PRINCE ALBERT LOCAL MUNICIPALITY

WATER SERVICES MASTER PLAN OF PRINCE ALBERT LOCAL MUNICIPALITY

Report Ref: AFR3108/01

Date: 17 April 2023

Prepared for:

Prince Albert Local Municipality
Private Bag X53
Prince Albert
6930

Contact Details

Name: Ashley America
Tel: 023 541 1036
Fax: 023 541 1035
Email: ashley@pamun.gov.za

Prepared by:

Africoast Consulting Engineers (Pty) Ltd
PO Box 5104, Walmer, 6065
South Africa
AfriCoast Building, Cnr Rose/Havelock Street,
Central, Port Elizabeth

Contact details:

Thomas Jachens
Tel: +27 41 505 8000
Fax: +27 41 585 3437
Email: thomas@africoast.com
URL: www.AfriCoast.com

TABLE OF CONTENTS:

LIST OF TABLES

LIST OF FIGURES

LIST OF ABBREVIATIONS & ACRONYMS

AADD - Annual average daily demand

AC - Asbestos Cement pipe

ACE - Africoast Consulting Engineers

AMP - Asset management plan

AR - Asset register

GIS - Geographic Information System

Ha - Hectare

HDPe - High Density Polyethylene pipe

kℓ - Kilolitre

kℓ/d - Kilolitre/day

km - Kilometre

ℓ/day/UE - Litre/day/unit erf

ℓ/s - Litre/second

m - Metre

mm -Millimetre

million m^3/a - Million cubic meters per annum

m a.s.l . - Metres above mean sea level

m/s - Metres per second

Mℓ - Megalitre

Mℓ/d - Megalitre per day

NRW - Non-revenue water

O&M - Operation and Maintenance

PALM - Prince Albert Local Municipality

PDF - Peak day factors

PHD - Peak hour demand

PHF - Peak hour factors

PRV - Pressure reducing valve

PS - Pumping station

PWF - Peak week factors

R - Rand

TWD - Total annual water demand

TWL - Top water level (in m a.s.l.)

UAW/UFW - Unaccounted-for-water

UE - Unit erf

uPVC - Unplasticised polyvinylchloride

UWD - Unit water demand (e.g. ℓ/stand/d, or kℓ/ha/d)

V - Flow velocity (in m/s)

VAT - Value added tax

WSMP - Water Services Master Plan

WTP - Water treatment plant

1. INTRODUCTION

AfriCoast Consulting Engineers has been appointed by Development Bank of South Africa (DBSA) as the suitably qualified and experienced service provider to conduct a comprehensive update of a Water Master Plan (WSMP) for PALM.

1.1 STUDY AREA

The location of PALM within the Western Cape is shown on Figure 1.1. The towns within the boundary of the PALM are:

- Prince Albert
- Leeu Gamka
- Klaarstroom

Figure 1.1: Prince Albert Locality Plan

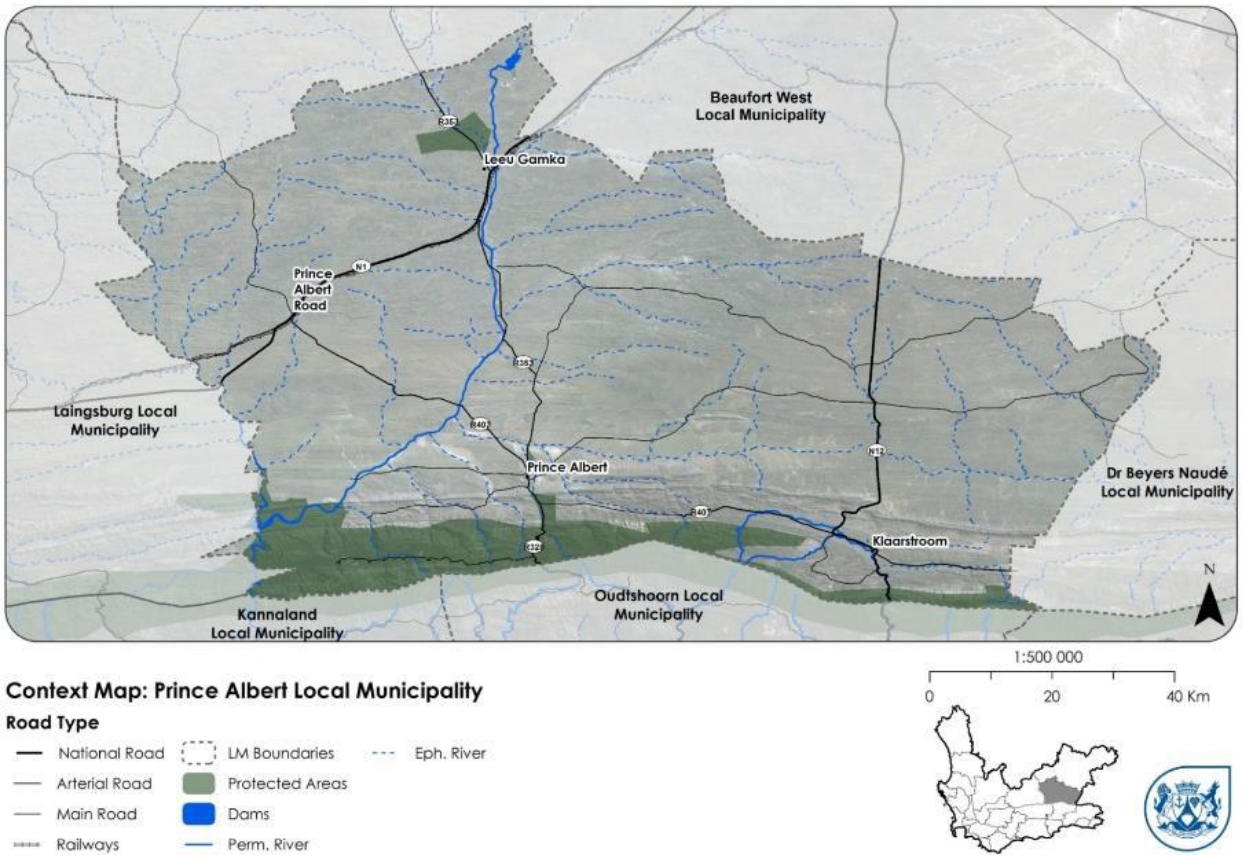


Figure 1.2 shows the suburbs with suburb names that will be entered during this assessment for all records in the Geographical Information System (GIS) database. The total area of these suburbs indicates the study area of this investigation.

1.2 PREVIOUS MASTER PLANNING

Community Engineering Services conducted a Water Master Plan study in November 2008 for the PALM for the towns of Prince Albert, Leeu Gamka and Klaarstroom.

1.3 STRUCTURE AND SCOPE OF REPORT

This report addresses the distribution of potable water within the PALM area. Water quality aspects and the analysis of the bulk water (raw water) pipelines upstream of the water treatment plants (WTP's) and reservoirs are not part of the scope of this report.

1.4 DISCLAIMER

The investigation has been performed and this report has been compiled based on the information made available to ACE. The information supplied to ACE by the PALM and other Consultants at the outset of this master planning process is assumed to be the most accurate representation of the existing system up to date hereof.

After the completion of the data capturing, the layout plans including the relevant attributes, were handed back to the Municipality so that the information could be verified by the Client. ACE can therefore under no circumstances be held accountable by any party for any direct, indirect, special, or consequential damages as a result of inaccurate information received pertaining to the components of the existing system.

The information in this report is intended for use by the PALM only.

2. EXISTING SITUATION ASSESSMENT

2.1 WATER SOURCES

Water sources ranges from boreholes to surface water. The PALM is independent from other external water suppliers and operates and maintains their own water systems, management, and infrastructure.

2.1.1 Prince Albert

Prince Albert Town has a total of sixteen boreholes, currently the town is supplied with water from nine production boreholes with varying supply levels as well as through a percentage allocation of "lei water" from the Water User's Association. Surface water is diverted to a holding reservoir and then pumped to the treatment works. The water is purified at Prince Albert Water Treatment Plant.

2.1.2 Leeu Gamka

Leeu Gamka is solely dependent on groundwater resources. The town has a total of eight boreholes though only three are in production and supply the reverse osmosis and ultra-filtration plant before being pumped into the final reservoir for distribution. All the boreholes are currently monitored manually.

2.1.3 Klaarstrooom

Klaarstroom is solely dependent on groundwater sources and the town has a total of ten boreholes, four of which are production boreholes. The water is purified at Klaarstroom Water Treatment Plant. All the town's water sources are pumped into the reservoirs. All the boreholes are currently monitored manually.

2.2 BULK SUPPLY SYSTEM

The analysis of the bulk supply system, viz. the system upstream of the storage reservoirs or WTP's is beyond the scope of this study.

2.3 WATER TREATMENT PLANTS

2.3.1 Prince Albert

The Prince Albert WTP receives raw water from nine different boreholes as well as the Dorps River. The water received from the boreholes is iron rich in which case the water first passes through the iron removal plant for pre-treatment before it gravitates to the raw water reservoir. The raw water is then pumped into the four balancing dams where it is treated by means of four sand-filters and a chlorination process.

2.3.2 Leeu Gamka

The Leeu-Gamka water is not treated by means of a conventional WTP. Occasionally water received from the boreholes contains fluorine in which case the water passes through a reverse osmosis and ultra-filtration plant to purify the water in Leeu Gamka. This has resulted in a significant improvement in the water quality.

2.3.3 Klaarstrooom

The raw water abstracted from the four boreholes is pumped to the WTP. The Klaarstroom WTP operates for 24 hours a day and the quality of the water is tested on a quarterly basis. Currently the condition of the WTP is still in working condition.

Table below shows the summary of the Existing Water Treatment Plants infrastructure.

Table 1: Water Treatment Plants Summary

General information	WTP1	WTP2	WTP3
Component name	Prince Albert WTPs	Klaarstroom WTPs	Leeu-Gamka WTPs
Scheme name	Prince Albert Bulk Supply	Klaarstroom Bulk Supply	Leeu-Gamka Bulk Supply
Operation			
Operating hours per day	24	24	24
Type and capacity			
Type of plant (description)	Iron Removal Plant / Sand Filter / Chlorination	Rapid Sand Filtration / Chlorination	Reverse Osmosis and Ultra-Filtration
Water source (purchased, ground, surface)	Ground and Surface	Ground	Ground
Design capacity (M*l*d)	3.0 Mℓ/d	0.36 Mℓ/d	0.5 Mℓ/d

2.4 SERVICE STORAGE

2.4.1 Prince Albert

There are nine reservoirs situated in and around Prince Albert. Overall, all nine reservoirs are operational. The total capacity of the distribution (potable water) reservoirs is 4.0 Mℓ and 4 raw water storage reservoirs with a capacity of 3.23 Mℓ.

2.4.2 Leeu Gamka

There are two concrete reservoirs situated in Leeu-Gamka, one old reservoir at Bitterwater, with a capacity of 0.2 Mℓ used for raw water storage and one newly constructed concrete reservoir for potable water with a capacity of 1 Mℓ. Both reservoirs are operational.

2.4.3 Klaarstrooom

The treated water in Klaarstroom is stored in a concrete panel reservoir with a capacity of 0.05 Mℓ and two newly constructed steel reservoirs with a combined capacity of 0.48 Mℓ.

Table 2 below shows the existing bulk water scheme and infrastructure per area.

Table 2: Existing bulk supply system summary

AREA	BULK WATER SCHEME	EXTENT	CAPACITY/YIELD
Prince Albert	Production Boreholes	9	0.229 million m³/a
	Dorps River		0.471 million m³/a
	Raw Water Storage Dams	4	3.23 Mℓ
	Water Treatment Plants (Prince Albert)	1	3.0 Mℓ/d
	Pumpstation/s Prince Albert	2	33 ℓ/s and 4.2 ℓ/s
	Bulk Supply Pipeline	4.84km	
	Potable Water Reservoirs @ Prince Albert	5	4.0 Mℓ
Leeu Gamka	Production Boreholes	2	0.0618 million m³/a
	Raw water Reservoir	1	0.2 Mℓ
	Water Treatment Plants (Leeu Gamka)	1	0.5 Mℓ/d
	Bulk Supply Pipelines (Leeu Gamka)	1.541km	-
	Potable Water Reservoir	1	1.0 Mℓ
Klaarstroom	Production Boreholes	4	0.031 million m³/a
	Water Treatment Plants (Klaarstroom)	1	0.36 Mℓ/d
	Pumpstation/s	2	2.8 ℓ/s
	Bulk supply pipelines	0.83km	-
	Reservoirs	3	0.53 Mℓ

2.5 RETICULATION SYSTEM LAYOUT AND OPERATION

2.5.1 General Description

The existing PALM water supply system is discussed in this section below.

The existing water system layouts are shown on Figures 2.1, with a separate Figure for each area as follows:

- a - Prince Albert
- b - Leeu Gamka
- c – Klaarstroom

This notation to distinguish between areas is used throughout this report for all Figures where appropriate.

The existing water distribution zones are shown in Figures 2.2

Table 3 to 6 provides a summary of the existing water infrastructure, pipes, reservoirs, and pumps in the existing system.

Table 3: Existing Water Infrastructure Summary per Area

AREA	INFRASTRUCTURE TYPE	EXTENT	CAPACITY
Prince Albert	Water Treatment Plant (Prince Albert)	1	3.0 Mℓ/d
	Reservoirs @ Prince Albert	9	7.23 Mℓ
	Pumpstation/s Prince Albert	2	33 ℓ/s and 4.2 ℓ/s
	Pipe Length (Prince Albert)	37 km	-
Leeu Gamka	Water Treatment Plant (Leeu Gamka)	1	0.5 Mℓ/d
	Reservoirs	2	1.2 Mℓ
	Pumpstation/s	0	-
	Pipe Length (Leeu Gamka)	15 km	-
Klaarstroom	Water Treatment Plant (Klaarstroom)	1	0.36 Mℓ/d
	Reservoirs	3	0.53 Mℓ
	Pumpstation/s	1	2.8 ℓ/s
	Pipe Length	3.4 km	-

Table 4: Existing water system summary – Pipes

PIPES	Length (m)			
Diam. (mm)	Bulk	Network	Total	%
Prince Albert				
≤ 45	0	1 405	1 405	3.8
> 45 ≤ 75	0	19 200	19 200	52
> 75 ≤ 125	560	8 373	8 933	24.1
> 125 ≤ 175	65	2 465	2 530	6.8
> 175 ≤ 275	4100	585	4 685	12.7
> 275	110	120	230	0.6
Prince Albert Total	**4 835**	**32 148**	**36 983**	**100**
Leeu Gamka				
≤ 45	0	0	0	0
> 45 ≤ 75	0	9 335	9 335	62
> 75 ≤ 125	1261	4 132	5 393	36
> 125 ≤ 175	279	0	279	1.9
> 175 ≤ 275	0	0	0	0
> 275	0	0	0	0
Leeu Gamka Total	**1540**	**13 467**	**15 007**	**100**
Klaarstroom				
≤ 45	0	0	0	0
> 45 ≤ 75	0	965	965	29
> 75 ≤ 125	1510	1556	2386	71
> 125 ≤ 175	0	0	0	0
> 175 ≤ 275	0	0	0	0
> 275	0	0	0	0
Klaarstroom Total	**1510**	**2 521**	**3 351**	**100**
Prince Albert Total	**7 205**	**48 136**	**55 341**	**100**

Table 5: Existing water system summary – Reservoirs

Name	Type	Capacity (kl)	TWL (m a.s.l.)
Prince Albert			
Klippies	Reservoir	1 000	645,6
Staandak	Reservoir	500	645,6
Hoe Druk	Reservoir	500	680,8
Noord End Oud	Reservoir	1 000	632,5
Noord End Nuwe	Reservoir	1 000	632.5
4 Raw Water Storage Dams	Reservoir	3 230	654.09
Total		7 230	
Leeu Gamka			
Leeu Gamka Final	Reservoir	1000	553
Leeu Gamka Reservoir (Bitterwater)	Reservoir	200	553
Total		1 200	
Klaarstroom			
Vaaldam	Reservoir	50	750.0
Blinkdam 1	Reservoir	200	750.0
Blinkdam 2	Reservoir	280	750.0
Total		530	

Table 6: Existing water system summary – Pumps

Town or Zone	Name	Capacity (l/s)	Head (m)
Prince Albert	Staandak pump station	33	Unknown
Prince Albert	High Pressure pump station	4.2	Unknown
Klaarstroom	Klaarstroom pump station	2.8	Unknown

2.5.2 Prince Albert Water Supply

The system is operated in 3 zones supplied from 5 reservoirs. From the Prince Albert WTP water is supplied through a 200 mm diameter pipe to the Klippies and Staandak reservoirs. The first zone is supplied from these two reservoirs.

From the Klippies and Staandak reservoirs water gravitates through a dedicated 200 mm diameter bulk pipeline to the Noord End Reservoirs from where the second zone is supplied. From the Staandak reservoir water is pumped from the Staandak pump station through a dedicated 100 mm diameter rising main to the Hoe Druk reservoir. From here the third zone is supplied.

2.5.3 Leeu Gamka Water Supply

The system is operated in 1 single zone, supplied from the Leeu Gamka reservoir.

2.5.4 Klaarstrooom Water Supply

The system is operated in 1 single zone, supplied from the Klaarstroom reservoirs.

2.6 EXISTING CONDITION OF THE WATER INFRASTRUCTURE

2.6.1 Boreholes / Groundwater Infrastructure

Prince Albert has a total of 16 boreholes, of which 9 are production boreholes. The current yield of the production boreholes is 0.229 million m^3/a. Klaarstroom has a total of 10 boreholes, 4 of which is production boreholes though only 2 boreholes are actively utilised to supply the town with water. The current yield of Klaarstroom production boreholes is 0.031 million m^3/a. Leeu Gamka has a total of 8 boreholes though only 3 are currently in production and supply the treatment plant before being pumped into the final reservoir for distribution. The current yield of Leeu Gamka's production boreholes is 0.0618 million m^3/a.

All the boreholes are generally in a good condition and there is frequent maintenance being carried out on the boreholes. All the production boreholes are currently monitored manually and captured on a Cellphone App and there are spare parts readily available and stored in the municipal general store. The production boreholes have built enclosure structures and security fencing around to protect the borehole equipment. Due to occasional flood damage, there are boreholes in Prince Albert that are flood prone which must be moved with their supporting equipment outside the river channel to mitigate against flood damage.

Currently there are 2 new production boreholes being drilled in Prince Albert Town, furthermore the yield testing is underway.

2.6.2 Surface Water Infrastructure

Dorps River is the only source of surface water available in Prince Albert and care is taken to ensure that the river is not polluted since it is the only surface water source to Prince Albert. Prince Albert is not the only user of the Dorps River there are other users as well and the licensed abstraction from this source for PALM is 0.471 million m³/a. Dorps River also supplies water irrigation through a furrow network to South End in Prince Albert. Approximately 10.4% of the licenced abstraction from the Dorps River is supplied to Prince Albert's annual water demand.

2.6.3 Water Treatment Plants

All three towns in Prince Albert Municipality have their own Water Treatment Plant and the physical condition of the facilities is good except for Klaarstroom plant which needs to be refurbished. The building / structure to be refurbished, new pumps to be installed and some sections of the pipework around the plant must be replaced as they are leaking. There is no fixed maintenance plan for all the facilities. All the treatment plants operate 24hrs per day and the water quality is being monitored quarterly.

2.6.4 Water Pumpstations

Only Prince Albert and Klaarstroom Towns have pump stations and they are generally in a good condition and the infrastructure is maintained on demand. The pump stations operate 24 hrs a day except the Treated water pump station in Prince Albert Town that operates 16 hours per day and there are standby pumps available on the facilities. Information on the pumping heads in Prince Albert is however not available.

2.6.5 Reservoirs

Prince Albert Municipality has 14 reservoirs and 1 Water Tank varying from raw water reservoirs to distribution reservoirs with a capacity ranging from 0.1 Mℓ to 1 Mℓ. The condition of all the reservoirs is good to average with some minor concrete refurbishments, the reservoirs are well maintained. All the reservoirs are operational.

2.6.6 Water Pipeline Infrastructure

Prince Albert has 7.2km of water bulk pipelines ranging from 75mm diameter to 350mm diameter and 48.14km of internal reticulation ranging from 40mm to 350mm diameter of which 65% of the pipeline is uPVC, 7% is AC pipes and 28% is HDPe pipes. The rate of leakages in the bulk and internal reticulation pipelines is very minimal which can be assumed that the condition of the pipeline is still good to fair and the infrastructure is maintained on demand.

2.6.7 Pictures

See below photos of Existing Water infrastructure per Area:

Prince Albert Photos

Production Borehole

Iron Removal Plant

Storage Reservoir @ WTW

North End Reservoirs

Dorps River Furrow Inlet

Klaarstroom Pictures

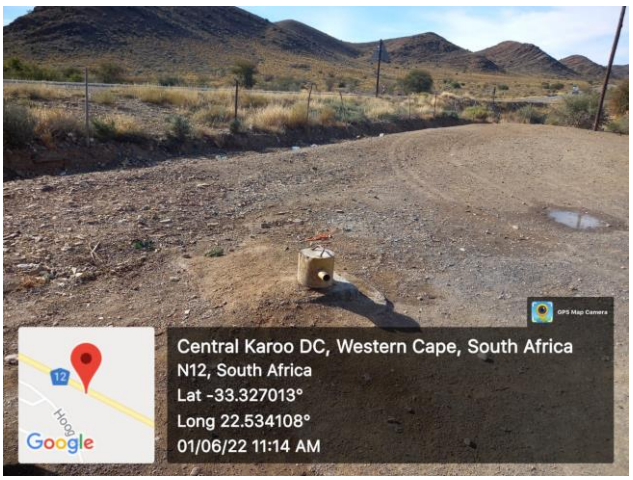
Water Treatment Works

WTW Sand Filters

Storage Tanks

Pump Station

Production Borehole



Monitoring Borehole

Blinkdam and Vaaldam Reservoirs

Leeu Gamka Pictures

Reverse Osmosis and Ultra Filtration Plant

Raw water Storage Reservoir

Potable water Reservoir

New Production Borehole

Monitoring Borehole

2.7 SPECIAL CONSIDERATIONS

2.7.1 General

Detailed drawings of the system are included in the plan book. The plan book should be used to indicate (by physical markings on the drawings) any additional information, or amendments, that would improve the quality of the final product.

2.7.2 Information to be clarified

Detail information regarding pump duty points and top water levels of reservoirs in Prince Albert (pump information), Leeu Gamka (reservoir information) and Klaarstroom (pump and reservoir information) should be clarified.

2.7.3 Data integrity

If this report is noted to have any discrepancies compared to alternative information, ACE should be contacted in this regard to ensure that the relevant sections of the system are verified to continuously improve the data integrity.

2.8 ZONAL METERING

On all the three towns all the zones are metered and zonal water meter readings are taken daily and captured by the municipality.

2.9 IDENTIFICATION OF THE SECTOR PLANS

The table below shows the Prince Albert Sector Plans and the status. All the sector plans are outdated and needs urgent attention.

Table 7: PALM Sector Plans

Sector Plan		Status
1	CKDM Bulk Infrastructure Master Plan 2010	Needs updating
2	Water Master Plan_2023	Currently being updated
3	Sanitation Master Plan_2023	Currently being updated
4	Water Service Development Plan 2023	Currently being updated
5	Water Conservation and Water Demand Management Strategy	Needs updating
6	Integrated Infrastructure Maintenance Plan	To be developed
7	Climate Change Response Strategy	In process of development with Central Karoo District Municipality

The table below shows the district actions or projects from the Central Karoo District Municipality which are relevant to PALM.

Table 8: CKDM Projects relevant to PALM

District wide action or project	Time Frame	Role-Players
Ensure that all efforts towards building water resilience in the municipality, and responses to the persistent drought conditions, consider the proposals of Policy A2 around building water resilience.	Ongoing	Central Karoo District Municipality Beaufort West Local Municipality Laingsburg Local Municipality PALM Provincial Department of Transport and Public Works National Department of Water and Sanitation
Ensure the District Municipality and all local municipalities develop and implement asset management and infrastructure maintenance policies and plans as per guideline C3 to ensure all infrastructure and assets are well maintained.	2020-2025	Central Karoo District Municipality Beaufort West Local Municipality Laingsburg Local Municipality PALM
Establish a Central Karoo Shared Service Centre for municipal planning and possibly a GIS function, and potentially other functions, within the Central Karoo.	2020-2025	Central Karoo District municipality Beaufort West Local Municipality Laingsburg Local Municipality PALM

2.10 EXISTING LEVEL OF SERVICE

2.10.1 Water Service Delivery Levels

Below is the table that specifies the different water service levels per household within the urban edge area for the financial years 2019/2020 and 2020/21.

Table 9: Water Service Delivery Levels

Description	2019/20	2020/21
	Actual	Actual
Household		
Water: (above minimum level)		
Piped water inside dwelling	2820	2820
Piped water inside yard	93	93
Using public tap (within 200m from dwelling)	0	0
Other water supply (within 200m)	0	0
Minimum service level and above subtotal	2913	2913
Minimum service level and above percentage	98.3%	98.3%
Water: (below minimum level)		
Using public tap (more than 200m from dwelling)	0	0
Other water supply (more than 200m from dwelling	0	0
No water supply	0	0
Below minimum service level subtotal	0	0
Below minimum service level percentage	0	0
Total number of households (formal and informal)	2913	2913
Source: PAMUN SDBIP 2020/2021		

2.10.2 Public Amenities Summary

PALM has 4 health facilities and Ambulance Depot and 5 Education facilities and all have adequate services. See table 10 below:

Table 10: Service Level Profile for Public Amenities

No.	Associated Services Facility	Number of Facilities	Water		Sanitation	
			Adequate	Inadequate	Adequate	Inadequate
Education Plan						
1	Schools	5	5	0	5	0
TOTAL		**5**	**5**	**0**	**5**	**0**
Health Plan						
2	Hospitals	1	1	0	1	0
3	Clinics	3	3	0	3	0
4	Ambulance Depot	1	1	0	1	0
TOTAL		**5**	**5**	**0**	**5**	**0**
Public Amenities						
TOTAL		**10**	**10**	**0**	**10**	**0**

2.11 CURRENT DEMAND

2.11.1 Current Water Demand

The table below provide a summary of the current water demand for PALM for the period 1 July 2021 to 30 June 2022.

Table 11: Present Water Demand Summary

USER	ACTUAL PRESENT AADD (kl/d) - 2022
PRINCE ALBERT	
Existing formal Stands	2 000
SUB-TOTAL	**2 000**
LEEU GAMKA	
Existing formal Stands	600
SUB-TOTAL	**600**
KLAARSTROOM	
Existing formal Stands	120
SUB-TOTAL	**120**
TOTAL	**2 720**

2.11.2 Current Sewer Discharge

The table below provide a summary of the current sewer discharge for PALM for the period 1 July 2021 to 30 June 2022.

Table 12: Present Sewer Discharge

USER	ACTUAL PRESENT PDDWF (kl/d) - 2022
PRINCE ALBERT	
Existing formal Stands	800
SUB-TOTAL	**800**
LEEU GAMKA	
Existing formal Stands	296
SUB-TOTAL	**296**
KLAARSTROOM	
Existing formal Stands	44
SUB-TOTAL	**44**
TOTAL	**1 140**

2.12 WATER BALANCE

By undertaking a water balance, WSA can calculate the amount of water that is being lost to their systems. The non-revenue water provides an indicator of how efficient the water supply system is being run, and provides information to the WSA on how to improve the system. Non-revenue water is a direct loss to the WSA. The bulk meter readings (total water abstracted / treated) less the individual meter readings (treasury sales) resulted in the following existing current water losses.

The tables below provide a summary of the water balance for PALM for the period 1 July 2021 to 30 June 2022 and for each town.

Table 13: PALM Water Balance for 1 July 2021 to 30 June 2022

Description	Volume (kl/annum)	Volume (kl/annum)	Percentage of System input
Bulk Water Supply at Source (Yield)		622 890	
Total System Input		622 890	
Revenue Water		443 912	71.27%
Non-Revenue Water		178 879	28.70%
>Unbilled Authorized Consumption	1246		0.002%
>Customer Meter and data Errors	178 979		28.7%
>Real Losses / Apparent losses	177 732		28.5%

Table 14: Prince Albert Town Water Balance for 1 July 2021 to 30 June 2022

Description	Volume (kl/annum)	Volume (kl/annum)	Percentage of System input
Bulk Water Supply at Source (Yield)		532 640	
Total System Input		532 640	
Revenue Water		362 842	58.25%
Non-Revenue Water		169 798	31.9%
>Unbilled Authorized Consumption	1246		0.0%
>Customer Meter and data Errors	169 798		31.9%
>Real Losses			

Table 15: Leeu Gamka Water Balance for 1 July 2021 to 30 June 2022

Description	Volume (kl/annum)	Volume (kl/annum)	Percentage of System input
Bulk Water Supply at Source (Yield)		43 960	
Total System Input		43 960	
Revenue Water		55 685	11.19%
Non-Revenue Water		-11 725	-27.0%
>Unbilled Authorized Consumption	1246		0.0%
>Customer Meter and data Errors	-11 725		-27.0%
>Real Losses			

Table 16: Klaarstroom Water Balance for 1 July 2021 to 30 June 2022

Description	Volume (kl/annum)	Volume (kl/annum)	Percentage of System input
Bulk Water Supply at Source (Yield)		46 291	
Total System Input		46 291	
Revenue Water		25 385	13.45%
Non-Revenue Water		20 905	45.20%
>Unbilled Authorized Consumption	1246		0.0 %
>Customer Meter and data Errors	20 906		45.2%
>Real Losses			

The water balance summary for PALM for the 2021/2022 financial year is as follows:

Table 17: Water Balance Summary for 1 July 2021 to 30 June 2022

Water resource	Treatment	Reticulation	Consumption	Billed / un-billed	Revenue
Raw water abstracted	Raw water input	System Input	Authorised Consumption	Billed metered	Free basic water
	WTW	WTW		443 912	
Dam	622 890	622 890	443 912	Billed unmetered	Revenue Water
-				-	443 912
	No treatment	No treatment			
Run-of-River	-	-		Unbilled metered	Non-revenue Water
532 640				-	
		Purchased			
Groundwater		-		Unbilled unmetered	
90 251				1 246	NRW internal
	Total into WTW	Total treated			178 879
Treated effluent	137 480	622 890	Reticulation losses	Apparent losses	28.7%
-					
		Total system input	177 732		
Seawater		622 890	28.5%	Real losses	
-					
Other / purchased		Treatment losses	Bulk supply losses	Apparent bulk loss	
-		- 177 732		177 732 28.5%	NRW Bulk & internal
Total	Bulk reticulation losses		- 0%	Real bulk losses	178 897 28.7%
622 891				-	

2.12.1 Non-Revenue Water

The non-revenue water for 2021/22 financial year amounts to 28.7%. The apparent losses for this period are 28.5%.

