Aquatic Biodiversity Impact Assessment

Proposed Expansion of Vineyards on the RE of Farm 585, Hemel and Aarde Valley, Western Cape

For: Lornay Environmental Consulting

December 2024

Report Information

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Executive Summary

The owner of the Remainder (RE) of Farm 585 (Mountain Rose Farm), located in the Hemel en Aarde Valley, Hermanus, is proposing the establishment of a vineyard. Currently three alternatives for the project are being considered including:

- Alternative 1, which is the No-Go scenario whereby no vineyards are established;
- Alternative 2 includes the proposed establishment of an approximate 19 Hectare (ha) vineyard area, split into two separate areas; and
- Alternative 3 includes the proposed establishment of an approximate 19 Hectare (ha) vineyard area, split into three separate areas.

The focus of this assessment was the extent of RE Farm 585 encompassing both Alternative 2 and 3, further referred to as the "proposed agricultural area". The eastern portion of RE of Farm 585 is located upstream of the proposed agricultural activities and was therefore excluded from this assessment.

According to the national Department of Forestry, Fisheries and the Environment (DFFE) web-based environmental screening tool report generated for the proposed agricultural area, the Combined Aquatic Biodiversity Theme Sensitivity is classified as "Very High" (DFFE, 2024). Delta Ecology was appointed by Lornay Environmental Consulting to clarify aquatic biodiversity constraints on the property.

Following the aquatic biodiversity screening assessment on the 9th of September 2024, a mapped National Wetland Map Version 5 (NWM5) (SANBI, 2018) Valley-Bottom (VB) wetland associated with the Antjies River was confirmed along the southern boundary of the proposed agricultural area (**Figure i**). Additionally, a seep wetland, two small non-perennial streams, and small farm dam (located within the seep wetland) were also confirmed within / within proximity of the proposed agricultural area (**Figure i**).

Given the confirmed presence of watercourses which are likely to be impacted by the development of either Alternative 2 or Alternative 3, the proposed agricultural area was determined to be of "Very High" aquatic sensitivity.

If the specialist determines that the Aquatic Biodiversity sensitivity is "Very High", the GN320 of 2020 requires that a full aquatic biodiversity impact assessment must be submitted as set out by the National Environmental Management Act (NEMA) (Act No. 107 of 1998) Regulations of 2020 (as amended) (GN R. 320 of 2020).

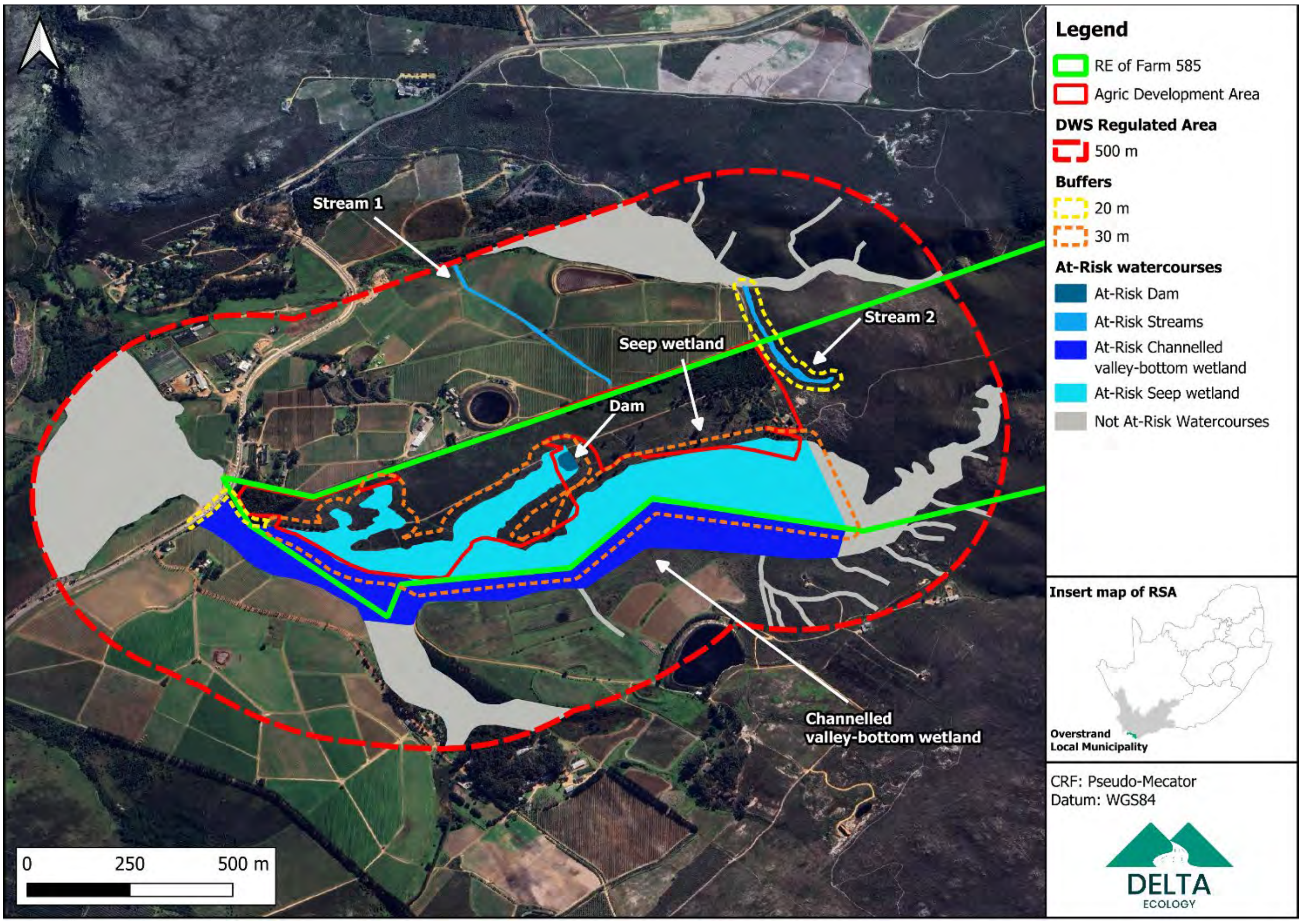

Figure i: At-risk watercourses including a CVB wetland, seep wetland, and two non-perennial streams.

In this impact assessment, the delineated at-risk watercourses (**Figure i**) were assessed using current best practice assessment methodologies to determine the Present Ecological State (PES), Index of Habitat Integrity (IHI), Ecological Importance and Sensitivity (EIS), the contribution to Wetland Ecosystem Services (WES), and Recommended Ecological Category (REC) metrics. The results of these assessments are as follows:

Table i: Results of the watercourse status quo assessment.

	PES	EIS	WES (Highest)	REC
Seep Wetland	C	Moderate	Moderate	C
CVB Wetland	D	Moderate	Moderate	D
Stream 1	E/F	Low/Marginal	-	N/A
Stream 2	D	Low/Marginal	-	D

Aquatic biodiversity impacts associated with the development were identified and assessed using both an impact assessment methodology compliant with NEMA requirements and the Risk Assessment Matrix (RAM) prescribed by GN4167 of 2023. The four potential aquatic impacts were assessed first without, and then with, application of mitigation measures, for the proposed Alternatives 2 and 3.

The construction and operational phase impacts of habitat disturbance, flow regime alteration and sedimentation for Alternative 2 were determined to be of "Medium" significance both prior and after implementing mitigation measures. All the post-mitigation scores fell within the "Low" significance category for impacts relating to Alternative 3.

Alternative 1 i.e. the "no go" scenario was assessed and found to be of "Low" impact significance as this scenario would result in continuation of existing impacts to the onsite watercourses due to the onsite disturbance (dirt tracks, dams, residential dwellings) and adjacent land uses.

In terms of the National Water Act (Act 36 of 1998) and its regulations, a Water Use Authorisation (WUA) will be required for any development within 500 m of the wetlands, that is deemed to impede / divert the flow or alter the bed, banks, course, or characteristics of the watercourses. The risks associated with all four impacts relating to Alternative Layout 2 were found to be of "Medium" Significance, apart from potential water quality impairment. This alternative is least preferred and would require a full Water Use License Application (WULA).

The risks associated with all four impacts relating to Alternative Layout 3 were found to be of "Low" Significance. Section c and i water uses associated with Alternative 3 can therefore be authorised under a General Authorisation (GA).

Alternatives 1 and 3 are therefore preferred from an aquatic perspective. It is the opinion that the proposed agricultural area as Alternative 3 can be approved with the implementation of the recommended mitigation and management measures in this report.

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Robyn Morton has a MSc. degree in Conservation Sciences from the Cape Peninsula University of Technology. Throughout her studies, internships, and consultancy experience, she has gained valuable and informed insight into the functioning of natural and socio-ecological systems, as well as many key research and monitoring skills. Prior to her consulting career, Robyn worked for Zandvlei Estuary Nature Reserve for 4 years and gained experience in the field of urban wetland and estuary management. Robyn specialises in aquatic ecology and is currently working for Delta Ecology as a junior associate under the guidance of Kimberley van Zyl.

A signed statement of independence will be provided as a separate document.

1. Introduction

The owner of the Remainder (RE) of Farm 585 (Mountain Rose Farm), located in the Hemel en Aarde Valley, Hermanus, in the Western Cape (**Figure 1-1**), is proposing the establishment of a vineyard (proposed agricultural area, see **Figure 1-2**).

Currently three alternatives for the project are being considered including:

- Alternative 1 which is the No-Go scenario whereby no vineyards are established,
- Alternative 2 includes the proposed establishment of an approximate 19 Hectare (ha) vineyard area, split into two separate areas (**Figure 1-3**), and
- Alternative 3 includes the proposed establishment of an approximate 19 Hectare (ha) vineyard area, split into three separate areas (**Figure 1-4**).

The focus of this assessment was the extent of RE Farm 585 encompassing both Alternative 2 and 3, further referred to as the "proposed agricultural area". The eastern portion of RE of Farm 585 is located upstream of the proposed agricultural activities and was therefore excluded from this assessment.

According to the national Department of Forestry, Fisheries and the Environment (DFFE) web-based environmental screening tool report generated for the proposed agricultural area, the Combined Aquatic Biodiversity Theme Sensitivity is classified as "Very High" (DFFE, 2024). Delta Ecology was appointed by Lornay Environmental Consulting to clarify aquatic biodiversity constraints on the property.

Following the aquatic biodiversity screening assessment on the 9th of September 2024, a mapped National Wetland Map Version 5 (NWM5) (SANBI, 2018) Valley-Bottom (VB) wetland associated with the Antjies River was confirmed along the southern boundary of the proposed agricultural area. Additionally, a seep wetland, two small non-perennial streams, and small farm dam were also confirmed within / within proximity of the proposed agricultural area.

Given the confirmed presence of watercourses which are likely to be impacted by the development of either Alternative 2 or Alternative 3, the proposed agricultural area was determined to be of "Very High" aquatic sensitivity. If the specialist determines that the Aquatic Biodiversity sensitivity is "Very High", the GN320 of 2020 requires that a full aquatic biodiversity impact assessment must be submitted as set out by the National Environmental Management Act (NEMA) (Act No. 107 of 1998) Regulations of 2020 (as amended) (GN R. 320 of 2020).

The aim of this aquatic biodiversity impact assessment is to (1) determine the Present Ecological State (PES) as well as the Ecological Importance and Sensitivity (EIS) of the watercourses present, (2) to assess the potential impact of the proposed development on the mapped and confirmed watercourses, and (3) to provide recommendations for impact mitigation.

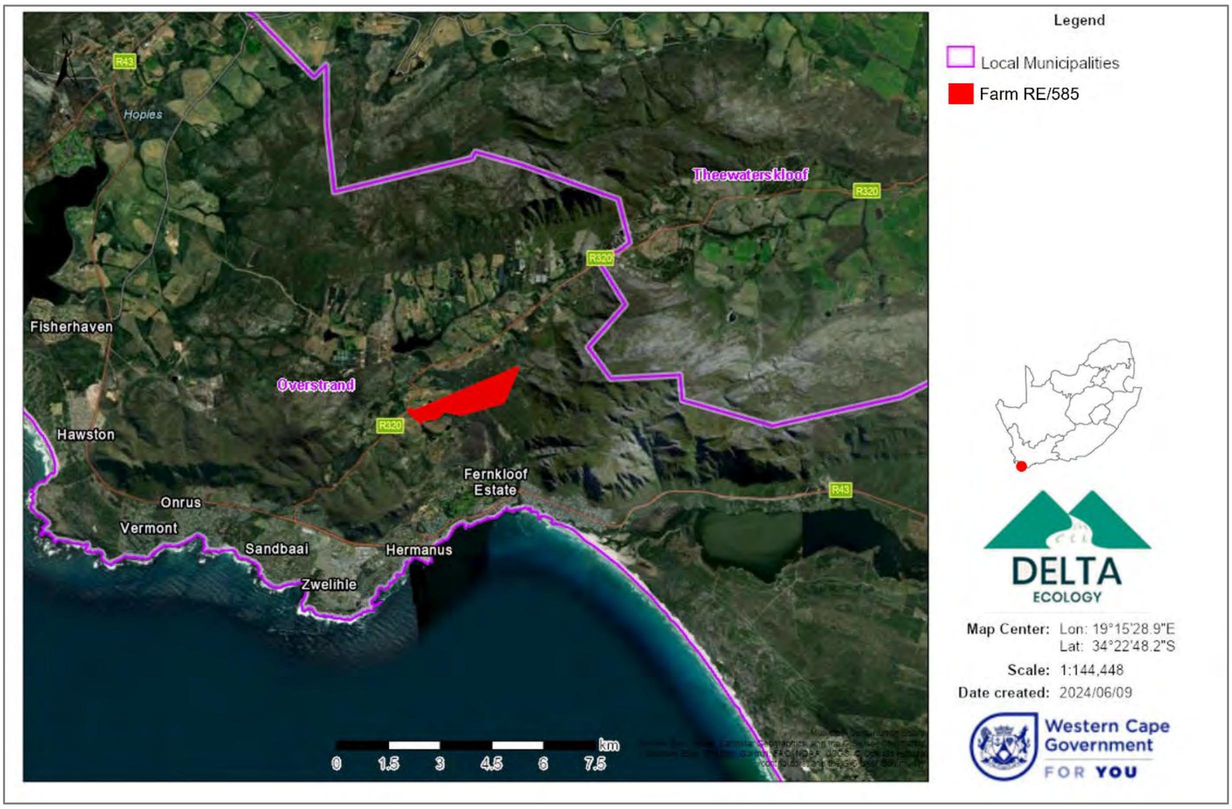

Figure 1-1: Location of RE of Farm 585.

