Freshwater Risk and Impact Assessment

Agricultural Development on Farm Rocklands 57/633, Hermanus

For: Lornay Environmental Consulting

November 2024

Report Information

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Executive Summary

The landowner of Portion 57 of Rocklands Farm 633 located 12 km east of Hermanus within the Western Cape Province, cleared and developed a macadamia nut orchard on approximately 9 ha of the 49-ha farm. Following an investigation conducted by the Department of Environmental Affairs and Development Planning (DEADP), it was determined that the landowner had commenced with National Environmental Management Act (NEMA) (Act 107 of 1998) listed activities on the farm without the necessary Environmental Authorisation (EA). In response to the unauthorised activities, Lornay Environmental Consulting has been appointed to submit a Section 24G (S24G) application to obtain the requisite retrospective EA.

Furthermore, according to the Department of Forestry, Fisheries and the Environment (DFFE) web-based environmental screening tool report generated for the site, the Combined Aquatic Biodiversity Theme Sensitivity is classified as "Very High" (DFFE, 2024). The classification trigger is the location of a mapped National Wetland Map Version 5 (NWM5) South Coast Fynbos Bioregion seep wetland and associated Western Cape Biodiversity Spatial Plan (WCBSP, 2017) Aquatic Critical Biodiversity Area 1 (CBA) within the site. Additionally, the site is located within a Strategic Water Source Area (SWSA) for Surface Water (Boland). Following the Terrestrial Biodiversity assessment of the site, it was determined that the extent of the mapped NWM5 seep is underrepresented and recommended that an Aquatic Biodiversity Assessment is undertaken (van Rensburg, 2024).

Lornay Environmental Consulting has subsequently appointed Delta Ecology to conduct a retrospective Freshwater Risk and Impact Assessment, with the aim of assessing the likely impacts of the unauthorised onsite activities and to identify suitable mitigation / remediation measures where and as needed.

The **at-risk watercourses** were classified and delineated during a site assessment on the 10th of September 2024 during Spring (**Figure i**). Two ephemeral drainage lines were confirmed and delineated, approximately 15 m east (Ephemeral Stream 1) and 10 m west (Ephemeral Stream 2) of the onsite agricultural activities (macadamia nut orchard). Associated with the eastern stream (Ephemeral Stream 1) is a natural seepage wetland (Seep Wetland 1). This seep wetland is a continuation of a larger seep wetland system that extends to neighbouring properties of Farm 57/633. Much of the agricultural area indicated wetland conditions, and following the investigation of historical aerial imagery, it was confirmed that two farm dams (Dam 1 and Dam 2), as well as overflow associated with an artificial furrow on the property**,** have resulted in artificial seepage areas (Seep Wetland 2). Historical imagery indicates that the artificial Seep wetland 2 was largely dominated by AIS prior to the macadamia nut orchard. After the development of the macadamia nut orchard, sparse indigenous wetland vegetation has established between the trees, and it is likely that this seepage area is currently augmented by the irrigation of the trees. This artificial seepage area may therefore have been smaller in extent prior to the establishment of the orchard.

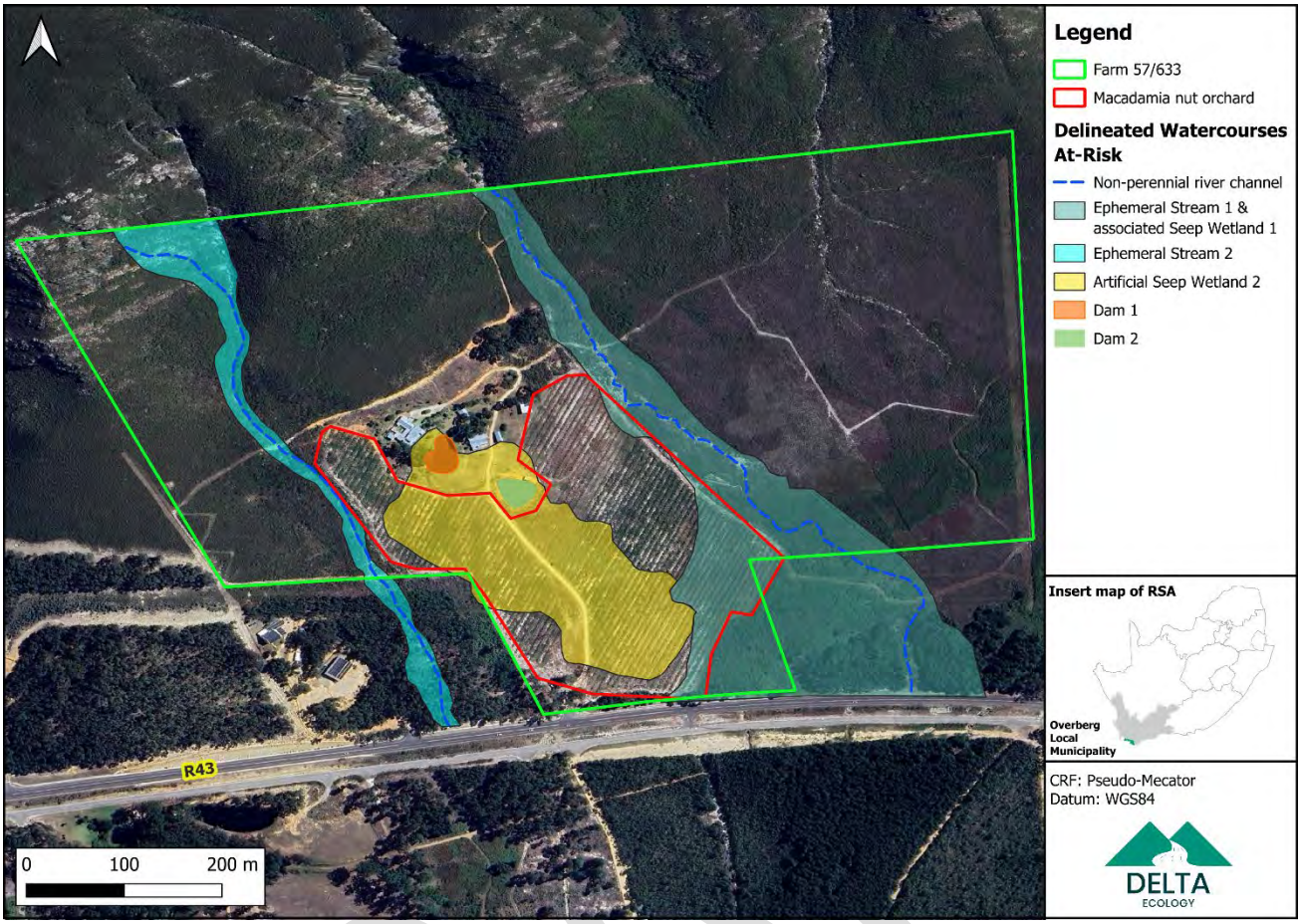

Figure i: Delineation of the at-risk watercourses on Farm 57/633, associated with the onsite activities.

The agricultural activities primarily affected the natural seep wetland associated with the eastern ephemeral stream (Seep Wetland 1) and the artificial seepage below the dam (Seep Wetland 2). The field assessment conducted confirmed that the two ephemeral streams were unlikely to be directly impacted, although a small amount of sedimentation and flow modification could have occurred due to the clearing and planting within the stream's catchment area.

In this study, the at-risk watercourses were assessed using current best practice methodologies to determine the Present Ecological State (PES), Habitat Integrity Assessment (IHI), Ecological Importance and Sensitivity (EIS), Wetland Ecosystem Services (WES) both prior to the development of the macadamia nut orchard– i.e. the pre-construction seep wetlands/streams, as well as in its current form – i.e. the post-construction seep wetlands/streams. These metrics were then used to determine the management objective expressed in terms of the Recommended Ecological Category (REC). The results of these assessments are as follows:

Table i: Results of the watercourse status quo assessment.

	PES	EIS	WES	REC
Seep wetland 1 pre orchard	**High Category C**	High	Moderately High	B
Seep wetland 1 post orchard	**Low Category C**	High	Moderately High	B
Seep wetland 2 (pre and post orchard)	**NA**	Low Marginal	Moderately Low	NA
Drainage lines pre orchard	**B**	Moderate	Moderately High	B
Drainage lines post orchard	**B**	Moderate	Moderately High	B

Aquatic biodiversity impacts associated with the development were identified and assessed using both an impact assessment methodology compliant with NEMA requirements. The construction and operational phase impacts of habitat disturbance, flow regime alteration and sedimentation within Seep Wetland 1 were determined to be of "Medium" significance both prior and subsequent to implementing mitigation measures, while all of the post-mitigation scores fell within the "Low" or "Very Low" significance categories for impacts relating to Seep Wetland 2 and the ephemeral streams. The 'no go' scenario was not assessed as the activities have already occurred.

In terms of the National Water Act (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 or 100 m of the drainage lines, that is deemed to impede / divert the flow or alter the bed, banks, course, or characteristics of the watercourses. The Risk Assessment Matrix (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 the artificial Seep Wetland 2 and ephemeral streams were all found to be of "Low" Significance due to the following:
    - Seep wetland 2 is an artificial system and it is highly unlikely that there was a pristine, diverse indigenous community of wetland vegetation associated with this artificial seepage prior to onsite agricultural activities. After the development of the macadamia nut orchard, sparse indigenous wetland vegetation has reestablished between the trees.
    - The wetland is fed by a stream diversion and therefore its hydrology is entirely artificial in nature.
    - It is likely that this seepage area is currently augmented by the irrigation of the macadamia nut trees. This artificial seepage area may therefore have been smaller in extent prior to the establishment of the orchard.
    - After the site assessment, no significant direct impacts were observed within the two ephemeral streams as a result of the orchard. Limited flow alteration and sedimentation may have occurred, but this was of Low Significance to these two streams that were, and are currently, in a largely natural condition (both prior and subsequent to the orchard establishment).
2. The construction and operational phase risk of habitat disturbance, flow regime alteration and sedimentation within Seep Wetland 1 were determined to be of "Medium" significance, thereby requiring a full Water Use License Application (WULA).

Noted during the site assessment was the ongoing clearance of AIS on the entire property, and the monitoring for erosion / rehabilitation currently being undertaken within the two ephemeral streams by the farm manager / landowner. Recommendations in this report include the continuation of the current monitoring schedule by the farm manager (for AIS, potential erosion, and sedimentation), and subsequent rehabilitation / clearance within the two ephemeral streams and Seep Wetland 2 if noted, during the lifecycle of the orchard.

Additionally, as far as possible, wetland vegetation should be allowed to recolonize in areas that have been cleared – as observed during the site assessment, wetland vegetation was already recolonizing to a degree. It is suggested that stormwater peak flow from the orchard is managed by establishing vegetated swales which discharge diffuse flow into seep wetland 1, where necessary.

The commitment of the landowner / farm manager to regenerative and sustainable farming practises, currently being utilized within the farm, is encouraged.

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Specialist Details

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Kimberley van Zyl is an ecologist and environmental scientist with over 6 years' experience in the environmental management field. She holds a MSc. degree in Water Resource Management from the University of Pretoria and her professional affiliations include the South African Council for Natural Scientific Professions (SACNASP) and the South African Society for Aquatic Scientists. Kimberley's work experience has exposed her to a range of projects across various business sectors such as mining, agriculture, and construction, as well as the public sector.

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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 landowner of Portion 57 of Rocklands Farm 633, located 12 km east of Hermanus within the Western Cape Province (**Figure 1-1**), cleared and developed a macadamia nut orchard on approximately 9 ha of the 49 ha farm (**Figure 1-2**). Following an investigation conducted by the Department of Environmental Affairs and Development Planning (DEADP), it was determined that the landowner had commenced with National Environmental Management Act (NEMA) (Act 107 of 1998) listed activities on the farm without the necessary Environmental Authorisation (EA). In response to the unauthorised activities, Lornay Environmental Consulting has been appointed to submit a Section 24G (S24G) application to obtain the requisite retrospective EA.

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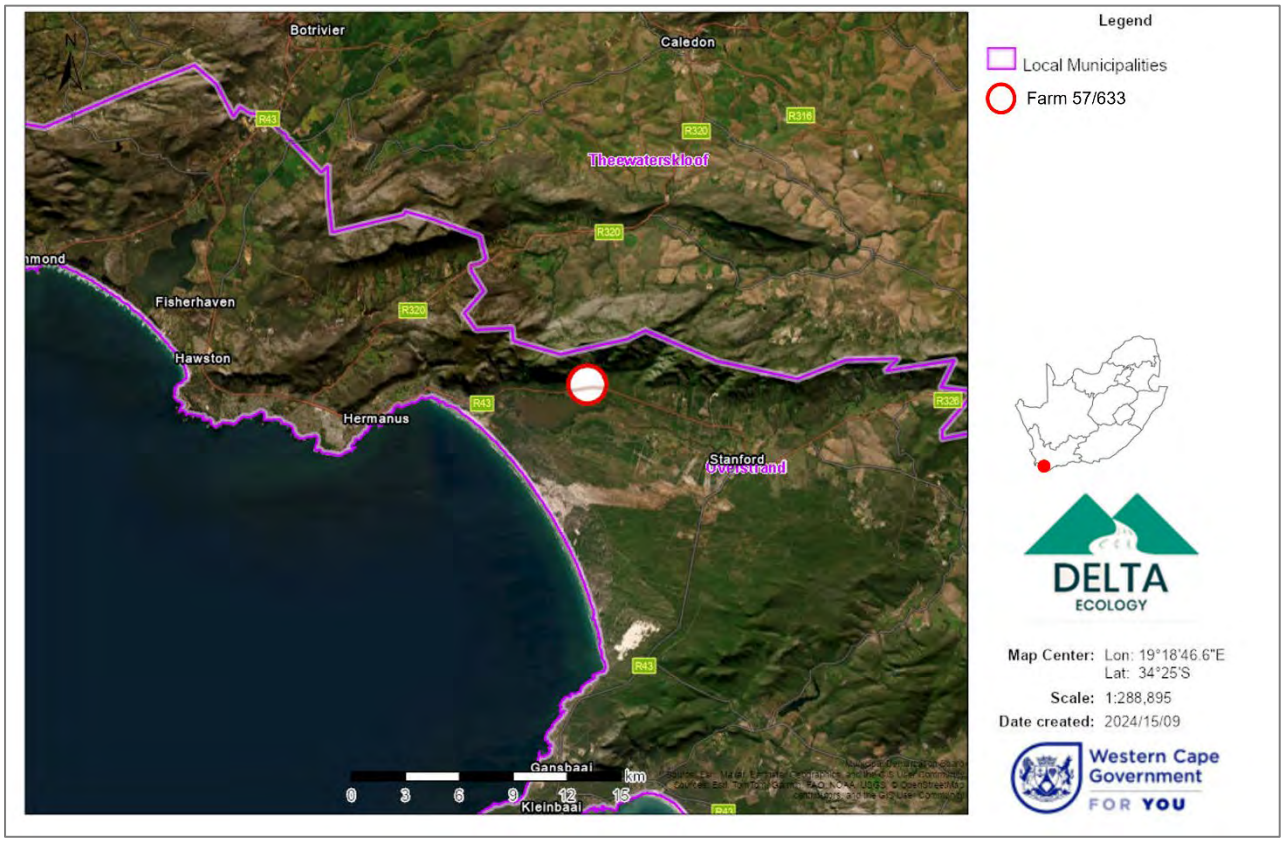

Figure 1-1: Location of the site.

