KUSILE POWER STATION - ASH DISPOSAL FACILITY PROJECT

Traffic Impact Assessment Study

June 2013

Proj. No. 022129

GOBA

CONSULTING ENGINEERS AND PROJECT MANAGERS

www.goba.co.za

TABLE OF CONTENTS

1. INTRODUCTION

1.1 BACKGROUND

Zitholele Consulting (Pty) Ltd appointed Goba (Pty) Ltd on behalf of Eskom as a traffic and transportation specialist in the Environmental Impact Assessment study conducted for the proposed Kusile Power Station Ash Disposal Facility. Kusile Power Station site is located on Hartbeesfontein and Klipfontein farms in the Nkangala District, Mpumalanga. Figure 1, Annexure A shows regional locality of the site.

Kusile Power Station construction is anticipated to take about 8 years to complete and will be ready for commissioning by year 2018. The power station will be coal fired and Anglo Coal (New Largo and Zondagfontein collieries) proposed on the east of the site will supply the coal. The station will consist of six units, each rated at approximately 800 MW installed capacity, giving a total of 4800 MW. As such, it will be one of the largest coal-fired power stations in the world, once finished. Figure 2, Annexure A depicts the locality of Kusile Power Station and New Largo Mine with respect to the study area.

New Largo Mine site is located directly to the east of Kusile Power Station and will be an opencast type of mine to supply the power station with about 17 million tons of coal a year. According to the information at our disposal, the New Largo Mine development is at the approval stage. The New Largo coal reserves span over the R545 provincial road and if the development is approved, the road will be relocated. Zitholele Consulting (Pty) Ltd provided the New Largo Traffic Impact Assessment January 2012 report and the associated recommendations were considered when this assessment was conducted. Option 1 was chosen as a favourable option in the WSP traffic impact report and a roundabout type of control was recommended at the Kusile Road & R545 intersection. Option 1 shows that R545 will be demolished from the Kusile Road intersection to the N12 interchange to accommodate the proposed mine as shown in Figure 2.2, Annexure D by WSP.

1.2 PROBLEM STATEMENT

Kendal Power Station is coal fired and the burnt up coal forms ash that must be disposed of onto a proper facility for treatment. The department of Environmental Affairs requires that an Environmental Impact Assessment be conducted and submitted for approval before any ash is disposed. Zitholele Consulting (Pty) Ltd subsequently identified five sites for investigation as possible location for the ash disposal facility that can accommodate ash for a period of 60 years. The locality of the alternative sites is shown in Figure 2, Annexure A. This report investigates the traffic impact of the proposed 60-year ash disposal facility on the road network surrounding the study area.

1.3 WARRANTS AND EXTENT OF STUDY

In order to identify the relevant input, the following guidelines taken from the Manual for Traffic Impact Studies of the Department of Transport were followed:

- ***Threshold Value*** (in terms of trips generated) for Traffic Impact Studies: For this development less than 150 trips will be generated in the Peak Hour, therefore a Traffic Impact Statement is warranted.
- ***Extent of Analysis***: The extent of the study area should be mutually agreed upon by the local authority and should cover all intersections at which the performance will deteriorate significantly (i.e. drop one level of service or the sum of the critical lane flows amounts to 75 vehicles).
- ***Assessment Years***: The development will generate between 50-150 trips in the peak hour, therefore a Base Year assessment is required however due to the nature of the development, a further seven years form the base year was analysed to assess the impact of operational traffic.

1.4 METHODOLOGY

The methodology adopted is as follows:

Desktop Study

- Project Inception and Planning
- Review of information provided by client (Zitholele (Pty) Ltd
- Identification of traffic counts locations

Data Collections

- Traffic Counts
- Visual Site Inspections – all alternatives

Status Quo Assessment (Baseline impact report)

- Analysis of collected data
- Assessment and description of the current traffic/transportation operations or conditions (Initial Impact to the environment)

Comparative Assessment

- Alternative sites rated during the construction; post construction, closure and post closure phases

Traffic Impact Assessment

- Evaluation of the impact related to the construction activities including transportation of heavy machinery to the preferred alternative using some of the public roads
- Evaluating the impact related to operations and maintenance of the proposed facility
- Assessment of the access requirements from a provincial or a district road for the preferred alternative
- Evaluating the impact of other developments both approved and not approved within the study area

1.5 RATING CRITERIA

The impacts investigated and the associated rankings are shown in the Impact Rating Matrix, attached in Annexure E. The impact assessment methodology makes provision for the assessment of impacts againts the following criteria:

1.5.1 Significance

The significance rating of the associated impacts embraces the notion of extent and magnitude. A more detailed description of impacts is shown in the **Table 1-1** below:

Table 1-1: Description of Spatial rating scale

Rating		Description
7	SEVERE	Impact most substantive, no mitigation possible
6	VERY HIGH	Impact substantive, mitigation difficult/expensive
5	HIGH	Impact substantive, mitigation possible and easier to implement
4	MODERATE-HIGH	Impact real, mitigation difficult/expensive
3	MODERATE-LOW	Impact real, mitigation easy, cost-effective and/or quick to implement
2	LOW	Impact negligible, with mitigation
1	VERY LOW	Impact negligible, no mitigation required
0	NO IMPACT	There is no impact at all - not even a very low impact on a party or system.

1.5.2 Spatial Scale

Spatial scale refers to the extent of the impact i.e. will the impact be felt on a local, regional or global scale. The spatial assessment scale is described in more detail in **Table 1-2** below:

Table 1-2: Description of Spatial rating scale

Rating		Description
7	National	The maximum extent of any impact.
6	Provincial	The spatial scale is moderate within the bounds of impacts possible, and will be felt at a provincial scale
5	District	The spatial scale is moderate within the bounds of impacts possible, and will be felt at a district scale
4	Local	The impact will affect an area up to 5 km from the proposed route corridor.
3	Adjacent	The impact will affect the development footprint and 5oom buffer around development footprint
2	Development footprint	Impact occurring within the development footprint
1	Isolated Sites	The impact will affect an area no bigger than the servitude.

1.5.3 Duration Scale

In order to accurately describe the impact it is necessary to understand the duration and persistence of an impact in the environment. The temporal scale is rated according to criteria set out in **Table 1-3** below:

Table 1-3: Description of Duration rating scale

Rating		Description
1	Incidental	The impact will be limited to isolated incidences that are expected to occur very sporadically.
2	Short-term	The environmental impact identified will operate for the duration of the construction phase or a period of less than 5 years, whichever is the greater.
3	Medium term	The environmental impact identified will operate for the duration of life of the line.
4	Long term	The environmental impact identified will operate beyond the life of operation.
5	Permanent	The environmental impact will be permanent.

1.5.4 Degree of Probability

Table 1-4: Description of Degree of probability rating scale

Rating	Description
1	Practically impossible
2	Unlikely
3	Likely
4	Very Likely
5	It's going to happen / has occurred

1.5.5 Degree of Certainty

Table 1-5: Description of Degree of certainty rating scale

Rating	Description
Definite	More than 90% sure of a particular fact.
Probable	Between 70 and 90% sure of a particular fact, or of the likelihood of that impact occurring.
Possible	Between 40 and 70% sure of a particular fact or of the likelihood of an impact occurring.
Unsure	Less than 40% sure of a particular fact or the likelihood of an impact occurring.
Can't know	The assessment is not possible even with additional research.

1.5.6 Quantitative Description of Impacts

To allow for impacts to be described in a quantitative manner in addition to the qualitative description given above, a rating scale of between 1 and 7 was used for each of the assessment criteria. Thus the total value of impact is described as the function of significance, spatial and temporal scale as described below:

$$\text{Impact Risk} = \frac{(\text{Magnitude} + \text{Spatial} + \text{Duration})}{2.714} \times \frac{(\text{Probability})}{5}$$

The impact is classified according to five classes as described in **Table 1-6.**

Table 1-6: Impact Risk Classes

RATING	Impact Class	DESCRIPTION
0.1 - 1	1	Very low
1.1 - 2	2	Low
2.1 - 3	3	Moderate-Low
3.1 - 4	4	Moderate-High
4.1 - 5	5	High
5.1 – 6	6	Very High
6.1 - 7	7	Severe

1.5.7 Cumulative Impact

It is a requirement that the impact assessment take cognisance of the cumulative impacts. In fulfilment of this requirement, the impact assessment will take cognisance of any existing impact sustained by the operations, any mitigation measures already in place, any additional impacts to environment through continued and proposed future activities and the residual impact after mitigation measures.

It is important to note that cumulative impacts at the national or regional level will not be considered in this assessment, as the total quantification of external companies on resources is not possible at project level due to lack of information and research documenting the effects of existing activities. Such cumulative impacts may occur across industry boundaries can also be only affectively addressed at Provincial and National Government level.

1.6 CAPACITY ANALYSIS

The intersections were evaluated using SIDRA Intersections V5.1 traffic software. The Highway Capacity Manual Criteria for Level of Service (LOS) based on delay were applied in the analysis. The measured peak hour factors for each intersection approach were used to reflect the peak hour traffic demand for the intersection. The results of the traffic evaluations are shown in Table 4-2, Annexure B.

The performance of intersections is defined by the level of service (LOS) for each approach to the intersection. These levels of service have been defined in the Highway Capacity Manual (HCM) as shown in Table 1-7 below. During the peak hours, the road infrastructure capacity provided should ensure that the intersection approach level of service should ideally not exceed LOS E; for example the average delay for a signalised intersection should not exceed 80 seconds as predicted by the model.

Table 1-7 : Level of Service Criteria (HCM)

Level of Service	Average Approach Delay for Signalised Intersections (seconds)	Average Approach Delay for Priority Intersections (seconds)
A	< 10	< 10
B	10 to 20	10 to 15
C	20 to 35	15 to 25
D	35 to 55	25 to 35
E	55 to 80	35 to 50
F	> 80.0	> 50

1.7 RELEVANT PEAK HOURS

The critical peak hour from a road capacity point of view, occurs when the traffic generated by the development is at a maximum or when the highest combination of existing road traffic and traffic generated by the development occurs.

Based on a consideration of the relevant land use, it was decided to consider the following peak hours for analyses:

- Weekday AM Peak hour (06:00 – 07:00) ; and
- Weekday PM Peak hour (17:00 – 18:00).

1.8 ASSESSED SCENARIOS

The trip assignment figures are provided in Annexure A. The traffic scenarios that were considered relevant in order to determine the expected traffic impact of the proposed development are as indicated in Table 1- 8 below:

Table 1-8 : Assessment Scenarios

SCENARIO	ASSESSMENT YEAR AND TRAFFIC DEMAND	ROAD NETWORK	FIGURE
1	2012/13 traffic volumes.	Existing 2012 road layout.	**3**
2	2012/13 Existing + New Largo Mine Traffic	Existing 2012 road layout PLUS road improvements if required.	**8**
3	2012/13 Existing + Ash Disposal Facility Traffic	Existing 2012 road layout PLUS road improvements if required.	**9**
4	2012/13 Existing + Ash Disposal Facility + New Largo Mine Traffic	Existing 2012 road layout PLUS road improvements if required.	**10**
5	Horizon 2020 Traffic	Future road layout before R545 Re-alignment	**11**
6	Horizon 2020 + Kusile Power Station + Ash Disposal Facility Traffic	Future road layout before R545 Re-alignment	**17**
8	Horizon 2020 + New Largo Mine Traffic	Future road layout with the R545 Re-alignment	**18**
9	Horizon 2020 + Kusile Power Station+ Ash Disposal Facility + New Largo Mine Traffic	Future road layout with R545 Re-alignment	**19**

2. STATUS QUO / BASELINE IMPACT ASSESSMENT

The status quo assesses the existing impact of traffic on the road network. The roads in the immediate vicinity of the site are shown in Figure 2, Annexure A and Figure 2-1 and are discused below:

2.1 DESCRIPTION OF ROAD INFRASTRUCTURE

N4 : **Paved** Class 1 National Dual Carriageway Road traversing east west located north of Kusile Power Station with two lanes per direction carrying moderate volumes of traffic during critical peak hours. The road is in a good condition and carries a moderate to high volume of heavy traffic.

N12 : **Paved** Class 1 National Dual Carriageway Road traversing east west located south of Kusile Power Station with two lanes per direction carrying moderate volumes of traffic during critical peak hours. The road is in a good condition and carries a moderate to high volume of heavy traffic.

R960 : **Gravel** Provincial Class 4 road also known as R960 traversing north south located south west of Kusile Power Station with one lane per direction and carries low volumes of traffic during critical peak hours. The road intersects with N12 National Road south of Kusile Power Station.

R545 : **Paved** Provincial Class 3 road also known as D680 traversing north south located east of Kusile Power Station with one lane per direction and carries moderate volumes of traffic during peak hours but a high proportion of heavies throughout the day. This road forms district road D686 approximately 10.6 km south of the Kusile Road / R545 intersection. The condition is poor.

D961 : **Gravel** District Class 4 District road also known as R961 traversing north south located west of Kusile Power Station with one lane per direction and carries low volumes of traffic during peak hours. The condition is poor.

Kusile Road : **Gravel** Class 4 road traversing north south located west of Kusile Power Station with one lane to each direction. Kusile Power Station and the planned New Largo Mine will gain access off this road. Parts of this road were under construction when the manual count was conducted. Kusile Road will be a tarred road with one lane per direction when completed.

2.2 DATA COLLECTION AND VISUAL SITE INSPECTIONS

Detailed 12 hour classified traffic counts were undertaken 20th November 2012 at the following locations:

1. R960 and R961
2. Kusile Road and Kusile Power Station Construction Access
3. Kusile Road and R545
4. R545 (D686) and R545

The current volumes on the road network in immediate vicinity of the development site are depicted in Figure 3, Annexure A. A visual site inspection was also conducted at the time the traffic counts were being undertaken to understand the prevailing traffic operations within the study area. The traffic on immediate vicinity of the development is moderate to high in volume. Kusile Power Station and Kusile Road are currently under construction and therefore adding significant number of trips on Kusile Road and intersections within the study area. The traffic counted manualy was therefore inclusive of the Kusile Road and Kusile Power Station construction traffic and was assessed as such.

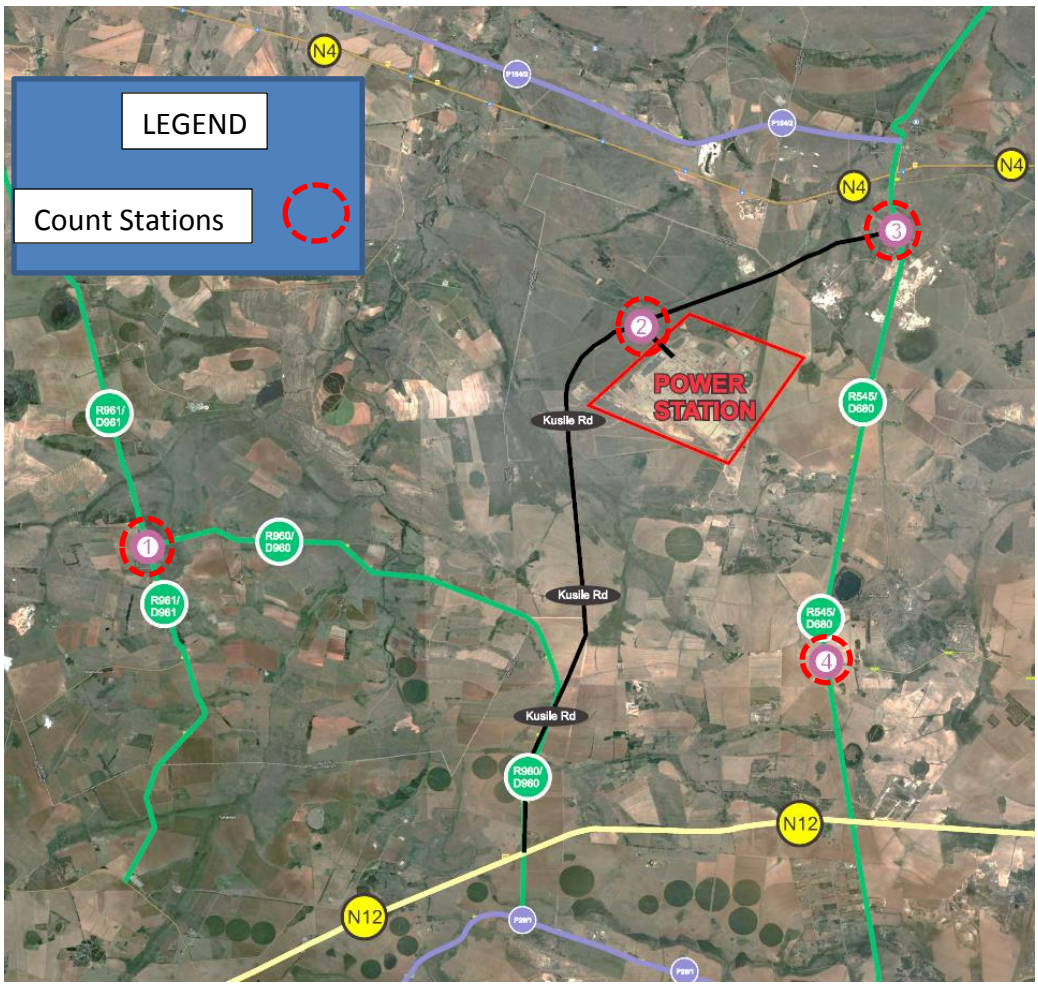


Figure 2-1: Traffic Counts Locations

2.3 LOCATION OF EMPLOYEE RESIDENCES

The travel patterns established from the traffic counts indicate clearly that the major source of employees or their residential areas are located in Delmas, Phola, Ogies, Emalahleni, Wilge and Bronkhorstspruit as shown in the regional locality Figure 1, in Annexure A.

2.4 BASELINE IMPACT

The five alternative sites identified by Zitholele Consulting (Pty) Ltd are depicted on Figure 2-2 below. The identified alternatives were investigated individualy to the same level of degree at the baseline impact stage of the study.

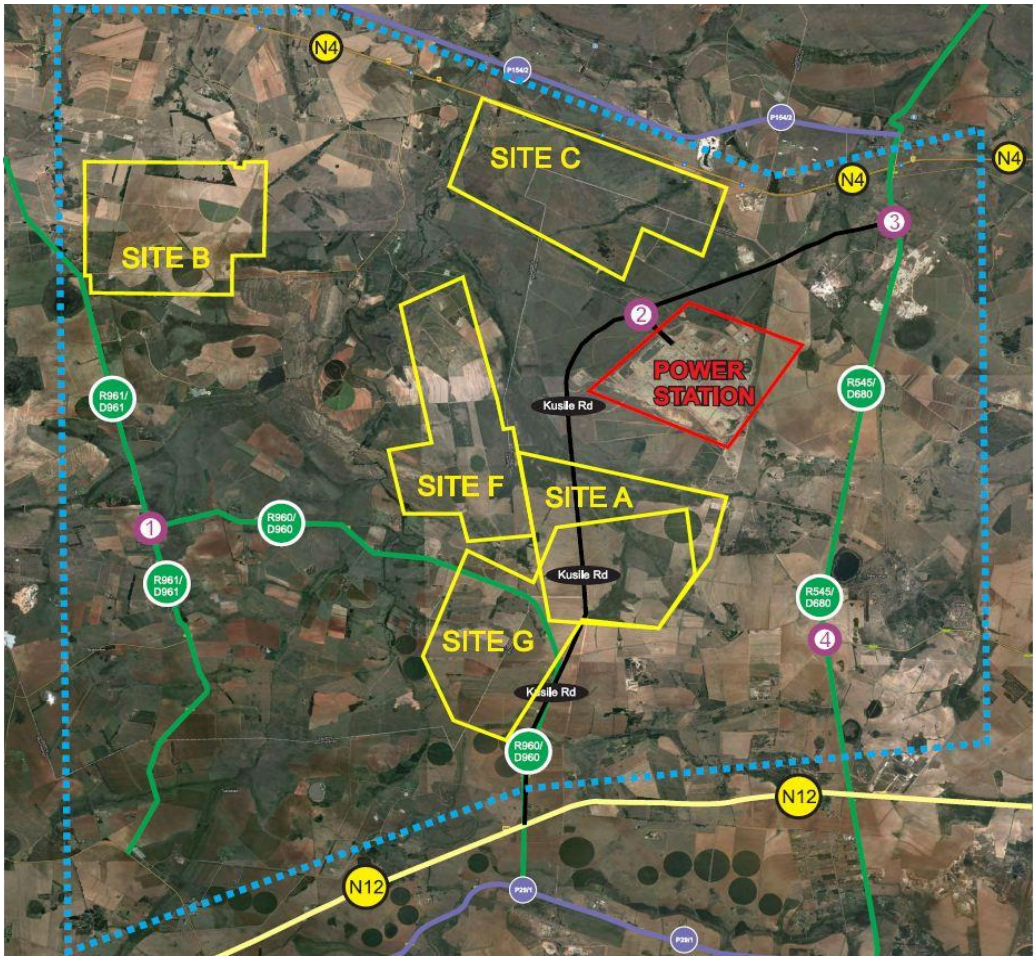


Figure 2-2: Sites Locality

In terms of traffic and transportation, a suitable site should be easily accessible. All five alternative sites can be easily accessed off existing roads. Site A, C, F and G can be easily accessed off Kusile Road and Site B can be accessed off R961. The condition of the R961 is however putting Site B in a disadvantage unless it is upgraded to a tarred road.

The trips expected to be generated by the ash disposal facility will be the same for all five sites, however the background traffic on the access road the new traffic will be discharged

on will determine the significance of impact the site will have on the intersections and the environment.

The proximity of the site to Kusile Power Station is directly propotional to the construction cost of the conveyor belt. Ideally a conveyor should not cross rivers or roads but in this case Site B, C, F and G's conveyor route will at some point cross either a river or a road. Site A and C are the closest sites to Kusile Power Station and based on this, they were deemed most favourable sites at the baseline stage of the EIA process.

2.5 INTERSECTIONS EVALUATION-SCENARIO 1 (2012/13 EXISTING TRAFFIC VOLUMES)

The manual traffic count that was conducted in November 2012 is inclusive of the Kusile Power Station and the Kusile Road Construction traffic therefore this scenario also takes into account the temporal impact these trips will have on the capacity of the intersections.

2.5.1.1 R960 / R961

All approaches are performing at acceptable LOS ranging from LOS A to LOS C.

2.5.1.2 Kusile Road / Kusile Power Station Access

The south approach is currently battling to find gaps and is performing at LOS E in the morning however the vehicles queue inside the site and do not interfere with the traffic on Kusile Road.

2.5.1.3 Kusile Road / R545

All approaches are performing at acceptable LOS ranging from LOS A to LOS C.

2.5.1.4 D686 / D680 / R545

All approaches are performing at acceptable LOS ranging from LOS A to LOS C.

2.6 SCENARIO 1: STATUS QUO RATING

The Status Quo impact is rated in the Impact Rating Matrix attached in Annexure F. The existing traffic recorded is much higher than anywhere else between the Kusile construction access and the Kusile Road & R545 intersection due to Kusile Power Station construction activities. The impact significance at this section is high, the spatial scale limited to areas adjacent to the site, the duration will be short term and the impact is likely to occur at this section. The impact will be arrested with the mitigation measure proposed.

The overall status quo impact's significance is MODERATE, the spatial scale is *limited to areas adjacent to the site*, duration is short term, the impact is *likely to occur*. The degree of certainty is **probable (70% – 90%)**.

3. COMPARATIVE IMPACT ASSESSMENT

The Rating Matrix is attached in Annexure F. After studying baseline reports from various specialists, Zitholele Consulting (Pty) Ltd revised the site alternatives and a new list was provided for consideration during the comparative stage. The new site alternatives were Site A, Site B, Site C, Sites A+F, Sites A+G and Sites F+G.

A comparative rating matrix was also provided by Zitholele Consulting (Pty) Ltd for use when ranking the sites. The cumulative impact at this stage was not quantitative and as such only the project impact was used to rank the sites. The latent demand or cumulative impacts include both the Kusile Power Station and the New Largo coalmine planned to the east of the Power Station. The scoring of the sites took cognisance of the upgrades proposed in both the Eskom Traffic Investigation & Kusile Access Study September 2012 and the New Largo Traffic Impact Assessment January 2012 reports. The rating conducted was for the traffic generated during the construction, post construction, commissioning and post commissioning phases.

3.1 SITES RATING DURING THE CONSTRUCTION PHASE

This traffic relates directly to the traffic expected during the construction of the liner or foundation of the ash disposal facility that will take place over a period of 24 months (2 years). The construction traffic will dissipate shortly after completion of construction of the liner or foundation.

The cumulative impact of sites A, A+G, A+F and F+G will be the same because of their close proximities and association to Kusile Road. The geotechnical specialist noted that there is a shortage of Clay material at Site C therefore suitable material must be hauled in from an outside source using public roads and this will result in new truck trips. The cumulative rating took cognisance of the Kusile Power Station and the proposed New Largo traffic and mitigation measures proposed in their respective reports. The sites were rated in the rating matrix attached in Annexure F.

3.1.1 Site A

The background traffic on the roads adjacent to Site A is low to average and the trip generation is not expected to result in additional delays at intersections. This development will have very low impact risk on the road network and surrounding intersections.

Clay material is available on site, which means the impact due to earth moving will be limited to the development footprint. The transportation of staff to and from site will have minimum impact on the road network.

Site A impact rating: Significance VERY LOW, spatial scale *will be limited to the development footprint*, duration will be short term, probability of the impact occurring is *unlikely* and the degree of certainty is **probable**.

3.1.2 Site B

The background traffic on R961 adjacent to Site B is low therefore; the probability of the trip generation causing additional delays at intersections is low. R961 is currently gravelled and has to be upgraded to an acceptable standard. The development will have negligible impact on the road network and surrounding intersections.

Clay material is available on site, which means the impact due to earth moving will be limited to the development footprint. The transportation of staff to and from site will have minimum impact on the road network.

The construction of the first 5-year liner will be 2 years making the duration scale of this impact short term. The conveyor from the Power Station to Site B will cross Kusile Road and its construction will cause traffic disruptions. As a mitigation measure, a temporal diversion road has to be constructed. The design and approval of the temporal diversion road can be both expensive and time consuming.

Site B impact rating: Significance is MODERATE HIGH, spatial scale *will be local*, duration will be short term, probability of the impact occurring is *very likely* and the degree of certainty is **definite**.

3.1.3 Site C

Site C's trip generation will impact negatively on the road network and the intersections within the study area due to the number of truck trips expected to transport clay material from an external source to be located south of the Power Station. The impact extent will be local (within a 10km radius).

The conveyor from the Power Station to site will cross Kusile road and the construction will cause traffic disruptions. As a mitigation measure, a temporal diversion road has to be constructed. The design and approval of the temporal diversion road can be both expensive and time consuming.

The construction of the first 5 year liner is estimated to be 2 years which is less than 5 years making the duration scale of this impact short term. It is very likely that a negative impact on the environment will occur due to Site C trip generation because of the unavailability of the clay material on site.

Site C impact rating: Significance is MODERATE HIGH, spatial scale *will be local*, duration will be short term, probability of the impact occurring is *likely* and the degree of certainty is **definite**.

3.1.4 Sites A+F, A+G, F+G

These sites rank the same as site A. The impact is likely to occur on the surrounding roads and intersections but will be restricted to an area adjacent to site. The conveyor will cross the Kusile road south of the Kusile Power Station and will require a temporal diversion road that is expensive to construct and time consuming to get it approved by relevant authorities.

Sites A+F, A+G, F+G impact rating: Significance MODERATE LOW, spatial scale *will be limited to an area adjacent site*, duration will be short term, probability of the impact occurring is *likely* and the degree of certainty is **definite**.

3.2 POST CONSTRUCTION TRAFFIC

This traffic relates to the operations and maintenance of the facility. This impact will only occur once the construction of the ash disposal facility is complete and it is operational. The operational traffic will be less than the construction traffic. The rating of the post construction traffic took cognisance of the mitigation measures proposed in the construction traffic scenario.

3.2.1 Site A

The development's post construction traffic will be significantly lower than that of the construction phase.

Site A impact rating: Significance VERY LOW, spatial scale will be *limited to the development footprint,* duration will be medium term, probability of the impact occurring is *unlikely* and the degree of certainty is **probable**.

3.2.2 Site B

The new traffic generated by the development will not have a negative impact on the R961 and associated impact because of the low background traffic.

Site B impact rating: Significance is VERY LOW, spatial scale will *limited to isolated sites*, duration will be medium term, probability of the impact occurring is very *unlikely* and the degree of certainty is **probable**.

3.2.3 Site C

Site C will not have a negative impact on the road network and will benefit from its close proximities to the power station. The intersections and Kusile Road will be paved by the time the development is operational.

Site C impact rating: Significance is VERY LOW, spatial scale will be *limited to the development footprint*, duration will be medium term, probability of the impact occurring is *unlikely* and the degree of certainty is **probable**.

3.2.4 Sites A+F, A+G, F+G

These sites rank the same as site A.