The main aim of the PALM is to manage the non-revenue water below 20%.

2.12.2 Water Losses

PALM Water losses for 2021/2022 are at 28.5% which is less than the previous financial year at 32.6% (2020/2021). To curb the water losses the Municipality took an initiative of doing a door-to-door campaign where water leakages are being repaired on private properties. The municipality is still investigating the high-water losses through the billing system as well as testing the accuracy of the data by conducting a field investigation however the report has not been finalised by PALM.

2.12.3 Impacts of Climate Change

Climate change impacts are likely to be felt primarily via effects on water resources. The State of Environment Outlook Report 2018 for the Western Cape indicates a general baseline decline in water quantity and quality, that invasive alien species are further adding to the limitations on water supply and that land use practices that are degrading ecosystems, and increasing sediment loads and run-off are further negatively impacting on water resources. Water Management Areas (WMAs) are severely stressed and vulnerable to any major changes in rainfall e.g., from drought and long-term climate change.

PALM is to update Water Services Strategies and Plans to include consideration of climate change. Interventions such as the review of the Specifications of the Regional Bulk Infrastructure Grant (RBIG), Municipal Infrastructure Grant (MIG), Accelerated Community Infrastructure Programmes (ACIP) and other similar funds and allocations to determine their climate responsive state, protection, and evaluation of Strategic Water Source Areas to ensure they receive appropriate protection in terms of supportive zoning in Spatial Development Framework. DBSA is part of Global Innovation Lab for Climate Change, identifying and piloting climate change financing instruments, created to catalyse private sector capital into climate change projects.

The impact of the climate change is drier conditions, reducing the safe yields of existing surface water resources. PALM is to continue with the implementation of specific WC/WDM measures to lower the current water requirements. Investigations for augmentation of existing water sources to allow for impact of climate change on yield of water resources, as well as increased allocation of licenced abstraction of available water is required, to ensure future water requirements are met.

2.12.4 Strategic Requirements

Without water, the municipality is economically, socially, and environmentally unsustainable. If the status quo remains, the region will continue to experience economic shocks related to water unavailability. Water sensitive design, water availability or water constraints must be considered as part of all land use management changes, urban development, infrastructure expansion or any other process that impacts on water use or availability in the municipality.

- Adopting an overarching approach to water demand management – maximise efficiencies, optimise storage capacity and ground water capacity. This approach would need to take cognizance of the policies below.

- Protect and rehabilitate the Dorp's River system. This would include the development of an investment programme to evaluate the carrying capacity of the Dorps river and reconciling this with future growth needs.

- Ensure the integrity of valuable rainwater catchment areas, groundwater recharge areas and riverine systems are kept clear of invasive plant species or any use that will either degrade the quality or quantity of water available for use.

- Develop agricultural water demand management programmes, focusing on ground water appropriate agricultural areas, particularly the historic town farms along the Dorps, the farms along the Gamka River and the farms along the Meirings River.

At the settlement scale, the following adaptation policy measures apply:

- Regulate borehole use to ensure sustainable use of groundwater systems.
- Developing water and sanitation infrastructure that utilizes water re-cycling and reuse.
- Promoting household and farm-scale rainwater capturing for non-potable uses.
- Ensure rainwater tanks are included in new developments of households on erven larger than 120m².
- Promoting compact urban development to minimise infrastructure expansion that increases the risks of water loss from expansive water reticulation systems
- Investing in a maintenance programme that seeks to minimise leaks from municipal water infrastructure.
- Implement water demand management programmes in Government facilities (e.g., municipal offices, education, health, and public works).

2.12.5 Priority Areas to be protected

Below are the core areas of priority for the ecosystem protection and conservation management:

- Critical Biodiversity Areas - these include habitats classified as highly irreplaceable, critically endangered, or endangered terrestrial (land), aquatic (rivers, wetlands, and estuaries) and marine habitats.

- Critical Biodiversity Area 2 (degraded and Ecological Support Area) - these areas are in a degraded or secondary condition that are required to meet biodiversity targets, for species, ecosystems or ecological processes and infrastructure. These should be maintained or rehabilitated into a natural or near-natural state with no further loss of natural habitat.

- Buffer Areas - these include habitats classified as highly irreplaceable, critically endangered, or endangered terrestrial (land), aquatic (rivers, wetlands, and estuaries) and marine habitats.

2.13 OPERATION AND MAINTENANCE PLAN

The effectiveness of Operation and Maintenance plays a vital role in the infrastructure as it extends the service life of the assets. PALM does not have an Operation and Maintenance Plan in place. All maintenance of the water and sanitation assets is conducted on an ad hoc basis. It is recommended that for PALM to be able to monitor properly all water and sanitation assets, an operation and maintenance plan is to be developed and maintained.

2.14 ASSET REGISTER AND GIS

PALM currently have an asset register in place. PALM does not have GIS information in place. Municipality must ensure that the asset register and the GIS information is continuously being updated.

2.15 ASSET MANAGEMENT PLAN

It is recommended that the current databases and master planning results be extended and applied to support the Asset Register (AR) and Asset Management Plan (AMP).

2.16 WATER CONSERVATION AND DEMAND MANAGEMENT

The need for demand-side interventions that effectively reduce physical losses in water networks, artificial demand at the end-user level created through leakage, as well as apparent losses due to metering and billing deficiencies is abundantly clear. In response to this need, the municipality has initiated interventions, programmes, and projects to reduce the demand for water.

Below are the initiatives that PALM have taken in order to reduce the current percentage of non-revenue water:

- Public information and education programmes
- Reducing high pressures for residential consumers
- Leak and meter repair programmes
- Conduct network and operational audit
- Replacement of old AC pipes reticulation networks and pipe failures.
- A detail water meter audit
- Reuse of wastewater

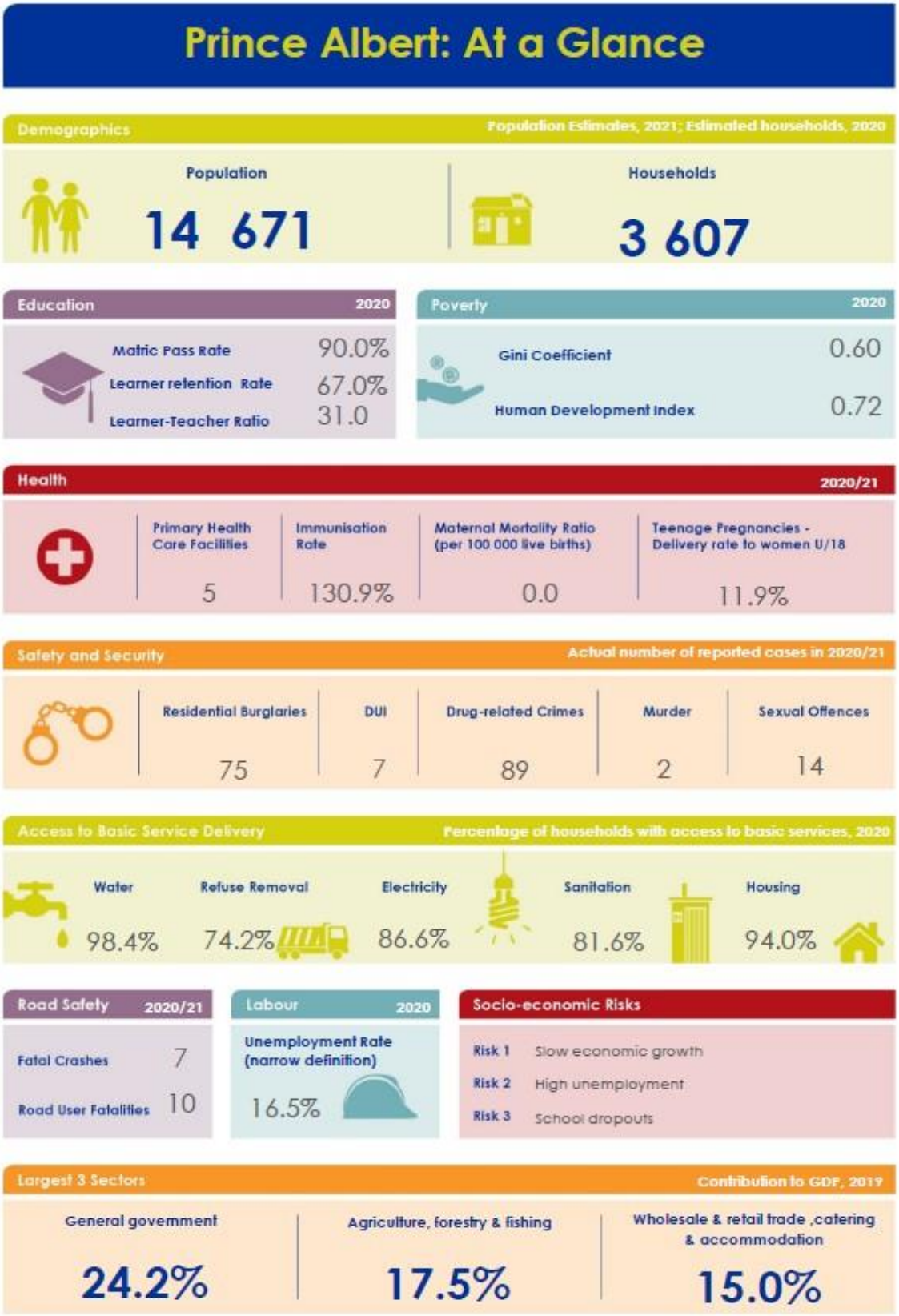
Below are other recommended initiatives the municipality can take in order to reduce water losses:

- Operation and Maintenance of network is very essential to increase the life of network, therefore, operation and maintenance policy needs to be developed.
- Reliable static and continuous data should be collected and mailed on priority basis which can be suitably used for performance evaluation purpose.
- It is observed that sensitivity of the water meter decreases as the age of meter increases and hence there should be appropriate policy for testing and replacement.
- Changes in community behaviour and attitude towards water usage which should be done through creating awareness and educating the people.
- Upgrading of the telemetry system, to act as an early warning system for e.g., pipe failures and reservoir overflows.

2.17 ALTERNATIVE TECHNOLOGIES AND MATERIALS

To avoid day zero, water use must be reduced in all areas and an investigation into the ground water availability must be taken. Artificial recharge possibilities must be implemented, improved water management must take place, a weir in the Swartberg Mountains must be build and in the long term a new well field must be developed. It is also necessary that the flood prone boreholes and supporting equipment must be moved out of the riverbed. To ensure effective management of water resources and emergency situations, a fully functional telemetric system will be needed.

3. PRINCE ALBERT SITUATION ANALYSIS



The following section will provide a brief overview of the information above.

3.1 Introduction

The importance of understanding demographics as a decisive factor in shaping our current socio-economic reality is critical for government, economists, and politicians alike. The following section provides a concise, yet meaningful overview of the most prominent demographic indicators relevant for municipal planning and budgeting in the Prince Albert Municipality. It is contended that the population and household statistics provided hereto will assist the Prince Albert municipality to set accurate and credible service delivery targets across the new 5-year integrated development cycle.

3.1.1 Description of Prince Albert

Prince Albert lies on the south edge of the Great Karoo, nestling under the majestic Swartberg Mountains. Prince Albert was found in 1762 on the loan farm De Queek Vallei with Zacharias De Beer as its first incumbent. Originally known as Albertsburg, when it obtained municipal status in 1845 it was renamed Prince Albert in honour of Queen Victoria's consort, Prince Albert of Saxe-Coburg.

The village has many well-preserved Cape Dutch, Karoo and Victorian buildings, thirteen of which are National Monuments. There are several olive farms and other very large export fruit farms in the area, as well as sheep farms, an export mohair trade. Birding, hiking, cycling and stargazing are other pursuits for visitors. The area is well known for its hardy endemic veld plants and is frequently a destination for botanists from all over the world. Visitors also enjoy excellent dining on fine Karoo lamb and cheese from the local dairy.

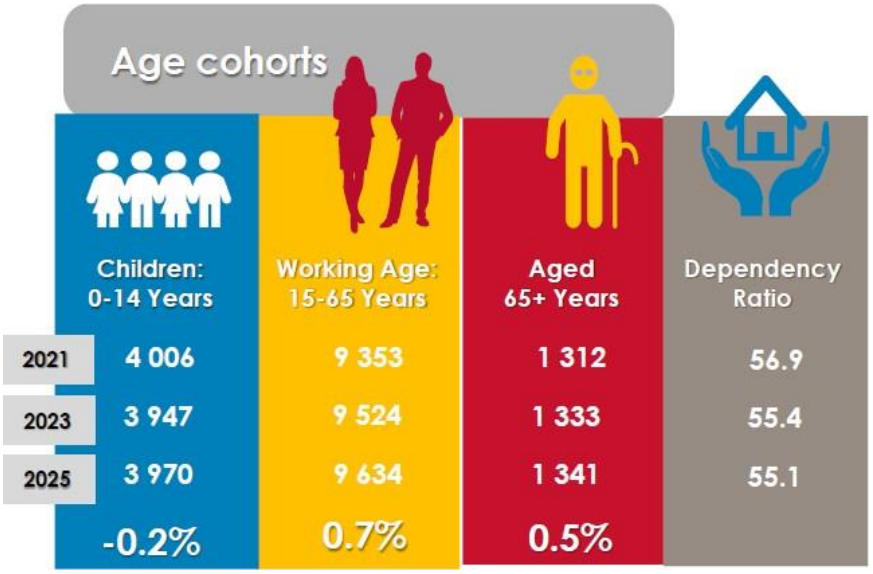
3.1.2 Climate

Prince Albert enjoys a beautifully healthy climate with high temperatures in summer and comfortable sunny but crisp conditions during winter with cold nights, reaching midwinter minimums of 2 ˚C, with frost in places. Summer and winter blend into one another, leaving only a matter of weeks for spring and autumn. Prince Albert's dry heat is ideal for anyone suffering from chest conditions and many people feel the health benefits of living here. This dry heat may spike up to 40 ˚C on a few days in the summer with an average of 33 – 35 ˚C, and 17 ˚C in the winter months (Source: eco impact environmental practitioners, 2018).

3.1.3 Geography

The municipality covers an area of 8,153 square kilometers (3,148 sq mi) in the Great Karoo immediately north of the Swartberg Mountains. It abuts on the Beaufort West Municipality to the north, the Dr Beyers Naudé local Municipality to the east, the Oudtshoorn and Kannaland Municipalities to the south, and the Laingsburg to the west.

The main town in the municipality is Prince Albert, which as of 2011 has a population of 7,054. North of Prince Albert on the N1 national road is the village of Leeu-Gamka (population 2,727), while Klaarstroom (population 584) is to the east of Prince Albert at the mouth of Meiringspoort.



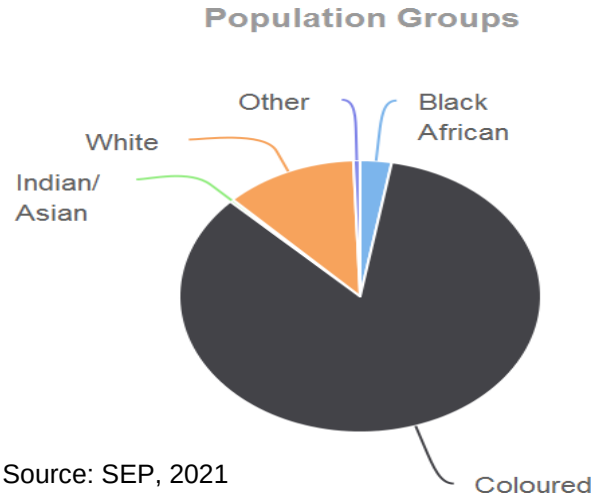
3.1.4 Gender

The below graph illustrates the Prince Albert Municipality's (PAM) population within their respective age groups for males and females respectively. The age distribution in a society is also a determinant for the government institutions to supply appropriate social investments for the relevant age groupings. At a municipal level the age group between 15 to 35 years, this is categorized as youth, the most dominant in PAM. This is the same group that forms part of the active labour group, which is also sexually active. This is the most vulnerable group to the social ills including unemployment, prone to HIV/ Aids and other infections, involvement in crime and drugs etc. Improper handling of this group may result to negative social challenges. The huge numbers of this age group call for a need for creation of employment opportunities, provision of educational facilities to cater for their needs. Failure to do so will result to a

huge influx of youthful members of PAM to other major towns for better employment and education opportunities. Thesenior citizens record the lowest number in the PAM.

3.1.5 Population Groups

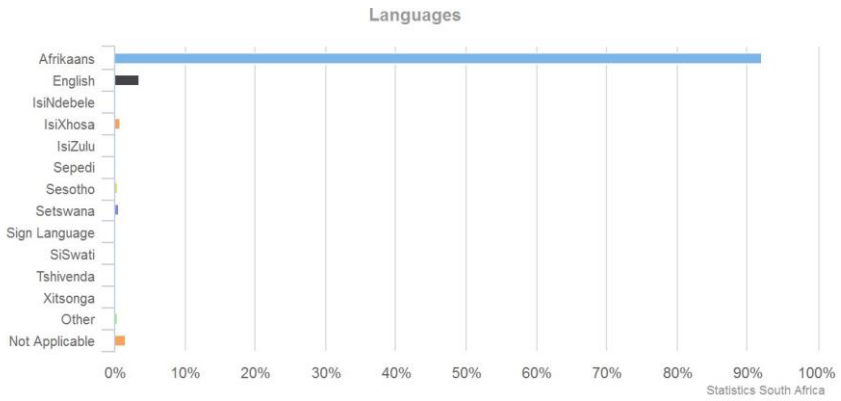
According to the Socio-Economic Profile, 2021 the municipality has a population of 14 671 people in 3 607 households. Of this population, 84.5% is, “Coloured”, 11.8% “White” and 2.8% as “Black African.



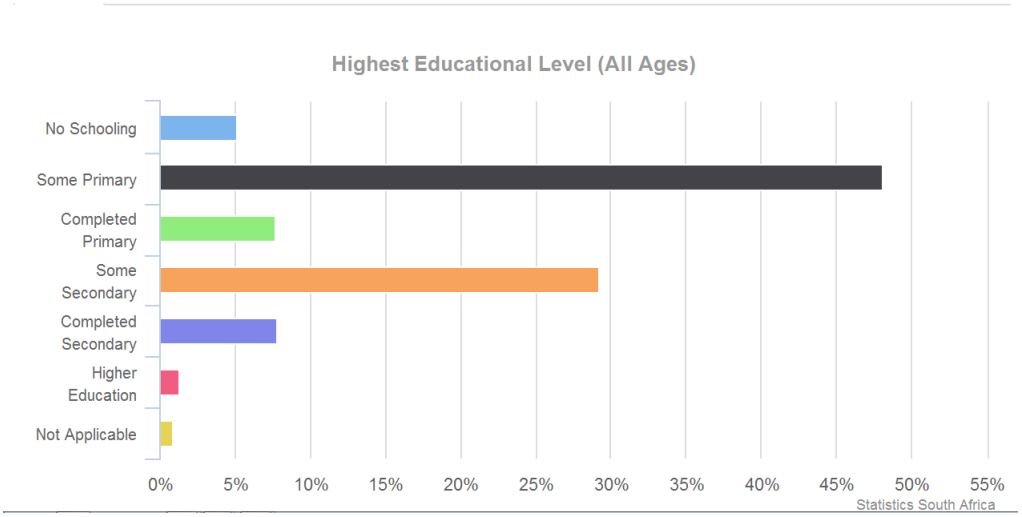
Source: SEP, 2021

3.1.6 Language

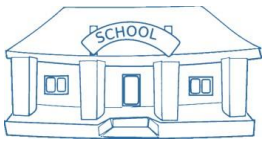
Afrikaans is the most prominent language spoken by residents, with 93.5% of the population, while 3.6% speak English and 0.9% speaks Xhosa as shown in the graph below.



3.2 Education levels



Source: Stats SA



The above diagram illustrates the literacy levels in the greater Prince Albert municipal area. The graphs indicate that 8% of the population had finished secondary school, while 2, 5% had higher education. Twenty-nine per cent had not finished their secondary education, while 48% had not finished their primary education. It should also be noted that this part seeks to address strategic objective 6: To commit to the continuous improvement of human skills and resources To deliver effective services

The Department of Social Development defines people aged 14 years and older as literate if they have successfully completed 7 years of formal education (passed Grade 7). An illiterate person would therefore be someone aged 14 years and older with less than 7 years of formal education completed. The literacy rate in Prince Albert was recorded at 69.9 per cent in 2016 which is lower than the average literacy rates of the Central Karoo District (73.4 per cent) the Western Cape (87.2 per cent) as well as the rest of South Africa (80.9 per cent)

3.2.1 Learner-teacher ratio

The learner-teacher ratio within Prince Albert was at its lowest in 2012 at 21.9 learners per teacher, increased to above 30 per teacher in 2016 and 2018 and increased further drastically to 58.4 learners per teacher in 2020. According to the Department of Education the number of learners per teacher was 30.3 in 2010. Factors' influencing the learner-teacher ratio includes the ability of schools to employ more educators when needed and the ability to collect school fees (Source: Western Cape Department of Education, 2020).

3.2.2 Grade 12 Drop-Out Rates

The drop-out rate for learners in Prince Albert that enrolled from grade 10 in 2016 to grade 12 in 2020 was recorded at 48.1 per cent, which is lower than the average drop- out rate for the Central Karoo District over the same period. The high levels of high school drop-outs are influenced by a wide array of factors, including socio-economic factors such as teenage pregnancies, poverty, indigent households, and unemployment (Source: Western Cape Education Department, 2020).

The availability of adequate education facilities such as schools, FET colleges and learning facilities equipped with libraries and media centres will have a positive effect on academic outcomes. The Prince Albert municipal area currently has no higher learning institutions, the nearest FET colleges (South Cape) are in Oudtshoorn and Beaufort West.

In 2018, there were a total of 5 schools in Prince Albert that had to accommodate 2 239 learners. Given the current extent of economic hardship, increasing living costs are putting additional strain on parents to afford school fees. To alleviate some of the funding challenges and to grant children access to their fundamental right to basic education, the Western Cape Department of Education offered certain fee-paying schools to become no fee schools. To this extent, most schools within Prince Albert (80 per cent) were considered no fee schools in 2020, which bodes well to improve access to quality education.

Prince Albert town now hosts three private education schools as an alternative to parents sending their children to schools outside the boarders of the municipality. The numbers of students are ever increasing and recently one of the schools has been approached by parents outside of the municipal area to accommodate their children at the private schools.

As it has been well documented that there is a strong relationship between access to media centres and academic achievement, the fact that 4 out of 5 schools in Prince Albert had a media/library centre in 2020, bodes considerably well for future improved educational outcomes. The Municipality strengthened access to media centres in partnership with the Office of the Premier by establishing Access Centres in Klaarstroom, two in Prince Albert and two in Leeu Gamka. These Access Centres provides free after-hours computer access and training to not only school students, but also entrepreneurs, NGO’s and the general public. There is however, a need to enhance the training provided to the visitors and participants at the Access Centres to maximise the potential benefits of the Centre.

There is a need to establish a secondary school in Leeu-Gamka that will provide education to the learners of Prince Albert Road, Leeu-Gamka and Merweville. At present, children must be transported to Beaufort-West at huge cost to both government and parents. The vast travelling also undermines quality of life and increases the risk of road fatalities. It is understood that there is no funding to build an

additional school building, but consideration should be given to build extra class rooms to the existing school and then to accommodate the secondary learners there.

Several student parents have opted for a home school option. This option is followed as parents believe it will provide quality education and allows them the opportunity not to send their children away for schooling. The challenge with this school is that it operates as an illegal land use activity and is thus not viable.

3.2.3 Further Educational Facilities

The establishment of a Community Learning Centre might be the greatest game changer with the most long-term benefits proposed for Prince Albert municipal area and is one of the Municipality's goals. It is believed that it could single handily change the future of Prince Albert for the better. It will influence the mind-set of the town as well as that of individuals. It has the potential to awake sleeping giants and strategically position Prince Albert and individuals, entrepreneurs with vision as worldly role players. The Prince Albert Municipality has, with the support of Department of Environmental Affairs constructed an Environmental Education Centre (EEC) that can facilitate the establishment of a Community Learning Centre. This Community Learning Centre will be our gateway to the world. By equipping it with broadband/fibre Prince Albert can link with learning institutions, universities, and FET colleges.

This has already been done with the opening of the Access Centre at the same venue. Students are afforded the opportunity, not normally afforded to rural areas, to attend accredited courses at affordable cost. The Centre is also equipped with business corners and training venues/facilities. In other words, without necessitating traveling and accommodation, more people can participate and use their disposable income proactively or effectively, for betterment will be within their reach. If this can happen then social ills will be countered for disposable income expenditure can be directed towards opportunities of betterment instead of leisure. The community learning centre facilitates partnerships and collaborative networking with reputable institutions, thus opening Prince Albert to the world and the world to Prince Albert. Satellite computer centres to facilitate community learning are available at Klaarstroom library and Leeu Gamka library. An additional computer access and training centre is situated within the Leeu Gamka community.

Prince Albert do not have any training colleges or entities where residents can further their education. As the area is considered as a poverty pocket within the Central Karoo and Western Cape, residents do not have the necessary funding to further their education and broaden their skills base. Though there may be bursaries to cover the cost of further studies, the accommodation and travel cost are not always included, and makes further education unaffordable. Bursaries are also targeting only youth and do not address those already out of school. It also does not speak to pre-completion exits of scholars. As

indicated above, the skills levels are also not aligned to the needs of the job market. This situation condemns residents to lives as unskilled labourers and do not support the business sector.

The high cost of traveling and accommodation to educational facilities outside the boundaries of the municipality makes further education unaffordable. It encourages early drop-out in schools as students realise their parents will not be able to pay for further studies and they will be limited to first-entry jobs. This situation limits residents' employment and income generating opportunities as low skills levels implies low remuneration. Many of the young people that cannot afford the cost of higher education ends up as participants in the Expanded Public Works Programme or Community Works Programme that provides a safety net against poverty, but have no real potential of developing marketable skills in the employment sector, dooming participants to a life of borderline poverty.

With a community condemned to poverty, social ills such as substance abuse, family and gender violence, criminal activity and grand dependency fosters a hand-out dependency culture which is detrimental to the sustainability of the town. The Municipality tries to address these challenges by facilitating training that will enhance the community members' skills base to make them more competitive in the labour market. Training courses is provided free of charge to participants on subjects such as call centre skills development, project management, plumbing, water processing, road construction, entrepreneurship and sports administration and coaching. These initiatives are done in partnership with government and the private sector with the Central Karoo District Municipality playing a pivotal role.

3.2.4 Matric pass rate

The matric pass rate for Prince Albert was 71.2% in 2018, and dropped to 57.4% in 2019 and increased to 90.0% in 2020. This measurement is vital as it impacts learner access to higher education institutions in order to broader access employment opportunities.

The decrease in some years can be attributed to several socio-economic factors such as increased teenage pregnancies, extent of substance abuse, learner-teacher ratios, etc. (Source: Western Cape Department of Education, Annual Survey of public and independent Schools (ASS) 2018)

It should however be noted that despite these negative figures and even though matric pass rates are an important education indicator, it is not the sole measure of quality education.

3.2.5 Early Childhood Development (ECD)

There are seven (7) ECD Centres in the Prince Albert area, four (4) in Prince Albert, two (2) in Leeu-Gamka and one (1) in Klaarstroom. The communities especially, Leeu Gamka highlighted the need for the ECD centre to be relocated closer to the community as there is a high risk crossing the N1.

3.3 People living with disabilities

Although the Constitution of South Africa protects the rights of people with disability and prohibits discrimination on the basis of disability, limited facilities currently exist in the Prince Albert area for people living with disability. Currently public amenities such as libraries, community halls, municipal offices & buildings and road infrastructure do not cater for people with disabilities. Council has however lately demonstrated more cognizance of this fact and new buildings and renovations to existing infrastructure are developed in such a way that access for people with disability are provided for. These include the main municipal building and the local magistrate's court. The municipality has recently embarked on a survey to determine which public facilities and businesses are disabled-friendly. In addition to the Municipality's constitutional obligation in this regard, it is imperative that greater consideration be given to disabled access, for the area to grow as a tourist destination. At present only five tourist establishments (out of the more than 100 establishments) are disabled-friendly. Consideration should be given in ensuring that disabled access be made conditional on approval of building plans and land use applications.

Many municipalities, such as Prince Albert, have not yet taken important steps to eliminate or reduce barriers to full participation in society by people with disabilities. The Constitution record government's commitment to attaining social justice and improving the quality of life for everyone, placing a high premium on human dignity for all. In order to ensure that Prince Albert Municipality delivers on these Constitutional rights the Municipality tasked three disabled people in our municipal area to evaluate the status quo in respect of access in our area. The results included:

- Infrastructure not accessible (potholes, gravel)
- Businesses and open spaces difficult to access (no ramps, potholes, etc)
- No recreational facilities or events
- No job opportunities
- Negative Social attitude

The Municipality will thus in future embark on the following initiatives:

- Sensitize community and staff on the needs and reality of disabled people
- Ensure that all municipal buildings and recreational facilities are disabled friendly
- Embark on a program to repair potholes and ensure access and mobility to disabled
- Enforce disabled requirements in all public buildings / businesses
- Improve communication with disabled persons

- Encourage and facilitate participation of people with disabilities in local government structures, including the provision of transport to and from consultative meetings.
- Provide books in libraries for people with sensory needs.
- Encourage the forming of partnerships with disabled people's organizations.
- Continue support to Health Sector in repair of wheelchairs.

