

# Hotspot analysis– Tana River county

Technical report

December 2025



GLOBAL  
CENTER ON  
ADAPTATION



# TABLE OF CONTENTS

- Table of contents ..... iii
- Table of Figures ..... vi
- 1. Introduction..... 1**
  - 1.1 Context ..... 1**
  - 1.2 Objectives of the report ..... 3**
  - 1.3 Methodology ..... 3**
  - 1.4 Hotspots hazard exposure screening ..... 5**
    - 1.4.1 Pluvial flood hazard mapping ..... 5
    - 1.4.2 River flood hazard mapping (100 years return period) ..... 6
    - 1.4.3 Rising water table flooding hazard ..... 7
    - 1.4.4 Others ..... 8
    - 1.4.5 Conclusion ..... 9
- 2. Hotspot analysis ..... 10**
  - 2.1 Mkomani village..... 10**
    - 2.1.1 Proposed Project Description ..... 10
    - 2.1.2 Site Description ..... 11
    - 2.1.3 Water Sources ..... 12
    - 2.1.4 Rapid climate risk screening in the area ..... 12
    - 2.1.5 WASH related challenges ..... 14
    - 2.1.6 Adaptation Mechanisms..... 15
    - 2.1.7 Community Organization ..... 16
    - 2.1.8 Community Recommendations ..... 16
    - 2.1.9 Gender and Socio-economic Impacts of Climate Hazards ..... 16
  - 2.2 Bura ..... 16**
    - 2.2.1 Proposed Project Description ..... 16
    - 2.2.2 Site Description ..... 17
    - 2.2.3 Rapid climate risk screening in the area ..... 19
    - 2.2.4 WASH related challenges ..... 21
    - 2.2.5 Adaptation Mechanisms..... 22
    - 2.2.6 Community Organization ..... 22
    - 2.2.7 Community Recommendations ..... 22
    - 2.2.8 Gender and Socio-economic Impacts of Climate Hazards ..... 22
  - 2.3 Wolestokocha ..... 24**

2.3.1	Proposed Project Description .....	24
2.3.2	Site Description .....	25
2.3.3	Water Sources .....	26
2.3.4	Rapid climate risk screening in the area .....	26
2.3.5	WASH related challenges .....	28
2.3.6	Adaptation Mechanisms .....	29
2.3.7	Community Organization .....	30
2.3.8	Community Recommendations .....	30
2.3.9	Gender and Socio-economic Impacts of Climate Hazards .....	30
<b>2.4</b>	<b>Minjilla .....</b>	<b>31</b>
2.4.1	Proposed Project .....	31
2.4.2	Site Description .....	31
2.4.3	Rapid climate risk screening in the area .....	33
2.4.4	WASH related challenges .....	36
2.4.5	Adaptation Mechanisms .....	37
2.4.6	Community Organization .....	38
2.4.7	Community Recommendations .....	38
2.4.8	Gender and Socio-economic Impacts of Climate Hazards .....	38
<b>2.5</b>	<b>Odole, Kipini West .....</b>	<b>39</b>
2.5.1	Proposed Project Description .....	39
2.5.2	Site Description .....	39
2.5.3	Rapid climate risk screening in the area .....	41
2.5.4	Challenges of Water Supply .....	44
2.5.5	Adaptation Mechanisms .....	44
2.5.6	Community Organization .....	45
2.5.7	Community Recommendations .....	45
2.5.8	Gender and Socio-economic Impacts of Climate Hazards .....	45
<b>2.6</b>	<b>Madogo Ward .....</b>	<b>46</b>
2.6.1	Project Description .....	46
2.6.2	Site Description .....	47
2.6.3	Rapid climate risk screening in the area .....	48
2.6.4	WASH related challenges .....	51
2.6.5	Adaptation Mechanisms .....	52
2.6.6	Community Organization .....	52
2.6.7	Community Recommendations .....	52
2.6.8	Gender and Socio-economic Impacts of Climate Hazards .....	52

<b>3. Lessons learnt.....</b>	<b>54</b>
<b>4. Next steps .....</b>	<b>55</b>
<b>Annex 1. Key informants for each hotspot.....</b>	<b>56</b>



# TABLE OF FIGURES

Figure 1: Tana River County 25-years return period flood mapping .....	2
Figure 2: Tana River Salinity Mapping .....	2
Figure 3: Overall assignment process .....	3
Figure 4: Hotspots location.....	4
Figure 5: Proposed investment location - Drilling of Mkomani borehole and construction of 3 water kiosks10	
Figure 7: Mkomani Well Field and Community Structures .....	11
Figure 8: Mkomani Village Existing Raised Borehole Platform and Community Water Tank.....	11
Figure 9: Proposed investment location - Bura domestic water supply project .....	17
Figure 11: Bura Irrigation Scheme Storage Water Tank and Pipe Termination.....	18
Figure 12: Proposed investment location - Construction of Wolestokocha water pan project .....	25
Figure 14: Scenes of the Wolestokocha Lagha channels .....	25
Figure 15: Existing Water Pan in Wolestokocha .....	26
Figure 16: Different water quality Shallow Wells in the same water pan in Wolestokocha.....	28
Figure 17: Adaptation of carrying water over long distances.....	29
Figure 18: Proposed investment location - Construction of Minjila decentralized treatment facility.....	31
Figure 20: Proposed Minjilla Decentralised Treatment Facility Project Site.....	32
Figure 21: Proposed investment location – Construction of .....	39
Figure 23: Odole Village Settlement Cluster .....	40
Figure 24: Proposed investment location – Upgrading of the Madogo Mainline from intake to Madogo Palace .....	46
Figure 27: Operational, Solarized and Elevated borehole platforms in Madogo.....	47
Figure 28: Stolen Solar Panel and Broken Water Pipe in Madogo.....	51
Figure 6: Mkomani Village Community Key Informant Interview Sessions.....	56
Figure 10: Bura Key Informant Interview Session Participants .....	57
Figure 13: Wolestokocha Key Informants.....	58
Figure 19: Minjilla Key Informant Participants .....	59
Figure 22: Odole Key Informants Interview Participants.....	60
Figure 25: Key Informants at Madogo .....	61
Figure 26: County Director for Water Giving a site Brief at Maroro Well Site in Madogo.....	61

# 1. INTRODUCTION

## 1.1 Context

This document is developed as part of the K-WASH program led by the Government of Kenya and the World Bank. GCA is providing additional support to the project by bringing in Climate and Gender and social inclusion expertise through the Consultancy services of Groupe Huit.

The K-WASH program will contribute to increase sustainable access to improved water and sanitation services, eliminate open defecation, and improve the financial performance of water services providers in selected counties, including refugee-hosting counties.

Result areas across which these program development objectives (PDO) will be implemented are:

- Results Area 1: Increasing sustainable access to improved water services for households in climate vulnerable rural areas.
- Results Area 2: Increased sustainable access to improved sanitation services and elimination of open defecation in climate-vulnerable rural areas.
- Results Area 3: Improved operational and financial performance of Water Services Providers in participating counties.
- Results Area 4: Improving sector reforms, coordination, and M&E Capacity for integrated water management.
- Results Area 5: Improving integrated WASH services delivery for refugees and host communities.

As per WB PAD from March 2024, World Bank financing will amount to 200 MUSD by June 2030.

As part of the GCA assignment, the Consultant has provided Climate Risk Analysis (CRA) for the Counties of Murang'a and Tana River and support to other counties for them to develop their own CRA. This has been done in parallel with ensuring that climate risk assessment outcomes were properly integrated into the Counties Water Supply and Sanitation Investment Plans (CWSSIP) for the latter to be validated by K-WASH task teams and the World Bank. CWSSIPs are guiding and strategic documentation which also enables to meet the first DLI of the K-WASH project.

More precisely the Climate Risk Assessment (CRA), based on a review of relevant literature – particularly the PCRA and CCAP documentation – identified key hazards that were mapped (see below) and studied further. The hazards outlined below have direct or indirect implications for WASH systems and are considered of major importance for the county:

- Floods:
  - ▶ Pluvial floods
  - ▶ River floods
  - ▶ Rising water table floods
- Soil and water salinity
- Heat stress and droughts
- Coastal erosion
- Sand and dust storms
- Pests and diseases

Building on this screening, the consultant further deepened the hazard exposure assessment at the county level in the CRA (as per figures below). The next step focuses on detailing these risks at the infrastructure level, to inform climate risk-informed WASH investment planning and design.

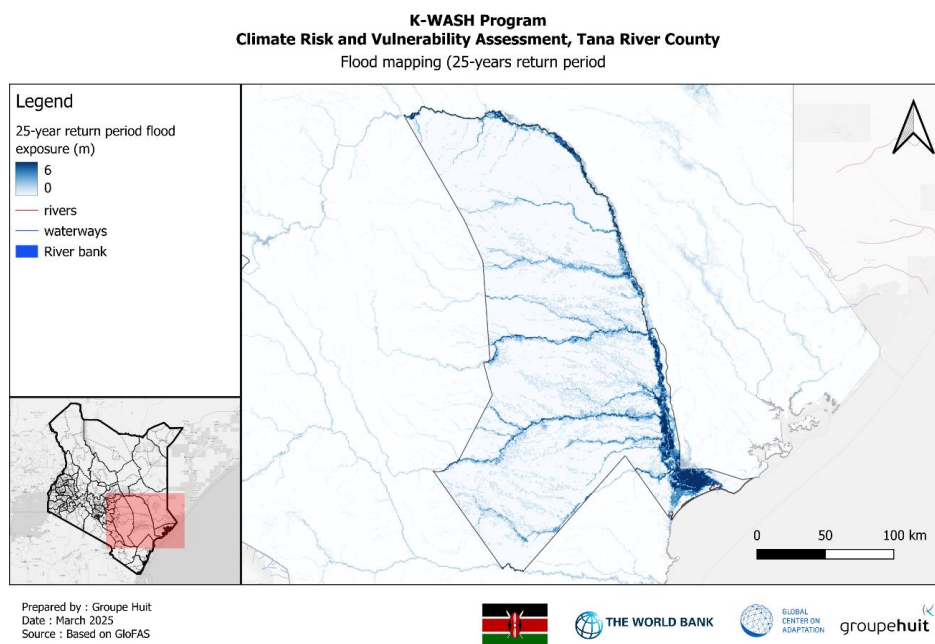


Figure 1: Tana River County 25-years return period flood mapping

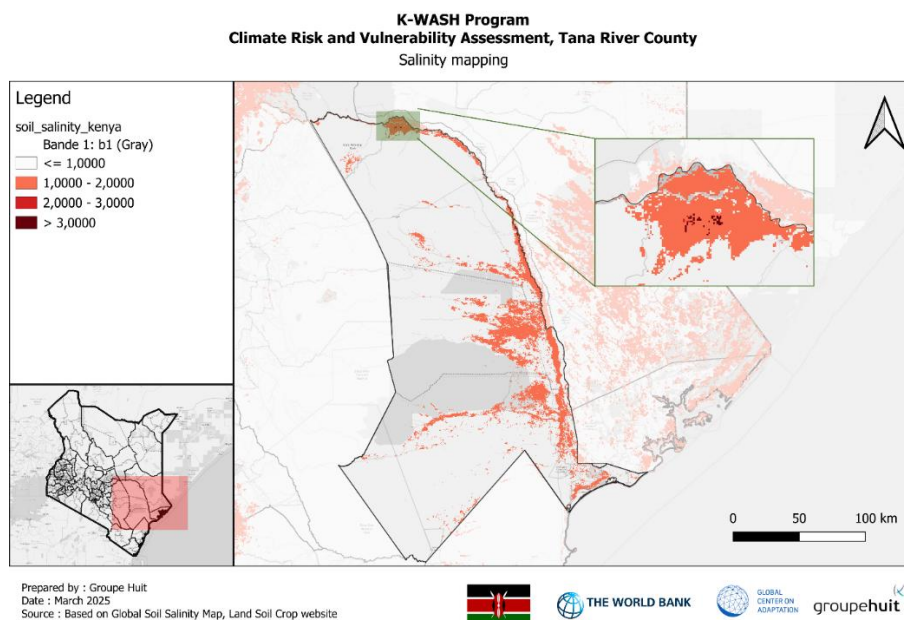


Figure 2: Tana River Salinity Mapping

## 1.2 Objectives of the report

This report presents assessments for six hotspots in Tana River County. It explains how the sites were selected building on the Climate Risk Assessment and the provided list of proposed infrastructure (CWSSIP), this document includes a hazard exposure screening and onsite assessments. The findings will inform the Adaptation Options Report, which will specify the technical adaptation measures that can improve WASH systems resilience in Kenya and in the County. This process is presented in the Figure below.

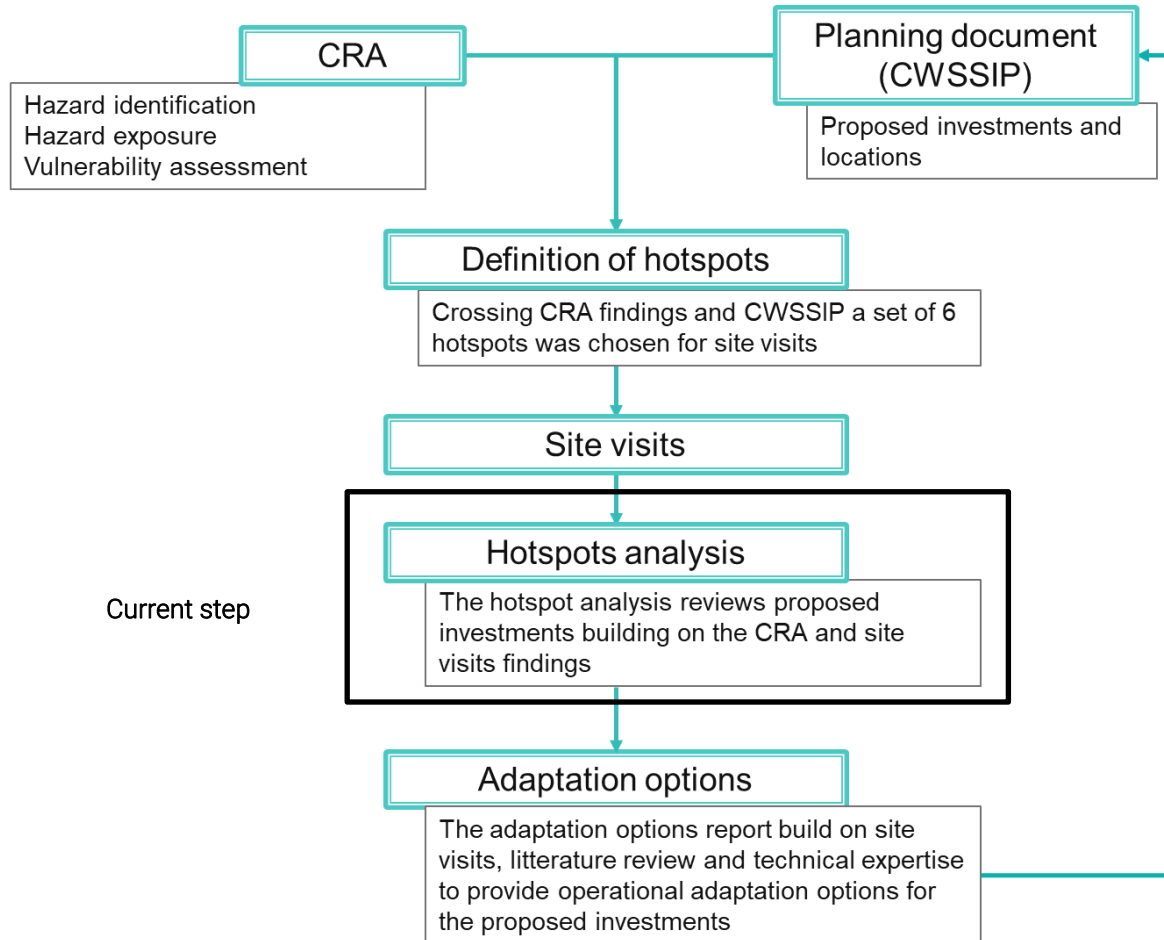


Figure 3: Overall assignment process

## 1.3 Methodology

The identified hotspots were selected prior to the mission to reflect (i) different typologies of WASH aspects—covering both water supply and sanitation interventions such as pipelines, boreholes, and latrine systems—and (ii) a range of hazard exposures influenced by the county’s diverse geographical and climatic conditions. These include differentiated vulnerability to pluvial and riverine flooding, saline intrusion, heatwaves, and recurrent drought conditions that characterize much of Tana River. Hazard mapping has been done to highlight exposure of each hotspot to main hazards identified in Tana River.

While the mission focused on areas with planned infrastructure under the K-WASH program, the field assessment necessarily extended to examining existing infrastructure, service conditions, and associated challenges. The site visits undertaken in August 2025 served as the main mode of data collection. The County Director for Water accompanied the consultants to each hotspot, where key informant interviews and direct

observations were carried out to gather data on the nature and extent of climate-related hazards, their frequency, impacts, and the adaptation measures currently in place.

The findings presented in this report are contextualized against the existing and proposed water and sanitation infrastructure in the identified hotspot areas. Subsequent sections provide a detailed account of the field observations, hazard characteristics, and recommended adaptation options to enhance the resilience and sustainability of planned K-WASH investments in Tana River County.

