# AQUADENE ROAD UPGRADE RICHARDS BAY

## Ecological Review of the proposed upgrades to the R619, uMhlatuze Municipal area

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Sustainable Development Projects cc

Compiled for
Henwood Nxumalo Consultants

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# ECOLOGICAL REVIEW – ROAD UPGRADES TO R619, RICHARDS BAY, UMHLATUZE

*Contents*



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| **Front page image** | Portion of R 619 |

**Acronyms and Abbreviations / Terminologies**

| | |
|---|---|
| EAP | Environmental Assessment Practitioner |
| EIA | Environmental Impact Assessment |
| Mesic | Dry land. Land that is neither aquatic or "wetland" |
| NEMA | National Environmental Management Act 1998 |
| PCA | Principle Component Analysis. Statistical method of identifying variation within data |
| SANBI | South African National Biodiversity Institute |
| Transect | A "cut" or length over which sampling of a portion of ground or similar environment is undertaken |
| TWINSPAN | Two Way Indicator Species Analysis. Statistical method of identifying similarities within data |
| Veld type | Vegetation or habitat form |
| Wetland | An area of land intermediate between aquatic and mesic environments |

## 1. INTRODUCTION

Henwood Nxumalo Consulting Engineers (Pty) Ltd are the appointed environmental assessment practitioners evaluating the proposed upgrades to the R619 roadway, which links the Aquadene and northern parts of Richards Bay with the N2 Freeway. The proposed upgrade includes widening of certain sections of the existing road and expansion or extension of culverts and drains in the area. The portion of roadway identified for expansion and upgrade is approximately 6 kilometres in length and traverses primarily lands presently under silviculture, as well as including portions of commercial and industrial, as well as residential areas. (See Annexure A)

The subject area extends from 28°41.41S 32°01" 44E, in the vicinity of the N2 interchange, to the south at 28°44" 29S , 32°02" 58'E. (See Fig. 1 and Fig. 2).

This report has been commissioned by Henwood Nxumalo Consultants in order to provide ecological guidance in respect of the proposed upgrades, and in particular the interface with any wetland or aquatic environments that intersect with the roadway. In addition, a water use license may be required in respect of this activity, or at a minimum consideration of the nature and extent of any wetland environment is required within 500m of the proposed activity.

In fulfilment of the above, this report gives due consideration to the bio physical factors inherent within the subject site, as well as the wetland and aquatic components of the site and their significance from an ecological perspective. The report identifies wetlands and riverine systems that may be affected by the activities envisaged and gives an indication of the functional state and significance of these systems, where appropriate. Management interventions in respect of the construction phase are also proposed.

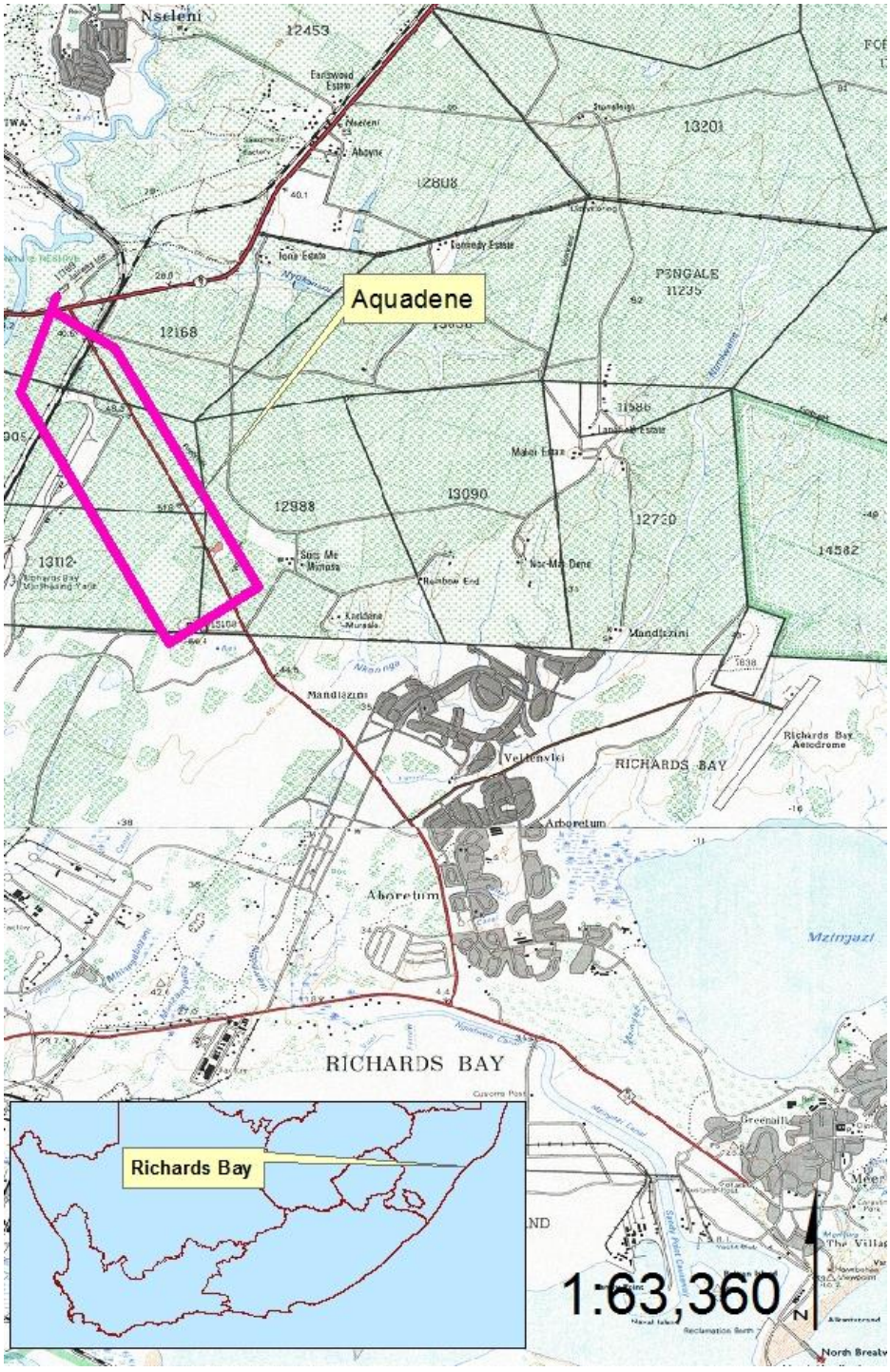



Fig. 1. Regional 1 : 50 000 topographic image indicating study site. Source SG Office