Sites A+F, A+G, F+G impact rating: Significance VERY LOW, spatial scale will be *limited to the development footprint*, duration will be medium term, probability of the impact occurring is *unlikely* and the degree of certainty is **probable**.

3.3 CLOSURE TRAFFIC

The traffic expected in this scenario is negligible and will therefore have no impact on the road network surrounding the site. The lifespan of the facility is the same as those of the Kusile Power Station and the New Largo mine therefore the operational traffic of all three by then will have decreased. All sites will have no impact on the road network because of the improved capacity due to mitigation measures taken to accommodate the construction and operational traffic.

3.4 POST CLOSURE TRAFFIC

This scenario will have no impact on the road network and intersections surrounding the sites.

4. TRAFFIC IMPACT ASSESSMENT

Subsequent the comparative assessment, which included a number of disciplines, **Site A** was chosen as a suitable site based on the ratings of all the specialists involved in the EIA process and as such the impact assessment will be based on this site only. The footprint (822 ha) of **Site A** was also revised as shown in Annexure E to prevent the encroachment onto Kusile Road. **Site A** is located south east of Kusile Power Station bounded by Kusile Road and R545.

The traffic impact of Site A was evaluated for traffic generated during construction and post construction once the ash disposal facility is operational. This traffic impact study evaluates the current traffic operating conditions of the key intersections surrounding the proposed development and the impact of the newly generated trips on these intersections. It also evaluates the access roads to/from the site and makes recommendations in this regard.

4.1 PROJECT IMPACT

The project impact in terms of traffic and transportation refers to the potential impact that the proposed development will have on the road network and associated intersections. This includes aspects such as the trip generation, proposed accesses and how new trips were assigned onto the road network.

4.1.1 Access

Site A is bounded by Kusile Road to the west and R545 to the east. It is proposed that Site A be accessed off Kusile Road approximately 12.5Km south of the Kusile Road and R545 intersection. The proposed access configurations are shown in Figure 4-1 below.

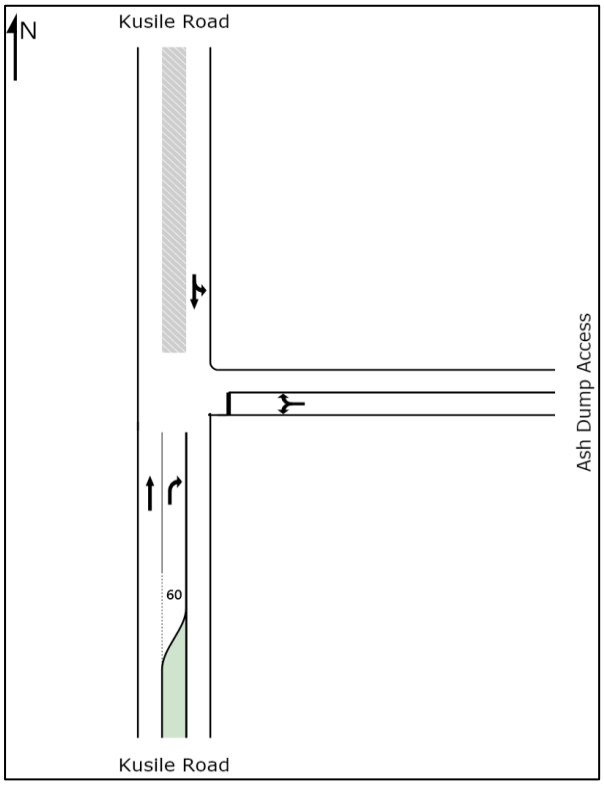


Figure 4-1: Access Lane Configurations

4.1.2 Intersections evaluated

A manual 12-hour traffic count was conducted at the following intersections in November 2012.

1. R960 & R961
2. Kusile Road & Kusile Power Station Access
3. Kusile Road & R545
4. R545 (D686) & R545

The above intersections were evaluated for capacity constraints and excessive delays using SIDRA Intersection 5.1 software.

4.1.3 Trip Generation

The new traffic is expected to impact on the environment in two aspects or phases. There will be traffic generated due to construction of the liner or foundation of the ash disposal facility and the impact of this traffic is generally short term. The second aspect refers to the traffic generated post construction and this traffic is refered to as operational traffic.

4.1.3.1 Construction Traffic

Construction traffic relates directly to the traffic expected during the construction of the liner or foundation of the ash disposal facility that will take place over a period of 24 months (2 years). The construction traffic will dissipate shortly after completion of construction of the liner or foundation.

The construction of the liner is phased in 5 year circles for the duration of the life span of the ash disposal facility in order to minimise exposure of the lining materials to the environment. The typical area in square metres required for the lining of the first five year terrace is 1 984 546m^2.

The foundation is made up of mostly clay material. The geotechnical specialist in the team indicated that there's sufficient clay materails on site. This means that all the truck trips during the earthworks phase will be internal and will not use public roads to haul materials from an outside source. It was also indicated that excavated top soil will be spoilt on site so no transportation to an off-site location will be required.

Trip generation rates for this type of development are not available from the standard sources and therefore a trip generation estimate had to be based on the labour force that will construct the foundation or liner. A labour force of approximately 400 people is currently used at Medupi Power Station Ash Disposal Facility liner construction which is a similar development and as such the same number was assumed to be conservative and was used to estimate new trips as shown in Table 4-1. The trips will emanate mostly from the transportation of labourers.

An 85/15 split between public tranport and private trips was assummed to be the best representation of the expected modal split. A further 20/80 split between taxis and buses respectively was assummed in the mode choice scenario based on the assumption that most of the labourers will be bused to site as done in the Medupi project. A vehicle capacity or occupancy that was used in the New Largo study was accommodated to estimate the number of public transport trips as shown in Table 4-1 below:

Land Use	Labour force	Modal Split		Modal Choice			Vehicle Occupancy				New Trips			
		85%	15%	100%	20%	80%	1.2	8	64		AM Peak		PM Peak	
		PT Trips	Private	Cars	Taxis	Buses	Cars	Taxis	Buses	TOTAL	IN	OUT	IN	OUT
Ash Disposal Facility	400	340	60	60	68	272	50	9	4	71	57	14	14	57

Table 4-1 : Construction phase trip generation

4.1.3.2 Post Construction Traffic

This traffic relates to the operations and maintenance of the facility. This impact will only occur once the construction of the ash disposal facility is complete and it is operational. The operational traffic will be less than the construction traffic. Trip generation rates for this type of development are not available from the standard sources and therefore a trip generation estimate had to be based on developments of similar nature in operations.

Goba Consulting Engineers was recently appointed to conduct a traffic impact study for an Eskom Kendal Power Station's Ash Disposal Facility expansion. A manual traffic count was conducted on the 5th of February 2013 at the access point and intersections surrounding the existing ash disposal facility. The manual traffic count is shown Figure 19, Annexure A.

Eskom furthermore provided information on daily traffic to and from the disposal facility and the traffic that is permanently based on site. The existing facility is operated by Roshcon SOC Ltd. Roshcon is responsible for the daily operation including site personnel. The site staff is transported to and from site by means of minibus taxis operated by Roshcon SOC Ltd. The summary of the Roshcon Ltd daily traffic provided by Eskom is as follows:

- 3 ADT's
- 1 tipper truck
- 4 Front-in loaders
- 2 Dozers
- 2 Mini buses
- 3 Bakkies
- 1 TLB
- 1 Bob cat
- 1 Water Tanker

Of this traffic only the 2 minibuses and 3 bakkies leave the site on a daily basis. The summary of the Eskom traffic from the Power Station to the Ash Disposal Facility is as follows:

- 10 Bakkies
- 5 Tipper trucks
- 5 x 30 ton trucks

Only the 10 bakkies and the 5 tipper trucks leave the site on a daily basis. The 5X30 ton trucks are only used in emergency situations when the conveyor that transports the ash from the power plant to the ash dump fails.

The combination of the two helped arrive at the estimation of 17 trips arriving and 10 leaving in the morning. The trips counted in the afternoon leaving the site are low and this is attributed to peak spread. Most of the trips left the site before the calculated peak hour. The worst-case scenario would be if all 20 vehicles per day provided by Eskom leaves the site at the same time during the afternoon peak hour. This scenario is considered adequate for assessing any potential impact that might be caused by the operational traffic on the road network surrounding the site; therefore 20 vehicles per hour (vph) will leave the site while 5 trips will be arriving.

4.1.4 Trip Distribution

The new trips generated by the development were distributed and assigned to the adjacent road network based on the existing proportions of origins and destinations observed on the network. Refer to Figure 4; 5; 6; 7; 12; 13; 14 and 15 for the trip generation and distribution in Annexure A for more details.

The traffic that is Emalahleni and Bronkhorspruit bound was assigned to the north along R545 towards the N4 based on the shorter distance to destinations. Traffic to Delmas, Joburg, Springs and associated areas was assigned to the west along Kusile Road towards the N12 interchange. Places like Phola, Ogies etc will contribute to the labour force and the trips bound for these areas were assigned to the south along R545. The trip generation was distributed as follows:

1. 20% from the west along Kusile Road

2. 80% from east along Kusile Road

    - 65% from the north along R545; and
    - 15% from the south along R545

4.1.5 Assessment years

- **Year 2013**: The 2013 traffic conditions.
- **Horizon Year 2020:** The expected year 2020 traffic conditions based on the 2013 traffic adjusted with a 2% per annum growth factor.

4.1.6 Traffic Growth

The Mpumalanga Traffic Department provided a report "Future Traffic Pojection, Mpumalanga Province, November 2010 by ITS Pty (Ltd)". This report states that (Table 3.1A and Table 3.1B on page 4) light vehicles will grow between 0.02% and 0.03% per year. Heavy vehicle growth rates are more varied but range from -0.65% to 2.7% per year. Subsequent to this, a conservative growth rate of 2% per annum was asummed to best represent the growth in traffic in this area. This report is provided in Annexure C.

4.1.7 Project Impact Rating

The trip generation of the proposed Ash Disposal Facility development is moderate in volume and is expected to cause negligible impact on the environment.

Impact rating: Significance VERY LOW, spatial scale will be *limited to the development footprint*, duration will be medium term, probability of the impact occurring is *unlikely* and the degree of certainty is **probable**.

4.2 CUMULATIVE IMPACT

4.2.1 Latent demand

The proposed ash disposal facility will serve the Kusile Power Station, which is being constructed and located north of the proposed Site A. Kusile Power Station will dispose of ash via ground level conveyor and the ash will be treated and compacted on site by a contractor. Kusile Power Station construction trips are currently on the road and therefore form part of the counted traffic in November 2012. Zitholele Consulting (Pty) Ltd provided a Traffic Investigation & Study to Improve Access to Kusile Power Station Final report dated 04 September 2012 by Pangae-KV3 Joint venture for considerations when assessing the impact of the proposed ash disposal facility. The operation and maintenance trips for Kusile Power Station are shown in Figure 14, Annexure A.

Another development in the area is an open cast coalmine proposed directly on the east of the power station by New Largo Colliery. The locality of New Largo Mine in relation to site A and Kusile Power Station is shown in Figure 2, Annexure A. Zitholele Consulting (Pty) Ltd provided the Proposed New Opencast Coal Mine, New Largo Colliery traffic impact assessment January 2012 report by WSP SA (Pty) Ltd for considerations when assessing the impact of the proposed Ash Disposal facility. New Largo Mine will gain access off Kusile Road. The trips generated by New Largo Mine are shown in Figure 6, Annexure A for construction phase and Figure 15 for the operational phase. The New Largo Traffic Impact Assessment report by WSP (Pty) Ltd is available on request.

4.2.2 Future Road Network

New Largo Mine will span along the R545 route and therefore will require that the road be relocated. A proposal to re-align Road R545 was made in the New Largo Traffic Impact Assessment report dated January 2012. The new R545 alignment is marked Option 1 in Annexure D. If Option 1 is constructed, the intersection R545 & Kusile Road will be converted to a roundabout. Option 1 shows that R545 will be demolished from the N12 interchange to the Kusile Road intersection to accommodate the proposed mine. The traffic traversing south will have to turn left and travel east around the mine perimeter and link up with R545 between Wilge and Phola north of the N12 / R545 interchange.

4.2.3 Intersection Evaluation - Scenario 2 (2012/13 ExistingTraffic + New Largo MineTraffic)

This scenario relates to the traffic currently on the road including the Kusile Power Station construction traffic and the Kusile Road construction traffic plus the expected New Largo Mine construction traffic.

4.2.3.1 R960 / R961

All approaches are performing at acceptable LOS ranging from LOS A to LOS C.

4.2.3.2 Kusile Road / Kusile Power Station Access

The south approach is expected to perform at unacceptable LOS F in the PM Peak due to additional traffic (New Largo Mine Traffic) on Kusile Road. It is proposed that a pointsman be deployed at this intersection in the afternoon peak (15:00 – 18:00) to control the flow of traffic so to offer gaps to the south approach. This scenario was modelled with a traffic signal to simulate a pointsman controlling traffic at this junction and the results are shown in Table 4-2, Annexure B. The intersection LOS is expected to improve from LOS F to LOS C in the afternoon.

4.2.3.3 Kusile Road / R545

All approaches are performing at acceptable LOS ranging from LOS A to LOS C.

4.2.3.4 D680 / D686 / R545

All approaches are performing at acceptable LOS ranging from LOS A to LOS C.

4.2.3.5 Kusile Road / New Largo Mine Access

All approaches are performing at acceptable LOS ranging from LOS A to LOS C.

4.2.4 Intersection Evaluation - Scenario 3 (2012/13 ExistingTraffic + Ash Disposal Facility Traffic)

This scenario relates to the traffic currently on the road including the Kusile Power Station construction traffic and the Kusile Road construction traffic plus the proposed ash disposal facility construction traffic.

4.2.4.1 R960 / R961

All approaches are performing at acceptable LOS ranging from LOS A to LOS C.

4.2.4.2 Kusile Road / Kusile Power Station Access

The south approach is expected to perform at unacceptable LOS F in the PM Peak due to additional traffic (Ash Disposal Traffic) on Kusile Road. It is proposed that a pointsman be deployed at this intersection in the afternoon peak (15:00 – 18:00) to control the flow of traffic so to offer gaps to the south approach. This scenario was modelled with a traffic signal to simulate a pointsman controlling traffic at this junction and the results are shown in Table 4-2, Annexure B. The intersection LOS is expected to improve from LOS F to LOS C in the afternoon.

4.2.4.3 Kusile Road / R545

All approaches are performing at acceptable LOS ranging from LOS A to LOS C.

4.2.4.4 D680 / D686 / R545

All approaches are performing at acceptable LOS ranging from LOS A to LOS C.

4.2.4.5 Kusile Road / Ash Disposal Facility

All approaches are performing at acceptable LOS ranging from LOS A to LOS C.

4.2.5 Intersection Evaluation - Scenario 4 (2012/13 Existing + New Largo + Ash Disposal Facility Traffic)

This scenario relates to the traffic currently on the road including the Kusile Power Station construction traffic and the Kusile Road construction traffic plus both New Largo Mine and the proposed Ash Disposal Facility construction traffic.

4.2.5.1 R960 / R961

All approaches are performing at acceptable LOS ranging from LOS A to LOS C.

4.2.5.2 Kusile Road / Kusile Power Station Access

The south approach is expected to perform at unacceptable LOS F in the PM Peak due to additional traffic on Kusile Road. It is proposed that a pointsman be deployed at this intersection in the afternoon peak (15:00 – 18:00) to control the flow of traffic so to offer gaps to the south approach. This scenario was modelled with a traffic signal to simulate a pointsman controlling traffic at this junction and the results are shown in Table 4-2, Annexure B. The intersection LOS is expected to improve from LOS F to LOS C in the afternoon.

4.2.5.3 Kusile Road / R545

The intersection is expected to operate at acceptable LOS C in both the AM and PM Peak hours.

4.2.5.4 D680 / D686 / R545

All approaches are performing at acceptable LOS ranging from LOS A to LOS C.

4.2.5.5 Kusile Road / Ash Disposal Facility

All approaches are performing at acceptable LOS ranging from LOS A to LOS C.

4.2.5.6 Kusile Road / New Largo Mine Traffic

The south approach will find difficulties in finding gaps onto Kusile Road. Deployment of a pointsman is proposed because the delays will only be experienced during the construction phase of the development. The intersection was however simulated as a signalised intersection and the results shows an improvement in the approach's LOS from LOS F to LOS C during the PM Peak.

4.2.6 Intersection Evaluation - Scenario 5 (Horizon Year 2020 Traffic)

This scenario investigates the intersection capacities post construction of the ash disposal facility assuming a growth of 2% per annum in background traffic. The traffic currently on Kusile Road is attributed to the construction of Kusile Road and the Kusile Power Station. Now looking at a scenario where there is neither Kusile Power Station nor New Largo Mine in year 2020, the traffic on Kusile Road will be that of local farmers.

4.2.6.1 R960 / R961

All approaches are performing at acceptable LOS ranging from LOS A to LOS C.

4.2.6.2 Kusile Road / R545

The intersection is expected to operate at acceptable LOS A in both the AM and PM Peak hours.

4.2.6.3 D680 / D686 / R545

The intersection is expected to operate at acceptable LOS B in both the AM and PM Peak hours.

4.2.7 Intersection Evaluation - Scenario 6 (Horizon Year 2020 + New Largo Traffic)

This scenario relates to the projected future year 2020 traffic grown with 2% per annum factor plus New Largo Mine Traffic. The mine will require that R545 Road be re-aligned resulting in the Kusile Road / R545 becoming a roundabout controlled intersection as shown in Figure 4-2 below:

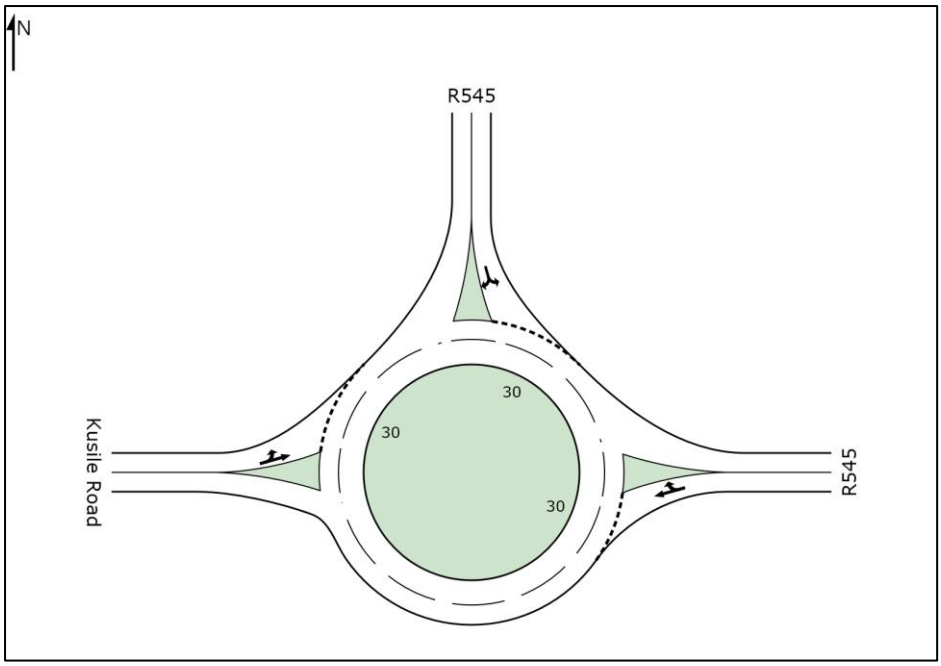


Figure 4-2 : Kusile Road / R545 intersection

4.2.7.1 R960 / R961

All approaches will perform at acceptable LOS ranging from LOS A to LOS C.

4.2.7.2 Kusile Road / R545

The intersection is expected to operate at acceptable LOS B in both the AM and PM Peak hours.

4.2.7.3 Kusile Road / New Largo Mine Traffic

The intersection will perform at acceptable LOS B during the AM peak and LOS C during the PM Peak hour.

4.2.8 Intersection Evaluation - Scenario 7 (Horizon Year 2020 + Kusile Power Station + Ash Disposal Facilty Traffic)

This scenario relates to the future traffic grown by a 2% per annum factor plus the projected Kusile Power Station Operations and maintenance traffic.

4.2.8.1 R960 / R961

All approaches are performing at acceptable LOS ranging from LOS A to LOS C.

4.2.8.2 Kusile Road / Kusile Power Station Access

This intersection was simulated as a priority controlled T-junction. The south approach is expected to perform at LOS C in the PM Peak due to less traffic projected for the operations and maintenance of the Power Station. The intersection will operate at LOS B in the morning and LOS C during the afternoon peak hour.

4.2.8.3 Kusile Road / R545

The intersection is expected to operate at acceptable LOS C during the AM Peak hour and LOS B during the PM Peak hour.

4.2.8.4 D680 / D686 / R545

The intersection will operate at LOS B during both AM and PM Peak hours.

4.2.8.5 Kusile Road / Ash Disposal Facility

The access intersection will operate at acceptable LOS A during the AM Peak and LOS B during the PM Peak hour.

4.2.9 Intersection Evaluation - Scenario 7 (Horizon Year 2020 + Kusile Power Station + Ash Disposal Facilty + New Largo MineTraffic)

This scenario relates to the future traffic grown by a 2% per annum factor plus the projected Operations and maintenance traffic for Kusile Power Station, New Largo Mine and the proposed Ash Disposal Facility. The mine will require that R545 Road be re-aligned or relocated resulting in the Kusile Road / R545 intersection becoming a roundabout controlled intersection as shown in Figure 4-2.

4.2.9.1 R960 / R961

All approaches will perform at acceptable LOS ranging from LOS A to LOS C.

4.2.9.2 Kusile Road / Kusile Power Station Access

The intersection will operate at LOS B during the morning peak hour and LOS C during the afternoon peak hour.

4.2.9.3 Kusile Road / R545

The intersection will operate at LOS B during both AM and PM Peak hours.

4.2.9.4 Kusile Road / Ash Disposal Facility

The access intersection will operate at acceptable LOS A during the AM Peak and LOS B during the PM Peak hour.

4.2.9.5 Kusile Road / New Largo Mine Traffic

The intersection will perform at acceptable LOS B during the AM peak and LOS C during the PM Peak hour.

4.2.10 Cumulative Impact Rating

The cumulative impact will have a MODERATELY LOW significance, the spatial scale will only affect intersections *adjacent to site*, the duration will be short term during the construction phase and expected to last for the life span of the development during the operational phase. The probability of the impact occurring is *likely* during the construction phase and is unlikely once the development is operational. The degree of certainty is **probable**. The impact risk is low.

4.3 MITIGATION MEASURES

No geometrical upgrades proposed to accommodate the additional traffic generated by the proposed ash disposal facility. It is however proposed that pointsment be deployed at both the Kusile Power Station and New Largo Mine Access during the construction phase to control the traffic so that the traffic from both developments can be afforded some gaps on Kusile Road.

4.4 RESIDUAL IMPACT

The proposed mitigation will improve the flow at intersections affected by the developments within the study area. The significance of the impact after mitigation will be LOW, spatial scale will be limited to intersections *adjacent to site*, the impact will be limited to isolated incidents. The impact is *unlikely* to occur with the proposed mitigation implemented. The degree of certainty is **probable** and the impact risk is low.

5. PUBLIC TRANSPORT

Generally, Eskom and Roshcon transport their staff to and from site and provide adequate public transport facilities to hold buses and minibus taxis during the day within the premises. There is no additional public transport facility proposed outside the development's footprint because facilities will be provided inside the site.

6. CONCLUSIONS

i. The development is located south east of Kusile Power Station Site
ii. Site A was selected as a suitable site for the development
iii. The site will gain access off Kusile Road
iv. The access will be stop controlled and served by one lane in and one lane out.
v. It is proposed that a pointsmen be deployed during the PM Peak (15:00 – 18:00) at both the Kusile Power Station access and New Largo access during the construction phase of these two developments and also during the construction period of the proposed Ash Disposal Facility.
vi. No mitigation measure is required once the development is operational.
vii. The re-alignment of Road R545 will not have a negative impact on the proposed Ash disposal facility.
viii. The ash will be transported by an overland conveyor from the Power Station to the Ash disposal facility.
ix. Clay material is available on site, which means the impact due to earth moving will be limited to the development footprint. The transportation of staff to and from site will have minimum impact on the road network.
x. The construction traffic impact of the selected site will be LOW, special scale will be limited to the *development footprint*, the duration will be short term, and *could occur* due to additional construction traffic on Kusile Road. The degree of certainty is **probable**.
xi. The post construction traffic impact will be VERY LOW, spatial scale will be limited to *isolated sites*, the duration will be medium term (lifespan of the development), and is *unlikely* to occur due to less traffic on Kusile Road. The degree of certainty is **probable**.

ANNEXURE A

Lists of Figures

ANNEXURE B

Sidra Results

ANNEXURE C

Relevant Reports

ANNEXURE D

R545 Relocation

ANNEXURE E

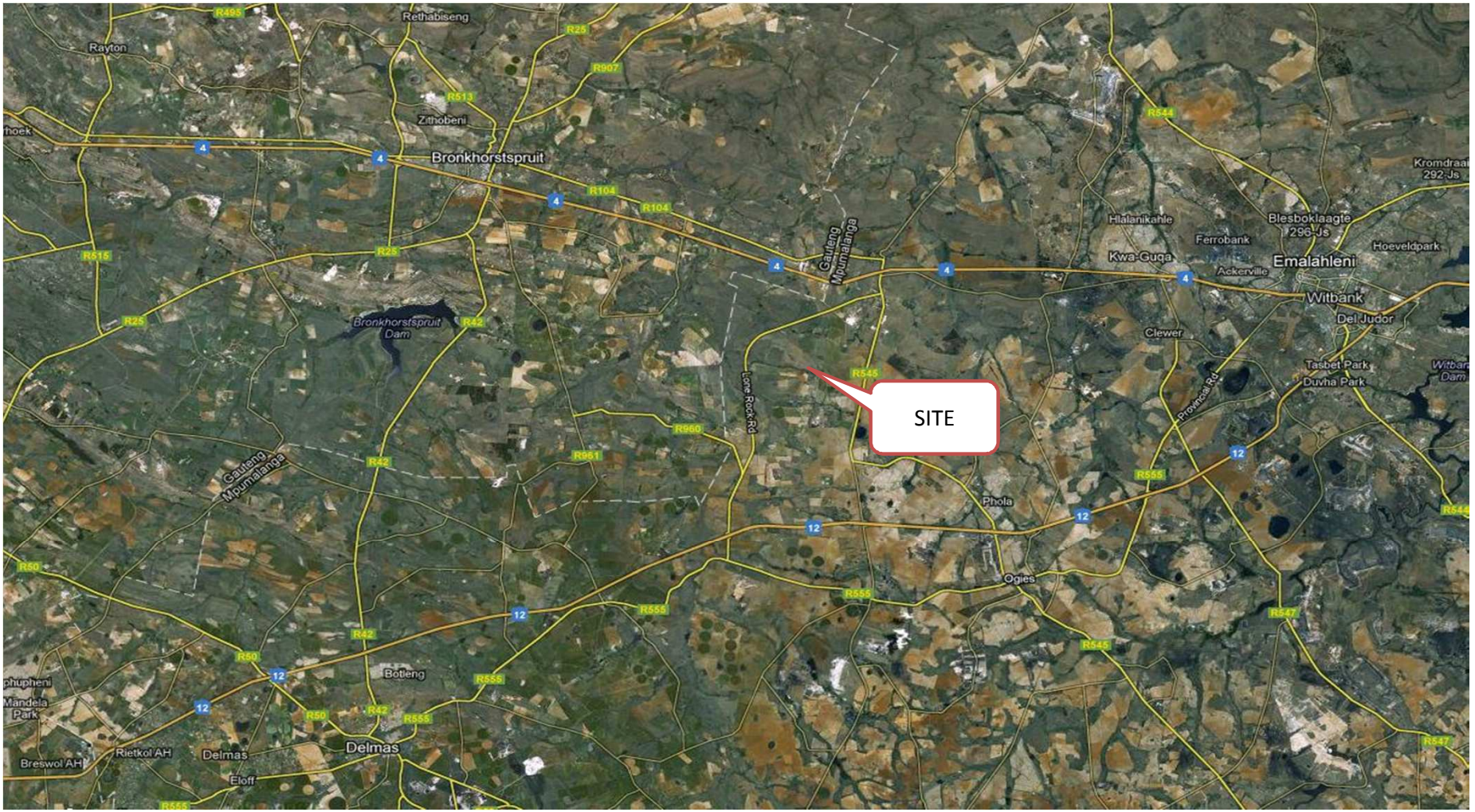
Site Layout

ANNEXURE F

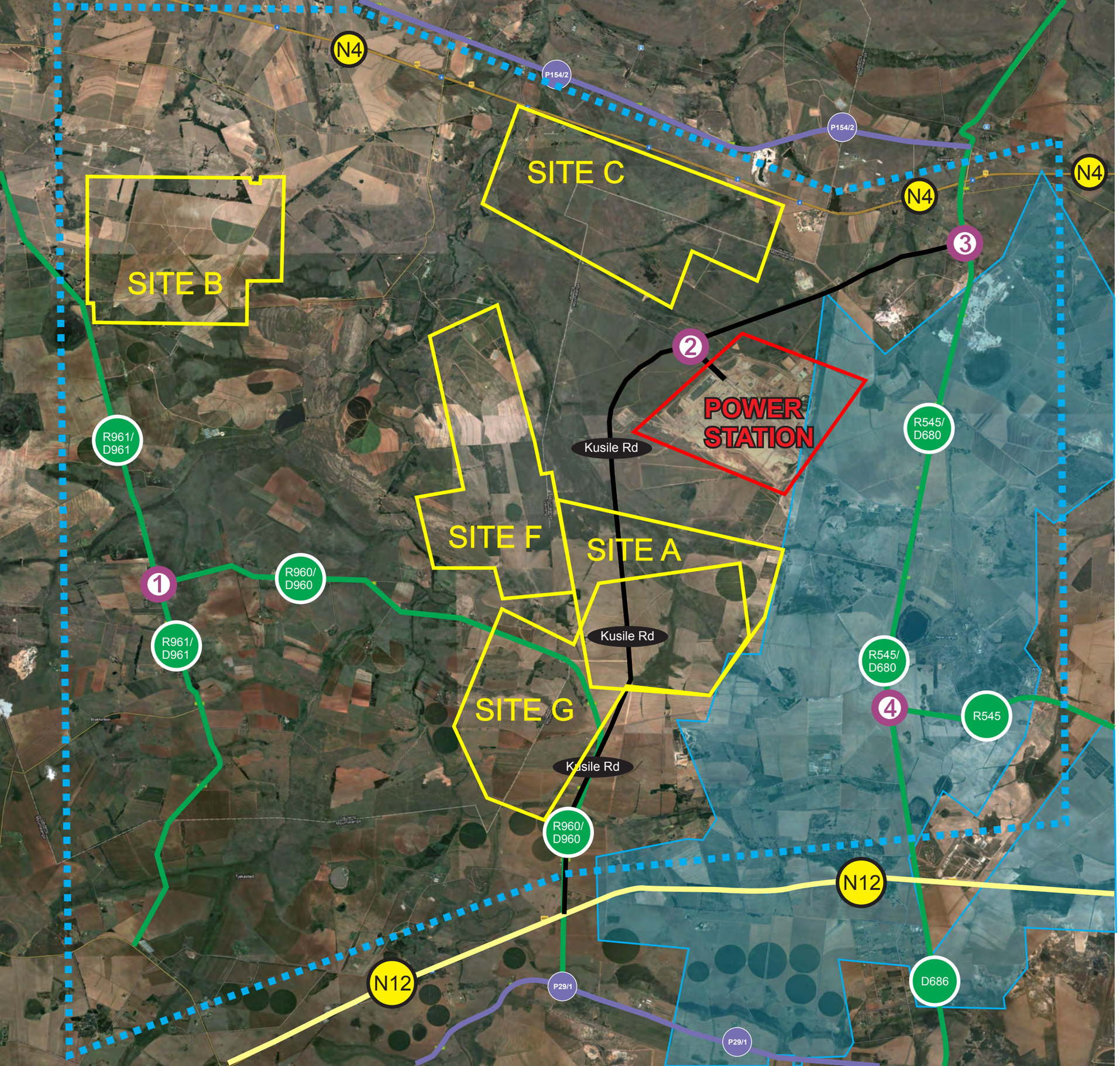
Impact Rating Matrix

ANNEXURE A

Lists of Figures



GOBA Consulting Engineers & Project Managers	**KUSILE POWER STATION-ASH DISPOSAL TRAFFIC IMPACT ASSESSMENT**	**FIGURE 1**
	REGIONAL LOCALITY PLAN	



