FIPAG
FUNDO DE INVESTIMENTO E PATRIMÓNIO DO ABASTECIMENTO DE ÁGUA

CONCEPT NOTE

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ABBREVIATIONS & ACRONYMS

AfdB	African Development Bank
AURA	Water Regulatory Authority (*Autoridade Reguladora de Água)- former CRA*
CRA	Water Regulatory Council *(Conselho de Regulação de Águas) – see AURA*
CREE	Foreign Economic Relations Commission *(Comissão das Relações Economicas Externas*
EC	European Commission
EIB	European Investment Bank
EMP	Environmental Management Plan
ESIA	Environmental and Social Impact Assessment
FIPAG	Water Supply Investment Fund [Asset Holder & Operator] *(Fundo de Investimento e Património do Abastecimento de Água)*
GDP	Gross Domestic Product
HDI	Human Development Index
MDG	Millennium Development Goals
MTA	Ministry of Land and Environment *(Ministério da Terra e Ambiente)*
MEF	Ministry of Economy & Finance
MOPHRH	Ministry of Public Works, Housing and Water Resources
NWRDP	National Water Resources Development Project
NRW	Non-Revenue Water
O&M	Operations & Maintenance
PDO	Project Development Objective
RAP	Resettlement Action Plan
UGEA	Procurement Management Unit (*Unidade Gestora e Executora das Aquisições*)
WASIS	Water Services and Institutional Support Project
WHO	World Health Organisation

1. INTRODUCTION

A. Purpose of the Note & Structure

As an asset holder, FIPAG is responsible for water supply services across all major urban areas in Mozambique. In the Summary of 2019-20 Report & Accounts, customer numbers totalled 3.9m, with 510,000 connections. Across the country water was supplied to approximately 54% of the potential customers in the service area.

Given the scale of the country, which is approx. 780,000km^{2}in land area and around 2,300km in length from north to south, FIPAG has established four regional operational areas for more effective service delivery. These are as follows:

- North;
- Centre;
- South; and
- Maputo

In 2011, the Government of Mozambique approved the National Urban Water Supply & Sanitation Strategy (2011- 2025). The strategy re-affirmed delegated management as the framework for service delivery, whilst promoting commercial sustainability in FIPAG and the principle of private sector involvement in water supply. To deliver those policy objectives, the strategy supports greater efficiency by grouping of water supply assets in secondary and tertiary urban areas into operational regions, with operations on a commercial basis, and gradually transforming municipal operations into public-private companies. The policy demands the professionalization of operations, and technical and financial support to build operator capacity. Finally, the policy envisions service coverage of 80% of the urban population by 2030.

To achieve this objective, substantial investment is required in physical assets, the organisation and the personnel working within the various functions across the organisation. This Concept Note deals with the various investments required for the North region.

The Note is structured as follows:

- An outline of the regional context, background, issues and challenges
- An outline of the various projects to address these issues and challenges
- A summary of the various projects for the relevant operational region.

Within each of these sections are more detailed discussions of technical, financial, environment/social, resources and organisational issues. Also included are summary cost estimates, expected outcomes, programme/implementation timelines together with risks and mitigations. The latter include supporting activities to be delivered by other parties (e.g. the Government of Mozambique) or those already in hand or in place.

2. THE REGIONAL CONTEXT & BACKGROUND

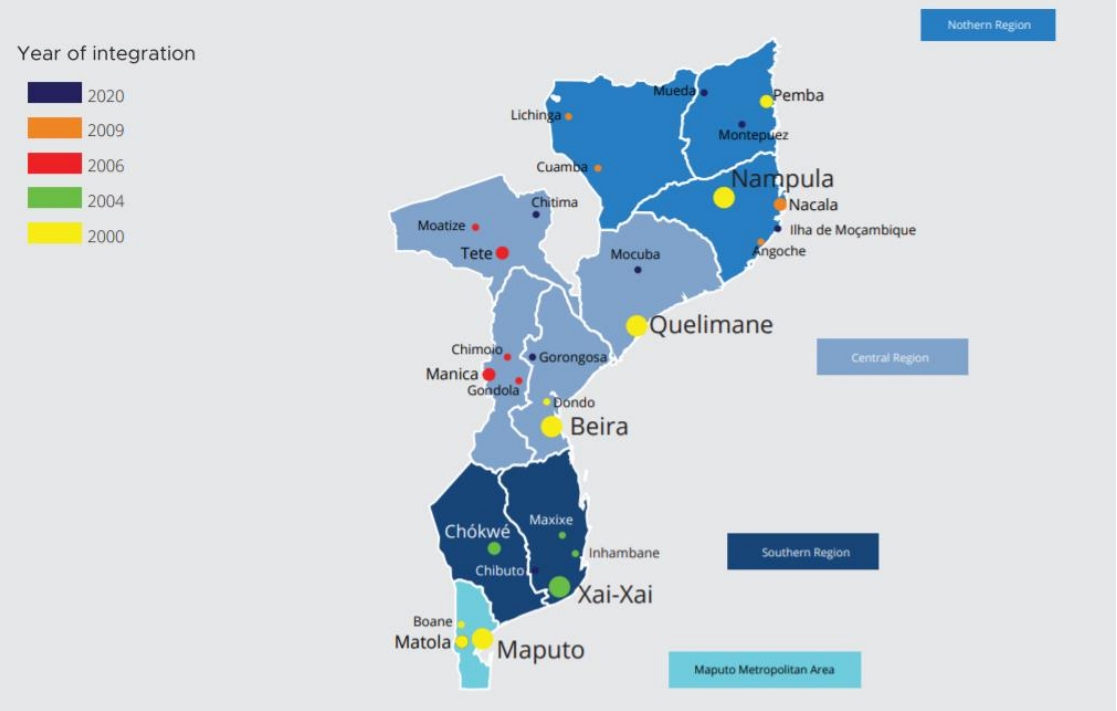
A. Description

1. Regional Characteristics

The North region of Mozambique consists of three provinces as shown in the table below;

Province	Area in km²	Popn in m (2017)
Cabo Delgado	82,625	2.333
Niassa	129,056	1.865
Nampula	79,010	6.102

source: 2017 Census: http://www.ine.gov.mz/operacoes-estatisticas/censos/censo-2007/censo-2017



Cabo Delgado

The province borders the Indian Ocean, with Tanzania lying to the north. In this province, the coastal plain is comparatively narrow, with the Mozambique Plateau rising rapidly to the west to an altitude of between 800m and 1,000m. The main rivers are the Rovuma, which forms the northern border with Tanzania, the Messalo River, and the Lúrio, which forms the boundary between Nampula and Cabo Delgado. All the rivers flow from the Plateau in generally north-easterly direction before reaching the Indian Ocean.

Population density is relatively low for Mozambique at 28 persons per km² with the main activity being agriculture, with forestry and mining also active. Economically it is the poorest province in Mozambique with an HDI around 80% of the national average.

In 2010 and 2011, two gas fields with significant quantities were discovered 40km off-shore. Exploitation of these two gas fields is estimated to require around US$57bn over a 10 year period, with first production in 2022.

Government revenues over the lifetime of the gas-fields are expected to be in the region of US$96bn. A core part of the project development strategy was to spend around 35% of the total spend on goods and services within Cabo Delgado province. This, together with using the fields to develop a regional hub for the industry, and a special fund for the revenues were expected to materially assist in raising income levels across the province.

The major urban areas are Pemba (approx. 257,000 population), Mueda (250,000), Mocímboa da Praia (128,000) and Montepuez City & District (180,000). FIPAG currently provides urban water supply in the ***Pemba, Mueda*** *and* ***Montepuez*** urban areas. In Mocímba da Praia, water supply is still the responsibility of the municipality.

Recent attacks in Cabo Delgado province by armed groups have increased insecurity. This has led to a significant movement of people within the province, with the largest numbers moving to Pemba city and the surrounding districts of Metuge and Mecufi. These internally displaced people (IDP) have been accommodated either in the houses of relatives or through the establishment of special centres (IDP centres) at Nanjua, Ngalane, ntimule, Tokota, Mieze, 25 de Junho and Naminawe.

These IDP Centres have a total of 22,038 inhabitants and FIPAG has undertaken to serve these centres as long as they remain in existence. The project to expand the Pemba distribution centres and network has been expanded to cover these IDP centres.

Niassa

This province lies to the west of Cabo Delgado, and also borders Tanzania to the north. 250km of the western boundary of the province is formed by the fresh-water Lake Niassa, with the remainder bordering Malawi. To the south-west lies Nampula province. Physically the entire province is part of the Mozambique Plateau lying between 1,000m and 2,000m above sea level.

