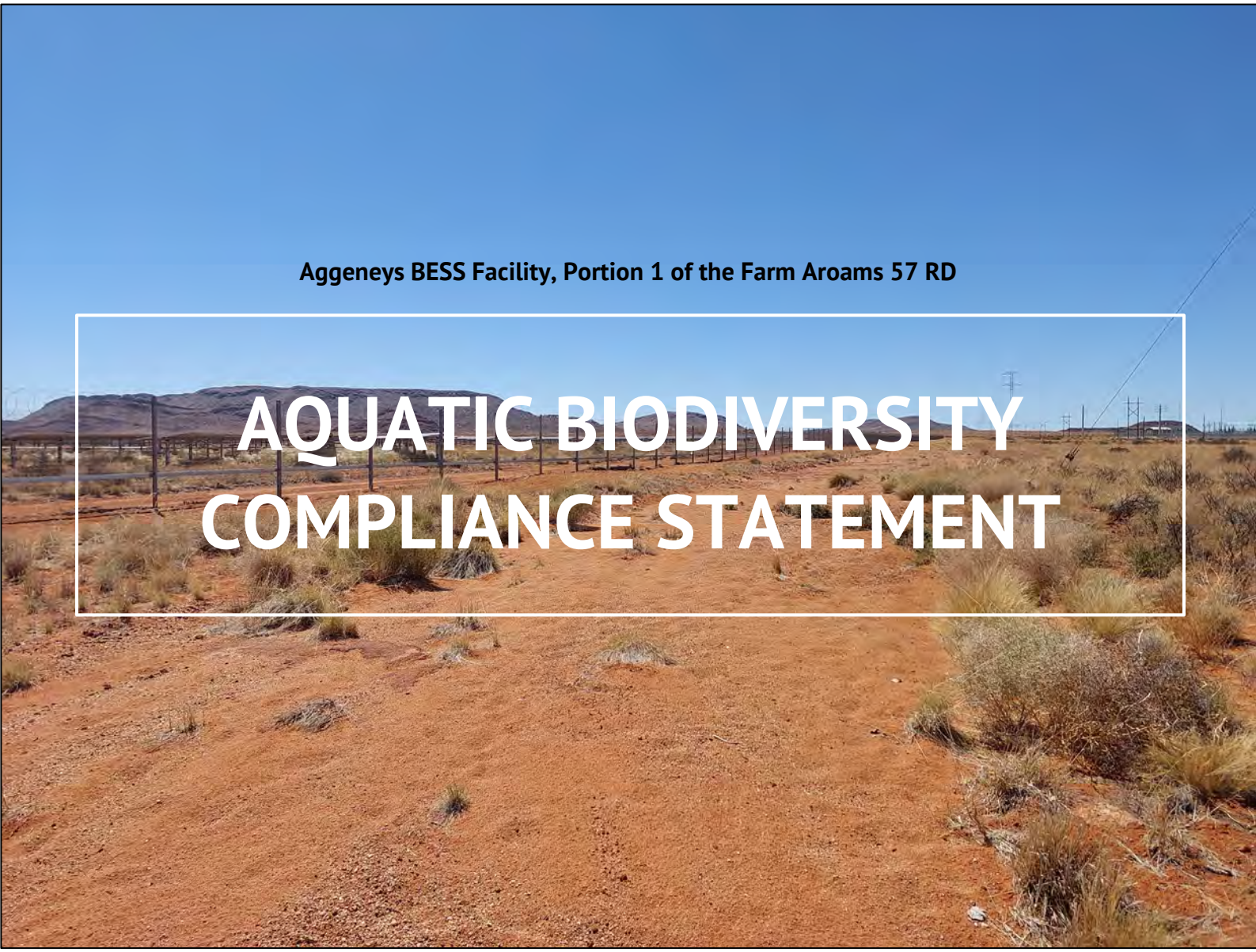
KIMBERLEY VAN ZYL
Pr. Sci. Nat.



Aggeneys BESS Facility, Portion 1 of the Farm Aroams 57 RD

AQUATIC BIODIVERSITY COMPLIANCE STATEMENT

PREPARED FOR: **WSP SOUTH AFRICA.**

DATE: **March 2023**

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Specialist Declaration:

This report has been prepared according to the requirements of Section 13 and Section 23 (5) of the Environmental Impact Assessments EIA Regulations (NEMA, No. 107 of 1998, as amended 2014).

I, Kimberley van Zyl, declare that;

- I act as the independent specialist in this application;
- I do not have and will not have any vested interest (either business, financial, personal or other) in the undertaking of the proposed activity, other than remuneration for work performed in terms of the Environmental Impact Assessment Regulations, 2014;
- I will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant;
- I declare that there are no circumstances that may compromise my objectivity in performing such work;
- I have expertise in conducting the specialist report relevant to this application, including knowledge of the Act, regulations and any guidelines that have relevance to the proposed activity;
- I will comply with the Act, regulations and all other applicable legislation;
- I have no, and will not engage in, conflicting interests in the undertaking of the activity;
- I undertake to disclose to the applicant and the competent authority all material information in my possession that reasonably has or may have the potential of influencing - any decision to be taken with respect to the application by the competent authority; and - the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority;
- all the particulars furnished by me in this form are true and correct; and
- I am aware that a person is guilty of an offence in terms of Regulation 48 (1) of the EIA Regulations, 2014, if that person provides incorrect or misleading information. A person who is convicted of an offence in terms of sub-regulation 48(1) (a)-(e) is liable to the penalties as contemplated in section 49B (1) of the National Environmental Management Act, 1998 (Act 107 of 1998).

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Name of Specialist: Kimberley van Zyl
Pr. Sci. Nat. (Ecological Science)
SACNASP registration number: 117097

The content of this specialist report complies with the "Protocol for the specialist assessment and minimum report requirements for environmental impacts on aquatic biodiversity" as prescribed in GN No. 320 of 20 March 2020.

Aquatic Biodiversity Compliance Statement Requirements	Section of Report
1. Contact details and curriculum vitae of the specialist including SACNASP registration number and field of expertise;	See attached CV
2. A signed statement of independence by the specialist;	Page 3
3. Baseline profile description of biodiversity and ecosystems, including the duration, date and season of the site inspection and the relevance of the season to the outcome of the assessment;	Section 2 and Section 4
4. Methodology used to verify the sensitivities of the aquatic biodiversity features on the national web based environmental screening tool;	Section 3
5. Methodology used to undertake the Initial Site Sensitivity Verification and preparation of the Compliance Statement, including equipment and modelling used, where relevant;	Section 3
6. Where required, proposed impact management actions and impact management outcomes proposed by the specialist for inclusion in the EMPr;	Section 5
7. A description of the assumptions made and any uncertainties or gaps in knowledge or data as well as a statement of the timing and intensity of site inspection observations; and	Section 1.3
8. Any conditions to which this statement is subjected.	Section 5.2

EXECUTIVE SUMMARY

The Aggeneys Battery Energy Storage System (BESS) project entails the construction and operation of a 153 MW/612 MWh BESS facility and associated infrastructure, near Aggeneys in the Northern Cape Province. The proposed BESS facility is located off the N14, adjacent to the existing Aggeneys Solar Energy Facility (SEF), on Portion 1 of the Farm Aroams 57 RD. The proposed BESS footprint will be up to 7.8 Hectares (Ha) in size, with a laydown area of up to 2.5 Ha.

According to the national web-based environmental screening tool report generated for the proposed BESS facility footprint area, the Combined Aquatic Biodiversity Theme Sensitivity is "Low". This report sets out the results from a desktop analysis, as well as a field assessment conducted on the 25th of March 2023, to assess the aquatic features associated with the proposed BESS facility project.

The proposed BESS facility is located within the Orange Water Management Area, quaternary catchment D82C. According to the DRDLR National Geo-spatial river line vector data of the 1:50 000 topography maps, there are no non-perennial or perennial drainage lines flowing within the BESS facility or within 500 m of the footprint area. According to the NWM5, there are no mapped watercourses within the DWS 500 m regulated area of the proposed BESS facility (CSIR, 2018). According to the NFEPA database, the proposed BESS facility is not located within a sub-quaternary catchment demarcated as a FEPA (CSIR, 2011).

Results from the desktop and field assessment conducted on the 25th of March 2023 determined that there is a small ephemeral drainage line, emanating to the north of the proposed BESS facility, located between the proposed BESS facility and the proposed laydown area. The ephemeral drainage line likely only flows after substantial stormflows and for short periods of time, considering the sandy soils in the region and the flat terrain. Sparse riparian vegetation such as *Stipagrostis* spp., *Rhigozum* spp., and *Euphorbia* spp. were observed. Given the limited vegetation cover, sediment is transported from the surrounding catchment into the ephemeral drainage line, and alluvial deposits were observed in the dry streambed.

The habitat integrity of the ephemeral drainage line was assessed using the Kleynhans *et al* (2008) Index of Habitat Integrity assessment methodology. The assessment produced an instream habitat integrity score within category E (seriously modified), and a riparian habitat integrity score within category F (critically modified). Impacts to the drainage line include vegetation removal and flow modification as a result of previous agricultural activities, and the upstream PV facility and associated access roads. The downstream farm road likely results in periodic inundation within the drainage line during stormwater flows, resulting in channel and bed modification, as well as erosion. Additionally, considering the previous agricultural land use, surrounding industrial land uses and dirt tracks through the drainage line, there has likely been physio-chemical modifications to the drainage line.

The potential impacts to the ephemeral drainage line as a result of the proposed activities include the following:

- Potential water quality impairment as a result of vegetation clearing/catchment hardening and resultant increased sedimentation during construction and operational phases; the mishandling of hazardous substances and/or improper maintenance of machinery during construction causing oil and diesel leaks and spills; and accidental leakage or spillage of hydrocarbons and electrolytes associated with the BESS during operation. The potential water quality impairment of the ephemeral drainage line would only occur during rainfall periods, which are limited in this region to approximately five times per year if not less. Additionally, the drainage line itself would only flow after substantial stormflows and for

a short period of time. As such, the significance of this potential impact is of "Low" significance prior to mitigation measures, and of "Very Low" significance with the implementation of mitigation measures.

- In addition, there is potential for clearance of vegetation within the delineated ephemeral drainage line and potential impacts to the bed and bank (geomorphology) of the ephemeral drainage line should new access roads be constructed or as a result of unrestricted vehicle movement within the watercourse. Both of these impacts are unlikely given the preferred layout and should the ephemeral drainage line be avoided as far as practically possible during construction and operation of the BESS, these impacts are considered to be of "Very Low" significance.

All three potential impacts were deemed of "Low" Significance prior to the implementation of mitigation measures, and "Very Low" Significance upon implementation of recommended mitigation measures. The impacts described can be effectively mitigated by implementing the following recommendations:

- The ephemeral drainage line should be avoided as far as practically possible during the construction and operation of the facility.
- Vehicles should remain on the existing dirt track with no new access roads/tracks constructed within the delineated drainage line.
- No vegetation should be removed from the ephemeral drainage line.
- The outer areas of the cleared BESS facility and lay-down area, within 100 m of the ephemeral drainage line should make use of sedimentation preventative measures such as the use of silt nets and/or sandbags to prevent sedimentation entering the watercourse via surface water run-off during construction activities.
- During construction activities, cover cleared areas with straw to minimize sedimentation by wind.
- Any soil stockpiles within 100 m of the watercourse should be bunded using an appropriate structure (silt nets, sandbags, etc.).
- Bunded, impervious areas must be designated by an Environmental Control Officer for temporary toilets, vehicle parking/servicing areas and for pouring and mixing of concrete/cement, paint, and chemicals. These bunded areas must be at least 15 m from the delineated drainage line.
- Contain electrolyte storage tanks within an adequately bunded area to prevent the migration of any spillage or leakage to the surrounding environment.

It is the opinion of the specialist that the proposed BESS facility and laydown area, as well as the surrounding DWS regulated area, is of "Low" aquatic sensitivity. Potential impacts as a result of the proposed project were deemed to be of "Very Low" significance should mitigation measures be implemented onsite. As such, there should be no reason from an aquatic ecological perspective, why the proposed Aggeneys BESS project on Portion 1 of the Farm Aroams 57 RD cannot be approved, provided that recommended mitigation measures in this report are implemented.

1. INTRODUCTION

1.1 Project Background

The Aggeneys Battery Energy Storage System (BESS) project entails the construction and operation of up to 153 MW/612 MWh BESS facility and associated infrastructure near Aggeneys in the Northern Cape Province (Figure 1). The proposed BESS facility is located off the N14, adjacent to the existing Aggeneys Solar Energy Facility (SEF), on Portion 1 of the Farm Aroams 57 RD (Figure 2).

The proposed BESS footprint will be up to 7.8 Hectares (Ha) in size, with a laydown area of up to 2.5 Ha (Figure 2). Both the BESS and the associated laydown area are further referred to in this report as the proposed "BESS facility". The proposed BESS comprises of a number of DC Battery Enclosures, Converter Stations, associated auxiliary transformers and an HV substation. Each DC Battery Enclosure is approximately 10 x 2 x 4 m (l x b x h) and houses a number of liquid cooled Lithium-ion batteries. The enclosure is equipped with a fire detection system, and gas detection and prevention mechanism. A generic BESS facility layout is shown in Figure 3.

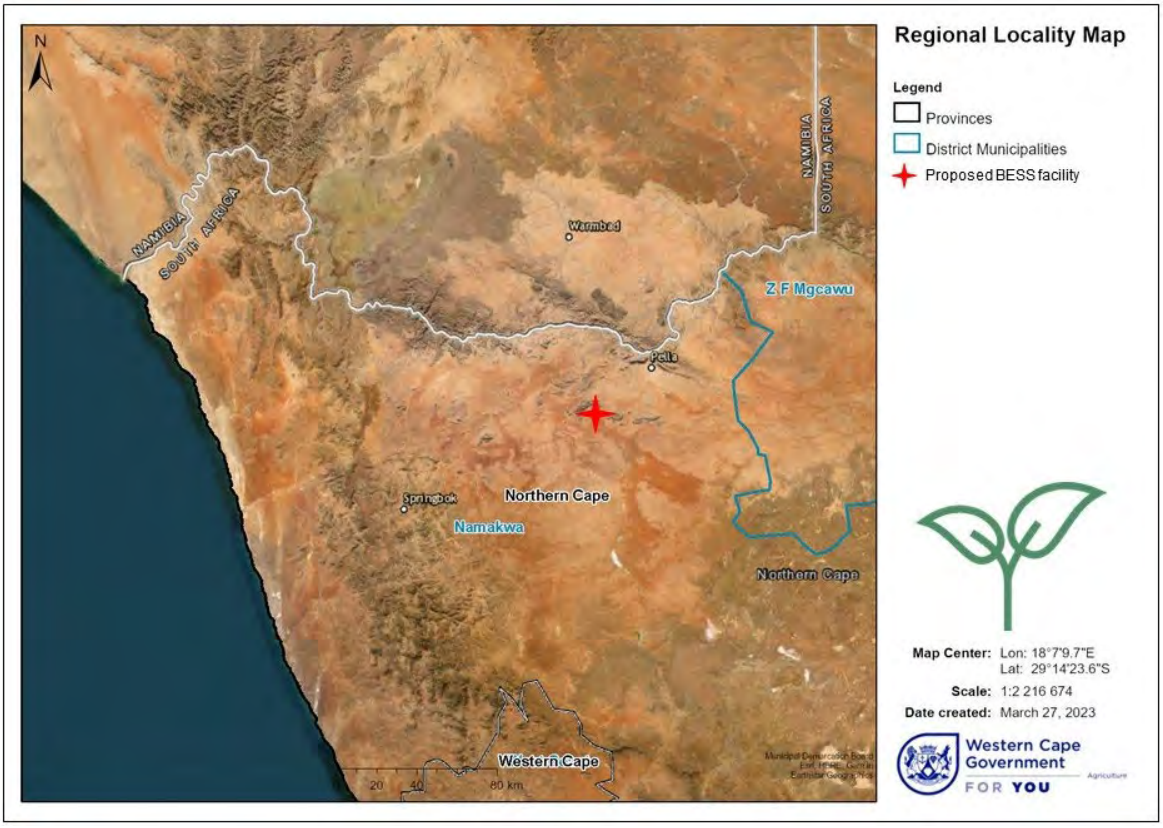

Figure 1: Regional locality map.

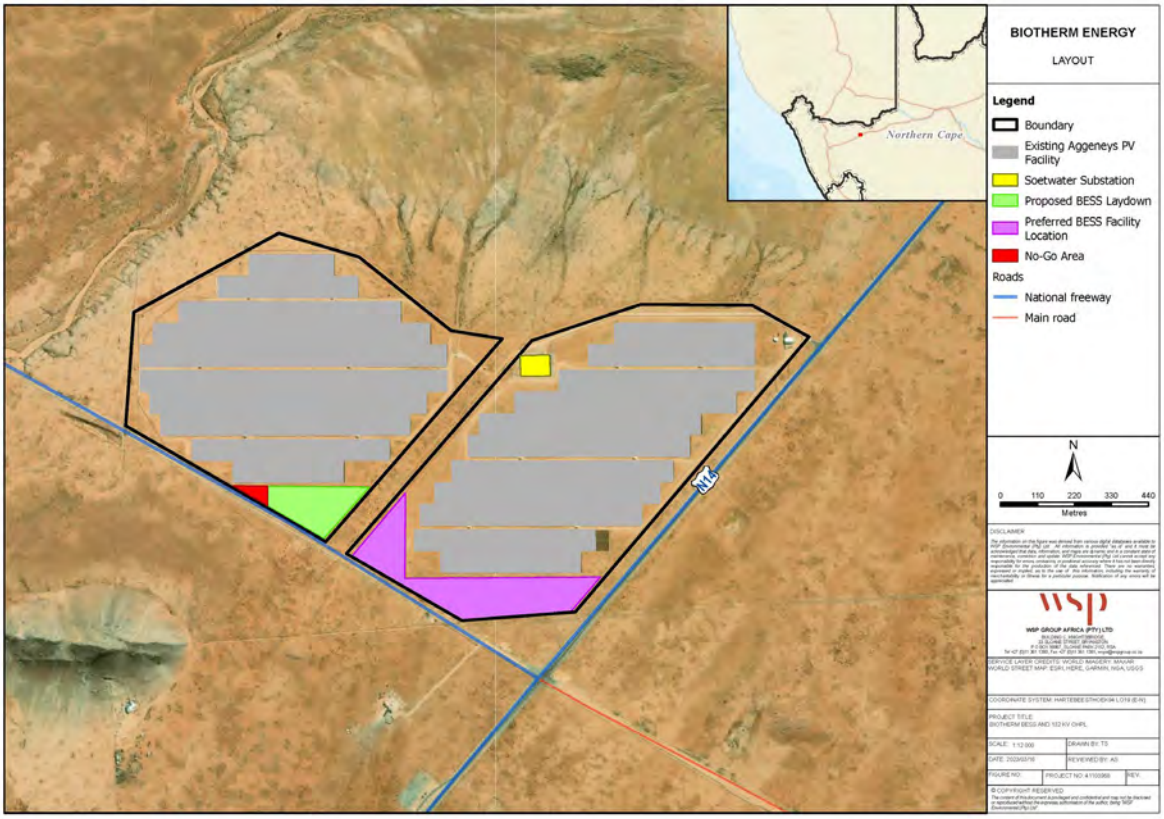

Figure 2: The preferred layout for the proposed BESS and laydown area adjacent to the existing Aggeneys PV Facility.

Figure 3: An example of a typical BESS facility layout.

DESIGN OF THE VANADIUM REDOX FLOW BATTERIES

In this design, VRFB's are a type of rechargeable battery that utilise a Vanadium electrolyte solution. They are unique in that they use Vanadium ions in different oxidation states (V2+ and V3+ for the negative electrode, V4+ and V5+ for the positive electrode) to store and release electrical energy. A single VRFB unit (Figure 4) comprises of a number of VRFB stacks, back cooler, flame arrestor, gas barriers, switch cabinets, pre-pressure tanks, electrolyte pumps and electrolyte tanks, additionally associated auxiliary transformers and an HV substation will be required.

The heart of a VRFB is the stack (Figure 5), which consists of multiple cells stacked on top of each other. Each cell consists of a positive and negative electrode compartment, separated by an ion exchange membrane. The positive and negative electrodes are made of carbon-based materials coated with a catalyst to facilitate the reaction with the vanadium ions.

When the VRFB is in use, the electrolyte solution is pumped from the storage tanks (Figure 6) through the stack, where the chemical reactions take place, producing electricity. The size of the stack and the number of cells depends on the desired capacity and power output of the battery.

One of the advantages of VRFBs is their scalability, as their capacity can be easily increased or decreased by simply adding or removing electrolyte solution. They also have a long cycle life and are able to maintain their capacity over many charge-discharge cycles.

Another advantage of VRFB stacks is their ability to operate at a constant voltage, which simplifies the power electronics required for the battery system. Additionally, because the chemical reactions take place outside the stack, there is no risk of cross-contamination between the electrolyte solutions, which improves the longevity and reliability of the battery.

- The proposed technology comprises of a number of VRFB stacks, back cooler, flame arrestor, gas barriers, switch cabinets, pre-pressure tanks, electrolyte pumps and electrolyte tanks, all within a single VRFB unit, additionally associated auxiliary transformers and an HV substation will be required.

- Each VRFB unit comprises of 5, 40 foot containers:

- The 2 containers situated at the top of the VRFB unit contains the stacks (where the charging and discharging of electrolyte solution occur) and control mechanisms (required for operation of each VRFB unit)
- The 3 containers situated at the bottom of the VRFB unit stores the charged/discharged electrolyte solution, housed within double containment tanks.

- There will be up to 230 VRFB units required to provide up to 153MW of generation capacity.
- The development area required for an up to 153MW VRFB facility is approximately up to 7.8 ha in extent.
- The entire facility will require bunding to contain 110% of the total electrolyte tank capacity.

Vanadium Electrolyte Solution

The Vanadium Electrolyte Solution comprises of approximately 15% concentration of Sulphuric Acid and <1% concentration of Phosphoric acid, as listed in the safety data sheet. Both these chemicals are listed in the SANS 10234-

A (2008) as a dangerous good. The total Vanadium electrolyte solution proposed to be stored in the positive and negative electrolyte tanks summates up to 33 603m^3, with an approximate dangerous good concentration of up to 5 040m^3.

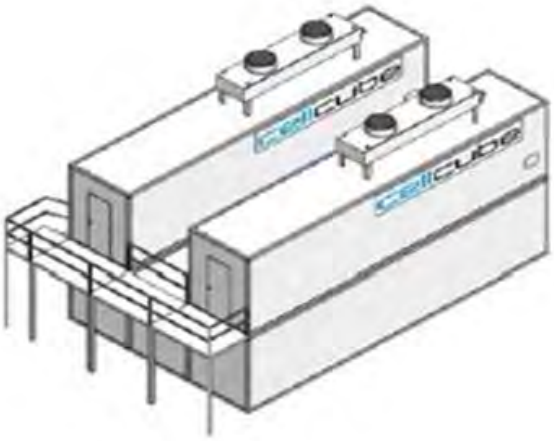

Figure 4: A VRFB unit

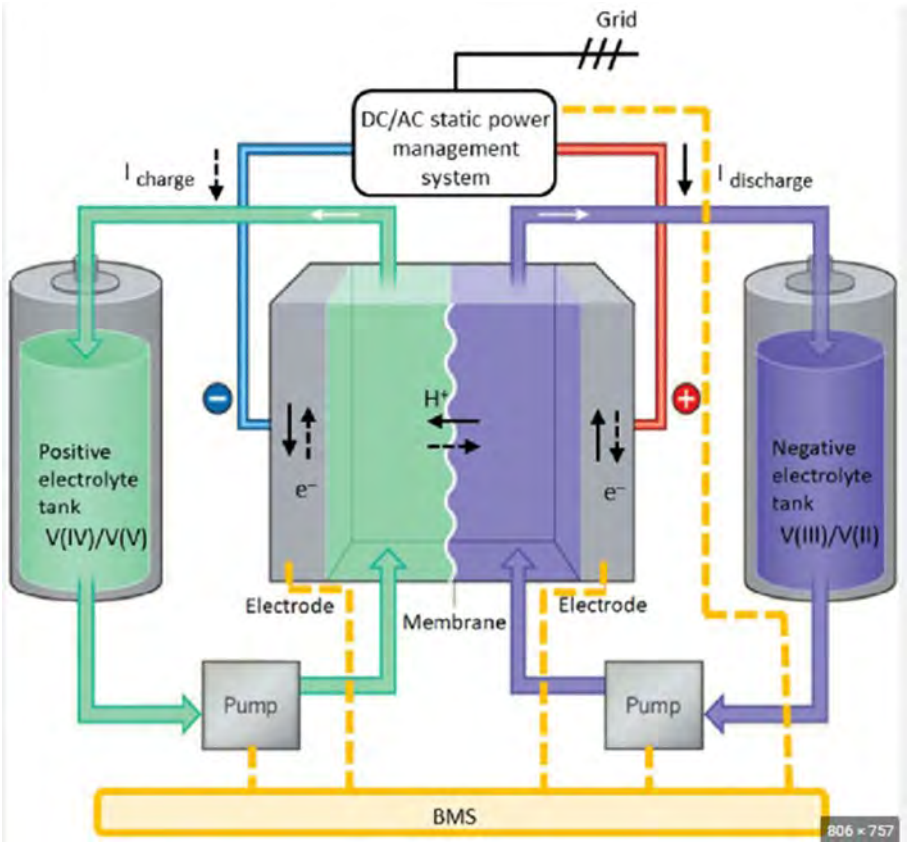

Figure 5: VRFB stack

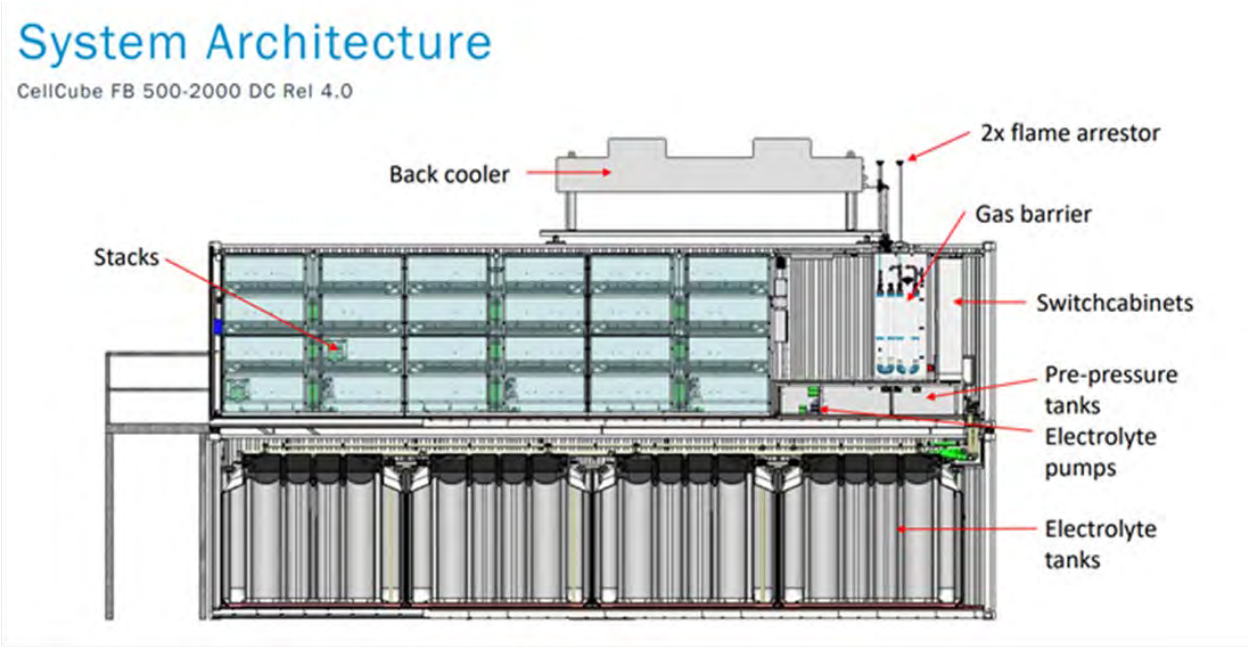

Figure 6: Cross section of a VRFB unit indicating the stacks and electrolyte tanks

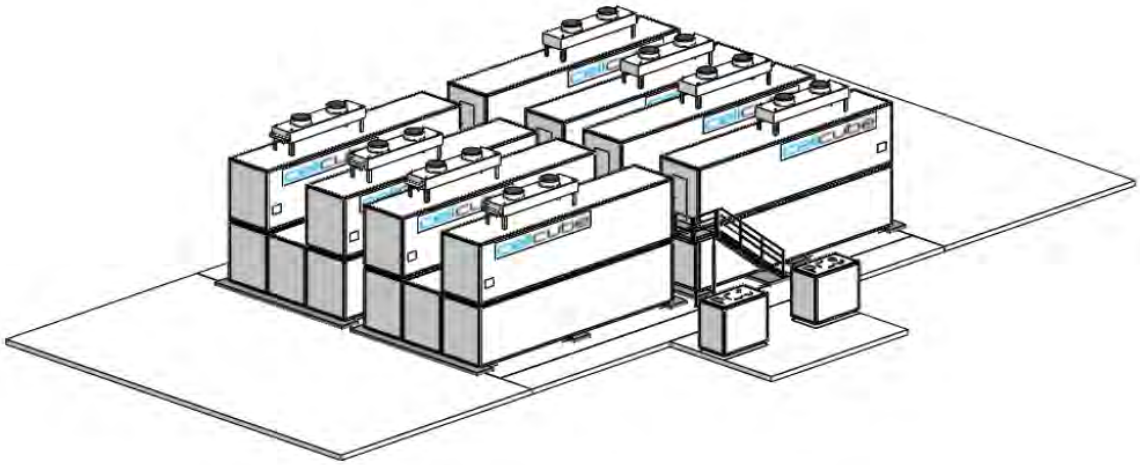

Figure 7: Conceptual VRFB Facility Layout

Additional infrastructure for the facility includes:

- Approx. 6m wide access road to BESS (6m wide road surface with 1m drainage on each side of the road), internal roads also up to 6m wide;
- MV cabling (underground/overhead);
- Fencing around the BESS;
- Temporary laydown area within the BESS footprint;
- Possible firebreak located within the footprint;
- Water supply.

1.2 The National Web-Based Environmental Screening Tool

According to the national web-based environmental screening tool report generated for the proposed BESS facility footprint area, the Combined Aquatic Biodiversity Theme Sensitivity is "Low" (**Figure 8**).

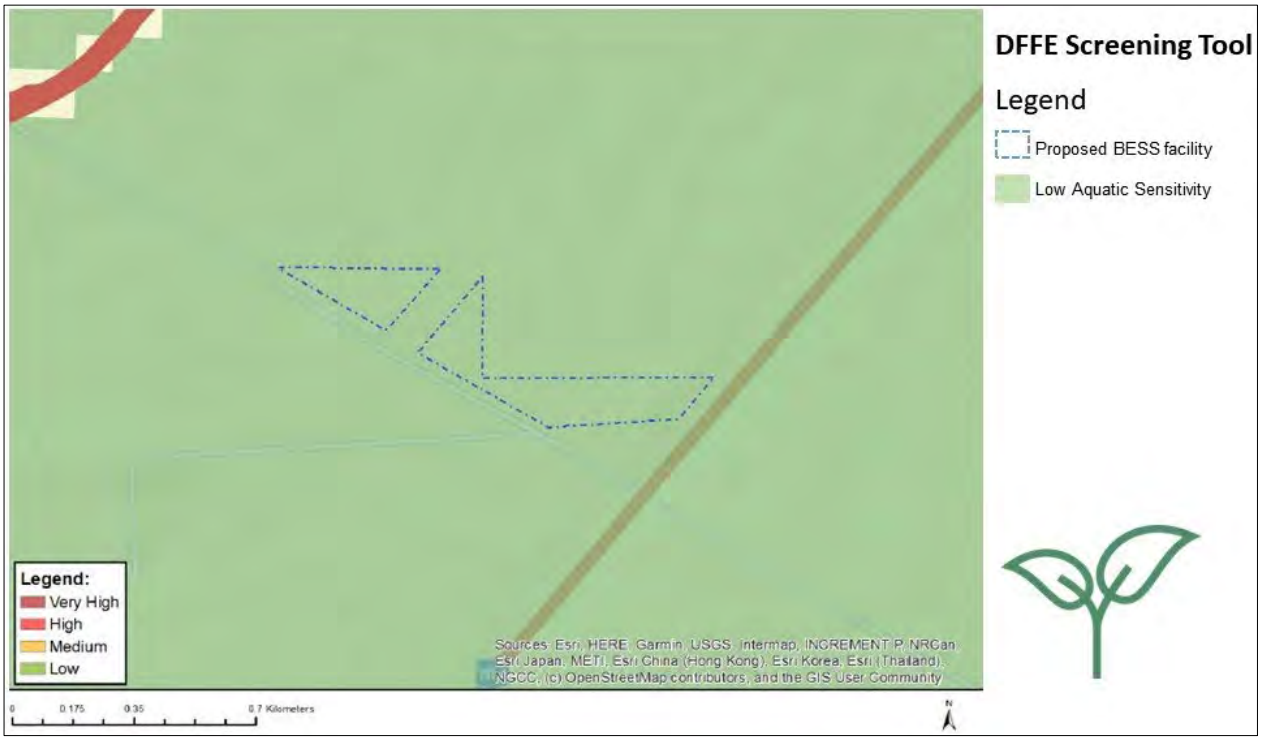

Figure 8: Combined Aquatic Biodiversity Sensitivity according to the DFFE's online screening tool.

As per the National Environmental Management Act (NEMA) (Act No. 107 of 1998) Regulations of 2020 (as amended) (GN R. 320 of 2020), prior to beginning specialist assessments, the current land use, and the potential environmental sensitivity of the site - as identified by the national web-based environmental screening tool - must be confirmed by undertaking an Initial Site Sensitivity Verification. This Initial Site Sensitivity Verification aims to confirm or dispute the current use of the land and environmental sensitivity as identified by the national web based environmental screening tool.

The Initial Site Sensitivity Verification was undertaken by a desktop and field assessment, conducted on the 25th of March 2023, of the proposed BESS facility and the 500 m DWS regulated area. The proposed BESS and laydown area's footprint, and the surrounding DWS regulated area, were deemed to be of "Low" aquatic sensitivity. There is a small ephemeral drainage line located between the BESS facility and laydown area, which is in a highly disturbed state. Potential impacts as a result of the proposed project were deemed to be of "Very Low" significance should mitigation measures be implemented onsite. According to GN R. 320 of 2020, if the specialist determines that the sensitivity of the site is "Low", an Aquatic Biodiversity Compliance Statement must be compiled.

1.3 Limitations

- The findings of this report were determined by a combination of a desktop assessment of existing aquatic biodiversity information for the proposed BESS footprint area and surrounding catchment area, as well as one site visit.

- The site was visited on the 25th of March 2023 during Summer. To obtain a comprehensive understanding of the dynamics of the aquatic ecosystem in an area, ecological assessments should consider investigations at different time scales (across seasons / years) and through replication. However, for the purposes of this study, one site assessment is deemed sufficient.
- The disturbed nature of the ephemeral drainage line resulted in areas that were difficult to delineate. This will however not have a significant impact on the conclusion made regarding the potential impacts of the proposed activities.

2. DESKTOP ASSESSMENT

2.1 Landscape, Geology, & Soils

The topography of the proposed BESS facilities footprint area is relatively flat. In general, the area slopes gently (<3%) from a small ridgeline in the north/northeast (approximately 903 masl) to the south/southwest plains (880 masl). The geology is described as bedrock comprising of ancient basement rocks of the Bushmanland Terrance of the Namaqua Province overlain by Quaternary sand cover. This sand cover is a combination of alluvium in the drainage lines and colluvium closer to the bedrock outcrops. The soils in the proposed BESS facility and surrounds are sandy red soils, partly infested with coarse fragments, indicating susceptibility to water and wind erosion as observed on site (Figure 13).

2.2 Vegetation

The vegetation within the area consists of Bushmanland Arid Grassland which is of Least Concern (LC), according to the South African National Biodiversity Institute (SANBI) Vegetation Map 2018 (Beta) obtained from CapeFarmMapper ver.2.2.3.1. However, the proposed BESS facility footprint area is currently considered to be in a degraded state consisting of sparse natural vegetation likely due to historic agricultural impacts such as overgrazing (Figure 11).

2.3 Aquatic Features and Conservation Importance

2.3.1 Regional Drainage

The proposed BESS facility is located within the Orange Water Management Area, quaternary catchment D82C. According to the Department of Rural Development and Land Reform (DRDLR) National Geo-spatial river line vector data of the 1:50 000 topography maps for the Northern Cape, there are no dry watercourses, dry pans, perennial or non-perennial drainage lines flowing within the BESS facility or within 500 m of the footprint area (Figure 9 & Figure 10).

According to the National Wetland Map version 5 (NWM5), there are no mapped wetlands within the proposed footprint area or the DWS 500 m regulated area of the proposed BESS facility (Figure 10) (CSIR, 2018). According to the NFEPA database, the proposed BESS facility is not located within a sub-quaternary catchment demarcated as a FEPA (CSIR, 2011).

2.3.5 2016 Northern Cape Critical Biodiversity Areas

According to the 2016 Northern Cape Critical Biodiversity Areas dataset, the proposed BESS facility and laydown area coincides with an Ecological Support Area (ESA), apart from the western corner of the proposed laydown area which coincides with a Critical Biodiversity Area (CBA) and has been designated as a No-Go Area (Northern Cape Department of Environment and Nature Conservation, 2016).

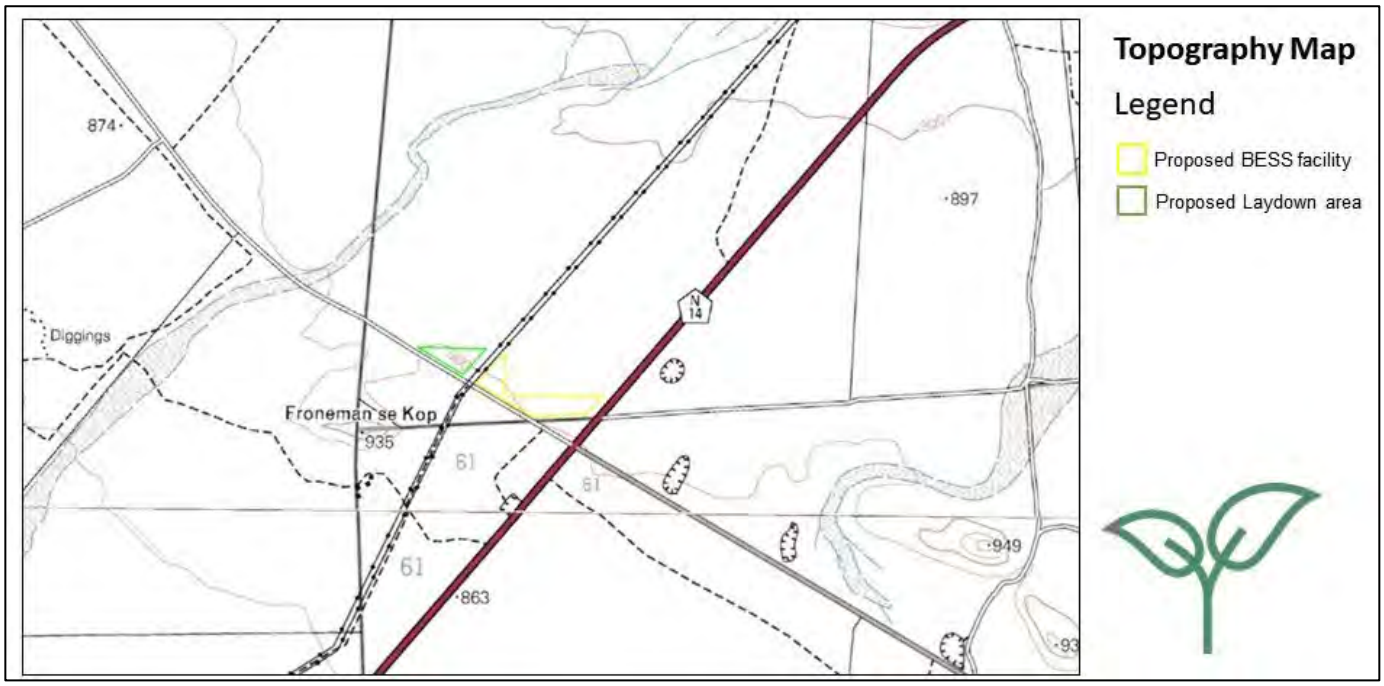

Figure 9: Topography Map (NGI, 2023).

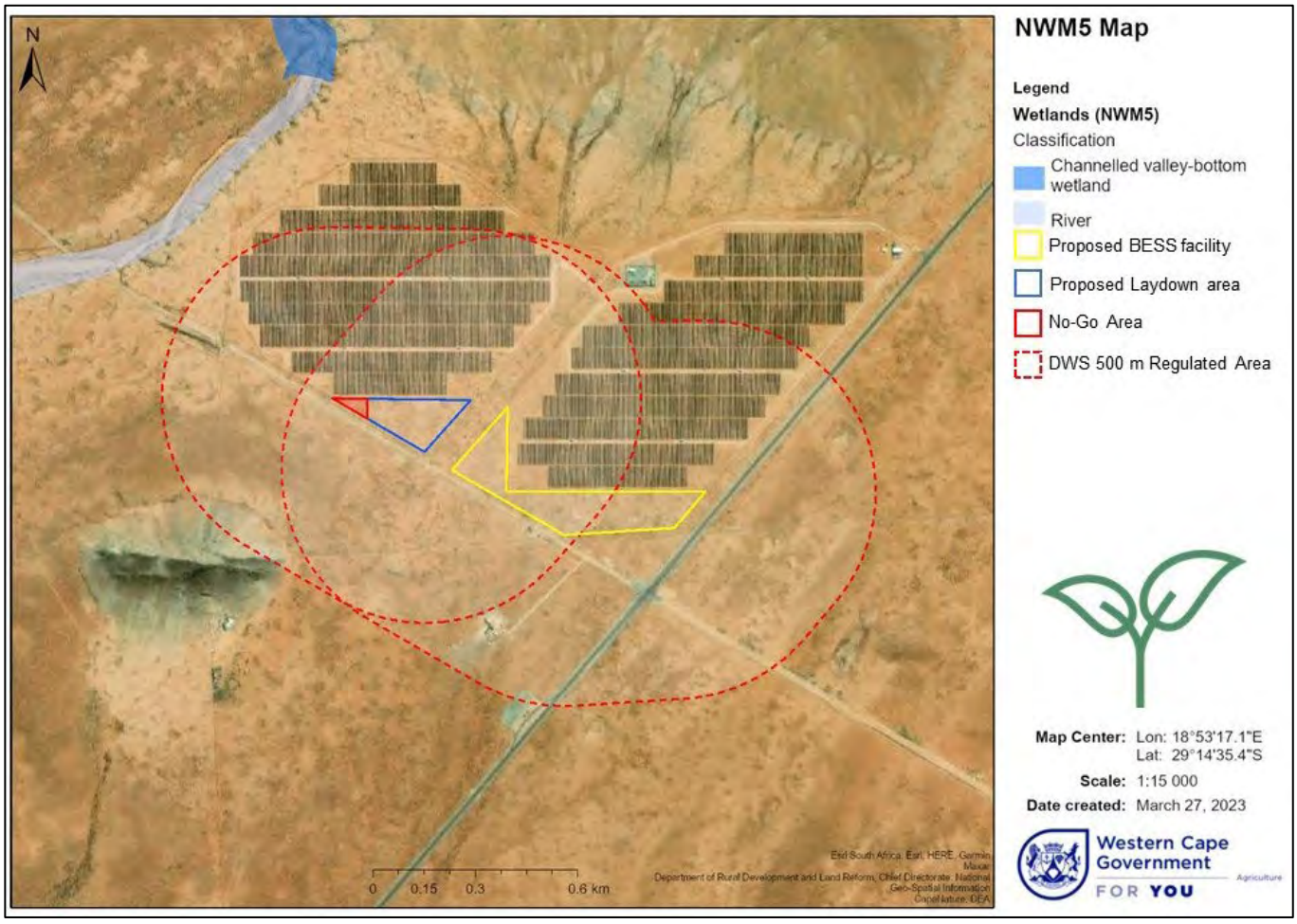

Figure 10: NWM5 Map.

3. METHODOLOGY

The following methodology was used to collect and interpret baseline aquatic assessment data for the proposed BESS facility:

- Desk top analysis using google earth satellite imagery, and a comprehensive background description of the proposed BESS footprint area in terms of available data.
- Field Assessment. For the purposes of this Initial Site Sensitivity Verification and Aquatic Biodiversity Compliance Statement report, the proposed BESS footprint area, as well as the 500 m DWS regulated area was assessed on the 25th of March 2023. The field assessment considered the current use of land and environmental status quo versus the environmental sensitivity as identified on the national web based environmental screening tool. The field assessment was done to determine if there are any discrepancies with the current use of land and environmental status quo versus the environmental sensitivity as identified on the national web-based environmental screening tool, such as new developments, infrastructure, indigenous/pristine vegetation, etc.

3.1. Riparian Delineation

Riparian areas are delineated at the outer edges of the channel bank using the method described in the Updated Manual for the Identification and Delineation of Wetlands and Riparian Areas (DWAF, 2008). This method is the accepted best practice method for delineating riparian areas in South Africa and its use is required by GN 509.

3.1.1 Desktop Delineation

For this assessment, a desktop delineation of the ephemeral drainage line was conducted and confirmed in field during the site assessment. The drainage line was identified using a range of tools, including:

- 1: 50 000 Topographical Maps;
- Historical Maps; and
- Recent aerial and satellite imagery, including Google Earth, ArcGIS and QGIS.

3.1.2 In-field Assessment

The following indicators stipulated in the Updated Manual for the Identification and Delineation of Wetlands and Riparian Areas (DWAF, 2008) were considered in the field:

- The position in the landscape – riparian areas are only likely to develop on valley bottom landscape units;
- The soil form – riparian areas are often (but not always) associated with alluvial soils and recently deposited material;
- Topography associated with riparian areas – riparian areas may have clearly identifiable banks associated with alluvial deposited material adjacent to the active channel;
- The presence of aquatic vegetation communities.

Watercourses encountered within the proposed area were assessed using the Classification System for Wetlands and other Aquatic Ecosystems in South Africa. User Manual: Inland Systems (Ollis *et al*., 2013), hereafter referred to as the "Classification System":

Level 1: Marine, Estuarine and Inland Systems

An inland system is defined as "an aquatic ecosystem with no existing connection to the ocean. These ecosystems are characterised by the complete absence of marine exchange and/or tidal influence." The user manual for classification of wetlands used for this report focuses solely on inland systems.

Level 2: Regional Setting

Two optional spatial frameworks have been suggested at Level 2 of the Classification System, namely Department of Water Affairs (DWA) Ecoregions (Level 1) and (2) National Freshwater Ecosystems Priority Areas (NFEPA) WetVeg Groups. Alternatively, another spatial framework other than these two can be chosen.

Level 3: Landscape Setting

The Landscape Units included in the Classification System for Inland Systems are valley floor, slope, plain and bench, defined as follows:

- Valley floor—the base of a valley, situated between two distinct valley side-slopes, where alluvial or fluvial processes typically dominate.
- Slope—an inclined stretch of ground typically located on the side of a mountain, hill or valley, not forming part of a valley floor. Includes scarp slopes, mid-slopes and foot-slopes.
- Plain—an extensive area of low relief. These areas are generally characterised by relatively level, gently undulating or uniformly sloping land with a very gentle gradient that is not located within a valley. Gradient is typically less than 0.01 or 1:100.
- Bench—a relatively discrete area of mostly level or nearly level high ground (relative to the broad surroundings), including hilltops, saddles and shelves. Benches are significantly less extensive than plains, typically being less than 50 ha in area.

Level 4: Hydrogeomorphic Unit

HGM Units are distinguished primarily based on: (i) Landform, which defines the shape and localised setting of the aquatic ecosystem. (ii) Hydrological characteristics, which describe the nature of water movement into, through and out of the aquatic ecosystem. (iii) Hydrodynamics, which describe the direction and strength of flow through the aquatic ecosystem.

The various HGM types include:

- River— a linear landform with clearly discernible bed and banks, which permanently or periodically carries a concentrated flow of water. A river is taken to include both the active channel and the riparian zone as a unit.
- Floodplain wetland—a wetland area on the mostly flat or gently-sloping land adjacent to and formed by an alluvial river channel, under its present climate and sediment load, which is subject to periodic inundation by overtopping of the channel bank.
- Channelled valley-bottom wetland—a valley-bottom wetland with a river channel running through it.
- Unchannelled valley-bottom wetland—a valley-bottom wetland without a river channel running through it.
- Depression—a wetland or aquatic ecosystem with closed (or near-closed1) elevation contours, which increases in depth from the perimeter to a central area of greatest depth and within which water typically accumulates.
- Seep—a wetland area located on gently to steeply sloping land and dominated by colluvial (i.e. gravity-driven), unidirectional movement of water and material down-slope.
- Wetland flat—a level or near-level wetland area that is not fed by water from a river channel, and which is typically situated on a plain or a bench. Closed elevation contours are not evident around the edge of a wetland flat.

3.1.3 Index of Habitat Integrity (IHI) Assessment

The Index of Habitat Integrity (IHI) assessment is a tool used to assess the habitat integrity of a river based on the intensity and extent of anthropogenic disturbances that impact both the instream and riparian habitat. The assessment of habitat integrity is based on an interpretation of the deviation from the reference condition (Kleynhans *et al*., 2008).

The disturbances assessed include abiotic factors such as water abstraction, weirs, dams, pollution and the dumping or rubble and biotic factors such as the presence of alien plants and aquatic animals which modify habitat (Kleynhans, 1996). These changes are all related and interpreted in terms of modification of the drivers of the system, namely hydrology, geomorphology, and physico-chemical conditions and how these changes would impact on the natural riverine habitats. The severity of each of these impacts is assessed, using scores as a measure of impact. See Annexure B for a detailed description of the IHI methodology used for this Aquatic Biodiversity Compliance Statement.

4. EVALUATION OF RESULTS & DISCUSSION

4.1. Description of the affected environment

The entirety of the proposed BESS facility area has been used previously for grazing (sheep) and currently consists of sparse low shrubland and barren land (Figure 11). The area surrounding the proposed BESS facility has been transformed as a result of the N14, mining activities, and the Aggeneys Solar Energy Facility (SEF) which is located to the north of the proposed BESS facility (Figure 11).

A small ephemeral drainage line, originating to the north of the proposed BESS facility, is located between the proposed BESS facility and the proposed laydown area (Figure 12 & Figure 13). An aerial image obtained from the National Geo-spatial Information (NGI) from 1980 (Figure 16) shows that this ephemeral drainage line emanates from a ridge located to the north of the proposed activities and flows south episodically through the Aggeneys SEF, dissipating shortly after the farm road to the south of the proposed BESS facility (Figure 11).

The ephemeral drainage line likely only flows after substantial stormflows and for short periods of time, considering the sandy soils in the region and the flat terrain. These ephemeral watercourse features are considered typical for the Northern Cape (Savannah Environmental, 2019). Sparse riparian vegetation such as *Stipagrostis* spp., *Rhigozum* spp., and *Euphorbia* spp. were observed (Figure 12, 13 & 14). Given the limited vegetation cover, sediment is transported from the surrounding catchment into the ephemeral drainage line, and alluvial deposits were observed in the dry streambed. (Figure 12, 13 & 14).

The habitat integrity of the ephemeral drainage line was assessed using the Kleynhans *et al* (2008) Index of Habitat Integrity assessment methodology. The assessment produced an instream habitat integrity score within category E (seriously modified), and a riparian habitat integrity score within category F (critically modified). The assessment results for the instream and riparian habitat are presented in Table 1 and Table 2 respectively. Impacts to the drainage line include vegetation removal and flow modification as a result of previous agricultural activities, and the upstream PV facility and associated access roads. The downstream farm road likely results in periodic inundation within the drainage line during stormwater flows, resulting in channel and bed modification, as well as erosion. Additionally, considering the previous agricultural land use, surrounding industrial land uses and dirt tracks through the drainage line, there has likely been physio-chemical modifications to the drainage line.

Figure 11: Proposed BESS facility footprint area, with the existing Aggeneys PV facility in the background.

Figure 12: Ephemeral drainage line located between the proposed BESS and layout area; upstream view.

Figure 13: Ephemeral drainage line and erosion; downstream view.

Figure 14: The ephemeral drainage line originates to the north of the existing PV area.

Figure 15: Dirt tracks and power lines present in the drainage line.

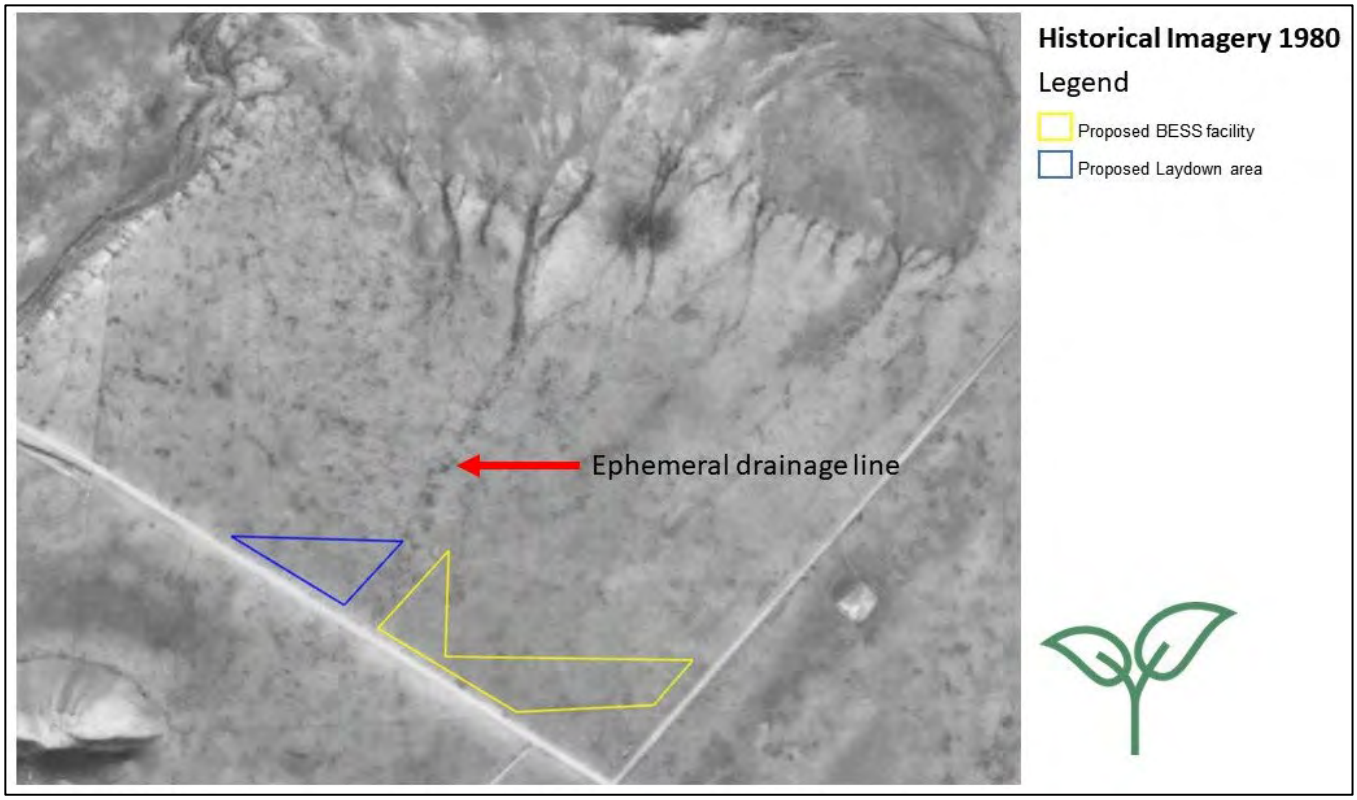

Figure 16: Historical imagery from 1980 (NGI), showing the ephemeral drainage line.

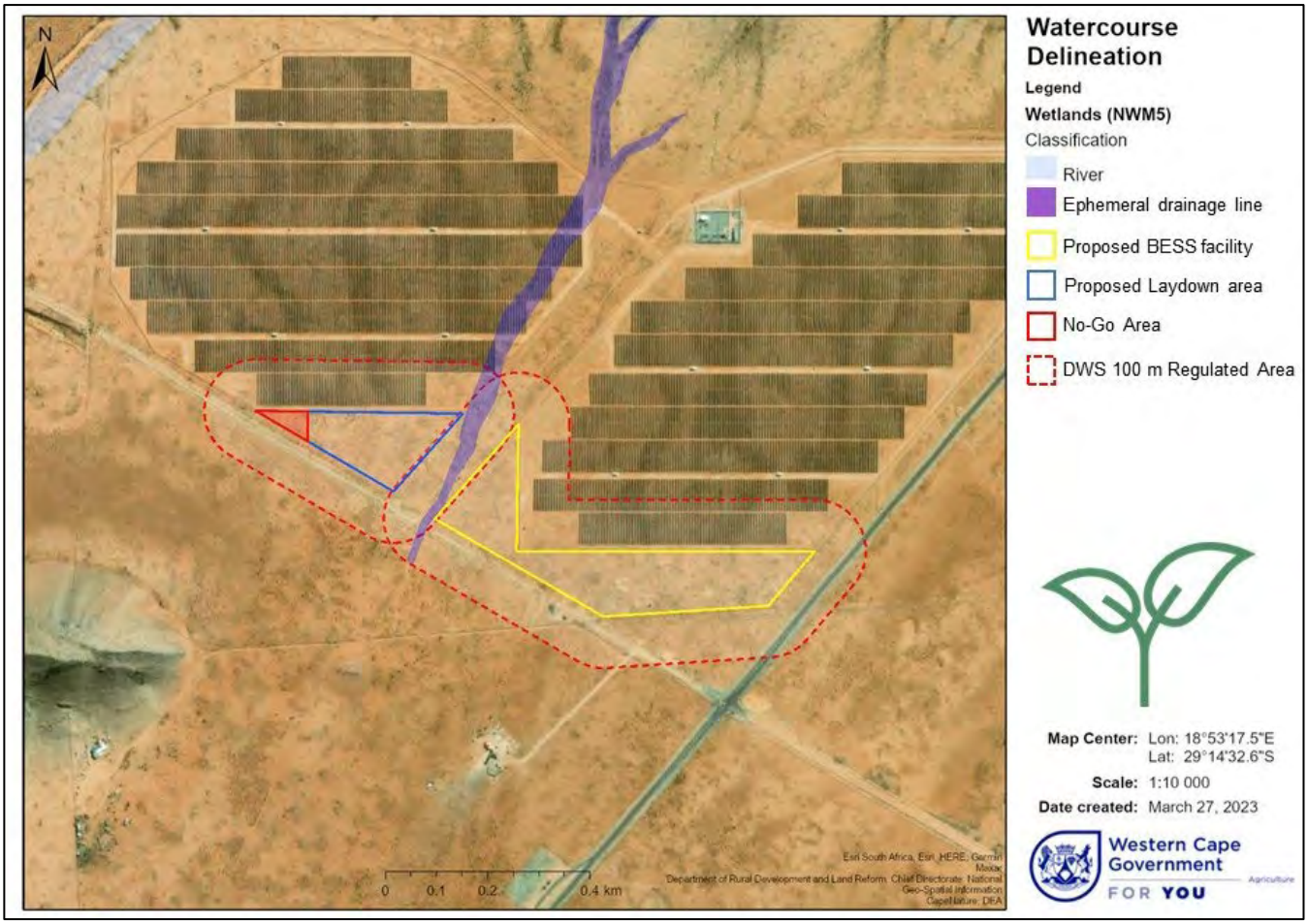

Figure 17: Watercourse delineation map.

Table 1: Instream IHI Score Rating Results.

CRITERIA	Ephemeral Drainage Line
Water Abstraction	0
Flow Modification	25
Bed Modification	20
Channel Modification	20
Water Quality	5
Extent of Inundation	15
Alien Macrophytes	0
Presence of exotic fauna	0
Solid Wate Disposal	0
Instream Habitat Integrity Score	37
Instream Integrity Category	**E**

Table 2: Riparian IHI Score Rating Results.

CRITERIA	Ephemeral Drainage Line
Indigenous Vegetation Removal	20
Exotic Vegetation Encroachment	0
Bank Erosion	20
Channel Modification	20
Water Abstraction	0
Extent of Inundation	15
Flow Modification	20
Water Quality	5
Riparian Habitat Integrity Score	7
Riparian Integrity Category	F

5. IMPACT MANAGEMENT OUTCOMES

5.1. Potential Impacts

The ephemeral drainage line is located adjacent to the proposed BESS facility and laydown area. The potential impacts to the ephemeral drainage line as a result of the proposed activities include the following:

Potential water quality impairment as a result of vegetation clearing/catchment hardening and resultant increased sedimentation during construction and operational phases; the mishandling of hazardous substances and/or improper maintenance of machinery during construction causing oil and diesel leaks and spills; and accidental leakage or spillage of hydrocarbons and electrolytes associated with the BESS during operation. However, the potential water quality impairment of the ephemeral drainage line would only occur during rainfall periods, which are limited in this region to approximately five times per year if not less. Additionally, the drainage line itself would only flow after substantial stormflows and for a short period of time. As such, the significance of this potential impact is of “Low” significance prior to mitigation measures, and of “Very Low” significance with the implementation of mitigation measures.

In addition, there is potential for clearance of vegetation within the delineated ephemeral drainage line and potential impacts to the bed and bank (geomorphology) of the ephemeral drainage line should new access roads be constructed or as a result of unrestricted vehicle movement within the watercourse. Both of these impacts are unlikely given the preferred layout, and should the ephemeral drainage line be avoided as far as practically possible during construction and operation of the BESS, these impacts are considered to be of “Very Low” significance.

5.2. Mitigation and Management Recommendations

The impacts described can be effectively mitigated by implementing the following recommendations:

- The ephemeral drainage line should be avoided as far as practically possible during the construction and operation of the facility.
- Vehicles should remain on the existing dirt track with no new access roads/tracks constructed within the delineated drainage line.
- No vegetation should be removed from the ephemeral drainage line.
- The outer areas of the cleared BESS facility and lay-down area, within 100 m of the ephemeral drainage line should make use of sedimentation preventative measures such as the use of silt nets and/or sandbags to prevent sedimentation entering the watercourse via surface water run-off during construction activities.
- During construction activities, cover cleared areas with straw to minimize sedimentation by wind.
- Any soil stockpiles within 100 m of the watercourse should be bunded using an appropriate structure (silt nets, sandbags, etc.).
- Bunded, impervious areas must be designated by an Environmental Control Officer for temporary toilets, vehicle parking/servicing areas and for pouring and mixing of concrete/cement, paint, and chemicals. These bunded areas must be at least 15 m from the delineated drainage line.
- Contain electrolyte storage tanks within an adequately bunded area to prevent the migration of any spillage or leakage to the surrounding environment.

5.3. Impact Assessment

Impact number	Aspect	Description	Stage	Character	Ease of Mitigation	Pre-Mitigation							Post-Mitigation						
						(M+	E+	R+	D)x	P=	S	Rating	(M+	E+	R+	D)x	P=	S	Rating
Impact 1:	Water Resource Management	Water Quality Impairment	Construction & Operational	Negative	High	3	1	3	2	3	**27**	**N2**	2	1	3	1	1	**7**	**N1**
					Significance	**N2 - Low**							**N1 - Very Low**						
Impact 2:	Water Resource Management	Riparian Vegetation Removal	Construction	Negative	High	3	1	3	2	2	**18**	**N2**	1	1	1	2	1	**5**	**N1**
					Significance	**N2 - Low**							**N1 - Very Low**						
Impact 3:	Water Resource Management	Modification to the Bed and Banks of the Ephemeral Drainage Line	Construction & Operational	Negative	High	3	1	3	2	2	**18**	**N2**	1	1	1	2	1	**5**	**N1**
					Significance	**N2 - Low**							**N1 - Very Low**						

6. CONCLUSION AND PROFESSIONAL OPINION

Results from the field assessment conducted on the 25th of March 2023 determined that there is a small ephemeral drainage line, emanating to the north of the proposed BESS facility, located between the proposed BESS facility and the proposed laydown area. The ephemeral drainage line likely only flows after substantial stormflows and for short periods of time, considering the sandy soils in the region and the flat terrain. Sparse riparian vegetation included *Stipagrostis* spp., *Rhigozum* spp., and *Euphorbia* spp. Given the limited vegetation cover, sediment is transported from the surrounding catchment into the ephemeral drainage line, and alluvial deposits were observed in the dry streambed.

The habitat integrity of the ephemeral drainage line was assessed using the Kleynhans *et al* (2008) Index of Habitat Integrity assessment methodology. The assessment produced an instream habitat integrity score within category E (seriously modified), and a riparian habitat integrity score within category F (critically modified). Impacts to the drainage line include vegetation removal and flow modification as a result of previous agricultural activities, and the upstream PV facility and associated access roads. The downstream farm road likely results in periodic inundation within the drainage line during stormwater flows, resulting in channel and bed modification, as well as erosion. Additionally, considering the previous agricultural land use, surrounding industrial land uses and dirt tracks through the drainage line, there has likely been physio-chemical modifications to the drainage line.

The potential impacts to the ephemeral drainage line as a result of the proposed activities include the following:

- Potential water quality impairment as a result of vegetation clearing/catchment hardening and resultant increased sedimentation during construction and operational phases; the mishandling of hazardous substances and/or improper maintenance of machinery during construction causing oil and diesel leaks and spills; and accidental leakage or spillage of hydrocarbons and electrolytes associated with the BESS during operation. The potential water quality impairment of the ephemeral drainage line would only occur during rainfall periods, which are limited in this region to approximately five times per year if not less. Additionally, the drainage line itself would only flow after substantial stormflows and for a short period of time. As such, the significance of this potential impact is of "Low" significance prior to mitigation measures, and of "Very Low" significance with the implementation of mitigation measures.
- In addition, there is potential for clearance of vegetation within the delineated ephemeral drainage line and potential impacts to the bed and bank (geomorphology) of the ephemeral drainage line should new access roads be constructed or as a result of unrestricted vehicle movement within the watercourse. Both of these impacts are unlikely given the preferred layout and should the ephemeral drainage line be avoided as far as practically possible during construction and operation of the BESS, these impacts are considered to be of "Very Low" significance.

All three potential impacts were deemed of "Low" Significance prior to the implementation of mitigation measures, and "Very Low" Significance upon implementation of recommended mitigation measures. The impacts described can be effectively mitigated by implementing the following recommendations:

- The ephemeral drainage line should be avoided as far as practically possible during the construction and operation of the facility.
- Vehicles should remain on the existing dirt track with no new access roads/tracks constructed within the delineated drainage line.

- No vegetation should be removed from the ephemeral drainage line.
- The outer areas of the cleared BESS facility and lay-down area, within 100 m of the ephemeral drainage line should make use of sedimentation preventative measures such as the use of silt nets and/or sandbags to prevent sedimentation entering the watercourse via surface water run-off during construction activities.
- During construction activities, cover cleared areas with straw to minimize sedimentation by wind.
- Any soil stockpiles within 100 m of the watercourse should be bunded using an appropriate structure (silt nets, sandbags, etc.).
- Bunded, impervious areas must be designated by an Environmental Control Officer for temporary toilets, vehicle parking/servicing areas and for pouring and mixing of concrete/cement, paint, and chemicals. These bunded areas must be at least 15 m from the delineated drainage line.
- Contain electrolyte storage tanks within an adequately bunded area to prevent the migration of any spillage or leakage to the surrounding environment.

It is the opinion of the specialist that the proposed BESS facility and laydown area, as well as the surrounding DWS regulated area, is of "Low" aquatic sensitivity. Potential impacts as a result of the proposed project were deemed to be of "Very Low" significance should mitigation measures be implemented onsite. As such, there should be no reason from an aquatic ecological perspective, why the proposed Aggeneys BESS project on Portion 1 of the Farm Aroams 57 RD cannot be approved, provided that recommended mitigation measures in this report are implemented.

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- Résumé -

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WORK EXPERIENCE

2022 – Current — Delta Ecology / Private

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RESPONSIBILITIES

- Freshwater Ecological Assessments.
- Water Use License Applications.

2021 — Elemental Sustainability

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RESPONSIBILITIES

- Scoping and Environmental Impact Assessments (S&EIA).
- Basic Assessments.
- Public Participation Process.
- Project Management.
- Water Use License Applications.
- Environmental Management Programmes.
- Freshwater ecological assessments.

2019 - 2021 — Resource Management Services (RMS)

ENVIRONMENTAL CONSULTANT

RESPONSIBILITIES

- Scoping and Environmental Impact Assessments (S&EIA).
- Basic Assessments.
- Public Participation Process.
  Project Management.
- Water Use License Applications.
- Environmental Management Programmes.
- Freshwater ecological assessments.

2016 - 2019 — Iggdrasil Scientific Services

ECOLOGIST

RESPONSIBILITIES

- Specialist aquatic ecological surveys.
- Specialist terrestrial ecological surveys.
- Assist with botanical and diatom surveys.
- Conduct in situ water quality analysis.
- ArcGIS data collection, analysis, and mapping.
- Administrative duties.
- Client acquisition.

INDUSTRY CERTIFICATIONS

MEMBERSHIP AND ASSOCIATIONS

- Professional Scientist (Pr.Sci.Nat) with the South African Council for Natural Scientific Professions (SACNASP).
- South African Society for Aquatic Scientists.
- Department of Water and Sanitation SASS5 practitioners (Freshwater Aquatic Zoology).

ADDITIONAL COURSES COMPLETED

2020
- Tools for Wetland Assessment Short Course

2019
- Snake Awareness, First Aid for Snake Bite & Venomous Snake Handling - African Snakebite Institute.
- Exploring Geographical Information Systems – University of South Africa.

2018
- Advanced Grass Identification - Africa Land-Use Training.

2017
- Wetland course, back to basics - Department of Water and Sanitation.

2016
- MIRAI (Macro invertebrate Response Assessment Index) - Department of Water and Sanitation.
- SASS5 Aquatic Biomonitoring Training Course - GroundTruth Consultants.
- Invasive Species and Herbicide Training - South African Green Industries Council (SAGIC).

EDUCATION

University of Pretoria
Master of Science (Water Resource Management)

2012 - 2014 *Title of Thesis: Application of the SWAT hydrological model in a small, mountainous catchment in South Africa.*

- Achievements: Golden Key International Honour Society
- Core Modules: Water Supply, Water Conservation, Water Quality Management, Environmental Law, Environmental Change, and Geographic Information Systems (GIS).

University of Pretoria

Bachelor of Science Honours (Zoology and Entomology)

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(Act 27 of 2003)
in the following fields(s) of practice (Schedule 1 of the Act)

Zoological Science (Candidate Natural Scientist)
Ecological Science (Professional Natural Scientist)
Zoological Science (Professional Natural Scientist)

Effective **13 September 2017** Expires **31 March 2024**

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ANNEXURE B

The Index of Habitat Integrity (IHI) assessment is a tool used to assess the habitat integrity of a river based on the intensity and extent of anthropogenic disturbances that impact both the instream and riparian habitat. The assessment of habitat integrity is based on an interpretation of the deviation from the reference condition (Kleynhans *et al*., 2008). The disturbances assessed include abiotic factors such as water abstraction, weirs, dams, pollution and the dumping or rubble and biotic factors such as the presence of alien plants and aquatic animals which modify habitat (Kleynhans, 1996). These changes are all related and interpreted in terms of modification of the drivers of the system, namely hydrology, geomorphology, and physico-chemical conditions and how these changes would impact on the natural riverine habitats. The severity of each of these impacts is assessed, using scores as a measure of impact. Descriptions of each criterion are provided to assist with the assessment.

Scoring procedures used to determine the Index of Habitat Integrity

IMPACT CLASS	DESCRIPTION	SCORE
None	No discernible impact or the modification is located in such a way that it has no impact on habitat quality, diversity, size and variability.	0
Small	The modification is limited to very few localities and the impact on habitat quality, diversity, size, and variability is limited.	1 – 5
Moderate	The modification is present at a small number of localities and the impact on habitat quality, diversity, size, and variability are fairly limited.	6 - 10
Large	The modification is generally present with a clearly detrimental impact on habitat quality, diversity, size, and variability. Large areas are, however, not affected.	11 -15
Serious	The modification is frequently present and the habitat quality, diversity, size and variability in almost the whole of the defined area affected. Only small areas are not influenced.	16 – 20
Critical	The modification is present overall with a high intensity. The habitat quality, diversity, size and variability in almost the whole of the defined section are influenced detrimentally.	21 – 25

Descriptions of criteria used in the IHI assessments

CRITERION	DESCRIPTION (KLEYNHANS, 1996)
Water abstraction	Direct abstraction from within the specified river/river reach as well as upstream (including tributaries) must be considered (excludes indirect abstraction by for example exotic vegetation). The presence of any of the following can be used as an indication of abstraction: cultivated lands, water pumps, canals, pipelines, cities, towns, settlements, mines, impoundments, weirs, industries. Water abstraction has a direct impact on habitat type, abundance, and size; is implicated in flow, bed, channel and water quality characteristics; and riparian vegetation may be influenced by a decrease in water quantity.
Extent of inundation	Destruction of instream habitat (e.g. riffle, rapid) and riparian zone habitat through submerging with water by, for example, construction of an in-channel impoundment such as a dam or weir. Leads to a reduction in habitat available to aquatic fauna and may obstruct movement of aquatic fauna; influences water quality and sediment transport.

CRITERION	DESCRIPTION (KLEYNHANS, 1996)
Water quality	The following aspects should be considered: untreated sewage, urban and industrial runoff, agricultural runoff, mining effluent, effects of impoundments. Ranking may be based on direct measurements or indirectly via observation of agricultural activities, human settlements, and industrial activities in the area. Water quality is aggravated by a decrease in the volume of water during low or no flow conditions.
Flow modification	This relates to the consequence of abstraction or regulation by impoundments. Changes in temporal and spatial characteristics of flow such as an increase in duration of low flow season can have an impact on habitat attributes, resulting in low availability of certain habitat types or water at the start of the breeding, flowering, or growing season.
Bed modification	This is regarded as the result of increased input of sediment from the catchment or a decrease in the ability of the river to transport sediment. The effect is a reduction in the quality of habitat for biota. Indirect indications of sedimentation are stream bank and catchment erosion. Purposeful alteration of the stream bed, e.g. the removal of rapids for navigation is also included. Extensive algal growth is also considered to be bed modification.
Channel modification	This may be the result of a change in flow which alters channel characteristics causing a change in instream and riparian habitat. Purposeful channel modification to improve drainage is also included.
Presence of exotic aquatic fauna	The disturbance of the stream bottom during exotic fish feeding may influence, for example, the water quality and lead to increased turbidity. This leads to a change in habitat quality.
Presence of exotic macrophytes	Exotic macrophytes may alter habitat by obstruction of flow and may influence water quality. Consider the extent of infestation over instream area by exotic macrophytes, the species involved and its invasive abilities.
Solid Waste disposal	The amount and type of waste present in and on the banks of a river (e.g. litter, building rubble) is an obvious indicator of external influences on stream and a general indication of the misuse and mismanagement of the river.
Decrease of indigenous vegetation from the riparian zone	This refers to physical removal of indigenous vegetation for farming, firewood, and overgrazing. Impairment of the riparian buffer zone may lead to movement of sediment and other catchment runoff products (e.g. nutrients) into the river.
Exotic vegetation encroachment	This excludes natural vegetation due to vigorous growth, causing bank instability and decreasing the buffering function of the riparian zone. Encroachment of exotic vegetation leads to changes in the quality and proportion of natural allochthonous organic matter input and diversity of the riparian zone habitat is reduced.
Bank erosion	A decrease in bank stability will cause sedimentation and possible collapse of the riverbank resulting in a loss or modification of both instream and riparian habitats. Increased erosion can be the result of natural vegetation removal, overgrazing or encroachment of exotic vegetation.

The score that has been allocated to an impact is then moderated by a weighting system, devised by Kleynhans (1996). Assignment of weights is based on the perceived relative threat of the impact to the habitat integrity of a riverine ecosystem. The total score for each impact is equal to the assigned score multiplied by the weight of that impact.

Weights assigned to each criterion

INSTREAM CRITERION	WGT	RIPARIAN ZONE CRITERION	WGT
Water abstraction	14	Water abstraction	13

Extent of inundation	10	Extent of inundation	11
Water quality	14	Water quality	13
Flow modification	7	Flow modification	7
Bed modification	13	Channel modification	12
Channel modification	13	Decrease of indigenous vegetation from the riparian zone	13
Presence of exotic macrophytes	9	Exotic vegetation encroachment	12
Presence of exotic fauna	8	Bank erosion	14
Solid waste disposal	6		

Based on the relative weights of the criteria, the impacts of each criterion are estimated as follows:

Rating for the criterion /maximum value (25) x the weight (percent).

The estimated impacts of all criteria calculated in this way are summed, expressed as a percentage, and subtracted from 100 to arrive at a present status score for the instream and riparian components, respectively. The Index of Habitat Integrity scores (%) for the instream and riparian zone components are then used to place these two components into a specific class. The assessment method in determining the severity of modifications to habitat integrity is a largely field-based site assessment, supplemented with information from aerial photographs (google earth images).

IHI classes and their description

CLASS	DESCRIPTION	SCORE (%)
A	Unmodified, natural.	90 – 100
B	Largely natural with few modifications. A small change in natural habitats and biota may have taken place, but the assumption is that ecosystem functioning is essentially unchanged.	80 - 89
C	Moderately modified. A loss or change in natural habitat and biota has occurred, but basic ecosystem functioning appears predominately unchanged.	60 – 79
D	Largely modified. A loss of natural habitat and biota and a reduction in basic ecosystem functioning is assumed to have occurred.	40 – 59
E	Seriously modified. The loss of natural habitat, biota and ecosystem functioning is extensive.	20 – 39
F	Modifications have reached a critical level and there has been an almost complete loss of natural habitat and biota. In the worst cases, the basic ecosystem functioning has been destroyed.	0 - 19