

Terms of Reference  
for  
Consultancy services in relation to the master plan for the improvement of

**MOYALE WATER SYSTEM, ETHIOPIA**

(Annex SCHEDULE 1 of Request for Proposal)

# Table of Contents

- CONTEXT..... 3
  - 1) Background..... 3
  - 2) ICRC intervention ..... 3
  - 3) Moyale area presentation..... 4
  - 4) Water resources ..... 8
  - 5) Population ..... 10
  - 6) Moyale Water Supply System ..... 12
- DESCRIPTION OF THE SERVICES ..... 27
  - 1) Objectives of the study..... 27
  - 2) Phase I – Inventory, surveying, modelling and diagnosis ..... 27
  - 3) Phase 2 – Proposition of scenarios for the development of the water supply system.31
  - 4) Documents ..... 33
  - 5) Missions and conditions..... 33
  - 6) Payment conditions..... 34
  - 7) Foreseen duration of the services..... 34

## CONTEXT

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### 1) Background

Moyale is the main Ethiopia city bordering Kenya. Within Ethiopia, the town is also bordering Oromia and Somalia regions. This location gives it an identity with a high commercial activity and exchange area. With an estimated population of more than 100,000 inhabitants, it has been plagued by large sequences of fighting and inter-communal violence. Indeed, the city is dually administered by Oromia and Somali Region administrations.

The different sequences of violence and fighting between communities have not spared the public services infrastructures in the region (health, electricity and water) in general and in particular the city's water supply.

Indeed, one of the main sources of production stopped working after the last conflict sequence creating a situation of city water scarcity.

### 2) ICRC intervention

Following last clashes of December 2018, ICRC decided to support the town which falls under ICRC mandate with Economic Security, Water Supply and Health projects. While local and international actors (government, NGOs) brought limited solutions to the significant shortage of drinking water or simply withdrew, ICRC initiated a water supply program for the whole town with a longer-term perspective, assuming that the political crisis and its local consequences will last.

ICRC project for Moyale Water Supply divides in two phases:

- Phase 1: The objective of phase 1 is to reduce the water stress on both Oromia and Somali populations by increasing as fast as technically feasible the water volume reaching Moyale population. Phase 1 aims to rehabilitate the two water resources: Bolkulubana and El Gof boreholes catchment areas. In Bolkulubana, a generator and electro-mechanical equipment will be installed to increase pumping time. In El Gof, boreholes will be cleaned, electro-mechanical equipment aged or destroyed by conflict will be replaced.

- Phase 2: The objective of phase 2 is to implement a broader water system to fulfill in a sustainable way the long-term water needs of Moyale town and its surroundings. Phase 2 will be initiated in 2020 with a comprehensive feasibility study, including regional resources studies, demographic and demand survey, technical and economic options, master plan and budget estimate. This is the object of the present RfP.

### 3) Moyale area presentation

- Moyale location

Moyale is situated south of Ethiopia, bordering Kenya, but also Oromia and Somali Regions. Moyale is the main border post on the Nairobi-Addis-Ababa road, about 800 km south from Addis-Ababa, capital of Ethiopia, and also about 800 km of Nairobi, capital of Kenya. It takes around one and half day by road to reach Moyale from Addis-Ababa.

Moyale GPS coordinates are: 37N, Northing: 505537, Easting: 390950.



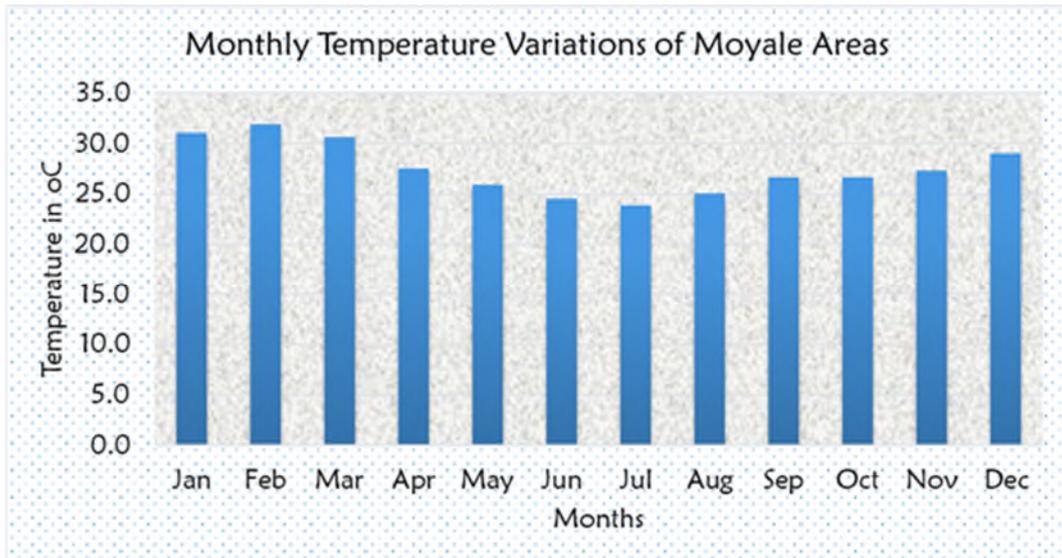
Except the main road Nairobi-Addis-Ababa which is in very good conditions and asphalted, all other roads, into Moyale town and in surroundings rural area, are not asphalted, dusty during the dry season, bumpy and potentially muddy during the short rainy events.

- Geography, topography and climate

Moyale town rises from an elevation of about 1040 and 1150 meters above sea level. The climate of the area is characterized by arid to semi-arid climate and with recurrent drought.

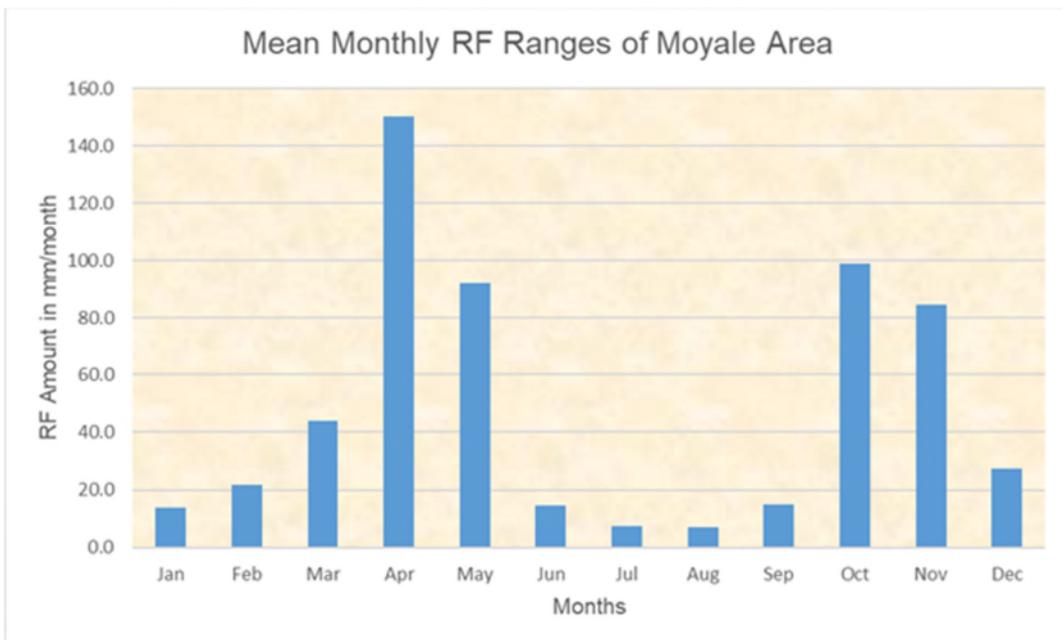
The drought is due to lack of adequate rainfall and limited or no availability of perennial fresh surface water bodies. That means the area has high flash floods during rainy seasons and all the streams of the area are intermittent. These facts cause the local community and institutions to rely mainly on groundwater as a major source of water supply.

The average minimum and maximum temperature of Moyale areas re 24 and 32°C respectively.



Rainfall in Ethiopia is controlled primarily by monsoon winds either from the Atlantic or from the Indian oceans depending on the season. Seventy five percent (75%) of annual rainfall on the NWP (Northwestern Plateau) and in the MER occurs during the summer (June-September) when the Inter-Tropical Convergence Zone (ITCZ) is located north of Ethiopia. During this period, the Indian and the Atlantic Ocean monsoons converge in the ITCZ. The other 25% of rainfall occurs in Spring (March-April) when the ITCZ passes southwards. During this period, the north Indian Ocean is believed to be the main source of moisture.

As a result, the study area is characterized by bimodal (two peak) type of rainfall. The area gets the first major rainy season during spring period with peak in April and the second rainy season from October to December with peak in October.



The spatial distribution of mean annual rainfall in the area generally decreases from the high land toward the low lands.

