MOKOLO AND CROCODILE RIVER (WEST)

WATER AUGMENTATION PROJECT

TRAFFIC MANAGEMENT PLAN

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1. INTRODUCTION

1.1 Background

Due to the current insufficiency of electricity throughout the country, ESKOM has been compelled to fast track the building of additional power stations to compensate for the chronic deficits. To this effect, plans are underway for major developments for the Waterberg coalfields located in the Lephalale area. As a direct result of these developments, it is anticipated that water demand will increase considerably in the next 20 years within the Lephalale area.

The Department of Water Affairs (DWA) has commissioned a feasibility study to determine how future water demands could be met. Due to the insufficient availability of water in the Lephalale area, a project has been identified to augment the existing water supply from Mokolo Dam, together with a water transfer scheme from the Crocodile River (West).

Nemai Consulting has been appointed by DWA to conduct Environmental Impact Assessments for the Mokolo and Crocodile River (West) Water Augmentation Project. The project is divided into distinct phases, with the first phase being the augmentation of the existing water supply from Mokolo Dam to Wolvenfontein balancing dams, Matimba Power Station and Steenbokpan area. The second phase of the project entails a transfer scheme from the Crocodile River (West) at Vlieëpoort near Thabazimbi to the Lephalale area. The final phase is the de-bottlenecking of the existing pipeline from Mokolo Dam to the Lephalale area.

During the scoping process for both Phase 1 and Phase 2, traffic impacts associated with the construction phase were identified as potential issues that required suitable management.

Kitso Engineers have been appointed by Nemai Consulting to undertake a Traffic Management Plan to address impacts associated with the construction of the pipeline and associated infrastructure, including the transportation of materials to and from borrow pits and delivery of pipes to site. The envisaged management plan will be a high-level plan indicating management measures, including best-practices, and recommendations on a monitoring programme during construction.

1.2 Study Area

Phase 1 of the project commences at Mokolo Dam, to the south-east of the study area. The augmentation pipeline follows the alignment of the existing Exxaro pipeline, traversing in a north-westerly direction until the Zeeland Water Treatment Works and the Matimba Power Station off-take. The alignment then turns westerly towards the Steenbokpan area. The locality of the pipeline is indicated in **Figure 1** below.

