GA Environment

EROSION AND SOIL MANAGEMENT PLAN

FOR THE

BASIC ASSESSMENT FOR THE PROPOSED UPGRADE OF NATIONAL ROAD R101 SECTION 8 FROM BELA BELA (KM 0.0) TO MODIMOLLE (KM 26.8), WATERBERG DISTRICT MUNICIPALITY, LIMPOPO PROVINCE

DFFE REFERENCE NR: 14/12/16/3/3/1/2354

AUGUST 2021

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PROJECT INFORMATION

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Competent Authority:	Department of Forestry, Fisheries and Environmental (DFFE)
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Applicant:	South African National Roads Agency SOC Ltd
Environmental Assessment Practitioner:	GA Environment (Pty) Ltd.
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SIGNING OF THE ORIGINAL DOCUMENT

Original	Prepared by	Reviewed by	Approved by
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1 INTRODUCTION

GA Environment (Pty) Ltd has been appointed by BVi Consulting Engineers Western Cape (Pty) Ltd (BVi Engineers hereafter) on behalf of the South African National Roads Agency SOC Ltd or (SANRAL) as independent Environmental Consultants to undertake the Basic Assessment process for the proposed upgrade of National Road R101 Section 8 from Bela Bela (km 0.0) to Modimolle (km 26.8), Waterberg District Municipality, Limpopo Province.

R101-8 is approximately 27km long road extending between Bela Bela and Modimolle. R101-8 consists of a two lane, single carriageway road with gravel shoulders along most of the route. The road has an average surfaced width of 7.0 m. Climbing/passing lanes are provided from km 6.2 to km 7.5 and km 14.4 to km 15.7. Road R101-8 has an average road reserve width of approximately 35 meters and an average traffic flow speed of 100km/hr. In both Bela Bela and Modimolle, the road widens to a four lane undivided single carriageway. Road R101-8 falls within the interurban collector and rural roads category and can therefore be classified as a Category B Road.

The broad goals of the road upgrade is to relieve traffic congestion to an acceptable level of service, improve road geometry and road safety, widen bridges and other structures where required for hydraulic and traffic capacity improvement, and provide adequate pavement capacity for the design period. Road R101 Section 8 is defined as a mobility road, connecting development centres over long distances. Road R101 Section 8 falls within the interurban collector and rural roads category and can therefore be classified as *a Category B Road*. This road category is seen as strategically important and is expected to deliver a good Level of Service to its users. It also connects other collector roads and can therefore be classified as a Class 2 rural major arterial.

The National Environmental Management Act 107 of 1998, as amended (NEMA) and the Environmental Impact Assessment Regulations 2014 (as amended) requires that listed activities warrant an Environmental Authorisation (EA) from the competent authority. Since SANRAL is a parastatal, the competent authority is the Department of Forestry, Fisheries and Environment (DFFE). Based on the triggered listed activities as indicated in the basic assessment report, a basic assessment process is required for the proposed road upgrade.

As part of the Basic Assessment (BA) process for the clearance of vegetation (bare soil), bulk earthworks and stockpiling, an erosion and soil management plan must be compiled to support the application. This document will provide the contractor, the developer, and the ECO with guidelines on how to plan erosion and soil management and assists in understanding the concepts behind successful erosion and soil

management. This plan must be implemented in conjunction with the approved EMPr as well as other management plans prepared for this proposed development. The exact details of the erosion and soil management plan will depend on the extent of construction site and activities that will have to be undertaken, available funding, and the desired end state of the project.

1.1 Locality Description and Surrounding Land-Uses

The R101 Section 8 is situated within two Local Municipalities (Bela Bela and Modimolle) both situated within the Waterberg District Municipality in the Limpopo Province. Bela-Bela and Modimolle Local Municipalities are located in the south-eastern part of the district and are the least populated municipalities within the Waterberg District Municipality. According to the Waterberg District Municipality Environmental Management Framework (Waterberg EMF), the biggest contributors to employment in the Waterberg District are mining and quarrying, wholesale and retail trade, agriculture, hunting and fishing, as well as the manufacturing sectors, with the percentage representation of the different sectors being 6.5%, 5.5%, 4.6%, and 3.7% (Waterberg EMF).

Nation Road R101 Section 8 (R101-8) extends from Bela Bela at the intersection of the R101 and Voortrekker Road/Chris Hani Drive (km 0.0) and ends in Modimolle at the intersection of the R101 and R33 (km 26.8). R101-8 starts at coordinates 24°53'5.16"S and 28°17'56.88"E in Bela Bela and ends at coordinates 24°42'0.33"S and 28°24'21.10"E in Modimolle. This section of the national road is defined as a mobility road, connecting development centres over long distances. It falls within the interurban collector and rural roads category and can therefore be classified as a Category B Road. This road category is seen as strategically important and is expected to deliver a good Level of Service to its users. It also connects other collector roads and can therefore be classified as a Class 2 rural major arterial. Refer to **Figure 1** and **Figure 2** for the locality and chainage maps