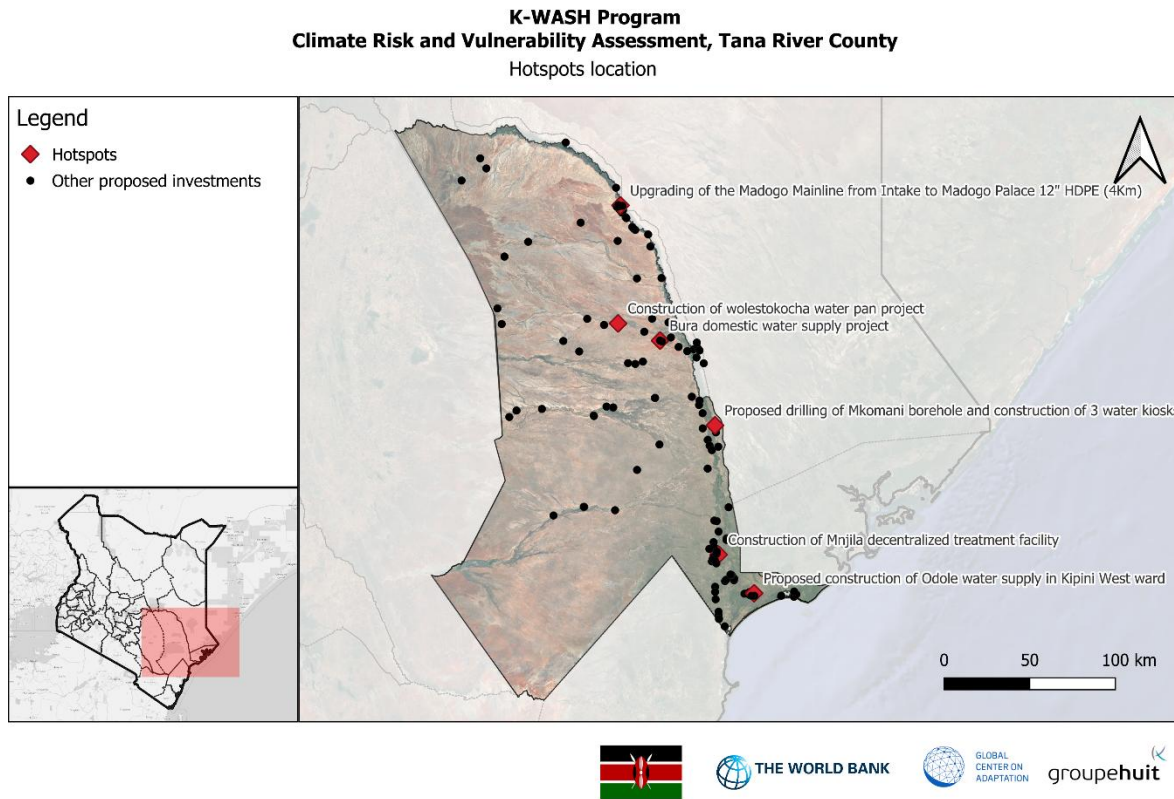
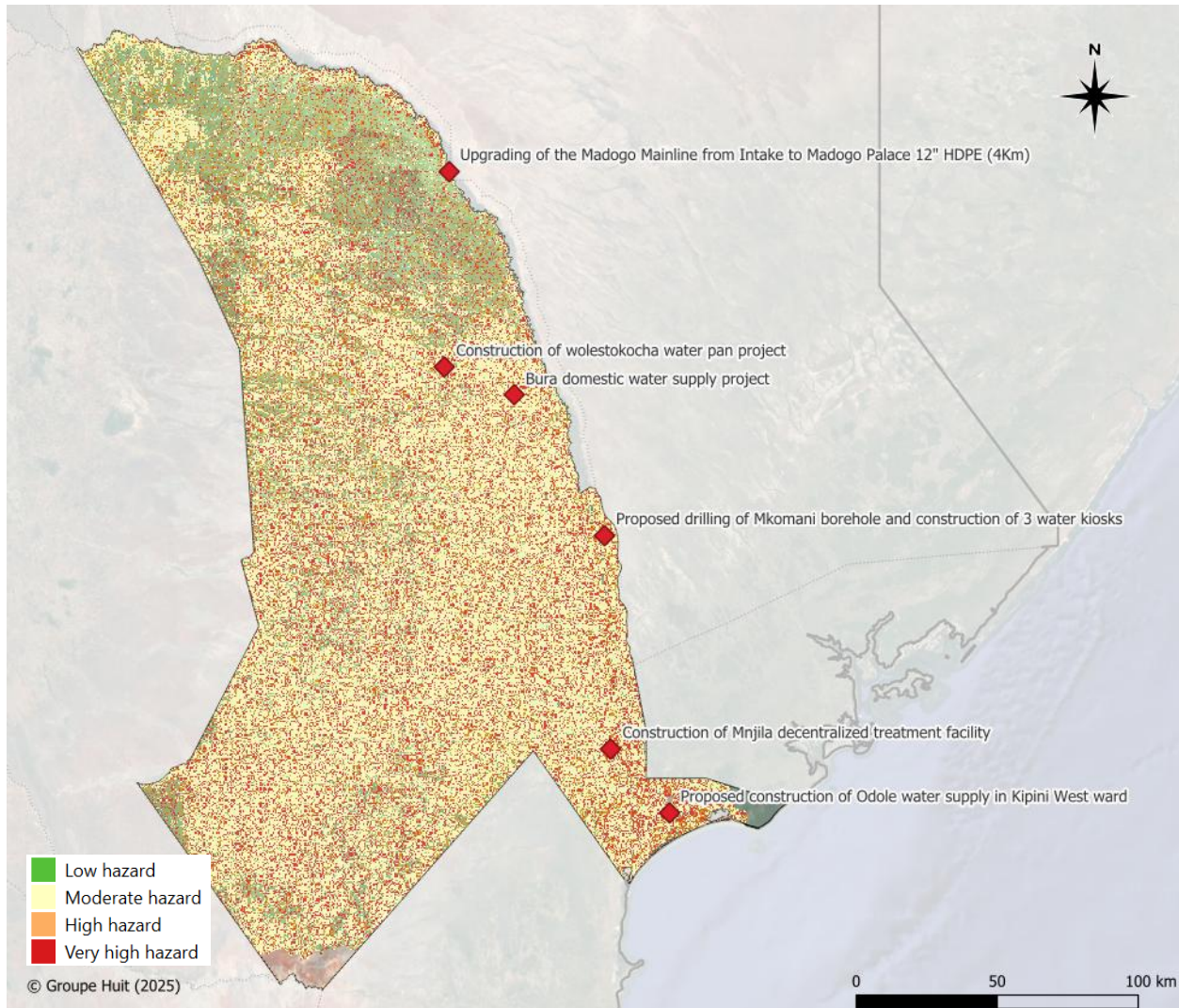


Figure 4: Hotspots location

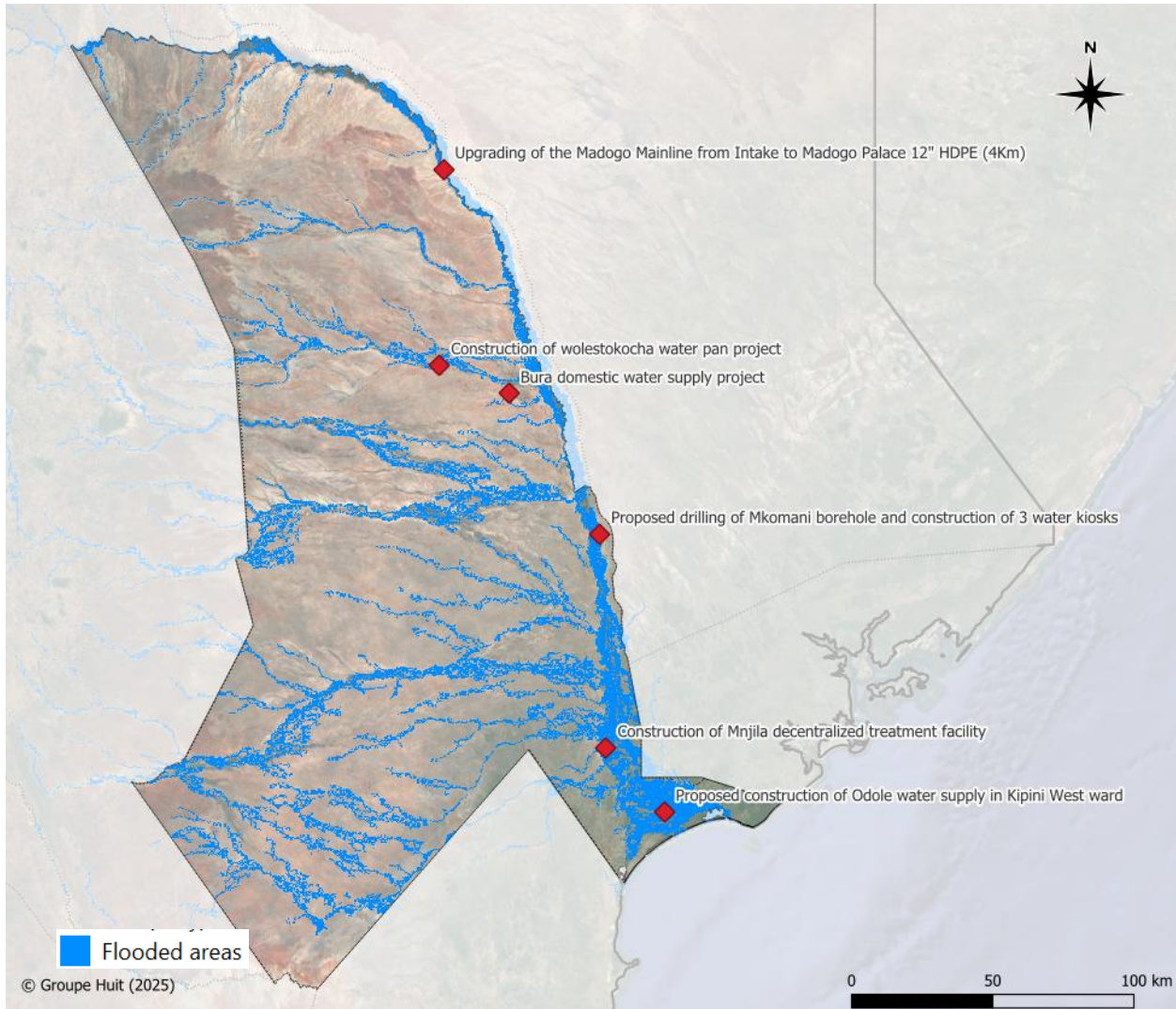
## 1.4 Hotspots hazard exposure screening

### 1.4.1 Pluvial flood hazard mapping



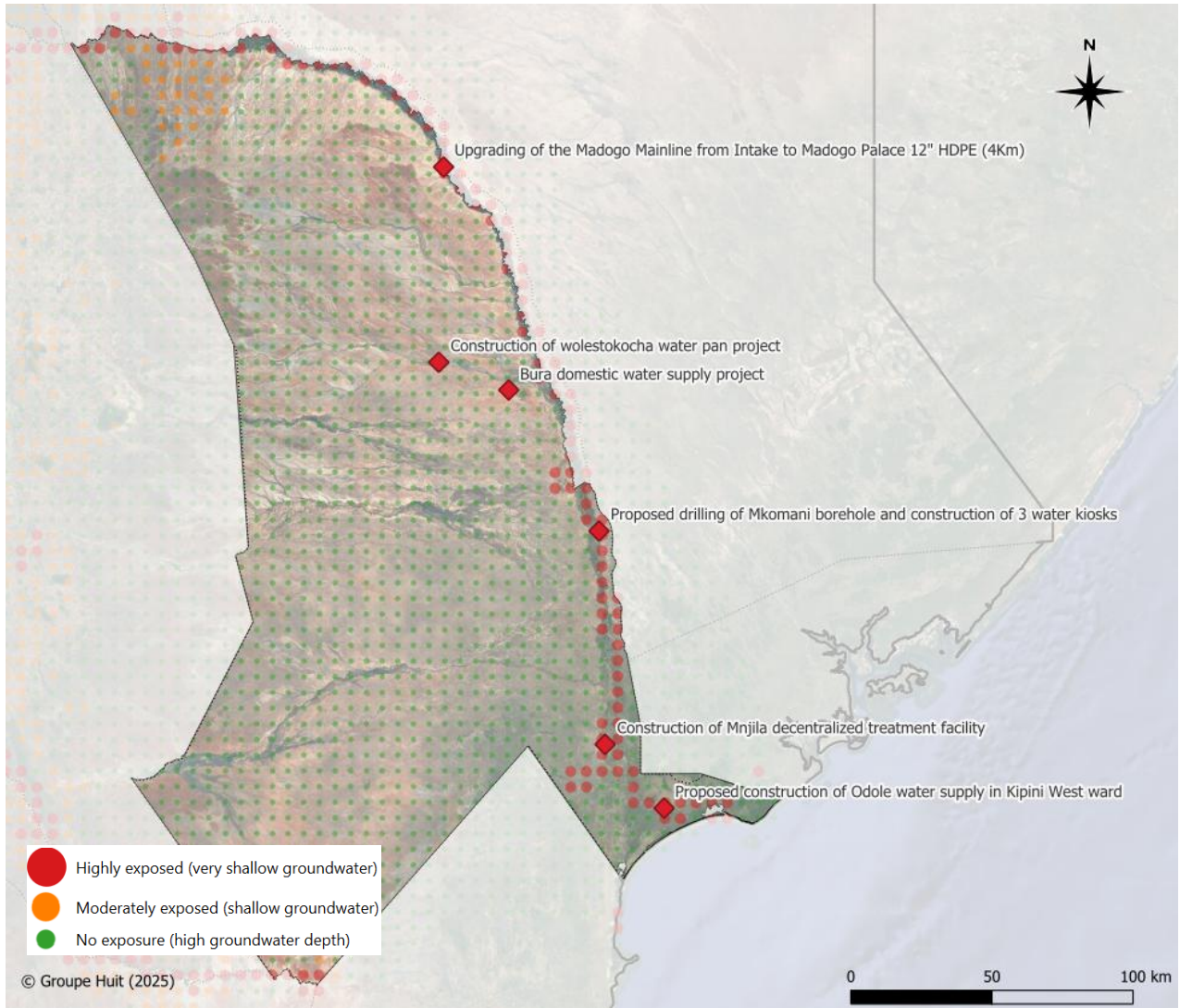
At county level the level of hazard exposure is hardly readable, maps will be zoomed in for each hotspot.

### 1.4.2 River flood hazard mapping (100 years return period)



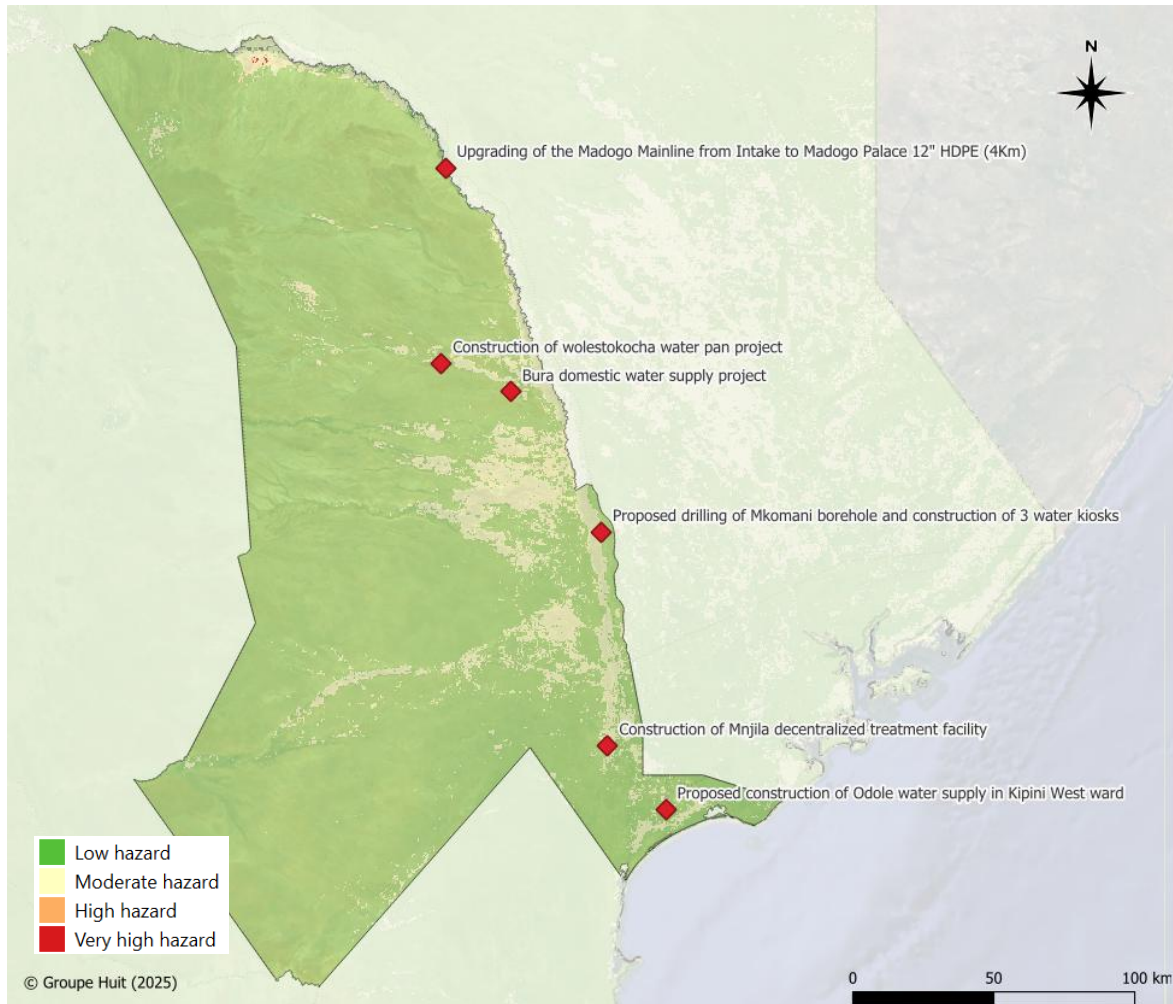
At this scale all hotspots appear close to flooded areas (100 years return period) nevertheless when zooming in it appears some are out of the flooded zones, this hazard will be studied with zoomed in maps for each hotspot in the following of the report.