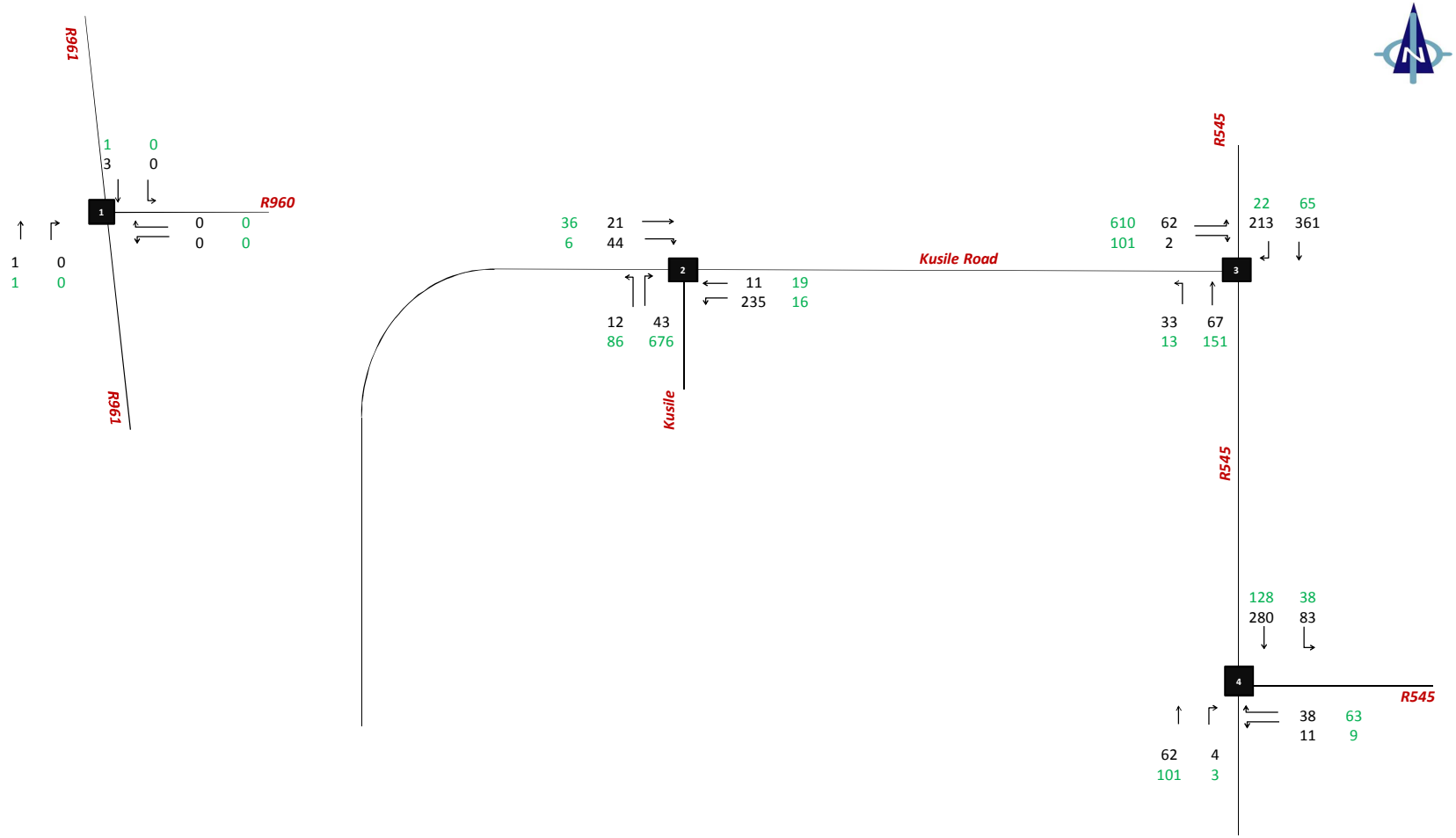
LEGEND

- Traffic Count Locations
- Power Station
- Ash Disposal Alternative
- Study Area
- New Largo Mine

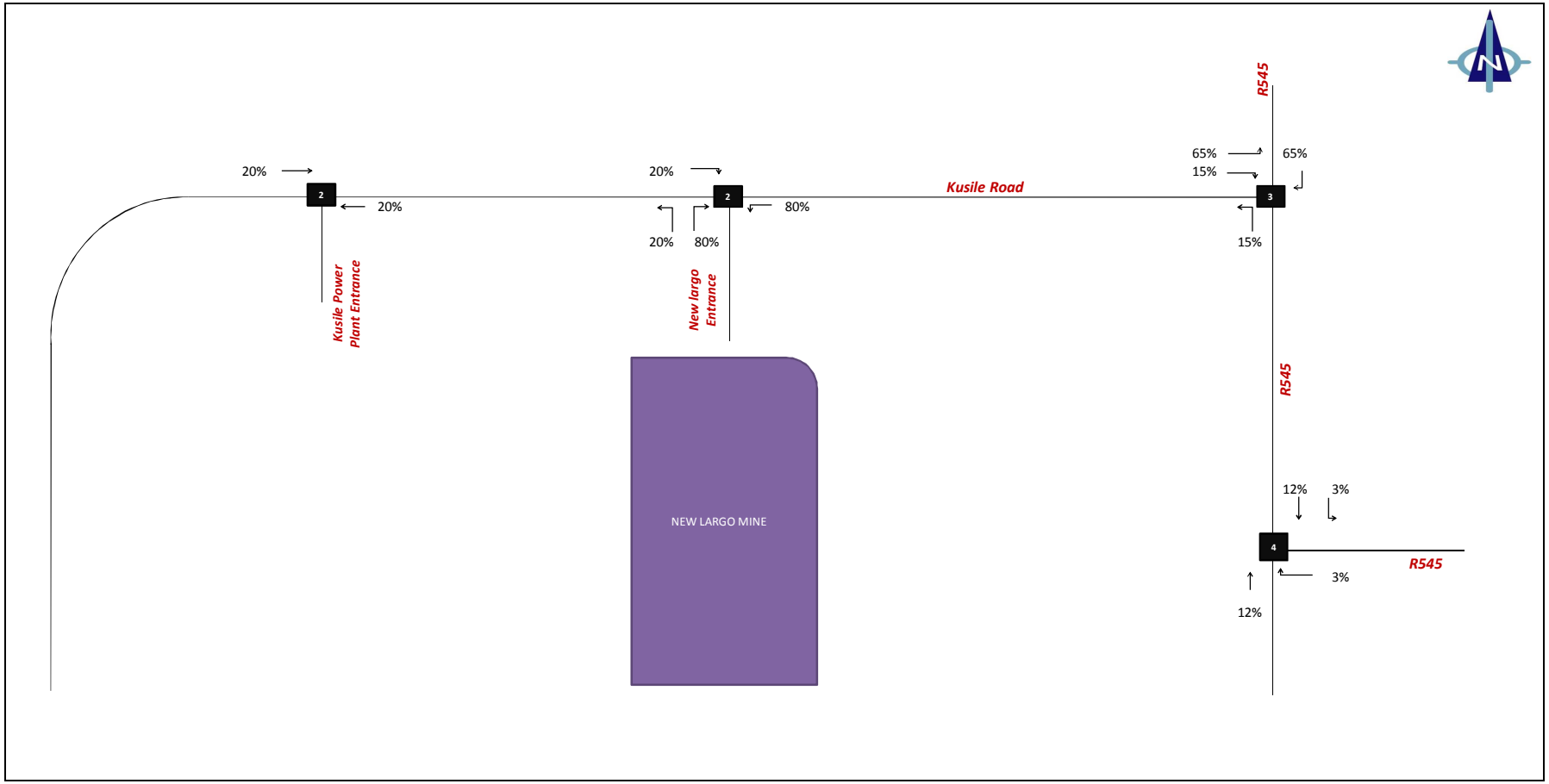
GOBA
CONSULTING ENGINEERS AND PROJECT MANAGERS

Figure 2

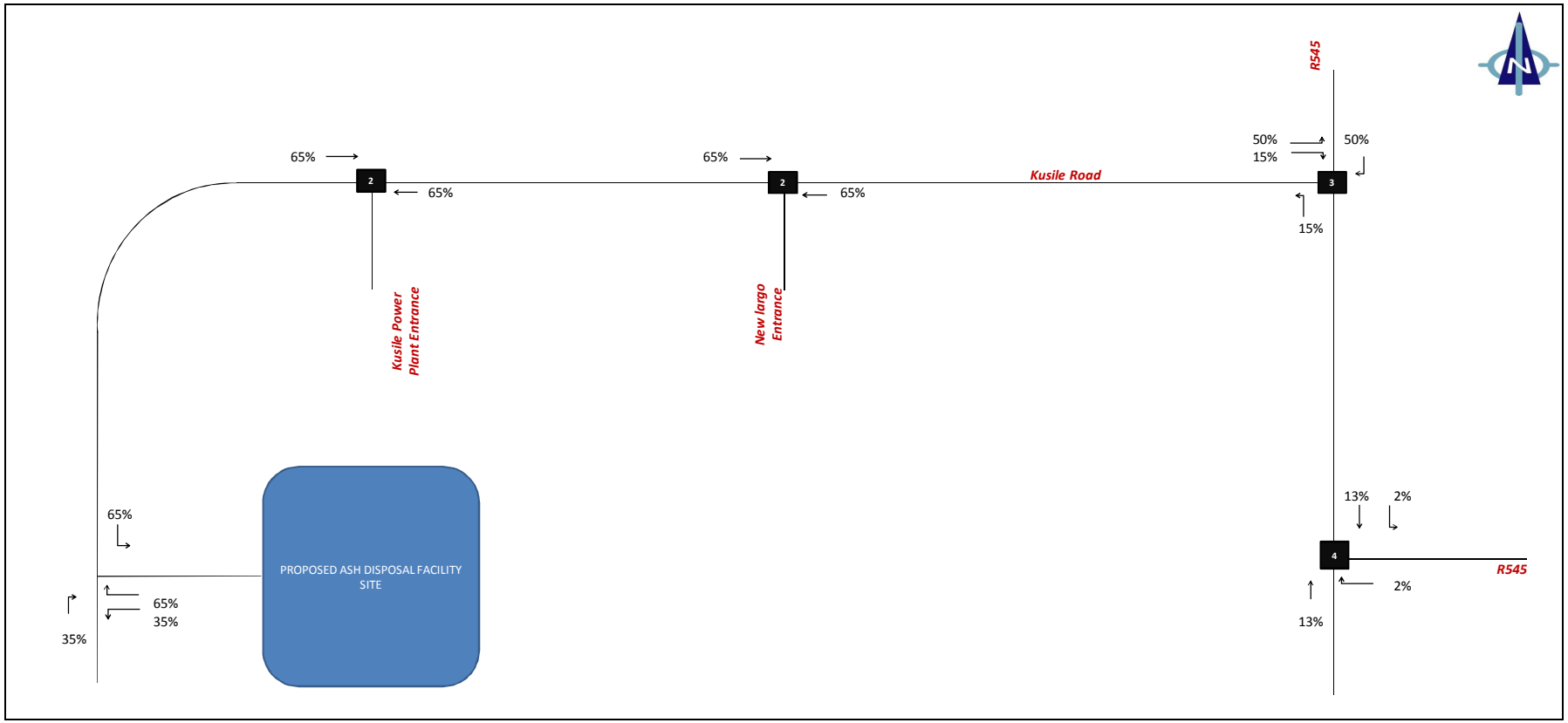
Local Locality



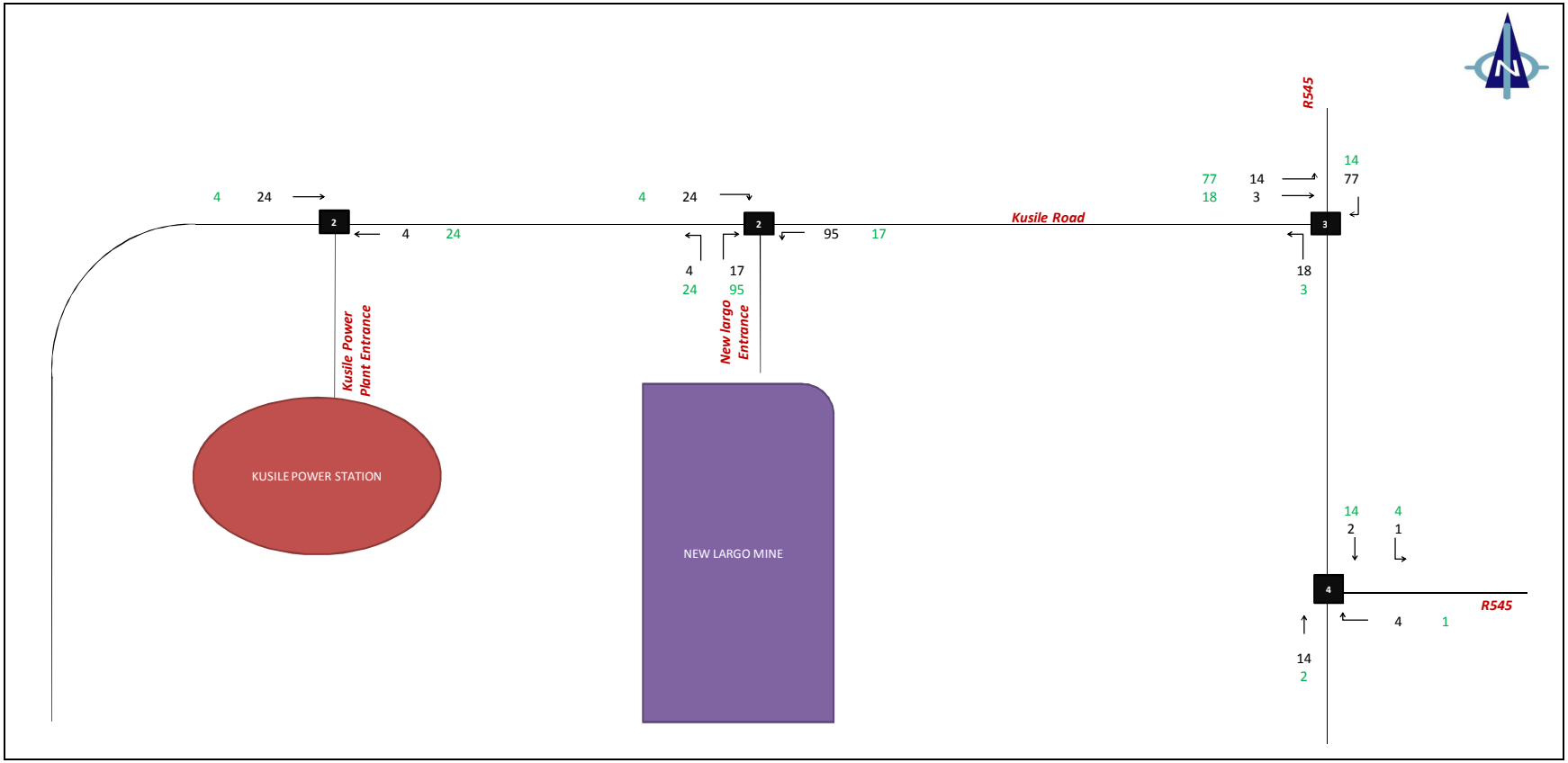
GOBA Consulting Engineers & Project Managers	KUSILE POWER STATION - ASH DISPOSAL FACILITY TRAFFIC IMPACT ASSESSMENT	FIGURE 3
	2012 / 13 EXISTING TRAFFIC	



GOBA Consulting Engineers & Project Managers	KUSILE POWER STATION - ASH DISPOSAL FACILITY TRAFFIC IMPACT ASSESSMENT	FIGURE 4
	NEW LARGO MINE TRIP DISTRIBUTION IN PERCENTAGES	



GOBA Consulting Engineers & Project Managers	KUSILE POWER STATION - ASH DISPOSAL FACILITY TRAFFIC IMPACT ASSESSMENT	FIGURE 5
	ASH DISPOSAL FACILITY TRIP DISTRIBUTION IN PERCENTAGES	

