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Water and Sanitation
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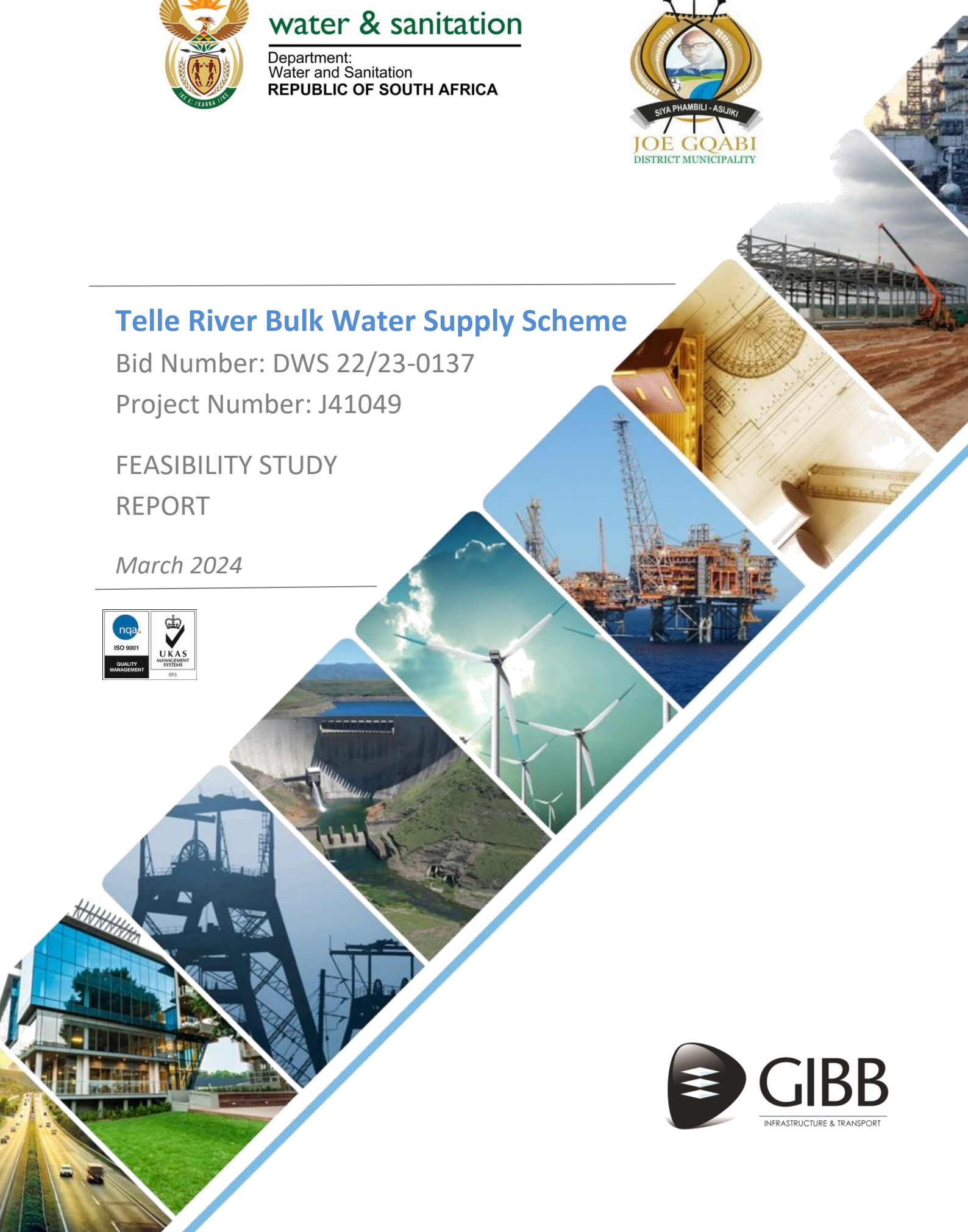
Telle River Bulk Water Supply Scheme

Bid Number: DWS 22/23-0137

Project Number: J41049

FEASIBILITY STUDY REPORT

March 2024



Telle River Bulk Water Supply Scheme: Situation Assessment Report

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Preliminary

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This document is reviewed to ensure its relevance. A record of contextual additions or omissions is given below.

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02	12/03/2024	Feasibility Report	Queen Zenani	Linda Nama	Wiero Vogelzang

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Abbreviations / Acronyms / Definitions

AMP	Asset Management Plan
BWSS	Bulk Water Supply Scheme
CFCs	Chlorofluorocarbons
CoGTA	Department of Co-operative Governance and Traditional Affairs
DEDEAT	Department of Economic Development, Environmental Affairs and Tourism
DWS	Department of Water and Sanitation

EAP	Economically Active Population
ECSECC	Eastern Cape Socio Economic Consultative Council
EIA	Environmental Impact Assessment
FS	Feasibility Study
FSR	Feasibility Study Report
GHG	Greenhouse Gases
GIS	Geographical Information System
IDP	Integrated Development Plan
IRR	Implementation Readiness Report
IRS	Implementation Readiness Study
ISD	Institutional and Social Development
ISO	International Standards Organisation
HDI	Human Development Index
JGDM	Joe Gqabi District Municipality
LM	Local Municipality
LoS	Level of Service
MWIG	Municipal Water Infrastructure Grant
Masl	Meters Above Sea Level
NEAP	Non-Economically Active Population
NEMA	National Environmental Management Act, 1998 (Act No. 107 of 1998)
NWA	National Water Act, 1998 (Act No. 36 of 1998)
O&M	Operation and Maintenance
PDR	Preliminary Design Report
PEP	Project Execution Plan
PE	Project Executive
PSC	Project Steering Committee
PSP	Professional Service Provider

RBIG	Regional Bulk Infrastructure Grant
SLM	Senqu Local Municipality
TR-BWSS	Telle River Bulk Water Supply Scheme
SMME	Small Medium and Micro Enterprises
WAR	Water Allocation Reform
WCDM	Water Conservation and Demand Management
WSA	Water Services Authority
WSP	Water Services Provider
WSDP	Water Services Development Plan
WULA	Water Use License Application

Acknowledgements

GIBB wishes to thank the Department of Water and Sanitation (DWS), Joe Gqabi District Municipality (JGDM), and the Senqu Local Municipality for their support in the delivery of this project.

Executive Summary

In November 2022, GIBB (PTY) Ltd was appointed by the Department of Water and Sanitation (DWS) to compile a Feasibility Study, develop Preliminary Designs and an Implementation Readiness Study for the Telle River Bulk Supply Scheme. The proposed Project Scope as detailed in the Terms of Reference under Contract *WP11360 PEP 6*, included the following:

- Identification of an ideal Abstraction Point
- Construction of a Raw Water Abstraction point
- Construction of a 7.5Mℓ/day Water Treatment Works, with water storage and pumps
- Construction of Bulk Supply Pipelines
- Construction of clear water Command Reservoirs
- Construction of clear water Supply Reservoirs
- Clear water high lift pump station
- Rising mains
- Electrification & Telemetry
- Access

The study Area covers approximately 700km² rural / peri-urban settlements in Wards 2,3,4 & 5, outside the town of Sterkspruit, bordering Lesotho in Senqu Local Municipality.

The estimated beneficiation is approximately 13 828 households, servicing a total estimated population of 42 296, as per calculations based on the STATSSA Census figures 2022. The estimated projections; assuming a growth rate of 1%; for the population and households estimates for 2053 is 57 038 and 17 798 respectively. The water demand adopted 7.5Mℓ/day for the domestic and institution consumption.

The Study area consists of settlements which can be referred to as rural and peri urban. JGDM as the Water Services Authority is currently servicing the study area by means of stand-alone borehole schemes, referred to as rudimentary water supply schemes in the Water Services Development Plan (WSDP) 2023. The WSDP identifies Elundini and Senqu to have the highest water and sanitation backlogs.

The Stand-Alone schemes generally consist of a borehole scheme, water storage and communal standpipes which dry up seasonally and are affected by lack of appropriate operations and maintenance.

A reliable regional water supply solution for the area is therefore urgently required to service the study area which is characterised by isolated villages and sporadic human settlements development around some nodes. In the Integrated Development Plan (IDP) for 2023/24 Financial Year one of the strategic risk and challenge was identified and mapped was :

Risk	Impact / Consequence	Current Measure	Required Intervention
Functionality of rural water supply schemes	<ul style="list-style-type: none">• Poor water supply and sanitation service provision.• Protests and vandalism.	Local based Operators. Centralised diesel management.	Convert diesel pumps to electricity. Establish regional water schemes.

The proposed regional water scheme must meet the current needs of residents and allow for the supply of a higher level of service to those that are willing and are able to pay for such a service.

Extensive Site Assessment and Stakeholder engagement sessions were held to form the basis of this report. From our observations of the infrastructure, we can surmise that there are challenges with regards to Operations and Maintenance (O&M), attributed to the following:

- The high number of stand-alone schemes.
- The Municipality does not generate any revenue for the supply of water in the peri-urban and rural areas.
- Distances from urban centres to access fuel and spares.
- Insufficient budgets for O&M.
- Slow turnaround time from when an incident is reported to it being fixed and closed.
- Reliance on diesel vs green energy which could be an alternative.
- Vandalism and sabotage.
- In some areas, it was reported that water is being commercialised by those that have borehole.

For the demand calculation information from the 2021 Census Statistics has been used. It must be noted that when comparing information from Census 2011 and Census 2022, the population within Senqu Local Municipality is increasing. The population growth rate as calculated from the Census 2022 is 0.84%, and households are growing at 2.2% per annum. However, due to future plans and outlook from the Municipality Data, a growth rate of 1% per annum has been used and the projected population per Ward is indicated **Table 3 - Table 6**.

Education Facilities have been included in the demand calculations, although currently they are serviced by on site schemes which have been upgraded by the Provincial Department of Education. It must be noted that supply to the Facilities currently is not optimum and is need of maintenance. Rainwater harvesting in most schools is relied on.

The total demand for the regional scheme was calculated to be 7.5Mℓ/d. Six (6) Delivery Options were investigated and costed. Option 2 which entails the construction of a dam on the eastern tributary of the Blikana River. The dam will have a storage capacity of 2 Million m³. The associated infrastructure will include the following:

- Pick-up Weir
- 7.5Mℓ Water Treatment Works
- Bulk Gravity Mains
- Bulk Rising Mains
- Reservoirs
- Borehole Schemes
- Associated infrastructures

The order of magnitude estimate for the capital costs is R 1.34 Bill, over an estimated implementation period of 5 years.

The unit reference value is estimated to be R32.85/m³, with full Grant Funding.

1 Introduction

1.1 Background

GIBB (PTY) Ltd was appointed by the Department of Water and Sanitation (DWS) to compile a Feasibility Study, develop Preliminary Designs and an Implementation Readiness Study for the Telle River Bulk Supply Scheme.

The Appointment Reference is as follows: WP11360 PEP 6 – BID NO: DWS 22/23-0137.

The Project shall be referred to as: **Telle River-Bulk Water Supply Scheme (TR-BWSS)**.

The proposed Project Scope as detailed in the Terms of Reference under Contract *WP11360 PEP 6*, included the following:

- Identification of an ideal Abstraction Point
- Construction of a Raw Water Abstraction point
- Construction of a 7.5Mℓ/day Water Treatment Works, with water storage and pumps
- Construction of Bulk Supply Pipelines
- Construction of clear water Command Reservoirs
- Construction of clear water Supply Reservoirs
- Clear water high lift pump station
- Rising mains
- Electrification & Telemetry
- Access.

The first deliverable titled: Inception and Scoping Report was submitted to DWS in February 2023.

A second deliverable titled: Situational Assessment Report was submitted in to DWS in July 2023.

The project is considered to be a Regional Bulk Project; therefore, this report is a Stage 3 Feasibility Study, Category B Feasibility Study Report in line with the ***DWS Infrastructure Planning Phase Business Planning Process Framework (July 2019)***. This report must be read in conjunction with the Situational Assessment Report. The focus is to develop Delivery Options that are feasible and select the most preferred option. A Preliminary Design and Implementation Readiness Study will be developed on the preferred option.

1.2 Problem Statement

“Peri-urbanisation relates to the processes of scattered and dispersive urban growth that create hybrid landscape of fragmented and mixed urban and rural characteristics” (Wikipedia). This best describes the settlements around towns that are of economic significance in the former Transkei, Bophuthatswana, Venda and Ciskei (TBVC) States. The town of Sterkspruit is situated on the northern borders of the Eastern Cape, neighbouring Lesotho. There is a proliferation of housing development in the peri-urban areas which has become a characteristic of the South African landscape. This development creates demand for services, water being the main one. Four (4) Wards in the Senqu Municipality have been identified in the Water Services Development Plan (WSDP) to have the highest water services backlogs. These Wards are what will be referred to as the Stud Area.

JGDM as the Water Services Authority is currently servicing the study area by means of stand-alone borehole schemes, referred to as rudimentary water supply schemes, in the Water Services Development Plan (WSDP). The WSDP identifies Elundini and Senqu to have the highest water and sanitation backlogs.

The Stand-Alone schemes generally consist of a borehole scheme, water storage and communal standpipes which dry up seasonally and are affected by lack of appropriate operations and maintenance and vandalism.

An upgraded regional water supply solution for the area is therefore urgently required to develop the area and ensure that inhabitants have an acceptable level of water service. The proposed water scheme must meet the current needs of residents and allow for the supply of a higher level of service to those that are willing and are able to pay for such a service.

The study area, referred to as the Telle Catchment Area, is situated on the boundary of Lesotho and South Africa, near Sterkspruit, in Senqu Local Municipality.

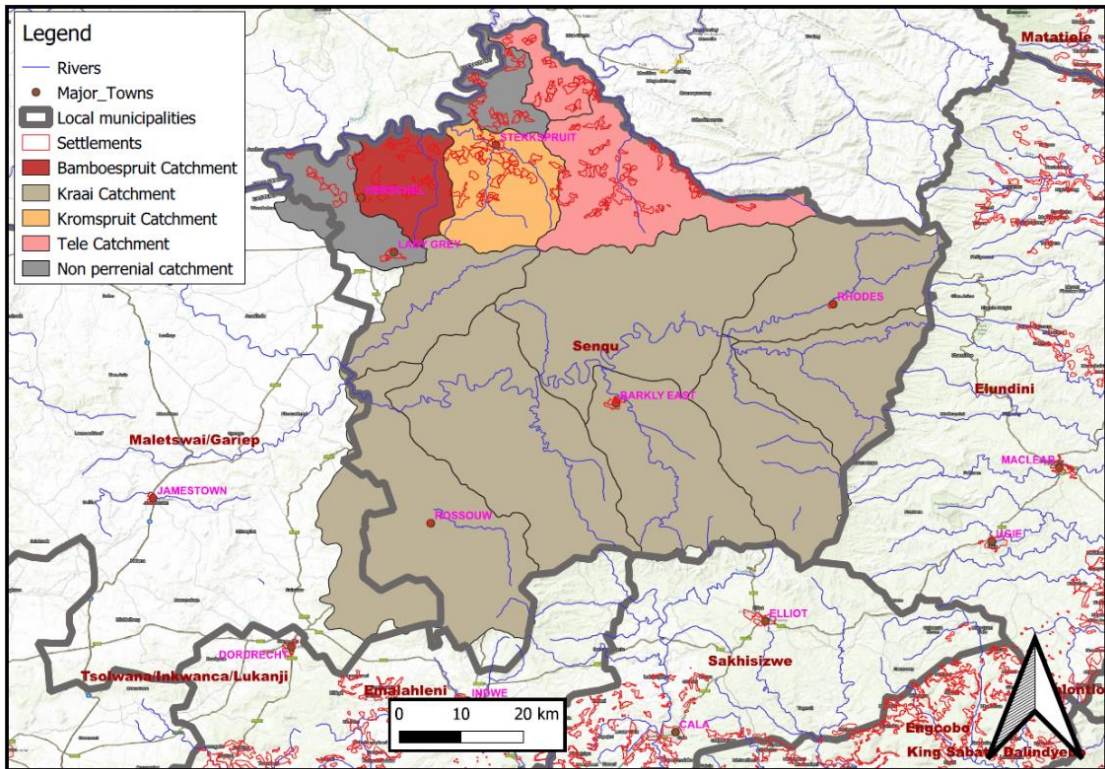


Figure 1: Catchment Area

1.3 Project Objectives

The aim of this study is to ensure a sustainable water supply for all the communities and institutions that lie within the supply area of the Telle River BWSS. The proposed Telle River BWSS is currently at the concept stage; so the objectives of this assignment are to:

- Investigate the feasibility of the proposed scheme or any alternative sources and technical solutions.
- Undertake a thorough cost-benefit analysis and recommend the most appropriate option.
- Confirm the geographical extent and develop and the development of a preliminary design for the most appropriate BWSS option as agreed by the DWS and JGDM.
- Populate a Implementation Readiness Study highlighting focus areas that need to be considered for project implementation.

2 Study Area

2.1 Project Location and Footprint

The Telle River Bulk Water Supply Scheme (BWSS) is a proposed regional bulk water supply scheme that will serve communities in an area of approximately 700km² that lies between the town of Sterkspruit and the border with Lesotho within Senqu Local Municipality.

Preliminary list of villages in the four wards in the study area as provided by JGDM.

