

FRESHWATER ASSESSMENT FOR THE WORKS UNDERTAKEN ON FARM 1314 AND 1315 NEAR STELLENBOSCH IN THE WESTERN CAPE

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Prepared by:



Ms Toni Belcher and Mr Dana Grobler

PO Box 455, Somerset Mall, 7137

Tel: (021) 851 0555

Email: toni.bluescience.co.za; dana@bluescience.co.za

EXECUTIVE SUMMARY

Farms 1314 and 1315 are located near Stellenbosch. The landowner has been issued with a Compliance Notice for works undertaken adjacent to the Paradyskloof Tributary. The main freshwater feature within the study area consists of the Paradyskloof Tributary of the Blaauwklippen River, a tributary of the Eerste River. The Paradyskloof River arises a short distance upstream of the site and flows in a south-westerly direction to its confluence with the Blaauwklippen River. There are some wetland areas along the length of the watercourses within the site and a number of small farm dams / pools.

The Eerste River and Blaauwklippen River are not mapped as Freshwater Ecosystem Priority Area rivers, only the upper reaches of the Eerste River upstream of Stellenbosch. The dam within the site is mapped as an artificial wetland. The 2017 Western Cape Biodiversity Spatial Plan for the study area has mapped some small aquatic critical biodiversity areas that are associated with wetlands within the site. The watercourse and its smaller tributaries are mapped as aquatic ecological support areas that provide important ecological services and should not be allowed to become degraded.

The instream and riparian habitat of the upper Paradyskloof River has been moderately modified as a result of past disturbance of the areas adjacent to the watercourse as well as the construction of the dam within the site. The instream aquatic habitat is in a slightly better condition, particularly as a result of the rehabilitation works undertaken and is considered to be in a largely natural to moderately modified ecological condition. The ecological importance and sensitivity of the upper reaches of the Paradyskloof River are considered to be moderate to high as the river plays an important role as providing an ecological corridor that links the lower Eerste River to the more natural habitat higher in the catchment.

There are three types of wetlands within the site: a hillslope seep wetland associated with the smaller tributary of the Paradyskloof River; some depression wetlands that have been artificially created and the valley bottom wetland associated with the Paradyskloof River channel. Although the depression wetlands are artificial wetlands and for this reason have been included in this assessment. The habitat of the seep area, although reduced from the original extent is considered to be largely natural in terms of its habitat integrity while valley bottom wetlands are considered to be largely natural to moderately modified and the depressions, although artificial have been created and vegetated to form natural wetlands that provide valued goods and services and are considered to be moderately modified.

The wetlands due their location on the hillslope and association with the watercourses, supply valued services in terms of regulating streamflow, mitigating erosion and providing habitat for biota amongst others. Given that much of the site has been rehabilitated for tourism / recreation purposes, this service is scored high. The wetlands are considered to be of a moderate to high ecological sensitivity and importance, providing a degree of refuge and connectivity for faunal and floral species within a landscape that is becoming increasingly cultivated.

Three alleged illegal and unlawful activities were assessed in terms of their potential freshwater impacts: Construction of a walkway and sculpture display within a watercourse with the associated infilling;

Diversion of the watercourse into a small dam and artificial pond; and Construction of a weir within a watercourse. Potential impacts of the activities undertaken are some aquatic habitat modification; and a localised impedance of flow within the watercourses at the crossings. Given that considerable effort has been undertaken to enhance and improve the aquatic habitats within the garden the impact of the created walkway has been limited and in general has resulted in the improvement of the ecological integrity of the aquatic features that had been modified by past agricultural activities.

*The only activity within or adjacent to the aquatic features that requires some rehabilitation is the infilled area adjacent to the Paradyskloof Stream. While it is not deemed necessary to remove the infilled material, it is recommended that the invasive kikuyu *Pennisetum clandestinum* grass cover on the embankment be removed and that the embankment be revegetated with indigenous vegetation. In particular, the banks of the stream where there is a bend in the watercourse should be vegetated and if necessary stabilised with larger boulders to prevent undercutting of the embankment by the stream.*

In terms of the potential impact of the diversion of the watercourse into the constructed dam and its impact on downstream volume of water in the watercourse and the associated impact of the ecological function of the watercourse and the aquatic biota in the stream, there would be a slight in terms of an increase in the low flows that are impounded by the dam. This impact on flow would have also occurred for the previously existing dam but would have increased as a result of the larger constructed dam. Given the degraded condition of the watercourse downstream of the site, and the fact that the stream along its length appears to have a baseflow contribution from groundwater that sustains the aquatic ecosystem during the dry summer period, the impact of the dam on the downstream flow and aquatic ecosystem is considered of a low significance. A water use authorisation will need to be applied for with the Department of Water and Sanitation.

Only one flow diversion appears to have been undertaken as part of the garden establishment, that is the diversion of some flow from the large dam within the site to maintain the created pond near the western boundary of the site. The series of ponds created along the southern boundary of the site is along one of the channels of the Paradyskloof River. The aquatic impact of this activity on the aquatic habitat and diversity is thus positive and has been adequately rehabilitated that no additional rehabilitation measures are deemed to be required.

The only formalised crossing along the pathway is at the existing weir where a concrete walkway has been strengthened with a concrete structure. The construction of the weir has addressed erosion taking place within the stream. The structure does not appear to significantly impede flow in the watercourse, except to facilitate the creation of the depression wetland habitat upstream. The created pond has been shaped and vegetated such that new wetland habitat has been created with an associated positive impact. No rehabilitation measures are deemed necessary for this activity.

The risk assessment determined that most of the proposed activities pose a moderate to low risk of impacting aquatic habitat and water flow. The reshaping and revegetation of disturbed areas with suitable local indigenous plants was undertaken following the works. It is likely that there has been an improvement

of the ecological condition of the aquatic features that were on the site from a C category or lower before the works to the current B/C category. The activities could thus potentially be authorised by means of the general authorisations for the Section 21(c) and (i) water uses.

No statement has been made on the increased storage of water that has taken place within the site. It is likely that a water use licence application may still be required for the increased storage of water in the site (Section 21(b) water use) and that the Section 21(c) and (i) water uses would then need to be included in this application. The impacts of the enlarged dam does not appear to have impacted on the ecological integrity of the aquatic features at the site.

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1. BACKGROUND

Farms 1314 and 1315 are located near Stellenbosch in the Eerste River Catchment. In February 2019, the Western Cape Department of Environmental Affairs and Development Planning's (DEADP) Environmental Law Enforcement Directorate issued the landowner with a Directive for works undertaken adjacent to the Paradyskloof Tributary of the Blaauwklippen (or Blouklip) River, a tributary in the Eerste River System. This freshwater assessment report is in response to the Directive and assesses the impact of the works undertaken on the aquatic ecosystems and provides recommendations on the mitigation and rehabilitation measures required to address these impacts.

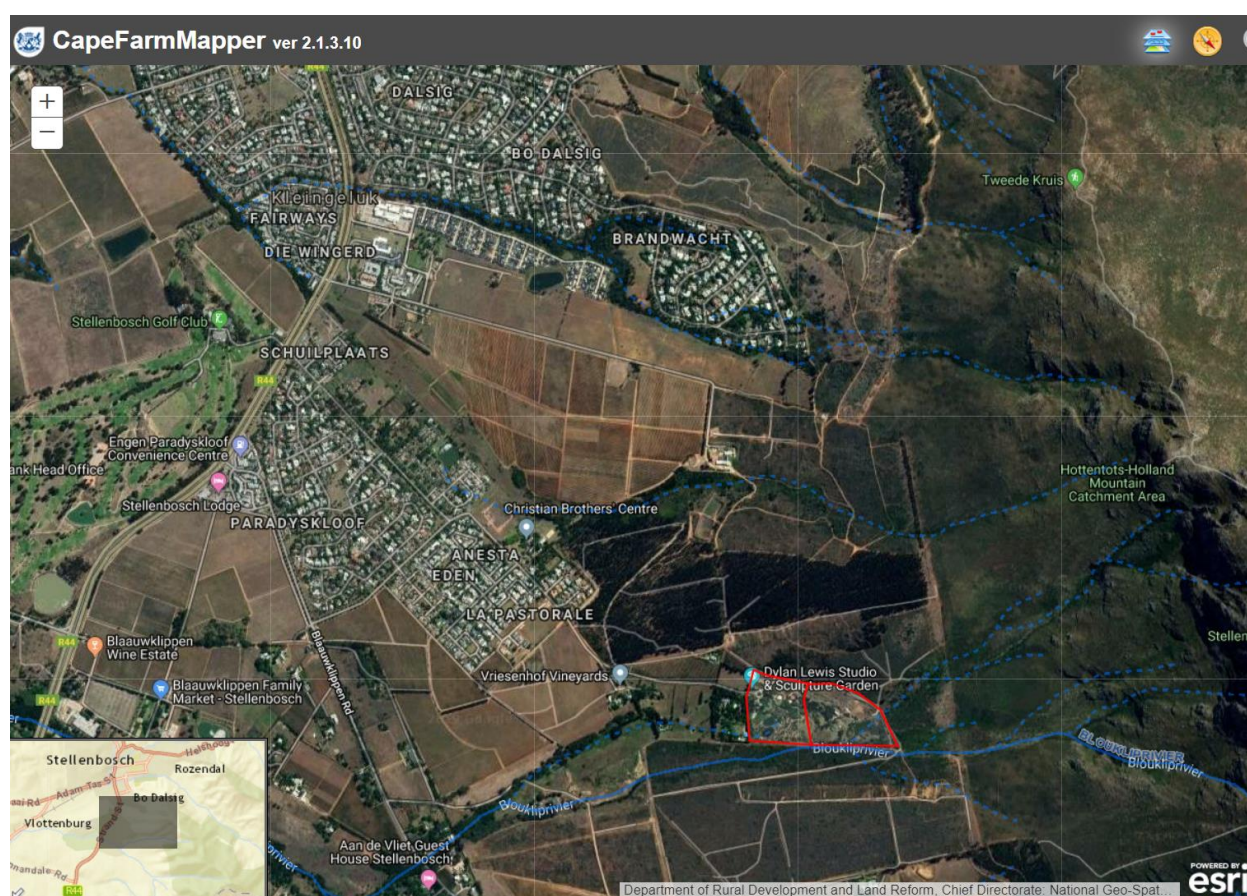


Figure 1. Map showing the locality of the property (CapeFarmMapper, 2019)

Table 1. Water resources information associated with the proposed activities

Descriptor	Name / details	Notes
Water Management Area (WMA)	Berg Olifants WMA	
Catchment Area	Blaauwklippen River	Tributary in the Eerste River System
Quaternary Catchment	G22H	
Present Ecological State	Largely modified (D)	
Ecological Importance; Ecological Sensitivity	Moderate; High	Blaauwklippen River (DWS PES, EI and ES;(2012)
Type of water resource	Paradyskloof Tributary & associated wetlands	
Latitude	33°58'19.35"S	Location of weir
Longitude	18°52'21.02"E	

2. TERMS OF REFERENCE

The agreed upon scope of works for this Freshwater Assessment is as follows:

Task 1: Freshwater impact assessment and Department of Water and Sanitation (DWS) risk assessment

- 1.1 Initialisation;
- 1.2 Site Assessment;
- 1.3 Freshwater Impact Assessment Report;
- 1.4. Maintenance Management Plan;
- 1.5 DWS Risk Assessment For Water Use Authorisation Consideration; and
- 1.6 Review And Liaison.

Task 2: Water use authorisation application input to the Section 21 c and i

- 2.1 Collate Relevant Information;
- 2.2. Pre-application meeting;
- 2.3 Section 21 b, c and i water use authorisation application; and
- 2.4 Liaison And Review.

3. APPROACH TO THE STUDY AND STUDY LIMITATIONS AND ASSUMPTIONS

Input into this report was informed by a combination of desktop assessments of existing freshwater ecosystem information for the study area and catchment, as well as by a more detailed assessment of the freshwater features along the proposed routes. The study area was visited for a single day in March 2019, in autumn. Although the winter rains had not yet commenced there was still some flow in the streams and the wetland areas were inundated. The timing was thus deemed suitable for the assessment.

During the field visit, the characterisation and integrity assessments of the freshwater features were undertaken. Mapping of the freshwater features was undertaken using PlanetGIS and Google Earth Professional. The SANBI Biodiversity GIS and CapeFarmMapper websites were also consulted to identify any constraints in terms of fine-scale biodiversity conservation mapping as well as possible freshwater features mapped in the Freshwater Ecosystem Priority Areas maps. This information/data was used to inform the resource protection related recommendations.

Limitations and uncertainties often exist within the various techniques adopted to assess the condition of ecosystems. The following techniques and methodology utilized to undertake this study:

- Analysis of the freshwater ecosystems was undertaken at a rapid level and did not involve detailed habitat and biota assessments;
- The guideline document, “A Practical Field Procedure for the Identification and Delineation of Wetlands and Riparian Areas” document, as published by DWAF (2005) was followed for the delineation of the wetland areas. According to the delineation procedure, the wetlands were delineated by considering the following wetland indicators: terrain unit indicator; Soil form indicator; Soil wetness indicator; and vegetation indicator.
- The wetlands were subsequently classified according to their hydro-geomorphic determinants based on a classification system devised by Kotze *et al* (2004) and SANBI (2009).
- A Present Ecological State (PES) assessment was conducted for each wetland unit identified and delineated within the study area.
- The functional wetland assessment technique, WET-EcoServices, developed by Kotze *et al* (2009) was used to provide an indication of the ecological benefits and services provided by delineated wetland habitat.
- The ecological importance and sensitivity assessment was conducted according to the guidelines as developed by DWAF (1999).
- Lists of plants, both alien and indigenous are for the purpose of describing the general and dominant habitat conditions and not comprehensive. A comprehensive botanical survey was not conducted.
- Invasive alien categories refer to the National Environmental Management Biodiversity Act (NEMBA) where:
 - Category 1a: Species which must be combatted or eradicated
 - Category 1b: Species which must be controlled
 - Category 2: Species which require a permit to carry out a restricted activity within an area specified in the notice or an area specified in the permit. Outside of the specified area is considered a Category 1b.
 - Category 3: A species which is subject to exemptions or prohibitions but if occurring in riparian areas is considered a Category 1b.

The level of aquatic assessment undertaken was considered to be adequate for this study

4. USE OF THIS REPORT

This report reflects the professional judgment of its authors. The full and unedited content of this should be presented to the client. Any summary of these findings should only be produced in consultation with the authors.

5. OVERVIEW OF THE PROPOSAL AND STUDY AREA

5.1. OVERVIEW OF STUDY AREA

The study area is located on the outskirts of the town of Stellenbosch. Farm 1314 and Farm 1315 are located on the lower, western slopes of the Helderberg Mountain, within the Hottentots Holland Mountain Range. The surrounding area has a gentle undulating topography that consists mostly of vineyards and agricultural land with natural vegetation cover on the higher mountain slopes. The study area for this assessment is largely within Farm 1314.

