3. WATER RESOURCE PROFILE

3.1 Water sources

All water supplied by the ZDM to the community is from sources within the DM's area of jurisdiction. Although there are sufficient internal resources, the ZDM are looking at the potential for more cost effective bulk water supplies from neighbouring municipalities. With a household count of approximately 142,543 the ZDM requires at least 1 710 Mℓ of water per month or 20,520 Mℓ per year to supply the population with basic water services. This does not account for increased consumption in urban areas or industrial requirements.

The ZDM falls within the Mfolozi (W2), Mkuze (W3) and Pongola (W4) secondary catchments of the Usuthu/Mhlathuze Water Management Area (WMA)[1]. The aerial extent of the ZDM occupies approximately 22% of this WMA. The total available water and requirements as at year 2000, based on a 98% assurance of supply within these sub-areas, is summarised in Table 3.1[2]. It is evident that apart from the Pongola catchments, water from these sub-areas is currently over-utilised and a deficit is created. However, according to Basson and Rossouw[3], this deficit is a result of the provision made for future implementation of the Reserve. The Reserve is a legislated requirement of the amount of water required to satisfy the ecological needs of a river system (provisionally estimated at 20%), as well as the basic human needs (that have been established as 25 litres per person per day).

Table 3.1: Water balance - summary of the water available and required within Zululand District Municipality for the year 2000 (Million m^3 (kℓ) per annum).

			Mfolozi	Mkuze	Pongola	Total
Available water	Natural resource	surface water	36	15	616	667
		groundwater	5	12	8	25
	Usable return flow	Irrigation	5	6	21	32
		Urban	4	0	0	4
		Mining & bulk	1	0	0	1
	Total local yield*		**51**	**33**	**645**	**729**
	Transfers in		0	30	0	30
		Total available	**51**	**63**	**645**	**759**
Water requirements	Consumer groups	Irrigation	51	61	213	325
		Urban**	12	1	1	14
		Rural**	11	10	6	27
		Mining & bulk industrial***	4	0	1	5
		Afforestation****	2	6	34	42
	Total local requirements		**80**	**78**	**255**	**413**
	Transfers out		18	0	30	**48**
		Total used	**98**	**78**	**285**	**461**
Balance			**-47**	**-15**	**360**	**298**

Source: Basson and Rossouw (2003).
**Includes allowance for impacts of the ecological component of the Reserve, river losses, alien vegetation, rain-fed agriculture and urban run-off on yield.*
***Includes allowance for basic human needs component of the Reserve (25 ℓ/c/d).*
****Mining and bulk industrial water uses that are not part of the urban system.****Afforestation quantities refer to the impact on yield only.*

[1] The Usuthu/Mhlathuze WMA is one of 19 areas defined across South Africa in terms of the National Water Act, 1998 (Act 36 of 1998). These WMAs have been defined to improve water resource management within South Africa. With time, each of the WMAs will establish a catchment management agency (CMA) for the regulation and control of water use in the WMA.
[2] Data for this table have been extracted from Basson and Rossouw (2003). *Usuthu to Mhlathuze Water Management Area: Overview of water resources availability and utilisation, September 2003*. DWAF: BKS. Report no. P WMA 06/000/00/0203. 31pp. At 13 & 21.
[3] Op cit 2 at 23.

ZDM is also currently undertaking a hydrological and yield assessment of the White uMfolozi catchment. A detailed catchment study for the Mfolozi River has not been undertaken before. The catchment has however been included in national water resource studies such as the Surface Water Resources of South Africa 1990 (WR90) and the Water Resources of South Africa 2005 (WR2005) studies of the Water Research Commission. Although the Usuthu to Mhlathuze Water Management Area (WMA6) is not considered by the Department of Water Affairs (DWA) to be a water stressed area as a whole, the Mfolozi River catchment is considered to have a net deficit in the water balance for the catchment according to the National Water Resource Strategy (September 2004 edition). The National Water Resource Strategy also indicates that there will be no net increase in water requirements within the catchment from 2000 to 2025. However there has been growing water demand over the past decade mainly due to an increase in the provision of water services to the large rural population within the catchment. The study is expected to be concluded by June 2010 and the results will be included into the next revision of the document.

