PROPOSED COAL-FIRED POWER STATION AND ASSOCIATED INFRASTRUCTURE IN THE WITBANK AREA, MPUMALANGA

ENVIRONMENTAL IMPACT ASSESSMENT

SPECIALIST TRANSPORT PLANNING REPORT

SEPTEMBER 2006

Eskom


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NINHAM SHAND
CONSULTING SERVICES

PROPOSED COAL-FIRED POWER STATION AND RELATED INFRASTRUCTURE IN THE WITBANK AREA, MPUMALANGA

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Synopsis

Ninham Shand (Pty) Ltd was appointed by Eskom to undertake an Environmental Impact Assessment (EIA) for the site for the proposed coal-fired power station and the related infrastructure in the Witbank geographical area. The purpose of this report is to provide specialist transportation planning and traffic input into the Environmental Impact Assessment process for the proposed coal-fired power station and associated infrastructure.

The study area under consideration is located in Mpumalanga near the Gauteng-Mpumalanga border. The two alternative sites, site X and Y, under investigation are situated north of the town of Kendal and the Kendal coal-fired Power Station, between the N12 Johannesburg National road and the N4 Pretoria National road, east of the R545 (D686) provincial road. The existing transport network, proposed future road alignments and the pavement conditions of the roads within the study area were evaluated.

A brief overview of the activities that will be occurring on the proposed power station site during the operational phase is included in the document.

According to the site selection criteria, an access route to the site was investigated that would have the least disruptive impact on the road and rail network and links. Access to site X was identified from the north along a proposed private road running from the D686 (R545)/ R104 (P154-2) intersection to site X and from the south along a proposed private road intersecting with the D960 lower-order gravel road. The D960, forming the eastern and northern borders of site Y, was identified to provide access from the N12 national road and the N4 national road via a proposed private road.

After a site evaluation process, site X was identified as the preferable site between the two alternative sites. The criteria influencing site X's preferential status are the more direct access links to the N4 and N12 national roads, the closer proximity to the coal source and the shorter lengths of private and existing roads that are required to be constructed and reconstructed.

After a traffic impact assessment, it was concluded that the proposed coal-fired power station will have an overall effect of increasing average annual daily traffic volumes on the roads as well as increasing the heavy vehicle traffic volumes. The operation stage generates a higher concentration of heavy vehicles on the road transport network compared with that generated by the construction stage.

In the event that the railway network will be used for the transport of sorbent and construction and operation materials, railway /haul road corridors providing access to the alternative sites were identified. Railway access doesn't necessarily have to be provided if an alternative such as dedicated haul roads are constructed between the proposed power station site and the nearest railway siding.

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ABBREVIATIONS

ISEP: Integrated Strategic Electricity Planning Process (applied by Eskom)
NIRP: National Integrated Resource Plan (driven by National Electricity Regulator)
EIA: Environmental Impact Assessment
FGD: Flue Gas Desulphurisation
E80's: Equivalent 80kN single axle vehicle loads
AADT: Average Annual Daily Traffic volume
ADTT: Average Daily Truck Traffic volume
HV%: Percentage of heavy vehicles in Average Annual Daily Traffic volumes
PS Influence: Power Station Generated Traffic Influence

INTRODUCTION

Introduction

The need for increased base load electricity generation by the year 2010 was identified by the Integrated Strategic Electricity Planning Process (ISEP) applied by Eskom. Derived from the National Integrated Resource Plan (NIRP) driven by the National Electricity Regulator, is the conclusion that South Africa will have to depend on coal as a fuel source for the next 20 years and coal-fired power stations will be required for generation capacity expansion during this period. To satisfy part of the need for increased base load electricity supply, Eskom is considering a coal-fired power station in Mpumalanga in the vicinity of the existing Kendal power station to the South-West of Witbank.

Ninham Shand (Pty) Ltd was appointed by Eskom to undertake an Environmental Impact Assessment (EIA) for the site for the proposed coal-fired power station and the related infrastructure in the Witbank geographical area. The purpose of this report is to provide specialist transportation planning and traffic input into the Environmental Impact Assessment process for the proposed coal-fired power station and associated infrastructure.

After a reconnaissance site visit on 9 March 2006 where the two initial sites identified by Eskom were viewed, a further site screening process commenced identifying different alternatives sites. On 10 and 11 July 2006, a site screening inspection visit and workshop was held, resulting in the identification of the current sites "X" and "Y", to be taken forward to the Scoping Stage. From the two alternative sites, a preferred site in terms of transportation planning efficiency, legislation and minimal impact on the local transport network was recommended.

Objectives

The objectives of the transport planning specialist input are:

a) Undertake a site visit, taking cognisance of the two alternative sites in the study area.
b) Undertake a review of existing information and conceptual plans of the study area.
c) Liaise with Eskom to determine proposed road alignments and intersections with existing transport infrastructure.
d) Identify and assess the significance of potential impacts of the proposed power station and associated infrastructure on the existing transport network in the study area.
e) Propose mitigation measures that could reduce or eliminate identified impacts.
f) Offer an opinion on which of the identified alternatives would be preferable from a traffic impact perspective.
g) Compile a report that reflects the objectives and includes appropriate mapping.

Scope of Work

The report summarises a review of available transport traffic data and network plans for the two sites under consideration. It provides insight into the existing transport network conditions, accessibility to the sites, proposed transport activities on site as well as forecasts the upgrading of the transport network system for the proposed Power Station.

The scope of work included the following activities:

- A desk study of all acquired available reports, data and mapping.
- Utilisation of the Firm's knowledge of the study area.
- Discussions with Mr Derek Cosijn of Jongens Keet Associates (Acoustical Engineering Consultants) regarding available current traffic data on National and Provincial roads in the

study area obtained from Mikros Traffic Monitoring and Mpumalanga Roads Department as well as data from the Traffic Impact Assessment for the proposed coal-fired Power Station.

- Discussions with Mr Grant Stock of Trac in connection with available current traffic data on the N4 and N12, National roads.
- Analysis and utilisation of feedback from Eskom regarding formulated data requirement requests, questions, proposed road and rail alignments and identified service corridors.
- A site visit to the proposed two sites to analyse and view the overall condition of the roads and transport network and determine possible access points to the alternative sites.
- A site visit to the Kendal Power Station to investigate the current traffic patterns and transport facilities, in order to gain insight into the activities and traffic generated to a coal-fired Power Station.
- Traffic Impact Assessment containing traffic generation to a coal-fired power station as well as traffic distribution and assignment to the transport network in the study area for the operation and construction phases.
- Telephonic discussions with Mr Riaan Viljoen of Mpumalanga Roads Department regarding a conceptual plan of the future road network in the study area and the proposed alignment of the P29-1 (Old route determination of P29-1 – Report book 711, October 1978).

Sources of Information

- **Mapping**
  - Four 1:50 000 topographical maps, namely 2528DD BALMORAL, 2529CC WITBANK, 2628BB KENDAL and 2629AA OGIES.
  - 1:100 000 topographical map of the greater area.
  - Map showing old route determination of P29-1, Report book 711, October 1978, Mpumalanga Roads Department.
- **Reports**
  - NINHAM SHAND, 2006. Environmental Impact Assessment: Proposed coal fired power station and associated infrastructure in the Witbank geographical area. Draft Scoping Report, *Report no. 4222/401281*.

GENERAL DESCRIPTION OF SITE AREA

Study Area

The study area under consideration is located in Mpumalanga near the Gauteng-Mpumalanga border. The two alternative sites under investigation are situated north of the town of Kendal and the Kendal coal-fired Power Station, between the N12 Johannesburg National road and the N4

Pretoria National road. The study area is shown on the Locality Map in Figure A.1, in Appendix A.

The present land-use for the study area comprises of farmland, used either for grazing or crop production. There is no mining activity or under-mined areas beneath the proposed sites, although site X is situated near the western edge of the coal field to be developed to supply coal to the proposed coal-fired power station.

The study area is located in the humid eastern region of the country within the zone representing a Weinert's N-value of less than 5. The influence of climate on the quality of natural road building materials as well as on the road's performance is significant. Broad generalisations are made in terms of predominant weathering types on road building materials with the use of the Weinert N-value. For a Weinert N-value of less than 5, decomposition is the predominant weathering process, which is more harmful to the quality and durability of road building materials compared with that of disintegration. Therefore, special attention needs to be given to drainage, especially subsurface drainage, in these areas.

The study area experiences summer rainfall and fairly cold/mild, dry winters. The terrain can be classified as being fairly flat with no steep gradients or obstacles influencing the transport network routes.

Site X

The site designated "X" is bounded on the east by the R545 (D686) provincial road, which runs parallel to the boundary a distance of 2.5km away. The northern boundary runs approximately 6 km from, and in a parallel direction to the N4 national road. The Apollo-Kendal 400 kV Eskom power line lines the western boundary. The position of site X is shown on the Locality Map (Figure A.1). Site X is located within the northeastern portion of the Delmas Local Municipality in the Mpumalanga province.