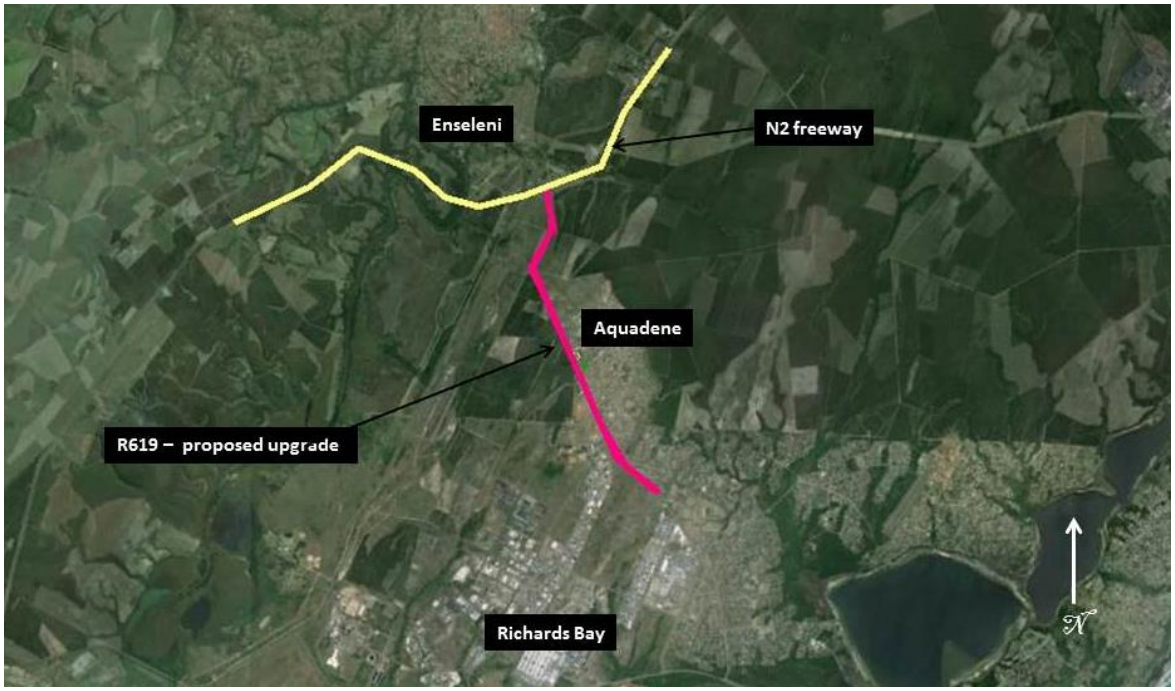


Fig. 2 Aerial image indicating R619 in regional context. (Source Google Earth)

## 2. METHODOLOGY

In pursuance of the above, SDP Ecological & Environmental Services undertook the following activities in the compilation of this report.

1. A desktop review of the site using aerial imagery and wetland data collated from the National Freshwater Ecological Priority Area Programme (2012).

2. A field review of the site undertaken on 22 December 2015,whereby a review of the prevailing landscape was undertaken, while specific confirmation of the presence of wetland components in the landscape were identified and confirmation or dismissal of the NFEPA data was undertaken.

3. Where wetland environments were encountered, the outer extent of discernible morphology, edaphic geohydromorphology or botanical habitat associated with wetland environments was identified using the techniques described below. *In toto*, four (4) extant or maturing wetland systems were identified, as per Fig. 3 below

4. All determined extents of wetlands were logged and recorded using Garmin Montana VI.

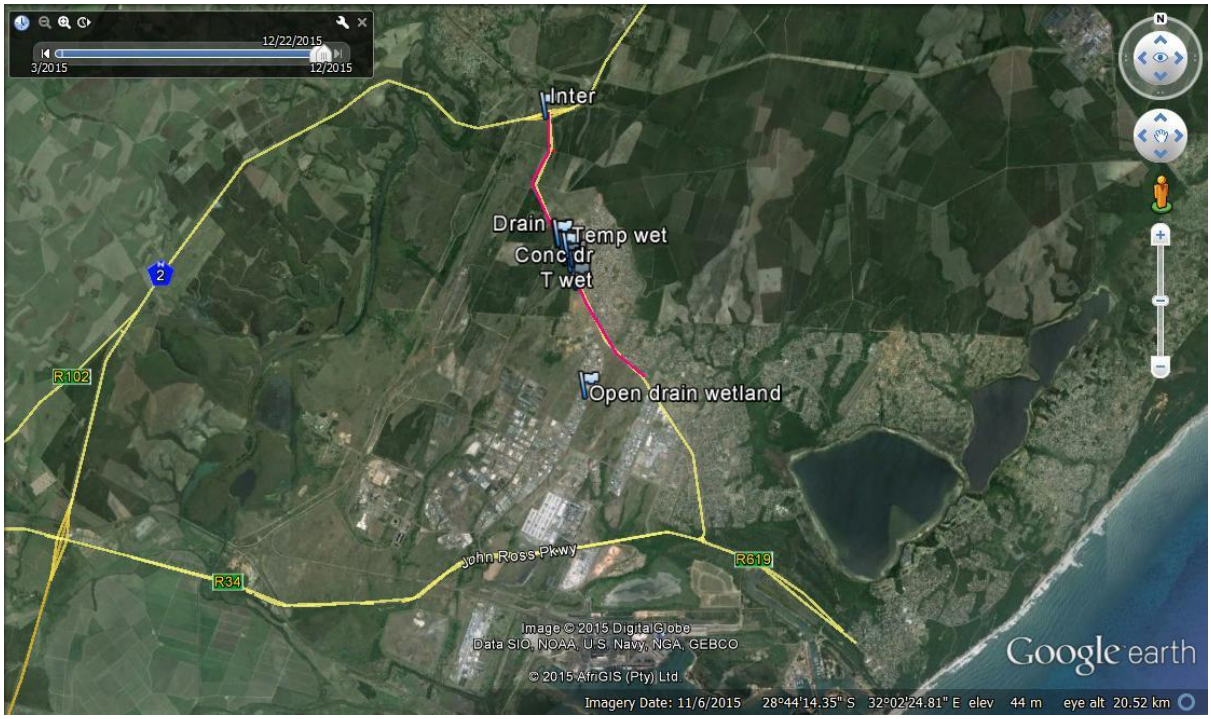



Fig. 3 Image indicating wetland environments identified along proposed road upgrade and those found within 500m of the roadway.

5. From interpretation of the above results and the observations undertaken at site, the nature of the habitat within the site was given due consideration from an ecological perspective. This included the opportunity or impact arising from transformation / further transformation.

6. Consideration was given to the functional state of riparian and wetland environments identified as per the Guidelines for the Delineation of Wetlands DWAF 2005

Indicators of a riparian system are suggested to include the following (as per DWAF 2005):

1. An obvious floodplain and active channel.
2. Evidence of active erosion indicating a high energy system.
3. The absence of classic hydromorphic vegetation, with species associated with riparian areas dominant, or simply a change in vegetation density and structure.

The approach to defining the riparian zone is not strictly defined (DWAF 2005) and a number of methods can be used. Accepted riparian indicators include (Fig 4 below):

1) **Topography**: identification on flood terraces and macro-channels.

2) **Vegetation :** identification of a distinct area of vegetation change, often in close association with the macro-channel. Changes can be in relation to species diversity or physical nature (density or health).

3) **Alluvial soils and deposited material**: identification of recent deposits of sand or mud serves as a confirmatory indicator of the higher extent of river associated inundations

A number of methods exist for identifying riparian indicators. Acceptable methods include (DWAF 2005):

1. The use of topographical maps.
2. Aerial photographs and aerial videos
3. Ecoregions (e.g. using climatic, geological or vegetative community indicators can be useful as a predictive method)
4. Field work (i.e. confirming desktop observations by locating indicators on site).