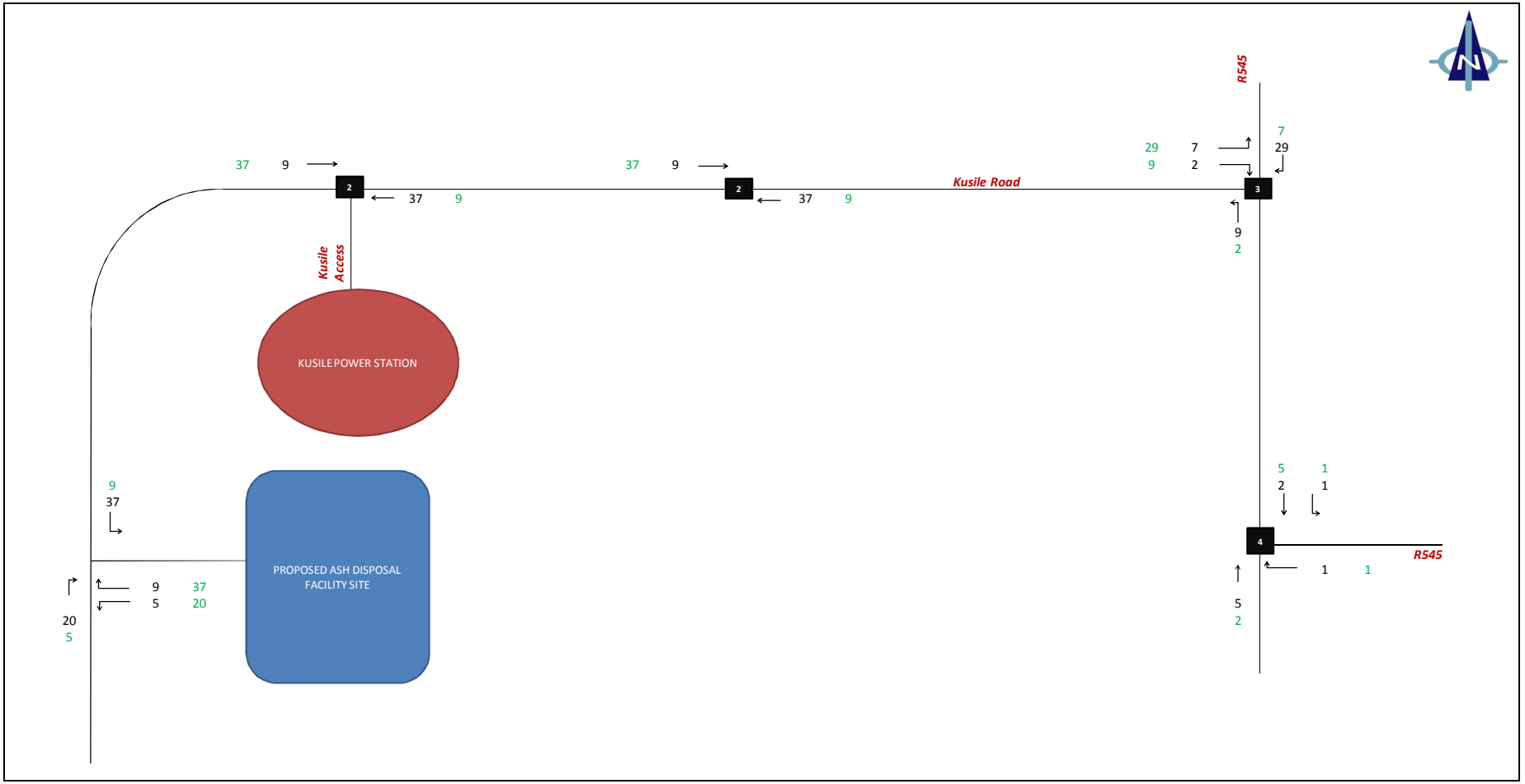


GOBA
Consulting Engineers & Project Managers

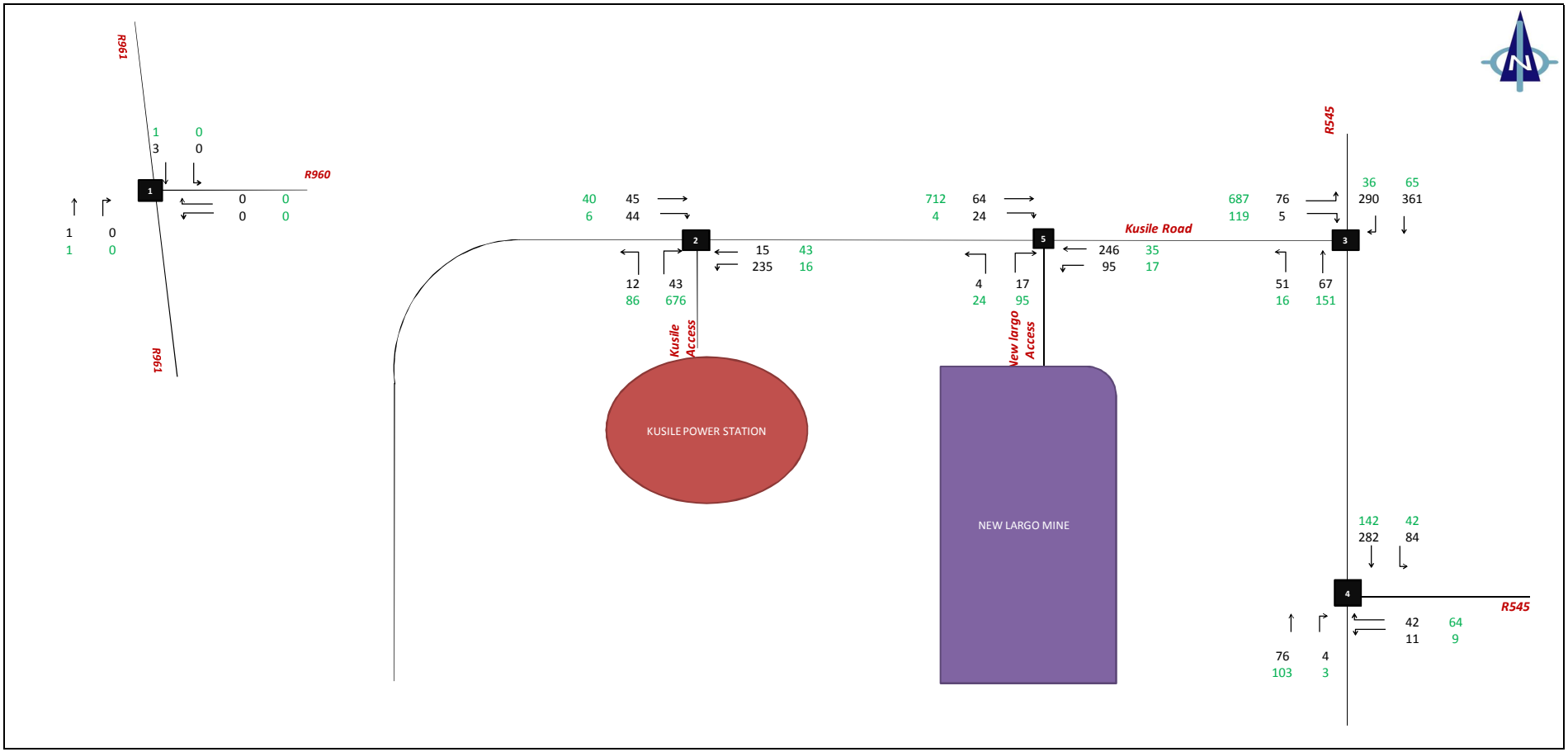
KUSILE POWER STATION - ASH DISPOSAL FACILITY TRAFFIC IMPACT ASSESSMENT

NEW LARGO MINE CONSTRCTION TRIP ASSIGNMENT

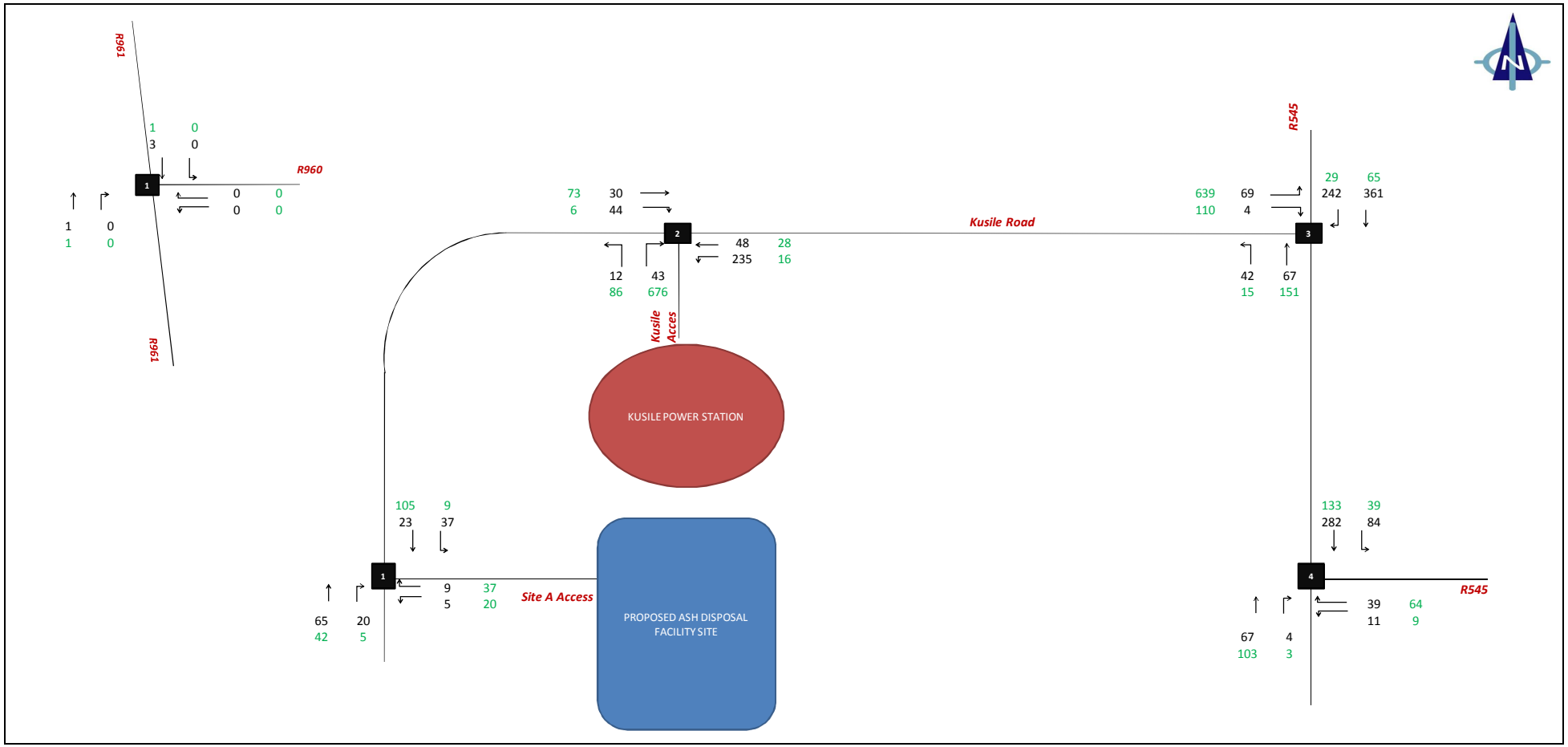
FIGURE 6



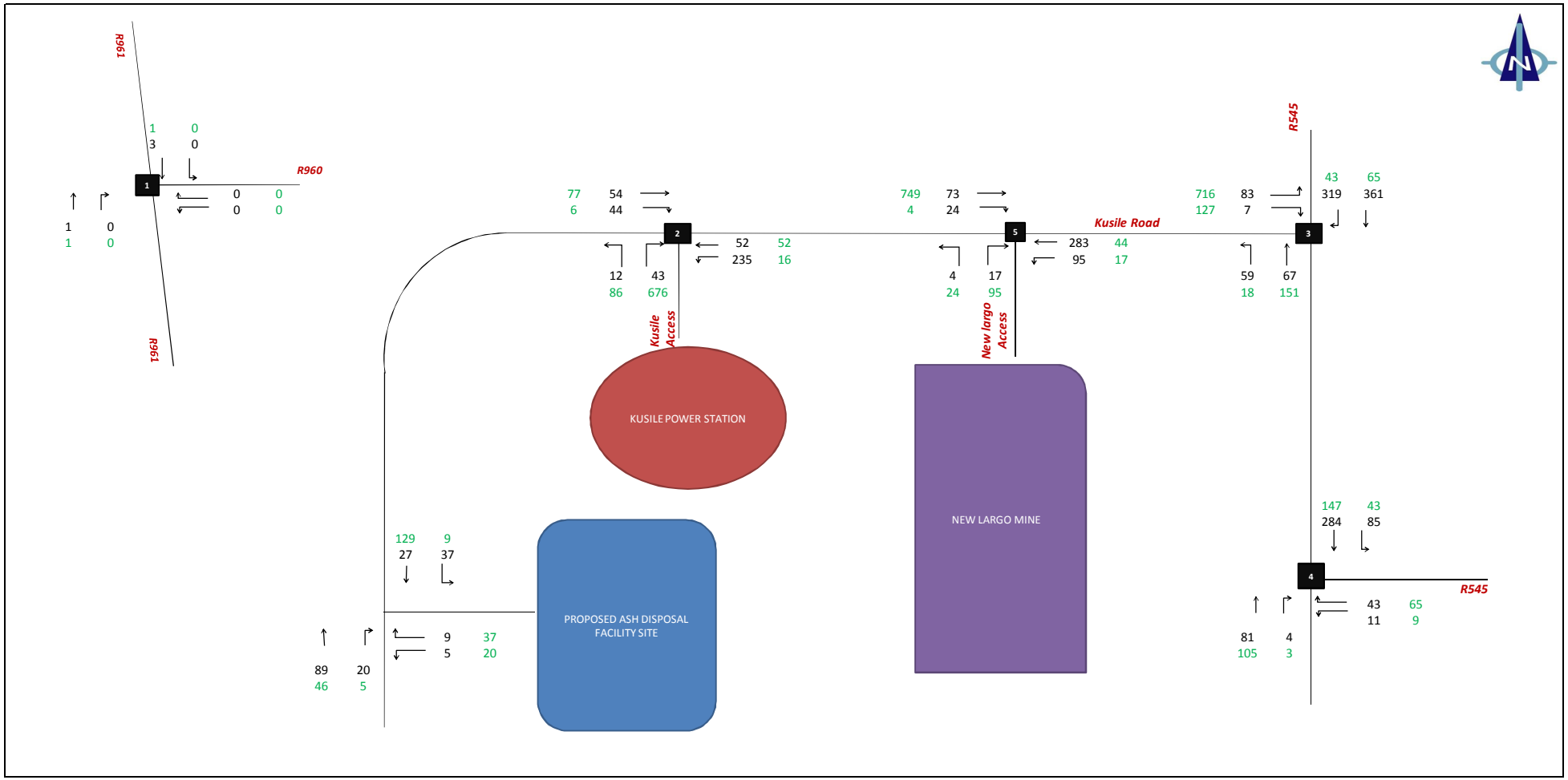
GOBA Consulting Engineers & Project Managers	KUSILE POWER STATION - ASH DISPOSAL FACILITY TRAFFIC IMPACT ASSESSMENT	FIGURE 7
	ASH DISPOSAL FACILITY CONSTRUCTION TRIP ASSIGNMNET	



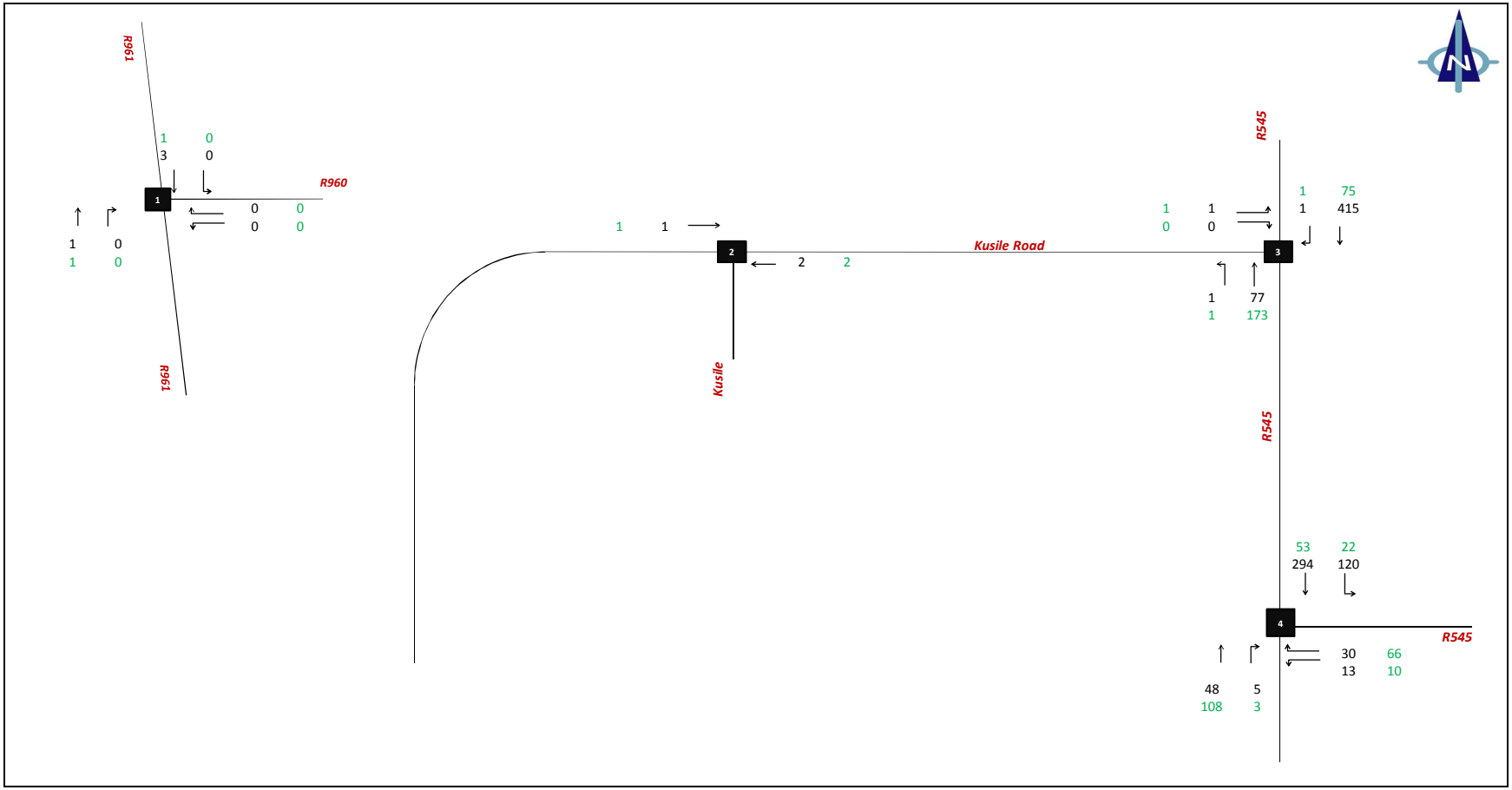
GOBA Consulting Engineers & Project Managers	KUSILE POWER STATION - ASH DISPOSAL FACILITY TRAFFIC IMPACT ASSESSMENT	FIGURE 8
	2012/13 EXISTING + NEW LARGO MINE CONSTRUCTION TRAFFIC	



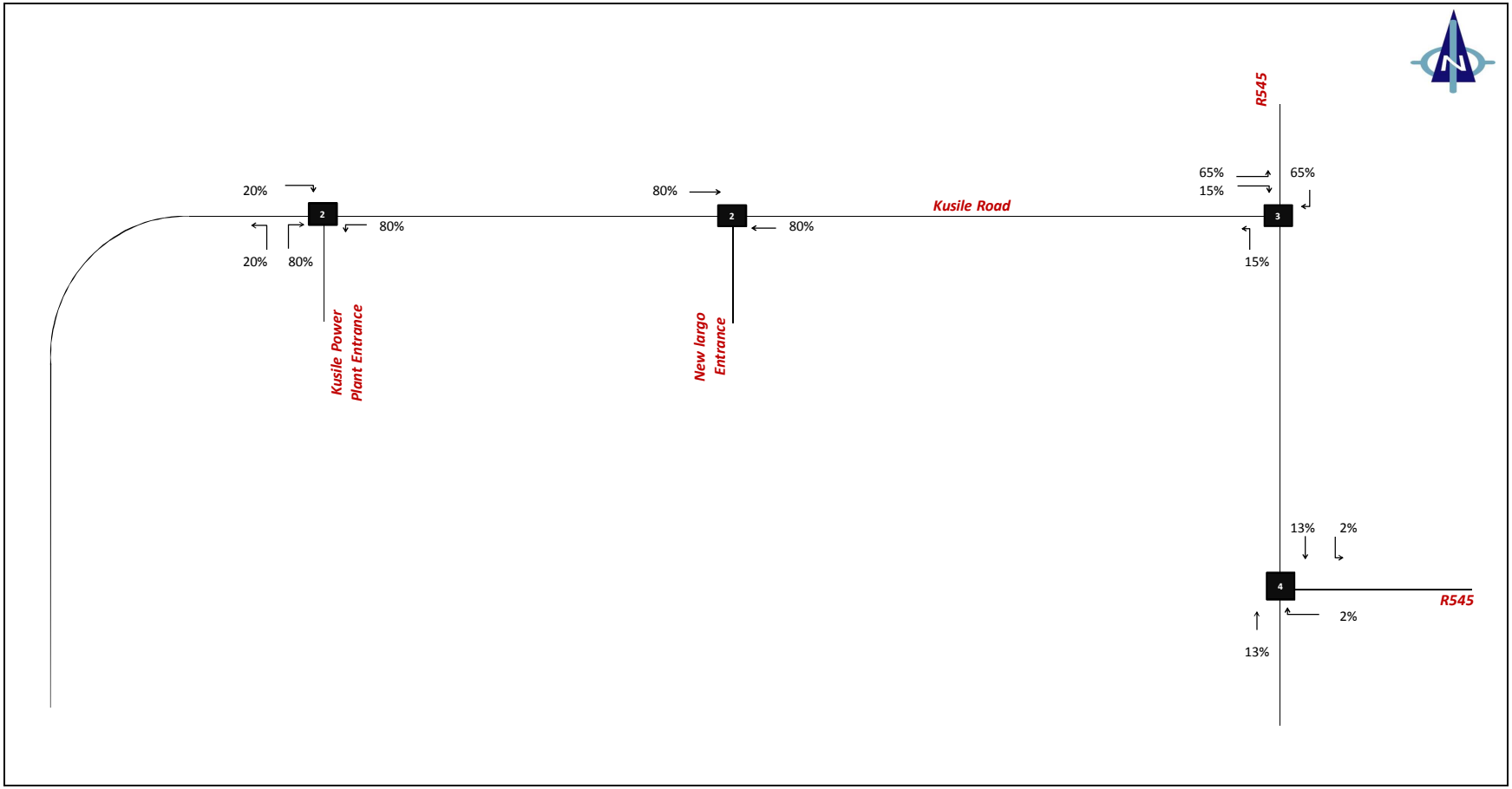
GOBA Consulting Engineers & Project Managers	KUSILE POWER STATION - ASH DISPOSAL FACILITY TRAFFIC IMPACT ASSESSMENT	FIGURE 9
	2012/13 EXISTING + PROPOSED ASH DISPOSAL FACILITY CONSTRUCTION TRAFFIC	



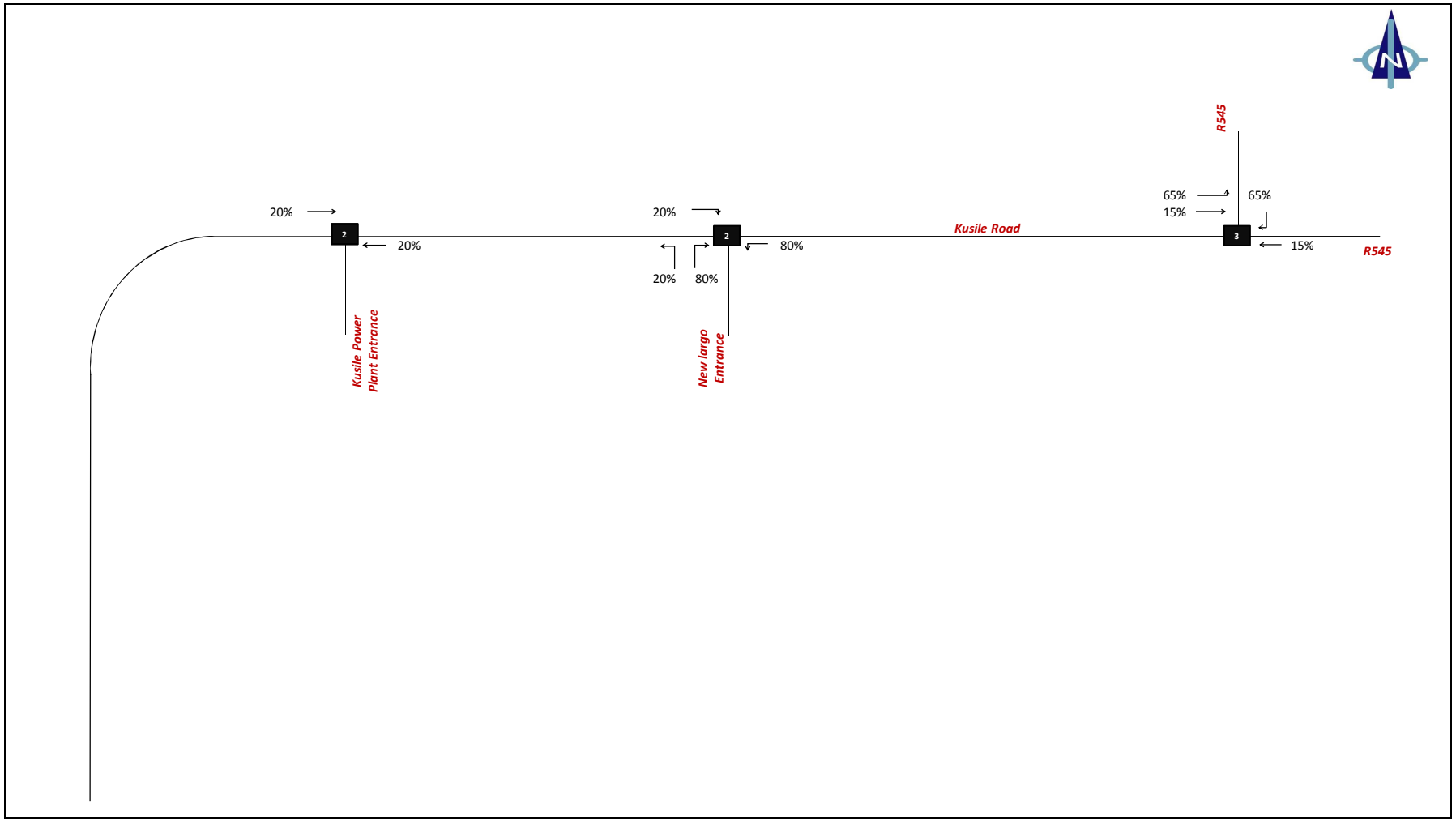
GOBA Consulting Engineers & Project Managers	KUSILE POWER STATION - ASH DISPOSAL FACILITY TRAFFIC IMPACT ASSESSMENT	FIGURE 10
	2012/13 EXISTING + NEW LARGO + ASH DISPOSAL FACILITY CONSTRUCTION TRAFFIC	



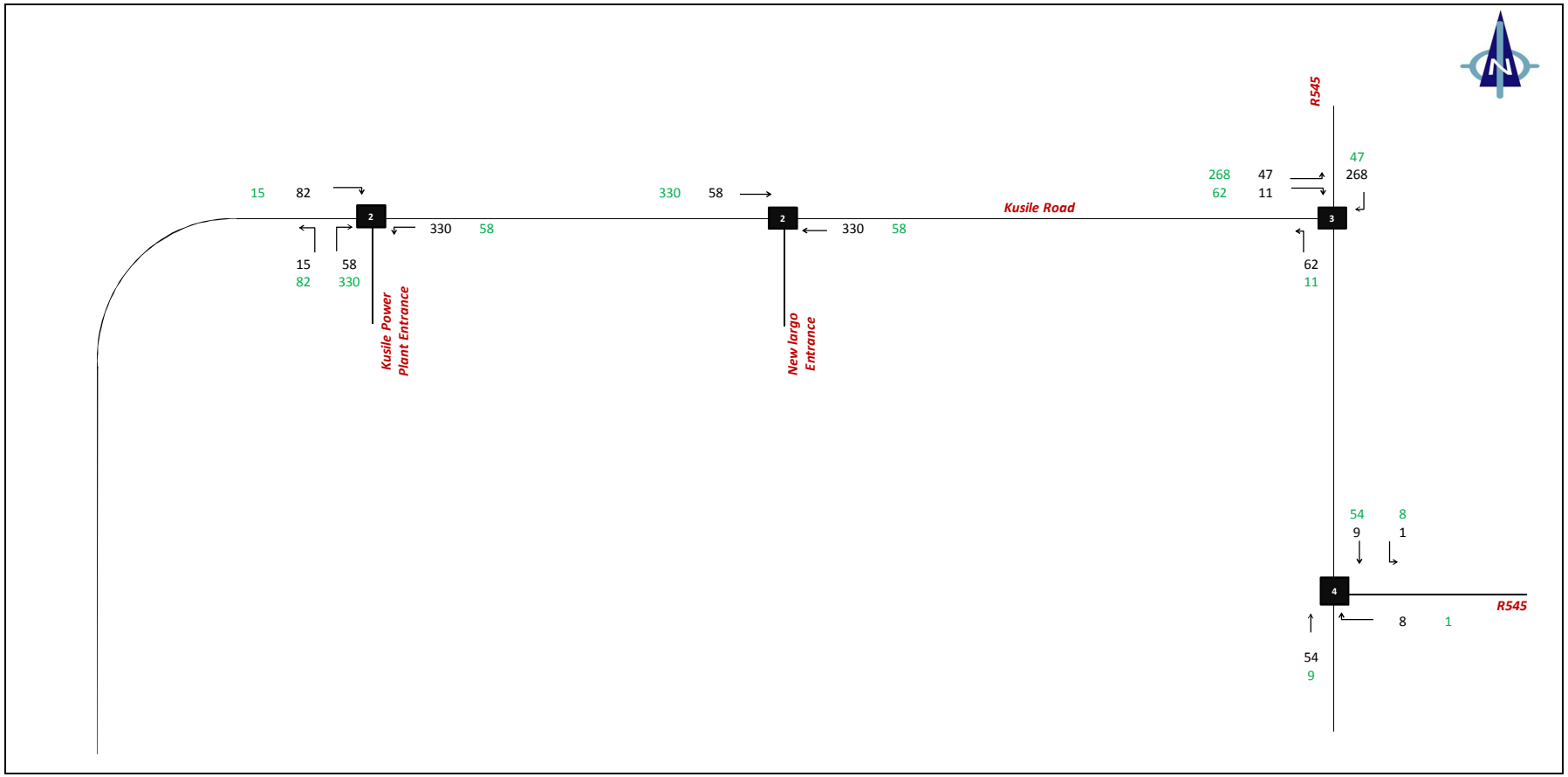
GOBA Consulting Engineers & Project Managers	KUSILE POWER STATION - ASH DISPOSAL FACILITY TRAFFIC IMPACT ASSESSMENT	FIGURE 11
	HORIZON YEAR 2020 BACKGROUND TRAFFIC	



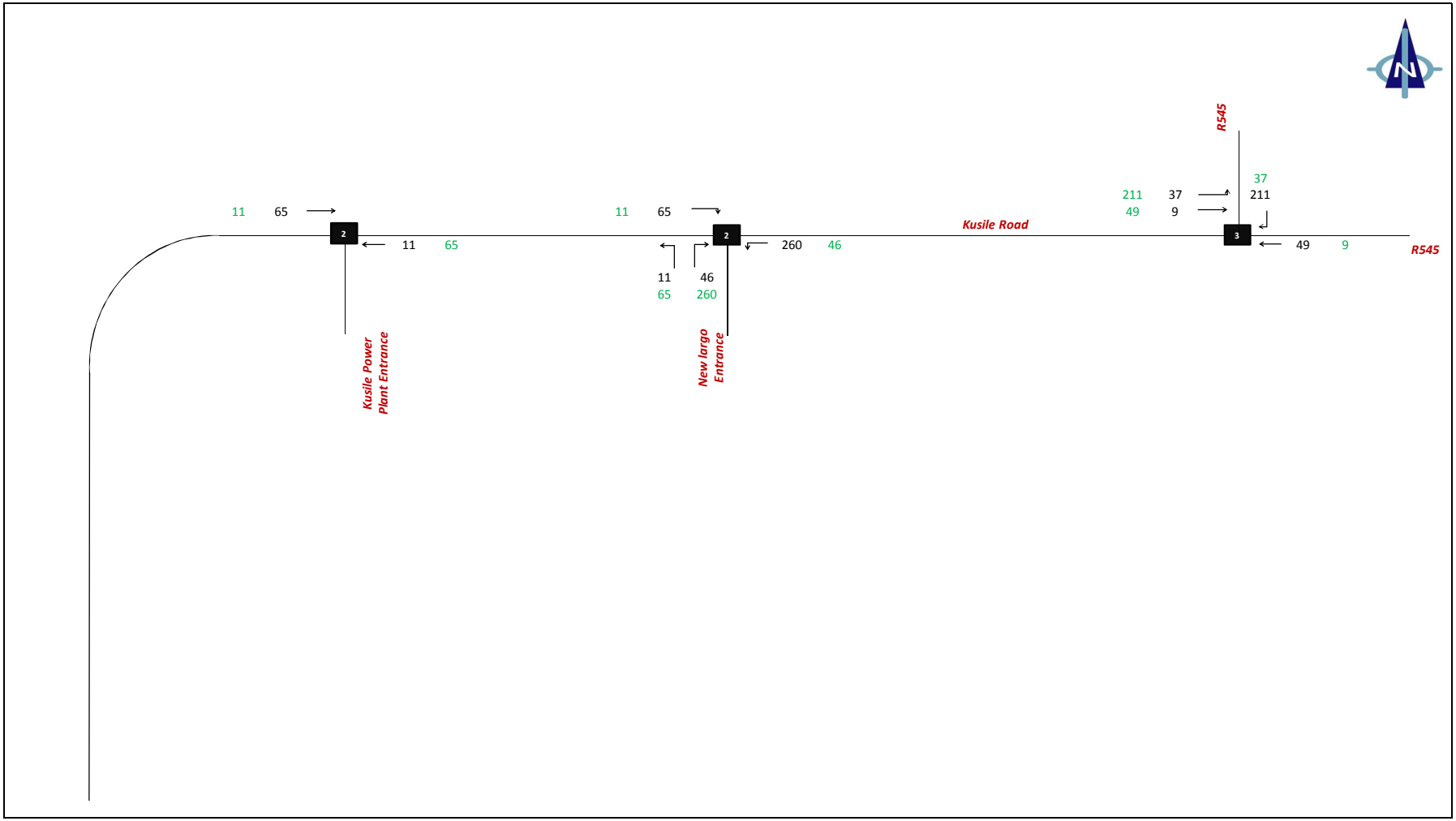
GOBA Consulting Engineers & Project Managers	KUSILE POWER STATION - ASH DISPOSAL FACILITY TRAFFIC IMPACT ASSESSMENT	FIGURE 12
	KUSILE POWER STATION OPERATIONS AND MAINTENANCE TRIP DISTRIBUTION IN PERCENTAGES	



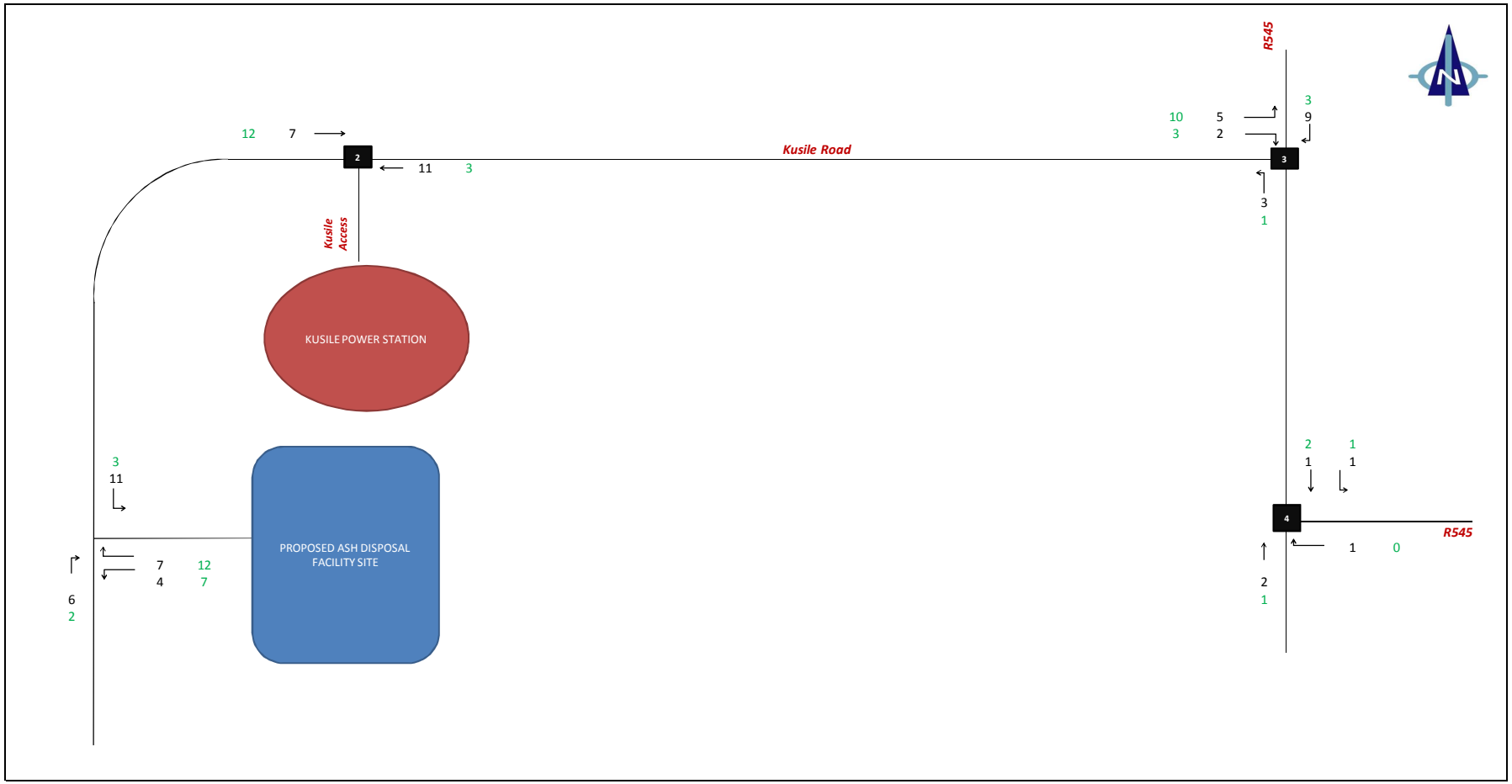
GOBA Consulting Engineers & Project Managers	KUSILE POWER STATION - ASH DISPOSAL FACILITY TRAFFIC IMPACT ASSESSMENT	FIGURE 13
	NEW LARGO MINE OPERATIONS AND MAINTANANCE TRIP DISTRIBUTION IN PERCENTAGES	



