<u>Aquatic Impact Assessment</u>:

Phezukomoya Wind Power (Pty) Ltd,

Northern Cape Province

Prepared for:

Arcus Consultancy Services

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Cape Town

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Prepared by:

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PORT ELIZABETH, 6070

October 2017

SPECIALIST STATEMENT DETAIL

This statement has been prepared with the requirements of the Environmental Impact Assessment Regulations and the National Environmental Management Act (Act 107 of 1998), any subsequent amendments and any relevant other National and / or Provincial Policies related to biodiversity assessments in mind.

Report prepared by: Dr. Brian Colloty Pr.Sci.Nat. (Ecology) / Certified EAP / Member SAEIES & SASAqS

Expertise / Field of Study: BSc (Hons) Zoology, MSc Botany (Rivers), Ph.D. Botany Conservation Importance rating (Estuaries) and interior wetland / riverine assessment consultant from 1996 to present. Please refer to the attached CV for additional detail and project related experience.

I, **Dr. Brian Michael Colloty** declare that this report has been prepared independently of any influence or prejudice as may be specified by the National Department of Environmental Affairs

Signed:… ……………… Date:…17 October 2017…………

Contents

1 - Introduction

Scherman Colloty & Associates (SC&A) was appointed by Arcus Consulting to conduct an aquatic impact assessment for the proposed Phezukomoya Wind Power (Pty) Ltd, Wind Energy Facility near Noupoort in the Northern Cape (Figure 1). This included delineating any natural waterbodies remaining on the properties in question, as well as the potential consequences of the layout on the surrounding water courses. This was based on information collected during a site visit in March 2016 and September 2017, while adhering to the assessment criteria contained in the DWAF 2005 / 2007 delineation manuals and the National Wetland Classification System (Ollis *et al*., 2013) found in the Appendix 1.

This report thus provides the relevant delineations and Present Ecological State status assessment of the observed waterbodies together with an analysis of the potential impact of the proposed facilities on the aquatic environment. For the purposes of the impact assessment the following has been assumed:

1. The final internal roads will avoid any water courses as far as possible, making use of existing tracks and roads
2. Excessively steep areas for roads will be avoided.
3. Existing road crossings will be upgraded, i.e. culverts and stormwater management features
4. Transmission line towers will be placed outside of any water courses (including the 32m buffer) where possible.

1.1 Scope

It is our understanding that the proposed project, has triggered the preparation of environmental impact assessments and potential applications under the National Water Act (Act 36 of 1998), where required. The potential impacts on the surrounding water bodies therefore need evaluation, with specific attention drawn to the likelihood of any changes to the regional hydrology and how this could impact on these systems. SC&A understands the study area well and has worked on several projects within the region and therefore possess a high level of information.

The following potential issue will be assessed:

- Potential loss of riverine and wetland habitat (road and services crossings)
- Increase in stormwater runoff and the potential to increase the amount of erosion in the catchment
- The possible impact of supplying the water requirements for construction and operation phases of the development, should a natural resource be considered as the supply source

All aspects of the SC&A study could then form part of the Water Use Licence process should this become a requirement

1.2 Terms of reference and methods

SC&A endeavours to provide a report which would include the following aspects related to potential wetlands and rivers for the site:

EIA Phase

- Maps depicting demarcated waterbodies delineated to a scale of 1:10 000 after a site visit has been conducted.
- The determination of the desktop ecological state of any aquatic systems, estimating their biodiversity, conservation and ecosystem function importance with regard ecosystem services.
- Recommend buffer zones and No-go areas around any delineated wetland areas based on the relevant legislation, e.g. Conservation Plan guidelines or best practice.
- Assess the potential impacts, based on the supplied methodology
- Provide mitigations regarding project related impacts, including engineering services that could negatively affect demarcated aquatic areas.
- Provide the relevant aspects with regard compiling the Environmental Management / Monitoring Plans.
- Supply the client with geo-referenced GIS shape files of the aquatic areas.

- Provide one draft report for comment, with a maximum of two rounds of comments addressed for the respective assessment phases as required.

The following checklist as per the NEMA specialist assessment requirements was also provided by Arcus Consulting:

Regulation GNR 326 of 4 December 2014, as amended 7 April 2017, Appendix 6	**Section of Aquatic Report**
(a) details of the specialist who prepared the report; and the expertise of that specialist to compile a specialist report including a *curriculum vitae*;	Page 3 and Appendix 2 of this report
(b) a declaration that the specialist is independent in a form as may be specified by the competent authority;	Appendix 3 of this report
(c) an indication of the scope of, and the purpose for which, the report was prepared;	Section 1 of this report
(d) an indication of the quality and age of base data used for the specialist report;	Yes – data included ranged from 2014 to September 2017
(e) a description of existing impacts on the site, cumulative impacts of the proposed development and levels of acceptable change;	Yes Section 7
(f) the duration, date and season of the site investigation and the relevance of the season to the outcome of the assessment;	Yes Section 3
(g) a description of the methodology adopted in preparing the report or carrying out the specialised process inclusive of equipment and modelling used;	Yes – Also see EIA
(h) details of an assessment of the specific identified sensitivity of the site related to the proposed activity or activities and its associated structures and infrastructure, inclusive of a site plan identifying site alternative;	Yes – See
(h) an identification of any areas to be avoided, including buffers;	Yes - Figure 3
(i) a map superimposing the activity including the associated structures and infrastructure on the environmental sensitivities of the site including areas to be avoided, including buffers;	Yes - Figure 3
(j) a description of any assumptions made and any uncertainties or gaps in knowledge;	Yes – Section 3 of this report
(k) a description of the findings and potential implications of such findings on the impact of the proposed activity, including identified alternatives on the environment, or activities;	Yes – Section 5, 6, 7 and 8 of this report
(l) any mitigation measures for inclusion in the EMPr;	Yes – Section 8 and 9 of this report
(m) any conditions for inclusion in the environmental authorisation;	Yes – Section 9 of this report
(n) any monitoring requirements for inclusion in the EMPr or environmental authorisation;	Yes – Section 8 and 9 of this report
(o) a reasoned opinion— i. as to whether the proposed activity, activities or portions thereof should be authorised; ii. Regarding the acceptability of the proposed activity or activities; and iii. if the opinion is that the proposed activity, activities or portions thereof should be authorised, any avoidance, management and mitigation measures that should be included in the EMPr or Environmental Authorization, and where applicable, the closure plan;	Yes – Section 9 of this report
(p) a summary and copies of any comments received during any consultation process and where applicable all responses thereto; and	Yes – Refer to EIA
(q) any other information requested by the competent authority	Yes – Refer to EIA
Where a government notice gazetted by the Minister provides for any protocol or minimum information requirement to be applied to a specialist report, the requirements as indicated in such notice will apply.	Yes – This report also meets the DWS requirements in terms of GN 40713 of March 2017

2 Project description

It is assumed that the proposed 315 MW Phezukomoya WEF would consist of the following infrastructural components:

The proposed 315 MW Phezukomoya WEF would consist of the following infrastructural components:

The proposed 315 MW Phezukomoya WEF would consist of the following infrastructural components:

- Up to 63 wind turbines with a generation capacity between 3 – 5 MW and a rotor diameter of up to 150 m, a hub height of up to 150 m and blade length of up to 75 m;
- Foundations and hardstands associated with the wind turbines;
- Internal access roads of between 8 m (during operation) and 14 m (during construction) wide to each turbine;
- Two 10 000 m^2 on-site switching stations
- Medium voltage underground electrical cables will be laid to transmit electricity generated by the wind turbines to the on-site switching station or substation;
- Overhead medium voltage cables between turbine rows where necessary;
- An on-site substation and OMS area (180 000 m^2) to facilitate stepping up the voltage from medium to high voltage (132 kV) to enable the connection of the WEF to the proposed Umsobomvu WEF 132/400 kV Substation, from which the generated power will be fed into the national grid;
- Two medium voltage overhead powerlines (approximately 3 km and 5.6 km in length) connecting the on-site switching stations with the on-site medium voltage/132 kV substation;
- An approximately 16 km 132 kV voltage overhead power line from the on-site substation to the proposed 132/400 kV Umsobomvu Substation where the electricity will be transferred to the national grid;
- A 100 m corridor surrounding the Umsobomvu substation so that the grid connection can turn into the substation from any direction;
- A 90 000 m^2 area for batching plant, temporary laydown area and construction compound;
- Temporary infrastructure including a site camp; and a laydown area approximately 7500 m^2 in extent, per turbine.

The total size of the development site is 15 271 hectares. The footprint of the proposed development is estimated to be less than 1% of this area.

Description	Dimensions		
	Length (m)	Breadth (m)	Area (sqm)
Eskom 400kV Umsobomvu substation	600	600	360000
Phezukomoya medium voltage/132 kV substation and OMS area	600	300	180000
Construction compound, temporary laydown area and batching plant	300	300	90000

Description of Construction Phase

It is estimated that construction will take approximately 18 - 24 months' subject to the final design of the WEF, weather and ground conditions, excluding time for testing and commissioning. The construction process will consist of the following principal activities:

- Site survey and preparation;
- Construction of site entrance, access tracks and passing places;
- Enabling works to sections of the public roads to the WEF sites (if required) to facilitate turbine delivery;
- Construction of the contractors' compound;

- Construction of crane pads;
- Construction of turbine foundations;
- Construction of substation building;
- Excavation of the cable trenches and cable laying;
- Delivery and erection of wind turbines;
- Erection of electricity distribution line;
- Testing and commissioning of the wind turbines; and
- Rehabilitation.

It is possible for certain operations to be carried out concurrently, although predominantly in the order mentioned above. This would minimise the overall length of the construction programme. Construction would be phased such that the civil engineering works would be continuing in some parts of the site, whilst wind turbines are being erected elsewhere. Site rehabilitation will be programmed and carried out to allow for the rehabilitation of disturbed areas as early as possible and in a progressive manner.

Early estimations are that between 75 000kl and 250 000kl will be needed per annum during construction, and will form part of the Section 21a (Abstraction) application Water for construction purposes (e.g. mass earthworks and roads) will be transferred from the source to the point of use on the site via tanker. All storage of water will be below WULA authorisation limits, i.e. 10 000m3.

Description of Operational Phase

The proposed development would be designed to have an operational life of up to 25 years. The current REIPPPP set out by the Department of Energy (DoE) grants a Power Producer Agreement (PPA) for 20 years. During operation of the development, the large majority of the WEF sites will continue with agricultural use as it is currently. The only development related activities on-site will be routine servicing and unscheduled maintenance, as detailed in the following sections.

Based on experience from other WEF developments, the operational phase is likely to create approximately 35 permanent employment opportunities. Of this total, approximately 70% (24) will be low and medium-skilled and 30% (11) will be high skilled positions. The number and nature of employment opportunities will be refined as the development process progresses.

Anticipated water usage for the operations stage is estimated to be in the range of $500m^3$ annum at most will be used for equipment cleaning, basic civil maintenance and for domestic water purposes e.g. sanitation, washing and drinking.