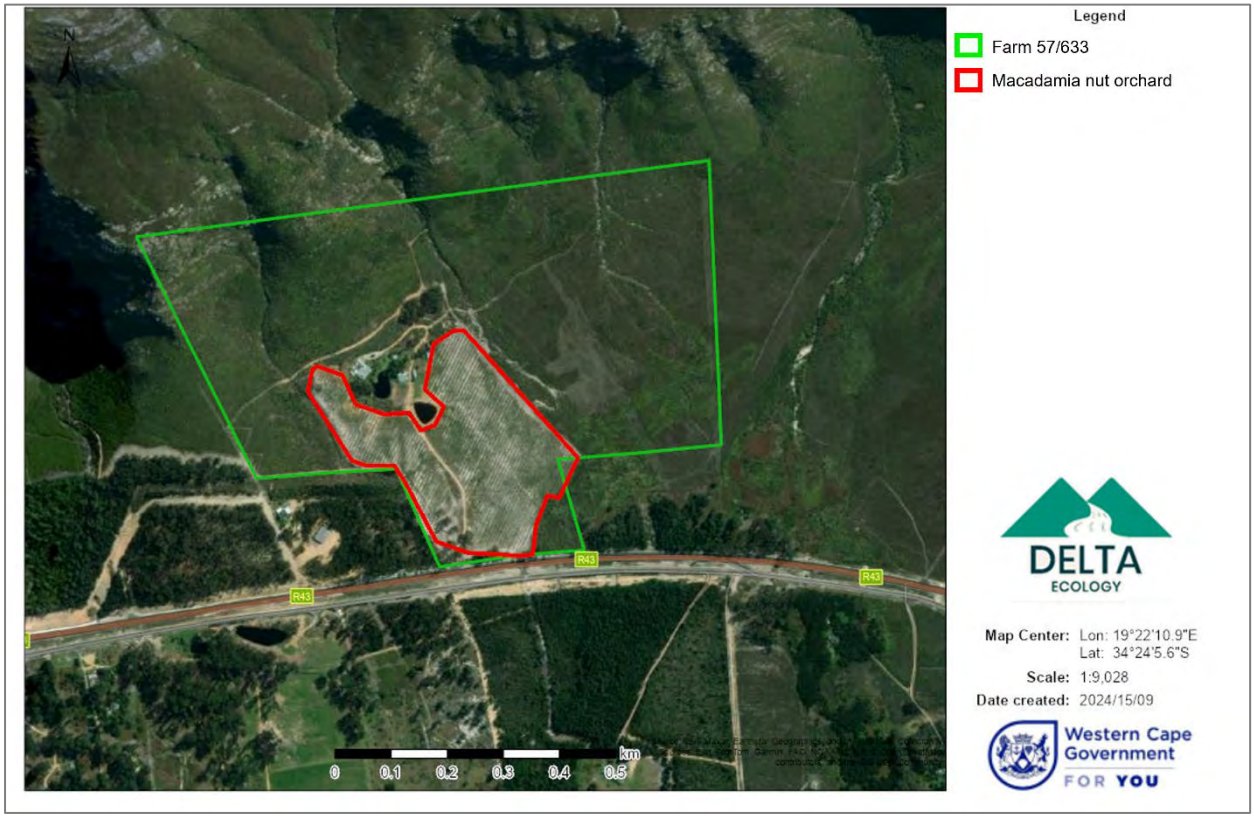

Figure 1-2: Location of onsite activities.

Figure 1-3: Historic imagery from before activities took place.

Figure 1-4: Historic imagery from 2020, prior to onsite activities.

Figure 1-5: Historic imagery from 2021, illustrating the onsite activities.

1.1. Terms of Reference

The Terms of Reference (ToR) agreed upon for this Freshwater Risk and Impact Assessment include:

- A desktop background assessment and site assessment to identify and confirm potential aquatic biodiversity constraints associated with the development activities.
- Delineation of watercourse (s) likely to have been impacted by the development activities, using a combination of site-based and desktop methodologies as appropriate.
- Verification of the aquatic site sensitivity as either "Very High" or "Low".
- Determination of the Index of Habitat Integrity (IHI), Present Ecological State (PES), Ecological Importance and Sensitivity (EIS), contribution to Wetland Ecosystem Services (WES), Recommended Ecological Category (REC), and buffer areas (if applicable).
- Assessment of potential aquatic biodiversity impacts of the development on the watercourses present within the site and application of the Risk Assessment Matrix (RAM) stipulated by Notice No 4167 of GG 49833, 2023 promulgated in terms of the National Water Act (NWA) (Act 36 of 1998); and
- Provision of mitigation measures to reduce aquatic biodiversity impacts/risks as far as possible.

1.2. Limitations and Assumptions

The following limitations and assumptions apply to this assessment:

- The site assessment was undertaken on the 10th of September 2024, during the spring season. Therefore, this assessment does not cover complete seasonal variation in conditions at the site. This will however not have a significant impact on the conclusions drawn regarding the potential impacts of the proposed development.
- Only watercourses that, in the opinion of the specialist, may have been impacted by the development activities, given the information available at the time, were assessed.
- 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 development activities had already taken place prior to the site visit, and as such, the onsite watercourses could not be assessed directly for the watercourse edge and ecological state prior to the commencement of the development activities. The PES assessment, and watercourse delineation of the seep wetlands, thus required that certain reasonable estimates be made, based on prior knowledge and learning, historical imagery (Google Earth and NGI), and based on site observations as far as practically possible. The specialist is of the opinion that sufficient information was obtained to facilitate informed decision making.
- Watercourse delineation plotted digitally may be offset by at least five meters to either side. Furthermore, it is important to note that, during the course of converting spatial data to final drawings, several steps in the process may affect the accuracy of areas delineated in the current report. 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.
- 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 and the 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 site have been adequately identified for the purposes of this assessment.

1.3. Use of this report

This report reflects the professional judgement of its author and, as such, the full and unedited contents of this should be presented in any application to relevant authorities. Any summary of the findings should only be produced with the approval of the author.

2. Site Sensitivity Verification

According to the web-based environmental screening tool report generated for the site, the Combined Aquatic Biodiversity Theme Sensitivity is classified as "Very High" (DFFE, 2024). The classification trigger is the location of the site within a Strategic Water Source Area (SWSA) for Surface Water (Boland), as well as the presence of a South Coast Fynbos Bioregion seep wetland and aquatic Critical Biodiversity Area 1 (CBA) within the site.

As per the 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 site (s) - as identified by the national web-based environmental screening tool - must be confirmed by undertaking an Initial Site Sensitivity Verification. This Initial Site Sensitivity Verification aims to confirm or dispute the current use of the land and environmental sensitivity as identified by the national web based environmental screening tool.

The Initial Site Sensitivity Verification was undertaken by a desktop assessment of the area (please refer to Section 4 of this report), and a site visit conducted on the 10th of September 2024. A natural seep and an artificial seep were determined to coincide with the agricultural activity on the site. Additionally, located 10 - 15 m from the agricultural activity, two non-perennial streams were delineated. Given that the clearance and earth work (ploughing / tilling) were conducted within the delineated seep wetlands and within proximity to the delineated streams, the site was determined to be of "very high" aquatic sensitivity.

According to GN R. 320 of 2020, if the specialist determines that the Aquatic Biodiversity sensitivity of the site is "Very High", then a full Aquatic Biodiversity Impact Assessment must be compiled.

3. Methodology

The methodology used in this Freshwater Risk and Impact Assessment Report, including a desktop background assessment, one site visit, and the delineation, and classification of the watercourses associated with the agricultural activities, is outlined in the subsections below.

3.1. Desktop Assessment

A review of desktop resources was undertaken to determine the nature of the site, the presence of watercourses in the vicinity, and the significance of the 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) Rivers 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. Wetland 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**.

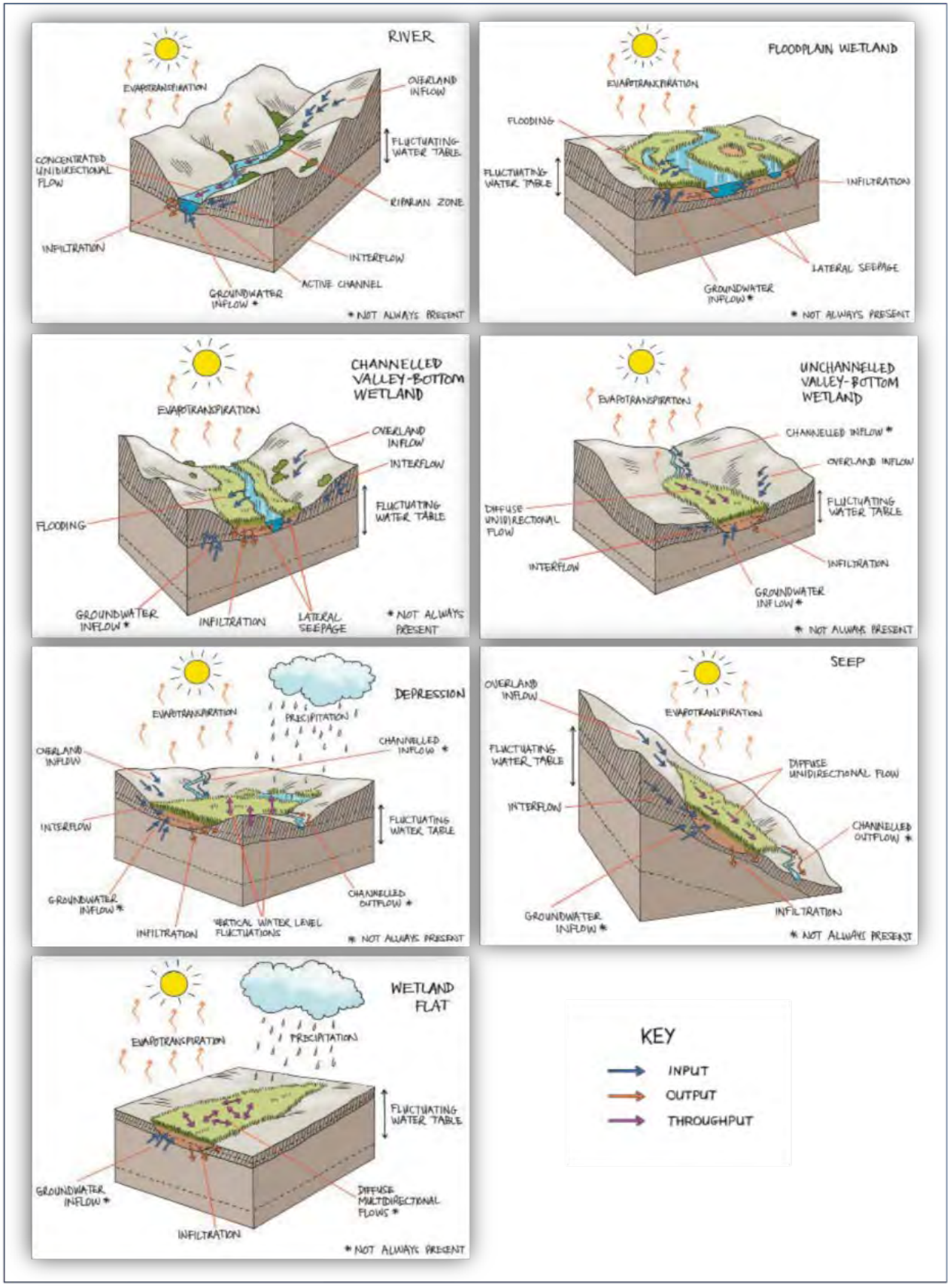

Figure 3-1: Wetland Hydrogeomorphic Types as defined in the Classification System for Wetlands and Other Aquatic Ecosystems in South Africa (Ollis *et al.*, 2013).

3.4. Wetland PES Assessment: WET-Health

WET-Health Version 2 (Macfarlane *et al*. 2020) is a modular tool designed to evaluate and assess the 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 Level 1A, a low-resolution desktop-based assessment; Level 1B, a high-resolution desktop-based assessment; and 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 (s) 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. Under normal circumstances, the Present Ecological State (PES) of the wetland is assessed prior to relevant development activities taking place. However, in this case development activities had been initiated prior to recognition of the need for a PES assessment. This necessitated the assessment of the wetland in a state that specialists had not seen first-hand, immediately prior to the agricultural activities taking place within the property. As such reasonable assumptions were made and clearly outlined based on the known disturbance history of the site and satellite imagery where available.

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 located in such a way that it has no impact on habitat quality, diversity, size and variability.	0
Small	The modification is limited to very few localities and the impact on habitat quality, diversity, size, and variability is limited.	1 – 5
Moderate	The modification is present at a small number of localities and the impact on habitat quality, diversity, size, and variability are fairly limited.	6 - 10
Large	The modification is generally present with a clearly detrimental impact on habitat quality, diversity, size, and variability. Large areas are, however, not affected.	11 -15
Serious	The modification is frequently present and the habitat quality, diversity, size and variability in almost the whole of the defined area affected. Only small areas are not influenced.	16 – 20
Critical	The modification is present overall with a high intensity. The habitat quality, diversity, size and variability in almost the whole of the defined section are influenced detrimentally.	21 – 25

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. Wetland EIS Assessment

The Ecological Importance and Sensitivity (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 3-6**.

Table 3-6: 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

3.7. 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 to 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 3-6**). 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 (**Table 3-6**), 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 3-7: 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

3.8. 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's 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.

3.9. 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 Assessment matrix stipulated by Notice No 4167 (DWS, 2023) promulgated in terms of the National Water Act (Act 36 of 1998).

4. Desktop Assessment

A review of desktop resources was undertaken. A summary of key desktop information relevant to this assessment is provided below.

4.1. Biophysical Context

According to the South African Atlas of Climatology and Agrohydrology (Schulze, 2009) obtained from CapeFarmMapper ver.3.2.6, the mean annual rainfall received for the area is 652 mm, obtained mostly during the winter months with the highest rainfall occurring from June to August.

According to the Council for Geoscience geological map (ENPAT), the soils in this region are dominated by grey regic sands. Geology in the region is typified by alluvium and aeolian sand on granite of the Hermanus Pluton, Cape Granite Suite in the north and aeolianite of the Waenhuiskrans Formation, Bredasdorp Group, in the south. The soil types and descriptions map developed by the Department of Agriculture, Forestry and Fisheries (DAFF) indicates that this region has soils that are greyish, sandy, and excessively drained. The soils tend to be low in clay (<15%).

According to the SANBI Vegetation Map 2018, the natural terrestrial vegetation in the southern portion of the development area consists of Agulhas Limestone Fynbos which is listed as Critically Endangered (CR) and Poorly Protected (PP), while the northern portion consists of Elim Ferricrete Fynbos which is listed as Endangered (EN) and PP. According to the NFEPA (CSIR, 2011) spatial dataset, this area corresponds to South Coast Limestone Fynbos wetland vegetation type in the north, while in the south the area consists of Southwest Ferricrete Fynbos wetland vegetation type (**Figure 4-1**). The South Coast Limestone Fynbos wetland vegetation type is listed as EN and PP. The Southwest Ferricrete Fynbos wetland vegetation type is listed as CR and PP.

The general biophysical characteristics of the site are summarised in **Table 4-1**.

Table 4-1: General characteristics of the site.