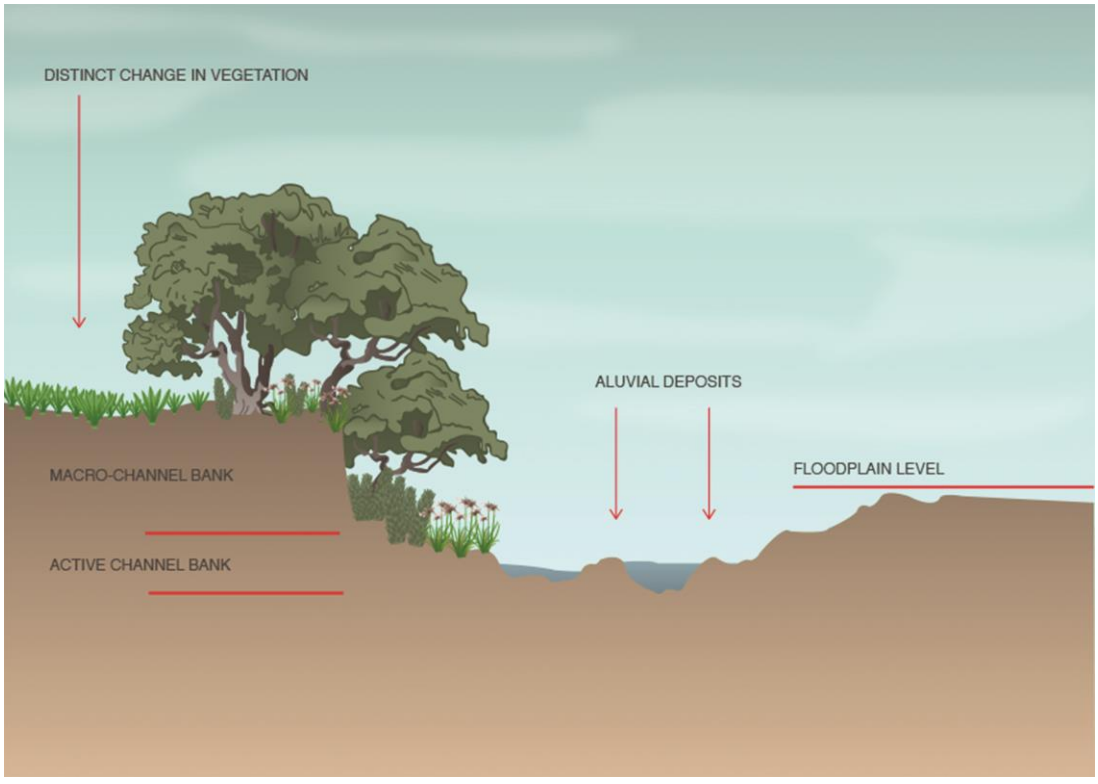



Fig 4. Illustration of a typical riparian cross section (Adapted from DWAF 2005)

Wetland systems are considered to be intermediate areas between mesic and aquatic systems. These systems are generally considered to be *temporary* (where evidence of inundation of water under a

high level precipitation event is apparent), *seasonal* (where regular intermittent inundation arises) or *permanent* (where the area is permanently saturated). Such areas are typically identified by:

- **Topography and geomorphology.**
- **Edaphics** – mottled and gley soils being evidence of such environments
- **Habitat** – *obligate* hydrophytes (e.g. Phragmites spp) are indicative of permanent inundation and *facultative* (e.g. *Centella asiatica*) are indicative of areas where inundation is regular to irregular in nature.

Such indicators are used to identify the nature and structure of wetland systems. Along the line route, the outer seasonal wetland system was identified using the above criteria.

**Wetland Functionality**

Use of the method proposed in the Wet-EcoServices tool (Kotze et. al. 2007) to determine the functionality of the wetlands in question was undertaken, following the collation of data from the specific wetlands. This task involved the identification of the various hydro-geomorphic (HGM) units, followed by an assessment of each unit according to the scoring criteria provided. In this case, 2 HGM units were identified for assessment within the affected area. The majority of systems were identified as being temporary systems associated with seasonal inundation, although the long term depression or deflation of the water table in the area as a consequence of the planting of *Eucalyptus grandis* as well as active drain establishment, has resulted in wetlands that would normally reflect greater inundation and possible extended aquatic conditions, being considered to be presently low functioning systems.

Identification of the HGM units was undertaken based on the following:

1) Change in gradient; and
2) Physical barriers, i.e. substantial fill, roadways.
3) Wetland type, e.g. hillslope seep, channeled valley bottom wetland

The HGM units were subject to a Level 2 assessment of their respective "Ecoservices". In total 15 eco-services (e.g. nutrient removal, phosphate removal etc.) which they provide, were evaluated and an eco-services score was calculated for each service. This score indicates the level of benefit

(service) offered by the HGM units and is ultimately an indication of the HGM's (or "wetland's") functional status. During the scoring process, criteria were scored as follows:

0 = Low ; 1 = Moderately Low ; 2 = Intermediate ; 3 = Moderately High ; 4 = High

Criteria are split into two sections; "effectiveness" and "opportunity". The average value of criteria provides a score of *effectiveness* and *opportunity*. These two scores are then summed and the average of these values provides an overall score for the service rendered. Table 1 below, provides the classes for determining the extent to which a "functional benefit" is provided.

Table 1. Classes for determining the possible extent to which a benefit is being supplied. The score represents the overall score for each benefit, e.g. flood attenuation (Kotze *et. al*. 2007).

| **Score:** | **<0.5** | **0.5-1.2** | **1.3-2.0** | **2.1-2.8** | **>2.8** |
|---|---|---|---|---|---|
| Rating of the likely extent to which a benefit is being supplied | **Low** | **Moderately Low** | **Intermediate** | **Moderately High** | **High** |

## 3. REGIONAL ECOLOGICAL PERSPECTIVE OF THE AREA

The study site falls within Quaternary catchment W 12J, a catchment which primarily serves the Mzingazi coastal lake system, and includes the Nkoninkha and Mzingazi systems. (Fig. 5). The catchment, according to www.dwaf/WAR/systems.html can be described as being of *moderate* ecological sensitivity, primarily on account of the presence of lakes Mzingazi and Nhlabane (DWAF 2013). Diederichs et al (2007) noted that the most significant land use on the Mzingazi catchment was plantation, with these forest products being primarily Eucalyptus spp and Pinus spp. 32% of the catchment was recorded in 2007 as being allocated to timber production. The next largest land use in the area was determined to be a combination of urban and peri-urban residential areas, which constitute 21% of the catchment. "Open space", which is not generally defined in Diederichs et al, is seen to constitute 15% of the catchment.

Notably Diederichs et al identify the area as becoming water stressed, particularly in respect of water quality deterioration, while the generally level nature of the area, with high water table may give rise to increased flood risk. The same authors also identify the impact of forestry on surface and sub surface flows serving the lake system.


Fig. 5 Map indicating catchment designation and subject site in relation to major river systems (source DWS)

The area under consideration encompasses an aeolian derived sand, which was established during the last marine transgression. These sands have only recently been stabilized with the natural vegetation cover being a grassland - palmveld mosaic (the KwaMbonambi Grasslands), which has since been largely replaced by plantation and urban settlement. A more clayey Miocene sediment underlies these sands and this generally impermeable horizon is responsible for the maintenance of wetland environments, where it lies proximal to the natural ground level. The availability of groundwater in the area has however, been compromised by the planting of commercial timbers in the area, which have served to establish a lens depression in the area.

In summary, the bio physical state of the Aquadene area which is traversed by the R619 can be considered to be highly transformed, primarily on account of silvicultural and urban expansion activities. The area is however, of some hydrological significance on account of its proximity and connectivity with Lake Mzingazi, a major water resource serving the Richards Bay urban complex.

## 4. SITE EVALUATION

Five wetland environments were noted to lie within 500m of the proposed road upgrade. Four such wetland systems were identified as being traversed by the roadway, while a third system lay approximately 2050m from the roadway. The wetland systems are identified in Fig. 6 below.