Table 1: Villages in the Study Area

	Ward 2	Ward 3	Ward 4	Ward 5
Villages	Kwa-Gcina	Magalagaleneni	Mabalane	Ntabamhlope
	Sitoromo	Henge	Mfinci	Sdakeni
	Ndingishe	Qhoboshane	Penhoek	Zingxengele
	Lower & Upper Nquthu	Mmusong/Mpoki	Boomplaas	Kugqobho
	Rooiwal	Era	Makhumsha	Nondundu
	Lower Telle		Bebeza North	Phelandaba
	Kwa-Mlamli		Bebeza East	Maqolweni
	Mdantsane		Nomlengane	Rockcliff
	Dryhoek Area		Dangershoek	Sjorha
	Ntlekana			Qolweni
	Gwadana			Gcobho
	Mzimtsha			Mkunyazo

2.2 Physical Characteristic of Study Area

The topography of the study area (Senqu LM) consists of flat plains interposed by steep mountains. Elevations ranges from 1 430masl at Lower Telle (Ward 3), near the confluence of the Orange River and the Telle River to 1 957masl at Nomlengane (Ward 4) in the upper reaches of the Telle River. The landscape can generally be considered as mountainous, and inaccessible in other areas by service vehicles.

Soil erosion is a problem, especially in areas with high rainfall because the steep topography increases the impact of soil erosion. The problem is further exacerbated by over-grazing which strips away vegetation, leaves the ground bare and so the rains are able to wash away the rich, top layer of soil. Figure 2 is from the Spatial Development Framework¹.

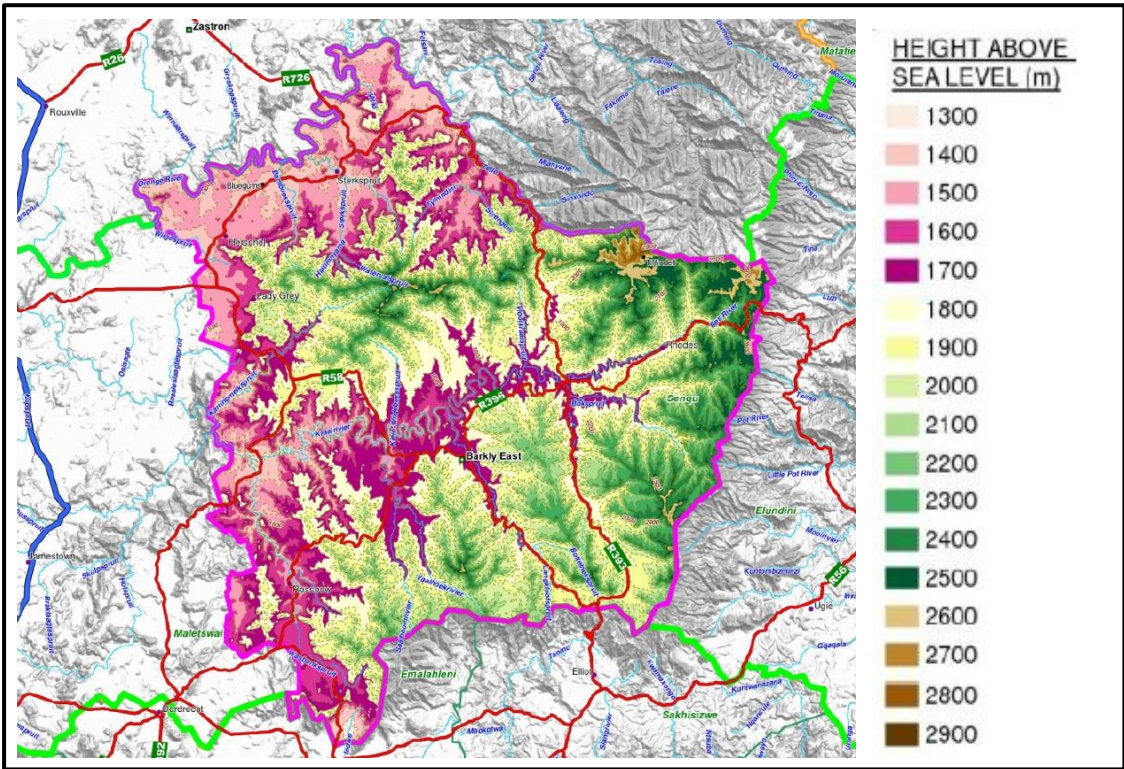


Figure 2: Topography of Senqu Local Municipality

2.3 Land Ownership, Servitude and Access

The study area is situated in the old Transkei, the land is designated as Unregistered State Land in the Surveyor Generals’ Office. It is therefore unlikely that there will be a need for land purchases and or servitude agreements with private landowners.

Access to the Settlements in the wards is predominately via gravel tracks. The R393 is the main corridor along the development nodes.

¹ Senqu LM Spatial Development Framework 2016 – Map 11

The Study Area, lying on the outskirts north of the Town of Sterkspruit, is characterised by a mountainous terrain bordering Lesotho, receives between 600mm and 800mm rainfall on average per annum. The rainy season is between October and January on average. Temperatures fluctuate between Summer and Winter extremes, reaching 42°C in Summer and plummeting to -11°C in Winter. On average there are 150 days of frost in a year, usually between March and November.

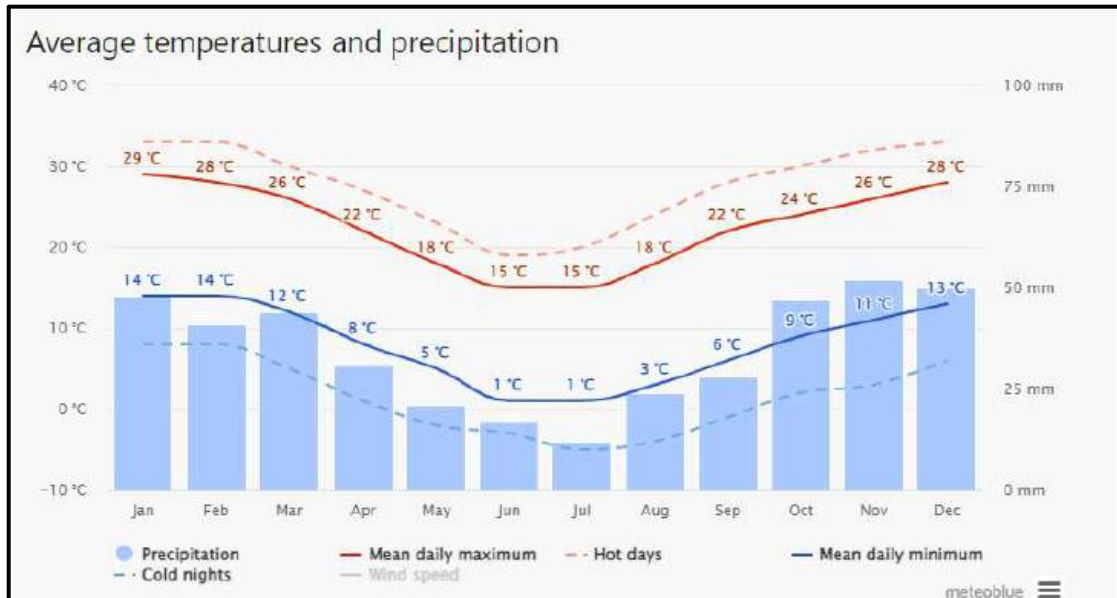
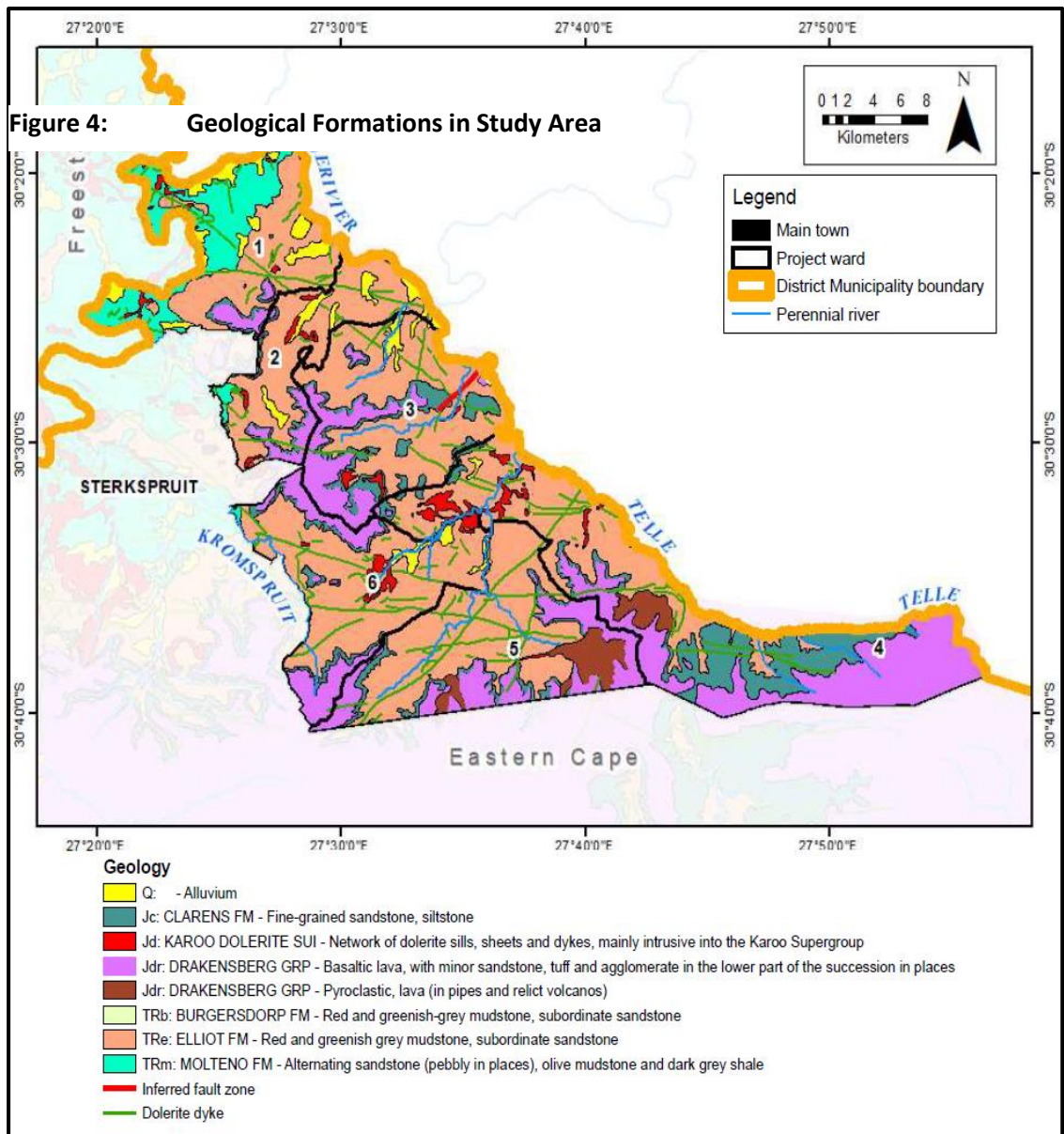


Figure 3: Average Temperatures and Precipitation

The greater portion of the Study Area is underlain by the Elliot Formation with the northern parts underlain by the Molteno Formation and the southern area and portions in the centre by the Drakensberg Group. The Elliot Formation consists of red and greenish grey mudstone with subordinate sandstone. The Molteno Formation consists of alternating sandstone (pebbly in places) with olive mudstone and dark grey shale. The Drakensberg group comprise basaltic lava, with minor sandstone, tuff, /cand agglomerate in the lower part of the succession in places. The sedimentary rocks are intruded by multiple dolerite dykes and sills. The strike direction of the dykes varies from northwest-southeast and northeast-southwest. Patches alluvium are mapped along the Orange River and other rivers. See **Figure 4** for a map showing the regional geology of Study Area ².

² SRK Hydrogeological Desk Study for Telle River BWSS Study Area – April 2023



3 Demographic

3.1 Communities / Villages to be served.

The Villages to be served are in Wards 2, 3, 4 and 5 in Senqu Local Municipality, as tabulated in Table 1 above.

3.2 Population Estimates & Population Growth

The following data sources were used to estimate the population within the study area:

- STATSSA Census 1996
- STATSSA Census 2001
- STATSSA Census 2011
- STATSSA Census 2022

Table 2: Population Data Senqu LM

Wards	Senqu LM Ward Population			
	Census 1996	Census 2001	Census 2011	*Census 2022
2	17 591	18 294	18 080	19 822
3	7 554	7 856	7 764	8 512
4	6 757	7 027	6 945	7 614
5	5 322	5 535	5 470	5 997
Total	37 223	38 711	38 259	41 944

*Projected based on Senqu Census 2022 population

In consultation with DWS it was decided that only STATSSA Census figures be used as a bases of projections. The Census figures indicate an increase from 2011 to 2022, with a growth rate of 1%. The estimated population figures for 2023 are tabulated below in **Table 3** to **Table 8**.

Table 3: Population Data for Ward 2

Telle River BWSS - Projected Population					
WARD	Settlement	Census 2011		Projection 2023	
		Population	No. of Households	Population	No. of Households
WARD 2	Senqu NU	7 021	1 940	7762	2552
	Sitoromo SP	1 202	332	1329	437
	Palmietfontein SP	1 776	491	1963	645
	Magalagalen SP	491	136	543	179
	Gcina SP	555	153	614	202
	Mayireni SP	3 175	877	3510	1154
	Ndingashe SP	1 173	324	1297	426
	Gumba-Gumba SP	377	104	417	137
	Rooiwal SP	634	175	701	230
	Makuyaze SP	375	104	415	136
	Dulcies Nek SP	182	50	201	66
	Mbini SP	389	107	430	141
	Mtsila SP	464	128	513	169
	Ngxingweni SP	266	72	294	95
		18 080	4 994	19 988	6 570

Table 4: Population Data for Ward 3

Telle River BWSS - Projected Population					
WARD	Settlement	Census 2011		Projection 2023	
		Population	No. of Households	Population	No. of Households
WARD 3	Mdeni SP	882	239	975	315
	Henge SP	588	160	650	210
	Lower Telle SP	424	115	469	151
	Telle Mission SP	390	106	431	139
	Sikroxweni SP	445	121	492	159
	Qoboshane SP	301	82	333	107
	Magalagaleni SP (1,2,3)	1 690	459	1868	603
	Hobeng SP	746	202	825	266
	Tlakong SP	426	116	471	152
	Era SP	452	123	500	161
	Tlankaneng	725	197	802	259
	Mpoki	263	71	291	94
	Musong SP	432	117	478	154
		7 764	2 107	8 583	2 772

Table 5: Population Data for Ward 4

Telle River BWSS – Projected Population					
WARD	Settlement	Census 2011		Projection 2023	
		Population	No. of Households	Population	No. of Households
WARD 4	Emqheyen	612	153	677	201
	White City	569	142	629	187
	Trappan	447	112	494	147
	Komkhulu SP	382	95	422	126
	Ntubeni SP	379	95	419	125
	Makumsha SP	384	96	425	126
	Mbango SP	190	47	210	62
	Mtunzini SP	1 215	304	1343	399
	Nothanda SP	215	54	238	71
	Blom SP	265	66	293	87
	Mfinci SP	333	83	368	109
	Juliwe	667	167	737	219
	Daweni	237	59	262	78
	Springkaanspoort SP	311	78	344	102
	Boomplaas SP	369	92	408	121
	Dangershoek SP	212	53	234	70
	Nomlengane SP	158	39	175	52
	6 945	1 735	7 678	2 283	

Table 6: Population Data for Ward 5

Telle River BWSS - Projected Population					
WARD	Settlement	Census 2011		Projection 2023	
		Population	No. of Households	Population	No. of Households
WARD 5	Sidakaneni	231	67	255	89
	Blikana SP	622	182	688	239
	Mtsono	135	39	149	52
	Lusizini	371	108	410	143
	Sketsheni	331	97	366	127
	Fort Hook SP	1 128	329	1247	433
	Ndungunya SP	435	127	481	167
	Pelandaba Mission SP	234	68	259	90
	Zingxangele	331	97	366	127
	Mahlathini	292	85	323	112
	Mhlabathini	263	77	291	101
	Ninakulu Mount SP	83	24	92	133
	Rock Cliff SP	265	77	293	103
	KwaMadume	346	101	383	133
	Emua Kwegolo	267	78	295	103
	Kusiphamo	136	40	150	52
		5 470	1 597	6 047	2 203

* Some of the population of Ward 5 lies outside the Study Area

Table 7: Institutions

Telle River BWSS - Institutions			
WARD	Institutions	Census 2011	Projection 2023
		Staff / Patients / Learners	Staff / Patients / Learners
WARD 2	St. Michael's Clinic	130	144
	St Michael's Junior Secondary School	138	153
	Ndingishe Junior Secondary School	57	64
	kwaGcina Junior Secondary School	11	13
	Mahedi Junior Secondary School	134	149
	St Teresa Senior Secondary School	237	263
	Sitoromo Junior Secondary School	363	402
		1 070	1 188
WARD 3	Palmietfontein Clinic	130	144
	Musong Clinic	130	144
	Tlhakong Senior Primary School	132	146
	Era Junior Secondary School	42	47
	Hohobeng Junior Secondary School	0	0
	Mpoki Primary School	109	121
	Musong Junior Secondary School	196	217
	Qhoboshane Junior Secondary School	360	399
	Telle Junction Senior Primary School	615	680
	Tlokweng Senior Senior Secondary School	1 366	1511
	3 080	3 409	

Telle River BWSS - Institutions			
WARD	Institutions	Census 2011	Projection 2023
		Staff / Patients / Learners	Staff / Patients / Learners
WARD 4	Bebeza Senoir Primary School	0	0
	Cebeno Junior Secondary School	182	202
	Danger's Hoek Junior Secondary School	47	52
	Kwabo Primary School	353	391
	Makumsha Junior Secondary School	235	260
	Momlengana Senior Primary School	0	0
	Mxokozeli Senior Primary School	0	0
	Ntlangano Primary Junior School	0	0
	Penhoek Senior Primary School	3	4
	Sivumelene Senior Secondary School	450	498
	Amavundle Junior Secondary School	0	0
	Mabele Junior Secondary School	271	300
	1 541	1 707	
WARD 5	Pelandaba Clinic	130	144
	Blikana Senior Secondary School	334	370
	Bongiwe Senior Primary School	0	0
	Impumelelo Senior Secondary School	150	166
	Lufefe Junior Secondary School	0	0
	Luyolo Primary School School	0	0
	Mkunyazo Senior Primary School	173	192
	Mthabiza Senior Primary School	100	111
	Mzondeki Junior Secondary School	0	0
	Pelandaba Primary Junior School	91	101
	Sijora Senior Primary School	0	0
	Sakakude Junior Secondary School	254	281
	Zingxengele Junior Secondary School	47	52
		1 279	1 417
TOTAL	6 970	7 721	

The concentration of the population is in Ward 2. The study areas has low population densities, ie. number of people per km², characterising a rural South African spatial settlement.