It is anticipated that only domestic waste water (sewage) will be generated during the construction and operation phases. All waste water would be stored in conservancy tanks (less than 10 000 m3) and transported to a licensed wastewater treatment works (e.g. Noupoort WWTW) as and when the tanks are full.

Routine Servicing

Wind turbine operations would be overseen by suitably qualified local contractors who visit the site regularly to carry out maintenance. The following turbine maintenance would be carried out along with any other maintenance required by the manufacturer's specifications:

- Initial service;
- Routine maintenance and servicing;
- Gearbox oil changes; and
- Blade inspections.

Routine scheduled servicing would likely take place twice per year with a main service likely to occur at twelve-month intervals. Servicing will include the performance of tasks such as maintaining bolts to the required torque, adjustment of blades, inspection of blade tip brakes and inspection of welds in the tower.

In addition, oil sampling and testing from the main gear. Other visits to the site would take place approximately once per week to ensure that the turbines are operating at their maximum efficiency.

Site tracks will be maintained in good order. Safe access will be maintained all year round.

Unscheduled Maintenance

Unscheduled maintenance associated with unforeseen events would be dealt with on an individual basis. In the unlikely event of a main component failure, cranes may be mobilised to site to carry out repairs and/or replacement works.

3 - Assumptions and limitations

In order to obtain a comprehensive understanding of the dynamics of both the flora and fauna of both the aquatic communities within a study site, as well as the status of endemic, rare or threatened species in any area, assessments should always consider investigations at different time scales (across seasons/years) and through replication. However, due to time constraints these long-term studies are not feasible and are mostly based on instantaneous sampling. This site was assessed after a period of spring rainfall, while the adjacent farms have been visited during other years and seasons. This provides the author of this report as an understanding of the region and the aquatic environment.

It should be emphasised that information, as presented in this document, only has reference to the study area as indicated on the accompanying maps. Therefore, this information cannot be applied to any other area without detailed investigation.

For the purposes of this report it is assumed that any existing roads and tracks within the facility will be upgraded, while the new roads Figure 3) and associated transmission lines can avoid or span (the observed water courses. A further assumption is that water will be sourced from a licensed resource and not illegally abstracted from any surrounding water courses, particularly if dust suppression is required.

4 – Study area description

The results of the respective surveys in 2016 and 2017 coincided with summer and early spring cycles, both following some degree of rainfall, totalling 6 full days in the field. However, the site was also visited during the 2012-2014 period when heavy rainfalls had occurred thus an understanding of the area by the author is known during both winter/summer and flooding/drought events.

The proposed development occurs within the following catchments associated with the Drought Corridor Ecoregion spanning the boundary between the Orange and Mzimvubu / Tsitsikamma Water Management Areas.

The WEF site is situated in the following subquaternary catchments (Figure 2):

- Q11C – Rooispruit River
- Q14B - Droe River
- D32G – Noupoortspruit
- D32C – Kleinseekoei (Portions of the transmission alternatives only)

These catchments are characterised by several perennial water courses and drainage lines associated with these mainstem systems listed above (Plate 1 & 2). The larger systems are characterised by alluvial riverbeds / washes. Most of these showing signs of erosion (Plate 3), with large head cuts forming in the upper catchment / foothills of these systems located within the study area. The turbines are however located on the higher lying ridges, and only the required road crossings would have a direct impact on these systems. The closest turbine was measured at 60m from one such system, while the remainder are far greater distances from the centre lines of the observed water courses.

The transmission line alternatives similarly span several systems, dominated by alluvial sediment transport systems, but also show some degree of alteration due to local road networks and grazing. The greatest current impact within the whole study area is the creation of dams, which are contributing to habitat fragmentation within the water courses as well as changes to the hydrological regimes of the riverine systems (Plate 4).

In terms of the National Freshwater Ecosystems Priority Areas (NFEPA) assessment, all of watercourses within the site were assigned condition scores between AB and C (Nel *et al.* 2011), indicating that they largely intact or moderately modified, but still with biological function. This is largely due to these catchments falling with the headwaters of the Gariep (Orange) River and thus some (D32C & G) were earmarked as upstream support areas for important fish habitats located in the Gariep River, by the NFEPA assessment.

The proposed transmission lines within the D32C catchment will cross the observed rivers within reaches that were classed as C (Moderately Modified) but it is anticipated that all towers could span these systems including their respective riparian zones (i.e. the 32m buffer). The riparian systems are mostly limited to a grass species associated with water courses, but no facultative or obligate species wetland species were found, i.e. species within any areas where soil moisture levels are higher, e.g. along roadsides were observed. These species included *Tenaxia disticha* (Mountain wire grass previously *Merxmerulla disticha*), *Miscanthus ecklonii* (previously *Miscanthus capensis*), *Agrostis lachnantha*. The only obligate tree species found included Willow trees (*Salix mucronata*) both near the Wind Farm and along the transmission line routes (Plate 2). The only well-defined riparian system was located on a tributary of the Noupoortspruit River, which was shown a high degree of Sweet thorn (*Vachellia karroo*) encroachment (Plate 3). No new direct impacts on this system are anticipated as the Oorlogskloof, the access road to the WEF is already constructed and was used by the Noupoort WEF.

Interestingly the wetlands (seeps and valley bottom systems) that were found on the Noupoort Wind Farm site, where not evident within this project area (WEF) and is possibly due to the site mostly occurring on the Eastern and Northern slopes of the mountain ranges which are typically drier. This coupled to the fact that most of the study area is located on the highest lying areas of the upper plateaus. This was also confirmed by the National Wetland Inventory (ver 5.2) (Figure 2), which indicated that no natural wetlands are located within the site and any of the springs which result in the wetland seeps within the area are all located within the WEF site (Figure 2).

The only wetland areas (Phragmites dominated reedbeds) observed were located within the Droe River and will not be affected by the transmission line alternatives, i.e. more than 3km away from the closest alternative alignment. These wetlands are intersected by the N10, and has always had higher runoff volumes than most rivers within the region possibly due to the road and its associated stormwater management structures, resulting in these small wetlands.

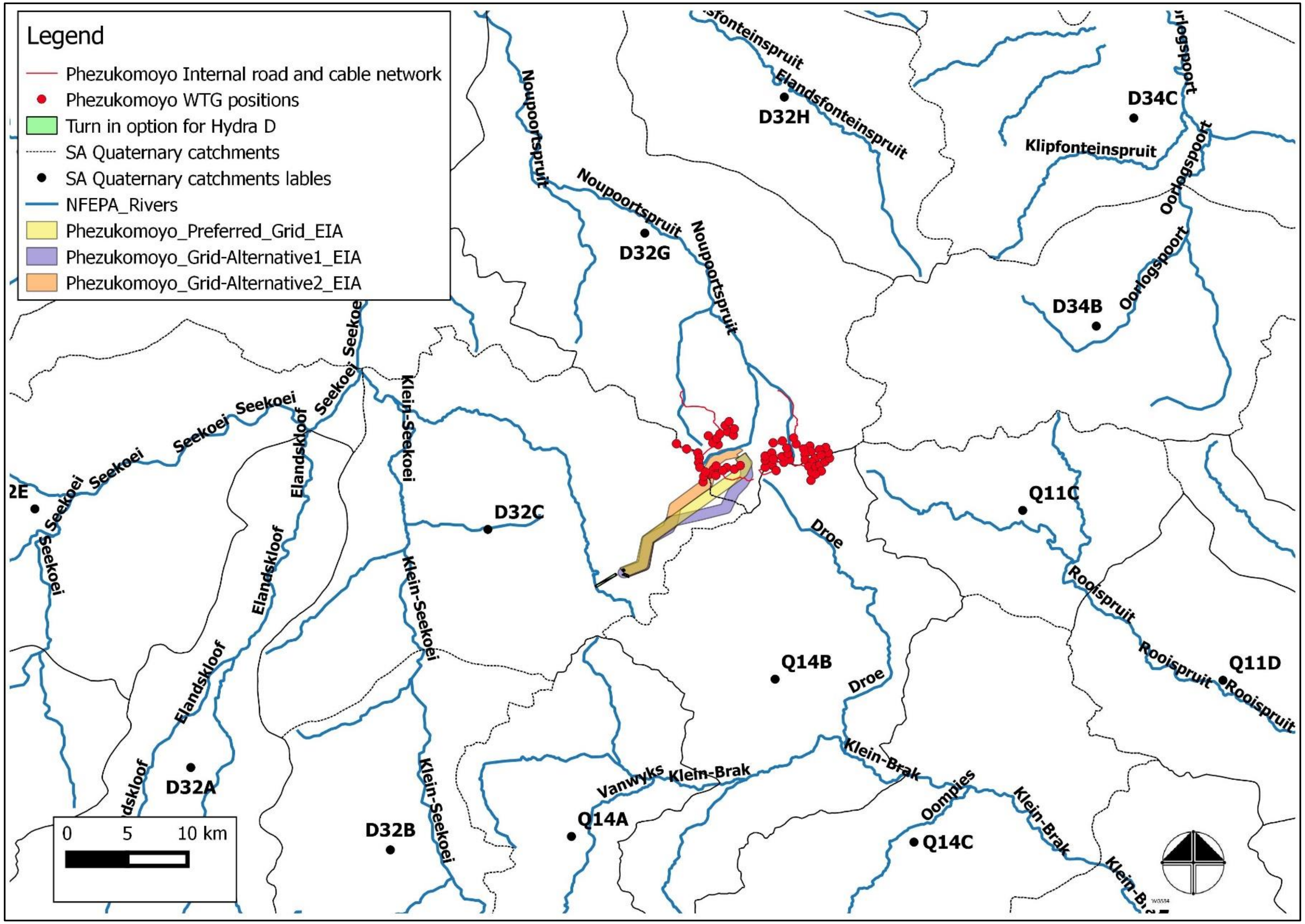

Figure 1: Project locality map indicating various quaternary catchments and mainstem rivers within the region (NFEPA & DWS)

5 – Waterbody delineation & classification

The water body delineation and classification was conducted using the standards and guidelines produced by the DWA (DWAF, 2005 & 2007) and the South African National Biodiversity Institute (SANBI, 2009). These methods are contained in the attached Appendix 1, which also includes wetland definitions, wetland conservation importance and Present Ecological State (PES) assessment methods used in this report. Reference is also included with regard relevant legislation related to the protection of waterbodies and the minimum requirements in terms of prescribed buffers.

