BRANDVALLEY WIND ENERGY FACILITY

AQUATIC ASSESSMENT

Prepared for:

EOH Coastal and Environmental Services

Prepared by:

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ACRONYMS

CARA	Conservation of Agricultural Resources Act
CBA	Critical Biodiversity Area
CSIR	Council for Scientific and Industrial Research
DWS	Department of Water and Sanitation formerly the Department of Water Affairs
EIA	Ecological Importance and Sensitivity
EIS	Ecological Importance and Sensitivity
ESA	Ecological Support Area
GIS	Geographic Information System
NFEPA	National Freshwater Ecosystem Priority Atlas (Nel, *et al*. 2011).
PES	Present Ecological State
SANBI	South African National Biodiversity Institute
SQ	Subquaternary catchment
WUL	Water Use License
WULA	Water Use License Application

1 EXECUTIVE SUMMARY

Scherman Colloty & Associates (SC&A) was appointed by EOH Coastal & Environmental Services to conduct an aquatic impact assessment for the proposed Brandvalley Wind Energy Facility between Laingsburg and Sutherland located within the Western Cape and Northern Cape provinces (Figure 1). The scope of this aquatic impact assessment included delineating any natural waterbodies remaining on the properties in question, as well as assessing the potential consequences of the proposed project development layout on the surrounding water courses. This was based on information collected during site visits within the region in late August 2012, July 2014 and a site specific visit in March 2016, which coincides with early winter / winter rainfall within the region while adhering to the assessment criteria contained in the DWAF 2005 / 2007 delineation manuals and the National Wetland Classification System (2014) found in the Appendix 1.

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 is provided, following from the results obtained in a survey of the regional literature and observations made during a site visit conducted in March 2016. These analyses were based on the models developed by the Department of Water and Sanitation, with the results producing ratings (A – F) and comment on the potential impact of the proposed development areas based on any constraints as a result of the presence of any sensitive terrestrial and aquatic habitats.

Certain aspects of the development may need for Water Use License Applications to be submitted for activities such as river crossings, as they may trigger Sections 21 (c) and (i) of the National Water Act (Act 36 of 1998). If applicable, these applications must be submitted to the Department of Water and Sanitation and information contained in this report must be used in the supporting documentation.

The proposed development occurs within the following catchments within the Nama Karoo ecoregion:

1. E23A – Wilgebos / Kleinpoorts tributaries of the Tankwa River
2. E22B – Muishond River
3. E22A – Groot River
4. J11D – Roggeveld River

These catchments are characterised by several perennial water courses associated with these mainstem systems listed above. While the larger systems towards the south of the study area are alluvial systems, characterised as natural sediment transport mechanisms within the regional environment. Overall with the exception of impacts such as erosion and present road crossings, conversion of floodplain areas to agriculture, while some areas still have small remaining *Juncus* wetlands (valley bottom wetland types – with and without channels).

The Present Ecological State scores (PES) for the respective subquaternary catchments within the study area were rated as follows (DWS, 2014 – where A = Natural or Close to Natural & C = Moderately Modified):

Subquaternary Catchment Number	Present Ecological State	Ecological Importance	Ecological Sensitivity
8162	C	High	High
8171	A	High	Very High
8258	A	High	Very High
8233	A	High	Very High
8134	A	High	Very High
7876	A	High	High
7875	A	High	High

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. 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 & 6. 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. Thus the DWS 2014 assessment for each of the study area systems is supported and the current ratings can be upheld.

According to the National Freshwater Ecosystems Priority Area (NFEPA) wetland data, several large natural wetlands could occur within the study area. While the remaining waterbodies are artificial or man-made systems such as dams. However, the natural wetlands observed within the study area are *Juncus* (Sedge) dominated valley bottom wetlands, some containing channels, while others i.e., those associated with broader floodplains have no channels. These natural wetland areas, were dominated by impacts such as dams, and the conversion to agricultural lands, thus most were Moderately Modified (PES = C), Largely Modified (PES = D) or somewhere between (PES = C/D).

These systems do still contain value in terms of acting as sponge areas within an arid environment, providing additional aquatic habitat (mostly for birds) and filtering any runoff due peak flow periods. For this reason, all the wetlands were rated as having a Moderate Ecological Importance and Sensitivity (EIS) Score.

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

- Impact 1: Loss of riparian systems and alluvial water courses in the construction, operation and decommissioning phases
- Impact 2: Impact on riparian systems through the possible increase in surface water runoff on riparian form and function during the operation and decommissioning phases
- Impact 3: Loss of wetlands and wetland function in the construction phase
- Impact 4: Increase in sedimentation and erosion in the construction, operation and decommissioning phases
- Impact 5: Potential impact on localised surface water quality during the construction and decommissioning phases
- Impact 6: Storage of hazardous substances particular in the construction phase
- Impact 7: The No-go Alternative

<u>The proposed layout for the facility would seem to have limited impact on the aquatic environment as the proposed structures for the most part have either avoided the delineated watercourses and wetlands with the exception of a number of water course crossings by the proposed access roads. Use of any existing roads will further support this conclusion, particularly with regard the two wetland crossings (Figure 6), although the wetlands concerned are already impacted by the surrounding roads, dams and farming activities. Thus based on the findings of this study no objection to the authorisation of any of the proposed activities inclusive of the alternatives is made.</u>

Where any road upgrades are required it is understood that these current crossings may be upgraded by increasing the current size of the culverts and provide additional erosion protection, thus a possible net benefit to the local aquatic systems. The actual requirements and designs will be finalized in the detail design phase. It is therefore recommended that these positions are assessed in the EMP walk down phase to provide detailed mitigations to the engineers as and when required.

Further, 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. This would apply to all the proposed alternatives with regard the substations, construction areas and roads.

Figure 6 further indicates the affected natural water courses / wetlands and those that would trigger the need for a Water Use License Application in terms of Section 21 c and i of the National Water Act (Act 36 of 1998) or potentially permitted in terms of the General Authorisation, should any construction take place within these areas. It should be noted that Figure 6 indicates the final delineations of all the natural wetlands as confirmed during the site visit and all the water course. Should any of the present road crossings need to be upgraded then the opportunity exists to improve the current state (lack of habitat continuity) for example by replacing pipe culverts with box culverts, while also reducing the height of the bridge footings (culvert bases) to reinstate natural water course levels. <u>This opportunity to improve the hydrological conditions can be seen as a net benefit and has been assessed as part of the cumulative impact statement</u>.

2 INTRODUCTION

Scherman Colloty & Associates (SC&A) was appointed by EOH Coastal & Environmental Services to conduct an aquatic impact assessment for the proposed Brandvalley Wind Energy Facility between Laingsburg and Sutherland located within the Western Cape and Northern Cape provinces (Figure 1). The scope of this aquatic impact assessment included delineating any natural waterbodies remaining on the properties in question, as well as identifying the potential consequences of the layout on the surrounding water courses. This was based on information collected during site visits in in the region late August 2012, July 2014 and a site specific visit in March 2016, which coincides with early winter / winter rainfall within the region while adhering to the assessment criteria contained in the DWAF 2005 / 2007 delineation manuals and the National Wetland Classification System 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. This document follows on from results obtained in a survey of the regional literature and observations made during the site specific visit conducted in March 2016. The objective of this report is to provide comment on the potential impact of the proposed development areas based on any constraints as a result of the presence of any sensitive terrestrial and aquatic habitats.

Several important national, provincial and municipal scale conservation plans were also reviewed, with the results of those studies being included in this report. Most conservation plans are produced at a coarse scale so it thus important to verify the actual status of the study area during this initial phase, prior to the final development plan being produced.

Certain aspects of the development may also trigger the need for approvals in terms of Section 21 of the National Water Act (Act 36 of 1998) such as for road river crossings. These applications must be submitted to the Department of Water and Sanitation and information contained in this report must be used in the supporting documentation.

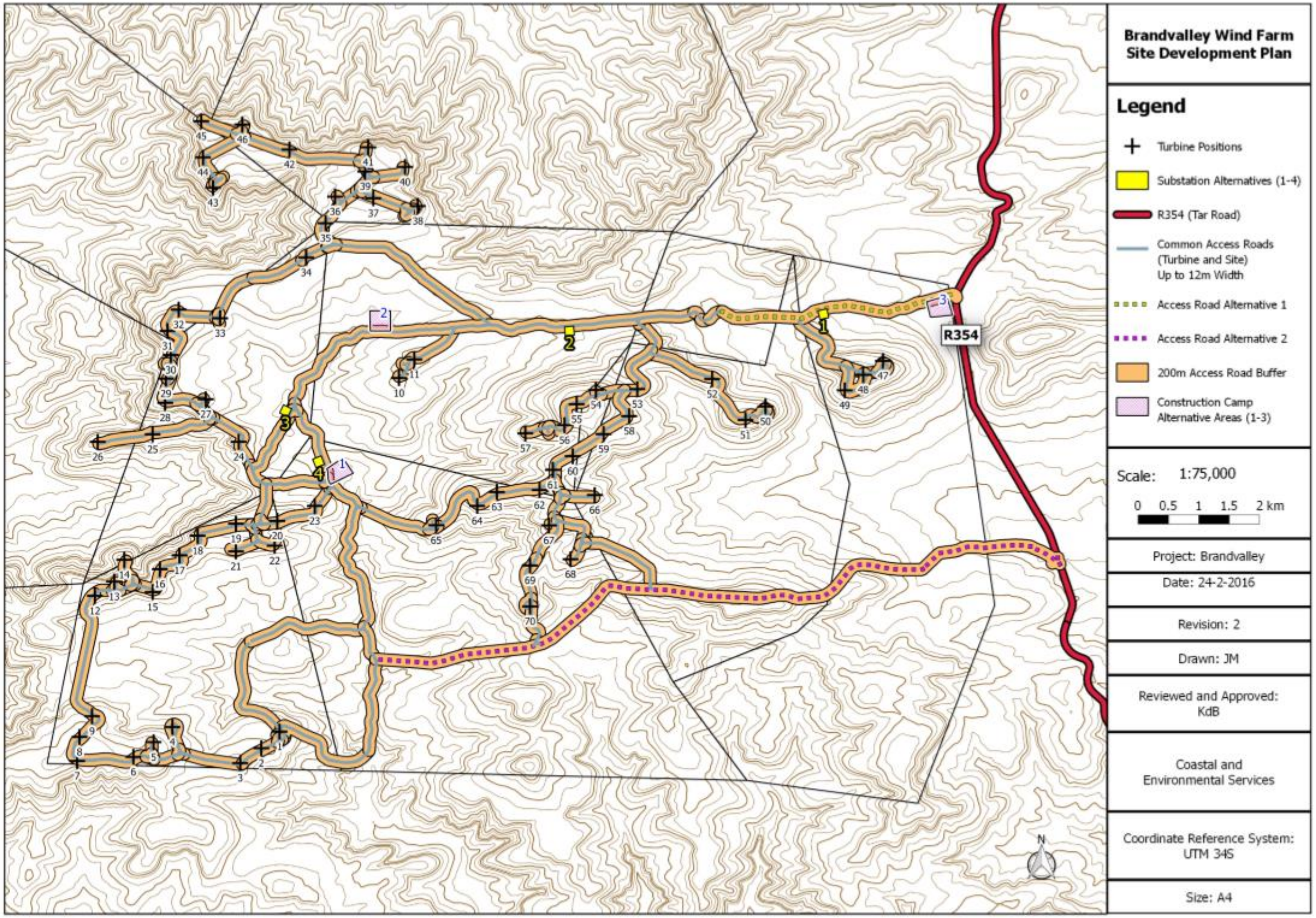

Figure 1: Proposed project layout in relation to topography, existing roads & tracks and the relevant farms

3 Project description

The Brandvalley WEF will have an energy generation capacity (at point of grid feed-in) of up to 140 megawatt (MW), and will include the following:

- Up to 70 potential wind turbine positions (between 1.5MW and 4MW in capacity each), each with a foundation of 25m in diameter and 4m in depth.
- The hub height of each turbine will be up to 120m, and the rotor diameter up to 140m.
- Permanent compacted hard-standing laydown areas for each wind turbine (70mx50m, total 24.5ha) will be required during construction and for on-going maintenance purposes.
- Electrical turbine transformers (690V/33kV) adjacent to each turbine (typical footprint of 2m x 2m, but can be up to 10m x 10m at certain locations) would be required to increase the voltage to 33kV.
- Underground 33kV cabling between turbines buried along access roads, where feasible.
- Internal access roads up to 12m wide, including structures for storm-water control would be required to access each turbine location and turning circles. Where possible, existing roads will be upgraded.
- 33kV overhead power lines linking groups of wind turbines to onsite 33/132kV substation(s). A number of potential electrical 33kV powerlines will be required in order to connect wind turbines to the preferred onsite substation. The layout of the 33kV powerlines will be informed by sensitive features identified. The facility will consist of both above and below ground 33kV electrical infrastructure depending on what will require the shortest distance and result in the least amount of impacts to the environment.
- Up to 4 x 120m tall wind measuring lattice masts strategically placed within the wind farm development footprint to collect data on wind conditions during the operational phase.
- Temporary infrastructure including a large construction camp (~10ha) and an on-site concrete batching plant (~1ha) for use during the construction phase.
- Borrow pits and quarries for locally sourcing aggregates required for construction (~4.5ha), in addition to onsite turbine excavations where required. All materials excavated will eventually be used on the compacting of the roads and hard-standing areas and no material will be sold to any third parties. The number and size of the borrow pits depends on suitability of the subsurface soils and the requirement for granular material for access road construction and other earthworks. Alternative borrow pit locations will be assessed in a separate BA process.
- Fencing will be limited to surrounding the construction camp and the entire facility would not necessarily need to be fenced off. The height of fences around the construction camp is anticipated to be up to 4m.
- Temporary infrastructure to obtain water from available local sources/ new or existing boreholes. Water will potentially be stored in temporary water storage tanks. The necessary approvals from the DWS will be applied for separately to this EIA process.