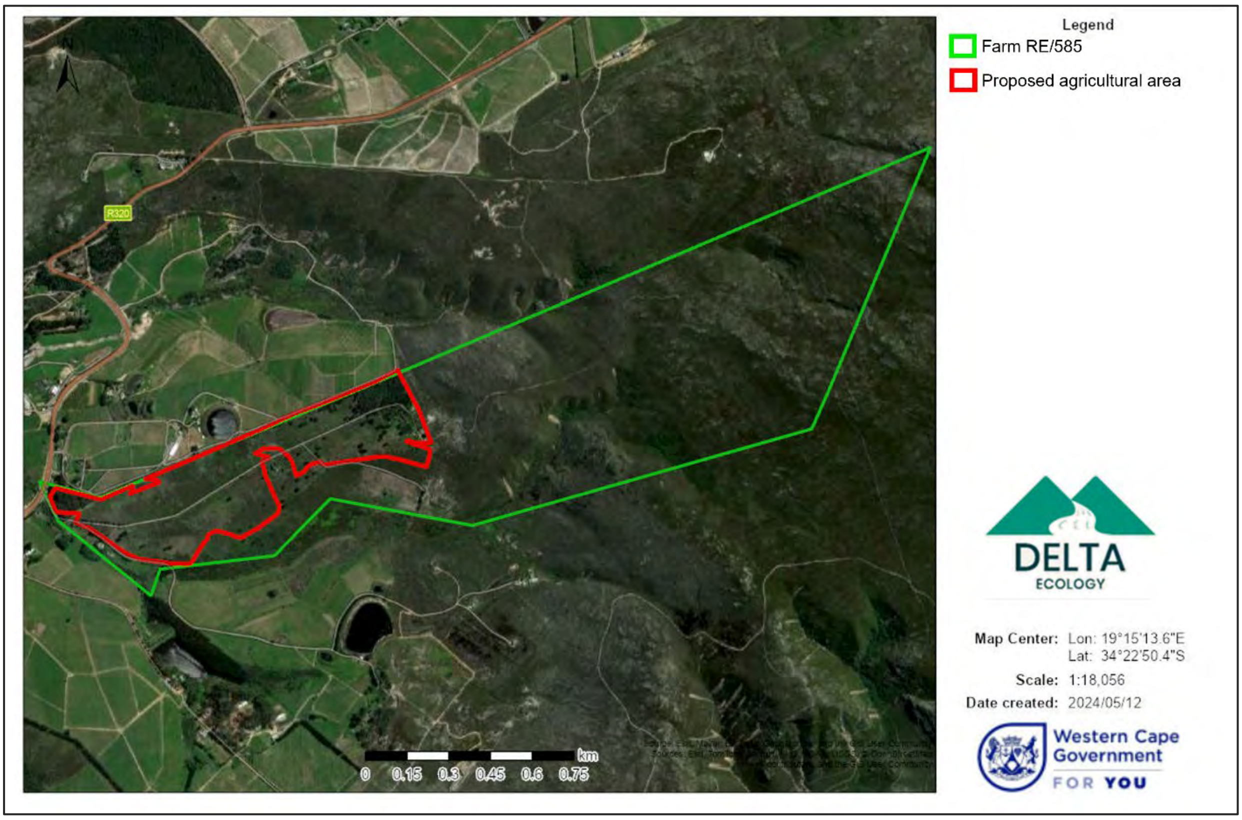

Figure 1-2: Footprint of the proposed agricultural area, encompassing Alternative 2 and 3.

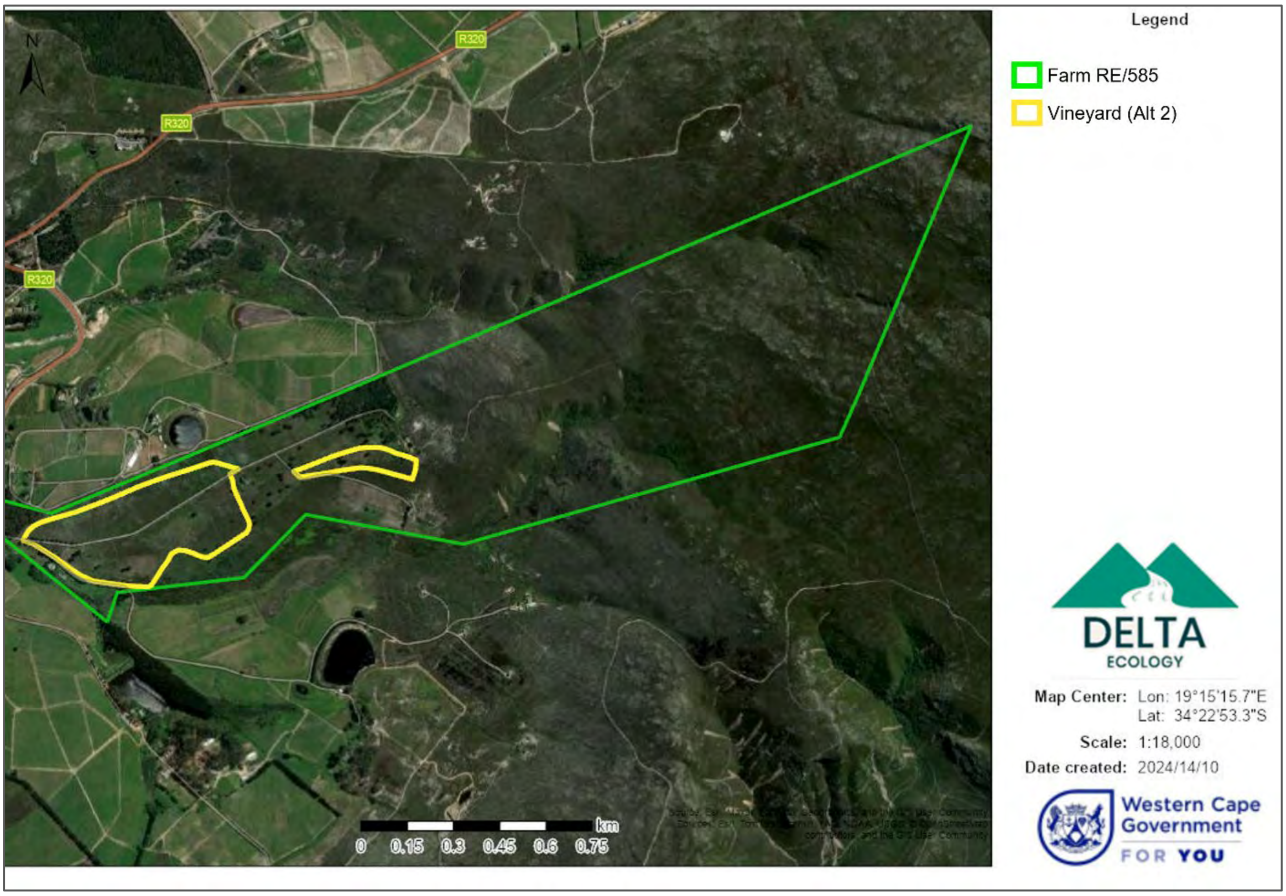

Figure 1-3: Layout plan of Alternative 2.

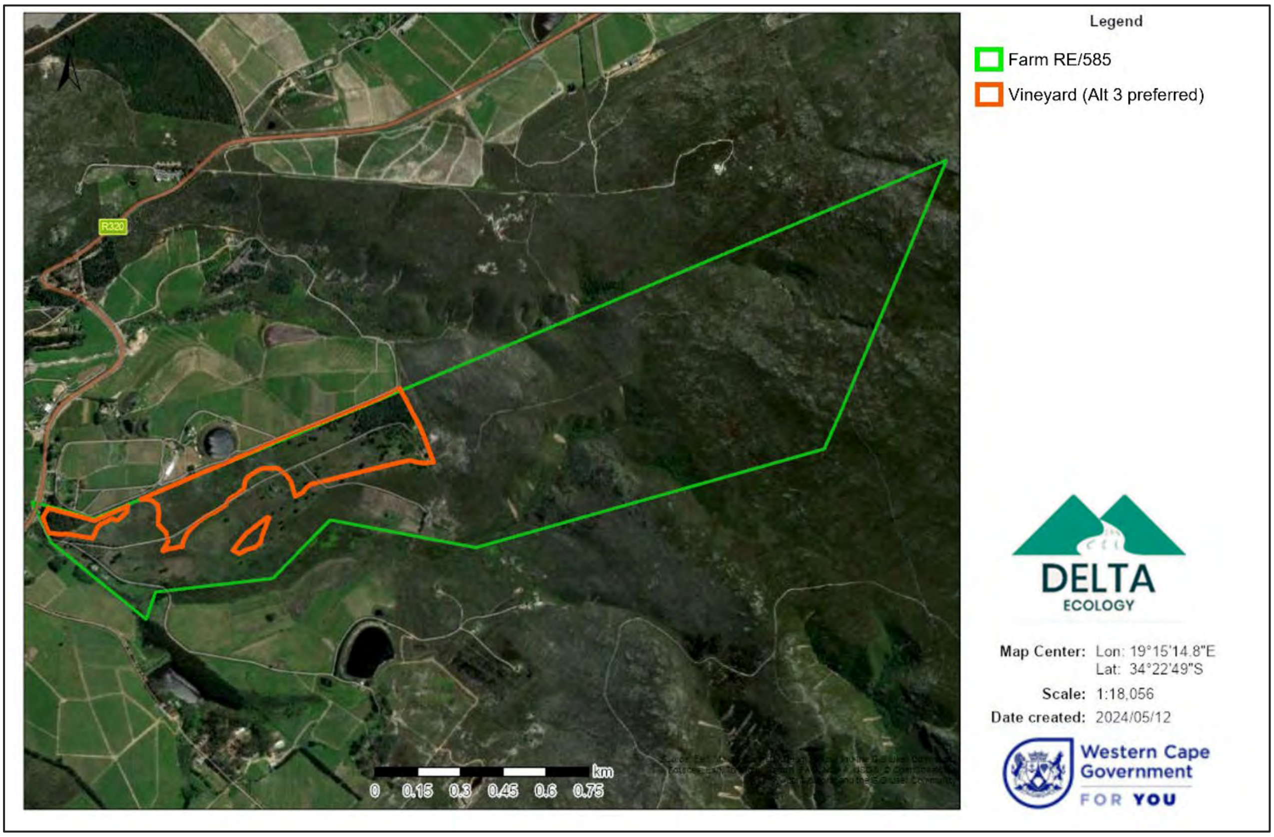

Figure 1-4: Development plan for preferred alternative 3.

1.1. Terms of Reference

The terms of reference agreed upon for this aquatic biodiversity impact assessment include:

- A desktop background assessment to identify potential aquatic biodiversity constraints within the proposed agricultural area, as well as within the 100 m regulated proximity for rivers/streams, and the 500 m regulated proximity for wetlands.
- A site assessment to confirm potential aquatic biodiversity constraints within the proposed area.
- Delineation of all watercourses within the proposed agricultural area using a combination of site-based and desktop methodologies as appropriate.
- Verification of the aquatic site sensitivity as either "Very High" or "Low".
- Drafting of an aquatic biodiversity impact assessment report including the following:
    - General site description;
    - Site sensitivity verification;
    - Determination of the Present Ecological State (PES), Index of Habitat Integrity (IHI), Ecological Importance and Sensitivity (EIS), the contribution to Wetland Ecosystem Services (WES), Recommended Ecological Category (REC), and buffer areas (if applicable);
    - Assessment of potential aquatic biodiversity impacts of the proposed development on the onsite watercourses;
    - Application of the RAM stipulated by GN 4167 of 2023 promulgated in terms of the NWA (Act 36 of 1998) to determine the risk of the proposed development activities on the delineated onsite watercourses;
    - Provision of mitigation measures to reduce aquatic biodiversity impact as far as possible.

1.2. Limitations and Assumptions

The following limitations and assumptions apply to the assessment:

- The site visit was conducted on the 9th of September 2024 during the spring season. This does not cover the complete seasonal variation in conditions experienced onsite. This will however not have an impact on the assessment outcome since hydric vegetation, hydrology, and soil indicators were present and adequate for the delineation and assessment of the onsite watercourses.
- The agricultural portion of the site was highly disturbed, compacted and heavily irrigated. This combination of factors can cause wetland soil indicators and vegetation communities to form artificially and delineation of natural wetland in this area was therefore difficult.
- The watercourse edge was delineated using a Garmin handheld GPSMAP 66i with an expected accuracy of 3 m or less at the 95% confidence interval. In the opinion of the specialist, this limitation is of no material significance to the assessment and all aquatic biodiversity constraints have been adequately identified.
- The "At-Risk" watercourses were delineated in the field, using methodology presented in **Section 3.2.**, while the watercourses deemed not to be At-Risk were delineated via desktop, such as the Google Earth, NWM5 (SANBI, 2018) wetland layer, and the Department of Rural Development and Land Reform (DRDLR) National Geo-spatial Information (NGI) river line

vector data. This was deemed sufficient as these watercourses will not be impacted upon by the proposed development.

- The information provided by the client forms the basis of the planning and layouts discussed.
- Formal vegetation sampling was not done by the specialist, however general observations pertaining to vegetation were recorded based on onsite visual observations. Furthermore, only dominant, and noteworthy plant species were recorded. Thus, the vegetation information provided has limitations for true botanical applications.
- Deriving a 100% factual report based on field collecting and observations can only be done over several years and seasons to account for fluctuating environmental conditions, species' seasonality, and migrations. Since environmental impact studies deal with dynamic natural systems, additional information may come to light at a later stage.
- Description of the depth of the regional water table and geohydrological and hydro pedological processes falls outside the scope of the current assessment.
- Flood line calculations fall outside the scope of the current assessment.
- A Species of Conservation Concern (SCC) scan, fauna and flora assessments were not included in the current study.
- Watercourse delineation plotted digitally may be offset by at least five meters to either side. Furthermore, it is important to note that, while converting spatial data to final drawings, several steps in the process may affect the accuracy of areas delineated in the current report. It is therefore suggested that the no-go area identified in the current report be pegged in the field in collaboration with the surveyor for precise boundaries. The scale at which maps and drawings are presented in the current report may become distorted should they be reproduced by, for example, photocopying and printing.
- Watercourse delineation and calculation of buffer zones does not consider climate change or future changes to watercourses resulting from increasing catchment transformation.

Notwithstanding the above limitations, the specialist is of the opinion that the aquatic biodiversity constraints for the project have been adequately identified for the purposes of this aquatic biodiversity impact assessment.

2. Site Sensitivity Verification

According to the national web-based environmental screening tool report generated for the proposed agricultural area, the Combined Aquatic Biodiversity Theme Sensitivity is classified as "Very High" (DFFE, 2024). The classification trigger is the location of the proposed development within a Strategic Water Source Area (SWSA) for Surface Water (Boland) and the presence of a VB wetland and aquatic Critical Biodiversity Areas (CBAs).

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 initiation of specialist assessments, the current land use, and the potential environmental sensitivity of the area - 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.

Following the aquatic biodiversity screening assessment on the 9th of September 2024, a mapped National Wetland Map Version 5 (NWM5) (SANBI, 2018) Valley-Bottom (VB) wetland associated with the Antjies River was confirmed along the southern boundary of the proposed agricultural area. Additionally, a seep wetland, two small non-perennial streams, and small farm dam were also confirmed within / within proximity of the proposed agricultural area.

Given the confirmed presence of watercourses which are likely to be impacted by the development of either Alternative 2 or Alternative 3, the proposed agricultural area was determined to be of "Very High" aquatic sensitivity. If the specialist determines that the Aquatic Biodiversity sensitivity is "Very High", the GN320 of 2020 requires that a full aquatic biodiversity impact assessment must be submitted as set out by the National Environmental Management Act (NEMA) (Act No. 107 of 1998) Regulations of 2020 (as amended) (GN R. 320 of 2020).

3. Methodology

The methodology used in this aquatic biodiversity impact assessment report, including a desktop background assessment, one site visit, and the delineation and classification of the watercourse(s) associated with the proposed agricultural area, is outlined in the subsections below.

3.1. Desktop Assessment

A brief review of desktop resources was undertaken to determine the nature of the proposed project area, the presence of watercourses in the vicinity and the significance of the proposed site in terms of biodiversity planning. The following desktop resources were consulted:

- Topographical and watercourse information from the Department of Rural Development and Land Reform (DRDLR).
- The South African Atlas of Climatology and Agrohydrology (1997, 2007, and 2009).
- Geological information from the Council for Geoscience.
- The SANBI (2018) National Vegetation Map (NVM).
- The National Wetlands Map Version 5 (NWM5 – SANBI, 2018).
- The National Freshwater Ecological Priority Areas (NFEPA – CSIR, 2011) wetland, wetland vegetation group classification, river, and FEPA datasets.
- The Chief Directorate: National Geo-spatial Information (DRDLR) River's dataset.
- The Western Cape Biodiversity Spatial Plan (WCBSP, 2017).

3.2. Watercourse Identification & Delineation

Watercourses were identified and delineated using the method described in the Manual for the Identification and Delineation of Wetlands and Riparian Areas for field-based delineation (DWAF, 2008). This method is the accepted best practice method for delineating watercourses in South Africa and its use is required by GN 509. For wetlands, the method makes use of four key field indicators to guide the delineation process (refer to **Box 1**):

Box 1. Four indicators of wetland presence as described in DWAF (2008):

1. The **position in the landscape** – Identifies parts of the landscape where wetlands are more likely to occur.
2. The presence of **aquatic vegetation communities**.
3. The presence of **hydromorphic soil features**, which are morphological signatures that appear in soils with prolonged periods of saturation (associated with anaerobic conditions). Key hydromorphic features include:
    a. Mottling – Formation of clumps of iron oxide within the soil matrix in the form of orange, yellow, black, or reddish-brown speckling. Mottling occurs in most soils and reaches maximum density in the centre of the seasonal zone with sparse mottling in the temporary zone and no mottling in the permanent zone.
    b. Gleying – Shift in soil colour from the terrestrial baseline towards a blue, green, or grey colour and an overall reduction in soil chroma. This phenomenon is normally difficult to identify in the temporary zone, noticeable in the seasonal zone and most significant in the permanent zone.
    c. Organic Surface Layers – surface layers with very high organic content that typically occur in the wetland seasonal and permanent zones.
    d. Organic Streaking – Streaks of organic matter within the soil column which may be present in all zones, but particularly the temporary and seasonal zones.