For reference the following definitions are as follows:

- **Drainage line**: A drainage line is a lower category or order of watercourse that does not have a clearly defined bed or bank. It carries water only during or immediately after periods of heavy rainfall i.e. non-perennial, and riparian vegetation may not be present.
- **Perennial and non-perennial:** Perennial systems contain flow or standing water for all or a large proportion of any given year, while non-perennial systems are episodic or ephemeral and thus contains flows for short periods, such as a few hours or days in the case of drainage lines.
- **Riparian**: the area of land adjacent to a stream or river that is influenced by stream-induced or related processes. Riparian areas which are saturated or flooded for prolonged periods would be considered wetlands and could be described as riparian wetlands. However, some riparian areas are not wetlands (e.g. an area where alluvium is periodically deposited by a stream during floods but which is well drained).
- **Wetland**: land which is transitional between terrestrial and aquatic systems where the water table is usually at or near the surface, or the land is periodically covered with shallow water, and which under normal circumstances supports or would support vegetation typically adapted to life in saturated soil (Water Act 36 of 1998); land where an excess of water is the dominant factor determining the nature of the soil development and the types of plants and animals living at the soil surface (Cowardin *et al*., 1979).
- **Water course**: as per the National Water Act means -
  - (a) a river or spring;
  - (b) a natural channel in which water flows regularly or intermittently;
  - (c) a wetland, lake or dam into which, or from which, water flows; and
  - (d) any collection of water which the Minister may, by notice in the Gazette, declare to be a watercourse, and a reference to a watercourse includes, where relevant, its bed and banks

According to the National Freshwater Ecosystems Priority Area (NFEPA) wetland data, no natural wetlands occur within the study area. The waterbodies identified are artificial or man-made systems as shown in Figure 2 (Plate 3). This was verified during the site visit that no natural wetlands were observed within the WEF or transmission line alignments.

Figure 3 indicates significant watercourses observed within the site (Plate 1 & 2). Any activities within these areas or the 32m buffer (or the 1:100 floodline, whichever is the greatest) will require a Water Use license (possible General Authorisation) should any structures (e.g. transmission line towers) be placed within these zones. At this point only the three water course crossings within the WEF are anticipated.

However, it has been assumed that all the proposed transmission lines (all alternatives) projects could adequately span any water courses, thus no direct impacts on these ephemeral systems are anticipated.

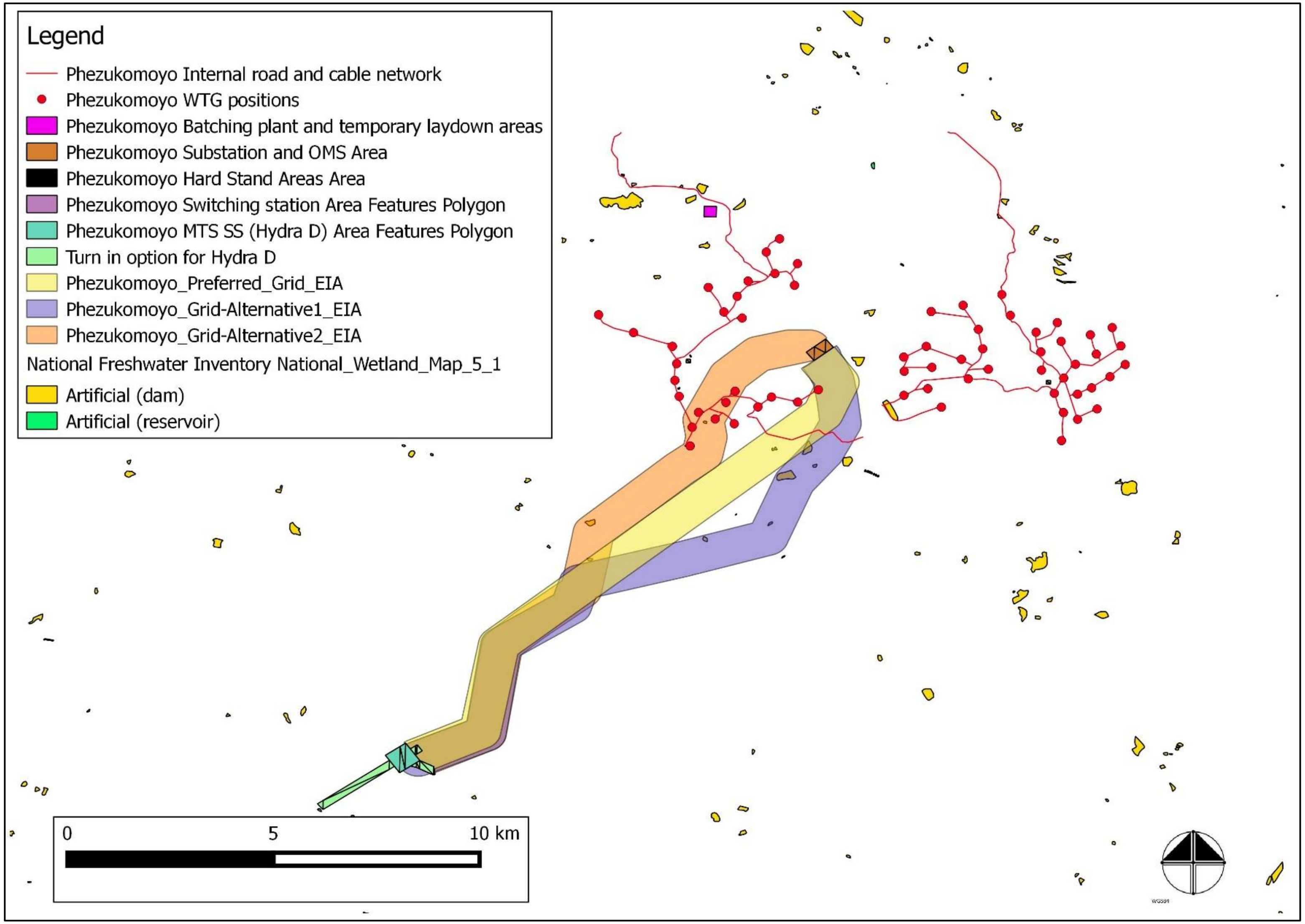

Figure 2: Potential wetlands according to the National Wetland Inventory (SANBI, 2017 ver. 5.1) in relation to the proposed WEF and transmission line alternatives (but none were located within the study area)

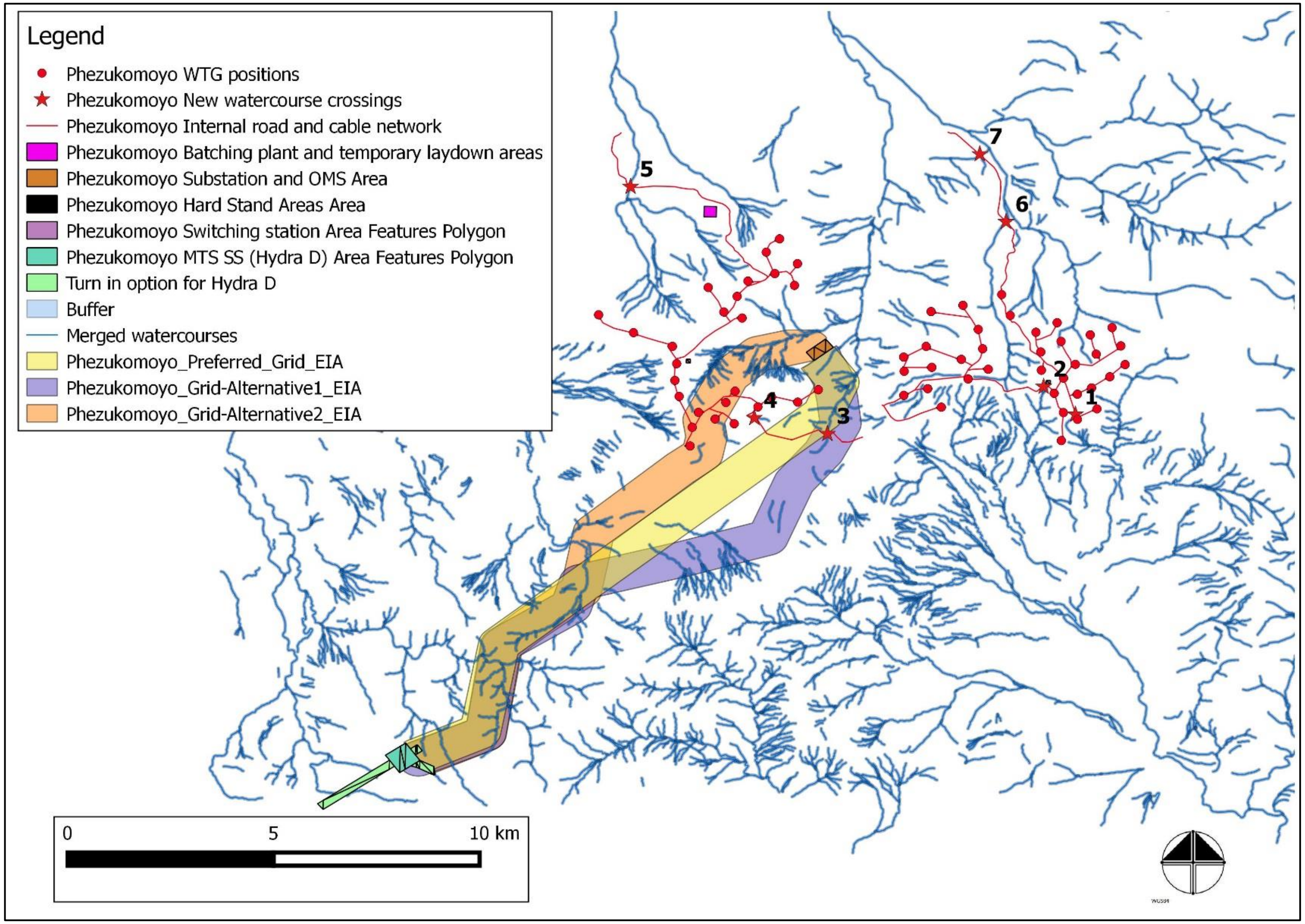

Figure 3: The various activities in relation to the water courses (with 32m buffer) associated with the WEF (7 crossings) and transmission line alternatives.

6 - Present Ecological State and conservation importance

The Present Ecological State of a river represents the extent to which it has changed from the reference or near pristine condition (Category A) towards a highly impacted system where there has been an extensive loss of natural habit and biota, as well as ecosystem functioning (Category E).

The national Present Ecological Score or PES scores have been revised for the country and based on the new models, aspects of functional importance as well as direct and indirect impacts have been included (DWS, 2014). The new PES system also incorporates EI (Ecological Importance) and ES (Ecological Sensitivity) separately as opposed to EIS (Ecological Importance and Sensitivity) in the old model. Although the new model is still heavily centered on rating rivers using broad fish, invertebrate, riparian vegetation and water quality indicators. The Recommended Ecological Category (REC) is still contained within the new models, with the default REC being B, when little or no information is available to assess the system or when only one of the above mentioned parameters is assessed or then overall PES is rated between a C or D.

The Present Ecological State scores (PES) for the drainage lines and the rivers in the study area were rated as follows (DWS, 2014 – where A = Natural or Close to Natural & B = Moderately Modified):

Subquaternary Catchment Number	Present Ecological State	Ecological Importance	Ecological Sensitivity
5861	C	Moderate	Moderate
6007	C	Low	Moderate
6010	C	Low	Moderate
6082	B	High	Moderate
6103	C	Moderate	Moderate

It is thus evident that the study area systems are largely functional and or have limited impacts as a result of current land use practices. Current impacts are mostly associated with grazing, livestock trampling, the large number of farm dams (see Figure 2) and alien Poplar trees (*Populus X canescens* – Plate 3).