The area under consideration is located on eight large and several smaller farms, extending for approximately 5 km in a west-east direction and 11 km in a north-south direction. An Eskom power line runs through the centre of the site. The site is in close proximity to the old Wilge power station near the new proposed coal supply mine. The old Klipfontein Colliery was located on the southeastern boundary of the site. Figure A.2 (Appendix A) is a map portraying the notional arrangement of the three main components of the proposed power station infrastructure on site X. Figure 2.1 is a photograph of site X looking from the south-west corner in a north east direction.

It was established from information provided that the area comprises solely of privately owned land, individuals and Anglo Coal being the stakeholders.

Figure 2.1: Site X

Site Y

The area designated site "Y" lies approximately 3 km south west of site X within the south eastern portion of the Kungwini Local Municipality in the Gauteng Province. The national road N12 to the south and provincial road R42 to the west form very rough identifying boundary features. The D960 gravel surface lower-order road forms the northern boundary of the site as well as a rough boundary in the east. The position of site Y is shown on the Locality Map (Figure A.1).

Site Y is located on five large and two smaller farms, extending in a diagonal direction, approximately 10 km in a southeast-northwest direction. Eskom power lines run diagonally from the northwestern corner of site Y as well as along the eastern boundary. It should be noted that an Eskom substation is located on site Y near the northern boundary road, D960. The area designated for site Y comprises solely of privately owned land.

Figure A.3 (Appendix A) is a map portraying the notional arrangement of the three main components of the proposed power station infrastructure on site Y. Figure 2.2 is a photograph of site Y showing the Eskom substation.

Figure 2.2: Site Y and the Eskom Substation

ACTIVITIES ON SITE

General

The proposed coal-fired power station will comprise of six units of approximately 900 MW each and will operate and function using a similar scenario to that used at the present Matimba Power Station. Dry cooling technology, either direct or indirect, will be used for the proposed power station. The power station will consume about 55 000 tons/day (16 million tons/year) of coal with about 2640 tons/day of ash production. The three main components of the proposed power station are the power station infrastructure itself, the coal stockyard and the ash dump - refer to Figure A.2 and Figure A.3 to view the proposed layout of the components on the two alternative sites. Conveyors will be used to transport coal from the source to the coal stockyard and from the stockyard to the power station as well as to transport ash to the ash dump.

Coal Source

Apart from the existing collieries providing coal, one of the key determinants in the power station's location in the designated area was the presence of coal reserves in the area.

In order to supply the requisite volume of coal to the proposed power station over its expected life of 40 to 50 years, a new coal mine will have to be developed. The identified source for the proposed power station is the new Greenfield mining reserves in the Witbank coalfield. The main coal body titled New Largo is the shaded area demarcated by a purple boundary line shown in

Figure C.1 in Appendix C. Figure C.3 (Appendix C) shows the main coal body shaded in pink in relation to the proposed sites and existing and proposed infrastructure. The resource is in close proximity to the current Kendal Power Station and will be located near the decommissioned Wilge Power Station site, north of the N12.

An estimated 60 million tons/year of coal will be transported from the mine to the power station's coal stockyard. Due to site X being located in close proximity to the coal supply mine, a conveyor line will run directly between the proposed power station coal stockyard and the coal supply mine. The coal conveyor corridor, identified as the blue-hatched area in Figure C.3, is the corridor that will be used to transport coal from the coal supply mine to the proposed power station on site Y. A crossing will have to be provided underneath the D960 road. The conveyor line crossing from the Kendal Power Station to the ash dump provides a typical example of a conveyor line crossing a road as shown in Figure 3.1.

Figure 3.1: Conveyor line crossing underneath a road.

Sorbent

Due to the present condition of the ambient air within the Kendal locality, it was assumed that plant with the appropriate air quality mitigation measures would be considered at the proposed new coal-fired power station. Therefore, sorbent (usually limestone or dolomite) may be required to reduce the amount of SO_2 that is emitted. The SO_2 reacts with the calcium in the limestone to form calcium sulphate ($CaSO_4$) or calcium sulphite ($CaSO_3$) and CO_2. This process is called Flue Gas Desulphurisation (FGD). The sorbent would be obtained from commercial sources in the Northern Cape, if dry FGD is implemented, or in Gauteng, Mpumalanga or North West Province if wet FGD is employed.

An environmental constraint that could exist is that sorbent should be transported by rail rather than road. Should this be the case, access to the railway network needs to be provided at the proposed new coal-fired power station site. Transport by road will increase the volume of heavy vehicles on the roads and the access routes to the sites will have to be constructed to carry the anticipated volumes of heavy vehicles. However, railway access doesn't necessarily have to be

provided if an alternative such as dedicated haul roads are constructed between the proposed power station site and nearest railway siding. The implementation of dedicated haul roads will concentrate the heavy vehicle traffic onto these roads thereby alleviating the heavy vehicle traffic that would use the transport network. Figure C.3 (Appendix C) shows the proposed alignments for the railway line or haul roads to the alternative sites.

Ash Handling

Ash produced comprises of powder-like, extremely fine fly ash and boiler bottom coarse ash. In a typical dry ash handling system, the coarse ash and conditioned fly ash will be transported via a conveyor belt to the ash dump.

At present, approximately 5 % of the ash produced at some existing power stations is used in the cement industry and a smaller amount in other products. The ash is transported in ash trucks from the power stations to the various industry sites.

Services

The water pipeline corridor running northwest from the existing Kendal Power Station is represented by blue lines on Figure C.3 in Appendix C. Alternative pipeline route alignments are identified within the corridor. Regardless of whether site X or site Y is selected, the pipeline will have to cross either underneath or over the N12 national road. Provision for the crossing of the D960 road will have to be provided for the pipeline running to site X.

Apart from an access road, internal roads will be constructed within the power station precinct to provide access to various structures and buildings.

TRANSPORT NETWORK

Overview of Existing Road Network

The two alternative sites X and Y are bordered to the north and south by two strategically important roads. The N4 national road runs in an east-west direction linking Witbank, Bronkhorstspruit and Pretoria. The N4 is a toll route overseen by trac, comprising of three lanes in each direction. It has surfaced shoulders, is of good riding quality and has been designed to carry heavy loads. The N12 national road runs in a northeast/ southwest direction linking Witbank, Delmas and the northeastern areas of Johannesburg. The 4-lane high-order road is of good riding quality and designed to carry heavy truck loads.

The provincial road R104 (P154–2) running parallel to the N4 linking Pretoria, Bronkhorstspruit and Witbank, intersects the N4 at the R545 (D686) /N4 intersection. The R545 (D686) provincial road traverses in a north-south direction, along site X's eastern border, linking the N4 to the N12 as well as to Phola and Ogies. Linking Witbank, Ogies, Kendal, Delmas and Johannesburg, the provincial road R555 (P29/1) runs parallel to the N12 from Ogies. From the intersection with the N12, the gravel low-order D960 road borders site Y to the north and east and forms a potential access route to site X and Y. The R42 runs in a north-south direction to the west of the study area

between Delmas and the R25 to Bronkhorstspruit. The R25 is a single carriageway road with neglected gravel shoulders that have not been maintained.

The road network is shown on Figure C.2 in Appendix C.

Existing Road Network Conditions

A pavement of a road comprises a combination of layers on the roadbed or in-situ material. The role of the pavement is to provide a structure to carry the traffic loads thereby fulfilling the bearing capacity requirements as well as to provide the desired riding quality (comfort) and safety for the road user.

The condition of a pavement can be considered in terms of the surface, structural and functional conditions and from two viewpoints, namely the road user and the road engineer. The road user regards the road as a service and appraises the road condition in terms of the characteristics that affect riding quality such as comfort, safety and operating costs. Whilst recognising these functional requirements, the road engineer views the pavement as a load-bearing structure requiring maintenance within good time in order to remain serviceable at optimum cost.

During the site visit, the overall condition of the roads that could form access routes to the alternative sites was determined by a brief visual and riding quality assessment.

- **D960 – Gravel, Low-Order Road**

The D960 is a gravel road 15.4 km in length between the N12 intersection and a T-junction formed by the D960 running north and the D2508, south. The road is not elevated and follows the contour of the ground, having slight super elevation though no substantial cut and fill operations were conducted during the construction of the road. It is evident that road construction consisted of the removal of the topsoil before the road level was shaped and compacted and a transported gravel layer placed for the riding surface. No drainage systems exist resulting in puddles of water on the road after the rainfall the previous night. The uneven riding surface creates areas where water is collected forming ponds and puddles, substantiating safety and road degradation issues. The present condition of the road is inadequate to carry heavy truck loads and construction vehicles. Figure 4.1 is a photograph of the D960 forming the north border of site Y.