3.4 The Elderly

The elderly are often neglected in municipal planning, especially the poorer and more vulnerable people who cannot afford decent housing. While there are a facility catering for the wealthier retirees and aged, the same cannot be said for the bottom-end of the market. Recreational activities for the aged are mostly organised by the wealthier retirees amongst themselves, leaving the poorest of the poor fending for themselves. The municipality will support and facilitate programs of the Department of Social Development to ensure the protection of the rights of the aged in our communities as per the signed Memorandum of Agreement with this Department.

A special engagement with the sector servicing the Elderly was held and the following input were provided by them: Huis Kweekvallei provides permanent care to 69 elderly residents and an additional 13 elderly who receive meals daily. They receive subsidies for 40 residents at R2 200 per person, but must subsidise the rest out of own funding. Huis Kweekvallei facilitates sport and recreational games for residents and is supported by 40 volunteers from within the community. The municipal library service visits them on a weekly basis. The Prince Albert Service Centre provides breakfast and lunch to fifteen elderly persons. They only receive subsidies for fifteen people.

Challenges faced by the Elderly include the following:

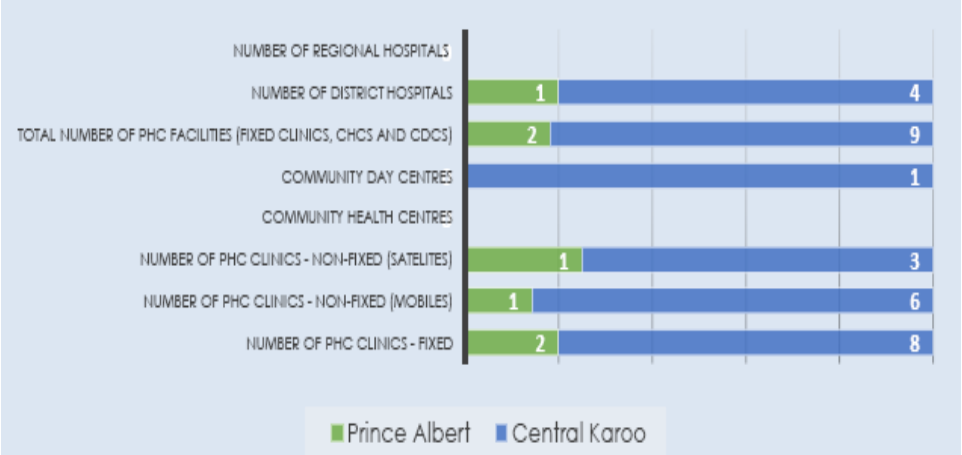
- A machine to process nappies in order to allow for save, environmentally friendly disposal
- Infrastructure that is suitable for the aged (no potholes)
- Transport for the service centre
- Financial support

3.5 Health

Good health is vital to achieving and maintaining a high quality of life. A diverse range of factors play a role in ensuring the good health of communities and that disease, especially preventable and contagious/communicable ones, are kept at bay. Some of the factors include lifestyle features that also depend on the provision of high

quality municipal services, such as clean water, sanitation, and the removal of solid waste. The information provided by the Department of Health as detailed in this section, pertains only to public sector healthcare institutions.

All citizens' right to access to health care services are directly affected by the number and spread of facilities within their geographical l reach. South Africa's healthcare system is geared in such a way that people must move from primary, with a referral system, to secondary and tertiary levels.



Source: 2020 SEP report

The Central Karoo District has a range of primary healthcare facilities which includes 8 fixed clinics, 9 mobile/satellite clinics, 1 community day centre and 4 district hospitals. Of these facilities, 2 fixed clinics, 2 mobile/satellite clinics and 1 district hospital are situated within the prince Albert municipal area.

3.5.1 EMS

Health indicator	Prince Albert	Central Karoo
EMS operational Ambulances	5	15
Population (2020)	14 671	78 022
No of operational ambulances per 10 000 people	3.58	2

Source: 2020 SEP report

Access to emergency medical services is critical for rural citizens due to rural distances between towns and health facilities being much greater than in the urban areas. Combined with the relatively lower population per square kilometre in rural areas, ambulance coverage is greater in rural areas in order to maintain adequate coverage for rural communities. Within the Central Karoo District, Prince Albert has 3.58 ambulances per 10 000 population, higher than the district average of 2.

Though these statistics may be within the Health Departments' norm of acceptable standards, the fact remains that the long distances between the respective towns and medical centra are a non-debatable life-threatening reality. This is more so now that the services at the local provincial hospital in Prince Albert have been further curbed in that the hospital is not allowed to accommodate birthing mothers except if they are already in labour. Pregnant women must be re-routed to medical centres outside the municipal borders, often nearly 200 kilometres away to have their babies. The medical theatre and staff is not equipped to deal with anything but the most basic care. This is seriously hampering not only medical care, but has a very negative impact on the finances of the vulnerable in the community. An accompanying problem that arises is the difficulty that the young parents have in obtaining the correct documentation to register their new borne. Late registration due to difficulty in obtaining the correct documentation may lead to delays in registration of children, resulting in hefty fines for parents.

The role that the home-based care health care programme plays in ensuring the health of community members cannot be emphasised enough. The Home-Based Care givers cover the towns of Klaarstroom, Prince Albert and Leeu Gamka and provide a safety net to the vulnerable in our communities.

3.5.2 HIV

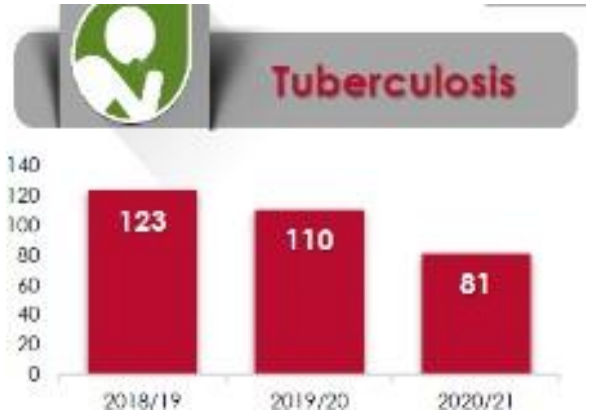
Health Indicator	Prince Albert	Central Karoo
Total registered patients receiving ART	279	2 037
No of new ART patients	15	326
HIV transmission rate	0.0%	3.4%

Source: 2020 SEP report

Patients receiving anti-retroviral treatment in the Prince Albert municipal area decreased by 33 between 2019 (312) and 2020 (279). The 279 patientsreceiving anti-retroviral are treated at 3 ART clinics/treatment sites. A total of 2 037 patients received anti retro viral treatment in CKD in 2020, down from 2050 in 2019.

In addition to improving the quality of life of the patient, anti-retroviral treatment to mothers both before and at birth, also decreases the chances that infants will contract HIV from their mothers. The most recent information for Prince Albert indicates a mother-to-child transmission rate of zero per cent which is lower than the 3.4 per cent District and the 1.4 per cent Provincial rate.

3.5.3 Tuberculosis (TB)



Source: 2020 SEP report

The number of TB patients in the Prince Albert decreased over the past few years, reaching 81 in 2020/21 treated at 6 clinics or treatment sites.

3.6 Child health

Health indicator	2019	2020
Immunisation	122.4%	130.9%
Neonatal mortality rate	26.3	0.0

Source: 2020 SEP report

A fall in the NMR may indicate improvement in new-born health outcomes, or it may potentially reflect reporting constraints.

3.6.1 Maternal health

Health indicator	Prince Albert	Central Karoo
Maternal Mortality ratio	0.0	0.0
Delivery rate to women under 18 years	16.9%	13.3%
Termination of pregnancy rate	0.0	0.0

Maternal mortality rate:

Prince Albert's most recent figures show a maternal mortality ratio of zero per 100000 live births which is the same as the district's ratio. The province has a maternal mortality ratio target of 65 per 100000 live births by 2020.

Births to teenage mothers: In 2020, the delivery rate to women under 20 years in the district was 17.7 per cent. At 11.9 per cent, Prince Albert's rate is lower than the district rate.

Termination of pregnancy: Prince Albert's termination of pregnancy rates of zero per 1000 live births is the same as the districts.

Overall, approximately half of the indicators for child and maternal health have improved in the last year which indicates that Prince Albert is making progress towards reaching its health targets. A concern is with regards to malnutrition rate which has increased sharply in the last year.

3.7 BASIC SERVICE DELIVERY

Basic service delivery is the primary responsibility of municipalities and plays an important role in poverty alleviation. In order to carry out this mandate, sufficient investment in infrastructure is necessary. Basic service infrastructure investment is not only essential to improving livelihoods, but also aids in the creation of jobs during development and maintenance and improving the competitiveness of private businesses. The data presented in this section analysed the state of basic services delivery, basic services infrastructure investment and revenue generation within Prince Albert.

The levels of access to basic services will be discussed below in terms of access to water, sanitation, energy, refuse removal and housing.

3.7.1 Households

In order to ensure basic service delivery to all, municipal budget allocations should be informed by credible and accurate assumptions regarding the number of households within a municipal area.

According to the latest available information from Quantec research for 2019. The latest official statistics was collected by Statistics South Africa for the 2016

Community Survey; the 2021 Census will provide the official statistics. There were 3 607 households within the greater Prince Albert region.

3.7.2 Water

According to the National Development Plan (NDP) all households must by 2030 have access to potable water above the minimum service level. This minimum service level is defined as any household with access to piped water less than 200 meters from their dwelling.

Access to piped water within the Prince Albert Municipal area stands at 98.4%. The municipality only has two informal settlements and access to water is shared between two structures. The Municipality is therefore on track to achieve the minimum servicelevel target as envisaged by the NDP.

3.7.3 Sanitation

Adequate sanitation can be defined as households with access to a flush toilet connected to a sewerage system. The biggest source of sanitationwas access to flush toilets connected to a sewerage system/chemical toilet whilst only 2.1 per cent of households make use of other sources of sanitation. Access to flush toilets/chemical toilets sits at 81.6%. A total of 94 households in Leeu-Gamka, PRASA area however still do not have any access to flush/chemical toilets.

3.7.4 Electricity

Adequate electricity can be defined as households with access toelectricity as primary source of energy for lightning purposes.

The biggest source of energy for lighting purposes in Prince Albert in 2020was electricity whilst 3.0 per cent of households make use of other sources of energy. Access to electricity within the municipal area sits at 95.3%.

3.7.5 Refuse removal

Adequate refuse removal can be defined as households whose waste is removed by a local municipality at least weekly.

Most households in Prince Albert have their refuse removed by local authorities at least weekly (95.4 per cent). Refuse removal takes place twice a week in Prince Albert as to curb illegal dumping.

3.7.6 Housing

The provision of affordable housing units remains a high priority for the Council of Prince Albert Municipality in order to restore the dignity of poor people and provide them with proper shelter asenshrined in Section 26 of the Constitution of South Africa, 1996. Housing can be defined as a formal dwelling. The three spheres of government (national, provincial, and local) share the responsibility for delivery of adequate housing.

The majority of households in the Prince Albert area reside in formal dwellings (93.9 per cent) whilst 6.1 per cent of the households reside either in informal, traditional and other dwellings.

3.8 SAFETY AND SECURITY

3.8.1 Murder

Within the Prince Albert area, the number of murders decreasedfrom 3 in 2019/20 to 2 in 2020/21. Prince Albert's murder rate (per 100 000 people) decreased from 18 in 2019/20 to 13 in 2020/21, while the murder rate (per 100 000 people) for the Central Karroo District also decreased from 33 in 2019/20 to 28 in 2020/21. The murder rate within Prince Albert area is below the district average

MURDER		2018/19	2019/20	2020/21
Actual number	Prince Albert	2	3	2
	Central Karoo District	19	25	21
Per 100 000	Prince Albert	16	18	13
	Central Karoo District	25	33	28

3.8.2 Sexual Offences

Sexual offences include rape (updated to the new definition of rape to provide for the inclusion of male rape), sexwork, pornography, public indecency and human trafficking.

In 2020/21, there were 14 sexual offences in the Prince Albertmunicipal area compared to the 66 reported cases in the Central Karoo District. The incidence of sexual offences (per 100 000 people) in Prince Albert (95) was above the District average (89).

SEXUAL OFFENCES		2018/19	2019/20	2020/21
Actual number	Prince Albert	21	15	14
	Central Karoo District	103	83	66
Per 100 000	Prince Albert	146	105	95
	Central Karoo District	138	111	89

3.8.3 Drug related offences

Drug-related crimes refer to the situation where the perpetrator is found to be in possession of, under the influence of, or selling illegal drugs. Drug-related crime within the Prince Albert area increased from 75 cases in 2019/20 to 89 cases in 2020/21. The Central Karroo District's drug-related offences also increased sharply from 545 in 2019/20 to 711 in 2020/21. When comparing Prince Albert area and the district's rate per 100 000 people, with 610 drug related offences per 100 000 people in 2020/21, the Prince Albert area is below the District's 946.

Drug related offences		2018/19	2019/20	2020/21
Actual number	Prince Albert	187	75	89
	Central Karoo District	853	545	711
Per 100 000	Prince Albert	1 291	511	610
	KarooDistrict	1 138	725	946

3.8.4 Residential Burglaries

The unlawful entry of a residential structure with the intent to commit a crime, usuallya theft.

The number of residential burglaries in the Prince Albert area increased from 62 in 2019/20 to 75 in 2020/21. However, Prince Albert's rate of 511 per 100 000 population was below the District's 625 for 2020/21.

RESIDENTIAL BURGLARIES		2018/19	2019/20	2020/21
Actual number	Prince Albert	54	62	75
	Central Karoo District	518	597	469
Per 100 000	Prince Albert	372	422	511
	Central Karoo District	692	794	625

3.8.5 Driving under the influence (DUI)

A situation where the driver of a vehicle is found to be over the legal blood alcohol limit. The number of cases of driving under the influence of alcohol or drugs in the Prince Albert municipal area shows a decrease from 8 in 2019/20 to 7 in 2020/21. This translates into a rate of 47 per 100 000 people in 2020/21, which is below the district's 66 per 100 000 people in 2020/21.

DRIVING UNEDR THE INFLUENCE		2018/19	2019/20	2020/21
Actual number	Prince Albert	9	8	7
	Central Karoo District	186	240	50
Per 100 000	Prince Albert	60	53	47
	Central Karoo District	248	319	66
Fatal crashes	Prince Albert	6	4	7
Road user fatalities	Prince Albert	29	6	10

3.8.6 Indigent households

The Prince Albert municipal area experienced an increase in the number of indigents between 2017 and 2022, which implies an increased burden on municipal resources. The table below is based on the targets for the respective financial years.

Services	Households 2017/18	Households 2018/19	Households 2019/20	Households 2020/21	Households 2021/22
Water	900	1 100	1 200	1 400	1 400
Electricity	900	1 100	1 200	1 400	1 400
Sanitation	900	1 100	1 200	1 400	1 400
Refuse removal	900	1 100	1 200	1 400	1 400

3.9 THE ECONOMY

3.9.1 Sectoral Overview

In 2019, the economy of Prince Albert was valued at R500. 5 million (current prices) and employed 3 878 people. Historical trends between 2015 and 2019 indicate that the municipal area realised an average annual growth rate of 0.6 percent which can mostly be attributed to the tertiary and secondary sectors that registered overall average annual growth rate of 1.9 percent and 0.6 percent, respectively.

In terms of sectoral contribution, the agriculture forestry & fishing sector (R87.5million in 2019 or 17.5 percent of total GDPR) was the main driver of growth in the Primary sector, while the General Government (R121.0 million or 24.2 percent), whole sale and retail trade, catering and accommodation (R74,7 million or 15.0 percent), transport, storage & communication (R44.1million or 8.8 percent) and finance, insurance, real estate and business services (R42.1 million or 8.4 percent) sectors were the main drivers that contributed to the positive growth in the tertiary sector.

The agriculture forestry & fishing sector is estimated to have performed relatively well in 2020, coming in with estimated growth of 11.6 percent. General government is also estimated to have grown strongly at 2.0 percent in 2020.

Employment creation for 2020 was poor overall, with most sectors registering poor employment growth or contractions in the number of jobs per sector. Overall, 192 jobs were shed, mostly through the losses in Community, social & personal services (loss 56 jobs), the wholesale & retail trade, catering & accommodation (loss of 51jobs) and Agriculture, forestry & fishing (loss of 42 jobs).

3.9.2 Formal and informal employment

It is estimated that Prince Albert's total employed will in 2022 amount to 3 686 workers of which 2 770 (75.1 percent) are in the formal sector while 916 (24.9 percent) are informally employed.

Most of the formally employed consisted of low-skilled (44.5 percent) and semi-skilled (38.2 percent) workers. Although the skilled category only contributed 17.2 percent to total formal employment (2020), it outpaced the other two categories in terms of average annual growth – between 2016 and 2020, the skilled cohort grew on average by 1.3 percent (albeit off a small base) while the semi-skilled and low-skilled categories grew at 0.6 and-1.3 percent, respectively. The growth in the skilled category reflects the market demand for more skilled labour. Evidently, the demand for skilled labour is on the rise which implies the need to capacitate and empower low-skilled and semi-skilled workers.

3.9.3 Unemployment

Prince Albert's unemployment rate of 16.5 percent in 2020 was the second lowest in the Central Karoo District (20.3percent). It was however notably lower than that the Western Cape's unemployment rate of 18.9 percent. The unemployment rates are concerning given that this estimate is based on the narrow definition of unemployment i.e., the percentage of people that are actively looking for work, but unable to find employment. In turn, the broad definition refers to people that want to work but are not actively seeking employment (excludes those who have given up looking for work).

SECTOR	GDP R			EMPLOYMENT		
	R million value 2019	Trend 2015 – 2019	Real GDP R growth 2020e	Number of jobs 2019	Average annual change 2015 – 2019	Net change 2020E
Primary sector	87.5	-2.6	11.6	1 352	37	-42
Agriculture, forestry &fishing	87.5	-2.6	11.6	1 352	37	-42
Mining & quarrying	-	-	-	-	-	-
Secondary sector	69.7	0.6	-13.4	281	-2	-41
Manufacturing	17.3	3.2	-2.6	42	0	-4
Electricity, gas & water	14.7	2.2	-4.4	11	0	-1

Tertiary sector	343.3	1.9	-4.1	2 245	59	-109
Wholesale & retail trade, catering & accommodation	74.7	-0.2	-10.7	674	13	-51
Transport, storage & communication	44.1	1.6	-14.8	110	2	-3
Finance, insurance, real estate &business services	42.1	3.8	-2.2	210	6	-9
General government	121.0	2.2	2.0	578	7	10
Community, social & personal services	61.4	2.6	-1.4	673	20	-56
Prince Albert	500.5	0.6	-18	3 878	84	-192

Skills level	Skill level	Average	number of jobs	
Formal employment	**Contribution (%)**	**growth (%) 2016 - 2020**	2019	2020
Skilled	17.2	1.3	491	477
Semi-skilled	38.2	0.6	1 100	1 059
Low skilled	44.5	-1.3	1 303	1 235
Total	100.0	-0.2	2 894	2 770

Informal employment	2015	2016	2017	2018	2019	2020
Number of informal jobs	1 113	1 034	1 057	1 023	984	916
% of total employment	29.0	27.1	27.5	26.5	25.4	24.9

Unemployment rate	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**
Prince Albert	17.0	17.7	18.3	17.6	18.4	16.5

3.9.4 PRINCE ALBERT SWOT ANALYSIS

The following table illustrates the Prince Albert municipality's main strengths, weaknesses, opportunities and threats that are based on the municipalities seven strategic goals:

Strengths	Weaknesses
• Relatively low crime • Tourism destination • Good Agricultural sector • High temperatures • Well managed town • Stable political environment • Functioning ward committees • Stable community • Good public participation record • Audit committee established and functional • Clean environment • Close to national roads, N1 & N12 • Silent and calm environment • Popular place for adventures sports, cycling routes and hiking trails	• Some rural communities still have gravel roads • Potholes in some areas • Inadequate storm water drainage in some areas; • Ageing service infrastructure • Water storage capacity • Limited public transport options • Limited marketing • Professional capacity shortage • Division in the private sector, rather than cooperation • Objections to reasonable and needed development • Geographic isolation • Apartheid spatial legacy
Opportunities	**Threats**
• Many development opportunities • Improve Public Transport Capitalising on the Extended Public Works Programme • SMME Development • Agri-processing	• HIV & AIDS • Increase in crime • ESKOM price increase • Government Grant Dependency • Increasing climate change, Droughts • Brain drain • Covid-19 pandemic

4. FUTURE DEMAND ASSESSMENT

4.1 DEMOGRAPHICS PROFILE

4.1.1 Population and Households

Prince Albert's municipal area is divided into four wards. Ward, one includes the Leeu Gamka and Prince Albert Road areas, including surrounding farms, while ward 2 represents Klaarstroom, the farming areas surrounding Seekoeigat, Oukloof Dam and Drie Riviere as well as South End, Ward three includes the portion of Prince Albert North End surrounding the Pentecostal Protestant Church, while ward 4 includes the area of Rondomskrik and West end in Prince Albert. According to the 2020 projection population and household growth, PALM has a total population of 14 381 people, of which 84,5% are coloured, 11,8% are white, with the other population groups making up the remaining 3,7%.

Table 18 shows the 10-year (2020-2030) population and household projections for what are considered in the Municipal Spatial Development Framework as low (0.67%), medium (1.1%) and high (1.73%) growth scenarios.

Table 18: Projected 10-year (2020-2030) Population and Household Growth and Land Requirement Scenarios for each Sub Place and Town

Area	Growth Rate %	Rank	Base Population 2020	Base No. of Households 2020 (Household size 3.8)	Projected Population 2025	No. of Households 2025	Projected Population 2030	No. of Households 2030	Additional People 2020-2030	Additional Households 2020-2030	Land Required @ 25duha	Land Required (ha)
Prince Albert TownSP	0.67	Low	1153	303	1192	314	1233	324	80	21	0.84	34
	1.1	Med			1218	321	1287	339	134	35	1.41	
	1.73	High			1257	331	1371	361	218	57	2.29	38
North End SP	0.67	Low	6595	1736	6820	1795	7052	1856	457	120	4.81	
	1.1	Med			6968	1834	7362	1937	767	202	8.07	44
	1.73	High			7191	1892	7841	2063	1246	328	13.11	
Bitterwater SP	0.67	Low	2290	603	2368	623	2449	644	159	42	1.67	16
	1.1	Med			2419	637	2556	673	266	70	2.80	
	1.73	High			2497	657	2723	716	433	114	4.55	17
Welgemoed & Leeu Gamka SP	0.67	Low	654	172	676	178	699	184	45	12	0.48	
	1.1	Med			691	182	730	192	76	20	0.80	19
	1.73	High			713	188	778	205	124	33	1.30	
Klaarstroom	0.67	Low	644	169	666	175	689	181	45	12	0.47	6
	1.1	Med			680	179	719	189	75	20	0.79	7
	1.73	High			702	185	766	201	122	32	1.28	7
Non-urban	0.67	Low	3045	801	3149	829	3256	857	211	56	2.22	2
	1.1	Med			3217	847	3399	894	354	93	3.73	4
	1.73	High			3320	874	3620	953	575	151	6.05	6
Total Municipal Area	0.67	Low	14381	3784	14871	3913	15378	4047	997	262	10.49	59
	1.1	Med			15194	3998	16053	4225	1672	440	17.60	66
	1.73	High			15680	4126	17097	4499	2716	715	28.59	77

4.2 PROPOSED FUTURE DEVELOPMENTS

For the future land use and water demand scenario the potential future developments for the area were considered. Much of the growth population is likely to take place in the towns of Prince Albert (particularly North End) and Leeu Gamka. The potential areas for future developments are information gathered from the Spatial Development Frameworks prepared for Prince Albert, Leeu Gamka and Klaarstroom.

The potential areas for future developments were identified per town and are shown on Figure 3.1a to 3.1c as follows:

4.2.1 Prince Albert

P1 to P5 (24.9 ha) can accommodate 622 units at 25 dwelling units per hectare (du/ha). P2 can also accommodate a primary / high school.

All future vacant infill totals 62 ha, which can accommodate up to 1624 units at densities between 25-50 du/ha. These areas will take more than 15 years to be developed. See Figure 3.1a

4.2.2 Leeu Gamka

All future vacant infill totals 27 ha which can accommodate 675 units at 25 du/ha, these vacant infills will not be developed within 15 years. A total 19ha of land has been designated for future business, which only if there does become enough opportunity, should housing be pursued in this area. L4 and L5 as per table 23 will See Figure 3.1b

4.2.3 Klaarstroom

All future vacant infill totals 2.29 ha which can accommodate 56 units at 25 du/ha. A total 0.7ha of land has been designated for future business, namely a filling station. See Figure 3.1c

The table 24 below shows the Future Development Areas.

Table 19: Future Development Areas

Future Development Name	Anticipated Land use	Area (ha)	Density (Units per ha)	No of units	Time Relating Phasing
Prince Albert					
P1	RDP Housing and Primary School	15	50	350 - 521	Medium Term
P2		5	50	250	Medium Term
P3	Group housing		50	69	Short to Medium Term
P4	Group housing	3.8	50	190	Medium Term
P5	Group housing	2.5	50	125	Medium Term
Total Prince Albert		**83.3**		**984**	
Leeu Gamka					
L1	RDP Housing			147	Short to Medium Term
L2	Group housing			20	Short to Medium Term
L3	Residential			92	Short to Medium Term
L4	Business	19			Long Term
L5	Mixed Use	27	25		Medium to Long Term

Sub-Total Leeu Gamka		**46**		**259**	
Klaarstroom					
K1	Affordable housing	0.57		14	Short to Medium Term
K2	Affordable housing	0.42		10	Short to Medium Term
K3	Affordable housing	1.3		33	Short to Medium Term
K4	Business	0.7			Long Term
Sub-Total Klaarstroom		**2.99**		**57**	

4.3 FUTURE WATER DEMAND

4.3.1 Future Water Demand

For the purposes of this report, the following land use planning was used to calculate the water and sanitation demand based on The Neighbourhood Planning and Design Guide (2019) published by the Department of Human Settlements:

The table below shows the water demand for the potential future land developments:

Table 20: Future Water Demand

Description	Unit	Qty	Water Demand (kl/unit/d)	AADD (kl/d)	Est. Real losses (%)	Total AADD (kl/d)
Prince Albert						
Stands for low-income housing (waterborne sanitation)	Units	984	0,4	394	25%	493
Leeu Gamka						
Stands for low-income housing (waterborne sanitation) Add 31kl/d for Business 0,55kl/d was used for Mixed Use	Units	259	0,4	130	25%	162
Klaarstroom						
Stands for low-income housing (waterborne sanitation) Add 4kl/d for Business	Units	57	0.4	23	25%	34

4.3.2 Future Sewer Discharge

The sanitation demand (peak daily dry weather flow) was calculated based on 90% of the AADD. See table below:

Table 21: Future Sewer Discharge

Description	Unit	Qty	Sewer flow (kl/unit/d)	PDDWF (kl/d)	Groundwater Infiltration (%)	SW Infiltration (%)	PDWWF (kl/d)
Prince Albert							
Stands for low-income housing (waterborne sanitation)	Units	984	0,36	354	10%	30%	987
Leeu Gamka							
Stands for low-income housing (waterborne sanitation)	Units	259	0,36	93	10%	30%	392
Klaarstroom							
Stands for low-income housing (waterborne	Units	57	0.36	20	10%	30%	119

4.3.3 Water Demand Projections

A summary of the projected water demand for the next 15 years is provided in Table 22 below.

Table 22: Current and Future Demand Summary Projections

USER	ACTUAL PRESENT AADD (kl/d) - 2022	POTENTIAL FUTURE AADD (kl/d) - 2037
PRINCE ALBERT		
Existing formal Stands	2 000	2 120
Potential Future Developments		493
SUB-TOTAL	**2 000**	**2 613**
LEEU GAMKA		
Existing formal Stands	600	655
Potential Future Developments		162
SUB-TOTAL	**600**	**817**
KLAARSTROOM		
Existing formal Stands	120	135
Potential Future Developments		34
SUB-TOTAL	**120**	**169**
TOTAL	**2 720**	**3 599**

4.3.4 Waste Water Discharge Projections

Table 23: Current and Future Discharge Projections

USER	ACTUAL PRESENT PDDWF (kl/d) - 2022	POTENTIAL FUTURE PDDWF (kl/d) - 2037
PRINCE ALBERT		
Existing formal Stands	800	917
Potential Future Developments		354
SUB-TOTAL	**800**	**1 271**
LEEU GAMKA		
Existing formal Stands	296	315
Potential Future Developments		93
SUB-TOTAL	**296**	**408**
KLAARSTROOM		
Existing formal Stands	44	55
Potential Future Developments		20
SUB-TOTAL	**44**	**75**
TOTAL	**1 140**	**1 754**

4.4 IMPACT OF PROJECTED FUTURE DEMAND

The impact that the projected future demand will have on the water infrastructure per town is as follows:

4.4.1 Prince Albert Water Infrastructure

Demand: The existing demand is 2000 kℓ/d which will increase to 2613 kℓ/d when the proposed developments are established.

Water Source: The current licenced abstraction at Prince Albert is 700 Mℓ/a. The existing demand is 657 Mℓ/a, and the future demand is 881 Mℓ/a. The current licenced abstraction is sufficient for existing demand only and not for the future demand. PALM to increase the current licenced abstraction to meet the future demand.

Water Treatment Plants: The capacity of the treatment works is 3.0 Mℓ/d which is sufficient for the current demand and the future demand.

Storage: The existing capacity of the reservoirs is 4 000 kℓ which is sufficient for the existing demand. For Future demand an additional 1.5 Mℓ reservoir capacity will be required to service the proposed residential areas.

4.4.2 Leeu Gamka Water Infrastructure:

Demand: The existing demand is 600 kℓ/d which will increase to 817 kℓ/d when the proposed developments are established.

Water Source: The current licenced abstraction at Leeu Gamka is 31 Mℓ/a. The existing demand is 219 Mℓ/a, and the future demand is 298 Mℓ/a. The existing and future demands are more than the current licenced abstraction. PALM to increase the current licenced abstraction to meet the current and future demand.

Water Treatment Plants: The capacity of the treatment works is 0.5 Mℓ/d which is not sufficient for the current and the future demand. Plant to be upgraded to 1 Mℓ/d to accommodate both the current and future demand.

Storage: The existing capacity of the reservoir is 1 000 kℓ which is sufficient for the existing demand. For Future demand an additional 1.0 Mℓ reservoir capacity will be required to service the proposed residential areas.

