MBOZA RIVER BRIDGE
No.3513
STORM WATER MANAGEMENT pLAN

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CONTENTS

1 INTRODUCTION

1.1 Background

The communities of Nyawo, Mashabane and Tembe Tribal Authorities in Ward 13 of the Umhlabuyalingana Municipality Local Municipality and Ezinhlabeni area do not have access to cross the Pongola River to access service facilities at Mboza. The facilities to the east are community Halls at Mboza, Mboza B Clinic, Mboza Primary School, Mshanguzana Primary School and Manaba Primary School. The social facilities to the west are Holy Farm Primary School, Mdladla health Centre and Munyu Primary School.

The nearest bridge crossing the Pongola in this area is about 12km away to the south (on D2375) and to the north the nearest bridge is about 18km away at Skemelele on P522. Currently the community crosses Pongola River by boat or dangerously by foot. The crossing point they use has in excess of 1m deep of water throughout the year. Famers and taxis do not have a nearby vehicle crossing point.

Initially a pedestrian bridge was planned for the area but this was changed to a road bridge to cater for the full requirements of the community.

The joint venture between Royal Haskoning DHV (Pty) Ltd (former SSI Engineers and Environmental Consultants), Impendle Consulting (Pty) Ltd was appointed by the KwaZulu Natal Department of Transport for the design and supervision for the bridge road approaches.

Services required from the engineering consultant were:
Road, Pavement and Structural design
Contract documentation
Tender evaluation
Construction supervision

1.2 Site Locality and Description

The site in located in Umkhanyakude District Municipality (DC27) on the Pongola River about 3,5km to the west of Mboza Clinic off District Road D1834 (geographic co-ordinates 27°11'16.67"S 32°14'20.99"E). The bridge will provide a link between D1834 to the east and D1836 to the west. The bridge locality is shown in Figure 1.2 below.