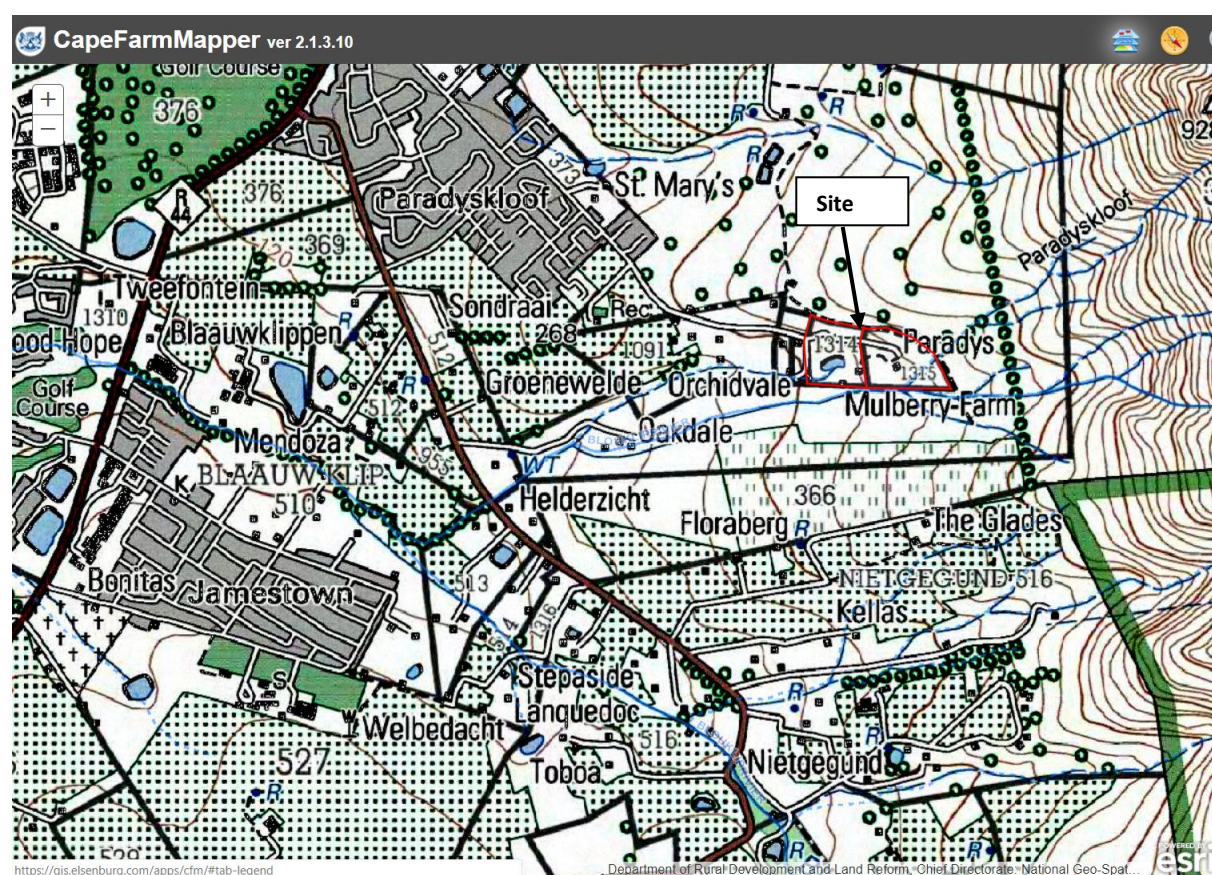


Figure 2. Topography map (3318DD) showing the location of the site (CapeFarmMapper, 2019)

The Blaauwklippen River and its smaller tributaries drain the still largely natural catchment upslope (east and south) of the site. The river downstream of the site becomes significantly modified by agricultural activities with much of the natural vegetation having been replaced by cultivated lands. There is also the urban development Jamestown and the De Zalze Estate within the Blaauwklippen River's middle to lower reaches, downstream of where the Paradyskloof Tributary joins the river.

5.2. ACTIVITY DESCRIPTION

This freshwater assessment is an assessment of the following activities indicated by the DEADP as listed activities in their Pre Compliance Notice (dated 8 May 2014) and Compliance Notice (dated 15 February 2019) to the landowner that have commenced without environmental authorisation (in terms of Activity 12 and Activity 19 of the EIA Regulations Listing Notice 1 of 2014):

- Construction of a walkway and sculpture display within a watercourse with the associated infilling;
- Diversion of the watercourse into a small dam and artificial pond; and
- Construction of a weir within a watercourse.

6. PHYSICAL CHARACTERISTICS OF THE STUDY SITE

6.1. VISUAL CHARACTERISTICS

The site is located south-east of the town of Stellenbosch within the surrounding agricultural areas. The area has an undulating topography associated with the western slopes of the lower foothills of the Hottentots Holland Mountains. The low hills are orientated east-west, interspersed by the Blaauwklippen and Bonte Rivers. The landscape is dominated by cultivated lands, with little remaining indigenous vegetation. The site itself is located at the upper limit of the cultivated land, where the gradient is still relatively steep and slopes down towards the Blaauwklippen Valley and the Eerste River in the west. The elevation at the site is between 207 m and 261m above mean sea level. This upper reach of the Paradyskloof Tributary within the site drops about 55 m over a distance of 300 m, with an average slope of approximately 18%.



Figure 3. Photograph taken from the Paradyskloof River where it enters Farm 1314

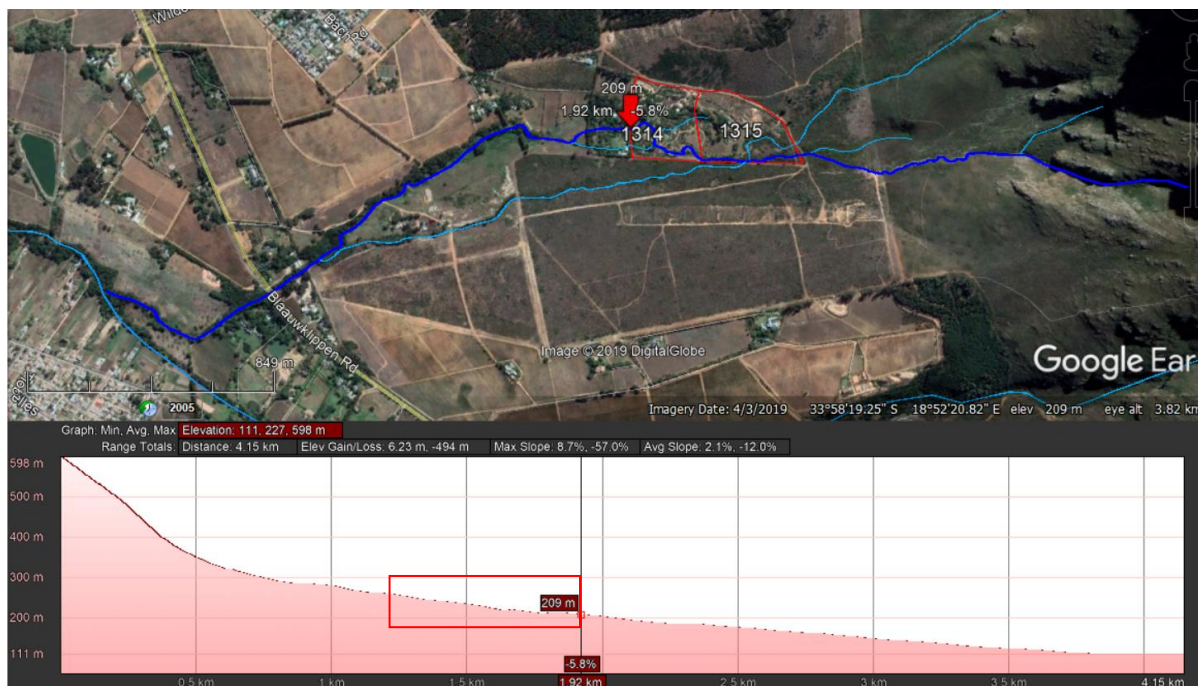


Figure 4. Google Earth image of the Paradyskloof Tributary, with the elevation profile for the river (darker blue line on aerial image). The red rectangle on the profile shows the location of the site on the river profile. Farm 1314 is located downslope from Farm 1315.

6.2 CLIMATE

The town of Stellenbosch has a Mediterranean climate. It receives most of its rainfall during a cold winter whilst its summers are typically hot and dry. The average rainfall for July is 37mm and the average daytime temperature is 20°C (Figure 6). In contrast, February receives an average of only 8mm and has an average temperature of 34°C. At the site, the mean annual rainfall is 781 mm with an annual evaporation total of 1115 mm. The average monthly flow distribution graph (Figure 7) shows that flows in the watercourses are slightly delayed to that of the average monthly rainfall pattern, with peak flows in the rivers typically occurring in August. Works in the watercourses should thus be avoided in the period June to September.

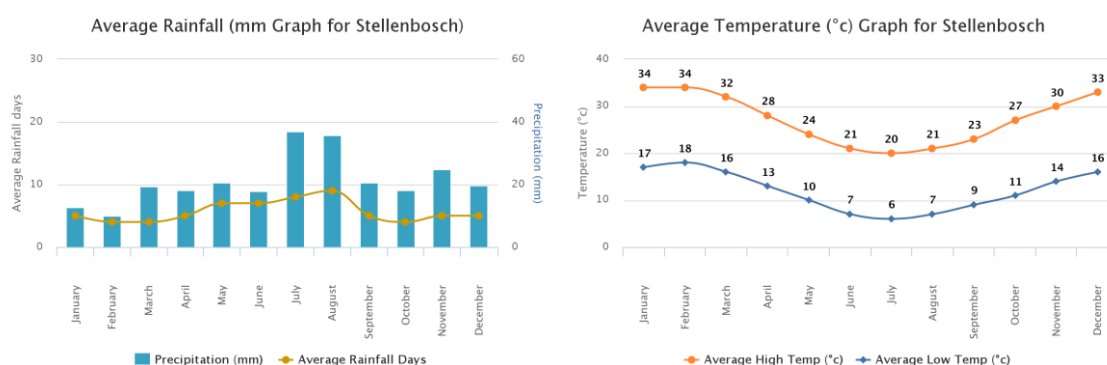


Figure 6. Average monthly rainfall and temperatures (Worldweatheronline, 2019)

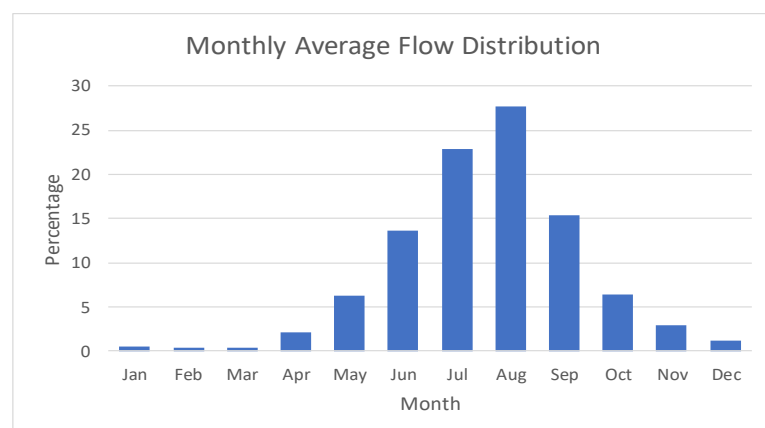


Figure 5. Average Monthly flows expressed as an average monthly percentage contribution to the mean annual runoff for watercourses within quaternary catchment G22H (Data obtained from Water Resources 2012)

6.3 GEOLOGY AND SOIL

The geology in the area comprises of greywacke, phyllite and quartzitic sandstone of the Malmesbury Group and granite of the Kuils River-Helderberg Pluton, Cape Granite Suite. Alluvium deposits occur within the river channels. Deep weathered soils (clay and coarse-grained sand) from

Cape Granites of the Stellenbosch-Kuilsrivier and Helderberg Plutons underlie the alluvial and colluvial deposit topsoils. The soils are in general red-yellow well drained soils that lack a strong texture contrast, are relatively low in clay content and of moderate erodibility (Figure 6).

6.4. FLORA

The natural vegetation cover to the east of Stellenbosch at the site would have consisted largely of Cape Winelands Shale Fynbos (Figure 7) which is a vegetation type that is considered to be Vulnerable in terms of its conservation status. The vegetation type is associated with the moist clay-loamy, red-yellow apedal and Glenrosa and Mispah forms derived from Malmesbury Shales and comprises largely of a tall dense proteoid shrubland and scrub fynbos. Natural vegetation still surrounds the site but the area has been disturbed by past cultivation activities. Within the site, the area has in the past also been disturbed and cultivated but is currently being rehabilitation with the revegetation of indigenous plants, particularly along the watercourses.

The vegetation along the Paradyskloof Tributary at and adjacent to the site comprises of some taller riparian trees such as wild olive *Olea europaea* subsp. *africana*, wild peach *Kiggelaria Africana*, Cape willow *Salix mucronata* and honey-bell bush *Freylinia lanceolata* as well as lower shrubs and wetland vegetation such as willow karee *Searsia augustifolia*, wild currant *S. tomentosa*, tree fuchsia *Halleria elliptica*, wildewingerd *Cliffortia odorata*, vleibos *C. strobilifera*, broom restios *Elegia capensis* and *Calopsis paniculata*, bracken fern *Pteridium aquilinum*, palmiet *Prionium serratum*, bloodroot *Wachendorfia thrysiiflora*, the riverbed grass *Pennisetum macrourum* and *Carpha glomerata*, *Cyperus denudatus*, *C. textilis*, *Isolepis prolifera*, *Juncus lomatophyllus*, *J. capensis* and *Pycnus polystachyos* sedges and rushes. Blue water lilies *Nymphaea nouchali* var. *caerulea* occur within the aquatic zones of the ponds and small dams.

Invasive alien vegetation is being controlled within the watercourses through the site. Alien kikuyu grass *Pennisetum clandestinum*, also a Category 1b invader in wetlands, is however invading the filled area adjacent to the watercourse and should be removed.

6.5. AQUATIC FEATURES

The main freshwater feature within the study area consists of the Paradyskloof Tributary of the Blaauwklippen River, a tributary of the Eerste River (Figure 9). The Eerste River originates as the Jonkershoek Stream in the Jonkershoek Valley and flows westwards towards Stellenbosch to be joined by the Kromme and Plankenberg tributaries where it becomes the Eerste River. Downstream of Stellenbosch the river is joined by the Veldwagters (originating in the Devon Valley), Blaauwklippen (originating in the Stellenbosch Berg) and Bonte rivers before its confluence with the Kuils River at Macassar. The river then flows into False Bay via a small estuary.

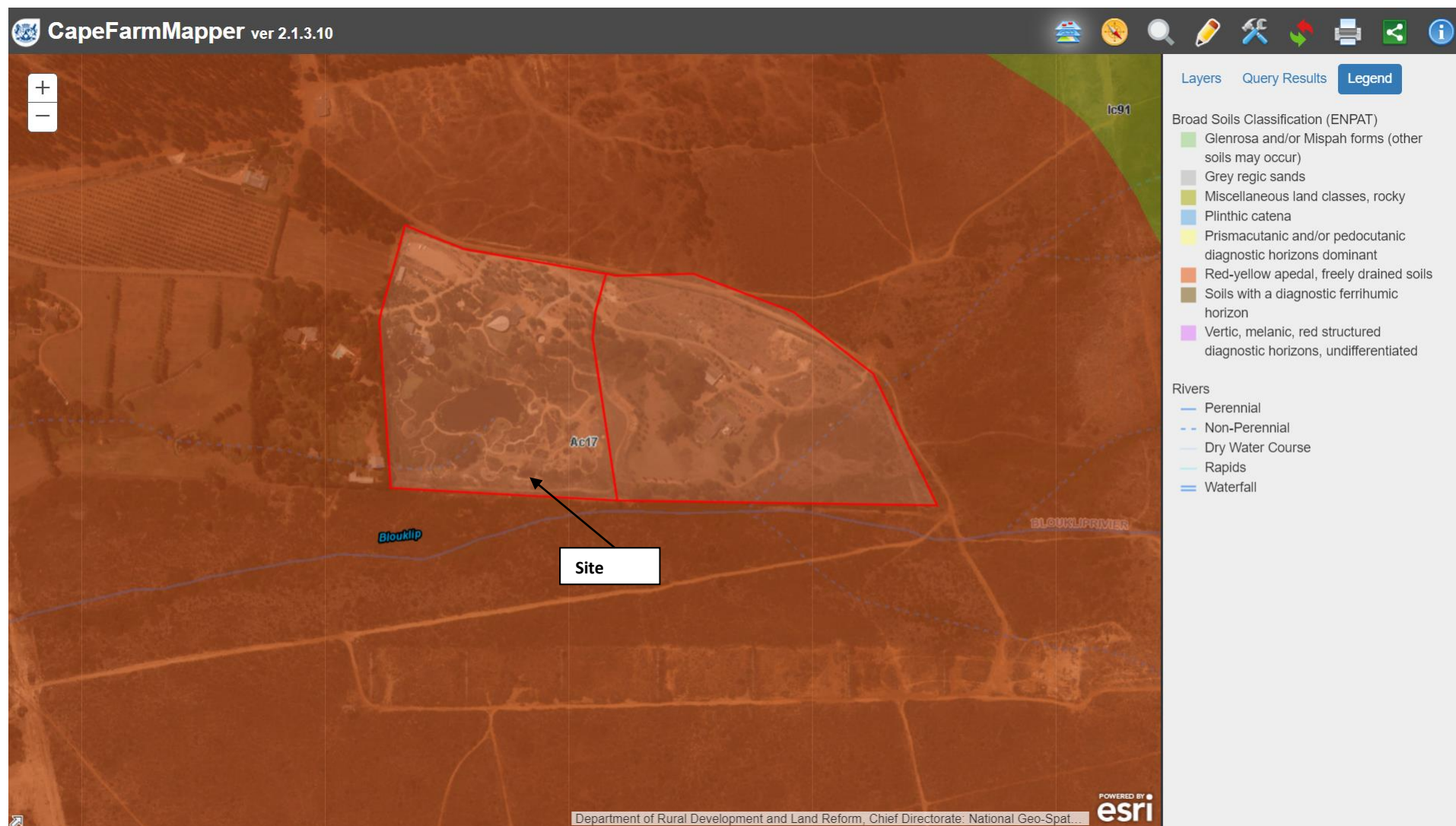


Figure 6. Soil map for the area (CapeFarmMapper, 2019)