This was confirmed for each of the affected reaches located within the development footprint and in particular the areas that would be crossed by the proposed road layout shown in Figure 3 (7 Crossings). In other words, the systems observed are largely natural, with small or narrow riparian zones, dominated by *Searsia lancea* and *Vachellia karroo.* The only obligate species observed include small areas of *Juncus rigidus* and *Phragmites australis* associated with small pools created by road culverts found throughout the study area.

7 - Recommended buffers

Presently there are no prescribed aquatic buffers other than those proposed in the Northern Cape, thus the, recommendations by Desmet and Berliner (2007) will be applied as these are becoming more widely accepted (Table 1). These are shown below, to make the engineers and contractors aware of these buffers during the planning phase, i.e. construction, associated batch plants, stockpiles, lay down areas and construction camps should avoid these buffer areas i.e. 32m for this development.

Table 1: Recommended buffers for rivers, with those applicable to the project highlighted in blue

River criterion used	Buffer width (m)	Rationale
Mountain streams and upper foothills of all 1:500 000 rivers, i.e. rivers mapped at this scale by DWS	▪ 50	▪ These longitudinal zones generally have more confined riparian zones than lower foothills and lowland rivers and are generally less threatened by agricultural practices.
Lower foothills and lowland rivers of all 1:500 000 rivers i.e. rivers mapped at this scale by DWS	▪ 100	▪ These longitudinal zones generally have less confined riparian zones than mountain streams and upper foothills and are generally more threatened by development practices.
All remaining 1:50 000 scale streams, i.e. all systems that appear on the topo-cadastral maps	▪ 32	▪ Generally smaller upland streams corresponding to mountain streams and upper foothills, smaller than those designated in the 1:500 000 rivers layer. They are assigned the riparian buffer required under South African legislation.

Plate 1: Some of the smaller foothill systems stilled contained water

Plate 2: A number of the larger water courses had some form of erosion or head cut formation present

Plate 3: Several large dams occur within the study area, with Poplar stands upstream and downstream

8 – Potential impacts and risk assessment

During the impact assessment study several potential key issues / impacts were identified and these were assessed based on the methodology supplied Arcus Consulting.

The following impacts were not assessed as the factors were not present within the study area aquatic ecosystems:

Loss of aquatic species of special concern, and

Wetland loss as no natural wetlands were observed near any of the proposed WEF infrastructure or transmission line alternatives (i.e. within 500m of the proposed layouts).

The following direct and indirect impacts were assessed with regard the riparian areas and water courses:

1. Impact 1: Loss of riparian systems and water courses
2. Impact 2: Impact on riparian systems through the possible increase in surface water runoff on riparian form and function
3. Impact 3: Increase in sedimentation and erosion
4. Impact 4: Potential impact on localised surface water quality

Note: Although no wind farm layout alternatives are considered here, the final layout was derived using sensitivity maps provided to the developer. This has allowed for a largely mitigated layout, with the number of impacts, such as new water course crossing being kept to the minimum.

The impacts were assessed as follows:

<table>
<tr><td colspan="3">Nature: Impact 1 - Loss of riparian systems and water courses during the construction phase

The physical removal of the narrow strips of riparian zones and disturbance of any watercourses by the road crossings only, being replaced by hard engineered surfaces. This biological impact would however be localised, as a large portion of the remaining catchment would remain intact, while the significant structures (e.g. turbines and hard standing areas) have been placed well outside of these areas.</td></tr>
<tr><td>▪ Reversibility</td><td>▪ High</td><td>▪ High</td></tr>
<tr><td>▪ Irreplaceable loss of resources</td><td>▪ No</td><td>▪ No</td></tr>
<tr><td>▪ Can impacts be mitigated</td><td>▪ Yes</td><td></td></tr>
<tr><td colspan="3">▪ Mitigation:
• Where water course crossings are required, the engineering team must provide an effective means to minimise the potential upstream and downstream effects of sedimentation and erosion (erosion protection) as well minimise the loss of riparian vegetation (small footprint).
• If several the transmission line towers for the grid need to be located within some of the watercourses, then this must be carried out in collaboration with an aquatic specialist during the micro siting process
• No vehicles to refuel or be maintained within drainage lines/ riparian vegetation.
• During the operational phase, monitor culverts to see if erosion issues arise and if any erosion control is required.
• Where possible culvert bases must be placed as close as possible with natural levels in mind so that these don't form additional steps / barriers.</td></tr>
<tr><td colspan="3">▪ Cumulative impacts:
The increase in surface run-off velocities and the reduction in the potential for groundwater infiltration is likely to occur, considering that the site is near the main drainage channels particularly when considering a possible 2 other renewable projects. However, the annual rainfall figures are low and this impact is not anticipated and only a small percentage of the proposed projects reach the construction phase and or cover large portions of the site.</td></tr>
<tr><td colspan="3">▪ Residual impacts:</td></tr>
</table>

Possible impact on the remaining catchment due to changes in run-off characteristics in the development site.							
	Extent	**Duration**	**Severity**	**Status**	**Significance**	**Probability**	**Confidence**
Without Mitigation	Local (L)	Medium Term (M)	L-	Negative	Medium (-)	High	High
With Mitigation	Local (L)	Short term (L)	L-	Negative	Low (-)	Low	High

Nature: Impact 2 - Impact on riparian systems through the possible increase in surface water runoff from hard surfaces and or new road crossings on riparian form and function during the operational phase		
	▪ **Without mitigation**	**With mitigation**
▪ **Reversibility**	▪ High	▪ High
▪ **Irreplaceable loss of resources**	▪ No	▪ No
▪ **Can impacts be mitigated**	▪ Yes	
▪ **Mitigation:** Any stormwater within the site must be handled in a suitable manner, i.e. trap sediments, and reduce flow velocities. This is particularly important due to the levels of erosion already observed within the affected catchments.		
▪ **Cumulative impacts:** Downstream alteration of hydrological regimes due to the increased run-off from the area. However due to low mean annual runoff within the region this is not anticipated due to the nature of the development together with the proposed layout. This is also coupled to the fact that surrounding developments would impact on a different catchment in the neighbouring water management area, coupled to the low average rainfall figures.		
▪ **Residual impacts:** Possible impact on the remaining catchment due to changes in run-off characteristics in the development site. However due to low mean annual runoff within the region this is not anticipated due to the nature of the development together with the proposed layout.		

	Extent	**Duration**	**Severity**	**Status**	**Significance**	**Probability**	**Confidence**
Without Mitigation	Local (L)	Short Term (L)	L-	Negative	Medium (-)	High	High
With Mitigation	Local (L)	Short term (L)	L-	Negative	Low (-)	Low	High

Nature: Impact 3 - Increase in sedimentation and erosion within the development footprint during the construction phase and to a lesser degree the operational phase		
	▪ **Without mitigation**	**With mitigation**
▪ **Reversibility**	▪ High	▪ High
▪ **Irreplaceable loss of resources**	▪ No	▪ No
▪ **Can impacts be mitigated**	▪ Yes	
▪ **Mitigation:** Any stormwater within the site must be handled in a suitable manner, i.e. trap sediments and reduce flow velocities.		
▪ **Cumulative impacts:** Downstream erosion and sedimentation of the downstream systems and farming operations. During flood events, any unstable banks (eroded areas) and sediment bars (sedimentation downstream). However due to low mean annual runoff within the region this is not anticipated due to the nature of the development together with the proposed layout.		
▪ **Residual impacts:**		

During flood events, any unstable banks (eroded areas) and sediment bars (sedimentation downstream) already deposited downstream. However due to low mean annual runoff within the region this is not anticipated due to the nature of the development together with the proposed layout.

	Extent	Duration	Severity	Status	Significance	Probability	Confidence
Without Mitigation	Local (L)	Medium- term (M)	L-	Negative	Medium (-)	High	High
With Mitigation	Local (L)	Short term (L)	L-	Negative	Low (-)	Low	High

Nature: Impact 4 – Impact on localized surface water quality mainly during the construction phase.

During construction and to a limited degree the operational activities, chemical pollutants (hydrocarbons from equipment and vehicles, cleaning fluids, cement powder, wet cement, shutter-oil, etc.) associated with site-clearing machinery and construction activities could be washed downslope via the ephemeral systems.

	Without mitigation	**With mitigation**
Reversibility	Yes (high)	Yes (high)
Irreplaceable loss of resources	Yes (medium)	Yes (low)
Can impacts be mitigated	Yes (high)	

Mitigation:

» Strict use and management of all hazardous materials used on site.

» Strict management of potential sources of pollution (e.g. litter, hydrocarbons from vehicles & machinery, cement during construction, etc.).

» Containment of all contaminated water by means of careful run-off management on the development site.

» Strict control over the behaviour of construction workers.

» Working protocols incorporating pollution control measures (including approved method statements by the contractor) should be clearly set out in the Construction Environmental Management Plan (CEMP) for the project and strictly enforced.

» Appropriate ablution facilities should be provided for construction workers during construction and on-site staff during the operation of the facility.

Cumulative impacts:

Possible impact on the remaining catchment due to changes in run-off characteristics in the development site. However due to low mean annual runoff within the region this is not anticipated due to the nature of the development together with the proposed layout.

Residual impacts:

Residual impacts will be negligible after appropriate mitigation.

	Extent	Duration	Severity	Status	Significance	Probability	Confidence
Without Mitigation	Local (L)	Medium term (M)	L-	Negative	Medium (-)	High	High
With Mitigation	Local (L)	Short term (L)	L-	Negative	Low (-)	Low	High

Nature: Impact 5 – Overall cumulative impact during the construction and operational phases. In the assessment of this project, the surrounding projects within a 35km radius of the site were assessed, including the Noupoort WEF that has recently been constructed. Other projects include, Naauw Poort Solar Energy Facility, Umsombomvu Wind Energy Facility, Aggenys Solar PV and Dida Solar PV. Of these potential projects, this report author has been involved in the initial EIA aquatic assessments or has managed / assisted with the Water Use License process for 2 of these projects. The author has also reviewed the outcomes of the remaining projects as part of this EIA or other EIA / WUL applications is the region. All of the projects have indicated that this is also their intention with regard mitigation, i.e. selecting the best possible routes to minimise the local and regional impacts, and improving the drainage or hydrological conditions with these rivers so that the cumulative impact would be negligible. However, the worse-case scenario has been assessed below, i.e. only the minimum of mitigation be implemented by the other projects, noting only a small number of projects ever reach the construction phase and that flows within these systems are sporadic.		
	Without mitigation	**With mitigation**
Reversibility	Yes (high)	Yes (high)
Irreplaceable loss of resources	Yes (medium)	Yes (low)
Can impacts be mitigated	Yes (high)	
Mitigation: » Improve the current stormwater and energy dissipation features not currently found along the tracks and roads within the region » Install properly sized culverts with erosion protection measures at the present road / track crossings		
Residual impacts: Residual impacts will be negligible after appropriate mitigation.		