Table 8: Population Data for all Wards in Study Area

	Area km ²	Census 2011		Population Density	HH Size
		Population	No. of Households	People / km ²	People / HH
Ward 2	81.3	18 080	4995	222.4	3.6
Ward 3	131.9	7 764	2107	58.9	3.7
Ward 4	223.8	6 945	1735	31.0	4.0
Ward 5	2 206.8	5 470	1597	2.5	3.4
Total	2 643.5	38 259	10 434	-	-

3.3 Households per Capita Income

The Study Area is a predominantly rural area, characterised by scattered settlements, ad hoc development and subsistence farming. As a result, the socio-economic status is characterised by relatively low household income, high unemployment and a large female population.

Table 9: Annual Income Data per Ward

Wards	No income	R 1 - R 4800	R 4 801 - R 9600	R 9 601 - R 19 600	R 19 601 - R 38 200	R 38 201 - R 76 400
Ward 2	714	348	723	1743	1146	324
Ward 3	267	126	225	492	393	111
Ward 4	252	144	237	555	429	72
Ward 5	243	117	216	447	378	123

Wards	R 76 401 - R 153 800	R 153 801 - R 307 600	R 307 601 - R 614 400	R 614 001 - R 1 228 800	R 1 228 801 - R 2 457 600	R 2 457 601 or more
Ward 2	171	114	93	30	21	6
Ward 3	36	21	12	0	0	0
Ward 4	12	9	6	0	0	0
Ward 5	48	21	6	0	0	0

The annual per capita income in Senqu Local Municipality is R 31,500 and is lower than both the Eastern Cape (R 41,000) and of the Joe Gqabi District Municipality (R 34,400) per capita income. The per capita income for Senqu Local Municipality (R 31,500) is lower than that of the South Africa which is R 58,700. (STASSA 2011)

3.4 Number of poor Households

Table 10: Number of Poor Households per Ward

Wards	No income	R 1 - R 4800
Ward 2	714	348
Ward 3	267	126
Ward 4	252	144
Ward 5	243	117

JGDM as a Water Services Authority and Provider, relies on Senqu Local Municipality to update the Indigent Register to correctly reflect households that will not be able to afford the provisioning of basic services, thus deemed poor households. These households will receive subsidies through the Equitable Share Grant.

3.5 Urban / Rural Configuration

The Study area consists of settlements which can best be referred to as rural and peri-urban. The spatial arrangement is sporadic with no formal access roads and or servitudes. There is a growth node of some significance along the R393 in Ward 2, around Sitoromo village. It is with noting that Ward 2 is the most populated ward.

4 Water Supply Service Level Profile

4.1 Water Demand Planning Criteria

The project's design horizon is 30 years, extending to 2053. This period has allowed for a 5 year stage implementation. It is assumed that all construction of the proposed infrastructure i.e. dam, water treatment facilities, pumpstations, pipelines etc will be commissioned within the first 5 years.

The Design Criteria for the Telle River Water Supply Scheme is based on the Guidelines for Human Settlement Planning and Design ('Red Book') as well as GIBB's previous experience in similar rural water supply projects. **Table 11** summarizes the Design criteria used. This is followed by the Pipeline and Reservoir Sizing Design Criteria in **Table 12** and **Table 13** respectively.

Table 11: General Planning Criteria

Element	Criteria
Design Horizon:	Water Treatment works 25 Years Pipelines 25 Years Mechanical and Electrical 10-15 Years Reservoirs (size dependent) 25-50 Years
Population Growth Rate:	1%
Design Water Usage	Households: 80ℓ/h/d It is assumed that the municipality will in future upgrade all consumers to Yard Tap level of service
Design Water Usage	Schools: 60 ℓ/pupil/day Clinics: 80 ℓ/patient/day Guidelines for Human Settlement Planning and Design Volume 2 "Red Book"
Design Loss Factors(LF):	Design Loss Factor – Clear Water: LFw=10% Design Loss Factor – Raw Water: LFr=10%
Gross Average Annual Daily Demand (GAADD):	<i>For treated water:</i> GAADD = (1+LFw)*AADD <i>For raw water:</i> GAADD = (1+LFr)*AADD
Summer Peak Factor:	SPF = 1.2 per annum
Summer Daily Demand, Water Treatment Works And Raw Water And Clean Water Pumps	SDD _{ww} =SPF*GAADD*(1+LFw) <i>For raw water</i> SDD _R =SPF*GAADD*(1+LFr) Design Pumping Period = 20 hrs/day
Residual Pressure (above GL):	6 m minimum at point of delivery.

Table 12: Pipeline Design Criteria

Element	Criteria
Velocity	Gravity Mains – 0.5 to 1.5m/s Pump mains – 1.5m/s maximum Applications with velocities exceeding 1.5m/s will be reviewed on a case-by-case basis.
Pressure zones on gravity supply	Maximum 90m.
Friction loss formula	Hazen Williams and Darcy Weisbach, using Colebrook White friction factor
Materials	uPVC, HDPE & Galvanized Mild Steel.

Table 13: Reservoir Sizing Criteria

Element	Criteria
Reservoirs	Borehole supplied Reservoirs 24Hrs x GAADD Bulk/Distribution Reservoir 48Hrs*GAADD distribution area Command Reservoir 48Hrs*GAADD for supply area

4.2 Existing and Future Demand Analysis

Information from the 2011 and 2022 Census Statistics have been used to compute the projected population growth to 2053. It must be noted that when comparing information from Census 2011 and Census 2022, the population within Senqu Local Municipality is increasing at a rate of 0.84% per annum. However, due to future plans and outlook from the Municipality Data, a growth rate of 1% per annum has been used for projections from 2023 to 2053. The projected population is indicated in the table below.

Table 14: Population Statistics

Telle River BWSS - Projected Population							
WARD	Cluster No.	Settlement	Average Elevation	Projection 2023		Projection 2053	
			(masl)	Population	No. of Households	Population	No. of Households
WARD 2	1	Senqu NU	1 497	7762	2552	10462	3279
	1	Sitoromo SP	1 489	1329	437	1792	562
	1	Palmietfontein SP	1 455	1963	645	2647	830
	2	Magalagalen SP	1 482	543	179	732	230
	2	Gcina SP	1 505	614	202	827	260
	2	Mayireni SP	1 509	3510	1154	4732	1483
	2	Ndingashe SP	1 577	1297	426	1748	548
	2	Gumba-Gumba SP	1 566	417	137	562	177
	3	Rooiwal SP	1 600	701	230	945	297
	4	Makuyaze SP	1 567	415	136	559	176
	4	Dulcies Nek SP	1 610	201	66	272	85
	4	Mbini SP	1 582	430	141	580	182
	4	Mtsila SP	1 560	513	169	692	217
	4	Ngxingweni SP	1 639	294	95	397	123
			SUM		19 988	6570	26 947

Telle River BWSS - Projected Population							
WARD	Cluster No.	Settlement	Average Elevation	Projection 2023		Projection 2053	
			(masl)	Population	No. of Households	Population	No. of Households
WARD 3	1	Mdeni SP	1 456	975	315	1315	405
	1	Henge SP	1 461	650	210	877	270
	1	Lower Telle SP	1 430	469	151	632	195
	1	Telle Mission SP	1 463	431	139	582	179
	1	Sikroxweni SP	1 436	492	159	664	205
	1	Qoboshane SP	1 452	333	107	449	139
	2	Magalagalani SP (1,2,3)	1 535	1868	603	2519	776
	3	Hobeng SP	1 543	825	266	1112	343
	3	Tlakong SP	1 573	471	152	635	196
	4	Era SP	1 600	500	161	674	208
	4	Tlankaneng	1 599	802	259	1081	333
	4	Mpoki	1 648	291	94	392	121
	4	Musong SP	1 681	478	154	644	199
			SUM		8 583	2 772	11 576
WARD 4	3	Emqheyen	1 521	677	201	912	259
	3	White City	1 520	629	187	848	241
	3	Trappan	1 543	494	147	667	189
	4	Komkhulu SP	1 761	422	126	570	162
	4	Ntubeni SP	1 565	419	125	565	161
	4	Makumsha SP	1 544	425	126	573	163
	5	Mbango SP	1 559	210	62	284	81
	5	Mtunzini SP	1 675	1343	399	1811	514
	5	Nothanda SP	1 619	238	71	321	91
	5	Blom SP	1 651	293	87	395	112
	1	Mfinci SP	1 750	368	109	497	141
	1	Juliwe	1 800	737	219	994	282
	1	Daweni	1 804	262	78	354	101
	2	Springkaanspoort SP	1 532	344	102	464	132
	2	Boomplaas SP	1 563	408	121	550	156
	6	Dangershoek SP	1 756	234	70	316	90
	6	Nomlengane SP	1 957	175	52	236	67
			SUM		7 678	2 283	10 357
WARD 5	1	Sidakaneni	1 578	255	89	345	115
	1	Blikana SP	1 649	688	239	927	307
	1	Mtsono	1 695	149	52	202	67
	1	Lusizini	1 554	410	143	553	184
	1	Sketsheni	1 730	366	127	494	164
	2	Fort Hook SP	1 594	1247	433	1681	557
	2	Ndungunya SP	1 594	481	167	649	215
	2	Pelandaba Mission SP	1 701	259	90	349	116
	2	Zingxangele	1 648	366	127	494	164
	2	Mahlathini	1 611	323	112	436	145
	2	Mhlabathini	1 695	291	101	392	130
	3	Ninakulu Mount SP	1 894	92	133	124	171
	3	Rock Cliff SP	1 816	293	103	395	132
	4	KwaMadume	1 661	383	133	516	171
	4	Emua Kwegolo	1 640	295	103	398	132
	4	Kusiphamo	1 670	150	52	203	68
		SUM		6 047	2 203	8 158	2 838
TOTAL				42 296	13 827	57 038	17 798

Education Facilities have been included in the demand calculations, although currently they are serviced by on site schemes which have been upgraded by the Provincial Department of Education. It must be noted that supply to the Facilities currently is not optimum and is in need of maintenance. Rainwater harvesting in most schools is relied on.

Table 15: Education Facilities

Telle River BWSS - Institutional Consumption			
WARD	Institutions	Projection 2023	Projection 2053
		Staff / Patients / Learners	Staff / Patients / Learners
WARD 2	St. Michael's Clinic	144	195
	St Michael's Junior Secondary School	153	207
	Ndingishe Junior Secondary School	64	87
	kwaGcina Junior Secondary School	13	18
	Mahedi Junior Secondary School	149	201
	St Teresa Senior Secondary School	263	355
	Sitoromo Junior Secondary School	402	542
		1 188	1 605
WARD 3	Palmietfontein Clinic	144	195
	Musong Clinic	144	195
	Tlhakong Senior Primary School	146	197
	Era Junior Secondary School	47	64
	Hohobeng Junior Secondary School	0	0
	Mpoki Primary School	121	164
	Musong Junior Secondary School	217	293
	Qhoboshane Junior Secondary School	399	538
	Telle Junction Senior Primary School	680	917
	Tlokweg Senior Senior Secondary School	1511	2037
		3 409	4 600
WARD 4	Bebeza Senoir Primary School	0	0
	Cebeno Junior Secondary School	202	273
	Danger's Hoek Junior Secondary School	52	71
	Kwabo Primary School	391	528
	Makumsha Junior Secondary School	260	351
	Momlengana Senior Primary School	0	0
	Mxokozeli Senior Primary School	0	0
	Ntlangano Primary Junior School	0	0
	Penhoek Senior Primary School	4	6
	Sivumelene Senior Secondary School	498	672
	Amavundle Junior Secondary School	0	0
	Mabele Junior Secondary School	300	405
		1 707	2 306
WARD 5	Pelandaba Clinic	144	195
	Blikana Senior Secondary School	370	499
	Bongiwe Senior Primary School	0	0
	Impumelelo Senior Secondary School	166	224
	Lufefe Junior Secondary School	0	0
	Luyolo Primary School School	0	0
	Mkunyazo Senior Primary School	192	259
	Mthabiza Senior Primary School	111	150
	Mzondeki Junior Secondary School	0	0
	Pelandaba Primary Junior School	101	137
	Sijora Senior Primary School	0	0
	Sakakude Junior Secondary School	281	379
	Zingxengele Junior Secondary School	52	71
		1 417	1 914
TOTAL	7 721	10 425	

4.3 Water Demand Assumptions and Service Levels

The water requirements for the villages and towns vary significantly throughout a study area, depending on socio-economic situation, institutional capacity and consumer behaviour. In this report the following service levels were used:

- The water demand per capita in the region was taken as 80 ℓ/c/d for all households;
- For institutions the water demand per capita was taken as 60 ℓ/ pupil /d for Schools and 80 ℓ/patient/day for clinics
- Distribution waterworks losses of 10%;
- Water treatment losses of 10%; and
- A seasonal peak factor of 1.2 was used.

It must be noted that the areas considered under this study exclude farms and irrigated lands.

4.4 Design Demand

Based on the level of service indicated in the section above, the estimated 2053 water demands are indicated in the Tables below.

Table 16: Projected Population and Water Demand for Ward 2

Telle River BWSS – Projected Population and Water Demand						
WARD	Cluster No.	Settlement	Average Elevation	Projection 2053		Water Demand 2053
			(masl)	Population	No. of Households	Peak Demand (m ³ /day)
WARD 2	1	Senqu NU	1 497	10 462	3 279	1 215.27
	1	Sitoromo SP	1 489	1 792	562	208.16
	1	Palmietfontein SP	1 455	2 647	830	307.48
	2	Magalagalen SP	1 482	732	230	85.03
	2	Gcina SP	1 505	827	260	96.06
	2	Mayireni SP	1 509	4 732	1 483	549.67
	2	Ndingashe SP	1 577	1 748	548	203.05
	2	Gumba-Gumba SP	1 566	562	177	65.28
	3	Rooiwal SP	1 600	945	297	109.77
	4	Makuyaze SP	1 567	559	176	64.93
	4	Dulcies Nek SP	1 610	272	85	31.60
	4	Mbini SP	1 582	580	182	67.37
	4	Mtsila SP	1 560	692	217	80.38
	4	Ngxingweni SP	1 639	397	123	46.12
	SUM				26 947	8 449

Table 17: Institutional Consumption

Telle River BWSS - Institutional Consumption			
WARD	Institutions	Projection 2053	Water Demand 2053
		Staff / Patients / Learners	Demand (m ³ /day)
WARD 2	St. Michael's Clinic	195	18.88
	St Michael's Junior Secondary School	207	15.03
	Ndingishe Junior Secondary School	87	6.32
	kwaGcina Junior Secondary School	18	1.31
	Mahedi Junior Secondary School	201	14.59
	St Teresa Senior Secondary School	355	25.77
	Sitoromo Junior Secondary School	542	39.35
		1 605	121.24

Table 18: Projected Population and Water Demand for Ward 3

Telle River BWSS – Projected Population and Water Demand						
WARD	Cluster No.	Settlement	Average Elevation	Projection 2053		Water Demand 2053
			(masl)	Population	No. of Households	Peak Demand (m ³ /day)
WARD 3	1	Mdeni SP	1 456	1 315	405	127.29
	1	Henge SP	1 461	877	270	101.87
	1	Lower Telle SP	1 430	632	195	73.41
	1	Telle Mission SP	1 463	582	179	67.61
	1	Sikroxweni SP	1 436	664	205	77.13
	1	Qoboshane SP	1 452	449	139	52.16
	2	Magalagalen (1,2,3) SP	1 535	2 519	776	292.61
	3	Hobeng SP	1 543	1 112	343	129.17
	3	Tlakong SP	1 573	635	196	73.76
	4	Era SP	1 600	674	208	78.29
	4	Tlankaneng	1 599	1 081	333	125.57
	4	Mpoki	1 648	392	121	45.53
	4	Musong SP	1 681	644	199	74.81
			SUM	-	11 576	3 569

Table 19: Institutional Consumption for Ward 3

Telle River BWSS - Institutional Consumption			
WARD	Institutions	Projection 2053	Water Demand 2053
		Staff / Patients / Learners	Demand (m ³ /day)
WARD 3	Palmietfontein Clinic	195	18.88
	Musong Clinic	195	18.88
	Tlhakong Senior Primary School	197	14.30
	Era Junior Secondary School	64	4.65
	Hohobeng Junior Secondary School	0	0.00
	Mpoki Primary School	164	11.91
	Musong Junior Secondary School	293	21.27
	Qhoboshane Junior Secondary School	538	39.06
	Telle Junction Senior Primary School	917	66.57
	Tlokweg Senior Senior Secondary School	2 037	147.89
		4 600	343.40

