Freshwater Screening of the proposed Hermanus Cliff Path Extension, Hermanus, Western Cape

Prepared for:

Ecosense Pty (Ltd)

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Date: 10/11/21

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SPECIALIST DETAILS AND EXPERIENCE

Joshua Gericke (Pr.Sci.Nat. 117997)

Joshua holds a Bachelor of Science Honours degree in Environmental Management from the University of Cape Town and graduated in 2008. He has completed several short courses in freshwater, estuarine and coastal resource management and in identification of freshwater and marine fish, birds and plants. He has more than 8 years of experience in management of freshwater, estuarine and coastal systems with the City of Cape Town. He has also consulted periodically on topics related to freshwater, estuarine and coastal ecology and management since 2010, and in 2017 began consulting full time.

Nick Steytler (Pr.Sci.Nat. 400029)

Nick Steytler is a registered Professional Natural Scientist (Pr.Sci.Nat) with the South African Council for Natural Scientific Professions (SACNASP) and is also a certified Environmental Assessment Practitioner (EAP) with over 20 years' experience in the field of environmental management. He holds a Masters of Science (MSc.) degree in the field of Entomology (University of KwaZulu-Natal, Pietermaritzburg campus). His employment record includes several years with the Institute of Natural Resources in KwaZulu-Natal where he worked within their Natural Resource Management Programme and with SRK Consulting in Cape Town where he worked as an Environmental Scientist in the field of environmental management (i.e. undertaking Environmental Impact Assessment [EIA] and the like). After leaving SRK, Nick founded KHULA Environmental Consultants and holds the position of Director. In developing his expertise as a freshwater specialist he initially worked in the capacity of an associate to EnviroSwift Western Cape (WC) but has since taken over the company and now undertakes all wetland specialist work in the Western, Southern, Eastern and Northern Cape.

Natasha van de Haar (Pr.Sci.Nat. 400229)

Natasha is a registered Professional Natural Scientist (Pr.Sci.Nat) with the South African Council for Natural Scientific Professions (SACNASP). She also holds a Masters Degree in Science (M.Sc.) inthe field of Botany. Over the course of Natasha's career, she completed a number of floral identification short courses and also obtained a certificate of competence for wetland assessments from Rhodes University. She is also a member of the South African Wetland Society, Botanical Society of SA as well as the Western Cape Wetlands Forum.

Her career kicked off as a field ecologist in 2009, focusing on floral biodiversity and ecological functioning, with special mention of wetland ecology and functioning within South Africa (all provinces). She further worked as a specialist project member in Mauritius, Lesotho and Ghana. During the course of her career she obtained extensive experience in conducting terrestrial as well as wetland related surveys in the mining, residential and infrastructure development industries as well as development of several alternative energy facilities. Natasha also gained experience in Biodiversity Offset Initiatives as well as RDL/protected plant permit applications. Presently her main focus is wetland assessments including delineation as well as present ecological state and function assessments.

Disclaimer

Nick Steytler Sole Proprietor (T/A EnviroSwift Western Cape) as exercised all due care in the reviewing of all available information. EnviroSwift Western Cape does not accept responsibility for any errors or omissions in the assessment and therefore does not accept any consequential liability arising from commercial decisions made, which are based on the information contained in this report. Opinions presented in this report apply to conditions/site conditions applicable at time of review and those conditions which are reasonably foreseeable.

SPECIALIST DECLARATION

I, Nick Steytler, as the appointed independent specialist, in terms of the 2014 NEMA EIA Regulations (as amended), hereby declare that:

I act as the independent specialist in this application;

I 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 regard the information contained in this report as it relates to my specialist input/study to be true and correct, and do not have and will not have any financial interest in the undertaking of the activity, other than remuneration for work performed in terms of the NEMA, the Environmental Impact Assessment Regulations, 2014 (as amended) and any other specific environmental management Act;

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 have no vested interest in the proposed activity proceeding;

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;

I have ensured that information containing all relevant facts in respect of the specialist input/study was distributed or made available to interested and affected parties and the public and that participation by interested and affected parties was facilitated in such a manner that all interested and affected parties were provided with a reasonable opportunity to participate and to provide comments on the specialist input/study;

I have ensured that the comments of all interested and affected parties on the specialist input/study were considered, recorded and submitted to the competent authority in respect of the application;

All the particulars furnished by me in this specialist input/study are true and correct; and
I realise that a false declaration is an offence in terms of regulation 48 and is punishable in terms of section 24F of the Act.

Signature of the specialist:

Name of Specialist: Nick Steytler

Date: 10.11.2021

Table of Contents

1 Introduction

EnviroSwift Western Cape has been appointed by Ecosense CC to undertake a freshwater screening assessment of a proposed extension of the Hermanus cliff path (the proposed path) in Hermanus, Western Cape. The existing cliff path extends for 12km from the New Harbour in the west to Piet Se Bos in the east, but abruptly ends near Protea Road and starts again just beyond Golf Road, creating a gap of approximately 850m in the middle of the cliff path. The proposal therefore entails the construction of a footpath below the highwater mark from the existing Cliff Path lookout bench below Sea Road on the western side to the historical steps at Mickey by the Eastern Section of the existing Cliff Path, and roughly parallel to Main Road, thereby completing the cliff path. Refer to Figure 1 for location.