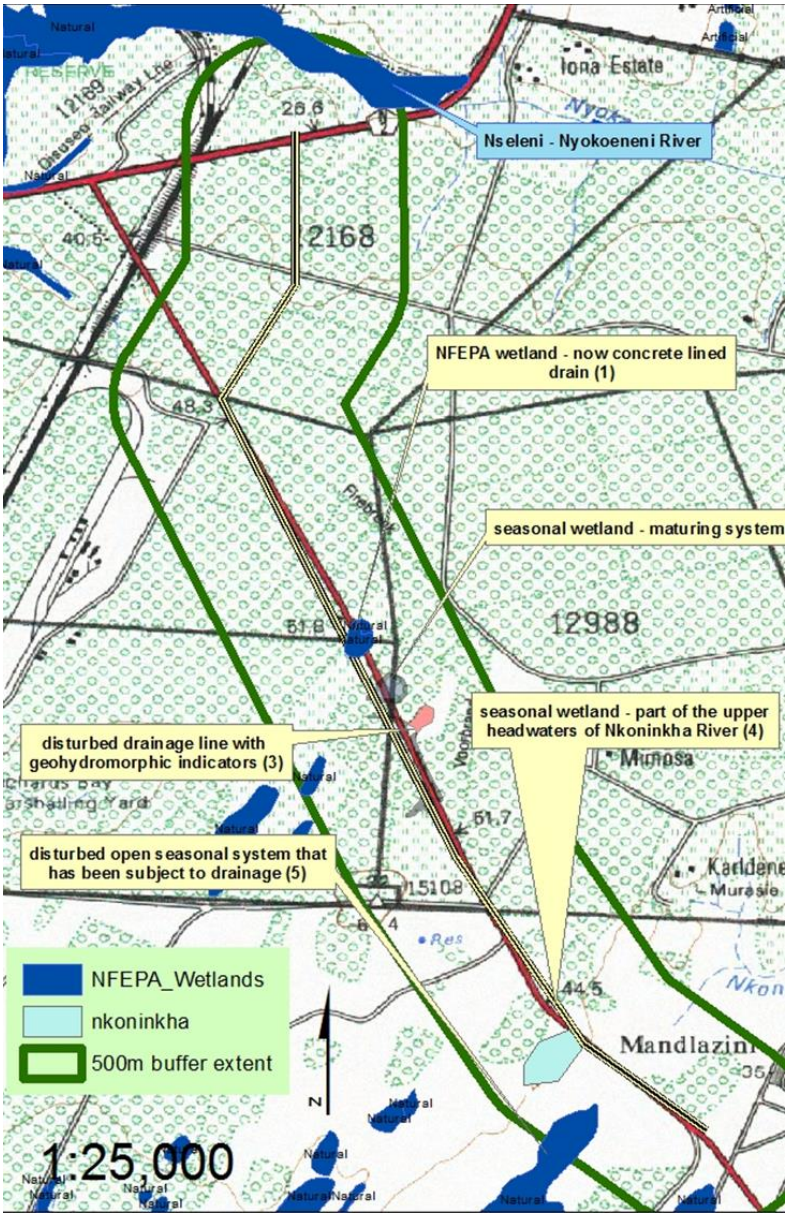



Fig. 6. Topographic map indicating aquatic and wetland systems under consideration.

The five wetlands identified in Fig. 6 comprise of

**Wetland system 1**. This wetland system identified in the NFEPA data base, is now a highly transformed drainage system that comprises of an excavated and concrete lined sluice drain that serves both the roadway and adjacent plantation. (Fig. 7)

Fig.7. Sluice drain on Wetland 1.

Given such transformation, it is evident that the sluice drains adjacent lands and directs run off in a southerly direction. No hygrophilous vegetation is noted around the drainage sluice, while geohydromorphic soils are absent from the area on account of infilling and other earthworks. It is anticipated that the former wetland system that was identified by the NFEPA evaluation was a shallow endoreic system that became inundated during high precipitation events. The high level of transformation in the region, including plantation establishment, roadworks and general infilling of the area through earthworks has served to change the structural nature of this wetland to a lined sluice, effectively removing all wetland function.

**Wetland system 2**. This wetland system lies just to the south of wetland 1. This area is a seasonal, closed endoreic system which has effectively been subject to some transformation on account of the construction of the R169, as well as, until recently the establishment of plantation, which served to lower the water table at this point (Fig. 8)

Fig.8. Image of wetland system 2. Note stumps indicating presence of commercial timber on site.

This wetland system comprises primarily of mesic grasses (*Eragrostis curvula*, *Melinis repens* and *Digitaria eriantha*), as well as forbs which include *Helichrysum cymosum* , *Crotalaria lanceolata*, and Argyrolobium sp. The presence of *Centella asiatica* and *Cyperus rupestris*, as well as the general morphology of the area, is indicative of the fact that this shallow depression is subject to minor inundation during high rainfall events. As indicated above, and evident from Fig. 8, the former plantation on this site has significantly altered wetland function at this point.

**Wetland system 3**. Approximately 150m south of wetland 2 lies a transformed endoreic system that has been subject to excavation and the establishment of a drainage channel. This drainage channel, unlike wetland system 1, has not been lined and effectively reflects a deeply incised seasonal stream that is driven by the excavation and exposure of the deeper clay soils associated with the water table. Hygrophillous species common to site include, *Persicaria senegalensis*, *Fimbristylis complanata*, *Mariscus solidus* and the exotic *Colocasia esculenta*. The most dominant herb within the drainage system is *Commelina erecta*, a facultative wetland liane. The area is tended to a "park like" state, with larger woody species including *Acacia karoo*, *Acacia xanthophloea* and *Acacia sieberiana*.

Surface water was evident in the drainage system at the time of inspection, however no flow was evident. It is likely that this particular drainage system was a low lying endoreic pan that has been subject to excavation in order to facilitate drainage away from the nearby Aquadene housing development. Much of the drainage system lies between the road and the housing development and is testimony to the poor drainage that is inherent within this area.

Fig. 9. Image of wetland system 2 near road culvert.

**Wetland system 4**. This wetland lies on the western side of the R619, opposite Via Fibrosa interchange. This particular wetland system has been subject to extensive transformation, including the establishment of a large electrical substation complex as well as apparent ongoing excavation and disturbance. (Fig 10).

Fig. 10. Image of wetland system 4, with substation in background.

This wetland system was, prior to the construction of the R619 and the urban settlement of Aquadene, part of the upper catchment of the Nkoninkha River, which feeds into the Mzingazi lake. Urban development has however severed surface linkage between these two systems.

**Wetland system 5**. This wetland system comprises of a wide, level expanse of graminoid dominated endoreic depression which has been subject to extensive drainage in order to establish commercial / industrial development and prevent possible inundation of waters during high rainfall periods. (Fig. 11).

Fig. 11. View across wetland system 5. Note excavated drain in foreground.

The wetland system drainage pattern is in a westerly direction with the main excavated channel lying in or proximal, to the subsurface water table. The wetland is generally seasonal in nature, with only occasional facultative wetland species being present, however larger woody species, comprising primarily of *Syzigium cordatum* and *Acacia karoo* dominate across the system.

This system lies some 250m south west of the subject area and as such, is unlikely to be affected by the expansion of the R619.