Soil samples were taken for inspection by hand augering to determine the presence of redoximorphic and other hydromorphic soil features. Aquatic vegetation communities were identified using the DWAF, 2008 classification of wetland plant species and descriptions of communities, along with auxiliary information (Van Ginkel *et al.*, 2011). Wetland plant species classification categories are as follows:

- Obligate species (occurring in wetlands >99% of the time – usually in the permanent or seasonal zone).
- Facultative Positive species (67 to 99% of the population occurs within wetlands – typically in the seasonal and temporary zones with the remaining 1 to 33% in the adjacent area on the wetland periphery).
- Facultative Species (33 – 67% of the population occurs within wetlands – usually in seasonal or temporary zones with the remaining 67 – 33% in the adjacent area on the wetland periphery).
- Facultative Negative Species (1 – 33% of the population occurs within wetlands – usually in the temporary zone with the remaining 99 to 67% in the adjacent area on the wetland periphery).
- Wetland Cosmopolitan Species (No specific affinity for wetlands and colonise wetland and terrestrial areas).

Riparian areas were identified using the method described in the DWAF, (2008) Updated Manual for the Identification and Delineation of Wetlands and riparian Areas. This method is the accepted best practice method for identifying and delineating riparian areas in South Africa and its use is required by GN 509. The method makes use of four key field indicators (refer to **Box 2**):

Box 2. Four indicators of riparian areas as described in DWAF (2008)

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

The identification of riparian areas relies heavily on vegetative indicators. Using vegetation, the outer boundary of a riparian area can be defined as the point where a distinctive change occurs in the:

- species composition relative to the adjacent terrestrial area; and
- physical structure, such as vigour or robustness of growth forms of species similar to that of adjacent terrestrial areas. Growth form refers to the health, compactness, crowding, size, structure and/or numbers of individual plants.

In addition to indicators of structural differences in vegetation, indicator species themselves can be used to denote riparian areas. Riparian plant species classification categories are as follows:

- Obligate riparian species occur almost exclusively in the riparian zone (> 90% probability)
- Preferential riparian species are preferentially, but not exclusively, found in the riparian zone (>75% probability). Preferential riparian species may harden to drought conditions but will always indicate sites with increased moisture availability.

3.3. Watercourse Classification

The (Ollis *et al.*, 2013) Classification System for Wetlands and Other Aquatic Ecosystems in South Africa, as used in this assessment, is a tiered structured classification system that provides a uniform description of wetland types based on their hydrogeomorphic characteristics. This classification system categorises wetlands into 7 distinct hydrogeomorphic units described in **Figure 3-1**.

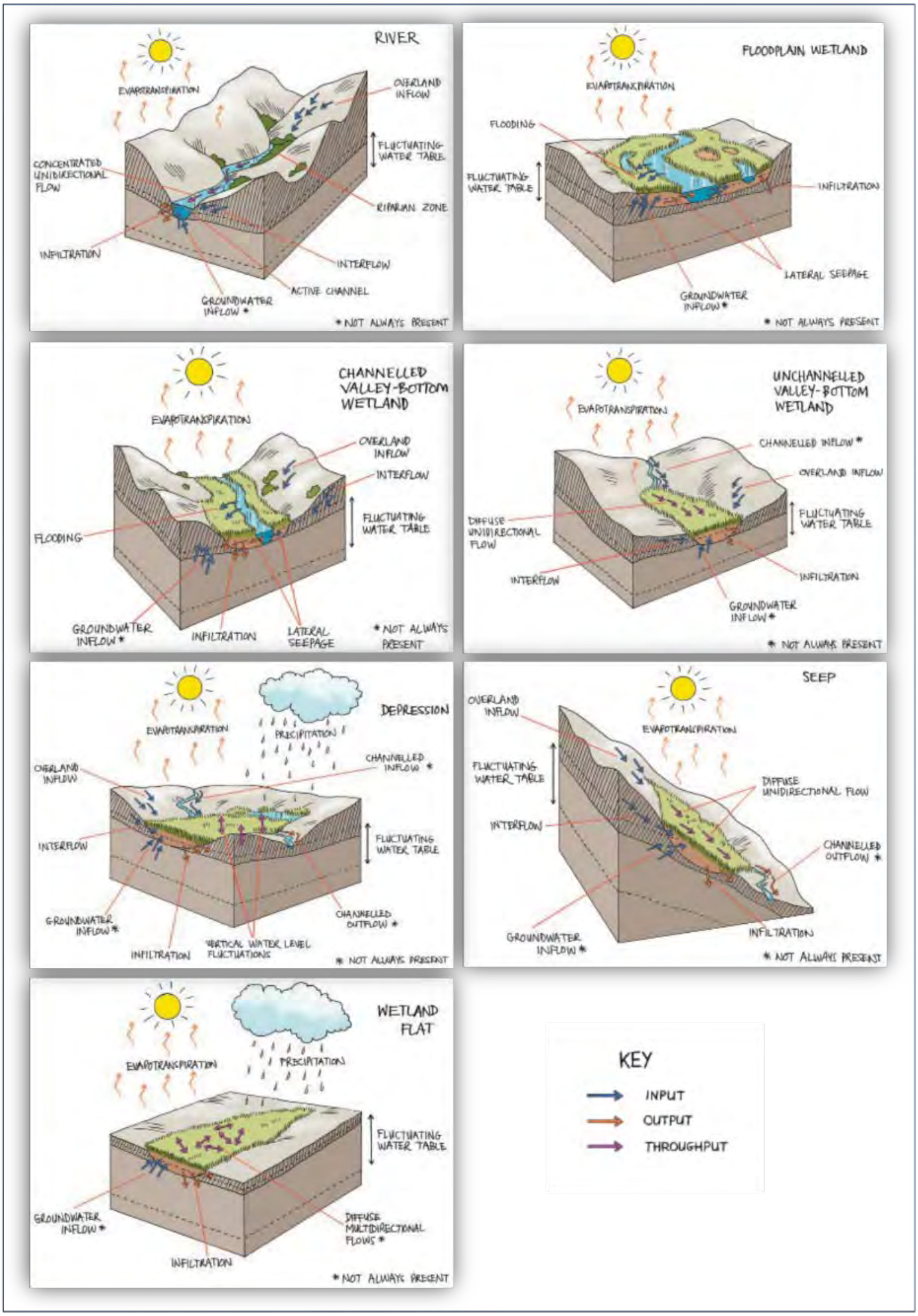

Figure 3-1: Wetland Hydrogeomorphic Types as defined in the Classification System for Wetlands and Other Aquatic Ecosystems in South Africa (Ollis *et al.*, 2013).

3.4. Present Ecological State Assessment

WET-Health Version 2 (Macfarlane *et al.* 2020) is a modular tool designed to evaluate and assess the Present Ecological State (PES) of wetland hydrogeomorphic units based on the degree to which the wetland has deviated from its natural reference condition. The tool accounts for four inter-related components that influence wetland health. These consist of three core drivers of wetland change namely hydrology, geomorphology, and water quality, along with vegetation as a responding variable. A separate PES score is derived for each of these components, which are then combined into a single PES score for the wetland hydrogeomorphic unit. The scores for each component and the overall score fall into one of six Ecological Categories defined in **Table 3-1** below.

The tool offers three levels of assessment:

1. Level 1A, a low-resolution desktop-based assessment;
2. Level 1B, a high-resolution desktop-based assessment; and
3. Level 2, a detailed rapid field-based assessment.

Level 1A is applied to provincial and national scale assessments of many wetlands, while Level 1B is applied to catchment scale assessments or to rapid individual assessments. The Level 2 assessment incorporates information from a direct onsite assessment of the wetland and its catchment and adds detail by separately assessing the various disturbance units within the wetland. The level 2 PES assessment was applied in this case.

Table 3-1: PES Categories Scores as defined WET-Health Version 2 (Macfarlane *et al.*, 2020).

Ecological Category	Description	Impact Score	PES Score (%)
A	Unmodified, natural.	0-0.9	90-00
B	Largely natural with few modifications. A slight change in ecosystem processes is discernible and a small loss of natural habitats and biota may have taken place.	1-1.9	80-89
C	Moderately modified. A moderate change in ecosystem processes and loss of natural habitats has taken place but the natural habitat remains predominantly intact.	2-3.9	60-79
D	Largely modified. A large change in ecosystem processes and loss of natural habitat and biota and has occurred.	4-5.9	40-59
E	Seriously modified. The change in ecosystem processes and loss of natural habitat and biota is great but some remaining natural habitat features are still recognizable.	6-7.9	20-39
F	Critically modified. Modifications have reached a critical level, and the ecosystem processes have been modified completely with an almost complete loss of natural habitat and biota.	8-10	0-19

3.5. Habitat Integrity 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 (**Table 3-2**). Descriptions of each criterion are provided to assist with the assessment (**Table 3-3**).

Table 3-2: Scoring procedures used to determine the Index of Habitat Integrity

IMPACT CLASS	DESCRIPTION	SCORE
None	No discernible impact or the modification is 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

Table 3-3: 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 (**Table 3-4**).

Table 3-4: 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	Indigenous vegetation removal	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. These classes are indicated in **Table 3-5**. 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).

Table 3-5: 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

3.6. Ecosystem Service Assessment

WET-EcoServices Version 2 (Kotze *et al*. 2020) is a structured and rapid field-based evaluation tool designed to assess the wetlands ecosystem services based on its Hydrogeomorphic (HGM) unit. The tool accounts for 16 ecosystem services which are derived from regulating (e.g., flood attenuation), provisioning (e.g., water supply), supporting (e.g., biodiversity maintenance), and cultural (e.g., tourism and recreation) services (refer to **Annexure 1**). The tool evaluates the scale of ecosystem services supplied (in terms of a score out of 4 per service) relative to other wetlands and furthermore compares the scale of service supply to the demand for each service. The scores are divided into seven categories as per **Table 3-6**. The tool offers two levels of assessment, namely Level 1 (a rapid desktop assessment) and Level 2 (a detailed field-based indicator assessment). Level 1 is designed for conducting rapid desktop assessments of many wetlands across provincial and national scales. Ratings are assigned based on the Hydrogeomorphic unit of the wetland. Level 2 is designed for conducting robust in-field assessments of ecosystem services for respective wetland types. The level 2 Ecosystem Service assessment was applied in this case.

Table 3-6: Ecosystem Services Importance Categories Scores as defined in WET-EcoServices Version 2 (Kotze *et al*. 2020).

Importance Category		Description
Very Low	0-0.79	The importance of services supplied is very low relative to that supplied by other wetlands.
Low	0.8 – 1.29	The importance of services supplied is low relative to that supplied by other wetlands.
Moderately-Low	1.3 – 1.69	The importance of services supplied is moderately-low relative to that supplied by other wetlands.
Moderate	1.7 – 2.29	The importance of services supplied is moderate relative to that supplied by other wetlands.
Moderately-High	2.3 – 2.69	The importance of services supplied is moderately-high relative to that supplied by other wetlands.
High	2.7 – 3.19	The importance of services supplied is high relative to that supplied by other wetlands.
Very High	3.2 – 4.0	The importance of services supplied is very high relative to that supplied by other wetlands.

3.7. Wetland EIS Assessment

The EIS method (Rountree *et al*. 2013) is a rapid scoring system designed to identify the ecological importance and sensitivity of wetlands to disturbances across multiple scales (i.e., catchment to international scales). The full EIS method integrates three important components, namely, ecological importance and sensitivity, hydro-functional importance, and basic socio-economic importance. The hydro-functional and socio-cultural benefits were however assessed using the updated WET-EcoServices assessment methodology and these two components were therefore omitted from this EIS assessment. The EIS score ranges from 0-4, and it provides an index for prioritisation and management of water resources. The EIS categories are presented in **Table 3-7**.

Table 3-7: Ecological Importance and Sensitivity Categories (DWAF, 1999).

EIS Category	Description	Range of Median
Very high	Ecologically important and sensitive on a national or even international level. These river systems and their biota are usually very sensitive to flow and habitat modifications and provide only a small capacity for use.	>3 and <=4
High	Ecologically important and sensitive on a regional or national scale. These river systems may be sensitive to flow and habitat modifications.	>2 and <=3
Moderate	Watercourses that are considered to be ecologically important and sensitive on a provincial or local scale. The biota of these watercourses is not usually sensitive to flow and habitat modifications.	>1 and <=2
Low/marginal	Watercourses that are not ecologically important and sensitive at any scale. The biota within these watercourses is not sensitive to flow and habitat modifications.	>0 and <=1

3.8. River EIS Assessment

The EIS was determined for the onsite streams using an adapted version of the Duthie *et al*., 1999, methodology. The EIS is a rapid scoring system designed to identify the EIS of floodplains to disturbances across multiple scales (i.e., catchment to international scales). In this case, it has been adapted for application to "Ecological importance" of a water resource is an expression of its importance to the maintenance of ecological diversity and functioning on local and wider scales. "Ecological sensitivity" refers to the system's ability to resist disturbance and its capability to recover from disturbance once it has occurred (Duthie *et al*., 1999). A series of determinants for EIS are assessed on a scale of 0 to 4, where 0 indicates "None" and 4 indicates "Very high importance" and the median of the determinants indicates the EIS category for the watercourse (**Table 3-8**). Weighting of the relative importance of the various determinants of ecological importance and sensitivity was not proposed. However, the relative confidence of each rating should be estimated based on a scale of four categories where 1 indicated "Marginal/low confidence" and 4 indicated "Very High confidence". The median score for the biotic and habitat determinants can be interpreted and translated into an EMC, however for the purposes of this assessment, the Recommended Ecological Category (REC) methodology as described in Rountree et al., (2013) was utilized (see **Section 3.9** below).

Table 3-8: Ecological Importance and Sensitivity Categories (DWAF, 1999).

EIS CATEGORY	RANGE OF MEDIAN	RECOMMENDED ECOLOGICAL MANAGEMENT CLASS
Very high Watercourses that are considered ecologically important and sensitive on a national or even international level. The biodiversity of these watercourses is usually very sensitive to flow and habitat modifications. They play a major role in moderating the quantity and quality of water of other major rivers.	>3 and <=4	A
High Watercourses that are considered to be ecologically important and sensitive. The biodiversity of these watercourses may be sensitive to flow and habitat modifications. They play a role in moderating the quantity and quality of water of other major rivers.	>2 and <=3	B
Moderate Watercourses that are considered to be ecologically important and sensitive on a provincial or local scale. The biodiversity of these watercourses is not usually sensitive to flow and habitat modifications. They play a small role in moderating the quantity and quality of water of other major rivers.	>1 and <=2	C
Low/marginal Watercourses that are not ecologically important and sensitive at any scale. The biodiversity of these watercourses is ubiquitous and not sensitive to flow and habitat modifications. They play an insignificant role in moderating the quantity and quality of water of other major rivers.	>0 and <=1	D

3.9. Recommended Ecological Category

The method for determining the Recommended Ecological Category (REC) for water resources is described in Rountree *et al*. (2013). The objective of the REC is to define the management objective for wetlands and does so in accordance with the following rules:

- A wetland within PES Category A (unmodified) cannot be rehabilitated. The management objective will therefore always be to maintain the existing PES Category.
- A wetland within PES Category B, C or D with a “Low-marginal” or “Moderate” EIS score must also be maintained in the pre-development PES category.
- A wetland within PES Category B, C or D with a “High” or “Very High” EIS score must, where practically possible, be rehabilitated to a PES category that is one higher than the pre-development category. E.g. a wetland with a pre-development PES score of C and a “High” EIS score must be rehabilitated to a PES category B. Where this is not practically possible, maintenance of the pre-development PES category will be the management objective.
- PES Categories E or F are considered unsuitable and always require rehabilitation to a PES Category D.