The proposed path would conform to the appearance of the existing path and would be constructed primarily from concrete. Refer to Figure 2. The alignment would be situated below the highwater mark as it cannot encroach onto any private property all of which extend down to the highwater mark. For the purposes of the assessment a corridor of approximately 3,5m wide within which the footpath (approximately 1,2m wide) will be constructed has been investigated. This entire corridor was screened as part of this assessment and will be referred to as the proposed site within this report.

Figure 1: The approximate route of the proposed path (in orange) in relation to the surroundings, with the existing cliff path visible in white on either end. The proposed pathway would fall below the highwater mark and therefore outside of the adjacent properties.

Figure 2: A portion of the Hermanus Cliff Path near the proposed site (Cape Town Daily Photo, 2013).

2 Limitations & Assumptions

The following limitations apply to the freshwater screening:

- The site was visited on two occasions, initially on 31th of March 2019 and the again on 23 September 2021. This means that the site was visited during both the dry and the wet seasons so hydrology could be confirmed.
- Maps from online sources included previously are still relevant and it was not required to update them.
- Freshwater features have been delineated using a Garmin Etrex 20 with an expected accuracy of within 3m. It is however the opinion of the specialist that this limitation is of no material significance and that the freshwater constraints have been adequately identified.
- This study is limited to the upper 50cm of soil in accordance with the Updated Manual for Identification and Delineation of Wetland and Riparian Areas (Department of Water Affairs and Forestry - DWAF, 2008) and the Application of the DWAF (2008) Method to Wetland Soils of Western Cape (Job *et. al.* 2009).
- This study clarifies freshwater constraints only. Identification of other environmental constraints are outside of the scope of this appointment.
- The proposed site is in the opinion of the specialist a difficult site to assess due to its coastal setting in which freshwater and coastal processes interact. However, wetlands which require the presence of hydromorphic soils and hydrophytic vegetation, do not occur below the splash zone because a) soil is absent because all fines between rock material are eroded away by wave action and b) without soil hydrophytic vegetation will not survive.

3 Scope of Works

The scope of work for this freshwater screening included the following:

1) Background information gathering as defined by provincial and national databases.
2) Identification and onsite delineation of any freshwater feature boundaries according to the method supplied by the DWAF (2005 updated in 2008).
3) Presentation of delineated freshwater features on maps - also provided as shape files.
4) Providing input into the layout / design of the proposed pathway so as to minimise freshwater impacts.
5) Providing guidance on the authorisations required for the proposed construction and operation of the path in terms of freshwater constraints.

4 Background Information

4.1 Legislation

4.1.1 The National Water Act (NWA)

The NWA of 1998 defines are regulated zone around all watercourses within which the risks to the watercourse must be assessed. The regulated zone for a wetland is defined as all land within 500m of its outer boundary. For a river or drainage line, it is defined as all land within the 1:100-year flood line. The following is applicable for any development within the regulated zone.

- Should a freshwater ecologist consider the proposed development to be of no risk to the applicable watercourse a letter may be provided to this effect. This is usually only applicable if the development is sufficiently far downslope of a wetland or is within a separate catchment to the wetland and is therefore entirely hydrologically and physically decoupled from the wetland.
- In all other cases, a risk assessment in terms of GN 509 of 2016 must be undertaken to determine the degree of risk posed to the watercourse by the development.
- Should the development pose a low risk, registration of the water use under the General Authorisation (GA) would be required.
- Should the development pose a medium risk, application for a Water Use License (WUL) would be required.
- High risk developments also require a WUL but are not readily approved.

The Department of Water and Sanitation (DWS) applies a “no net loss” policy to wetlands. Therefore, should the proposed development result in permanent or long-term loss of any wetland habitat or function, the loss must be compensated by means of an offset scheme in order to secure a water use licence. Significant loss of riparian habitat may also require compensation by means of an offset in order for the application to be successful.

An offset scheme may entail rehabilitation and management of another portion of wetland or riparian habitat within the applicable property, or if this is not feasible or adequate, it may entail purchase, rehabilitation and management (in perpetuity) of another wetland or riparian property. Rehabilitation, purchase of an additional property (if necessary) and management of the offset may be costly processes.

4.1.2 The National Environmental Management Act (NEMA)

In terms of the National Environmental Management Act (NEMA, 1998), development of any infrastructure exceeding 100m^2 or any activity that involves excavating or depositing 10m^2 or more of any material within 32m of a watercourse if outside of the urban edge, or otherwise within a watercourse requires, application for an Environmental Authorisation (EA) via the Basic Assessment (BA) process.

4.2 Ecological Setting

The proposed site is situated within the Southern Coastal Belt Ecoregion, the main features of which are summarised in Table 1. Local climatic, topographic and soil conditions for the proposed site are presented in Table 2, which is adapted from the Cape Farm Mapper website (https://gis.elsenburg.com/apps/cfm/).

The study area is furthermore within the Breede Water Management Area (WMA), the Overberg West Sub-WMA and just outside the G40H quaternary catchment, within the adjacent coastal zone.

Table 1: Overview of the Southern Coastal Belt Ecoregion (adapted from DWA, 2005).