### 1.4.3 Rising water table flooding hazard



All hotspots appear to be exposed to flooding from high water tables, except Wolestokocha and Bura.

## ◆ Soil salinity



### 1.4.4 Others

Heat stress and droughts is considered a common hazard for all hotspots with a high exposure level, this hazard has not been mapped.

None of the site is exposed directly to coastal erosion as they are located far enough from the shoreline, nevertheless salinity is linked to this issue and such hazard is mapped (see above). Finally sand and dust storms as well as pest and diseases have not been mapped because of a lack of data and they did not appear as the main concern (sand and dust storms) or correspond to a cascading impact of other hazards (pest and disease).

### 1.4.5 Conclusion

	Hazard exposure				
	Pluvial Flood	River Flood	Rising water table	Soil salinity	Drought & heat stress
Mkomani village	Moderate	High	High	Moderate	High
Bura	Moderate	Low	No exposure	Low	High
Wolestokocha	Moderate	Moderate	No exposure	Moderate	High
Minjila	Very high	High	High	Low	High
Odole, Kipini West	Very high	High	High	Low	High
Madogo	Moderate	High	High	Moderate	High

## 2. HOTSPOT ANALYSIS

### 2.1 Mkomani village

#### 2.1.1 Proposed Project Description

Proposed drilling of Mkomani borehole and construction of water kiosk. Preliminary and general items, hydrogeological survey, borehole drilling 60m, equipping of borehole, rising mains 1km, 1 Water kiosk, 1 cattle trough.

Coordinates : -1,62393 ; 40,11726

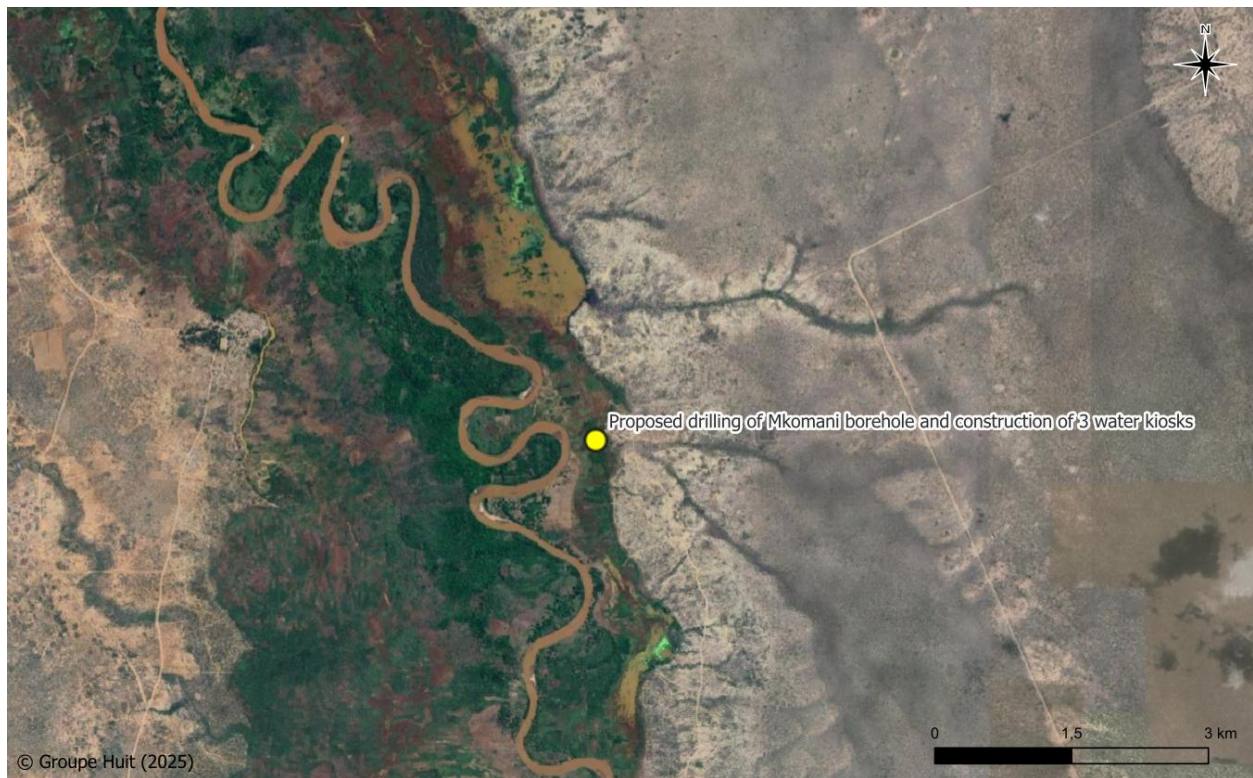


Figure 5: Proposed investment location - Drilling of Mkomani borehole and construction of 3 water kiosks

### 2.1.2 Site Description

Situated in Mazuri, the Mkomani Well Field lies within a flood-prone area along the River Tana (coordinates: -1.664° S, 40.139° E). The area has clay soil with poor drainage, surrounded by thicket vegetation, primarily bushes. Stagnant water pools were observed near the well field, indicating frequent flooding. The terrain is mostly flat, with an elevation of approximately 27.7 meters above sea level. Community structures are predominantly grass-thatched, with some iron-sheet roofs also present. The area experience flooding and drought with flooding as the most severe climate related hazard with up to 1km land surface inundated during floods.



*Mkomani Well Field*



*Community Structures*

Figure 6: Mkomani Well Field and Community Structures

*Source: Fieldwork, August 2025*

The location has existing water supply interventions, including several boreholes, though none are currently operational. A community borehole developed under the Water Sector Trust Fund (WSTF) programme was equipped by Samaritan's Purse with a solar-powered pump, pipe and an elevated storage tank to supply Mkomani village. Despite the infrastructure remaining structurally intact, the system is non-functional as the hand-dug well exhibited low yield and subsequently dried up after a short operational period.



Figure 7: Mkomani Village Existing Raised Borehole Platform and Community Water Tank

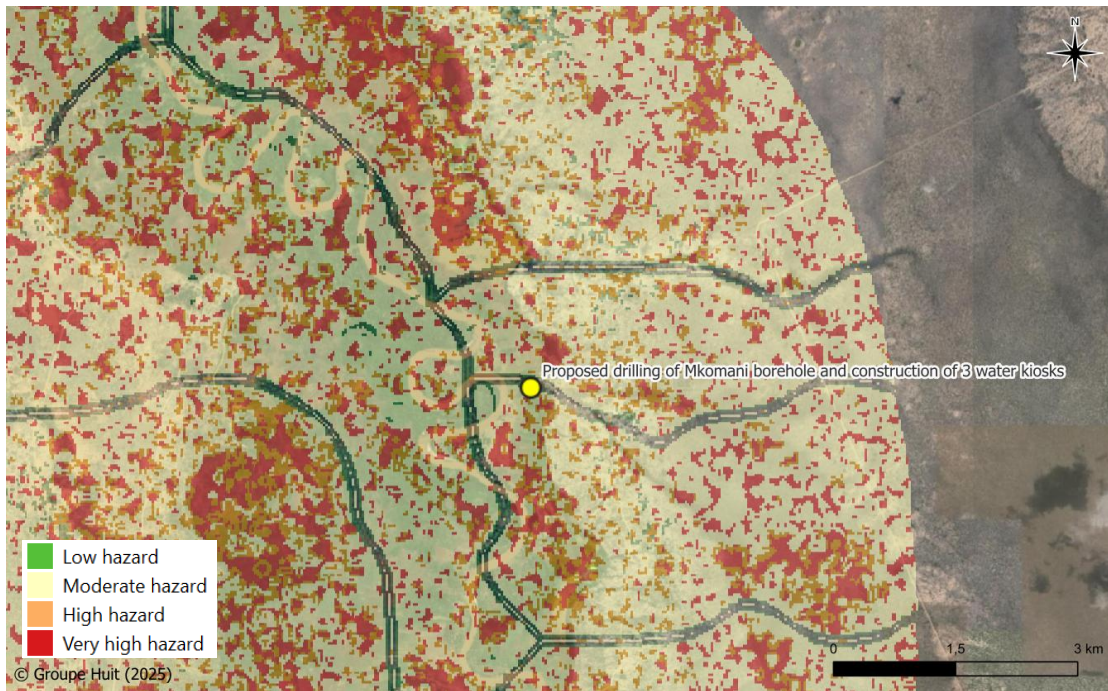
Source: Fieldwork, August 2025

### 2.1.3 Water Sources

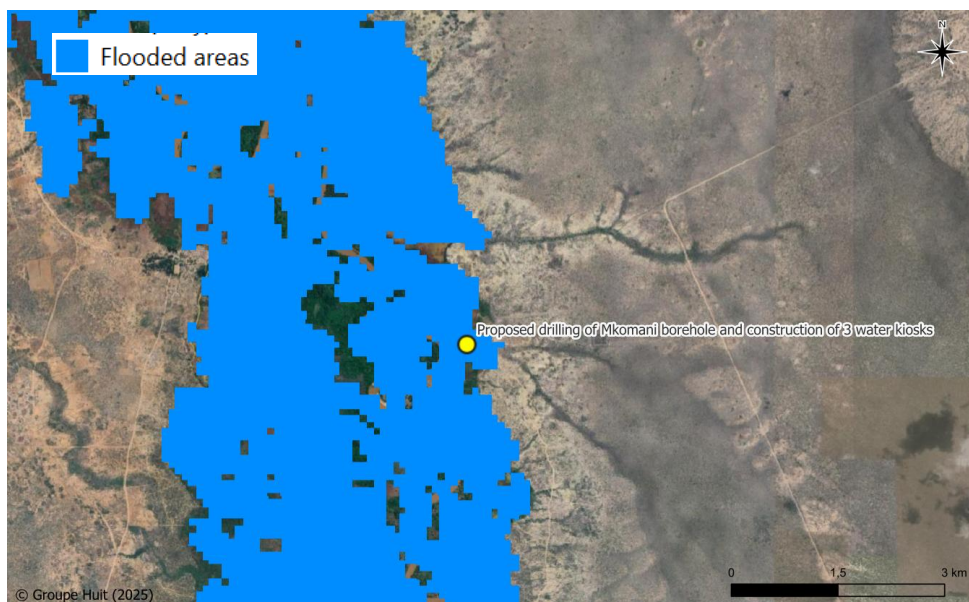
- ▶ River Tana
- ▶ Water Vendor - Boozers
- ▶ Community Water Kiosk - Not currently Functional

### 2.1.4 Rapid climate risk screening in the area

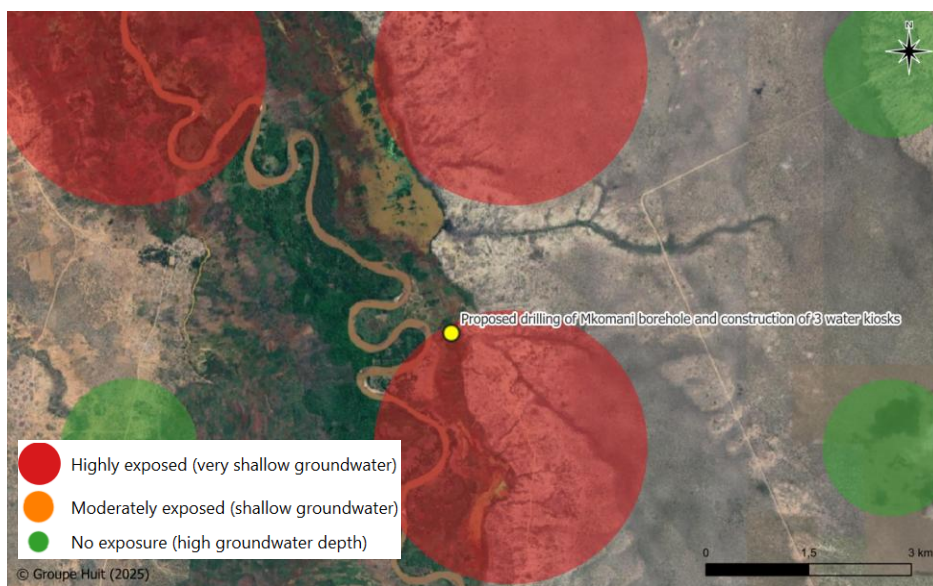
#### 2.1.4.1 Pluvial flood hazard mapping



### 2.1.4.2 River flood (100 years return period mapping)



■ Rising water table flooding hazard



### 2.1.4.3 Soil salinity hazard



### 2.1.4.4 Conclusion

According to GIS analysis of hazards datasets this proposed investment is **very exposed to climate hazards**, especially flooding with **high exposure to both rising water table flooding and river flooding** and to a lower extent pluvial flooding. Salinity does not appear to be the main concern also exposure is considered **moderate**. Finally, Tana River CRA had shown that the area is **highly exposed to heat stress and droughts**, and these hazards should therefore be considered as well.

	Hazard exposure				
	Pluvial Flood	River Flood	Rising water table	Soil salinity	Drought & heat stress
Mkomani village	Moderate	High	High	Moderate	High

### 2.1.5 WASH related challenges

The fieldworks and discussions have enabled to identify the following challenges :

- **Inadequate Existing Facilities**
  - ▶ The current water facility when functioning was not sufficient to meet the needs of the entire community.
  - ▶ The existing well was hand-dug and did not reach the required depth, resulting in low yield capacity. Although it was equipped with a solarized pump and elevated storage tank, the well dried up within three months and is no longer functional.
- **Unimplemented Borehole Project**
  - ▶ A borehole project funded through the Equalization Fund was allocated for the community; however, implementation has stalled as the contractor cites lack of capital to complete the work.
- **Unsafe Alternative Water Sources**

- ▶ Water from the River Tana is often turbid and discolored, especially during floods, rendering it unsafe for domestic use.
- ▶ Residents face risks of crocodile and hippopotamus attacks when accessing water from the river. Crocodiles killed three women and a child in the past year.
- ▶ Community members, particularly women and the elderly must walk long distances to fetch water, which is physically demanding.
- ▶ High water table salinity levels during the drought season
- **Social and Safety Concerns**
  - ▶ Girls are exposed to insecurity while fetching water, with reported cases of sexual assault and early pregnancies.
  - ▶ High poverty levels hence many cannot build iron sheet-roofed houses to support water harvesting.
  - ▶ Failure of agricultural produce during drought season and destruction of crop and animal deaths during floods resulting to food insecurity and hunger.
- **Ineffective Water Pan**
  - ▶ A water pan constructed at the community's request to provide water during dry seasons was poorly sited, limiting its capacity to harvest and store sufficient water.

## 2.1.6 Adaptation Mechanisms

### 2.1.6.1 Design Adaptation Measures

Diverse adaptation measures on infrastructures have already been implemented, amongst them :

- Borehole platforms sighted were equipped with solar-powered pumping systems to harness solar insolation, thereby minimizing reliance on grid electricity or diesel generators and reducing operational costs.
- Elevated storage tank enables gravity-fed water distribution, which lowers energy demand and reduces wear and tear on pumps, thereby minimizing maintenance costs. See figure 8 above.
- Elevated borehole platform heads to approximately 1.5m above ground level to avoid borehole contamination by floodwater during flooding events as seen in figure 8 above.
- The community has constructed ladder-like steps at designated water collection points along the River Tana. These steps facilitate safer and easier water access while improving visibility, allowing residents to spot crocodiles before approaching the river, thereby reducing the risk of attacks.

### 2.1.6.2 Community Level Adaptation Measures

Diverse adaptation measures have arisen at community level, amongst them :

- The community uses Kukube seeds from the Mkube tree to stir and treat water for domestic use. This traditional practice helps settle suspended mud and sediments; however, it has not been scientifically validated as a method for making water potable, even though the community consumes the treated water.
- Suggestion by the community to use borehole drilling machines and site investigations before drilling to ensure that the required water depth is reached to ensure enough yield capacity and sustainable water supply was echoed.
- Community members practice sack gardening as a water-efficient method to sustain vegetable production for household consumption during drought seasons.

- During drought season, women organize themselves into groups to practice subsistence farming along the riverbanks, where they pump water from the river to irrigate their farms to produce food for their families.

### 2.1.7 Community Organization

The community has an established a Water Management Committee comprising 15 members out of which seven are women and eight are men out which 6 are youths and 2 old men The committee is responsible for the following functions:

- Water Rationing especially during drought seasons for community water supply infrastructure
- Guard the infrastructure against Vandalism
- Collecting funds for maintenance and setting water tariffs. When operational, the committee prices 3 jerricans (20 liters each) at KES 5, whereas private water vendors sell a single jerrican at KES 20

### 2.1.8 Community Recommendations

Discussions with communities had led to the formulation of some recommendations from them :

- Community recommends for treated piped water from R. Tana with water tanks and water kiosk for sustainable water supply.
- Construction of water point at Mkomani Primary for Greening and Tree Planting.
- Densification of community water taps linked to storage tank.