GOBA Consulting Engineers & Project Managers	KUSILE POWER STATION - ASH DISPOSAL FACILITY TRAFFIC IMPACT ASSESSMENT	FIGURE 14
	KUSILE POWER STATION OPERATION AND MAINTENANCE TRIP ASSIGNMENT	



GOBA Consulting Engineers & Project Managers	KUSILE POWER STATION - ASH DISPOSAL FACILITY TRAFFIC IMPACT ASSESSMENT	FIGURE 15
	NEW LARGO MINE OPERATIONS AND MAINTANANCE TRIP ASSIGNMENT	

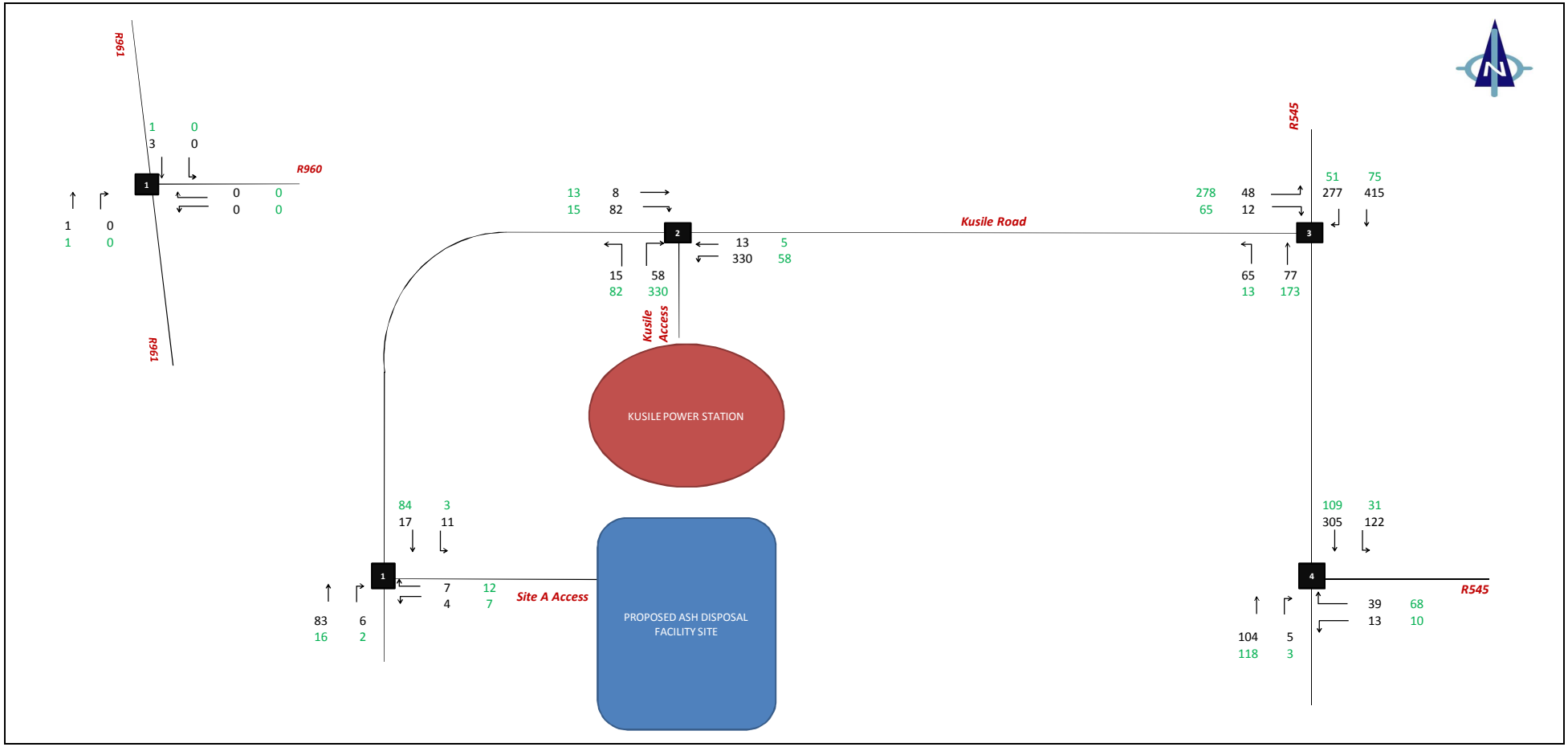


GOBA
Consulting Engineers & Project Managers

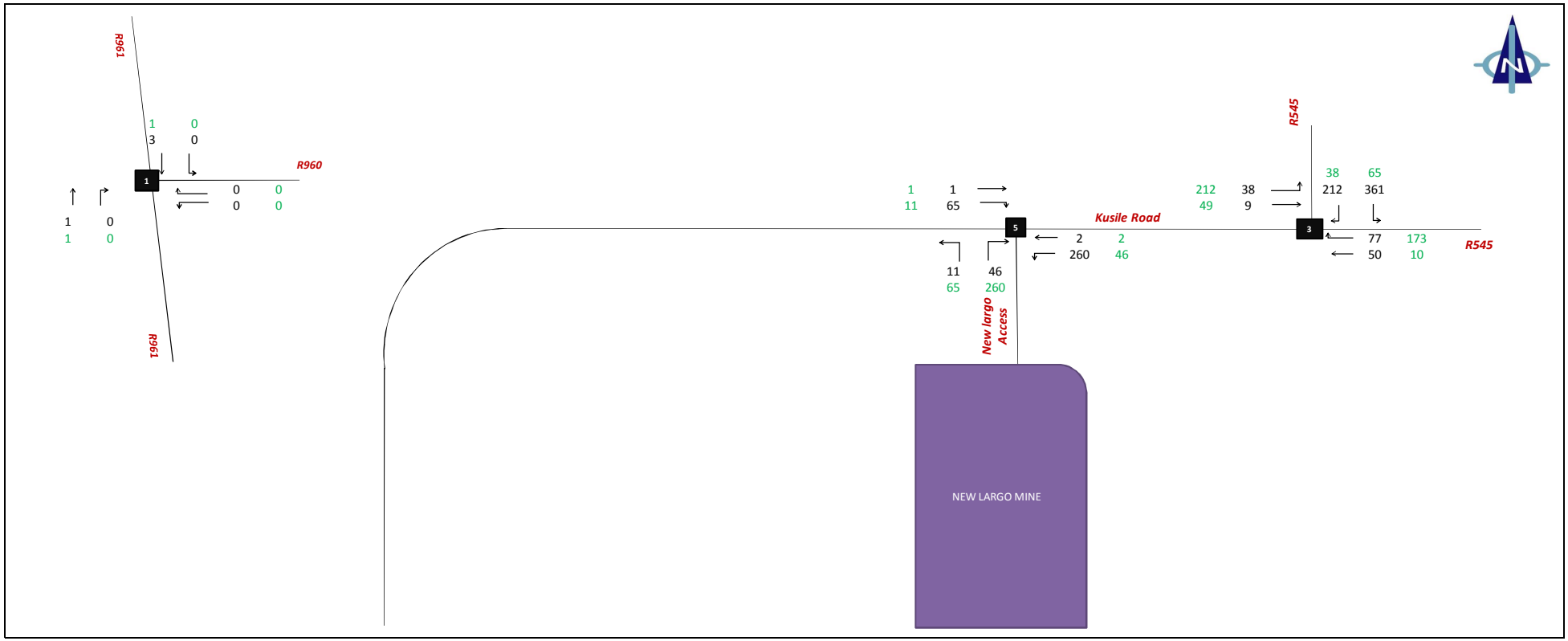
KUSILE POWER STATION - ASH DISPOSAL FACILITY TRAFFIC IMPACT ASSESSMENT

PROPOSED ASH DISPOSAL FACILITY OPERATIONS AND MAINTANANCE TRIP ASSIGNMENT

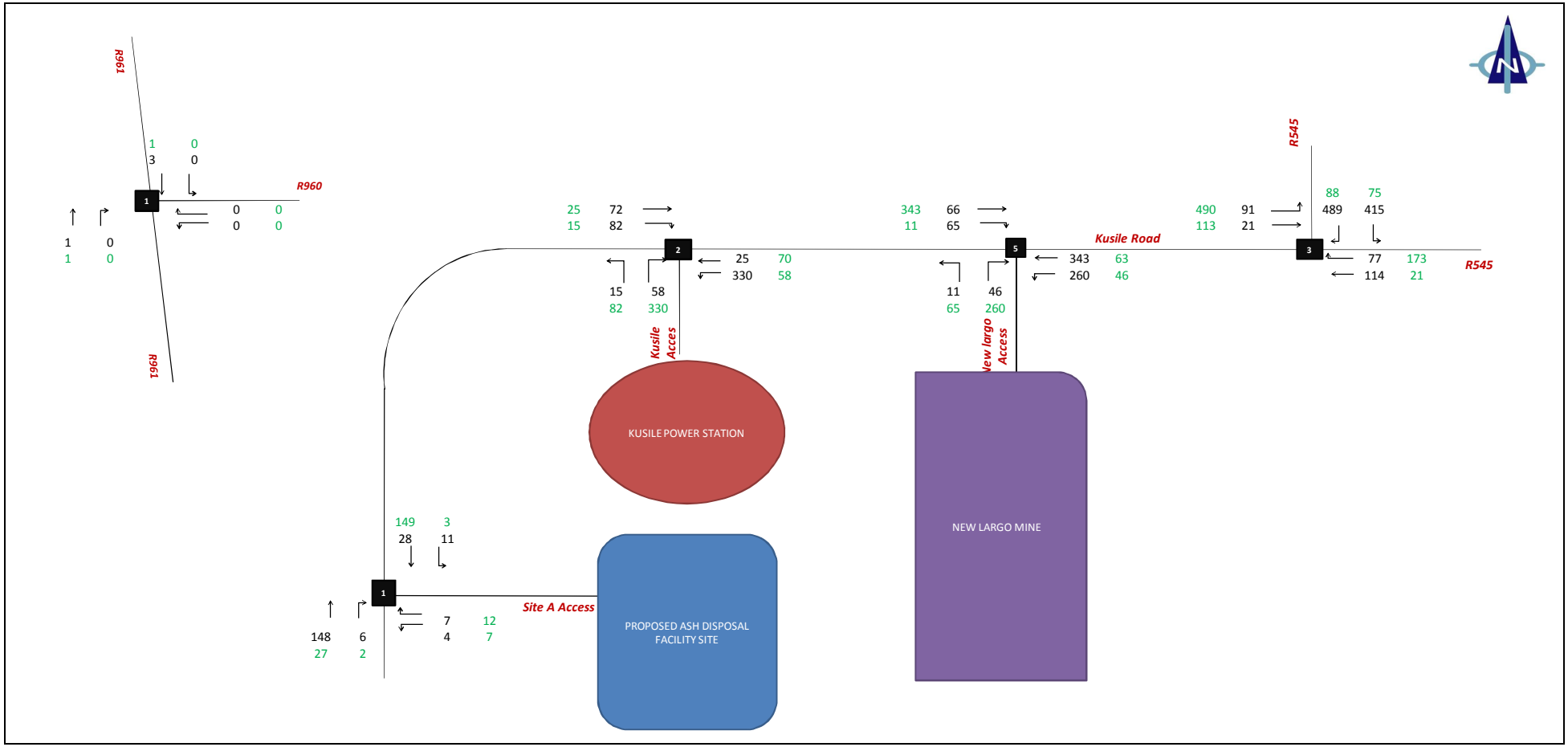
FIGURE 16



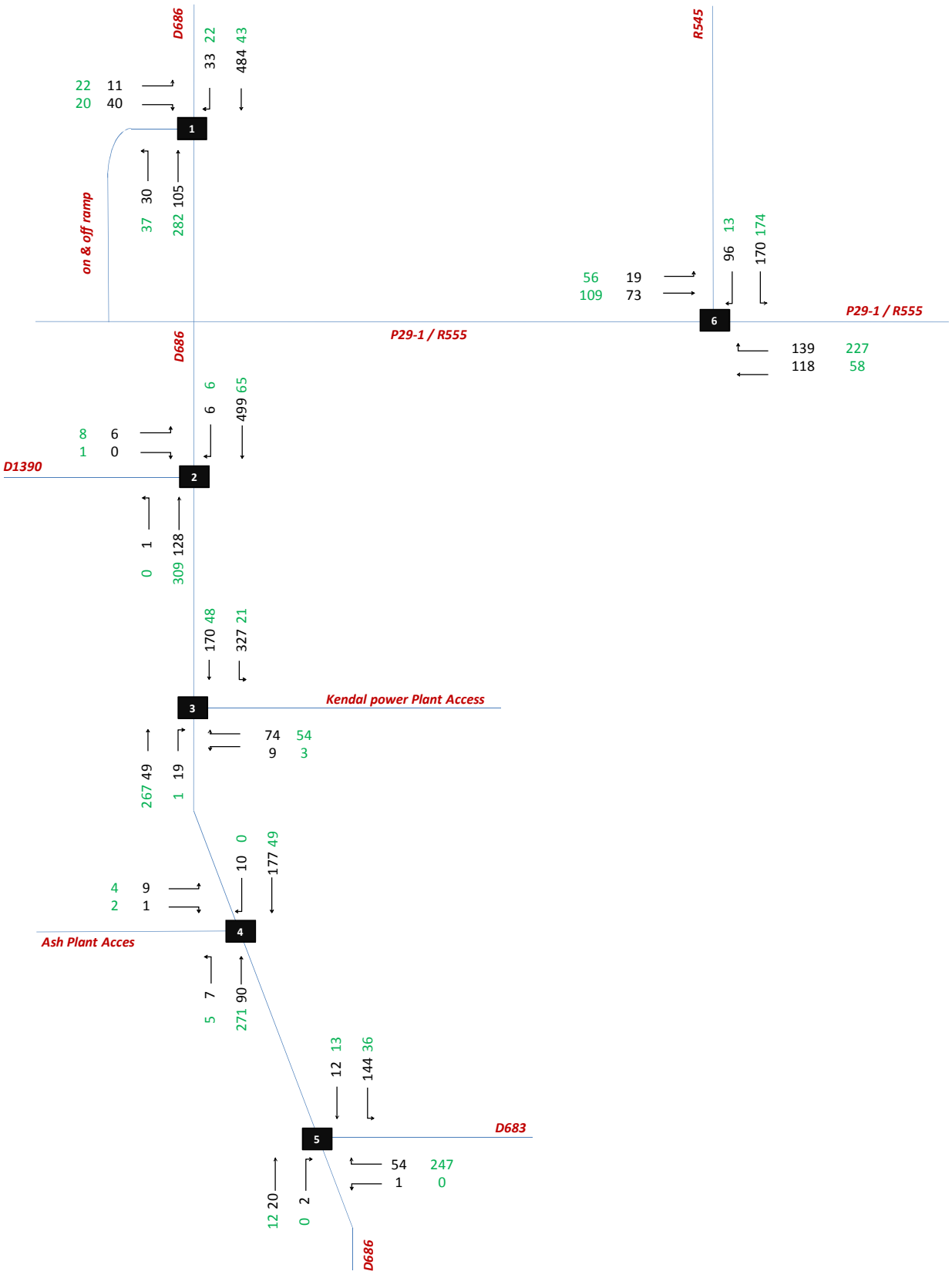
GOBA Consulting Engineers & Project Managers	KUSILE POWER STATION - ASH DISPOSAL FACILITY TRAFFIC IMPACT ASSESSMENT	FIGURE 17
	HORIZON 2020 + KUSILE POWER STATION + ASH DISPOSAL FACILITY OPERATIONS AND MAINTENANCE TRAFFIC	



GOBA Consulting Engineers & Project Managers	KUSILE POWER STATION - ASH DISPOSAL FACILITY TRAFFIC IMPACT ASSESSMENT	FIGURE 18
	HORIZON 2020 + NEW LARGO MINE OPERATIONS AND MAINTENANCE TRAFFIC	



GOBA Consulting Engineers & Project Managers	KUSILE POWER STATION - ASH DISPOSAL FACILITY TRAFFIC IMPACT ASSESSMENT	FIGURE 19
	HORIZON 2020 + KUSILE POWER STATION + ASH DISPOSAL FACILITY + NEW LARGO MINE OPERATIONS AND MAINTENANCE TRAFFIC	



	Kendal TIA 2012/2013 Existing Traffic - Total	Fig 20

ANNEXURE B

Sidra Results

Table 4-2: Analysis Results

Intersection 1 : R960 / R961

Approach	2012/13 Existing Traffic				2012/13 Existing + New Largo Traffic				2012/13 Existing + Ash Dump Traffic				2012/13 + Ash Dump + New Largo Traffic				Horizon 2020 Traffic				2020 + New Largo Traffic				2020 + Kusile + Ash Dump Traffic				2020 + Kusile + Ash Dump + New Largo Traffic			
	Demand	V/C (%)	Delay	LOS	Demand	V/C (%)	Delay	LOS	Demand	V/C (%)	Delay	LOS	Demand	V/C (%)	Delay	LOS	Demand	V/C (%)	Delay	LOS	Demand	V/C (%)	Delay	LOS	Demand	V/C (%)	Delay	LOS	Demand	V/C (%)	Delay	LOS
South	2.00	0.00	4.3	A	2.00	0.00	4.3	A	2.00	0.00	4.3	A	2.00	0.00	4.3	A	2.00	0.00	4.3	A	2.00	0.00	4.3	A	2.00	0.00	4.3	A	2.00	0.00	4.3	A
East	2.00	0.00	10.6	C	2.00	0.00	10.6	C	2.00	0.00	10.6	C	2.00	0.00	10.6	C	2.00	0.00	10.6	C	2.00	0.00	10.6	C	2.00	0.00	10.6	C	2.00	0.00	10.6	C
North	4.00	0.00	2.00	A	4.00	0.00	2.00	A	4.00	0.00	2.00	A	4.00	0.00	2.00	A	4.00	0.00	2.00	A	4.00	0.00	2.00	A	4.00	0.00	2.00	A	4.00	0.00	2.00	A
West																																
Int Total	8	0.00	4.7	A	8	0.00	4.7	A	8	0.00	4.7	A	8	0.00	4.7	A	8	0.00	4.7	A	8	0.00	4.7	A	8	0.00	4.7	A	8	0.00	4.7	A
South	2.00	0.00	4.2	A	2.00	0.00	4.2	A	2.00	0.00	4.2	A	2.00	0.00	4.2	A	2.00	0.00	4.2	A	2.00	0.00	4.2	A	2.00	0.00	4.2	A	2.00	0.00	4.2	A
East	2.00	0.00	10.6	C	2.00	0.00	10.6	C	2.00	0.00	10.6	C	2.00	0.00	10.6	C	2.00	0.00	10.6	C	2.00	0.00	10.6	C	2.00	0.00	10.6	C	2.00	0.00	10.6	C
North	2.00	0.00	4.10	A	2.00	0.00	4.10	A	2.00	0.00	4.10	A	2.00	0.00	4.10	A	2.00	0.00	4.10	A	2.00	0.00	4.10	A	2.00	0.00	4.10	A	2.00	0.00	4.10	A
West																																
Int Total	6	0.00	6.3	B	6	0.00	6.3	B	6	0.00	6.3	B	6	0.00	6.3	B	6	0.00	6.3	B	6	0.00	6.3	B	6	0.00	6.3	B	6	0.00	6.3	B

Intersection 2 : Kusile Road / Kusile Power Station Access

Approach	2012/13 Existing Traffic				2012/13 Existing + New Largo Traffic				UPGRADES				2012/13 Existing + Ash Dump Traffic				UPGRADES				2012/13 + Ash Dump + New Largo Traffic				UPGRADES				Horizon 2020 Traffic				2020 + New Largo Traffic				2020 + Kusile + Ash Dump Traffic				2020 + Kusile + Ash Dump + New Largo Traffic			
	Demand	V/C (%)	Delay	LOS	Demand	V/C (%)	Delay	LOS	Demand	V/C (%)	Delay	LOS	Demand	V/C (%)	Delay	LOS	Demand	V/C (%)	Delay	LOS	Demand	V/C (%)	Delay	LOS	Demand	V/C (%)	Delay	LOS	Demand	V/C (%)	Delay	LOS	Demand	V/C (%)	Delay	LOS	Demand	V/C (%)	Delay	LOS	Demand	V/C (%)	Delay	LOS
South	58	0.08	12.5	C	58	0.08	12.8	C	58	0.08	12.8	C	58	0.09	13.0	C	58	0.09	13.0	C	58	0.09	13.4	C	58	0.09	13.4	C									77	0.12	13.5	C	77	0.14	14.5	C
East	259	0.14	7.9	B	263	0.15	7.8	B	263	0.15	7.8	B	298	0.16	6.9	B	298	0.16	6.9	B	302	0.17	6.8	B	302	0.17	6.8	B									361	0.20	8.0	B	374	0.21	7.7	B
North																																													
West	68	0.05	6.9	B	94	0.07	5.4	B	94	0.07	5.4	B	78	0.06	6.4	B	78	0.06	6.4	B	103	0.07	5.2	B	103	0.07	5.2	B									95	0.09	9.6	B	162	0.13	6.5	B
Int Total	385	0.14	8.4	B	415	0.15	8.0	B	415	0.15	8.0	B	434	0.16	7.6	B	434	0.16	7.6	B	463	0.17	7.3	B	463	0.17	7.3	B									533	0.20	9.1	B	613	0.21	8.3	B
South	802	0.96	32.7	E	802	1.00	51.3	F	802	0.81	21.3	C	802	1.02	66.0	F	802	0.81	21.3	C	802	1.00	51.3	F	802	0.81	21.3	C									434	0.50	11.7	C	434	0.56	14.2	C
East	37	0.02	3.8	A	62	0.03	2.3	A	62	0.22	19.6	C	46	0.03	3.0	A	62	0.17	20.2	C	62	0.03	2.3	A	72	0.26	19.4	C									66	0.04	7.7	B	135	0.07	3.8	A
North																																													
West	44	0.03	1.4	A	48	0.03	1.3	A	48	0.18	18.4	B	77	0.05	0.8	A	83	0.31	18.4	B	48	0.03	1.3	A	87	0.32	18.4	B									29	0.02	4.8	A	42	0.03	3.7	A
Int Total	883	0.96	29.9	D	912	1.00	45.3	F	912	0.81	21.0	C	925	1.02	57.0	F	947	0.81	21.0	C	912	1.00	45.3	F	961	0.81	20.9	C									529	0.50	10.8	C	611	0.56	11.1	C

Intersection 3: Kusile Road / R545

Approach	2012/13 Existing Traffic				2012/13 Existing + New Largo Traffic				2012/13 Existing + Ash Dump Traffic				2012/13 + Ash Dump + New Largo Traffic				Horizon 2020 Traffic				2020 + New Largo Traffic				2020 + Kusile + Ash Dump Traffic				2020 + Kusile + Ash Dump + New Largo Traffic			
	Demand	V/C (%)	Delay	LOS	Demand	V/C (%)	Delay	LOS	Demand	V/C (%)	Delay	LOS	Demand	V/C (%)	Delay	LOS	Demand	V/C (%)	Delay	LOS	Demand	V/C (%)	Delay	LOS	Demand	V/C (%)	Delay	LOS	Demand	V/C (%)	Delay	LOS
South	105	0.04	2.7	A	124	0.04	2.7	A	115	0.04	3.2	A	133	0.04	3.9	A	82	0.04	0.1	A												
East																					134	0.12	9.7	B	149	0.04	3.8	A	201	0.23	10.3	C
North	604	0.50	6.6	B	685	0.50	6.6	B	635	0.55	8.2	B	716	0.68	13.3	C	438	0.23	1.0	A	603	0.37	7.5	B	728	0.64	11.6	C	952	0.60	8.7	B
West	67	0.05	11.0	C	85	0.05	11.0	C	77	0.06	11.1	C	95	0.08	11.3	C	2	0.00	11.9	C	49	0.04	5.5	B	63	0.06	11.9	C	118	0.10	5.5	B
Int Total	776	0.50	6.6	B	894	0.50	6.6	B	827	0.55	7.8	B	944	0.68	11.7	C	522	0.68	0.9	A	786	0.37	7.7	B	940	0.64	10.4	C	1271	0.60	8.6	B
South	173	0.08	0.7	A	176	0.08	0.8	A	175	0.08	0.8	A	178	0.08	0.9	A	183	0.09	0.0	A												
East																																
North	92	0.09	8.9	B	106	0.13	11.0	C	99	0.11	9.9	B	114	0.16	12.0	C	80	0.04	1.9	A	108	0.08	7.7	B	133	0.14	7.8	B	172	0.15	9.1	B
West	748	0.61	13.0	C	848	0.70	14.0	C	788	0.65	13.4	C	887	0.73	14.6	C	2	0.00	11.4	C	275	0.24	6.1	B	361	0.31	11.8	C	635	0.53	6.5	B
Int Total	1013	0.61	10.5	C	1130	0.70	11.7	C	1062	0.65	11.0	C	1179	0.73	12.2	C	265	0.09	0.7	A	576	0.24	8.1	B	690	0.31	7.8	B	1011	0.53	7.9	B

Intersection 4 : R545 (D868) / R545

Approach	2012/13 Existing Traffic				2012/13 Existing + New Largo Traffic				2012/13 Existing + Ash Dump Traffic				2012/13 + Ash Dump + New Largo Traffic				Horizon 2020 Traffic				2020 + New Largo Traffic				2020 + Kusile + Ash Dump Traffic				2020 + Kusile + Ash Dump + New Largo Traffic			
	Demand	V/C (%)	Delay	LOS	Demand	V/C (%)	Delay	LOS	Demand	V/C (%)	Delay	LOS	Demand	V/C (%)	Delay	LOS	Demand	V/C (%)	Delay	LOS	Demand	V/C (%)	Delay	LOS	Demand	V/C (%)	Delay	LOS	Demand	V/C (%)	Delay	LOS
South	69	0.04	0.5	A	84	0.04	0.4	A	75	0.04	0.5	A	89	0.05	0.4	A	56	0.03	0.8	A					115	0.06	0.4	A				
East	52	0.06	11.5	C	56	0.07	11.7	C	53	0.06	11.6	C	57	0.07	11.8	C	45	0.05	11.6	C					55	0.07	12.3	C				
North	382	0.22	10.30	C	385	0.23	10.30	C	385	0.23	10.30	C	388	0.23	10.30	C	436	0.27	10.40	C					449	0.27	10.40	C				
West																																
Int Total	503	0.22	9.1	B	525	0.23	8.9	B	513	0.23	9.0	B	534	0.23	8.8	B	537	0.27	9.5	B					619	0.27	8.7	B				
South	109	0.06	0.2	A	112	0.06	0.2	A	112	0.06	0.2	A	114	0.06	0.2	A	117	0.06	0.2	A					127	0.07	0.2	A				
East	76	0.09	11.7	C	77	0.10	11.8	C	77	0.10	11.8	C	78	0.10	11.8	C	80	0.10	11.7	C					82	0.10	11.9	C				
North	175	0.10	10.30	C	194	0.11	10.30	C	181	0.11	10.30	C	200	0.12	10.30	C	79	0.05	10.40	C					147	0.09	10.30	C				
West																																
Int Total	360	0.10	7.6	B	383	0.11	7.7	B	370	0.11	7.6	B	392	0.12	7.7	B	276	0.10	6.5	B					356	0.10	7.1	B				