3.10. Buffer Determination

The Buffer Zone Tool (Macfarlane & Bredin, 2017) is a rapid, excel based, scoring tool designed to determine an appropriate buffer around rivers, wetlands and estuaries.

The tool offers two levels of assessment:

1. A desktop-based assessment and
2. A detailed rapid field-based assessment.

All three watercourse types (river, wetland, and estuary) can be assessed using the desktop-based assessment tool. When a field-based assessment is undertaken, different tools are available for each watercourse type. In this case, a field-based assessment was undertaken.

3.11. Impact and Risk Assessment

The impact assessment utilised the Delta Ecology impact assessment methodology as specified in **Annexure 2**. The risk assessment utilised the methodology and risk matrix specified in GN 4167 of 2023 for the purpose.

4. Desktop Assessment

A brief review of desktop resources was undertaken during the aquatic biodiversity impact assessment. A summary of key desktop information relevant to this assessment is provided below.

4.1. Biophysical & Biodiversity Planning Context

The proposed agricultural area has relatively shallow soils, underlain by mudstone, siltstone and shale, (**Table 4-1**) which predisposes the site to the formation of perched flat/depressional and hillslope seep wetlands under the right conditions. The terrestrial vegetation within the site is predominantly Critically Endangered (CR), Poorly Protected (PP) Elim Ferricrete Fynbos, although the southeastern corner is indicated as CR, Well Protected (WP) Overberg Sandstone Fynbos (**Figure 4-1**). Wetlands within these terrestrial vegetation types are associated with the Southwest Ferricrete Fynbos (CR – PP) and the Southwest Sandstone Fynbos (CR – PP) wetland vegetation types.

According to the Western Cape Biodiversity Spatial Plan (WCBSP, 2017), the proposed agricultural area has small portions demarcated as an Aquatic CBA 1, and ESA 2 for River / Wetland / Watercourse (**Figure 4-2**). These CBAs / ESAs are associated with the Anjies Rivier and associated wetland area along the southern boundary of the proposed agricultural area. Additionally, the proposed agricultural area has Aquatic CBAs and ESAs within the 500 m regulated proximity associated with the surrounding mapped watercourses.

The general characteristics of the proposed agricultural area are summarised in **Table 4-1**.

Table 4-1: General characteristics of the proposed site.

Site attribute	Description	Data source
Eco-region	Southern Folded Mountains	Department of Water Affairs Level 1 Ecoregions (Department of Water and Sanitation, 2011)
Terrestrial Vegetation Type(s)	1) Elim Ferricrete Fynbos (CR-PP) 2) Overberg sandstone fynbos (CR-WP)	National Vegetation Map of South Africa, 2018 (SANBI, 2018)
Dominant Geology and Soils	Geology consists of mainly mudstone, siltstone and shale of the Gydo Formation, Bokkeveld Group. Soils consist of prismacutanic and/or pedocutanic diagnostic horizons dominant, B horizons mainly not red.	Soil descriptions for the Western Cape. (ENPAT, 2021)
Soil Erodibility Factor (K)	0.7 (High Erodibility)	SA Atlas of Climatology and Agrohydrology (Schultz, 2009)
Soil depth and clay %	<450 mm & <15%	Soil types and descriptions for the Western Cape, Department of Agriculture, Forestry and Fisheries (DAFF, 2021)
Mean Annual Precipitation (mm)	645 mm	SA Atlas of Climatology and Agrohydrology (Schultz, 2009)
Rainfall seasonality	Winter rainfall	
Mean Annual Temperature (°C)	16.40 °C	
Water Management Area (WMA)	Breede - Olifants WMA	Water Management Areas (DWAF, 2011)
Quaternary Catchment	G40H	South African Quaternary Catchments Database (Schulze et al., 2007)
Wetland Vegetation Group (for wetlands within the applicable terrestrial vegetation type)	1) Southwest Ferricrete Fynbos (CR – PP) 2) Southwest Sandstone Fynbos (CR – PP)	NFEPA Wetland Vegetation Types (SANBI, 2011)

Figure 4-1: NFEPA Wetland vegetation map (SANBI, 2018).

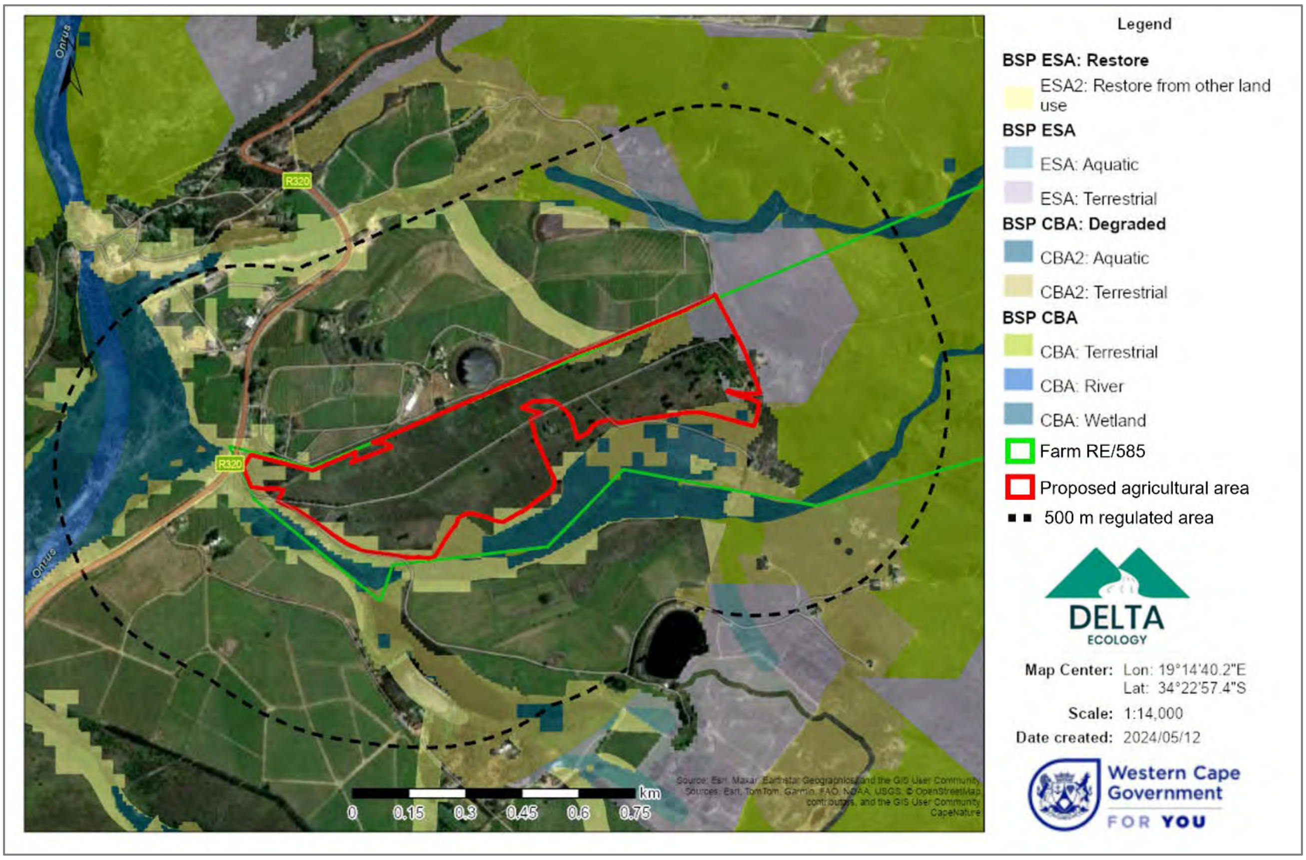

Figure 4-2: Western Cape Biodiversity Spatial Plan (WCBSP 2017).

4.2. Water Resources

The NWM5 (SANBI, 2018) wetland layer indicates an Unchanneled Valley-Bottom (UVB) wetland (associated with the Anjies River) along the southern boundary of the proposed agricultural area (**Figure 4-3**). The National Freshwater Ecological Priority Areas (NFEPA) (CSIR, 2011) maps the NWM5 UVB wetland as a CVB wetland (**Figure 4-4**). This watercourse is a tributary of the Onrus River, an important peatland located approximately 85 m downslope of the proposed agricultural area. Given the distance, along with the fact that the Hemel en Aarde Road and associated culvert separates the proposed agriculture, it is unlikely that the Onrus River will be impacted upon given the proposed mitigation measures in this report.

Additionally, the NWM5 and the NFEPA map a Channelled Valley-Bottom (CVB) wetland 160 m north of the proposed agricultural area, within the 500 m regulated proximity thereof, which is unlikely to be impacted by the proposed agriculture (**Figure 4-3**). Furthermore, the NFEPA (CSIR, 2011) indicates various artificial wetlands within the 500 m regulated proximity which are unlikely to be impacted by the proposed agriculture.

The Department of Rural Development and Land Reform (DRDLR) National Geo-spatial Information (NGI) river line vector data indicates various non-perennial drainage lines within the 100 m regulated proximity.

Following the aquatic biodiversity screening assessment on the 9th of September 2024, a mapped National Wetland Map Version 5 (NWM5) (SANBI, 2018) Valley-Bottom (VB) wetland associated with the Antjies River was confirmed along the southern boundary of the proposed agricultural area. Additionally, a seep wetland, two small non-perennial streams, and small farm dam were also confirmed within / within proximity of the proposed agricultural area.

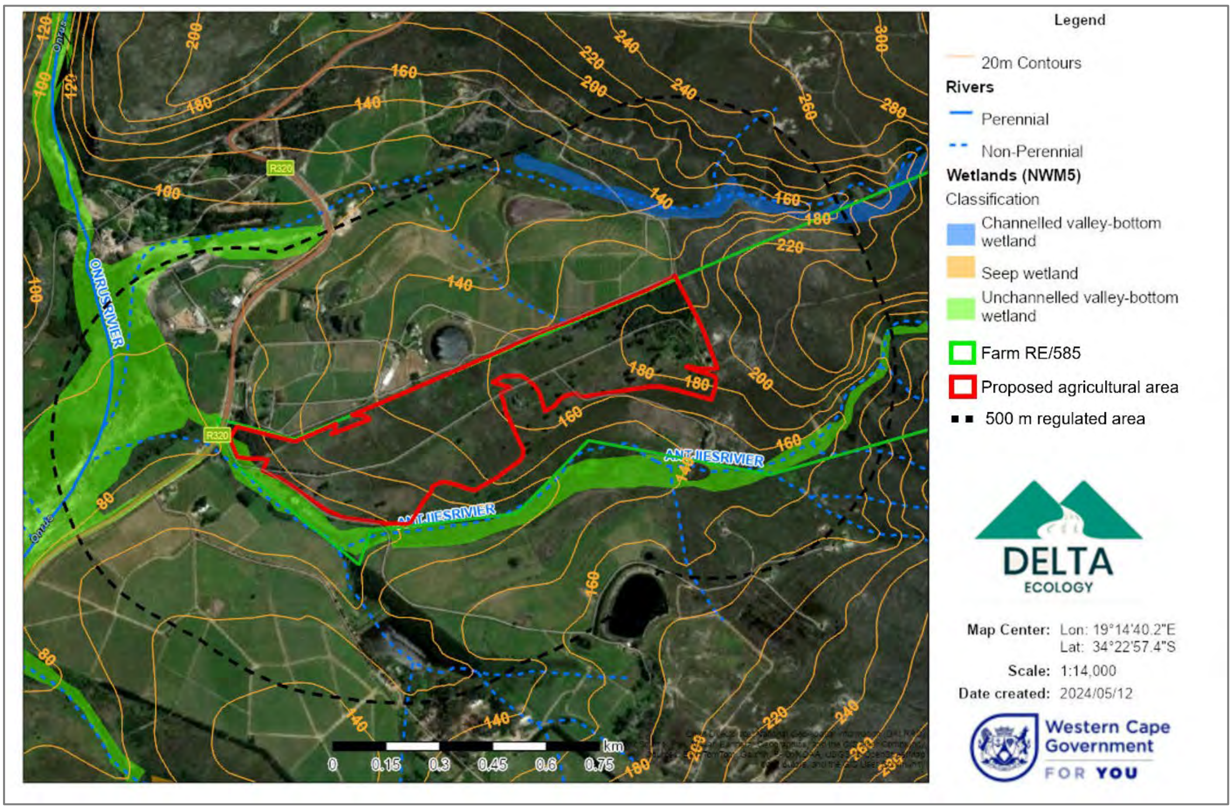

Figure 4-3: Regional Drainage Map (NGI Rivers and NWM5 Wetlands).

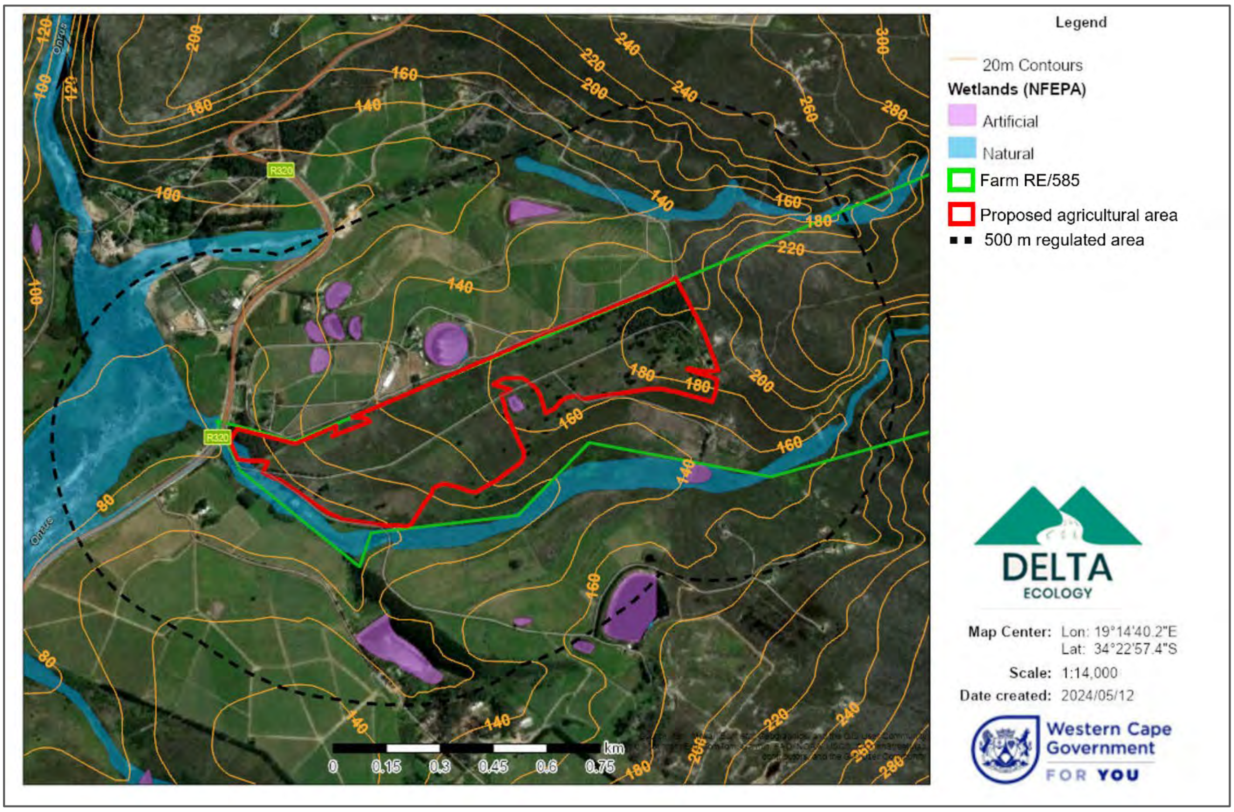

Figure 4-4: NFEPA Wetlands map.

5. Site Description

The site is situated in the Hemel en Aarde Valley along the R320 (Hemel en Aarde) Road. It is bordered by agricultural fields to the north, west and south, with largely pristine natural vegetation to the east. The site slopes from an elevation of 156 m in the north to 141 m in the south. Currently the proposed agricultural area consists of natural vegetation that has historically been cleared and ploughed for agriculture and has a gravel track running through its centre.

