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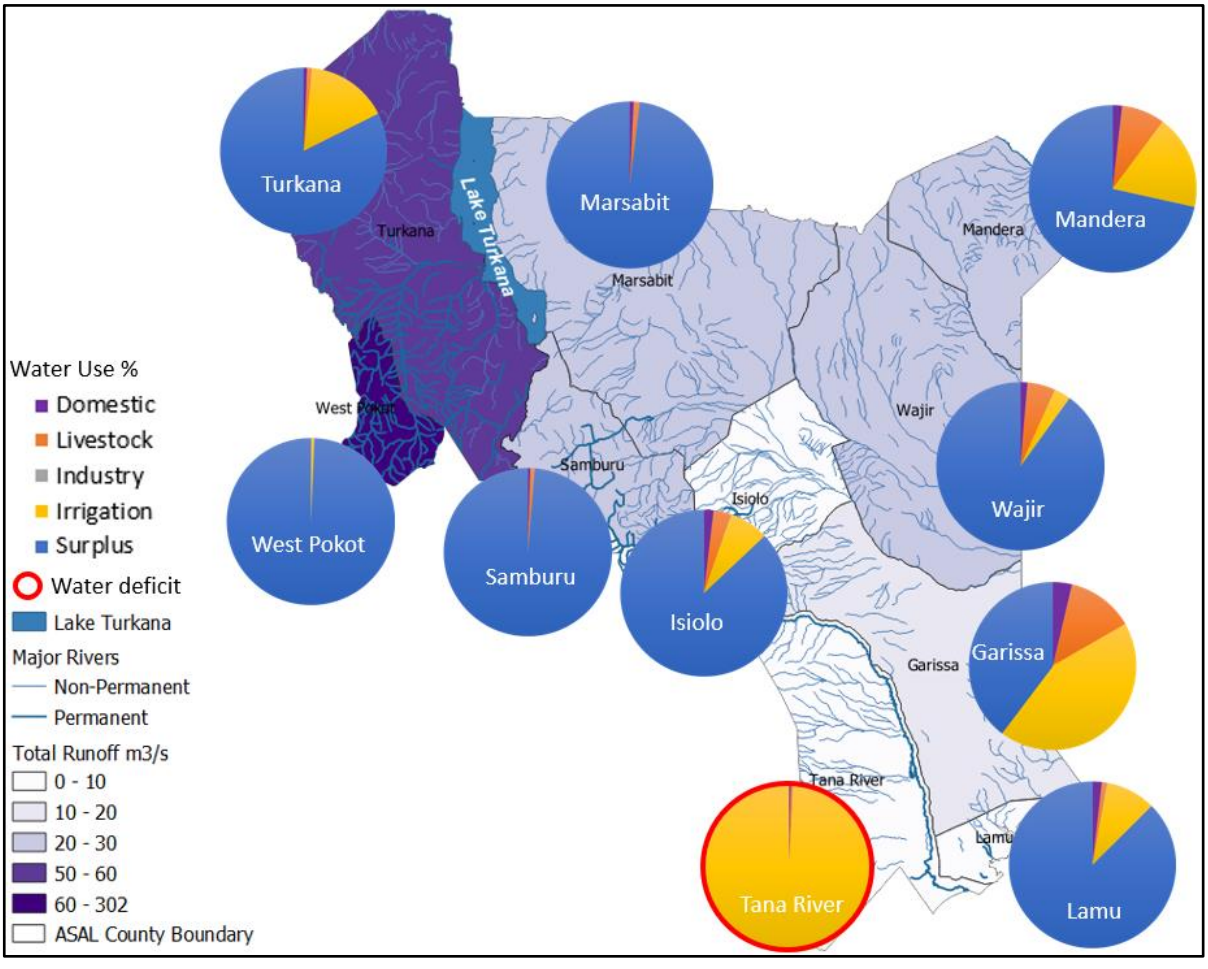
Prepared for UNEP Regional Office for Africa

Rapid Integrated Water Assessment, ASAL Kenya



Rapid Integrated Water Assessment in 10 Arid and Semi-Arid Land (ASAL) Counties, Kenya

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Introduction

The Technical Committee for Water Security in the ASAL regions of Kenya identified a need for this rapid integrated assessment of water resources in 10 counties as part of the larger Government of Kenya and UN Strategic Partnership for Water Security in ASAL regions of Kenya. This holistic, multi-disciplinary assessment of water resources and management is based on a desk study of data provided by members of the Technical Committee and County governments. The aim of the rapid assessment is to identify challenges and opportunities for building water security in the ASAL regions by considering relevant hydrological and socioeconomic conditions and institutional arrangements that impact water security and water provision to inform future interventions in the region to be supported by the UN and other relevant actors. The target audience of this rapid assessment is the Technical Committee for Water Security in the ASAL regions of Kenya, county governments, relevant national government ministries, departments and agencies (MDSs) and donors active in the region.

The ASAL regions, comprising 29 counties with various degrees of aridity, are home to 36% of Kenya's population, 70 per cent of its livestock and 90 per cent of its wildlife. Improving the quality and availability of water in the region within sustainable limits is necessary for the improvement of health and economic development outcomes, and for achieving goals to increase water security. 10 counties were selected by the Technical Committee for this rapid assessment: Garissa, Isiolo, Lamu, Mandera, Marsabit, Samburu, Tana River, Turkana, Wajir and West Pokot.

