P WMA 12/T30/00/5212/6

water & sanitation

Department:
Water and Sanitation
REPUBLIC OF SOUTH AFRICA

DIRECTORATE: OPTIONS ANALYSIS

FEASIBILITY STUDY FOR THE MZIMVUBU WATER PROJECT

WATER REQUIREMENTS

OCTOBER 2014

FEASIBILITY STUDY FOR THE MZIMVUBU WATER PROJECT APPROVAL

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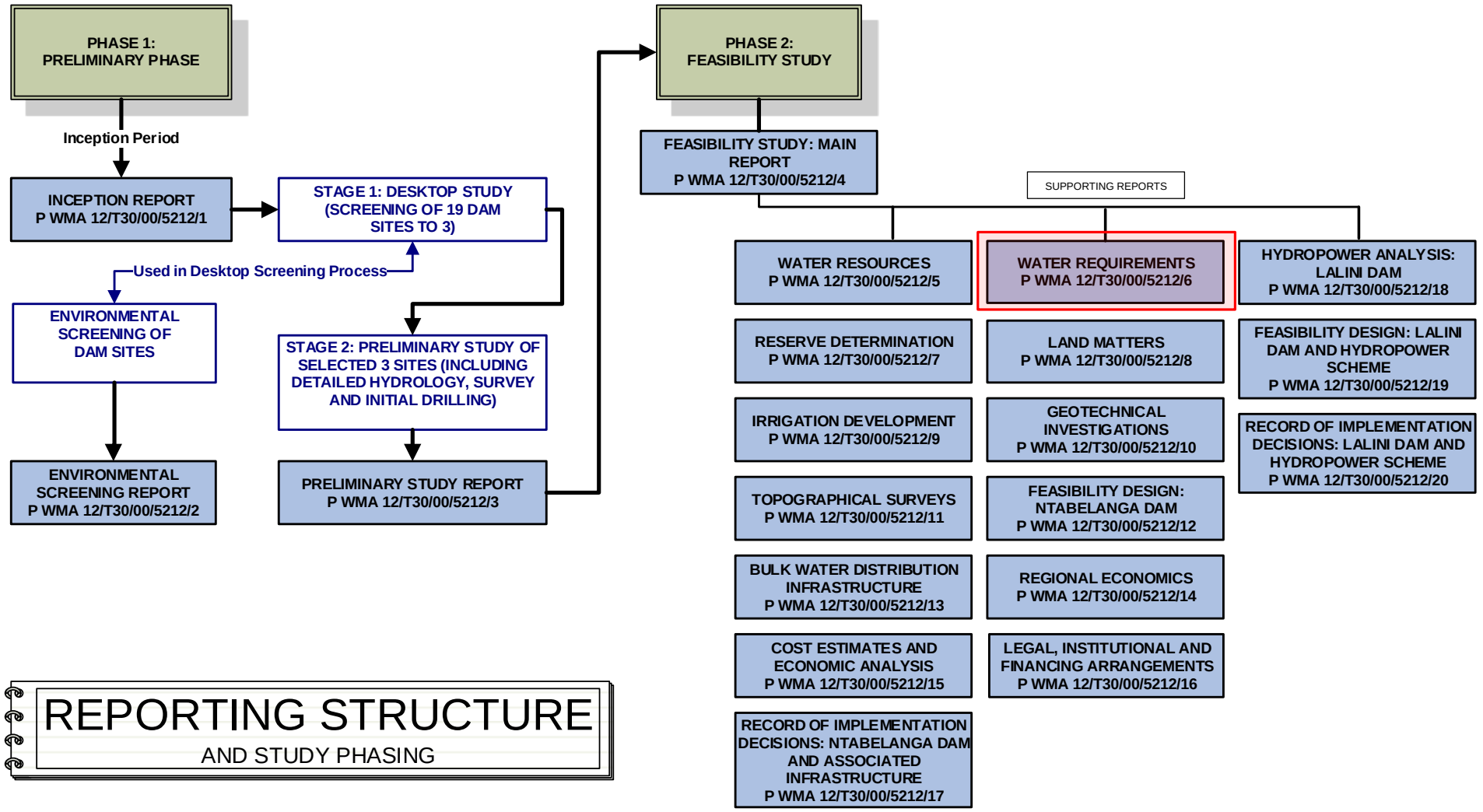
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REFERENCE

This report is to be referred to in bibliographies as:

Department of Water and Sanitation, South Africa (2014). ***Feasibility Study for the Mzimvubu Water Project: Water Requirements***

DWS Report No: P WMA 12/T30/00/5212/6

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Note on Departmental Name Change:

In 2014, the Department of Water Affairs changed its name to the Department of Water and Sanitation, which happened during the course of this study. In some cases this was after some of the study reports had been finalized. The reader should therefore kindly note that references to the Department of Water Affairs and the Department of Water and Sanitation herein should be considered to be one and the same.

Note on Spelling of Laleni:

The settlement named Laleni on maps issued by the Surveyor General is locally known as Lalini and both names therefore refer to the same settlement.

EXECUTIVE SUMMARY

INTRODUCTION

This report describes the water requirements for potable and irrigation usage within the area to be supplied by the Ntabelanga Dam, which was selected as the preferred dam site, as described in the Preliminary Study Report No. P WMA 12/T30/00/5212/3, and for which the feasibility design is described in Report No. P WMA 12/T30/00/5212/12. Water requirements for the Lalini Dam and hydropower scheme (to be operated conjunctively with the Ntabelanga Dam) are also discussed and summarized (see Report Nos. P WMA 12/T30/00/5212/18 and 19).

It was confirmed and agreed that the sizing and modus operandi of the Ntabelanga Dam and its associated works would take into account its multi-purpose role, namely:

i. To supply potable water to an estimated current population of 502 822 people (rising to some 726 616 people in 2050), and other potable water consumers in the region;
ii. To supply raw water for irrigation of some 2 868 ha of high potential agricultural land;
iii. To generate hydropower locally at the dam wall to reduce the cost of energy consumption when pumping water;
iv. To provide sufficient flow of water downstream of the Ntabelanga Dam to meet environmental water requirements for an ecological Class C; and
v. To provide additional balancing storage volume and consistent downstream flow releases to enable a second dam at Lalini (just above the Tsitsa Falls) to generate significant hydropower for supply into the national grid.

NTABELANGA DAM LOCATION

The proposed Ntabelanga Dam is located approximately 55 km north of Mthatha on the Tsitsa River, as illustrated in Figure 1. This also shows the areas of jurisdiction of the three District Municipalities (DMs) that will benefit from the water supplied by the dam.

The relative locations of the proposed Ntabelanga Dam and Lalini Dam are shown in Figure 2.

DOMESTIC WATER SUPPLY AREA

In Phase 1, the domestic water supply area was initially defined as the area adjacent to and below the Ntabelanga dam wall extending to the watersheds on either side of the catchment.

This initial study water supply area was as shown on Figure 3, and includes information (shown in red lines) of the existing water supply infrastructure taken from information gained from the DWA All Towns Study, and from information supplied by the District Municipalities. Most of these schemes are supplied from local sources including small streams, springs, and groundwater, but many do suffer with source unreliability, high maintenance, and limited coverage of the population served. As can be seen, there are also many areas where no formalized water supplies exist, which form a high proportion of the study supply area.

In the course of this study, additional settlements located on the other side of the watersheds were also considered in order to maximise the benefit of the reliable water source, and treated water supply offered by the dam and its bulk water infrastructure to improve the water services delivery to these neighbouring areas. These additional supply areas were first defined in the Ntabelanga Dam Potential Supply Area Investigation Study commissioned by the Amatola Water (as Implementing Agent) and OR Tambo District Municipality and undertaken by Aurecon in 2011.

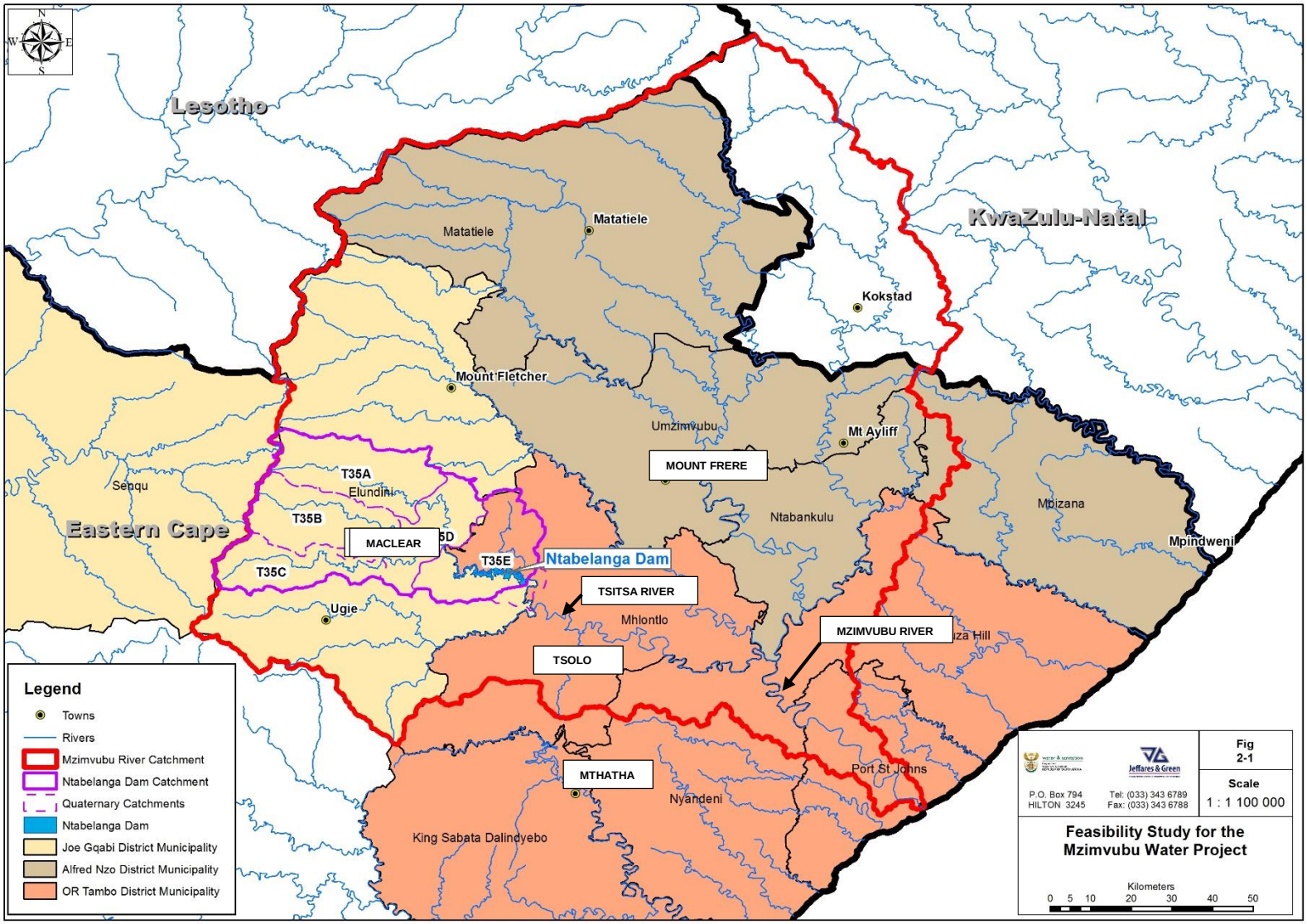

Figure 1: Locality Map of the Mzimvubu River Catchment Area at Ntabelanga Dam

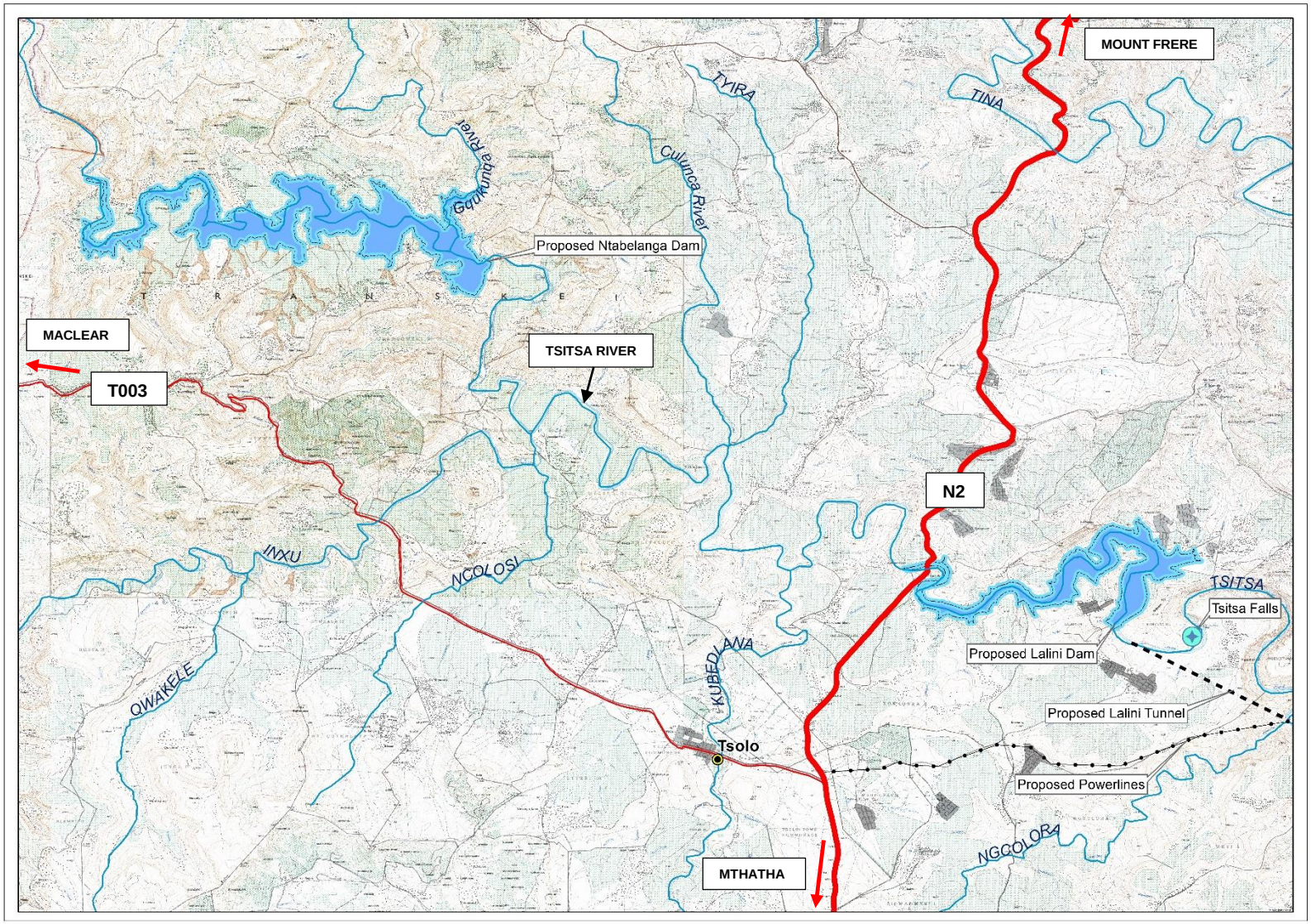

Figure 2: Locality of Ntabelanga Dam Relative to the Lalini Dam

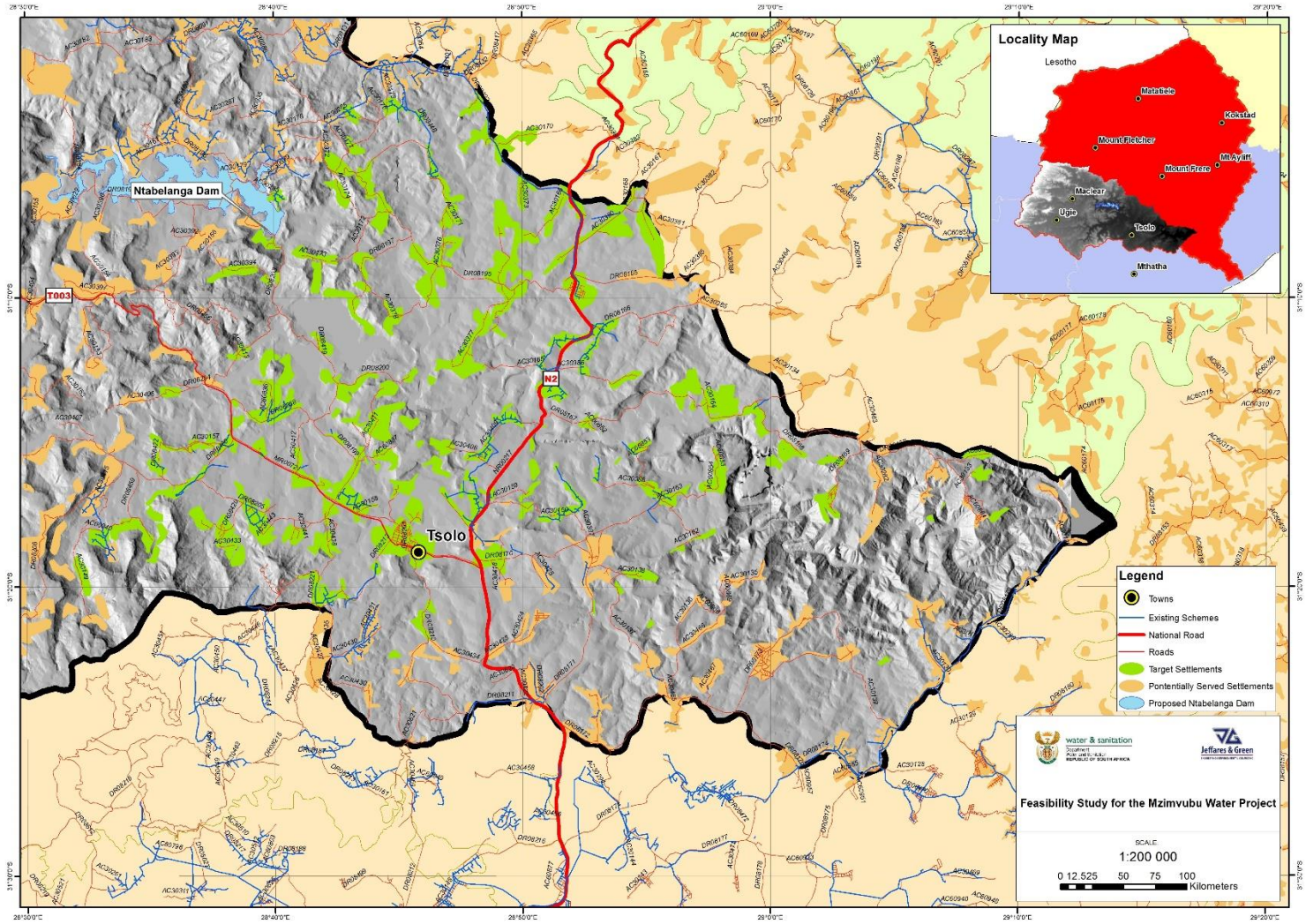

Figure 3: Initial Supply Area Showing Target Settlements and Existing Water Infrastructure

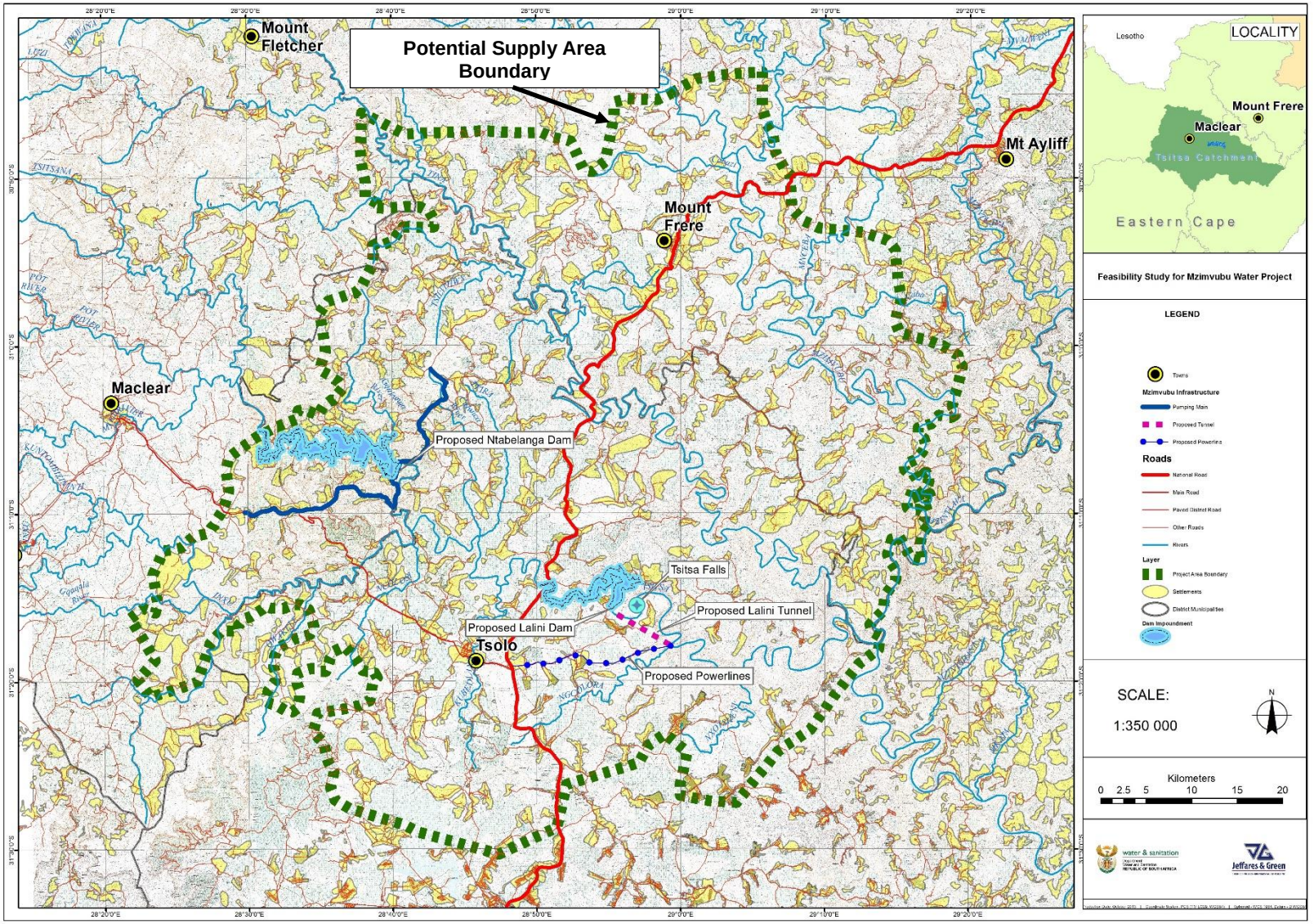

Figure 4: Potential Ntabelanga Water Supply Area Boundary

Following on from Phase 1 of this study, meetings and discussions were held with Amatola Water, their PSP, Aurecon, and other DM representatives, to confirm the potential extent of the domestic water supply area based upon using the Ntabelanga Dam as the main source, and to agree design criteria for assessment of the long-term water requirements through to the planning horizon of 2050.

This significantly increased the potential area of supply and the number of households to be supplied from that which was used for the Preliminary Study in Phase 1. This extended area of supply included settlements in and around the Mount Frere area as well as in the Joe Gqabi DM.

The subsequently expanded potential supply area is shown in Figure 4. This extended supply area boundary should itself not be considered to be a specific definition of the settlements that could be supplied from the Ntabelanga Dam, but is an indication of the likely extent of community water supply systems that could be supplied by gravity from the Ntabelanga secondary bulk water supply system. Indeed, water could possibly be supplied to settlements outside of this indicative boundary by booster pumping if this is deemed to be more efficient than developing other separate bulk water supply systems.

POTABLE WATER REQUIREMENTS

In developing the potable water requirements for this study area, consideration was made as to how the physical components of the bulk water distribution infrastructure should be implemented, operated, and zoned, and the breakdown of water demands used for design was thus matched to the zoning of the infrastructure to be developed.

Also, for the purposes of identifying the maximum raw water requirements to be supplied by the dam, the water supplied by the existing scheme sources was not deducted from the total. This is also justified on the basis that many of the existing smaller schemes would have previously been designed on the basis of relatively low water demand per capita, some could be reaching their design life, some would have source reliability issues, or might need extensive plant and pipeline replacement.

The figures derived herein therefore represent an "upper" demand growth scenario. The detailed design and implementation of such infrastructure should include a review of the water requirements and consider the optimum packaging and phasing of infrastructure components in order to defer capital expenditures until actually required. Given that a key objective of this project is to stimulate economic development and to create jobs, then this upper demand growth scenario can also be justified on the basis that water consuming commercial and industrial development should also be stimulated under the same economic development initiative. This social and economic upliftment objective is one of the key reasons that this project has been given Strategic Integrated Project (SIP) status by the Presidential Infrastructure Coordinating Commission (PICC).

The design horizon for this project is to year 2050. The assumption made is that the dam will be functional and in operation and be able to deliver the projected requirements, with the bulk infrastructure for conveyance of potable water to the various users being developed as soon as possible.

In practice, it is likely that the actual bulk water distribution infrastructure would be implemented in phases, with primary and secondary pipelines and reservoirs being developed at the same time as the dam and water treatment works, but the tertiary lines to the many settlements in the supply area, being implemented in stages under the usual bulk infrastructure grant funding available to the respective DMs.

Population growth projections have been developed from the latest national census databases together with other information provided by the DWS and District Municipalities in the project area. The annual population growth rate used was 1% p.a. in line with the planning documentation for the project. The population figures on Table 1 show an estimated current population in the project area to be supplied of 502 822 which is projected to increase to 726 616 in the year 2050. This is broken down into four supply zones that can be feasibly supplied by gravity for four command reservoirs as determined during the implementation planning of the bulk water distribution system. These Zones are as indicated on Figure 5.

Should this population growth rate be higher or lower than projected, then the date when the proposed system would reach its full capacity would be earlier or later. Given that the projections are considered to be an upper demand scenario, the likelihood is that the infrastructure as planned would have a longer lifespan than 2050 before needing to be augmented.

Table 1: Population Estimates and Growth Projections

	Population				
	2013	**2020**	**2030**	**2040**	**2050**
Zone 1	39 404	42 247	46 667	51 549	56 942
Zone 2	288 234	309 026	341 357	377 071	416 521
Zone 3	147 195	157 813	174 324	192 562	212 708
Zone 4	27 988	30 007	33 147	36 615	40 445
Total	**502 822**	**539 094**	**595 495**	**657 796**	**726 616**

The Ntabelanga Dam and its bulk potable water distribution infrastructure would thus be required to supply the following:

- *The current supply area population shown in the table above with an estimated population of 502 822 people in 102 723 households; and*
- *Population growth projections to year 2050, bringing the total population supplied to 726 616 in 148 443 households.*

Table 2 shows this same projection broken down by the areas of jurisdiction of the three DMs being supplied by the scheme.