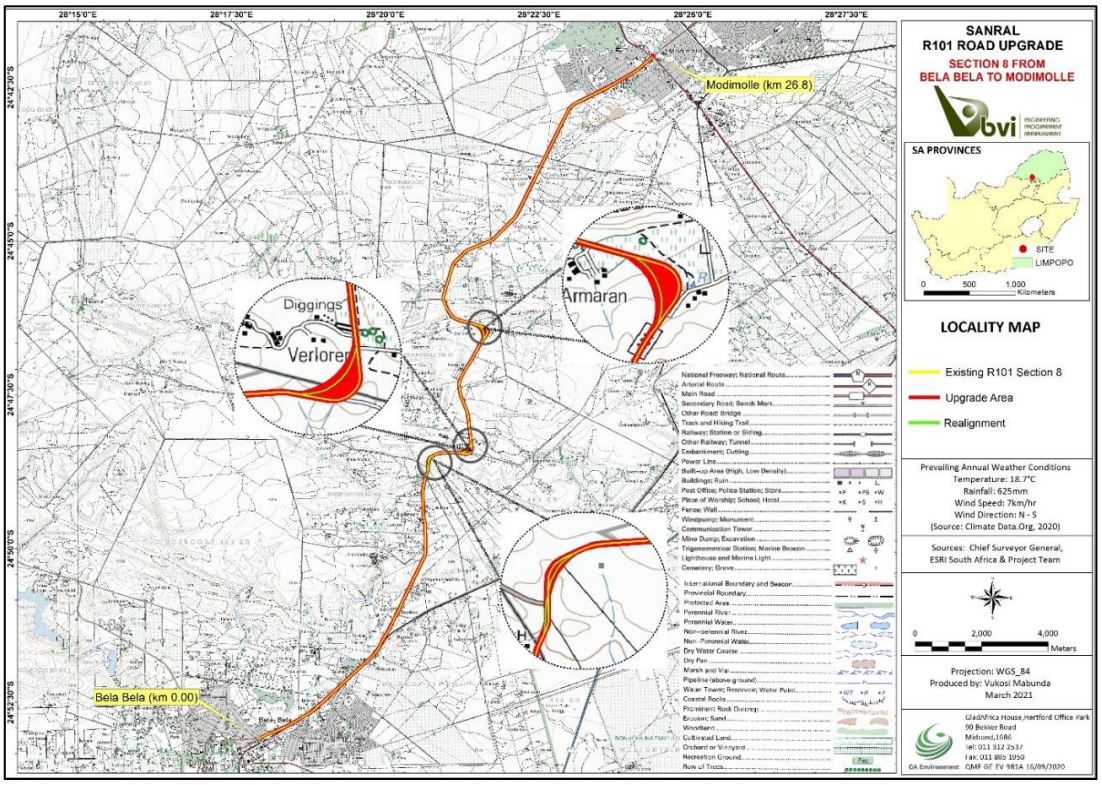

Figure 1: SANRAL R101 Section 8 Locality Map

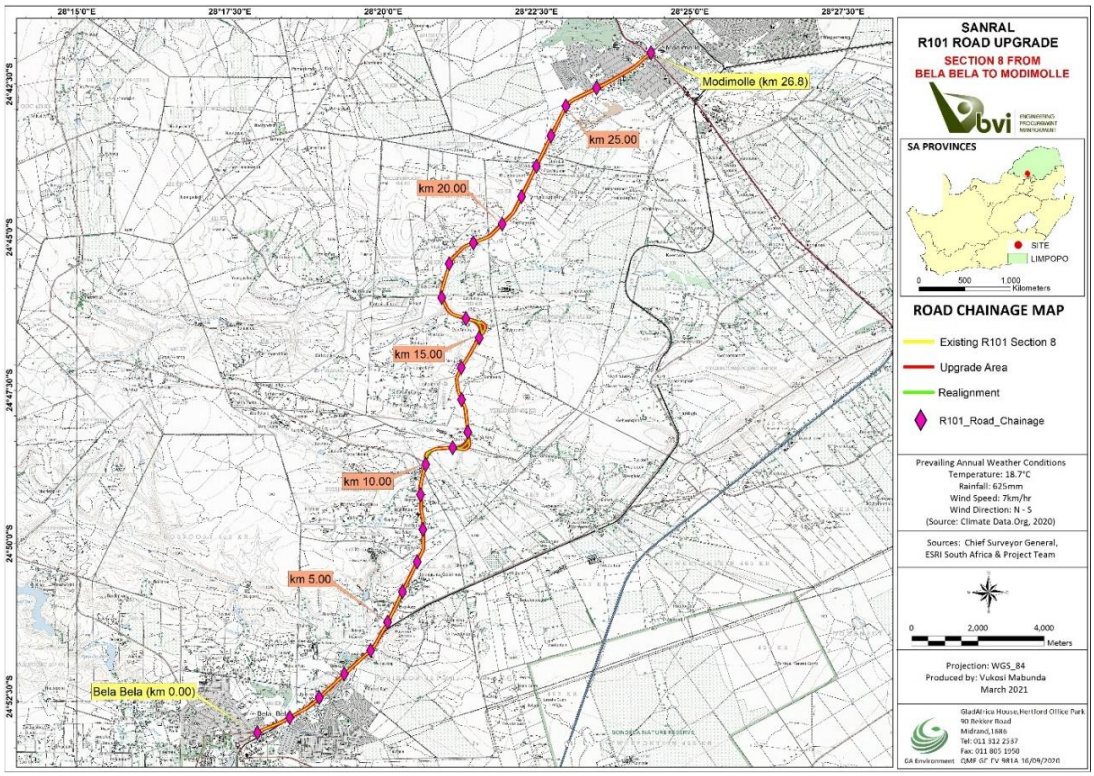

Figure 2: Road Chainage Map

Drainage along Road R101-8 is effected through culverts and bridges. The proposed road upgrade intends to replace bridges and other structures where required for hydraulic and traffic capacity improvement and

provide adequate pavement capacity for the design period. The riparian area of the Bad se Loop, Klein Kariba and Groot Nyl Rivier forms part of the study area and impacts on the rivers are anticipated during the replacement of the bridges and major culverts. **Figure 3** presents the locations and type of hydraulic infrastructure which will be replaced as part of the upgrades.