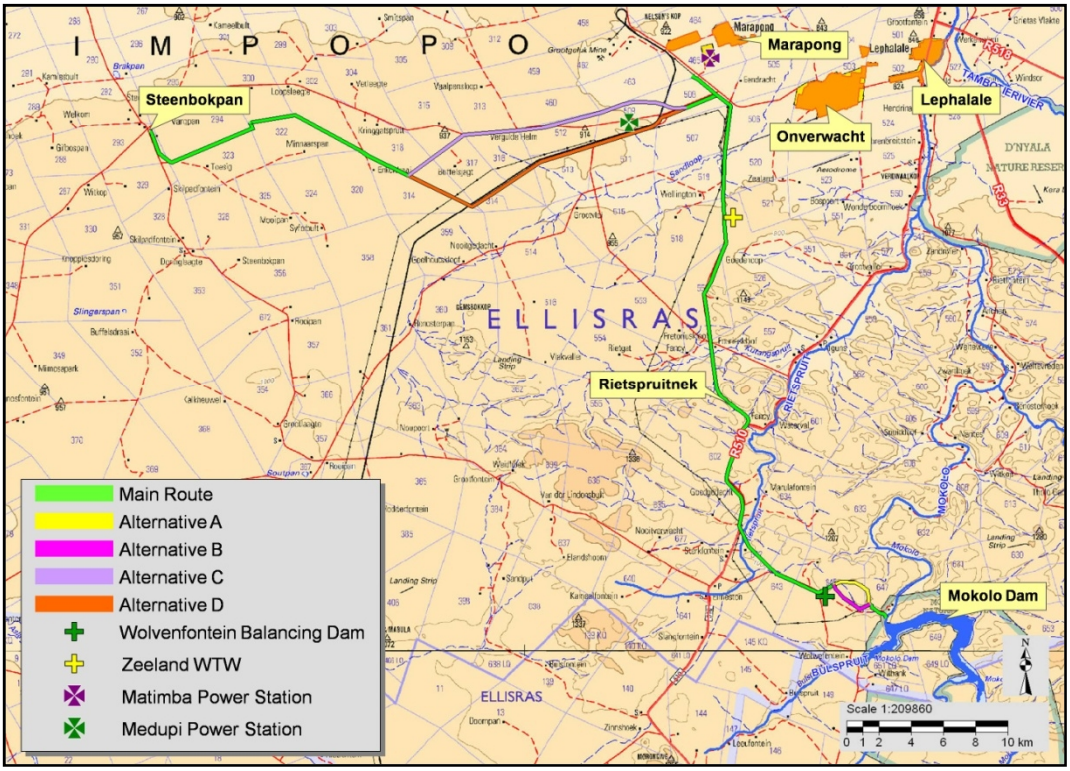

Figure 1 Locality Plan (Phase 1)

The route for the Phase 2 water transfer scheme commences on the right bank of the Crocodile River at the Mooivallei Farms, to the Break Pressure Reservoir (BPR) 18km north of Thabazimbi and along the R510. The gravity main then continues northbound to the Operational Reservoir (OR) located approximately 20km south-east of Steenbokpan, and follows the alignment of the existing railway line. This phase is finally completed with a delivery line from the OR to Steenbokpan, thus connecting to Phase 1 of the project. The locality of the transfer scheme is indicated in **Figure 2** below.

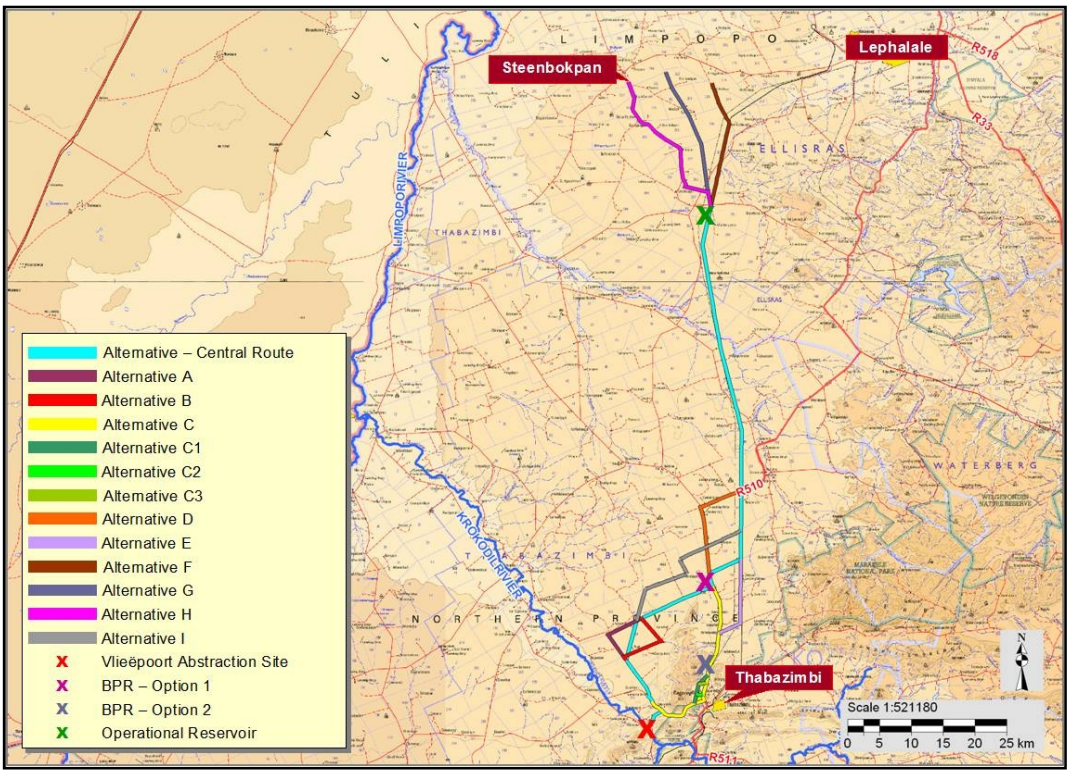

Figure 2 Locality Plan (Phase 2)

1.3 Objectives

The preparation of a Traffic Management Plan and proper implementation of measure identified in the plan is essential to ensure safety to all road users as well as workers at respective sites. The preparation of such a plan will also ensure the efficient operation of the road network together with construction activities on site.

This Traffic Management Plan is a high-level desktop study, which should form a precursor for a detailed Traffic Management Plan forming part of an all-encompassing Construction Management Plan.