In general, the spatial and temporal distribution of rainfall tends to decrease with decreasing altitude. As a result, those areas situated on the escarpment and plateau get annual rainfall amount of greater than 680mm/year while the areas found in the low lands (including Moyale areas) get mean annual rainfall of less than 580 mm/year.

Another source gives the following figures temperature and rainfall for Moyale (Kenya side):

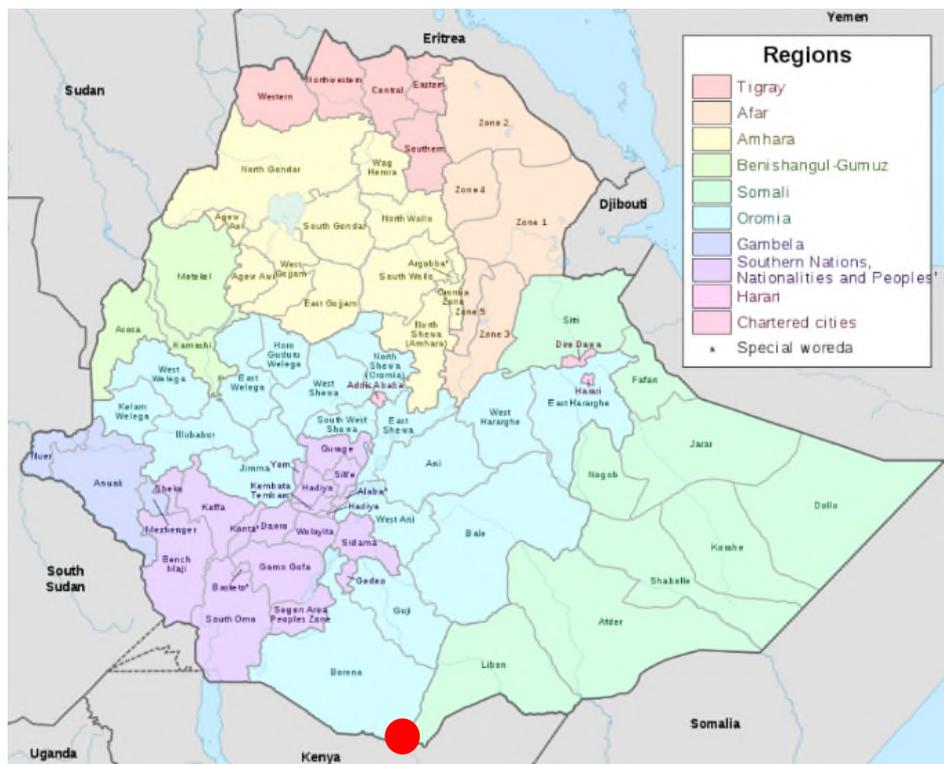
Climate data for Moyale, Kenya (1968-1994)													[hide]
Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Record high °C (°F)	34.4 (93.9)	35.0 (95.0)	35.0 (95.0)	32.8 (91.0)	30.0 (86.0)	27.8 (82.0)	27.8 (82.0)	28.9 (84.0)	30.6 (87.1)	31.7 (89.1)	31.7 (89.1)	32.2 (90.0)	35.0 (95.0)
Average high °C (°F)	30.6 (87.1)	31.1 (88.0)	30.8 (87.1)	27.2 (81.0)	25.0 (77.0)	24.4 (75.9)	23.9 (75.0)	24.4 (75.9)	25.1 (79.0)	25.1 (79.0)	27.2 (81.0)	28.3 (82.9)	27.1 (80.8)
Average low °C (°F)	18.3 (64.9)	18.9 (66.0)	18.9 (66.0)	18.3 (64.9)	17.8 (64.0)	16.1 (61.0)	15.6 (60.1)	15.6 (60.1)	16.1 (61.0)	18.3 (64.9)	17.2 (63.0)	17.8 (64.0)	17.4 (63.3)
Record low °C (°F)	13.9 (57.0)	15.0 (59.0)	14.4 (57.9)	14.4 (57.9)	13.3 (55.9)	12.8 (55.0)	12.2 (54.0)	12.8 (55.0)	13.9 (57.0)	14.4 (57.9)	13.9 (57.0)	13.9 (57.0)	12.2 (54.0)
Average rainfall mm (inches)	10.9 (0.43)	18.5 (0.73)	53.3 (2.10)	176.8 (6.96)	119.6 (4.71)	16.8 (0.66)	16.5 (0.65)	16.5 (0.65)	27.4 (1.08)	95.8 (3.77)	80.8 (3.18)	38.6 (1.52)	671.5 (26.44)

Source: Sistema de Clasificación Bioclimática Mundial<sup>13</sup>

- Administration and political Units

The Federal Democratic Republic of Ethiopia is a federation subdivided into 9 ethnolinguistically based Regional States and 2 chartered cities (Addis-Ababa and Dire Dawa) since 1992. One specificity of Moyale is that the town spread over 2 regions, Oromia and Somali Regional States.

Regions are subdivided into Zones, which are a second-level subdivision of Ethiopia, then in Woredas (districts), and finally into Kebeles (ward), which are the smallest unit of local government in Ethiopia.



Moyale town is split since 2018 between two Woredas: Moyale Woreda of Oromia Region, under Borena Zone, and Moyale Woreda of Somali Region located at the extreme south west of the Dawa Zone. The administrative special limits of Moyale are not precisely defined since the Regions creation in the 1990's and border issue is a very sensitive subject as the area is disputed between the two regional entities.

- Political situation and land dispute

Moyale is historically disputed between the two dominant Borana (Oromia) and Garre (Somali) communities, the tensions being exacerbated during drought conditions. This led up to armed clashes, especially in 2012 which stayed in local memories and was presented in national and international media. In the recent years, the community tensions increased with the question of the regional border. New clashes with more consequent weaponry occurred in 2017 and 2018. For the first time, the water resources boreholes catchment of Moyale was targeted. Moyale Water office underlined that never in history of local clashes people targeted water resources, considered as almost sacred for pastoralist culture in the very dry climate of Moyale.

The inter-communities and regional tensions directly affected the water supply. First the main water production site for Moyale town, El Gof, is one of the main disputed land. Second, the water management ownership is perceived by some as a powerful tool to get influence and control on populations. Third, the management of water distribution, through the money collection, is also perceived by some as a key components of community responsibility.

In September 2020, El Gof pumping site is still out of order, and the local Oromia and Somali administrations have not yet found a common agreement to allow the water supply to the whole city population. After having been authorized to carrying out field evaluation and boreholes studies, the ICRC has initiated a dialogue between both parties. This dialogue has been slow down by the COVID crisis but should be resumed in fall 2020.

- Presentation of the main stakeholders

The complexity of the project is revealed by the large number of stakeholders. There are several administrative levels involved: federal, regional, zonal and woreda levels. On each of those levels, there are specific stakeholders. In addition, there are two organograms at regional, zonal and woreda levels because Moyale town is shared between two regions.

At technical level, the main partners are the water office and the water board of Moyale city, and the regional water bureaus of Somali and Oromia regions.

At political level, the main partners are the Mayor of Moyale city and his administration, the traditional leaders (religious, elders, women), the Oromia and Somali regional state administrations.