4 APPROACH TO STUDY

4.1 Study terms of reference

SC&A based this study on the following scope of work:

- Identify and delineate any aquatic systems and associated biota that may be impacted upon by the proposed project based on the DWS wetland and riparian delineation methodology (DWAF, 2007);
- Identify and rate potential environmental impacts on these systems and associated biota using the CES assessment methodology;
- Provide a significance rating of surface water impacts which includes a rating of the ecological sensitivity of the site, and the effect of the development on the aquatic ecology of the site; and
- Identify mitigation measures for negative and enhancement measures for positive impacts.

Based on our understanding of these requirements, SC&A would produce the following:

- Riparian and /or wetland area delineation supplied together with an analysis of the potential aquatic sensitivity (including any wetlands should they occur).
- Present Ecological State (PES) assessment of any watercourses after a short site visit has been conducted, in line with the Department of Water Affairs requirements should any Section 21 c & i water use licenses be required.
- Compile the required impact assessment and provide suitable recommendations.
- 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.

4.2 Study methods

This assessment was initiated with a survey of the pertinent literature, including past reports 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 water courses and associated habitats.

A site visit was then conducted in March 2016 to ground-truth the above findings, thus allowing critical comment on the possible impacts. Information was also collected to determine the PES and Ecological Importance and Sensitivity (EIS). These analyses were based on the models developed by the Department of Water and Sanitation, with the results producing ratings (A – F), descriptions for which are summarised in Table 2.

Table 1: Description of A – F ecological categories based on Kleynhans *et al*., (1999).

<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>

Several terms and definitions are used in this report and the reader is referred to the box below for additional detail.

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.

Ecological Importance and Sensitivity (EIS) are the terms used to describe the rating of any given wetland or river reach that provides an indication of the ecological importance of the aquatic system using criteria such as conservation needy habitat or species, protected ecosystems or unique habitat observed. The sensitivity is then derived by assessing the resilience the habitat exhibits under stress as a result of changes in flow or water quality.

4.3 Relevant legislation and policy

Nationally, the South African Constitution and seven (7) Acts, as well as one (1) international treaty promote the protection of rivers and water courses. These systems are thus protected from destruction or pollution in accordance with the following statutes:

- 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;
- National Environmental Management Act (NEMA), 1998 (Act No. 107 of 1998) inclusive of all amendments, as well as the NEM: Biodiversity Act, 2004 (Act 10 of 2004);
- National Water Act, 1998 (Act No. 36 of 1998);
- Conservation of Agricultural Resources Act, 1983 (Act No. 43 of 1983);
- Minerals and Petroleum Resources Development Act, 2002 (Act No. 28 of 2002);
- National Forest Act (No. 84 of 1998); and
- National Heritage Resources Act (No. 25 of 1999).

In addition to the EIA process for the Brandvalley WEF under NEMA, this report will be used as part of the relevant submissions to the Department of Water and Sanitation in terms of the registration / licensing (as required) for Section 21 c & i water uses should they be required.

4.3.1 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 have been be applied (Berliner & Desmet, 2007). Table 2 provides recommended buffers for rivers to provide a form of consistent appraisal for this project as well as others being conducted by the author within the greater Northern and Western Cape areas. A 50m buffer is proposed for any wetlands found in the region, although most already have impacts such as dams, berms or existing roads.

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 – (Nel *et al*., 2011). This mapping product highlights potential rivers and wetlands that should be earmarked for conservation on a national basis.

Table 2: Recommended buffers for rivers (the predominant buffer for the study region is highlighted in blue) (Berliner & Desmet, 2007)

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 development practices.
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.

4.4 Specialist details

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

Report prepared by: Dr. Brian Colloty Pr.Sci.Nat. (Ecology) / Certified EAP / Member SAIEES and 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.

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:…19 July 2016…………

5 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.

Therefore, due to the scope of the work presented in this report, a detailed investigation of all, or part of, the proposed site was not possible and are not perceived as part of the Terms of Reference, and was focused on the present layouts and their position in relation to 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 and associated transmission lines can avoid or span (Figure 1) 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.

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6 BASELINE DESCRIPTION

The proposed development occurs within the following catchments within the Nama Karoo ecoregion (Figure 2):

1. E23A – Wilgebos / Kleinpoorts tributaries of the Tankwa River
2. E22B – Muishond River
3. E22A – Groot River
4. J11D – Roggeveld River

These catchments are characterised by several perennial water courses associated with these mainstem systems listed above (Figure 3a). Overall, with the exception of impacts such as erosion (Plate 1), dams (Figure 3b), present road crossings (Plate 2), and conversion of floodplain areas to agriculture (Plate 3), some areas still have small remaining *Juncus* wetlands (valley bottom wetland types – with and without channels) (Plate 4). The large systems towards the south of the study area are alluvial systems (Plate 5), characterised as natural sediment transport mechanisms within the regional environment.

In terms of the National Freshwater Ecosystems Priority Areas (NFEPA) assessment, all of the watercourses within the site have been assigned a condition score of AB (Nel *et al.* 2011), indicating that they are largely intact and of biological significance. This is largely due to this catchments falling within the headwaters of the Buffels and Tankwa Rivers respectively. However, as the study area systems are mostly ephemeral, these don't support any wide riparian zones and the vegetation associated with these watercourse was between 4 and 10m wide. Species consisted mostly of *Searsia* species (*undulata*, *lanceolate* & *crenata*) and *Vachellia karroo*.

The National Freshwater Ecosystems Priority Areas project (Nel *et al*., 2011), also earmarked sub-quaternaries, based either on the presence of important biota (e.g. rare or endemic fish species) or conversely the degree of riverine degradation, i.e. the greater the catchment degradation the lower the priority to conserve the catchment. The important catchments areas are then classified as Freshwater Ecosystems Priority Areas or FEPAs. The survey area does fall within Upstream FEPAs, as the downstream systems, outside of the project area, such as the Buffels and Tankwa rivers are considered important regionally (Figure 4), and are supported hydrologically by the study area systems. Thus any impacts within the study area will then impact on the downstream FEPAs.

According to the National Freshwater Ecosystems Priority Area (NFEPA) wetland data, several large natural wetlands could occur within the study area (Figure 3c). The remaining waterbodies are artificial or man-made systems such as dams as shown in Figure 5 & 6. However, the natural wetlands observed within the study area, as the potential wetlands observed were either farm dams / borrow-pits (Plate 5), are *Juncus* (Sedge) dominated valley bottom wetlands, some containing channels, while others, those associated with broader floodplains have no channels.

Figure 6 indicates significant watercourses and natural wetlands observed within the site (Plate 3). Any activities within these areas or the 32m buffer (66 potential crossings) or 500m (3 potential applications) from a wetland boundary will require a Water Use license (possible General Authorisation) under Section 21 c & i. Appendix 2 summarizes the potential applications that will required based on the assumption that the roads although existing will require some degree of works.

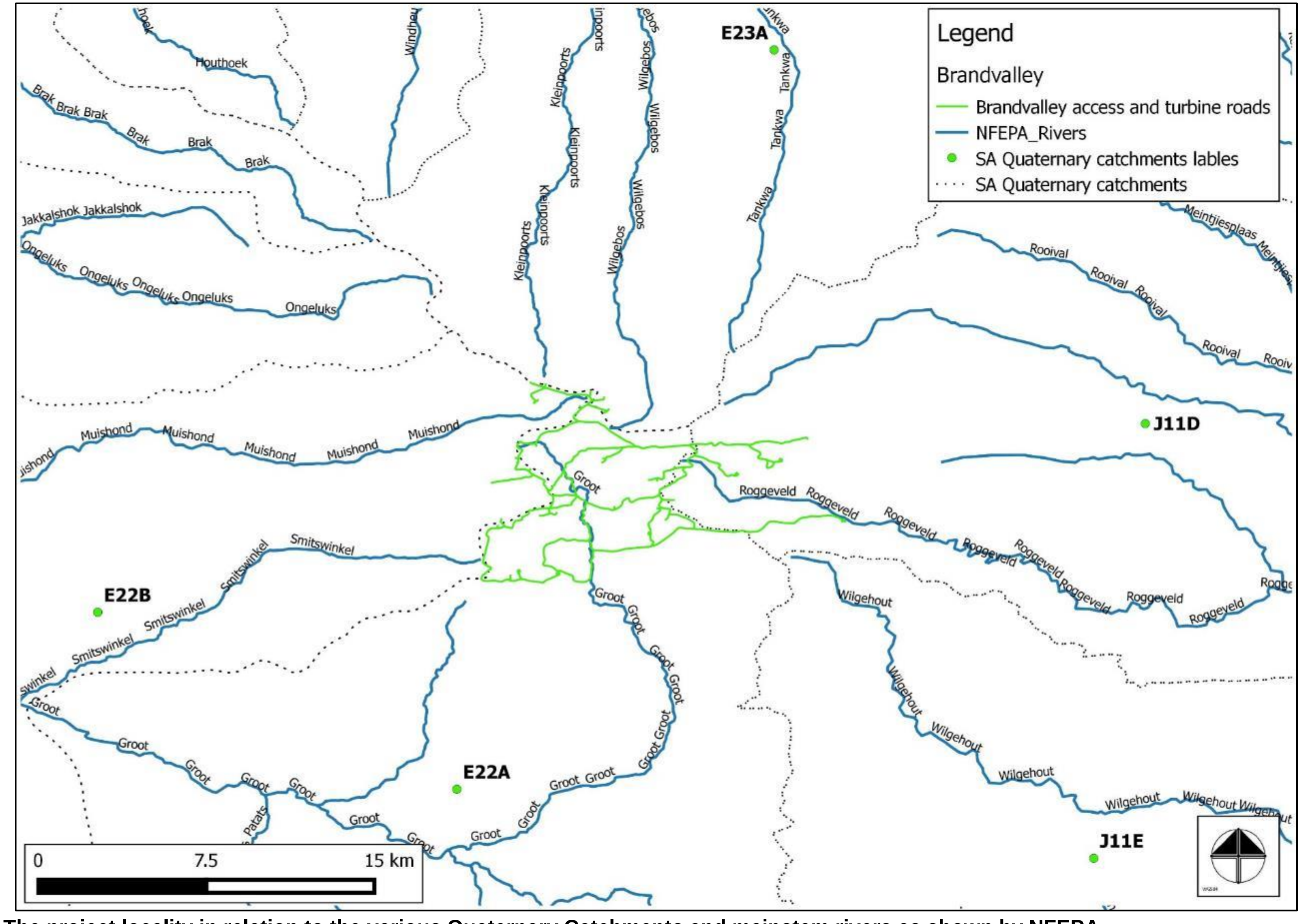


Figure 2: The project locality in relation to the various Quaternary Catchments and mainstem rivers as shown by NFEPA

Plate 1: An unknown tributary adjacent to the proposed WEF, showing high levels of degradation in terms of erosion, that has resulted in riverbed incision and loss of riparian function

Plate 2: Presently the road crossings impede upstream flows as a result of being undersized thus trapping sediments and becoming blocked.

Plate 3: Plate 2: A view of an agricultural field that was shown as natural wetland by NFEPA (Nel *et al*. 2011) and thus not a waterbody.