This plan has been prepared based on international literature and similar studies, and the South African Road Traffic Signs Manual Volume 2 – Chapter 13 Roadworks Signing.

2. GUIDELINES FOR TMP

2.1 Scope of TMP

The scope of a detailed traffic management plan includes provision for the safe movement of vehicular and pedestrian traffic, the protection of workers from passing traffic and construction vehicles, the provision of access to properties, the design, construction, maintenance, and removal of temporary roads and detours, provision of traffic controllers, the installation of temporary roads signage, road markings, lighting and safety barriers.

The detailed TMP should also address routine maintenance of the existing road corridor and detours used for temporary diversion of traffic, communication protocols of the plan, and incident and accident reporting and management.

2.2 Format of TMP

In order to develop a detailed and appropriate Traffic Management Plan during the construction phase, the following issues would be addressed in detail:

2.2.1 Description or Detailed Plan

A detailed description or plan should be provided for the proposed works and construction sites, together with proposed road closures, detours and lane restrictions where applicable. The closure types include, for example, number of lanes and length of road affected from the works and construction sites and the number of lanes available for through traffic.

The above may take the form of a detailed plan where there are a large number of measures which are best described in a plan. This plan could also indicate the road hierarchy proposed as a result of the proposed measures. In the event that simple measures are implemented, a written description will suffice.

2.2.2 Identification and Assessments of Impacts

The assessment should include approximate classified traffic flow data (e.g. light / heavy / public transport / pedestrians / non-motorised etc.) for the roads and intersections affected, including the re-assignment of traffic, intersection and accident analysis and co-ordinated modelling where necessary.

The assessment should also include possible impacts on adjoining properties, and in particular access arrangements.

2.2.3 Traffic Management Measures

Details should be provided of provisions to ameliorate and minimise the impact of re-assigned traffic as a result of road closures and / or lane restrictions. This will become crucial particularly where national, provincial and district roads are affected.

The proposed mitigation measures can include, amongst others, traffic controllers, part closures and detours.

2.2.4 Assessment of Public Transport Services

Public transport service that may be affected by the works should be detailed, and provisions be made to minimise impact on such services. In the development of such measures, it must be ensured that adequate communication and notification of such measures is undertaken.

2.2.5 Public Consultation and Notification Process

This process entails consultation and notification of the public directly affected by the proposed works and mitigation measures. The interested and affected parties that were identified in the EIA process can be used as a reference group for such consultation. These parties can furthermore include land owners, public transport operators, business, law enforcement agencies, road authorities, and government departments.

2.2.6 Provisions for Emergency Vehicles / Heavy Vehicles and NMT

Details should be provided of provisions made for emergency and heavy vehicles, together with non-motorised transport such as pedestrians, cyclists and animal-drawn carts.

2.2.7 Assessment of Effects of Measures

The assessment should describe the transport implications on all existing and future developments as a consequence of the proposed traffic management measures. The assessment would include forecasted traffic flow data for roads and intersections of adjoining roads. Specific attention should be drawn to the roads where traffic is proposed to be detoured.

In addition to the above, the detailed traffic management plan should include details such as the location of the various construction works, relative to adjoining roads and properties. The details of the relevant contractor and client, including their representatives, should be included in the TMP. The construction schedule, where possible, should form part of the plan. The TMP should be available on site for inspection by whoever has the authority and jurisdiction to do so.

3. PROJECT DESCRIPTION

3.1 Phase 1: Augment Supply from Mokolo Dam

The following are the major scheme components of Phase 1 of the project:

- High lift pump station at Mokolo Dam
- 900mm diameter rising main for ± 5.7 km
- Maximum 1900mm diameter gravity main for ± 7.8 km

A new pump station will be constructed downstream of the existing pump station at Mokolo Dam. This pump station will be at a higher level, thus limiting the probability of flooding. The station will abstract water from the dam via one of the two existing outlet pipes.

A new rising main will be constructed from the pump station to the balancing reservoirs at Wolvenfontein. Various structures and facilities associated with pipelines will be installed en-route, with the road crossings having a direct impact on traffic during construction.

The final component of this phase is the gravity pipeline system delivering water to the end-users supplied by Mokolo Dam. These will include the power stations, water treatment works, and consumers in the Steenbokpan area. The road crossings will also have a direct impact on traffic operations during construction.

