrate measures to achieve a number of SDGs. The below diagram shows the Integration of the SDGs into the six Basin Plans.

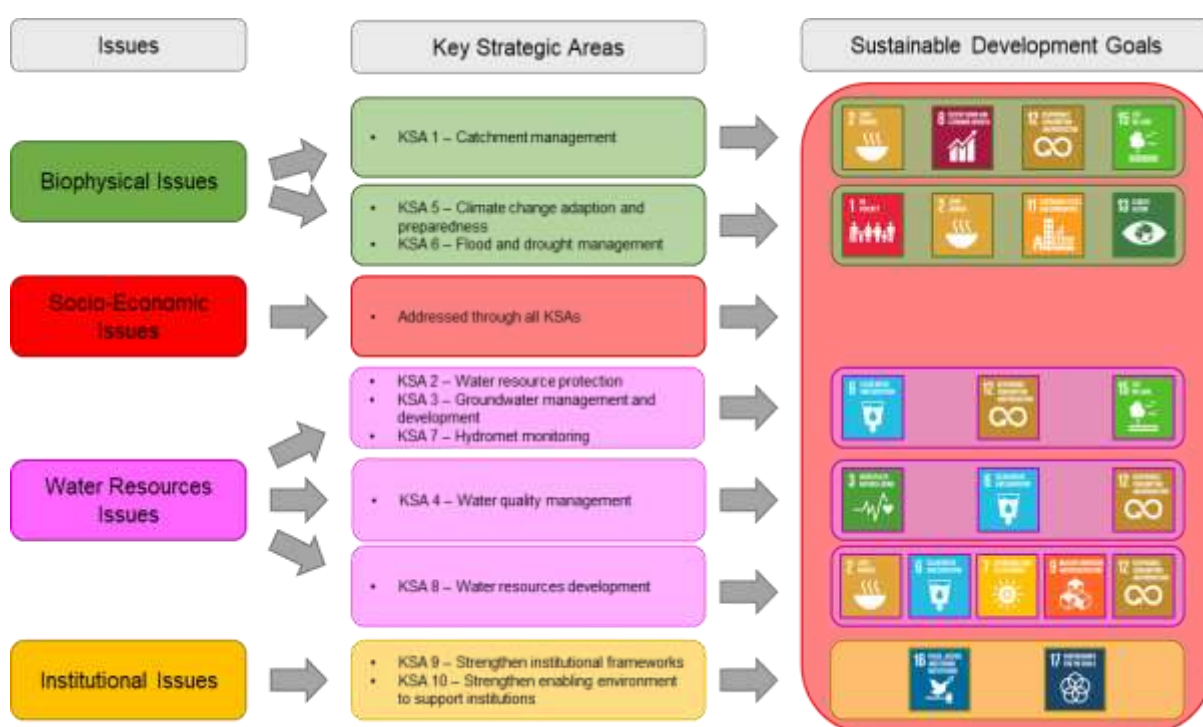


Figure 5-1: Integration of the SDGs into the six Basin Plans

5.2.3 Linkages with other existing plans

The Basin Plans provide a vision and framework for the development and management of the water and related land resources of Kenya’s six river basins. Essentially the plans reinforce the CMSs (2015-2022), supplement the NWMP 2030 and act as a source of information for the development of Sub-Catchment Management Plans (SCMPs), which Water User Associations (WRUAs) will implement. Whereas the basin plans contextualise the SCMPs, the SCMPs remain the resource mobilisation tools that WRUAs will use to source implementation funds and other resources. County governments are also involved in implementation activities, and as such will be required to review the basin plans and SCMPs to ensure that the County Integrated Development Plans (CIDPs) are linked and synchronised with the overall basin planning initiatives. Relevant Regional Development Authorities as well as Water Works Development Agencies also need to review their proposed and existing projects to align with the investment plan as presented in the Basin Plans.

5.3 Key Strategic Areas, Themes and Budgets

Under the Themes and Strategies which were formulated for the ten Key Strategic Areas (KSAs), prioritised implementation / action plans were prepared for each of the six river basins in Kenya.