Intersection 5 : Kusile Road / Ash Disposal Facility Access

Approach	2012/13 Existing Traffic				2012/13 Existing + New Largo Traffic				2012/13 Existing + Ash Dump Traffic				2012/13 + Ash Dump + New Largo Traffic				Horizon 2020 Traffic				2020 + New Largo Traffic				2020 + Kusile + Ash Dump Traffic				2020 + Kusile + Ash Dump + New Largo Traffic			
	Demand	V/C (%)	Delay	LOS	Demand	V/C (%)	Delay	LOS	Demand	V/C (%)	Delay	LOS	Demand	V/C (%)	Delay	LOS	Demand	V/C (%)	Delay	LOS	Demand	V/C (%)	Delay	LOS	Demand	V/C (%)	Delay	LOS	Demand	V/C (%)	Delay	LOS
South									89	0.05	2	A	115	0.06	1.5	A									94	0.05	0.6	A	162	0.09	0.3	A
East									15	0.02	11.5	C	15	0.02	11.7	C									12	0.01	11.4	C	12	0.01	12.3	C
North									63	0.05	10.6	C	67	0.05	10.6	C									29	0.02	10.4	C	41	0.03	10.6	C
West																																
Int Total									167	0.05	6.1	B	197	0.06	5.4	B									135	0.05	3.7	A	215	0.09	2.9	A
South									49	0.03	0.9	A	54	0.03	0.8	A									19	0.01	0.9	A	31	0.02	0.6	A
East									60	0.06	11	C	60	0.06	11	C									20	0.02	10.7	C	20	0.02	11	C
North									120	0.07	10.3	C	145	0.08	10.3	C									92	0.05	10.2	C	160	0.09	10.5	C
West																																
Int Total									229	0.07	8.4	B	259	0.08	8.5	B									131	0.05	9.0	B	211	0.09	9.1	B

Intersection 6 : Kusile Road / New Largo Mine Access

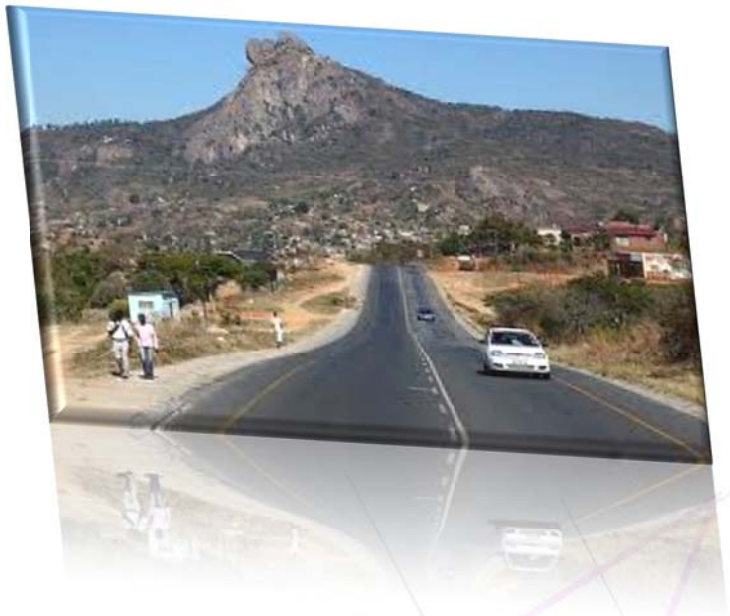
Approach	2012/13 Existing Traffic				2012/13 Existing + New Largo Traffic				2012/13 Existing + Ash Dump Traffic				2012/13 + Ash Dump + New Largo Traffic				UPGRADES				Horizon 2020 Traffic				2020 + New Largo Traffic				2020 + Kusile + Ash Dump Traffic				2020 + Kusile + Ash Dump + New Largo Traffic			
	Demand	V/C (%)	Delay	LOS	Demand	V/C (%)	Delay	LOS	Demand	V/C (%)	Delay	LOS	Demand	V/C (%)	Delay	LOS	Demand	V/C (%)	Delay	LOS	Demand	V/C (%)	Delay	LOS	Demand	V/C (%)	Delay	LOS	Demand	V/C (%)	Delay	LOS	Demand	V/C (%)	Delay	LOS	Demand	V/C (%)	Delay	LOS	Demand	V/C (%)	Delay	LOS
South					22	0.04	14.8	C					22	0.05	15.6	C	22	0.05	15.6	C					60	0.09	12.6	C									60	0.18	19.9	C
East					359	0.19	2.3	A					398	0.21	2.1	A	398	0.21	2.1	A					276	0.15	8.3	B									635	0.34	3.6	A
North																																												
West					93	0.061	4	A					102	0.068	4.1	A	102	0.068	4.1	A					69	0.064	9.6	B									138	0.139	8.6	B
Int Total					474	0.19	3.2	A					522	0.21	3.1	A	522	0.21	3.1	A					405	0.15	9.1	B									833	0.34	5.6	B
South					125	0.48	29.9	D					125	0.53	34.2	E	125	0.46	26.8	C					342	0.38	11.2	C									342	0.70	24.6	D
East					55	0.03	2.7	A					64	0.03	2.3	A	64	0.06	6.9	B					51	0.03	8.0	B									115	0.06	3.5	A
North																																												
West					754	0.399	4.5	A					793	0.42	0.5	A	793	0.763	10.1	B					13	0.009	8.1	B									373	0.2	0.8	A
Int Total					934	0.48	4.5	A					982	0.53	4.9	A	982	0.76	12.0	B					406	0.38	10.7	C									830	0.70	11.0	C

ANNEXURE C

Relevant Reports

Manual Traffic Count Report
Mpumalanga Province
(Mpumalanga Traffic Information Management System)

Draft report, version 1
September 2011



ITS Engineers
29 De Havilland Crescent
Pro Park
Building 1
Persequor Park 0020

Tel: (012) 349 1664
Fax: (012) 349 1665
e-mail:mail@itse.co.za

TABLE OF CONTENTS

1. Introduction

1.1 Background

Lidwala Engineers was appointed for the Mpumalanga Road Asset Management (RAMS) project. This project included various aspects of the Road Asset Management System, which also includes the Traffic Information Management System (TIMS). ITS Engineers was appointed as a specialist sub-consultant to Lidwala Engineers, focusing on the Traffic Information Management System component of the Mpumalanga RAMS.

The Traffic Information Management System consisted of various elements, but in terms of the physical data collection of traffic information, provision was made for the following aspects there-of:

- Manual traffic counting
- Electronic traffic counting

In order to inform both the manual and electronic traffic counting processes, the formulation of a traffic counting report is required. The definition of a traffic counting report is as follows:

"The ideal traffic information system would consist of traffic counting actions on the complete road network on a continuous basis. However, due to limited resources, this approach would not be possible and a traffic counting report is thus formulated to focus on the collection of traffic data throughout the Province on a cost-effective basis, This report describes the type of traffic counts, the location of the specific traffic counts and the required frequency of these counts. The report might distinguish between different approaches to be followed on different road categories in the Province and would be depending on the available funding sources."

1.2 Structure of the report

The intention is that this report should be revised on a continuous basis, when new information becomes available on the characteristics of the road network. At the moment the road network definition is being updated on the GIS system, based on visual surveys recently completed. This information might be introduced in a following version of the traffic counting report document.

A reliable road transport network has always been of utmost importance to the growth of any province. It is the Directorate's duty as public service provider to maintain the existing road network and infrastructure to ensure that traffic can flow safely throughout the province. Reliable and up to date traffic information is required to meet this objective and implement possible alternative service delivery models.

2. General traffic Characteristics on the mpumalanga road network

Mpumalanga is divided into 3 district municipalities. All provincial roads provide mobility and accessibility towards and within these municipalities and are therefore classified into six different functional categories as defined by the National Department of Transport.

This road network information assists the managers of the road infrastructure in the allocation of financial resources when assessing demand on each road based on the acquired traffic information.

3. Objectives of the Traffic Information Management System (TIMS)

The objectives of the Traffic Information Management System (TIMS) for Mpumalanga can be defined as follows:

- Provide an overview of traffic volumes (Average Annual Daily Traffic- AADT) on the provincial road network, including the coal haulage and various other routes.
- Provide an indication of annual traffic growth rates in the Mpumalanga Province.
- Provide an indication of the person trips on the various commuter routes in the Mpumalanga Province.
- Provide input to other management systems, such as the Pavement Management System (PMS), the Gravel Road Management System (GrMS) and the Road Safety Management System (RSMS) and others.
- Provide input to the prioritisation process for the upgrading of roads infrastructure in the Province.

These objectives are to be addressed by the continuous collection of traffic count data throughout the Mpumalanga Province, on a cost effective basis.

4. Status quo of Traffic Counts in the Mpumalanga Province

4.1 Road Network Links

The existing road network in the Mpumalanga Province can be classified according to various criteria for defining road network links. However, from the Traffic Information point of view, the definition of a road link is as follows:

"A road link is defined as the road section between any two intersections. These intersections exclude farm accesses and very low volume intersections."

Based on the current information regarding the road network in Mpumalanga, the following road links were defined, based on shape files in the GIS databases, as shown in **Table 4.1**.

Table 4.1: Road network links in Mpumalanga Province

Road class	Description (Functionality)	Road Length(Km)
1 – Primary Distributer	High mobility roads with limited access for rapid movement of large volumes of people, raw materials, manufactured goods , and agricultural produce of national importance	771.33
2 – Regional Distributer	Relatively high mobility roads with lower levels of access for the movement of large volumes of people, raw materials, manufactured goods, and agricultural produce of regional importance in rural and urban areas	1 948.56
3 – District Distributer	Moderate mobility with controlled higher levels of access for the movement of people, raw materials, manufactured goods, agricultural produce in rural and urban areas of regional importance	0
4 – District Collector	High levels of access and lower levels of mobility for lower traffic volumes of people, raw materials, manufactured goods, agricultural produce in rural and urban areas of local importance	1 882.47
5 – Access Roads	High access and very low mobility routes for the movement of people and goods within urban and rural areas	9 366.28
6 – Non Motorised Access Ways	Public rights of way for non-motorized transport providing basic and dedicated movement.	447.18
Total Gravel roads		9 023.61
Total Surfaced roads		5 429.22
TOTAL		**14 452.83**

It should be noted that the fact that these road links were defined from a Traffic Information System point of view does not necessarily imply that a traffic count is required at all of these road links. Also, all of these GIS defined links are not necessarily of interest for the definition of links for the purposes of the Traffic Information System. It is expected that the number of road links for survey purposes would be slightly less than the GIS shape file links.

4.2 Traffic Counts

The status quo regarding traffic counts in Mpumalanga Province is as follows:

- Before the start of the Mpumalanga RAMS project in 2008, the latest available traffic count information was dated 2004. These counts were done on a manual counting basis.

- No electronic traffic counting was done in the Province (on provincial routes) prior to 2008. The implementation of 10 permanent loop counting stations early in 2009 took place, and data collection on these stations played an integral roll on the road network of the province.

- No Weigh – in – Motion (WIM) counting was done in the Mpumalanga Province (on provincial routes) for a number of years.

The traffic counting process has commenced again in 2008 as part of the Mpumalanga RAMS project, where focus has been placed again on the Traffic Information Management System. These counts continued in 2009, 2010 as well as in 2011. The extent of the counts completed in these years will be discussed in more detail in the following sections of the report.

Mpumalanga province consists of a vast road network with over 14,000 numbered road links that aim to provide effective accessibility throughout the province. Mpumalanga is however mostly a rural province with most of these road links situated in the rural, less trafficked, areas. This raises a question surrounding the efficiency of the road network (regarding the excessive number of rural roads that have to cater for localized traffic movement) and the unnecessary burden being placed on maintenance requirements for under-utilised corridors.

5. Traffic Counting

5.1 Traffic Counting Report – Manual Traffic Counts

The traffic counts for all four financial years have been addressed as follows, in terms of the rationale for the counts:

2008/09 Financial Year. In the 2008/09 financial year the Coal haulage routes in the western part of Mpumalanga were covered during these manual counts. Initial manual traffic counts were conducted in August 2008 on the primary and secondary coal haulage routes. These counts had to be completed within very short time duration, as the information was urgently required as input to other processes associated with the coal haulage routes.

After completion of the traffic counts on the coal haulage routes, the additional traffic counts had to be prioritised to be completed in time to provide input to the Pavement Management System's DTIMS analyses too, which in turn provides input to the budget cycle. The traffic counting nodes were selected with a focus on the intersections of higher volume routes, and also to ensure that a reasonable geographic distribution was obtained for the first year's counts throughout the Province.

Data was collected in the field surveys for five vehicle classes, i.e light, bus, taxi, heavy and very heavy. This provides the opportunity to obtain a better understanding of both person trips and coal haulage trips. An example of the manual data collection form is included in **Appendix B**.

2009/10 Financial Year. In the 2009/10 financial year more focus was laid on gravel roads, after these roads where not taken into consideration in the previous year. This implicates that 50% of the gravel roads had to be covered in this financial year and another 50% in the 2010/11 year. Focus was also places on obtaining counts on the paved roads.

2010/11 Financial Year. The 2010/11 financial year also being the year of the FIFA Soccer World Cup, made it imperative to do the manual counts before the tournament started. The expectations were that the soccer tournament will have an impact on the movement of traffic on the network, and therefore the manual counts were completed beforehand. Emphasis was laid on the 50% gravel link counts as well as the rest of the paved counts.

2011/12 Financial Year. With the extension of the initial 3 year Contract to a fourth year, the emphasis was laid on all road links not counted during the initial 3 year period. The graph in **Figure 5.1** below illustrates the road links counted in the 2011/12 financial year.

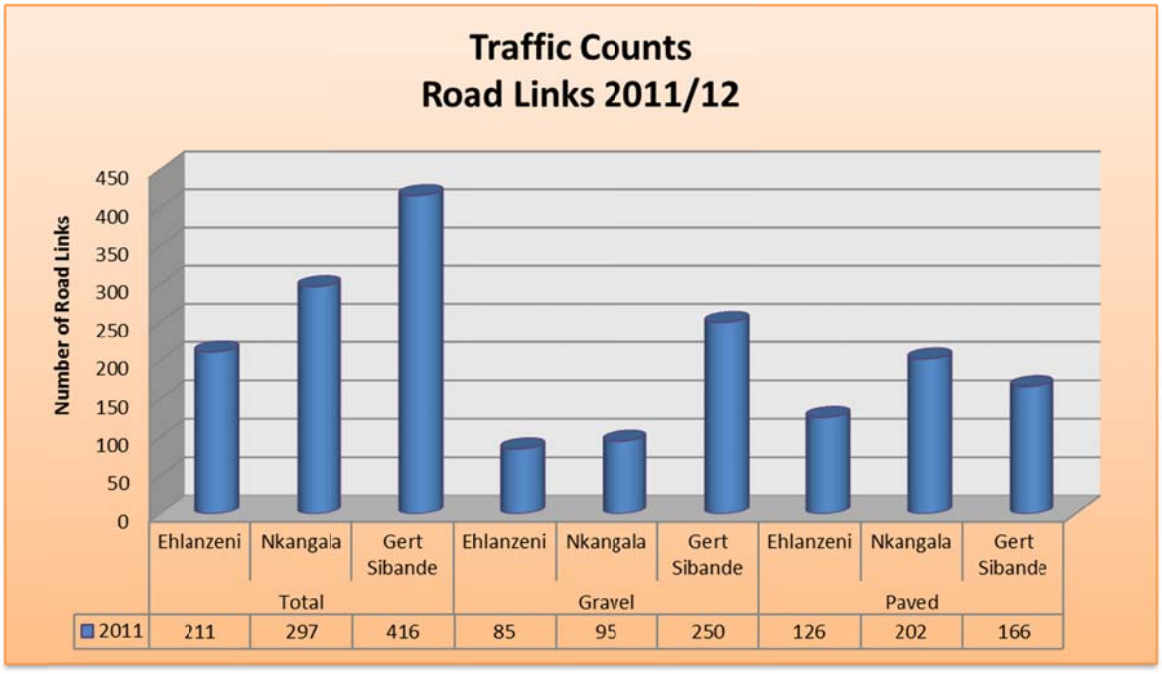


Figure 5.1: Graph illustrating Paved Road Links

An example of the presentation of the data for the manual traffic counts is included in **Appendix C**. This presentation of data provides a thorough summary of the flow characteristics for the various modes of transport on a link basis.

The collection of manual traffic counting data is based on the following procedure:

- Identification of nodes (intersections)
- Collection of traffic data, with reference to the principles indicated in Diagram 1, with the use of the form included in **Appendix B**.

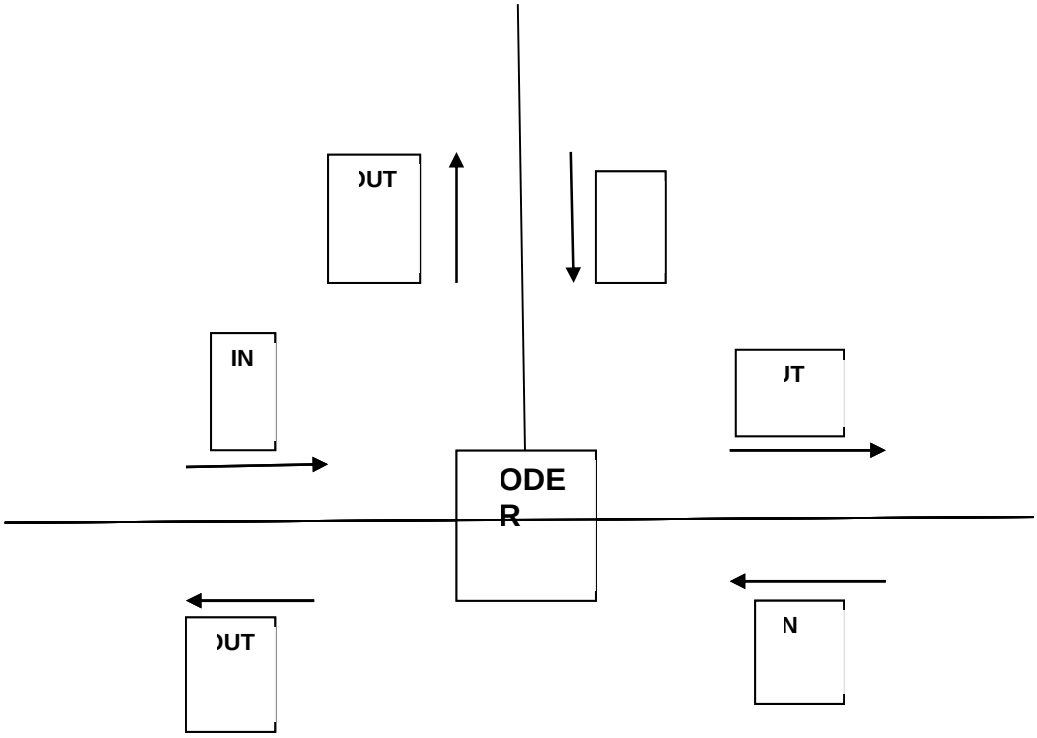


Diagram 1: Traffic counting principle at a typical T-junction node

Verification of accuracy of field data

Adjustment of the 12-hour counts to 24-hour ADT estimates. A factor of 1,25 was applied uniformly for the 2008 traffic counts, as no specific data was available from permanent counting stations which will only be implemented in the beginning of 2009.

5.2 Traffic Counting Report – Electronic Traffic Counts

The electronic traffic counts have been approached as follows:

- The need for the introduction of permanent traffic counting stations has been identified. This was necessitated based on the need to obtain representative permanent traffic count information in the Province for the following purposes:

- Determination of traffic growth rates throughout the Province, which is to be based on the data obtained from permanent traffic count information for a minimum of 3 consecutive years.
- Provision of "mother" counting stations, which is defined as permanent traffic count stations. These "mother" stations will provide traffic patterns which will serve as typical patterns to be adopted by temporary counting stations.
- The provision of data from "mother" stations will be supplemented by counting information from the SANRAL CTO system's Mpumalanga counts. This has the advantage that not all the new mother stations have to be introduced by the Province.

- A total of 10 permanent counting stations were identified as the required number of stations, after consideration of a total of 15 stations. The reasons for the selection of 10 stations was that based on the available budget, 15 stations could not be afforded. A list of the 10 selected permanent counting stations is shown in Table 5.3.

Table 5.3: Shortlist of possible permanent traffic counting stations in Mpumalanga

Site Number	Site Name	Road	Route	Site Discription	District
6121	MP Rooidraai	P081	R 540	Between R577 T/O & Lydenburg (R36)	Ehlanzeni
6122	MP Witklip	P008	R 36	Between Lydenburg and Bumbi	Ehlanzeni
6123	MP Nelspruit North	P017	R 40	Between Nelspruit and Plaston T/O	Ehlanzeni
6124	MP Welgelegen	P025	R 36	Between Carolina and Machadodorp	Gert Sibande
6125	MP Badplaas South	D225	R 541	Between Badplaas and Lochiel	Gert Sibande
6126	MP Riverloo	P030	R 39	Between Standerton and Morgenzon	Gert Sibande
6127	MP Ermelo East	P005	R 65	Between Ermelo and Amsterdam	Gert Sibande
6128	MP Phooko	P095	R 25	Between Verena and Groblersdal	Nkangala
6129	MP Verena	-	R 544	Between Vlaklaagte and Verena	Nkangala
6130	MP Mkholwane	P255	R 568	Between KwaMhlanga and Kameelpoort	Nkangala

6. Summary and Conclusion

The data gathered from the traffic management system is crucial to the proper management and maintenance of the Departmental road network and infrastructure. It is of crucial importance that data be gathered on a continuous basis each consecutive year.

The Department needs to ensure that enough funding is made available to meet the demands of the counting strategy. The current strategy calls for the counting of all roads at least once every five years. Roads with higher ADT's should be counted every three years. The break in counting from 2004 to 2008 had a major impact on the counting strategy. Almost all counts on roads in the province were older than five years. This implied that ten years would be needed to recount all the roads and to ensure that no count on any road would be older than five years.

Accurate growth rates can also only be calculated when data is available on the road for at least five years.

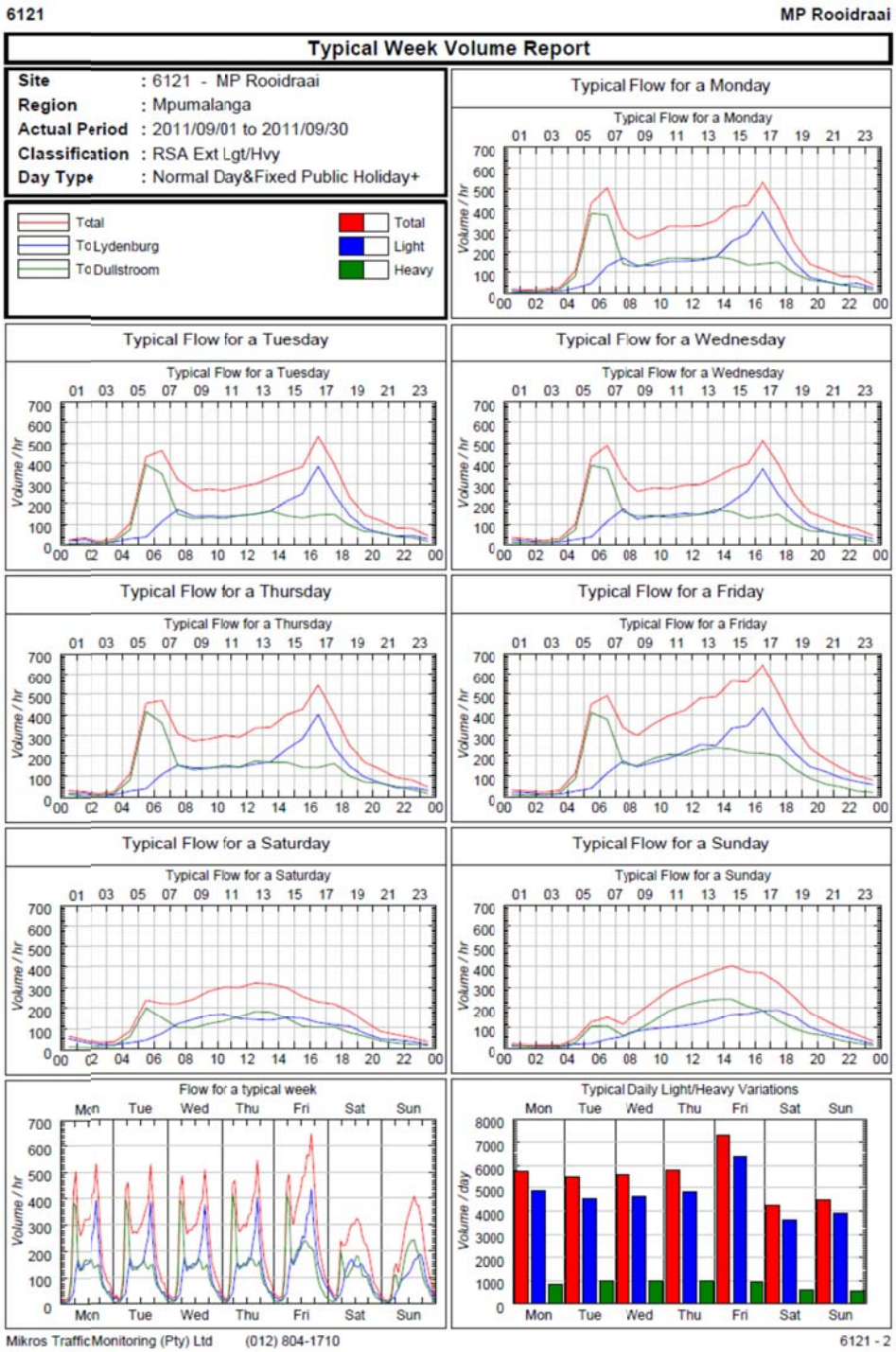
The Department should ensure that a new traffic counting contract is in place when the current contract expires at the end of the 2011/12 financial year. A break in counting at this stage would result in a new backlog being created. This backlog would take at least five years to clear.