3.2 Phase 2: Transfer Scheme – Crocodile River (West)

The following are the major scheme components of Phase 2 of the project:

- Concrete weir and primary de-silting works at Vlieëpoort
- Abstraction works with low-lift pump station
- Balancing dams and high lift pump station
- Gauging weirs
- Rising main from pump station to a BPR
- Gravity Main from the BPR to the OR
- Delivery line from OR to Steenbokpan

A number of possible extraction weir sites were evaluated for suitability along the Crocodile River (West). Factors that were considered were the topography, access, founding conditions and river morphology. The Vlieëpoort site is regarded as the preferred option due to more favourable topographical conditions, shorter rising main to the BPR, and better founding conditions. The construction of the weir will impact on gravel road D727 on the left bank, as it will need to be raised locally at the weir.

The low-lift pump station is divided into several separate pumping bays, with electrical supply to the site via overhead cables to a switchyard. The balancing reservoirs will be in the

form of artificial dams formed by shallow excavation and surrounding earthfill embankments. The de-silting works with flushing facility will be located next to the balancing reservoir within the earthfill embankment. A new pump station will be constructed below the balancing reservoirs.

Access to the site will be provided by a new access road that closely follows the alignment of the existing road, and will be dependent on the final location of the balancing dams. The existing alignment will need to be diverted around the balancing reservoir and high-lift pump station, before continuing on the existing alignment of the access roads to the farms of Mooivallei. An existing road will be extended by an additional of 1.5km along the low pressure pipeline to the low-lift pump station.

4. ROAD INFRASTRUCTURE

Important and existing major road networks within the vicinity of the study area for Phase 1 and Phase 2 are indicated in **Figure 3** and **Figure 4** respectively and discussed below.

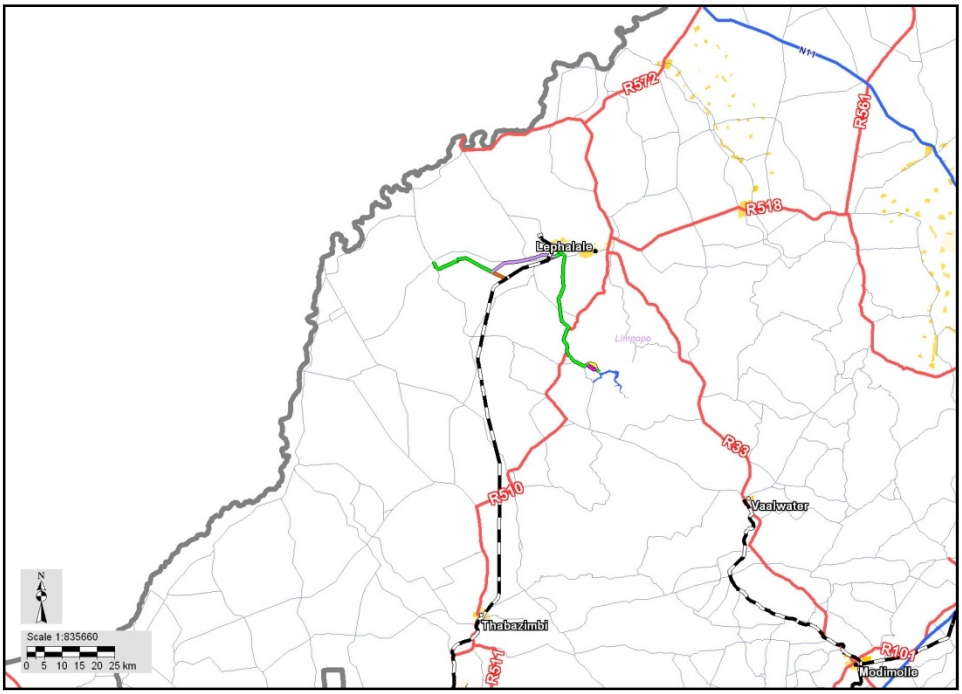

Figure 3 Major Road Network (Phase 1)