Table 2: Population and Household Projections

Population					
	2013	**2020**	**2030**	**2040**	**2050**
Alfred Nzo DM	165 735	177 691	196 281	216 816	239 500
Joe Gqabi DM	33 513	35 931	39 690	43 842	48 429
OR Tambo DM	303 574	325 472	359 524	397 138	438 687
Totals	**502 822**	**539 094**	**595 495**	**657 796**	**726 616**
Households					
	2013	**2020**	**2030**	**2040**	**2050**
Alfred Nzo DM	33 859	36 301	40 099	44 294	48 928
Joe Gqabi DM	6 847	7 340	8 108	8 957	9 894
OR Tambo DM	62 018	66 492	73 448	81 133	89 621
Totals	**102 724**	**110 133**	**121 655**	**134 384**	**148 443**

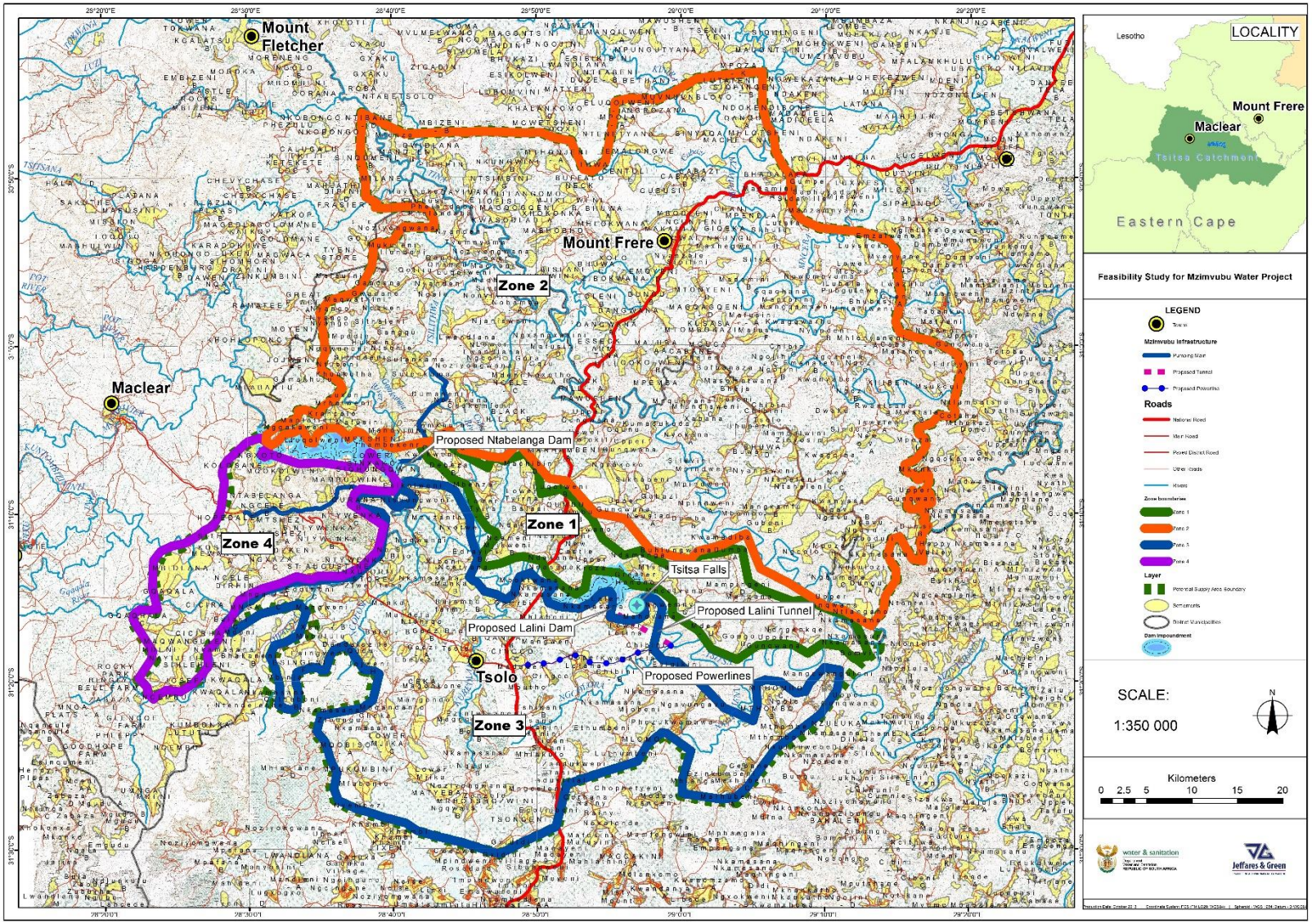

Figure 5: Supply Zones for Infrastructure Planning

A list of all settlements included in the supply area is given in Appendix A. The list details the following:

- *The name of each settlement to be supplied;*
- *Its census category as regards rural and urban settlement type;*
- *Its District Municipality; and*
- *The population and growth projection from current figures through to the planning horizon year 2050.*

WATER REQUIREMENTS CRITERIA

The design criteria used for the development of the scheme were:

- *Domestic water requirement – rural:* *60 litres per capita per day (ℓ/c/d)*
- *Domestic water requirement – urban:* *125 ℓ/c/d*
- *Allowance for transmission losses:* *10%*
- *Allowance for water treatment works losses:* *5%*
- *Summer peak factor for bulk water supply:* *1.2 x Annual Average Daily Demand (AADD)*
- *Bulk water transfer pipelines peak factor:* *1.2 (20 hours pumping per day)*
- *Population growth rate* *1% per annum.*

The summer peak factor and bulk water requirement peak factors are standards per the DWS's "Technical Guidelines for the Development of Water and Sanitation Infrastructure" and the "Guidelines for Development of Human Settlements Planning and Design" prepared by the Department of Housing.

The summer peak factor is described as a factor to cater for higher water use in the summer period. This recommended factor of 1.2 is applied to the design of the water treatment works, primary pumping system and reservoirs, while the bulk peak factor of 1.2 is a recommended factor to cater for the inflow into bulk storage as well as gravity flow between one command reservoir and another command reservoir. This bulk peak factor is applied to the design of the bulk pipelines, but does not change the overall water requirement on source. On pumping mains this can also be achieved by delivering a day's requirement in 20 hours of pumping. This allows adequate spare capacity in the pumping system in order to recover quickly from interruption or failure of the system operation.

The local daily peaks encountered in the reticulation system at settlement level are catered for in local bulk reservoirs which are designed for 48 hours storage, feeding into elevated tanks which themselves balance out hourly peak requirements.

These particular criteria are more relevant to the bulk infrastructure planning as is described in Report No. P WMA 12/T30/00/5212/13, but are included herein as a water requirement criteria guideline.

The breakdown of water volumes supplied to the three DMs, and growth to 2050, is given in Table 3.

Table 3: Potable Water Requirements by District Municipality

	Projected Average Demands (m^3/d)			
	2020	***2030***	***2040***	***2050***
Alfred Nzo DM	*20 687*	*22 852*	*25 243*	*27 884*
Joe Gqabi DM	*4 183*	*4 621*	*5 104*	*5 638*
OR Tambo DM	*37 893*	*41 857*	*46 236*	*51 074*
Total	***62 764***	***69 330***	***76 583***	***84 596***

Figure 6 summarises the growth projection of domestic water requirements, including allowances for conveyance losses, but excluding water treatment losses.

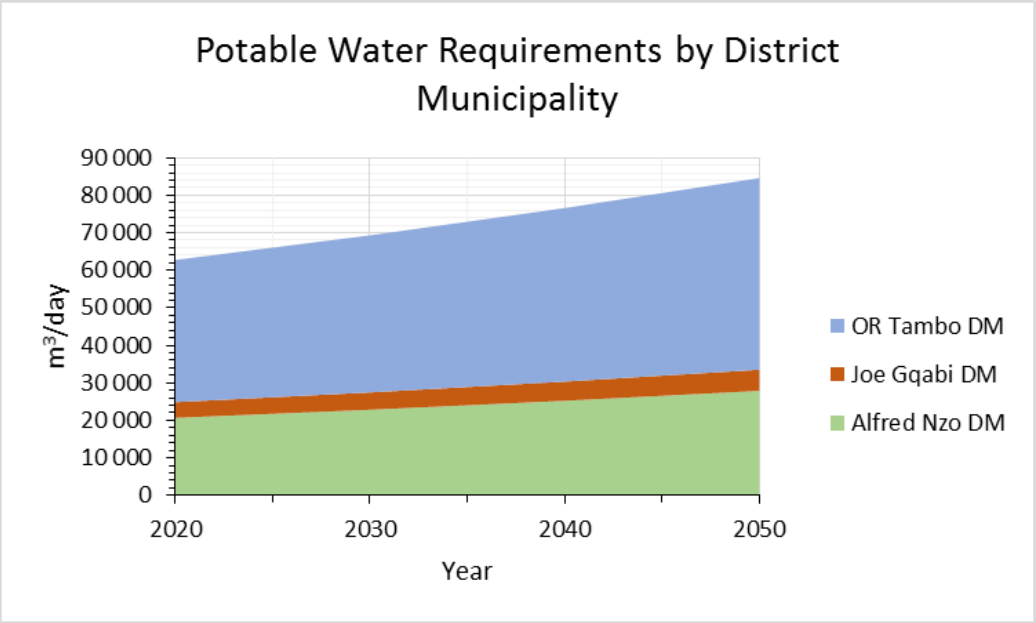

Figure 6: Potable Water Requirements by District Municipality

The starting point of the projection assumes a fully developed bulk water delivery distribution network by the year 2020.

If this completion date or the expected demand uptake is later than this, then certain works (e.g. water treatment works (WTW), installed pumping plant, and bulk water storage facilities) could be developed in stages.

However, the actual economics of such staged development will be dependent upon the amount of available initial grant funding as well as the expected "roll-out" of the tertiary distribution system and rate uptake of water connections as determined during the detailed design stage of the project.

*From the above table, and adding allowances for treatment losses, the total average daily water requirement for domestic purposes in the year 2050 is expected to be **32.4 million m³/annum**.*

AGRICULTURAL WATER REQUIREMENTS

During Phase 1 of the study, a desktop GIS exercise was carried out to identify high potential irrigable soils according to certain criteria, for purposes of ranking the dam sites identified.

The criteria were:

- *High potential soils according to soil form, depth, texture;*
- *Slope < 12%;*
- *Elevation < 60 m above the river at the dam site, or in the river below the dam site;*
- *Distance < 5 km from the dam wall on either side of the river below the dam site; and*
- *Water deficit – medium to high water stress (shortage of natural rainfall).*

When combined with other non-agricultural criteria in a ranking matrix, the three highest ranked dam sites that emerged for further consideration and study were Somabadi, Thabeng, and Ntabelanga.

The identified high potential irrigable land that could be supplied by these three highest ranked dam sites had areas of 1 261 ha (Somabadi), 1 553 ha (Thabeng) and 1 247 ha (Ntabelanga). A field verification exercise was carried out and the verified land areas with high irrigation potential were reduced to 504 ha for Ntabelanga Dam, and 1 062 ha for each of Thabeng and Somabadi Dams.

The three dams were compared in a ranking matrix and Ntabelanga Dam emerged as the top ranked dam, when all factors were taken into account. This was the dam selected at the end of Phase 1 of the study for further investigation.

In Phase 2 of the study, the screening criteria of distance from the water source and elevation above the water source were revised to cast the net wider and to find more potentially suitable agricultural land for irrigation, and thus increase the opportunities for economic development and social upliftment. The GIS analysis was re-run, and 7 708 ha of potential agricultural land were identified, as modified for existing land use. Much of these lands were situated around the town of Tsolo to the south east of the dam. A second field verification exercise was carried out, following which 3 675 ha of land suitable for irrigated agriculture were confirmed. A critical review of where these lands lay relative to the dam, as well as comprising contiguous soil bodies, resulted in a final estimate of 2 868 ha of viable irrigable land around the Ntabelanga Dam.

The climate of the Tsolo area is characterised by mean daily maximum temperature of 22°C, a mean minimum temperature of 9°C, and a mean temperature of 16°C. Mean annual precipitation is 780 mm, total annual evapotranspiration is 1 659 mm and mean humidity 65%. Frost does occur and occasional snow on the higher lying areas cannot be ruled out. Crops tolerant of a cool climate must therefore be considered.

A range of crops suited to the climate are presented in the body of the report, together with expected yields and water requirement per crop. For a mixed enterprise farming operation, a range of crops could be planted on varying areas. A typical irrigation water use was therefore determined based upon a likely planting scenario. This resulted in an irrigation rate of 619 mm/a, in an average year.

An upper limit of irrigation requirement has been determined by considering a reference crop with a crop factor of 1 planted year round. The upper limit was 1 141 mm/a for this reference crop.

The total water requirement determined for this upper limit was used to size the bulk water distribution system's capacity. For a total irrigated area of 2 868 ha, it was thus estimated that the maximum water requirement from the dam would be 32.7 million m^3/a.

In order to model average annual operating costs and to estimate the average annual irrigation water abstraction from the Ntabelanga Dam, an average irrigation application rate of 880 mm/a (i.e. (1 141 + 619) / 2) was applied to the above irrigable areas, which after allowing 10% for losses, gave an annual irrigation raw water requirement of ***27.8 million m³/annum****.*

TOTAL WATER REQUIREMENTS

Taking the two water requirement components described above, Table 4 summarizes the total water requirements from the Ntabelanga Dam before other considerations are included.

Table 4: Summary of Raw Water Demand on Ntabelanga Dam

Treated Bulk Water Supply Requirements				
Bulk Supply Service Reservoir	***Population Served***	***Average***	***Conveyance***	***Total Required***
	Year 2050	***litres/capita/day***	***Losses***	***m3/day***
Sidwadweni Nduku Reservoir	*90 545*	*60*	*10%*	*5 976*
Reservoir B	*186 794*	*125*	*10%*	*25 684*
Reservoir C (Mount Frere)	*33 589*	*125*	*10%*	*4 619*
Reservoir D	*55 549*	*99*	*10%*	*7 638*
Reservoir E (Joe Gqabi DM)	*40 445*	*125*	*10%*	*5 561*
Cullunca Command Reservoir	*94 553*	*125*	*10%*	*13 001*
Mvlimwlano Scheme	*84 935*	*125*	*10%*	*11 679*
Nduku Reservoir in Nyandeni LM	*140 207*	*60*	*10%*	*10 438*
Totals:	***726 616***			***84 596***
		add treatment losses	*5%*	*4 230*
Total Raw Water Required at Source for Potable Use (m3/day)				***88 825***
Total Raw Water Required at Source for Potable Use (million m3/a)				***32.42***
Irrigation Water Supply Requirements				
Estimated high potential irrigable land availability			*ha*	*2 868*
Average application rate per hectare			*mm/a*	*880*
Allowance for losses			*%*	*10*
Total Raw Water Required at Source for Irrigation (million m3/a)				***27.76***
Grand Total Raw Water Requirement at Ntabelanga Dam (million m3/a)				***60.18***

NB: for hydropower modelling scenario, this has been rounded to 60 million m3/yr

This annual average raw water requirement was applied to the WRYM yield model, together with the Environmental Water Requirements value developed to meet the ecological Class C classification recommended by the Reserve Determination team and as given in Report No. P WMA 12/T30/00/5212/7.

WATER REQUIREMENTS FOR HYDROPOWER

The primary focus for the hydropower component of the study was to investigate a conjunctive use scheme that would include the Lalini Dam downstream of the initially proposed Ntabelanga Dam. The Lalini Dam would be used primarily for hydropower generation (after allowing the EWR downstream of the dam to be maintained) with the objective being to seek to improve the financial viability of the scheme as a whole through the provision of an additional income stream from energy sales.

The proposed infrastructure configuration to generate hydropower is described in Report No. P WMA 12/T30/00/5212/19, and, in summary, comprises a balancing storage and flow diversion facility at the identified Lalini dam site (some 3.5 km along the river centreline upstream of the Tsitsa Falls, and the development of a 7.9 km long conduit (comprising a pipeline laid partly in the ground and partly in a tunnel) to convey diverted river flow through a drop in elevation of approximately 300 m to a hydro-electric plant (HEP), and back into the Tsitsa River in the gorge downstream of the Tsitsa Falls.

The hydropower assessment of the Lalini Dam, including the simulation of the Ntabelanga Dam as a balancing dam upstream, required a slightly different modelling configuration when compared to the domestic and irrigation supply only configuration, in order to assess the hydropower generation capabilities at Lalini.

The analysis undertaken produced results which showed that the simulated base load (average) hydropower generation from the Lalini Dam ranged from 12.5 MW to 50 MW, depending on the status of the river in terms of season, drought or flood conditions, and the combination of storage capacity options for the Ntabelanga and Lalini Dams. Given the physical dam capacity constraints which are limited by topography and environmental and social impacts, the preferred installed capacity solution was determined to be some 37.5 MW.

The outcome of the investigations indicated that hydropower generation potential at the Lalini Dam, with Ntabelanga Dam acting as a regulating dam for the production of hydropower at Lalini, is potentially cost-beneficial in a multi-purpose scheme. The optimum solution was shown to be one where the Ntabelanga Dam was constructed to a maximum capacity of 1.18 MAR_{PD} (Mean Annual Runoff based upon present day conditions), as constrained by topographical limitations, with the Lalini Dam capacity set at 0.28 MAR_{PD}. The current and future water requirements for domestic water users and irrigation potential (combined and rounded to 60 million m^3/a) could, however, be met in all of the hydropower scenarios presented. The above analysis also made allowances for the continuous maintenance of the recommended EWR for the river reaches below both these dams

For the recommended conjunctive scheme where this maximum capacity Ntabelanga Dam was analysed, hydropower generation of an average of 1.57 MW and 1.83 MW is also possible at the Ntabelanga Dam and Lalini Dam respectively.

Given that Lalini Dam is currently solely to be used for hydropower and is purely a storage balancing component, it is not normal to use the terminology of "yield" other than in terms of an energy yield.

From the hydropower model with the recommended 37.5 MW installed capacity, the following water requirements resulted:

1. *an average of 297.3 million m^3/a would be required to be released from the dam as EWR, and*
2. *an average of 291.2 million m^3/a would be passed through the main hydropower plant conduit, through the plant, and then returned back to the river downstream of the Tsitsa Falls.*

The remaining unused inflow is either stored in the dam or passes over the spillway as spills.

Table 5: Average Water Balance at Each Dam

Reconciliation of Average Annual Water Usage at each Dam by 2050 (million m^3/a)							
	MAR_{PD}	***Potable Water***	***Irrigation***	***EWR***	***Mini Hydropower***	***Main Hydropower***	***Spills or Other D/S Release***
Ntabelanga Dam	*415*	*32*	*28*	*87*	*uses EWR release*	*none*	*268*
*Lalini Dam**	*828*	*-*	*-*	*297*	*uses EWR release*	*291*	*240*

**NB: There is no net abstraction from the river by the Lalini Dam as the water used for hydropower is returned to the river at the main HEP*

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LIST OF ACRONYMS AND ABBREVIATIONS

ASGISA-EC	Accelerated and Shared Growth Initiative for South Africa – Eastern Cape
CAPEX	Capital Expenditure
CFRD	Concrete-faced rockfill dam
CMA	Catchment Management Agency
CTC	Cost to Company
CV	Coefficient of Variability
DAFF	Department of Agriculture, Forestry and Fisheries
DBSA	Development Bank of Southern Africa
DEA	Department of Environment Affairs
DM	District Municipality
DME	Department of Minerals and Energy
DoE	Department of Energy
DRDAR	Department of Rural Development and Agrarian Reform
DRDLR	Department of Rural Development and Land Reform
DWA	Department of Water Affairs
DWS	Department of Water and Sanitation
EA	Environmental Authorisation
EAP	Environmental Assessment Practitioner
EC	Eastern Cape
ECRD	Earth core rockfill dam
EF	Earthfill (dam)
EIA	Environmental Impact Assessment
EMP	Environmental Management Plan
EPWP	Expanded Public Works Programme
ESIA	Environmental and Social Impact Assessment
EWR	Environmental Water Requirements
FSL	Full Supply Level
GERCC	Grout enriched RCC
GN	Government Notices
GW	Gigawatt
GWh/a	Gigawatt hour per annum
IAPs	Invasive Alien Plants
IB	Irrigation Board
IFC	International Finance Corporation
IPP	Independent Power Producer
IRR	Internal Rate of Return
IVRCC	Internally vibrated RCC
ISO	International Standards Organisation
kW	Kilowatt
LM	Local Municipality
ℓ/s	Litres per second
ℓ/c/d	Litres per capita per day

MAP	Mean Annual Precipitation
MAR	Mean Annual Runoff
MEC	Member of the Executive Council
MIG	Municipal Infrastructure Grant
million m^3	Million cubic metres
MW	Megawatt
NEMA	National Environmental Management Act
NERSA	National Energy Regulator of South Africa
NHRA	National Heritage Resources Act
NOCL	Non-overspill crest level
NWA	National Water Act
NWPR	National Water Policy Review
NWRMS	National Water Resources Management Strategy
O&M	Operations and Maintenance
OPEX	Operational Expenditure
PICC	Presidential Infrastructure Co-Ordinating Committee
PPA	Power Purchase Agreement
PPP	Public Private Partnership
PSC	Project Steering Committee
PSP	Professional Services Provider
RBIG	Regional Bulk Infrastructure Grant
RCC	Roller-compacted concrete
REIPPPP	Renewable Energy Independent Power Producer Procurement Programme
RWI	Regional Water Institution
RWU	Regional Water Utilities
SAWS	South African Weather Service
SEZ	Special Economic Zone
SIP	Strategic Integrated Project
SMC	Study Management Committee
SPV	Special Purpose Vehicle
TCTA	Trans Caledon Tunnel Authority
ToR	Terms of Reference
UOS	Use of System
URV	Unit Reference Value
WEF	Water Energy Food
WRYM	Water Resources Yield Model
WSA	Water Services Authority
WSP	Water Services Provider
WTE	Water Trade Entity
WUA	Water User Association

LIST OF UNITS

Description	Standard unit
Elevation	m a.s.l.
Height	m
Distance	m, km
Dimension	mm, m
Area	m^2 , ha or km^2
Volume (storage)	m^3
Yield, Mean Annual Runoff	m^3/a
Rotational speed	rpm
Head of Water	m
Pressure	Pa
Diameter	mm or m
Temperature	^oC

Description	Standard unit
Velocity, speed	m/s, km/hr
Discharge	m^3/s
Mass	kg, tonne
Force, weight	N
Gradient (V:H)	%
Slope (H:V) or (V:H)	1:5 (H:V) or 5:1 (V:H)
Volt	V
Power	W
Energy used	kWh
Acceleration	m/s^2
Density	kg/m^3
Frequency	Hz

1. BACKGROUND AND INTRODUCTION

The Mzimvubu River catchment in the Eastern Cape of South Africa is within one of the poorest and least developed regions of the country. Development of the area to accelerate the social and economic upliftment of the people was therefore identified as one of the priority initiatives of the Eastern Cape Provincial Government.

Harnessing the water resources of the Mzimvubu River, the only major river in the country which is still largely unutilised, is considered by the Eastern Cape Provincial Government as offering one of the best opportunities in the Province to achieve such development. In 2007, a special-purpose vehicle (SPV) called ASGISA-Eastem Cape (Pty) Ltd (ASGISA-EC) was formed in terms of the Companies Act to initiate planning and to facilitate and drive the Mzimvubu River Water Resources Development.

The five pillars on which the Eastern Cape Provincial Government and ASGISA-EC proposed to model the Mzimvubu River Water Resources Development are:

- Afforestation;
- Irrigation;
- Hydropower;
- Water transfer; and
- Tourism.

As a result of this the Department of Water Affairs (DWA) commissioned the Mzimvubu Water Project with the overarching aim of developing water resources schemes (dams) that can be multi-purpose reservoirs in order to provide benefits to the surrounding communities and to provide a stimulus for the regional economy, in terms of irrigation, forestry, domestic water supply and the potential for hydropower generation amongst others.

1.1 Catchment Locality

The Mzimvubu River Catchment is situated in the Eastern Cape (EC) Province of South Africa which consists of six District Municipalities (DM) and two Metropolitan Municipalities (Buffalo City and Nelson Mandela Bay). The DMs include Cacadu DM in the west across to the Alfred Nzo DM in the east with the two Metropolitan Areas being located around the two major centres of the province, East London and Port Elizabeth, both of which border the Indian Ocean.

The Mzimvubu River Catchment traverses four DMs, namely the Joe Gqabi DM in the north west, a small portion of the Sisonke DM in the north east, the OR Tambo DM in the south west and the Alfred Nzo DM in the east and north east. A locality map of the catchment area and its position in relation to the DMs in the area is provided in Figure 1-1. This also shows the location of the Ntabelanga Dam and its catchment relative to the overall Mzimvubu catchment boundary.

The feasibility study for the Mzimvubu Water Project commenced in January 2012 and was completed in October 2014 in three stages as follows:

- Inception;
- Phase 1 – Preliminary Study; and
- Phase 2 – Feasibility Study.

The purpose of this study was not to repeat or restate the research and analyses undertaken on the several key previous studies described below, but to make use of that information previously collected, to update and add to this information, and to undertake more focussed and detailed investigations and feasibility level analyses on the dam site options that have then been identified as being the most promising and cost beneficial.

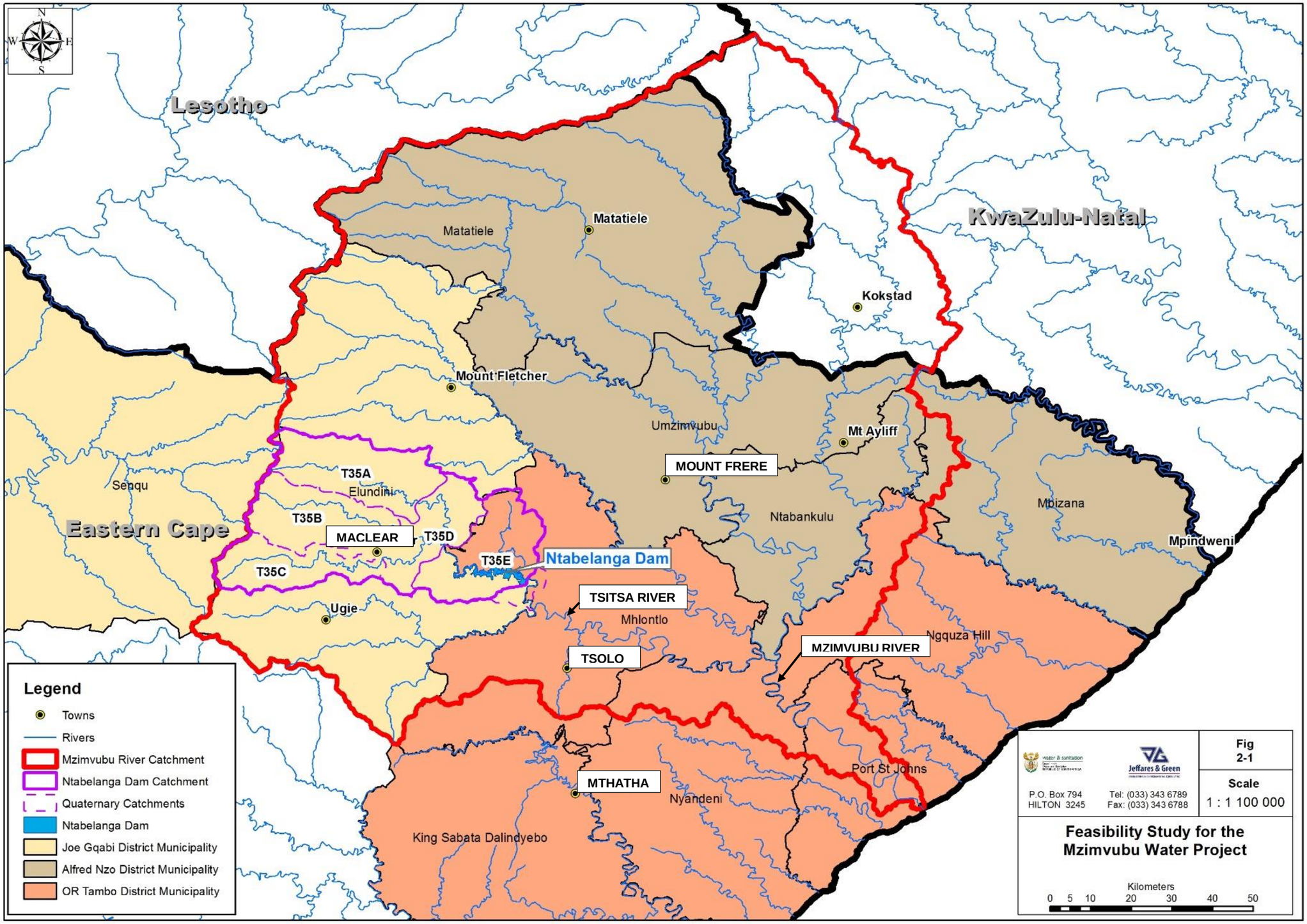

Figure 1-1: Locality Map of Mzimvubu Catchment

1.1.1 Inception Stage

The aim of the inception stage was to update the Terms of Reference (TOR) as well as include, *inter alia,* the following:

- A detailed review of all the data and information sources that were available for the assignment;
- A revised study methodology and scope of work;
- A detailed review of the proposed project schedule, work plan and work breakdown structure indicating major milestones;
- Provision of an updated organogram and human resources schedule; and
- Provision of an updated project budget and monthly cash flow projections.

This culminated in the production of an Inception Report (DWS Report Number P WMA 12/T30/00/5212/1) which also constituted the final TOR for the study.

1.1.2 Preliminary Study

The Preliminary Study Report describes the activities undertaken during the preliminary study phase, summarizes the findings and conclusions thereof, and provides recommendations for the way forward and scope of work to be undertaken during the Feasibility Study phase.

The Preliminary Study Phase was divided into two stages:

1. Desktop Study; and
2. Preliminary Study.

The aim of the Desktop Study was, through a process of desktop review, analyses of existing reports and data, and screening, to determine the three best development options from the pre-identified 19 development options (from the previous investigations). This process is described in Section 2 of this Report.