4.4.3 Klaarstroom Water Infrastructure:

Demand: The existing demand is 120 kℓ/d which will increase to 169 kℓ/d when the proposed developments are established.

Water Source: The current licenced abstraction at Klaarstroom is 61.8Mℓ/a. The existing demand is 43.8 Mℓ/a, and the future demand is 61.7 Mℓ/a. The existing licenced abstraction is sufficient for the existing and future demand.

Water Treatment Plants: The capacity of the treatment works is 0.36 Mℓ/d which is sufficient for the current demand and the future demand.

Storage: The existing capacity of the reservoirs is 530 kℓ which is sufficient for the existing demand and future demand.

4.5 HYDRAULIC ANALYSIS AND MODELLING – EXISTING SYSTEM

4.6 WATER DEMANDS AND PEAK FACTORS

4.6.1 Present and future AADD's

Existing systems were evaluated based on the existing AADD as documented, including UAW.

For planning of future systems, it was accepted that all existing vacant stands are occupied and are using water in accordance with the assumed UWD's, and AADD's of all potential future developments were added.

4.6.2 Peak factors

The peak factors used for this study are dependent on type of land use in the area under consideration, and the magnitude of water demand in the area, and are prescribed in Table J9 of The Neighbourhood Planning and Design Guidelines (Guidelines for Human Settlement Planning and Design - Dept. of Housing, July 2019).

4.7 OPERATIONAL CRITERIA

4.7.1 Maximum and minimum pressures, Firefighting flows

The pressure criteria used for the evaluation and planning of the reticulation networks and the Firefighting flow and pressure criteria are as per Table J.17 the requirements are in conformity with those prescribed by the Neighbourhood Planning and Design Guidelines (Guidelines for Human Settlement Planning and Design - Dept. of Housing, July 2019).

4.7.2 Flow velocities

Flow velocities must be limited in order to protect pipeline coatings and reduce the effects of water hammer. The preferred maximum allowed is 1,8 m/s, but an absolute maximum of 2,2 m/s is acceptable where only intermittent peak flows occur.

4.7.3 Pump stations (PS)

PS should always have one standby pump available. An electrically driven standby pump should suffice except in the case of high-risk areas, where the standby pump should be diesel-driven.

4.7.4 Redundancy

Within distribution networks to end-users, branched systems should be avoided as far as possible, i.e., there must be at least two directions of flow to a consumer. For bulk supply systems branched portions may be acceptable, due to the role of reservoirs, and redundancy refers more to the level of integration in the system.

4.8 RESERVOIR SUPPLY RATES AND STORAGE CAPACITIES

The criteria for total reservoir volume used in this study for evaluation and planning is 48 hours of the AADD (of the reservoir supply zone) for gravity and pumped supply to the reservoir, as The Neighbourhood Planning and Design Guidelines (Guidelines for Human Settlement Planning and Design - Dept. of Housing, July 2019).

4.9 EXISTING WATER SYSTEM

4.9.1 Overview

The results of the existing water system analysis are presented in the following figures:

- Figure 3.2 shows the existing water static pressures in each system, thus the maximum pressure that could be expected in the system at any time.
- Figure 3.3 shows the existing water residual pressures in each system under peak hour demand conditions.
- Figure 3.4 shows the existing water peak flow velocity in each system under peak hour demand conditions.

4.9.2 Water Distribution network

Prince Albert

The static analysis indicates no areas where pressures exceed 90 m.

The residual pressures in the existing system under peak hour demand conditions are mainly in the 24m to 90m range, except for the higher lying areas of the Klippies and Staandak zone

There are no pipes with velocities exceeding 1,5 m/s in the system.

Leeu Gamka

The static analysis indicates no areas where pressures exceed 90 m. The higher lying erven of Leeu Gamka experience pressures below 24m.

The residual pressures in the existing system under peak hour demand conditions are mainly between the 15m to 24m range. This is due to the low-lying nature of the reservoir.

There are no pipes with velocities exceeding 1,5 m/s in the system.

Klaarstroom

The static analysis indicates that the higher lying erven to the north east of Klaarstroom experience pressures below 24m. There are no areas where pressures exceed 90 m.

The residual pressures in the existing system under peak hour demand conditions are mainly between the 15m to 24m range. This is due to the low-lying nature of the reservoir.

There are no pipes with velocities exceeding 1,5 m/s in the system.

4.9.3 Feeder mains

All the feeder mains in PALM has sufficient capacity.

4.9.4 Pumping stations

The capacities of the pumps in PALM are sufficient for the existing water demands.

4.9.5 Existing Required Works

Figure 3.5 show that there are no existing required works on the water system on all the areas of PALM.

4.10 FUTURE WATER SUPPLY SYSTEM

4.10.1 PRINCE ALBERT

Proposed distribution zones

The proposed future distribution zones are indicated on Figure 3.7a

The changes to the existing distribution zones are the following:

The boundaries of the Klippies and Staandak zone, the Hoe Druk zone and the Noord End Oud zone are increased to accommodate future development areas in the zones.

A new Reservoir 6 booster zone is proposed for future development areas P1 - P5

Proposed future system and required works

The existing Prince Albert water distribution system has insufficient capacity to supply the future water demands for the fully occupied scenario and the additional future development areas.

A few distribution pipelines are required to reinforce water supply within the Prince Albert distribution network.

The proposed master plan items are presented in Figure 3.8a

Bulk System

The existing bulk water supply system has sufficient capacity to supply the future water demands for the fully occupied scenario and the additional future development areas.

Feeder mains

No feeder mains require upgrading in future.

Pumping stations

- New Reservoir 6 booster pump station.

4.10.2 LEEU GAMKA

Proposed distribution zones

The proposed future distribution zones are indicated on Figure 3.7b

The only change to the existing distribution zone is that the existing boundary of the existing zone is increased to accommodate future development areas.

Proposed future system and required works

The existing Leeu Gamka water distribution system has insufficient capacity to supply the future water demands for the fully occupied scenario and the additional future development areas.

The proposed master plan items are presented in Figure 3.8b

Bulk System

The existing bulk water supply system has insufficient capacity to supply the future water demands for the fully occupied scenario and the additional future development areas.

Feeder mains

No feeder mains require upgrading in future.

Pumping stations

No future pumping stations are required.

4.10.3 KLAARSTROOM

Proposed distribution zones

The proposed future distribution zones are indicated on Figure 3.7c

The only change to the existing distribution zone is that the existing boundary of the existing zone is increased to accommodate future development areas.

Proposed future system and required works

The existing Klaarstroom water distribution system has sufficient capacity to supply the future water demands for the fully occupied scenario.

The proposed master plan items are presented in Figure 3.8c.

Bulk System

The existing bulk water supply system has sufficient capacity to supply the future water demands for the fully occupied scenario.

Feeder mains

No feeder mains require upgrading in future.

Pumping stations

The pump station in Klaarstroom requires upgrading and refurbishment.

5. INSTITUTIONAL ARRANGEMENTS AND REQUIRED AUTHORIZATIONS

5.1.1 Introduction

Institutional arrangements are policies, systems, processes, and structures used by the municipality to legislate plan and manage their activities efficiently and effectively coordinate with others in fulfilling their mandates.

5.2 Existing PALM Water Services Institutional Arrangements

5.2.1 Water Service Authority Functions and Outputs

PALM is the official Water Services Authority (WSA) within this municipality. Its functions and outputs are briefly summarised in the following table.

Table 24: Functions and Outputs

WSA functions / output	In place? (YES/NO/ N/A)	Resources available to perform function? (YES/NO/N/A)				If NO, when will it be in place?	Support required (YES/NO)
		Budget	Bylaws	Infra-structure	Personnel		
Policy development							
Indigent policy	Yes	Yes	No	Yes	Yes	-	No
Free basic water policy (including equitable share)	Linked to Indigent Policy	Yes	No	Yes	Yes	-	No
Free basic sanitation policy	Linked to Indigent Policy	Yes	No	Yes	Yes	-	No
Procurement policy	Yes	Yes	No	Yes	Yes	-	No
Credit control & debt collection policy	Yes	Yes	No	Yes	Yes	-	No
Regulation & tariffs							
Water services bylaws with conditions as required by the Water Services Act	**No**	No	N/A	Yes	No	2009	**Yes**
Mechanisms to ensure compliance with bylaws	**No**	No	No	Yes	No	2009	**Yes**
Tariff structure	Yes	Yes	No	Yes	Yes	-	No
Tariffs promulgated	Yes	Yes	No	Yes	Yes	-	No
Infrastructure development (projects)							
Mechanisms to undertake project feasibility studies	Yes	Yes	N/A	Yes	Yes	-	**Yes**
Criteria for prioritizing projects	Yes	Yes	No	Yes	Yes	-	**Yes**
Mechanisms to assess and approve project business plans	Yes	Yes	No	Yes	Yes	-	No
Mechanisms for selecting, contracting, managing, and monitoring implementing agents	Yes	Yes	No	Yes	Yes	-	
Mechanisms to monitor project implementation	Yes	Yes	No	Yes	Yes	-	

Water conservation and demand management							
Water conservation and demand management strategy	Draft proposed in WSDP	No	No	Yes	No	2008	**Yes**
Performance management and monitoring							
Performance management systems	**No**	No	No	Yes	Yes	2008	**Yes**
Water service monitoring and evaluation (M&E) system	**No**	No	No	Yes	Yes	2008	**Yes**
WSDP							
WSDP information system	**No**	No	No	Yes	No	2008	**Yes**
Mechanisms for stakeholder participation	Yes	Yes	No	Yes	Yes	-	No
Mechanisms to monitor and report on WSDP implementation	**No**	No	No	Yes	No	2008	**Yes**
WSDP institutional arrangements							
Criteria to select appropriate WSPs	**No**	No	No	Yes	No	2009	**Yes**
Mechanisms to contract, manage and monitor WSPs	**No**	No	No	Yes	No	2009	**Yes**
Mechanisms to approve WSP business plans	**No**	No	No	Yes	No	2009	**Yes**
WSA overall capacity							
Sufficient staff and systems to fulfil all WSA functions.	**No**	No	No	Yes	No	2009	**Yes**
Other (state)	-	-	-	-	-	-	-

5.2.2 WSA Capacity Development

Training and awareness development is continuously promoted by the PALM although funding limits the extent of these awareness campaigns. Wherever new or upgrade developments occur the end users are informed of the benefits and management of these services.

Table 25: Public Awareness and Skills Development

Training and skills development interventions	Up to NQF Level 1	NQF Level 2	NQF Level 3	NQF Level 4	NQF Level 5	NQF Level 6	NQF Level 7	NQF Level 8	Total
ABET	1								1
Client service				3					3
Computer Literacy	3			9		1			13
Financial	3			2		1			6
Project Management / Planning	3			5		1			9

5.2.3 By laws affecting water services

The by-laws for the provision of water and sewer are not in place for the Prince Albert Municipality.

5.2.4 Retail water service providers

PALM acts as both WSA and WSP to the consumers in Prince Albert, Leeu-Gamka and Klaarstroom.

Table 26: Water and Sanitation Resource Availability (Bulk and Retail Functions)

Bulk & Retail Functions	Resources available to perform function? (YES/NO)			
	Budget	Bylaws	Infrastructure	Personnel
1. Water services providers (retail water)	Yes	No	Yes	Yes
2. Water service providers (sanitation)	Yes	No	Yes	Yes
3. Water service providers (bulk water)	Yes	No	Yes	Yes
4. Water service providers (bulk sanitation)	Yes	No	Yes	Yes
5. Support service agents (water)	Yes	No	Yes	Yes
6. Sanitation promotion agent	No	No	No	No
7. Support service contracts	Yes	No	Yes	Yes
8. Water service institutions	No	No	No	No
9. WSP staffing levels: water	Yes	No	Yes	Yes
10. WSP staffing levels: sanitation	Yes	No	Yes	Yes
11. WSP training programme	Yes	No	Yes	Yes

5.2.5 Water Service Provider training programmes

There are no formal training programmes or schedules in place. Training occurs on an ad-hoc base or on the job. No criteria to meet training needs are in place.

5.2.6 Required Authorizations

The municipality does not have plans in place for all authorization requirements in terms of water and sanitation infrastructure.

PALM, as the authority responsible for ensuring access to and delivery of water supply and sanitation services, is authorised by the WSA to choose the appropriate institutional arrangement for providing these services. The process for determining a provider of municipal services may be a rigorous one, but it is important to ensure that providers have the capacity and are well suited to deliver these services.

Once a municipality has selected a preferred institutional arrangement, municipalities, water service providers and water boards must work together in a coordinated way to ensure everyone has access to water services. This entails adequate and coordinated planning, sufficient financial resources, and coordinating tariff structures that are affordable and sustainable. The financial capabilities of the institution, however, pose problems to effective service deliver– which impacts on all other areas of managing water services.

Managing water services is a complex process that involves different institutions working together in a coordinated way. If one institution is not functioning optimally it adversely affects the chain of service delivery, implicating constitutional rights in the process.

5.2.7 Recommended Capacity Development

Capacity building is the process of strengthening a system or organization in order to increases its effectiveness, impacts, and achieve its goals and sustainability over time.

So institutional arrangements for capacity building are the necessary policies, systems and structures used to plan and manage the process of capacity building for an organization in a holistic manner.

It is important for municipality to consider additional measures to boost their capacity.

Below are the recommendations to assist the municipality capacitate the water and sanitation department:

- A focus by the municipality to be on organizational capability development rather than individual capacity building.
- The municipality to have a capacity building programme with clear outcome targets for the water and sanitation department
- The municipality should focus on long term improvements rather than short term fixes.
- Transfer of skills
- Education, training, and public awareness
- Municipality could also request the assistance of MISA with the qualified personnel to assist on a contract basis with the agreement that the municipality will absorb the staff.

6. PROJECT PRIORITIZATIONS AND COST ESTIMATES

The table below indicates the prioritized current water and sanitation projects, funded projects, proposed projects as per WSMP

Table 27: Water and Sanitation Projects

Table 28: Proposed works, cost estimates & phasing – Future systems for Prince Albert

Item No.	Description	Estimated Cost* (R-yr 2022/2023 value)	Time Related Phasing	Comments
Prince Albert				
Distribution System Items				
PAW3.2	155 m x 110 mm Ø supply pipe	R299 613.00	2030	
PAW4.1	290 m x 160 mm Ø supply pipe	R595 205.00	2030	When future areas develop
Sub-totals Distribution System Items		**R 894 818.00**		
Bulk Supply Items				
PAW.B1	New 1,0 Ml reservoir	R3 153 981.00	2030	Required when existing storage nears capacity
PAW.B6	New 21 l/s @ 30m Reservoir 5 Booster pump station	R1 399 535.00	2030	
Sub-totals Bulk Supply Items		**R 4 553 516.00**		
Totals		**R 5 448 334.00**		

Table 29: Proposed works, cost estimates & phasing – Future systems for Leeu Gamka

Item No. (Ref. Fig. 3.8b)	**Description**	**Estimated cost *** (R-yr 2022/23 value)	**Time Related Phasing**	**Comments**
Leeu Gamka				
Distribution System Items				
LGW1.1	480m x 160 mm supply pipe	858 623.00	2025	
LGW1.2	530m x 160 mm supply pipe	924 980.00	2025	
LGW1.3	385 m x 160 mm supply pipe	735 962.00	2030	
LGW1.4	300 m x 160 mm supply pipe	625 367.00	2030	To improve network conveyance
LGW1.5	215 m x 160 mm supply pipe	516 782.00	2025	
LGW1.6	165 m x 160 mm supply pipe	450 425.00	2030	
LGW1.7	675 m x 160 mm supply pipe	1 109 976.00	2030	
LGW1.8	505 m x 160 mm supply pipe	890 796.00	2020	
LGW1.9	830 m x 110 mm supply pipe	900 850.00	2025	
LGW1.10	415 m x 160 mm supply pipe & N1 crossing	1 618 715.00	2030	
LGW1.11	360 m x 160 mm supply pipe	703 789.00	2025	
LGW1.12	310 m x 110 mm supply pipe	436 349.00	2025	
LGW1.13	585 m x 160 mm supply pipe	995 359.00	2025	
LGW1.14	785 m x 110 mm supply pipe	862 644.00	2025	To improve network conveyance
LGW1.15	415m x 110 mm supply pipe & N1-crossing	1 375 405.00	2030	To improve network conveyance
Sub-totals Distribution System Items		**R13 006 022**		
Bulk Supply Items				
LG BW 1	Elevated Tanks @ Newton Park	650 000.00	2030	
LG BW 2	New WTW (RO/UF)	3 000 000.00	2030	
LG BW 3	Upgrade WTW	1 000 000.00	2030	

LG BW 4	Elevated Tanks @ Welgemoed - North End	1 492 500.00	2030	
Sub-totals Bulk Supply Items		**R6 142 500**		
TOTALS		**R19 148 522**		

Table 30: Proposed works, cost estimates & phasing – Future systems for Klaarstroom

Item No. (Ref. Fig. 3.8c)	**Description**	**Estimated cost *** (R-yr 2022/23 value)	**Time Related Phasing**	**Comments**
Klaarstroom				
Distribution System Items				
KW1.1	55 m x 110 mm Ø supply pipe	R243 910	2030	To improve network conveyance
KW1.2	450 m x 160 mm Ø parallel reinforcement of main pipe	R820 417	2030	To improve network conveyance
KW1.3	205 m x 160 mm Ø parallel reinforcement of main pipe	R504 717	2030	To improve network conveyance
KW1.4	290 m x 160 mm Ø supply pipe	R615 312	2030	To improve network conveyance
KW1.5	415 m x 160 mm Ø supply pipe	R774 168	2030	
KW1.6	85 m x 110 mm Ø supply pipe	R237 278	2030	
KW1.7	315 m x 110 mm Ø supply pipe	R442 382	2030	
KW1.8	265 m x 110 mm Ø supply pipe	R398 144	2030	
Sub-totals Distribution System Items		**4 036 328**		
TOTALS		**R 4 036 328**		

7. FUNDING AND IMPLEMENTATION ARRANGEMENTS

Below is the list of all the sources of funding for Prince Albert Municipality:

7.1.1 Sources of Funding

- Municipal Infrastructure Grant (MIG)
- Taxes on water, houses, market, and vehicles
- Tariffs and Levies
- Municipal Drought Relief Grant
- Cumulative Risk Ratio (CRR)
- Expanded Public Works Programme
- Water Services Infrastructure Grant (WSIG)
- DBSA Infrastructure Fund

The Municipality has a total budget of R 75 920 182.41 for water and sanitation projects for 2022 – 2025.

7.1.2 Green Bond Framework / Projects

Green bonds are specifically destined for the funding of projects that are sustainable and socially responsible in areas as diverse as renewable energy, energy efficiency, clean transportation, and responsible waste management.

The green bond framework should be aligned with Green Bond Principles and as such it should rests on the values of transparency, disclosure, and reporting. The green bond principles are set out in terms of four key components, viz. use of proceeds, process for project evaluation and selection, management of proceeds and reporting.

The Municipality to have an independent service provider to review its green bond programme and its compliance with its green bond framework.

PALM during their Local Economic Development review process have identified the Alternative Green Energy Project (develop solar energy, wind farms and waste to energy) with the objective of developing new energy industries to encourage green growth and sustainable development.

The municipality to take the following actions / activities in terms of green projects:

- Research green energy projects relevant to PALM and identify possible business opportunities and investors.
- Source in expertise through external funding to assist municipality to get policies and by-laws in place as prescribed by legislation and regulatory bodies.

7.1.3 Project Implementation

The municipality strive to put people and their concerns first and ensuring constant contact with communities through effective public participation platforms and create conditions for decent living by consistently delivering municipal services to the right quality and standard.

8. RISK MANAGEMENT

8.1 CRITICAL ASSETS TO THE WATER SYSTEM

First, a little about determining which assets should be considered critical to your water system. Critical assets are defined as assets that sustain your water or wastewater systems performance. Determining the criticality of assets is based on an asset having a high risk of failure, and, major consequences if it does fail.

Water and wastewater systems are made up of assets. Some of these assets are buried and are "invisible" while others are visible. Water system assets include **wells, pipes, valves, storage tanks, pumps, water treatment plants** and any other components that are necessary to operate the water system. Wastewater system assets include ponds, mechanical plants, pumps, lift stations, valves, collection lines, force mains, manholes and any other components that are necessary to operate the wastewater system. As a water and/or wastewater system ages and deteriorates, the assets will lose value over time. As this happens, the level of service that the utility's customer's desire may become compromised, operation and maintenance costs can increase and the WSA may have extreme costs that it cannot afford.

8.2 IMPACTS OF FAILURE AND RISK OF CRITICAL ASSETS

8.2.1 Water sources

Contamination and reduced water quantity are two concerned problems associated with water sources. Contamination of source water is of concern because contaminants can enter surface or ground water sources and make it difficult removed in the treatment utilities. Reduced water quantity is of concern because customers would not have enough water if this happened.

The variations of water quantity and quality are important characteristics of a water source since they influence the operations of the following water treatment and the finished water supplied to the customers (WHO, 2004). A water source is vulnerable to multiple external hazards or threats, and would thus be contaminated or in the condition of reduced capacity. Generally, the potential hazards or threats are categorised as natural and human-caused factors. Important natural factors include drought, flood, underground minerals, etc. Human-related factors include sewage discharge, industrial discharge, wilful chemical/biological contamination, etc. For example, discharge of municipal wastewater can be a major source of pathogens; urban runoff and livestock

can contribute substantial microbial load; and serious drought can dramatically reduce the quantity supplied to customers, etc. (WHO, 2004) Associated with these hazards, relative failure states and risks are identified for the water source object and summarised in Table 31.

8.2.2 Water treatment plant

Water treatment, the primary barrier to prevent contaminants from reaching the customer, may not be effective due to failures inside the treatment plant, and thus introduce contaminants to the distribution system analysed the reliability of water supply system by including the reliability of treatment plant operations.

Water treatment plant is the most important facility in a water supply system to remove contaminants in raw water, disinfect treated water, and produce drinkable water to consumers. However, hazards may be introduced during the process of treatment, or hazardous circumstances may allow contaminants to pass through treatment in significant concentrations. Constituents of drinkable water can be introduced through the treatment process, including chemical additives used in the treatment process or products in contact with water. Furthermore, suboptimal filtration following filter backwashing can lead to the introduction of pathogens into the distribution system. Meanwhile extreme natural hazards, wilful human attacks, or interdependency failures (e.g., power failures) can all introduce risks in water treatment process.

.

Table 31: Hazards or threats associated with basic components in a water supply system

Basic components	Failure states	Hazards/Threats	Relative risk
Water source	Natural hazards failure	Drought	Reduced water quantity
	Natural hazards failure	Flood Underground minerals	Water contamination
	Human-caused threat	Sewage discharge Industrial discharge Livestock Chemical/biological	Water contamination
	Interdependence failure	Spills Contaminated site	Water contamination
Water treatment plant	Natural hazards failure	Earthquake Flood	Reduced water quantity and water contamination
	Human-caused threat	Chemical/biological	Water contamination
	Operational failure	Process control Equipment failure Alarm and monitoring Inadequate backup Inappropriate treatment	Reduced water quantity and water contamination
	Interdependence failure	Power failure	Reduced water quantity and water contamination
	Interdependence failure	Contaminated material	Water contamination
Pipe	Natural hazards failure	Earth movement	Reduced water quantity
		Flood	Reduced water quantity and water contamination
	Operational failure	External load Temperature Internal pressure Natural deterioration	Reduced water quantity
	Operational failure	Regrowth of organism Leaching of chemicals	Water contamination
	Interdependence failure	Contaminated water Contaminated soil	Contamination
Pump	Natural hazards failure	Earthquake Flood	Reduced water quantity
	Human-caused threat	Bombing	Reduced water quantity
	Operational failure	Control failure Equipment failure Alarm and monitoring Inadequate backup Age	Reduced water quantity
	Interdependence failure	Power failure	Reduced water quantity
Storage	Natural hazards failure	Animal Rainfall	Water contamination
	Human-caused threat	Disruption of structure	Reduced water quantity
	Human-caused threat	Chemical/biological Contaminated water	Water contamination

8.2.3 Pipes

Pipelines are the most important part in a water distribution network. Extensive research has been performed to analyse the risks associated with them among which are leakage, deterioration, corrosion, contamination intrusion, etc. Leakages of pipes can occur from multiple reasons such as slow deterioration caused by mechanical cycling of pipes, joints, and fittings; corrosion of the internal or external surfaces of network components; specific events and situations such as ground movement, stresses from road traffic, excessive water pressure; and/or faulty workmanship or construction

Leakage rates can range from a slow leak or “drip” to large compromise of integrity called a “main break”. Examples of typical drips include loose joints, gaskets, or service connections. Typical examples of a break include a longitudinal crack in a pipe body or end bell, a circumferential crack in a pipe body, or a through-wall penetration of a network component. Drips usually result in loss of water. While main breaks in large transmission lines could result in wide spread outages and/or present the potential for contamination.

Normally, water contamination events in the pipelines in distribution system can be influenced by five major categories as (Kleiner 1998):

- Intrusion of contaminants into the distribution system through system components whose integrity was compromised or through misuse;
- Regrowth of micro-organisms in the distribution network;
- Microbial/Chemical breakthrough and by-products and residual chemicals from water treatment plant;
- Leaching of chemicals and corrosion products from system components into the water; and
- Permeation of organic compounds from the soil through system components into the water supplies.

Based on the above discussion, Table 31 summarises the hazards, relative failure states and risks associated with pipes in the water supply systems.

8.2.4 Pump

Pumps also play the important roles in the process of delivering water. However, hazards or threats sometimes more easily affect pumps than pipes because it is visible and its normal operation depends highly on control, equipment reliability, and human proper activity. In risk analysis of pumps, analysts must consider all the four failure states, i.e., natural hazard failure, human-caused failure, operational failure, and interdependence failure. Hazards to pumps in a water supply system are listed in Table 31.

8.2.5 Storage

Water storages are another important part contributing to water quality problems in distribution systems besides pipes. Contamination can occur within the distribution system through open or insecure treated water storage reservoirs and tanks, as they are potentially vulnerable to surface runoff from the land and to attracting animals and waterfowl as faecal contamination sources and may be insecure against vandalism and tampering (WHO, 2004). Meanwhile water quantity can also be decreased due to cracks of storage facilities. Table 31 lists the hazards, failure states, and relative risks of storage in water supply systems.

8.3 IMPACT OF LOAD SHEDDING ON THE WATER AND WASTEWATER SYSTEMS

8.3.1 Water and Sewer Treatment Plant

All the Water Treatment Plants in Prince Albert have backup generators, i.e., Klaarstroom and Leeu Gamka have automatic generators and Prince Albert's has a manual generator. Only Leeu Gamka WWTP has a generator and is a manual generator.

With the current state of electricity, the situation of water supply is exacerbated especially where Municipalities are already battling to supply water full time to their communities.

8.3.2 Pumps

We need to understand that when a water pump ceases to operate it is not as simple to replace. There are certain municipal supply chain procedures that must be followed by the Municipality to get the pump either repaired or replaced. This can take weeks or even months. Load shedding does not only stop pumps from working but the whole plant. There are many stages that water goes through in order to be safe for consumption after abstraction from a river or borehole and most processes are done electronically. When the power goes off it means that the plant ceases to operate. PALM to install automatic pumps with back-up power supply in the case of load shedding.

8.3.3 Conclusion

The main challenge for the municipality is enhancing and further developing the current bulk service offering. The municipality stated that power outages and load-shedding have had a notable impact on the operational aspect of water services and other bulk services. This has thus impacted on the overall bulk service security.

Power outages have a noticeable impact on PALM water services infrastructure. Not only have power outage caused damage to existing equipment, but they also have necessitated the purchase of further equipment. Power outages have negatively affected the delivery of potable water to end

users. Pumping is the most critical function in the distribution of water from boreholes and pump stations (used in water/wastewater treatment plants and those used for the reticulation of water).

Power outages have caused damage to infrastructure: telemetry equipment (which electronically interlinks the operation of water systems) and motor equipment are often damaged; pumps are sometimes caused to overheat when power outages impact on normal processes within water and wastewater treatment facilities, as well as the distribution of water to end users. The costs associated with the replacement and repair of broken and damaged infrastructure, due to power outages, is estimated to be ±R 250 000 per year for the total PALM.

Loadshedding not only causes serious damage to expensive machinery and equipment, but also leads to an increase in crime and infrastructure vandalism which is already costing municipalities millions of rands in repair work and replacements – money that was destined for crucial maintenance.

Even though load shedding is the enemy of all, it teaches us a valuable lesson for future planning. As communities continue to grow and more Water and Waste Water Treatment Plants are constructed, backup power supply should be included as part of the plan.

The following Plants require generators:

- Prince Albert WWTP, Klaarstroom WWTP
- Prince Albert WTP has a manual generator this must be changed to an automatic generator in cases where load shedding occurs after hours.

As per MTREF 2022 to 2025 PALM requires an estimated R 3 000 000.00 to purchase power generators to provide back-up for its water services during periods of load-shedding.

It is recommended that the water master plan as described in this report be implemented in order to allow the water distribution system of the PALM to keep in step with the anticipated growth and expansion of water demand.