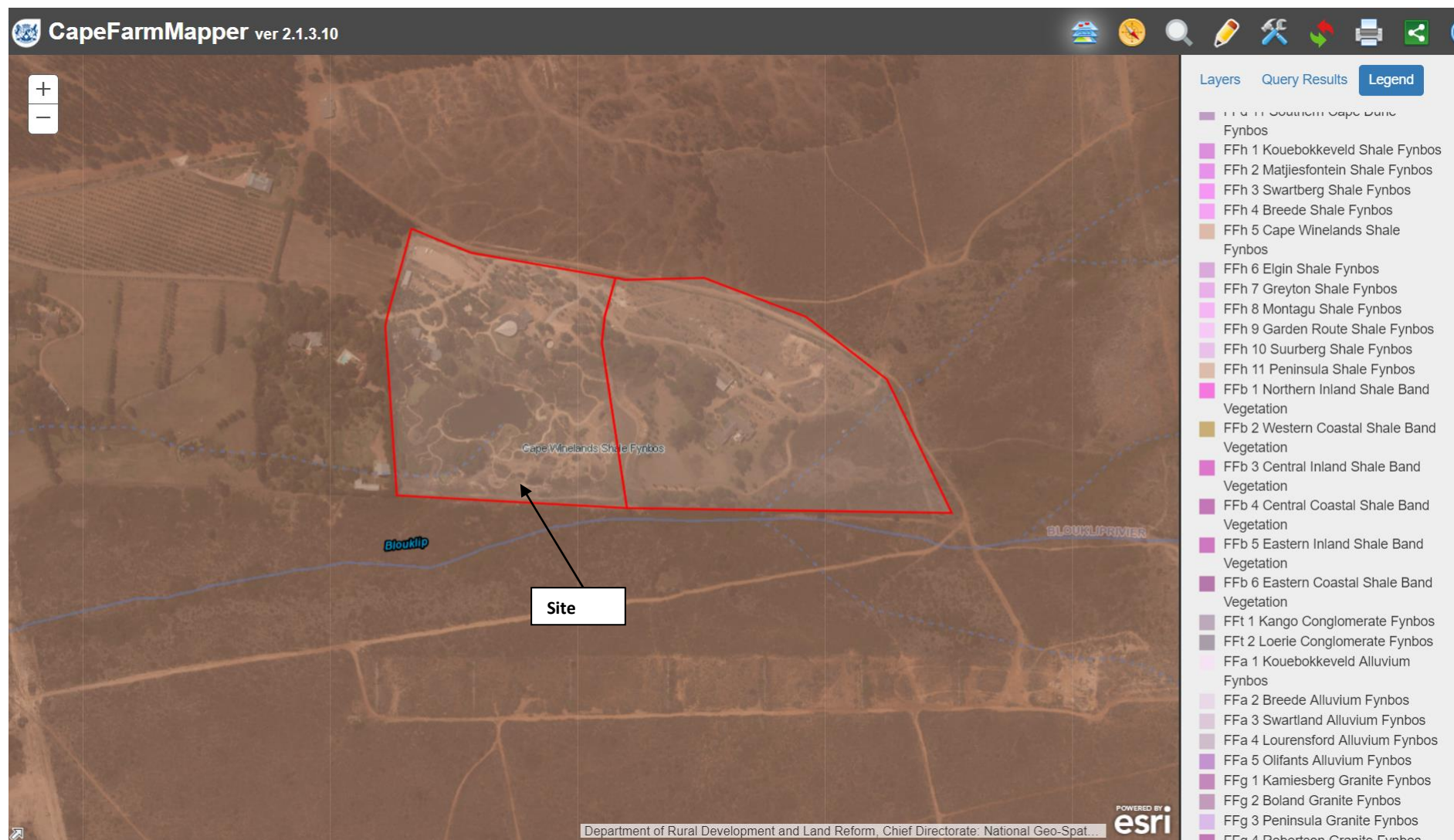


Figure 7. Vegetation types for the study area (CapeFarmMapper, 2019)

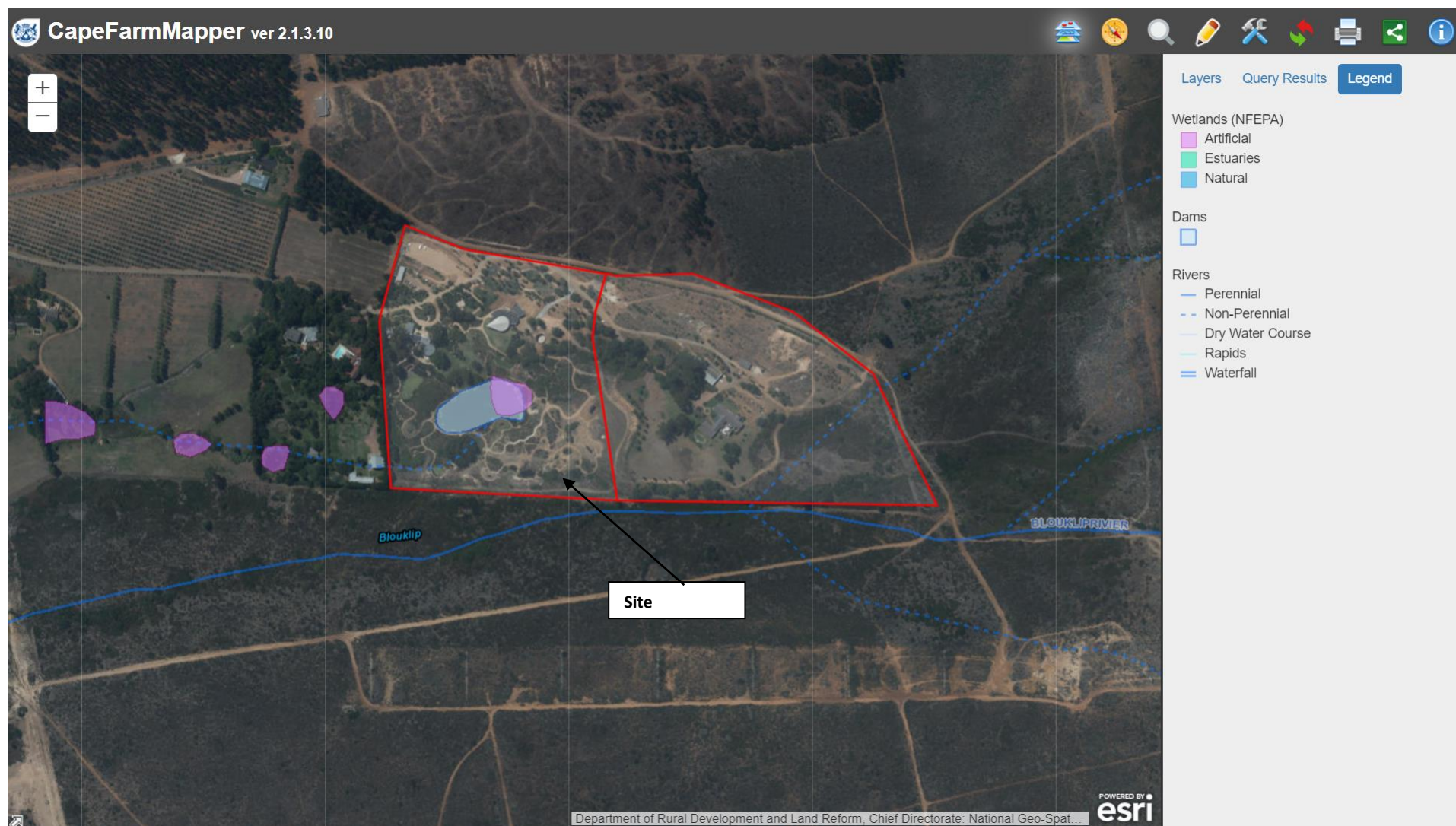


Figure 8. Aquatic features within the study area

The Blaauwklippen River is a tributary of the Eerste River that flows from the Helderberg in a westerly direction for about 13km before joining the Eerste River. The Paradyskloof Tributary of the Blaauwklippen River arises a short distance upstream of the site and flows in a south-westerly direction to its confluence with the Blaauwklippen River. There are some wetland areas along the length of the river and a number of small farm dams (Figure 8). The Paradyskloof Tributary and associated wetland areas are further discussed and described in Section 7 of this report.

6.6 LAND USE

The land cover for the area west of the site comprises of cultivated fields (pink areas in Figure 9) while that to the east and north is mapped as shrublands and wooded areas (grey and green areas). The river corridor downstream of the site is also mapped as wooded area. There is a small patches of wetland area (light blue area in Figure 9) within the river corridor. Some built up areas occur within the cultivated areas to the south that relate to farm infrastructure and further to the southwest that relate to Jamestown and Paradyskloof suburbs of Stellenbosch. The formally protected Hottentots-Holland Mountain Catchment Area is located approximately 300m upslope (east) from the site.

6.7. BIODIVERSITY CONSERVATION VALUE

Two sets of biodiversity conservation mapping results are of relevance to the national and provincial identification of the ecological importance that has been attributed to the freshwater features in the study area. The National Freshwater Ecosystem Priority Areas (FEPA) map and the 2017 Western Cape Biodiversity Spatial Plan (WCBSP) that was a product of the Provincial Fine Scale mapping process undertaken at a local authority level.

The National FEPA initiative identified freshwater resources which should be protected against modification. Freshwater Ecosystem Priority Area (FEPA) wetlands were mapped nationally using available data. According to this mapping, the Eerste River and Blaauwklippen River are not mapped as FEPA rivers, only the upper reaches of the Eerste River upstream of Stellenbosch (Figure 10). The dam is mapped as an artificial wetland. Thus, in terms of the FEPA mapping, there are not considered to be any aquatic constraints to the proposed activity.

The WCBSP map for the study area has mapped some small aquatic critical biodiversity areas that are associated with wetlands within the site. The watercourse and its smaller tributaries are mapped as aquatic ecological support areas that provide important ecological services and should not be allowed to become degraded (Figure 11).

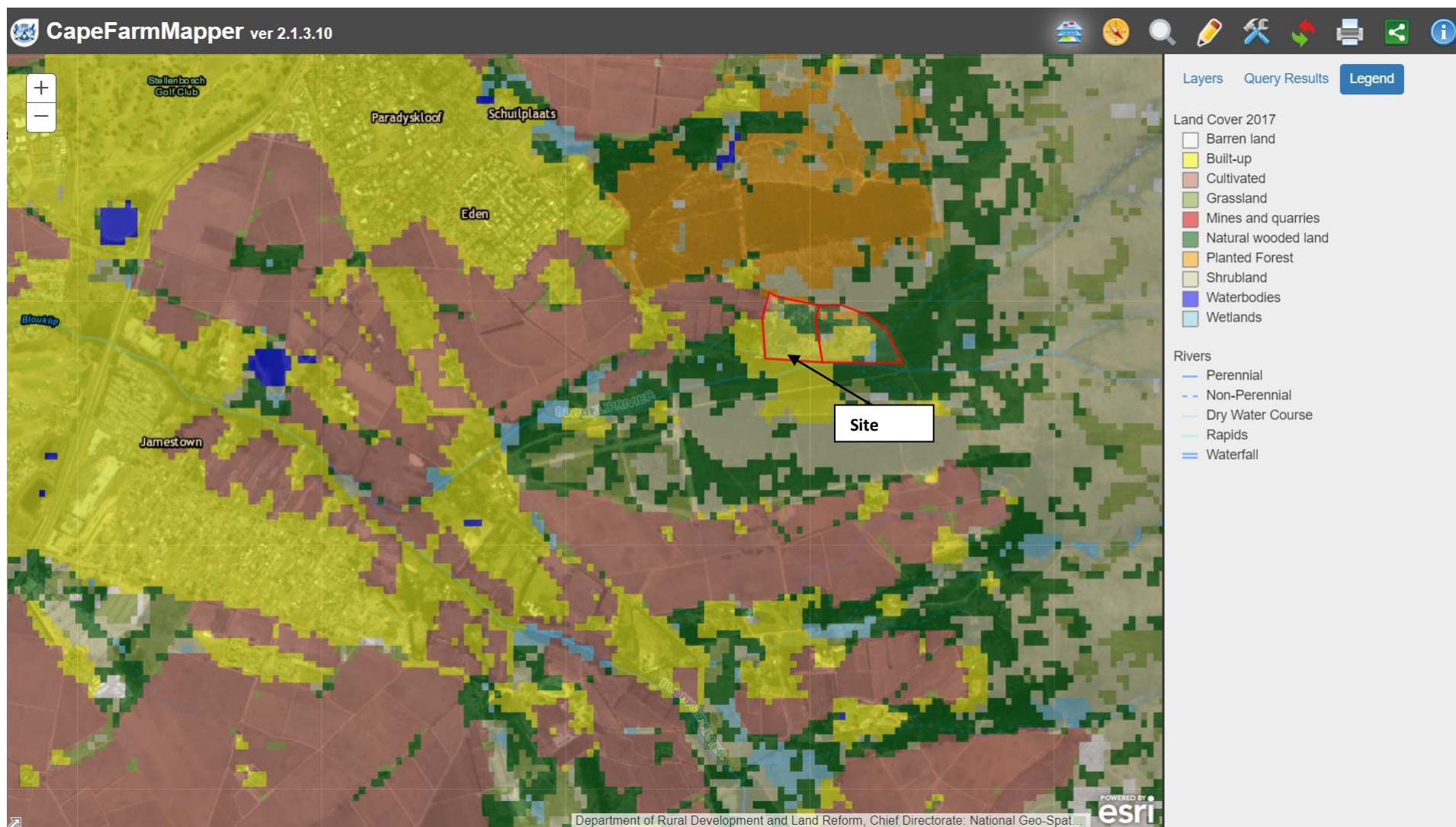


Figure 9. Land use map for surrounding area (CapeFarmMapper, 2019)

