Ncwabeni Off-Channel Storage Dam: Assessment of potential impacts on the Mzimkhulu Estuary

Prepared for:

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June 2012

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1 Introduction

The Mzimkhulu Regional Water Supply Scheme, which forms part of the KwaZulu Natal's Lower South Coast System, supplies water to the coastal region from Hiberdeen to Margate, including Port Shepstone. Water for this purpose is currently sourced from non-regulated river flows in the Mzimkhulu River. The water is abstracted at the St. Helen's Rock abstraction works near Port Shepstone and is pumped into the water treatment works, from there the water is distributed to the various user nodes.

Water supply infrastructure is currently at or near to capacity so in order to provide for the future water requirements for all user sectors, including the Reserve, the Department of Water Affairs (DWA) has proposed the construction of an off-channel storage (OCS) dam in one of the tributaries to the Mzimkhulu River. It is proposed that the reservoir be filled from its incremental catchment, supplemented by pumping from the Mzimkhulu River during times of high river flows. During times of low flows, water will be released back into the Mzimkhulu River for abstraction downstream at the existing St. Helen's Rock abstraction works (Figure 1). Two alternative sites have been identified for the OCS dam, the first in the Ncwabeni River (Alternative 2D) and the second in Gugamela River (Alternative D3A) (Figure 2).

The proposed project triggers certain activities listed in Government Notice No. R 544, R 545 and R 546, which require environmental authorisation in terms of the Environmental Impact Assessment (EIA) Regulations (2010) that were promulgated in terms of the National Environmental Management Act, 1998 (Act No. 107 of 1998) (NEMA).

Nemai Consulting was appointed by the Department of Water Affairs (DWA) as the independent Environmental Assessment Practitioner (EAP) to undertake the environmental assessment for the proposed Ncwabeni OCS Dam. Nemai in turn appointed Anchor Environmental Consultants to provide an Impact Statement regarding the significance of potential impacts of the dam and abstraction works on the Mzimkhulu Estuary based on available information.



Figure 1. Location of the St Helens Rock abstraction works on the Mzimkhulu estuary.



Figure 2. Map showing the location of the proposed dam on the Ncwabeni River (Alternative 2D, orange shading) and an alternative dam on the Gugamela River (pink shading). Source: Nemai Consulting (2012).

2 Structure of this report

This document is the Impact Statement addressing potential impacts of the project on the Mzimkhulu estuary and provides (1) a brief description of the proposed project, (2) a brief description of the affected environment (the Mzimkhulu Estuary), and its importance from a biodiversity conservation perspective, (3) an assessment of the significance of all potential impacts on the estuary associated with all project alternatives (direct, indirect and cumulative) using suitable evaluation criteria, and (4) recommends suitable mitigation measures as required. A statement of the significance of impacts associated with each issue is also provided, which specifies whether or not a pre-determined threshold of significance (i.e. changes in effects to the environment which would change a significance rating) has been exceeded, and whether or not the impact presents a potential flaw or not, both before and after application of impact management actions.

3 Project description

The proposed project will consist of the following components (Nemai Consulting 2012):

- 1. An Off-Channel Storage (OCS) dam on either the Ncwabeni River (site D2) or Gugamela River (site D3A);
- 2. An abstraction / gauging weir on the Mzimkhulu River;
- 3. An abstraction works with a mechanism to remove silt;
- 4. A pump station and pipeline to deliver water to the dam; and
- 5. An outlet infrastructure to make measured releases back to the Mzimkhulu River.

4 Description of the affected environment: the Mzimkhulu Estuary

This description of the Mzimkhulu estuary is drawn largely from a recent estuarine ecological water requirements study (Forbes *et al.* 2011) that was completed as part of the Mzimkhulu River Catchment Water Resources Study (Aurecon 2011). It should be noted that the overall confidence regarding the hydrodynamics of the estuary and hence the overall study was low, owing to the lack of historical water level data for the system, lack of good data on the state of the mouth, and the lack of a flow record just upstream of the estuary. This does not necessarily affect the accuracy of the information on the status of the system but may affect the accuracy of prediction made in the study.