	Extent	**Duration**	**Severity**	**Status**	**Significance**	**Probability**	**Confidence**
Without Mitigation	Local (L)	Medium term (M)	L-	Negative	Medium (-)	High	High
With Mitigation	Local (L)	Short term (L)	L-	Negative	Low (-)	Low	High

Grid Connection and substation alternatives

It is anticipated the no impacts on the aquatic environment will occur based on the proposed alignments and the alternatives. This is based on the assumption that during the final design process all transmission line towers will be located outside of the delineated water courses and the 32m buffer. This includes the 100m corridor extension around the current Eskom substation.

The only recommendation being that should any of the towers be located on steep slopes adequate erosion protection should be installed to prevent any surface water run-off from eroding these areas.

It is however recommended that a walk down of the final tower positions is conducted by an aquatic specialist prior to construction. This will allow for critical comment on the tower positions and allow for any adjustments to avoid any impacts by shifting tower positions where required.

9 – Conclusion and recommendations

The proposed mitigated layouts for the facilities and proposed transmission lines (inclusive of substations and turn-ins) would seem to have limited impact on the aquatic environment as the proposed structures can avoid the delineated watercourses except for the seven water course crossings. Thus, based on the findings of this study no objection to the authorisation of any of the proposed activities for within the WEF site and that the Preferred transmission route alignment, including the 100m corridor extension is used.

No aquatic protected or species of special concern (flora) were observed during the site visit. Therefore, based on the site visit the significance of the impacts assessed for the aquatic systems after mitigation would be LOW.

Figure 3 further indicates the seven (7) affected water courses and those that would trigger the need for a Water Use License application (a potential GA) in terms of Section 21 c and i of the National Water Act, within these areas.

Furthermore, an application for the abstraction of groundwater (Section 21a) and the temporary storage of domestic waste (Section 21g - conservancy tanks, if exceeding 10 000cm3) will be required

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11 – Appendix 1: Wetland assessment methods

The assessment was initiated with a survey of the pertinent literature, past reports and the various conservation plans that exist for the study region. Maps and Geographical Information Systems (GIS) were then employed to ascertain, which portions of the proposed development, could have the greatest impact on the wetlands and associated habitats.

A one day site visit was then conducted to ground-truth the above findings, thus allowing critical comment of the development when assessing the possible impacts and delineating the wetland areas.

Wetland and riparian areas were then assessed on the following basis:
Vegetation type – verification of type and its state or condition based, supported by species identification using Germishuizen and Meyer (2003), Vegmap (Mucina and Rutherford, 2006 as amended) and the South African Biodiversity Information Facility (SABIF) database.

Plant species were further categorised as follows:

- Terrestrial: species are not directly related to any surface or groundwater base-flows and persist solely on rainfall
- Facultative: species usually found in wetlands (inclusive of riparian systems) (67 – 99% of occurrences), but occasionally found in terrestrial systems (non wetland) (DWAF, 2005)
- Obligate: species that are only found within wetlands (>99% of occurrences) (DWAF, 2005)

Assessment of the wetland type based on the NWCS method discussed below and the required buffers with Mitigation or recommendations as required

National Wetland classification System (Ollis *et al*, 2013)

Since the late 1960's, wetland classification systems have undergone a series of international and national revisions. These revisions allowed for the inclusion of additional wetland types, ecological and conservation rating metrics, together with a need for a system that would allude to the functional requirements of any given wetland (Ewart-Smith *et al*., 2006). Wetland function is a consequence of biotic and abiotic factors, and wetland classification should strive to capture these aspects.

The South African National Biodiversity Institute (SANBI) in collaboration with a number of specialists and stakeholders developed the newly revised and now accepted National Wetland Classification Systems (Ollis *et al*., 2013). This system comprises a hierarchical classification process of defining a wetland based on the principles of the Hydrogeomorphic (HGM) approach at higher levels, with including structural features at the finer or lower levels of classification (Ollis *et al*., 2013).

Wetlands develop in a response to elevated water tables, linked either to rivers, groundwater flows or seepage from aquifers (Parsons, 2004). These water levels or flows then interact with localised geology and soil forms, which then determines the form and function of the respective wetlands. Water is thus the common driving force, in the formation of wetlands (DWAF, 2005). It is significant that the HGM approach has now been included in wetland classification as the HGM approach has been adopted throughout the water resources management realm with regard the determination of the Present Ecological State (PES) and Ecological Importance and Sensitivity (EIS) and WET-Health assessments for aquatic environments. All of these systems are then easily integrated using the HGM approach in line with the Eco-classification process of river and wetland reserve determinations used by the Department of Water Affairs. The Ecological Reserve of a wetland or river is used by DWA to assess the water resource allocations when assessing water use license applications (WULA).

The NWCS process is provided in more detail in the methods section of the report, but some of the terms and definitions used in this document are present below:

Definition Box

Present Ecological State is a term for the current ecological condition of the resource. This is assessed relative to the deviation from the Reference State. Reference State/Condition is the natural or pre-impacted condition of the system. The reference state is not a static condition, but refers to the natural dynamics (range and rates of change or flux) prior to development. The PES is determined per component - for rivers and wetlands this would be for the drivers: flow, water quality and geomorphology; and the biotic response indicators: fish, macroinvertebrates, riparian vegetation and diatoms. PES categories for every component would be integrated into an overall PES for the river reach or wetland being investigated. This integrated PES is called the EcoStatus of the reach or wetland.

EcoStatus is the overall PES or current state of the resource. It represents the totality of the features and characteristics of a river and its riparian areas or wetland that bear upon its ability to support an appropriate natural flora and fauna and its capacity to provide a variety of goods and services. The EcoStatus value is an integrated ecological state made up of a combination of various PES findings from component EcoStatus assessments (such as for invertebrates, fish, riparian vegetation, geomorphology, hydrology and water quality).

Reserve: The quantity and quality of water needed to sustain basic *human needs* and *ecosystems* (e.g. estuaries, rivers, lakes, groundwater and wetlands) to ensure ecologically sustainable development and utilisation of a water resource. The *Ecological Reserve* pertains specifically to aquatic ecosystems.

Reserve requirements: The quality, quantity and reliability of water needed to satisfy the requirements of basic human needs and the Ecological Reserve (inclusive of instream requirements).

Ecological Reserve determination study: The study undertaken to determine Ecological Reserve requirements.

Licensing applications: Water users are required (by legislation) to apply for licenses prior to extracting water resources from a water catchment.

Ecological Water Requirements: This **is the quality and quantity of water flowing through a natural stream course that is needed to sustain instream functions and ecosystem integrity at an acceptable level as determined during an EWR study. These then form part of the conditions for managing achievable water quantity and quality conditions as stipulated in the Reserve Template**

Water allocation process (compulsory licensing): This is a process where all existing and new water users are requested to reapply for their licenses, particularly in stressed catchments where there is an over-allocation of water or an inequitable distribution of entitlements.

Ecoregions are geographic regions that have been delineated in a top-down manner on the basis of physical/abiotic factors. • NOTE: For purposes of the classification system, the 'Level I Ecoregions' for South Africa, Lesotho and Swaziland (Kleynhans *et al.* 2005), which have been specifically developed by the Department of Water Affairs & Forestry (DWAF) for rivers but are used for the management of inland aquatic ecosystems more generally, are applied at Level 2A of the classification system. These Ecoregions are based on physiography, climate, geology, soils and potential natural vegetation.

Wetland definition

Although the National Wetland Classification System (Ollis *et al*., 2013) is used to classify wetland types it is still necessary to understand the definition of a wetland. Wetland definitions as with classification systems have changed over the years. Terminology currently strives to characterise a wetland not only on its structure (visible form), but also to relate this to the function and value of any given wetland.

The Ramsar Convention definition of a wetland is widely accepted as **"areas of marsh, fen, peatland or water, whether natural or artificial, permanent or temporary, with water that is static or flowing, fresh, brackish or salt, including areas of marine water the depth of which at low tide does not exceed six metres"** (Davis 1994). South Africa is a signatory to the Ramsar Convention and therefore its extremely broad definition of wetlands has been adopted for the proposed NWCS, with a few modifications.

Whereas the Ramsar Convention included marine water to a depth of six metres, the definition used for the NWCS extends to a depth of ten metres at low tide, as this is recognised seaward boundary of the shallow photic zone (Lombard *et al*., 2005). An additional minor adaptation of the definition is the removal of the term 'fen' as fens are considered a type of peatland. The adapted definition for the NWCS is, therefore, as follows (SANBI, 2009):

WETLAND: an area of marsh, peatland or water, whether natural or artificial, permanent or temporary, with water that is static or flowing, fresh, brackish or salt, including areas of marine water the depth of which at low tide does not exceed ten metres.

This definition encompasses all ecosystems characterised by the permanent or periodic presence of water other than marine waters deeper than ten metres. The only legislated definition of wetlands in South Africa, however, is contained within the National Water Act (Act No. 36 of 1998) (NWA), where wetlands are defined as "land which is transitional between terrestrial and aquatic systems, where the water table is usually 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 adapted to life in saturated soil." This definition is consistent with more precise working definitions of wetlands and therefore includes only a subset of ecosystems encapsulated in the Ramsar definition. It should be noted that the NWA definition is not concerned with marine systems and clearly distinguishes wetlands from estuaries, classifying the later as a water course (Ollis *et al*., 2013). The DWA is however reconsidering this position with regard the management of estuaries due to the ecological needs of these systems with regard to water allocation. Table 1 provides a comparison of the various wetlands included within the main sources of wetland definition used in South Africa.

Although a subset of Ramsar-defined wetlands was used as a starting point for the compilation of the first version of the National Wetland Inventory (i.e. "wetlands", as defined by the National Water Act, together with open waterbodies), it is understood that subsequent versions of the Inventory include the full suite of Ramsar-defined wetlands in order to ensure that South Africa meets its wetland inventory obligations as a signatory to the Convention (Ollis *et al*., 2013).

Wetlands must therefore have one or more of the following attributes to meet the above definition (DWAF, 2005):

A high water table that results in the saturation at or near the surface, leading to anaerobic conditions developing in the top 50cm of the soil.

Wetland or hydromorphic soils that display characteristics resulting from prolonged saturation, i.e. mottling or grey soils

The presence of, at least occasionally, hydrophilic plants, i.e. hydrophytes (water loving plants).

It should be noted that riparian systems that are not permanently or periodically inundated are not considered true wetlands, i.e. those associated with the drainage lines.

Table 1: Comparison of ecosystems considered to be 'wetlands' as defined by the proposed NWCS, the National Water Act (Act No. 36 of 1998), and ecosystems are included in DWAF's (2005) delineation manual.