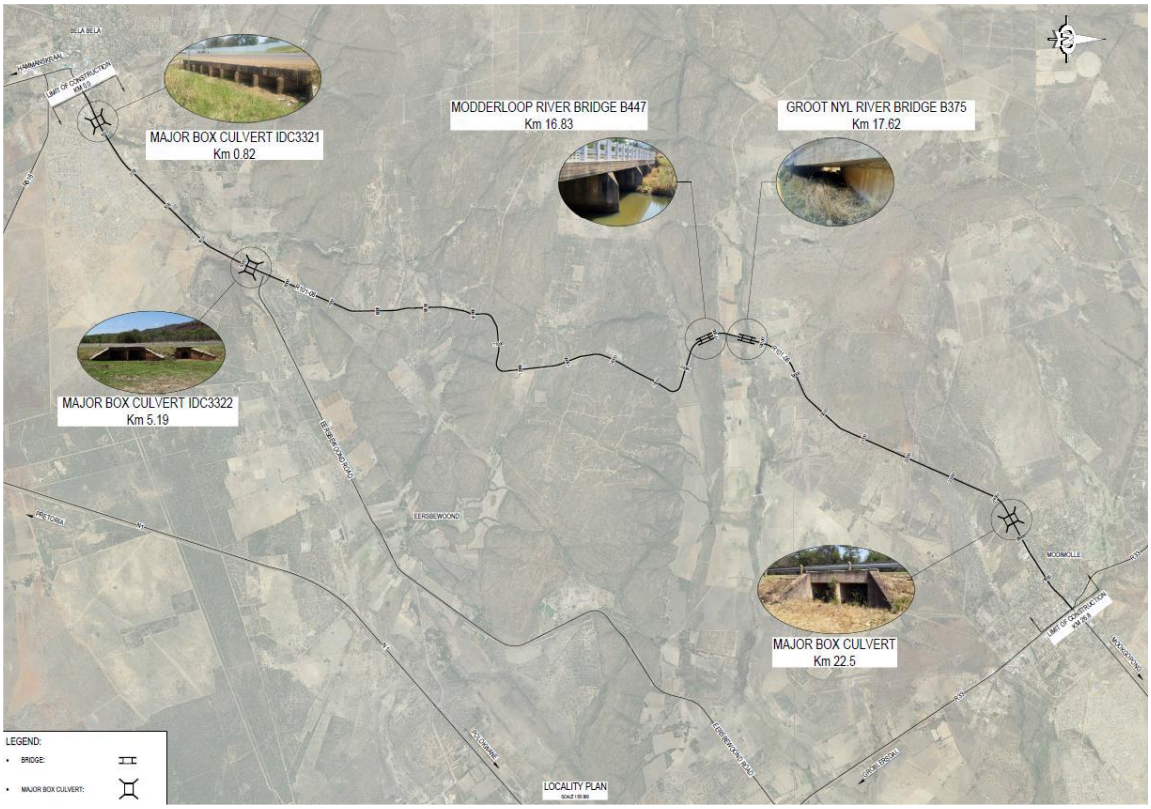

Figure 3: Hydraulic upgrade locations (BVi Consulting Engineers, 2020)

1.2 Purpose of the management plan

The Erosion and Soil Management Plan (ESMP) addresses the management and mitigation of significant impacts relating to soil erosion and habitat degradation in the disturbed areas. Exposed and unprotected soils are the main cause of erosion in most situations (Coetzee, 2005). Therefore, this erosion management plan and the rehabilitation plan attached to Appendix G of the Draft Basic Assessment Report (DBAR) are closely linked to one another. The aims of the ESMP are to provide:

The objective of the plan is to provide:

- A general framework for soil erosion and sediment control, which enables the contractor to identify areas where erosion can occur and is likely to be accelerated by construction related activities.
- An outline of general methods to monitor, manage and rehabilitate erosion prone areas, ensuring that all erosion resulting from all phases of the development is addressed.

The objectives of the ESMP are:

- To reduce the effects of raindrop splash erosion on exposed soil surfaces.
- To keep rainwater on the soil surface for as long as possible to increase the infiltration rate and reduce surface runoff.
- To reduce the speed of surface runoff to reduce the erosion effect of the soil surface.
- To provide methods to retain soil, debris, seed banks and organic matter being carried away by runoff.
- To improve water retention of the area.

This ESMP must be read in conjunction with the following rehabilitation plans and procedures as identified by the appointed specialists in the DBAR:

Appendix F1: Fauna and Flora Assessment

Appendix F4: Wetland Assessment and Wetland Rehabilitation Plan.

Appendix F5: Desktop Agricultural and Soils Assessment.

Appendix G: Environmental Management Programme

Appendix G: Rehabilitation Plan

Appendix G: Alien and Invasive Species Management Plan

1.3 Project Description

The purpose of this section is to provide a description of the proposed route, stormwater and drainage as well as construction and operation activities. The disturbance associated with construction and operation of the road frequently exposes the subsoil which impacts on the agriculture potential of the soil and surface water resources located downstream. Each activity described below will contribute to specific geomorphic process changes that will result in increased soil erosion and must therefore be controlled either in terms of related structural designs that facilitate soil erosion processes or soil control measures installed during and after construction.

1.3.1 Route Description

The National Road R101 Section 8 (R101-8) is approximately 27km long road extending between Bela Bela and Modimolle. R101-8 consists of a two lane, single carriageway road with gravel shoulders along most of the route. The road has an average surfaced width of 7.0 m. Climbing/passing lanes are provided from km 6.2 to km 7.5 and km 14.4 to km 15.7. Road R101-8 has an average road reserve width of approximately 35 meters and an average traffic flow speed of 100km/hr. In both Bela Bela and Modimolle, the road widens to a four lane undivided single carriageway. Road R101-8 falls within the interurban collector and

rural roads category and can therefore be classified as a Category B Road. This road category is seen as strategically important and is expected to deliver a good Level of Service to its users. The proposed road upgrade is categorized into three (3) sections:

a. Bela Bela Urban Section:
    - Bela Bela (km 0.0) to Klein Kariba (km 5.5).
    - Proposed upgrade will include a 4 x 3.7m wide lanes, kerbed median and sidewalks.

b. Rural Section:
    - Klein Kariba (km 5.5) to Modimolle entrance (km 24).
    - Proposed upgrade will include a 2 x 3.7m wide lanes and 3m wide surfaced shoulders (climbing and bypass lanes).

c. Modimolle Urban Section:
    - Modimolle (km 24) to limit of contract (km 26.8).
    - Proposed upgrade will include a 4 x 3.7m wide lanes, kerbed median and sidewalks.

According to the Preliminary Design Report (PDR), there are three possible route designs as part of the proposed upgrade. The route designs follow the same path as the existing road and are not anticipated to influence the overall length of Road R101 Section 8. The only difference between the route alternatives and existing road is that the route alternatives will slightly deviate from the existing road between km 10 and km 11 (realignment area 1), between km 11 and km 12 (realignment area 2) and between km 15 and km 16 (realignment area 3) as indicated on **Figure 1**. It must be noted that although there are three realignment areas, the route alternatives are the same for all of the three realignment areas. The routes deviate at the aforementioned road chainage and link back to the existing road as indicated on **Figure 4**. Overall, the route alternatives are limited to the realignment areas (sharp curves) located within the rural section of R101 Section 8 and are based on maximum permissible speeds.