The main rivers are the Rovuma in the north and the Lugenda, draining Lakes Chiuta (Malawi) and Amaramba (Mozambique) and then running diagonally SW-NE across the province to join the Rovuma. The Niassa Game Reserve and Hunting Areas cover 38,000km^2, around 30% of the province.

The province is the most sparsely populated in Mozambique at 14 persons per km^2 with the main activity being agriculture. Economically it has an HDI around 93% of the national average, making it third poorest in Mozambique. It is probably the least developed of the 11 provinces.

Niassa has two major urban areas, the capital, Lichinga, with approx. 200,000 inhabitants, and Cuamba (110,000) in the south of the province. FIPAG currently provides water supply to the ***Lichinga*** and ***Cuamba*** urban areas.

Nampula

The third province in North region, Nampula consists mostly of coastal plain along the Indian Ocean, although the western section does reach a maximum of 1,800m along the boundary with Niassa province. The main rivers are the Lúrio, forming the northern boundary with Cabo Delgado province, and the Lugela, rising on the Malawi border near Mt. Mulanje and forming the southern boundary with Zambézia province.

The province is the most densely populated in Mozambique at 75 persons per km^2 and the number of inhabitants has nearly doubled in the last 25 years. The main activities are agriculture (cotton, cashews and tobacco) and mining (gemstones). Economically it has an HDI around 97% of the national average, ranking 7th of 11 in Mozambique. The main coal-exporting port of Mozambique, Nacala, is located in the province, some 910km by rail from the mines in Moatize in Tete province and since 2017 shipping some 18m tonnes per year.

Nampula has three main urban areas, the capital, Nampula City, with approx. 568,000 inhabitants, Nacala (260,000) and Angoche (110,000) on the southern coast of the province. FIPAG currently provides urban water supply in the ***Nampula***, ***Nacala, Angoche*** and ***Ilha de Moçambique*** urban areas.

Although GDP growth has slowed in the last 5 years, the urbanisation process is forecast to continue in the next 10 years. By 2030, the urban population of Mozambique is expected to exceed 50%, from its current 33%. In all three provinces, it is likely that the larger urban areas will continue to expand in both population and geographical terms and probably do so at a faster rate than smaller towns.

2. Specific city issues

The table below shows the current and future populations in the service areas of each of the cities. Growth rates differ between urban areas, driven by specific factors, whether local economic growth or forced displacement by natural disasters or civil disturbance.

Table 1. Population growth to 2030 for Northern Region in FIPAG Water Supply Areas

City	Population			
	2019 (actual)	2020 (est.)	2025 (fcst)	2030 (fcst)
Pemba	180,110	184,072	205,231	228,822
Muede (district)	237,073	242,039	269,861	300,881
Lichinga	238,619	249,119	308,964	383,187
Montepuez	125,210	129,574	153,131	179,786
Cuamba	132,466	138,295	171,517	212,721
Nampula	664,762	684,040	789,148	910,406
Nacala	290,936	299,373	345,374	398,443
Angoche	126,829	130,507	150,560	173,695
Ilha de Mocambique	59,300	62,790	70,396	81,213

Source: INE

In all cases, much of this growth is expected to be accommodated in informal settlement areas around the cities. The remainder will occur within the existing built-up area, with increasing household sizes.

Pemba

In Cabo Delgado province, the development of the gas industry along with the current unrest and forced displacement of rural populations caused by natural disasters (e.g. Cyclone Kenneth in 2019) is expected to further accelerate population growth in the Pemba urban area. It is forecast to continue at around 2.2% per annum to 2030. The 2019 cyclone also had a significant impact on Pemba itself, with severe damage to both economy and infrastructure.

Mueda

This inland district is located on the Mueda Plateau and is primarily agricultural in nature. It has grown rapidly over the past 10 years with the challenging civil situation in Cabo Delgado province. Within the Mueda district, the FIPAG service area consists of three towns, Mueda itself (136,000), Muidumbe (57,000) and Nangade (49,200). Population growth is forecast to continue at around 2.2% per annum to 2030.

Lichinga

Even though Lichinga is a relatively isolated urban area in Mozambique, its population is still forecast to increase at a rate of 4.4% per annum; from 184,000 in 2013 to over 250,000 in 2020. Much of this growth will be in peri-urban low income/informal settlements around the city.

Cuamba

Located in the southern corner of Niassa province, the city is located on the Moatize – Nacala rail line at its junction with the line north to Lichinga. Much of the economy is based around processing local agricultural produce such as cotton and cashew nuts.

Cuamba has grown rapidly in the recent past and is forecast to continue at 4.4% p.a. with population rising from 102,000 in 2013 to over 210,000 by 2030. As with Lichinga, much of Cuamba's growing population will be in peri-urban low income/informal settlements around the city.

Nampula

With a current population of over 700,000, the city is now the third largest in Mozambique after Maputo and Beira. It is located at the centre of Nampula province some 200km from the coast, and in the heart of the fertile and highly productive agricultural coastal plain. The city also sits on the east-west rail link between Nacala and Moatize (the 'Nacala Corridor'). The city is generally held to be the business and commercial capital of northern Mozambique.

The city's growth has been phenomenal, being founded just over 100 years ago. Significant population growth has occurred due to displacement of rural dwellers during both colonial and post-independence periods. Most of this growth has been unplanned, with growing slums and the city's ageing infrastructure unable to meet demand for services. It is estimated that more than 80 per cent of residents live in high-density squatter settlements, in substandard living conditions and without access to basic services.

Growth is forecast to continue over the next decade, albeit only at an annual rate of 2.9%. This still means an additional 200,000 people by 2030.

Nacala

Nacala is situated on one of the best and deepest natural harbours in East Africa. Nacala is also the main port servicing the rich agricultural province of Nampula, as well as being the main link in the 'Nacala Corridor' to Malawi. A large proportion of both Malawi's imports and exports pass through the port and coal from the Moatize mines in Tete province is also exported through Nacala harbour. It also contains significant agro-processing and cement manufacturing plants.

The city currently has 290,000 residents and is forecast to add another 100,000 by 2030. With such rapid growth, many of the new inhabitants will reside in unplanned settlements on the peri-urban fringes of the city.

Angoche

Located on the coast around 120km south of Nampula, Angoche is a city of around 125,000 population growing at around 2.5% p.a. Historically reliant on fishing and trading, the economy has recently expanded due to exploitation since 2010 of the local mineral sands for their rare earth and heavy mineral

(e.g. zircon, titanium) content. There are also prospects for offshore gas deposits. Re-settlement projects associated with the mining have also had an impact on local population dispersal.

Ilha de Mocambique

An UNESCO World Heritage site, the settlement of Ilha de Mocambique is reckoned to have been in existence for nearly 1,000 years. Initially a coastal trading hub, the 4km^2 island became the main centre for early Portuguese settlement in the early 1500's growing to become the main port and then capital of the colony. The opening of the Suez Canal in 1867 had a major impact with the colonial capital moving to Lourenco Marques (now Maputo) in 1898. The construction of the port of Nacala in 1947 eliminated nearly all maritime activities bar fishing.

The main activity is tourism, with both the historical island settlement and the local beaches and coastline being a major draw. The total population is around 60,000 of which 15,000 live on the island. The remainder live in the land-side settlements of Lumbo, Murromone and Tocolo 3.5km away by bridge which act as a service centre and housing area. Tourism has suffered heavily in the last 2 years because of both Cyclone Kenneth and COVID-19.

Montepuez

Montepuez is the second largest urban city in Cabo Delgado Province. It is located 200km west of Pemba city. With fertile and highly productive land and mineral resources of the District, Montepuez city is experiencing a rapid growth. Due to current unrest, Montepuez is receiving internal displaced population from North of Province, therefore it is foreseen an unexpected growth of inhabitants in the offing.

B. Water sector – regional & local issues and challenges

1. Resources (e.g. dams, boreholes, treatment, transmission pipes etc)

Pemba

Pemba obtains its water supply from the Metuge and Chuiba well-fields located about 49 km and 7km west of the city respectively. Total production capacity is estimated at 19,000m^3/day. Water is abstracted from 10 boreholes at Metuge well-field with a total estimated capacity of 17,000m^3/day and from 5 boreholes at Chuiba well-field with the total production capacity of about 2,000m^3/day. The Chuiba aquifer is prone to saline intrusion and therefore its use is restricted.

Water abstracted at Metuge is treated close to the well-field to remove Fe and Mn through a treatment process of pre-oxidation with chlorine, aeration, decantation, filtration, and disinfection. Total treatment capacity is 15,000m^3/day. Water from Chuiba only receives disinfection using calcium hypochlorite.