Groundwater sources – aquifer characteristics

Groundwater is a useful water resource with potential quality and quantity being controlled by the geology of an area (see Figure 3.1 below). The Zululand district is underlain predominantly by Karoo Sequence basalts, shales, siltstones, sandstones and conglomerates that have been intruded by dolerite dykes, sills and plugs of Jurassic age (i.e. post Karoo; see Appendix 6 for geological maps). The formations making up the Karoo Supergroup sediments are often relatively massive such that primary storage and permeability is negligible. Groundwater storage and movement is confined to joints and bedding planes within the rock mass that yield between 0.5 and 2 ℓ/s. In the absence of faulting or dolerite intrusions, the groundwater potential of these sediments is marginal to poor (i.e. 0 to 0.5 ℓ/s (0 to 1,800 ℓ/h)). In addition, water quality is generally poor (Class 2) and some boreholes produce high concentrations of dissolved salts (Nyoka Formation), with high NaCl and SO_4 concentrations (Vryheid and Dwyka Formations) or high Iron and/or Manganese (Pietermaritzburg Formation). The indurated contact zones in the sediments adjacent to the intrusive Jurassic age dolerite intrusions are often highly fractured and these discrete zones enhance groundwater storage and rockmass permeability. As a result, boreholes drilled to intersect these structures usually produce higher yields and superior quality groundwater than that of the surrounding host rock. These contact zones usually produce yields ranging from 0.1 – 10 l/s and groundwater quality range from Class 0 to Class 3 depending on the composition of the sedimentary host rock.

The groundwater development potential of each of the quaternary catchments have been characterized using the criteria outlined as follows:

- The geological information underlying each quaternary and associated median yields for the geological formations.
- The ambient groundwater quality each of the geological formations.
- The renewable resource derived from rainfall recharge as a percentage of MAP over the effective surface area of the quaternary (base flow included in the estimates).
- Current utilization was calculated using the following assumptions
    - Handpumps - 250 l/hr for 12 hours = 3 kl/day
    - Motorized systems - 1000 l/hr for 10 hours = 10 kl/day

The potential extractable volume was derived from the difference between renewable groundwater resource (recharge) and current utilization (groundwater abstraction).

In general the overall groundwater quality in the ZDM is good (see Appendix 6), with the water quality in eDumbe, uPhongola and Abaqulusi LMs falling within Class 0 and 1 (Kempster Classification) and Nongoma and Ulundi LMs ranging from Class 0 to Class 4 (mostly due to the high NaCl concentrations). It is pertinent to note that a large number of the Traditional Authority areas are situated within these areas of poorer groundwater quality. The deterioration of groundwater quality from west to east, can be ascribed to:

- Declining rainfall from west to east.
- Concentration of dissolved solids from through flow below the Dwyka Formation and coal seams in the Vryheid Formation in the central and eastern regions of the catchments.

The sedimentary rocks that underlie the study area represent a secondary or fractured rock aquifer with negligible primary porosity or permeability. Groundwater storage and movement is therefore mainly confined to fractures and joints that occur within the rock mass, and is therefore structurally controlled.

The groundwater development potential within each of the quaternary catchments is adequate to meet the basic water demand of rural communities either through:

- Stand-alone basic levels of water supply by boreholes equipped with hand pumps; or
- Limited reticulation schemes through production boreholes that target structural features offering high groundwater development potential.

Groundwater monitoring

Owing to the fact that groundwater is utilised extensively in the supply of water services to the rural communities of the ZDM, it is important that groundwater levels and quality are monitored to ensure sustainability and SABS drinking water standards. The outbreak of cholera in KZN in 2000 resulted in extensive emergency work into the protection of surface water resources and sanitation supply. However groundwater quality is only occasionally monitored.