Ecoregion Attributes	Southern Coastal Belt
Geology	Limestone, sandstone, conglomerate, quartzitic sandstone, minor shale, unconsolidated dune sand
Vegetation	South and South West Coast Renosterveld; Central Mountain Renosterveld; Limestone fynbos; Mountain Fynbos; Laterite Fynbos (limited); Dune Thicket; Patches of Afromontane Forest
Landscape	Closed hills, mountains with moderate to high relief, occasional plains
Mean altitude	0-700; 700-1500 (limited)
Rainfall seasonality	Winter to all year

Table 2: Local climate, topography and soil conditions (adapted from Cape Farm Mapper, 2019).

Parameters	Local Conditions
Mean annual precipitation (mm)	610 mm
Mean annual runoff (mm/annum)	113.6 mm
Mean annual temperature (°C)	16.5°C
Elevation (m above mean sea level)	0 m
Slope classification (%)	3-10%
Soil and Geology	Alluvium and aeolian sand on granite of the Hermanus Pluton, Cape Granite Suite in the north and aeolianite of the Waenhuiskrans Formation, Bredasdorp Group, in the south. The sands are grey, regic and excessively drained.
Soil depth (mm)	>= 750 mm
Soil clay content (%)	< 15%

According the National Vegetation Map of South Africa by Mucina and Rutherford (2006, updated 2012), the site falls within the Overberg Sandstone Fynbos (Refer to Figure 3) vegetation type listed as Critically Endangered (CR) by the National List of Threatened Terrestrial Ecosystems (2011). Wetlands associated with the proposed site fall within the Southwest Sandstone Fynbos wetland vegetation group (also CR) as defined by the National Freshwater Ecosystem Priority Areas database (NFEPA, 2011 - Figure 4).

The vegetation type is associated with grey, regic, excessively drained aeolian sand, underlain by aeolianite (sandstone) which is largely impermeable to water (refer to Figure 5). In the experience of the specialist, hillslope seep wetlands are very common along the rocky coastal parts of the Overberg as water that drains through the coarse mineral sands flows along the bedrock layer below and emerges where the sandy soil shallows and bedrock emerges to form the rocky coastline.

The proposed site falls near the highwater mark along a stretch of coastline that is largely rocky with several areas best described as cliffs. There is also a single bay where the substrate consists largely of pebbles and terrain is gentler. Cape Farm Mapper indicates a slope of between 3 and 10% (refer to Figure 6), but the scale at which terrain is mapped in this case cannot account for the small scale

changes in terrain common along rocky shorelines, which may vary from stretches of flat bedrock, cobbles or pebbles, to boulders and vertical cliffs.

Figure 3: The local terrestrial vegetation type according to the National Vegetation Map (Mucina and Rutherford, 2006; updated 2012) is Overberg Sandstone Fynbos.

Figure 4: The applicable wetland vegetation type according to NFEPA (2011) for any wetlands found within the proposed site is Southwest Sandstone Fynbos.