ANNEXURES

Figure 1.2a: Prince Albert Town and Suburbs

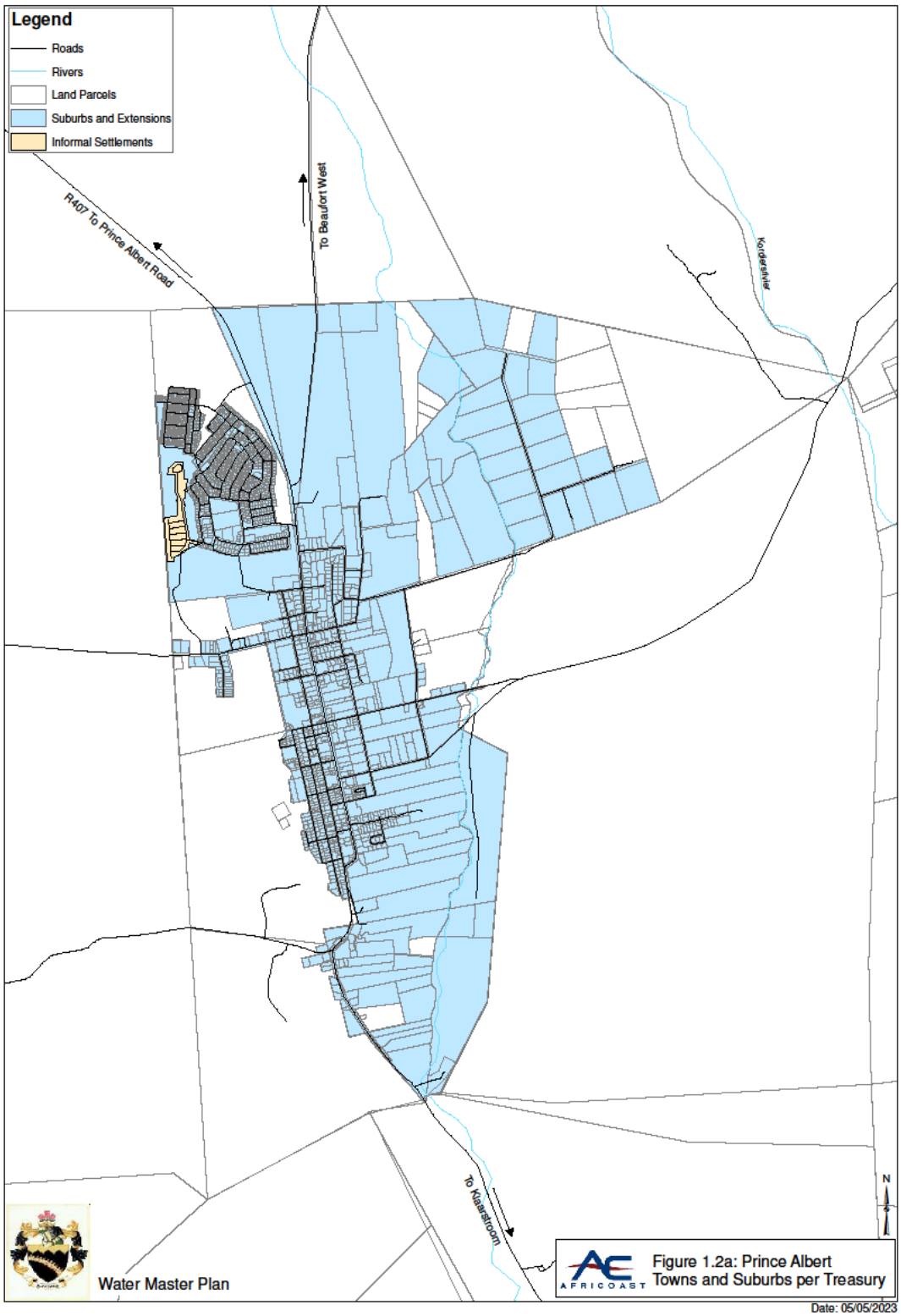


Figure 1.2.b: Leeu Gamka Town and Suburbs

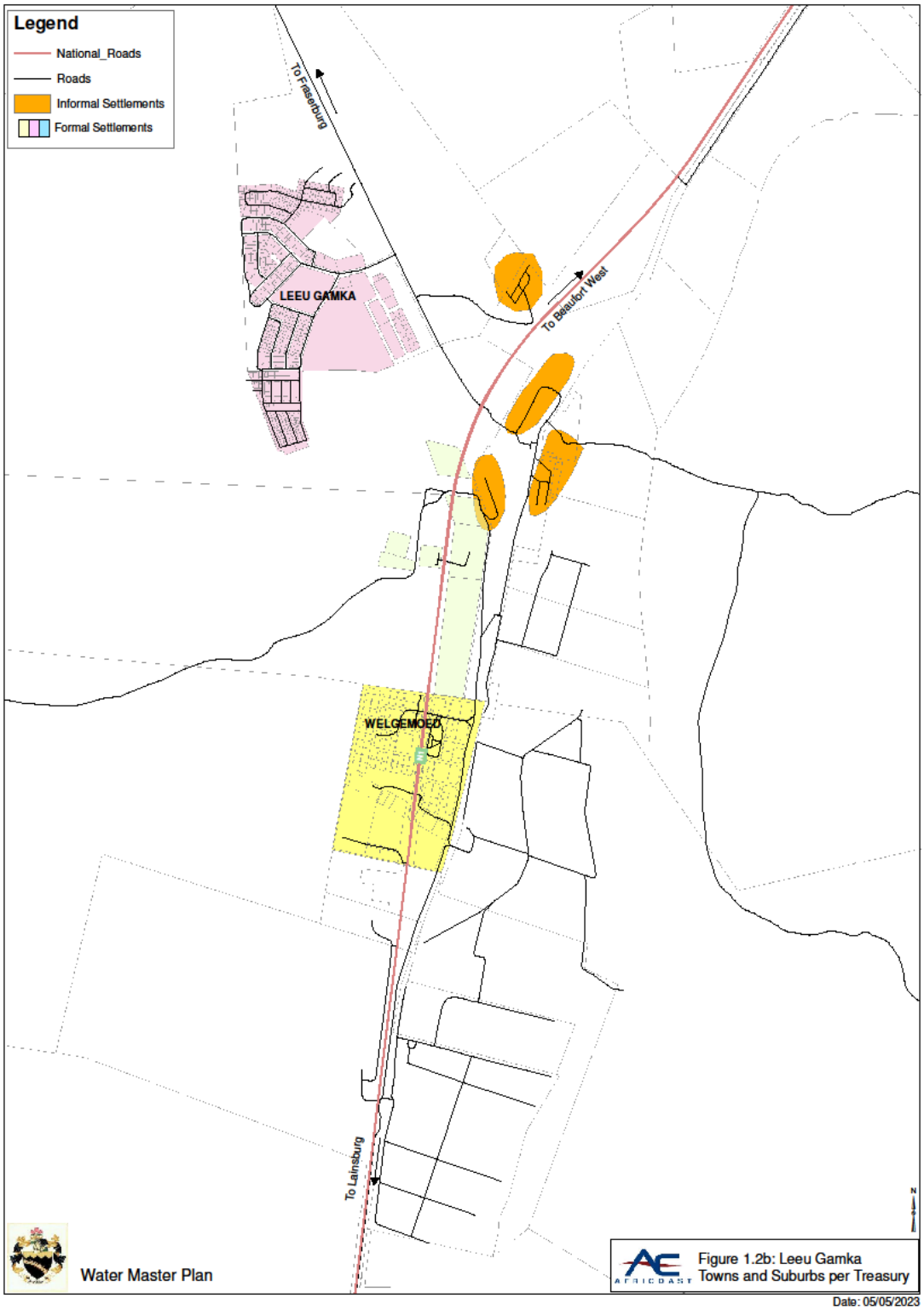


Figure 1.2c: Klaarstroom Town and Suburbs

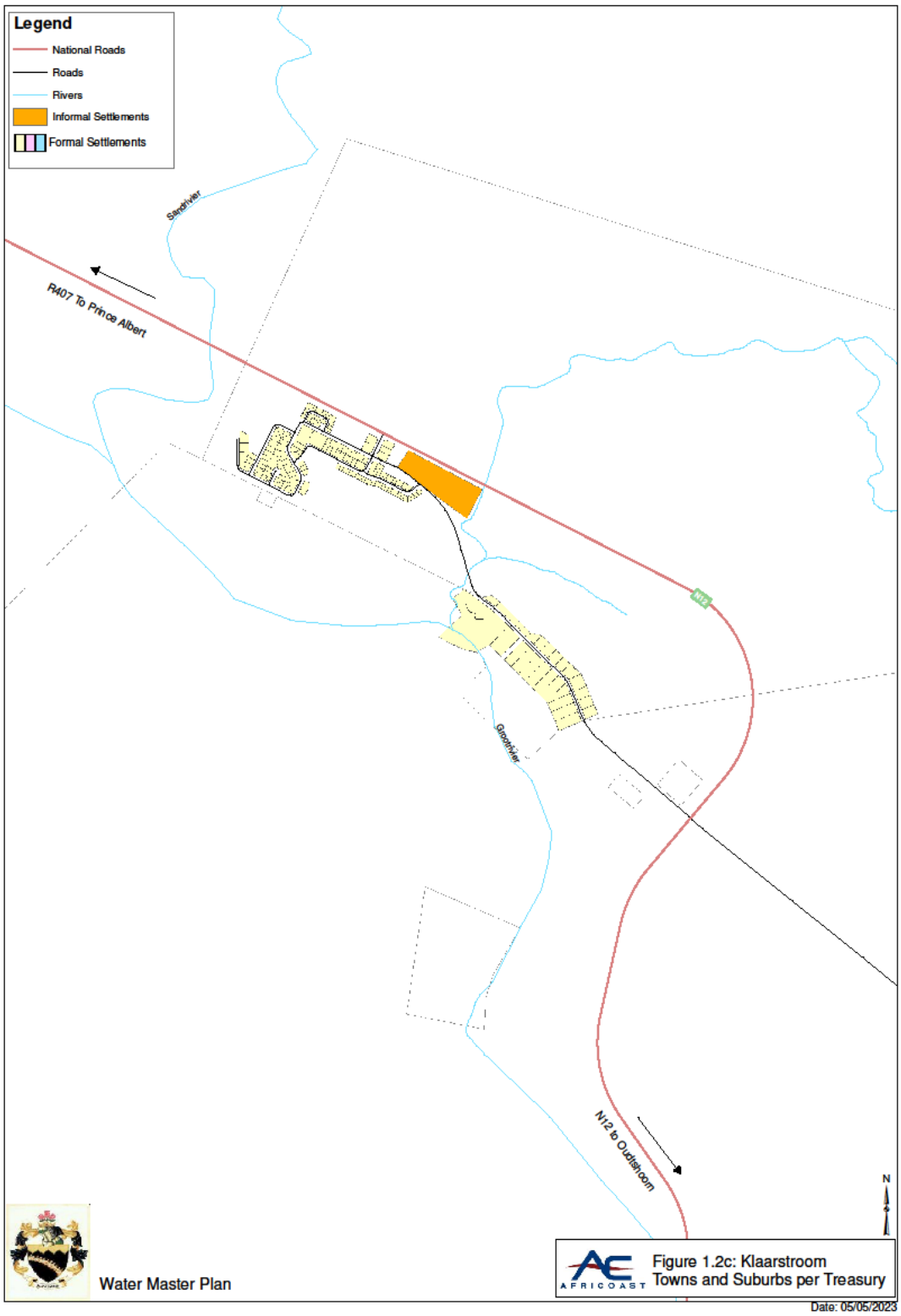


Figure 2.1a: Prince Albert Existing Water System Layout

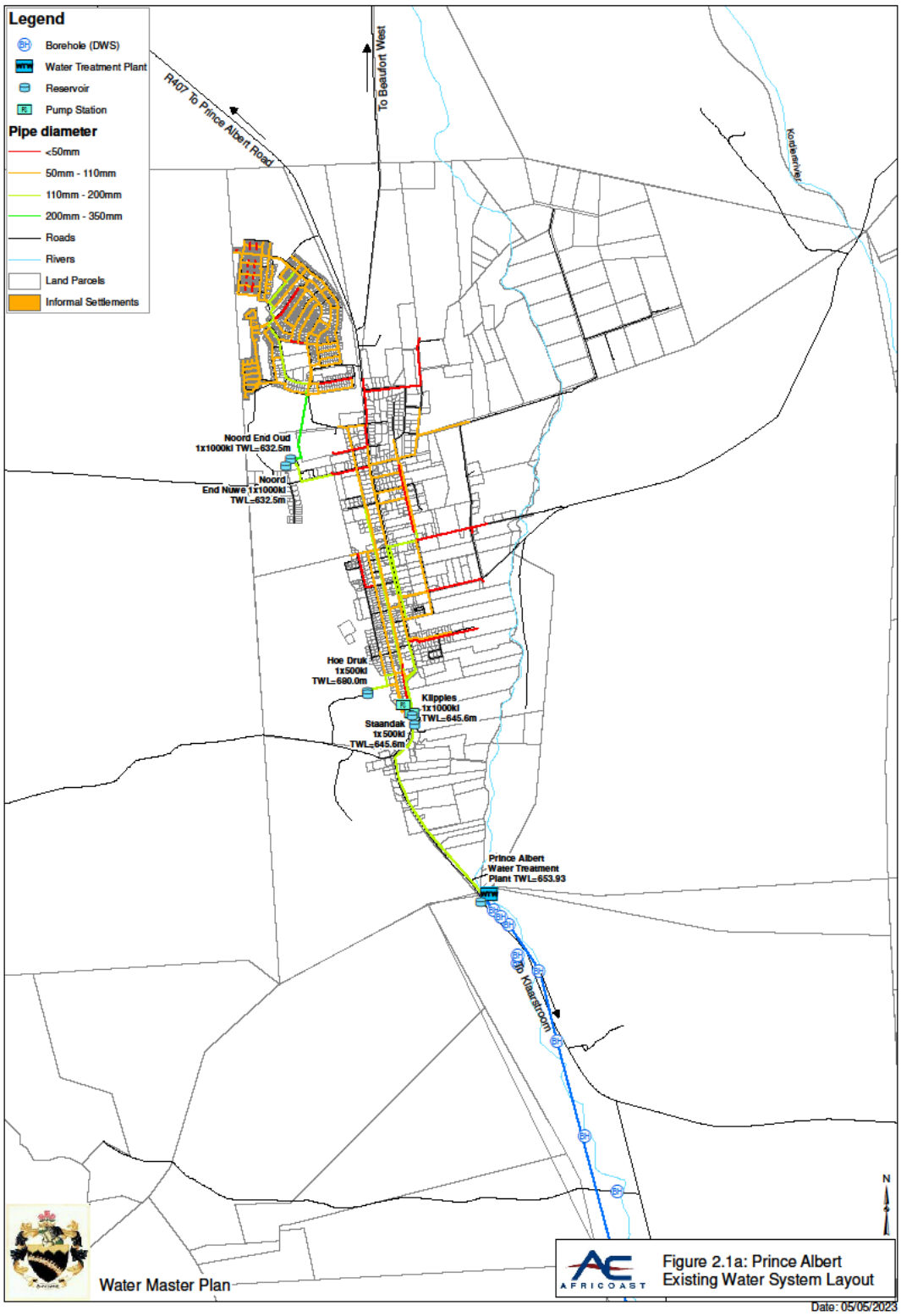


Figure 2.1b: Leeu Gamka Existing Water System Layout

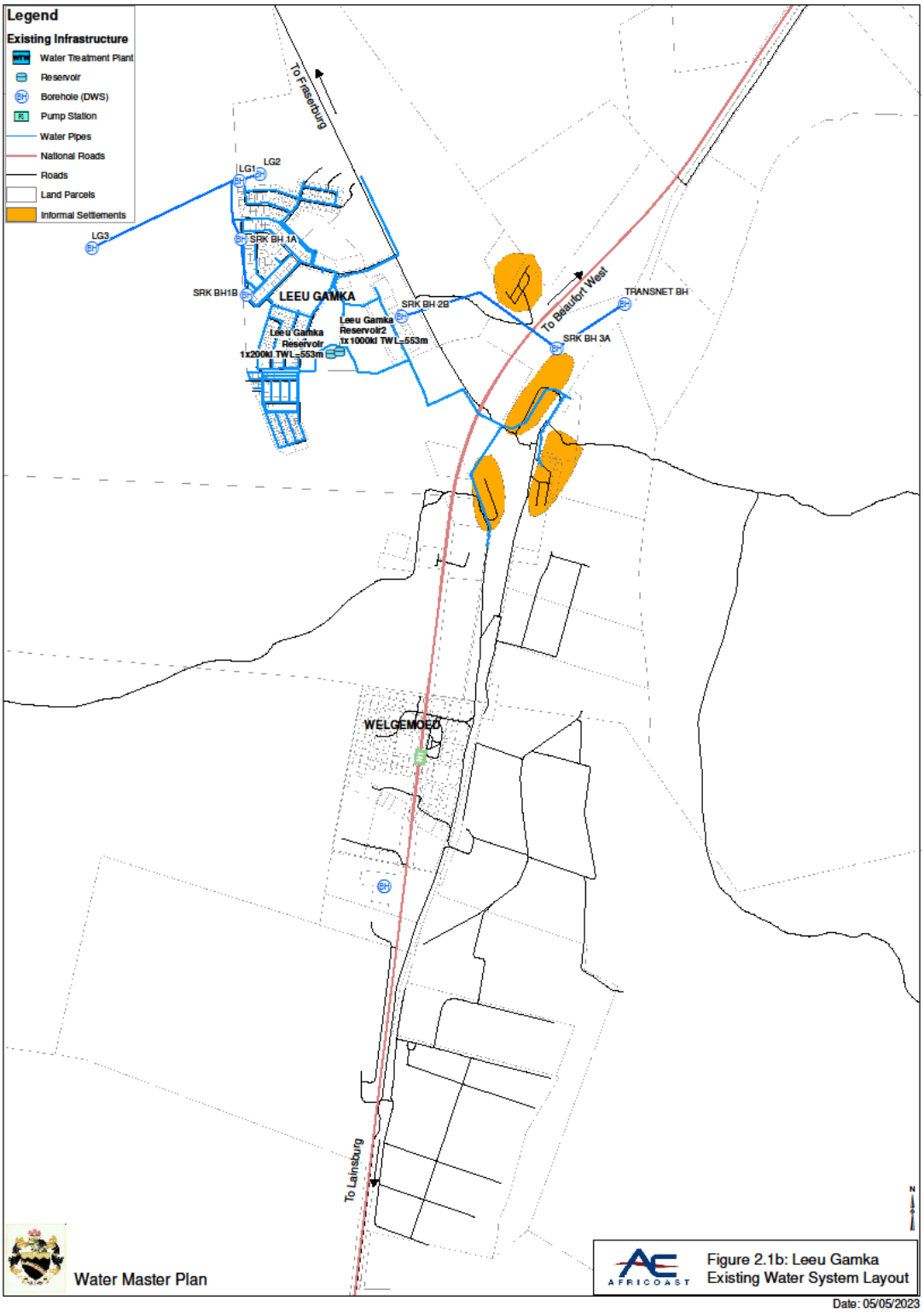


Figure 2.1c: Klaarstroom Existing Water System Layout

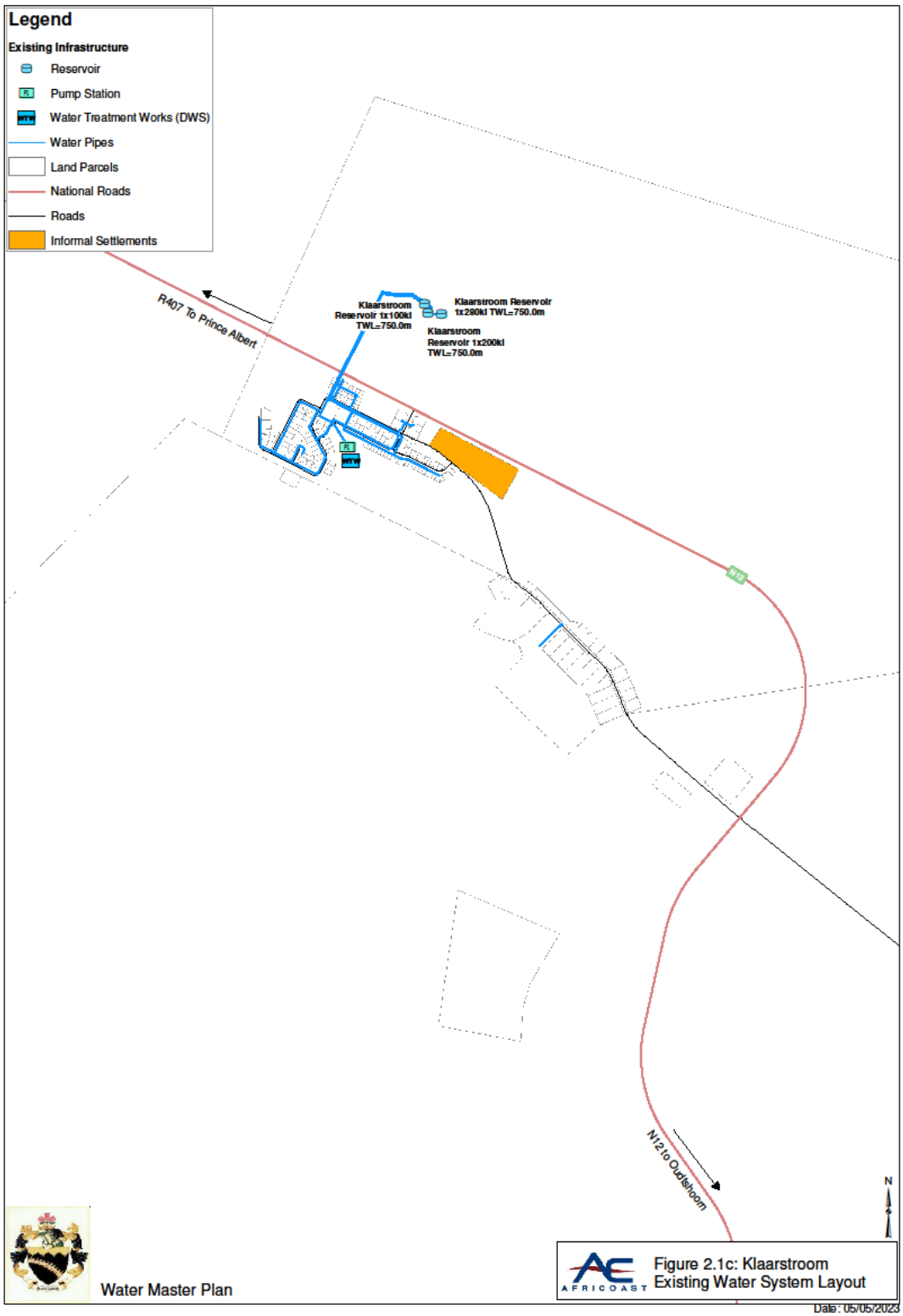


Figure 2.2a: Prince Albert Existing Water Distribution Zones

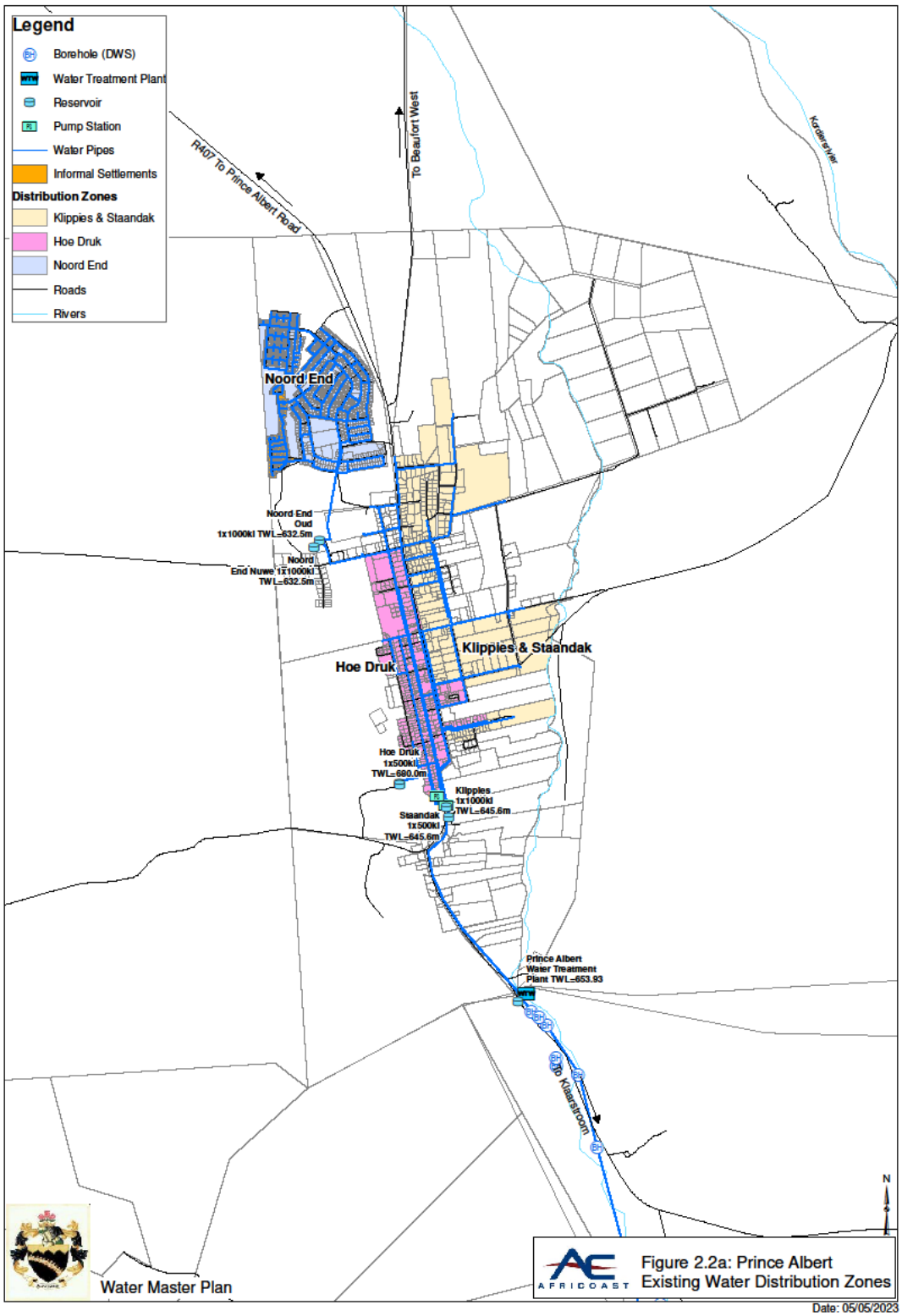


Figure 2.2b: Leeu Gamka Existing Water Distribution Zones

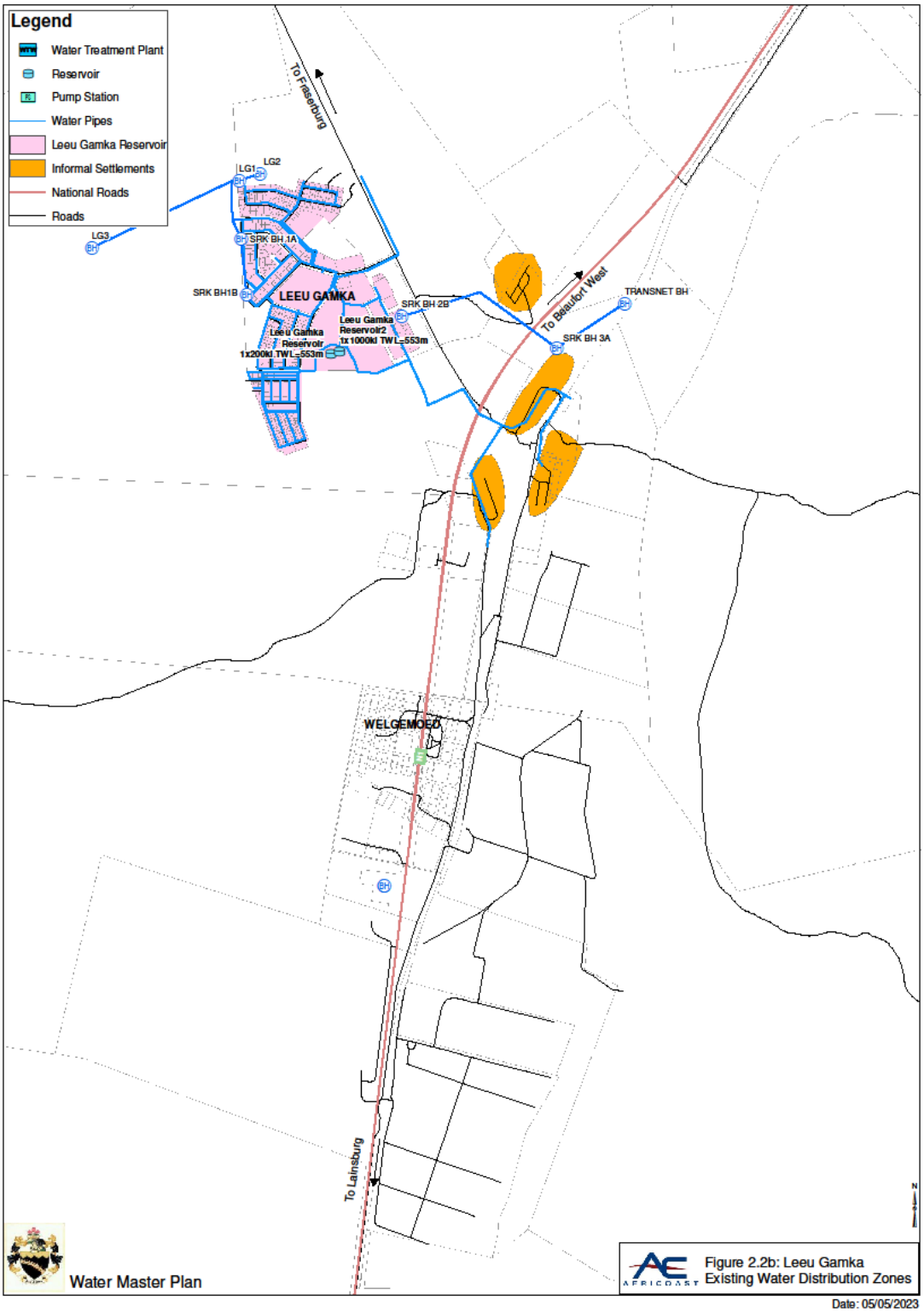


Figure 2.2c: Klaarstroom Existing Water Distribution Zones