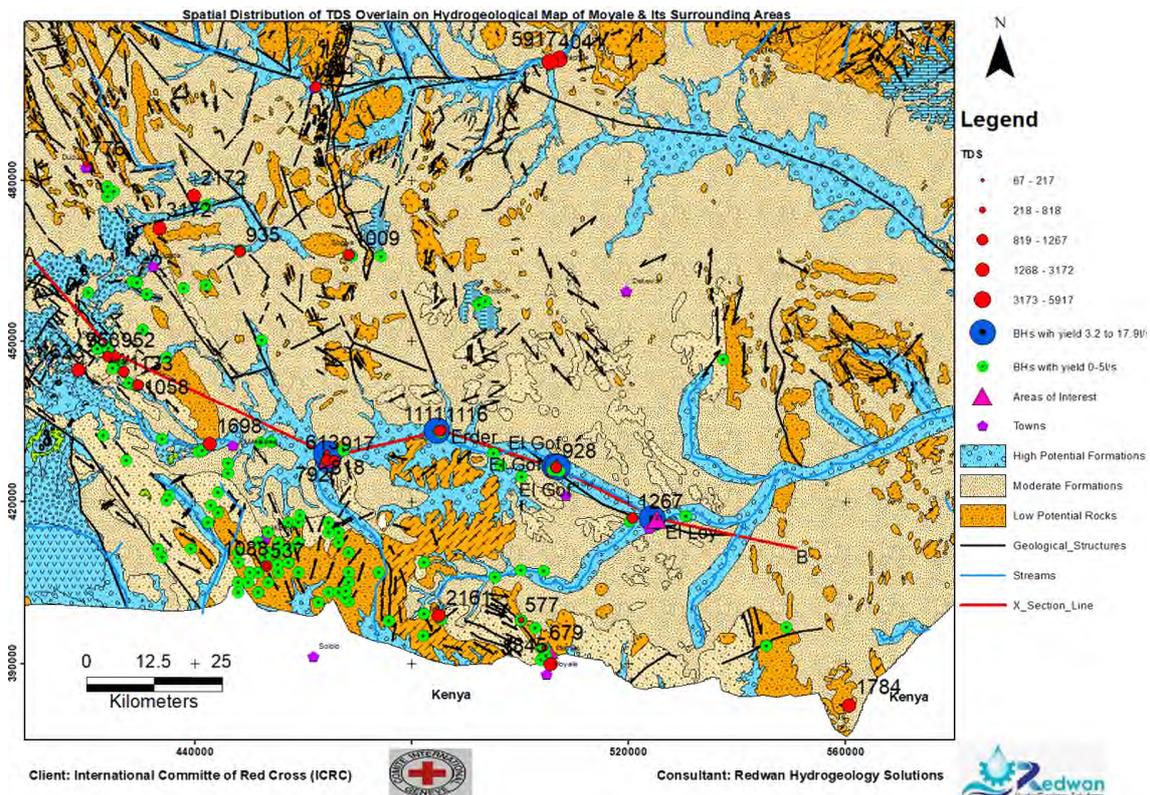
- Language

Amharic used to be the official language in Ethiopia and remains the government working language. Regional languages are all official languages and Moyale being populated by Somalis and Oromos people, those two languages should be used during field visits. ICRC will provide interpreters to the consultant during the field visits.

#### 4) Geology, Hydrogeology, Water resources

ICRC conducted a bibliographic geological survey end of 2019 to collect data and update available knowledge on water resources in a radius circus of 80 km from Moyale (Kenya area excluded). The conclusion showed that:

- Water resources available in the region are only underground ones (no surface water).
- Moyale town does not benefit of consequent water resources at proximity (less than 30 kilometers).
- The main water bearing formations in the area are intergranular unconsolidated formations (alluvial, buried channels deposits and lacustrine sediments) and top weathered section of basement rocks.



This report gives a good picture of the geological and hydrogeological environments of Moyale region. It is available upon request.

In March 2020, a second hydrogeological survey has been launched to:

- conduct a hydrogeology bibliography of Mega area, 100 km north west of Moyale, since the first survey showed this area presented promising potential water capacities.
- undertake geophysical site investigations in the two best identified zones to identify the groundwater potentialities and aquifer characteristics: Bolkulubana and Elder.

The findings of this survey are:

<b>Factors considered for comparison</b>	<b>Bolkulubana site of Moyale areas Bibliography analysis</b>	<b>Erder site of Moyale areas Bibliography analysis</b>	<b>Megado site of current Mega areas analysis</b>
<b>Type of geology</b>	Alluvium underlain by basement rock	Alluvium underlain by basement rock	Alluvium underlain by Volcanic aquifers and basement rock
<b>Geomorphology</b>	Lowland	Lowland	Lowland
<b>Maximum well depth /Aquifer thickness</b>	Maximum depth to be drilled 100m & maximum depth drilled so far 75m to 86m	Maximum depth to be drilled 100m & maximum depth drilled so far 85m	Basaltic thickness is about 200m, maximum depth of well drilled so far is 214m
<b>Aquifer media</b>	Alluvium & weathered section of basement rock	Alluvium & weathered section of basement rock	Fractured & weathered basaltic & weathered basement
<b>Aquifer extent</b>	Limited to along stream channel bank & beds, due to shallow depth of basement outcrops	Limited to along stream channel bank & beds, due to shallow depth of basement outcrops	Wider volcanic aquifer overlaying the basement rock at deeper depth below 210m
<b>Static water level</b>	47.6m	10.7m	75m
<b>Wells discharge</b>	7-15 l/s	17.9 l/s	>22 l/s
<b>Groundwater recharge</b>	Localized	Localized	Regional
<b>Water quality</b>	TDS of less or equal to 1,100mg/l	TDS of less or equal to 1,100mg/l	TDS values varying from 1,003 to 1,239 mg/l, but very high in the vicinities of crater lakes. So, care should be taken not to get close to it.

In July 2020, a third hydrogeological survey has been launched to:

- carry out aquifer characterization tests to evaluate the potential sources of groundwater from the Bolkulubana and Erder areas.

The conclusions of this survey are:

- Bolkulubana and Erder areas are equally prioritized on the first order for groundwater potential development due to their groundwater potentiality in terms of groundwater quantity. In addition to this, the aquifer thicknesses and yield of the wells made these areas to be preliminarily selected and prioritized for further hydrogeological and geophysical field investigations. Unlike in Bolkulubana, water quality analysis carried out in Erder pointed out that some of the parameters like TDS, sodium, chloride and total hardness concentrations in the water are out of the permissible range of WHO standards
- Elgof areas are ranked to be the second prioritized areas for Moyale town and surrounding rural community water supply purposes.
- Finally, El leh areas are put on the last/third optional sites to be investigated for groundwater development due to its minimum aquifer thickness and poor water quality which has to be investigated further spatially. However, according to the document analysis Moyale town areas are not selected and cannot be the focus area for groundwater investigation due to its poor water quantity as well as quality.

## **5) Population**

- Population counting

Huge discrepancies exist in literature concerning Moyale population figures. First probably because there is a confusion between woreda vs urban area. Second because the city is split in the two Oromia and Somalia administrations. On top of that, such figure is sensitive in a disputed area where it can be used for political purposes. The neutrality of ICRC must apply to the consultant and the consultant will carefully make sure that population numbers will not serve any political purpose.

The last official census of 2005, 2007 omits to give the population for Moyale city, while it's given for most of town in the country. Indeed, the CSA (Central Statistical Agency of Ethiopia) gives the population counting only for Moyale rural areas. For Moyale woreda of Oromia region, the 2007 national census reported a total population of 31'162 (none were urban dwellers), while in the figures published by the CSA in 2005, this woreda has an estimated total population of 128,016 (among it, 25'038 were urban dwellers). For Moyale Woreda of Somali region, the 2007 national census reported a total population of 254,137 (none were urban dwellers).

Some internet site (like Wikipedia, city population) give figures between 25'038 (in 2005), 41'600 (in 2015) to 134'314 dwellers without mentioning clearly their sources.

Local authorities and contacts (administration, Ethiopian Red Cross and Water Office) gives figures for Moyale town between 200'000 and 250'000 people. However, these figures seem exaggerated.

- Other population

On top of Moyale urban population, the present consultancy has to consider at least rural populations living along pipelines and water infrastructures and the ones from Moyale Kenya side.

For rural areas, on top of official figures for the two Moyale woreda mentioned above, the NGO World Vision, which implemented the water project from Bolkulubana water production site to Moyale (65 km line in Borena Zone), conducted population calculation using density area method for populations living up to 4 km along the transmission pipeline in the project area. They estimate for the year 2015 a population of 18'000-24'000 households<sup>1</sup> (126'000-192'000 inhabitants) for rural villages benefiting from the project (and 18'100 urban inhabitants for Moyale town section supplied by the project). Today, the Bolkulubana transmission pipeline feeds the rural area with 27 water points. The number of water points fed by El Gof transmission pipeline is still unknown to us.

For the Kenyan side, the population census of 2009 counted 37'387 urban dwellers for Kenyan side of the town and projected 48'102 for 2017 (Kenya of National Bureau Statistic, 2013). One visit with Kenyan Water Authority gave the figure of 70'000 dwellers for Moyale Kenya according a 2019 census.

- Population GIS counting

Facing these discrepancies and the sensitiveness of the population figures, ICRC initiated a population counting using satellite imaging and GIS support. The different elements of the satellite picture have been classified (vectorization) and areas have been defined (zoning) per type of activity (commercial, residential, etc.), using the following assumptions:

- The buildings in Moyale Ethiopia and Moyale Kenya are counted
- All buildings covered in the imagery are considered in the counting
- All buildings with in a parcel are counted as individual entity
- The number of people per household is taken to be 8.
- The factor of 1 and 0.5 are used to compute number of people in residential and commercial areas respectively but no population considered for the rest of land use types.

We could get the following preliminary results

- Total of **26 958** buildings counted (**18 871** in Ethiopia and **8087** in Kenya)
- The **24693** buildings are residential, **863** commercial, and the rest other land use types
- Total estimated population is **200 696** people (**139 080** for Moyale Ethiopia and **61616** for Moyale Kenya)

- Economic

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<sup>1</sup> Figure given by the Zonal Water Bureau in October 2020

The extreme south of Ethiopia is a semi-arid area historically dominated by pastoralist activities. Moyale is naturally born from trading activities and market, the city being placed at the border of Ethiopia and Kenya along the main road Nairobi – Addis-Ababa, and at the crossroads of different pastoralists groups. Agriculture is present in a very limited space, usually along short strips of dry river beds.