The aim of the Preliminary Study was to gather more information with regards to the three selected development options as well as to involve the Eastern Cape Provincial Government and key stakeholders in the process of selecting the single best development option to be taken forward into Phase 2 of the Study.

The main activities undertaken were, *inter alia*, as follows:

- Stakeholder involvement;
- Environmental screening;
- Water requirements determination (including domestic water supply, irrigation and hydropower);
- Hydrological investigations;
- Geotechnical investigations;
- Topographical survey investigations; and
- Selection process.

1.1.3 Phase 2 – Feasibility Study

Upon conclusion of the Preliminary Study a single preferred dam site and scheme development was recommended and taken forward to Feasibility Study level.

Key activities that have been undertaken during the Feasibility Study are as follows:

- Detailed hydrology (over and above that undertaken during the Preliminary Study);
- Reserve determination;
- Water requirements investigation (including agricultural and domestic water supply investigations);
- Topographical survey (over and above that undertaken during the Preliminary Study);
- Geotechnical investigation (more detailed investigations than during the Preliminary Study);
- Dam design;
- Land matters;
- Regional economics; and
- Legal, institutional and financial arrangements.

1.1.4 Lalini Dam and Hydropower Scheme

Following a variation order which extended the study programme to the end of October 2014, further detailed investigations were undertaken for a second dam on the Tsitsa River at Lalini (located some 3.5 km above the Tsitsa Falls) and its hydropower scheme, which would be operated conjunctively with the Ntabelanga Dam to generate significant hydropower for supply into the national grid.

1.2 Purpose of this Report

This report describes the water requirements for potable, irrigation and hydropower usage within the area to be supplied by the Ntabelanga Dam, which was selected as the preferred dam site in Phase 1, as described in the Preliminary Study Report No. P WMA 12/T30/00/5212/3.

Apart from providing balancing storage to be used for regulating flow in the river and through the proposed main Lalini Dam hydropower plant, there are no other water requirements from the Lalini Dam given that the main Ntabelanga Dam potable water supply scheme extends into the areas adjacent to Lalini.

It was confirmed and agreed that the sizing and modus operandi of the Ntabelanga Dam and its associated works would take into account its multi-purpose role, namely:

i. To supply potable water to a current population of some 502 822 people (rising to 726 616 people in 2050) and other water consumers in the region;
ii. To supply raw water for irrigation of some 2 868 ha of high potential agricultural land;
iii. To generate hydropower locally at the dam wall to reduce the cost of energy consumption when pumping water;
iv. To provide sufficient flow of water downstream of the Ntabelanga Dam to meet environmental water requirements for an ecological Class C; and
v. To provide additional balancing storage volume and consistent downstream flow releases to enable a second dam at Lalini (just above the Tsitsa Falls) to generate significant hydropower for supply into the national grid.

1.3 Ntabelanga Dam Catchment Area

The proposed Ntabelanga Dam is located approximately 55 km north of Mthatha on the Tsitsa River, as illustrated in Figure 1-1. As shown in Table 1-1, the catchment area contributing to the Ntabelanga Dam is approximately 1 971 km^2 for the contributing quaternary catchment areas, which are depicted in Figure 1-1).

The quaternary catchment areas contributing to the Ntabelanga Dam in the tertiary catchment T35 are somewhat developed, with approximately 10% of the catchment area under commercial forestry.

Table 1-1: Catchment Area: Ntabelanga Dam

Quaternary Catchment	Catchment Area (km^2)
T35A	476.5
T35B	396.8
T35C	307.0
T35D	348.9
T35E to Ntabelanga Dam Wall	441.9
TOTAL	**1 971.1**

Note: The total area of quaternary catchment T35E is 493.5 km^2, of which 51.6 km^2 lies below the dam wall.

Figure 1-1 also shows the areas of jurisdiction of the three District Municipalities that will benefit from the water supplied by the dam.

2. DOMESTIC WATER REQUIREMENTS

2.1 Domestic Water Supply Area

In Phase 1, the domestic water supply area was initially defined as the area adjacent to and below the Ntabelanga dam wall extending to the watershed crests on either side of the catchment.

This initial study area is shown on Figure 2-1, and includes information (shown in red lines) of the existing water supply infrastructure taken from information gained from the DWA All Towns Study, and from information supplied by the District Municipalities. Many of these schemes are supplied from local sources including small streams, springs, and groundwater, but many do suffer with source unreliability, high maintenance, and limited coverage of the population served. The water resources potential in this study area is described in Report No. P WMA 12/T30/00/5212/5.

2.1.1 Groundwater Potential

The findings from the groundwater potential aspects of the study were that there was a low to moderate water supply potential distributed across the Mzimvubu Catchment that could possibly meet the individual water requirements of selected settlements or very small areas of irrigated agriculture.

The range of potential yield per borehole was estimated to be 0.5 ℓ/s to 5 ℓ/s, with groundwater table depths of up to 50 m. Given that this project seeks to supply a large and widely scattered population it is conceivable that this could require between 500 and 1 500 boreholes, each with its own pumping arrangement and distribution system, which constitutes a huge operation and maintenance requirement, in locations with limited access. Water quality issues and lack of reliability in drought years could add to the problems of sustaining such a system.

The main concerns regarding multiple groundwater sources were:

- Maintaining a scheme with multiple abstraction sites spread across a vast spatial area has practical limitations regarding manpower and logistics when considering the operations and maintenance of the infrastructure;
- Operations and maintenance costs associated with a widespread, multi-abstraction scheme;
- The reliability of groundwater is not always as good as a large-scale surface water supply option, i.e. during the dry years, water tables drop and groundwater schemes can often experience low yields or failures, and, thus, restrictions could be imposed. Such restrictions should not be necessary in a large single-source scheme; and
- Management of groundwater resources is critical in order to ensure the sustainability of the resource. This cannot always be monitored comprehensively in a widely dispersed supply scheme as would be required in this case, thus, the resource is open to misuse, which could have negative impacts for water supply and for the aquifer.

Based on the above, and after discussions with the PSC and DWS, it was decided that there was still a role to be played by groundwater in supplying some of the communities within the study area, and that where such groundwater schemes are considered to be operating reliably and supplying potable water of adequate quantity and quality, then such schemes should be integrated into the overall bulk water supply planning and implementation for the area.

2.1.2 *Surface Water Sources*

The track record of small dams and river abstraction schemes in this region is also not good. Given the very high sediment loads in the Mzimvubu River catchment, small dams and abstraction weirs would quickly silt up and become inoperable or very difficult to maintain. The water supply dam at Mount Fletcher is an example of this, in that this 200 000 m^3 capacity dam (estimated as less than 10% of the MAR) filled with sediment to about 70% of its capacity within four years of commissioning. The District Municipalities report the same problems occurring with abstraction weirs, which also suffer from damage under flood conditions.

River abstraction points also rarely meet the EWR requirements as they have no balancing storage, and are often unreliable in the dry season. Off-channel storage dams can be an option to alleviate some of these problems but, given the scale of the proposed scheme, these would need to be substantial dams, each requiring suitable site and impoundment conditions and each off-channel dam normally requires its own river abstraction/pumping facilities. These dams are normally themselves located in tributaries of the main river, and such tributaries would likely also exhibit the same severe sedimentation problems as the main river. Building several river abstraction or off-channel facilities also multiplies the number of water treatment works and associated infrastructure required to be constructed, operated and maintained.

The findings from this study thus highlighted that there was a low to moderate groundwater potential, and vulnerable surface water sources distributed across the Mzimvubu catchment that could possibly meet the individual water requirements of selected settlements. However, this approach would involve many boreholes and multiple abstraction sites spread across a wide geographical area, with very onerous operation and maintenance obligations leading to high risk of failure.

In consultation with the stakeholders during the project steering committee meetings, the water services authorities in the area concurred that they would prefer one single surface water source rather than multiple groundwater and river abstraction sources. The water requirements for the Ntabelanga supply area have therefore been developed on this basis, and cover the demand growth for the whole area.

The planning for the bulk water distribution system for this study has been based upon a surface water-sourced system. However, it is recommended that the detailed design and implementation of the bulk water system takes into account those viable existing groundwater-based schemes, but existing schemes based upon vulnerable river abstraction points could be integrated into the future bulk water distribution system.

2.1.3 *Broadening Proposed Area of Supply*

In the course of this study, additional settlements located outside the Tsitsa River watershed were also considered in order to maximise the benefit of the proposed water source and treated water supply solution offered by the Ntabelanga Dam and its bulk water infrastructure. These additional potential supply areas were first defined in the *Ntabelanga Dam Potential Supply Area Investigation Study* commissioned by the Amatola Water (as Implementing Agent) and OR Tambo District Municipality and undertaken by Aurecon in 2011.

Meetings and discussions were held with Amatola Water, their PSP, Aurecon, and other DM representatives, to confirm the extent of the domestic water supply area based upon using the Ntabelanga Dam as the main source, and to agree design criteria for assessment of the long-term water requirements through to the planning horizon of 2050. This significantly increased the area of supply and the number of households to be supplied from that which was used for the Preliminary Study in Phase 1. This extended potential area of supply included settlements in and around the Mount Frere area as well as in the Joe Gqabi DM, towards Maclear. This finally agreed supply area is as shown on Figure 2-2.

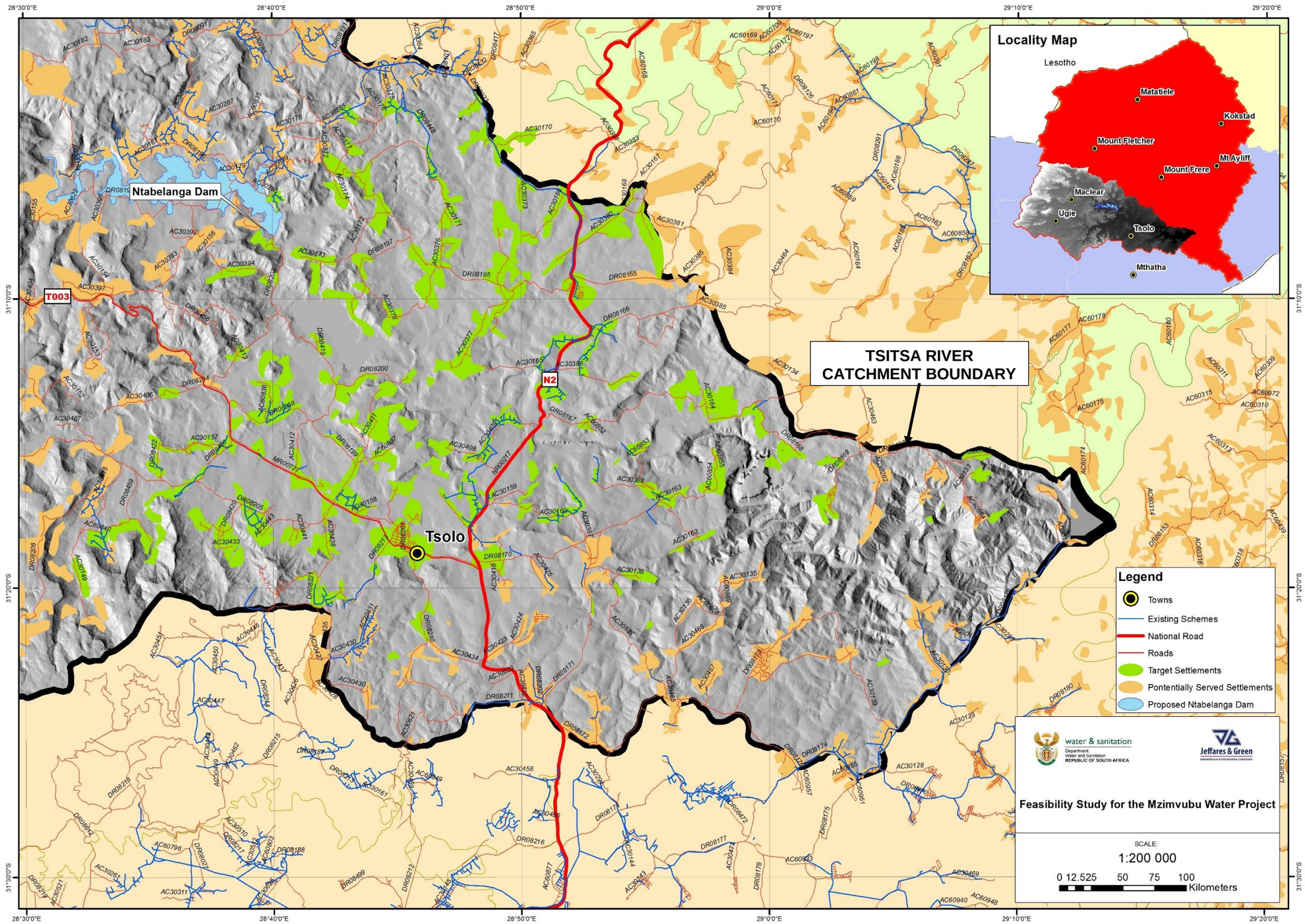

Figure 2-1: Initial Ntabelanga Supply Area

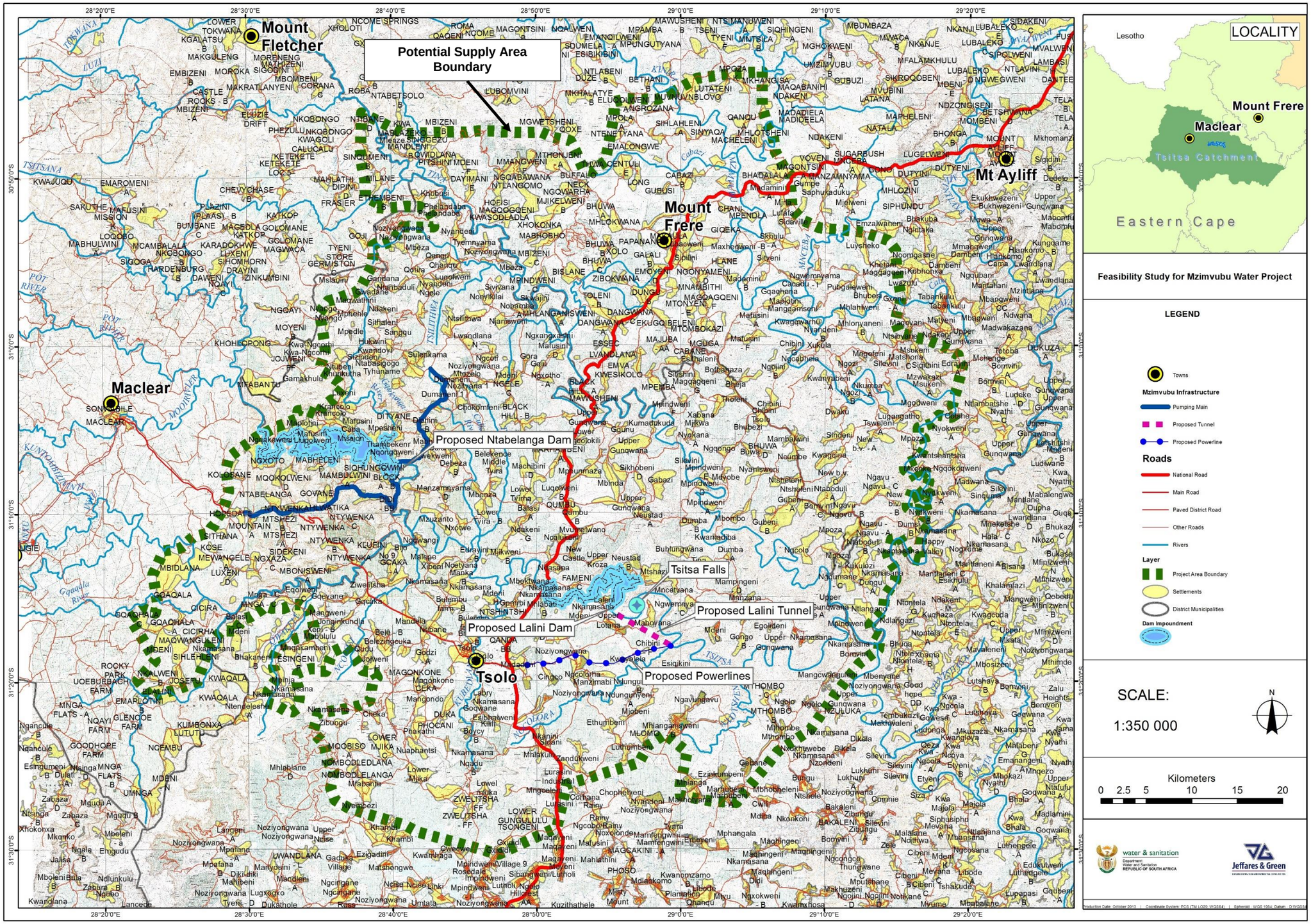

Figure 2-2: Extended Domestic Water Supply Area Boundary

2.2 Planning Approach

In developing the water requirements for this study area, consideration was made as to how the bulk water delivery infrastructure would be developed and zoned, so that the breakdown of water requirements used for design was matched to the infrastructure to be developed. Please refer to Report No. P WMA 12/T30/00/5212/13 – Bulk Water Distribution Infrastructure.

Also, for the purposes of identifying the maximum raw water requirements to be supplied by the dam, the water supplied by the existing schemes was not deducted from the total. This is also justified on the basis that many of the existing smaller schemes would have been designed on the basis of relatively low water demand per capita, some could be reaching their design life, some would have source reliability issues, or might need extensive plant and pipeline replacement. Water supply schemes that have been recently constructed or are in the process of being implemented have been incorporated into the planning of the overall bulk water delivery infrastructure.

The figures derived below therefore represent an upper water requirement scenario. The detailed design and implementation of such infrastructure should include a review of the water requirements and consider the optimum packaging of development stages.

2.3 Inter-basin Transfer Options

Consideration was given to the potential for inter-basin transfer from the Tsitsa River in general and the Ntabelanga Dam in particular. The closest potential need for such a scheme was the main regional centre of Mthatha, which is a fast-growing town of strategic importance.

Apart from some groundwater sources, the main water supply for Mthatha is the existing Mthatha Dam on the Mthatha River which is the main source for potable water production as well as having an allocation for release downstream to maintain flow to two small hydroelectric plants at First Falls and Second Falls.

Given that Mthatha was experiencing challenges with its water supply, consideration was made as to whether inter-basin transfer of raw water from the Ntabelanga Dam to the Mthatha Dam would be a solution.

A high-level conceptual design was undertaken for a water transfer scheme comprising a 37 km long pipeline with capacity to convey some 1 m^3/sec between these two dams.

As this pipeline would need to cross the watershed dividing the Tsitsa and the Mthatha Rivers, some 240 m pumping head would be required.

In summary, such a scheme would cost an estimated R600 million to construct and R20 million/annum to operate and maintain. Excluding capital redemption, the net cost of raw water transferred would be R0.70/m^3. It must also be noted that there would be significant interception, infiltration and evaporation losses once the water is released from this pipeline into the Mthatha Dam's catchment, before supplementing the inflow into the dam.

The DWS *Reconciliation Strategy for Mthatha and surrounding village clusters* (June 2011) identified that Mthatha's main problem was very high water losses in the system (up to 60%) and that resolution of this problem would secure Mthatha's water supply needs for at least the medium term. In addition, it was stated that the water allocation from the dam between water supply and downstream release for environmental and hydropower purposes was conservative and did not need to be reviewed at this time.

The conclusion was that there was not currently a case for further investigation of an inter-basin transfer scheme between Ntabelanga Dam and Mthatha Dam, but this could be revisited in the longer term.

The DWA Report No. P RSA 000/00/12610, *Assessment of the Ultimate Potential and Future Marginal Cost of Water Resources in South Africa*, September 2010, investigated all major water resources in the country and undertook an economic and financial analysis to determine the marginal cost and preferred development timing of resources by region.

Inter-basin transfer options were included in this study, and the transfer of water from the Mzimvubu catchment was included in the following augmentation options:

- Vaal River,
- Orange River, and
- Algoa Water Supply Area (WSA).

The results of the study were a ranking of the various water supply resource options in terms of yield and unit reference value (URV) of raw water supplied, against the projected growth in water requirements for each supply area. Figures 2-3 to 2-5 are extracted from the above report and summarize the results.

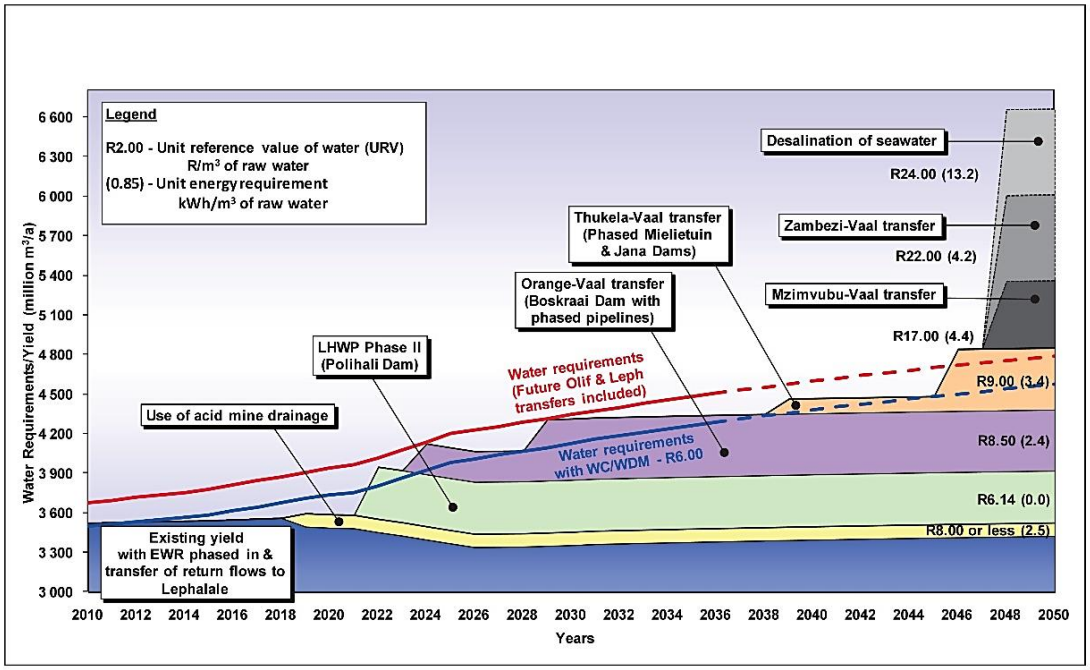

Figure 2-3: Vaal River Augmentation Options

For the Vaal River option, the conclusion was that *"the transfer of water from the Mzimvubu River to the Vaal River system will be very expensive and measures such as the re-allocation of water (through trading) may be more advisable".*

For the Orange River option, the conclusion was *"It is doubtful whether the transfer of water from the Mzimvubu catchment for the express purpose of augmenting supplies along the Orange River will ever be necessary and justifiable".*

For the Algoa WSA the Mzimvubu transfer is shown to be the last and most expensive option to be developed and produces a URV even higher than desalination.

The conclusion from all of these options is that there is no case for the development of a long-distance inter-basin transfer scheme from the Mzimvubu River in the medium to long-term.

It is recommended, however, that the situation be regularly reassessed in the future.

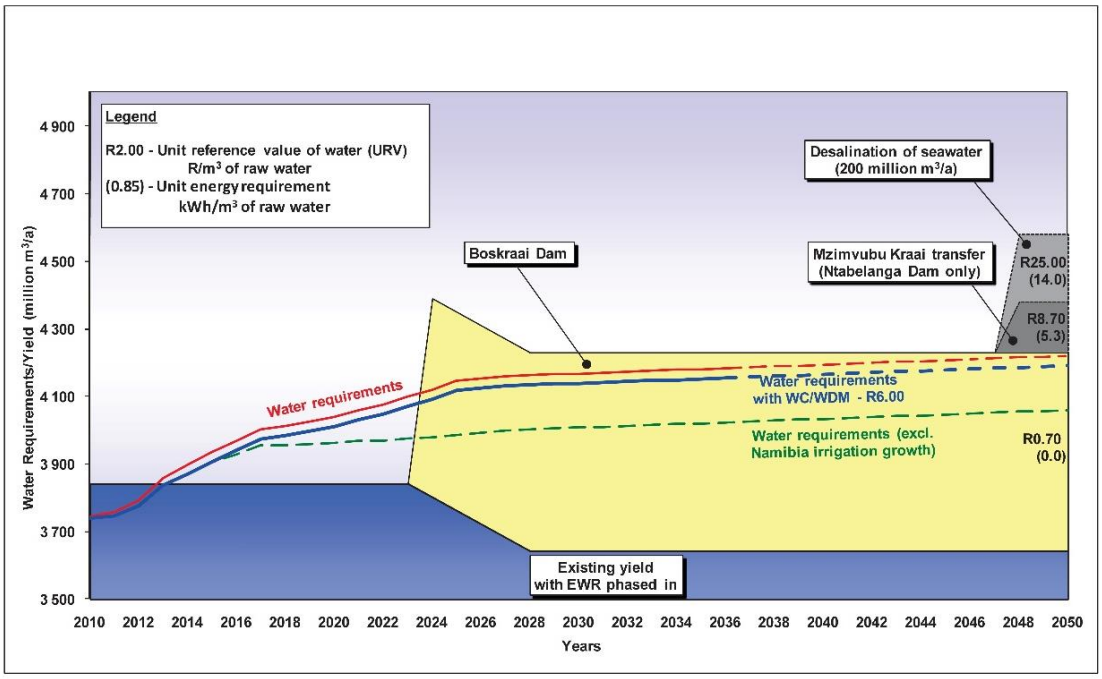

Figure 2-4: Orange River Augmentation Options

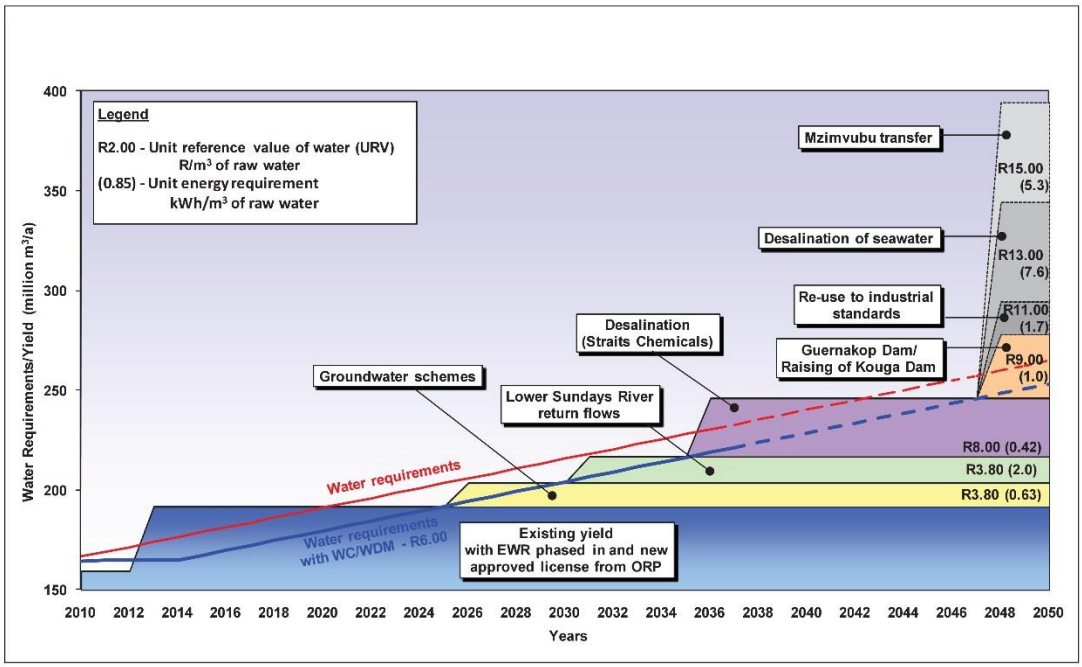

Figure 2-5: Algoa WSA Augmentation Options

2.4 Population of Supply Area

For the purposes of designing bulk infrastructure, the area has been separated into four supply zones based on their geographical location within an elevation band, and the practicalities of building and operating a water supply system within the given terrain. This is discussed in more detail in the report on the bulk infrastructure. This zoning is as shown on Figure 2-6.

The population figures used in Phase 1 of the study were derived from the GIS database created for this project based on Census 2001 figures (updated in 2006) which have then been escalated at an agreed growth rate of 1% per annum for the design horizon to 2050.

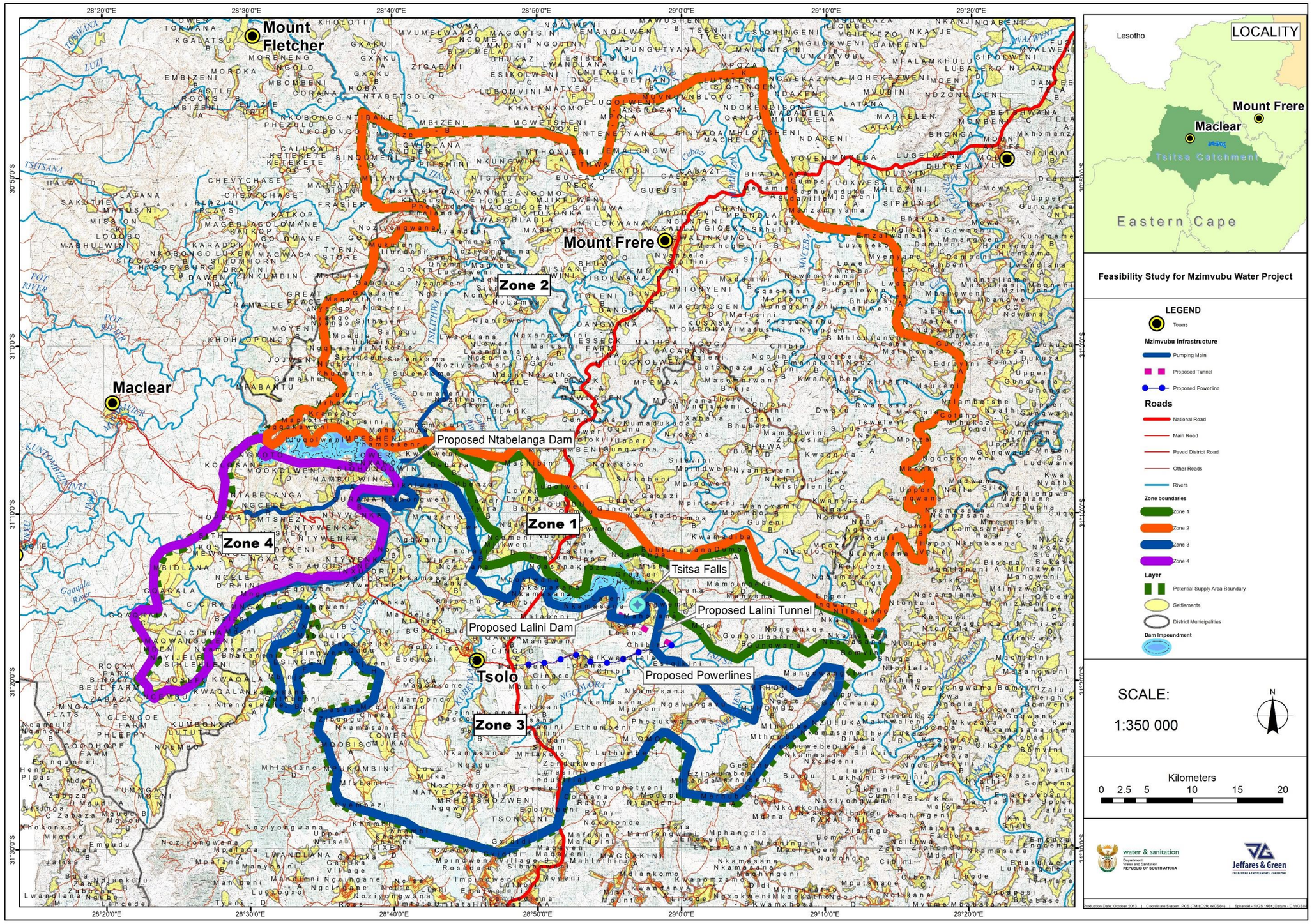

Figure 2-6: Supply Zones for Infrastructure Planning

The 2011 census database became available during Phase 2 of the study, and was used as the final basis of the population growth projections.

The projected population to be supplied by the water supply schemes emanating from the construction of the Ntabelanga Dam is depicted in the following table.

Table 2-1: Population Served by Zone

	Population				
	2013	**2020**	**2030**	**2040**	**2050**
Zone 1	39 404	42 247	46 667	51 549	56 942
Zone 2	288 234	309 026	341 357	377 071	416 521
Zone 3	147 195	157 813	174 324	192 562	212 708
Zone 4	27 988	30 007	33 147	36 615	40 445
Total	**502 822**	**539 094**	**595 495**	**657 797**	**726 616**

2.5 Water Requirement Design Criteria

The design criteria used for the development of the scheme are:

- Domestic water requirement - rural - 60 litres/capita/day (ℓ/c/d)
- Domestic water requirement – urban - 125 ℓ/c/d
- Allowance for transmission losses - 10%
- Allowance for water treatment works losses - 5%
- Summer peak factor for bulk water supply - 1.2 x Annual Average Daily Demand (AADD)
- Bulk water transfer pipelines peak factor - 1.2 (20 hours pumping per day)
- Population growth rate - 1% per annum.

The summer peak factor and bulk water requirement peak factors are standards per the DWA's "Technical Guidelines for the Development of Water and Sanitation Infrastructure" and the "Guidelines for Development of Human Settlements Planning and Design" prepared by the Department of Housing. The summer peak factor is described as a factor to cater for higher water use in the summer period. This recommended factor of 1.2 is applied to the design of the water treatment works, primary pumping system and reservoirs, while the bulk peak factor of 1.2 is a recommended factor to cater for the inflow into bulk storage as well as gravity flow between one command reservoir to another command reservoir.

This bulk peak factor is applied to the design of the bulk pipelines, but does not change the overall average annual water requirement on source. On pumping mains this can also be achieved by delivering a day's requirement in 20 hours of pumping. This allows adequate spare capacity in the pumping system in order to recover quickly from interruption or failure of the system operation, as well as being able to avoid pumping during the hours when peak energy tariffs apply. The local daily peaks encountered in the reticulation system at settlement level are catered for in local bulk reservoirs which are designed for 48 hours storage, feeding into elevated tanks which themselves balance out hourly peak requirements.

These particular criteria are more relevant to the bulk infrastructure planning as is described in Report No. P WMA 12/T30/00/5212/13, but are included herein as a water requirement criteria guideline.

The choice of unit water requirement and losses are based upon the "Guidelines for Development of Human Settlements Planning and Design" prepared by the Department of Housing. Typically a lower unit requirement is allocated to rural requirements while the urban requirements are of the order of a range between 80 ℓ/c/d and 250 ℓ/c/d depending on the classification of the water use area.

The unit water requirement for rural users of 60 ℓ/c/d is a typical value assigned to rural users in the DWS Guidelines for Water Services Provision. This is an average requirement and caters for the use of water for a yard connection type of water supply system. From experience with past rural schemes, the actual water consumption in these areas ranges from 5 to 25 ℓ/c/d due to the use of water for purely consumption purposes with no use for waterborne sanitation. However, the planning of this project is based upon the assumption that no one should be limited to only basic levels of water supply, and it is expected that standards of living conditions in the region will be increased and that water supply quantity should not be a limitation to such development objectives.

The unit water requirement for urban users is of the order of a range between 80 ℓ/c/d and 250 ℓ/c/d depending on the classification of the water use area as per the Guideline for Development of Human Settlements. In consideration of this being an average requirement, and the nature of the area, the use of 125 ℓ/c/d is deemed to be an appropriate estimate, which was in line with the planning criteria being used by the DMs. These design criteria are average consumption figures per capita. This allows for cases where larger properties might be built in rural areas, where the water requirement would be that of an urban development. The higher consumption of such properties would be balanced by other rural consumers using less than 60 ℓ/c/d.

Similarly in urban areas, there will be other water requirements such as commercial and institutional organisations that will use more than 125 ℓ/c/d, but again this is balanced by those properties that use less than this figure.

2.6 Domestic Water Demand Projections

A list of all settlements included in the area to be supplied with potable water by the Ntabelanga Dam and its bulk water infrastructure is given in Appendix A. This details the name of each settlement to be supplied, the census category as regards rural and urban settlement type, the location of each settlement as regards the District and Local Municipalities and Water Supply Authority, and the population and growth projection from current figures through to the planning horizon year 2050.

The domestic water requirements for the project area are based on the average unit consumptions for these different settlement classifications. From the GIS database that has been developed for the project, all settlements within the study area have been classified as being either rural or urban in type.

Applying the design factors to the population projections results in the water requirement for the study area being determined as shown in the Table 2-2.

Table 2-2: Domestic Water Requirement Projections

Projection Year:>	2013	2020	2030	2040	2050
Average daily requirements (m^3/d)	58 541	62 764	69 330	76 583	84 596
Peak daily requirement (m^3/d)	70 248	75 316	83 196	91 900	101 515
Average annual requirements (million m^3/a)	**21.6**	**22.9**	**25.3**	**28.0**	**30.9**

From the above table the average daily water requirements to be supplied by the Ntabelanga Dam for domestic purposes is expected to range from **22.9 million m³/a** in 2020 to **30.9 million m³/a** in 2050.

Together with an allowance for water treatment works losses, the average annual demand figure of **32.4 million m³/a** for 2050 has been applied to the dam yield modelling to determine dam size, with allowances made for EWR purposes.

The peak daily demand figure for 2050 has been used to determine the ultimate sizing of the WTW itself, as well as the treated water pumping plant at these works. These works will be designed in a modular arrangement so that the works can be implemented in stages to match actual demand growth, if the considerations described above are adopted.

The peak daily requirement figure has been used in sizing raw water transfer systems from the dam to the water treatment works (WTW), the ultimate sizing of the WTW itself, as well as the treated water pumping plant at these works. For more details in this regard please see Report No. P WMA 12/T30/00/5212/13.

2.7 Domestic Water Requirements Summary

The Ntabelanga Dam and its bulk water distribution infrastructure will be able to supply the following:

- All existing communities shown on the figures above comprising a total of 502 822 people in 102 723 households; and
- Population growth projections to year 2050 have been undertaken, bringing the total population supplied to 726 616 in 148 443 households.

These populations supplied are distributed between the District Municipalities, as shown in Table 2-3.

Table 2-3: Population and Households Supplied

Population					
	2013	**2020**	**2030**	**2040**	**2050**
Alfred Nzo DM	165 735	177 691	196 281	216 816	239 500
Joe Gqabi DM	33 513	35 931	39 690	43 842	48 429
OR Tambo DM	303 574	325 472	359 524	397 138	438 687
Totals	**502 822**	**539 094**	**595 495**	**657 797**	**726 616**
Households					
	2013	**2020**	**2030**	**2040**	**2050**
Alfred Nzo DM	33 859	36 301	40 099	44 294	48 928
Joe Gqabi DM	6 847	7 340	8 108	8 957	9 894
OR Tambo DM	62 018	66 492	73 448	81 133	89 621
Totals	**102 723**	**110 133**	**121 656**	**134 383**	**148 443**

The breakdown of water volumes to be supplied to the three DMs, and growth to 2050, is as shown in Table 2-4.

Table 2-4: Potable Water Requirements by District Municipality

	Projected Average Demands (m^3/d)			
	2020	**2030**	**2040**	**2050**
Alfred Nzo DM	20 687	22 852	25 243	27 884
Joe Gqabi DM	4 183	4 621	5 104	5 638
OR Tambo DM	37 893	41 857	46 236	51 074
Total	**62 764**	**69 330**	**76 583**	**84 596**

Figure 2-7 summarises the growth projection of domestic water requirements, including allowances for conveyance losses.

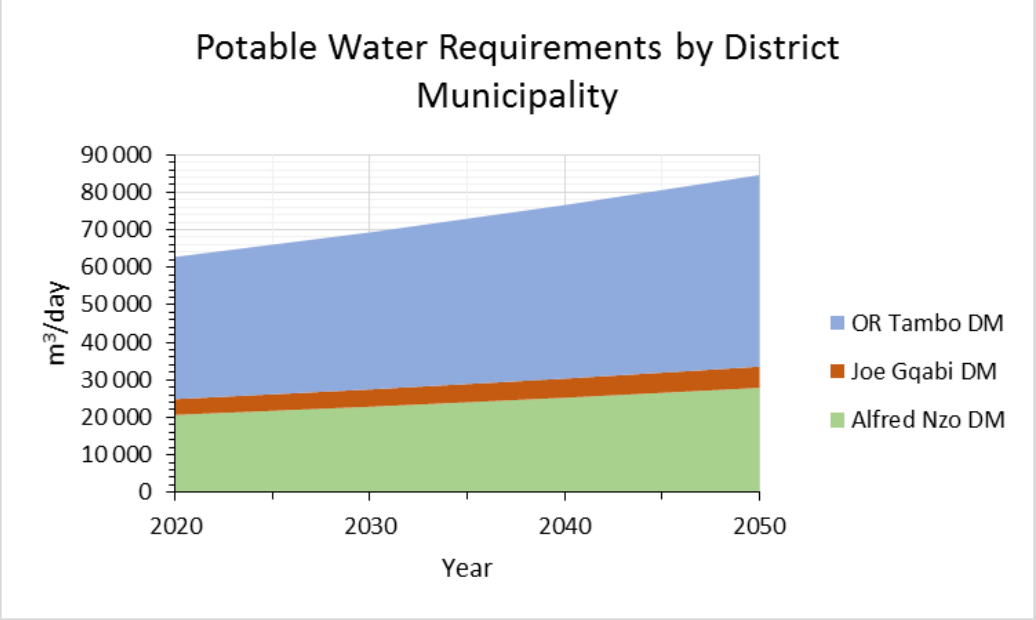

Figure 2-7: Potable Water Requirements by District Municipality

Figure 2-8 summarises the growth projection of raw water requirement on the Ntabelanga Dam to meet domestic water requirements, including allowances for conveyance and treatment losses.

This assumes a fully developed treated water delivery distribution network being in service by the year 2020. If, as is likely, the actual water consumption uptake is slower than projected, and/or the implementation of the tertiary water distribution system is undertaken in stages and over a longer period, then certain works (e.g. WTW, installed pumping plant, and bulk water storage facilities) could be developed in phases to defer capital expenditure accordingly.

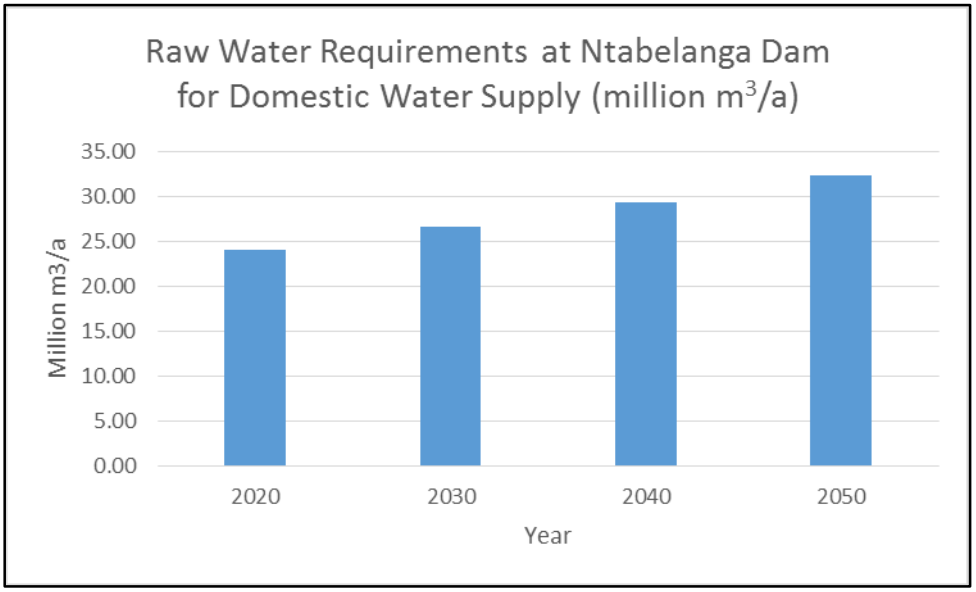

Figure 2-8: Raw Water Requirements: Domestic Supply

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3. AGRICULTURAL WATER REQUIREMENTS

3.1 Determination of Potential Irrigable Soils

The full methodology and description of findings of this process are given in the Irrigation Development Report No. P WMA 12/T30/00/5212/9.

3.1.1 Phase 1: Desktop Study

Phase 1 of the study required the screening of dam site options and the selection of a shortlist of three dam sites that made best possible use of the water resources of the Mzimvubu River catchment. The focus of the irrigation development task in this stage was to objectively identify the potential for developing irrigated agriculture around or below these three screened and shortlisted dam site options. This formed one of the criteria for decision making in terms of selecting the best dam site for further study in Phase 2 of the project.

The following factors were used to evaluate the irrigation potential of land surrounding the candidate dams, with a view to forming viable commercial farming units:

- *irrigable soil quality*, as determined by soil classification, soil depth and soil texture. Soils across the catchment were classified on a 1 km x 1 km raster grid basis as either “high”, “medium” or “low” potential, based on an algorithm which took into account the soil series, depth and texture;
- *slope*: commercial viability will require mechanisation, and therefore slopes need to be within the limit that can be mechanically farmed. Slope across the catchment was calculated from existing elevation data, and slopes less than 12% were considered suitable for mechanised farming operations;
- *proximity to water source*: commercial viability requires that the water source should be located within certain horizontal and vertical distance of the irrigable lands. For economic viability reasons, the areas considered were limited to those within 60 m vertical of the river at the proposed dam wall location or in the river below a proposed dam, and 5 km horizontal from the dam or the river below the proposed dam. This allowed the river below a potential dam to be used as a natural channel for conveying water to high potential areas downstream of a dam;
- *natural rainfall*: areas with high natural rainfall would not respond as well to irrigation when compared to areas with a medium to low occurrence of natural rainfall. To determine water deficit, the mean annual precipitation (MAP) was expressed as a ratio to mean annual evapotranspiration. Areas were then classified as “low”, “medium” and “high”. A “low” classification means the area has a low MAP to evapotranspiration ratio, and therefore a significant water stress, which will likely severely limit the yield potential and choice of crops that can be grown. It will therefore respond well to irrigation; and
- *water availability within the proposed dams*.

All of the identified sites were analysed, so that they could be objectively ranked against each other in terms of irrigation potential. For this preliminary stage analysis, a desktop study was undertaken using GIS analysis techniques.

A desktop level study was undertaken using primarily GIS modelling together with some ground-truthing reconnaissance in this first phase. This developed sufficient data from some 19 potential dam sites to use in the decision making process.

When combined with other non-agricultural criteria in a ranking matrix, the three highest ranked dam sites that emerged for further consideration and study were Somabadi, Thabeng, and Ntabelanga. Table 3-1 summarises the high potential agricultural land findings from this screening stage of the study.

Table 3-1: High Potential Agricultural Land: All Dam Options

No	Catchment	Total Catchment Agric Land (ha)	Dam	High Potential Area (ha)
1	T31	8 561	Siqingeni	0
2			Dam2	0
3			Dam2 Alt	0
4	T32	957	Dam B	0
5			Bokpoort	0
6			Luzi	0
7	T33	22 647	Ntlabeni	0
8			**Somabadi**	1 261
9			**Thabeng**	1 553
10	T34	31 976	Mangwaneni	0
11			Ku-Mdyobe	0
12			Mfanta	0
13			Mpindweni	0
14			Hlabakazi	0
15			Pitseng	1 476
16	T35	57 953	**Ntabelanga**	1 247
17			Nomhala	747
18			Malepelepe	22
19			Lower Malepelepe	22
20			Lalini	0
21			Tsitsa	0
22			Gongo	0
23	T36	0	Mbokazi	0

3.1.2 Phase 1: Field Review

The three shortlisted dam sites were reconnoitred to verify the desktop information as derived above. It was also important that ground-truthing of the desktop information took place, to ensure that decisions were being made on reliable and accurate information. Budgetary constraints did not allow for extensive soil sampling and testing at this high level stage of the study.

The blocks of land were critically assessed to remove disparate blocks, or small irregular blocks far from the main blocks of identified land. The final areas assessed per dam were as shown in Table 3-2.

Table 3-2: High Potential Agricultural Land: Three Screened Dam Sites

Dam Site	High Potential Area (ha)
Ntabelanga	840
Somabadi	1 327
Thabeng	1 621

3.1.3 Summary Phase 1 Irrigation Potential

Although soil types are a key element of irrigation potential, other important factors also require consideration, in particular climate and topography. Overall, the land areas sampled and observed for each dam site were classified according to an eight class scale as shown below:

- Class I: very high potential
- Class II: high potential
- Class III: good potential
- Class IV: moderate potential
- Class V: wetland
- Class VI: very restricted potential
- Class VII: low potential
- Class VIII: very low potential

Classes I to IV are generally considered suitable for irrigation, while Classes V to VIII are generally considered unsuitable. As shown in Table 3-3, no Class I and II soils were found.

Table 3-3: Breakdown of Soil Classes per Dam Site

	Extent (ha)	Irrigation Class III (ha)	Irrigation Class III to IV (ha)	Irrigation Class V (wetland) (ha)	Irrigation Class VII (ha)	Irrigation Capability and Recommendation	Limitations to irrigation within Classes III and IV
Ntabelenga	840	504	-	336	-	504 hectares are recommended for irrigation, having good potential. Remainder is wetland and is unsuited to irrigation.	Some shallow soils
Somabadi	1327	-	1062	-	265	1062 hectares are recommended for irrigation, having good to moderate potential. Rest is unsuited duplex soil, outcrops and dongas.	Low Mean Annual Temperature. Some shallow soils
Thabeng	1621	-	1062	-	559	1062 hectares are recommended for irrigation, having good to moderate potential. Rest is unsuited duplex soil, outcrops and dongas.	Low Mean Annual Temperature . Some shallow soils

Phase 1 of the study concluded with the selection of Ntabelanga as the preferred dam site, considering all of the criteria being evaluated, which included technical, economic, environmental, potable water supply and irrigation considerations.

3.2 Phase 2: Detailed Investigation

In Phase 2 of the study, following a decision to maximise the potentially irrigable agricultural land in the area around Ntabelanga Dam, the two economic criteria of elevation less than 60 m above the river at the dam site or in the river below the dam site, and distance less than 5 km from the dam wall or either side of the river below the dam site, were removed from the criteria.

This resulted in more agricultural land being included for consideration without being constrained by economic factors to early, and this was deemed important in order to maximize the potential for economic development and social upliftment in the study area.

The land identified around Ntabelanga Dam now met the following criteria:

- high irrigation potential soils,
- slope < 12%, and
- water deficit – medium to high water stress (shortage of natural rainfall).

A total area of over 8 000 ha was identified, the largest increase in area coming from the land in and around the town of Tsolo, approximately 20 km due south-east of the proposed dam wall. This land was reviewed for existing land use, particularly existing settlements constructed on the land, and the specific areas to be investigated were thus trimmed down to 7 708 ha of land potentially available for irrigated agriculture.

3.2.1 Phase 2 Field Review

As in Phase 1, it was necessary to visit the 7 708 ha, to review the soils on site, to physically assess the identified lands from an agricultural perspective, and to correlate physical observations on the ground with the desktop mapping carried out in the GIS.

The resulting more detailed soils assessment was carried out over 17 days and resulted in:

- 249 augered soil samples and observations,
- 12 modal soil profiles, and
- laboratory analyses of various soil parameters, including salinity and sodicity.

See Appendix A of the Irrigation Development Report No. P WMA 12/T30/00/5212/9.

3.2.2 Phase 2 Results

In summary, the soils were classified as shown in Table 3-4.

Table 3-4: Irrigable Soils Suitability: Ntabelanga

Irrigability Class	Irrigability Class Description	Extent (ha)	Extent (%)
I	Very high potential	255	3
II	High potential	2 796	36
III	Good potential	624	8
IV	Moderate potential	2 131	28
V	Wetland	1 906	25

Thus, the findings were as follows:

- irrigation classes I, II and III are recommended for irrigation, and this totalled 3 675 ha or 47% of the study area;
- irrigation class IV is not normally recommended for irrigation, whilst irrigation classes V to VIII are totally unsuited to irrigation. These sites total 4 033 ha or 53% of the study areas, and
- limitations to irrigation in classes IV and V are either slope gradients more than 12%, shallow soils, duplex soils, sodic soils or soils with rocky outcrops.

Based on this assessment to determine the irrigation capability of soils for agriculture in the Ntabalenga area, a general recommendation and conclusion of the irrigation capability of soils and sites was made as follows:

- Soil bodies recommended for irrigation
  - 3 675 ha or 47% of the study area
  - Oxidic soils of the Hutton, Griffin, Clovelly and Inanda forms
  - These soils are generally located on midslope and some crest terrain units.
- Soil bodies not recommended for irrigation
  - 4 037 ha or 53% of the study area
  - Duplex, hydromorphic and lithic soils of the Swartland, Estcourt, Klapmuts, Katspruit, Westleigh, Glenrosa and Mispah soil forms
  - Generally located on footslopes, valley bottom and some crest terrain units.

Whilst class IV irrigability soils are not recommended at this feasibility study stage, further, more detailed investigations should be undertaken at the implementation stage, which might identify that some of these soils could also be suitable for irrigated agriculture.

The land generally rises towards the north, south and west of the dam and the issue of economic viability was again raised, as some of the identified lands were in excess of 300 m static lift above the proposed dam. These areas were excluded on the basis that no economically feasible irrigation farming would be possible on these lands considering the vertical pumping lift required to get the water to these lands and consequent high costs.

The final step in the process was a critical review of the remaining areas of identified high potential soils. In some cases, patterns or trends that had been established in the field could be used to further interpret and calibrate the soil polygons on the GIS.

A particular example is that the poorer soils not recommended for irrigation were generally found in the valley bottoms and in the drainage lines. The upslope portions, and areas without obvious drainage problems are generally good for irrigated farming, provided they contain a good soils form. A final interrogation of the identified good soils polygons from the field verification exercise, allowed some truncated polygons to be reasonably extended according to the principles above.

Thus, the final estimate of potentially irrigable land that could be supplied with water from the Ntabelanga dam was established as 2 868 ha, of which 2 451 ha is located in the areas adjacent to Tsolo, and the remaining 417 ha are located on the north shore of the future impoundment basin of the Ntabelanga Dam, and close to the Tsitsa River channel downstream and close to the Ntabelanga Dam itself.

The locations of these areas of higher agricultural potential land are shown in Figure 3-1.

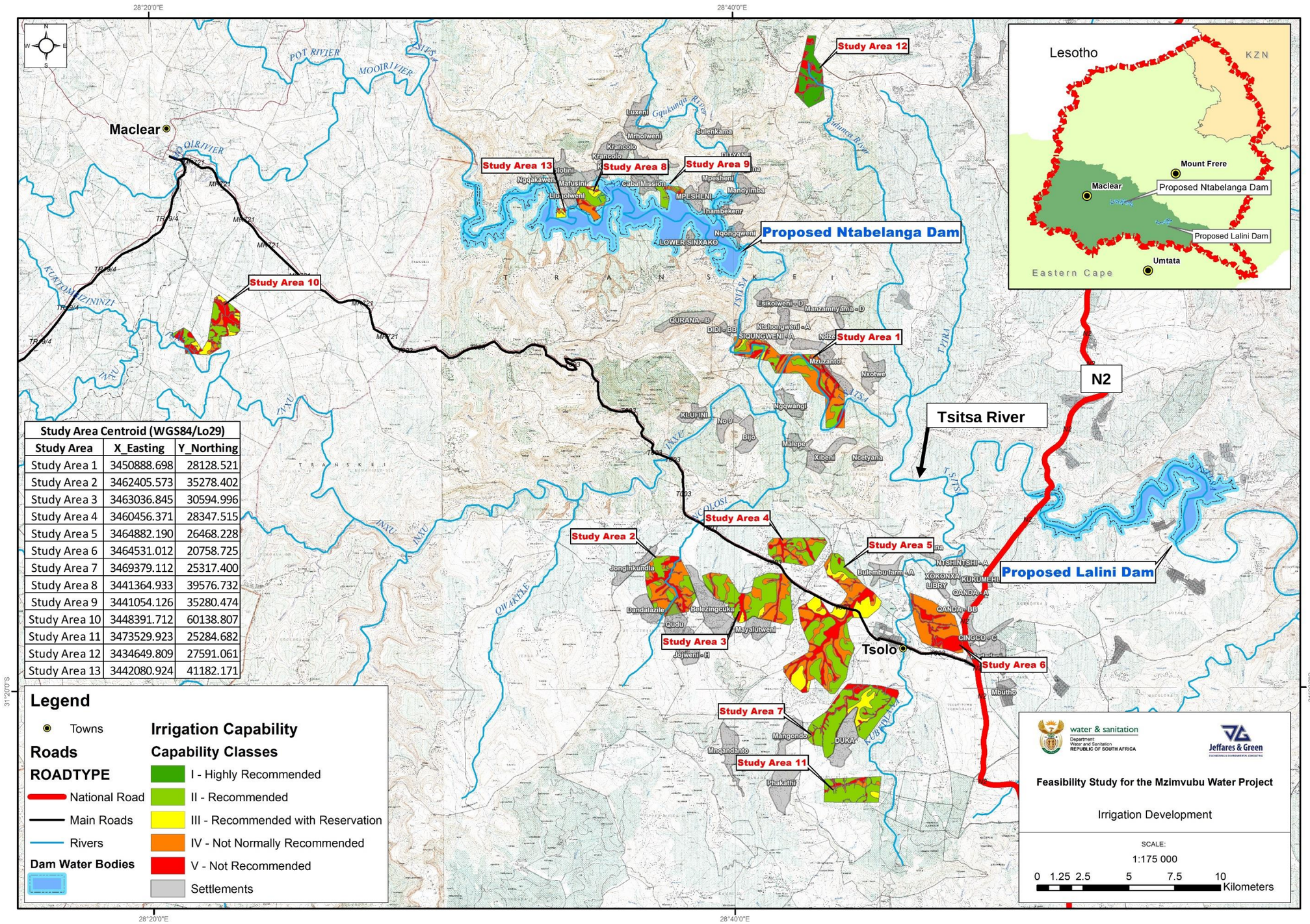

Figure 3-1: Locations of Higher Potential Agricultural Land

Two remote "outlier" areas 10 and 12 were noted.

Area 10 is far from the proposed raw water source and has a low proportion of the higher soil classes.

Area 12 has a significant area of high class soils but is at a straight line distance of 12 km, and at an elevation some 440 m above the raw water pumping station. The terrain between the pump station and area 12 is particularly mountainous and highly problematical for pipeline construction. An intermediate booster pumping station would also be required. This area is not consider viable with regard to being supplied with water from the Ntabelanga Dam.

3.3 Irrigation Water Requirements

3.3.1 Climate

The ultimate determination of annual water use for the irrigation of this land first requires the selection of suitable crops for the prevailing climate, and finally the determination of a monthly irrigation regimes, taking into account the rainfall and evapotranspiration of the area.

There is no reliable, long-term recorded climate data available for the study area, hence the climate data presented in Table 3-5 is modelled data[1].

About 89% of the study area is located in the Tsolo vicinity, and hence climate data is presented for this location.

Tsolo receives 780 mm mean annual precipitation (MAP) and has a mean annual temperature (MAT) of 16°C. The mean annual evaporation (A pan) is high at 1 659 mm. Frost occurs in winter. Snow cannot be ruled out on high-lying ground.

The climate dictates that crops tolerant of cool conditions and frost be established. The somewhat low MAT suggests that crop growth will be retarded to some extent due to low heat units and that subsequent crop yields will be somewhat restricted.

Irrigation will supplement soil moisture deficits during the dry winter months and will provide a significant yield increase compared to current rain-fed agricultural practice.

3.3.2 Suitable Crops and Expected Yields

Based on the climate data presented (particularly mean annual temperature and frost occurrence), soil types and soil properties, and assuming a medium level of irrigation management input, a variety of possible crops recommended for irrigation in the Tsolo area are presented in Table 3-6.

3.3.3 Water Requirement Estimation

Estimating the irrigation water use of a potential farm in the Tsolo area depends on a number of factors, including what crop is planted to what area, expected rainfall, planting and harvesting dates, whether crops are perennial or seasonal, whether double cropping occurs for seasonal crops, and management factors.

These factors make it impractical to predict the multitude of crop types, areas and planting combinations that might occur in practice.

[1] *Schulze, R.E. 2007. Preface and Executive Summary. In: Schulze, R.E. (Ed). 2007. South African Atlas of Climatology and Agrohydrology. Water Research Commission, Pretoria, RSA, WRC Report 1489/1/06, Section 1.1.*

Table 3-5: Climate of the Tsolo Area

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual Mean
Mean monthly rainfall (mm)	129	108	108	46	18	5	8	14	36	69	105	101	**780**
Mean daily maximum temperature (°C)	26	26	25	22	21	18	18	20	21	22	23	25	**22**
Mean daily minimum temperature (°C)	14	14	13	10	7	4	4	5	8	10	11	13	**9**
Mean daily temperature (°C)	20	20	19	16	14	11	11	13	15	16	17	10	**16**
Mean Evapotranspiration (mm)	184	149	149	111	102	89	98	126	138	158	164	191	**1 659**
Humidity (%)	69	69	68	65	62	62	60	60	63	67	68	68	**65**

Table 3-6: Suitable Crops and Expected Yields

Crop	Uses	Suitability	Expected Yield
Cabbage	Food	Moderate	50 tons/ha
Carrot	Food	High	30 tons/ha
Green Bean	Food	High	8 tons/ha
Italian Ryegrass	Nutritious grazing	High	10 tons/ha
Lettuce	Food	Moderate	20 tons/ha
Lucerne	Fodder crop	Moderate	18 tons/ha
Lupin	Forage	High	3 tons/ha
Maize	Grain	Moderate	8 tons/ha
Oats	Winter grazing or green feed	High	7 tons/ha
Onion	Food	High	25 tons/ha
Potato	Food	High	30 tons/ha
Soya bean	Food, oil seed, animal feed	Moderate	3 tons/ha
Spinach	Food	High	20 tons/ha
Tomato	Food	Moderate	35 tons/ha

However, a theoretical maximum water use per hectare can be determined by studying the water demand of a reference crop. This is a crop with a crop factor of 1 all year round, and assumes that irrigation is supplied where evapotranspiration (ETo) > rainfall, i.e. irrigation is calculated as the difference between evapotranspiration and expected rainfall for a crop with a crop factor of 1 in all months.

This has been modelled in the SAPWAT model, and the results are presented in Table 3-7.

While this is a theoretical water demand based on a reference crop it is useful in that it provides an upper limit of irrigation requirement, irrespective of the crop mix, or areas under crops that will be grown. Any crop mix should require less than this in practice.

Table 3-7: Irrigation Water Demand: Reference Crop

Water use (mm @ 80% assurance of supply)												Water use	Water use
Jan	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**(m^3/ha/a)**	**(mm/a)**
96	84	74	75	82	80	91	116	118	110	97	118	**11 410**	**1 141**

Another approach taken was to develop the water requirements for a feasible crop mix that might be grown on a 60 ha farming unit, as is presented in Table 3-8.

Table 3-8: Feasible Crop Mix: 60 ha Farm Unit

Cropped area (ha)	Crop 1	Crop 2	Water use (mm @ 80% assurance of supply)												Water use
			Jan	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**(m^3/a)**
1	Green beans											43	42	81	**1 660**
		Carrot		81	69	54	60								**2 640**
1	Lettuce										87	68	92	87	**3 340**
		Lettuce	92	64	75	65									**2 960**
2	Potatoes		109	0								37	56	164	**7 320**
		Cabbage			81	41	60	82	36						**6 000**
10	Lucerne		92	74	45	18	18	41	21	36	73	96	91	114	**71 900**
5	Oats						41	21	40	81	111	127	29		**22 500**
1	Spinach		112	96								84	67	128	**4 870**
		Onion			136	68	80	62	60	40	91				**5 370**
4	Soybean		148	113	69								181	76	**23 480**
5	Ryegrass							182	41	80	164	187	49		**35 150**
1	Tomatoes		118	101	64							73	48	100	**5 040**
30	Maize		166	89	44							125	29	145	**179 400**
Total = 60														**Total**	**371 630**

This would provide for a mixed enterprise, economically viable irrigated farm with a manageable mix of row crops, vegetable cash crops, and pasture/forage crops suitable for livestock farming.

The above total estimate consumption per year is equivalent to an average of 619 mm/year of irrigation. The above two methods thus give a range of irrigation from 619 to 1 141 mm/year.

As the occurrence frequency of such "maximum" and "likely" irrigation requirements cannot be predicted with any degree of certainty, a figure of an average of this range was used to determine the likely average annual irrigation water demand upon the Ntabelanga Dam, which, including allowance for wastage and losses) amounted to some 880 mm/year of irrigation applied over the total areas to be irrigated.

For the purposes of determining the average raw water requirements on the Ntabelanga Dam for irrigation purposes, the average application rate of 880 mm/a was applied to the above irrigable areas, which after allowing 10% for losses, gave an annual irrigation raw water requirement of **27.8 million m³/annum**.

3.4 Ntabelanga Water Requirements Summary

Taking the two consumptive water requirement components described above, Table 3-9 summarizes the total water requirements from the Ntabelanga Dam before other considerations are included.

Table 3-9: Summary of Raw Water Demand

Treated Bulk Water Supply Requirements				
Bulk Supply Service Reservoir	**Population Served**	**Average**	**Conveyance**	**Total Required**
	Year 2050	**litres/capita/day**	**Losses**	**m³/day**
Sidwadweni Nduku Reservoir	90 545	60	10%	5 976
Reservoir B	186 794	125	10%	25 684
Reservoir C (Mount Frere)	33 589	125	10%	4 619
Reservoir D	55 549	99	10%	7 638
Reservoir E (Joe Gqabi DM)	40 445	125	10%	5 561
Cullunca Command Reservoir	94 553	125	10%	13 001
Mvumelwano Scheme	84 935	125	10%	11 679
Nduku Reservoir in Nyandeni LM	140 207	60	10%	10 438
Totals:	***726 616***			***84 596***
	add treatment losses		*5%*	*4 230*
Total Raw Water Required at Source for Potable Use (m³/day)				**88 825**
Total Raw Water Required at Source for Potable Use (million m³/a)				**32.4**
Irrigation Water Supply Requirements				
Estimated high potential irrigable land availability			ha	2 868
Average application rate per hectare			mm/a	880
Allowance for losses			%	10
Total Raw Water Required at Source for Irrigation (million m³/a)				**27.8**
Grand Total Raw Water Requirement at Ntabelanga Dam (million m³/a)				**60.2**

NB: for hydropower modelling scenario, this has been rounded to 60 million m³/yr.

4. HYDROPOWER WATER REQUIREMENTS

An assessment of the potential for hydropower generation was undertaken, based on the water resources investigations undertaken during this Feasibility Study, and as presented in the Water Resources Report No. P WMA 12/T30/00/5212/5, in the Lalini Dam: Hydropower Analysis Report No. P WMA 12/T30/00/5212/18, and also in the Feasibility Design: Lalini Dam and Hydropower Scheme Report No. P WMA 12/T30/00/5212/19.

4.1 Hydropower Analysis

The primary focus for this aspect of the study was a conjunctive use hydropower scheme that includes the Lalini Dam downstream of the proposed Ntabelanga Dam. This arrangement is shown on Figure 4-1.

The Lalini Dam, its tunnel and hydroelectric plant (HEP) would be used solely for hydropower generation and, if shown to be viable, would improve the economics of the scheme as a whole if the revenue earned from the energy produced can be utilised to cross-subsidize the power costs of the water supply and irrigation schemes, as well as potentially producing surplus income to cross-subsidise other scheme operating and maintenance costs. This might also produce sufficient revenue surplus (i.e. over and above that used to subsidize Ntabelanga power costs) to either allow for capital redemption, or to fund future capital works development in the region. This is discussed in detail in the Cost Estimates and Economic Analysis Report No. P WMA 12/T30/00/5212/15.

The proposed infrastructure configuration to generate hydropower is a balancing storage and flow diversion facility at the identified Lalini dam site (some 3.5 km above the Tsitsa Falls along the river centreline) and the development of a 7.9 km long pipeline conduit and tunnel to convey diverted river flow through an elevation drop of approximately 300 m to a hydroelectric generation plant (HEP) and back into the Tsitsa River in the gorge some 14 km downstream of the Tsitsa Falls.

A hydropower analysis was therefore undertaken to assess the output potential of the Lalini Dam hydropower scheme when used conjunctively with the Ntabelanga Dam. This analysis used the detailed hydrology developed for the catchment and the naturalised and historical flow series that was developed therefrom.

In order to facilitate this analysis detailed investigations were undertaken of the Lalini Dam components of the scheme, inter alia:

- LiDAR topographical survey and positioning of the proposed Lalini Dam,
- geotechnical investigations of the dam site, sources of construction materials, and tunnel alignments,
- detailed elevation-head-efficiency relationship for the hydropower plant and configuration proposed at the Lalini Dam, and
- hydropower modelling simulation of the Lalini hydropower plant and two mini-hydropower plants at Ntabelanga and Lalini dams for the conjunctive scheme.

A reserve determination needed to be completed for the Lalini Dam and hydropower plant sites as the hydropower releases may have a significant impact upon the riverine ecology downstream of the proposed dam site and hydropower tunnel exit point. This was undertaken as a part of the independent EIA contract and results are given in that suite of reports. This included the undertaking of a rapid determination of the EWR of the Tsitsa River downstream of the Tsitsa Falls, which indicated an ecological class of B/C. This EWR value and its recommended rules of operation were included into a new hydropower simulation model to improve the accuracy of the estimation the potential hydropower outputs of the scheme.

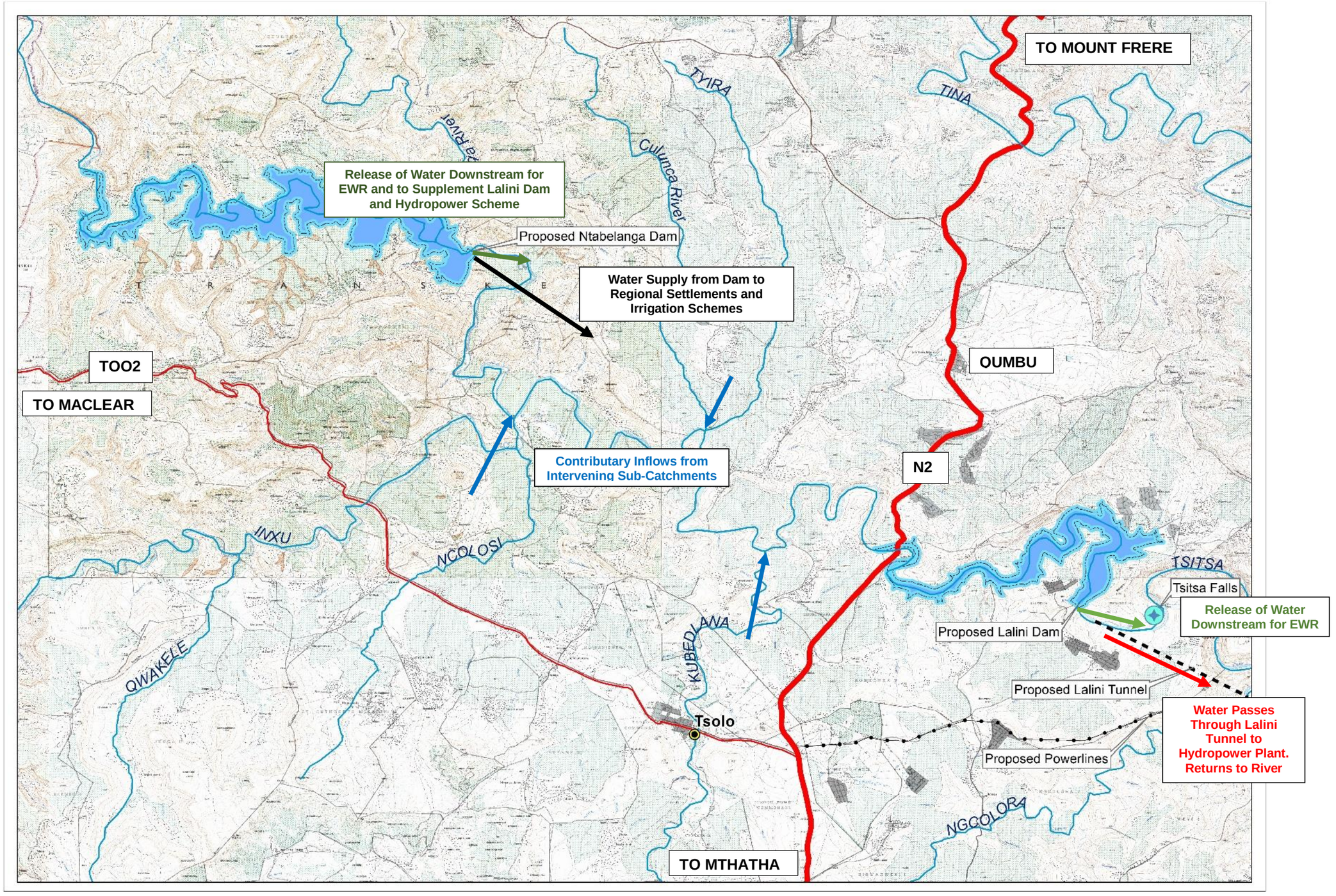

Figure 4-1: Conjunctive Hydropower Scheme

The process and results of the detailed hydropower potential assessment and the feasibility design of the Lalini Dam and its hydropower scheme are described in Report Nos. P WMA 12/T30/00/5212/18 and 19.

4.2 Hydropower Generation Results

The hydropower assessment of the conjunctive use of the Ntabelanga and Lalini Dams on the Tsitsa River system, was undertaken using detailed hydrology produced in the earlier analyses stage of this feasibility study, as well as new and highly accurate topographical survey data for the Lalini dam basin.

The analysis was undertaken using the previously recommended Ntabelanga Dam capacity of 489.7 million m^3, or 1.18 MAR_{PD} (Mean Annual Runoff under Present Day conditions), and for a range of Lalini Dam capacities from 0.10 MAR_{PD} to 0.75 MAR_{PD}.

The optimum Lalini Dam size selection was based on several factors, such as the cost benefits, as well as social and environmental impacts.

The main objective of the hydropower generation assessment was to determine the average amount of energy that can be produced per year from each dam capacity option assuming that the environmental, domestic and agricultural water requirements are met first.

Three HEPs were modelled:

1. a 5 MW installed capacity mini-HEP just downstream of the Ntabelanga Dam;
2. a 5 MW installed capacity mini-HEP just downstream of the Lalini Dam, and
3. the main HEP at Lalini located in gorge in location shown in Figure 4-1.

The two mini-HEPs would make use of the water released downstream to meet the EWR, and the head of water available in each dam. This means that they could generate between 0.75 and 5 MW each, depending on the head and flow available at the time.

Two base case options were investigated for the main Lalini HEP, namely:

i) installed capacity 50 MW, and
ii) installed capacity 37.5 MW

The results from the hydropower modelling analyses for the recommended Ntabelanga Dam capacity and the range of Lalini Dam storage volumes given above are presented in Figures 4-2 and 4-3, and Tables 4-1 and 4-2.

The energy figures thus produced were incorporated into the economic and financial models undertaken to determine the best conjunctive use solution.

These analyses are described in the Feasibility Design of the Lalini Dam and Hydropower Scheme Report No. P WMA 12/T30/00/5212/19, and in the Cost Estimates and Economic Analysis Report No. P WMA 12/T30/00/5212/15

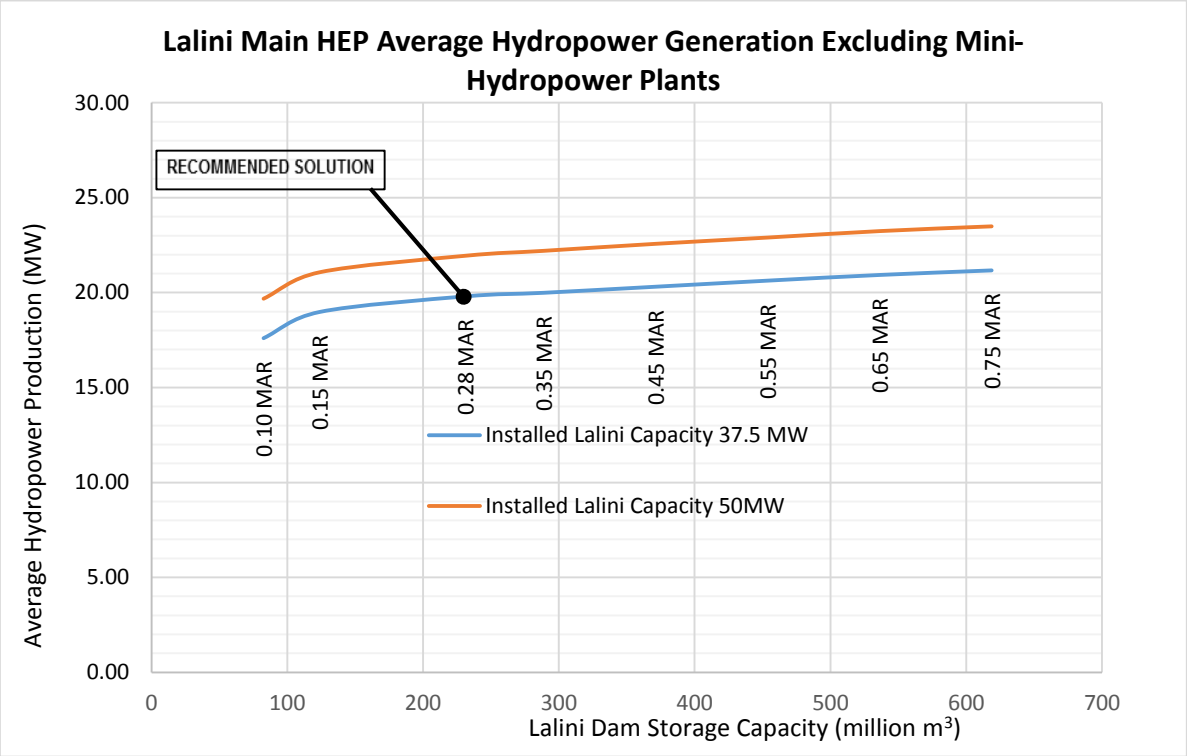

Figure 4-2: Hydropower Output: Lalini Main HEP

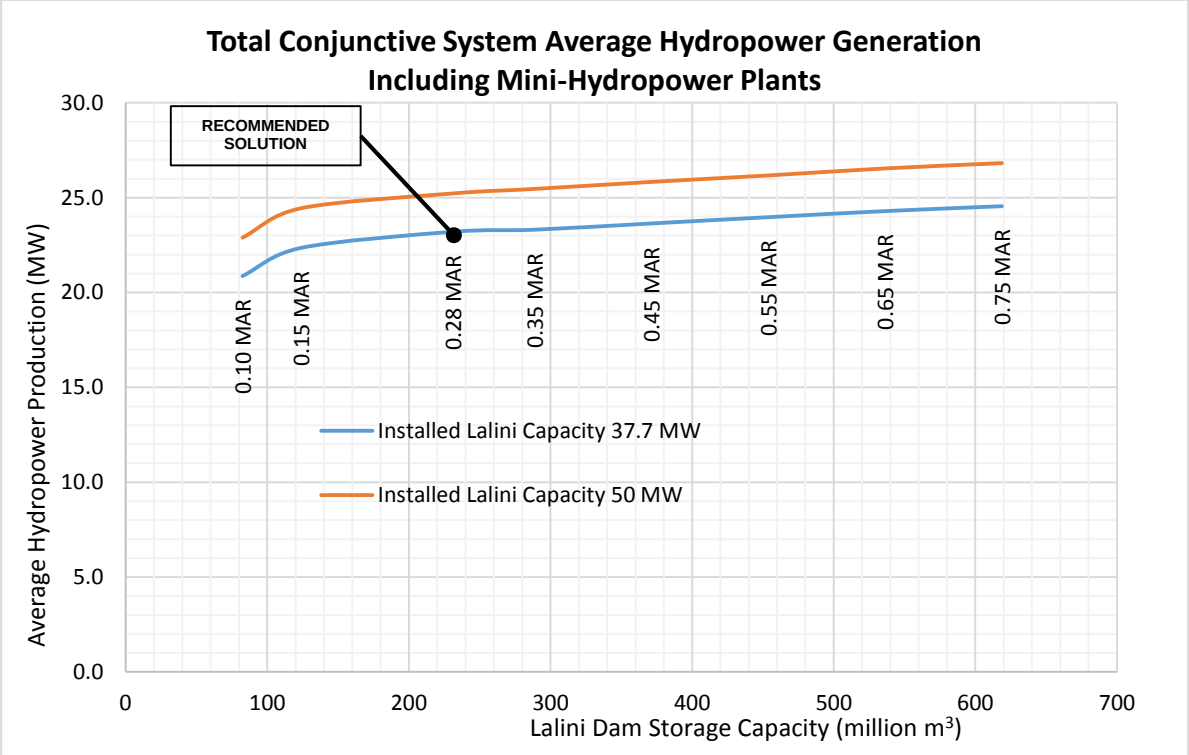

Figure 4-3: Hydropower Output: Including Mini-HEPs

Note: Recommended solution would produce an average of 23.17 MW.

Table 4-1: Hydropower Generation Results: 37.5 MW Installed

Scenario		Lalini Dam Statistics					Lalini Dam EWR			Ntabelanga Mini-HEP Maximum Installed Capacity	Ntabelanga Mini-HEP Ave. Annual Power Output	Lalini Main HEP Installed Capacity	Lalini Main HEP Ave. Annual Power Output	Lalini Mini-HEP Maximum Installed Capacity	Lalini Mini-HEP Ave. Annual Power Output
No.	Description	FSL	MOL	Gross storage capacity	Live storage capacity	*Area	Class	Requirements		HydroPower	HydroPower	HydroPower	HydroPower	HydroPower	HydroPower
		m.a.s.l	m.a.s.l	million m^3	million m^3	km^2		million m^3/a	% MAR	MW	MW	MW	MW	MW	MW
01	1.18 MAR Ntabelanga + 0.10 MAR Lalini	751.8	745.2	82.5	40.3	7.61	BC	287.1	33.05	5	1.67	37.5	17.60	5	1.60
02	1.18 MAR Ntabelanga + 0.15 MAR Lalini	756.5	745.2	123.8	81.6	9.85	BC	287.1	33.05	5	1.66	37.5	18.98	5	1.71
03	**1.18 MAR Ntabelanga + 0.28 MAR Lalini**	**765.5**	**745.2**	**231.0**	**188.8**	**14.02**	**BC**	**287.1**	**33.05**	**5**	**1.57**	**37.5**	**19.77**	**5**	**1.83**
04	1.18 MAR Ntabelanga + 0.35 MAR Lalini	769.4	745.2	288.8	246.6	15.80	BC	287.1	33.05	5	1.45	37.5	19.99	5	1.87
05	1.18 MAR Ntabelanga + 0.45MAR Lalini	774.2	745.2	371.3	329.1	18.18	BC	287.1	33.05	5	1.40	37.5	20.31	5	1.93
06	1.18 MAR Ntabelanga + 0.55 MAR Lalini	778.4	745.2	453.8	411.6	20.67	BC	287.1	33.05	5	1.35	37.5	20.63	5	1.99
07	1.18 MAR Ntabelanga + 0.65 MAR Lalini	782.3	745.2	536.3	494.1	22.65	BC	287.1	33.05	5	1.31	37.5	20.93	5	2.05
08	1.18 MAR Ntabelanga + 0.75 MAR Lalini	785.8	745.2	618.75	576.56	24.5	BC	287.1	33.05	5	1.28	37.5	21.17	5	2.10

** Surface area at Full Supply Level*

Recommended Scheme

Table 4-2: Hydropower Generation Results: 50 MW Installed

Scenario		Lalini Dam Statistics					Lalini Dam EWR			Ntabelanga Mini-HEP Maximum Installed Capacity	Ntabelanga Mini-HEP Ave. Annual Power Output	Lalini Main HEP Installed Capacity	Lalini Main HEP Ave. Annual Power Output	Lalini Mini-HEP Maximum Installed Capacity	Lalini Mini-HEP Ave. Annual Power Output
No.	Description	FSL	MOL	Gross storage capacity	Live storage capacity	*Area	Class	Requirements		HydroPower	HydroPower	HydroPower	HydroPower	HydroPower	HydroPower
		m.a.s.l	m.a.s.l	million m^3	million m^3	km^2		million m^3/a	% MAR	MW	MW	MW	MW	MW	MW
01	1.18 MAR Ntabelanga + 0.10 MAR Lalini	751.8	745.2	82.5	40.3	7.61	BC	287.1	33.05	5	1.65	50	19.68	5	1.56
02	1.18 MAR Ntabelanga + 0.15 MAR Lalini	756.5	745.2	123.8	81.6	9.85	BC	287.1	33.05	5	1.71	50	21.07	5	1.66
03	1.18 MAR Ntabelanga + 0.28 MAR Lalini	765.5	745.2	231.0	188.8	14.02	BC	287.1	33.05	5	1.54	50	21.94	5	1.74
04	1.18 MAR Ntabelanga + 0.35 MAR Lalini	769.4	745.2	288.8	246.6	15.80	BC	287.1	33.05	5	1.47	50	22.20	5	1.79
05	1.18 MAR Ntabelanga + 0.45MAR Lalini	774.2	745.2	371.3	329.1	18.18	BC	287.1	33.05	5	1.41	50	22.57	5	1.85
06	1.18 MAR Ntabelanga + 0.55 MAR Lalini	778.4	745.2	453.8	411.6	20.67	BC	287.1	33.05	5	1.37	50	22.90	5	1.90
07	1.18 MAR Ntabelanga + 0.65 MAR Lalini	782.3	745.2	536.3	494.1	22.65	BC	287.1	33.05	5	1.35	50	23.24	5	1.95
08	1.18 MAR Ntabelanga + 0.75 MAR Lalini	785.8	745.2	618.75	576.56	24.5	BC	287.1	33.05	5	1.34	50	23.49	5	1.99

** Surface area at Full Supply Level*

4.3 Overall Water Requirements

The current and future water requirements for domestic water users and irrigation potential (i.e. some 60 million m^3/a) can be met in all of the hydropower scenarios presented. The above analysis also made allowances for the continuous maintenance of the recommended EWR release for the river reaches below both these dams

Given that Lalini Dam is currently solely to be used for hydropower and is purely a storage balancing component, it is not normal to use the terminology of "yield" other than in terms of an energy yield.

From the hydropower model with the recommended 37.5 MW installed capacity, the following hydropower water requirements resulted:

- an average of 297.3 million m^3/a would be required to be released from the dam as EWR, and
- an average of 291.2 million m^3/a would be passed through the main hydropower plant conduit, through the plant, and then returned back to the river downstream of the Tsitsa Falls.

The remaining unused inflow is either stored in the dam or passes over the spillway as spills.

Table 4-3 summarizes the average annual water allocations and balance of usage of the MAR_{PD} for the two dams when used conjunctively.

Table 4-3: Average Water Balance at Each Dam

Reconciliation of Average Annual Water Usage at each Dam by 2050 (million m^3/a)							
	MAR_{PD}	***Potable Water***	***Irrigation***	***EWR***	***Mini Hydropower***	***Main Hydropower***	***Spills or Other D/S Release***
Ntabelanga Dam	*415*	*32*	*28*	*87*	*uses EWR release*	*none*	*268*
*Lalini Dam**	*828*	*-*	*-*	*297*	*uses EWR release*	*291*	*240*

**NB: There is no net abstraction from the river by the Lalini Dam as the water used for hydropower is returned to the river at the main HEP*

4.4 Recommendations

The outcome of the investigations indicated that hydropower generation potential at the Lalini Dam, with Ntabelanga Dam acting as a regulating dam for the production of hydropower at Lalini, is potentially cost-beneficial in such a multi-purpose scheme.

The analysis undertaken produced results which showed that the simulated base load (average) hydropower generation from the Lalini Dam ranged from 12.5 MW to 50 MW, depending on the status of the river in terms of season, drought or flood conditions, and the combination of storage capacity options for the Ntabelanga and Lalini Dams. Given the physical dam capacity constraints which are limited by topography, environmental and social impacts, the preferred installed capacity solution at the main Lalini HEP was determined to be some 37.5 MW.

For the recommended conjunctive scheme, where this maximum capacity Ntabelanga Dam was analysed, hydropower generation of an average of 1.57 MW and 1.83 MW is also possible at the Ntabelanga Dam and at Lalini Dam.

The instantaneous maximum output of the Ntabelanga and Lalini conjunctive scheme hydropower plants would be 47.5 MW, and the average annual output on a base load operational regime (24/7) would be 23.17 MW, or 203 million kWh/annum.

The optimum solution was shown to be one where the Ntabelanga Dam was constructed to a maximum capacity of 1.18 MAR_{PD}, as constrained by topographical limitations, with the Lalini Dam capacity set at 0.28 MAR_{PD}.

Should there be a need to later effect a change of usage of the Lalini Dam to include water supply as well as hydropower generation, then this would reduce the amount of energy that could be produce by this scheme. In such a case, the effects of such change of usage would need to be verified through the running of a modified WRYM model.

Similarly, the recommended storage capacity of the Ntabelanga Dam assumes that the projected potable and irrigation water requirements are eventually realized. Further detailed studies and consultation processes are recommended as regards determination of the extent of the potable water supply to actually be developed, and to determine whether the proposed irrigation schemes can be viably implemented.

Should the results of such detailed studies significantly reduce the future water requirements, then a decision could be made regarding the final capacity of the Ntabelanga Dam to be implemented. This emphasizes the importance of completing these further studies and consultations before the completion of the detailed design and commencement of construction of the Ntabelanga Dam.

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APPENDIX A

LIST OF SETTLEMENTS TO BE SUPPLIED BY THE SCHEME

Settlement Name	Type	Classification	DM	LM	WSA	Pop 2013	Pop 2020	Pop 2030	Pop 2040	Pop 2050
Mvumelwano - B	Rural	Rural Scattered	Alfred Nzo	Umzimvubu	Alfred Nzo	513	550	607	671	741
Liberton Farm	Rural	Rural Scattered	Joe Gqabi	Elundini	Joe Gqabi	32	34	37	41	46
Josefu	Rural	Rural Scattered	Joe Gqabi	Elundini	Joe Gqabi	326	349	386	426	471
Maqwanguleni	Rural	Rural Scattered	Joe Gqabi	Elundini	Joe Gqabi	315	338	373	412	456
Ngxothwana	Rural	Rural Scattered	Joe Gqabi	Elundini	Joe Gqabi	420	451	498	550	608
Mtshezi - A	Rural	Rural - Small Village <= 5000	Joe Gqabi	Elundini	Joe Gqabi	1 072	1 149	1 270	1 402	1 549
Sithana	Rural	Rural - Small Village <= 5000	Joe Gqabi	Elundini	Joe Gqabi	1 431	1 535	1 695	1 873	2 069
Mountain - A	Rural	Rural - Small Village <= 5000	Joe Gqabi	Elundini	Joe Gqabi	1 209	1 296	1 431	1 581	1 747
Mqokolweni - B	Rural	Rural - Small Village <= 5000	Joe Gqabi	Elundini	Joe Gqabi	1 062	1 138	1 257	1 389	1 534
Lower Sinxako	Rural	Rural - Small Village <= 5000	Joe Gqabi	Elundini	Joe Gqabi	1 471	1 578	1 743	1 925	2 126
Elalini	Rural	Rural - Small Village <= 5000	Joe Gqabi	Elundini	Joe Gqabi	544	584	645	712	787
Gqagala	Rural	Rural - Small Village <= 5000	Joe Gqabi	Elundini	Joe Gqabi	564	605	668	738	816
Mdeni	Rural	Rural Scattered	Joe Gqabi	Elundini	Joe Gqabi	477	512	565	624	690
Nayijele	Rural	Rural - Small Village <= 5000	Joe Gqabi	Elundini	Joe Gqabi	550	589	651	719	794
Mbidlana	Rural	Rural - Small Village <= 5000	Joe Gqabi	Elundini	Joe Gqabi	774	829	916	1 012	1 118
Gqaqala	Rural	Rural - Small Village <= 5000	Joe Gqabi	Elundini	Joe Gqabi	590	632	698	771	852
Sihlehleni	Rural	Rural Scattered	Joe Gqabi	Elundini	Joe Gqabi	133	143	158	175	193
Cicira	Rural	Rural Scattered	Joe Gqabi	Elundini	Joe Gqabi	463	497	549	606	670
Hopedale	Rural	Rural - Small Village <= 5000	Joe Gqabi	Elundini	Joe Gqabi	1 593	1 708	1 887	2 084	2 302
Sidekeni	Rural	Rural Scattered	Joe Gqabi	Elundini	Joe Gqabi	218	233	258	285	314
Ntabelanga	Rural	Rural - Small Village <= 5000	Joe Gqabi	Elundini	Joe Gqabi	1 166	1 250	1 380	1 525	1 684
Ngxoto	Rural	Rural - Small Village <= 5000	Joe Gqabi	Elundini	Joe Gqabi	672	720	795	879	971
Upper Sinxago	Rural	Rural Scattered	Joe Gqabi	Elundini	Joe Gqabi	465	498	550	608	671
Nkalweni - B	Rural	Rural Scattered	Joe Gqabi	Elundini	Joe Gqabi	357	383	423	467	516
Cicirha	Rural	Rural Scattered	Joe Gqabi	Elundini	Joe Gqabi	67	72	80	88	97
Gqaqhala - A	Rural	Rural Scattered	Joe Gqabi	Elundini	Joe Gqabi	210	225	249	275	304

Settlement Name	Type	Classification	DM	LM	WSA	Pop 2013	Pop 2020	Pop 2030	Pop 2040	Pop 2050
Gqaqhala - C	Rural	Rural Scattered	Joe Gqabi	Elundini	Joe Gqabi	368	394	436	481	532
Xolombana	Rural	Rural Scattered	Joe Gqabi	Elundini	Joe Gqabi	82	88	97	107	118
Ngxaza - C	Rural	Rural Scattered	Joe Gqabi	Elundini	Joe Gqabi	255	274	302	334	369
Kose	Rural	Rural Scattered	Joe Gqabi	Elundini	Joe Gqabi	184	197	218	241	266
Mtshezi - B	Rural	Rural - Small Village <= 5000	Joe Gqabi	Elundini	Joe Gqabi	1 072	1 149	1 270	1 402	1 549
Ntywenka - C	Rural	Rural - Small Village <= 5000	Joe Gqabi	Elundini	Joe Gqabi	1 030	1 104	1 220	1 347	1 488
Hlwatika	Rural	Rural - Small Village <= 5000	Joe Gqabi	Elundini	Joe Gqabi	631	676	747	825	911
Gugwini - C	Rural	Rural - Small Village <= 5000	Joe Gqabi	Elundini	Joe Gqabi	740	793	876	968	1 069
Ngcele - B	Rural	Rural - Small Village <= 5000	Joe Gqabi	Elundini	Joe Gqabi	788	845	934	1 031	1 139
Didi - Bb	Rural	Rural Scattered	Joe Gqabi	Elundini	Joe Gqabi	353	379	418	462	510
Siqungweni - A	Rural	Rural Scattered	Joe Gqabi	Elundini	Joe Gqabi	305	327	361	399	440
Qurana - B	Rural	Rural - Small Village <= 5000	Joe Gqabi	Elundini	Joe Gqabi	631	676	747	825	911
Govane	Rural	Rural Scattered	Joe Gqabi	Elundini	Joe Gqabi	213	229	253	279	308
Qurana - A	Rural	Rural - Small Village <= 5000	Joe Gqabi	Elundini	Joe Gqabi	631	676	747	825	911
Block A - B	Rural	Rural Scattered	Joe Gqabi	Elundini	Joe Gqabi	176	188	208	230	254
Mambulwini - A	Rural	Rural - Small Village <= 5000	Joe Gqabi	Elundini	Joe Gqabi	1 197	1 283	1 418	1 566	1 730
Siqhungqwini	Rural	Rural Scattered	Joe Gqabi	Elundini	Joe Gqabi	387	415	458	506	559
Mabheleni - F	Rural	Rural Scattered	Joe Gqabi	Elundini	Joe Gqabi	347	372	411	454	501
Mqokolweni - D	Rural	Rural - Small Village <= 5000	Joe Gqabi	Elundini	Joe Gqabi	1 062	1 138	1 257	1 389	1 534
Kolosane	Rural	Rural Scattered	Joe Gqabi	Elundini	Joe Gqabi	124	133	147	162	179
Dirhini	Rural	Rural Scattered	Joe Gqabi	Elundini	Joe Gqabi	195	210	232	256	282
Mboniswebi - B	Rural	Rural Scattered	Joe Gqabi	Elundini	Joe Gqabi	277	297	329	363	401
Luxeni - D	Rural	Rural Scattered	Joe Gqabi	Elundini	Joe Gqabi	297	319	352	389	430
Ncele	Rural	Rural Scattered	Joe Gqabi	Elundini	Joe Gqabi	114	122	134	148	164
Mewangele - B	Rural	Rural Scattered	Joe Gqabi	Elundini	Joe Gqabi	114	122	134	148	164
Mewangele - A	Rural	Rural Scattered	Joe Gqabi	Elundini	Joe Gqabi	297	319	352	389	430
Mpinkone	Rural	Rural - Small Village <= 5000	Joe Gqabi	Elundini	Joe Gqabi	533	571	631	697	770

Settlement Name	Type	Classification	DM	LM	WSA	Pop 2013	Pop 2020	Pop 2030	Pop 2040	Pop 2050
Nkamasana	Rural	Rural Scattered	Joe Gqabi	Elundini	Joe Gqabi	105	113	124	137	152
Nkanini	Rural	Rural - Small Village <= 5000	O R Tambo	Mhlontlo	O R Tambo	1 183	1 269	1 402	1 548	1 710
Mthombo	Rural	Rural - Small Village <= 5000	O R Tambo	Nyandeni	O R Tambo	962	1 031	1 139	1 258	1 390
Mhlanga	Rural	Rural - Small Village <= 5000	O R Tambo	Ngquza Hill	O R Tambo	1 130	1 211	1 338	1 478	1 633
Mnga - C	Rural	Rural Scattered	O R Tambo	Mhlontlo	O R Tambo	512	549	606	670	740
Gcaka - A	Rural	Rural Scattered	O R Tambo	Mhlontlo	O R Tambo	913	979	1 082	1 195	1 320
Malongwe	Rural	Rural Scattered	O R Tambo	Mhlontlo	O R Tambo	613	657	726	802	885
Ngxotho - A	Rural	Rural Scattered	O R Tambo	Mhlontlo	O R Tambo	840	900	995	1 099	1 214
Mnqunyana	Rural	Rural Scattered	O R Tambo	Mhlontlo	O R Tambo	501	537	594	656	724
Mpindweni - F	Rural	Rural Scattered	O R Tambo	Mhlontlo	O R Tambo	132	142	157	173	191
Ngxotho - B	Rural	Rural Scattered	O R Tambo	Mhlontlo	O R Tambo	592	634	701	774	855
Mangwaneni - CC	Rural	Rural Scattered	O R Tambo	Mhlontlo	O R Tambo	53	56	62	69	76
Gqunu	Rural	Rural Scattered	O R Tambo	Mhlontlo	O R Tambo	634	679	751	829	916
Mjikwa	Rural	Rural Scattered	O R Tambo	Mhlontlo	O R Tambo	359	385	426	470	519
Kumadukuda	Rural	Rural Scattered	O R Tambo	Mhlontlo	O R Tambo	164	176	194	214	237
Mhlangala	Rural	Rural Scattered	O R Tambo	Mhlontlo	O R Tambo	180	193	213	235	260
Mbokodwebomvu	Rural	Rural Scattered	O R Tambo	Mhlontlo	O R Tambo	280	300	331	366	404
Nyokana - A	Rural	Rural Scattered	O R Tambo	Mhlontlo	O R Tambo	644	691	763	843	931
Nkamasana	Rural	Rural Scattered	O R Tambo	Ngquza Hill	O R Tambo	68	73	81	89	99
Manxiweni - B	Rural	Rural Scattered	O R Tambo	Mhlontlo	O R Tambo	354	380	419	463	512
Ngwemnyama - A	Rural	Rural Scattered	O R Tambo	Mhlontlo	O R Tambo	433	464	513	566	626
Mpoza - I	Rural	Rural Scattered	O R Tambo	Mhlontlo	O R Tambo	211	226	250	276	305
Ngonyameni - C	Rural	Rural Scattered	O R Tambo	Mhlontlo	O R Tambo	164	176	194	214	237
Neustad - A	Rural	Rural - Small Village <= 5000	O R Tambo	Mhlontlo	O R Tambo	962	1 031	1 139	1 258	1 390
Kwekweni	Rural	Rural Scattered	O R Tambo	Mhlontlo	O R Tambo	718	770	850	939	1 037
Mbeza	Rural	Rural Scattered	O R Tambo	Mhlontlo	O R Tambo	122	131	144	159	176
Gwali	Rural	Rural Scattered	O R Tambo	Mhlontlo	O R Tambo	681	730	807	891	984

Settlement Name	Type	Classification	DM	LM	WSA	Pop 2013	Pop 2020	Pop 2030	Pop 2040	Pop 2050
Cingco	Rural	Rural - Small Village <= 5000	O R Tambo	Mhlontlo	O R Tambo	1 030	1 104	1 220	1 347	1 488
Mangcwanguleni	Rural	Rural Scattered	O R Tambo	Nyandeni	O R Tambo	1 685	1 806	1 995	2 204	2 435
Mbombo	Rural	Rural - Small Village <= 5000	O R Tambo	Mhlontlo	O R Tambo	1 119	1 200	1 326	1 464	1 618
Dumba - B	Rural	Rural Scattered	O R Tambo	Mhlontlo	O R Tambo	702	753	831	918	1 015
Dumba - B	Rural	Rural Scattered	O R Tambo	Mhlontlo	O R Tambo	295	317	350	386	427
Buhlungwana	Rural	Rural - Small Village <= 5000	O R Tambo	Mhlontlo	O R Tambo	1 907	2 044	2 258	2 494	2 755
Ngcolo	Rural	Rural Scattered	O R Tambo	Mhlontlo	O R Tambo	644	691	763	843	931
Dumba - A	Rural	Rural Scattered	O R Tambo	Mhlontlo	O R Tambo	475	509	563	621	686
Tina Falls	Rural	Rural - Small Village <= 5000	O R Tambo	Mhlontlo	O R Tambo	1 606	1 722	1 902	2 101	2 321
Mampingeni - D	Rural	Rural - Small Village <= 5000	O R Tambo	Mhlontlo	O R Tambo	1 304	1 398	1 545	1 706	1 885
Manzana - A	Rural	Rural - Small Village <= 5000	O R Tambo	Mhlontlo	O R Tambo	871	934	1 032	1 140	1 259
Gubeni - B	Rural	Rural Scattered	O R Tambo	Mhlontlo	O R Tambo	2 530	2 712	2 996	3 309	3 656
Cingco - B	Rural	Rural Scattered	O R Tambo	Mhlontlo	O R Tambo	63	68	75	82	91
Belekence	Rural	Rural - Small Village <= 5000	O R Tambo	Mhlontlo	O R Tambo	1 225	1 314	1 451	1 603	1 771
Nyandeni	Rural	Rural Scattered	O R Tambo	Mhlontlo	O R Tambo	962	1 031	1 139	1 258	1 390
Duka	Rural	Rural - Small Village <= 5000	O R Tambo	Mhlontlo	O R Tambo	2 065	2 214	2 446	2 702	2 984
Magonkone	Rural	Rural - Small Village <= 5000	O R Tambo	Mhlontlo	O R Tambo	829	889	982	1 085	1 198
Ceka	Rural	Rural Scattered	O R Tambo	Mhlontlo	O R Tambo	686	736	813	898	992
Libry	Rural	Rural Scattered	O R Tambo	Mhlontlo	O R Tambo	433	464	513	566	626
Xokonxa	Rural	Rural Scattered	O R Tambo	Mhlontlo	O R Tambo	58	62	68	76	84
Qanda - A	Rural	Rural Scattered	O R Tambo	Mhlontlo	O R Tambo	777	833	920	1 016	1 122
Ntshintshi - A	Rural	Rural Scattered	O R Tambo	Mhlontlo	O R Tambo	153	165	182	201	222
Mnqandanto - C	Rural	Rural Scattered	O R Tambo	Mhlontlo	O R Tambo	365	391	432	477	527
Phocani	Rural	Rural Scattered	O R Tambo	Mhlontlo	O R Tambo	274	294	325	359	396
Emanxiweni - B	Rural	Rural Scattered	O R Tambo	Mhlontlo	O R Tambo	127	136	151	166	184
Mncetvana	Rural	Rural Scattered	O R Tambo	Mhlontlo	O R Tambo	750	805	889	982	1 084
Mboktwana	Rural	Rural - Small Village <= 5000	O R Tambo	Mhlontlo	O R Tambo	1 225	1 314	1 451	1 603	1 771

Settlement Name	Type	Classification	DM	LM	WSA	Pop 2013	Pop 2020	Pop 2030	Pop 2040	Pop 2050
Kuhleke	Rural	Rural Scattered	O R Tambo	Mhlontlo	O R Tambo	407	436	482	532	588
Gandana	Rural	Rural - Small Village <= 5000	O R Tambo	Mhlontlo	O R Tambo	454	487	538	594	656
Mtozelo	Rural	Rural Scattered	O R Tambo	Mhlontlo	O R Tambo	243	260	288	318	351
Natal	Rural	Rural Scattered	O R Tambo	Mhlontlo	O R Tambo	295	317	350	386	427
Lower Ngcolokili	Rural	Rural Scattered	O R Tambo	Mhlontlo	O R Tambo	100	107	118	131	144
Ngqwangi	Rural	Rural - Small Village <= 5000	O R Tambo	Mhlontlo	O R Tambo	956	1 025	1 133	1 251	1 382
Gqcaka	Rural	Rural Scattered	O R Tambo	Mhlontlo	O R Tambo	665	713	788	870	961
Ngolo	Rural	Rural Scattered	O R Tambo	Nyandeni	O R Tambo	501	537	594	656	724
Dandalazile	Rural	Rural Scattered	O R Tambo	Mhlontlo	O R Tambo	681	730	807	891	984
Qudu	Rural	Rural - Small Village <= 5000	O R Tambo	Mhlontlo	O R Tambo	1 426	1 529	1 689	1 866	2 061
Mayalutweni	Rural	Rural - Small Village <= 5000	O R Tambo	Mhlontlo	O R Tambo	1 547	1 659	1 832	2 024	2 236
Jojweni - K	Rural	Rural Scattered	O R Tambo	Mhlontlo	O R Tambo	671	719	794	877	969
Jojweni - H	Rural	Rural Scattered	O R Tambo	Mhlontlo	O R Tambo	386	414	457	505	557
Bele - B	Rural	Rural Scattered	O R Tambo	Mhlontlo	O R Tambo	37	39	44	48	53
Malepe	Rural	Rural - Small Village <= 5000	O R Tambo	Mhlontlo	O R Tambo	697	747	825	912	1 007
Ntshiqo	Rural	Rural Scattered	O R Tambo	Mhlontlo	O R Tambo	301	322	356	393	434
Bijo	Rural	Rural Scattered	O R Tambo	Mhlontlo	O R Tambo	238	255	281	311	343
No 9	Rural	Rural Scattered	O R Tambo	Mhlontlo	O R Tambo	153	165	182	201	222
Goqwana - G	Rural	Rural Scattered	O R Tambo	Mhlontlo	O R Tambo	253	272	300	331	366
Kukumehlo	Rural	Rural Scattered	O R Tambo	Mhlontlo	O R Tambo	232	249	275	304	336
Qanda - Bb	Rural	Rural Scattered	O R Tambo	Mhlontlo	O R Tambo	243	260	288	318	351
Cingco - C	Rural	Rural Scattered	O R Tambo	Mhlontlo	O R Tambo	777	833	920	1 016	1 122
Nkamasana	Rural	Rural Scattered	O R Tambo	Ngquza Hill	O R Tambo	74	79	87	96	106
Nkamasana	Rural	Rural Scattered	O R Tambo	Ngquza Hill	O R Tambo	32	34	37	41	46
Nkamasana	Rural	Rural Scattered	O R Tambo	Ngquza Hill	O R Tambo	58	62	68	76	84
Nkamasana	Rural	Rural Scattered	O R Tambo	Ngquza Hill	O R Tambo	117	125	138	153	169
Nkamasana	Rural	Rural Scattered	O R Tambo	Ntabankulu	O R Tambo	37	39	44	48	53

Settlement Name	Type	Classification	DM	LM	WSA	Pop 2013	Pop 2020	Pop 2030	Pop 2040	Pop 2050
Nkamasana	Rural	Rural Scattered	O R Tambo	Ntabankulu	O R Tambo	47	51	56	62	68
Malonggwe	Rural	Rural Scattered	O R Tambo	Mhlontlo	O R Tambo	285	305	337	373	412
Mcheni	Rural	Rural Scattered	O R Tambo	Mhlontlo	O R Tambo	164	176	194	214	237
Waterfall	Rural	Rural Scattered	O R Tambo	Mhlontlo	O R Tambo	105	113	124	137	152
Emdibanisweni - B	Rural	Rural Scattered	O R Tambo	Mhlontlo	O R Tambo	26	28	31	34	38
Xibeni	Rural	Rural - Small Village <= 5000	O R Tambo	Mhlontlo	O R Tambo	845	906	1 001	1 105	1 221
Tshisani - A	Rural	Rural Scattered	O R Tambo	Mhlontlo	O R Tambo	517	554	612	676	747
Lower Tyira - A	Rural	Rural Scattered	O R Tambo	Mhlontlo	O R Tambo	375	402	444	491	542
Ndamanga	Rural	Rural - Small Village <= 5000	O R Tambo	Mhlontlo	O R Tambo	908	974	1 075	1 188	1 312
Bhayi	Rural	Rural - Small Village <= 5000	O R Tambo	Mhlontlo	O R Tambo	1 210	1 297	1 433	1 583	1 748
Mdeni - U	Rural	Rural - Small Village <= 5000	O R Tambo	Mhlontlo	O R Tambo	1 405	1 507	1 664	1 838	2 031
Mpindweni - I	Rural	Rural Scattered	O R Tambo	Nyandeni	O R Tambo	95	101	112	124	137
Egolideni	Rural	Rural Scattered	O R Tambo	Mhlontlo	O R Tambo	407	436	482	532	588
Nongenkqe	Rural	Rural Scattered	O R Tambo	Mhlontlo	O R Tambo	359	385	426	470	519
Gongo - B	Rural	Rural Scattered	O R Tambo	Mhlontlo	O R Tambo	777	833	920	1 016	1 122
Esiqikini - D	Rural	Rural Scattered	O R Tambo	Nyandeni	O R Tambo	217	232	256	283	313
Ngavungavu	Rural	Rural - Small Village <= 5000	O R Tambo	Nyandeni	O R Tambo	1 189	1 274	1 408	1 555	1 718
Phezukwamawa	Rural	Rural - Small Village <= 5000	O R Tambo	Nyandeni	O R Tambo	962	1 031	1 139	1 258	1 390
Dokodela	Rural	Rural Scattered	O R Tambo	Nyandeni	O R Tambo	576	618	682	753	832
Mhlanganisweni - B	Rural	Rural - Small Village <= 5000	O R Tambo	Nyandeni	O R Tambo	2 250	2 413	2 665	2 944	3 252
Endwe B	Rural	Rural - Small Village <= 5000	O R Tambo	Mhlontlo	O R Tambo	1 093	1 172	1 295	1 430	1 580
Gongo - A	Rural	Rural Scattered	O R Tambo	Nyandeni	O R Tambo	148	159	176	194	214
Lutubeni - A	Rural	Rural Scattered	O R Tambo	Nyandeni	O R Tambo	174	187	207	228	252
Tsolo	Rural	Rural Scattered	O R Tambo	Mhlontlo	O R Tambo	962	1 031	1 139	1 258	1 390
Nkamasana	Rural	Rural Scattered	O R Tambo	Ntabankulu	O R Tambo	132	142	157	173	191
Nkamasana	Rural	Rural Scattered	O R Tambo	Ntabankulu	O R Tambo	63	68	75	82	91
Nkamasana	Rural	Rural Scattered	O R Tambo	Ntabankulu	O R Tambo	47	51	56	62	68

Settlement Name	Type	Classification	DM	LM	WSA	Pop 2013	Pop 2020	Pop 2030	Pop 2040	Pop 2050
Ezinkumbeni	Rural	Rural - Small Village <= 5000	O R Tambo	Nyandeni	O R Tambo	1 938	2 078	2 295	2 535	2 801
Ethumbeni	Rural	Rural - Small Village <= 5000	O R Tambo	Nyandeni	O R Tambo	1 701	1 823	2 014	2 225	2 457
Mthombe	Rural	Rural - Small Village <= 5000	O R Tambo	Nyandeni	O R Tambo	782	838	926	1 023	1 130
Nkanini	Rural	Rural - Small Village <= 5000	O R Tambo	Mhlontlo	O R Tambo	517	554	612	676	747
Mhlanga	Rural	Rural - Small Village <= 5000	O R Tambo	Nyandeni	O R Tambo	1 812	1 943	2 146	2 370	2 618
Marhubeni	Rural	Rural - Small Village <= 5000	O R Tambo	Nyandeni	O R Tambo	2 086	2 237	2 471	2 729	3 015
Mmangweni	Rural	Rural - Small Village <= 5000	O R Tambo	Ntabankulu	O R Tambo	728	781	863	953	1 053
Ntibane	Rural	Rural Scattered	O R Tambo	Mhlontlo	O R Tambo	692	741	819	905	999
Bomvini	Rural	Rural Scattered	O R Tambo	Nyandeni	O R Tambo	227	243	269	297	328
Nkamasana	Rural	Rural Scattered	O R Tambo	Nyandeni	O R Tambo	63	68	75	82	91
Nkamasana	Rural	Rural Scattered	O R Tambo	Ntabankulu	O R Tambo	26	28	31	34	38
Nkamasana	Rural	Rural Scattered	O R Tambo	Mhlontlo	O R Tambo	317	340	376	415	459
Nkamasana	Rural	Rural Scattered	O R Tambo	Mhlontlo	O R Tambo	290	311	344	379	419
Gpmrbi	Rural	Rural - Small Village <= 5000	O R Tambo	Mhlontlo	O R Tambo	1 030	1 104	1 220	1 347	1 488
Lalini	Rural	Rural - Small Village <= 5000	O R Tambo	Mhlontlo	O R Tambo	956	1 025	1 133	1 251	1 382
Manka	Rural	Rural Scattered	O R Tambo	Mhlontlo	O R Tambo	454	487	538	594	656
Mandela	Rural	Rural - Small Village <= 5000	O R Tambo	Mhlontlo	O R Tambo	1 616	1 733	1 914	2 115	2 336
Mdeni	Rural	Rural Scattered	O R Tambo	Mhlontlo	O R Tambo	180	193	213	235	260
Jonginkundla	Rural	Rural Scattered	O R Tambo	Mhlontlo	O R Tambo	1 035	1 110	1 226	1 354	1 496
Kwam	Rural	Rural - Small Village <= 5000	O R Tambo	Mhlontlo	O R Tambo	1 373	1 472	1 626	1 796	1 984
Upper Lotana	Rural	Squatter Camp - Rural	O R Tambo	Mhlontlo	O R Tambo	1 495	1 602	1 770	1 955	2 160
Belezingcuka	Rural	Rural - Small Village <= 5000	O R Tambo	Mhlontlo	O R Tambo	2 921	3 131	3 459	3 821	4 221
Lower Lotina	Rural	Squatter Camp - Rural	O R Tambo	Mhlontlo	O R Tambo	929	996	1 100	1 215	1 343
Ngolo	Rural	Rural Scattered	O R Tambo	Nyandeni	O R Tambo	602	646	713	788	870
Sidani	Rural	Rural - Small Village <= 5000	O R Tambo	Mhlontlo	O R Tambo	517	554	612	676	747
Zandukweni	Rural	Rural - Small Village <= 5000	O R Tambo	Nyandeni	O R Tambo	3 623	3 884	4 291	4 739	5 235
Luthumbeni	Rural	Rural - Small Village <= 5000	O R Tambo	Nyandeni	O R Tambo	1 753	1 880	2 076	2 293	2 533

Settlement Name	Type	Classification	DM	LM	WSA	Pop 2013	Pop 2020	Pop 2030	Pop 2040	Pop 2050
Sidani	Rural	Rural - Small Village <= 5000	O R Tambo	Mhlontlo	O R Tambo	311	334	368	407	450
Mhlakulo	Rural	Rural - Small Village <= 5000	O R Tambo	Mhlontlo	O R Tambo	1 526	1 636	1 807	1 996	2 205
Gebane	Rural	Rural - Small Village <= 5000	O R Tambo	Nyandeni	O R Tambo	1 595	1 711	1 889	2 087	2 306
Magonkone	Rural	Rural Scattered	O R Tambo	Mhlontlo	O R Tambo	491	526	581	642	709
Nkamasana	Rural	Rural Scattered	O R Tambo	Mhlontlo	O R Tambo	159	170	188	208	229
Mthombo - C	Rural	Rural - Small Village <= 5000	O R Tambo	Nyandeni	O R Tambo	792	850	939	1 037	1 145
Mthombo - B	Rural	Rural - Small Village <= 5000	O R Tambo	Nyandeni	O R Tambo	650	696	769	850	939
Mlomo	Rural	Rural - Small Village <= 5000	O R Tambo	Nyandeni	O R Tambo	1 964	2 106	2 326	2 570	2 839
Ziwelitsha	Rural	Rural Scattered	O R Tambo	Mhlontlo	O R Tambo	185	198	219	242	267
Nogqadasi - B	Rural	Rural Scattered	O R Tambo	Mhlontlo	O R Tambo	132	142	157	173	191
Mnga - B	Rural	Rural Scattered	O R Tambo	Mhlontlo	O R Tambo	132	142	157	173	191
Inxu-Drift Store	Rural	Rural Scattered	O R Tambo	Mhlontlo	O R Tambo	37	39	44	48	53
Mabululu	Rural	Rural Scattered	O R Tambo	Mhlontlo	O R Tambo	164	176	194	214	237
Xeni - B	Rural	Rural Scattered	O R Tambo	Mhlontlo	O R Tambo	290	311	344	379	419
Maqakambeni	Rural	Rural Scattered	O R Tambo	Mhlontlo	O R Tambo	618	663	732	808	893
Sivivana	Rural	Rural Scattered	O R Tambo	Mhlontlo	O R Tambo	105	113	124	137	152
Upper Gunqwana	Rural	Rural Scattered	O R Tambo	Ntabankulu	O R Tambo	122	131	144	159	176
Upper Gunqwana	Rural	Rural Scattered	O R Tambo	Ngquza Hill	O R Tambo	100	107	118	131	144
Upper Gunqwana	Rural	Rural Scattered	O R Tambo	Ngquza Hill	O R Tambo	84	90	100	110	122
Upper Gunqwana	Rural	Rural Scattered	O R Tambo	Ntabankulu	O R Tambo	47	51	56	62	68
Upper Gunqwana	Rural	Rural Scattered	O R Tambo	Ntabankulu	O R Tambo	53	56	62	69	76
Upper Gunqwana	Rural	Rural Scattered	O R Tambo	Ntabankulu	O R Tambo	117	125	138	153	169
Upper Gunqwana	Rural	Rural Scattered	O R Tambo	Ntabankulu	O R Tambo	164	176	194	214	237
Upper Gunqwana	Rural	Rural Scattered	O R Tambo	Ntabankulu	O R Tambo	79	85	93	103	114
Upper Gunqwana	Rural	Rural Scattered	O R Tambo	Ntabankulu	O R Tambo	143	153	169	187	207
Komkhulu - F	Rural	Rural Scattered	O R Tambo	Mhlontlo	O R Tambo	253	272	300	331	366
Mabholomba	Rural	Rural Scattered	O R Tambo	Mhlontlo	O R Tambo	665	713	788	870	961

Settlement Name	Type	Classification	DM	LM	WSA	Pop 2013	Pop 2020	Pop 2030	Pop 2040	Pop 2050
Madwaleni - D	Rural	Rural Scattered	O R Tambo	Mhlontlo	O R Tambo	671	719	794	877	969
Nqadu - C	Rural	Rural Scattered	O R Tambo	Mhlontlo	O R Tambo	243	260	288	318	351
Nqadu - B	Rural	Rural Scattered	O R Tambo	Mhlontlo	O R Tambo	117	125	138	153	169
Ncemeni	Rural	Rural - Small Village <= 5000	O R Tambo	Mhlontlo	O R Tambo	913	979	1 082	1 195	1 320
Balasi - A	Rural	Rural - Small Village <= 5000	O R Tambo	Mhlontlo	O R Tambo	1 241	1 331	1 470	1 624	1 794
Ebelezi	Rural	Rural Scattered	O R Tambo	Mhlontlo	O R Tambo	496	532	588	649	717
Erayini	Rural	Rural Scattered	O R Tambo	Mhlontlo	O R Tambo	122	131	144	159	176
Bulembu Farm - A	Rural	Rural Scattered	O R Tambo	Mhlontlo	O R Tambo	280	300	331	366	404
Lower Tyira - C	Rural	Rural Scattered	O R Tambo	Mhlontlo	O R Tambo	501	537	594	656	724
Goqwane	Rural	Rural Scattered	O R Tambo	Mhlontlo	O R Tambo	576	618	682	753	832
Ndzebe - B	Rural	Rural Scattered	O R Tambo	Mhlontlo	O R Tambo	264	283	312	345	381
Labry	Rural	Rural Scattered	O R Tambo	Mhlontlo	O R Tambo	301	322	356	393	434
Emdibanisweni - C	Rural	Rural - Small Village <= 5000	O R Tambo	Mhlontlo	O R Tambo	819	878	970	1 071	1 183
Ezintutyaneni	Rural	Rural Scattered	O R Tambo	Mhlontlo	O R Tambo	195	210	232	256	282
Esibhalweni	Rural	Rural Scattered	O R Tambo	Mhlontlo	O R Tambo	449	481	531	587	649
Balasi - B	Rural	Rural Scattered	O R Tambo	Mhlontlo	O R Tambo	105	113	124	137	152
Diphini - B	Rural	Rural Scattered	O R Tambo	Mhlontlo	O R Tambo	264	283	312	345	381
Magoqoza	Rural	Rural Scattered	O R Tambo	Mhlontlo	O R Tambo	206	221	244	269	298
Kilili	Rural	Rural Scattered	O R Tambo	Mhlontlo	O R Tambo	507	543	600	663	732
Bulembu Farm - B	Rural	Rural Scattered	O R Tambo	Mhlontlo	O R Tambo	222	238	263	290	320
Godzi - B	Rural	Rural Scattered	O R Tambo	Mhlontlo	O R Tambo	634	679	751	829	916
Bhungeni - B	Rural	Rural - Small Village <= 5000	O R Tambo	Mhlontlo	O R Tambo	571	612	676	747	825
Madadeni	Rural	Rural Scattered	O R Tambo	Mhlontlo	O R Tambo	1 479	1 585	1 751	1 935	2 137
Mngwnvbeni	Rural	Rural Scattered	O R Tambo	Mhlontlo	O R Tambo	354	380	419	463	512
Nkamasana	Rural	Rural Scattered	O R Tambo	Mhlontlo	O R Tambo	159	170	188	208	229
Nonyikilai	Rural	Rural - Small Village <= 5000	O R Tambo	Mhlontlo	O R Tambo	1 030	1 104	1 220	1 347	1 488
Njanisweni	Rural	Rural - Small Village <= 5000	O R Tambo	Mhlontlo	O R Tambo	845	906	1 001	1 105	1 221

Settlement Name	Type	Classification	DM	LM	WSA	Pop 2013	Pop 2020	Pop 2030	Pop 2040	Pop 2050
Lwandlana - N	Rural	Rural - Small Village <= 5000	O R Tambo	Mhlontlo	O R Tambo	950	1 019	1 125	1 243	1 373
Mafusini - D	Rural	Rural - Small Village <= 5000	O R Tambo	Mhlontlo	O R Tambo	1 442	1 546	1 708	1 886	2 084
Gqili - A	Rural	Rural Scattered	O R Tambo	Mhlontlo	O R Tambo	68	73	81	89	99
Mfundisweni - C	Rural	Rural Scattered	O R Tambo	Mhlontlo	O R Tambo	444	476	525	580	641
Mampola - B	Rural	Rural - Small Village <= 5000	O R Tambo	Mhlontlo	O R Tambo	1 030	1 104	1 220	1 347	1 488
Mdyobe	Rural	Rural Scattered	O R Tambo	Mhlontlo	O R Tambo	428	459	507	560	618
Mpindweni - E	Rural	Rural Scattered	O R Tambo	Mhlontlo	O R Tambo	338	363	401	443	489
Gabazi	Rural	Rural - Small Village <= 5000	O R Tambo	Mhlontlo	O R Tambo	2 313	2 480	2 740	3 026	3 343
Mpindweni - A	Rural	Rural Scattered	O R Tambo	Mhlontlo	O R Tambo	401	430	475	525	580
Mangxamfu - B	Rural	Rural Scattered	O R Tambo	Mhlontlo	O R Tambo	380	408	451	498	550
Esikolweni - D	Rural	Rural Scattered	O R Tambo	Mhlontlo	O R Tambo	459	492	544	601	664
Emagqubeni	Rural	Rural Scattered	O R Tambo	Mhlontlo	O R Tambo	512	549	606	670	740
Eqolweni - C	Rural	Rural Scattered	O R Tambo	Mhlontlo	O R Tambo	528	566	625	690	762
Gqeyane	Rural	Rural Scattered	O R Tambo	Mhlontlo	O R Tambo	159	170	188	208	229
Balasi - C	Rural	Rural - Small Village <= 5000	O R Tambo	Mhlontlo	O R Tambo	132	142	157	173	191
Esingweni	Rural	Rural Scattered	O R Tambo	Mhlontlo	O R Tambo	323	346	382	422	466
Quthubeni - B	Rural	Rural Scattered	O R Tambo	Mhlontlo	O R Tambo	206	221	244	269	298
Maqhubini	Rural	Rural Scattered	O R Tambo	Mhlontlo	O R Tambo	122	131	144	159	176
Gora	Rural	Rural - Small Village <= 5000	O R Tambo	Mhlontlo	O R Tambo	576	618	682	753	832
Sitishini	Rural	Rural Scattered	O R Tambo	Mhlontlo	O R Tambo	354	380	419	463	512
Mbinda	Rural	Squatter Camp - Rural	O R Tambo	Mhlontlo	O R Tambo	945	1 013	1 119	1 236	1 365
Sikhobeni - D	Rural	Rural - Small Village <= 5000	O R Tambo	Mhlontlo	O R Tambo	929	996	1 100	1 215	1 343
Xabana	Rural	Rural Scattered	O R Tambo	Mhlontlo	O R Tambo	438	470	519	573	633
Ngxakoko	Rural	Rural Scattered	O R Tambo	Mhlontlo	O R Tambo	560	601	663	733	810
Langeni - BB	Rural	Rural Scattered	O R Tambo	Mhlontlo	O R Tambo	11	11	12	14	15
Culunca	Rural	Rural Scattered	O R Tambo	Mhlontlo	O R Tambo	713	764	844	932	1 030
Debeza - B	Rural	Rural - Small Village <= 5000	O R Tambo	Mhlontlo	O R Tambo	1 627	1 744	1 927	2 128	2 351

Settlement Name	Type	Classification	DM	LM	WSA	Pop 2013	Pop 2020	Pop 2030	Pop 2040	Pop 2050
Middle Tyira	Rural	Rural Scattered	O R Tambo	Mhlontlo	O R Tambo	898	962	1 063	1 174	1 297
Machibini - D	Rural	Rural - Small Village <= 5000	O R Tambo	Mhlontlo	O R Tambo	1 426	1 529	1 689	1 866	2 061
Marhambeni - B	Rural	Rural - Small Village <= 5000	O R Tambo	Mhlontlo	O R Tambo	1 241	1 331	1 470	1 624	1 794
Mbenza	Rural	Rural - Small Village <= 5000	O R Tambo	Mhlontlo	O R Tambo	2 107	2 259	2 496	2 757	3 045
Manzamnyama - D	Rural	Rural - Small Village <= 5000	O R Tambo	Mhlontlo	O R Tambo	956	1 025	1 133	1 251	1 382
Ntshongweni - A	Rural	Rural Scattered	O R Tambo	Mhlontlo	O R Tambo	665	713	788	870	961
Luqolweni - B	Rural	Squatter Camp - Rural	O R Tambo	Mhlontlo	O R Tambo	740	793	876	968	1 069
Lower Tyira - B	Rural	Rural Scattered	O R Tambo	Mhlontlo	O R Tambo	681	730	807	891	984
Lower Tyirha	Rural	Rural - Small Village <= 5000	O R Tambo	Mhlontlo	O R Tambo	1 828	1 960	2 165	2 391	2 641
Nxotwe	Rural	Rural - Small Village <= 5000	O R Tambo	Mhlontlo	O R Tambo	972	1 042	1 151	1 272	1 405
Mzuzanto	Rural	Rural Scattered	O R Tambo	Mhlontlo	O R Tambo	702	753	831	918	1 015
Ndakeni - G	Rural	Rural Scattered	O R Tambo	Mhlontlo	O R Tambo	185	198	219	242	267
Mjikweni - B	Rural	Rural - Small Village <= 5000	O R Tambo	Mhlontlo	O R Tambo	1 764	1 891	2 089	2 307	2 549
Edrayini - B	Rural	Rural Scattered	O R Tambo	Mhlontlo	O R Tambo	243	260	288	318	351
Upper Kroza	Rural	Rural Scattered	O R Tambo	Mhlontlo	O R Tambo	787	844	932	1 030	1 138
Ncetyana	Rural	Rural Scattered	O R Tambo	Mhlontlo	O R Tambo	290	311	344	379	419
Manka - B	Rural	Rural Scattered	O R Tambo	Mhlontlo	O R Tambo	856	917	1 013	1 119	1 236
Mdeni - H	Rural	Rural Scattered	O R Tambo	Mhlontlo	O R Tambo	602	646	713	788	870
Godzi - A	Rural	Rural Scattered	O R Tambo	Mhlontlo	O R Tambo	734	787	869	960	1 060
Mbutho	Rural	Rural - Small Village <= 5000	O R Tambo	Mhlontlo	O R Tambo	993	1 065	1 176	1 299	1 435
Boycy - A	Rural	Rural Scattered	O R Tambo	Mhlontlo	O R Tambo	571	612	676	747	825
Hlangani - C	Rural	Rural Scattered	O R Tambo	Mhlontlo	O R Tambo	190	204	225	249	275
Boycy - B	Rural	Rural Scattered	O R Tambo	Mhlontlo	O R Tambo	37	39	44	48	53
Marhubeni - C	Rural	Rural Scattered	O R Tambo	Nyandeni	O R Tambo	349	374	413	456	504
Noziyongwana	Rural	Rural Scattered	O R Tambo	Nyandeni	O R Tambo	74	79	87	96	106
Noziyongwana	Rural	Rural Scattered	O R Tambo	Mhlontlo	O R Tambo	169	181	200	221	245
Phakathi	Rural	Rural Scattered	O R Tambo	Mhlontlo	O R Tambo	750	805	889	982	1 084

Settlement Name	Type	Classification	DM	LM	WSA	Pop 2013	Pop 2020	Pop 2030	Pop 2040	Pop 2050
Mangondo	Rural	Rural Scattered	O R Tambo	Mhlontlo	O R Tambo	259	277	306	338	374
Gqiu	Rural	Rural Scattered	O R Tambo	Mhlontlo	O R Tambo	550	589	651	719	794
Neustad - B	Rural	Rural - Small Village <= 5000	O R Tambo	Mhlontlo	O R Tambo	803	861	951	1 050	1 160
Mtshazi	Rural	Rural - Small Village <= 5000	O R Tambo	Mhlontlo	O R Tambo	2 128	2 282	2 521	2 784	3 076
Mkhotshozweni - A	Rural	Rural Scattered	O R Tambo	Mhlontlo	O R Tambo	323	346	382	422	466
Ngwemnyama - B	Rural	Rural Scattered	O R Tambo	Mhlontlo	O R Tambo	824	883	976	1 078	1 191
Mahoyana	Rural	Rural - Small Village <= 5000	O R Tambo	Mhlontlo	O R Tambo	1 299	1 393	1 538	1 699	1 877
Mhlabati - B	Rural	Rural Scattered	O R Tambo	Mhlontlo	O R Tambo	180	193	213	235	260
Kwayalela	Rural	Rural Scattered	O R Tambo	Nyandeni	O R Tambo	180	193	213	235	260
Upper Lotana	Rural	Rural Scattered	O R Tambo	Mhlontlo	O R Tambo	1 606	1 722	1 902	2 101	2 321
Chibini - B	Rural	Rural Scattered	O R Tambo	Nyandeni	O R Tambo	571	612	676	747	825
Esiqikini - C	Rural	Rural - Small Village <= 5000	O R Tambo	Nyandeni	O R Tambo	840	900	995	1 099	1 214
Ngcolorha	Rural	Rural Scattered	O R Tambo	Nyandeni	O R Tambo	728	781	863	953	1 053
Manzimabi	Rural	Rural Scattered	O R Tambo	Nyandeni	O R Tambo	201	215	238	263	290
Ndungunyeni - A	Rural	Rural Scattered	O R Tambo	Nyandeni	O R Tambo	100	107	118	131	144
Tshisani - B	Rural	Rural - Small Village <= 5000	O R Tambo	Mhlontlo	O R Tambo	1 046	1 121	1 238	1 368	1 511
Mjobeni	Rural	Rural Scattered	O R Tambo	Nyandeni	O R Tambo	1 088	1 166	1 288	1 423	1 572
Ngwemnyama - C	Rural	Rural Scattered	O R Tambo	Mhlontlo	O R Tambo	306	328	362	400	442
Mhlabeni - E	Rural	Rural Scattered	O R Tambo	Mhlontlo	O R Tambo	190	204	225	249	275
Chibini - F	Rural	Rural Scattered	O R Tambo	Nyandeni	O R Tambo	328	352	388	429	474
Ndungunyeni - B	Rural	Rural Scattered	O R Tambo	Nyandeni	O R Tambo	201	215	238	263	290
Fameni - C	Rural	Rural Scattered	O R Tambo	Mhlontlo	O R Tambo	248	266	294	324	358
Greater Honono	Rural	Rural Scattered	O R Tambo	Mhlontlo	O R Tambo	185	198	219	242	267
Mmangweni - D	Rural	Rural Scattered	O R Tambo	Mhlontlo	O R Tambo	232	249	275	304	336
Endwe A	Rural	Rural - Small Village <= 5000	O R Tambo	Mhlontlo	O R Tambo	929	996	1 100	1 215	1 343
Nkamasana	Rural	Rural Scattered	O R Tambo	Port St Johns	O R Tambo	105	113	124	137	152

Settlement Name	Type	Classification	DM	LM	WSA	Pop 2013	Pop 2020	Pop 2030	Pop 2040	Pop 2050
Noziyongwana	Rural	Rural Scattered	O R Tambo	Ngquza Hill	O R Tambo	195	210	232	256	282
Noziyongwana	Rural	Rural Scattered	O R Tambo	Ngquza Hill	O R Tambo	227	243	269	297	328
Noziyongwana	Rural	Rural Scattered	O R Tambo	Nyandeni	O R Tambo	68	73	81	89	99
Noziyongwana	Rural	Rural Scattered	O R Tambo	Nyandeni	O R Tambo	26	28	31	34	38
Noziyongwana	Rural	Rural Scattered	O R Tambo	Mbizana	O R Tambo	100	107	118	131	144
Noziyongwana	Rural	Rural Scattered	O R Tambo	Ngquza Hill	O R Tambo	42	45	50	55	61
Noziyongwana	Rural	Rural Scattered	O R Tambo	Ntabankulu	O R Tambo	84	90	100	110	122
Tsolo	Urban	Urban Fringe - Ex-homeland Towns (Formal Towns)	O R Tambo	Mhlontlo	O R Tambo	1 130	1 211	1 338	1 478	1 633
Tsolo	Urban	Service Centres - Mines, Prisons etc.	O R Tambo	Mhlontlo	O R Tambo	2 889	3 098	3 422	3 780	4 175
Tsolo	Urban	Urban Fringe - Ex-homeland Towns (Formal Towns)	O R Tambo	Mhlontlo	O R Tambo	808	867	957	1 057	1 168
Tsolo	Urban	Service Centres - Mines, Prisons etc.	O R Tambo	Mhlontlo	O R Tambo	2 013	2 158	2 384	2 633	2 908
Gxididi	Rural	Rural - Small village <=5000	O R Tambo	King Sabata	O R Tambo	983	1 054	1 164	1 286	1 420
Gxididi	Rural	Rural - Small Village <= 5000	O R Tambo	King Sabata	O R Tambo	993	1 065	1 176	1 299	1 435
Magonkone	Rural	Rural - Small Village <= 5000	O R Tambo	Mhlontlo	O R Tambo	829	889	982	1 085	1 198
Tonti - A	Rural	Rural - Small Village <= 5000	O R Tambo	Ntabankulu	O R Tambo	686	736	813	898	992
Lower Mjika - C	Rural	Rural - Small Village <= 5000	O R Tambo	Mhlonto	O R Tambo	956	1 025	1 133	1 251	1 382
Mqobiso - A	Rural	Rural Scattered	O R Tambo	Mhlontlo	O R Tambo	983	1 054	1 164	1 286	1 420
Nombodledlana	Rural	Rural Scattered	O R Tambo	Mhlontlo	O R Tambo	344	368	407	450	497
Mpukumbini	Rural	Rural Scattered	O R Tambo	Mhlontlo	O R Tambo	222	238	263	290	320
Nombodlelanga	Rural	Rural Scattered	O R Tambo	Mhlontlo	O R Tambo	248	266	294	324	358
Ncetshani	Rural	Rural Scattered	O R Tambo	Mhlontlo	O R Tambo	206	221	244	269	298
Cheka	Rural	Rural Scattered	O R Tambo	Mhlontlo	O R Tambo	501	537	594	656	724
Mfabantu	Rural	Rural - Small Village <= 5000	O R Tambo	Mhlontlo	O R Tambo	1 732	1 857	2 051	2 266	2 503
Luxeni	Rural	Rural Scattered	O R Tambo	Mhlontlo	O R Tambo	375	402	444	491	542

Settlement Name	Type	Classification	DM	LM	WSA	Pop 2013	Pop 2020	Pop 2030	Pop 2040	Pop 2050
Noziyongwana	Rural	Rural Scattered	O R Tambo	Mhlontol	O R Tambo	301	322	356	393	434
Lower Mluka	Rural	Rural Scattered	O R Tambo	Mhlontlo	O R Tambo	428	459	507	560	618
Lurasini	Rural	Rural Scattered	O R Tambo	Nyandeni	O R Tambo	892	957	1 057	1 167	1 289
Mngceleni	Rural	Rural Scattered	O R Tambo	Mhlontlo	O R Tambo	718	770	850	939	1 037
Egotyibeni	Rural	Rural - Small Village <= 5000	O R Tambo	Mhlontlo	O R Tambo	1 014	1 087	1 201	1 327	1 466
Mnqandanto	Rural	Rural Scattered	O R Tambo	Mhlontlo	O R Tambo	945	1 013	1 119	1 236	1 365
Zandukweni	Rural	Rural - Small Village <= 5000	O R Tambo	Nyandeni	O R Tambo	3 623	3 884	4 291	4 739	5 235
Mhlakulo	Rural	Rural - Small Village <= 5000	O R Tambo	Mhlontlo	O R Tambo	1 526	1 636	1 807	1 996	2 205
Lower Mjika	Rural	Rural Scattered	O R Tambo	Mhlontlo	O R Tambo	1 315	1 410	1 557	1 720	1 900
Nkamasana	Rural	Rural Scattered	O R Tambo	Mhlontlo	O R Tambo	153	165	182	201	222
Nkamasana	Rural	Rural Scattered	O R Tambo	Mhlontlo	O R Tambo	42	45	50	55	61
Zwelitsha - FF	Rural	Rural Scattered	O R Tambo	King Sabata	O R Tambo	1 083	1 161	1 282	1 416	1 564
Zwelitsha - FF	Rural	Rural Scattered	O R Tambo	Mhlontlo	O R Tambo	792	850	939	1 037	1 145
Lower Gungululu	Rural	Rural - Small Village <= 5000	O R Tambo	Mhlontlo	O R Tambo	1 606	1 722	1 902	2 101	2 321
Matyeba	Rural	Rural - Small Village <= 5000	O R Tambo	Mhlontlo	O R Tambo	2 350	2 520	2 783	3 074	3 396
Mrhotshozweni	Rural	Rural - Small Village <= 5000	O R Tambo	Mhlontlo	O R Tambo	1 268	1 359	1 501	1 658	1 832
Tsongeni	Rural	Rural Scattered	O R Tambo	Mhlontlo	O R Tambo	401	430	475	525	580
Nqadu - C	Rural	Rural Scattered	O R Tambo	Mhlontlo	O R Tambo	243	260	288	318	351
Nqadu - B	Rural	Rural Scattered	O R Tambo	Mhlontlo	O R Tambo	117	125	138	153	169
Mhlahlane - D	Rural	Rural Scattered	O R Tambo	Mhlontlo	O R Tambo	756	810	895	989	1 092
Langeni - A	Rural	Rural - Small Village <= 5000	O R Tambo	Mhlontlo	O R Tambo	3 792	4 066	4 491	4 961	5 480
Phakathi	Rural	Rural Scattered	O R Tambo	Mhlontlo	O R Tambo	750	805	889	982	1 084
Nuaphantsi	Rural	Rural Scattered	O R Tambo	Mhlontlo	O R Tambo	607	651	719	795	878
Mhlakulu	Rural	Rural Scattered	O R Tambo	Mhlontlo	O R Tambo	550	589	651	719	794
Ngqwala - B	Rural	Rural Scattered	O R Tambo	King Sabata	O R Tambo	507	543	600	663	732
Ngqwala - A	Rural	Rural Scattered	O R Tambo	Mhlontlo	O R Tambo	782	838	926	1 023	1 130
Zenzele	Rural	Rural Scattered	O R Tambo	Mhlontlo	O R Tambo	100	107	118	131	144

Settlement Name	Type	Classification	DM	LM	WSA	Pop 2013	Pop 2020	Pop 2030	Pop 2040	Pop 2050
Lurasini Industrial	Rural	Rural Scattered	O R Tambo	Mhlontlo	O R Tambo	259	277	306	338	374
Nyembezi	Rural	Rural Scattered	O R Tambo	Mhlontlo	O R Tambo	180	193	213	235	260
Mangondo	Rural	Rural Scattered	O R Tambo	Mhlontlo	O R Tambo	259	277	306	338	374
Noziyongwana	Rural	Rural Scattered	O R Tambo	Mhlontlo	O R Tambo	37	39	44	48	53
Noziyongwana	Rural	Rural Scattered	O R Tambo	Mhlontlo	O R Tambo	68	73	81	89	99
Noziyongwana	Rural	Rural Scattered	O R Tambo	Mhlontlo	O R Tambo	127	136	151	166	184
Noziyongwana	Rural	Rural Scattered	O R Tambo	King Sabata	O R Tambo	100	107	118	131	144
Mpoza - K	Rural	Rural - Small Village <= 5000	Alfred Nzo	Umzimvubu	Alfred Nzo	951	1 020	1 126	1 244	1 375
Cabazi - A	Rural	Rural - Small Village <= 5000	Alfred Nzo	Umzimvubu	Alfred Nzo	903	968	1 069	1 181	1 305
Ekutsheni	Rural	Rural Scattered	Alfred Nzo	Umzimvubu	Alfred Nzo	607	651	719	795	878
Mafusini - N	Rural	Rural Scattered	Alfred Nzo	Umzimvubu	Alfred Nzo	476	510	564	623	688
Mafusini - H	Rural	Rural Scattered	Alfred Nzo	Umzimvubu	Alfred Nzo	283	303	335	370	409
Mhlotsheni	Rural	Rural Scattered	Alfred Nzo	Umzimvubu	Alfred Nzo	818	877	968	1 070	1 182
Bhadalala	Rural	Rural - Small Village <= 5000	Alfred Nzo	Umzimvubu	Alfred Nzo	1 998	2 142	2 366	2 614	2 887
Mkhangisa	Rural	Rural Scattered	Alfred Nzo	Umzimvubu	Alfred Nzo	297	319	352	389	430
Siqhingeni - B	Rural	Rural Scattered	Alfred Nzo	Umzimvubu	Alfred Nzo	815	873	965	1 066	1 177
Chani	Rural	Rural Scattered	Alfred Nzo	Umzimvubu	Alfred Nzo	357	383	423	467	516
Muvnuvnblovo	Rural	Rural - Small Village <= 5000	Alfred Nzo	Umzimvubu	Alfred Nzo	1 975	2 117	2 339	2 584	2 854
Lutateni	Rural	Rural - Small Village <= 5000	Alfred Nzo	Umzimvubu	Alfred Nzo	1 681	1 802	1 990	2 199	2 429
Mbodleni	Rural	Squatter Camp - Rural	Alfred Nzo	Umzimvubu	Alfred Nzo	2 566	2 751	3 038	3 356	3 707
Qanqu - A	Rural	Rural Scattered	Alfred Nzo	Umzimvubu	Alfred Nzo	787	844	932	1 030	1 138
Sihlahleni - A	Rural	Rural Scattered	Alfred Nzo	Umzimvubu	Alfred Nzo	331	355	392	433	478
Sinyaqa	Rural	Rural Scattered	Alfred Nzo	Umzimvubu	Alfred Nzo	394	423	467	516	570
Sihlahleni - B	Rural	Rural - Small Village <= 5000	Alfred Nzo	Umzimvubu	Alfred Nzo	764	819	905	1 000	1 104
Macheleni	Rural	Rural Scattered	Alfred Nzo	Umzimvubu	Alfred Nzo	274	294	325	359	396
Macheleni	Rural	Rural - Small Village <= 5000	Alfred Nzo	Umzimvubu	Alfred Nzo	1 399	1 500	1 657	1 830	2 022
Mpendla	Rural	Rural Scattered	Alfred Nzo	Umzimvubu	Alfred Nzo	376	403	446	492	544

Settlement Name	Type	Classification	DM	LM	WSA	Pop 2013	Pop 2020	Pop 2030	Pop 2040	Pop 2050
Ncuneni	Rural	Rural Scattered	Alfred Nzo	Umzimvubu	Alfred Nzo	797	854	943	1 042	1 151
Giqeka	Rural	Rural Scattered	Alfred Nzo	Umzimvubu	Alfred Nzo	123	132	146	161	178
Cwalinkungu	Rural	Rural Scattered	Alfred Nzo	Umzimvubu	Alfred Nzo	242	259	286	316	349
Hlane	Rural	Rural Scattered	Alfred Nzo	Umzimvubu	Alfred Nzo	472	506	559	617	682
Magqagqeni - F	Rural	Rural Scattered	Alfred Nzo	Umzimvubu	Alfred Nzo	380	408	451	498	550
Qumrha	Rural	Rural Scattered	Alfred Nzo	Umzimvubu	Alfred Nzo	659	707	780	862	952
Magxeni - A	Rural	Rural Scattered	Alfred Nzo	Umzimvubu	Alfred Nzo	812	871	962	1 063	1 174
Mtonyeni - D	Rural	Rural Scattered	Alfred Nzo	Umzimvubu	Alfred Nzo	238	255	281	311	343
Magqagqeni - A	Rural	Rural Scattered	Alfred Nzo	Umzimvubu	Alfred Nzo	213	229	253	279	308
Ekugqibeleni	Rural	Rural - Small Village <= 5000	Alfred Nzo	Umzimvubu	Alfred Nzo	745	799	883	975	1 077
Macholweni	Rural	Rural Scattered	Alfred Nzo	Umzimvubu	Alfred Nzo	223	239	264	291	322
Mtombokazi	Rural	Rural Scattered	Alfred Nzo	Umzimvubu	Alfred Nzo	297	319	352	389	430
Mguga	Rural	Rural Scattered	Alfred Nzo	Umzimvubu	Alfred Nzo	160	171	189	209	231
Magqagqeni - D	Rural	Rural Scattered	Alfred Nzo	Umzimvubu	Alfred Nzo	246	264	291	322	355
Mtonyeni - E	Rural	Rural Scattered	Alfred Nzo	Umzimvubu	Alfred Nzo	404	433	478	528	583
Kusasa	Rural	Rural Scattered	Alfred Nzo	Umzimvubu	Alfred Nzo	302	323	357	395	436
Mnambithi	Rural	Rural Scattered	Alfred Nzo	Umzimvubu	Alfred Nzo	459	492	544	601	664
Ngonyameni - D	Rural	Rural Scattered	Alfred Nzo	Umzimvubu	Alfred Nzo	678	727	803	887	980
Nushwini	Rural	Rural Scattered	Alfred Nzo	Umzimvubu	Alfred Nzo	242	259	286	316	349
Bislane	Rural	Rural - Small Village <= 5000	Alfred Nzo	Umzimvubu	Alfred Nzo	1 522	1 632	1 802	1 991	2 199
Dungu - B	Rural	Rural - Small Village <= 5000	Alfred Nzo	Umzimvubu	Alfred Nzo	3 959	4 245	4 689	5 179	5 721
Xolo	Rural	Rural Scattered	Alfred Nzo	Umzimvubu	Alfred Nzo	220	236	260	287	317
Mhlanganisweni - A	Rural	Rural Scattered	Alfred Nzo	Umzimvubu	Alfred Nzo	623	668	738	815	901
Toleni - B	Rural	Rural - Small Village <= 5000	Alfred Nzo	Umzimvubu	Alfred Nzo	1 802	1 933	2 135	2 358	2 605
Lvandlana	Rural	Rural Scattered	Alfred Nzo	Umzimvubu	Alfred Nzo	840	900	995	1 099	1 214
Bhuwa - B	Rural	Rural Scattered	Alfred Nzo	Umzimvubu	Alfred Nzo	700	750	829	916	1 012

Settlement Name	Type	Classification	DM	LM	WSA	Pop 2013	Pop 2020	Pop 2030	Pop 2040	Pop 2050
Dangwana - a	Rural	Rural - Small Village <= 5000	Alfred Nzo	Umzimvubu	Alfred Nzo	791	848	937	1 035	1 144
Dangwana - B	Rural	Rural Scattered	Alfred Nzo	Umzimvubu	Alfred Nzo	111	119	132	146	161
Esseck Farm	Rural	Rural Scattered	Alfred Nzo	Umzimvubu	Alfred Nzo	139	149	164	181	200
Esseck Farm	Rural	Rural Scattered	Alfred Nzo	Umzimvubu	Alfred Nzo	151	162	179	198	219
Zibokwana	Rural	Rural Scattered	Alfred Nzo	Umzimvubu	Alfred Nzo	710	762	841	929	1 027
Bhuwa - C	Rural	Rural Scattered	Alfred Nzo	Umzimvubu	Alfred Nzo	641	687	759	839	926
Bumbeni	Rural	Rural Scattered	Alfred Nzo	Umzimvubu	Alfred Nzo	96	103	113	125	138
Magcakini - D	Rural	Rural Scattered	Alfred Nzo	Umzimvubu	Alfred Nzo	778	834	921	1 017	1 124
Cabane	Rural	Rural Scattered	Alfred Nzo	Umzimvubu	Alfred Nzo	472	506	559	617	682
Mpemba	Rural	Rural Scattered	Alfred Nzo	Umzimvubu	Alfred Nzo	448	480	530	586	647
Gingweni	Rural	Rural - Small Village <= 5000	Alfred Nzo	Umzimvubu	Alfred Nzo	692	741	819	905	999
Lwandlana - B	Rural	Rural Scattered	Alfred Nzo	Umzimvubu	Alfred Nzo	513	550	607	671	741
Mawusheni - A	Rural	Rural Scattered	Alfred Nzo	Umzimvubu	Alfred Nzo	357	383	423	467	516
Majuba - AA	Rural	Rural - Small Village <= 5000	Alfred Nzo	Umzimvubu	Alfred Nzo	669	717	792	874	966
Emva Kwesikolo	Rural	Rural - Small Village <= 5000	Alfred Nzo	Umzimvubu	Alfred Nzo	1 183	1 269	1 402	1 548	1 710
Majuba - B	Rural	Rural Scattered	Alfred Nzo	Umzimvubu	Alfred Nzo	228	245	270	298	330
Qokolweni - B	Rural	Rural Scattered	Alfred Nzo	Umzimvubu	Alfred Nzo	174	187	207	228	252
Black Hill - A	Rural	Rural Scattered	Alfred Nzo	Umzimvubu	Alfred Nzo	90	97	107	118	131
Tina Hill	Rural	Rural Scattered	Alfred Nzo	Umzimvubu	Alfred Nzo	12	12	14	15	17
Dangwana - C	Rural	Rural - Small Village <= 5000	Alfred Nzo	Umzimvubu	Alfred Nzo	1856	1990	2198	2428	2682
Bobana	Urban	Urban - Former Township	Alfred Nzo	Umzimvubu	Alfred Nzo	652	699	772	852	942
Sipilini	Urban	Urban - Former Township	Alfred Nzo	Umzimvubu	Alfred Nzo	2081	2231	2465	2722	3007
Nyanzele	Urban	Urban - Former Township	Alfred Nzo	Umzimvubu	Alfred Nzo	836	896	990	1093	1207
Ngqumane - C	Rural	Rural Scattered	O R Tambo	Ntabankulu	O R Tambo	602	646	713	788	870
Gubeni - A	Rural	Rural - Small Village <= 5000	O R Tambo	Mhlontlo	O R Tambo	977	1048	1158	1279	1412
Bomvini - C	Rural	Rural Scattered	O R Tambo	Mhlontlo	O R Tambo	676	725	800	884	977
Mpoza - I	Rural	Rural Scattered	O R Tambo	Mhlontlo	O R Tambo	211	226	250	276	305

Settlement Name	Type	Classification	DM	LM	WSA	Pop 2013	Pop 2020	Pop 2030	Pop 2040	Pop 2050
Bomvini - D	Rural	Rural Scattered	O R Tambo	Mhlontlo	O R Tambo	470	504	556	615	679
Mpoza - H	Rural	Rural Scattered	O R Tambo	Mhlontlo	O R Tambo	201	215	238	263	290
Mhlahlweni	Rural	Rural Scattered	O R Tambo	Ntabankulu	O R Tambo	301	322	356	393	434
Silevini	Rural	Rural Scattered	O R Tambo	Ntabankulu	O R Tambo	53	56	62	69	76
Magqagqeni - G	Rural	Rural Scattered	O R Tambo	Mhlontlo	O R Tambo	919	985	1088	1202	1327
Mangwanene - CC	Rural	Rural Scattered	O R Tambo	Mhlontlo	O R Tambo	53	56	62	69	76
Nkamasana	Rural	Rural Scattered	O R Tambo	Ntabankulu	O R Tambo	117	125	138	153	169
Mvenyane	Rural	Rural - Small Village <= 5000	O R Tambo	Ntabankulu	O R Tambo	993	1065	1176	1299	1435
Msukeni	Rural	Rural - Small Village <= 5000	O R Tambo	Ntabankulu	O R Tambo	1362	1460	1613	1782	1968
Mgodweni	Rural	Rural Scattered	O R Tambo	Ntabankulu	O R Tambo	311	334	368	407	450
Mwalala - A	Rural	Rural Scattered	O R Tambo	Ntabankulu	O R Tambo	100	107	118	131	144
Rwantsana - B	Rural	Rural Scattered	O R Tambo	Ntabankulu	O R Tambo	522	560	619	683	755
Dwaku	Rural	Rural Scattered	O R Tambo	Ntabankulu	O R Tambo	1104	1183	1307	1444	1595
Mwalala - B	Rural	Rural Scattered	O R Tambo	Ntabankulu	O R Tambo	539	578	639	705	779
Cotshe	Rural	Rural Scattered	O R Tambo	Ntabankulu	O R Tambo	11	11	12	14	15
Dundulu	Rural	Rural Scattered	O R Tambo	Ntabankulu	O R Tambo	550	589	651	719	794
New b.v. - A	Rural	Rural - Small Village <= 5000	O R Tambo	Ntabankulu	O R Tambo	1727	1851	2045	2259	2495
Kwagqina	Rural	Rural - Small Village <= 5000	O R Tambo	Ntabankulu	O R Tambo	2102	2254	2489	2750	3038
Ntsheleni	Rural	Rural - Small Village <= 5000	O R Tambo	Mhlontlo	O R Tambo	501	537	594	656	724
Mvane	Rural	Rural - Small Village <= 5000	O R Tambo	Mhlontlo	O R Tambo	1146	1228	1357	1499	1655
Mpoza - J	Rural	Rural Scattered	O R Tambo	Ntabankulu	O R Tambo	496	532	588	649	717
Mambalwini	Rural	Rural - Small Village <= 5000	O R Tambo	Mhlontlo	O R Tambo	1595	1711	1889	2087	2306
Sityeni	Rural	Rural Scattered	O R Tambo	Ntabankulu	O R Tambo	391	419	463	511	565
Magqoozini	Rural	Rural Scattered	O R Tambo	Ntabankulu	O R Tambo	370	397	438	484	535
Khetani	Rural	Rural - Small Village <= 5000	O R Tambo	Ntabankulu	O R Tambo	676	725	800	884	977
Sidaville	Rural	Rural Scattered	O R Tambo	Ntabankulu	O R Tambo	998	1070	1182	1306	1443
Mngazana	Rural	Rural Scattered	O R Tambo	Ntabankulu	O R Tambo	206	221	244	269	298

Settlement Name	Type	Classification	DM	LM	WSA	Pop 2013	Pop 2020	Pop 2030	Pop 2040	Pop 2050
Lower Mceba	Rural	Rural - Small Village <= 5000	O R Tambo	Ntabankulu	O R Tambo	1004	1076	1189	1313	1450
Magqagqeni - G	Rural	Rural Scattered	O R Tambo	Ntabankulu	O R Tambo	317	340	376	415	459
Cacudu	Rural	Rural - Small Village <= 5000	O R Tambo	Ntabankulu	O R Tambo	1077	1155	1276	1409	1557
Pubguleweni	Rural	Rural - Small Village <= 5000	O R Tambo	Ntabankulu	O R Tambo	993	1065	1176	1299	1435
Lubala	Rural	Rural Scattered	O R Tambo	Ntabankulu	O R Tambo	486	521	575	635	702
Bhubesi	Rural	Rural - Small Village <= 5000	O R Tambo	Ntabankulu	O R Tambo	1004	1076	1189	1313	1450
Mchilankuku	Rural	Rural - Small Village <= 5000	O R Tambo	Ntabankulu	O R Tambo	512	549	606	670	740
Caba	Rural	Rural - Small Village <= 5000	O R Tambo	Ntabankulu	O R Tambo	655	702	775	857	946
Ntsibyane	Rural	Rural - Small Village <= 5000	O R Tambo	Ntabankulu	O R Tambo	629	674	744	822	908
Bofbanaza	Rural	Rural - Small Village <= 5000	O R Tambo	Mhlontlo	O R Tambo	1 447	1 552	1 714	1 893	2 091
Masomntwana	Rural	Rural - Small Village <= 5000	O R Tambo	Ntabankulu	O R Tambo	1 014	1 087	1 201	1 327	1 466
Bheja	Rural	Rural Scattered	O R Tambo	Mhlontlo	O R Tambo	1 690	1 812	2 002	2 211	2 442
Sindeni	Rural	Rural - Small Village <= 5000	O R Tambo	Ntabankulu	O R Tambo	2 345	2 514	2 777	3 067	3 388
Zinyosimi	Rural	Rural - Small Village <= 5000	O R Tambo	Ntabankulu	O R Tambo	771	827	914	1 009	1 115
Ncumbe	Rural	Rural Scattered	O R Tambo	Mhlontlo	O R Tambo	1 252	1 342	1 482	1 638	1 809
Ntsheleni	Rural	Rural - Small Village <= 5000	O R Tambo	Mhlontlo	O R Tambo	2 303	2 469	2 727	3 012	3 328
Lufafa	Rural	Rural - Small Village <= 5000	O R Tambo	Ntabankulu	O R Tambo	792	850	939	1 037	1 145
Mhlabeniomhlophe	Rural	Rural Scattered	O R Tambo	Ntabankulu	O R Tambo	438	470	519	573	633
Gqaqhana	Rural	Rural Scattered	O R Tambo	Ntabankulu	O R Tambo	644	691	763	843	931
Emthojeni	Rural	Rural Scattered	O R Tambo	Ntabankulu	O R Tambo	143	153	169	187	207
Gxeni - A	Rural	Rural Scattered	O R Tambo	Ntabankulu	O R Tambo	153	165	182	201	222
Mangqamseni	Rural	Rural Scattered	O R Tambo	Ntabankulu	O R Tambo	428	459	507	560	618
Nqalo	Rural	Rural Scattered	O R Tambo	Ntabankulu	O R Tambo	280	300	331	366	404
Kunyingweni	Rural	Rural Scattered	O R Tambo	Ntabankulu	O R Tambo	84	90	100	110	122
Ngqalo	Rural	Rural Scattered	O R Tambo	Ntabankulu	O R Tambo	217	232	256	283	313
Mzwakazi	Rural	Rural Scattered	O R Tambo	Ntabankulu	O R Tambo	328	352	388	429	474
Chibini	Rural	Rural Scattered	O R Tambo	Ntabankulu	O R Tambo	295	317	350	386	427

Settlement Name	Type	Classification	DM	LM	WSA	Pop 2013	Pop 2020	Pop 2030	Pop 2040	Pop 2050
Tsolo	Rural	Rural Scattered	O R Tambo	Mhlontlo	O R Tambo	962	1 031	1 139	1 258	1 390
Mmangweni - A	Rural	Rural Scattered	O R Tambo	Ntabankulu	O R Tambo	449	481	531	587	649
Nkumba - A	Rural	Rural Scattered	O R Tambo	Ntabankulu	O R Tambo	433	464	513	566	626
Msukeni - A	Rural	Rural Scattered	O R Tambo	Ntabankulu	O R Tambo	465	498	550	608	671
Ngozi - B	Rural	Rural Scattered	O R Tambo	Ntabankulu	O R Tambo	586	629	695	767	847
Nkamasana	Rural	Rural Scattered	O R Tambo	Ntabankulu	O R Tambo	132	142	157	173	191
Nkamasana	Rural	Rural Scattered	O R Tambo	Ntabankulu	O R Tambo	63	68	75	82	91
Nkamasana	Rural	Rural Scattered	O R Tambo	Ntabankulu	O R Tambo	47	51	56	62	68
Xhibeni	Rural	Rural Scattered	O R Tambo	Ntabankulu	O R Tambo	707	758	838	925	1 022
Mpendlamoya	Rural	Rural Scattered	O R Tambo	Ntabankulu	O R Tambo	227	243	269	297	328
Luysheko	Rural	Rural - Small Village <= 5000	O R Tambo	Ntabankulu	O R Tambo	3 063	3 284	3 627	4 007	4 426
Chibini	Rural	Rural - Small Village <= 5000	O R Tambo	Ntabankulu	O R Tambo	1 748	1 874	2 070	2 287	2 526
Tholeni	Rural	Rural - Small Village <= 5000	O R Tambo	Mhlontlo	O R Tambo	2 657	2 849	3 147	3 476	3 840
Mjrla	Rural	Rural - Small Village <= 5000	O R Tambo	Ntabankulu	O R Tambo	766	821	907	1 002	1 107
Upper Gunqwana	Rural	Rural Scattered	O R Tambo	Mhlontlo	O R Tambo	79	85	93	103	114
Kwaveni	Rural	Rural Scattered	O R Tambo	Ntabankulu	O R Tambo	190	204	225	249	275
Madamini - A	Rural	Rural Scattered	O R Tambo	Ntabankulu	O R Tambo	491	526	581	642	709
Skhulu - A	Rural	Rural Scattered	O R Tambo	Ntabankulu	O R Tambo	550	589	651	719	794
Ngwemnyama - E	Rural	Rural Scattered	O R Tambo	Ntabankulu	O R Tambo	565	606	670	740	817
Maxhegweni -B	Rural	Rural Scattered	O R Tambo	Ntabankulu	O R Tambo	151	162	179	198	219
Lugalakaxa	Rural	Rural Scattered	O R Tambo	Ntabankulu	O R Tambo	227	243	269	297	328
Madamini - B	Rural	Rural Scattered	O R Tambo	Ntabankulu	O R Tambo	74	79	87	96	106
Ngwemnyama - I	Rural	Rural Scattered	O R Tambo	Ntabankulu	O R Tambo	290	311	344	379	419
Mpoza - L	Rural	Rural Scattered	O R Tambo	Ntabankulu	O R Tambo	159	170	188	208	229
New B.V. - C	Rural	Rural Scattered	O R Tambo	Ntabankulu	O R Tambo	1 109	1 189	1 313	1 451	1 602
Ntaboduli - A	Rural	Rural - Small Village <= 5000	O R Tambo	Ntabankulu	O R Tambo	2 931	3 143	3 472	3 835	4 236
Nydkweni - B	Rural	Rural Scattered	O R Tambo	Ntabankulu	O R Tambo	89	96	106	117	129

Settlement Name	Type	Classification	DM	LM	WSA	Pop 2013	Pop 2020	Pop 2030	Pop 2040	Pop 2050
Ngozi - C	Rural	Rural Scattered	O R Tambo	Ntabankulu	O R Tambo	143	153	169	187	207
Lugangatho	Rural	Rural Scattered	O R Tambo	Ntabankulu	O R Tambo	602	646	713	788	870
Tsweleni - A	Rural	Rural Scattered	O R Tambo	Ntabankulu	O R Tambo	53	56	62	69	76
New B.V. - B	Rural	Rural Scattered	O R Tambo	Ntabankulu	O R Tambo	243	260	288	318	351
Ngavu - Ngavu - B	Rural	Rural Scattered	O R Tambo	Ntabankulu	O R Tambo	311	334	368	407	450
Kwanyasa	Rural	Rural Scattered	O R Tambo	Ntabankulu	O R Tambo	539	578	639	705	779
Ngojini - C	Rural	Rural Scattered	O R Tambo	Ntabankulu	O R Tambo	190	204	225	249	275
Ngavu - Ngavu - C	Rural	Rural - Small Village <= 5000	O R Tambo	Ntabankulu	O R Tambo	2 694	2 888	3 190	3 524	3 893
Xukula	Rural	Rural Scattered	O R Tambo	Ntabankulu	O R Tambo	269	288	319	352	389
Ngavu - Ngavu - A	Rural	Rural - Small Village <= 5000	O R Tambo	Ntabankulu	O R Tambo	934	1 002	1 107	1 222	1 350
Dumsi - B	Rural	Rural Scattered	O R Tambo	Ntabankulu	O R Tambo	227	243	269	297	328
Ntaboduli - B	Rural	Rural Scattered	O R Tambo	Ntabankulu	O R Tambo	777	833	920	1 016	1 122
Kukulozi	Rural	Rural - Small Village <= 5000	O R Tambo	Ntabankulu	O R Tambo	993	1 065	1 176	1 299	1 435
Dungu - A	Rural	Rural Scattered	O R Tambo	Ntabankulu	O R Tambo	565	606	670	740	817
Ntlangano	Rural	Rural Scattered	O R Tambo	Ntabankulu	O R Tambo	459	492	544	601	664
Esithaleni	Rural	Rural Scattered	O R Tambo	Mhlontlo	O R Tambo	317	340	376	415	459
Sitishini	Rural	Rural Scattered	O R Tambo	Mhlontlo	O R Tambo	354	380	419	463	512
Maplotini	Rural	Rural Scattered	O R Tambo	Ntabankulu	O R Tambo	180	193	213	235	260
Mhlonyaneni - A	Rural	Rural Scattered	O R Tambo	Ntabankulu	O R Tambo	323	346	382	422	466
Mhlonyaneni - B	Rural	Rural Scattered	O R Tambo	Ntabankulu	O R Tambo	756	810	895	989	1 092
Mafusini - A	Rural	Rural Scattered	O R Tambo	Ntabankulu	O R Tambo	180	193	213	235	260
Kwagqwarhu	Rural	Rural Scattered	O R Tambo	Ntabankulu	O R Tambo	243	260	288	318	351
Mafusini - F	Rural	Rural - Small Village <= 5000	O R Tambo	Ntabankulu	O R Tambo	1 753	1 880	2 076	2 293	2 533
Mangqamzeni - A	Rural	Rural Scattered	O R Tambo	Ntabankulu	O R Tambo	280	300	331	366	404
Nyandeni - B	Rural	Rural Scattered	O R Tambo	Ntabankulu	O R Tambo	248	266	294	324	358
Chibini - G	Rural	Rural Scattered	O R Tambo	Ntabankulu	O R Tambo	243	260	288	318	351
Mngeni - C	Rural	Rural Scattered	O R Tambo	Ntabankulu	O R Tambo	323	346	382	422	466

Settlement Name	Type	Classification	DM	LM	WSA	Pop 2013	Pop 2020	Pop 2030	Pop 2040	Pop 2050
Ngcabhela	Rural	Rural Scattered	O R Tambo	Ntabankulu	O R Tambo	206	221	244	269	298
Mngefeni	Rural	Rural Scattered	O R Tambo	Ntabankulu	O R Tambo	761	816	901	995	1 100
Siqithini	Rural	Rural Scattered	O R Tambo	Ntabankulu	O R Tambo	248	266	294	324	358
Ngcabeia	Rural	Rural Scattered	O R Tambo	Ntabankulu	O R Tambo	396	425	469	518	573
Matshona - C	Rural	Rural Scattered	O R Tambo	Ntabankulu	O R Tambo	534	572	632	698	772
Ngojini - B	Rural	Rural Scattered	O R Tambo	Ntabankulu	O R Tambo	713	764	844	932	1 030
Ngozi - A	Rural	Rural Scattered	O R Tambo	Ntabankulu	O R Tambo	507	543	600	663	732
Edrayini - A	Rural	Rural Scattered	O R Tambo	Ntabankulu	O R Tambo	501	537	594	656	724
Emanaleni - B	Rural	Rural Scattered	O R Tambo	Ntabankulu	O R Tambo	528	566	625	690	762
Kwanyabeni - A	Rural	Rural Scattered	O R Tambo	Ntabankulu	O R Tambo	740	793	876	968	1 069
Upper Gunqwana	Rural	Rural Scattered	O R Tambo	Ntabankulu	O R Tambo	53	56	62	69	76