APPENDIX A:

EXAMPLE OF DATA PRESENTATION FOR ELECTRONIC COUNTS

6121 **MP Rooidraai**

TRAFFIC HIGHLIGHTS OF SITE 6121				
1.1	Site Identifier			6121
1.2	Site Name			MP Rooidraai
1.3	Site Description			Between R577 T/O & Lydenburg (R36)
1.4	Road Description	Route : R540	Road : P081 Section : 01	Distance : 3.5km
1.5	GPS Position			30.417150E -25.124430S
1.6	Number of Lanes			2
1.7	Station Type			Permanent
1.8	Requested Period			2011/01/01 - 2011/12/31
1.9	Length of record requested (hours)			8760
1.10	Actual First & Last Dates			2011/09/01 - 2011/09/30
1.11	Actual available data (hours)			720
1.12	Percentage data available for requested period			8.2
		To Lydenburg	To Dullstroom	Total
2.1	Total number of vehicles	83676	84303	167979
2.2	Average daily traffic (ADT)	2789	2810	5599
2.3	Average daily truck traffic (ADTT)	431	424	854
2.4	Percentage of trucks	15.4	15.1	15.3
2.5	Truck split % (short:medium:long)	32 : 16 : 52	31 : 16 : 53	32 : 16 : 52
2.6	Percentage of night traffic (20:00 - 06:00)	11.9	21.1	16.5
3.1	Speed limit (km/hr)			120
3.2	Average speed (km/hr)	78.6	78.9	78.8
3.3	Average speed - light vehicles (km/hr)	81.5	80.9	81.2
3.4	Average speed - heavy vehicles (km/hr)	62.5	67.5	65.0
3.5	Average night speed (km/hr)	80.3	76.6	77.9
3.6	15th centile speed (km/hr)	59.4	61.6	59.4
3.7	85th centile speed (km/hr)	104.0	97.9	99.9
3.8	Percentage vehicles in excess of speed limit	3.4	1.4	2.4
4.1	Percentage vehicles in flows over 600 vehicles/hr	0.0	0.0	3.8
4.2	Highest volume on the road (vehicles/hr)		2011/09/30 17:00:00	682
4.3	Highest volume in the North (vehs/hr)		2011/09/02 17:00:00	468
4.4	Highest volume in the South (vehs/hr)		2011/09/29 06:00:00	442
4.5	Highest volume in a lane (vehicles/hr)		2011/09/02 17:00:00	468
4.6	15th highest volume on the road (vehicles/hr)		2011/09/29 17:00:00	566
4.7	15th highest volume in the North direction (vehs/hr)		2011/09/05 17:00:00	385
4.8	15th highest volume in the South direction (vehs/hr)		2011/09/15 06:00:00	394
4.9	30th highest volume on the road (vehicles/hr)		2011/09/07 17:00:00	516
4.10	30th highest volume in the North direction (vehs/hr)		2011/09/05 16:00:00	324
4.11	30th highest volume in the South direction (vehs/hr)		2011/09/26 07:00:00	369
5.1	Percentage of vehicles less than 2s behind vehicle ahead	12.3	19.4	15.9
6.1	Total number of heavy vehicles	12919	12707	25626
6.2	Estimated average number of axles per truck	5.1	5.1	5.1
6.3	Estimated truck mass (Ton/truck)	29.1	29.4	29.2
6.4	Estimated average E80/truck	1.7	1.7	1.7
6.5	Estimated daily E80 on the road			1436
6.6	Estimated daily E80 in the North direction			721
6.7	Estimated daily E80 in the South direction			715
6.8	Estimated daily E80 in the worst North lane			721
6.9	Estimated daily E80 in the worst South lane			715
6.10	ASSUMPTION on Axles/Truck (Short:Medium:Long)			(2.0 : 5.0 : 7.0)
6.11	ASSUMPTION on Mass/Truck (Short:Medium:Long)			(10.9 : 31.5 : 39.8)
6.12	ASSUMPTION on E80s/Truck (Short:Medium:Long)			(0.6 : 2.5 : 2.1)


6121
MP Rooidraai
Typical Week Volume Report
Site : 6121 - MP Rooidraai
Region : Mpumalanga
Actual Period : 2011/09/01 to 2011/09/30
Classification : RSA Ext Lgt/Hvy
Day Type : Normal Day&Fixed Public Holiday+
To Lydenburg
To Dullstroom
Total
Light
Heavy
Typical Flow for a Monday
Typical Flow for a Tuesday
Typical Flow for a Wednesday
Typical Flow for a Thursday
Typical Flow for a Friday
Typical Flow for a Saturday
Typical Flow for a Sunday
Volume / hr
Flow for a typical week
Mon Tue Wed Thu Fri Sat Sun
Typical Daily Light/Heavy Variations
Volume / day
Mikros TrafficMonitoring (Pty) Ltd (012) 804-1710
6121 - 2

APPENDIX B:
EXAMPLE OF MANUAL COUNTING FORM

Traffic Counting Sheet

Page 1 | Mphumalanga RAMS | PR NR : 2513

Intersection: ---------- SER.NO: ----------

Count Date: ---------- Hours Counted: 12 H

Latitude: ----------

Longitude: ----------

N

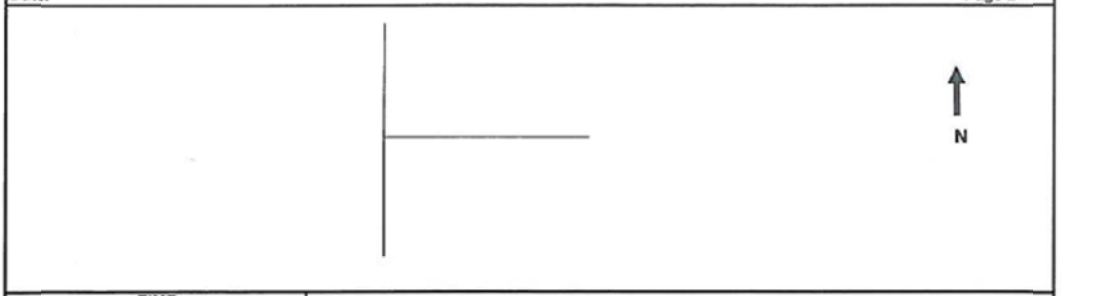
TIME		VEHICLES					
							
START	END	Light		Heavy		V.Heavy	
TIME	TIME	1	2	1	2	1	2
06:00	07:00						
07:00	08:00						
08:00	09:00						
09:00	10:00						
10:00	11:00						
11:00	12:00						
12:00	13:00						
13:00	14:00						
14:00	15:00						
15:00	16:00						
16:00	17:00						
17:00	18:00						

Counters Details

Name & Surname:

Tel No:

Traffic Count: Mphumalanga RAMS						PR NR : 2513
SER.NO ..... Intersection:						
Date:						Page 2



TIME		VEHICLES			
		Taxi		BUS	
START TIME	END TIME	1	2	1	2
06:00	07:00				
07:00	08:00				
08:00	09:00				
09:00	10:00				
10:00	11:00				
11:00	12:00				
12:00	13:00				
13:00	14:00				
14:00	15:00				
15:00	16:00				
16:00	17:00				
17:00	18:00				

Counters Details

Name & Surname:

Tel No:

APPENDIX C:

EXAMPLE OF DATA PRESENTATION FOR MANUAL COUNTS

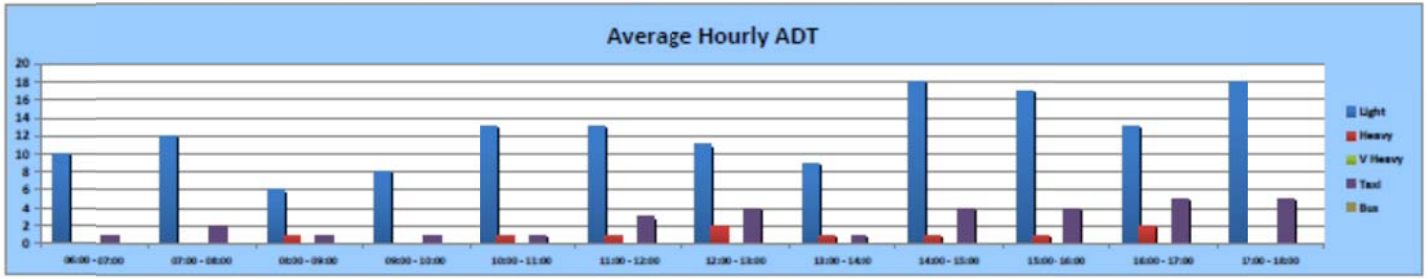
Hand Count Report For Road Number D2950_90 - KM Distance 25.75 to 27.34 - Date 08/06/2011

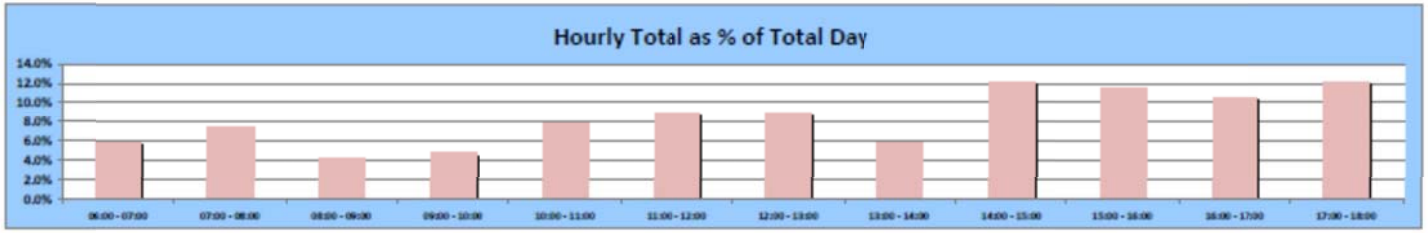
Mpumalanga Department of Public Works, Roads and Transport

Lidwala
SPECIALIST ENGINEERS

Hand Count Report - Hourly Volumes Observed on the Road - Total Link Volumes Shown for Both Directions

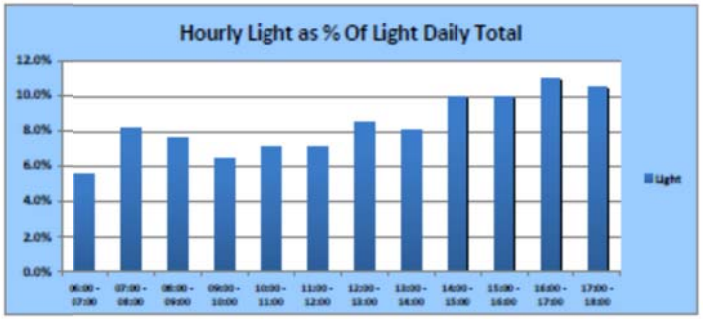
Day	Average Hourly ADT						Hourly Total As % Of Total Day	Hourly Volume Distribution as % of Total Hourly Volume						Hourly Distribution as % Of Daily Total Volumes				
	Light	Heavy	V Heavy	Taxi	Bus	Total		Light	Heavy	V Heavy	Taxi	Bus	Total	Light	Heavy	V Heavy	Taxi	Bus
06:00 - 07:00	10	0	0	1	0	11	5.8%	91%	0%	0%	9%	0%	100%	6.8%	0.0%	0.0%	3.1%	0.0%
07:00 - 08:00	12	0	0	2	0	14	7.4%	86%	0%	0%	14%	0%	100%	8.1%	0.0%	0.0%	6.3%	0.0%
08:00 - 09:00	6	1	0	1	0	8	4.2%	75%	13%	0%	13%	0%	100%	4.1%	10.0%	0.0%	3.1%	0.0%
09:00 - 10:00	8	0	0	1	0	9	4.7%	89%	0%	0%	11%	0%	100%	5.4%	0.0%	0.0%	3.1%	0.0%
10:00 - 11:00	13	1	0	1	0	15	7.9%	87%	7%	0%	7%	0%	100%	8.8%	10.0%	0.0%	3.1%	0.0%
11:00 - 12:00	13	1	0	3	0	17	8.9%	76%	6%	0%	18%	0%	100%	8.8%	10.0%	0.0%	9.4%	0.0%
12:00 - 13:00	11	2	0	4	0	17	8.9%	65%	12%	0%	24%	0%	100%	7.4%	20.0%	0.0%	12.5%	0.0%
13:00 - 14:00	9	1	0	1	0	11	5.8%	82%	9%	0%	9%	0%	100%	6.1%	10.0%	0.0%	3.1%	0.0%
14:00 - 15:00	18	1	0	4	0	23	12.1%	78%	4%	0%	17%	0%	100%	12.2%	10.0%	0.0%	12.5%	0.0%
15:00 - 16:00	17	1	0	4	0	22	11.6%	77%	5%	0%	18%	0%	100%	11.5%	10.0%	0.0%	12.5%	0.0%
16:00 - 17:00	13	2	0	5	0	20	10.5%	65%	10%	0%	25%	0%	100%	8.8%	20.0%	0.0%	15.6%	0.0%
17:00 - 18:00	18	0	0	5	0	23	12.1%	78%	0%	0%	22%	0%	100%	12.2%	0.0%	0.0%	15.6%	0.0%
	148	10	0	32	0	190	100.0%	79%	5%	0%	16%	0%	100%	100.0%	100.0%	0.0%	100.0%	0.0%
	TOTAL							AVERAGE						TOTAL				

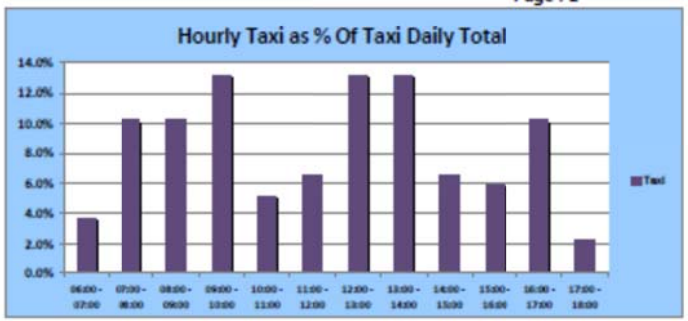


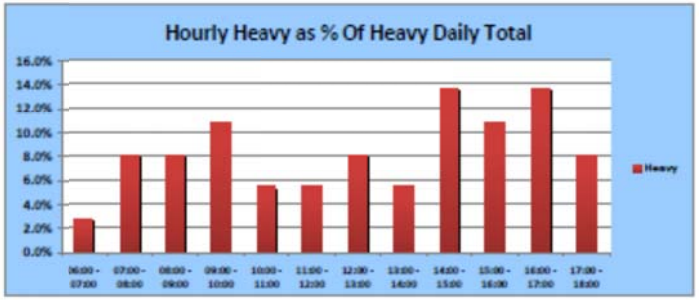


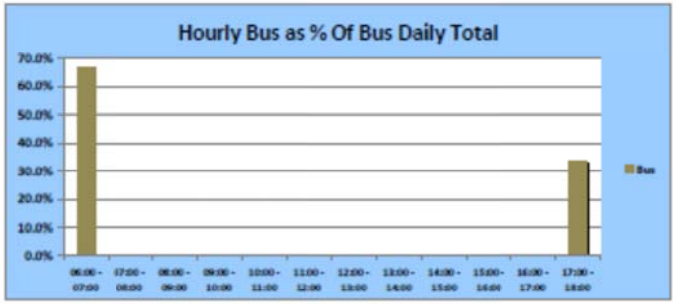
Lidwala its Engineers
SPECIALIST ENGINEERS

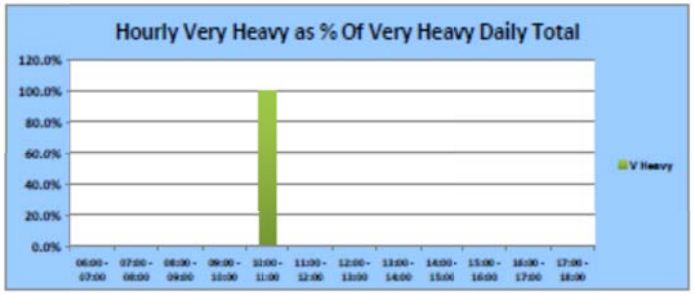
Hand Count Report For Road Number D2951_060 - KM Distance 6.79 to 12.3 - Date 08/06/2011

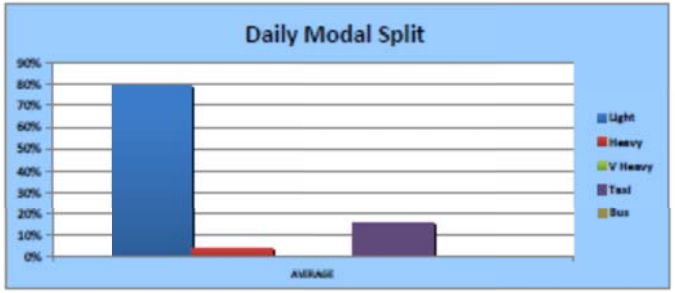






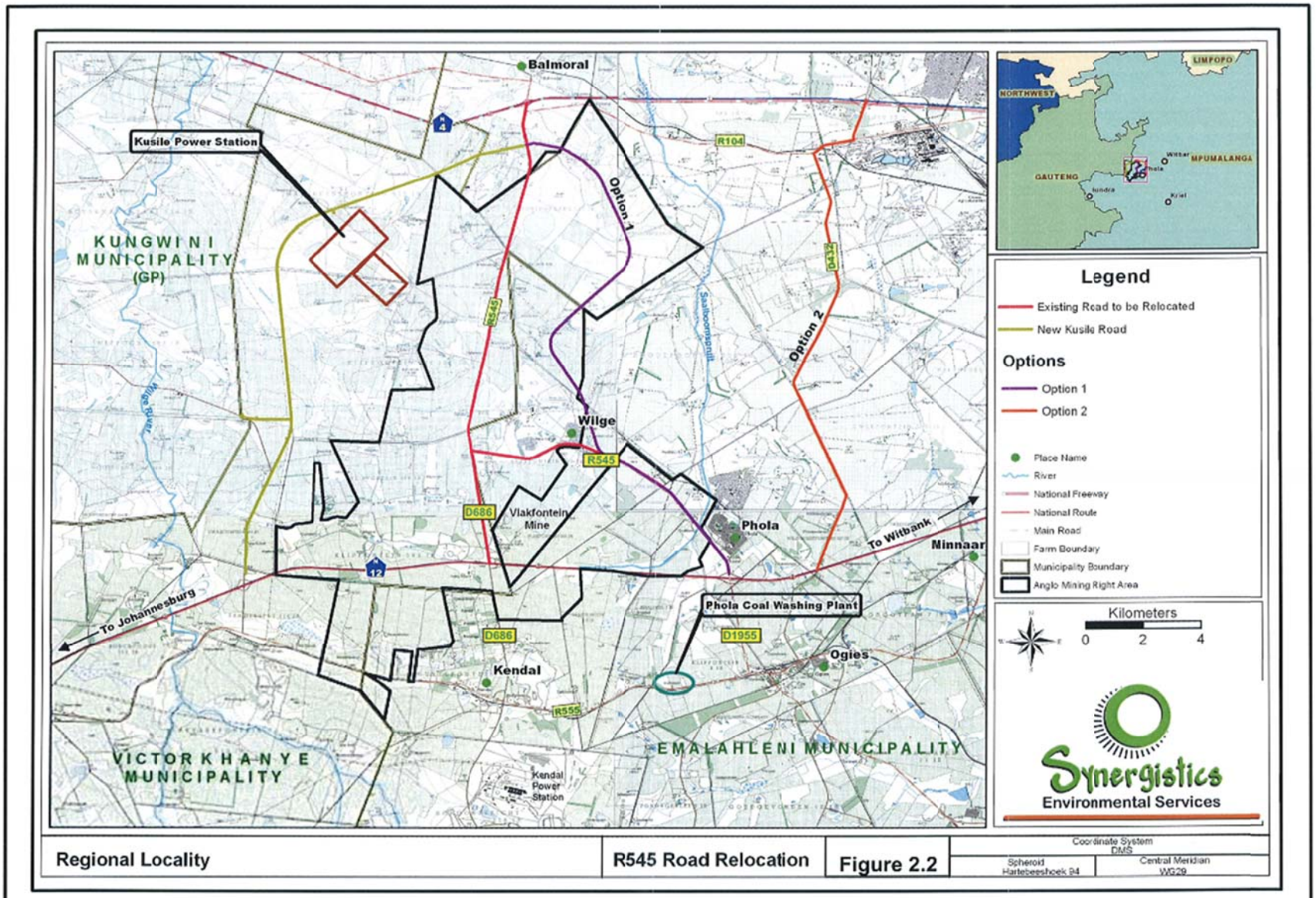






ANNEXURE D

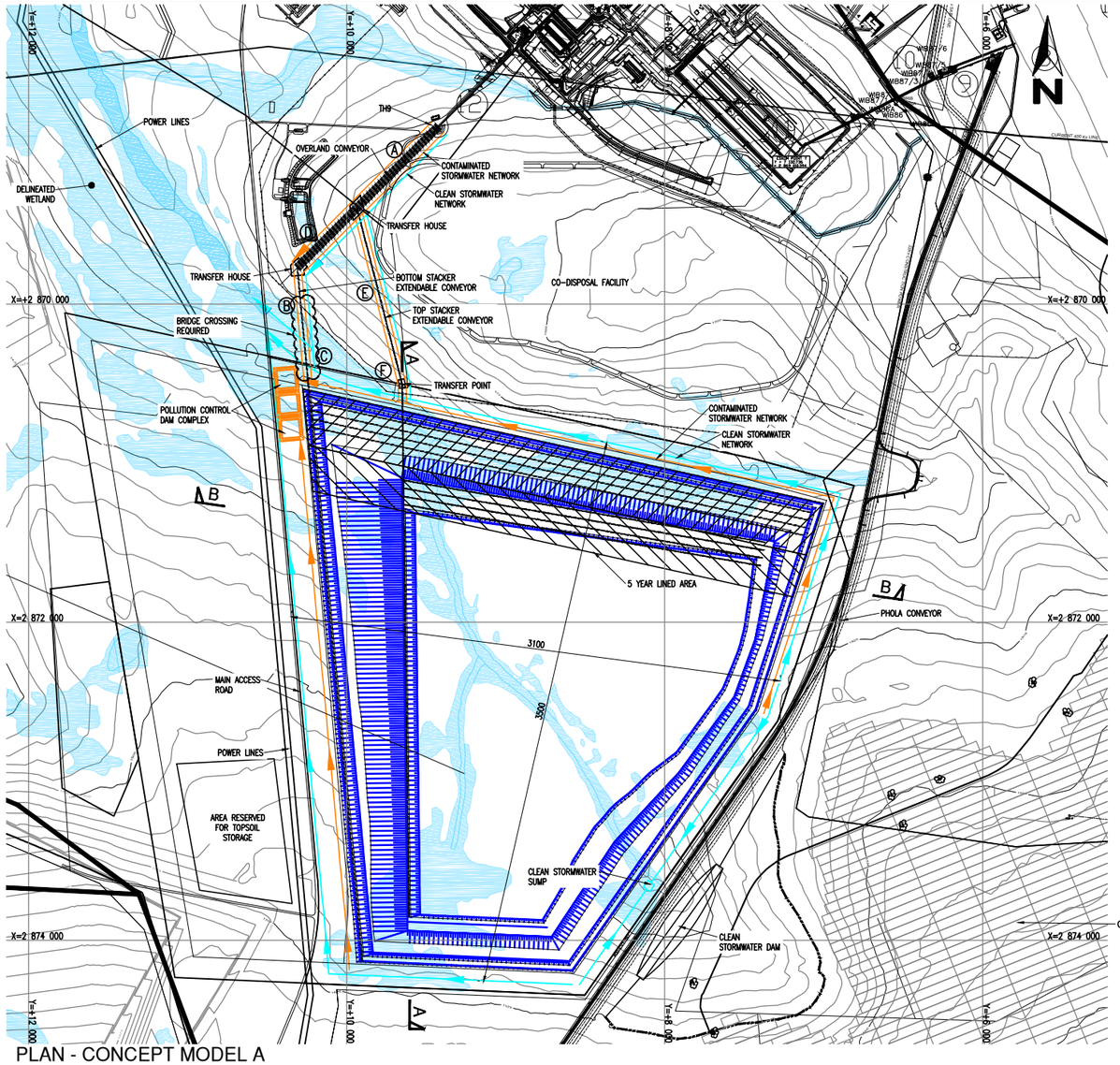
R545 Relocation



Regional Locality	R545 Road Relocation	Figure 2.2	Coordinate System DMS
			Spheroid Hartebeeshoek 94 / Central Meridian WG29

ANNEXURE E

Site Layout



PLAN - CONCEPT MODEL A

1:12 500

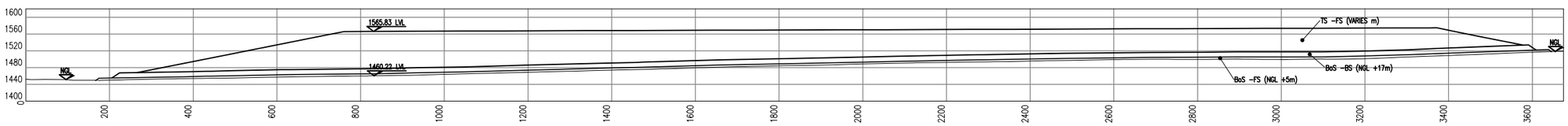
	Mechanical Information
Description	**Site A**
Overland Conveyor	
Length	1250
Extendable Conveyor	
Top Stack	
Initial Length (m)	1750
Additional Length (m)	2750
Bottom Stack	
Initial Length (m)	800
Additional Length (m)	3410
Shiftable Conveyor	
Top Stack	
Length [Range] (m)	630 to 2310
Number of Shifts	54
Bottom Stack	
Length [Range] (m)	630 to 3240
Number of Shifts	65
Transfer Points	3

	Ash Facility Characteristics
Description	**Site A**
Footprint Area (ha)	822
Facility Volume (Million m3)	530.4
Volume Split	
Top Stacker	75%
Bottom Stacker	25%
Life Expectancy	60
Total Height (m)	100
Area of first 5 year lined terrace	1 984 546
Borrow Pit Area (ha)	-

	Infrastructure Demolish / Diversion Requirements
Description	**Site A**
Powerlines 400 KV – Demolish	0
Diversion	0
88 KV – Demolish	3 180
Diversion	4 270
Main Access Road – Demolish	3 160
Diversion	5 230
Provincial Road – Demolish	0
Diversion	-
Secondary roads – Demolish	-
Diversion	0
Railway – Demolish	0
Diversion	0
Water Pipeline–Demolish	0
Diversion	0
Fuel Pipeline–Demolish	0
Diversion	0

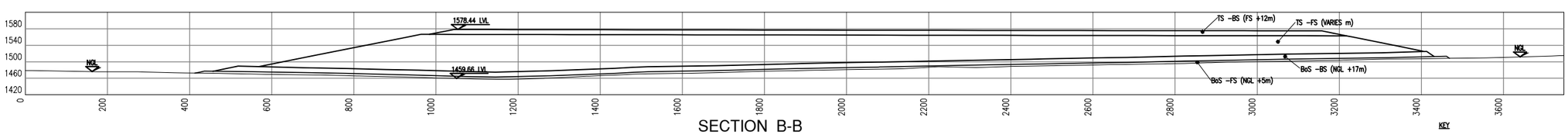
	Civil Infrastructure Requirements
Description	**Site A**
No. of Dams required	
Ash facility	2
Overland Conveyor	0
Single Dam Size (m3)	40000
Storm Water Sump	2
No. of bridges required	1
Main Access Road Crossing	0
Borrow Pit Required	0

Conveyor Intersections	
Site A	
TH9 Access Road	A
CDF Security Fence	B
Klipfontein Crossing	C
Wetland Crossing 1	D
Wetland Crossing 2	E
Wetland Crossing 3	F



SECTION A-A

1:4000



SECTION B-B

1:4000

KEY

TS = TOP STACK
BoS = BOTTOM STACK
BS = BACK STACK
FS = FRONT STACK
N.G.L. = NATURAL GROUND LEVEL

FOR INFORMATION

Reference Drawings	Rev.	Revision	Name	Date	Approved
GENERAL ARRANGEMENT	D121-00-001	A	ISSUED FOR INFORMATION	R.Mol.	26.02.13	C.C.