Site attribute	Description	Data source
Eco-region	Southern Coastal Belt	Department of Water Affairs Level 1 Ecoregions (DWS, 2011)
Terrestrial Vegetation Type	1) Agulhas Limestone Fynbos (CR - PP) 2) Elim Ferricrete Fynbos (EN - PP)	National Vegetation Map of South Africa, 2018 (SANBI, 2018)
Dominant Geology and Soils	Grey regic sands Alluvium and aeolian sand on granite of the Hermanus Pluton, Cape Granite Suite in the north and aeolianite of the Waenhuiskrans Formation, Bredasdorp Group, in the south	Cape Farm Mapper (ENPAT, 2021)
Soil Erodibility Factor (K)	0.64 (High Erodibility)	SA Atlas of Climatology and Agrohydrology (Schulze, 2009)
Soil Depth & Clay Percentage (%)	>= 750 mm & <15%	Soil types and descriptions for the Western Cape, Department of Agriculture, Forestry and Fisheries (DAFF, 2021)
Mean Annual Precipitation (mm)	652 mm	SA Atlas of Climatology and Agrohydrology (Schulze, 2009)
Rainfall seasonality	Winter rainfall	
Mean Annual Temperature (°C)	15.6 °C	
Water Management Area (WMA)	Breede- Olifants	Water Management Areas (DWAF, 2023)
Quaternary Catchment	G40L	South African Quaternary Catchments Database (Schulze *et al.* 2007)
Wetland Vegetation Group (for wetlands within the applicable terrestrial vegetation type)	South Coast Limestone Fynbos (EN-PP) Southwest Ferricrete Fynbos (CR-PP)	NFEPA Wetland Vegetation Types (CSIR, 2011)

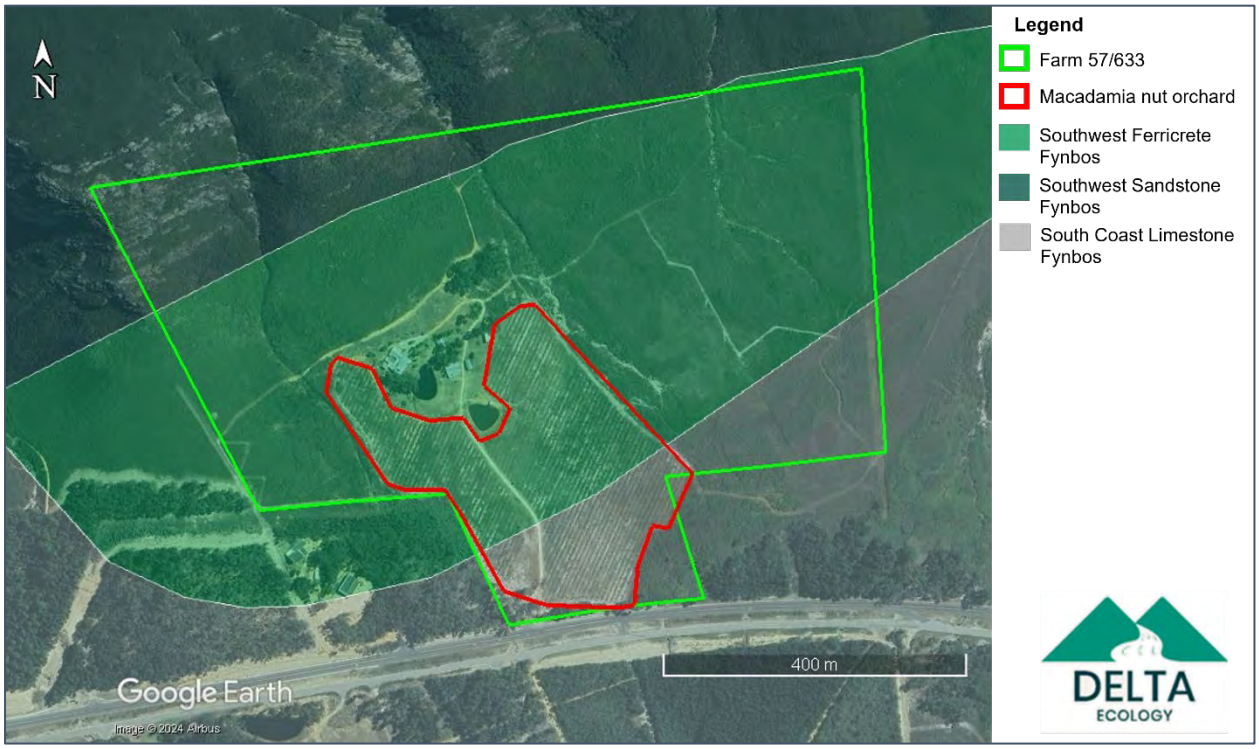

Figure 4-1: Wetland vegetation types within the site.

4.2. Biodiversity Planning Context

The site under evaluation is located within the Breede-Olifants WMA, quaternary catchment G40L. The applicable sub-quaternary catchment is not demarcated as a Freshwater Ecosystem Priority Area (FEPA) (CSIR, 2011). The regional setting, in terms of the Level 1 Department of Water Affairs (DWA) (now Department of Water and Sanitation) Ecoregions, is within the Southern Coastal Belt (**Table 4-1**).

According to the NGI river line vector data, two non-perennial rivers border the development area, one to the east and the other to the west (**Figure 4-2**). Two additional non-perennial rivers are present within the 500 m proximity thereof but were not impacted upon by the onsite activities.

The South African National Biodiversity Institute (SANBI, 2018) NWM5 and the NFEPA spatial data (CSIR, 2011) indicates a seep wetland within the site and extending south of the site, within the 500 m regulated proximity thereof (**Figure 4-2** & **Figure 4-3**). Additionally, a small portion of the Klein River Estuary is within the 500 m regulated proximity of the development area but would not have been impacted by the onsite activities.

The WCBSP (2017) indicates the development area primarily overlays a terrestrial Critical Biodiversity Area 2 (CBA), and small areas demarcated as an aquatic CBA 1, terrestrial CBA 1 and an Ecological Support Area 2 (ESA) (**Figure 4-4**). Additionally, the Coppull Private Nature Reserve is located within the 500 m regulated proximity of the development area. This would indicate that the site is of high biological value for conserving biodiversity and maintaining ecosystem functioning.

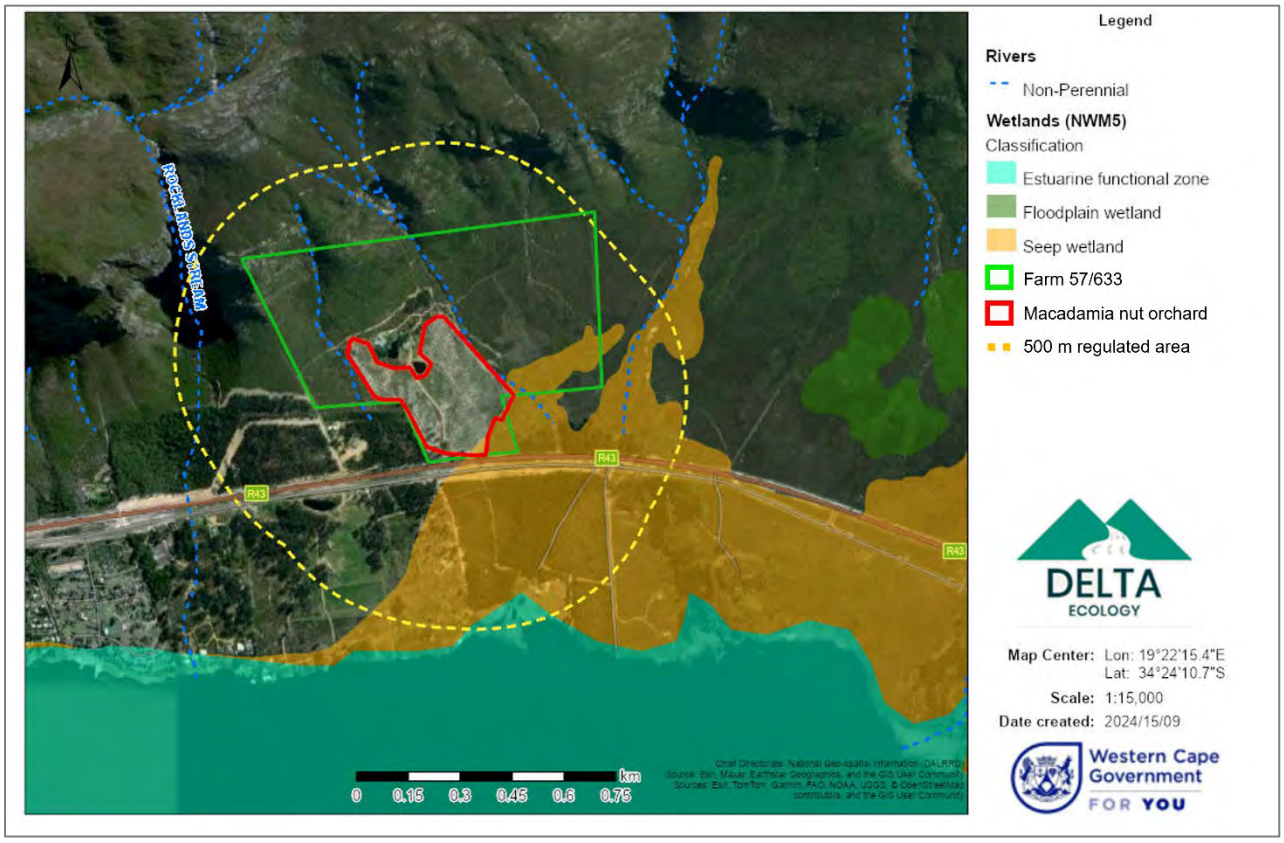

Figure 4-2: Watercourses indicated by desktop resources.

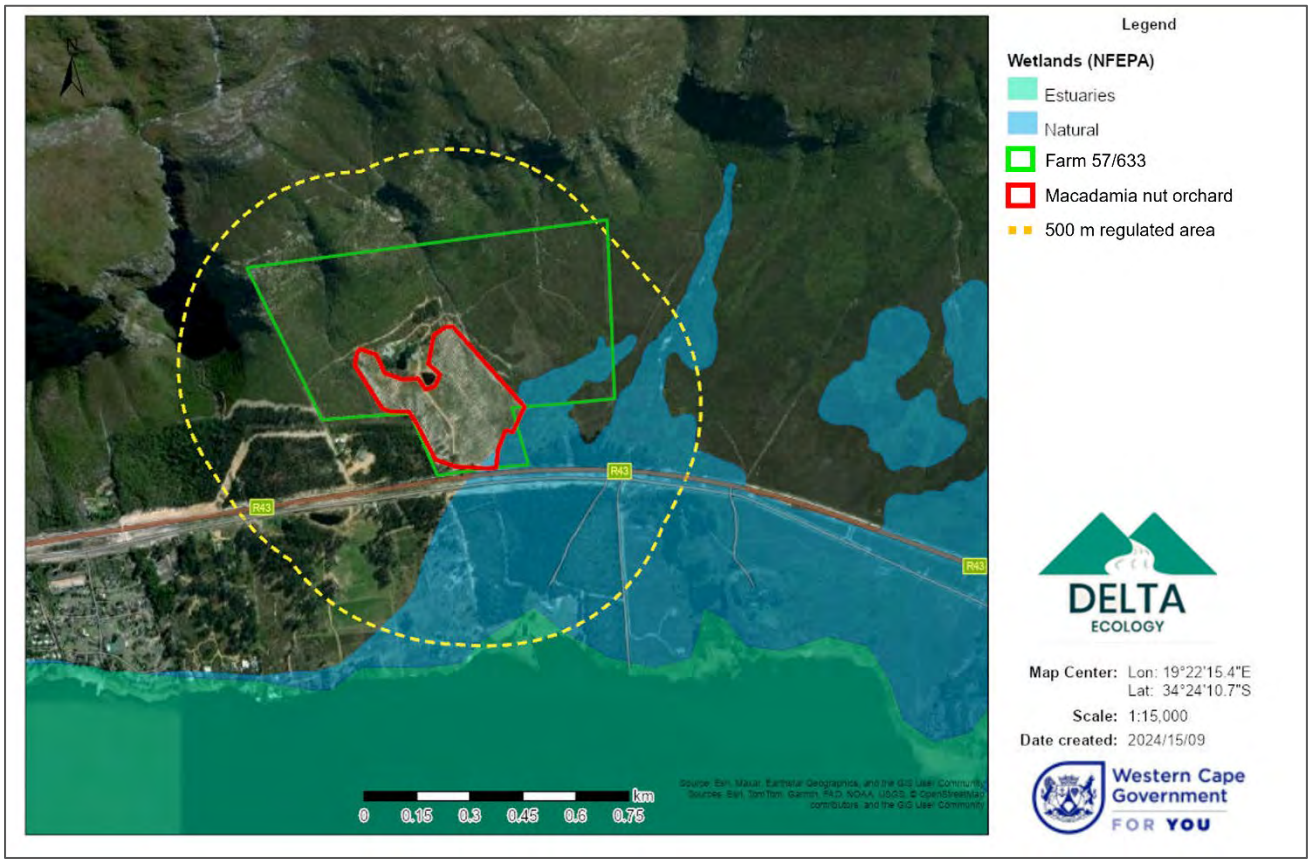

Figure 4-3: NFEPA map

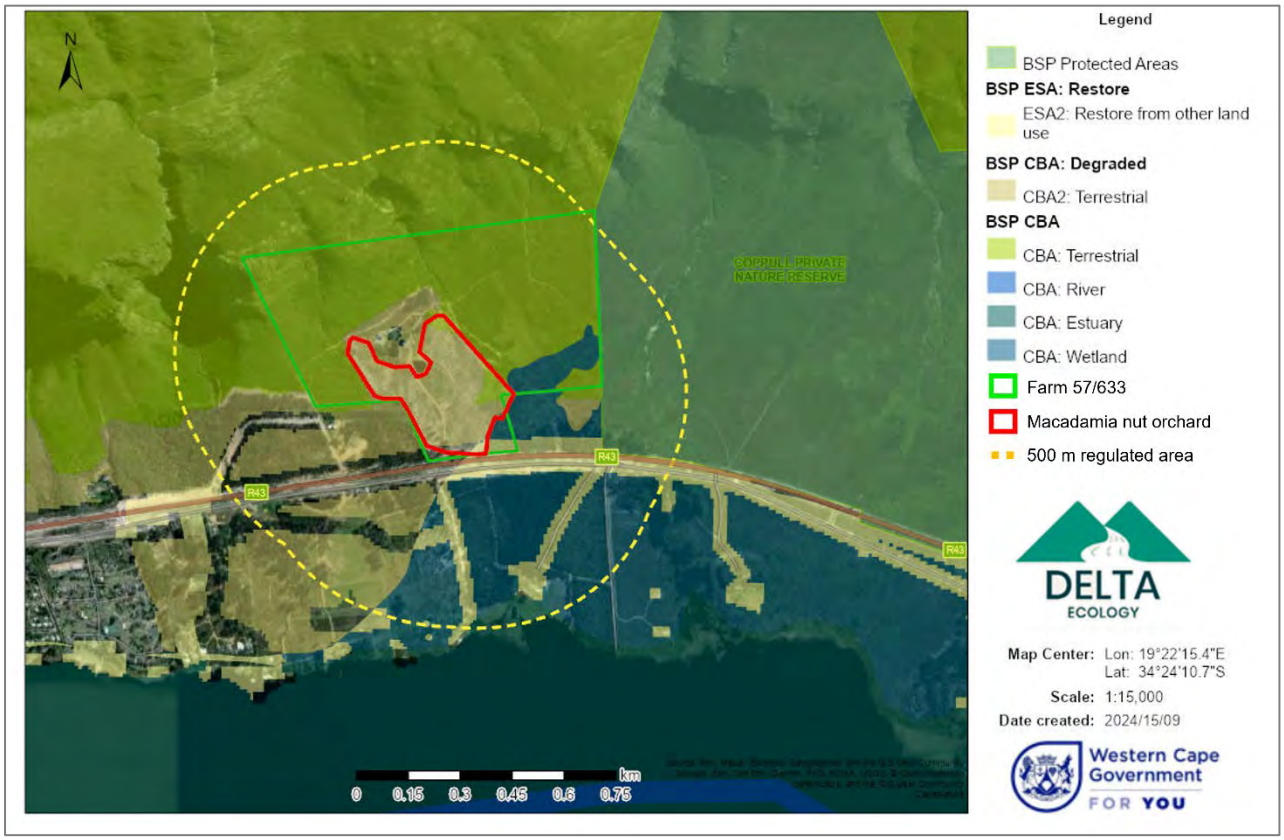

Figure 4-4: WCBSP Map.

5. Site Description

5.1. Historical Context of the Site

An analysis of historical aerial imagery from 1901 to 1997 was conducted to assess the presence of watercourses within the study area and potential impacts from the surrounding changes in land use and anthropogenic activities, prior to the establishment of the orchard. The earliest image, 1901, indicates several drainage lines and associated hillslope seeps along the south-facing slopes of the mountain range (**Figure 5-1**). The site is characterised by sparse vegetation cover, some exposed soils and a dirt track visible along the centre to southeastern boundary. A portion of hillslope seep appears to extend into the east - southeast of the site (**Figure 5-1**). By 1997, vegetation cover along the northern edge of the Klein River Lagoon appears dense in comparison to the surrounding landscape, suggesting that it is likely an invasive alien species. Vegetation in this area was cleared for development along the lagoon. By 1997, the R43 had been constructed across the drainage lines and associated hillslope seep systems, this likely altered the natural hydrology and geomorphic processes within these systems. Vegetation cover across the site, which appears to be AIS, had increased (**Figure 5-2**).