Following the aquatic biodiversity screening assessment on the 9th of September 2024, the watercourses considered to be at-risk of the proposed agricultural activities were delineated and classified (**Figure 5-1**). A CVB wetland associated with the Antjies River was confirmed along the southern boundary of the proposed agricultural area. This watercourse is a tributary of the Onrus River, an important peatland located approximately 85 m downslope of the proposed agricultural area. Given the distance, along with the fact that the Hemel en Aarde Road and associated culvert separates the proposed agriculture, it is unlikely that the Onrus River will be impacted upon given the proposed mitigation measures in this report.

Additionally, a seep wetland and associated farm dam, along with two small non-perennial streams were also confirmed within / within proximity of the proposed agricultural area (**Figure 5-1**). The wetlands were delineated, using the presence of saturated soils, mottling within the upper 500 mm of the soil, in conjunction with the presence of hydrophytic vegetation.

The wetland vegetation within the seep consisted of *Berzelia lanuginosa* (Button bush) and *Pennisetum macrourum* (African Feather Grass), interspersed with *Zantedeschia aethiopica* (Arum Lily), *Pteridium aquilinum* (Common bracken), and *Cannomois virgata* (Branching Fountainreed). Additionally, there were some alien invasive Pine and *Eucalyptus* trees sparsely dispersed within the wetland.

The western portion of the CVB wetland, the area closest to the proposed agricultural area, is in a seriously modified condition. The wetland has been transformed into horse paddocks, vineyards, invaded by *Eucalyptus* and *Poplar* trees, residential dwellings, dirt roads, small dams and areas that are maintained as lawns. The eastern portion of the CVB wetland is slightly more natural with vegetation consisting of *Psoralea pinnata* (Fountain bush), *Pennisetum macrourum* and *Berzelia lanuginosa*.

Stream 1 located approximately 27 m north of the proposed agricultural area has been transformed into an agricultural channel through the adjacent property's vineyards. Stream 2 is located approximately 28 m east of the proposed agricultural area and has been impacted severely by head cut erosion. The small farm dam, and both streams exhibit negligible ecosystem services due to limited presence of wetland vegetation (farm dam) and riparian zones (streams).

Figure 5-2 to **Figure 5-13** provide an overview of the site, specifically the proposed agricultural area and the at-risk watercourses.

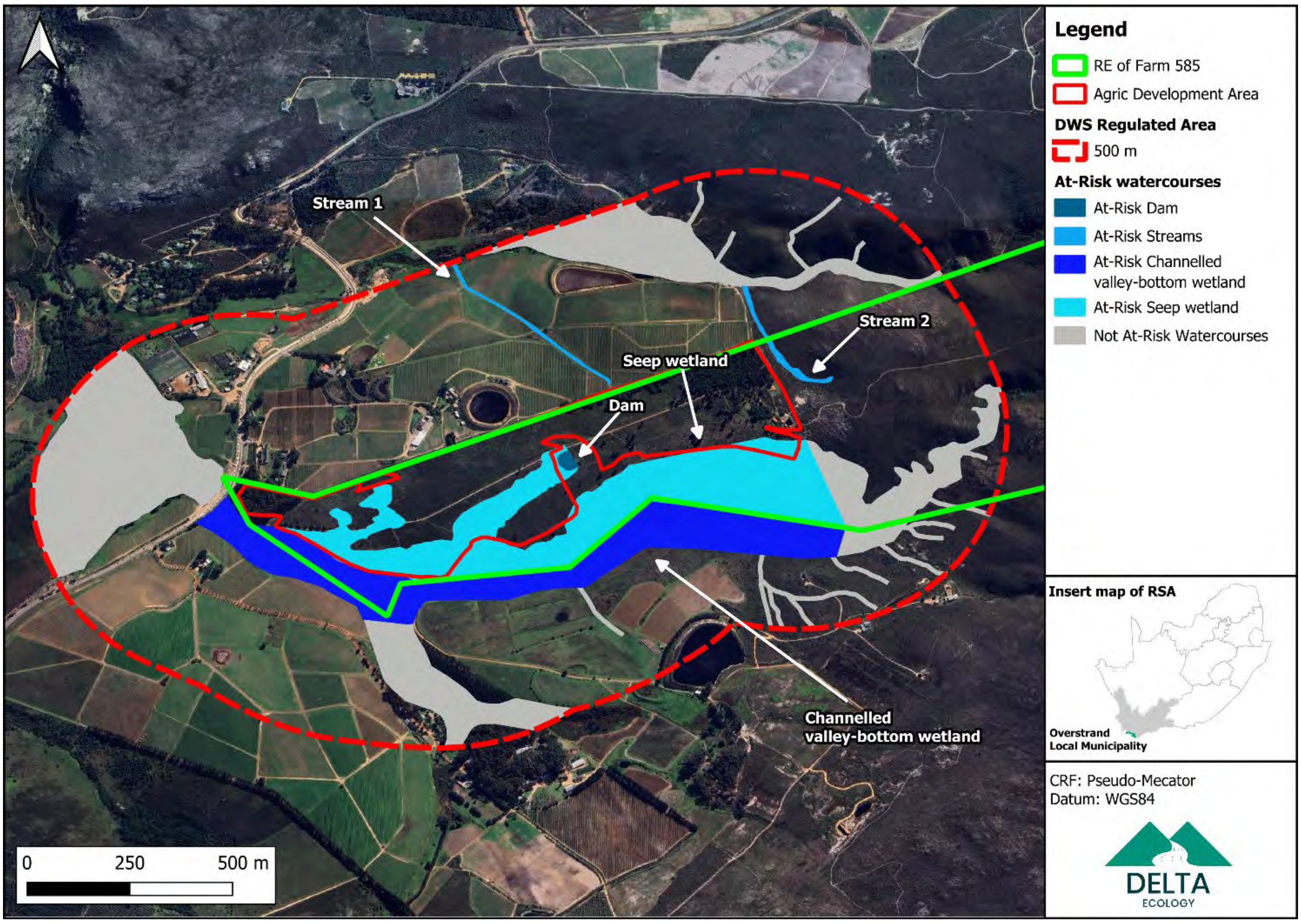

Figure 5-1: At-risk watercourses include the CVB wetland, seep wetland, and two non-perennial streams.

Figure 5-2: Seep wetland area dominated by *Berzelia lanuginosa*.

Figure 5-3: A portion of the seep dominated by *Pennisetum macrourum*.

Figure 5-4: A portion of the seep wetland with *Pteridium aquilinum*.

Figure 5-5: Seep wetland leading to the downslope CVB wetland.

Figure 5-6: The CVB wetland associated with the Anjies River.

Figure 5-7: The CVB wetland associated with the Anjies River, close to the R320.

Figure 5-8: Part of the CVB wetland, close to the R320.

Figure 5-9: Clay dense soils exhibiting mottling.

Figure 5-10: A) Historical Stream 1 and B) Stream 2.

Figure 5-11: Small farm dam within the seep wetland.

Figure 5-12: Hemel en Aarde Road and associated culvert.

Figure 5-13: Onrus River located 85 m downslope.

Table 5-1: Classification of the at-risk watercourses

Factor	Wetland 1	Wetland 2	River 1	River 2
System	Inland	Inland	Inland	Inland
Ecoregion	Southern Coastal Belt	Southern Coastal Belt	Southern Coastal Belt	Southern Coastal Belt
Landscape Setting	Valley-Floor	Hillslope	-	-
Hydrogeomorphic type	Channelled valley bottom	Hillslope Seep	Mountain headwater stream / Mountain Stream	Mountain headwater stream / Mountain Stream
Drainage	Rainfall and Interflow	Rainfall and Interflow	Rainfall and Interflow	Rainfall and Interflow
Seasonality	Seasonal/ temporary	Seasonal/ temporary	Non-perennial	Non-perennial
Anthropogenic influence	Vegetation clearing, excavation, infilling and alien invasive vegetation	Vegetation clearing, excavation, inundation and alien invasive vegetation	Canalization, vegetation clearing, excavation, inundation and alien invasive vegetation	Erosion, vegetation clearing, excavation, inundation and alien invasive vegetation
Vegetation	Southwest Ferricrete Fynbos (CR – PP) and Southwest Sandstone Fynbos (CR – PP).	Southwest Ferricrete Fynbos (CR – PP) and Southwest Sandstone Fynbos (CR – PP).	Southwest Ferricrete Fynbos (CR – PP)	Southwest Sandstone Fynbos (CR – PP).
Geology	Mainly mudstone, siltstone and shale of the Gydo Formation, Bokkeveld Group.			
Substrate	Wetland soils were dark brown and exhibited mottling.			
Salinity	Fresh			

6. Watercourse Status Quo Assessment

In this study, the onsite at-risk watercourses were assessed to determine their PES (Wetlands) / IHI (Streams), EIS, and contribution to WES. These metrics were used to determine the management objective expressed in terms of the REC. It is noted that the small farm dam is completely artificial and exhibits negligible ecosystem services due to limited presence of wetland vegetation. This watercourse was therefore excluded from the Status Quo Assessment. The two streams exhibit negligible ecosystem services due to the limited extent of the riparian zones, therefore although IHI, and EIS was assessed the WES assessment was excluded.

6.1. Present Ecological State

The Macfarlane *et al.* (2020) WET-Health Version 2.0 assessment for the seep wetland produced an overall PES score within category C (**Table 6-1**). This indicates that the wetland was in a moderately modified condition at the time of the assessment. The WET-Health Version 2.0 assessment for CVB wetland produced an overall Present Ecological State (PES) score within category D (**Table 6-2**). This indicates that the wetland was in a largely modified condition at the time of the assessment. The assessment results for the wetlands are presented in **Table 6-1**-**Table 6-2** and the definitions of the ecological categories are presented in **Table 6-3**. The key factors that influenced the scoring are summarised below.

6.1.1. Seep wetland

Hydrology

The natural flow regime of the seep wetland has been altered because of onsite disturbances such as excavation of a dam, compaction of soil, vegetation clearing and infilling, and catchment hardening associated with the onsite dirt tracks. The vineyards on adjacent farms have likely altered the natural flow regime of the wetland due to clearance of natural vegetation, and by concentrating flow along furrows. Similarly, the gravel tracks through the wetland concentrate flow along its path and alters the wetlands natural flow regime. The small farm dam within the seep has led to impoundment of flow, and inundation within the dam itself.

Vegetation

Much of the seep wetland has been historically cleared of natural vegetation for agricultural activities; which has been left fallow and natural wetland vegetation has subsequently reestablished. There are a few instances of alien pine trees within the seep wetland. No Species of Conservation Concern (SCC) were noted but may be present.

Geomorphology

The geomorphology of the seep wetland was historically impacted by ploughing, and the compaction of soil, related to the historical agriculture. The construction of the small farm dam within the wetland, along with small residential dwellings have resulted in excavation, and infill within the seep. The construction of dirt tracks has altered the geomorphology of the wetland as removing vegetation can destabilise soil.

Water Quality

The majority of the seep wetland's catchment is made up of natural vegetation, parts of which is pristine although some areas have been cleared historically for agricultural fields that have been left for natural vegetation to recolonise with limited additional anthropogenic impacts. The farm dam, adjacent vineyards, and dirt tracks through the wetland might result in some sediment input.

6.1.2. CVB wetland

Hydrology

The wetland likely receives water primarily from lateral flow originating from adjacent shallow slopes, including subsurface flow. The natural flow regime of the CVB Wetland has been altered because of construction of within wetland vineyards, residential dwellings, roads, channels and small dams within the wetland which affect the wetland's natural water flow patterns. Additionally, the hydrology of the CVB wetland has been impacted by the surrounding catchment land use, such as the presence of agricultural areas immediately adjacent to the wetland.

Vegetation

The CVB wetland has a mixture of natural vegetation and alien invasive species present such as the *Eucalyptus* trees present within the eastern portion of the wetland. Areas of the wetland are maintained as grazing lawns. A small portion of the wetland coincides with agricultural fields / vineyards.

Geomorphology

The geomorphology of the CVB wetland has been modified by the excavation associated with dams and channels as well as infilling for roads and the residential dwellings. In places, the channel is eroding slightly.

Water Quality

Agricultural activities such as fertiliser and pesticide use may result in contaminated runoff which enters the wetland area and degrades water quality. Agricultural activities may also result in sedimentation. The water quality within the wetland is likely to be impacted by the infilling for the roads and residential dwellings.

Table 6-1: Outcome of the WET-Health Assessment for the delineated seep wetland.

PES Assessment	Hydrology	Geomorphology	Water Quality	Vegetation
Impact Score	4.0	3.9	1.0	3.7
PES Score (%)	60%	61%	90%	63%
Ecological Category	D	C	B	C
Trajectory of change	↓	↓	↓	↓
Confidence (revised results)	Not rated	Not rated	Not rated	Not rated
Combined Impact Score	3.3			
Combined PES Score (%)	67%			
Combined Ecological Category	C			
Hectare Equivalents	14.2 Ha			

Table 6-2: Outcome of the WET-Health Assessment for the delineated CVB wetland.

PES Assessment	Hydrology	Geomorphology	Water Quality	Vegetation
Impact Score	6.1	4.2	5.3	4.3
PES Score (%)	39%	58%	47%	57%
Ecological Category	E	D	D	D
Trajectory of change	↓	↓	↓	↓
Confidence (revised results)	Not rated	Not rated	Not rated	Not rated
Combined Impact Score	5.3			
Combined PES Score (%)	47%			
Combined Ecological Category	D			
Hectare Equivalents	7.0 Ha			

Table 6-3: Descriptions and definitions of the impact scores.

ECOLOGICAL CATEGORY	DESCRIPTION	IMPACT SCORE*	PES SCORE (%)*
A	Unmodified, natural.	0-0.9	90-00
B	Largely natural with few modifications. A slight change in ecosystem processes are discernible and a small loss of natural habitats and biota may have taken place.	1-1.9	80-89
C	Moderately modified. A moderate change in ecosystem processes and loss of natural habitats has taken place but the natural habitat remains predominantly intact	2-3.9	60-79
D	Largely modified. A large change in ecosystem processes and loss of natural habitat and biota and has occurred.	4-5.9	40-59
E	Seriously modified. The change in ecosystem processes and loss of natural habitat and biota is great but some remaining natural habitat features are still recognizable.	6-7.9	20-39
F	Critically modified. Modifications have reached a critical level, and the ecosystem processes have been modified completely with an almost complete loss of natural habitat and biota.	8-10	0-19

6.1.3. Non-perennial Streams

The habitat integrity of the two at-risk streams was assessed using the Kleynhans *et al.* (2008) Index of Habitat Integrity assessment methodology. The assessment produced a riparian habitat integrity score within category F (critically modified) and instream habitat integrity score within category E (seriously modified) for Stream 1. The majority of Stream 1 has been transformed into an agricultural channel which flows through the adjacent farm's vineyards. There is therefore limited to no natural riparian or instream habitat present. The catchment of this stream is predominantly vineyards. The assessment produced an instream and riparian habitat integrity score within category D (largely modified) for Stream 2. Stream 2 has been impacted by head cut erosion, dirt tracks through the stream, and vineyards which encroach into the stream. Catchment land use is predominantly natural although some has been transformed into residential development and vineyards.

The assessment results for the instream and riparian habitat are presented in **Table 6-4** and **Table 6-5** respectively. The definitions of the ecological categories are presented in **Table 6-6**.

Table 6-4: Instream IHI Score Rating Results.

CRITERIA	Drainage Line 1	Stream 2
Water Abstraction	16	12
Flow Modification	18	14
Bed Modification	18	16
Channel Modification	18	12
Water Quality	12	8
Extent of Inundation	8	8
Alien Macrophytes	0	0
Presence of exotic fauna	0	0
Solid Wate Disposal	0	0
Instream Habitat Integrity Score	18	52
Instream Integrity Category	**E**	**D**

Table 6-5: Riparian IHI Score Rating Results.

CRITERIA	Stream 1	Stream 2
Indigenous Vegetation Removal	12	8
Exotic Vegetation Encroachment	8	5
Bank Erosion	5	16
Channel Modification	18	8
Water Abstraction	16	10
Extent of Inundation	8	8
Flow Modification	16	10
Water Quality	12	8
Riparian Habitat Integrity Score	16	52
Riparian Integrity Category	**F**	**D**

Table 6-6: Descriptions and definitions of the integrity class scores.