From storage on-site at Metuge, the treated water is pumped via a 42km long series of transmission pipes, balancing reservoirs and storage points to

the main distribution centre in central Pemba. Storage capacity at this DC is 10,000m^3, with a further 4,500m^3 storage capacity at various locations along the transmission pipe. Water from Chuiba is also piped to the central Pemba DC where it is blended with water from Metuge. Raw water resources in the Metuge well-field do not appear to be a constraint at present (2012 studies showed the well-field capacity to be 40,000m^3/day). The condition and capacity of both pumping and treatment do however appear to require attention to allow the expected increase in demand to be satisfied before more distant water sources such as the Lurio River are required.

Mueda

As previously noted, the geology of the Mueda district with its permeable sandy soil, where water is only found in very limited quantities and at great depth, makes securing sufficient long term water resources a major issue. Water is currently supplied from 4 local boreholes with a total capacity of 2,300m^3/day serving a total of 11,000 people. The water is disinfected prior to transmission.

There is little information available on raw water resources in the Mueda plateau although it is likely that these are limited. There is a nearby river, the Muela, to the south-east which has some potential for longer term water use.

Montepuez

Montepuez water supply is abstracted from Castelo Branco and Mecuia wellfields with 4 and 1 boreholes, respectively. Total capacity of 5 boreholes is 2.000m3/d.

From the wellfields, water is conveyed through a 16km long transmission main to WTP which consist of limestone removal. The system has a storage of 670m^3 capacity.

The total network is 31km with, 1833 connections and 3 stand posts. With a population of 134,045 only around 8% have access to water from the current system.

Montepuez was incorporated into Delegated Management Framework in 2020. Therefore, currently FIPAG is updating data of the water supply scheme.

Lichinga

The main source of water is the Locumué earth dam reservoir built between 1968 and 1970 originally for irrigation but re-purposed in 1995 for water supply only. The Locumué reservoir is located 3 km east of the city, is fed by springs in the area and has a current capacity of 1.76 Mm^3. The true capacity of the Locumué reservoir is unknown due to significant silt accumulation. Groundwater sources are very limited due to the granite-gneiss geology of the area.

Water flows via gravity through a 3km long 315mm main to a 40m^3 storage tank and is then pumped to a treatment facility consisting of five pressure

filters. Treatment plant capacity was estimated to be around 4,080m^3/day with current average daily water production of 5,200m^3/day. The pressure filters appear to be inoperable with the sole treatment of the raw water being disinfection via manual hypochlorite dosing. The treatment facility also includes a 100m^3 treated water reservoir. Water is then transferred to three distribution centres composed of six reservoirs with a total capacity of 520m^3.

The current major issue for Lichinga is adequate raw water resource. Coverage is currently at 21% and this limitation is partly due to the availability of water. With little or no treatment capacity, water quality is also an issue. Only a partial set of tests (11 from the 23 indicator national suite) are undertaken and compliance with these parameters is only achieved on 8 from 11 indicators. In-network bacteriological testing appears extremely limited.

Cuamba

The main water source for Cuamba is the Mpopole Dam located some 25km north-east of the city. The reservoir has a storage capacity of approximately 3 million m^3 and is fed by springs and run-off from the surrounding mountains. The reservoir is also fed by the Metucué Basin higher up the Mpopole River. This was built in 1988 for local hydro-electricity generation although with the connection of Cuamba to the national power grid, its use for this purpose has declined significantly. This means that its current use is almost entirely as a regulating reservoir for the lower water storage barrage/dam. Raw water is abstracted and transferred via gravity to a treatment plant close to the city.

Between 2009 and 2015, a major US$37m project significantly upgraded the water storage, treatment and transmission infrastructure in Cuamba. This project increased the sustainable yield of the Mpopole Dam with a new intake and constructed two new 30km long 500mm diameter raw water transmission pipes. These now transfer around 4,000m^3/day to the WTP.

The plant also has a water quality testing and control laboratory. During the rainy season, aluminium sulphate is added to the treatment process prior to the filtration stage to bring turbidity down to an acceptable level. Total plant design capacity is around 10,000m^3/day.

Treated water is pumped and conveyed through an 11km long, 500mm diameter ductile iron pipe to the Mpopole distribution centre. The second distribution centre for Cuamba is located on the treatment plant site.

With raw water resources and capacity within the treatment system forecast to be sufficient for the medium ter. The issues for the Cuamba system in this area are around operational efficiency and ongoing improvements in water quality.

Nampula

The main water supply comes from the Nampula Dam around 10km north of the city on the Monapo River. Reservoir capacity is estimated to hold about

4M m^3 of water although the resource is distinctly seasonal. The maximum volume of water abstracted during the rainy season is estimated at 38,000m^3/day and 14,000m^3/day during the dry season. The reservoir only recently (March 2021) returned to 100% capacity.

The treatment plant is located closed to the reservoir with water abstracted conveyed through two parallel 200m long, 400mm diameter mains. The water treatment plant was enlarged in 2013 and now consists of two 20,000m^3/day treatment trains with pre-oxidation with solid calcium hypochlorite, coagulation with aluminium sulphate, flocculation, filtration and disinfection with solid calcium hypochlorite. As a result of the treatment process, significant sludge volumes require treatment and disposal. There is also a water testing and quality laboratory at the plant.

The treated water is pumped from the plant clear water tank to four storage reservoirs via three 3km long parallel transmission mains, one being 600mm diameter and two at 400mm diameter. From this point, water is further pumped to three distribution centres via four differing length transmission mains, one 600mm in diameter and three at 400mm diameter. Total in-system storage capacity is approximately 23,800m^3.

Total water treatment plant production capacity is 40,000m3/day. A further 6,000m^3 is available from well-fields at Namiteca and a potential 20,0000m^3 from 6 boreholes in the Muatala well-fields. Total water demand is reportedly estimated to be 120,000m^3/day.

The current water source requires better management to protect it from pollution. There are agricultural estates upstream of the current Monapo dam, so that the reservoir probably receives nutrients and pesticides. The reservoir is also subject to eutrophication and development of algae which require better monitoring. A minimal flow should also be maintained at the dam outlet, which will also contribute to limiting eutrophication.

Nacala

Nacala is supplied by two main water sources; the Nacala dam situated on Muecula river is located 30 km from the city and the Serra da Mesa aquifer with two well fields, Mpaco and Mutuzi. The total production volume is 30,000m3/day.

The Nacala Dam was built in 1968, with an assessed secure long-term supply in the order of 11,800m^3/day and higher volumes during those months of the year with significant rainfall. In 2012, the dam was expanded to increase reservoir capacity from 4.2m m^3 to 6.6m m^3. A separate project upgraded the water treatment plant (conventional surface water treatment) for a capacity of 25,000m^3/day. The 2013 project also included expanding the transmission mains although this was postponed and only recently completed with an upgrade from the former 7,300m^3/day capacity.

On the Mpaco and Mutuzl well-fields the operating production wells have a capacity of 11,800 m^3/day (3,800m^3/day in Mutuzi and 8,000m^3/day in

Mpaco) although actual production is lower. Well-field water is only disinfected.

Angoche

No significant surface water catchments drain into the Angoche area, and no major productive aquifers. The current water source is the spring-fed Malatane lagoon located in the coastal dunes just outside Angoche. The field has 6 boreholes and a reported production capacity of 2,300m^3/day. The sole treatment is disinfection using hypochlorite. Groundwater wells, not managed by FIPAG, are also used locally for water supply. The treated FIPAG water is supplied to Angoche City via a 4.5km transmission pipe.

The Malatane lagoon suffers from sedimentation and algae growth and there is the potential for saline intrusion in the event of over-exploitation. Further water is potentially available from the Namaue lagoon, located 13km from Angoche in the coastal dunes. It is estimated that jointly the two lagoons could provide 8,400 m^3/day.

For greater volumes, the lagoons would have to be supplemented from another source, most likely groundwater. Options for artificial storage of rainfall in the dunes have not been assessed. No information exists on the current quality of groundwater. There is also the potential for disturbance (destruction or pollution) of the dune-based ground water resources by mineral sand extraction activities.

Ilha de Mocambique

Water is abstracted from a well field at Entente located 23 km inland. The well-field comprises 9 boreholes around 42m deep of which only 3 were active (2010) as the remainder are saline. Water is pumped from the wells to a 100m^3 elevated reservoir located 2km from the well field. In 2020, the treatment capacity was estimated at 5,200m^3/day with the water treatment being disinfection.