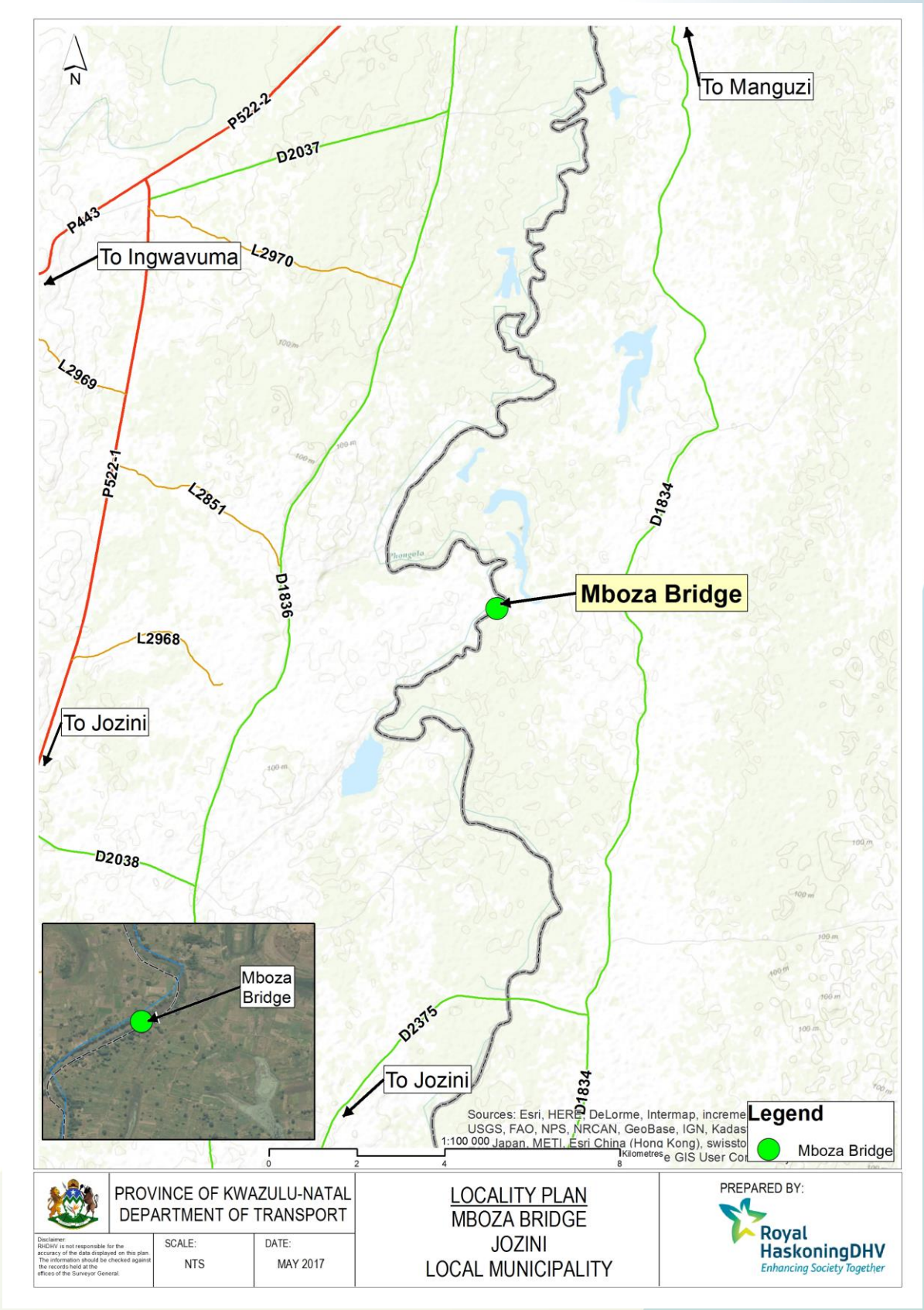

Figure 1.2: Pongola (Mboza) River Bridge Locality

2 OBJECTIVE

2.1 "*Man and the Pongola Flood Plain*"

This is a snap shot summary of *"South African National Programmes Report No 56 Dated June 1982."* This was a report to the Committee for Inland Water Ecosystems National Programme of Environmental Sciences authored by J Heeg and C M Breen and prefaced by W J R Alexander.

In the Preface W J R Alexander wrote:

"Long protected by nagana, malaria, and sandy soils which made access by motor vehicles difficult, the Pongola floodplain was one of the last remaining undisturbed areas in South Africa. Then the tsetse flies were eradicated, malaria controlled, and roads were built. Now the Pongola River itself has been harnessed by construction of the large Pongolapoort Dam, and in the not too distant future the flood plain will be surrounded by irrigated lands. The population in the area will increase and some agriculturally –oriented industries may be established…….
However it was soon realised that the need for conservation could not be separated from the need for planned development…"

Construction of the Pongola Bridge at Mboza is part of the planned development to promote growth of agro industries in the now well cultivated flood plain and provide the communities with access to services.

2.2 Summary of objectives

The primary objective of the report is to outline the Storm water Management Plan for the construction of then Pongola River Bridge at Mboza. The objectives include the following:

- Protecting all life and property from damages by floods and storm water.
- Protecting the water resources in the catchment areas from pollution and siltation.
- Protecting and enhancing the watercourses locally and downstream.
- Conserving the natural flora and fauna in the environment.
- Preventing soil erosion by wind and water.

This report has been prepared to provide details of the generic analysis to ensure that adequate drainage measures are implemented to promote the dissipation of storm water run-off, during and after construction.