Table 20: Projected Population and Water Demand for Ward 4

Telle River BWSS – Projected Population and Water Demand						
WARD	Cluster No.	Settlement	Average Elevation	Projection 2053		Water Demand 2053
			(masl)	Population	No. of Households	Peak Demand (m ³ /day)
WARD 4	3	Emqheyen	1 521	912	259	105.94
	3	White City	1 520	848	241	98.50
	3	Trappan	1 543	667	189	77.48
	4	Komkhulu SP	1 761	570	162	66.21
	4	Ntubeni SP	1 565	565	161	65.63
	4	Makumsha SP	1 544	573	163	66.56
	5	Mbango SP	1 559	284	81	32.99
	5	Mtunzini SP	1 675	1 811	514	210.37
	5	Nothanda SP	1 619	321	91	37.29
	5	Blom SP	1 651	395	112	45.88
	1	Mfinci SP	1 750	497	141	57.73
	1	Juliwe	1 800	994	282	115.46
	1	Daweni	1 804	354	101	41.12
	2	Springkaanspoort SP	1 532	464	132	53.90
	2	Boomplaas SP	1 563	550	156	63.89
	6	Dangershoek SP	1 756	316	90	36.71
	6	Nomlengane SP	1 957	236	67	27.41
			SUM	-	10 357	2 942

Table 21: Institutional Consumption for Ward 4

Telle River BWSS - Institutional Consumption			
WARD	Institutions	Projection 2053	Water Demand 2053
		Staff / Patients / Learners	Demand (m ³ /day)
WARD 4	Bebeza Senoir Primary School	0	0.00
	Cebeno Junior Secondary School	273	19.82
	Danger's Hoek Junior Secondary School	71	5.15
	Kwabo Primary School	528	38.33
	Makumsha Junior Secondary School	351	25.48
	Momlengana Senior Primary School	0	0.00
	Mxokozeli Senior Primary School	0	0.00
	Ntlangano Primary Junior School	0	0.00
	Penhoek Senior Primary School	6	0.44
	Sivumelene Senior Secondary School	672	48.79
	Amavundle Junior Secondary School	0	0.00
	Mabele Junior Secondary School	405	29.40
		2 306	167.42

Table 22: Projected Population and Water Demand for Ward 5

Telle River BWSS – Projected Population and Water Demand						
WARD	Cluster No.	Settlement	Average Elevation	Projection 2053		Water Demand 2053
			(masl)	Population	No. of Households	Peak Demand (m ³ /day)
WARD 5	1	Sidakaneni	345	115	40.08	345
	1	Blikana SP	927	307	107.68	927
	1	Mtsono	202	67	23.46	202
	1	Lusizini	553	184	64.24	553
	1	Sketsheni	494	164	57.38	494
	2	Fort Hook SP	1 681	557	195.26	1 681
	2	Ndungunya SP	649	215	75.39	649
	2	Pelandaba Mission SP	349	116	40.54	349
	2	Zingxangele	494	164	57.38	494
	2	Mahlathini	436	145	50.65	436
	2	Mhlabathini	392	130	45.53	392
	3	Ninakulu Mount SP	124	171	14.40	124
	3	Rock Cliff SP	395	132	45.88	395
	4	KwaMadume	516	171	59.94	516
	4	Emua Kwegolo	398	132	46.23	398
	4	Kusiphamo	203	68	23.58	203
		SUM	-	8 158	2 838	947.63

Table 23: Institutional Consumption for Ward 5

Telle River BWSS - Institutional Consumption			
WARD	Institutions	Projection 2053	Water Demand 2053
		Staff / Patients / Learners	Demand (m ³ /day)
WARD 5	Pelandaba Clinic	195	18.88
	Blikana Senior Secondary School	499	36.23
	Bongiwe Senior Primary School	0	0.00
	Impumelelo Senior Secondary School	224	16.26
	Lufefe Junior Secondary School	0	0.00
	Luyolo Primary School School	0	0.00
	Mkunyazo Senior Primary School	259	18.80
	Mthabiza Senior Primary School	150	10.89
	Mzondeki Junior Secondary School	0	0.00
	Pelandaba Primary Junior School	137	9.95
	Sijora Senior Primary School	0	0.00
	Sakakude Junior Secondary School	379	27.52
	Zingxengele Junior Secondary School	71	5.15
	1 914	143.68	

The table below is the summary of the Water demand which will form the design basis of the proposed scheme.

Table 24: Water Demand

WARD	2011 (m ³ /d)	2023 (m ³ /d)	2053 (m ³ /d)	2053 (Mℓ/d)
Ward 2 Domestic	2 100.19	2 321.83	3 130.16	3.13
Ward 2 Institutions	80.83	89.73	121.24	0.12
Ward 3 Domestic	884.77	978.14	1 319.21	1.32
Ward 3 Institutions	229.90	254.46	343.40	0.34
Ward 4 Domestic	806.73	891.87	1 203.07	1.20
Ward 4 Institutions	111.88	123.93	167.42	0.17
Ward 5 Domestic	635.40	702.45	947.63	0.95
Ward 5 Institutions	96.00	106.36	143.68	0.14
TOTAL	4 945.70	5 468.77	7 375.81	7.38

The water demand of the proposed scheme is 7.5 Mℓ/d.

4.5 Free Basic Water Provision

The study area comprises of villages and is in one of the poorest and least developed regions of the country. The WSA does not generate any income from the Water Services provided.

5 *Water Resources Potential*

5.1 Groundwater

Bulk Supply is limited to stand-alone borehole schemes that service a cluster of villages. Currently the Study Area is solely dependent on groundwater in the form of boreholes and springs. Extensive work over the years has been done in the exploration and exploitation of ground water in the area. From our investigations there are no Groundwater Protocols in place that will assist in aquifer protections and management. Drilling of boreholes is ad hoc, and there are several unregistered private boreholes in operation.

The envisaged high groundwater potential zones were verified using satellite imagery. Based on the previously completed projects within the Study Area, regional dolerite dykes were found to deliver high yielding boreholes along rivers where high groundwater recharge is expected. These dykes form preferred flow paths with expected high groundwater potential. The criteria for the target selections for future groundwater development should include geological targets such as dolerite dykes and dolerite sill contact zones within the sedimentary rock formations.

Groundwater recharge to these geological targets is crucial, as the structure could be dry if not fed with water from a catchment area. Therefore, topographically high lying geological targets will most likely be dry and low-lying areas along well-developed drainage patterns would have an expected higher groundwater recharge.

The last criteria included in the target selection is accessibility. Dense vegetation as well as steep topography limits access to certain geological targets. From the aster images analysed, slopes exceeding 15o should be excluded from target zone selection. These areas will still need to be verified on site for accessibility purposes.

A total of 32 drill target zones have been identified as high potential zones for groundwater exploitation. These coordinates are not drilling positions, merely the centre point of areas where further hydrogeological investigation could be considered for groundwater development.

Table 25: Drill Target Zones

No	Latitude	Longitude	Comment	Priority
1	-30.628093	27.785924	Dolerite dyke - access not visible from the satellite image	3 - Low
2	-30.639663	27.831874	Dolerite dyke - topography is very high, with expected low recharge. Area looks very bushy	3 - Low
3	-30.599137	27.733508	Multiple dykes	1 - High
4	-30.593800	27.729576	Two dykes	1 - High
5	-30.588262	27.725532	Two dykes	1 - High
6	-30.545431	27.688501	Dyke, intersecting the Telle River as well. Existing borehole, rec at 1.0L/s	1 - High
7	-30.535968	27.657484	Dyke, intersecting the Telle River as well. Existing borehole rec at 0.8L/s	1 - High
8	-30.530872	27.605019	Dyke intersecting the Blikana River - existing borehole plots in zone	1 - High
9	-30.526691	27.606553	Dyke intersecting the Blikana River	1 - High
10	-30.523428	27.584074	Dyke - looks topographically high - existing borehole plots in the zone	2 - Medium
11	-30.500651	27.565189	Dyke - 3 borehole previously drilled - 1 borehole had a rec. yield of 0.44 L/s	2 - Medium
12	-30.491681	27.554883	Dyke	1 - High
13	-30.497960	27.548358	Dyke - access to be determine - could be topographically high	2 - Medium
14	-30.607814	27.588473	2 dykes intersecting at the Pelandaba River	1 - High
15	-30.592722	27.599415	Multiple dykes at the intersection of the Blikana and Pelandab Rivers - existing borehole rec at 3.5L/s	1 - High
16	-30.619766	27.490331	Dyke - topography and access to be confirmed	2 - Medium
17	-30.620640	27.625358	Prominent dyke	1 - High
18	-30.578404	27.530478	Prominent dyke - confirmation of an existing borehole will be required	1 - High
19	-30.576708	27.559602	Dyke - is not too visible on satellite image	3 - Low
20	-30.584338	27.559968	Prominent dyke - but access could be problematic	2 - Medium
21	-30.553546	27.442122	Two dykes	1 - High
22	-30.467664	27.432927	Dolerite sill and dykes - not prominently defined	3 - Low
23	-30.464869	27.414776	Dyke - access to be confirmed	1 - High
24	-30.416106	27.490058	Dyke intersecting 3 non-perennial rivers	1 - High
25	-30.441443	27.529932	Dyke	1 - High
26	-30.413918	27.543664	Dyke - land ownership to be confirmed	1 - High
27	-30.418121	27.557674	Dykes - covered by alluvium - land ownership to be confirmed	2 - Medium
28	-30.402369	27.493901	Dyke	1 - High
29	-30.376533	27.499781	Dyke / Sill - could be too high from the river	2 - Medium
30	-30.402649	27.356208	Weathering along the Orange River	2 - Medium
31	-30.333212	27.409905	Weathering along the Orange River	3 - Low
32	-30.345608	27.391288	Dolerite sill - check accessibility	3 - Low

A detailed report entitled “Hydrogeological Desk Study Telle River Bulk Water Supply Scheme – SRK April 2023 “ is attached as **Appendix A**.

5.2 Surface Water

The main river system that runs through the Project Area consists of the Telle River, and couple of its tributaries. The Telle River runs along the Lesotho-South Africa border and drains into the Orange River. The confluence with the Orange River is located to the east of Ward 2 at elevation 1 400 masl. While it is tempting to target an abstraction site downstream of this confluence, as water availability in terms of meeting the projected water demands would not be an issue, the fact remains that any water delivery system would then need to pump against a static head in excess of 400 m. Given the order of magnitude of water volumes to be abstracted, and the nature of the terrain in the area, this is deemed impractical. This argument holds if a central abstraction site is to be considered to supply all the identified settlements. However, should a decentralised approach be considered, where multiple pick-up weirs may become an option, then the area downstream of the confluence can be revisited.

Therefore, the area of interest for potential abstraction sites is mainly confined to the river system upstream of the Telle / Orange confluence. An abstraction site on the Telle River itself may be practical if it is situated in the higher reach (with ground elevations higher than 1 500 masl). Other options can consider the Blikana River, a tributary of the Telle River. The Blikana River, like the Telle River, is perennial and the upper reach of this river has ground elevations higher than 1 500 masl as well.

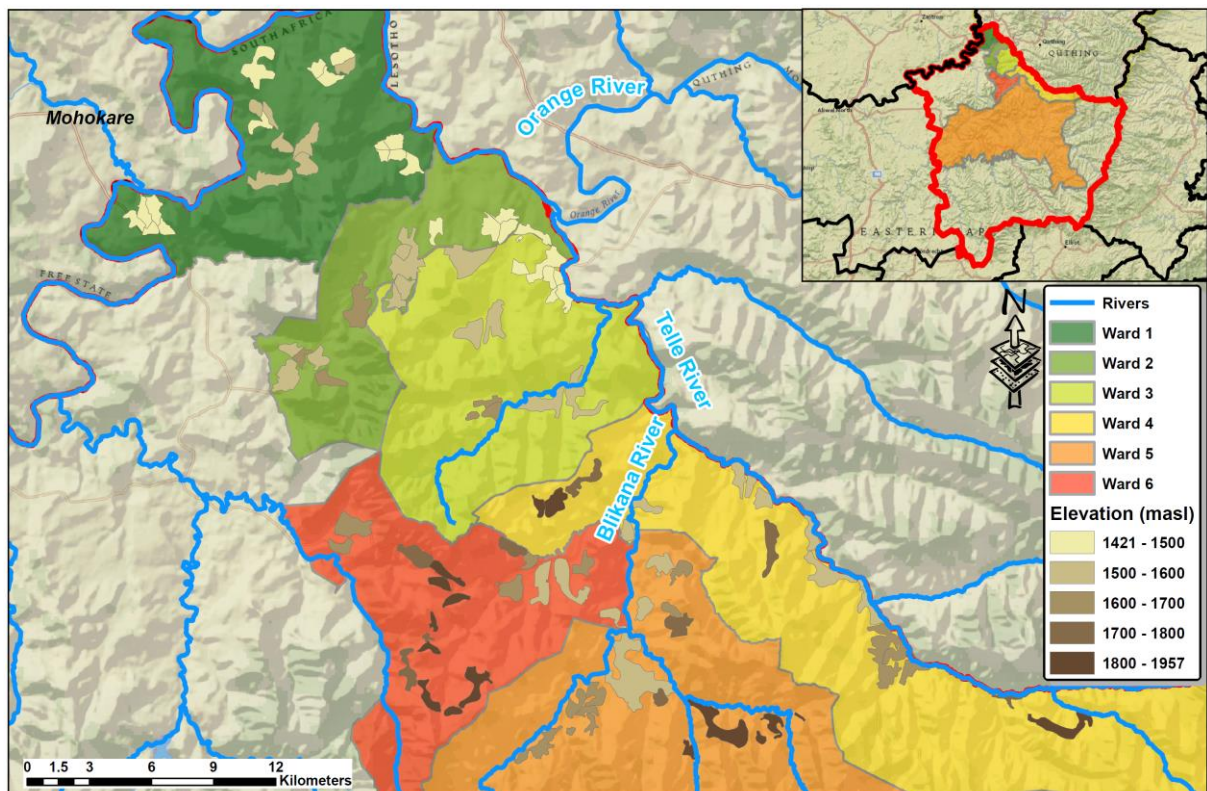


Figure 5: River Systems within the Project Area.

5.3 Potential Abstraction Sites

5.3.1 Scenario A: Centralized Abstraction Site

Should a single abstraction site be selected to serve as the sole surface water source for all the identified settlements within all six (6) wards, then such a site will need to be located in the higher reaches of the river system. Four (4) potential sites that can be considered have been identified and are shown in **Figure 6**.

Two (2) sites are identified along the Telle River, namely A-T1 and A-T2, and two (2) sites are identified along the Blikana River (A-B1 and A-B2).

An abstraction site along the Telle River itself has the advantage of providing access to higher assurance of supply compared to the sites on its tributary (Blikana River). This then can translate to potentially a smaller abstraction structure, which would reduce construction costs and reduce the footprint of the abstraction site. However, since the Telle River forms the border between Lesotho and South Africa, and since its catchment is split between the two countries, complications arise regarding the authorisations required to abstract water as well as construct the required infrastructure.

In contrast, the abstraction sites along the Blikana River would provide less assurances of supply, but the catchment area is entirely within South Africa. This simplifies the process required to obtain the necessary water abstraction and water use licenses. Furthermore, the two identified sites along the Blikana River are more closely positioned to the water demand centres (settlements) compared to those sites along the Telle River. The configuration of the envisaged abstraction structures can be adjusted to increase assurance of supply if needed.

All four of these potential sites have a disadvantage in needing to deliver at least some of the abstracted water against a static head up to 300 m. This will be required irrespective of the location of the abstraction site itself.

Given the above, the order of preference amongst the four identified sites is as follows:

1. Site A-B2
2. Site A-B1
3. Site A-T2
4. Site A-T1

Site A-B2 is recommended for further investigations should this scenario be adopted.

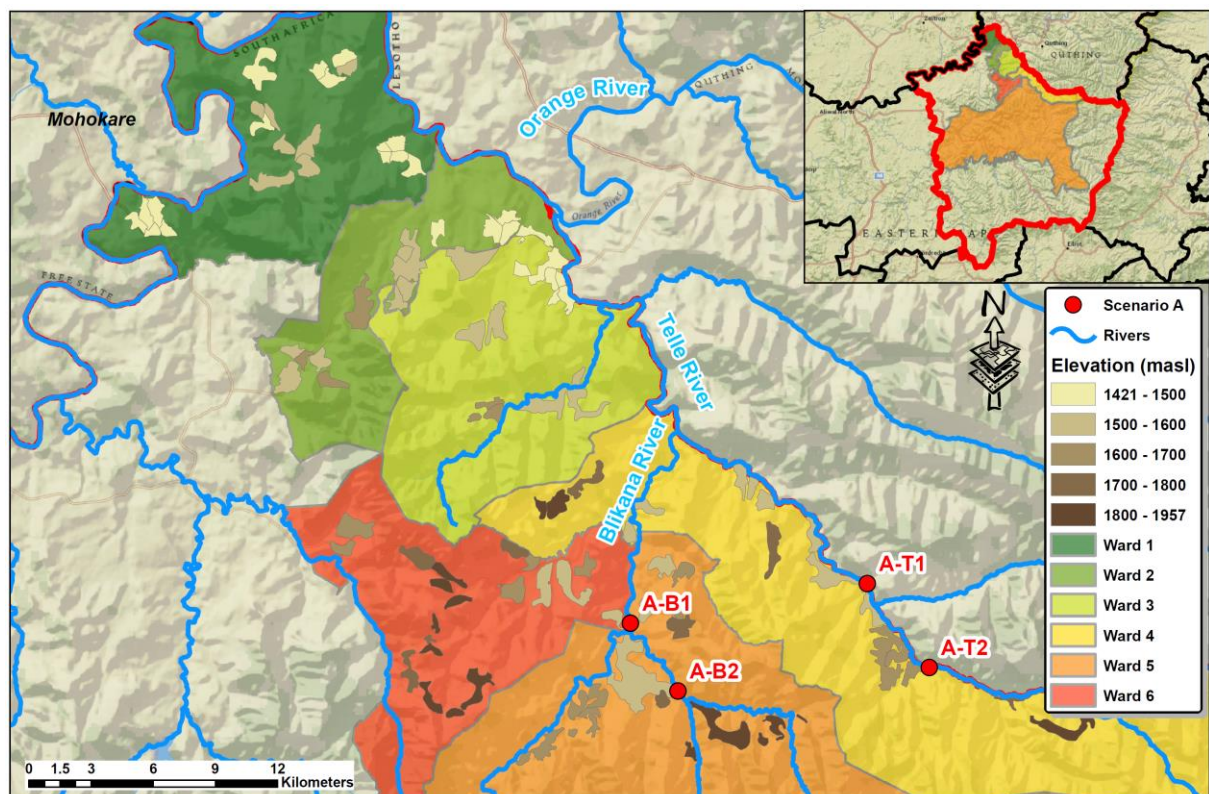


Figure 6: Potential Water Abstraction Sites – Scenario A.