34km of gravity transmission mains deliver to two small storage reservoirs on the island. The transmission main is hung below the 3.5 km bridge connecting the island to the mainland. The mainland settlements are supplied directly by branches from the transmission main.

A part of the WASIS I project covered the system with the following works completed in 2014:

- Well-field refurbishment and construction of new boreholes
- Transmission pipe refurbishment and replacement (where required)
- Construction of a new ground storage tank and water tower near Lumbo (3.5km from the coast); and
- Introduction of new storage on the island re-using historic facilities.

The Ilha de Mocambique area appears to have sufficient raw water resource although clearly saline intrusion is a significant issue as is the relatively shallow

depth of the aquifer. There would also appear to be significant levels of Fe and Mn in the raw water resource.

2. **Technical (e.g. distribution infrastructure, coverage, quality and quantity, physical water loss)**

Pemba

The existing Pemba water distribution network is approximately 320km in length. Pipe diameters range from 50mm to 315mm; 85% of this being between 50 and 110mm. 93% of the pipe material is PVC. The oldest pipes date from 1965 with around 120km laid between 2007 and 2013.

In 2013, there were 14,921 total active legal connections and 130 active stand-posts. Currently there are 16,655 active connections (96% domestic) with 94 stand-posts. Despite this rising on number of connections the coverage has fallen from 64% in 2016 to 54%. It would seem from analysis that is decrease is related to the network extent not keeping pace with population increases.

The average hours of supply in 2020 is 10, with 8 bar as the average system pressure. These relatively low values are most likely part of the impact of Cyclone Kenneth on the city's infrastructures. The further impact of Cyclone Kenneth on the water supply infrastructure in Pemba can be seen in the non-revenue water statistics; between 2016 and 2018, it was around 45%, whereas since 2019, it has been around 60%.

The issues facing Pemba can be summarised as follows:

- Expanding the water transmission and distribution networks to keep pace with population growth.
- Repairing the damage from cyclone Kenneth.
- Reducing non-revenue water to both increase revenues and reduce water losses.

Mueda

The distribution network was significantly re-bulit in the 1980's and is now around 55km in length with a large number (27) of small reservoirs around 100m^3 in capacity. There are 1084 domestic connections and 98 active stand-posts. Coverage is low; within the direct urban area it is around 14%. The average hours of supply is 10, with 8 bar as the average system pressure. NRW within the system is estimated at 36%.

The main issue for Mueda is in expanding the water transmission and distribution networks to keep pace with population growth, provided there is sufficient water to supply.

Lichinga

The existing Lichinga distribution network is approximately 75km in length, with 3 distribution centres. Pipe diameters range from 30 to 315 mm and materials include PVC (73%), galvanized, asbestos cement and steel. The network was largely re-built in the 1990's.

The number of active legal connections has grown from 5,900 in 2016 to 8,838 at the moment with active stand-posts increasing from 28 to 94 over the same period. Whilst this is a significant increase with over 43,000 people now served, 20,000 of them are served by the stand-posts.

Coverage has risen from 18% in 2016 to 35%, with average hours of supply increasing from 6 to 8 hours per day. The average daily hours of service being 8 and system pressure is 8 bar although it is low in some supply areas due to the age of the pumps. Whilst raw water resource is a significant limiting issue within Lichinga, around 50% of the water produced is not billed to the customer (between 800,000 and 950,000 m^3/year). Work to identify and upgrade the relevant distribution networks would also mean that the extra volumes produced by the expanded treatment plant reach all the expected customers.

On the network side, the issues facing Lichinga can be summarised as follows:

- Expanding the water transmission and distribution networks to keep pace with population growth; and
- Reducing non-revenue water to both increase revenues and reduce water losses.

Cuamba

The 2009-2015 rehabilitation project significantly improved and extended the distribution network to over 150km in length, with 2 main distribution centres and associated water towers. Distribution pipe diameters range from 50mm to 500mm and materials include PVC (71%), ductile iron (22%), galvanized steel and asbestos cement.

The number of active legal connections has grown from 4,700 in 2016 to 8,959 with active stand-posts increasing from 28 to 37 over the same period. Around 59,000 people are now served, with approx. 11,000 from stand-posts. The coverage rose from 28% in 2016 to 38% with average hours of supply increasing to 16 per day a and the average system pressure is 8 bar.

With a relatively new network, non-revenue water is lower than elsewhere in the Northern region at around 30% (it was 51% in 2016). The water abstracted and water into supply has remained broadly stable at 1,400,000m^3/year whilst billed volumes rose from 672,000m^3/year to 986,000m^3/year.

On the network side, the issues facing Cuamba can be summarised as follows:

- Expanding the water transmission and distribution networks to keep pace with population growth.
- Maintaining the rehabilitated network in its current state.
- Continuing to reduce non-revenue water to both increase revenues and decrease water losses.

Nampula

The first part of the Nampula distribution network were laid in 1947 and the total length is now 580km. Pipe diameters range from 38mm to 450mm with the main materials being PVC (77%) and asbestos cement (22%). Around 180 km of this network was laid from 2007 to 2013 as part of the World Bank WASIS I project.

The number of active legal connections has grown from 28,850 in 2016 to 37,318 up to now and 498 active stand-posts falling. Around 197,000 people are now served, with approx. 60,000 from stand-posts.

Coverage has risen from 38% in 2016 to 53% at the present. The average hours of supply is 13 per day with average system pressures at 8 bar.

Non-revenue water has averaged around 55% over the past 3 years. Over the 2016 – 2020 period, water abstracted and water into supply has ranged between 11,400,000m^3/year and 13,485,000m^3/year. Billed volumes ranged from 5,440,000m^3/year to 6,387,000m^3/year. Seasonal availability of water doubtless influences both these values.

For the Nampula network, the issues can be summarised as follows:

- Finding a reliable source of water with sufficient capacity;
- Expanding the water transmission and distribution networks to keep pace with population growth; and
- Reducing non-revenue water to both increase revenues and ensure maximum use of scarce water resources.

Nacala

The Nacala network has 6 distribution centres, with storage capacity consisting of 5 ground reservoirs totalizing 4,500 m^3 in size. Total capacity across all three parts of the service area (Nacala Porto, Nacala-a-Velha and Mossuril) is around 8,250m^3.

Pipe diameters range from 50mm to 500mm with the main materials being PVC (75%), and asbestos cement (24%). As part of FIPAG project co-funded by the Government of the Netherlands and the World Bank there has been significant recent investment (US$17.6m) in construction and rehabilitation of distribution centres, as well as network extension, with a 15% increase since 2016. The total length of the distribution network is now 346km in length with over 80% in Nacala Porto.

The number of active legal connections in Nacala Porto has grown from 8,250 in 2016 to 12,933 in 2020 with active stand-posts growing from 72 to 118 over the same period. Around 96,000 people are now served, with approx. 30,000 from stand-posts.

Coverage has risen from 24% in 2016 to 33% in 2020. For those on the system, average hours of supply are 20 per day with average system pressures at 8 bar.

Non-revenue water has averaged around 52% over the past 5 years with significant fluctuations probably related to treated water scarcity. In 2018, water into supply was 4,650,000m^3/year and has risen to 7,621,000m^3/year in 2020. Over the same period, billed volumes grew from 2,767,000m^3/year to 3,196,000m^3/year.

For the Nacala network, the issues can be summarised as follows:

- Maintaining sufficient raw water reserves and treatment capacity,
- Expanding the water transmission and distribution networks to keep pace with population growth; and
- Reducing non-revenue water to both increase revenues and ensure maximum use of scarce water resources.

Angoche

The distribution network in Angoche was originally installed in 1955, and received a significant upgrade and extension completed in 2013 under the WASIS I program. The network is around 79km in length. Pipe diameters range from 50mm to 500mm with the main materials being PVC (79%), asbestos cement (17%) and HPDE (4%).

The number of active legal connections has grown by 20% from 3,730 in 2016 to 4,500 in 2020 with active stand-posts remaining at 58 over the period. Around 41,000 people are now served, with approx. 17,400 via stand-posts.

Coverage is 32% and it didn't grow since 2016, largely due to population growth over the period. For those on the system average hours of supply is 15 per day with average system pressures at 6 bar.

Non-revenue water has averaged around 30% over the past 3 years. Over the 2016 – 2020 period, water abstracted and water into supply has ranged between 730,000m^3/year and 810,000m^3/year. Billed volumes ranged from 700,000m^3/year to 800,000m^3/year.

For Angoche, the issues can be summarised as follows:

- Securing sufficient supply to deliver water, and
- Expanding the water transmission and distribution networks to keep pace with population growth.