The aim was to deliver a rapid integrated assessment that considers the key social, environmental, institutional, and economic issues facing water resources management in the 10 counties. The project was conducted as a desk study over a period of 18 weeks from August to December 2021.

Methodology

A four-week inception phase assessed the extent of the data previously submitted by the counties and members of the Technical Committee the UNEP Regional Office for Africa. The Office had circulated an Excel sheet early in 2021 for stakeholders to populate with relevant data from their counties. A basic mapping tool was used to categorize the data and reports into four broad categories which form the overarching structure of the study:

1. Governance
2. Demographics
3. Water Resources
4. Risks

This data assessment sought to establish whether there were any data gaps that needed to be filled prior to proceeding with the desk study. The outcome of the data mapping exercise, which is documented in the inception report, was that insufficient data had been submitted to conduct a comprehensive rapid integrated water management assessment for the 10 counties. While sufficient

data had been submitted on Governance and Demographics, insufficient data was submitted on water resources and risks in the counties.

A request was made for additional data to be submitted for consideration, with a deadline of 8 October 8, 2021. Following limited data submission after the additional data drive, it was decided, in agreement with UNEP that the study would proceed using freely available Earth observation data, as well as some additional internet searches to locate relevant reports and documents for review[1].

The main sources of external data that supported the development of this rapid assessment were the Kenya Census data from 2019, the National Water Master Plan 2030 reports, Earth observation data and derived indices including Copernicus Global Land Service (CGLS), Copernicus ERA5 rainfall, Shuttle Radar Topography Mission (SRTM) Digital Elevation Model, Normalized Vegetation Deviation Index (NDVI), Flash Flood Potential Index (FFPI), Flood Hazard Assessment, and the Effective Drought Index (EDI). Finally, DHI's Global Hydrological Model (GHM) has been used to estimate current and future water availability in the 10 counties. The time scales for assessments and planning for future scenarios are the years 2030 and 2050, which align with political targets and ambitions as well as climate change scenarios sourced from CORDEX.

Governance profile

The ASAL region's governance profile is shaped by international, regional and national goals and frameworks including Agenda 2030 (Sustainable Development Goals), the African Union Commissions' Agenda 2063, Kenya Vision 2030 and the National Water Master Plan 2030. The institutional framework for the Kenyan water sector is presented at national, regional, county and basin levels. The institutions are further divided to consider either water resources management or water supply and sanitation. Outside of the traditional water sector framework complementary institutions, which are key collaborators for water resources management are identified, including in agriculture and irrigation, environment, climate and meteorology, and drought management. Finally, an important consideration for the rapid assessment is the devolved system of governance which provides county governments with responsibility for provision of water services to their populations, while the overall responsibility for the management of water resources remains at the national level. Policies with respect to water are listed and the regulatory institutional frameworks presented in this section.

The major findings and conclusions from the section are:

- While many water sector and partner institutions are mandated to maintain national databases for information on, among others, water resources, water services and irrigation schemes, most of this data was not submitted for review for this study. This brings into question whether the county governments have access to relevant and up-to-date data on water resources and related infrastructure.
- There are overlapping and potentially competing governance structures in place in relation to water and its management. County borders and

[1] Disclaimer: As a result, the majority of the data used to develop the water resources profile (Chapter 7) and the risk profile (Chapter 8) is based on satellite data and could not be calibrated with data from the ground.

hydrological catchment delineations are not aligned and basin and catchment management structures often cross county-borders. It is unclear whether collaboration across county-borders is functioning, but measures have been put in place, such as trans-county water resources management frameworks, to try and address the issue.

Demographic profile

The 10 counties selected for the study make up just over 10% of the population of Kenya but constitute an area that makes up more than 60% of the territory of the country. Population density is generally low in comparison to the national average. 2019 Census data allows for projections of population growth in each county for the years 2030, 2040 and 2050 using a growth rate of 2.2 per cent per annum from the 2019 Census. While no data was submitted on rates of urbanization in the region, projections for future urban population were calculated by adapting UN DESA's national urbanization rate for Kenya to the counties to estimate county numbers. Combining these figures enabled projections of the urban population in each county, important when considering future water demand.

Limited socioeconomic data was submitted to the study, but some data were available from the Kenya National Bureau of Statistics' 2017 Gross County Product (GCP) report, showing that per capita GCP was highest in Lamu and lowest in Mandera. Overall, the 10 counties are amongst the most economically challenged within Kenyat. An overview of water and sanitation services for the counties was also extracted from census data. While the National Water Master Plan 2030 (launched in 2014) targets 100 per cent access to good quality water by the end of this decade, the numbers show that drinking water sources and human waste disposal methods are well below national averages in terms of safety and hygiene.

