FRESHWATER ECOLOGICAL ASSESSMENT AS PART OF THE ENVIRONMENTAL ASSESSMENT AND AUTHORISATION PROCESS FOR THE PROPOSED ESKOM DENOVA 132kV POWERLINE AND SUBSTATION, KRAAIFONTEIN, WESTERN CAPE PROVINCE

Prepared for

SRK CONSULTING

October 2014

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Report Reference:	**SAS 214260**
Date:	**October 2014**

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EXECUTIVE SUMMARY

Scientific Aquatic Services (SAS) was appointed to conduct a freshwater ecological assessment as part of the environmental assessment and authorisation process for the proposed Eskom Denova powerline and substation. Two alternatives have been proposed and will be hereafter referred to as Alternative A and Alternative B (preferred route by Eskom). The proposed development of these two alternatives, hereafter collectively referred to as the "project footprint", is located approximately 2km east of Bloekombos and approximately 380m north west of De Novo.

The proposed development will involve the construction of a double-circuit 132 kV powerline, of approximately 1.75 km in length in a servitude which will be 31 m wide, to connect the proposed new Denova Substation to the existing Muldersvlei–Stikland 132kV line. The new Denova Substation will be fenced with steel palisade fencing, have a footprint of 1 ha and will have a Low Level Tubular Busbar design.

DESKTOP ASSESSMENT

The following general conclusions were drawn on completion of the desktop assessment:

- According to the Drakenstein- Stellenbosch Fine Scale Map the south eastern portion of Alternative B and the western portion of Alternative A intersect an Aquatic Ecological Support Area (ESA). It is recommended by the Fine Scale Plan that these areas be maintained in a natural to near natural state;
- According to the National Freshwater Ecosystem Priority Area (NFEPA, 2011) database:
    - The sub Water Management Area (subWMA) is not regarded as important in terms of fish translocation, relocation, sanctuaries rehabilitation or corridors;
    - The perennial Bottelary River is intersected by Alternative A and Alternative B. The feature is considered to be in Class D (largely modified) ecological condition;
    - Twenty wetlands indicated by NFEPA (2011) will fall within 500m of Alternative A and Alternative B, all of which are indicated to be artificial and in Z3 condition (critically modified);
    - None of the wetlands within 500m are considered important in terms of wetland faunal conservation; and
    - The Wetland Vegetation Types indicated for the wetland features associated with the project footprint are the Southwest Sand Fynbos and West Coast Shale Renosterveld (both critically endangered).

WETLAND ASSESSMENT

The following general conclusions were drawn on completion of the wetland assessment:

- Upon investigation of the topographical sequencing of the area, the portion of the Bottelary River within the vicinity of the project footprint was identified as an unchannelled valley bottom wetland and was assessed accordingly;
- Both alternatives intercept the same unchannelled valley bottom at different locations;
- Alternative A passes within 100m of 7 isolated natural depressions and 2 artificial depressions. The 7 isolated natural depressions most likely formed part of the larger unchannelled valley bottom wetland, however have been isolated as a result of significant vegetation and landscape transformation as a result of past agriculture, road and residential development. Due to their possible historical connection, the isolated natural depressions were assessed as part of the unchannelled valley bottom wetland and not as separate Hydrogeomorphic (HGM) units;
- Alternative B passes within 100m of 2 artificial depressions and within 120m of 1 artificial depression;
- Two artificially created stormwater drainage canals are located within 50m of both alternatives, wetland conditions were identified within the stormwater canal near Alternative B, most likely due to its close vicinity to the R101 road that resulted in greater water volumes reaching the canal. No wetland conditions were identified within the stormwater canal near Alternative A;
- Overall, the HGM units assessed in this report include the following:
    - In the vicinity of Alternative A: an unchannelled valley bottom wetland and artificial depressions;
    - In the vicinity of Alternative B: an unchannelled valley bottom wetland and artificial depressions;
- The function and service provision was calculated for the HGM units encountered within the vicinity of Alternative A and Alternative B. From the results of the assessment it is evident that:

- In the vicinity of Alternative A: The unchannelled valley bottom wetland has a moderately low level of ecological function and service provision mainly as a result of hydrological and geomorphological modifications;
- In the vicinity of Alternative B: The unchannelled valley bottom wetland has an intermediate level of ecological function and service provision mainly as a result of a loss in a diverse assemblage of wetland vegetation and change of the natural hydrological regime; and
- The artificial depressions have a moderately low level of ecological function and service provision due to the features being located in an area surrounded by crop cultivation and tilled land.

- Ecological Importance and Sensitivity (EIS) was calculated for each HGM unit. From the results it is evident that:
  - In the vicinity of Alternative A and Alternative B: The unchannelled valley bottom wetland has an EIS that falls within Category C[1] (moderate sensitivity); and
  - The artificial depressions have an EIS that falls within Category D[2] (low sensitivity).
- The Present Ecological State (PES) of the unchannelled valley bottom wetland within the vicinity of Alternative A and Alternative B was determined separately using the WET-health methodology. The overall score calculated for both falls within Category D: A large change in ecosystem processes and loss of natural habitat and biota and has occurred;
- It was not possible to determine the PES of the artificial depressions using WET-Health, because the methodology requires a reference state and there are no natural reference states to use as a baseline for an assessment of an artificially created feature;
- Due to the significance of impacts already present within the unchannelled valley bottom wetland and due to the disturbance and transformation of the surrounding catchment area, it is doubtful that the PES can be significantly increased. However, it is deemed important that the PES category be maintained and that additional disturbance due to the proposed 132kV powerline and substation construction be prevented; and
- If all the results obtained within the previous bullets are considered the following can be concluded for the different HGM units:
  - The unchannelled valley bottom wetland within the vicinity of Alternative B can be considered important in terms of wetland conservation. It is deemed necessary that a 32m buffer zone be demarcated in which only essential activities be allowed in order to prevent additional disturbance;
  - The unchannelled valley bottom wetland within the vicinity of Alternative A can be considered to provide fewer functions and ecoservices than within the vicinity of Alternative B due to its significant hydrological modification. Therefore a smaller, 20m buffer zone is to be demarcated in which only essential activities be allowed in order to prevent additional disturbance; and
  - A smaller 10m buffer zone is advocated to the artificial depressions and development activities within the buffer zone should not be allowed in order to prevent impacts from edge effects.

The tables below serve to summarise the significance of perceived impacts with and without the implementation of mitigation measures on the wetland biodiversity associated with Alternative A and Alternative B.

Table A: Summary of impact assessment results for Alternative A

Impact	*Consequence*	*Probability*	*Significance*	*Status*	*Confidence*
IMPACT 1: LOSS OF WETLAND HABITAT AND ECOLOGICAL STRUCTURE ASSOCIATED WITH ALTERNATIVE A					
Construction Phase					
Prior to mitigation	Very Low	Probable	**VERY LOW**	–ve	High
With Mitigation	Very Low	Improbable	**INSIGNICANT**	–ve	High
Operational Phase					

[1] Wetlands/rivers that are considered to be ecologically important and sensitive on a provincial or local scale. The biodiversity of these wetlands is not usually sensitive to flow and habitat modifications.

[2] Wetlands that are not ecologically important and sensitive at any scale. The biodiversity of these wetlands is ubiquitous and not sensitive to flow and habitat modifications.

Prior to mitigation	Very Low	Possible	**INSIGNIFICANT**	–ve	High
With Mitigation	Very Low	Improbable	**INSIGNIFICANT**	–ve	High

Table B: Summary of impact assessment results Alternative B

Impact	***Consequence***	***Probability***	***Significance***	***Status***	***Confidence***
IMPACT 1: LOSS OF WETLAND HABITAT AND ECOLOGICAL STRUCTURE ASSOCIATED WITH ALTERNATIVE A					
Construction Phase					
Prior to mitigation	Low	Definite	**LOW**	–ve	High
With Mitigation	Very Low	Definite	**VERY LOW**	–ve	High
Operational Phase					
Prior to mitigation	Very Low	Probable	**VERY LOW**	–ve	High
With Mitigation	Very Low	Possible	**INSIGNIFICANT**	–ve	High

From the results of the impact assessment it is evident that:

- Alternative A intersects with a portion of the unchannelled valley bottom wetland that is significantly transformed in terms of hydrological modification and has a moderately low ecoservice function and service provision. Therefore construction is likely to have a very low impact if unmanaged. The probability of the impact can be decreased to an insignificant level with adequate planning and management; and
- Alternative B intersects with a portion of the unchannelled valley bottom wetland that has an intermediate ecoservice and function provision with a moderate sensitivity and therefore construction is likely to have a low impact if unmanaged. This impact can be decreased to a very low impact with adequate planning and management.

Out of a wetland ecological point of view Alternative A is considered the most favourable, provided that the management and monitoring recommendations as provided in the impact assessment of this report are strictly adhered to and integrated into the Environmental Management Plan for the proposed development.

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GLOSSARY OF TERMS

Alien Invasive vegetation	Alien invaders are plants that are of exotic origin and are invading previously pristine areas or ecological niches.
Obligate Wetland Species	Floral species that that almost always grow in wetlands (>99% occurrence).
Red Data listed species	Organisms that fall into the Extinct in the Wild, Critically Endangered, Endangered, Vulnerable categories of ecological status as listed by the International Union for Conservation of Nature (IUCN).
Species of Conservation Concern	Floral species that have a high conservation importance in terms of preserving South Africa's high floristic diversity and include not only threatened species, but also those classified in the categories Extinct in the Wild, Regionally Extinct, Near Threatened, Critically Rare, Rare, Declining and Data Deficient - Insufficient Information.
Wetland	Land which is transitional between terrestrial and aquatic systems where the water table is at or near the surface, or the land is periodically covered with shallow water, and which land in normal circumstances supports or would support vegetation typically adapted to life in saturated soils.

ACRONYMS

BGIS	Biodiversity Geographic Information Systems
CBA	Critical Biodiversity Area
DWS	Department of Water and Sanitation
EAP	Environmental Assessment Practitioners
EIA	Environmental Impact Assessment
EIS	Environmental Importance and Sensitivity
ESA	Environmental Support Area
GIS	Geographic Information System
GPS	Global Positioning System
HGM	Hydrogeomorphic Unit
NBA	National Biodiversity Assessment
NEMA	National Environmental Management Act
NFEPA	National Freshwater Ecosystem Priority Areas
NWA	National Water Act
PES	Present Ecological State
REC	Recommended Ecological Category
SANBI	South African National Biodiversity Institute
SAS	Scientific Aquatic Services
SCC	Species of Conservation Concern
Sp.	*Species*
SubWMA	Sub Water Management Area
WMA	Water Management Area
WUL	Water Use Licence

1 INTRODUCTION

1.1 Background

Scientific Aquatic Services (SAS) was appointed to conduct a freshwater ecological assessment as part of the environmental assessment and authorisation process for the proposed Eskom Denova 132kV powerline and substation. Two alternatives have been proposed and will be hereafter referred to as Alternative A and Alternative B (preferred route by Eskom) (locations depicted in figures below). The proposed development of these two alternatives, hereafter collectively referred to as the "project footprint", is located approximately 2km east of Bloekombos and approximately 380m north west of De Novo.

The proposed development will involve the construction of a double-circuit 132 kV powerline, of approximately 1.75 km in length in a servitude which will be 31 m wide, to connect the proposed new Denova Substation to the existing Muldersvlei–Stikland 132kV line. The new Denova Substation will be fenced with steel palisade fencing, have a footprint of 1 ha and will have a Low Level Tubular Busbar design.

By presenting the results, discussions and recommendations this report assesses the viability of the proposed development and should guide the proponent, Environmental Assessment Practitioners (EAPs), authorities and potential developers, as to viability of the proposed development activities from a freshwater ecological point of view.