Ilha de Mocambique

On the island, water is pumped from the storage reservoirs located near the bridge to a 100m³, 20m high water tower located at the northern end of the island. From the tower water is distributed via a small diameter pipe network to consumers. The network is around 80km in length, with 18km of this on the island.

The number of active legal connections has grown from 1,850 in 2016 to 2,784 in 2020 with active stand-posts falling from 47 to 41 over the period. Around 23,800 people are now served, with approx. 12,300 via stand-posts.

On the island itself, the older colonial Stone Town is served by house connections and the few people who live there are reasonably well covered. Supply in the Thatched Town, where most of population are resident, is limited to public standpipes that are in poor condition and receive only intermittent supplies.

Coverage has fallen slightly from 59% in 2016 to around 43% in 2020, largely due to population growth in the land-side areas over the period. For those on the system, average hours of supply are 20 per day with average system pressures at 6 bar.

Non-revenue water has averaged around 17% over the past 5 years with significant annual variations. Over the 2016 – 2019 period, water abstracted and water into supply has ranged between 450,000m³/year and 480,000m³/year, falling in 2020 to 348,000. Billed volumes ranged from 336,000m³/year to 400,000m³/year over the 2016 – 2019 period, falling back to 335,000m³/day in 2020. There is no information on the causes of this reduction in volumes into supply and billed.

For both the on- and off-island networks, the issues can be summarised as follows:

- Protecting the water resources in the short term and securing new sources of supply in the long term.
- Expanding the water transmission and distribution networks to keep pace with population growth.
- Maintaining the low levels of non-revenue water to both increase revenues and ensure maximum use of scarce water resources.

3. Financial & organisational

The table below shows the reported billings and collections for the Northern Region urban areas up to August 2020.

Table 2. Billings and Collections figures

Revenues in US$	*Billing*				*Collection*			
US$1 = MZN 57.2	Residential	Non-res	Stand-posts	Total	Residential	Non-res	Stand-posts	Totals
Pemba	1,056,713	449,983	8,916	1,515,612	927,640	331,643	2,238	1,261,521
Muede	41,783	55,122	6,329	103,234	34,983	19,353	227	54,563
Lichinga	396,364	123,217	2,150	521,731	294,441	108,042	699	403,182
Cuamba	410,542	73,322	594	484,458	390,122	68,724	524	459,371
Nampula	2,614,843	959,703	10,682	3,585,227	2,099,965	798,706	5,682	2,904,353
Nacala	941,783	739,248	6,976	1,688,007	699,650	664,685	2,168	1,366,503
Angoche	166,836	59,003	1,538	227,378	141,276	41,818	769	183,864
IdeM	118,934	28,042	752	147,727	104,388	21,294	1,171	126,853
Northern Region	5,747,797	2,487,640	37,937	8,273,374	4,692,465	2,054,266	13,479	6,760,210

These values provide the collection ratios shown in the table below.

	Collection ratio (in %)			
	Domestic	Industrial	Stand-posts	Total
Pemba	88	74	25	83
Mueda	84	35	4	53
Montepuez	80	40	6	58
Lichinga	74	88	33	77
Cuamba	95	94	88	95
Nampula	80	83	53	81
Nacala	74	90	31	81
Angoche	81	75	50	81
Ilha de Mocambique	88	76	156[1]	86
Northern Region	**82**	**84**	**36**	**82**

Note 1: collection of arrears.

3. CURRENT PROJECTS TO ADDRESS THESE CHALLENGES

A. Description and components (for each city)

Pemba

After Cyclone Kenneth in 2019, the World Bank increased its support for FIPAG through the WASIS II programme. As part of US$116m package, in Pemba this included rehabilitation and expansion of water supply production and distribution.

By 2019, the activities related to water production were reported as well-advanced. The rehabilitation and expansion of the well-fields was completed, and the construction of the transmission main started. In addition, the design for the expansion of the water treatment plant is expected to be completed by July 2019, with works planned to start in January 2020. The impact of COVID-19 on these works has not been reported.

Lichinga

The main issues for Lichinga are (a) expanding the raw water resource to (b) increase coverage from the current 35% towards 80%.

A US$8m project is currently underway to raise the Locumué Dam wall to increase storage from the current 1.76 M m^3 to 3.4 M m^3. Works include a new intake for the treatment plant, which will also be expanded from 4,200m^3/day to 8,500m^3/day. There are a series of plans for projects to add pumping, storage and pipe capacity at various locations in both the transmission and distribution networks. These will facilitate a further expansion of the service to over 22,000 connections; a further 70,000 served to a total of 118,000 people.

With the city forecast to add 50,000 people in the next 5 years alone, water demand will continue to rise. In 2024 daily demand is estimated at 15,000m^3 and 31,200m^3 by 2030. Reducing physical losses and improving water quality through more effective treatment does not seem to form a large part of the CIP in Lichinga.

Mueda

There are outline plans to use the Muela River to the south of the current plateau for water supply. These plans include a new dam, a treatment plant, transmission pipes, storage reservoirs and distribution networks, although more detailed studies have yet to be undertaken.

Cuamba

With sufficient raw water resources until 2030, an upgraded treatment plant less than ten years old and a significantly rehabilitated distribution network the short- and medium-term challenges for the Cuamba system are much more orientated towards:

a) maintaining and extending the infrastructure to address population growth; and
b) improving operational performance through NRW reduction and energy efficiency.

The latter activity will help in providing the water to be supplied via local network extension projects. This will also improve water quality and maintain service levels and system pressures.

Nampula

With such a mismatch between demand and available supply, the proposed projects in Nampula are focussed around increasing water resources. There are both short-term and longer-term solutions in planning and execution.

Short- term:

A further 6,000m^3 is currently available from well-fields at Namiteca together with a potential 20,000m^3 from 6 boreholes in the Muatala well-fields. There is a project currently underway to construct 10 boreholes at Namiteca to further increase production.

Long term

Additional investigations are ongoing in Nampula to assess the best options for a new water source. Since rainfall is substantial but highly variable, a large storage dam seems to be a suitable option.

According to the 2010 feasibility study, the proposed dam at Mugica some 10km downstream of the current dam would entail only limited resettlement. Located further downstream however are cities such as Monapo (286,000 population in 2011), Meconta (130,000) and Muecate (105,000). The river basin is also an important agricultural area, with plans to develop hydropower, and finally, there are plans to supply also Nacala from the Monapo river. A thorough assessment of impacts on downstream water uses and downstream ecosystems should be performed.

Nacala

A project currently in detailed planning in Nacala (the DRIVE/WASIS II project) is underway. This consists of a new treatment plant with capacity of 25,000 m^3/day close by the Nacala Dam, a second treatment plant (Mutuzi II) with capacity of around 4,600m^3/day, together with additional distribution centres, pumping stations and 150km of new network. This will enable 9,000 new household connections.

In respect of longer-term supply, whilst the raised Nacala dam can supply 10,000m^3/day of water, the dam regularly dries up. The reasons for drying up of the Muecula River have not been identified in the available studies but may be a combination of variability in rainfall, increasing water usage upstream and deficiencies of the dam itself. Agriculture is certainly an important water user in all catchments in the area, and requirements are growing, as Mozambique intends to develop irrigation and large-scale agriculture.

The small rivers in the vicinity of Nacala have only seasonal flows and no suitable locations were identified for dam. A 2010 feasibility study recommended maximization of the well fields and existing dam, together with a new dam on the Monapo river as the long-supply source of water. This dam on the Monapo river could possibly supply water to Monapo and Nacala.

This option has however not been investigated in detail, as it would require a complete hydraulic assessment of the Monapo catchment, which also serves the city of Nampula.

Angoche

As noted in the previous section, there is a potential source of water from the Namaue lagoon some 15km further from Angoche. There is an estimated 8,400m^3/day of water from both fields.

There are also significant risks to both lagoons and groundwater resources from (a) saline intrusion from over-extraction, (b) pollution from poor sanitation in Angoche itself and (c) disturbance from heavy mineral sands mining activities. These issues ought to be addressed by detailed studies.

Ilha de Mocambique

With the completion of the 2014 WASIS I project, the short-term future of the Ilha de Moçambique water supply system seems relatively assured. There is however a need to maintain the security of the raw water resource aquifers from both saline intrusion and pollution.

A high-level study which addresses both the need for further bore-holes as well as further treatment for Fe and Mn removal has been hired. This study also includes outline requirements to expand storage and the distribution network to increase the coverage towards 80% by 2030.