Awareness of the interconnectivity of the ten KSAs within the context of IWRM is important to guide the systematic and integrated implementation of actions emanating from the various KSAs. The interrelatedness of the KSAs are depicted schematically in **Error! Reference source not found.** The interconnectivity ranges from direct impacts or benefits, such as the construction of a dam (KSA 8) which can improve flood control (KSA 6), to multi-dimensional impacts or benefits, such as creating a stone check dam to reduce soil erosion (KSA 1), which also reduces runoff (KSA 6) and improves water quality (KSA 4). These relationships, both direct and indirect, are important to note during implementation. Addressing one issue in a specific area through implementation of an activity may create further issues that were not predicted or could provide additional benefits.

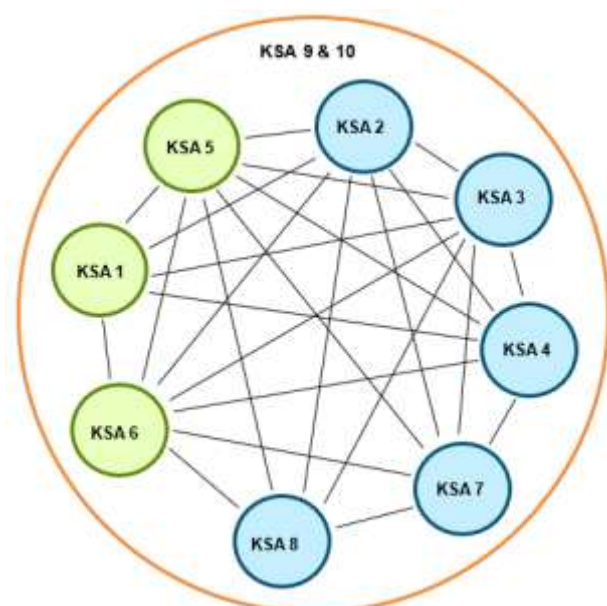


Figure 5-2: Interconnectivity of the KSAs

Table 5-1 presents key themes under each KSA which are relevant to agriculture, along with estimated implementation budgets, per basin, up to the planning horizon of 2040.

The national estimated budget which is required for implementation of integrated water resources management and development activities up to 2040 in all basins and across all KSAs equals about **29 billion USD**. The **agricultural sector** is linked to about **11 billion USD** of the National Budget (Table 5-1). Tana Basin requires the largest budget and the KSA that requires the largest budget is KSA 8: Water Resources Development.

It is important to ensure that the implementation of the KSA actions emanating from the Basin Plans are aligned with relevant legislative, policy and institutional principles and guided by internationally accepted standards for good practice to attain the goals of social acceptability, economic viability and technical sustainability.

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Table 5-1: Summarised IWRM budget for implementation activities linked to agriculture under specific Key Strategic Areas

Key Strategic Areas and Themes		Budget (USD million)						Total
		Athi	Tana	LVS	LVN	ENN	RV	
KSA 1	Catchment management							
	Promote improved and sustainable catchment management							
	Sustainable water and land use and management practices	124	118	85	91	99	89	606
	Natural resources management for protection & sustainable use							
	Rehabilitation of degraded environments							
KSA 2	Water resources protection							
	Classification of water resources							
	Reserve determination	5	5	5	5	5	5	28
	Determine Resource Quality Objectives							
	Conserve and protect ecological infrastructure							
KSA 3	Groundwater management and development							
	Groundwater resource assessment, allocation and regulation							
	Groundwater development	105	51	138	86	103	109	593
	Groundwater asset management							
	Conservation and protection of groundwater							
KSA 4	Water quality management							
	Efficient and effective management of point and nonpoint sources of water pollution	16	16	13	9	13	13	80
KSA 5	Climate change adaptation and preparedness							
	Understand impacts of climate change on water resources at appropriate spatial scales	39	39	32	35	33	33	210
	Climate change mitigation							
	Climate change adaptation							
KSA 6	Flood and drought management							
	Flood management	60	54	43	51	54	52	314
	Drought management							
KSA 8	Water resources development							
	Water storage and conveyance	1 213	2 616	1 402	1 945	202	2 034	9 413
	Groundwater development							

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Key Strategic Areas and Themes		Budget (USD million)						Total
		Athi	Tana	LVS	LVN	ENN	RV	
	Water for agriculture							
KSA 10	Strengthen enabling environment to support institutions	6	6	5	6	5	6	34
	Develop institutional capacities to support improved IWRM&D							
Total		1 568	2 905	1 723	2 227	515	2 341	11 278

5.4 Roadmap for Sector Integration

In order to ensure the successful implementation of the strategies and actions from the six Basin Plans and National Plan as they relate to agriculture, a Roadmap for Implementation is proposed. This Roadmap proposes that before any actions identified under the KSA implementation plans are implemented, there are preceding critical activities. These are as follows:

1. Immediate KSA activities
 - a. Strengthening of institutional capacity and coordination;
 - b. Imminent infrastructure feasibility and impact assessments;
 - c. Expand on the basin plan knowledge base
2. Financial Resource Mobilisation for the KSA activities
3. Implementation of the short to long-term KSA activities
4. Monitoring and Evaluation of the KSA activities

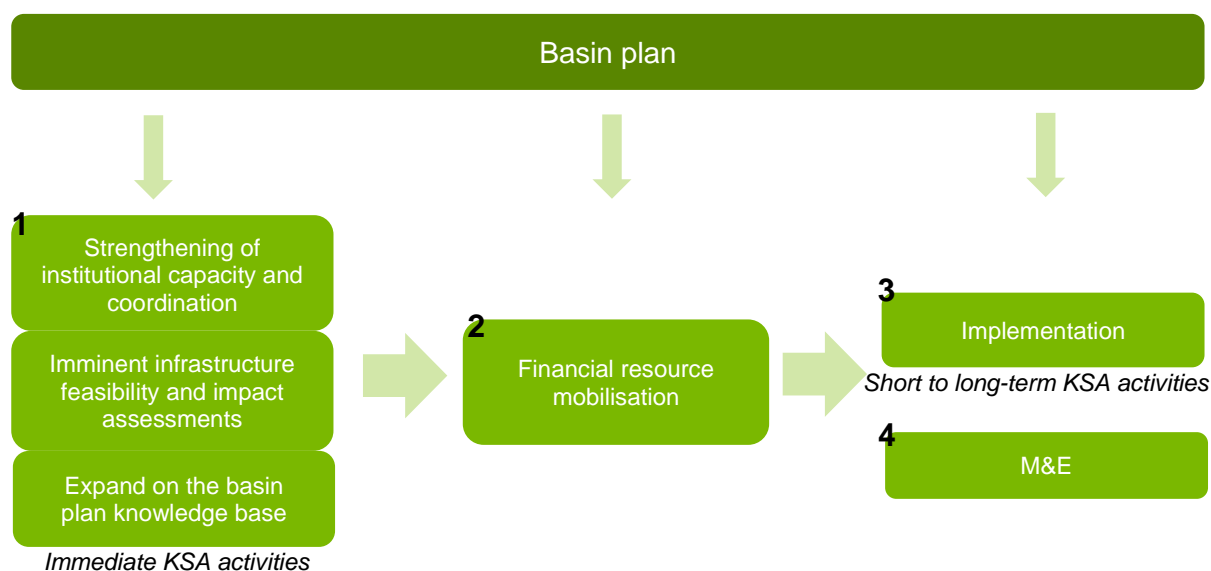


Figure 5-3: Roadmap for implementation of the Basin Plans

5.4.1 Immediate actions

5.4.1.1 Strengthening of institutional capacity and coordination

Strong institutions are necessary for effective governance. Not only must they be strong, but they must be well linked with partner institutions. On a national scale, there are many role players working in similar areas, and poor coordination can result in the duplication of efforts and failure of implementation. It is therefore not surprising that effective implementation must be rooted in strong institutions and partnerships. Having strong institutions also provides invaluable benefits for securing external financing. When completing a risk assessment, strong institutions with good coordination mechanisms will have a much lower risk profile than their counterparts, making them an attractive investment opportunity for both development partners and the private sector.

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IWRM requires the integration of various activities for the equitable and efficient management and sustainable use of water. There are many role players involved, at different scales (i.e. national to local scale), and before any activity is initiated it is critical to ensure that there are platforms in place for engagement. The KSAs can also be used as a planning tool for key role players, without these institutions needing to sit in the same room. For example, should KFS want to implement a reforestation program, they can refer to the Basin Plans for information on which institutions and organisations they should collaborate with, and over what timelines implementation should take place.

The main role players in the agricultural sector are summarised in Table 5-2.