HABITAT INTEGRITY CATEGORY	DESCRIPTION	RATING (% OF TOTAL)
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

6.2. Ecosystem Services

Seep wetlands typically provide moderate level of streamflow regulation (low flow augmentation / maintenance), nitrate removal (denitrification), and toxicant removal. The onsite seep provides moderate levels of streamflow regulation, sediment trapping, and nitrate removal. Although the catchment is largely natural, there are adjacent agriuclutral areas, dirt tracks and residential dwellings present. Additionally, the seep provides moderate levels of biodivirsity maintenance as the wetland vegetation types that coincide with the seep wetland has a high threat status (CR), there is high connectivity to the downstream CVB wetland, the ecological condition is moderate, and the area has high scenic beauty.

CVB wetlands typically provide moderate levels of flood attenuation, sediment trapping, phosphate removal (adsorption). The CVB wetland provides moderate levels of sediment trapping, erosion control, phosphate assimilation, and nitrate assimilation. The provision of water for human use was considered of moderate due to the largely natural upstream catchment resulting in easily treatable water for human consumption. The wetland provides moderately important biodiversity maintenance supporting services. The wetland vegetation types that coincides with the CVB wetland has a high threat status (CR), the CVB wetland is demarcated as a NFEPA wetland and occurs within a CBA. The area has high secenic beauty and the Onrus River also occurs downstream of the CVB wetland. The demand is considered to be very high however, due to the degradation of the wetland in the section considered for the proposed agriuclutre, the suppyl was moderate.

The assessment results are summarised in **Table 6-7** to **Table 6-8**. The score categories and their descriptions are provided in **Table 6-9**.

Table 6-7: The outcome of the ecosystem services assessment for the delineated seep wetland.

ECOSYSTEM SERVICE		Present State			
		Supply	Demand	Importance Score	Importance
REGULATING AND SUPPORTING SERVICES	Flood attenuation	1.3	0.6	0.1	Very Low
	Stream flow regulation	2.0	2.7	1.8	Moderate
	Sediment trapping	2.6	2.0	2.1	Moderate
	Erosion control	2.2	1.0	1.2	Low
	Phosphate assimilation	2.6	1.0	1.6	Moderately Low
	Nitrate assimilation	2.5	2.0	2.0	Moderate
	Toxicant assimilation	2.5	1.0	1.5	Moderately Low
	Carbon storage	1.5	2.7	1.3	Moderately Low
	Biodiversity maintenance	2.5	2.0	2.0	Moderate
PROVISIONING SERVICES	Water for human use	2.0	0.7	0.8	Low
	Harvestable resources	2.5	0.0	1.0	Low
	Food for livestock	3.0	0.3	1.7	Moderately Low
	Cultivated foods	1.8	0.0	0.3	Very Low
CULTURAL SERVICES	Tourism and Recreation	0.8	0.3	0.0	Very Low
	Education and Research	0.5	0.0	0.0	Very Low
	Cultural and Spiritual	3.0	0.0	1.5	Moderately Low

Table 6-8: The outcome of the ecosystem services assessment for the delineated CVB wetland.

ECOSYSTEM SERVICE		Present State			
		Supply	Demand	Importance Score	Importance
REGULATING AND SUPPORTING SERVICES	Flood attenuation	1.4	1.5	0.7	Very Low
	Stream flow regulation	1.5	1.3	0.7	Very Low
	Sediment trapping	2.5	2.0	2.0	Moderate
	Erosion control	2.3	2.0	1.8	Moderate

	Phosphate assimilation	2.4	2.0	1.9	Moderate
	Nitrate assimilation	2.3	2.0	1.8	Moderate
	Toxicant assimilation	2.4	1.0	1.4	Moderately Low
	Carbon storage	1.5	2.7	1.3	Moderately Low
	Biodiversity maintenance	1.6	4.0	2.1	Moderate
PROVISIONING SERVICES	Water for human use	2.4	1.7	1.7	Moderate
	Harvestable resources	2.0	2.0	1.5	Moderately Low
	Food for livestock	2.3	0.7	1.1	Low
	Cultivated foods	1.8	2.0	1.3	Moderately Low
CULTURAL SERVICES	Tourism and Recreation	0.8	0.7	0.0	Very Low
	Education and Research	0.3	0.0	0.0	Very Low
	Cultural and Spiritual	3.0	0.0	1.5	Moderately Low

Table 6-9: Score categories and descriptions.

Importance Category		Description
Very Low	0-0.79	The importance of services supplied is very low relative to that supplied by other wetlands.
Low	0.8 – 1.29	The importance of services supplied is low relative to that supplied by other wetlands.
Moderately-Low	1.3 – 1.69	The importance of services supplied is moderately-low relative to that supplied by other wetlands.
Moderate	1.7 – 2.29	The importance of services supplied is moderate relative to that supplied by other wetlands.
Moderately-High	2.3 – 2.69	The importance of services supplied is moderately-high relative to that supplied by other wetlands.
High	2.7 – 3.19	The importance of services supplied is high relative to that supplied by other wetlands.
Very High	3.2 - 4.0	The importance of services supplied is very high relative to that supplied by other wetlands.

6.3. Ecological Importance and Sensitivity

The seep and CVB wetland both achieved a median score of 2.0 which falls within the "Moderate" category. The results of the assessment and the reasoning behind the scores are presented in **Table 6-10**. The two non-perennial streams both achieved a median score of between 0 - 1.0 which falls within the "Low/Marginal" category. The results of the assessment and the reasoning behind the scores are presented in **Table 6-12**.

Table 6-10: Results of the EIS assessment.

Ecological Importance and Sensitivity	Seep	CVBW	Reason
	1.33	**1.33**	
Presence and status of Red Data species:	1	1	Given that both wetland vegetation types (Southwest Sandstone Fynbos and Southwest Ferricrete Fynbos) are CR, and largely natural surrounding catchment area, it is possible that SCCs may occur. However, none were noted.
Populations of unique species/uncommonly large populations of wetland species:	1	1	No unique species or uncommonly large populations were noted.
Migration/breeding/feeding sites: (Importance of the unit for migration, breeding sites and/or feeding):	2	2	Highly likely to be a breeding site for hardy amphibians and potential important corridor for faunal movement.
Landscape Scale (Median)	**2.00**	**2.00**	
Protection status of the wetland: (National (4), Provincial/Private (3), municipal (1 or 2), public area (0 or 1)	1	1	The wetlands are located within a privately owned property, which is not designated as protected area.
Protection status of the vegetation type: (SANBI guidance on the protection status of the surrounding vegetation)	3	3	Both wetland vegetation types (Southwest Sandstone Fynbos and Southwest Ferricrete Fynbos) associated with the wetlands are CR. Vegetation present is disturbed but has and should continue to reestablish.

Ecological Importance and Sensitivity	Seep	CVBW	Reason
Regional context of the ecological integrity: (Assessment of the PES (habitat integrity), especially considering regional utilisation)	2	1	PES – C for the seep. PES – D for the CVBW.
Size and rarity of the wetland type/s present: (Identification and rarity assessment of wetland types)	2	3	The CR status indicates slight rarity.
Diversity of habitat types: (Assessment of the variety of wetland types present within a site)	2	2	The onsite watercourse comprises a moderately diverse assemblage of aquatic vegetation with slight disturbance.
Sensitivity of the Wetland (Median)	**1.00**	**2.33**	
Sensitivity to changes in floods: (Floodplains at 4; valley bottoms 2 or 3; pans and seeps 0 or 1)	1	2	The CVBW may be sensitive to flooding. The seep is deemed not as sensitive to flooding.
Sensitivity to changes in low flows/dry season: (Unchanneled VB's probably most sensitive)	1	3	The CVBW is fed by interflow and surface runoff; changes in low flows/dry season could affect water quality/hydrology.
Sensitivity to changes in water quality: (Especially natural low nutrient waters – lower nutrients likely to be more sensitive)	1	1	The watercourses are located in a largely natural catchment within a naturally low nutrient system. The wetlands may be impacted by the adjacent agricultural activities.
Ecological Importance and Sensitivity Score	**2.0**	**2.0**	
Ecological Importance and Sensitivity Category	**Moderate**	**Moderate**	

Table 6-11: Results of the EIS assessment for the two Streams.

Determinant	Stream 1 Score (0-4)	Stream 2 Score (0-4)	Confidence (1-4)
PRIMARY DETERMINANTS			
Rare and endangered Species	0	0	3
Populations of unique Species	0	1	3
Species/taxon richness*	0	1	3
Diversity of habitat types or features*	0	1	4
Migration route/breeding and feeding site for riverine species: Importance in terms of the link it provides for biological functioning.	1	2	4
Sensitivity to changes in the natural hydrological regime*: Determined by the size of the feature, available habitat types and frequency of flood events.	0	1	3
Sensitivity to water quality changes*: Determined by the size of the feature, available habitat types and frequency of flood events.	0	1	3
Energy dissipation and particulate/element removal: Roughness coefficient/Storage capacity and size.	0	1	3
MODIFYING DETERMINANTS			
Protected status: Ramsar Site, National Park, Wilderness area and Nature Reserve.	0	0	4
Ecological integrity: Degree of change of the flood regime, water quality and habitat from reference conditions.	0	1	4
TOTAL	1	9	34
MEDIAN	0	1	3
OVERALL EIS	**Low/Marginal**	**Low/Marginal**	**High**

6.4. Recommended Ecological Category

According to the Rountree et al. (2013) method for determining REC, the management objective for any wetland within PES Category B, C or D with a "Low-marginal" or "Moderate" EIS score must be maintained in the pre-development PES category. In this case, the seep wetland has a PES of C and the CVB wetland has a PES of D, both wetlands have a Moderate EIS score, so the management objective should be to maintain the condition of the wetlands in the pre-development PES category. Stream 1 is located on an adjacent farm, and currently functions as an agricultural furrow. Stream 2's IHI is D and has Low/Marginal EIS. Therefore, the management objective should be to maintain within the pre-development category of D.

6.5. Buffer Determination

Based on the present and proposed activities on the site, along with the PES (largely - moderately modified), ecological importance and sensitivity (Moderate to High), and the REC of the watercourses, buffers have been recommended for the onsite watercourses. An appropriate buffer of 30 m for the seep wetland, and 20 m for the CVBW wetland and non-perennial stream 2, has been determined using the method described in the Buffer Zone Guidelines for Rivers, Wetlands and Estuaries (Macfarlane and Bredin, 2016). The onsite watercourses and buffer areas should be designated as No-Go areas for development on the site. The buffer areas should be rehabilitated (CVBW) / maintained (Seep and Stream 2) as dense indigenous fynbos.

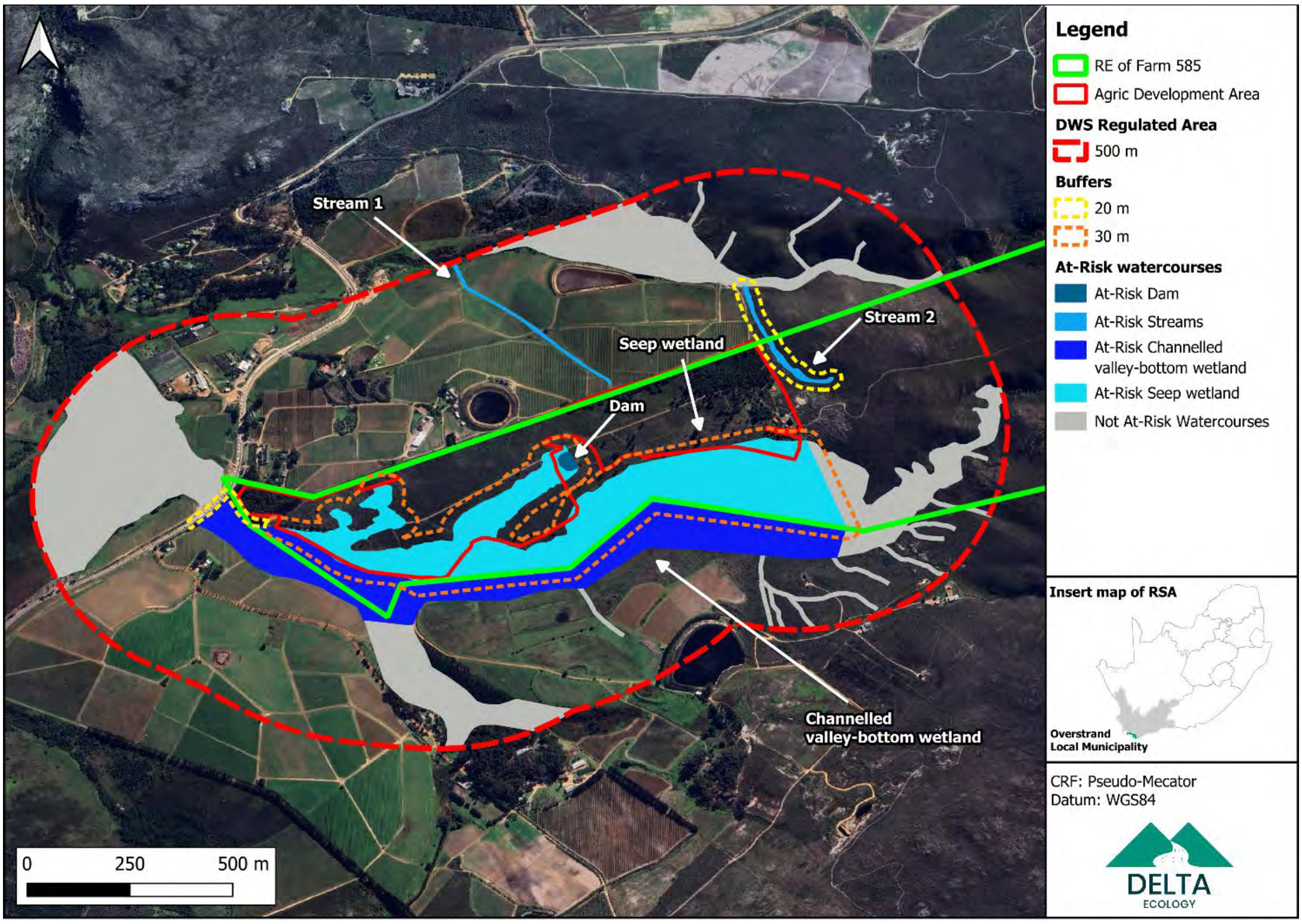

Figure 6-1: Buffers surrounding the at-risk watercourses.

7. Aquatic Impact Identification

The proposed project entails the establishment of a vineyard on the Remainder of Farm 585, Hemel en Aarde Valley.

At present there are two proposed development plans for the vineyard, Alternative 2 coincides with approximately 6.72 Ha of the seep wetland (**Figure 7-1**), while Alternative 3 avoids all onsite watercourses (**Figure 7-2**).

The following applicable activities are noted for the construction phase of the vineyard:

- Vegetation clearing to make way for the vineyard.
- Additionally tilling / ploughing for the vineyard trees to be planted.

The following applicable activities are noted for the operational phase of the vineyard:

- Maintenance largely consists of irrigating the vineyards during Summer (if necessary due to the high annual average rainfall of the region), along with several personnel walking each row, approximately 3 times a week.
- During harvest, which will occur in Summer (between December to February), several personnel will walk each row every day for approximately one - three months.

Direct construction and operational phase impacts are limited to Alternative 2; where the vineyard is proposed within portions of the seep wetland. Additionally, as the proposed vineyard for both alternatives is in the catchment area of all watercourses, indirect impacts may occur as a result of the development.

The potential impacts to the seep wetland and the CVB wetland as a result of the proposed vineyard include the following:

<u>*Construction & Operational Phase Impacts*</u>:

1. Wetland habitat disturbance within the onsite watercourses as a result of vegetation clearing, ploughing / tilling, and planting of the vineyards and ongoing maintenance thereof.
2. Alteration of flow within onsite watercourses due to ploughing / tilling within the wetland (seep) or within the catchment area of the watercourses.
3. Increased sediment input within onsite watercourses, due to vegetation clearing and ploughing / tilling within the wetland (seep) or within the catchment area of watercourses.
4. Water quality impairment due to potential spillage of hydrocarbons/contaminants due to the use of the access roads / machinery in proximity to the onsite watercourses.