B. Rationale/technical areas to be addressed (incl. critical/steady state/growth components)

As part of a review of FIPAG's investment programme for the urban areas it served in the Northern region, an overall water demand model was created. This model used data for each of their service areas as follows:

- the current and forecast populations for the areas served by FIPAG;
- the current number of domestic, industrial, commercial and municipal connections;
- the current number of stand-posts;
- the current asset infrastructure in place e.g. reservoirs and well-fields, treatment plants, transmission pipes, storage reservoirs & distribution networks lengths; and
- The current level of non-revenue water (physical and commercial losses).

Based on existing information the following engineering assumptions were established:

Overall coverage in 2030	*80% (75% by connections, 25% by stand-posts)*
Total reserve capacity	*1 day's production*
Household size	*5.3 people*
No. of people served by stand-post	*300*
Consumption – current average	*65,0 litres/capita/day*
Consumption – new /future	*100,0 litres/capita/day*
Consumption @stand-post	*20 litres/capita/day*
Hours of supply	*24*
Maximum day demand production factor	*1.1*
Production capacity	*24h/day*

From this data and assumptions, water demand forecasts for each urban area were developed that meet the **80%** through conventional system and **20%** coverage through point sources coverage by 2030. For the Northern region, the 2030 target for NRW is 26% of water into supply.

The outcomes of this water demand assessment are shown in the table below.

Table 3. 2030 water demand projection with installed treatment capacities: 80% coverage

Forecast water demand & current available/installed capacity		2021	2024	2030
		(m3/day)		
PROVINCE	***DISTRICT***	*CURRENT CAPACITY*	***FORECASTED DEMAND***	
Cabo Delgado	PEMBA	15,000	35,000	75,000
Cabo Delgado	MUEDE	2,300	6,300	26,300
Cabo Delgado	MONTEPUEZ	2,000	5,000	10,000
Niassa	LICHINGA	5,500	15,200	31,200
Niassa	CUAMBA	5,500	11,000	17,000
Nampula	NAMPULA	40,000	50,000	120,000
Nampula	NACALA-PORTO	33,000	40,000	46,000
Nampula	ANGOCHE	2,300	7,400	10,400
Nampula	ILHA DE MOCAMBIQUE	2,500	4,500	8,500

As reported in earlier sections, for several of these urban areas the issue of raw water resource is critical and requires further investigation. A part from raw water, other constraint identified is treatment capacity. Whilst those aspects are important, there are associated downstream issues such as storage capacity that would also need to be addressed in the event of an increase in treatment capacity.

C. Results, objectives, outputs and outcomes

The table below shows for each of the Northern Region urban areas the increase in numbers of people served by 2030 with 80% coverage, separated into individual connections and stand-posts.

Table 4. 2030 served population by urban area with 80% coverage.

AREA		POPULATION SERVED			
		Connections		Stand-Posts	
PROVINCE	SERVICE AREA/CITY	2020	2030	2020	2030
Cabo Delgado	PEMBA	102,036	194,324	28,200	17,400
	MUEDA	5,745	206,838	29,400	30,900
	MUENTEPUEZ	6,413	85,463	7,500	66,600
	Total	***114,194***	***488,655***	***67,120***	***116,930***
Niassa	LICHINGA	42,861	194,754	19,500	64,800
	CUAMBA	46,455	134,207	11,100	44,700
	Total	***89,316***	***328,961***	***30,600***	***109,500***
Nampula	NAMPULA	215,233	745,074	149,400	248,400
	NACALA-PORTO	65,980	281,780	30,300	93,900
	ANGOCHE	23,283	104,081	17,400	34,800
	ILHA DE MOÇAMBIQUE	11,543	63,277	12,300	21,000
	Total	***316,039***	***1,194,212***	***209,400***	***398,100***

More importantly, the following table identifies some of the additional infrastructure required to achieve this 80% coverage target by 2030.

Table 5. Asset requirements by Northern region urban area with 80% coverage by 2030.

		Assets							
		Intakes+WTP (m3/day)		Distrib (km)		Connections		Stand Posts	
PROVINCE	SERVICE AREA/CITY	2020	2040	2020	2030	2020	2030	2020	2030
Cabo Delgado	PEMBA	19,000	34,362	312	486	19,252	36,665	107	216
	MUEDA	2,300	34,234	223	604	926	39,026	98	230
	MONTEPUEZ	2,000	10,000	31	160	1,210	16,125	25	222
	Total	***21,300***	***68,596***	***535***	***1,090***	***20,178***	***75,691***	***205***	***446***
Niassa	LICHINGA	5,500	34,024	98	385	8,087	36,746	65	216
	CUAMBA	5,500	23,352	207	373	8,765	25,322	37	149
	Total	**11,000**	**57,376**	**305**	**758**	**16,852**	**62,068**	**102**	**365**
Nampula	NAMPULA	40,000	123,730	460	1,460	40,610	140,580	498	828
	NACALA-PORTO	33,000	49,132	277	684	12,449	53,166	101	313
	ANGOCHE	2,300	16,995	79	231	4,393	19,638	58	116
	ILHA DE MOÇAMBIQUE	2,500	10,375	78	176	2,178	11,938	41	70
	Total	**77,800**	**200,232**	**894**	**2,551**	**59,630**	**225,322**	**698**	**1,327**

It should be noted when the 2030 water demand forecast was not met by the current installed capacity, the requirements for new abstraction, treatment plants, storage reservoirs and transmission main were based on 2040 water demand forecasts.

D. Cost estimates

The capital costs estimates were based on the following new asset infrastructure:

- Water treatment by source: surface water, borehole (Cl_2 disinfection only) and borehole (Fe & Mn removal and disinfection).
- Ground reservoirs (by volume from 1,000m^3 to 10,000m^3)
- Transmission mains (by diameter)

- Elevated storage (towers @average capacity of 250m^3) and pumping stations
- Distribution networks (by diameter)
- Individual connections and stand-posts

These were used to develop estimates for the costs of the required new assets to meet the 2030 coverage target of 80%. These are shown by urban area in Table 6 below.

Table 6. New asset costs by urban area with 80% coverage by 2030.

NEW ASSET COSTS (BY URBAN AREA)			Cost by Asset Type (in US$ 2020 values)				
			Intakes+WTP	Transmission Main	Storage	Distrib	Connections
PROVINCE	**SERVICE AREA/CITY**	**533,550,000**	**228,513,000**	**148,436,500**	**51,106,000**	**76,454,000**	**29,040,500**
Cabo Delgado	PEMBA	*117,500,000*	82,000,000	26,965,000		6,000,000	2,535,000
	MONTEPUEZ	*25,240,000*	5,400,000	6,000,000	6,000,000	6,400,000	1,440,000
	MUEDA	*55,790,000*	25,000,000	10,000,000	12,563,500	6,200,000	2,026,500
	TOTAL	***198,530,000***	***112,400,000***	***42,965,000***	***18,563,500***	***18,600,000***	***6,001,500***
Niassa	LICHINGA	*27,090,000*	8,653,000	5,000,000	3,750,000	6,000,000	3,687,000
	CUMBA	*22,140,000*	4,300,000	6,450,000	4,792,500	5,000,000	1,597,500
	TOTAL	**49,230,000**	**12,953,000**	**11,450,000**	**8,542,500**	**11,000,000**	**5,284,500**
Nampula	NAMPULA	200,100,000	94,670,000	69,021,500	18,000,000	12,500,000	5,908,500
	NACALA-PORTO	30,510,500	3,000,000			24,554,000	2,956,500
	ANGOCHE	30,920,000	2,490,000	15,000,000	3,500,000	6,000,000	3,930,000
	ILHA DE MOÇAMBIQUE	24,259,500	3,000,000	10,000,000	2,500,000	3,800,000	4,959,500
	TOTAL	**285,790,000**	**103,160,000**	**94,021,500**	**24,000,000**	**46,854,000**	**17,754,500**

The approach also included the costs of existing asset renewal in line with current FIPAG policies for each asset type. The totals are shown in Table 7 below:

Table 7. Asset renewal costs by urban area with 80% coverage by 2030.