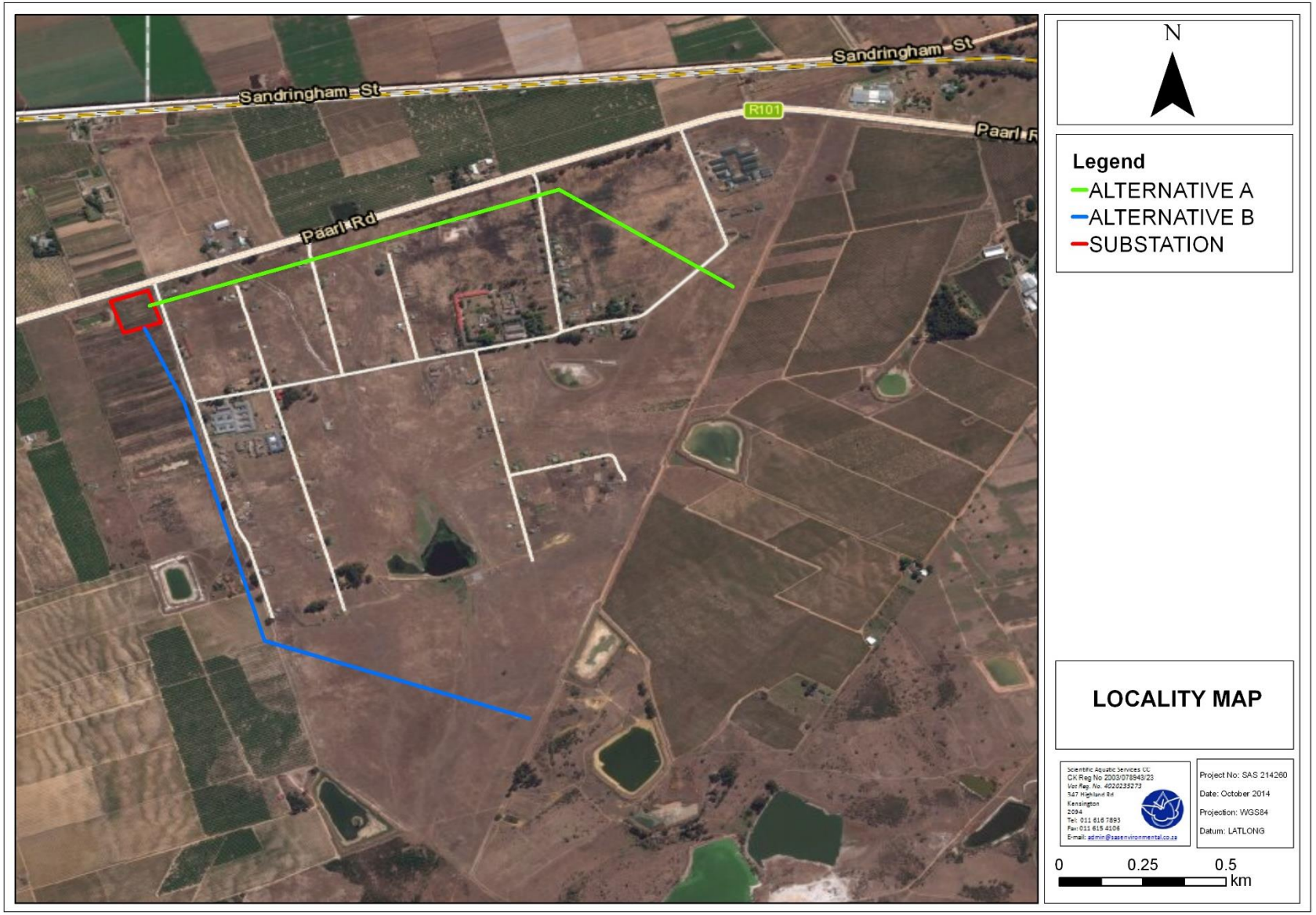

Figure 1: Locality map of Alternative A and Alternative B

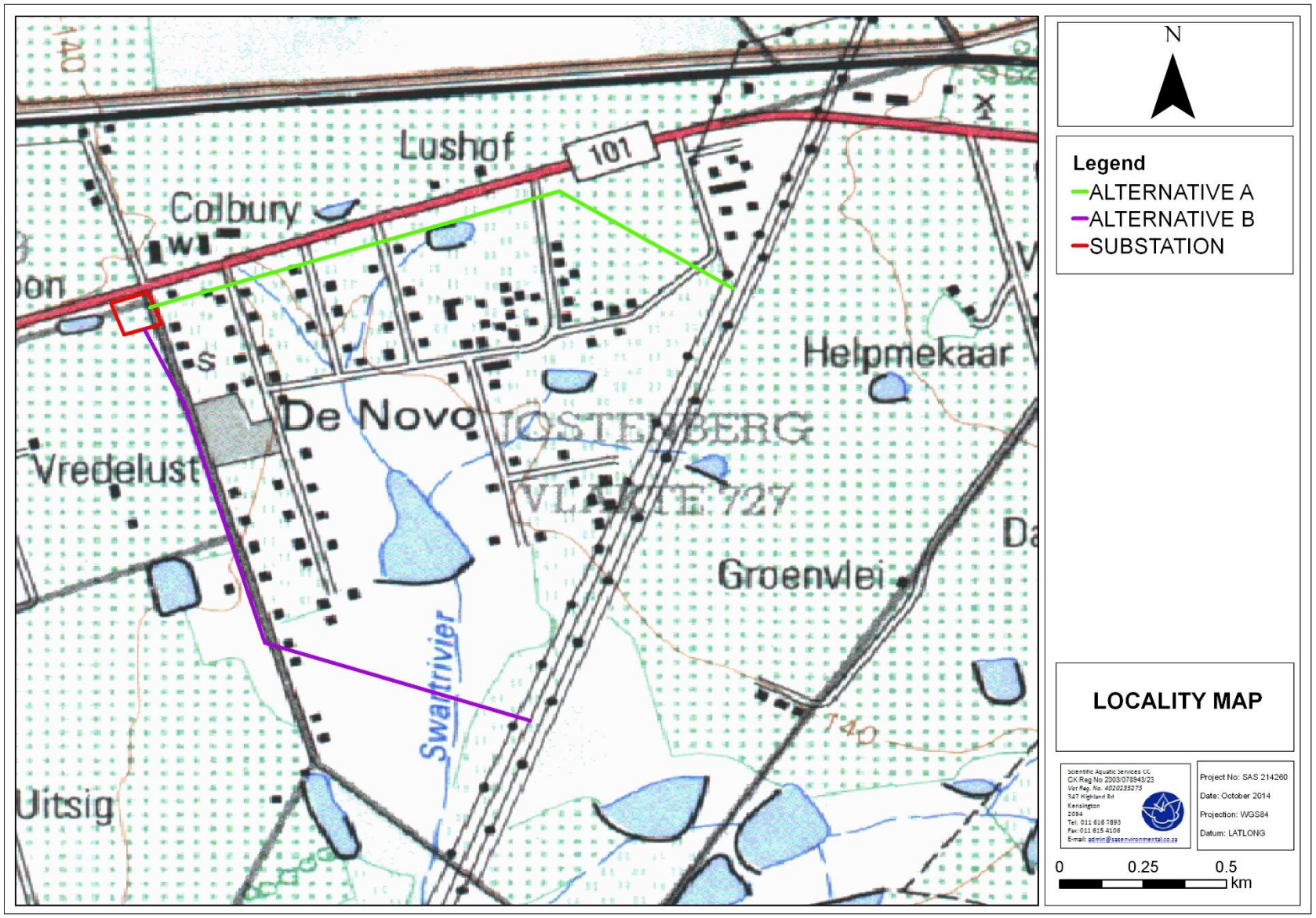

Figure 2: Location of the project footprint depicted on a 1:50 000 topographical map in relation to surrounding areas

1.2 Scope

The scope of the project includes the following:

- Assess the freshwater features of the project footprint using the following methods:
  - Classification of wetland features according the Classification System for Wetlands and other Aquatic Ecosystems in South Africa as defined by Ollis *et al*. (2013);
  - Define the wetland services provided by the resources according to the method of Kotze *et al* (2009) in which services to the ecology of the area will be defined and services to the people of the area will be defined;
  - Determine the Present Ecological State (PES) according to the WET-Health methodology for unchannelled valley bottom wetland types (Macfarlane *et al*. 2009);
  - Determine the Environmental Importance and Sensitivity (EIS) of features according to the method as adapted from Department of Water Affairs (DWA; 1999) for floodplains;
  - Advocate a Recommended Ecological Category (REC) for the wetland features based on the findings of the EIS assessment;
  - Delineate the wetland temporary zone according to DWA (2005): A practical Guideline Procedure for the Identification and Delineation of Wetlands and Riparian Zones"; and
  - Delineate buffer zones around the wetlands.
- Identify and assess the impacts of the proposed development on the freshwater biodiversity of the project footprint during the construction and operational phases of the project, using SRK's standard impact assessment methodology;
- Summarise, categorise and assess all identified impacts on freshwater ecology in appropriate Impact Assessment tables, to be incorporated in the overall basic assessment;
- Recommend practicable management measures to avoid and mitigate and/or optimise impacts;
- Compile a monitoring plan to monitor impacts, if required; and
- Assist the EAP team in responding to any comments received from stakeholders as they relate to freshwater ecology impacts.

1.3 Assumptions and Limitations

The following assumptions and limitations are applicable to this report:

- The freshwater assessment is confined to the project footprint as well as the immediate adjacent areas of relevance and does not include the neighbouring and adjacent properties. These were however considered as part of the desktop assessment;
- The assessment focused on areas in a corridor width of approximately 200m (100m either side of Alternative A and Alternative B). This would allow for fine scale adjustments of the powerline support structure positions;
- Wetlands and terrestrial areas from transitional areas where an ecotone is formed as vegetation species change from terrestrial species to facultative and obligate wetland species and soil forms change from terrestrial soil forms to wetland soil forms. Within this transition zone some variation of opinion on the wetland boundary may occur, however if the Department of Water Affairs and Forestry (DWAF 2005) method is followed, all assessors should get largely similar results. The delineation as presented in this report is not definitive and is considered to be a best estimate of the wetland boundary;
- With ecology being dynamic and complex, some aspects (some of which may be important) may have been overlooked; and
- Global Positioning System (GPS) technology is inherently inaccurate and some inaccuracies due to the use of handheld GPS instrumentation may occur. If more accurate assessments are required the wetland will need to be surveyed and pegged according to surveying principles.

Notwithstanding the limitations listed above, the level of detail undertaken in the study is considered sufficient to ensure that the results of this assessment accurately define the EIS and the PES of the project footprint and to provide the relevant planners and decision makers with sufficient information to formulate an opinion on the viability of the proposed development from an ecological conservation viewpoint.

1.4 Indemnity and Terms of use of this Report

The findings, results, observations, conclusions and recommendations given in this report are based on the author's best scientific and professional knowledge as well as available information. The report is based on survey and assessment techniques which are limited by time and budgetary constraints relevant to the type and level of investigation undertaken and SAS CC and its staff reserve the right to modify aspects of the report including the recommendations if and when new information may become available from ongoing research or further work in this field, or pertaining to this investigation.

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1.5 Legislative Requirements

National Environmental Management Act, (NEMA, Act 107 of 1998)

The guiding principles of NEMA refer specifically to biodiversity management in the following Clause:

(4) (a) *Sustainable* development requires the consideration of all relevant factors including the following:

(i) That the disturbance of ecosystems and loss of biological diversity are avoided, or, where they cannot be altogether avoided, are minimised and remedied.

- NEMA (Act 107 of 1998) and the associated Regulations (Listing No R. 544, No R. 545 and R. 546) as amended, states that prior to any development taking place within a wetland or riparian area, an environmental authorisation process needs to be followed. This could follow either the Basic Assessment process or the EIA process depending on the nature of the activity and scale of the impact.
- Listed Activities in R386 including:
  - Activity 11 - The construction of infrastructure or structures covering 50 square metres or more where such construction occurs within a watercourse or within 32 metres of a watercourse, measured from the edge of a watercourse, excluding where such construction will occur behind the development setback line.

NWA (Act 36 of 1998)

- The NWA (Act 36 of 1998) recognises that the entire ecosystem and not just the water itself in any given water resource constitutes the resource and as such needs to be conserved;
- No activity may therefore take place within a watercourse unless it is authorised by the Department of Water and Sanitation (DWS); and

- Any area within a wetland or riparian zone is therefore excluded from development unless authorisation is obtained from DWS in terms of Section 21.

2 METHOD OF ASSESSMENT

2.1 Wetland

The scope of work includes a literature review, followed by a site assessment undertaken in September and October 2014. Delineation of the wetland zones took place according to "DWA, 2005: A practical Guideline Procedure for the Identification and Delineation of Wetlands and Riparian Zones". Aspects such as soil morphological characteristics, vegetation types and wetness were used to delineate the temporary zones of the wetlands according to the guidelines. The buffer zones were then delineated around the temporary zone. The wetland classification assessment was then undertaken according to the Classification System for Wetlands and other Aquatic Ecosystems in South Africa. User Manual: Inland systems (Ollis *et al*., 2013). In addition, the PES according to WET-health for unchannelled valley bottom wetland types (Macfarlane et al. 2009), wetland ecological and socio-economic service provision (Kotze *et al.* 2009) and EIS of wetlands was determined. The method used for the EIS determination was adapted from the method as provided by DWA (1999) for floodplains. The method takes into consideration PES scores obtained for WET-Health as well as function and service provision to enable the assessor to determine the most representative EIS Category for the wetland feature or group being assessed.