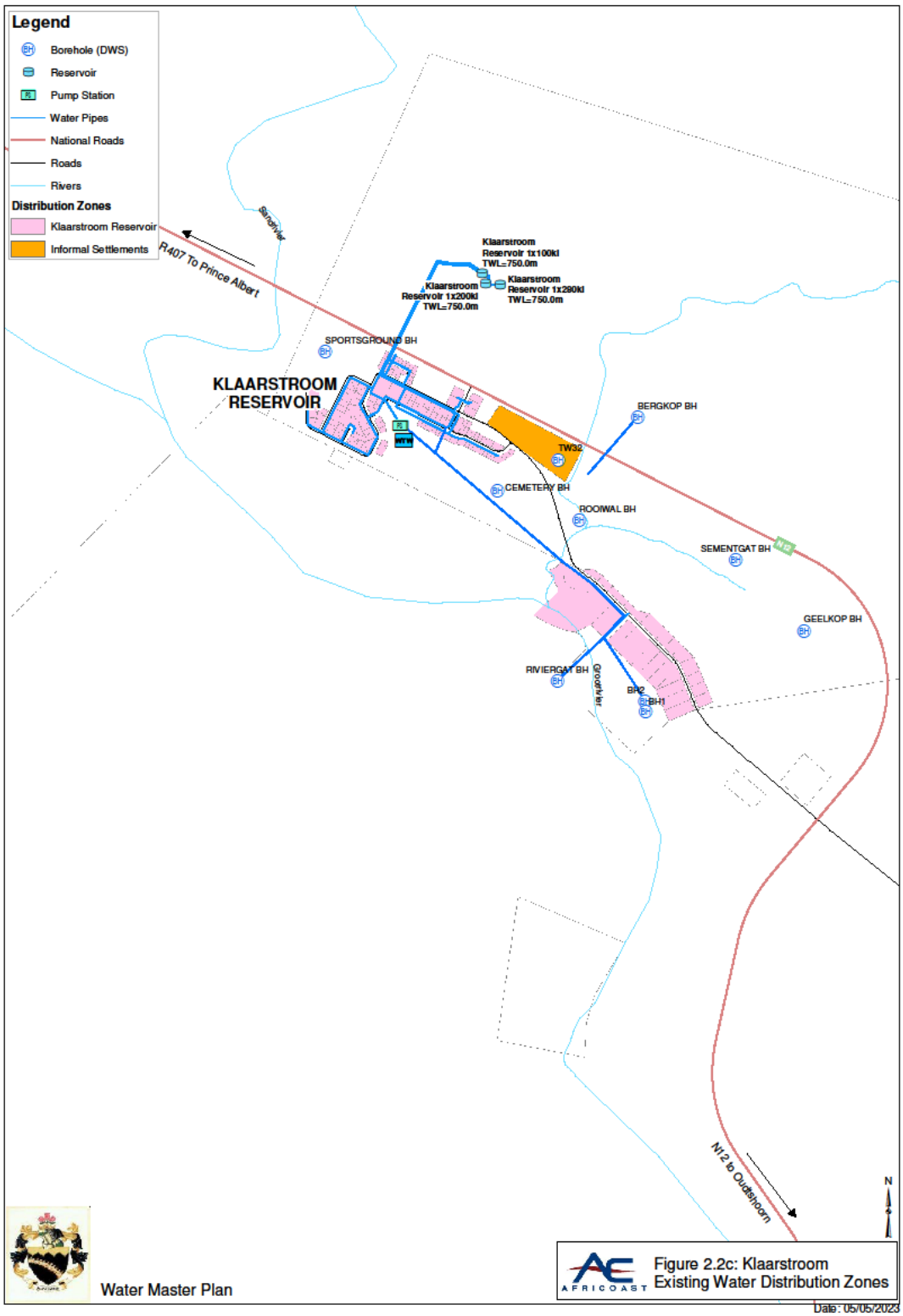


Figure 3.1a: Prince Albert Potential Future Developments

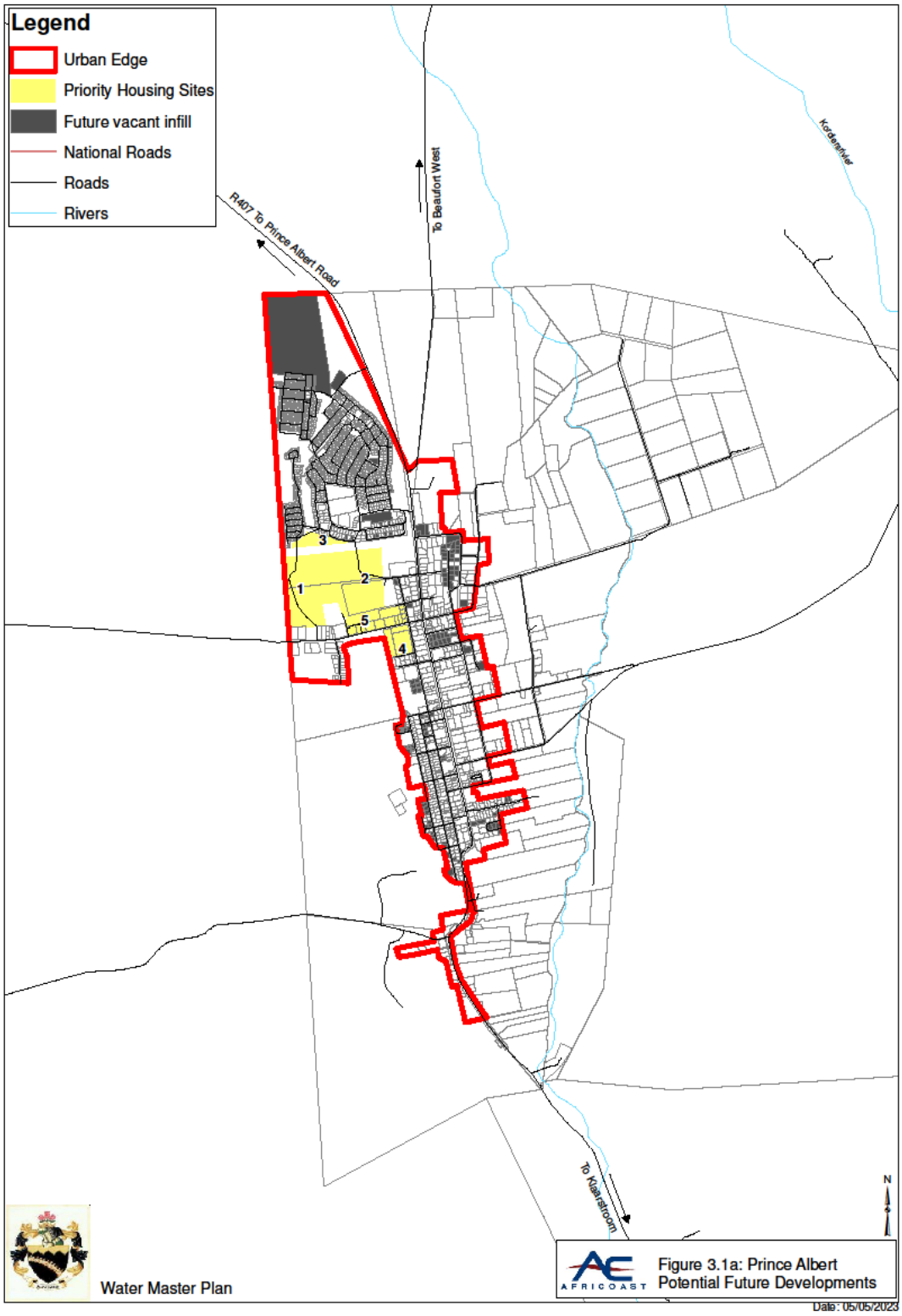


Figure 3.1b: Leeu Gamka Potential Future Developments

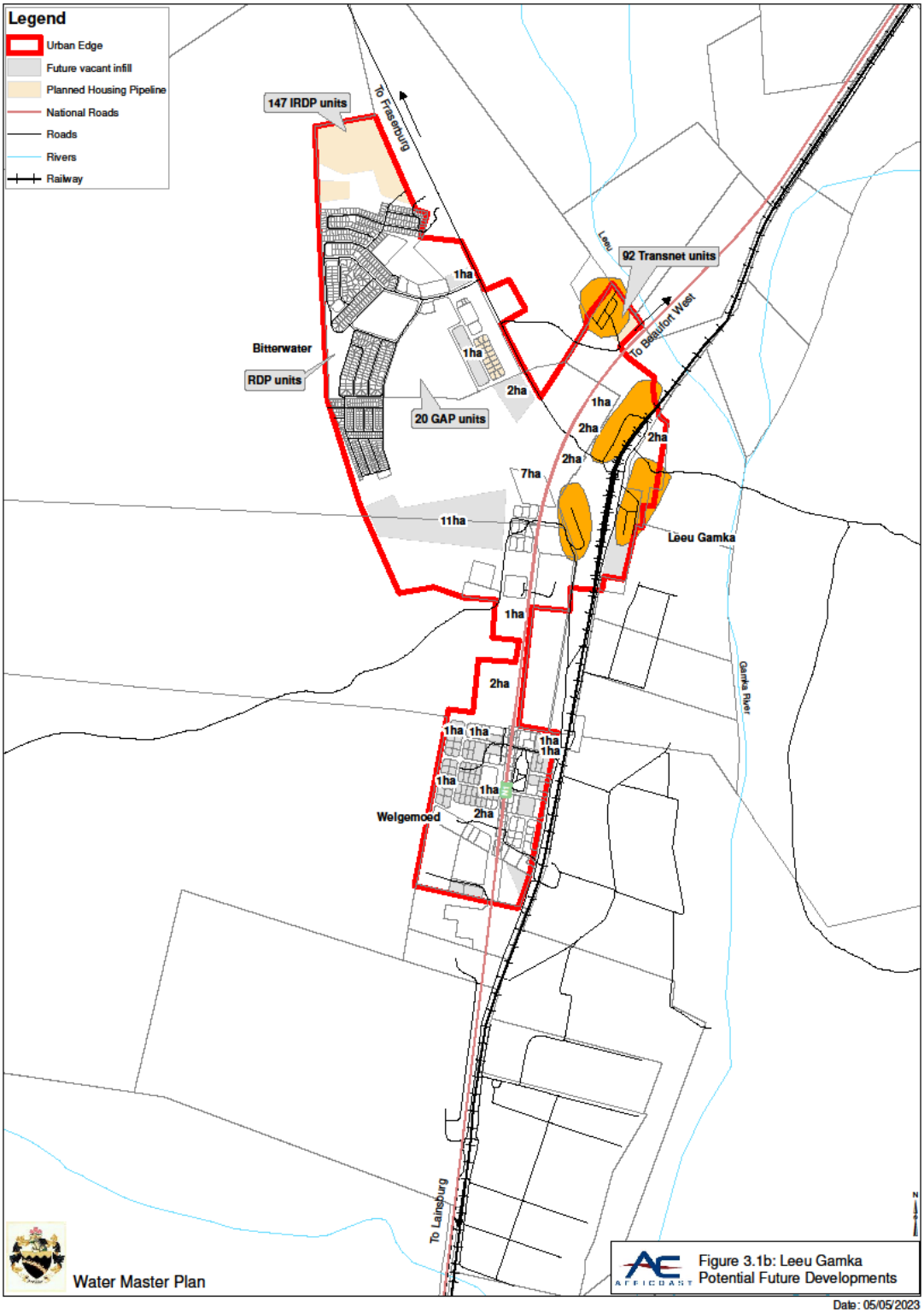


Figure 3.1c: Klaarstroom Potential Future Developments

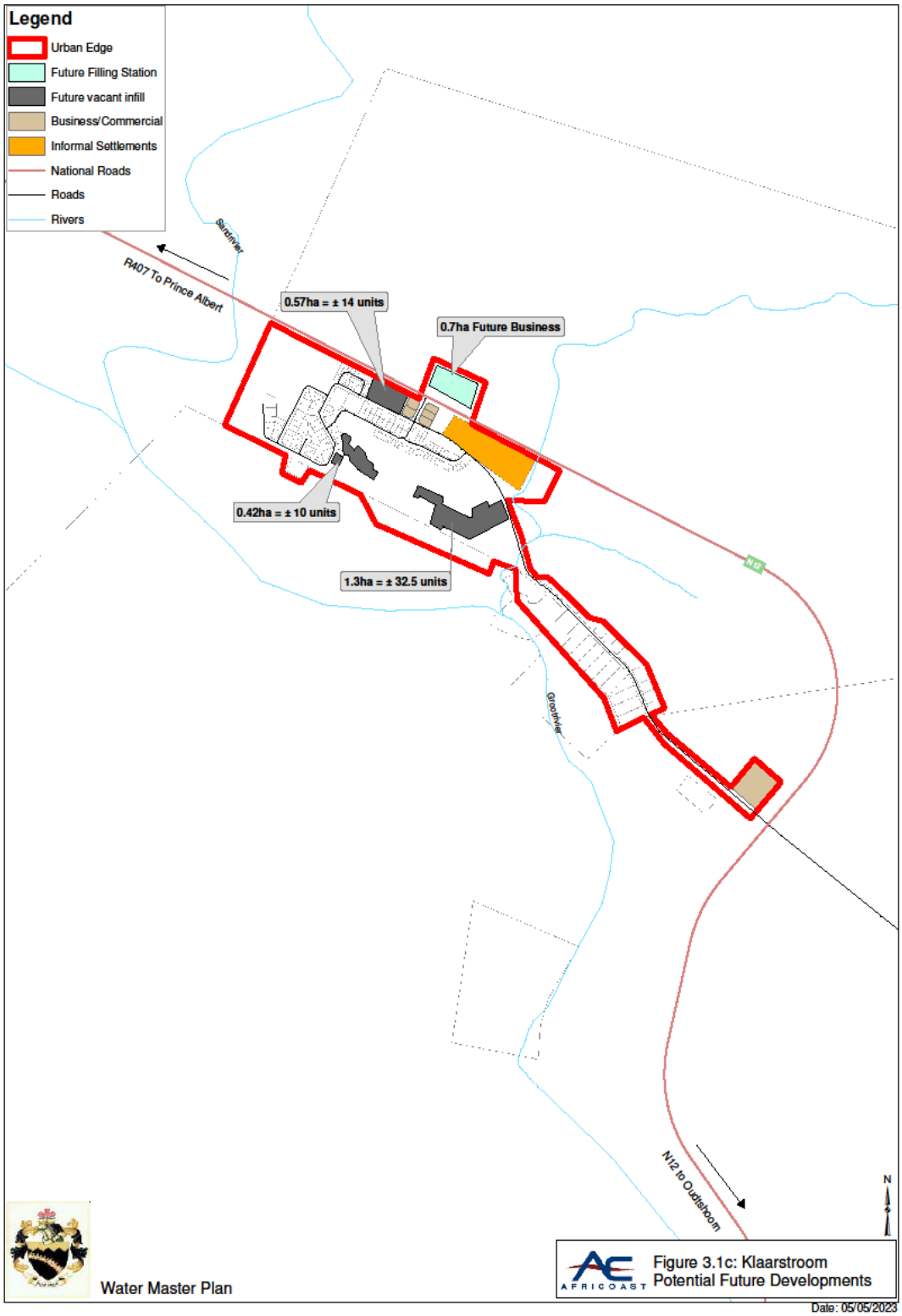


Figure 3.2a: Prince Albert Existing Water Static Pressure

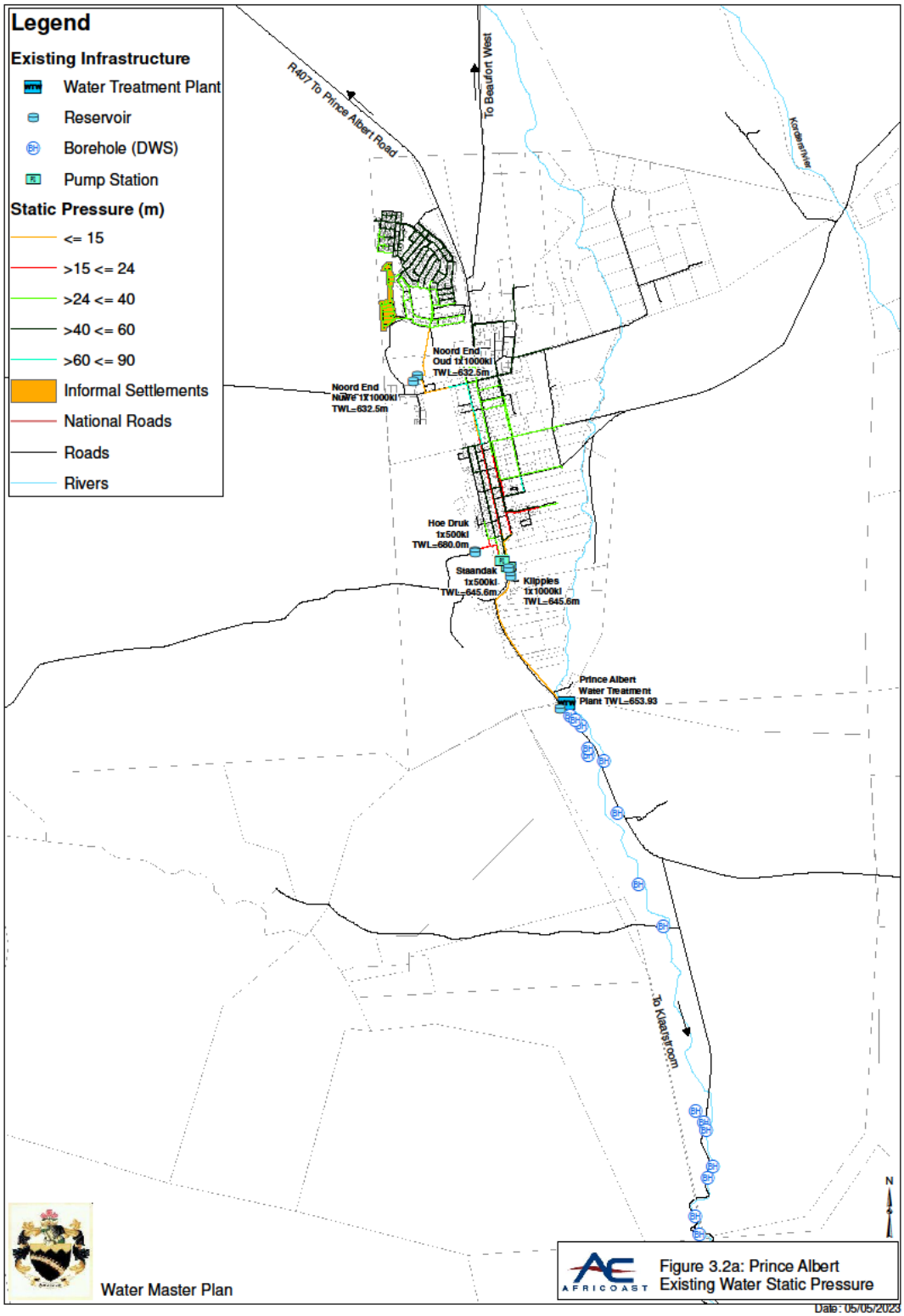


Figure 3.2b: Leeu Gamka Existing Water Static Pressure

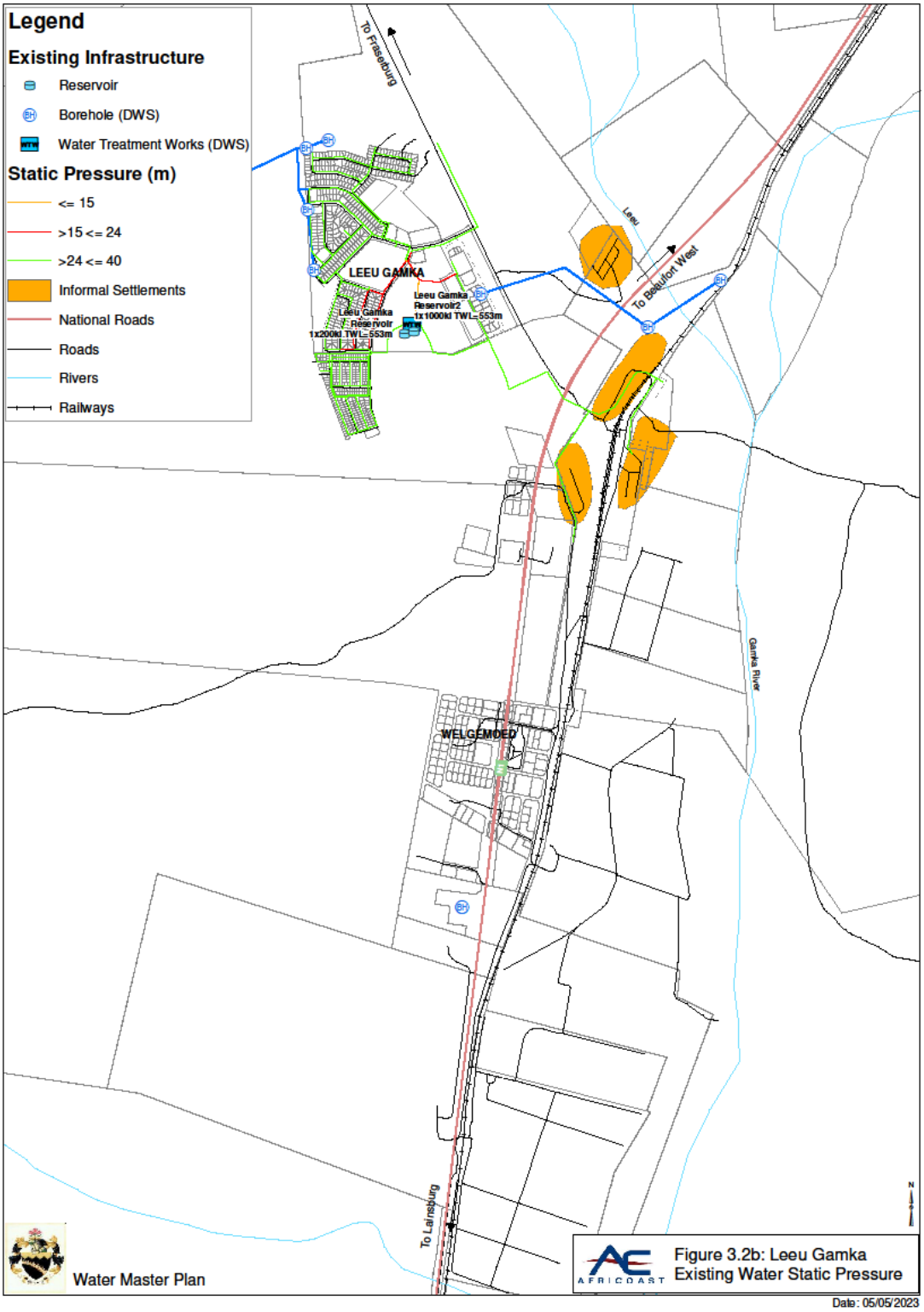


Figure 3.2c: Klaarstroom Existing Water Static Pressure

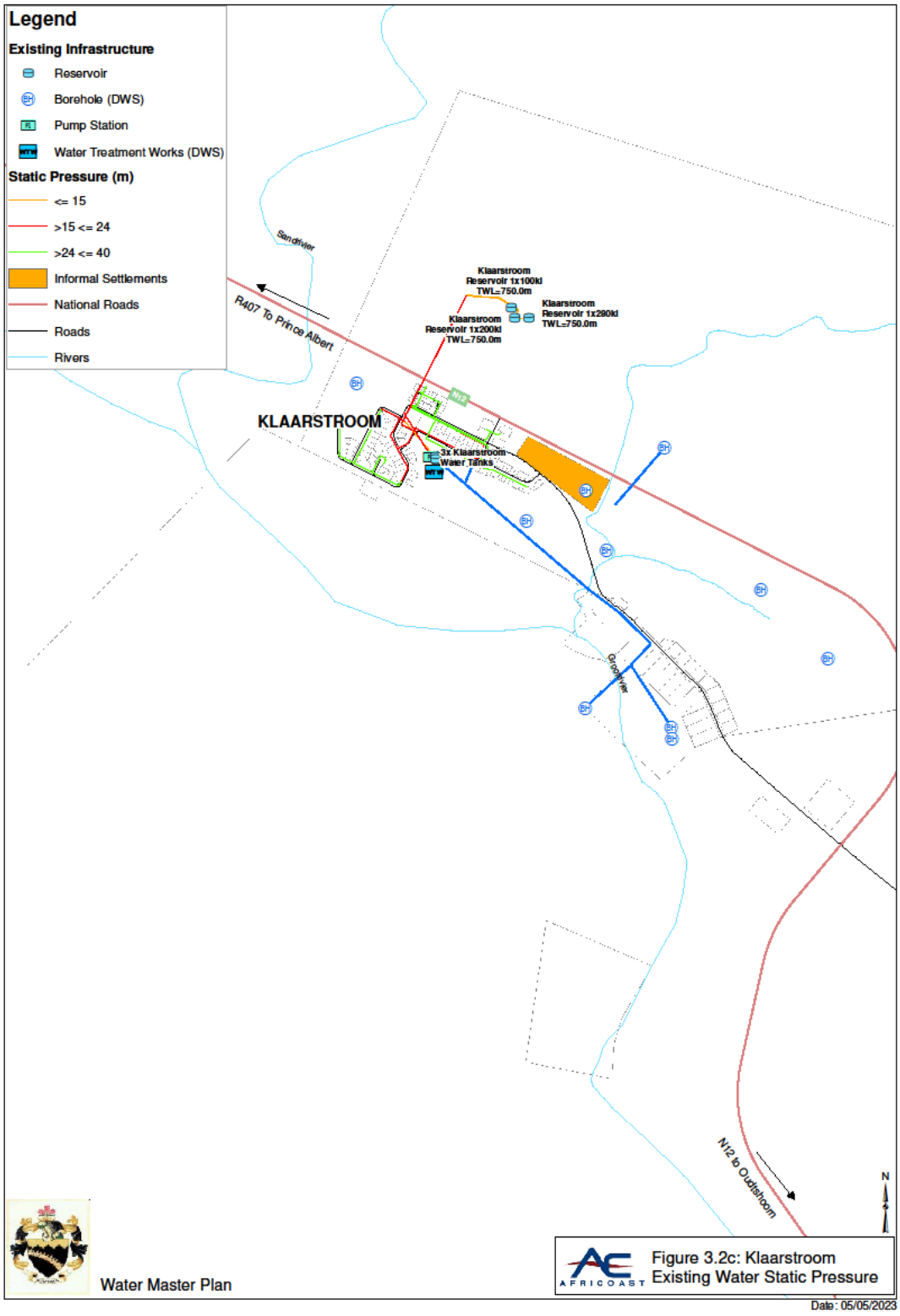


Figure 3.3a: Prince Albert Existing Water Residual Pressure

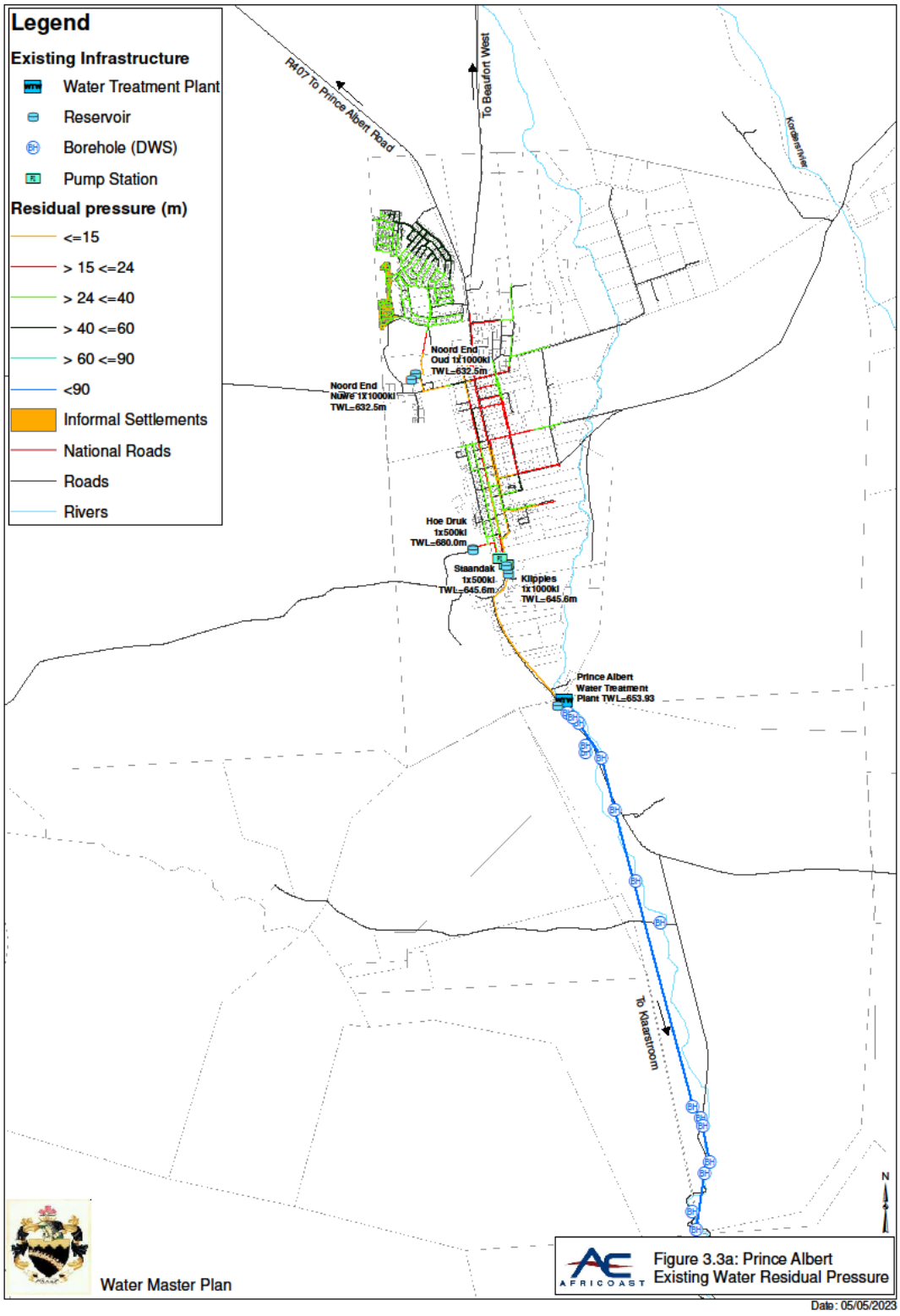


Figure 3.3b: Leeu Gamka Existing Water Residual Pressure