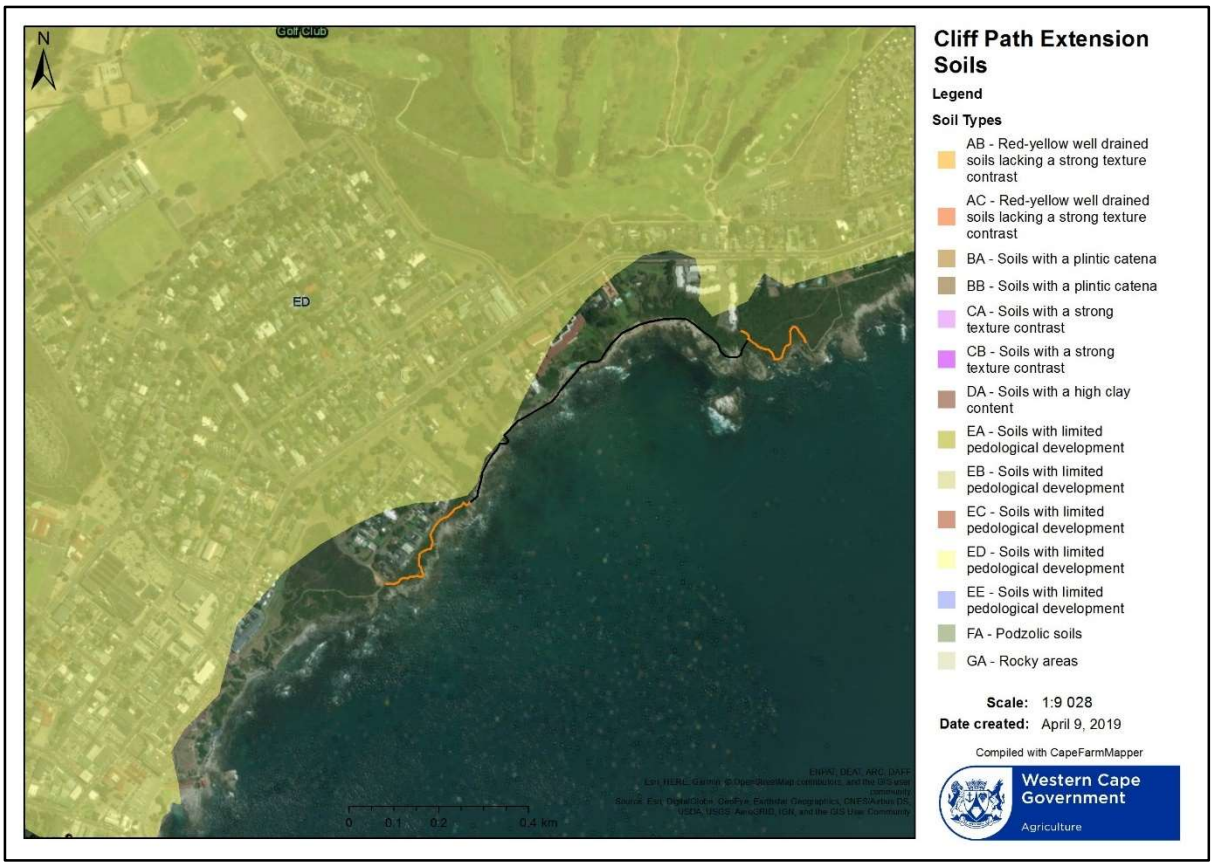

Figure 5: Soil characteristics, according to Cape Farm Mapper, 2019.

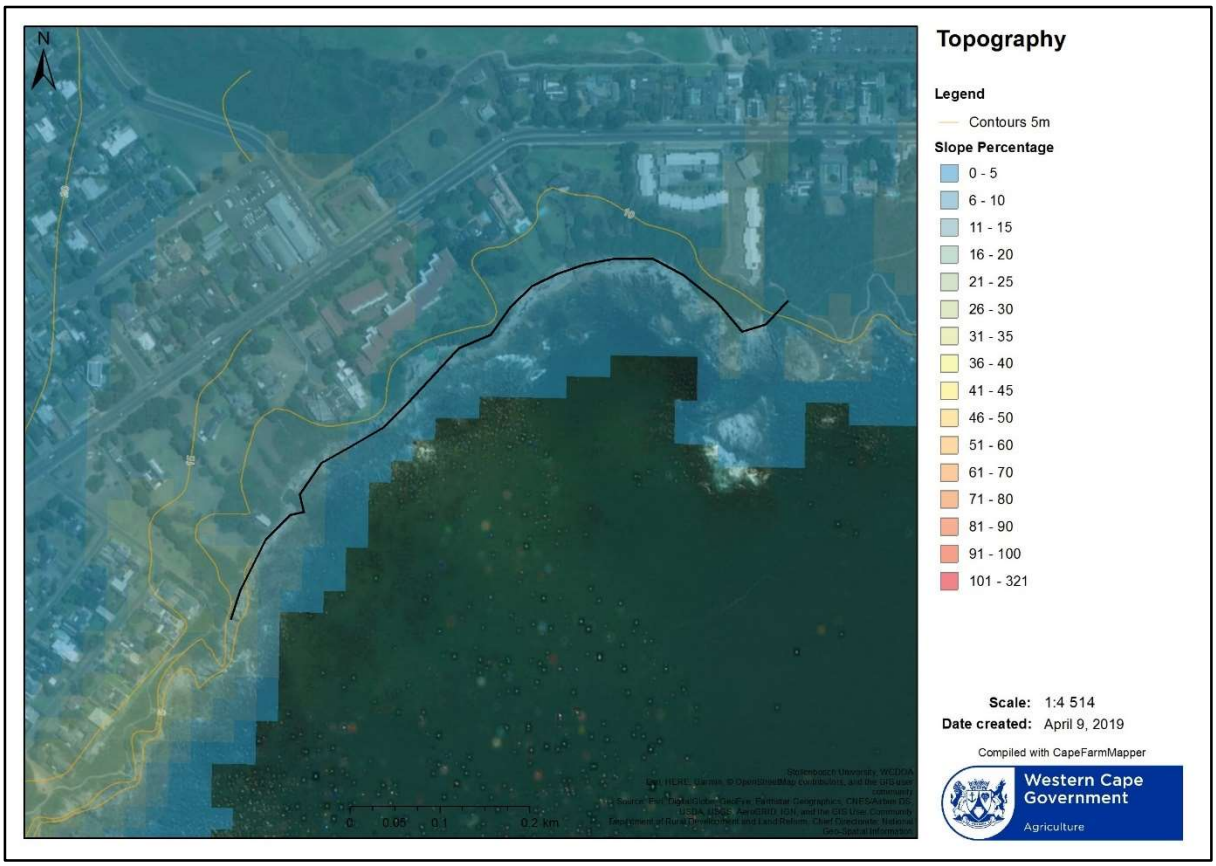

Figure 6: Five-meter contour intervals and slope of the proposed site (Cape Farm Mapper, 2019).

4.3 Watercourses Within 500m

GN509 of 2016 promulgated in terms of the NWA (1998) defines a regulated area of 500m around wetlands, within which risks to wetlands posed by any development must be considered. It also requires that risks to rivers, streams and drainage lines are considered for any development within a regulated area defined by the 1:100- year floodline or 100m, whichever is greater. No rivers, streams or drainage lines were indicated by desktop resources in this case.

NFEPA (2011) indicates two large wetland systems to the north of the proposed site (refer to Figure 7). The two wetlands are also at a higher elevation, over 100m away from the proposed site and separated by a suburban area. It is therefore the opinion of the specialist that there is therefore no risk to these two wetlands from the proposed development.

The WCBSP (2017) indicates a single freshwater feature falling just within the proposed site and classed partially as an aquatic Ecological Support Area (ESA) class 1, and also as an aquatic ESA class 2. ESA's are areas that are required to support the functioning of Critical Biodiversity Areas which are essential in averting loss of biodiversity. ESA class 1 is in good ecological condition, while an ESA class 2 requires rehabilitation..

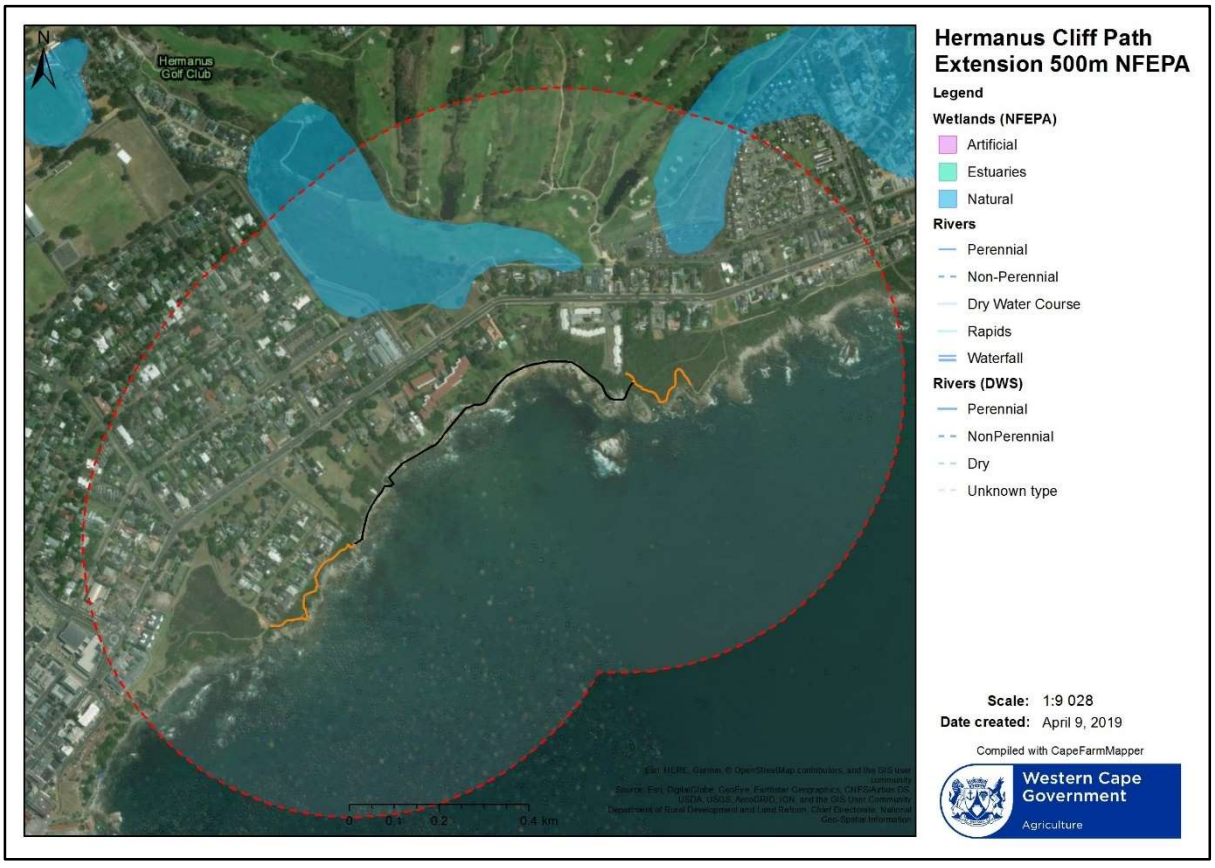

Figure 7: Wetlands 500m of the proposed site as indicated by the NFEPA (2011) wetlands layer. The 500m boundary is indicated by a red dashed line.

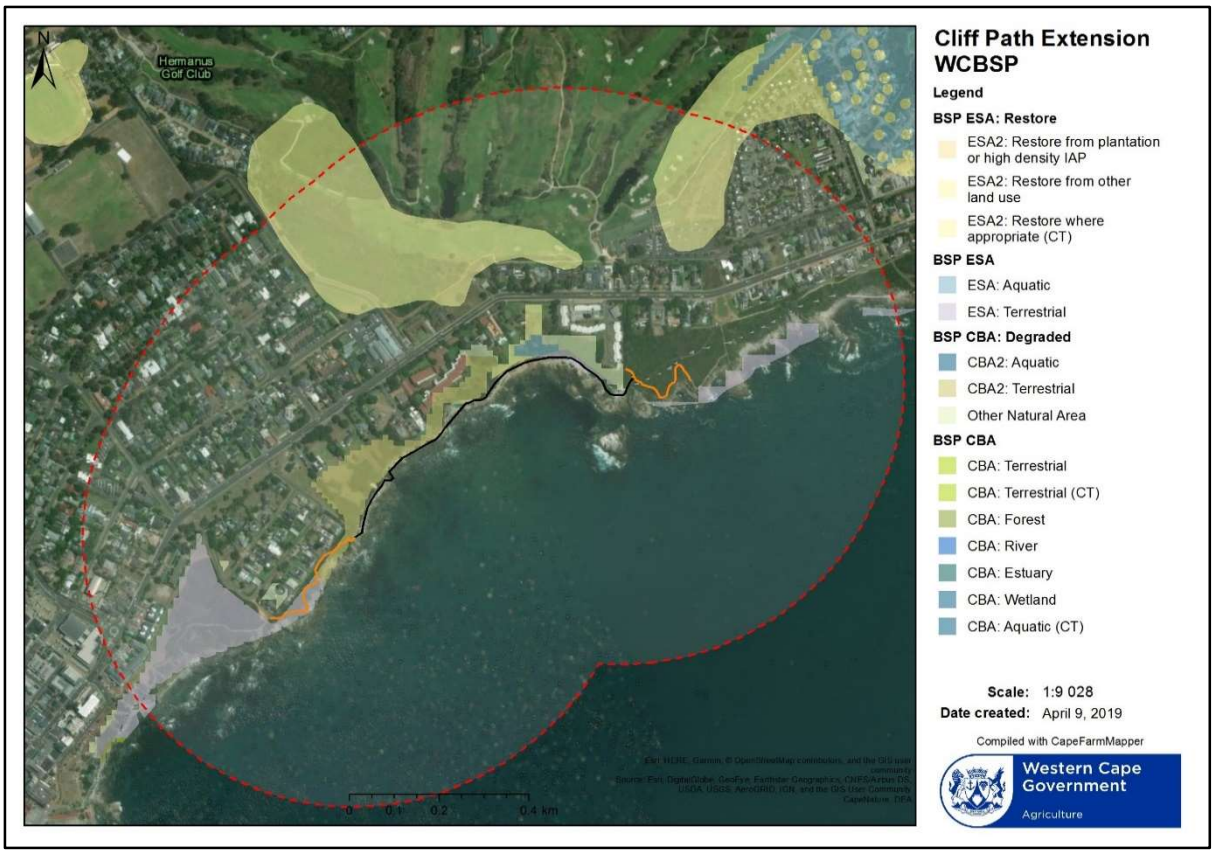

Figure 8: Areas of biodiversity importance indicated by the WCBSP within 500m of the proposed site. The 500m boundary is indicated by a red dashed line.

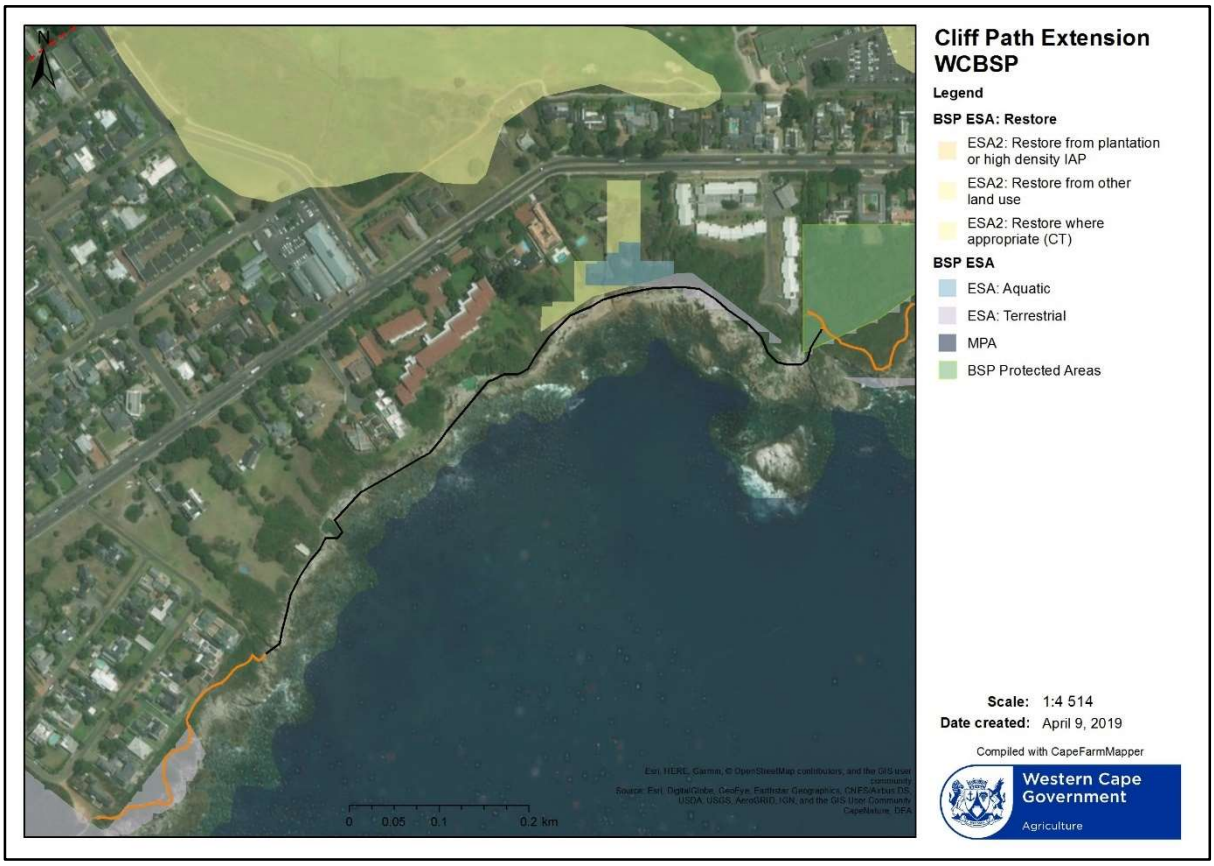

Figure 9: A closer view of the aquatic ESA feature.

5 Site Assessment

5.1 Method of Assessment

A site assessment was undertaken on the 31th of March 2019 with a follow up site visit on 23 September 2021. The methods defined in the Updated Manual for Identification and Delineation of Wetlands and Riparian Zones (DWAF, 2008) and the Application of the DWAF (2008) Method to Wetland Soils of Western Cape (Job, *et. al*., 2009) were applied in order to identify and delineate watercourses, as defined by the NWA, within the proposed site.

The methods employed make use of hydrophytic vegetation and hydromorphic soil features to determine the presence and boundaries of wetlands. Hydrophytic vegetation includes plant species that are adapted to saturated soil conditions. These may be wetland obligate species that can only survive under prolonged soil saturation, or wetland facultative species that are often found within saturated soil but may also be found outside of wetland conditions.

Hydromorphic soil features form in soils that are saturated for long periods of time. Mottling and gleying are the two most common hydromorphic features. Mottling occurs when iron leaches out of the soil when wet and clumps together, and then oxidises to form iron oxide when exposed to air. The clumps may be recognised as spots or mottles within the soil of a rusty orange colour. Mottling density increases from the temporary zone to the centre of the seasonal zone, and then decreases again and is completely absent from the permanent zone. Gleying occurs under anoxic conditions and may be recognised as a change in colour from a terrestrial soil baseline toward a grey, blueish or greenish hue. Gleying tends to increase from the wetland temporary zone towards the permanent zone.

5.2 Results

The proposed site consists largely of bedrock and boulders with a single stretch of pebbled beach, with limited cobbles present. Soil and plant life within the proposed site were scarce and limited to isolated pockets. Two small wetlands were however identified and delineated within the proposed site. The wetlands were dominated by hydrophytic vegetation. Hand augering was conducted and wetland soil indicators were noted at both wetlands. The wetland delineations are presented in Figures 10 below. Descriptions of the two wetlands follow in 5.2.1 and 5.2.2.

Also included in the map below is the location / discharge point of an extremely old collapsed concrete pipe that carries water of unknown origins into the ocean. The water currently spills out onto a small rocky beach but cannot be considered a watercourse as it is entirely of unnatural origin and would not flow over the beach if the pipe were fixed.

Figure 10: Location of the two delineated wetlands, stream and the broken pipe in relation to the high-water mark (shown as a light blue line).

5.2.1 Wetland 1

Wetland 1 is fed by the wetlands situated within the Hermanus Golf Course and included a small clearly defined stream of approximately 1.8m in width. The banks of the stream exhibited extensive wetland vegetation and soil indicators on both sides (refer to Figures 13 and 14) and the watercourse was therefore classified as a channelled valley bottom wetland.

Vegetation on the banks was dominated by the indigenous sedge *Cyperus textilis* and the alien grass *Pennisetum clandestinum* with alien *Nasturtium officinale* dominating the stream channel. Upstream, where the wetland is within private erven, it has been extensively landscaped. It is likely that seawater enters the lower portion of the wetland channel during exceptional spring high tides or during a storm, but the presence of aquatic plants with a relatively low salinity tolerance (such as *Nasturtium officinale)* indicates that such events are rare and that freshwater predominates.

The soil throughout Wetland 1 was found to have a high organic content and exhibited orange mottling and iron oxide deposits along root channels, indicative of the wetland seasonal and temporary zone, except within the channel which forms the permanent zone. At the pebbled beach, the channel ends and the wetland simply flows over and through the pebbles and cobbles, next to a historical concrete pipe casing. In this area, it is no longer classified as a wetland. Refer to Figure 15.

Figure 11: A photograph of Wetland 1 taken from the pebbled beach, facing upstream. The channel (choked with *Nasturtium officianale*), is visible, with the *Pennisetum clandestinum* in the foreground and the *Cyperus textillis* in the background.

Figure 12: An example of a mottle found within the upper 50cm of the soil at Wetland 1.

Figure 13: The outflow of the wetland over and through the pebbles and cobbles.

5.2.2 Wetland 2

Wetland 2, in contrast with Wetland 1, is not associated with a drainage line, but rather with a hillslope and was classified as a hillslope seep. The wetland was dominated by *Ficinia nodosa* with *Orphium frutescen*s and *Xanthedescia aethiopica* also present. The soil was noticeably sandier and mottling was sparse (indicative of temporary wetland conditions), but the soil was moist and balled easily. Refer to Figures 16 and 17.

The fenced property upslope of the portion of wetland within the proposed site also exhibited extensive wetland vegetation on both the low ground and high ground, despite the recent construction of a central drainage channel and the presence of a historical drainage pipe that both empty into the wetland within the proposed site. The wetland is however significantly larger than the area directly augmented by drainage from the fenced property upslope and it is evident that much of the water within the fenced property upslope still percolates through the sandy soils into the wetland below as per the natural wetland hydrological regime.