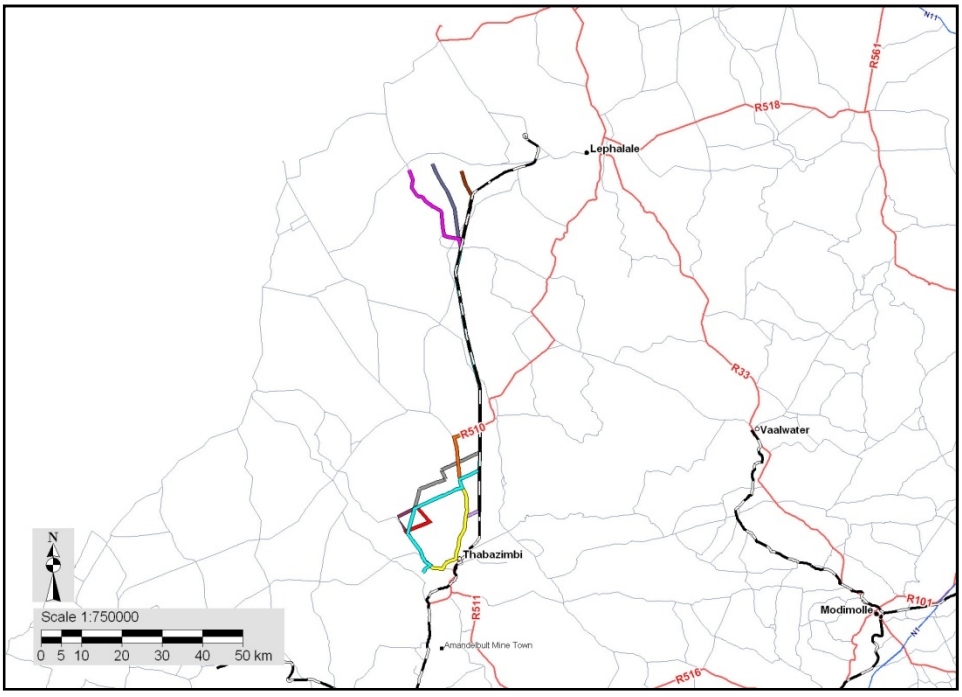

Figure 4 Major Road Network (Phase 2)

4.1 National Road Network

- N1 – This is a national road of cross-border significance, linking the RSA with Zimbabwe. It traverses in a north-east and south-west direction to the far south-east of the site. The road is in excess of 100km from Mokolo Dam, and it can be expected the project will not directly impact on the road.
- N11 – This is a national road of provincial and cross-border importance. The road commences from the N3 in KwaZulu-Natal and terminates at the Groblersdrift Border Post with Botswana. The road traverses in a north-west and south-east direction in the vicinity of the study area, and is in excess of 90km from Mokolo Dam.
- R510 – is an inter-provincial road falling within the jurisdiction of the South African National Roads Agency Limited (SANRAL). It commence in Rustenburg in the Northwest Province and traverses in a north-south direction through Thabazimbi and onto Lephalale in Mpumalanga. The road continues as the R572 to the far north of the study area, approximately 70km north of Mokolo Dam

4.2 Provincial Road Network

- P84/1(R517) – This is a provincial road that commences in Modimolle in the south-east and traverses through Vaalwater, before continuing in a north-westerly direction and connecting with the R510. The road diverts to the west from the R572 / R510 intersection north of Lephalale, and terminates at the Stockpoort Border Post with Botswana.
- P19/2 (R518) – This is a provincial road linking the town of Marken in the east with Lephalale in the west. The road traverses in an east-west direction to the north of Mokolo Dam, and will not be directly impacted upon by the project.
- P198/1 (R33) –The road traverses in a north-south direction providing connectivity between Vaalwater and Lephalale. The provincial road is located directly to the east of Mokolo Dam.
- P16/2 – This is a provincial road following the alignment of the R510 through Thabazimbi. The road diverts in a north-westerly direction from the R510, to the north of Thabazimbi. This road will be directly impacted by the transfer scheme pipeline, which is expected to follow its alignment or cross it at certain places, depending on the final pipe alignment.
- P110/1 (R511) – This is an inter-provincial road linking Brits in the Northwest Province with Thabazimbi. The road intersects with the R510 directly to the south of where the transfer scheme is expected to commence.
- P20/1 (R516) – This road is the main link between Bela-Bela in the south-west with Thabazimbi, and is not directly influenced by the project.
- D1649 – This is a provincial road traversing in an east-west direction directly linking Thabazimbi with Dwaalboom in the west. The road is located directly to the north of

where the transfer scheme commences, and is directly impacted by the proposed transfer scheme as it crosses the road.