### 2.1.9 Gender and Socio-economic Impacts of Climate Hazards

Women carry the primary responsibility of fetching water for their households, often walking long distances through bush areas and spending many hours on the task. Girls face heightened security risks, including sexual assault and early pregnancies, particularly during drought periods when water sources are far from the village.

During floods, women also collect fish from floodwaters around their homes. Women also rely heavily on rain-fed agriculture. While flooding of the River Tana can provide water for farming, it often results in the destruction of crops. Erratic rainfall and unpredictable flooding patterns further undermine agricultural productivity.

In times of drought, women organize themselves into groups to practice subsistence farming along the riverbanks, where they pump water from the river to irrigate their farms as a coping strategy.

Men are predominantly engaged in fishing activities along the river. They report that drought periods are particularly favourable for their trade, as business tends to flourish during these times

## 2.2 Bura

### 2.2.1 Proposed Project Description

Bura Domestic Water Supply Project (Distribution Pipeline Extension). The construction works will involve repairing village distribution lines, repair of 5 No. steel elevated tanks and automation of 9No. Standard water kiosks. Replace existing 3km 14" PVC pipes with 14" HDPE PN16 pipes. Last mile connectivity. Construct a new 12.5km HDPE PN16 pipe to Hosingo Village from Bura Water works. supply and installation of 7No Zonal meters, supply and installation of 3000 No. consumer metres

Coordinates : -1,17805 ; 39,82872

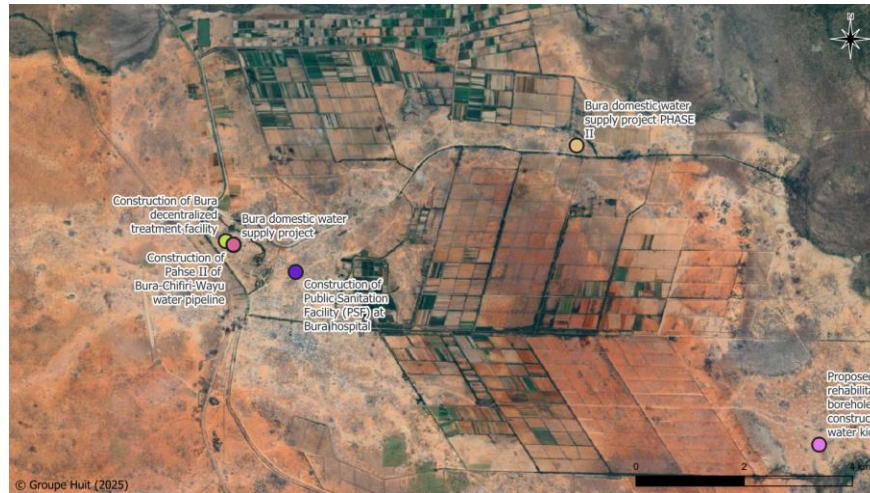


Figure 8: Proposed investment location - Bura domestic water supply project

### 2.2.2 Site Description

The proposed Bura Domestic Water Supply Project is intended to serve the villages of Idi Kalanklan, Suna, Mlimani, Village 5 and 6 in Bura, located in Tana North Sub-County, Hirimani Ward. The area lies on about 81.2 meters above sea level (Coordinates:  $-1.17847^{\circ}$ ,  $39.85608^{\circ}$ ).

The region experiences prolonged drought conditions lasting up to 11 months, with rainfall occurring mainly in April. Flooding also affects the area but is typically the result of dam failure or the release of water from upstream reservoirs, such as Masinga Dam.

Soils in the area are predominantly alluvial, ranging from sandy loams to clays, with patches of black cotton soils. Vegetation cover is largely dominated by *Prosopis juliflora*. Housing structures are mainly constructed from stone, mud, and wood, with roofing materials consisting of iron sheets and grass.

Settlement in these villages is clustered, with the surrounding land primarily utilized for irrigation agriculture. The area has a cosmopolitan population comprising diverse ethnic groups, including Kikuyu, Luhya, Orma, Pokomo, Cushite's, and Luo, among others.

Within the project area, there is an existing pipeline termination connected to two elevated storage tanks constructed and rehabilitated between 1974 and 1979. The tanks, each with an approximate capacity of 250 m<sup>3</sup> and elevated about 9 meters above ground level, remain in good structural condition but are currently not in use. They have been earmarked for integration as storage facilities in the proposed pipeline extension as shown in the image below.



Figure 9: Bura Irrigation Scheme Storage Water Tank and Pipe Termination

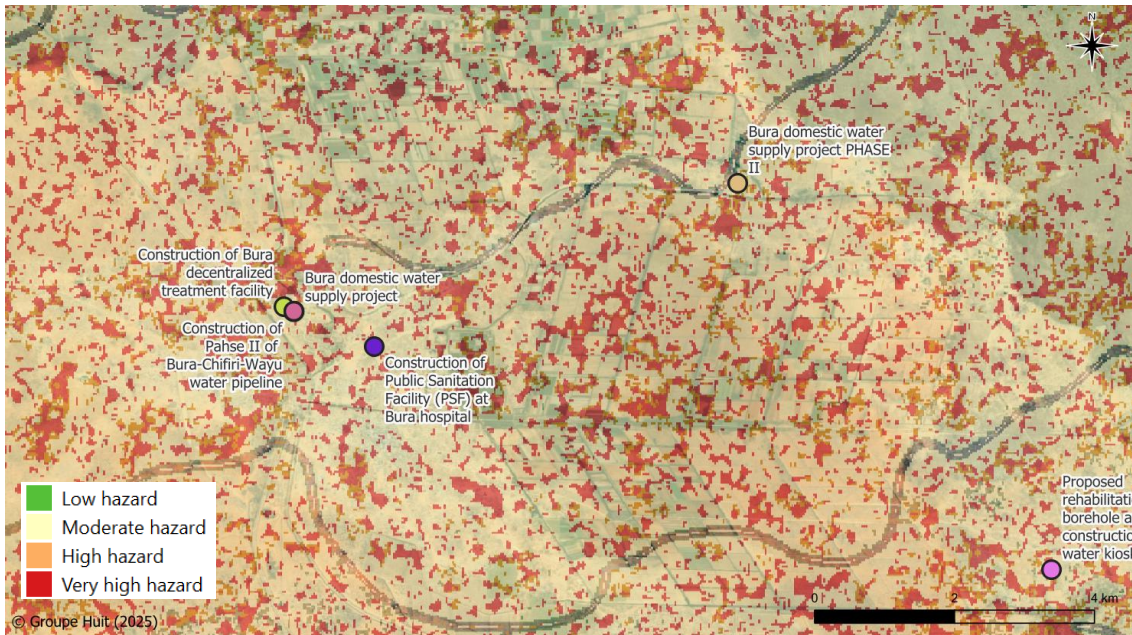
Source: Fieldwork, August 2025

### 2.2.2.1 Water Sources

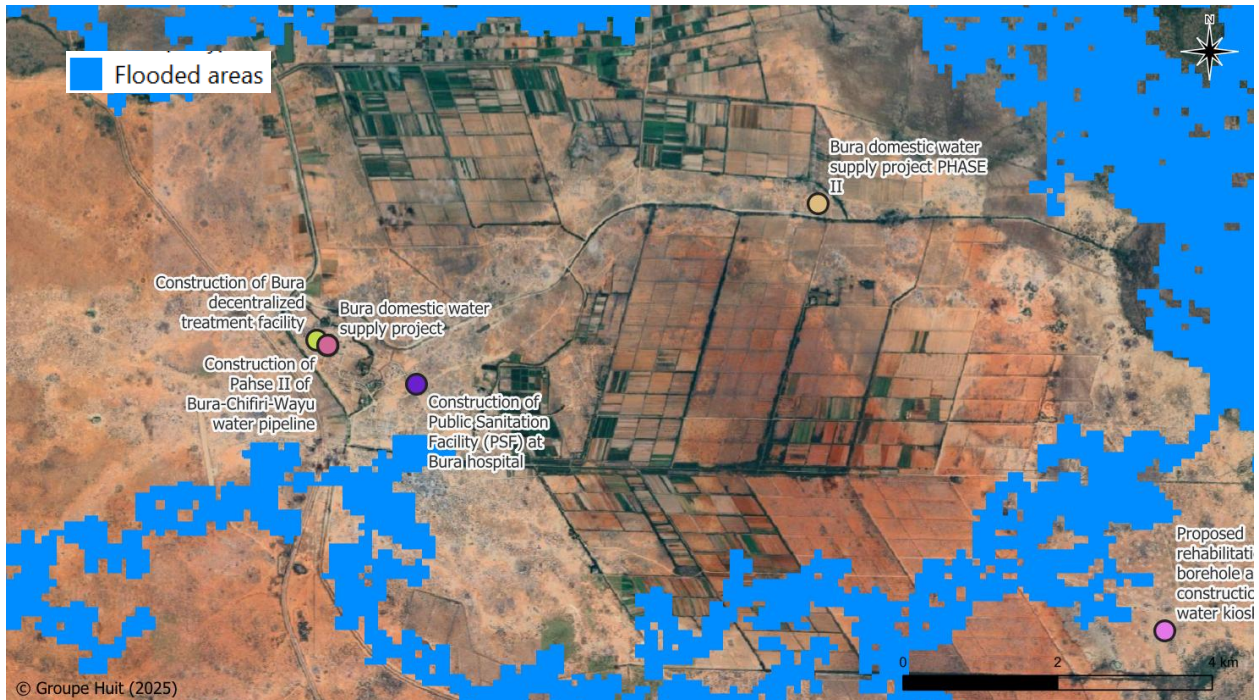
- Laghas (Seasonal Rivers)
- Bura Canal
- Shallow Wells – along Hirimani Lagha about 6-7m deep
- Bura Water Works
- Surface Ponds/Pans
- Water Vendors – Donkeys

## 2.2.3 Rapid climate risk screening in the area

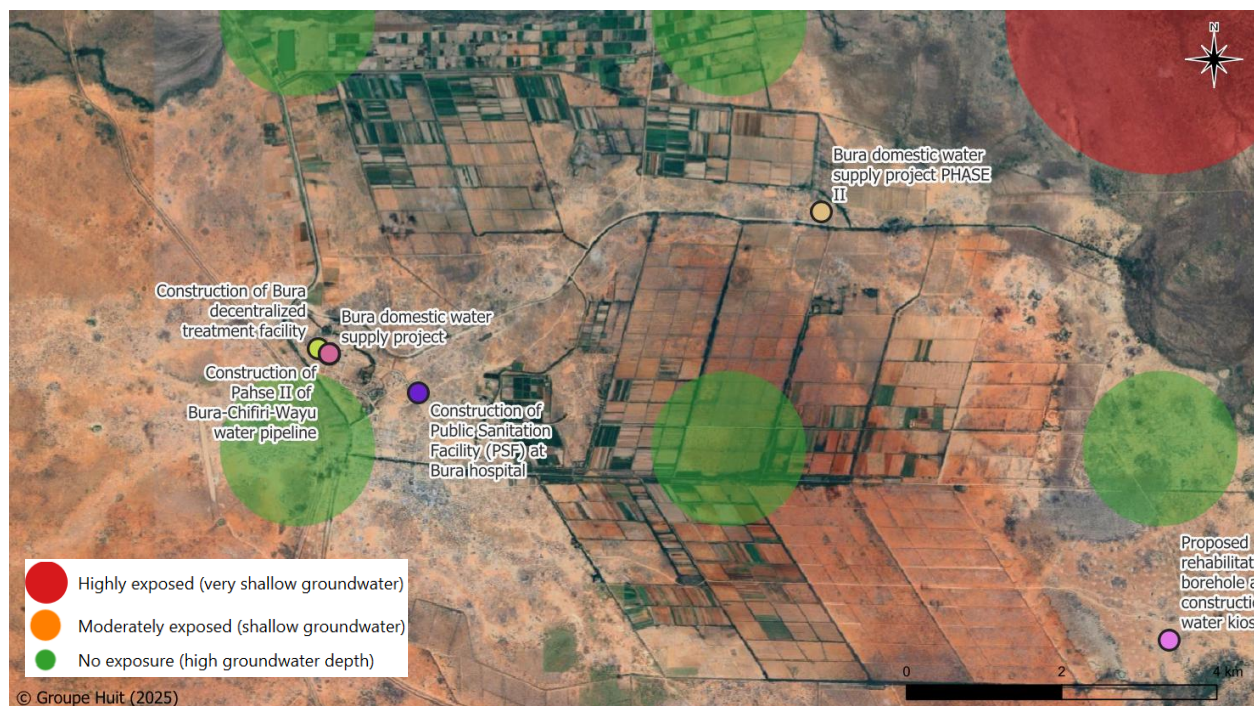
### 2.2.3.1 Pluvial flooding hazard mapping



### 2.2.3.2 River flooding hazard mapping



### 2.2.3.3 Rising water table flooding hazard



### ■ Soil salinity hazard



### 2.2.3.4 Conclusion

According to GIS analysis of hazards datasets this proposed investment is **moderately exposed to climate hazards**, indeed while the area is **moderately to highly exposed to pluvial flood** it is not directly exposed to rising water tables and river flooding. Salinity exposure is considered low. Finally, Tana River CRA had shown that the area is **highly exposed to heat stress and droughts**, and these hazards should therefore be considered as well.

	Hazard exposure				
	Pluvial Flood	River Flood	Rising water table flood	Soil salinity	Drought & heat stress
Bura	Moderate	Low	No exposure	Low	High

### 2.2.4 WASH related challenges

The fieldworks and discussions have enabled to identify the following challenges :

**Infrastructure Vandalism**- Water pipelines are frequently vandalized by youth, with lack of employment cited as the main driver of theft and sale of water infrastructure materials.

**Prolonged Drought** - The area experiences extended droughts lasting up to 11 months, with rainfall occurring mainly in April. This results in severe water scarcity and significant livestock losses.

**Inadequate Water Supply** -The Bura Water Works cannot meet the growing demand. Within Bura town, water rationing occurs up to three days per week, with some periods extending to a full week without piped water.

**Decline in Water Quality** - Water treatment at Bura Water Works has reduced significantly, rendering piped water unsafe for consumption.

**Metering and Billing Issues** - Faulty water meters result in inflated bills, with households reportedly paying between KES 3,000–7,000 per month.

**Unsafe Canal Water** - Irrigation canal water is heavily contaminated with agricultural chemicals and is unsafe for domestic use.

**Groundwater Limitations** - Borehole development is constrained by low water tables, slow recharge rates during droughts, and high salinity levels, which have led to the abandonment of many boreholes.

**Frequent Supply Interruptions** - Water outages are common due to frequent pipeline breakages. Repairs often take long, leaving residents without water for extended periods.

**High Water Tariffs** - Consumers face high water costs with limited protection mechanisms. TAWASCO kiosks charge KES 5 per 20 liters, while private water vendors sell the same quantity at up to KES 30.

Residents, particularly women and girls, walk long distances and spend many hours in search of water.

**Disease Outbreak** – because of consuming contaminated untreated water and stress associated to water scarcity within Bura, the residents have in the past suffered from Ulcers, High Blood Pressure, Diabetes, Cholera and Bilharzia outbreaks.

## 2.2.5 Adaptation Mechanisms

### 2.2.5.1 Design Adaptation Measures

It was noted that the use of HDPE water supply pipes with electro-fused joints ensures a watertight system, preventing water seepage and protecting the pipes from damage by *Prosopis juliflora* (Mathenge) roots seeking moisture.

### 2.2.5.2 Community Level Adaptation Measures

Diverse adaptation measures have arisen at community level, amongst them :

- The community is cosmopolitan with sedentary farmers and pastoralists. During drought, livestock (cattle, goats and sheep) are migrated to the Tan Delta here there is lush green pastures for the animals and water.
- Ponds and troughs to store water during rainy/flood season to be used during the dry season.
- For those who go to fetch water, they shower at the source to reduce the amount of water utilized at household level.
- During drought, men have spaced showering patterns to conserve the little water within the household.
- Construction of sand dams along the lagha to capture water during the flood season and use it during the dry season.
- The community uses Kukube seeds from the Mkube tree to stir and treat water for domestic use. This traditional practice helps settle suspended mud and sediments; however, it has not been scientifically validated as a method for making water potable, even though the community consumes the treated water.
- Water rationing by Tawasco although very high at 3 days a week ensures steady supply of potable water.
- Residents use chlorine, Alum and Pur to treat the contaminated water from canals to make it safe for consumption.
- Majority of household have extra jerricans for water storage.
- Some families opt to migrate to the Bura town area from the rural area to do business to enable them access water and food.

## 2.2.6 Community Organization

The Bura Water Works is managed solely by TAWASCO, with no community-based organization involved in decision-making regarding water supply, tariff setting, or the day-to-day management of the piped water system. This is not following common practices and WASREB rules which indicates that where some public participation should be done while setting public water supply tariffs. However inadequate sensitization/mobilisation may have resulted in most residents missing it.

## 2.2.7 Community Recommendations

The residents' proposal is to have a major dam along Tana River to supply water within Bura.