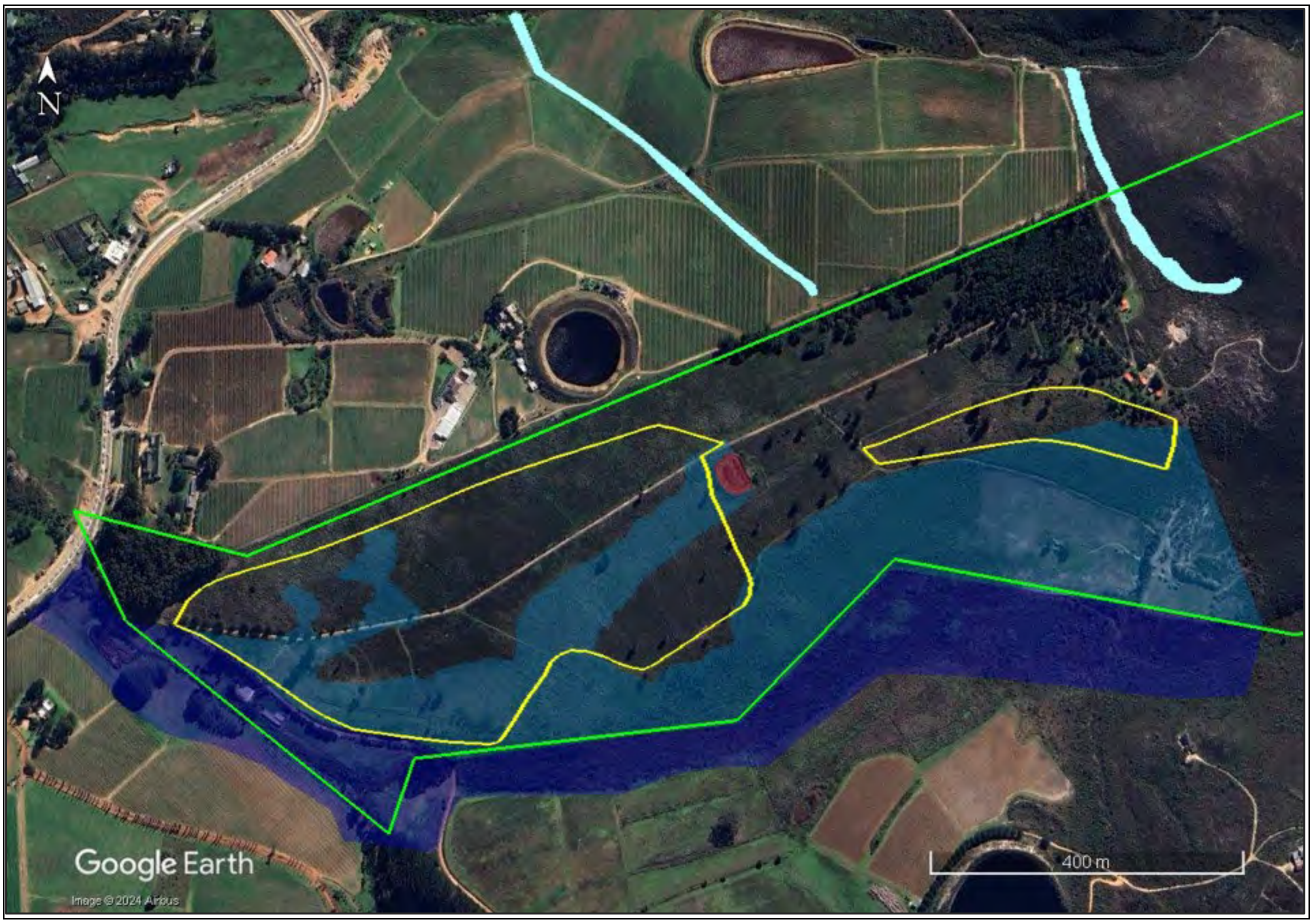

Figure 7-1: Proposed agricultural area alternative 2 overlain with delineated watercourses.

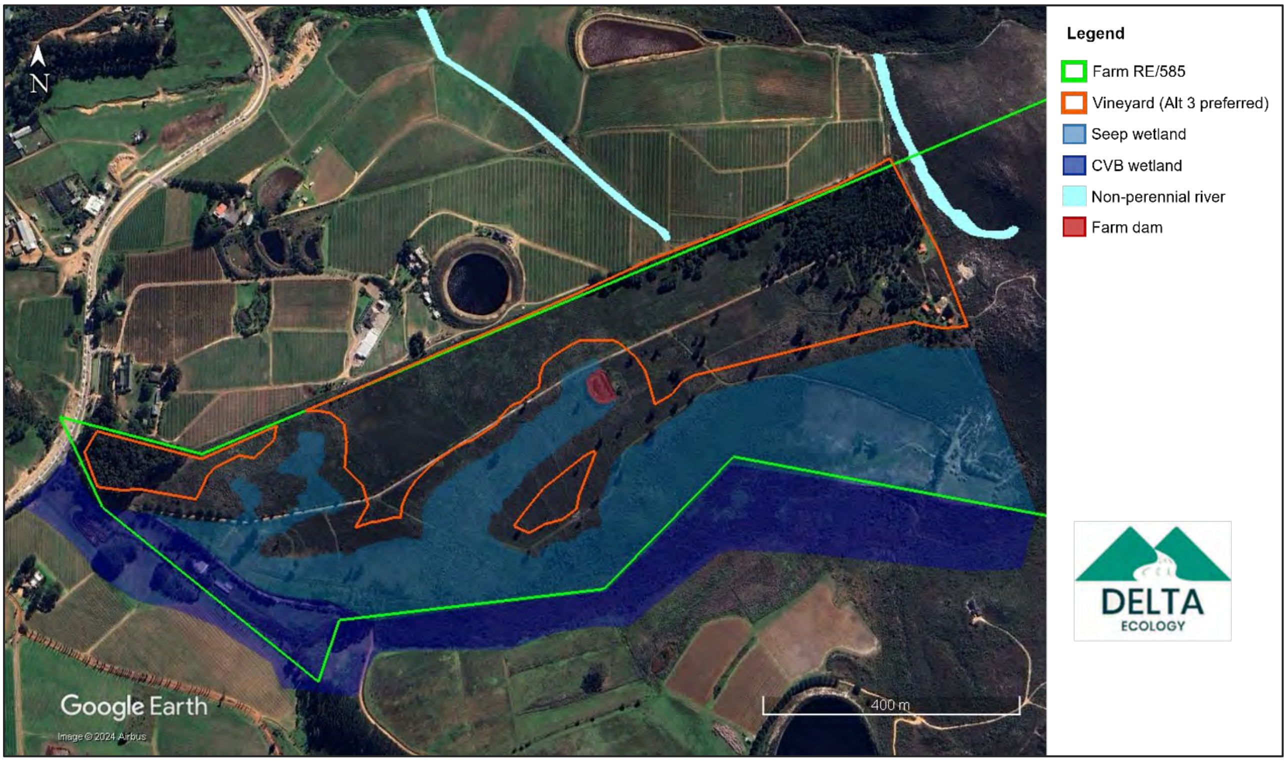

Figure 7-2: Proposed agricultural area alternative 3 overlain with delineated watercourses.

8. Impact Assessment

Recommended mitigation and management measures are provided in **Section 8-4**. This section should be read in conjunction with **Section 8-4** of this report.

The four potential aquatic impacts identified in Section 7 were assessed first without, and then with, application of mitigation measures, for the proposed alternatives. The construction and operational phase impacts of habitat disturbance, flow regime alteration and sedimentation for Alternative 2 were determined to be of "Medium" significance both prior and after implementing mitigation measures, while all the post-mitigation scores fell within the "Low" significance categories for impacts relating to Alternative 3.

Alternative 1 i.e. the "no go" scenario was assessed and found to be of "Low" impact significance as this scenario would result in continuation of existing impacts to the onsite watercourses due to the onsite disturbance (dirt tracks, dams, residential dwellings) and adjacent land uses.

8.1. Alternative 1: No-Go Scenario

Table 8-1: Assessment results for the "No Go" Scenario

"No Go" Scenario				
Description		**Although it is unknown whether the site would be further developed in future, it is assumed that the area would remain as is, which is in a moderately disturbed condition. The No-Go option would result in the continuation of impact to the onsite watercourses due to current onsite and adjacent land uses – and would therefore still result in negative impact to the watercourses onsite.**		
Mitigation Measures		**None**		
	Impact Without Mitigation		**Impact With Mitigation**	
Consequence				
Intensity of Impact	2	Low / Slightly Harmful	0	Not Applicable
Duration of Impact	5	Beyond 20 years / Permanent	0	Not Applicable
Extent / spatial scale of impact	1	Limited to project site	0	Not Applicable
Reversibility	1	Passive restoration / High likelihood of success	0	Not Applicable
Loss of irreplaceable resources	1	None	0	Not Applicable

Cumulative Impact	1	Very Low	0	Not Applicable
Probability				
Frequency of the Activity	1	Once off activity / less than once in 20 years	0	Not Applicable
Likelihood of the Incident / Impact occurring	3	Possible	0	Not Applicable
Impact Significance				
Consequence	1,72	Low	0,00	Not Applicable
Probability	2	Low	0,00	Not Applicable
Impact Significance	**1,78**	**Low**	**0,00**	**Not Applicable**

8.2. Alternative 2: Construction & Operational Phase

Table 8-2: Assessment results for Impact 1

Impact 1: Watercourse Habitat Loss / Disturbance				
Description		**Currently the proposed agricultural development Alternative 2 will cause wetland habitat loss / disturbance within the seep wetland, due to the clearing of native wetland vegetation and subsequent ploughing and tilling to create the vineyard.**		
Mitigation Measures		**Not Applicable**		
	Impact Without Mitigation		**Impact With Mitigation**	
Consequence				
Intensity of Impact	4	High / Very Harmful	-	NA
Duration of Impact	4	5 to 20 years	-	NA
Extent / spatial scale of impact	1	Limited to project site	-	NA
Reversibility	3	Moderate cost / Moderate likelihood of success	-	NA
Loss of irreplaceable resources	3	Medium	-	NA

Cumulative Impact	3	Medium	-	NA
Probability				
Frequency of the Activity	4	Monthly to annually	-	NA
Likelihood of the Incident / Impact occurring	5	Definite	-	NA
Impact Significance				
Consequence	2,90	Low	-	NA
Probability	5,00	Very High	-	NA
Impact Significance	**3,32**	**Medium**	**-**	**NA**

Table 8-3: Assessment results for Impact 2.

Impact 2: Altered flow regime				
Description		**Site clearance and ploughing/tilling within the seep will lead to alteration of the flow regime. The ploughing/tilling within the wetland (seep), and within all onsite watercourses' catchment area, will likely result in diversion and concentration of flow due to the created berms, while the clearance of indigenous wetland / terrestrial vegetation and slight soil compaction will likely increase / divert flow downstream into the CVBW, and two non-perennial streams.**		
Mitigation Measures		**Refer to Section 8-4.**		
	Impact Without Mitigation		**Impact With Mitigation**	
Consequence				
Intensity of Impact	4	High / Very Harmful	3	Medium / Harmful
Duration of Impact	4	5 to 20 years	4	5 to 20 years
Extent / spatial scale of impact	1	Limited to project site	1	Limited to project site
Reversibility	3	Moderate cost / Moderate likelihood of success	3	Moderate cost / Moderate likelihood of success

Loss of irreplaceable resources	3	Medium	3	Medium
Cumulative Impact	3	Medium	2	Low
Probability				
Frequency of the Activity	4	Monthly to annually	4	Monthly to annually
Likelihood of the Incident / Impact occurring	5	Definite	5	Definite
Impact Significance				
Consequence	2,90	Medium	2,45	Low
Probability	5,00	Very High	5,00	Very High
Impact Significance	**3,32**	**Medium**	**2,96**	**Medium**

Table 8-4: Assessment results for Impact 3.

Impact 3: Increased sediment input				
Description		**Soil disturbance during clearing and ploughing/tilling will make loose soil available for transport in runoff. Vegetation clearing will increase runoff volumes and velocities allowing for larger grain sizes to be transported into the onsite watercourses**		
Mitigation Measures		**Refer to Section 8-4.**		
	Impact Without Mitigation		**Impact With Mitigation**	
Consequence				
Intensity of Impact	4	High / Very Harmful	3	Medium / Harmful
Duration of Impact	4	5 to 20 years	4	5 to 20 years
Extent / spatial scale of impact	1	Limited to project site	1	Limited to project site

Reversibility	3	Moderate cost / Moderate likelihood of success	2	Moderate cost / Moderate likelihood of success
Loss of irreplaceable resources	3	Medium	2	Low
Cumulative Impact	3	Medium	2	Low
Probability				
Frequency of the Activity	4	Monthly to annually	4	Monthly to annually
Likelihood of the Incident / Impact occurring	5	Definite	5	Definite
Impact Significance				
Consequence	2,90	Medium	2,27	Low
Probability	5,00	Very High	5,00	Very High
Impact Significance	**3,32**	**Medium**	**2,81**	**Medium**

Table 8-5: Assessment results for Impact 4.

Impact 4: Water quality impairment				
Description		**Accidentally spilled chemicals, or petrochemicals from farm vehicles or machinery may find their way into the onsite watercourses. Dumping and littering may occur during construction and operation.**		
Mitigation Measures		**Refer to Section 8-4.**		
	Impact Without Mitigation		**Impact With Mitigation**	
Consequence				
Intensity of Impact	3	Medium / Harmful	3	Medium / Harmful
Duration of Impact	2	One month to one year	1	Up to 1 month

Extent / spatial scale of impact	1	Limited to project site	1	Limited to project site
Reversibility	2	Low-cost rehabilitation / Moderately high likelihood of success	1	Passive restoration / High likelihood of success
Loss of irreplaceable resources	2	Low	1	None
Cumulative Impact	2	Low	1	Very Low
Probability				
Frequency of the Activity	4	Monthly to annually	3	1 to 5 years
Likelihood of the Incident / Impact occurring	3	Possible	3	Possible
Impact Significance				
Consequence	2,09	Low	1,72	Low
Probability	3,5	Low	3,00	Low
Impact Significance	**2,37**	**Low**	**1,98**	**Low**

8.3. Alternative 3: Construction & Operational Phase

Table 8-6: Assessment results for Impact 1.

Impact 1: Watercourse Habitat Disturbance		
Description		**The movement of vehicles, machinery, and personnel during construction, the setting up of the establishment of temporary access roads as well as the inappropriate storage or dumping of excavated material and removed vegetation in areas of open space surrounding the agricultural footprint may result in the disturbance of the onsite watercourses. This disturbance may result in the loss of vegetation and will encourage the proliferation of AIPS. There may be slight habitat disturbance due to the ongoing maintenance / irrigating of the vineyard (from farm workers) and harvesting activities.**
Mitigation Measures		**Refer to Section 8-4.**
	Impact Without Mitigation	**Impact With Mitigation**
Consequence		

Intensity of Impact	4	High / Very Harmful	3	Medium / Harmful
Duration of Impact	4	5 to 20 years	4	5 to 20 years
Extent / spatial scale of impact	1	Limited to project site	1	Limited to project site
Reversibility	3	Moderate cost / Moderate likelihood of success	1	Passive restoration / High likelihood of success
Loss of irreplaceable resources	3	Medium	1	None
Cumulative Impact	3	Medium	1	Very Low
Probability				
Frequency of the Activity	4	Monthly to annually	4	Monthly to annually
Likelihood of the Incident / Impact occurring	4	Likely	3	Possible
Impact Significance				
Consequence	2,90	Medium	2,00	Low
Probability	4,00	Very High	3,50	Medium
Impact Significance	**3,12**	**Medium**	**2,30**	**Low**

Table 8-7: Assessment results for Impact 2.