## 4.1 Wetland Functionality

The Wet-Eco-services assessment method identifying and ranking the environmental services provided by the various HGM units, was applied to wetlands 2, 3 and 4. This method is defined in Kotze et al (2007). It should however be noted that these methods, although generally accepted by the authorities as a rapid means of evaluating the state of wetland systems, are dubious in terms of scientific rigour. The results of these functionality assessments are indicated below

Wetland system 2

This system was considered to show the highest level of ecological services, this being related primarily to sediment trapping and nitrate - toxicant removal, however most other identified services are limited (Fig. 12). The highly transformed nature of the system and the generally low score of 1.35 identifies this system as having an intermediate level of function of the three systems evaluated.

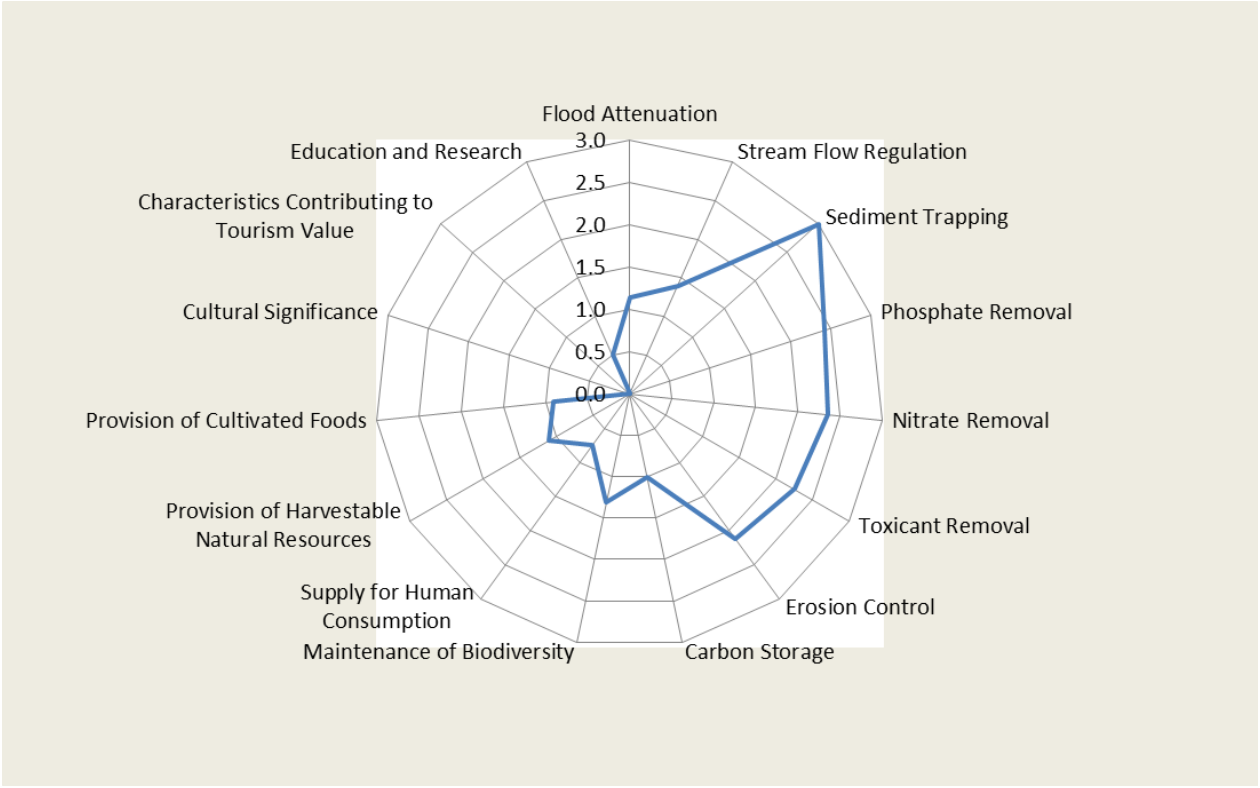



Fig. 12. Graph indicating functional score across eco-service suite for Wetland 1

Wetland system 3.

This highly disturbed system, which is tenuously linked with wetland 4 through the establishment of a stormwater drain shows a "moderately low" functional state. As per wetland 2, the removal of

nitrates and other chemical species from inundating waters is the primary driver of this increased state of function. Some flood attenuation function, on account of the engineered aspects applied to this system, are also offered by this wetland. It is suggested that this score is higher than should be applied to such system, particularly if the ongoing management of the drainage system is considered.

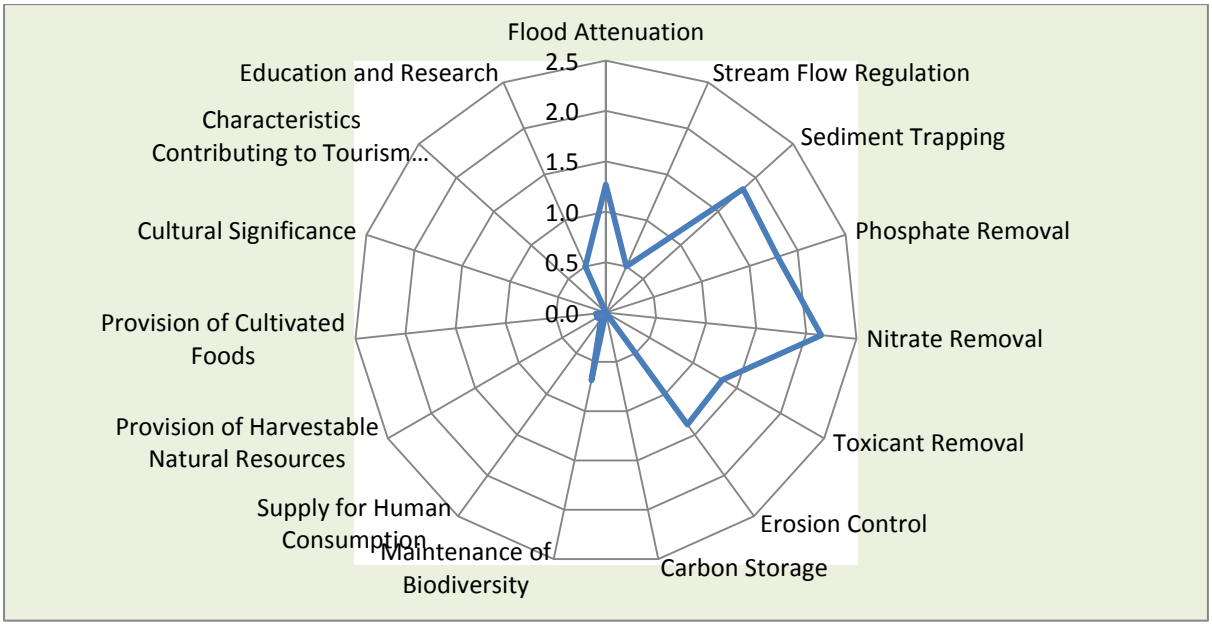



Fig 13 Graph indicating functional score across eco-service suite for Wetland 3.

Wetland system 4

Wetland system 4, is a relic valley head associated with the Nkoninga River, but on account of the construction of Aquadene residential area, drainage from this system has been diverted into wetland 3, discussed above. Fig. 14 below, shows the relationship between these two systems and the interlinking drainage channel established adjacent to the R 619.