Ecosystem	**NWCS "wetland"**	**National Water Act wetland**	**DWAF (2005) delineation manual**
Marine	YES	NO	NO
Estuarine	YES	NO	NO
Waterbodies deeper than 2 m (i.e. limnetic habitats often describes as lakes or dams)	YES	NO	NO
Rivers, channels and canals	YES	NO[1]	NO
Inland aquatic ecosystems that are not river channels and are less than 2 m deep	YES	YES	YES
Riparian[2] areas that are permanently / periodically inundated or saturated with water within 50 cm of the surface	YES	YES	YES[3]
Riparian[2] areas that are not permanently / periodically inundated or saturated with water within 50 cm of the surface	NO	NO	YES[3]

Wetland importance and function

South Africa is a Contracting Party to the Ramsar Convention on Wetlands, signed in Ramsar, Iran, in 1971, and has thus committed itself to this intergovernmental treaty, which provides the framework for the national protection of wetlands and the resources they could provide. Wetland conservation is now driven by the South African National Biodiversity Institute, a requirement under the National Environmental Management: Biodiversity Act (No 10 of 2004).

Wetlands are among the most valuable and productive ecosystems on earth, providing important opportunities for sustainable development (Davies and Day, 1998). However wetlands in South Africa are still rapidly being lost or degraded through direct human induced pressures (Nel *et al.,* 2004).

The most common attributes or goods and services provided by wetlands include:

Improve water quality;

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[1] Although river channels and canals would generally not be regarded as wetlands in terms of the National Water Act, they are included as a 'watercourse' in terms of the Act

[2] According to the National Water Act and Ramsar, riparian areas are those areas that are saturated or flooded for prolonged periods would be considered riparian wetlands, opposed to non –wetland riparian areas that are only periodically inundated and the riparian vegetation persists due to having deep root systems drawing on water many meters below the surface.

[3] The delineation of 'riparian areas' (including both wetland and non-wetland components) is treated separately to the delineation of wetlands in DWAF's (2005) delineation manual.

- Impede flow and reduce the occurrence of floods;
- Reeds and sedges used in construction and traditional crafts;
- Bulbs and tubers, a source of food and natural medicine;
- Store water and maintain base flow of rivers;
- Trap sediments; and
- Reduce the number of water borne diseases.

In the past wetland conservation has focused on biodiversity as a means of substantiating the protection of wetland habitat. However not all wetlands provide such motivation for their protection, thus wetland managers and conservationists began assessing the importance of wetland function within an ecosystem.

Table 2 summarises the importance of wetland function when related to ecosystem services or ecoservices (Kotze *et al*., 2008). One such example is emergent reed bed wetlands that function as transformers converting inorganic nutrients into organic compounds (Mitsch and Gosselink, 2000).

Table 2: Summary of direct and indirect ecoservices provided by wetlands from Kotze *et al.*, 2008.

<table>
<tr><td rowspan="15">Ecosystem services supplied by wetlands</td><td rowspan="9">Indirect benefits</td><td rowspan="8">Hydro-geochemical benefits</td><td colspan="2">Flood attenuation</td></tr>
<tr><td colspan="2">Stream flow regulation</td></tr>
<tr><td rowspan="5">Water quality enhancement benefits</td><td>Sediment trapping</td></tr>
<tr><td>Phosphate assimilation</td></tr>
<tr><td>Nitrate assimilation</td></tr>
<tr><td>Toxicant assimilation</td></tr>
<tr><td>Erosion control</td></tr>
<tr><td colspan="2">Carbon storage</td></tr>
<tr><td colspan="3">Biodiversity maintenance</td></tr>
<tr><td rowspan="6">Direct benefits</td><td colspan="3">Provision of water for human use</td></tr>
<tr><td colspan="3">Provision of harvestable resources[2]</td></tr>
<tr><td colspan="3">Provision of cultivated foods</td></tr>
<tr><td colspan="3">Cultural significance</td></tr>
<tr><td colspan="3">Tourism and recreation</td></tr>
<tr><td colspan="3">Education and research</td></tr>
</table>

Relevant wetland legislation and policy

Locally the South African Constitution, seven (7) Acts and two (2) international treaties allow for the protection of wetlands and rivers. These systems are protected from the destruction or pollution by the following:

- Section 24 of The Constitution of the Republic of South Africa;
- Agenda 21 – Action plan for sustainable development of the Department of Environmental Affairs and Tourism (DEAT) 1998;
- The Ramsar Convention, 1971 including the Wetland Conservation Programme (DEAT) and the National Wetland Rehabilitation Initiative (DEAT, 2000);
- National Environmental Management Act (NEMA), 1998 (Act No. 107 of 1998) inclusive of all amendments, as well as the NEM: Biodiversity Act;
- National Water Act, 1998 (Act No. 36 of 1998);
- Conservation of Agricultural Resources Act, 1983 (Act No. 43 of 1983); and
- Minerals and Petroleum Resources Development Act, 2002 (Act No. 28 of 2002).
- Nature and Environmental Conservation Ordinance (No. 19 of 1974)
- National Forest Act (No. 84 of 1998)
- National Heritage Resources Act (No. 25 of 1999)

Apart from NEMA, the Conservation of Agricultural Resources Act (CARA), 1983 (Act No. 43 of 1983) will also apply to this project. The CARA has categorised a large number of invasive plants together with associated obligations of the land owner. A number of Category 1 & 2 plants were found at all of the sites investigated, thus the contractors must take extreme care further spread of these plants doesn't occur. This should be done through proper stockpile management (topsoil) and suitable rehabilitation of disturbed areas after construction.

An amendment of the National Environmental Management was promulgated late December 2011, namely the Biodiversity Act or NEM:BA (Act No 10 of 2004), which lists 225 threatened ecosystems based on vegetation type (Vegmap, 2006 as amended). Should a vegetation type or ecosystem be listed, actions in terms of NEM:BA are triggered.

Provincial legislation and policy

Various provincial guidelines on buffers have been issued within the province. These are stated below so that the engineers and contractors are aware of these buffers during the planning phase. Associated batch plants, stockpiles, lay down areas and construction camps should avoid these buffer areas.

Until national guidelines for riverine and wetland buffers are established, the guidelines set out in the Eastern Cape Biodiversity Conservation Plan documentation should be applied (Berliner & Desmet, 2007). Table 3 recommends buffers for rivers.

Table 3: Recommended buffers for rivers, with the applicable buffer related to this study shaded in grey

River criterion used	Buffer width (m)	Rationale
Mountain streams and upper foothills of all 1:500 000 rivers	50	These longitudinal zones generally have more confined riparian zones than lower foothills and lowland rivers and are generally less threatened by agricultural practices.
Lower foothills and lowland rivers of all 1:500 000 rivers	100	These longitudinal zones generally have less confined riparian zones than mountain streams and upper foothills and are generally more threatened by agricultural practices. These larger buffers are particularly important to lower the amount of crop-spray reaching the river.
All remaining 1:50 000 streams	32	Generally smaller upland streams corresponding to mountain streams and upper foothills, smaller than those designated in the 1:500 000 rivers layer. They are assigned the riparian buffer required under South African legislation.

Currently there is no accepted priority ranking system for wetlands. Until such a system is developed, it is recommended that a **50m buffer be set for all wetlands**.

Other policies that are relevant include:

- Provincial Nature Conservation Ordinance (PNCO) – Protected Flora. Any plants found within the sites are described in the ecological assessment.
- National Freshwater Ecosystems Priority Areas – CSIR 2011 draft. This mapping product highlights potential rivers and wetlands that should be earmarked for conservation on a national basis.

National Wetland Classification System method

During this study due to the nature of the wetlands and watercourses observed, it was decided that the newly accepted National Wetlands Classification System (NWCS) be adopted. This classification approach has integrated aspects of the HGM approached used in the WET-Health system as well as the widely accepted eco-classification approach used for rivers.

The NWCS (SANBI, 2009) as stated previously, uses hydrological and geomorphological traits to distinguish the primary wetland units, i.e. direct factors that influence wetland function. Other wetland assessment techniques, such as the DWAF (2005) delineation method, only infer wetland function based on abiotic and biotic descriptors (size, soils & vegetation) stemming from the Cowardin approach (SANBI, 2009).

The classification system used in this study is thus based on SANBI (2009) and is summarised below:

The NWCS has a six tiered hierarchical structure, with four spatially nested primary levels of classification (Figure 1). The hierarchical system firstly distinguishes between Marine, Estuarine and Inland ecosystems (**Level 1**), based on the degree of connectivity the particular systems has with the open ocean (greater than 10 m in depth). Level 2 then categorises the regional wetland setting using a combination of biophysical attributes at the landscape level, which operate at a broad bioregional scale. This is opposed to specific attributes such as soils and vegetation. **Level 2** has adopted the following systems:

- Inshore bioregions (marine)
- Biogeographic zones (estuaries)
- Ecoregions (Inland)

Level 3 of the NWCS assess the topographical position of inland wetlands as this factor broadly defines certain hydrological characteristics of the inland systems. Four landscape units based on topographical position are used in distinguishing between Inland systems at this level. No subsystems are recognised for Marine systems, but estuaries are grouped according to their periodicity of connection with the marine environment, as this would affect the biotic characteristics of the estuary.

Level 4 classifies the hydrogeomorphic (HGM) units discussed earlier. The HGM units are defined as follows:

Landform – shape and localised setting of wetland

Hydrological characteristics – nature of water movement into, through and out of the wetland

Hydrodynamics – the direction and strength of flow through the wetland

These factors characterise the geomorphological processes within the wetland, such as erosion and deposition, as well as the biogeochemical processes.

Level 5 of the assessment pertains to the classification of the tidal regime within the marine and estuarine environments, while the hydrological and inundation depth classes are determined for the inland wetlands. Classes are based on frequency and depth of inundation, which are used to determine the functional unit of the wetlands and are considered secondary discriminators within the NWCS.

Level 6 uses of six descriptors to characterise the wetland types on the basis of biophysical features. As with Level 5, these are non hierarchal in relation to each other and are applied in any order, dependent on the availability of information. The descriptors include:

- Geology;
- Natural vs. Artificial;
- Vegetation cover type;
- Substratum;
- Salinity; and
- Acidity or Alkalinity.

It should be noted that where sub-categories exist within the above descriptors, hierarchical systems are employed, thus are nested in relation to each other.

The HGM unit (Level 4) is the **focal point of the NWCS**, with the upper levels (Figure 2 – Inland systems only) providing means to classify the broad bio-geographical context for grouping functional wetland units at the HGM level, while the lower levels provide more descriptive detail on the particular wetland type characteristics of a particular HGM unit. Therefore Level 1 – 5 deals with functional aspects, while Level 6 classifies wetlands on structural aspects.