Land use is a strong indicator not only of socioeconomic development but of water use and balance. Agricultural land use, for commercial and subsistence farming, takes place to varying degrees across the counties. Tana River County is above the national average level when it comes to the level of commercial farming, while Mandera and Wajir have the largest total area of agricultural land in the 10 counties. The counties are below the national average in terms of the number of rural households that practice agricultural farming, and the percentage of households that practice irrigation is very low. While the development of county irrigation plans is under the auspices of the National Irrigation Authority (NIA), none were submitted for review for this rapid assessment. Data has been extracted from the County Integrated Development Plans 2018-2022 on actual and potential irrigated land, as well as the National Water Master Plan 2030 and the NIA Strategic Plan. Discrepancies between the data on irrigation potential presented in these reports warrants further investigation, especially in Tana River County where the numbers are inconsistent. Analysis into the status of proposed irrigation and dam infrastructure from the National Water Master Plan show that of the 11 proposed investments within the 10 counties, only two have been completed since 2014 while the remaining 9 have yet to begin. Livestock is another important form of land use in the ASAL regions, with the latest data on livestock population extracted from census data. This data will be used in a subsequent section to calculate present and future water demands.

The major findings and conclusions of this section are:

- Inconsistencies in available data on the irrigation potential of the counties, especially in Tana River County, requires further investigation
- Most of the proposed irrigation and dam infrastructure set out in the Water Master Plan 2030 is yet to be initiated in the 10 counties. It is unclear whether the planned infrastructure is on schedule or whether financing has been secured.
- More data and information are needed on livestock and pastoralism, which is an important form of land use in several counties
- There is a general lack of data on environmental issues

Water resources profile

This section provides an overview of water availability, including future water availability based on climate change projections, and an assessment of water demand to estimate the current and future water balance in the 10 counties. The key variable for water availability in the area is rainfall. As there were limited ground measurements available, Earth observation data were used to capture the full spatial variability across the 10 counties. Total run-off for each county is an output from DHI's Global Hydrological Model and provide estimates of the current water availability for the baseline period 2003 to 2020. High temperatures and potential evaporation in the area means that the spatial pattern of run-off (shown in the figure below) is similar to the pattern of rainfall.

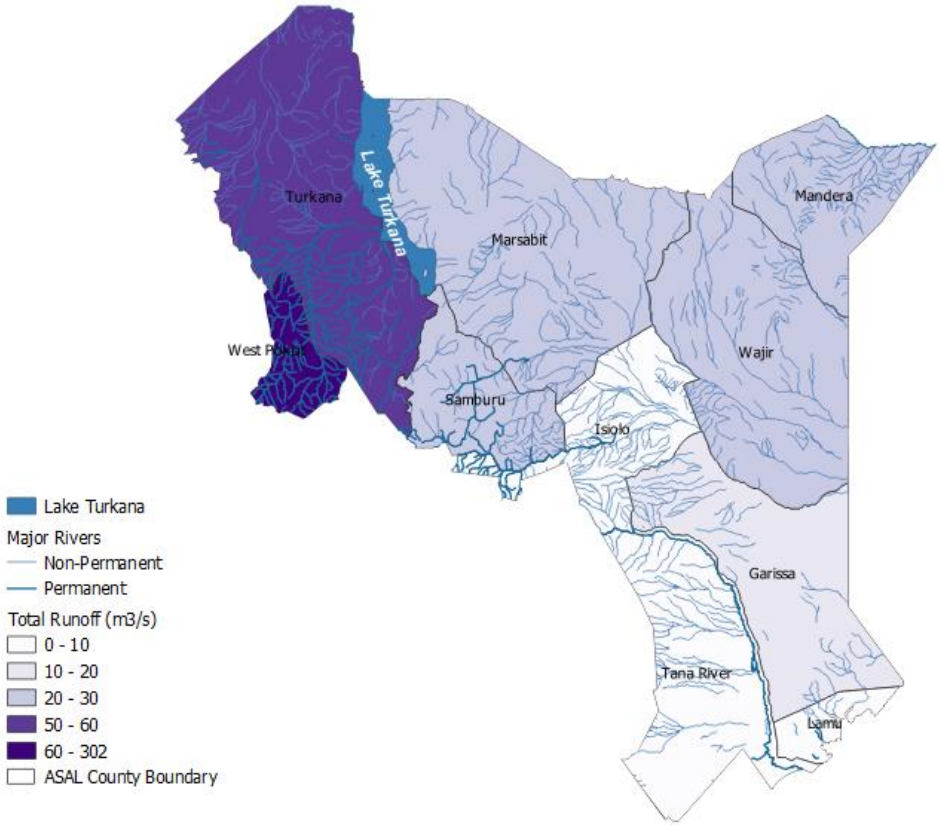
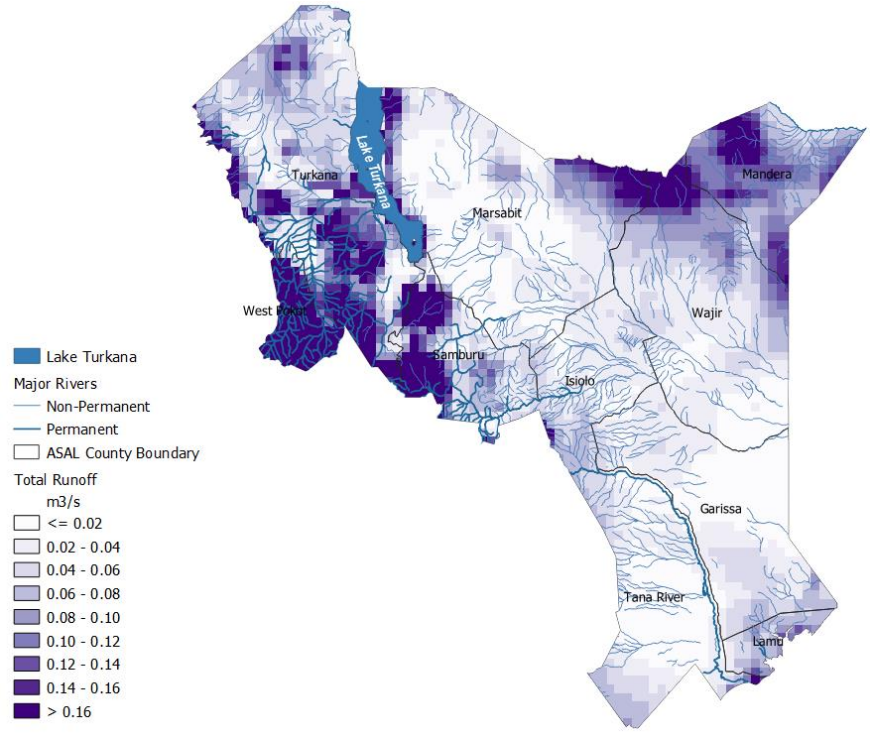