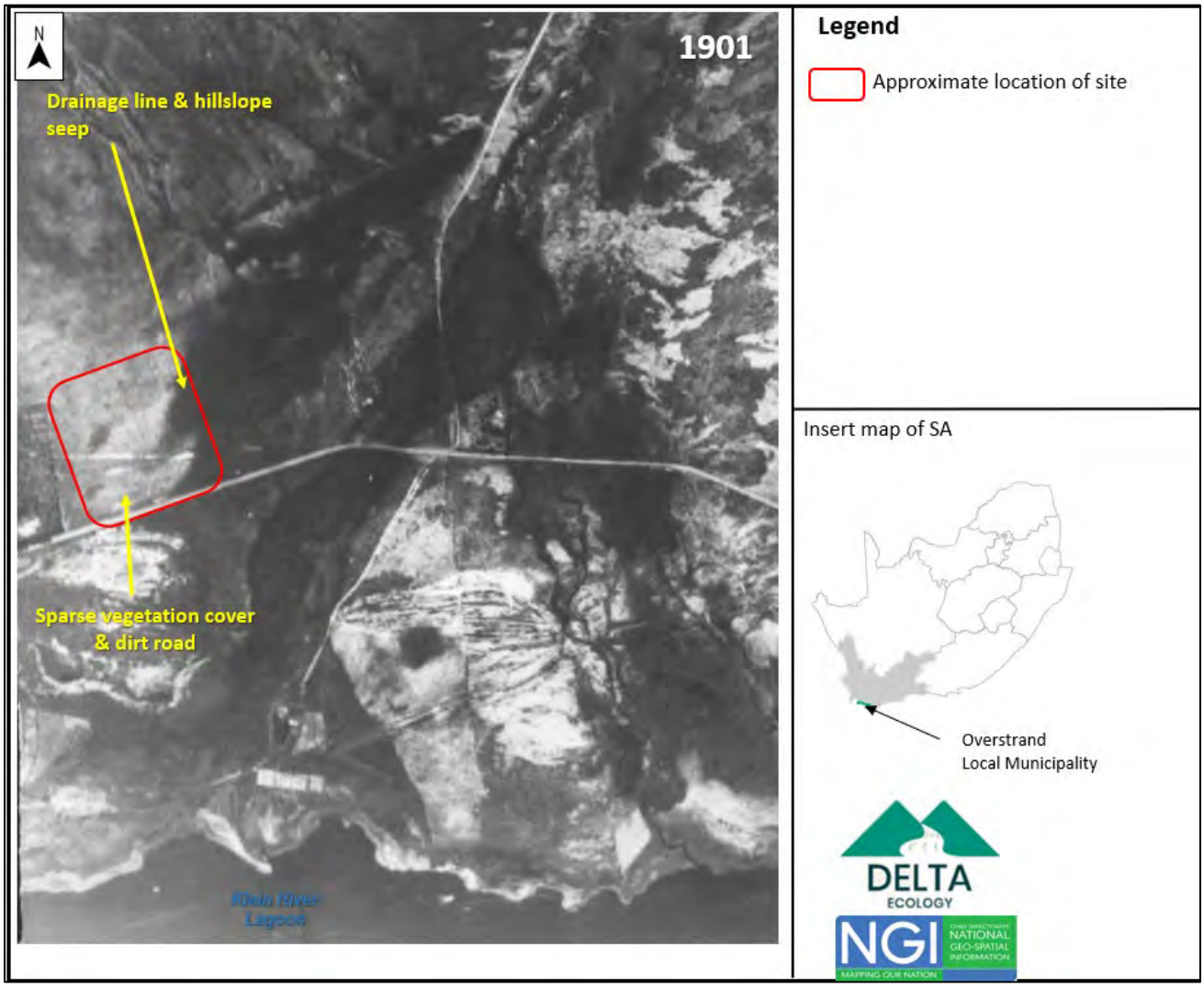

Figure 5-1: 1901 aerial image of the study area and surrounding landscape. Note that this image is not drawn to scale.

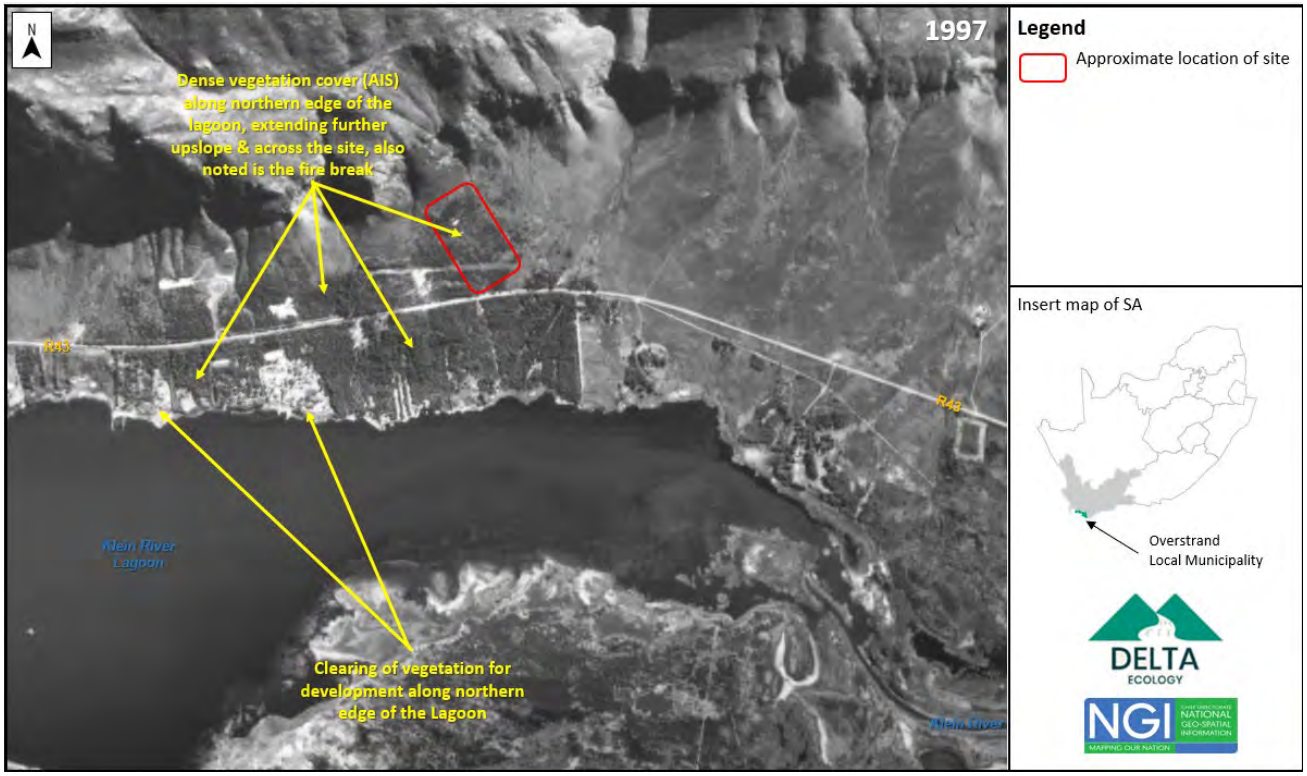

Figure 5-2: 1997 aerial image of the study area and surrounding landscape. Note that this image is not drawn to scale.

5.2. Present Overview

The site is situated between the Kleinrivier Mountains, and the Kleinrivier Estuary in Hermanus. It is bordered by the R43 road along the southern boundary. The site slopes from an elevation of 118 m in the north to 35 m in the south. The current land use includes five dwellings, two dams (dam 1 and dam 2), gravel tracks, a macadamia nut orchard, dense infestation of Alien Invasive Species (AIS), and some mature, near-pristine fynbos.

The majority of the site was characterised by grey, quartzitic sand. The primary wetland indicators used to determine wetland extent were hydromorphic soil features (such as mottling, gleying, and organic streaking all within the upper 50 cm), soil saturation, along with terrain and the presence of hydrophytic vegetation communities. The two mapped ephemeral drainage lines were confirmed and delineated, approximately 15 m east (Ephemeral Stream 1) and 10 m west (Ephemeral Stream 2) of the onsite activities (**Figure 5-3**). Associated with Ephemeral Stream 1 is a natural seepage wetland (Seep Wetland 1) (**Figure 5-3**). Much of the agricultural area indicated wetland conditions, and after the consultation of historical aerial imagery, it was confirmed that the two farm dams, as well as overflow associated with an artificial furrow on the property have resulted in artificial seepage areas which have been augmented by irrigation of the orchard (Seep Wetland 2) (**Figure 5-3**).

The agricultural activities primarily affected the portion of Seep wetland 2 located below dam 2 as well as the southwestern portion of Seep wetland 1. The field assessment conducted confirmed that the two ephemeral streams were unlikely to be significantly directly impacted, although a small amount of sedimentation and flow modification could have occurred due to the clearing and planting occurring in the stream's catchment area.

The degree of habitat disturbance within the Seep Wetland 1 varied from near-pristine to largely transformed, while the two ephemeral drainage lines were in near-pristine condition. Seep Wetland 2 was moderately to largely disturbed. Habitat descriptions of the onsite watercourse are detailed below.

Unimpacted Seep Wetland 1

The wetland vegetation within the undisturbed or unimpacted portion of seep wetland 1 was in a near-pristine condition with a high level of biodiversity (**Figure 5-4** & **Figure 5-5**), dominated by *Berzelia lanuginosa* (Button bush), interspersed with *Erica perspicua* (Prince of Wales heath), *Osmitopsis asteriscoides* (Swamp daisy), *Pteridium aquilinum* (Common bracken), *Psoralea pinnata* (Fountain bush), *Carpha glomerata* (Vlei sedge), *Pycreus polystachyos* (Manyspike flatsedge) and *Fuirena hirsuta* (Hairy hippo-sedge). The dominance of *Berzelia lanuginosa* indicates a lack of disturbance either due to a reduction in the fire frequency (the most significant factor) and historical removal of large game animals.

Disturbed seep wetland 1 within macadamia nut orchard

The potion of seep wetland 1 that coincides with the macadamia nut orchard, had wetland vegetation sparsely interspersed within the orchard, indicating that the hydrology of the system is still intact, and that partial habitat recovery had begun in this area. Wetland vegetation predominately consisted of *Pteridium aquilinum*, with some occurrences of *Carpha glomerata*, *Psoralea pinata* and *Fuirena hirsuta* (**Figure 5-8**). Soil samples exhibited soil saturation, leaching and organic streaking (**Figure 5-9**).

Artificial seep wetland 2

Historical imagery indicates that the artificial Seep wetland 2 (**Figure 5-7**) was largely dominated by AIS prior to the macadamia nut orchard. After the development of the macadamia nut orchard, sparse indigenous wetland vegetation such as *Carpha glomerata*, *Psoralea pinata* and *Fuirena hirsuta* has established within the orchard and it is likely that this seepage area is augmented by the irrigation of the trees. This artificial seepage area may therefore have been a smaller area prior to the establishment of the orchard.

Ephemeral streams

The riparian vegetation within Ephemeral Stream 1 was in a near-pristine condition with high diversity and was dominated by *Berzelia lanuginosa*, interspersed with *Wachendorfia thyrsiflora* (Marsh butterfly lily), *Elegia capensis* (Horsetail restio), *Schoenus compar* (Ivory veldrush) and *Passerina corymbosa* (Gonna bush) (**Figure 5-10**-**Figure 5-12**). The instream substrate mainly consisted of stones, gravel, bedrock and sand. The ephemeral stream was impacted by a dirt road crossing the channel (**Figure 5-13** & **Figure 5-14**), previous flood events resulting in deposition of rocks and debris within the channel and riparian zone, and minimal erosion was evident.

The riparian vegetation within Ephemeral Stream 2 was in a near-pristine condition, however with lower riparian diversity than Stream 1. Stream 2 was dominated by *Berzelia lanuginosa*, interspersed with *Passerina corymbosa* (**Figure 5-15**). The substrate mainly consisted of stones, gravel and sand. Some erosion was evident. The stream was impacted by a dirt road crossing the channel (**Figure 5-17**).

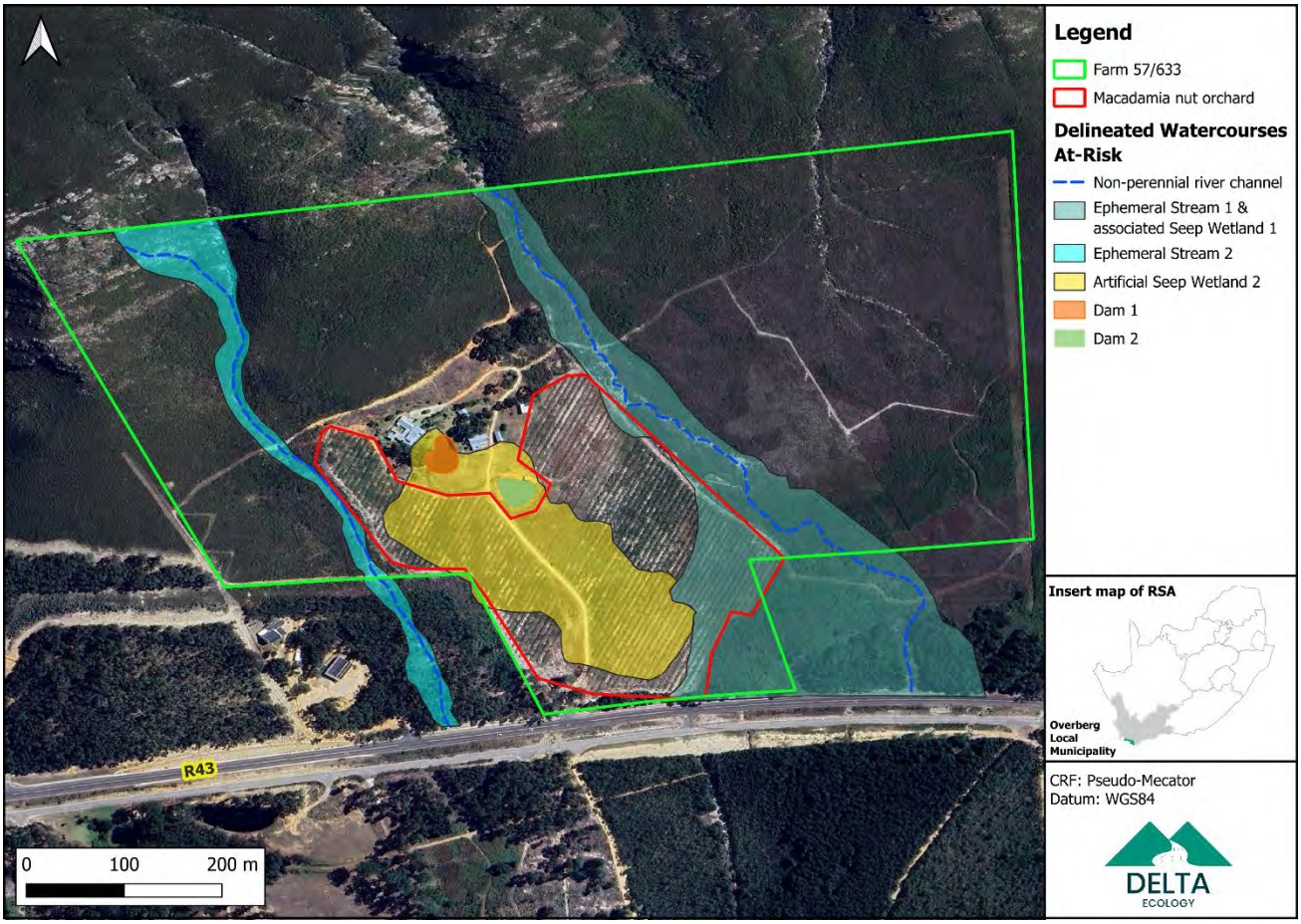

Figure 5-3: Delineation of watercourses on Farm 57/633, associated with the onsite activities.

Figure 5-4: Undisturbed portion of Seep Wetland 1.

Figure 5-5: Boundary between the undisturbed portion of Seep Wetland 1 (right), and the impacted portion of the wetland (indicated by red arrow).

Figure 5-6: Portion of Seep Wetland 1 within the macadamia nut orchard.