Concerning water usage, on top of drinking water, the main water consumption is the livestock supply (camels, cattle, donkeys) all over rural areas. In the pastoralist culture, it is to be noted that water for animals is as important as for human population. Thus, livestock demand has to be integrated in the global water demand, if planners do not want the project water supply to be diverted to livestock support.

## **6) Moyale Water Supply System**

- General

Moyale water supply system exist since more than 30 years. El Gof boreholes catchment and pipeline to Moyale were implemented at the end of the 1980's. Since its creation to 2017, the traditional operator of the water supply system was the public Water Board, which belongs to Oromia Region administration. Some INGO (Oxfam) supported the Water Board with substantial rehabilitation and equipment renewal. Around 2015/2017, the NGO World Vision implemented Bolkulubana boreholes catchment site and transmission line for the supply of rural villages along the line Bolkulubana-Moyale and to increase water volume delivered to the town of Moyale.

In 2017, the city of Moyale was thus supplied from two boreholes sites: El Gof and Bolkulubana with two transmission lines of respectively about 35 and 65 km. The town itself is equipped with one water reservoir and a very basic distribution network limited to the old town center. The whole system generally is old and was not upgraded to follow population and town growths.



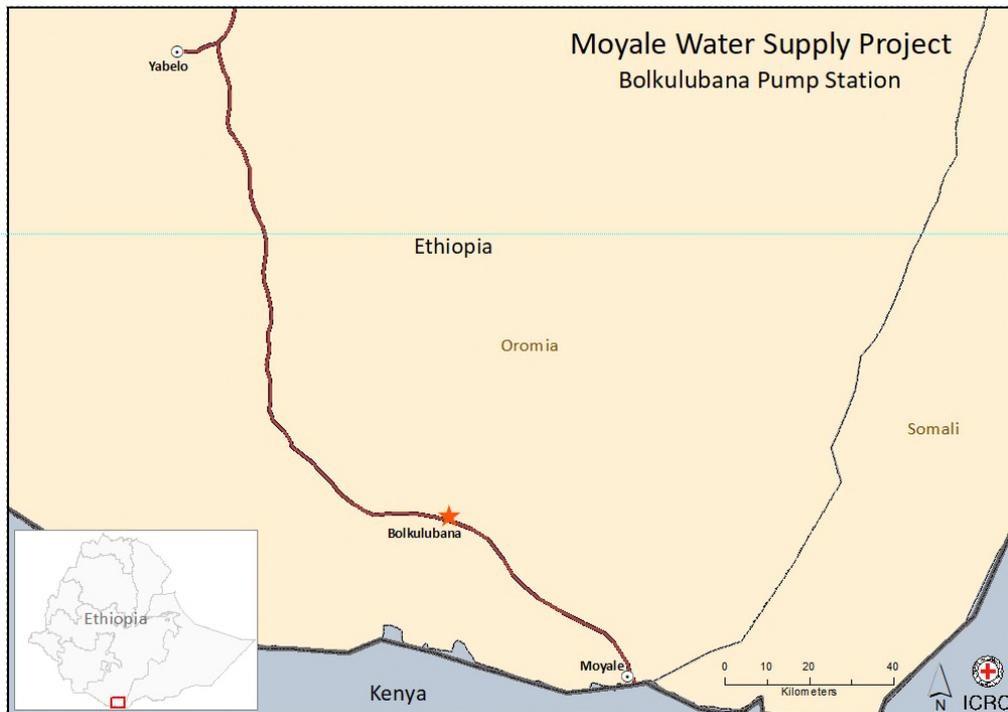
Consequently, before the clashes of 2017, Moyale city was already suffering from water stress and lack of investment to cope with the situation. In 2017, El Gof water production site was damaged and stopped operating. El Gof area also passed under Somali control. In response to that unprecedented action of destruction against public infrastructure, valves were closed to shut down the network serving the Somali suburbs. While directly after December 2018 clashes, INGO coped the situation with water trucking up to April 2019, the population now is highly suffering from water scarcity, relying on unsafe shallow wells and governmental or regional water trucks.

- Resources and transmission pipelines

Moyale city gets its water from two mains sites, Bolkulubana and El Gof boreholes catchment areas, then from shallow wells.

#### **Bolkulubana resource and transmission pipeline to Moyale**

Bolkulubana area is situated 65 km North West of Moyale, close to the road Moyale-Yabelo.

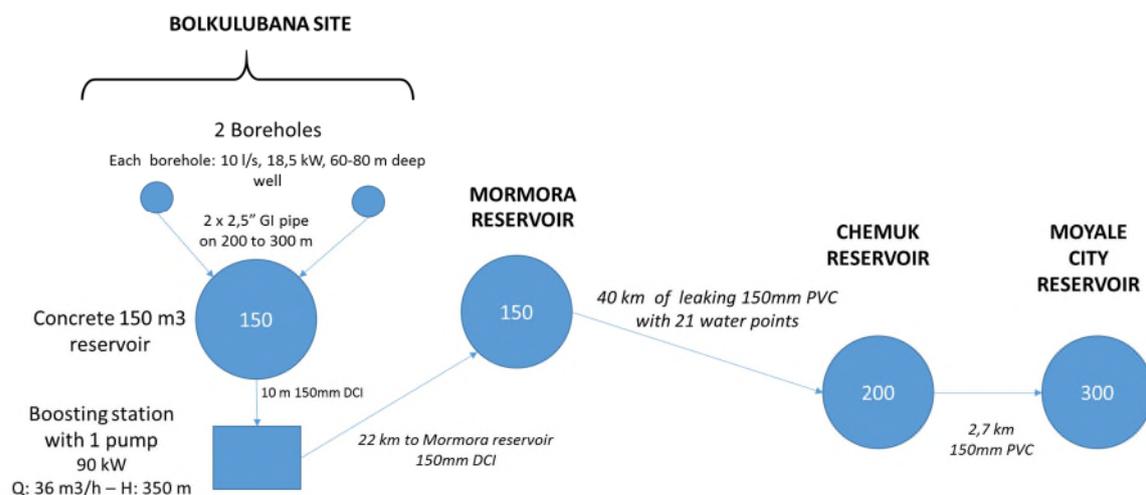


The infrastructures were built by the NGO World Vision between 2015 and 2017.

The site welcomes 2 operational boreholes, one 150 m<sup>3</sup> concrete reservoir and one boosting station (one pump) pushing water on 22 km of 6" ductile cast iron pipe up to Mormora reservoir. Then on the other 43 km to Moyale town, the water flows by gravity. Along the 65 km of piping, 21 water points serve villages and communities for people and livestock, including 2 hydrants for water trucks feeding.

On Bolkulubana area, 2 other drilled holes are condemned, the city of Bolku has its own borehole system independently.

### BOLKULUBANA water resource & pipeline



Bolkulubana boreholes: the two boreholes are about 70 meters deep and equipped with 18.5 kW submersible pumps. Each one has a theoretical yield of 10 l/s. According to the Bolkulubana technicians, the 150 m<sup>3</sup> reservoir is filled in 2.5 hours (when everything is alright), meaning that actual yield of both boreholes are 60 m<sup>3</sup>/h. Each borehole pushes water through an about 500 and 200 meters 2.5" GI pipe to the reservoir. Drilling report concerning one of the wells were given to ICRC, with depth, static and dynamic levels, tested yield. No precise data are available on submersible pumps (Brand, Q, TMH...).

Each borehole is supplied by two different grid lines (city town grid and federal grid). Both of them have very often cuts and suffer from under voltage. Each borehole has its own 3 phase line on poles to their position and a proper transformer. The site suffers from frequent electrical cuts and low voltage. As mentioned below, when arrived at Moyale city tank, Bolkulubana site only provide about 100 m<sup>3</sup>/d on average!



*Left: one borehole's dedicated building and transformer*



*Right: borehole head's piping*

Bolkulubana reservoir: one reservoir of 150 m<sup>3</sup>, concrete made (not respecting the state of the arts (walls bended) but no leaks) receives the water from the 2 boreholes with 2.5" GI pipe. The outlet is a 150 mm Ductile Cast Iron pipe with one valve feeding the boosting pump. The distance of the outlet pipe between reservoir and boosting pumps is around 10 meters.



*Left: The reservoir with electric building - Right: the reservoir with pumping station building (corrugated sheet).*

Bolkulubana boosting station: Bolkulubana water is pushed through 22 km piping to Mormora tank with a boosting station with only one split case horizontal pump (motor 90 kW, nominal point: H: 350 m, Q: 36 m<sup>3</sup>/h), not new but in good conditions. The pump seems good quality and in good conditions but the transformer post and the station building in corrugated sheet are built like temporary devices with light materials, which do not allow equipment to be properly protected. The station is not equipped with measure devices. According to technicians, the 150 m<sup>3</sup> tank is emptied in 3 hours, meaning estimated pumping flow is 50 m<sup>3</sup>/h.