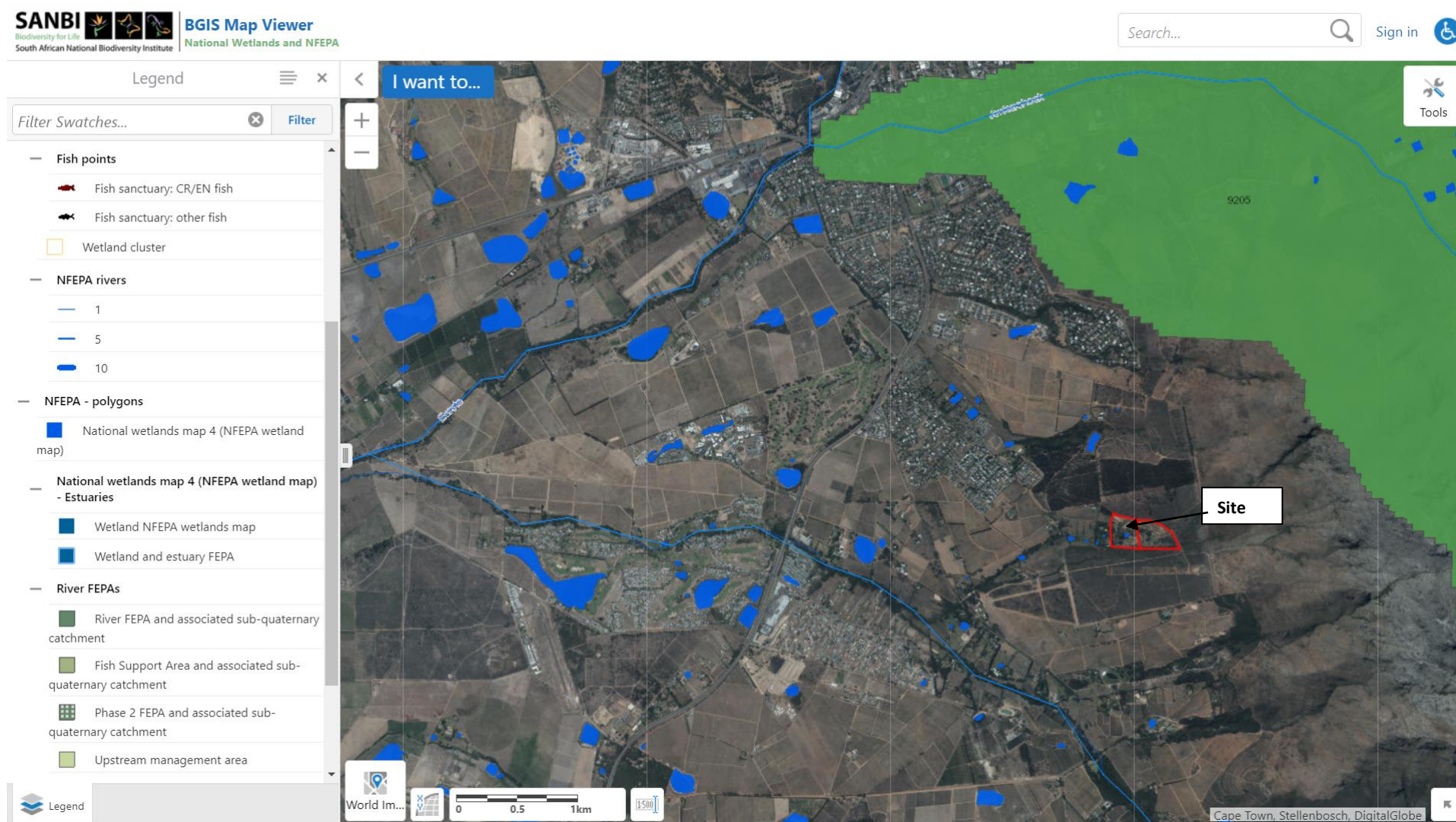


Figure 10. FEPA wetlands and rivers in the study area (SANBI Biodiversity GIS, 2019)

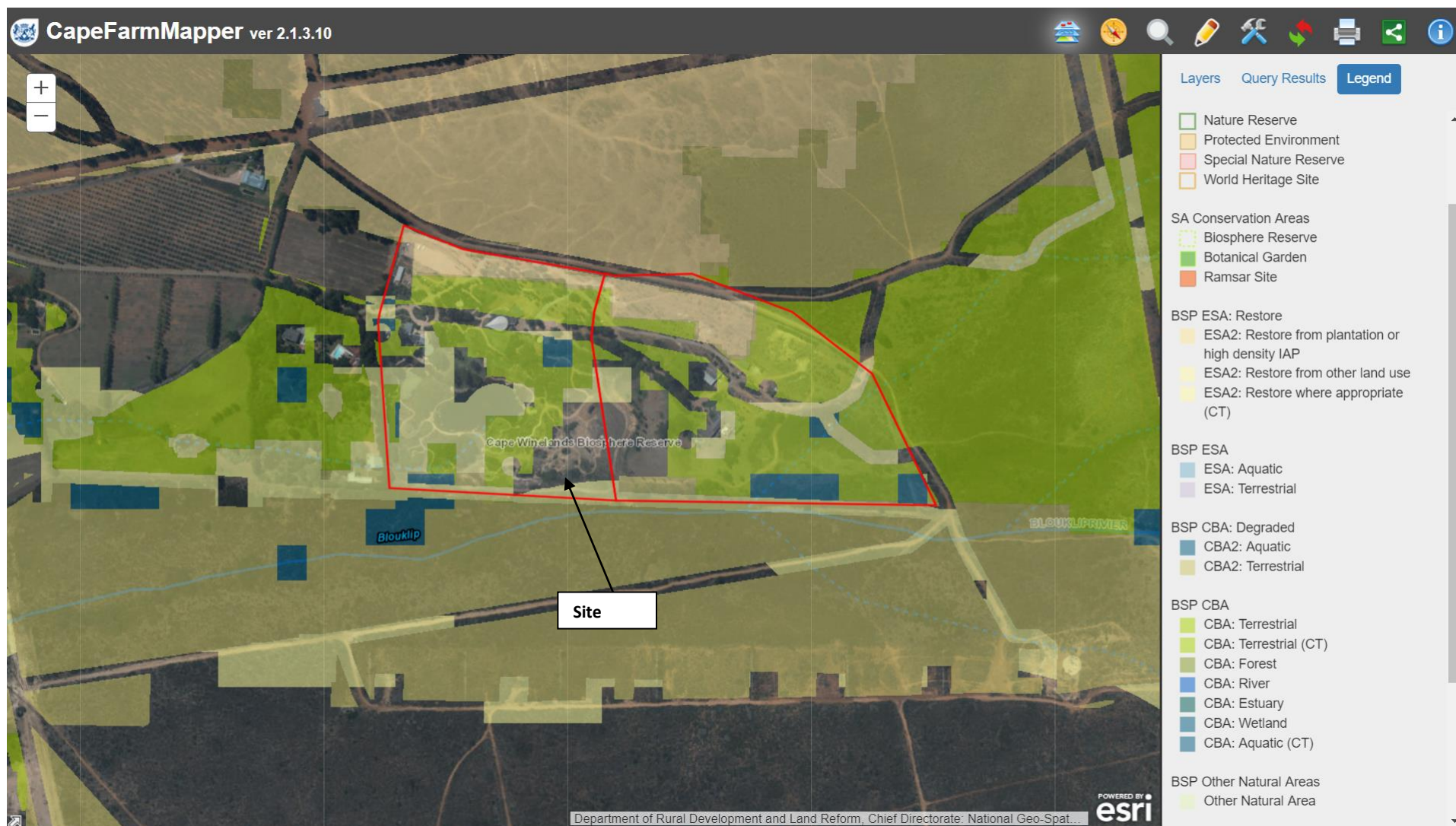


Figure 11. Critical Biodiversity Areas map for the study area (CapeFarmMapper, 2019)

The remnants of natural vegetation cover are also mapped as terrestrial critical biodiversity areas that should be maintained and rehabilitated within the site. This has been taking place within the property with significant clearing of alien vegetation and revegetating of the area with local indigenous vegetation (both terrestrial and aquatic) having taken place. The works undertaken, given the rehabilitation works that is being undertaken within the site, has thus not degraded the quality of the critical biodiversity areas and ecological support areas within the site but has rather enhanced them.

7. ASSESSMENT OF FRESHWATER FEATURES AND THEIR SIGNIFICANCE

The freshwater features relevant to the proposed activity and which are assessed in this report comprise of the upper Paradyskloof Tributary and its smaller tributaries as well as the wetland habitat associated with the watercourses within the site. These freshwater features are assessed within this section.



Figure 12. Google Earth image with the mapped aquatic features at the site where the blue lines indicate watercourses, the green polygons wetland areas and the pale blue polygon the large dam. The focus area of the study is within Farm 1314 and thus the wetland areas have only been mapped in detail within this property.

7.1. HISTORICAL MODIFICATION

The area of the proposed activity has been subject to anthropogenic modification for a long time. The town of Stellenbosch was founded in 1679. Agricultural activity has taken place along the Eerste River since the 17th century. As a result, most of the rivers in this system have been modified for some time already. Past aerial photographs taken in 1938 show that at that time, the site was already significantly disturbed although the watercourses appeared to still be relatively undisturbed, within their natural watercourses and the large dam had not yet been constructed (Figure 13).

From the image it can be seen that there was a large seep wetland area (darker area in the image) at the start of the stream where the dam has been constructed that likely feeds the smaller tributary of the stream. There was also patches of valley bottom wetlands along the stream that natural appeared to flow along the southern border of the site. It would appear that at some stage the larger Paradyskloof River flowed in a north-westerly direction to join the smaller tributary in the north (indicated by the blue arrow in Figure 13), although the main channel appears to have been quite braided at that time.

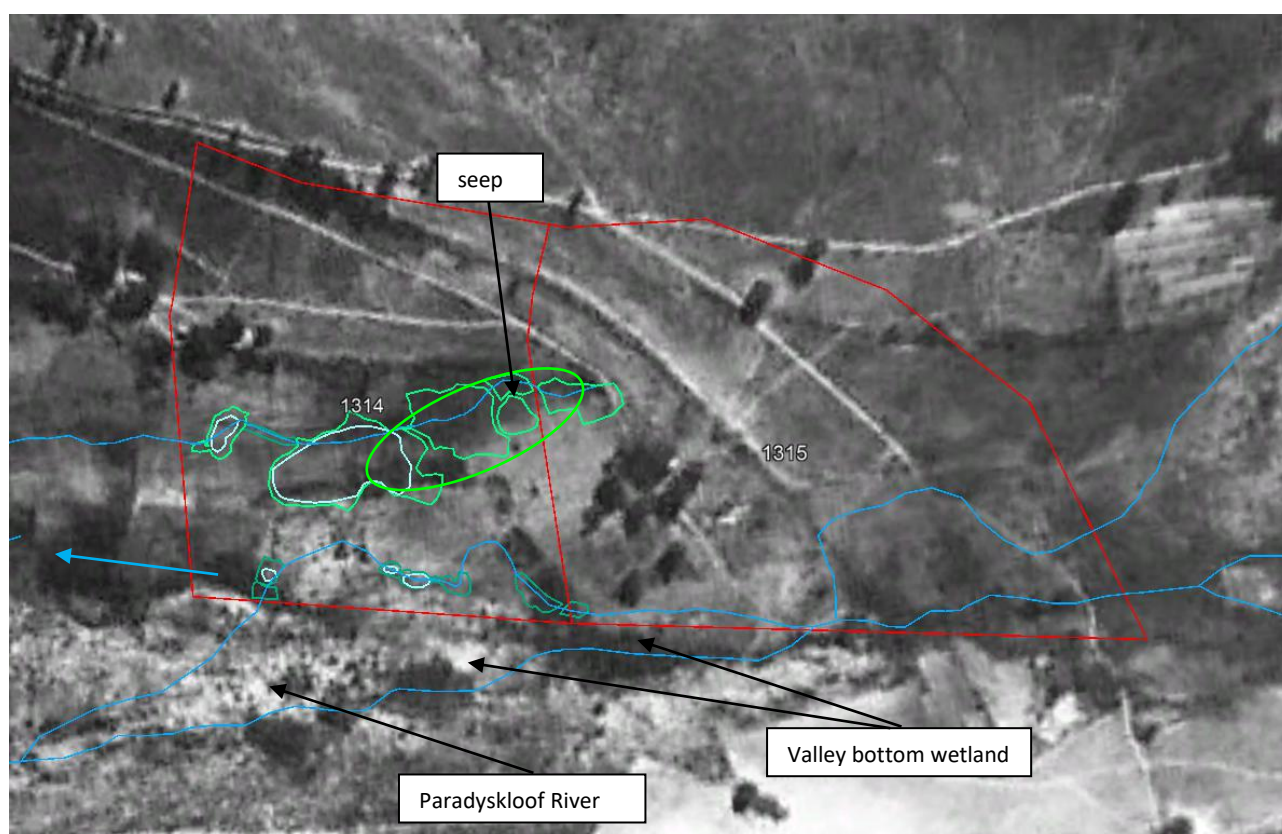


Figure 13: An aerial photograph taken of the study area in 1938 with the present day delineated aquatic features shown

The earliest Google Earth image from March 2005 (Figure 14) shows land use within the site to still largely comprise of farming activities. A smaller instream dam occurs within a larger seep area with a straightened and modified channel carrying any overflow from the dam downstream. Access to the southern portion of

the properties appear to have been from a road along the border between the two properties as well as within Farm 1315. The Paradyskloof River split into two channels within Farm 1314, much as it is today. The three smaller ponded areas were not in place at that time.

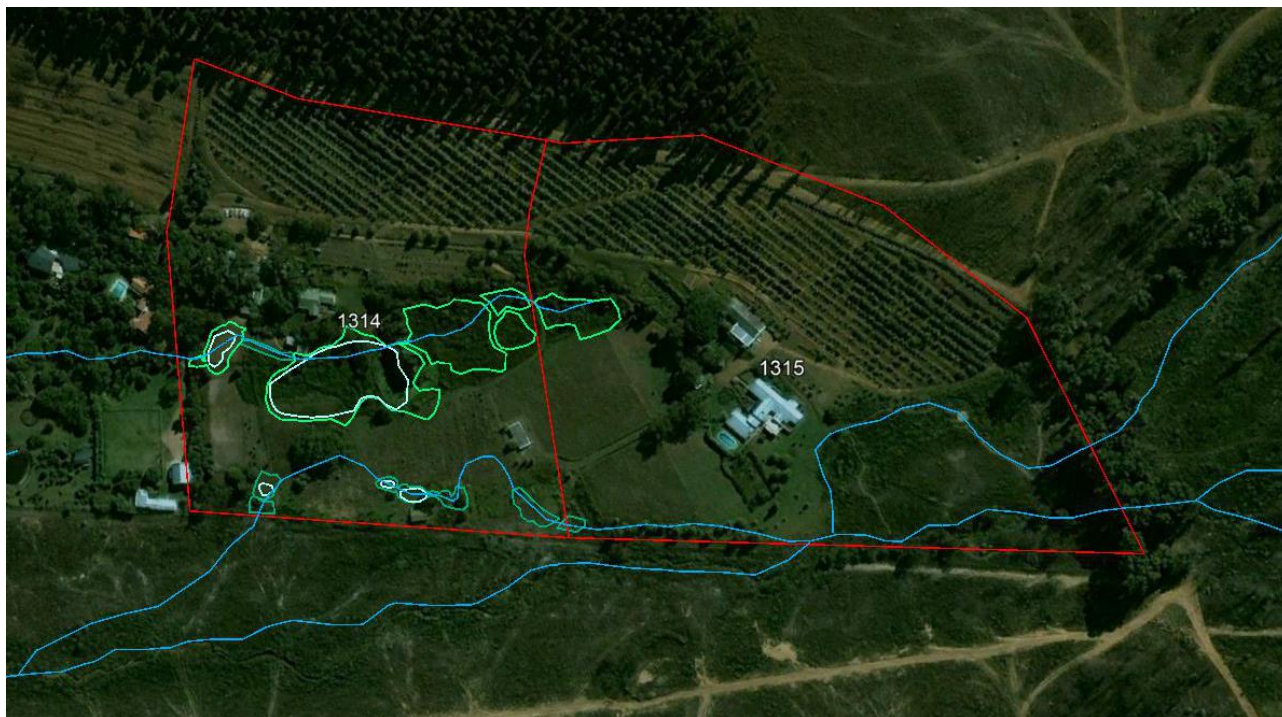


Figure 14. Google Earth image of the site with the present day delineated aquatic features, taken in March 2005