The proposed route has an 'open up' parabola shape with a lower curve angle. The proposed route alignment has the highest permissible speed of 100km/hr, is much flatter and slightly longer than the two other routes (**Green Line** in **Figure 4)** Although the cut and fill material that will be generated is similar to that of route alternative one, realignment to accommodate a 100 km/h horizontal design speeds will generate sufficient quantities of material which is intended to be utilised for construction of the Lower Selected Subgrade. In addition, this alternative will allow the curves to meet the speed standard of the road. Therefore, this alternative emerged as the **Preferred Option.**

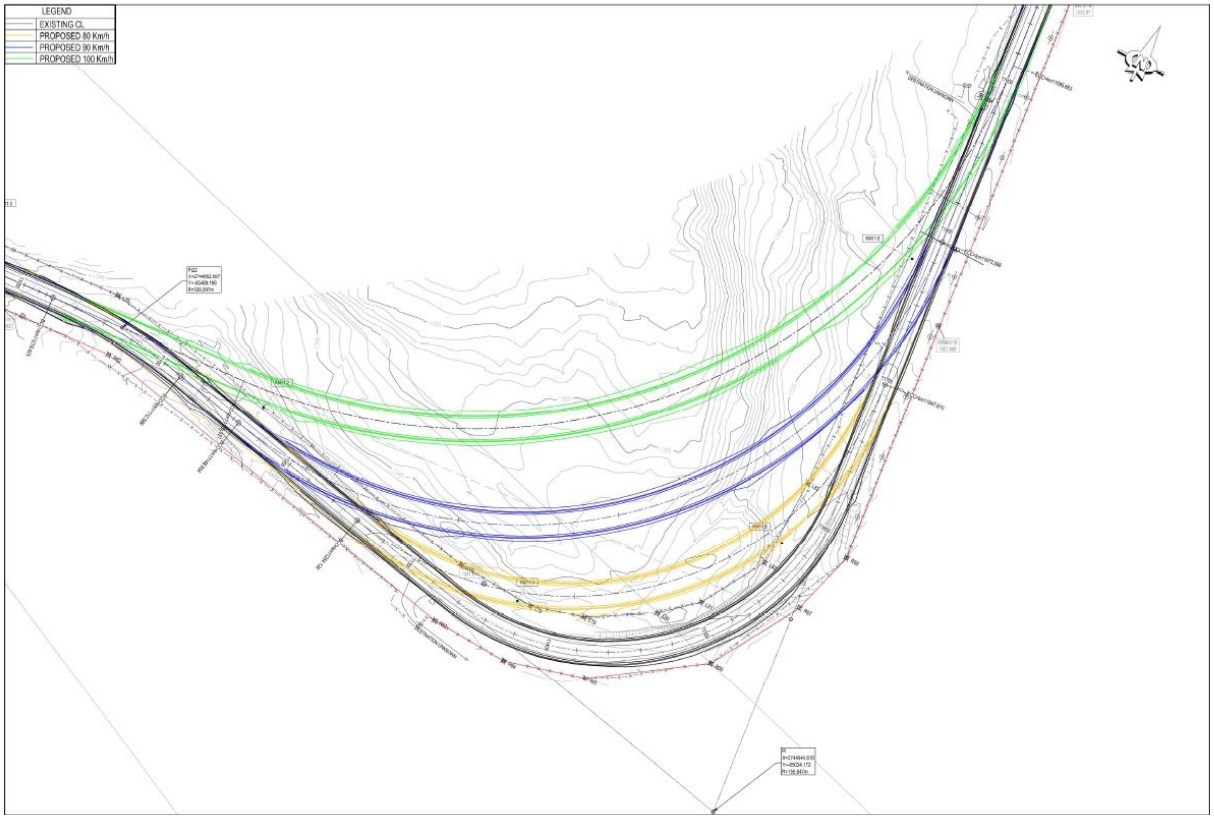

Figure 4: Route Alternatives assessed (realignment area 2)

1.3.2 Stormwater Drainage and Bridge Structures

The Stormwater and Bridge Structures have been identified as areas where effective soil erosion controls must be implemented. The existing route traverses through two bridges (Modderloop and Groot Nyl River), three major culverts and fifty-five minor culverts. The proposed upgrade intends to demolish and replace the bridges and major culverts while also repairing and upgrading the minor culverts.

In order to ensure that stormwater is accommodated, and adequate drainage is allowed, BVi Engineers undertook a hydrological analysis based on the hydrological study undertaken for the respective catchment. Basic hydrological parameters as per the SANRAL drainage manual was used in determining flood peaks for the lesser culverts and the major structures. The findings of the hydrological analysis summarized below are available on the PDR (**Appendix B of the DBAR**).

a) <u>Replacement of bridges</u>

The bridges are located at 24°46'04.34"S; 28°20'59.74"E and 24°45'40.30"S; 28°21'00.58"E respectively. The bridges are Class 3 Road bridges and were constructed in 1936, widened and extended in 1966. There are four alternatives pertaining to upgrading the two bridges. Option 1 was to rehabilitate the bridges, option 2 was to install a new deck, the third option was to raise the deck or install additional spans and

the last option was to replace the entire bridge. The Drainage Manual 6th Edition as indicated in the PDR, states that the clearing of siltation to increase the hydraulic capacity of an existing structure is not recommended, therefore Option 1 is not recommended. Option 2 was the preliminary preferred option as it is the most cost-effective solution to bring the existing structure up to current standards. Option 3 does not address the overall ageing structures and therefore not recommended. According to information obtained from BVi Engineers both the Modderloop Bridge and Groot Nyl Bridges will be demolished and replaced by new bridges to address the issue of ageing structures and substantially implement the proposed upgrades.

b) Major Culverts

Based on the hydrological analysis, the three major box culverts will also be replaced. The major culverts are located at R101-Section 8 km 0.82, km 5.19 km 22.5 respectively. The culverts provide access to tributaries at the various locations. The proposed upgrade include the demolition and replacement of the major culverts by new major box and pipe culverts of a suitable size to accommodate the peak design flood by installing additional cells, extending the length of the culverts and widening the culverts.

c) Minor Culverts

A total of 55 minor culverts are located along this road section. Majority of the culverts are blocked, mainly by silt. The majority of culvert head walls and wing walls along Road R101-8 were constructed in concrete and are in a fair to warning condition. The culverts have no in- or outlet structures or are missing wing walls. Four box culverts were previously extended using Ø900mm pipes and six pipe culverts are misaligned. It is proposed that the culverts upgrades will be undertaken as follows:

- Extension of all culvert structures to align with road widening (max width of 20m);
- Construction of new side drains;
- New in- and outlet structures will be constructed;
- Misaligned culverts will be rehabilitated;
- Damaged pipes will be replaced; and
- Damaged or missing danger plates will be replaced.

Road surface drainage would be managed with inside drains, kerb and channel combinations that outlet into down chutes or catch pits for urban drainage networks. All concrete side drains will include subsoil drains.

1.3.3 Material Sources

Construction material will be required for the proposed upgrade of Road R101 (Section 8). Material sources cannot be exploited without authorisations from the Department of Mineral Resources and

Energy (DMR). However, BVi Engineers have indicated that they will obtain the required construction material from approved material sources. These material sources will be obtained from a nearby road upgrade project where SANRAL is the project proponent. The approval of materials sources is outside the scope of the EA.