The D960 is a potential access route to the proposed power station on site X and site Y. To fulfil this role it would have to be upgraded and reconstructed with a deep, surfaced pavement structure to carry the anticipated traffic volumes and loads. Adequate drainage systems would have to be implemented to prevent degradation of the pavement surface and structure as well as for safety aspects.
It should be noted that the bridge crossing the Klipspruit can only accommodate one vehicle at a time. Extremely poor drainage on the bridge surface was experienced during the site visit with a layer of water on the bridge deck after the rainfall the night before. The bridge would have to be rebuilt and widened should the main access to site Y occur on the D960 after the Klipspruit, this could be avoided.

Figure 4.1: D960, forming the north border of site Y.

- **D686 – Surfaced, Provincial Road**

The D686, running along the eastern side of the study area, is a single carriageway road with no shoulders, providing a link between the N4 and N12 national roads. The condition of the road is poor, displaying severe rutting, cracking, potholes, patching and structural failure over some sections of the road. The D686 pavement can be classified as having a "shallow" structure and is overstressed and has undergone failure in most sections of the road. The width of the single carriageway road together with the poor shoulder and edge condition causes capacity and safety problems. Lack of drainage structures and maintenance of shoulders has resulted in failures and potholes in low-lying areas

From a visual analysis of a pothole on the D686, the pavement structure composition comprises of a base of fine, low quality material that has been highly stabilised. The base material is not from a commercial source and seems to have been obtained from a borrow pit in the surrounding area. The surfacing of the road consists of a thin asphalt layer with no presence of a seal. The pothole is shown in Figure 4.2.

Figure 4.2: Pothole on the R545 road

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The D686 bisects the coal resource identified for the coal supply mine. Due to the present alignment of the D686, the road or sections of the road will seize to exist once coal operations commence. The existing provincial road, having a relatively important status, would have to be realigned or an alternative route identified, in order to carry the traffic volumes presently using the road as well as those anticipated to use the road in future and to provide access to the private properties. The realignment of the D686(R545) provincial road should be included within the coal mine's Environmental Impact Assessment process and will not be included within this report.

Proposed Road Network

Due to the rerouting or realignment of the D686 (R545) provincial road, Eskom proposed alternative road alignments to provide access to the alternative sites. These proposed roads are assumed to be private roads to the site and will not carry the traffic that the R545 (D686) provincial road carried. Once the site selection process has been completed, the proposed road alignments to be used should be accepted by the authorities before the Preliminary Design process.

According to the Mpumalunga Roads Department, the proposed alignment of the P29-1 is shown in Figure C.2 in Appendix C. The proposed alignment starts at an intersection with the R555 (P29-1) where it runs in a northeast direction crossing the N12 and D960, before crossing the D686, it curves in an easterly direction to Witbank. The authorities at the Department are sceptical of the importance placed on this alignment as it was obtained from Report book 711 (October 1978) and referred to as the old route determination of the P29-1.

The proposed P29-1 cuts through site X, intersecting the northern corner of the proposed area for the ash dump and splitting the power station area with the coal stockyard and ash dump areas. If this proposed alignment is still valid and site X is selected, a rearrangement of the main power station components would be recommended to reduce the conveyor line – road crossings. The proposed road could be the access route to the site. The construction of this route will not likely occur within the construction or operational phases of the power station, although this issue should be validated with the department before the commencement of the design phase.

4.4 Overview of Existing Rail Network

A railway line runs parallel to the N4, north of the study area, in an east – west direction with stations or sidings in Pretoria, Rayton, Bronkhorstspruit, Balmoral, Wakefield, Clewer and Witbank. As part of this rail network, to the south of the study area, another railway line runs in a northeast / southwest direction parallel to the N12. This line links Witbank, Bleekhill, Minnaar, Ogies, Kendal, Arbor, Argent, Delmas, Eloff and Johannesburg. Additional railway lines branch off from the main line, providing access to many collieries such as Arthur Taylor, Landali, Tavistock, Khutala, Stuart, Lakeside and Leeuwfontein Collieries. The remains of the old railway track to the old Wilge Power Station run to the east of the D686 road.

If the situation should arise that the coal supply mine cannot supply the total amount of coal required by the proposed power station and access to the railway network is provided at the power station, coal could be transported via the railway network from collieries with access to this network. Materials for the construction of the proposed power station could be transported via rail, if access is provided. Although, the current situation and operation of the railway network and system would have to be improved before this network is used more extensively and as an alternative to road transport.

Railway access doesn't necessarily have to be provided if an alternative such as dedicated haul roads are constructed between the proposed power station site and nearest railway siding. The implementation of haul roads would decrease the volume of heavy vehicles on the transport network, which would have a positive influence on the long-term pavement conditions of the transport network.

The proposed railway access alignments or haul road alignments are represented as dark green lines on Figure C.3 in Appendix C. The southern alignment starts at a connection to the main railway line in the south at the Kendal station, crosses the N12 national road before running parallel to this road. Thereafter, the alignment splits crossing the D960 road to provide access to site Y or running in a northerly direction to site X. The northern proposed alignment starts at a connection to the main railway line in the north, crosses the N4 and R104 (P154 – 2) roads, before providing access to site X.

SITE ACCESSIBILTY

According to the site selection criteria, an access route to the site must be investigated that will have the least disruptive impact on the road and rail network and links. The cost of upgrading and construction of the access routes will influence the selection of the site. The study is based on the existing road network and proposed alignments and the workings of the proposed coal mine for AngloCoal may necessitate the realignment of certain infrastructure such as roads. This should be taken cognizance of in the preliminary design phase of the project.

Site X

Due to the existing alignment of the D686 (R545) provincial road bisecting the coal resource, the road will seize to exist once coal operations commence. Access to site X via this road will not be possible, therefore Eskom proposed two road alignments that would provide access to site X from the north (to the N4) and south (to the N12). The proposed roads were assumed to be private roads. The northern proposed road alignment runs in a northwest direction between the northern border of the site to the D686 (R545)/ R104 (P154 – 2) provincial roads intersection, south of the N4.

This proposed road alignment, labelled as road A, is shown in Figure C.2 in Appendix C. The southern proposed access road, labelled road B in Figure C.2 (Appendix C), runs between the D960 lower-order road and site X. Access to the N12 national road is provided via the D960 road. This road access alternative will require the reconstruction of the D960 lower-order road between the intersection with the private access road and the N12 national road intersection.

Site Y

The D960, forming the eastern and northern borders of site Y, is identified as the potential access route to the site. The D960 provides direct access to the N12. Eskom has identified a proposed alignment for the access road from the N4 national road to the D960 lower-order road as shown in Figure C.3 in Appendix C. Due to the sharp bends present in this proposed alignment, an alternative alignment is proposed that would be more satisfactory, in terms of design standards. The suggested preliminary alignment is based on an assumed design speed of 100km/h with a corresponding minimum radius of 530m. A detailed road alignment and design should be performed and approval received from the provincial authority before the design phase, should site Y be selected. The alternative proposed road runs between the intersection with the N4, west of the R104/N4 intersection, follows a gravel road before running along the Gauteng-Mpumalanga border and a section of site X's western border as shown as road C in Figure C.2 (Appendix C). The proposed road (road C) to be constructed is longer than the proposed roads (road A and B) for site X, influencing construction cost. Due to the D960 bordering site Y, shorter access roads within the site need to be constructed compared to those for site X. The D960 gravel road is in a poor condition and will require reconstruction with a deep, surfaced pavement structure to carry the anticipated heavy loads as well as construction of adequate drainage systems. Potential access construction would include construction of the main access road to the power station precinct; coal stockyard access road, reconstruction of approximately 12.5 km of the D960 gravel road and the construction of the proposed road alignment.

Site Accessibility Comparison

Table 5.1 contains a comparison between the elements affecting the site accessibility for the two alternative sites.

Table 5.1: Site Accessibility Comparison

	Site X	Site Y
Access via:	Proposed road linking with the R104/D686 intersection (north) and the proposed road from the D960 road (south).	Proposed road linking with the N4 and D960 (north) and D960 linking with the N12 (south).
Direct Access to N4 and N12	Yes (if both access roads are implemented)	Yes (if both access roads are implemented)
Length of main access from site boundary within site area	Longer as proposed infrastructure located in the south of site area (for northern access alternative)	Shorter as proposed infrastructure located near D960, which forms site Y border
Construction of:	Proposed roads (Road A and B)	Proposed road from the N4 (road C)
	Main access road to power station	Main access road to power station
	Access road to coal stockyard	Access road to coal stockyard
	Internal roads within site	Internal roads within site
Reconstruction of:	Approximately 4.5km of D960 gravel road between main access road (road B) and N12	Approximately 12.5 km of D960, gravel road, between main access road (road C) and N12
Possible reconstruction of bridge structures:		Bridge crossing Klipspruit (could be avoided by selection of access point)

TRAFFIC IMPACT ASSESSMENT

Current Traffic Situation

- **Traffic Volume Data**

Traffic volume data on the N4 and N12 was obtained from Mikros Traffic Monitoring as well as from trac for the N4. The Mpumalanga Roads Department provided the traffic volume data for the provincial and lower-order roads. Table 6.1 contains a summary of the traffic volume data for the transport network influencing the study area.