5.3.2 Scenario B: De-centralized Abstraction Sites

This scenario allows for the inclusion of multiple abstraction sites such that water pumping is minimised. Each abstraction site with its water delivery system would be an independent water conveyance subsystem and would be sized / configured to meet the demand of those specific settlements / villages. It is key for this scenario to construct weirs as abstraction structures and eliminate the need for dam structures. Up to eleven (11) abstraction sites would be needed (see **Figure 7**). This scenario complicates the management, operation and maintenance of the proposed infrastructure. Given the order of magnitude of the water volumes involved, which is rather low, developing so many abstraction sites would be impractical. In order to deliver water to settlements in Ward 6 with minimal pumping arrangements, this scenario requires the utilization of a river system other than the Telle River, namely the Kromspruit River, which is a perennial river.

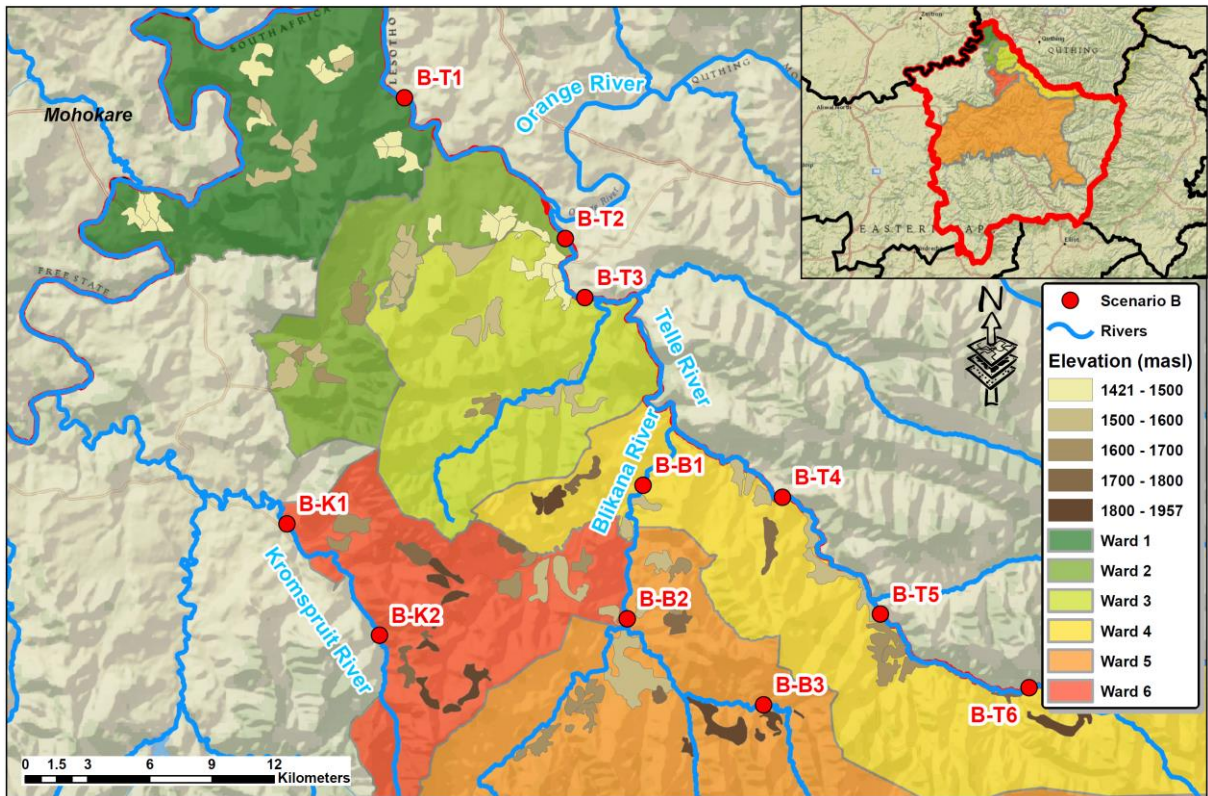


Figure 7: Potential Water Abstraction Sites – Scenario B.

5.3.3 Scenario C: Hybrid Abstraction Sites

This scenario considers the coupling of both Scenario A and Scenario B in order to reduce pumping costs while reducing the number of abstraction sites. A possible configuration to that end is to develop two (2) main abstraction sites in the higher river system reaches, with one (1) abstraction sites in the lower river system reaches, as shown in **Figure 8**. Depending on the finalised water delivery system costs per Ward, or per cluster of settlements, various configuration can be arrived at. This scenario offers a level of flexibility in the developed designs as long as the benefit / cost ratio for the adopted design is favourable. However, this scenario will likely call for the utilization of the Telle River itself and potentially even the Kromspruit River as well, should we need to include Ward 6.

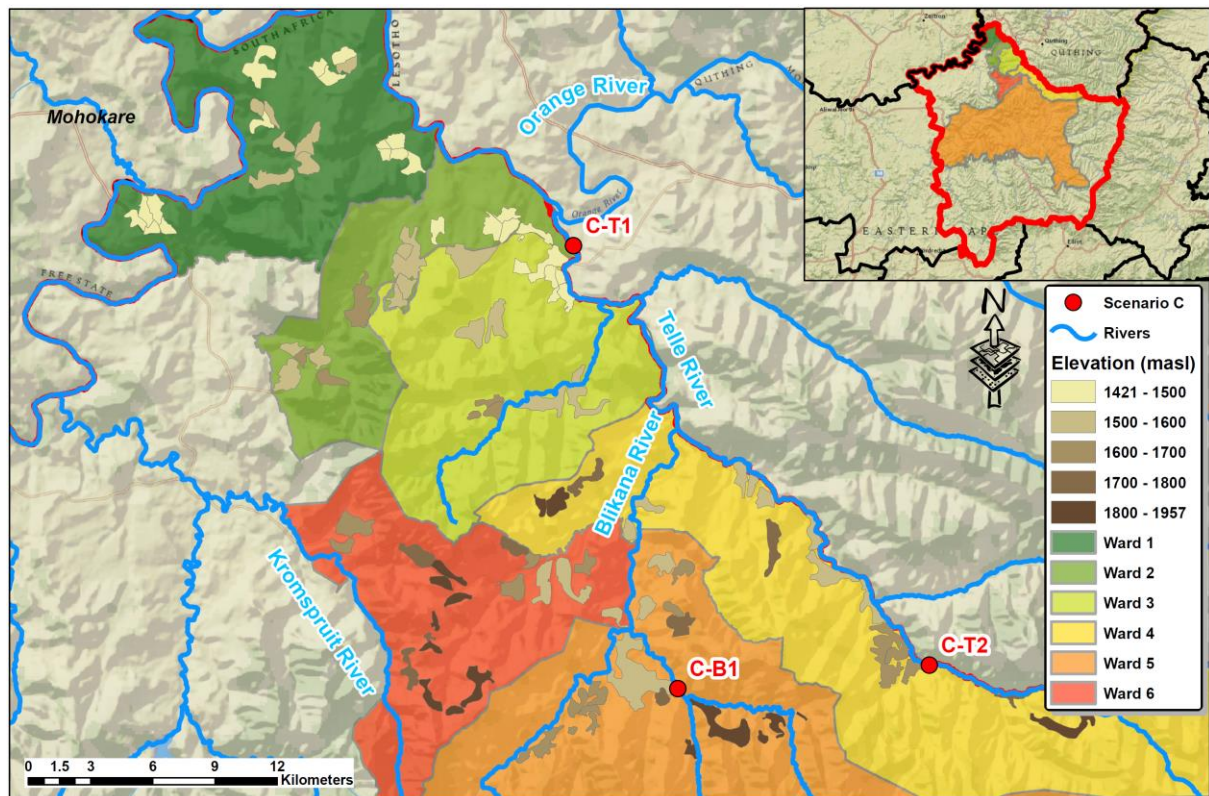


Figure 8: Potential Water Abstraction Sites – Scenario C.

5.3.4 Recommended Approach for Abstraction Sites

It is recommended to explore Scenario C further, with the starting point being site C-B1 (which is the same as site A-B2) and introduce additional abstraction points only when deemed necessary to do so. It is also recommended to engage with the relevant stakeholders in order to establish the extent of possible development on the Telle River itself. Should it be confirmed that such development can go ahead then sites C-T1 and C-T2 can be explored further as needed. At this stage, this approach is expected to improve the costing structure for the water delivery to Wards 1, 2, 3 and 4. It needs to be noted, however, that it may be required to exclude some of the settlements within Ward 4 due to the natural terrain and location which may render the cost of water delivery from the Telle River system to these settlements impractical.

5.4 Water Conservation and Water Demand Management

The WSA has adopted a Water Conservation and Demand Management Business Plan. A key programme for intervention in the rural areas in Senqu is the replacement of leaking reservoirs and infrastructure upgrade.

WCDM is not practiced within the area.

6 Existing Infrastructure

6.1 Existing Water Reticulation

The existing water reticulation is difficult to assess due to the non-existence of record drawings and state of disrepair. From field investigations it is evident that the pipe sizing is inadequate, mainly due to illegal connections. The existing pumping mains range from 63mm to 75mm diameter, steel pipes. There are no zone meters and or fire hydrants. Isolation valves have either been damaged or are buried.

6.2 Water Treatment Works (WtW)

There is no WtW in the study area. The closest WtW to the study area is in Sterkspruit approximately 23km to the closest ward in the study area.

6.3 Reservoirs

The existing reservoirs are predominately elevated rectangular steel tanks, or plastic tanks on ground. Most of the elevated steel tanks are in a state of disrepair.



6.4 Pumpstations

The boreholes have brick or concrete pump rooms which house the diesel motors and switch gear.



6.5 Bulk Electrical Capacity

Most of the area is electrified by a low voltage line. The nearest line in the study area is a 22kV Overhead Line. Sterkspruit/Dangershoek. The Rural areas are serviced by ESKOM.

7 Options Assessment

7.1 Option 1 – Scenario C-B1 (Blikana Dam & Water Treatment Works)

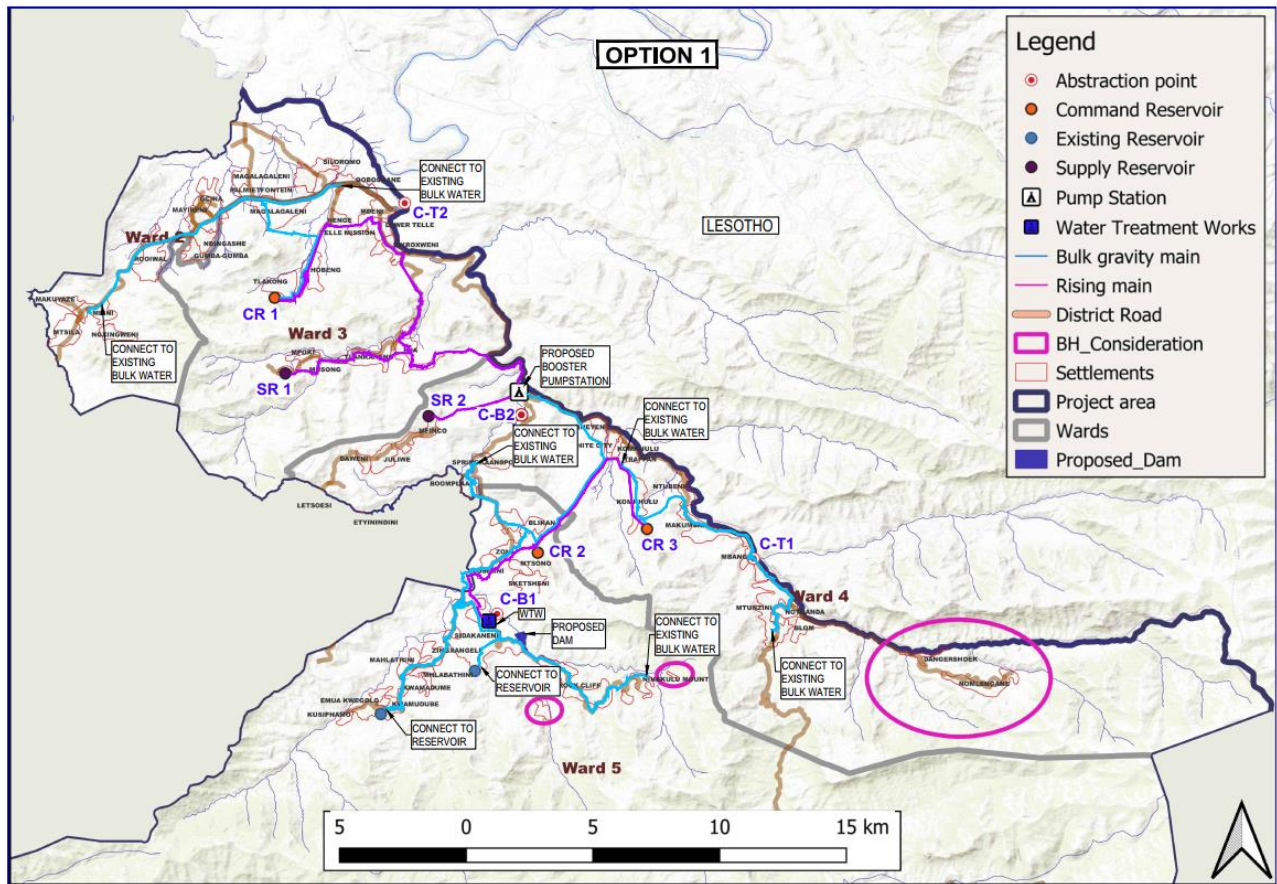


Figure 9: Option 1

Surface water will be abstracted from the eastern tributary of the Blikana River. A dam with a storage capacity of 2 Million m³ will be constructed upstream of abstraction point C-B1. Water will be abstracted from the dam and pumped to a new Water Treatment Works (WTW) with a capacity of 7.5Mℓ/d. The WTW will have a clear water reservoir and a pumpstations (PS). From the WTW water will be pumped to Command Reservoirs CR2 and CR3, with storage capacity of 10.5Mℓ and 2.5Mℓ respectively.

Water from CR2 will gravitate to a booster Pumpstation (PS) located at the Blikana/Telle River confluence. From the PS, water will be pumped to CR1 (9Mℓ), Supply Reservoirs SR1 (0.8Mℓ) and SR2 (0.8Mℓ). From these reservoirs, water will be distributed to the different villages through existing infrastructure.

Since Dangershoek and surrounding villages cannot be supplied by the scheme, based on current conditions and yields, the existing boreholes will be refurbished or new boreholes will have to be commissioned. A new reservoir (0.20Mℓ) will be built and connected to existing water supply pipelines.

The reservoir supply areas can be divided as follows:

- CR1 – Supplies water to Ward 2 and Ward 3 (Northern Portion)

- CR2 – Supplies water to CR1, SR1, SR2 and Ward 5.
- CR3 – Supplies water to Ward 4 (Eastern Side)
- SR1 – Supplies water to Ward 3 (Southern Portion)
- SR2 – Supplies water to Ward 4 (Northern Section)

Pipelines for this option include the following:

- Rising main from WTW to CR2, 6376m long, 400mm steel pipe.
- Rising main from WTW to CR3, 15463m long, 200mm steel pipe
- Gravity line from WTW to Booster PS, 10532m long, 400mm steel pipe.
- Rising main from Booster PS to CR1, 22851m long, 400mm steel pipe.
- Rising main from Booster PS to SR1, 14047m long, 150mm steel pipe.
- Rising main from Booster PS to SR2, 4078m long, 150mm steel pipe
- Gravity lines from command reservoirs to smaller villages reservoirs, 74513m long, 50mm to 400mm pipes (Steel/PVC/HDPE).

This option is located close to the proposed dam, however it is located in a remote area where access will be a challenge. It also does not take full advantage of the Blikana River catchment area, as it only utilises the eastern tributary of the River.