Table 5-2: Agriculture implementation plan key role players

		KSA1	KSA2	KSA3	KSA4	KSA5	KSA6	KSA8	KSA10
Ministries	MoWSI	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
	MoALF	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
	MoEF	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	MoLPP	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	MoICNG	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	MoTIHUDPW	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	MoH	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	MoDASAL	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
National	WRA	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
	AFFA	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	NEMA	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	KWTA	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	KFS	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	NLC	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	WASREB	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
	KNCPC	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	KURA	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	NECC	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	EPRA	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	KeRRA	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	NIB	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
	PCPB	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	KALRO	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	NWHS	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	KenGen	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	KMD	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	NDMA	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	NDOC	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
KPLCO	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
CETRAD	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Basin	BWRC	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
	WWDA	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	DRMC	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Local	CG	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
	WRUA	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>

5.4.1.2 Immediate implementation activities

The timelines of the KSAs have been developed in such a way as to stagger the activity implementation across four planning horizons: immediate (2020 – 2022), short-term (2022 – 2025), medium-term (2025 – 2030) and long-term (2030 – 2040).

The ‘immediate’ time-frame has specifically been developed to provide direction on which activities will be most beneficial to institutional strengthening. These immediate activities will also require funding, and the key role players and other relevant partners should develop strategies for generating financing. However, it is likely that the financing may have to come from the institutions themselves. This can be considered as a long-term investment – by investing now in strengthening institutional capacity, finances will be more easily mobilised for future activities. These immediate activities are also relatively cheap in comparison to larger catchment size activities, or infrastructure activities.

Table 5-3 presents the ‘immediate’ activities under the most important KSAs which are relevant to the agricultural sector.

Table 5-3: Immediate implementation of IWRM activities related to agriculture

KSA	Priority activities (immediate)
KSA 1 Catchment Management	
<ul style="list-style-type: none"> – Increase awareness of sustainable catchment management with relevant ministries, WRUAs, CGs etc. through training, brochures, social media, internet, factsheets, forums and workshops. – Devolve ownership of catchment management activities to WRUAs through SCMP development. – Embed catchment-based water conservation and management activities related to crop and livestock production in SCMPs – Embed catchment-based soil conservation and management activities related to crop and livestock production in SCMPs – Embed conservation agriculture and improved farm management activities related to crop and livestock production in SCMPs – Coordinate approach to forestry management – roles, responsibilities and mandates 	
KSA 3 Groundwater management	
<ul style="list-style-type: none"> – Implement aquifer mapping and groundwater modelling – Complete aquifer classification – Improve estimates of sustainable groundwater yield in priority areas using advanced techniques – Prepare groundwater abstraction plan and undertake groundwater abstraction and water quality survey – Develop groundwater allocation plan for strategic aquifers – Undertake groundwater balance to determine sustainable yield available – For each aquifer, develop Allocation Plan and disaggregate to sub-basins – Implement groundwater abstraction schemes in accordance with groundwater development planning 	
KSA 4 Water quality management	
<ul style="list-style-type: none"> – Advocate for alignment of strategies to serve a common purpose of rehabilitating urban rivers and streams – Establish a coordination and cooperation mechanism to ensure there is alignment of actions to address water pollution management – Embed water quality management activities related to domestic water use, crop and livestock production in SCMPs 	
KSA 5 Climate change adaptation and preparedness	
<ul style="list-style-type: none"> – Quantify climate change impacts (rainfall & temperature) on surface water and groundwater resources and demands at appropriate scales for planning and management – Assess potential social impacts: flooding; droughts; human conflict; migration; vulnerable groups; ocean acidification; agriculture; food production – Assess potential environmental impacts: droughts; sea temperature; rising sea levels; ocean acidification; desertification; land degradation; loss of biodiversity; deforestation; forest degradation – Assess potential economic impacts: irrigation water requirements; crop type and yield; GDP; public Infrastructure; hydropower; coastal assets; livelihoods and income generation. – Incorporate flexible adaptation infrastructure principles in infrastructure planning and investment plans 	