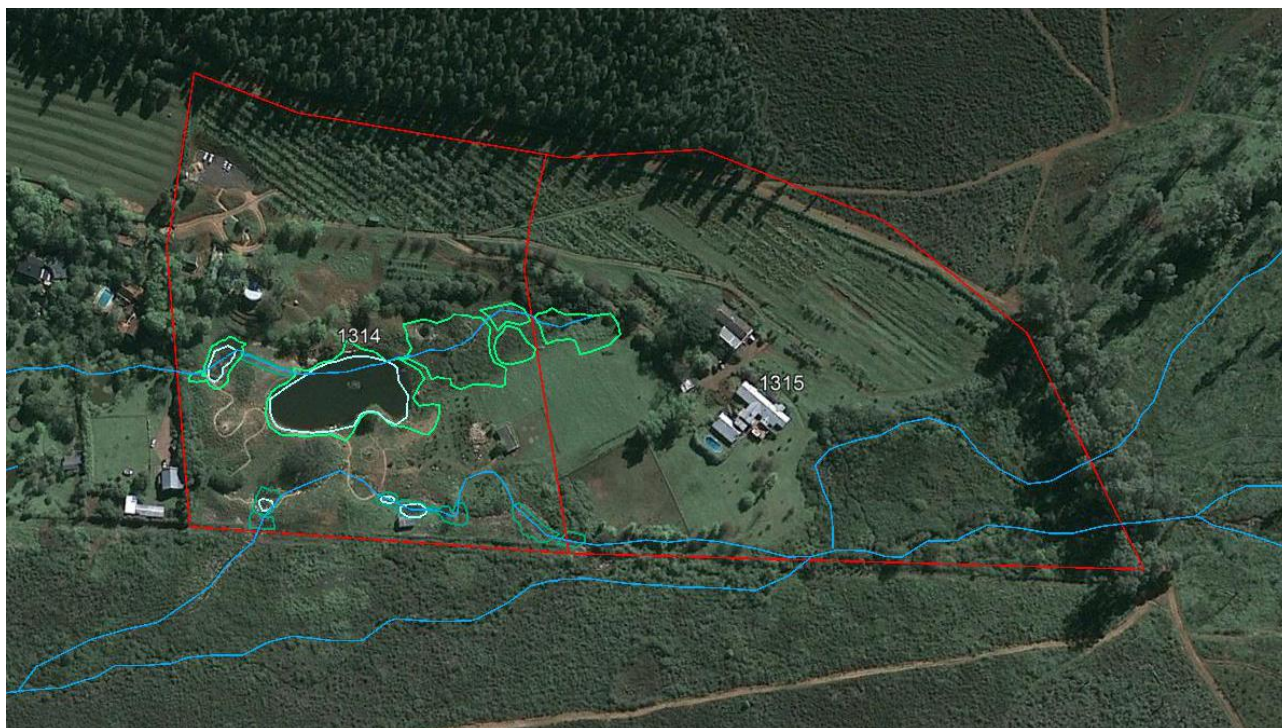


Figure 15. Google Earth image of the site with the present day delineated aquatic features, taken in September 2009

Figure 15 shows the existing larger dam as well as the small pond near the western border of the site had been constructed but not the series of detention ponds to reduce the erosion potential of the Paradyskloof River. Clearing of alien vegetation such as Port Jackson willows *Acacia saligna* and Paterson's curse *Echium plantagineum* and revegetating with indigenous vegetation had also not yet commenced. A pathway through Farm 1314 was already underway and although the date when the weir over the stream along the western border of the farm was constructed, it is highly likely to have been constructed by this date.

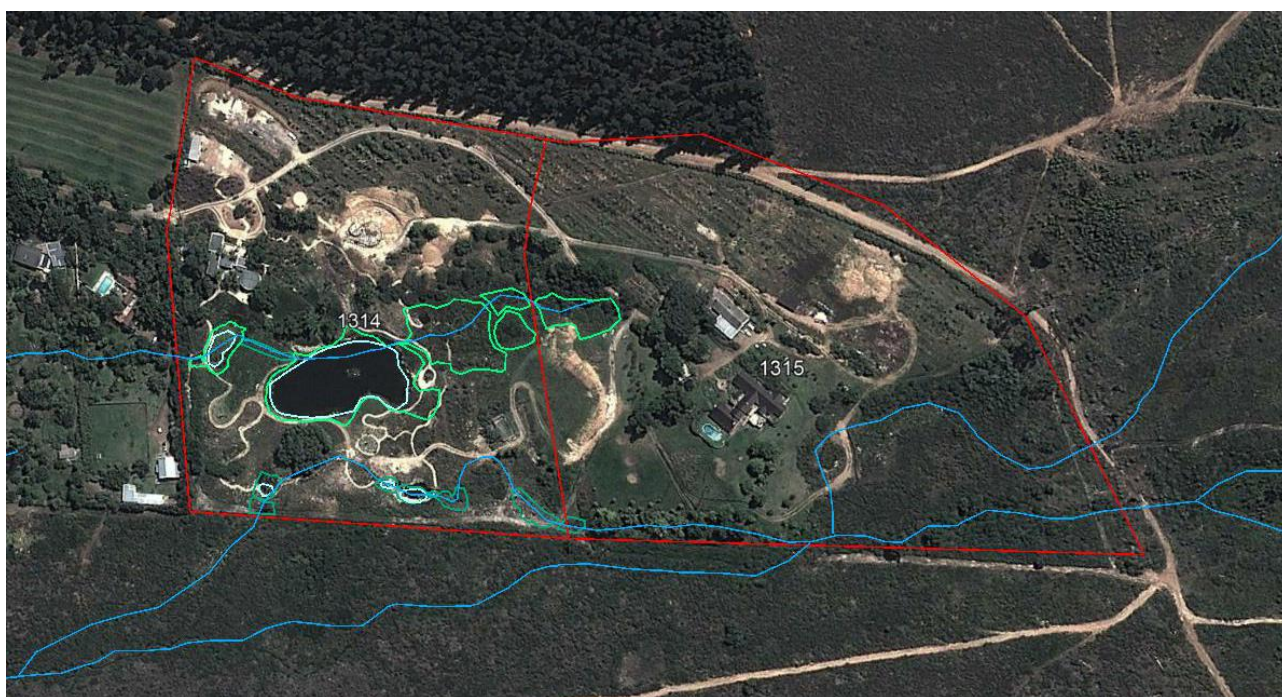


Figure 16. Google Earth image of the site with the present day delineated aquatic features, taken in November 2013



Figure 17. Google Earth image of the site with the present day delineated aquatic features, taken in February 2017

By 2014 (Figure 16), construction of the sculpture garden had commenced and establishment of the pathway was well underway. The small detention dams also appear to have been created during this period. Figure 17 shows the further creation of the pathway, revegetating of the area and clearing of alien vegetation. The large filled platform along the border between Farm 1314 and Farm 1315 was also being undertaken at this time.

7.2. RIVER ASSESSMENT

PARADYSKLOOF RIVER

The Paradyskloof River is only still natural within its first kilometre within the Hottentots-Holland Mountain Catchment Area. Downstream of this it becomes increasingly modified. The upper reaches of the river are impounded by the dam within the site and then it flows through agricultural areas to its confluence with the Blaauwklippen River. Through most of this area, apart from the flow modification from abstraction and storage, the river channel has been modified through removal of the riparian habitat and modifications to the channel. Within the site the river has been modified by past activities but has also been rehabilitated.



Figure 18. The rehabilitated Paradyskloof River within the site

7.2.1. RIVER CLASSIFICATION

In order to assess the condition and ecological importance and sensitivity of the Paradyskloof River at the site, it is necessary to understand how the river might have appeared under unimpacted conditions. This is achieved through classifying rivers according to their ecological characteristics, in order that it can be compared to ecologically similar rivers.

River typing or classification involves the hierarchical grouping of rivers into ecologically similar units so that inter- and intra-river variation in factors that influence water chemistry, channel type, substratum composition and hydrology are best accounted for. Any comparative assessment of river condition should only be done between rivers that share similar physical and biological characteristics under natural conditions. Thus, the classification of rivers provides the basis for assessing river condition to allow comparison between similar river types. The primary classification of rivers is a division into ecoregions. Rivers within an ecoregion are further divided into sub-regions.

Ecoregions are groups of rivers within South Africa, which share similar physiography, climate, geology, soils and potential natural vegetation. For the purposes of this study, the ecoregional classification presented in DWS, which divides the country's rivers into ecoregions, was used. The three rivers assessed lie within the South Western Coastal Belt Ecoregion, with the characteristics as described in Table 2.

Sub-regions (or geomorphological zones) are groups of rivers, or segments of rivers, within an ecoregion, which share similar geomorphological features, of which gradient is the most important. The use of geomorphological features is based on the assumption that these are a major factor in the determination of the distribution of the biota. Table 3 provides the geomorphological features of the Paradyskloof River.

Table 2. Characteristics of the South Western Coastal Belt Ecoregion (Dominant Types In Bold)

Main Attributes	Characteristics
Terrain Morphology	Plains; Low Relief; Plains Moderate Relief; E: Closed Hills; Mountains; Moderate and High Relief
Vegetation types	Sand Plain Fynbos; Mountain Renosterveld; West Coast Renosterveld; Dune Thicket; Strandveld Succulent Karoo
Altitude	0-300; 300-900 limited (m a.m.s.l)
MAP	100 to 1000 (mm)
Coefficient of Variation	20 to 39 (% of annual precipitation)
Rainfall concentration index	30 to 60
Rainfall seasonality	Winter
Mean annual temp. (°C)	14 to 20
Median annual simulated runoff	<5; 20 to >250 (mm) for quaternary catchment

7.2.2. SITE CHARACTERISATION

From the Site Characterisation assessment, the geomorphological and physical characteristics of the Paradyskloof River at the site can be classified as follows:

Table 3. Geomorphological and Physical features of the upper Paradyskloof River

River	Paradyskloof River
Geomorphological Zone	Upper Foothill River
Lateral mobility	Partially confined
Channel form	Simple but has multiple channels in places
Channel pattern	Single to multiple thread: Low sinuosity
Channel type	Alluvium with boulders, cobbles and occasional bedrock
Channel modification	Moderate modification in the upper reaches
Hydrological type	Perennial mainstem with seasonal tributaries
Ecoregion	South Western Coastal Belt
DWA catchment	G22H
Vegetation type	Cape Winelands Shale Fynbos
Rainfall region	Winter

7.2.3. INDEX OF HABITAT INTEGRITY

The evaluation of Index of Habitat Integrity (IHI) provides a measure of the degree to which a river has been modified from its natural state. The methodology (DWAf, 1999) involves a qualitative assessment of the number and severity of anthropogenic perturbations on a river and the damage they potentially inflict upon the system. These disturbances include both abiotic and biotic factors, which are regarded as the primary causes of degradation of a river. The severity of each impact is ranked using a six-point scale with 0 (no impact) and 25 (critical impact).

The IHI assessment is based on an evaluation of the impacts of two components of a river, the riparian zone and the instream habitat. The total scores for the instream and riparian zone components are then used to place the habitat integrity of both in a specific habitat category (Table 5).

The instream and riparian habitat of the upper Paradyskloof River has been moderately modified as a result of past disturbance of the areas adjacent to the watercourse as well as the construction of the dam within the site. The instream aquatic habitat is in a slightly better condition, particularly as a result of the rehabilitation works undertaken and is considered to be in a largely natural to moderately modified ecological condition.

Table 4. Index of Habitat Integrity Assessment results and criteria assessed in the upper Paradyskloof River

Instream Habitat Integrity	Paradyskloof	Riparian Zone Habitat Integrity	Paradyskloof
Water Abstraction	7	Vegetation Removal	7
Flow Modification	9	Exotic Vegetation	5
Bed Modification	6	Bank Erosion	4
Channel Modification	9	Channel Modification	9
Water Quality	5	Water Abstraction	7
Inundation	3	Inundation	8
Exotic Macrophytes	3	Flow Modification	9
Exotic Fauna	2	Water Quality	5
Rubbish Dumping	2		
Integrity Class	B/C	Integrity Class	C

Table 5. Habitat Integrity categories (From DWAF, 1999)

Category	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 ecosystem functions are essentially unchanged.	80-90
C	Moderately modified. A loss and change of natural habitat and biota have occurred but the basic ecosystem functions are still predominantly unchanged.	60-79
D	Largely modified. Large loss of natural habitat, biota and basic ecosystem functions..	40-59
E	The loss of natural habitat, biota and basic ecosystem functions is extensive.	20-39
F	Modifications have reached a critical level and the lotic system has been modified completely with an almost complete loss of natural habitat and biota. In worst instances, basic ecosystem functions have been destroyed and changes are irreversible.	0

7.2.4. ECOLOGICAL IMPORTANCE AND SENSITIVITY

The Ecological Importance and Sensitivity (EIS) Assessment considers a number of biotic and habitat determinants surmised to indicate either importance or sensitivity. The determinants are rated according to a four-point scale (Table 6). The median of the resultant score is calculated to derive the EIS category (Table 7).

Table 6. Scale used to assess biotic and habitat determinants that indicate either importance or sensitivity

Scale	Definition
1	One species/taxon judged as rare or endangered at a local scale.
2	More than one species/taxon judged to be rare or endangered on a local scale.
3	One or more species/taxon judged to be rare or endangered on a Provincial/regional scale.
4	One or more species/taxon judged as rare or endangered on a National scale (i.e. SA Red Data Books)

Table 7. Ecological importance and sensitivity categories (DWAF, 1999)

EISC	General description	Range
Very high	Quaternaries/delineations considered unique on a national and international level based on unique biodiversity. These rivers are usually very sensitive to flow modifications and have no or only a small capacity for use.	>3-4
High	Quaternaries/delineations considered unique on a national scale based on their biodiversity. These rivers may be sensitive to flow modifications but in some cases may have substantial capacity for use.	>2-≤3
Moderate	Quaternaries/delineations considered unique on a provincial or local scale due to biodiversity. The rivers are not very sensitive to flow modification and have substantial capacity for use.	>1-≤2
Low/ marginal	Quaternaries/delineations that are not unique on any scale. These rivers are generally not very sensitive to flow modifications and usually have substantial capacity for use.	≤1

Table 8. Results of the EIS assessment for the upper Paradyskloof River

Biotic Determinants	Upper Paradyskloof
Rare and endangered biota	2
Unique biota	2
Intolerant biota	2.5
Species/taxon richness	2.5
Aquatic Habitat Determinants	
Diversity of aquatic habitat types or features	2.5
Refuge value of habitat type	2.5
Sensitivity of habitat to flow changes	2.5
Sensitivity of flow related water quality changes	2

Migration route/corridor for instream and riparian biota	2
National parks, wilderness areas, Nature Reserves, Natural Heritage sites, Natural areas, PNEs	2
EIS CATEGORY	Moderate to high

The ecological importance and sensitivity of the upper reaches of the Paradyskloof River are considered to be moderate to high. Indigenous fish populations (Cape galaxias *Galaxia zebratus* and Cape kurper *Sandelia capensis*) still occur within the lower river system and the river plays an important role as providing an ecological corridor that links the lower Eerste River to the more natural habitat higher in the catchment. As the river still has elements of natural riparian vegetation, it is more sensitive to flow and water quality changes.

7.3. WETLAND ASSESSMENT

Wetlands as defined by the National Water Act (Act 36 of 1998) “are a portion of land that is transitional between terrestrial and aquatic systems where the water table is usually at or near the surface, or the land is periodically covered with shallow water, and which under normal circumstances supports or would support vegetation typically adapted to life in saturated soil.” Wetland delineation relates to the determination and marking of the boundary of a wetland to the outer edge of the temporary zone of wetness. This section contains an assessment of the wetland area identified on site based on existing information as well as the field assessment. The wetland assessment consists of the following aspects: Wetland classification; Wetland integrity; and Ecosystem services supplied by the wetland.

7.3.1. WETLAND DELINEATION AND DESCRIPTION

The Wetland delineation process uses four wetland indicators to provide an estimate of the extent of a wetland. They are: landscape position (must be flat or depressed), vegetation (must be hydrophilic), soil form (must compliment an existing wetland type) and soil wetness (water table must be within 50 cm of profile). The delineated wetland area is shown in Figure 14.

There are three types of wetlands within the site: a hillslope seep wetland associated with the smaller tributary of the Paradyskloof River; some depression wetlands that have been artificially created and the valley bottom wetland associated with the Paradyskloof River channel (Figure 15). Although the depression wetlands are artificial wetlands they have been created and vegetated to form natural wetlands that provide valued goods and services and for this reason have been included in this assessment.