7.2 Option 2 – Scenario C-B2 (Blikana Dam & Wier)

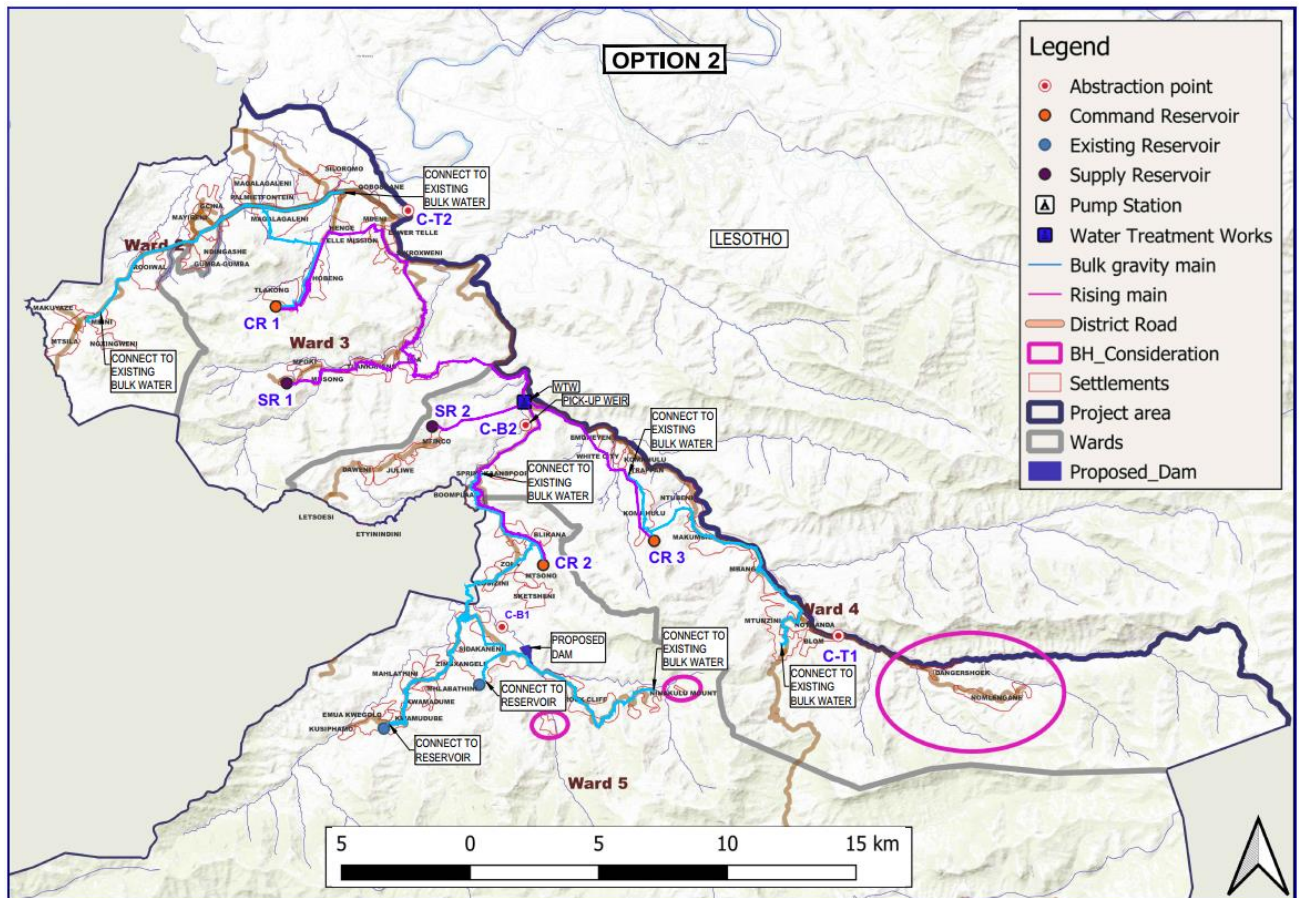


Figure 10: Option 2

The Blikana River's eastern and western tributaries will supply water for this option. Similar to Option 1, a dam will be constructed upstream of abstraction point C-B1. However, required water will be released from the dam and then abstracted from a pick-up weir located at C-B2. A WTW (7.5Mℓ/d) will be constructed downstream of the abstraction point, where water will be treated, stored and pumped to the various reservoirs. Water to Dangershoek will be supplied via boreholes. The reservoir supply areas and sizes are indicated below:

- CR1 (9Mℓ) – Supplies water to Ward 2 and Ward 3 (Northern Portion)
- CR2 (2Mℓ) – Supplies water to Ward 4 (Western Side) & 5.
- CR3 (2.5Mℓ) – Supplies water to Ward 4 (Eastern Side)
- SR1 (0.8Mℓ) – Supplies water to Ward 3 (Southern Portion)
- SR2 (0.8Mℓ) – Supplies water to Ward 4 (Northern Section)
- Dangershoek (0.2Mℓ)

Pipelines for this option include the following:

- Rising main from WTW to CR1, 19191m long, 400mm steel pipe.
- Rising main from WTW to CR2, 14545m long, 200mm steel pipe
- Rising main from WTW to CR3, 12524m long, 200mm steel pipe
- Rising main from WTW to SR1, 10524m long, 150mm steel pipe
- Rising main from WTW to SR2, 7179m long, 150mm steel pipe
- Gravity lines from command reservoirs to smaller villages reservoirs, 74513m long, 50mm to 400mm pipes (Steel/PVC/HDPE).

The main advantage of this option is that it makes use of the entire Blikana River Catchment area, and the WTW is located at the Telle / Blikana confluence, which means that the scheme can be supplemented from the Telle River should the need arise. The WTW can be easily accessed from the R393 by maintenance personnel and delivery vehicles (chemicals, equipment etc.), therefore there is no need for constructing new access roads. Another advantage is that it allows centralisation of many operations i.e. treatment, pumping, storage of materials etc. This will lead to easier management and integration of infrastructure. However the Dam is located in a remote location.

7.3 Option 3 – Scenario C-B1 & C-B2 (Blikana Dam & Groundwater Development)

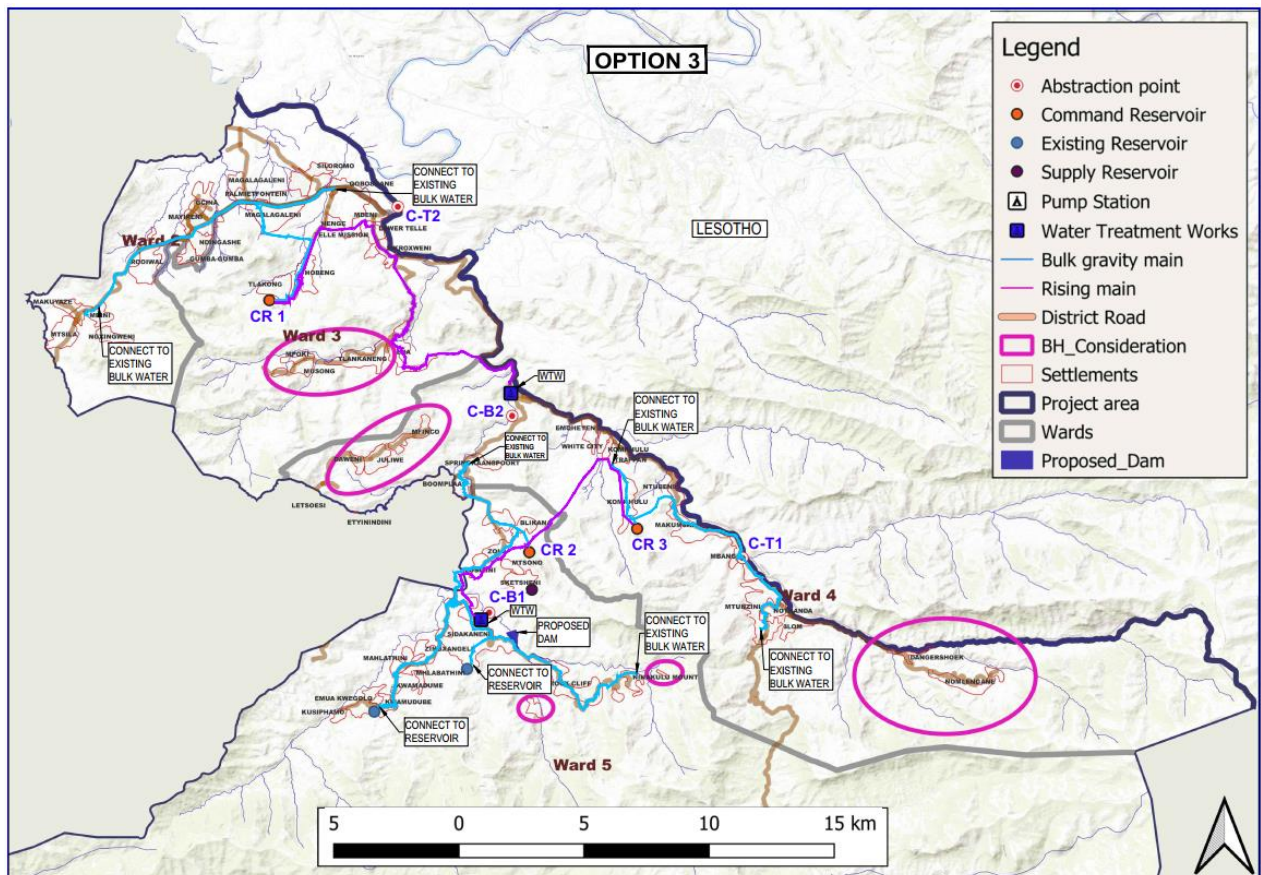


Figure 11: Option 3

Similar to Option 2, water for this option will be sourced from both the eastern and western tributaries of the Blikana River. This Option is a combination of surface water and boreholes, and it maximises the use of existing infrastructure. A dam will be constructed upstream of abstraction point C-B1. Two (2) WTW will be built, one will be situated downstream of C-B1 (2.5Mℓ) and the other one near C-B2 (5Mℓ). Abstraction of the water will be as per the two previous options. Water to CR1 will be pumped from the WTW near C-B2, while water to C-R2 & C-R3 will be pumped from the WTW downstream of C-B1. The remaining settlements will be supplied via boreholes. These areas include Mpoki, Musong, Tlankaneng and Era which are within Ward 3, and under Ward 4 Mfico, Juliwe, Daweni and Dangershoek. The reservoir supply areas and sizes are indicated below:

- CR1 (9Mℓ) – Supplies water to Ward 2 and Ward 3 (Northern Portion)
- CR2 (2Mℓ) – Supplies water to Ward 4 (Western Side) & 5.
- CR3 (2.5Mℓ) – Supplies water to Ward 4 (Eastern Side)
- WARD 3 (Mpoki, Musong, Tlankaneng, Era) – 0.5Mℓ or refurbish existing reservoirs
- WARD 4 (Mfico, Juliwe, Daweni) – 0.5Mℓ or refurbish existing reservoirs
- Dangershoek (0.2Mℓ)

Pipelines for this option include the following:

- Rising main from WTW1 to CR1, 22851m long, 400mm steel pipe.
- Rising main from WTW2 to CR2, 6376m long, 200mm steel pipe
- Rising main from WTW2 to CR3, 15463m long, 250mm steel pipe
- Gravity lines from command reservoirs to smaller villages reservoirs, 74513m long, 50mm to 400mm pipes (Steel/PVC/HDPE).

This option has all the advantages of Option 1 and 2, but has multiple water abstraction points which lead to higher Capital costs, and Operation and Maintenance costs due to the lack of infrastructure integration.

7.4 Option 4 – Scenario C-T2 (Telle Dam & Water Treatment Works)

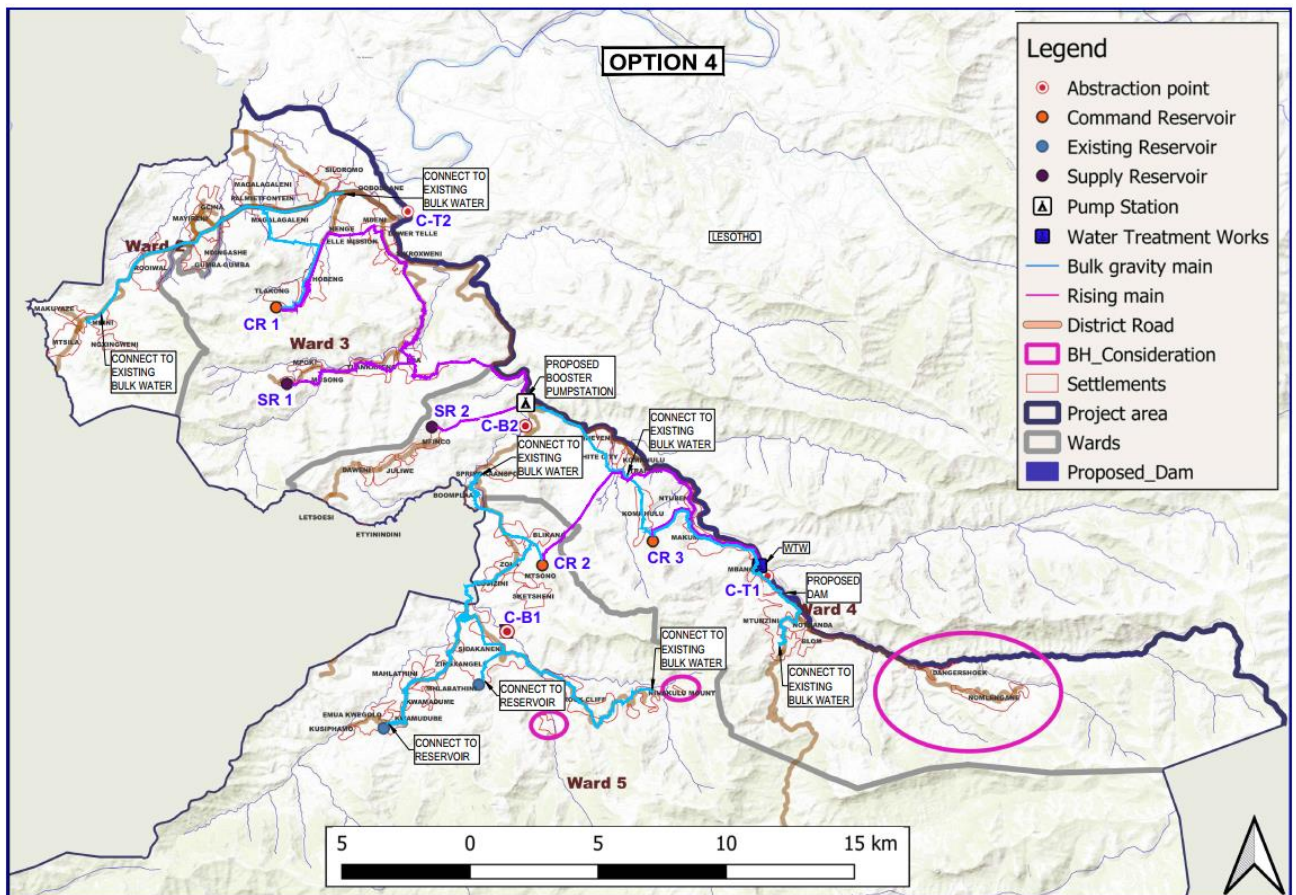


Figure 12: Option 4

For this Option, water to the study area will be supplied from the upper reaches Telle River. A dam will be constructed near C-T2. Water will be drawn from the dam and pumped into a new 7.5MI/d WTW west of C-T2. From the WTW, water will be pumped from to CR2 and CR3. Water from CR3 will naturally gravitate to a booster pumpstation (PS) at the confluence of the Blikana and Telle Rivers. Water will then be pumped from the PS to CR1, SR1, and SR2. Boreholes will be used to supply water to Dangershoek.

The sizes and reservoir supply areas are listed below:

- CR1 (9Mℓ) – Supplies water to Ward 2 and Ward 3 (Northern Portion)
- CR2 (2Mℓ) – Supplies water to Ward 4 (Western Side) & 5.
- CR3 (12Mℓ) – Supplies water to Ward 4 (Eastern Side)
- SR1 (0.8Mℓ) – Supplies water to Ward 3 (Southern Portion)
- SR2 (0.8Mℓ) – Supplies water to Ward 4 (Northern Section)
- Dangershoek (0.25Mℓ)

Pipelines for this option include the following:

- Rising main from WTW to CR2, 7526m long, 250mm steel pipe
- Rising main from WTW to CR3, 15125m long, 400mm steel pipe
- Gravity line from CR3 to Booster PS, 5991m long, 600mm steel pipe.
- Rising main from Booster PS to CR1, 19190m long, 400mm steel pipe.
- Rising main from Booster PS to SR1, 10405m long, 150mm steel pipe.
- Rising main from Booster PS to SR2, 7179m long, 150mm steel pipe.
- Gravity lines from command reservoirs to smaller villages reservoirs, 74513m long, 50mm to 600mm pipes (Steel/PVC/HDPE).

The benefits of this option include easy access and proximity to the proposed dam. The major disadvantage is the regulatory and permitting requirements. Water will be extracted the Telle River which forms the border between Lesotho and South Africa. The project may suffer major delays if there are complications relating to water abstraction authorisations, infrastructure ownership and management agreements between South Africa and Lesotho.