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KSA	Priority activities (immediate)
KSA 6 Flood and drought management	
	<ul style="list-style-type: none"> – Government institutions/agencies and other stakeholders with partnership roles in flood management will form the Basin Flood Response Forum (FRF) for each basin under the auspices of the KMD to integrate all flood-relevant resource mobilisations and related interventions in their respective basin. – Establish a Secretariat for the Basin FRFs with accommodation in the WRA Regional Offices. – Develop appropriate SOPs for the Basin FRFs. – Organisational alignment/ collaboration: The Basin FRFs will expand organisational capacity by aligning the flood response roles and responsibilities of the government institutions/agencies, International Relief Aid Agencies, Kenya Red Cross, NGOs and other stakeholders with partnership roles in flood management. – Establish a Secretariat for the Basin Drought Response Forum (DRF) for each basin with accommodation in the Offices of one of the drought-prone counties in each basin. – The NDMA issues regular Drought Early Warning Bulletins for ASAL counties and sub-county Bulletins will be arranged for drought-vulnerable areas. – Organisational alignment/collaboration: Basin DRFs will expand organisational capacity by aligning the drought response roles and responsibilities of the government institutions/ agencies, International Relief Aid Agencies, Kenya Red Cross, NGOs and other stakeholders with partnership roles in drought management.
KSA 8 Water Resources Development	
	<ul style="list-style-type: none"> – Develop programme for implementation of small dams & pans. Undertake relevant studies. Identify locations and types of dams to improve assurance of supply to local urban, domestic, small scale irrigation and livestock water users; complete relevant feasibility and impact studies and plans. – Phased design and construction of identified small dams / pans in accordance with proposed investment plan – Large scale irrigation development: Develop new / expand existing irrigation schemes. Limit to max sustainable areas.
KSA 10 Strengthen the enabling environment to support institutions	
	<ul style="list-style-type: none"> – Development of technical and management capacity through focused training, continuous professional development, bursary schemes, audits, incentive schemes – Develop a partnerships framework – Identify potential partners – Strengthen existing partnerships, particularly on a local level – Undertake stakeholder consultations – Undertake awareness creation and information dissemination activities – Develop and strengthen guidelines for MOU Final Drafting and development – Develop a basin-wide stakeholder engagement framework – Undertake stakeholder analysis – Implement the stakeholder engagement framework – Strengthen stakeholder engagement platforms i.e. forums – Strengthen links with tertiary education / research institutions – Incorporate R&D into WRM planning and decision making – Establish a network of supporting research institutions – Develop strategic partnerships for R&D – Promote innovative financing for basin level institutions (BWRCs, WRUAs, forums) – Develop internal resource mobilization strategies – Develop external resource mobilization strategies – Exploring private sector financing channels – Strategic partnerships for resource mobilization

5.4.2 Financial resource mobilisation

Resource mobilisation refers to the various activities involved in making better use of existing resources to maximum benefit, whilst ensuring the ongoing acquisition of additional resources to ensure the achievement of organisational intent. These resources include financial resources, but also include human resources and their organisational management, equipment, services, and technical cooperation. The range of these resources and their impact is outlined in the resource mobilisation position paper.

Section 5.4.1. outlined the importance of developing strong institutions. Part of this strengthening refers to developing the human and organisational resources. While this is a vital component, financial resources are needed to strengthen these other resources, as well as implement projects.

A review of successive WRA performance reports reflects the challenges that WRA has faced financially, and shows successive funding gaps (WRA, 2017). These have considerable institutional implications for the WRA that require consideration in developing an approach to not only strengthen the WRA, but to also underpin this with a sustained funding regime. Without this strategic intent to coherently develop the business model together with resource mobilization, the overall sustainability of the institution is at risk.

There are numerous forms of external financing, each with their own type of stakeholders and investment mechanisms.

- Innovative financing avenues can include philanthropic and public, water funds and facilitates, payment for ecosystem services, effluent charges, climate change funding schemes, carbon finance, corporate grants, impact investments and conservation finance.
- The key stakeholders and partners for these avenues can include development agencies, governments, multilateral development banks, public private partnerships, private or state banks, private sector, NGOs, asset managers and international councils and secretariats.
- The investment mechanisms can include grants, subsidies, guarantees, soft/hard loans, guaranteed philanthropy, result based payments, equity, loans, environmental impact bonds and microfinance.

It is important to note that different KSA activities will require different levels of partnership and will therefore have to tap into different financing avenue. Using the resource mobilization strategy as a base, it will be necessary for the WRA or the key implementing agency (as outlined in the KSA) to develop a resource mobilization and financier engagement strategy that is applicable to each specific activity.

The **agricultural sector** will need to engage with WRA to ensure that Financial Mobilisation is shared according to aligned objectives.