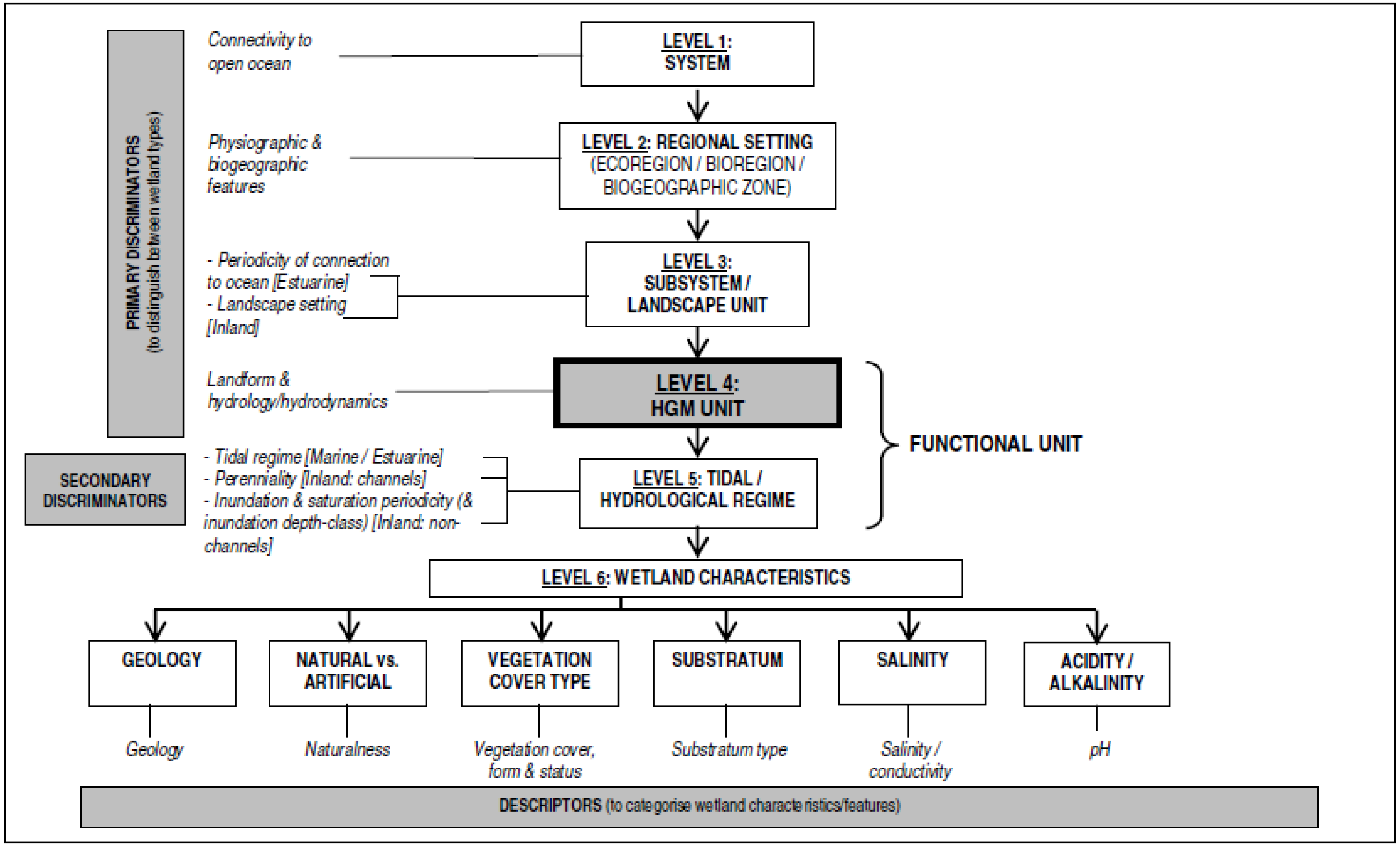

Figure 1: Basic structure of the National Wetland Classification System, showing how 'primary discriminators' are applied up to Level 4 to classify Hydrogeomorphic (HGM) Units, with 'secondary discriminators' applied at Level 5 to classify the tidal/hydrological regime, and 'descriptors' applied at Level 6 to categorise the characteristics of wetlands classified up to Level 5 (From Ollis *et al*., 2013).

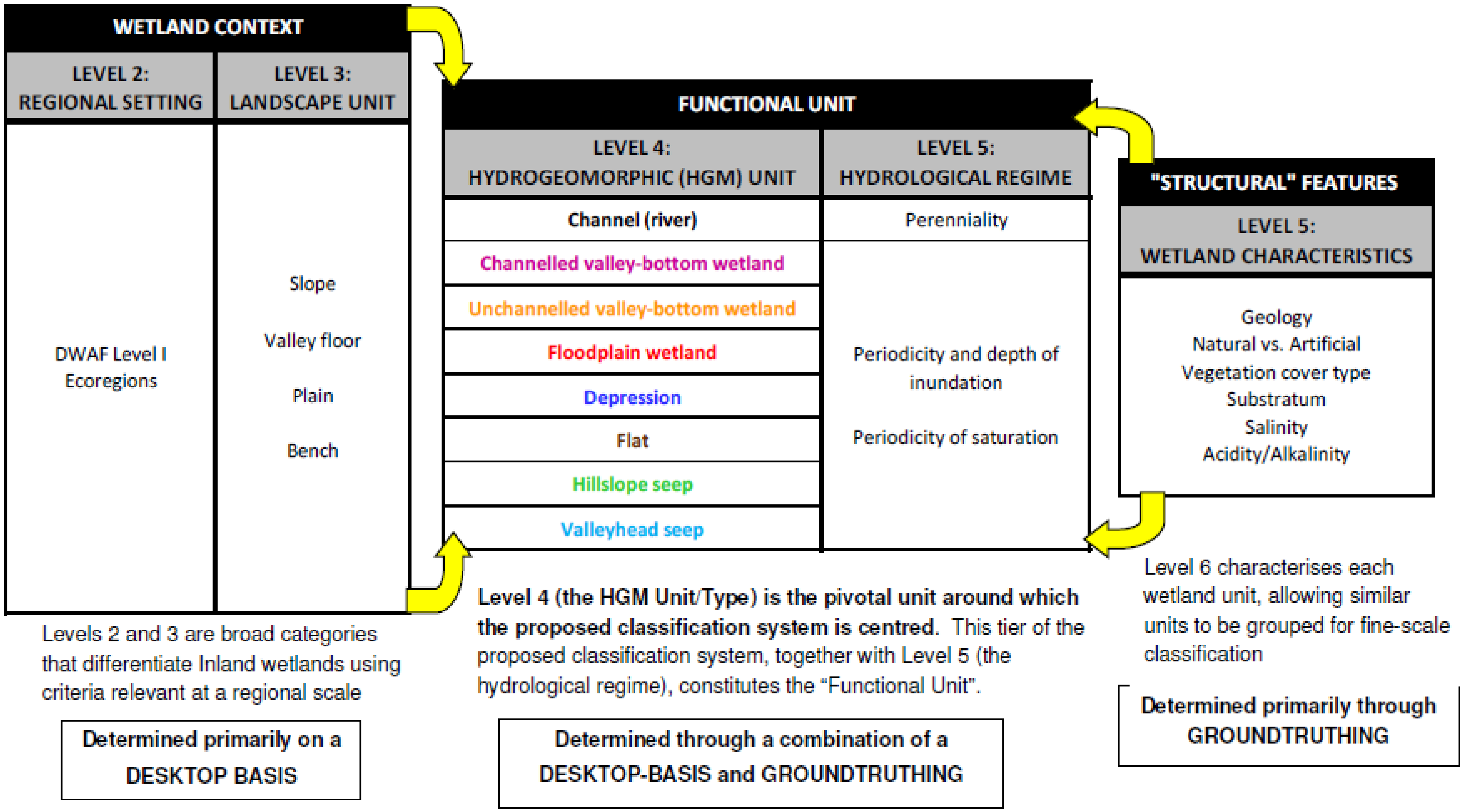

Figure 2 Illustration of the conceptual relationship of HGM Units (at Level 4) with higher and lower levels (relative sizes of the boxes show the increasing spatial resolution and level of detail from the higher to the lower levels) for Inland Systems (from Ollis *et al*., 2013).

Wetland condition and conservation importance assessment

To assess the Present Ecological State (PES) or condition of the observed wetlands, a modified Wetland Index of Habitat Integrity (DWAF, 2007) was used. The Wetland Index of Habitat Integrity (WETLAND-IHI) is a tool developed for use in the National Aquatic Ecosystem Health Monitoring Programme (NAEHMP), formerly known as the River Health Programme (RHP). The output scores from the WETLAND-IHI model are presented in the standard DWAF A-F ecological categories (Table 4), and provide a score of the Present Ecological State of the habitat integrity of the wetland system being examined. The author has included additional criteria into the model based system to include additional wetland types. This system is preferred when compared to systems such as WET-Health – wetland management series (WRC 2009), as WET-Health (Level 1) was developed with wetland rehabilitation in mind, and is not always suitable for impact assessments. This coupled to degraded state of the wetlands in the study area, a complex study approach was not warranted, i.e. conduct a Wet-Health Level 2 and WET-Ecosystems Services study required for an impact assessment.

Table 4: Description of A – F ecological categories based on Kleynhans *et al*., (2005).

<table>
<tr><th>ECOLOGICAL CATEGORY</th><th>ECOLOGICAL DESCRIPTION</th><th>MANAGEMENT PERSPECTIVE</th></tr>
<tr><td>A</td><td>Unmodified, natural.</td><td>Protected systems; relatively untouched by human hands; no discharges or impoundments allowed</td></tr>
<tr><td>B</td><td>Largely natural with few modifications. A small change in natural habitats and biota may have taken place but the ecosystem functions are essentially unchanged.</td><td>Some human-related disturbance, but mostly of low impact potential</td></tr>
<tr><td>C</td><td>Moderately modified. Loss and change of natural habitat and biota have occurred, but the basic ecosystem functions are still predominantly unchanged.</td><td rowspan="2">Multiple disturbances associated with need for socio-economic development, e.g. impoundment, habitat modification and water quality degradation</td></tr>
<tr><td>D</td><td>Largely modified. A large loss of natural habitat, biota and basic ecosystem functions has occurred.</td></tr>
<tr><td>E</td><td>Seriously modified. The loss of natural habitat, biota and basic ecosystem functions is extensive.</td><td rowspan="2">Often characterized by high human densities or extensive resource exploitation. Management intervention is needed to improve health, e.g. to restore flow patterns, river habitats or water quality</td></tr>
<tr><td>F</td><td>Critically / Extremely modified. Modifications have reached a critical level and the system has been modified completely with an almost complete loss of natural habitat and biota. In the worst instances the basic ecosystem functions have been destroyed and the changes are irreversible.</td></tr>
</table>

The WETLAND-IHI model is composed of four modules. The “Hydrology”, “Geomorphology” and “Water Quality” modules all assess the contemporary ***driving processes*** behind wetland formation and maintenance. The last module, “Vegetation Alteration”, provides an indication of the intensity of human landuse activities on the wetland surface itself and how these may have ***modified*** the condition of the wetland. The integration of the scores from these 4 modules provides an overall Present Ecological State (PES) score for the wetland system being examined. The WETLAND-IHI model is an MS Excel-based model, and the data required for the assessment are generated during a rapid site visit.