Impact 2: Altered flow regime				
Description		**The site clearance, ploughing/tilling within onsite watercourse's catchment area, may result in diversion and concentration of flow due to the created berms, while the clearance of indigenous terrestrial vegetation and slight soil compaction likely increased flow downstream.**		
Mitigation Measures		**Refer to Section 8-4.**		
	Impact Without Mitigation		**Impact With Mitigation**	
Consequence				
Intensity of Impact	4	High / Very Harmful	3	Medium / Harmful

Duration of Impact	4	5 to 20 years	4	5 to 20 years
Extent / spatial scale of impact	1	Limited to project site	1	Limited to project site
Reversibility	3	Moderate cost / Moderate likelihood of success	2	Low-cost rehabilitation / Moderately high likelihood of success
Loss of irreplaceable resources	3	Medium	2	Low
Cumulative Impact	3	Medium	2	Low
Probability				
Frequency of the Activity	4	Monthly to annually	4	Monthly to annually
Likelihood of the Incident / Impact occurring	4	Likely	3	Possible
Impact Significance				
Consequence	2,90	Medium	2,27	Low
Probability	4,00	Very High	3,5	Medium
Impact Significance	**3,12**	**Medium**	**2,51**	**Low**

Table 8-8: Assessment results for Impact 3.

Impact 3: Increased sediment input		
Description	**Soil disturbance during any maintenance work may result in loose soil available for transport in runoff. Sediment laden stormwater runoff from the ploughed catchment will likely lead to sedimentation within downstream watercourses predominantly during the rainy season.**	
Mitigation Measures	**Refer to Section 8-4.**	
	Impact Without Mitigation	**Impact With Mitigation**
Consequence		

Intensity of Impact	4	High / Very Harmful	3	Medium / Harmful
Duration of Impact	4	5 to 20 years	4	5 to 20 years
Extent / spatial scale of impact	1	Limited to project site	1	Limited to project site
Reversibility	3	Moderate cost / Moderate likelihood of success	2	Low-cost rehabilitation / Moderately high likelihood of success
Loss of irreplaceable resources	3	Medium	2	Low
Cumulative Impact	3	Medium	2	Low
Probability				
Frequency of the Activity	4	Monthly to annually	4	Monthly to annually
Likelihood of the Incident / Impact occurring	4	Likely	3	Possible
Impact Significance				
Consequence	2,90	Medium	2,27	Low
Probability	4,00	Very High	3,5	Medium
Impact Significance	**3,12**	**Medium**	**2,51**	**Low**

Table 8-9: Assessment results for Impact 4.

Impact 4: Water quality impairment		
Description	**Accidentally spilled chemicals, or petrochemicals from farming vehicles or machinery (if applicable) may find their way into the onsite watercourses. Dumping or littering may occur in the onsite watercourses.**	
Mitigation Measures	**Refer to Section 8-4.**	
	Impact Without Mitigation	**Impact With Mitigation**

Consequence				
Intensity of Impact	3	Medium / Harmful	3	Medium / Harmful
Duration of Impact	2	One month to one year	1	Up to 1 month
Extent / spatial scale of impact	1	Limited to project site	1	Limited to project site
Reversibility	2	Low-cost rehabilitation / Moderately high likelihood of success	1	Passive restoration / High likelihood of success
Loss of irreplaceable resources	2	Low	1	None
Cumulative Impact	2	Low	1	Very Low
Probability				
Frequency of the Activity	4	Monthly to annually	3	1 to 5 years
Likelihood of the Incident / Impact occurring	3	Possible	3	Possible
Impact Significance				
Consequence	2,09	Low	1,72	Low
Probability	3,5	Low	3,00	Low
Impact Significance	**2,37**	**Low**	**1,98**	**Low**

8.4. Proposed Mitigation and Management Measures

The following mitigation and management measures are recommended:

- In terms of Alternative 3, the delineated watercourses should be set aside as No – Go areas for the proposed construction and operational phases of the vineyard. *This is not possible for Alternative 2.*
- The western portion of the CVB wetland located closest to the proposed vineyard should be surrounded by a 20 m No Go buffer. This buffer area should be planted with indigenous fynbos to prevent sedimentation and attenuate stormwater peak flows to the downstream CVB wetland.
- The seep wetland should be surrounded by a 30 m No Go buffer, which is maintained as dense fynbos.
- Stream 2 should be surrounded by a 20 m No Go buffer, which is maintained as dense fynbos.
- The buffer areas should be regularly monitored (once a month) to ensure that the vegetation is healthy; and that no Alien Invasive Plant Species colonize this area.
- Any dumping / littering within the No Go areas is strictly prohibited.
- Effective stormwater management should be implemented, which ensures that sediment laden stormwater flow from the vineyard, particularly during storm events, does not enter downslope watercourses. A regular monitoring system should be set up by the farm manager which ensures that if sedimentation does occur downslope, remediation measures are implemented.
- Erosion should be monitored for and addressed immediately, especially after rainfall events. Implement erosion control measures if / where required. Examples of erosion control measures may include:
- Covering steep/unstable/erosion prone areas with geotextiles.
- Covering areas prone to erosion with brush packing, straw bales, mulch.
- Stabilizing cleared/disturbed areas susceptible to erosion with sandbags.
- Constructing silt fences / traps in areas prone to erosion, to retain sediment-laden runoff. Silt fences must be adequately maintained. Furthermore, the farm manager must monitor sediment fences / traps after every heavy rainfall event and any sediment that has accumulated must be removed by hand.
- Regenerative and sustainable farming practises are encouraged within the farm, without the use of herbicides and pesticides.
- All farming machinery and vehicles used within the farm should be regularly serviced.
- Clean up any spillages immediately with the use of a chemical spill kit and dispose of contaminated material at an appropriately registered facility.
- Provide portable toilets where work is being undertaken (1 toilet per 10 workers). These toilets must be located within an area designated by the farm manager outside of the no-go areas, should preferably be located on level ground, and must be regularly serviced and maintained.
- Provide an adequate number of bins on site and encourage construction personnel to dispose of their waste responsibly.
- Waste generated by farm personnel must be removed from the site and disposed of at a registered waste disposal facility on a weekly basis.

9. Risk Assessment

The completed RAM is attached as **Annexure 3**. The RAM prescribed by GN 4167 of 2023 was applied to the onsite agricultural activities with the following outcomes:

1. The risks associated with all four impacts relating to Alternative Layout 2 were all found to be of "Medium" Significance, apart from potential water quality impairment. This alternative is least preferred and would require a full Water Use License Application (WULA).
2. The risks associated with all four impacts relating to Alternative Layout 3 were all found to be of "Low" Significance due to the following:

- The onsite watercourses; along with relevant buffer areas surrounding the watercourses, will be avoided by the proposed vineyard.
- Additional mitigation and management measures as per Section 8-4 will result in low risk to onsite watercourses.
- Section c and i water uses associated with Alternative 3 can therefore be authorised under a GA.

10. Conclusion and Recommendation

This report sets out the results from a desktop analysis, as well as a field assessment conducted on the 9th of September 2024, to assess the potential aquatic impacts associated with the proposed agricultural development on the RE of Farm 585, Hemel en Aarde Valley, Western Cape.

A CVB wetland associated with the Antjies River was confirmed along the southern boundary of the proposed agricultural area. Additionally, a seep wetland, two small non-perennial streams, and small farm dam were also confirmed within / within proximity of the proposed agricultural area.

In this impact assessment, the delineated at-risk watercourses were assessed using current best practice assessment methodologies to determine the PES, IHI, EIS, WES, and REC metrics. The results of these assessments are as follows:

Table 10-1: Results of the watercourse status quo assessment.

	PES	EIS	WES (Highest)	REC
Seep Wetland	C	Moderate	Moderate	C
CVB Wetland	D	Moderate	Moderate	D
Stream 1	E/F	Low/Marginal	-	N/A
Stream 2	D	Low/Marginal	-	D

Aquatic biodiversity impacts associated with the development were identified and assessed using both an impact assessment methodology compliant with NEMA requirements and the RAM prescribed by GN4167 of 2023.

The four potential aquatic impacts identified in Section 7 were assessed first without, and then with, application of mitigation measures, for the proposed alternatives. The construction and operational phase impacts of habitat disturbance, flow regime alteration and sedimentation for Alternative 2 were determined to be of "Medium" significance both prior and after implementing mitigation measures. All the post-mitigation scores fell within the "Low" significance category for impacts relating to Alternative 3.

Alternative 1 i.e. the "no go" scenario was assessed and found to be of "Low" impact significance as this scenario would result in continuation of existing impacts to the onsite watercourses due to the onsite disturbance (dirt tracks, dams, residential dwellings) and adjacent land uses.

In terms of the NWA (Act 36 of 1998) and its regulations, a Water Use Authorisation (WUA) will be required for any development within 500 m of the wetlands, that is deemed to impede / divert the flow or alter the bed, banks, course, or characteristics of the watercourses. The risks associated with all four impacts relating to Alternative Layout 2 were found to be of "Medium" Significance, apart from potential water quality impairment. This alternative is least preferred and would require a full Water Use License Application (WULA).

The risks associated with all four impacts relating to Alternative Layout 3 were found to be of "Low" Significance. Section c and i water uses associated with Alternative 3 can therefore be authorised under a GA.

Alternatives 1 and 3 are therefore preferred from an aquatic perspective. It is the opinion that the proposed agricultural area as Alternative 3 can be approved with the implementation of the recommended mitigation and management measures in this report.

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Annexure 1: Ecosystem Services

Table A1: Ecosystem Services included in the WET-EcoServices v.2 (Kotze *et al*., (2020)).

Services contributing to indirect benefits	Regulating and supporting services	Flood attenuation		The spreading out and slowing down of floodwaters in the wetland/riparian area, thereby reducing the severity of floods downstream (Adamus et al. 1987; MEA 2005)
Services contributing to indirect benefits	Regulating and supporting services	Streamflow regulation		Sustaining streamflow during low flow periods (McInnes and Everard 2017)
Services contributing to indirect benefits	Regulating and supporting services	Water quality enhancement services	Sediment trapping	The trapping and retention in the wetland/riparian area of sediment carried by runoff water (Adamus et al. 1987)
Services contributing to indirect benefits	Regulating and supporting services	Water quality enhancement services	Phosphate assimilation	Removal by the wetland/riparian area of phosphates carried by runoff water, thereby enhancing water quality (O'Geen et al. 2010)
Services contributing to indirect benefits	Regulating and supporting services	Water quality enhancement services	Nitrate assimilation	Removal by the wetland/riparian area of nitrates carried by runoff water, thereby enhancing water quality (O'Geen et al. 2010)
Services contributing to indirect benefits	Regulating and supporting services	Water quality enhancement services	Toxicant assimilation	Removal by the wetland/riparian area of toxicants (e.g. metals, biocides and salts) carried by runoff water, thereby enhancing water quality (O'Geen et al. 2010)
Services contributing to indirect benefits	Regulating and supporting services	Water quality enhancement services	Erosion control	Controlling of erosion at the wetland/riparian area, principally through the protection provided by vegetation (MEA 2005).
Services contributing to indirect benefits	Regulating and supporting services	Carbon storage		The trapping of carbon by the wetland/riparian area, principally as soil organic matter (Kumar et al. 2017)
Services contributing to indirect benefits	Biodiversity maintenance[1]			Through the provision of habitat and maintenance of natural process by the wetland/riparian area, a contribution is made to maintaining biodiversity (Liquete et al. 2016)
Services contributing to direct benefits	Provisioning services	Provision of water for human use		The provision of water which is taken directly from the wetland/riparian area for domestic, agriculture or other purposes (Kumar et al. 2017)
Services contributing to direct benefits	Provisioning services	Provision of harvestable resources		The provision of natural resources from the wetland/riparian area - including craft plants, fish, wood, etc. (McInnes and Everard 2017)
Services contributing to direct benefits	Provisioning services	Food for livestock		The provision of grazing for livestock (McInnes and Everard 2017)
Services contributing to direct benefits	Provisioning services	Provision of cultivated foods		The provision of cultivated foods from within the wetland/riparian area (McInnes and Everard 2017)
Services contributing to direct benefits	Cultural (non-material) services	Cultural and spiritual experience		Places of special cultural significance in the wetland/riparian area - e.g. for baptisms or gathering of culturally significant plants (McInnes and Everard 2017)
Services contributing to direct benefits	Cultural (non-material) services	Tourism and recreation		Sites of value for tourism and recreation in the wetland/riparian area, often associated with scenic beauty and abundant birdlife (McInnes and Everard 2017)[2]
Services contributing to direct benefits	Cultural (non-material) services	Education and research		Sites of value in the wetland/riparian area for education or research (McInnes and Everard 2017)

[1]It is recognized that biodiversity maintenance is not an ecosystem service in the strict sense (Liquete *et al.* 2016) and is framed in less anthropocentric terms than all the other services, but it underpins many other services and is widely acknowledged as having high value to society broadly, even in the absence of any local or downstream beneficiaries.

[2]WET-EcoServices focuses on recreational services which are specifically nature-based, e.g., bird watching. It does not account specifically for recreational services from wetland/riparian areas that have been converted into sports grounds, children's playgrounds, or other built infrastructure.

Annexure 2: Impact Assessment Methodology

Impact assessment methodologies are based on qualitative ratings of the various factors and represent a standardised method for presenting a substantiated specialist opinion regarding the significance of a particular class of impact. Delta Ecology has developed a rapid numerical impact assessment methodology, applied in this report, that incorporates a range of factors commonly assessed to which numerical values from 1 to 5 are assigned to each rating category. Six primary factors are used to determine Consequence, and two primary factors are used to determine Probability. These two secondary factors are used to determine Impact Significance for each identified impact. Consequence, Probability and Impact Significance are determined by a set of formulae which incorporate weightings for each primary and secondary factor.

The weightings for each factor were determined by application of the formulae to over 50 pre-existing ecological impact assessments. These assessments employed other methodologies and were accepted by the relevant environmental authorities. These assessments were primarily from reports drafted by Delta Ecology staff during previous employment, but also included unrelated ecological impact assessments freely available on the internet. The weighting system has therefore been derived as a means of real-world formula calibration rather than by logic alone. The final methodology achieves impact significance ratings that are consistently in line with industry standards.

Key elements of the approach include a detailed description of the nature of the impact and of the proposed mitigation measures, assessment of each factor for both the "with mitigation" and "without mitigation" scenarios and includes the provision of a rationale for each rating where appropriate. The resulting impact significance ratings may be adjusted, if necessary, in accordance with specialist opinion, given adequate motivation for the deviation from the standard methodology.

The various factors, formulae and weightings are provided in the table below:

Scoring of impacts			
Factor	**Weighting**	**Score**	**Description/Rating**
Consequence	**8**		
Intensity	4	1	Very Low / Non-harmful
		2	Low / Slightly Harmful
		3	Medium / Harmful
		4	High / Very Harmful
		5	Very High / Disastrous
Duration	1	1	Up to 1 month
		2	1 month to 1 year
		3	One year to 5 years
		4	5 to 20 years
		5	Beyond 20 years / Permanent
Spatial scale/extent	3	1	Limited to project site
		2	Limited to local catchment
		3	Multiple local catchments
		4	Limited to quaternary catchment
		5	Regional, National, International

Reversibility	1	1	Passive restoration / High likelihood of success
		2	Low-cost rehabilitation / Moderately high likelihood of success
		3	Moderate cost / Moderate likelihood of success
		4	High cost / Low likelihood of success
		5	Very high cost / Very low likelihood of success
Loss of irreplaceable resources	1	1	None
		2	Low
		3	Medium
		4	High
		5	Very High
Cumulative Impact	1	1	Very Low
		2	Low
		3	Medium
		4	High
		5	Very High
Probability	**2**		
Frequency of the activity	1	1	Once off activity / less than once in 20 years
		2	5 to 20 years
		3	1 to 5 years
		4	Monthly to annually
		5	Weekly to Monthly
Likelihood of the Incident / Impact occurring	1	1	Highly unlikely
		2	Unlikely
		3	Possible
		4	Likely
		5	Definite
Consequence = (Intensity x 4) + Duration + (Extent x 3) + Reversibility + Loss of Irreplaceable Resources + Cumulative Impact) / 11			
Probability = (Frequency + Probability) / 2 OR = 5 where likelihood is definite			
Impact Significance = (Consequence x 8) + (Likelihood x 2) / 10			
Impact Significance Categories			
0 - 1.5			Very Low
1.6 - 2.5			Low
2.6 - 3.5			Medium
3.6 - 4.5			High
4.5 and above			Very High

Annexure 3: DWS RISK ASSESSMENT