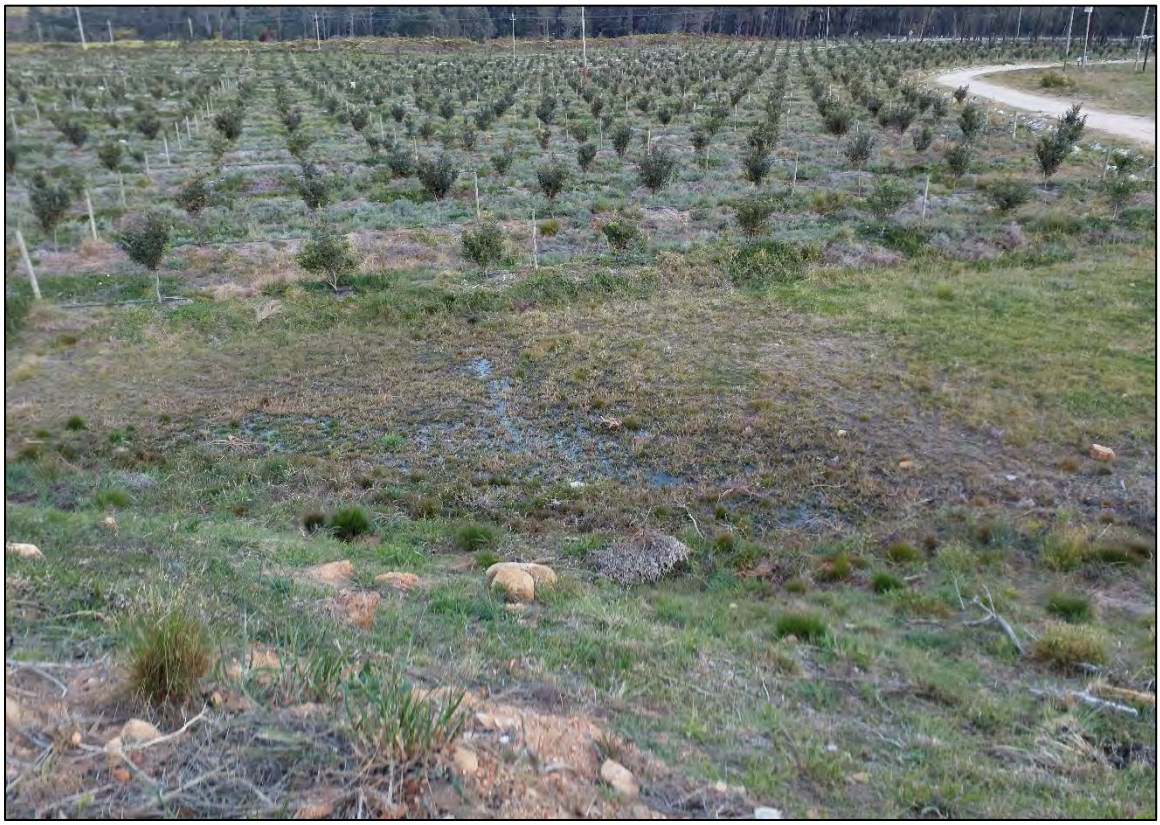

Figure 5-7: Portion of Seep Wetland 2 within the macadamia nut orchard.

Figure 5-8: Wetland vegetation growing within the macadamia nut orchard, *Carpha glomerata* (left) and *Pteridium aquilinum* (right).

Figure 5-9: Soil samples from the seep wetlands within the macadamia nut orchard exhibiting wetland characteristics such as organic streaking and mottles (left) and leaching (right).

Figure 5-10: Ephemeral Stream 1.

Figure 5-11: Overview of the riparian vegetation in Ephemeral Stream 1.

Figure 5-12: *Elegia capensis* and *Berzelia lanuginosa* identified in Ephemeral Stream 1.

Figure 5-13: Dirt Road crossing Ephemeral Stream 1.

Figure 5-14: Ephemeral Stream 1.

Figure 5-15: Overview of the riparian vegetation in Ephemeral Stream 2, dominated *Berzelia lanuginosa*.

Figure 5-16: Stream channel of Ephemeral Stream 2.

Figure 5-17: Ephemeral Stream 2.

Table 5-1: Classification of the wetlands within Farm 57/633.

Factor	Seep wetland 1	Seep wetland 2
System	Inland	Inland
Ecoregion	Southern coastal belt	Southern coastal belt
Landscape Setting	Slope	Slope
Hydrogeomorphic type	Seep	Seep
Drainage	Rainfall and Interflow	Rainfall and Interflow
Seasonality	Seasonal - Permanent	Seasonal - Permanent
Anthropogenic influence	Vegetation Clearing, alien invasive vegetation, and earthworks	Vegetation Clearing, alien invasive vegetation, and earthworks
Vegetation	South Coast Limestone Fynbos & Southwest Ferricrete Fynbos	South Coast Limestone Fynbos & Southwest Ferricrete Fynbos
Geology	Alluvium and aeolian sand on granite of the Hermanus Pluton, Cape Granite Suite in the north and aeolianite of the	Alluvium and aeolian sand on granite of the Hermanus Pluton, Cape Granite Suite in the north

	Waenhuiskrans Formation, Bredasdorp Group, in the south	and aeolianite of the Waenhuiskrans Formation, Bredasdorp Group, in the south
Substrate	Sand	Sand
Salinity	Fresh	Fresh
Natural V Artificial	Natural	Artificial

6. Status Quo Assessment

In this study, seep wetland 1 and the two ephemeral drainage lines associated with the agricultural activities were assessed to determine the IHI, PES, EIS, and contribution to WES These metrics were used to determine the management objective expressed in terms of the REC. It should be noted that Seep Wetland 2 is of artificial origin and therefore does not have a reference state and cannot be assessed using the Macfarlane *et al*. (2020) WET-Health Version 2.0 method. Seep wetland 1 was assessed as a whole, i.e. the entire seep unit that is associated with Stream 1 was assessed, not just the area that was impacted by the orchard.

6.1. Present Ecological State

The Macfarlane *et al.* (2020) WET-Health Version 2.0 assessment was completed for Seep Wetland 1 both prior to and after the agricultural activities in order to determine the reduction in PES caused by these activities. Prior to the onsite activities Seep Wetland 1 produced an overall PES score within upper category C (Moderately Modified) with a combined PES score of 74%. After onsite activities, Seep Wetland 1 produced an overall PES score within lower category C (Moderately Modified) with a combined PES score of 60%. The assessment results for the wetland are presented in **Table 6-1** and **Table 6-2**, and the definitions of the ecological categories are presented in **Table 6-3**.

Historical imagery from before the onsite agricultural activities indicates that Seep Wetland 1 was impacted by the construction of the R43, brush cutting associated with fire breaks, dirt tracks through the wetland, previous flood events, encroachment and subsequent clearing of AIS, and construction activities associated with the onsite dwellings and dams (Refer to **Section 5.1**). These within-wetland and catchment scale impacts likely resulted in flow alteration (particularly the R43 and AIS infestation), vegetation disturbance due to the fire break and dirt tracks, along with sedimentation from the historical onsite construction activities. Despite the historic disturbances, there was likely a fairly diverse community of indigenous hydrophytic species within the wetland area transformed into the orchard, prior to the establishment of the orchard, as seen by current diversity increasing along the edges of the orchard, within the undisturbed seep wetland.

After the macadamia nut orchard was developed, the portion of Seep Wetland 1 that coincides with the orchard had been cleared and tilled. Wetland vegetation had been disturbed in this area, and portions of the wetland's geomorphology had been slightly disturbed by creating the berms for the macadamia nut trees. However, no foreign soil was introduced to create the berms. The clearing and tilling, along with the dirt tracks, likely altered the flow regime of the seep, diverting flow along unnatural paths. Additionally, during the rainy period, the seep likely experienced increased sediment input because of the agriculture. The presence of the macadamia nut orchard within the seep wetland, and within its catchment could affect hydrology by slightly increased water uptake (as the trees increase in size). Alternatively, the irrigation system used in the macadamia orchard may impact the seep wetland by introducing excess water into the system. Potential water quality impairment should be limited to sedimentation, due to the organic farming practises conducted on the farm.

Table 6-1: WET-Health Assessment for Seep Wetland 1 before the macadamia nut orchard was created.

PES Assessment	Hydrology	Geomorphology	Water Quality	Vegetation
Impact Score	3.4	2.3	2.1	2.0
PES Score (%)	66%	77%	79%	80%
Ecological Category	**C**	**C**	**C**	**B**
Trajectory of change	↓	↓	↓	↓
Confidence (revised results)	Not rated	Not rated	Not rated	Not rated
Combined Impact Score	2.6			
Combined PES Score (%)	74%			
Combined Ecological Category	**C**			
Hectare Equivalents	3.1 Ha			

Table 6-2: WET-Health Assessment for Seep Wetland 1 after the macadamia nut orchard was created.

PES Assessment	Hydrology	Geomorphology	Water Quality	Vegetation
Impact Score	4.5	4.2	3.1	3.7
PES Score (%)	55%	58%	69%	63%
Ecological Category	**D**	**D**	**C**	**C**
Trajectory of change	↓	↓	↓	↓
Confidence (revised results)	Not rated	Not rated	Not rated	Not rated
Combined Impact Score	4.0			
Combined PES Score (%)	60%			
Combined Ecological Category	**C**			
Hectare Equivalents	2.5 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

6.2. Habitat Integrity Assessment

The habitat integrity of the two ephemeral streams, was assessed before and after agricultural activities were undertaken. The assessment for the two ephemeral streams, produced an instream and riparian habitat integrity within category B (Largely Natural) for before and after agricultural activities. The assessment results for the instream and riparian habitat are presented in **Table 6-3** and **Table 6-4** respectively. The definitions of the ecological categories are presented in **Table 6-5**. The key factors that influenced the habitat integrity scoring are summarised below:

Instream Habitat Integrity:

The ephemeral streams were flowing at the time of the site visit. The catchment consists primarily of pristine natural vegetation, except for the macadamia nut orchard. Water abstraction takes place in Stream 1 to feed the onsite dams. However, no water abstraction takes place in Stream 2. A degree of bed modification was observed in both ephemeral streams due to historical flooding. Minimal erosion within both stream channels is present and has resulted in increased sediment input although this is noted to not be from the orchard. Channel modification was observed within both streams, and both channels have a dirt road crossing where the water is piped under the road. The only potential impact to the streams as a result of the agricultural activities is that water quality may have been slightly impacted by agricultural runoff from the macadamia nut orchard (increased sediment input).

Riparian Habitat Integrity:

The riparian vegetation associated with the ephemeral streams is relatively dense and natural. A very small degree of bank erosion is present in both ephemeral streams. The presence of the agriculture (orchard) within the catchment of the streams may result in some modification to the natural flow and inundation of the riparian area. The factors influencing the riparian water quality are the same as those impacting instream water quality, however riparian habitat quality is influenced to a lesser degree by water quality impacts when compared to instream habitats.

Table 6-4: Instream IHI Score Rating Results for prior and after onsite orchard.

CRITERIA	Ephemeral stream 1		Ephemeral stream 2	
	Prior to onsite orchard	After onsite orchard	Prior to onsite orchard	After onsite orchard
Water Abstraction	9	9	2	2
Flow Modification	5	6	4	5
Bed Modification	4	5	4	5
Channel Modification	5	5	5	5
Water Quality	2	4	3	6
Extent of Inundation	4	4	4	4
Alien Macrophytes	0	0	0	0
Presence of exotic fauna	1	1	1	1
Solid Wate Disposal	0	0	0	0
Instream Habitat Integrity Score	85	82	88	86
Instream Integrity Category	**B**	**B**	**B**	**B**

Table 6-5: Riparian IHI Score Rating Results for prior and after onsite orchard.

CRITERIA	Ephemeral stream 1		Ephemeral stream 2	
	Prior to onsite orchard	After onsite orchard	Prior to onsite orchard	After onsite orchard
Indigenous Vegetation Removal	5	5	6	6
Exotic Vegetation Encroachment	1	1	3	3
Bank Erosion	5	5	5	5
Channel Modification	3	5	3	5
Water Abstraction	1	1	1	1

Extent of Inundation	5	5	5	5
Flow Modification	3	5	3	5
Water Quality	2	4	2	4
Riparian Habitat Integrity Score	87	85	86	83
Riparian Integrity Category	**B**	**B**	**B**	**B**

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

6.3. Ecosystem Services

The onsite seep wetlands and streams were assessed for their contribution to ecosystem services using the WET-EcoServices Version 2 methodology before and after the onsite agricultural activities. The results for the assessment remained largely the same for all watercourses prior and subsequent to the agriuclutral activities on the site. The assessment results are summarised in **Table 6-7-Table 6-13.** The score categories and their descriptions are provided in **Table 6-14**.

The majority of importance scores fell within the 'Low - Very Low' category for the streams indicating negligible contribution to ecosystem services, before and after the onsite activities, apart from the provision of water for cultivation for stream 1 after the orchard was established which fell within the 'Moderate' category. The exceptions were the provision of biodiversity maintenance which fell within the 'Moderately High' category along with cultural and spiritual services which fell within the 'Moderatately Low' category. The wetland vegetation type that coincides with the drainage lines has a high threat status (CR), there is high connectivity to other

wetlands and aquatic habitats including seep wetland area, the ecological condition is moderate, and the area has high scenic beauty.

In terms of Seep Wetland 1, the broader catchment area consists primarily of pristine vegetation, except for the macadamia nut orchard immediately upslope of the seep (present state), and previous onsite construction of the residential dwellings and dams resulted in sediment input. Therefore, the seep provides sediment trapping to a degree of 'Moderately Low' importance. The wetland vegetation type that coincides with the seep wetland has a high threat status (CR), the seep is demarcated as a NFEPA wetland and occurs within a CBA. The Klein River Estuary also occurs downstream of the seep. Therefore, an overall importance score within the 'Moderately High' category was obtained for biodiversity maintenance. The seep wetland received a score of 'Moderate' importance for Carbon Storage supply, both before and after onsite agricultural activities. There is a global demand for storage of carbon, thereby reducing total atmospheric greenhouse gas concentrations.

The historical imagery assessment concluded that there was unlikely to be a pristine, diverse indigenous community of wetland vegetation associated with the artificial Seep Wetland 2 prior to onsite agricultural activities (**Figure 1-3**). The site assessment confirmed similarly that this wetland area is unlikely to provide significant ecosystem services. Therefore, all ecosystem services associated with this wetland area both before and after the development of the orchard was found to be in a 'Moderately Low' to 'Very Low' category. The artificial seepage area likely provided, and currently provides, limited amounts of sediment trapping services. After the orchard was planted this area also provides a small amount of cultivated foods provisioning services.

Table 6-7: The outcome of the ecosystem services assessment for the ephemeral stream 1 prior to onsite activities.

		Present State			
ECOSYSTEM SERVICE		Supply	Demand	Importance Score	Importance
REGULATING AND SUPPORTING SERVICES	Flood attenuation	0.9	0.1	0.0	Very Low
	Stream flow regulation	-	-	#VALUE!	#VALUE!
	Sediment trapping	1.0	0.0	0.0	Very Low
	Erosion control	2.2	0.0	0.7	Very Low
	Phosphate assimilation	1.0	0.0	0.0	Very Low
	Nitrate assimilation	1.1	0.0	0.0	Very Low
	Toxicant assimilation	1.0	0.0	0.0	Very Low
	Carbon storage	2.4	0.0	0.9	Low
	Biodiversity maintenance	2.9	2.0	2.4	Moderately High
PROVISIONING SERVI	Water for human use	0.8	0.3	0.0	Very Low

	Harvestable resources	2.5	0.3	1.2	Low
	Food for livestock	2.3	0.0	0.8	Very Low
	Cultivated foods	2.3	0.0	0.8	Very Low
CULTURAL SERVICES	Tourism and Recreation	1.9	1.0	0.9	Low
	Education and Research	1.5	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 ephemeral stream 1 subsequent to onsite activities.

		Present State			
ECOSYSTEM SERVICE		Supply	Demand	Importance Score	Importance
REGULATING AND SUPPORTING SERVICES	Flood attenuation	0.9	0.1	0.0	Very Low
	Stream flow regulation	-	-	#VALUE!	#VALUE!
	Sediment trapping	1.0	0.0	0.0	Very Low
	Erosion control	2.2	0.0	0.7	Very Low
	Phosphate assimilation	1.0	0.0	0.0	Very Low
	Nitrate assimilation	1.1	0.0	0.0	Very Low
	Toxicant assimilation	1.0	0.0	0.0	Very Low
	Carbon storage	2.4	0.0	0.9	Low
	Biodiversity maintenance	2.9	2.0	2.4	Moderately High
PROVISIONING SERVICES	Water for human use	0.8	2.7	0.6	Very Low
	Harvestable resources	2.5	0.3	1.2	Low
	Food for livestock	2.3	0.0	0.8	Very Low
	Cultivated foods	2.3	2.0	1.8	Moderate
CULTURAL SERVICES	Tourism and Recreation	1.9	1.0	0.9	Low
	Education and Research	1.5	0.0	0.0	Very Low
	Cultural and Spiritual	3.0	0.0	1.5	Moderately Low

Table 6-9: The outcome of the ecosystem services assessment for the ephemeral stream 2 prior and subsequent to onsite activities.