Additional data may be obtained from remotely sensed imagery (aerial photos; maps and/or satellite imagery) to assist with the assessment. The interface of the WETLAND-IHI has been developed in a format which is similar to DWAF’s River EcoStatus models which are currently used for the assessment of PES in riverine environments.

Conservation importance of the individual wetlands was based on the following criteria:

- Habitat uniqueness
- Species of conservation concern
- Habitat fragmentation with regard ecological corridors
- Ecosystem service (social and ecological)

The presence of any or a combination of the above criteria would result in a HIGH conservation rating if the wetland was found in a near natural state (high PES). Should any of the habitats be found modified the conservation importance would rate as MEDIUM, unless a Species of conservation concern was observed (HIGH). Any systems that was highly modified (low PES) or had none of the above criteria, received a LOW conservation importance rating. Wetlands with HIGH and MEDIUM ratings should thus be excluded from development with incorporation into a suitable open space system, with the maximum possible buffer being applied. Wetlands which receive a LOW conservation importance rating could be included into stormwater management features, but should not be developed to retain the function of any ecological corridors

12 - Appendix 2: Specialist CV

CURRICULUM VITAE
Dr Brian Michael Colloty
7212215031083

1 Rossini Rd
Pari Park
Port Elizabeth, 6070
brian@itsnet.co.za
083 498 3299

Profession: Ecologist & Environmental Assessment Practitioner (Pr. Sci. Nat. 400268/07 & EAPSA certified). Member of the South African Wetland Society
Specialisation: Ecology and conservation importance rating of inland habitats, wetlands, rivers & estuaries
Years experience: 21 years

SKILLS BASE AND CORE COMPETENCIES

- 21 years experience in environmental sensitivity and conservation assessment of aquatic and terrestrial systems inclusive of Index of Habitat Integrity (IHI), WET Tools, Riparian Vegetation Response Assessment Index (VEGRAI) for Reserve Determinations, estuarine and wetland delineation throughout Africa. Experience also includes biodiversity and ecological assessments with regard sensitive fauna and flora, within the marine, coastal and inland environments. Countries include Mozambique, Kenya, Namibia, Central African Republic, Zambia, Eritrea, Mauritius, Madagascar, Angola, Ghana, Guinea-Bissau and Sierra Leone. Current projects also span all nine provinces in South Africa.
- 12 years experience in the coordination and management of multi-disciplinary teams, such as specialist teams for small to large scale EIAs and environmental monitoring programmes, throughout Africa and inclusive of marine, coastal and inland systems. This includes project and budget management, specialist team management, client and stakeholder engagement and project reporting.
- GIS mapping and sensitivity analysis

TERTIARY EDUCATION

- 1994: B Sc Degree (Botany & Zoology) - NMMU
- 1995: B Sc Hon (Zoology) - NMMU
- 1996: M Sc (Botany - Rivers) - NMMU
- 2000: Ph D (Botany – Estuaries & Mangroves) – NMMU

EMPLOYMENT HISTORY

- 1996 – 2000 Researcher at Nelson Mandela Metropolitan University – SAB institute for Coastal Research & Management. Funded by the WRC.
- 2001 – January 2003 Training development officer AVK SA (reason for leaving – sought work back in the environmental field rather than engineering sector)
- February 2003- June 2005 Project manager & Ecologist for Strategic Environmental Focus (Pretoria) – (reason for leaving – sought work related more to experience in the coastal environment)
- July 2005 – June 2009 Principal Environmental Consultant Coastal & Environmental Services (reason for leaving – company restructuring)
- June 2009 – present Owner / Ecologist of Scherman Colloty & Associates cc

SELECTED RELEVANT PROJECT EXPERIENCE

World Bank IFC Standards

- Kenmare Mining Pilivilli, Mozambique - wetland (mangroves, peatlands and estuarine) assessment and biodiversity offset analysis - current
- Botswana South Africa 400kv transmission line (400km) biodiversity assessment on behalf of Aurecon - current
- Farim phosphate mine and port development, Guinea Bissau – biodiversity and estuarine assessment on behalf of Knight Piesold Canada – 2016.
- Tema LNG offshore pipeline EIA – marine and estuarine assessment for Quantum Power (2015).
- Colluli Potash South Boulder, Eritrea, SEIA marine baseline and hydrodynamic surveys co-ordinator and coastal vegetation specialist (coastal lagoon and marine) (on-going).
- Wetland, estuarine and riverine assessment for Addax Biofeuls Sierra Leone, Makeni for Coastal & Environmental Services: 2009
- ESHIA Project manager and long-term marine monitoring phase coordinator with regards the dredge works required in Luanda bay, Angola. Monitoring included water quality and biological changes in the bay and at the offshore disposal outfall site, 2005-2011

South African

- Wetland specialist appointed to update the Eastern Cape Biodiversity Conservation Plan, for the Province on behalf of EOH CES appointment by SANBI – current. This includes updating the National Wetland Inventory for the province, submitting the new data to CSIR/SANBI.

Dr Brian Colloty 1

- Nelson Mandela Bay Municipality Baakens River Integrated Wetland Assessment (Inclusive of Rehabilitation and Monitoring Plans) for CEN IEM Unit - Current
- Rangers Biomass Gasification Project (Uitenhage), wetland assessment and wetland rehabilitation / monitoring plans for CEM IEM Unit – current.
- Gibson Bay Wind Farm implementation of the wetland management plan during the construction and operation of the wind farm (includes surface / groundwater as well wetland rehabilitation & monitoring plan) on behalf of Enel Green Power - current
- Gibson Bay Wind Farm 133kV Transmission Line wetland management plan during the construction of the transmission line (includes wetland rehabilitation & monitoring plan) on behalf of Eskom – 2016.
- Tsitsikamma Community Wind Farm implementation of the wetland management plan during the construction of the wind farm (includes surface / biomonitoring, as well wetland rehabilitation & monitoring plan) on behalf of Cennergi – completed May 2016.
- Alicedale bulk sewer pipeline for Cacadu District, wetland and water quality assessment, 2016
- Mogalakwena 33kv transmission line in the Limpopo Province, on behlaf of Aurecon, 2016
- Cape St Francis WWTW expansion wetland and passive treatment system for the Kouga Municipality, 2015
- Macindane bulk water and sewer pipelines wetland and wetland rehabilitation plan for the Indwe 2015
- Eskom Prieska to Copperton 132kV transmission line aquatic assessment, Northern Cape on behalf of Savannah Environmental 2015.
- Joe Slovo sewer pipeline upgrade wetland assessment for Nelson Mandela Bay Municipality 2014
- Cape Recife Waste Water Treatment Works expansion and pipeline aquatic assessment for Nelson Mandela Bay Municipality 2013
- Pola park bulk sewer line upgrade aquatic assessment for Nelson Mandela Bay Municipality 2013
- Transnet Freight Rail – Swazi Rail Link (Current) wetland and ecological assessment on behalf of Aurecon for the proposed rail upgrade from Ermelo to Richards Bay
- Eskom Transmission wetland and ecological assessment for the proposed transmission line between Pietermaritzburg and Richards Bay on behalf of Aurecon (2012).
- Port Durnford Exarro Sands biodiversity assessment for the proposed mineral sands mine on behalf of Exxaro (2009)
- Fairbreeze Mine Exxaro (Mtunzini) wetland assessment on behalf of Strategic Environmental Services (2007).
- Wetland assessment for Richards Bay Minerals (2013) – Zulti North haul road on behalf of RBM.
- Biodiversity and aquatic assessments for 85 renewable projects in the past four years in the Western, Eastern, Northern Cape, KwaZulu-Natal and Free State provinces. Clients included RES-SA, RedCap, ACED Renewables, Mainstream Renewable, GDF Suez, Globeleq, ENEL, Abengoa amongst others. Particular aquatic sensitivity assessment and Water Use License Applications on behalf of Mainstream Renewable Energy (8 wind farms and 3 PV facilities.), Cennergi / Exxaro (2 Wind farm), WKN Wind current (2 wind farms & 2 PV facilities), ACED (6 wind farms) and Windlab (3 Wind farms) were also conducted. Several of these projects also required the assessment of the proposed transmission lines and switching stations, which were conducted on behalf of Eskom.
- Vegetation assessments on the Great Brak rivers for Department of Water and Sanitation, 2006 and the Gouritz Water Management Area (2014)
- Proposed FibreCo fibre optic cable vegetation assessment along the N2, PE to Cape Town, 2012 on behalf of SRK (2013).

13 - Appendix 3: Signed declaration

environmental affairs

Department:
Environmental Affairs
REPUBLIC OF SOUTH AFRICA

DETAILS OF SPECIALIST AND DECLARATION OF INTEREST

	(For official use only)
File Reference Number:	12/12/20/ or 12/9/11/L
NEAS Reference Number:	DEA/EIA
Date Received:	

Application for integrated environmental authorisation and waste management licence in terms of the-

(1) National Environmental Management Act, 1998 (Act No. 107 of 1998), as amended and the Environmental Impact Assessment Regulations, 2014; and

(2) National Environmental Management Act: Waste Act, 2008 (Act No. 59 of 2008) and Government Notice 921, 2013

PROJECT TITLE

PROPOSED PHEZUKOMOYO WEF AND ASSOCIATED TRANSMISSION LINES

Specialist:	Scherman Colloty and Associates		
Contact person:	Dr Brian Colloty		
Postal address:	1 Rossini Rd Pari Park Port Elizabeth		
Postal code:	6070	Cell:	0834983299
Telephone:	041 363 2077	Fax:	-
E-mail:	brian@itsnet.co.za		
Professional affiliation(s) (if any)	Pr Sci Nat – Ecologist 400268/07 Member of the South African Wetland Society		

Project Consultant:	Arcus Consulting		
Contact person:	Anja Albertyn		
Postal address:	Office 220 Cube Workspace cnr Long and Hans Strijdom CPT		
Postal code:	8001	Cell:	0762658933
Telephone:	0214121533	Fax:	-
E-mail:	anjaa@arcusconsulting.co.za		

4.2 The specialist appointed in terms of the Regulations_

I, Brian Colloty, declare that --

General declaration:

- I act as the independent specialist in this application;
- I will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant;
- I declare that there are no circumstances that may compromise my objectivity in performing such work;
- I have expertise in conducting the specialist report relevant to this application, including knowledge of the Act, Regulations and any guidelines that have relevance to the proposed activity;
- I will comply with the Act, Regulations and all other applicable legislation;
- I have no, and will not engage in, conflicting interests in the undertaking of the activity;
- I undertake to disclose to the applicant and the competent authority all material information in my possession that reasonably has or may have the potential of influencing - any decision to be taken with respect to the application by the competent authority; and - the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority;
- all the particulars furnished by me in this form are true and correct; and
- I realise that a false declaration is an offence in terms of regulation 48 and is punishable in terms of section 24F of the Act.

[signature]

Signature of the specialist:

Scherman Colloty and Associates

Name of company (if applicable):

16/10/2017.

Date: