

**EMPR APPENDIX B**

**SOUTH AFRICAN NATIONAL ROADS AGENCY SOC LIMITED (SANRAL)**

**WETLAND AND RIPARIAN AREAS REHABILITATION PLAN**

**STRATEGIC INFRASTRUCTURE PROJECT (SIP2)**

**CAPACITY UPGRADES TO THE N3 FROM LYNNFIELD PARK (KM 30.6)  
TO GLADYS MANZI (FORMERLY MURRAY) ROAD (KM 6.1), KWAZULU-  
NATAL**

**DEA REF NO: 14/12/16/3/3/1/1966**

**FINAL**

**Report prepared for:**

SANRAL SOC LIMITED  
PO Box 100401  
Scottsville  
3209



**Report prepared by:**

ACER (Africa) Environmental Consultants  
P O Box 503  
Mtunzini  
3867



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## 1. PURPOSE

The Wetland and Riparian Rehabilitation Plan provides rehabilitation and monitoring specifications to mitigate impacts on wetland and riparian areas as a result of construction activities associated with the widening of the N3 from Lynnfield Park (Km 30.6) to Gladys Manzi (formerly Murray) Road (Km 6.1), KwaZulu-Natal. The specifications have been drawn from the following specialist reports which were undertaken as part of the requirements for the applications for environmental and/or water use authorisations.

- ❑ Ground Truth Water Wetlands and Environmental Engineering (2018). Wetland and Riparian Impact Assessment Specialist Report 2018 Update. Capacity Upgrades to the N3 from Lynnfield Park (Km 30.6) to Murray Road (Km 6.1)
- ❑ Ground Truth Water Wetlands and Environmental Engineering (2018) Assessment of Vegetation Ecology Updated Specialist Report 2018. Capacity Upgrades to the N3 from Lynnfield Park (Km 30.6) to Murray Road (Km 6.0)

## 2. SCOPE

This document serves as a guideline to be applied by all contractors working on the widening/upgrades of the N3 from Lynnfield Park (Km 30.6) to Gladys Manzi Road (Km 6.1). This management plan is an evolving guideline that needs to be updated or adapted as progress is made with the re-vegetation and rehabilitation of the project area, and successes and failures of procedures are identified.

The objectives of re-vegetation and rehabilitation for the project area are:

- ❑ To stabilise rehabilitated areas by planting suitable indigenous plants, removing alien invasive plants and ensuring slopes associated with the drainage areas are stabilised.
- ❑ Within the context of the development, to preserve natural wetland and riparian habitats or features on site where possible.
- ❑ To ensure re-vegetation and rehabilitation interventions support wetland/riparian ecosystem function in and around the project area as far as possible.

## 3. INTEGRATION WITH OTHER MANAGEMENT PLANS

It is imperative that this management plan is implemented in conjunction with other management plans appended to the EMP, specifically focussing on plant rescue, erosion control, alien plant control, storm water management and revegetation of terrestrial areas. This rehabilitation plan must be read in conjunction with the following rehabilitation plans and procedures as identified by the appointed specialists:

- ❑ EMP Appendix A: Sensitive Areas Rehabilitation Plan (with plant rescue, plant translocation, alien invasive plant control, erosion control and soil management guidelines).
- ❑ EMP Appendix C: Erosion and Soil Management Plan
- ❑ EMP Appendix D: Storm Water Management Plan

#### **4. LEGISLATION AND STANDARDS**

There are a host of legal requirements (National, Provincial and Local Government spheres) which the project proponent must adhere to for the proposed development. Fundamentally, the proponent is required to include and integrate environmental principles and values into all planning and implementation procedures taken for development purposes. 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 (NEMA), 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.

Relevant legislation pertaining to the rehabilitation of wetlands and water courses on the site is described hereunder.

##### **4.1 National Environmental Management Act (NEMA), 1998 (Act 107 of 1998)**

- ❑ Environmental Impact Assessment (EIA) regulations: There are a number of listed activities in these regulations with regards to watercourse (wetlands). Among others it includes activities within 32 m of a watercourse. The Department of Environmental Affairs (DEA) needs to be consulted with regards to the additional activities their regulations trigger, as well as the procedures that should be followed if additional activities should apply.

##### **4.2 National Water Act (NWA), 1998 (Act 36 of 1998)**

Pertinent to this project is that authorisation from the Department of Water and Sanitation (DWS) is required for activities that will occur within 500 m of a wetland, as well as for these water uses in terms of Section 21 of the NWA:

- ❑ (a) (Taking Water from a Water Resource)
- ❑ (c) (Impeding or Diverting the Flow of Water in a Watercourse)
- ❑ (i) (Altering the Beds, Banks, Course or Characteristics of a Watercourse).

The recent Government Notice (509 of 2016) pertaining to General Authorisation (GA) in terms of Section 39 of the National Water Act (No. 36 of 1998) for Section 21(c) and/or (i) water uses, includes a number of activities that are generally authorized for State Owned Companies (SOC's) and institutions that are then subject only to compliance with the conditions of the GA, including "All maintenance of bridges over rivers, streams and wetlands and the new construction of bridges done according to the SANRAL Drainage Manual or similar norms and standards" undertaken by SANRAL. This essentially replaces the need for SANRAL to apply for a water use license and the proposed development can potentially be authorised under the provisions of the GA subject to compliance with the conditions of the GA.

Applications to the Department of Water and Sanitation will be submitted by ACER (Africa), on behalf of SANRAL, as part of the requirements of the Water Use License authorisation process.

#### **4.3 Conservation of Agricultural Resources Act (CARA), 1983 (Act No. 43 of 1983)**

- Declared weeds and invader plants have been divided into three categories:
  - Category 1: These are plants which may not occur on any land or inland water surface other than in biological control reserves. They are sold or imported as propagating material, or be established, planted or maintained outside of a biological control reserve;
  - Category 2: These are plants that may not occur on any land or inland water surface other than demarcated or biological areas or biological control reserves. Demarcated areas includes areas where a water use license for stream flow reduction activities has been issued in terms of section 36 of the National Water Act, 1998 (Act No. 36 of 1998).
  - Category 3: These are plants that shall not occur on any land or inland water surface other than in a biological control reserve. Not allowed to occur within 30 meters of the 1:50 year flood line of a watercourse where water flows regularly or intermittently. The land owner must take use all plausible manners of preventing the spread of the invaders or weeds in question.
- The amendments to the Conservation of Agricultural Resources Act, 1983 (Act No. 43 of 1983) Section 15E propose various methods of control. According to the amendments to Act No. 43 it is the duty of the land owner to implement the control and monitoring mitigation measures on their properties.

#### **4.4 National Environmental Management: Biodiversity Act (Act No 10 of 2004)**

This Act provides for the management and conservation of South Africa's biodiversity. The Act also covers alien and invasive species and genetically modified organisms that pose a threat to biodiversity. Regulation No R. 598 published under this Act applies, viz. *Alien and Invasive Species Regulations, 2014 (1 August 2014)*. Alien and invasive species are listed in Government Notice No 599 (1 August 2014).

#### **4.5 National Forests Act, 1998 (Act 84 of 1998)**

In terms of the National Forests Act, 1998 (Act 84 of 1998), trees in natural forests or protected tree species (as listed in Government Gazette Notice 1012 of 27 August 2004) may not be cut, disturbed, damaged, destroyed and their products may not be possessed, collected, removed, transported, exported, donated, purchased or sold, except under licence granted by the Department of Agriculture, Forestry and Fisheries (DAFF). Each application is evaluated on merit (including site visits) before a decision is taken whether or not to issue a licence (with or without conditions). Such decisions must be in line with national policy and guidelines.

#### **4.6 Natal Nature Conservation Ordinance (Ordinance 15 of 1974) and the KwaZulu-Natal Nature Conservation Management Act (9 of 1997)**

The main aim of the Natal Nature Conservation Ordinance (Ordinance 15 of 1974) and the KwaZulu-Natal Nature Conservation Management Act (9 of 1997) is the protection of the natural resources of the province of KwaZulu-Natal. In particular, the Ordinance and Act provides local conservation authorities with the power to enforce the protection of the province's resources through a permitting system, which is legally binding. Certain indigenous plant and animal species in KwaZulu-Natal are provided with special protection under the Ordinance and Act and permits are required from Ezemvelo KZN Wildlife (EKZNW) for their removal, destruction or translocation.