## 2.2.8 Gender and Socio-economic Impacts of Climate Hazards

As in Mkomani, women and children carry the main responsibility for securing household water, often walking long distances and spending many hours fetching it. This heavy burden not only exposes them to fatigue but

also heightens their vulnerability to gender-based violence. Prolonged droughts intensify these challenges, as women are frequently left to manage households alone when men migrate in search of pasture and water for livestock.

Men, on the other hand, are primarily responsible for livestock care, ensuring that animals are watered and fed, and supporting household food security. During extended dry spells, many men are compelled to abandon their families temporarily while seeking grazing lands and water sources, leaving women and children with increased domestic and livelihood pressures. Some men end up marrying a second wife and forgetting the first families while out there searching for green pastures.

This division of roles creates gender-differentiated vulnerabilities:

- Women face greater exposure to physical and security risks when fetching water, reduced time for income-generating activities, and added household responsibilities during male outmigration.
- Men experience livelihood insecurity tied to livestock survival and income from pastoralism, which can force migration and weaken household cohesion

## 2.3 Wolestokocha

### 2.3.1 Proposed Project Description

Construction of Wolestokocha Water Pan. Construction of a 50,000cum water pan, fencing, construction of auxilliary works, construction of a solarized draw-off system with a floating pontoon, extension pipeline to Wolestokocha village.

Coordinates : -1,08764 ; 39,60781

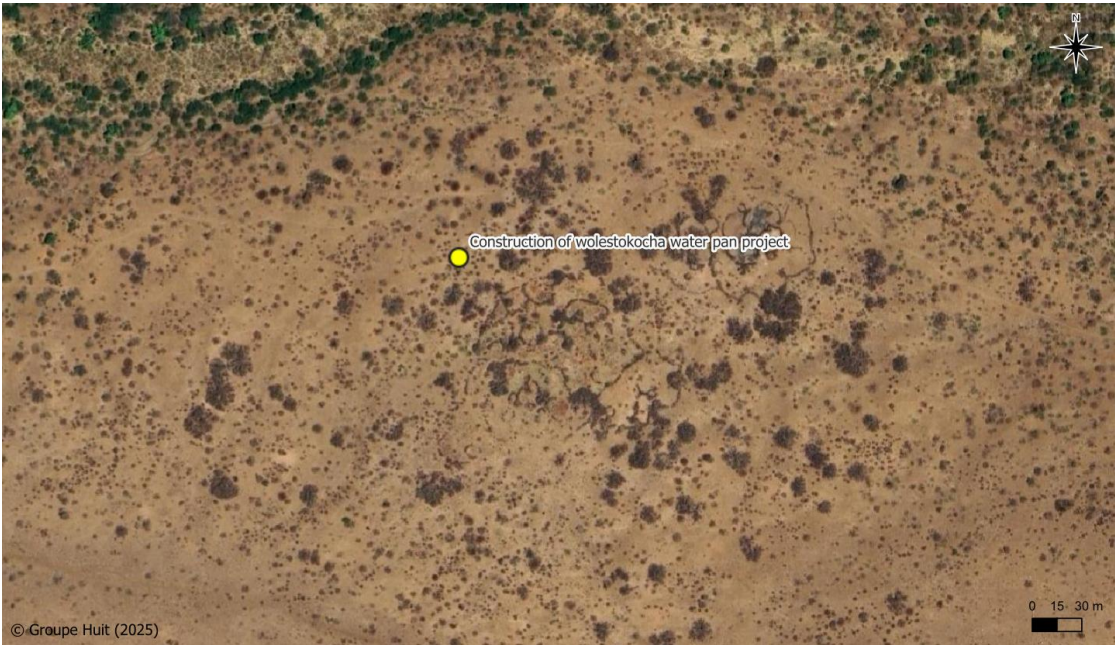


Figure 10: Proposed investment location - Construction of Wolestokocha water pan project

### 2.3.2 Site Description

Wolestokocha, located in Hosingo Location in Tana North, lies at an altitude of approximately 118 meters above sea level. The area is predominantly flat and experiences very high temperatures, with severe drought conditions typically setting in from May, following the rains in April. The area experience rainfall in April and November though the rainfall pattern is more erratic and unreliable. Vegetation cover mainly consists of shrubs, with Acacia and Prosopis being the dominant species.

The soils are highly weathered, ranging from fine sandy to clay types, with clay and silt dominating along the laghas, where the proposed water pan is planned for construction. A similar project already exists at coordinate's  $-1.10709^{\circ}$ ,  $39.64743^{\circ}$ , a few kilometers from Wolestokocha Primary School, as shown in the image 8 below. The settlements in this region are sparse but where they exist they are clustered into villages with an average household size of 8 persons per household.



Figure 11: Scenes of the Wolestokocha Lagha channels

Source: Fieldwork, August 2025



Figure 12: Existing Water Pan in Wolestokocha

Source: Fieldwork, August 2025

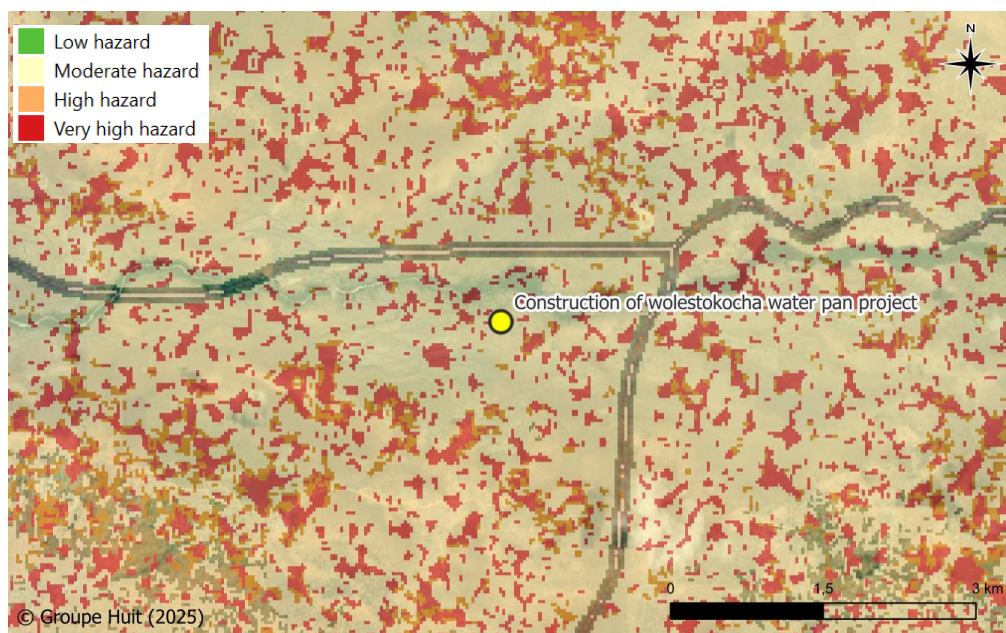
### 2.3.3 Water Sources

- Boreholes
- Water Pan
- Shallow Well inside the Water Pan

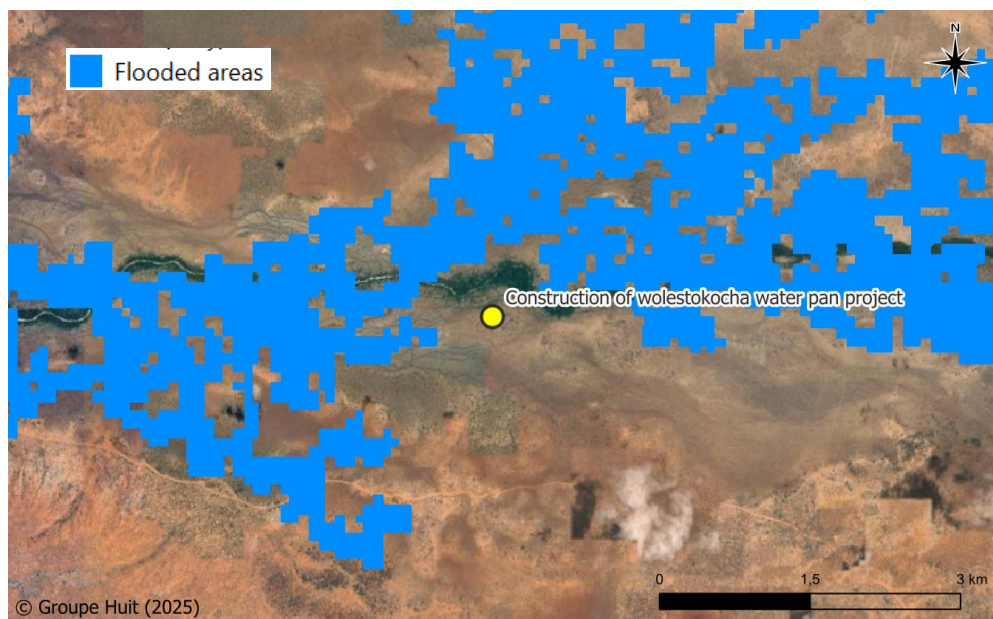
The water from these sources is used for domestic use (drinking, cooking, washing) and watering of animals.

### 2.3.4 Rapid climate risk screening in the area

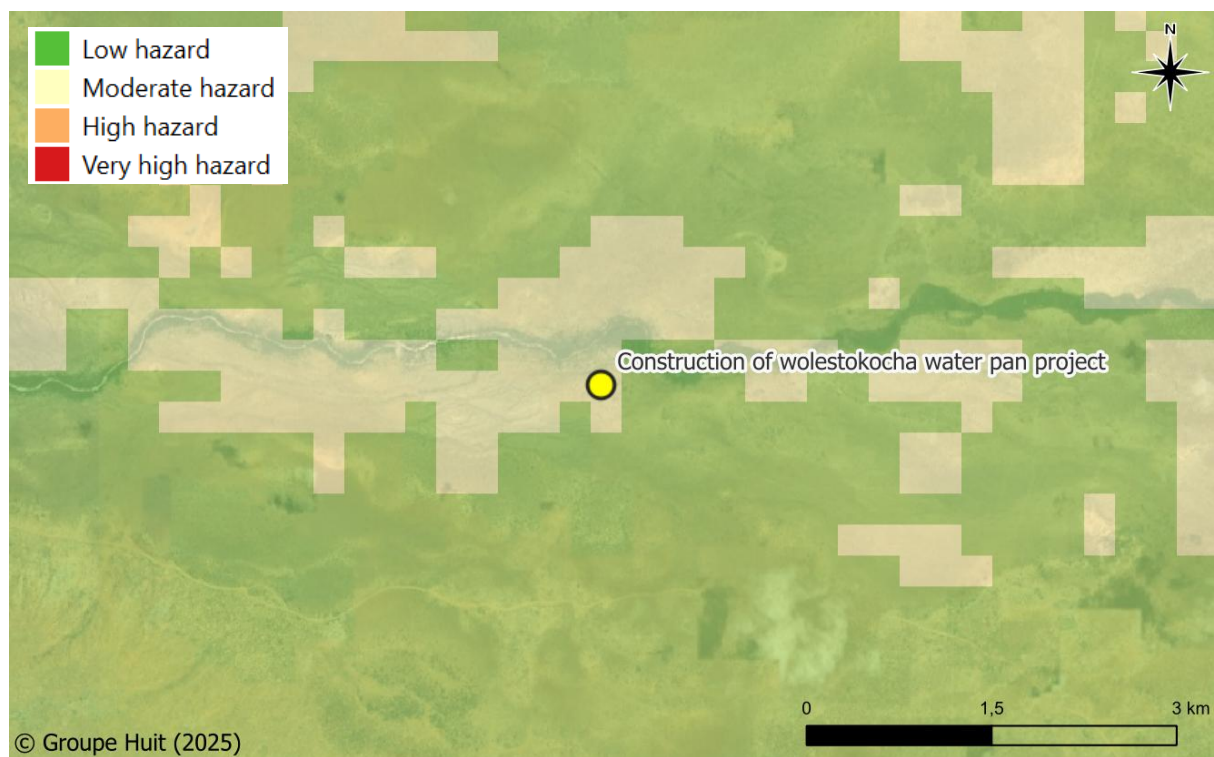
#### 2.3.4.1 Pluvial flood mapping



### 2.3.4.2 River flood (100 years return period mapping)



### 2.3.4.3 Soil salinity hazard



### 2.3.4.4 Others

GIS mapping reveals that there is no exposure to rising water table flooding hazard.

### 2.3.4.5 Conclusion

According to GIS analysis of hazards datasets this proposed investment is **moderately exposed to climate hazards**, indeed exposure to flood hazards (pluvial, rising water table, river) and salinity exposure are considered moderate. Nevertheless, Tana River CRA had shown that the area is **highly exposed to heat stress and droughts**, as waterpan infrastructures are very vulnerable to these hazards they should duly be considered.

	Hazard exposure				
	Pluvial Flood	River Flood	Rising water table flood	Soil salinity	Drought & heat stress
Wolestokocha	Moderate	Moderate	No exposure	Moderate	High

### 2.3.5 WASH related challenges

The borehole water is located 7 kilometres away from the settlement forcing the residents to walk long distances and take long hours to fetch water.

The water pan (shown in Figure 15 above) serves as the only alternative water source in the area. However, it dries up during prolonged droughts, compelling the community to dig shallow wells within the pan. These wells are highly prone to contamination from animal waste, and algae blooms frequently develop, rendering the water unsafe for consumption with poor quality and taste. Figure 16 illustrates this contrast, with an algae-infested shallow well on the left and a relatively clean, algae-free well on the right, both located within the same water pan.



Figure 13: Different water quality Shallow Wells in the same water pan in Wolestokocha

Source: Fieldwork, August 2025

The majority of community residents are pastoralists, and during drought periods they experience significant losses of livestock (cattle, goats, and sheep) due to water and pasture shortages, severely undermining their economic livelihoods.

Prolonged drought conditions leads to food shortages, as the community largely depends on milk for sustenance. This results in malnutrition among children and increased health complications for both people and livestock. The situation is further worsened by the absence of a health facility in Wolestokocha, with the nearest dispensary located in Sorea or Bura, more than 23 kilometers away with no public means of transport available.

The area has high levels of open defecation, which leads to contamination of water pan sources by fecal matter, especially during the rainy season.

Outbreak of stomach diseases (Mara Mara) and Constipation due to drinking of contaminated untreated water from the water pan.

Siltation of the water pans often after the rainy season reducing the facilities capacity to hold more water.

## 2.3.6 Adaptation Mechanisms

### 2.3.6.1 Design Adaptation Measures

To cope with the long distances and the heavy burden of carrying water jerricans, women and children use an improvised method. A jerrican filled with water is wrapped in a broken jerrican casing, with a string tied to both ends. This setup allows the container to roll on the ground as it is pulled while maintaining quality of the water in the jerrican, reducing the strain and making water transportation easier over long distances, as shown in Figure 17 thereafter.

Schools in the area like Wolestokocha Primary School have their building fitted with gutters to harvest rainwater into a tank for use during the dry seasons.



Figure 14: Adaptation of carrying water over long distances

Source: Fieldwork, August 2025

### 2.3.6.2 Community Level Adaptation Measures

Diverse adaptation measures have arisen at community level, amongst them :

- The community traditionally uses Kukube seeds from the Mkube tree to stir and purify water for domestic use. This practice helps settle suspended mud and sediments; however, it has not been scientifically validated as a method of water purification, despite being widely consumed after

treatment. Kenya Water Institute (KEWI), is now validating the efficacy of this method as a sustainable non-toxic alternative to chemical coagulants (UNEP, 2024)<sup>1</sup>.

- During water scarcity, residents sometimes rely on boreholes located in Ole Sorea, approximately 3 km away, as these sources provide permanent and relatively clean water.
- Pastoralist households migrate with their livestock to the Tana Delta in search of pasture and water during severe drought periods.
- In times of drought, pastoralists also purchase post-harvest farmland, previously used for agriculture, to provide fodder for their livestock when natural pasture is unavailable.
- Households practice boiling of drinking water as a means of killing harmful bacteria and reducing waterborne health risks.
- The County Government supplements community efforts by distributing water treatment agents such as Pur and Aqua alum.
- During severe drought period, majority of the residents do not do showers to conserve water.

### 2.3.7 Community Organization

There is no community-based structure in water resource management in Wolestokocha as the community is mainly pastoral. (Orma Community)

### 2.3.8 Community Recommendations

Discussions with communities had led to the formulation of some recommendations from them :

- The County Government should prioritize the desiltation of existing water pans to restore their storage capacity.
- Rehabilitation and proper maintenance of water pan filtration systems are necessary to reduce siltation and prolong the lifespan of the pans.
- The community expressed a preference for a borehole over a water pan. However, they were advised that groundwater in the area is highly saline, making boreholes unsuitable. As a short-term measure, the water pan remains the most viable option, while the County Government is exploring long-term solutions, including the possibility of extending piped water supply from Bura to Wolestokocha.
- Construct toilets separately for men and women at least three toilets per village (Koti Koti, Kichacho and Wolestokocha centre.)

### 2.3.9 Gender and Socio-economic Impacts of Climate Hazards

Wolestokocha and Bura have similar gender and socio-economic settings, therefore observations were the same in both wards.

---

<sup>1</sup> Water purification using the Kukube tree

## 2.4 Minjilla

### 2.4.1 Proposed Project

Minjilla decentralized treatment facility with a mini grid. The construction works will involve Survey and mapping, Civil design, Process design, structural design, architectural design, electrical, construction of DTF and Construction of 100No. safisan Households toilets in Minjilla Town.