5.4.3 Implementation and M&E

Having initiated the coordinated strengthening of institutional capacity as well as resource mobilisation as immediate critical actions, other activities in each KSA should be considered for implementation. These activities are typically costlier and have a longer implementation horizon. They also often deal with more physical interventions, and therefore require a stronger local presence and engagement. Implementation Plans for each KSA were developed, which provide a clear intent and prioritised plan of action. The implementation plans present theme priorities (i.e. critical, very important, important), activities (i.e. implementation actions), indicators to measure outcomes of activities, implementation horizon (i.e. immediate (1-2yr), short (2-5yr), medium (6-10yr) or long (11-20yr) term), responsibility for activity (i.e. at the basin scale, national scale, local scale and key stakeholders) and estimated budgets for implementation of individual activities along with possible funding sources per activity identified.

Table 5-4 summarises IWRM budgets for implementation activities linked to agricultural under specific Key Strategic Areas up to 2040. Detailed implementation plans are provided in the respective basin plans.

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Table 5-4: Summarised IWRM budget for implementation activities linked to agriculture under specific Key Strategic Areas up to 2040

Key Strategic Areas and Themes		Budget (USD Million)				
		2020-2022	2022-2025	2025-2030	2030-2040	Total
KSA 1	Catchment management					
	Promote improved and sustainable catchment management					
	Sustainable water and land use and management practices	45	221	197	144	606
	Natural resources management for protection & sustainable use					
	Rehabilitation of degraded environments					
KSA 2	Water resources protection					
	Classification of water resources					
	Reserve determination	2	5	11	11	28
	Determine Resource Quality Objectives					
	Conserve and protect ecological infrastructure					
KSA 3	Groundwater management and development					
	Groundwater resource assessment, allocation and regulation					
	Groundwater development	59	188	145	200	593
	Groundwater asset management					
	Conservation and protection of groundwater					
KSA 4	Water Quality Management					
	Efficient and effective management of point and nonpoint sources of water pollution	6	18	23	34	80
KSA 5	Climate change adaptation and preparedness					
	Understand impacts of climate change on water resources at appropriate spatial scales	21	70	72	46	210
	Climate change mitigation					
	Climate change adaptation					

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KSA 6	Flood and drought management	42	212	22	39	314
	Flood management					
	Drought management					
KSA 8	Water Resources Development	296	1 659	3 780	3 677	9 413
	Water storage and conveyance					
	Groundwater development					
KSA 10	Strengthen enabling environment to support institutions	13	17	1	2	34
	Develop institutional capacities to support improved IWRM&D					
Total		484	2 389	4 251	4 155	11 278

5.4.4 Stakeholder engagement

During the National workshop on the 13th and 14th October 2020 stakeholders were given the opportunity to discuss the roadmap for sector integration. They provided inputs for step 1-4 for the agricultural sector. The main outcomes are presented in **Annexure A**. The main outcomes from the session indicated that the WRA plays a pivotal role in institutional partnerships, there are opportunities for cost-recovery and co-financing options. The flow of information to the local level is not happening and the top-down approach is not working well. There needs to be an engagement forum coordinated by WRA to ensure the needed coordination between farmers and WRUAs. Once basin plans are finalised, all players involved in implementation should be included, possibly through a basin plan implementation committee.

6 Conclusion

Integrated Water Resources Management is based on the equitable and efficient management and sustainable use of water. It recognises that water is an integral part of the ecosystem, a natural resource, and a social and economic good, whose quantity and quality determine the nature of its utilisation (Global Water Partnership, 2006). This emphasises the importance of an integrated approach towards water resources planning, development and management – focusing on an enabling environment, institutional framework and setting up the management instruments required by institutions to understand mandates, roles and responsibilities to effectively and seamlessly do their job.

The basin planning process provides a status quo of the current water resources management situation and a plan for future management. There is no correct administrative model to ensure successful implementation. However, the principles of IWRM allow for selecting, adjusting and applying a mix of tools for a given situation and agreeing on milestones and timeframes is critical for success.

The Sectoral Integration Plans can be used to implement activities outlined in the Key Strategic Areas of the Basin Plans, particularly where the responsibilities are for sector-specific role players or institutions. Some activities should be implemented sector-wide rather than basin-wide as implementing via a sectoral-wide approach will enable implementation across the country and will not be limited to the hydrological boundaries. It is recommended for WRA to plan for the activities of which responsibility will be given to another institution, as well as how WRA will manage that partnership, such as receiving monthly reports or conducting regular meetings. At the same time, WRA will need to decide whether full responsibility is given to another institution or how and where WRA should maintain involvement. The detailed implementation tables in the Basin Plans provide key role players for each activity, which should guide these decisions.