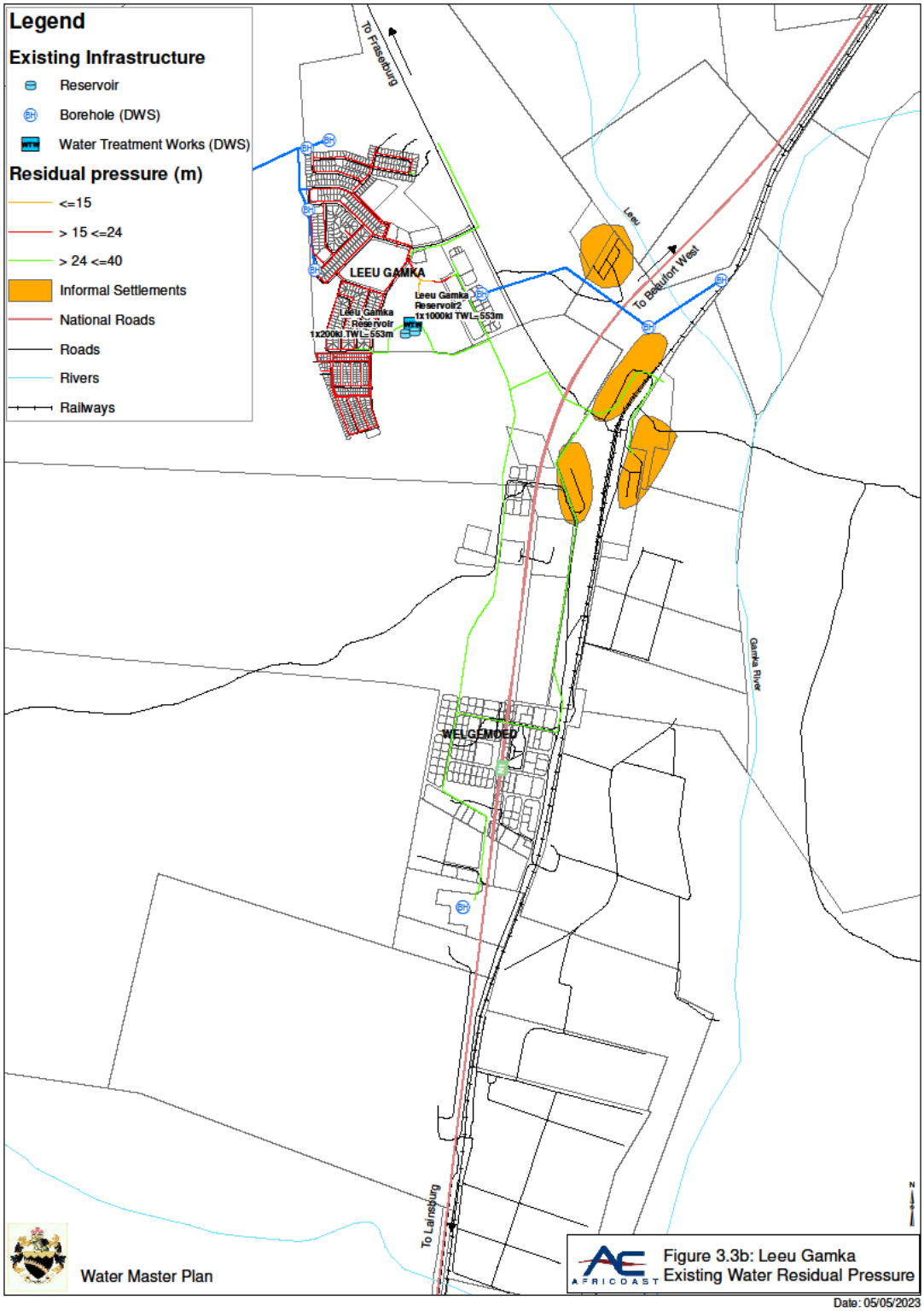


Figure 3.3c: Klaarstroom Existing Water Residual Pressure

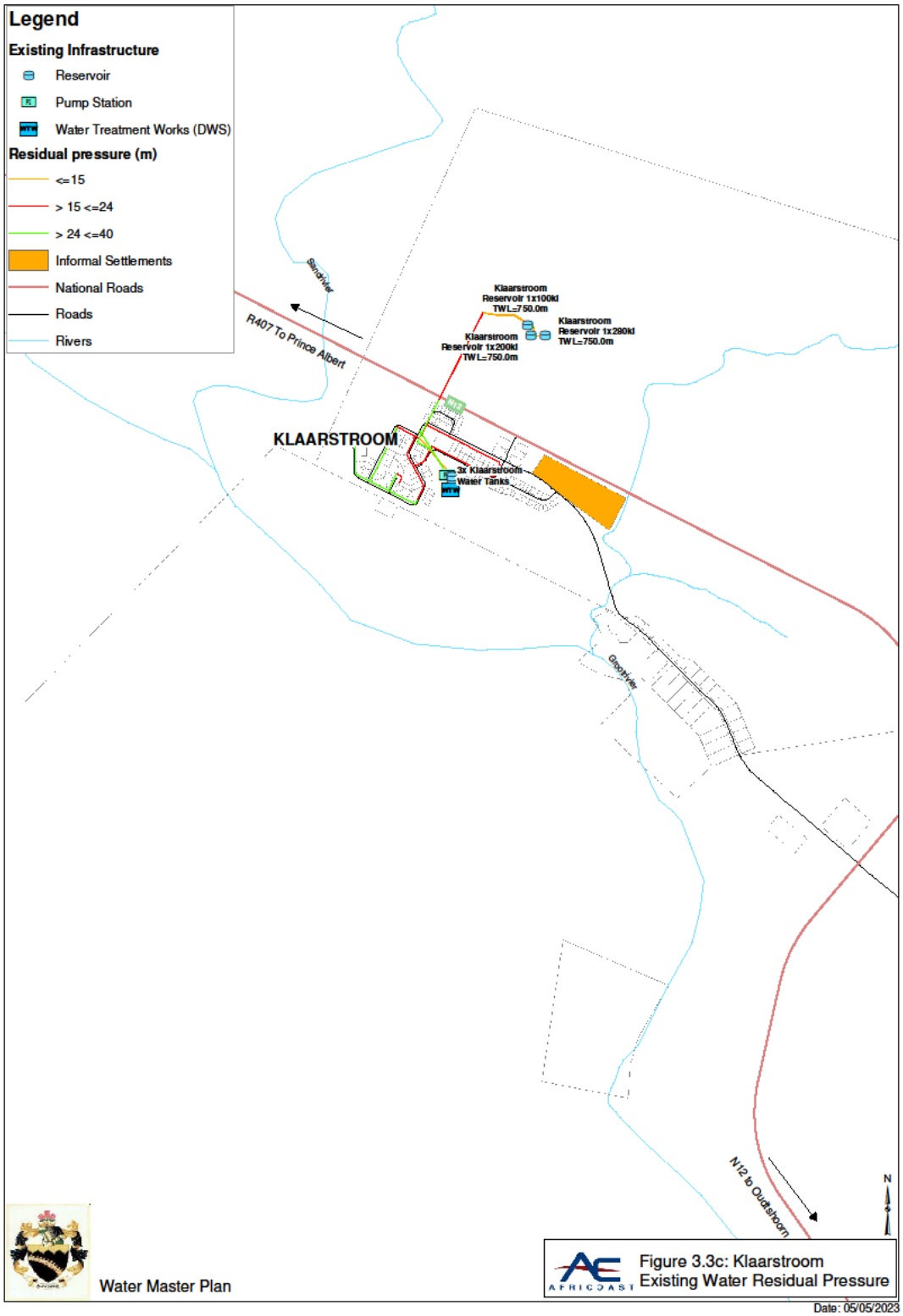


Figure 3.4a: Prince Albert Existing Water Peak Flow Velocity

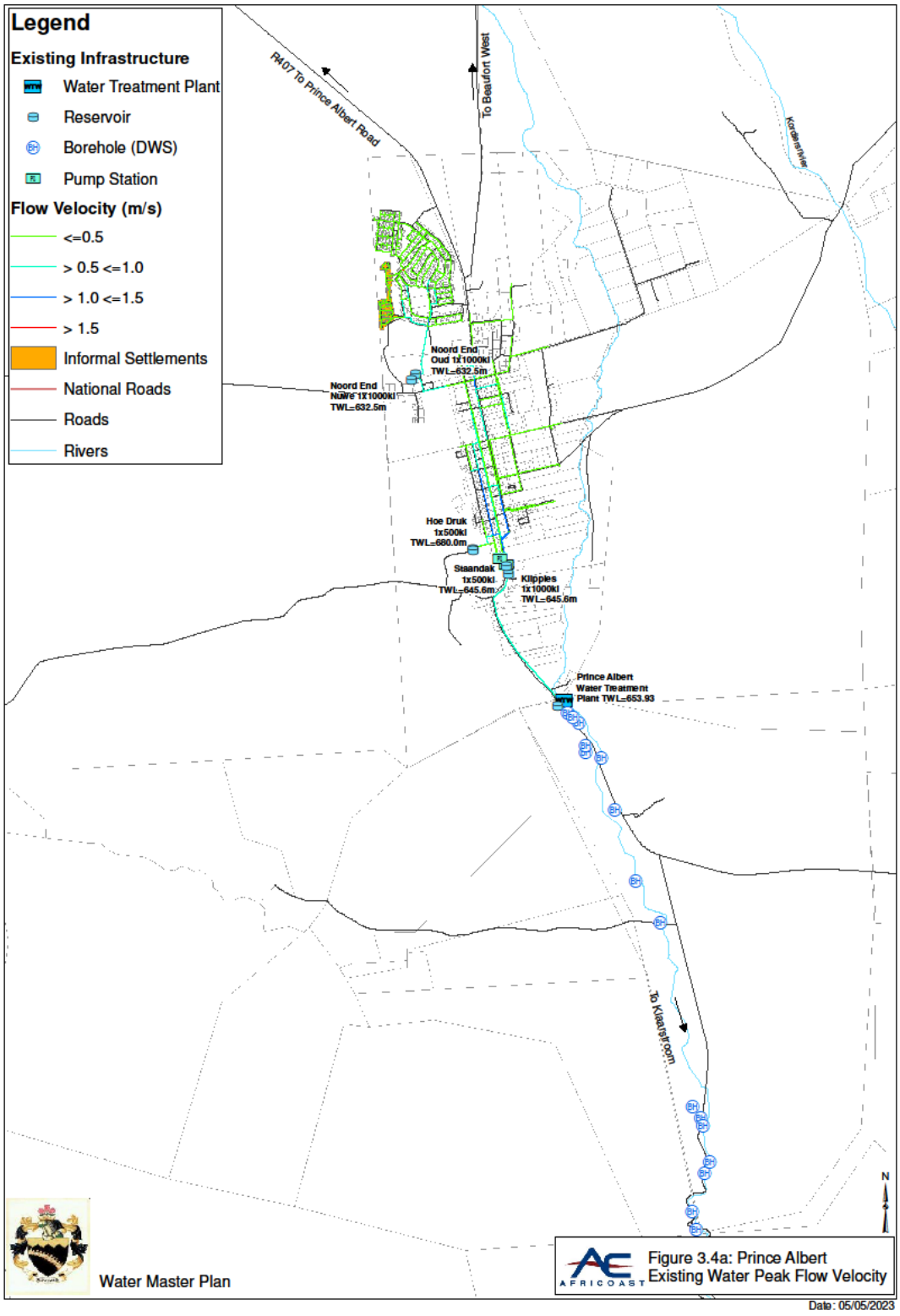


Figure 3.4b: Leeu Gamka Existing Water Peak Flow Velocity

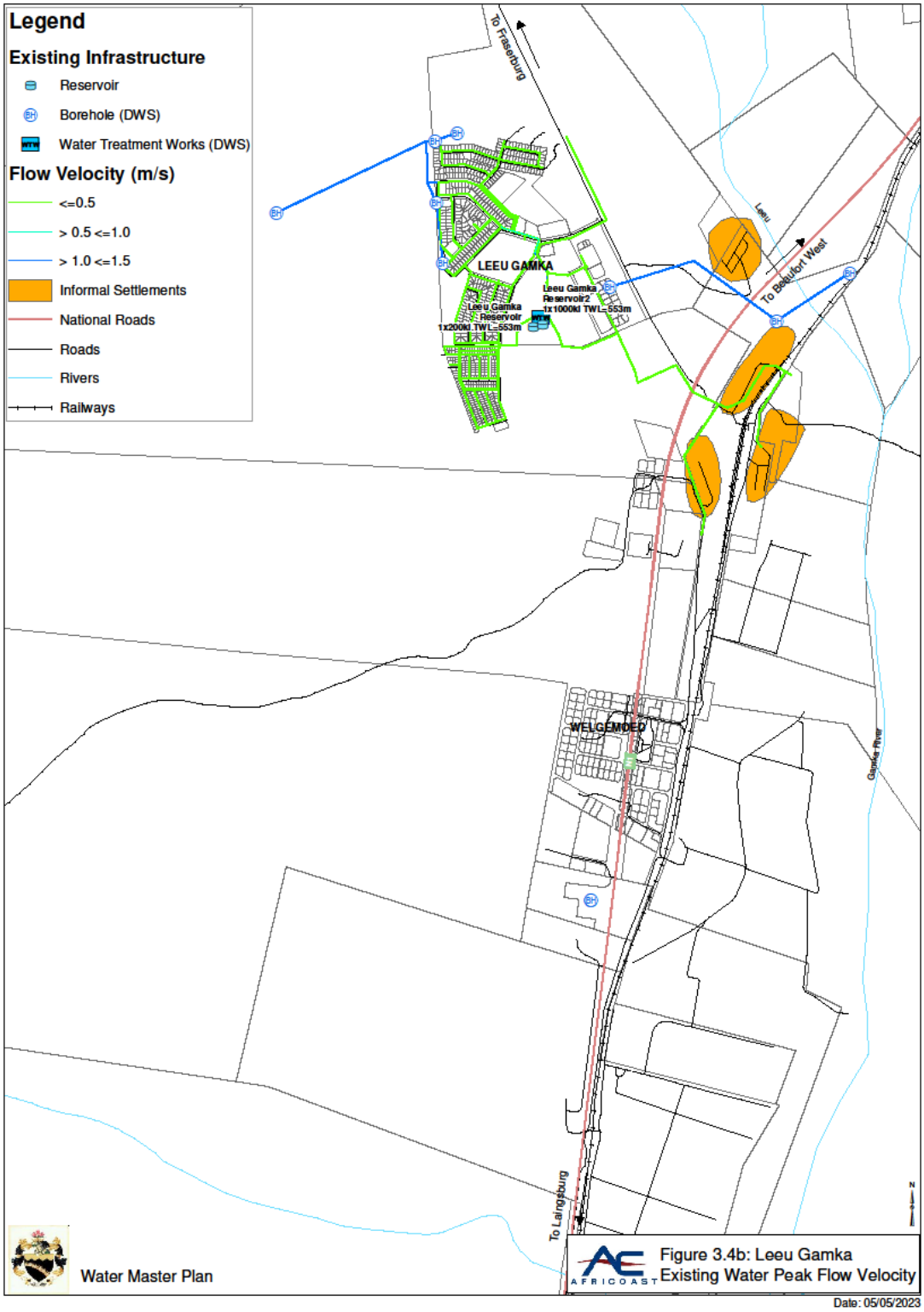


Figure 3.4c: Klarstroom Existing Water Peak Flow Velocity

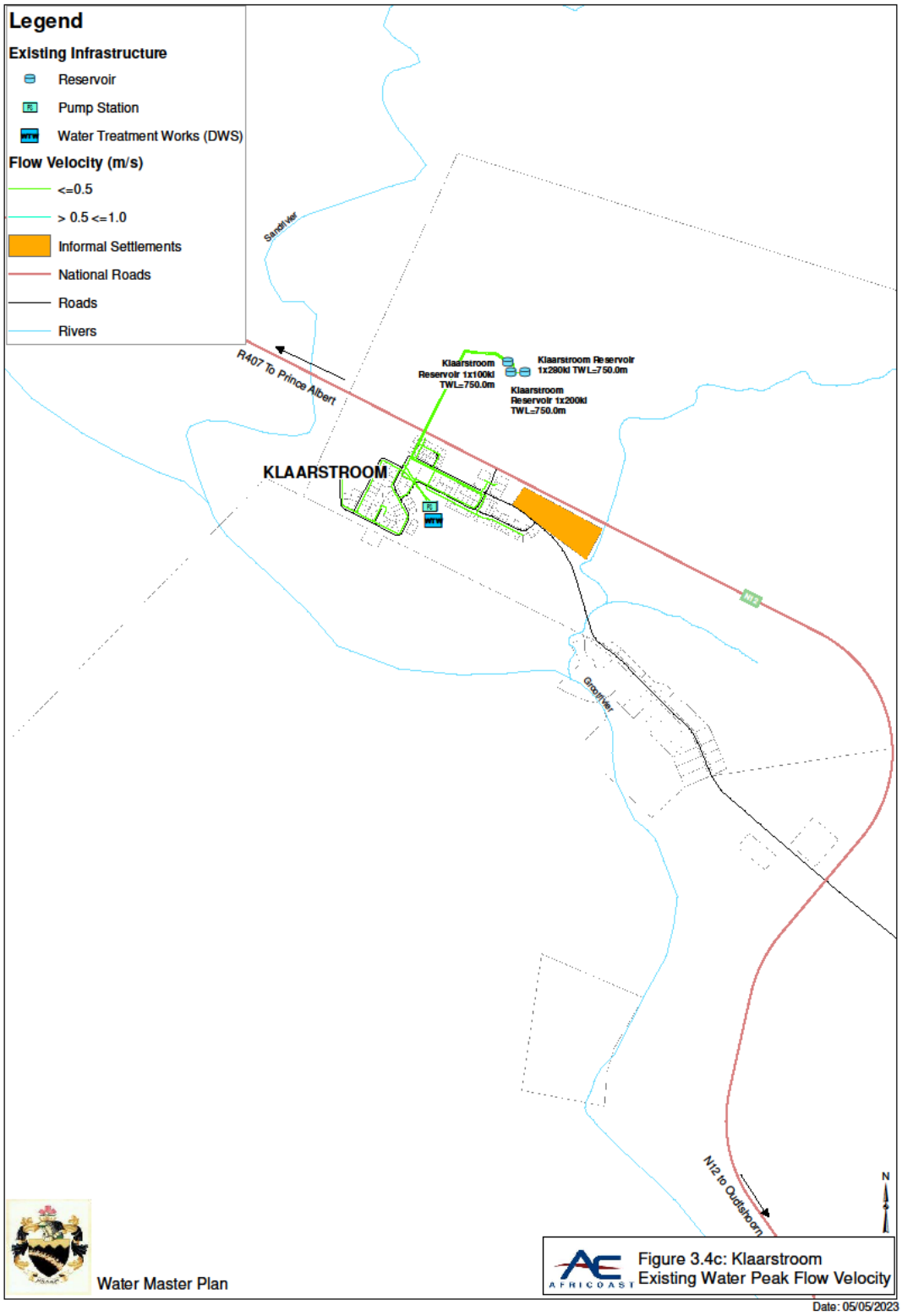


Figure 3.5a: Prince Albert Existing Water Required Work

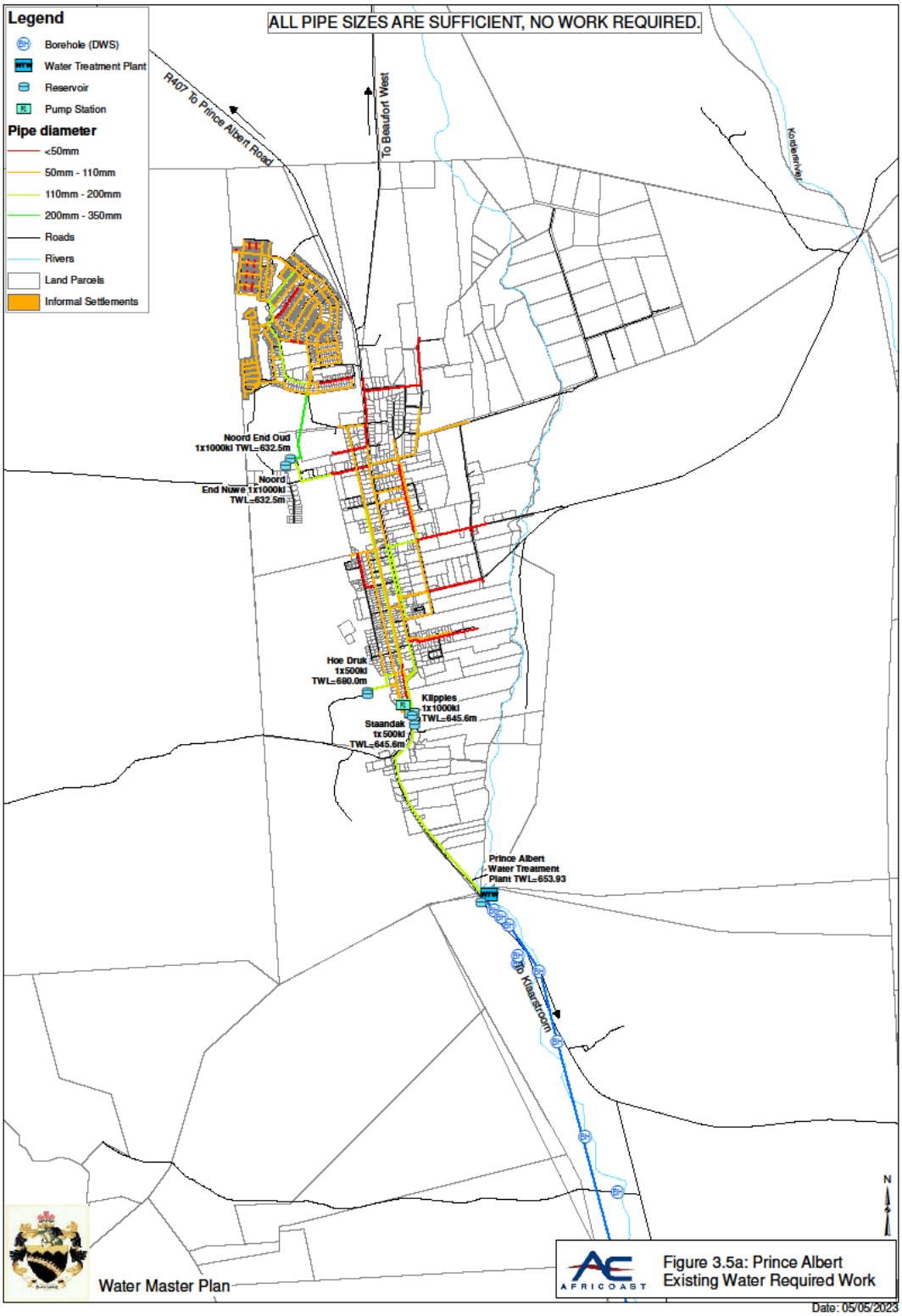


Figure 3.5b: Leeu Gamka Existing Water Required Work

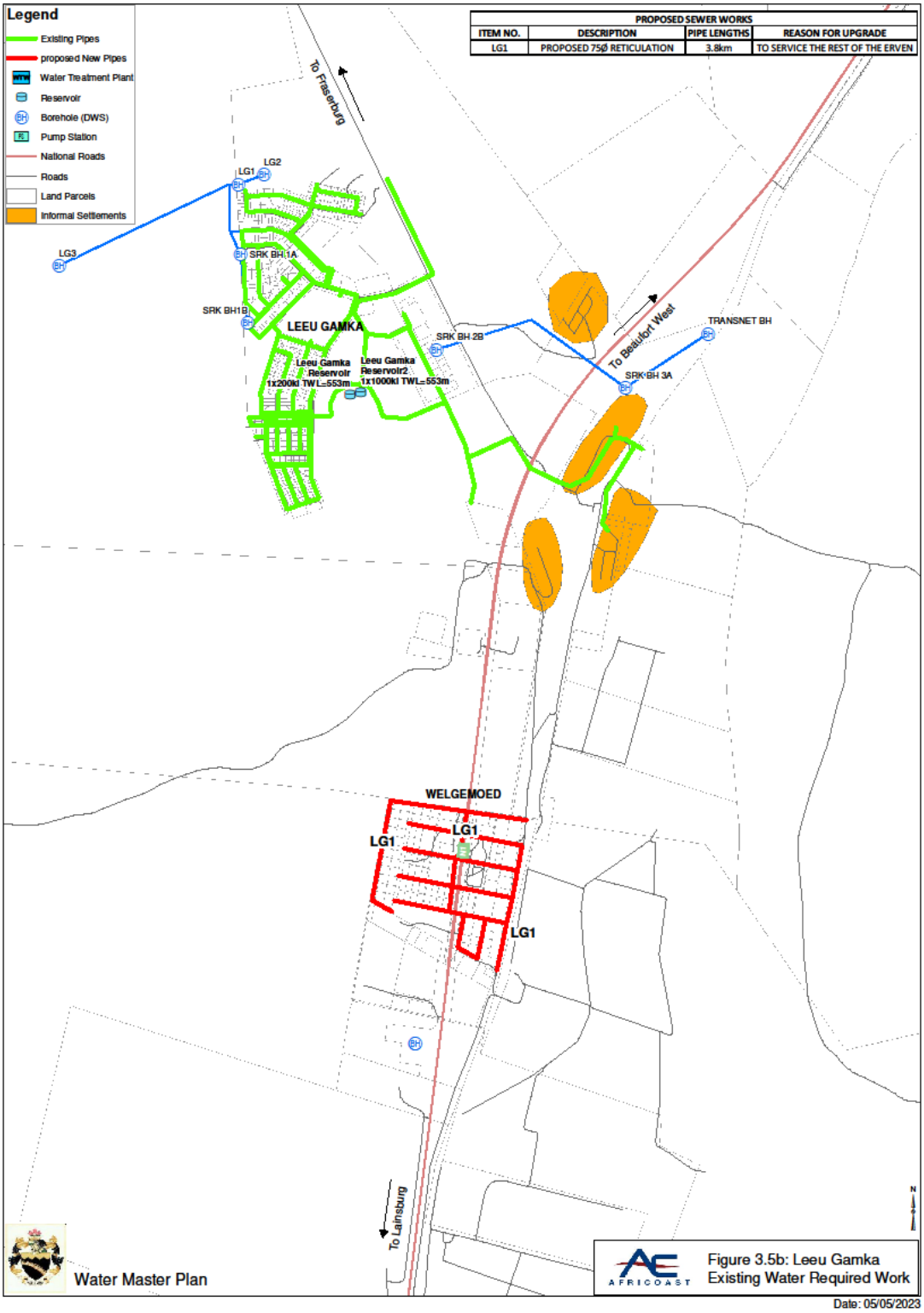


Figure 3.5c: Klaarstroom Existing Water Required Work

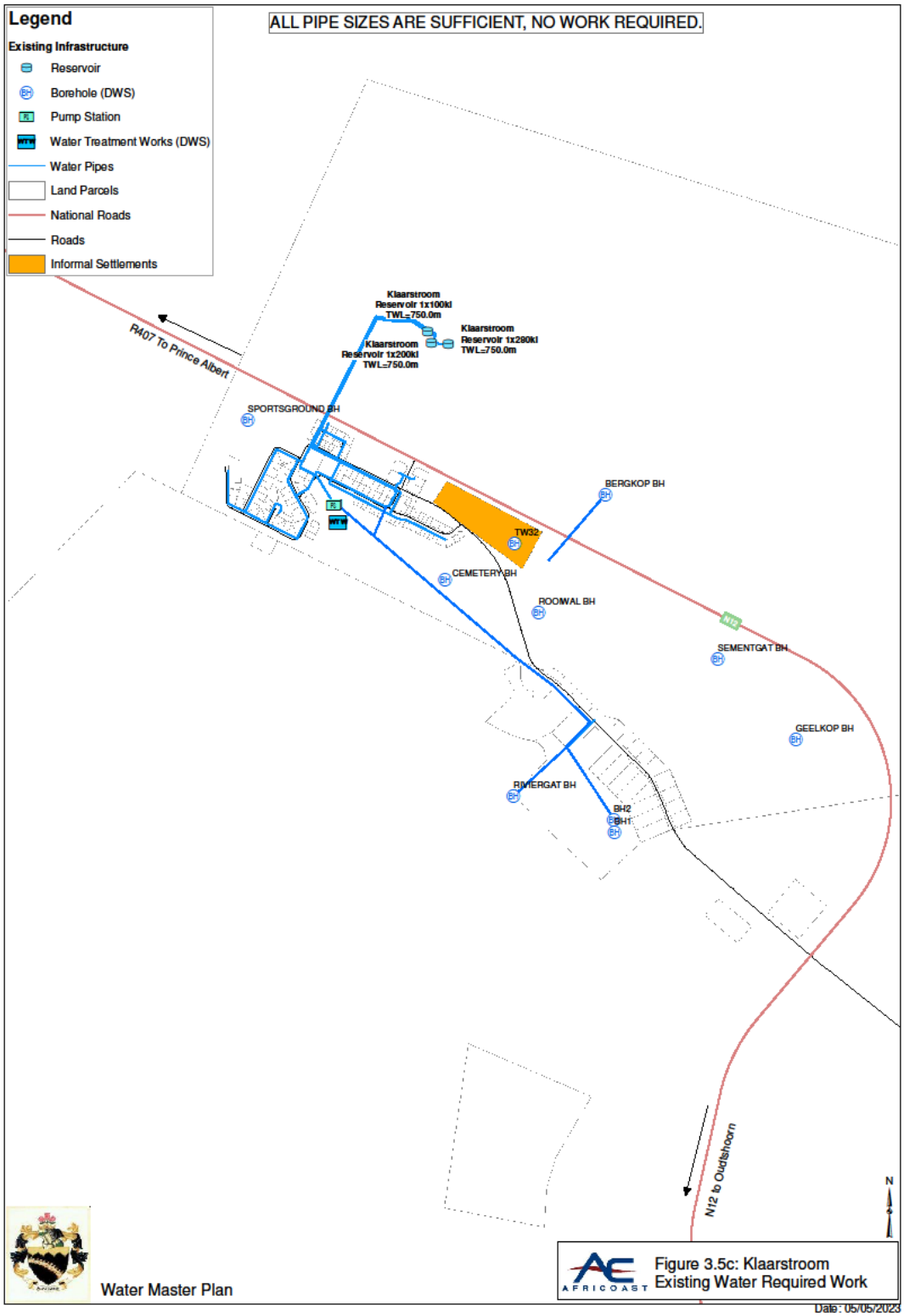


Figure 3.6a: Prince Albert Future Water Residual Pressure