3 STORM WATER MANAGEMENT: Erosion

3.1 Erosion Mitigation Main Channel: Design Measures

The main aim of the proposed storm water system is to conserve the natural drainage system around the development alignment.

a) The main bridge has been designed to take even a 1 in 100 year flood without constricting the river channel.
b) The bridge spans have been made long (17,5+25,0+17.5) total 60m metres this prevents any tree logs and debris from blocking the waterways and causing erosions in the flood plain.
c) Only two piers are in the main channel and this prevents water constriction.
d) The provided bridge configuration allows normal water flow that is normal being up to 1 in 10 year return period flows to remain in the original 55m wide main channel (see Annexure A)

thus preventing ecological damage to the flood plains. I this case even the 1 in 50 flood only gets to the top of the main channel.

e) The bridge structure does not constrict the water such that the flow velocities are less than 2m/sec and these do not induce undue stress on the existing ecology.

f) The bridge is not submersible under any flood hence safe for the local users.

3.2 Erosion Mitigation Bridge Approaches: Design Measures

Design for flood plains is different from that of conventional roads. When the flood gates are opened the water submerges the flood plain providing irrigation and sediments for the agricultural land. When the flood is normal the flood plains are accessible again. The bridge will to allow the community use during all times, when gates are opened and when the water has recessed. The access is such that when the water is flooded in the plain there are no erosions to the access and when the water has receded the access and bridge are usable again. This scenario is achieved the following design measures;

a) Provision of 50m long ramps on either side protected with gabions founded 500mm into the ground and secured to the fill slopes and reinforced concrete paving (see Annexure B).

3.3 Erosion Mitigation Flood Plain Road: Design Measures

a) The access road in the flood plain will be provided with a concrete paving at natural ground level or up to 300mm above natural ground level and keyed into the ground (see Figure 3.3 (a) below).

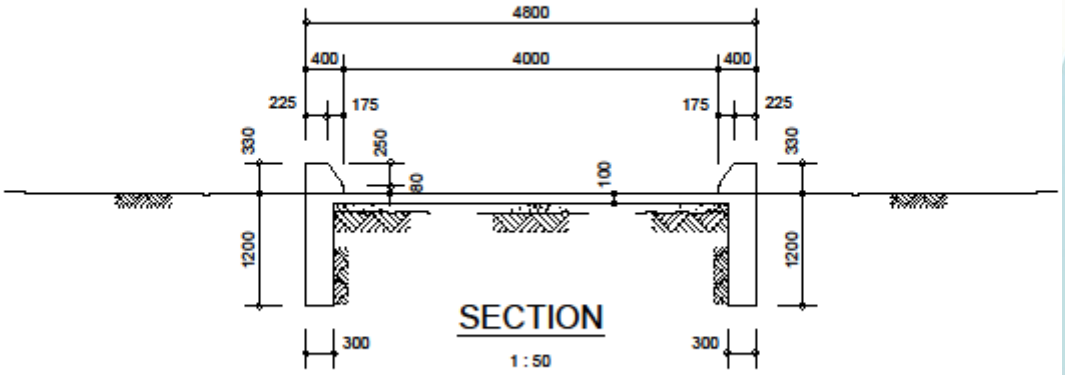

Figure 3.3 (a): Paved road with cut off walls

3.4 Erosion Mitigation Flood Plain Storm Water Pipes: Design Measures

a) The deeper areas in the flood plain will be provided with low lying 1800x1800mm culverts to allow water under as well as allow peak floods over without causing erosion and without trapping debris. The large culvert openings are to prevent blockings and to allow ease of maintenance. Smaller culverts would easily block and would not allow a person to fit through during maintenance. See example photos in Figure 3.4 (a) below.

Figure 3.4 (a) (i):ZPC3691

Figure 3.4 (a) (ii):ZPC3691

Figure 3.4 (a) (iii) ZPC3691

Figure 3.4 (a) (iv) ZPC3691

These photos are for culvert number ZPC3691 on D1861 on the Pongola River about 25km downstream of the Mboza site. This solution is working very well and is the planned solution at Mboza. Except the corrugated pipes will be replaced by concrete pipes which are more durable. These photos were taken in 2012.

b) To demonstrate that this solution works we refer to Figure 3.4 (b) below. The photos below are on the Pongola River about 12 km upstream on D2375 culvert number STC3780. Apart from the pipes being too small, the pipes do not have a concrete cover slab and the gabions impede flow instead of allowing flow over the structures. These pipes cause high velocities and erosion and are always damaged. This (Figure 3.4 (b) is an example of what not to do on the Pongola at Mboza. These photos were taken in 2012.