4.1 Hydrology

The mean annual runoff for the Mzimkhulu estuary is estimated at 1 453 Mm³ p.a. in the reference condition and 1 176 Mm³ p.a. under present day conditions (i.e. 80.9% of natural). This places the Mzimkhulu amongst the three largest rivers in KZN, along with the Thukela and the Mkomazi systems. Flow in the river is highly seasonal, with most of the runoff (88.3%) occuring between November and April each year (Figure 3).



Figure 3. Seasonal variation in flow to the Mzimkhulu estuary. Data from Forbes et al. (2011).

4.2 Hydrodynamics and mouth condition

The estuary is estimated to extend approximately 9.5 km upstream from the mouth, based on measured salinities and tidal penetration (Figure 4). Forbes *et al.* (2011) report that the estuary used to close periodically in the past but that the frequency of close may have increased in recent times. They describe five abiotic states for the system based on mouth state and water quality characteristics (Table 1). Transition from one state to another reportedly may take place gradually or can occur within the space of a few hours.

Table 1.	Abiotic states for the Mzimkhulu estuary with associated flow ranges and estimated frequency of occur	
	during the reference (natural) and under present day conditions.	

Abiotic states	Flow Bange (m ³ /s)	Reference (% Occurrence)	Present Day
			(// Occurrence)
State 1: Closed mouth	<0.5	0.0	3.1
State 2: Intermittently closed	0.5-3.0	1.7	16.6
State 3: Open, marine	3.0-5.0	9.7	8.9
State 4: Open, brackish	5.0-20.0	35.8	23.8
State 5: Open, fresh	>20.0	52.8	47.6

4.3 Water quality

Water quality in the system is reportedly good despite the observed reductions in flow and other anthropogenic impacts on the system including bridge construction and rubble deposits placed in the middle reaches of the system, bank stabilisation, construction of a golf course on the south bank of the estuary, sand mining in the estuary, and agriculture in the catchment which has probably increased sediment inputs to the system. Average salinities in the system are estimated to be higher now than in the reference condition, particularly during the summer months when freshwater input

is lowest. Dissolved Inorganic Nitrogen (DIN) and Dissolved Inorganic Phosphorous (DIP) are also modestly elevated above reference conditions mostly as a result of anthropogenic inputs into the catchment.



Figure 4. Extent of the Mzimkhulu estuary (outlined in yellow).

4.4 Microalgae and vegetation

Microalgae (phytoplankton and benthic microalgae) under the present day conditions are reportedly similar to the reference state, but may exhibit localised increases in abundance when nutrient levels spike. Vegetation in around the estuary is also in a good state of health. Some riparian vegetation on the banks of the estuary has been lost due to the construction of the golf course and sugar cane plantations on the south bank, and through invasion by alien species.

4.5 Invertebrates, fish and birds

Zooplankton, benthic invertebrate and fish communities of the estuary are considered to be healthy and resemble those in the reference conditions reasonably closely. Some reduction in abundance of these faunal groups may have occurred due to habitat loss (bridge construction and sand winning – particular important for the benthic invertebrates), reductions in food supply and fishing pressure (affecting the fish and bird communities), and loss of fringing wetlands (affecting the bird communities in paticular).

4.6 Health and Conservation importance of the estuary

Forbes *et al.* (2011) evaluated the health and conservation importance of Mzimkhulu estuary in accordance with the method prescribed by DWAF (2008). On the basis of this evaluation, the estuary under its present state was allocated an Estuary Health Index Score (EHI) of 79 out of 100 or Category B (i.e. "Largely natural with few modifications", Table 2) and received an Estuarine Importance Score (EIS) of 84 out of 100, which corresponds to "Highly Important" category (Table 3).