Figure 0-1 Total run-off (total water available) in each county simulated by DHI's Global Hydrological Model

Future projected changes in precipitation are generally more uncertain and more complex than temperature, with increases projected in some months and areas and decreases in others. Annual rainfall is projected to increase across

the 10 counties from present day to 2050 by approximately 10-20 per cent. However, there is substantial variability in future rainfall projections through the year. In dry season months, rainfall is projected to increase in December to February from present day to 2050 but decrease in June to August. Annual temperatures are projected to increase between 1 and 1.6°C across all counties by 2050, with generally lower increases towards the coast.

Projected changes in temperature, evaporation and precipitation for 2050 indicate an expected increase in annual average run-off across most counties (see Figure 0-2 below for present and 2050 run-off).



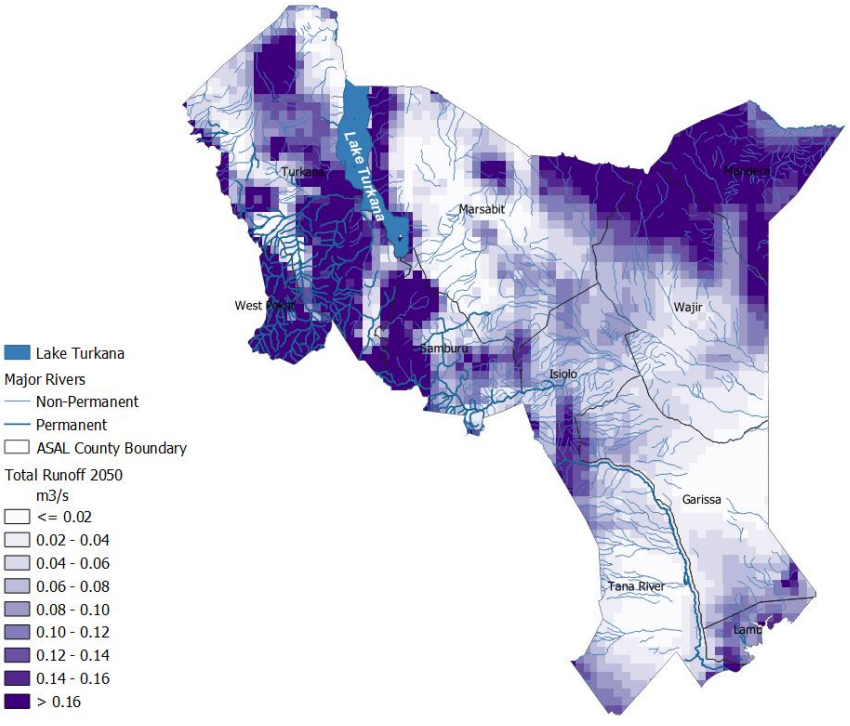


Figure 0-2 Total annual run-off simulated by DHI's Global Hydrological Model for present day (top) and under future climate change 2050 (bottom)

Data on existing water infrastructure in the 10 counties submitted for review were limited and, in many cases, outdated. Some data were submitted on location of boreholes, but not for all counties. Boreholes are an important source of drinking water. Households in the 10 counties depend more on water from boreholes than the national average, with over one quarter of households in Garissa and Wajir sourcing their drinking water from boreholes. No data were submitted on non-revenue water levels in the counties, hence attempts to calculate future losses were aligned with national targets which may be significantly lower than actual figures.