ASSET RENEWAL COSTS (BY URBAN AREA)			Cost by Asset Type (in US$ 2020 values)				
			Intakes+WTP	Transmission Mains	Storage	Distribution	Connections
PROVINCE	**SERVICE AREA/CITY**	**61,209,560**	**23,413,884**	**15,239,546**	**3,208,693**	**13,174,560**	**6,172,878**
Cabo Delgado	PEMBA	**14,165,789**	4,576,781	4,877,813	905,414	2,619,960	1,185,821
	MUEDE	**4,065,003**	619,344	838,926	763,815	1,717,100	125,818
	Total	***18,230,792***	***5,196,125***	***5,716,739***	***1,669,229***	***4,337,060***	***1,311,639***
Niassa	LICHINGA	**3,651,098**	1,481,040	562,964	286,096	754,600	566,398
	CUAMBA	**4,041,782**	1,812,000	217,425	25,751	1,449,000	537,605
	Total	***7,692,880***	***3,293,040***	***780,389***	***311,848***	***2,203,600***	***1,104,003***
Nampula	NAMPULA	**18,670,170**	9,168,720	3,209,701	261,736	3,542,000	2,488,013
	NACALA-PORTO	**12,544,236**	4,348,800	4,795,860	668,760	1,937,600	793,216
	ANGOCHE	**1,843,656**	458,436	338,367	115,600	608,300	322,953
	ILHA DE MOCAMBIQUE	**2,227,827**	948,763	398,490	181,521	546,000	153,054
	Total	**35,285,889**	**14,924,719**	**8,742,418**	**1,227,616**	**6,633,900**	**3,757,235**

It should be emphasised that these cost estimates do not include the budget(s) for any project(s) currently under construction within the Northern region. Several outline studies have been undertaken/are underway for further projects in the region to address the water demands in the various urban areas.

This Concept Note does not contain details of those studies, nor does it undertake a detailed review. From a brief cursory review of what has been provided, it is evident however that any proposed project will seek to improve the service to FIPAG customers. The limitations on delivery are those of resources (mainly water), finance and expertise.

E. Programme/implementation timeline

As part of model development, it was necessary to assume an expenditure profile for works to meet the growth in demand. The assumption used is shown in the table below.

2022	2023	2024	2025	2026	2027
5%	10%	25%	25%	25%	10%

It should be emphasised that this is a general profile for demand modelling purposes not a profile for any project in any city. These would be developed as needed for specific projects.

F. Environmental & social aspects (incl. SDG aspects)

The main interventions identified include surface water abstraction works, expanding water supply intakes, borehole drilling, construction of water treatment plants, transmission mains, storage and water distribution networks.

These activities are considered likely to generate significant and irreversible environmental and social impacts. All projects should include mitigation measures to minimize the impacts; inter alia, noise vibrations, generation and disposal of construction waste, health and safety risks for contracted workers involved in construction activities, health risks and community safety.

These activities may be also associated with soil erosion and degradation, dust emissions of increased road traffic and construction activities within the community, workflow, physical and economic displacement of PAPs and risks related to Gender Based Violence (GBV).

All proposed projects must be preceded by an Environmental and Social Impact Assessment (ESIA). This will include the Environmental and Social Management Plan (ESMP) according to the Mozambican Environment Law (Law No. 20/97 of 1 October) and other international Environmental & Social Safeguards including those from the financier.

These policies are based on the precautionary principle that focuses on preventing the occurrence of significant or irreversible negative environmental impacts, regardless of the existence of scientific certainty about the occurrence of such impacts on the environment.

The environmental policies define the procedures for assessing the environmental impact as a preventive tool in the environmental management of projects. They also support the Government of Mozambique in making decisions regarding the granting of the environmental licenses for project development.

A range of Environmental and Social instruments will be prepared as appropriate. These are as follows;

(i) Environmental and Social Management Framework (ESMF) due to the size of project area.

(ii) Environmental and Social Impact Assessment/ESMP when the projects have been defined and for the environmental licensing following the Mozambican legislation.
(iii) Resettlement Policy Framework (RPF) and subsequently the Resettlement Action Plan to address the physical and economic displacement of Project Affected People (PAP).
(iv) Gender Based Violence and Sexual Harassment (GBV/ SH) Plan.
(v) Stakeholder Engagement Plan (SEP) including the Grievance Redness Mechanism (GRM).

Conducting an Environmental and Social Impact Assessment involves the following key steps:

1) Screening and classification by the Ministry of Land and Environment (MTA).
2) Preparation of a Pre-Feasibility Study and Environmental Scoping (EPDA) and preparation of a Terms of Reference (ToR) for the ESIA.
3) Preparation of the ESIA, including an Environmental and Social Management Plan (ESMP) and Resettlement Action Plan after the approval of the EPDA and ToR.

FIPAG has significant experience of preparing and presenting ESIA's as part of the Greater Maputo Water Supply Master Plan Project Phase II (GMWSP II). This experience will prove invaluable for application on other projects in the Northern Region as appropriate.

G. Risks & mitigations (city-specific if required)

FIPAG has developed a standard framework for assessing high-level risks and identifying suitable mitigations. For each specific project, a more detailed risk assessment and mitigation process would be developed and implemented.

FACTOR/ RISK	COMMENTS	RISK CHARACTERIZATION			MITIGATION MEASURES
		PROBABILITY	SEVERITY	RISK TYPE	
EXTERNAL FACTOR/ RISK *Absence of alternative sources and redundancy of water supply systems*		High Probability 4	Strong 4	Extreme	Planned measures to strengthen the capacity of sources and establish links to ensure alternative supply solutions in vulnerable systems.
EXTERNAL FACTOR/ RISK *Unsustainability of interventions due weak territorial ordering and projection of urban settlements*		Possible 3	Moderate 3	Moderate	The implementation of the planned actions should be preceded by water supply master plans aligned with the urban expansion plans, with a strong involvement of the municipalities.
EXTERNAL FACTOR/ RISK *Poor maintenance capacity reducing equipment life and efficiency.*		Possible 3	Strong 4	High 12	An institutional capacity building plan will be developed, including regular staff training and retention strategy, maintenance planning and equipment performance audit.
EXTERNAL FACTOR/ RISK *High level of non-revenue water reducing the financial sustainability of water supply operations.*		Almost Certain 5	Extreme 5	Extreme	The actions for services expansion will be anchored to non-revenue water programs and community education.
EXTERNAL FACTOR/ RISK *Climate change affecting water supply infrastructures.*		Possible 3	Moderate 3	Moderate	The interventations will include incorporating resilience actions towards impact of climate change.

4. REGIONAL SUMMARY

A. Summary cost table

The various requirements to meet water demand and the objective of 80% coverage service area populations in the urban areas served by FIPAG are summarised for the region by province in the table below.

Table 8. Total estimated new & renewal costs by province with 80% coverage by 2030.

Value (in US$m)	Extension Works	Secured Projects
Cabo Delgado	198,530,000	
Niassa	49,230,000	
Nampula	285,790,000	
NRW	22,700,000	
EEP	4,300,000	
Capacity Building	9,460,000	
Total	**570,010,000**	**570,010,000**

As noted in the previous section it should be emphasised that these cost estimates do not include the budget(s) for any project(s) currently under construction within the Northern region. Several outline studies have been undertaken/are underway for further projects in the region to address the water demands in the various urban areas.

This Concept Note does not contain details of those studies, nor does it undertake a detailed review as insufficient details exists for this purpose. From a brief cursory review of what has been provided, it is evident however that any proposed project will seek to improve the service to FIPAG customers. The limitations on delivery are those of resources (mainly water), finance and expertise.

B. Summary technical results, objectives, outputs and outcomes – with contribution to regional/national measures

The technical results for various indicators are summarised below at the national level, with the Northern regional contribution to these listed separately. There is no attempt to list these indicators by specific urban area; this would be done for each project as it is developed.

Indicator by 2030	National	Northern Region
Total connections	1,200,000	277,934
Additional connections	480,000	162,000
Total population served	9,000,000	1,354,744
Additional population served	2,500,000	858,600
Coverage by conventional system	80%	80%
Additional coverage by points sources	20%	20%
Network length (km)	15,000	3,371

C. Summary financial outcomes (revenue growth, OPEX falls, P&L etc)

The financial impact of the various actions to meet water demand and the objective of 80% coverage service area populations in the urban areas served by FIPAG are summarised at the national level in the tables below.

SUMMARY FINANCIAL OUTCOMES - RATIOS											
	2,020	2,021	2,022	2,023	2,024	2,025	2,026	2,027	2,028	2,029	2,030
Revenue Growth Rate	-16%	24.4%	5.4%	4.1%	3.1%	3.1%	3.1%	3.1%	3.1%	3.1%	3.1%
OPEX Variations	-6%	2.1%	6.5%	5.0%	4.9%	4.9%	5.0%	5.0%	5.0%	5.1%	3.7%
Operating cost coverage ra	89%	73%	74%	74%	75%	77%	78%	80%	81%	82%	83%
Debt Service Coverage Rat											
Minimum	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5
Projection	-0.03	2.74	2.86	2.73	2.73	2.05	2.02	1.98	0.73	0.71	0.71

Revenue Growth Rate

The expected revenue growth rate fell by 16% between 2019 and 2020, due to the COVID-19 pandemic. This situation influenced the forecast for the year 2021, which ends up with an increase of about 24% (which seems high). From 2022 onwards, growth is forecast to return to trend levels of 5.4%, 4.1% and 3.1% to 2024, and from 2025 onwards, the growth rate is fixed in 3.1% until 2030.