1.3.4 Construction Camp and Materials Storage Area

The construction camp and materials storage area will be situated in the vicinity of the construction area. Landowners permission and negotiations will be undertaken by the Applicant prior to establishment. The exact position of the camp will be negotiated with the Contractor. The Construction camp cannot be situated within the wetland area/riparian area, its buffer zone or within SCC habitats. The construction camp will include the following amongst others:

- Site Office;
- Temporary refuelling area;
- Temporary ablution facilities;
- Hazardous materials storage area;
- Concrete batching area;
- Overnight parking area for all machinery and construction vehicles;
- Demarcated general waste and hazardous waste storage areas; and
- Demarcated area for the storage of construction road signs, surveyor pegs and all other construction materials.

2 APPLICABLE LEGISLATION AND STANDARDS

This section of the plan discusses applicable legal provisions and the legal context for the management of the soil aspect for the proposed development. It provides a review of legislation, regulations, policies and guidelines, which are applicable to, or have implications, for the proposed project. The contents of this plan are based on a review of the information that was available at the time of the compilation of the report. The discussion in this chapter is by no means an exhaustive list of the legal obligations of the applicant in respect of environmental management of soil for the proposed development.

Soil conservation pertaining to erosion has been included in South African legislation since the 1930s and internationally there are standards that have been set by funding institutions such as the International Financial Corporation and the World Bank to address soil erosion during the lifecycle of developments. As such, this document outlines what the developer needs to implement to meet the South African legislative requirements and international standards concerning monitoring, managing and rehabilitating soil erosion on site.

Underlying the reasoning above is the Constitutional right that people have to environmental protection, as set out in the Bill of Rights in the Constitution (Section 24). These rights have now been interpreted and included into the National Environmental Management Act, 1998 (Act 107 of 1998), which, together with other national and provincial legislation, governs the way environmental principles are incorporated into any form of development.

2.1 Constitution of the Republic of South Africa, 1996 (Act No. 108 of 1996)

The environmental right is mentioned in Section 24 of the Constitution of the Republic of South Africa, 1996 (Act No. 108 of 1996). This states the following:

"...everyone has the right to have the environment protected, for the benefit of present and future generations, through reasonable legislative and other measures that prevent pollution and ecological degradation, promote conservation, and secure ecologically sustainable development and use of natural resources while promoting justifiable economic and social development".

The State must therefore respect, protect, promote and fulfil the social, economic and environmental rights of everyone and strive to meet the basic needs of previously disadvantaged communities. The Constitution therefore recognises that the environment is a functional area of concurrent national and provincial legislative competence, and all spheres of government and all organs of state must cooperate with, consult and support one another if the State is to fulfil its constitutional mandate.

2.2 National Environmental Management Act, 1998 (Act No. 107 of 1998)

In order to bring section 24 of the Constitution of the Republic of South Africa, 1996 (Act No. 108 of 1996) into realisation, the National Environmental Management Act, 1998 (NEMA) (Act No. 107 of 1998) was promulgated to serve to *'provide for co-operative environmental governance by establishing principles for decision-making on matters affecting the environment, institutions that will promote cooperative governance and procedures for co-ordinating environmental functions exercised by organs of state; to provide for certain aspects of the administration and enforcement of other environmental management laws; and to provide for matters connected therewith'.* NEMA is main Environmental Legislation in South Africa and other Specific Environmental Management Acts (SEMA's) support its objectives.

2.3 Conservation of Agricultural Resources Act 43 of 1983

Amendments to regulations under the CARA (Act No. 43 of 1983) provide for the declaration of weeds and invader plants, with weeds regarded as alien plants with no known useful economic purpose, while invader plants may serve useful purposes as ornamentals, as sources of timber and may provide many other benefits, despite their aggressive nature. Declared weeds are described as Category 1 plants, while declared invader plants with a commercial or utility value are described as Category 2 plants and ornamental species as Category 3 plants. CARA indicates that Category 1 weeds are prohibited, and that Category 2 and 3 plants must be controlled. A list of alien floral species recorded in the project area, including an indication of the alien and invasive species categories in terms of CARA is included in the Fauna and Flora Assessment attached in **Appendix F1 of the DBAR**.

2.4 Environment Conservation Act 73 of 1989

The primary objective of the Environment Conservation Act, 1989 (Act 73 of 1989) (ECA) is to provide for the effective protection and controlled utilisation of the environment. In terms of Section 20 of ECA, all wastes generated from the construction and operational phases of a development may only be disposed at licensed waste disposal sites. Cognisance must also be taken of the relevant provincial legislation given that controlling authority and regulations pertaining to litter in terms of ECA (Sections 19, 19A and 24A) have been delegated to provinces.

2.5 Soil Conservation Act 76 of 1969

The main feature of the Act was that it provided in a democratic spirit a basis for co-operation between the State and the farming community with a view to soil conservation and the stimulation of conservation farming. The Act enabled farmers themselves to initiate action without waiting for the State, and to play an active role in determining and carrying out appropriate soil conservation measures. It was to this end that provision was made for the establishment of soil conservation districts principally on the volition of

the farmers concerned and for the constitution of soil conservation district committees composed of a majority of farmer members, which committees were entitled to effect soil conservation measures in their respective districts.

3 REGIONAL AND LOCAL SOIL CONDITIONS

According to the Agricultural and Soils Assessment undertaken by Afzelia Environmental Consultants (2021), this section of the R101 traverses soils of the Central Sandy Bushveld Ecosystem of the central Bushveld Bioregion of the Savanna Biome. These are generally poor soils whose agricultural potential is also challenged by a relatively low rainfall during hot, subtropical summers. The study area can be categorised into two parts, the northern and southern portions. Soils in the southern half are likely to have a depth of 1 m or more, to have a poor water holding capacity and a moderate to high erosion hazard. Red soils will have a good yield potential but due to seasonal factors will require substantial amount of irrigation water. In contrast, the soils in the northern portion of the route will be mainly shallow and steep with a very poor yield potential.

The southern portion is generally level or gently undulating a while the northern portion is steep with mountains and deep valleys. Where there are level areas the soils are likely to be as sandy and deep as in the southern section. The soils map is presented on **Figure 6**. The arrows on the map below indicate the locality of the two soil parent materials along the route. The dark yellow area indicated by the upper arrow which is intrusive dolerite approximately 200 million years old. This is probably deep, red, high yield potential soil. The pale yellow area indicated by the lower arrow reflects soil parent material of sedimentary origin of the Waterberg and Soutpansberg Groups, approximately 1800 million years old. These are likely to be deep sandy soils with a moderate too poor yield potential.