Table 6.1: Summary of Current Traffic Data

Road	ADT	Total Heavy Vehicles	% Heavy Vehicles	Survey Date	Description
D686 (R545)	2856	839	29.4	Jun-06	Between D1955 intersection and N4
D686	2218	452	20.4	Jun-06	Between D1955 intersection and N12
P29/1 (R555)	1563	383	24.5		Between Kendal and Delmas
P95/2 (R42)	1277	270	21.1		Between N12 and R25
N4	12034	1275	10.6	Jan 2006 - Jun 2006	6 km West of Highveld Steel/Clewer Interchange
N4	11864	1505	12.7	Aug 2001 - Nov 2004	Western side of R545/Ogies l/C
N12	10969	1071	9.8	Jan 2006 - Jun 2006	Close proximity to N4/N12 split
N12	11478	1730	15	1999 - 2004	Western side of R545/Ogies l/C

- **Road Category Classification**

According to the TRH4 classifications, the roads in the transport network can be categorised from the daily traffic volumes, as shown in Table 6.2:

Table 6.2: Road Category Classification

Road	ADT	Category	Importance	Service Level	Typical pavement class	Total Equivalent Traffic Loading (E80/lane)
D686 (R545)	< 600 >10 000	B	Important	High	ES 10	3 - 10
D686	< 600 >10 000	B	Important	High	ES 10	3 - 10
R555 (P29/1)	< 600 >10 000	B	Important	High	ES 10	3 - 10
R42 (P95/2)	< 600 >10 000	B	Important	High	ES 10	3 - 10
N4	> 6500	A	Very	Very High	ES 100	30 - 100
N12	> 6500	A	Very	Very High	ES 100	30 - 100

The cumulative damaging effect of all individual axle loads from the spectrum of vehicles is expressed as the number of equivalent 80kN single axle loads (E80's). This number represents the number of 80kN single axle loads that would cause the same damage to the pavement as that caused by the actual spectrum of vehicle axle loads. Heavy and fully loaded industrial trucks and tankers will have 3 to 7 equivalent 80kN (E80's) single axle loads.

- **Forecasted Traffic Volumes**

Traffic volume data was required at identified periods in the future to determine the situations with and without the proposed power station, in order to analyse the effect on the existing traffic volumes and transport network capacity. It was assumed that construction would commence at the end of 2007. The construction and operation phases will run parallel between 2012 and 2013, with the first 2 units going into operation in 2012 and 2 units being commissioned per year thereafter until full commercial operation in 2014.

The N4 dataset contained records with traffic volumes from August 2001 to November 2004 recorded at Balmoral counting station. Another data record for 2006 was obtained from a station 6 km west of the Highveld Steel/Clewer Interchange. This data was analysed and growth factors for the Average Annual Daily Traffic (AADT) and Average Daily Truck Traffic (ADTT) determined by taking the mean of the yearly growth factors. This mean growth factor was applied to calculate the AADT for 2006, 2008 and 2012 to 2014. A growth factor for the AADT of 3.17% and for the ADTT of 11.53% was used.

The N12 dataset contained records with traffic volumes from January 1999 to December 2004 recorded at a station on the western side of the R545 (D686)/Ogies interchange. Another data record was obtained for 2006 from a station located at the N4/N12 interchange, situated outside the study area. This data was analysed and growth factors for the Average Annual Daily Traffic (AADT) and Average Daily Truck Traffic (ADTT) determined by taking the mean of the yearly growth factors. This mean growth factor was applied to calculate the AADT for 2006, 2008 and 2012 to 2014. Growth factors for the AADT of 3.81% and for the ADTT of 4.65% were used.

The provincial and lower-order road traffic data for 2008 and 2012 to 2014 were calculated using a growth factor for AADT of 3.5% and ADTT of 5%. A traffic impact assessment was performed on the roads where no existing traffic data was available such as D960 lower-order road, in order to evaluate the anticipated volumes.

The traffic volumes for the years, 2006, 2008 and 2012 to 2014 are shown in Table B.1 in Appendix B.

Due to the present alignment of the D686 (R545) provincial road bisecting the identified coal resource, the road will seize to exist once coal operations commence. The present road is a category B road having a relatively important status. The road would have to be realigned or an alternative route identified, in order to carry the traffic volumes presently using the road as well as those anticipated to use the road in the future. The realignment of the D686 provincial road should be included within the coal mine's Environmental Impact Assessment process and will not be included within this report. The proposed roads providing access to the proposed power station sites are assumed to be private roads to the site and will not carry the traffic that the D686 (R545) carried.

Future Predicted Traffic for Operation Stage

- **Trip Generation**

The traffic that the proposed power station will generate was based on basic employee numbers and distributions obtained from Eskom as well as approximate traffic volumes obtained from an interview with a guard at the main entrance to the existing Kendal Power station.

Eskom stated that between 600 to 800 employees commute to the station, of which 30% consist of unskilled labour. Conservatively, 800 employees were used for this analysis, assuming that 240 unskilled and 360 skilled labourers used public transport. It was assumed that 1 manager was allocated to 8 employees so approximately 100 managers are included in the skilled employees commuting with cars. According to these assumptions, the proposed power station will generate 400 cars, including the morning and afternoon peaks.

It was assumed that a bus could transport 64 people and a mini-bus taxi, 8 people. These figures were applied to the employees using public transport to determine the distribution of mini-bus taxis and buses generated to the proposed power station. Approximately 100 mini-bus taxis and 8 buses will commute to the power station.

The heavy vehicle traffic generated by the power station will comprise of 240 ash trucks per day and 20 materials trucks. The ash trucks collect ash that is to be used commercially such as for fly ash in concrete mixes. The remainder of the ash is transported via conveyor line to the ash dump. The ash trucks and materials trucks are assumed to have a mass of 20 tons. An example of an ash truck is shown in Figure 6.1.

Figure 6.1: An Ash Truck

The traffic volumes split per mode of transport that will be generated by the proposed power station for the operation stage are shown in Table 6.3.

Table 6.3: Operation Stage Traffic Generation Volumes

Vehicle	Generated Traffic	
Minibus taxi	50	AM Peak
	50	PM Peak
	100	
Bus	4	AM Peak

	4	PM Peak
	8	
Car	200	AM Peak
	200	PM Peak
	400	

Trucks		
Materials	**20**	per day
Ash	**240**	per day

- **Trip Distribution**

Traffic distribution was performed after evaluating the possible locations, towns and cities that employees would commute from to get to work. The unskilled and skilled labour commuting in public transport would travel from Phola, Ogies, Witbank, Bronkhorstspruit (Ekangela) and Delmas. The skilled labour travelling in cars would commute from Witbank, Bronkhorstspruit and Delmas as well as from Johannesburg and Pretoria.

The commercial sources generating the ash and materials truck traffic are located in Witbank, Pretoria and Johannesburg.

Table 6.4 contains the results from the trip distribution analysis.

Table 6.4: Operation Stage Trip Distribution

Materials

Assumptions:

Ash Trucks:	**240**		**N4**
	Witbank	60% North	70%
	Pretoria		30%
	Johannesburg	40% South	

Materials Trucks:	**20**		**N4**
	Witbank	40% North	20%
	Pretoria		80%
	Johannesburg	60% South	

Commuters

Minibus Taxi	**100**	**Distribution**	**No./day**
	Phola/Ogies	0.2	20
	Witbank	0.5	50
	Bronkhorstspruit	0.15	15
	Delmas	0.15	15

Buses:	**8**	**Distribution**	**No./day**
	Bronkhorstspruit	0.15	1
	Witbank	0.5	4
	Phola	0.2	2
	Delmas	0.15	1

Cars:	**400**	**Distribution**	**No./day**
	Witbank	0.5	200
	Bronkhorstspruit	0.1	40
	Pretoria	0.2	80
	Johannesburg/Delmas	0.2	80

- **Traffic Assignment**

Traffic assignment to the road transport network from the trip distribution results was analysed for each site. The traffic volumes distributed to each town were assigned to the road network representing the shortest trip to the town. The traffic volumes assigned to each road were totalled and added to the AADT for that year in order to determine the influence of the generated traffic to the proposed power station on the existing road network. The traffic assignment results for the two alternative situations where site X or site Y is selected are shown in Table B - 2 and Table B – 3 in Appendix B.