- D175 – This road is located directly to the north of the proposed operational reservoir of the transfer scheme. It is a provincial road that commences from the R510, and traverses in an east-west direction in the vicinity of the site. The delivery line to the Steenbokpan area is expected to cross this road.

4.3 District Road Network

- D2649 – This is a district road traversing in a north-west and south-east direction, linking the R510 in the east with the D1675 in the north. The augmenting pipeline is expected to cross this road both in the south-east and north-west, depending on the final pipe alignment
- D1925 – This is a north-south district road that connects the D2649 in the north with the D2701 in the south. The delivery line of the transfer scheme is expected to cross this road.
- D2701 – The road traverses in a north-west and south-east direction. It connects the R510 in the south with the P16/2 in the west. The district road will be crossed by the central route of the transfer pipeline.

5. ACCESS

This chapter of the report briefly describes site access arrangements and access roads that will be impacted upon by the pipeline alignment for the augmenting and transfer scheme.

The initial section of the Phase 1 pipeline from Mokolo Dam follows the existing access road to the dam for approximately 2,5 km in a north-westerly direction. The pipeline then continues along the access road for ± 3km, where it feeds into the balancing dams.

From the balancing dams, the pipeline follows the alignment of road D2132, which is a gravel district road. The route then deviates in a northerly direction, following the alignment of a minor access road, before turning further to the north.

After crossing the Rietspruit River, the pipeline follows the alignment of the R510, which falls under the jurisdiction of SANRAL. The pipeline continues for approximately 7km, before diverting north-westerly along an existing pipeline. The route crosses district road D2649, a gravel road, ±5,3 km west of its intersection with the R510.

The route continues in a north-westerly direction along an access road, before diverting north-easterly approximately 3,2km north of it crossing road D2649. The route continues for approximately 3,4km before proceeding northbound towards the Zeeland Water Treatment Works and beyond.

From the Zeeland Water Treatment Works, the route continues in a northerly direction along an access road, before diverting to the north-west along provincial road D1675. The pipeline crosses this road at its intersection with district road D2001, before terminating at the Matimba Power Station.

Two alternative route alignments are proposed for the gravity line from the Matimba Power Station to serve the Steenbokpan area. The first route, which is the preferred option, branches to the west before turning south-westerly to follow the alignment of provincial road D1675 in a westerly direction for approximately 14,4km. The route then diverts south-westerly along a gravel access road to merge with the second alternative route. It should be noted that the in order to merge with the second alternative, the preferred option has to traverse on open land for approximately 1,85km, and doesn't follow any pre-existing access road.

The combined final route traverses in a north-westerly direction for ±8,1 km before turning south-westerly. The route continues in that direction for approximately 8,7km. The route then redirects in a north-westerly direction towards its termination point at the Steenbokpan area.

The second phase of the project, the transfer scheme, commences on the right bank of the Crocodile River. Various route alternatives have been considered, but the central route will further be discussed in detail.

The transfer scheme commences at the Vlieëpoort Abstraction Site located to the north-east of the Crocodile River (West) and to the west of Thabazimbi. The route traverses on an existing road in a north-easterly direction, towards it intersection with provincial road D1649.

The route follows the alignment of road D1649 in a north-westerly direction for ±2,9km, from where it continues in the same direction on the alignment of Rooibokkraal Road (D769). The route then redirects to the north-east to follow the alignment of the Eskom power line servitude. It then continues for approximately 6,5km along the servitude prior to turning further to the north-east. This route follows the alignment of an existing gravel access road for ±12,2km until its intersection with the R510 from Thabazimbi.

The route, which includes the break pressure reservoir for the central alternative, continues on the alignment of the R510 for approximately 2,1km prior to rerouting in a north-easterly direction towards the railway line. At the rail way line, the route diverts northbound, following the alignment of the railway line for approximately 55km before terminating at the proposed operational reservoir immediately to the south of provincial road D175. The route crosses national road R510 and district road D2701 along this section of the alignment.

Three alternatives have been considered for the delivery system from the operational reservoir to the terminal point. At present a preferred route for the delivery pipeline has not been identified. However, comments from interested and affected parties from the public participation process during the scoping phase suggested that Alternative F is the preferred option.

The proposed delivery alternative continues in a north-easterly direction along the alignment of the existing railway line for approximately 14km from the operational reservoir. This alignment crosses the D1925, which is a gravel road. The route then diverts in a north-westerly direction, terminating immediately to the south of provincial road D1675.