A detailed explanation of the wetland method of assessment is available upon request.

3 DESKTOP RESULTS

3.1 Municipal Fine Scale Plan

The Critical Biodiversity Areas (CBA) map aims to guide sustainable development by providing a synthesis of biodiversity information to decision makers. The main CBA Map categories are CBAs (Terrestrial and Aquatic), Ecological Support Areas (ESAs; Critical and Other), Other Natural Remaining Areas and No Natural Remaining Areas. The first two mentioned categories represent the biodiversity priority areas which should be maintained in a natural to near natural state. The last two mentioned categories are not considered as priority areas and a loss of biodiversity within these areas may be acceptable. According to the Drakenstein- Stellenbosch Fine Scale Map the south eastern portion of Alternative B and the western portion of Alternative A intersect an Aquatic ESA (Figure 5).

3.2 National Freshwater Ecosystem Priority Areas (NFEPA; 2011)

The NFEPA database was consulted to define the aquatic ecology of the wetland or river systems close to or traversing the project footprint that may be of ecological importance. Aspects applicable to the project footprint and surroundings are discussed below:

- The project footprint falls within the Berg Water Management Area (WMA). Each WMA is divided into several sub-Water Management Areas (subWMA), where catchment or watershed is defined as a topographically defined area which is drained by a stream or river network. The SubWMA indicated for the project footprint is the Greater Cape Town subWMA;
- The subWMA is not regarded as important in terms of fish translocation, relocation, sanctuaries, rehabilitation or corridors;
- The perennial Bottelary River is intersected by Alternative A and Alternative B. The feature is considered to be in Class D (largely modified) ecological condition;

- Twenty wetlands indicated by NFEPA (2011) will fall within 500m of Alternative A and Alternative B, all of which are indicated to be artificial (Figure 3) and in Z3 condition (critically modified) (Figure 4);
- None of the wetlands within 500m are considered important in terms of wetland faunal conservation; and
- The Wetland Vegetation Types indicated for the wetland features associated with the project footprint are the Southwest Sand Fynbos and West Coast Shale Renosterveld (both critically endangered).

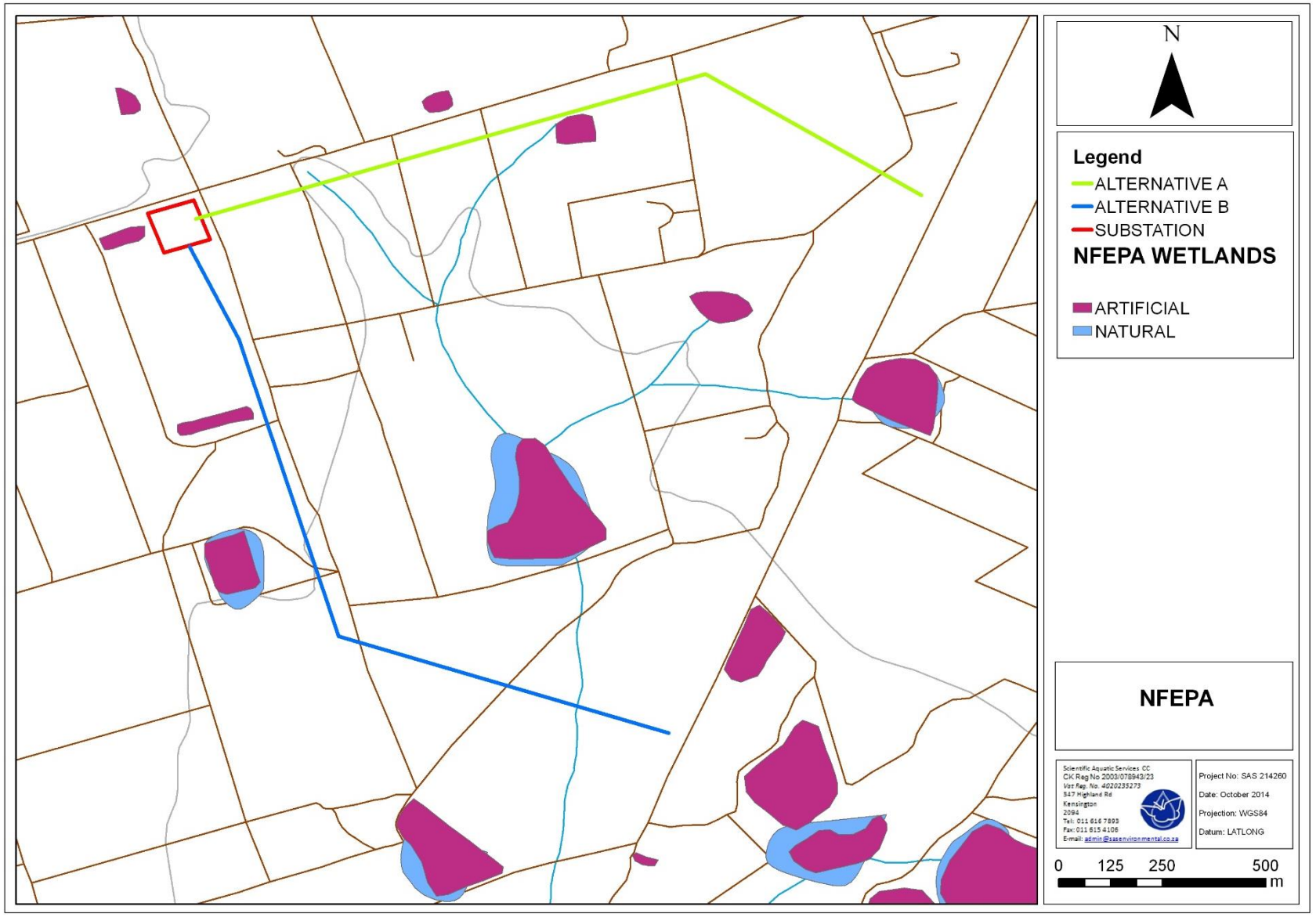

Figure 3: Natural and artificial wetlands associated with the project footprint.

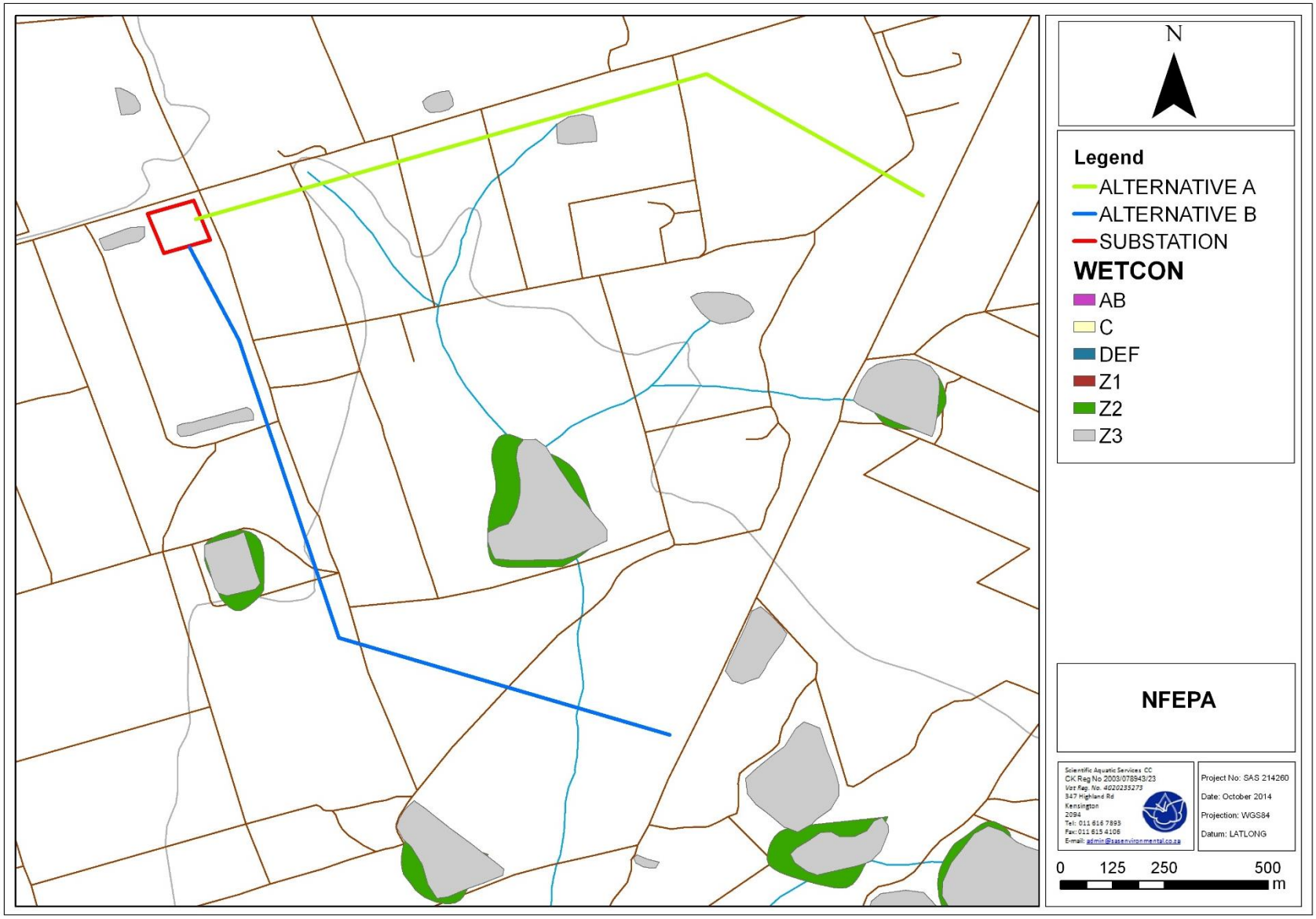

Figure 4: Wetland condition of features within the vicinity of the project footprint.

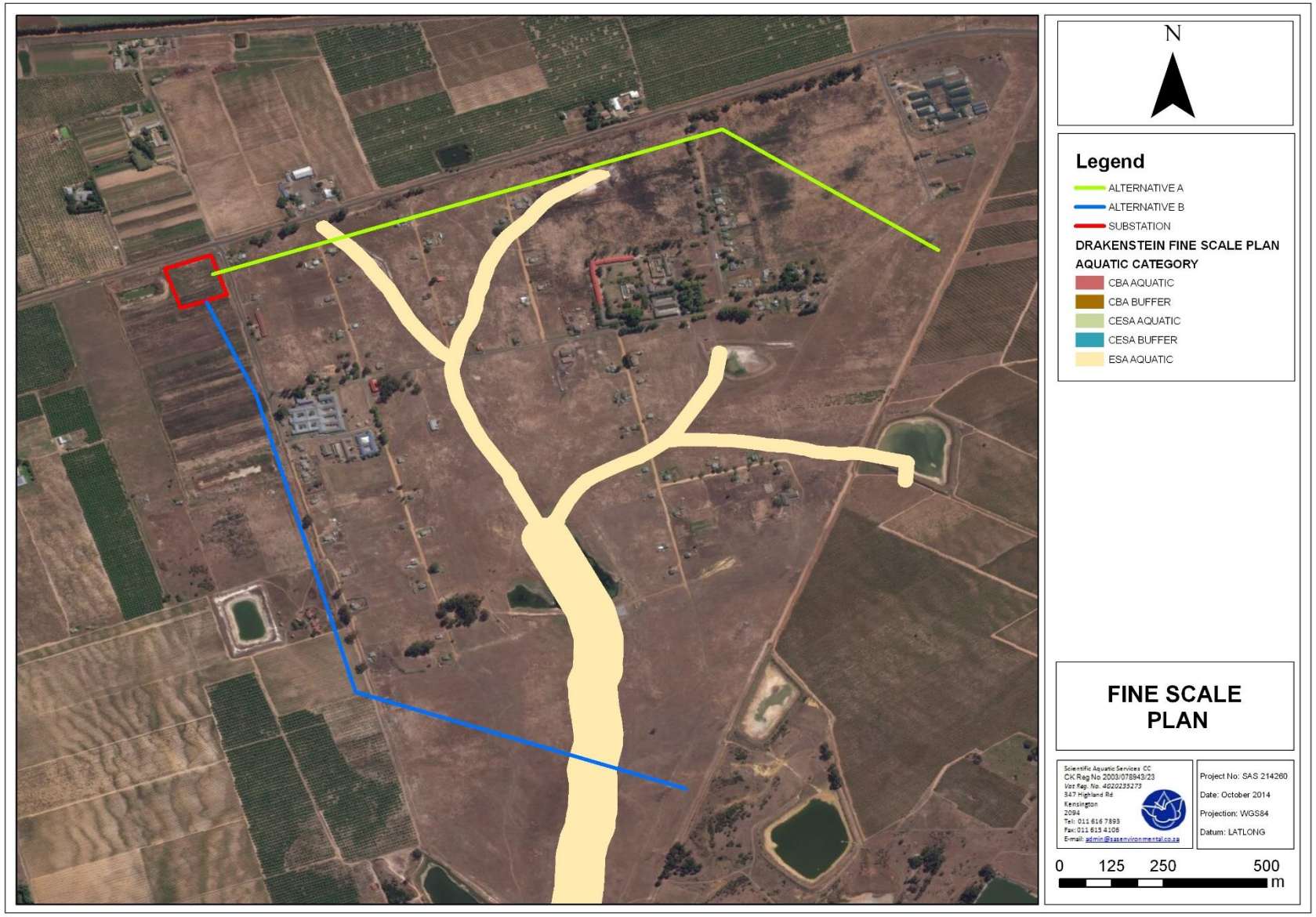

Figure 5: Aquatic ESA identified within the vicinity of Alternative A and Alternative B

4 DECRIPTION OF AFFECTED ENVIRONMENT: FRESHWATER SYSTEMS

4.1 General Wetland Assessment Results

Upon investigation of the topographical sequencing of the area, the portion of the Bottelary River within the vicinity of the project footprint was identified as an unchannelled valley bottom wetland and will be assessed accordingly in the sections to follow. It should be noted that both alternatives intercept the same unchannelled valley bottom wetland. However, the portion intercepted by Alternative A is located closer to residential development as well as several access roads off the R101 road; whereas the portion intercepted by Alternative B is only used for livestock grazing.

Unchannelled Valley Bottom Wetland within the vicinity of Alternative A

Alternative A extends over approximately 1.5km and passes through an unchannelled valley bottom wetland and within 100m of 7 isolated natural depressions and 2 artificial earth dams. The 7 isolated natural depressions most likely formed part of the larger unchannelled valley bottom wetland, however have been isolated as a result of significant vegetation and landscape transformation caused by past agriculture, road and residential development. According to Macfarlane *et al.* (2009) a wetland may consist of several different HGM units and therefore the isolated natural depressions and the unchannelled valley bottom were assessed as one wetland system (hereinafter referred to as an unchannelled valley bottom wetland).

Impacts of canalisation and residential expansion have transformed the natural hydrological regime of the unchannelled valley bottom wetland resulting in a change in the seasonal inundation and therefore the persistence of wetland vegetation. Disturbance, especially due to livestock grazing and residential development, has altered the natural wetland community assemblage. For Alternative A, the isolated natural depressions were dominated by *Cynodon dactylon* with certain depressions dominated by *Pennisetum macrourum*, known to grow in moist environments (Van Oudtshoorn, 2004). Obligate[3] wetland species such as *Aponogeton distachyos* and *Drosera Aliceae* were scattered within the deeply incised earth canals of the unchannelled valley bottom (Van Oudtshoorn 2004). However, the majority of the route traverses areas heavily infested by *Echium plantagineum* and *Avena fatua*. The impact of livestock and residential developments on the natural vegetation community assemblage has likely contributed to the proliferation of alien invasive species such as *Echium plantagineum.*

Figure 6: Representative photographs indicating deeply incised artificial earth canals and general surrounding area of the unchannelled valley bottom wetland within the vicinity of Alternative A

[3] Floral species that almost always grow in wetlands (>99% occurrence)

Unchannelled Valley Bottom Wetland within the vicinity of Alternative B

Alternative B extends over approximately 1.8km and passes through an unchannelled valley bottom wetland, within 100m of 2 artificial earth dams and within 120m of 1 artificial earth dam. Within the vicinity of Alternative B, smaller artificial earth canals have channelled the water in certain areas and dumped material within the unchannelled valley bottom has created a mosaic of different hydrological zones. Furthermore, the large earth dam above Alternative B on the De Novo property is likely to reduce flow releases and as a result decreases the quantity of water flowing into the system downstream of the feature.

Vegetation composition has been severely altered, and any characteristic wetland species that still remain have a very low abundance. The dominant species within the development footprint and in the surrounding area was *Echium plantagineum,* a naturalised alien invasive. Wetland species such as *Geranium incanum* were present within the temporary zone with *Baeometra uniflora* scattered.

Although transformed, the unchannelled valley bottom wetland in the vicinity of Alternative B does in its current state provide some habitat for avifaunal species. At the time of the assessment *Anthropoides paradiseus* (Blue Crane), listed as vulnerable (IUCN RDL), was observed. This species' decline is largely owing to power-line collisions and loss of its grassland breeding habitat, although it typically prefers cultivated habitats. Therefore the impact on wetland habitat is unlikely to pose a significant threat to *A. paradiseus* population status.

Figure 7: Representative photographs showing artificial earth canals and general surrounding area of the unchannelled valley bottom wetland within the vicinity of Alternative B

Artificial Earth Dams

During the field assessment 2 artificial earth dams were identified to fall within 100m north of Alternative A and three artificial earth dams within 100m west of Alternative B. The four most northern artificial earth dams of the project footprint had obligate floral species such as *Juncus krausii* and *Typha capensis.* These features provide suitable habitat for avifaunal and amphibian communities, although no Red Data Listed (RDL) species were observed.

Figure 8: Representative photographs of the artificial depressions.

Stormwater Drainage Canals

An artificial stormwater drainage canal extended the length of the R101 approximately 50m from Alternative A. Certain areas within this artificial stormwater drainage canal had wetland characteristics as defined by DWA (2005) such as obligate wetland species and hydrophilic soil properties. However, it was dominated by *Pennisetum clandestinum,* an alien invasive species with indigenous *Zantedeschia aethiopica* scattered. An additional artificial stormwater drainage canal was noted along the dirt road adjacent to Alternative B. This feature did not show wetland characteristics as defined by DWA (2005) and was therefore not considered wetland habitat and was not assessed in the sections that follow.

Figure 9: Representative photographs of the artificial stormwater drainage canals within the vicinity of Alternative A (left) and Alternative B (right).

4.2 Wetland Characterisation

The wetland features within the project footprint were categorised with the use of the Classification System for Wetlands and other Aquatic Ecosystems in South Africa (Ollis, *et. al.* 2013). Upon investigation, the Bottelary River crossing Alternative A and Alternative B was identified as an unchannelled valley bottom wetland and was assessed accordingly. Due to the historical connection between the isolated natural depressions and the unchannelled valley bottom wetland in the vicinity of Alternative A, the two HGM units were assessed as one wetland system in the sections to follow (hereafter referred to as an unchannelled valley bottom wetland). Furthermore, the five earth dams falling within 100m to 120m of Alternative A and Alternative B were further assessed as artificial depressions (Figure 10).

Table 1: Classification for the unchannelled valley bottom wetland within the vicinity of Alternative A and Alternative B (South African National Biodiversity Institute (SANBI) 2013).

			Level 4: Hydrogeomorphic (HGM) unit	
Level 1: System	Level 2: Regional Setting	Level 3: Landscape unit	HGM Type	Longitudinal zonation / landform / Inflow drainage
An ecosystem that has no existing connection to the ocean but which is inundated or saturated with water, either permanently or	The project footprint falls within the South Western Coastal Belt Ecoregion and within the Southwest Sand Fynbos and West Coast Shale Renosterveld	Valley Floor: the base of a valley, situated between two distinct valley side slopes, where alluvial or fluvial processes typically dominate.	Unchannelled valley-bottom wetland—a valley-bottom wetland without a river channel running through it.	N/A

periodically.	(critically endangered) (NFEPA WetVeg).			

Table 2: Classification for the artificial depression wetlands (SANBI 2013).

Level 1: System	Level 2: Regional Setting	Level 3: Landscape unit	Level 4: Hydrogeomorphic (HGM) unit	
			HGM Type	Longitudinal zonation / landform / Inflow drainage
An ecosystem that has no existing connection to the ocean but which is inundated or saturated with water, either permanently or periodically.	The project footprint falls within the South Western Coastal Belt Ecoregion and within the Southwest Sand Fynbos and West Coast Shale Renosterveld (critically endangered) (NFEPA WetVeg).	Valley Floor: the base of a valley, situated between two distinct valley side slopes, where alluvial or fluvial processes typically dominate.	Depression—a wetland or aquatic ecosystem with closed (or near-closed) elevation contours, which increases in depth from the perimeter to a central area of greatest depth and within which water typically accumulates.	N/A

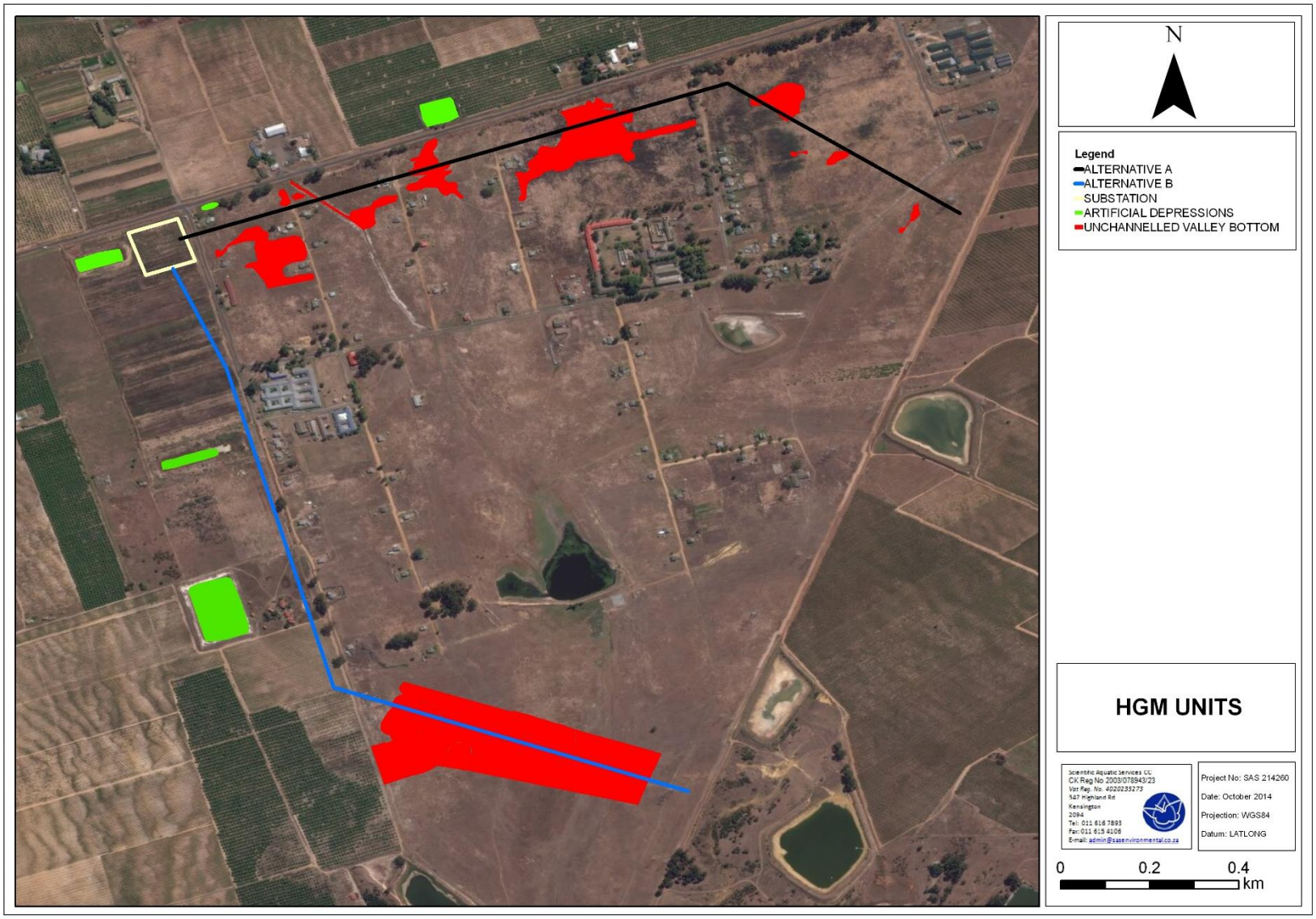

Figure 10: HGM units associated with the project footprint.