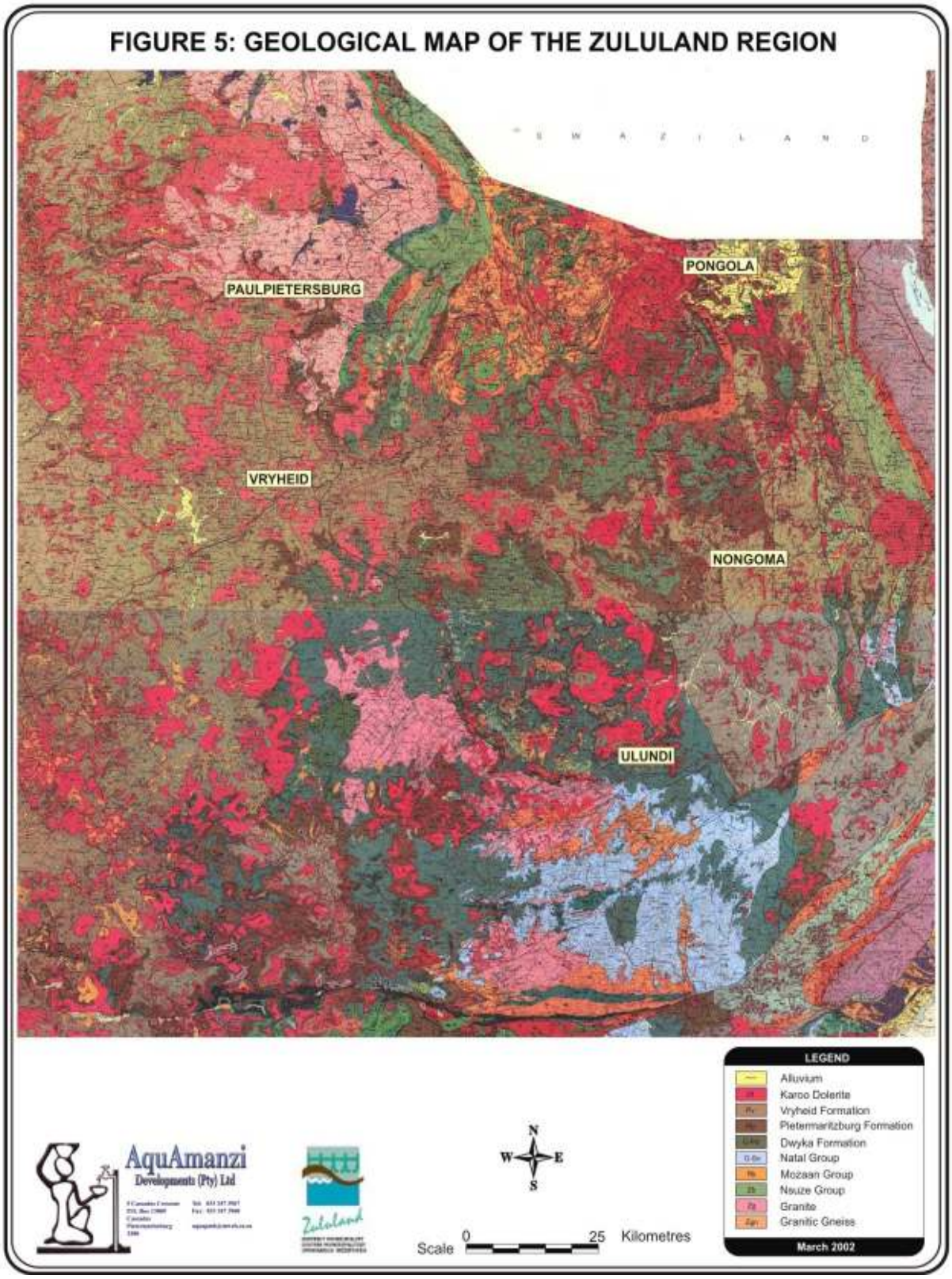
External sources (where the WSA purchases water from others)

All water currently supplied by the ZDM to the communities is from water resources within the DM's area of jurisdiction. However, as part of the regional scheme planning to alleviate the water services backlogs, the ZDM is approaching the surrounding WSAs to determine whether water can either be purchased from or supplied to others more cost effectively.

Water returned to resources

Water is returned through discharge from Wastewater Treatment Works (WWTW) in the urban areas into the Pongola and White Mfolozi River systems. However, the quantities of water returned to resources still needs to be obtained from the WWTWs and the current ZDM reporting systems will be extended to start monitoring the volumes discharged.

Figure 3.1: Geology of the Zululand District Municipality



3.2 Water quality

The quality of bulk water taken from the resource is measured at the source; water treatment works (WTW) and the reservoir (Table 3.2). More detailed information on water quality and monitoring frequency per WTW and WWTW is given in Section 7 of this document.

Table 3.2 (a): Water quality monitoring.