- **Discussion of Results**

A summary of the influence of the generated traffic to the proposed power station on the road transport network for the two alternative sites is shown in Table 6.5 and Table 6.6.

Table 6.5: Summary of Traffic Influence Generated to Site X – Operation Stage

Road	Description of Section	AADT	PS Influence	HV %	AADT % Increase
N4	West of D686 (R545) intersection towards Bronkhorstspruit	15452	15637	19.8	1.2
N4	East of D686 (R545) intersection towards Witbank	15452	15809	20.0	2.3
D686 (R545)	Between N4 and site X access road	0	542	28.0	-
D960	Between site X main access road and N12	0	226	47.8	-
N12	West of D960/N12 intersection towards Johannesburg	15481	15685	16.6	1.3
N12	East of D960/N12 intersection towards Ogies	14794	14816	10.4	0.1
Access (N)	Access from North	0	542	28.0	-
Access (S)	Access from South	0	226	47.8	-

Table 6.6: Summary of Traffic Influence Generated to Site Y – Operation Stage

Road	Description of Section	AADT	PS Influence	HV %	AADT % Increase
N4	West of proposed road intersection towards Bronkhorstspruit	15452	15637	19.8	1.2
N4	East of proposed road intersection towards Witbank	15452	15809	20.0	2.3
D960	Between proposed road intersection and N12	0	226	47.8	-
N12	West of D960/N12 intersection towards Johannesburg	15481	15685	16.6	1.3
N12	East of D960/N12 intersection towards Ogies	14794	14816	10.4	0.1
D960	Between proposed road intersection and main access road to site Y	0	768	33.9	-
Proposed Road	Proposed road alignment running between N4 intersection and D960 intersection	0	542	28.0	-

The influence on the road transport network, in most cases, is minimal ranging from an increase in average annual daily traffic volumes of 0.1 to 2.3%. The site X and Y situations portray a concentration of high heavy vehicle volume percentages of approximately 48% on the D960 road compared with the concentration on other roads. The present poor condition of the lower-order D960 road is unsatisfactory and inadequate to carry the anticipated volumes of heavy vehicles. It is suggested that the D960 road will have to be reconstructed with a deep pavement structure having a high bearing capacity and composed of good quality materials, in order to carry the anticipated loads. The percentage of heavy vehicles expected on the road transport network affecting the study area and the new proposed access roads is high indicating that the pavement structure and

conditions will have to be improved or designed in some cases, in order to carry the anticipated, heavier loads.

Future Predicted Traffic for Construction Stage

- **Trip Generation**

The traffic that the construction stage of the proposed power station will generate was based on basic construction employee numbers estimated by Eskom as well as assumed truck volumes estimated from the approximate quantities of materials that would be transported.

Eskom stated that on average, 2000 to 6000 employees would commute to the construction site of the proposed power station, of which 50% consist of unskilled labour. Conservatively, 5000 employees were used for this analysis, assuming that 2500 unskilled and 1700 skilled labourers used public transport. It was assumed that 1 manager was allocated to 8 employees so approximately 625 managers are included in the 800 skilled employees commuting with cars. According to these assumptions, the construction stage of the proposed power station will generate 1600 cars, including the morning and afternoon peaks.

It was assumed that a bus could transport 64 people and a mini-bus taxi, 8 people. These figures were applied to the employees using public transport to determine the distribution of mini-bus taxis and buses generated to the construction site. Approximately 410 mini-bus taxis and 80 buses will commute to the power station construction site.

The heavy vehicle traffic generated by the construction stage will comprise of 60 concrete trucks, 60 materials trucks and 10 earthworks trucks per day. The trucks are assumed to have a mass of approximately 20 tons.

The traffic volumes per mode of transport that will be generated by the proposed power station for the construction stage are shown in Table 6.7.

Table 6.7: Construction Stage Traffic Generation Volumes

Vehicle	Generated Traffic	
Minibus taxi	205	AM Peak
	205	PM Peak
	410	
Bus	40	AM Peak
	40	PM Peak
	80	
Car	800	AM Peak
	800	PM Peak
	1600	

Trucks		
Concrete	**60**	per day
Materials	**60**	per day
Earthworks	**10**	per day

- **Trip Distribution**

Traffic distribution was performed after evaluating the possible locations, towns and cities that construction employees would commute from to get to work. The unskilled and skilled labour commuting in public transport would travel from Phola, Ogies, Witbank, Bronkhorstspruit (Ekangela), Johannesburg and Pretoria. The skilled labour travelling in cars would commute from Witbank, Bronkhorstspruit and Delmas as well as from Johannesburg and Pretoria.

It was assumed that Witbank would supply all the concrete requirements for the construction of the proposed power station; therefore the concrete trucks would travel between the selected site and Witbank. Materials would be transported by truck from Johannesburg and Witbank. Due to earthwork material suppliers and borrow pits not having been identified, the earthwork truck distribution percentage to the N4 and N12 national roads was assumed.

Table 6.8 contains the results from the trip distribution analysis.

Table 6.8: Construction Stage Trip Distribution

Materials

Assumptions:

Concrete Trucks **60**/day from Witbank

Materials Trucks	**60**	**No./day**
	Witbank	37
	Johannesburg	23

Earthworks	**10** trucks/day	**No./day**
	N4	4
	N12	6

Commuters

Minibus Taxi	**410**	**Distribution**	**No./day**
	Phola/Ogies	0.15	62
	Witbank	0.4	164
	Bronkhorstspruit	0.2	82
	Johannesburg	0.15	62
	Pretoria	0.1	40

Buses	**80**	**Distribution**	**No./day**
	Bronkhorstspruit	0.1	10
	Witbank	0.2	16
	Phola	0.1	6
	Johannesburg	0.35	28
	Pretoria	0.25	20

Cars	**1600**	**Distribution**	**No./day**
	Bronkhorstspruit	0.2	320
	Witbank	0.4	640
	Delmas	0.05	80
	Johannesburg	0.15	240
	Pretoria	0.2	320

- **Traffic Assignment**

Traffic assignment to the road transport network from the trip distribution results was analysed for each site. The traffic volumes distributed to each town were assigned to the road network representing the shortest trip to the town. The traffic volumes assigned to each road were totalled and added to the AADT for that year in order to determine the influence of the generated traffic for the construction stage of the proposed power station on the existing road network. The traffic assignment results for the two alternative situations where site X or site Y is selected are shown in Table B – 2 and Table B – 3 in Appendix B.

- **Discussion of Results**

A summary of the influence of the generated traffic for the construction stage of the proposed power station on the road transport network for the two alternative sites is shown in Table 6.9 and Table 6.10.

Table 6.9: Summary of Traffic Influence Generated to Site X – Construction Stage

Road	Description of Section	AADT	PS Influence	HV %	AADT % Increase
N4	West of D686 (R545) intersection towards Bronkhorstspruit	12810	13603	11.7	5.8
N4	East of D686 (R545) intersection towards Witbank	12810	13730	12.3	6.7
D686 (R545)	Between N4 and site X main access road	0	1713	5.9	-
D960	Between site X main access road and N12	0	507	5.7	-
N12	West of D960/N12 intersection towards Johannesburg	12369	12808	15.0	3.4
N12	East of D960/N12 intersection towards Ogies	11821	11889	9.8	0.6
Access (N)	Main access road from R545 (D686) and R104 intersection	0	1713	5.9	-
Access (S)	Main access road from D960	0	507	5.7	-

Table 6.10: Summary of Traffic Influence Generated to Site Y – Construction Stage

Road	Description of Section	AADT	PS Influence	HV %	AADT % Increase
N4	West of proposed road intersection towards Bronkhorstspruit	12810	13603	11.7	5.8
N4	East of proposed road intersection towards Witbank	12810	13730	12.3	6.7
D960	Between proposed road intersection and N12	0	507	5.7	-
N12	West of D960/N12 intersection towards Johannesburg	12369	12808	15.0	3.4
N12	East of D960/N12 intersection towards Ogies	11821	11889	9.8	0.6
D960	Between proposed road intersection and main access road to site	0	2220	5.9	-
Proposed road	Proposed road alignment running between N4 intersection and intersection with D960	0	1673	6.0	-

The influence on the road transport network, in most cases, is minimal ranging from an increase in average annual daily traffic volumes of 0.6 to 6.7%. The influence from the power station generated traffic on the AADT from the existing transport network is greater for the construction stage compared with that from the operation stage. However, the operation stage generates a higher concentration of heavy vehicles on the road transport network compared with that generated by the construction stage. This effect could be due to the larger volumes of lighter vehicles generated by the construction stage reducing the overall heavy vehicle percentage. A larger percentage of heavy vehicles occur on the N12 and N4 national roads compared to the volumes anticipated on the provincial and lower-order roads. The percentage of heavy vehicles expected on the road transport network affecting the study area is high indicating that the pavement structure and conditions will have to be improved in some cases in order to carry the anticipated, heavier loads.