In light of the above route alignments for both the augmenting and transfer scheme, it is evident that significant sections of the alignment follow existing gravel access roads and the railway line alignment respectively. In certain sections, the route follows the alignment of national, provincial and district roads such as the R510, D175 and D2649.

The alignment along existing road infrastructure was an influential factor in the route selection process, as these sections would be less environmentally sensitive due to the environment already being disturbed. This proposed route alignment therefore enjoys good accessibility from the existing road network, barring the sections traversing along the power line servitude and section through open land.

6. TRAFFIC MANAGEMENT

This chapter of the report address traffic management measures to be adopted at temporary road works, with specific reference to the envisaged road crossings. It is not possible to predetermine how all crossings and construction sites will be managed, as there are too many variables. Nonetheless, it is necessary to develop standardised approaches to the traffic management of the roadworks sites. These management measures could then be applied to the more complex situations.

The standardised layouts that have been developed in the road signs manual have been used and documentation extensively over the years. It will nonetheless be necessary to adopt a structured planning process during the execution of a detailed construction management plan.

In order to have more efficient and safe site operation, a systematic break-down of a site into standardised sub-components is necessary. This will allow the site supervisor to clearly understand the traffic operation of the site. These sub-components could be several hundred metres in length at major sites, or a few metres at much localised sites. These standardised sub-components are discussed in detail below.

6.1 Warning Area

This is the area of the construction works that is used to alert motorists of impending temporary conditions that will require particular care. A stepped reduction in speed will inevitably be required within this area. This stepped reduction should occur to 20 km/hr decrements and in reasonable intervals (minimum 200 metres), until the speed for which the traffic control is designed is indicated. This final speed limit should be repeated at least once as good practice.

The length of the advance warning area should relate directly to measured approach speeds, and a reasonable distance must be allowed for speed reduction. In situations of high traffic volumes, a generous length will be required as more time is needed to take in the sign message and to react accordingly. The advance warning area will become longer in the event of a combination of higher approach speeds and high traffic volumes.

6.2 Transition Area

This is the area in which the motorist is required to take an action. This action can be in instances where the is a shift of position on the roadway without a reduction in the number of lanes (diversion), merge of two lanes into one (lane drop), crossing of the central median (crossover), or entering a detour that is completely separate from the construction works.

The transition area must be clearly demarcated using delineator plates and should confirm to the layout, if any, depicted on the guidance signs preceding it. In more complex roadworks, these should be broken down into a number of standard transition areas. Care should be taken that no signing for subsequent transition conditions is included within a specific transition area.

The length of a transition area will depend on the approach speed of traffic and the amount of shift in alignment involved by the transition.

6.3 Stabilising Area

The purpose of a stabilising area is to allow traffic flow to stabilise after negotiating a transition area, and before reaching another change of condition. In the instance of where more than one transition area is required to achieve the final traffic configuration, the signing of subsequent transitions should be located within the stabilising area(s).

The stabilising area is normally defined by delineator plates.

6.4 Buffer Zone

The buffer zone is the limiting form of a stabilising area. It is normally used between a transition area and the actual work area. In a situation involving more than one transition area the buffer zone will occur after the transition area closest to the work area. The buffer zone can be relatively short, but should be a minimum of 50 metres.

The principal function of a buffer zone is to separate the traffic from the workers at the site in the interests of worker safety. The provision of a longitudinal buffer zone, together with a lateral buffer zone, should be considered as fundamental to effective worker safety.

6.5 Work Area

The work area can be adequately defined by delineators in the less complex conditions. However, where there is a risk to traffic or workers for vehicles entering the work area, temporary barriers of a standard sufficient to prevent vehicle penetration should be put in place.

In the event that traffic is relocated well away from the work area, in cases such as detours, then little action is required along the length of the work area other than to protect the workers and construction vehicles.

In the event of detours resulting in two-way traffic flow, special attention should be given to the definition of the line separating the two traffic flows. Under normal conditions, the normal

treatment should involve the marking of a temporary dividing or no overtaking line where appropriate. This line can be supplemented with temporary road studs where applicable.

If the detour running parallel to the work area uses asymmetrical lane configurations, then drivers should continuously be reminded of these conditions by using appropriate lane arrangement signs. If this condition exists for a considerable distance, these signs should be repeated at regular intervals with the addition of a distance plate indicating the remaining extent of the condition.