Figure 19. Google Earth image with the mapped areas within the site where the activities have been undertaken



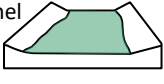





Figure 20. View of the hillslope seep (top), valley bottom wetland (middle) and depression wetlands (bottom)

7.3.2. WETLAND CLASSIFICATION

The classification of the wetlands in the study area into different wetland types was based on the WET-EcoServices technique (Kotze *et al*, 2005). The WET-EcoServices technique identifies seven main types of wetland based on hydro-geomorphic characteristics (Table 9).

Table 9. Wetland hydro-geomorphic types typically supporting inland wetlands in South Africa

Hydro-geomorphic types	Description	Source of water ¹	
		Surface	Sub-surface
Floodplain 	Valley bottom areas with a well-defined stream channel, gently sloped and characterized by floodplain features (oxbow depressions and natural levees) with alluvial transport and deposition, usually leading to sediment accumulation. Water inputs from main channel and adjacent slopes.	***	*
Valley bottom with a channel 	Valley bottom areas with a well-defined channel but lacking characteristic floodplain features. May be gently sloped with alluvial accumulation or may have steeper slopes and a net loss of sediment. Water inputs from main channel (when channel banks overspill) and from adjacent slopes.	***	*/ ***
Valley bottom without a channel 	Valley bottom areas with no clearly defined stream channel, usually gently sloped and characterized by alluvial sediment deposition, generally leading to a net accumulation of sediment. Water inputs mainly from channel into wetland and adjacent slopes.	***	*/ ***
Hillslope seepage linked to channel 	Slopes on hillsides, which are characterized by the colluvial (transported by gravity) movement of materials. Water inputs are mainly from sub-surface flow and outflow is usually via a well-defined stream channel connecting the area directly to a stream channel.	*	***
Isolated seepage Hillslope 	Slopes on hillsides, which are characterized by the colluvial movement of materials. Water inputs mainly from sub-surface flow and outflow either very limited or through diffuse sub-surface and/or surface flow but with no direct surface water connection to a stream channel.	*	***
Depression (includes Pans) 	A basin shaped area with a closed elevation contour that allows for the accumulation of surface water (i.e. it is inward draining). It may also receive sub-surface water. An outlet is usually absent, and therefore this type is usually isolated from the stream channel network.	*/ ***	*/ ***

¹ Precipitation is an important water source and evapotranspiration an important

Water source: * Contribution usually small
 *** Contribution usually large
 */ *** Contribution may be small or important depending on the local circumstances
 Wetland

According to Table 9, the wetland features within the study area can be classified as follows:

Table 10. Classification of wetlands occurring at the site

Name	Hillslope seeps	Valley bottom wetlands	Depressions
System	Inland		
Ecoregion	South Western Coastal Belt		
Landscape setting	Hillslope	Valley bottom	Flat/ depression created within hillside
Hydrogeomorphic Type	Hillslope seep with channel	Valley bottom with channel	Depression (pond or dam)
Longitudinal zonation	Upper foothill		-
Drainage	Associated with smaller tributary	Associated with Paradyskloof River	Associated with watercourses through site
Seasonality	Seasonal to permanent		
Anthropogenic influence	Some habitat and flow modification		Artificially created
Vegetation	Cape Wineland Shale Fynbos with freshwater wetland vegetation		
Substrate	Sand and Clay		
Salinity	Fresh		

The hillslope seep and valley-bottom wetland areas were natural wetland areas that are currently in a modified ecological state as a result of the surrounding land use activities while the depression wetlands have been artificially created but then rehabilitated to create more natural habitat, the is with the exception of the large dam.

7.3.3. WETLAND INTEGRITY

The Present Ecological Status (PES) Method (DWAF 2005) was used to establish the integrity of the wetland in the study area and was based on the modified Habitat Integrity approach developed by Kleynhans (DWAF, 1999; Dickens *et al*, 2003). Table 11 shows the criteria and results from the assessment of the habitat integrity of the wetland. These criteria (Table 12) were selected based on the assumption that anthropogenic modification of the criteria and attributes can generally be regarded as the primary causes of the ecological integrity of a wetland.

Table 11. Wetland habitat integrity assessment (score of 0=critically modified to 5=unmodified)

Criteria & Attributes	Hillslope seeps	Valley bottom wetlands	Depressions
Hydrologic			
Flow Modification	3.8	3.2	2.0
Permanent Inundation	2.1	2.6	1.5
Water Quality			
Water Quality Modification	4.1	3.9	3.9
Sediment Load Modification	3.5	2.9	3.0
Hydraulic/Geomorphic			
Canalisation	2.9	2.5	2.2
Topographic Alteration	3.4	3.2	1.8
Biota			
Terrestrial Encroachment	2.7	2.9	3.0
Indigenous Vegetation Removal	3.5	3.5	2.5
Invasive Plant Encroachment	3.8	3.0	3.4
Alien Fauna	3.8	3.7	3.0
Over utilisation of Biota	4.1	3.5	3.0
Category	B – Largely natural	B/C – Largely natural to moderately modified	C – Moderately modified

Table 12. Habitat integrity assessment criteria for palustrine wetlands (Dickens *et al*, 2003)

Criteria & Attributes	Relevance
Hydrologic	
Flow Modification	Consequence of abstraction, regulation by impoundments or increased runoff from human settlements or agricultural land. Changes in flow regime (timing, duration, frequency), volumes, velocity which affect inundation of wetland habitats resulting in floristic changes or incorrect cues to biota. Abstraction of groundwater flows to the wetland.
Permanent Inundation	Consequence of impoundment resulting in destruction of natural wetland habitat and cues for wetland biota.
Water Quality	
Water Quality Modification	From point or diffuse sources. Measure directly by laboratory analysis or assessed indirectly from upstream agricultural activities, human settlements and industrial activities. Aggravated by volumetric decrease in flow delivered to the wetland.
Sediment Load Modification	Consequence of reduction due to entrapment by impoundments or increase due to land use practices such as overgrazing. Cause of unnatural rates of erosion, accretion or infilling of wetlands

	and change in habitats.
Hydraulic/Geomorphic	
Canalisation	Results in desiccation or changes to inundation patterns of wetland and thus changes in habitats. River diversions or drainage.
Topographic Alteration	Consequence of infilling, ploughing, dykes, trampling, bridges, roads, railway lines and other substrate disruptive activities that reduce or change wetland habitat directly in inundation patterns.
Biota	
Terrestrial Encroachment	Consequence of desiccation of wetland and encroachment of terrestrial plant species due to changes in hydrology or geomorphology. Change from wetland to terrestrial habitat and loss of wetland functions.
Indigenous Vegetation Removal	Direct destruction of habitat through farming activities, grazing or firewood collection affecting wildlife habitat and flow attenuation functions, organic matter inputs and increases potential for erosion.
Invasive Plant Encroachment	Affects habitat characteristics through changes in community structure and water quality changes (oxygen reduction and shading).
Alien Fauna	Presence of alien fauna affecting faunal community structure.
Over utilisation	Overgrazing, overfishing, etc.

Table 13. Relation between scores given and ecological categories

Scoring Guidelines Per Attribute*	Interpretation of Mean* of Scores for all Attributes: Rating of Present Ecological Status Category (PESC)
Natural, unmodified - score=5.	Within general acceptable range CATEGORY A >4; Unmodified, or approximates natural condition.
Largely natural - score=4.	CATEGORY B >3 and ≤4; Largely natural with few modifications, but with some loss of natural habitats.
Moderately modified - score=3.	CATEGORY C >2 and ≤3; moderately modified, but with some loss of natural habitats.
Largely modified - score=2.	CATEGORY D ≤2; largely modified. A large loss of natural habitats and basic ecosystem functions has occurred. OUTSIDE GENERALLY ACCEPTABLE RANGE
Seriously modified - rating=1.	CATEGORY E >0 and <2; seriously modified. The losses of natural habitats and basic ecosystem functions are extensive.
Critically modified - rating=0.	CLASS F 0; critically modified. Modifications have reached a critical level and the system has been modified completely with an almost complete loss of natural habitat.

The habitat of the seep area, although reduced from the original extent is considered to be largely natural in terms of its habitat integrity while valley bottom wetlands are considered to be largely natural to moderately modified and the depressions, although artificial have a habitat integrity that could be considered to be moderately modified. The wetland areas are impacted by much the same impacts as the watercourses that are associated with the past surrounding land use activities.

7.3.4. ECOSYSTEM SERVICES SUPPLIED BY THE WETLANDS

The assessment of the ecosystem services supplied by the identified wetlands was conducted according to the guidelines as described by Kotze *et al* (2005). An assessment was undertaken that examines and rates the services listed in Table 14. The characteristics were scored according to the general levels of services

provided. It is important to manage the wetlands to ensure that they can continue to provide the valued goods and services:

Table 14. Goods and services assessment results for wetlands (high=4; low=0)

Goods and services	Hillslope seeps	Valley bottom wetlands	Depressions
Flood attenuation	1.8	2.6	3.5
Stream flow regulation	3.6	2.8	3.0
Sediment trapping	3.5	2.5	3.4
Phosphate trapping	2.8	2.1	2.2
Nitrate removal	2.5	2.4	2.0
Toxicant removal	1.5	1.3	1.0
Erosion control	2.6	2.5	3.8
Carbon storage	2.2	2.0	2.0
Maintenance of biodiversity	3.6	2.9	2.5
Water supply for human use	2.6	2.5	3.5
Natural resources	1.0	0.5	1.5
Cultivated foods	0	0	1.5
Cultural significance	0.5	0	0.5
Tourism and recreation	3.5	3.5	3.5
Education and research	1.5	1.5	1.0

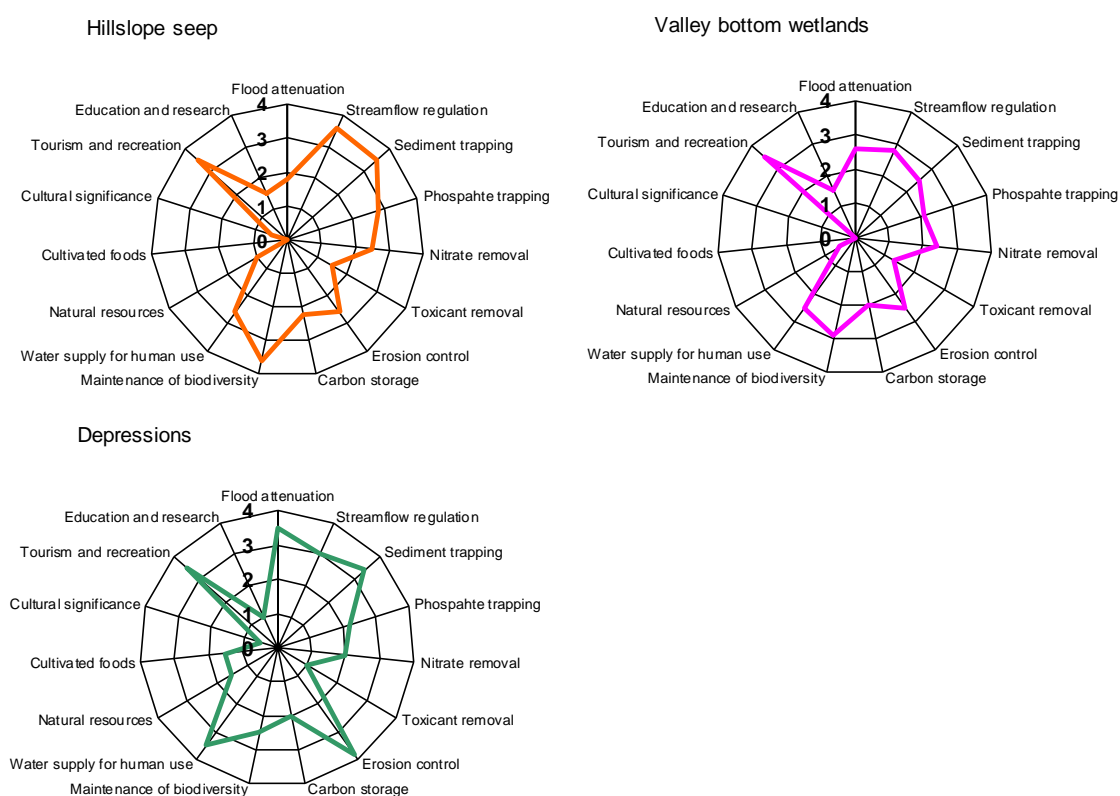


Figure 21. Ecosystem services provided by the wetlands within the site

From Figure 16 it can be seen that in terms of goods and services, the wetlands due their location on the hillslope and association with the watercourses, supply valued services in terms of regulating streamflow, mitigating erosion and providing habitat for biota amongst others. Given that much of the site has been rehabilitated for tourism / recreation purposes, this service is scored high.

7.3.5. ECOLOGICAL IMPORTANCE AND SENSITIVITY (EIS)

The EIS Assessment for the wetland areas is undertaken in the same manner as that for the river and considers a number of biotic and habitat determinants surmised to indicate either importance or sensitivity.

Table 15. Results of the EIS assessment for the wetland area

ECOLOGICAL IMPORTANCE AND SENSITIVITY:	Hillslope seeps	Valley bottom wetlands	Depressions
Ecological Importance			
Biodiversity support	2.17	2.50	1.50
Presence of Red Data species	2	2.5	1.5
Populations of unique species	2.5	2.5	1
Migration/breeding/feeding sites	2	2.5	2
Landscape scale	1.70	1.70	1.30
Protection status of the wetland	1	2	1
Protection status of the vegetation type	2	2	2
Regional context of the ecological integrity	2	2	1.5
Size and rarity of the wetland type/s present	1.5	1	1
Diversity of habitat types	2	1.5	1
Sensitivity of the wetland	2.00	2.17	1.17
Sensitivity to changes in floods	1.5	2	1
Sensitivity to changes in low flows/dry season	2.5	2.5	1
Sensitivity to changes in water quality	2	2	1.5
ECOLOGICAL IMPORTANCE & SENSITIVITY	2.17	2.50	1.50
HYDROLOGICAL/FUNCTIONAL IMPORTANCE	2.56	2.28	2.61
IMPORTANCE OF DIRECT HUMAN BENEFITS	1.52	1.33	1.92
OVERALL IMPORTANCE	2.56	2.50	1.92

The wetlands are considered to be of a moderate to high ecological sensitivity and importance, providing a degree of refuge and connectivity for faunal and floral species within a landscape that is becoming increasingly cultivated. The hillslope wetland and valley bottom wetlands are considered of high importance due to the ecological and hydrological importance that they provide while the depression wetlands are of moderate importance primarily of hydrological functionality as they form an integral part of the aquatic mosaic within the site.

8. LEGISLATIVE REQUIREMENTS

The following Acts, regulations and ordinances are specifically applicable to the proposed activities in terms of the freshwater aspects of the activities undertaken.

A. THE NATIONAL ENVIRONMENTAL MANAGEMENT ACT (ACT NO. 107 OF 1998)

Chapter Seven of the National Environmental Management Act (NEMA) states that:

“Every person who causes, has caused or may cause significant pollution or degradation of the environment must take reasonable measures to prevent such pollution or degradation from occurring, continuing or recurring, or, in so far as such harm to the environment is authorised by law or cannot reasonably be avoided or stopped, to minimise and rectify such pollution or degradation of the environment”.

The Act also clearly states that the landowner, or the person using or controlling the land, is responsible for taking measures to control and rectify any degradation. These may include measures to:

- “(a) investigate, assess and evaluate the impact on the environment;
- (b) inform and educate employees about the environmental risks of their work and the manner in which their tasks must be performed in order to avoid causing significant pollution or degradation of the environment:
- (c) cease, modify or control any act, activity or process causing the pollution or degradation:
- (d) contain or prevent the movement of pollutants or degradation: or
- (e) eliminate any source of pollution or degradation: or
- (f) remedy the effects of the pollution or degradation.”