4.3 Wetland Function Assessment

The function and service provision of the wetlands located near Alternative A and B were assessed based on the method defined by Kotze *et. al*., (2009). The characteristics of each HGM unit were used to quantitatively determine the value, and by extension sensitivity, of the wetlands. Each characteristic was scored to give the likelihood that the service is being provided. The scores for each service were then averaged to give an overall score to each HGM unit, presented in the table below (Table 4). Scores for the various ecosystem services are graphically presented in the radar plot to follow. Due to the similarity in type it was deemed possible to assess all artificial depressions according to HGM unit group and not individually.

Table 3: Classes for determining the likely extent to which a benefit is being supplied.

Score	Rating of the likely extent to which the benefit is being supplied
<0.5	Low
0.6-1.2	Moderately low
1.3-2	Intermediate
2.1-3	Moderately high
>3	High

Table 4: Wetland function and service provision.

Ecosystem service	Unchannelled Valley Bottom within vicinity of Alternative A	Unchannelled Valley Bottom within vicinity of Alternative B	Artificial depression
Flood attenuation	2	2.1	1.3
Streamflow regulation	1.8	2	0
Sediment trapping	1.2	0.9	0.7
Phosphate assimilation	1.9	2.1	1.7
Nitrate assimilation	2.3	2.6	1.3
Toxicant assimilation	1.4	1.6	1
Erosion control	1.7	2	1.5
Biodiversity maintenance	1.1	2.6	1.6
Carbon Storage	1.3	1.3	2
Water Supply	1.2	2.1	0.8
Harvestable resources	0	0	0
Cultural value	0	0	0
Cultivated foods	0	0	0
Tourism and recreation	0	0	0
Education and research	0	0	0
SUM	**15.9**	**19.3**	**12.1**
Average score	**1.1**	**1.3**	**0.8**

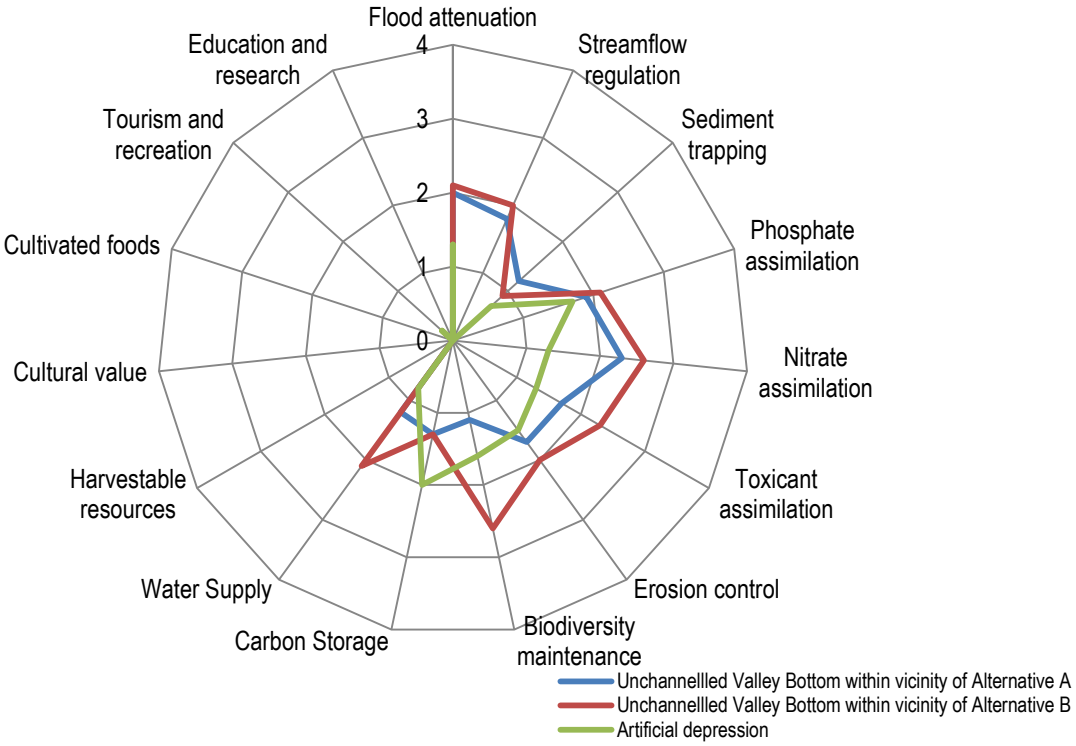

Figure 11: Radar plot of wetland services provided by the different HGM units.

From the results of the assessment, it is evident that the unchannelled valley bottom wetland has a moderately low and an intermediate level of ecological function and service provision in the vicinity of Alternative A and Alternative B, respectively. The scores differ slightly because the portion of the unchannelled valley bottom wetland intercepted by Alternative A is located closer to residential development as well as several access roads off the R101 road; whereas the portion intercepted by Alternative B is only used for livestock grazing. The artificial depressions have a moderately low level of ecological function and service provision due to the features being surrounded by crop cultivation and previously tilled land.

Alternative A and Alternative B are located in a catchment area in which agricultural activities dominate. This increases the importance of the unchannelled valley bottom wetland in terms of the assimilation of phosphates, nitrates and toxicants which enter into the feature in runoff from surrounding areas. Furthermore, shallow waters of the unchannelled valley bottom wetland near Alternative B promote sunlight penetration contributing to the photo degradation of certain toxicants (Kotze *et al.* 2009). However, significant disturbance of the hydrological regime within the vicinity of Alternative A and the absence of abundant indigenous obligate and facultative floral species within the feature is likely to reduce the ability to assimilate these substances therefore lowering the score.

The unchannelled valley bottom wetland in the vicinity of Alternative B is considered to play a moderately high role in the maintenance of biodiversity within the area. Five floral species of conservational concern (SCC) were encountered during the site visit, all located within the unchannelled valley bottom wetland within the vicinity of Alternative B, namely, *Brunsvigia orientalis,*

Babiana regia, Hesperantha falcata, Corycium orobanchoides and a *Moraea* sp. (listed as Schedule 4 protected species). All the species are listed due to the family being protected, however all are considered relatively common within the region with the exception of *Babiana regia* listed as 'Critically Endangered' within the SANBI Red List of South African Plants. *B. regia* populations are only known to still exist in very few locations mainly due to rapid decline of its habitat as a result of agriculture and urban development. For Alternative A, only *Moraea sp*. and one *Disa bracteata* (both listed as Schedule 4 protected Species) were identified within wetland areas.

The artificial depressions are surrounded by crop cultivation and tilled areas thereby lowering their biodiversity maintenance scores. However, they do provide suitable habitat for an avifaunal assemblage with common avifaunal species observed.

Although the unchannelled valley bottom wetland within the vicinity of both Alternative A and Alternative B is used for livestock grazing, no crop cultivation was noted within the wetland and no evidence was encountered during the field visit that the wetlands are used by the local community as a source of harvestable resources or that the wetland is of any cultural significance. Therefore, the features cannot be considered to be of significant importance in terms of harvestable resources, cultivated foods or cultural value.

4.4 WET-Health

A level 1 WET-health assessment was undertaken to determine the PES of the unchannelled valley bottom wetland within the vicinity of Alternative A and Alternative B using hydrology, geomorphology and vegetation indicators. It was not possible to determine the PES of the artificial depressions using WET-Health, because the methodology requires a reference state and there are no natural reference states to use as a baseline for an assessment of an artificially created feature.

According to Macfarlane *et al.* 2009) a wetland may consist of several different HGM units. In the vicinity of Alternative A the unchannelled valley bottom wetland is comprised of two HGM units: i) unchannelled valley bottom and ii) isolated natural depressions. Both HGM units were assessed and a summary of health for the wetland as a whole is provided below.

Table 5: Impact scores and categories of present State used by WET-Health for describing the integrity of wetlands.

Impact category	Description	Impact score range	Present State category
None	Unmodified, natural	0-0.9	A
Small	Largely natural with few modifications. A slight change in ecosystem processes is discernible and a small loss of natural habitats and biota may have taken place.	1-1.9	B
Moderate	Moderately modified. A moderate change in ecosystem processes and loss of natural habitats has taken place but the natural habitat remains predominantly intact.	2-3.9	C
Large	Largely modified. A large change in ecosystem processes and loss of natural habitat and biota and has occurred.	4-5.9	D
Serious	The change in ecosystem processes and loss of natural habitat and biota is great but some remaining natural habitat features are still recognizable.	6-7.9	E

Impact category	Description	Impact score range	Present State category
Critical	Modifications have reached a critical level and the ecosystem processes have been modified completely with an almost complete loss of natural habitat and biota.	8-10	F

Table 6: Summary of the Hydrological, Geomorphological and Vegetation PES of the unchannelled valley bottom wetland within vicinity of Alternative A and Alternative B based on impact score and change score where A = Trajectory of change should development not proceed; and B = Trajectory of change should development proceed.

Feature type	Hydrology			Geomorphology			Vegetation		
	Impact Score	A	B	Impact Score	A	B	Impact Score	A	B
Unchannelled Valley Bottom wetland within vicinity of Alternative A	E	→	→	D	→	→	D	↓	↓
Unchannelled Valley Bottom wetland within vicinity of Alternative B	D	→	↓	C	→	↓	D	↓	↓

Note: C – moderately modified, D – Largely modified, ↓ - slight deterioration, ↓↓ significant deterioration

Alternative A

The present hydrological state of the unchannelled valley bottom wetland falls within Category E (seriously modified). The unchannelled valley bottom wetland within the vicinity of Alternative A is artificially canalised. Due to the incised nature of these artificial earth canals, the extent of the unchannelled valley bottom wetland has decreased. Furthermore, it is augmented by stormwater which increases the amount of water that should reach the system naturally.

The geomorphological health of the unchannelled valley bottom wetland falls within Category D (largely modified). Negative impacts on geomorphic integrity include canalisation, channel straightening and incision. Channel straightening has an appreciable impact on the geomorphic state in that it steepens the channel slope and thus promotes headward erosion (erosion that proceeds upstream along the channel), lowering the elevation of the channel bed (Macfarlane et al. 2009). Furthermore, the impacts of earth dams on the system result in the trapping of sediments that are necessary for certain functions.

The vegetation health of the unchannelled valley bottom wetland falls within Category D (largely modified). The majority of the route traverses areas heavily infested by *Echium plantagineum* and *Avena fatua* with a slight increase in diversity and abundance of indigenous vegetation within natural wetland features. The impact of livestock and residential developments on the natural vegetation community assemblage has likely contributed to the proliferation of alien invasive species such as *Echium plantagineum.*

The overall score, which aggregates the scores for the three aspects (hydrology, geomorphology and vegetation), was calculated using the formula as provided by the Wet-Health methodology. The

overall score calculated falls within Category D: A large change in ecosystem processes and loss of natural habitat and biota has occurred.

In terms of anticipated trajectory[4], should the construction of the project footprint not proceed, it is considered highly likely that the PES of the wetland feature would remain the same. Should the development take place, it is considered possible that the PES (specifically in terms of vegetation health) of the currently disturbed wetland feature will deteriorate slightly as a result of the disturbance associated with construction related activities (without mitigation).

Alternative B

The present hydrological state of the unchannelled valley bottom wetland falls within Category D (largely modified). The presence of the dams upstream of the project footprint have resulted in a reduction of flow into the feature. Furthermore, artificial earth canals that were created as part of previous agricultural activities have channelled the water in certain areas and therefore decreased the extent of the different hydrological zones.

The geomorphological health falls within Category C (moderately modified). At the time of assessment there was evidence of dumped material within the unchannelled valley bottom wetland. Previous tilling activities and the creation of artificial earth canals has also altered the geomorphology of the feature from its natural reference state.

The vegetation health of the unchannelled valley bottom wetland falls within Category D (largely modified). Alternative B traverses large areas of cultivated lands with the southern portion intercepting an unchannelled valley bottom wetland used primarily for grazing purposes. Vegetation composition is therefore been severely altered, and any characteristic wetland species that still remain have a very low abundance.

The overall score, which aggregates the scores for the three aspects (hydrology, geomorphology and vegetation), was calculated using the formula as provided by the Wet-Health methodology. The overall score calculated falls within Category D: A large change in ecosystem processes and loss of natural habitat and biota has occurred.

In terms of anticipated trajectory, should the construction of the project footprint not proceed, it is considered highly likely that the PES of the wetland feature would remain the same. Should the development take place, the development footprint will fall within the unchannelled valley bottom wetland. It is therefore considered highly likely that the PES of the currently disturbed wetland feature will deteriorate slightly as a result of the disturbance associated with construction related activities (without mitigation).