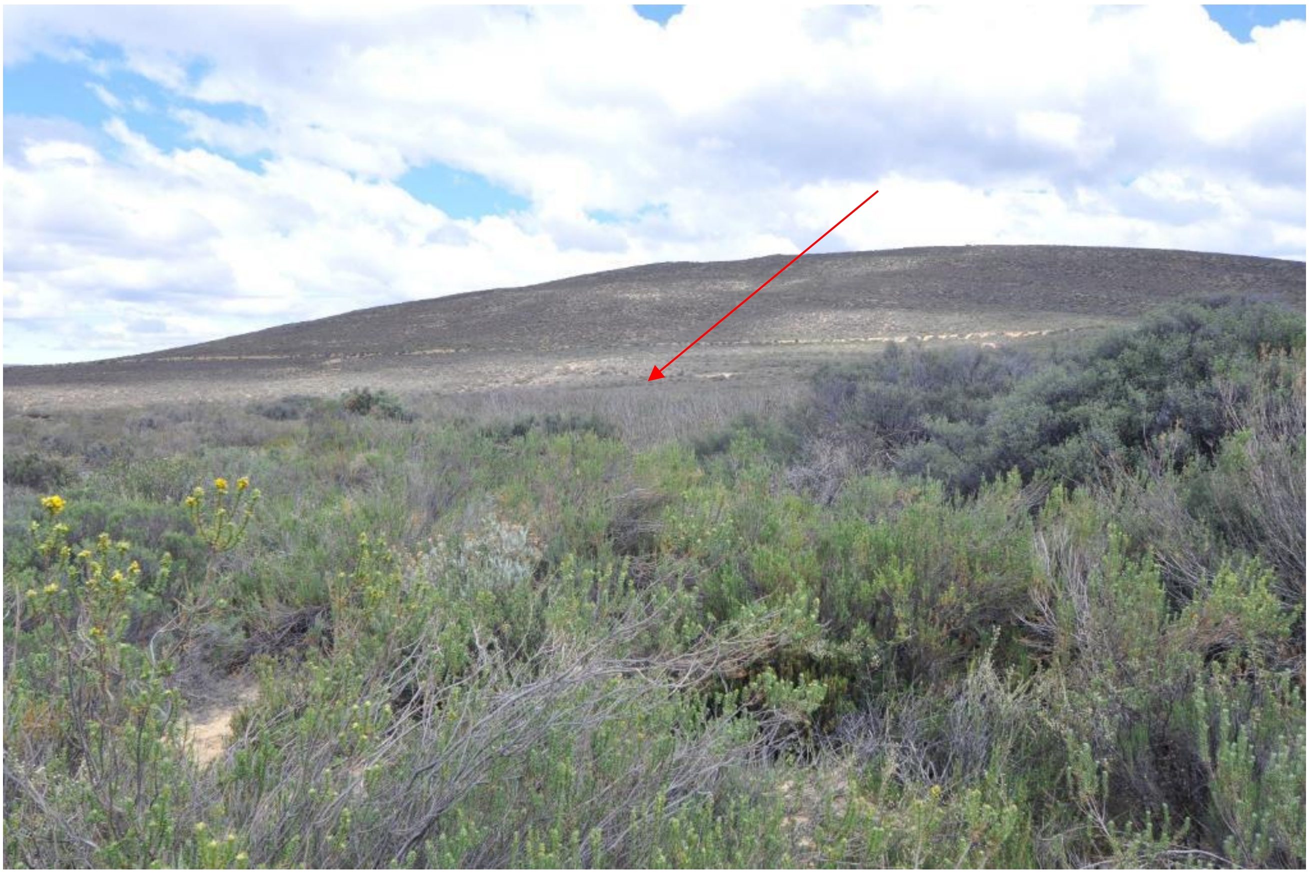


Plate 4: An example of the valley bottom wetlands (Unchannelled) found in the study area

Plate 5: A typical alluvial water course observed within the study area, consisting of a dry riverbed and narrow riparian zone, with no obligate / facultative plant species

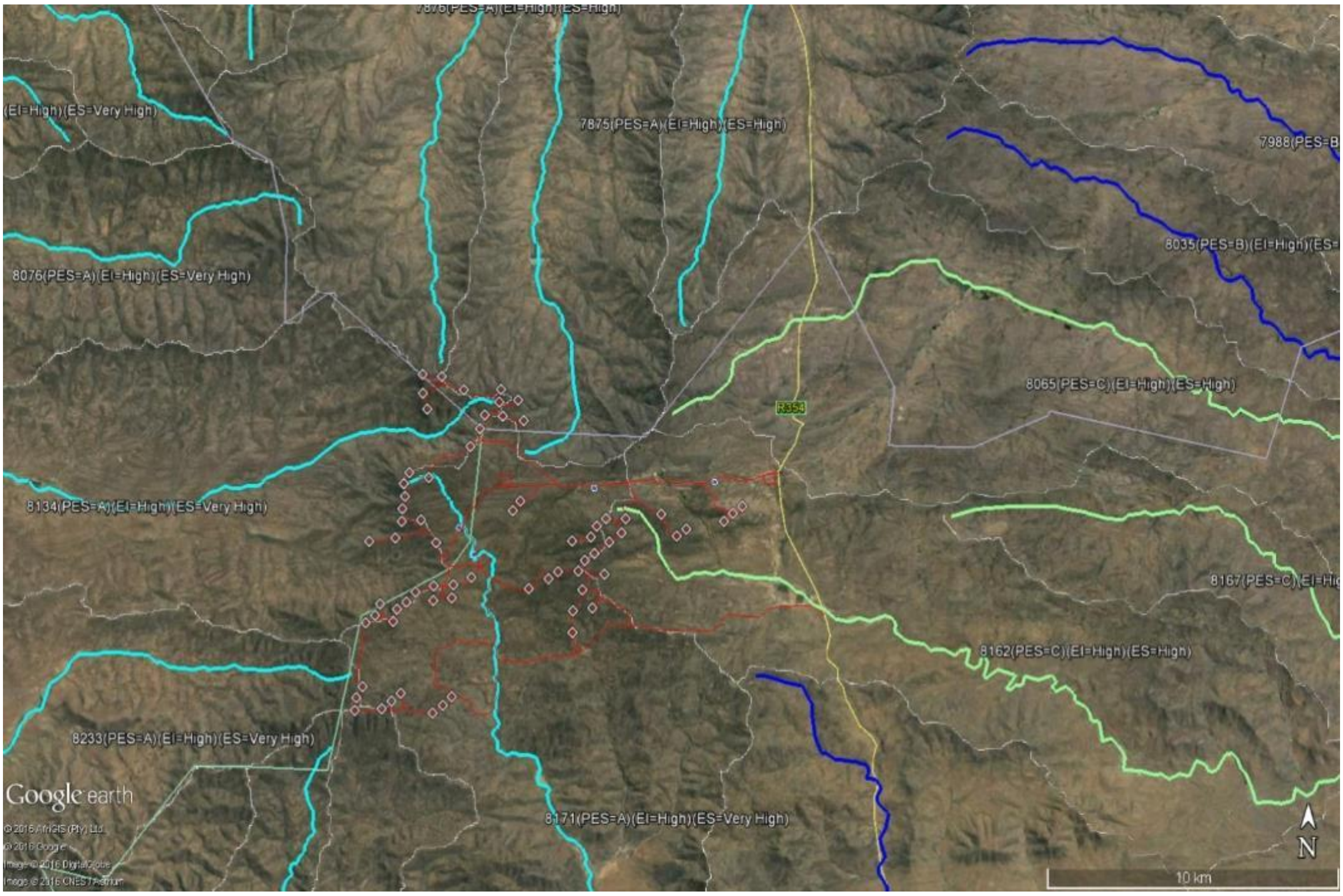
6.1 The Present Ecological State (PES) of the Rivers and Wetlands

6.1.1 Rivers / watercourses

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 main watercourses in the study area were rated as follows (DWS, 2014 – where A = Natural or Close to Natural & C = Moderately Modified):



Subquaternary Catchment Number	Present Ecological State	Ecological Importance	Ecological Sensitivity
8162	C	High	High
8171	A	High	Very High
8258	A	High	Very High
8233	A	High	Very High
8134	A	High	Very High
7876	A	High	High
7875	A	High	High

It is thus evident that the study area mainstem systems (rivers/water courses) are largely functional and or **have limited** impacts as a result of current land use practices. The impacts observed were thus farm dams, and existing road / tracks that will be used proposed road layout shown in Figure 3 & 6 to reduce the number of new impacts on these systems. 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. Thus the DWS 2014 assessment for each of the study area systems is supported and the current ratings can be upheld for both the mainstem rivers / watercourses but also for the any systems occurring within the subquaternary catchments within the study area.

6.1.2 Wetlands

The wetland areas, were dominated by impacts such as the dam, and the conversion to agricultural lands, thus most were Moderately Modified (PES = C), Largely Modified (PES = D) or somewhere between (PES = C/D).

These systems do still contain value in terms of acting as sponge areas within an arid environment, provide additional aquatic habitat (mostly for birds) and filter any runoff during peak flow periods. For this reason, all the wetlands were rated as having a Moderate Ecological Sensitivity and Importance Score (EIS).

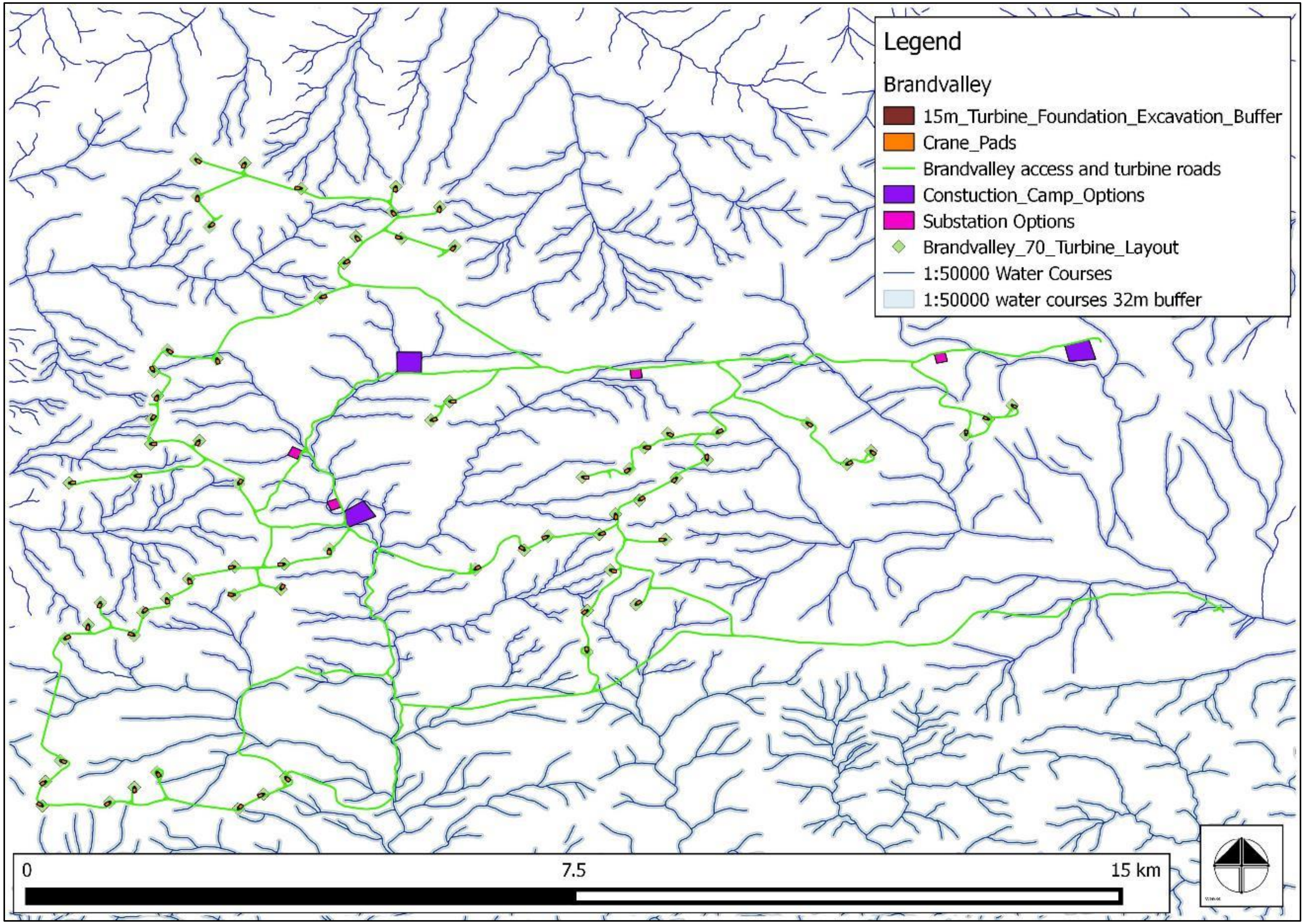


Figure 3a: The project locality in relation the known watercourses within the study area