7.5 Option 5 – Scenario C-T1 (Telle River Weir & Water Treatment Works)

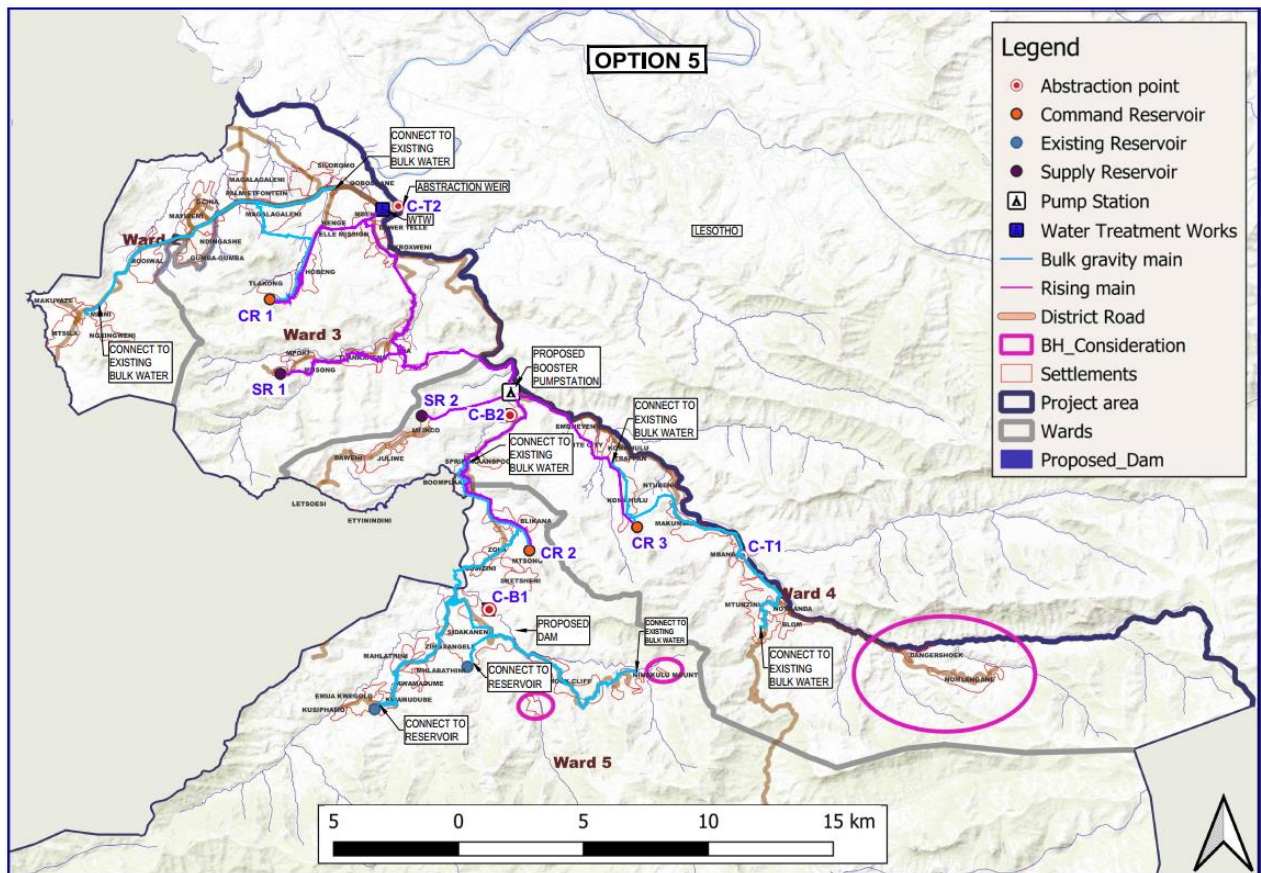


Figure 13: Option 5

The Telle Rivers will supply the study area. A water abstraction weir will be built at C-T1 and water will be pumped to new 7.5Ml/d WTW west of C-T1. From the WTW, water will be pumped from to CR1, SR1 and to a booster pumpstation (PS) at the confluence of the Blikana and Telle Rivers. From the PS water will be pumped to CR2, CR3 and SR2. Boreholes will be used to supply water to Dangershoek. The sizes and reservoir supply areas are listed below:

- CR1 (9Mℓ) – Supplies water to Ward 2 and Ward 3 (Northern Portion)
- CR2 (2Mℓ) – Supplies water to Ward 4 (Western Side) & 5.
- CR3 (2.5Mℓ) – Supplies water to Ward 4 (Eastern Side)
- SR1 (0.8Mℓ) – Supplies water to Ward 3 (Southern Portion)
- SR2 (0.8Mℓ) – Supplies water to Ward 4 (Northern Section)
- Dangershoek (0.2Mℓ)

Pipelines for this option include the following:

- Rising main from WTW to CR1, 8553m long, 400mm steel pipe.
- Rising main from WTW to SR1, 16039m long, 150mm steel pipe
- Rising main from WTW to Booster PS, 17238m long, 300mm steel pipe.
- Rising main from Booster PS to CR2, 11309m long, 200mm steel pipe

- Rising main from Booster PS to CR3, 9335m long, 200mm steel pipe
- Rising main from Booster PS to SR2, 4078m long, 150mm steel pipe
- Gravity lines from command reservoirs to smaller villages reservoirs, 74513m long, 50mm to 600mm pipes (Steel/PVC/HDPE).

In terms of water security and management this is the best option for the scheme. It has easy access, it is located the closest to the ward 2 where the bulk of the population is located. Also there is no need for a dam since the scheme is supplied by both rivers. The major disadvantage is the location of the abstraction point between Lesotho and South Africa, which may delay the project as per Option 4.

7.6 Option 6 – Scenario C-T1 & C-T2 (Upper Telle Dam & Lowe Telle Weir)

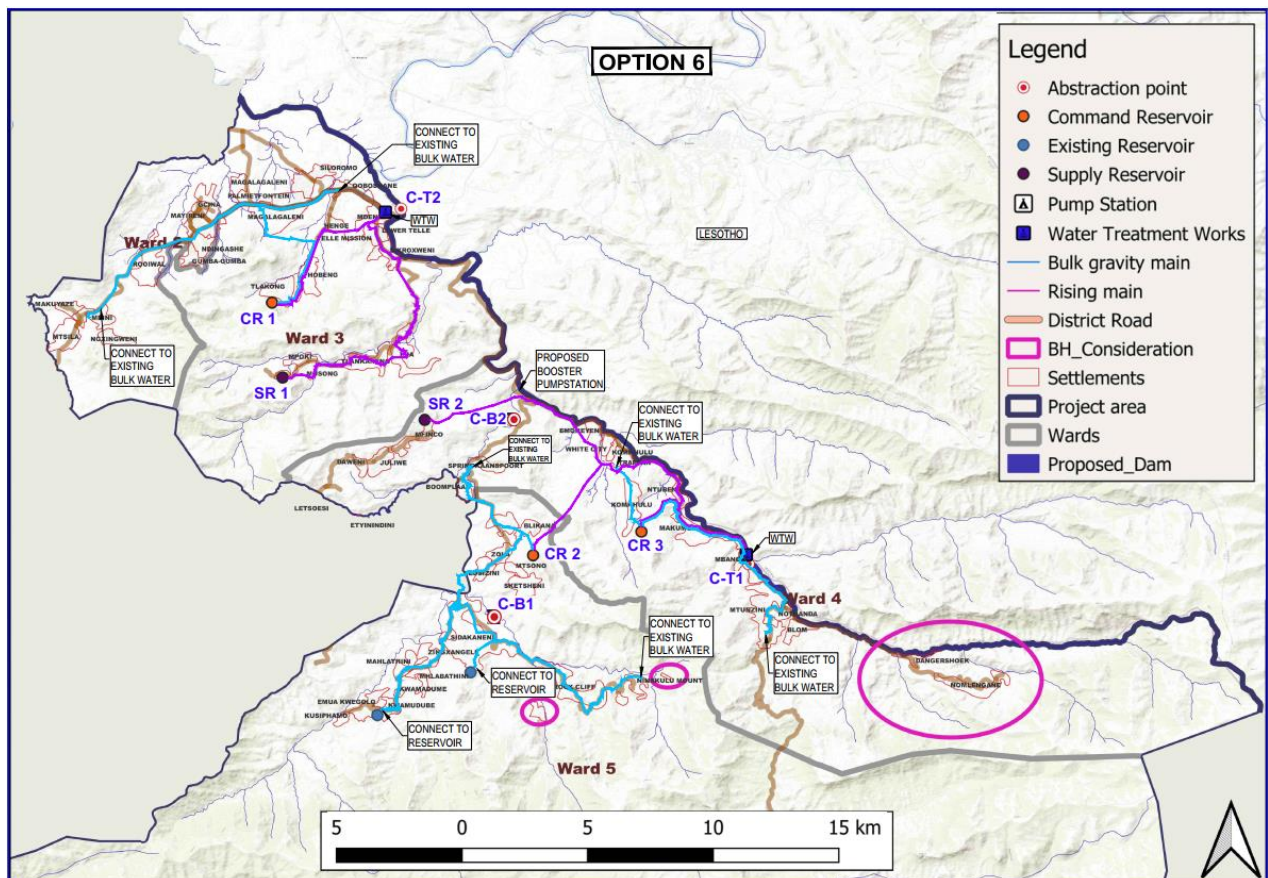


Figure 14: Option 6

Water to Wards 4 and 5 will be supplied from the upper reaches Telle River, while Wards 2 and 3 will sourced from the lower reaches. A dam will be constructed upstream of abstraction point C-T2 and a water abstraction weir will built at C-T1. Two (2) WTW will be built, one will be situated downstream of C-T2 (2.5Mℓ) and the other one near C-T1 (5Mℓ). Abstraction of the water will be as per Option 4 and 5. Water to CR1 and SR1 will be pumped from the WTW near C-T1, while water to CR2, CR3 and SR2 will be pumped from the WTW downstream of C-T2. Dangershoek will be supplied via boreholes.

The reservoir supply areas and sizes are indicated below:

- CR1 (9Mℓ) – Supplies water to Ward 2 and Ward 3 (Northern Portion)
- CR2 (2Mℓ) – Supplies water to Ward 4 (Western Side) & 5.
- CR3 (2.5Mℓ) – Supplies water to Ward 4 (Eastern Side)
- SR1 (0.8Mℓ) – Supplies water to Ward 3 (Southern Portion)
- SR2 (0.8Mℓ) – Supplies water to Ward 4 (Northern Section)
- Dangershoek (0.25Mℓ)

Pipelines for this option include the following:

- Rising main – WTW1 to CR1, 8553m long, 400mm steel pipe.
- Rising main from WTW1 to SR1, 16039m long, 150mm steel pipe.
- Rising main from WTW2 to CR2, 25674m long, 200mm steel pipe
- Rising main from WTW2 to CR3, 7253m long, 200mm steel pipe
- Rising main from WTW2 to SR2, 18934m long, 150mm steel pipe.
- Gravity lines from command reservoirs to smaller villages reservoirs, 74513m long, 50mm to 600mm pipes (Steel, PVC, HDPE).

This option has all the advantages and disadvantages of Options 4 and 5. Additionally, due to its lack of infrastructure integration it will require more Capital costs, and Operation and Maintenance costs.

7.7 Summary of Options

After analysing all the proposed six options, it is evident that Option 5 is the most attractive option. However, it will be developed on the Telle River which forms the boundary between Lesotho and South Africa. With Telle River being categorised as a shared water course, planning and approvals will be subjected to international regulatory and permitting requirements, which may delay the project.

The second most favourable Option is Option 2. This option will be developed on the Blikana River, which is within the borders of South Africa. However, to increase water security, this option will require the construction a new Dam.

8 Cost Scenarios

8.1 Lifecycle Costing Methodology

On 19 February 2024, DWS instructed GIBB to revise the allowance made for contingencies from 30% to 10% on all costs estimated for the various project options. Since the project is still at feasibility stage, it must be noted that the revised contingency allowance is purely for DWS budgeting purposes and does not reflect GIBB's confidence level on the project scope of works and estimated costs. During the preliminary design stage, GIBB will undertake further investigations, refine the designs and provide cost estimates with a higher confidence level correlating with contingencies.

High level cost estimates and project lifecycle cashflows have been revised for the study, refer to **Annexure C**. The intention of the estimates is to assist in the assessment of the different options for cost effectiveness. The following general assumptions have been made:

- P&G at 30%
- Institutional & Social development at R 1 000 per household
- EIA at 1% of construction cost
- Geotechnical investigation at 1% of construction cost
- Quantity Surveying at 0.5% of construction cost
- Land Surveying at 0.5% of construction cost
- Professional fees as follows:
 - First R 800 000.00 at 13%
 - Next R 2 600 000.00 at 10%
 - Next R 9 700 000.00 at 8%
 - Balance at 6%
- Construction supervision at 30% of professional fees.
- Maintenance, Administration and Energy Cost between 3.0% and 5.0% (depending on the number and duplication of structures)

It must be noted that the high-level costing assessment has a confidence level of 40%. Selection of the most feasible option to develop should be based on detailed feasibility studies based on reasonably detailed infrastructure design, accurate bill of quantities, associated additional costs (e.g., expropriation and servitude costs, etc) and appropriate rates.

8.2 Capital Costing per Development Option

Capital costs have been estimated for all the 6 options. These include expenses that will be incurred for the planning, installation, construction and/or upgrading of the proposed infrastructure. Consideration was given to the following aspects in developing the costing model of the options.

- A dam with a storage capacity of 2 Million m³ and a 10m high wall;
- River abstraction structures and raw water pumpstation;
- Boreholes;
- Surveys, excavations, concrete works, inlets/outlets;
- Water treatment works including clearwater reservoirs and pumpstations;
- Pipelines, pipe fittings, bedding;

- Storage reservoirs;
- Electricity connection to the water treatment works and pumpstations;
- Bulk electricity supply construction was unaccounted for.

Refer to the table below and **Annexure C** for estimated capital costs, operation and maintenance costs and unit cost per m³ of water produced. These tables reflect costing of the options and how they vary financially. To develop the costing model, a project design horizon of 30 years was selected, with a construction period of 5 years (2024 to 2028) and the scheme operating from 2029 to 2053. To understand the unit cost of the water produced per m³, each option was broken down into annual costs and a cashflow programme indicating capital and running costs was developed. The running costs include operating costs, maintenance and ongoing management costs for the design life of the infrastructure.

To arrive at the cost of water per m³ and to calculate the current value of the future project cost streams, the Net present value (NPV) was used. The usable life of infrastructure that exceeds the project lifecycle was also taken into account. As indicated in the table below, annual lending rates ranging from 0 to 12% have been used. Other assumptions include a payment period of 25 years, 365 days of operations, an ultimate 2053 flow rate of 7376m³/d, and a flow growth rate of 1% has been adopted (2029 to 2053). The rates used in the costing models are based on recent market related rates, and no detailed bill of quantities was done.

Table 26: Estimated Project Costs

	Option 1	Option 2	Option 3
Total Capital Cost	R 1 683 321 855.11	R 1 346 303 922.28	R 1 373 702 421.39
O&M Cost	R 11 614 237.43	R 10 439 518.70	R 14 499 785.97
Administration Cost	R 7 318 790.67	R 5 853 495.31	R 11 945 238.45
Discount Rate	Unit Reference Value (R/m³)		
0%	R 40.43	R 32.85	R 38.98
2%	R 46.07	R 37.26	R 43.02
4%	R 52.26	R 42.11	R 47.56
6%	R 58.82	R 47.25	R 52.45
8%	R 65.55	R 52.54	R 57.53
10%	R 72.30	R 57.84	R 62.66
12%	R 78.92	R 63.05	R 67.72

	Option 4	Option 5	Option 6
Total Capital Cost	R 1 613 817 692.42	R 1 233 172 660.68	R 1 449 906 373.29
O&M Cost	R 11 546 981.50	R 10 673 398.88	R 16 554 247.54
Administration Cost	R 7 016 598.66	R 5 361 620.26	R 14 900 223.60
Discount Rate	Unit Reference Value (R/m³)		
0%	R 40.53	R 31.24	R 41.84
2%	R 46.26	R 35.30	R 46.04
4%	R 52.54	R 39.76	R 50.77
6%	R 59.19	R 44.49	R 55.86
8%	R 66.01	R 49.35	R 61.15
10%	R 72.84	R 54.22	R 66.49
12%	R 79.54	R 58.99	R 71.76

8.3 Cost Assessment and Preference

In terms of Capital, Operating and Maintenance costs, the cost analysis of the six proposed options shows Option 5 as the most cost effective option while the second cheapest is Option 2. It must be understood that Option 5 will be subject to international regulatory and permitting requirements, which have not been taken into account in the cost analysis.

8.4 Options Assessment & Preference

The next Phase of this assignment is to develop a Preliminary Design Report. This will require a decision on which option is preferred. A number of interactions have been held with the Stakeholders, DWS and JGDM in this regard.

GIBB has extensively analysed the proposed six options and it is evident that Option 5 is the most cost-effective option. However it poses other project risks, as it will be developed on the Telle River which forms the boundary between Lesotho and South Africa. With Telle River being categorised as a shared watercourse, planning and approvals will be subjected to international regulatory and permitting requirements, which may delay the project.

To avoid project delays and unforeseen risks, Option 2 is recommended and should be developed further to the next stage, Preliminary Design. Advantages of this option compared to Option 5 include:

- **Regulatory and Permitting Requirements** – Water will be extracted from the Blikana River, which is located within South Africa, and all requirements are understood and potential threats to the project can be anticipated.
- **Stakeholder Management** - Abstracting water from Telle River will require international stakeholder engagements which will have an impact on Project Schedule and Project Cost.
- **Future Source Augmentation** – The WtW will be located at the Telle / Blikana confluence, and the scheme can be supplemented from the Telle River in future should the need arise. Construction on the Blikana River can continue while all necessary regulatory and permitting requirements for the Telle River abstraction are being concluded.
- **Management and Infrastructure Integration** – Operation and maintenance activities will be managed from one central point, which is at the WtW (Treatment, pumping, material storage etc.). This will improve security and also enable easy management of the scheme.
- **Accessibility** – The WtW will be located at the Telle / Blikana confluence and there will be no need to construct a new access road. The WtW can be easily accessed from the R393 by maintenance personnel and delivery vehicles (chemicals, equipment etc.)

9 *Institutional Perspective*

9.1 Stakeholder Identification

- Department of Water and Sanitation
- Joe Gqabi District Municipality
- Senqu Local Municipality
- Amatola and Bloem Water
- Ward Water Committees
- Household end users

9.2 Ownership of the Infrastructure

Joe Gqabi District Municipality will be the owner of the Infrastructure.