*Left: the boosting pump*



*Right: the pump transformer*

Bolkulubana to Moyale transmission pipeline: From the boosting station (Bolkulubana site) to Mormora reservoir site, there is 22 km of DCI 6" pipeline. On Mormora site, there is a reservoir of 150 m<sup>3</sup>. This place is supposed to be the most elevated point of Bolkulubana line. From Mormora reservoir site to Chemuk site (city entrance reservoir), there is 43 km of U PVC 6" pipeline, with many leaks. On Chemuk site (outskirts of Moyale), there is a reservoir of 200 m<sup>3</sup>. From Chemuk site to Moyale City site, there is 2.7 km of U PVC 6" pipeline. In Moyale City, there is a reservoir of 300 m<sup>3</sup>, from which starts the city distribution network.



*Left: Mormora reservoir*



*Right: Chemuk Reservoir*

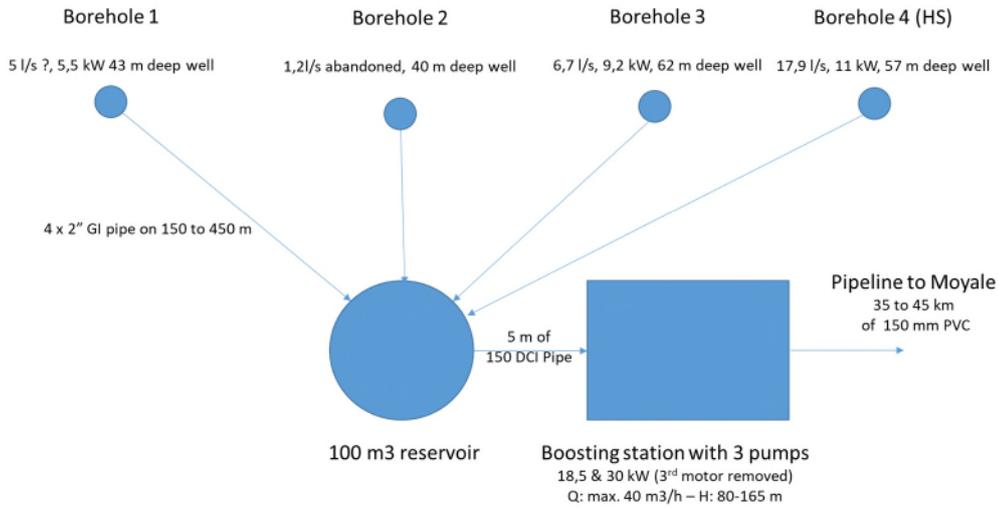
All along the pipeline, there are 21 water points serving villages and cattle. These points have agreement with Moyale Water Board and are supposed to respect some rules (maximum volume) but according to this Water Office, they probably do not respect. Among these water points, 2 of them have pumping devices to fill water trucks (the ones used for Moyale city by private and governmental trucks).

#### **El Gof resource and transmission pipeline to Moyale**

El Gof area is situated 35 to 45 km north east of Moyale. The infrastructures were built by government end of the 1980's. The site welcomes 4 boreholes, one 100 m<sup>3</sup> concrete reservoir and one boosting station pushing water on 35/45 km of 6" PVC pipe directly to 300 m<sup>3</sup> main city reservoir. Along the 35/45 km of piping, 12 water points serve villages and communities for people and cattle. The water compound is now occupied by Somali soldiers.

El Gof site has suffered from destruction (transformer shot, electric cables cut) during 2017 clashes. Furthermore, population testifies that electric poles have been put down close to Moyale on several kilometers.

## EL GOF water catchment site



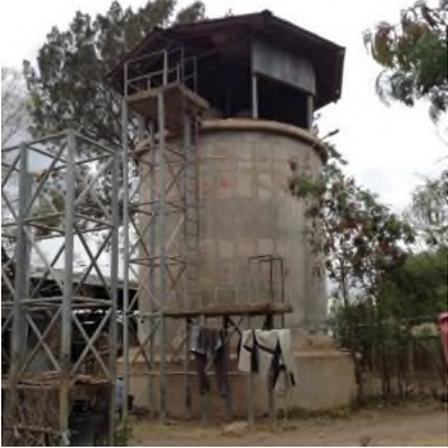
Boreholes: El Gof catchment area has 4 boreholes but one was not functioning before clashes. Boreholes have not run since 2017, with all negative consequence on the submersible pump and borehole itself. ICRC subcontracted end of 2019 a campaign of borehole cleaning (flushing and development) and pump test on El Gof boreholes. 3 submersible pumps among the four boreholes are functional (the borehole with 1,2 l/s safe yield was abandoned). The depth of boreholes is between 40 to 50 meters with casing of 6 and 8". Yields after pump tests are for BH#1: 5 l/s, BH#2: 1,2 l/s, BH#3: 6,7 l/s and BH#4: 17,9 l/s. The boreholes are between 150 to 500 meters from the 100 m<sup>3</sup> reservoir they feed through 2" GI pipe. According to El Gof operator, the reservoir was filled in one hour by the 3 boreholes (thus 100 m<sup>3</sup>/h, but in contradiction with sum of the yields). Report on El Gof pump test is available upon request.

Some electric cables have been cut at the borehole head, allegedly during El Gof site attack. Otherwise, boreholes infrastructures show no trace of destruction. However, the components of the manifold are old, flow meters and manometers are broken, gate valve are also aged and need to be replaced. Concerning power, each borehole is connected to electric control panel (3 phases) installed in the boosting station electric room. All electric devices have been replaced by Oxfam around 2015 but all control panels have been damaged during conflict (cables cut, panel teared out).



*2 borehole heads*

El Gof reservoir: 1 reservoir of about 100 m<sup>3</sup> (diameter 5 m, 5 m high), concrete made in good condition with no leaks receives the water from the boreholes with 2"/2,5" GI pipe. The outlet goes with a 150 mm Ductile Cast Iron (DCI) pipe to the boosting pumps. The distance of the outlet pipe between reservoir and boosting pumps is around 5 meters. The reservoir was equipped with a chlorination system (2 parallel HTH mixing tanks and dosing pumps) on the roof of the reservoir but is nowadays out of order.



*Left: Reservoir with mirador on top*



*Right: Boosting station (left) and reservoir(right).*

El Gof boosting station: El Gof water is pushed through 35/45 km piping to Chamuk reservoir (Moyale town) with a boosting station with 3 horizontal surface pumps. Two electro pumps are still in place, the third motor has been removed. Electromechanics of the two pumps in place was working up to clashes and does not seem to have been damaged. However, they are aged and need replacement or strong maintenance. The characteristics of the pump are: 1/ 30kW, H min/max: 85 / 165 m - Q min/max: 4 / 17 L/s, 2/ 18,5 kW, unknown H and Q.



*Left: Boosting station pictured from suction*



*Right: Boosting station pictured from boosted line*

Electric cables have been cut. Control panels of the boosting pumps are closed in the electric board. Some panels are destroyed. The boosting pump is also equipped with old anti hammer system (Charlatte model Hydrofort 750 L).



*Left: Electric board*



*Right: Anti hammer system with boosted line (150 DCI)*

El Gof site energy supply: El Gof site has one generator (5 other generators are in the compound, 2 could be potentially repaired) and electricity grid with transformer.

This generator, 165 kVA capacity on continuous mode, used to function long hours since the electric grid is too frequently cut. Today, the generator is not used anymore since cables have been cut two years ago, but it is still in working condition. Basic maintenance is required because it was not used for two years.

El Gof being the only site equipped with generator (Bolkulubana is not), most of the volume of water used to come from El Gof site

During the clashes, the transformer has also been shot and the electric cable have been put down in an area closer to Moyale, according to local population. Reparation of the national grid is not expected.

El Gof pipeline: The pipeline, not visible (underground in El Ley site), could not have been assessed since the road "main road-El Gof" was not accessible for security reason. According to technicians, the pipeline is between 35 and 45 km long, probably UPVC. Diameter is not sure, either 100 but most probably 150 mm (4 to 6"). El Gof pipeline goes from El Gof site to Chamuk reservoir at the entrance of Moyale town.

- Other resources of water

The city network is only supplied by Bolkulubana and El Gof water production areas. However, looking at the volumes produced, it's obvious that the city network does not bring enough water for the whole city. Population relies also on shallow wells.

Oromia side: the Oromia suburbs of the city present low-level areas between hills where rivers flow during rainy seasons. The river beds are constituted by sands and sandstones. Population,

through private initiatives, dig shallow wells of 5 to 20 meters deep. The suburban population uses a lot these water resources since it's close to their living place. Since these dry river beds welcome all kind of rubbishes, the contamination of wells is probable.



*Hand dug shallow wells in Oromia suburbs of Moyale*

Somali side: In Somali zone, shallow wells and shallow ponds exist in dry river beds situated at 8 to 30 km from Moyale city. These water points are used by Somali population for humans and cattle. Somali from Moyale city comes also to fetch water to these points with water “donkeying” or motorbike transport. The NGO Save the Children rehabilitated 2 to 3 hand pump boreholes. Another NGO (CIFA) also improved some water points with trough for cattle. But other points (including El Lay) need rehabilitation according Save the Children WASH officer. The population told us that the rehabilitation made by Save the Children and CIFA were very useful as it reduced the waiting time (and tensions) and saved water. Moyale population uses partly these resources.