		Present State			
ECOSYSTEM SERVICE		Supply	Demand	Importance Score	Importance
REGULATING AND SUPPORTING SERVICES	Flood attenuation	0.9	0.1	0.0	Very Low
	Stream flow regulation	-	-	#VALUE!	#VALUE!
	Sediment trapping	1.0	0.0	0.0	Very Low
	Erosion control	2.2	0.0	0.7	Very Low
	Phosphate assimilation	1.0	0.0	0.0	Very Low
	Nitrate assimilation	1.1	0.0	0.0	Very Low
	Toxicant assimilation	1.0	0.0	0.0	Very Low
	Carbon storage	2.4	0.0	0.9	Low
	Biodiversity maintenance	2.9	2.0	2.4	Moderately High
PROVISIONING SERVICES	Water for human use	0.8	0.3	0.0	Very Low
	Harvestable resources	2.5	0.3	1.2	Low
	Food for livestock	2.3	0.0	0.8	Very Low
	Cultivated foods	2.3	0.0	0.8	Very Low
CULTURAL SERVICES	Tourism and Recreation	1.9	1.0	0.9	Low
	Education and Research	1.5	0.0	0.0	Very Low
	Cultural and Spiritual	3.0	0.0	1.5	Moderately Low

Table 6-10: The outcome of the ecosystem services assessment for seep wetland 1 before agricultural development.

		Present State			
ECOSYSTEM SERVICE		Supply	Demand	Importance Score	Importance
REGULATING AND SUPPORTING SERVICES	Flood attenuation	1.0	0.2	0.0	Very Low
	Stream flow regulation	2.3	0.0	0.8	Very Low
	Sediment trapping	2.1	2.0	1.6	Moderately Low
	Erosion control	1.7	1.3	0.9	Low
	Phosphate assimilation	1.8	0.0	0.3	Very Low
	Nitrate assimilation	2.1	0.0	0.6	Very Low
	Toxicant assimilation	2.2	0.0	0.7	Very Low
	Carbon storage	2.2	2.7	2.1	Moderate
	Biodiversity maintenance	2.2	4.0	2.7	Moderately High
PROVISIONING SERVICES	Water for human use	2.0	0.0	0.5	Very Low
	Harvestable resources	2.0	1.3	1.2	Low
	Food for livestock	1.5	0.0	0.0	Very Low
	Cultivated foods	1.8	0.0	0.3	Very Low
CULTURAL SERVICES	Tourism and Recreation	2.3	1.0	1.3	Low
	Education and Research	1.5	0.0	0.0	Very Low
	Cultural and Spiritual	3.0	0.0	1.5	Moderately Low

Table 6-11: The outcome of the ecosystem services assessment for the seep wetland 1 after agricultural development.

		Present State			
ECOSYSTEM SERVICE		Supply	Demand	Importance Score	Importance
REGULATING AND SUPPORTING SERVICES	Flood attenuation	1.0	0.2	0.0	Very Low
	Stream flow regulation	2.3	0.0	0.8	Very Low
	Sediment trapping	2.1	2.0	1.6	Moderately Low
	Erosion control	1.7	2.0	1.2	Low
	Phosphate assimilation	1.8	0.0	0.3	Very Low
	Nitrate assimilation	2.1	0.0	0.6	Very Low
	Toxicant assimilation	2.2	0.0	0.7	Very Low
	Carbon storage	2.0	2.7	1.8	Moderate
	Biodiversity maintenance	2.2	4.0	2.7	Moderately High
PROVISIONING SERVICES	Water for human use	2.0	0.7	0.8	Low
	Harvestable resources	2.0	1.3	1.2	Low
	Food for livestock	1.5	0.0	0.0	Very Low
	Cultivated foods	1.8	1.0	0.8	Low
CULTURAL SERVICES	Tourism and Recreation	2.3	1.0	1.3	Low
	Education and Research	1.5	0.0	0.0	Very Low
	Cultural and Spiritual	3.0	0.0	1.5	Moderately Low

Table 6-12: The outcome of the ecosystem services assessment for the seep wetland 2 before agricultural development.

		Present State			
ECOSYSTEM SERVICE		Supply	Demand	Importance Score	Importance
REGULATING AND SUPPORTING SERVICES	Flood attenuation	1.0	0.1	0.0	Very Low
	Stream flow regulation	2.3	0.0	0.8	Very Low
	Sediment trapping	2.6	1.0	1.6	Moderately Low
	Erosion control	1.9	0.2	0.5	Very Low
	Phosphate assimilation	2.3	0.0	0.8	Low
	Nitrate assimilation	2.6	0.0	1.1	Low
	Toxicant assimilation	2.8	0.0	1.3	Moderately Low
	Carbon storage	2.2	0.0	0.7	Very Low
	Biodiversity maintenance	0.5	2.0	0.0	Very Low
PROVISIONING SERVICES	Water for human use	0.0	0.0	0.0	Very Low
	Harvestable resources	2.0	0.3	0.7	Very Low
	Food for livestock	1.5	0.0	0.0	Very Low
	Cultivated foods	1.8	0.0	0.3	Very Low
CULTURAL SERVICES	Tourism and Recreation	1.6	0.0	0.1	Very Low
	Education and Research	0.0	0.0	0.0	Very Low
	Cultural and Spiritual	3.0	0.0	1.5	Moderately Low

Table 6-13: The outcome of the ecosystem services assessment for the seep wetland 2 after agricultural development.

		Present State			
ECOSYSTEM SERVICE		Supply	Demand	Importance Score	Importance
REGULATING AND SUPPORTING SERVICES	Flood attenuation	1.0	0.1	0.0	Very Low
	Stream flow regulation	2.3	0.0	0.8	Very Low
	Sediment trapping	2.6	1.0	1.6	Moderately Low
	Erosion control	1.9	1.0	0.9	Low
	Phosphate assimilation	2.3	0.0	0.8	Low
	Nitrate assimilation	2.6	0.0	1.1	Low
	Toxicant assimilation	2.8	0.0	1.3	Moderately Low
	Carbon storage	2.0	0.0	0.5	Very Low
	Biodiversity maintenance	0.5	2.0	0.0	Very Low
PROVISIONING SERVICES	Water for human use	0.0	2.0	0.0	Very Low
	Harvestable resources	2.0	0.3	0.7	Very Low
	Food for livestock	1.5	0.0	0.0	Very Low
	Cultivated foods	1.8	1.0	0.8	Low
CULTURAL SERVICES	Tourism and Recreation	1.6	0.0	0.1	Very Low
	Education and Research	0.0	0.0	0.0	Very Low
	Cultural and Spiritual	3.0	0.0	1.5	Moderately Low

Table 6-14: Ecosystem services 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.

6.4. Ecological Importance and Sensitivity

Seep Wetland 1 achieved a median score of 2.8 which falls within the "High" category, while Seep Wetland 2 achieved a median score of 1.0 which falls within the "Low Marginal" category. The two ephemeral streams achieved EIS scores of 2.0 which falls within the "Moderate" category. The results of the assessment and the reasoning behind the scores are presented in **Table 6-15** and **Table 6-14.**

Table 6-15: Results of the EIS assessment for the two onsite seep wetlands.

Ecological Importance and Sensitivity	Seep wetland 1	Seep wetland 2	Reason
Biodiversity Support (Median)	**1,67**	**1,00**	
Presence and status of Red Data species:	2	1	Species of terrestrial conservation concern were noted on the site according to the terrestrial specialist (van Rensburg, 2024). None of the noted sp. are specifically associated with wetlands, however wetland SCC may occur. SCC are not likely to occur in the artificial seepage below the dam.
Populations of unique species/uncommonly large populations of wetland species:	1	1	Aquatic vegetation communities were present on the site, however no unique species or uncommonly large populations were not noted.
Migration/breeding/feeding sites: (Importance of the unit for migration, breeding sites and/or feeding):	2	1	Highly likely to be a breeding site for amphibians and potential corridor for faunal movement.

Ecological Importance and Sensitivity	Seep wetland 1	Seep wetland 2	Reason
Landscape Scale (Median)	**2.80**	**1,00**	
Protection status of the wetland/watercourse: (National (4), Provincial/ Private (3), municipal (1 or 2), public area (0 or 1)	3	1	Seep wetland 1 is recognised as a CBA. The property is also private property, therefore offering some form of protection (WP according to the NBA, 2018). The artificial wetland is not demarcated as an ESA or CBA.
Protection status of the vegetation type: (SANBI guidance on the protection status of the surrounding vegetation)	4	3	The wetland vegetation type is comprised of South Coast Limestone Fynbos (EN-PP) and Southwest Ferricrete Fynbos (CR-PP); however, for seep wetland 2, indigenous wetland vegetation is lacking.
Regional context of the ecological integrity: (Assessment of the PES (habitat integrity), especially in light of regional utilisation)	2	0	Seep Wetland: PES within category C
Size and rarity of the wetland type/s present: (Identification and rarity assessment of wetland types)	2	0	The threat status of the wetland vegetation type and the CBA classification of the seep wetland 1 indicates rarity.
Diversity of habitat types: (Assessment of the variety of wetland types present within a site)	3	1	Seep wetland 1 comprises a moderately diverse assemblage of aquatic vegetation with slight disturbance.
Sensitivity of the Wetland (Median)	**1.67**	**0,67**	
Sensitivity to changes in floods: (Floodplains at 4; valley bottoms 2 or 3; pans and seeps 0 or 1)	1	0	Onsite wetlands, particularly seep wetland 1, is located in a relatively large catchment dominated by natural land use. Seep wetland 1 is artificial and fed by the upstream farm dams.
Sensitivity to changes in low flows/dry season: (Unchanneled VB's probably most sensitive)	1	0	Seep wetland 1 is fed by interflow and surface runoff; changes in low flows/dry season could affect water quality/hydrology. Artificial seep wetland 2 is fed by the two farm dams.
Sensitivity to changes in water quality:	3	2	The wetlands are in a natural catchment - naturally low nutrient system.

Ecological Importance and Sensitivity	Seep wetland 1	Seep wetland 2	Reason
(Especially natural low nutrient waters – lower nutrients likely to be more sensitive)			
Ecological Importance and Sensitivity Score	**2.8**	**1,0**	
Ecological Importance and Sensitivity Category	**High**	**Low/Marginal**	

Table 6-16: Score sheet for determining the EIS of the ephemeral streams.

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

Determinant	Score (0-4)	Confidence (1-4)
TOTAL	17	34
MEDIAN	2	3
OVERALL EIS	**Moderate**	**High**

Score guideline Very high = 4; High = 3, Moderate = 2; Marginal/Low = 1; None = 0
Confidence rating Very high confidence = 4; High confidence = 3; Moderate confidence = 2; Marginal/low confidence = 1
* a rating of zero is not appropriate in this context.

6.5. Recommended Ecological Category

According to the Rountree *et al.* (2013) method for determining REC, the management objective for any wetland within PES Category C or D with a "High" EIS score must, where practically possible, be rehabilitated to a PES category that is one higher than the pre-development category. In this case, the REC category for the Seep Wetland 1 is set at B and should include rehabilitating the southeastern corner of the orchard which coincides with Seep Wetland 1. During the site visit, it was observed that recolonization of wetland vegetation had already begun and should be encouraged to continue, and therefore rehabilitating this area is highly feasible.

The REC for the two ephemeral streams is to maintain these streams in the pre-development PES category, i.e. within PES of B (Largely Natural). The two streams should be set aside as No Go areas during the operation of the orchard, trampling should be avoided as far as possible, and no dumping / littering should occur in these areas. Erosion in the streams should be monitored and addressed immediately, especially after rainfall events. Implement erosion control measures 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.

7. Aquatic Impact Identification

The aquatic impact of the construction and operation of the macadamia nut orchard was identified and assessed. The following applicable activities are noted for the construction phase of the orchard:

- Vegetation clearing was conducted to make way for the macadamia nut orchard.
- Additionally tilling / ploughing was done to create berms for the macadamia nut trees to be planted in.

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

- Maintenance largely consists of irrigating the trees during Summer, one person walks each row, approximately 3 times a week.
- During harvest, which will occur once a year, one person walks each row every day for approximately a month.

Direct construction and operational phase impacts were/are limited to the two seep wetlands. However, as the orchard is located in the catchment area, and within proximity to the two streams, indirect impacts may have occurred as a result of the development. The potential impacts to the two seep wetlands and the two streams include the following:

Construction & Operational Phase Impacts:

1. Wetland habitat disturbance within the two seep wetlands as a result of vegetation clearing, ploughing / tilling, and planting of the macadamia nut trees and ongoing maintenance thereof.
2. Alteration of flow within onsite watercourses due to ploughing / tilling for constructing berms for macadamia nut trees to be planted in.
3. Increased sediment input within onsite watercourses, due to vegetation clearing and ploughing / tilling.
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.

8. Impact Assessment

The four potential aquatic construction and operational phase impacts identified in Section 7 were assessed first without, and then with, application of mitigation measures. The construction and operational phase impacts of habitat disturbance, flow regime alteration and sedimentation within Seep Wetland 1 were determined to be of “Medium” significance both prior and subsequent to implementing mitigation measures, while all of the post-mitigation scores fell within the “Low” or “Very Low” significance categories for impacts relating to Seep Wetland 2 and the ephemeral streams. The ‘no go’ scenario was not assessed as the activities have already occurred.

8.1. Construction Phase

Table 8-1: Assessment results for Impact 1 for Seep Wetland 1.

Impact 1: Wetland Habitat Disturbance in Seep Wetland 1				
Description		Approximately 1.4 Ha of the 8.5 Ha Seep wetland 1 underwent disturbance due to the clearing of native wetland vegetation and subsequent ploughing and tilling to create the macadamia nut orchard. However, despite the clearing, wetland vegetation has begun to naturally recolonize, growing between the rows of macadamia nut trees. The landowner consistently clears AIS from the onsite watercourses, and surrounding catchment.		
Mitigation Measures		Although technically the impact has already occurred, the agricultural area coinciding with wetland 1, specifically the southeastern corner of the orchard, should remain fallow thereby allowing the indigenous wetland vegetation to further recolonize. AIS are currently being removed by the landowner and should continue to be removed from the onsite watercourses.		
	Impact Without Mitigation		**Impact With Mitigation**	
Factor		-		-
Consequence				
Intensity of Impact	3	Medium / Harmful	-	NA
Duration of Impact	2	One month to one year	-	NA
Extent / spatial scale of impact	1	Limited to project site	-	NA
Reversibility	2	Low-cost rehabilitation / Moderately high likelihood of success	-	NA
Loss of irreplaceable resources	3	Medium	-	NA
Cumulative Impact	3	Medium	-	NA
Probability				
Frequency of the Activity	1	Once off activity / less than once in 20 years	-	NA
Likelihood of the Incident / Impact occurring	5	Definite	-	NA
Impact Significance				
Consequence	2.27	Low	-	NA
Probability	5,00	Very High	-	NA
Impact Significance	**2,81**	**Medium**	**-**	**NA**

Table 8-2: Assessment results for Impact 1 for Seep Wetland 2.

Impact 1: Wetland Habitat Disturbance in Seep Wetland 2 (seepage below dams)				
Description		**Seep Wetland 2 underwent disturbance due to the clearing of native wetland vegetation and subsequent tilling to create the macadamia nut orchard. However, despite the clearing, some wetland vegetation has begun to naturally regenerate, growing between the rows of trees. Additionally, there was unlikely to be a pristine, diverse indigenous community of wetland vegetation associated with the artificial Seep Wetland 2 prior to onsite agricultural activities, which reduces the significance of this impact.**		
Mitigation Measures		**It is recommended that the portion of the orchard coinciding with the Seep Wetland 2 remains fallow as far as possible. Dumping and littering in the orchard should be strictly prohibited. AIS, which might colonize disturbed areas and outcompete natural wetland vegetation, should be monitored for, and removed, during the ongoing management of the orchard.**		
	Impact Without Mitigation		**Impact With Mitigation**	
Factor		**-**		**-**
Consequence				
Intensity of Impact	3	Medium / Harmful	-	NA
Duration of Impact	2	One month to one year	-	NA
Extent / spatial scale of impact	1	Limited to project site	-	NA
Reversibility	1	Passive restoration / High likelihood of success	-	NA
Loss of irreplaceable resources	1	None	-	NA
Cumulative Impact	1	Very Low	-	NA
Probability				
Frequency of the Activity	1	Once off activity / less than once in 20 years	-	NA
Likelihood of the Incident / Impact occurring	5	Definite	-	NA
Impact Significance				
Consequence	1,81	Low	-	NA
Probability	5,00	Very High	-	NA
Impact Significance	**2,45**	**Low**	**-**	**NA**

Table 8-3: Assessment results for Impact 2 for Seep Wetland 1.