Limited data were submitted on the state of the environment and ecosystems in the 10 counties. NDVI derived from Earth observation data is presented as an indicator of green vegetation and the findings are consistent with spatial rainfall patterns. Plotting change over time in NDVI can indicate changes in vegetation patterns and indicate longer term ecosystem changes. Based on this data alone, there is limited evidence to suggest that vegetation has decreased in the region as a whole since 2000. Using data submitted to UNEP's SDG 6.6.1 Indicator's Freshwater Ecosystem Explorer, the study was able to identify the main wetlands in the project area, but lack of data submitted to the monitoring exercise meant that it was not possible to measure the extent of change over time. Protected areas including national parks, forests reserves, national reserves and game sanctuaries are found in the project area, while Lake Turkana is an important waterbody. Thousands of livelihoods are dependent on its ecosystem services. More information is needed to conduct a more in-depth assessment of the state of ecosystems in the project area.

Present and future water demand in the counties considers several sectors, including domestic consumption, institutional and commercial water demand, non-revenue water, irrigation, livestock, and industry. Irrigation is by far the largest use of water. Based on potential irrigated areas used in future scenarios, there may be a mismatch between water availability and planned irrigation expansion, especially in Tana River County. Water demand from livestock was calculated using Livestock Units for each livestock type, based on population figures from the census and how much water each type required per day. Data on water demand due to industrial activities were limited, and there were no data available to assess future demand.

To estimate the water balance for each county, the modelled water availability (total run-off) and the estimated water demand are used. Limited data availability means that the final water balance is a best estimate but comes with inherent uncertainties and should be used with caution when drawing conclusions and making recommendations.

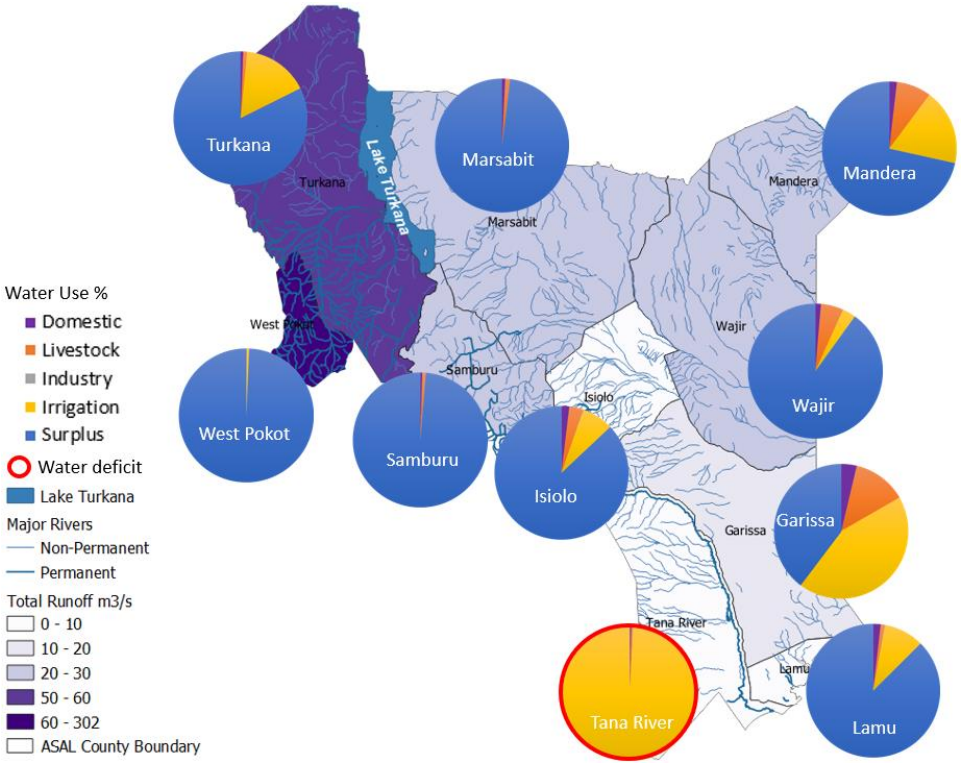


Figure 0-3 Present day total annual run-off and percentage water use by sector including surplus

The water balance has been calculated for the years 2030 and 2050. While total run-off is expected to increase, potential irrigation demand is so great that there is a negative water balance in Tana River, Garissa and Lamu counties.