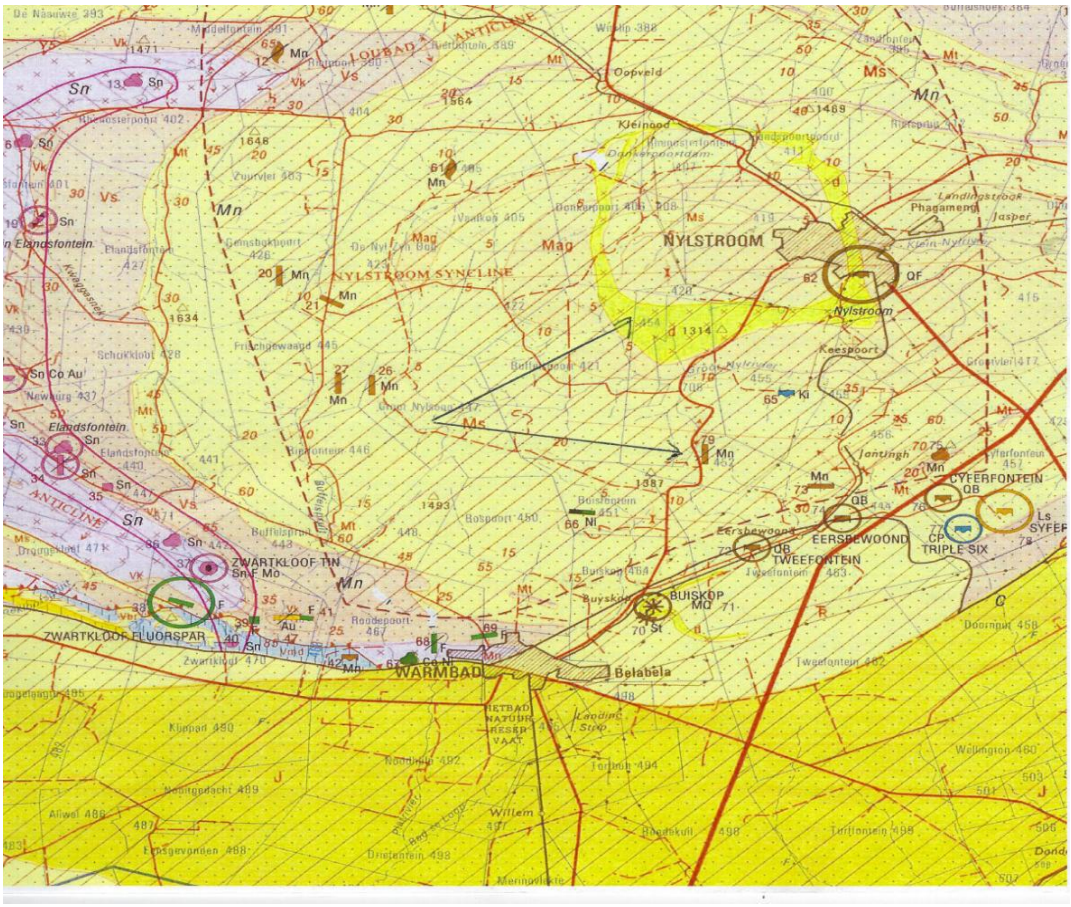

Figure 5: Soils map of the study area (Afzelia, 2021)

4 EROSION CONTROL MANAGEMENT

The critical step in the erosion control process is to eliminate the cause of habitat degradation. If the cause is vegetation clearance, then it is important to ensure that only areas where the road footprint will be developed are cleared and all other temporary infrastructure such as construction site camps are located **only** on disturbed areas.

The erosion control methods recommended in this plan are in line with the erosion protection controls for each infrastructure as per the SANRAL drainage manual. The erosion control measures can be implemented by using unskilled, but carefully supervised workers. The cost of implementation is a major consideration and the methods show the minimum of effort and costs required for the effective protection and rehabilitation of degraded habitat.

An important aspect of rehabilitation work which is often completely neglected, is the much-needed follow-up maintenance of rehabilitation efforts. After installation, the erosion control structures and treatments need constant attention (particularly after heavy rainfall) to ensure that they remain effective and that they will continue to contribute to gradual but significant habitat improvement.

The Contractor and the ECO must identify the degraded sites that need to be treated and to provide a guideline for practical and cost-effective methods that can be used to combat each type of soil erosion. Careful attention to detail is a prerequisite for the planning and implementation of soil erosion control work irrespective of the habitat type, or environment, in which it is to be done.

As with all kinds of field practice, the methods described must be suitably modified in order to accommodate any particular site or condition, but it is critical that the basic principles, as described for each method, are used as a guide. There are many additional methods that could also be used in the control of soil erosion, but the methods described have been assessed in terms of cost, ease of implementation and also suitable for most habitat conditions for the proposed upgrade of National Road R101 Section 8.

4.1 Erosion Control Principles

The goals of erosion and sediment control during and after construction are to:

a) protect the land surface from erosion
b) Intercept and safely direct run-on water from undisturbed upslope areas through the site without allowing it to cause erosion within the site or become contaminated with sediment.
c) Progressively revegetate or stabilise disturbed areas.

These goals can be achieved by applying the following principles:

- Integrate project design with site constraints including the location of the site camp, access roads and phasing of the project.
- Plan and integrate erosion and sediment control with construction activities.
- Minimise the extent and duration of disturbance. Clearance must be limited to areas where permanent structures will be constructed.
- Use erosion controls to prevent on-site damage.
- Use sediment controls to prevent off-site damage.
- Control erosion and sediment at the source.
- Stabilise disturbed areas promptly.
- Inspect and maintain control measures.

For the overall project site, the following objectives have been drawn up for the Developer and Contractor to manage soil erosion have been broadly summarised as follows:

- Reduce the effects of raindrop splash erosion on exposed soil surfaces.
- Keep rainwater on the soil surface for as long as possible and thus increase the rate at which water infiltrates the soil and improve water retention in the soil.
- Slow down the speed of runoff water and thus reduce the erosive force of water on unprotected soil surfaces.
- Provide the methods to hold back and retain soil, plant debris, animal droppings and seeds that are usually carried away from the soil surface by runoff water.
- Provide stable and protected sites for pioneer vegetation re-establishment.