Jones & Wagener
Consulting Civil Engineers
Box 1434 Rivonia 2128 South Africa
Tel. (011) 519-0200
Fax. (011) 519-0201
Email post@jaws.co.za

Drawn	R.Mol.	15.01.13
Designed	C.C.	JAN 13
Checked	C.C.	JAN 13
Pr. Eng. Approval	D.B.	JAN 13
Signature		

Client: ZITHOLELE

Project: KUSILE POWER STATION
60 YEAR ASH FACILITY
EIA CONCEPT DESIGN
CONCEPT MODEL - A

Scale: 1 : 8 000 A0

Drawing No: D121-00-002

Revision: A

ANNEXURE F

Impact Rating Matrix

Rated By: *Naye Miya*
Reviewed By: *Adrian Brislin*

ALTERNATIVES:

Code	IMPACT DESCRIPTION	Weighting	Site A Direction of Impact	Degree of Certainty	Magnatude	Spatial	Temporal	Probability	**Impact Risk**	
Code	*Phase*									
	CONSTRUCTION	5								
Impact 1	additional delays at intersections due to additional traffic generated by the development. This will take cognisance of the availability of materials on site	4	Negative	Probable	2 LOW	3 ADJ	2 SHORT	2 UNLIKE	**-1** **VLOW**	-1
Impact 2	Condition of the Roads or Accessibilty	4	Negative	Definite	1 VLOW	3 ADJ	2 SHORT	2 UNLIKE	**-0.9** **VLOW**	-1
Impact 3	Conveyor Crossing the Road	5	Negative	Probable	0 NO					-1
COMBINED WEIGHTED RATING	**BEFORE MITIGATION**		Negative		-0.8 VLOW	-1.6 DEV	-1.1 SHORT	1.1 UNLIKE	**-0.3** **VLOW**	
PROJECT IMPACT	**AFTER MITIGATION**				2 LOW	3 ADJ	2 SHORT	2 UNLIKE	**1** **VLOW**	1
STATUS QUO	INITIAL BASELINE IMPACTS TO ENVIRONMENT				3 MODL	3 ADJ	1 INCID	2 UNLIKE	**1** **VLOW**	1
CUMULATIVE IMPACT	INITIAL IMPACTS TO ENVIRONMENT + ADDITIONAL IMPACTS FROM PROJECT, **BEFORE MITIGATION**				3 MODL	3 ADJ	1 INCID	3 LIKE	**1.5** **LOW**	1
RESIDUAL IMPACT	INITIAL IMPACTS TO ENVIRONMENT + ADDITIONAL IMPACTS FROM PROJECT, **AFTER MITIGATION**				2 LOW	3 ADJ	1 INCID	2 UNLIKE	**0.9** **VLOW**	1

Code	SITE B Direction of Impact	Degree of Certainty	Magnatude	Spatial	Temporal	Probability	**Impact Risk**	
Impact 1	Negative	Probable	2 LOW	3 ADJ	2 SHORT	2 UNLIKE	**-1** **VLOW**	-1
Impact 2	Negative	Probable	5 HIGH	4 LOC	2 SHORT	5 OCCUR	**-4.1** **HIGH**	-1
Impact 3	Negative	Definite	6 VHIGH	4 LOC	2 SHORT	4 VLIKE	**-3.5** **MODH**	-1
COMBINED WEIGHTED RATING	Negative		-3.9 MODH	-3.2 LOC	-1.7 SHORT	3.2 VLIKE	**-2.1** **MODL**	
PROJECT IMPACT			1 VLOW	3 ADJ	2 SHORT	2 UNLIKE	**0.9** **VLOW**	1
STATUS QUO			1 VLOW	1 ISO	1 INCID	2 UNLIKE	**0.4** **VLOW**	1
CUMULATIVE IMPACT			5 HIGH	4 LOC	2 SHORT	4 VLIKE	**3.2** **MODH**	1
RESIDUAL IMPACT			2 LOW	2 DEV	2 SHORT	2 UNLIKE	**0.9** **VLOW**	1

Code	SITE C Direction of Impact	Degree of Certainty	Magnatude	Spatial	Temporal	Probability	**Impact Risk**	
Impact 1	Negative	Probable	5 HIGH	4 LOC	2 SHORT	4 VLIKE	**-3.2** **MODH**	-1
Impact 2	Negative	Probable	1 VLOW	3 ADJ	2 SHORT	2 UNLIKE	**-0.9** **VLOW**	-1
Impact 3	Negative	Definite	6 VHIGH	4 LOC	2 SHORT	4 VLIKE	**-3.5** **MODH**	-1
COMBINED WEIGHTED RATING	Negative		-3.6 MODH	-3.2 LOC	-1.7 SHORT	2.9 COULD	**-1.8** **LOW**	
PROJECT IMPACT			3 MODL	4 LOC	2 SHORT	2 UNLIKE	**1.3** **LOW**	1
STATUS QUO			5 HIGH	4 LOC	2 SHORT	5 OCCUR	**4.1** **HIGH**	1
CUMULATIVE IMPACT			6 VHIGH	4 LOC	2 SHORT	5 OCCUR	**4.4** **HIGH**	1
RESIDUAL IMPACT			3 MODL	4 LOC	2 SHORT	2 UNLIKE	**1.3** **LOW**	1

Code	SITE A+F Direction of Impact	Degree of Certainty	Magnatude	Spatial	Temporal	Probability	**Impact Risk**	
Impact 1	Negative	Probable	2 LOW	3 ADJ	2 SHORT	2 UNLIKE	**-1** **VLOW**	-1
Impact 2	Negative	Probable	1 VLOW	3 ADJ	2 SHORT	2 UNLIKE	**-0.9** **VLOW**	-1
Impact 3	Negative	Definite	6 VHIGH	4 LOC	2 SHORT	4 VLIKE	**-3.5** **MODH**	-1
COMBINED WEIGHTED RATING	Negative		-2.8 MODL	-2.9 ADJ	-1.7 SHORT	2.4 COULD	**-1.3** **LOW**	
PROJECT IMPACT			2 LOW	3 ADJ	2 SHORT	2 UNLIKE	**1** **VLOW**	1
STATUS QUO			3 MODL	3 ADJ	1 INCID	2 UNLIKE	**1** **VLOW**	1
CUMULATIVE IMPACT			3 MODL	3 ADJ	1 INCID	2 UNLIKE	**1** **VLOW**	1
RESIDUAL IMPACT			2 LOW	3 ADJ	1 INCID	2 UNLIKE	**0.9** **VLOW**	1

Code	SITEA+G Direction of Impact	Degree of Certainty	Magnatude	Spatial	Temporal	Probability	**Impact Risk**	
Impact 1	Negative	Probable	2 LOW	3 ADJ	2 SHORT	2 UNLIKE	**-1** **VLOW**	-1
Impact 2	Negative	Probable	1 VLOW	3 ADJ	2 SHORT	2 UNLIKE	**-0.9** **VLOW**	-1
Impact 3	Negative	Definite	6 VHIGH	4 LOC	2 SHORT	4 VLIKE	**-3.5** **MODH**	-1
COMBINED WEIGHTED RATING	Negative		-2.8 MODL	-2.9 ADJ	-1.7 SHORT	2.4 COULD	**-1.3** **LOW**	
PROJECT IMPACT			2 LOW	3 ADJ	2 SHORT	2 UNLIKE	**1** **VLOW**	1
STATUS QUO			3 MODL	3 ADJ	1 INCID	2 UNLIKE	**1** **VLOW**	1
CUMULATIVE IMPACT			3 MODL	3 ADJ	1 INCID	2 UNLIKE	**1** **VLOW**	1
RESIDUAL IMPACT			7 SEV	2 DEV	3 MED	1 IMPOS	**2** **LOW**	1

Code	SITE F+G Direction of Impact	Degree of Certainty	Magnatude	Spatial	Temporal	Probability	**Impact Risk**	
Impact 1	Negative	Probable	2 LOW	3 ADJ	2 SHORT	2 UNLIKE	**-1** **VLOW**	-1
Impact 2	Negative	Probable	1 VLOW	3 ADJ	2 SHORT	2 UNLIKE	**-0.9** **VLOW**	-1
Impact 3	Negative	Definite	6 VHIGH	4 LOC	2 SHORT	4 VLIKE	**-3.5** **MODH**	-1
COMBINED WEIGHTED RATING	Negative		-2.8 MODL	-2.9 ADJ	-1.7 SHORT	2.4 COULD	**-1.3** **LOW**	
PROJECT IMPACT			2 LOW	3 ADJ	2 SHORT	2 UNLIKE	**1** **VLOW**	1
STATUS QUO			3 MODL	3 ADJ	1 INCID	2 UNLIKE	**1** **VLOW**	1
CUMULATIVE IMPACT			3 MODL	3 ADJ	1 INCID	2 UNLIKE	**1** **VLOW**	1
RESIDUAL IMPACT			7 SEV	2 DEV	3 MED	1 IMPOS	**2** **LOW**	1

Code	NO-GO Direction of Impact	Degree of Certainty	Magnatude	Spatial	Temporal	Probability	**Impact Risk**	
Impact 1	Negative	Probable	2 LOW	3 ADJ	2 SHORT	2 UNLIKE	**-1** **VLOW**	-1
Impact 2	Negative	Probable	0 NO					-1
Impact 3	Negative	Definite	0 NO					-1
COMBINED WEIGHTED RATING	Negative		-0.5 VLOW	-0.8 ISO	-0.5 INCID	0.5 IMPOS	**-0.1** **VLOW**	
PROJECT IMPACT			2 LOW	3 ADJ	2 SHORT	2 UNLIKE	**1** **VLOW**	1
STATUS QUO			3 MODL	3 ADJ	1 INCID	2 UNLIKE	**1** **VLOW**	1
CUMULATIVE IMPACT			3 MODL	3 ADJ	1 INCID	2 UNLIKE	**1** **VLOW**	1
RESIDUAL IMPACT			2 LOW	3 ADJ	1 INCID	2 UNLIKE	**0.9** **VLOW**	1

MITIGATION MEASURES	Site A	SITE B	SITE C	SITE A+F	SITEA+G	SITE F+G	NO-GO
GENERAL:	*SITE SPECIFIC:*	*SITE SPECIFIC:*	*SITE SPECIFIC:*	*SITE SPECIFIC:*	*SITE SPECIFIC:*	*SITE SPECIFIC:*	*SITE SPECIFIC:*
Add lanes at intersections or Improve control measure i.e signal or roundabout	No upgrades	Upgrade R960 Provincial Road from Gravel to Tar	Convert intersection R545 / Kusile Road to a Roundabout intersection	No upgrades	No upgrades	No upgrades	
For deep Cuts, a total closure or stop and go system is used	Conveyor do not cross the road	A temporal diversion road has to be designed, approved and built which is both expensive and time consuming	A temporal diversion road has to be designed, approved and built which is both expensive and time consuming	A temporal diversion road has to be designed, approved and built which is both expensive and time consuming	A temporal diversion road has to be designed, approved and built which is both expensive and time consuming	A temporal diversion road has to be designed, approved and built which is both expensive and time consuming	

Rated By: *Naye Miya*
Reviewed By: *Adrian Brislin*

ALTERNATIVES:

Site A

Code	IMPACT DESCRIPTION	Weighting	Direction of Impact	Degree of Certainty	Magnatude	Spatial	Temporal	Probability	**Impact Risk**	
Code	*Phase*									
	POST CONSTRUCTION	5								
Impact 1	additional delays at intersections due to additional traffic generated by the development. This will take cognisance of the mitigations proposed during the construction phase evaluation	4	Negative	Probable	1 VLOW	2 DEV	3 MED	2 UNLIKE	**-0.9** **VLOW**	-1
COMBINED WEIGHTED RATING	**BEFORE MITIGATION**		Negative		-0.8 VLOW	-1.6 DEV	-2.4 MED	1.6 UNLIKE	**-0.6** **VLOW**	
PROJECT IMPACT	**AFTER MITIGATION**				1 VLOW	2 DEV	3 MED	2 UNLIKE	**0.9** **VLOW**	1
STATUS QUO	INITIAL BASELINE IMPACTS TO ENVIRONMENT				3 MODL	3 ADJ	3 MED	3 LIKE	**2** **LOW**	1
CUMULATIVE IMPACT	INITIAL IMPACTS TO ENVIRONMENT + ADDITIONAL IMPACTS FROM PROJECT, **BEFORE MITIGATION**				3 MODL	3 ADJ	3 MED	3 LIKE	**2** **LOW**	1
RESIDUAL IMPACT	INITIAL IMPACTS TO ENVIRONMENT + ADDITIONAL IMPACTS FROM PROJECT, **AFTER MITIGATION**				3 MODL	3 ADJ	3 MED	2 UNLIKE	**1.3** **LOW**	1

SITE B

Code	Direction of Impact	Degree of Certainty	Magnatude	Spatial	Temporal	Probability	**Impact Risk**	
Impact 1	Negative	Probable	1 VLOW	1 ISO	3 MED	2 UNLIKE	**-0.7** **VLOW**	-1
COMBINED WEIGHTED RATING	Negative		-0.8 VLOW	-0.8 ISO	-2.4 MED	1.6 UNLIKE	**-0.5** **VLOW**	
PROJECT IMPACT			1 VLOW	1 ISO	3 MED	2 UNLIKE	**0.7** **VLOW**	1
STATUS QUO			1 VLOW	1 ISO	1 INCID	2 UNLIKE	**0.4** **VLOW**	1
CUMULATIVE IMPACT			2 LOW	1 ISO	3 MED	2 UNLIKE	**0.9** **VLOW**	1
RESIDUAL IMPACT			2 LOW	1 ISO	3 MED	2 UNLIKE	**0.9** **VLOW**	1

SITE C

Code	Direction of Impact	Degree of Certainty	Magnatude	Spatial	Temporal	Probability	**Impact Risk**	
Impact 1	Negative	Probable	1 VLOW	3 ADJ	3 MED	2 UNLIKE	**-1** **VLOW**	-1
COMBINED WEIGHTED RATING	Negative		-0.8 VLOW	-2.4 ADJ	-2.4 MED	1.6 UNLIKE	**-0.7** **VLOW**	
PROJECT IMPACT			1 VLOW	3 ADJ	3 MED	2 UNLIKE	**1** **VLOW**	1
STATUS QUO			3 MODL	4 LOC	3 MED	3 LIKE	**2.2** **MODL**	1
CUMULATIVE IMPACT			3 MODL	4 LOC	3 MED	3 LIKE	**2.2** **MODL**	1
RESIDUAL IMPACT			3 MODL	4 LOC	3 MED	2 UNLIKE	**1.5** **LOW**	1

SITE A+F

Code	Direction of Impact	Degree of Certainty	Magnatude	Spatial	Temporal	Probability	**Impact Risk**	
Impact 1	Negative	Probable	1 VLOW	2 DEV	3 MED	2 UNLIKE	**-0.9** **VLOW**	-1
COMBINED WEIGHTED RATING	Negative		-0.8 VLOW	-1.6 DEV	-2.4 MED	1.6 UNLIKE	**-0.6** **VLOW**	
PROJECT IMPACT			1 VLOW	1 ISO	3 MED	2 UNLIKE	**0.7** **VLOW**	1
STATUS QUO			3 MODL	4 LOC	3 MED	3 LIKE	**2.2** **MODL**	1
CUMULATIVE IMPACT			3 MODL	4 LOC	3 MED	3 LIKE	**2.2** **MODL**	1
RESIDUAL IMPACT			3 MODL	3 ADJ	3 MED	2 UNLIKE	**1.3** **LOW**	1

SITEA+G

Code	Direction of Impact	Degree of Certainty	Magnatude	Spatial	Temporal	Probability	**Impact Risk**	
Impact 1	Negative	Probable	1 VLOW	2 DEV	3 MED	2 UNLIKE	**-0.9** **VLOW**	-1
COMBINED WEIGHTED RATING	Negative		-0.8 VLOW	-1.6 DEV	-2.4 MED	1.6 UNLIKE	**-0.6** **VLOW**	
PROJECT IMPACT			1 VLOW	2 DEV	3 MED	2 UNLIKE	**0.9** **VLOW**	1
STATUS QUO			3 MODL	4 LOC	3 MED	3 LIKE	**2.2** **MODL**	1
CUMULATIVE IMPACT			3 MODL	4 LOC	3 MED	3 LIKE	**2.2** **MODL**	1
RESIDUAL IMPACT			3 MODL	3 ADJ	3 MED	2 UNLIKE	2 **LOW**	1

SITE F+G

Code	Direction of Impact	Degree of Certainty	Magnatude	Spatial	Temporal	Probability	**Impact Risk**	
Impact 1	Negative	Probable	1 VLOW	2 DEV	3 MED	2 UNLIKE	**-0.9** **VLOW**	-1
COMBINED WEIGHTED RATING	Negative		-0.8 VLOW	-1.6 DEV	-2.4 MED	1.6 UNLIKE	**-0.6** **VLOW**	
PROJECT IMPACT			1 VLOW	2 DEV	3 MED	2 UNLIKE	**0.9** **VLOW**	1
STATUS QUO			3 MODL	4 LOC	3 MED	3 LIKE	**2.2** **MODL**	1
CUMULATIVE IMPACT			3 MODL	4 LOC	3 MED	3 LIKE	**2.2** **MODL**	1
RESIDUAL IMPACT			3 MODL	3 ADJ	3 MED	2 UNLIKE	2 **LOW**	1

NO-GO

Code	Direction of Impact	Degree of Certainty	Magnatude	Spatial	Temporal	Probability	**Impact Risk**	
Impact 1	Negative	Probable	0 NO					-1
COMBINED WEIGHTED RATING			0					
PROJECT IMPACT			1 VLOW	2 DEV	3 MED	2 UNLIKE	**0.9** **VLOW**	1
STATUS QUO			3 MODL	4 LOC	3 MED	3 LIKE	**2.2** **MODL**	1
CUMULATIVE IMPACT			3 MODL	4 LOC	3 MED	3 LIKE	**2.2** **MODL**	1
RESIDUAL IMPACT			3 MODL	4 LOC	3 MED	2 UNLIKE	**1.5** **LOW**	1

		Site A	SITE B	SITE C	SITE A+F	SITEA+G	SITE F+G	NO-GO
MITIGATION MEASURES	*GENERAL:*	*SITE SPECIFIC:*	*SITE SPECIFIC:*	*SITE SPECIFIC:*	*SITE SPECIFIC:*	*SITE SPECIFIC:*	*SITE SPECIFIC:*	*SITE SPECIFIC:*
	Add lanes at intersections or Improve control measure i.e signal or roundabout	No upgrades	No upgrades	The background traffic will be higher than on the southern part of the Kusile Road however the development traffic will be negligeble therefore no upgrade proposed	No upgrades	No upgrades	No upgrades	No upgrades

Rated By: *Naye Miya*
Reviewed By: *Adrian Brislin*

ALTERNATIVES:

Code	IMPACT DESCRIPTION	Weighting
Code	*Phase*	
	CLOSURE	5
Impact 1	additional delays at intersections due to additional traffic generated by the development. This will take cognisance of the mitigations proposed during the construction phase evaluation. It is further assummed that cover material will be available on site.	4
COMBINED WEIGHTED RATING	**BEFORE MITIGATION**	
PROJECT IMPACT	**AFTER MITIGATION**	
STATUS QUO	INITIAL BASELINE IMPACTS TO ENVIRONMENT	
CUMULATIVE IMPACT	INITIAL IMPACTS TO ENVIRONMENT + ADDITIONAL IMPACTS FROM PROJECT, **BEFORE MITIGATION**	
RESIDUAL IMPACT	INITIAL IMPACTS TO ENVIRONMENT + ADDITIONAL IMPACTS FROM PROJECT, **AFTER MITIGATION**	

Site A

Row	Direction of Impact	Degree of Certainty	Magnatude	Spatial	Temporal	Probability	**Impact Risk**	
Impact 1	Negative	Probable	1	1	2	2	**-0.6**	-1
			VLOW	ISO	SHORT	UNLIKE	**VLOW**	
COMBINED WEIGHTED RATING	Negative		-0.8	-0.8	-1.6	1.6	**-0.4**	
			VLOW	ISO	SHORT	UNLIKE	**VLOW**	
PROJECT IMPACT			1	1	2	2	**0.6**	1
			VLOW	ISO	SHORT	UNLIKE	**VLOW**	
STATUS QUO			3	3	2	2	**1.2**	1
			MODL	ADJ	SHORT	UNLIKE	**LOW**	
CUMULATIVE IMPACT			3	3	2	2	**1.2**	1
			MODL	ADJ	SHORT	UNLIKE	**LOW**	
RESIDUAL IMPACT			3	3	2	2	**1.2**	1
			MODL	ADJ	SHORT	UNLIKE	**LOW**	

SITE B

Row	Direction of Impact	Degree of Certainty	Magnatude	Spatial	Temporal	Probability	**Impact Risk**	
Impact 1	Negative	Probable	1	1	2	2	**-0.6**	-1
			VLOW	ISO	SHORT	UNLIKE	**VLOW**	
COMBINED WEIGHTED RATING	Negative		-0.8	-0.8	-1.6	1.6	**-0.4**	
			VLOW	ISO	SHORT	UNLIKE	**VLOW**	
PROJECT IMPACT			1	1	2	2	**0.6**	1
			VLOW	ISO	SHORT	UNLIKE	**VLOW**	
STATUS QUO			2	1	2	2	**0.7**	1
			LOW	ISO	SHORT	UNLIKE	**VLOW**	
CUMULATIVE IMPACT			2	1	2	2	**0.7**	1
			LOW	ISO	SHORT	UNLIKE	**VLOW**	
RESIDUAL IMPACT			2	1	2	2	**0.7**	1
			LOW	ISO	SHORT	UNLIKE	**VLOW**	

SITE C

Row	Direction of Impact	Degree of Certainty	Magnatude	Spatial	Temporal	Probability	**Impact Risk**	
Impact 1	Negative	Probable	1	1	2	2	**-0.6**	-1
			VLOW	ISO	SHORT	UNLIKE	**VLOW**	
COMBINED WEIGHTED RATING	Negative		-0.8	-0.8	-1.6	1.6	**-0.4**	
			VLOW	ISO	SHORT	UNLIKE	**VLOW**	
PROJECT IMPACT			1	1	2	2	**0.6**	1
			VLOW	ISO	SHORT	UNLIKE	**VLOW**	
STATUS QUO			3	4	3	2	**1.5**	1
			MODL	LOC	MED	UNLIKE	**LOW**	
CUMULATIVE IMPACT			3	4	2	2	**1.3**	1
			MODL	LOC	SHORT	UNLIKE	**LOW**	
RESIDUAL IMPACT			3	4	2	2	**1.3**	1
			MODL	LOC	SHORT	UNLIKE	**LOW**	

SITE A+F

Row	Direction of Impact	Degree of Certainty	Magnatude	Spatial	Temporal	Probability	**Impact Risk**	
Impact 1	Negative	Probable	1	1	2	2	**-0.6**	-1
			VLOW	ISO	SHORT	UNLIKE	**VLOW**	
COMBINED WEIGHTED RATING	Negative		-0.8	-0.8	-1.6	1.6	**-0.4**	
			VLOW	ISO	SHORT	UNLIKE	**VLOW**	
PROJECT IMPACT			1	1	2	2	**0.6**	1
			VLOW	ISO	SHORT	UNLIKE	**VLOW**	
STATUS QUO			3	3	2	2	**1.2**	1
			MODL	ADJ	SHORT	UNLIKE	**LOW**	
CUMULATIVE IMPACT			3	3	2	2	**1.2**	1
			MODL	ADJ	SHORT	UNLIKE	**LOW**	
RESIDUAL IMPACT			3	3	2	2	**1.2**	1
			MODL	ADJ	SHORT	UNLIKE	**LOW**	

SITEA+G

Row	Direction of Impact	Degree of Certainty	Magnatude	Spatial	Temporal	Probability	**Impact Risk**	
Impact 1	Negative	Probable	1	1	2	2	**-0.6**	-1
			VLOW	ISO	SHORT	UNLIKE	**VLOW**	
COMBINED WEIGHTED RATING	Negative		-0.8	-0.8	-1.6	1.6	**-0.4**	
			VLOW	ISO	SHORT	UNLIKE	**VLOW**	
PROJECT IMPACT			1	1	2	2	**0.6**	1
			VLOW	ISO	SHORT	UNLIKE	**VLOW**	
STATUS QUO			3	3	2	2	**1.2**	1
			MODL	ADJ	SHORT	UNLIKE	**LOW**	
CUMULATIVE IMPACT			3	3	2	2	**1.2**	1
			MODL	ADJ	SHORT	UNLIKE	**LOW**	
RESIDUAL IMPACT			3	3	2	2	2	1
			MODL	ADJ	SHORT	UNLIKE	**LOW**	

SITE F+G

Row	Direction of Impact	Degree of Certainty	Magnatude	Spatial	Temporal	Probability	**Impact Risk**	
Impact 1	Negative	Probable	1	1	2	2	**-0.6**	-1
			VLOW	ISO	SHORT	UNLIKE	**VLOW**	
COMBINED WEIGHTED RATING	Negative		-0.8	-0.8	-1.6	1.6	**-0.4**	
			VLOW	ISO	SHORT	UNLIKE	**VLOW**	
PROJECT IMPACT			1	1	2	2	**0.6**	1
			VLOW	ISO	SHORT	UNLIKE	**VLOW**	
STATUS QUO			3	3	2	2	**1.2**	1
			MODL	ADJ	SHORT	UNLIKE	**LOW**	
CUMULATIVE IMPACT			3	3	2	2	**1.2**	1
			MODL	ADJ	SHORT	UNLIKE	**LOW**	
RESIDUAL IMPACT			3	3	2	2	2	1
			MODL	ADJ	SHORT	UNLIKE	**LOW**	

NO-GO

Row	Direction of Impact	Degree of Certainty	Magnatude	Spatial	Temporal	Probability	**Impact Risk**	
Impact 1	No Impact	Definite	0					-1
			NO					
COMBINED WEIGHTED RATING			0					
PROJECT IMPACT			0	0	0	0	**0**	1
			NO	#N/A	#N/A	#N/A	**NO**	
STATUS QUO			3	4	3	2	**1.5**	1
			MODL	LOC	MED	UNLIKE	**LOW**	
CUMULATIVE IMPACT			3	4	2	2	**1.3**	1
			MODL	LOC	SHORT	UNLIKE	**LOW**	
RESIDUAL IMPACT			3	4	2	2	**1.3**	1
			MODL	LOC	SHORT	UNLIKE	**LOW**	

MITIGATION MEASURES

	GENERAL	Site A	SITE B	SITE C	SITE A+F	SITEA+G	SITE F+G	NO-GO
	GENERAL:	*SITE SPECIFIC:*	*SITE SPECIFIC:*	*SITE SPECIFIC:*	*SITE SPECIFIC:*	*SITE SPECIFIC:*	*SITE SPECIFIC:*	*SITE SPECIFIC:*
	Add lanes at intersections or Improve control measure i.e signal or roundabout	No upgrades	No upgrades	No upgrades	No upgrades	No upgrades	No upgrades	

Rated By: *Naye Miya*
Reviewed By: *Adrian Brislin*

ALTERNATIVES:

Site A

IMPACT DESCRIPTION		Weighting	Direction of Impact	Degree of Certainty	Magnatude	Spatial	Temporal	Probability	**Impact Risk**	
Code	*Phase*									
	POST CLOSURE	5								
Impact 1	No additional traffic on the road network due to the development	4	No Impact	Definite	0 NO					-1
COMBINED WEIGHTED RATING	**BEFORE MITIGATION**				0					
PROJECT IMPACT	**AFTER MITIGATION**				0 NO	0 #N/A	0 #N/A	0 #N/A	**0** **NO**	1
STATUS QUO	INITIAL BASELINE IMPACTS TO ENVIRONMENT				3 MODL	3 ADJ	1 INCID	2 UNLIKE	**1** **VLOW**	1
CUMULATIVE IMPACT	INITIAL IMPACTS TO ENVIRONMENT + ADDITIONAL IMPACTS FROM PROJECT, **BEFORE MITIGATION**				3 MODL	3 ADJ	1 INCID	2 UNLIKE	**1** **VLOW**	1
RESIDUAL IMPACT	INITIAL IMPACTS TO ENVIRONMENT + ADDITIONAL IMPACTS FROM PROJECT, **AFTER MITIGATION**				3 MODL	3 ADJ	1 INCID	2 UNLIKE	**1** **VLOW**	1

SITE B

Code	Direction of Impact	Degree of Certainty	Magnatude	Spatial	Temporal	Probability	**Impact Risk**	
Impact 1	No Impact	Definite	0 NO					-1
COMBINED WEIGHTED RATING			0					
PROJECT IMPACT			0 NO	0 #N/A	0 #N/A	0 #N/A	**0** **NO**	1
STATUS QUO			2 LOW	1 ISO	1 INCID	2 UNLIKE	**0.6** **VLOW**	1
CUMULATIVE IMPACT			2 LOW	1 ISO	1 INCID	2 UNLIKE	**0.6** **VLOW**	1
RESIDUAL IMPACT			2 LOW	1 ISO	1 INCID	2 UNLIKE	**0.6** **VLOW**	1

SITE C

Code	Direction of Impact	Degree of Certainty	Magnatude	Spatial	Temporal	Probability	**Impact Risk**	
Impact 1	No Impact	Definite	0 NO					-1
COMBINED WEIGHTED RATING			0					
PROJECT IMPACT			0 NO	0 #N/A	0 #N/A	0 #N/A	**0** **NO**	1
STATUS QUO			3 MODL	4 LOC	1 INCID	2 UNLIKE	**1.2** **LOW**	1
CUMULATIVE IMPACT			3 MODL	4 LOC	1 INCID	2 UNLIKE	**1.2** **LOW**	1
RESIDUAL IMPACT			3 MODL	4 LOC	1 INCID	2 UNLIKE	**1.2** **LOW**	1

SITE A+F

Code	Direction of Impact	Degree of Certainty	Magnatude	Spatial	Temporal	Probability	**Impact Risk**	
Impact 1	No Impact	Definite	0 NO					-1
COMBINED WEIGHTED RATING			0					
PROJECT IMPACT			0 NO	0 #N/A	0 #N/A	0 #N/A	**0** **NO**	1
STATUS QUO			3 MODL	3 ADJ	1 INCID	2 UNLIKE	**1** **VLOW**	1
CUMULATIVE IMPACT			3 MODL	3 ADJ	1 INCID	2 UNLIKE	**1** **VLOW**	1
RESIDUAL IMPACT			3 MODL	3 ADJ	1 INCID	2 UNLIKE	**1** **VLOW**	1

SITEA+G

Code	Direction of Impact	Degree of Certainty	Magnatude	Spatial	Temporal	Probability	**Impact Risk**	
Impact 1	No Impact	Definite	0 NO					-1
COMBINED WEIGHTED RATING			0					
PROJECT IMPACT			0 NO	0 #N/A	0 #N/A	0 #N/A	**0** **NO**	1
STATUS QUO			3 MODL	3 ADJ	1 INCID	2 UNLIKE	**1** **VLOW**	1
CUMULATIVE IMPACT			3 MODL	3 ADJ	1 INCID	2 UNLIKE	**1** **VLOW**	1
RESIDUAL IMPACT			3 MODL	3 ADJ	1 INCID	2 UNLIKE	2 **LOW**	1

SITE F+G

Code	Direction of Impact	Degree of Certainty	Magnatude	Spatial	Temporal	Probability	**Impact Risk**	
Impact 1	No Impact	Definite	0 NO					-1
COMBINED WEIGHTED RATING			0					
PROJECT IMPACT			0 NO	0 #N/A	0 #N/A	0 #N/A	**0** **NO**	1
STATUS QUO			3 MODL	3 ADJ	1 INCID	2 UNLIKE	**1** **VLOW**	1
CUMULATIVE IMPACT			3 MODL	3 ADJ	1 INCID	2 UNLIKE	**1** **VLOW**	1
RESIDUAL IMPACT			3 MODL	3 ADJ	1 INCID	2 UNLIKE	2 **LOW**	1

NO-GO

Code	Direction of Impact	Degree of Certainty	Magnatude	Spatial	Temporal	Probability	**Impact Risk**	
Impact 1	No Impact	Definite	0 NO					-1
COMBINED WEIGHTED RATING			0					
PROJECT IMPACT			0 NO	0 #N/A	0 #N/A	0 #N/A	**0** **NO**	1
STATUS QUO			3 MODL	4 LOC	1 INCID	2 UNLIKE	**1.2** **LOW**	1
CUMULATIVE IMPACT			3 MODL	4 LOC	1 INCID	2 UNLIKE	**1.2** **LOW**	1
RESIDUAL IMPACT			3 MODL	4 LOC	1 INCID	2 UNLIKE	**1.2** **LOW**	1

MITIGATION MEASURES

	GENERAL:	*SITE SPECIFIC:* Site A	*SITE SPECIFIC:* SITE B	*SITE SPECIFIC:* SITE C	*SITE SPECIFIC:* SITE A+F	*SITE SPECIFIC:* SITEA+G	*SITE SPECIFIC:* SITE F+G	*SITE SPECIFIC:* NO-GO
	Add lanes at intersections or Improve control measure i.e signal or roundabout	No upgrades	No upgrades	No upgrades	No upgrades	No upgrades	No upgrades	