4.5 Hydrological Function

Wetland hydrology generally refers to the inflow and outflow of water through a wetland therefore land is characterised as having wetland hydrology when, under normal circumstances, the land surface is either inundated or the upper portion of the soil is saturated at a sufficient frequency and duration to create anaerobic conditions[5].

Naturally, an unchannelled valley bottom wetland's stream input is spread diffusely across the wetland even at low flows (Kotze *et al.* 2009). However, the unchannelled valley bottom wetland within the vicinity of Alternative A is artificially canalised. Due to the incised nature of these artificial

[4] Anticipated change over the next 5 years.
[5] www.*forestandrange.org/new_wetlands*

earth canals, the extent of the unchannelled valley bottom wetland has decreased resulting in the formation of isolated depressions.

For Alternative B, the presence of the dams upstream of the proposed development have resulted in a reduction of surface flow into the feature. Furthermore, artificial earth canals that were created as part of previous agricultural activities have channelled the water in certain areas and therefore decreased the extent of the different hydrological zones.

The artificial depressions did not have natural hydrological regimes historically. However, over time wetland conditions persisted and presently these areas can be considered to function as wetland depressions (a landform with closed elevation contours that increases in depth from the perimeter to a central area of greatest depth, and within which water typically accumulates).

4.6 EIS Determination

The method used for the EIS determination was adapted from the method as provided by DWA (1999) for floodplains. The method takes into consideration PES scores obtained for WET-Health as well as function and service provision to enable the assessor to determine the most representative EIS Category for the wetland feature or group being assessed. A series of determinants for EIS are assessed on a scale of 0 to 4, where 0 indicates no importance and 4 indicates very high importance. In addition, the confidence of scores is indicated within the table below (Conf), where 0 indicates a very low confidence and 4 indicates a high confidence. The average of the determinants is used to assign the EIS Category as listed in the table below.

Table 7: EIS Category definitions

EIS Category	Range of Median	Recommended Ecological Management Class[6]
Very high Wetlands that are considered ecologically important and sensitive on a national or even international level. The biodiversity of these wetlands is usually very sensitive to flow and habitat modifications.	>3 and <=4	A
High Wetlands that are considered to be ecologically important and sensitive. The biodiversity of these wetlands may be sensitive to flow and habitat modifications.	>2 and <=3	B
Moderate Wetlands that are considered to be ecologically important and sensitive on a provincial or local scale. The biodiversity of these wetlands is not usually sensitive to flow and habitat modifications.	>1 and <=2	C
Low/marginal Wetlands that are not ecologically important and sensitive at any scale. The biodiversity of these wetlands is ubiquitous and not sensitive to flow and habitat modifications.	>0 and <=1	D

From the results (table below) it is evident that the transformation of the unchannelled valley bottom wetland has resulted in a low EIS scores falling within Category C[7] (moderate sensitivity). The assessment of the artificial depressions resulted in an EIS score within Category D[8] (low sensitivity).

[6] Ed's note: Author to confirm exact wording for version 1.1

[7] Wetlands/rivers that are considered to be ecologically important and sensitive on a provincial or local scale. The biodiversity of these wetlands is not usually sensitive to flow and habitat modifications.

[8] Wetlands that are not ecologically important and sensitive at any scale. The biodiversity of these wetlands is ubiquitous and not sensitive to flow and habitat modifications.

Table 8: EIS determination.

Determinant	Unchannelled Valley Bottom Wetland within the vicinity of Alternative A		Unchannelled Valley Bottom Wetland within the vicinity of Alternative B		Artificial Depressions	
	Score	Conf	Score	Conf	Score	Conf
PRIMARY DETERMINANTS						
1. Rare & Endangered Species	0	4	2	4	0	3
2. Populations of Unique Species	0	4	1	4	0	4
3. Species/taxon Richness	0	4	0	4	1	2
4. Diversity of Habitat Types or Features	1	4	1	4	1	3
5 Migration route/breeding and feeding site for wetland species	1	2	1	2	1	3
6. PES as determined by Wet-Health assessment	2	4	2	4	N/A	N/A
7. Importance in terms of function and service provision	2	4	2	4	1	4
MODIFYING DETERMINANTS						
8. Protected Status according to NFEPA Wetveg	4	4	4	4	4	4
9. Ecological Integrity	1	4	1	4	0	3
TOTAL	10		14		9	
AVERAGE	1.1		1.6		1	
OVERALL EIS	**C**		**C**		**D**	

Based on the findings of the study it is evident that the wetland features calculated scores that fall within a moderate to low EIS category. The following key aspects were considered for the rating of each determinant:

- *A.paradiseus* listed as 'Vulnerable' and *Babiana regia* listed as 'Critically Endangered' were found within the unchannelled valley bottom wetland in the vicinity of Alternative B and contributed to the unique species population score;
- The PES calculated for the unchannelled valley bottom wetland within the vicinity of both alternatives indicated that a large change in ecosystem processes and loss of natural habitat and biota has occurred;
- Connectivity to similar or natural habitat is absent for the artificial depressions;
- The Southwest Sand Fynbos and West Coast Shale Renosterveld are listed as a critically endangered Wetveg types; and
- The ecological integrity of the HGM units encountered was considered to be low.

4.7 Recommended Ecological Category

Although isolated, the artificial depressions provide suitable habitat for an avifaunal community and need to be safeguarded. Based on the findings of the assessment it is evident that the unchannelled valley bottom wetland is degraded to some degree with significant hydrological modifications within the vicinity of Alternative A. Due to the significance of impacts already present within the unchannelled valley bottom wetland and due to the disturbance and transformation of the surrounding catchment area, it is doubtful that the PES of the feature can be significantly increased within the vicinity of either Alternative A or Alternative B. However, it is deemed important that the PES category be maintained and that additional disturbance due to the proposed 132kV powerline and substation construction be prevented.

4.8 Wetland Delineation

The wetlands were delineated according to the guidelines advocated by DWA (2005) taking into consideration wetland soil characteristics as defined by Job (2009). The wetland delineation as presented in this report is regarded as a best estimate of the wetland boundaries based on the site conditions present at the time of assessment.

During the assessment, the following indicators were used in order to determine the wetland boundary of the unchannelled valley bottom wetland in the vicinity of Alternative A and Alternative B (Figure 13)*:*

- For the soil wetness indicator the presence of surface water and saturated soils were investigated. The assessments were undertaken during winter months therefore both characteristics proved to be informative during the delineation;
- High organic content in the surface horizon and saturated soils were used to delineate the permanent/seasonal zone boundary;
- For the soil form indicator, the presence of gleyed soils (most of the iron has been leached out of the soil leading to a low chroma greyish/greenish/bluish colour) and mottling (created by a fluctuating water table) were investigated. Mottling and gleying of the soil was noted within the first 50cm of the soil layer at various soil test holes and could be used as the primary indicator of the seasonal zone;
- Clay was present at various soil test holes within 30-40cm of the soil surface within the seasonal zone in the vicinity of Alternative B; and
- Although the vegetation has been significantly transformed the wetland species *Geranium incanum* was abundant within the seasonal zone in the vicinity of Alternative B and was used as an indicator. *Pennisetum macrourum*, known to grow in moist environments (Van Oudtshoorn, 2004) was used in the delineation for areas along the eastern portion of Alternative A.

Figure 12: Mottling and gleyed soils evident within the unchannelled valley bottom wetland (used as primary indicators).

It should be noted that the different hydrological zones have been delineated for the unchannelled valley bottom wetland in the vicinity of Alternative B (Figure 14). Recommendations for the placement of the powerline support structures within the unchannelled valley bottom wetland will be provided and the different hydrological zones will be used as wetland sensitivity indicators (Section 5). The development of Alternative A will not require the delineation of different hydrological zones as it is possible for the development footprint to fall outside wetland habitat.

During the assessment, the following indicator was used in order to determine the wetland hydrological zones of the artificial depressions*:*

- Terrain units were used as the primary indicator during the delineation.

4.9 Buffer Allocation

For biodiversity protection a buffer between 10 and 25 metres for wetlands with minimal wildlife habitat functions and adjacent low intensity land uses is recommended; 20 to 50 metres for wetlands with moderate habitat functions or adjacent high intensity land uses; and 50 and up to 200 metres to wetlands with high habitat functions (DWA, 2013).

If all the results obtained within the previous sections are considered the following applies to the different HGM units (Figure 13):

- The unchannelled valley bottom wetland within the vicinity of Alternative B can be considered important in terms of wetland conservation. It is deemed necessary that a 32m buffer zone be demarcated and only essential activities done in an ecologically responsible way be allowed within the wetland and buffer zone in order to prevent additional disturbance;
- The unchannelled valley bottom wetland within the vicinity of Alternative A can be considered to provide fewer functions and ecoservices due to its significant hydrological modification. Therefore a smaller, 20m buffer zone is to be demarcated and only essential activities done in an ecologically responsible way be allowed within the wetland and buffer zone in order to prevent additional disturbance; and
- A smaller 10m buffer zone is advocated to the artificial depressions and development activities within the buffer zone should not be allowed in order to prevent impacts from edge effects.

It should be noted that any activity occurring within a wetland feature or within the buffer of a wetland feature, will require a Water Use Licence (WUL) and any development within 32m of the wetland boundary will require authorisation in terms of NEMA (Act 107 of 1998).

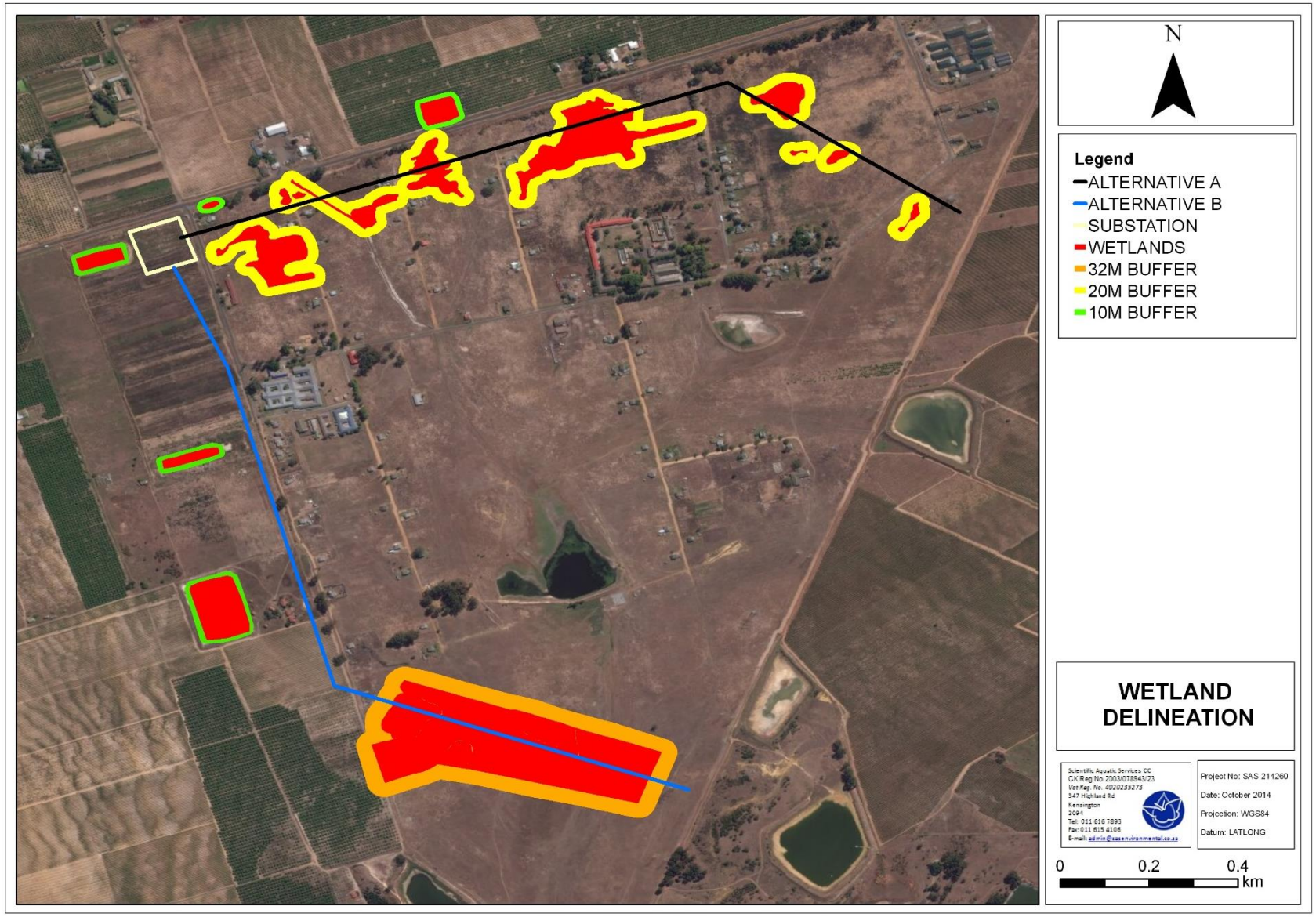

Figure 13: Wetland delineation and associated buffer zones.