*Left: rehabilitated water hand pump*



*Right: river beds where lie wells and ponds*

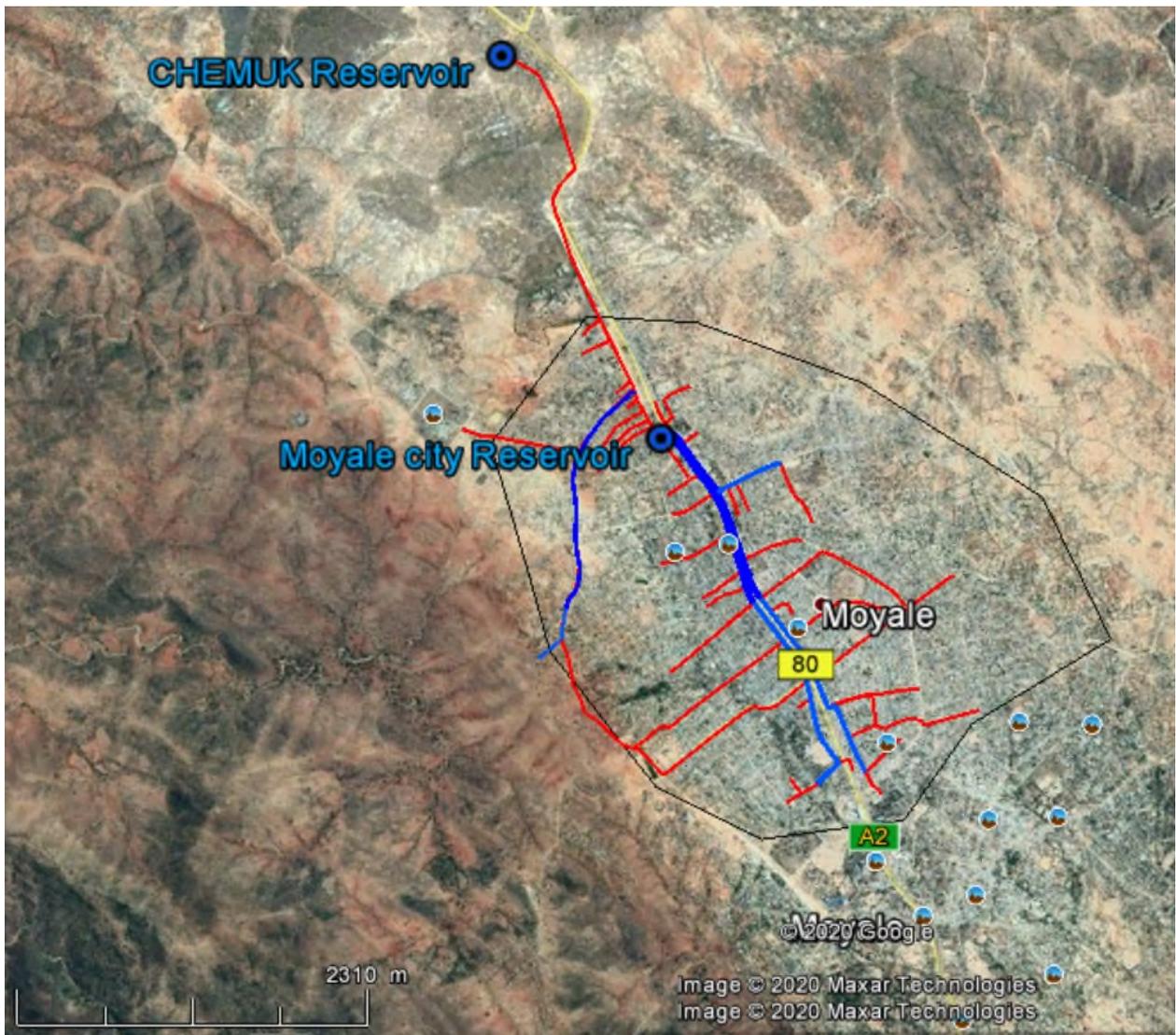


Left: ponds in river bed for cattle



Right: rehabilitated trough

- Moyale town reservoir and distribution network



The city network (2" HDPE/PVC lines in red, 6 and 4" lines PVC lines)

The city water network is quite old (more than 30 years) and embryonic. Indeed, it has never been upgraded to follow the city growth so that periphery suburbs are not supplied. The architecture is very basic: one 300 m<sup>3</sup> reservoir receives water from Bolkulubana and El Gof. From this only reservoir goes one main distribution line along the main road (6" on 1.2 km then 4"). From this main line start secondary lines to the right and left from the main road (lines from 1"1/2 to 3").



*The main city 300 m<sup>3</sup> reservoir and its valve chamber*

Before conflict, Water Office had 1340 private connections, paying per volume and 20 to 40 public distribution points. Beginning of 2019, the private connections had decreased to 774, no figures on public points. Since El Gof passed under Somali side, the valves of pipes feeding the Somali suburbs have been closed.

- Water consumption trends and cost

Following street random population interview, it appears that Moyale population have today about 10 l/p/d, a bit more from Oromia side, between 10 to 15 l/d/p, Somali side suffers far more from water scarcity with around +/- 5 l/p/d. On top of the water scarcity, cost of water is an added constraint. Indeed, water has to be transported from far away (except shallow wells in Oromia side of the city) by private trucking, donkey or moto.

In Oromia side in March 2019, the population interviewed answered that they purchased for about 1 to 10 ETB/ container of 20 L and consumed on average 10 to 15 l/p/day (1 CHF is about 30 ETB). In Somali side, the population interviewed, and the NGO Save the Children told that the cost of 20 ETB about 10 birr/ container of 20 L and consumed between 5 to 10 l/p/day.

All people we interviewed told ICRC that water was the main issue of the city.

- Water volume discussion

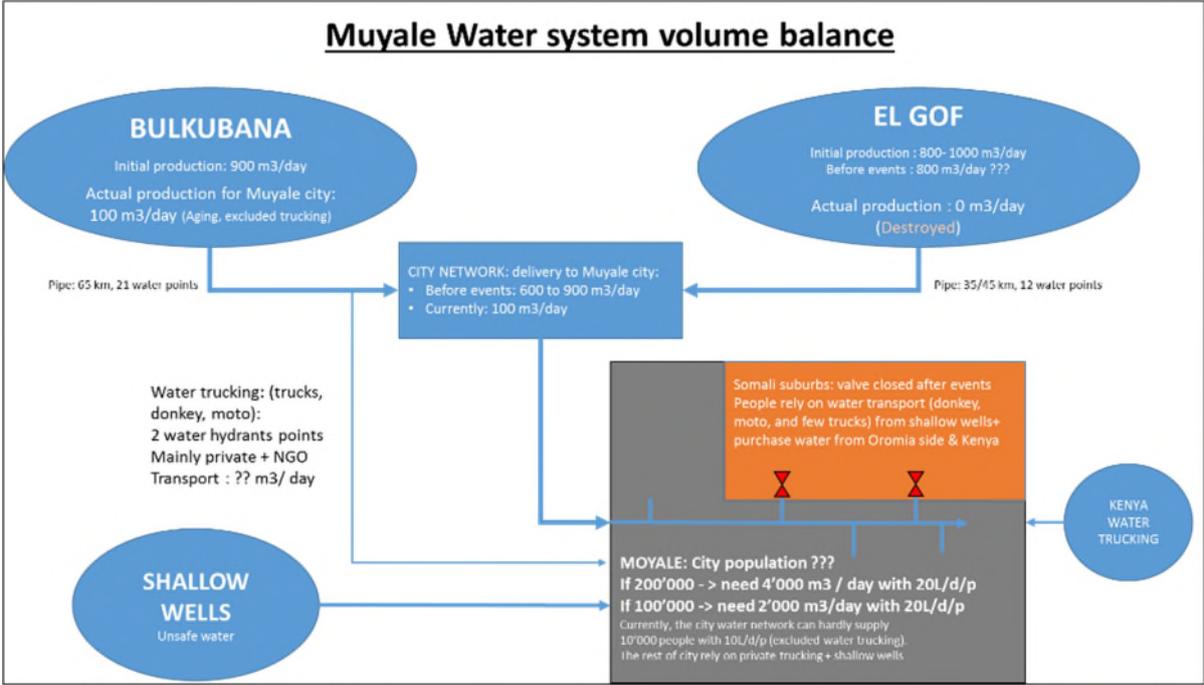
During discussion with Moyale Water Office mid-2019, technicians gave indications about the water production. Since there are no documents available, neither measuring devices (flow meter, private water meter statistics...), the more accurate means to measure water volume

seems to be the filling of the main city tank, as technicians used to fill it full before opening distribution valve to the distribution network.