4.2 Erosion and Soil Management Controls

Exposed and unprotected soils are the main cause of erosion in most situations. For the identification of erosion sources, site-specific information must be acquired to establish the various on-site parameters associated with soil erosion and remedial actions must be established to ensure that existing erosion

concerns are addressed with an erosion control strategy towards long-term rehabilitation. The following is a set of well tested soil erosion control methods determined to be suitable for the overall site.

4.2.1 Management of Access Roads and Haulage Trucks

All access and haul roads required by the Contractor must be approved by the Engineer and ECO prior to the start of works. The use of existing roads will be limited to public roads only. The construction of new roads may only be done within the construction servitude within areas of low ecological sensitivity. A photographic survey of all existing roads used must be compiled and kept for the duration of the contract. The Contractor shall be responsible for the upkeep and maintenance and where necessary the upgrade of all roads under his use. Compaction will be managed closely in areas where there are no access roads with No go areas designated on site.

4.2.2 Protection of Vegetation and Natural Features

In order to effectively manage all vegetation cover outside the construction footprint, the Contractor shall compile a method statement for approval by the Engineer on the protection of vegetation and natural features. Furthermore, the method statement shall contain a monitoring program to ensure that vegetation from no go areas is not removed and is protected from dust or any construction activities. Monitoring shall be implemented upon completion of the project. A photographic record with details of the No go areas from start to the end of the project must be filed and made available for review by the ECO.

4.2.3 Earthworks and Topsoil Management

Where excavation is required during construction, soil management practices must be adhered to in order to limit soil loss and encourage rehabilitation efforts post-construction. The two most import aspects to consider when removing topsoil are the depth of soil to remove as topsoil, and the conditions for storing topsoil. The correct handling of the topsoil layer is, in most cases, the key to rehabilitation success.

4.3 Rehabilitation steps to mitigate the moderately eroded areas

Rehabilitation of disturbed areas will take place progressively as these areas are identified for rehabilitation. General rehabilitation activities can be applied to bare and lose soil. Different methods will be employed according to the sensitivity and level of erosion through the project area as follows:

- Stockpiled topsoil must be evenly spread over disturbed areas (150 – 200 mm thick) just prior to planting/seeding.
- Bare surfaces are grassed as soon as possible after construction to minimise the time of exposure.
- Watering is essential and rehabilitation should ideally occur during the wet season.
- The topsoil in the area is vulnerable to erosion therefore the hydro-seeded surfaces must be covered with a shade cloth material or natural fibre (hessian material) to reduce the loss of soil while the plants establish.
- Soil compaction should be minimised by keeping vehicle and construction plant access ways and parking areas to a minimum.
- The re-growth of alien plant species will need to be monitored and removed as per the Alien Invasives Management Plan.

4.4 Rehabilitation steps to mitigate significantly eroded areas

4.4.4 Erosion Control Fences

These are simple, low wire netting and geotextile fences which, backed up by a thick layer of organic mulch, can slow-down and trap runoff water and silt. The fences become productive and vegetated bands across degraded areas, or they can help to stabilize small erosion gullies and drainages (Coetzee, 2005). Example of erosion control fences is indicated on **Figure 6** below.

Figure 6: Example of erosion control fences

Fences slow down the speed of destructive runoff water flow as water filters through the fence, but silt and plant litter remain behind, helping to build up a new and fertile topsoil layer behind the fence. Fences are suitable for use on flat areas and on moderate slopes. It is important to preserve and work around

existing vegetation. Mulching is important for effective water control and microclimate creation. The fence also acts as a windbreak, trapping windblown dust and seeds. Old low- grade fencing materials can be used together with geotextiles. The method is very quick to install but must be carefully planned to be effective. Vegetated strips are created across barren sites, stabilizing the soil and producing seeds for the dispersal of pioneer plants (Coetzee, 2005).

4.4.5 Installing Stone Gabions

Traditional stone gabions are required to manage and rehabilitate areas with degraded drainage channel and eroded gulley systems due to increased surface water runoff from the road surface or associated stormwater infrastructure. These erosion controls are placed at the storm water outlet to control the flow of water and reduce the erosion impact. Examples of the effective use of stone gabions are provided on **Figure 7** below.

Figure 7 Site highlighting severe gulley erosion due to increased stormwater runoff and rehabilitation after the installation of a functional stone gabion

The correct shape, foundation and height of a stone gabion is critical and must be very carefully planned because the cost of failure is very high. The use of stone gabions only if an adequate source of stone is available nearby. The Contractor must avoid collecting stones from the veld as this may cause further soil erosion and destroy the natural habitat of small wildlife. Gabions must be enclosed in wire netting to prevent stones from rolling downstream during flooding. The velocity of water flow must be slowed, but also channelled in a non- erosive way. Silt and organic material should be trapped by geotextile in the gabion (**Figure 8**). The use of gabions must only be if the erosion problem cannot be solved with a quicker, cheaper method like erosion fences.

Figure 8 Trench digging and lined with wire netting and gabion stones

4.4.6 Revegetation of degraded areas

Once the final topsoil layer has been placed on the site, it must be seeded with indigenous grass species and monitored to ensure that it successfully grows. Grassing must be used for revegetation. Grassing is the covering of the ground with grass. It is crucial that all grassing be undertaken by a suitably qualified Contractor, making use of the appropriate equipment. Where seed is used in grassing, all seed supplied should be labelled in accordance with the Government Seed Act (Act No. 20 of 1961). One of the ways in which grassing can be undertaken is through hydroseeding or sodding.

Hydroseeding

Hydro-seeding entails adding a specified seed mix to a slurry containing water, seed, fertilizer and other approved materials to enhance plant growth potential. This mixture is applied by means of a spraying device onto the prepared ground areas to be seeded. Hydroseeding is a quick and cost-effective method of seeding and is especially suited to slopes associated with landfills. It provides homogenous cover which

is key in rehabilitation efforts and also prevents possible erosion. The following must however be borne in mind for hydroseeding:

- The soil should be loose and uniformly wet to a specified depth before any seeding commences.
- Add the specified seed mix and necessary fertiliser to the required amount of water and apply using an approved hydro-seeding machine.
- Unless otherwise specified, the rate of application of the slurry will not be less than 30 cubic metres per hectare and will be applied in such a manner as to ensure even distribution of seed and fertiliser throughout.
- Additional ingredients to be added to the slurry may be specified.
- In certain cases, the specification may require that mulch be applied by hand to the area to be hydro-seeded, prior to hydro-seeding.
- If possible, keep the seedbed moist after hydro-seeding, to ensure good germination.
- Irrigate as required until the grass is able to survive independently (i.e. depending on the rainfall).