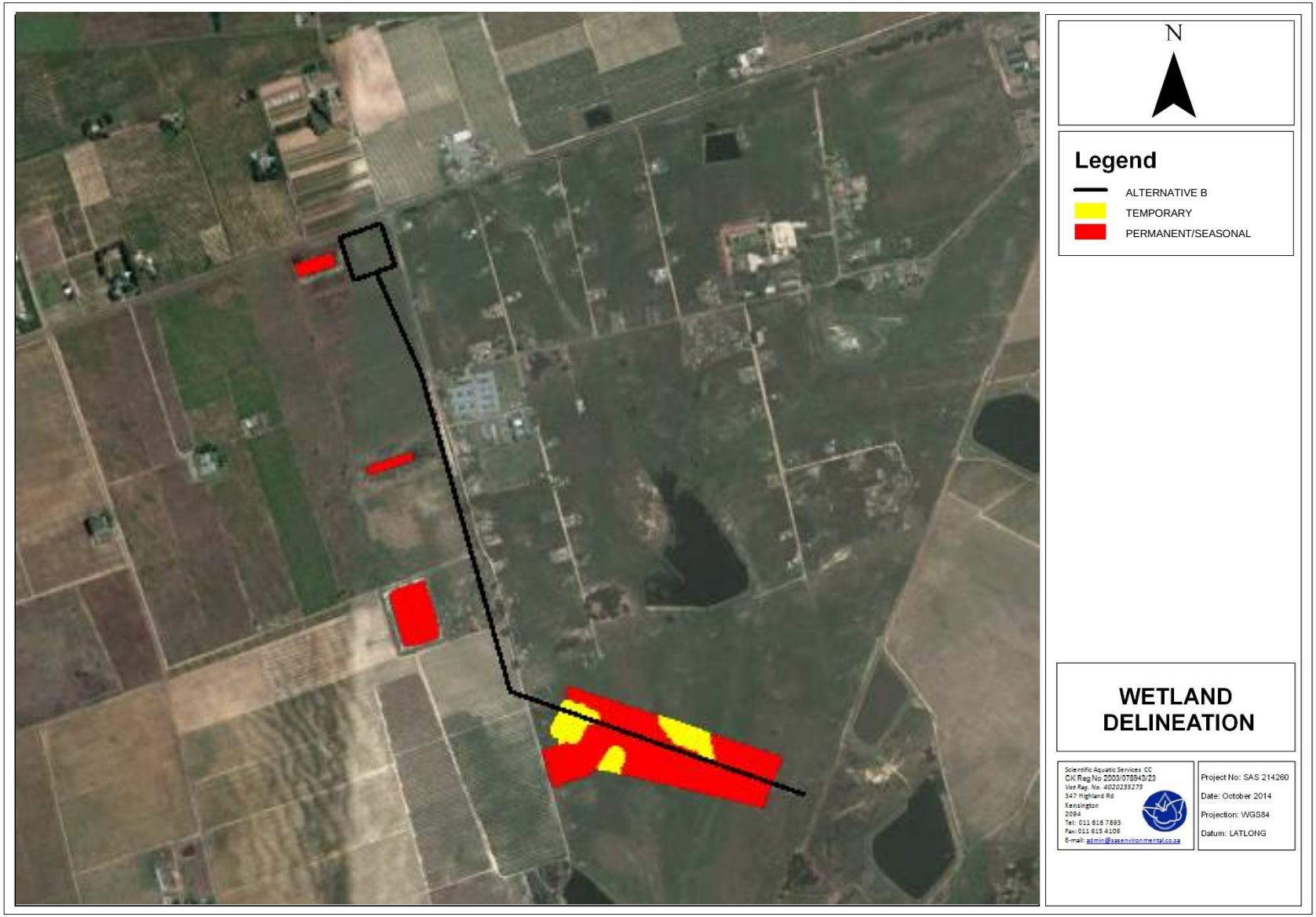

Figure 14: Hydrological zones of the unchannelled valley bottom wetland within the vicinity of Alternative B.

5 IMPACT ASSESSMENT

The tables below serve to summarise the significance of potential impacts on the freshwater ecology due to the proposed development. Impacts have been assessed separately for the two route alternatives: Alternative A and Alternative B. In addition, impacts associated with the construction and operational phase have been assessed separately. The sections below present the impact assessment according to the method prescribed by SRK. In addition, it also indicates the required mitigation and management measures needed to minimise potential ecological impacts and presents an assessment of the significance of the impacts taking into consideration the available mitigation measures, assuming that they are fully implemented. In the assessment of impacts prior to the implementation of mitigation measures the assumption has been made that all general good housekeeping measures as listed below will be strictly adhered to throughout all phases of the development.

The list below provides an indication of the general good housekeeping mitigation measures that must be adhered to in order to avoid or reduce general wetland impacts:

- Avoid damage to wetland areas that fall outside of the direct construction footprint e.g. through careful placement of laydown areas, construction camps, etc. on previously disturbed areas with a low ecological value;
- Wetland habitat falling outside of the project footprint must be strictly off-limits to construction personnel;
- Ensure that the site office, ablution facilities and storage areas for building materials are located outside the buffer zones;
- Regularly inspect all construction vehicles for leaks;
- Carry out all servicing and refuelling of construction vehicles on a concrete platform with runoff traps and containment. If refuelling takes place in the field use drip trays at all times;
- Treat contaminated soils with appropriate product;
- Remove and appropriately dispose of any contaminated soil and water to a designated dump site as rapidly as possible following contamination;
- All waste, with special mention of waste rock and spoils and remaining building material should be removed from the site on completion of the construction phase;
- Reduce airborne dust at the construction site through:
    - Damping dust generation areas with freshwater;
    - Use of cloth or brush barrier fences;
    - Covering dumps or stockpiles with plastic sheets;
- Vegetation in the vicinity of the project footprint must be maintained where possible to intercept polluting particles such as dust emanating from the access roads during operation; and
- The remainder of the vegetation should be left undisturbed with special mention of vegetation associated with wetland areas.

5.1 Direct Impact

IMPACT 1: LOSS OF WETLAND HABITAT AND ECOLOGICAL STRUCTURE ASSOCIATED WITH ALTERNATIVE A AND ALTERNATIVE B

Wetland habitat, ecoservice and function provision and hydrological function and sediment balance are closely interlinked, such that an impact to any one factor will result in a concurrent impact on another. The loss of wetland habitat is therefore likely to result in the loss of wetland ecoservices and function, and the loss of wetland hydrological function and sediment balance will result in the loss of wetland habitat as well as function. For this reason the impact on wetland features and their associated habitat, ecoservice provision and function, and hydrological function and sediment balance has been assessed in one impact, namely the loss of wetland habitat and ecological structure.

Construction phase

Activities and aspects leading to impact:

- Site clearing and the disturbance of soil;
- Site clearing and the removal of vegetation;
- Compaction of soils; and
- Sedimentation of the wetland features.

The development of Alternative A and Alternative B within the vicinity of the unchannelled valley bottom wetland may have a negative impact on the hydrological function and sediment balance. Site clearing and the removal of vegetation may result in an increase in runoff from disturbed areas and an increase in erosion and sedimentation with the possibility of these impacts extending into downstream areas of the unchannelled valley bottom wetland.

For Alternative B, it is highly recommended that the powerline support structures be placed within the temporary wetland zone of the unchannelled valley bottom wetland (Figure 13). It is in the wetland ecologist's opinion that this will significantly minimise the impact to the hydrological functioning of the feature and prevent disturbance to downstream areas. For Alternative A, it is highly recommended that the powerline support structures remain outside the delineated wetland areas and be placed within higher lying terrestrial zones dominated by *Echium plantagineum.*

The development of Alternative B will likely require the physical disturbance and removal of portions of the unchannelled valley bottom wetland's vegetation and soils for placement of the powerline support structures, which will result in the permanent loss of wetland habitat within the construction footprint. The removal and disturbance of the few wetland species identified is unlikely to reduce the unchannelled valley bottom wetland's ability to perform assimilation functions. These impacts are all regarded local in extent and with mitigation measures can be reduced to a very low consequence on wetland resources. The implementation of the mitigation measures and recommendations may reduce the intensity of impact for Alternative B by restricting construction activities and disturbance to the less sensitive wetland habitat. The overall impact after the implementation of mitigation measures and recommendations can therefore be considered of a very low significance for Alternative B.

From a wetland ecologist's point of view the impact during construction is considered to be lower for Alternative A. The unchannelled valley bottom wetland within the vicinity of Alternative A has a lower EIS and function and ecoservice provision score due to the significant hydrological modification that has taken place. Furthermore, use of the existing access roads along the R101 will ensure that additional wetland habitat is not disturbed. If the recommendations and mitigation measures are adhered to it is deemed possible that the consequence of the impact on wetland resources be decreased to an insignificant level.

Although it is highly unlikely that construction activities will fall near the 10m buffer zone of the artificial depressions, mitigation measures have been recommended so as to prevent potential impacts.

ALTERNATIVE A

	Extent	***Intensity***	***Duration***	***Consequence***	***Probability***	***Significance***	***Status***	***Confidence***
Without mitigation	Local	Low	Medium-Term	**Very Low**	Probable	**VERY LOW**	**– ve**	High
	1	1	2	4				
Essential mitigation measures during the construction phase • Construction of the powerline support structure should take place within the terrestrial zones to minimise the significance of the impact to wetland hydrological function; • Limit the footprint area of the construction activity to what is absolutely essential in order to minimise environmental damage;								

- The boundaries of footprint areas are to be clearly defined and it should be ensured that all activities remain within defined footprint areas;
- Construction vehicles must be confined to designated roadways and the indiscriminate movement of construction vehicles through wetland habitat falling outside of the project footprint must be strictly prohibited;
- Use existing dirt roads as access roads to construction areas;
- Incorporate adequate erosion and stormwater management measures in order to prevent erosion and the associated sedimentation of the unchannelled valley bottom wetland. Management measures may include berms, silt fences, hessian curtains, stormwater diversion away from areas susceptible to erosion and stormwater attenuation. Care should however be taken so as to avoid additional disturbance during the implementation of these measures. In this regard specific attention should be given to the attenuation of stormwater in order to prevent erosion;
- Curtail sheet runoff from cleared areas and access roads; and
- Remain outside the 10m buffer of the artificial depressions.

Recommended mitigation measures

- Restrict construction in sensitive wetland areas to the drier summer months, as far as possible, to minimise erosion of exposed soils and sedimentation of wetland habitats associated with the project footprint;

Managed	*Extent*	*Intensity*	*Duration*	*Consequence*	*Probability*	*Significance*	*Status*	*Confidence*
With mitigation	Local	Low	Short Term	**Very Low**	Possible	**INSIGNIFICANT**	**– ve**	High
	1	1	1	**3**				

ALTERNATIVE B

	Extent	*Intensity*	*Duration*	*Consequence*	*Probability*	*Significance*	*Status*	*Confidence*
Without mitigation	Local	Medium	Medium Term	**Low**	Definite	**LOW**	**– ve**	High
	1	2	2	5				

Essential mitigation measures during the construction phase

- Construction of the powerline support structure should take place within the temporary wetland zones as indicated in Section 5.9 (Depicted in Figure 13) so as to minimise the significance of the impact on wetland hydrological function;
- Limit the footprint area of the construction activity to what is absolutely essential in order to minimise environmental damage;
- The boundaries of footprint areas are to be clearly defined and it should be ensured that all activities remain within defined footprint areas;
- Construction vehicles must be confined to designated roadways and the indiscriminate movement of construction vehicles through wetland habitat falling outside of the project footprint must be strictly prohibited;
- Restrict, as far as possible, construction of powerline support structures and use of access roads to the extreme western and eastern sides of the southern most portion of Alternative B;
- Ensure that wetland habitat connectivity is maintained where crossing of wetland habitat is unavoidable:
    - Designate specific areas for the access road across the unchannelled valley bottom wetland and keep vehicles on the same tracks; and
    - Rehabilitate access roads within the unchannelled valley bottom wetland after construction has taken place.
- Use construction materials that do not generate toxic leachates or lead to significant changes in pH or dissolved salt concentration within wetland features;
- Incorporate adequate erosion and stormwater management measures in order to prevent erosion and the associated sedimentation of the unchannelled valley bottom wetland. Management measures may include berms, silt fences, hessian curtains, stormwater diversion away from areas susceptible to erosion and stormwater attenuation. Care should however be taken so as to avoid additional disturbance during the implementation of these measures. In this regard specific attention should be given to the attenuation of stormwater in order to prevent erosion;
- Curtail sheet runoff from cleared areas and access roads;
- Any discharge of runoff into wetland features must be done in such a way as to prevent erosion. In this regard special mention is made of the use of energy dissipating structures in stormwater discharge; and
- Remain outside the 10m buffer of the artificial depressions.