The wetland functionality status of wetland 4 identifies a *moderately low* functional system, with toxicant removal and erosion control being considered the highest scoring service categories in this wetland. The wetland is however, subject to ongoing disturbance, on account of the continued infilling and dumping of material. In addition the establishment of infrastructure and services in this area, have served to reduce the extent of the wetland system. It is suggested that the ecological and environmental services offered by this wetland are over-emphasised in this evaluation method

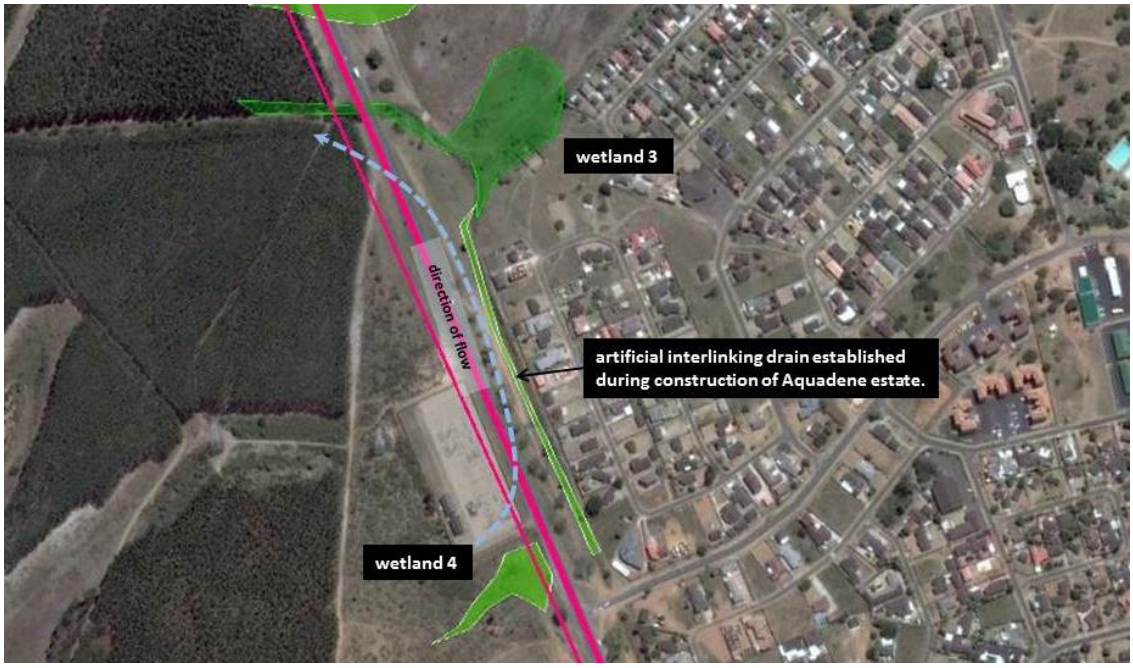



Fig. 14 Image indicating artificial linkage between wetlands 3 and 4.

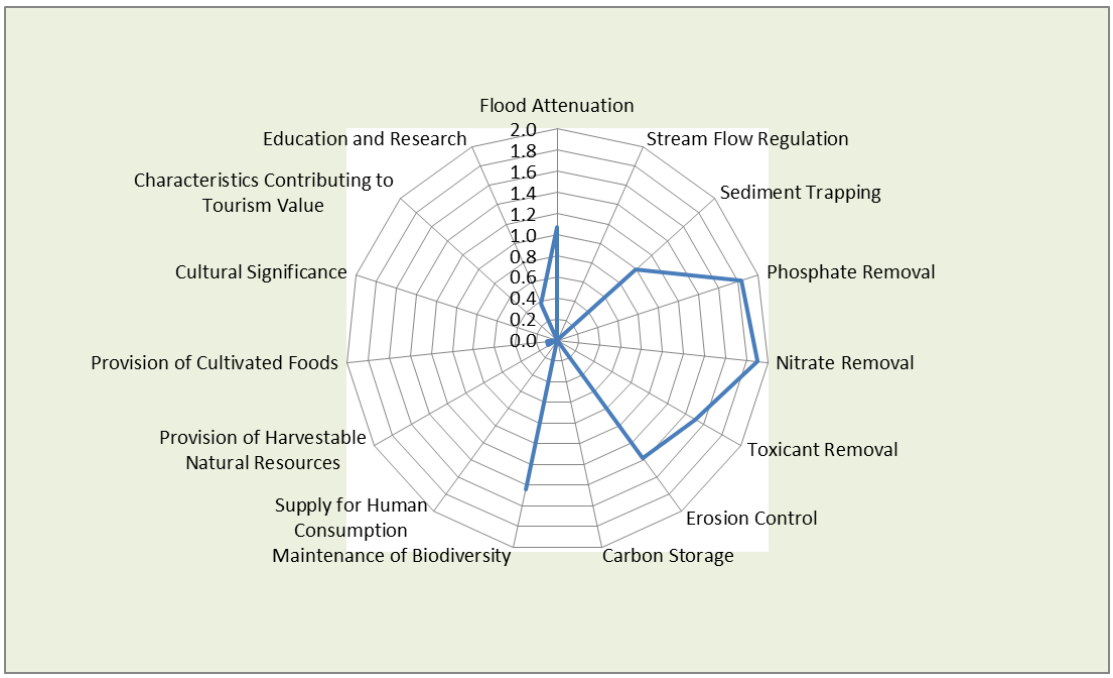



Fig. 15. Graph indicating functional score across eco-service suite for Wetland 3

From the above, it is evident that the wetland systems directly affected by the proposed road upgrade are limited, having been subject to significant and temporally regular disturbance and change. The nature of the Aquadene area, whereby high rainfall events are generally common occurrence, the water table lies proximal to natural ground level and the generally level nature of the area gives rise to

a necessity to alter and improve drainage if infrastructure is to be established in this area. In turn, such drainage serves to reduce and alter the functional state of wetlands.

## 5. CONCLUSION

From the above the following summary of bio physical and geophysical data is provided:

1. The proposed upgrade route along the R619, indicates that the project area will intersect with four wetland systems. One such system has been transformed into a concrete sluice to facilitate drainage, while the three remaining systems have been subject to varying levels of disturbance and transformation.

2. The Nseleni / Nyokoneni River to the north of the site is considered to not interface with the project area in any manner on account of topography and other factors.

3. A further wetland system, lies to the south of the project area and has been subject to significant drainage and transformation.

4. The wetland systems identified along the proposed route of the R619, that is subject to upgrade and expansion, are primarily closed, endoreic systems that have been transformed to effect improved drainage. The most functional system (wetland 2) is a relatively intact depression, that shows limited emergence of early seral species, following the cessation of silviculture practices on site.

5. Wetlands 3 and 4 have been subject to excavation and ongoing maintenance and effectively act as drainage canals for infrastructure in and around the Aquadene area. These systems both score a "*moderately low*" functional state.

6. Given the above, it is evident that some management of the roadway upgrade must be applied to site, particularly around wetland and general drainage systems. The placement of camps and mobile asphalt plants at site should take consideration of the presence of these various landscape components and take a risk averse approach to the operations of these facilities. Annexure B proposes some rehabilitation methods for implementation following the upgrade of the roadway.

Table 2 below summarises the impacts of the proposed upgrade on wetland and aquatic habitats.