Future Predicted Traffic for Construction and Operation Stages (2012 and 2013)

The construction and operation phases will run parallel between 2012 and 2014, with the first 2 units going into operation in 2012 and 2 units being commissioned per year thereafter until full commercial operation in 2014. The following two situations occurring in this period were analysed, namely:

- Construction Phase and Operation of 2 units Phase (2012)
- Construction Phase and Operation of 4 units Phase (2013)

The trip generation, distribution and assignment volumes from the operation stage and construction stage as discussed in section 6.2 and 6.3 were used in this analysis. It was assumed that the operation stage traffic applied in the analysis would increase in increments as the units were commissioned while the construction stage traffic would decrease in increments. The resultant traffic volumes for the two alternative sites for the two situations are shown in Table 6.11 and Table 6.12 for the Construction Phase and 2 units Operation Phase in 2012 and in Table 6.13 and Table 6.14 for the Construction Phase and 4 units Operation Phase in 2013.

- **Construction Phase and Operation of 2 units Phase, 2012**

Table 6.11: Summary of Traffic Influence Generated to Site X (2012)

Road	Description of Section	AADT	PS Influence	HV %	AADT % Increase
N4	West of D686 (R545) intersection towards Bronkhorstspruit	14516	15203	16.3	4.5
N4	East of D686 (R545) intersection towards Witbank	14516	15385	16.8	5.6
D686 (R545)	Between N4 and site X main access road	0	1556	9.8	-
D960	Between site X main access road and N12	0	493	15.4	-
N12	West of D960/N12 intersection towards Johannesburg	14365	14796	15.9	2.9
N12	East of D960/N12 intersection towards Ogies	13728	13790	10.2	0.4
Access (N)	Main access road from R545 (D686) and R104 intersection	0	1556	9.8	-
Access (S)	Main access road from D960	0	493	15.4	-

Table 6.12: Summary of Traffic Influence Generated to Site Y (2012)

Road	Description of Section	AADT	PS Influence	HV %	AADT % Increase
N4	West of proposed road intersection towards Bronkhorstspruit	14516	15203	16.3	4.5
N4	East of proposed road intersection towards Witbank	14516	15385	16.8	5.6
D960	Between proposed road intersection and N12	0	493	15.4	-
N12	West of D960/N12 intersection towards Johannesburg	14365	14796	15.9	2.9
N12	East of D960/N12 intersection towards Ogies	13728	13790	10.2	0.4
D960	Between proposed road intersection and main access road to site Y	0	2049	11.1	-
Proposed road	Proposed road alignment running between N4 intersection and intersection with D960 road	0	1526	9.9	-

- **Construction Phase and Operation of 4 units Phase, 2013**

Table 6.13: Summary of Traffic Influence Generated to Site X (2013)

Road	Description of Section	AADT	PS Influence	HV %	AADT % Increase
N4	West of D686 (R545) intersection towards Bronkhorstspruit	14976	15511	17.9	3.5
N4	East of D686 (R545) intersection towards Witbank	14976	15704	18.2	4.6
D686 (R545)	Between N4 and site X main access road	0	1263	13.0	-
D960	Between site X main access road and N12	0	423	22.6	-
N12	West of D960/N12 intersection towards Johannesburg	14913	15286	16.2	2.4
N12	East of D960/N12 intersection towards Ogies	14251	14302	10.3	0.4
Access (N)	Main access road from R545 (D686) and R104 intersection	0	1263	13.0	-
Access (S)	Main access road from D960	0	423	22.6	-

Table 6.14: Summary of Traffic Influence Generated to Site Y (2013)

Road	Description of Section	AADT	PS Influence	HV %	AADT % Increase
N4	West of proposed road intersection towards Bronkhorstspruit	14976	15511	17.9	3.5
N4	East of proposed road intersection towards Witbank	14976	15704	18.2	4.6
D960	Between proposed road intersection and N12	0	423	22.6	-
N12	West of D960/N12 intersection towards Johannesburg	14913	15286	16.2	2.4
N12	East of D960/N12 intersection towards Ogies	14251	14302	10.3	0.4
D960	Between proposed road intersection and main access road to site	0	1686	15.4	-
Proposed Road	Proposed road alignment running between N4 intersection and D960	0	1243	13.2	-

- **Discussion of Results**

The general trend that occurs across the years from construction to the commissioning of the units to full commercial operation is a decrease on the AADT influence with an increase in the heavy vehicle influence on the existing transport network. As interpreted in sections 6.2.and 6.3, the influence on the road transport network, in most cases, is minimal ranging from an increase in average annual daily traffic volumes of 0.1 to 6.7%.

The heavy vehicle percentage of the AADT increases from the construction phase to full commercial operation phase. The largest increase in heavy vehicles occurs on the D960 with 5.7% of heavy vehicles for the construction phase increasing to 47.8% for the operation stage. The road network will have to withstand the anticipated loads expected during the operation phase. The percentage of heavy vehicles expected on the road transport network affecting the study area is high indicating that the pavement structure and conditions will have to be improved in order to carry the anticipated, heavier loads.

IMPACTS ON TRANSPORT NETWORK

Road Transport Network

Due to the present alignment of the D686 (R545) provincial road bisecting the identified coal resource, the road or sections of the road will seize to exist once coal operations commence. The

existing provincial road, having a relatively important status, would have to be realigned or an alternative route identified, in order to carry the traffic volumes presently using the road as well as those anticipated to use the road in future and to provide access to the private properties. The realignment of the D686 provincial road should be included within the coal mine's Environmental Impact Assessment process and will not be included within this report. The proposed roads providing access to the proposed power station sites are assumed to be private roads to the site and will not carry the traffic that the D686 (R545) provincial road carried.

On the road transport network, the proposed coal-fired power station will have an overall effect of increasing average annual daily traffic volumes on the roads as well as increasing the heavy vehicle traffic volumes. The general trend that occurs across the years from construction to the commissioning of the units to full commercial operation is a decrease on the AADT influence with an increase in the heavy vehicle influence on the existing transport network.

It was observed for all situations ranging from the construction stage through to full commercial operation that the influence on the road transport network is minimal ranging from an increase in average annual daily traffic volumes of 0.1 to 6.7%. The site X and Y situations portray a concentration of high heavy vehicle percentages of approximately 48% on the D960 road for the operation stage, with the largest increase in volumes occurring between the construction and operation stage, compared with the concentrations and increases on other roads.

The operation stage generates a higher concentration of heavy vehicles on the road transport network compared with that generated by the construction stage. The percentage of heavy vehicles expected on the road transport network affecting the study area is high, which will have a detrimental affect on the existing 'shallow' pavement structures and surface conditions on the provincial and lower-order roads. In order for a pavement to carry a high volume of heavy vehicles, it must comprise of a 'deep' pavement structure having a high load bearing capacity and constructed using good quality materials.

The construction of the surfaced, private proposed access roads to and on the alternative sites will consist of two phases. Phase one will consist of the construction of the lower layers of the pavement structure to serve as a gravel road during the construction phase to mitigate the detrimental effect that the construction vehicles would have on the pavement structures and surfaces. Phase two would be the upgrading of the lower layers and the construction of the upper layers and paved surfacing for the operation stage of the proposed power station and infrastructure.

The proposed power station generates higher volumes of heavy vehicles and increases the average annual daily traffic volumes on the road transport network serving the study area. This impact on the poor condition of the existing roads will be detrimental. Mitigation of this impact and for the proposed power station to operate at an optimal and efficient level, the road network requires the resurfacing, upgrading and reconstruction of the provincial and lower order roads serving the study area. The roads to be reconstructed and construction cost depends on the site selected. For the situation where site X or Y is the selected site for the proposed power station, the D960 lower order gravel road will have to be reconstructed with a deep, surfaced pavement structure composed of good quality materials to carry the anticipated heavy traffic loads and fulfil the role as the access road. Special attention must be given in providing adequate drainage and subsurface drainage systems on all roads to mitigate the dominant weathering process, decomposition. The implementation of these strategies will uplift the present condition of the road transport network, having a positive effect on road users in the area.

A road – water pipeline crossing over or underneath the N12 will have to be made provision for, regardless of the chosen site.

Rail Transport Network

The requirement for rail network access on the proposed power station site depends on a number of factors such as the mode of transport selected for sorbent transport as well as for the transport of materials for the construction and operation of the proposed power station and the ability of the coal mine to supply the required quantities of coal. Railway access doesn't necessarily have to be provided if an alternative such as dedicated haul roads are constructed between the proposed power station site and nearest railway siding. The implementation of haul roads would decrease the volume of heavy vehicles on the transport network, which would have a positive influence on the long-term pavement conditions of the transport network.

According to the identified corridors and the chosen alignment, the railway track/ haul roads would have to cross the N12 or N4 national roads. The construction of a structure to provide this crossing will only be required depending on the existing crossings and chosen alignment.