## 5. ANTICIPATED CONSTRUCTION PHASE IMPACTS TO WATERCOURSES

The following impacts are anticipated during the construction phase of the development and are likely to necessitate the need for rehabilitation of the affected/receiving watercourses:

- Alteration of the physical structure of watercourses (wetlands, rivers and streams) a result of excavation, infilling and other construction related activities.
- Erosion and sedimentation of watercourses.
- Alteration of the natural longitudinal gradient of channelled watercourses.
- Disturbance or destruction of vegetation within watercourses.
- Increased invasive alien plant (IAP) invasion within and around watercourses.
- Increased discharge of road stormwater into watercourses.
- Construction of road embankments / batters within or adjoining watercourses. This is a source of sediment.
- Temporary to permanent flow diversion.

## 6. IMPACTED AREAS (WETLAND AND RIPARIAN) REQUIRING REHABILITATION

Within the project area a total of 8 watercourses, including 6 wetland units and 2 drainage lines (Section 6.1 – 6.8 below), were identified as potentially being impacted (either directly or indirectly) by the road upgrade project. These watercourses were assessed as being at moderate to high potential of incurring impacts that can alter the habitat characteristics of the water and therefore would require post-construction rehabilitation. The wetlands were also allocated a flag rating as described below:

Flag rating	Description
<b>Green Flag</b>	Wetland/riparian habitat that requires protection and mitigation but is already modified /highly impacted and the planned mitigation /rehabilitation activities will maintain or improve present condition if correctly implemented.
<b>Orange Flag</b>	Wetland/riparian habitat is currently in a less impacted state, with the potential to be negatively impacted by the activity if the required mitigation and rehabilitation measures are not strictly implemented.
<b>Red Flag</b>	Red flag or fatal flaw issues or impacts. Sites where the rapid assessment tools indicate habitat of unique value and condition which will be irreversibly impacted and impacts cannot be mitigated, including sites which are protected, irreplaceable, highly sensitive or provide known habitat for Red Data/CITES species.

## 6.1 Wetland 1: Site N3-05-01

This wetland is flagged as orange due to size of wetland indicating mitigation is important; however, the site is critically modified and the wetland edge is outside of development footprint.

<b>Site N3-05-01</b>	<b>Latitude</b>	29° 40' 30.1" S	<b>Longitude</b>	30° 28' 4.5" E
<b>Flag rating</b>	Orange	<b>Habitat type</b>		Wetland
<b>Description</b>	Unnamed Valley bottom wetland without channel, near Lynnfield Park adjacent to road marker N3-2 34.0 N			
<b>Photograph &amp; map</b>				
<b>Wet-Health composite score</b>	<b>Health score</b>	<b>Key current wetland impacts</b>		
	Critically Modified	Erosion, sedimentation, pollution, compaction, wetland habitat disturbance, increased alien invasion.		
<b>Red data/ CITES</b>	None observed, none present on spatial data coverages.			
<b>Risks &amp; Impacts</b>	Sedimentation, pollution, compaction, wetland habitat disturbance, increased invasion by invasive alien plants.			
<b>Risk assessment rating</b>	Low			
<b>Mitigation</b>	General mitigation measures within Section 8 of this report.			
<b>Monitoring</b>	Monitoring requirements within Section 9 of this report.			
<b>Application</b>	Generally authorised			

6.2 Wetland 2: Site N3-05-02

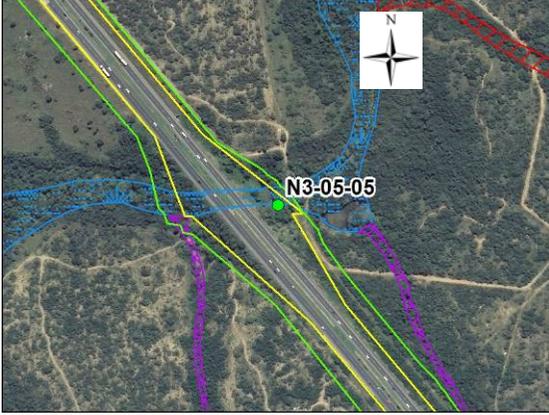
<b>Site N3-05-02</b>	<b>Latitude</b>	29 ° 39' 46.3" S	<b>Longitude</b>	30 ° 27' 46.9" E
<b>Flag rating</b>	Green	<b>Habitat type</b>		Riparian
<b>Description</b>	Crossing at Mpushini River. Moderate density of exotic vegetation, channel modified by N3.			
<b>Photograph &amp; map</b>				
<b>Index of Habitat Integrity</b>	<b>Health score</b>	<b>Main riparian impacts</b>		
	Good	Invasion by exotic plants, channel modification.		
<b>Red data/ CITES</b>	None observed, none present on spatial data coverages.			
<b>Risks &amp; Impacts</b>	Disturbance of vegetation within riparian zone.			
<b>Risk assessment rating</b>	Low			
<b>Mitigation</b>	General mitigation measures within Section 8 of this report. Rehabilitation of access to culvert also required.			
<b>Monitoring</b>	Monitoring requirements within Section 9 of this report.			
<b>Application</b>	Generally authorised			