Table 2. Table indicating qualitative forecast of impact significance for R619 upgrade project

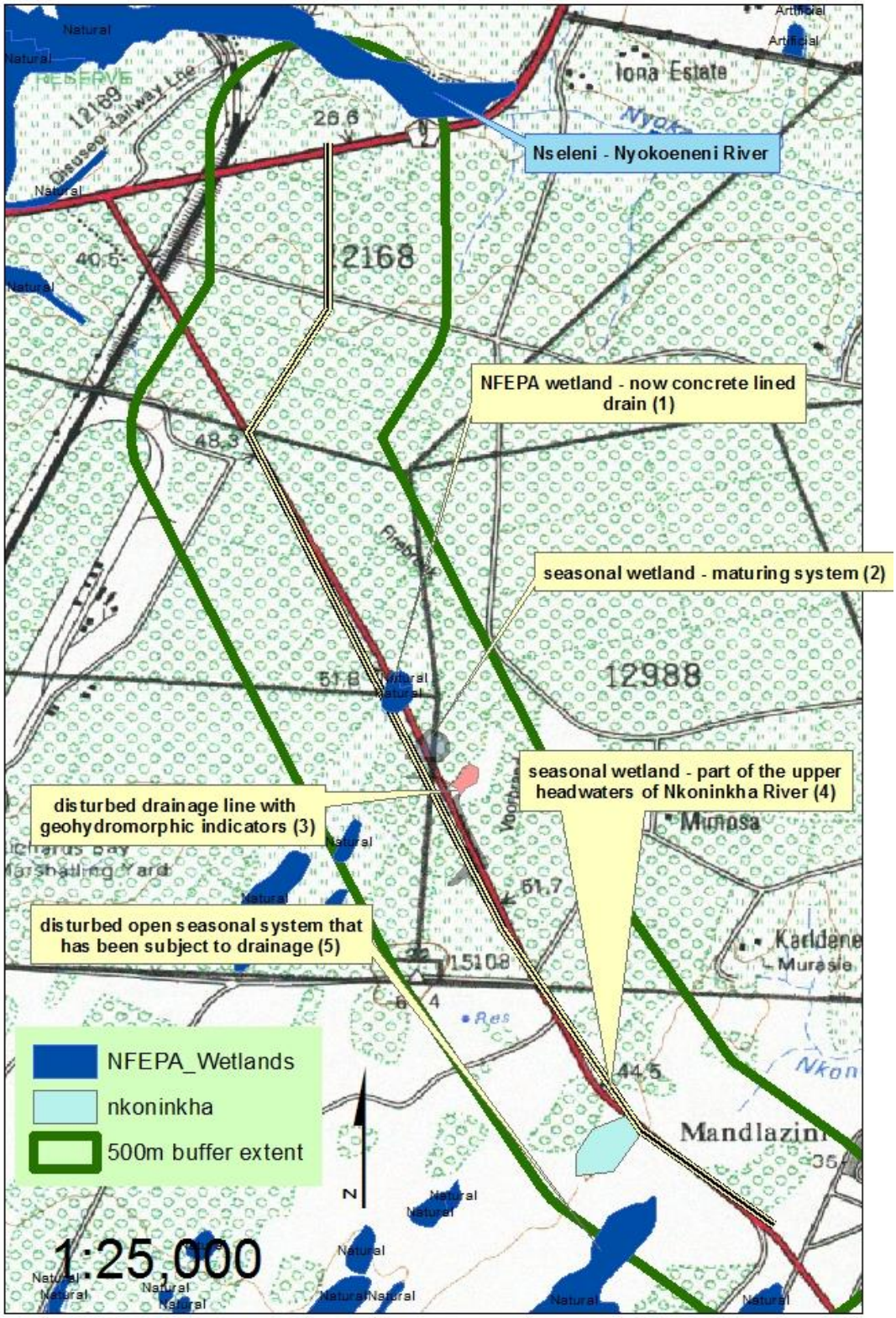
| **R619 : Aquadene Road Upgrade – Ecological impacts and mitigation** | | | | | |
|---|---|---|---|---|---|
| **Spatial extent** | **Duration** | **Probability** | **Significance** | **Status** | **Confidence** |
| Local | Long term | Probable | Low | Low | High |
| **Comment:**<br>**The proposed upgrade of the R619 near Aquadene, Richards Bay, a project with a linear extent of approximately 6 kms will affect primarily existing transformed lands presently under silviculture and urban settlement. The route will traverse 4 identified wetland systems including a concrete sluice. It is proposed that minimal impact will arise on the existing wetland systems on account of :**<br>• The highly transformed nature of the systems.<br>• The ongoing maintenance of these systems as drainage channels for the area.<br>• The limited expansion of the roadway.<br>It is proposed that the following management considerations be applied during the project:<br>• Suitable sculpting and reinstatement of affected points around wetland systems should be undertaken immediately after construction. The management of flow, stabilization of embankments and other factors should be taken into account.<br>• Exotic weed control should be practiced along the roadway following construction/upgrade. | | | | | |
| **Assessment status after all mitigation measures are applied** | | | | | |
| **Spatial extent** | **Duration** | **Probability** | **Significance** | **Status** | **Confidence** |
| Local | Long term | Probable | Low | Low | High |

**References (cited and uncited)**

Diederichs N A Markewicz ; M Mander, A Martens, SZ Ngubane (2007) "eThekweni Catchments : A Strategic Tool for Planning" eThekweni Municipality and USAID

L. Mucina and M Rutherford (2006). "*The Vegetation of South Africa, Swaziland and Lesotho*". Strelitzia

www.dwaf/WARS/systems.html DWAF Quaternary Listing 2013.2


Nseleni - Nyokoeneni River
NFEPA wetland - now concrete lined drain (1)
seasonal wetland - maturing system (2)
seasonal wetland - part of the upper headwaters of Nkoninkha River (4)
disturbed drainage line with geohydromorphic indicators (3)
disturbed open seasonal system that has been subject to drainage (5)
Iona Estate
Mandlazini
Karldene
Murasie
Richards Bay Marshalling Yard
NFEPA_Wetlands
nkoninkha
500m buffer extent
N
1:25,000

## REHABILITATION PROGRAMME FOR THE R619, AQUADENE

**Annexure B**

| | Action | Description | Rate (if applicable) | Timing | Legal issues | Biodiversity issues |
|---|---|---|---|---|---|---|
| 1 | **Review surface state** | | | Upon completion | | |
| 2 | **Contour and sculpt to mimic prevailing landform** | Using plant (TLB) area to be sculpted to appropriate level to align with prevailing land form. No stockpiles to remain and large stony material to be removed | | 1 - 2 days after infill of trench | | |
| 3 | **Establish silt traps and geo fabric on slopes >8 °** | | | 1 -2 days after infill of trench | Control of surface erosion under CARA and NEMA required, while National Water Act stipulates that surface erosion must be controlled | |
| 4 | **Remove exotic weed established on site** | Glyphosphate or Triclopyr herbicide applied by hand | R2500/ha | 1 - 2 days after infill of trench | | |
| 5 | **Confirm nature of site with land owner for hand over** | Landowner may wish to re-establish / cane or timber | | Prior to project commencement | Written agreement with landowner as to final state of land must be confirmed prior to handing site back to landowner. Farmer should be compensated for crop loss PRIOR to commencement of project | |
| 6 | **Till or scarify to tolerance of 100 to 150mm** | | | within 7 days of infill of trench | | |
| 7 | **Apply turf 300mm width across slopes >18 °** | | | | | |
| 8 | **Apply seed mix Cynodon dactylon / Chloris gayana / Eragrostic curvula** | Alternative mix may be considered (Digitaria eriantha, depending upon final state of affected portion of route | | within 7 days of infill of trench | | Possible reapplication of grasses arising from adjacent lands where applicable. |
| 9 | **Apply organic based fertilizer at identified rate 2:3:2.** | | rate to be confirmed | | | |
| 10 | **Compact soils** | Using hand stamp | | | | |
| 11 | **General irrigation using "bakkie sakkie"** | General irrigation at set down of seed. | | | | |
| 12 | **Follow up irrigation within 3 days of seeding** | | | | | |
| 13 | **Follow up herbicide application by hand approximately 21 days after germination of seed** | Spot spray any emergent weeds within rehabilitated area | | | | |

# Declaration

I Simon C Bundy (ID No 6609097 5257 081), declare that I have no vested interest in the proposed development of the R 619 road upgrade.