Sodding

Sodding is defined as the laying of grass sods. Sodding may be done at any time of the year, but seeding must be done during the summer when the germination rate is better. The following is key for sodding:

- The soil should be uniformly wet to a depth of at least 150 mm before planting of grass sods;
- Protect sods against drying out: keep these moist from the time of harvesting until final placement;
- Rake or spike the area to give a loose surface to a depth of 100 mm;
- Lay the first row of sods in a straight line, starting at the bottom of a slope, where possible;
- Place the next row of sods in the same way, tightly against the bottom row with the joints staggered, until the full area is covered with sods;
- Tightly butt sods together, taking care not to stretch or overlap sods;
- Where a good fit cannot be obtained, the intervening spaces may be filled with parts of sods or topsoil;
- On steep slopes the sods must be secured using timber stakes of at least 300 mm in length;
- After planting, water sods to prevent drying out; and
- Irrigate as required until the grass is able to survive independently (i.e. depending on the rainfall).

4.5 Monitoring and Auditing

The vegetative cover must comprise grasses that are indigenous to the study area. Maintenance of rehabilitation

- Allow for a maintenance period of at least one year following practical completion,
- Cordon off areas that are under rehabilitation as no-go areas using danger tape and steel droppers. If necessary, these areas should be fenced off to prevent vehicular, pedestrian and livestock access.
- Re-vegetation must match the vegetation type which previously existed.
- A minimum grass cover of 80% is required, and individual plants must be strong and healthy growers at the end of the Maintenance Period.
- In the case of sodding, acceptable cover entails that 100% cover is attained by the specified vegetation.
- Bare areas that show no specified vegetation growth after three months of the Rehabilitation Work are to be spread with additional topsoil, ripped to a depth of 100mm and re-planted, re-sodded, re-hand sown or re-hydroseeded.

Table 1 : Monitoring of Soil Erosion Control

Mitigation: Action/Control	Responsibility	Timeframe
Areas to be cleared must be clearly marked on-site to eliminate the potential for unnecessary clearing.	Contractor in consultation with Specialist	Pre-construction
Stockpiled topsoil should be covered to prevent erosion	Contractor	Site establishment & duration of contract
Erosion control measures should be implemented in areas where soil has been disturbed due to construction activities	Contractor	Site establishment & duration of contract
No activities must take place outside of demarcated construction site	Contractor	Site establishment & duration of contract
All bare areas, as a result of the development, should be revegetated as soon as possible with locally occurring species, to bind the soil and limit erosion potential.	Contractor	Site establishment & duration of contract
Silt traps should be used where there is a danger of topsoil or material stockpiles eroding and entering streams and other sensitive areas.	Contractor	Site establishment & duration of contract
Topsoil should be removed and stored separately and should be reapplied where appropriate as soon as possible in order to encourage and facilitate rapid regeneration of the natural vegetation on cleared areas.	Contractor	Site establishment & duration of contract

Mitigation: Action/Control	Responsibility	Timeframe
Any fill material required must be sourced from a commercial off-site suitable/permitted source, quarry or borrow pit. Where possible, material from foundation excavations must be used as fill on-site.	Contractor	Duration of contract
Excavated topsoil must be stockpiled in designated areas separate from base material at a maximum height of 2m and covered (during windy conditions) until replaced during rehabilitation.	Contractor	Site establishment & duration of contract
Topsoil must not be stripped or stockpiled when it is raining or when the soil is wet as compaction will occur.	Contractor	Site establishment Maintenance: for duration of contract
Identify disturbed areas and restrict construction activity to these areas.	Contractor	Before and during construction
Rehabilitate disturbed areas as soon as practicable when construction in an area is complete.	Contractor	During and after construction
Any erosion problems observed should be rectified as soon as possible and monitored thereafter to ensure that they do not re-occur.	Contractor/ECO	Duration of the contract
All bare areas, as a result of the development, should be revegetated with locally occurring species, to bind the soil and limit erosion potential.	Contractor/ECO	Duration of the contract
Silt traps should be used where there is a danger of topsoil or material stockpiles eroding and entering streams and other sensitive areas.	Contractor/ECO	Duration of the contract
Topsoil should be removed and stored separately and should be reapplied where appropriate as soon as possible in order to encourage and facilitate rapid regeneration of the natural vegetation on cleared areas.	Contractor/ECO	Duration of the contract
Erosion control measures should be implemented in areas where soil has been disturbed due to construction activities.	Contractor	During and after construction
Due to the disturbance at the site as well as the increased runoff generated at the site, alien plant species are likely to be a long-term problem.	Contractor	During and after construction
Any new access roads required to be carefully planned and constructed to minimise the impacted area and prevent unnecessary excavation, placement, and compaction of soil.	Engineer Contractor	Design and construction
Where new access roads cross natural drainage lines, culverts must be designed to allow free flow and regular maintenance must be carried out. A Water Use Authorisation may be required for this activity.	Contractor	Design, before and during construction
Minimise removal of vegetation which adds stability to soil.	Contractor	Construction
Soil conservation: Stockpile topsoil for re-use in rehabilitation phase, protect stockpile from erosion	Contractor	Before and during construction
Erosion control measures (i.e. run-off attenuation on slopes (sand bags, logs), silt fences, storm water catch-pits, shade nets, or temporary mulching over denuded area as required).	Contractor	Erection: Before construction Maintenance: Duration of contract
Control depth of excavations and stability of cut faces/sidewalls.	Contractor	Duration of contract

5 CONCLUSIONS AND RECOMMENDATIONS

The erosion and soil management plan is a document that provides an effective guideline to SANRAL, the Contractor and the ECO on how to manage soil erosion associated with the proposed activities of the project. Each control and mitigation measure has been specifically identified with the intension to address anticipated soil erosion effects that could result from each proposed activity. The proposed road construction will result in soil erosion due to the impacts of rainfall affecting geomorphic and hydrologic processes. The creation of roadcut and fill embankments with steep slopes and little vegetation cover, as well as the concentration of runoff from the road surface and intercepted subsurface flows influence the hydrologic and geomorphic processes.

The soil erosion control techniques provided have the potential to reduce runoff and soil loss. The soil erosion control techniques utilised on roadside embankments have shown that the most effective methods are those that promote revegetation and reduce both velocity and quantity of storm water runoff. To achieve full compliance, the management actions stipulated in this document must be adhered to as well as the conditions stipulated within the EMPr, its associated appendices and the Environmental Authorisation.

6 REFERENCES

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