Coordinates : -2,30399 ; 40,13608



Figure 15: Proposed investment location - Construction of Minjilla desentralized treatment facility

### 2.4.2 Site Description

Minjilla is an urban centre located in Shirikisho Location, Garsen Central Ward in Tana Delta. The proposed project site lies at an elevation of approximately  $-8.12$  meters above sea level, with geographic coordinates  $(-2.320109, 40.122524)$ .

The area is highly vulnerable to both prolonged droughts and flash floods. Drought periods can extend for up to nine months, with rainfall largely confined to the short rains (October–December) and long rains (March–May). During these rainy seasons, flash floods are common, with floodwaters reaching heights of 3–5 meters. In addition, strong onshore winds from the Indian Ocean have been observed blowing across the proposed site.

The site is presently dominated by bushland vegetation, mainly *Acacia* species, *Prosopis juliflora*, and other shrubs. It is accessible through a wide murrum road and is underlain by black cotton soils, as illustrated in Image 12 below.



Figure 16: Proposed Minjilla Decentralised Treatment Facility Project Site

Source: *Fieldwork, August 2025*

#### 2.4.2.1 Sources of Water Supply

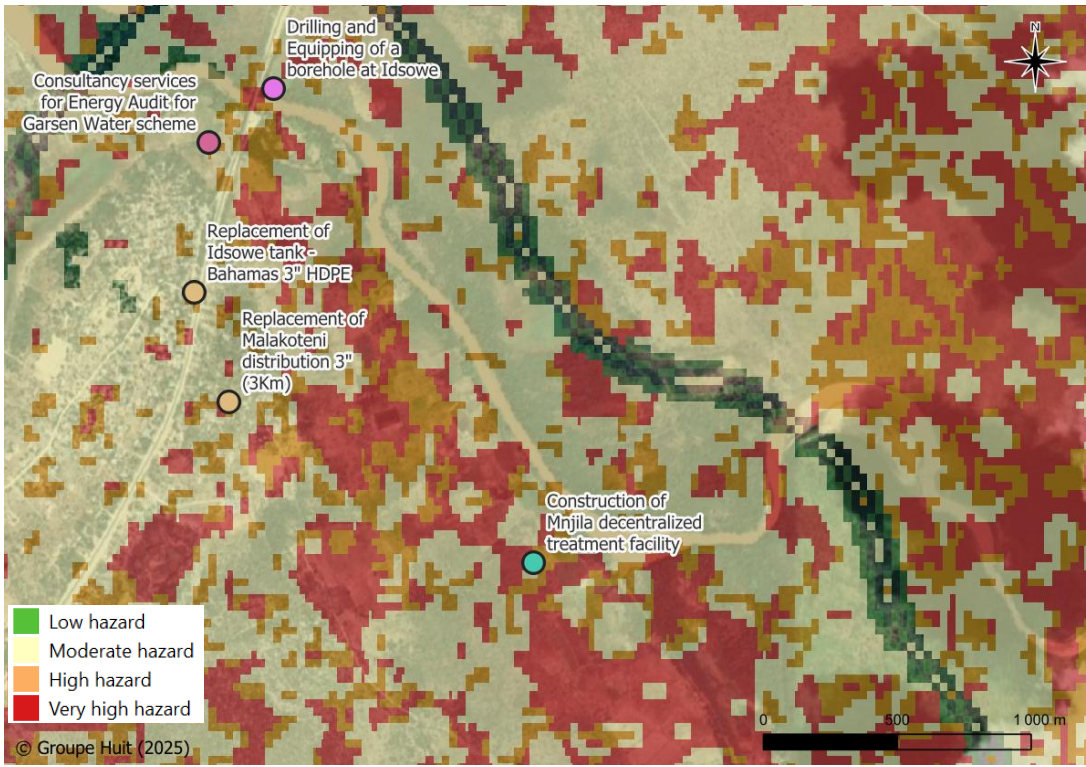
- Tawasco
- Boreholes
- Water Vendors
- River Tana

#### 2.4.2.2 Types of Sanitation Facilities Used

- Pit Latrines
- Flush Toilets with Septic and Soak Pits
- VIP Toilets
- Bush - ODF

2.4.3 Rapid climate risk screening in the area

2.4.3.1 Pluvial flood hazard mapping

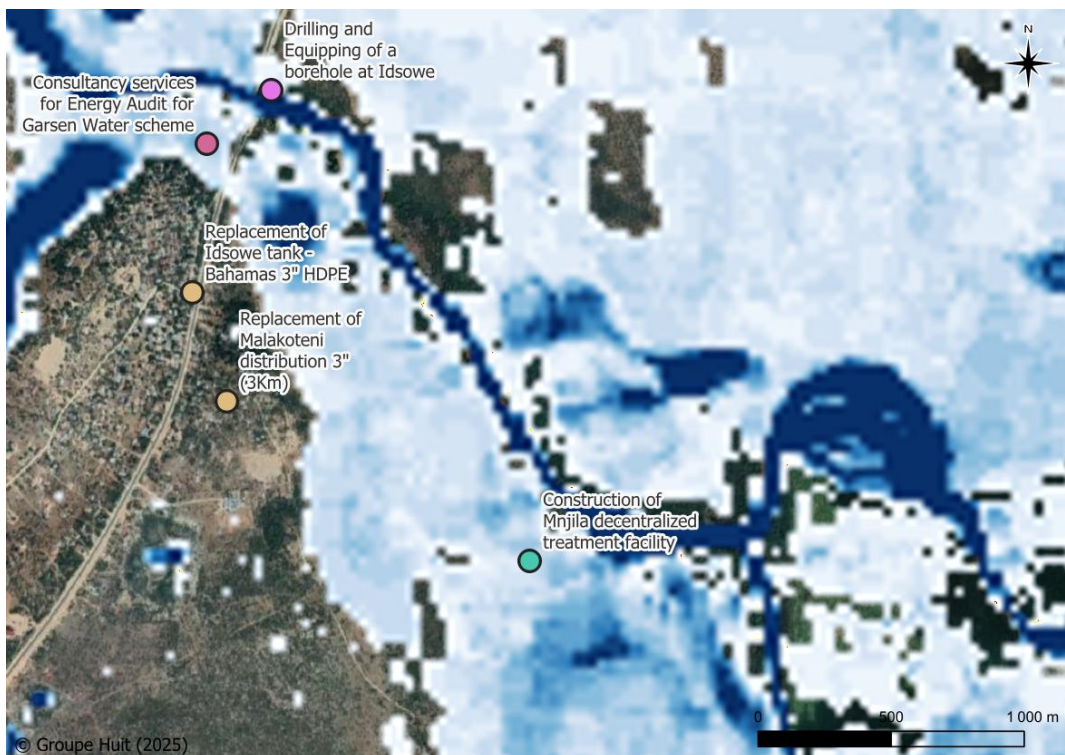


2.4.3.2 River flood hazard mapping

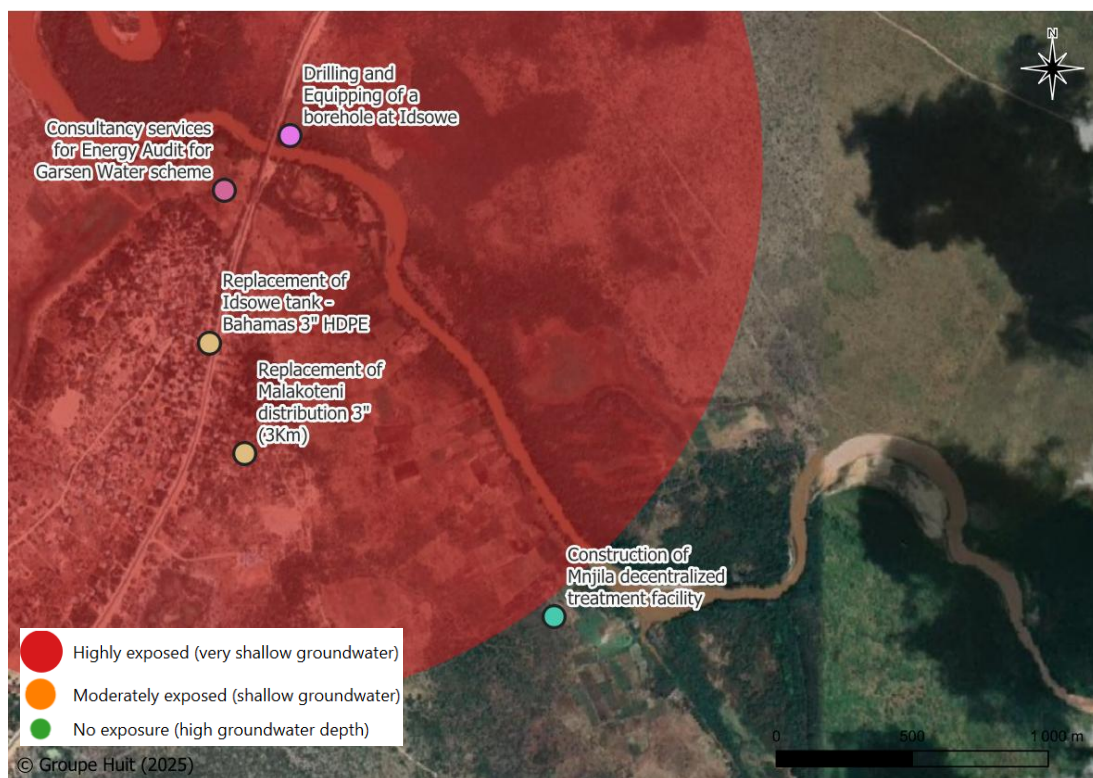
100 years return period flood



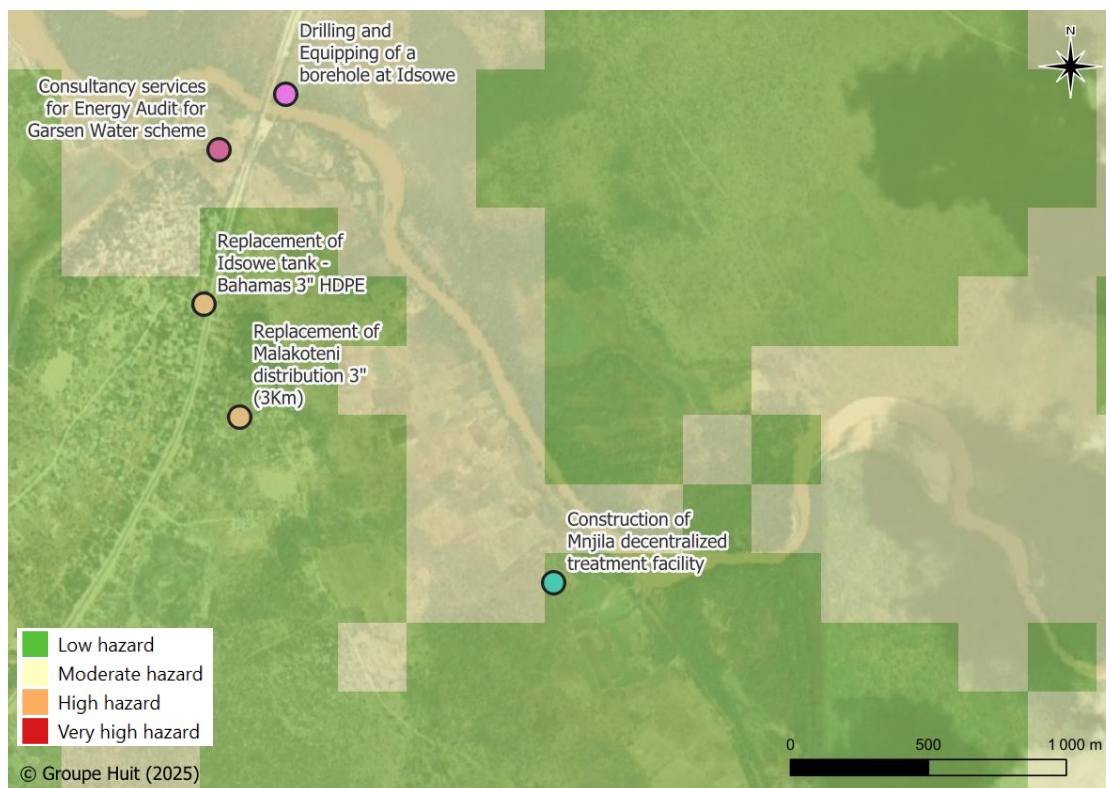
2024 flood extent



### 2.4.3.3 Rising water table flooding hazard



### ■ Soil salinity hazard



### 2.4.3.4 Conclusion

According to GIS analysis of hazards datasets this proposed investment is **very exposed to climate hazards**, especially flooding with **very high exposure to all kinds of flooding** (pluvial, river, rising water tables). Salinity does not appear to be the main concern as exposure is considered low to moderate. Finally, Tana River CRA had shown that the area is **highly exposed to heat stress and droughts**, and these hazards should therefore be considered as well.

	Hazard exposure				
	Pluvial Flood	River Flood	Rising water table flood	Soil salinity	Drought & heat stress
Minjila	Very high	High	High	Low	High

### 2.4.4 WASH related challenges

The fieldworks and discussions have enabled to identify the following challenges :

- **Prolonged drought causes significant livestock losses and crop failures**, the primary sources of livelihood for most residents in Minjilla, Tana Delta, thereby undermining household incomes and food security.
- **Drought exacerbates human–wildlife conflicts**, with elephants and buffaloes invading farms in search of pasture and water.
- **Water scarcity contributes to outbreaks of diseases** such as influenza, diarrhea, typhoid and cholera, particularly among pastoralist communities in Shake, due to limited water for sanitation and hygiene. Cases of children suffering from stomach ulcers because of consuming contaminated water have also been reported.

- The **influx of people and livestock** from drought-affected areas such as Bangale places additional **pressure on the already strained water and sanitation infrastructure** in Minjilla.
- **Prolonged drought leads to malnutrition**, outbreaks of animal diseases, and a decline in livestock value. During such periods, large numbers of cattle from drought-affected areas such as Bangale, Bura, and Wolestokocha are moved into the Tana Delta. Many of these animals arrive in poor health, and as they intermingle with local herds, they often trigger the spread of diseases.
- **Prolonged drought causes the drying up of the River Tana tributary at Matoma, as the main river diverts into the forest.** This leaves the tributary dry, significantly reducing the water available for both residents and livestock who depend on it, thereby intensifying **water stress** among the local population.
- **Water rationing** is high in Minjilla, this affects the town sanitation and hygiene as water is required to maintain high standards of sanitation.
- **High water tariffs** for piped water going up to KES 1000-4000 per household. A 20 liter jerrican at a water kiosk sells at KES 5 per jerrican. For Boda Boda vendor, KES 300 for five 20 litres jerricans.
- **Cases of snakebites have been reported in Minjilla and across Tana Delta during instances of open defecation.** This has been attributed to lack of enough water for proper sanitation hygiene hence people preferred ODF.
- **During flash floods, pit latrines often collapse** and become unsafe for use as floodwaters inundate them. This challenge is further compounded by the unstable soils in the area, which weaken the structures.
- Some residents empty their pit latrines into the nearby environment and septic tanks overflowing into neighboring lands hence **propagating diseases**.
- **Haphazard solid waste management especially disposal of baby diapers within Minjilla town is a menace as it is a form of open defecation**, when it rains flash floods carry this waste into water sources hence contamination. During drought, add to the town's odour.
- **The narrow roads within Minjilla restrict access for exhauster trucks**, making it difficult to empty and safely manage filled pit latrines.
- **Flooding submerges boreholes and damages water infrastructure, reducing access to safe water and contaminating available sources.**

## 2.4.5 Adaptation Mechanisms

### 2.4.5.1 Design Adaptation Measures

Diverse adaptation measures on infrastructures have already been implemented, amongst them :

- Community members have adopted Ventilated Improved Pit (VIP) latrines with soak pits, while some households have invested in septic tanks, demonstrating a shift towards safer and more sustainable sanitation options.
- Residents are constructing pit latrines with the pit positioned separately from the superstructure, ensuring that even during flooding events, the toilet structure remains intact and usable.
- Some households have reinforced and raised the latrine pits with concrete to reduce the risk of inundation and collapse during floods.
- Boreholes are constructed on raised platforms, elevated up to 3 meters, using waterproof cement and reinforced concrete. This design minimizes the risk of inundation during floods and prevents contamination of the water supply.

### 2.4.5.2 Community Level Adaptation Measures

Diverse adaptation measures have arisen at community level, amongst them :

- Public health officers conduct hygiene awareness campaigns in each sub-location to prevent cholera.
- A dedicated cholera treatment centre has been established in Garsen.
- At the household level, residents treat drinking water using Puri Tabs and AquaLam tablets supplied by the County, although distribution is inconsistent.
- Many households also boil drinking water to eliminate harmful bacteria.
- Families share toilets to reduce open defecation (ODF).
- The County Government, FCF, and IOM have been constructing tents and houses to resettle flood-displaced persons (IDPs) in Konani and Dumi villages, Garsen
- Water rationing is the practice during severe drought conditions for animals and households within Minjilla town.

### 2.4.6 Community Organization

There is no community-based structure to water and wastewater management. All are management by Tawasco.

### 2.4.7 Community Recommendations

Discussions with communities had led to the formulation of some recommendations from them :

- Need for town planning and opening of roads within Minjilla town to allow for ease of access to pit latrines sites by honey suckers.
- Equipping of Garsen hospital with drugs to aid in alleviating the impacts of diseases associated to drought and flooding conditions.
- Use of solarized borehole pumps in areas with potential for safe potable water.