The wetland extends over the highwater mark where the terrain changes to the rocky shore. No vegetation exists below the splash zone as this area is subject to wave action which has eroded all soil away leaving rocks of various sizes. It is evident that once the water that flows through the hillslope seep reaches the rocky shore, it flows through fissures and holes in the rock and then into the sea.

Figure 14: An overview of Wetland 2, a hillslope seep.

Figure 15: Soil from Wetland 2 with a dark orange mottle circled in orange.

6 Conclusion

A screening assessment of the proposed site was conducted in accordance with the DWAF (2008) method. Two wetlands were identified within the proposed site and delineated. Wetland 1 was classified as a channelled valley bottom wetland (which becomes a stream when it reaches the beach), while Wetland 2 was classified as a hillslope seep.

In terms of the NEMA EIA Regulations (2014, as amended), a Basic Assessment is only required in terms of freshwater constraints if, in urban areas, construction excavation and/or infilling of 10m^3 or more of sediment or any other substance is required within either wetland/watercourse. Given that the proposed footpath will be aligned below the high-water mark there is a possibility of the footpath traversing both delineated wetlands as Figure 10 shows that the wetlands extend below the high-water mark. Provided that no infilling or excavations take place within the delineated wetland area (e.g. through traversing the wetlands with a boardwalk) then the relevant activity in the NEMA EIA Regulations (2014, as amended) would not be triggered.

Construction within 500m of either wetland (unavoidable in this case) would require authorisation in terms of the NWA. Seeing as both wetlands extend below the high-water mark the proposed footpath would need to cross the delineated wetland areas. If the wetland areas can be traversed in such a way to ensure that there would be no wetland loss (e.g. using a boardwalk without any excavation into the wetland area) then there is a possibility that the proposed development would have a LOW Risk Rating (based on the DWS risk matrix) and would therefore qualify for a General Authorisation. If the risks are determined to be greater than LOW then a WULA would be required. Further to ensuring that the boardwalk spans the entire wetland area would be the requirement to ensure that the wetland vegetation is not excessively shaded thereby causing die-back. It is accordingly recommended that the boardwalk is permeable (e.g. is constructed with gaps between the planks) so that direct sunlight can pass through. The base of the boardwalk must also be raised sufficiently to allow the wetland vegetation sufficient space to grow. A height above ground level of approximately 600mm would be sufficient in this regard.

In terms of construction method, it is understood that temporary access for workers and construction materials (transported via wheel-barrow only) would be required. It is considered essential that no temporary structures are located within the wetland areas (i.e. that the construction access route is aligned across the beach or over the rocks seaward of both wetland areas) to ensure that wetland vegetation is not trampled or damaged in any way. In addition, a barrier must be erected that prevents workman access and spills of construction materials into the wetland area.

If it is deemed necessary to construct a bridge over the stream which flows over the rocky beach seawards of Wetland 1 (see Figure 10) then it is essential that the bridge does not interrupt the current flow over and through the pebbles. Any damming-up of the stream could result in inundation of the upstream wetland which would comprise a significant risk and therefore must be avoided. It is noted that bridges are susceptible to wave damage during storms therefore an acceptable alternative would be to construct a concrete causeway directly through the pebbled area with concrete pipes inlayed such that the pathway allows uninterrupted flow from the wetland towards the sea.

If the recommendations provided above can be implemented (e.g. via the implementation of a Construction phase Environmental Management Plan), several potentially significant risks on the wetlands would be satisfactorily minimised thereby allowing the proposed development to qualify for a GA rather than a WULA which has more onerous procedural requirements.

7 References

Cape Farm Mapper, 2018, 2021. https://gis.elsenburg.com/apps/cfm/.

Cape Town Daily Photo. 2013. <https://www.capetowndailyphoto.com/blog/2013/07/cliff-path-pathway/> {Accessed 09.04.2019}.

Department of Water Affairs and Forestry. 2008. Updated Manual for the Identification and Delineation of Wetlands and Riparian Areas, prepared by M. Rountree, A. L. Batchelor, J. MacKenzie and D. Hoare. Stream Flow Reduction Activities, Department of Water Affairs and Forestry, Pretoria, South Africa.

Job, N. 2009. Application of the Department of Water Affairs and Forestry (DWAF) Wetland Delineation Method to Wetland Soils of the Western Cape. Water Research Commission, Cape Town, RSA.

Macfarlane, D., Holness, S.D., von Hase, A., Brownlie, S. & Dini, J., 2014. Wetland offsets: a best-practice guideline for South Africa. South African National Biodiversity Institute and the Department of Water Affairs. Pretoria

Mucina, L. and Rutherford, M.C. (EDS.). 2006. The vegetation of South Africa, Lesotho and Swaziland. Strelitizia 19. South African National Biodiversity Institute, Pretoria, South Africa.

NFEPA, 2011. National Freshwater Ecosystem Priority Areas project. Water Research Commission, 2011.

The South African National Biodiversity Institute - Biodiversity GIS (BGIS) [online]. URL: http://bgis.sanbi.org.

WCBSP, 2017. Western Cape Biodiversity Spatial Plan. Department of Environmental Affairs and Development Planning, 2017.