Before the conflict, they use to fill 2 to 3 times a day the 300 m<sup>3</sup> reservoir, meaning Bolkulubana and El Gof were giving to the city (they are also supplying 33 rural villages/communities + water trucking) about 600 to 900 m<sup>3</sup>/day.

Mid 2019, the reservoir was filled in 3 days, meaning Bolkulubana site is providing the city about 100 m<sup>3</sup>/day (excluded 21 rural points and 2 water trucking points for the city). Since the difference between the actual and previous situation is the shutdown of El Gof, we can also deduct that El Gof was providing 500 to 800 m<sup>3</sup>/day.

If we compare these figures to the population, we can relativize the importance of the water network. Indeed, even before conflict situation (600- 900 m<sup>3</sup>/day), the volume supplied to the city network gives ratio of 3 to 5 l/p/d (without taking into account the losses) for a population of 200'000, 6 to 9 l/p/d for a population of 100'000 which is extremely low for normal living conditions.



- Management of the Water Supply System

General description of water sector in Ethiopia:

The water sector in Ethiopia is organized in line with the Government structure: national, regional, zone, woreda and kebele, and towns and cities. There are Regional Water Bureaus (RWB) at regional (state) level that are in charge of planning and implementing water supply

projects and exercise operational oversight. Following Water Resources Management Policy, the water service provision is highly decentralized and service providers manage themselves autonomously at local level.

At town level there are either utilities or water committees that are responsible for the provision of water supply. In small towns as in rural areas and under district water offices, there are voluntary water committees to operate water systems. In practice, these water committees have limited responsibilities. Their responsibilities are limited to activities such as operating simpler water facilities, reading meters and collecting bills from the users. When a town water system expands, a formal town water utility or water supply and sewerage enterprise is formed. The utilities are completely independent of district water offices and are accountable to town water boards and the regional authority. The town water boards are formed by city or municipal councils and oversee the utilities' operations.

The water service provision framework in Ethiopia and the subsequent administrative structures are highly fragmented. Service providers are heterogeneous in term of scope of services (water supply and or partial or total sanitation, design, procurement, construction or simply O&M), structures, levels of autonomy, size and space delimitation.

Moyale water supply management:

The water system in Moyale was historically operated by Moyale Woreda Water Office under a Water Board gathering Oromia city administration and Borena Zonal Water Board.

- Consideration of the Kenyan part of Moyale

As Moyale lays also on Kenya side, consultancy need to consider the population needs, the water resources and the potentialities of exchange with the Kenya urban area.

Moyale town in Kenya belongs to Marsabit County. According Kenyan Water Authority, there are 70'000 dwellers for Moyale Kenya based on 2019 census. The geological context is the same than around Moyale in Ethiopia: the north of Kenya is mainly covered by low water potential Precambrian hard rocks with no consequent underground water resources. All Marsabit county is perennially water deficient and Moyale town rely on shallow wells, boreholes with yield of few m<sup>3</sup> per hour and retention water dams collecting water streams during rainy season. Holale dam and its borehole field are the main water resource for Moyale town however it's volume has divided by more than two (less than 50'000 m<sup>3</sup> due to siltation). According interview of Moyale Kenyan Water Authority, about 300 to 500 m<sup>3</sup> are daily distributed with two big challenges: the water is saline (no measures given but above standards) and the transmission of water from Holale to the town request lot of energy for the four pumping stations. Investments to increase water production are planned but regularly postponed. There are no permanent river streams. Moyale Water and Sanitation Company operates the water supply system which seems adequately developed with reservoirs and distribution network. According to Ethiopia Moyale Water Office and also from

different internet sources, Ethiopia side used to provide water to Kenyan side before the events of 2017 but through private trucking (no direct pipe interborder connection).

## DESCRIPTION OF THE SERVICES

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Methodology and presentation of the results are left to the Consultant initiative, in the respect of the objectives of these Terms or Reference.

Means to be employed to attain the project goals, such as site visits, time spend of various activities, meetings with stakeholders shall be defined by the Consultant and include in its offer. The minimum described in the Terms of Reference are to be adapted by the Consultant if deemed necessary.

Methodology, results and means shall be comprehensively described in the Consultant bid.

### 1) Objectives of the study

The general objective of the study is to propose a water supply system and works to ensure, by 2040, the Moyale water supply system can effectively provide sufficient quality water to its foreseen inhabitants. The proposed works, which are likely to include the mobilization of additional water resources, will be based on a comprehensive analysis of the existing situation, of demographic perspectives and interactions between communities, as well as on a sound understanding of the constraints and possibilities of the natural environment.

Specifically, activities should include:

- Establishing a complete inventory of the existing systems, as well as developing a deeper analysis on water resources.
- Monitor field investigations on the existing and potential water resources to be implemented.
- Collect and structure information on the water demand (population with its spatial distribution, commercial, livestock).
- Undertaking a comprehensive diagnosis of the administrative and infrastructural operation of the water supply system, based on local interlocutor meetings.
- Defining scenarios, with scheduled phases, of investments and works to be implemented to ensure the water supply system will be able to meet the population needs by 2040.
- Design a comprehensive water supply system, from the selected scenario and based on field investigations.

### 2) Phase I – Inventory, surveying and diagnosis

**Objective: gain the most accurate and reliable understanding of the structure and operation of the water supply system, including:**

- Knowledge of the infrastructures and the functioning of the system, such as:

- Existing facilities (boreholes, pressure lines, reservoirs, distribution pipelines and network)
- Existing major consumers
- Management of the Water System (legislation, administration, commercial, local practice).
  - Identify, through existing and to be implemented relevant hydrogeology surveys, the potential water supply resources in the area of Moyale.
  - Predict the situation in the mid-term future (20 years), to determine the water demand to be met and the water resource by 2040.
  - Compare the capacity of the system with the water demand at different time horizons and assess the potentials shortfalls of the system, present and future.

This phase includes four major stages:

- Stage 1: Collect and analyze the existing data, as provided by ICRC, gathered on the field or obtained from various stakeholders. Then detail, if needed, the remaining information to obtain in order to fulfil the study.
- Stage 2: From existing data and surveys available provided by ICRC, pilot complementary hydrogeological site survey to identify and size the requested water resources to reach the water demand by 2040.
- Stage 3: Define actual and future water demand by 2040.
- Stage 4: Analyze the system with comparative assessment between water system capacities and water needs at different time horizons, emphasizing on water system deficiencies and problematic to be expected in future.

- **Stage 1: Data collection and analysis of the existing water supply system**

The consultancy will start with a site visit dedicated to data collection and meetings with stakeholders concerning the water system existing infrastructures, administration, water demand.

The Consultant work will, amongst others, concern the following topics:

- Existing infrastructures

As a preliminary study, ICRC will proceed with an inventory of the facilities of the Moyale water supply system. This will include a description of the boreholes, transmission lines to the city, reservoir and distribution network. This inventory will not include detailed investigations of buried pipelines but will present a general mapping of the network on DTM plans provided by the ICRC.

Although the data collected by ICRC will be provided to the Consultant, it will remain the Consultant responsibility to ensure that the study benefits from sufficient and reliable information. The ICRC inventory will be controlled and complemented by the Consultant during his field missions.

Considering city's reservoir and the distribution network, the system is so aged and embryonic that the Consultant can consider a complete new design of these infrastructures.

Finally, as the reliability of the water production and distribution depends largely on power supply, the Consultant shall conduct a comprehensive review of the power supply infrastructure and the associated problems affecting pumping and treatment equipment.

- Demography and land occupation

As explained page 10, ICRC initiated a population counting of Moyale town (Ethiopian and Kenyan side) using satellite imaging and GIS support.

At this stage, rural areas along the existing and potentials transmission pipelines and water resources catchment sites have not been counted with satellite imagery.

However, they will have to be included as water supply infrastructures will not be culturally accepted if they do not also benefit the local rural population. The Consultant will quantify this population with a relevant methodology.

After its first field visit and field investigations, the Consultant will confirm, complement and/or possibly amend the population numbers provided by the ICRC.

The data on the current situation and the projection that will result from the Consultant works will be used to develop a set of cartographic documents that will illustrate the distribution of the water demand and the structure of the water supply system.

- Water Management

Based on available documentation and field investigation, the Consultant will undertake a research and a global presentation of the structural, administrative and commercial management of the Water Board of Moyale that will include elements such as:

- Financial (income from network, expenses post)
- Staffing of the Water Board
- Administrative organization (legislation, decision making process...)
- Operation and maintenance analysis

The Consultant will analyze and understand the functioning of the management of the water utility.

Detailed investigations and field surveys are not foreseen within this study.

- Socio-economic studies

Based on existing studies and documentation, the Consultant will undertake a research and a global presentation of the socio-economical characteristics of the population of Moyale that will include elements such as:

- Information on households (size, income, expenses, etc.)

- Current practices and sources of water supply for humans and animals
- Customer satisfaction (Does the service proposed meet the expectations of the customers at a price they are willing to pay?)
- Patterns of water consumption
- Consequences of the impairment of the water supply,

Detailed investigations and field surveys are not foreseen within this study.

- **Stage 2: Hydrogeological site surveys**

This is one of the key component of this Consultancy Service. The challenge will be to identify the potential water resources sites (aquifers) available to reach the projected 2040 water demand. The sustainability of the selected site should also be evaluated (hydrological study of the watershed).

The Consultant will review the available information on the existing water aquifers (water quality, aquifers distance from Moyale, aquifers properties) from reports and surveys gathered by ICRC. The Consultant will carry out field investigations to support this verification.

For any additional required field surveys identified by the Consultant, the consultant will provide a plan of action, and a draft of Terms of Reference and the ICRC will be responsible for tendering, contracting and direct site supervision. The consultant will provide advice and technical support to the ICRC during those phases, and quality appraisal of the surveys carried out. No direct supervision of field surveys is planned for the Consultant.

- **Stage 3: Definition of future water demand by 2040**

Based on the current and projected population, on realistic assumptions regarding urban development, on socio-economic data and on the characteristics of the various neighborhoods, the needs in terms of water consumption will be defined in 2 steps:

- First, a definition of the current needs (which differ from the current consumptions which are conditioned by the limitations of the existing system).
- Secondly, a forecast for the years 2025 and 2040, of the water demand.

The forecasted needs will take into consideration several hypotheses for population growth. Other parameters influencing water consumption, such as evolution of living standards, the impact of livestock economy, efficiency of systems etc., will be considered and incorporated in the forecasts.

- **Stage 4: System analysis with comparative assessment between water system capacities and water needs**

The Consultant will compile the overall documentation in a comprehensive description of the existing water supply system. He will then compare the water production and distribution capacities to the actual and future water demands.

The diagnosis will identify the water supply system deficiencies present and future as least in terms of:

- water deficits,
- infrastructures (production, transmission pipelines, storage, connections, yields...),
- operation and maintenance of the system,
- water quality,
- reliability.

### **3) Phase 2 – Proposition of scenarios for the development of the water supply system**

**Objectives: After updating the needs to be satisfied, identifying the potentials water resources, propose and compare various scenarios allowing to reach the water demand balancing the various constraints. Describe the selected scenarios with phasing and costing.**

The study should allow to identify the works to be implemented and to propose a relevant phasing of the interventions, differentiating emergency operations to remedy the current shortfalls of the system, essential structuring works that will allow to obtain reliable backbone infrastructures (production, primary network) and other improvement works (improving distribution, development to newly urbanized areas etc.).

The results of the study should clearly identify, emergency, short term and long-term works taking into consideration the evolution of the population and the limitations of the existing infrastructures:

- Emergency works on the 2021 – 2025 period;
- Short term works on the 2025 – 2030 period;
- Long-term works on the 2030 – 2040 period;

This phase includes three major stages:

- Stage 1: Description of evolution scenarios
- Stage 2: Selection of scenario
- Stage 3: General design of the selected scenario.

- **Stage 1: Description of evolution scenarios**

Based on the diagnosis established in Phase 1, the Consultant will develop several scenarios to improve the current situation and provide appropriate water supply in future, as explained in the objective above.

Based on the outputs of the evaluation of the management issues identified in Phase 1, stage 1, the Consultant will include improvements suggestions related to the management issues, but the scenarios should focus mainly on infrastructure and facilities works (“hardware”).

All the proposed activities (emergency, short and long terms) of the scenarios will be clearly sequenced.

The study of the scenarios will include several possibilities such as:

- Increase and diversification of water resources: selection of sites among the various existing and potentials water resources, with discussion on benefits and constraints in term of water quantity and quality, resource sustainability, investment (transmission pipeline), operational constraints. The water resources to be dedicated for rural populations and the ones most fitted for Moyale will be also discussed.
- Water distribution network strategies (storage spatial implementation, sectorization of the water network, connection to Kenya).
- Energy constraints: reflection on energy in a context of poor qualitative electric supply will discuss on alternative and back up process
- Estimated funding envelop and sequencing for each scenario

If additional information is missing and cannot be obtained to support/ clarify the description of scenarios, the Consultant will ensure that the study doesn’t stall by proposing:

- Broader categories of scenarios and explaining the remaining points to clarify,
- A plan of action for complementary studies or investigations that will allow to lift the uncertainties on scenarios and would allow to select the best one.
- Draft of Terms of Reference and estimated budget envelop for identified complementary studies or investigations

Last point of the stage 1, the consultant will propose and define and justify several relevant comparative selection criteria.

- **Stage 2: Selection of scenario**

The selection will involve various stakeholders (authorities, etc. to be selected by the ICRC), and the Consultant is expected to travel to Ethiopia (Addis-Ababa or Moyale) in order to:

- Organize one meeting to present and discuss the scenarios as well as the criteria to evaluate them and to select the best scenario/s.
- List the possible required information to complete the selected scenario/s
- If no scenario appears to be satisfactory and/or feasible, define alternative scenarios and undertake a new presentation meeting.

- **Stage 3: General design of the selected scenario**

Following the selection of the best scenario by ICRC and the relevant selected stakeholders, the Consultant will prepare a preliminary design of the selected technical options, that should at least include the following:

- Broad technical description of the selected solution,
- General dimensioning of the main elements,
- Design of the distribution network, including theoretical computerized hydraulic model
- General layouts and updates of networks plans,
- Tentative planning for the implementation of the works,
- Foreseen expenses, investment costs, operation and maintenance costs

The Consultant will explain and justify its technical choices, discussing on advantages of selected technical options and consequences if these ones are not applied.

The organization and presentation of the final study should easily allow potential future updates, especially to correct differences appearing between the projections and the real evolutions.

#### **4) Documents**

At the end of each phase of the study, a preliminary report will be communicated (soft copy) to ICRC engineers. A week later, a videoconference will be organized to discuss the report and suggested corrections/amendments.

After approval of the preliminary phase report, a final phase report of the phase will then be sent to ICRC in 2 hard and 1 soft copies.

At the end of the mission, a final report, regrouping all phase reports as well as all the annex documentation and eventually tools developed within the mission, will be compiled and 3 hard copies and 1 soft copy will be handed over to the ICRC.

#### **5) Missions and conditions**

- Field visits

The proposal of the Consultant should at least include the following missions in Ethiopia:

- Initial mission: 2 weeks at the beginning of Phase 1 with the following content: data collection, meetings with stakeholders, assessment of the current system, observation of the hydrogeological environment. In Addis-Ababa and Moyale.
- Hydrogeological survey: two missions of 10 days to pilot water resources site investigations in Moyale area.

- Presentation and selection of the scenarios: 1 week during Phase 2, presentation of the diagnosis during phase 1, presentation of the possible evolution scenarios, discussions and selection of the best scenario, in Addis-Ababa.
- Final presentation of the selected scenario and design: 1 week in Addis-Ababa

During his missions in Ethiopia, the Consultant will be taken by in charge by the ICRC (accommodation in hotel or ICRC residence, working space, vehicle, domestic flights). Meals remain at the expenses of the Consultant.

ICRC will provide support for the visa procedure providing required invitation letters and support for obtaining preliminary agreements within Ethiopia. The process for obtaining visas for Ethiopia is estimated to take about one week (online). The Consultant remains responsible to organize, pay and obtain the visa from his country of origin.

## **6) Payment conditions**

The amount of the Consultancy shall be a global lumpsum, with no revision of the prices.

Foreseen terms of payment are:

- 20 % advance payment at the contract signature
- 50 % upon completion of Phase 1 (after approval of the phase report)
- 30 % upon completion of the mission (acceptance of the final report)

## **7) Foreseen duration of the services**

The duration of the mission is expected to last around 11 months. The tentative planning presented below illustrates the estimated timing of the consultancy from ICRC vision.

The Consultant will detail his planning in his offer.



Description	Month 1				M 2				M 3				M 4				M 5				M 6				M 7				M 8				M 9				M 10				M 11			
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	33	34	35	36	33	34	35	36
Phase 1: Inventory, surveying and diagnosis																																												
P1 - Stage 1: Collection & Analysis of existing data																																												
P1 - Stage 1: Site visit in Addis, Moyale area																																												
P1 - Stage 2: Piloting hydrogeology site survey																																												
P1 - Stage 2: Site visit in Moyale area																																												
P1 - Stage 3: Definition of future demand																																												
P1 - Stage 4: System analysis and diagnosis																																												
Phase 1: report																																												
Phase 2: Proposition of scenarios and design																																												
P2 - Stage 1: Definition of scenarios																																												
P2 - Stage 2: Selection of scenario																																												
P2 - Stage 2: Visit in Ethiopia for scenario																																												
P2 - Stage 3: General design of selected scenario																																												
P2 - Stage 3: Visit in Ethiopia for final presentation																																												
Phase 2: Final report																																												

Time 0: contract signature