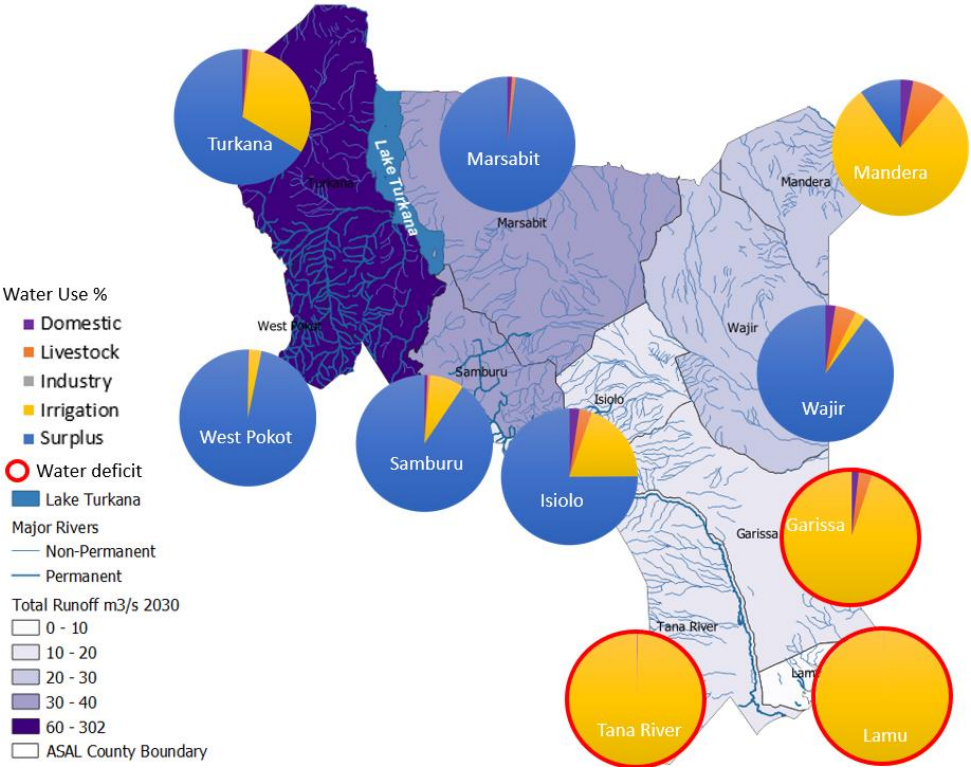


Figure 0-4 2030 total annual run-off and percentage water use by sector including surplus

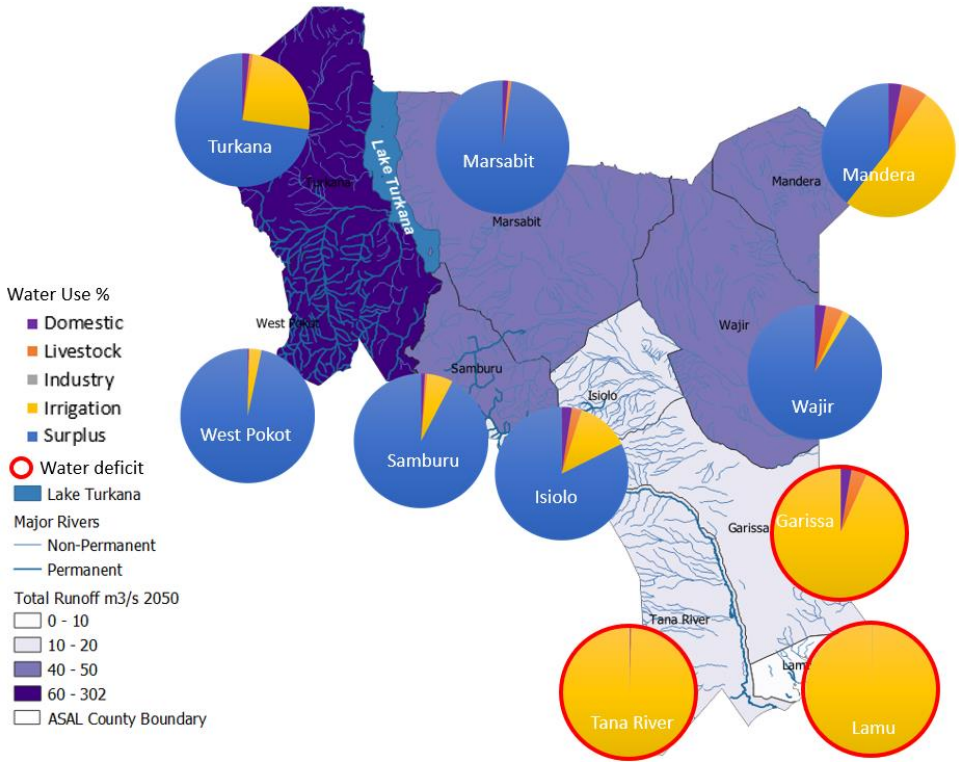


Figure 0-5 2050 total annual run-off and percentage water use by sector including surplus

The major findings and conclusions of this section are:

- Temperatures are projected to increase by 2050 across all counties and in all months, with increases in precipitation projected in both rainy and dry months
- Most counties have a surplus of annual water at present, and in future climate change projections, though most run-off occurs in the rainy seasons and a water deficit in the dry months is likely.
- Further analysis of the situation is needed in Tana River, Garissa and Lamu counties where there is an annual water deficit due to the irrigation
- Limited data has been submitted on groundwater, further analysis is needed of present and future groundwater resources

Risk profile

Climate change is expected to influence water resource availability around the globe, resulting in less or more water, and an increase in the frequency and intensity of hydrometeorological events such as floods and droughts. Competition for scarce resources could increase, thus increasing the risk and vulnerability of exposed populations. Studies on climate and vulnerability risk assessments have been conducted in some of the 10 counties, and an increase in focus on reducing hazard risk has led to the supposed development of community-based drought and flood risk action plans according to the Ministry of Water and Sanitation Strategic Plan 2018-2022 for the 29 most risk prone counties of Kenya, which include all 10 counties of this rapid assessment. No action plans were submitted for review as part of this study.

Water scarcity is projected to increase according to IPCC assessments. To analyse water availability in water scarce years, the lowest run-off year in the baseline period 2003 – 2020 was selected to represent a water scarce year. The resulting negative water balances in Garissa, Lamu and Tana River counties in the most water scarce years indicate that current demand cannot be met in water-scarce years.