SITE EVALUATION

In order to evaluate the two alternative sites for selection, the following criteria were identified, as shown in Table 8.1. The criteria were scored individually for the two alternative sites, using a point range of 1 to 5 (1 being the worst and 5, the best). Criteria that will have an equal impact on the two sites resulted in a 0 scoring.

Table 8.1: Site Evaluation

Criteria	Site X	Site Y	Comment
Proximity to coal resource	4	3	Site Y slightly further away from coal supply mine.
Proximity to rail access point	3	2	Access corridors have been identified for site X from the south and north, whereas site Y only has access identified from the south.
Sorbent Locality	0	0	No evaluable difference as transported from Northern Cape, Gauteng, Mpumalanga or North West Province.
Direct access to N4 and N12	4	2	Both sites have direct access although a longer access road to the N4 from site Y will have to be constructed compared to the roads to be constructed for site X.
Least disruptive site access point to road network	0	0	No difference as the site access points are located off major roads. Regardless of the chosen site, the D686 (R545) provincial road will have to be closed and re-routed.
Construction length of proposed, private main access roads from site boundary to road network	4	2	Site Y requires the construction of a longer access road to the N4 compared with the construction of two shorter access roads for site X.
Proximity to local communities	3	2	Commuters traveling from Bronkhorstspruit and Pretoria to site Y have to travel slightly further compared with those traveling to site X.
Public transport facilities along access route to site	0	0	No public transport infrastructure such as bus stops exists at present

Reconstruction of roads within road network	3	2	Selection of either site would require the reconstruction of the D960 lower-order road, although the length of reconstruction is longer for site Y.
Total	**21**	**13**	

From the site evaluation process conducted in Table 8.1, site X is the preferred site of the two alternative sites. However, in order to conduct a more comprehensive comparison a more in depth construction cost comparison could be performed before a site is selected. Site X requires a shorter length of the D960 road to be reconstructed compared with the length for site Y. The length of construction of the proposed private access roads to site X is also shorter than those required for site Y, which could have a substantial influence on the construction cost. Site X has more direct access to the N4 and N12 national roads and is in closer proximity to the coal source, which influences site X's preferable selection.

In the case that a major deciding factor for a site selection is encountered within another specialist study, such as problematic soil conditions, either site could be selected, as there is no presence of a prevalent deciding factor in terms of transport parameters.

CONCLUSIONS

From a transport and traffic impact perspective, the following conclusions were reached:

- Access to site X was identified from the north along a proposed private road running from the D686 (R545) / R104 (P154-2) intersection to site X and from the south along a proposed private road intersecting with the D960 lower-order gravel road. The D960 gravel road, forming the eastern and northern border of site Y, was identified to provide access from the N12 national road and the N4 national road via a proposed private road.
- After a site evaluation process, site X was identified as the preferable site between the two alternative sites. However, it was suggested that an in depth construction cost evaluation should be performed before selection of a site. The criteria influencing site X's preferential status are the more direct access links to the N4 and N12 national roads, the closer proximity to the coal source and the shorter lengths of private and existing roads to be constructed and reconstructed.
- Construction costs could play a major role in the selection of the preferable site. Site X requires the reconstruction of a shorter length of the D960 road compared with that required for site Y as well as the construction of two proposed private access roads. Site Y requires the reconstruction of a longer length of the D960 road as well as the construction of the proposed private road linking with the N4. Although, shorter internal access roads are required within site Y as the D960 forms the northern and eastern borders of site Y.
- The proposed coal-fired power station will have an overall effect of increasing average annual daily traffic volumes on the roads as well as increasing the heavy vehicle traffic volumes.

- The full commercial operation stage generates a higher concentration of heavy vehicles on the road transport network compared with that generated by the construction stage. The percentage of heavy vehicles expected on the road transport network affecting the study area for both stages is high, which will have a detrimental affect on the existing 'shallow' pavement structures and surface conditions on the provincial and lower-order roads. In order for a pavement to carry a high volume of heavy vehicles, it must comprise of a 'deep' pavement structure having a high load bearing capacity and constructed using good quality materials.
- In the event that the railway network will be used for the transport of sorbent and construction and operation materials, railway/ haul road corridors were identified providing access to the alternative sites. Railway access doesn't necessarily have to be provided if an alternative such as dedicated haul roads are constructed between the proposed power station site and the nearest railway siding. The implementation of haul roads would decrease the volume of heavy vehicles on the transport network, which would have a positive influence on the long-term pavement conditions of the transport network
- The future proposed alignment of the K29/1 intersects site X. This road alignment should be validated with the department before the commencement of the design phase, as the proposed route is 38 years old.
- A water pipeline – road crossing will have to be provided along the N12, regardless of the selected site, as the pipeline will run from the Kendal power station to the proposed power station along the identified corridor.
- The study is based on the existing road network and information and the workings of the proposed coal mine necessitate the realignment of the D686 (R545) provincial road. An alternative route or alignment of this road should be identified to accommodate the existing and anticipated traffic that uses the existing road as well as to provide access to the private properties.

REFERENCES

- Mpumalanga Roads Department. Old Route Determination of P29 -1, Report book 711, Oct 1978
- Technical Recommendations for Highways. Draft TRH4: 1996. Structural Design of Flexible Pavements for Interurban and Rural roads. ISBN 1-86844-218-7.1996

APPENDICES

- **APPENDIX A - MAPPING**
- **APPENDIX B – TRAFFIC IMPACT ASSESSMENT**
- **APPENDIX C – TRANSPORT NETWORK MAP AND MAIN COAL BODY**

APPENDIX A – MAPPING

FIGURE A – 1: Locality Map

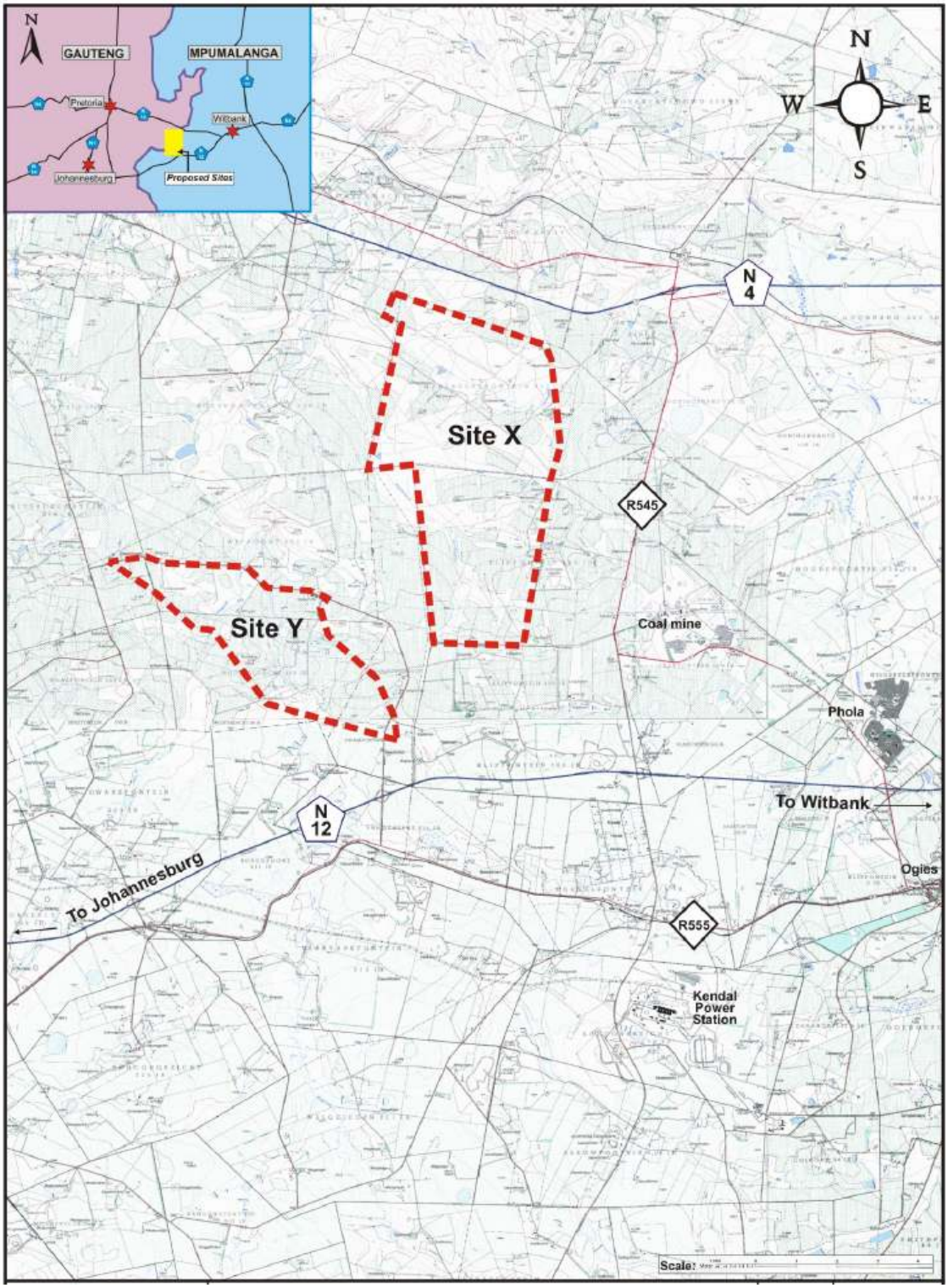


FIGURE A – 2: Site X – Proposed Layout of Main Elements of Power Station Infrastructure