### 2.4.8 Gender and Socio-economic Impacts of Climate Hazards

Prolonged and severe droughts exacerbate water scarcity, disrupting menstrual hygiene management for school-going girls. This often results in absenteeism, reduced class participation, and lowered self-esteem.

Open defecation increases the vulnerability of women and girls to gender-based violence and sexual harassment, as they are often forced to relieve themselves in unsafe and secluded areas without privacy or protection. The lack of privacy and safe sanitation facilities therefore heightens their vulnerability and undermines dignity and safety.

**Cultural norms influence toilet use in this area, as men and women do not share sanitation facilities.** Consequently, men primarily use existing pit latrines, while women resort to open defecation in the bush, thereby perpetuating unhygienic sanitation practices.

## 2.5 Odole, Kipini West

### 2.5.1 Proposed Project Description

Odole water supply in Kipini West Ward. The construction works will include the drilling and equipping of a borehole, solarized, 1No. Water kiosk, inline chlorine dosage, fencing and an elevated water tank.

Coordinates : -2,50709 ; 40,32281



Figure 17: Proposed investment location – Construction of

### 2.5.2 Site Description

Odole village is located in the southern part of Tana River County, within Kipini West Ward, bordering the Indian Ocean. It lies at an altitude of approximately -24.8 meters below sea level, at latitude 2.51313° S and longitude 40.32294° E.

The community experiences climate-induced hazards, mainly floods and droughts. Droughts typically occur once a year between August and October, while floods are the most severe hazard, occurring twice annually during the October–December short rains and the March–May long rains. Severe flooding, which happens roughly once every five years, often leads to displacement, loss of property, livestock, and human lives.

Odole is characterized by fertile black cotton soils that support both crop farming and livestock rearing. The village sits adjacent to the mangrove belt along the coast and the forested inland of Kipini, with generally high temperatures and humidity due to its proximity to the ocean.

Settlements are clustered with 400 households and a population of 2400, consisting of a mix of iron-sheet and grass-thatched houses, many of which are built on raised foundations to reduce the risk of floodwater entering the homes. The 400 household units depend only on 3 toilets flush toilets with a septic tank.



Figure 18: Odole Village Settlement Cluster

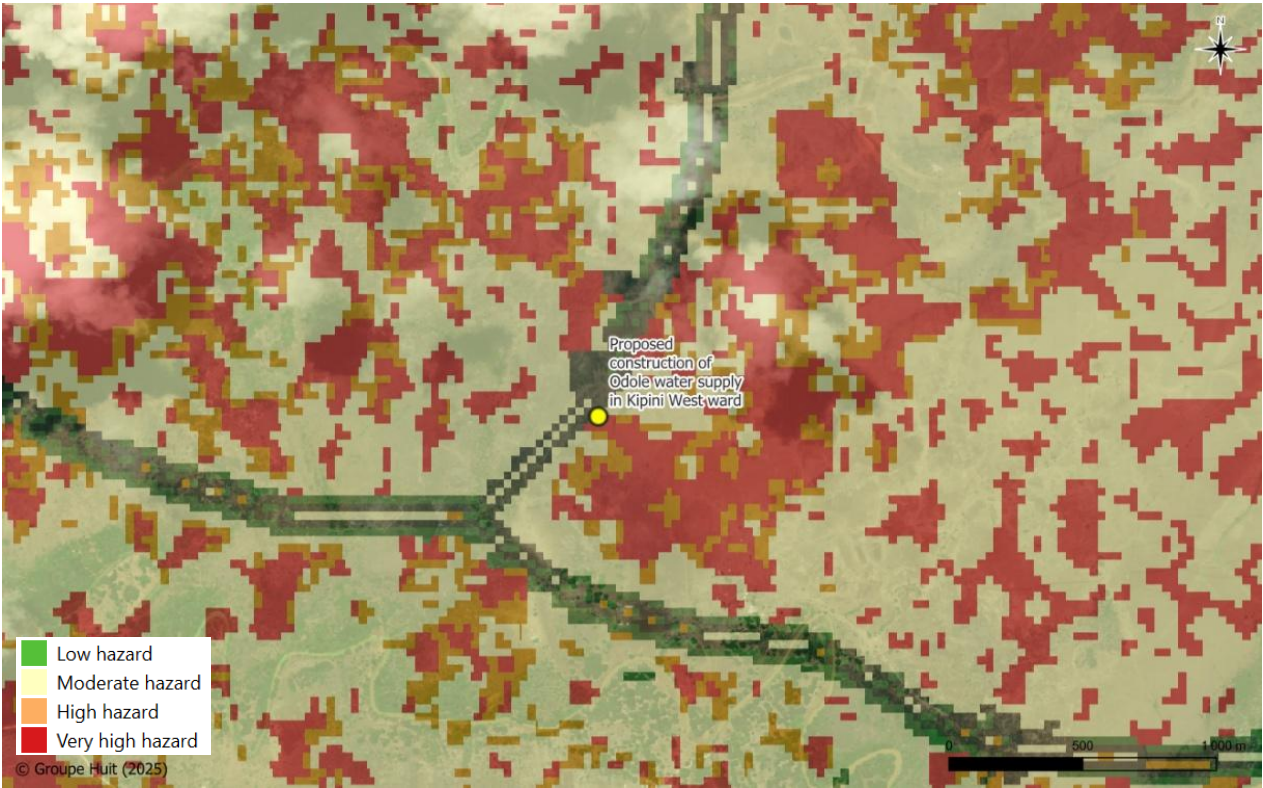
*Source: Fieldwork, August 2025*

### 2.5.2.1 Sources of Water Supply

- Only source for potable water is the shallow well at Odole Primary School
- Flood water
- River Tana

2.5.3 Rapid climate risk screening in the area

2.5.3.1 Pluvial flood hazard mapping

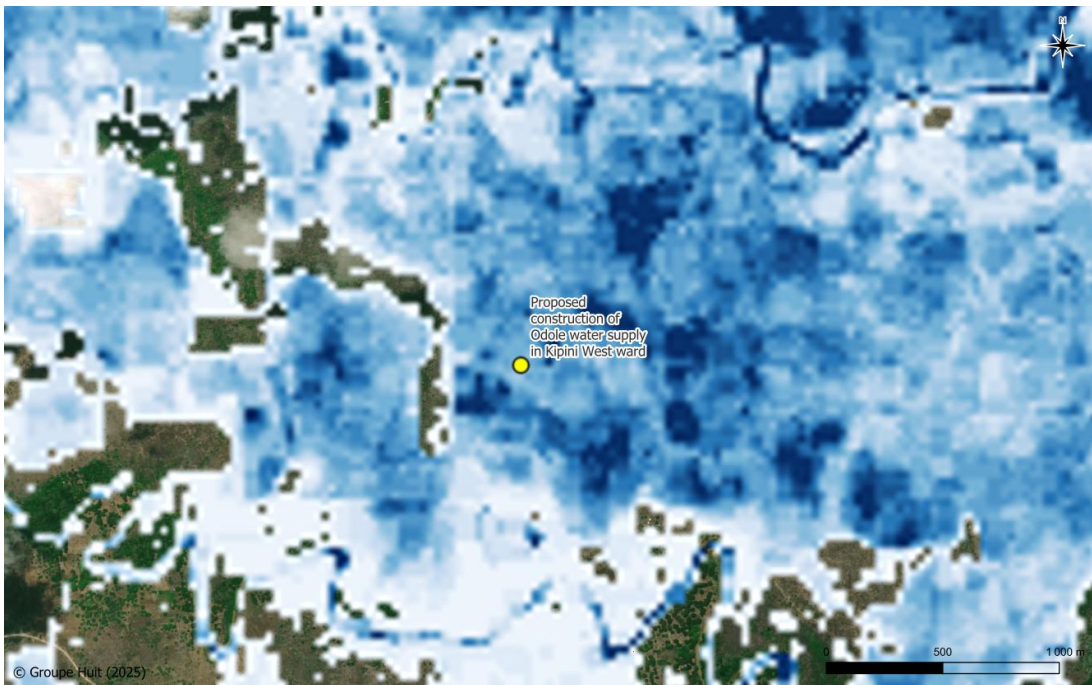


2.5.3.2 River flood hazard mapping

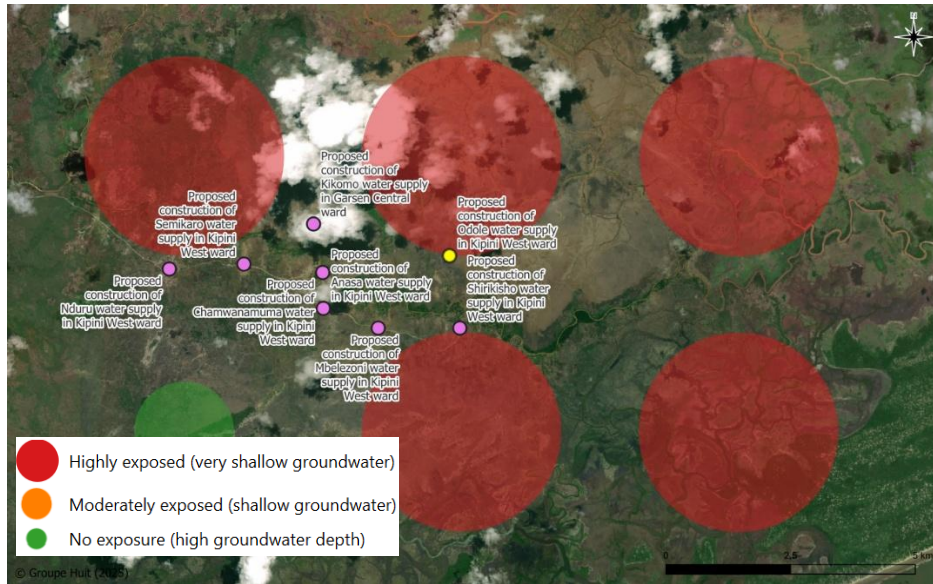
100 years return period mapping



2024 flood extent



### 2.5.3.3 Rising water table flooding hazard



### 2.5.3.4 Soil salinity hazard



### 2.5.3.5 Conclusion

According to GIS analysis of hazards datasets this proposed investment is **very exposed to climate hazards**, especially flooding **with very high exposure to all kinds of flooding** (pluvial, river, rising water tables). Salinity does not appear to be the main concern as exposure is considered low. Finally, Tana River CRA had shown that the area is **highly exposed to heat stress and droughts**, and these hazards should therefore be considered as well.

	Hazard exposure				
	Pluvial Flood	River Flood	Rising water table flood	Soil salinity	Drought & heat stress
Odole, Kipini West	Very high	High	High	Low	High

## 2.5.4 Challenges of Water Supply

Severe flooding in Odole leads to the inundation of shallow wells, restricting access to clean and safe drinking water. This not only creates acute water shortages but also results in contamination of water sources, rendering them unsafe for human consumption. The use of contaminated water increases the risk of waterborne disease outbreaks such as cholera, dysentery, and diarrhea. The situation is further compounded by the absence of a functional health facility in the village. The existing dispensary is neither equipped nor staffed with medical personnel, making it unable to respond to health emergencies triggered by flooding. The nearest hospital is Ngao hospital which takes KES 2,000 to get there.

Additionally, shallow wells collapse during floods and during the dry season shallow wells dry up leaving residents without alternative water sources.

During the dry season, when water levels in the Tana River drop, the tributary passing through Odole is affected by seawater intrusion. Saline water pushed inland by high ocean tides contaminates both the river water and surrounding soils, making them unsuitable for domestic use and agriculture. Shallow wells become saline and water from these wells becomes unsafe for human consumption. Seawater intrusion also kills freshwater fish especially at Kalota, which supports the livelihood of residents of Odole.

Overdrawing of the shallow well at Odole primary school, which is the only source with potable water as the other shallow wells water, remains dirty even after treatment.

Because of seawater intrusion, manual water pumps rust and pose health threats to continued use of water from such boreholes.

## 2.5.5 Adaptation Mechanisms

### 2.5.5.1 Design Adaptation Measures

Little specific design adaptation measures were identify apart from some families having roofs fitted with gutters for rainwater harvesting.

### 2.5.5.2 Community Level Adaptation Measures

Diverse adaptation measures have arisen at community level, amongst them :

During severe floods, the entire community of Odole migrates to Golicha Cluster, a settlement established by the County Government in a flood-safe area. The cluster is equipped with temporary water and sanitation facilities as well as basic relief infrastructure. Once the floodwaters recede, residents return to their homes.

To ensure safe drinking water, households use Puri Tabs and Aqua Tabs provided by the County Government, although supply is not always consistent. At the household level, residents also practice water rationing; during drought, families consume an average of five 20-litre jerricans per day, while in times of flooding, when water is more readily available, consumption doubles.

Due to high groundwater levels leading to frequent collapse of pit latrines, a few residents have managed to construct lined pit latrines while other have pit latrines with the superstructure separated from the pit.

Some wells in the area yield water with a sour taste, but when the water is stored for a while, the taste improves, making it more palatable

### **2.5.6 Community Organization**

Community water resources are held through the chief in collaboration with some CBOs especially the shallow wells.

### **2.5.7 Community Recommendations**

The main community recommendation was to promote awareness on use of toilets.

### **2.5.8 Gender and Socio-economic Impacts of Climate Hazards**

**Flooding in Odole causes widespread displacement of residents.** During severe flood events, the entire community is forced to migrate to Golicha Cluster to seek relief. In these temporary shelters, men, women, and children are accommodated together in single rooms, resulting in limited privacy and compromised dignity.

Flooding also disrupts education. School-going children are often sent to stay with relatives in safer areas until floodwaters recede. This leads to interrupted learning, absenteeism, increased school dropouts, and early marriages among girls. This also interferes with family cohesion as children are separated from their families.

Women bear the primary responsibility for water provision, family health, and sanitation. In addition, they engage in crop farming (e.g., maize, melons), livestock rearing for milk, and women's self-help groups (chamas or merry-go-rounds). These livelihoods are severely disrupted by flooding.

Men, on the other hand, largely depend on fishing to support their households. However, flooding makes fishing risky and less productive, as floodwaters wash away fish and saltwater intrusion kills freshwater species, further reducing yields from the river.

## 2.6 Madogo Ward

### 2.6.1 Project Description

Upgrading of the Madogo Mainline from intake to Madogo palace 12" HDPE (Distribution pipeline replacement). The works involved upgrading the existing UPVC 8" line and replace a 12" HDPE PN12.5 pipeline from the intake to Madogo Palace (4 Km).

Coordinates: -0,469194 ; 39,617181



Figure 19: Proposed investment location – Upgrading of the Madogo Mainline from intake to Madogo Palace

## 2.6.2 Site Description

Madogo urban centre, located in Madogo Ward, lies at an altitude of approximately 120 meters above sea level at coordinates  $-0.46857^{\circ}$  latitude and  $39.63158^{\circ}$  longitude. The area experiences severe droughts, often lasting up to two years, recurring every two to three years. It falls within a semi-arid climatic zone, characterized by extremely high temperatures and dominated by acacia and *Prosopis juliflora* vegetation. Current drought period started in January. Often it starts from July to December. Flooding is also experienced in Madogo but it is often caused by release of dam water from Masinga and Kindaruma dams upstream on River Tana and occurs annually.

This project has been completed and is awaiting commissioning. Solar-powered borehole pumps have been installed at the Maroro Well Field and the Bulla Riama Borehole intake, as illustrated in the images below. The borehole platforms have been elevated up to 2 meters above ground level to safeguard against flooding, thereby preventing submersion of the borehole heads and contamination of the water source.



Figure 20: Operational, Solarized and Elevated borehole platforms in Madogo.