Increased evidence of observed changes in extremes such as heavy precipitation could indicate future increases in flooding. Flood indicators were used to analyse flood risk across the 10 counties, with the Flash Flood Potential Index showing that Turkana, Samburu, Marsabit and West Pokot counties have the largest areas with a high (or above average) risk of flash flood. Parts of Tana River, Isiolo and Lamu counties are also at high risk.

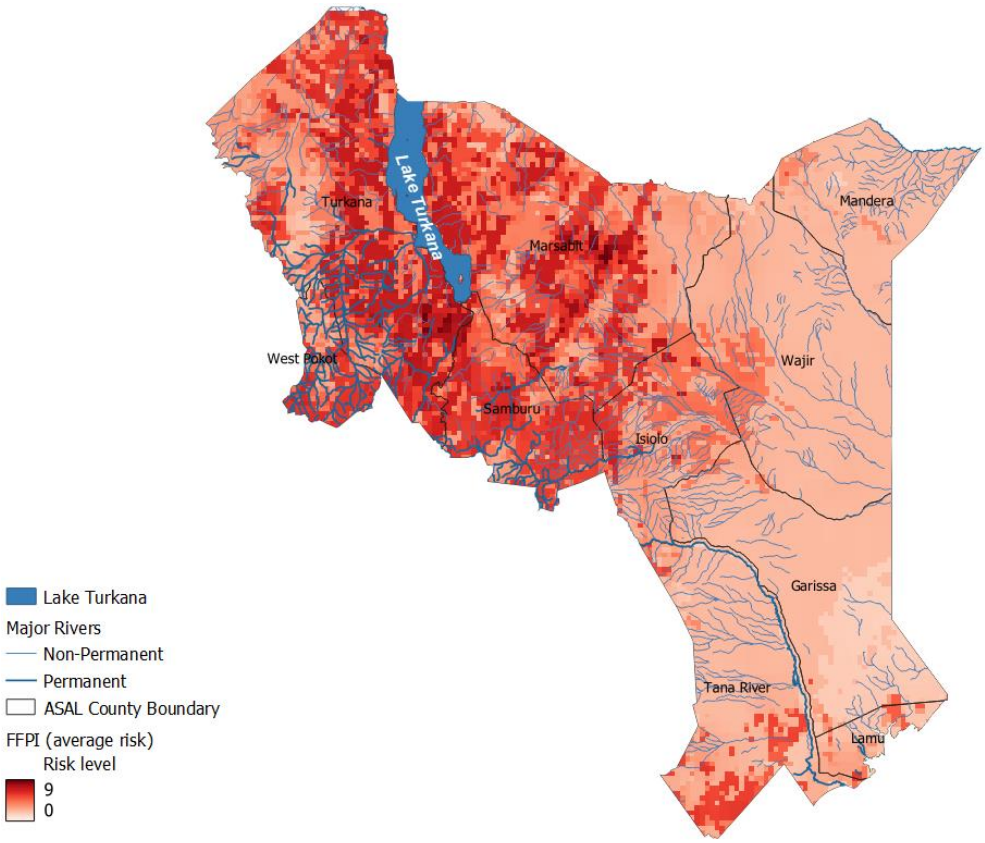


Figure 0-6 Average Flash Flood Potential Index (FFPI) 2007-2021 from low risk (0) to very high risk (9)

Riverine flooding, where water overflows riverbanks, is also mostly caused by heavy rain. Hazard maps for a 25- and 100-year return period are presented, and it is possible that riverine flood risk could increase in frequency and magnitude with projected increases in heavy rainfall.

Conflicts between water users are expected to be exacerbated as competition for scarce resources increase in the future. Limited data were submitted on existing conflicts, but hazard atlases developed for Garissa, Tana River and Turkana showed some of the more frequent water related conflicts arising include inadequate water and pasture, resource inequality, competition over limited resources, and conflicts between pastoral communities over land and water. During times of drought, pastoralists are often required to migrate to grazing ground or in search of water resources that are further away which can lead to conflict over available resources. The ASAL region also hosts most of

the refugees in Kenya, with the two largest camps in Garissa and Turkana counties. This can also lead to conflict over water resources between host and refugee communities.

Limited data were submitted on health and water-borne diseases in the project area. Access to sanitation and handwashing services is important for hygiene and to combat the spread of Covid-19, and some additional financing has been channeled to the counties to combat the spread of the pandemic. It is unclear whether future potential impacts of the pandemic would result in a re-allocation of financing priorities.