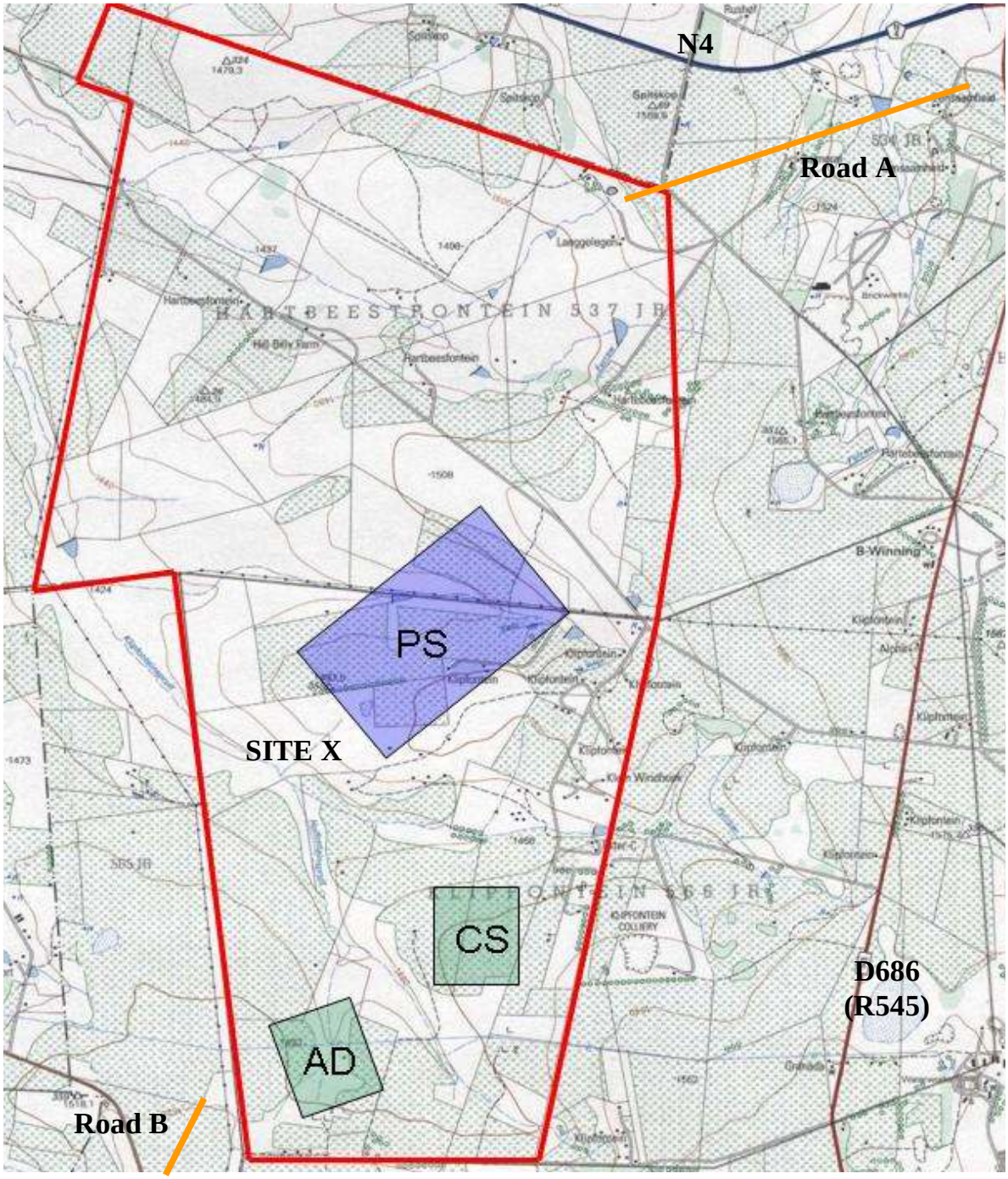
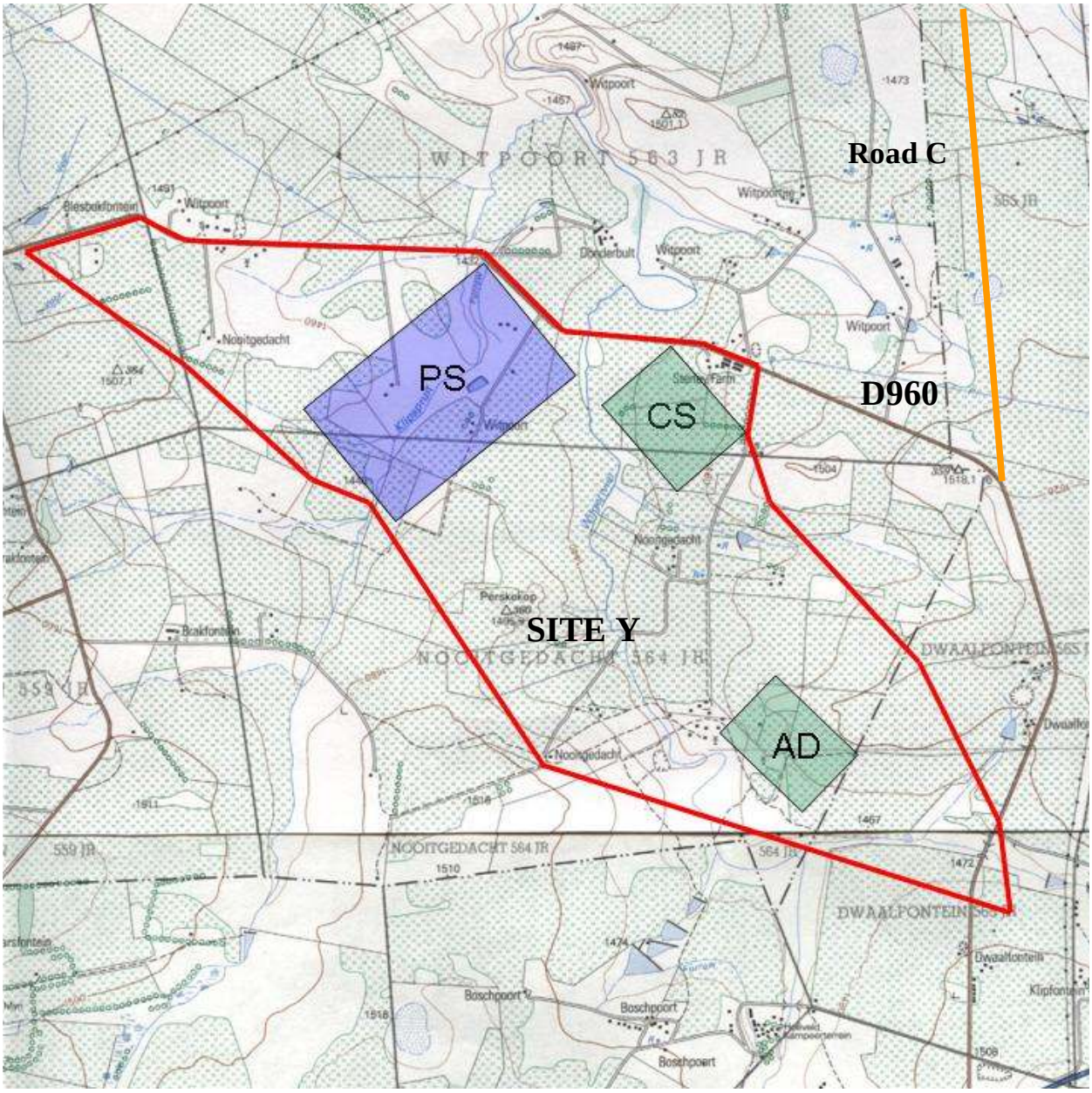


FIGURE A – 3: Site Y – Proposed Layout of Main Elements of Power Station Infrastructure



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APPENDIX B – TRAFFIC IMPACT ASSESSMENT

APPENDIX C – TRANSPORT NETWORK MAP AND MAIN COAL BODY

FIGURE C – 1: Main Coal Body including identified source, New Largo