NEMA ENVIRONMENTAL IMPACT ASSESSMENT REGULATIONS, GN R982 OF 2014

NEMA provides for the identification of activities which will impact the environment, in terms of Section 24. These activities were promulgated in terms of Government Notice No. R. 983, 984 and 985, dated 4 December 2014, as amended by GN 324, GN 325, GN 326 and GN 327 (April 2017), and require environmental authorisation. The impacts of the listed activities must be investigated, assessed and reported to the competent authority before authorisation to commence with such listed activities can be granted.

In terms Section 24F of NEMA, no activity listed in the above-mentioned regulations may take place without environmental authorisation. Of the various activities undertaken, the following listed activity within or adjacent to watercourses have been triggered:

In terms Section 24F of NEMA, no activity listed in the above-mentioned regulations may take place without environmental authorisation. Of the various activities undertaken, the following listed activity

within or adjacent to watercourses have been triggered in terms of Listing Notice 1 (GN No. R. 544 of 18 June 2010):

- Activity 11: The construction of canals; channels; bridges; dams; weirs; etc. within a watercourse or within 32 m from a watercourse; and
- Activity 18: The infilling or depositing of any material of more than 5 cubic metres into, or the dredging, excavation, removal or moving of soil, sand, shells, shell grit, pebbles or rock of more than 10 cubic metres from a watercourse.

In terms of Listing Notice 1 (GN No. R. 983 of 8 December 2017 as amended):

- Activity 19: The infilling or depositing of any material of more than 10 cubic metres into, or the dredging, excavation, removal or moving of soil, sand, shells, shell grit, pebbles or rock of more than 10 cubic metres from (i) a watercourse;

Cornerstone Environmental Consultants have been appointed to undertake the 24G process for the consideration of the works undertaken. This freshwater assessment is required to inform that assessment process.

B. NATIONAL WATER ACT, 1998 (ACT NO. 36 OF 1998)

The purpose of the National Water Act, 1998 (NWA) is to provide a framework for the equitable allocation and sustainable management of water resources. Both surface and groundwater sources are redefined by the Act as national resources which cannot be owned by any individual, and rights to which are not automatically coupled to land rights, but for which prospective users must apply for authorisation and register as users. The NWA also provides for measures to prevent, control and remedy the pollution of surface and groundwater sources.

The Act aims to regulate the use of water and activities (as defined in Part 4, Section 21 of the NWA), which may impact on water resources through the categorisation of 'listed water uses' encompassing water abstraction and flow attenuation within catchments as well as the potential contamination of water resources, where the DWS is the administering body in this regard. Defined water use activities require the approval of DWS in the form of a General Authorisation or Water Use Licence authorisation. There are restrictions on the extent and scale of listed activities for which General Authorisations apply.

In terms of the water use activities associated with the activities, the listed water use activities are:

- Section 21(c) – Impeding or diverting flow in a watercourse; and
- Section 21(i) – Altering the bed, banks, course or characteristics of a watercourse,

where, the Paradyskloof River, its tributaries and associated wetlands as described and assessed in this report can be defined as watercourses.

Section 22(3) of the National Water Act allows for a responsible authority (DWS) to dispense with the requirement for a Water Use Licence if it is satisfied that the purpose of the Act will be met by the grant of a licence, permit or authorisation under any other law.

GENERAL AUTHORISATION IN TERMS OF SECTION. 39 OF THE NWA

According to the preamble to Part 6 of the NWA, *“This Part established a procedure to enable a responsible authority, after public consultation, to permit the use of water by publishing general authorisations in the Gazette...”* *“The use of water under a general authorisation does not require a licence until the general authorisation is revoked, in which case licensing will be necessary...”*

The General Authorisations for Section 21 (c) and (i) water uses (impeding or diverting flow or changing the bed, banks or characteristics of a watercourse) as defined under the NWA have recently been revised (Government Notice R509 of 2016). The proposed works within or adjacent to the wetland areas and river channels are likely to change the characteristics of the associated freshwater ecosystems and may therefore require authorization. Determining if a water use licence is required for these water uses is now associated with the risk of degrading the ecological status of a watercourse. A low risk of impact could be authorised in terms of a General Authorisations (GA). A risk assessment for the proposed project is included in this report.

REGULATIONS REQUIRING THAT A WATER USER BE REGISTERED, GN R.1352 (1999)

Regulations requiring the registration of water users were promulgated by the Minister of DWA in terms of provision made in section 26(1)(c), read together with section 69 of the National Water Act, 1998. Section 26(1)(c) of the Act allows for registration of all water uses including existing lawful water use in terms of section 34(2). Section 29(1)(b)(vi) also states that in the case of a general authorisation, the responsible authority may attach a condition requiring the registration of such water use. The Regulations (Art. 3) oblige any water user as defined under Section 21 of the Act to register such use with the responsible authority and effectively to apply for a Registration Certificate as contemplated under Art.7(1) of the Regulations.

9. ASSESSMENT OF IMPACT OF ACTIVITIES ALREADY UNDERTAKEN

This section provides an assessment of the three alleged illegal and unlawful activities:

- Construction of a walkway and sculpture display within a watercourse with the associated infilling;
- Diversion of the watercourse into a small dam and artificial pond; and

- Construction of a weir within a watercourse.

9.1. CONSTRUCTION OF A WALKWAY AND SCULPTURE DISPLAY WITHIN A WATERCOURSE WITH THE ASSOCIATED INFILLING

The walkway through the created garden has needed to cross the delineated watercourses and wetland areas in a number of places (Figure 22). These crossings are largely comprised of steppingstones placed within the watercourses (Figure 23). The pathway itself just comprises of a narrow sand / gravel track with minimal intrusion into the aquatic features. Adjacent to the pathway, the aquatic habitats have been rehabilitated and vegetated with suitable local indigenous wetland vegetation. Where necessary, the aquatic habitats have been reshaped and alien vegetation has been removed to enhance the habitats.

Infilling of the area that has primarily taken place associated with the creation of the sculpture garden comprises of a platform along the eastern boundary of Farm 1314 (Figure 22 and Figure 24). A portion of the infilling is directly adjacent to the watercourse but outside of the active channel of the watercourse.



Figure 22. Google Earth image showing the mapped aquatic features with the yellow ovals indicating where the walkway has been constructed within these delineated aquatic features



Figure 23. View of the typical watercourse crossings at the site

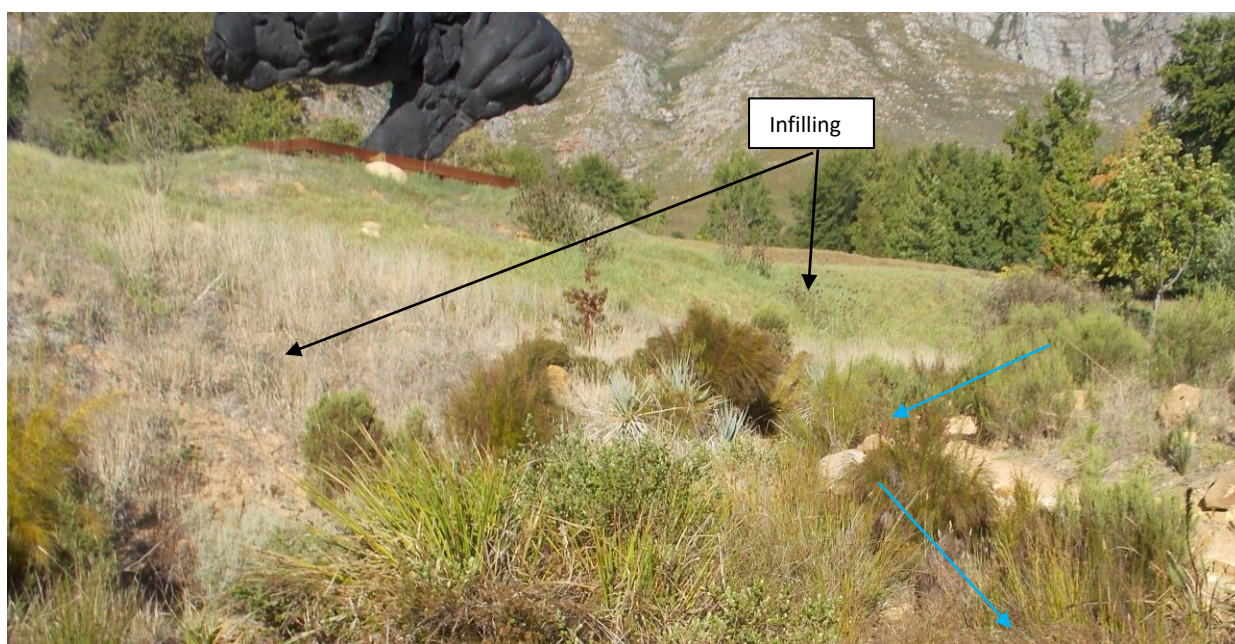


Figure 24. View of the infilling along the north-eastern bank of the watercourse within the site

Potential impacts of the activities undertaken are some aquatic habitat modification; and a localised impedance of flow within the watercourses at the crossings. Given that considerable effort has been undertaken to enhance and improve the aquatic habitats within the garden the impact of the created walkway has been limited and in general has resulted in the improvement of the ecological integrity of the aquatic features that had been modified by past agricultural activities within the site and were invaded with alien vegetation such as Paterson's curse (Figure 25).



Figure 25. View of the Paradyskloof River at the infilled embankment shown in Figure 25, prior to rehabilitation

In addition, erosion and bank instability along the Paradyskloof River within the site has also been mitigated by reshaping of the watercourse, removal of alien vegetation and re-establishing indigenous vegetation. Construction of the small pools have had very limited impacts that have been adequately mitigated and, in the process, have increased aquatic habitat diversity within the site.

The only activity within or adjacent to the aquatic features that requires some rehabilitation is the infilled area adjacent to the Paradyskloof Stream. While it is not deemed necessary to remove the infilled material, it is recommended that the invasive kikuyu *Pennisetum clandestinum* grass cover on the embankment be removed and that the embankment be revegetated with indigenous vegetation. In particular, the banks of the stream where there is a bend in the watercourse should be vegetated and if necessary stabilised with larger boulders to prevent undercutting of the embankment by the stream.

Significance of impact: From the discussion and assessment of the activities undertaken, it can be said that the impacts of the construction of a walkway and sculpture display within a watercourse with the associated infilling are limited and of low significance considering the condition of the site prior to the activity. These impacts have largely already been mitigated. The only rehabilitation measure recommended is the partial removal of the infilled area discussed above. A method statement for this rehabilitation measure is provided in the following section.

9.2. DIVERSION OF THE WATERCOURSE INTO A SMALL DAM AND ARTIFICIAL POND

Only one flow diversion appears to have been undertaken as part of the garden establishment, that is the diversion of some flow from the large dam within the site to maintain the created pond near the western

boundary of the site. The series of ponds created along the southern boundary of the site is along one of the channels of the Paradyskloof River (Figure 26).



Figure 26. Comparison of the Google Earth image for 2005 with the most recent image (2019) with the mapped aquatic features. The flow diversion is indicated by the blue arrow.

As can be seen from Figure 27, a significant amount of new / enhanced aquatic habitat has been created as a result of the diversion of the watercourse. The water use associated with the diversion of the watercourse is largely non-consumptive with only a slight impedance of flow within the artificial ponds. The aquatic impact of this activity on the aquatic habitat and diversity is thus positive and has been adequately rehabilitated that no additional rehabilitation measures are deemed to be required. The aquatic habitat at the created pond along the western boundary can be seen in Figure 20, bottom image.

In terms of the potential impact of the diversion of the watercourse into the constructed dam and its impact on downstream volume of water in the watercourse and the associated impact of the ecological function of the watercourse and the aquatic biota in the stream, the water use from the dam is largely non-consumptive, with the main use being for aesthetic purposes. The property, as shown in Figure 26, did contain a smaller dam at the same location for irrigation of cultivated areas. The consumptive use within the property is unlikely to have increased. Most of the revegetation of the surrounding terrestrial landscape is with indigenous vegetation that largely does not require irrigation, only during the establishment phase.

The impact on downstream flow would thus not be such much an impact on the downstream volume of water but rather an impact on the flow pattern. As the water in the dam is not significantly utilised, the dam usually spills and it is the low flows that are impounded by the dam when there are insufficient flows for the dam to spill and there is still evaporative water losses from the dam. This impact on flow would have also occurred for the previously existing dam but would have increased as a result of the larger constructed dam. Given the degraded condition of the watercourse downstream of the site, and the fact that the stream along its length appears to have a baseflow contribution from groundwater that sustains the aquatic ecosystem during the dry summer period, the impact of the dam on the downstream flow and aquatic ecosystem is considered of a low significance. A water use authorisation will need to be applied for with the Department of Water and Sanitation.

9.3. CONSTRUCTION OF A WEIR WITHIN A WATERCOURSE

The only formalised crossing along the pathway is at the existing weir where a concrete walkway has been strengthened with a concrete structure of approximately 1.5 m wide and 2 m high (Figure 24). The structure acts also as an erosion mitigation as the watercourse drops downstream of the property and is likely to erode back into the site and the wetland area immediately upstream.



Figure 27. View of the constructed weir on the western boundary of the site

Significance of impact: Insignificant with the potential for a positive impact. There was an existing structure at the site of the weir that was degraded and becoming undercut but the eroding river channel downstream. The construction of the weir has addressed erosion taking place within the stream. The structure does not appear to significantly impede flow in the watercourse, except to facilitate the creation of the depression wetland habitat upstream. The created pond has been shaped and vegetated such that new wetland habitat has been created with an associated positive impact. No rehabilitation measures are deemed necessary for this activity.

10. RISK ASSESSMENT

A risk assessment was carried out for the activities that have been undertaken at the site and adjacent to the Paradyskloof River. The assessment indicates the level of risk certain activities pose to freshwater resources where the outcomes are used to guide decisions regarding water use authorisation of the proposed activity. A summary of the potential risks can be seen in

Table 15 and the full assessment tables are contained in Appendix 4. These risk rating classes can be seen in Table 16.

Table 15: Summary risk assessment for the proposed project

Phases	Activity	Aspect	Impact	Significance	Risk Rating	Adjusted Risk	Control Measures
Construction	Construction works adjacent to aquatic habitats associated with the upper Paradyskloof River within the site	Construction of a walkway and crossings within and adjacent to aquatic habitats	Aquatic habitat modification; potential flow/hydraulic modification	72	M	L	None required - reshaping and revegetation of disturbed areas has been undertaken. It is likely that there has been an improvement of the ecological condition of the aquatic features that were on the site from a C category or lower before the works to the current B/C category
		Construction of a weir within the tributary of the Paradyskloof River		72	M	L	
		Diversion of the watercourse into a small dam and artificial pond		88	M	L	
		Infilling adjacent to the Paradyskloof River for the platform		80	M	L	The invasive kikuyu grass cover on the embankment should be removed and the embankment revegetated with indigenous vegetation.
Operation	Operational activities associated with the pathway and associated infrastructure in and adjacent to the watercourse	Rehabilitation and Maintenance works in the river		63	M	L	Longer term monitoring and maintenance associated with the rehabilitated areas, such as erosion mitigation and alien vegetation clearing, should be ongoing.

Table 16: Risk rating classes for the Risk Assessment

RATING	CLASS	MANAGEMENT DESCRIPTION
1 – 55	(L) Low Risk	Acceptable as is or consider requirement for mitigation. Impact to watercourses and resource quality small and easily mitigated. Wetlands may be excluded.
56 – 169	(M) Moderate Risk	Risk and impact on watercourses are notably and require mitigation measures on a higher level, which costs more and require specialist input. Wetlands are excluded.
170 – 300	(H) High Risk	Always involves wetlands. Watercourse(s) impacts by the activity are such that they impose a long-term threat on a large scale and lowering of the Reserve.

The risk assessment determined that most of the proposed activities pose a **moderate to low** risk of impacting aquatic habitat and water flow. The reshaping and revegetation of disturbed areas with suitable local indigenous plants was undertaken following the works. It is likely that there has been an improvement

of the ecological condition of the aquatic features that were on the site from a C category or lower before the works to the current B/C category. The activities could thus potentially be authorised by means of the general authorisations for the Section 21(c) and (i) water uses.