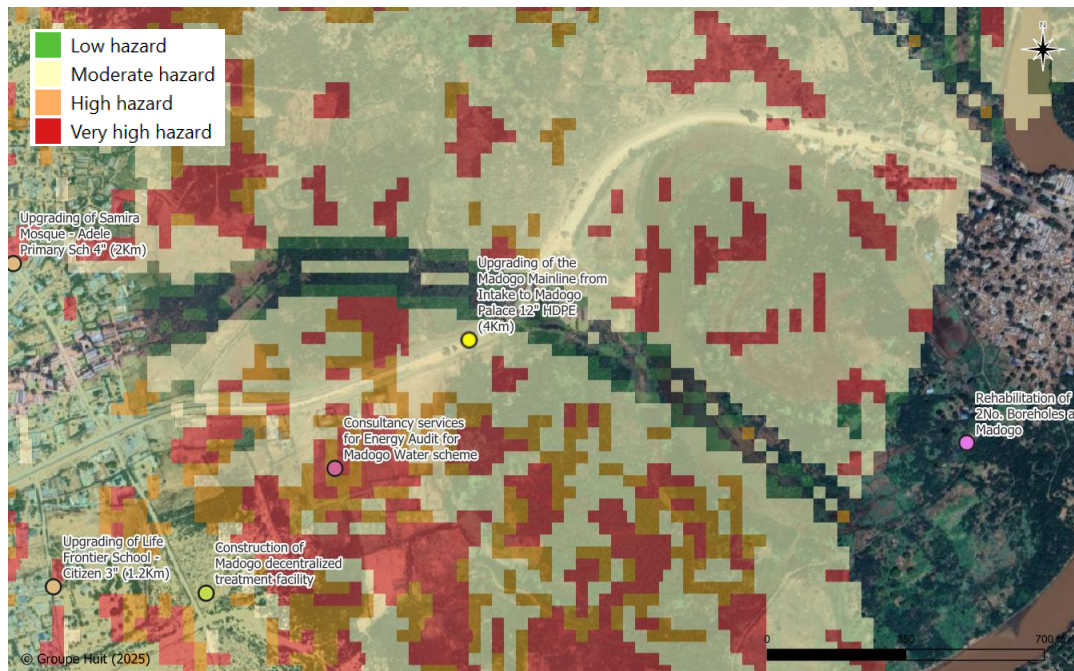
Source: Fieldwork, August 2025

### 2.6.2.1 Sources of Water Supply

- Tawasco Piped Water
- Shallow Wells
- Boreholes
- River Tana

### 2.6.3 Rapid climate risk screening in the area

#### 2.6.3.1 Pluvial flood hazard mapping

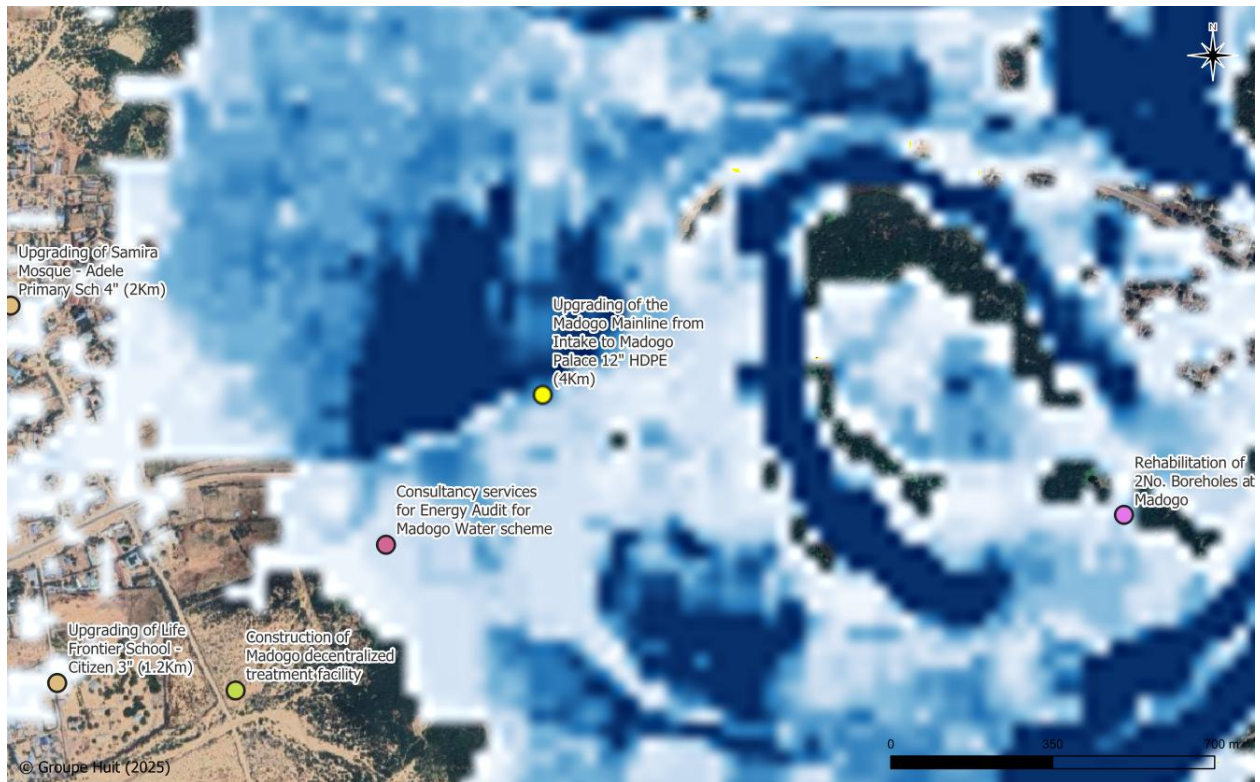


#### 2.6.3.2 River flood hazard mapping

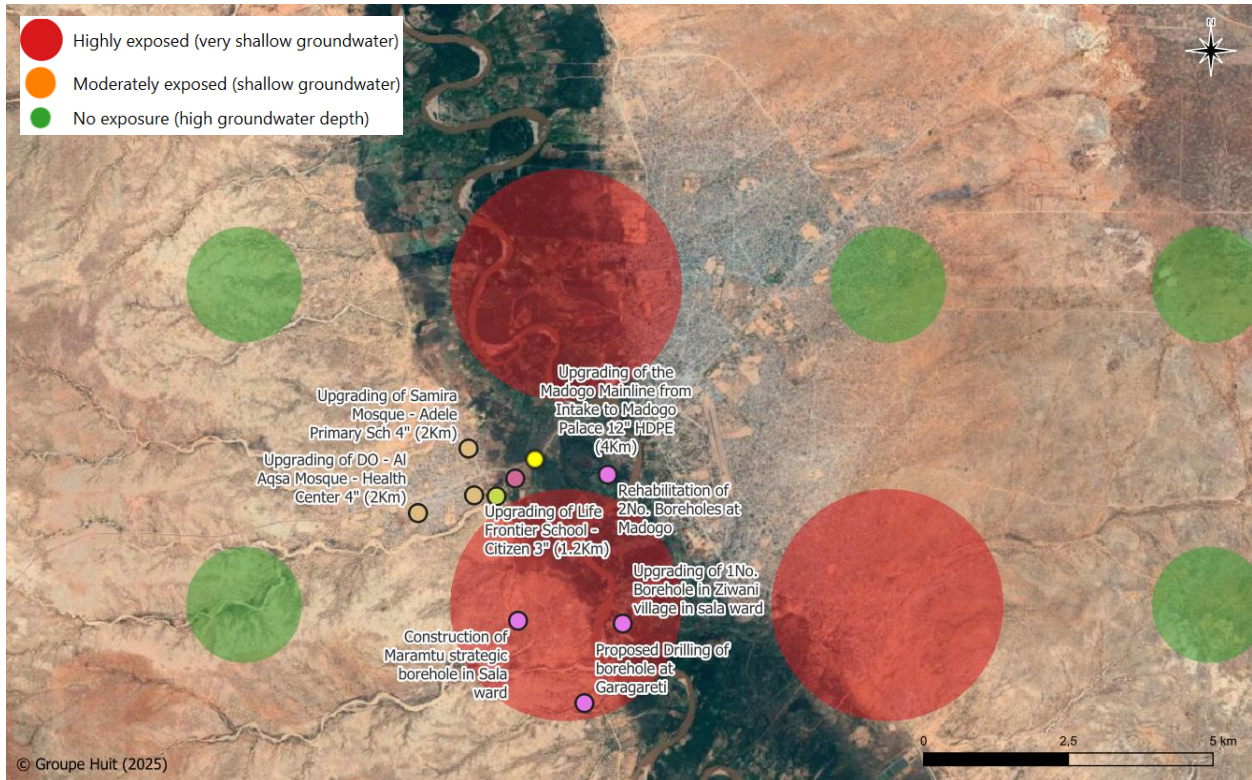
100 years return period flood



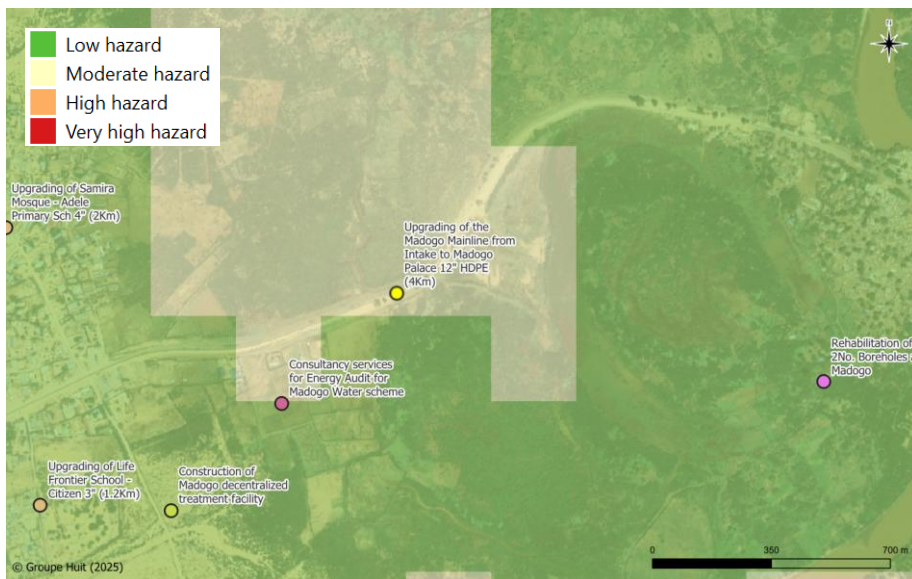
2024 flood extent



### 2.6.3.3 Rising water table flooding hazard



### 2.6.3.4 Soil salinity hazard



### 2.6.3.5 Conclusion

According to GIS analysis of hazards datasets this proposed investment is **very exposed to climate hazards**, especially flooding with high exposure to both river and rising watertable flooding but also moderate

exposure to pluvial flood and soil salinity. Finally, Tana River CRA had shown that the area is **highly exposed to heat stress and droughts**, and these hazards should therefore be considered as well.

	Hazard exposure				
	Pluvial Flood	River Flood	Rising water table flood	Soil salinity	Drought & heat stress
Madogo	Moderate	High	High	Moderate	High

## 2.6.4 WASH related challenges

The major challenge Madogo faces is high levels of vandalism and theft of water infrastructure. Even the newly installed systems have already experienced the loss of a solar panel and a broken pipe caused by herders watering their livestock, despite the design including a cattle-watering trough at the borehole platform. Fences have also been vandalized and stolen, disrupting the steady supply of water and contributing to shortages in the town.



Figure 21: Stolen Solar Panel and Broken Water Pipe in Madogo.

Source: Fieldwork, August 2025

Other challenges caused by **drought**:

- Prolonged water shortages in Madogo, with periods lasting up to 2–3 months without adequate supply.
- Increased cost of water, making access unaffordable for some households.
- Use of unsafe water from vendors, often leading to health risks.
- Heightened human–wildlife conflicts as both compete for scarce water and pasture.
- Outbreaks of waterborne and hygiene-related diseases.
- Limited ability to cook or bathe daily due to water scarcity.
- Vandalism of pipelines, where individuals break pipes to divert water or create makeshift troughs for livestock, leading to further shortages for communities relying on the same supply.

During **flood events**, water supply systems and sanitation facilities are frequently damaged, submerged, or completely washed away. This leaves the community without access to safe water and proper sanitation. As a result, residents are forced to resort to unhygienic practices such as open defecation, reliance on contaminated water sources, and makeshift waste disposal methods. These conditions significantly

increase the risk of waterborne diseases, including cholera, diarrhea, and typhoid, further compounding the vulnerability of affected households.

## **2.6.5 Adaptation Mechanisms**

### **2.6.5.1 Design Adaptation Measures**

Diverse adaptation measures on infrastructures have already been implemented, amongst them :

- Installation of solar-powered borehole pumps to utilize solar energy for water abstraction.
- Construction of concrete reinforced borehole heads elevated 2 meters above ground level to protect against flooding and contamination as shown in image 17 above.

### **2.6.5.2 Community Level Adaptation Measures**

Diverse adaptation measures have arisen at community level, amongst them :

- Practicing spaced showering and cooking routines to minimize water consumption.
- Constructing troughs and small storage facilities to preserve available water.
- Digging shallow wells along seasonal rivers (laghas) to supplement water supply.
- Using boda bodas, tractors, and donkeys to transport water from the River Tana.
- Receiving support during floods, where the County Government provides water and iron sheets while the Red Cross supplies food to help resettle affected households into clusters and then go back after floodwater has receded.

## **2.6.6 Community Organization**

At present, all water infrastructure, distribution, and pricing are managed solely by TAWASCO, with no community-level committee in place to support management.

## **2.6.7 Community Recommendations**

The community has expressed strong willingness to establish a water management committee and actively participate in safeguarding water infrastructure. However, they emphasized the need for capacity building and technical support from the County Government to enable them to manage effectively. They further recommended adopting a collaborative management approach between the community and TAWASCO to improve resource governance, minimize vandalism and theft, and ensure sustainable access to water.

Community members also highlighted that other organizations such as World Vision, Islamic Relief, and Helping Hand have operated water infrastructure in the area for over 10 years without major cases of vandalism. This success is attributed to the fact that these organizations involved the community directly in management. In contrast, TAWASCO has not established similar community engagement structures, resulting in recurrent vandalism and theft of their infrastructure, with little community ownership or accountability.

## **2.6.8 Gender and Socio-economic Impacts of Climate Hazards**

During drought women are forced to walk long distances in search of water as they are charged with the responsibility of ensuring water is available for their families for domestic use and hygiene. This exposes them to risks of sexual assault and gender-based violence.

Water shortages during drought exacerbate gender-based violence, particularly in displacement camps.

Family disintegration occurs as men migrate with livestock to the Tana Delta in search of water and pasture, with some never returning to their households.

Prolonged drought contributes to high school dropout rates, especially among girls, due to early marriages, teenage pregnancies, and lack of adequate water for menstrual hygiene management, which undermines their confidence and self-esteem



### 3. LESSONS LEARNT

The hotspot analysis offered valuable insights into how climate change considerations can be more effectively integrated into investment planning and infrastructure design thanks to community consultation and review of current practices (current infrastructure designs). A key takeaway is that community engagement provides an indispensable foundation for understanding context-specific vulnerabilities and identifying feasible, locally accepted adaptation measures.

The consultant used the August field visits as an opportunity to pilot the ClimateFIRST tool—a structured analytical framework designed to support climate risk screening for infrastructure projects. While conceptually robust, the tool proved somewhat too advanced for the current stage of project development, where infrastructure designs remain at very early conceptual phases or, in some cases, are yet to be defined. Nevertheless, both the County and the consulting team recognized the potential value of such tools **when applied as broad, early-stage screening checklists**, rather than as detailed technical assessments. Conducting an initial high-level screening can help raise awareness of climate-related risks and serve as a foundation for more detailed analyses once designs are further developed. At this stage, the emphasis should be on building awareness and understanding of risks through simple, practical approaches—such as engaging local communities to capture their lived experiences of climate challenges and reviewing climate projections to anticipate future conditions.

The exercise also highlighted the importance of involving teams with prior experience in climate risk assessment (CRA) processes to undertake the assignment. Such expertise allows for the right framing of questions in line with the specific topic considered (in this case: WASH), encourages adaptive thinking during consultations, and supports the identification of effective, locally relevant good practices.

## 4. NEXT STEPS

These lessons will inform the next phase of the assignment – the “Adaptation Options” report – which will build directly on this hotspot analysis to propose practical and technically grounded adaptation measures for future K-WASH investments in Tana River County.

This hotspots analysis also provides most relevant information of gender and socio-economic impacts of climate events in the hotspots areas which will be most valuable for the Gender vulnerability and gap assessment and the related recommendations and action plan.

## ANNEX 1. KEY INFORMANTS FOR EACH HOTSPOT

### Key Informants Mkomani Village

The key informants comprised the following:

- Community Representatives:
  - ▶ 2 Youth Representatives
  - ▶ 5 Women Representatives
  - ▶ 4 Men Representatives
  - ▶ Former Councilor
  - ▶ Community Security Representative
  - ▶ Community Head
- Administration:
  - ▶ Area Chief
  - ▶ Ward Administrator



Figure 22: Mkomani Village Community Key Informant Interview Sessions

Source: Fieldwork, August 2025

## Key Informants Bura

The key informants comprised the following:

- Ward Admin
- Community Leader
- Environmental Activist
- Bura Disaster Management Committee Member
- Village Headmen
- Women Representatives
- Youth Representatives
- Men Representatives



Figure 23: Bura Key Informant Interview Session Participants

Source: Fieldwork, August 2025

## Key Informants Wolestokocha

The key informants comprised the following:

- Bura Special Programmes Officer
- Ward Admin
- Community Headman
- Men Resident Representatives
- Youth Residents Representatives
- Women Resident Representatives



Figure 24: Wolestokocha Key Informants

Source: Fieldwork, August 2025

## Key Informants Minjila

The key Informants comprise of:

- Youths Representative
- Assistant Chief – Thalu Sublocation
- Businessmen
- Women Representatives
- Herdsmen
- Ward Admin – Garsen Central Ward
- Water Officer ,Tana Delta
- Water and Sanitation Officer, Tana Delta
- Public Health Officer, Tana Delta



Figure 25: Minjilla Key Informant Participants

Source: *Fieldwork, August 2025*

## Key Informants Odole, Kipini West

The Key informants comprised of:

- Assistant Chief – Odole Sub location
- Odole Village Headmen
- Ward Admin – Kipini West
- Water Officer, Tana Delta
- Water and Sanitation Officer, Tana Delta
- Women Representatives
- Men Representatives
- Youth Representatives



Figure 26: Odole Key Informants Interview Participants

Source: Fieldwork, August 2025

## Key Informants Madogo Ward

The Key informants comprised of :

- Disaster Management Officer
- Governor's Office Representative
- Deputy county commissioner (DCC)
- Women Representative
- Men Representative



Figure 27: Key Informants at Madogo

Source: Fieldwork, August 2025



Figure 28: County Director for Water Giving a site Brief at Maroro Well Site in Madogo

Source: Fieldwork, August 2025