 Table 2.
 Guidelines for the classification of the Present Ecological Status (PES) of an estuary based on an integrity score which indicates Present State as a percentage of pristine state (from DWAF 2008)

ESTUARINE HEALTH INDEX (EHI) SCORE	PRESENT ECOLOGICAL STATUS	DESCRIPTION
100 - 91	A	Unmodified, natural
76 – 90	В	Largely natural with few modifications
61 – 75	С	Moderately modified
41 - 60	D	Largely modified
21-40	E	Highly degraded
0 - 20	F	Extremely degraded

Table 3. Interpretation of the estuary importance scores

IMPORTANCE SCORE	DESCRIPTION
80 – 100	Highly important
60 – 80	Important
0 – 60	Of average importance

In additional to being categorised as "Highly important", the Mzimkhulu estuary is also listed as one of a core set of estuaries that should be at least partially protected in order to meet the countries biodiversity conservation targets (Turpie *et al.* 2010) and has been listed as" irreplaceable" in the KwaZulu-Natal (KZN) Systematic Conservation Plan.

5 Assessment of potential impacts for the project on the Mzimkhulu Estuary

The following observations are pertinent to the assessment of impacts for this study, and provide an assessment of the significance of the likely impacts of the proposed project on the Mzimkhulu estuary:

- The level of aforestation and abstraction of water from the Mzimkhulu catchment for agriculture and domestic and industrial use is likely to increase in the future under the "Do nothing" or status quo scenario and will lead to a gradual decline in the freshwater flows reaching the estuary over time, particularly in the low flow months (May-Oct each year), which are most critical for the estuary, leading to a decline in the health of the estuary.
- The implementation of the proposed OCS dams on the Ncwabeni River or the Gugamela River has the potential to mitigate the negative impacts of reduced freshwater flows during the low flow months by abstracting water from the mainstem of the system during the high flow months (November to April each year), pumping this water up to the dams and releasing it again during the low flow months. Mitigation will only be effective, however, if this scheme is able to ensure that flows reaching the estuary are not permitted to decline below present day levels.
- A potential positive impact on the estuary could be achieved by ensuring that releases from the dam during the low flow period are sufficient to restore flow levels at this time of the year back towards those experienced under natural conditions, and that any future increases in abstraction from the system are also maintained within reasonable limits.
- Projected yield for the two dams is very similar, at 23.0 Mm³ p.a. for the Ncwabeni River dam and 22.9 Mm³ p.a. for the Gugamela River dam. The likely difference between these two alternatives for the estuary is thus likely to be negligible.
- The projected pumping rate for the scheme is estimated at 0.5 m³/s, and if maintained at this rate would reduce the average flow rate during the high flow months (Nov-Apr each year) by a nominal 1.3% which is also very unlikely to have significant impact on the ecology of the Mzimkhulu estuary.
- The two proposed dams on are both off-channel storage (OCS) dams and as such they, along with the abstraction / gauging weir on the Mzimkhulu River, do not have the potential to influence flood flows in the systems, and hence impacts from this source are likely to be negligible.

6 References

- Aurecon 2011. Mzimkhulu River Catchment Water Resources Study. WP9900. Main Report. Report No. WMA 11/T50/00/3009. Volume 1. Prepared for Department of Water Affairs, Pretoria. 54 pp.
- Department Of Water Affairs And Forestry (DWAF) (2008) Water Resource Protection and Assessment Policy Implementation Process. Resource Directed Measures for protection of water resources: Methodology for the Determination of the Ecological Water Requirements for Estuaries. Version 2. Pretoria.
- Forbes, N.T, Forbes, A.T., van Niekerk, L., Taljaard, S., Huizinga, P. Allan, D., Connell, A.C., Bate, G. and C. McLean. 2011. Estuarine Ecological Water Requirements. Mzimkhulu River Catchment Water Resources Study. Report No. WMA 11/T50/00/3009. Volume 6. Prepared for Department of Water Affairs, Pretoria. 107 pp.
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