Figure 3.4 (b) (i):STC3780

Figure 3.4 (b) (ii):STC3780

c) The scenario on D1861 as per example in Figure 3.4 (a) above would keep the status quo as well as providing the locals with a firm access road to the all-weather bridge.

3.5 Erosion Mitigation Main Channel: Maintenance Measures

Irrespective of the design measures provided in items 3.1 to 3.4 above some debris will be trapped on the concrete pavement as well as on the low lying culverts and the debris must be removed regularly. The region shall be advised to have a maintenance system where the local famers maintain the access road by removing debris and keeping the roadway clean and safe. Department of Transport already have such a system in most areas and they call it Zimbambele Road Maintenance system.

4 STORM WATER MANAGEMENT: Construction

4.1 Erosion Mitigation during Construction

Stormwater Management encourages the developer, professional teams and contractor to conduct the following aspects:

Maintaining adequate ground cover at all times and in all areas to negate erosion caused by wind, water and vehicular traffic.

- Preventing the concentration of stormwater flow where the soil is susceptible to erosion.
- Adding devices to reduce the stormwater flows to acceptable levels.
- Ensuring that the development does not increase the stormwater flow above that of which the natural ground can safely accommodate.
- Ensuring that the construction of the stormwater devices is carried out in safe and aesthetic manner.
- Containing soil erosion during construction.
- Avoiding conditions where the embankments may become saturated and unstable.

Poor stormwater management can result in the stormwater causing erosion and flooding.

Suitable erosion control measures shall be implemented at stormwater discharge points, exposed areas and high embankments. These measures may include the following options:

- Sand bags on trenches (trench breakers).
- Bunds or grips adjacent to watercourses.

- Technologies similar to Soil Saver on embankments.
- Planting of indigenous vegetation on embankments.
- Minimise clearing and grubbing to necessary sections within the road reserve.
- Over-wetting, saturation and unnecessary runoff during dust control, curing and irrigation activities will be avoided.

Sandbag berms will be placed at regular intervals on all steep slopes and on the trench line before and after backfilling in order to minimise erosion and the discharge of contaminated storm water runoff into water courses.

If there is a scour risk or risks that potholes may form on the existing roads, it can be managed by using suitable gravel to temporarily repair the scouring or potholes.

5 STORM WATER MANAGEMENT: Pollution

Pollution and or contamination of the surface water and stormwater must be well controlled. This can be achieved by managing activities such as:

- Mixing concrete on wooden boards in a plastic lined and leak-proof area.
- Removing all surplus material from the watercourse.
- Reducing spills of hazardous substances (e.g. Fuel).
- Opening of frequent chutes on long steep grades with unlined drains.
- Ensuring that banks are re-vegetated as soon as construction work is completed.
- Avoid water contamination by construction as well as general traffic.
- Containing the first-flush runoff, collectively or individually.

The stormwater system must be maintained to remove and reduce debris that may pose any pollution risk. The lack of maintenance will lower the transportation of the runoff to the existing watercourses and which may cause flooding.

6 STORM WATER MANAGEMENT: Flooding

The proposed upgrade will not increase the stormwater runoff significantly as the bridge is designed to take a hundred year flood.

The approach road is generally at ground level and does not change the flow regime at the site (see item 3 above)

The design of the stormwater system addresses the above issues and was designed as such that the post-development flood risks are not greater than the pre-development flood risks.

ANNEXURE A

A: Bridge Longitudinal Section

ANNEXURE B

B: Bridge Protection Works