9.3 Institutional Capacity

The district has established an institutional structure to deliver water and sanitation services. Both the planning and regulatory (WSA) and the operations and maintenance (O&M) functions are mapped out in organisational structures, albeit in different departments. The WSA function resides in the Community Services Department and the O&M units is located in the Technical Services Department.

The municipality also has an ISD unit that plays a critical role in the facilitation and monitoring of water and sanitation services between the WSA and the WSP. The unit requires additional support as incumbents are not always strong in water services specific competencies.

The JGDM operates and maintains all water and sanitation bulk services in its area of jurisdiction. Works that were previously operated by contracted WSP's are now competently operated by JGDM staff. Refurbishment and rehabilitation is undertaken as resources allows.

9.4 Financial Status

JGDM relies on grant funding programmes of the DWS and COGTA and utilises these whenever opportunities avail themselves. Water Conservation and Demand management (WCDM) is a flagship project and continuous intervention that requires external funding support to realise sustainable gains from the programme.

Operations and maintenance is funded primarily by the Equitable Share Grant (ESG), supplemented by user charges in the form of tariffs based on consumption of the service.

9.5 Cost Recovery arrangements

Tariff levels, collections, and the equitable share allocations are inadequate to cover the full cost of waterborne service provision to all. Tariffs have been reset to be cost reflective. This is to align income with the cost profile to operate and maintain services and to support a capital replacement fund.

The view is to improve operational sustainability in the long run, as an improvement in user charge collections will ensure adequate financing of the operations function and hence improved sustainability of water services. The earnings potential of tariffs must be assessed using fact-based approaches.

10 Social Perspective

10.1 Stakeholder Consultation

Various meeting and engagements were held with all relevant stakeholders including DWS officials, JGDM officials, ward councillors, community leaders, and community at large.

A 16 member Project Steering Committee was established representing the affected villages in the study area wards.

10.2 Community Structures

Community structures have been consulted and are on board for the implementation of the water infrastructure project.

The community structures are made up of the following stakeholders:

- Chief
- Ward councillor
- Ward committee
- Project steering committee
- General community

10.3 Community Populations and Growth Rate

STATSSA Census 2011 and STATSSA Census 2022 are the principal demographic datasets used in determining the current and projected future population in the study area.

This has been covered in Chapter 3 of the report.

10.4 Level of Education and Skills in Community

SLM's educational levels are low, as can be seen from the graph below, with 47 % of its population having only a primary school education. In tertiary education, there is only one facility Municipality in Sterkspruit.

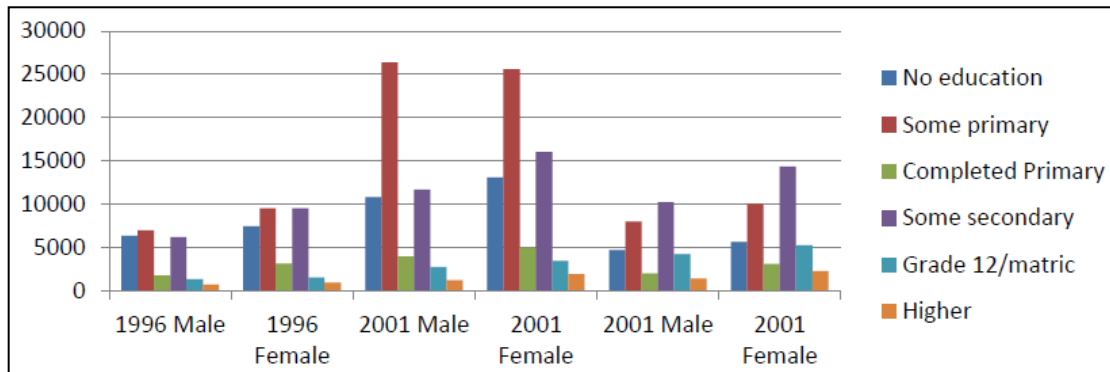


Figure 15: Level of Education

The general skills level is below average, with most citizens having access to public and community services for work or their main business activities like agriculture.

The largest proportion of employees in the Senqu municipality is elementary or unskilled workers, accounting for about 39%. The number of senior managers and technical staff in Senqu Municipality is only 3%. They would be 4% and 4% respectively. This is indicative of the low level of training facilities in this sector, which means there is a need to develop skills and education programmes.

10.5 Proposed Water and Sanitation Tariffs

The Municipality as Water Service Provider (WSP) and Joe Gqabi District Municipality as Water Services Authority (WSA) shall provide water services to consumers under a service level agreement.

10.6 Social Upliftment Potential

The Municipality has several social cohesion programmes. These involve door to door campaigns whereby the municipality and sector department target certain areas and run campaigns on problems being experienced in that area such as child headed households. A plan is then formulated to resolve these issues and all stakeholders state their commitment to resolving these issues.

10.7 Skills Development and Training Opportunities

The purpose of the skills development priority is to:

- Build the necessary skills base for economic growth and development.
- Improve employability and active economic participation.
- Support key growth and employment sectors.

10.8 Associated Beneficiaries of Scheme

- Schools
- Healthcare facilities
- Communal facilities

11 Environmental Impact Screening

Environmental Impact screening is recommended once a viable option has been chosen for further development:

- Necessary Environmental Authorisations –
 - Based on the information available at this stage, a Scoping and Environmental Impact Assessment Report (S&EIR) Process will be required to obtain Environmental Authorisation from DEDEAT, in terms of NEMA.
 - A WUL will be required, in terms of NWA.

Given the limitations of the scope provided, in that not all project information may have been available at the time when the Report was compiled, the Environmental Screening undertaken was high level in some aspects where the scope had not yet been well defined. Therefore, it would be important to ensure that the findings of the Screening Report be re-evaluated when the detailed design for the planned scope of works becomes available including any additional information.

11.1 Environmental Authorisation Process

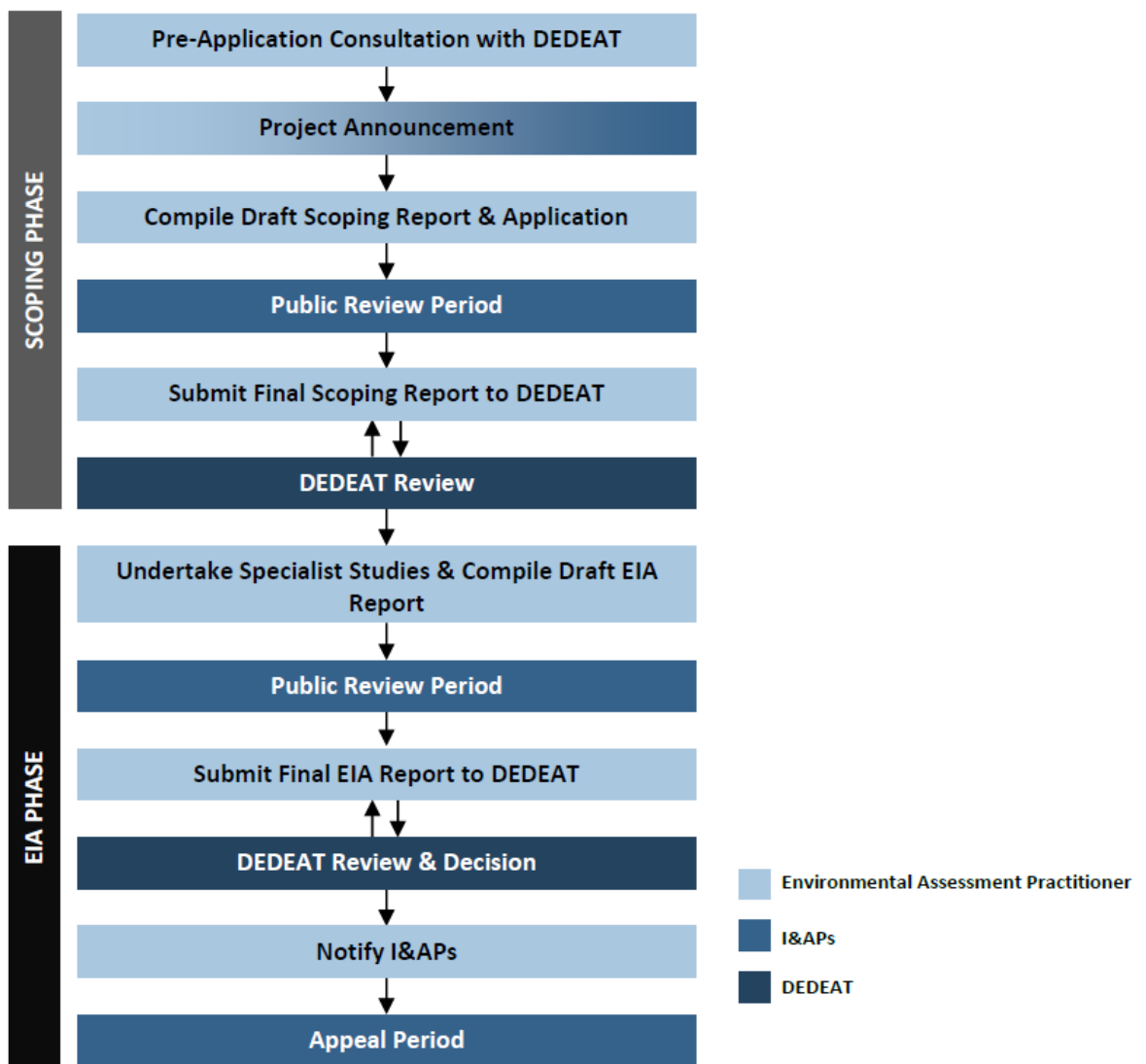
Potential Environmental Authorisations Required

The table below provides a summary of the possible environmental approvals required for the Project.

Authorisation	Legislation	Regulatory Authority
Approval required for listed activities in terms of the 2014 EIA Regulations (as amended) associated with the project. A S&EIR Process / BA Process is required.	National Environmental Management Act (Act No. 107 of 1998)	DFFE
Approval required as the proposed development involves <ul style="list-style-type: none"> – Abstraction of water from a water resource, – Storing of water, and – Potentially impeding or diverting the flow of water in a watercourse and – Altering the bed, banks, course or characteristics of a watercourse watercourses on site. A Water Use Licence Application (WULA) Process is required.	National Water Act (Act No. 36 of 1998)	DWS
Waste management licence may be required depending on the manner in which residue from the WTP is to be managed.	National Environmental Management: Waste Act (Act No. 59 of 2008) (NEM:WA)	DEDEAT

11.2 Scoping and EIR Process

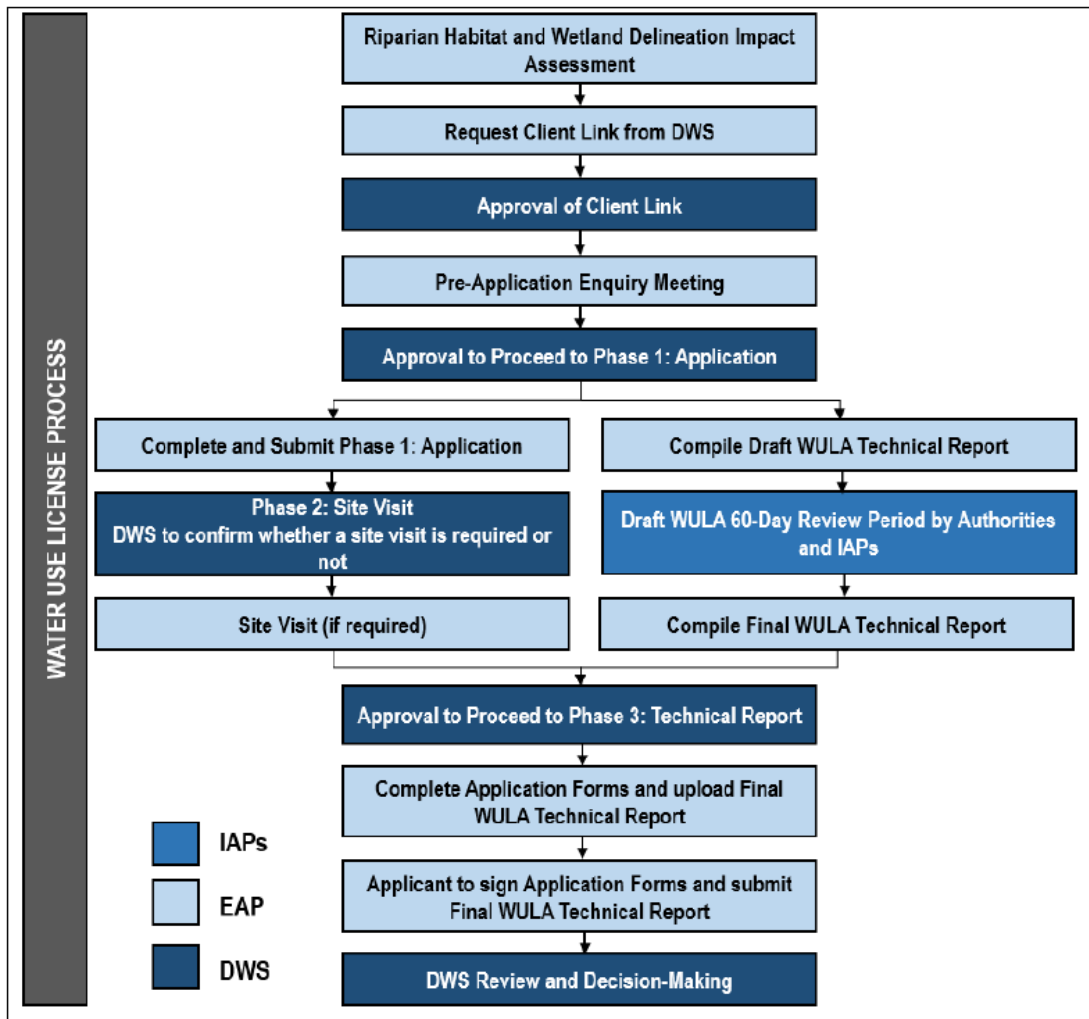
The figure below provides an overview of the process to be followed for the S&EIR Process.



11.3 WULA Process

It is anticipated that a Water Use Licence will be required, based on the water uses associated with the Project (see Table 8). This process will be undertaken via the Electronic Water Use Licence Application and Authorisation System (EWULAAS), whereby the WULA Process is completed online.

The figure provides an overview of the WULA Process to be undertaken via EWULAAS.



For a full Environmental Screening Report please see **Appendix D: Environmental Screening Report**, attached to this report.

12 High Level Risks

12.1 Project Risk

Risks are possible events or occurrences, which will cause the project not to achieve one or more of its objectives. The risk matrix below outlines some of the initial **high-level** risks identified. A qualitative rating of probability of the event and the impact of the event ranges from high (H), medium (M) to low (L) has been used, and a mitigation measure is proposed.

Table 27: Risk Matrix

Risk Category	Risk	Risk Probability	Mitigation
Institutional	Telle River is a Shared Water Resource , within the Orange-Senqu River Commission Basin, environmental approvals and licencing will delay the project.	High	Avoid abstraction on the Telle River.
	Lack of Capacity by the WSA to Operate and Maintain the Scheme.	Medium	Develop a training programme for all staff to be involved, supported by systems tools and procedure manuals that are relevant.
Financial	Lack of or insufficient Capital Funding.	High	Explore alternative funding (i.e BFI) and Co-Funding by the WSA
	Water tariffs are not cost reflective, and the mismanagement of the Indigent Register exposes the WSA to financial losses.	High	Adopt a Cost Reflective Tariff using the user pays principle.
Social	Vandalism	Medium	Solicit a Community Compact through social engagement at all stages of the project.
	“Construction Mafia” interference	Medium	Partner with all stakeholders including SAPS and maximise local beneficiation though well packaged EME packages.
Contractual	Poor Contractor Performance	Medium	Adopt a stringent criteria and effect strict contract management processes.
	Mountainous terrain and isolated areas posing a challenge to access areas to be developed.	High	This needs to be considered at detailed design stage, and if needs be packaged as pre-works.
Political	Changes in the Political Leadership and re-prioritisation mid-stream in the project life cycle.	High	Key decisions with financial implications be processed through Council.
	Political Interference	Medium	Set-up and adopt protocols and structures for engagement and reporting.

13 Conclusion and Recommendations

13.1 Conclusion

Currently the infrastructure is dilapidated due to several reasons. As a quick intervention JGDM has identified packaged projects for immediate implementation in seven (7) Work Packages. This intervention will focus on in the main on:

- Ground Water Source Development
- Equipping and testing of Boreholes
- Construction and or upgrading of pumpstations
- Construction and or upgrading of reservoirs
- Reticulation to communal standpipes

These projects are a mediate intervention as they are solely dependent on ground water. The WSA has expressed concerns in managing multiple standalone schemes from an operations and maintenance stance. The quality and quantity of the ground water has also in the past posed to be challenge especially during drought conditions which have become more sporadic. An alternative source in the form of surface water abstraction is therefore a necessity in order to ensure water supply in the region.

The implementation of this Integrated Scheme will improve the wate supply to the study area, ensuring a more reliable and sustainable potable water provisioning to the communities, social amenities, and businesses.

13.2 Recommendations

Based on the above the following is recommended:

- I. That Option 2 which entails the construction of a dam on the eastern tributary of the Blikana River be adopted, and further developed into Preliminary Designs.
- II. That the quick interventions identified by JGDM be implemented in the interim.
- III. That a Consumer Education Campaign be embarked on early should the project be approved.

14 References

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Appendix A: SRK Hydrogeological Desk Study Report

Appendix B: Hydrological Assessment Report

Appendix C: Order of Magnitude Estimates

Appendix D: Environmental Screening Report