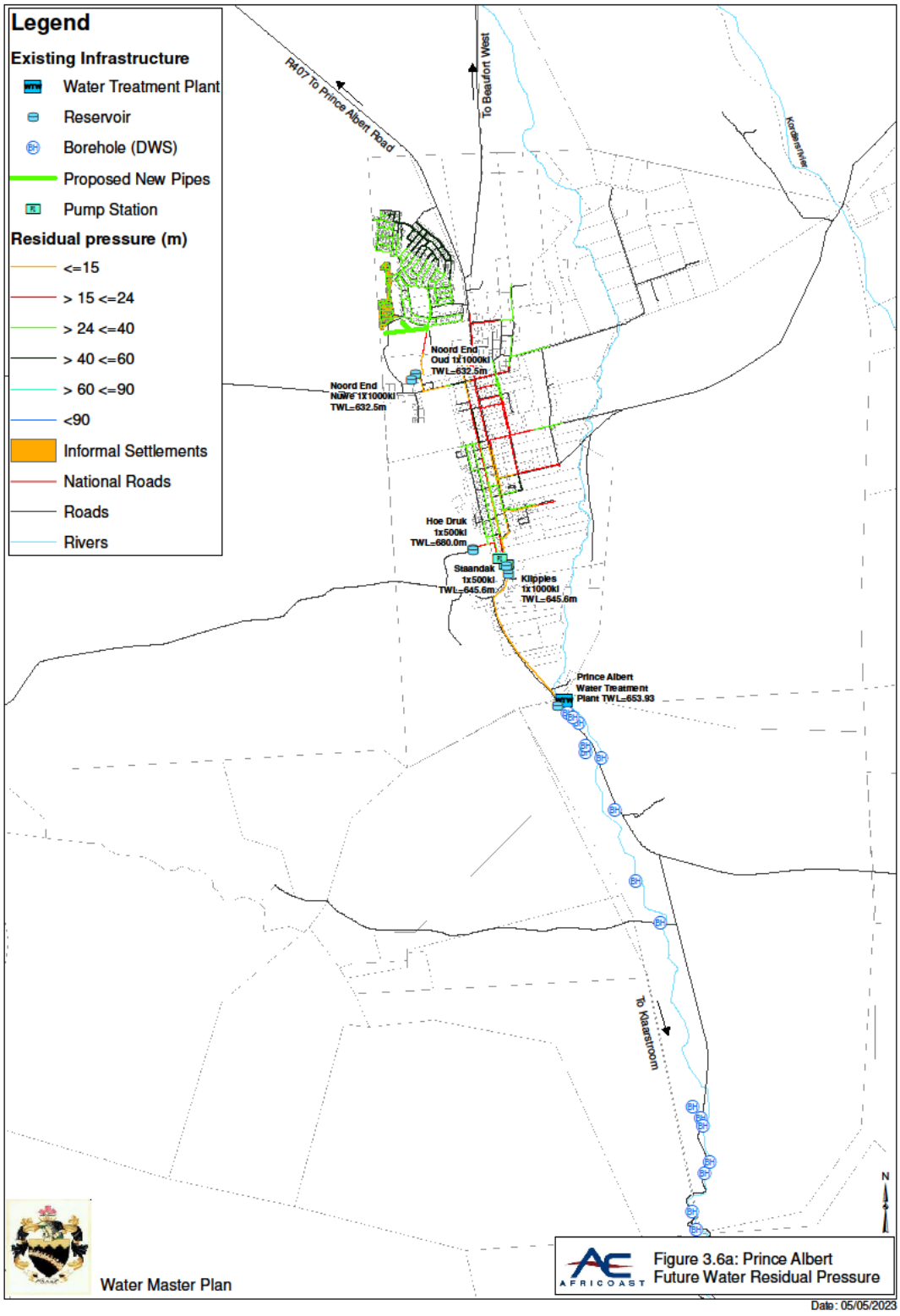


Figure 3.6b: Leeu Gamka Future Water Residual Pressure

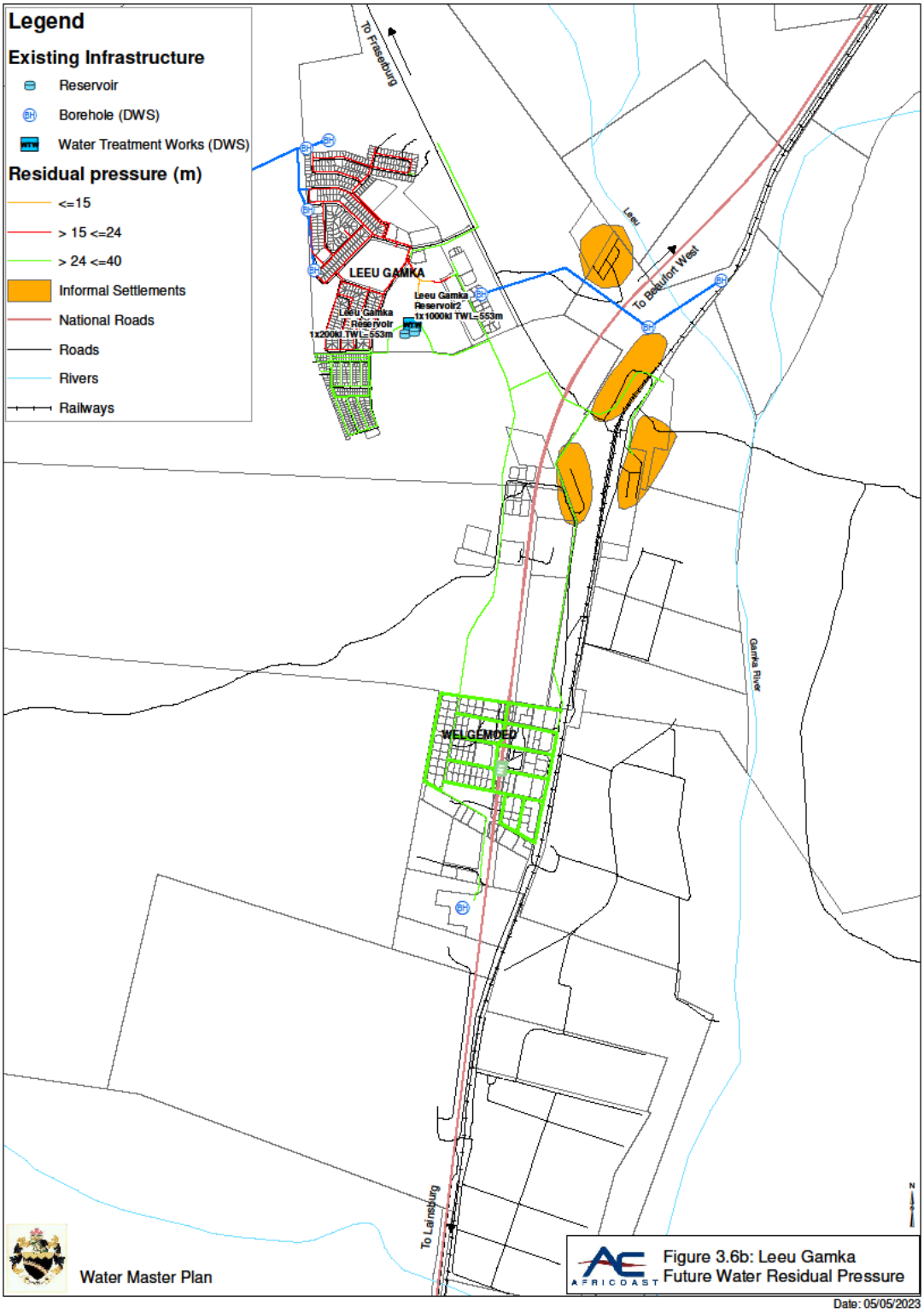


Figure 3.6c: Klaastroom Future Water Residual Pressure

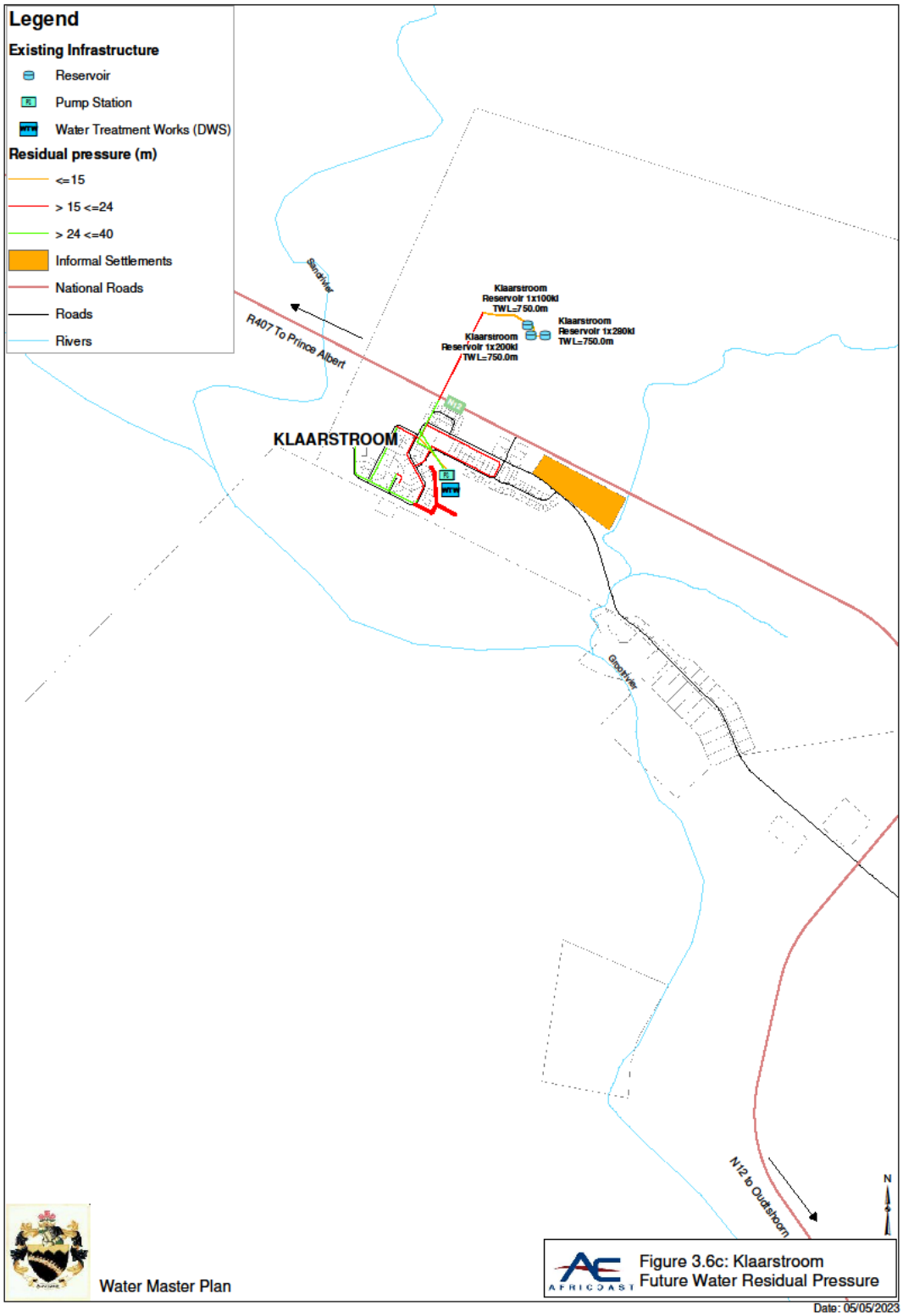


Figure 3.7a: Prince Albert Future Water Distribution Zones

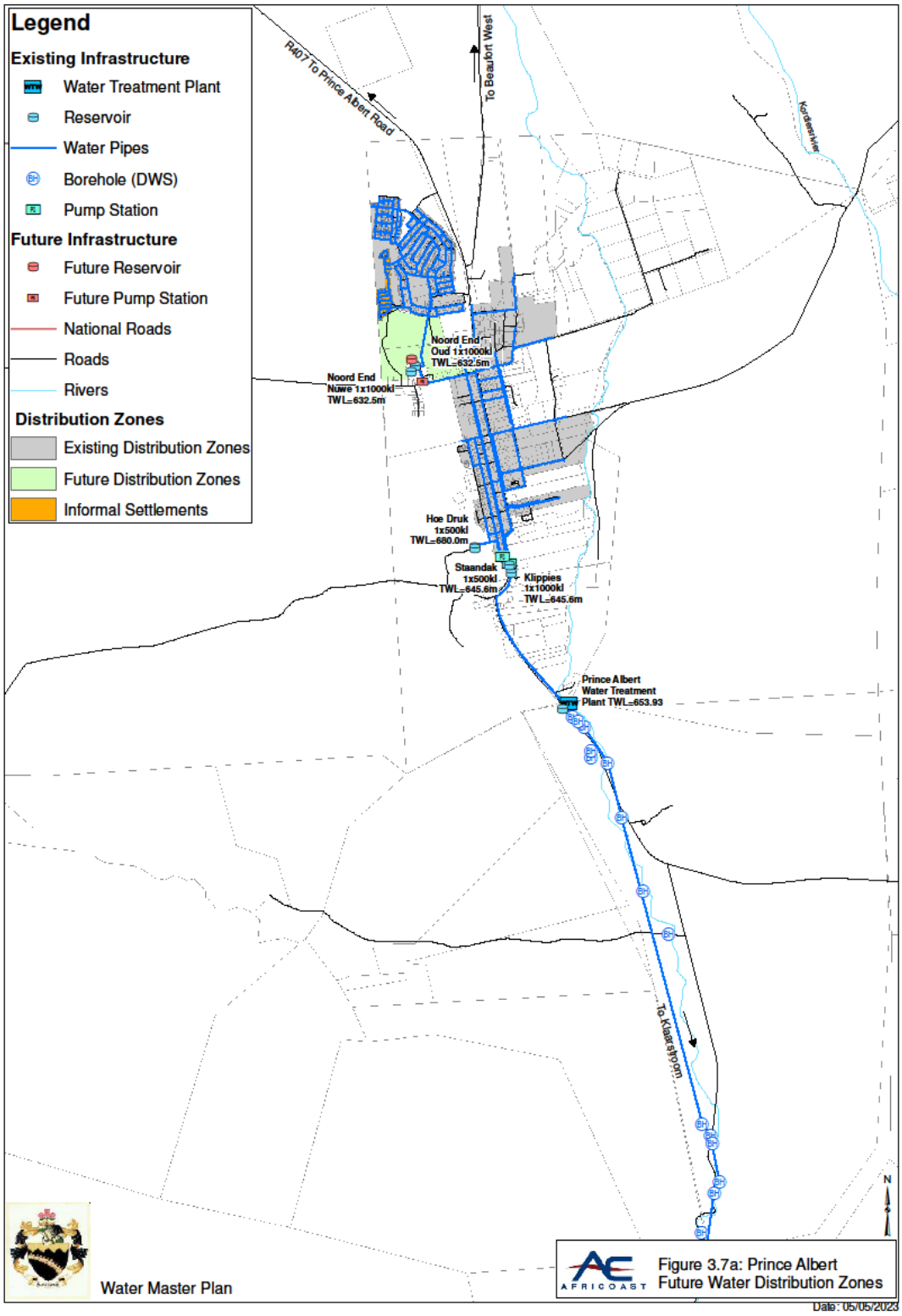


Figure 3.7b: Leeu Gamka Future Water Distribution Zones

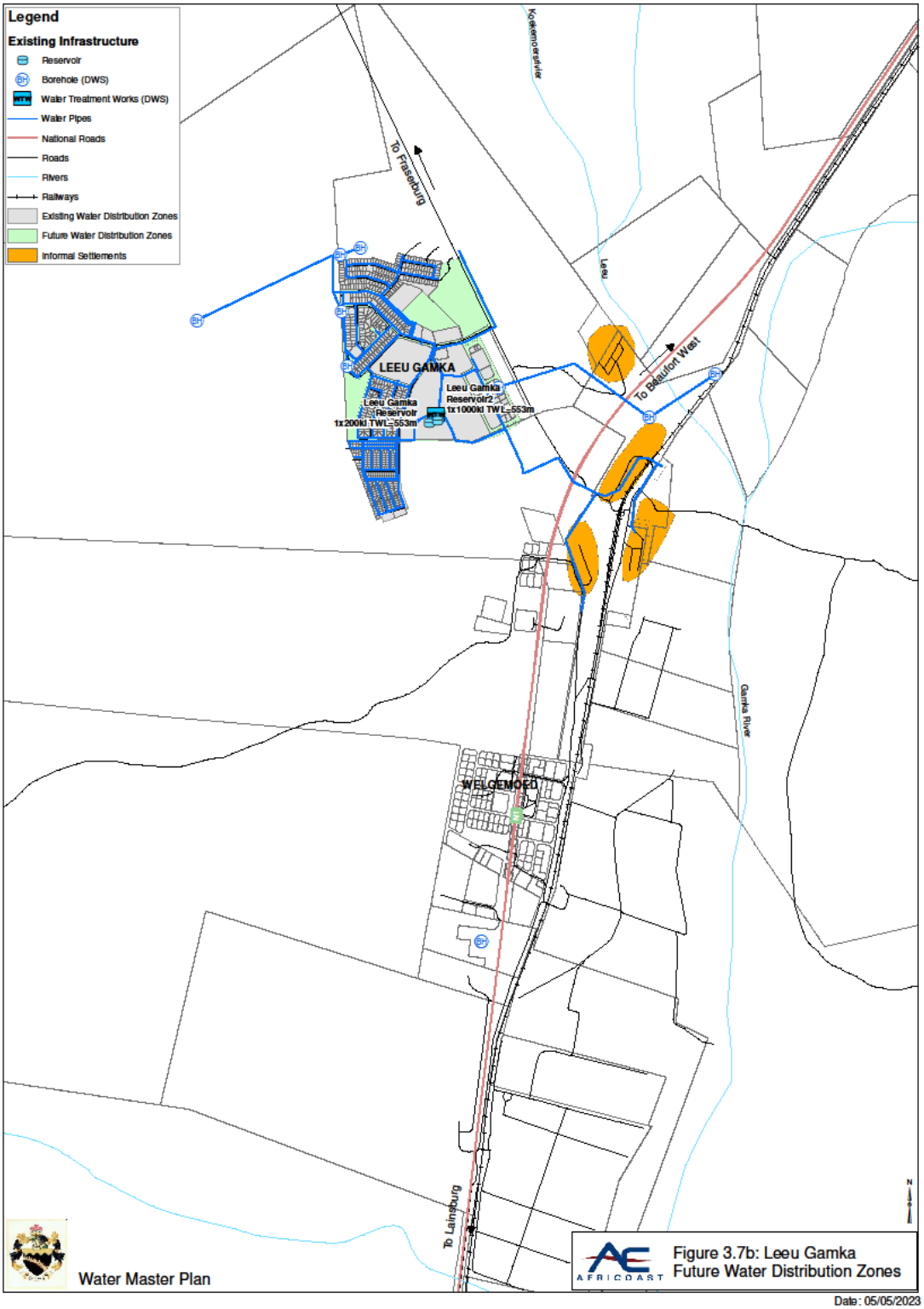


Figure 3.7c: Klaarstroom Future Water Distribution Zones

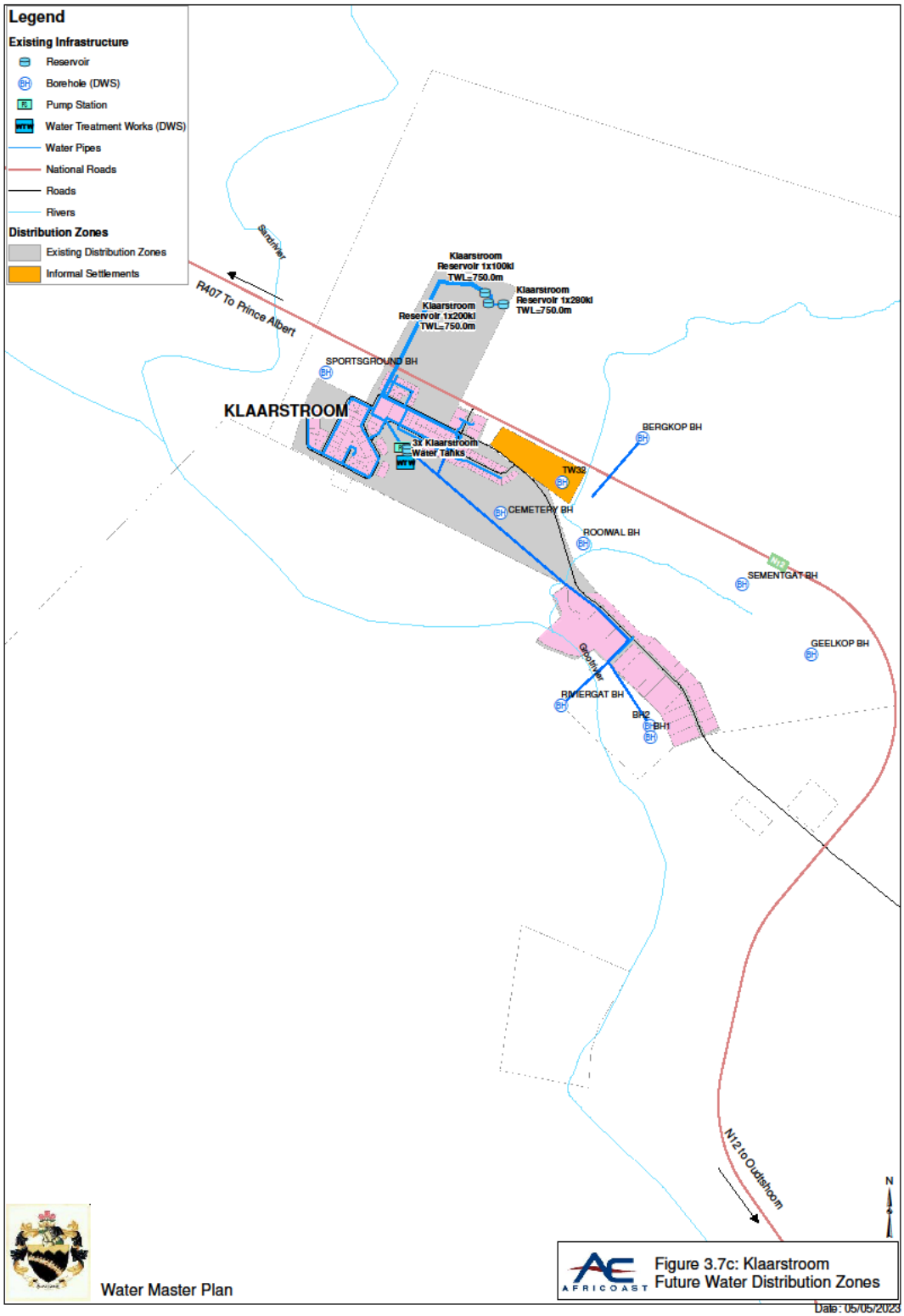


Figure 3.8a: Prince Albert Future Water Required Work

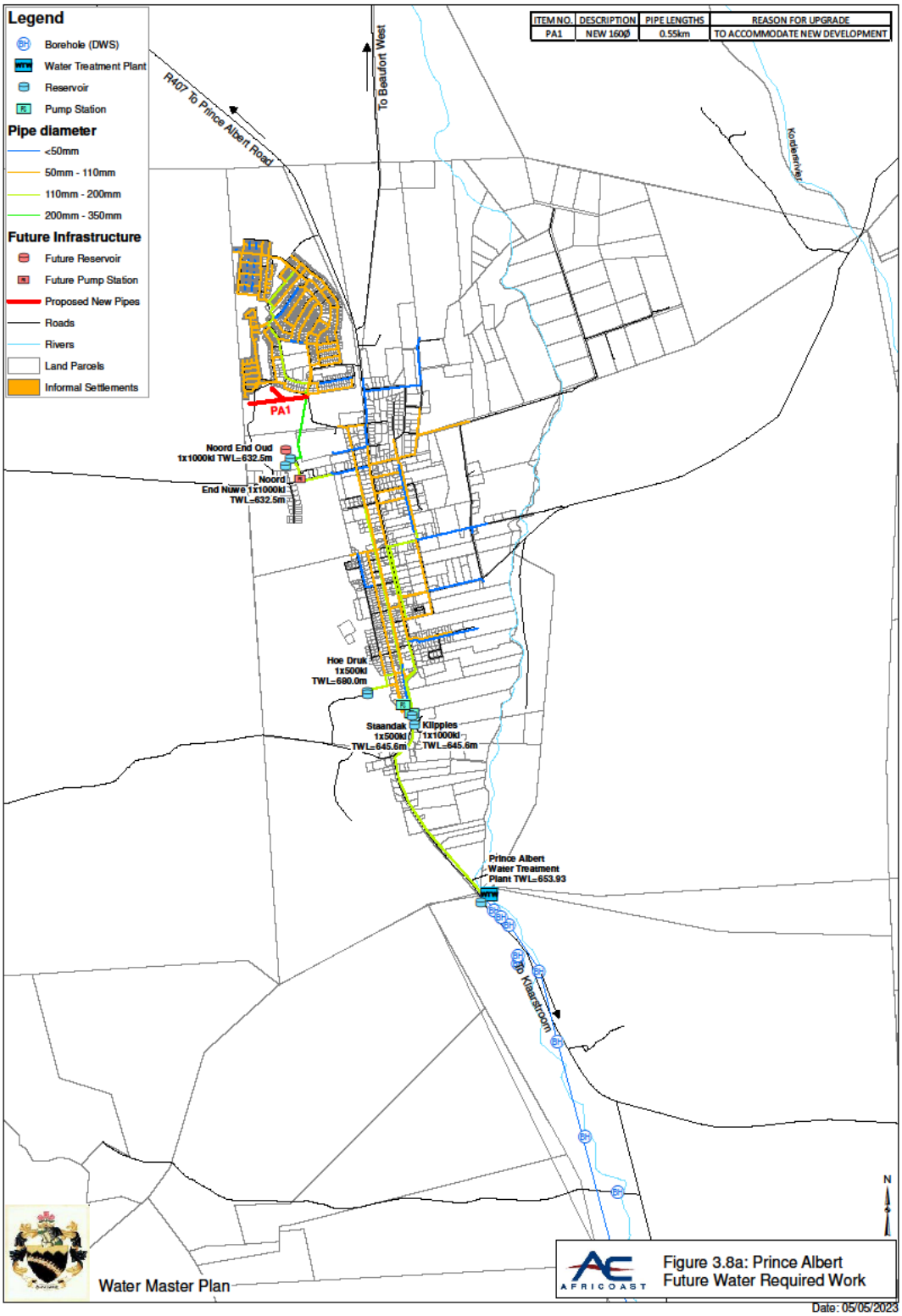


Figure 3.8b: Leeu Gamka Future Water Required Work

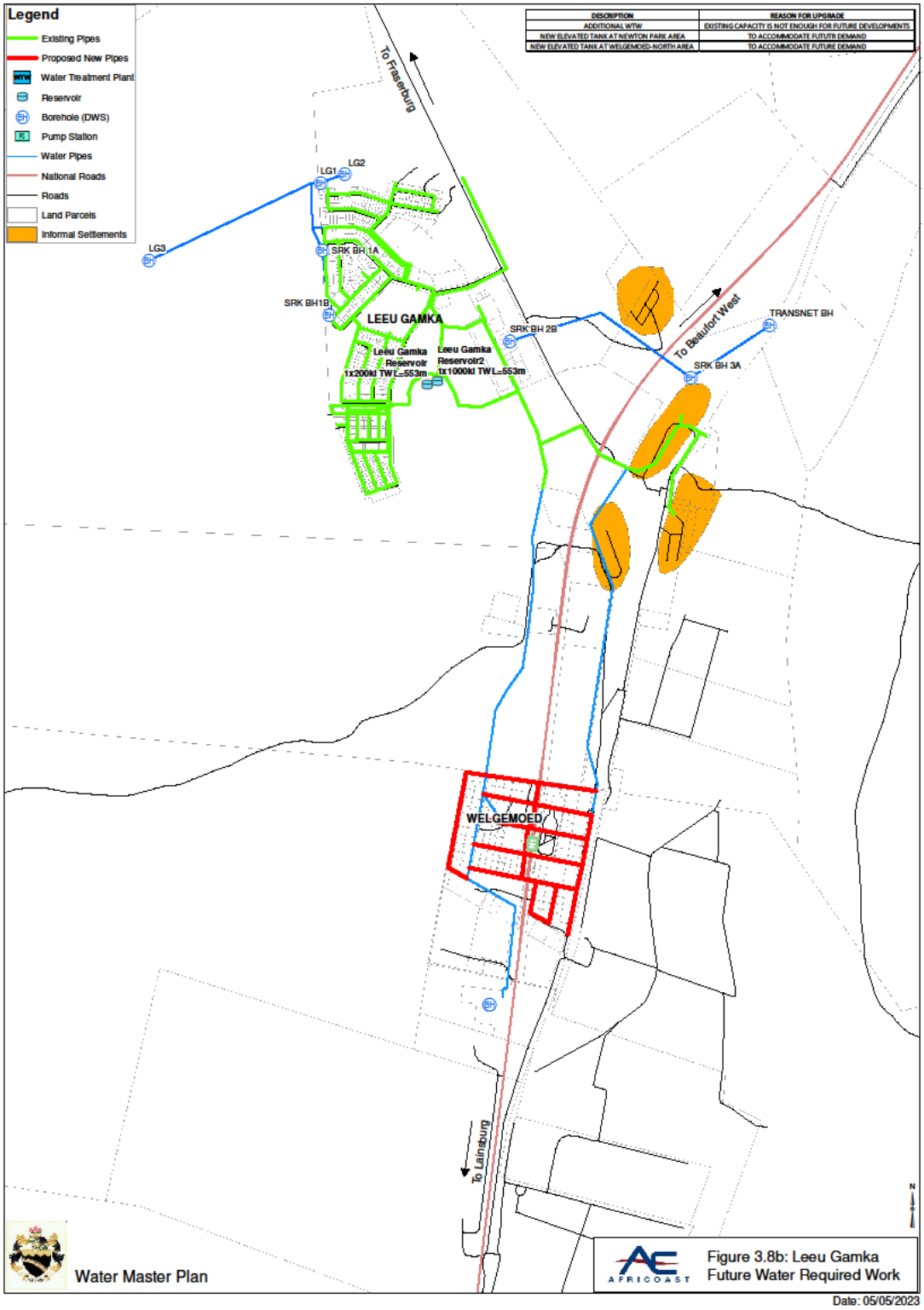


Figure 3.8c: Klaarstroom Future Water Required Work