Major findings and conclusions from this section:

- The IPCC Sixth Assessment Report shows increased evidence of observed changes in extremes such as heatwaves, droughts and heavy precipitation, including in the ASAL area
- Future climate change projections show increases in temperature extremes and in maximum one-day precipitation across Africa
- Turkana, Samburu, Marsabit and West Pokot have the largest areas with a high (or above average) risk of flash flood, and parts of Tana River, Isiolo and Lamu counties are also at high risk
- Conflicts for scarce water resources and climate change will exacerbate this risk

Projects and financing

ASAL counties receive financing for water resources from a range of partners, including internal partners such as ministries, departments and agencies, and ASAL county government budgets. External partners include bilateral and multilateral organizations, NGOs, CSOs, FBOs, UN Agencies and the Private sector. The ASAL Partnership Coordination Framework was created to ensure collaboration and cooperation between these partners. The two main internal funding mechanisms which finance water sector projects, which compliment county and national government allocations for water sector development, are the Equalization Fund and the Water Sector Trust Fund. Some external financers have grouped together, such as the ASAL Development Partners Group. A list of projects submitted for review is available in Annex 2 of this report, though it is not complete, as it does not include submissions from all members of the ASAL Development Partners Group. A comprehensive mapping of all donors and financers and their ongoing and planned projects is required as limited data were submitted upon request.

The major findings and recommendations from this section are:

- Technical trends: Most projects and programmes financed in the 10 counties focus on water supply and sanitation, with some climate proofing of existing infrastructure. These projects are aligned with the goals of the WSTF to tackle water supply and sanitation issues. There are fewer projects focused on water governance and data. Projects implemented using an IWRM approach are financed by the Netherlands Ministry of Foreign Affairs and include a focus on environmental considerations and nature-based solutions. No data were submitted on projects with a focus on groundwater.
- Financing gaps: Due to limited data it is challenging to estimate what the existing financing gaps are in the 10 counties. To achieve the SDG 6 goal of

100 per cent access to water supply and sanitation by 2030, Kenya needs to more than double its current investments annually. An analysis into the status of planned water infrastructure may shed light on further financing gaps. No data were submitted on financing or efforts made to leverage financing from the private sector, which may be an important stakeholder in plugging gaps.

Recommendations

Based on the rapid assessment exercise conducted across the four main profiles of this study (governance, demography, water resources, and risk) several gaps and topics which require further investigation or elaboration have been identified. Several key documents that support this study include plans and recommendations to be implemented by 2030. Achieving these goals will require continued support and investment in water resources planning and infrastructure. Priority actions for investments for IWRM have already been identified in the SDG 6.5.1 IWRM Action Plan, and many of these could be taken forward in the 10 counties. The rapid assessment exercise makes 9 high-level recommendations across three broad areas: improvement of physical infrastructure, governance arrangements, and data.

While data availability has limited the full potential of this rapid assessment, these recommendations target the areas where data has been sufficient or point towards gaps where further analysis would be beneficial. The recommendations require further consideration by the Technical Committee members.

1. Invest in more water supply and sanitation in the 10 counties to achieve targets, as standards are far below the national average (see section 6.3). This could be done by financing additional water storage capacity, improving water harvesting infrastructure, and increased understanding and research into groundwater recharge, to increase resilience to droughts, and bridge the increasing seasonal differences that have been projected to create a basis for secure livelihoods. This should be financed from government, private sector and development partner sources.
2. A comprehensive mapping exercise of available and planned financing from all stakeholders, including NGOs and organisations which were not considering in this study, could identify further gaps or opportunities for investment synergies. To compliment this, an analysis of the status of all planned interventions, including the CIDPs, MTP, Vision 2030 and the National Water Master Plan 2030 should be considered in each of the 10 counties. This could identify if plans are on track or whether there is a need to reprioritize planned investments in line with the water balance exercise. This exercise could also identify infrastructure investments that may require additional funding (see Table 6-13).
3. Investigate the potential for inclusion of nature-based solutions in future investments in water resources (see Section 9.3.1).
4. Increase capacity at the county level to access and engage with water resources data and information. This entails data collection, access to data, data consolidation, and management, as well as building staff capacity and system capacity on data access and handling.
5. Map stakeholder engagement more comprehensively to understand actors outside the public sphere who are engaging in water management and

could potentially finance some of the gaps identified. This is also important for the continuation of the project. The right stakeholders need to be engaged for future planning of interventions. This includes stakeholders engaging in data, water services and water resources management.

6. Analyse and address potentially escalating conflict over water resources, including the increase of floods and drought as a driver of conflict for pastoral communities There are no obvious governance structures that apply to cross-border or mobile water users. One suggestion could be to investigate how this can be addressed at ASAL or cross-county level, with a recommendation to prioritize counties with the highest livestock populations, such as Mandera, Wajir, Garissa (see Figure 6-10).
7. Improve monitoring and access to data at county level on physical water-related resources, infrastructure, and the state of environment.
8. Improve access to data by implementing a Decision Support System (DSS) to support the relevant agencies in Kenya getting easy access to data to inform robust decision making. A DSS would improve monitoring and access to data (see Recommendation 8) and increase capacity for engagement with water resources data and information (see Recommendation 5). In addition, a DSS can support robust decision-making regarding investment and interventions, including nature-based solutions (see Recommendation 3), by providing a tool to analyse and compare the impact of interventions (e.g. irrigation schemes, dams, flood prevention) and prioritise investment through scenarios and multi-criterial decision analysis. The DSS, or existing databases, should be supplemented by freely available Earth observation datasets to provide easy access to a consolidated database of all available information.
9. Check whether the irrigation potential for each county is calculated appropriately considering the available water balance, including under climate change scenarios, in addition to soil/land potential, and support county governments to develop county water services strategies to inform future CIDPs in line with the Water Act 2016 regulations-