Impact 2: Altered flow regime in Seep Wetland 1				
Description		Site clearance and ploughing/tilling has led to alteration of the flow regime for the onsite seep wetland 1. The ploughing/tilling within the wetland, and within its catchment, likely resulted in diversion and concentration of flow due to the created berms, while the clearance of indigenous wetland / terrestrial vegetation and slight soil compaction likely increased flow downstream.		
Mitigation Measures		Although technically the impact has already occurred, the agricultural area coinciding with wetland 1, specifically the southeastern corner of the orchard, should remain fallow thereby allowing the indigenous wetland vegetation to further recolonize. AIS should be continuously removed from the onsite watercourses. Effective stormwater management should be implemented, which ensures that peak stormwater flows are adequately managed or dissipated, before they enter downslope Seep Wetland 1.		
	Impact Without Mitigation		**Impact With Mitigation**	
Factor		-		-
Consequence				
Intensity of Impact	3	Medium / Harmful	-	NA
Duration of Impact	2	One month to one year	-	NA
Extent / spatial scale of impact	1	Limited to project site	-	NA
Reversibility	2	Low-cost rehabilitation / Moderately high likelihood of success	-	NA
Loss of irreplaceable resources	3	Medium	-	NA
Cumulative Impact	3	Medium	-	NA
Probability				
Frequency of the Activity	1	Once off activity / less than once in 20 years	-	NA
Likelihood of the Incident / Impact occurring	5	Definite	-	NA
Impact Significance				
Consequence	2.27	Low	-	NA

Probability	5,00	Very High	-	NA
Impact Significance	**2,81**	**Medium**	**-**	**NA**

Table 8-4: Assessment results for Impact 2

Impact 2: Altered flow regime of Seep Wetland 2 and ephemeral streams				
Description		**Site clearance and ploughing/tilling has led to alteration of the flow regime for the onsite seep wetland 2. The ploughing/tilling within the wetland, within its catchment and within the catchment of the streams, likely resulted in diversion and concentration of flow due to the created berms, while the clearance of indigenous wetland / terrestrial vegetation and slight soil compaction likely increased flow downstream. The hydrology of the wetland is completely artificial which decreases the significance of the impact. Direct impacts to the flow of the streams did not appear significant and are related to catchment land use transformation.**		
Mitigation Measures		**It is recommended that the portion of the orchard coinciding with the Seep Wetland 2 remains fallow as far as possible, thereby allowing indigenous wetland vegetation to recolonize and reducing the impact of altered flow both within the wetland and within the streams.**		
	Impact Without Mitigation		**Impact With Mitigation**	
Factor		**-**		**-**
Consequence				
Intensity of Impact	3	Medium / Harmful	-	NA
Duration of Impact	2	One month to one year	-	NA
Extent / spatial scale of impact	1	Limited to project site	-	NA
Reversibility	1	Passive restoration / High likelihood of success	-	NA
Loss of irreplaceable resources	1	None	-	NA
Cumulative Impact	1	Very Low	-	NA
Probability				
Frequency of the Activity	1	Once off activity / less than once in 20 years	-	NA
Likelihood of the Incident / Impact occurring	5	Definite	-	NA

Impact Significance				
Consequence	1,81	Low	-	NA
Probability	5,00	Very High	-	NA
Impact Significance	**2,45**	**Low**	**-**	**NA**

Table 8-5: Assessment results for Impact 3 for natural seep wetland 1.

Impact 3: Increased sediment input into Seep Wetland 1				
Description		**Soil disturbance during clearing and ploughing/tilling would have made 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 wetland and the downslope seep wetland area.**		
Mitigation Measures		**Effective stormwater management should be implemented, which ensures that sediment laden stormwater flow from the orchard, particularly during storm events, does not enter downslope Seep Wetland 1. 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, although currently not present in the wetland and minimal in the catchment, 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.**		
	Impact Without Mitigation		**Impact With Mitigation**	
Factor		**-**		**-**
Consequence				
Intensity of Impact	3	Medium / Harmful	-	NA
Duration of Impact	2	One month to one year	-	NA
Extent / spatial scale of impact	1	Limited to project site	-	NA
Reversibility	2	Low-cost rehabilitation / Moderately high likelihood of success	-	NA

Loss of irreplaceable resources	3	Medium	-	NA
Cumulative Impact	3	Medium	-	NA
Probability				
Frequency of the Activity	1	Once off activity / less than once in 20 years	-	NA
Likelihood of the Incident / Impact occurring	5	Definite	-	NA
Impact Significance				
Consequence	2.27	Low	-	NA
Probability	5,00	Very High	-	NA
Impact Significance	**2,81**	**Medium**	**-**	**NA**

Table 8-6: Assessment results for Impact 3 for Seep Wetland 2 and DLs.

Impact 3: Increased sediment input into seep wetland 2 and streams				
Description		**Soil disturbance during clearing and earth works would have made 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 watercourses.**		
Mitigation Measures		**It is recommended that the portion of the orchard coinciding with the Seep Wetland 2 remains fallow as far as possible. Erosion in the streams (minimal at present) and in the orchard / catchment area 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.**		
	Impact Without Mitigation		**Impact With Mitigation**	
Factor		**-**		**-**
Consequence				

Intensity of Impact	3	Medium / Harmful	-	NA
Duration of Impact	2	One month to one year	-	NA
Extent / spatial scale of impact	1	Limited to project site	-	NA
Reversibility	1	Passive restoration / High likelihood of success	-	NA
Loss of irreplaceable resources	1	None	-	NA
Cumulative Impact	1	Very Low	-	NA
Probability				
Frequency of the Activity	1	Once off activity / less than once in 20 years	-	NA
Likelihood of the Incident / Impact occurring	5	Definite	-	NA
Impact Significance				
Consequence	1,81	Low	-	NA
Probability	5,00	Very High	-	NA
Impact Significance	**2,45**	**Low**	**-**	**NA**

Table 8-7: Assessment results for Impact 4 for all onsite watercourses.

Impact 4: Water quality impairment of onsite watercourses				
Description		**Accidentally spilled chemicals, or petrochemicals from construction vehicles or machinery may have found their way into the onsite watercourses. Dumping and littering may have occurred during construction.**		
Mitigation Measures		**All onsite watercourses should be routinely checked for dumping / littering, which should be strictly prohibited in onsite watercourses. Ensure that regenerative and sustainable farming practises are utilized within the farm, without the use of herbicides and pesticides.**		
	Impact Without Mitigation		**Impact With Mitigation**	
Factor		**-**		**-**
Consequence				
Intensity of Impact	3	Medium / Harmful	-	NA
Duration of Impact	2	One month to one year	-	NA
Extent / spatial scale of impact	1	Limited to project site	-	NA
Reversibility	1	Passive restoration / High likelihood of success	-	NA
Loss of irreplaceable resources	1	None	-	NA
Cumulative Impact	1	Very Low	-	NA
Probability				
Frequency of the Activity	1	Once off activity / less than once in 20 years	-	NA
Likelihood of the Incident / Impact occurring	3	Possible	-	NA
Impact Significance				
Consequence	1,81	Low	-	NA
Probability	2,00	Low	-	NA
Impact Significance	**1,85**	**Low**	**-**	**NA**

8.2. Operational Phase

Table 8-8: Assessment results for Impact 6 for Seep Wetland 1.

Impact 6: Wetland Habitat Disturbance in Seep Wetland 1				
Description		**Wetland vegetation has begun to naturally regenerate, growing between the rows of trees in the orchard. There will likely be slight habitat disturbance due to the ongoing maintenance / irrigating of the orchard (3 farm workers) approximately one person walking a row, 3 times a week. The harvest will be once a year and involve the same 3 workers. However, as the trees grow, it is likely that they will shade vegetation beneath them, and therefore over time, the wetland vegetation may die.**		
Mitigation Measures		**The agricultural area coinciding with wetland 1, specifically the southeastern corner of the orchard, should remain fallow thereby allowing the indigenous wetland vegetation to further recolonize. AIS are currently being removed by the landowner and should continue to be removed from the onsite watercourses. Ensure that regenerative and sustainable farming practises are utilized within the farm, without the use of herbicides and pesticides.**		
	Impact Without Mitigation		**Impact With Mitigation**	
Factor		-		-
Consequence				
Intensity of Impact	4	High / Very Harmful	3	Medium / Harmful
Duration of Impact	5	Beyond 20 years / permanent	5	Beyond 20 years / permanent
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	2	Low-cost rehabilitation / Moderately high likelihood of success
Loss of irreplaceable resources	3	Medium	3	Medium
Cumulative Impact	3	Medium	3	Medium
Probability				
Frequency of the Activity	5	Weekly to monthly	5	Weekly to monthly
Likelihood of the Incident / Impact occurring	5	Definite	5	Definite
Impact Significance				
Consequence	2.9	Medium	2,5	Low
Probability	5,00	Very High	5	Very High
Impact Significance	**3,32**	**Medium**	**3,03**	**Medium**

Table 8-9: Assessment results for Impact 6 for Seep Wetland 2

Impact 6: Wetland Habitat Disturbance in Seep Wetland 2				
Description		**Wetland vegetation has begun to naturally regenerate, growing between the rows of trees in the orchard. Despite this there will likely be slight habitat disturbance due to the ongoing maintenance / irrigating of the orchard (3 farm workers) approximately one person walking a row, 3 times a week. The harvest will be once a year and involve the same 3 workers. However, as the trees grow, it is likely that they will shade vegetation beneath them, and therefore over time, the wetland vegetation may die. However, there was unlikely to be a pristine, diverse indigenous community of wetland vegetation associated with the artificial Seep Wetland 2 prior to onsite agricultural activities, which reduces the significance of this impact.**		
Mitigation Measures		**Wetland vegetation should be encouraged to recolonize where possible. It is recommended that the portion of the orchard coinciding with the Seep Wetland 2 remains fallow as far as possible, and that any maintenance required for the trees is conducted during irrigation to limit the amount of trampling within the wetland area. AIS should be monitored for and removed during ongoing management of the orchard. Erosion (if applicable) in the streams should be monitored and addressed immediately, especially after rainfall events. Implement erosion control measures 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.** **Ensure that regenerative and sustainable farming practises are utilized within the farm, without the use of herbicides and pesticides.**		
	Impact Without Mitigation		**Impact With Mitigation**	
Factor		-		-
Consequence				
Intensity of Impact	2	Low / Slightly harmful	2	Low / Slightly harmful
Duration of Impact	5	Beyond 20 years / permanent	5	Beyond 20 years / permanent
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	1	None	1	None
Cumulative Impact	1	Very Low	1	Very Low
Probability				
Frequency of the Activity	5	Weekly to Monthly	5	Weekly to Monthly

Likelihood of the Incident / Impact occurring	5	Definite	5	Definite
Impact Significance				
Consequence	1,81	Low	1,72	Low
Probability	5,00	Very High	5,00	Very High
Impact Significance	**2,45**	**Low**	**2,38**	**Low**

Table 8-10: Assessment results for Impact 6 for Seep Wetland 1.

Impact 6: Altered flow regime of seep wetland 1				
Description		**Site clearance and ploughing/tilling has led to alteration of the flow regime for the onsite seep wetland 1. The ploughing/tilling within the wetland, and within its catchment, likely resulted in diversion and concentration of flow due to the created berms, while the clearance of indigenous wetland / terrestrial vegetation and slight soil compaction likely increased flow downstream. Additionally, the areas on top of the berms may likely dry out and therefore flow may be completely altered in these areas.**		
Mitigation Measures		**The agricultural area coinciding with wetland 1, specifically the southeastern corner of the orchard, should remain fallow thereby allowing the indigenous wetland vegetation to further recolonize. AIS are currently being removed by the landowner and should continue to be removed from the onsite watercourses. Effective stormwater management should be implemented, which ensures that peak stormwater flows from the orchard are adequately managed or dissipated, before they flow into downslope Seep Wetland 1.**		
	Impact Without Mitigation		**Impact With Mitigation**	
Factor		**-**		**-**
Consequence				
Intensity of Impact	4	High / Very Harmful	3	Medium / Harmful
Duration of Impact	5	Beyond 20 years / permanent	5	Beyond 20 years / permanent
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	2	Low-cost rehabilitation / Moderately high likelihood of success
Loss of irreplaceable resources	3	Medium	3	Medium
Cumulative Impact	3	Medium	3	Medium

Probability				
Frequency of the Activity	5	Weekly to monthly	4	Monthly to annually
Likelihood of the Incident / Impact occurring	5	Definite	5	Definite
Impact Significance				
Consequence	2.9	Medium	2,54	Low
Probability	5,00	Very High	4,5	High
Impact Significance	**3, 32**	**Medium**	**2,93**	**Medium**

Table 8-11: Assessment results for Impact 6 for Seep wetland 2 and streams

Impact 6: Altered flow regime of Seep Wetland 2 and Streams				
Description		**Site clearance and ploughing/tilling has led to alteration of the flow regime for the onsite seep wetland 2. The ploughing/tilling within the wetland, within its catchment and within the catchment of the streams, likely resulted in diversion and concentration of flow due to the created berms, while the clearance of indigenous wetland / terrestrial vegetation and slight soil compaction likely increased flow downstream. Irrigation of the trees may increase runoff and give rise to potential erosion. The hydrology of the wetland is completely artificial which decreases the significance of the impact. Direct impacts to the flow of the streams did not appear significant and are related to catchment land use transformation.**		
Mitigation Measures		**It is recommended that the portion of the orchard coinciding with the Seep Wetland 2 remains fallow as far as possible, thereby allowing indigenous wetland vegetation to recolonize and reducing the impact of altered flow both within the wetland and within the streams. Effective stormwater management should be implemented, which ensures that peak stormwater flows are adequately managed or dissipated, before they flow into downslope Seep Wetland 1. AIS should be monitored for and removed during ongoing management of the orchard. Erosion in the streams and orchard should be monitored and addressed immediately, especially after rainfall events. Implement erosion control measures where/if 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.**		
	Impact Without Mitigation		**Impact With Mitigation**	
Factor		-		-
Consequence				

Intensity of Impact	2	Low / Slightly Harmful	2	Low / Slightly Harmful
Duration of Impact	5	Beyond 20 years / permanent	5	Beyond 20 years / permanent
Extent / spatial scale of impact	1	Limited to project site	1	Limited to project site
Reversibility	1	Passive restoration / High likelihood of success	1	Passive restoration / High likelihood of success
Loss of irreplaceable resources	1	None	1	None
Cumulative Impact	1	Very Low	1	Very Low
Probability				
Frequency of the Activity	5	Weekly to monthly	4	Monthly to annually
Likelihood of the Incident / Impact occurring	5	Definite	3	Possible
Impact Significance				
Consequence	1,72	Medium	1,72	Low
Probability	5,00	Very High	3,5	Medium
Impact Significance	**2,38**	**Low**	**2,08**	**Low**

Table 8-12: Assessment results for Impact 7 for natural seep wetland.