No statement has been made on the increased storage of water that has taken place within the site. It is likely that a water use licence application will still be required for the increased storage of water in the site (Section 21(b) water use) and that the Section 21(c) and (i) water uses would then need to be included in this application. The impacts of the enlarged dam does not appear to have impacted on the ecological integrity of the aquatic features at or downstream of the site.

11. RECOMMENDED REHABILITATION AND MITIGATION MEASURES

Below are recommended rehabilitation measures associated with the works undertaken:

- The rehabilitation that has taken place should be continued in an upstream direction into the area of the embankment and upstream thereof within the Paradyskloof River;
- Indigenous vegetation that would naturally occur in the area should be used for rehabilitation. The use of hybridised plant species should preferably not be allowed;
- The use of commercial grass seeds and sods should not be used in the rehabilitation;
- The management and control of indigenous nuisance plants within the wetland areas should be anticipated and prevented to prevent an overgrown situation which would then require large scale disturbance to rectify in the future. This includes but not limited to:
 - *Typha capensis*, and
 - *Phragmites australis*; and
- Control of invasive alien vegetation (including the invasive kikuyu grass) should be ongoing.

To inform the ongoing maintenance activities that would need to take place within the watercourses within the site, it is advised that the works be undertaken in accordance with an approved Management Maintenance Plan.

REHABILITATION OF THE EMBANKMENT

The invasive alien kikuyu grass on the embankment should be removed from the slope of the embankment and should be controlled so that it does not regrow into this area. The most desirable way of achieving this, is to create a pathway or walkway along the top of the embankment beyond which the kikuyu grass should

not be allowed to re-establish. No retained brick should be used and no further structures should be placed on the embankment. The bank stabilisation should be achieved with planting of indigenous plants that would naturally have occurred in the area on the embankment and within the broader riparian zone. In particular, the banks of the stream where there is a bend in the watercourse should be vegetated and if necessary stabilised naturally with larger boulders to prevent undercutting of the embankment by the stream.

12. CONCLUSIONS AND RECOMMENDATIONS

The main freshwater feature within the study area consists of the Paradyskloof Tributary of the Blaauwklippen River, a tributary of the Eerste River. The Paradyskloof River arises a short distance upstream of the site and flows in a south-westerly direction to its confluence with the Blaauwklippen River. There are some wetland areas along the length of the river and a number of small farm dams.

The Eerste River and Blaauwklippen River are not mapped as Freshwater Ecosystem Priority Area rivers, only the upper reaches of the Eerste River upstream of Stellenbosch. The dam is mapped as an artificial wetland. The 2017 Western Cape Biodiversity Spatial Plan for the study area has mapped some small aquatic critical biodiversity areas that are associated with wetlands within the site. The watercourse and its smaller tributaries are mapped as aquatic ecological support areas that provide important ecological services and should not be allowed to become degraded

The instream and riparian habitat of the upper Paradyskloof River has been moderately modified as a result of past disturbance of the areas adjacent to the watercourse as well as the construction of the dam within the site. The instream aquatic habitat is in a slightly better condition, particularly as a result of the rehabilitation works undertaken and is considered to be in a largely natural to moderately modified ecological condition. The ecological importance and sensitivity of the upper reaches of the Paradyskloof River are considered to be moderate to high as the river plays an important role as providing an ecological corridor that links the lower Eerste River to the more natural habitat higher in the catchment.

There are three types of wetlands within the site: a hillslope seep wetland associated with the smaller tributary of the Paradyskloof River; some depression wetlands that have been artificially created and the valley bottom wetland associated with the Paradyskloof River channel. Although the depression wetlands are artificial wetlands they have been created and vegetated to form natural wetlands that provide valued goods and services and for this reason have been included in this assessment.

The habitat of the seep area, although reduced from the original extent is considered to be largely natural in terms of its habitat integrity while valley bottom wetlands are considered to be largely natural to moderately modified and the depressions, although artificial have a habitat integrity that could be considered to be moderately modified. The wetland areas are impacted by much the same impacts as the watercourses that are associated with the past surrounding land use activities.

The wetlands due their location on the hillslope and association with the watercourses, supply valued services in terms of regulating streamflow, mitigating erosion and providing habitat for biota amongst others. Given that much of the site has been rehabilitated for tourism / recreation purposes, this service is scored high. The wetlands are considered to be of a moderate to high ecological sensitivity and importance, providing a degree of refuge and connectivity for faunal and floral species within a landscape that is becoming increasingly cultivated.

Three alleged illegal and unlawful activities were assessed in terms of their potential freshwater impacts: Construction of a walkway and sculpture display within a watercourse with the associated infilling; Diversion of the watercourse into a small dam and artificial pond; and Construction of a weir within a watercourse. Potential impacts of the activities undertaken are some aquatic habitat modification; and a localised impedance of flow within the watercourses at the crossings. Given that considerable effort has been undertaken to enhance and improve the aquatic habitats within the garden the impact of the created walkway has been limited and in general has resulted in the improvement of the ecological integrity of the aquatic features that had been modified by past agricultural activities.

While it is not deemed necessary to remove the infilled material, it is recommended that the invasive kikuyu *Pennisetum clandestinum* grass cover on the embankment be removed and that the embankment be revegetated with indigenous vegetation. In particular, the banks of the stream where there is a bend in the watercourse should be vegetated and if necessary stabilised with larger boulders to prevent undercutting of the embankment by the stream.

Only one flow diversion appears to have been undertaken as part of the garden establishment, that is the diversion of some flow from the large dam within the site to maintain the created pond near the western boundary of the site. The series of ponds created along the southern boundary of the site is along one of the channels of the Paradyskloof River. The aquatic impact of this activity on the aquatic habitat and diversity is thus positive and has been adequately rehabilitated that no additional rehabilitation measures are deemed to be required.

In terms of the potential impact of the diversion of the watercourse into the constructed dam and its impact on downstream volume of water in the watercourse and the associated impact of the ecological function of the watercourse and the aquatic biota in the stream, there would be a slight increase in the low flows that are impounded by the dam. This impact on flow would have also occurred for the previously existing dam but would have increased as a result of the larger constructed dam. Given the degraded condition of the watercourse downstream of the site, and the fact that the stream along its length appears to have a baseflow contribution from groundwater that sustains the aquatic ecosystem during the dry summer period, the impact of the dam on the downstream flow and aquatic ecosystem is considered of a low significance. A water use authorisation will need to be applied for with the Department of Water and Sanitation.

The only formalised crossing along the pathway is at the existing weir where a concrete walkway has been strengthened with a concrete structure. The construction of the weir has addressed erosion taking place

within the stream. The structure does not appear to significantly impede flow in the watercourse, except to facilitate the creation of the depression wetland habitat upstream. The created pond has been shaped and vegetated such that new wetland habitat has been created with an associated positive impact. No rehabilitation measures are deemed necessary for this activity.

The risk assessment determined that most of the proposed activities pose a moderate to low risk of impacting aquatic habitat and water flow. The reshaping and revegetation of disturbed areas with suitable local indigenous plants was undertaken following the works. It is likely that there has been an improvement of the ecological condition of the aquatic features that were on the site from a C category or lower before the works to the current B/C category. The activities could thus potentially be authorised by means of the general authorisations for the Section 21(c) and (i) water uses.

No statement has been made on the increased storage of water that has taken place within the site. It is likely that a water use licence application may still be required for the increased storage of water in the site (Section 21(b) water use) and that the Section 21(c) and (i) water uses would then need to be included in this application. The impacts of the enlarged dam does not appear to have impacted on the ecological integrity of the aquatic features at the site.

13. REFERENCES

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APPENDIX 1: DECLARATION OF INDEPENDENCE**DECLARATION OF INDEPENDENCE BY THE INDEPENDENT PERSON WHO COMPILED A SPECIALIST REPORT OR UNDERTOOK A SPECIALIST PROCESS**

I, Antonia Belcher, as the appointed Specialist hereby declare/affirm the correctness of the information provided or to be provided as part of the application, and that I :

- in terms of the general requirement to be independent:
 - other than fair remuneration for work performed in terms of this application, have no business, financial, personal or other interest in the development proposal or application and that there are no circumstances that may compromise my objectivity; or
 - am not independent, but another specialist (the “Review Specialist”) that meets the general requirements set out in Regulation 13 has been appointed to review my work (Note: a declaration by the review specialist must be submitted);
- in terms of the remainder of the general requirements for a specialist, have throughout this EIA process met all of the requirements;
- have disclosed to the applicant, the EAP, the Review EAP (if applicable), the Department and I&APs all material information that has or may have the potential to influence the decision of the Department or the objectivity of any report, plan or document prepared or to be prepared as part of the application; and
- am aware that a false declaration is an offence in terms of Regulation 48 of the EIA Regulations, 2014 (as amended).

Signature of the Specialist:



Name of Company:

BlueScience (Pty) Ltd

Date:

7 June 2019

APPENDIX 2: ABBREVIATED CURRICULUM VITAE:

Organisation:	BlueScience (Pty) Ltd
Contact details:	PO Box 455, Somerset Mall, 7137
Names:	Ms Toni Belcher
Profession:	Senior Aquatic Ecologist for BlueScience, SACNASP No 400040/10
Expertise:	<p>BlueScience (Pty) Ltd provides water resource management services and includes the following:</p> <ul style="list-style-type: none"> • Rivers and wetlands scoping and impact assessments; • River rehabilitation plans and implementation; • Wetland rehabilitation plans and implementation; • Water use authorisation applications (WULA); • Biomonitoring of rivers (including macro-invertebrates, fish & water quality); • Water use compliance auditing (internal auditing); • Water use compliance monitoring and reporting for license holders (including water quality sampling and measurements); • Ecological Reserve determination of rivers and wetlands; • River Maintenance and Management Plans (MMP); • NEMBA – alien vegetation assessment and management plans; and • Water resources capacity building and training.

Summary of projects undertaken by BlueScience since July 2012:

Type of project	Number of projects undertaken
Dam developments	74
Other freshwater and freshwater impact assessments	364
River reach MMP	6
ESKOM	34
Renewable energy (WEF and Solar)	29
Roads (Provincial and National roads)	47
River monitoring and rehabilitation projects	58
Water resource study	12
Water use authorisation applications (not linked to a freshwater assessment study)	26
Water use authorisation audits and licensing monitoring)	7

APPENDIX 3: PRESENT ECOLOGICAL STATUS AND ECOLOGICAL IMPORTANCE AND ECOLOGICAL SENSITIVITY OF THE BLAAUWKLIPPEN RIVER

SELECT SQ REACH	SQR NAME	LENGTH km	STREAM ORDER	PES ASSESSED BY XPRTS? (IF TRUE="Y")	REASONS NOT ASSESSED	PES CATEGORY DESCRIPTION	PES CATEGORY BASED ON MEDIAN OF METRICS
G22H-09237	Blouklip	13.66	1	Y		LARGELY MODIFIED	D
MEAN EI CLASS	MEAN ES CLASS	DEFAULT ECOLOGICAL CATEGORY (DEC)	RECOMMENDED ECOLOGICAL CATEGORY (REC)				
MODERATE	HIGH	B	0.00				
PRESENT ECOLOGICAL STATE		ECOLOGICAL IMPORTANCE			ECOLOGICAL SENSITIVITY		
INSTREAM HABITAT CONTINUITY MOD	LARGE	FISH SPP/SQ	2.00	INVERT TAXA/SQ	35.00	FISH PHYS-CHEM SENS DESCRIPTION	MODERATE
RIP/WETLAND ZONE CONTINUITY MOD	SERIOUS	FISH: AVERAGE CONFIDENCE	1.00	INVERT AVERAGE CONFIDENCE	4.37	FISH NO-FLOW SENSITIVITY DESCRIPTION	MODERATE
POTENTIAL INSTREAM HABITAT MOD ACT.	MODERATE	FISH REPRESENTIVITY PER SECONDARY: CLASS	LOW	INVERT REPRESENTIVITY PER SECONDARY, CLASS	HIGH	INVERT PHYS-CHEM SENS DESCRIPTION	VERY HIGH
RIPARIAN-WETLAND ZONE MOD	LARGE	FISH REPRESENTIVITY PER SECONDARY: CLASS	LOW	INVERT RARITY PER SECONDARY: CLASS	VERY HIGH	INVERTS VELOCITY SENSITIVITY	VERY HIGH
POTENTIAL FLOW MOD ACT.	LARGE	FISH RARITY PER SECONDARY: CLASS	MODERATE	ECOLOGICAL IMPORTANCE: RIPARIAN-WETLAND-INSTREAM VERTEBRATES (EX FISH) RATING	HIGH	RIPARIAN-WETLAND-INSTREAM VERTEBRATES (EX FISH) INTOLERANCE WATER LEVEL/FLOW CHANGES DESCRIPTION	VERY HIGH
POTENTIAL PHYSICO-CHEMICAL MOD ACTIVITIES	MODERATE	ECOLOGICAL IMPORTANCE: RIPARIAN-WETLAND-INSTREAM VERTEBRATES (EX FISH) RATING	HIGH	HABITAT DIVERSITY CLASS	VERY HIGH	STREAM SIZE SENSITIVITY TO MODIFIED FLOW/WATER LEVEL CHANGES DESCRIPTION	HIGH
		RIPARIAN-WETLAND NATURAL VEG RATING BASED ON % NATURAL VEG IN 500m (100%=5)	VERY LOW	HABITAT SIZE (LENGTH) CLASS	MODERATE	RIPARIAN-WETLAND VEG INTOLERANCE TO WATER LEVEL CHANGES DESCRIPTION	HIGH
		RIPARIAN-WETLAND NATURAL VEG IMPORTANCE BASED ON EXPERT RATING	HIGH	INSTREAM MIGRATION LINK CLASS	MODERATE		
				RIPARIAN-WETLAND ZONE MIGRATION LINK	LOW		
				RIPARIAN-WETLAND ZONE HABITAT INTEGRITY CLASS	MODERATE		
				INSTREAM HABITAT INTEGRITY CLASS	HIGH		

APPENDIX 4: RISK ASSESSMENT FOR ACTIVITIES UNDERTAKEN

ASPECTS AND IMPACT REGISTER/RISK ASSESSMENT FOR WATERCOURSES INCLUDING RIVERS, PANS, WETLANDS, SPRINGS, DRAINAGE LINES: WORKS UNDERTAKEN ON FARM 1314 AND 1315 NEAR STELLENBOSCH IN THE WESTERN CAPE

COMPILED BY: Toni Belcher, BlueScience (SACNASP No 400040/10)

DATE: JULY 2019

Nr.	Phases	Activity	Aspect	Impact	Severity				Severity	Spatial scale	Duration	Consequence	Frequency of activity	Frequency of impact	Legal Issues	Detection	Likelihood	Significance	Risk Rating	Adjusted Risk	Control Measures	Confidence	Type Watercourse; PES; EIS
					Flow Regime	Physico & Chemical (Water Quality)	Habitat (Geomorph +Vegetation)	Biota															
1	Construction	Construction works adjacent to aquatic habitats associated with the upper Paradyskloof River within the site	Construction of a walkway and crossings within and adjacent to aquatic habitats	Aquatic habitat modification; potential flow/hydraulic modification	5	5	5	5	5	1	2	8	1	1	5	2	9	72	M	L	None required - reshaping and revegetation of disturbed areas has been undertaken. It is likely that there has been an improvement of the ecological condition of the aquatic features that were on the site from a C category or lower before the works to the current B/C category	High	Paradyskloof River, its tributary and associated wetland areas; PES= B/C; EIS=Moderate to high
			Construction of a weir within the tributary of the Paradyskloof River		5	5	5	5	5	1	2	8	1	1	5	2	9	72	M	L			
			Diversion of the watercourse into a small dam and artificial pond		5	5	5	5	5	1	2	8	1	3	5	2	11	88	M	L			
			Infilling adjacent to the Paradyskloof River for the platform		5	5	5	5	5	1	2	8	1	2	5	2	10	80	M	L			
	Operation	Operational activities associated with the pathway and associated infrastructure in and adjacent to the watercourse	Rehabilitation and Maintenance works in the river		5	5	5	5	5	1	1	7	1	1	5	2	9	63	M	L	Longer term monitoring and maintenance associated with the rehabilitated areas, such as erosion mitigation and alien vegetation clearing, should be ongoing.	Med/High	