Recommended mitigation measures

- Restrict construction in sensitive wetland areas to the drier summer months, as far as possible, to minimise erosion of exposed soils and sedimentation of wetland habitats associated with the project footprint.

Managed	*Extent*	*Intensity*	*Duration*	*Consequence*	*Probability*	*Significance*	*Status*	*Confidence*
With mitigation	Local	Low	Short-Term	**Very Low**	Definite	**VERY LOW**	**– ve**	High
	1	1	1	**3**				

Operational phase.

- Maintenance activities.

Maintenance activities are likely to have a very low impact on the function and ecoservice ability of the unchannelled valley bottom wetland provided that the project implements good housekeeping measures as previously stated. For Alternative A, the impact of maintenance on wetland habitat will be of an insignificant level prior to and after mitigation measures, provided that the powerline support structures are constructed within terrestrial areas. For Alternative B, crossing of wetland habitat is likely and therefore the impact is of a higher probability if unmanaged. With the implementation of mitigation measures the impact on wetland habitat is considered possible, but insignificant.

ALTERNATIVE A

	Extent	*Intensity*	*Duration*	*Consequence*	*Probability*	*Significance*	*Status*	*Confidence*
Without mitigation	Local	Low	Short-term	**Very Low**	Possible	**INSIGNIFICANT**	**– ve**	High
	1	1	1	3				

Essential mitigation measures during the operational phase

- Access roads for maintenance activities within the powerline servitude should use existing dirt roads within the vicinity of Alternative A; and
- Restrict mowing in the powerline servitude and restrict mowing of vegetation associated with wetland areas.

Recommended mitigation measures during the operational phase

- NA

Managed	*Extent*	*Intensity*	*Duration*	*Consequence*	*Probability*	*Significance*	*Status*	*Confidence*
With mitigation	Local	Low	Short-term	**Very Low**	Improbable	**INSIGNIFICANT**	**– ve**	High
	1	1	1	**3**				

ALTERNATIVE B

	Extent	*Intensity*	*Duration*	*Consequence*	*Probability*	*Significance*	*Status*	*Confidence*
Without mitigation	Local	Low	Short-term	**Very Low**	Probable	**VERY LOW**	**– ve**	High
	1	1	1	3				

Essential mitigation measures during the operational phase

- Access roads for maintenance activities within the powerline servitude should not cross the unchannelled valley bottom wetland but instead go around Alternative B using the R101 and existing access roads; and
- Limit mowing in the powerline servitude and restrict mowing of vegetation associated with wetland areas.

Recommended mitigation measures during the operational phase

- Maintenance activities within the unchannelled valley bottom wetland should, as far as possible, be done on foot.

Managed	***Extent***	***Intensity***	***Duration***	***Consequence***	***Probability***	***Significance***	***Status***	***Confidence***
With mitigation	Local	Low	Short-term	**Very Low**	Possible	**INSIGNIFICANT**	**– ve**	High
	1	1	1	**3**				

5.2 Cumulative Impact

Wetlands within the region are under continued threat due to ongoing agricultural and development activities. The unchannelled valley bottom wetland in the vicinity of Alternative B has a marginally higher EIS and ecoservice and function provision. Therefore the loss of wetland habitat for Alternative B will be of a higher significance in terms of cumulative impact on wetlands in the region.

For Alternative A, only *Moraea sp*. and one *Disa bracteata* (both listed as Schedule 4 protected Species) were identified within wetland areas. For Alternative B, five floral SCC were encountered during the site visit all located within the unchannelled valley bottom wetland namely *Brunsvigia orientalis, Babiana regia, Hesperantha falcata, Corycium orobanchoides* and a *Moraea* sp. Therefore, the loss of wetland habitat associated with Alternative B is likely to be of a higher significance in terms of loss of SCC.

5.3 No Go Alternative

No diverse community of wetland vegetation presently occurs within the any of the wetland features and alien vegetation is abundant. With continued livestock grazing and residential development, it is unlikely that the vegetation community assemblage would become more diverse should the proposed development of Alternative A or Alternative B not take place. It is also highly unlikely that the no go alternative would have an impact on the artificial depressions due to their isolated positions within a largely agricultural and urban landscape.

5.4 Indirect Impacts

Impacts on wetland ecology will occur as a result of activities associated with the construction and operation of the development. The activities of either Alternative A or Alternative B that could lead to an impact have been comprehensively discussed in the impact assessment for the site specific activities. No additional indirect impacts are considered applicable to the proposed development activities.

6 CONCLUSION

Scientific Aquatic Services (SAS) was appointed to conduct a freshwater ecological assessment as part of the environmental assessment and authorisation process for the proposed Eskom Denova 132kV powerline and substation. Two alternatives have been proposed referred to as Alternative A and Alternative B (preferred route by Eskom).

DESKTOP ASSESSMENT

The following general conclusions were drawn on completion of the desktop assessment:

- According to the Drakenstein- Stellenbosch Fine Scale Map the south eastern portion of Alternative B and the western portion of Alternative A intersect an Aquatic Ecological Support Area (ESA). It is recommended by the Fine Scale Plan that these areas be maintained in a natural to near natural state;
- According to the National Freshwater Ecosystem Priority Area (NFEPA, 2011) database:
    - The sub Water Management Area (subWMA) is not regarded as important in terms of fish translocation, relocation, sanctuaries rehabilitation or corridors;
    - The perennial Bottelary River is intersected by Alternative A and Alternative B. The feature is considered to be in Class D (largely modified) ecological condition;
    - Twenty wetlands indicated by NFEPA (2011) will fall within 500m of Alternative A and Alternative B, all of which are indicated to be artificial and in Z3 condition (critically modified);
    - None of the wetlands within 500m are considered important in terms of wetland faunal conservation; and
    - The Wetland Vegetation Types indicated for the wetland features associated with the project footprint are the Southwest Sand Fynbos and West Coast Shale Renosterveld (both critically endangered).

WETLAND ASSESSMENT

The following general conclusions were drawn on completion of the wetland assessment:

- Upon investigation of the topographical sequencing of the area, the portion of the Bottelary River within the vicinity of the project footprint was identified as an unchannelled valley bottom wetland and was assessed accordingly;
- Both alternatives intercept the same unchannelled valley bottom at different locations;
- Alternative A passes within 100m of 7 isolated natural depressions and 2 artificial depressions. The 7 isolated natural depressions most likely formed part of the larger unchannelled valley bottom wetland, however have been isolated as a result of significant vegetation and landscape transformation as a result of past agriculture, road and residential development. Due to their possible historical connection, the isolated natural depressions were assessed as part of the unchannelled valley bottom wetland and not as separate Hydrogeomorphic (HGM) units;
- Alternative B passes within 100m of 2 artificial depressions and within 120m of 1 artificial depression;
- Two artificially created stormwater drainage canals are located within 50m of both alternatives, wetland conditions were identified within the stormwater canal near Alternative B, most likely due to its close vicinity to the R101 road that resulted in greater water volumes reaching the canal. No wetland conditions were identified within the stormwater canal near Alternative A;
- Overall, the HGM units assessed in this report include unchannelled valley bottom wetland and artificial depressions;
    - ;
- The function and service provision was calculated for the HGM units encountered within the vicinity of Alternative A and Alternative B. From the results of the assessment it is evident that:

- In the vicinity of Alternative A: The unchannelled valley bottom wetland has a moderately low level of ecological function and service provision mainly as a result of hydrological and geomorphological modifications;
- In the vicinity of Alternative B: The unchannelled valley bottom wetland has an intermediate level of ecological function and service provision mainly as a result of a loss in a diverse assemblage of wetland vegetation and change of the natural hydrological regime; and
- The artificial depressions have a moderately low level of ecological function and service provision due to the features being located in an area surrounded by crop cultivation and tilled land.

- (EIS was calculated for each HGM unit. From the results it is evident that:
  - In the vicinity of Alternative A and Alternative B: The unchannelled valley bottom wetland has an EIS that falls within Category C[9] (moderate sensitivity); and
  - The artificial depressions have an EIS that falls within Category D[10] (low sensitivity).
- The PES of the unchannelled valley bottom wetland within the vicinity of Alternative A and Alternative B was determined separately using the WET-health methodology. The overall score calculated for both falls within Category D: A large change in ecosystem processes and loss of natural habitat and biota has occurred;
- It was not possible to determine the PES of the artificial depressions using WET-Health, because the methodology requires a reference state and there are no natural reference states to use as a baseline for an assessment of an artificially created feature;
- Due to the significance of impacts already present within the unchannelled valley bottom wetland and due to the disturbance and transformation of the surrounding catchment area, it is doubtful that the PES can be significantly increased. However, it is deemed important that the PES category be maintained and that additional disturbance due to the proposed 132kV powerline and substation construction be prevented; and
- If all the results obtained within the previous bullets are considered the following can be concluded for the different HGM units:
  - The unchannelled valley bottom wetland within the vicinity of Alternative B can be considered important in terms of wetland conservation. It is deemed necessary that a 32m buffer zone be demarcated in which only essential activities be allowed in order to prevent additional disturbance;
  - The unchannelled valley bottom wetland within the vicinity of Alternative A can be considered to provide fewer functions and ecoservices than within the vicinity of Alternative B due to its significant hydrological modification. Therefore a smaller, 20m buffer zone is to be demarcated in which only essential activities be allowed in order to prevent additional disturbance; and
  - A smaller 10m buffer zone is advocated to the artificial depressions and development activities within the buffer zone should not be allowed in order to prevent impacts from edge effects.

The tables below serve to summarise the significance of perceived impacts with and without the implementation of mitigation measures on the wetland biodiversity associated with Alternative A and Alternative B.

Table A: Summary of impact assessment results for Alternative A

Impact	*Consequence*	*Probability*	*Significance*	*Status*	*Confidence*
IMPACT 1: LOSS OF WETLAND HABITAT AND ECOLOGICAL STRUCTURE ASSOCIATED WITH					

[9] Wetlands/rivers that are considered to be ecologically important and sensitive on a provincial or local scale. The biodiversity of these wetlands is not usually sensitive to flow and habitat modifications.

[10] Wetlands that are not ecologically important and sensitive at any scale. The biodiversity of these wetlands is ubiquitous and not sensitive to flow and habitat modifications.

ALTERNATIVE A					
Construction Phase					
Prior to mitigation	Very Low	Probable	**VERY LOW**	–ve	High
With Mitigation	Very Low	Improbable	**INSIGNICANT**	–ve	High
Operational Phase					
Prior to mitigation	Very Low	Possible	**INSIGNIFICANT**	–ve	High
With Mitigation	Very Low	Improbable	**INSIGNIFICANT**	–ve	High

Table B: Summary of impact assessment results Alternative B

Impact	*Consequence*	*Probability*	*Significance*	*Status*	*Confidence*
IMPACT 1: LOSS OF WETLAND HABITAT AND ECOLOGICAL STRUCTURE ASSOCIATED WITH ALTERNATIVE A					
Construction Phase					
Prior to mitigation	Low	Definite	**LOW**	–ve	High
With Mitigation	Very Low	Definite	**VERY LOW**	–ve	High
Operational Phase					
Prior to mitigation	Very Low	Probable	**VERY LOW**	–ve	High
With Mitigation	Very Low	Possible	**INSIGNIFICANT**	–ve	High

From the results of the impact assessment it is evident that:

- Alternative A intersects with a portion of the unchannelled valley bottom wetland that is significantly transformed in terms of hydrological modification and has a moderately low ecoservice function and service provision. Therefore construction is likely to have a very low impact if unmanaged. The probability of the impact can be decreased to an insignificant level with adequate planning and management; and
- Alternative B intersects with a portion of the unchannelled valley bottom wetland that has an intermediate ecoservice and function provision with a moderate sensitivity and therefore construction is likely to have a low impact if unmanaged. This impact can be decreased to a very low impact with adequate planning and management.

From a wetland ecological point of view Alternative A is considered the most favourable, provided that the management and monitoring recommendations as provided in the impact assessment of this report are strictly adhered to and integrated into the Environmental Management Plan for the proposed development.

7 REFERENCES

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