Impact 7: Increased sediment input into Seep Wetland 1		
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 downstream watercourses (Seep Wetland 1) during the rainy season.**
Mitigation Measures		**The agricultural area coinciding with wetland 1, specifically the southeastern corner of the orchard, should remain fallow thereby allowing the indigenous wetland vegetation to further recolonize. AIS are currently being removed by the landowner and should continue to be removed from the onsite watercourses.** **Effective stormwater management should be implemented, which ensures that sediment laden stormwater flow from the orchard, particularly during storm events, does not enter downslope**

		Seep Wetland 1. A regular monitoring system should be set up by the farm manager which ensures that if sedimentation occurs downslope, remediation measures are implemented. **Erosion (if applicable) in the wetland and catchment should be monitored and addressed immediately, especially after rainfall events. Implement erosion control measures 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.**

	Impact Without Mitigation		**Impact With Mitigation**	
Factor		-		-
Consequence				
Intensity of Impact	4	High / Very Harmful	3	Medium / Harmful
Duration of Impact	5	Beyond 20 years / permanent	5	Beyond 20 years / permanent
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	2	Low-cost rehabilitation / Moderately high likelihood of success
Loss of irreplaceable resources	3	Medium	3	Medium
Cumulative Impact	3	Medium	3	Medium
Probability				
Frequency of the Activity	5	Weekly to monthly	4	Monthly to annually
Likelihood of the Incident / Impact occurring	5	Definite	5	Definite
Impact Significance				
Consequence	2.9	Medium	2,54	Low
Probability	5,00	Very High	4,5	High

Impact Significance	**3, 32**	**Medium**	**2,93**	**Medium**

Table 8-13: Assessment results for Impact 8 for seep wetland 2 and streams

Impact 8: Increased sediment input into seep wetland 2 and streams				
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 downstream watercourses during the rainy season.**		
Mitigation Measures		**It is recommended that the portion of the orchard coinciding with the Seep Wetland 2 remains fallow as far as possible. Erosion in the streams and in the orchard / catchment area should be monitored and addressed immediately, especially after rainfall events. Implement erosion control measures 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.**		
	Impact Without Mitigation		**Impact With Mitigation**	
Consequence				
Intensity of Impact	2	Low / Slightly Harmful	2	Low / Slightly Harmful
Duration of Impact	5	Beyond 20 years / permanent	5	Beyond 20 years / permanent
Extent / spatial scale of impact	1	Limited to project site	1	Limited to project site
Reversibility	1	Passive restoration / High likelihood of success	1	Passive restoration / High likelihood of success
Loss of irreplaceable resources	1	None	1	None
Cumulative Impact	1	Very Low	1	Very Low
Probability				
Frequency of the Activity	5	Weekly to monthly	4	Monthly to annually

Likelihood of the Incident / Impact occurring	5	Definite	3	Possible
Impact Significance				
Consequence	1,72	Medium	1,72	Low
Probability	5,00	Very High	3,5	Medium
Impact Significance	**2,38**	**Low**	**2,08**	**Low**

Table 8-14: Assessment results for Impact 9 for onsite watercourses

Impact 9: Water quality impairment of the onsite watercourses				
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. The potential intensity of the impact is limited by the scale of the development.**		
Mitigation Measures		**All farming machinery and vehicles used must be regularly serviced, fuel must be stored more than 15 m away from any wetland in a bunded area. All onsite watercourses should be routinely checked for dumping / littering, which should be strictly prohibited in onsite watercourses. Ensure that regenerative and sustainable farming practises are utilized within the farm, without the use of herbicides and pesticides.**		
	Impact Without Mitigation		**Impact With Mitigation**	
Factor		**-**		**-**
Consequence				
Intensity of Impact	2	Low /Slightly Harmful	2	Low /Slightly Harmful
Duration of Impact	1	Up to one month	1	Up to one month
Extent / spatial scale of impact	1	Limited to project site	1	Limited to project site
Reversibility	1	Passive restoration / High likelihood of success	1	Passive restoration / High likelihood of success
Loss of irreplaceable resources	1	None	1	None
Cumulative Impact	1	Very Low	1	Very low
Probability				

Frequency of the Activity	1	Once off activity / less than once in 20 years	1	Once off activity / less than once in 20 years
Likelihood of the Incident / Impact occurring	3	Possible	2	Unlikely
Impact Significance				
Consequence	1,36	Very Low	1,36	Low
Probability	2	Low	1,5	Low
Impact Significance	**1,49**	**Very Low**	**1,39**	**Very Low**

9. Risk Assessment

The completed RAM is attached as **Annexure 1**. The Risk Assessment Matrix 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 the artificial Seep Wetland 2 and ephemeral streams were all found to be of "Low" Significance due to the following:

   - Seep wetland 2 is an artificial system and it is highly unlikely that there was a pristine, diverse indigenous community of wetland vegetation associated with this artificial seepage prior to onsite agricultural activities.
   - The wetland is fed by a stream diversion and storage of water within the two onsite dams, and therefore its hydrology is entirely artificial in nature.
   - After the development of the macadamia nut orchard, sparse indigenous wetland vegetation has established between the trees, and it is likely that this seepage area is currently augmented by the irrigation of the trees. This artificial seepage area may therefore have been smaller in extent prior to the establishment of the orchard.
   - After the site assessment, no significant direct impacts were observed within the two ephemeral streams as a result of the orchard. Limited flow alteration and sedimentation may have occurred, but this was of Low Significance to these two streams that were, and are currently, in a largely natural condition (both prior and subsequent to the orchard establishment).

2. The construction and operational phase risk of habitat disturbance, flow regime alteration and sedimentation within Seep Wetland 1 were determined to be of "Medium" significance, thereby requiring a full Water Use License Application (WULA).

10. Conclusion and Recommendation

The **at-risk watercourses** were classified and delineated during a site assessment on the 10th of September 2024 during Spring. Two ephemeral drainage lines were confirmed and delineated, approximately 15 m east (Ephemeral Stream 1) and 10 m west (Ephemeral Stream 2) of the onsite agricultural activities (macadamia nut orchard). Associated with the eastern stream (Ephemeral Stream 1) is a natural seepage wetland (Seep Wetland 1). This seep wetland is a continuation of a larger seep wetland system that extends to neighbouring properties of Farm 57/633. Much of the agricultural area indicated wetland conditions, and following the investigation of historical aerial imagery, it was confirmed that two farm dams (dam 1 and dam 2), as well as overflow associated with an artificial furrow on the property**,** have resulted in artificial seepage areas (Seep Wetland 2). Historical imagery indicates that the artificial Seep wetland 2 was largely dominated by AIS prior to the macadamia nut orchard. After the development of the macadamia nut orchard, sparse indigenous wetland vegetation has established between the trees, and it is likely that this seepage area is currently augmented by the irrigation of the trees. This artificial seepage area may therefore have been smaller in extent prior to the establishment of the orchard.

The agricultural activities primarily affected the natural seep wetland associated with the eastern ephemeral stream (Seep Wetland 1) and the artificial seepage below the dam (Seep Wetland 2). The field assessment conducted confirmed that the two ephemeral streams were unlikely to be directly impacted, although a small amount of sedimentation and flow modification could have occurred due to the clearing and planting within the stream's catchment area.

In this study, the at-risk watercourses were assessed using current best practice methodologies to determine the PES, EIS, WES both prior to the development of the macadamia nut orchard– i.e. the pre-construction seep wetlands/streams, as well as in its current form – i.e. the remnant seep wetlands/streams. These metrics were then used to determine the management objective expressed in terms of the Recommended Ecological Category (REC). The results of these assessments are as follows:

Table 12-1: Results of the watercourse status quo assessment.

	PES	EIS	WES	REC
Seep wetland 1 pre orchard	**C**	High	Moderately High	B
Seep wetland 1 post orchard	**C**	High	Moderately High	B
Seep wetland 2 (pre and post orchard)	**NA**	Low Marginal	Moderately Low	NA
Drainage lines pre orchard	**B**	Moderate	Moderately High	B
Drainage lines post orchard	**B**	Moderate	Moderately High	B

Aquatic biodiversity impacts associated with the development were identified and assessed using both an impact assessment methodology compliant with NEMA requirements. The construction and operational phase impacts of habitat disturbance, flow regime alteration and sedimentation within Seep Wetland 1 were determined to be of "Medium" significance both prior and subsequent to implementing mitigation measures, while all of the post-mitigation scores fell within the "Low" or "Very Low" significance categories for impacts relating to Seep Wetland 2 and the ephemeral streams. The 'no go' scenario was not assessed as the activities have already occurred.

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 or 100 m of the drainage lines, that is deemed to impede / divert the flow or alter the bed, banks, course, or characteristics of the watercourses. The Risk Assessment Matrix prescribed by GN 4167 of 2023 was applied to the onsite agricultural activities with the following outcomes:

3. The risks associated with all four impacts relating to the artificial Seep Wetland 2 and ephemeral streams were all found to be of "Low" Significance due to the following:

    - Seep wetland 2 is an artificial system and it is highly unlikely that there was a pristine, diverse indigenous community of wetland vegetation associated with this artificial seepage prior to onsite agricultural activities. After the development of the macadamia nut orchard, sparse indigenous wetland vegetation has reestablished between the trees.

    - The wetland is fed by a stream diversion and therefore its hydrology is entirely artificial in nature.

    - It is likely that this seepage area is currently augmented by the irrigation of the macadamia nut trees. This artificial seepage area may therefore have been smaller in extent prior to the establishment of the orchard.

    - After the site assessment, no significant direct impacts were observed within the two ephemeral streams as a result of the orchard. Limited flow alteration and sedimentation may have occurred, but this was of Low Significance to these two streams that were, and are currently, in a largely natural condition (both prior and subsequent to the orchard establishment).

4. The construction and operational phase risk of habitat disturbance, flow regime alteration and sedimentation within Seep Wetland 1 were determined to be of "Medium" significance, thereby requiring a full Water Use License Application (WULA).

Noted during the site assessment was the ongoing clearance of AIS on the entire property, and the monitoring for erosion / rehabilitation currently being undertaken within the two ephemeral streams by the farm manager / landowner. Recommendations in this report include the continuation of the current monitoring schedule by the farm manager (for AIS, potential erosion, and sedimentation), and subsequent rehabilitation / clearance within the two ephemeral streams and Seep Wetland 2 if noted, during the lifecycle of the orchard.

Additionally, as far as possible, wetland vegetation should be allowed to recolonize in areas that have been cleared – as observed during the site assessment, wetland vegetation was already recolonizing to a degree. It is suggested that stormwater peak flow from the orchard is managed by establishing vegetated swales which discharge diffuse flow into seep wetland 1, where necessary.

The commitment of the landowner / farm manager to regenerative and sustainable farming practises, currently being utilized within the farm, is encouraged.

11. References

Beck HE, Zimmermann NE, McVicar TR, Vergopolan N, Berg A, Wood EF. 2018. Data Descriptor: Present and future Koppen-Geiger climate classification maps at 1-km resolution. Scientific Data.

CapeNature. 2017. Protected Areas. CapeFarmMapper ver.2.6.10.

CSIR. 2011. Freshwater Priority Areas.

DAFF. 2021. Soil Clay & Depth. CapeFarmMapper Ver.2.6.10.

DFFE. 2023. National Web based Environmental Screening Tool.

Department of Water and Sanitation. 2011. Ecoregions (Level 1) for South Africa [Data set]. Department of Water and Sanitation.

DWAF. 2008. Updated Manual for the Identification and Delineation of Wetlands and Riparian Areas:75.

DWAF. 2011. Water Management Areas. CapeFarmMapper Ver.2.6.10.

ENPAT. 2021. Soils & Geology (ENPAT). Cape Farm Mapper ver 2.6.10.

Macfarlane D, Ollis D, Kotze D. 2020. WET-Health (Version 2.0) A Refined Suite of Tools for Assessing the Present Ecological State of Wetland Ecosystems.

NFEPA. 2011. National Freshwater Priority Area. CSIR.

NWM5. 2018. National Wetlands Map 5.

Rountree MW, Malan HL, Weston BC. 2013. Manual for the Rapid Ecological Reserve Determination of Inland Wetlands (Version 2.0). Available from www.wrc.org.za.

SANBI. 2011. NFEPA Wetland Vegetation. Available from https://bgis.sanbi.org.

SANBI. 2018. VegMap. Available from https://gis.elsenburg.com/apps/cfm/.

Schulze R. 2009. South African Atlas of Agrohydrology and Climatology. Water Research Commission, WRC (TT82-96).

Schulze R, Hallowes L, Horan M, Lumsden T, Pike A, Thornton-Dibb S, Warburton M. 2007. South African Quaternary Catchments Database. Page South African Atlas of Climatology and Agrohydrology. WRC Report 1489/1/06, Section 2.3. Pretoria.

Van Ginkel CE, Glen RP, Gordon-Gray KD, Cilliers CJ, Muasya M, van Deventer PP. 2011. Easy identification of some South African wetland plants (Grasses, Restios, Sedges, Rushes, Bulrushes, Eriocaulons and Yellow-eyed grasses). Page Water Research Commission.

van Rensburg, J. 2024. Terrestrial Plant Species Assessment: Farm Rocklands 57/633 Agricultural Development. Nature Works Environmental Consultancy. RSA.

Annexure 1: DWS RISK ASSESSMENT

PROJECT: Portion 57 of Farm 633

RISK ASSESSMENT MATRIX for Section 21 (c) and (i) Water Use activities - Version 2.1.1

Name of Assessor: Kimberley van Zyl **Signature:**

SACNASP Registration Number: Pr. Nat. Sci. Reg. No.117097 (Ecological Science)

Date of assessment: 14-Oct-24

Risk to be scored for all relevant phases of the project (factoring in specified control measures). MUST BE COMPLETED BY SACNASP PROFESSIONAL MEMBER REGISTERED IN AN APPROPRIATE FIELD OF EXPERTISE.

Phase	Activity	Impact	Potentially affected watercourses			Severity of impact on watercourse Quality					Overall Intensity (max = 10)	Spatial scale (max = 2)	Duration (max = 5)	Severity (max = 20)	Importance rating (max = 5)	Consequence (max = 100)	Likelihood (Probability) of Impact	Significance (max = 100)	Risk Rating	Confidence level
			Name/s	PES	Overall Watercourse Importance	Abiotic Habitat (Drivers)			Biota (Responses)											
						Hydrology	Water Quality	Geomorph	Vegetation	Fauna										
CONSTRUCTION	<1> vegetation clearing, ploughing, infill with soils from the property, and planting of macadamia nut trees	<1a>Wetland Habitat Disturbance	Seep Wetland 1	C	High	2	2	2	3	1	6	1	2	8	4	32	100%	32	M	Medium
		<1a>Wetland Habitat Disturbance	Seep Wetland 2	n/a (artificial)	Low / Very low	2	2	2	3	1	6	1	2	8	2	16	100%	16	L	Medium
		<1b>Alteration of flow	Seep Wetland 1	C	High	3	1	2	2	1	6	1	2	8	4	32	100%	32	M	Medium
		<1b>Alteration of flow	Seep Wetland 2	n/a (artificial)	Low / Very low	3	1	1	1	1	6	1	2	8	2	16	100%	16	L	Medium
		<1b>Alteration of flow	Streams	B	Moderate	2	1	1	1	1	4	1	2	7	3	21	50%	10.5	L	Medium
		<1c>Increased sediment input	Seep Wetland 1	C	High	1	3	2	2	1	6	1	2	8	4	32	100%	32	M	Medium
		<1c>Increased sediment input	Seep Wetland 2	n/a (artificial)	Low / Very low	1	3	2	2	1	6	1	2	8	2	16	100%	16	L	Medium
		<1c>Increased sediment input	Streams	B	Moderate	1	3	2	2	1	6	1	2	7	3	21	50%	10.5	L	Medium
		<1c>Water quality impairment	Seep Wetland 1	C	High	0	3	0	1	0	4	1	2	7	4	28	50%	14.0	L	Medium
		<1c>Water quality impairment	Seep Wetland 2	n/a (artificial)	Low / Very low	0	3	0	1	0	4	1	2	7	2	14	50%	7.4	L	Medium
		<1c>Water quality impairment	Streams	B	Moderate	0	3	0	1	0	4	1	2	7	3	21	50%	12.0	L	Medium
OPERATIONAL	<1><Operation of macadamia nut orchard	<2a>Wetland Habitat Disturbance	Seep Wetland 1	C	High	2	2	2	3	1	6	1	4	11	4	44	100%	44	M	High
		<2a>Wetland Habitat Disturbance	Seep Wetland 2	n/a (artificial)	Low / Very low	2	2	2	3	1	6	1	4	11	2	22	100%	22	L	High
		<2b>Alteration of flow	Seep Wetland 1	C	High	3	1	1	1	1	6	1	4	11	4	44	100%	44	M	High
		<2b>Alteration of flow	Seep Wetland 2	n/a (artificial)	Low / Very low	3	2	2	2	1	6	1	4	11	2	22	100%	22	L	High
		<2b>Alteration of flow	Streams	B	Moderate	2	1	1	1	1	4	1	4	9	3	27	60%	16.2	L	High
		<2c>Increased sediment input	Seep Wetland 1	C	High	1	3	1	1	1	6	1	4	11	4	44	100%	44	M	High
		<2c>Increased sediment input	Seep Wetland 2	n/a (artificial)	Low / Very low	1	1	1	1	1	2	1	4	7	2	14	100%	14	L	High
		<2c>Increased sediment input	Streams	B	Moderate	1	2	1	1	1	4	1	4	9	3	27	60%	16.2	L	High
		<2b>Water quality impairment	Seep Wetland 1	C	High	1	2	1	1	1	4	1	4	9	4	36	60%	21.6	L	High
		<2b>Water quality impairment	Seep Wetland 2	n/a (artificial)	Low / Very low	1	2	1	1	1	4	1	4	9	2	18	60%	10.8	L	High
		<2b>Water quality impairment	Streams	B	Moderate	1	2	1	1	1	4	1	4	9	3	27	60%	21.6	L	High