I am a registered ecologist with the South African Council of Natural Scientific Professionals (No.400093/06) with 25 years experience. A curriculum vitae is attached below

**CURRICULUM VITAE**

**SIMON COLIN. BUNDY**

**NAME OF FIRM : Sustainable Development Projects cc**

**NAME OF STAFF** Simon Colin Bundy

**PROFESSION** Ecologist / Environmental Assessment Practitioner

**DATE OF BIRTH** 7 September 1966

**PLACE OF BIRTH** Glasgow, Scotland

**NATIONALITY** South African / British

**MEMBERSHIP OF PROFESSIONAL BODIES** : South African Council of Natural Scientific Professionals No. 400093/06 – Professional Ecologist

## KEY QUALIFICATIONS

Simon Bundy has been involved in environmental and development projects and programmes since 1991 at provincial, national and international level, with employment in the municipal, NGO and private sectors, providing a broad overview and understanding of the function of these sectors.

With a core competency in coastal ecology and coastal management, Bundy has worked on coastal projects in the Seychelles and Tanzania providing ecological and general environmental advice and support. Within South Africa , Bundy has been involved in a number of large coastal projects including residential estates, infrastructure and linear developments in KwaZulu Natal, Eastern Cape and Western Cape. In such projects Bundy has provided both technical ecological support, as well as the undertaking of environmental impact assessments.

Allied to the above, Bundy has provided technical assistance to the "Save the Wild Coast" initiative through a technical report outlining the concerns relating to dune mining in and around the Xolobeni prospecting region while also evaluating critically, a number of environmental impact assessments and technical reports for various clients. Such evaluations have included "sea defence structures at Buffalo Bay, Western Cape", through the Nelson Mandela University. Bundy has also assisted iSimangaliso Wetland Park in its initiatives against unlawful developments in the Bangha Nek region. Bundy has also acted as expert witness on ecological issues on a number of legal cases.

From a technical specialist perspective, Bundy is competent in a large number of ecological methodologies and analytical methods including statistical methods ; multivariate analysis and canonical analysis. Bundy is competent in wetland delineation and has formulated ecological coastal set back methodologies for EKZN Wildlife and the Oceanographic Research Institute. Bundy acts as botanical specialist for Eskom Eastern Region, with specific interest in coastal habitat forms.

## EDUCATION

Matriculation : DHS 1986

BSc Biological Science (1990) University of Natal

Diploma Project Management (1997) Executive Education

MSc (2004) University of KwaZulu Natal

1998 : Guest of Konrad Adenhauer Foundation to Berlin to consider "sustainable development initiatives" in Europe

2000 : Training course : "Environmental Economics and Development". University of Colorado (Boulder) USA.

**SELECTED RELEVANT PROJECT EXPERIENCE**

**Task Team Chair and Project Ecologist : Task Team for Coastal Disaster Management, KwaDukuza 2007 - 2011**

Management of coastal clean up programme immediately following March storm event of 2007. Activities included introduction of geofabric bag protection options, coastal retreat implementation and development of policy on coastal management following destruction of coastline.

**Ecological Review of Lake Mzingazi for Umhlatuze Water : University of kwaZulu Natal – (2010)**

Review of habitat structure and integrity of Mzingazi Lake System at Richards Bay required to interpret transformation of aquatic system over time and evaluate forecast for future reference.

**Ecological Review of Lake Mzingazi for Umhlatuze Water : CSIR – (2013)**

Review of water quality and habitat structure and integrity of Mzingazi Lake System as expansion of existing knowledge base at uMhlatuze Water

**Project Leader and Coastal Specialist : Addington Farm Strategic Environmental Assessment (2010)**

Strategic assessment in and around the Addington Farm / KwaDukuza region relating to development in sensitive coastal and estuarine environments including the Seteni and Umvoti River estuaries.

**Ecologist and Environmental Specialist : Dukuduku Resettlement Programme (2008 - date)**

As environmental consultant to this COGTA led initiative, the project has entailed understanding the ecological function of various components of the Dukuduku forest and identifying an ecologically defendable boundary line between the iSimangaliso Park and the proposed Dukuduku development area. Other components of project have included defining "development regions", providing ecological and general environmental guidance and liaising with various government departments.

**Terrestrial and Coastal Ecologist : Environmental management and ecological component - Port of Richards Bay Expansion (2010)**

Investigation and due diligence report into the requirement for "off set" and "connectivity" following the proposed expansion of the Port of Richards Bay for Transnet. Project entailed identification and evaluation of various estuarine and coastal components and recommendations on the opportunity to offset, mitigate and avoid destruction under a port expansion scenario.

**Ecological Services for Emnambithi Open Space System review – Emnambithi Municipality(2010)**

Review and identification of ecological components within the Emnambithi Municipal area in order to establish an open space management system within the Municipal area.

**Ecological and Dune retreat investigation of the Sodwana Bay Node Isimangaliso Wetland Park Authority (2013)**

Specialist investigation into the retreat of frontal and secondary dune forms at the Sodwana Beach node, calculating retreat and progradation over a 60 year timeframe and provision of management recommendations on redevelopment of node.

**PUBLICATIONS**

**Bundy S C and Smith A M 2009** *" Analysis of the Recovery of Two Separate Coastal Dune Systems Following the 2006 – 2007 Marine Erosion Event and Assessment of the Artificial Dune System in Coastal Management*" KZN Marine and Coastal Management Symposium, Durban South Africa.

**Bundy S C , Smith AM, Mather AA** 2010" Dune retreat and stability on the Northern Amanzimtoti Dune Cordon" EKZN Wildlife Conservation Symposium 2010

**Smith, A Mather AM Bundy SC, Cooper AS Guastella L, Ramsay PJ and Theron A ; 2010** "*Contrasting styles of swell-driven coastal erosion: examples from KwaZulu-Natal, South Africa*" Geology Journal", Cambridge University Press

**Smith, AM, L Guastella , SC Bundy and AA Mather 2007**"*Coastal Storm Damage in the March 2007 Storm* SA Journal of Science 2007 "A Synopsis of Recent Storm Events"

**Guastella L, Smith A Mather A and Bundy S** 2008 "*As Memories Fade - A Review of the Post 2007 Coastal Erosion Events"* African Wildlife 32 / 2008

**Smith A, Mather A, Theron A, Bundy S and Guastella L** 2008 **"***The 2006-2007 KwaZulu – Natal Coastal Erosion Event in Perspective*" 2009 Contribution to the The South African Environmental Observation Network publication " Climate Change in Southern Africa"

**Smith A and Bundy S 2009** "*Coastal erosion: reparative work on the Ballito coastline, KwaZulu-Natal, South Africa, was it enough?*" 2009 International Multi Purpose Reef and Coastal Conference, Jeffrey's Bay South Africa.

**Smith AM, SC Bundy 2012** "Review of Coastal Defence Systems in Southern Africa" Article for Springer Scientific Publications through Ulster University, Pilkey and Cooper

**Bundy SC AM Smith, L Guastella 2012** "*A Review of Select Dune Rehabilitation Initiatives and a Proposed Methodology towards Ensuring a Prudent Approach towards the "Greening of Dunes*" VI International Sandy Beaches Symposium Emphakweni Port Alfred

Various popular articles including documentaries on coastal and climate change issues