6.3 Drainage Line 1: Site N3-05-03

<b>Site N3-05-03</b>	<b>Latitude</b>	29 ° 39' 52.9" S	<b>Longitude</b>	30 ° 27' 34.5" E
<b>Flag rating</b>	Green	<b>Habitat type</b>		Drainage line
<b>Description</b>	Drainage line – Riparian/wetland assessments cannot be effectively applied.			
<b>Photograph &amp; map</b>	N/A			
<b>Mitigation</b>	General mitigation measures within Section 8 of this report.			
<b>Application</b>	Generally authorised			

**6.4 Wetland 3: Site N3-05-05**

This wetland is flagged orange due to the fact that the wetland is in a fair condition, therefore mitigation measures are important.

<b>Site N3-05-05</b>	<b>Latitude</b>	29° 39' 11.1" S	<b>Longitude</b>	30° 27' 0.5" E
<b>Flag rating</b>	Orange	<b>Habitat type</b>		Wetland
<b>Description</b>	Valley bottom wetland with channel at road marker N3-3 2.4N			
<b>Photograph &amp; map</b>				
<b>Wet-Health composite score</b>	<b>Health score</b>	<b>Key current wetland impacts</b>		
	Fair	Alterations to flow regime, erosion, sedimentation, pollution, compaction, wetland habitat disturbance, invasive alien plants.		
<b>Red data/ CITES</b>	None observed, none present on spatial data coverages.			
<b>Risks &amp; Impacts</b>	Alterations to flow regime, erosion, sedimentation, pollution, compaction, wetland habitat disturbance, increased invasion by invasive alien plants.			
<b>Risk assessment rating</b>	Low			
<b>Mitigation</b>	General mitigation measures within Section 8 of this report.			
<b>Monitoring</b>	Monitoring requirements within Section 9 of this report.			
<b>Application</b>	Generally authorised			

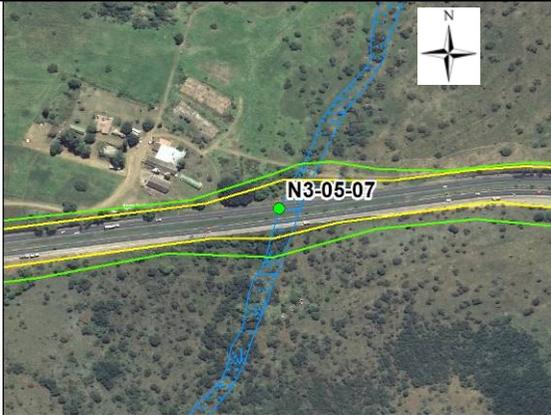
## 6.5 Wetland 4: Site N3-05-06

This wetland is flagged orange due to the fact that the wetland is in a fair condition, therefore mitigation measures are important.

<b>Site</b> N3-05-06	<b>Latitude</b>	29 ° 38' 51.3" S	<b>Longitude</b>	30 ° 26' 43.1" E
<b>Flag rating</b>	Orange	<b>Habitat type</b>		Wetland
<b>Description</b>	Valley bottom wetland with channel near road marker N3-3 3.0S			
<b>Photograph &amp; map</b>				
<b>Wet-Health composite score</b>	<b>Health score</b>	<b>Key current wetland impacts</b>		
	Fair	Alterations to flow regime, erosion, sedimentation, pollution, compaction, wetland habitat disturbance, invasive alien plants.		
<b>Red data/ CITES</b>	None observed, none present on spatial data coverages.			
<b>Risks &amp; Impacts</b>	Alterations to flow regime, erosion, sedimentation, pollution, compaction, wetland habitat disturbance, increased invasion by invasive alien plants.			
<b>Risk assessment rating</b>	Low			
<b>Mitigation</b>	General mitigation measures within Section 8 of this report.			
<b>Monitoring</b>	Monitoring requirements within Section 9 of this report.			
<b>Application</b>	Generally authorised			

**6.6 Wetland 5: Site N3-05-07**

This wetland is flagged orange due to the fact that the wetland is in a fair condition, therefore mitigation measures are important.