6.6 Termination Area

This area involves the return of traffic to normal flow conditions. For simple cases, a relatively short taper or delineator signs will suffice. In more complex situations, a reverse crossover may be required. This should follow the same principles given for such conditions at the commencement of the construction works.

7. CONCLUDING REMARKS

The Department of Water Affairs has commissioned a feasibility study to determine how future water demand due major developments in the Waterberg coalfields could be met. Due to the scarcity of water in the Lephalale area, a project has been identified to augment the existing water supply from Mokolo Dam and implementation of a water transfer scheme from the Crocodile River (West).

The first phase of the project, which is augmenting the water supply, commences with a high lift pump station downstream of the existing pump station at Mokolo Dam. A new rising main will be constructed from the station to the Wolvenfontein balancing dams. From thereon the water will be conveyed through a series of gravity pipelines to the end-users, including the water treatment works, power stations and consumers in the Steenbokpan area.

The major scheme components of the second phase of the project include a concrete weir and primary de-silting works at the Vlieëpoort abstraction site. From the abstraction site, a rising main will pump water to a break pressure reservoir along the R510 north of Thabazimbi. A gravity main will then feed water from the BPR to an operational reservoir further to the north. A delivery line will be constructed from the OR to the end-users in the Steenbokpan area.

A traffic management plan guideline has been developed as a framework for a detailed traffic impact assessment study, which should form part of a detailed construction management plan. The preparation of a detailed traffic management plan and proper implementation of identified measures will ensure the safety of workers and road user during construction. The plan will also ensure efficient operation of the road network together with construction activities on site.

The detailed traffic management plan will entail identification and assessment of impacts associated with the construction activities, including assessment of traffic flow data, re-assignment of traffic, and impacts on adjoining properties. Details of measures to mitigate the impacts should be provided, which will include amongst others traffic controllers, part closures and detours.

Assessment of public transport services that may be affected by the works would also need to be taken into account. Furthermore, a detailed public consultation and notification process should be clearly formulated. Interested and affected parties that would need consultation and notification could include public transport operators, land owners, business and roads authorities and government departments.

The traffic management plan should indicate details of provisions made for heavy vehicles and emergency vehicles. Provisions would also need to be made for non-motorised transport including pedestrian, cyclists and animal-drawn carts.

Finally, the assessment of transport implications on all existing and future developments as a consequence of the proposed traffic management measures should be described in the TMP. The assessment would include forecasted traffic flow data for roads and intersections of adjoining roads. Specific attention would need to be drawn to the roads where traffic is proposed to be detoured.

Traffic management measures to be adopted at temporary road works, and in particular at road crossings, would need to be properly signed. Standardised approached to traffic management at the roadworks sites should be developed in accordance with road traffic signs manual.

In order to have more efficient and safe site operation, a systematic break-down of a site into standardised sub-components is necessary. This will allow the site supervisor to clearly understand the traffic operation of the site. These sub-components could be several hundred metres in length at major sites, or a few metres at much localised sites. These standardised sub-components at construction works include the warning area, transition area, stabilising area, buffer zone, work area and termination area.

In light of route alignments for both the augmentation and transfer scheme, it is evident that significant sections of the alignment will follow existing gravel access roads and the railway line alignment. In certain sections, the route follows the alignment and crosses national, provincial and district roads.

The alignment along existing road infrastructure was an influential factor in the route selection process, as these sections would be less environmentally sensitive due to the environment already being disturbed. This proposed route alignment therefore enjoys good accessibility from the existing road network, barring the sections traversing along the power line servitude and section through open land.

8. REFERENCES

The following references were used in the compilation of this report:

1. Final Scoping Report – Mokolo and Crocodile River (West) Water Augmentation Project : Phase 1 Augment Supply from Mokolo Dam; Nemai Consulting (December 2009)
2. Extended Draft Scoping Report for Public Review – Mokolo and Crocodile River (West) Water Augmentation Project : Phase 2 Transfer Scheme from the Crocodile River (West) to the Lephalale Area; Nemai Consulting (December 2009)
3. Procedures for use in the Preparation of a Traffic Management Plan – Version 2.0, Roads and Traffic Authority NSW (December 2001)
4. Guideline for Preparing a Traffic Management Plan (TMP), City of Botany Bay (date unknown)
5. South African Road Traffic Signs Manual – Volume 2 Chapter 13 Roadworks Signing, Department of Transport (June 1999)