Operating Cost Coverage Rate

The operating cost coverage ratio normally ranges between 60% and 80%. Lower values indicate good cost control. For 2020, the percentage was higher, due to loss of revenue caused by the pandemic. From 2021, the coverage ratio is expected to be within the accepted limits, except from 2028 to 2029 which it is forecast to be above the accepted range.

OPEX

Operating costs are forecast to increase annually by a constant 5% rate. There was a sharp reduction in this rate of increase to 2.1% between 2020

and the forecast for 2021. In addition, from 2019 to 2020 there was also a fall due to the pandemic.

SUMMARY OF PROFIT & LOSS											
	2,020	2,021	2,022	2,023	2,024	2,025	2,026	2,027	2,028	2,029	2,030
Operating Revenue	2,141,164,627	2,664,460,932	2,809,470,903	2,923,700,886	3,015,573,754	3,110,183,186	3,207,552,478	3,308,042,708	3,411,786,965	3,518,923,018	3,629,536,914
Operating Expenses	1,900,375,630	1,939,570,055	2,065,236,719	2,168,679,328	2,274,494,258	2,386,424,783	2,504,820,670	2,630,137,690	2,762,761,403	2,903,063,692	3,011,439,435
Operating Results	**240,788,998**	**724,890,877**	**744,234,184**	**755,021,558**	**741,079,496**	**723,758,403**	**702,731,808**	**677,905,018**	**649,025,562**	**615,859,326**	**618,097,480**
Financial result	(250,048,435)										
EBITDA	(9,259,437)	724,890,877	744,234,184	755,021,558	741,079,496	723,758,403	702,731,808	677,905,018	649,025,562	615,859,326	618,097,480
Depreciation	291,442,899	507,000,000	452,185,171	455,075,373	458,047,803	461,032,309	464,114,436	467,380,527	470,749,178	474,225,867	477,816,470
Total interest expenses	60,883,255	56,268,639	51,654,024	57,212,460	52,371,777	68,048,310	62,423,709	56,799,109	108,813,097	103,785,362	99,073,435
Net earnings	**(361,585,591)**	**161,622,238**	**240,394,989**	**242,733,725**	**230,659,916**	**194,677,784**	**176,193,662**	**153,725,382**	**69,463,287**	**37,848,096**	**41,207,576**

Revenue Growth

The growth of sales by almost 59% until 2030 can be explained as follows:

- ✓ Over the period up to 2030, new connections will increase by 145,500.
- ✓ The current customer base will grow from 594,070 active connections to approximately 739,600.
- ✓ The coverage rate is currently (2020) at around 54%, but the forecast until 2030 is to maintain it, therefore, it will somehow increase the population growth forecasted by INE in more than 50% from 2020 to 2030.
- ✓ In 2020, there were about 10,415 km of network. By 2030 this is expected to increase to 15,082 km, an increase of about 45%. Extending the network allows more customers to be connected.
- ✓ The tariff will increase 2% annually from 2021 to 2030. This increase will be applied across all FIPAG Operational Companies.

D. Supporting measures for delivery & risk mitigation (e.g. tariffs, organisational changes)

Sustainability Support Measures Based on Tariffs Adjustment

The new Tariff Schedule and the proposed tariff adjustments will allow:

- ✓ Full recovery of operation and maintenance costs.
- ✓ Recovery of investments in the medium term.
- ✓ Promotion of decentralization of services and guarantee of sustainability.

Thus, a tariff proposal is presented, focused on the cost and investment coverage targets previously mentioned and corrected for the effects of inflation.

Despite the adjustments applied, given the revenues generated by the companies, it has not been possible to cover the costs related to the operation of the companies and the payment of the debt service, since the cost of limited cross-subsidy and conditions of financial equilibrium, the systems are conditioned to provide continuity of these services, putting pressure on the installed capacity of the systems.

Tariff Adjustment Impact

The adjustment process is designed to deliver the following outcomes:

- Continuation of the subsidy for an additional 1.5 million people in the social bracket, thus contributing to the maintenance of the basic food basket.
- Improvements in the efficiency in the provision of services, reductions in losses and increased hours of service and water quality.
- Creation of favourable conditions to attract investment and participation from the private sector.
- Guaranteeing the payment of the debt service of approximately US$9.8m per year.
- Supporting the smaller scale water supply systems that are or have been rehabilitated and operate under the delegated management regime.
- Continue to guarantee coverage of costs from the current 70% to 86%.

Management Process Support & Risk Management

RISK LOG FRAME APPROACH				
FACTOR/ RISK	RISK CHARACTERIZATION			Mitigation Actions
	PROBABILITY	SEVERITY	RISK TYPE	
EXTERNAL FACTOR/ RISK or Risk Title	Possible	Strong	High	The Government of Mozambique (GoM) has implemented measures austerity, to minimize the effects; In 2019, FIPAG implemented cost / expense containment measures to ensure the continuity of the operation.
Change in the country's political and macroeconomic situation	*3*	*4*		
INTERNAL FACTOR/ RISK	Unlikely	Low	Low	FIPAG, established the ethics and anti-corruption committee at central and operational levels; FIPAG will publish its performance (report of accounts) for public knowledge, in an efficient and continuous manner.
Governance	*2*	*2*		
EXTERNAL FACTOR/ RISK	Possible	Moderate	Moderate	The government approved the decree that encourages the participation of the private sector in the strategic initiatives of the DMF and the creation of Regional Societies; FIPAG approved the new organic statute to respond to the current institutional changes.
Weak implementation of DMF strategic options	*3*	*3*		
INTERNAL & EXTERNAL FACTOR/ RISK	High Probability	Strong	Extreme	The Government has encouraged the search option capabilities through PPPs and other internal investment options; FIPAG has been sharing projects with other financing coverage with other partners; FIPAG has prepared pre-feasibility studies and economic analyzes to guide future investments.
Lack of resources for projects implementation	*4*	*4*		
EXTERNAL FACTOR/ RISK	Possible	Moderate	Moderate	FIPAG, has observed the adjustments tariff rates in compliance with the cycle approved by the government. The last tariff adjustment took place in 2018.
Non-adjustment of water tariffs	*3*	*3*		
EXTERNAL FACTOR/ RISK	Almost Certain	Strong	Extreme	The Government, through the water sector, has coordinated efforts to respond to the insufficiency of resources, through financing from other sources of resources (eg water desalination); FIPAG has prepared pre-feasibility studies and Master Plan, to answer and guide current demands in terms ofsources.
Insufficiency of water resources to ensure sources of water abstraction (Climate changes - Droughts and Floods)	*5*	*4*		
EXTERNAL FACTOR/ RISK	Possible	Moderate	Moderate	FIPAG has been developing internal strategies to involve the private sector in systems management in order to engage new financing opportunities and fill the existing deficit
The water sector has been experiencing a retraction of funding to invest in the expansion of water supply(difficulties in finding other alternative sources of funding)	*3*	*3*		

5. FINAL REMARKS

The estimated budget to achieve the objectives mentioned above is estimated at **992.48 M USD.** The summary of investment needs (table 9) below details the budget proposed.

Table 9. The northern regional proposed budget

NORTH REGION	TOTAL (Million USD)
RESILIENT INFRASTRUCTURE - WATER SUPPLY	$ 533.55
RESILIENT INFRASTRUCTURE - DAM	$ 422.47
SUSTAINABLE SERVICES- NRW	$ 22.70
SUSTAINABLE SERVICE - ENERGY EFFICIENCY	$ 4.30
SUSTAINABLE SERVICE - OTHERS	$ 0.00
CAPACITY BUILDING	$ 9.46
TOTAL WATER SUPPLY	$ 570.01
TOTAL WATER RESOURCES (DAM)	$ 422.47
TOTAL	$ 992.48

The implementation of this project will increase coverage from 38% to 80% in Northern Region of the country, allowing for an additional 858,600 people to have access to safe drinking water. It will also increase the hours of supply to at least 20 hours per day and reduce water losses from average 40% to 25%. Therefore, the implementation of the current project is essential for the Economic and Social development of the Northern Provinces of Nampula, Niassa and Cabo Delgado.