<b>Site N3-05-07</b>	<b>Latitude</b>	29 ° 38' 46.6" S	<b>Longitude</b>	30 ° 26' 17.5" E
<b>Flag rating</b>	Orange	<b>Habitat type</b>	Wetland	
<b>Description</b>	Valley bottom wetland with channel at road marker N3-3 4.2N			
<b>Photograph &amp; map</b>				
<b>Wet-Health composite score</b>	<b>Health score</b>	<b>Key current wetland impacts</b>		
	Fair	Alterations to flow regime, erosion, sedimentation, pollution, compaction, wetland habitat disturbance, invasive alien plants.		
<b>Red data/ CITES</b>	None observed, none present on spatial data coverages.			
<b>Risks &amp; Impacts</b>	Alterations to flow regime, erosion, sedimentation, pollution, compaction, wetland habitat disturbance, increased invasion by invasive alien plants.			
<b>Risk assessment rating</b>	Low			
<b>Mitigation</b>	General mitigation measures within Section 8 of this report.			
<b>Monitoring</b>	Monitoring requirements within Section 9 of this report.			
<b>Application</b>	Generally authorised			

6.7 Drainage Line 2: Site N3-05-08

<b>Site</b> N3-05-08	<b>Latitude</b>	29 ° 38' 48" S	<b>Longitude</b>	30 ° 25' 56" E
<b>Flag rating</b>	Green	<b>Habitat type</b>		Drainage line
<b>Description</b>	Drainage line – Riparian/wetland assessments cannot be effectively applied.			
<b>Photograph &amp; map</b>	N/A			
<b>Mitigation</b>	General mitigation measures within Section 8 of this report.			
<b>Application</b>	Generally authorised			

6.8 Wetland 6: Site N3-05-09

<b>Site N3-05-09</b>	<b>Latitude</b>	29 ° 39' 40.5" S	<b>Longitude</b>	30 ° 27' 26.8" E
<b>Flag rating</b>	Green	<b>Habitat type</b>		Riparian
<b>Description</b>	Riparian channel, draining eastern off ramp of the Ashburton Interchange			
<b>Photograph &amp; map</b>				
<b>Wet-Health composite score</b>	<b>Health score</b>	<b>Main riparian impacts</b>		
	Fair	Alterations to flow regime, exotic vegetation, bed/channel modification, water quality		
<b>Red data/ CITES</b>	None observed, none present on spatial data coverages.			
<b>Risks &amp; Impacts</b>	Alterations to flow regime, erosion, pollution, increased invasion by invasive alien plants.			
<b>Risk assessment rating</b>	Low			
<b>Mitigation</b>	General mitigation measures within Chapter 7 of this report.			
<b>Monitoring</b>	Monitoring requirements within Chapter 8 of this report.			
<b>Application</b>	Generally authorised			

## 7. KEY REHABILITATION AIMS

The key rehabilitation aims for this project are to:

- Control infestation of alien invasive species in newly rehabilitated areas.
- Manage stormwater to limit erosion.
- Ensure continued water flow through wetland areas to retain wetland functions.
- Stabilise riparian banks with good vegetation cover, to limit erosion. Rehabilitation should aim to maintain flow characteristics (quantity, quality, velocity) as close as possible to pre-construction levels.

## 8. CONSTRUCTION AND REHABILITATION SPECIFICATIONS

### 8.1 General construction methodology applicable to wetlands

During construction, special care needs to be given towards the impacts of the construction activities within wetlands in order for the rehabilitation process not to be jeopardised. A detailed Method Statement must be provided by the Contractor for approval by the ECO and Engineer, for road construction over a wetland.