This Sectoral Integration Plan for the agricultural sector is a key deliverable towards the overall objective of the KWSCRIP namely to strengthen the Water Resources Authority as it relates to water resource management and planning through the development of tools, skills and infrastructure to deliver on its mandate. The outcome will be a stronger Water Resources Authority institution that has strengthened capacity to carry out its core functions with regard to integrated basin management and planning in a manner that is based on extensive knowledge-driven analysis and that meets the expectations of key stakeholders.

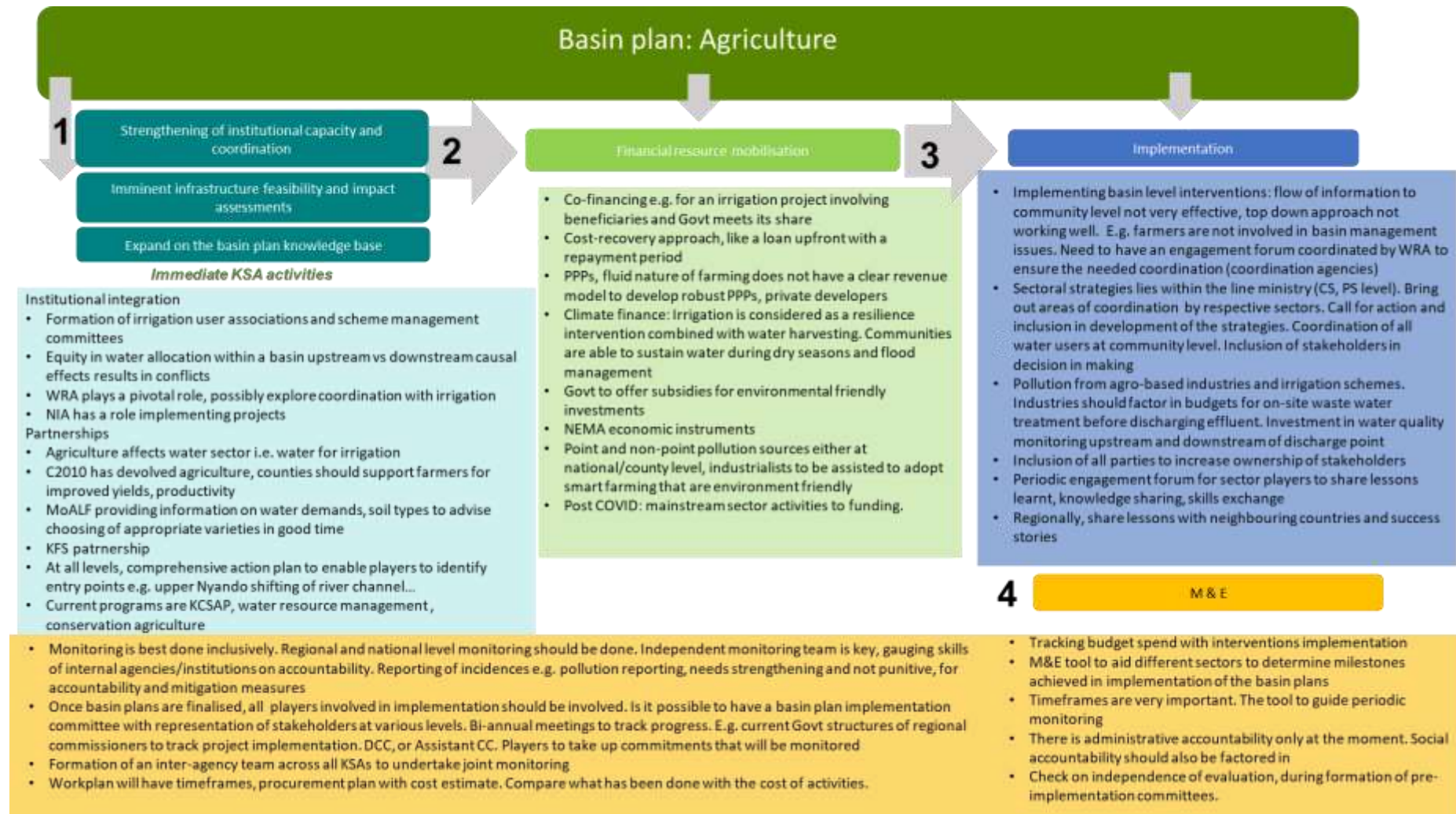
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Annexure A: Stakeholder engagement



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