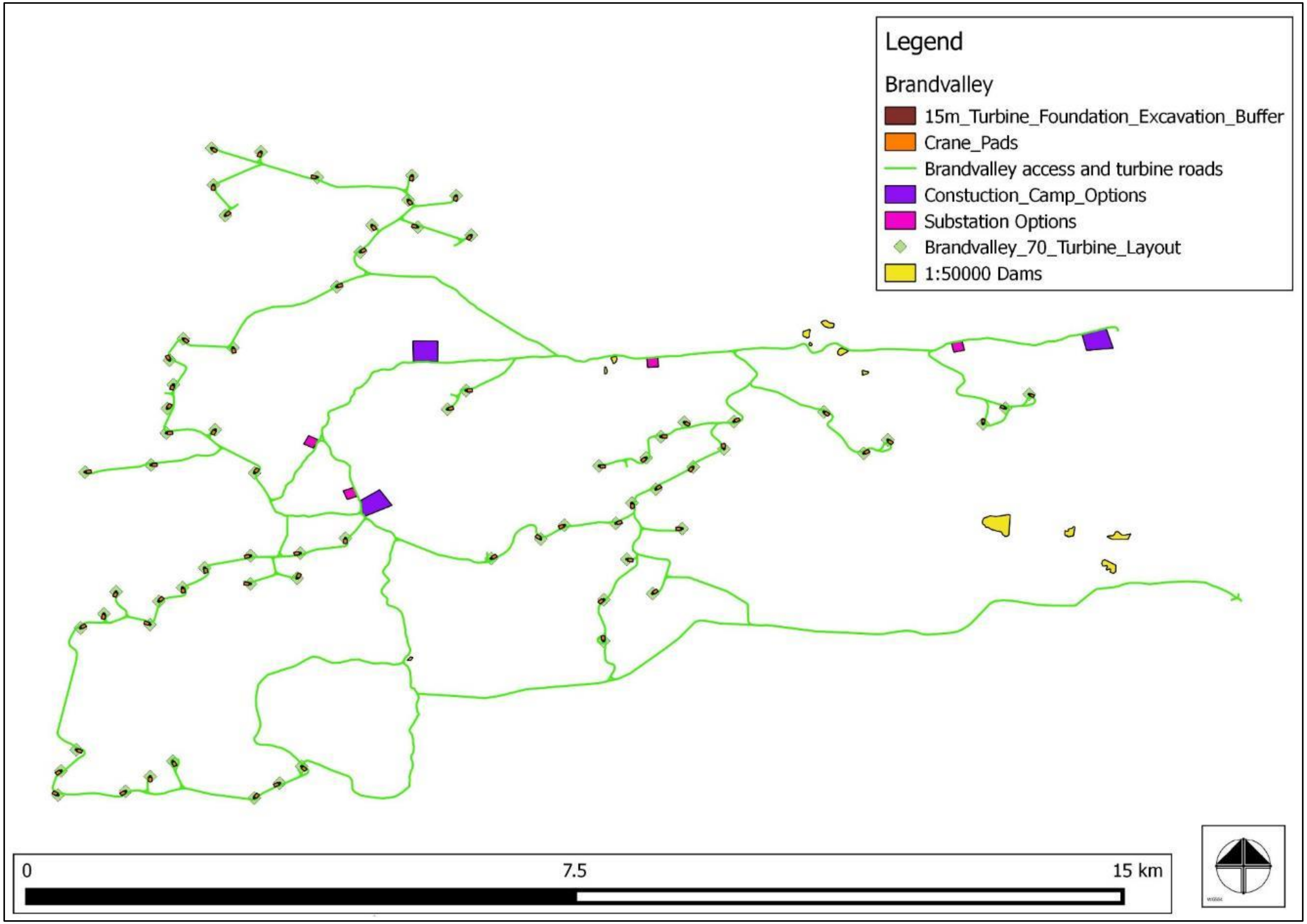


Figure 3b: The project locality in relation the known artificial dams within the study area

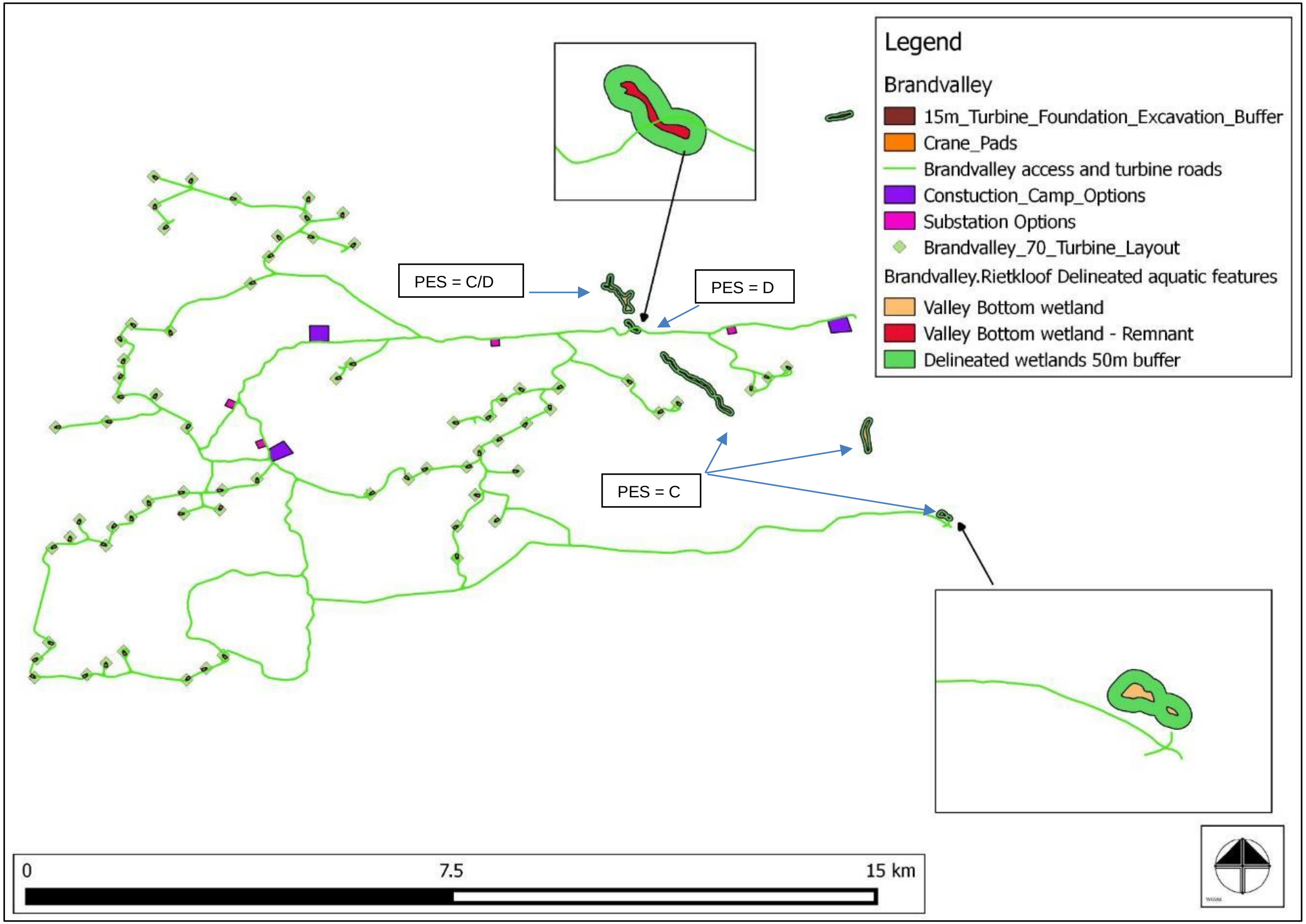


Figure 3c: The project locality in relation the delineated natural wetlands observed within the study area together with the assessed Present Ecological State Scores (PES) for the respective wetlands

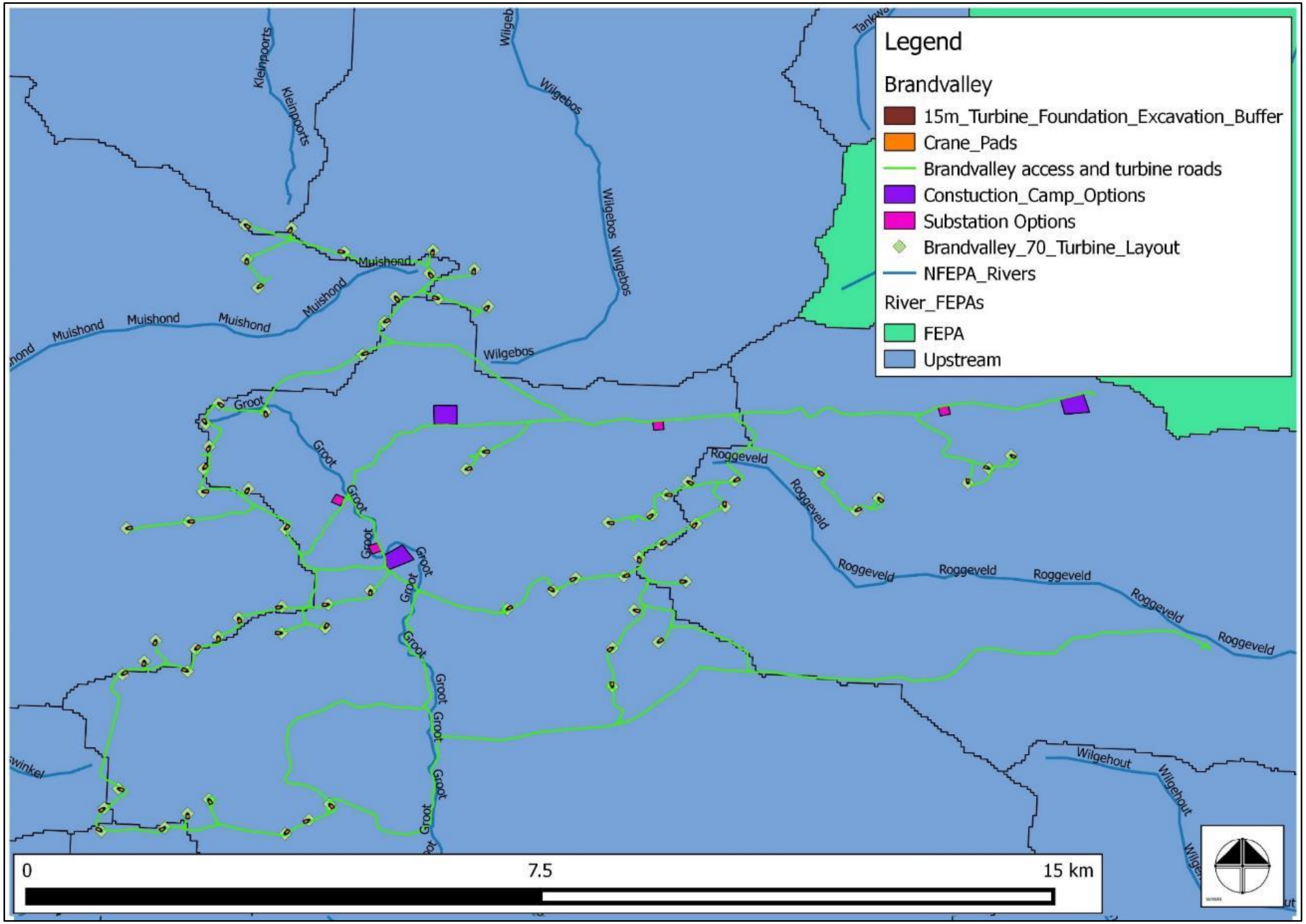


Figure 4: The project locality in relation the Freshwater Ecosystems Priority Areas (Nel *et al.*, 2011)

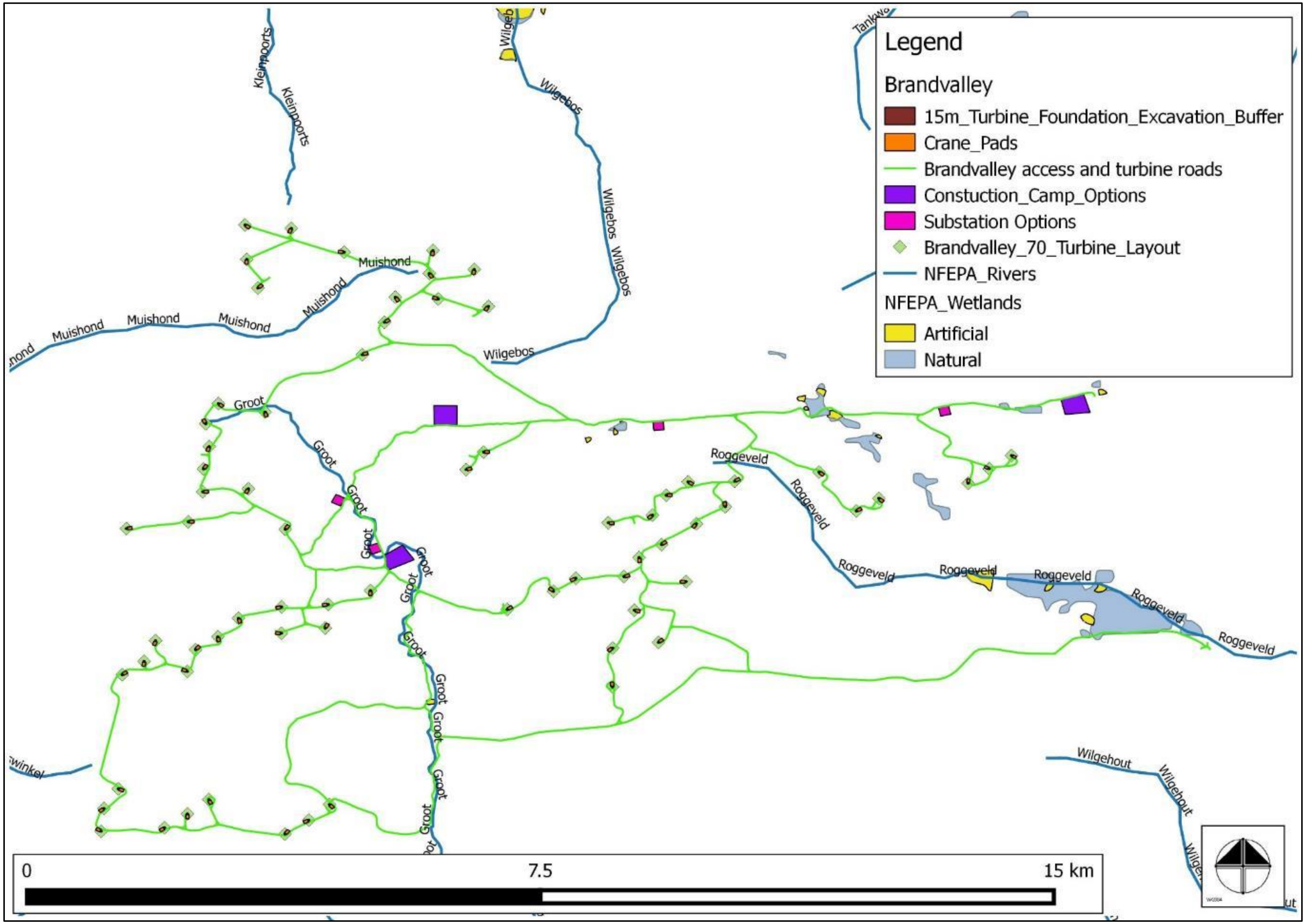


Figure 5: The project locality in relation the Freshwater Ecosystems Priority Areas (Nel *et al.*, 2011) – potential Wetlands

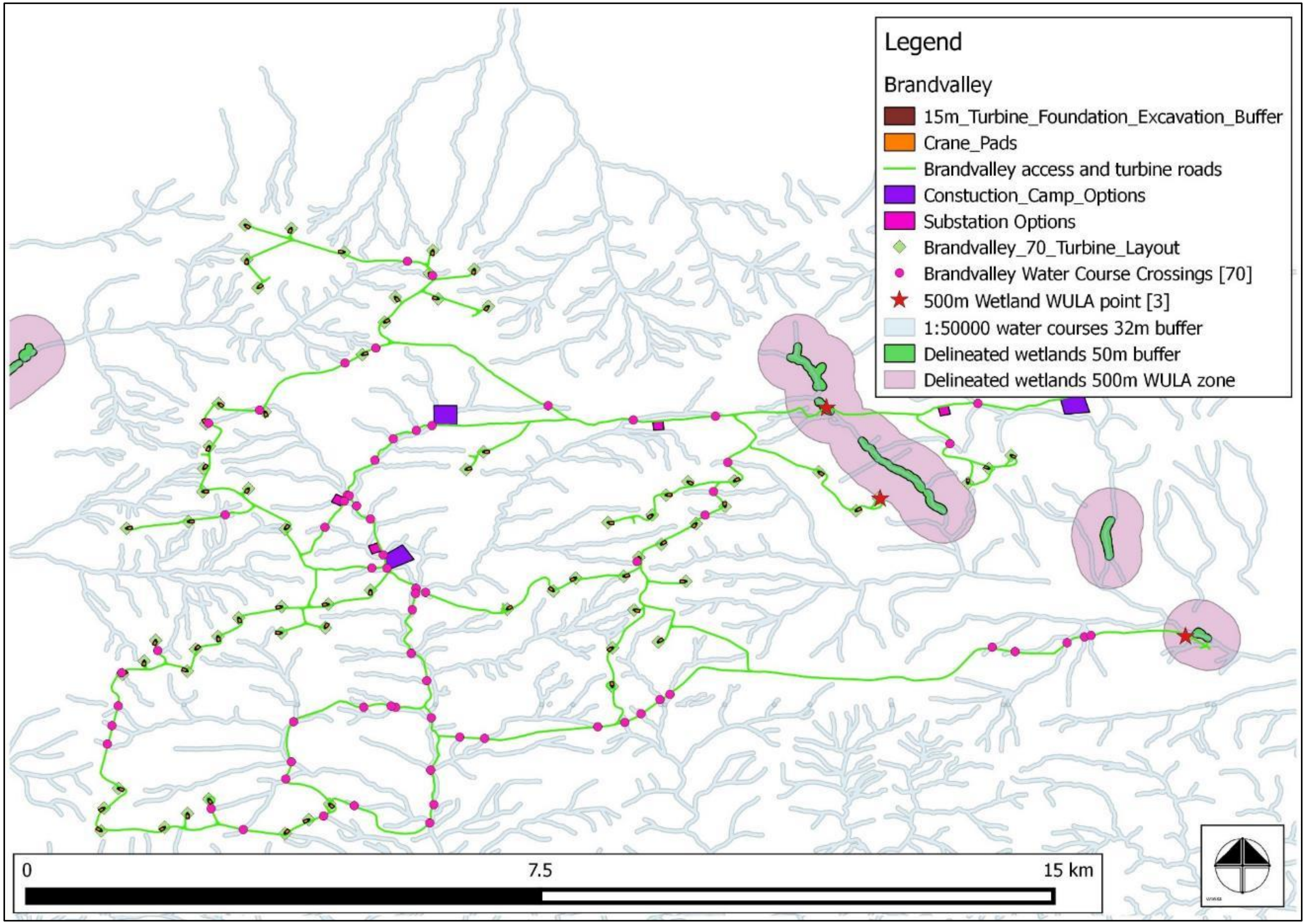


Figure 6: The project components in relation the respective Water Use License regulated zones i.e. watercourse crossings (66) and 500m from a wetland boundary (3)

7 DESCRIPTION OF ALTERNATIVES

Brandvalley alternatives
The following alternatives are considered:

1. Fundamental alternatives:
   1.1 Project area location alternative: One project location alternative namely Brandvalley Wind Farm
   1.2 Access road location alternatives: two access road alternatives namely access road alternative 1 and access road alternative 2
   1.3 Construction camp alternatives namely construction camp 1, 2, or 3.
   1.4 Four onsite substation location alternatives namely substation alternative 1, 2, 3 or 4.
   1.5 Technology alternative: One technology alternative namely a WEF
2. Incremental alternatives:
   2.1 Turbine layout alternatives
   2.2 200m buffer on access roads for sensitivity alternatives
3. No-go alternative

8 IMPACT ASSESSMENT

During the impact assessment study a number of potential key issues / impacts were identified and these were assessed based on the methodology supplied by EOH Coastal and Environmental Services (Pty) Ltd.

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

- Impact 1: Loss of riparian systems and disturbance of the alluvial water courses in the construction, operational and decommissioning phases
- Impact 2: Impact on riparian systems through the possible increase in surface water runoff on riparian form and function during the operational and decommissioning phases
- Impact 3: Loss of wetlands and wetland function in the construction phase
- Impact 4: Increase in sedimentation and erosion in the construction, operational and decommissioning phases
- Impact 5: Potential impact on localised surface water quality during the construction and decommissioning phases
- Impact 6: Storage of hazardous substances particular in the construction and operational phase
- Impact 7: The No-go Alternative
- <u>Impact 8: Cumulative impacts for the overall project due to the high number of projects surrounding this application</u>

The impacts were assessed as follows:

Nature: Impact 1 - Loss of riparian systems and disturbance to alluvial water courses The physical removal of the riparian zones and disturbance of any alluvial watercourses by new road crossings or upgrades of existing roads are likely within the watercourses within the site. These disturbances will be the greatest during the construction and again in the decommissioning phases as the related disturbances could result in lost or damaged vegetation.		
	▪ **Without mitigation**	**With mitigation**
Spatial Scale	▪ Local (1)	▪ Local (1)
Temporal Scale	▪ Long-term (3)	▪ Long-term (3)
Severity	▪ Moderate (2)	▪ Slight (1)
Likelihood	▪ Probable (3)	▪ Probable (3)
Significance	▪ **Moderate (9)**	▪ **Low (8)**
Status (positive or negative)	▪ Negative	▪ Negative
Can impacts be mitigated	▪ Yes	
Mitigation: • Where new 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 (reduce footprint as much as possible). • During the operational and decommissioning 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 from additional steps / barriers. • Vegetation clearing should occur in in a phased manner in accordance with the construction programme to minimise erosion and/or run-off. Large tracts of bare soil will either cause dust pollution or quickly erode and then cause sedimentation in the lower portions of the catchment. • It is also advised that an Environmental Control Officer, with a good understanding of the local flora be appointed during the construction phase. The ECO should be able to make clear recommendations with regards to the re-vegetation of the newly completed / disturbed areas, using selected species detailed in this report. • All alien plant re-growth must be monitored and should it occur these plants should be eradicated. The scale of the operation does however not warrant the use of a Landscape Architect and / or Landscape Contractor.
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, however the annual rainfall figures are low and this impact is not anticipated if the mitigation measures listed above are properly implemented.
Residual impacts: Possible impact on the remaining catchment due to changes in run-off characteristics in the development site.

Nature: Impact 2 - Impact on riparian systems through the possible increase in surface water runoff on downstream riparian form and function, due to impacts to the hydrological regime such as alteration of surface run-off patterns. This could occur within the operational and decommissioning phases, when any of the hard or compacted surfaces (roads or hard stand areas) increase the volume and velocity of the surface runoff increases. This could impact the hydrological regime through the increase in flows that are concentrated in area, and as most plants are drought tolerant an increase in water will allow for other species to develop and outcompete typical plant species found within the region. This then affects the structure (i.e. larger taller grasses / shrubs / trees) and function (greater attenuation of flows, restricting any runoff from reaching downstream areas). The opposite can also happen. If flows are too concentrated with high velocities, scour and erosion results, with a complete reduction or disturbance of riparian habitat.		
	▪ **Without mitigation**	**With mitigation**
Spatial Scale	▪ Local (1)	▪ Local (1)
Temporal Scale	▪ Long-term (3)	▪ Long-term (3)
Severity	▪ Moderate (2)	▪ Slight (1)
Likelihood	▪ Probable (3)	▪ Probable (3)
Significance	▪ **Moderate (9)**	▪ **Low (8)**
Status (positive or negative)	▪ Negative	▪ Negative
Can impacts be mitigated	▪ Yes	
Mitigation: • Vegetation clearing should occur in in a phased manner in accordance with the construction programme to minimise erosion and/or run-off. Large tracts of bare soil will either cause dust pollution or quickly erode and then cause sedimentation in the lower portions of the catchment. • Any storm-water within the site must be handled in a suitable manner, i.e. trap sediments, and reduce flow velocities. • No stormwater runoff must be allowed to discharge directly into any water course along roads, and flows should thus be allowed to dissipated over a broad area covered by natural vegetation. • Stormwater from hard stand areas, buildings and substation must be managed using appropriate channels and swales when located within steep areas of have steep embankments		
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.		

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.

Nature: Impact 3 - Impact on the possible loss of wetlands due to the potential need to upgrade the existing crossing through the most northern wetland (Figure 3c). The southern-most structures are outside of the wetland boundary and the proposed 50m buffer (Figure 3c), but located within 500m of the wetland boundaries. The potential impacts could occur during the construction and again in the decommissioning phase

	▪ **Without mitigation**	**With mitigation**
Spatial Scale	▪ Regional (3)	▪ Local (1)
Temporal Scale	▪ Long-term (3)	▪ Long-term (3)
Severity	▪ Moderate (2)	▪ Slight (1)
Likelihood	▪ Probable (3)	▪ Probable (3)
Significance	▪ **Moderate (11)**	▪ **Low (8)**
Status (positive or negative)	▪ Negative	▪ Negative
Reversibility	▪ High	▪ High
Irreplaceable loss of resources	▪ No	▪ No
Can impacts be mitigated	▪ Yes	

Mitigation:

- Although the current wetlands are impacted upon by the present farming activities, dams and roads, the project could improve the situation by placing the upgraded structures within the crossing that won't impede the flows.
- Vegetation clearing should occur in in a phased manner in accordance with the construction programme to minimise erosion and/or run-off. Large tracts of bare soil will either cause dust pollution or quickly erode and then cause sedimentation in the lower portions of the catchment.
- All construction materials including fuels and oil should be stored in demarcated areas that are contained within berms / bunds to avoid spread of any contamination. Washing and cleaning of equipment should also be done in berms or bunds, in order to trap any cement and prevent excessive soil erosion. Mechanical plant and bowsers must not be refuelled or serviced within or directly adjacent to any channel. It is therefore suggested that all construction camps, lay down areas, batching plants or areas and any stores should be more than 50m from any demarcated water courses.
- It is also advised that an Environmental Control Officer, with a good understanding of the local flora be appointed during the construction phase. The ECO should be able to make clear recommendations with regards to the re-vegetation of the newly completed / disturbed areas, using selected species detailed in this report.
- All alien plant re-growth must be monitored and should it occur these plants should be eradicated. The scale of the operation does however not warrant the use of a Landscape Architect and / or Landscape Contractor.

Cumulative impacts:
These are not anticipated due to the state of the current wetlands, lack of connectivity within the impact area and the nature of the development together with the proposed layout.

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.

Nature: Impact 4 - Increase in sedimentation and erosion within the development footprint i.e, impacts to the hydrological regime such as alteration of surface run-off patterns which could occur during the construction, operational and decommissioning phases.

	▪ **Without mitigation**	**With mitigation**
Spatial Scale	▪ Local (1)	▪ Local (1)
Temporal Scale	▪ Long-term (3)	▪ Long-term (3)
Severity	▪ Moderate (2)	▪ Slight (1)
Likelihood	▪ Probable (3)	▪ Probable (3)
Significance	▪ **Moderate (9)**	▪ **Low (8)**
▪ **Status (positive or**	▪ Negative	▪ Negative

negative)		
▪ **Can impacts be mitigated**	▪ Yes	
▪ **Mitigation:** Any storm-water within the site must be handled in a suitable manner, i.e. trap sediments and reduce flow velocities.		
▪ **Cumulative impacts:** Erosion and sedimentation of the downstream systems and farming operations could result in cumulative impacts. 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 could be remobilised. 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.		

Nature: Impact 5 – Impact on localized surface water quality

During both preconstruction, 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**
Spatial Scale	Local (1)	Local (1)
Temporal Scale	Long-term (3)	Long-term (3)
Severity	Moderate (2)	Slight (1)
Likelihood	Probable (3)	Probable (3)
Significance	**Moderate (9)**	**Low (8)**
Status (positive or negative)	Negative	Negative
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.
- Appropriate ablution facilities should be provided for construction workers during construction and on-site staff during the operation of the facility.
- 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.

Cumulative impacts:
Cumulative impacts can be avoided by implementing the abovementioned mitigation measures at the proposed Brandvalley wind farm and through other developments adhering to their EMPs.

Residual impacts:
Residual impacts will be negligible after appropriate mitigation.

Nature: Impact 6 – Impact on localized aquatic systems due to the storage of hazardous substances.

During the construction and to a limited degree the operational activities, hazardous substances mostly associated with the substations could be washed downslope via the ephemeral systems. This impact would be similar for all substation options.

	Without mitigation	**With mitigation**
Spatial Scale	Local (1)	Local (1)
Temporal Scale	Long-term (3)	Long-term (3)
Severity	Moderate (2)	Slight (1)
Likelihood	Probable (3)	Probable (3)
Significance	**Moderate (9)**	**Low (8)**

Status (positive or negative)	Negative	Negative
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.
- » Containment of all contaminated water by means of careful run-off management on the development site.
- » Working protocols incorporating pollution control measures (including approved method statements and emergency procedures by the contractor) should be clearly set out in the Construction Environmental Management Plan (CEMP) for the project and strictly enforced.

Cumulative impacts:
None as the use of such substances will be in low volumes and widespread over the greater region.

Residual impacts:
Residual impacts will be negligible after appropriate mitigation.

Nature: Impact 7 – No-go alternative.

Should the project not proceed the current conditions together with the present day impacts would prevail, leading to a slow deterioration of the aquatic systems that were classified as "Largely Natural".

	Without mitigation	**With mitigation**
Spatial Scale	Local (1)	Local (1)
Temporal Scale	Long-term (3)	Long-term (3)
Severity	Moderate (2)	Slight (1)
Likelihood	Probable (3)	Probable (3)
Significance	**Moderate (9)**	**Low (8)**
Status (positive or negative)	Negative	Negative
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
- Manage grazing or exclude livestock from watercourses that are showing signs or erosion or bank instability.

Cumulative impacts:
Cumulative impacts can be avoided by implementing the abovementioned mitigation measures by the farmers in the region.

Residual impacts:
Residual impacts will be negligible after appropriate mitigation.

Nature: Impact 8 – Overall cumulative impact.

In the assessment of this project, all the surrounding potential projects of which 14 (17 if the sub projects are counted) shown in Figure and listed below:

1. Konstabel Solar Project;
2. Roggeveld Wind Project;
3. **Karreebosch Wind Project;**
4. **Komsberg East Wind Project**
5. **Komsberg West Wind Project;**
6. Perdekraal Wind Project;
7. Witberg Wind Project;
8. Sutherland Wind and Solar Project;
9. Hidden Valley Wind Project (Note this has been separated into three separate projects namely **Karusa, Soetwater and Great Karoo**);
10. PV Solar Project, south of Sutherland;
11. Suurplaat Wind Project;
12. **Gunstfontein Wind Project**;
13. Komsberg Substation; and
14. Rietkloof Wind Project.

Of these 17 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 the projects shown in bold above. The author has also reviewed the outcomes of the remaining projects as part of this EIA or other EIA / WUL is the region. Other projects within the region and or associated with this project have been the review and development of the Construction EMP for the Kappa Substation near Touwsrivier on behalf of Eskom.

Also related to the authors understanding of this environment and the adjacent projects includes the preparation of the Water Use Licenses for the Karusa & Soetwater WEF (ACED Renewables), the only two projects that have moved into the construction phase. As these with all projects, once they move into the construction phase the final project designs are then produced based on the recommendations / conditions of the EA. In the case of the ACED projects, the road layouts have been revised in such a manner that all of the important wetland areas / rivers were avoided, through the use of impacted areas at existing crossings. This further reduced the impacts on the aquatic ecosystems, but also provided an opportunity to improve the current road crossings, by providing better erosion protection measures and improving the hydrology of the systems through the use of properly sized box culverts instead of pipe culverts that are prone to blocking (See Plate 2 as a typical example). Thus the project designs post mitigation will prove to have a net benefit to the river and catchment.

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 the cumulative impact could be seen as a net benefit. 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**
Spatial Scale	Local (1)	Local (1)
Temporal Scale	Long-term (3)	Long-term (3)
Severity	Moderate (2)	Slight (1)
Likelihood	Probable (3)	Probable (3)
Significance	**Moderate (9)**	**Low (8)**
Status (positive or negative)	Negative	Negative
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
- Manage grazing or exclude livestock from watercourses that are showing signs or erosion or bank instability.

Cumulative impacts:

Cumulative impacts can be avoided by implementing the abovementioned mitigation measures by the farmers and other projects in the region.

Residual impacts:

Residual impacts will be negligible after appropriate mitigation.

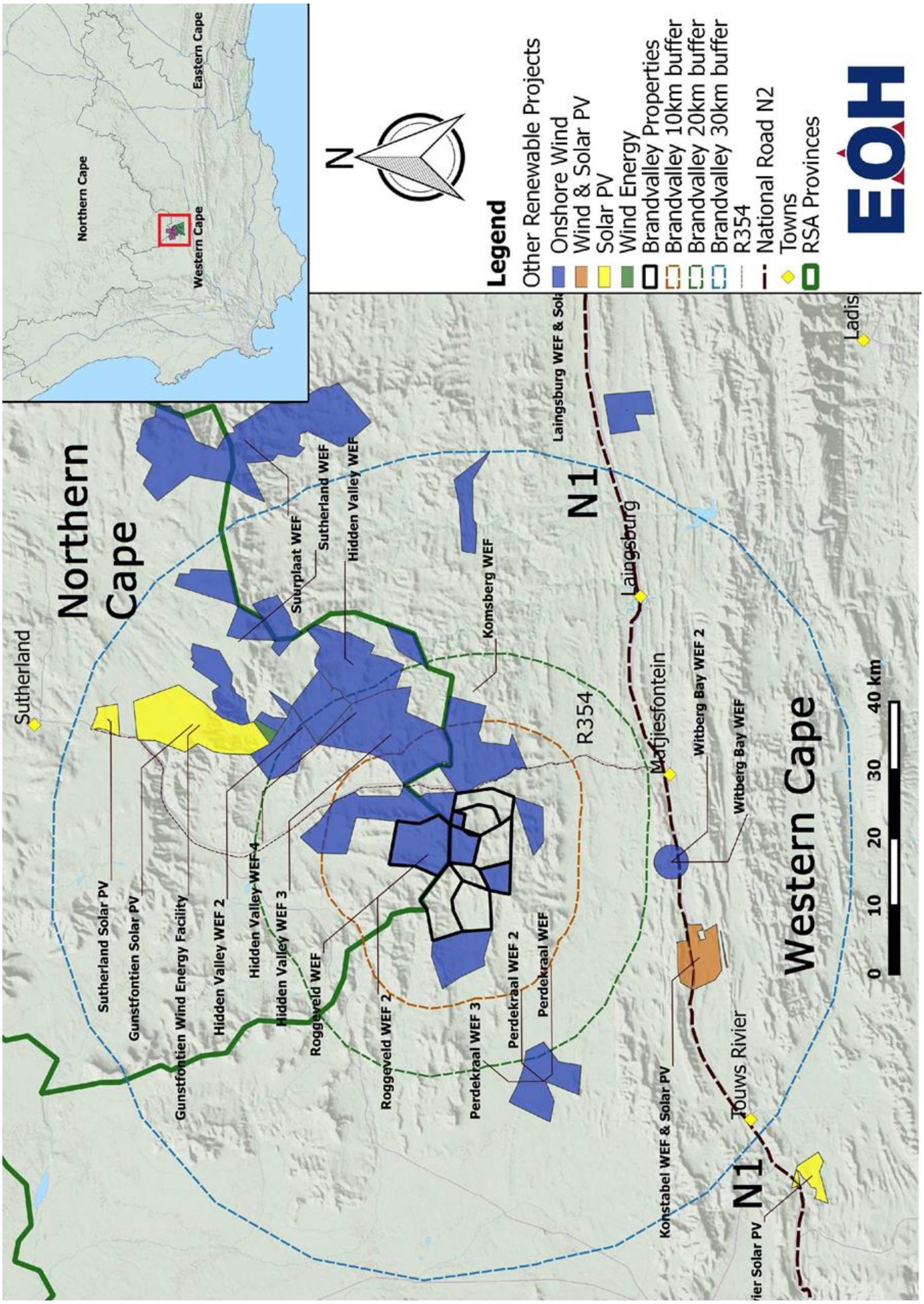


Figure 7: The Brandvalley WEF project in relation to the adjacent or surrounding renewable wind and solar projects within a 30km radius

9 EVIRONMENTAL MANAGEMENT PLAN

Construction and Operation Phase					
Objective	**Potential Impact**	**Mitigation Measures**	**Indicator**	**Responsibility**	**Timeframes**
Soil erosion control, water quality management - Both road access alternatives connecting the site to the R354 and internal roads may need to cross water courses	» Erosion and soil loss within **watercourses (incl of wetlands)** » Negative impacts on **watercourses (incl of wetlands)** » Disturbance to or loss of **watercourses (incl of wetlands)** » Sedimentation of **watercourse areas (incl of wetlands)** » A loss of indigenous vegetation cover, particularly in **watercourse areas (incl of wetlands)** » Increased runoff into rivers can potentially be associated with accelerated erosion in **watercourses (incl of wetlands)**	» Identify and demarcate construction areas for general construction work and restrict construction activity to these areas. Prevent unnecessary destructive activity within construction areas (prevent over-excavations and double handling) » Stockpile topsoil for re-use in rehabilitation phase. Maintain stockpile shape and protect from erosion. All stockpiles must be positioned at least 50 m away from water courses. Limit the height of stockpiles as far as possible in order to reduce compaction. » Any excavation, including those for cables, must be supervised by the ECO. Disturbance of vegetation and topsoil must be kept to a practical minimum. » Rehabilitate disturbance areas as soon as construction in an area is completed.	» No activity in identified no-go areas » Acceptable level of activity within disturbance areas, as determined by ECO » Acceptable level of soil erosion around site, as determined by ECO » Acceptable level of increased siltation in water courses, as determined by ECO » Acceptable level of soil degradation, as determined by ECO » Acceptable state of excavations, as determined by Resident Engineer & ECO	ECO Contractor	During site establishment, construction and operational phase

Construction and Operation Phase					
Objective	**Potential Impact**	**Mitigation Measures**	**Indicator**	**Responsibility**	**Timeframes**
The construction phase and at time the operational phase of the wind energy facility may involve the storage and handling of a variety of chemicals including adhesives, abrasives, oils and lubricants, paints and solvents although in small amounts. The main wastes expected to be generated by the construction of the facility will include **general solid waste, hazardous waste and liquid waste**.	» The watercourse areas could be impacted via: 1. Release of contaminated water from contact with spilled chemicals could impact the 2. Generation of contaminated wastes from used chemical containers 3. Inefficient use of resources resulting in excessive waste generation 4. Litter or contamination of the site or water through poor waste management practices	» Storage areas must be located more than 50 m away from the watercourse. » The storage of flammable and combustible liquids such as oils must be in designated areas which are appropriately bunded, and stored in compliance with MSDS files, as defined by the SHE Representative / ECO. » Any spills must receive the necessary clean-up action. If required, bioremediation kits are to be kept on-site and used to remediate any spills that may occur. Appropriate arrangements to be made for appropriate collection and disposal of all cleaning materials, absorbents and contaminated soils (in accordance with a waste management plan). » Any storage and disposal permits/approvals which may be required will be obtained, and the conditions attached to such permits and approvals must be complied with. » Routine servicing and maintenance of vehicles is not to take place on-site (except for emergency situations or large cranes which cannot be moved off-site). If repairs of vehicles must take place on site, an appropriate drip tray must be used to contain any fuel or oils. » Transport of all hazardous substances must be in accordance with the relevant legislation and regulations. » Waste disposal records must be available for review at any time. » Construction contractors must	» No chemical spills outside of designated storage areas » No water or soil contamination by chemical spills » No complaints received regarding waste on site or indiscriminate dumping » Internal site audits ensuring that waste segregation, recycling and reuse is occurring appropriately » Provision of all appropriate waste manifests for all waste streams » Designated areas for fires identified on site at the outset of the construction phase » Firefighting equipment and training provided before the construction phase commences » No activity in identified no-go areas » Acceptable level of activity within disturbance areas, as determined by ECO » Acceptable level of soil erosion around site, as determined	ECO Contractor	During site establishment, construction and operational phase

		provide specific detailed waste management plans to deal with all waste streams. » Specific areas must be designated on-site for the temporary management of various waste streams, i.e. general refuse, construction waste (wood and metal scrap) and contaminated waste. Location of such areas must seek to minimise the potential for impact on the surrounding environment, including prevention of contaminated runoff, seepage and vermin control. » Where possible, construction and general wastes on-site must be reused or recycled. Bins and skips must be available on-site for collection, separation and storage of waste streams (such as wood, metals, general refuse etc). » Disposal of waste must be in accordance with relevant legislative requirements, including the use of licensed contractors. » Hydrocarbon waste must be contained and stored in sealed containers within an appropriately bunded area. » Waste and surplus dangerous goods must be kept to a minimum and must be transported by approved waste transporters to sites designated for their disposal. » Documentation (waste manifest) must be maintained detailing the quantity, nature and fate of any hazardous waste. » An incident/complaints register must be established and maintained on-site. » Hazardous and non-hazardous waste must be separated at source. Separate waste collection bins must be provided for this purpose. These bins must be clearly marked and appropriately covered. » All solid waste collected must be disposed of at a registered waste disposal site. A certificate of disposal must be obtained and kept on file. The disposal of waste must be in accordance with all relevant legislation. Under no circumstances may solid waste be burnt or buried on site. » Supply waste collection bins at construction equipment and construction crew camps. » Construction equipment must be refuelled within designated refuelling locations, or where remote refuelling is required, appropriate drip trays must be utilised. » All stored fuels to be maintained within a bund and on a sealed surface. » Fuel storage areas must be inspected regularly to ensure bund stability, integrity and function. » Construction machinery must be stored in an appropriately sealed area. » Oily water from bunds at the	by ECO » Acceptable level of increased siltation in water courses, as determined by ECO » Acceptable level of soil degradation, as determined by ECO » Acceptable state of excavations, as determined by Resident Engineer & ECO		

		substation must be removed from site by licensed contractors. » Spilled cement or concrete must be cleaned up as soon as possible and disposed of at a suitably licensed waste disposal site. » Corrective action must be undertaken immediately if a complaint is received, or potential/actual leak or spill of polluting substance identified. This includes stopping the contaminant from further escaping, cleaning up the affected environment as much as practically possible and implementing preventive measures. » In the event of a major spill or leak of contaminants, the relevant administering authority must be immediately notified as per the notification of emergencies/incidents. » Any contaminated/polluted soil removed from the site must be disposed of at a licensed hazardous waste disposal facility. » Upon the completion of construction, the area will be cleared of potentially polluting materials. » Identify and demarcate construction areas for general construction work and restrict construction activity to these areas. Prevent unnecessary destructive activity within construction areas (prevent over-excavations and double handling) » Stockpile topsoil for re-use in rehabilitation phase. Maintain stockpile shape and protect from erosion. All stockpiles must be positioned at least 50 m away from water courses. Limit the height of stockpiles as far as possible in order to reduce compaction. » Any excavation, including those for cables, must be supervised by the ECO. Disturbance of vegetation and topsoil must be kept to a practical minimum. » Rehabilitate disturbance areas as soon as construction in an area is completed.			

10 CONCLUSION AND RECOMMENDATIONS

The proposed layout for the facility would seem to have limited impact on the aquatic environment as the proposed structures for the most part have either avoided the delineated watercourses and wetlands with the exception of a number of roads crossing watercourses. Use of any existing roads and upgrading thereof will further support this conclusion, particularly with regard the öne direct wetland crossing. Although the wetlands concerned are already impacted by the surrounding, roads dams and farming activities. <u>Thus based on the findings of this study no objection to the authorisation of any of the proposed activities inclusive of the alternatives is made.</u>

Where any road upgrades are required it is understood that these current crossings may be upgraded by increasing the current size of the culverts and providing additional erosion protection, thus a possible net benefit to the local aquatic systems may result. The actual requirements and designs will be finalized in the detail design phase. It is therefore recommended that these positions are assessed in the EMP walk down phase to provide detailed mitigations to the engineers as and when required.

Further, 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 6 and Appendix 2 further indicates the 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 (Act 36 of 1998), should any construction take place within these areas. Should any of the present road crossings need to be upgraded then the opportunity exists to improve the current state (lack of habitat continuity) for example by replacing pipe culverts with box culverts, while also reducing the height of the bridge footings (culvert bases) to reinstate natural water course levels. <u>This opportunity to improve the hydrological conditions can be seen as a net benefit and has been assessed as part of the cumulative impact statement.</u>

As the proposed activities have the potential to create erosion the following recommendations and assumptions are reiterated:

- Vegetation clearing should occur in in a phased manner in accordance with the construction programme to minimise erosion and/or run-off. Large tracts of bare soil will either cause dust pollution or quickly erode and then cause sedimentation in the lower portions of the catchment.
- All construction materials including fuels and oil should be stored in demarcated areas that are contained within berms / bunds to avoid spread of any contamination. Washing and cleaning of equipment should also be done in berms or bunds, in order to trap any cement and prevent excessive soil erosion. Mechanical plant and bowsers must not be refuelled or serviced within or directly adjacent to any channel. It is therefore suggested that all construction camps, lay down areas, batching plants or areas and any stores should be more than 50m from any demarcated water courses.
- It is also advised that an Environmental Control Officer, with a good understanding of the local flora be appointed during the construction phase. The ECO should be able to make clear recommendations with regards to the re-vegetation of the newly completed / disturbed areas, using selected species detailed in this report.
- All alien plant re-growth must be monitored and should it occur these plants should be eradicated. The scale of the operation does however not warrant the use of a Landscape Architect and / or Landscape Contractor.

This is based on the assumption that following conditions will be adhered to:

  - No transmission line towers, substations and construction camps will be placed within the delineated water courses as well as their respective buffers without obtaining the required approvals.
  - It is further recommended that a comprehensive rehabilitation plan be implemented from the project onset within these areas (inclusion of buffers) to ensure a net benefit to the aquatic environment. This should from part of the suggested walk down as part of the final EMP preparation

11 REFERENCES

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12 APPENDIX 1 – WETLAND ASSESSMENT METHODOLOGY

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, 2005/2007)
    - Obligate: species that are only found within wetlands (>99% of occurrences) (DWAF, 2005/2007)
- Assessment of the wetland type based on the NWCS method discussed below and the required buffers
- Mitigation or recommendations required

National Wetland Classification System (NWCS 2014)

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 (NWCS, 2014). 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.

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, 2005/2007). 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 (2014) 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:

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 (NWCS, 2014). 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 (NWCS, 2014).

Wetlands must therefore have one or more of the following attributes to meet the above definition (DWAF, 2005/2007):

- 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;
- 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.

[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.

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.

Ecosystem services supplied by wetlands	Indirect benefits	Hydro-geochemical benefits	Flood attenuation	
			▪ Stream flow regulation	
			▪ Water quality enhancem	▪ Sediment trapping
				▪ Phosphate assimilation
				▪ Nitrate assimilation
				▪ Toxicant assimilation
				▪ Erosion control
			▪ Carbon storage	
		▪ Biodiversity maintenance		
	▪ *Direct benefits*	▪ *Provision of water for human use*		
		▪ *Provision of harvestable resources*[2]		
		▪ *Provision of cultivated foods*		
		▪ *Cultural significance*		
		▪ *Tourism and recreation*		
		▪ *Education and research*		

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:

(i) Landform – shape and localised setting of wetland
(ii) Hydrological characteristics – nature of water movement into, through and out of the wetland
(iii) 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:

- (i) Geology;
- (ii) Natural vs. Artificial;
- (iii) Vegetation cover type;
- (iv) Substratum;
- (v) Salinity; and
- (vi) 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.

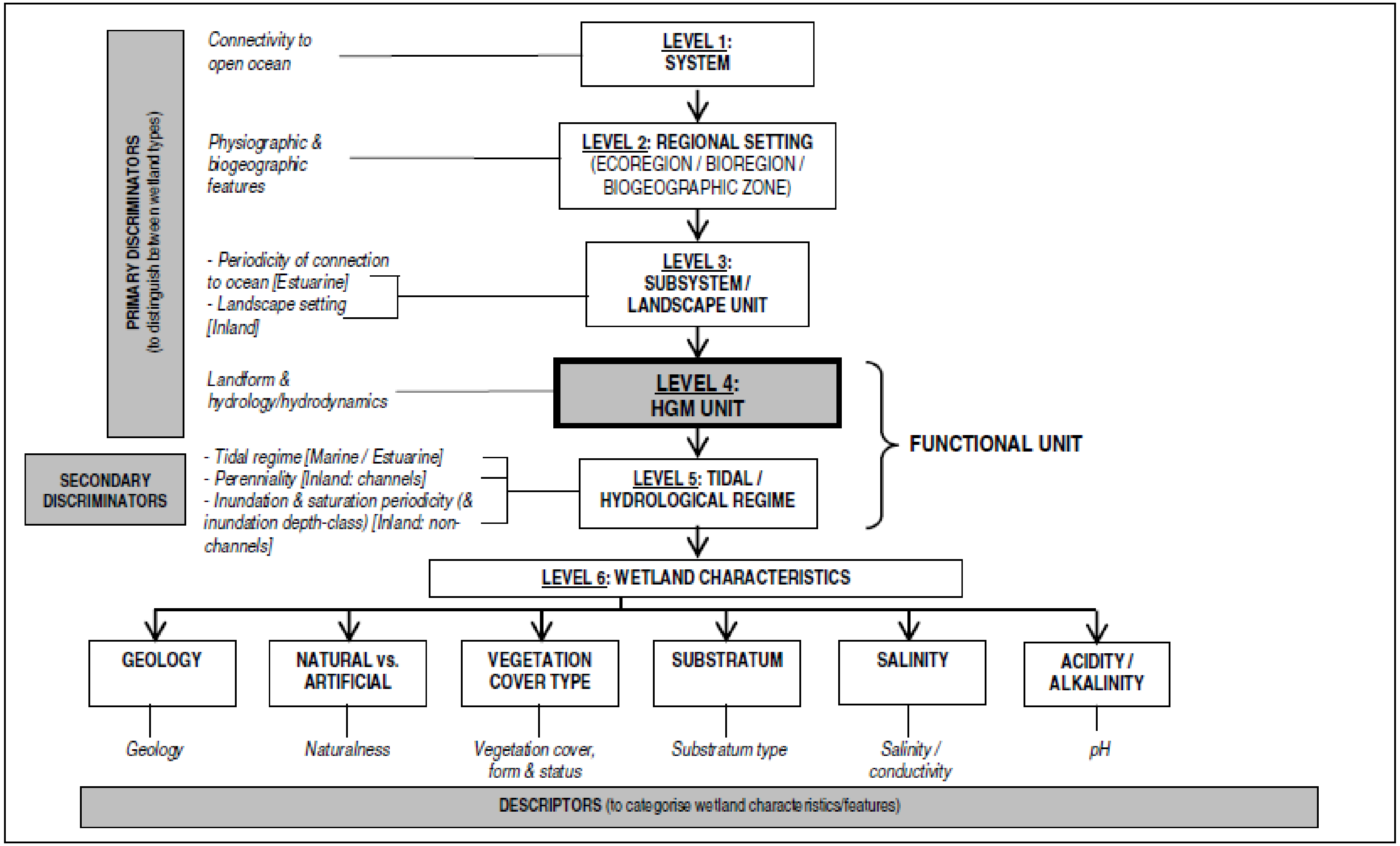

Figure 1: Basic structure of the National Wetland Classification System, showing how 'primary discriminators' are applied up to Level 4 to classify Hydrogeomorphic (HGM) Units, with 'secondary discriminators' applied at Level 5 to classify the tidal/hydrological regime, and 'descriptors' applied at Level 6 to categorise the characteristics of wetlands classified up to Level 5 (From SANBI, 2009).

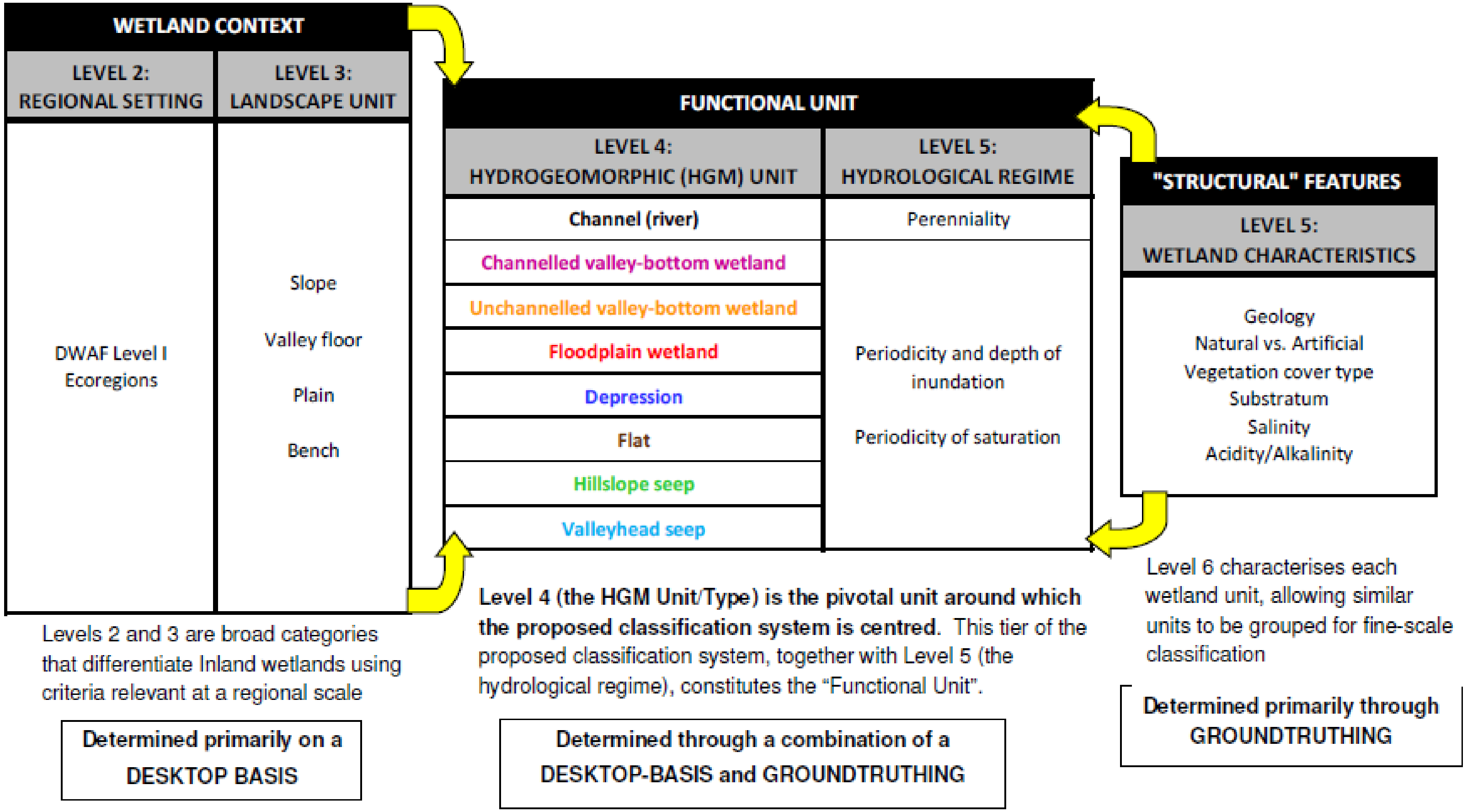

Figure 2 Illustration of the conceptual relationship of HGM Units (at Level 4) with higher and lower levels (relative sizes of the boxes show the increasing spatial resolution and level of detail from the higher to the lower levels) for Inland Systems (from SANBI, 2009).

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).

ECOLOGICAL CATEGORY	ECOLOGICAL DESCRIPTION	MANAGEMENT PERSPECTIVE
A	▪ Unmodified, natural.	▪ Protected systems; relatively untouched by human hands; no discharges or impoundments allowed
B	▪ Largely natural with few modifications. A small change in natural habitats and biota may have taken place but the ecosystem functions are essentially unchanged.	▪ Some human-related disturbance, but mostly of low impact potential
C	▪ Moderately modified. Loss and change of natural habitat and biota have occurred, but the basic ecosystem functions are still predominantly unchanged.	▪ **Multiple disturbances associated with need for socio-economic development, e.g. impoundment, habitat modification and water quality degradation**
D	▪ Largely modified. A large loss of natural habitat, biota and basic ecosystem functions has occurred.	
E	▪ Seriously modified. The loss of natural habitat, biota and basic ecosystem functions is extensive.	▪ **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**
▪ F	▪ 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.	

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 so as to retain the function of any ecological corridors.

13 APPENDIX 2 – DETAILS OF THE POTENTIAL SECTION 21 C & I WATER USE LICENSE APPLICATIONS

13.1 Potential Water Use License Application for activities located within 500m of a wetland boundary (3 activities). Only one of the activities shown in blue involves a direct crossing of a wetland area

#	DD.ddd WGS84 S	DD.ddd WGS84 E
1	-32.95355753003030941	20.50689510963585249
2	-32.98930919976322684	20.56308569349916837
3	-32.96757231600557247	20.51515939726253279

13.2 Potential Water Use License Application for activities that either cross a water course or are located within 32m of the water course, i.e. affect bed, banks or riparian zone (66 activities)

#	DD.ddd WGS84 S	DD.ddd WGS84 E
1	-32.93059455787462753	20.44130656847138283
2	-32.93282903723292776	20.44524976733897859
3	-32.94418216397255605	20.43636113989160563
4	-32.94651522330254778	20.43154715127407073
5	-32.95389229118401175	20.41815670511952874
6	-32.95592961059893611	20.41017172741264574
7	-32.9702729964798209	20.41278409666243121
8	-32.97221995092070301	20.42839259218000336
9	-32.96719237236451505	20.43190861117027879
10	-32.96729095233620654	20.43220435108534616
11	-32.9681453120908472	20.43141571131182843
12	-32.968868231883242	20.43335445075506129
13	-32.97093841128873493	20.43552321013224216
14	-32.97654925467741549	20.43752766955660505
15	-32.97860300408762413	20.43573680007090232
16	-32.97866050907111202	20.43811093438910476
17	-32.98175756318170926	20.44263739808920732
18	-32.98261192293634991	20.44257167810808085
19	-32.98241476299297403	20.44414895765511986
20	-32.98513392721209669	20.4420623482543462
21	-32.99197085899867687	20.44192269329445111
22	-32.99625087276955071	20.44432968760322566
23	-33.00039739282877349	20.43947873149631533
24	-33.00021666288067479	20.43874759670628194
25	-33.00203833860753377	20.4450484998967994
26	-33.00039533907936118	20.4344675829354081
27	-33.00265446343058784	20.42349234608725084
28	-33.00893072162818953	20.42313088619105343
29	-33.01162524085438577	20.42227652643640923
30	-33.01627492951909915	20.41057836979585716

#	DD.ddd WGS84 S	DD.ddd WGS84 E
31	-33.01742502918881428	20.42819132473780996
32	-33.01581488965121025	20.43298888336005703
33	-33.0102286912554419	20.44494991992511501
34	-33.01565058969839583	20.44544281978356537
35	-33.01851762387504152	20.44481026496521991
36	-33.00507788773462892	20.44950924361578259
37	-33.0052750476780048	20.45338672250225898
38	-33.00346774819702489	20.47109825741590328
39	-33.00277768839519155	20.47533719619857706
40	-33.00140578378917411	20.47786741547195177
41	-32.99920416442142823	20.48082481462265392
42	-32.99838266465734904	20.48240209416969648
43	-33.00617048242087037	20.39433731945991823
44	-33.00327880325129115	20.39506023925231304
45	-33.00018996413833605	20.39604603896921375
46	-32.99499808562932657	20.39657179881822913
47	-32.99153135662488978	20.40222371719512395
48	-32.9617273451839452	20.43621737743291433
49	-32.95839205614176137	20.43909262660720572
50	-32.95707765651922472	20.44270722556917619
51	-32.95630544674099127	20.44515529486614724
52	-32.95320017763275899	20.46332686964766978
53	-32.95543465699106633	20.47666802581639089
54	-32.95484317716092448	20.48951628212666876
55	-32.96207237508486543	20.49145502156990872
56	-32.9666399137731716	20.48922054221159783
57	-32.97032023271626855	20.48790614258906473
58	-32.9775905056284131	20.47725950564655051
59	-32.9591560509223811	20.52622089158594321
60	-32.95284693273421084	20.53059127033086995
61	-32.99099738177827135	20.53282574968918439
62	-32.99168744158010469	20.53640748866058985
63	-32.99030732197644511	20.54455676632030148
64	-32.98938724224066732	20.54728414553706273
65	-32.98915722230672998	20.5483028052445249
66	-33.01954039108149885	20.41562648584616113