When construction activities cross wetlands, very careful investigations and planning must be undertaken in order to establish and limit the overall effect of the final product on the wetland. Best management practices are applied to construct access without serious long-term impact on the natural functioning of the particular wetlands. Below is a typical construction sequence:

- Establish depths of wetland bottom at various chainages along the road.
- Establish approximate bearing capacities of soil at bottom of wetland.
- Excavate to the required width and depth, with shoring or cofferdams to prevent slumping of the saturated material.
- If required, excavate further to acceptable bearing capacities.
- Place a pioneer layer of permeable material (e.g. rockfill) over the bed of the excavation, or place a layer of suitable geo grid.
- Lay down a double layer of suitable geotextile to cover the base and sides of the excavation, plus sufficient geotextile to fold over the rockfill.
- Place rock fill, size between 50 mm and 200 mm to width of road bed in layers not exceeding 500 mm. The top layer is not to extend above any required culvert invert levels.
- Fold geotextile back over rock fill and tuck in on other side.
- Construct road fill embankment with dry, selected materials.
- Allow the fill embankment time to settle and install culverts as necessary.
- Construct pavement and sub-base layers to specified compactions.
- Construct base course layers to specified compaction.
- Apply road surface and auxiliary works (guardrails, signage, etc.).

## 8.2 Construction at culverts and viaducts

Specific management must be employed with regard to site access to viaducts and culverts:

- ❑ Access to the Mpushini Bridge is to come off the N3 embankment to avoid construction of a long approach road through floodplain vegetation.
- ❑ The number of access tracks is to be kept to a minimum. Adequate drainage (mitre drains) should be constructed at regular intervals in accordance with the local topography to minimise soil erosion potential. Alien plant control should also be undertaken along these access tracks.
- ❑ As far as possible, work must take place during the winter low flow period.
- ❑ Existing crossings are to be used as far as possible for vehicle access.
- ❑ The width of the crossings must be kept to the absolute minimum required for access. Construction of new and/or temporary crossings must be suitably designed and constructed to limit interference of hydrological flows and connectivity. Crossing designs must be accompanied by stormwater management plans.
- ❑ Soil compaction must be minimised by keeping access and parking areas for vehicle and construction plant to a minimum, and making use of existing compacted/hardened surfaces wherever possible.
- ❑ Where new tracks are required, sensitive areas of vegetation, wetlands and riparian zones are to be avoided. Wherever feasible, shaping new tracks with a grader is to be avoided, and new vehicle tracks are to be created by simply driving over the grass cover without removing grass cover/topsoil.
- ❑ The same track is to be used to access a site and widening and creating alternative or parallel tracks must not be allowed. Likewise, the same vehicle turning areas are to be used (for both construction and maintenance).
- ❑ Where new access tracks are required, as far as possible, these must follow the contour on steep slopes, rather than being aligned directly down steep slopes. Stormwater runoff must be such to limit concentration of runoff, and consequently erosion of soils.
- ❑ Where watercourse and drainage line crossings are unavoidable, drains and culverts must be designed in conjunction with relevant experts to the correct invert levels to prevent damming of flows or draining of wet areas. Culverts should be designed to prevent concentration of flows, and to maintain natural flows as free flowing as possible. Levels and elevations must also be set and aligned according to the natural flow of water to limit headcuts and channel incision developing.
- ❑ If water for construction is to be sourced from local water bodies, then this must occur at existing disturbed sites due to potential for damage by temporary access roads and water tankers.
- ❑ Temporary access tracks are to be rehabilitated as quickly as possible after construction ceases by removing excess imported material, ripping compacted soils, reinstating natural ground levels, implementing soil erosion controls and re-establishing a dense cover of indigenous vegetation appropriate to the plant community in which the road/track is located.
- ❑ Where dewatering of silt laden water is required at excavations, it is recommended that this water is not pumped directly into watercourses (i.e. wetlands and rivers), and that separate collection areas/sumps should be created in existing disturbed areas where suspended sediments can be settled out.

## 8.2 Plant Rescue prior to construction (wetland and riparian areas)

A plant rescue operation must be undertaken under the direction of an ecologist/botanist prior to construction, where plants of high conservation value will be impacted by any part of the development (construction or operation phase). Refer to Appendix A of the EMPr for guidelines on plant rescue.

## 8.3 Preparation of site prior to construction (wetlands and riparian areas)

- ❑ Stripping of vegetation for construction must be restricted to the building footprint to reduce the risk of erosion during times of high precipitation. Stripping should also be done incrementally to minimise the total area of exposed soil on site at any one time.
- ❑ Where possible, remove vegetation in such a way that it can be replanted as part of the rehabilitation of vegetation. Store vegetation in already cleared areas and water at least once weekly, but every second day during summer (or in a nursery depending on anticipated length of construction period and available budget).
- ❑ Where soils are removed, the topsoil and subsoil must be stockpiled separately in low heaps as recommended in the Erosion and Soil Management Plan appended to this document.
- ❑ Soils to be excavated in such a manner that the methods of removal align with the method discussed in the method statement for road construction. This needs to be done in order to ensure that an excess of soil is not removed prior to construction.
- ❑ No spoil or stockpiled materials are to be placed within riparian areas, wetlands or associated buffer zone (with the exception of the construction footprint).

## 8.4 Site rehabilitation following construction (wetlands)

- ❑ Remove all alien invasive species within the project footprint.
- ❑ Implement temporary stormwater management measures, to diffuse flow during construction of the permanent stormwater measures, where necessary.
- ❑ Compacted areas should be ripped and topsoil replaced from the areas where it was removed. Impacted areas can be re-vegetated using the sods from the vegetation that was removed prior to construction and/or sods from similar vegetation (also depending on its availability in the market)<sup>1</sup>. The sods should be placed level with, or slightly deeper, than surrounding vegetation, on ripped soils. Against slopes, the sods should be pegged to ensure that they do not wash away before the roots are established.
- ❑ Where soils are not saturated, ripping shall be done to a depth of 250 mm in two directions at right angles, in all rehabilitated areas. (However, note that ripping or scarifying soils which are saturated with water is ineffective and should be avoided.)
- ❑ All sloped areas must be re-vegetated by either using removed sods or by seeding with a grass mixture containing indigenous species naturally occurring in the area<sup>2</sup>. All areas where vegetation has been removed or destroyed should be replanted immediately after completion of construction of that particular section to avoid erosion (i.e. rehabilitation should be prompt and progressive).
- ❑ Badly damaged areas should be fenced-in to allow for rehabilitation to take place without further impacting the areas.
- ❑ Areas where minimal disturbance took place, can be ripped where necessary and allowed to naturally re-vegetate (take note that this excludes steeply sloped areas).

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<sup>1</sup> Advice from a qualified botanist should be obtained in this regard.

<sup>2</sup> This will also depend on availability in the market during rehabilitation; if not available then something similar can be used with the advice of a qualified botanist.

- ❑ If situations arise where bare soil may remain uncovered for extended periods of time, a suitable indigenous groundcover must be established. On slopes steeper than 1:6, a biodegradable geo-fabric should be placed on the soil surface together with seeding / planting of indigenous species to control soil erosion.
- ❑ Ideally, the rehabilitated construction footprints, especially on slopes and along the wetland areas, must be fenced-off to prevent pedestrian traffic and trampling.
- ❑ Heavy vehicle traffic should be kept to the same tracks to combat soil compaction.
- ❑ Only soils removed as part of construction should be used to rehabilitate the disturbed soils – avoid importing soils from other areas.
- ❑ Very steep slopes of 1(V):1(H) or 1(V):2(H) must be stabilised using hard structures, preferably with a natural look, and with facilities allowing for plant growth. The engineer, in collaboration with the Environmental Control Officer (ECO), will specify a solution in terms of the most appropriate approved method and technology. One or more of the following methods may be required:
  - Retaining walls (DWAF 2005)
  - Stone pitching
  - Gabions
  - Shotcrete
- ❑ Protect all areas susceptible to erosion and ensure that there is no undue soil erosion resultant from activities within work areas.
- ❑ All alien invasive and exotic species seedlings and saplings within the development footprint must be removed as they become evident for the duration of construction.
- ❑ Manual / mechanical removal is preferred to chemical control.
- ❑ All construction vehicles and equipment, as well as construction material should be free of alien plant material. Equipment and vehicles should be thoroughly cleaned prior to access onto the construction site.
- ❑ If structures are used on sensitive sloped areas it is important that sediment does not pass through these structures e.g. gabions should be lined.
- ❑ An ecologically-sensitive storm-water management plan should be developed and implemented that does not allow concentrated storm-water to enter into a wetland or watercourse directly, but instead makes use of flow diffusers and retention areas (such as artificial wetland areas, swales, baffles and gabion structures).