	At source	At treatment plant	At reservoir	At tap
Is water quality measured?	Yes	Yes	Yes	Yes
Do you monitor it yourself?	Yes	Yes	Yes	Yes
If no, who does?	n/a	n/a	n/a	n/a
Monitoring intervals	Daily	Daily	Daily	Monthly
Are these results available in electronic format?	Yes	Yes	Yes	Yes
% time (days) within SABS 241 standards per year	100	100	100	unknown

Monitoring of water quality within the rural areas is dependent upon the water source. Water supplied through boreholes and protected springs are not monitored for quality. In these instances the boreholes are not equipped, nor the springs protected if the water quality does not satisfy the SABS drinking water specifications. Water abstracted from surface water or supplied from urban areas is usually treated at a WTW and will have undergone the necessary quality monitoring and testing.

Reporting on quality of water:

ZDM has developed a water quality reporting system where all water quality test results are captured and management reports drawn for immediate interventions where needed. ZDM also reports monthly to DWAF on water quality results, as part of the DWAF regulation process. Table 3.2 (b) below shows such a water quality report that is produced on a monthly basis and that is used to monitor water quality in the district. Schemes that indicate inferior water quality results are then immediately acted upon to resolve such issues. The actual report for each month is available from the ZDM MANZI system on request.

The water quality system also produces a report on water quality trends the past 12 months as shown in Table 3.2 (c) below:

Figure 3.2 (a): Water quality trends the past 12 months

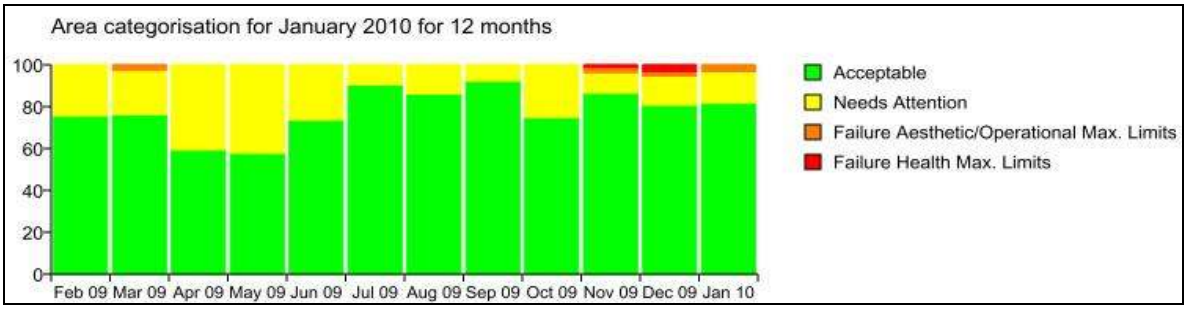


Table 3.2 (b): Monthly water quality report (January 2010)

SchemeID	Plant Name	Month	Year	No of Tests	Class	Colour	Description
2	Bloemveld	1	2010	22	II		Marginal water quality - conditionally acceptable, Negative effects may occur in some sensitive groups
13	Coronation	1	2010	11	II		Marginal water quality - conditionally acceptable, Negative effects may occur in some sensitive groups
14	Hlobane	1	2010	11	II		Marginal water quality - conditionally acceptable, Negative effects may occur in some sensitive groups
15	eDumbe Paulpietersburg	1	2010	19	I		Good water quality - suitable for use, rare instances of negative effects
21	Louwsberg	1	2010	11	II		Marginal water quality - conditionally acceptable, Negative effects may occur in some sensitive groups
37	Mpungamhlope	1	2010	19	I		Good water quality - suitable for use, rare instances of negative effects
38	Makhosini WTW	1	2010	10	I		Good water quality - suitable for use, rare instances of negative effects
40	Babanango	1	2010	19	II		Marginal water quality - conditionally acceptable, Negative effects may occur in some sensitive groups
45	Golela New	1	2010	17	II		Marginal water quality - conditionally acceptable, Negative effects may occur in some sensitive groups
47	Mandlakazi	1	2010	19	II		Marginal water quality - conditionally acceptable, Negative effects may occur in some sensitive groups
50	Enyokeni Royal Palace	1	2010	19	II		Marginal water quality - conditionally acceptable, Negative effects may occur in some sensitive groups
51	Kombuzi	1	2010	10	I		Good water quality - suitable for use, rare instances of negative effects
57	Imbile (Nongoma) WTW	1	2010	38	II		Marginal water quality - conditionally acceptable, Negative effects may occur in some sensitive groups
97	Ophuzane	1	2010	10	II		Marginal water quality - conditionally acceptable, Negative effects may occur in some sensitive groups
99	Tholakele	1	2010	10	II		Marginal water quality - conditionally acceptable, Negative effects may occur in some sensitive groups
104	Frischgewaagd	1	2010	19	II		Marginal water quality - conditionally acceptable, Negative effects may occur in some sensitive groups
106	eMondlo	1	2010	11	II		Marginal water quality - conditionally acceptable, Negative effects may occur in some sensitive groups
116	Msibi	1	2010	10	I		Good water quality - suitable for use, rare instances of negative effects
118	Nkosentsha	1	2010	10	IV		Dangerous water quality - totally unsuitable for use. Acute efects may occur
119	Belgrade	1	2010	19	II		Marginal water quality - conditionally acceptable, Negative effects may occur in some sensitive groups
120	Khiphunyawo	1	2010	10	IV		Dangerous water quality - totally unsuitable for use. Acute efects may occur
122	Khambi WTW	1	2010	10	II		Marginal water quality - conditionally acceptable, Negative effects may occur in some sensitive groups
125	Mountain View	1	2010	10	II		Marginal water quality - conditionally acceptable, Negative effects may occur in some sensitive groups
128	Osingisingini	1	2010	10	I		Good water quality - suitable for use, rare instances of negative effects
139	Ceza (Ezembeni Community)	1	2010	19	II		Marginal water quality - conditionally acceptable, Negative effects may occur in some sensitive groups
140	Sidinsi	1	2010	10	IV		Dangerous water quality - totally unsuitable for use. Acute efects may occur
147	Ulundi	1	2010	19	I		Good water quality - suitable for use, rare instances of negative effects
161	Pongola Town / Pongola Simdlangentsha	1	2010	19	I		Good water quality - suitable for use, rare instances of negative effects
163	Spekboom	1	2010	10	II		Marginal water quality - conditionally acceptable, Negative effects may occur in some sensitive groups
164	Khangela Royal palace	1	2010	19	II		Marginal water quality - conditionally acceptable, Negative effects may occur in some sensitive groups
165	Mvuzini WTW	1	2010	10	II		Marginal water quality - conditionally acceptable, Negative effects may occur in some sensitive groups
195	Nkonjeni Hospital	1	2010	19	II		Marginal water quality - conditionally acceptable, Negative effects may occur in some sensitive groups
334	Itshelejuba Hospital	1	2010	19	II		Marginal water quality - conditionally acceptable, Negative effects may occur in some sensitive groups
341	Thulasizwe Hospital	1	2010	19	I		Good water quality - suitable for use, rare instances of negative effects
350	Masokaneni WTW	1	2010	19	III		Poor water quality - unsuitable for use without treatment. Chronic effects may occur
351	WTW Rud Purim	1	2010	10	II		Marginal water quality - conditionally acceptable, Negative effects may occur in some sensitive groups

Quality of water returned to the resource

The water returned to the resources in the urban areas is from the WWTW and storm water systems. Monitoring of stormwater quality does not occur. The WWTW treat domestic wastewater and wet industrial effluent, and once treated the return effluent is sampled. The effluent produced by "wet" industries needs to be monitored and sampled to ensure compliance with the municipal by-laws in terms of discharge into the WWTW.

There is no formal wastewater treatment process in the rural areas as the rural areas are supplied through dry-pit VIPs and not waterborne sewerage systems. The quality of sewage returned to the water sources must also be monitored and reported to DWA on a monthly basis but at this stage limited information is available and useful reports do not yet exist.

Pollution contingency measures

The ZDM forms part of the Usuthu/Mhlathuze WMA and as such will form part of the CMA for this region. A proposal for the establishment of the Usuthu/Mhlathuze CMA has been put forward to national government. Once established the ZDM and all other water users within the Usuthu/Mhlathuze WMA will have input into, and have to comply with, the Usuthu/Mhlathuze catchment management strategy (CMS). This strategy should include pollution contingency measure/s that may be required to maintain the desired river reach classes. However, although groundwater forms part of holistic water resource management it is likely that this aspect may be treated as secondary by the CMA and it will therefore fall on the ZDM to ensure that they put suitable contingency measures in place.

3.3 Abstraction licenses and effluent permits

ZDM is in the process of registering all water and sewage works in the district with DWA. Shown below in Table 3.3 (a) is a list of the water and sewage works in the district and the status of the license registration processes.

Table 3.3 (a): List of water permits

WTW Name	Latitude	Longitude	Registration Status
Babanango Town	-28.398321	31.071465	Forms Submitted - Pending
Belgrade Township	-27.280166	31.279082	Forms Submitted - Pending
Ceza WTW	-27.995517	31.375931	Forms Submitted - Pending
eDumbe	-27.439965	30.820735	Forms Submitted - Pending
Makhosini	-28.356472	31.272092	Forms Submitted - Pending
Enyokeni Royal Palace	-27.959809	31.521190	Forms Submitted - Pending
Frischgewaagd Town/Blinkwater	-27.389440	30.954311	Forms Submitted - Pending
Itshelejuba	-27.276854	31.346154	Forms Submitted - Pending
Khangela Royal Palace	-27.738193	31.705480	Forms Submitted - Pending
Khiphunyawo	-27.311995	31.209771	Forms Submitted - Pending
Khombuzi WTW	-27.730019	31.727438	Forms Submitted - Pending
Mandlakazi RWSS	-27.680543	31.916534	Forms Submitted - Pending
Mountain View	-27.784817	31.427912	Forms Submitted - Pending
Mpungamhlope	-28.234665	31.271593	Forms Submitted - Pending
Msibi	-27.351458	31.206944	Forms Submitted - Pending
Mvuzini	-28.004120	30.679364	Forms Submitted - Pending
Nkonjeni	-28.228463	31.423898	Forms Submitted - Pending
Nkosentsha	-27.390240	31.254435	Forms Submitted - Pending
Ophuzane	-27.491598	30.939828	Forms Submitted - Pending
Osingisingini	-27.997320	31.685002	Forms Submitted - Pending
Pongola/Ncotshane Town	-27.389033	31.617976	Forms Submitted - Pending
Sidinsi	-27.955112	31.773067	Forms Submitted - Pending
SpekBoom	-27.304730	31.395382	Forms Submitted - Pending
Tholakela	-27.442931	30.970889	Forms Submitted - Pending
Thulasizwe	-27.951000	31.366717	Forms Submitted - Pending
Ulundi Town	-28.281655	31.340042	Forms Submitted - Pending
Nongoma Town	-27.962509	31.613695	Forms Submitted - Pending
Ncome	-27.944885	30.659276	Forms Submitted - Pending
Coronation RWSS	-27.677210	31.052570	Forms Submitted - Pending
Klipfontein	-27.791003	30.786818	Forms Submitted - Pending
Bloemveldt	-27.727868	30.746585	Forms Submitted - Pending
eMondlo Township	-27.971017	30.691998	Forms Submitted - Pending
Hlobane Region	-27.717325	31.031722	Forms Submitted - Pending
Louwsburg Town	-27.580634	31.271741	Forms Submitted - Pending
Enyathi Town	-27.813338	31.060888	Forms Submitted - Pending
Khambi RWSS	-27.773071	31.227059	Forms Submitted - Pending
Purim WTW	-28.016124	30.758741	Forms Submitted - Pending
Masokaneni WTW	-28.187636	31.738694	Forms Submitted - Pending

Table 3.3 (b): List of sewage effluent permits

WWTW Name	Latitude	Longitude	Registration Status
Pongolo WWTW	-27.38861111	31.61805556	Forms Submitted - Pending
Itshelejuba WWTW	-27.27341506	31.35323088	Forms Submitted - Pending
Dumbe WWTW	-27.40916667	30.81444444	Forms Submitted - Pending
Ulundi WWTW	-28.34812720	31.42949714	Forms Submitted - Pending
James Nxumalo WWTW	-28.33960865	31.39827575	Forms Submitted - Pending
St Francis WWTW	-28.22511079	31.47935490	Forms Submitted - Pending
Nkonjeni WWTW	-28.22638889	31.41916667	Forms Submitted - Pending
Ceza WWTW	-27.99833333	31.37777778	Forms Submitted - Pending
Thulasizwe WWTW	-27.95194444	31.36777778	Forms Submitted - Pending
Coronation WWTW	-27.66906843	31.06491781	Forms Submitted - Pending
Hlobane WWTW	-27.71695336	31.00818335	Forms Submitted - Pending
Vryheid WWTW	-27.79237777	30.78693412	Forms Submitted - Pending