### **8.5 Site rehabilitation following construction (riparian areas)**

- ❑ In riparian areas, backfilling should occur as soon as possible, with compaction undertaken and shaping to original levels.
- ❑ All disturbed areas are to be rehabilitated, with the riparian habitat at the crossing points and areas where disturbance has resulted from excavation being restored to near-natural conditions. This must be implemented immediately following completion of construction activity at each localised crossing.
- ❑ The crossings should be rehabilitated to ensure that no barriers exist within the stream and that in-stream habitat is comparable to the natural state.
- ❑ Re-vegetation and rehabilitation must take place at worked sections immediately following completion so that vegetation can re-establish.
- ❑ Within, and in proximity to riparian areas, successful re-vegetation is crucial to stabilise soils and limit infestation by invasive alien plant species and dominance by ruderal species. Rehabilitation should be undertaken on a progressive basis in these areas.
- ❑ Simple re-vegetation with terrestrial species will not be suitable. Correct species for riparian habitats of the region must be re-established in consultation with an appropriately qualified specialist.

- ❑ Progress of vegetation establishment must be monitored regularly, with slow recovery requiring intervention to ensure site recovery and integrity, as well as physical stability.
- ❑ Vehicle access tracks, footpaths and other areas of soil compaction and vegetation denudation as a result of the construction activities must be appropriately contoured, scarified and re-vegetated where required.
- ❑ Any soil stockpile sites and sites of excavation must also be rehabilitated in the same fashion. Rehabilitation of such sites must be monitored and the results reported to the ECO.
- ❑ All excess soil stockpile not taken off site must be spread evenly over the disturbed areas prior to rehabilitation and re-vegetation.
- ❑ Construction areas must be rehabilitated to a land surface which integrates with the surrounding slope morphology and river channel form so as not to create areas of soil instability, or flowpaths which incorrectly direct stormflows and floods causing scour, erosion and damage to adjacent habitats and infrastructure.
- ❑ Areas subject to concentrated water flows during rainfall or high flow events must receive particular attention during rehabilitation and re-vegetation. Where possible these must be identified prior to commencement of construction activities. Where required, erosion protection structures may need to be designed and installed.
- ❑ Artificial embankments, depressions and holes created by the construction activity must be contoured/rehabilitated to minimise risk to, and death of, all fauna types from large mammals to small invertebrates.
- ❑ Upon site closure all infrastructure, foreign materials, waste, litter and contaminated water, rock or soil must be removed from site and disposed of authorised disposal sites.

## 9. MAINTENANCE AND MONITORING

### 9.1 Aims and objectives of monitoring

Monitoring refers to the repetitive and continued observation, measurement and evaluation of environmental criteria to follow changes over a period of time and to assess the efficiency of control measures. The monitoring plan aims to establish whether rehabilitation was successful, and whether maintenance or related activities have impacts.

- ❑ If natural re-vegetation is unsuccessful, corrective action should be taken and includes seeding and planting by an appropriate specialist.
- ❑ Once rehabilitation has been observed to be successful during monitoring, the fencing/demarcation may be removed.
- ❑ Alien invasive species distribution and densities should be controlled after construction is completed.

### 9.2 Monitoring programme

#### 9.2.1 *Once-off Monitoring (Contractor's responsibility)*

- ❑ **Monitoring during construction:** During construction, rehabilitation efforts must be monitored and impacts on already rehabilitated areas monitored and corrective action taken where needed.

- ❑ **Monitoring after construction:** Once construction is completed, the site should be monitored to evaluate the success of rehabilitation and to identify corrective action where needed. This monitoring activity can also provide lessons for further rehabilitation.

#### 9.2.2 Routine Monitoring (SANRAL's responsibility)

- ❑ **Seasonal monitoring:** rehabilitation success, as well as signs of erosion, sedimentation and the presence of exotic vegetation should be monitored twice during the summer months: once at the start and once at the end of the rainy season. This should be continued for at least one year after construction is completed.
- ❑ Any remediation requirements identified should be implemented as soon as possible. Corrective action should be taken and could include the re-initiation of rehabilitation in severe cases, or by correction of the problem (e.g. mend broken fences). If problems arise due to construction of the upgrades that was not pre-empted in this plan, an engineer and wetland specialist should be consulted as soon as possible.

## 10. CONCLUSION

This Wetland and Riparian Rehabilitation Plan provides the Contractor, SANRAL and the ECO with guidelines on re-vegetation and rehabilitation work, and assists in understanding the concepts behind successful rehabilitation. This plan must be implemented in conjunction with the approved EMPr as well as other management plans prepared for the proposed development.